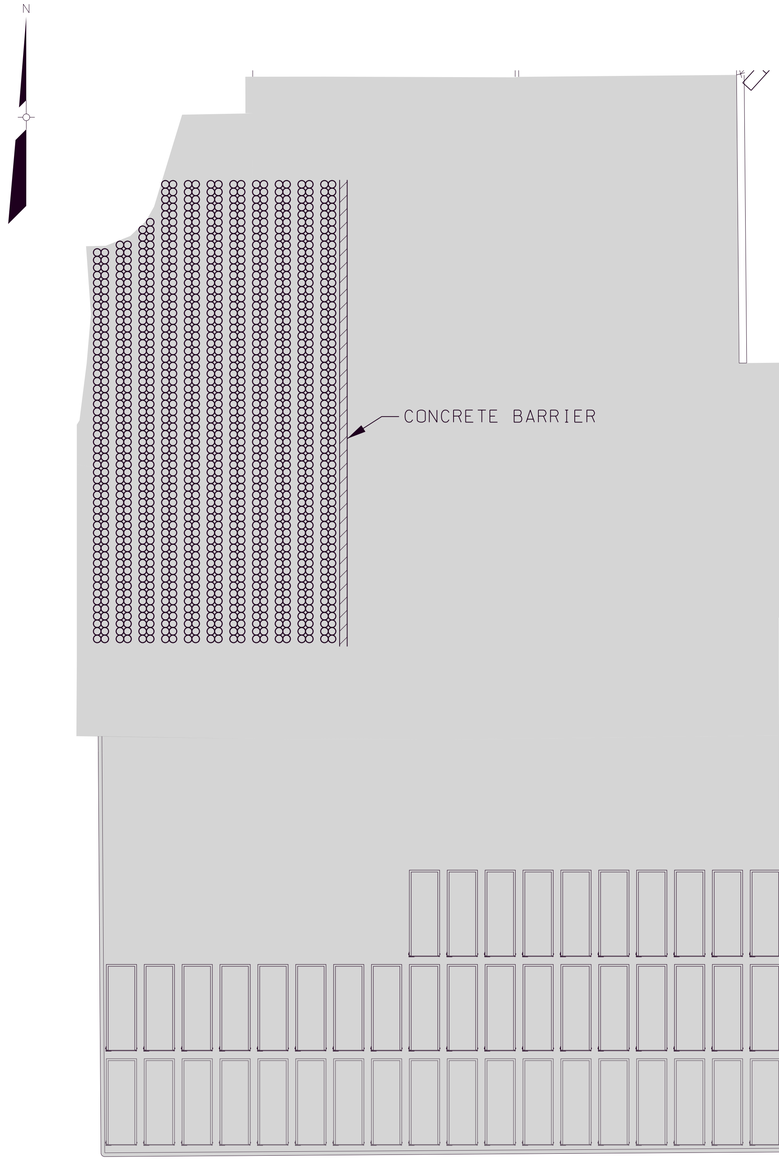
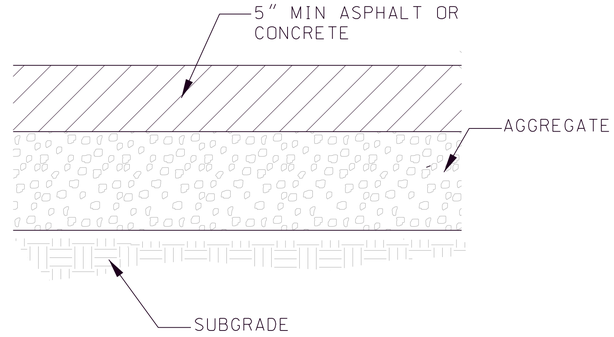
APPENDIX A
FIGURE 1 CONTAINER STORAGE VOLUME ESTIMATE



NON-BULK CONTAINER STORAGE AREA

NUMBER OF CONTAINERS SHOWN ASSUMING ALL CONTAINERS ARE DOUBLE STACKED: 2594

VOLUME OF STORAGE AVAILABLE: 142,670 GALLONS



PAVEMENT
NOT TO SCALE

BULK CONTAINER STORAGE AREA

NUMBER OF CONTAINERS SHOWN: 46

VOLUME OF STORAGE AVAILABLE: 185,840 GALLONS

LEGEND

ASPHALT OR CONCRETE PAVEMENT

20 CUBIC YARD ROLL-OFF BOX

55 GALLON DRUM

NOTE:

1. 2 FEET OF AISLE SPACE SHOWN.

SCALE 0' 20' 40' 80'

PROJECT: WAYNE DISPOSAL, INC
BELLEVILLE, MICHIGAN

SHEET TITLE: **CONTAINER STORAGE VOLUME ESTIMATE**

cti

PROJECT NO: 23L023
SCALE: 1"= 40'
DATE: 05-19-25

FIGURE NO. 1

TIME PLOTTED: 10:00:41 AM
DATE PLOTTED: 5/19/2025

DRAWING SIZE: 11"x17"

APPENDIX B
CQA PLAN REVISION 2

WAYNE DISPOSAL, INC.

CONSTRUCTION QUALITY ASSURANCE PLAN

MASTER CELL VI-E, VI-F, and VI-G

2021

Wayne Disposal, Inc.
49350 North I-94 Service Drive
Belleville, Michigan 48111

Rev. 2
May 2025

WAYNE DISPOSAL, INC.
CONSTRUCTION QUALITY ASSURANCE PLAN
MASTER CELL VI-E, VI-F, AND VI-G

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WAYNE DISPOSAL, INC.
CONSTRUCTION QUALITY ASSURANCE PLAN

This Construction Quality Assurance Plan (CQA Plan, Plan) has been prepared for Wayne Disposal, Inc. (WDI). WDI is a licensed Type I hazardous waste disposal facility located in Belleville, Michigan. This CQA Plan has been developed to ensure high quality installation and construction of various landfill components including the foundation liner and final cover systems at WDI. This Plan shall be implemented at the direction of WDI, under the direction of a CQA Officer designated by WDI, who is a registered professional engineer. This Plan addresses the following components:

- Foundation of Master Cell VI-F and Master Cell VI-G:
  - Structural fill including perimeter berms;
  - Attenuation layer;
  - Subgrade;
  - Geosynthetic clay liner;
  - Geomembrane;
  - Geogrid, Geonet, Geotextile, and Geocomposite;
  - Leak detection and leachate collection systems;
  - Granular soils and select aggregate, and
  - Piping.
- Final cover systems over Master Cell VI-E, VI-F, and VI-G.

1 RESPONSIBILITY AND AUTHORITY

This section contains a general description of the responsibility and authority of the parties involved in construction projects. All parties involved in construction projects at WDI shall comply with the responsibilities presented in this section.

1.1 Owner

Wayne Disposal, Inc. (WDI) is the Owner/Operator to whom all subcontractors are directly responsible. Referred to herein as WDI, WDI will employ all parties performing work described in this Plan.

1.2 Construction Contractor

The Construction Contractor may be one or several parties. The Owner may hire a General Contractor who shall assume responsibility for the entire construction project, including the hiring and managing of subcontractors. If the Owner does not hire a General Contractor to manage the project, construction projects shall, at a minimum, involve an Earthwork Contractor and a Geosynthetics Contractor.

The Earthwork Contractor is responsible for the proper construction of the earthwork-related portions of the liner and/or final cover system. These tasks could include site preparation, excavation, pre-processing of soil materials, backfilling, placement and compaction of soil components, grading the construction area, placement of granular materials, protection of the soil components during construction, stormwater management/dewatering and placement of vegetative cover.

The Geosynthetics Contractor is contracted directly by the Owner or Subcontracted to the General Contractor to install the specified geosynthetic materials. The Geosynthetics Contractor is responsible for supplying all labor and equipment needed to install the geosynthetic materials which meet the project standards as well as all geosynthetic materials not supplied by Others.

1.3 Design Engineer

The Design Engineer is responsible for the project design and shall prepare the project plans and drawings. The design shall meet the approved permit plans and Owner's operational and performance requirements for the landfill. Additionally, the Design Engineer is responsible for the review, generation, and approval of all design and/or specification modifications which apply to the design. The Design Engineer reports directly to the Owner.

1.4 Construction Quality Assurance Consultant

The Construction Quality Assurance (CQA) Consultant is responsible for the implementation of the CQA Plan for the construction project. The CQA Consultant shall be responsible for construction monitoring to observe compliance with the project plans, drawings, and the CQA Plan. The CQA Consultant shall observe and document the completion of each component of the project prior to the placement of subsequent components. Specific duties of the CQA Consultant include observation of construction materials, documentation of construction conditions, performance testing in accordance with project plans and the CQA Plan, documentation that construction is performed in substantial conformance with the approved project plans and drawings, preparation of as-constructed records, and preparation of a final construction documentation report detailing the observations and testing associated with the construction.

1.5 Construction Quality Assurance Officer

The CQA Officer shall be a Professional Engineer registered in the State of Michigan with experience in civil engineering and construction projects. The CQA Officer is typically an employee of the CQA Consultant. The CQA Officer is responsible for the overall coordination of documentation submitted in support of the CQA. Additionally, the CQA Officer is responsible for implementation of this CQA Plan and shall certify that the construction of project components is performed in substantial conformance with the project plans and drawings.

1.6 Surveyor

The Surveyor shall provide equipment and personnel needed to perform surveying activities as required by the construction project.

1.7 Testing Laboratory

The Testing Laboratory is responsible for providing soil and/or geosynthetic testing as required in the project plans and drawings.

2 DOCUMENTATION

The CQA Consultant shall prepare a daily written summary report for each day's construction and monitoring activities. The daily reports shall contain, at a minimum, the following information:

1. Date, project name, location, unit or area under construction, personnel involved in major activities, and other relevant identification information.
2. Name and title of the construction supervisor.
3. Description of weather conditions including maximum and minimum temperatures, and amount of precipitation, if any.
4. Time work starts and ends each construction day. Additionally, include any stoppages in work due to weather conditions or insufficient equipment or personnel.
5. Specific work units and locations of construction underway during that day.
6. Equipment and personnel being utilized in each work task, including subcontractors.
7. Identification of areas or units of work being inspected.
8. Chronological description of progress.
9. Description of off-site materials received, including any quality control data provided by the supplier.
10. Calibrations conducted for field test equipment.
11. Decisions made regarding approval of units of material or work, and/or corrective action, to be taken in areas that require rework.
12. Laboratory samples collected, identified, forwarded to the testing laboratory, and identity of the laboratory.
13. Results of monitoring activities and data, including material delivery report, geomembrane deployment, trial weld information, geomembrane seaming and repair

records, non-destructive seam testing, destructive sample records, soil placement, test pad information, and soil samples/tests taken. This data shall be maintained on appropriate forms and shall be cross-referenced, as necessary.

2.1 Report Forms and Record Keeping Documents

The CQA Consultant is responsible for preparing all field report forms, checklists, and data sheets to substantiate that the required construction monitoring tasks have been implemented. Typically, these report forms and checklists shall include: Daily Field Report, Design and/or Specification Modification/Clarification Form, and Photographic Records.

2.2 Identification and Resolution of Construction Challenges

A challenge is defined as material or workmanship that does not meet the requirements of the project plans or the CQA Plan, or any obvious defect in material or workmanship, even if there is conformance with the above referenced plans.

At a minimum, identification and resolution shall be documented in written communication with the Owner and shall include:

1. A description of the problem or deficiency
2. A discussion of the probable cause of the problem or deficiency.
3. Reference to any test results or retests performed.
4. Detailed description of measures implemented to resolve the problem and prevent recurrence.

2.3 Final Construction Report

Upon completion of the construction project, the CQA Consultant shall prepare a final construction report for the Owner. At a minimum, the final construction report shall contain the following information:

1. A description of the construction project and activities.
2. Project parties.
3. Project submittals.
4. As-constructed report to document elevations and locations of the construction project. Record drawings shall indicate the following information: (1) dimensions and elevations of each landfill cell; (2) the location and elevation of sumps and leachate collection pipelines; and (3) the surface elevation of the final cover system. Tolerance requirements for the surveyed components are listed in the respective Sections of this Plan.
5. Field test data summaries including sample numbers, test locations, lift, and pass/fail status for each test.
6. Laboratory samples collected and test results reported by the laboratory.
7. Diagrams which indicate location of tests, as necessary.
8. Geomembrane drawings that show the location of destructive tests, repairs, and panel layouts including the panel number and including the panel layout floor plans of the existing cells that tie-in to the newly constructed cell if the drawings of the geomembrane panels placed in the existing cell can be found.
9. Summary of construction problems/deficiencies that were identified and resolutions of the problems/deficiencies, as necessary.
10. Documentation that all applicable project plans, drawings, and the CQA Plan were met.

11. A certification by the CQA Officer that the construction meets the requirements of the applicable Rules, permits, and plans.

3 PROJECT MEETINGS

3.1 Preconstruction Meeting

After the Owner selects the contractor(s) for the construction project, and prior to initiation of any construction activities, a Preconstruction Meeting may be conducted to review the scope of the project. The meeting may be attended by all parties involved. The CQA Consultant shall document the Preconstruction Meeting discussions which may include the following topics:

1. Roles and responsibilities of all parties as defined in the project plans, and CQA Plan.
2. Lines of communication and authority.
3. Testing frequency and procedures.
4. Procedures for documentation and report submittals.
5. Coordination of work effort.
6. Project schedule.
7. On-site safety.
9. Soil requirements and specifications.
10. Geosynthetic requirements and specifications.
11. Equipment and usage.
12. Procedures for final acceptance of work.

3.2 Weekly Progress Meetings

Routine weekly progress meetings may be held and attended by the Owner, the Contractor(s), the CQA Consultant, and the CQA Officer, as appropriate to agenda topics for each meeting. Additionally, the attendance of subcontractor(s), supplier(s), or the Surveyor may be necessary. The weekly meetings may be held to review the construction progress of the previous week, the status of the project schedule, construction challenges

and resolutions, and the proposed construction schedule for the next week. The weekly progress meeting will be documented by the CQA Consultant.

3.3 Challenge Resolution Meeting

A challenge resolution meeting between appropriate parties may be held as necessary to review any construction issue that has been identified. The intent of the meeting is to identify, isolate, and resolve the challenge to meet the specifications of the project. This meeting shall be documented by the CQA Consultant.

4 FOUNDATION FOR MASTER CELL VI-F AND VI-G

The foundation for Master Cell VI-F shall be formed on native ground and on the closed Master Cell IV. The foundation for Master Cell VI-G shall be formed on native ground and on the closed Master Cell I. Where the foundation is formed over native ground, vegetation and topsoil shall be stripped and the underlying soils excavated to meet design specifications. Where the foundation is formed over closed cells, vegetation and topsoil shall be stripped from the existing cover and the foundation shall be regraded prior to placing components of the new cell.

4.1 Inspection of Foundation Surface

The foundation surface for placement of new cell components will be visually inspected by the CQA Consultant to locate unacceptable foundation conditions. Unacceptable foundation surface conditions include but are not limited to moisture seeps and soft spots identified during proof rolling of the subgrade. Where unacceptable foundation surface conditions exist, the surface shall be re-compacted or over-excavated. When the foundation is over-excavated, the resulting excavation may be backfilled with structural fill if the excavation is in existing clay materials or may be backfilled with existing waste if the excavation is in the existing underlying waste mass. Requirements for waste fill will be specified on the project Plans and drawings.

5 STRUCTURAL FILL

Structural fill consists of granular and/or cohesive soils used to construct the perimeter berm, cell floor, and other earthwork. The soil used in the construction of structural fill shall be relatively free of organic material, debris, or other deleterious material such that none of these deleterious materials are visible in the completed layer and do not penetrate the overlying layers. Material used as structural fill must meet the requirements of the project plans and drawings.

5.1 Pre-Construction Testing

For every structural fill material type, source, or when visual observations indicate that a change has occurred in the soils, obtain a soil sample and perform the following tests. These tests must be performed and acceptable results obtained prior to construction.

The CQA Consultant shall perform the following:

1. Index Testing
    - Natural Moisture Content according to ASTM D2216. One test per 5,000 cubic yards of material.
    - Grain Size according to ASTM D6913. One test per 5,000 cubic yards of material.
    - Atterberg Limits according to ASTM D4318. One test per 5,000 cubic yards of cohesive soil material.
    - Unified Soil Classification according to ASTM D2487. One test per 5,000 cubic yards of material.
2. Compaction Testing
    - Modified Proctor Compaction Test according to ASTM D1557. One test per 5,000 cubic yards of material.

3. Strength Testing

Reconstituted test specimens shall be prepared according to the results of the compaction test(s). Initial specimens shall be prepared at 90% of maximum dry unit weight and optimum moisture content according to the results of the ASTM D1557 compaction test(s). Subsequent test specimens may be prepared at different moisture contents to establish the maximum acceptable value for compaction. The laboratory may consider preparing a range of different moisture contents (such as +0, +4, +6% of ASTM D1557 optimum moisture content) for this purpose so that the resulting strength-based compaction criteria are comprehensive. Subsequent test specimens may also be prepared to greater unit weights as needed to achieve the minimum required strength. Reconstituted test specimens shall be subject to one of the following tests, depending on the character of the sample:

- One test per 10,000 cubic yards of material.
- Unconfined Compressive Strength (for samples exhibiting cohesive or cementing behavior only) according to ASTM D2166. A minimum passing result is 3,000 pounds per square foot (psf). If the strength tests fail to meet the minimum required strength, the samples shall be reconstituted to a higher density and retested. Three reconstituted specimens prepared and unconfined compressive strength measured shall constitute one test. The moisture content at which the sample is tested and passes shall be recorded as the maximum acceptable in-place moisture content. The dry unit weight at which the sample is tested and passes shall be recorded as the minimum acceptable in-place dry unit weight.
- As an alternative to the unconfined compressive strength test for samples exhibiting cohesive or cementing behavior, vane shear testing may be used according to ASTM D2573. A minimum passing result is 1,500 pounds per square foot. If the strength tests fail to meet the minimum required values, the samples shall be reconstituted to a higher density and retested. Three reconstituted specimens prepared and vane shear tests measured shall constitute one test. The

moisture content at which the sample is tested and passes shall be recorded as the maximum acceptable in-place moisture content. The dry unit weight at which the sample is tested and passes shall be recorded as the minimum acceptable in-place dry unit weight.

- Direct Shear Strength (for samples exhibiting non-cohesive behavior) according to ASTM D3080. Normal stresses of 2, 10, and 20 pounds per square inch (psi) shall be applied. A minimum passing result of 32 degrees peak friction angle is required. If the strength tests fail to meet the minimum required strength, the samples shall be reconstituted to a higher density and retested. Alternatively, the project-specific soil strength parameters may be evaluated by a qualified geotechnical engineer with respect to the specific berm geometry and anticipated loadings. If this evaluation meets the slope stability criteria from the design slope stability analyses, the test results may be accepted by the CQA Officer. The moisture content at which the sample is tested and passes shall be recorded as the maximum acceptable in-place moisture content. The dry unit weight at which the sample is tested and passes shall be recorded as the minimum acceptable in-place unit weight. For granular soils, preconstruction strength testing frequencies may be reduced if the CQA Officer determines that 1) the initial three strength tests show consistent results, 2) the resulting strength parameters exceed minimum requirements, 3) the source material exhibits consistent gradation (+/- 10% passing each sieve by weight) as determined by ASTM D6913, and 4) the strength parameters are insensitive to dry unit weight.

5.2 Testing During Construction

CQA Consultant

During construction, the CQA Consultant will monitor and document the placement and compaction of the soils used for structural fill. The CQA Consultant will determine the in-place moisture content and dry unit weight of the structural fill material following ASTM D6938, latest edition. In-place tests will be performed at a minimum frequency of

one test for each 1,000 cubic yards placed, with a minimum of one test per day of construction or per lift of clay placed to verify compliance with the requirements of Items 1 and 2 below, unless otherwise indicated in the project plans.

1. Verify that structural fill is compacted to at least the minimum acceptable in-place density determined from the strength testing as described above, unless otherwise indicated in the project plans.

2. Verify that the in-place moisture content is between -4 and +0 percentage points of the maximum acceptable in-place moisture content determined from the strength testing as described above, unless otherwise indicated in the project plans.

3. Perform photographic documentation of construction to confirm conformance to project requirements.

Earthwork Contractor

The Earthwork Contractor will perform all the following during construction of structural fill:

1. Place and compact each lift with a general thickness of 9-inches after compaction for cohesive soils and 12-inches after compaction for granular soils, unless otherwise indicated in the project plans. In cases where the first lift of soil material is placed over geosynthetics, it will be placed at a minimum thickness of 18 inches after compaction, unless otherwise indicated in the project plans.

2. Compact each soil lift thoroughly and uniformly to the required density.

3. Protect the structural fill from detrimental climatic effects during construction. Remove all ice, snow, and frozen soil during cold weather construction prior to placing a lift and do not use any frozen soil in any part of the structural fill.

4. Remove observed roots, rocks, rubbish, or soils that do not meet the specifications of the project plans and drawings.

6 ATTENUATION LAYER

Attenuation layer material consists of cohesive materials which are used for the purpose of the attenuation layer. The soil used in the construction of the attenuation layer shall be relatively free of organic material, debris, or other deleterious material such that none of these deleterious materials are visible in the completed layer and do not penetrate the overlying layers. Material used as attenuation layer will meet the classification requirements of SC, CH, CL, CL/ML, or ML per the Unified Soil Classification System, ASTM D2487. Modified proctor moisture-density correlation (ASTM D1557) will also be tested to determine the maximum dry density of the soil.

6.1 Pre-Construction Testing

For every attenuation layer material type, source, or when visual observations indicate that a change has occurred in the soils, a soil sample will be collected, tested and acceptable results obtained prior to utilizing soil in construction.

The CQA Consultant shall perform the following tests:

1. Index Testing

    - Natural Moisture Content according to ASTM D2216. One test per 5,000 cubic yards of material.

    - Grain Size according to ASTM D6913. One test per 5,000 cubic yards of material.

    - Atterberg Limits according to ASTM D4318. One test per 5,000 cubic yards of material.

    - Unified Soil Classification according to ASTM D2487. One test per 5,000 cubic yards of material.

2. Compaction Testing

   - Modified Proctor Compaction Test according to ASTM D1557. One test per 5,000 cubic yards of material.

3. Strength Testing

   Reconstituted test specimens shall be prepared according to the results of the compaction test(s). Initial specimens shall be prepared at 90% of maximum dry unit weight and optimum moisture content according to the results of the ASTM D1557 compaction test(s). Subsequent test specimens may be prepared at different moisture contents to establish the maximum acceptable value for compaction. The laboratory may consider preparing a range of different moisture contents (such as +0, +4, +6% of ASTM D1557 optimum moisture content) for this purpose so that the resulting strength-based compaction criteria are comprehensive. Subsequent test specimens may also be prepared to greater unit weights as needed to achieve the minimum required strength. Reconstituted test specimens shall be subject to one of the following tests, depending on the character of the sample:

   - One test per 10,000 cubic yards of material.
   - Unconfined Compressive Strength (for samples exhibiting cohesive or cementing behavior only) according to ASTM D2166. A minimum passing result is 3,000 pounds per square foot (psf). If the strength tests fail to meet the minimum required strength, the samples shall be reconstituted to a higher density and retested. Three reconstituted specimens prepared and unconfined compressive strength measured shall constitute one test. The moisture content at which the sample is tested and passes shall be recorded as the maximum acceptable in-place moisture content. The dry unit weight at which the sample is tested and passes shall be recorded as the minimum acceptable in-place dry unit weight.
   - As an alternative to the unconfined compressive strength test for samples exhibiting cohesive or cementing behavior, vane shear testing may be used

according to ASTM D2573. A minimum passing result is 1,500 pounds per square foot. If the strength tests fail to meet the minimum required values, the samples shall be reconstituted to a higher density and retested. Three reconstituted specimens prepared and vane shear tests measured shall constitute one test. The moisture content at which the sample is tested and passes shall be recorded as the maximum acceptable in-place moisture content. The dry unit weight at which the sample is tested and passes shall be recorded as the minimum acceptable in-place dry unit weight.

- Direct Shear Strength (for samples exhibiting non-cohesive behavior) according to ASTM D3080. Normal stresses of 2, 10, and 20 psi shall be applied. A minimum passing result of 32 degrees peak friction angle is required. If the strength tests fail to meet the minimum required strength, the samples shall be reconstituted to a higher density and retested. The moisture content at which the sample is tested and passes shall be recorded as the maximum acceptable in-place moisture content. The dry unit weight at which the sample is tested and passes shall be recorded as the minimum acceptable in-place unit weight.

6.2 Testing During Construction

CQA Consultant

During construction, the CQA Consultant will monitor and document the placement and compaction of the soils used for attenuation layer. The CQA Consultant will determine the in-place moisture content and dry unit weight of the attenuation layer material following ASTM D6938, latest edition. In-place tests will be performed at a minimum frequency of one test for each 1,000 cubic yards placed, with a minimum of one test per day of construction or per lift of clay placed to verify compliance with the requirements of Items 1 and 2 below, unless otherwise indicated in the project plans.

1. Verify that attenuation layer is compacted to at least the minimum acceptable in-place density determined from the strength testing as described above, unless otherwise indicated in the project plans.

2. Verify that the in-place moisture content is between -4 and +0 percentage points of the maximum acceptable in-place moisture content determined from the strength testing as described above, unless otherwise indicated in the project plans.

3. Perform photographic documentation of construction to confirm conformance to project requirements.

Earthwork Contractor

The Earthwork Contractor will perform all the following during construction of the attenuation layer:

1. Place and compact each lift, except the first lift of material over geosynthetics, with a general thickness of 6-inches after compaction. The first lift of soil material over geosynthetics will be placed at a minimum thickness of 12-inches after compaction, compacted with a Caterpillar D6 dozer or equivalent to achieve compaction specifications, unless otherwise indicated in the project plans. All required in-place density testing must meet specifications prior to placement of subsequent lifts.

2. Compact each soil lift thoroughly and uniformly to the required density.

3. Protect the attenuation layer material from detrimental climatic effects during construction by doing all the following:

    - Remove all ice, snow, and frozen soil during cold weather construction prior to placing a lift and do not use any frozen soil in any part of the attenuation layer;

- Recompact any soil lift of which its integrity is so adversely affected by weather that it no longer meets the requirements of the CQA Plan or project plans, at the discretion of the Owner and CQA Officer;

- Provide cover to prevent frost penetration during and following placement during winter construction; and

4. Remove observed roots, rocks, rubbish, or soils that do not meet the specifications of the project plans and drawings.

7 SUBGRADE PREPARATION

Surveyor

Prior to installation of geosynthetic material, the Surveyor shall establish a 100-foot survey grid system and survey locations along the cell perimeter to verify proper line and grade in accordance with the drawings. The grade tolerance for the landfill cell subgrade shall be 0.0 to -0.1 feet for the bottom of the structural fill layer and top of the secondary liner grades and 0.0 to +0.1 for the top of the attenuation layer. The final thickness of structural fill and attenuation layers shall not be less than the design thickness at any point.

CQA Consultant

During preparation of the subgrade for the Geosynthetic Clay Liner (GCL) and/or other geosynthetic installation, the CQA Consultant shall verify that:

1. The Surveyor has documented that the subgrade is properly prepared for the installation of geosynthetic materials and complies with the following:
    - The underlying soil has been smooth drum rolled, adequately compacted or hand-worked and is free of irregularities, protrusions, loose soil and abrupt changes in grade.
    - The surface is free of roots, standing water, stones or desiccation cracks which would adversely affect the performance of the soil.
    - Elevations of the subgrade are verified before geosynthetics installation and are within the tolerance specified.
2. Areas that do not meet the requirements of the CQA Plan are properly repaired and documented.

Earthwork Contractor

The Earthwork Contractor shall perform the following during the preparation of subgrade for geosynthetics installation:

1. Prepare the soil to a smooth surface, using a smooth drum roller or other suitable equipment, to grades which meet the project plans and grade tolerances.
2. Remove debris, organic materials, roots, any angular or sharp rocks or other material which may damage the geosynthetics. All protrusions (stone, etc.) greater than 1-inch in size, or more angular than "sub-rounded" in shape will be removed and the remaining cavity will be backfilled with clay.
3. Repair any surface which exhibits significant desiccation cracking as directed by the CQA Consultant. All backfill soils used for repair shall meet the applicable requirements of the CQA Plan.
4. Protect the prepared surface from damage from desiccation, flooding, and freezing.

Geosynthetics Contractor/Installer

The Geosynthetics Contractor/Installer shall perform the following during the preparation of the subgrade for geosynthetics installation:

1. Inspect the subgrade surface.
2. Accept, with the Geosynthetic Installer's signature on a Subgrade Acceptance Certification form, that the soil surface is acceptable for geosynthetics installation prior to deployment of the geosynthetic material.

8 GEOSYNTHETIC CLAY LINER

Geosynthetic Clay Liners (GCLs) consist of low hydraulic conductivity montmorillonite-rich expansive clay (bentonite) core, supported by geotextile and/or geomembranes which are held together by needling, stitching or chemical adhesives.

8.1 Materials

The GCL Manufacturer shall submit copies of the GCL roll Quality Control (QC) Certificates to the CQA Consultant for review and approval. These certificates shall be supplied at the minimum frequency as detailed in the Standard Practice for Quality Control of Geosynthetic Clay Liners (ASTM D5889). The results reported on the GCL roll QC Certificates shall, at a minimum, meet the property values detailed in the project plans.

The GCL Manufacturer shall submit representative samples taken from the proposed product for direct shear interface testing as required by the drawings. The CQA Consultant shall manage the direct shear testing of the GCL samples, as needed, per the direction of the Design Engineer and in accordance with the design requirements of the project. Proposed GCL rolls shall not be accepted for installation until the manufacturer provides GCL samples representative of the rolls proposed for installation with test results satisfactory to the Design Engineer according to the design requirements. The Design Engineer and the CQA Consultant shall reject any proposed GCL rolls and/or products that do not demonstrate the design requirements when subjected to direct shear interface testing.

8.2 Geosynthetic Contractor Submittals

When providing materials, the Geosynthetic Contractor will submit a schedule of GCL delivery and installation to the Owner prior to the start of the GCL installation.

The CQA Consultant shall verify that all submittals required of the Geosynthetic Contractor have been received and meet the requirements of the CQA Plan. The schedule

and any drawings submitted by the Geosynthetic Contractor, once approved by the CQA Consultant, shall be the basis of GCL deployment.

8.3 GCL Delivery and Storage

Geosynthetic Contractor

The Geosynthetic Contractor shall perform the following:

1. Prepare the GCL roll storage area to protect the GCL from dirt, mud, dust, moisture, and damage prior to deployment (i.e. a well-drained area protected from the elements and high traffic areas.) The GCL rolls shall be protected against adverse weather and other hazards. The rolls should be stored per the GCL Manufacturer's recommendations and to allow access for roll identification. The integrity and legibility of roll labels must be maintained during storage. The rolls must be protected from the elements by the application and maintenance of a proper cover.
2. Be responsible for off-loading the GCL rolls when delivered to the Site.
3. Instruct all personnel of the proper handling techniques so as not to damage the GCL rolls. Lifting of rolls shall be performed so as not to cause damage to the GCL or the protective covering.
4. Assure that the GCL rolls are packaged, shipped, and stored on-site in such a manner that the GCL rolls are not subjected to damage or moisture.
5. Identify and separate all damaged rolls from undamaged rolls and store these rolls at a location designated by the Owner until disposition of the damaged roll(s) is determined.

CQA Consultant

The CQA Consultant shall perform the following:

1. Inspect the GCL roll storage area to verify compliance with the CQA Plan.
2. Visually inspect the surface of all GCL rolls for visible defects and/or damage.

3. Compare the roll number against the GCL Manufacturer's QC Certifications for compliance with the project plans and the CQA Plan. Any damage detected shall be documented and the Geosynthetic Contractor shall be notified.

8.4 GCL Installation

The GCL can be deployed on the soil subgrade which has been inspected and accepted by the CQA Consultant and the Geosynthetic Contractor.

8.4.1 Weather Conditions

The Geosynthetic Contractor shall not deploy the GCL material during precipitation events or on areas with frost or precipitation accumulation. The GCL material shall not be deployed on softened or unstable subgrade.

8.4.2 Placement

GCL panels shall be placed in a controlled manner to prevent damage to the GCL materials or other in-place material. Any such damage shall be repaired by the Geosynthetic Contractor.

Personnel working on the GCL shall not smoke, wear damaging shoes, or engage in other activities which could damage the material. Wheeled vehicle traffic on the GCL panels is prohibited. Permission to drive other equipment on the GCL will only be granted in writing by the manufacturer on a case-by-case basis as outlined in the Manufacturer's installation guidelines. Foot traffic on the GCL panels shall be minimized. The Geosynthetic Contractor shall provide protection of the GCL from equipment or concentrated personnel traffic associated with the project.

GCL panels shall be deployed in such a manner as to minimize seams, be in contact with the material directly beneath it, and preclude folds or wrinkles which may become folds, and bridging. Any wrinkle, fold, or bridging that is observed shall be removed through

realignment of the GCL panel or cutting and repairing the panel in accordance with the CQA Plan.

Each adjoining GCL panel shall be overlapped a minimum of 6-inches on each side and a minimum end-to-end overlap of 12- inches or greater if required by the Manufacturer's installation recommendations. GCL panels on perimeter sideslopes shall be overlapped a minimum of 24-inches. The minimum overlap shall be indicated by a line, or series of lines spaced no more than 50-feet on the exposed surface of the GCL panel. The overlap area shall be free of dirt, gravel, and debris. The overlap shall be shingled following the presumed flow direction. The overlap shall be maintained to prevent seam openings during the installation and covering process. The Geosynthetic Contractor is responsible for assuring that the GCL panels remain overlapped throughout the installation process and until the overlying material is placed. Bentonite clay powder, or other approved supplement, shall be applied between the GCL layers in the overlap area as required by the GCL Manufacturer's specifications and the Geosynthetic Contractor's Installation QC Procedures.

Overlapping seams of adjacent GCL panels will be offset between layers of GCL to ensure that each overlap seam in the upper GCL does not vertically coincide with the overlap seam in the lower GCL (see figure below).

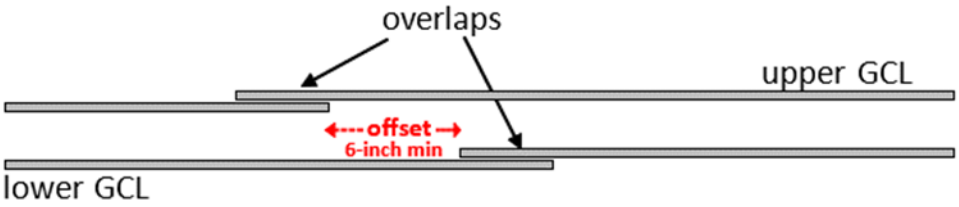


Figure 1. Offset of Overlap Seams between Upper and Lower GCL

Horizontal GCL seams on sideslopes greater than 5 percent shall be minimized. If horizontal seams are required due to the length of the sideslope, horizontal seams shall

be bounded on each side by continuous panels and horizontal seams shall be staggered by a minimum distance of 25-feet. Panels shall be placed such that the up-slope panels overlie those down-slope.

Placement of the GCL shall be in such a manner as to reduce the risk of water infiltration into the bentonite clay portion of the GCL. The GCL shall be covered with geomembrane and/or soil materials as required by the project design, as soon as practical, to provide maximum protection against the elements. The Geosynthetic Contractor shall direct stormwater drainage away from the GCL by construction of temporary stormwater diversion berms or other similar structures.

The Geosynthetic Contractor shall not install more GCL panels than can reasonably be covered with geomembrane that same day. The Geosynthetic Contractor shall also limit the installation of GCL panels during periods of impending bad weather such that the amount of uncovered GCL panels is minimized.

Premature hydration of the GCL prior to completion of the project may be cause for removal of the hydrated material, as directed by the CQA Officer.

If the bentonite clay portion of the GCL becomes prematurely hydrated, the CQA Officer shall inspect the material to ensure the integrity of the GCL has not been compromised. The CQA Officer shall inspect the material to ensure that significant thinning of the GCL has not occurred, that the reinforcing geotextile fibers have not been broken causing the internal strength of the GCL to be reduced, or that other properties of the GCL have not been detrimentally affected. The CQA Officer shall also consult with the Design Engineer to ensure that the stability of the liner has not be affected. If the CQA Officer finds that the integrity and or stability of the GCL has been compromised, the Geosynthetic Contractor shall either install new GCL over the compromised GCL or replace the compromised GCL, as directed by the CQA Officer after consultation with the Design Engineer.

The Geosynthetic Contractor shall clean the work area daily by removing scrap material and other debris associated with geosynthetic activities and dispose of scrap material properly.

The CQA Consultant shall observe and document the GCL deployment to verify that all provisions of the CQA Plan have been followed.

8.4.3 Temporary Anchoring

The Geosynthetic Contractor is responsible for the temporary anchoring of the GCL during construction. The Geosynthetic Contractor shall use sandbags or other means necessary to restrain the GCL without damage and to prevent the material from being pulled from proper alignment. Areas of damage caused by improper or insufficient temporary anchoring shall, as determined by the CQA Consultant and required by the Owner, be repaired or removed, disposed, and replaced by the Geosynthetic Contractor.

8.4.4 Permanent Anchoring

The Earthwork Contractor is responsible for the permanent anchoring of the GCL material. Permanent anchorage shall comply with the project plans and shall be installed as soon as practical following installation of the GCL material and the installation of the overlying materials.

8.4.5 Repairs

Holes, tears, or damage to the GCL material shall be repaired by placing a patch extending a minimum of 1-foot in all directions beyond the edges of the defect. Bentonite clay powder or other approved supplement shall be applied between the GCL panel and the patch as required by the GCL Manufacturer's installation recommendations and the Geosynthetic Contractor's Installation QC Procedures.

GCL panels with holes or tears extending more than 25 percent across the panel width shall be removed and replaced or covered by a single patch. GCL panels, or portions of

panels, which contain excessive patching, as determined by the Owner, shall be removed and replaced or repaired with a single patch.

The CQA Consultant shall verify and document that GCL repairs are performed as required by the CQA Plan.

8.5 GCL Acceptance

The Geosynthetic Contractor shall retain ownership and responsibility of the GCL until acceptance by the Owner or Owner's representative. Acceptance of the GCL will be complete when:

1. All required documentation from the GCL Manufacturer and the Geosynthetic Contractor has been received and accepted.
2. The geosynthetic installation is complete, the GCL material is intact and the GCL is not in a hydrated condition.
3. All repairs have been completed and tested.

9 GEOMEMBRANE

Geomembranes are synthetic membrane liners with very low permeability. They are used in landfill lining, capping and other fluid control systems. This section is applicable to field and factory fabricated panels of smooth and textured linear low density polyethylene (LLDPE) and high density polyethylene (HDPE) materials but is not valid when using geomembranes manufactured with other materials such as polyvinyl chloride (PVC).

9.1 Materials

9.1.1 Resin

The geomembrane manufacturer shall provide the following information prior to delivery of the geomembrane to the Site:

1. The resin supplier's name, resin production facility, resin identification, and production date of the resin.

2. A copy of the quality control certificates issued by the resin supplier.

3. Results of tests conducted by the resin supplier to verify the raw material quality including specific gravity and carbon black content.

4. A certification from the resin supplier that the polymer used in the geomembrane meets the criteria of the specifications.

5. Reports of tests or a certification by the manufacturer verifying the quality of the raw materials including specific gravity and melt flow index. These tests shall be performed at a frequency of at least one per resin batch but not less than once per 180,000 pounds of resin used in the manufacturing of the geomembrane.

6. A certification that reclaimed polymer is not added to the resin and that polymer recycled during the manufacturing process does not exceed 2 percent of the resin.

The CQA Consultant shall review the submittals provided by the manufacturer to verify compliance with the requirements of the specifications.

9.1.2 Geomembrane

Geomembrane Manufacturer

The geomembrane manufacturer shall perform the following:

1. Provide a certification that the geomembrane manufactured for this project meets the following criteria:

    a) The geomembrane contains no more that 1 percent by weight of additives, fillers, or extenders, excluding carbon black.

    b) The geomembrane is without holes, cracks, thin spots, tears, punctures, blisters, undispersed raw materials, roughness other than produced due to texturing, or any other indication of contamination.

    c) HDPE geomembrane must conform to the minimum properties of the project plans and the latest revisions to Geosynthetic Research Institute Test Method GRI-GM13.

2. Provide a copy of the manufacturer's geomembrane properties and quality control requirements, and instructions for geomembrane delivery, storage and handling.

3. Provide QC Certificates which represent each roll of geomembrane to be delivered to the job site. Each QC Certificate shall include:

    a) Roll number, geomembrane type, thickness, manufacturer, date of production, and roll dimensions. Each finished roll shall be identified by a number corresponding to the batch of resin used.

    b) The manufacturer's test results on samples from rolls from the same production lot, which verify that the rolls meet the requirements of the project plans. These

samples shall be tested to confirm that the requirements of the project plans are met, except that testing for environmental stress crack resistance and low temperature impact need not be performed. The test data shall be identified by roll number.

c) Certification that the roll meets the requirements of the project plans.

4. The manufacturer is responsible for the production of extrusion beads and/or welding rod from polyethylene resin which shall meet the requirements of the project plans.

CQA Consultant

The CQA Consultant shall verify that the manufacturer's submittals meet the requirements of the project plans.

The Manufacturer shall also submit representative samples taken from the proposed product for direct shear interface testing as directed by the CQA Consultant. The CQA Consultant shall manage the direct shear testing of the geomembrane samples, as needed, per the direction of the Design Engineer and in accordance with the design requirements. Proposed geomembrane rolls shall not be accepted for installation until the manufacturer provides geomembrane samples representative of the rolls proposed for installation with test results satisfactory to the Design Engineer according to the design requirements. The Design Engineer and the CQA Consultant shall reject any proposed geomembrane rolls and/or products that do not demonstrate the design requirements when subjected to direct shear interface testing.

9.2 Geosynthetics Contractor Submittals

Geosynthetics Contractor

The Geosynthetics Contractor shall submit to the Owner the following information prior to the start of geomembrane installation:

1. Schedule of geomembrane installation.

2. Panel layout drawings.

3. Drawings of construction details for anchor trenches, sumps and other features as required by the CQA Consultant.

4. A resume for the Master Seamer to be assigned to the project. A Master Seamer must be present on-site during all geomembrane seaming operations and shall have completed seaming on at least 1,000,000 square feet of polyethylene geomembrane, using both extrusion and fusion welding methods.

5. A resume for each Seamer to be assigned to the project. Each Seamer shall have completed seaming on a minimum of 100,000 square feet of polyethylene geomembrane.

6. A resume for each Seamer subsequently assigned to the project shall also be submitted. Seamer apprentices or assistants do not need the requisite experience if they are working under the direct supervision of a qualified Seamer.

CQA Consultant

The CQA Consultant shall verify that all submittals required of the Geosynthetics Contractor have been received and meet the requirements of the CQA Plan. The schedule and drawings submitted by the Geosynthetics Contractor, once approved by the CQA Consultant, shall be the basis of geomembrane deployment.

9.3 Geomembrane Delivery and Storage

The Contractor handling the supplied materials shall perform the following:

1. Assure that the geomembrane rolls or panels are packaged, shipped, off-loaded, and stored on-site in such a manner that the rolls are not subjected to damage.

2. Prepare the roll storage area to protect the geomembrane from dirt, mud, dust, and damage at all times prior to deployment. The geomembrane shall be protected against adverse weather, and other hazards.

3. Be responsible for off-loading of the geomembrane rolls when delivered to Site.
4. Instruct all personnel of the proper handling techniques so as not to damage any of the geomembrane rolls.
5. Assure that the geomembrane material is not folded. Folded geomembrane material shall be rejected.
6. Stack the geomembrane rolls per the manufacturer's recommendations but no more than five rolls high.
7. Identify and separate all damaged rolls from undamaged rolls and store these rolls at a location designated by the Owner until disposition of the damaged rolls is determined.

CQA Consultant

The CQA Consultant shall perform the following:

1. Inspect the geomembrane roll storage area to verify compliance with the CQA Plan.
2. Document the following information for all liner material delivered to the Site:
    - Storage location,
    - Name of the manufacturer and fabricator,
    - Name, type and thickness of the liner,
    - Batch code,
    - Roll number or Panel number (if prefabricated),
    - Date of fabrication, and
    - Physical dimensions.
3. Observe the material off-loading and storage of geomembrane rolls to verify compliance with the requirements of the CQA Plan.

4. Visually inspect the surface of all geomembrane rolls for visible defects and/or damage. Any damage observed shall be documented.

9.4 Geomembrane Installation

9.4.1 Anchor Trench

CQA Consultant

The CQA Consultant shall verify that the anchor trench has been constructed according to the requirements of the project plans and drawings. The CQA Consultant shall observe and document the placement of the geomembrane in the anchor trench and the placement of the anchor trench backfill material as required by the project plans and drawings. The anchor trench shall not be backfilled until the destructive and non-destructive testing of the seams to be buried have met requirements of the CQA Plan.

Earthwork Contractor

The Earthwork Contractor shall perform the following:

1. Construct anchor trenches to the nominal dimensions shown on the project plans and drawings plans with rounded edges and maintain trenches until properly backfilled.
2. Provide for adequate drainage of anchor trenches.
3. Backfill the anchor trench according to the drawings and the CQA Plan.

9.4.2 Weather Conditions

The CQA Consultant shall verify and document that geomembrane seaming is performed only during weather conditions which are considered acceptable, as described in the following sections.

All reasonable efforts will be made to install geomembrane when the geomembrane sheet temperature and the ambient temperature (measured 1 to 3 feet above the geomembrane) are above 32 degrees Fahrenheit. Welding performed at temperatures below 32 degrees Fahrenheit will only occur as allowed by the manufacturer's installation

guidelines and with authorization by the Owner or CQA Consultant. If authorized, welding at temperatures below 32 degrees Fahrenheit shall be performed in accordance with Geosynthetic Research Institute Test Method GRI-GM9 and in accordance with the following procedures:

1. CQA Consultant shall continue to monitor and record the ambient temperature and geomembrane sheet temperature hourly during liner installation or field seaming. If seaming is occurring in an enclosed structure, recorded temperatures shall be those in the enclosure. Maximum geomembrane sheet temperatures will be determined based on the geomembrane manufacturer's installation guidelines.
2. Extrusion welding shall be performed only with a hot air pre-heat operating immediately in front of the extrusion nozzle.
3. A specimen will be obtained from the end of each fusion welded seam that exceeds 25 feet in length, exclusive of cross-seams. The specimen will be hand-tested for peel adhesion. The result of peel testing will be recorded as a pass/fail on the CQA Consultant's Panel Seaming Form.
4. Destructive sample test frequency may be increased based on observation and determinations of the CQA Consultant.

Cold weather seaming procedures may be revised or modified with approval of the CQA Consultant.

Geosynthetics Contractor

The Geosynthetics Contractor shall:

1. Not weld during precipitation events, in the presence of excess moisture (i.e. heavy fog or dew, in an area of ponded water), or during conditions of winds which affect the control of the welding temperatures (unless engineering controls are installed).

2. Ensure that field seaming is not performed in adverse weather conditions that could impair the quality of the geomembrane installation unless protective structures or other methods are used to maintain seam integrity during construction.

9.4.3 Deployment Methods

The Geosynthetics Contractor shall install the geomembrane according to the panel layout drawings previously submitted to the Owner. Any changes to the panel layout must be approved by the Owner. The geomembrane shall be deployed so that it is in a loose and relaxed condition at the time of geomembrane seaming.

9.4.4 Prevention of Damage

The Geosynthetics Contractor shall be responsible to assure that:

1. Installation personnel do not use equipment or tools that may damage the geomembrane.
2. No installation personnel shall smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane.
3. The method used to unroll the panels shall not cause scratches or crimps in the geomembrane and shall not damage the underlying materials.
4. The method used to deploy the geomembrane shall minimize wrinkles.
5. Bridging of grade changes by the geomembrane shall be removed as directed by, and at the discretion of, the CQA Consultant.
6. Adequate loading (i.e. sandbags or similar items that will not damage the geomembrane) shall be placed on the geomembrane to prevent uplift and relocation of panels by wind.
7. Direct contact with the geomembrane shall be minimized (i.e. geomembrane in traffic areas shall be protected by geotextiles, additional geomembrane layers, or other materials approved by the CQA Consultant).

8. Use of wheeled vehicles driving on underlying geosynthetic material is prohibited.

9.4.5 Field Panel Identification and Deployment

The CQA Consultant or their representative shall assign each field panel a unique identification number consistent with the panel layout drawings submitted to the Owner. The Geosynthetics Contractor shall deploy field panels according to the panel layout drawing. Deviations from the approved panel layout drawing shall be approved in advance by the CQA Consultant. Each panel deployed shall be recorded by the Geosynthetics Contractor. Identification number, location, and date shall be recorded.

The CQA Consultant shall perform the following activities regarding geomembrane placement:

1. Verify that each panel is clearly identified, and its location noted.
2. Verify and document that the panel deployment proceeds according to the panel layout drawing and that pertinent information including panel overlap is recorded.
3. Visually observe the geomembrane for uniformity, damage and imperfections, including any of the following: holes, cracks, thin spots, tears, punctures, blisters or foreign material.

9.4.6 Geomembrane Panel Thickness Measurements

Panel thickness measurements shall be provided by the geomembrane manufacturer on the material certifications. Panels suspected to not meet the requirements based on field observations may be removed.

9.5 Seaming Specifications

9.5.1 General Procedures

The Geosynthetics Contractor shall perform the following:

1. Overlap (shingle) the geomembrane panels such that any fluid flowing across the seams would flow from the top panel to the underlying panel.
2. Orient all seams located on slopes steeper than 5 percent parallel to the fall of the slope, unless approved by the Design Engineer. Horizontal seams on sideslopes greater than 5 percent should be minimized. If horizontal seams are required due to the length of the sideslope, horizontal seams shall be bounded on each side by continuous panels and horizontal seams shall be staggered by a minimum distance of 25-feet. Panels shall be placed such that the up-slope panels overlie those down-slope. Geomembrane panels placed on slopes shall extend a minimum 5-feet beyond the toe of the slope.
3. Clean the seam area such that the seam area is free of moisture, dust, dirt, debris, and foreign matter of any kind prior to seaming.
4. Align seams with the least possible number of wrinkles and "fish mouths". Fish mouths are to be cut, removed, and patched.
5. Field seam only in weather conditions which shall not impair the quality of the geomembrane, unless approved by the Owner.

The CQA Consultant shall verify that all geomembrane Seamers meet the experience requirements of the CQA Plan and that a Master Seamer who meets the experience requirements of the CQA Plan is present on-site whenever seaming is conducted. The CQA Consultant shall observe and document the geomembrane seaming activities to verify that the requirements of the CQA Plan are met.

9.5.2 Trial Welds

The Geosynthetic Contractor shall perform the following:

1. Begin geomembrane seaming only after Seamers and their assigned seaming equipment have successfully completed trial welds.
2. Perform trial welds at: (1) at the beginning of each seaming period; (2) at least once each 5-hour period; (3) after extended periods of shutdown; or (3) as directed by the CQA Consultant if materials, equipment or environmental conditions have changed since the last successful trial weld.
3. Perform trial welds using similar materials and in the same surroundings and environmental conditions as the production welds.
4. The trial weld specimen shall be a minimum of 10-feet long for self-propelled seaming(fusion) devices, and a minimum of 3-feet long for hand-held (extrusion) devices.
5. One-inch wide cutouts of the trial weld shall be subject to shear and peel adhesion testing in the field. A minimum of two cutouts shall be tested for bonded seam strength (shear) and an additional three cutouts shall be tested for peel adhesion using a properly calibrated digital readout tensiometer and the testing procedures of ASTM D6392.

A trial weld sample shall be considered passing, according to the following table (Table 9.1), for all specimens tested in shear and peel adhesion:

Table 9.1

Smooth or Textured Geomembrane Seam Strength Requirements

Property	Criteria		
	40 mill HDPE	60 mil HDPE	80 mil HDPE
1. Shear Strength (lb./inch)	80	120	160
2. Peel Adhesion (lb./inch) - Fusion	60	91	121
3. Peel Adhesion (lb./inch) - Extrusion	52	78	104

For trial welds, all specimens must meet the seam strength criteria with 0 percent incursion into the welded area.

A failed trial weld shall not be retested. The seaming equipment and the Seamer that produced the failed trial weld shall not be allowed to weld the geomembrane until deficiencies or conditions are corrected and two consecutive successful trial welds are achieved.

The CQA Consultant shall observe the trial weld preparation and testing and verify that requirements of the CQA Plan are met. The CQA Consultant shall document trial welds, test results, and appropriate responses.

9.5.3 Seaming and Testing Equipment

Approved processes for field seaming are fusion and extrusion welding. Fusion welding shall be the primary (production) seaming method with extrusion welding used for geomembrane repairs unless specified otherwise by the Design Engineer. Proposed alternate processes shall be documented and submitted by the Geosynthetics Contractor to the CQA Consultant for approval prior to use in the field.

The Geosynthetics Contractor shall:

1. Use dual track fusion welders and extrusion welders for field seaming. Extrusion welders shall be equipped with gauges to indicate the temperature in the welder and in the pre-heat nozzle.
2. Provide a properly calibrated field tensiometer for on-site shear and peel adhesion tests. This device shall meet the requirements for testing shear and peel adhesion according to ASTM D6392.
3. Provide an air pressure/vacuum pump, air pressure measuring devices, and vacuum testing viewing boxes with the capabilities for air pressure and vacuum box nondestructive testing as required by the CQA Plan.
4. Provide a coupon die and press to produce test specimens (coupons) in the field for shear and peel adhesion testing.
5. Provide protective lining material and a splash pad large enough to collect spilled fuel under generators if portable gasoline-powered electric generators are used.

9.5.4 Fusion Welding Seam Preparation

The Geosynthetics Contractor shall:

1. Overlap the geomembrane panels a minimum of 4 inches.
2. Clean the geomembrane seam area prior to seaming to assure that the area is clean and free from moisture, dirt, dust, and debris. No grinding is required for fusion geomembrane welding.
3. Use a protective, moveable layer (“rub sheet”) directly below the overlap of geomembrane to be seamed, as required, to prevent build-up of moisture between the panels.
4. The welding technician shall legibly mark the following information on the geomembrane at the start of each seam:

- Date and start time,
- Technician identification, and
- Welding machine identification.

The CQA Consultant shall verify and document that geomembrane overlapping and preparation for fusion seaming is performed as required by the CQA Plan.

9.5.5 Extrusion Welding Seam Preparation

The Geosynthetics Contractor shall:

1. Overlap the geomembrane panels to be welded a minimum of 3-inches. Unless approved by the Engineer, extrusion welding shall not be used as the primary (production) field seaming method.
2. Clean the geomembrane panels prior to seaming to assure that the area is clean and free of moisture, dirt, dust, and debris.
3. For geomembranes greater than 60 mils in thickness, the edge of the upper geomembrane to be extrusion welded shall be beveled with a hand grinder at a 45-degree angle prior to heat tacking into place.
4. Weld the geomembrane within 15 minutes of grinding and cover all abraded areas with extrudate.
5. Purge the extruder prior to beginning the seam to remove all heat degraded extrudate from the barrel of the extrusion machine.
6. Keep the welding rod clean and dry.
7. For the age of geomembrane older than two years at the time of tie-in installation, the extrusion welds serving as a tie-in between two cells will be capped.
8. The welding technician shall legibly mark the following information on the geomembrane at the start of each seam or repair:

- Date and start time,
- Technician identification, and
- Welding machine identification.

The CQA Consultant shall verify and document that geomembrane seam overlapping and preparation for extrusion welding is performed as required by the CQA Plan.

9.6 Non-Destructive Seam Testing

The Geosynthetic Contractor shall perform non-destructive tests on all field seams and repairs over their full length. Test equipment required for non-destructive testing shall be furnished and operated by the Geosynthetics Contractor. Where the seam cannot be non-destructively tested, as determined by the CQA Consultant, the Geosynthetics Contractor shall submit to the CQA Consultant an alternate testing method for approval. Non-destructive testing shall be performed as the seaming work progresses, not at the completion of all field seaming.

The CQA Consultant shall observe and document the results of all non-destructive seam testing. The CQA Consultant shall verify that the test methods meet the requirements of the CQA Plan and document that all seams which fail non-destructive tests are repaired according to the CQA Plan.

9.6.1 Air Pressure Testing

Air pressure testing is applicable to dual track fusion welding which produces a double seam separated by an air channel.

The Geosynthetics Contractor shall perform the following:

1. Conduct air pressure testing wherever determined feasible by the CQA Consultant on dual track fusion seams.

2. Use the following equipment for air pressure testing of dual track fusion seams:

    a) An air pump or pressure tank equipped with a pressure gauge capable of generating and sustaining a minimum pressure of 50 psi and mounted on a cushion to protect the geomembrane. The air pump may be manual or motor driven.

    b) A manometer or other pressure measuring device capable of indicating the air pressure in 1.0 psi increments within the test range and equipped with a sharp needle.

3. Use the following procedures when performing air pressure testing:

    a) Seal the air channel at both ends of the seam area to be tested.

    b) Insert a manometer or other approved pressure gauge directly into the air channel created by the dual track fusion welding. Means of pressurizing must be provided.

    c) Energize the air pump to a minimum pressure of 30 psi. The air pump valve shall be closed and the pressure shall be allowed to stabilize for 2 minutes. After the stabilization period, the pressure must be sustained for an additional 5 minutes.

    d) If there is a loss of pressure exceeding 3 psi, or if the pressure does not stabilize, the reason for failure shall be investigated and the faulty area shall be located, repaired, and the seam retested.

    e) Ensure that the air channel is not obstructed by releasing air from the end of the seam opposite the manometer and observing the resulting pressure drop on the manometer.

    f) Remove the manometer and repair the holes.

9.6.2 Vacuum Box Testing

Vacuum box testing is applicable to extrusion welded seams. Fusion welded seams which cannot otherwise be air pressure tested may be vacuum box tested with prior approval of the CQA Consultant.

The Geosynthetics Contractor shall:

1. Use the following equipment for vacuum pressure testing:
    a) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft gasket attached to the bottom, a valve assembly, and a vacuum gauge.
    b) A vacuum pump assembly equipped with a pressure controller and pipe connections.
    c) Additional fittings and connections as needed to perform the tests.
2. Use the following procedure when performing the vacuum pressure testing:
    a) Trim excess geomembrane sheet overlap, if any.
    b) Apply a soapy solution to a length of the geomembrane approximately 12 inches by 48 inches along the seam (approximately the length of the vacuum box).
    c) Place the vacuum box over the area wetted by the soapy solution and apply pressure to seal the box over the seam. Apply a minimum vacuum pressure of five pounds per square inch gauge (psig) to the interior of the box.
    d) For a period of approximately 10 seconds, examine the geomembrane seam through the viewing window for the indication of soap bubbles.
    e) If no bubbles appear, release the vacuum and move the vacuum box to the next area of the seam, with a minimum 3-inch overlap. Repeat the process.
    f) Mark all areas where soap bubbles formed and repair the marked seam as required. Retest the repaired seam.

9.7 Destructive Seam Testing

The purpose of destructive testing is to evaluate seam strength. Destructive seam testing shall be performed as the seaming work progresses, not at the completion of all field seaming.

9.7.1 Sampling

Geosynthetic Contractor

The Geosynthetic Contractor shall:

1. Obtain at least one destructive test sample per day per seaming crew or machine, or every 500-feet of seam, whichever is greater, from locations specified by the CQA Consultant. Additional destructive test samples shall be taken as directed by the CQA Consultant.
2. Cut the destructive test samples as seaming progresses in the locations designated by the CQA Consultant. The destructive test samples shall be nominally 12-inches wide by 42-inches long, with the seam centered lengthwise. One cutout from each end of the sample shall be field tested prior to destructive testing. The remaining sample shall be cut into thirds (two 15-inch samples, one 12-inch sample), with two pieces given to the CQA Consultant (one 15-inch laboratory sample and one 12-inch archive sample) and the other sample retained by the Geosynthetics Contractor.
3. Label all samples with the location and seam number and record the date, location, panel numbers, seam number, welding machine and welding technician.
4. Repair all holes in the geomembrane resulting from obtaining the destructive test samples. All extrusion welded patches shall be vacuum tested.

CQA Consultant

The CQA Consultant shall:

1. Determine and identify the locations for destructive test sampling.

2. Verify and document that the Geosynthetic Contractor's destructive sampling and testing procedures meet the requirements of the CQA Plan.

3. Send the destructive test samples to an off-site laboratory for testing described below. On-site destructive testing performed in a controlled environment by qualified individuals of the CQA Consultant may be utilized in place of an off-site laboratory, if approved by the CQA Officer.

4. Verify and document that all destructive test results meet the requirements of the CQA Plan. Observe and document all subsequent activities relating to the repair and patching of the destructive test sample location.

5. Locate and document the destructive test sample locations on the panel layout drawing.

9.7.2 Testing

The CQA Consultant shall perform the following:

1. Test destructive samples for bonded seam strength (shear) and for peel adhesion. Samples from dual track welds shall be tested for peel adhesion on both tracks of the seam.

2. Cut out ten, 1-inch wide specimens from the destructive test sample. Test five specimens for shear and five specimens for peel strength in accordance with ASTM D6392. The passing criteria is as follows:

   a) For peel testing, five out of five test specimens must each pass the criteria listed in Table 9.1, with 25 percent or less seam separation as a percentage of the total weld area.

   b) For shear testing, five out of five test specimens must each pass the criteria listed in Table 9.1 with 50 percent seam elongation achieved at break and 25 percent or less seam separation as a percentage of the total weld area

c) Geomembrane destructive sample test results must conform to the minimum requirements of the CQA Plan and the latest revisions to Geosynthetics Research Institute Test Method GRI-GM19a.

9.7.3 Destructive Test Failure

The Geosynthetic Contractor shall ensure that the following procedures are followed if a sample fails a field destructive test:

1. Retrace the welding path to an intermediate location (approximately 10-feet from each side of the failed test), at the CQA Consultant's discretion, and take additional destructive test samples. If the bounding test passes the CQA Plan criteria, then the seam shall be repaired between that location and the original failed test location. If the test fails, the process is repeated. All failed test samples must be bounded by passing test samples or bounded by the point at which the seamer/seaming device was taken out of service.
2. With approval from the CQA Consultant, a laboratory destructive test of a previously performed trial weld may be used as a bounding sample for a failed destructive test.
3. Over the length of seam failure, either cut out the old seam, reposition the panel and re-seam, or install a cap-strip, as required by the CQA Consultant.
4. In lieu of installing a cap-strip over a failed fusion-welded seam, the Geosynthetics Contractor may elect to extrusion weld the upper flap of the fusion seam to the lower geomembrane, provided that the upper flap has a 2-inch minimum extension beyond the fusion weld.
5. Vacuum test all extrusion weld repairs. Additional destructive samples shall be taken at the discretion of the CQA Consultant.

9.8 Destructive Testing of Tie-in Seams to Existing Geomembrane

The following section applies to tie-in seams with existing cells where the existing geomembrane has been in place for more than 2 years.

Trial welds shall be conducted using the same geomembrane material as the actual production seams, e.g. new geomembrane to existing geomembrane, following the requirements of Section 9.5. The production weld shall be destructively and nondestructively tested following the requirements of Sections 9.6 and 9.7. See Figure 2 below for identification of the production weld.

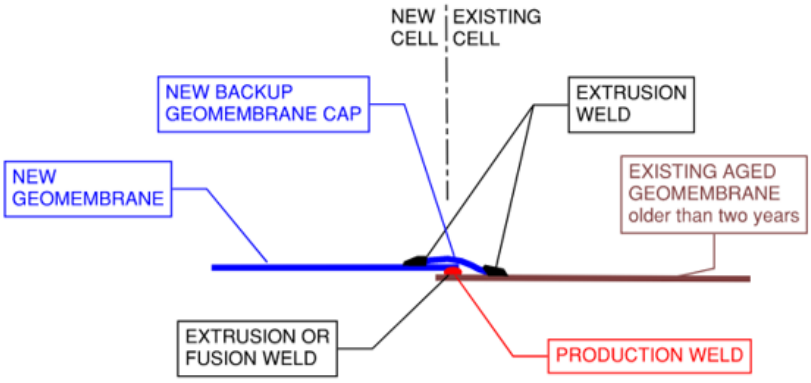


Figure 2. Location of Production Weld in Tie-in Seams to Existing Geomembrane

Based on destructive test results, any failed production weld shall be resampled, tested, and reconstructed per the requirements of Section 9.7. Additional destructive testing may be performed on any production weld geomembrane cap at the discretion of the CQA Consultant (Figure 3 below).

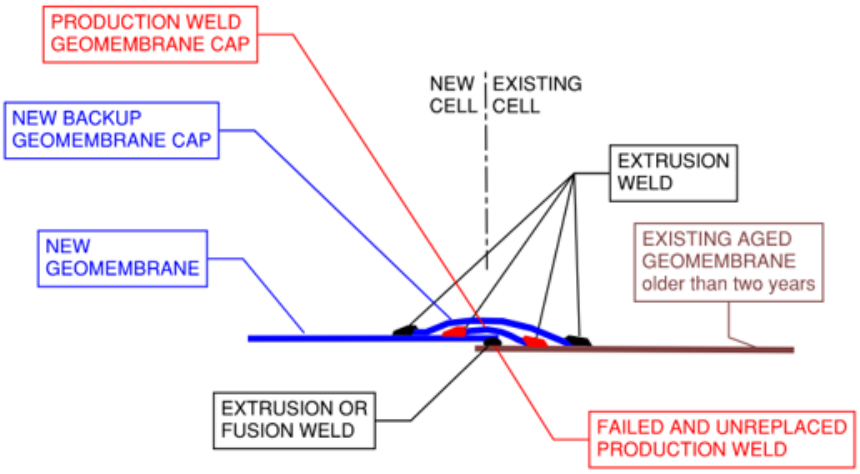


Figure 3. Location of Production Weld Geomembrane Cap

Upon receipt of successfully passing production weld destructive testing results, a final backup geomembrane cap will be extrusion welded over the entire length of the production weld, including over any production weld geomembrane cap. The final backup geomembrane cap shall be nondestructively tested per the requirements of Section 9.6. Destructive testing of the final backup geomembrane cap is not required.

9.9 Defects and Repairs

The CQA Consultant shall perform the following:

1. As each geomembrane panel is deployed, or as soon as possible after deployment, observe the geomembrane surface for damage and imperfections including holes, cracks, thin spots, tears, punctures, blisters, and foreign material. The surface of the geomembrane shall be clean at the time of the CQA Consultant's observations.
2. Identify, mark, and observe non-destructive testing of suspect locations.
3. Verify and document that all defects found as a result of: (1) the inspection and testing of suspected areas;(2) non-destructive tests; (3) destructive tests; and (4) any other inspection or observation, are identified for repair.

4. Verify and document that all identified defects are properly repaired in accordance with the CQA Plan. Repair equipment, materials, and procedures are subject to the approval of the CQA Consultant.
5. Verify and document that all repairs are non-destructively tested and either pass the tests or are again repaired and tested until passing test results are achieved.
6. Record the locations and types of defects and record the repairs and non-destructive testing at these locations.

The Geosynthetic Contractor shall perform the following:

1. Clean the geomembrane surface prior to inspection of the geomembrane by the CQA Consultant. The geomembrane surface shall be brushed, blown, or washed if the amount of dust or mud inhibits observations.
2. Perform non-destructive tests of each suspect location in the presence of the CQA Consultant. Each location that fails the non-destructive tests shall be marked by the CQA Consultant and repaired according to the procedures in the CQA Plan.
3. Repair any portion of the geomembrane which exhibits a flaw or fails a destructive or non-destructive test as follows:
    a) Small holes shall be repaired by extrusion welding. If the hole is larger than 0.25-inches, the hole shall be patched.
    b) Failed seams shall be repaired in accordance with the sections above.
    c) Tears shall be repaired by patching. If the tear is on a slope or an area of stress and has a sharp edge, the tear shall be rounded by cutting prior to patching.
    d) Blisters, large holes, undispersed raw materials, and contamination by foreign matter shall be repaired by large patches.
    e) Surfaces of the geomembrane which are to be patched shall be abraded and cleaned no more than 15 minutes prior to the repair. All abraded areas shall be

covered by extrudate. No more that 5-10 percent of the thickness shall be removed by abrading.

f) Folded geomembrane that has been creased or otherwise damaged shall be replaced. Patching shall be permitted with the approval of the CQA Consultant.

g) Patches shall be round or oval shaped, made of the same geomembrane, and extend a minimum of 6-inches beyond the edge of the defect. All patches shall be of the same compound and thickness as the geomembrane being repaired.

h) All surfaces must be clean and dry at the time of repairs. All seaming equipment used in the repairs must be approved by the CQA Consultant. All repair procedures, materials, and techniques must be approved by the CQA Consultant.

4. Perform non-destructive tests on each repair location. Repairs that pass the non-destructive test shall be noted as an acceptable repair. Failed tests indicate that the repair shall be repeated and retested until a passing test is achieved. The CQA Consultant may also require a destructive seam test sample to be taken from a repaired seam. Acceptance of the repaired seam shall then also be subject to the sampling, testing, and acceptance criteria of the CQA Plan.

9.10 Geomembrane Acceptance

The Geosynthetic Contractor shall retain ownership and responsibility for the geomembrane until acceptance by the Owner. The Owner shall accept the geomembrane installation when:

1. All required documentation from the geomembrane manufacturer and the Geosynthetics Contractor has been received and accepted.
2. The geomembrane installation is complete.
3. Verification that all field seams and repairs, including associated testing is complete.
4. The geosynthetic installation has been accepted in a final approval notice signed by the Geosynthetics Contractor and the CQA Consultant.

10 GEOGRID, GEONET, GEOTEXTILE, AND GEOCOMPOSITE MATERIALS

The design may include geogrid, geonet, geotextile, and/or geocomposite materials as indicated in the project plans and drawings for drainage and stability purposes in the landfill foundation liner and final cover system. This section of the CQA Plan addresses geogrid, geonet, geotextile, and geocomposite materials for use in the landfill liner system and/or the final cover.

10.1 Submittals

The manufacturer of the geogrid, geonet, geotextile, and geocomposite shall submit the following:

1. Manufacturer's specifications and certification stating that the materials meet or exceed the applicable requirements of the project plans and drawings.
2. Manufacturer's instructions for handling and storage of the geogrid, geonet, geotextile, and/or the geocomposite.
3. Manufacturer's QC test results for geogrid, geonet, geotextile, and/or geocomposite. These test results shall identify each roll of geocomposite with the corresponding roll identifications of the geonet and geotextiles incorporated therein such that the results of the following tests can be positively correlated with the geocomposite roll identification. The testing shall be performed by the manufacturer as follows:
    a) The geogrid shall be sampled at a minimum frequency of one sample for each 100,000 square feet delivered and shall be tested by the manufacturer to verify that the requirements in the project plans and drawings are met.
    b) The geonet shall be sampled at a minimum frequency of one sample for each 100,000 square feet delivered and shall be tested by the manufacturer to verify that the requirements in the project plans and drawings are met.
    c) The geotextile shall be sampled at a minimum frequency of one sample for each 100,000 square feet delivered and shall be tested by the manufacturer to verify

that the requirements in the specifications are met. Testing for UV Resistance is not required. Certification by the manufacturer that the UV Resistance requirement is achieved shall be provided.

d) The geocomposite shall be sampled at a minimum frequency of one sample for each 100,000 square feet delivered. The geonet and the geotextile from the geocomposite samples shall be certified that the requirements of the project plans and drawings are met.

The CQA Consultant shall verify and document that the information submitted by the manufacturer meets the requirements of the project plans and drawings.

The Manufacturer shall also submit samples taken from the proposed product rolls for direct shear interface testing as requested by the CQA Consultant. The CQA Consultant shall manage the direct shear testing of the geosynthetic samples, as needed, per the direction of the Design Engineer. Proposed geosynthetic rolls shall not be accepted for installation until the manufacturer provides geosynthetic samples representative of the rolls proposed for installation with test results satisfactory to the Design Engineer according to the design requirements. The Design Engineer and the CQA Consultant shall reject any proposed geosynthetic rolls and/or products that do not demonstrate the design requirements when subjected to direct shear interface testing.

10.2 Materials

10.2.1 Geogrid

The geogrid shall be comprised of geosynthetic materials and shall meet the minimum average roll values outlined in the project plans and drawings.

10.2.2 Geonet

The geonet shall be comprised of HDPE and shall meet the minimum average roll values outlined in the project plans and construction drawings.

10.2.3 Geotextile

The geotextile shall consist of continuous filament, needle punched, non-woven material and shall meet the minimum average roll values outlined in the project plans and drawings.

10.2.4 Geocomposite

The geocomposite shall be comprised of a geonet heat-bonded to geotextile. The geonet and geotextile shall meet the requirements of the project plans and drawings. Additionally, the geocomposite shall meet the requirements of the project plans and drawings.

10.3 Material Delivery, Handling, and Storage

The Geosynthetics Contractor shall perform the following:

1. Assure that the geogrid, geonet, geotextile, and geocomposite rolls are packed, shipped, off-loaded and stored by appropriate methods to prevent damage. The Geosynthetics Contractor shall be responsible for replacing any damaged or unacceptable material.
2. Protect the materials from mud, dust, dirt, and other damaging conditions. The manufacturer's procedures for shipping, handling, and storage shall be followed.
3. Assure that the geogrid, geonet, geotextile, and the geocomposite rolls are clearly labeled with the manufacturer's name, roll number, lot number, and batch number. Information shall be provided by the manufacturer which clearly identifies the corresponding roll information for the geonet and geotextiles incorporated into the geocomposite.

The CQA Consultant shall observe the off-loading of the geogrid, geonet, geotextile, and geocomposite and shall visually inspect the surface of all rolls for defects and/or damage. The CQA Consultant shall document any observed damage to any of the rolls.

10.4 Material Deployment

The Geosynthetics Contractor shall perform the following:

1. Assure that all geogrid, geonet, geotextile, and geocomposite materials are handled in a manner to prevent damage.
2. Assure that no materials are placed over the geomembrane until all required documentation regarding the geomembrane installation is complete.
3. Assure that the surface on which the materials are to be placed does not contain stones or excessive dust that could cause damage to any geosynthetic component.
4. In periods of high winds, weight all geosynthetic components with sandbags or similar material. The Geosynthetics Contractor shall be responsible for damage to the geosynthetic components resulting from wind damage.
5. Cut the geogrid, geonet, geotextile, and geocomposite materials using an approved tool. Care must be taken to protect the underlying geomembrane when the materials are being cut in-place.
6. Use equipment to deploy the geosynthetic components that shall not cause damage to any material.
7. Assure that no personnel working on the geosynthetic materials shall smoke, wear damaging shoes, or engage in other activities that could damage the materials.
8. Use of wheeled vehicles driving on underlying geosynthetic materials is prohibited.
9. If tri-planar geocomposite is used, the geocomposite roll should be installed in the direction of the slope. Tri-planar geocomposite directs flow predominately in the machine direction (along the roll length) and thus should be installed in the intended direction of flow or as specified by the Design Engineer.

The CQA Consultant shall observe and document the deployment of geogrid, geonet, geotextile, and geocomposite to verify that the provisions of the CQA Plan are met.

10.5 Field Seams

The Geosynthetic Contractor shall perform the following:

1. Field seams for geogrid:
    a) The overlap for seams shall be as specified by the geogrid manufacturer.
    b) Adjacent panels of the geogrid shall be joined as specified by the geogrid manufacturer.
    c) Where more than one layer of geogrid is installed, overlaps must be staggered.
    d) Orient all seams located on slopes steeper than 5 percent parallel to the fall of the slope, unless approved by the Design Engineer. Horizontal seams shall be minimized. If horizontal seams are required due to the length of the slope, horizontal seams shall be bounded on each side by continuous panels and horizontal seams shall be staggered by a minimum distance of 25-feet.
2. Field seams for geonet:
    a) The overlap for seams shall be 4-inches along panel edges and 6-inches at panel ends.
    b) Adjacent panels of the geonet shall be joined using self-locking nylon straps placed at 5-feet intervals along the seam length on the sides and at one-foot intervals along the seam length at the ends. Only ties which do not damage the underlying geomembrane shall be used. Metal ties shall not be allowed.
    c) Ties shall be white or bright colored for easy identification.
    d) Where more than one layer of geonet is installed, overlaps must be staggered and layers tied together.
    e) Orient all seams located on slopes steeper than 5 percent parallel to the fall of the slope, unless approved by the Design Engineer. Horizontal seams shall be minimized. If horizontal seams are required due to the length of the slope,

horizontal seams shall be bounded on each side by continuous panels and horizontal seams shall be staggered by a minimum distance of 25-feet.

3. Field seams for geotextile:

   a) The initial overlap for seams shall be at least 4-inches, configured into a “prayer” seam for sewing.

   b) The geotextile shall be continuously sewn between panels. Alternate methods of bonding the geotextile must be approved by the CQA Consultant prior to use.

   c) The thread used to sew the geotextile panels together shall meet the manufacturer's requirements.

   d) Orient all seams located on slopes steeper than 5 percent parallel to the fall of the slope, unless approved by the Design Engineer. Horizontal seams shall be minimized. If horizontal seams are required due to the length of the slope, horizontal seams shall be bounded on each side by continuous panels and horizontal seams shall be staggered by a minimum distance of 25-feet.

4. Field seams for geocomposite:

   a) The overlap for seams shall be 4-inches along panel edges and 12-inches along panel ends.

   b) Adjacent panels of the geonet shall be joined using self-locking nylon ties placed at 5-feet intervals along the seam length on the sides and at 1-foot intervals along the seam length on the ends. End seams shall be covered by a piece of geotextile overlapped 6-inches on each side of the geocomposite seam and heat bonded in place. Only ties which do not damage the underlying geomembrane shall be used. Metal ties shall not be allowed.

   c) Ties shall be white or bright colored for easy identification.

   d) The geotextile shall be continuously sewn between panels. Alternate methods of bonding the geotextile must be approved by the CQA Consultant prior to use.

e) The thread used to sew the geotextile panels together shall meet the manufacturer's requirements and be white or bright colored for easy identification.

f) Orient all seams located on slopes steeper than 5 percent parallel to the fall of the slope, unless approved by the Design Engineer. Horizontal seams shall be minimized. If horizontal seams are required due to the length of the slope, horizontal seams shall be bounded on each side by continuous panels and horizontal seams shall be staggered by a minimum distance of 25-feet.

The CQA Consultant shall observe and document the seaming of geogrid, geonet, geotextile, and geocomposite to verify that the following requirements of the CQA Plan are met:

1. Observations that all synthetic drainage materials are placed according to project plans.
2. Observations and measurements to ensure that the overlap of all synthetic drainage materials or geotextiles specified in the design and this CQA Plan are achieved.
3. Observations to verify that the synthetic drainage materials and geotextiles are placed free from excessive wrinkles or folds.
4. Observations to verify that weather conditions are appropriate for the placement of the synthetic drainage layer or geotextile materials and that exposure to rain, wind, and direct sunlight during and after installation follows the manufacturer’s recommendations.

10.6 Defects and Repairs

The Geosynthetic Contractor shall repair any holes or tears in the geosynthetic materials as follows, using patches made from the same material:

1. Damaged areas of geotextile shall be repaired by sewing or heat-bonding a patch in place with a 12-inch overlap in all directions.

2. Damaged areas of geogrid shall be repaired by placing a patch overlapping 2-feet beyond the edges of the hole or tear in all directions or according to the procedures recommended by the manufacture.

3. Damaged areas of geonet shall be repaired by placing a patch overlapping 2-feet beyond the edges of the hole or tear in all directions.

4. A geogrid or geonet patch shall be secured to the original geonet every 6-inches using nylon ties. If the damaged area comprises over 50 percent or more of the geonet roll width, the damaged area shall be cut out and the two portions of the geonet shall be joined.

5. Damage to the geocomposite shall be repaired as noted for geonets and the upper geotextile of the patch shall be sewn or heat-bonded to the upper geotextile of the geocomposite.

6. Use of equipment producing an open flame is prohibited when combustible gas including methane may be present.

The CQA Consultant shall observe and document the repairs made to the geogrid, geonet, geotextile, and geocomposite to verify that repairs are made according to the requirements of the CQA Plan.

10.7 Material Acceptance

The Geosynthetics Contractor retains ownership and responsibility for the geogrid, geonet, geotextile, and geocomposite materials until accepted by the Owner.

The Owner shall accept the geosynthetic components installation when:

1. All required documentation from the manufacturer and the Geosynthetics Contractor has been received and accepted.

2. The installation is complete.

3. The completion of field seams and repairs, including associated testing, is verified.

4. Written certification documents, including drawings, sealed by the CQA Consultant have been received by the Owner.

11 LEAK DETECTION AND LEACHATE COLLECTION SYSTEM

11.1 Leak Detection System

The leak detection system is comprised of geosynthetic materials installed by the Geosynthetics Contractor and may also include sumps and sampling pipes. Geosynthetic materials will be handled and installed in accordance with Section 10 of this Plan. Leak detection system materials will meet the specifications listed in the project plans and drawings.

11.2 Leachate Collection System

The leachate collection system is comprised of geosynthetic materials, granular soils, aggregate materials, and piping as shown on the project plans and drawings. Materials will be handled and installed in accordance with corresponding sections of this CQA Plan. Leachate collection system materials will meet the specifications listed in the project plans and drawings.

12 GRANULAR SOILS AND SELECT AGGREGATE

All granular materials and select aggregates used in landfill cell and final cover construction shall meet the requirements of the project plans and this section of the CQA Plan.

12.1 Materials

The granular soils and select aggregates used in the leachate collection and removal system and drainage layer components of the final cover shall meet the following requirements:

1. The granular soil and drainage aggregate shall be free of organic material, debris, trash, clay clods, or other deleterious material. No sharp-edged rocks or hard objects shall be allowed.
2. The granular soil drainage layer shall have maximum particle size as required by the drawings and project plans. The granular soil drainage layer shall be comprised of clean, subangular material of durable non-carbonate origin and shall be free of any materials capable of damaging the liner material.
3. Granular drainage soils shall have a minimum permeability shown in the project plans.
4. The drainage aggregate used around the leachate collection system piping and in sumps shall meet the requirements shown on the drawings and project plans.
5. In no instance shall the drainage aggregate be place directly on the geomembrane.
6. Granular soil samples shall be obtained on a frequency of at least one per every 5,000 cubic yards placed and tested for grain size distribution using a sieve analysis in accordance with ASTM D6913.
7. Granular soil samples shall be obtained on a frequency of at least one per every 5,000 cubic yards placed and tested for permeability in accordance with ASTM D2434.

8. The granular soil samples shall be collected and tested by the CQA Consultant. The CQA Consultant shall verify that the test results meet the requirements of the project plans and CQA Plan.

12.2 Construction Methods / Placement

Earthwork Contractor

The Earthwork Contractor shall install the granular soils in accordance with the following:

1. Low ground-pressure tire or track equipment shall be utilized for work on the granular soil materials whenever the thickness of the granular soil material is less than 24-inches. The granular soil beneath roadways for transporting material over the cell floor and sideslopes shall always be at least 3-feet thick. Excessive rutting shall be prevented. No portion of any earthmoving equipment shall be allowed to contact the underlying geomembrane material at any time.
2. Granular soil material shall be placed to minimize stresses on the underlying geomembrane. Placement of granular soil shall generally proceed by pushing the granular soil up the sideslope. No granular soil shall be allowed to fall or slide into place down the sideslopes.
3. During granular soil material placement, wrinkle propagation of geosynthetic materials shall be minimized.

CQA Consultant

The CQA Consultant shall perform the following:

1. Observe the placement of the granular soil and document soil material uniformity and the presence or absence of foreign materials.
2. Observe for potential and actual damage to the geomembrane during granular soil placement. When damage is suspected, the geomembrane surface shall be exposed to verify its condition. Actual damage to the geomembrane shall be documented and

corrective action shall be taken in accordance with procedures outlined in the CQA Plan.

3. Observe construction procedures to prevent the transport of fine soil particles by surface water run-off into the leachate collection system.

4. Observe and document that the granular soil material meets the material specifications, placement procedures, and thickness requirements of the project plans and the CQA Plan.

12.3 Survey

The Surveyor shall survey the granular soil layer on a 100-foot grid system to verify thickness. Alternately, direct depth checks may be performed by the CQA Consultant to determine the granular soil layer thickness. Locations where the granular soil layer thickness is less than required shall be corrected. The CQA Consultant shall document the placement of additional granular soil material to meet the requirements of the project plans and drawings.

13 PIPING

All piping used in the landfill cell construction or final cover shall meet the requirements of the project plans.

13.1 Pipe Materials

The pipe manufacturer shall provide the CQA Consultant documentation that the pipe provided meets the project plans and drawings.

The CQA Consultant shall review the manufacturer's information to verify that the project plans and CQA Plan requirements are met.

13.2 Delivery and Storage

The CQA Consultant shall obtain the following information when the pipe is delivered to the Site:

1. Name of manufacturer;
2. Product type and identification number;
3. Pipe diameter; and
4. Pipe wall thickness schedule or Standard Dimension Ratio.

The pipe shall be protected during shipment from excessive heat or cold, puncture, or other damage. The pipe shall be stored on-site in a manner to protect it from damage.

The CQA Consultant shall inspect the pipe delivery paperwork to ensure that the information is correct. The CQA Consultant shall also document the pipe material delivery in the daily summary report.

13.3 Pipe Installation

The pipe shall be joined by methods as defined by the pipe manufacturer and the project plans and drawings.

CQA Consultant

The CQA Consultant shall perform the following:

1. Inspect the pipe material for compliance with the project plans.
2. Observe and document the placement and joining of the pipe for compliance with the pipe manufacturer's specifications and the project plans and drawings.
3. Observe and document the backfill of the pipe for compliance with the project plans.
4. Observe and document the placement of filter materials, if used, around the pipe for compliance with project plans.

Earthwork Contractor

The Earthwork Contractor shall perform the following:

1. Pipe placement shall not be performed in the presence of excessive moisture.
2. Prepare the pipe subgrade condition and slope according to the project plans.
3. Join the pipe sections according to the pipe manufacturer's specifications and the project plans and drawings.
4. After joining, de-bead the pipe as required by the Owner.
5. Backfill the pipe according to the project plans.

The Surveyor shall survey the installed pipe every 100-feet and at appurtenances to verify that the pipe grade is in conformance with the project plans and drawings.

14 FINAL COVER SYSTEM

The final cover system may contain geosynthetic, granular, aggregate, piping, soil components, and Engineered Artificial Turf Landfill Cover (EATLC). EATLC, geosynthetic, granular, aggregate, and piping components of the final cover system will be installed per the project plans and drawings and according to corresponding sections of this CQA Plan. Soil components will be installed per the project plans and drawings and according to the installation guidelines of the following subsections. EATLC components will be installed per the latest manufacturers installation guidelines, for the EATLC product selected unless otherwise specifically stated on the project drawings.

14.1 Soil Material

The protective soil layer and topsoil layer of the final cover will meet the specifications of the approved project plans, drawings, and this section of the CQA Plan. Protective soil and topsoil will meet the following requirements:

1. The protective soil layer shall be free of debris, trash, stumps, or other deleterious materials. No sharp-edged rocks or other hard objects which could damage the geosynthetics shall be allowed.
2. The topsoil layer shall be capable of supporting shallow rooted vegetation and shall conform to the specifications of the project plans and drawings.

14.2 Soil Material Construction and Placement

CQA Consultant

The CQA Consultant shall perform the following:

1. Observe and document the placement of the soil layers. Visually inspect for material uniformity and the presence or absence of foreign materials.
2. Monitor the placement of the soil layers for potential or actual damage to the underlying components of the final cover system. Where damage of underlying

geosynthetic material is suspected, the geosynthetic material surface shall be exposed to verify its condition. If damage of geosynthetic material is found, the damage shall be documented, and corrective actions and repairs shall be made according to the CQA Plan.

3. Conduct field and laboratory testing at the frequency specified by project plans and drawings.
4. Certify that the soil layers have been placed and tested in accordance with the specifications of the project plans and drawings.

Earthwork Contractor

The Earthwork Contractor shall perform the following:

1. Place and compact each lift, except the first lift of material over geosynthetics, with a general thickness of 6-inches after compaction. The first lift of soil material over geosynthetics will be placed at a minimum thickness of 1 foot after compaction, unless otherwise indicated in the project plans.
2. Monitor the placement of the soil layers for potential or actual damage to the underlying components of the final cover system. Where damage of underlying geosynthetic material is suspected, the geosynthetic material surface shall be exposed to verify its condition. If damage of geosynthetic material is found, the damage shall be documented, and corrective actions and repairs shall be made according to the CQA Plan.
3. Soil placement shall be accomplished to minimize stresses on the underlying geosynthetic components of the final cover system.

Surveyor

The Surveyor shall survey the final cover soil components on a 100-foot grid system to verify thickness. Alternately, direct depth checks may be performed by the CQA Consultant to determine soil thickness. Locations where soil thickness is less than

required shall be corrected. The CQA Consultant shall document placement of additional soil material to meet the requirements of the project plans and drawings.

14.3 Engineered Artificial Turf Landfill Cover

An Engineered Artificial Turf Landfill Cover may be selected as part of the final cover system. EATLC components will be installed per the latest manufacturers installation guidelines for the EATLC product selected, unless otherwise specifically stated on the project drawings.

CQA Consultant

The CQA Consultant shall perform the following:

1. Materials submittals and certifications per the manufacturer's installation guidelines.
2. Observe and document the placement of the EATLC. Visually inspect for material uniformity and the presence or absence of foreign materials.
3. Monitor the placement of the EATLC layers for potential or actual damage to the underlying components of the final cover system. Where damage of underlying geosynthetic material is suspected, the geosynthetic material surface shall be exposed to verify its condition. If damage of geosynthetic material is found, the damage shall be assessed and any correction actions or repairs deemed necessary shall be documented and made according to the CQA Plan.
4. Conduct field and laboratory testing at the frequency specified by the EATLC manufacturer's installation guidelines and project drawings.
5. Certify that the EATLC has placed and tested in accordance with the specifications of the project plans and drawings.

Engineered Turf Installer

The Engineered Turf Installer shall conform to the following:

1. Inspect the subgrade and observe the following:
    a. The protective cover soil is substantially free of surface irregularities and protrusions including stones or other objects that could damage and of the EATLC components
    b. The anchor trench dimensions have been checked and the trenches are free of sharp objects and other deleterious materials.
    c. Accept, with the Installer's signature on a Subgrade Acceptance Certification form, that the soil surface is acceptable for EATLC installation prior to deployment of the material.
    d. Survey shots and as-built drawings will be carefully reviewed and evaluated to verify the surface grades will drain as intended on the drawings.
2. Installation of the geomembrane liner component of the EATLC must be completed by a geosynthetics contractor meeting the minimum qualifications stated in the manufacturer's installation guidelines. Installation shall follow the EATLC manufacturer's installation guidelines.
3. Construction equipment on the EATLC geomembrane component will be limited to reduce the potential for geosynthetics damage. Manufacturer's installation guidelines regarding construction equipment on the geomembrane component will be followed.
4. Anchor trench backfill will be completed as required by the manufacturer's installation guidelines.
5. Installation of the Engineered Turf component of the EATLC must be completed by a contractor meeting the minimum qualifications stated in the manufacturer's installation guidelines. Installation shall follow the EATLC manufacturer's installation guidelines.

6. The infill components of the EATLC must meet the requirements of the project drawings and manufacturer's installation guidelines. Installation shall follow the EATLC manufacturer's installation guidelines.

Surveyor

The Surveyor shall survey the EATLC on a 100-foot grid system.

APPENDIX C
PERMIT DRAWINGS REVISION L

WAYNE DISPOSAL, INC. SITE NO. 2
MASTER CELL VI-F&G

VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

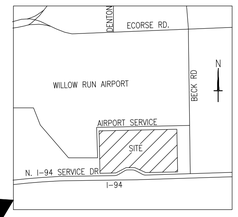
CTI PROJECT NO.1218070017

FEBRUARY 2011
REVISED: SEPTEMBER 2011
REVISED: MAY 2018
REVISED: MAY 2021
REVISED: JULY 2021
REVISED: AUGUST 2021
REVISED: NOVEMBER 2021
REVISED: MAY 2022
REVISED: FEBRUARY 2024
REVISED: APRIL 2025

OWNER:
Wayne Disposal, Inc.
49350 N. I-94 Service Drive
Belleville, Michigan 48111

ENGINEER:
CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377

MICHIGAN
APPROX. SCALE: 1"=50 MILES



LOCATION MAP- WAYNE COUNTY
NO SCALE

SHEET INDEX

01	TITLE SHEET
02	GENERAL SITE PLAN
03	CONSTRUCTION PHASING
04	TOP OF SUBGRADE GRADING PLAN
05	TOP OF SECONDARY LINER GRADING PLAN
06	TOP OF PRIMARY LINER GRADING PLAN
07	LEACHATE MANAGEMENT PLAN
08	FINAL COVER GRADING PLAN (1 OF 2)
09	FINAL COVER GRADING PLAN (2 OF 2)
10	STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)
10 A	ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)
11	STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)
11 A	ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)
12	CROSS SECTION (1 OF 3)
13	CROSS SECTION (2 OF 3)
14	CROSS SECTION (3 OF 3)
15	LINER SYSTEM DETAILS (1 OF 2)
16	LINER SYSTEM DETAILS (2 OF 2)
17	GEOSYNTHETIC MATERIALS REQUIREMENTS
18	LEACHATE COLLECTION SYSTEM DETAILS
18A	LEAK DETECTION AND LEACHATE SYSTEM FOR MC VI F4 EAST
18B	CONNECTION DETAILS FOR MC VI-E PHASE 2 WEST LEAK DETECTION SUMP
18C	CROSS SECTION OF MC IV-E PHASE 2 WEST SUMP MODIFICATION
19	FINAL COVER DETAILS
19 A	ENGINEERED TURF FINAL COVER DETAILS
20	STORMWATER MANAGEMENT SYSTEM DETAILS
20 A	ENGINEERED TURF STORMWATER MANAGEMENT SYSTEM DETAILS
21	CONCEPTUAL GAS VENTING SYSTEM

CTI and Associates, Inc.
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www.ctiengineers.com

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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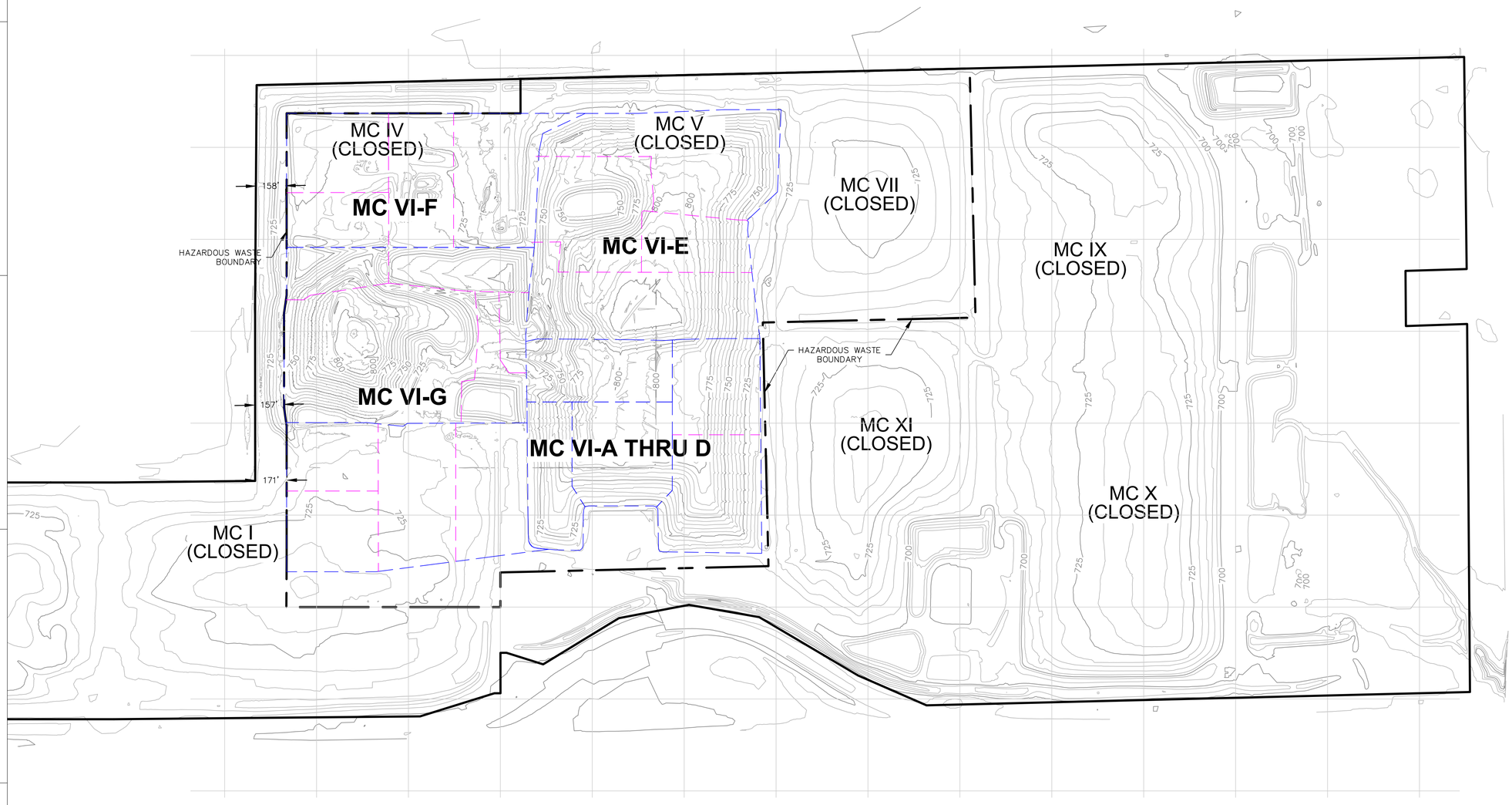
REV	DATE	REVISION DESCRIPTION	DRN	APP
L	04/25/25	MC VI-E PHASE 2 WEST SUMP MODIFICATION	AN	XZ
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN	XZ
J	05/18/22	SUBCELLS G4-G6 REVISIONS	LEH	XZ
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H1	5/10/22	REVISED LINER GRADES IN F3	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	5/28/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
E	5/29/18	ADDENDUM 1	PAA	XZ
D	5/08/18	REV. BASED ON MDEQ'S COMMENTS	PAA	XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ
B	9/23/11	PERMIT MDEQ COMMENTS		DRL
A	6/10/11	PHASING DESIGNATIONS		DRL

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TITLE SHEET

PROJECT NUMBER 1218070017
SCALE NONE
DRAWING NO 01



N

0 300 600

SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- PREVIOUSLY PERMITTED HAZARDOUS WASTE BOUNDARY
- PROPERTY BOUNDARY
- SUBCELL BOUNDARY
- CELL BOUNDARY
- CELL BOUNDARY (CLOSED)

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	
F	05/17/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG XZ
			DRN APP

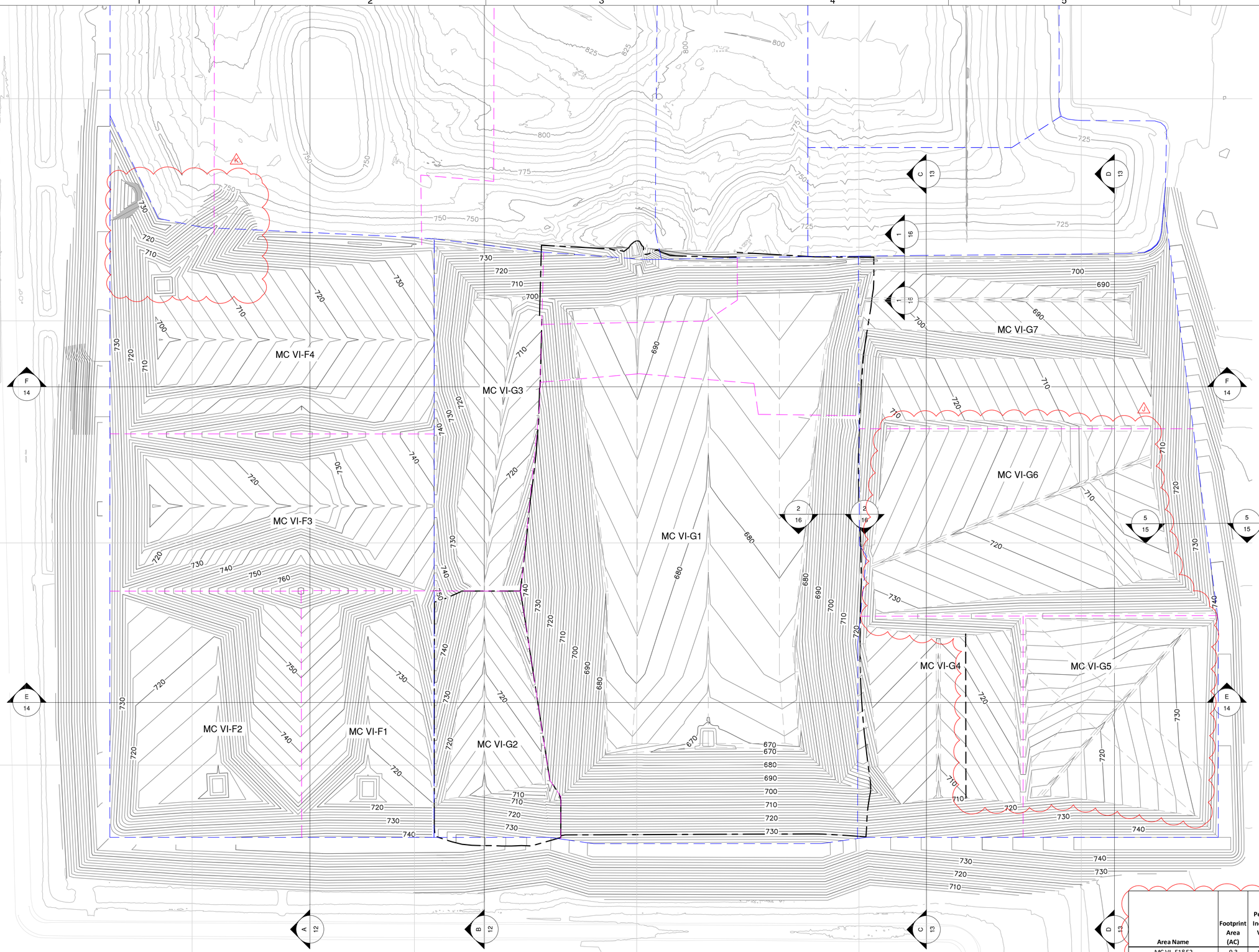
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

GENERAL SITE PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 300'

DRAWING NO
02



NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES DEPICTED IN MC VI G4–G7 REPRESENT REDESIGN TOP OF PRIMARY LINER. GRADES DEPICTED IN MC VI G3 AND MC VI F1–F4 REPRESENT PERMITTED TOP OF PRIMARY LINER. GRADES DEPICTED IN MC VI G1 AND G2 REPRESENT AS-BUILT TOP OF PRIMARY LINER.

Area Name	Footprint Area (AC)	2018 Permitted Incremetal Volume (CY)	2021 Proposed Incremetal Volume Rev. I (CY)	2022 Proposed Incremetal Volume Rev. J (CY)	2024 Proposed Incremetal Volume Rev. K (CY)	Volume Adjustment from 2018 Permit Rev. K (CY)
MC VI- F1&F2	9.3	810,822	779,386	779,386	779,386	-31,436
MC VI- F3&F4	12.9	1,865,000	1,854,314	1,854,314	1,860,480	-4,520
MC VI - G1	19.9	2,354,444	2,354,444	2,354,444	2,354,444	0
MC VI- G2&G3	7.2	796,778	785,806	785,806	785,806	-10,972
MC VI- G4	5.3	694,662	678,662	674,689	674,689	-19,973
MC VI- G5	5.5	490,000	364,000	561,933	561,933	71,933
MC VI- G6	7.4	3,598,173	3,650,173	3,648,588	3,648,588	50,415
MC VI- G7	5.5	1,120,000	1,213,000	1,129,083	1,129,083	9,083
Final Grade Changes	-	-	3,871,240	3,871,240	4,412,664	4,412,664
Engineered Artificial Turf Cover	-	-	687,764	687,764	687,764	687,764
Total	**73**	**11,729,879**	**16,238,789**	**16,347,247**	**16,894,837**	**5,164,958**

REVISIONS			
REV	DATE	REVISION DESCRIPTION	BY
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN
J	05/18/22	SUBCELLS G4–G6 REVISIONS	LEH
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
H1	5/10/22	REVISED LINER GRADES IN F3	LEH
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PJA
REV	DATE	REVISION DESCRIPTION	DRN

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www.ctiengineers.com

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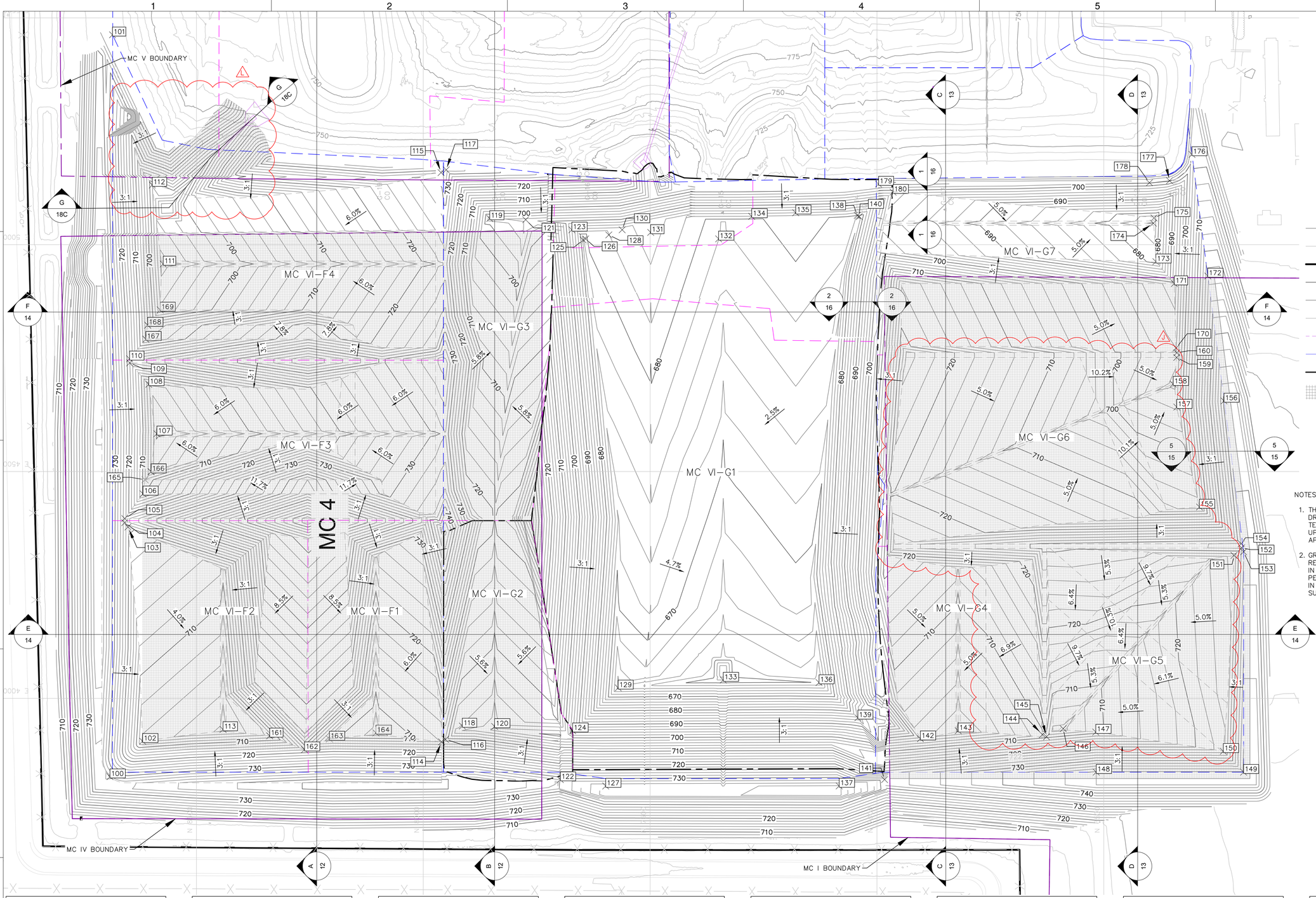
DATE:	05/18/22
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CONSTRUCTION PHASING

PROJECT NUMBER 1218070017
SCALE 1" = 100'
DRAWING NO 03



NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES DEPICTED IN MC VI G4–G7 REPRESENT REDESIGN TOP OF SUBGRADE. GRADES DEPICTED IN MC VI G3 AND MC VI F1–F4 REPRESENT PERMITTED TOP OF SUBGRADE. GRADES DEPICTED IN MC VI G1–G2 REPRESENT AS–BUILT TOP OF SUBGRADE.

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
100	8690.50	3827.42	734.59
101	8685.01	5462.64	720.71
102	8618.55	3905.51	705.52
103	8651.01	4377.72	720.55
104	8658.02	4387.32	722.90
105	8657.98	4396.41	722.90
106	8617.74	4450.87	709.61
107	8587.22	4583.16	699.69
108	8605.02	4692.10	704.63
109	8647.15	4739.42	718.12
110	8647.41	4748.52	718.10

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
111	8573.16	4957.47	690.00
112	8597.34	5131.53	698.08
113	8441.35	3931.51	700.30
114	7959.71	3904.14	712.08
115	7960.81	5158.83	731.11
116	7951.05	3909.68	712.00
117	7949.45	5164.97	732.77
118	7913.92	3939.16	705.45
119	7853.52	5057.82	696.85
120	7842.73	3938.19	702.00
121	7774.33	5054.99	702.31

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
122	7697.89	3821.03	730.74
123	7672.54	5032.68	686.26
124	7670.81	3928.84	694.50
125	7647.66	5010.45	678.68
126	7641.99	5012.71	680.19
127	7597.89	3806.80	735.60
128	7591.06	5021.51	682.01
129	7570.41	4023.20	663.24
130	7561.67	5032.75	683.13
131	7498.71	5027.05	685.09
132	7349.00	5012.85	678.14

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
133	7338.74	4040.41	658.10
134	7276.06	5062.38	679.69
135	7179.18	5070.45	681.75
136	7127.70	4034.87	660.23
137	7083.24	3807.01	736.24
138	7043.49	5064.48	678.89
139	7042.16	3957.20	684.60
140	7039.03	5062.00	677.47
141	6983.25	3821.03	729.35
142	6904.32	3911.10	702.78
143	6821.02	3928.71	699.29

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
144	6635.43	3920.12	709.62
145	6626.33	3915.27	709.38
146	6589.57	3933.24	704.54
147	6517.71	3925.72	709.11
148	6516.74	3837.32	738.70
149	6191.88	3837.32	738.70
150	6236.64	3883.43	723.04
151	6213.12	4315.18	726.74
152	6196.33	4331.76	732.33
153	6191.88	4323.06	733.99
154	6197.28	4340.86	732.32

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
155	6289.21	4421.83	704.87
156	6235.08	4655.62	730.74
157	6339.21	4642.09	695.71
158	6347.00	4692.65	692.54
159	6339.40	4751.42	694.40
160	6339.09	4761.72	694.38
161	8338.55	3917.48	706.54
162	8261.82	3887.03	717.74
163	8206.84	3910.54	710.69
164	8104.44	3923.96	705.92
165	8613.32	4481.85	708.19

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
166	8600.04	4499.82	703.81
167	8611.51	4791.69	705.67
168	8607.53	4822.70	704.00
169	8579.88	4856.23	694.33
170	6340.69	4772.28	694.00
171	6344.57	4914.23	690.81
172	6270.86	4931.07	715.66
173	6385.28	4962.52	677.18
174	6390.87	5047.34	674.35
175	6389.40	5058.83	674.71
176	6305.65	5198.88	701.00

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
177	6355.11	5141.16	700.60
178	6399.40	5136.66	700.50
179	6996.47	5133.58	702.89
180	6964.50	5115.83	696.87

REVISIONS				
REV	DESCRIPTION	DATE	APP	
K	SUBCELL F4 AND FINAL COVER REVISIONS	02/23/24	AN	XZ
J	SUBCELLS G4–G6 REVISIONS	05/18/22	LEH	XZ
I	SUBCELLS G4–G7 REVISIONS, FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	10/08/21	WRG	XZ
H1	REVISED LINER GRADES IN F3	5/10/22	LEH	XZ
H	RESPONSE TO EGLE COMMENTS	8/25/21	LEH	XZ
G	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	7/14/21	LEH	XZ
F	SUBCELLS F1–F4 REVISIONS	11/20/20	WRG	XZ
E	PER MDEQ COMMENTS	9/23/11	DRL	XZ
B	REVISION DESCRIPTION	DATE	DRN	APP

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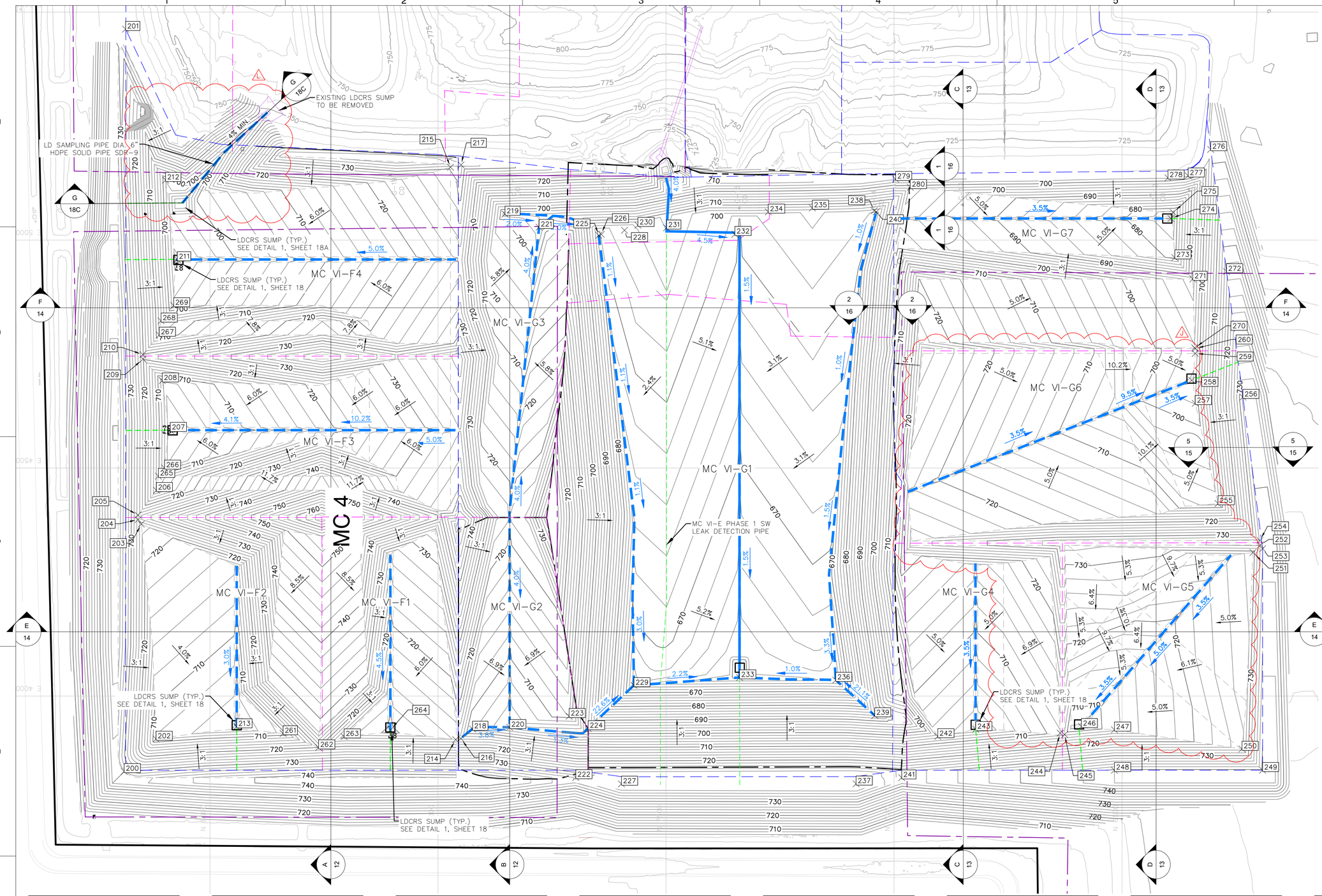
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF SUBGRADE GRADING PLAN (BOTTOM OF STRUCTURAL FILL)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
04



LEGEND

- EXISTING MAJOR CONTOURS (500)
- EXISTING MINOR CONTOURS
- PROPERTY BOUNDARY
- MASTER CELL VI–F & G MAJOR CONTOURS (500)
- MASTER CELL VI–F & G MINOR CONTOURS
- GRADE BREAK
- AS–BUILT BOUNDARY
- COORDINATE POINT NO. (100)
- SLOPE (3:1)
- 2 EXTRA LAYERS OF GEONET 7.5' WIDE BENEATH GEOCOMPOSITE WITH FLOW DIRECTION
- 5 EXTRA LAYERS OF GEONET, 11.5' WIDE, BENEATH GEOCOMPOSITE WITH FLOW DIRECTION
- SUBCELL BOUNDARY
- CELL BOUNDARY
- SOLID SUMP RISER PIPE
- LEAK DETECTION SUMP

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES, PIPING, AND GEOCOMPOSITE DEPICTED IN MC VI–G SUBCELLS G1–G2 REPRESENT AS–BUILT TOP OF SECONDARY LINER.

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
200	8688.12	3834.75	734.54
201	8685.01	5462.64	722.82
202	8618.20	3905.87	707.73
203	8650.61	4377.11	722.72
204	8657.79	4386.96	725.14
205	8657.75	4396.77	725.14
206	8617.41	4451.36	711.82
207	8587.09	4583.16	701.96
208	8604.65	4691.67	706.83
209	8646.85	4739.06	720.34
210	8647.14	4748.88	720.32

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
211	8571.60	4957.47	692.34
212	8597.34	5131.53	698.08
213	8441.35	3933.09	702.62
214	7961.13	3904.60	714.25
215	7972.65	5159.77	730.25
216	7949.91	3907.03	713.51
217	7949.45	5164.97	732.77
218	7924.24	3927.69	706.53
219	7853.05	5057.35	696.67
220	7842.87	3931.37	703.56
221	7778.32	5028.27	695.84

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
222	7697.85	3821.52	733.74
223	7712.50	3955.68	716.00
224	7670.78	3929.03	697.65
225	7647.54	5010.47	681.80
226	7641.99	5012.71	683.24
227	7597.85	3807.29	738.60
228	7591.06	5021.51	685.01
229	7570.29	4023.33	666.36
230	7561.67	5032.75	686.20
231	7498.71	5027.05	688.09
232	7349.00	5012.85	681.14

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
233	7338.74	4040.54	661.22
234	7275.80	5061.92	682.69
235	7179.18	5070.45	684.75
236	7127.83	4034.99	663.35
237	7083.28	3807.50	739.24
238	7043.49	5064.48	681.99
239	7042.34	3957.36	687.71
240	7039.01	5061.89	680.59
241	6983.25	3821.03	729.35
242	6904.12	3911.47	704.92
243	6821.02	3927.03	701.43

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
244	6635.79	3918.76	727.26
245	6625.98	3915.61	711.60
246	6589.27	3933.58	706.76
247	6516.74	3926.02	711.36
248	6516.74	3837.32	740.80
249	6191.88	3837.32	740.80
250	6237.05	3883.85	728.94
251	6213.04	4314.83	728.94
252	6196.66	4331.41	734.53
253	6191.88	4323.06	736.09
254	6197.69	4341.22	734.52

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
255	6289.64	4422.21	707.06
256	6235.08	4655.62	732.84
257	6339.55	4642.05	697.92
258	6347.33	4692.52	694.75
259	6339.72	4751.42	696.61
260	6339.39	4762.08	696.60
261	8339.62	3917.89	708.70
262	8261.82	3887.03	720.06
263	8205.80	3910.98	712.87
264	8104.44	3925.52	708.25
265	8612.99	4482.34	710.40

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
266	8599.66	4500.45	706.00
267	8611.29	4791.97	707.91
268	8607.34	4822.95	706.25
269	8579.58	4856.63	696.54
270	6340.78	4763.72	696.12
271	6344.93	4914.63	693.00
272	6270.86	4931.07	717.76
273	6384.46	4961.54	679.80
274	6392.85	5047.34	675.52
275	6387.94	5060.54	677.00
276	6305.65	5198.88	703.10

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
277	6355.11	5141.16	702.70
278	6399.40	5136.66	702.60
279	6996.47	5133.58	704.99
280	6964.50	5115.83	698.97

REVISIONS			
REV	DATE	DESCRIPTION	APP
A	5/03/18	SUBCELLS G2 AND G3 REVISIONS	XZ
B	11/20/20	SUBCELLS F1–F4 REVISIONS	XZ
C	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	XZ
D	8/25/21	RESPONSE TO EGLE COMMENTS	XZ
E	5/10/22	REVISED LINER GRADES IN F3	XZ
F	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
G	8/24/22	SUBCELLS G4–G6 REVISIONS	LEH
H	05/18/22	SUBCELL F4 AND FINAL COVER REVISIONS	XZ
H1	02/23/24		AN
I	5/10/22		LEH
J	10/08/21		WRG
K	05/18/22		LEH

DATE:	05/18/22
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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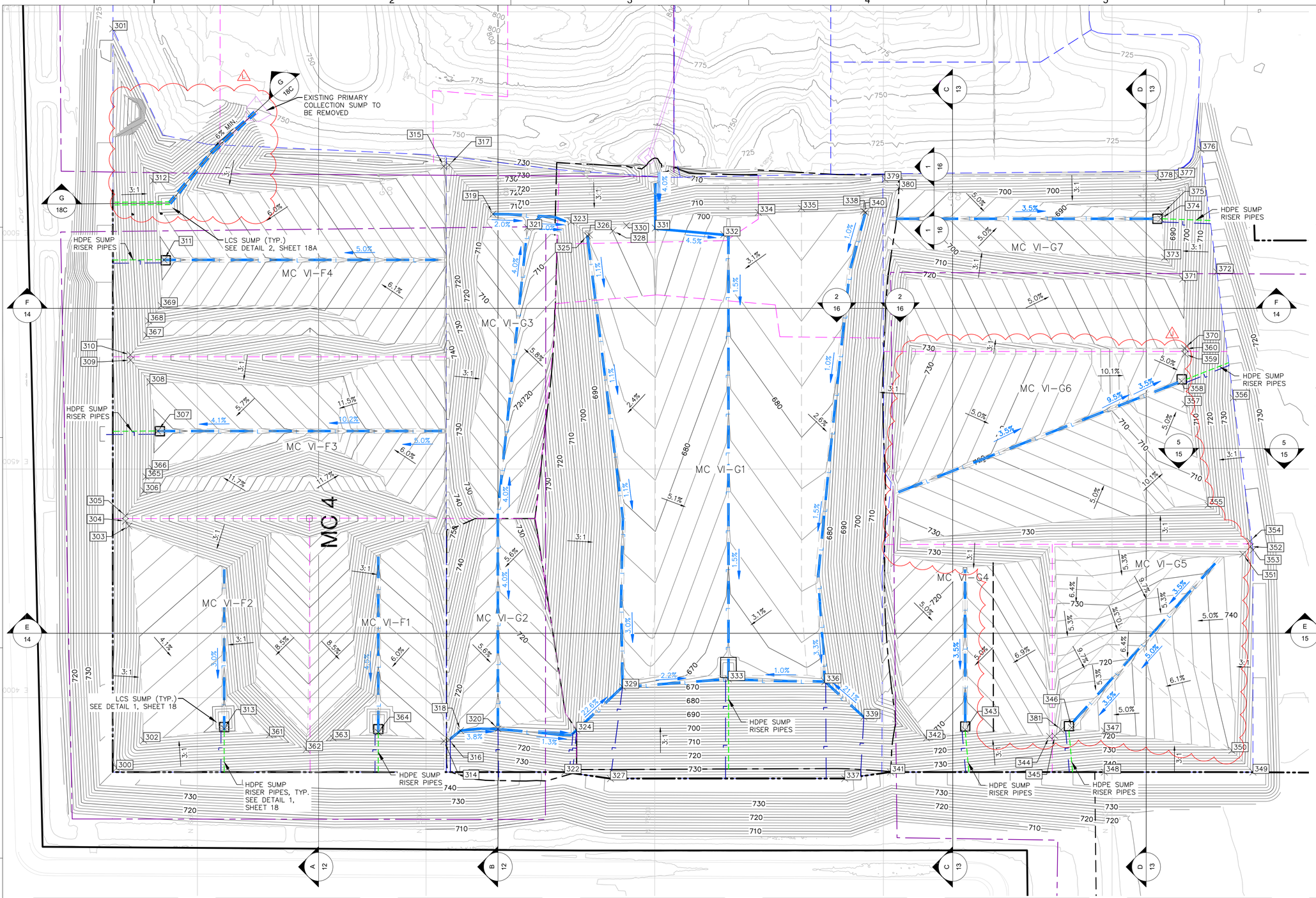
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF SECONDARY LINER GRADING PLAN

PROJECT NUMBER 1218070017

SCALE 1" = 100'

DRAWING NO 05



LEGEND

- EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- MASTER CELL VI–F & G MAJOR CONTOURS
- MASTER CELL VI–F & G MINOR CONTOURS
- GRADE BREAK
- PROPOSED POINT NO.
- SLOPE
- SUBCELL BOUNDARY
- CELL BOUNDARY
- AS–BUILT BOUNDARY
- LEACHATE COLLECTION PIPE AND FLOW DIRECTION
- LEACHATE CLEANOUT PIPE
- PRIMARY COLLECTION SUMP
- SOLID SUMP RISER PIPE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES, PIPING, AND GEOCOMPOSITE DEPICTED IN MC VI–G SUBCELLS G1–G2 REPRESENT AS–BUILT TOP OF PRIMARY LINER.

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
300	8676.40	3846.28	734.54
301	8685.01	5462.64	728.25
302	8617.38	3906.71	712.94
303	8649.60	4375.66	727.86
304	8657.24	4386.11	730.42
305	8657.19	4397.62	730.43
306	8616.71	4452.40	717.06
307	8586.84	4583.16	738.81
308	8603.70	4689.90	712.00
309	8646.14	4738.22	725.58
310	8646.48	4749.72	725.56

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
311	8572.76	4957.47	697.64
312	8596.51	5130.39	703.29
313	8441.35	3932.29	707.95
314	7960.91	3905.27	719.50
315	7961.26	5161.96	736.10
316	7949.75	3907.70	718.61
317	7949.45	5164.97	738.31
318	7924.50	3928.02	711.75
319	7853.52	5057.82	702.31
320	7842.87	3931.97	708.82
321	7778.32	5028.27	701.20

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
322	7696.73	3837.32	733.74
323	7682.58	5040.91	697.50
324	7670.57	3929.29	702.88
325	7647.35	5010.49	687.00
326	7642.85	5012.25	688.18
327	7596.74	3823.09	738.60
328	7591.06	5021.51	690.24
329	7570.10	4023.55	671.56
330	7561.67	5032.75	691.59
331	7498.71	5027.05	693.52
332	7349.00	5012.85	686.42

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
333	7338.74	4040.74	666.42
334	7273.49	5061.28	687.73
335	7179.18	5070.45	689.94
336	7128.04	4035.19	668.55
337	7084.38	3823.30	739.24
338	7043.49	5064.48	687.10
339	7042.63	3957.62	692.90
340	7038.96	5061.69	685.79
341	6984.38	3837.32	732.38
342	6905.54	3911.96	710.13
343	6821.04	3929.78	706.74

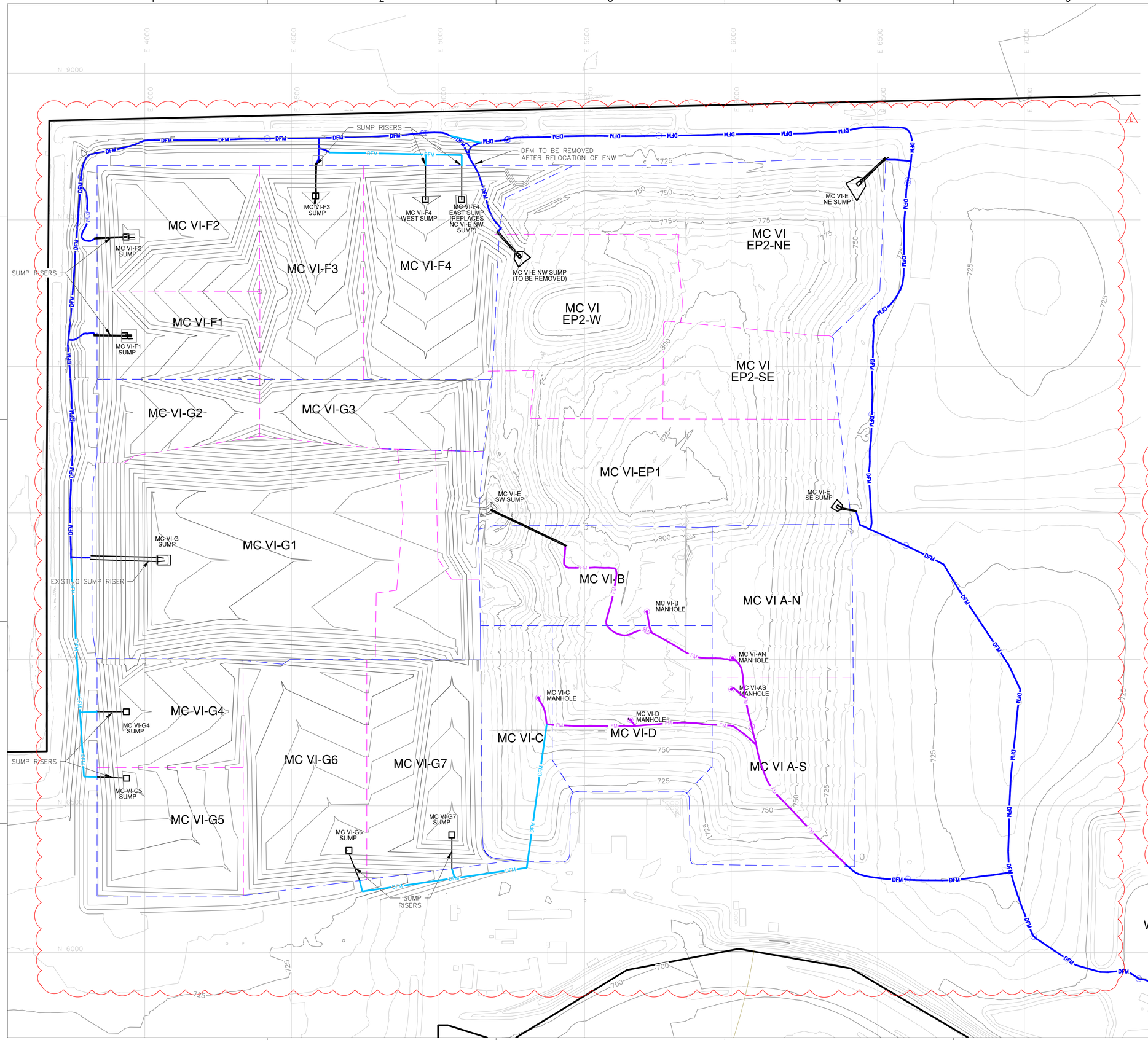
PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
344	6636.63	3915.52	716.79
345	6625.13	3916.54	716.85
346	6588.59	3934.36	711.99
347	6516.55	3927.33	716.00
348	6516.74	3837.32	746.00
349	6191.88	3837.32	746.00
350	6237.97	3884.80	730.38
351	6214.06	4313.84	734.09
352	6197.42	4330.56	735.81
353	6191.88	4323.06	741.29
354	6198.61	4342.06	739.71

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
355	6290.21	4421.30	712.32
356	6235.08	4655.62	738.04
357	6340.31	4641.95	703.14
358	6348.07	4692.23	699.98
359	6340.43	4751.42	701.83
360	6340.08	4762.92	701.83
361	8342.16	3918.88	713.80
362	8261.82	3887.00	725.54
363	8203.29	3912.03	718.03
364	8104.44	3924.55	713.57
365	8612.28	4483.38	715.64

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
366	8598.82	4501.60	711.19
367	8610.47	4793.01	713.10
368	8606.52	4823.99	711.44
369	8578.86	4857.57	701.75
370	6341.52	4764.63	701.33
371	6345.63	4915.50	698.23
372	6270.86	4931.07	722.96
373	6385.28	4962.52	684.48
374	6393.59	5047.34	680.74
375	6389.40	5058.83	682.01
376	6305.65	5198.88	708.30

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
377	6355.11	5141.16	707.90
378	6399.40	5136.66	707.80
379	6996.47	5133.58	710.19
380	6964.50	5115.83	704.17
381	6611.15	3929.60	712.90

| REVISIONS | | |



N

0 150 300

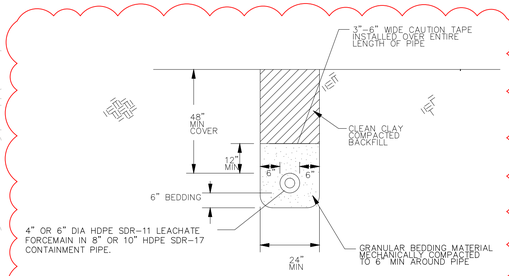
SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- SUBCELL BOUNDARIES
- CELL BOUNDARIES
- PROPERTY BOUNDARY
- DFM — 4"/8" LEACHATE FORCEMAIN
- FM — 4" LEACHATE FORCEMAIN
- CLEANOUT
- PROPOSED 4"/8" LEACHATE FORCEMAIN

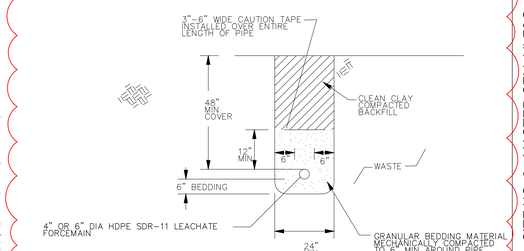
NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.



TYPICAL DUAL-CONTAINED FORCEMAIN OUTSIDE WASTE LIMIT TRENCH DETAIL 1

NOT TO SCALE



TYPICAL SINGLE CONTAINED FORCEMAIN TRENCH IN WASTE AREA DETAIL 2

NOT TO SCALE

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REV	DATE	DESCRIPTION	DRN	APP
L	04/18/25	AS-BUILT FORCEMAINS	AN	XZ
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN	XZ
J	10/06/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG	XZ
H	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR COMMENTS	LEH	XZ
G	6/10/20	SUBCELLS F1-F4 REVISIONS	WRG	XZ
F	11/20/20	PHASING DESIGNATIONS		
A	6/10/11	REVISION DESCRIPTION	DRL	

DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ
DATE: 10/06/21

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEACHATE MANAGEMENT PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 150'

DRAWING NO
07

AIRPORT SERVICE RD.

MC VI-F1
MC VI-F2
MC VI-F3
MC VI- F4
MC VI-G2
MC VI-G3
MC VI-EP1
MC VI EP2-W
MC VI EP2-SE
MC VI EP2-NE

MC VI-F1 SUMP
MC VI-F2 SUMP
MC VI-F3 SUMP
MC VI-F4 SUMP
MC VI-E NE SUMP

FINAL COVER PENETRATION DETAIL SEE DETAIL 5, SHEET 19

EXTEND CLEANOUT NORTH ALONG TOP OF CELL DIKE AND DAYLIGHT AT NORTH PERIMETER DIKE OR THROUGH WASTE (TYP.)

PROTECT ALL MC V MANHOLES WITH 3' RETAINING WALL/CONCRETE MH SECTION (TYP.)

SHEET 08
SHEET 09

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- SUBCELL BOUNDARY
- CELL BOUNDARY
- G-6 CO — LEACHATE COLLECTION SYSTEM CLEANOUTS
- V-A — EXISTING MANHOLES
- SUMP LOCATION AND COVER PENETRATION

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. CLEANOUTS IN MC VI-AN, AS, B, C, AND D ARE TO BE ABANDONED EXCEPT B1, C1, D1 THROUGH D3, D14, D17, D18, AND AS1.
3. BEFORE PLACING WASTE AROUND MC VI-C SUMP RISER, A MONITORING PROGRAM SHOULD BE IMPLEMENTED TO MONITOR ITS FUNCTIONALITY.
4. PRIOR TO PLACING WASTE AROUND CLEANOUTS E-22 THROUGH E-26, THE CLEANOUTS SHOULD BE EVALUATED TO DETERMINE IF THE LEACHATE COLLECTION LINE CAN BE CLEANED BY A SINGLE ACCESS POINT. IF NOT, THE CLEANOUT SHOULD BE EXTENDED.

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DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN XZ
J	10/08/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG XZ
I	8/25/21	RESPONSE TO EGLE COMMENTS	LEH XZ
H	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH XZ
G	05/17/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG XZ
F	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA XZ
C		REVISION DESCRIPTION	DRN APP
REVISIONS	DATE		

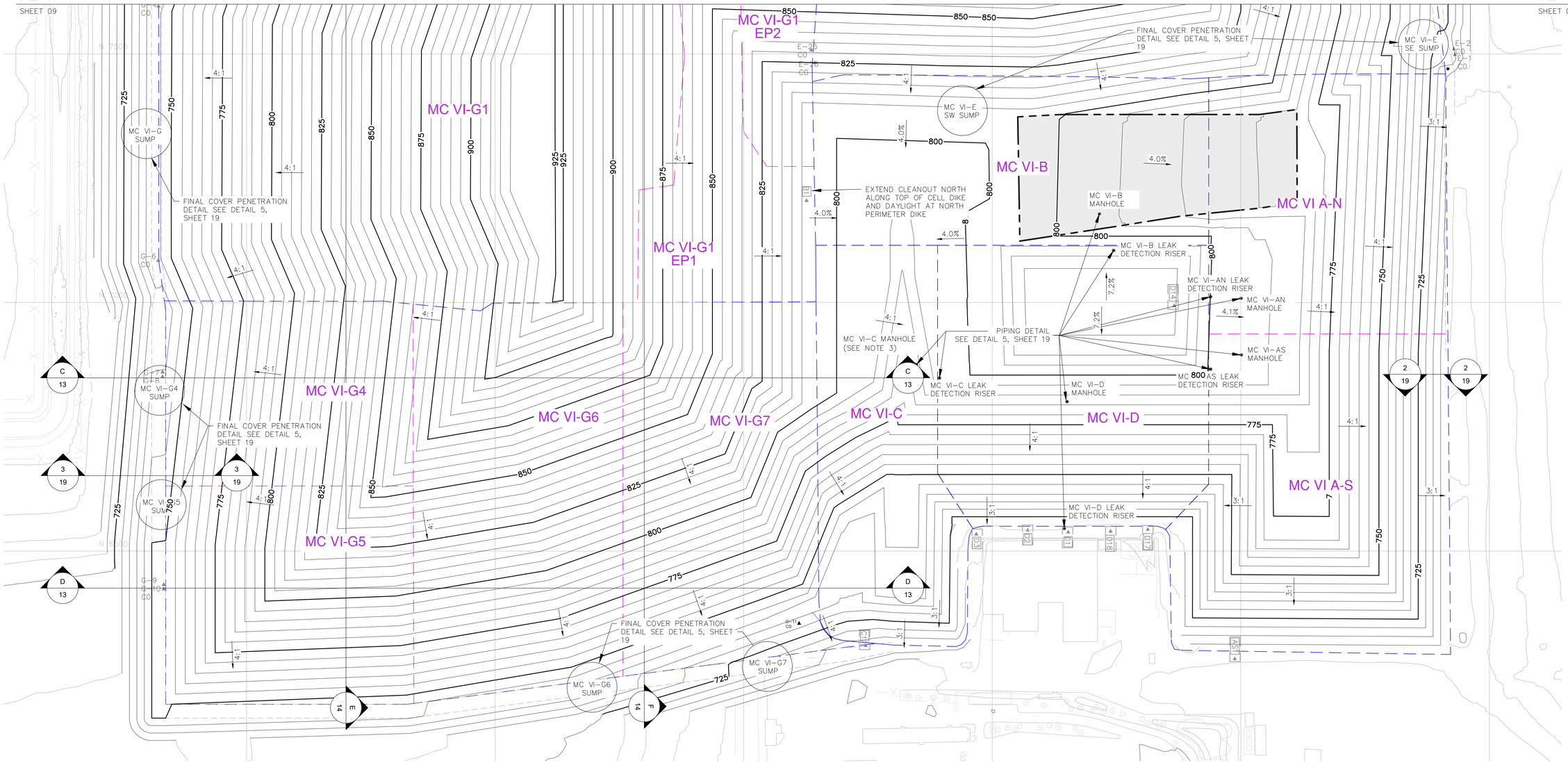
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

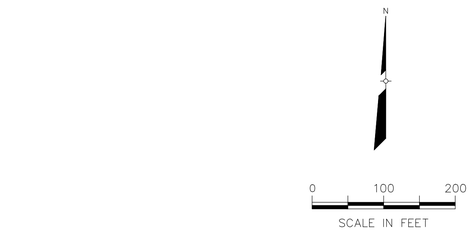
FINAL COVER GRADING PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
08





LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- SUBCELL BOUNDARY
- CELL BOUNDARY
- GEOCOMPOSITE (TRANSMISSIVITY 5.0 X 10^{-4} M^2/S)
- G–6 CO — LEACHATE COLLECTION SYSTEM CLEANOUTS
- EXISTING LEAK DETECTION OR SUMP RISERS
- SUMP LOCATION AND COVER PENETRATION

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. CLEANOUTS IN MC VI–AN, AS, B, C, AND D ARE TO BE ABANDONED EXCEPT B1, C1, D1 THROUGH D3, D14, D17, D18, AND AS1.
3. BEFORE PLACING WASTE AROUND MC VI–C SUMP RISER, A MONITORING PROGRAM SHOULD BE IMPLEMENTED TO MONITOR ITS FUNCTIONALITY.
4. PRIOR TO PLACING WASTE AROUND CLEANOUTS E–22 THROUGH E–26, THE CLEANOUTS SHOULD BE EVALUATED TO DETERMINE IF THE LEACHATE COLLECTION LINE CAN BE CLEANED BY A SINGLE ACCESS POINT. IF NOT, THE CLEANOUT SHOULD BE EXTENDED.

REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN
1	10/08/21	SUBCELLS G4–G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH
F	05/28/21	SUBCELLS G2 AND G3 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG
E	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA
C	6/16/11	PHASING DESIGNATIONS	XZ
A		REVISION DESCRIPTION	APP

	DATE:	
	DESIGNED BY:	LEH
	DRAWN BY:	WRG
	CHECKED BY:	CAB
	APPROVED BY:	XZ

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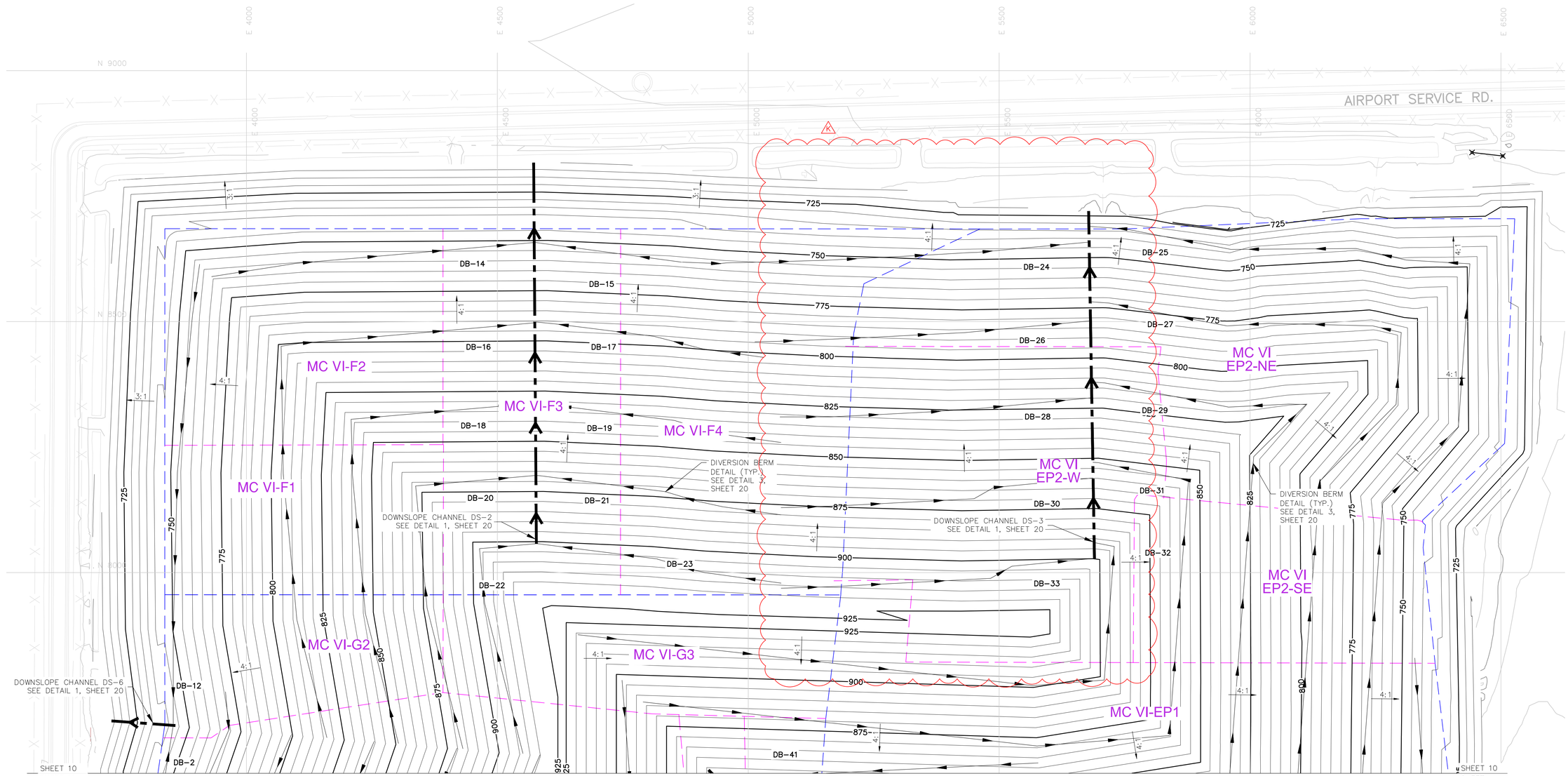
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (2 OF 2)

PROJECT NUMBER 1218070017

SCALE 1" = 100'

DRAWING NO 09



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (3/20)
- DOWNSLOPE CHANNELS (1/20)

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

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REV	DATE	REVISION DESCRIPTION	DRN	APP
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN	XZ
I	10/08/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR COMMENTS	LEH	XZ
F	01/20/21	SUBCELLS F1-F4 REVISIONS	WRG	XZ

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

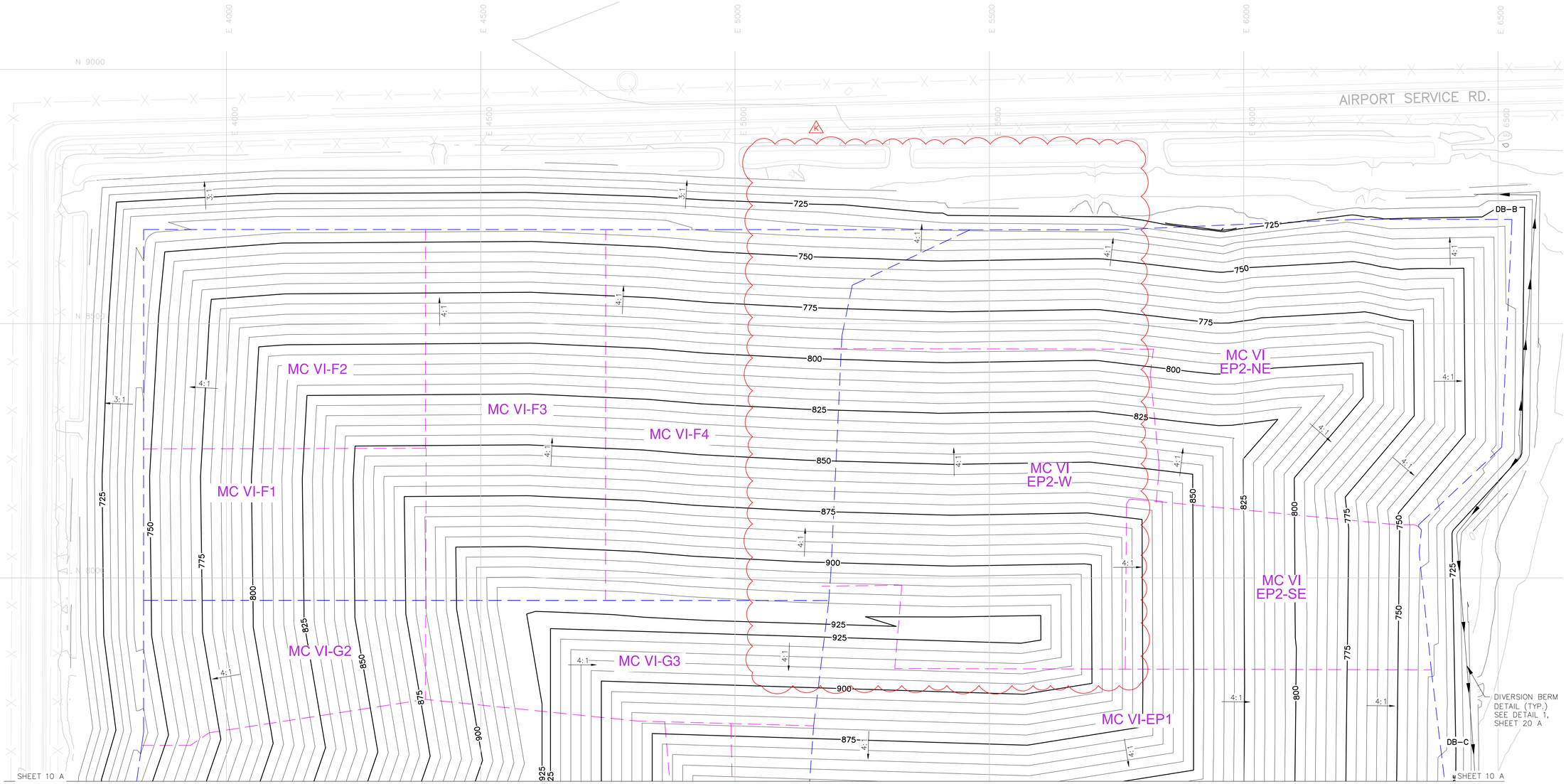
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
10



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (1 / 20 A)

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

REVISIONS					
REV	DATE	REVISION DESCRIPTION	DRN	APP
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN	XZ
I	10/08/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG	XZ

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)

PROJECT NUMBER 1218070017
SCALE 1" = 100'
DRAWING NO 10 A

SHEET 10
SHEET 11

MC VI-G1
MC VI-G1 EP2
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-B
MC VI A-N
MC VI-C
MC VI-D
MC VI A-S

DOWNSLOPE CHANNEL DS-1
SEE DETAIL 1, SHEET 20

DOWNSLOPE CHANNEL DS-5
SEE DETAIL 1 SHEET 20

DOWNSLOPE CHANNEL DS-4
SEE DETAIL 1, SHEET 20

DIVERSION BERM
DETAIL (TYP.). SEE
DETAILS 3, SHEET 20

CATCH BASIN S4A

DB-1 DB-2 DB-3 DB-4 DB-5 DB-6 DB-7 DB-8 DB-9 DB-10 DB-11 DB-12 DB-34 DB-35 DB-36 DB-37 DB-38 DB-39 DB-40 DB-42 DB-43 DB-44 DB-45

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (3/20)
- DOWNSLOPE CHANNELS (1/20)

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

REV	DATE	REVISION DESCRIPTION	DRN	APP
F	01/20/21	SUBCELLS F1-F4 REVISIONS	WRG	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR COMMENTS	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
I	10/08/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG	XZ

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
11

SHEET 10 A
SHEET 11 A

SHEET 10 A
SHEET 11 A

MC VI-G1
EP2

MC VI-G1

MC VI-G1
EP1

MC VI-B

MC VI A-N

MC VI-C

MC VI-D

MC VI A-S

MC VI-G4

MC VI-G6

MC VI-G7

MC VI-G5

DB-A-2

DB-A-1

DB-39

DB-D-2

DB-D-1

DB-E

DB-F

DB-G

DB-H

DIVERSION BERM DETAIL (TYP.)
SEE DETAILS 1, SHEET 20 A

CATCH BASIN S4A

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (1 / 20 A)

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES

WRG XZ
DRN APP

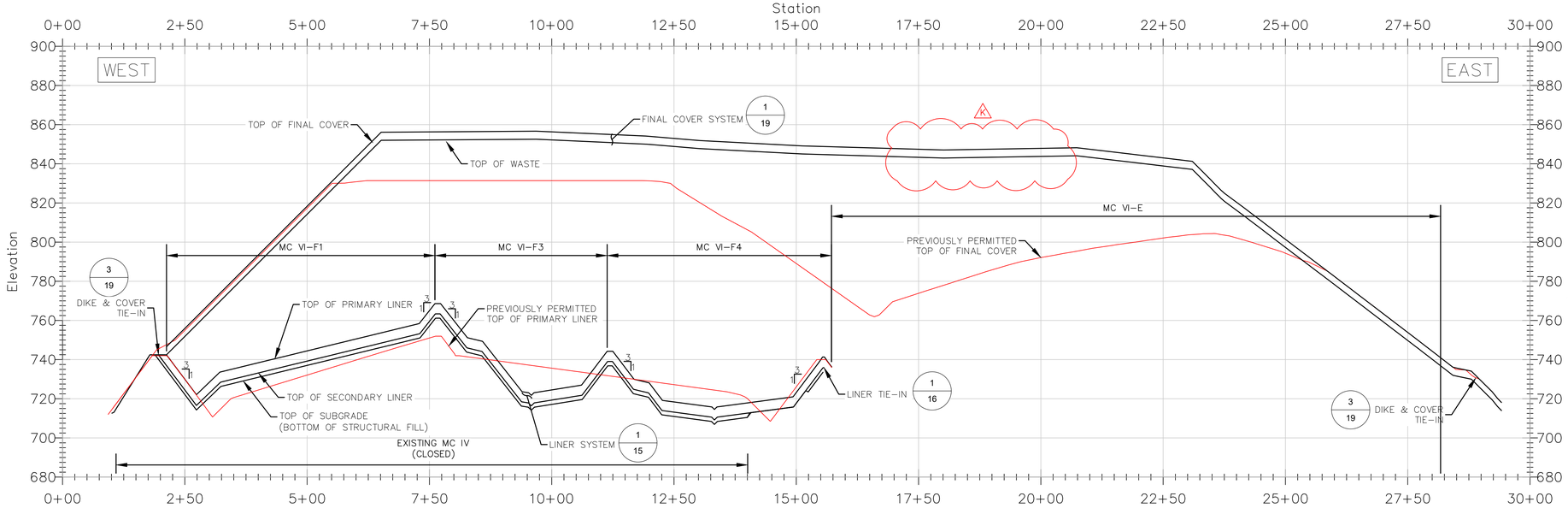
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)

PROJECT NUMBER
1218070017

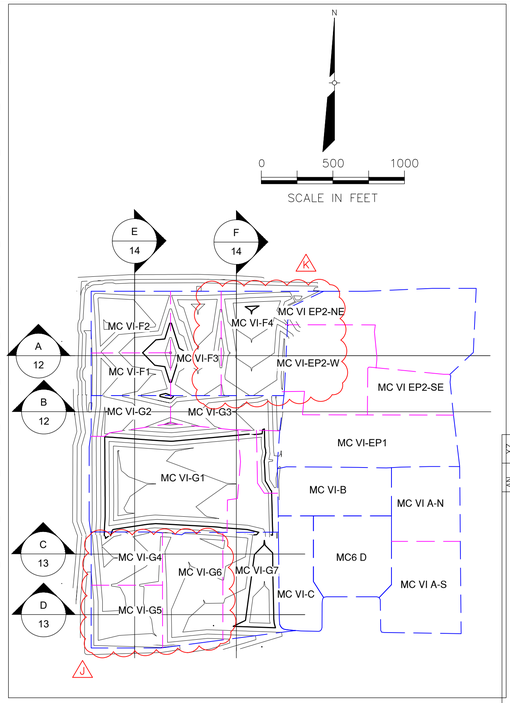
SCALE
1" = 100'

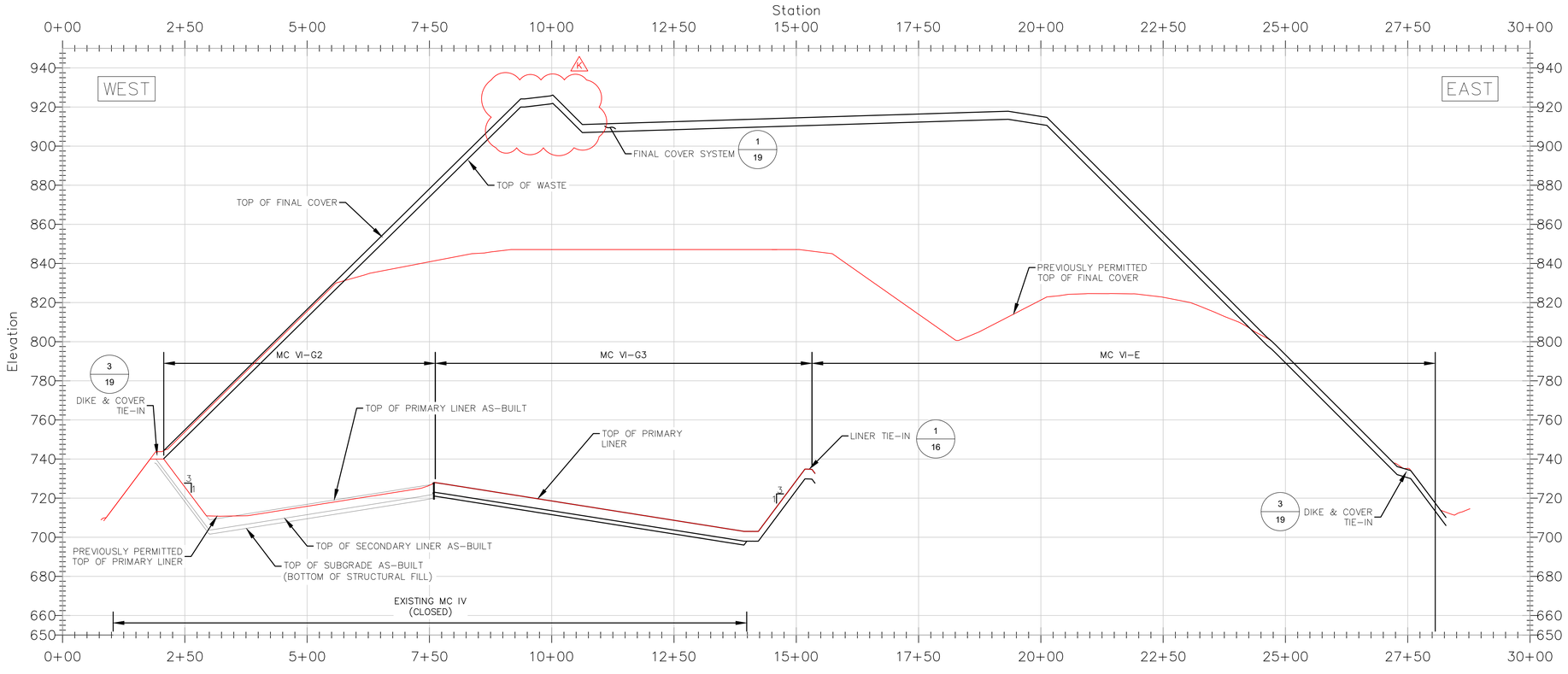
DRAWING NO
11 A



A/12 SECTION THROUGH MC VI–F AND MC VI–E

SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)





B/12 SECTION THROUGH MC VI–G2, G3, AND MC VI–E

SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)

REVISIONS						
REV	DATE	REVISION DESCRIPTION	DRL			
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	XZ			
J	05/18/22	SUBCELLS G4–G6 REVISIONS	XZ			
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	XZ	AN	XZ	
H1	5/10/22	REVISED LINER GRADES IN F3	XZ	LEH	XZ	
G	07/14/21	REVISED LINER GRADES IN F1–F2 AND OTHER MINOR CORRECTIONS	XZ	LEH	XZ	
F	05/17/21	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	XZ	WRG	XZ	
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	XZ			
B	9/23/11	PER WDEQ COMMENTS				DRN APP

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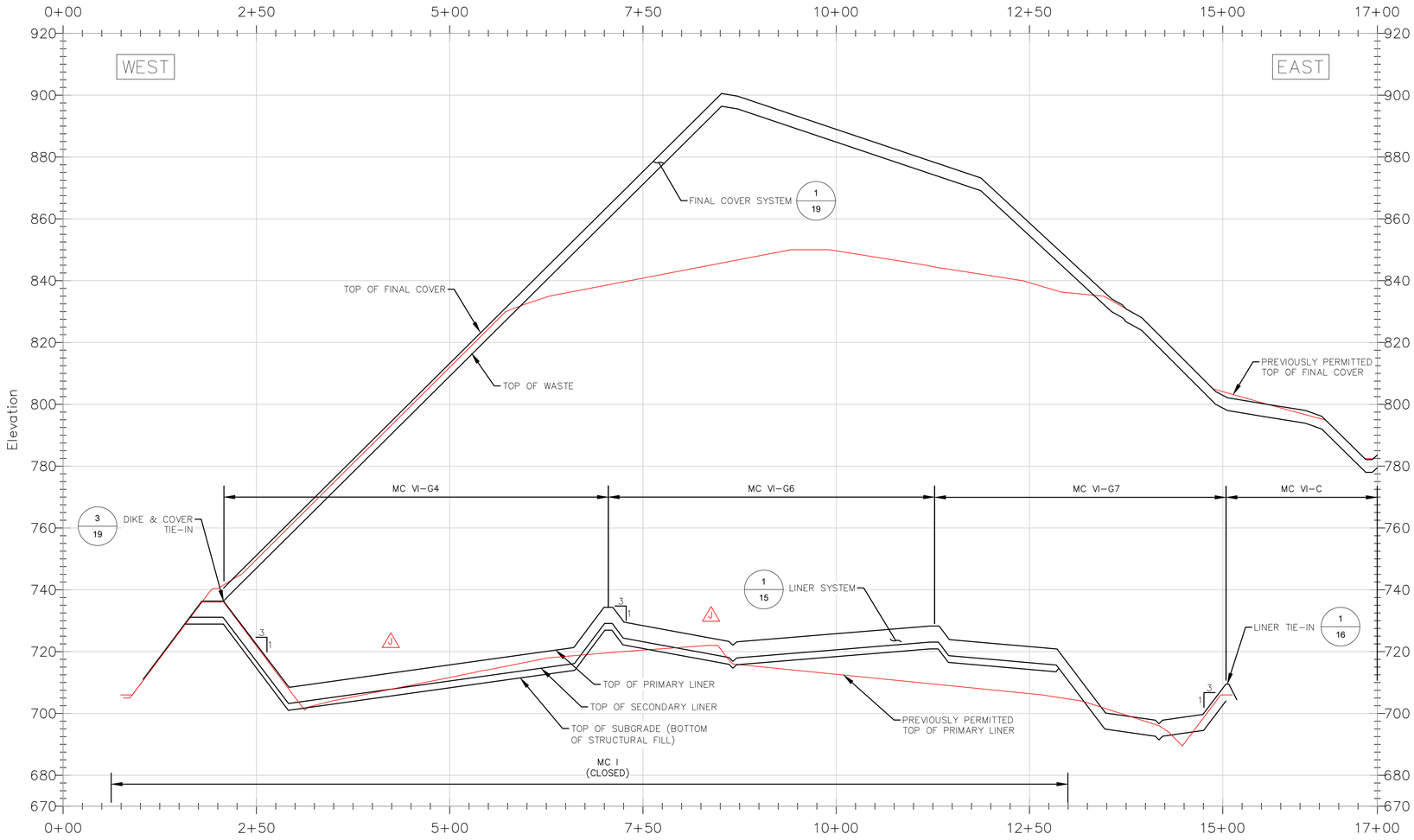
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (1 OF 3)

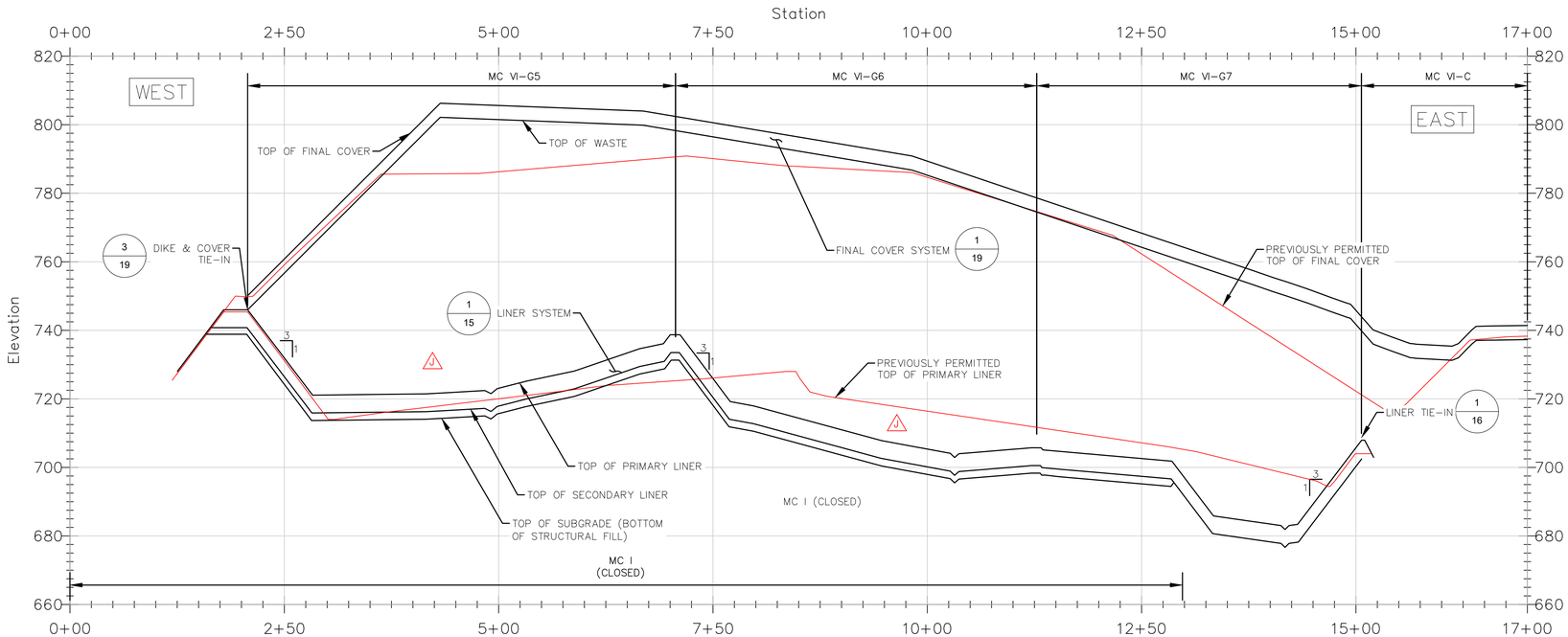
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

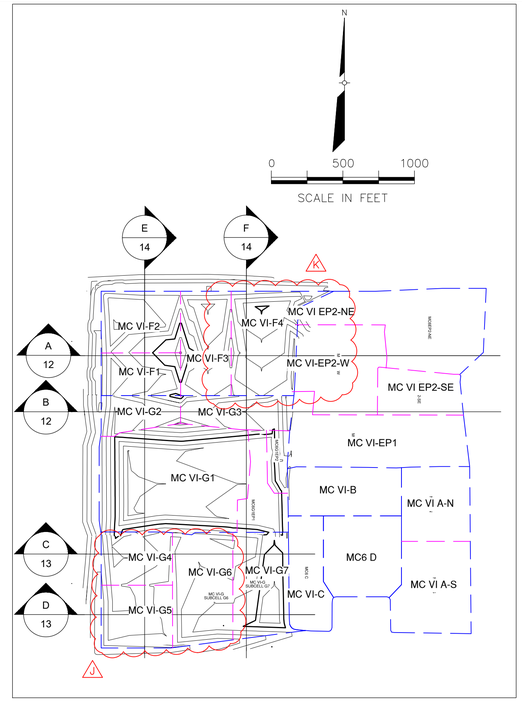
DRAWING NO
12



C/13 SECTION THROUGH MC VI–G4, G6, G7
SCALE: 1"=80' (HORIZONTAL), 1"=10' (VERTICAL)



D/13 SECTION THROUGH MC VI–G5, G6, G7
SCALE: 1"=80' (HORIZONTAL), 1"=10' (VERTICAL)



REVISIONS			
REV	DATE	REVISION DESCRIPTION	
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA
D	11/20/20	SUBCELLS F1-F4 REVISIONS	MRG
E	07/14/21	REVISED LINER GRADES IN F1-F2 AND OTHER MINOR CORRECTIONS	LEH
G	5/10/22	REVISED LINER GRADES IN F3	LEH
H1	10/08/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
I	05/18/22	SUBCELLS G4-G6 REVISIONS	LEH
J			

DATE:	05/18/22
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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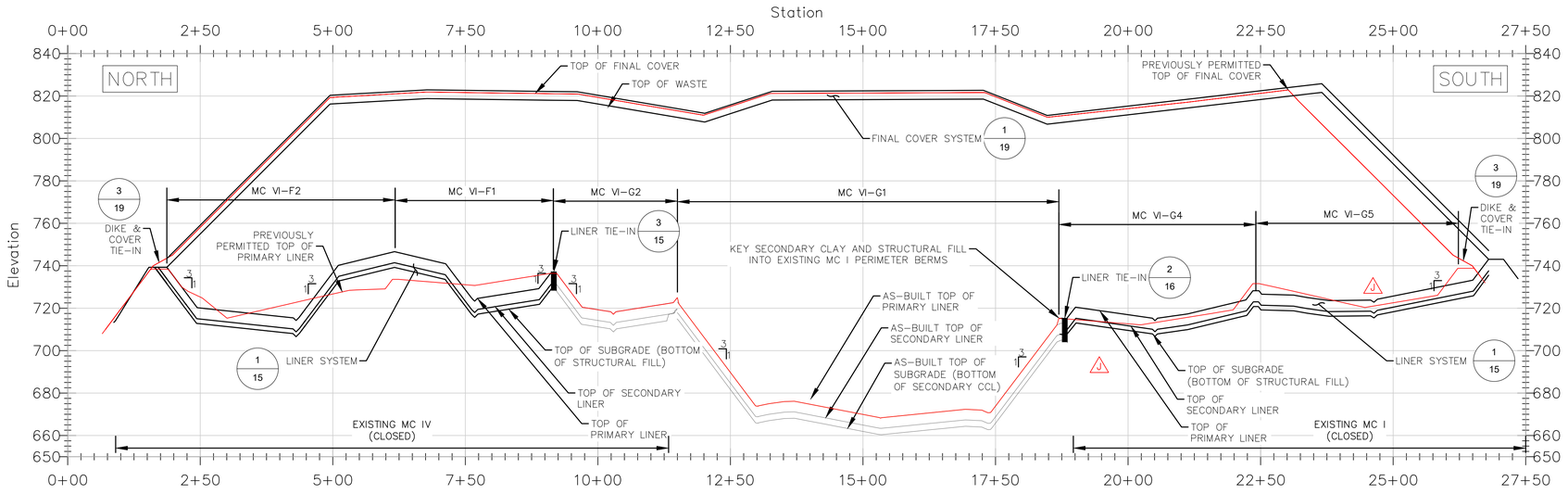
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (2 OF 3)

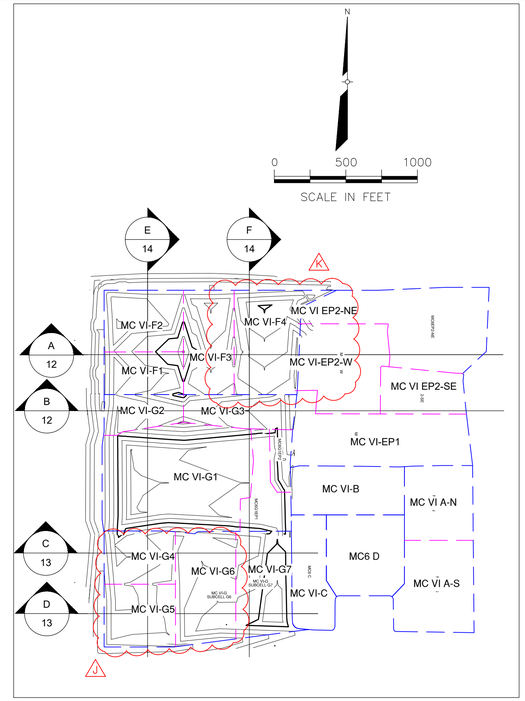
PROJECT NUMBER
1218070017

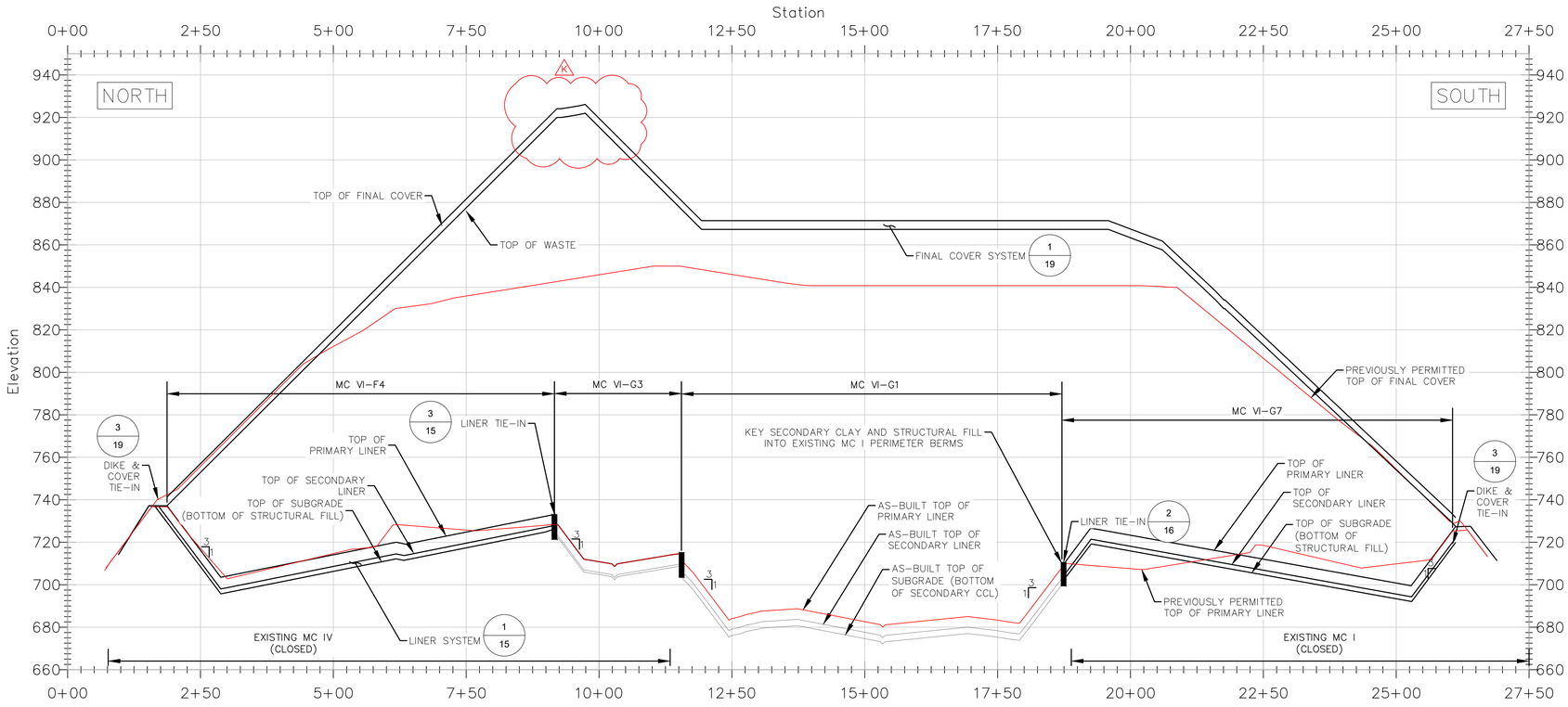
SCALE
AS SHOWN

DRAWING NO
13



E
14
SECTION THROUGH PROPOSED MC VI–F AND MC VI–G
SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)





F
14
SECTION THROUGH PROPOSED MC VI–F AND MC VI–G
SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)

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DATE:	05/18/22
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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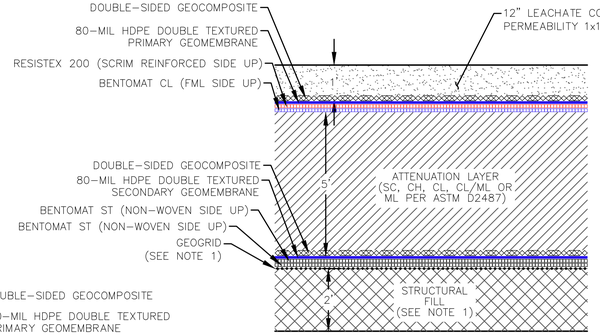
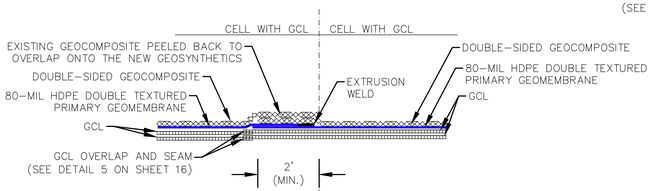
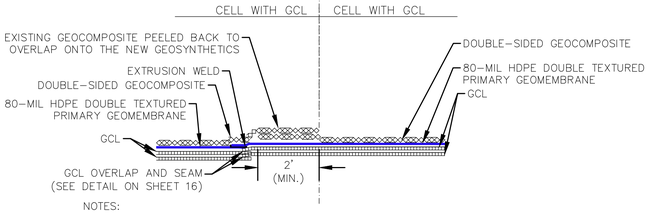


1/15 **FLOOR LINER SYSTEM USING GCL**
NOT TO SCALE

NOTE:
1. STRUCTURAL FILL AND GEOGRID NOT REQUIRED OUTSIDE OF MC I, MC IV AND MC V. SEE LIMITS ON SHEET 04
2. SEE DETAIL 5 SHEET 16 FOR GCL OVERLAP



OR



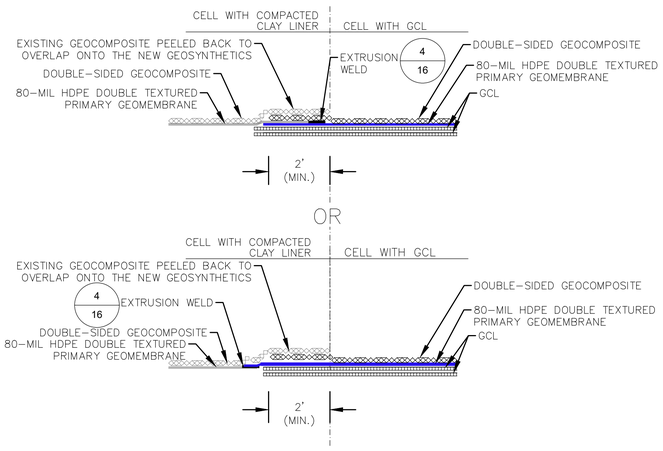
NOTES:

A. NEW AND EXISTING GEOCOMPOSITE LAYERS SHALL BE CONNECTED AS FOLLOWS:
   – GEONET CORES SHALL BE JOINED BY PLASTIC FASTENERS.
   – TOP GEOTEXTILE SHALL BE SEWN TOGETHER OR COVERED WITH EXTRA NON-WOVEN GEOTEXTILE (MINIMUM 24" WIDE) HEAT BONDED TO THE EXISTING GEOTEXTILE.

B. AT GCL SEAMS, DRY BENTONITE POWDER SHALL BE APPLIED PER MANUFACTURER'S INSTALLATION GUIDELINES.

C. SEAMS SHOULD BE CONSTRUCTED SUCH THAT THEY ARE SHINGLED IN THE DIRECTION OF THE GRADE TO PREVENT FLOW FROM ENTERING THE OVERLAP ZONE.

3/15 **LINER TIE-IN DETAIL I**
NOT TO SCALE

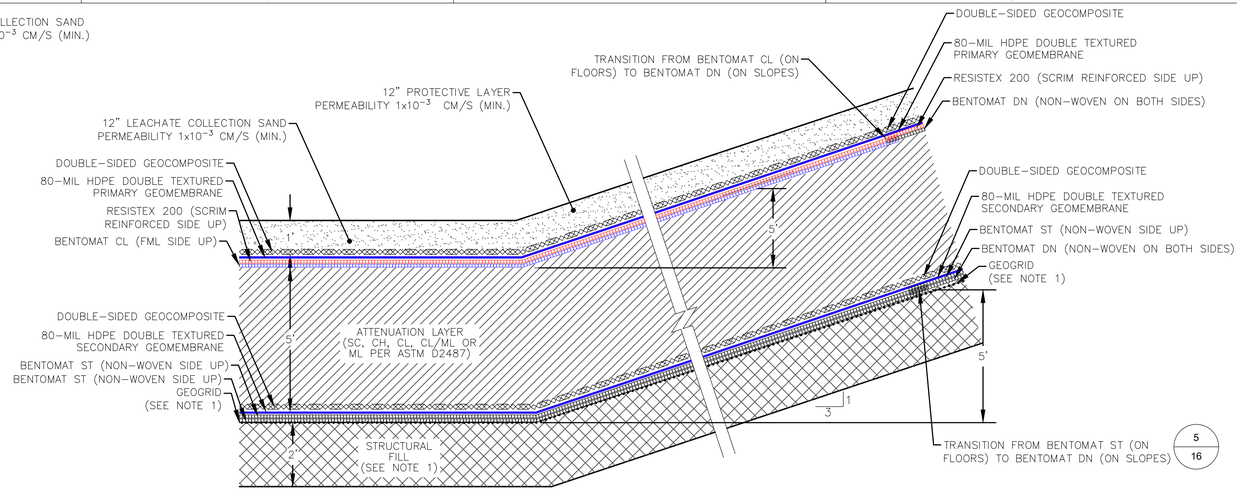


NOTES:

A. NEW AND EXISTING GEOCOMPOSITE LAYERS SHALL BE CONNECTED AS FOLLOWS:
   – GEONET CORES SHALL BE JOINED BY PLASTIC FASTENERS.
   – TOP GEOTEXTILE SHALL BE SEWN TOGETHER OR COVERED WITH EXTRA NON-WOVEN GEOTEXTILE (MINIMUM 24" WIDE) HEAT BONDED TO THE EXISTING GEOTEXTILE.

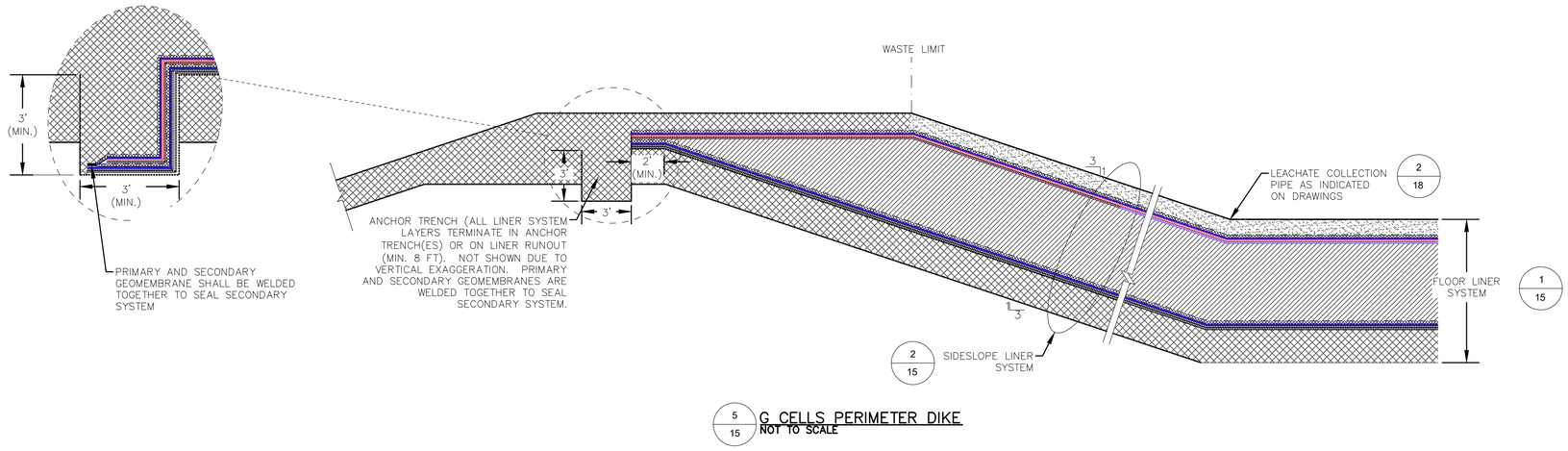
B. SEAMS SHOULD BE CONSTRUCTED SUCH THAT THEY ARE SHINGLED IN THE DIRECTION OF THE GRADE TO PREVENT FLOW FROM ENTERING THE OVERLAP ZONE.

4/15 **LINER TIE-IN DETAIL II**
NOT TO SCALE



2/15 **SIDESLOPE LINER SYSTEM USING GCL**
NOT TO SCALE

NOTE:
1. STRUCTURAL FILL AND GEOGRID NOT REQUIRED OUTSIDE OF MC I, MC IV AND MC V. SEE LIMITS ON SHEET 04
2. SEE DETAIL 5 SHEET 16 FOR GCL OVERLAP REQUIREMENT.



5/15 **G CELLS PERIMETER DIKE**
NOT TO SCALE

REVISIONS			
REV	DATE	REVISION DESCRIPTION	
K	2/13/24	REVISED NOTE TO INCLUDE MC I, MC IV, AND MC V	JWC
I	10/08/21	SUBCELLS G4–G7 REVISONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG
B	9/23/11	PER MDEQ COMMENTS	
A	6/10/11	PHASING DESIGNATIONS	
			DRL
			DRN

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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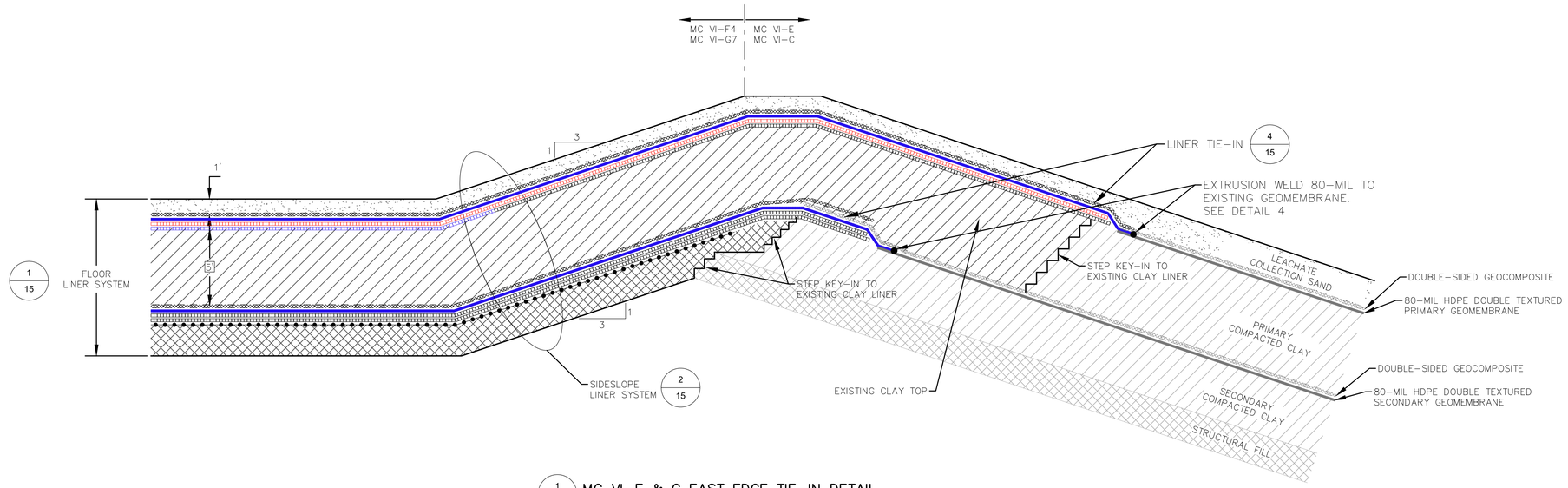
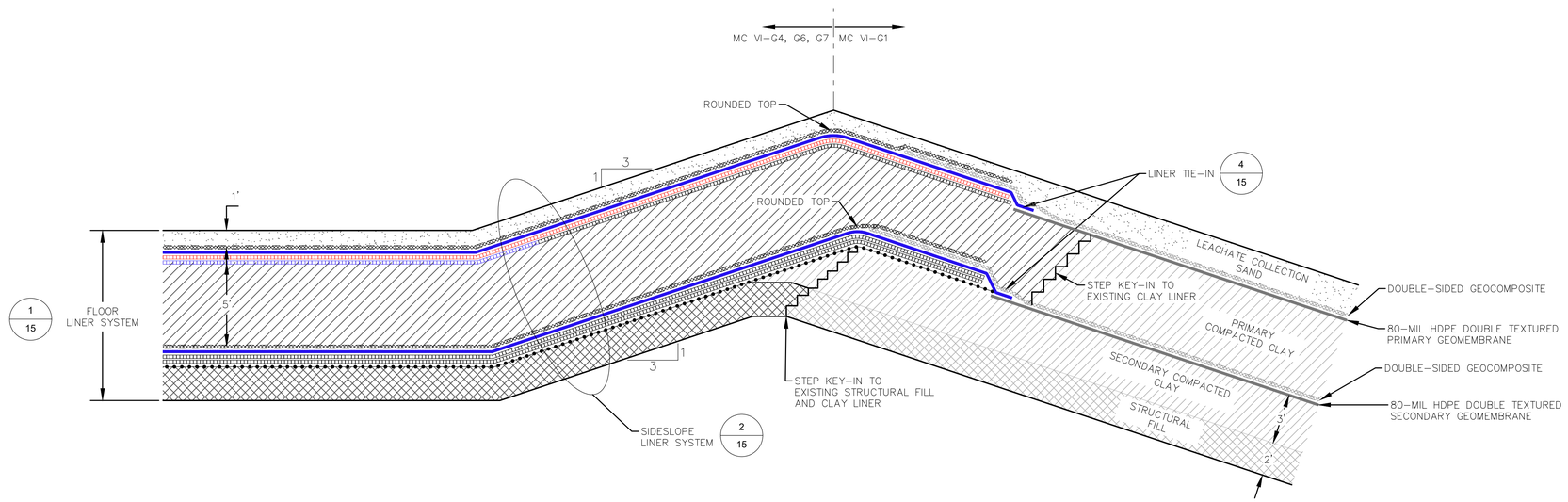
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (1 OF 2)

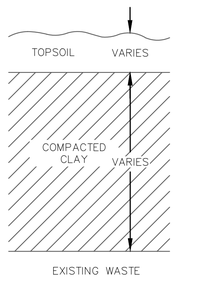
PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 15



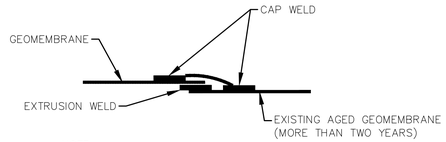
1/16 MC VI-F & G EAST EDGE TIE-IN DETAIL
NOT TO SCALE



2/16 MC VI-G1 TO MC VI-G4, G6, AND G7 TIE-IN DETAIL
NOT TO SCALE

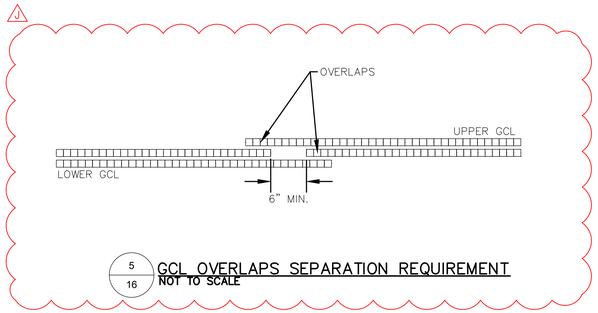


3/16 MC I & MC IV COVER DETAIL
NOT TO SCALE



NOTE:
DETAIL APPLIES AT LOCATIONS WHERE GEOMEMBRANE
TIES INTO EXISTING GEOMEMBRANE

4/16 GEOMEMBRANE WELDING DETAIL
NOT TO SCALE



5/16 GCL OVERLAPS SEPARATION REQUIREMENT
NOT TO SCALE

REV	DATE	DESCRIPTION
J	5/18/22	SUBCELLS G4-G6 REVISIONS
I	10/06/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS
F	11/20/20	SUBCELLS F1-F4 REVISIONS
E	5/29/18	ADDENDUM 1
D	5/08/18	REVISION BASED ON MDEQ'S COMMENTS
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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REV	DATE	DRN	APP
J	5/18/22	LEH	XZ
I	10/06/21	WRG	XZ
G	7/14/21	LEH	XZ
F	11/20/20	WRG	XZ
E	5/29/18	PAA	XZ
D	5/08/18	PAA	XZ
C	5/02/18	PAA	XZ
B	10/27/17	DRN	APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
LINER SYSTEM DETAILS (2 OF 2)
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (2 OF 2)

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

DRAWING NO
16

Geosynthetic Materials

Material	Location	Description	Product	Additional Requirements
80-mil Geomembrane	Primary and secondary liners	80-mil HDPE, textured both sides	GSE HD textured, or equivalent	The CQA Consultant shall manage the direct shear testing of the geomembrane samples, as needed, per the direction of the Design Engineer and in accordance with the design requirements of the project.
40-mil Geomembrane	Final cover	40-mil HDPE, textured both sides	GSE HD textured, or equivalent	
Geosynthetic Clay Liner	Final cover and secondary liner	Sodium bentonite encapsulated between two geotextiles that are needle-punched or stitch-bonded together	CETCO Bentomat ST, or equivalent	The CQA Consultant shall manage the direct shear testing of the GCL samples, as needed, per the direction of the Design Engineer and in accordance with the design requirements of the project.
Geosynthetic Clay Liner	Primary and secondary liners	Sodium bentonite encapsulated between two geotextiles that are needle-punched together	CETCO Bentomat DN, or equivalent	
Geosynthetic Clay Liner	Primary liner	Sodium bentonite encapsulated between two geotextiles that are needle-punched and laminated to a geofilm	CETCO Bentomat CL, or equivalent	
Geosynthetic Clay Liner	Primary Liner	Polymer-modified bentonite	CETCO Resistex 200 FLW9, or equivalent	
Geocomposite	LCS	HDPE, bonded top and bottom to geotextile meeting requirements of geotextile; geocomposite transmissivity* (minimum): MC VI-F1, F3, and F4: 3.2E-04 m2/sec MC VI- F2: 4.1E-04 m2/sec MC VI-G4, G5, and G6: 4.2E-04 m2/sec MC VI-G7: 7.4E-04 m2/sec	GSE FABRINET, or equivalent	Geonet and geotextile shall meet the requirements of the project plans and drawings.
Geocomposite	LDCRS	200-mil HDPE, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET, or equivalent	
Cover Geocomposite	Final cover	Refer to Stormwater Calculation (A.6.8) for minimum geocomposite transmisssivity, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET, or equivalent	
Geonet	LCS and LDCRS sumps, and LDCRS collectors	200-mil HDPE	GSE HYPERNET, or equivalent	Transmissivity requirements per the direction of the Design Engineer and in accordance with the design requirements of the project.
Geotextile	All geocomposites, gravel/geotextile envelopes for LCS, and final cover perimeter drain	Nominal 8 oz/yd^2, needle-punched, non-woven polypropylene	Amoco 4508, Synthetic Industries Geotex 801, or equivalent	AASHTO M288-96 requirements for Separation Geotextile (Class 2)
Geogrid	Above structural fill	Biaxial Polymeric Grid	Huesker Fortrac 80-80, or equivalent	None

LCS denotes leachate collection system
LDCRS denotes leak detection, collection, and removal system.
*Geocomposite Transmissivity Test Requirements:
Per ASTM 4716 with a gradient of 0.1, confining pressure of 10,000 psf, boundary conditions of geomembrane/sand;transmissivity test should be run until the sample reaches equilibrium (becomes asymptotic) or 100 hours, whichever comes first.

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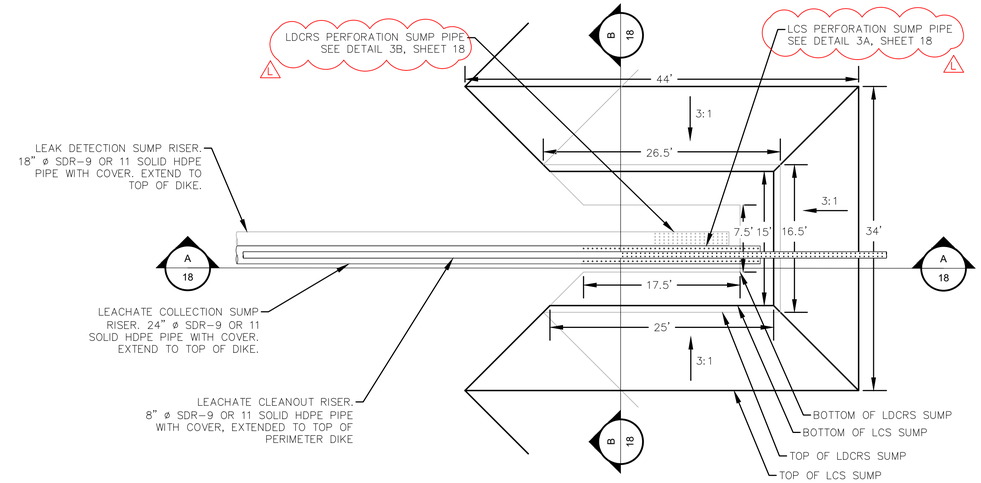
DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REV	DATE	DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
E	11/10/20	SUBCELLS F1-F4 REVISIONS	WRG	XZ
F	5/29/18	ADDENDUM 1	PAA	XZ
D	5/09/18	REVISION BASED ON MDEQ'S COMMENTS	PAA	XZ

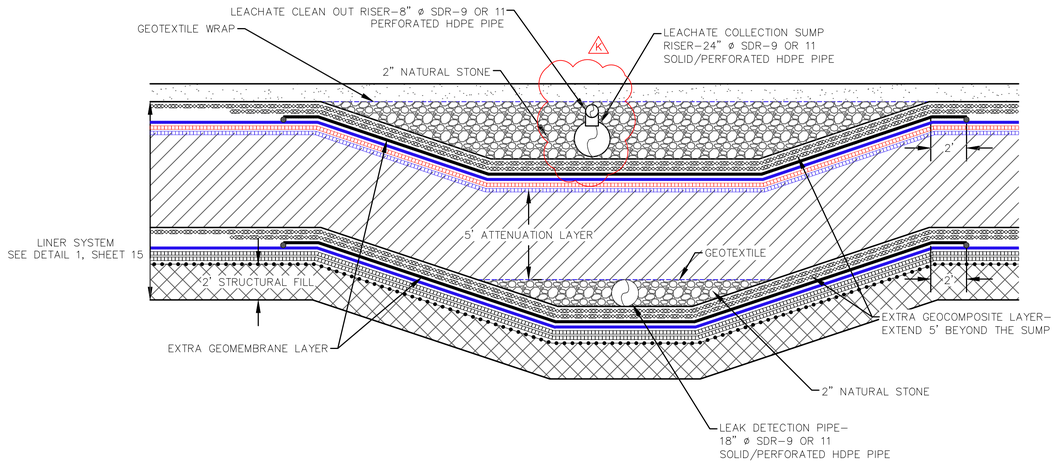
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

GEOSYNTHETIC MATERIALS REQUIREMENTS

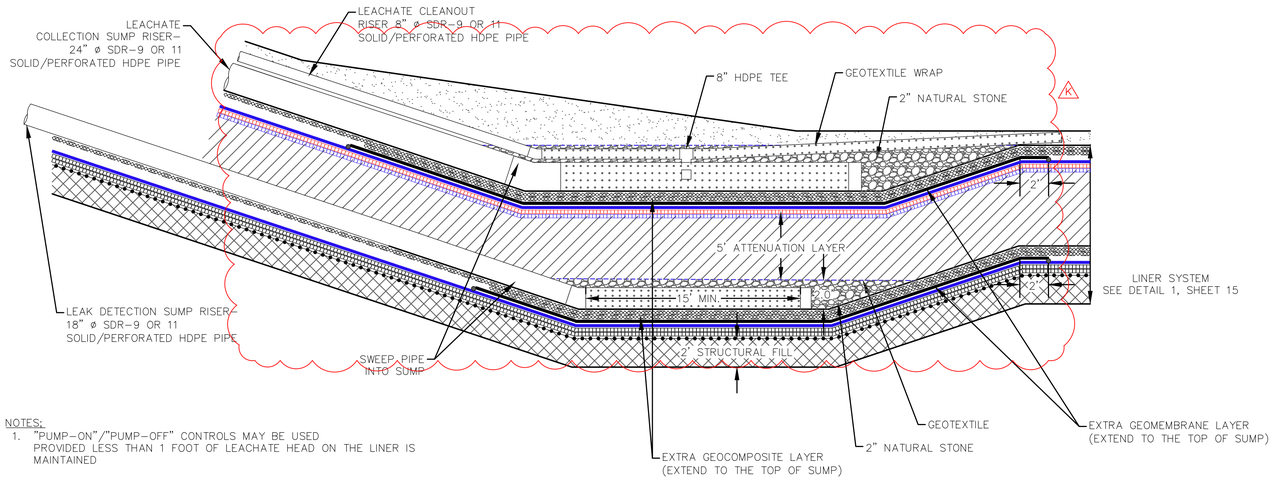
PROJECT NUMBER
1218070017
SCALE
AS SHOWN
DRAWING NO
17



1/18 LCS-LDCRS SUMP (TYP.)
NOT TO SCALE

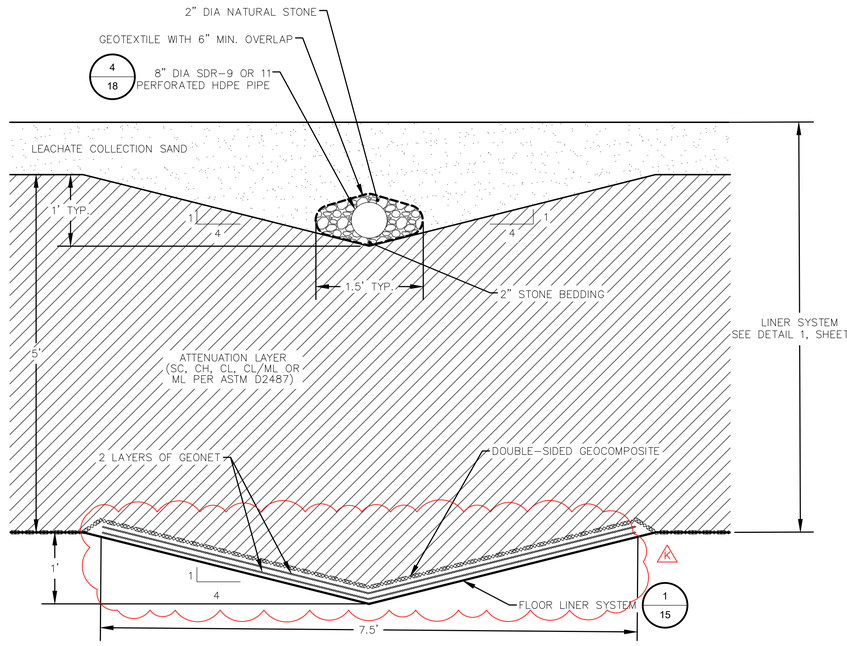


B 18 SUMP CROSS-SECTION B
NOT TO SCALE

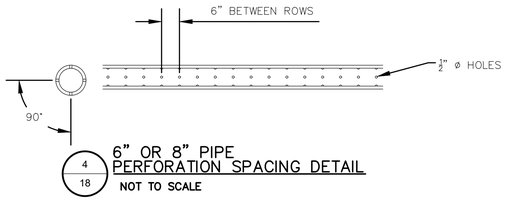


NOTES:
1. "PUMP-ON"/"PUMP-OFF" CONTROLS MAY BE USED PROVIDED LESS THAN 1 FOOT OF LEACHATE HEAD ON THE LINER IS MAINTAINED

A 18 SUMP CROSS-SECTION A
NOT TO SCALE



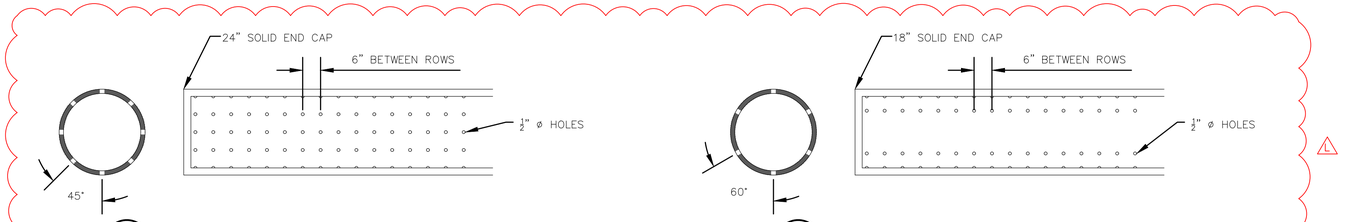
2 18 CELL FLOOR LEACHATE COLLECTION PIPE AND LEAK DETECTION GEONET (TYP.)
NOT TO SCALE



4 18 6" OR 8" PIPE PERFORATION SPACING DETAIL
NOT TO SCALE

Parameter	Symbol	Value	Unit	Notes and Equations
Sump Length (Top)	L_T	44	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Width (Top)	W_T	34	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Top Area	A_T	1,496	ft^2	L X W
Sump Length (Bottom)	L_B	25	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Width (Bottom)	W_B	15	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Bottom Area	A_B	375	ft2	L X W
Depth of Sump	h_0	3.2	ft	Based on Slope 3:1 and Sump Dimensions
Porosity of Aggregates	n	0.3		assumption
Pump On from Bottom	h_1	36	inch	
Pump Off from Bottom	h_2	12	inch	
Pump On Area	A_1	1,419	ft^2	L=43 ft; W=33 ft
Pump Off Area	A_2	651	ft^2	L=31 ft; W=21 ft
Leachate Generation Rate	Q_{in}	47,693	GPD	Source: Attachment A-4_Leachate Collection System Flow Capacity Analysis
		33.1	GPM	
Leachate Pumping Rate	Q_{out}	37.0	GPM	typical pumping rate; minimum pumping rate is 34 gpm.
Effective Sump Storage Volume	Veff	4,535	gal.	$V_{eff} = \frac{1}{3} n \frac{h_1 - h_2}{12} \left(A_1 + A_2 + \sqrt{A_1 A_2}\right) \times 7.481$
Pump Off Time	Toff	2.3	hr	$T_{off} = \frac{V_{eff}}{Q_{in}} \times 24$
Pump On Time	Ton	19.5	hr	$T_{on} = \frac{V_{eff}}{Q_{out} \times 60 - \frac{Q_{in}}{24}}$
Pump Cycle Time	T_{cycle}	21.8	hr	$T_{cycle} = T_{on} + T_{off}$
Pump Cycle	N	1.1		$N = \frac{24}{T_{cycle}}$

NOTES
1. Dimension of the sump used in this calculation is an example. The actual dimension of the sump can be varied.
2. The effective sump storage volume presented in this calculation is a minimum required volume.
3. The leachate pumping rate presented in this calculation is for illustration purpose. Other size of pump with different flow rate can be used as long as the leachate level above the primary liner can be maintained below 12-inch.



3A 18 LCS SUMP PERFORATION SPACING DETAIL
NOT TO SCALE

3B 18 LDCRS SUMP PERFORATION SPACING DETAIL
NOT TO SCALE

REV	DATE	REVISION DESCRIPTION	DRN	APP
L	01/10/25	REVISED DETAILS	AN	XZ
K	02/13/24	CHANGED LINETYPE FOR LAYERS OF GEONET AND GEOCOMPOSITE IN DETAIL 2B	JWC	
J	05/18/22	SUBCELLS C4-C6 REVISIONS	LEH	XZ
I	10/08/21	SUBCELLS C4-C7 REVISIONS; MISCELLANEOUS CHANGES	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	11/20/20	SUBCELLS F1-F4 REVISIONS	WRG	XZ
B	9/23/11	PER WDEQ COMMENTS	DRL	

DATE:	05/18/22
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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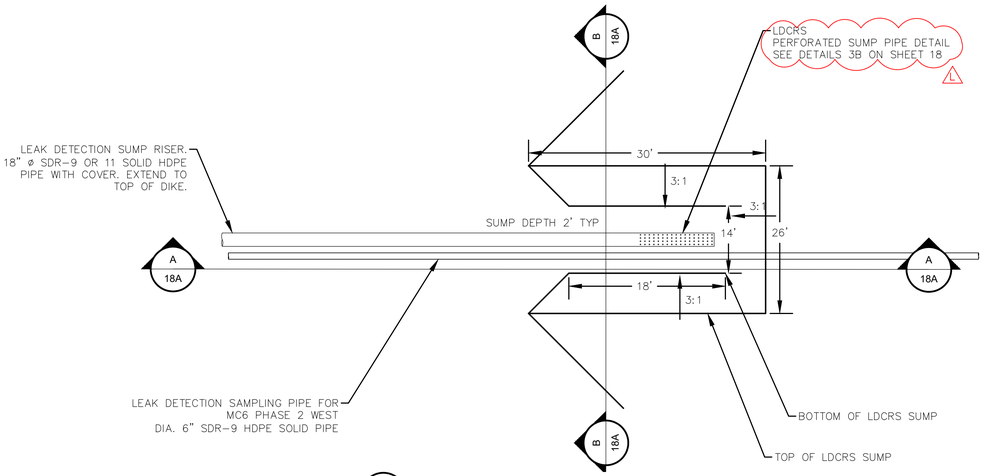
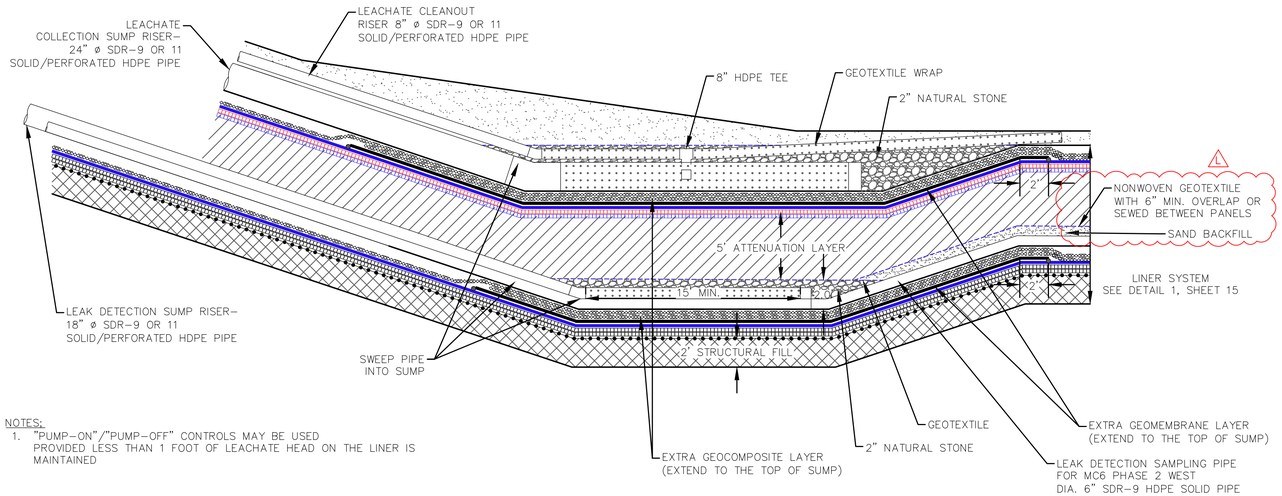
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEACHATE COLLECTION SYSTEM DETAILS

PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 18

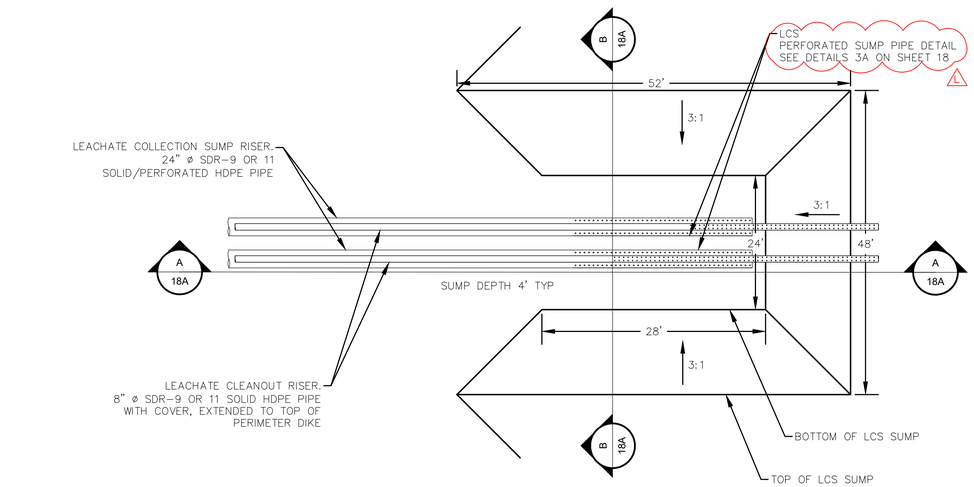


1 / 18A MC6F4 EAST LDCRS SUMP (TYP.)
NOT TO SCALE

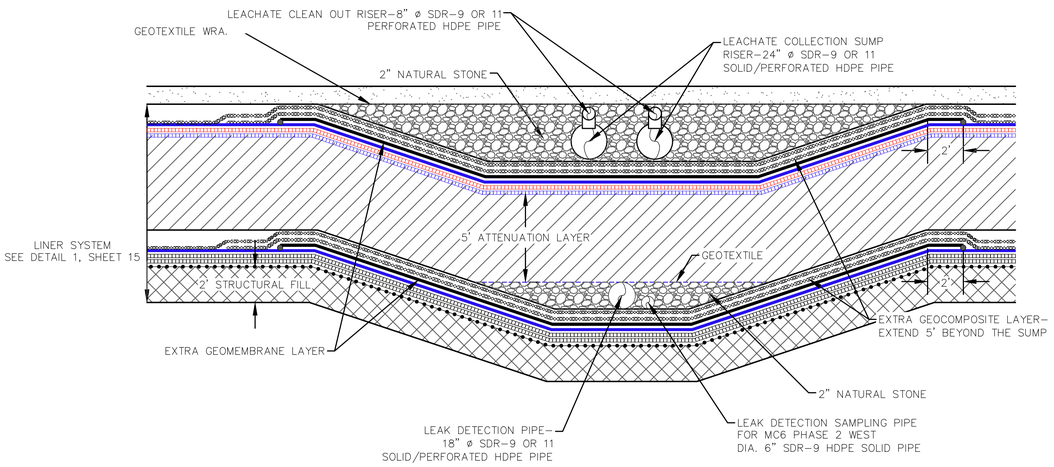


NOTES:
1. "PUMP-ON"/"PUMP-OFF" CONTROLS MAY BE USED PROVIDED LESS THAN 1 FOOT OF LEACHATE HEAD ON THE LINER IS MAINTAINED

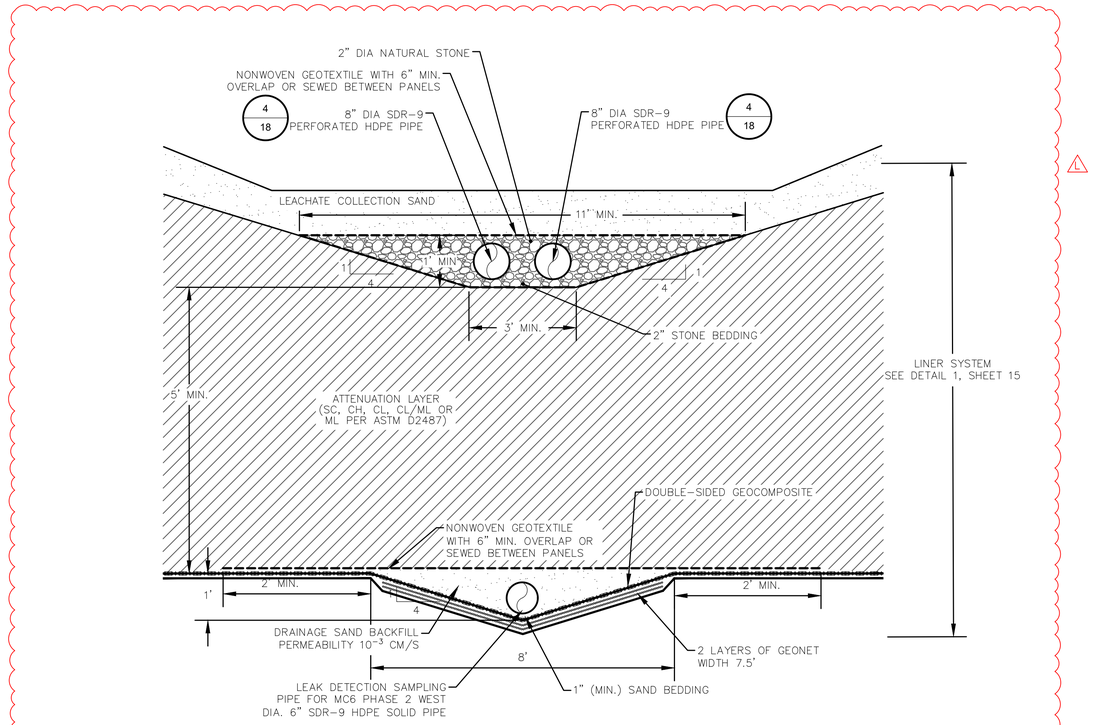
A / 18A MC6F4 EAST SUMPS CROSS-SECTION A
NOT TO SCALE



2 / 18A MC6F4 EAST LCS SUMP (TYP.)
NOT TO SCALE



B / 18A MC6F4 EAST SUMPS CROSS-SECTION B
NOT TO SCALE



3 / 18A CELL FLOOR LEACHATE COLLECTION PIPE AND LEAK DETECTION COLLECTION SYSTEM FROM MC6E PHASE 2 WEST TO MC6F4 EAST (TYP.)
NOT TO SCALE

DATE:	05/18/22
DESIGNED BY:	XZ
DRAWN BY:	JC
CHECKED BY:	BA
APPROVED BY:	XZ

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REVISIONS	REV	DATE	REVISION DESCRIPTION
	K	01/10/25	REVISED DETAILS
	L	02/13/24	NEW SHEET

AN	XZ	APP
JC	XZ	DRN

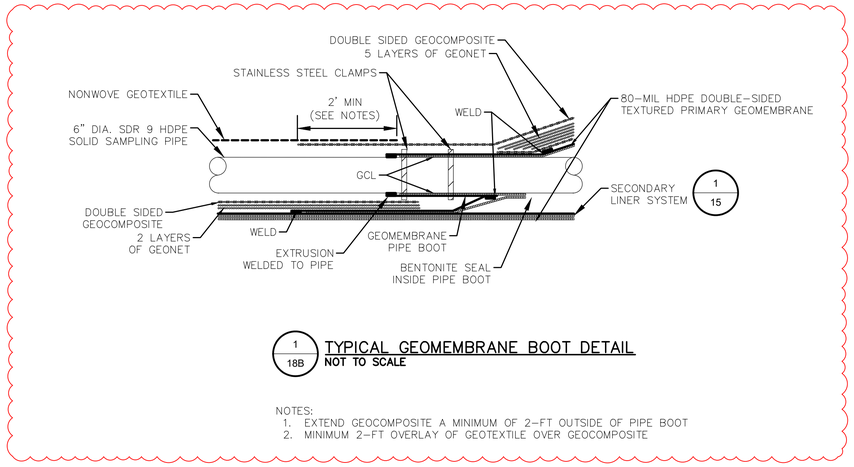
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEAK DETECTION AND LEACHATE SYSTEM FOR MC VI F4 EAST

PROJECT NUMBER
1218070017

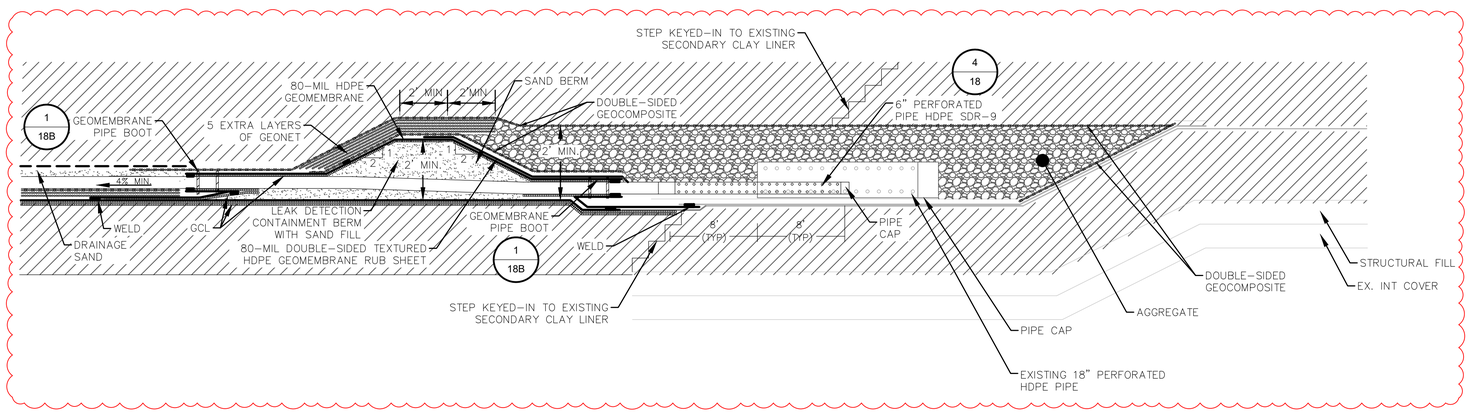
SCALE
AS SHOWN

DRAWING NO
18A



1
18B
TYPICAL GEOMEMBRANE BOOT DETAIL
NOT TO SCALE

NOTES:
1. EXTEND GEOCOMPOSITE A MINIMUM OF 2-FT OUTSIDE OF PIPE BOOT
2. MINIMUM 2-FT OVERLAY OF GEOTEXTILE OVER GEOCOMPOSITE



2
18B
MODIFICATION OF EXISTING LEAK DETECTION SUMP IN SUBCELL MC VI-E PHASE 2 WEST
NOT TO SCALE

DATE:	05/18/22
DESIGNED BY:	XZ
DRAWN BY:	JC
CHECKED BY:	BA
APPROVED BY:	XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	
K	01/10/25	REVISED DETAILS	AN
L	02/11/25	NEW SHEET	JC

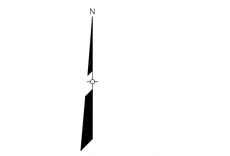
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

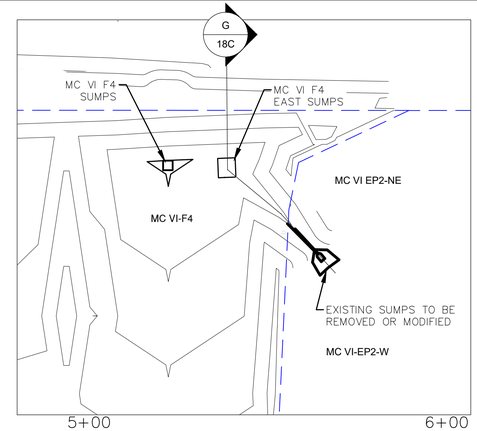
CONNECTION DETAILS FOR MC VI-E PHASE 2 WEST LEAK DETECTION SUMP

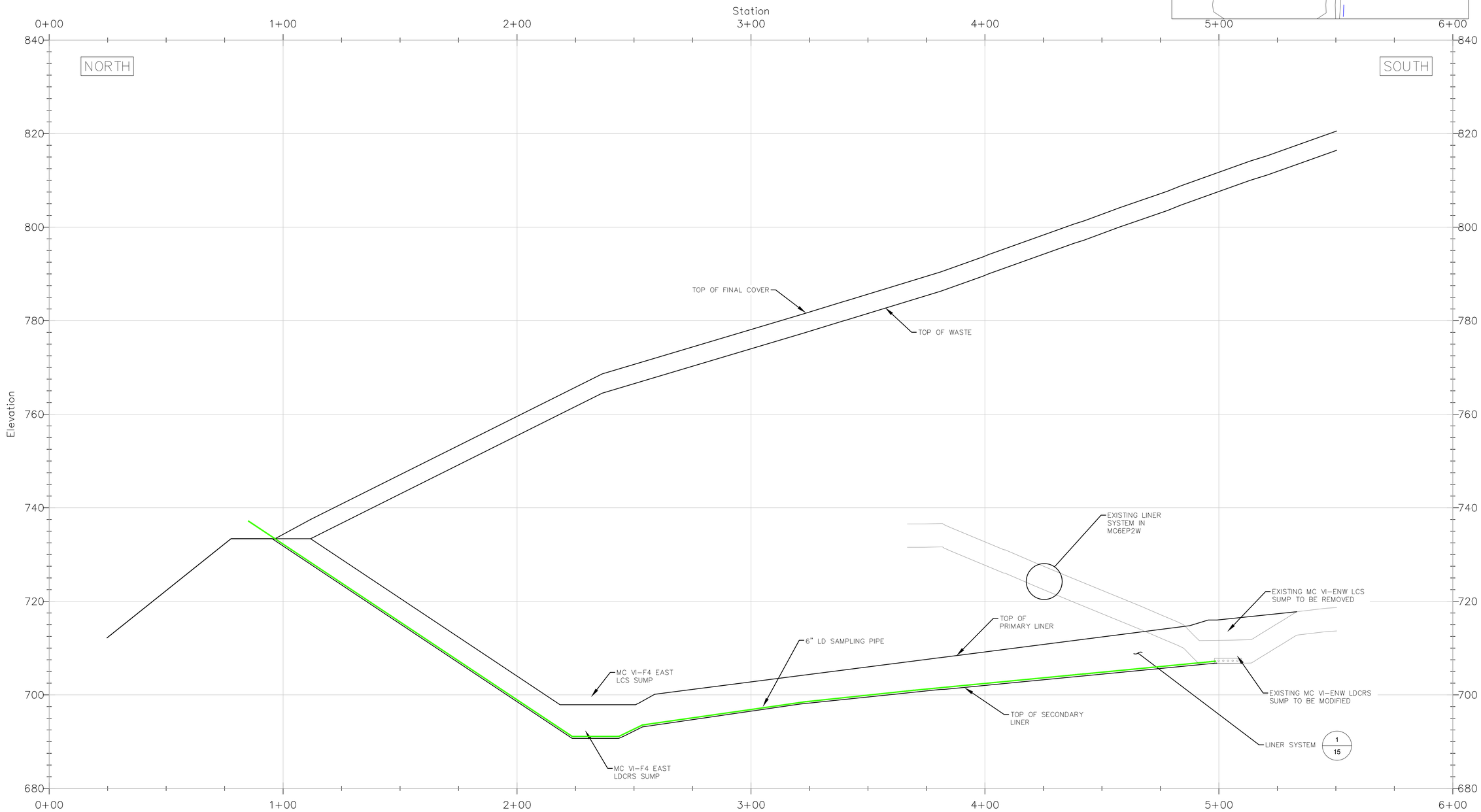
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

DRAWING NO
18B







G
18C
SECTION THROUGH PROPOSED MC VI-E PHASE 2 WEST SUMP MODIFICATION
SCALE: 1"=20' (HORIZONTAL), 1"=10' (VERTICAL)

DATE: 1/10/25
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	APP
1	1/10/25	NEW SHEET	XZ
			DRN
			AN

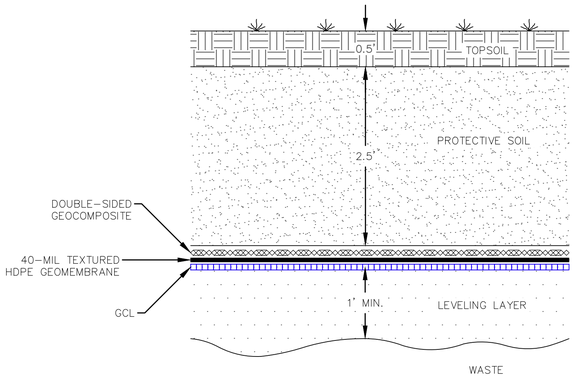
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION OF MC IV-E PHASE 2 WEST SUMP MODIFICATION

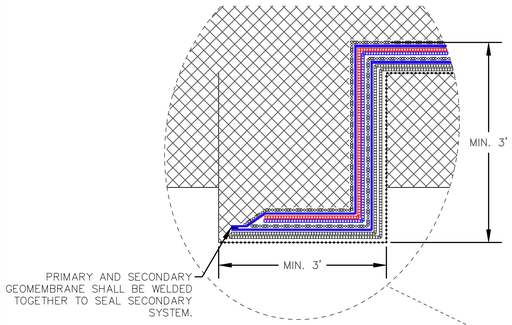
PROJECT NUMBER
1218070017

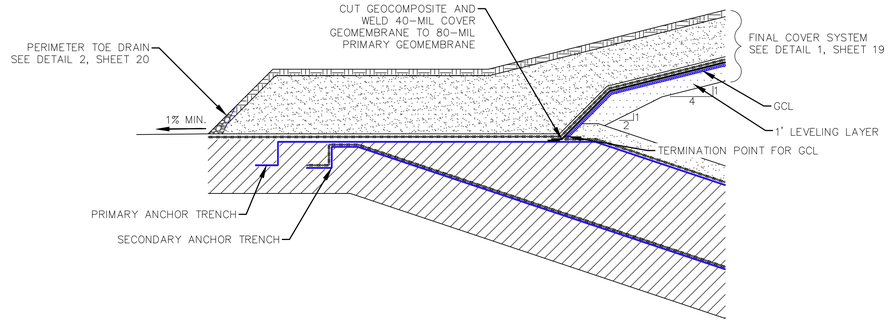
SCALE
AS SHOWN

DRAWING NO.
18C



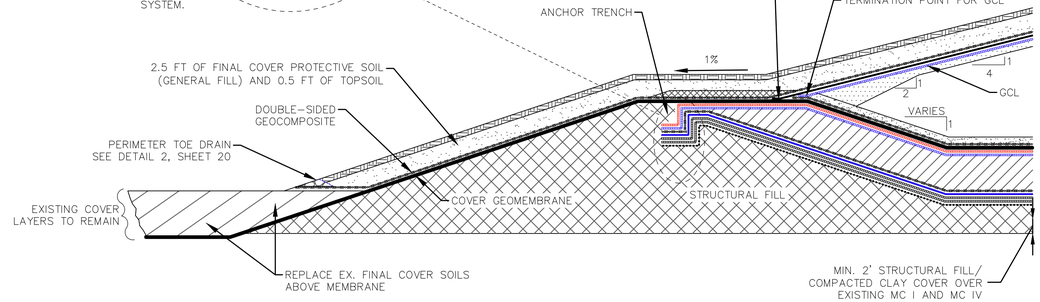
FINAL COVER SYSTEM
1"=2'



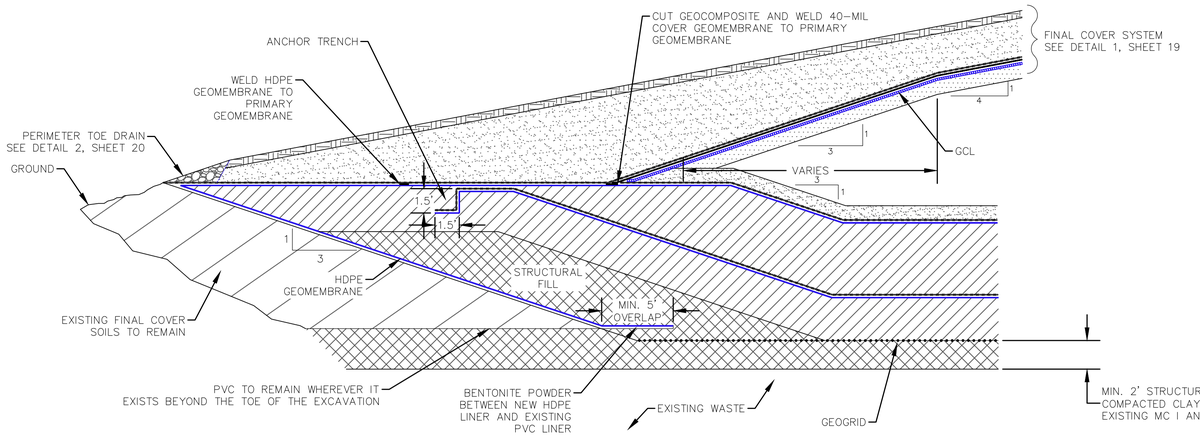


FINAL COVER TIE-IN DETAIL
MC VI-AN, AS, C & D
NOT TO SCALE

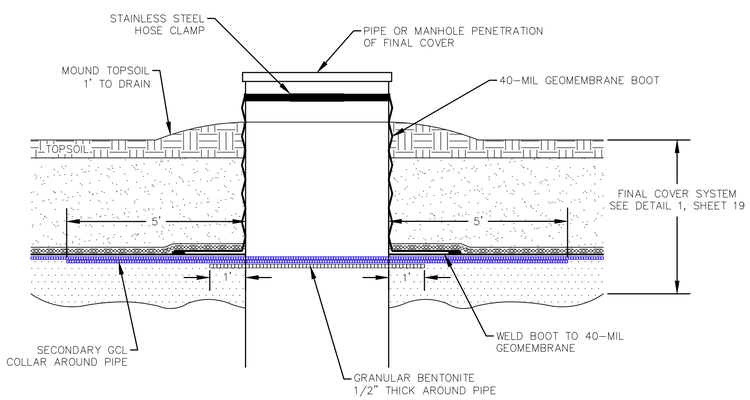
NOTE:
THE GEOMEMBRANE DOES NOT EXTEND TO THE OUTSIDE FACE OF THE PERIMETER DIKE WHERE IT IS LOCATED OUTSIDE OF THE MC I/MC IV FOOTPRINT.



DIKE AND COVER TIE-IN DETAIL (TYP.)
MC VI-F, MC VI-G, & EAST SIDE OF MC VI-E
NOT TO SCALE



DIKE AND COVER TIE-IN DETAIL
NORTH SIDE OF MC VI-E
NOT TO SCALE



FINAL COVER PENETRATION DETAIL (TYP.)
NOT TO SCALE

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REVISIONS	REV	DATE	DESCRIPTION	DRN	APP
1	F	11/20/20	SUBCELLS F1-F4 REVISIONS	WRG	XZ
H	G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
I	H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
	I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

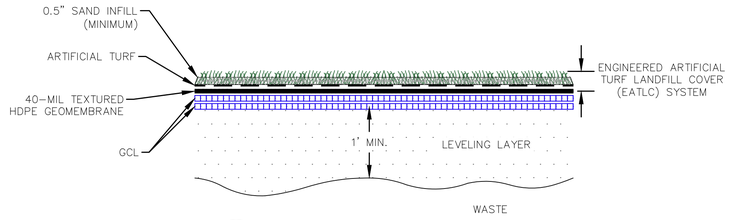
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER DETAILS

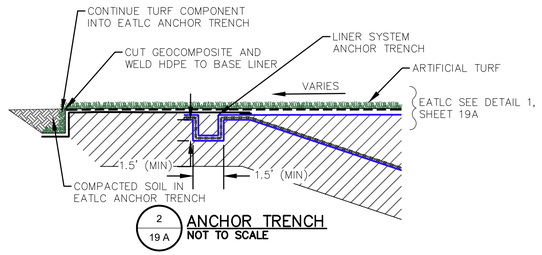
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

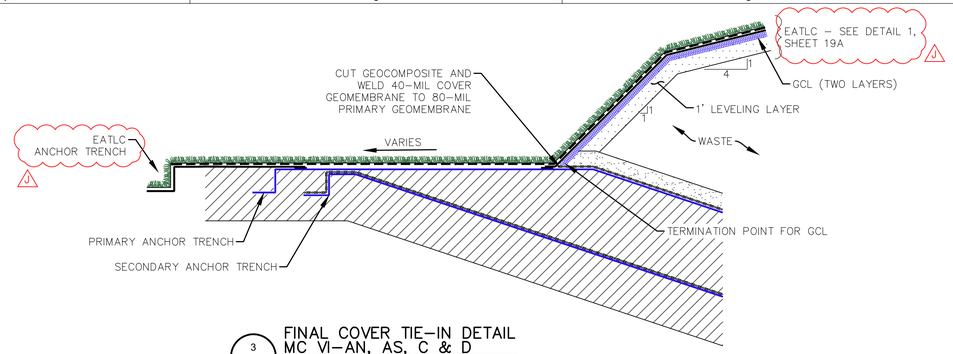
DRAWING NO
19



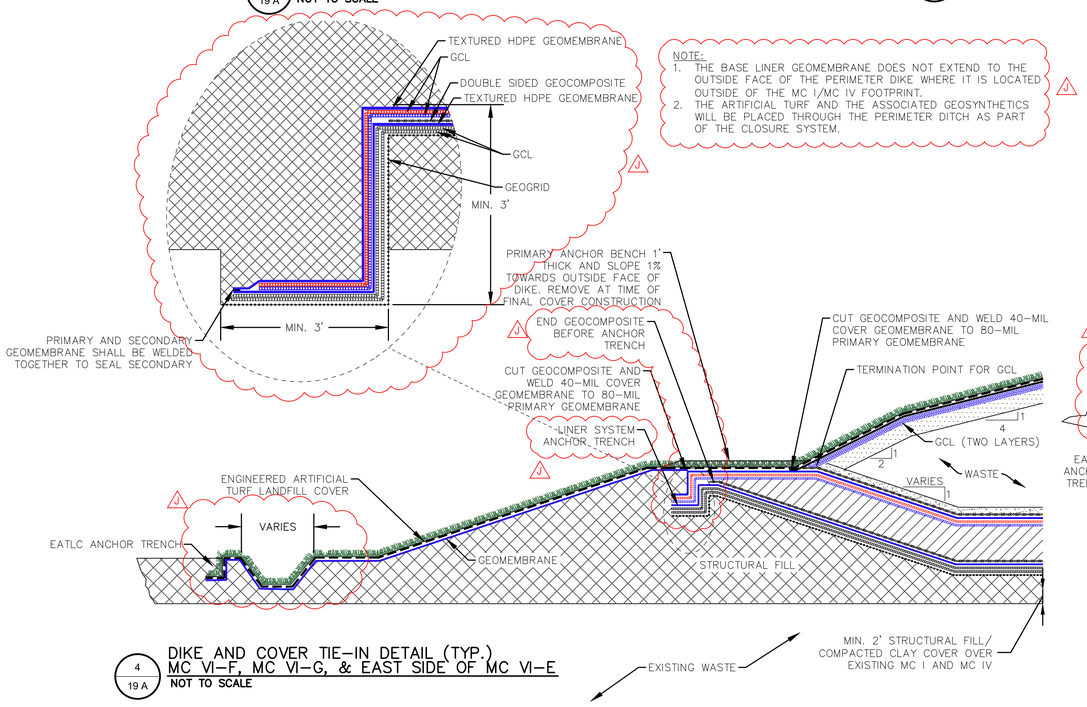
1 / 19 A **FINAL COVER SYSTEM**
NOT TO SCALE



2 / 19 A **ANCHOR TRENCH**
NOT TO SCALE

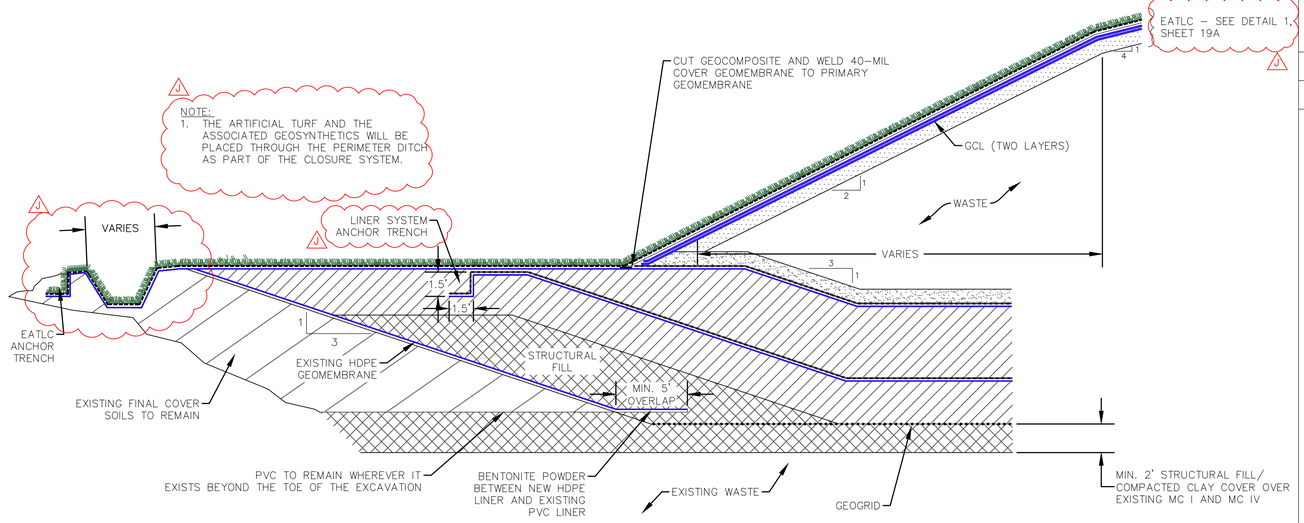


3 / 19 A **FINAL COVER TIE-IN DETAIL MC VI-AN, AS, C & D**
NOT TO SCALE

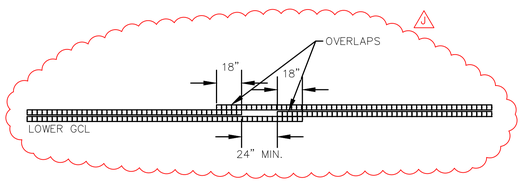


NOTE:
1. THE BASE LINER GEOMEMBRANE DOES NOT EXTEND TO THE OUTSIDE FACE OF THE PERIMETER DIKE WHERE IT IS LOCATED OUTSIDE OF THE MC I/MC IV FOOTPRINT.
2. THE ARTIFICIAL TURF AND THE ASSOCIATED GEOSYNTHETICS WILL BE PLACED THROUGH THE PERIMETER DITCH AS PART OF THE CLOSURE SYSTEM.

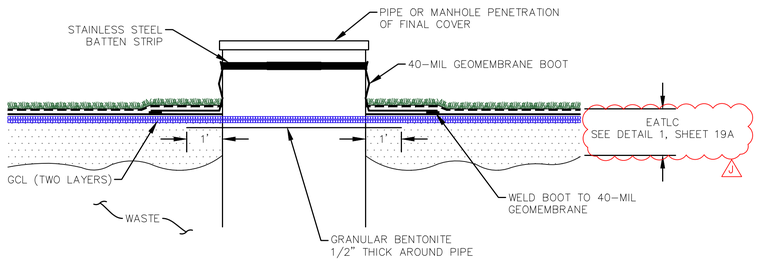
4 / 19 A **DIKE AND COVER TIE-IN DETAIL (TYP.) MC VI-F, MC VI-G, & EAST SIDE OF MC VI-E**
NOT TO SCALE



5 / 19 A **DIKE AND COVER TIE-IN DETAIL NORTH SIDE OF MC VI-E**
NOT TO SCALE



6 / 19 A **GEOSYNTHETIC CLAY LINER OVERLAP DETAIL**
NOT TO SCALE



7 / 19 A **FINAL COVER PENETRATION DETAIL (TYP.)**
NOT TO SCALE

NOTE:
1. ALL GEOSYNTHETIC CLAY LINER (GCL) SHALL BE COVERED WITH GEOMEMBRANE WITHIN 24 HOURS AFTER PLACEMENT OF GCL AND OVERLAPPED A MINIMUM OF 18-INCHES DURING INSTALLATION.
2. ALL OVERLAPPED SEAMS ARE TO BE HEAT-TACKED USING A QUICK PASS OF A FLAME TORCH FOLLOWED BY QUICK APPLICATION OF APPROPRIATE PRESSURE AS PROVIDED BY A ROLLER, FOOT PRESSURE, OR OTHER MEANS.
3. THE CONTRACTOR SHALL INSTALL THE TWO LAYERS OF THE GCL STAGGERED BY A MINIMUM OF 24-INCHES BETWEEN UPPER AND LOWER GCL SEAMS.
4. REINFORCED GCL MUST BE USED ON ALL SLOPES AS PART OF THE CLOSURE SYSTEM.
5. CONSTRUCTION OF THE FINAL COVER SYSTEM SHALL BE SUPPORTED BY A VENEER STABILITY ANALYSIS. EACH GEOSYNTHETIC/GEOSYNTHETIC AND GEOSYNTHETIC/SOIL INTERFACE INCLUDED IN EATLC SYSTEM SHALL BE CONSIDERED FOR PREQUALIFICATION TESTING PRIOR TO INSTALLATION OF THE COVER SYSTEM. THE CRITICAL INTERFACE SHALL BE DETERMINED BY A COMPARISON OF INTERFACE STRENGTH TEST RESULTS OF REPRESENTATIVE SAMPLES OF MATERIALS USED FOR CONSTRUCTION FOR EACH INTERFACE. THE CRITICAL INTERFACE IS THE LOWEST SHEAR STRENGTH TEST RESULT THAT CORRESPONDS TO THE NORMAL STRESS EXHIBITED BY THE EATLC COVER SYSTEM WHICH IS EXPECTED TO BE BETWEEN 5 AND 6 PSF.

AT MINIMUM, THE FOLLOWING INTERFACES SHALL HAVE INTERFACE TEST RESULTS FOR COMPARISON.
- BASE GEOTEXTILE OF THE EATLC AND GEOMEMBRANE
- GEOMEMBRANE AND TOP LAYER OF GCL.
- TOP LAYER OF GCL AND BOTTOM LAYER OF GCL.
- BOTTOM LAYER OF GCL AND LEVELING SOIL LAYER.
- INTERNAL SHEAR STRENGTH OF THE GCL UNDER HYDRATED CONDITIONS.

7. INTERFACE FRICTION TESTS PERFORMED TO QUALIFY ACCEPTABLE MATERIALS FOR PLACEMENT OF EATLC COVER MATERIALS SHALL CONSIDER LARGE-DISPLACEMENT STRENGTH TEST RESULTS ON THE FINAL COVER SIDE-SLOPES STEEPER THAN 10% AND PEAK STRENGTH TEST RESULTS FOR ALL OTHER SLOPES. THE MINIMUM DESIGN FACTOR OF SAFETY FOR STATIC STABILITY SHALL BE 1.3 FOR FINAL COVER SIDE-SLOPES STEEPER THAN 10% THAT CONSIDER LARGE-DISPLACEMENT STRENGTH TESTING RESULTS. THE MINIMUM DESIGN FACTOR OF SAFETY FOR STATIC STABILITY SHALL BE 1.5 FOR ALL OTHER FINAL COVER SLOPES THAT CONSIDER PEAK STRENGTH.
8. NO EQUIPMENT TRAFFIC SHALL BE ALLOWED TO TRAVERSE AREAS OF EATLC WITHOUT PRIOR APPROVAL BY THE ENGINEER.

VENEER STABILITY INTERFACE STRENGTH REQUIREMENTS		
	FINAL COVER SLOPES > 10%	FINAL COVER SLOPES ≤ 10%
REQUIRED INTERFACE STRENGTH TEST DATA	LARGE-DISPLACEMENT STRENGTH	PEAK STRENGTH
MIN. EQUIV. ACCEPTABLE INTERFACE STRENGTH*	18 DEGREES	20.5 DEGREES
MIN. ACCEPTABLE FS FOR VENEER STABILITY	1.3	1.5

*COMBINATIONS OF TESTED INTERFACE FRICTION ANGLE AND SHEAR STRENGTH INTERCEPT MEASURED AT THE NORMAL STRESS (5-6 PSF)EXHIBITED BY THE EATLC COVER SYSTEM THAT SATISFIES THE FACTOR OF SAFETY CRITERIA ARE ACCEPTABLE

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: C4B
APPROVED BY: XZ

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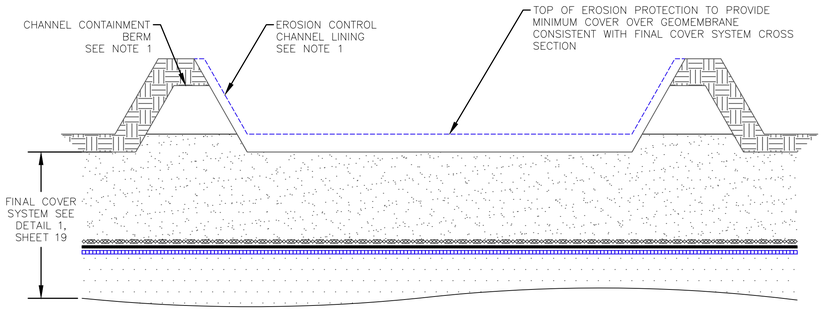
REVISIONS	REV	DATE	DESCRIPTION	BY	APP
	J	05/18/22	RESPONSE TO EGLE COMMENTS DATED 3/29/2022	LEH	XZ
	I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
			REVISION DESCRIPTION	DRN	APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF FINAL COVER DETAILS

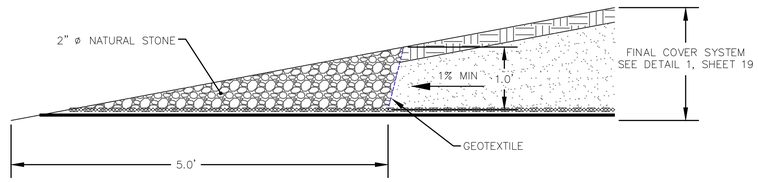
PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 19 A



1/20 TYPICAL DOWNSLOPE CHANNEL DETAIL
NOT TO SCALE

NOTE:

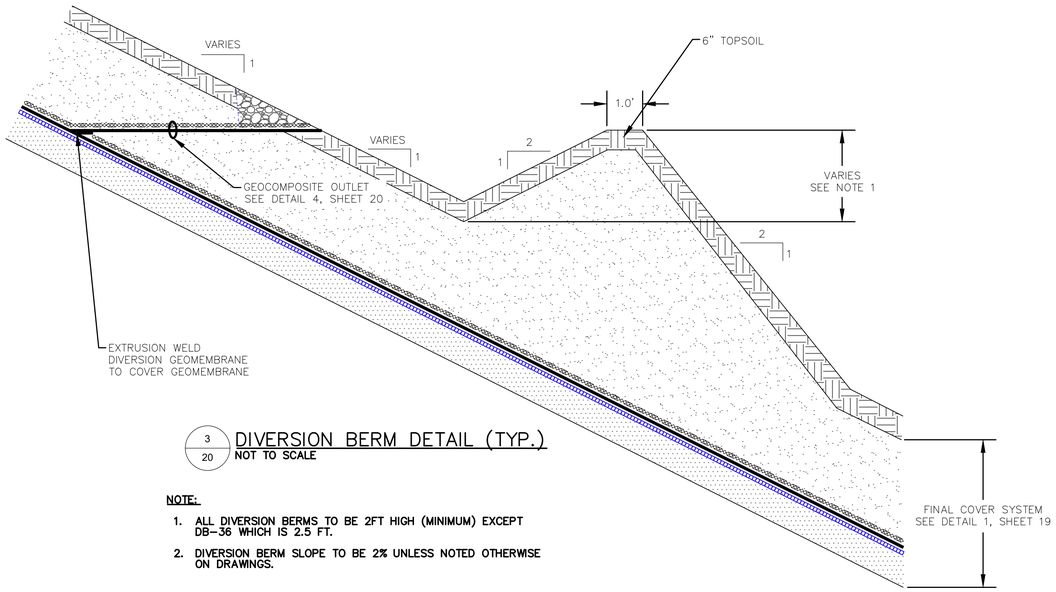
1. DIMENSIONS AND CONFIGURATION OF DOWNSLOPE CHANNEL CONTAINMENT BERMS AND CHANNEL WILL BE DETERMINED BY THE EROSION CONTROL CHANNEL LINING CHOSEN. CHANNEL AND OUTLET ENERGY DISSIPATER DESIGN TO BE COMPLETED PRIOR TO CONSTRUCTION.



2/20 PERIMETER TOE DRAIN
NOT TO SCALE

Erosion Control Channel Lining	Maximum Allowable Design		Comments
	Velocity	Slope	
Grass	5 fps	Varies	Maximum allowable design slope varies based on peak flows within channel.
Riprap	Varies	25%	Maximum allowable design velocity varies with slope to maintain stable riprap.
TRM (Turf Reinforcement Mat)	15 fps	25%	Final design limits to be determined based on actual TRM chosen.
Articulated Concrete Block Mat (e.g. Flexamat)	30 fps	33.30%	Final design limits to be determined based on actual product chosen.
Other	Varies	Varies	Additional erosion control materials may be utilized based on availability, effectiveness, and cost.

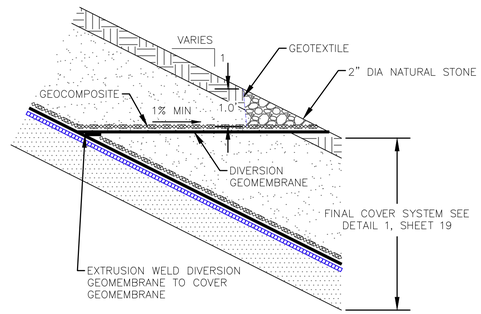
K



3/20 DIVERSION BERM DETAIL (TYP.)
NOT TO SCALE

NOTE:

1. ALL DIVERSION BERMS TO BE 2FT HIGH (MINIMUM) EXCEPT DB-36 WHICH IS 2.5 FT.
2. DIVERSION BERM SLOPE TO BE 2% UNLESS NOTED OTHERWISE ON DRAWINGS.



4/20 GEOCOMPOSITE OUTLET DETAIL (TYP.)
NOT TO SCALE

NOTE:

1. ALTERNATE GEOCOMPOSITE OUTLETS SUCH AS PIPE MAY BE USED.

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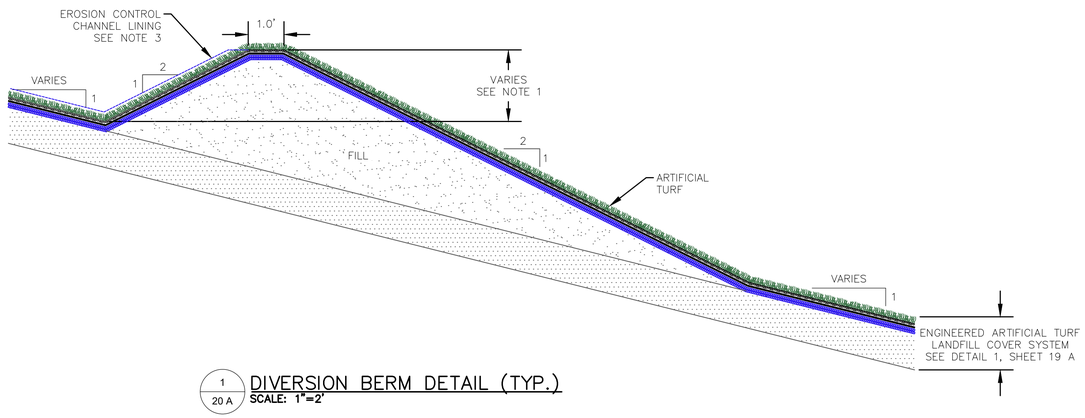
DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION	DRN	APP
K	02/08/24	ADDED EROSION CONTROL TABLE	JWC	XZ
I	10/08/21	SUBCELLS C4-C7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
F	11/20/20	SUBCELLS F1-F4 REVISIONS	WRG	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORMWATER MANAGEMENT SYSTEM DETAILS

PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 20



1 / 20 A DIVERSION BERM DETAIL (TYP.)
SCALE: 1"=2'

NOTE:

1. ALL DIVERSION BERMS TO BE 2FT HIGH (MINIMUM).
2. DIVERSION BERM SLOPE TO BE 2% UNLESS NOTED OTHERWISE ON DRAWINGS.
3. DIMENSIONS AND CONFIGURATION OF DIVERSION BERMS WILL BE DETERMINED BY THE EROSION CONTROL CHANNEL LINING CHOSEN. CHANNEL AND OUTLET ENERGY DISSIPATER DESIGN TO BE COMPLETED PRIOR TO CONSTRUCTION.

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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REVISIONS

REV	DATE	DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORMWATER MANAGEMENT SYSTEM DETAILS

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

DRAWING NO
20 A

GAS VENTING LINE (TYP) 1/21

CONDENSATE SUMP

MC VI-F4

MC VI-F3

MC VI-F2

MC VI-F1

MC VI-G3

MC VI-G1

MC VI-G2

MC VI-G7

MC VI-G6

MC VI-G4

MC VI-G5

MC 4

5000 E

4500 E

4000 E

450' (MAX)

0 100 200

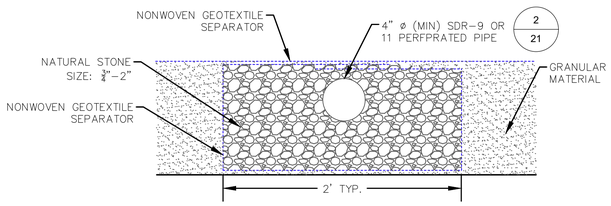
SCALE IN FEET

LEGEND

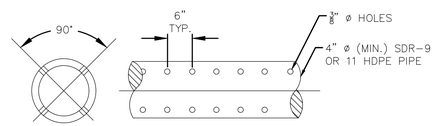
- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — MASTER CELL VI–F & G MAJOR CONTOURS
- MASTER CELL VI–F & G MINOR CONTOURS
- SUBCELL BOUNDARIES
- CELL BOUNDARIES
- PROPOSED GAS VENTING LINE
- EXISTING LANDFILL GAS VENTING PIPE (SOLID)
- EXISTING LANDFILL GAS VENTING PIPE (PERFORATED)
- PROPOSED 6" CLEANOUT FOR GAS EXTRACTION

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. THE GAS SYSTEM IN MC1 IS CONCEPTUAL. THE ACTUAL LAYOUT OF THE VENTING LINES CAN BE ADJUSTED BASED ON THE NEED FOR THE CONSTRUCTION AS LONG AS THE MAX DISTANCE BETWEEN THE GAS VENTING LINES IS NOT LARGER THAN 450 FT.



1/21 VENTING LINE DETAIL FOR SUBCELLS F1–4 AND G4–7 OVER EXISTING MC I AND MC IV
NOT TO SCALE



2/21 VENTING PIPE DETAIL
NOT TO SCALE

REVISIONS													
REV	DATE	DESCRIPTION											
L	04/18/25	MC VI–F ASBUILT GAS											
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS											
J	05/18/22	SUBCELLS G4–G6 REVISIONS											
I	10/08/21	SUBCELLS G4–G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES											
H1	5/10/22	REVISED LINER GRADES IN F3											
H	8/25/21	RESPONSE TO EGLE COMMENTS											
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS											
F	11/20/20	SUBCELLS F1–F4 REVISIONS											
E	5/29/18	ADDENDUM #1											
REV	DATE	REVISION DESCRIPTION											
			AN	AN	XZ	LEH	WRG	XZ	LEH	XZ	LEH	XZ	WRG	XZ	P-AA	XZ	DRN	APP

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WAYNE DISPOSAL, INC. SITE NO. 2- MASTER CELL VI-F&G
CONCEPTUAL GAS VENTING SYSTEM
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

AS-BUILT AND CONCEPTUAL GAS VENTING SYSTEM

PROJECT NUMBER 1218070017

SCALE AS SHOWN

DRAWING NO 21

APPENDIX D
PREVIOUS SUBMITTALS

ORIGINAL SUBMITTAL
2021 PERMIT APPLICATION

ATTACHMENT B.6 ENGINEERING PLANS

2021 Permit Application

Attachment B6 Engineering Plans

Introduction

This report provides the technical basis for landfill design improvements to Master Cell VI (MC-VI) requested in Wayne Disposal Inc.'s (WDI) 2021 Part 111, Hazardous Waste Operating License renewal application. The improvements being requested include:

- Adjusting the MC VI-G1 through G7 (here in referred to as MC VI-G) base liner to improve the leachate management operations and provide additional leak detection capabilities. The proposed upgrades include the addition of dedicated leachate collection and leak detection sumps for each cell in MC VI-G.
- Enhancing the final cover design with the use of a geosynthetic engineered artificial turf final cover system.
- Improving the geometry of the final grade in order to improve the storm water management system

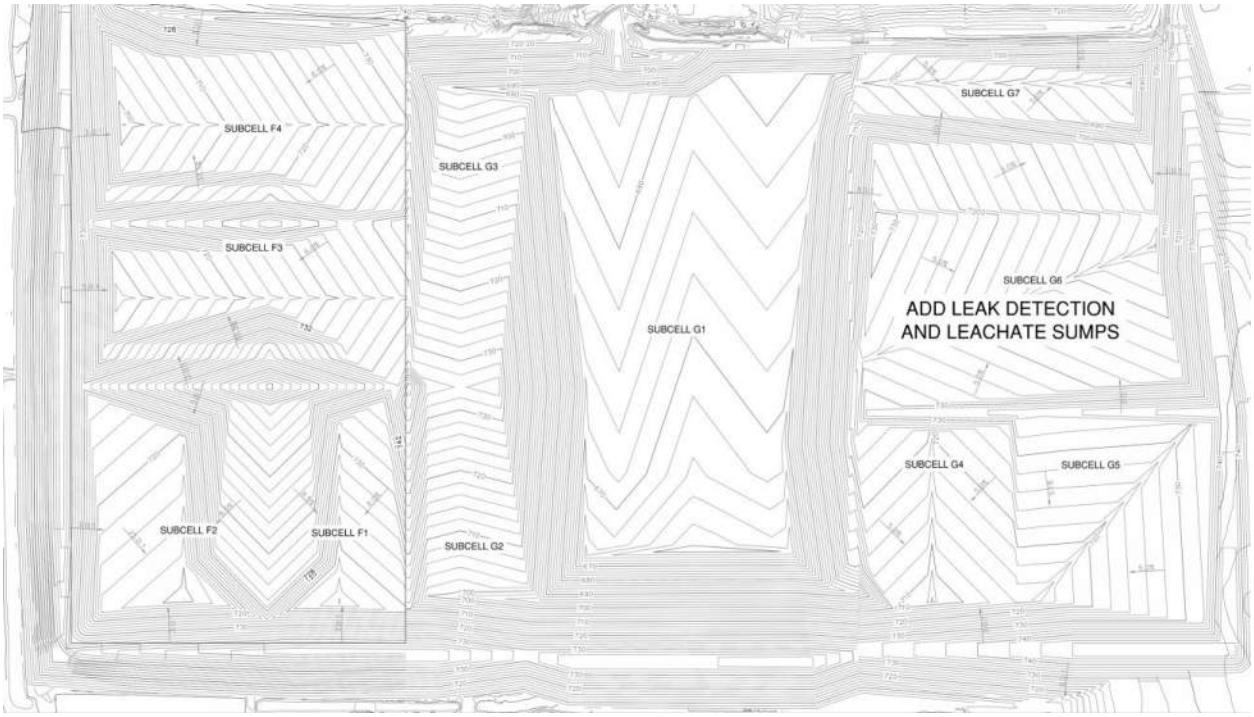
The design improvements at WDI alter the theoretical hazardous waste design capacity of the facility. As a result, WDI also requested to update the permit capacity to reflect the adjusted theoretical hazardous waste design capacity. Calculations, included in Attachments A and B of this section, provide the basis for design of the alternative final cover system. A complete set of permit engineering drawings is included in Attachment C of this section for ease of review and reference.

CTI and Associates, Inc. (CTI) is providing a summary of the methodology used to evaluate the upgrades and recommendations along with supporting documentation, which includes calculations and the revised permit engineering drawings.

Master Cell VI-G4 through G7 Upgrade

The proposed upgrades to MC VI-G include a liner grade change to facilitate the addition of dedicated leachate collection and leak detection sumps for each cell including MC VI-G4 through G7. To incorporate these sumps into the design, cell layouts have been modified to allow for optimal flow of the leachate collection and leak detection systems. Figure 1 displays the proposed area of the MC VI-G base liner grades and layout.

Figure 1. Proposed Master Cell VI-G Layout



Final Cover Grade

Prior to the 2012 WDI landfill capacity expansion, the Willow Run Airport Runway 14/32 restricted the height of the vertical boundary of the landfill. The runway was removed in 2014, allowing WDI to reevaluate the geometry of the final grade. This proposed change allows the geometry of the final grade to have a more consistent slope, which will allow for a more controlled and direct storm water management system.

Figure 2. Proposed Final Grades

Alternative Final Cover – Engineered Artificial Turf Landfill Cover System

As part of this submittal, WDI is proposing an alternate to the final cover system design. The alternative final cover is an engineered three component system comprised of a structured geomembrane, an engineered turf, and a specialized sand infill. The foundation of the system is an impermeable, highly transmissive structured geomembrane. The engineered turf component gives the system the appearance of grass while eliminating the maintenance challenges associated with a vegetation-based system (e.g., mowing, erosion). The specialized sand infill component is placed between the blades of the engineered

turf and allows the system to be trafficked while also providing enhances UV protection. The engineered alternative final cover system is fast and easy to install for an aesthetically pleasing, cost-effective landfill closure solution. During post closure, the proposed alternative cover system is highly erosion resistant, very low maintenance and easy to repair on the rare occasions it is needed. Details and calculations in support of this proposed alternate are included in Attachment B of this section.

Summary of Design Capacity

WDI's currently permitted design capacity is approximately 22,453,720 million cubic yards of hazardous waste. The original hazardous waste capacity was 11,000,000 cubic yards. However, the Willow Run Airport Runway 14/32 that existed at the time of the original permit restricted the height of the vertical boundary, which limited the hazardous waste capacity to 10,723,720 cubic yards. In 2012, the MC VI-F/G expansion increased the capacity by 11,730,000 cubic yards.

As part of this submittal, the final grade elevations of MC IV-G2 and MC VI-G3 are being adjusted to their original configuration which was revised in 2018 to ensure a net zero capacity change with a geocomposite clay liner design. Additionally, the area previously restricted by Willow Run Airport Runway 14/32 has been adjusted to improve the storm water management system and increase the maximum elevation to 930 feet above mean sea level. This adjustment will result in an increased capacity of 3,871,240 cubic yards. The floor grades (in MC VI F and G) have been adjusted to include leachate collection and leak detection sumps. Adjusting the floor grades results in an increase in capacity of 149,906 cubic yards.

The use of an alternative final cover system design provides approximately 687,764 cubic yards of capacity.

The total net gain in the hazardous waste capacity incorporating the sum of these adjustments is 4,708,910 cubic yards.

Design Calculations

In order to add leachate collection and leak detection sumps, the base liner grades in MC VI-G were revised and cell layouts were updated. The grades of the final cover have been adjusted to allow for more controlled and direct storm water management. Design calculations to support the liner grade and final cover grade changes are included in Attachment A of this section. Calculations contained in Attachment A of this section include:

- Geotechnical Slope Stability Analysis (Attachment A-1)
- Geotechnical Settlement Calculations (Attachment A-2)
- Pipe Strength and Deflection Calculations (Attachment A-3)
- Leachate Collection System Flow Capacity Analysis (Attachment A-4)
- Head-on-Liner Calculations (Attachment A-5)
- Surface Water Calculations (Attachment A-6)

The design calculations related to the engineered artificial turf landfill cover system are included in Attachment B of this section.

Permit Drawings

The proposed upgrades to the MC VI-G base liner and WDI final grades will result in revisions to the permit engineering drawing sheets listed in Table 1. A complete set of permit engineering drawings is included in Attachment C of this section for ease of review and reference.

Table 1. List of Revised Permit Engineering Drawings

Sheet	Title
01	Title Sheet
02	General Site Plan
03	Construction Phasing
04	Top of Subgrade Grading Plan
05	Top of Secondary Liner Grading Plan
06	Top of Primary Liner Grading Plan
07	Leachate Management Plan
08	Final Cover Grading Plan (1 of 2)
09	Final Cover Grading Plan (2 of 2)
10	Stormwater Management and Sedimentation Plan (1 of 2)
10A	Engineered Turf Stormwater Management Plan (1 of 2)
11	Stormwater Management and Sedimentation Plan (2 of 2)
11A	Stormwater Management and Sedimentation Plan (2 of 2)
12	Cross Sections (1 of 3)
13	Cross Sections (2 of 3)
14	Cross Sections (3 of 3)
15	Liner System Details (1 of 2)
16	Liner System Details (2 of 2)
17	Leachate Collection System Details (1 of 2)
18	Leachate Collection System Details (2 of 2)
19	Final Cover Details
19A	Engineered Turf Final Cover Details
20	Stormwater Management System Details
20A	Engineered Turf Stormwater Management System Details
21	Conceptual Gas Venting System

List of Attachments to This Section

Attachment A: Design Calculations

- Attachment A-1: Slope Stability Analysis
- Attachment A-2: Settlement Calculations
- Attachment A-3: Pipe Strength and Deflection Calculations
- Attachment A-4: Leachate Collection System Flow Capacity Analysis
- Attachment A-5: Head-on-Liner Calculations and Minimum Geocomposite Transmissivity
- Attachment A-6: Surface Water Calculations

Attachment B: Engineered Artificial Turf Landfill Final Cover Alternate

Attachment C: Permit Engineering Drawings (under separate cover)

ATTACHMENT A
DESIGN CALCULATIONS

Physical/Mechanical Properties

A-1: Stability

The stability of the proposed liner system on the Master Cell (MC) VI-G liner and final grade slopes have been evaluated. The proposed liner grade changes do not introduce any interface and/or internal shear plane that is more critical than what is in the currently permitted liner system.

The slope stability analyses were conducted following similar approaches documented in the Basis of Design Report in the current permit (approved by the Michigan Department of Environmental Quality on May 4, 2012 and the Environmental Protection Agency on September 27, 2013), where the stability of the sideslope under excavation, stability of the liner system under construction, stability of the waste mass during filling, stability of the final cover, and stability of the long-term final closure were evaluated. **Attachment A-1** includes the results of the performed stability analyses.

A-2: Settlement

As required in Michigan Part 111 R299.9620 (4), the liner grades were designed at a minimum slope of 2% in directions perpendicular to the leachate collection pipes. The leachate collection pipes were designed at a minimum slope of 1%. Actual liner grades are shown in the Permit Engineering Drawings in Attachment C.

The ability of the liner grades to maintain the required minimum slopes in the post-settlement was evaluated for MC VI-E, MC VI-F and MC VI-G cells. The settlement of the underlying foundational soils and existing MC I and MC IV waste due to the expected loading was examined. For each of the cells, the post-settlement slope along the leachate collections pipe and a section of the cross-slope was calculated. The calculation showed the slopes are equal or greater than the required values in all cells. **Attachment A-2** includes the results of the performed settlement analyses.

Leachate Collection System Design

A-3: Pipe Strength

Leachate collection pipes and leachate sideslope risers were analyzed for structural stability under the expected loads in MC VI-G. The pipes were analyzed for both deflection and factor of safety against wall buckling. Both SDR 11 and SDR 9 pipes achieved acceptable factors of safety for wall buckling and deflections. In addition, the leachate collection pipes in MC VI-E were evaluated for performance with the final grade adjustments. The existing SDR-7 and 7.3 pipes achieved acceptable factors of safety for wall buckling and acceptable deflections. Refer to **Attachment A-3** for additional calculation information.

A-4: Leachate Collection System Flow Capacity

The leachate collection system consists of the leachate collection geocomposite, overlying sand leachate collection layer, and leachate collection pipes. The perforated 8-inch diameter leachate collection pipes are designed to be recessed in trenches on the cell floors of MC VI-F and G. The capacity of the leachate collection pipes and the capacity of the perforations in the leachate collection pipes were analyzed and found to surpass the maximum open condition leachate generation flow to the most critical pipes. Therefore the 8-inch pipes along with the proposed perforation pattern meet the required flow capacity for MC VI-G cells. For additional details see **Attachment A-4**.

A-5: Leachate Head on Liner Analysis

The leachate collection system geocomposite drainage layer was designed using McEnroe's equation for maximum head on liner. The leachate collection system geocomposite and sand layers were designed by determining the minimum geocomposite transmissivity required to achieve 1 foot of head on the liner or less through a process of iteration. The resultant minimum geocomposite transmissivity for the MC VI G subcells was determined to be within the range of standard industry materials and will be set as the requirement for the construction of each subcell. For additional details see **Attachment A-5**.

A-6: Surface Water Management System

The storm water management system provides management of storm water runoff including control of soil erosion. The storm water management system includes diversion berms, downslope channels, ditches, culverts, storm sewers, and sedimentation basins. The system is designed to collect and control the run-off from a 25-year, 24-hour storm event. Storm water basins are designed to contain run-off from a 100-year, 24-hour storm event. Detailed design information for the storm water management system is provided in Attachment A-6.

Conclusions

The calculations and information provided above and contained in the attachments demonstrate that the proposed MC VI-G and Final Grade modification calculations, including slope stability, settlement, pipe strength, leachate collection system flow, and storm water comply with the currently effective hazardous waste regulatory requirements.

List of Supplemental Attachments

Attachment A-1: Slope Stability Analysis

Attachment A-2: Settlement Calculations

Attachment A-3: Pipe Strength and Deflection Calculations

Attachment A-4: Leachate Collection System Flow Capacity Analysis

Attachment A-5: Head-on-Liner Calculations and Minimum Geocomposite Transmissivity

Attachment A-6: Surface Water Calculations

Attachment A-1
Slope Stability Analysis

Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification	Client:	Wayne Disposal, Inc.
Project Number:	1208070039.004	Project Manager:	Chris Backus
Project Location:	Belleville, Michigan	QA Manager:	

Calculation Sheet Information

Calculation Medium: ☒ Electronic
☐ Hard copy Number of pages (including cover sheet):

Title of Calculation:	Slope Stability Analyses
Calculation Originator:	Mohammad Kabalan
Calculation Contributors:	Mohammad Kabalan
Calculation Checker:	James Moseley, Kevin Foye

Calculation Objective

This calculation evaluates the stability of the proposed MC-VI-G at Wayne Disposal, Inc. (WDI) Landfill. The analyses include consideration of global slope stability for failures through the waste mass, along the liner system, and/or through the foundation soils at interim and final conditions. The analyses also determined the minimum required interface friction angle to attain a satisfactory factor of safety against failure at the liner system interface. Cross sections that are the most critical for analysis and design include cross sections with the steepest slopes and highest embankment (waste or soil) heights. The following critical cross sections were examined:

1. Cross Section C-C' oriented East-West and going through Cell MC VI-G4.
2. Cross Section G-G' oriented North-South and going through Cell MC VI-G6.

Assumptions and Open Items

1. Representative total and effective stress shear strength parameters were used for all layers in the profile. Material properties were retrieved from existing site data (NTH 2012) and are presented in Table 1. Strength properties for the lower clay were modeled as a relationship of shear stress to effective normal stress, whereas all other layers used the Mohr-Coulomb model with either an undrained shear strength or friction angle as input. A shear strength to effective stress ratio of 0.22 was applied for the lower clay in accordance with existing analyses (NTH 2012) to account for increases in shear strength resulting from increased overburden pressure within the lower clay layer.

Table 1: Material Properties

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103[A]	26[B]	300[B]
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0

Notes:
[A] unit weight of waste determined from site survey data reported in 2020.
[B] representative value of waste strength as reported by Qian et al. (2002)
All other properties obtained from NTH (2012)

2. For liner system stability cases, the domain of the slip surfaces are defined so that a portion of the failure surface conforms to the liner system.
3. Applicable data used in the analysis that was provided by third parties is assumed to be accurate.

Design Criteria/Design Basis

1. The minimum allowable factor-of-safety (FS) against slope stability failures is 1.5 for final conditions and 1.3 for interim conditions.
2. The analyses were conducted using the computer program SLOPE/W within the software package GeoStudio 2021 by GEOSLOPE International Ltd. This program performs an automatic search to identify a critical failure surface that has the lowest FS value.
3. The analyses were conducted using the Morgenstern-Price method, which considers both moment and force equilibrium.
4. The geometry of the cross sections was derived from the engineering drawing set submitted as part of the permit mod package.
5. The required/assumed interface friction angles shall be met by considering peak strength values for the cell floor and large-displacement strength values for the cell sideslopes.
6. The required minimum interface friction angle for the liner system components is determined under the final conditions (after final cover is installed).
7. Due to the complex nature of the waste fill phasing during operation, the liner stability shall be evaluated based on the actual measurements of the interface friction angle for the liner system components and the design waste filling geometry for each phase. An example one such calculation was prepared to illustrate how to evaluate required minimum interface friction angle for the liner system components. This example analysis was performed on cross section C-C' assuming an interim waste slope of 3H:1V.

Results/Conclusions

1. Global slope stability analyses of the waste and foundation for each cross section determined that filling to proposed final grades yields acceptable factors of safety.
    a. Cross Section C-C': Factor of Safety =1.66
    b. Cross Section G-G': Factor of Safety = 1.50
2. Under the final conditions (after installation of final cover, the liner system analyses determined the minimum required interface friction angle for geosynthetics in the floor and slideslope liner systems to yield a factor of safety = 1.50. These values are **13.2 degrees for the floor (peak) and 9 degrees for the sideslope (large-displacement) with zero adhesion** .
    a. Cross Section C-C': Factor of Safety = 1.50 (used to evaluate minimum friction angle)
    b. Cross Section G-G': Factor of Safety = 1.54
3. The above values are minimum acceptable secant friction angles. Any combination of adhesion and friction angle resulting in comparable shear strength under representative normal stresses to final site conditions are also acceptable. Stability analysis using lab interface shear strength tests results from previous products used on site show that a combination of **$C_{\alpha,peak}$=164 psf / ϕ_{peak}=11.1° and $C_{\alpha,large\ displacement}$=110 psf / $\phi_{large\ displacement}$=7.3°** achieves an acceptable factor of safety. **Conformance testing of the selected geosynthetics shall be performed to confirm that the interface shear strength of the actual liner system components is sufficient to ensure the stability of the liner system.**
    a. Cross Section C-C': Factor of Safety = 1.5
    b. Cross Section G-G': Factor of Safety = 1.5
4. An example calculation of liner stability for an interim waste filling conditions is presented in Attachment 7. The required interface friction angle for the floor liner system was determined to be 13 degrees (peak). Actual interim phasing plan slopes and tested liner system interface properties shall be evaluated for each phase of fill per this example.

Source Documents and References

NTH (2012). WDI Operating License Application Master Cells VI F & G Volume III – Basis of Design Report

Qian, X., Gray, D.H., and Koerner, R.M. (2002) *Geotechnical Aspects of Landfill Design and Construction.*

Attachments

1. C-C' Foundation Stability
2. G-G' Foundation Stability
3. C-C' Liner Stability under Final Conditions with zero adhesion
4. G-G' Liner Stability under Final Conditions with zero adhesion
5. C-C' Liner Stability under Final Conditions with non-zero adhesion (previously tested values)
6. G-G' Liner Stability under Final Conditions with non-zero adhesion (previously tested values)
7. C-C' Liner Stability under Interim Conditions (example interim stability calculation)

Attachment A-1.1

C-C’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

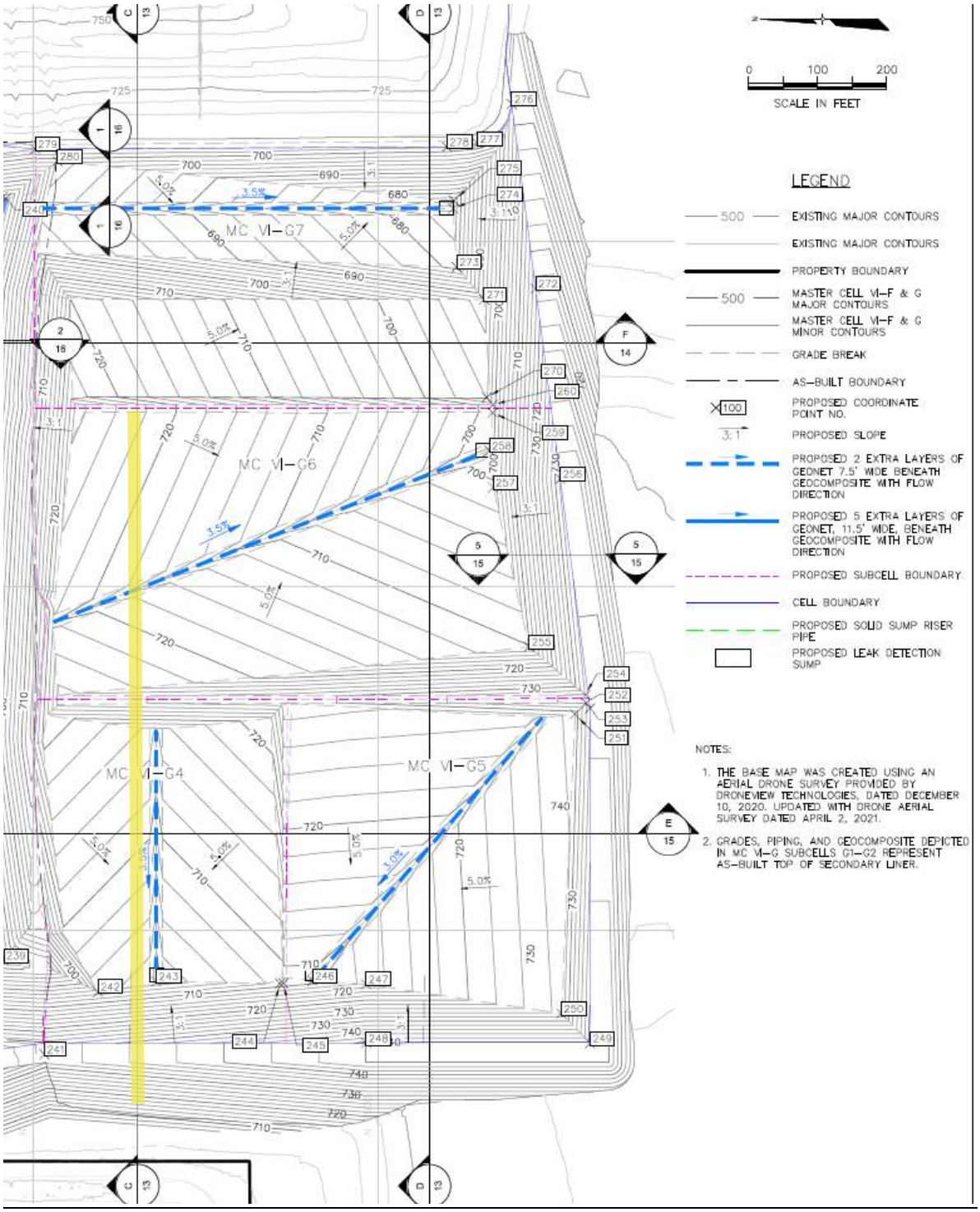
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	C-C' Foundation Stability				**File name:**	MC-VI-G_CrossSection_C_Foundation.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/05/21	**Date:**	10/05/21	**Date:**	10/6/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section C-C'. This case considers a west-facing slope, with fill to the final permitted grade elevations.		
☒ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The friction angle of the liner system was set equal to the required minimum interface friction angle determined from the liner stability analysis performed on Cross Section C. The groundwater level was set at elevation 655ft based on historical borings as documented in the Basis of Design Report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressure conditions may occur after loading. This is considered a conservative approach for this scenario.		

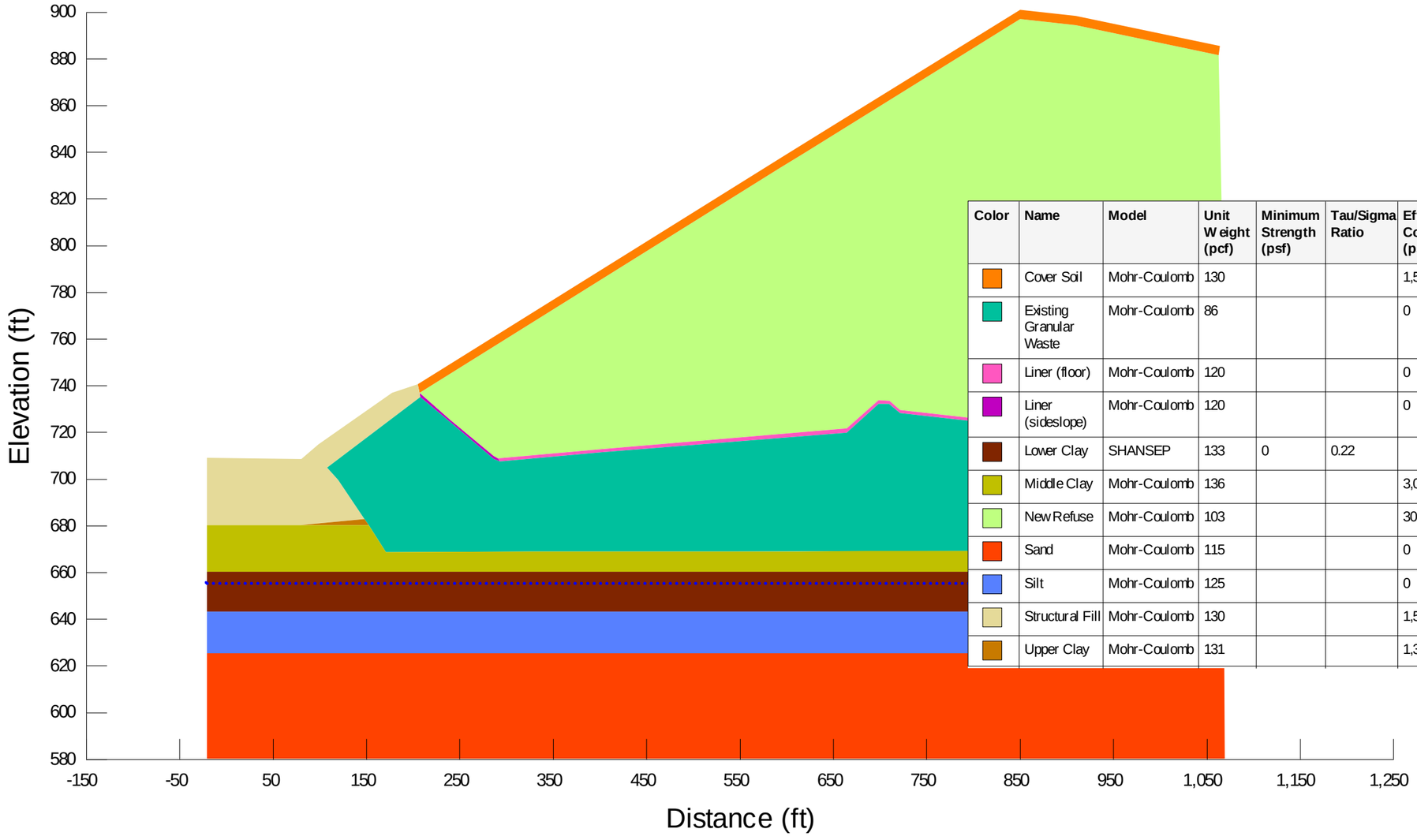
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0

Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section C

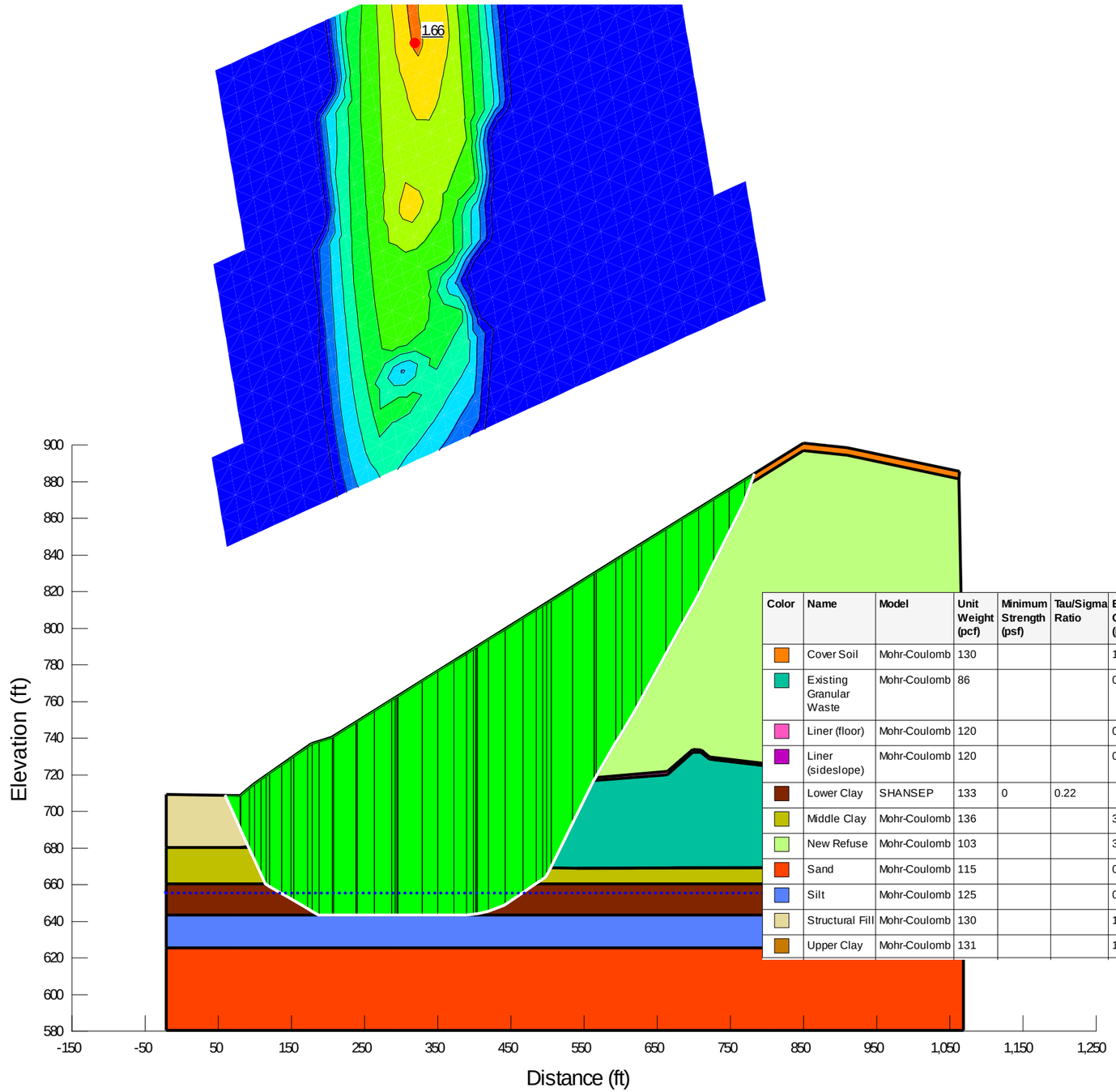
Plan View:



Factor of Safety:	1.66	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	86			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	133	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	131			1,325	17.1	0	1	0	No



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	86			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	133	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	131			1,325	17.1	0	1	0	No

Attachment A-1.2

G-G’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

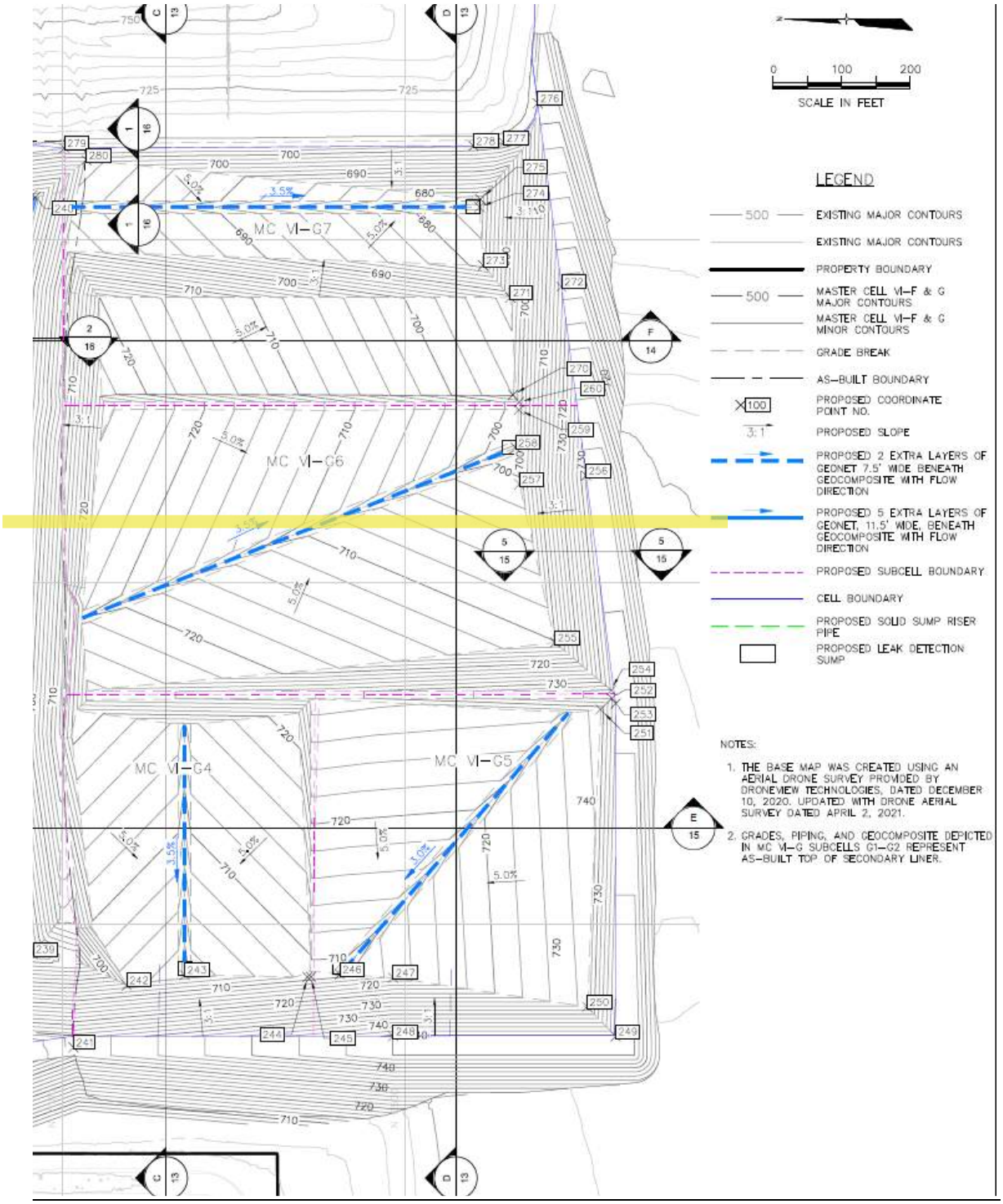
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	G-G' Foundation Stability				**File name:**	MC-VI-G_CrossSection_G_Foundation.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/05/21	**Date:**	10/05/21	**Date:**	10/6/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a south-facing slope, with fill to the final permitted grade elevations.		
☒ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The friction angle of the liner system was set equal to the required minimum interface friction angle determined from the liner stability analysis performed on Cross Section C. The groundwater level was set at elevation 655ft based on historical borings as documented in the Basis of Design Report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressure conditions may occur after loading. This is considered a conservative approach for this scenario.		

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0

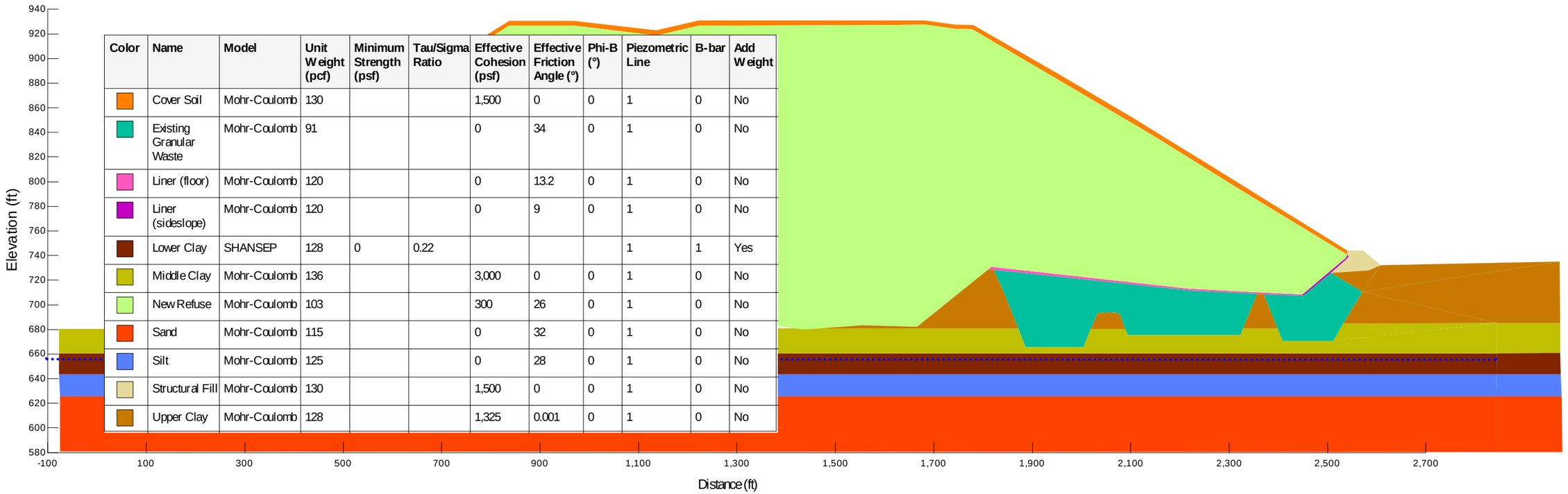
Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section C

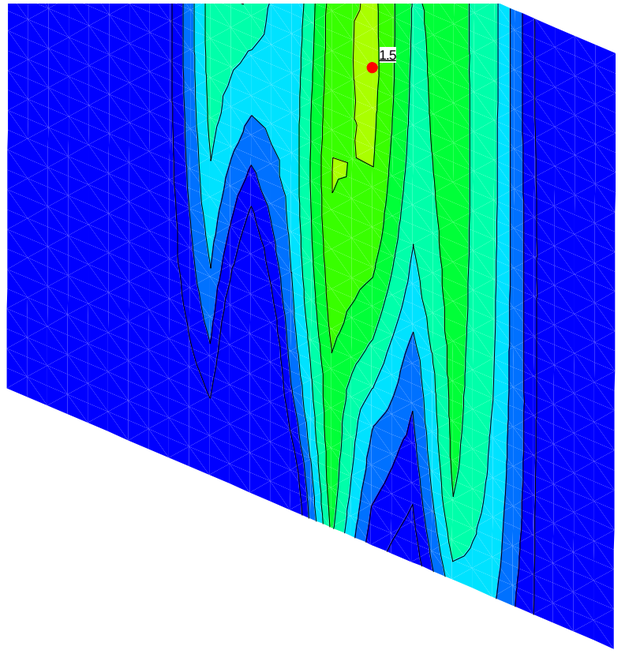
Plan View:



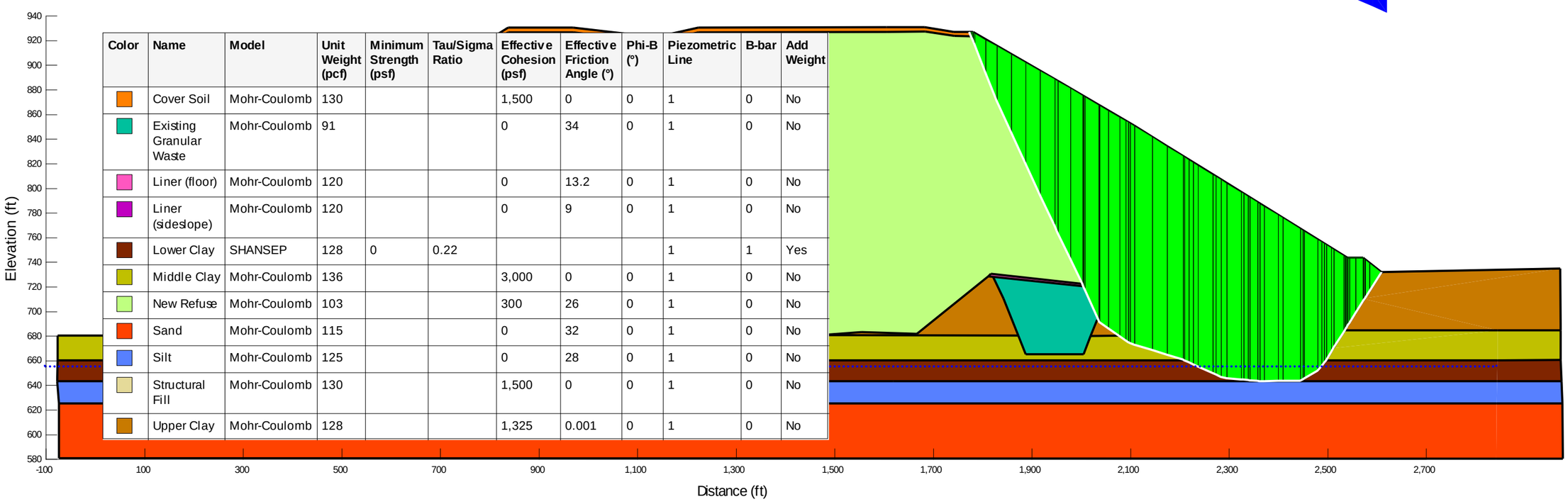
Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	

Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	128			1,325	0.001	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	128			1,325	0.001	0	1	0	No



Attachment A-1.3

C-C’ Liner Stability under Final Conditions with zero adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

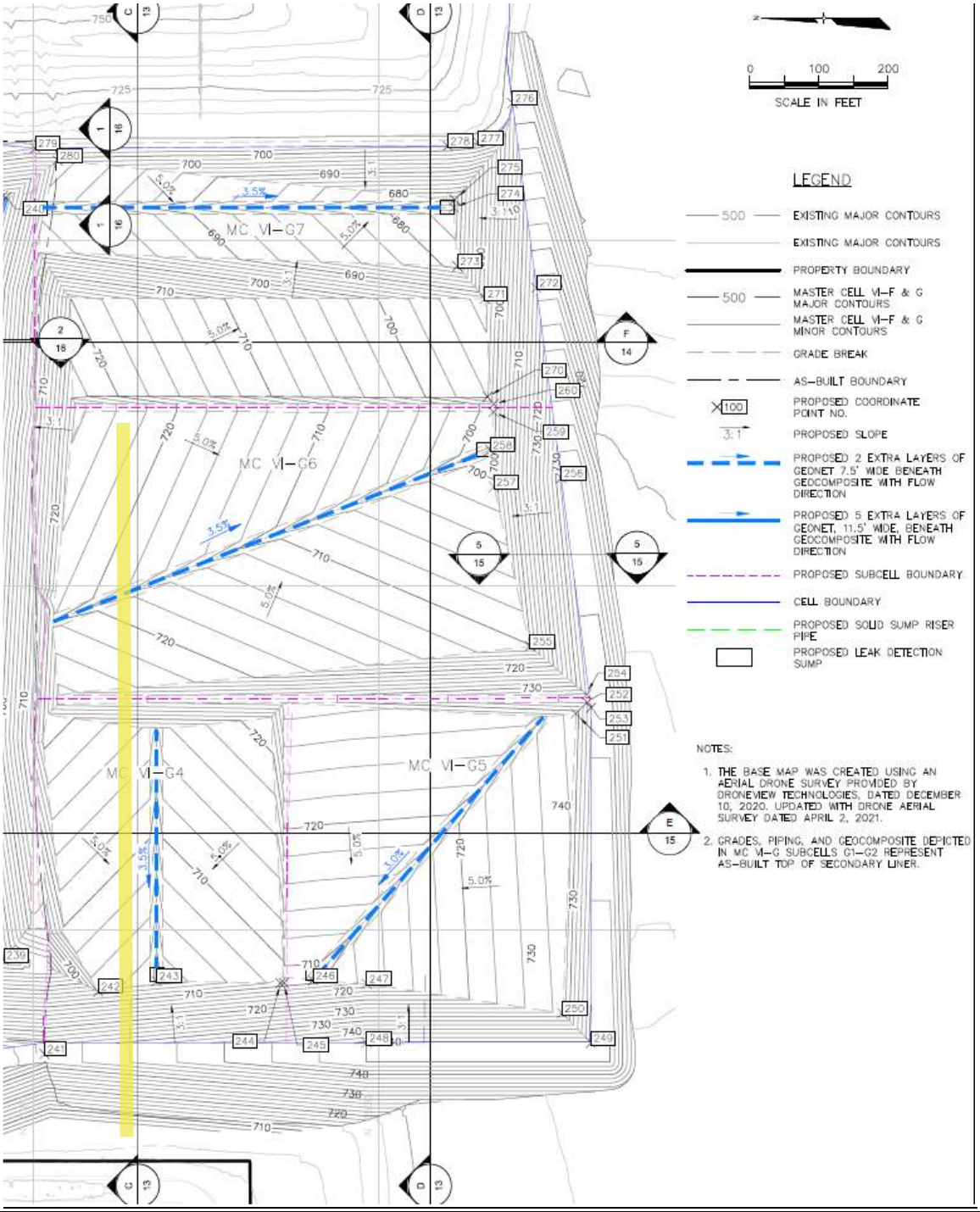
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	C-C' Liner Stability				**File name:**	MC-VI-G_CrossSection_C_Liner_HOL.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/05/21	**Date:**	10/05/21	**Date:**		**Date:**	

Purpose of Analysis:	To determine the minimum required liner interface friction angle to achieve an acceptable factor of safety of the proposed final waste grades using cross-section C-C'. This case considers a west-facing slope, with fill to the final permitted grade elevations under undrained conditions.		
☒ Effective Stress ☐ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The liner system was modeled in 2 sections (floor and sideslope) to allow use of Peak and Large-Displacement strength parameters appropriately. The friction angle of the sideslope was set at 9° corresponding to commonly achievable large-displacement interface secant friction angle. The friction angle of the floor liner system was varied to determine the required peak interface secant friction angle to achieve the required factor of safety of 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

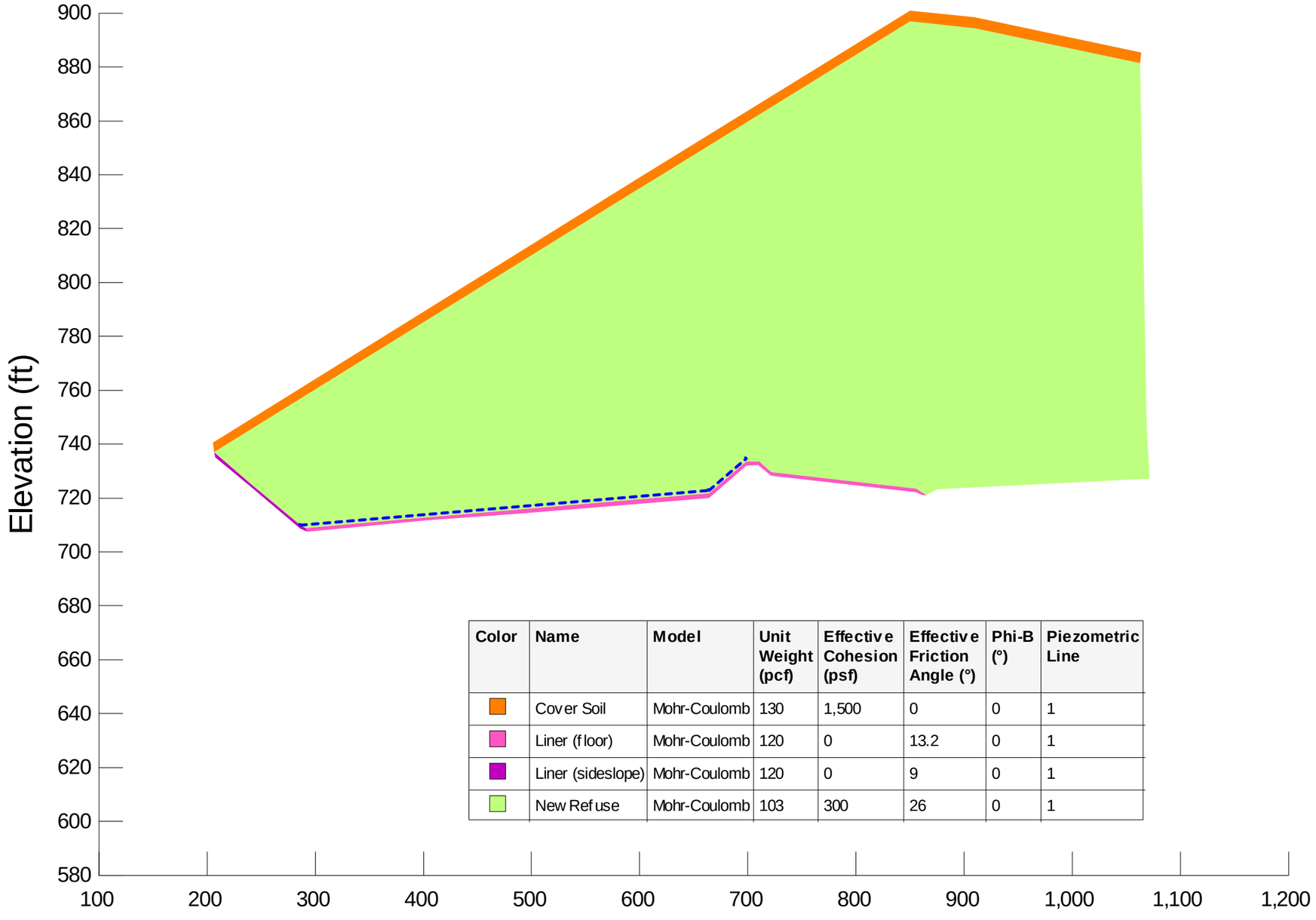
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	?	0
10	Liner (sideslope)	Magenta	120	9	0

Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section B

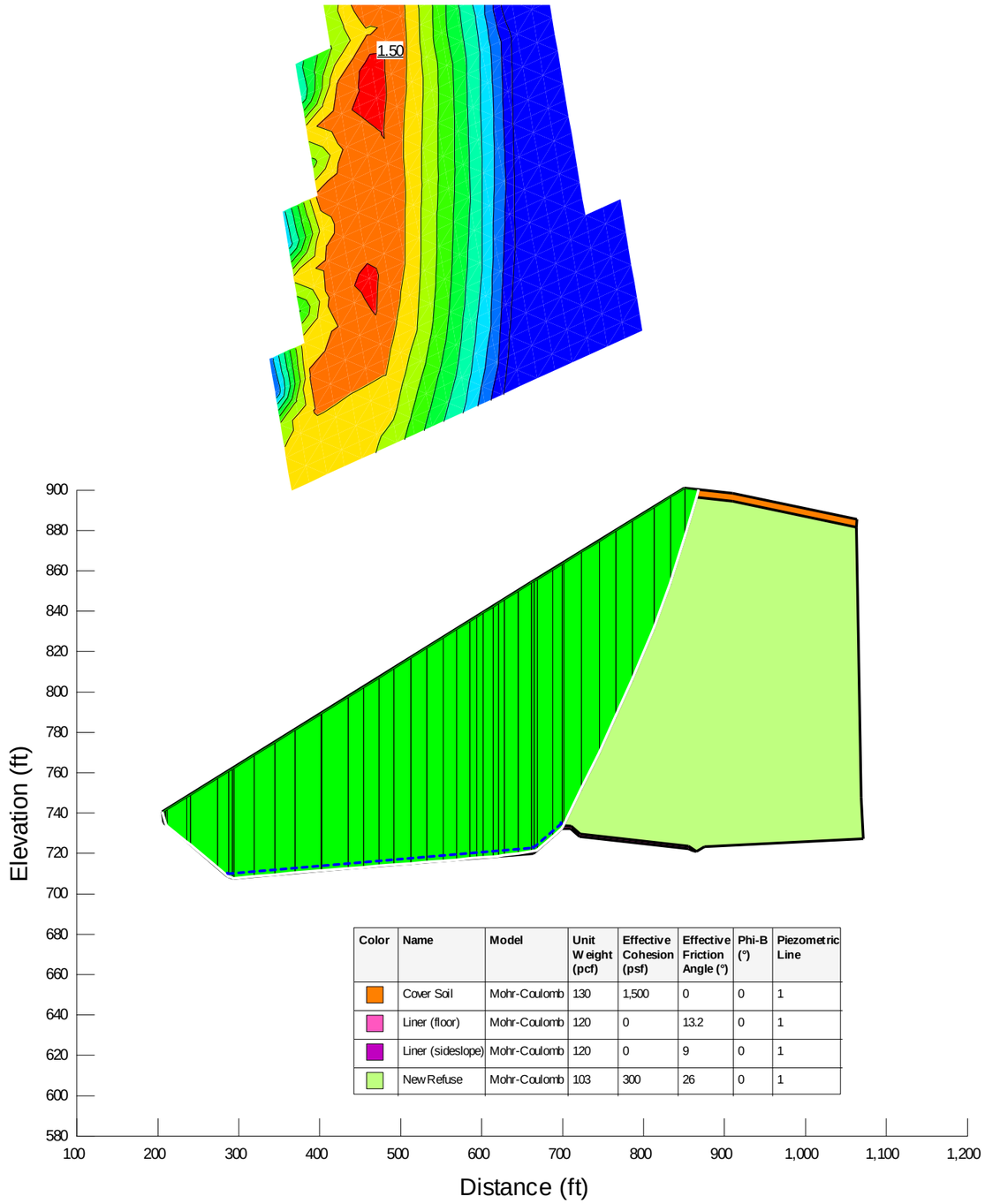
Plan View:



Factor of Safety:	1.50	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:	The required peak interface friction for the floor liner system was determined to be 13.2°.	
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1
	New Refuse	Mohr-Coulomb	103	300	26	0	1



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1
	New Refuse	Mohr-Coulomb	103	300	26	0	1

Attachment A-1.4

G-G’ Liner Stability under Final Conditions with zero adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

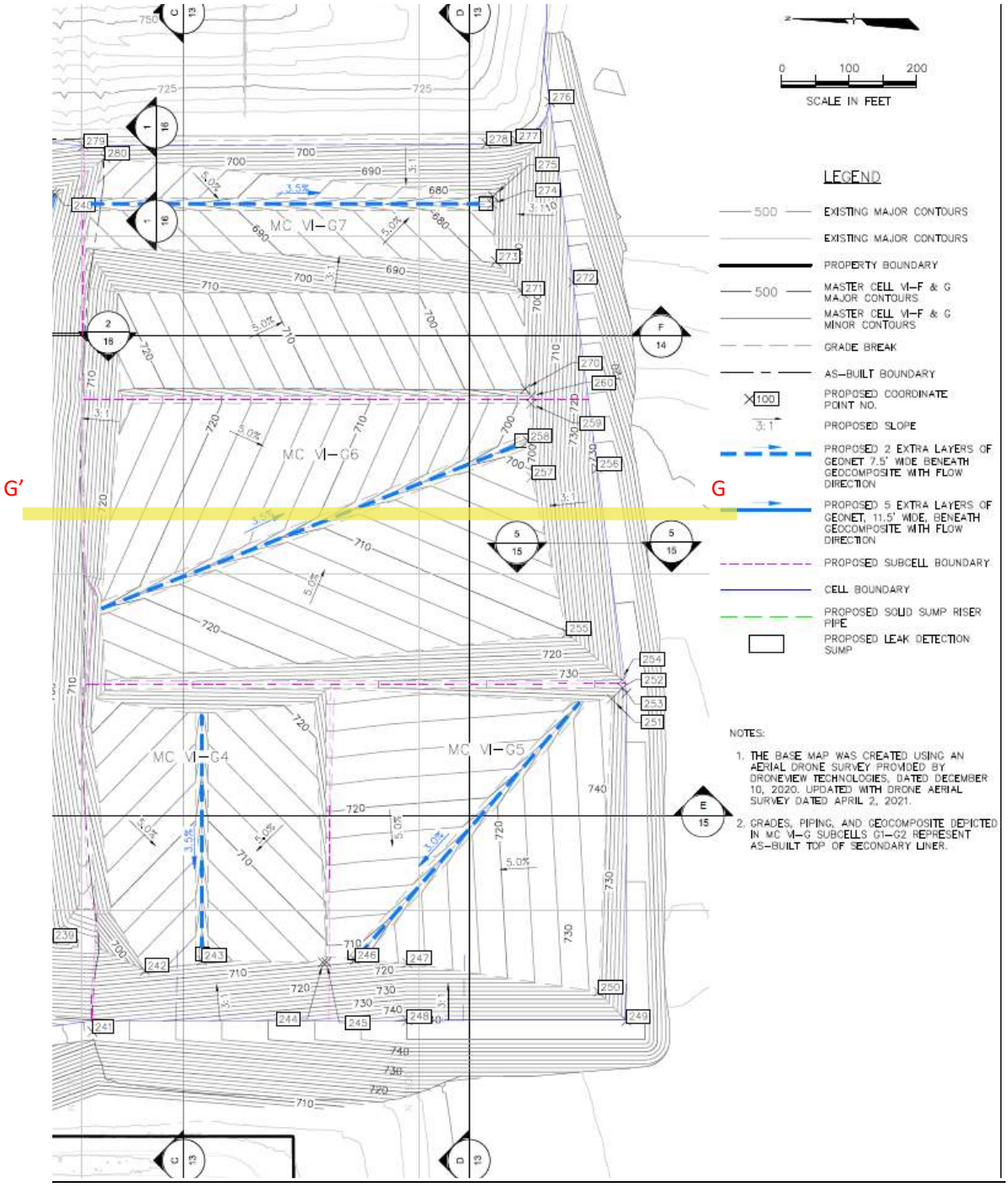
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	G-G' Liner Stability				**File name:**	MC-VI-G_CrossSection_G_Liner.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/05/21	**Date:**	10/05/21	**Date:**	10/6/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a south-facing slope, with fill to the final permitted grade elevations.		
☒ Effective Stress ☐ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The friction angle of the liner system was set equal to the required minimum interface friction angle determined from the liner stability analysis performed on Cross Section C. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

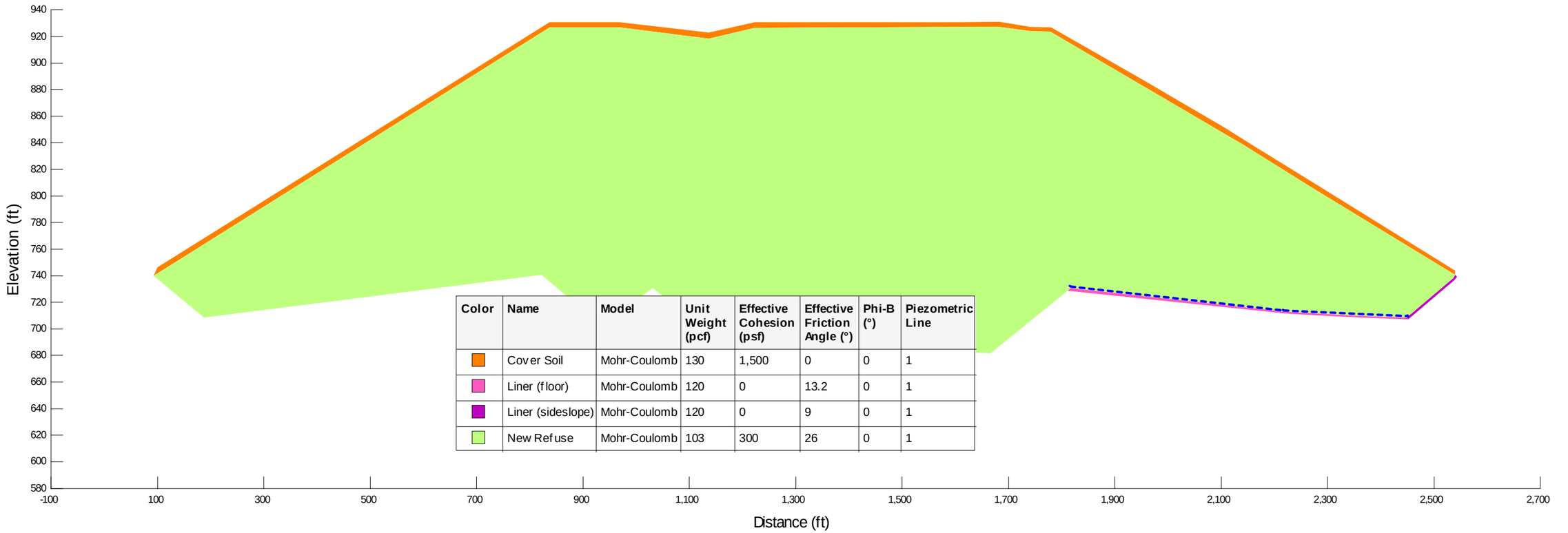
Material	**Name**	**Color in Profile**	**Unit Wt(s) (pcf)**	**Strength ϕ or δ (deg.)**	**Strength C or Ca (psf)**
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0

Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section C

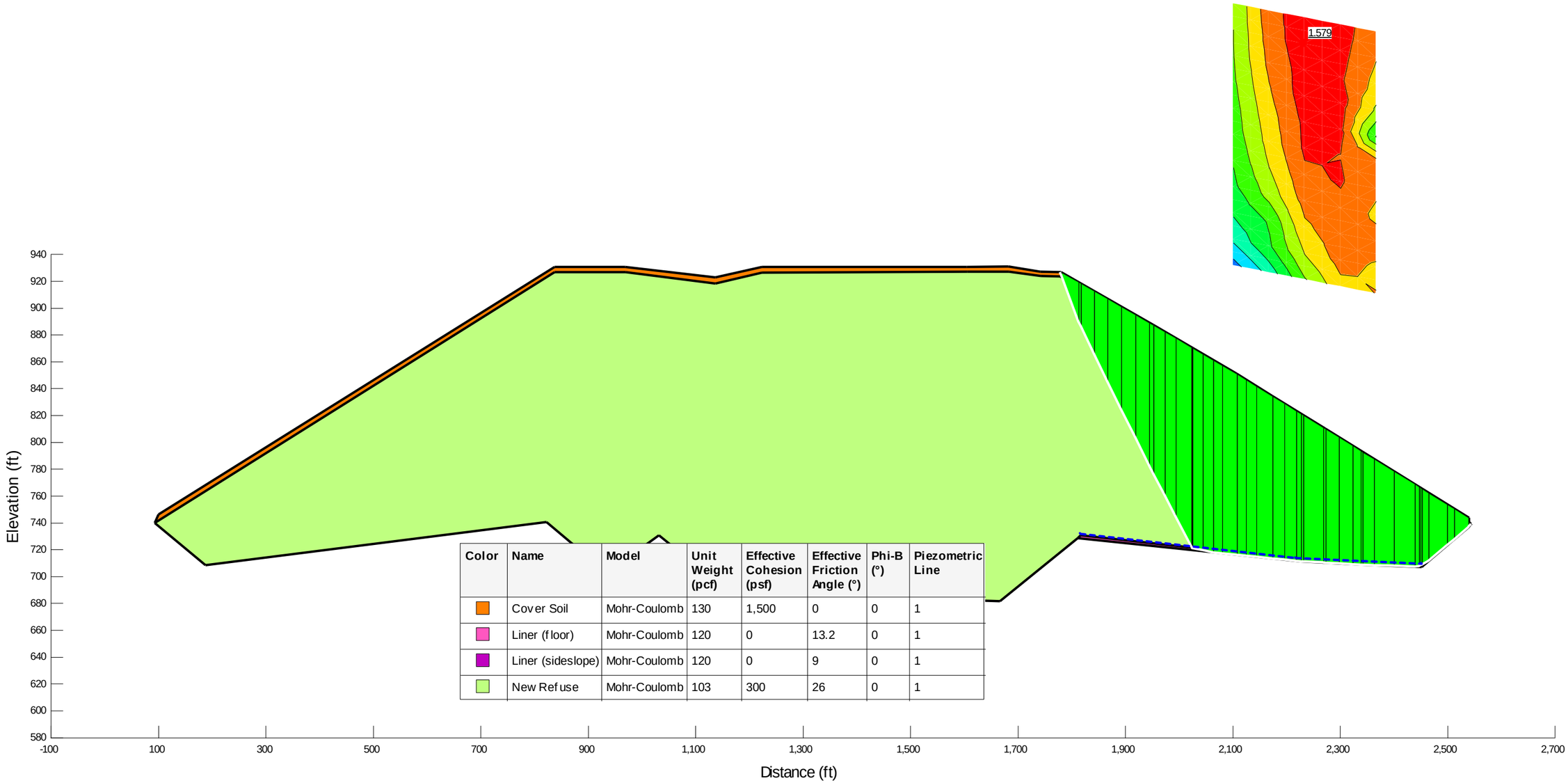
Plan View:



Factor of Safety:	1.58	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1
	New Refuse	Mohr-Coulomb	103	300	26	0	1



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1
	New Refuse	Mohr-Coulomb	103	300	26	0	1

Attachment A-1.5

C-C’ Liner Stability under Final Conditions with non-zero adhesion (previously tested values)

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	C-C' Liner Stability				**File name:**	MC-VI-G_CrossSection_C_Liner_tested_values.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/05/21	**Date:**	10/05/21	**Date:**	10/6/21	**Date:**	

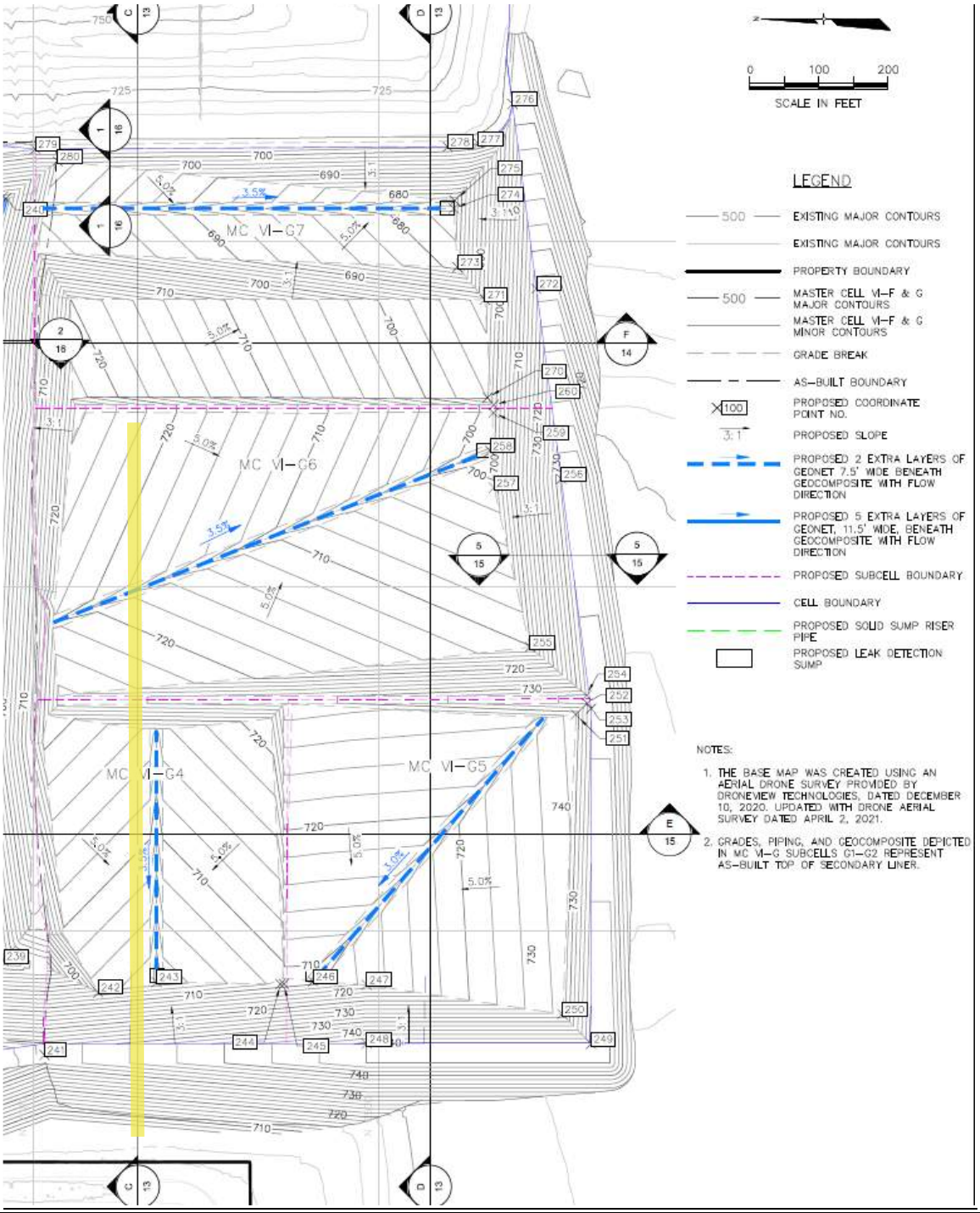
Purpose of Analysis:	To determine the minimum required liner interface friction angle to achieve an acceptable factor of safety of the proposed final waste grades using cross-section C-C'. This case considers a west-facing slope, with fill to the final permitted grade elevations under undrained conditions.		
☐ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The liner system was modeled in 2 sections (floor and sideslope) to allow use of Peak and Large-Displacement strength parameters appropriately. The liner interface strength properties are based on interface strength test results of a similar liner system installed on site. The required factor of safety of 1.5.		

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	11.1	164
10	Liner (sideslope)	Magenta	120	7.3	110

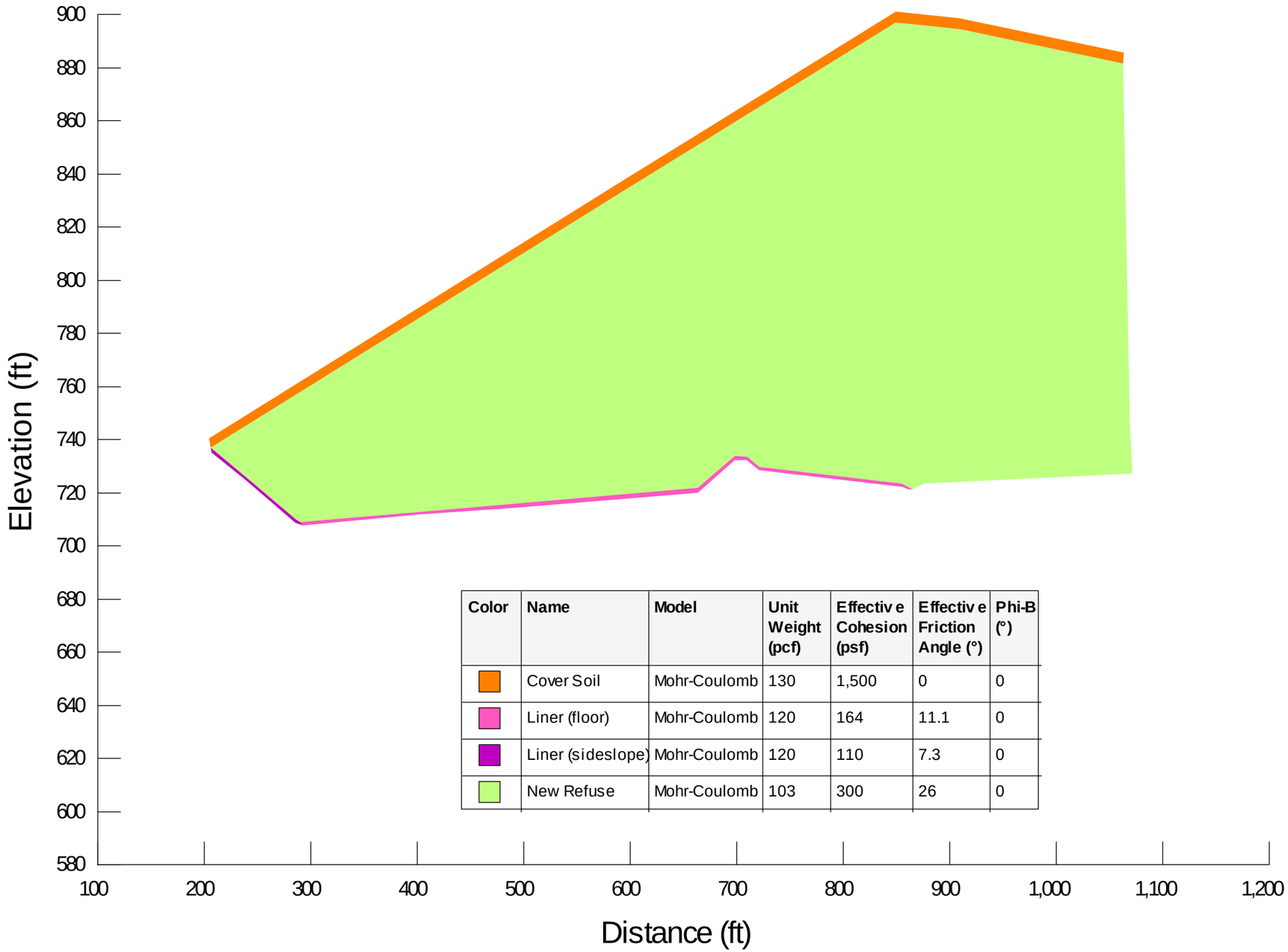
Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section B

SLOPE STABILITY ANALYSIS REPORT FORM

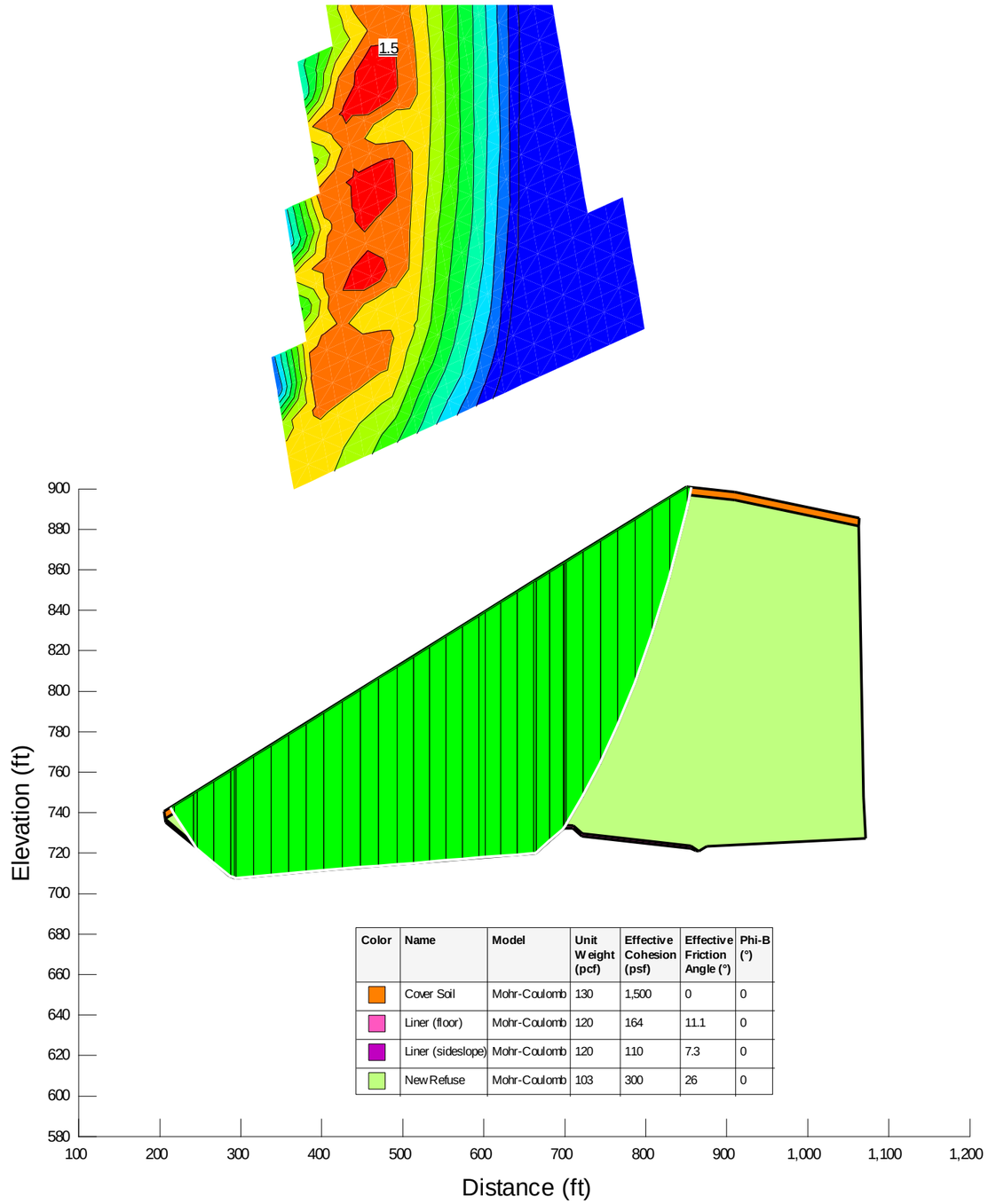
Plan View:



Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Cover Soil	Mohr-Coulomb	130	1,500	0	0
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0
	New Refuse	Mohr-Coulomb	103	300	26	0



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Cover Soil	Mohr-Coulomb	130	1,500	0	0
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0
	New Refuse	Mohr-Coulomb	103	300	26	0

Attachment A-1.6

G-G’ Liner Stability under Final Conditions with non-zero adhesion (previously tested values)

SLOPE STABILITY ANALYSIS REPORT FORM

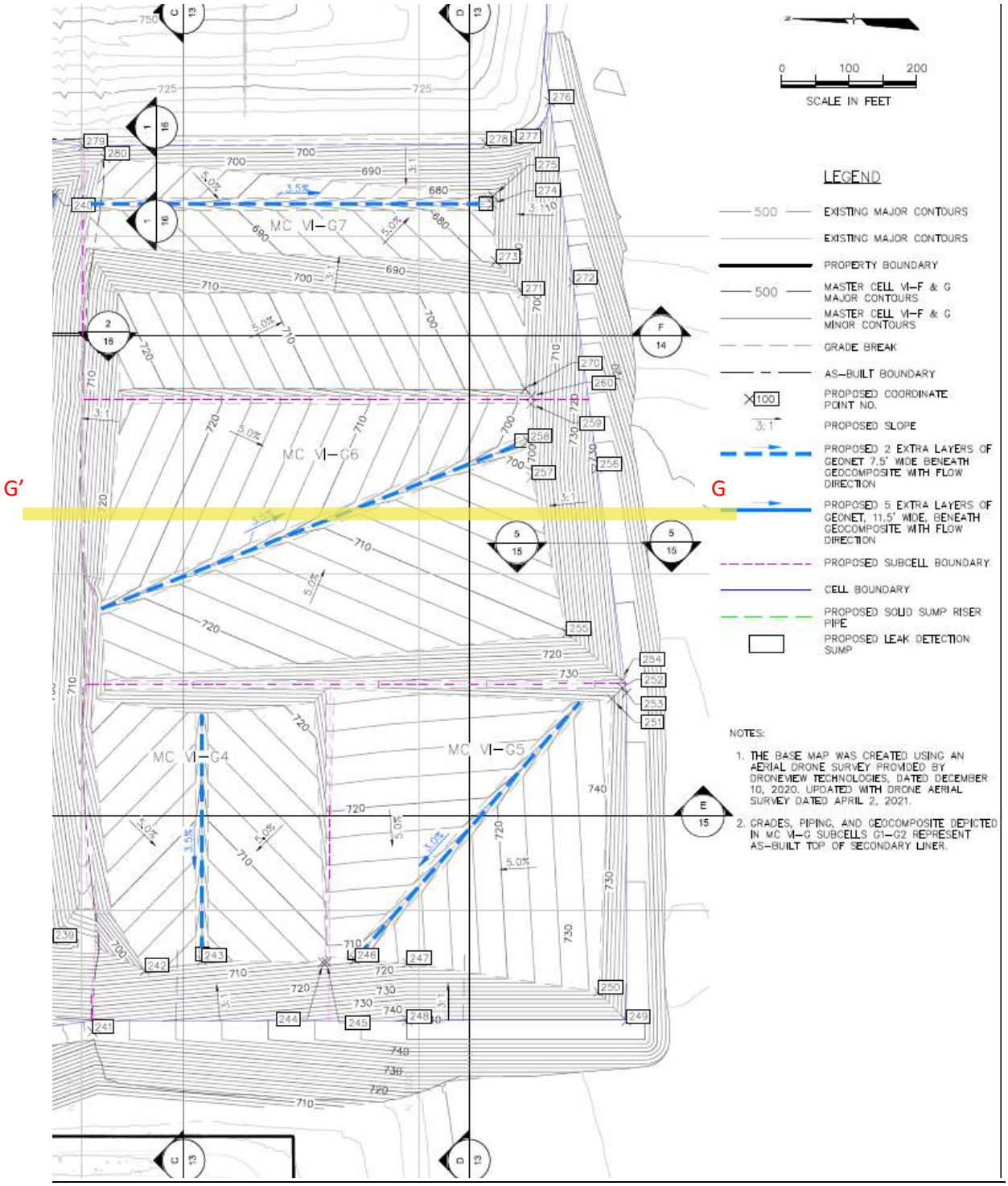
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	G-G' Liner Stability				**File name:**	MC-VI-G_CrossSection_G_Liner_tested_values.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/05/21	**Date:**	10/05/21	**Date:**	10/6/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a south-facing slope, with fill to the final permitted grade elevations.		
☒ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☐ Pore Pressure	☒ Optimized Surface
Additional Details:	The liner system was modeled in 2 sections (floor and sideslope) to allow use of Peak and Large-Displacement strength parameters appropriately. The liner interface strength properties are based on interface strength test results of a similar liner system installed on site. The required factor of safety of 1.5.		

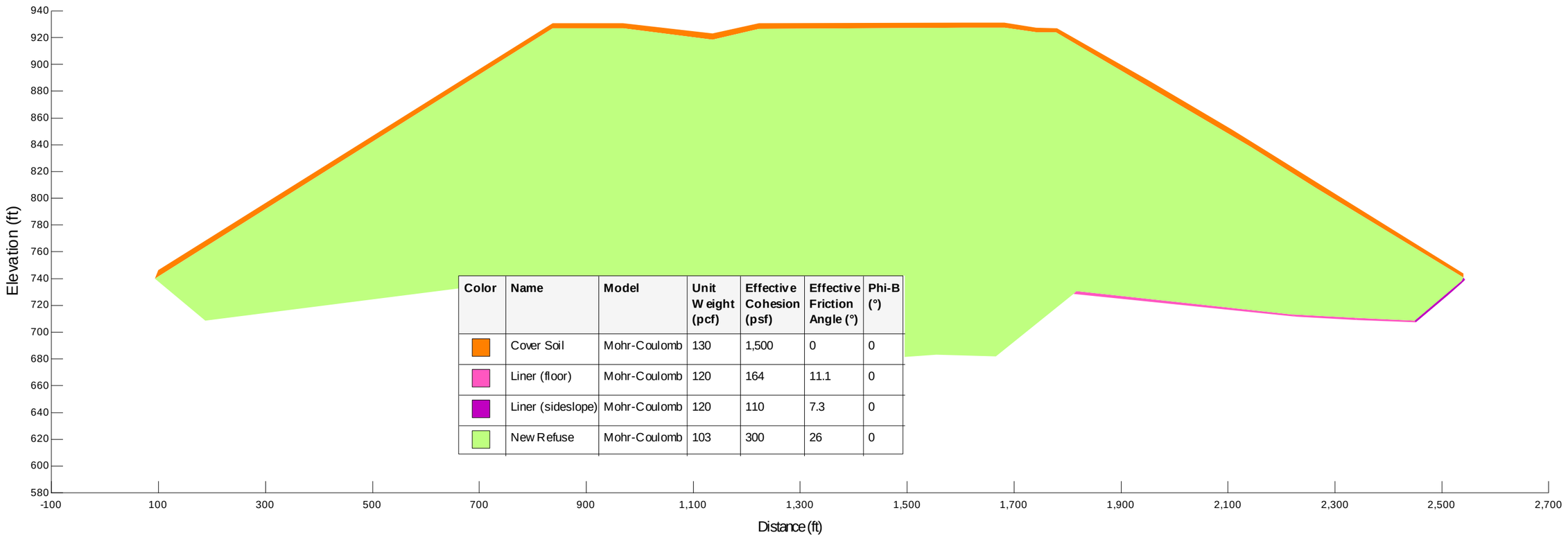
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	11.1	164
10	Liner (sideslope)	Magenta	120	7.3	110

Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section C

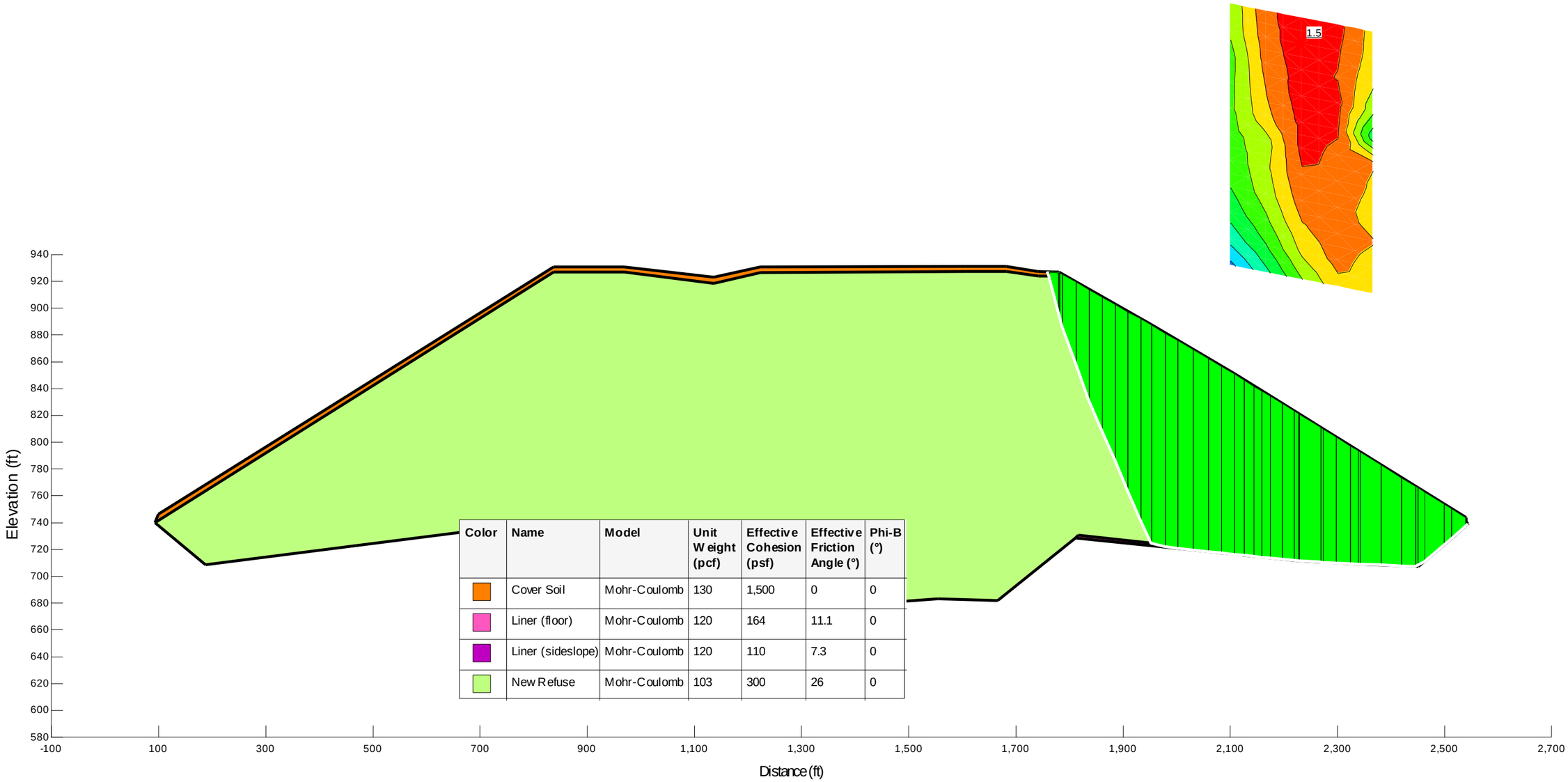
Plan View:



Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Cover Soil	Mohr-Coulomb	130	1,500	0	0
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0
	New Refuse	Mohr-Coulomb	103	300	26	0



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Cover Soil	Mohr-Coulomb	130	1,500	0	0
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0
	New Refuse	Mohr-Coulomb	103	300	26	0

Attachment A-1.7

C-C’ Liner Stability under Interim Conditions (example interim stability calculation)

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	C-C' Liner Stability				**File name:**	MC-VI-G_CrossSection_C_InterimSlope.gsz	
Revision:	1	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	11/03/21	**Date:**	11/03/21	**Date:**	11/04/21	**Date:**	

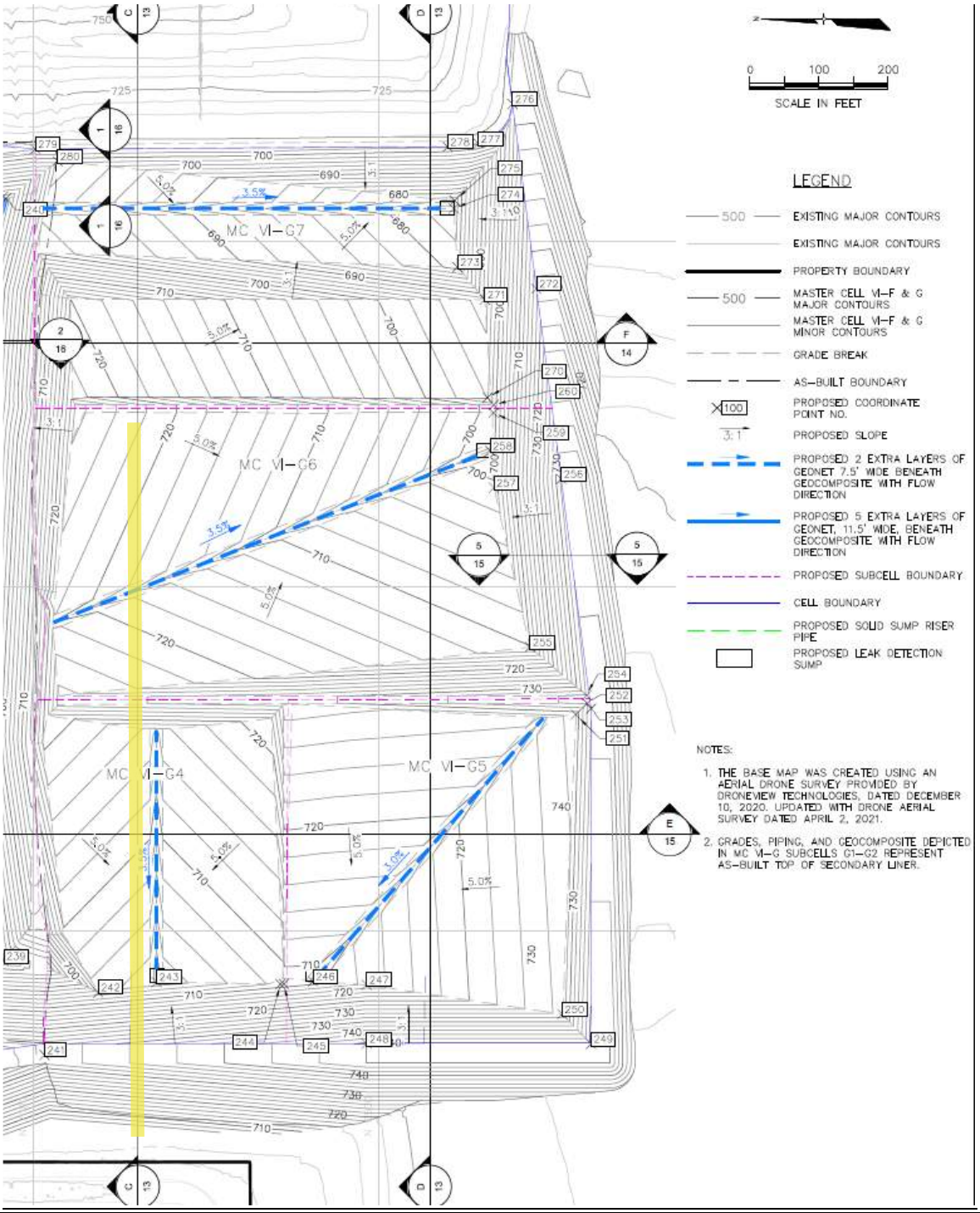
Purpose of Analysis:	To determine the required interface friction angle of the liner system to achieve an acceptable interim factor of safety of 1.3 using cross-section C-C'. This case considers a west-facing slope, with fill to a design interim grade elevation of 840 ft at an interim slope of 3H:1V. The failure surface is defined such that failure occurs in the underlying liner in order to evaluate the stability of the liner system.		
☐ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☐ Pore Pressure	☒ Optimized Surface
Additional Details:			

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	?	
10	Liner (sideslope)	Magenta	120		

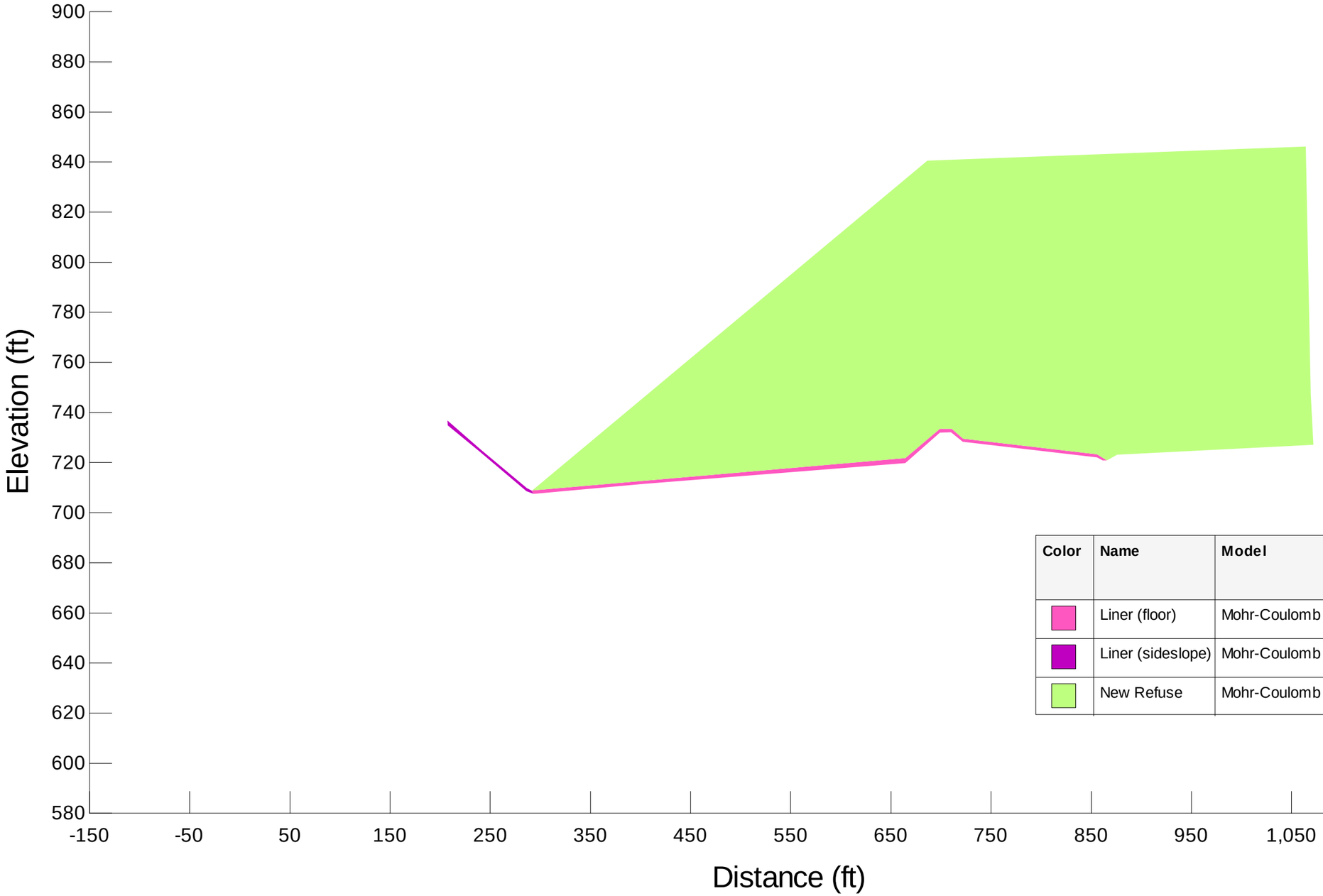
Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☒ Interim ☐ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Interim Waste Filling
Other Geometry Notes:	Cross Section C

SLOPE STABILITY ANALYSIS REPORT FORM

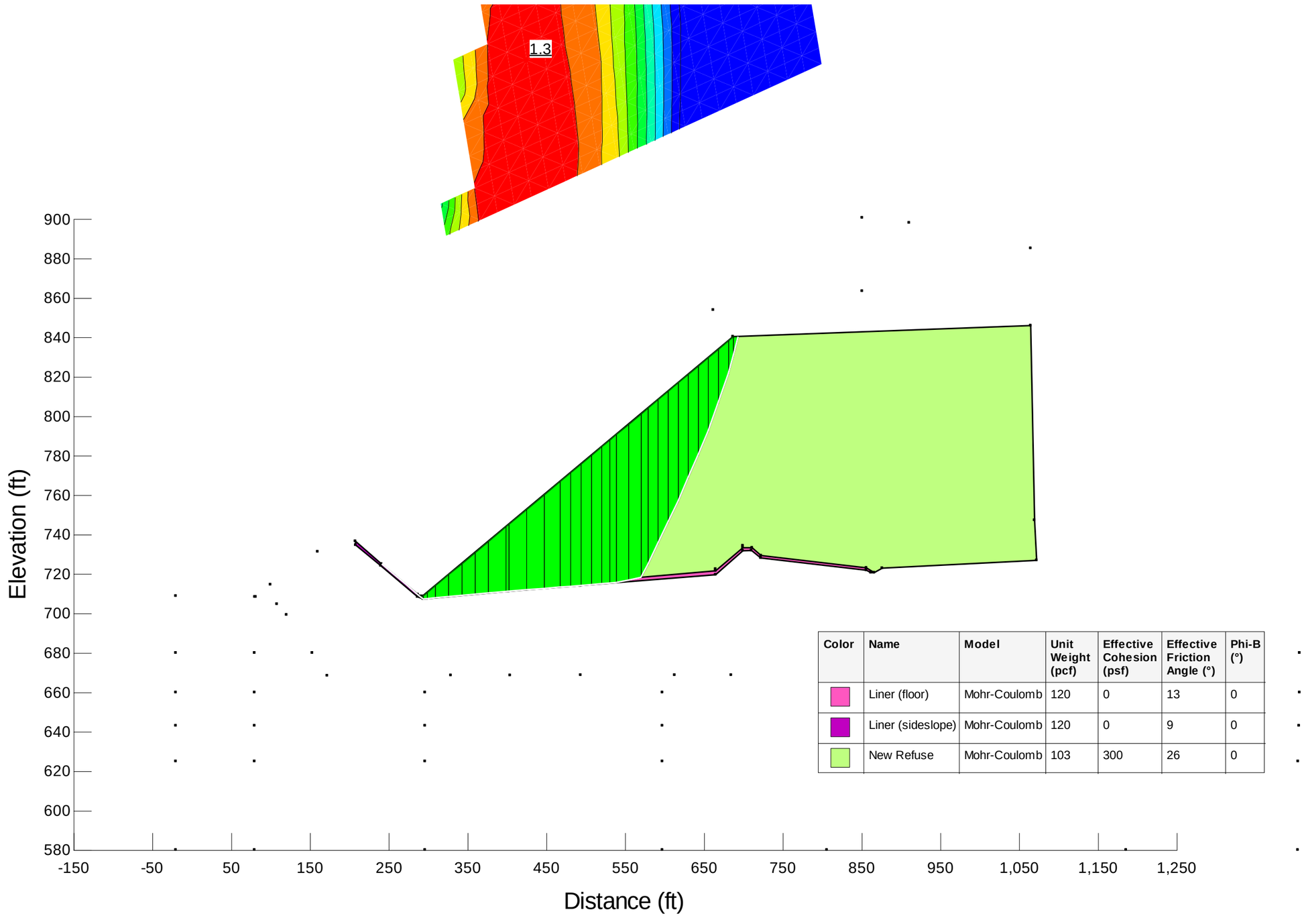
Plan View:



Factor of Safety:	1.3	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:	The required interface friction angle is 13 degrees (peak). Any combination of adhesion and friction angle that yields a comparable shear strength under modeled site conditions is acceptable.	
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Liner (floor)	Mohr-Coulomb	120	0	13	0
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0
	New Refuse	Mohr-Coulomb	103	300	26	0



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Liner (floor)	Mohr-Coulomb	120	0	13	0
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0
	New Refuse	Mohr-Coulomb	103	300	26	0

Project Name:	WDI Final Cover Grading Modification	Client:	Wayne Disposal, Inc.
Project Number:	1208070017.003	Project Manager:	Chris Backus
Project Location:	Belleville, Michigan	QA Manager:	

Calculation Sheet Information

Calculation Medium: ☒ Electronic
☐ Hard copy Number of pages (including cover sheet):

Title of Calculation:	Slope Stability Analyses
Calculation Originator:	Mohammad Kabalan
Calculation Contributors:	Mohammad Kabalan, Kazuhisa Matsuda
Calculation Checker:	Kevin Foye

Calculation Objective

This calculation evaluates the stability of the Wayne Disposal, Inc. (WDI) landfill under the proposed modification to the final cover grading. The analyses include consideration of global slope stability for failures through the waste mass, along the liner system, and/or through the foundation soils at interim and final conditions. The analyses also determined the minimum required interface friction angle to attain a satisfactory factor of safety against failure at the liner system interface. Cross sections that are the most critical for analysis and design include cross sections with the steepest slopes and highest embankment (waste or soil) heights. The following critical cross sections were examined and traces of each cross section is provided in Attachment 1:

1. Cross Section G-G' oriented North-South passing through Cell MC-VI-F.
2. Cross Section H-H' oriented North-South at Easting 5300 and going through Cell MC VI-E and existing MC IV.
3. Cross Section I-I' oriented East-West and going through Cell MC VI-G, Sub Cell G1.
4. Cross Section J-J' oriented East-West and going through Cell MC VI-G, Sub Cell G2.

Assumptions and Open Items

1. Representative total and effective stress shear strength parameters were used for all layers in the profile. Material properties were retrieved from existing site data (NTH 2012, NTH 2008) and are presented in Table 1. Strength properties for the lower clay were modeled as a relationship of shear stress to effective normal stress, whereas all other layers used the Mohr-Coulomb model with either an undrained shear strength or friction angle as input. A shear strength to effective stress ratio of 0.22 was applied for the lower clay in accordance with existing analyses (NTH 2012) to account for increases in shear strength resulting from increased overburden pressure within the lower clay layer.

Table 1: Material Properties

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103[A]	26[B]	300[B]
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28[C]	0

Notes:
[A] Unit weight of waste determined from site survey data reported in 2020.
[B] Representative value of waste strength as reported by Qian et al. (2002).
[C] MC V waste properties as reported in NTH (2008).
All other properties obtained from NTH (2012).

2. For liner system stability cases, the domain of the slip surfaces are defined so that a portion of the failure surface conforms to the liner system.
3. Applicable data used in the analysis that was provided by third parties is assumed to be accurate.

Design Criteria/Design Basis

1. The minimum allowable factor-of-safety (FS) against slope stability failures is 1.5 for final conditions and 1.3 for interim conditions.
2. The analyses were conducted using the computer program SLOPE/W within the software package GeoStudio 2021 by GEOSLOPE International Ltd. This program performs an automatic search to identify a critical failure surface that has the lowest FS value.
3. The analyses were conducted using the Morgenstern-Price method, which considers both moment and force equilibrium.
4. The geometry of the cross sections was derived from the engineering drawing set submitted as part of the permit mod package.
5. The required/assumed interface friction angles shall be met by considering peak strength values for the cell floor and large-displacement strength values for the cell sideslopes.
6. The required minimum interface friction angle for the liner system components is determined under the final conditions (after final cover is installed).
7. Due to the complex nature of the waste fill phasing during operation, the liner stability shall be evaluated based on the actual measurements of the interface friction angle for the liner system components and the design waste filling geometry for each phase. An example one such calculation was prepared to illustrate how to evaluate required minimum interface friction angle for the liner system components. This example analysis was performed on cross section J-J' assuming an interim waste slope of 3H:1V.

Results/Conclusions

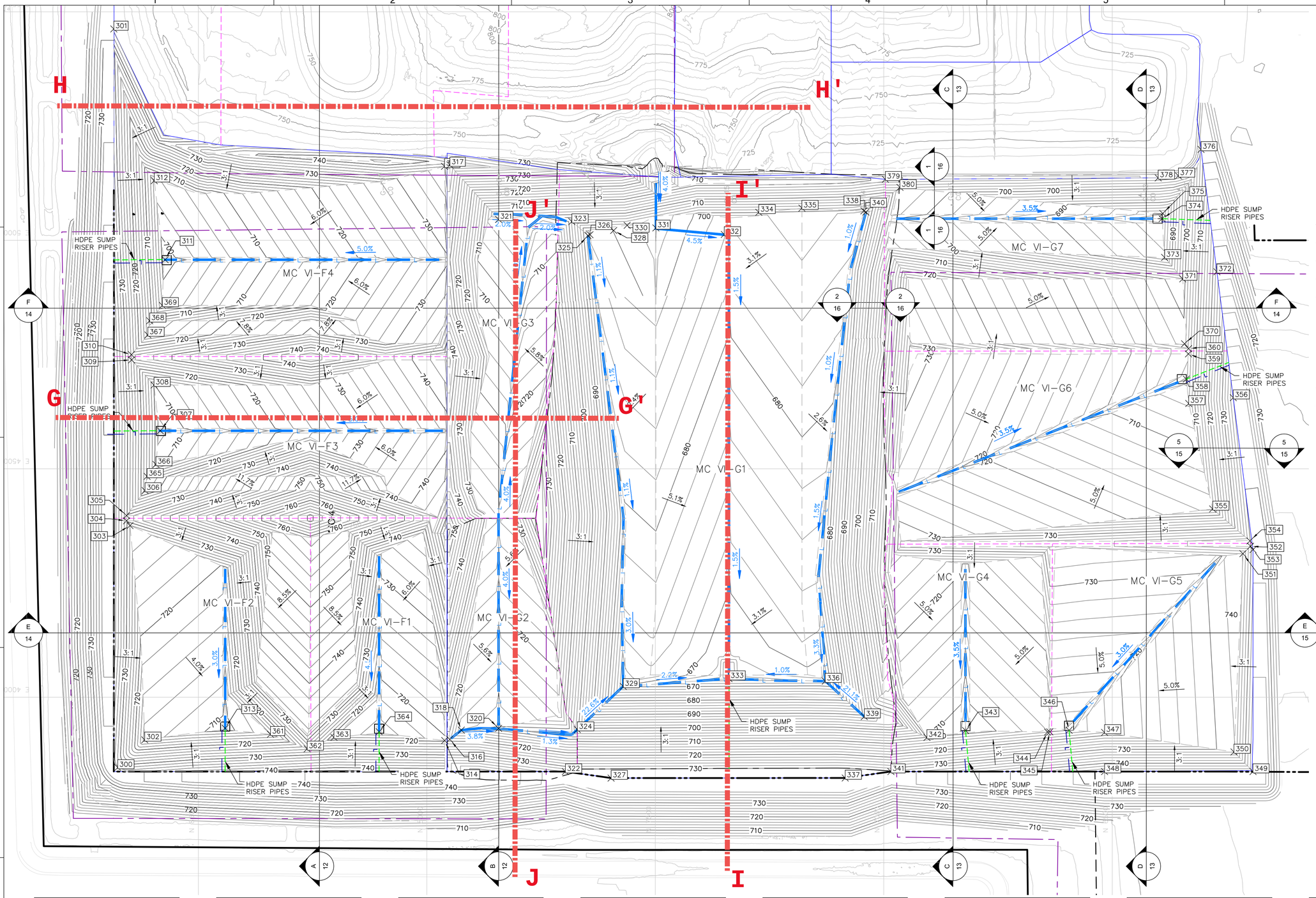
1. Global slope stability analyses of the waste and foundation for each cross section determined that filling to proposed final grades yields acceptable factors of safety.
    a. Cross Section G-G': Factor of Safety = 1.63
    b. Cross Section H-H': Factor of Safety = 1.57
    c. Cross Section I-I': Factor of Safety = 1.5
    d. Cross Section J-J': Factor of Safety = 1.5
2. Under the final conditions (after installation of final cover), the stability of the landfill along the liner system was analyzed. The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. These parameters are shown in Table 1 and are considered values that could be typically achieved with commercial geosynthetic products. Any combination of adhesion and friction angle resulting in comparable shear strength under representative normal stresses to final site conditions are also acceptable. Conformance testing of the selected geosynthetics shall be performed to confirm that the interface shear strength of the actual liner system components is sufficient to ensure the stability of the liner system.
    a. Cross Section G-G': Factor of Safety = 1.65
    b. Cross Section H-H': Factor of Safety = 1.85
    c. Cross Section I-I': Factor of Safety = 1.7
    d. Cross Section J-J': Factor of Safety = 1.6
3. For Cells that have already been constructed, A stability analysis using lab interface shear strength tests results from previous products used on site was performed. The analyses show that a combination of **$C_{\alpha,peak}$=164 psf / ϕ_{peak}=11.1° and $C_{\alpha,large\ displacement}$=110 psf / $\phi_{large\ displacement}$=7.3°** achieves an acceptable factor of safety.
    a. Cross Section I-I': Factor of Safety = 1.6
    b. Cross Section J-J'': Factor of Safety = 1.5
4. An example calculation of liner stability for an interim waste filling conditions is presented in Attachment 7. The required interface friction angle for the floor liner system was determined to be 12 degrees (peak). Actual interim phasing plan slopes and tested liner system interface properties shall be evaluated for each phase of fill per this example.

Source Documents and References
NTH (2008). Basis of Design Report. *Master Cell VI E Design Modification* NTH (2012). *WDI Operating License Application Master Cells VI F & G Volume III – Basis of Design Report* Qian, X., Gray, D.H., and Koerner, R.M. (2002) *Geotechnical Aspects of Landfill Design and Construction.*

Attachments
1. Traces of Cross Sections 2. G-G' Foundation Stability 3. H-H' Foundation Stability 4. I-I' Foundation Stability 5. J-J' Foundation Stability 6. G-G' Liner Stability under Final Conditions with zero adhesion 7. H-H' Liner Stability under Final Conditions with zero adhesion 8. I-I' Liner Stability under Final Conditions with zero adhesion 9. J-J' Liner Stability under Final Conditions with zero adhesion 10. I-I' Liner Stability under Final Conditions with non-zero adhesion (previously tested values) 11. J-J' Liner Stability under Final Conditions with non-zero adhesion (previously tested values) 12. J-J' Liner Stability under Interim Conditions (example interim stability calculation)

Attachment A-1.1

Traces of Cross Sections



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — MASTER CELL VI–F & G MAJOR CONTOURS
- MASTER CELL VI–F & G MINOR CONTOURS
- GRADE BREAK
- 100 — PROPOSED DIKE COORDINATE POINT NO.
- 3:1 — PROPOSED SLOPE
- PROPOSED SUBCELL BOUNDARY
- CELL BOUNDARY
- AS–BUILT BOUNDARY
- PROPOSED LEACHATE COLLECTION PIPE AND FLOW DIRECTION
- PROPOSED LEACHATE CLEANOUT PIPE
- PROPOSED PRIMARY COLLECTION SUMP
- PROPOSED SOLID SUMP RISER PIPE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES, PIPING, AND GEOCOMPOSITE DEPICTED IN MC VI–G SUBCELLS G1–G2 REPRESENT AS–BUILT TOP OF SECONDARY LINER.

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
300	8676.40	3846.28	734.54
301	8685.01	5462.64	728.25
302	8617.38	3906.71	712.94
303	8649.60	4375.66	727.86
304	8657.24	4386.11	730.42
305	8657.19	4397.62	730.43
306	8616.71	4452.40	717.06
307	8583.27	4583.16	706.16
308	8597.12	4683.16	709.89
309	8646.14	4738.22	725.58
310	8646.48	4749.72	725.56

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
311	8572.76	4957.47	697.64
312	8596.51	5130.39	703.29
313	8441.35	3932.29	707.95
314	7960.91	3905.27	719.50
315	7961.26	5161.96	736.10
316	7949.75	3907.70	718.61
317	7949.45	5164.97	738.31
318	7924.50	3928.02	711.75
319	7904.56	5051.05	703.11
320	7842.87	3931.97	708.82
321	7842.87	5045.77	700.84

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
322	7696.73	3837.32	733.74
323	7682.58	5040.91	697.50
324	7670.57	3929.29	702.88
325	7647.35	5010.49	687.00
326	7642.85	5012.25	688.18
327	7596.74	3823.09	738.60
328	7591.06	5021.51	690.24
329	7570.10	4023.55	671.56
330	7561.67	5032.75	691.59
331	7498.71	5027.05	693.52
332	7349.00	5012.85	686.42

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
333	7338.74	4040.74	666.42
334	7273.49	5061.28	687.73
335	7179.18	5070.45	689.94
336	7128.04	4035.19	668.55
337	7084.38	3823.30	739.24
338	7043.49	5064.48	687.10
339	7042.63	3957.62	692.90
340	7038.96	5061.69	685.79
341	6984.38	3837.32	732.38
342	6905.54	3911.96	710.13
343	6821.02	3927.03	707.63

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
344	6641.59	3923.81	713.92
345	6636.63	3924.19	713.94
346	6594.37	3927.75	714.00
347	6516.74	3922.88	717.86
348	6516.74	3837.32	746.00
349	6191.88	3837.32	746.00
350	6233.58	3880.28	731.87
351	6214.04	4314.26	734.09
352	6197.41	4330.56	739.73
353	6191.88	4323.06	741.29
354	6198.61	4342.06	739.71

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
355	6280.17	4412.07	715.30
356	6235.08	4655.62	738.04
357	6332.61	4642.95	705.70
358	6337.83	4696.24	703.34
359	6333.17	4751.42	704.26
360	6332.82	4762.92	704.25
361	8342.16	3918.88	713.80
362	8261.82	3887.00	725.54
363	8203.29	3912.03	718.03
364	8104.44	3924.55	713.57
365	8612.28	4483.38	715.64

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
366	8592.85	4509.67	709.22
367	8610.47	4793.01	713.10
368	8606.52	4823.99	711.44
369	8578.86	4857.57	701.75
370	6341.76	4773.54	701.15
371	6345.63	4915.50	698.23
372	6270.86	4931.07	722.96
373	6385.28	4962.52	684.48
374	6390.87	5047.34	681.65
375	6389.40	5058.83	682.01
376	6305.65	5198.88	708.30

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
377	6355.11	5141.16	707.90
378	6399.40	5136.66	707.80
379	6996.47	5133.58	710.19
380	6964.50	5115.83	704.17

REVISIONS					
REV	DATE	DRN	APP		
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ	XZ
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR COMMENTS	LEH	XZ	XZ
F	05/28/21	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ	XZ
E	5/29/18	ADDENDUM 1	PAA	XZ	XZ
D	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ	XZ
C	9/23/11	PER MDEQ COMMENTS			DRL
B	6/10/11	PHASING DESIGNATIONS			DRL
A	6/10/11	REVISION DESCRIPTION	DRN	APP	

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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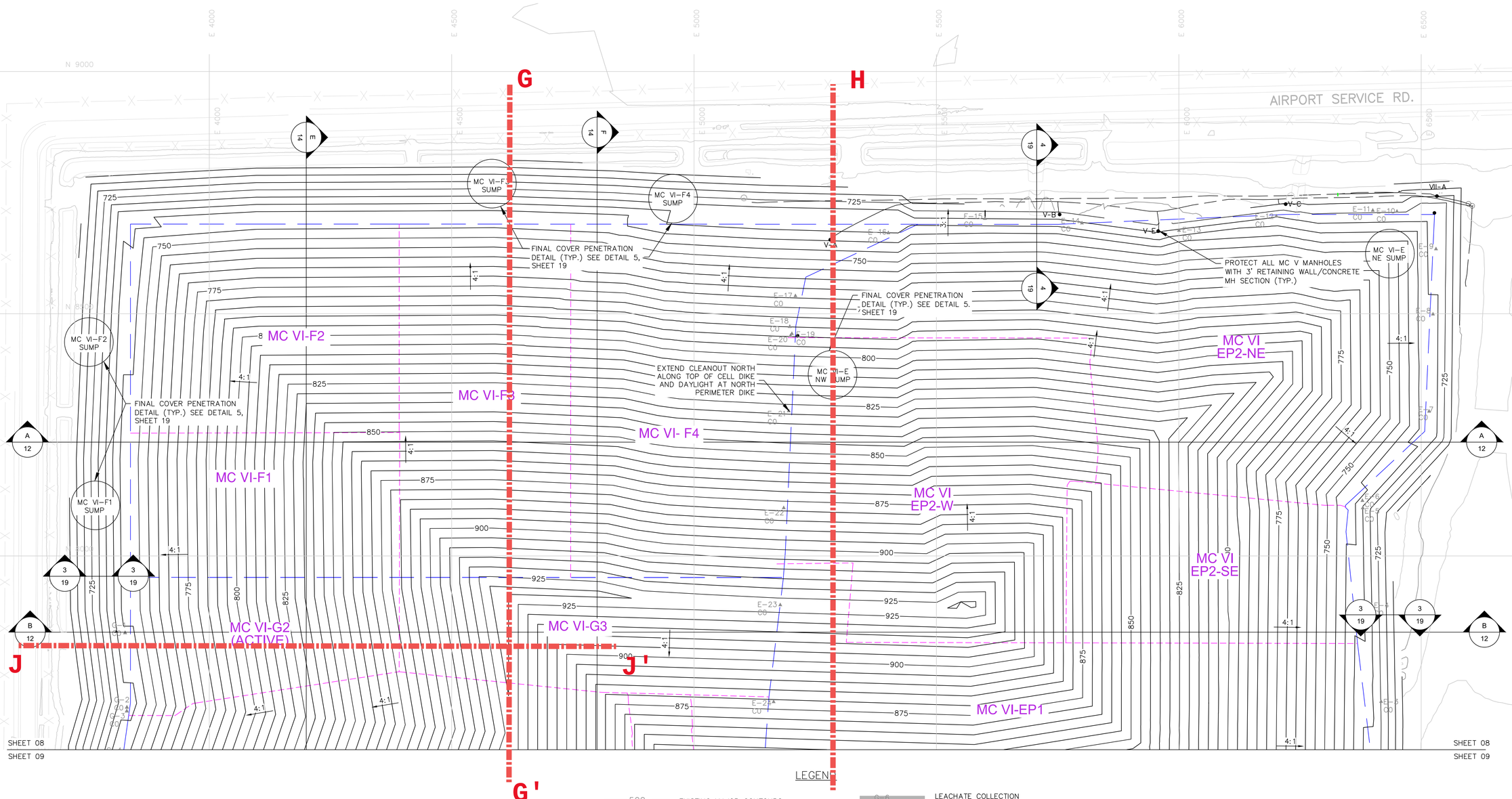
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI - REV I
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF PRIMARY LINER GRADING PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
06



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — PERMITTED TOP OF FINAL COVER MAJOR CONTOURS
- PERMITTED TOP OF FINAL COVER MINOR CONTOURS
- EXISTING GRADE BREAKLINES
- EXISTING LEACHATE FORCEMAIN
- SUBCELL BOUNDARY
- CELL BOUNDARY
- LEACHATE COLLECTION SYSTEM CLEANOUTS
- EXISTING MANHOLES
- PROPOSED SUMP LOCATION AND COVER PENETRATION

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.

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DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION		
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	06/17/21	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
E	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ
C		REVISION DESCRIPTION	DRN	APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI - REV I
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
08

SHEET 08
SHEET 09

MC VI-G1
MC VI-G1 EP2
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-B
MC VI A-N
MC VI-C
MC VI-D
MC VI A-S

MC VI-G4 SUMP
MC VI-G5 SUMP
MC VI-G6 SUMP
MC VI-G7 SUMP
MC VI-E SW SUMP
MC VI-E SE SUMP
MC VI-B SUMP RISER
MC VI-C SUMP RISER (SEE NOTE 3)
MC VI-B LEAK DETECTION RISER
MC VI-AN LEAK DETECTION RISER
MC VI-AN SUMP RISER
MC VI-AS SUMP RISER
MC VI-AS LEAK DETECTION RISER
MC VI-C LEAK DETECTION RISER
MC VI-D SUMP RISER
MC VI-D LEAK DETECTION RISER

FINAL COVER PENETRATION DETAIL (TYP.) SEE DETAIL 5, SHEET 19

CLEANOUT EXTENSION SEE DETAIL 7, SHEET 17

LEACHATE SUMP RISER PIPING DETAIL (TYP.) SEE DETAIL 5, SHEET 19

OUTLET SWALE CROSS SECTION (TYP.) SEE DETAIL 4, SHEET 20

N

0 100 200
SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — PERMITTED TOP OF FINAL COVER MAJOR CONTOURS
- PERMITTED TOP OF FINAL COVER MINOR CONTOURS
- EXISTING VEGETATION
- EXISTING GRADE BREAKLINES
- EXISTING LEACHATE FORCEMAIN
- SUBCELL BOUNDARY
- CELL BOUNDARY
- PROPOSED GEOCOMPOSITE (TRANSMISSIVITY 5.0 X 10^{-4} M^2/S)
- G-6 CO — LEACHATE COLLECTION SYSTEM CLEANOUTS
- EXISTING LEAK DETECTION OR SUMP RISERS
- PROPOSED SUMP LOCATION AND COVER PENETRATION

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. CLEANOUTS IN MC VI-AN, AS, B, C, AND D ARE TO BE ABANDONED EXCEPT B1, C1, D1 THROUGH D3, D14, D17, D18, AND AS1.
3. BEFORE PLACING WASTE AROUND MC VI-C SUMP RISER, A MONITORING PROGRAM SHOULD BE IMPLEMENTED TO MONITOR ITS FUNCTIONALITY.
4. PRIOR TO PLACING WASTE AROUND CLEANOUTS E-22 THROUGH E-26, THE CLEANOUTS SHOULD BE EVALUATED TO DETERMINE IF THE LEACHATE COLLECTION LINE CAN BE CLEANED BY A SINGLE ACCESS POINT. IF NOT, THE CLEANOUT SHOULD BE EXTENDED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	05/28/21	SUBCELLS G2 AND G3 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
C	5/02/18	F1-F4 REVISIONS AND G2 AND G3 REVISIONS	P.A.A.	DRL
A	6/10/11	PHASING DESIGNATIONS		

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI - REV I
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (2 OF 2)

PROJECT NUMBER 1218070017
SCALE 1" = 100'
DRAWING NO 09

Attachment A-1.2

G-G’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	G-G' Foundation Stability				**File name:**	MC-VI-F_CrossSection_G_Foundation.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/07/21	**Date:**	10/07/21	**Date:**	10/7/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. The groundwater level was set at elevation 655 based on historical borings as documented in the Basis of Design report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressure may accumulate after loading. This is considered a conservative approach for this scenario.		

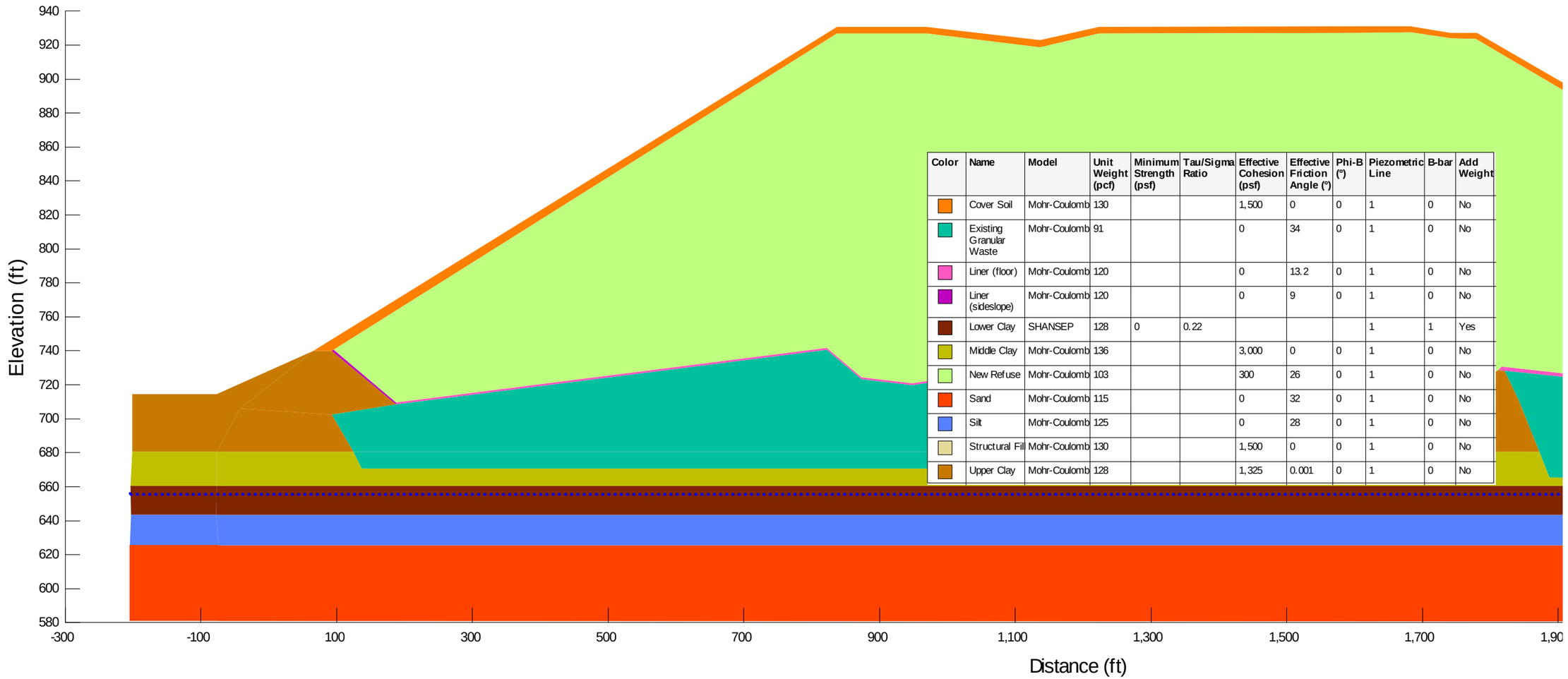
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)

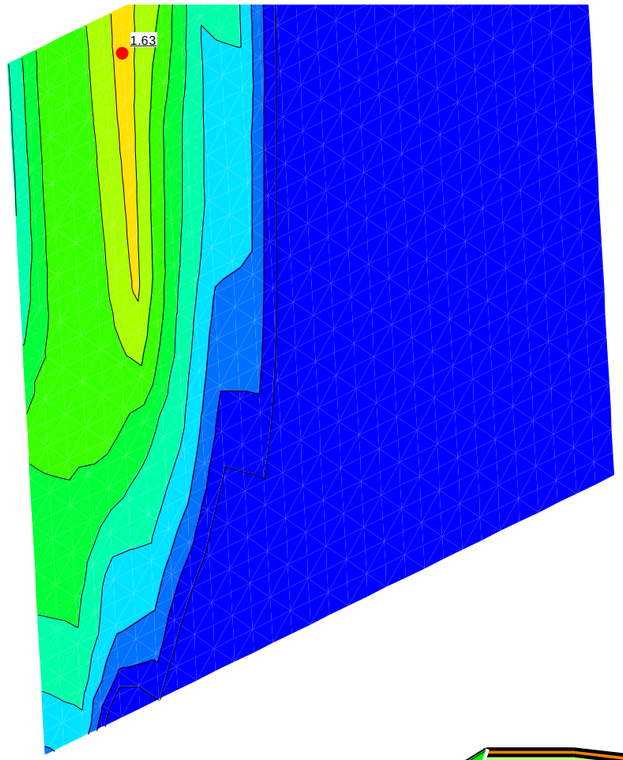
SLOPE STABILITY ANALYSIS REPORT FORM

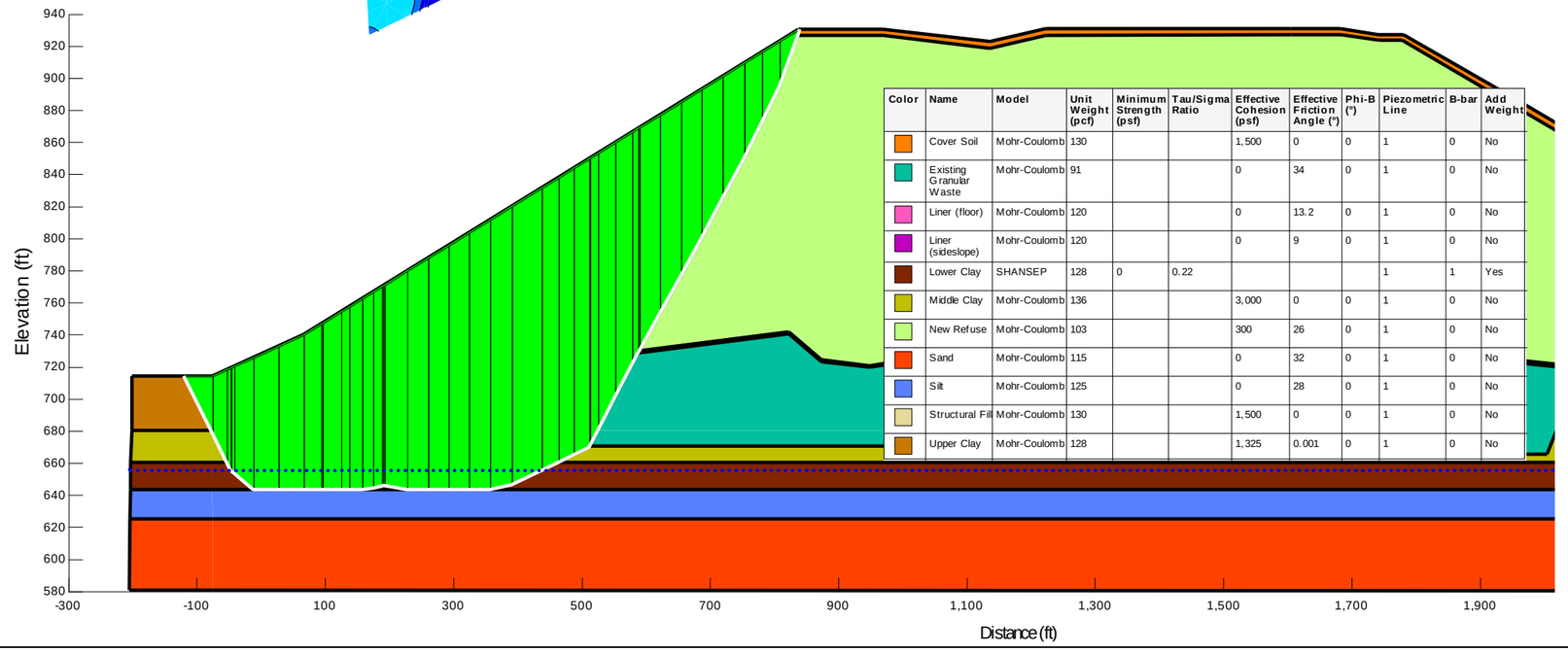
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section G

Factor of Safety:	1.6	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	128			1,325	0.001	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	128			1,325	0.001	0	1	0	No

Attachment A-1.3

H-H’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	H-H' Foundation Stability				**File name:**	MC-VI-E_CrossSection_H_Foundation.gsz	
Revision:	0	**Originated:**	KM	**Checked:**	MK	**Approved:**	KF
Date:	10/07/21	**Date:**	6/3/21	**Date:**	10/07/21	**Date:**	10/7/21

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section H-H'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. The groundwater level was set at elevation 655 based on historical borings as documented in the Basis of Design report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressures may accumulate after loading. This is considered a conservative approach for this scenario.		

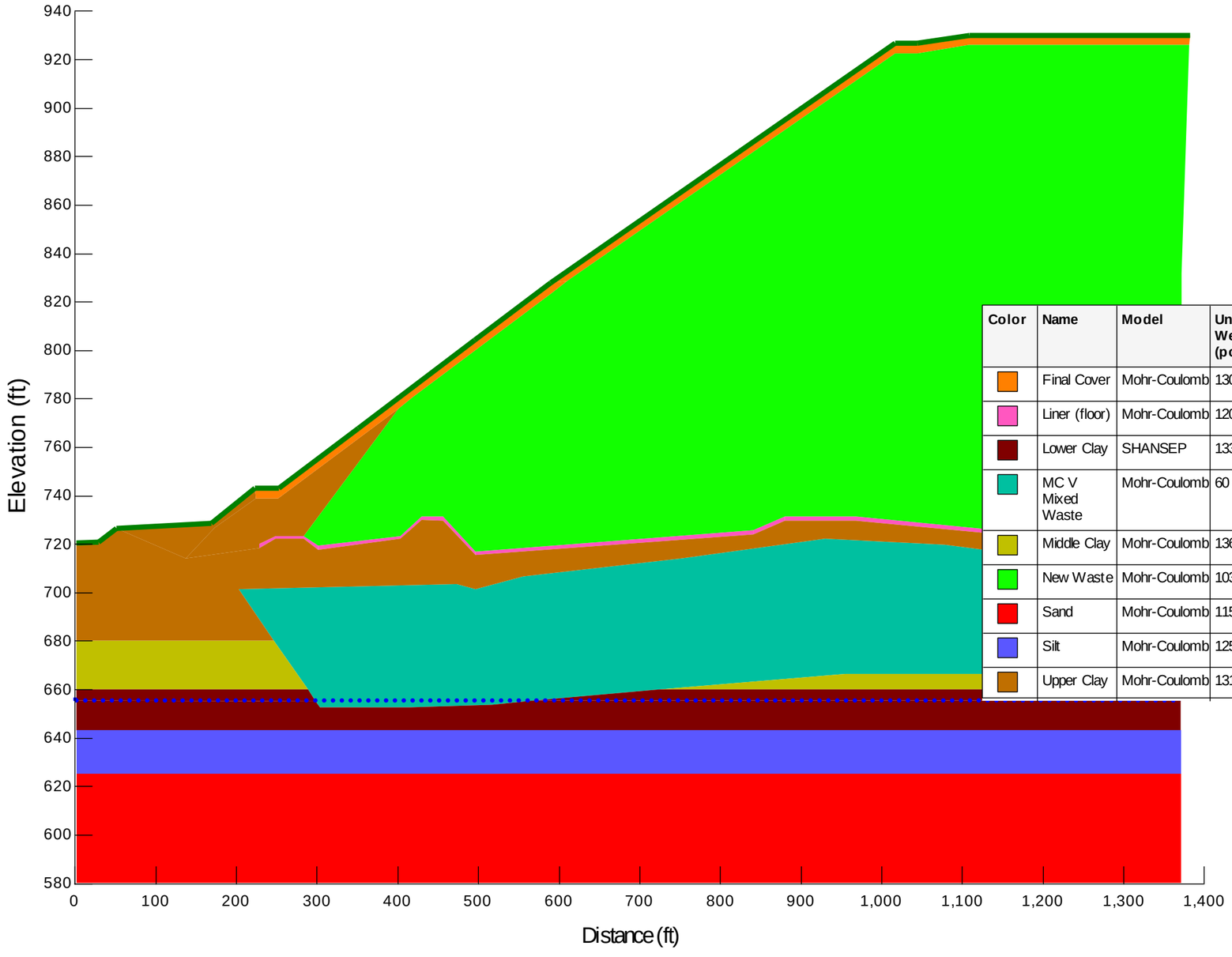
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The overfill liner elevations are from Master Cell VI-E Design Modification Plans, Wayne Disposal Inc., Site No. 2 by NTH Consultants (2011) and Master Cell VI Design Modification

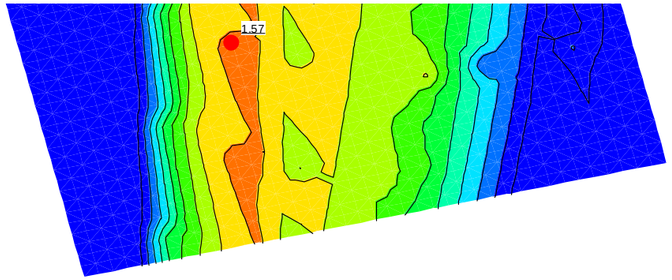
SLOPE STABILITY ANALYSIS REPORT FORM

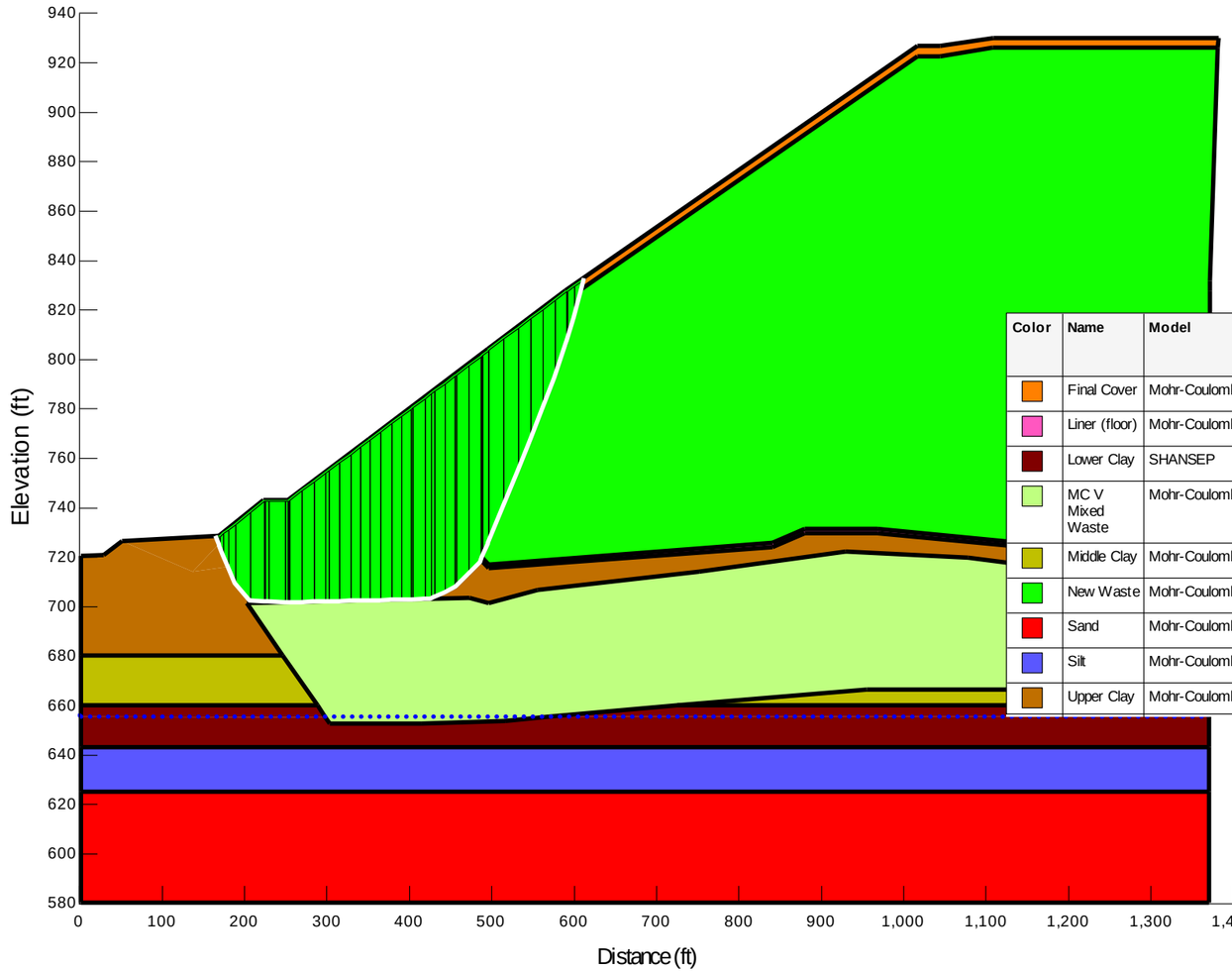
	Plans. Wayne Disposal, Inc. Site No. 2 by NTH Consultants (2008). The elevations for bottom and top of existing waste are from Appendix A Settlement Analysis, WDI MC VI-E Major Design Modification by NTH Consultants (2008). The proposed final cover elevations are from WDI MCVI-E/F Final Cover Proposed Grading Plan by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section H

Factor of Safety:	1.6	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Final Cover	Mohr-Coulomb	130			1,500	0.01	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	22.5	0	1	0	No
	Lower Clay	SHANSEP	133	0	0.22				1	1	Yes
	MC V Mixed Waste	Mohr-Coulomb	60			0	28	0	1	0	No
	Middle Clay	Mohr-Coulomb	136			3,000	0.01	0	1	0	No
	New Waste	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	131			1,325	0.01	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Final Cover	Mohr-Coulomb	130			1,500	0.01	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	22.5	0	1	0	No
	Lower Clay	SHANSEP	133	0	0.22				1	1	Yes
	MC V Mixed Waste	Mohr-Coulomb	60			0	28	0	1	0	No
	Middle Clay	Mohr-Coulomb	136			3,000	0.01	0	1	0	No
	New Waste	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	131			1,325	0.01	0	1	0	No

Attachment A-1.4

I-I’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	I-I' Foundation Stability				**File name:**	MC-VI-G1_CrossSection_I_Foundation.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/07/21	**Date:**	10/07/21	**Date:**	10/7/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section I-I'. This case considers a west-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. The groundwater level was set at elevation 655 based on historical borings as documented in the Basis of Design report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressures may accumulate after loading. This is considered a conservative approach for this scenario.		

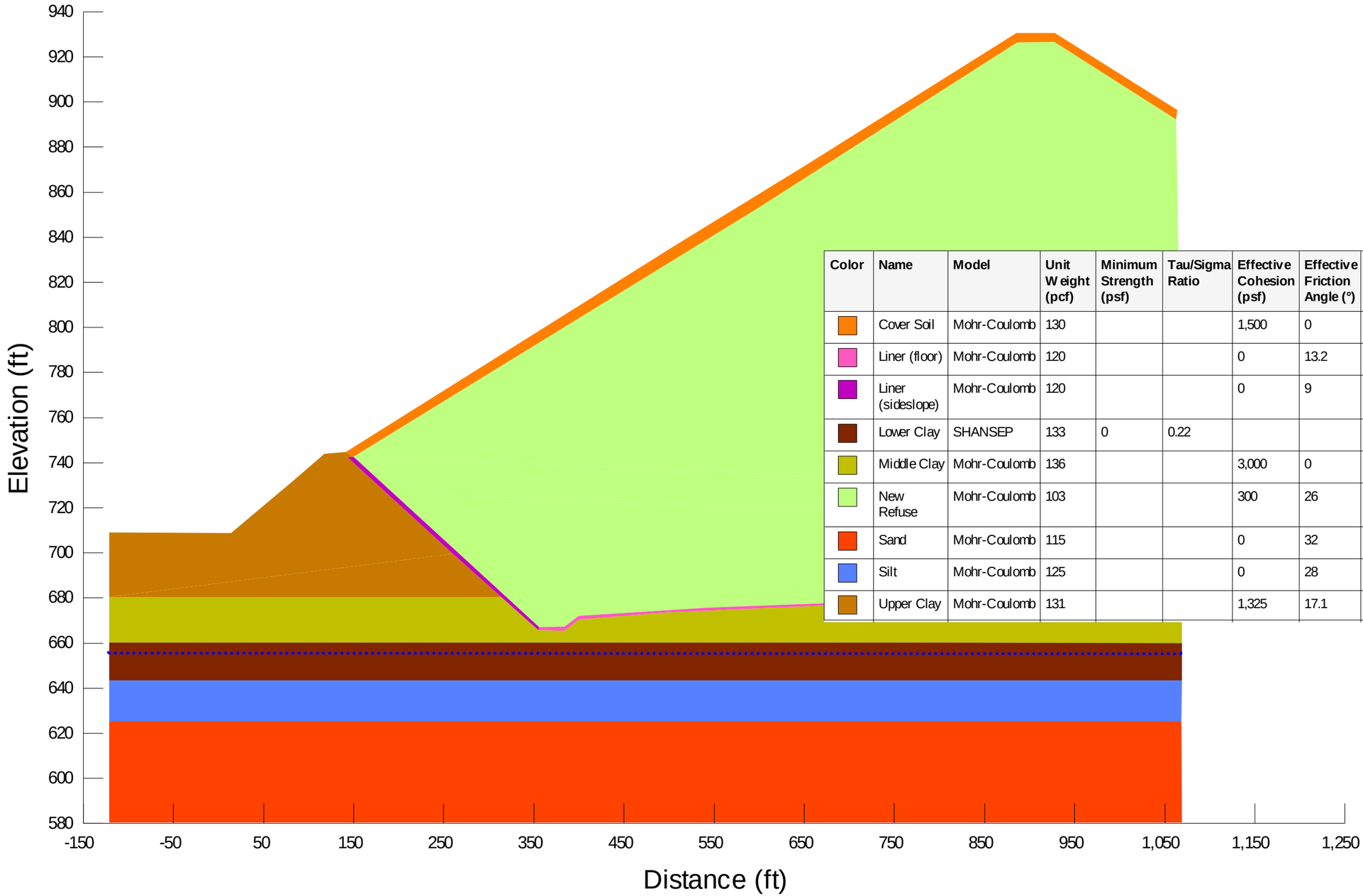
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)

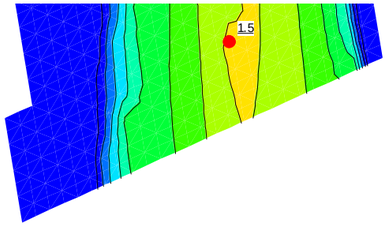
SLOPE STABILITY ANALYSIS REPORT FORM

☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section I

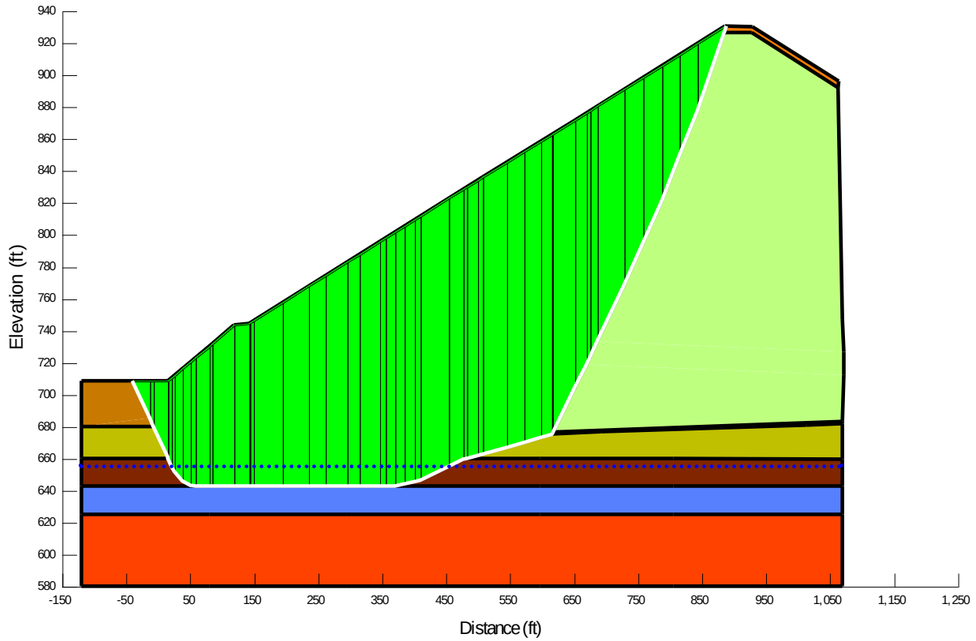
Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	133	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	131			1,325	17.1	0	1	0	No



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	133	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	131			1,325	17.1	0	1	0	No



Attachment A-1.5

J-J’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	J-J' Foundation Stability				**File name:**	MC-VI-G2_CrossSection_J_Foundation.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/07/21	**Date:**	10/07/21	**Date:**	10/7/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section J-J'. This case considers a west-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. The groundwater level was set at elevation 655 based on historical borings as documented in the Basis of Design report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressures may accumulate after loading. This is considered a conservative approach for this scenario.		

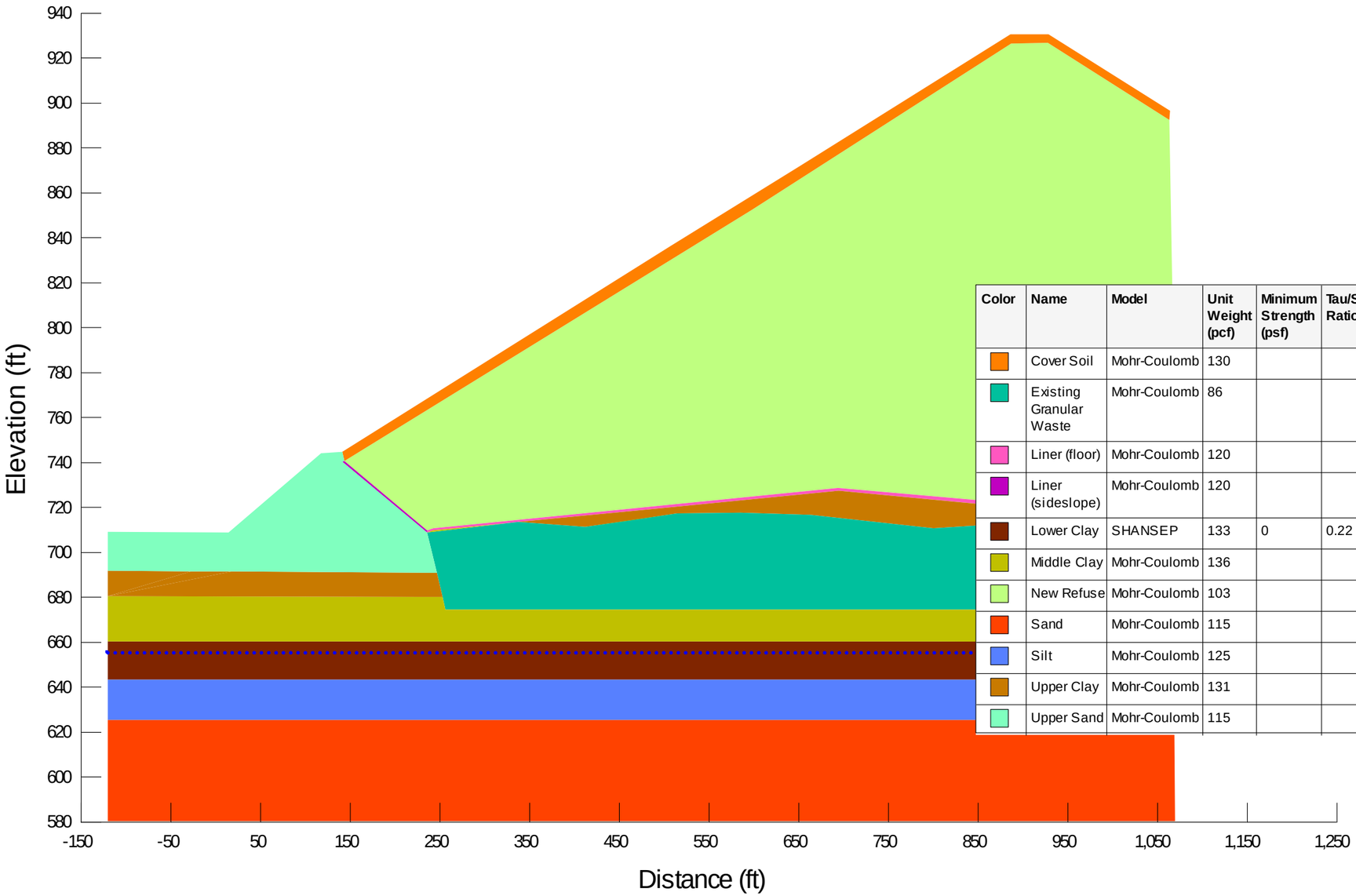
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand/aqua	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)

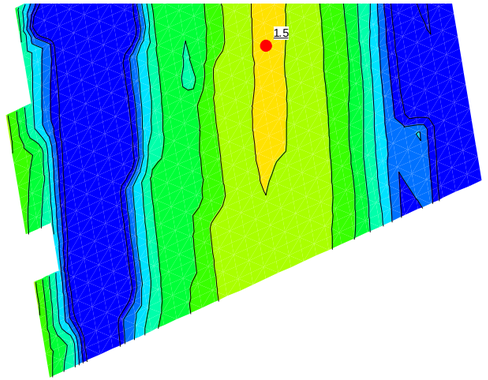
SLOPE STABILITY ANALYSIS REPORT FORM

☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section J

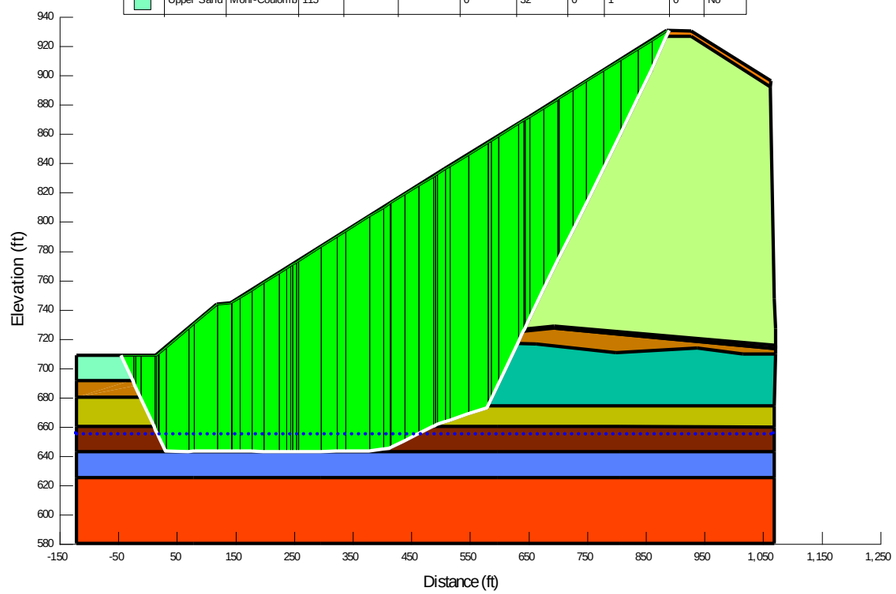
Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	86			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	133	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	131			1,325	0.0001	0	1	0	No
	Upper Sand	Mohr-Coulomb	115			0	32	0	1	0	No



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	86			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	133	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			300	26	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	131			1,325	0.0001	0	1	0	No
	Upper Sand	Mohr-Coulomb	115			0	32	0	1	0	No



Attachment A-1.6

G-G’ Liner Stability under Final Conditions with Zero Adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	G-G' Liner Stability				**File name:**	MC-VI-F_CrossSection_G_Liner.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/07/21	**Date:**	10/07/21	**Date:**	10/7/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☐ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. These values are achievable using available geosynthetic materials. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

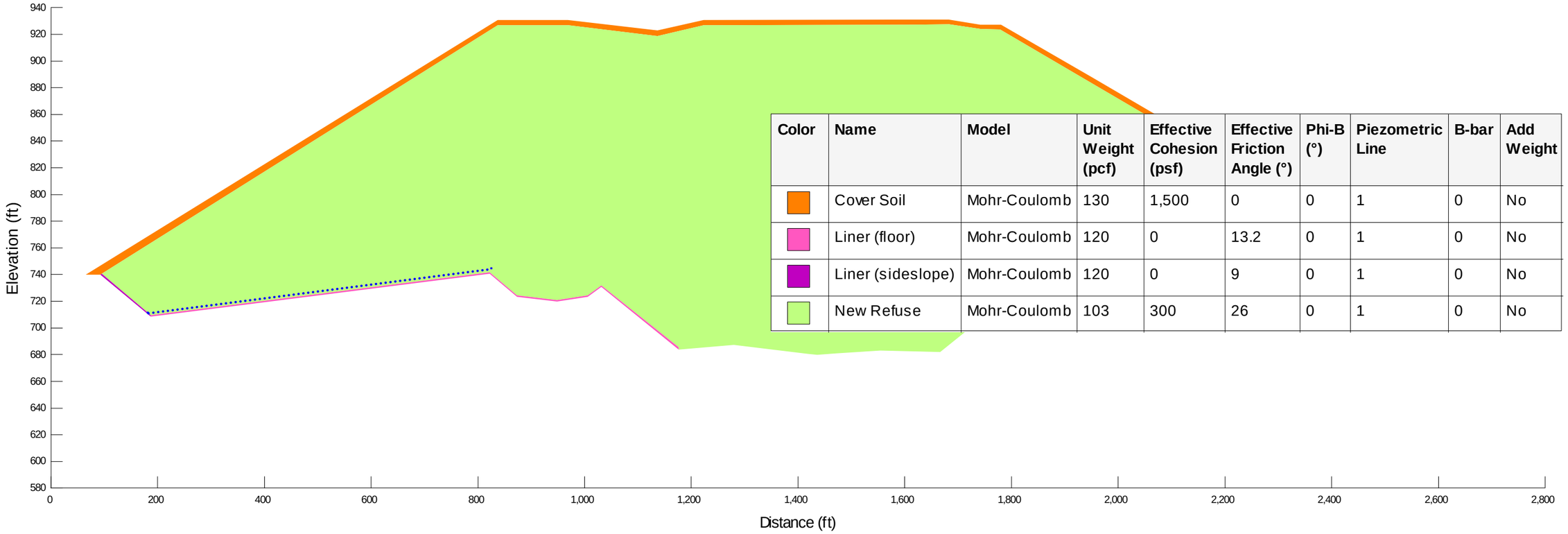
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out

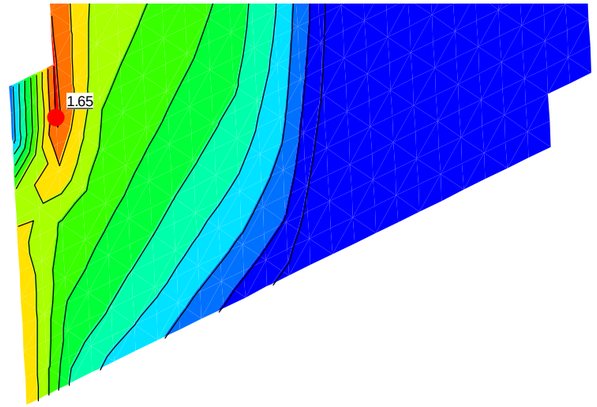
SLOPE STABILITY ANALYSIS REPORT FORM

Other Geometry Notes:	Cross Section G

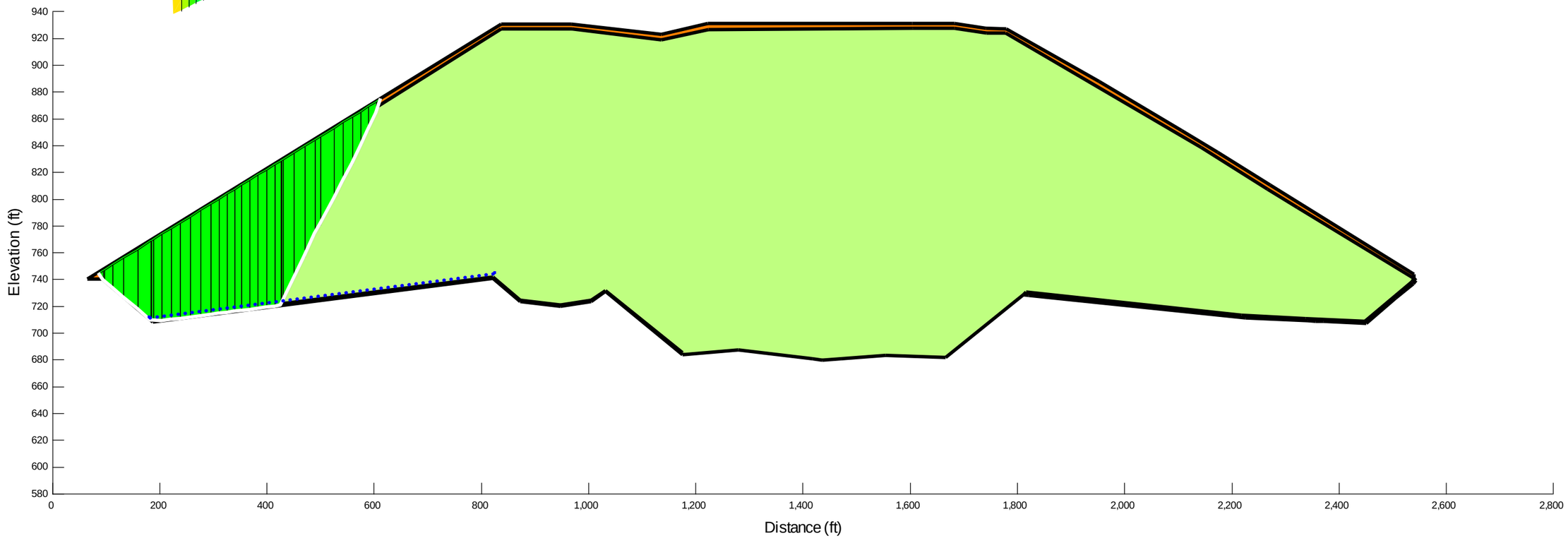
Factor of Safety:	1.7	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No



Attachment A-1.7

H-H’ Liner Stability under Final Conditions with Zero Adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	H-H' Foundation Stability				**File name:**	MC-VI-E_CrossSection_H_Liner.gsz	
Revision:	0	**Originated:**	KM	**Checked:**	MK	**Approved:**	KF
Date:	10/07/21	**Date:**	6/3/21	**Date:**	10/07/21	**Date:**	10/7/21

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section H-H'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☐ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. These values are achievable using available geosynthetic materials. Available data from interface testing performed on the liner system during installation suggests the interface friction angle may be as high as 22.5 degrees. This analysis was performed using a lower value which is a conservative approach. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

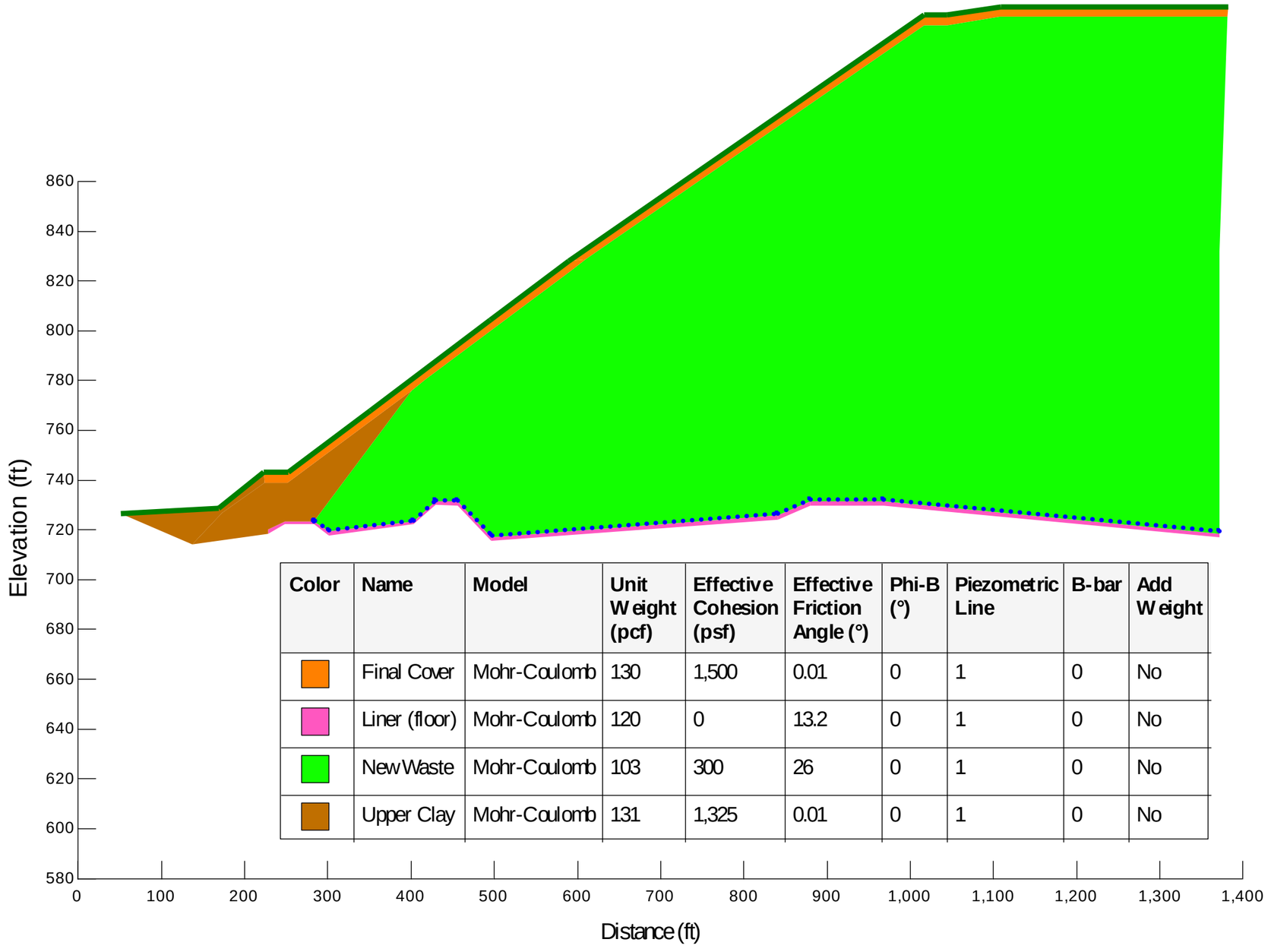
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The overfill liner elevations are from Master Cell VI-E Design Modification Plans, Wayne Disposal Inc., Site No. 2 by NTH Consultants (2011) and Master Cell VI Design Modification

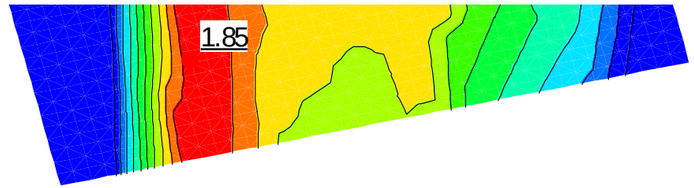
SLOPE STABILITY ANALYSIS REPORT FORM

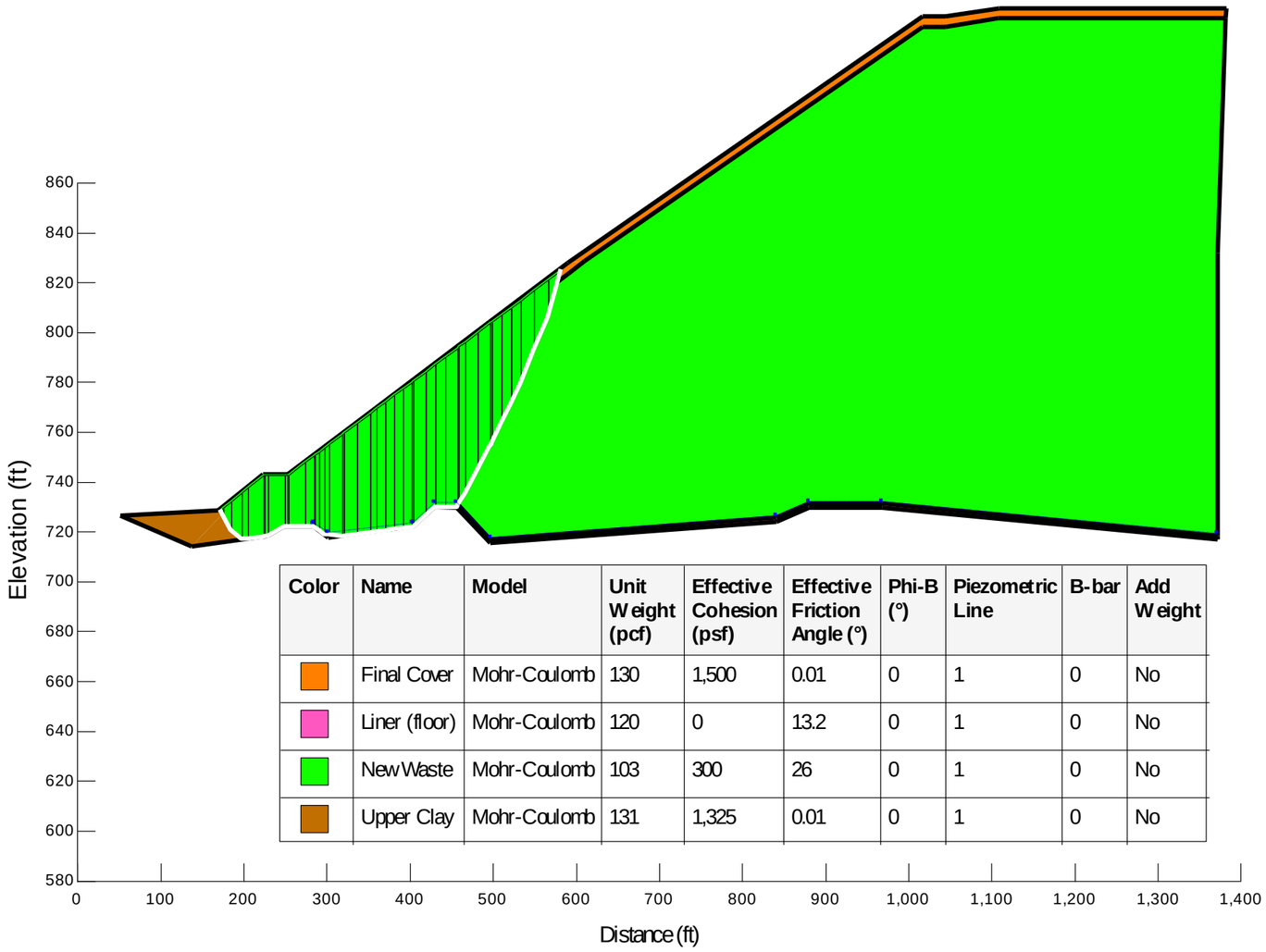
	Plans. Wayne Disposal, Inc. Site No. 2 by NTH Consultants (2008). The proposed final cover elevations are from WDI MCVI-E/F Final Cover Proposed Grading Plan by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section H

Factor of Safety:	1.9	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Final Cover	Mohr-Coulomb	130	1,500	0.01	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	New Waste	Mohr-Coulomb	103	300	26	0	1	0	No
	Upper Clay	Mohr-Coulomb	131	1,325	0.01	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Final Cover	Mohr-Coulomb	130	1,500	0.01	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	New Waste	Mohr-Coulomb	103	300	26	0	1	0	No
	Upper Clay	Mohr-Coulomb	131	1,325	0.01	0	1	0	No

Attachment A-1.8

I-I’ Liner Stability under Final Conditions with Zero Adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	I-I' Liner Stability				**File name:**	MC-VI-G1_CrossSection_I_Liner.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/07/21	**Date:**	10/07/21	**Date:**	10/7/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section I-I'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☐ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. These values are achievable using available geosynthetic materials. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

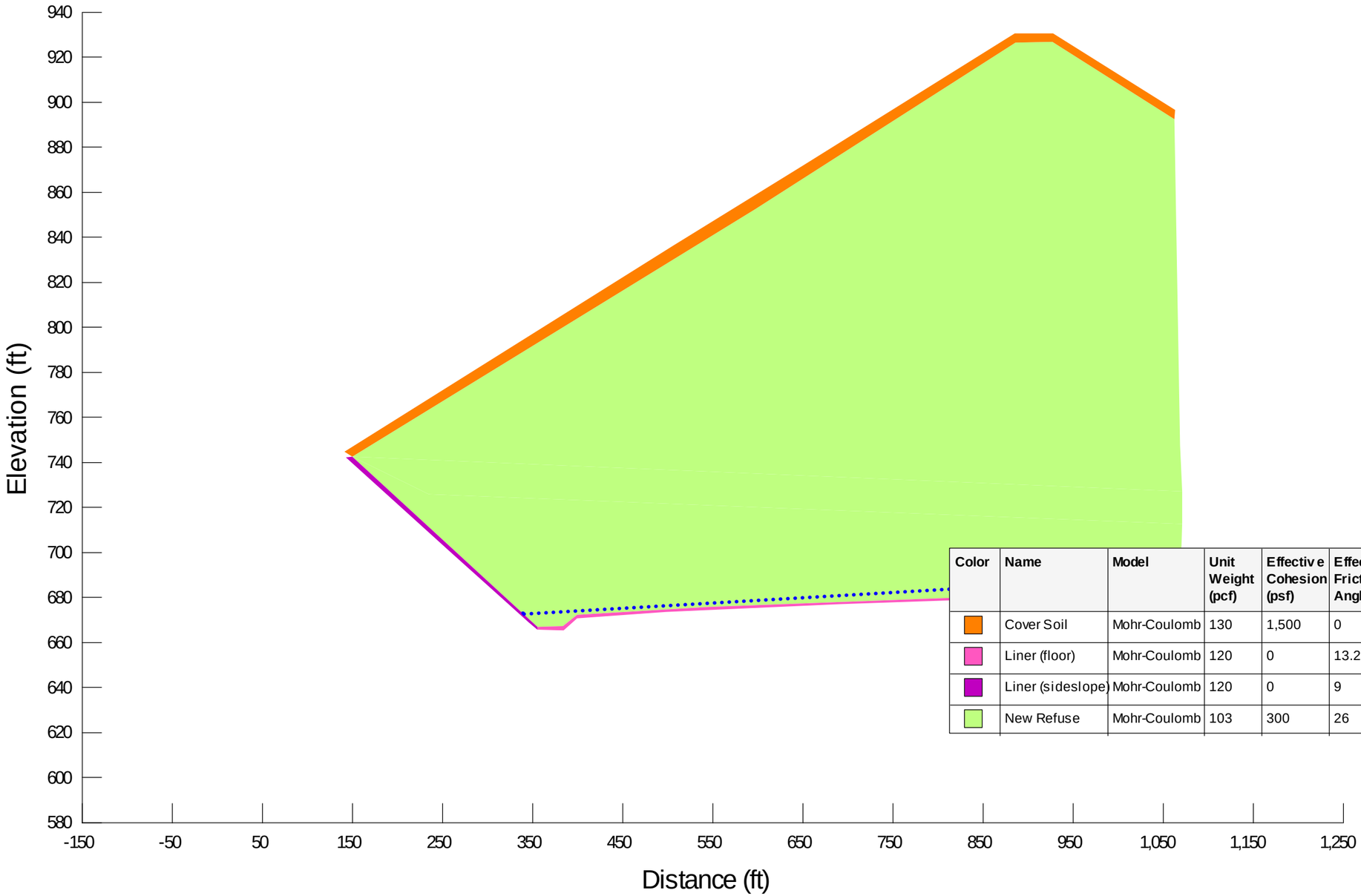
Material	**Name**	**Color in Profile**	**Unit Wt(s) (pcf)**	**Strength ϕ or δ (deg.)**	**Strength C or Ca (psf)**
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out

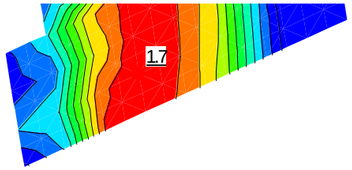
SLOPE STABILITY ANALYSIS REPORT FORM

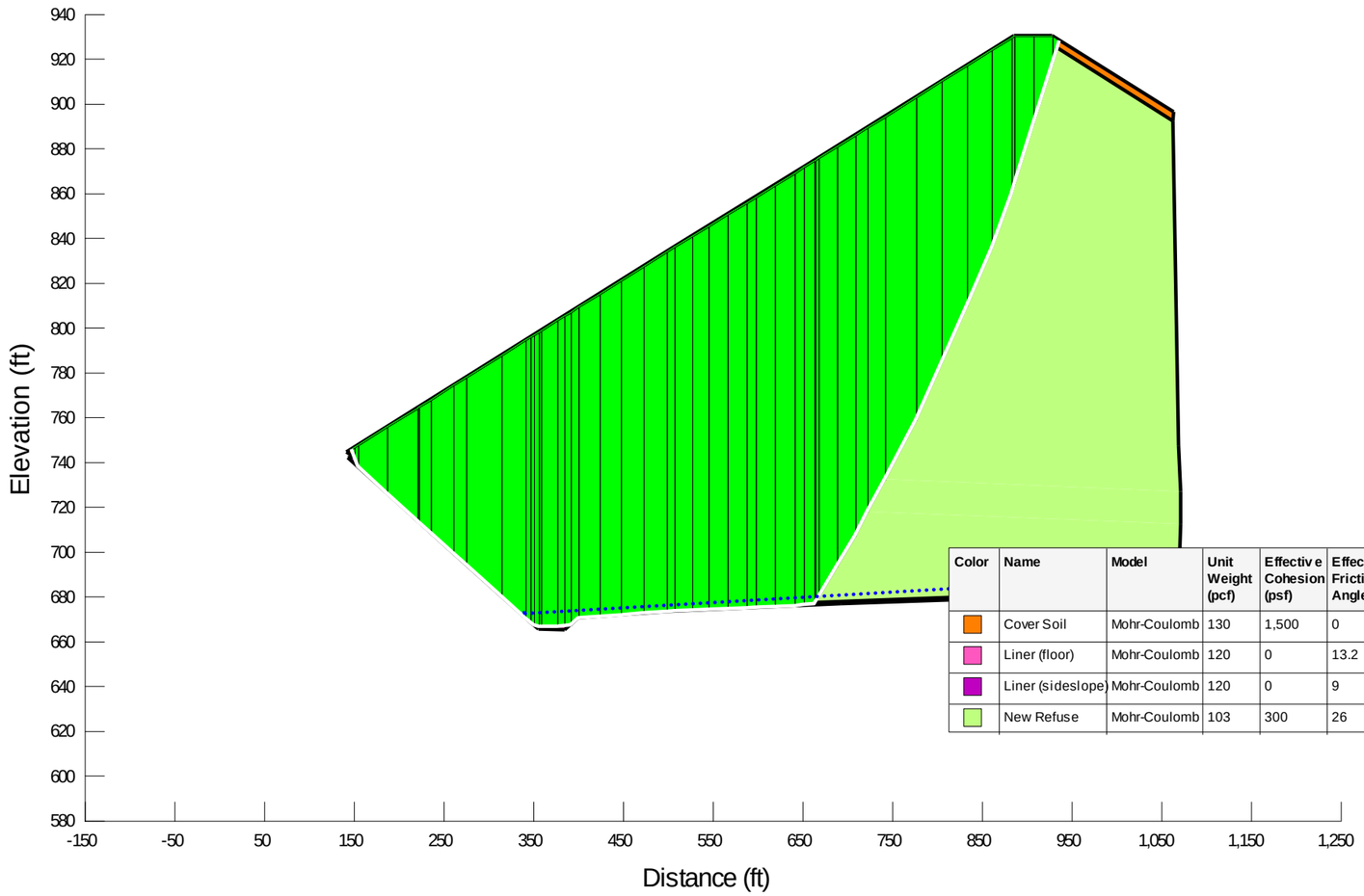
Other Geometry Notes:	Cross Section I

Factor of Safety:	1.7	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No

Attachment A-1.9

J-J’ Liner Stability under Final Conditions with Zero Adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	J-J' Liner Stability				**File name:**	MC-VI-G2_CrossSection_J_Liner.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/07/21	**Date:**	10/07/21	**Date:**	10/7/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section J-J'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☐ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. These values are achievable using available geosynthetic material. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

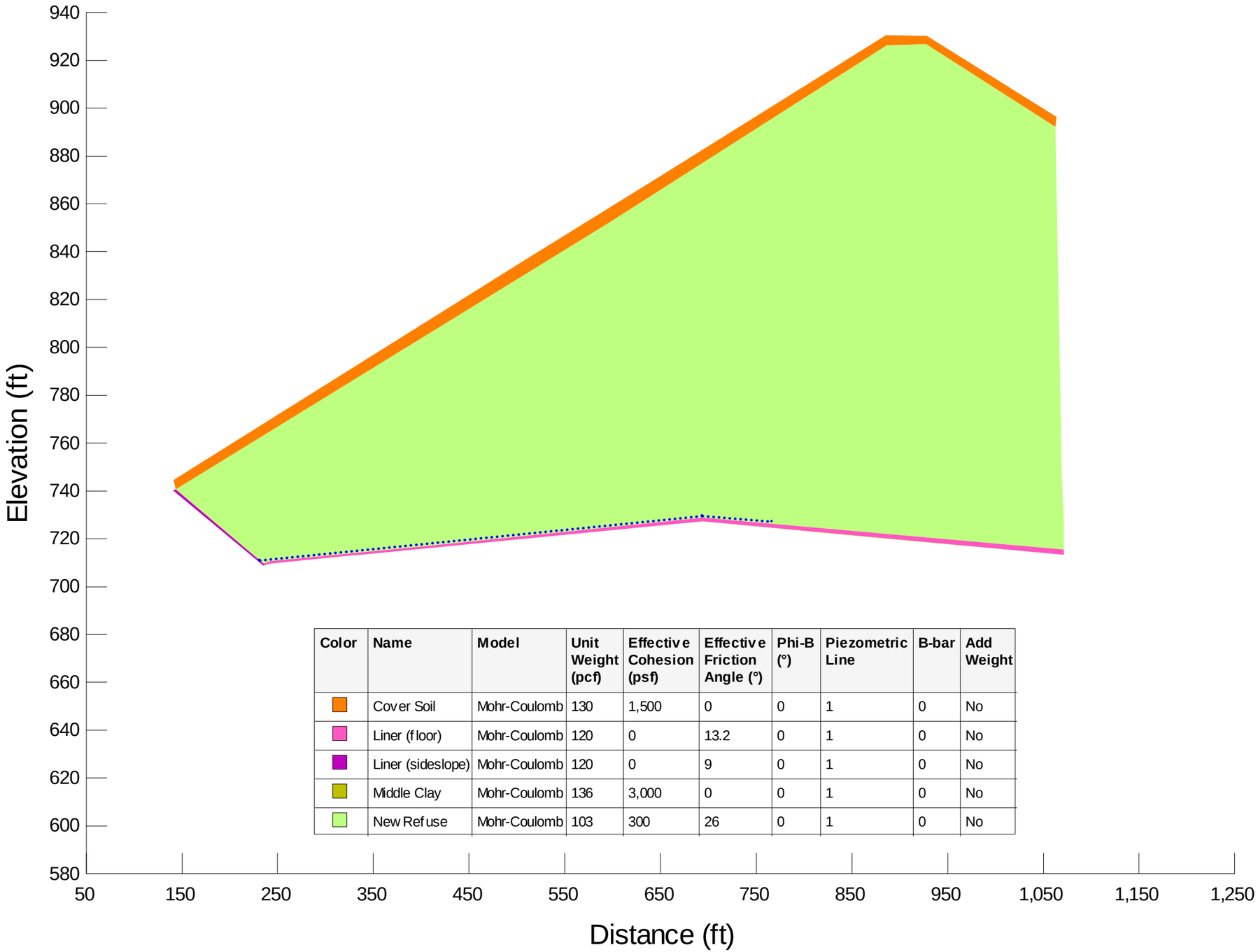
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out

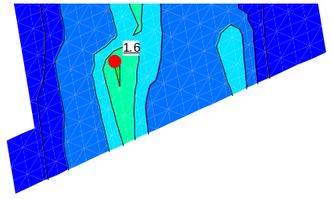
SLOPE STABILITY ANALYSIS REPORT FORM

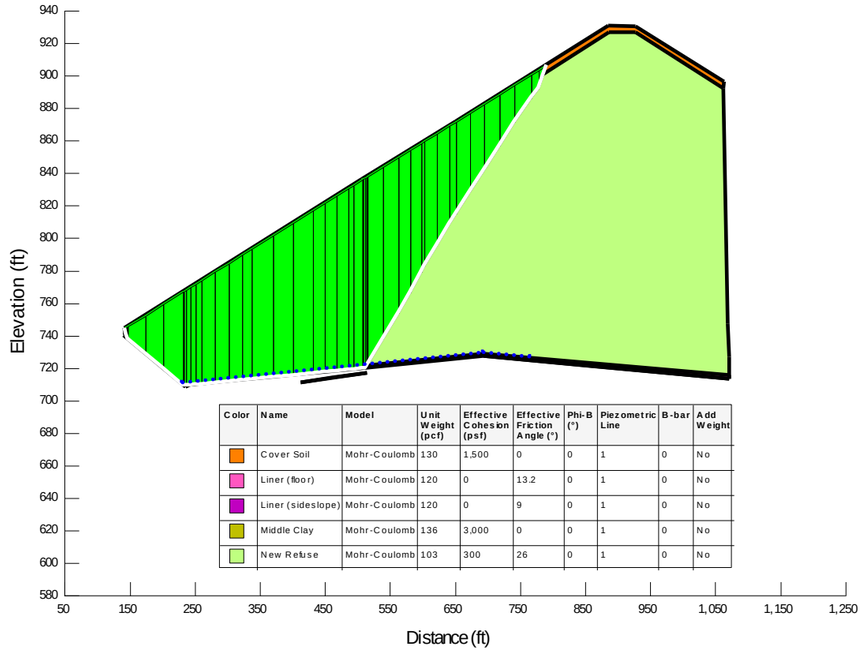
Other Geometry Notes:	Cross Section J

Factor of Safety:	1.6	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Reuse	Mohr-Coulomb	103	300	26	0	1	0	No

Attachment A-1.10

I-I’ Liner Stability under Final Conditions with non-Zero Adhesion (previously tested values)

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	I-I' Liner Stability				**File name:**	MC-VI-G1_CrossSection_I_Liner_Tested_Values.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/07/21	**Date:**	10/07/21	**Date:**	10/7/21	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section I-I'. This case considers a west-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☐ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were determined from existing interface strength testing performed on existing similar liner system materials at WDI. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

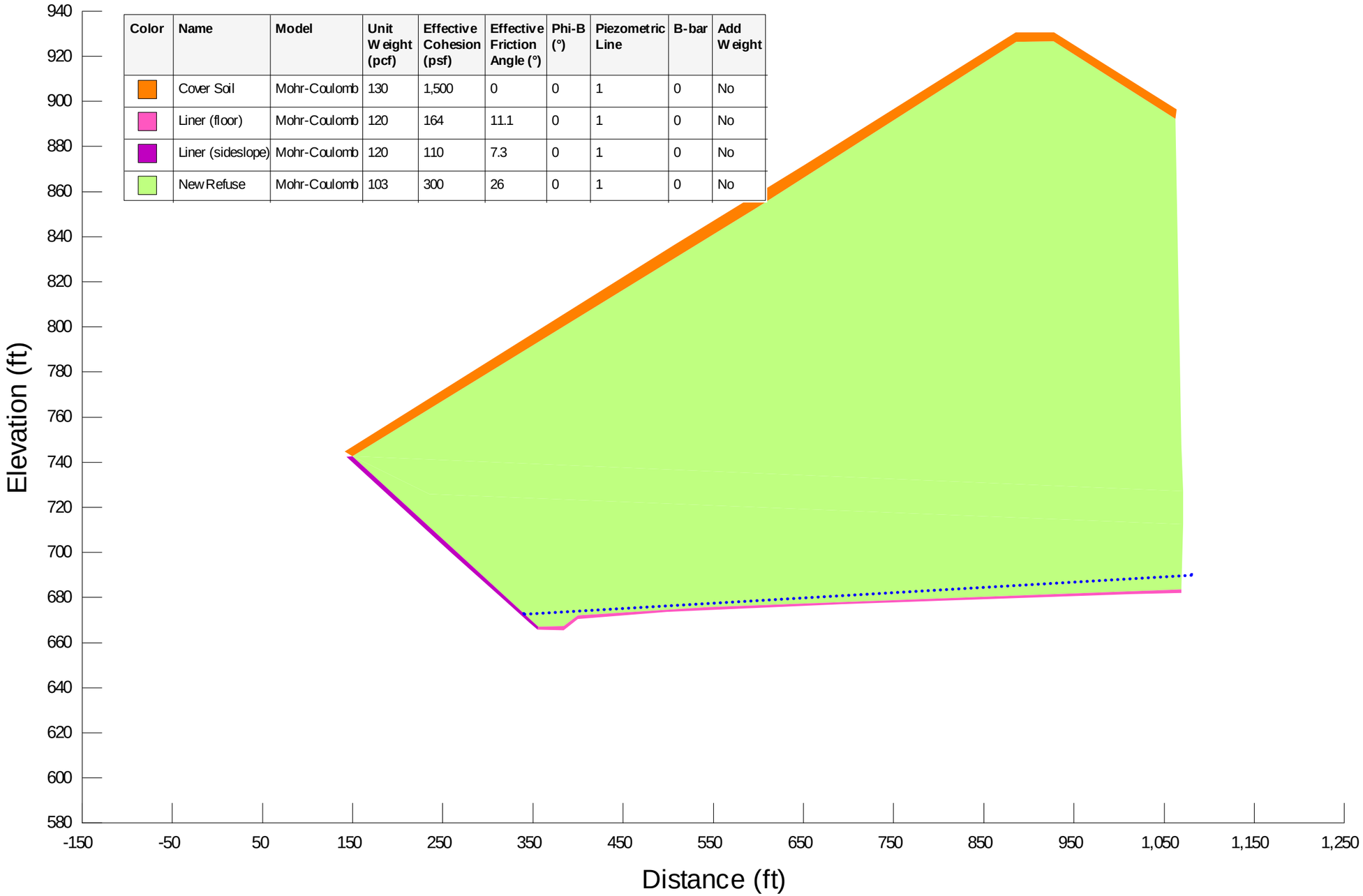
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	11.1	164
10	Liner (sideslope)	Magenta	120	7.3	110
11	Existing MC V Waste	Teal	120	28	0

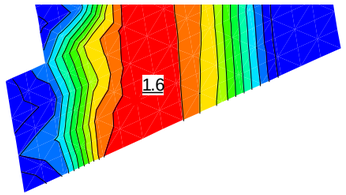
Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section I

SLOPE STABILITY ANALYSIS REPORT FORM

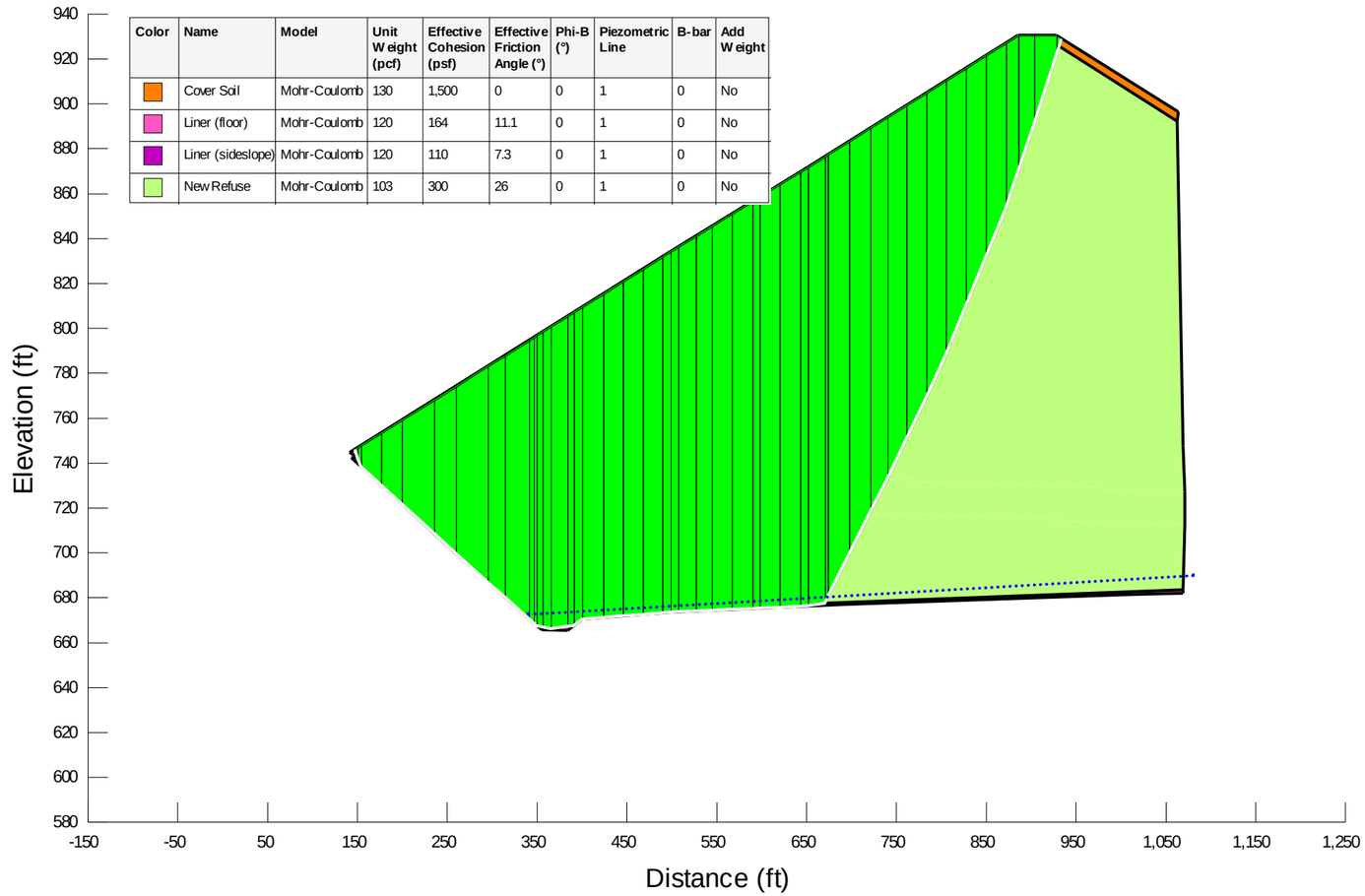
Factor of Safety:	1.6	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No



Attachment A-1.11

J-J’ Liner Stability under Final Conditions with non-Zero Adhesion (previously tested values)

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	J-J' Liner Stability				**File name:**	MC-VI-G2_CrossSection_J_Liner_Tested_Values.gsz	
Revision:	0	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	10/07/21	**Date:**	10/07/21	**Date:**	10/7/21	**Date:**	

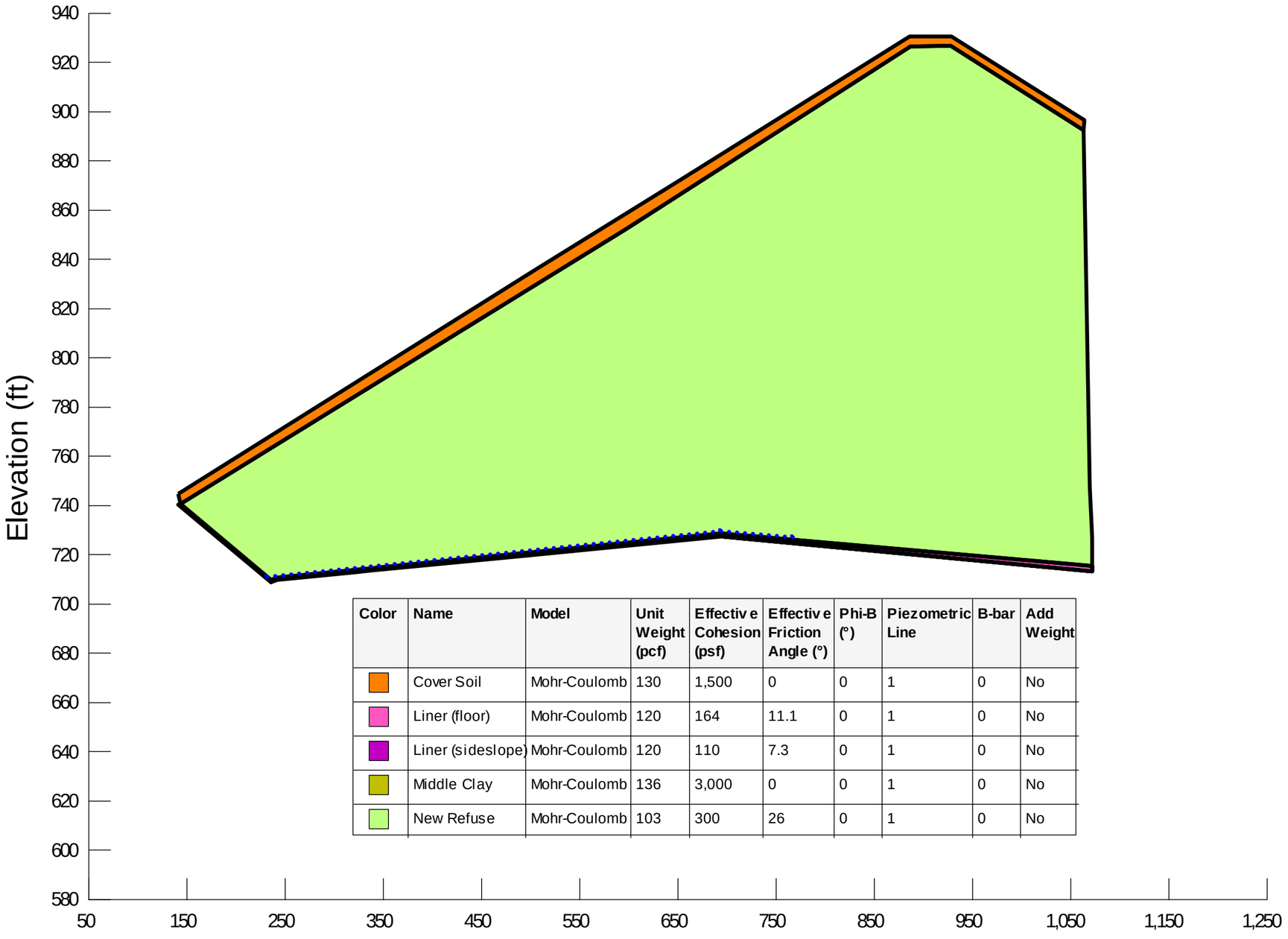
Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section J-J'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☐ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were determined from existing interface strength testing performed on existing similar liner system materials at WDI. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	11.1	164
10	Liner (sideslope)	Magenta	120	7.3	110
11	Existing MC V Waste	Teal	120	28	0

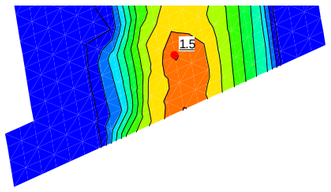
Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section J

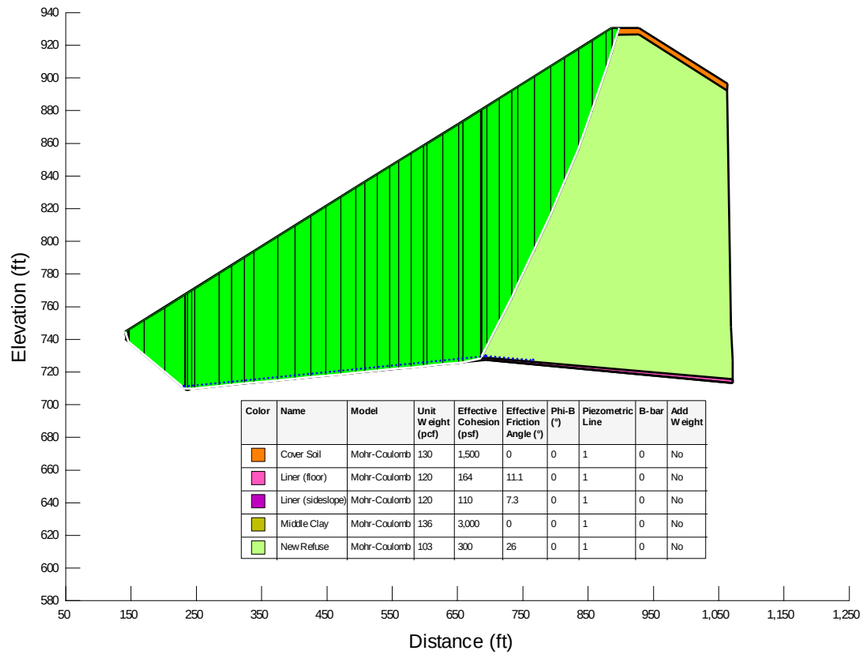
SLOPE STABILITY ANALYSIS REPORT FORM

Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	130	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No

Attachment A-1.12

J-J’ Liner Stability under Interim Conditions (example interim stability calculation)

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	J-J' Liner Stability				**File name:**	MC-VI-G2_CrossSection_J_Liner_Interim.gsz	
Revision:	1	**Originated:**	MK	**Checked:**	KF	**Approved:**	
Date:	11/03/21	**Date:**	11/03/21	**Date:**	10/7/21	**Date:**	

Purpose of Analysis:	To determine the required interface friction angle of the liner system to achieve an acceptable interim factor of safety of 1.3 using cross-section J-J'. This case considers a west-facing slope, with fill to the final permitted grade elevations at an interim slope of 3H:1V. The failure surface is defined such that failure occurs in the underlying liner in order to evaluate the stability of the liner system.		
☐ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The required factor of safety is 1.3 for temporary conditions.		

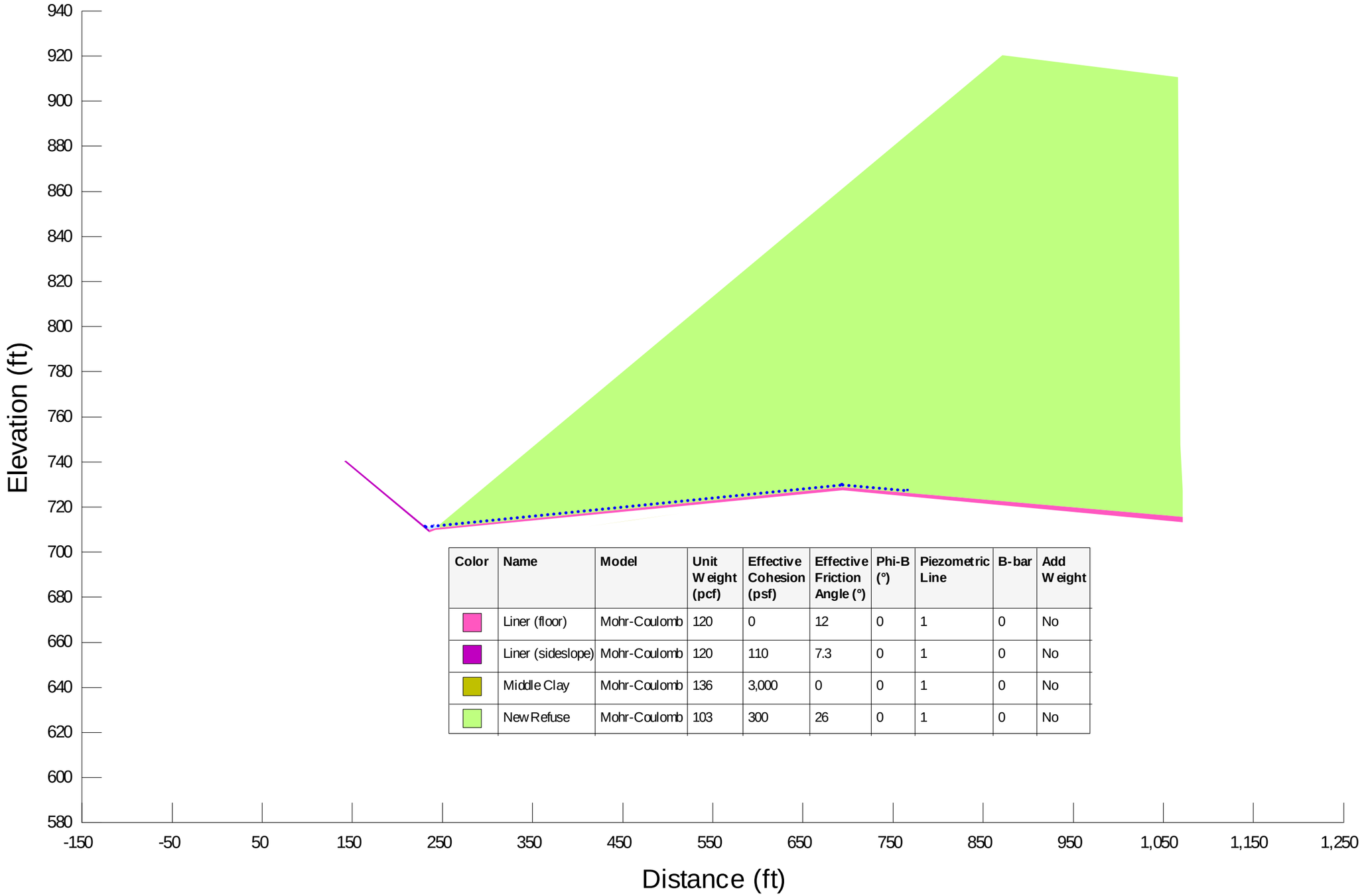
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	?	0
10	Liner (sideslope)	Magenta	120	n/a	n/a
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☒ Interim ☐ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Interim Waste Filling to max height at 3H:1V
Other Geometry Notes:	Cross Section J

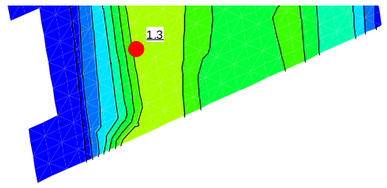
Factor of Safety:	1.3	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded

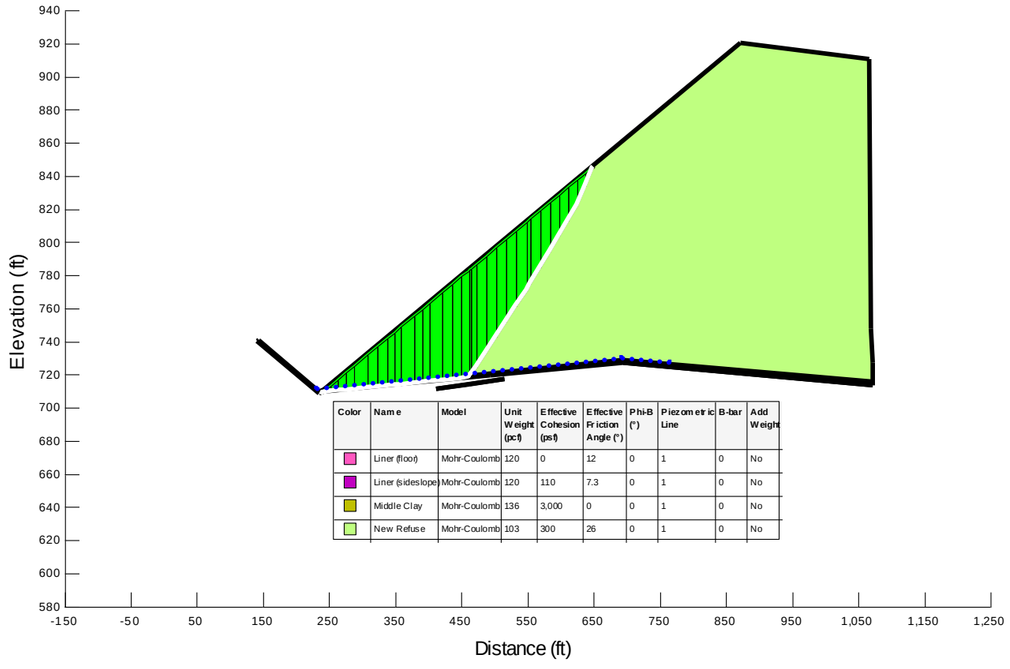
SLOPE STABILITY ANALYSIS REPORT FORM

Comments:	The required interface friction angle for the liner system is 12 degrees (Peak). Any combination of adhesion and friction angle that yields a comparable shear strength under modeled site conditions is acceptable.
Attachments:	Slope/W Cross Section and Results



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Liner (floor)	Mohr-Coulomb	120	0	12	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Liner (floor)	Mohr-Coulomb	120	0	12	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103	300	26	0	1	0	No

Attachment A-2
Settlement Calculations

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: KM | Date: 3/26/2021

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: MK | Date: 10/5/2021

Calculation: Leachate Collection System Settlement Analysis | Approved By: KF | Date: 10/5/2021

LEACHATE COLLECTION SYSTEM SETTLEMENT ANALYSIS

OBJECTIVE

This calculation evaluates the post-settlement slopes of the leachate collection pipe and cell floor cross slopes for proposed Master Cell VI-G (MC VI-G4 through G7), at Wayne Disposal, Inc. (WDI). This evaluation is based on the estimated settlement of the existing waste and soil underlying the proposed cells due to additional overburden stresses induced by waste placement and the impact of such settlement on the post settlement cell floor slopes. The purpose of this calculation is to determine the minimum required design slopes.

DESIGN CRITERIA AND ASSUMPTIONS

- The slope of each leachate collection pipe should be at least 1% and each cell floor cross slope should be at least 2% per Rule 299.9620 (4) (EGLE 2020).
- Pipe flowline analysis points were selected along the leachate collection pipe flowlines within MC-VI-G (Attachment 1). The specific locations of these points were selected to correspond to the cell floor high point, low point, changes in final cover slope and at regular intervals in between. In addition, points were selected at the top and bottom of existing below-grade subcell berms. Total settlement is estimated for each point, allowing an assessment of the post-settlement slope(s) along the flowline.
- Cross slope analysis points (also shown in Attachment 1) were selected at the location of maximum fill height within each cell in order to evaluate post-settlement slopes under maximum load.
- Maximum settlement is expected to occur at the completion of the cap construction when the foundation is subjected to the maximum overburden pressure. Under the worst-case scenario modeled, maximum load is applied (in full) to the foundation instantaneously during settlement analysis for a conservative (i.e., greater than anticipated) estimate of total settlement. In reality, loads would be applied incrementally as waste is placed gradually during the active life of the landfill. Additionally, the resulting settlement is assumed to occur immediately, conservatively accounting for the maximum settlement at the end of foundation soil consolidation.
- Table 1 lists the material properties used for the settlement analysis.
- Table 2 summarizes the compressibility parameters used in the settlement analysis. The compacted clay liner is only very slightly compressible relative to the in-situ clay layer due to the much greater thickness of the insitu clay. Considering the insignificant magnitude of the settlement of the compacted clay liner, it was not included in the analysis.

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: KM | Date: 3/26/2021

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: MK | Date: 10/5/2021

Calculation: Leachate Collection System Settlement Analysis | Approved By: KF | Date: 10/5/2021

Table 1. Soil Properties for Settlement Analysis

Soil Type	Thickness [ft]	Moist Unit Weight [pcf]
Final cover soil	4	135
New waste	Varies	103*
Existing cover soil	Varies	135
Existing waste	Varies	82
In-situ middle clay	Varies	136
Attenuation Layer	5	135
Structural Fill	2	135
Venting Layer	1	135
Leachate Collection Sand	1	135
In-situ middle clay	Varies	136
In-situ lower clay (moist)	5	128
In-situ lower clay (saturated)	12	128
In-situ silt (saturated)	18	125
In-situ sand (saturated)	45	115

** New waste unit weight obtained from email correspondence with WDI dated 11/18/2020*

Table 2. Compressibility Parameters of Waste and Soils

Soil Type	Primary Compression Ratio $C_c/(1+e_0)$	Secondary Compression Ratio $C_\alpha/(1+e_0)$	Recompression Ratio $C_r/(1+e_0)$
Existing cover	0.102[B]	0.005[B]	0.017[A]
Existing waste	0.147	0	0.0245[A]
In-situ middle clay	0.102	0.005	0.017[A]
In-situ lower clay	0.171	0.009	0.0285[A]
In-situ silt	0.15[B]	0[B]	0[B]
In-situ sand	0.1[B]	0[B]	0[B]

[A] Estimated from $C_r = C_c/6$.

[B] Assumed values.

The information for subsurface soils is based on MCIV General Profiles (South), Appendix A Subsurface Soil/Waste Profiles & Corresponding Physical Properties, Volume III – WDI Operating License Application Master Cells VI F & G by NTH Consultants (2011a). Specifically, subsurface investigation boring logs, cross section profiles, and laboratory test results were used to assess the subgrade soil profile and its properties. Note that some uncertainty may exist in the interpretation of

hydrogeological data due to natural soil's inherent variability, conservative assumptions have been applied to ensure a conservative estimate of settlement in this analysis.

METHODOLOGY

Total settlement is estimated using the 1-D compression equations (Coduto 1999). Total settlement is calculated as:

$$S = S_c + S_s \quad (1)$$

Where:

S = total settlement [ft]
S_c = primary compression settlement due to load application [ft]
S_s = secondary compression settlement due to creep effects [ft]

Settlement caused by primary compression for a given layer of soil with uniform properties is calculated as:

$$S_c = \frac{h_0}{1+e_0}\left(C_r \log\frac{\sigma_c}{\sigma_0} + C_c \log\frac{\sigma_i}{\sigma_c}\right) \quad (2)$$

Where:

C_c = primary compression index
C_r = recompression index
h_0 = initial compressible layer thickness [ft]
e_0 = initial void ratio of the clay subgrade
σ_0 = initial overburden pressure acting on the compressible layer [psf]
σ_i = final overburden pressure acting on the compressible layer [psf]
σ_c = preconsolidation stress [psf], calculated using Equation 4.

Settlement due to secondary compression is calculated using Equation 3 below:

$$S_s = h_0 \frac{C_\alpha}{1+e_0} \log\left(\frac{t_2}{t_1}\right) \quad (3)$$

Where:

C_α = secondary compression index
H = layer thickness [ft]

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: KM | Date: 3/26/2021

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: MK | Date: 10/5/2021

Calculation: Leachate Collection System Settlement Analysis | Approved By: KF | Date: 10/5/2021

t_2 = time after application of load (assumed 70 years)

t_1 = time required to complete primary consolidation (assumed 40 years)

- The elevations in this report are referenced to Mean Sea Level (MSL).
- The initial ground elevation (prior to initial development) was assumed to be approximately 705 ft. This value was inferred from the cross section profile from Engineering Drawings, Wayne Disposal, Inc. Site No.2 MC VI-F&G by NTH Consultants (2011b).
- The preconsolidation pressure of the middle clay and lower clay, the major contributing compressible layers below the existing waste, was set equal to the initial effective overburden pressure acting on them prior to development. This value is used in Equation 2 to estimate settlement resulting from an initial load less than the preconsolidation pressure. Note that both layers have historically experienced a higher overburden pressure since initial development of the site and placement of the now existing waste. This value is calculated using Equation 4.
- Calculation of settlement following MC-VI-G construction accounts for changes in overburden pressure resulting from the excavation of existing materials, the placement of new liner system components, the placement of new MC-VI-G waste, and the placement of new MC-VI-G final cover.
- At each point selected along the leachate collection pipe system, the elevations for the existing ground, proposed MC-VI-G liner system, final cover, and the foundation soils are determined and used to compute the initial and final overburden pressures at each settlement point within the analysis using Equation 4 similarly to the preconsolidation pressure. An example calculation at 2 adjacent settlement points along MC-VI-G4 is presented in Attachment 2.

$$\sigma_{c,0,f} = \sum_{i=0}^{n} \gamma_i \times h_i \qquad (4)$$

Where:

$\sigma_{c,0,f}$ = σ_c: preconsolidation stress [psf]; σ_0: initial stress [psf]; σ_f: final stress [psf]

γ_i = Unit weight of soil layer i [psf]

h_i = Thickness of layer i [ft] at settlement point as follows: For σ_c use thicknesses of layers prior to development; For σ_0 use thicknesses of layers up to existing elevations; For σ_f use thicknesses of layers up to proposed final elevations

- Soil layers are identified using subsurface soil profiles provided in MCIV General Profiles (South), Appendix A Subsurface Soil/Waste Profiles & Corresponding Physical Properties, Volume III –

WDI Operating License Application Master Cells VI F & G by NTH Consultants (2011a). These layers include in-situ clay with varying degrees of compressibility (see Table 2).

- The MC-VI-G liner system grades were determined from preliminary design drawings with a proposed leachate collection pipe slope of 4% and a proposed cell floor resultant slope of approximately 6%. The respective pre-settlement slopes are shown in Tables 3 through 14 below.
- Attachment 1 presents the plan locations of the settlement analysis points within MC-VI-G with respect to proposed cell floor grades.

CALCULATIONS:

Equations 1 through 3 were incorporated into a spreadsheet to conduct the settlement calculations. The settlement calculation output and resulting post-settlement slope(s) for the leachate collection pipes within MC-VI-G are presented in Table 3 through Table 6. The settlement calculation output and resulting post-settlement slope(s) for each analyzed cross slope within MC-VI-G are presented in **Table 7**Table 3 through 10.

Table 3. MC-VI-G4 Leachate Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-01	6820.92	3929.81	707.74	4.87	122	702.87	3.5%	1.7%	1%
SP-02	6821.20	4051.75	712.00	7.11		704.89			
SP-02	6821.20	4051.75	712.00	7.11	114	704.89	3.5%	2.3%	1%
SP-03	6821.37	4166.03	716.00	8.49		707.51			
SP-03	6821.37	4166.03	716.00	8.49	130	707.51	4.6%	2.8%	1%
SP-04	6821.37	4295.92	722.00	10.85		711.15			

Table 4. MC-VI-G5 Leachate Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-07	6594.33	3927.79	714.00	5.12	114	708.88	3.5%	2.6%	1%
SP-08	6519.13	4013.90	718.00	6.13		711.87			
SP-08	6519.13	4013.90	718.00	6.13	81	711.87	3.5%	1.5%	1%
SP-09	6466.34	4075.75	720.88	7.82		713.06			
SP-09	6466.34	4075.75	720.88	7.82	91	713.06	3.5%	3.6%	1%
SP-10	6407.04	4144.24	724.07	7.72		716.35			
SP-10	6407.04	4144.24	724.07	7.72	171	716.35	3.5%	4.3%	1%
SP-11	6293.54	4272.06	730.00	6.31		723.69			
SP-11	6293.54	4272.06	730.00	6.31	48	723.69	4.23%	5.75%	1%
SP-12	6263.71	4309.98	732.04	5.57		726.47			

CALCULATION SHEET

Client: Wayne Disposal, Inc.
Project: WDI MC VI-G4 through G7 Liner Grade Modification
Calculation: Leachate Collection System Settlement Analysis

Project No.: 1218070017.003
Calculated By: KM Date: 3/26/2021
Checked By: MK Date: 10/5/2021
Approved By: KF Date: 10/5/2021

Table 5. MC-VI-G6 Leachate Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-15	6338.90	4697.51	703.42	3.85	55	699.57	3.5%	1.1%	1%
SP-16	6389.74	4677.62	705.33	5.17		700.16			
SP-16	6389.74	4677.62	705.33	5.17	282	700.16	3.5%	1.9%	1%
SP-17	6651.75	4573.81	715.16	9.69		705.47			
SP-17	6651.75	4573.81	715.16	9.69	211	705.47	3.5%	2.2%	1%
SP-18	6847.57	4495.87	722.53	12.42		710.11			
SP-18	6847.57	4495.87	722.53	12.42	126	710.11	3.5%	4.4%	1%
SP-19	6964.61	4450.12	726.93	11.35		715.58			

Table 6. MC-VI-G7 Leachate Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-22	6393.49	5048.84	681.79	2.63	141	679.16	3.5%	2.0%	1%
SP-23	6534.01	5048.84	686.71	4.72		681.99			
SP-23	6534.01	5048.84	686.71	4.72	253	681.99	3.5%	2.5%	1%
SP-24	6787.25	5048.84	695.57	7.32		688.25			
SP-24	6787.25	5048.84	695.57	7.32	168	688.25	3.5%	2.8%	1%
SP-25	6954.90	5048.84	701.44	8.49		692.95			

Table 7. MC-VI-G4 Cross Slope Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-04	6821.37	4295.92	722.00	10.85	154	711.15	3%	3%	2%
SP-05	6975.85	4293.88	725.99	10.28		715.71			
SP-04	6821.37	4295.92	722.00	10.85	150	711.15	3%	3%	2%
SP-06	6671.32	4298.49	725.99	10.78		715.21			

Table 8. MC-VI-G5 Cross Slope Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-09	6466.34	4075.75	720.88	7.82	294	713.06	4%	5%	2%
SP-14	6241.30	3886.84	731.50	4.82		726.68			
SP-10	6407.04	4144.24	724.07	7.72	279	716.35	4%	3%	2%
SP-13	6622.32	4321.61	733.95	10.22		723.73			

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: KM | Date: 3/26/2021

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: MK | Date: 10/5/2021

Calculation: Leachate Collection System Settlement Analysis | Approved By: KF | Date: 10/5/2021

Table 9. MC-VI-G6 Cross Slope Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-16	6389.74	4677.62	705.33	5.17	288	700.16	4%	4%	2%
SP-21	6289.94	4407.03	716.84	4.66		712.18			
SP-18	6847.57	4495.87	722.53	12.42	278	710.11	3%	3%	2%
SP-20	6944.02	4756.08	730.07	12.10		717.97			

Table 10. MC-VI-G7 Cross Slope Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-23	6534.01	5048.84	686.71	4.72	81	681.99	3%	3%	2%
SP-26	6532.88	4967.83	689.46	5.21		684.25			
SP-25	6954.90	5048.84	701.44	8.49	62	692.95	4%	5%	2%
SP-27	6955.68	5111.30	703.70	7.86		695.84			
SP-25	6954.90	5048.84	701.44	8.49	63	692.95	3%	2%	2%
SP-28	6954.65	4986.17	703.56	9.50		694.06			

CONCLUSIONS

The post-settlement slope of the leachate collection pipe should be at least 1% and each cell floor cross slope should be at least 2% per Rule 299.9620 (4) (EGLE 2020). This calculation estimated the settlement at points along the leachate collection pipe and the cross slopes within MC-VI-G. The settlement of each of these points was used to calculate the post-settlement slopes of the MC-VI-G floor. This settlement analysis determined that all design leachate collection pipe slopes and cross slopes within MC-VI-G meet the required minimum slopes.

REFERENCES

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EGLE (2020) *Part 111 Administrative Rules*, Department of Environment, Great Lakes, and Energy *Hazardous Waste Management*, Materials Management Division.

NTH Consultants, Ltd. (2011a) *Volume III – WDI Operating License Application Master Cells VI F & G.*

NTH Consultants, Ltd. (2011b) Engineering Drawings. *Wayne Disposal, Inc. Site No. 2 Master Cell VI-F&G.*

NTH Consultants, Ltd. (2008) Master Cell VI Design Modification Plans. *Wayne Disposal, Inc. Site No. 2.*

Attachment A-2.1

Settlement Analysis Points

MC6EP2-W

MC6EP1-SW

MC6 B

MC6 C

SP-27
703.700

SP-25
701.440

SP-24
695.570

SP-23
686.710

SP-22
681.790

SP-28
703.560

SP-26
689.460

EXISTING MC VI-G
SUBCELL G1-EAST
PHASE 2

MC VI-F
FUTURE
SUBCELL F4

EXISTING
MC VI-G
SUBCELL G3

EXISTING MC VI-G
SUBCELL G1-EAST
PHASE 1

MC VI-G
FUTURE
SUBCELL G7

SP-20
730.070

SP-15
703.420

SP-16
705.330

SP-17
715.160

MC VI-F
FUTURE
SUBCELL F3

MC VI-G
FUTURE
SUBCELL G6

SP-18
722.530

SP-19
726.930

SP-21
716.840

EXISTING MC VI-G
SUBCELL G1

SP-13
733.950

SP-12
732.040

SP-05
725.990

SP-04
722.000

SP-06
725.990

SP-11
730.000

SP-03
716.000

SP-10
724.070

MC VI-F
FUTURE
SUBCELL F2

MC VI-F
FUTURE
SUBCELL F1

EXISTING
MC VI-G
SUBCELL G2

SP-02
712.000

MC VI-G
FUTURE
SUBCELL G4

SP-09
720.850

MC VI-G
FUTURE
SUBCELL G5

SP-08
718.000

SP-01
707.740

SP-07
714.000

SP-14
731.500

Attachment A-2.2

Sample Calculation

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-02	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6821.20	4051.75	712.00	794.71	717.43	660.00	655.00	643.00	625.00	580.00	670.00	708.07

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	78.71	103.0	0	8107.1									
	3	OFL	5.43	135.0	TRUE	-733.0									
	4	Existing Waste	0.00	82.0	1	-									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	1.96	135.0	0	265.3	0.102	0.017	0.005	865.7	865.7	8779.8	NC	0.202	0.003
	3	OFL	1.96	135.0	0	265.3	0.102	0.017	0.005	1131.0	1131.0	9045.0	NC	0.181	0.003
	4	Existing Waste	4.76	82.0	0	390.2	0.147	0.025	-	1458.7	1458.7	9372.8	NC	0.565	-
	4	Existing Waste	4.76	82.0	0	390.2	0.147	0.025	-	1848.9	1848.9	9763.0	NC	0.506	-
	4	Existing Waste	4.76	82.0	0	390.2	0.147	0.025	-	2239.1	2239.1	10153.2	NC	0.459	-
	4	Existing Waste	4.76	82.0	0	390.2	0.147	0.025	-	2629.4	2629.4	10543.4	NC	0.422	-
	4	Existing Waste	4.76	82.0	0	390.2	0.147	0.025	-	3019.6	3019.6	10933.7	NC	0.391	-
	4	Existing Waste	4.76	82.0	0	390.2	0.147	0.025	-	3409.8	3409.8	11323.9	NC	0.365	-
	4	Existing Waste	4.76	82.0	0	390.2	0.147	0.025	-	3800.0	3800.0	11714.1	NC	0.342	-
	4	Existing Waste	4.76	82.0	0	390.2	0.147	0.025	-	4190.2	4190.2	12104.3	NC	0.322	-
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4725.3	4950.0	12639.4	OC-2	0.209	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5405.3	5630.0	13319.4	OC-2	0.192	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6065.3	6290.0	13979.4	OC-2	0.299	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6582.1	6806.8	14496.2	OC-2	0.339	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6975.7	7200.4	14889.8	OC-2	0.326	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7454.2	7678.9	15368.3	OC-2	0.407	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8017.6	8242.3	15931.7	OC-2	0.386	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8536.0	8760.7	16450.1	OC-2	0.246	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9009.4	9234.1	16923.5	OC-2	0.237	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9482.8	9707.5	17396.9	OC-2	0.228	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9956.2	10180.9	17870.3	OC-2	0.220	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10429.6	10654.3	18343.7	OC-2	0.212	-
														7.057	0.057
													Total Settlement [ft]	**7.11**	

Variables & Constants	
Point Name	SP-02
Settlement Layer [ft]	132.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-03	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6821.37	4166.03	716.00	823.27	721.16	660.00	655.00	643.00	625.00	580.00	670.00	709.13

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	103.27	103.0	0	10636.8									
	3	OFL	5.16	135.0	TRUE	-696.6									
	4	Existing Waste	0.00	82.0	1	-									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	3.44	135.0	0	463.7	0.102	0.017	0.005	928.5	928.5	11408.7	NC	0.382	0.004
	3	OFL	3.44	135.0	0	463.7	0.102	0.017	0.005	1392.2	1392.2	11872.4	NC	0.326	0.004
	4	Existing Waste	4.89	82.0	0	401.1	0.147	0.025	-	1824.6	1824.6	12304.8	NC	0.596	-
	4	Existing Waste	4.89	82.0	0	401.1	0.147	0.025	-	2225.7	2225.7	12705.9	NC	0.544	-
	4	Existing Waste	4.89	82.0	0	401.1	0.147	0.025	-	2626.8	2626.8	13107.0	NC	0.502	-
	4	Existing Waste	4.89	82.0	0	401.1	0.147	0.025	-	3027.8	3027.8	13508.0	NC	0.467	-
	4	Existing Waste	4.89	82.0	0	401.1	0.147	0.025	-	3428.9	3428.9	13909.1	NC	0.437	-
	4	Existing Waste	4.89	82.0	0	401.1	0.147	0.025	-	3830.0	3830.0	14310.2	NC	0.412	-
	4	Existing Waste	4.89	82.0	0	401.1	0.147	0.025	-	4231.1	4231.1	14711.3	NC	0.389	-
	4	Existing Waste	4.89	82.0	0	401.1	0.147	0.025	-	4632.2	4632.2	15112.4	NC	0.369	-
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5172.7	4950.0	15652.9	NC	0.245	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5852.7	5630.0	16332.9	NC	0.227	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6512.7	6290.0	16992.9	NC	0.356	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7029.5	6806.8	17509.7	NC	0.407	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7423.1	7200.4	17903.3	NC	0.392	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7901.6	7678.9	18381.8	NC	0.495	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8465.0	8242.3	18945.2	NC	0.472	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8983.4	8760.7	19463.6	NC	0.302	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9456.8	9234.1	19937.0	NC	0.292	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9930.2	9707.5	20410.4	NC	0.282	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10403.6	10180.9	20883.8	NC	0.272	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10877.0	10654.3	21357.2	NC	0.264	-
														8.430	0.061
											Total Settlement [ft]			**8.49**	

Variables & Constants	
Point Name	SP-03
Settlement Layer [ft]	136.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

CALCULATION SHEET

Project No.: 1208070015.005

Client: Wayne Disposal, Inc. | Calculated By: KM | Date: 3/16/2021

Project: WDI Final Cover Grading Modification | Checked By: MK | Date: 10/05/2021

Calculation: Settlement Analysis | Approved By: KF | Date: 10/5/2021

LEACHATE COLLECTION PIPE SETTLEMENT ANALYSIS

OBJECTIVE

This calculation evaluates the post-settlement slopes of the leachate collection pipe and cell floor cross slopes for cells affected by the proposed Final Cover Grading Modification at Wayne Disposal, Inc. (WDI). This calculation evaluates the following Cells:

- Master Cell-VI-E (MC6E)
- Master Cell-VI-F (MC6F)
- Master Cell VI-G, Sub cells G1, G2, and G3

This evaluation is based on the estimated settlement of the existing waste and soil underlying the proposed cells due to additional overburden stresses induced by waste placement and the impact of such settlement on the post settlement cell floor slopes.

DESIGN CRITERIA AND ASSUMPTIONS

- The slope of each leachate collection pipe should be at least 1% and each cell floor cross slope should be at least 2% per Rule 299.9620 (4) (EGLE 2020).
- Pipe flowline analysis points were selected along the leachate collection pipe flowlines within the analyzed cells (Attachment 1). The specific locations of these points were selected to correspond to the cell floor high point, low point, changes in final cover slope, locations along leachate collection toe drain, and at regular intervals in between. Total settlement is estimated for each point, allowing an assessment of the post-settlement slope(s) along the flowline.
- Cross slope analysis points (also shown in Attachment 1) were selected at the location of maximum fill height within each cell in order to evaluate post-settlement slopes under maximum load.
- Maximum settlement is expected to occur at the completion of the cap construction when the foundation is subjected to the maximum overburden pressure. Under the worst-case scenario, maximum load is applied (in full) to the foundation instantaneously during settlement analysis for a conservative (i.e., greater than anticipated) estimate of total settlement. In reality, loads would be applied incrementally as waste is placed gradually during the active life of the landfill. Additionally, the resulting settlement is assumed to occur immediately, conservatively accounting for the maximum settlement at the end of foundation soil consolidation.
- Table 1 lists the material properties used for the settlement analysis.
- Table 2 summarizes the compressibility parameters used in the settlement analysis. The compacted clay liner is only very slightly compressible relative to the in-situ clay layer due to the much greater thickness of the insitu clay. Considering the insignificant magnitude of the settlement of the compacted clay liner, it was not included in the analysis.

CALCULATION SHEET

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Calculation: Settlement Analysis Approved By: KF Date: 10/5/2021

Table 1. Soil Properties for Settlement Analysis

Soil Type	Thickness [ft]	Moist Unit Weight [pcf]
Final cover soil	4	135
New waste	Varies	103*
Existing cover soil	Varies	135
Existing waste	Varies	82
In-situ middle clay	Varies	136
In-situ lower clay (moist)	Varies	128
In-situ lower clay (saturated)	Varies	128
In-situ silt (saturated)	18	125
In-situ sand (saturated)	45	115

** New waste unit weight obtained from email correspondence with WDI dated 11/18/2020*

Table 2. Compressibility Parameters of Waste and Soils

Soil Type	Primary Compression Ratio $C_c/(1+e_0)$	Secondary Compression Ratio $C_\alpha/(1+e_0)$	Recompression Ratio $C_r/(1+e_0)$
Existing cover	0.102[B]	0.005[B]	0.017[A]
Existing waste	0.147	0	0.0245[A]
In-situ middle clay	0.102	0.005	0.017[A]
In-situ lower clay	0.171	0.009	0.0285[A]
In-situ silt	0.15[B]	0[B]	0[B]
In-situ sand	0.1[B]	0[B]	0[B]

[A] Estimated from $C_r = C_c/6$.

[B] Assumed values.

The information for subsurface soils is based on General Profiles presented in Appendix A, Subsurface Soil/Waste Profiles & Corresponding Physical Properties, Volume III – WDI Operating License Application Master Cells VI F & G by NTH Consultants (2011a). The same general profile was used in the current MC VI-E permits for MC-VI-E, MC-VI-F, and MC-VI-. Note that some uncertainty may exist in the interpretation of hydrogeological data due to natural soil's inherent variability, conservative assumptions have been applied to ensure a conservative estimate of settlement in this analysis.

CALCULATION SHEET

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METHODOLOGY

Total settlement is estimated using the 1-D compression equations (Coduto 1999). Total settlement is calculated as:

$$S = S_c + S_s \quad (1)$$

Where:

S = total settlement [ft]
S_c = primary compression settlement due to load application [ft]
S_s = secondary compression settlement due to creep effects [ft]

Settlement caused by primary compression for a given layer of soil with uniform properties is calculated as:

$$S_c = \frac{h_0}{1+e_0}\left(C_r \log\frac{\sigma_c}{\sigma_0} + C_c \log\frac{\sigma_i}{\sigma_c}\right) \quad (2)$$

Where:

C_c = primary compression index
C_r = recompression index
h_0 = initial compressible layer thickness [ft]
e_0 = initial void ratio of the clay subgrade
σ_0 = initial overburden pressure acting on the compressible layer [psf]
σ_i = final overburden pressure acting on the compressible layer [psf]
σ_c = preconsolidation stress [psf], calculated using Equation 4.

Settlement due to secondary compression is calculated using Equation 3 below:

$$S_s = h_0 \frac{C_\alpha}{1+e_0} \log\left(\frac{t_2}{t_1}\right) \quad (3)$$

Where:

C_α = secondary compression index
H = layer thickness [ft]
t_2 = time after application of load (assumed 70 years)
t_1 = time required to complete primary consolidation (assumed 40 years)

- The elevations in this report are referenced to Mean Sea Level (MSL).

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- The initial ground elevation (prior to initial development) was assumed to be approximately 705 ft. This value was inferred from the cross section profile from Engineering Drawings, Wayne Disposal, Inc. Site No.2 MC VI-F&G by NTH Consultants (2011b).
- The preconsolidation pressure of the middle clay and lower clay, the major contributing compressible layers below the existing waste, was set equal to the initial effective overburden pressure acting on them prior to development. This value is used in Equation 2 to estimate settlement resulting from an initial load less than the preconsolidation pressure. Note that both layers have historically experienced a higher overburden pressure since initial development of the site and placement of the now existing waste. This value is calculated using Equation 4.
- When applicable, calculation of settlement following cell construction accounts for changes in overburden pressure resulting from the excavation of existing materials, the placement of new liner system components, the placement of new waste, and the placement of new final cover.
- At each point selected along the leachate collection pipe system, the elevations for the existing ground, proposed or existing liner system, final cover, and the foundation soils are determined and used to compute the initial and final overburden pressures at each settlement point within the analysis using Equation 4 similarly to the preconsolidation pressure. An example calculation at 2 adjacent settlement points along MC-VI-F4 is presented in Attachment 2.

$$\sigma_{c,0,f} = \sum_{i=0}^{n} \gamma_i \times h_i \qquad (4)$$

Where:

$\sigma_{c,0,f}$ = σ_c: preconsolidation stress [psf]; σ_0: initial stress [psf]; σ_f: final stress [psf]

γ_i = Unit weight of soil layer i [psf]

h_i = Thickness of layer i [ft] at settlement point as follows: For σ_c use thicknesses of layers prior to development; For σ_0 use thicknesses of layers up to existing elevations; For σ_f use thicknesses of layers up to proposed final elevations

- Soil layers are identified using subsurface soil profiles provided in "General Profiles" presented in Appendix A, Subsurface Soil/Waste Profiles & Corresponding Physical Properties, Volume III – WDI Operating License Application Master Cells VI F & G by NTH Consultants (2011a). These layers include in-situ clay with varying degrees of compressibility (see Table 2).
- Attachment 1 presents the plan locations of the settlement analysis points within the cells along with the liner elevations at those points.

CALCULATION SHEET

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Calculation: Settlement Analysis | Approved By: KF | Date: 10/5/2021

CALCULATIONS

Equations 1 through 4 were incorporated into a spreadsheet to conduct the settlement calculations. The settlement calculation output and resulting post-settlement slope(s) for the leachate collection pipes and cross slopes within the cells are presented in Tables 3 through 19 below.

Table 3. MC6E Leachate Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
P514	8641.95	6454.04	701.00	7.98	229	693.02	1.8%	2.50%	1%
P512	8666.18	6226.32	705.21	6.47		698.74			
P512	8666.18	6226.32	705.21	6.47	276	698.74	1.5%	1.0%	1%
P510	8599.09	5958.86	709.36	7.90		701.46			
P510	8599.09	5958.86	709.36	7.90	216	701.46	1.3%	2.1%	1%
P508	8649.05	5748.66	712.17	6.18		705.99			
P508	8649.05	5748.66	712.17	6.18	281	705.99	1.4%	1.6%	1%
P506	8657.89	5468.01	716.07	5.57		710.50			
P506	8657.89	5468.01	716.07	5.57	240	710.50	1.5%	1.2%	1%
P505	8565.19	5246.41	719.62	6.33		713.29			

Table 4. MC6E E5300 Cross Slope Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-84	8581.38	5296.64	719.00	4.74	48	714.26	4%	3%	2%
SP-85	8533.44	5296.64	721.00	5.49		715.51			
SP-85	8533.44	5296.64	721.00	5.49	45	715.51	4%	2%	2%
SP-86	8488.08	5296.64	723.00	6.37		716.63			

CALCULATION SHEET

Client: Wayne Disposal, Inc.
Project: WDI Final Cover Grading Modification
Calculation: Settlement Analysis

Project No.: 1208070015.005
Calculated By: KM Date: 3/16/2021
Checked By: MK Date: 10/05/2021
Approved By: KF Date: 10/5/2021

Table 5. MC6E Phase II-NE Cross Slope Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
P-512	8666.18	6226.32	705.21	4.03	202	701.18	8%	6%	2%
SP-67	8464.52	6211.68	722.00	7.70		714.30			
SP-66	8566.99	6221.70	714.00	7.59	103	706.41	8%	8%	2%
SP-67	8464.52	6211.68	722.00	7.70		714.30			
SP-67	8464.52	6211.68	722.00	7.70	57	714.30	5%	5%	2%
SP-68	8408.01	6206.15	725.00	8.03		716.97			
SP-68	8408.01	6206.15	725.00	8.03	54	716.97	4%	3%	2%
SP-69	8354.03	6200.87	727.00	8.62		718.38			
SP-69	8354.03	6200.87	727.00	8.62	97	718.38	4%	7%	2%
SP-70	8257.04	6191.39	731.00	5.60		725.40			
SP-70	8257.04	6191.39	731.00	5.60	98	725.40	4%	5%	2%
SP-71	8159.20	6181.82	735.00	4.96		730.04			

Table 6. MC6G – G1 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-13	7339.00	4082.84	668.00	4.36	38	663.64	5.2%	4.7%	1%
SP-14	7339.00	4120.94	670.00	4.57		665.43			
SP-14	7339.00	4120.94	670.00	4.57	208	665.43	2.4%	2.1%	1%
SP-15	7339.00	4329.23	675.00	5.10		669.90			
SP-15	7339.00	4329.23	675.00	5.10	242	669.90	1.7%	1.6%	1%
SP-16	7339.00	4571.07	679.00	5.28		673.72			
SP-16	7339.00	4571.07	679.00	5.28	257	673.72	1.2%	1.3%	1%
SP-17	7338.93	4827.73	682.00	5.03		676.97			
SP-17	7338.93	4827.73	682.00	5.03	141	676.97	1.4%	1.5%	1%
SP-18	7338.96	4968.72	684.00	4.85		679.15			

Table 7. MC6G – G2 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-11	7842.87	3939.91	709.22	7.06	70	702.16	4.0%	2.2%	1%
SP-10	7842.87	4009.79	712.00	8.30		703.70			
SP-10	7842.87	4009.79	712.00	8.30	151	703.70	4.0%	2.9%	1%
SP-09	7842.87	4160.67	718.00	9.98		708.02			
SP-09	7842.87	4160.67	718.00	9.98	101	708.02	4.0%	2.9%	1%
SP-08	7842.87	4261.26	722.00	11.05		710.95			
SP-08	7842.87	4261.26	722.00	11.05	120	710.95	4.0%	4.2%	1%
SP-07	7843.09	4381.18	726.82	10.89		715.93			

CALCULATION SHEET

Project No.: 1208070015.005

Client: Wayne Disposal, Inc. | Calculated By: KM | Date: 3/16/2021

Project: WDI Final Cover Grading Modification | Checked By: MK | Date: 10/05/2021

Calculation: Settlement Analysis | Approved By: KF | Date: 10/5/2021

Table 8. MC6G – G3 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	**Length**	Post-Settlement	Pre-Settlement	Post-Settlement	**Min. Slope**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-04	7776.87	5044.82	700.70	10.54	233	690.16	4.0%	3.8%	1%
SP-03	7800.62	4813.09	710.00	10.94		699.06			
SP-03	7800.62	4813.09	710.00	10.94	211	699.06	4.1%	3.9%	1%
SP-02	7822.70	4603.12	718.57	11.19		707.38			
SP-02	7822.70	4603.12	718.57	11.19	209	707.38	4.0%	4.2%	1%
SP-01	7842.77	4394.77	726.99	10.84		716.15			

CALCULATION SHEET

Client: Wayne Disposal, Inc.
Project: WDI Final Cover Grading Modification
Calculation: Settlement Analysis

Project No.: 1208070015.005
Calculated By: KM Date: 3/16/2021
Checked By: MK Date: 10/05/2021
Approved By: KF Date: 10/5/2021

Table 9. MC6G – G1 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-15	7339.00	4329.23	675.00	5.04	159	669.96	2%	2%	2%
SP-20	7180.19	4317.03	678.00	4.97		673.03			
SP-17	7338.93	4827.73	682.00	4.96	160	677.04	3%	3%	2%
SP-19	7179.21	4823.35	686.00	4.90		681.10			
SP-17	7338.93	4827.73	682.00	4.96	154	677.04	5%	5%	2%
SP-21	7493.33	4826.63	689.69	4.82		684.87			

Table 10. MC6G – G2 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-10	7842.87	4009.79	712.00	8.30	129	703.70	5%	6%	2%
SP-12	7714.37	4002.92	717.80	6.61		711.19			

Table 11. MC6G – G3 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-02	7822.70	4603.12	718.57	11.19	76	707.38	6%	6%	2%
SP-05	7898.60	4609.46	723.20	11.57		711.63			
SP-02	7822.70	4603.12	718.57	11.19	58	707.38	9%	11%	2%
SP-06	7764.39	4602.88	724.00	10.39		713.61			

CALCULATION SHEET

Client: Wayne Disposal, Inc.
Project: WDI Final Cover Grading Modification
Calculation: Settlement Analysis

Project No.: 1208070015.005
Calculated By: KM Date: 3/16/2021
Checked By: MK Date: 10/05/2021
Approved By: KF Date: 10/5/2021

Table 12. MC6F – F1 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-18	8104.51	3913.57	714.00	5.27	154	708.73	3.9%	1.8%	1%
SP-19	8104.44	4067.43	720.00	8.43		711.57			
SP-19	8104.44	4067.43	720.00	8.43	133	711.57	4.5%	4.7%	1%
SP-20	8104.44	4200.76	726.00	8.22		717.78			
SP-20	8104.44	4200.76	726.00	8.22	110	717.78	5.0%	4.3%	1%
SP-21	8103.62	4310.91	731.56	9.09		722.47			

Table 13. MC6F – F2 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-14	8439.33	3930.05	708.73	5.89	204	702.84	2.6%	1.4%	1%
SP-15	8441.35	4133.87	714.00	8.38		705.62			
SP-15	8441.35	4133.87	714.00	8.38	148	705.62	3.3%	3.5%	1%
SP-16	8441.72	4282.12	718.91	8.14		710.77			

Table 14. MC6F – F3 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-7	8588.77	4584.00	708.00	2.07	162	705.93	3.7%	1.3%	1%
SP-8	8426.54	4583.16	714.00	5.97		708.03			
SP-8	8426.54	4583.16	714.00	5.97	200	708.03	5.0%	5.2%	1%
SP-9	8226.54	4583.16	724.00	5.62		718.38			
SP-9	8226.54	4583.16	724.00	5.62	160	718.38	5.0%	2.0%	1%
SP-10	8066.54	4583.16	732.00	10.39		721.61			
SP-10	8066.54	4583.16	732.00	10.39	97	721.61	5.0%	2.5%	1%
SP-11	7969.29	4583.16	736.86	12.86		724.00			

Table 15. MC6F – F4 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-1	8577.97	4957.91	699.37	4.18	292	695.19	4.3%	2.5%	1%
SP-2	8285.65	4957.47	712.00	9.43		702.57			
SP-2	8285.65	4957.47	712.00	9.43	200	702.57	5.0%	3.5%	1%
SP-3	8085.65	4957.47	722.00	12.52		709.48			
SP-3	8085.65	4957.47	722.00	12.52	102	709.48	5.0%	4.6%	1%
SP-4	7983.70	4957.47	727.10	12.91		714.19			

Table 16. MC6F – F1 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-18	8104.44	3913.57	714.00	5.27	143	708.73	4%	4%	2%
SP-22	7961.43	3910.35	719.71	5.34		714.37			

Table 17. MC6F – F2 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-14	8439.33	3930.05	708.73	5.89	180	702.84	3%	3%	2%
SP-17	8619.11	3915.98	713.69	5.37		708.32			

Table 18. MC6F – F3 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-11	7969.29	4583.16	736.86	12.86	158	724.00	4%	4%	2%
SP-12	7970.76	4741.64	743.04	12.23		730.81			
SP-11	7969.29	4583.16	736.86	12.86	186	724.00	4%	4%	2%
SP-13	7977.37	4397.40	743.72	11.65		732.07			

Table 19. MC6F – F4 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-4	7983.70	4957.47	727.10	12.91	181	714.19	4%	4%	2%
SP-5	7989.83	4776.82	733.88	12.56		721.32			
SP-4	7983.70	4957.47	727.10	12.91	202	714.19	4%	5%	2%
SP-6	7988.38	5159.20	736.00	11.79		724.21			

CONCLUSIONS

The post-settlement slope of the leachate collection pipe should be at least 1% and each cell floor cross slope should be at least 2% per Rule 299.9620 (4) (EGLE 2020). This calculation estimated the settlement at points along the leachate collection pipe and cross slopes within cells affected by the proposed revised final grades. The settlement of each of these points was used to calculate the post-settlement slopes of the liner system in these cells. This settlement analysis determined that all leachate collection pipes and cross slopes within MC VI-E, MC-VI-F, and MC-VI-G sub cells G1, G2, and G3 meet the required minimum post-settlement slopes.

CALCULATION SHEET

Project No.: 1208070015.005

Client: Wayne Disposal, Inc. | Calculated By: KM | Date: 3/16/2021

Project: WDI Final Cover Grading Modification | Checked By: MK | Date: 10/05/2021

Calculation: Settlement Analysis | Approved By: KF | Date: 10/5/2021

REFERENCES

Coduto, D.P. (1999) *Geotechnical Engineering: Principles and Practices*, Prentice-Hall Inc., New Jersey

EGLE (2020) *Part 111 Administrative Rules*, Department of Environment, Great Lakes, and Energy *Hazardous Waste Management*, Materials Management Division.

NTH Consultants, Ltd. (2011a) *Volume III – WDI Operating License Application Master Cells VI F & G.*

NTH Consultants, Ltd. (2011b) Engineering Drawings. *Wayne Disposal, Inc. Site No. 2 Master Cell VI-F&G.*

NTH Consultants, Ltd. (2008) Master Cell VI-E Design Modification Plans. *Wayne Disposal, Inc. Site No. 2.*

Attachment A-2.1

Settlement Analysis Points

Pt-506
716.070

MC6EP2-W

MC6EP1-SW

MC6 B

MC6 C

Pt-505
719.620

SP-6
736.000

SP-04
700.700

EXISTING MC VI-G
SUBCELL G1-EAST
PHASE 2

SP-1
699.570

MC VI-F
FUTURE
SUBCELL F4

SP-2
712.000

SP-3
722.000

SP-4
727.100

EXISTING
MC VI-G
SUBCELL G3

SP-18
684.000

EXISTING MC VI-G
SUBCELL G1-EAST
PHASE 1

MC VI-G
FUTURE
SUBCELL G7

SP-21
689.690

SP-17
682.000

SP-19
686.000

SP-03
710.000

SP-5
733.880

SP-12
743.040

SP-7
708.000

SP-8
714.000

SP-9
724.000

SP-10
732.000

SP-11
736.860

MC VI-F
FUTURE
SUBCELL F3

SP-05
725.200

SP-02
718.570

SP-06
724.000

SP-16
679.000

MC VI-G
FUTURE
SUBCELL G6

SP-13
743.720

SP-01
726.990

SP-07
726.820

EXISTING MC VI-G
SUBCELL G1

SP-21
731.560

SP-16
718.910

SP-15
675.000

SP-20
678.000

SP-08
722.000

SP-20
726.000

SP-09
718.000

SP-15
714.000

SP-14
670.000

SP-13
668.000

MC VI-F
FUTURE
SUBCELL F2

SP-19
720.000

MC VI-F
FUTURE
SUBCELL F1

EXISTING
MC VI-G
SUBCELL G2

MC VI-G
FUTURE
SUBCELL G4

MC VI-G
FUTURE
SUBCELL G5

SP-10
712.000

SP-12
717.800

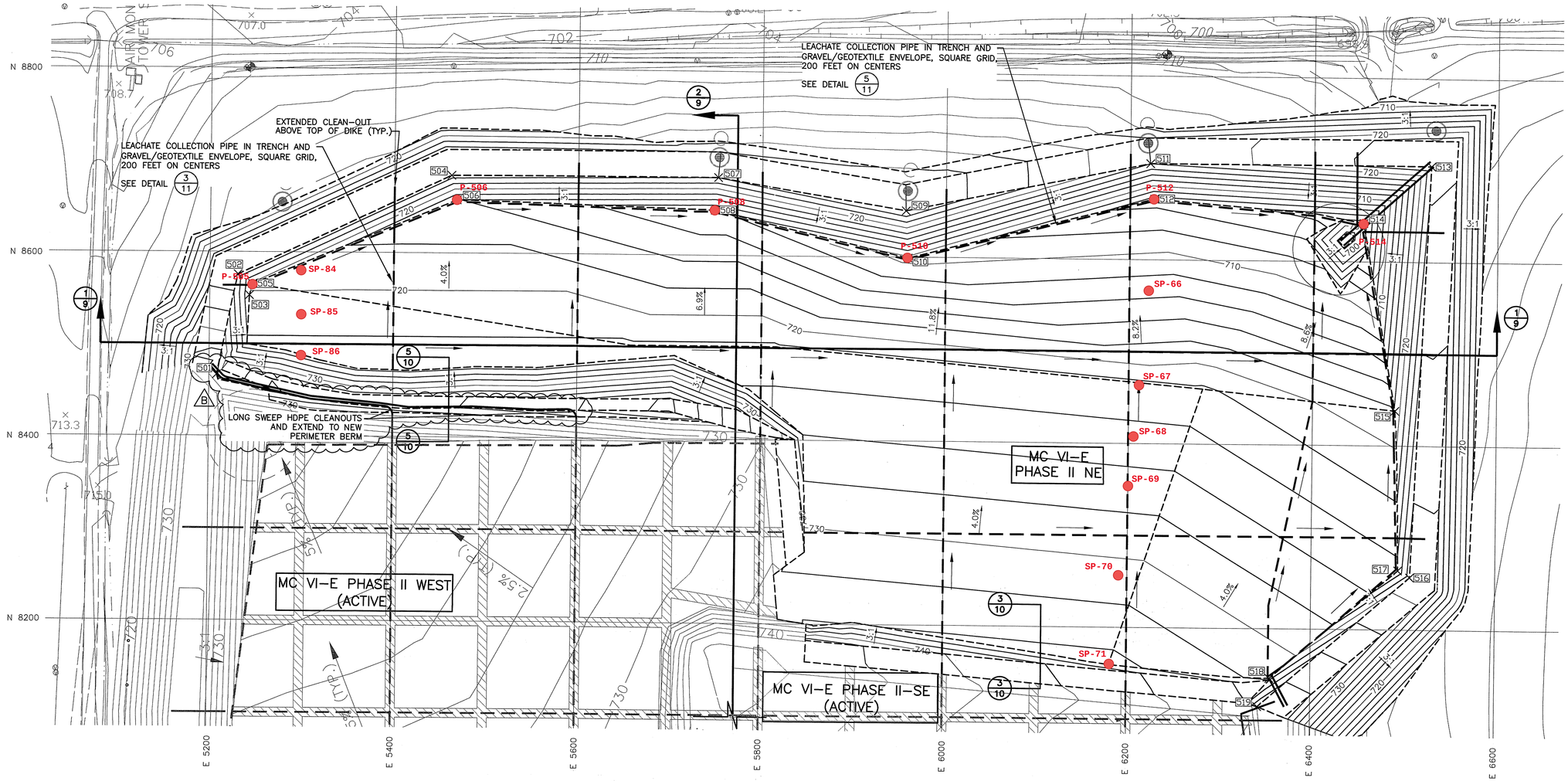
SP-11
708.220

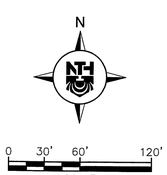
SP-17
713.690

SP-14
708.730

SP-18
717.230

SP-22
719.710





LEGEND:

- 730 — PROPOSED TOP OF DIKE/ PRIMARY CLAY LINER CONTOURS
- 730 — EXISTING CONTOUR
- PROPOSED GRADE BREAK
- 520 PROPOSED PRIMARY CLAY LINER POINT NUMBER ID
- PROPOSED LEACHATE COLLECTION SUMP LOCATION SEE DETAIL 1/11
- EXISTING LEACHATE COLLECTION SUMP LOCATION
- PROPOSED LEACHATE COLLECTION PIPE AND FLOW DIRECTION
- EXISTING LEACHATE COLLECTION PIPE AND FLOW DIRECTION
- EXISTING 2 EXTRA LAYERS OF GEONET, 7.5' WIDE, BENEATH GEOCOMPOSITE IN SQUARE GRID 100 FEET ON CENTERS
- ±8% FLOOR SLOPE
- EXISTING LEACHATE SUMP
- EXISTING LEACHATE SUMP VALVE PIT
- EXISTING CLEANOUT
- PROPOSED CLEANOUT

PRIMARY CLAY LINER COORDINATES

POINT NO.	NORTHING	EASTING	ELEVATION	
501	8466.47	5208.11	732.36	
502	8575.56	5230.55	725.00	
503	8552.98	5243.24	720.23	
504	8684.58	5461.79	725.00	
505	8565.19	5246.41	719.62	B
506	8657.89	5468.01	716.07	
507	8684.58	5752.00	724.00	
508	8649.05	5748.66	712.17	A A
509	8650.52	5956.38	726.00	
510	8599.09	5958.86	709.36	
511	8704.86	6221.78	718.00	
512	8666.18	6226.32	705.21	
513	8704.86	6527.36	723.50	
514	8641.95	6454.04	701.00	
515	8437.99	6489.67	718.29	
516	8257.01	6507.34	729.00	
517	8264.46	6494.44	724.51	
518	8146.02	6355.69	731.45	
519	8115.19	6342.71	737.66	

DRAFT

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY
A	PER MDEQ COMMENTS	1/23/09	JHL
B	MODIFY FLOOR/TIE IN	8/1/11	DRL

PROJECT NAME:
MASTER CELL VI-E
DESIGN MODIFICATION

PROJECT LOCATION:
WDI SITE NO. 2
VAN BUREN TWP., WAYNE COUNTY, MICHGAN

NTH PROJECT NO.: 13-070804-05	CAD FILE NAME: SHEET 5
DESIGNED BY: JHL	INCEP DATE: 1/21/08
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY: ISS	SUBMITTED DATE: 8/1/2011

SHEET TITLE:
TOP OF PRIMARY LINER ELEVATION PLAN

SHEET REFERENCE NUMBER:
5

J:\GEM\2010145\production sets\civil\permit modifications\3 top of primary liner elevation plan.dwg Plotted: 8/1/2011 10:54 AM by kastrowski

Attachment A-2.2

Sample Calculation

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-2	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8285.65	4957.47	712.00	834.98	715.80	660.00	655.00	643.00	625.00	580.00	670.00	708.50

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	118.98	103.0	0	12254.9									
	3	OFL	3.80	135.0	TRUE	-513.0									
	4	Existing Waste	0.00	82.0	1	-									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	1.75	135.0	0	236.3	0.102	0.017	0.005	631.1	631.1	12913.1	NC	0.234	0.002
	3	OFL	1.75	135.0	0	236.3	0.102	0.017	0.005	867.4	867.4	13149.3	NC	0.211	0.002
	4	Existing Waste	4.81	82.0	0	394.6	0.147	0.025	-	1182.8	1182.8	13464.8	NC	0.747	-
	4	Existing Waste	4.81	82.0	0	394.6	0.147	0.025	-	1577.4	1577.4	13859.4	NC	0.668	-
	4	Existing Waste	4.81	82.0	0	394.6	0.147	0.025	-	1972.1	1972.1	14254.0	NC	0.608	-
	4	Existing Waste	4.81	82.0	0	394.6	0.147	0.025	-	2366.7	2366.7	14648.6	NC	0.560	-
	4	Existing Waste	4.81	82.0	0	394.6	0.147	0.025	-	2761.3	2761.3	15043.3	NC	0.521	-
	4	Existing Waste	4.81	82.0	0	394.6	0.147	0.025	-	3155.9	3155.9	15437.9	NC	0.488	-
	4	Existing Waste	4.81	82.0	0	394.6	0.147	0.025	-	3550.6	3550.6	15832.5	NC	0.459	-
	4	Existing Waste	4.81	82.0	0	394.6	0.147	0.025	-	3945.2	3945.2	16227.1	NC	0.434	-
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4482.5	4950.0	16764.4	OC-2	0.274	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5162.5	5630.0	17444.4	OC-2	0.254	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5822.5	6290.0	18104.4	OC-2	0.397	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6339.3	6806.8	18621.2	OC-2	0.454	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6732.9	7200.4	19014.8	OC-2	0.438	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7211.4	7678.9	19493.3	OC-2	0.546	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7774.8	8242.3	20056.7	OC-2	0.521	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8293.2	8760.7	20575.1	OC-2	0.334	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8766.6	9234.1	21048.5	OC-2	0.322	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9240.0	9707.5	21521.9	OC-2	0.311	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9713.4	10180.9	21995.3	OC-2	0.301	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10186.8	10654.3	22468.7	OC-2	0.292	-
														9.373	0.056
											Total Settlement [ft]			**9.43**	

Variables & Constants	
Point Name	SP-2
Settlement Layer [ft]	132.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-3	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8085.65	4957.47	722.00	884.76	715.71	660.00	655.00	643.00	625.00	580.00	670.00	712.28

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	158.76	103.0	0	16352.3									
	3	OFL	6.29	135.0	FALSE	849.1									
	4	Existing Waste	0.00	82.0	1	-									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	4.86	135.0	0	656.1	0.102	0.017	0.005	328.1	328.1	18069.5	NC	0.863	0.006
	3	OFL	4.86	135.0	0	656.1	0.102	0.017	0.005	984.2	984.2	18725.6	NC	0.634	0.006
	4	Existing Waste	5.29	82.0	0	433.4	0.147	0.025	-	1528.9	1528.9	19270.3	NC	0.855	-
	4	Existing Waste	5.29	82.0	0	433.4	0.147	0.025	-	1962.3	1962.3	19703.7	NC	0.778	-
	4	Existing Waste	5.29	82.0	0	433.4	0.147	0.025	-	2395.6	2395.6	20137.1	NC	0.718	-
	4	Existing Waste	5.29	82.0	0	433.4	0.147	0.025	-	2829.0	2829.0	20570.4	NC	0.669	-
	4	Existing Waste	5.29	82.0	0	433.4	0.147	0.025	-	3262.4	3262.4	21003.8	NC	0.628	-
	4	Existing Waste	5.29	82.0	0	433.4	0.147	0.025	-	3695.7	3695.7	21437.2	NC	0.593	-
	4	Existing Waste	5.29	82.0	0	433.4	0.147	0.025	-	4129.1	4129.1	21870.5	NC	0.562	-
	4	Existing Waste	5.29	82.0	0	433.4	0.147	0.025	-	4562.5	4562.5	22303.9	NC	0.535	-
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5119.2	4950.0	22860.6	NC	0.331	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5799.2	5630.0	23540.6	NC	0.310	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6459.2	6290.0	24200.6	NC	0.490	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6976.0	6806.8	24717.4	NC	0.564	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7369.6	7200.4	25111.0	NC	0.546	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7848.1	7678.9	25589.5	NC	0.693	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8411.5	8242.3	26152.9	NC	0.665	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8929.9	8760.7	26671.3	NC	0.428	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9403.3	9234.1	27144.7	NC	0.414	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9876.7	9707.5	27618.1	NC	0.402	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10350.1	10180.9	28091.5	NC	0.390	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10823.5	10654.3	28564.9	NC	0.379	-
														12.451	0.064
											Total Settlement [ft]			**12.52**	

Variables & Constants	
Point Name	SP-3
Settlement Layer [ft]	142.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

Attachment A-3

Pipe Strength and Deflection Calculations

CALCULATION SHEET

Project No.: 1218070017
Client: Wayne Disposal — Calculated By: NSG Date: 10/5/2021
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification — Checked By: CAB Date: 10/7/2021
Calculation: SSR Pipe Strength and Deflection — Approved By: XZ Date: 10/7/2021

Leachate Collection Sump Pipe Strength and Deflection

OBJECTIVE

Evaluate the strength and deflection of the leachate collection sump riser pipes for Master Cell VI-G4 through G7. In addition, evaluate the strength of existing MC VI-EP2-W sump risers with the proposed final grade adjustments.

DESIGN CRITERIA, ASSUMPTIONS AND METHODOLOGY

The leachate sump risers for MC VI-G4 through G7 are:

- 24-inch diameter – either HDPE SDR-9 or SDR-11 perforated pipe
- Sump riser pipe will operate at "non-pressurized" condition.
- The Sump Riser is perforated with a pattern of 8 perforations, 1/2 inch diameter, around the circumference (45 degree spacing), at 6 inches between sets of holes (See Figure 1).

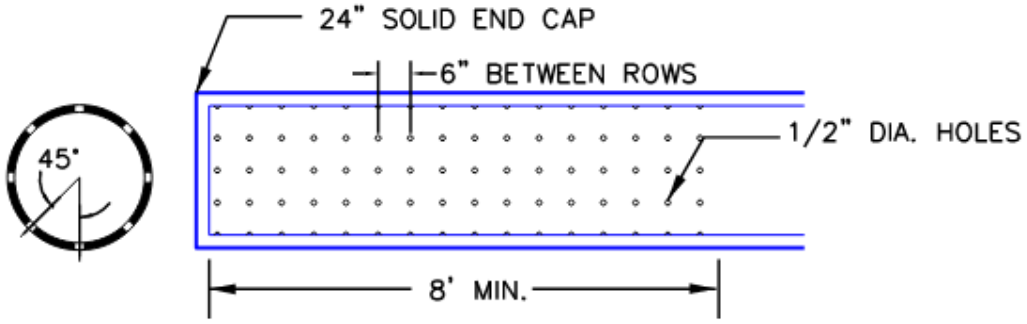


Figure 1 - Pipe Perforation Detail for MC VI G4 – G7

The leachate sump risers for MC VI EP2-W analysis are:

- MC VI-EP2-W Sump riser pipes: 18-inch diameter – HDPE SDR-7.3 perforated pipe and 20-inch diameter HDPE SDR-7.3
- Sump riser pipe will operate at "non-pressurized" condition.
- The Sump Riser is perforated with a pattern of 8 perforations, 3/8" diameter, around the circumference (45 degree spacing), at 3 inches between sets of holes (See Figure 1).

CALCULATION SHEET

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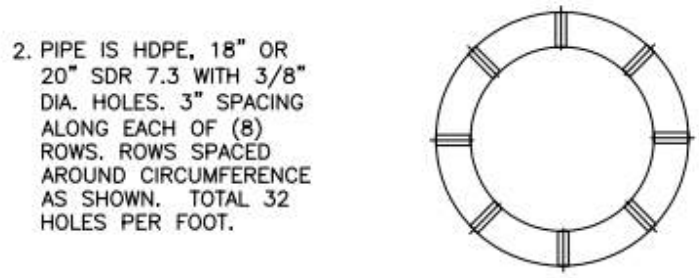

Figure 2 - MC VI EP2-W Sump Perforation Detail

Leachate sump pipes will be subjected to static loadings from the deposited waste vehicular traffic during the early stages of waste disposal. Previous analyses demonstrated that the live loading due to equipment loading was insignificant in comparison with the static loading at full height of the landfill so long as the initial cover over the riser pipes was at least 5 feet. The modification does not change this.

Static Loading

Pipe static loads were calculated using the Prism Load Method. The overburden load on the leachate collection pipe, (from top to bottom) includes the protective cover layer, waste layer, and the drainage layer. Because all of the layer thicknesses are constant except the waste layer, the most critical case (maximum static load) occurs where the waste thickness is greatest.

A comparison between the final cover grade plan and leachate collection system plan shows that the maximum waste thickness for Cells G4 through G7 is in the MC VI-G7 Sump. Waste thickness is 50 feet with 4 feet of cover soil in the cap system and 4 feet of drainage gravel in the sump. For MC VI-EP2-W sump riser, the height of waste above the riser has been adjusted to approximately 105 feet. Note that the other existing sumps were evaluated and the proposed final grade adjustments did not affect the remaining cells' maximum height of waste over the sumps. Figure 2 illustrates the thicknesses and unit weights of the various soil materials above the sump risers.

CALCULATION SHEET

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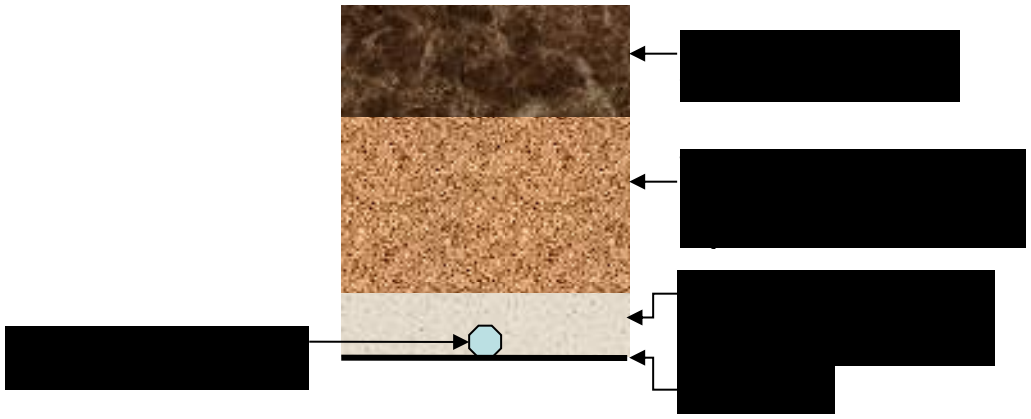

Figure 3. Cross Section of Typical Profile of Leachate Pipe for Static Loading Analysis
Figure Not To Scale

The Prism Load Method is most conservative as it does not make use of any reduction factors (Moser 1990). Equation 1 shows how the pressure on the pipe is calculated.

$$\sigma_s = \gamma_{c.s}\ h_{c.s.} + \gamma_{waste}\ h_{waste} + \gamma_{l.s}\ h_{l.s} \quad (1)$$

Where:

σ_s = static load on the leachate pipes, pounds per square foot [psf]
$\gamma_{c.s}$ = unit weight of final cover soil, pounds per cubic foot [pcf]
$h_{c.s}$ = thickness of final cover soil [ft]
γ_{waste} = unit weight of waste [pcf]
h_{waste} = depth of waste above the pipe [ft]
$\gamma_{l.s}$ = unit weight of sumpfloor aggregate above the pipe [pcf]
$h_{l.s}$ = thickness of sump floor aggregate above the pipe [ft]

Pipe and Soil Properties Sources

The maximum allowable deflection ratios of HDPE pipes is 7.5% (ASTM F1962-11). As stated in the Handbook of PE Pipe, "for non-pressure applications, a 7.5 percent defection limit provides a large safety factor against instability and strain and is considered a safe design defection. Some engineers will design profile wall pipe and other non-pressure pipe applications to a 5% defection limit, but allow spot defections up to 7.5% during field inspection." (Plastic Pipe Institute, 2020). Based on this, a 5% deflection limit will be used for this design.

The elastic modulus for HDPE pipe material (E_p) was reduced to 21,170 pounds per square inch (psi) to account for potential creep effects assuming a temperature of 100° F for 50 years (Plastic Pipe Institute, 2020).

The soil reaction modulus (E') depends on the soil elastic modulus (E_s) which is in turn based on soil stress.

(Qian et al 2001).

$$E' = 2 \times E_s \quad (2)$$

Where:

E' = soil reaction modulus, psi
E_s = soil elastic modulus, psi

The soil elastic modulus was conservatively selected as 4,151 psi for MC VI-G7 (*see Attachment 2 – Determination of Soil Elasticity Modulus*). The soil elastic modulus for MC VI EP2W is 5098 psi (*see Attachment 2 – Determination of Soil Elasticity Modulus*).

Parameter Sources

Table 2 summarizes the sources used to gather the various parameters made in these calculations.

Table 1. Sources of Pipe and Soil Parameters

	Parameter	Source
HDPE Pipe	Dimensions (*OD, ID,* t_p)	ISCO Product Catalog
	Perforation	CTI 2020
	Elastic Modulus (E_p)	Plastic Pipe Institute, 2020
	Acceptable Deflection	ASTM F1962-11
Soil	Unit Weights (γ_c, γ_d, γ_{waste})	Soil – typical values Waste – based on historical site-specific waste density
	Elastic Modulus (E_s)	Attachment 1
Misc.	Modified Iowa Method Parameters	Moser 1990

CALCULATIONS AND RESULTS

Vertical Deflection – Modified Iowa State Method

An engineering approach to estimate the deflection of buried pipes was developed by a group of research faculty and students at Iowa State University. Equation 6 is a summary of the effort of the Iowa State Group's to model buried, flexible pipe deflection (Moser 1990).

$$y \approx \frac{D_L K_b W_P}{\left(E_P I / r^3\right) + \left(0.061 E'\right)} \quad (3)$$

Where:

y = vertical pipe deflection [in]
D_L = deflection lag factor
K_b = bedding constant
W_P = vertical load per unit length (in the pipe length direction) [lb/in]
= $W \times \left(\frac{12}{12 - (D \times N)} \right)$
W = unadjusted (for perforation) vertical load per unit length [lb/ft]
= $\sum \gamma_i H_i$
γ_i = unit weight of material i on the pipe
H_i = thickness of material i
OD = outside diameter of pipe [in]
D = diameter of perforations [in]
N = number of perforation per row per linear foot of pipe
E_P = modulus of elasticity of pipe material [psi]
I = moment of inertia of the pipe wall per unit length [in^3]
r = mean radius of pipe [in]
= $\frac{OD - t_p}{2}$
E' = soil reaction modulus [psi]

Since the conservative Prism Load Method is being applied, no adjustment for lag is required. Therefore the deflection lag factor is set to 1.0. It is typical in designs to assume a bedding constant of 0.1, as this is also a conservative value (Moser 1990).

Once the vertical pipe deflection is determined, the corresponding percent pipe wall strain/deflection ratio can be calculated as follows.

$$\varepsilon = \frac{y}{2r} \times 100\% \quad (4)$$

Where:

ε = pipe wall strain/deflection ratio
y = vertical pipe deflection [in]
r = mean radius of pipe [in]

Wall Buckling

Local wall buckling is a longitudinal wrinkling of the pipe wall. Although wall buckling is seldom the limiting

factor in the design of a pipe-soil system, a check can be made according to Equation 8 (Moser 1990).

$$FS = \frac{P_{cb}}{\sigma_z} = \frac{0.8\sqrt{\frac{2E'E_P}{SDR^3}}}{\sigma_z} \quad (5)$$

Where:

P_{cb} = critical buckling pressure at top of pipe [psi]
σ_z = actual vertical pressure on the pipe [psi]
E' = modulus of soil reaction [psi]
E_p = modulus of elasticity of pipe material [psi]
SDR = standard dimension ratio = OD/t_p
OD = outside diameter of pipe [in]
T_p = pipe wall thickness [in]

A calculation spreadsheet, based on equations presented in the previous section, was developed to analyze pipe strength. See Table 3 for calculation details of HDPE pipes in the proposed modification area.

CALCULATION SHEET

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Table 2. Pipe Deflection and Buckling Strength Worksheet for MC VI-G4 through G7 Sump and MC VI-EP2W

Item	Notation	Units	1	1	2	3
			18" HDPE SDR	20" HDPE SDR	24" HDPE SDR	24" HDPE SDR
			7.3	**7.3**	**11**	**9**
			Perforated	Perforated	Perforated	Perforated
Vertical load						
Design vertical stress on pipe	H_{refuse}	ft	105.0	105.0	50.0	50.0
	σ_z	psf	11,585	11,585	6,030	6,030
		psi	80.5	80.5	41.9	41.9
Outside diameter of pipe	OD	in	18.000	20.000	24.000	24.000
Inside Diameter of pipe	ID	in	12.773	14.192	19.375	18.347
Pipe Wall Thickness OD/SDR	t_p	in	2.466	2.740	2.182	2.667
Unadjusted vertical load per unit length $W = \gamma*H*OD$	W	lbs/in	1448	1609	1005	1005
Dia. of perforations	D	in	0.375	0.375	0.50	0.50
No. of Perforation Rows per foot	N		**4**	**4**	**2**	**2**
Modified Vertical stress $W_p = W*(12/(12-(D*N)))$	W_p	lbs/in	1655	1839	1096	1096
Vertical Deflection (Modified Iowa Method)						
Deflection Lag factor	D_L		1.00	1.00	1.00	1.00
Mean Pipe radius $r = (OD-t_p)/2$	r	in	7.77	8.63	10.91	10.67
Bedding Constant	K_b		0.10	0.10	0.10	0.10
Soil Modulus of Elasticity	E_s	psi	5098	5098	4151	4151
Modulus Soil Reaction $E' = 2E_s$	E'	psi	10,197	10,197	8,303	8,303
Pipe Modulus of elasticity	E_p	psi	21,170	21,170	21,170	21,170
Moment of Inertia $I = (t_p^3/12)$	I	in^3	1.2493	1.7137	0.8655	1.5802
Vertical Deflection $y = [(D_L K_b W_p)/((E_p I/r^3)+(0.061E_s)]$	y	in	0.2439	0.2710	0.2106	0.2053
Percentage Deflection $y/(2r)$ for both PVC and HDPE	ε	%	**1.6%**	**1.6%**	**0.97%**	**0.96%**
Limiting Strain for HDPE pipe		%	5.0%	5.0%	5.0%	5.0%
Buckling Analysis (for HDPE pipes only)						
Critical Buckling Pressure $P_{bc} = 0.8*(2E_s E_p/SDR^3)^{0.5}$	P_{bc}	psi	842.77	842.77	411.13	555.53
Required Factor of Safety	FS		*1.0*	*1.0*	*1.0*	*1.0*
Provided F.S against wall buckling $FS = P_{bc}/[\sigma z/(1-nd/12)]$	FS		**9.2**	**9.2**	**9.0**	**12.2**

CALCULATION SHEET

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Calculation: SSR Pipe Strength and Deflection | Approved By: XZ | Date: 10/7/2021

CONCLUSIONS

The vertical deflection and factors of safety against buckling and collapse were examined for the leachate sump risers in the proposed modification. The strength and deflection analyses are shown in Table 3.

Based on the results in Table 3 for the MC VI-G4 through G7 Sump risers, it is concluded that the calculations indicate acceptable levels of deflection will occur and an adequate factor of safety is provided against buckling for both SDR-9 and SDR-11. Existing sump risers in MC VI-EP2W also achieved acceptable levels of deflection and adequate factor of safety against buckling

CALCULATION SHEET

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Calculation: SSR Pipe Strength and Deflection — Approved By: XZ — Date: 10/7/2021

REFERENCES

ASTM F1962-11 (2011) "*Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings*"

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Xuede Qian, Robert M. Koerner and Donald H. Gray (2001) "*Geotechnical Aspects of Landfill Design and Construction*" Prentice Hall, New Jersey.

CALCULATION SHEET

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ATTACHMENTS

CALCULATION SHEET

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Attachment A-3.1.1
Pipe Properties Charts

CALCULATION SHEET

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TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) (1,2,3)					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

(1) Although there are various factors that determine the exact apparent modulus response of a PE, a major factor is its ratio of crystalline to amorphous content – a parameter that is reflected by a PE's density. Hence, the major headings PE2XXX, PE3XXX and, PE4XXX, which are based on PE's Standard Designation Code. The first numeral of this code denotes the PE's density category in accordance with ASTM D3350 (An explanation of this code is presented in Chapter 5).

(2) The values in this table are applicable to both the condition of sustained and constant loading (under which the resultant strain increases with increased duration of loading) and that of constant strain (under which an initially generated stress gradually relaxes with increased time).

(3) The design values in this table are based on results obtained under uni-axial loading, such as occurs in a test bar that is being subjected to a pulling load. When a PE is subjected to multi-axial stressing its strain response is inhibited, which results in a somewhat higher apparent modulus. For example, the apparent modulus of a PE pipe that is subjected to internal hydrostatic pressure – a condition that induces bi-axial stressing – is about 25% greater than that reported by this table. Thus, the Uni-axial condition represents a conservative estimate of the value that is achieved in most applications.

It should also be kept in mind that these values are for the condition of continually sustained loading. If there is an interruption or a decrease in the loading this, effectively, results in a somewhat larger modulus.

In addition, the values in this table apply to a stress intensity ranging up to about 400psi, a value that is seldom exceeded under normal service conditions.

(Plastic Pipe Institute, 2020, Ch. 3)

TABLE B.1.2

Temperature Compensating Multipliers for Determination of the Apparent Modulus of Elasticity at Temperatures Other than at 73°F (23°C)

Equally Applicable to All Stress-Rated PE's (e.g., All PE2xxx's, All PE3xxx's and All PE4xxx's)

Maximum Sustained Temperature of the Pipe °F (°C)	Compensating Multiplier
-20 (-29)	2.54
-10 (-23)	2.36
0 (-18)	2.18
10 (-12)	2.00
20 (-7)	1.81
30 (-1)	1.65
40 (4)	1.49
50 (10)	1.32
60 (16)	1.18
73.4 (23)	1.00
80 (27)	0.93
90 (32)	0.82
100 (38)	0.73
110 (43)	0.64
120 (49)	0.58
130 (54)	0.50
140 (60)	0.43

(Plastic Pipe Institute, 2020, Ch. 3)

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PE 4710 IPS HDPE Pipe Sizes

Pressure Rating	Nominal Size	1"	1 1/4"	1 1/2"	2"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"
	Actual O.D.	1.32"	1.660"	1.90"	2.38"	3.500"	4.50"	5.563"	6.625"	8.625"	10.750"	12.75"	14.00"	16.00"	18.00"
DR 7 (333psi)	Min. wall	0.188"	0.237"	0.271"	0.339"	0.500"	0.643"	0.795"	0.946"	1.232"	1.536"	1.821"	2.000"	2.286"	2.571"
	Average I.D.	0.917"	1.157"	1.325"	1.656"	2.440"	3.137"	3.878"	4.619"	6.013"	7.494"	8.889"	9.760"	11.154"	12.549"
	Weight lb/lf	0.291	0.463	0.607	0.950	2.060	3.402	5.200	7.374	12.498	19.416	27.312	32.930	43.010	54.435
DR 7.3 (312psi)	Min. wall	0.180"	0.227"	0.260"	0.325"	0.479"	0.616"	0.762"	0.908"	1.182"	1.473"	1.747"	1.918"	2.192"	2.466"
	Average I.D.	0.933"	1.178"	1.348"	1.685"	2.484"	3.193"	3.947"	4.701"	6.120"	7.628"	9.047"	9.934"	11.353"	12.773"
	Weight lb/lf	0.281	0.450	0.590	0.920	1.990	3.290	5.022	7.130	12.070	18.750	26.380	31.810	41.550	52.580
DR 9 (250psi)	Min. wall	0.146"	0.184"	0.211"	0.264"	0.389"	0.500"	0.618"	0.736"	0.958"	1.194"	1.417"	1.556"	1.778"	2.000"
	Average I.D.	1.005"	1.269"	1.452"	1.816"	2.676"	3.440"	4.253"	5.064"	6.593"	8.218"	9.747"	10.702"	12.231"	13.760"
	Weight lb/lf	0.235	0.374	0.490	0.770	1.664	2.751	4.204	5.963	10.110	15.700	22.085	26.630	34.780	44.020

PE 4710 IPS HDPE Pipe Sizes

20"	22"	24"	26"	28"	30"	32"	34"	36"	42"	48"	54"	63"	Nominal Size	Pressure Rating
20.00"	22.00"	24.00"	26.00"	28.00"	30.00"	32.00"	34.00"	36.00"	42.00"	48.00"	54.00"	62.99"	Actual O.D.	
2.857"	3.143"	3.429"	---	---	---	---	---	---	---	---	---	---	Min. wall	DR 7 (333psi)
13.943"	15.337"	16.731"	---	---	---	---	---	---	---	---	---	---	Average I.D.	
67.203	80.591	95.916	---	---	---	---	---	---	---	---	---	---	Weight lb/lf	
2.740"	3.014"	3.288"	3.562"	---	---	---	---	---	---	---	---	---	Min. wall	DR 7.3 (317psi)
14.192"	15.611"	17.030"	18.449"	---	---	---	---	---	---	---	---	---	Average I.D.	
64.910	78.550	93.480	110.769	---	---	---	---	---	---	---	---	---	Weight lb/lf	
2.222"	2.444"	2.667"	2.889"	3.111"	3.333"	3.556"	---	---	---	---	---	---	Min. wall	DR 9 (250psi)
15.289"	16.818"	18.347"	19.876"	21.404"	22.933"	24.462"	---	---	---	---	---	---	Average I.D.	
54.342	65.754	78.250	92.535	107.312	123.183	140.183	---	---	---	---	---	---	Weight lb/lf	
1.818"	2.000"	2.182"	2.364"	2.545"	2.727"	2.909"	3.091"	3.273"	---	---	---	---	Min. wall	DR 11 (200psi)
16.145"	17.760"	19.375"	20.989"	22.604"	24.218"	25.833"	27.447"	29.062"	---	---	---	---	Average I.D.	
45.541	55.105	65.580	77.440	89.785	103.076	117.285	132.411	148.454	---	---	---	---	Weight lb/lf	

(*ISCO Product Catalog*)

CALCULATION SHEET

Project No.: 1218070017
Client: Wayne Disposal — Calculated By: NSG — Date: 10/5/2021
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification — Checked By: CAB — Date: 10/7/2021
Calculation: SSR Pipe Strength and Deflection — Approved By: XZ — Date: 10/7/2021

Designation: F1962 – 11

Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings[1]

This standard is issued under the fixed designation F1962; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

X2.6 *Deflection Limits*—The limiting deflection (in percent) is determined by the geometric stability of the deflected pipe, hydraulic capacity, and the strain occurring in the pipe wall. It has been observed that for PE, pressure-rated pipe, subjected to soil pressure only, no upper limit from a practical design point of view seems to exist for the bending strain (**15**). Therefore, for non-pressure pipes or conduits the safe long-term deflection is 7.5 % of the diameter. When subjected to internal pressure in addition to soil pressure, the localized bending strain resulting from deflection combines with the hoop tensile strain caused by internal pressure to produce a higher, localized tensile fiber-stress. However, as the internal pressure is increased the pipe re-rounds and the bending strain is reduced. At high pressures, the bending strain is reduced and the ring tensile stress approaches that due to internal pressure alone. For calculation method, see Ref. (**16**). This fact coupled with the ductility of PE permits the designer to ignore the combined effect of pressure and deflection. In lieu of an exact calculation based on allowable strain, the designer can use the safe long-term design deflection values for pressure pipe shown to Table X2.1.

TABLE X2.1 Safe Long-Term Design Deflection values for Buried Pressurized Polyethylene Pipe

DR or SDR	Deflection Limits as % of Diameter
21	7.5
17	6.0
15.5	6.0
13.5	6.0
11	5.0
9	4.0
7.3	3.0

(**15**) Janson, L.E.," Long-Term Studies of PVC and PE Pipes Subjected to Forced Constant Deflection", Report No. 3, KP-Council, Stockholm, Sweden, 1991.
(**16**) Janson, L.E., *Plastics Pipes for Water Supply and Sewage Disposal*, Borealis, Stockholm, Sweden, 1995.

CALCULATION SHEET

Project No.: 1218070017

Client: Wayne Disposal — Calculated By: NSG — Date: 10/5/2021

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Calculation: SSR Pipe Strength and Deflection — Approved By: XZ — Date: 10/7/2021

Attachment A-3.1.2
Determination of Soil Elasticity Modulus

CALCULATION SHEET

Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Attachment 2 – Soil Modulus Determination

Project No.: 121807017
Calculated By: NSG Date: 10/5/2021
Checked By: CAB Date:
Approved By: Date:

DETERMINATION OF SOIL MODULUS OF ELASTICITY

OBJECTIVE

Determine an appropriately conservative soil modulus of elasticity (E_s) for use in calculating the strength of the MC VI-G4 through G7 leachate collection sump riser.

ASSUMPTIONS AND METHODOLOGY

Calculation of E_s

The following assumptions were made to ensure the accuracy of the final calculated value while preserving conservatism.

- The pipe under strength analysis is to be backfilled with stone (gravel).
- Maximum estimated stress on leachate collection MC VI-G4 through G7 riser = 41.9 psi
- Soil modulus of elasticity can be conservatively calculated as follows (from Table 1).

$$E_s = 2 \cdot q_c \quad \text{[psi]} \tag{1}$$

Where:

q_c = Cone Penetration Test (CPT) value [psi]

The CPT value of the stone is not available through direct test data, but it can be estimated using the friction angle and relative density. The following values were conservatively estimated based on likely properties that the gravel backfill would possess:

- Friction angle (ϕ) = 32°
- Relative Density (D_R) = 70%

CALCULATION SHEET
Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
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Table 1. Equations for computing E_s by making use of SPT and CPT values [kpa] (Murthy 2003)

Soil	SPT	CPT
Sand (normally consolidated)	500 (N_{cor} + 15)	2 to 4 q_c
	(35000 to 50000) log N_{cor} (U.S.S.R Practice)	(1+ D_r^2) q_c
Sand (saturated)	250 (N_{cor} + 15)	
Sand (overconsolidated)	–	6 to 30 q_c
Gravelly sand and gravel	1200 (N_{cor} + 6)	
Clayey sand	320 (N_{cor} + 15)	3 to 6 q_c
Silty sand	300 (N_{cor} + 6)	1 to 2 q_c
Soft clay	–	3 to 8 q_c

Figure 1 shows an accepted correlation between these two properties and the CPT value, as well as stress state (in terms of horizontal stress, calculated in Equation 2)

$$\sigma_h = k_0 \cdot \sigma_v \quad \text{[psi]} \tag{2}$$

Where:

σ_h = Horizontal stress due to overburden pressure [psi]
k_0 = Lateral earth pressure coefficient
= 0.36 (conservative assumption, Table 2)
σ_v = Stress due to overburden soils
= 41.9 psi for the MC VI-G4 through G7 riser

Table 2. Coefficients of Earth Pressure for "at-rest" condition (Murthy 2003)

Type of soil	I_p	K_0
Loose sand, saturated	–	0.46
Dense sand, saturated	–	0.36
Dense sand, dry (e = 0.6)	–	0.49
Loose sand, dry (e = 0.8)	–	0.64
Compacted clay	9	0.42
Compacted clay	31	0.60
Organic silty clay, undisturbed (w_l = 74%)	45	0.57

Thus, once certain properties are known / calculated, the CPT value can be inferred and ultimately the soil modulus determined.

CALCULATION SHEET

Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Attachment 2 – Soil Modulus Determination

Project No.: 121807017
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Checked By: CAB Date:
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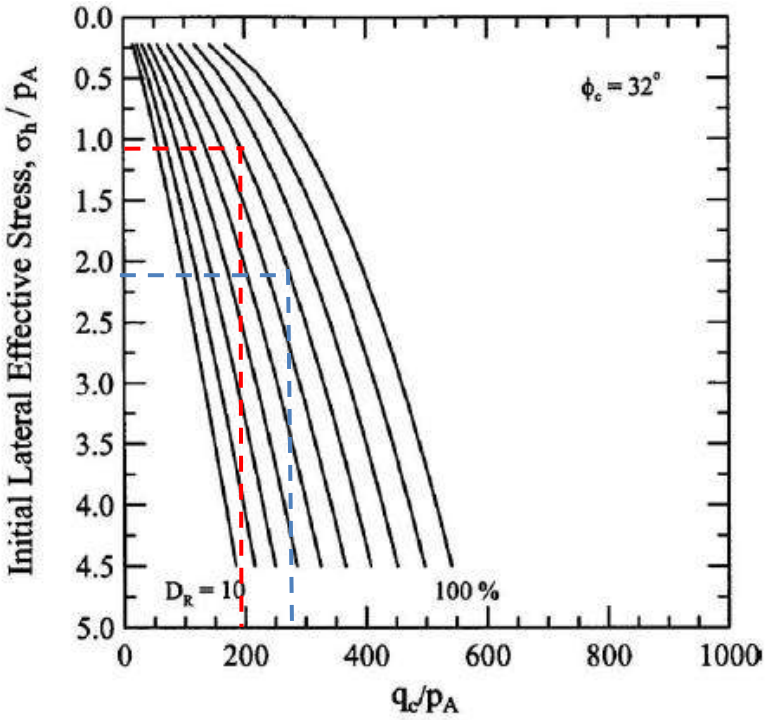

Figure 1. Correlation between Stress, Relative Density and CPT value for ϕ = 32º (Salgado and Prezzi 2007)

Extrapolation of E_s

In addition to the aforementioned calculation approach (known to be conservative), the previously approved correlation between stress and soil modulus developed by Selig (1990) and referenced by Qian et al (2001) will be extrapolated for comparison with the calculated value.

CALCULATIONS AND RESULTS

MC VI-EP2W

- The horizontal stress (σ_h in Equation 2) was calculated as 15.1 pounds per square inch (psi).
- The σ_h / p_A ratio is therefore 1.1 (p_A = standard reference stress = 1 tsf = 13.88 psi) correlating to a q_c / p_A ratio of approximately 275. This yields a CPT value of 3,800 psi.
- Finally, the soil modulus (E_s in equation 1) is calculated to be **7,600 psi**.

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Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
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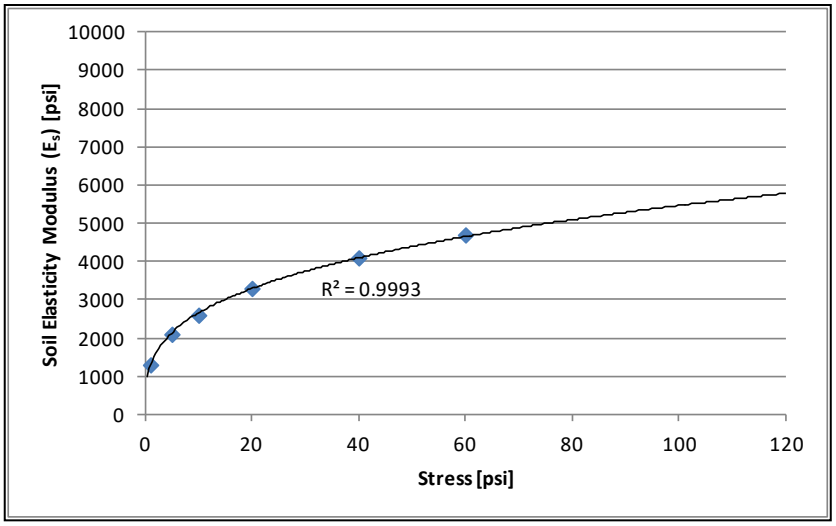
Another method of analysis uses Table 3 as the basis of determining the soil modulus E_s.

Table 3. Elasticity of Soil Under Stress (Selig 1990 c/o *Qian et al 2001*)

Soil Type	Stress Level		85% Standard Density			95% Standard Density		
			E_s			E_s		
	psi	kPa	psi	MPa	ν_s	psi	MPa	ν_s
SW, SP, GW, GP	1	7	1,300	9	0.26	1,600	11	0.40
	5	35	2,100	14	0.21	4,100	28	0.29
	10	70	2,600	18	0.19	6,000	41	0.24
	20	140	3,300	23	0.19	8,600	59	0.23
	40	280	4,100	28	0.23	13,000	90	0.25
	60	420	4,700	32	0.28	16,000	110	0.29
GM, SM, ML, and GC, SC with < 20% fines	1	7	600	4	0.25	1,800	12	0.34
	5	35	700	5	0.24	2,500	17	0.29
	10	70	800	6	0.23	2,900	20	0.27
	20	140	850	6	0.30	3,200	22	0.29
	40	280	900	6	0.38	3,700	25	0.32
	60	420	1,000	7	0.41	4,100	28	0.35
CL, MH, GC, SC	1	7	100	1	0.33	400	3	0.42
	5	35	250	2	0.29	800	6	0.35
	10	70	400	3	0.28	1,100	8	0.32
	20	140	600	4	0.25	1,300	9	0.30
	40	280	700	5	0.35	1,400	10	0.35
	60	420	800	6	0.40	1,500	10	0.38

- This approved correlation is plotted in Figure 2, showing a coefficient of determination (i.e. accuracy of trend line).



CALCULATION SHEET

Client: Wayne Disposal | Project No.: 121807017

Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification | Calculated By: NSG | Date: 10/5/2021

Calculation: Attachment 2 – Soil Modulus Determination | Checked By: CAB | Date:

Approved By: | Date:

Figure 2. Correlation between overburden stress and soil elasticity modulus (from Table 3)

- The equation of the trend line shown is given below. Equation 3 was used to estimate E_s under the specified overburden pressure for both the horizontal and vertical expansion cases.

$$E_s = 1281.6{\sigma_v}^{0.3147} \quad (3)$$

- This correlation indicates that at 80.5 psi (estimated overburden scenario) the soil modulus of elasticity will be approximately **5,098 psi**.

- To preserve a conservative calculation, the smaller values of elastic modulus – 5,098 psi for MC VI-EP2W will be used in the pipe strength and deflection analysis.

MC VI-G4 through G7

- The horizontal stress (σ_h in Equation 2) was calculated as 29.0 pounds per square inch (psi).

- The σ_h / p_A ratio is therefore 2.1 (p_A = standard reference stress = 1 tsf = 13.88 psi) correlating to a q_c / p_A ratio of approximately 190. This yields a CPT value of 2,700 psi.

- Finally, the soil modulus (E_s in equation 1) is calculated to be **5,400 psi**.

Using the trendline equation for Es vs overburden pressure:

- This correlation indicates that at 41.9 psi (estimated overburden scenario) the soil modulus of elasticity will be approximately **4,151 psi**.

- To preserve a conservative calculation, the smaller values of elastic modulus – 4,152 psi for MC VI G4 through G7 will be used in the pipe strength and deflection analysis.

CALCULATION SHEET

Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Attachment 2 – Soil Modulus Determination

Project No.: 121807017
Calculated By: NSG Date: 10/5/2021
Checked By: CAB Date:
Approved By: Date:

REFERENCES

Murthy, V.N.S. (2003) *Geotechnical Engineering: Principles and Practices of Soils Mechanics and Foundation Engineering* Marcel Dekker, Inc., New York, NY.

Salgado, R. and Prezzi, M. (2007). "Computation of Cavity Expansion Pressure and Penetration Resistance in Sands." International Journal of Geomechanics. American Society of Civil Engineers.

Xuede Qian, Robert M. Koerner and Donald H. Gray (2001). "Geotechnical Aspects of Landfill Design and Construction" Prentice Hall, New Jersey.

CALCULATION SHEET

Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: LCS Pipe Strength and Deflection

Project No.: 1218070017
Calculated By: NSG Date: 10/5/2021
Checked By: CAB Date: 10/7/2021
Approved By: XZ Date: 10/7/2021

Leachate Collection Pipe Strength and Deflection

OBJECTIVE

Evaluate the strength and deflection of the proposed and existing leachate collection pipes for Master Cell VI-G, Master Cell VI-F, and Master Cell VI-E due to the proposed final grade adjustments.

DESIGN CRITERIA, ASSUMPTIONS AND METHODOLOGY

The leachate collection pipes selected for this analysis are:

- Leachate collection pipes: 8-inch diameter HDPE SDR-11 (MC VI G4 – G7) or SDR-9 perforated pipe (MC VI G4 – G7) or 6-inch SDR-7 (existing MC VI E, MC VI G1 – G3) or 6-inch SDR-7.3 (existing MC VI E, MC VI G1 – G3)
- Leachate collection pipes will operate at "non-pressurized" condition.
- The leachate collection pipes for MC VI-G4 – G7 are perforated with a pattern of 4 perforations around the circumference (90 degree spacing), at 6 inches between sets of holes (See Figure 1). Perforations are 0.5-inch diameter.
- The leachate collection pipes for existing MC VI-E cells, MC VI-G1 – G3 are perforated with a pattern of 4 perforations around the circumference (90 degree spacing), at 2 inches between holes (6 rows per foot). Perforations are 0.25-inch diameter.

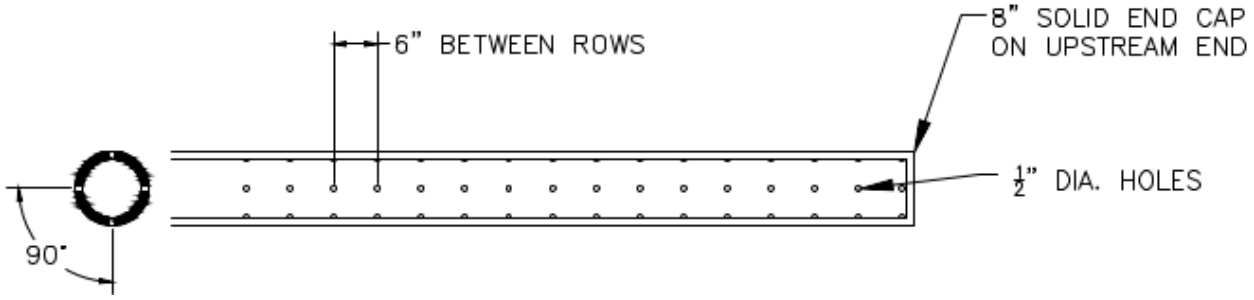


Figure 1 - Pipe Perforation Detail for MC VI-G4 through G7

CALCULATION SHEET

Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: LCS Pipe Strength and Deflection

Project No.: 1218070017
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Checked By: CAB Date: 10/7/2021
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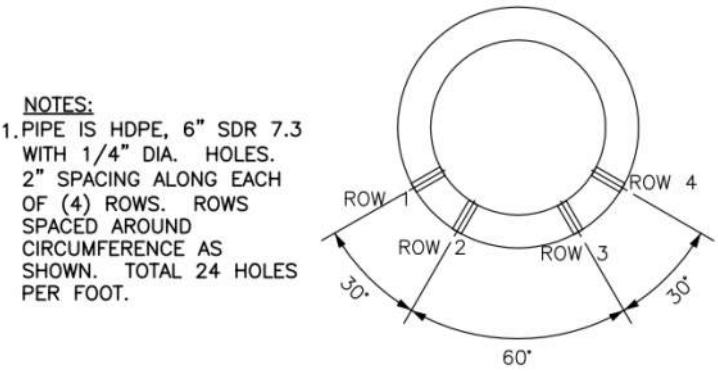

Figure 2 - Pipe Perforation Detail for MC VI-E, G1 – G3

Leachate collection pipes will be subjected to static loadings from the deposited waste vehicular traffic during the early stages of waste disposal. Previous analyses demonstrated that the live loading due to equipment loading was insignificant in comparison with the static loading at full height of the landfill so long as the initial cover over the riser pipes was at least 5 feet. The modification does not change this.

Static Loading

Pipe static loads were calculated using the Prism Load Method. The overburden load on the leachate collection pipe, (from top to bottom) includes the protective cover layer, waste layer, and the drainage layer. Because all of the layer thicknesses are constant except the waste layer, the most critical case (maximum static load) occurs where the waste thickness is greatest.

A comparison between the final cover grading plan and leachate collection system plan shows that the maximum waste thickness in MC VI E, MC VI F, and MC VI G is approximately 210 feet, 185 feet, and 250 feet, respectively. Each cell also includes 4 feet of cover soil in the cap system and a 1-foot drainage layer below the waste. Existing pipes in MC VI E is 6" SDR 7 or 6" SDR-7.3 and existing MC VI G1 is 8" SDR 9. The proposed pipes in MC VI G and MC VI F are to be either 8" SDR-9 or 8" SDR-11. To be conservative, the calculation will be performed using 250 feet of waste thickness for 8" SDR-9, 8" SDR-11, 6" SDR-7.3 and 6" SDR-7. Figure 2 illustrates the thicknesses and unit weights of the various soil material layers above the sump riser.

CALCULATION SHEET

Client: Wayne Disposal | Project No.: 1218070017

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Calculation: LCS Pipe Strength and Deflection | Checked By: CAB | Date: 10/7/2021

Approved By: XZ | Date: 10/7/2021

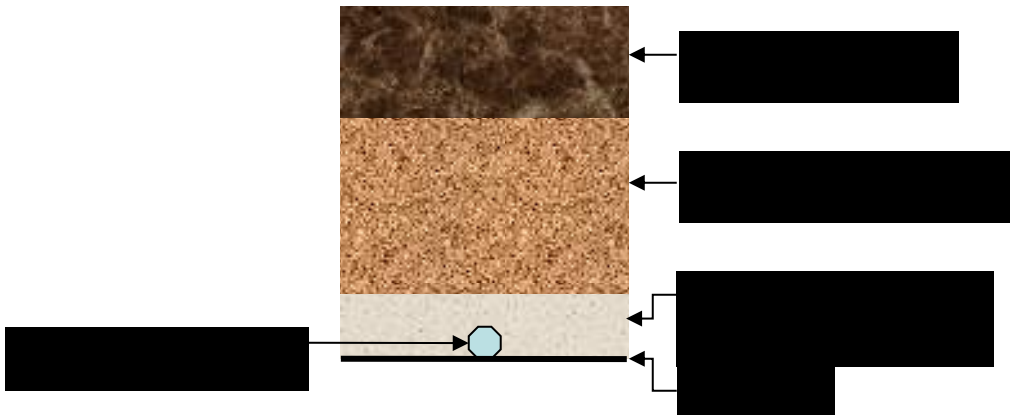

Figure 3. Cross Section of Typical Profile of Leachate Pipe for Static Loading Analysis
Figure Not To Scale

The Prism Load Method is most conservative as it does not make use of any reduction factors (Moser 1990). Equation 1 shows how the pressure on the pipe is calculated.

$$\sigma_s = \gamma_{c.s}\ h_{c.s.} + \gamma_{waste}\ h_{waste} + \gamma_{l.s}\ h_{l.s} \quad (1)$$

Where:

σ_s = static load on the leachate pipes, pounds per square foot [psf]
$\gamma_{c.s}$ = unit weight of final cover soil, pounds per cubic foot [pcf]
$h_{c.s}$ = thickness of final cover soil [ft]
γ_{waste} = unit weight of waste [pcf]
h_{waste} = depth of waste above the pipe [ft]
$\gamma_{l.s}$ = unit weight of sumpfloor aggregate above the pipe [pcf]
$h_{l.s}$ = thickness of sump floor aggregate above the pipe [ft]

Pipe and Soil Properties Sources

The maximum allowable deflection ratios of HDPE pipes is 7.5% (ASTM F1962-11). As stated in the Handbook of PE Pipe, "for non-pressure applications, a 7.5 percent defection limit provides a large safety factor against instability and strain and is considered a safe design defection. Some engineers will design profile wall pipe and other non-pressure pipe applications to a 5% defection limit but allow spot defections up to 7.5% during field inspection." (Plastic Pipe Institute, 2019). Based on this, a 5% deflection limit will be used for this design to be conservative.

The elastic modulus for HDPE pipe material (E_p) was reduced to 21,170 pounds per square inch (psi) to account for potential creep effects assuming a temperature of 100° F for 50 years (Plastic Pipe Institute, 2020).

The soil reaction modulus (E') depends on the soil elastic modulus (E_s) which is in turn based on soil stress. (Qian et al 2001).

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$$E' = 2 \times E_s \quad (2)$$

Where:

E' = soil reaction modulus, psi
E_s = soil elastic modulus, psi

The soil elastic modulus was estimated as 6,525 psi (*See Attachment 2 – Determination of Soil Elasticity Modulus*).

Parameter Sources

Table 2 summarizes the sources used to gather the various parameters made in these calculations.

Table 1. Sources of Pipe and Soil Parameters

	Parameter	Source
HDPE Pipe	Dimensions (*OD, ID,* t_p)	ISCO Pipe Catalog
	Perforation	CTI 2020
	Elastic Modulus (E_p)	Plastic Pipe Institute, 2020
	Acceptable Deflection	ASTM F1962-11, Handbook of PE Pipe
Soil	Unit Weights (γ_c, γ_d, γ_{waste})	Soil – typical values Waste – based on historical site-specific waste density
	Elastic Modulus (E_s)	Attachment 1
Misc.	Modified Iowa Method Parameters	Moser 1990

CALCULATIONS AND RESULTS

Vertical Deflection – Modified Iowa State Method

An engineering approach to estimate the deflection of buried pipes was developed by a group of research faculty and students at Iowa State University. Equation 6 is a summary of the effort of the Iowa State Group's to model buried, flexible pipe deflection (Moser 1990).

$$y \approx \frac{D_L K_b W_P}{\left(E_P I / r^3\right) + \left(0.061 E'\right)} \quad (3)$$

Where:

y = vertical pipe deflection [in]
D_L = deflection lag factor

K_b = bedding constant
W_P = vertical load per unit length (in the pipe length direction) [lb/in]

$$= W \times \left(\frac{12}{12 - (D \times N)} \right)$$

W = unadjusted (for perforation) vertical load per unit length [lb/ft]

$$= \sum \gamma_i H_i$$

γ_i = unit weight of material i on the pipe
H_i = thickness of material i
OD = outside diameter of pipe [in]
D = diameter of perforations [in]
N = number of perforation per row per linear foot of pipe
E_P = modulus of elasticity of pipe material [psi]
I = moment of inertia of the pipe wall per unit length [in^3]
r = mean radius of pipe [in]

$$= \frac{OD - t_p}{2}$$

E' = soil reaction modulus [psi]

Since the conservative Prism Load Method is being applied, no adjustment for lag is required. Therefore the deflection lag factor is set to 1.0. It is typical in designs to assume a bedding constant of 0.1, as this is also a conservative value (Moser 1990).

Once the vertical pipe deflection is determined, the corresponding percent pipe wall strain/deflection ratio can be calculated as follows.

$$\varepsilon = \frac{y}{2r} \times 100\% \qquad (4)$$

Where:
ε = pipe wall strain/deflection ratio
y = vertical pipe deflection [in]
r = mean radius of pipe [in]

Wall Buckling

Local wall buckling is a longitudinal wrinkling of the pipe wall. Although wall buckling is seldom the limiting factor in the design of a pipe-soil system, a check can be made according to Equation 8 (Moser 1990).

CALCULATION SHEET

Client: Wayne Disposal | Project No.: 1218070017

Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification | Calculated By: NSG | Date: 10/5/2021

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Approved By: XZ | Date: 10/7/2021

$$FS = \frac{P_{cb}}{\sigma_z} = \frac{0.8\sqrt{\frac{2E'E_P}{SDR^3}}}{\sigma_z} \quad (5)$$

Where:

P_{cb} = critical buckling pressure at top of pipe [psi]

σ_z = actual vertical pressure on the pipe [psi]

E' = modulus of soil reaction [psi]

E_p = modulus of elasticity of pipe material [psi]

SDR = standard dimension ratio = OD/t_p

OD = outside diameter of pipe [in]

T_p = pipe wall thickness [in]

A calculation spreadsheet, based on equations presented in the previous section, was developed to analyze pipe strength. See Table 3 for calculation details of HDPE pipes in the proposed modification area.

CALCULATION SHEET
Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: LCS Pipe Strength and Deflection

Project No.: 1218070017
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Table 2. Pipe Deflection and Buckling Strength Worksheet for MC VI E, MC VI F, and MC VI G Leachate Collection pipes

Item	Notation	Units	1 8" HDPE SDR 11 Perforated	2 8" HDPE SDR 9 Perforated	3 6" HDPE SDR 7 Perforated	4 6" HDPE SDR 7.3 Perforated
Vertical load						
Design vertical stress on pipe	H_{refuse}	ft	250.0	250.0	250.0	250.0
	σ_z	psf	25,870	25,870	25,870	25,870
		psi	179.7	179.7	179.7	179.7
Outside diameter of pipe	*OD*	in	8.625	8.625	6.625	6.625
Inside Diameter of pipe	*ID*	in	6.963	6.593	4.619	4.701
Pipe Wall Thickness *OD/SDR*	t_p	in	0.784	0.958	0.946	0.908
Unadjusted vertical load per unit length $W = \gamma * H * OD$	*W*	lbs/in	1550	1550	1190	1190
Dia. of perforations	*D*	in	0.50	0.50	0.25	0.25
No. of Perforation Rows per foot	*N*		**2**	**2**	**6**	**6**
Modified Vertical stress $W_p = W*(12/(12-(D*N)))$	W_p	lbs/in	1690	1690	1360	1360
Vertical Deflection (Modified Iowa Method)						
Deflection Lag factor	D_L		1.00	1.00	1.00	1.00
Mean Pipe radius $r = (OD-t_p)/2$	*r*	in	3.92	3.83	2.84	2.86
Bedding Constant	K_b		0.10	0.10	0.10	0.10
Soil Modulus of Elasticity	E_s	psi	6564.8	6564.8	6564.8	6564.8
Modulus Soil Reaction $E' = 2E_s$	*E'*	psi	13,130	13,130	13,130	13,130
Pipe Modulus of elasticity	E_p	psi	21,170	21,170	21,170	21,170
Moment of Inertia $I = (t_p^3/12)$	*I*	in^3	0.0402	0.0733	0.0706	0.0623
Vertical Deflection $y = [(D_L K_b W_p)/((E_p I/r^3)+(0.061E_s)]$	*y*	in	0.2074	0.2040	0.1570	0.1587
Percentage Deflection *y/(2r) for both PVC and HDPE*	ε	%	**2.6%**	**2.7%**	**2.8%**	**2.8%**
Limiting Strain for HDPE pipe		%	5.0%	5.0%	5.0%	5.0%
Buckling Analysis (for HDPE pipes only)						
Critical Buckling Pressure $P_{bc} = 0.8*(2E_s E_P/SDR^3)^{0.5}$	P_{bc}	psi	517.01	698.60	1018.46	956.33
Required Factor of Safety	*FS*		*1.0*	*1.0*	*1.0*	*1.0*
Provided F.S against wall buckling $FS = P_{bc}/[\sigma z/(1-nd/12)]$	*FS*		**2.6**	**3.6**	**5.0**	**4.7**

CONCLUSIONS

The vertical deflection and factors of safety against buckling and collapse were examined for the leachate collection pipes in the proposed modification. The strength and deflection analyses are shown in Table 3.

Based on the results in Table 3 for the MC VI E, MC VI F, and MC VI G leachate collection pipes, it is concluded that the calculations indicate acceptable levels of deflection will occur and an adequate factor of safety is provided against buckling for 8" SDR-11, 8" SDR-9, 6" SDR-7.3, and 6" SDR-7.

CALCULATION SHEET

Project No.: 1218070017
Client: Wayne Disposal — Calculated By: NSG — Date: 10/5/2021
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification — Checked By: CAB — Date: 10/7/2021
Calculation: LCS Pipe Strength and Deflection — Approved By: XZ — Date: 10/7/2021

REFERENCES

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CALCULATION SHEET

Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: LCS Pipe Strength and Deflection

Project No.: 1218070017
Calculated By: NSG Date: 10/5/2021
Checked By: CAB Date: 10/7/2021
Approved By: XZ Date: 10/7/2021

ATTACHMENTS

CALCULATION SHEET

Project No.: 1218070017
Client: Wayne Disposal — Calculated By: NSG — Date: 10/5/2021
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification — Checked By: CAB — Date: 10/7/2021
Calculation: LCS Pipe Strength and Deflection — Approved By: XZ — Date: 10/7/2021

Attachment A-3.2.1
Pipe Properties Charts

CALCULATION SHEET

Client: Wayne Disposal | Project No.: 1218070017

Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification | Calculated By: NSG | Date: 10/5/2021

Calculation: LCS Pipe Strength and Deflection | Checked By: CAB | Date: 10/7/2021

Approved By: XZ | Date: 10/7/2021

TABLE B.1.1

Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

(1) Although there are various factors that determine the exact apparent modulus response of a PE, a major factor is its ratio of crystalline to amorphous content – a parameter that is reflected by a PE's density. Hence, the major headings PE2XXX, PE3XXX and, PE4XXX, which are based on PE's Standard Designation Code. The first numeral of this code denotes the PE's density category in accordance with ASTM D3350 (An explanation of this code is presented in Chapter 5).

(2) The values in this table are applicable to both the condition of sustained and constant loading (under which the resultant strain increases with increased duration of loading) and that of constant strain (under which an initially generated stress gradually relaxes with increased time).

(3) The design values in this table are based on results obtained under uni-axial loading, such as occurs in a test bar that is being subjected to a pulling load. When a PE is subjected to multi-axial stressing its strain response is inhibited, which results in a somewhat higher apparent modulus. For example, the apparent modulus of a PE pipe that is subjected to internal hydrostatic pressure – a condition that induces bi-axial stressing – is about 25% greater than that reported by this table. Thus, the Uni-axial condition represents a conservative estimate of the value that is achieved in most applications.

It should also be kept in mind that these values are for the condition of continually sustained loading. If there is an interruption or a decrease in the loading this, effectively, results in a somewhat larger modulus.

In addition, the values in this table apply to a stress intensity ranging up to about 400psi, a value that is seldom exceeded under normal service conditions.

(Plastic Pipe Institute, 2020, Ch. 3)

CALCULATION SHEET

Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: LCS Pipe Strength and Deflection

Project No.: 1218070017
Calculated By: NSG Date: 10/5/2021
Checked By: CAB Date: 10/7/2021
Approved By: XZ Date: 10/7/2021

TABLE B.1.2

Temperature Compensating Multipliers for Determination of the Apparent Modulus of Elasticity at Temperatures Other than at 73°F (23°C)

Equally Applicable to All Stress-Rated PE's (e.g., All PE2xxx's, All PE3xxx's and All PE4xxx's)

Maximum Sustained Temperature of the Pipe °F (°C)	Compensating Multiplier
-20 (-29)	2.54
-10 (-23)	2.36
0 (-18)	2.18
10 (-12)	2.00
20 (-7)	1.81
30 (-1)	1.65
40 (4)	1.49
50 (10)	1.32
60 (16)	1.18
73.4 (23)	1.00
80 (27)	0.93
90 (32)	0.82
100 (38)	0.73
110 (43)	0.64
120 (49)	0.58
130 (54)	0.50
140 (60)	0.43

(Plastic Pipe Institute, 2020, Ch. 3)

CALCULATION SHEET

Project No.: 1218070017
Client: Wayne Disposal — Calculated By: NSG — Date: 10/5/2021
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Calculation: LCS Pipe Strength and Deflection — Approved By: XZ — Date: 10/7/2021

PE 4710 IPS HDPE Pipe Sizes

Pressure Rating	Nominal Size	1"	1 1/4"	1 1/2"	2"	3"	4"	5"	6"	8"	10"
	Actual O.D.	1.32"	1.660"	1.90"	2.38"	3.500"	4.50"	5.563"	6.625"	8.625"	10.750"
DR 7 (333psi)	Min. wall	0.188"	0.237"	0.271"	0.339"	0.500"	0.643"	0.795"	0.946"	1.232"	1.536"
	Average I.D.	0.917"	1.157"	1.325"	1.656"	2.440"	3.137"	3.878"	4.619"	6.013"	7.494"
	Weight lb/lf	0.291	0.463	0.607	0.950	2.060	3.402	5.200	7.374	12.498	19.416
DR 7.3 (312psi)	Min. wall	0.180"	0.227"	0.260"	0.325"	0.479"	0.616"	0.762"	0.908"	1.182"	1.473"
	Average I.D.	0.933"	1.178"	1.348"	1.685"	2.484"	3.193"	3.947"	4.701"	6.120"	7.628"
	Weight lb/lf	0.281	0.450	0.590	0.920	1.990	3.290	5.022	7.130	12.070	18.750
DR 9 (250psi)	Min. wall	0.146"	0.184"	0.211"	0.264"	0.389"	0.500"	0.618"	0.736"	0.958"	1.194"
	Average I.D.	1.005"	1.269"	1.452"	1.816"	2.676"	3.440"	4.253"	5.064"	6.593"	8.218"
	Weight lb/lf	0.235	0.374	0.490	0.770	1.664	2.751	4.204	5.963	10.110	15.700
DR 11 (200psi)	Min. wall	0.120"	0.151"	0.173"	0.216"	0.318"	0.409"	0.506"	0.602"	0.784"	0.977"
	Average I.D.	1.062"	1.340"	1.534"	1.917"	2.825"	3.633"	4.491"	5.348"	6.963"	8.678"
	Weight lb/lf	0.200	0.314	0.411	0.642	1.395	2.310	3.523	5.000	8.470	13.160

(*ISCO Product Catalog*)

Designation: F1962 – 11

Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings[1]

This standard is issued under the fixed designation F1962; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

X2.6 *Deflection Limits*—The limiting deflection (in percent) is determined by the geometric stability of the deflected pipe, hydraulic capacity, and the strain occurring in the pipe wall. It has been observed that for PE, pressure-rated pipe, subjected to soil pressure only, no upper limit from a practical design point of view seems to exist for the bending strain (**15**). Therefore, for non-pressure pipes or conduits the safe long-term deflection is 7.5 % of the diameter. When subjected to internal pressure in addition to soil pressure, the localized bending strain resulting from deflection combines with the hoop tensile strain caused by internal pressure to produce a higher, localized tensile fiber-stress. However, as the internal pressure is increased the pipe re-rounds and the bending strain is reduced. At high pressures, the bending strain is reduced and the ring tensile stress approaches that due to internal pressure alone. For calculation method, see Ref. (**16**). This fact coupled with the ductility of PE permits the designer to ignore the combined effect of pressure and deflection. In lieu of an exact calculation based on allowable strain, the designer can use the safe long-term design deflection values for pressure pipe shown to Table X2.1.

TABLE X2.1 Safe Long-Term Design Deflection values for Buried Pressurized Polyethylene Pipe

DR or SDR	Deflection Limits as % of Diameter
21	7.5
17	6.0
15.5	6.0
13.5	6.0
11	5.0
9	4.0
7.3	3.0

(**15**) Janson, L.E.," Long-Term Studies of PVC and PE Pipes Subjected to Forced Constant Deflection", Report No. 3, KP-Council, Stockholm, Sweden, 1991.
(**16**) Janson, L.E., *Plastics Pipes for Water Supply and Sewage Disposal*, Borealis, Stockholm, Sweden, 1995.

CALCULATION SHEET

Project No.: 1218070017
Client: Wayne Disposal — Calculated By: NSG — Date: 10/5/2021
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification — Checked By: CAB — Date: 10/7/2021
Calculation: LCS Pipe Strength and Deflection — Approved By: XZ — Date: 10/7/2021

Attachment A-3.2.2
Determination of Soil Elasticity Modulus

CALCULATION SHEET
Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Attachment 2 – Soil Modulus Determination

Project No.: 1218070017
Calculated By: NSG Date: 10/1/2021
Checked By: CAB Date: 10/4/2021
Approved By: Date:

DETERMINATION OF SOIL MODULUS OF ELASTICITY

OBJECTIVE

Determine an appropriately conservative soil modulus of elasticity (E_s) for use in calculating the strength of the for Master Cell VI-G, Master Cell VI-F, and Master Cell VI-E leachate pipes due to the proposed final grade adjustments.

ASSUMPTIONS AND METHODOLOGY

Calculation of E_s

The following assumptions were made to ensure the accuracy of the final calculated value while preserving conservatism.

- The pipe under strength analysis is to be backfilled with stone (gravel).
- Maximum estimated stress on leachate collection for Master Cell VI-G, Master Cell VI-F, and Master Cell VI-E leachate collection pipes = 179.7 psi
- Soil modulus of elasticity can be conservatively calculated as follows (from Table 1).

$$E_s = 2 \cdot q_c \quad \text{[psi]} \qquad (1)$$

Where:
q_c = Cone Penetration Test (CPT) value [psi]

The CPT value of the stone is not available through direct test data, but it can be estimated using the friction angle and relative density. The following values were conservatively estimated based on likely properties that the gravel backfill would possess:

- Friction angle (ϕ) = 32°
- Relative Density (D_R) = 70%

CALCULATION SHEET
Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Attachment 2 – Soil Modulus Determination

Project No.: 1218070017
Calculated By: NSG Date: 10/1/2021
Checked By: CAB Date: 10/4/2021
Approved By: Date:

Table 1. Equations for computing E_s by making use of SPT and CPT values [kpa] (Murthy 2003)

Soil	SPT	CPT
Sand (normally consolidated)	500 (N_{cor} + 15) (35000 to 50000) log N_{cor} (U.S.S.R Practice)	2 to 4 q_c (1+ D_r^2) q_c
Sand (saturated)	250 (N_{cor} + 15)	
Sand (overconsolidated)	–	6 to 30 q_c
Gravelly sand and gravel	1200 (N_{cor} + 6)	
Clayey sand	320 (N_{cor} + 15)	3 to 6 q_c
Silty sand	300 (N_{cor} + 6)	1 to 2 q_c
Soft clay	–	3 to 8 q_c

Figure 1 shows an accepted correlation between these two properties and the CPT value, as well as stress state (in terms of horizontal stress, calculated in Equation 2)

$$\sigma_h = k_0 \cdot \sigma_v \quad \text{[psi]} \tag{2}$$

Where:

σ_h = Horizontal stress due to overburden pressure [psi]

k_0 = Lateral earth pressure coefficient
= 0.36 (conservative assumption, Table 2)

σ_v = Stress due to overburden soils
= 179.7 psi for the for Master Cell VI-G, Master Cell VI-F, and Master Cell VI-E leachate collection pipes

Table 2. Coefficients of Earth Pressure for "at-rest" condition (Murthy 2003)

Type of soil	I_p	K_0
Loose sand, saturated	–	0.46
Dense sand, saturated	–	0.36
Dense sand, dry (e = 0.6)	–	0.49
Loose sand, dry (e = 0.8)	–	0.64
Compacted clay	9	0.42
Compacted clay	31	0.60
Organic silty clay, undisturbed (w_l = 74%)	45	0.57

Thus, once certain properties are known / calculated, the CPT value can be inferred and ultimately the soil modulus determined.

CALCULATION SHEET
Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Attachment 2 – Soil Modulus Determination

Project No.: 1218070017
Calculated By: NSG Date: 10/1/2021
Checked By: CAB Date: 10/4/2021
Approved By: Date:

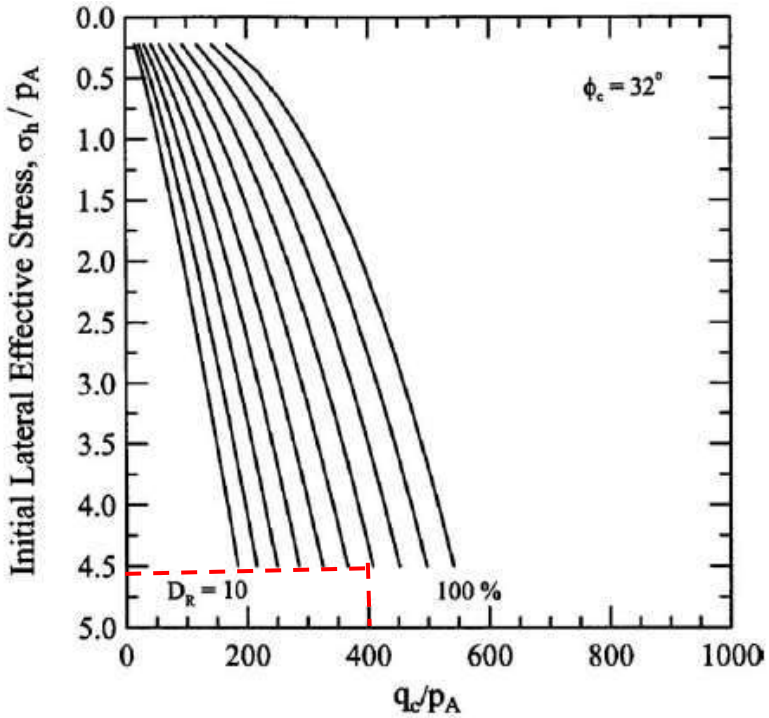

Figure 1. Correlation between Stress, Relative Density and CPT value for ϕ = 32º (Salgado and Prezzi 2007)

Extrapolation of E_s

In addition to the aforementioned calculation approach (known to be conservative), the previously approved correlation between stress and soil modulus developed by Selig (1990) and referenced by Qian et al (2001) will be extrapolated for comparison with the calculated value.

CALCULATIONS AND RESULTS

- The horizontal stress (σ_h in Equation 2) was calculated as 64.7 pounds per square inch (psi).
- The σ_h / p_A ratio is therefore 4.6 (p_A = standard reference stress = 1 tsf = 13.88 psi) correlating to a q_c / p_A ratio of approximately 400. This yields a CPT value of 11,100 psi.
- Finally, the soil modulus (E_s in equation 1) is calculated to be **22,200 psi**.

Another method of analysis uses Table 3 as the basis of determining the soil modulus E_s.

CALCULATION SHEET
Client: Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Attachment 2 – Soil Modulus Determination

Project No.: 1218070017
Calculated By: NSG Date: 10/1/2021
Checked By: CAB Date: 10/4/2021
Approved By: Date:

Table 3. Elasticity of Soil Under Stress (Selig 1990 c/o *Qian et al 2001*)

Soil Type	Stress Level		85% Standard Density			95% Standard Density		
			E_s			E_s		
	psi	kPa	psi	MPa	ν_s	psi	MPa	ν_s
SW, SP, GW, GP	1	7	1,300	9	0.26	1,600	11	0.40
	5	35	2,100	14	0.21	4,100	28	0.29
	10	70	2,600	18	0.19	6,000	41	0.24
	20	140	3,300	23	0.19	8,600	59	0.23
	40	280	4,100	28	0.23	13,000	90	0.25
	60	420	4,700	32	0.28	16,000	110	0.29
GM, SM, ML, and GC, SC with < 20% fines	1	7	600	4	0.25	1,800	12	0.34
	5	35	700	5	0.24	2,500	17	0.29
	10	70	800	6	0.23	2,900	20	0.27
	20	140	850	6	0.30	3,200	22	0.29
	40	280	900	6	0.38	3,700	25	0.32
	60	420	1,000	7	0.41	4,100	28	0.35
CL, MH, GC, SC	1	7	100	1	0.33	400	3	0.42
	5	35	250	2	0.29	800	6	0.35
	10	70	400	3	0.28	1,100	8	0.32
	20	140	600	4	0.25	1,300	9	0.30
	40	280	700	5	0.35	1,400	10	0.35
	60	420	800	6	0.40	1,500	10	0.38

- This approved correlation is plotted in Figure 2, showing a coefficient of determination (i.e. accuracy of trend line).

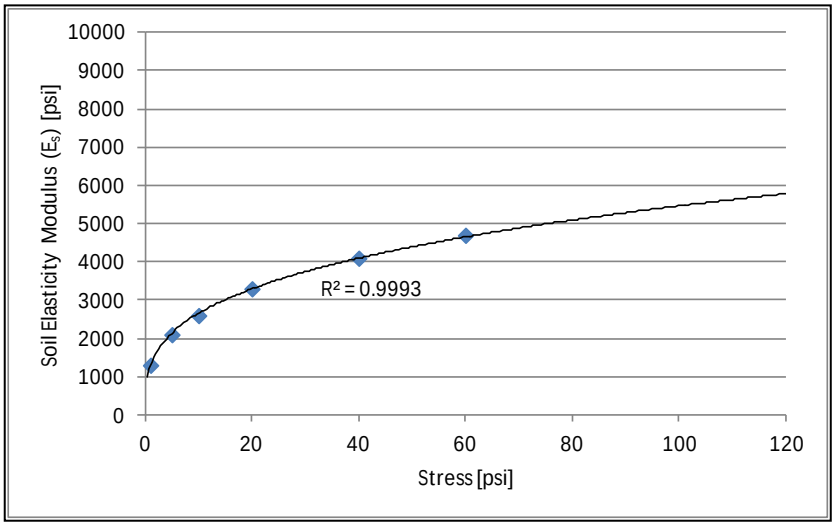

Figure 2. Correlation between overburden stress and soil elasticity modulus (from Table 3)

- The equation of the trend line shown is given below. Equation 3 was used to estimate E_s under the specified overburden pressure for both the horizontal and vertical expansion cases.

$$E_s = 1281.6\sigma_v^{0.3147} \quad (3)$$

- This correlation indicates that at 179.7 psi (estimated overburden scenario) the soil modulus of elasticity will be approximately **6,565 psi**.

- To preserve a conservative calculation, the smaller values of elastic modulus – 6,565 psi for horizontal expansion cells will be used in the pipe strength and deflection analysis.

REFERENCES

Murthy, V.N.S. (2003) *Geotechnical Engineering: Principles and Practices of Soils Mechanics and Foundation Engineering* Marcel Dekker, Inc., New York, NY.

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Attachment A-4

Leachate Collection System Flow Capacity Analysis

CALCULATION SHEET

Client: US Ecology - Wayne Disposal | Project No.: 1218070017

Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification | Calculated By: LEH | Date: 6/2/21

Calculation: Leachate Collection System Flow Capacity Analysis | Checked By: NSG | Date: 10/4/2021

Approved By: XZ | Date: 10/6/2021

Leachate Collection System Flow Capacity Analysis

Objective

To evaluate the flow capacity of the leachate collection system as a part of the proposed MC VI-G operation in Cell G4, G5, G6 and G7 at Wayne Disposal Inc. (WDI).

Design Criteria, Assumptions, and Methodology

1. The leachate collection system of the proposed design MC VI G4, G5, G6 and G7 are described below:

    a. The constructed system in MC VI G4, G5, G6, and G7 all consist of one layer of geocomposite, a 8-inch HDPE SDR-9 or 11 perforation pipe, and a 12-inch thick drainage sand layer.

2. Use Manning's equation to calculate the allowable leachate collection pipe flow:

$$Q_{pipe} = \frac{1.49}{n} A R_h^{2/3} S^{1/2} \qquad (1)$$

where;

Q_{pipe} = allowable flow rate, cubic feet per second (ft^3/sec),
n = Manning's roughness coefficient ≈ 0.011 for HDPE or PVC pipe,
A = cross-sectional area of the pipe, square feet (ft^2)
R_h = hydraulic radius, feet = ID/4 for full flow,
S = slope of pipe, minimum 1% after settlement.

CALCULATION SHEET

Client: US Ecology - Wayne Disposal | Project No.: 1218070017
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification | Calculated By: LEH | Date: 6/2/21
Calculation: Leachate Collection System Flow Capacity Analysis | Checked By: NSG | Date: 10/4/2021
Approved By: XZ | Date: 10/6/2021

For a partial flow pipe:

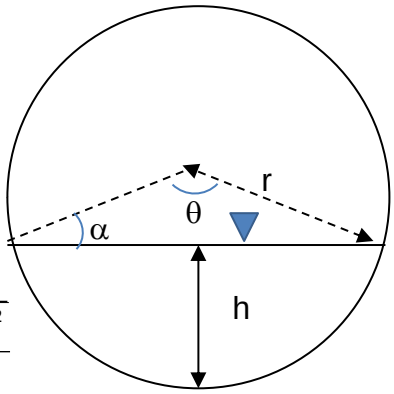
$$\alpha = \sin^{-1}\frac{r-h}{r} \quad \text{in radians}$$

$$\theta = \pi\text{-}2\alpha$$

$$\text{Wet Area}: \ A = r^2\frac{\theta}{2} - (r-h)\left(\sqrt{2rh-h^2}\right)$$

$$\text{Wet Perimeter}: \ P = r\theta$$

$$\text{Hydraulic Radius}: \ R_h = \frac{A}{P} = \frac{r}{2} - \frac{(r-h)\sqrt{2rh-h^2}}{r\theta}$$



Where:

r = pipe radius (ft)
h = liquid depth in the pipe (ft)

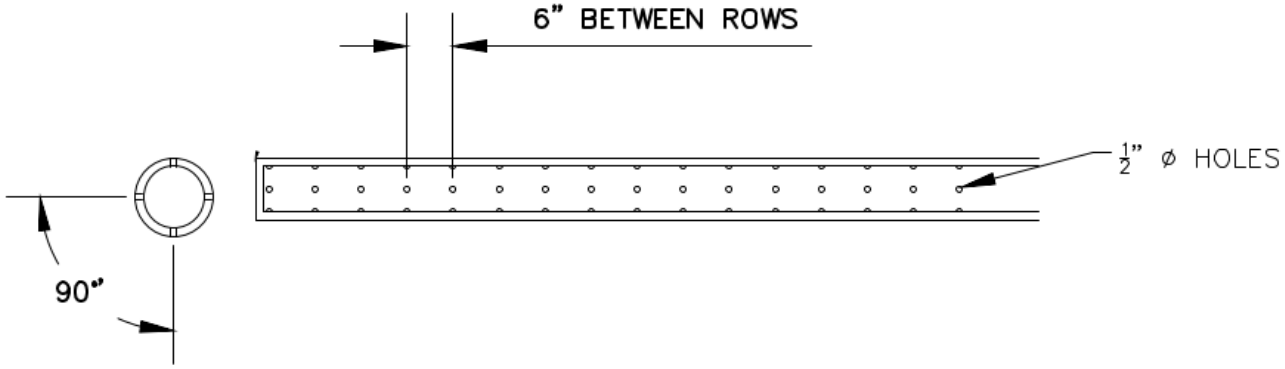
3. Leachate collection pipes used (or to be used) in Cell G4, G5, G6 and G7 are 8-inch diameter SDR 9 or 11 HDPE pipes with an average inside diameter (ID) of 6.593 inches (SDR 9 ID used for conservatism).

4. Flow rate for each orifice (pipe perforation) is calculated as follows [1]:

$$Q_{orifice} = CAV_{ent} \qquad (2)$$

Where
$Q_{orifice}$ = flow rate, cubic feet per second (ft^3/sec)
C = discharge coefficient = 0.62 [1]
A = area of orifice, square feet (ft^2)
V_{ent} = limit leachate entrance velocity, 0.1 feet per square second (ft/sec)

5. Perforations of leachate collection pipes used in MC VI G4, G5, G6 and G7 are ½ inches in diameter. Four rows of perforations along the bottom portion of the pipe were drilled with 6-inch spacing between perforations. To be conservative, it is assumed that only the bottom two rows of perforations are submerged under leachate.



CALCULATION SHEET

Project No.: 1218070017
Client: US Ecology - Wayne Disposal — Calculated By: LEH — Date: 6/2/21
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification — Checked By: NSG — Date: 10/4/2021
Calculation: Leachate Collection System Flow Capacity Analysis — Approved By: XZ — Date: 10/6/2021

6. The 8-inch leachate collection pipes in MV VI G4, G5, G6 and G7 are assumed to flow ½ full (See Appendix B-1 for detail).

7. Leachate generation was modeled using the HELP Model. The estimated leachate generation rate for the floor area and the sideslope areas is 6,560 gallons/acre/day (gpad) and 6,674 gpad, respectively. For the analysis area, the higher value of 6,674 gpad for the sideslopes was used for all pipes for conservatism.

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Collection System Flow Capacity Analysis

Project No.: 1218070017
Calculated By: LEH Date: 6/2/21
Checked By: NSG Date: 10/4/2021
Approved By: XZ Date: 10/6/2021

Calculation

Leachate Collection System - Pipe Flow Capacity

MC VI G4, G5, G6 & G7:

Assuming the pipe is flowing full.

$$Q_{allow} = \frac{1.49}{n} A R_h^{\frac{2}{3}} S^{\frac{1}{2}} = \frac{1.49}{0.011}\left(\frac{\pi}{4}\left(\frac{6.593}{12}\right)^2\right)\left(\frac{6.593}{4\times 12}\right)^{\frac{2}{3}}(0.01)^{\frac{1}{2}} = 0.85\frac{ft^3}{s} = 552{,}498 gpd$$

Assuming the pipe is flowing ½ full (r=h, θ=π).

$$Q_{allow} = \frac{1.49}{n} A R_h^{2/3} S^{1/2} = (1.49/0.011)(0.119)(0.137)^{2/3}(0.01)^{1/2}$$

$$= 0.43 \text{ ft}^3/\text{s} = 192 \text{ gpm} = 276{,}249 \text{ gpd}$$

Where:

$$A = r^2\frac{\theta}{2} = \left(\frac{3.2965}{12}\right)^2 \times \frac{3.14}{2} = 0.119\, ft^2$$

$$R_h = \frac{A}{P} = \frac{r}{2} = \left(\frac{3.2965}{12}\right) \times \frac{1}{2} = 0.137 ft$$

S = 1%

Leachate Collection System – Perforation Flow Capacity

MC VI G4, G5, G6 & G7 :

$$Q_{orifice} = CVA = 0.62 \times 0.1 \times \frac{\pi d^2}{4}$$

$$= 0.062 \times \frac{\pi(0.5/12)^2}{4}$$

$$= 8.45 \times 10^{-5} \text{ ft}^3/\text{sec}$$

$$= 54.64 \text{ gallon/day}$$

The total flow capacity for the perforations can be determined using the following equation and the results are presented in Table 1:

$$Q_{perforation} = n \times L \times Q_{orifice}$$

Where
$Q_{perforation}$ = total flow capacity through the perforations (gpd)
n = number perforation per foot (4 holes per foot)
L = perforated pipe length (ft)

CALCULATION SHEET

Client: US Ecology - Wayne Disposal | Project No.: 1218070017

Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification | Calculated By: LEH | Date: 6/2/21

Calculation: Leachate Collection System Flow Capacity Analysis | Checked By: NSG | Date: 10/4/2021

Approved By: XZ | Date: 10/6/2021

Table 1. Flow Capacity for the Pipe Perforations

	MC VI G4	MC VI F2	MC VI F3	MC VI F4
Leachate collection pipe length (ft)	364	507	681	595
Maximum flow capacity of perforation (gpd)	79,549	110,801	148,827	130,032
Estimated leachate generation based upon HELP Model (gpd)	24,714	33,509	47,693	40,253

Conclusion

Based on the above calculations, flow capacities of leachate collection pipes and perforations are shown in Table 2. Note that the geocomposite layer and stone pack around the pipe can provide additional flow capacity for leachate collection system. Therefore, the presented value is conservative.

Table 2. Flow Capacity for the Leachate Collection Systems

	MC VI G4	MC VI G5	MC VI G6	MC VI G7
Flow Capacity of Collection pipe (gpd)	276,249	276,249	276,249	276,249
Maximum flow capacity of perforation (gpd)	79,549	110,801	148,827	130,032
Cell Acreage (acres)	3.70	5.02	7.15	6.03
Estimated leachate generation based upon HELP Model (gpd)	24,714	33,509	47,693	40,253

Note: Pipe flow capacities are based on half full pipe conditions

Reference

1. Qian, Xuede; Koerner, Robert; and Gray, Donald "Geotechnical Aspects of Landfill Design and Construction" Prentice Hall, 2001.

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Collection System Flow Capacity Analysis

Project No.: 1218070017
Calculated By: LEH Date: 6/2/21
Checked By: NSG Date: 10/4/2021
Approved By: XZ Date: 10/6/2021

ATTACHMENT A-4.1

PIPE SIZES

CALCULATION SHEET

Client: US Ecology - Wayne Disposal | Project No.: 1218070017

Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification | Calculated By: LEH | Date: 6/2/21

Calculation: Leachate Collection System Flow Capacity Analysis | Checked By: NSG | Date: 10/4/2021

Approved By: XZ | Date: 10/6/2021

HDPE Pipe
Source: www.hdpepipeco.com

PE 3608/3408 IPS HDPE PIPE SIZES

Pressure Rating		DR 7 (267psi)			DR 7.3 (254psi)			DR 9 (200psi)			DR 11 (160psi)			DR 13.5 (128psi)			DR 15.5 (110psi)		
Nominal Size	Actual O.D.	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf
3/4"	1.05"	0.150"	0.732"	0.184	0.144"	0.745"	0.178	0.117"	0.803"	0.150	0.095"	0.848"	0.125	--	--	--	--	--	--
1"	1.315"	0.188"	0.917"	0.289	0.180"	0.933"	0.279	0.146"	1.005"	0.234	0.120"	1.062"	0.197	--	--	--	--	--	--
1 1/4"	1.66"	0.237"	1.157"	0.460	0.227"	1.178"	0.444	0.184"	1.269"	0.372	0.151"	1.340"	0.312	--	--	--	--	--	--
1 1/2"	1.90"	0.271"	1.325"	0.603	0.260"	1.348"	0.582	0.211"	1.452"	0.488	0.173"	1.534"	0.409	--	--	--	--	--	--
2"	2.375"	0.339"	1.656"	0.943	0.325"	1.685"	0.762	0.264"	1.816"	0.762	0.216"	1.917"	0.639	0.176"	2.002"	0.531	0.153"	2.050"	0.467
3"	3.500"	0.500"	2.440"	2.047	0.479"	2.484"	1.656	0.389"	2.676"	1.656	0.318"	2.825"	1.387	0.259"	2.950"	1.153	0.226"	3.021"	1.015
4"	4.500"	0.643"	3.137"	3.384	0.616"	3.193"	2.737	0.500"	3.440"	2.737	0.409"	3.633"	2.294	0.333"	3.793"	1.906	0.290"	3.885"	1.678
5"	5.375"	0.768"	3.747"	4.830	0.736"	3.814"	4.663	0.597"	4.109"	3.903	0.489"	4.339"	3.272	0.398"	4.531"	2.718	0.347"	4.640"	2.396
5"	5.563"	0.795"	3.878"	5.172	0.762"	3.947"	4.182	0.618"	4.253"	4.182	0.506"	4.491"	3.505	0.412"	4.689"	2.912	0.359"	4.802"	2.564
6"	6.625"	0.946"	4.619"	7.336	0.908"	4.701"	5.932	0.736"	5.064"	5.932	0.602"	5.348"	4.971	0.491"	5.585"	4.130	0.427"	5.719"	3.637
7"	7.125"	1.018"	4.967"	8.195	0.976"	5.056"	8.200	0.792"	5.447"	6.863	0.648"	5.752"	5.750	0.528"	6.006"	4.779	0.460"	6.150"	3.985
8"	8.625"	1.232"	6.013"	12.433	1.182"	6.120"	10.054	0.958"	6.593"	10.054	0.784"	6.963"	8.425	0.639"	7.271"	7.001	0.556"	7.445"	6.164
10"	10.750"	1.536"	7.494"	19.314	1.473"	7.628"	15.618	1.194"	8.218"	15.618	0.977"	8.678"	13.089	0.796"	9.062"	10.875	0.694"	9.280"	9.576
12"	12.750"	1.821"	8.889"	27.170	1.747"	9.047"	21.970	1.417"	9.747"	21.970	1.159"	10.293"	18.412	0.944"	10.748"	15.299	0.823"	11.006"	13.471
14"	14.000"	2.000"	9.760"	32.758	1.918"	9.934"	26.489	1.556"	10.702"	26.489	1.273"	11.302"	22.199	1.037"	11.801"	18.445	0.903"	12.085"	16.242
16"	16.00"	2.286"	11.154"	42.786	2.192"	11.353"	34.598	1.778"	12.231"	34.598	1.455"	12.916"	28.994	1.185"	13.487"	24.092	1.032"	13.812"	21.214
18"	18.00"	2.571"	12.549"	54.151	2.466"	12.773"	43.788	2.000"	13.760"	43.788	1.636"	14.531"	36.696	1.333"	15.173"	30.491	1.161"	15.538"	26.849
20"	20.00"	2.857"	13.943"	66.853	2.740"	14.192"	54.059	2.222"	15.289"	54.059	1.818"	16.145"	45.304	1.481"	16.859"	37.643	1.290"	17.265"	33.146
22"	22.00"	3.143"	15.337"	80.170	3.014"	15.611"	65.412	2.444"	16.818"	65.412	2.000"	17.760"	54.818	1.630"	18.545"	45.548	1.419"	18.991"	40.107
24"	24.00"	3.429"	16.731"	96.267	3.288"	17.030"	92.988	2.667"	18.347"	77.845	2.182"	19.375"	65.237	1.778"	20.231"	54.206	1.548"	20.717"	47.731
26"	26.00"	---	---	---	3.562"	18.449"	110.192	2.889"	19.876"	92.050	2.364"	20.989"	76.563	1.926"	21.917"	63.617	1.677"	22.444"	56.018
28"	28.00"	--	--	--	--	--	--	3.111"	21.404"	106.750	2.545"	22.604"	88.795	2.074"	23.603"	73.781	1.806"	24.170"	64.967
30"	30.00"	--	--	--	--	--	--	3.333"	22.933"	121.633	2.727"	24.218"	101.934	2.222"	25.289"	84.697	1.935"	25.897"	74.580
32"	32.00"	--	--	--	--	--	--	3.556"	24.462"	139.452	2.909"	25.833"	116.670	2.370"	26.975"	96.367	2.065"	27.623"	84.855
34"	34.00"	--	--	--	--	--	--	--	--	--	3.091"	27.447"	130.930	2.519"	28.661"	109.332	2.194"	29.350"	96.209
36"	36.00"	--	--	--	--	--	--	--	--	--	3.273"	29.062"	146.780	2.667"	30.347"	121.960	2.323"	31.076"	107.395
42"	42.00"	--	--	--	--	--	--	--	--	--	--	--	--	3.111"	35.404"	166.800	2.710"	36.255"	146.176
48"	48.00"	--	--	--	--	--	--	--	--	--	--	--	--	3.556"	40.462"	217.895	3.097"	41.435"	175.891
54"	54.00"	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.484"	46.614"	242.649
63"	62.99"	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTE

Attachment A-5

Head-on-Liner Calculations and Minimum Geocomposite Transmissivity

CALCULATION SHEET
Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Head-on-Liner Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/02/2021
Checked By: NSG Date: 10/04/2021
Approved By: XZ Date: 10/5/2021

Leachate Head-on-Liner Analysis for Liner Sideslopes

Objective

To determine the required geocomposite drainage layer transmissivity to maintain less than 1 foot of head on the liner system for the sideslopes for Master Cell VI-G4 through Master Cell VI-G7 at Wayne Disposal Inc. (WDI).

Design Criteria, Assumptions, and Methodology

The analysis was conducted using the following procedures:

1. Estimate the anticipated leachate impingement rate using the leachate generation estimate from the Hydrologic Evaluation of Landfill Performance (HELP) Model. Two separate models were developed for the 3H:1V sideslope area and the floor area. The resultant impingement rate for the floor and sideslope areas are 6,560 and 6,674 gal/acre/day, respectively. See Attachment 5.2 for additional details.

2. MC VI-G4 through MC VI-G7 have a 5% floor slope and sideslopes at 3H:1V. See Figure 1. Two critical sideslopes were analyzed for this analysis. The first was MC VI-G5 which the longest total slope length has a 39 foot long 3H:1V sideslope and 365 feet of 5% floor. The second critical slope was for MC VI-G7. The longest total slope length was a 85 foot long 3.3% floor, a 63 foot long 22.35% sideslope, a 324 foot long 5% floor and a 12 foot long 3H:1V sideslope.

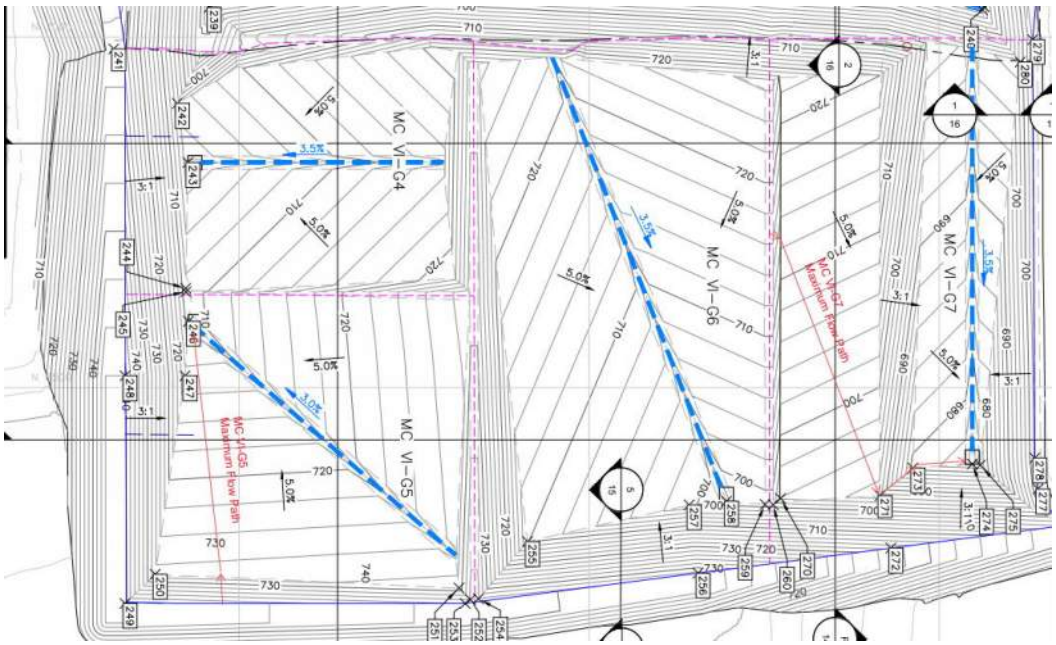


Figure 1 - Cell Layout

3. When the drainage geocomposite is used as part of the leachate collection system, the protection/drainage soil layer is constructed on top of the geocomposite layer. The combine (apparent) hydraulic conductivity of both layers can be calculated as [1]:

$$K_{combined} = K_{geonet} + \left(K_{sand} - K_{geonet}\right)\frac{t_{sand}^{\ 2}}{\left(t_{sand} + t_{geonet}\right)^2} \qquad (1)$$

where,

$K_{combined}$ = combined hydraulic conductivity of the saturated drainage layer (cm/s)
K_{sand} = hydraulic conductivity of the protective/drainage soil (cm/s)
K_{geonet} = hydraulic conductivity of the geonet or geocomposite (cm/s)
t_{sand} = thickness of the saturated protective/drainage soil layer (in)
t_{geonet} = thickness of the geocomposite (in)

4. Vary the transmissivity of the geocomposite to estimate the minimum required drainage geocomposite transmissivity required. An additional cumulative reduction-factor of 5.28 is also applied to the transmissivity of the geocomposite drainage layer based on the following reduction factors based on GRI GC8:

   Reduction Factor for Intrusion – 1.0 – 100 hour test results to be used
   Reduction Factor for Creep – 1.2 – Typical value for high performance geocomposite under high loading
   Reduction factor for Chemical Clogging – 2.0 – highest value from GRI GC8
   Reduction Factor for Biological Clogging – 1.1 – not expected to be significant due to the nature of the waste
   Factor of Safety – 2.0

5. Head-on-Liner Calculation – Numerical Solution of McEnroe's Equation

   The design for MC VI-G4 through MC VI-G7 utilizes a leachate collection pipe that is laid on top of the base liner within a recessed trench.

   The McEnroe 93 Method is an analytical solution form the differential flow governing equation under a free draining condition. However, the differential flow governing equation can be integrated numerically to describe the saturated depth profile without preconditions such as the free draining requirement. This numerical solution of McEnroe's equation can be used to calculate the maximum head-on-liner calculation for all cells (See Attachment 5.1.2: Slope Combined Numerical Method).

   The differential flow governing equation is:

$$Ky\left(\frac{dy}{dx} - \tan\alpha\right)\cos^2\alpha + rx = 0 \qquad (2)$$

where,

K = hydraulic conductivity of the saturated drainage layer (cm/s)
y = saturated liquid depth over the liner (cm or inch)
x = horizontal coordinate (cm or inch)
r = leachate infiltration rate (cm/s)
α = slope angle

Equation 2 can be rearranged in a finite differential form:

$$y_{i+1} = y_i + \left(\tan\alpha - \frac{rx_i}{Ky_i \cos^2\alpha} \right) dx \qquad (3)$$

$$dx = x_{i+1} - x_i$$

Equation 3 can be numerically integrated using a pre-selected saturated liquid depth (y_L) at the low end of the slope where "x" is equivalent to the maximum drainage length (Figure 1). The procedure will result in a full phreatic surface profile and from which, the maximum head-on-liner value can be determined.

Two cases were analyzed: (1) assuming the geocomposite drainage layer in the sand are both conveying leachate to the sump and (2) the case in which the leachate head is maintained within the thickness of the geonet and the sand layer serves only as a protective cover layer above the geocomposite and not as a lateral leachate drainage layer. For the first case, the calculated saturated depth of the sand was iterated until the predicted head on the liner and the saturated thickness converged at approximately 12 inches by varying the geocomposite transmissivity. For the second case, the transmissivity of the geocomposite was adjusted until the flow depth was equal to the thickness of the geonet component (0.20 inches).

CALCULATION SHEET
Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Head-on-Liner Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/02/2021
Checked By: NSG Date: 10/04/2021
Approved By: XZ Date: 10/5/2021

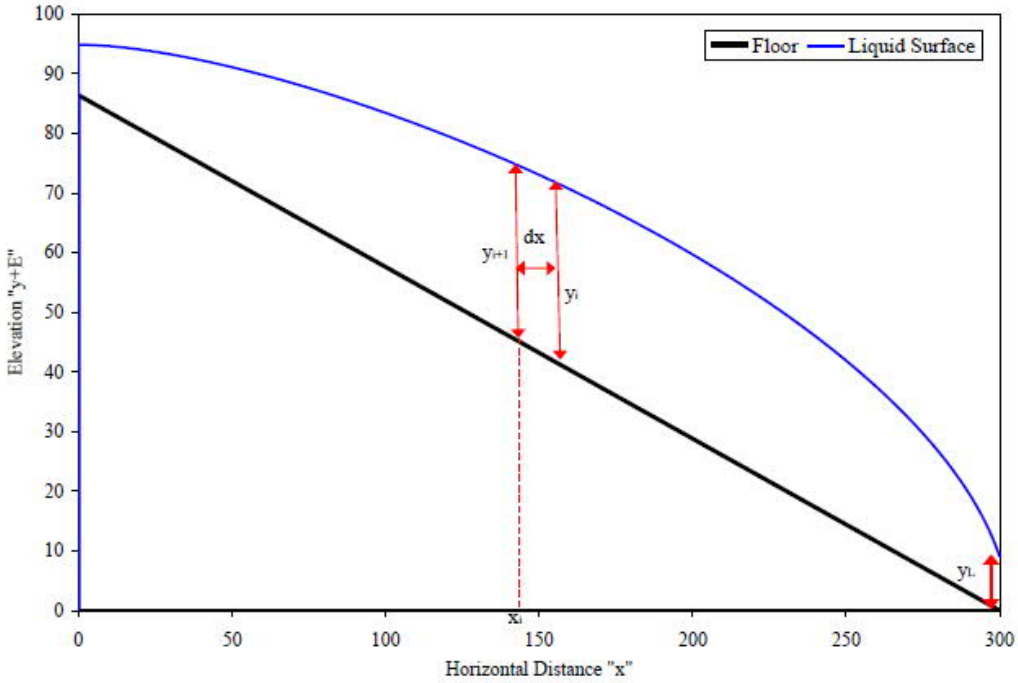


Figure 1. Example of Phreatic Leachate Surface

Calculation

For all cells, the starting leachate depth (y_L) is 0.1-inch since the leachate collection pipes were laid in recessed trenches. An interval of 0.5 inches was used as the incremental distance (dx) to generate a smooth surface. Geocomposite drainage layer transmissivity was adjusted until the predicted leachate thickness was less than 12 inches or less than 0.20 inches for the geocomposite/sand combination or geocomposite-alone analyses, respectively.

Results and Conclusion

The results are summarized in Table 1 for all cells. The minimum transmissivity for MC VI-G5 should be utilized for MC VI-G4 and MC VI-G6 to be conservative. The MC VI-G7 minimum transmissivity is to be utilized for only that cell because of its unique geometry. If the geocomposite transmissivity exceeds the minimum value for each cell neglecting the sand then the sand layer will serve only as a protective cover layer and not serve as a lateral leachate drainage layer.

The maximum leachate head on liner at the toe of the sideslope is below 1 inch in all cases.

CALCULATION SHEET
Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Head-on-Liner Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/02/2021
Checked By: NSG Date: 10/04/2021
Approved By: XZ Date: 10/5/2021

Table 1 – Input Parameters and Minimum Required Geocomposite Transmissivity Results

Parameter	**MC VI-G5**	**MC VI-G5 - Neglecting Sand (2)**	**MC VI-G7**	**MC VI-G7 - Neglecting Sand (2)**
Estimated leachate generation rate - floor (gpad)	6,560	6,560	6,560	6,560
Floor slope used in calculation	5.0%	5.0%	5.0%	5.0%
Maximum drainage distance on floor (ft)	365	365	409	109
Length of 3H:1V sideslope	39	39	75	75
Estimated leachate generation rate - sideslopes (gpad)	6,674	6,674	6,674	6,674
Maximum allowable head-on-liner (in)	12	0.2	12	0.2
Maximum leachate depth at discharge point (in) (at leachate collection pipe)	0.1	0.1	0.1	0.1
Assumed sand permeability (cm/sec) (1)	1.0E-03	n/a	1.0E-03	n/a
Minimum required transmissivity for geocomposite on floor (m^2/sec)	**4.2E-04**	**9.4E-04**	**7.4E-04**	**1.7E-03**
Estimated Maximum Head-on-Liner (inches)	**11.91**	**0.2**	**11.86**	**0.2**

NOTES
(1) Minimum requirement for protective sand layer in Part 115 Rules R299.4423(2)(ii) with geocomposite
(2) Minimum requirement of the geocomposite drainage layer to keep the flow within the thickness of the geonet.

Reference

1. Qian, Xuede; Gray, D.H.; Koerner, R.M. 2004, "Estimation of Maximum Liquid Head over Landfill Barriers", Journal of Geotechnical and Geoenvironmental Engineering, Vol. 130, No.5, Page 488-497.

2. McEnroe, B (1993) "Maximum Saturated Depth over Landfill Liner" Journal of Environmental Engineering, Val. 119, No.2, Page 262-270

CALCULATION SHEET
Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Head-on-Liner Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/02/2021
Checked By: NSG Date: 10/04/2021
Approved By: XZ Date: 10/5/2021

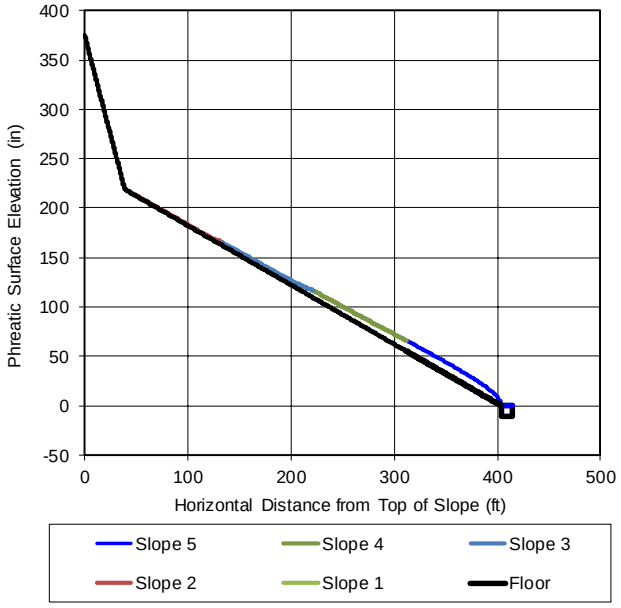
ATTACHMENT A-5.1.1

Head-on-Liner Calculation Spreadsheets

WDI MC VI G5
R.01

Prepared by: LH 6/2/21							
Reviewed by:			**SLOPE 5**	**SLOPE 4**	**SLOPE 3**	**SLOPE 2**	**SLOPE 1**
Approved by:	*minimum y (in)*	*0.010*	**Bottom**				**Top**
Slope in the direction of flow	S	ft./ft.	**5.00%**	**5.00%**	**5.00%**	**5.00%**	**33.33%**
Slope angle	α	radians	0.0500	0.0500	0.0500	0.0500	0.3217
Flow length in the direction of flow	L	ft.	**92**	**91**	**91**	**91**	**39**
Rate of vertical inflow per unit area	r	gal/acre/day	**6,560**	**6,560**	**6,560**	**6,560**	**6,674**
Saturated thickness of sand (or protective soil)	t_{sand}	in	**12.0**	**11.0**	**7.2**	**2.8**	**0.3**
		ft.	*1.000*	*0.916*	*0.598*	*0.231*	*0.028*
Permeability of sand (or protective soil)	K_{sand}	cm/sec	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**
Thickness of geonet	t_{geonet}	in.	**0.200**	**0.200**	**0.200**	**0.200**	**0.200**
		ft.	**0.017**	**0.017**	**0.017**	**0.017**	**0.017**
Geocomposite transmissivity	m2/s	m2/s	**4.15E-04**	**4.15E-04**	**4.15E-04**	**4.15E-04**	**4.15E-04**
Reduction Factor			**5.28**	**5.28**	**5.28**	**5.28**	**5.28**
Permeability of geocomposite	K_{geonet}	cm/sec	1.55E+00	1.55E+00	1.55E+00	1.55E+00	1.55E+00
Combined (apparent) permeability	**K_{app}**	**cm/sec**	**5.13E-02**	**5.58E-02**	**8.37E-02**	**2.02E-01**	**9.34E-01**
Leachate Head at Discharge Point	**h at L=0**	in	**0.10**	**10.99**	**7.18**	**2.77**	**0.34**
Step Size	dL	in	0.1	0.1	0.1	0.1	0.1
Unit Width	W	ft	1	1	1	1	1

Maximum head on liner (McEnroe numerical) in each slope	**in**	**11.91**	**10.99**	**7.18**	**2.77**	**0.34**
Maximum head on liner location (McEnroe numerical) in each slope	**ft**	**356.68**	**312.00**	**221.00**	**130.00**	**39.00**
		0.08	*0.04*	*0.04*	*0.04*	*0.04*
Maximum head on liner (McEnroe numerical) in all slope	**in**	**11.91**				



McEnroe 1993 "Maximum Saturated Depth over Landfill Liner"
Journal of Environmental Engineering

For Slope 1

$$y_{i+1} = y_i + \left(\tan \alpha_1 - \frac{r_1 x_i}{k_1 y_i \cos^2 \alpha_1} \right) (x_{i+1} - x_i)$$

Fore Slopes 2 - 5

$$y_{i+1} = y_i + \left(\tan \alpha_j - \frac{\sum_{f=1}^{j-1} r_f L_f + r_j \left(x_i - \sum_{f=1}^{j-1} L_f \right)}{k_j y_i \cos^2 \alpha_j} \right) (x_{i+1} - x_i)$$

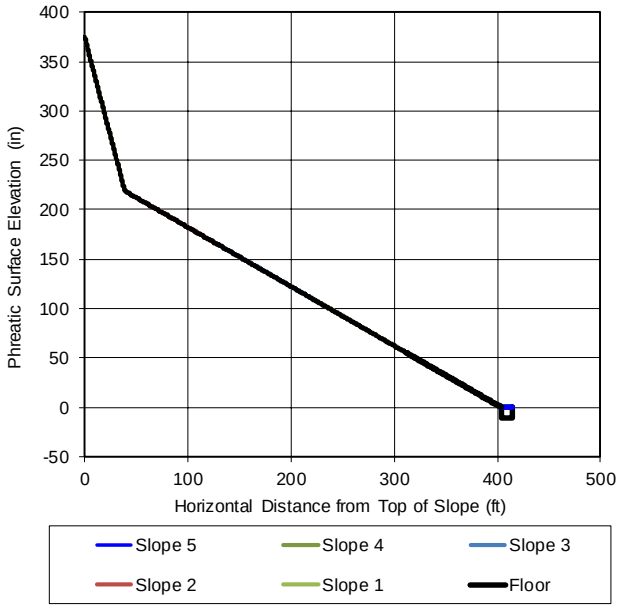
CALCULATION SHEET
Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Head-on-Liner Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/02/2021
Checked By: NSG Date: 10/04/2021
Approved By: XZ Date: 10/5/2021

WDI MC VI G5 - Neglected Sand

Prepared by: LH 6/2/21		***R.01***					
Reviewed by:			**SLOPE 5**	**SLOPE 4**	**SLOPE 3**	**SLOPE 2**	**SLOPE 1**
Approved by:	*minimum y (in)*	*0.010*	**Bottom**				**Top**
Slope in the direction of flow	S	ft./ft.	**5.00%**	**5.00%**	**5.00%**	**5.00%**	**33.33%**
Slope angle	α	radians	0.0500	0.0500	0.0500	0.0500	0.3217
Flow length in the direction of flow	L	ft.	**92**	**91**	**91**	**91**	**39**
Rate of vertical inflow per unit area	r	gal/acre/day	**6,560**	**6,560**	**6,560**	**6,560**	**6,674**
Saturated thickness of sand (or protective soil)	t_{sand}	in	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
		ft.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Permeability of sand (or protective soil)	K_{sand}	cm/sec	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**
Thickness of geonet	t_{geonet}	in.	**0.200**	**0.200**	**0.200**	**0.200**	**0.200**
		ft.	**0.017**	**0.017**	**0.017**	**0.017**	**0.017**
Geocomposite transmissivity	m2/s	m2/s	**9.40E-04**	**9.40E-04**	**9.40E-04**	**9.40E-04**	**9.40E-04**
Reduction Factor			**5.28**	**5.28**	**5.28**	**5.28**	**5.28**
Permeability of geocomposite	K_{geonet}	cm/sec	3.50E+00	3.50E+00	3.50E+00	3.50E+00	3.50E+00
Combined (apparent) permeability	**K_{app}**	**cm/sec**	**3.50E+00**	**3.50E+00**	**3.50E+00**	**3.50E+00**	**3.50E+00**
Leachate Head at Discharge Point	**h at L=0**	in	**0.10**	**0.15**	**0.11**	**0.06**	**0.02**
Step Size	dL	in	0.1	0.1	0.1	0.1	0.1
Unit Width	W	ft	1	1	1	1	1

Maximum head on liner (McEnroe numerical) in each slope	**in**	**0.20**	**0.15**	**0.11**	**0.06**	**0.02**
Maximum head on liner location (McEnroe numerical) in each slope	**ft**	**402.08**	**312.00**	**221.00**	**130.00**	**39.00**
		0.00	*0.00*	*0.01*	*0.02*	*0.03*
Maximum head on liner (McEnroe numerical) in all slope	**in**	**0.20**				



McEnroe 1993 "Maximum Saturated Depth over Landfill Liner"
Journal of Environmental Engineering

For Slope 1

$$y_{i+1} = y_i + \left(\tan\alpha_1 - \frac{r_1 x_i}{k_1 y_i \cos^2\alpha_1} \right)(x_{i+1} - x_i)$$

Fore Slopes 2 - 5

$$y_{i+1} = y_i + \left(\tan\alpha_j - \frac{\sum_{f=1}^{j-1} r_f L_f + r_j \left(x_i - \sum_{f=1}^{j-1} L_f \right)}{k_j y_i \cos^2\alpha_j} \right)(x_{i+1} - x_i)$$

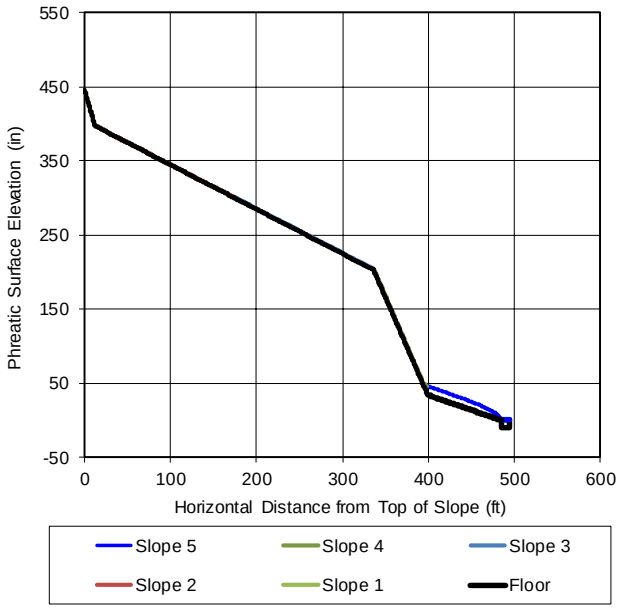
CALCULATION SHEET
Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Head-on-Liner Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/02/2021
Checked By: NSG Date: 10/04/2021
Approved By: XZ Date: 10/5/2021

WDI MC VI G7
R.01

Prepared by: LH 6/2/21 / *Reviewed by:* / *Approved by:*			SLOPE 5	SLOPE 4	SLOPE 3	SLOPE 2	SLOPE 1
	minimum y (in)	*0.010*	**Bottom**				**Top**
Slope in the direction of flow	S	ft./ft.	**3.33%**	**22.35%**	**5.00%**	**5.00%**	**33.33%**
Slope angle	α	radians	0.0333	0.2199	0.0500	0.0500	0.3217
Flow length in the direction of flow	L	ft.	**85**	**63**	**162**	**162**	**12**
Rate of vertical inflow per unit area	r	gal/acre/day	**6,560**	**6,674**	**6,560**	**6,560**	**6,674**
Saturated thickness of sand (or protective soil)	t_{sand}	in	**12.0**	**11.7**	**1.5**	**0.5**	**0.0**
		ft.	*1.000*	*0.976*	*0.121*	*0.040*	*0.002*
Permeability of sand (or protective soil)	K_{sand}	cm/sec	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**
Thickness of geonet	t_{geonet}	in.	**0.200**	**0.200**	**0.200**	**0.200**	**0.200**
		ft.	**0.017**	**0.017**	**0.017**	**0.017**	**0.017**
Geocomposite transmissivity	m2/s	m2/s	**7.40E-04**	**7.40E-04**	**7.40E-04**	**7.40E-04**	**7.40E-04**
Reduction Factor			**5.28**	**5.28**	**5.28**	**5.28**	**5.28**
Permeability of geocomposite	K_{geonet}	cm/sec	2.76E+00	2.76E+00	2.76E+00	2.76E+00	2.76E+00
Combined (apparent) permeability	**K_{app}**	**cm/sec**	**9.07E-02**	**9.28E-02**	**6.29E-01**	**1.38E+00**	**2.74E+00**
Leachate Head at Discharge Point	**h at L=0**	in	**0.10**	**11.71**	**1.45**	**0.48**	**0.02**
Step Size	dL	in	0.1	0.1	0.1	0.1	0.1
Unit Width	W	ft	1	1	1	1	1

Maximum head on liner (McEnroe numerical) in each slope	**in**	**11.86**	**11.71**	**1.45**	**0.48**	**0.02**
Maximum head on liner location (McEnroe numerical) in each slope	**ft**	**418.33**	**399.00**	**336.00**	**174.00**	**12.00**
		0.12	*0.04*	*0.04*	*0.04*	*0.04*
Maximum head on liner (McEnroe numerical) in all slope	**in**	**11.86**				



McEnroe 1993 "Maximum Saturated Depth over Landfill Liner"
Journal of Environmental Engineering

For Slope 1

$$y_{i+1} = y_i + \left(\tan \alpha_1 - \frac{r_1 x_i}{k_1 y_i \cos^2 \alpha_1} \right) (x_{i+1} - x_i)$$

Fore Slopes 2 - 5

$$y_{i+1} = y_i + \left(\tan \alpha_j - \frac{\sum_{f=1}^{j-1} r_f L_f + r_j \left(x_i - \sum_{f=1}^{j-1} L_f \right)}{k_j y_i \cos^2 \alpha_j} \right) (x_{i+1} - x_i)$$

CALCULATION SHEET
Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Head-on-Liner Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/02/2021
Checked By: NSG Date: 10/04/2021
Approved By: XZ Date: 10/5/2021

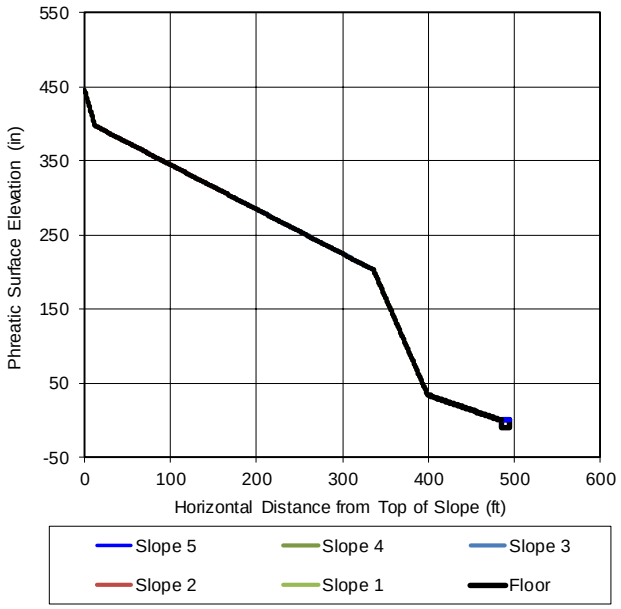
WDI MC VI G7 - Neglected Sand

Prepared by: LH 6/2/21
Reviewed by:
Approved by:

R.01

			SLOPE 5	SLOPE 4	SLOPE 3	SLOPE 2	SLOPE 1
minimum y (in)		*0.010*	**Bottom**				**Top**
Slope in the direction of flow	S	ft./ft.	**3.33%**	**22.35%**	**5.00%**	**5.00%**	**33.33%**
Slope angle	α	radians	0.0333	0.2199	0.0500	0.0500	0.3217
Flow length in the direction of flow	L	ft.	**85**	**63**	**162**	**162**	**12**
Rate of vertical inflow per unit area	r	gal/acre/day	**6,560**	**6,674**	**6,560**	**6,560**	**6,674**
Saturated thickness of sand (or protective soil)	t_{sand}	in	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
		ft.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Permeability of sand (or protective soil)	K_{sand}	cm/sec	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**
Thickness of geonet	t_{geonet}	in.	**0.200**	**0.200**	**0.200**	**0.200**	**0.200**
		ft.	**0.017**	**0.017**	**0.017**	**0.017**	**0.017**
Geocomposite transmissivity	m2/s	m2/s	**1.70E-03**	**1.70E-03**	**1.70E-03**	**1.70E-03**	**1.70E-03**
Reduction Factor			**5.28**	**5.28**	**5.28**	**5.28**	**5.28**
Permeability of geocomposite	K_{geonet}	cm/sec	6.34E+00	6.34E+00	6.34E+00	6.34E+00	6.34E+00
Combined (apparent) permeability	**K_{app}**	**cm/sec**	**6.34E+00**	**6.34E+00**	**6.34E+00**	**6.34E+00**	**6.34E+00**
Leachate Head at Discharge Point	**h at L=0**	in	**0.10**	**0.16**	**0.02**	**0.05**	**0.01**
Step Size	dL	in	0.1	0.1	0.1	0.1	0.1
Unit Width	W	ft	1	1	1	1	1

Maximum head on liner (McEnroe numerical) in each slope		**in**	**0.20**	**0.16**	**0.09**	**0.05**	**0.01**
Maximum head on liner location (McEnroe numerical) in each slope		**ft**	**481.23**	**399.00**	**335.03**	**174.00**	**12.00**
			0.00	*0.00*	*0.01*	*0.02*	*0.04*
Maximum head on liner (McEnroe numerical) in all slope		**in**	**0.20**				



McEnroe 1993 "Maximum Saturated Depth over Landfill Liner"
Journal of Environmental Engineering

For Slope 1

$$y_{i+1} = y_i + \left(\tan \alpha_1 - \frac{r_1 x_i}{k_1 y_i \cos^2 \alpha_1} \right) (x_{i+1} - x_i)$$

Fore Slopes 2 - 5

$$y_{i+1} = y_i + \left(\tan \alpha_j - \frac{\sum_{f=1}^{j-1} r_f L_f + r_j \left(x_i - \sum_{f=1}^{j-1} L_f \right)}{k_j y_i \cos^2 \alpha_j} \right) (x_{i+1} - x_i)$$

CALCULATION SHEET
Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Head-on-Liner Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/02/2021
Checked By: NSG Date: 10/04/2021
Approved By: XZ Date: 10/5/2021

ATTACHMENT A-5.1.2

Slope Combined Numerical Method

CALCULATION SHEET

Client: Landfill | Project No.:
Project: Head-on-Liner Calculation | Calculated By: XZ Date: 3/6/2012 | Checked By: TY Date: 3/9/2012
Calculation: Head-on-liner calculation using numerical approach | Approved By: KF Date: 5/30/2012

HEAD-ON-LINER CALCULATION USING NUMERICAL APPROACH

OBJECTIVE

To determine the maximum saturated leachate depth within leachate drainage media above an impermeable liner using a numerical implementation of the McEnroe (1993) Equations .

DESIGN CRITERIA, ASSUMPTIONS AND METHODOLOGY

The head-on-liner calculation is conducted according to the following procedure:

1. Determine the average transmissivity value of drainage geocomposite using test results obtained under the design normal stress. This value is reduced through the application of several reduction factors as described in following equation (Koerner 2005):

$$\theta_{allow} = \frac{\theta_{test}}{RF_{IN} \times RF_{CR} \times RF_{CC} \times RF_{BC}} \quad (1)$$

Where,

RF_{IN} = reduction factor for intrusion (or elastic deformation)
RF_{CR} = reduction factor for creep deformation
RF_{CC} = reduction factor for chemical clogging
RF_{BC} = reduction factor for biological clogging
θ_{allow} = allowable transmissivity for the geocomposite, m^2/s
θ_{test} = tested transmissivity for the geocomposite, m^2/s

2. Determine the combined (apparent) hydraulic conductivity of the drainage layer (geocomposite overlain by a sand layer) using the equation by Qian et al. (2004):

$$k_{combined} = k_{geonet} + \left(k_{sand} - k_{geonet}\right)\frac{t_{sand}^{\ 2}}{\left(t_{sand} + t_{geonet}\right)^2} \quad (2)$$

where,

$k_{combined}$ = combined hydraulic conductivity of the saturated drainage layer (cm/s)
k_{sand} = hydraulic conductivity of sand (cm/s)
k_{geonet} = hydraulic conductivity of geocomposite (cm/s)
t_{sand} = thickness of the saturated sand layer (in)
t_{geonet} = thickness of geocomposite (in)

3. Head-on-liner calculation – McEnroe (1993) Method (valid only for free draining condition)

A commonly used method for calculating the maximum head-on-liner was developed by McEnroe (1993). McEnroe (1993) developed a differential equation to describe the flow in the drainage layer using the extended Dupuit assumptions. McEnroe also derived an

analytical solution from the governing differential equation to determine the maximum head (saturated depth) buildup under free draining conditions. McEnroe's 1993 method (under free draining conditions) is expressed as:

If R<1/4

$$y_{\max} = LS*\left(R - RS + R^2S^2\right)^{1/2} * \left\{\left[(1-A-2R)(1+A-2RS)\right]/\left[(1+A-2R)(1-A-2RS)\right]\right\}^{1/(2A)} \quad (3)$$

If R=1/4

$$y_{\max} = LSR*(1-2RS)/(1-2R)*\exp\left\{2R*(S-1)/\left[(1-2RS)(1-2R)\right]\right\} \quad (4)$$

If R>=1/4

$$y_{\max} = LS*\left(R - RS + R^2S^2\right)^{1/2} * \exp\left\{(1/B)*\tan^{-1}\left[(2RS-1)/B\right] - (1/B)*\tan^{-1}\left[(2R-1)/B\right]\right\} \quad (5)$$

The parameters "R", "A", and "B" used in the above equations are defined as:

$$R = q/\left(k\sin^2\alpha\right) \quad (6)$$

$$A = (1-4R)^{1/2} \quad (7)$$

$$B = (4R-1)^{1/2} \quad (8)$$

Where: k = hydraulic conductivity of the saturated drainage layer
L = drainage length
q = leachate infiltration rate
α = slope angle

There are several limitations to the McEnroe (1993) method:

a. The analytical solution requires "free draining conditions".
b. Hydraulic conductivity, leachate infiltration rate, and slope angle must be consistent along the entire drainage length.

4. Head-on-liner calculation –numerical approach

The McEnroe (1993) method is an analytical solution of the differential equation governing flow under free draining conditions. However, this differential equation can be integrated numerically to describe the saturated depth profile based on the boundary conditions. In other words, the governing differential equation can be solved numerically without preconditions such as the free-draining requirement.

The differential equation governing flow along a single drainage length is McEnroe (1993):

$$ky\left(\frac{dy}{dx} - \tan\alpha\right)\cos^2\alpha + rx = 0 \quad (9)$$

where,

k = hydraulic conductivity of the combined saturated drainage layer (cm/s)
y = saturated liquid depth over the liner (cm or in)
x = horizontal coordinate (cm or in)
r = leachate infiltration rate (cm/s)
α = slope angle

Equation 9 can be rearranged into finite difference form:

$$y_{i+1} = y_i + \left(\tan\alpha - \frac{r x_i}{k y_i \cos^2\alpha} \right) dx \qquad (10)$$

$$dx = x_{i+1} - x_i$$

Equation 10 can be numerically integrated using a pre-selected saturated liquid depth (y_L) at the low point of the drainage path, where "x" is equivalent to the maximum drainage length (Figure 1). The procedure will result in a full phreatic surface profile. From this profile the maximum head-on-liner value can be determined.

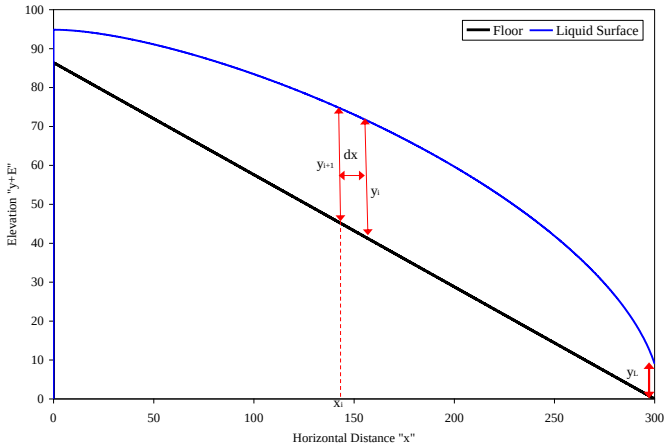


Figure 1. Example of Phreatic Leachate Surface

For a drainage system with multiple slopes (Figure 2), Equation 10 is arranged for each slope segment. Note that dimensions shown in Figure 2 are arbitrarily selected for illustrative purposes.

For slope segment 1: $0 \le x_i \le L_1$

$$y_{i+1} = y_i + \left(\tan\alpha_1 - \frac{r_1 x_i}{k_1 y_i \cos^2\alpha_1} \right)\left(x_{i+1} - x_i \right) \qquad \text{Eq. 11}$$

at $x = L_1$: y is equal to the value calculated from segment 2 at the same value of x.

For other slope segments (segment j where j >1): $\sum_{f=1}^{j-1} L_f \le x_i \le \sum_{f=1}^{j} L_f$:

$$y_{i+1} = y_i + \left(\tan\alpha_j - \frac{\sum_{f=1}^{j-1} r_f L_f + r_j \left(x_i - \sum_{f=1}^{j-1} L_f \right)}{k_j y_i \cos^2 \alpha_j} \right) \left(x_{i+1} - x_i \right) \qquad \text{Eq. 12}$$

at $x = \sum_{f=1}^{j-1} L_f$: y is equal to the value calculated from segment *j-1* at the same value of x.

Where

k_1 and k_j = combined hydraulic conductivity of the saturated drainage layer in slope segments 1 and *j*, respectively

r_1 and r_j = leachate infiltration rate to slope segments 1 and *j*, respectively

α_1 and α_j = slope angle of slope segments 1 and *j*, respectively

L_1 and L_j = total drainage length of slope segments 1 and *j*, respectively

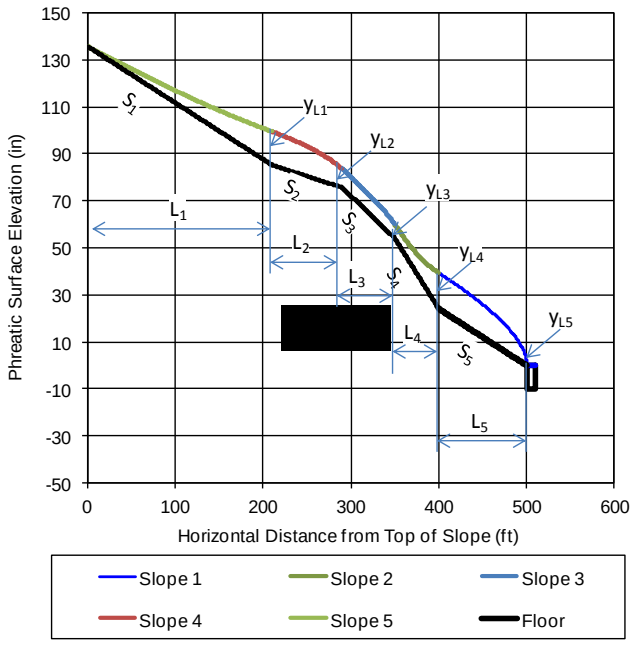


Figure 2. Example of Multiple Phreatic Leachate Surface

VERIFICATION OF THE NUMERICAL MODEL

A spreadsheet (in Microsoft Excel) was developed for the numerical integration of Equations 11 and 12. This spreadsheet included five slope segments. Multiple input parameters can be adjusted

independently for each slope segment (Figure 3). To verify the accuracy of the numerical model results, the maximum values of leachate head on liner were calculated using a variety of input parameters and compared to the results estimated using the McEnroe (1993) method. Due to the limitations of the McEnroe (1993) method, constant values of leachate infiltration rate, slope angle, and permeability were applied to all slope segments in the numerical model and the free draining conditions were simulated using the numerical approach by applying a small leachate depth at the lowest point of the slope.

Test 1: Step distance for numerical integration

The maximum head-on-liner values were calculated using both the McEnroe (1993) Method and the numerical approach for six different permeability values (Table 1) and five leachate infiltration rates (Table 2). Four integration step distances (ranging from 0.2 to 3 inches) were used. In both tests, the results from the numerical approach are very close to the results calculated using McEnroe (1993) method. Therefore, the numerical approach was verified. Moreover, the incremental variation in numerical integration step distance (dx) did not significantly impact the results under the trial conditions. To minimize the file size and reduce computation time, an integration step distance of **0.5 inches** is recommended when using the numerical modeling approach.

Table 1. Sensitivity of Numerical Approach to Integration Step Distance for Various Permeability Values.

INPUT PARAMETERS					
		Infiltration Rate (gpad)	Drainage Length (ft)	Slope	Liquid Depth at Lowest Point (in)
Numerical Solution	Slope 1	3,000	140	2.00%	-
	Slope 2	3,000	235	2.00%	-
	Slope 3	3,000	200	2.00%	-
	Slope 4	3,000	75	2.00%	-
	Slope 5	3,000	350	2.00%	1.0
McEnroe 93 Method		3,000	1,000	2.00%	free drain

RESULTS					
Sand	Ymax (in)				
k (cm/s)	McEnroe 93	Numerical			
		dx=0.2 in	dx=0.5 in	dx=1.0 in	dx=3.0 in
0.01	112.35	102.98	112.35	112.38	112.56
0.05	30.64	30.61	30.65	30.65	30.67
0.10	16.63	16.63	16.64	16.64	16.65
0.50	3.70	3.70	3.70	3.70	3.70
1.00	1.89	1.89	1.89	1.89	1.89
5.00*	0.39	0.39	0.39	0.39	0.57

Table 2. Sensitivity of Numerical Approach to Integration Step Distance for Various Permeability Values and Leachate Infiltration Rates

INPUT PARAMETERS				
		Drainage Length (ft)	Slope	Liquid Depth at Lowest Point (in)
Numerical Solution	Slope 1	140	2.00%	-
	Slope 2	235	2.00%	-
	Slope 3	200	2.00%	-
	Slope 4	75	2.00%	-
	Slope 5	350	2.00%	1.0
McEnroe 93 Method		1,000	2.00%	free drain

RESULTS							
			Ymax (in)				
				Numerical			
Infiltration Rate r (gpad)	Sand k (cm/s)	r/k*	McEnroe 93	dx=0.2 in	dx=0.5 in	dx=1.0 in	dx=3.0 in
100	0.01	1.08E-05	6.02	6.02	6.02	6.02	6.03
500	0.01	5.41E-05	26.16	26.16	26.17	26.17	26.19
1,000	0.05	2.17E-05	11.50	11.50	11.50	11.50	11.51
3,000	0.05	6.50E-05	30.64	30.61	30.65	30.65	30.67
5,000	0.05	1.08E-04	47.18	47.18	47.18	47.19	47.23
5,000	0.10	5.41E-05	26.16	26.16	26.17	26.17	26.19
5,000	0.50	1.08E-05	6.02	6.02	6.02	6.02	6.03

Note:
* The ratio of infiltration rate and hydraulic conductivity of the drainage layer will control the maximum leachate depth on the liner (see Eq. 12).

Test 2: Starting leachate depth

In the numerical integration approach, a starting leachate depth at the lowest point (discharge point) of the slopes will be needed to initialize the integration. Four starting leachate depths were used in this test. The maximum head-on-liner values from both the McEnroe (1993) Method and the numerical solution were calculated for four different permeability values (Table 3). The results from the numerical approach are very close to the results calculated using the McEnroe (1993) method with one exception. Under the high permeability condition, the maximum head-on-linear was determined to be 3.70 inches using McEnroe 93 method. The results from numerical approach with a starting leachate depth of 1 inch or less were same as the value calculated from the McEnroe (1993) method. However, if the starting leachate depth was selected as 9 inches, the maximum leachate depth will occur at the starting point. This result indicates that the numerical integration approach can be used to determine the maximum head-on-liner when the "free draining" condition is not satisfied. In most cases, a starting leachate depth of **1.0 inch** can be used to represent the "free

draining" condition. Note that under same conditions such as very high value of the ratio between infiltration rate and conductivity (high infiltration rate and low conductivity), the low starting leachate depth may result unstable solutions from the model. If it is occurred, user can adjust the staring value. A stable result can be verified by the trails and demonstrate that the the numerical solution is stable and not unduly affected by the starting leachate depth

Table 3. Sensitivity of Numerical Solution to the Starting Leachate Depth

INPUT PARAMETERS					
		Infiltration Rate (gpad)	Drainage Length (ft)	Slope	Liquid Depth at Lowest Point (in)
Numerical Solution	Slope 1	3,000	140	2.00%	-
	Slope 2	3,000	235	2.00%	-
	Slope 3	3,000	200	2.00%	-
	Slope 4	3,000	75	2.00%	-
	Slope 5	3,000	350	2.00%	-
McEnroe 93 Method		3,000	1,000	2.00%	free drain

RESULTS					
Sand k (cm/s)	Ymax (in)				
	McEnroe 93	Numerical dx=0.5 in			
		Yo=0.1 in	Yo=0.5 in	Yo=1 in	Yo=9 in
0.01	112.35	112.83	112.37	112.35	112.45
0.05	30.64	30.67	30.65	30.65	30.80
0.10	16.63	16.64	16.64	16.64	16.85
0.50	3.70	3.70	3.70	3.70	9.00

Test 3: Add geocomposite layer

To improve the drainage capacity of the drainage layer, a geocomposite layer can be added under the sand drainage layer. The combined hydraulic conductivity can be calculated using Equation 2. Two permeability values for sand with and without geocomposite layer were tested. The results from the numerical approach are very close to the values calculated using McEnroe 93 method (Table 4).

Table 4. Head-on-Liner Calculation with and without Geocomposite Layer

INPUT PARAMETERS					
		Infiltration Rate (gpad)	Drainage Length (ft)	Slope	Liquid Depth at Lowest Point (in)
Numerical Solution	Slope 1	3,000	70	2.00%	-
	Slope 2	3,000	117	2.00%	-
	Slope 3	3,000	100	2.00%	-
	Slope 4	3,000	38	2.00%	-
	Slope 5	3,000	175	2.00%	1.0
McEnroe 93 Method		3,000	500	2.00%	free drain

RESULTS					
				Ymax (in)	
Sand k (cm/s)	Geocomposite	Saturated Depth (inch)	Combined k (cm/s)	McEnroe 93	Numerical dx=0.5 in
0.0100	no	n/e	0.010	112.35	112.35
0.0100	yes	6.4	0.138	6.19	6.20
0.0010	no	n/e	0.001	267.21	266.93
0.0010	yes	7.8	0.108	7.78	7.79

n/e: no effect on the results.

DESIGN EXAMPLES USING THE NUMERICAL APPROACH

Six design examples are presented below to demonstrate the application of the numerical approach to the calculation of the maximum head-on-liner values. Descriptions and results for each example are summarized in Table 5. The detailed input parameters and phreatic surface plot for each example is presented in Figures 4 to 9, respectively. As demonstrated in Table 5, the numerical approach can accomodate multiple design conditions. In all design examples, the head-on-liner value cannot be estimated using the McEnroe (1993) method due to the complexity of the system.

Table 5. Summary of Design Examples

EXAMPLE	DESCRIPTION	Max Head-on-Liner (INCHES)
1	Single slope with different leachate infiltration rates for each slope segment	8.08
2	Five slopes with constant leachate infiltration rate for each slope segment	16.64
3	Five slopes with different leachate infiltration rates for each slope segment	8.08
4	Single slope with constant leachate infiltration rate; Increased flow capacity in bottom two slope segments by installing geocomposite layer	11.73
5	Five slopes with different leachate infiltration rates for each slope segment; High infiltration rate at top of the slope (representing open conditions); Increased flow capacity in bottom two slope segments by installing geocomposite layer	10.48
6	Single slope with constant leachate infiltration rate; Increased flow capacity by installing geocomposite layer in all slope segments; Applied different leachate depths for each slope segment; no trench at lowest point of the slope (no "free drain") and the leachate depth is 9 inches at lowest point (discharge point).	10.74

CONCLUSION

A numerical approach was developed to solve the differential equation governing flow in permeable media above an impermeable barrier presented by McEnroe (1993). This new approach was verified by analyzing multiple different boundary conditions and comparing the results to those calculated using analytical solutions developed by McEnroe (1993). Several design examples were provided to demonstrate the capability of this approach.

REFERENCES

Koerner, R. M. (2005). *Designing with Geosynthetics*, 5th ed. Upper Saddle River, NJ: Prentice Hall.

McEnroe, B. (1993) "Maximum Saturated Depth over Landfill Liner" Journal of Environmental Engineering, Val. 119, No.2, Page 262-270

Qian, X.D., Gray, D.H., and Koerner, R.M. (2004), "Estimation of Maximum Liquid Head over Landfill Barriers," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, 130:5, 488-497

CALCULATION SHEET

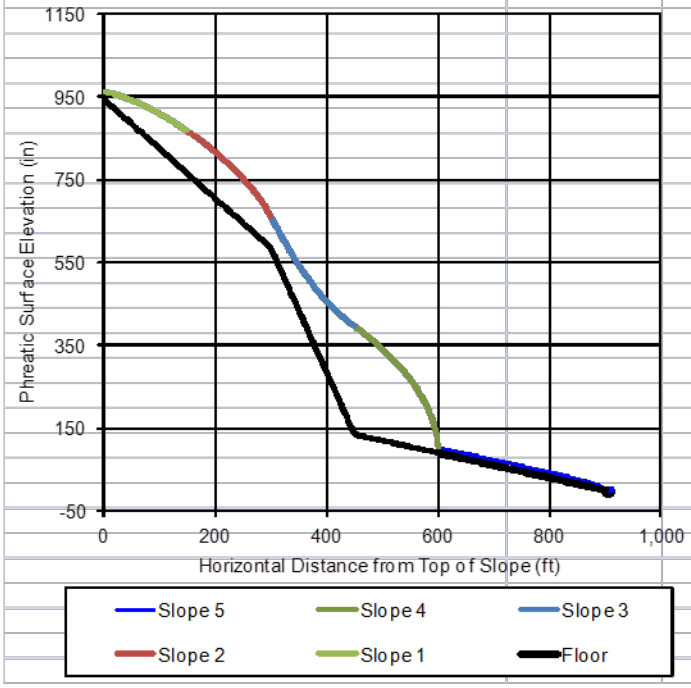
Client: Landfill | Project No.:
Project: Head-on-Liner Calculation | Calculated By: XZ | Date: 3/6/2012 | Checked By: TY | Date: 3/9/2012
Calculation: Head-on-liner calculation using numerical approach | Approved By: KF | Date: 5/30/2012

HEAD ON LINER CALCULATIONS

			SLOPE 5	SLOPE 4	SLOPE 3	SLOPE 2	SLOPE 1
			Bottom				Top
Slope in the direction of flow	S	ft./ft.	**2.50%**	**2.50%**	**25.00%**	**10.00%**	**10.00%**
Slope angle	α	radians	0.0250	0.0250	0.2450	0.0997	0.0997
Flow length in the direction of flow	L	ft.	**300**	**150**	**150**	**150**	**150**
Rate of vertical inflow per unit area	r	gal/acre/day	**1,000**	**2,000**	**3,000**	**4,000**	**4,000**
Thickness of sand (or protective soil)	t_{sand}	in	**10.3**	**10.0**	**12.0**	**12.0**	**12.0**
		ft.	*0.858*	*0.833*	*1.000*	*1.000*	*1.000*
Permeability of sand (or protective soil)	K_{sand}	cm/sec	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**
Thickness of geonet	t_{geonet}	in.	**0.200**	**0.000**	**0.000**	**0.000**	**0.000**
		ft.	**0.017**	**0.000**	**0.000**	**0.000**	**0.000**
Geonet transmissivity	m2/s	m2/s	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**
Reduction Factor			**9.11**	**9.11**	**9.11**	**9.11**	**9.11**
Permeability of geonet	K_{geonet}	cm/sec	2.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Combined (apparent) permeability	**K_{app}**	**cm/sec**	**8.25E-02**	**1.00E-03**	**1.00E-03**	**1.00E-03**	**1.00E-03**
			7.97E-03	*1.00E-03*	*1.00E-03*	*1.00E-03*	*1.00E-03*
Leachate Head at Discharge Point	**h at L=0**	in	**1.0**	**12.56**	**260.82**	**76.52**	**102.66**
Step Size	dL	in	**0.5**	0.5	0.5	0.5	0.5
Unit Width	W	ft	1	1	1	1	1

Maximum head on liner (McEnroe numerical) in each slope		**in**	**13.31**	**260.82**	**260.82**	**112.22**	**102.66**
Maximum head on liner location (McEnroe numerical) in each slope		**ft**	**760.75**	**450.00**	**450.00**	**213.79**	**150.00**
			9.04	*62910.07*	*61910.79*	*10044.19*	*8218.51*
Maximum head on liner (McEnroe numerical) in all slope		**in**	**260.82**				

			Average	*Average*
Maximum head on liner (McEnroe 93 with free drain)		**in**	**5.32**	**McEnroe 93**
		R	**0.02**	*k* *2.82E-02* *HOL*
Maximum head on liner (McEnroe 93 with free drain+Superposition)		**in**	**6.32**	*S* *8.75%* *(in)*
				q *2500* *11.44*



McEnroe 1993 "Maximum Saturated Depth over Landfill Liner"
Journal of Environmental Engineering

For Slope 1

$$y_{i+1} = y_i + \left(\tan\alpha_1 - \frac{r_1 x_i}{k_1 y_i \cos^2\alpha_1} \right)(x_{i+1} - x_i)$$

Fore Slopes 2 - 5

$$y_{i+1} = y_i + \left(\tan\alpha_j - \frac{\sum_{f=1}^{j-1} r_f L_f + r_j \left(x_i - \sum_{f=1}^{j-1} L_f \right)}{k_j y_i \cos^2\alpha_j} \right)(x_{i+1} - x_i)$$

Figure 3. Input and Output Sheet in the Head-on-Liner Calculation Spreadsheet

CALCULATION SHEET

Client: Landfill | Project No.:
Project: Head-on-Liner Calculation | Calculated By: XZ | Date: 3/6/2012 | Checked By: TY | Date: 3/9/2012
Calculation: Head-on-liner calculation using numerical approach | Approved By: KF | Date: 5/30/2012

EXAMPLE 1: Variance in Leachate Infiltration Rates

INPUT PARAMETERS (dx=0.5 in)							
		Infiltration Rate (gpad)	Drainage Length (ft)	Slope	Combined k (cm/s)	Liquid Depth at Lowest Point (in)	Max Head-on-Liner (in)
Numerical Solution	Slope 1	3,000	140	2.00%	0.10	-	2.90
	Slope 2	2,000	235	2.00%	0.10	-	5.95
	Slope 3	1,000	200	2.00%	0.10	-	7.18
	Slope 4	500	75	2.00%	0.10	-	7.43
	Slope 5	500	350	2.00%	0.10	1.0	8.08
						OVERALL	8.08
McEnroe 93 Method		3,000	1,000	2.00%	0.10	free drain	16.63

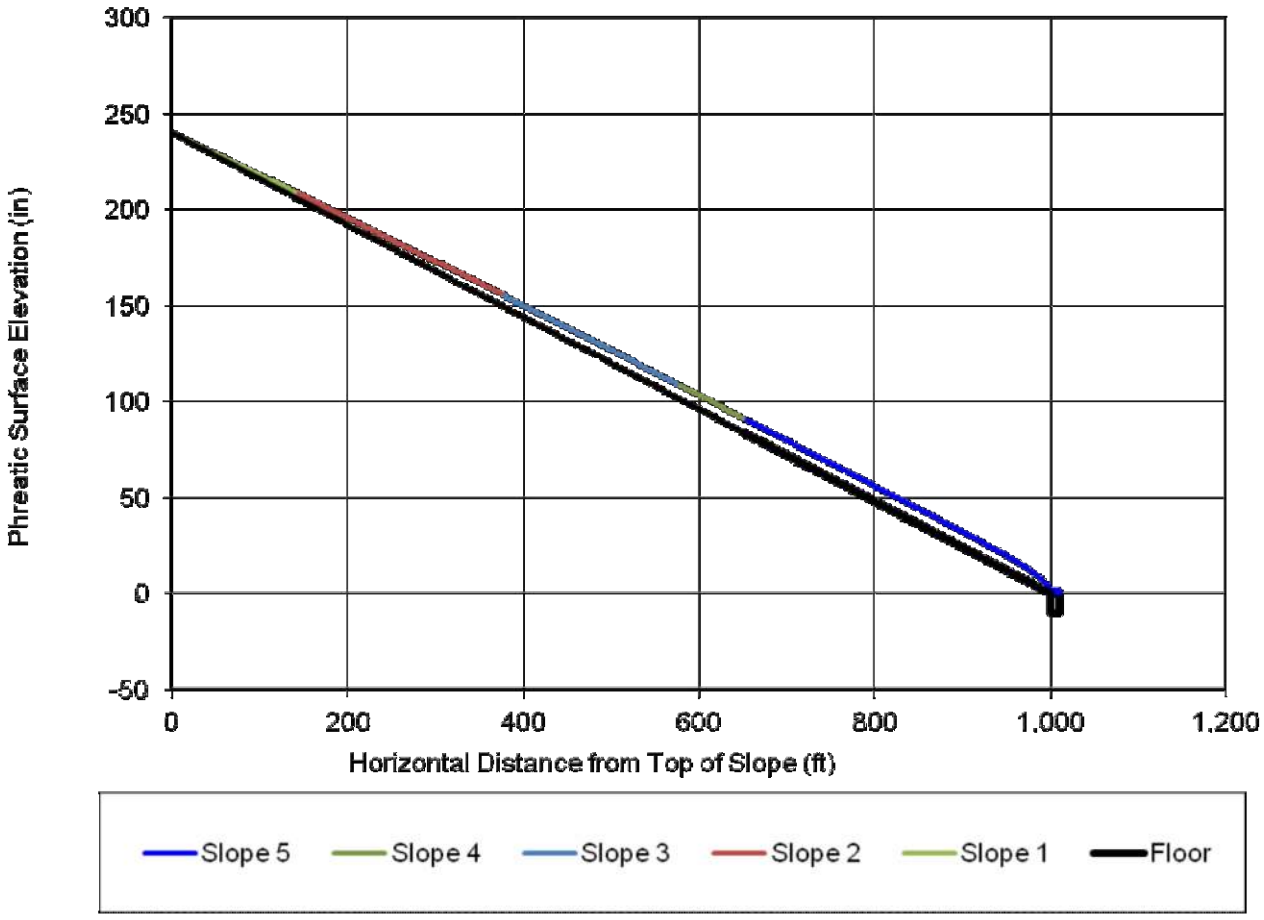


Figure 4. Design Example 1
Variance in Leachate Infiltration Rates

EXAMPLE 2: Variance in Slopes

INPUT PARAMETERS (dx=0.5 in)							
		Infiltration Rate (gpad)	Drainage Length (ft)	Slope	Combined k (cm/s)	Liquid Depth at Lowest Point (in)	Max Head-on-Liner (in)
Numerical Solution	Slope 1	3,000	140	20.00%	0.10	-	0.83
	Slope 2	3,000	235	12.00%	0.10	-	1.48
	Slope 3	3,000	200	10.00%	0.10	-	12.28
	Slope 4	3,000	75	2.00%	0.10	-	13.82
	Slope 5	3,000	350	2.00%	0.10	1.0	16.64
						OVERALL	16.64
McEnroe 93 Method		3,000	1,000	2.00%	0.10	free drain	16.63

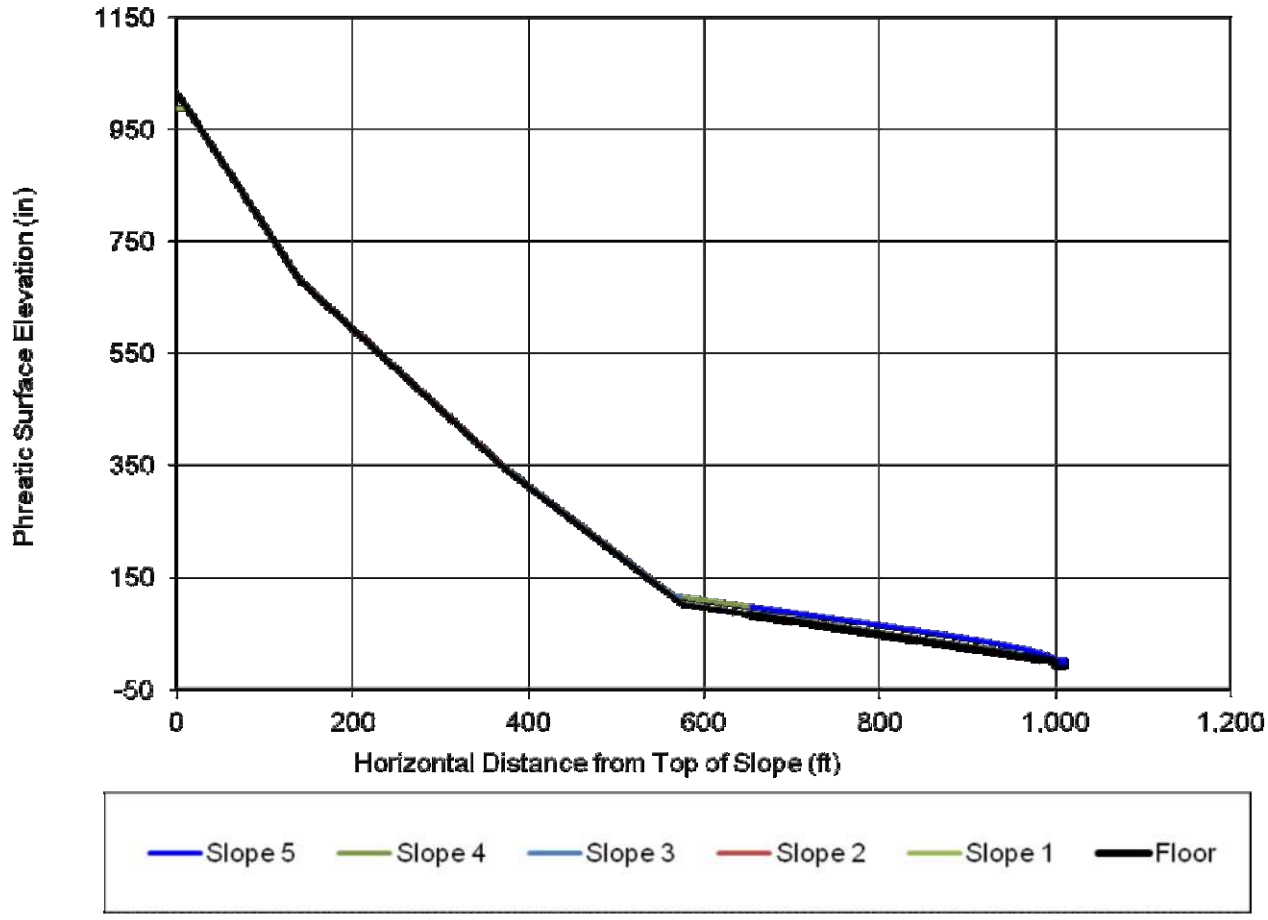


Figure 5. Design Example 2
Variance in Slopes

EXAMPLE 3: Variance in Slopes and Leachate Infiltration Rates

INPUT PARAMETERS (dx=0.5 in)							
		Infiltration Rate (gpad)	Drainage Length (ft)	Slope	Combined k (cm/s)	Liquid Depth at Lowest Point (in)	Max Head-on-Liner (in)
Numerical Solution	Slope 1	3,000	140	20.00%	0.10	-	0.83
	Slope 2	2,000	235	12.00%	0.10	-	1.17
	Slope 3	1,000	200	10.00%	0.10	-	7.18
	Slope 4	500	75	2.00%	0.10	-	7.43
	Slope 5	500	350	2.00%	0.10	1.0	8.08
						OVERALL	8.08
McEnroe 93 Method		3,000	1,000	2.00%	0.10	free drain	16.63

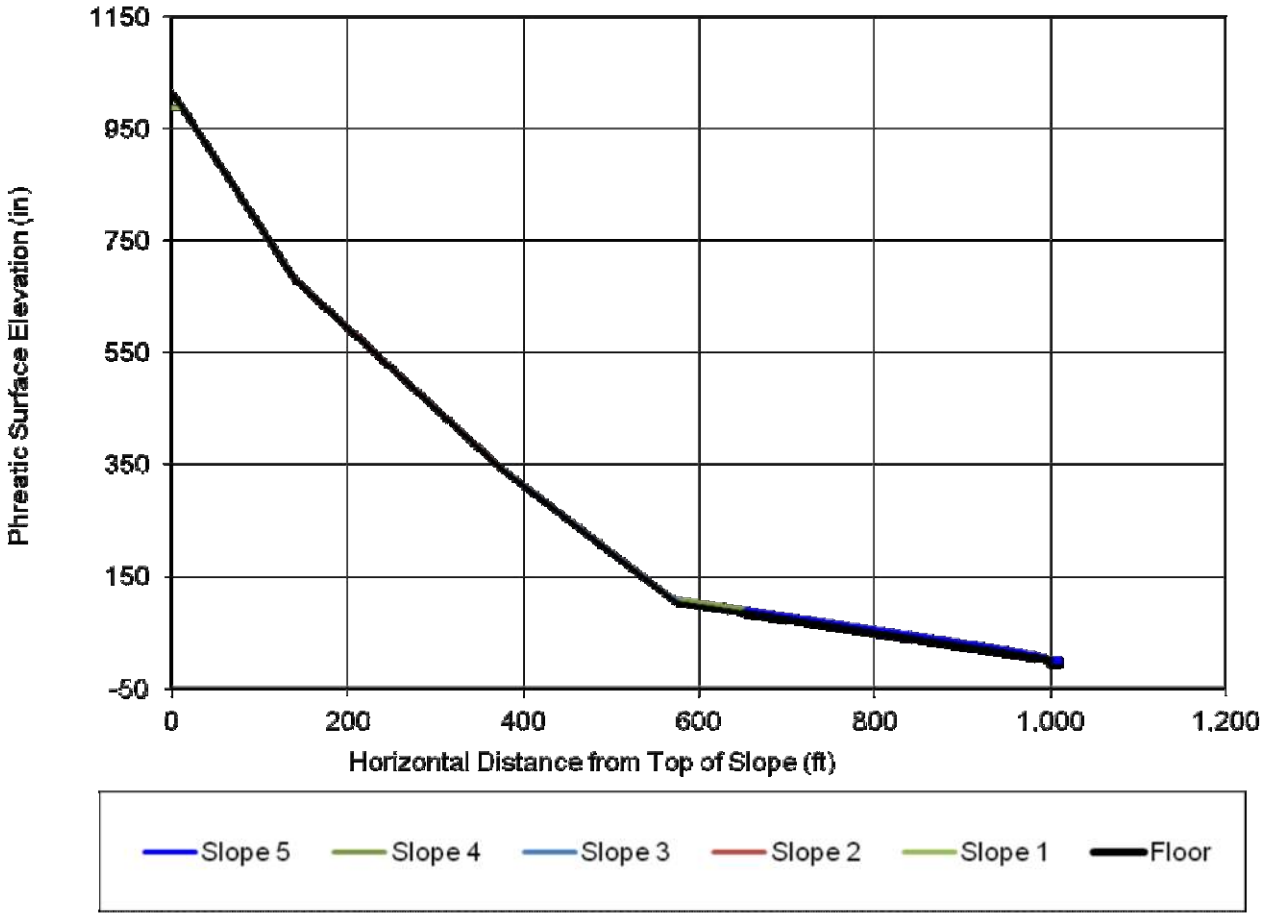


Figure 6. Design Example 3
Variance in Leachate Infiltration Rates and Slopes

CALCULATION SHEET

Client: Landfill | Project No.:
Project: Head-on-Liner Calculation | Calculated By: XZ | Date: 3/6/2012 | Checked By: TY | Date: 3/9/2012
Calculation: Head-on-liner calculation using numerical approach | Approved By: KF | Date: 5/30/2012

EXAMPLE 4: Variance in Combined Permeabilitiy

INPUT PARAMETERS (dx=0.5 in)									
		Infiltration Rate (gpad)	Drainage Length (ft)	Slope	Combined k (cm/s)	Geonet Layer	Saturated Sand Thickness (in)	Liquid Depth at Lowest Point (in)	Max Head-on-Liner (in)
Numerical Solution	Slope 1	3,000	150	2.50%	0.050	no	-	-	5.30
	Slope 2	3,000	150	2.50%	0.050	no	-	-	10.35
	Slope 3	3,000	150	2.50%	0.050	no	-	-	11.73
	Slope 4	3,000	150	2.50%	0.184	yes	6.00	-	5.84
	Slope 5	3,000	150	2.50%	0.166	yes	7.00	1.0	6.49
								OVERALL	11.73
McEnroe 93 Method		3,000	750	2.50%	0.050			free drain	19.45

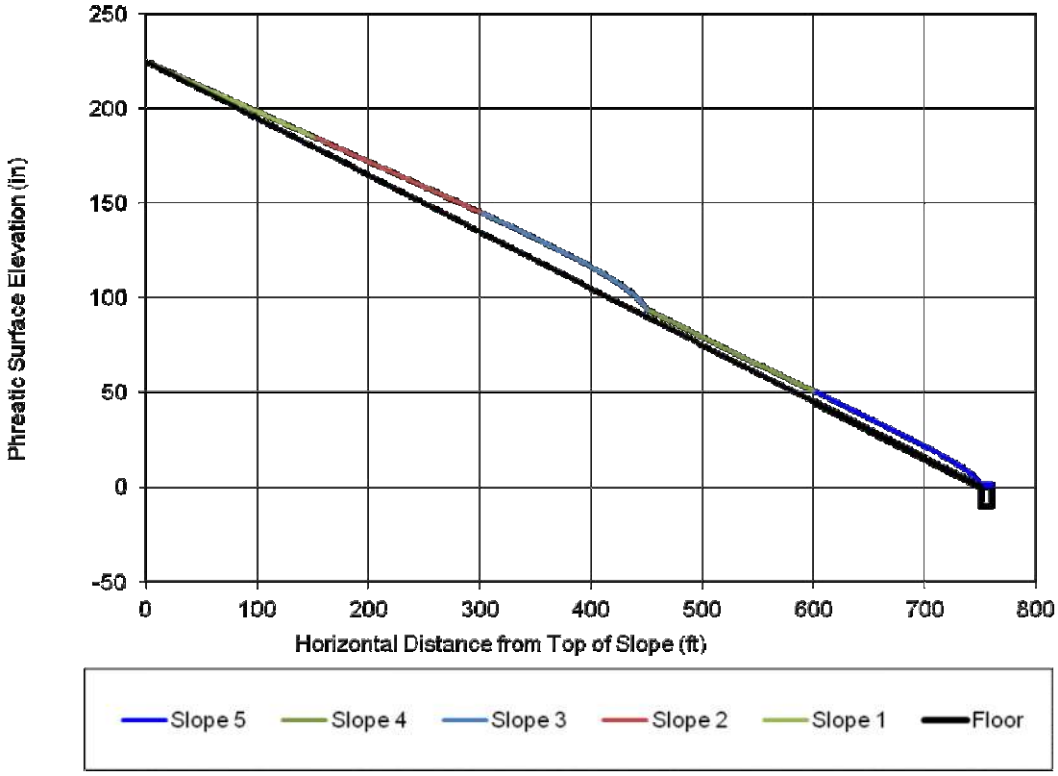


Figure 7. Design Example 4:
Variance in Combined Permeability (using geocomposite)

CALCULATION SHEET

Client: Landfill | Project No.:
Project: Head-on-Liner Calculation | Calculated By: XZ | Date: 3/6/2012 | Checked By: TY | Date: 3/9/2012
Calculation: Head-on-liner calculation using numerical approach | Approved By: KF | Date: 5/30/2012

EXAMPLE 5: Variance in Slopes, Leachate Infiltration Rates, and Combined Permeability

INPUT PARAMETERS (dx=0.5 in)									
		Infiltration Rate (gpad)	Drainage Length (ft)	Slope	Combined k (cm/s)	Geonet Layer	Saturated Sand Thickness (in)	Liquid Depth at Lowest Point (in)	Max Head-on-Liner (in)
Numerical Solution	Slope 1	4,000	150	10.00%	0.020	no	-	-	4.03
	Slope 2	4,000	150	10.00%	0.020	no	-	-	7.39
	Slope 3	3,000	150	25.00%	0.020	no	-	-	8.48
	Slope 4	2,000	150	2.50%	0.103	yes	10.00	-	10.15
	Slope 5	500	300	2.50%	0.101	yes	10.30	1.0	10.48
								OVERALL	10.48
McEnroe 93 Method		4,000	900	2.50%	0.020			free drain	64.99

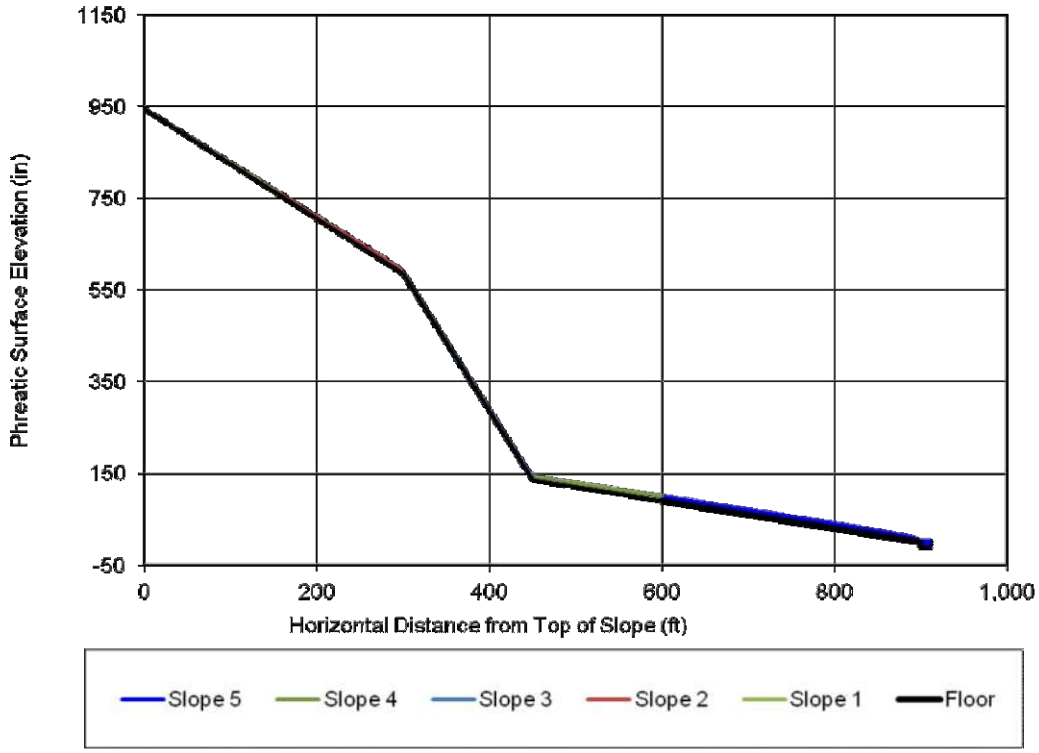


Figure 8. Design Example 5:
Variance in Slopes, Leachate Infiltration Rates, and Combined Permeability

CALCULATION SHEET

Client: Landfill | Project No.:
Project: Head-on-Liner Calculation | Calculated By: XZ | Date: 3/6/2012
Calculation: Head-on-liner calculation using numerical approach | Checked By: TY | Date: 3/9/2012
Approved By: KF | Date: 5/30/2012

EXAMPLE 6: No Resisted Trench (free drain condition is not satisfied)

INPUT PARAMETERS (dx=0.5 in)									
		Infiltration Rate (gpad)	Drainage Length (ft)	Slope	Combined k (cm/s)	Geonet Layer	Saturated Sand Thickness (in)	Liquid Depth at Lowest Point (in)	Max Head-on-Liner (in)
Numerical Solution	Slope 1	3,000	100	2.00%	0.661	yes	1.00	-	0.96
	Slope 2	3,000	100	2.00%	0.248	yes	3.79	-	3.94
	Slope 3	3,000	100	2.00%	0.120	yes	7.72	-	7.89
	Slope 4	3,000	100	2.00%	0.095	yes	10.22	-	10.39
	Slope 5	3,000	100	2.00%	0.078	yes	10.63	9.0	10.74
								OVERALL	10.74
McEnroe 93 Method		3,000	500	2.00%	0.078		free drain+superposition		19.39

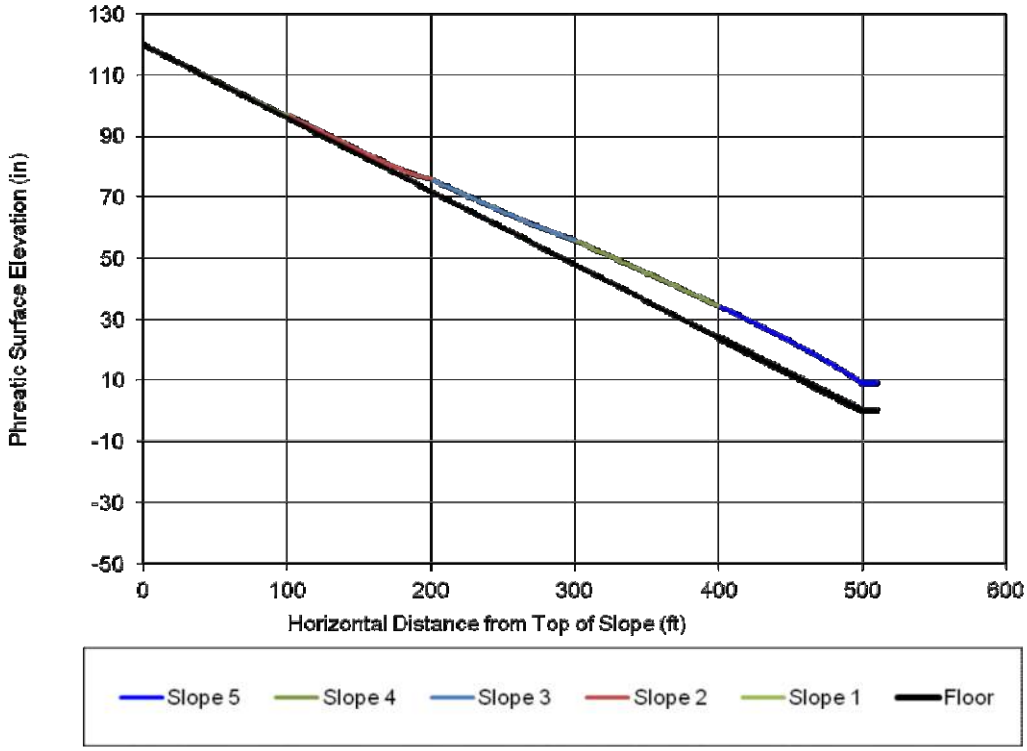


Figure 9. Design Example 6:
Free drain condition is not satisfied

CALCULATION SHEET

Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Generation (HELP Model) Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/01/2021
Checked By: NSG Date: 10/4/2021
Approved By: XZ Date: 10/5/21

LEACHATE GENERATION (HELP MODEL) ANALYSIS

OBJECTIVE

Estimate the leachate generation rate in the proposed cells for MC6G Cells 4 to 7 at Wayne Disposal Inc. (WDI) using the Hydraulic Evaluation of Landfill Performance (HELP) computer program. Select the appropriate leachate generation rate for the design of leachate collection and removal system.

DESIGN CRITERIA, ASSUMPTIONS AND METHODOLOGY

In the HELP model analysis, only the open condition was considered since it is expected to be the highest leachate generation and therefore the most critical period for a leachate collection system from a flow capacity standpoint. All 4 Cells have 5% floor slopes and 3H:1V sideslopes.

Steeper floor sections lead to additional leachate generation in HELP Model, so the floor section for all 4 cells was modeled as a 5% slope with a drainage flow length of 390 feet. For the sideslope section, a slope of 33.33% and a flow length of 135 feet was utilized. A modeling period of 5 years was utilized for open conditions.

Initial soil moisture contents were set equal to the field capacity for each vertical percolation layer assuming a steady state condition. For waste, the is conservatively modeled as a loamy fine sand with a thickness of 10 feet. Other soil and geosynthetic properties are generally modeled using HELP default values.

The hydrologic evaluation was conducted using HELP Model (4.0.1) from USEPA for both data input and result output.

HELP Model Version 4 Input

1. Synthetically generated climatological data for Belleville, Michigan was used to simulate the weather conditions at the site. Wind speed and humidity data which are used by HELP to simulate evapotranspiration were imported from the National Solar Radiation Data Base for Willow Run Airport, which is adjacent to WDI.
2. The growing season was estimated at approximately 160 days in length (http://geo.msu.edu/extra/geogmich/growseason&frost.html) starting on Day 100 (mid-April) and ending on day 260 (mid-September).
3. The pinhole density for the geomembrane liner is assumed to be one hole per acre. The diameter of the hole is assumed as 0.1 cm with a corresponding opening area of approximately 0.008 cm^2. Note that the above assumption was made for conservatism since pinholes (manufacturing defects) are very unlikely when producing polyethylene (PE) geomembranes.
4. The installation defect for the geomembrane liner was assumed at a density of one hole per

acre. The area of the hole was assumed to be 1.0 cm^2.

5. The placement quality for the geomembrane liner was assumed to be "good." According to the HELP Model User's Guide for Version 4, a "good" placement quality assumes "good field installation with well-prepared, smooth soil surface, and geomembrane wrinkle control to insure good contact between geomembrane and adjacent soil that limits drainage rate."

5. A one-acre design area was used for modeling purposes to compute unit quantities.

6. The following system was used to model the leachate generation for the proposed cell floor and sideslope liner system (from top to bottom):

   - 120 inches of waste material – modeled as a custom waste layer based on HELP default material #5 (loamy fine sand)
   - 12-inch sand protective layer – modeled as a sand with $1x10^{-3}$ cm/s permeability
   - Geocomposite drainage layer
   - 80-mil HDPE geomembrane
   - 2 layers of Geosynthetic clay liner (GCL) – modeled as a GCL with 2x thickness
   - 60 inches of clayey soil – modeled as HELP default material #25 – clay loam.
   - Geocomposite drainage layer
   - 80-mil HDPE geomembrane
   - 2 layers of (GCL) – modeled as a GCL with 2x thickness
   - 24-inch compacted soil layer – modeled as HELP default material #14 Silty Clay

6. Open condition inputs:

   - Bare soil conditions.
   - Evaporative zone depth = 12 in.
   - Maximum leaf area index = 0 (recommended by HELP Model for bare ground).
   - Fraction of area allowing runoff = 0 %.

CALCULATIONS AND RESULTS

Multiple simulations were conducted for cell floor, side slope, and overfill liner conditions by varying drainage length of the drainage layer for each cell. The output from HELP for each of the analyzed scenarios is included in Attachments 5.2.1 and 5.2.2. The peak daily leachate generation rates for the cell floor, side slope and overfill liner under open and intermediate cover conditions were estimated and presented in the following table.

CALCULATION SHEET

Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Generation (HELP Model) Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/01/2021
Checked By: NSG Date: 10/4/2021
Approved By: XZ Date: 10/5/21

Table 1- Leachate Percolation Rate

Scenario	Percolation (in/day)	Percolation (gal/acre/day)
Sideslopes (33.33%)	0.2458	6,674
Floor (5%)	0.2416	6,560

CONCLUSIONS

Results of the HELP analyses are summarized in Table 1. These maximum percolation rates will be used in the leachate collection pipes and geocomposite drainage layer.

CALCULATION SHEET

Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Generation (HELP Model) Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/01/2021
Checked By: NSG Date: 10/4/2021
Approved By: XZ Date: 10/5/21

ATTACHMENT 5.2.1

HELP Model Analysis - Sideslope

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: Wayne Disposal-Initial Lift-Si… **Simulated On:** 3/10/2021 12:59

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
Sandy Waste Material
Material Texture Number 83

Thickness	=	120	inches
Porosity	=	0.457	vol/vol
Field Capacity	=	0.131	vol/vol
Wilting Point	=	0.058	vol/vol
Initial Soil Water Content	=	0.2206	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-03	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
Custom Soil 1
Material Texture Number 43

Thickness	=	12	inches
Porosity	=	0.417	vol/vol
Field Capacity	=	0.045	vol/vol
Wilting Point	=	0.018	vol/vol
Initial Soil Water Content	=	0.1689	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-03	cm/sec

Layer 3

Type 2 - Lateral Drainage Layer
Drainage Net (0.5 cm)
Material Texture Number 20

Thickness	=	0.2	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.0115	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	33.33333	%
Drainage Length	=	135	ft

Layer 4

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.08	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5

Type 3 - Barrier Soil Liner
Bentonite (High)
Material Texture Number 17

Thickness	=	0.5	inches
Porosity	=	0.75	vol/vol
Field Capacity	=	0.747	vol/vol
Wilting Point	=	0.4	vol/vol
Initial Soil Water Content	=	0.75	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-09	cm/sec

Layer 6

Type 1 - Vertical Percolation Layer
CL - Clay Loam (Moderate)
Material Texture Number 25

Thickness	=	60	inches
Porosity	=	0.437	vol/vol
Field Capacity	=	0.373	vol/vol
Wilting Point	=	0.266	vol/vol
Initial Soil Water Content	=	0.373	vol/vol
Effective Sat. Hyd. Conductivity	=	3.60E-06	cm/sec

Layer 7

Type 2 - Lateral Drainage Layer
Drainage Net (0.5 cm)
Material Texture Number 20

Thickness	=	0.5	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	33.33333	%
Drainage Length	=	135	ft

Layer 8

Type 4 - Flexible Membrane Liner

HDPE Membrane

Material Texture Number 35

Thickness	=	0.08	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 9

Type 3 - Barrier Soil Liner

Bentonite (High)

Material Texture Number 17

Thickness	=	0.5	inches
Porosity	=	0.75	vol/vol
Field Capacity	=	0.747	vol/vol
Wilting Point	=	0.4	vol/vol
Initial Soil Water Content	=	0.75	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-09	cm/sec

Layer 10

Type 1 - Vertical Percolation Layer

SiC - Silty Clay

Material Texture Number 14

Thickness	=	24	inches
Porosity	=	0.479	vol/vol
Field Capacity	=	0.371	vol/vol
Wilting Point	=	0.251	vol/vol
Initial Soil Water Content	=	0.3709	vol/vol
Effective Sat. Hyd. Conductivity	=	2.50E-05	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	97.2	
Fraction of Area Allowing Runoff	=	0	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	12	inches
Initial Water in Evaporative Zone	=	0.696	inches
Upper Limit of Evaporative Storage	=	5.484	inches
Lower Limit of Evaporative Storage	=	0.696	inches

Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	60.544	inches
Total Initial Water	=	60.544	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	42.18	Degrees
Maximum Leaf Area Index	=	0	
Start of Growing Season (Julian Date)	=	100	days
End of Growing Season (Julian Date)	=	260	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	72	%
Average 2nd Quarter Relative Humidity	=	68	%
Average 3rd Quarter Relative Humidity	=	73	%
Average 4th Quarter Relative Humidity	=	74	%

Note: Evapotranspiration data was obtained for Belleville, Michigan

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.538481	1.745211	2.296427	2.857607	4.464435	2.825752
2.250299	3.02094	2.983072	2.062363	2.406094	1.756356

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
25.6	33.7	47.8	46.5	63.1	73.4
83.7	75.9	66.4	54.7	44.5	44

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Daily Output for Year 1

Column key: Head #1: drainage from Layer 4 | Head #2: drainage from Layer 8
Drain #1: drainage from Layer 3 | Drain #2: drainage from Layer 7
Leak #1: leakage thru Layer 5 | Leak #2: leakage thru Layer 9 | Leak #3: leakage thru Layer 10

Title: Wayne Disposal-Initial Lift-Sideslope
Simulated On: 3/10/2021 13:00

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1	Head #2	Drain #2	Leak #2	Head #3	Drain #3	Leak #3
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1			0.00	0.000	0.000	0.0580	0.0003	0.0409	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
2			0.04	0.000	0.006	0.0580	0.0004	0.0467	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
3			0.04	0.000	0.006	0.0580	0.0002	0.0258	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
4	*		0.34	0.000	0.025	0.0580	0.0003	0.0377	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
5			0.10	0.000	0.000	0.0580	0.0006	0.0698	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
6			0.02	0.000	0.005	0.0580	0.0004	0.0513	6.19E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
7	*		0.00	0.000	0.003	0.0580	0.0009	0.1182	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
8			0.00	0.000	0.000	0.0580	0.0010	0.1211	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
9			0.00	0.000	0.000	0.0580	0.0008	0.0979	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
10			0.00	0.000	0.000	0.0580	0.0006	0.0753	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
11			0.04	0.000	0.006	0.0580	0.0005	0.0676	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
12			0.02	0.000	0.008	0.0580	0.0002	0.0266	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
13			0.00	0.000	0.000	0.0580	0.0003	0.0347	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
14	*		0.00	0.000	0.000	0.0580	0.0004	0.0463	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
15	*		0.23	0.000	0.026	0.0580	0.0004	0.0565	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
16	*		0.08	0.000	0.024	0.0580	0.0004	0.0465	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
17	*		0.00	0.000	0.029	0.0580	0.0004	0.0501	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
18			0.00	0.000	0.019	0.0580	0.0005	0.0619	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
19	*		0.00	0.000	0.000	0.0580	0.0004	0.0478	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
20	*		0.00	0.000	0.000	0.0580	0.0007	0.0900	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
21	*		0.00	0.000	0.000	0.0580	0.0007	0.0909	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
22	*		0.14	0.000	0.030	0.0580	0.0007	0.0870	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
23	*		0.86	0.000	0.023	0.0580	0.0005	0.0645	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
24	*		0.05	0.000	0.011	0.0580	0.0004	0.0564	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
25	*		0.00	0.000	0.012	0.0580	0.0004	0.0550	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
26	*	*	0.16	0.000	0.005	0.0580	0.0004	0.0512	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
27	*	*	0.08	0.000	0.000	0.0580	0.0005	0.0656	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
28	*	*	0.00	0.000	0.021	0.0580	0.0005	0.0671	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
29	*	*	0.00	0.000	0.019	0.0580	0.0005	0.0641	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
30	*	*	0.00	0.000	0.023	0.0580	0.0005	0.0603	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
31		*	0.05	0.000	0.000	0.0621	0.0005	0.0570	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
32	*	*	0.00	0.000	0.028	0.0621	0.0004	0.0545	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
33		*	0.00	0.000	0.000	0.1490	0.0004	0.0529	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
34	*	*	0.03	0.000	0.031	0.1490	0.0004	0.0521	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
35	*	*	0.00	0.000	0.001	0.1490	0.0004	0.0518	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
36	*	*	0.10	0.000	0.010	0.1490	0.0004	0.0518	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
37	*	*	0.16	0.000	0.000	0.1490	0.0004	0.0520	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

38		*	0.00	0.000	0.012	0.1673	0.0004	0.0524	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
39		*	0.00	0.000	0.014	0.1673	0.0004	0.0526	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
40		*	0.01	0.000	0.001	0.1677	0.0004	0.0529	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
41		*	0.14	0.000	0.001	0.1794	0.0004	0.0530	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
42		*	0.00	0.000	0.000	0.1794	0.0004	0.0530	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
43		*	0.00	0.000	0.001	0.1795	0.0004	0.0529	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
44		*	0.19	0.000	0.001	0.1949	0.0004	0.0527	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
45		*	0.27	0.000	0.001	0.2172	0.0004	0.0524	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
46		*	0.00	0.000	0.000	0.2172	0.0004	0.0520	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
47		*	0.00	0.000	0.000	0.2172	0.0004	0.0516	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
48			0.00	0.000	0.102	0.1777	0.0004	0.0544	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
49			0.00	0.000	0.049	0.1632	0.0004	0.0491	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
50	*		0.00	0.000	0.000	0.1581	0.0003	0.0381	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
51	*		0.01	0.000	0.005	0.1544	0.0003	0.0400	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
52	*		0.00	0.000	0.003	0.1516	0.0004	0.0539	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
53			0.02	0.000	0.084	0.1439	0.0005	0.0648	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
54			0.10	0.000	0.048	0.1455	0.0005	0.0638	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
55	*		0.53	0.000	0.018	0.1464	0.0004	0.0562	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
56	*		0.00	0.000	0.008	0.1472	0.0005	0.0607	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
57	*		0.07	0.000	0.004	0.1480	0.0005	0.0574	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
58	*		0.19	0.000	0.007	0.1489	0.0004	0.0503	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
59	*		0.13	0.000	0.000	0.1498	0.0004	0.0455	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
60	*		0.01	0.000	0.000	0.1506	0.0003	0.0392	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
61			0.00	0.000	0.000	0.2136	0.0003	0.0326	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
62			0.04	0.000	0.085	0.1824	0.0003	0.0373	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
63			0.00	0.000	0.070	0.1662	0.0001	0.0151	3.84E-09	0.0000	0.0000	1.73E-10	0.0000	0.0000	0.00E+00
64			0.00	0.000	0.073	0.1553	0.0000	0.0005	1.70E-09	0.0000	0.0000	1.64E-10	0.0000	0.0000	0.00E+00
65			1.31	0.000	0.102	0.2352	0.0001	0.0187	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
66			0.00	0.000	0.055	0.1810	0.0002	0.0223	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
67			0.00	0.000	0.083	0.1635	0.0001	0.0186	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
68			0.10	0.000	0.095	0.1588	0.0002	0.0260	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
69			0.01	0.000	0.054	0.1523	0.0002	0.0301	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
70			0.06	0.000	0.100	0.1452	0.0003	0.0395	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
71			0.13	0.000	0.086	0.1475	0.0003	0.0410	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
72	*		0.05	0.000	0.073	0.1449	0.0003	0.0404	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
73	*		0.10	0.000	0.015	0.1455	0.0003	0.0366	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
74	*		0.00	0.000	0.008	0.1460	0.0003	0.0316	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
75	*	*	0.05	0.000	0.005	0.1460	0.0002	0.0278	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
76	*	*	0.00	0.000	0.062	0.1460	0.0002	0.0214	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
77		*	0.00	0.000	0.026	0.1460	0.0001	0.0083	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
78		*	0.75	0.000	0.001	0.2081	0.0000	0.0001	1.17E-09	0.0000	0.0000	1.57E-10	0.0000	0.0000	0.00E+00
79		*	0.24	0.000	0.001	0.2277	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
80		*	0.11	0.000	0.001	0.2368	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
81		*	0.00	0.000	0.000	0.2368	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
82		*	0.00	0.000	0.000	0.2368	0.0000	0.0004	1.62E-09	0.0000	0.0000	1.63E-10	0.0000	0.0000	0.00E+00

83		*	0.00	0.000	0.000	0.2368	0.0001	0.0113	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
84		*	0.00	0.000	0.000	0.2368	0.0002	0.0270	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
85		*	0.00	0.000	0.000	0.2368	0.0003	0.0409	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
86	*	*	0.00	0.000	0.000	0.2368	0.0004	0.0519	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
87	*	*	0.00	0.000	0.000	0.2368	0.0005	0.0596	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
88		*	0.21	0.000	0.001	0.2545	0.0005	0.0647	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
89		*	0.06	0.000	0.001	0.2593	0.0005	0.0677	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
90		*	0.00	0.000	0.000	0.2593	0.0005	0.0692	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
91			0.74	0.000	0.124	0.2223	0.0006	0.0731	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
92			0.11	0.000	0.219	0.1793	0.0003	0.0431	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
93			0.00	0.000	0.237	0.1510	0.0007	0.0860	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
94			0.00	0.000	0.197	0.1302	0.0007	0.0932	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
95			0.00	0.000	0.118	0.1196	0.0007	0.0877	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
96			0.00	0.000	0.049	0.1151	0.0008	0.0968	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
97			0.00	0.000	0.038	0.1106	0.0006	0.0816	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
98			0.01	0.000	0.032	0.1072	0.0005	0.0611	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
99			0.02	0.000	0.028	0.1060	0.0003	0.0349	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
100			0.02	0.000	0.026	0.1049	0.0002	0.0231	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
101			0.01	0.000	0.024	0.1028	0.0001	0.0131	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
102	*		0.10	0.000	0.031	0.1040	0.0000	0.0050	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
103	*		0.20	0.000	0.034	0.1052	0.0001	0.0141	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
104	*		0.21	0.000	0.034	0.1064	0.0002	0.0261	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
105			0.00	0.000	0.069	0.1291	0.0003	0.0394	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
106			0.02	0.000	0.022	0.1284	0.0004	0.0526	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
107			0.01	0.000	0.021	0.1272	0.0005	0.0594	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
108			0.19	0.000	0.020	0.1410	0.0006	0.0729	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
109			0.00	0.000	0.156	0.1277	0.0006	0.0739	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
110			0.33	0.000	0.019	0.1521	0.0007	0.0853	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
111			0.00	0.000	0.165	0.1357	0.0006	0.0699	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
112	*		0.09	0.000	0.041	0.1337	0.0007	0.0851	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
113	*		0.29	0.000	0.021	0.1315	0.0006	0.0780	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
114			0.00	0.000	0.052	0.1483	0.0006	0.0743	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
115			0.56	0.000	0.112	0.1821	0.0006	0.0769	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
116			0.11	0.000	0.303	0.1417	0.0008	0.0960	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
117			0.30	0.000	0.308	0.1336	0.0005	0.0626	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
118			0.00	0.000	0.291	0.1057	0.0007	0.0886	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
119			0.06	0.000	0.119	0.0995	0.0008	0.1018	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
120			0.05	0.000	0.050	0.0964	0.0008	0.1018	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
121			0.34	0.000	0.038	0.1198	0.0006	0.0744	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
122			0.03	0.000	0.206	0.0995	0.0007	0.0856	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
123			0.08	0.000	0.032	0.0960	0.0004	0.0475	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
124	*		0.00	0.000	0.000	0.0939	0.0002	0.0279	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
125	*		0.00	0.000	0.028	0.0902	0.0004	0.0487	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
126			0.00	0.000	0.025	0.0871	0.0004	0.0535	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
127			0.00	0.000	0.023	0.0845	0.0004	0.0508	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

128	0.00	0.000	0.022	0.0821	0.0004	0.0444	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
129	0.00	0.000	0.020	0.0799	0.0003	0.0370	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
130	0.00	0.000	0.019	0.0779	0.0002	0.0301	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
131	0.09	0.000	0.019	0.0830	0.0002	0.0281	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
132	0.43	0.000	0.018	0.0970	0.0002	0.0289	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
133	0.63	0.000	0.126	0.1046	0.0002	0.0209	6.30E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
134	0.56	0.000	0.066	0.1044	0.0000	0.0041	2.03E-09	0.0000	0.0000	1.67E-10	0.0000	0.0000	0.00E+00
135	0.03	0.000	0.075	0.0858	0.0001	0.0181	5.69E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
136	0.06	0.000	0.105	0.0773	0.0004	0.0514	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
137	0.00	0.000	0.125	0.0586	0.0006	0.0705	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
138	0.03	0.000	0.017	0.0592	0.0005	0.0598	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
139	0.00	0.000	0.006	0.0580	0.0006	0.0812	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
140	0.00	0.000	0.000	0.0580	0.0005	0.0626	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
141	0.03	0.000	0.004	0.0580	0.0004	0.0496	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
142	0.20	0.000	0.015	0.0580	0.0002	0.0287	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
143	0.20	0.000	0.014	0.0580	0.0000	0.0000	1.50E-10	0.0000	0.0000	8.22E-11	0.0000	0.0000	0.00E+00
144	0.27	0.000	0.129	0.0580	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
145	0.20	0.000	0.070	0.0580	0.0004	0.0504	6.78E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
146	0.00	0.000	0.000	0.0580	0.0002	0.0234	5.44E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
147	0.56	0.000	0.044	0.0646	0.0009	0.1115	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
148	0.48	0.000	0.074	0.0645	0.0001	0.0181	4.76E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
149	0.03	0.000	0.027	0.0613	0.0005	0.0652	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
150	0.02	0.000	0.012	0.0621	0.0008	0.1009	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
151	0.00	0.000	0.014	0.0600	0.0008	0.0957	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
152	0.00	0.000	0.010	0.0580	0.0005	0.0661	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
153	0.00	0.000	0.000	0.0580	0.0001	0.0171	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
154	0.00	0.000	0.000	0.0580	0.0000	0.0003	1.39E-09	0.0000	0.0000	1.61E-10	0.0000	0.0000	0.00E+00
155	0.00	0.000	0.000	0.0580	0.0001	0.0073	5.11E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
156	0.00	0.000	0.000	0.0580	0.0003	0.0418	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
157	0.00	0.000	0.000	0.0580	0.0006	0.0815	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
158	0.02	0.000	0.003	0.0580	0.0009	0.1100	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
159	0.00	0.000	0.000	0.0580	0.0010	0.1221	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
160	0.00	0.000	0.000	0.0580	0.0011	0.1380	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
161	0.00	0.000	0.000	0.0580	0.0011	0.1371	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
162	0.00	0.000	0.000	0.0580	0.0011	0.1326	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
163	0.09	0.000	0.003	0.0580	0.0010	0.1287	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
164	0.00	0.000	0.000	0.0580	0.0009	0.1147	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
165	0.50	0.000	0.008	0.0645	0.0011	0.1326	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
166	0.58	0.000	0.117	0.0646	0.0009	0.1078	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
167	0.33	0.000	0.145	0.0642	0.0008	0.1044	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
168	0.00	0.000	0.024	0.0586	0.0012	0.1496	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
169	0.00	0.000	0.003	0.0580	0.0011	0.1376	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
170	0.69	0.000	0.046	0.0648	0.0011	0.1399	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
171	0.00	0.000	0.019	0.0593	0.0003	0.0389	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
172	0.00	0.000	0.006	0.0580	0.0006	0.0780	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

173	0.06	0.000	0.025	0.0580	0.0008	0.1042	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
174	0.00	0.000	0.003	0.0580	0.0005	0.0650	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
175	0.00	0.000	0.000	0.0580	0.0003	0.0413	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
176	0.22	0.000	0.018	0.0580	0.0002	0.0282	5.33E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
177	0.00	0.000	0.000	0.0580	0.0000	0.0008	8.92E-10	0.0000	0.0000	1.51E-10	0.0000	0.0000	0.00E+00
178	0.00	0.000	0.000	0.0580	0.0003	0.0412	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
179	0.08	0.000	0.003	0.0580	0.0006	0.0705	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
180	0.85	0.000	0.012	0.0649	0.0004	0.0463	6.45E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
181	0.49	0.000	0.078	0.0645	0.0006	0.0705	5.43E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
182	0.00	0.000	0.025	0.0584	0.0012	0.1565	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
183	0.00	0.000	0.001	0.0580	0.0013	0.1695	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
184	0.00	0.000	0.003	0.0580	0.0010	0.1298	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
185	0.27	0.000	0.024	0.0580	0.0006	0.0697	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
186	0.03	0.000	0.013	0.0580	0.0001	0.0092	2.64E-09	0.0000	0.0000	1.70E-10	0.0000	0.0000	0.00E+00
187	0.44	0.000	0.018	0.0580	0.0005	0.0691	6.26E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
188	0.07	0.000	0.023	0.0580	0.0004	0.0493	4.15E-09	0.0000	0.0000	1.74E-10	0.0000	0.0000	0.00E+00
189	0.00	0.000	0.003	0.0580	0.0013	0.1686	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
190	0.01	0.000	0.005	0.0580	0.0010	0.1303	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
191	0.00	0.000	0.000	0.0580	0.0006	0.0696	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
192	0.00	0.000	0.000	0.0580	0.0004	0.0541	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
193	0.00	0.000	0.000	0.0580	0.0006	0.0815	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
194	0.04	0.000	0.004	0.0580	0.0009	0.1168	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
195	0.03	0.000	0.003	0.0580	0.0011	0.1425	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
196	0.00	0.000	0.000	0.0580	0.0014	0.1770	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
197	0.00	0.000	0.000	0.0580	0.0014	0.1798	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
198	0.24	0.000	0.010	0.0580	0.0013	0.1610	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
199	0.01	0.000	0.003	0.0580	0.0011	0.1428	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
200	0.00	0.000	0.000	0.0580	0.0013	0.1691	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
201	0.00	0.000	0.000	0.0580	0.0011	0.1445	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
202	0.00	0.000	0.000	0.0580	0.0010	0.1225	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
203	0.00	0.000	0.000	0.0580	0.0009	0.1100	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
204	1.03	0.000	0.013	0.0651	0.0009	0.1080	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
205	0.04	0.000	0.012	0.0626	0.0006	0.0771	6.39E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
206	0.07	0.000	0.014	0.0631	0.0012	0.1562	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
207	0.09	0.000	0.024	0.0631	0.0012	0.1456	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
208	0.00	0.000	0.022	0.0587	0.0008	0.0952	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
209	0.00	0.000	0.002	0.0580	0.0006	0.0797	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
210	0.00	0.000	0.000	0.0580	0.0005	0.0663	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
211	0.00	0.000	0.000	0.0580	0.0004	0.0444	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
212	0.82	0.000	0.016	0.0649	0.0003	0.0432	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
213	0.00	0.000	0.025	0.0584	0.0001	0.0188	3.46E-09	0.0000	0.0000	1.72E-10	0.0000	0.0000	0.00E+00
214	0.00	0.000	0.001	0.0580	0.0010	0.1218	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
215	0.00	0.000	0.000	0.0580	0.0011	0.1337	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
216	0.75	0.000	0.024	0.0648	0.0008	0.0980	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
217	0.01	0.000	0.021	0.0605	0.0001	0.0092	2.60E-09	0.0000	0.0000	1.70E-10	0.0000	0.0000	0.00E+00

218		0.06	0.000	0.010	0.0629	0.0010	0.1202	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
219		0.43	0.000	0.041	0.0644	0.0008	0.1014	6.75E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
220		0.27	0.000	0.050	0.0641	0.0001	0.0144	2.98E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
221		0.00	0.000	0.024	0.0585	0.0009	0.1116	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
222		0.00	0.000	0.002	0.0580	0.0011	0.1432	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
223		0.11	0.000	0.012	0.0580	0.0006	0.0784	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
224		0.02	0.000	0.006	0.0580	0.0001	0.0079	3.31E-09	0.0000	0.0000	1.72E-10	0.0000	0.0000	0.00E+00
225		0.02	0.000	0.005	0.0580	0.0004	0.0538	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
226		0.14	0.000	0.004	0.0580	0.0007	0.0838	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
227		0.02	0.000	0.004	0.0580	0.0010	0.1254	6.67E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
228		0.00	0.000	0.000	0.0580	0.0015	0.1918	7.00E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
229		0.14	0.000	0.003	0.0580	0.0013	0.1621	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
230		0.17	0.000	0.027	0.0580	0.0009	0.1180	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
231		0.00	0.000	0.000	0.0580	0.0015	0.1839	7.00E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
232		0.00	0.000	0.000	0.0580	0.0016	0.2031	7.01E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
233		0.00	0.000	0.000	0.0580	0.0011	0.1427	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
234		0.03	0.000	0.005	0.0580	0.0009	0.1074	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
235		0.01	0.000	0.004	0.0580	0.0007	0.0873	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
236		0.00	0.000	0.002	0.0580	0.0009	0.1074	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
237		0.08	0.000	0.003	0.0580	0.0010	0.1198	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
238		0.47	0.000	0.012	0.0645	0.0009	0.1104	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
239		0.17	0.000	0.053	0.0638	0.0009	0.1191	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
240		0.00	0.000	0.009	0.0606	0.0014	0.1713	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
241		0.00	0.000	0.014	0.0580	0.0014	0.1712	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
242		0.01	0.000	0.012	0.0580	0.0010	0.1282	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
243		0.39	0.000	0.024	0.0580	0.0008	0.1025	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
244		0.00	0.000	0.000	0.0580	0.0001	0.0146	3.23E-09	0.0000	0.0000	1.72E-10	0.0000	0.0000	0.00E+00
245		0.17	0.000	0.018	0.0580	0.0008	0.1069	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
246		0.07	0.000	0.004	0.0580	0.0003	0.0427	5.89E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
247		0.00	0.000	0.000	0.0580	0.0007	0.0857	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
248		0.00	0.000	0.000	0.0580	0.0008	0.1065	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
249		0.00	0.000	0.000	0.0580	0.0006	0.0758	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
250		0.00	0.000	0.000	0.0580	0.0004	0.0491	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
251		0.04	0.000	0.003	0.0580	0.0003	0.0438	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
252		0.02	0.000	0.003	0.0580	0.0003	0.0332	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
253		0.03	0.000	0.003	0.0580	0.0006	0.0764	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
254		0.60	0.000	0.009	0.0647	0.0008	0.1029	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
255		0.00	0.000	0.008	0.0607	0.0008	0.0948	6.58E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
256		0.00	0.000	0.005	0.0597	0.0014	0.1765	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
257		0.07	0.000	0.010	0.0631	0.0013	0.1621	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
258		0.01	0.000	0.006	0.0615	0.0007	0.0827	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
259	*	0.58	0.000	0.033	0.0624	0.0006	0.0735	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
260		0.00	0.000	0.041	0.0645	0.0005	0.0688	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
261		0.00	0.000	0.013	0.0601	0.0002	0.0206	3.83E-09	0.0000	0.0000	1.73E-10	0.0000	0.0000	0.00E+00
262		0.00	0.000	0.011	0.0580	0.0009	0.1150	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

263		0.00	0.000	0.000	0.0580	0.0009	0.1173	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
264		0.00	0.000	0.000	0.0580	0.0007	0.0890	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
265		0.00	0.000	0.004	0.0580	0.0005	0.0588	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
266		0.07	0.000	0.019	0.0580	0.0004	0.0490	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
267		0.21	0.000	0.055	0.0580	0.0002	0.0242	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
268		0.00	0.000	0.000	0.0580	0.0004	0.0531	5.45E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
269		0.00	0.000	0.000	0.0580	0.0010	0.1264	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
270		0.28	0.000	0.016	0.0580	0.0010	0.1242	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
271		0.00	0.000	0.003	0.0580	0.0005	0.0674	5.93E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
272		0.17	0.000	0.031	0.0580	0.0011	0.1433	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
273		0.02	0.000	0.017	0.0580	0.0005	0.0624	6.17E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
274		0.02	0.000	0.012	0.0580	0.0010	0.1228	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
275		0.29	0.000	0.023	0.0580	0.0009	0.1163	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
276		0.00	0.000	0.000	0.0580	0.0002	0.0286	4.63E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
277	*	0.00	0.000	0.000	0.0580	0.0008	0.1060	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
278	*	0.00	0.000	0.002	0.0580	0.0008	0.0991	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
279		0.00	0.000	0.000	0.0580	0.0006	0.0746	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
280		0.00	0.000	0.000	0.0580	0.0004	0.0553	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
281	*	0.00	0.000	0.000	0.0580	0.0004	0.0468	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
282	*	0.00	0.000	0.002	0.0580	0.0004	0.0490	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
283		0.00	0.000	0.000	0.0580	0.0005	0.0585	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
284		0.00	0.000	0.000	0.0580	0.0006	0.0704	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
285		0.06	0.000	0.003	0.0580	0.0007	0.0841	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
286		0.04	0.000	0.003	0.0580	0.0006	0.0784	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
287		0.12	0.000	0.003	0.0580	0.0007	0.0902	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
288		0.51	0.000	0.008	0.0646	0.0008	0.1050	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
289		0.00	0.000	0.005	0.0611	0.0007	0.0939	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
290		0.00	0.000	0.006	0.0599	0.0012	0.1459	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
291		0.01	0.000	0.008	0.0602	0.0011	0.1410	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
292		0.00	0.000	0.007	0.0591	0.0009	0.1152	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
293		0.00	0.000	0.008	0.0580	0.0006	0.0806	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
294		0.13	0.000	0.013	0.0580	0.0006	0.0742	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
295		0.14	0.000	0.011	0.0580	0.0002	0.0273	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
296		0.22	0.000	0.042	0.0580	0.0001	0.0103	5.36E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
297		0.00	0.000	0.000	0.0580	0.0002	0.0225	4.24E-09	0.0000	0.0000	1.74E-10	0.0000	0.0000	0.00E+00
298		0.00	0.000	0.000	0.0580	0.0007	0.0937	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
299	*	0.00	0.000	0.000	0.0580	0.0009	0.1092	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
300		0.00	0.000	0.000	0.0580	0.0007	0.0900	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
301		0.00	0.000	0.000	0.0580	0.0005	0.0683	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
302		0.00	0.000	0.000	0.0580	0.0004	0.0512	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
303		0.00	0.000	0.003	0.0580	0.0003	0.0405	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
304		0.00	0.000	0.000	0.0580	0.0003	0.0367	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
305		0.19	0.000	0.013	0.0580	0.0003	0.0396	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
306		0.00	0.000	0.000	0.0580	0.0003	0.0360	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
307	*	0.00	0.000	0.000	0.0580	0.0005	0.0647	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

308	*	0.18	0.000	0.022	0.0580	0.0006	0.0751	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
309	*	0.07	0.000	0.012	0.0580	0.0005	0.0621	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
310		0.00	0.000	0.023	0.0580	0.0005	0.0667	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
311		0.00	0.000	0.000	0.0580	0.0004	0.0466	6.67E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
312		0.45	0.000	0.011	0.0645	0.0008	0.1059	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
313		0.80	0.000	0.022	0.0649	0.0004	0.0516	6.41E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
314		0.00	0.000	0.005	0.0610	0.0006	0.0708	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
315		0.00	0.000	0.005	0.0600	0.0008	0.0988	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
316		0.33	0.000	0.029	0.0642	0.0010	0.1273	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
317		0.00	0.000	0.004	0.0611	0.0003	0.0391	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
318		0.40	0.000	0.019	0.0644	0.0008	0.0977	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
319	*	0.00	0.000	0.003	0.0615	0.0002	0.0203	5.88E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
320	*	0.08	0.000	0.020	0.0624	0.0006	0.0741	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
321		0.00	0.000	0.044	0.0613	0.0007	0.0868	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
322		0.00	0.000	0.004	0.0605	0.0005	0.0608	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
323		0.06	0.000	0.008	0.0629	0.0003	0.0406	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
324	*	0.00	0.000	0.003	0.0612	0.0000	0.0042	1.34E-09	0.0000	0.0000	1.60E-10	0.0000	0.0000	0.00E+00
325		0.07	0.000	0.004	0.0632	0.0001	0.0165	4.80E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
326	*	0.14	0.000	0.029	0.0624	0.0001	0.0082	3.65E-09	0.0000	0.0000	1.73E-10	0.0000	0.0000	0.00E+00
327		0.05	0.000	0.052	0.0633	0.0005	0.0676	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
328		0.00	0.000	0.004	0.0611	0.0005	0.0686	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
329		0.00	0.000	0.006	0.0600	0.0010	0.1289	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
330		0.01	0.000	0.009	0.0601	0.0010	0.1253	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
331		0.18	0.000	0.036	0.0638	0.0010	0.1220	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
332		0.00	0.000	0.006	0.0609	0.0006	0.0709	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
333		1.21	0.000	0.044	0.0652	0.0008	0.0960	6.54E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
334		0.00	0.000	0.008	0.0607	0.0007	0.0865	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
335		0.00	0.000	0.008	0.0594	0.0011	0.1374	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
336		0.03	0.000	0.007	0.0611	0.0011	0.1441	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
337		0.00	0.000	0.006	0.0601	0.0008	0.1027	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
338		0.00	0.000	0.009	0.0586	0.0004	0.0519	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
339		0.00	0.000	0.002	0.0580	0.0002	0.0197	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
340		0.72	0.000	0.047	0.0648	0.0003	0.0343	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
341		0.02	0.000	0.004	0.0624	0.0002	0.0279	3.95E-09	0.0000	0.0000	1.73E-10	0.0000	0.0000	0.00E+00
342		0.02	0.000	0.007	0.0622	0.0011	0.1427	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
343		0.00	0.000	0.006	0.0607	0.0010	0.1279	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
344		0.00	0.000	0.005	0.0598	0.0007	0.0865	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
345		0.00	0.000	0.007	0.0586	0.0005	0.0589	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
346		0.00	0.000	0.002	0.0580	0.0004	0.0511	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
347	*	0.00	0.000	0.000	0.0580	0.0005	0.0689	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
348		0.00	0.000	0.000	0.0580	0.0007	0.0902	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
349		0.20	0.000	0.016	0.0580	0.0009	0.1071	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
350		0.02	0.000	0.004	0.0580	0.0008	0.1070	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
351	*	0.07	0.000	0.027	0.0580	0.0012	0.1470	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
352		0.00	0.000	0.027	0.0580	0.0011	0.1342	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

353		0.02	0.000	0.006	0.0580	0.0010	0.1312	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
354		0.05	0.000	0.005	0.0580	0.0009	0.1135	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
355		0.06	0.000	0.005	0.0580	0.0008	0.0957	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
356		0.06	0.000	0.005	0.0580	0.0008	0.1063	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
357		0.06	0.000	0.006	0.0580	0.0009	0.1162	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
358		0.22	0.000	0.036	0.0580	0.0010	0.1275	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
359		0.15	0.000	0.009	0.0580	0.0008	0.0965	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
360		0.00	0.000	0.000	0.0580	0.0010	0.1213	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
361		0.00	0.000	0.000	0.0580	0.0012	0.1467	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
362	*	0.00	0.000	0.004	0.0580	0.0010	0.1280	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
363	*	0.00	0.000	0.000	0.0580	0.0008	0.0964	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
364	*	0.00	0.000	0.000	0.0580	0.0006	0.0703	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
365	*	0.00	0.000	0.000	0.0580	0.0004	0.0517	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

* = Frozen (air or soil)

Annual Totals for Year 1			
	inches	cubic feet	percent
Precipitation	35.38	128,415.6	100.00
Runoff	0.000	0.0000	0.00
Evapotranspiration	8.395	30,473.1	23.73
Drainage Collected from Layer 3	26.9861	97,959.4	76.28
Percolation/Leakage through Layer 5	0.000002	0.0086	0.00
Average Head on Top of Layer 4	0.0006	---	---
Drainage Collected from Layer 7	0.0000	0.0084	0.00
Percolation/Leakage through Layer 9	0.000000	0.0002	0.00
Average Head on Top of Layer 8	0.0000	---	---
Percolation/Leakage through Layer 10	0.000000	0.0000	0.00
Change in Water Storage	-0.0047	-17.0	-0.01
Soil Water at Start of Year	60.5438	219,774.0	171.14
Soil Water at End of Year	60.5391	219,757.0	171.13
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	0.0000	0.0000	0.00

Daily Output for Year 2

Column key: Head #1: drainage from Layer 4 | Head #2: drainage from Layer 8
Drain #1: drainage from Layer 3 | Drain #2: drainage from Layer 7
Leak #1: leakage thru Layer 5 | Leak #2: leakage thru Layer 9 | Leak #3: leakage thru Layer 10

Title: Wayne Disposal-Initial Lift-Sideslope
Simulated On: 3/10/2021 13:00

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1	Head #2	Drain #2	Leak #2	Head #3	Drain #3	Leak #3
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1	*		0.12	0.000	0.008	0.0580	0.0004	0.0463	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
2	*		0.00	0.000	0.005	0.0580	0.0002	0.0301	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
3	*		0.00	0.000	0.006	0.0580	0.0003	0.0349	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
4	*		0.07	0.000	0.008	0.0580	0.0004	0.0487	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
5	*		0.00	0.000	0.005	0.0580	0.0005	0.0630	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
6	*		0.05	0.000	0.007	0.0580	0.0006	0.0736	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
7	*		0.00	0.000	0.005	0.0580	0.0006	0.0800	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
8	*	*	0.00	0.000	0.003	0.0580	0.0006	0.0797	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
9	*	*	0.30	0.000	0.004	0.0580	0.0007	0.0914	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
10	*	*	0.00	0.000	0.017	0.0580	0.0007	0.0878	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
11	*	*	0.00	0.000	0.023	0.0580	0.0006	0.0812	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
12	*	*	0.38	0.000	0.021	0.0580	0.0006	0.0753	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
13		*	0.07	0.000	0.000	0.1072	0.0006	0.0709	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
14		*	0.00	0.000	0.018	0.1190	0.0005	0.0679	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
15		*	0.00	0.000	0.000	0.1190	0.0005	0.0661	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
16		*	0.00	0.000	0.000	0.1190	0.0005	0.0651	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
17		*	0.00	0.000	0.000	0.1190	0.0005	0.0645	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
18	*	*	0.00	0.000	0.000	0.1190	0.0005	0.0642	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
19	*	*	0.00	0.000	0.000	0.1190	0.0005	0.0640	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
20	*	*	0.01	0.000	0.006	0.1190	0.0005	0.0638	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
21		*	0.00	0.000	0.000	0.1190	0.0005	0.0636	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
22		*	0.00	0.000	0.000	0.1190	0.0005	0.0632	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
23		*	0.00	0.000	0.000	0.1190	0.0005	0.0627	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
24	*	*	0.11	0.000	0.017	0.1190	0.0005	0.0621	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
25	*	*	0.00	0.000	0.011	0.1190	0.0005	0.0615	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
26	*	*	0.00	0.000	0.005	0.1190	0.0005	0.0608	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
27	*	*	0.00	0.000	0.007	0.1190	0.0005	0.0600	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
28	*	*	0.02	0.000	0.000	0.1190	0.0005	0.0592	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
29	*	*	0.00	0.000	0.016	0.1190	0.0005	0.0584	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
30	*	*	0.00	0.000	0.006	0.1190	0.0005	0.0575	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
31	*	*	0.00	0.000	0.025	0.1190	0.0004	0.0566	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
32	*	*	0.00	0.000	0.039	0.1190	0.0004	0.0557	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
33		*	0.00	0.000	0.007	0.1190	0.0004	0.0549	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
34	*	*	0.00	0.000	0.000	0.1190	0.0004	0.0540	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
35		*	0.00	0.000	0.000	0.1190	0.0004	0.0531	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
36	*	*	0.64	0.000	0.030	0.1190	0.0004	0.0522	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
37	*	*	0.00	0.000	0.013	0.1190	0.0004	0.0514	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

38	*	*	0.00	0.000	0.022	0.1190	0.0004	0.0505	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
39		*	0.00	0.000	0.000	0.1665	0.0004	0.0497	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
40	*	*	0.00	0.000	0.000	0.1665	0.0004	0.0489	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
41	*	*	0.01	0.000	0.007	0.1665	0.0004	0.0481	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
42	*	*	0.02	0.000	0.019	0.1665	0.0004	0.0473	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
43	*	*	0.00	0.000	0.003	0.1665	0.0004	0.0466	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
44	*	*	0.00	0.000	0.000	0.1665	0.0004	0.0458	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
45	*	*	0.00	0.000	0.000	0.1665	0.0004	0.0451	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
46		*	0.00	0.000	0.000	0.1665	0.0004	0.0444	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
47	*	*	0.00	0.000	0.001	0.1665	0.0003	0.0437	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
48		*	0.16	0.000	0.001	0.1799	0.0003	0.0430	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
49		*	0.12	0.000	0.001	0.1899	0.0003	0.0424	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
50		*	0.08	0.000	0.001	0.1967	0.0003	0.0417	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
51		*	0.03	0.000	0.001	0.1988	0.0003	0.0411	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
52		*	0.02	0.000	0.001	0.2001	0.0003	0.0405	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
53		*	0.00	0.000	0.000	0.2001	0.0003	0.0399	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
54	*	*	0.00	0.000	0.000	0.2001	0.0003	0.0393	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
55		*	0.00	0.000	0.000	0.2001	0.0003	0.0387	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
56		*	0.00	0.000	0.000	0.2001	0.0003	0.0382	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
57	*	*	0.00	0.000	0.000	0.2001	0.0003	0.0376	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
58	*	*	0.01	0.000	0.012	0.2001	0.0003	0.0371	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
59		*	0.23	0.000	0.001	0.2196	0.0003	0.0366	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
60		*	0.02	0.000	0.001	0.2210	0.0003	0.0361	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
61		*	0.20	0.000	0.001	0.2376	0.0003	0.0356	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
62		*	0.00	0.000	0.000	0.2376	0.0003	0.0351	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
63		*	0.03	0.000	0.001	0.2403	0.0003	0.0346	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
64	*	*	0.05	0.000	0.051	0.2403	0.0003	0.0342	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
65	*	*	0.03	0.000	0.017	0.2403	0.0003	0.0337	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
66	*	*	0.21	0.000	0.015	0.2403	0.0003	0.0333	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
67		*	0.07	0.000	0.011	0.2633	0.0003	0.0329	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
68	*	*	0.42	0.000	0.016	0.2633	0.0003	0.0324	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
69	*	*	0.27	0.000	0.016	0.2633	0.0003	0.0320	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
70	*	*	0.00	0.000	0.024	0.2633	0.0003	0.0316	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
71		*	0.00	0.000	0.000	0.3163	0.0002	0.0312	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
72	*	*	0.00	0.000	0.000	0.3163	0.0002	0.0308	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
73		*	0.00	0.000	0.000	0.3163	0.0002	0.0305	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
74	*	*	0.00	0.000	0.000	0.3163	0.0002	0.0301	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
75	*	*	0.14	0.000	0.034	0.3163	0.0002	0.0297	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
76		*	0.01	0.000	0.119	0.3165	0.0002	0.0294	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
77		*	0.45	0.000	0.001	0.3540	0.0002	0.0290	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
78		*	0.33	0.000	0.001	0.3810	0.0002	0.0287	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
79	*	*	0.00	0.000	0.000	0.3810	0.0002	0.0284	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
80	*	*	0.01	0.000	0.010	0.3810	0.0002	0.0281	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
81	*	*	0.00	0.000	0.000	0.3810	0.0002	0.0277	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
82		*	0.00	0.000	0.000	0.3810	0.0002	0.0274	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

83		*	0.00	0.000	0.000	0.3810	0.0002	0.0271	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
84		*	0.00	0.000	0.000	0.3810	0.0002	0.0268	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
85		*	0.06	0.000	0.001	0.3860	0.0002	0.0265	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
86	*	*	0.68	0.000	0.016	0.3860	0.0002	0.0262	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
87	*	*	0.02	0.000	0.029	0.3860	0.0002	0.0260	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
88	*	*	0.00	0.000	0.018	0.3860	0.0002	0.0257	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
89		*	0.11	0.000	0.000	0.4487	0.0002	0.0254	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
90	*	*	0.06	0.000	0.032	0.4487	0.0002	0.0251	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
91	*	*	0.38	0.000	0.012	0.4487	0.0002	0.0249	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
92	*	*	0.03	0.000	0.000	0.4487	0.0002	0.0246	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
93	*	*	0.05	0.000	0.000	0.4487	0.0002	0.0244	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
94	*	*	0.27	0.000	0.018	0.4487	0.0002	0.0241	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
95	*	*	0.00	0.000	0.045	0.4487	0.0002	0.0239	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
96	*	*	0.72	0.000	0.027	0.4487	0.0002	0.0237	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
97		*	0.10	0.000	0.000	0.4570	0.0002	0.0248	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
98		*	0.07	0.000	0.001	0.4570	0.0001	0.0095	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
99		*	0.04	0.000	0.001	0.4570	0.0001	0.0183	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
100		*	0.10	0.000	0.001	0.4570	0.0002	0.0239	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
101	*	*	0.00	0.000	0.000	0.4570	0.0002	0.0272	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
102	*	*	0.00	0.000	0.000	0.4570	0.0002	0.0288	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
103	*	*	0.00	0.000	0.000	0.4570	0.0002	0.0293	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
104		*	0.06	0.000	0.001	0.4570	0.0003	0.0440	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
105	*	*	0.00	0.000	0.003	0.4570	0.0002	0.0205	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
106		*	0.00	0.000	0.000	0.4570	0.0002	0.0219	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
107		*	0.00	0.000	0.000	0.4570	0.0002	0.0228	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
108		*	0.00	0.000	0.000	0.4570	0.0002	0.0242	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
109		*	0.00	0.000	0.000	0.4570	0.0002	0.0276	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
110		*	0.00	0.000	0.000	0.4570	0.0002	0.0286	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
111		*	0.00	0.000	0.000	0.4570	0.0002	0.0279	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
112		*	0.00	0.000	0.000	0.4570	0.0002	0.0263	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
113		*	0.00	0.000	0.000	0.4570	0.0002	0.0242	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
114		*	0.10	0.000	0.001	0.4570	0.0002	0.0222	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
115			0.00	0.000	0.221	0.2440	0.0000	0.0024	2.87E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
116			0.00	0.000	0.122	0.2181	0.0000	0.0031	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
117			0.00	0.000	0.237	0.1904	0.0001	0.0065	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
118			0.00	0.000	0.130	0.1746	0.0001	0.0091	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
119			0.00	0.000	0.054	0.1678	0.0001	0.0139	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
120			0.08	0.000	0.042	0.1691	0.0002	0.0256	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
121			0.00	0.000	0.035	0.1638	0.0002	0.0229	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
122			0.39	0.000	0.032	0.1915	0.0002	0.0208	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
123			0.06	0.000	0.260	0.1724	0.0002	0.0189	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
124			0.83	0.000	0.029	0.2380	0.0001	0.0174	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
125			0.00	0.000	0.212	0.2115	0.0001	0.0140	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
126			0.36	0.000	0.170	0.2140	0.0001	0.0098	4.97E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
127			0.15	0.000	0.191	0.2021	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00

128	0.09	0.000	0.282	0.1812	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
129	0.02	0.000	0.220	0.1608	0.0000	0.0000	2.35E-10	0.0000	0.0000	1.02E-10	0.0000	0.0000	0.00E+00
130	0.18	0.000	0.133	0.1620	0.0000	0.0045	6.36E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
131	0.36	0.000	0.186	0.1756	0.0001	0.0106	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
132	0.00	0.000	0.294	0.1494	0.0003	0.0345	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
133	0.00	0.000	0.126	0.1374	0.0002	0.0256	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
134	0.00	0.000	0.054	0.1237	0.0002	0.0260	6.56E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
135	0.47	0.000	0.042	0.1547	0.0000	0.0003	4.05E-10	0.0000	0.0000	1.25E-10	0.0000	0.0000	0.00E+00
136	0.10	0.000	0.335	0.1313	0.0002	0.0206	5.00E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
137	0.15	0.000	0.036	0.1297	0.0005	0.0576	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
138	0.06	0.000	0.153	0.1111	0.0004	0.0487	6.72E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
139	0.21	0.000	0.032	0.1197	0.0004	0.0498	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
140	0.05	0.000	0.106	0.1131	0.0009	0.1102	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
141	0.15	0.000	0.081	0.1143	0.0008	0.1008	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
142	0.01	0.000	0.084	0.1071	0.0006	0.0750	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
143	0.06	0.000	0.103	0.0990	0.0007	0.0891	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
144	0.02	0.000	0.093	0.0865	0.0004	0.0484	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
145	0.14	0.000	0.055	0.0931	0.0001	0.0148	5.06E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
146	0.07	0.000	0.042	0.0916	0.0005	0.0669	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
147	0.00	0.000	0.035	0.0845	0.0004	0.0472	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
148	0.11	0.000	0.032	0.0899	0.0003	0.0345	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
149	0.15	0.000	0.288	0.0669	0.0007	0.0861	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
150	0.16	0.000	0.029	0.0778	0.0002	0.0279	4.90E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
151	0.00	0.000	0.125	0.0591	0.0006	0.0758	6.47E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
152	0.00	0.000	0.002	0.0587	0.0006	0.0762	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
153	0.00	0.000	0.002	0.0584	0.0007	0.0880	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
154	0.00	0.000	0.001	0.0580	0.0006	0.0749	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
155	0.00	0.000	0.000	0.0580	0.0005	0.0619	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
156	0.00	0.000	0.000	0.0580	0.0004	0.0528	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
157	0.18	0.000	0.009	0.0580	0.0005	0.0574	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
158	0.03	0.000	0.003	0.0580	0.0002	0.0249	6.75E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
159	0.00	0.000	0.000	0.0580	0.0004	0.0548	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
160	0.01	0.000	0.003	0.0580	0.0007	0.0830	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
161	0.00	0.000	0.000	0.0580	0.0006	0.0797	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
162	0.00	0.000	0.000	0.0580	0.0006	0.0755	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
163	0.00	0.000	0.000	0.0580	0.0006	0.0702	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
164	0.00	0.000	0.000	0.0580	0.0005	0.0667	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
165	0.00	0.000	0.000	0.0580	0.0005	0.0653	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
166	0.00	0.000	0.000	0.0580	0.0005	0.0656	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
167	0.00	0.000	0.000	0.0580	0.0005	0.0669	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
168	0.63	0.000	0.007	0.0647	0.0006	0.0736	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
169	0.21	0.000	0.142	0.0638	0.0003	0.0406	6.17E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
170	0.06	0.000	0.014	0.0629	0.0007	0.0923	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
171	0.00	0.000	0.014	0.0599	0.0008	0.1007	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
172	0.00	0.000	0.010	0.0580	0.0008	0.1019	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

173	0.00	0.000	0.000	0.0580	0.0007	0.0870	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
174	0.00	0.000	0.000	0.0580	0.0006	0.0739	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
175	0.00	0.000	0.000	0.0580	0.0005	0.0570	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
176	0.00	0.000	0.000	0.0580	0.0003	0.0415	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
177	0.00	0.000	0.000	0.0580	0.0002	0.0295	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
178	0.00	0.000	0.000	0.0580	0.0002	0.0224	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
179	0.00	0.000	0.000	0.0580	0.0002	0.0207	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
180	0.00	0.000	0.000	0.0580	0.0002	0.0240	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
181	0.00	0.000	0.000	0.0580	0.0002	0.0307	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
182	0.09	0.000	0.003	0.0580	0.0004	0.0449	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
183	0.00	0.000	0.000	0.0580	0.0003	0.0316	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
184	0.00	0.000	0.000	0.0580	0.0005	0.0584	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
185	0.00	0.000	0.000	0.0580	0.0005	0.0683	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
186	0.00	0.000	0.000	0.0580	0.0006	0.0704	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
187	0.00	0.000	0.000	0.0580	0.0006	0.0697	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
188	0.00	0.000	0.000	0.0580	0.0005	0.0683	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
189	0.00	0.000	0.000	0.0580	0.0005	0.0669	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
190	0.00	0.000	0.000	0.0580	0.0005	0.0657	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
191	0.00	0.000	0.000	0.0580	0.0005	0.0649	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
192	0.77	0.000	0.007	0.0649	0.0005	0.0686	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
193	1.02	0.000	0.110	0.0650	0.0003	0.0400	6.56E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
194	0.00	0.000	0.021	0.0590	0.0005	0.0603	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
195	0.03	0.000	0.017	0.0600	0.0007	0.0849	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
196	0.10	0.000	0.024	0.0632	0.0008	0.1061	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
197	0.59	0.000	0.056	0.0647	0.0007	0.0895	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
198	0.00	0.000	0.024	0.0585	0.0001	0.0165	6.03E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
199	0.01	0.000	0.010	0.0580	0.0004	0.0472	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
200	0.21	0.000	0.056	0.0580	0.0007	0.0902	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
201	0.04	0.000	0.032	0.0580	0.0002	0.0212	5.84E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
202	0.22	0.000	0.024	0.0580	0.0006	0.0773	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
203	0.00	0.000	0.000	0.0580	0.0000	0.0055	2.28E-09	0.0000	0.0000	1.68E-10	0.0000	0.0000	0.00E+00
204	0.00	0.000	0.000	0.0580	0.0005	0.0590	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
205	0.00	0.000	0.000	0.0580	0.0005	0.0624	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
206	0.00	0.000	0.000	0.0580	0.0003	0.0407	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
207	0.00	0.000	0.000	0.0580	0.0002	0.0200	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
208	0.00	0.000	0.000	0.0580	0.0001	0.0125	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
209	0.00	0.000	0.000	0.0580	0.0002	0.0214	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
210	0.00	0.000	0.000	0.0580	0.0003	0.0417	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
211	0.00	0.000	0.000	0.0580	0.0005	0.0645	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
212	0.00	0.000	0.000	0.0580	0.0007	0.0831	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
213	0.00	0.000	0.000	0.0580	0.0008	0.0954	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
214	0.00	0.000	0.000	0.0580	0.0008	0.1022	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
215	0.00	0.000	0.000	0.0580	0.0008	0.1052	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
216	0.00	0.000	0.000	0.0580	0.0008	0.1057	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
217	0.00	0.000	0.000	0.0580	0.0008	0.1048	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

218	0.00	0.000	0.000	0.0580	0.0008	0.1032	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
219	0.00	0.000	0.000	0.0580	0.0008	0.1011	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
220	0.14	0.000	0.003	0.0580	0.0008	0.1007	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
221	0.00	0.000	0.000	0.0580	0.0007	0.0869	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
222	0.00	0.000	0.000	0.0580	0.0008	0.1003	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
223	0.00	0.000	0.000	0.0580	0.0008	0.0980	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
224	0.00	0.000	0.000	0.0580	0.0007	0.0920	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
225	0.01	0.000	0.002	0.0580	0.0007	0.0870	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
226	0.00	0.000	0.000	0.0580	0.0006	0.0793	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
227	0.02	0.000	0.002	0.0580	0.0007	0.0819	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
228	0.00	0.000	0.000	0.0580	0.0005	0.0657	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
229	0.00	0.000	0.000	0.0580	0.0006	0.0743	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
230	0.00	0.000	0.000	0.0580	0.0006	0.0755	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
231	0.00	0.000	0.000	0.0580	0.0006	0.0739	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
232	0.00	0.000	0.000	0.0580	0.0006	0.0714	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
233	0.00	0.000	0.000	0.0580	0.0005	0.0689	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
234	0.04	0.000	0.002	0.0580	0.0006	0.0704	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
235	0.10	0.000	0.002	0.0580	0.0005	0.0608	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
236	0.00	0.000	0.000	0.0580	0.0004	0.0515	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
237	0.00	0.000	0.000	0.0580	0.0005	0.0657	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
238	0.00	0.000	0.000	0.0580	0.0005	0.0683	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
239	0.00	0.000	0.000	0.0580	0.0005	0.0663	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
240	0.00	0.000	0.000	0.0580	0.0005	0.0629	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
241	0.00	0.000	0.000	0.0580	0.0005	0.0593	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
242	0.22	0.000	0.006	0.0580	0.0005	0.0617	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
243	0.00	0.000	0.000	0.0580	0.0003	0.0367	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
244	0.00	0.000	0.000	0.0580	0.0004	0.0544	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
245	0.00	0.000	0.000	0.0580	0.0005	0.0587	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
246	0.00	0.000	0.000	0.0580	0.0005	0.0571	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
247	0.00	0.000	0.000	0.0580	0.0004	0.0534	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
248	0.37	0.000	0.005	0.0580	0.0005	0.0589	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
249	0.11	0.000	0.014	0.0580	0.0003	0.0374	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
250	0.02	0.000	0.020	0.0580	0.0001	0.0135	6.01E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
251	0.00	0.000	0.000	0.0580	0.0003	0.0395	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
252	0.00	0.000	0.000	0.0580	0.0004	0.0527	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
253	1.08	0.000	0.029	0.0651	0.0006	0.0780	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
254	0.03	0.000	0.014	0.0623	0.0002	0.0276	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
255	0.00	0.000	0.017	0.0591	0.0003	0.0376	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
256	0.05	0.000	0.009	0.0626	0.0003	0.0420	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
257	0.00	0.000	0.007	0.0606	0.0004	0.0515	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
258	0.00	0.000	0.010	0.0590	0.0004	0.0559	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
259	0.00	0.000	0.005	0.0580	0.0004	0.0470	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
260	0.00	0.000	0.000	0.0580	0.0003	0.0409	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
261	0.03	0.000	0.005	0.0580	0.0003	0.0349	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
262	0.30	0.000	0.016	0.0580	0.0002	0.0303	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

263		0.03	0.000	0.005	0.0580	0.0000	0.0002	2.81E-10	0.0000	0.0000	1.10E-10	0.0000	0.0000	0.00E+00
264		0.00	0.000	0.000	0.0580	0.0000	0.0019	2.07E-09	0.0000	0.0000	1.67E-10	0.0000	0.0000	0.00E+00
265		0.00	0.000	0.000	0.0580	0.0002	0.0229	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
266		0.00	0.000	0.000	0.0580	0.0003	0.0316	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
267		0.00	0.000	0.000	0.0580	0.0002	0.0288	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
268		0.42	0.000	0.016	0.0644	0.0003	0.0363	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
269		0.07	0.000	0.009	0.0631	0.0000	0.0018	7.13E-10	0.0000	0.0000	1.45E-10	0.0000	0.0000	0.00E+00
270		0.00	0.000	0.003	0.0612	0.0000	0.0011	1.14E-09	0.0000	0.0000	1.56E-10	0.0000	0.0000	0.00E+00
271		0.00	0.000	0.002	0.0607	0.0002	0.0280	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
272		0.00	0.000	0.002	0.0603	0.0004	0.0466	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
273		0.38	0.000	0.011	0.0643	0.0004	0.0565	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
274		0.00	0.000	0.007	0.0608	0.0000	0.0025	6.03E-10	0.0000	0.0000	1.39E-10	0.0000	0.0000	0.00E+00
275		0.00	0.000	0.013	0.0586	0.0002	0.0251	6.71E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
276		0.29	0.000	0.026	0.0642	0.0005	0.0628	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
277		0.00	0.000	0.008	0.0607	0.0001	0.0072	3.71E-09	0.0000	0.0000	1.73E-10	0.0000	0.0000	0.00E+00
278		0.00	0.000	0.011	0.0589	0.0003	0.0425	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
279		0.00	0.000	0.004	0.0580	0.0004	0.0561	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
280		0.00	0.000	0.000	0.0580	0.0004	0.0524	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
281		0.00	0.000	0.000	0.0580	0.0003	0.0407	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
282		0.00	0.000	0.000	0.0580	0.0002	0.0261	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
283	*	0.00	0.000	0.000	0.0580	0.0001	0.0149	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
284		0.00	0.000	0.000	0.0580	0.0001	0.0106	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
285	*	0.00	0.000	0.000	0.0580	0.0001	0.0145	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
286		0.00	0.000	0.000	0.0580	0.0002	0.0247	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
287		0.00	0.000	0.000	0.0580	0.0003	0.0382	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
288		0.13	0.000	0.003	0.0580	0.0004	0.0562	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
289		0.00	0.000	0.003	0.0580	0.0004	0.0470	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
290		0.00	0.000	0.000	0.0580	0.0006	0.0790	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
291		0.16	0.000	0.005	0.0580	0.0007	0.0923	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
292		0.00	0.000	0.000	0.0580	0.0005	0.0630	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
293		0.00	0.000	0.000	0.0580	0.0007	0.0925	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
294		0.00	0.000	0.000	0.0580	0.0007	0.0911	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
295		0.00	0.000	0.000	0.0580	0.0007	0.0827	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
296		0.55	0.000	0.008	0.0646	0.0007	0.0830	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
297		0.00	0.000	0.005	0.0610	0.0003	0.0315	6.07E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
298		0.00	0.000	0.006	0.0599	0.0006	0.0802	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
299		0.02	0.000	0.008	0.0606	0.0008	0.0967	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
300		0.28	0.000	0.038	0.0641	0.0008	0.1041	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
301		0.00	0.000	0.006	0.0609	0.0002	0.0271	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
302		0.00	0.000	0.014	0.0589	0.0005	0.0607	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
303		0.00	0.000	0.004	0.0580	0.0005	0.0652	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
304		0.12	0.000	0.008	0.0580	0.0006	0.0755	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
305		0.00	0.000	0.000	0.0580	0.0001	0.0131	4.93E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
306		0.03	0.000	0.005	0.0580	0.0004	0.0519	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
307		0.00	0.000	0.000	0.0580	0.0002	0.0294	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

308		0.00	0.000	0.000	0.0580	0.0003	0.0399	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
309		0.00	0.000	0.000	0.0580	0.0003	0.0390	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
310	*	0.00	0.000	0.000	0.0580	0.0003	0.0350	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
311	*	0.00	0.000	0.000	0.0580	0.0003	0.0319	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
312		0.00	0.000	0.000	0.0580	0.0002	0.0313	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
313		0.00	0.000	0.000	0.0580	0.0003	0.0335	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
314		0.00	0.000	0.000	0.0580	0.0003	0.0380	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
315	*	0.24	0.000	0.020	0.0580	0.0004	0.0491	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
316		0.18	0.000	0.005	0.0580	0.0003	0.0430	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
317	*	0.03	0.000	0.033	0.0580	0.0002	0.0286	5.14E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
318	*	0.43	0.000	0.011	0.0580	0.0007	0.0928	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
319		0.22	0.000	0.000	0.0647	0.0008	0.1011	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
320		0.00	0.000	0.003	0.0612	0.0003	0.0319	6.74E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
321	*	0.00	0.000	0.003	0.0605	0.0005	0.0692	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
322		0.00	0.000	0.005	0.0597	0.0007	0.0860	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
323		0.00	0.000	0.004	0.0590	0.0007	0.0883	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
324	*	0.00	0.000	0.000	0.0590	0.0006	0.0718	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
325		0.00	0.000	0.004	0.0583	0.0005	0.0578	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
326		0.00	0.000	0.000	0.0580	0.0003	0.0369	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
327		0.00	0.000	0.000	0.0580	0.0002	0.0264	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
328		0.00	0.000	0.000	0.0580	0.0002	0.0197	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
329		0.00	0.000	0.000	0.0580	0.0001	0.0182	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
330		0.00	0.000	0.000	0.0580	0.0002	0.0217	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
331		0.00	0.000	0.000	0.0580	0.0002	0.0291	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
332		0.00	0.000	0.000	0.0580	0.0003	0.0384	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
333		0.02	0.000	0.004	0.0580	0.0004	0.0527	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
334		0.34	0.000	0.014	0.0580	0.0004	0.0483	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
335		0.16	0.000	0.010	0.0580	0.0004	0.0550	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
336		0.00	0.000	0.000	0.0580	0.0004	0.0458	6.26E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
337		0.00	0.000	0.000	0.0580	0.0009	0.1074	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
338		0.00	0.000	0.000	0.0580	0.0009	0.1111	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
339		0.00	0.000	0.000	0.0580	0.0007	0.0934	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
340		0.00	0.000	0.000	0.0580	0.0006	0.0752	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
341	*	0.00	0.000	0.000	0.0580	0.0005	0.0603	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
342		0.01	0.000	0.004	0.0580	0.0004	0.0502	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
343		0.00	0.000	0.000	0.0580	0.0003	0.0399	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
344	*	0.00	0.000	0.000	0.0580	0.0003	0.0377	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
345	*	0.00	0.000	0.000	0.0580	0.0003	0.0377	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
346		0.06	0.000	0.003	0.0580	0.0004	0.0470	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
347		0.11	0.000	0.003	0.0580	0.0003	0.0349	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
348		0.00	0.000	0.000	0.0580	0.0002	0.0247	6.43E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
349		0.01	0.000	0.003	0.0580	0.0005	0.0601	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
350		0.21	0.000	0.010	0.0580	0.0006	0.0774	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
351		0.05	0.000	0.006	0.0580	0.0004	0.0459	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
352		0.00	0.000	0.000	0.0580	0.0004	0.0524	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

353		0.00	0.000	0.000	0.0580	0.0006	0.0807	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
354		0.00	0.000	0.000	0.0580	0.0006	0.0791	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
355		0.02	0.000	0.005	0.0580	0.0006	0.0736	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
356		0.02	0.000	0.004	0.0580	0.0005	0.0577	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
357		0.05	0.000	0.004	0.0580	0.0004	0.0558	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
358		0.00	0.000	0.002	0.0580	0.0001	0.0180	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
359		0.13	0.000	0.003	0.0580	0.0004	0.0531	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
360		0.03	0.000	0.003	0.0580	0.0002	0.0239	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
361	*	0.00	0.000	0.000	0.0580	0.0003	0.0317	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
362	*	0.00	0.000	0.000	0.0580	0.0005	0.0569	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
363	*	0.01	0.000	0.010	0.0580	0.0005	0.0611	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
364	*	0.00	0.000	0.000	0.0580	0.0005	0.0576	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
365	*	0.10	0.000	0.024	0.0580	0.0005	0.0600	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

* = Frozen (air or soil)

Annual Totals for Year 2			
	inches	cubic feet	percent
Precipitation	23.58	85,610.0	100.00
Runoff	0.000	0.0000	0.00
Evapotranspiration	6.793	24,658.8	28.80
Drainage Collected from Layer 3	17.9510	65,162.2	76.12
Percolation/Leakage through Layer 5	0.000002	0.0088	0.00
Average Head on Top of Layer 4	0.0004	---	---
Drainage Collected from Layer 7	0.0000	0.0085	0.00
Percolation/Leakage through Layer 9	0.000000	0.0002	0.00
Average Head on Top of Layer 8	0.0000	---	---
Percolation/Leakage through Layer 10	0.000000	0.0000	0.00
Change in Water Storage	-1.1600	-4,211.0	-4.92
Soil Water at Start of Year	60.5391	219,757.0	256.70
Soil Water at End of Year	59.3276	215,359.3	251.56
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0514	186.8	0.22
Annual Water Budget Balance	0.0000	0.0000	0.00

Daily Output for Year 3

Column key: Head #1: drainage from Layer 4 | Head #2: drainage from Layer 8
Drain #1: drainage from Layer 3 | Drain #2: drainage from Layer 7
Leak #1: leakage thru Layer 5 | Leak #2: leakage thru Layer 9 | Leak #3: leakage thru Layer 10

Title: Wayne Disposal-Initial Lift-Sideslope
Simulated On: 3/10/2021 13:00

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1	Head #2	Drain #2	Leak #2	Head #3	Drain #3	Leak #3
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1			0.01	0.000	0.055	0.0580	0.0003	0.0342	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
2			0.00	0.000	0.000	0.0580	0.0003	0.0374	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
3	*		0.00	0.000	0.000	0.0580	0.0003	0.0398	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
4			0.00	0.000	0.000	0.0580	0.0003	0.0402	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
5			0.00	0.000	0.000	0.0580	0.0003	0.0398	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
6	*		0.00	0.000	0.000	0.0580	0.0003	0.0395	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
7	*		0.00	0.000	0.000	0.0580	0.0003	0.0394	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
8	*		0.00	0.000	0.000	0.0580	0.0003	0.0397	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
9	*		0.00	0.000	0.000	0.0580	0.0003	0.0403	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
10	*		0.00	0.000	0.000	0.0580	0.0003	0.0411	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
11			0.04	0.000	0.003	0.0580	0.0004	0.0477	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
12	*		0.10	0.000	0.017	0.0580	0.0003	0.0396	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
13	*		0.00	0.000	0.018	0.0580	0.0003	0.0379	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
14	*		0.15	0.000	0.022	0.0580	0.0003	0.0395	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
15	*		0.00	0.000	0.027	0.0580	0.0003	0.0421	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
16	*		0.00	0.000	0.025	0.0580	0.0004	0.0457	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
17	*	*	0.13	0.000	0.023	0.0580	0.0003	0.0423	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
18	*	*	0.13	0.000	0.000	0.0580	0.0005	0.0579	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
19	*	*	0.10	0.000	0.022	0.0580	0.0005	0.0616	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
20	*	*	0.00	0.000	0.018	0.0580	0.0005	0.0601	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
21	*	*	0.00	0.000	0.000	0.0580	0.0005	0.0568	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
22	*	*	0.21	0.000	0.008	0.0580	0.0004	0.0530	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
23	*	*	0.00	0.000	0.017	0.0580	0.0004	0.0495	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
24	*	*	0.00	0.000	0.000	0.0580	0.0004	0.0464	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
25		*	0.00	0.000	0.011	0.0710	0.0003	0.0438	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
26	*	*	0.16	0.000	0.016	0.0710	0.0003	0.0417	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
27		*	0.12	0.000	0.000	0.1217	0.0003	0.0400	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
28		*	0.00	0.000	0.000	0.1217	0.0003	0.0387	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
29		*	0.00	0.000	0.000	0.1217	0.0003	0.0377	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
30		*	0.00	0.000	0.000	0.1217	0.0003	0.0370	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
31		*	0.00	0.000	0.000	0.1217	0.0003	0.0364	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
32		*	0.01	0.000	0.001	0.1223	0.0003	0.0360	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
33		*	0.26	0.000	0.001	0.1435	0.0003	0.0357	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
34	*	*	0.00	0.000	0.000	0.1435	0.0003	0.0355	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
35		*	0.19	0.000	0.001	0.1595	0.0003	0.0354	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
36		*	0.00	0.000	0.000	0.1595	0.0003	0.0352	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
37		*	0.00	0.000	0.000	0.1595	0.0003	0.0351	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

38		*	0.00	0.000	0.000	0.1595	0.0003	0.0351	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
39			0.00	0.000	0.097	0.1422	0.0003	0.0369	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
40			0.00	0.000	0.104	0.1266	0.0003	0.0369	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
41			0.00	0.000	0.048	0.1199	0.0003	0.0334	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
42			0.10	0.000	0.092	0.1181	0.0003	0.0318	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
43			0.00	0.000	0.084	0.1083	0.0002	0.0314	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
44			0.05	0.000	0.066	0.1059	0.0002	0.0233	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
45			0.43	0.000	0.051	0.1365	0.0003	0.0372	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
46	*		0.00	0.000	0.028	0.1333	0.0003	0.0344	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
47	*		0.01	0.000	0.015	0.1333	0.0003	0.0344	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
48	*		0.04	0.000	0.031	0.1333	0.0004	0.0450	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
49	*		0.01	0.000	0.006	0.1316	0.0004	0.0508	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
50	*		0.01	0.000	0.012	0.1297	0.0003	0.0405	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
51	*		0.00	0.000	0.000	0.1281	0.0002	0.0308	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
52	*		0.00	0.000	0.000	0.1267	0.0002	0.0273	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
53	*		0.00	0.000	0.000	0.1255	0.0002	0.0272	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
54	*		0.23	0.000	0.008	0.1260	0.0002	0.0281	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
55	*		0.01	0.000	0.000	0.1268	0.0002	0.0295	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
56			0.06	0.000	0.046	0.1427	0.0003	0.0340	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
57	*		0.03	0.000	0.033	0.1423	0.0002	0.0257	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
58			0.00	0.000	0.063	0.1346	0.0003	0.0411	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
59			0.00	0.000	0.128	0.1205	0.0003	0.0348	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
60			0.09	0.000	0.091	0.1191	0.0002	0.0235	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
61			0.09	0.000	0.097	0.1170	0.0002	0.0253	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
62	*		0.00	0.000	0.057	0.1100	0.0002	0.0270	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
63	*		0.00	0.000	0.050	0.1043	0.0002	0.0195	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
64	*		0.00	0.000	0.000	0.1038	0.0001	0.0162	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
65	*		0.00	0.000	0.056	0.0978	0.0002	0.0300	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
66			0.00	0.000	0.073	0.0907	0.0002	0.0288	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
67			0.08	0.000	0.053	0.0921	0.0002	0.0255	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
68			0.02	0.000	0.045	0.0896	0.0002	0.0265	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
69			0.00	0.000	0.034	0.0867	0.0002	0.0288	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
70			0.08	0.000	0.030	0.0906	0.0003	0.0343	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
71			0.07	0.000	0.026	0.0937	0.0002	0.0300	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
72	*		0.00	0.000	0.023	0.0916	0.0002	0.0247	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
73			0.00	0.000	0.021	0.0898	0.0002	0.0233	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
74			0.00	0.000	0.019	0.0882	0.0002	0.0234	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
75			0.00	0.000	0.019	0.0867	0.0002	0.0228	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
76			0.01	0.000	0.018	0.0853	0.0002	0.0252	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
77			0.00	0.000	0.018	0.0837	0.0002	0.0211	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
78			0.02	0.000	0.017	0.0839	0.0001	0.0182	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
79			0.23	0.000	0.016	0.1010	0.0001	0.0162	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
80			0.00	0.000	0.074	0.0948	0.0001	0.0132	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
81			0.00	0.000	0.015	0.0936	0.0001	0.0125	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
82			0.00	0.000	0.014	0.0924	0.0001	0.0133	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

83	*		0.00	0.000	0.000	0.0922	0.0001	0.0153	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
84	*		0.12	0.000	0.025	0.0937	0.0001	0.0141	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
85	*		0.00	0.000	0.016	0.0952	0.0001	0.0138	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
86	*		0.00	0.000	0.035	0.0950	0.0001	0.0134	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
87			0.00	0.000	0.014	0.0939	0.0001	0.0120	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
88			0.00	0.000	0.013	0.0928	0.0001	0.0131	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
89	*		0.00	0.000	0.000	0.0926	0.0001	0.0157	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
90	*		0.05	0.000	0.035	0.0938	0.0001	0.0148	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
91			0.00	0.000	0.013	0.0925	0.0001	0.0145	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
92	*		0.00	0.000	0.012	0.0915	0.0001	0.0138	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
93	*		0.16	0.000	0.081	0.0929	0.0001	0.0166	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
94	*		0.04	0.000	0.019	0.0944	0.0001	0.0165	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
95	*		0.00	0.000	0.026	0.0959	0.0001	0.0166	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
96	*		0.00	0.000	0.017	0.0958	0.0001	0.0169	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
97	*		0.00	0.000	0.000	0.0957	0.0001	0.0173	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
98	*		0.00	0.000	0.000	0.0956	0.0001	0.0178	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
99	*		0.00	0.000	0.003	0.0954	0.0001	0.0183	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
100	*	*	0.00	0.000	0.000	0.0954	0.0001	0.0181	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
101	*	*	0.42	0.000	0.008	0.0954	0.0002	0.0194	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
102	*	*	0.37	0.000	0.015	0.0954	0.0002	0.0204	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
103	*	*	0.23	0.000	0.026	0.0954	0.0002	0.0210	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
104	*	*	0.03	0.000	0.017	0.0954	0.0002	0.0215	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
105	*	*	0.00	0.000	0.008	0.0954	0.0002	0.0217	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
106	*	*	0.00	0.000	0.019	0.0954	0.0002	0.0219	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
107	*	*	0.00	0.000	0.000	0.0954	0.0002	0.0220	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
108	*	*	0.02	0.000	0.018	0.0954	0.0002	0.0220	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
109	*	*	0.27	0.000	0.000	0.0954	0.0002	0.0220	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
110		*	0.08	0.000	0.000	0.1028	0.0002	0.0219	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
111		*	0.06	0.000	0.000	0.2092	0.0002	0.0219	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
112		*	0.00	0.000	0.001	0.2095	0.0002	0.0218	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
113		*	0.00	0.000	0.000	0.2095	0.0002	0.0217	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
114		*	0.02	0.000	0.001	0.2108	0.0002	0.0216	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
115		*	0.01	0.000	0.001	0.2117	0.0002	0.0216	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
116		*	0.41	0.000	0.001	0.2461	0.0002	0.0215	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
117		*	0.23	0.000	0.001	0.2650	0.0002	0.0214	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
118		*	0.12	0.000	0.001	0.2748	0.0002	0.0213	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
119		*	0.09	0.000	0.001	0.2824	0.0002	0.0213	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
120			0.08	0.000	0.082	0.2229	0.0002	0.0240	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
121	*		0.00	0.000	0.067	0.2033	0.0001	0.0163	6.77E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
122			0.02	0.000	0.095	0.1908	0.0001	0.0081	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
123	*		0.18	0.000	0.047	0.1877	0.0001	0.0169	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
124	*		0.00	0.000	0.075	0.1859	0.0002	0.0225	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
125	*		0.00	0.000	0.015	0.1828	0.0002	0.0259	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
126	*	*	0.08	0.000	0.030	0.1828	0.0002	0.0277	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
127	*	*	0.52	0.000	0.025	0.1828	0.0002	0.0284	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

128	*	*	0.01	0.000	0.000	0.1828	0.0002	0.0284	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
129		*	0.00	0.000	0.031	0.1911	0.0002	0.0279	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
130		*	0.19	0.000	0.021	0.2402	0.0002	0.0272	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
131		*	0.11	0.000	0.001	0.2495	0.0002	0.0277	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
132		*	0.00	0.000	0.000	0.2495	0.0002	0.0295	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
133		*	0.00	0.000	0.000	0.2495	0.0002	0.0294	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
134		*	0.35	0.000	0.001	0.2787	0.0002	0.0283	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
135		*	0.01	0.000	0.001	0.2798	0.0002	0.0265	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
136		*	0.26	0.000	0.001	0.3015	0.0002	0.0244	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
137		*	0.00	0.000	0.000	0.3015	0.0002	0.0222	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
138		*	0.24	0.000	0.001	0.3211	0.0002	0.0200	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
139			0.00	0.000	0.289	0.2390	0.0001	0.0188	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
140			0.77	0.000	0.261	0.2667	0.0000	0.0026	1.22E-09	0.0000	0.0000	1.58E-10	0.0000	0.0000	0.00E+00
141			0.00	0.000	0.086	0.2519	0.0000	0.0025	2.84E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
142			0.30	0.000	0.199	0.2441	0.0000	0.0045	6.51E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
143			0.00	0.000	0.214	0.2187	0.0000	0.0044	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
144			0.00	0.000	0.117	0.2023	0.0001	0.0072	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
145			0.00	0.000	0.182	0.1837	0.0001	0.0094	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
146			0.90	0.000	0.159	0.2427	0.0001	0.0111	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
147			0.00	0.000	0.272	0.2179	0.0001	0.0124	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
148			0.06	0.000	0.221	0.2035	0.0001	0.0134	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
149			0.01	0.000	0.189	0.1877	0.0001	0.0174	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
150			0.33	0.000	0.104	0.2037	0.0002	0.0233	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
151			0.01	0.000	0.082	0.1954	0.0002	0.0201	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
152			0.00	0.000	0.192	0.1763	0.0002	0.0205	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
153			0.00	0.000	0.119	0.1640	0.0001	0.0180	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
154			0.00	0.000	0.054	0.1589	0.0001	0.0080	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
155			0.01	0.000	0.043	0.1563	0.0001	0.0125	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
156			0.39	0.000	0.036	0.1831	0.0001	0.0169	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
157			0.50	0.000	0.105	0.2128	0.0001	0.0106	5.10E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
158			0.35	0.000	0.318	0.1952	0.0001	0.0132	5.77E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
159			0.18	0.000	0.117	0.1909	0.0000	0.0058	2.98E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
160			0.82	0.000	0.222	0.2284	0.0001	0.0064	3.05E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
161			0.08	0.000	0.192	0.1826	0.0001	0.0080	3.31E-09	0.0000	0.0000	1.72E-10	0.0000	0.0000	0.00E+00
162			0.00	0.000	0.192	0.1571	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
163			0.04	0.000	0.210	0.1292	0.0000	0.0011	9.63E-10	0.0000	0.0000	1.53E-10	0.0000	0.0000	0.00E+00
164			0.13	0.000	0.357	0.0968	0.0000	0.0021	1.93E-09	0.0000	0.0000	1.66E-10	0.0000	0.0000	0.00E+00
165			0.42	0.000	0.122	0.1177	0.0000	0.0045	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
166			0.25	0.000	0.118	0.1285	0.0001	0.0103	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
167			0.80	0.000	0.299	0.1448	0.0002	0.0291	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
168			0.16	0.000	0.256	0.1147	0.0001	0.0090	3.68E-09	0.0000	0.0000	1.73E-10	0.0000	0.0000	0.00E+00
169			0.00	0.000	0.157	0.0943	0.0001	0.0074	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
170			0.00	0.000	0.220	0.0637	0.0001	0.0172	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
171			0.00	0.000	0.069	0.0580	0.0001	0.0149	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
172			0.01	0.000	0.012	0.0580	0.0003	0.0377	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

173	0.00	0.000	0.000	0.0580	0.0003	0.0327	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
174	0.00	0.000	0.000	0.0580	0.0002	0.0286	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
175	0.06	0.000	0.005	0.0580	0.0002	0.0254	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
176	0.03	0.000	0.004	0.0580	0.0000	0.0028	2.63E-09	0.0000	0.0000	1.70E-10	0.0000	0.0000	0.00E+00
177	0.03	0.000	0.004	0.0580	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
178	0.35	0.000	0.012	0.0580	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
179	0.00	0.000	0.000	0.0580	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
180	0.07	0.000	0.004	0.0580	0.0003	0.0374	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
181	0.05	0.000	0.004	0.0580	0.0002	0.0294	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
182	0.00	0.000	0.000	0.0580	0.0003	0.0416	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
183	0.00	0.000	0.000	0.0580	0.0006	0.0714	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
184	0.18	0.000	0.010	0.0580	0.0006	0.0796	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
185	0.00	0.000	0.003	0.0580	0.0001	0.0179	4.19E-09	0.0000	0.0000	1.74E-10	0.0000	0.0000	0.00E+00
186	0.00	0.000	0.000	0.0580	0.0006	0.0707	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
187	0.00	0.000	0.000	0.0580	0.0006	0.0767	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
188	0.21	0.000	0.009	0.0580	0.0006	0.0789	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
189	0.00	0.000	0.000	0.0580	0.0002	0.0292	5.02E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
190	0.00	0.000	0.000	0.0580	0.0007	0.0855	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
191	0.11	0.000	0.003	0.0580	0.0008	0.0990	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
192	0.00	0.000	0.000	0.0580	0.0003	0.0391	6.10E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
193	0.00	0.000	0.000	0.0580	0.0007	0.0866	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
194	0.02	0.000	0.003	0.0580	0.0007	0.0896	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
195	0.00	0.000	0.000	0.0580	0.0006	0.0709	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
196	0.00	0.000	0.000	0.0580	0.0006	0.0735	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
197	0.06	0.000	0.003	0.0580	0.0006	0.0789	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
198	0.00	0.000	0.000	0.0580	0.0004	0.0490	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
199	0.00	0.000	0.000	0.0580	0.0006	0.0800	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
200	0.00	0.000	0.000	0.0580	0.0007	0.0861	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
201	0.00	0.000	0.000	0.0580	0.0007	0.0845	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
202	0.00	0.000	0.000	0.0580	0.0006	0.0815	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
203	0.07	0.000	0.003	0.0580	0.0007	0.0840	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
204	0.07	0.000	0.003	0.0580	0.0005	0.0682	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
205	0.05	0.000	0.003	0.0580	0.0006	0.0694	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
206	0.21	0.000	0.006	0.0580	0.0006	0.0768	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
207	0.00	0.000	0.000	0.0580	0.0005	0.0659	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
208	0.00	0.000	0.000	0.0580	0.0010	0.1210	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
209	0.00	0.000	0.000	0.0580	0.0009	0.1125	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
210	0.29	0.000	0.006	0.0642	0.0009	0.1088	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
211	0.00	0.000	0.020	0.0591	0.0003	0.0367	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
212	0.00	0.000	0.001	0.0589	0.0005	0.0604	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
213	0.02	0.000	0.003	0.0601	0.0006	0.0767	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
214	0.00	0.000	0.001	0.0600	0.0006	0.0710	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
215	0.00	0.000	0.001	0.0598	0.0005	0.0587	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
216	0.00	0.000	0.001	0.0597	0.0004	0.0472	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
217	0.00	0.000	0.001	0.0595	0.0003	0.0381	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

218		0.00	0.000	0.001	0.0594	0.0003	0.0322	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
219		0.00	0.000	0.001	0.0592	0.0002	0.0296	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
220		2.00	0.000	0.010	0.0654	0.0002	0.0299	5.18E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
221		0.00	0.000	0.013	0.0601	0.0001	0.0134	4.55E-09	0.0000	0.0000	1.74E-10	0.0000	0.0000	0.00E+00
222		0.00	0.000	0.011	0.0580	0.0004	0.0524	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
223		0.00	0.000	0.000	0.0580	0.0007	0.0937	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
224		0.00	0.000	0.000	0.0580	0.0006	0.0799	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
225		0.08	0.000	0.006	0.0580	0.0005	0.0584	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
226		0.12	0.000	0.005	0.0580	0.0001	0.0129	3.52E-09	0.0000	0.0000	1.73E-10	0.0000	0.0000	0.00E+00
227		0.03	0.000	0.005	0.0580	0.0000	0.0001	2.43E-10	0.0000	0.0000	1.04E-10	0.0000	0.0000	0.00E+00
228		0.75	0.000	0.015	0.0648	0.0004	0.0465	6.21E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
229		1.24	0.000	0.194	0.0652	0.0001	0.0181	3.66E-09	0.0000	0.0000	1.73E-10	0.0000	0.0000	0.00E+00
230		0.00	0.000	0.022	0.0588	0.0008	0.1013	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
231		0.00	0.000	0.008	0.0580	0.0012	0.1543	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
232		0.25	0.000	0.091	0.0580	0.0008	0.1015	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
233		0.01	0.000	0.009	0.0580	0.0001	0.0183	4.11E-09	0.0000	0.0000	1.74E-10	0.0000	0.0000	0.00E+00
234		0.00	0.000	0.000	0.0580	0.0004	0.0517	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
235		0.00	0.000	0.000	0.0580	0.0004	0.0550	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
236		0.00	0.000	0.000	0.0580	0.0008	0.0962	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
237		0.00	0.000	0.000	0.0580	0.0012	0.1478	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
238		0.00	0.000	0.000	0.0580	0.0014	0.1796	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
239		0.11	0.000	0.004	0.0580	0.0015	0.1865	7.00E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
240		0.94	0.000	0.020	0.0650	0.0015	0.1894	7.00E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
241		0.55	0.000	0.144	0.0646	0.0017	0.2111	7.02E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
242		0.08	0.000	0.029	0.0631	0.0019	0.2416	7.05E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
243		0.12	0.000	0.058	0.0634	0.0017	0.2137	7.02E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
244		0.00	0.000	0.022	0.0588	0.0008	0.1059	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
245		0.00	0.000	0.004	0.0580	0.0004	0.0557	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
246		0.00	0.000	0.000	0.0580	0.0003	0.0385	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
247		0.05	0.000	0.005	0.0580	0.0004	0.0560	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
248		0.00	0.000	0.000	0.0580	0.0009	0.1125	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
249		0.00	0.000	0.000	0.0580	0.0014	0.1763	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
250		0.00	0.000	0.000	0.0580	0.0014	0.1788	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
251	*	0.00	0.000	0.000	0.0580	0.0014	0.1753	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
252		0.00	0.000	0.000	0.0580	0.0014	0.1721	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
253		0.00	0.000	0.000	0.0580	0.0013	0.1685	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
254		0.00	0.000	0.000	0.0580	0.0013	0.1641	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
255		0.07	0.000	0.003	0.0580	0.0013	0.1579	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
256		1.10	0.000	0.015	0.0651	0.0012	0.1475	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
257		0.41	0.000	0.068	0.0644	0.0012	0.1500	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
258		0.11	0.000	0.048	0.0634	0.0016	0.1973	7.01E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
259		0.00	0.000	0.007	0.0607	0.0014	0.1752	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
260		0.00	0.000	0.014	0.0584	0.0012	0.1473	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
261		0.00	0.000	0.001	0.0580	0.0006	0.0804	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
262		0.00	0.000	0.000	0.0580	0.0003	0.0329	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

263		0.00	0.000	0.000	0.0580	0.0001	0.0148	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
264		0.51	0.000	0.024	0.0646	0.0003	0.0405	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
265		0.00	0.000	0.014	0.0599	0.0006	0.0724	5.10E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
266		0.00	0.000	0.010	0.0580	0.0013	0.1691	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
267		0.00	0.000	0.000	0.0580	0.0011	0.1379	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
268		0.00	0.000	0.000	0.0580	0.0008	0.1048	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
269		0.00	0.000	0.000	0.0580	0.0007	0.0895	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
270		0.00	0.000	0.000	0.0580	0.0007	0.0935	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
271		0.00	0.000	0.000	0.0580	0.0008	0.1068	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
272		0.00	0.000	0.000	0.0580	0.0010	0.1200	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
273		0.00	0.000	0.000	0.0580	0.0010	0.1288	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
274		0.00	0.000	0.000	0.0580	0.0011	0.1329	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
275		0.05	0.000	0.003	0.0580	0.0011	0.1337	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
276		0.06	0.000	0.003	0.0580	0.0010	0.1238	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
277		0.00	0.000	0.000	0.0580	0.0010	0.1309	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
278		0.01	0.000	0.003	0.0580	0.0012	0.1476	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
279		0.04	0.000	0.003	0.0580	0.0011	0.1346	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
280		0.00	0.000	0.000	0.0580	0.0009	0.1091	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
281		0.57	0.000	0.009	0.0646	0.0010	0.1274	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
282		0.00	0.000	0.013	0.0601	0.0007	0.0865	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
283		0.00	0.000	0.001	0.0598	0.0011	0.1440	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
284		0.00	0.000	0.001	0.0596	0.0011	0.1357	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
285		0.00	0.000	0.001	0.0594	0.0008	0.1046	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
286		0.00	0.000	0.001	0.0592	0.0006	0.0777	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
287		0.00	0.000	0.001	0.0590	0.0005	0.0581	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
288		0.00	0.000	0.001	0.0588	0.0004	0.0461	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
289		0.00	0.000	0.001	0.0586	0.0003	0.0415	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
290		0.00	0.000	0.001	0.0584	0.0003	0.0430	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
291		0.00	0.000	0.001	0.0580	0.0004	0.0483	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
292		0.00	0.000	0.000	0.0580	0.0004	0.0560	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
293		0.00	0.000	0.000	0.0580	0.0005	0.0636	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
294		0.00	0.000	0.000	0.0580	0.0006	0.0693	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
295		0.03	0.000	0.003	0.0580	0.0006	0.0772	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
296	*	0.42	0.000	0.018	0.0580	0.0005	0.0673	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
297	*	0.00	0.000	0.011	0.0580	0.0006	0.0722	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
298	*	0.00	0.000	0.022	0.0580	0.0006	0.0789	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
299	*	0.00	0.000	0.023	0.0580	0.0007	0.0837	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
300		0.00	0.000	0.017	0.0580	0.0007	0.0878	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
301		0.09	0.000	0.006	0.0580	0.0006	0.0800	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
302		0.41	0.000	0.024	0.0644	0.0007	0.0878	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
303		0.08	0.000	0.008	0.0632	0.0005	0.0647	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
304		0.04	0.000	0.010	0.0626	0.0008	0.0997	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
305		0.00	0.000	0.008	0.0611	0.0008	0.0998	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
306		0.05	0.000	0.005	0.0629	0.0008	0.1063	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
307		0.39	0.000	0.023	0.0644	0.0008	0.0946	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

308	*		0.00	0.000	0.000	0.0615	0.0002	0.0247	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
309	*		0.01	0.000	0.010	0.0611	0.0003	0.0436	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
310			0.14	0.000	0.025	0.0636	0.0006	0.0762	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
311	*		0.02	0.000	0.024	0.0615	0.0002	0.0291	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
312			0.11	0.000	0.006	0.0635	0.0005	0.0661	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
313			0.05	0.000	0.006	0.0629	0.0002	0.0294	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
314			0.00	0.000	0.011	0.0602	0.0002	0.0289	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
315			0.00	0.000	0.009	0.0588	0.0003	0.0441	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
316			0.00	0.000	0.003	0.0580	0.0003	0.0429	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
317			0.70	0.000	0.019	0.0648	0.0004	0.0519	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
318			0.14	0.000	0.033	0.0636	0.0000	0.0009	3.72E-10	0.0000	0.0000	1.22E-10	0.0000	0.0000	0.00E+00
319			0.00	0.000	0.007	0.0607	0.0001	0.0117	5.92E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
320			0.00	0.000	0.003	0.0601	0.0003	0.0434	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
321	*		0.00	0.000	0.003	0.0596	0.0005	0.0691	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
322	*		0.00	0.000	0.002	0.0592	0.0005	0.0578	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
323	*		0.00	0.000	0.000	0.0592	0.0003	0.0386	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
324			0.43	0.000	0.018	0.0644	0.0003	0.0328	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
325	*		0.00	0.000	0.000	0.0615	0.0000	0.0004	5.06E-10	0.0000	0.0000	1.34E-10	0.0000	0.0000	0.00E+00
326	*		0.00	0.000	0.002	0.0611	0.0001	0.0166	5.08E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
327	*		0.01	0.000	0.007	0.0606	0.0003	0.0438	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
328			0.37	0.000	0.025	0.0643	0.0005	0.0586	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
329			0.00	0.000	0.004	0.0611	0.0000	0.0018	1.17E-09	0.0000	0.0000	1.57E-10	0.0000	0.0000	0.00E+00
330			0.00	0.000	0.003	0.0605	0.0004	0.0508	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
331	*		0.00	0.000	0.000	0.0605	0.0006	0.0703	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
332			0.00	0.000	0.004	0.0598	0.0005	0.0597	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
333			0.00	0.000	0.006	0.0588	0.0003	0.0420	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
334			0.00	0.000	0.003	0.0580	0.0003	0.0316	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
335	*		0.03	0.000	0.022	0.0580	0.0003	0.0388	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
336	*		0.08	0.000	0.020	0.0580	0.0004	0.0533	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
337	*		0.07	0.000	0.024	0.0580	0.0005	0.0589	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
338			0.05	0.000	0.043	0.0580	0.0006	0.0788	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
339	*		0.16	0.000	0.022	0.0580	0.0006	0.0819	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
340	*		0.00	0.000	0.009	0.0580	0.0009	0.1101	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
341	*		0.00	0.000	0.005	0.0580	0.0009	0.1118	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
342	*		0.00	0.000	0.012	0.0580	0.0008	0.1068	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
343	*		0.00	0.000	0.014	0.0580	0.0008	0.1004	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
344			0.13	0.000	0.005	0.0580	0.0008	0.1027	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
345	*	*	0.00	0.000	0.000	0.0580	0.0006	0.0711	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
346	*	*	0.00	0.000	0.000	0.0580	0.0008	0.1065	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
347	*	*	0.00	0.000	0.000	0.0580	0.0008	0.1005	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
348		*	0.00	0.000	0.000	0.0580	0.0007	0.0874	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
349		*	0.00	0.000	0.000	0.0580	0.0006	0.0761	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
350		*	0.24	0.000	0.002	0.0782	0.0005	0.0680	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
351		*	0.12	0.000	0.002	0.0880	0.0005	0.0631	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
352		*	0.38	0.000	0.002	0.1197	0.0005	0.0607	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

353		*	0.02	0.000	0.002	0.1215	0.0005	0.0602	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
354		*	0.01	0.000	0.002	0.1225	0.0005	0.0607	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
355	*	*	0.00	0.000	0.000	0.1225	0.0005	0.0618	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
356	*	*	0.00	0.000	0.000	0.1225	0.0005	0.0631	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
357	*	*	0.07	0.000	0.020	0.1225	0.0005	0.0642	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
358	*	*	0.01	0.000	0.010	0.1225	0.0005	0.0650	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
359	*	*	0.13	0.000	0.015	0.1225	0.0005	0.0656	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
360		*	0.23	0.000	0.000	0.1548	0.0005	0.0658	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
361		*	0.03	0.000	0.002	0.1571	0.0005	0.0657	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
362		*	0.00	0.000	0.000	0.1571	0.0005	0.0655	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
363		*	0.00	0.000	0.000	0.1571	0.0005	0.0650	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
364		*	0.00	0.000	0.000	0.1571	0.0005	0.0644	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
365		*	0.00	0.000	0.000	0.1571	0.0005	0.0637	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

* = Frozen (air or soil)

Annual Totals for Year 3			
	inches	cubic feet	percent
Precipitation	30.94	112,313.6	100.00
Runoff	0.000	0.0000	0.00
Evapotranspiration	10.446	37,918.7	33.76
Drainage Collected from Layer 3	19.5834	71,087.9	63.29
Percolation/Leakage through Layer 5	0.000002	0.0087	0.00
Average Head on Top of Layer 4	0.0004	---	---
Drainage Collected from Layer 7	0.0000	0.0084	0.00
Percolation/Leakage through Layer 9	0.000000	0.0002	0.00
Average Head on Top of Layer 8	0.0000	---	---
Percolation/Leakage through Layer 10	0.000000	0.0000	0.00
Change in Water Storage	0.9110	3,307.0	2.94
Soil Water at Start of Year	59.3276	215,359.3	191.75
Soil Water at End of Year	60.2901	218,853.1	194.86
Snow Water at Start of Year	0.0514	186.8	0.17
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	0.0000	0.0000	0.00

Daily Output for Year 4

Column key: Head #1: drainage from Layer 4 | Head #2: drainage from Layer 8
Drain #1: drainage from Layer 3 | Drain #2: drainage from Layer 7
Leak #1: leakage thru Layer 5 | Leak #2: leakage thru Layer 9 | Leak #3: leakage thru Layer 10

Title: Wayne Disposal-Initial Lift-Sideslope
Simulated On: 3/10/2021 13:00

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1	Head #2	Drain #2	Leak #2	Head #3	Drain #3	Leak #3
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1		*	0.00	0.000	0.000	0.1571	0.0005	0.0629	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
2		*	0.31	0.000	0.002	0.1826	0.0005	0.0620	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
3			0.00	0.000	0.026	0.1477	0.0005	0.0642	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
4			0.00	0.000	0.028	0.1372	0.0005	0.0575	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
5			0.00	0.000	0.029	0.1306	0.0004	0.0441	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
6	*		0.00	0.000	0.027	0.1256	0.0004	0.0557	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
7	*		0.00	0.000	0.028	0.1214	0.0006	0.0703	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
8	*		0.00	0.000	0.023	0.1180	0.0006	0.0747	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
9			0.00	0.000	0.029	0.1147	0.0006	0.0700	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
10	*		0.02	0.000	0.019	0.1139	0.0005	0.0682	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
11	*		0.01	0.000	0.007	0.1130	0.0005	0.0600	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
12	*		0.08	0.000	0.005	0.1138	0.0004	0.0519	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
13	*		0.00	0.000	0.004	0.1147	0.0004	0.0450	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
14	*		0.00	0.000	0.005	0.1157	0.0003	0.0393	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
15	*	*	0.07	0.000	0.000	0.1157	0.0002	0.0313	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
16		*	0.04	0.000	0.028	0.1234	0.0003	0.0324	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
17	*	*	0.12	0.000	0.033	0.1234	0.0002	0.0313	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
18	*	*	0.51	0.000	0.029	0.1234	0.0002	0.0293	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
19		*	0.00	0.000	0.010	0.1369	0.0002	0.0274	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
20		*	0.40	0.000	0.000	0.2032	0.0002	0.0258	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
21	*	*	0.36	0.000	0.018	0.2032	0.0002	0.0248	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
22		*	0.07	0.000	0.000	0.2376	0.0002	0.0245	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
23		*	0.09	0.000	0.002	0.2448	0.0002	0.0249	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
24		*	0.00	0.000	0.001	0.2449	0.0002	0.0258	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
25		*	0.00	0.000	0.000	0.2449	0.0002	0.0271	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
26		*	0.00	0.000	0.000	0.2449	0.0002	0.0288	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
27		*	0.00	0.000	0.000	0.2449	0.0002	0.0305	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
28		*	0.00	0.000	0.000	0.2449	0.0003	0.0323	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
29		*	0.00	0.000	0.000	0.2449	0.0003	0.0339	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
30		*	0.00	0.000	0.000	0.2449	0.0003	0.0355	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
31	*	*	0.01	0.000	0.006	0.2449	0.0003	0.0368	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
32		*	0.00	0.000	0.000	0.2449	0.0003	0.0379	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
33	*	*	0.13	0.000	0.038	0.2449	0.0003	0.0388	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
34	*	*	0.00	0.000	0.034	0.2449	0.0003	0.0395	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
35	*	*	0.10	0.000	0.017	0.2449	0.0003	0.0400	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
36	*	*	0.06	0.000	0.000	0.2449	0.0003	0.0404	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
37	*	*	0.01	0.000	0.000	0.2449	0.0003	0.0406	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

38	*	*	0.00	0.000	0.020	0.2449	0.0003	0.0408	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
39	*	*	0.00	0.000	0.033	0.2449	0.0003	0.0408	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
40		*	0.00	0.000	0.037	0.2523	0.0003	0.0407	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
41		*	0.00	0.000	0.029	0.2523	0.0003	0.0406	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
42		*	0.06	0.000	0.002	0.2568	0.0003	0.0404	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
43	*	*	0.00	0.000	0.000	0.2568	0.0003	0.0401	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
44	*	*	0.20	0.000	0.012	0.2568	0.0003	0.0398	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
45		*	0.02	0.000	0.017	0.2723	0.0003	0.0395	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
46		*	0.00	0.000	0.000	0.2723	0.0003	0.0392	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
47		*	0.09	0.000	0.002	0.2794	0.0003	0.0388	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
48		*	0.05	0.000	0.002	0.2835	0.0003	0.0385	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
49		*	0.00	0.000	0.000	0.2835	0.0003	0.0381	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
50		*	0.08	0.000	0.002	0.2900	0.0003	0.0377	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
51			0.06	0.000	0.155	0.2158	0.0003	0.0399	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
52			0.33	0.000	0.224	0.2127	0.0002	0.0215	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
53			0.00	0.000	0.075	0.1988	0.0002	0.0295	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
54			0.00	0.000	0.052	0.1921	0.0003	0.0419	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
55			0.01	0.000	0.057	0.1856	0.0004	0.0469	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
56			0.03	0.000	0.136	0.1728	0.0004	0.0498	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
57			0.00	0.000	0.109	0.1607	0.0004	0.0450	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
58			0.00	0.000	0.086	0.1519	0.0003	0.0434	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
59	*		0.00	0.000	0.000	0.1497	0.0003	0.0415	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
60	*		0.00	0.000	0.000	0.1484	0.0003	0.0389	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
61	*		0.02	0.000	0.024	0.1474	0.0003	0.0402	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
62			0.20	0.000	0.055	0.1585	0.0003	0.0433	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
63	*		0.00	0.000	0.000	0.1581	0.0003	0.0345	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
64	*		0.00	0.000	0.000	0.1572	0.0003	0.0370	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
65			0.02	0.000	0.108	0.1483	0.0003	0.0315	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
66			0.06	0.000	0.093	0.1444	0.0002	0.0284	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
67			0.00	0.000	0.109	0.1353	0.0001	0.0168	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
68			0.03	0.000	0.049	0.1328	0.0002	0.0226	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
69			0.10	0.000	0.054	0.1371	0.0001	0.0130	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
70	*		0.05	0.000	0.039	0.1366	0.0002	0.0202	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
71	*		0.01	0.000	0.005	0.1361	0.0001	0.0103	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
72			0.23	0.000	0.041	0.1511	0.0001	0.0104	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
73			0.12	0.000	0.078	0.1541	0.0000	0.0046	1.98E-09	0.0000	0.0000	1.66E-10	0.0000	0.0000	0.00E+00
74			0.09	0.000	0.110	0.1489	0.0001	0.0145	6.74E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
75			0.00	0.000	0.064	0.1389	0.0000	0.0056	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
76			0.27	0.000	0.189	0.1419	0.0000	0.0014	5.27E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
77			0.00	0.000	0.149	0.1256	0.0000	0.0001	1.61E-09	0.0000	0.0000	1.63E-10	0.0000	0.0000	0.00E+00
78			0.26	0.000	0.245	0.1254	0.0000	0.0025	2.88E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
79			0.00	0.000	0.284	0.0981	0.0001	0.0133	4.86E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
80			0.02	0.000	0.070	0.0860	0.0002	0.0206	6.42E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
81			0.09	0.000	0.054	0.0869	0.0000	0.0027	3.07E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
82			0.00	0.000	0.040	0.0782	0.0002	0.0236	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

83		0.00	0.000	0.034	0.0724	0.0001	0.0114	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
84		0.35	0.000	0.031	0.0955	0.0003	0.0319	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
85		0.01	0.000	0.028	0.0828	0.0003	0.0385	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
86		0.00	0.000	0.025	0.0778	0.0002	0.0228	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
87		0.11	0.000	0.024	0.0847	0.0002	0.0311	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
88		0.04	0.000	0.023	0.0845	0.0003	0.0402	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
89		0.00	0.000	0.020	0.0795	0.0004	0.0487	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
90		0.00	0.000	0.021	0.0763	0.0003	0.0319	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
91		0.13	0.000	0.020	0.0855	0.0002	0.0238	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
92		0.00	0.000	0.018	0.0804	0.0004	0.0460	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
93		0.14	0.000	0.019	0.0900	0.0002	0.0207	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
94		0.66	0.000	0.057	0.1055	0.0003	0.0364	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
95		0.05	0.000	0.068	0.0887	0.0001	0.0088	4.62E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
96	*	0.41	0.000	0.030	0.0890	0.0001	0.0096	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
97		0.15	0.000	0.000	0.0972	0.0002	0.0250	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
98		0.29	0.000	0.000	0.1059	0.0003	0.0389	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
99	*	0.52	0.000	0.023	0.0912	0.0000	0.0061	6.41E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
100	*	0.17	0.000	0.034	0.0897	0.0001	0.0132	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
101		0.00	0.000	0.097	0.1044	0.0003	0.0363	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
102		0.00	0.000	0.079	0.0824	0.0001	0.0104	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
103		0.06	0.000	0.119	0.0709	0.0001	0.0158	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
104		0.01	0.000	0.058	0.0610	0.0002	0.0218	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
105		0.30	0.000	0.058	0.0641	0.0003	0.0428	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
106		0.01	0.000	0.015	0.0613	0.0001	0.0092	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
107		0.03	0.000	0.017	0.0620	0.0002	0.0309	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
108		0.03	0.000	0.009	0.0625	0.0003	0.0415	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
109	*	0.02	0.000	0.019	0.0611	0.0003	0.0353	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
110		0.00	0.000	0.010	0.0593	0.0002	0.0307	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
111		0.00	0.000	0.006	0.0580	0.0001	0.0147	6.09E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
112	*	0.14	0.000	0.052	0.0580	0.0000	0.0037	3.10E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
113		0.00	0.000	0.065	0.0580	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
114		0.00	0.000	0.000	0.0580	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
115		0.00	0.000	0.000	0.0580	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
116		0.01	0.000	0.004	0.0580	0.0001	0.0101	6.78E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
117		0.00	0.000	0.004	0.0580	0.0002	0.0267	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
118		0.00	0.000	0.004	0.0580	0.0004	0.0551	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
119		1.05	0.000	0.017	0.0651	0.0006	0.0770	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
120		0.12	0.000	0.043	0.0635	0.0004	0.0546	6.09E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
121		0.04	0.000	0.021	0.0624	0.0010	0.1210	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
122		0.00	0.000	0.010	0.0601	0.0010	0.1303	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
123		0.00	0.000	0.008	0.0589	0.0009	0.1193	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
124		0.00	0.000	0.004	0.0580	0.0007	0.0847	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
125		0.00	0.000	0.000	0.0580	0.0005	0.0568	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
126		0.00	0.000	0.000	0.0580	0.0003	0.0351	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
127		0.16	0.000	0.010	0.0580	0.0003	0.0336	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

128	0.01	0.000	0.004	0.0580	0.0000	0.0058	2.90E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
129	0.00	0.000	0.000	0.0580	0.0004	0.0482	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
130	0.00	0.000	0.000	0.0580	0.0006	0.0740	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
131	0.00	0.000	0.000	0.0580	0.0006	0.0785	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
132	0.17	0.000	0.011	0.0580	0.0007	0.0840	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
133	0.00	0.000	0.000	0.0580	0.0004	0.0564	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
134	0.08	0.000	0.003	0.0580	0.0009	0.1087	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
135	0.34	0.000	0.010	0.0580	0.0006	0.0786	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
136	0.00	0.000	0.000	0.0580	0.0005	0.0658	6.37E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
137	0.00	0.000	0.000	0.0580	0.0011	0.1394	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
138	0.45	0.000	0.055	0.0645	0.0012	0.1513	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
139	0.02	0.000	0.028	0.0611	0.0003	0.0407	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
140	0.91	0.000	0.142	0.0650	0.0008	0.1004	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
141	0.28	0.000	0.069	0.0641	0.0004	0.0462	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
142	0.63	0.000	0.078	0.0647	0.0006	0.0769	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
143	0.03	0.000	0.028	0.0615	0.0006	0.0762	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
144	0.01	0.000	0.012	0.0603	0.0008	0.1018	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
145	0.20	0.000	0.097	0.0638	0.0007	0.0820	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
146	0.09	0.000	0.019	0.0633	0.0004	0.0493	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
147	0.00	0.000	0.014	0.0599	0.0000	0.0023	6.60E-10	0.0000	0.0000	1.42E-10	0.0000	0.0000	0.00E+00
148	0.00	0.000	0.010	0.0580	0.0001	0.0069	5.35E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
149	0.00	0.000	0.000	0.0580	0.0002	0.0275	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
150	0.00	0.000	0.000	0.0580	0.0005	0.0579	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
151	0.01	0.000	0.005	0.0580	0.0007	0.0881	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
152	0.00	0.000	0.000	0.0580	0.0009	0.1150	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
153	0.00	0.000	0.000	0.0580	0.0011	0.1400	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
154	0.10	0.000	0.004	0.0580	0.0012	0.1459	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
155	0.00	0.000	0.000	0.0580	0.0011	0.1423	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
156	0.00	0.000	0.000	0.0580	0.0013	0.1664	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
157	0.00	0.000	0.000	0.0580	0.0012	0.1519	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
158	0.00	0.000	0.000	0.0580	0.0011	0.1382	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
159	0.00	0.000	0.000	0.0580	0.0010	0.1292	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
160	0.00	0.000	0.000	0.0580	0.0010	0.1235	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
161	0.67	0.000	0.009	0.0648	0.0010	0.1219	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
162	0.03	0.000	0.017	0.0620	0.0007	0.0940	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
163	0.00	0.000	0.022	0.0580	0.0013	0.1626	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
164	0.00	0.000	0.000	0.0580	0.0011	0.1368	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
165	0.00	0.000	0.000	0.0580	0.0009	0.1110	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
166	0.11	0.000	0.005	0.0580	0.0008	0.0960	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
167	0.11	0.000	0.005	0.0580	0.0003	0.0316	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
168	0.04	0.000	0.004	0.0580	0.0002	0.0264	4.96E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
169	0.04	0.000	0.004	0.0580	0.0007	0.0828	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
170	0.00	0.000	0.003	0.0580	0.0007	0.0860	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
171	0.00	0.000	0.000	0.0580	0.0007	0.0944	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
172	0.41	0.000	0.011	0.0580	0.0007	0.0935	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

173	0.98	0.000	0.097	0.0650	0.0003	0.0332	4.28E-09	0.0000	0.0000	1.74E-10	0.0000	0.0000	0.00E+00
174	0.16	0.000	0.054	0.0637	0.0004	0.0487	6.58E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
175	0.04	0.000	0.014	0.0626	0.0008	0.0974	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
176	0.00	0.000	0.024	0.0580	0.0010	0.1241	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
177	0.00	0.000	0.000	0.0580	0.0008	0.0975	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
178	0.00	0.000	0.000	0.0580	0.0005	0.0666	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
179	0.00	0.000	0.000	0.0580	0.0002	0.0259	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
180	0.00	0.000	0.000	0.0580	0.0000	0.0043	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
181	0.22	0.000	0.016	0.0580	0.0001	0.0177	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
182	0.00	0.000	0.000	0.0580	0.0003	0.0342	4.72E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
183	0.74	0.000	0.013	0.0648	0.0009	0.1153	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
184	0.00	0.000	0.027	0.0580	0.0007	0.0822	6.06E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
185	0.00	0.000	0.000	0.0580	0.0014	0.1745	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
186	0.26	0.000	0.056	0.0580	0.0013	0.1616	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
187	0.00	0.000	0.003	0.0580	0.0004	0.0479	5.22E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
188	0.14	0.000	0.005	0.0580	0.0010	0.1224	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
189	0.00	0.000	0.004	0.0580	0.0004	0.0500	5.58E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
190	0.00	0.000	0.000	0.0580	0.0008	0.1007	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
191	0.00	0.000	0.000	0.0580	0.0006	0.0794	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
192	0.00	0.000	0.000	0.0580	0.0005	0.0624	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
193	0.04	0.000	0.004	0.0580	0.0005	0.0659	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
194	0.05	0.000	0.004	0.0580	0.0006	0.0700	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
195	0.00	0.000	0.000	0.0580	0.0009	0.1079	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
196	0.00	0.000	0.000	0.0580	0.0012	0.1468	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
197	0.00	0.000	0.000	0.0580	0.0011	0.1382	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
198	0.00	0.000	0.000	0.0580	0.0010	0.1271	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
199	0.00	0.000	0.000	0.0580	0.0010	0.1202	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
200	0.00	0.000	0.000	0.0580	0.0009	0.1165	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
201	0.00	0.000	0.000	0.0580	0.0009	0.1144	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
202	0.06	0.000	0.003	0.0580	0.0009	0.1145	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
203	0.00	0.000	0.000	0.0580	0.0008	0.1006	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
204	0.02	0.000	0.003	0.0580	0.0010	0.1199	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
205	0.00	0.000	0.000	0.0580	0.0009	0.1081	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
206	0.00	0.000	0.000	0.0580	0.0009	0.1137	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
207	0.00	0.000	0.000	0.0580	0.0009	0.1082	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
208	0.00	0.000	0.000	0.0580	0.0008	0.1015	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
209	0.00	0.000	0.000	0.0580	0.0008	0.0959	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
210	0.00	0.000	0.000	0.0580	0.0007	0.0915	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
211	0.00	0.000	0.000	0.0580	0.0007	0.0882	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
212	0.00	0.000	0.000	0.0580	0.0007	0.0856	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
213	0.00	0.000	0.000	0.0580	0.0007	0.0834	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
214	0.00	0.000	0.000	0.0580	0.0006	0.0815	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
215	0.00	0.000	0.000	0.0580	0.0006	0.0798	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
216	0.00	0.000	0.000	0.0580	0.0006	0.0782	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
217	0.00	0.000	0.000	0.0580	0.0006	0.0766	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

218	0.00	0.000	0.000	0.0580	0.0006	0.0750	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
219	0.00	0.000	0.000	0.0580	0.0006	0.0735	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
220	0.15	0.000	0.003	0.0580	0.0006	0.0747	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
221	0.00	0.000	0.000	0.0580	0.0005	0.0616	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
222	0.04	0.000	0.003	0.0580	0.0006	0.0772	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
223	0.00	0.000	0.000	0.0580	0.0005	0.0605	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
224	0.00	0.000	0.000	0.0580	0.0006	0.0703	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
225	0.01	0.000	0.003	0.0580	0.0006	0.0733	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
226	0.00	0.000	0.000	0.0580	0.0005	0.0626	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
227	0.00	0.000	0.000	0.0580	0.0005	0.0633	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
228	0.32	0.000	0.006	0.0580	0.0005	0.0672	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
229	0.00	0.000	0.000	0.0580	0.0003	0.0352	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
230	0.00	0.000	0.000	0.0580	0.0005	0.0655	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
231	0.01	0.000	0.003	0.0580	0.0006	0.0732	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
232	0.10	0.000	0.003	0.0580	0.0006	0.0763	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
233	0.18	0.000	0.006	0.0580	0.0003	0.0367	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
234	0.00	0.000	0.000	0.0580	0.0002	0.0273	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
235	0.00	0.000	0.000	0.0580	0.0004	0.0486	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
236	0.20	0.000	0.006	0.0580	0.0007	0.0821	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
237	0.00	0.000	0.000	0.0580	0.0002	0.0221	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
238	0.03	0.000	0.002	0.0580	0.0004	0.0448	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
239	0.24	0.000	0.006	0.0580	0.0005	0.0670	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
240	0.28	0.000	0.048	0.0580	0.0003	0.0319	5.22E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
241	0.16	0.000	0.028	0.0580	0.0001	0.0094	6.13E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
242	0.29	0.000	0.099	0.0580	0.0002	0.0267	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
243	0.00	0.000	0.002	0.0580	0.0003	0.0360	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
244	0.02	0.000	0.008	0.0580	0.0003	0.0402	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
245	0.04	0.000	0.011	0.0580	0.0004	0.0515	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
246	0.00	0.000	0.000	0.0580	0.0003	0.0428	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
247	0.00	0.000	0.000	0.0580	0.0004	0.0504	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
248	0.00	0.000	0.000	0.0580	0.0003	0.0425	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
249	0.00	0.000	0.000	0.0580	0.0003	0.0361	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
250	0.00	0.000	0.000	0.0580	0.0002	0.0309	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
251	0.00	0.000	0.000	0.0580	0.0002	0.0202	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
252	0.00	0.000	0.000	0.0580	0.0001	0.0083	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
253	0.00	0.000	0.000	0.0580	0.0000	0.0007	2.99E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
254	0.00	0.000	0.000	0.0580	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
255	0.00	0.000	0.000	0.0580	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
256	0.00	0.000	0.000	0.0580	0.0000	0.0007	2.88E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
257	0.00	0.000	0.000	0.0580	0.0001	0.0084	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
258	0.00	0.000	0.000	0.0580	0.0002	0.0190	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
259	0.26	0.000	0.009	0.0580	0.0003	0.0350	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
260	0.28	0.000	0.009	0.0580	0.0003	0.0336	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
261	0.00	0.000	0.000	0.0580	0.0002	0.0193	4.88E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
262	0.00	0.000	0.003	0.0580	0.0006	0.0731	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

263		0.00	0.000	0.000	0.0580	0.0007	0.0895	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
264		0.00	0.000	0.000	0.0580	0.0007	0.0826	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
265		0.00	0.000	0.000	0.0580	0.0006	0.0700	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
266		0.00	0.000	0.000	0.0580	0.0005	0.0577	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
267		0.00	0.000	0.000	0.0580	0.0004	0.0475	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
268		0.00	0.000	0.000	0.0580	0.0003	0.0397	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
269		0.83	0.000	0.007	0.0649	0.0004	0.0454	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
270	*	0.00	0.000	0.007	0.0608	0.0000	0.0026	2.23E-09	0.0000	0.0000	1.68E-10	0.0000	0.0000	0.00E+00
271		1.07	0.000	0.058	0.0651	0.0004	0.0474	5.46E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
272		0.28	0.000	0.045	0.0641	0.0002	0.0261	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
273		0.11	0.000	0.048	0.0634	0.0004	0.0494	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
274		0.00	0.000	0.014	0.0599	0.0005	0.0597	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
275		0.00	0.000	0.007	0.0589	0.0006	0.0811	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
276		0.02	0.000	0.018	0.0593	0.0005	0.0654	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
277		0.09	0.000	0.015	0.0632	0.0004	0.0519	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
278		0.04	0.000	0.009	0.0627	0.0002	0.0271	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
279		0.06	0.000	0.010	0.0630	0.0000	0.0017	2.45E-09	0.0000	0.0000	1.69E-10	0.0000	0.0000	0.00E+00
280		0.00	0.000	0.005	0.0610	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
281		0.00	0.000	0.003	0.0603	0.0001	0.0091	4.18E-09	0.0000	0.0000	1.74E-10	0.0000	0.0000	0.00E+00
282		0.05	0.000	0.005	0.0629	0.0004	0.0490	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
283		0.00	0.000	0.003	0.0612	0.0004	0.0497	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
284		0.00	0.000	0.002	0.0606	0.0006	0.0722	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
285		0.00	0.000	0.002	0.0602	0.0007	0.0894	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
286		0.00	0.000	0.002	0.0599	0.0008	0.0952	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
287		0.16	0.000	0.011	0.0637	0.0008	0.1027	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
288		0.27	0.000	0.010	0.0641	0.0007	0.0857	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
289		0.00	0.000	0.007	0.0608	0.0006	0.0764	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
290		0.01	0.000	0.006	0.0610	0.0011	0.1426	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
291	*	0.00	0.000	0.003	0.0608	0.0010	0.1302	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
292		0.02	0.000	0.010	0.0618	0.0008	0.1013	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
293		0.42	0.000	0.024	0.0644	0.0007	0.0926	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
294		0.03	0.000	0.012	0.0623	0.0002	0.0209	4.59E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
295		0.02	0.000	0.018	0.0617	0.0007	0.0880	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
296		0.34	0.000	0.056	0.0642	0.0010	0.1213	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
297		0.20	0.000	0.039	0.0639	0.0002	0.0244	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
298		0.50	0.000	0.022	0.0645	0.0005	0.0605	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
299		0.04	0.000	0.006	0.0627	0.0005	0.0568	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
300		0.47	0.000	0.031	0.0645	0.0007	0.0861	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
301		0.00	0.000	0.007	0.0608	0.0004	0.0550	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
302		0.00	0.000	0.010	0.0592	0.0007	0.0907	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
303		0.00	0.000	0.006	0.0580	0.0007	0.0887	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
304		0.00	0.000	0.000	0.0580	0.0005	0.0654	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
305		0.02	0.000	0.012	0.0580	0.0002	0.0262	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
306		0.28	0.000	0.021	0.0580	0.0001	0.0105	3.05E-09	0.0000	0.0000	1.71E-10	0.0000	0.0000	0.00E+00
307		0.00	0.000	0.000	0.0580	0.0000	0.0017	1.14E-09	0.0000	0.0000	1.56E-10	0.0000	0.0000	0.00E+00

308			0.00	0.000	0.000	0.0580	0.0004	0.0532	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
309			0.00	0.000	0.000	0.0580	0.0006	0.0756	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
310			0.00	0.000	0.000	0.0580	0.0006	0.0787	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
311	*		0.00	0.000	0.000	0.0580	0.0007	0.0850	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
312			0.00	0.000	0.000	0.0580	0.0008	0.0958	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
313			0.00	0.000	0.000	0.0580	0.0008	0.1070	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
314			0.00	0.000	0.000	0.0580	0.0009	0.1154	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
315			0.00	0.000	0.000	0.0580	0.0010	0.1204	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
316			0.00	0.000	0.000	0.0580	0.0010	0.1223	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
317			0.00	0.000	0.000	0.0580	0.0010	0.1222	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
318			0.03	0.000	0.004	0.0580	0.0010	0.1217	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
319			0.09	0.000	0.004	0.0580	0.0009	0.1105	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
320			0.42	0.000	0.011	0.0644	0.0009	0.1163	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
321	*		0.49	0.000	0.023	0.0624	0.0008	0.1070	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
322	*		0.11	0.000	0.008	0.0624	0.0012	0.1521	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
323	*		0.35	0.000	0.005	0.0624	0.0010	0.1312	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
324	*		0.09	0.000	0.000	0.0624	0.0008	0.1050	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
325			0.37	0.000	0.000	0.0652	0.0006	0.0799	5.83E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
326	*		0.00	0.000	0.006	0.0613	0.0004	0.0480	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
327			0.00	0.000	0.005	0.0603	0.0007	0.0908	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
328			0.00	0.000	0.004	0.0597	0.0009	0.1188	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
329	*		0.00	0.000	0.000	0.0597	0.0007	0.0902	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
330	*		0.00	0.000	0.000	0.0597	0.0004	0.0507	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
331	*		0.00	0.000	0.000	0.0597	0.0001	0.0170	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
332	*		0.00	0.000	0.000	0.0597	0.0000	0.0059	6.81E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
333	*		0.00	0.000	0.000	0.0597	0.0002	0.0207	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
334	*		0.00	0.000	0.000	0.0597	0.0004	0.0507	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
335	*		0.46	0.000	0.014	0.0613	0.0006	0.0805	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
336	*		0.02	0.000	0.013	0.0624	0.0008	0.1046	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
337	*	*	0.05	0.000	0.000	0.0624	0.0009	0.1077	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
338	*	*	0.00	0.000	0.009	0.0624	0.0010	0.1205	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
339	*	*	0.00	0.000	0.017	0.0624	0.0010	0.1219	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
340		*	0.00	0.000	0.000	0.0995	0.0009	0.1196	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
341		*	0.00	0.000	0.000	0.0995	0.0009	0.1164	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
342		*	0.00	0.000	0.000	0.0995	0.0009	0.1130	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
343		*	0.08	0.000	0.002	0.1062	0.0009	0.1097	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
344		*	0.02	0.000	0.002	0.1075	0.0008	0.1064	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
345		*	0.00	0.000	0.000	0.1075	0.0008	0.1033	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
346		*	0.79	0.000	0.002	0.1736	0.0008	0.1002	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
347		*	0.11	0.000	0.002	0.1825	0.0008	0.0973	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
348		*	0.02	0.000	0.002	0.1842	0.0008	0.0945	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
349		*	0.09	0.000	0.002	0.1917	0.0007	0.0918	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
350			0.03	0.000	0.042	0.1490	0.0007	0.0914	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
351			0.12	0.000	0.076	0.1442	0.0006	0.0770	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
352			0.12	0.000	0.049	0.1476	0.0005	0.0692	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

353			0.05	0.000	0.043	0.1472	0.0010	0.1200	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
354			0.03	0.000	0.061	0.1399	0.0009	0.1084	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
355			0.01	0.000	0.033	0.1344	0.0006	0.0738	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
356	*		0.15	0.000	0.016	0.1338	0.0005	0.0646	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
357	*		0.12	0.000	0.014	0.1331	0.0005	0.0683	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
358	*		0.02	0.000	0.000	0.1329	0.0005	0.0595	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
359	*	*	0.00	0.000	0.011	0.1329	0.0004	0.0507	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
360	*	*	0.08	0.000	0.000	0.1329	0.0005	0.0578	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
361	*	*	0.00	0.000	0.009	0.1329	0.0004	0.0536	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
362	*	*	0.00	0.000	0.015	0.1329	0.0004	0.0463	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
363	*	*	0.00	0.000	0.015	0.1329	0.0003	0.0393	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
364	*	*	0.00	0.000	0.000	0.1329	0.0003	0.0340	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
365	*	*	0.17	0.000	0.000	0.1329	0.0002	0.0310	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

* = Frozen (air or soil)

Annual Totals for Year 4			
	inches	cubic feet	percent
Precipitation	29.81	108,212.4	100.00
Runoff	0.000	0.0000	0.00
Evapotranspiration	6.909	25,079.9	23.18
Drainage Collected from Layer 3	22.3213	81,026.5	74.88
Percolation/Leakage through Layer 5	0.000002	0.0087	0.00
Average Head on Top of Layer 4	0.0005	---	---
Drainage Collected from Layer 7	0.0000	0.0084	0.00
Percolation/Leakage through Layer 9	0.000000	0.0002	0.00
Average Head on Top of Layer 8	0.0000	---	---
Percolation/Leakage through Layer 10	0.000000	0.0000	0.00
Change in Water Storage	0.5801	2,105.9	1.95
Soil Water at Start of Year	60.2901	218,853.1	202.24
Soil Water at End of Year	60.4704	219,507.6	202.85
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.3998	1,451.4	1.34
Annual Water Budget Balance	0.0000	0.0000	0.00

Daily Output for Year 5

Column key: Head #1: drainage from Layer 4 | Head #2: drainage from Layer 8
Drain #1: drainage from Layer 3 | Drain #2: drainage from Layer 7
Leak #1: leakage thru Layer 5 | Leak #2: leakage thru Layer 9 | Leak #3: leakage thru Layer 10

Title: Wayne Disposal-Initial Lift-Sideslope
Simulated On: 3/10/2021 13:00

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1	Head #2	Drain #2	Leak #2	Head #3	Drain #3	Leak #3
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1		*	0.00	0.000	0.000	0.1663	0.0003	0.0317	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
2		*	0.00	0.000	0.000	0.1663	0.0003	0.0345	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
3		*	0.00	0.000	0.000	0.1663	0.0003	0.0382	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
4		*	0.00	0.000	0.000	0.1663	0.0003	0.0422	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
5		*	0.00	0.000	0.000	0.1663	0.0004	0.0459	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
6		*	0.14	0.000	0.002	0.1781	0.0004	0.0492	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
7		*	0.01	0.000	0.002	0.1785	0.0004	0.0519	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
8		*	0.07	0.000	0.002	0.1844	0.0004	0.0540	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
9		*	0.00	0.000	0.000	0.1844	0.0004	0.0554	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
10		*	0.00	0.000	0.000	0.1844	0.0004	0.0564	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
11	*	*	0.01	0.000	0.010	0.1844	0.0005	0.0569	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
12	*	*	0.00	0.000	0.000	0.1844	0.0005	0.0571	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
13	*	*	0.00	0.000	0.000	0.1844	0.0005	0.0571	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
14	*	*	0.00	0.000	0.000	0.1844	0.0005	0.0568	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
15	*	*	0.00	0.000	0.000	0.1844	0.0004	0.0564	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
16		*	0.26	0.000	0.002	0.2056	0.0004	0.0559	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
17		*	0.01	0.000	0.002	0.2061	0.0004	0.0553	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
18	*	*	0.00	0.000	0.000	0.2061	0.0004	0.0547	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
19	*	*	0.01	0.000	0.006	0.2061	0.0004	0.0540	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
20	*	*	0.00	0.000	0.000	0.2061	0.0004	0.0533	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
21	*	*	0.00	0.000	0.000	0.2061	0.0004	0.0525	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
22	*	*	0.00	0.000	0.000	0.2061	0.0004	0.0518	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
23	*	*	0.07	0.000	0.015	0.2061	0.0004	0.0510	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
24		*	0.03	0.000	0.034	0.2098	0.0004	0.0502	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
25	*	*	0.02	0.000	0.018	0.2098	0.0004	0.0495	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
26		*	0.01	0.000	0.002	0.2101	0.0004	0.0487	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
27	*	*	0.01	0.000	0.013	0.2101	0.0004	0.0480	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
28	*	*	0.28	0.000	0.016	0.2101	0.0004	0.0472	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
29	*	*	0.00	0.000	0.007	0.2101	0.0004	0.0465	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
30	*	*	0.09	0.000	0.004	0.2101	0.0004	0.0458	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
31	*	*	0.10	0.000	0.000	0.2101	0.0004	0.0451	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
32	*	*	0.67	0.000	0.009	0.2101	0.0004	0.0444	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
33	*	*	0.00	0.000	0.005	0.2101	0.0003	0.0438	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
34	*	*	0.00	0.000	0.000	0.2101	0.0003	0.0431	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
35	*	*	0.00	0.000	0.000	0.2101	0.0003	0.0425	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
36	*	*	0.00	0.000	0.000	0.2101	0.0003	0.0418	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
37		*	0.01	0.000	0.000	0.3011	0.0003	0.0412	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

38		*	0.00	0.000	0.000	0.3011	0.0003	0.0406	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
39		*	0.00	0.000	0.000	0.3011	0.0003	0.0400	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
40		*	0.02	0.000	0.002	0.3029	0.0003	0.0394	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
41		*	0.09	0.000	0.002	0.3104	0.0003	0.0389	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
42		*	0.19	0.000	0.002	0.3262	0.0003	0.0383	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
43		*	0.00	0.000	0.000	0.3262	0.0003	0.0378	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
44		*	0.20	0.000	0.002	0.3431	0.0003	0.0373	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
45	*	*	0.00	0.000	0.000	0.3431	0.0003	0.0368	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
46	*	*	0.10	0.000	0.014	0.3431	0.0003	0.0363	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
47	*	*	0.00	0.000	0.017	0.3431	0.0003	0.0358	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
48		*	0.00	0.000	0.060	0.3435	0.0003	0.0353	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
49	*	*	0.00	0.000	0.000	0.3435	0.0003	0.0348	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
50	*	*	0.00	0.000	0.000	0.3435	0.0003	0.0344	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
51	*	*	0.00	0.000	0.000	0.3435	0.0003	0.0339	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
52	*	*	0.21	0.000	0.010	0.3435	0.0003	0.0335	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
53	*	*	0.06	0.000	0.018	0.3435	0.0003	0.0330	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
54	*	*	0.18	0.000	0.009	0.3435	0.0003	0.0326	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
55	*	*	0.13	0.000	0.006	0.3435	0.0003	0.0322	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
56	*	*	0.00	0.000	0.004	0.3435	0.0003	0.0318	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
57	*	*	0.55	0.000	0.003	0.3435	0.0002	0.0314	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
58	*	*	0.04	0.000	0.006	0.3435	0.0002	0.0310	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
59	*	*	0.38	0.000	0.003	0.3435	0.0002	0.0306	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
60	*	*	0.00	0.000	0.000	0.3435	0.0002	0.0303	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
61		*	0.04	0.000	0.000	0.4448	0.0002	0.0299	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
62		*	0.00	0.000	0.003	0.4570	0.0002	0.0307	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
63		*	0.00	0.000	0.000	0.4570	0.0002	0.0260	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
64		*	0.00	0.000	0.000	0.4570	0.0002	0.0281	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
65		*	0.00	0.000	0.000	0.4570	0.0002	0.0292	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
66	*	*	0.00	0.000	0.000	0.4570	0.0002	0.0296	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
67		*	0.00	0.000	0.000	0.4570	0.0002	0.0295	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
68		*	0.07	0.000	0.002	0.4570	0.0003	0.0328	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
69		*	0.56	0.000	0.002	0.4570	0.0002	0.0293	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
70		*	0.07	0.000	0.002	0.4570	0.0001	0.0110	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
71		*	0.00	0.000	0.000	0.4570	0.0002	0.0213	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
72		*	0.00	0.000	0.000	0.4570	0.0002	0.0278	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
73			0.00	0.000	0.069	0.2543	0.0003	0.0323	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
74			0.00	0.000	0.101	0.2284	0.0003	0.0319	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
75			0.21	0.000	0.056	0.2321	0.0003	0.0324	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
76			0.00	0.000	0.093	0.2187	0.0003	0.0322	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
77			0.00	0.000	0.118	0.2051	0.0003	0.0320	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
78			0.00	0.000	0.109	0.1925	0.0003	0.0405	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
79			0.22	0.000	0.084	0.2013	0.0003	0.0389	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
80			0.00	0.000	0.168	0.1852	0.0003	0.0334	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
81			0.00	0.000	0.175	0.1681	0.0002	0.0291	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
82			0.00	0.000	0.154	0.1546	0.0002	0.0258	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

83		0.00	0.000	0.130	0.1432	0.0002	0.0231	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
84		0.00	0.000	0.054	0.1377	0.0002	0.0209	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
85		0.01	0.000	0.042	0.1339	0.0001	0.0133	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
86	*	0.05	0.000	0.045	0.1337	0.0000	0.0004	1.29E-09	0.0000	0.0000	1.59E-10	0.0000	0.0000	0.00E+00
87		0.04	0.000	0.036	0.1333	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
88		0.33	0.000	0.032	0.1577	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
89		0.50	0.000	0.029	0.1967	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
90		0.02	0.000	0.240	0.1727	0.0000	0.0020	2.72E-09	0.0000	0.0000	1.70E-10	0.0000	0.0000	0.00E+00
91		0.00	0.000	0.071	0.1540	0.0000	0.0001	7.39E-10	0.0000	0.0000	1.46E-10	0.0000	0.0000	0.00E+00
92		0.00	0.000	0.229	0.1229	0.0001	0.0065	4.87E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
93		0.20	0.000	0.131	0.1212	0.0001	0.0074	4.62E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
94		0.00	0.000	0.054	0.1128	0.0005	0.0570	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
95		0.00	0.000	0.041	0.1075	0.0008	0.0980	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
96		0.10	0.000	0.036	0.1114	0.0008	0.1014	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
97		0.02	0.000	0.032	0.1092	0.0007	0.0889	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
98		0.16	0.000	0.029	0.1197	0.0006	0.0700	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
99		0.16	0.000	0.027	0.1305	0.0005	0.0600	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
100		0.00	0.000	0.270	0.1077	0.0004	0.0460	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
101		0.00	0.000	0.024	0.1055	0.0003	0.0409	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
102		0.00	0.000	0.022	0.1023	0.0003	0.0415	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
103		0.00	0.000	0.021	0.0987	0.0002	0.0305	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
104		0.00	0.000	0.020	0.0948	0.0002	0.0297	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
105		0.00	0.000	0.019	0.0914	0.0002	0.0277	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
106		0.00	0.000	0.018	0.0888	0.0003	0.0429	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
107	*	0.07	0.000	0.067	0.0880	0.0005	0.0578	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
108	*	0.02	0.000	0.035	0.0859	0.0005	0.0661	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
109		0.14	0.000	0.018	0.0957	0.0005	0.0681	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
110		0.03	0.000	0.018	0.0960	0.0005	0.0675	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
111		0.46	0.000	0.017	0.1328	0.0005	0.0646	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
112		0.00	0.000	0.138	0.1024	0.0006	0.0730	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
113	*	0.03	0.000	0.053	0.0940	0.0004	0.0443	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
114	*	0.00	0.000	0.001	0.0919	0.0004	0.0484	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
115	*	0.00	0.000	0.000	0.0907	0.0006	0.0739	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
116	*	0.09	0.000	0.039	0.0914	0.0006	0.0798	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
117	*	0.01	0.000	0.036	0.0912	0.0006	0.0751	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
118	*	0.10	0.000	0.020	0.0923	0.0005	0.0670	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
119	*	0.22	0.000	0.027	0.0935	0.0005	0.0586	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
120	*	0.06	0.000	0.012	0.0947	0.0004	0.0513	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
121	*	0.05	0.000	0.010	0.0960	0.0004	0.0454	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
122	*	0.07	0.000	0.009	0.0973	0.0003	0.0410	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
123	*	0.30	0.000	0.009	0.0987	0.0003	0.0383	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
124	*	0.00	0.000	0.018	0.1001	0.0003	0.0369	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
125	*	0.62	0.000	0.000	0.1016	0.0003	0.0361	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
126	*	0.66	0.000	0.000	0.1032	0.0003	0.0375	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
127		0.59	0.000	0.000	0.1554	0.0004	0.0469	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

128	0.32	0.000	0.000	0.1546	0.0001	0.0179	4.62E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
129	0.17	0.000	0.139	0.1248	0.0003	0.0383	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
130	0.14	0.000	0.096	0.1233	0.0005	0.0612	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
131	1.28	0.000	0.136	0.1532	0.0006	0.0817	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
132	0.15	0.000	0.165	0.1208	0.0003	0.0399	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
133	0.27	0.000	0.424	0.0964	0.0006	0.0762	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
134	0.04	0.000	0.231	0.0622	0.0004	0.0525	5.02E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
135	0.11	0.000	0.020	0.0635	0.0005	0.0608	6.59E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
136	0.00	0.000	0.019	0.0592	0.0004	0.0524	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
137	0.00	0.000	0.006	0.0580	0.0001	0.0092	4.03E-09	0.0000	0.0000	1.74E-10	0.0000	0.0000	0.00E+00
138	0.84	0.000	0.024	0.0649	0.0000	0.0051	1.41E-09	0.0000	0.0000	1.61E-10	0.0000	0.0000	0.00E+00
139	0.00	0.000	0.028	0.0580	0.0001	0.0171	1.96E-09	0.0000	0.0000	1.66E-10	0.0000	0.0000	0.00E+00
140	0.00	0.000	0.000	0.0580	0.0013	0.1582	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
141	0.00	0.000	0.000	0.0580	0.0007	0.0851	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
142	0.00	0.000	0.000	0.0580	0.0004	0.0561	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
143	0.02	0.000	0.005	0.0580	0.0010	0.1224	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
144	0.00	0.000	0.000	0.0580	0.0016	0.1985	7.01E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
145	0.00	0.000	0.000	0.0580	0.0018	0.2295	7.04E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
146	0.00	0.000	0.000	0.0580	0.0018	0.2257	7.04E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
147	0.13	0.000	0.003	0.0580	0.0017	0.2121	7.02E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
148	0.12	0.000	0.003	0.0580	0.0016	0.2051	7.02E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
149	0.01	0.000	0.003	0.0580	0.0018	0.2225	7.03E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
150	0.03	0.000	0.003	0.0580	0.0017	0.2159	7.03E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
151	0.00	0.000	0.000	0.0580	0.0014	0.1721	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
152	0.00	0.000	0.000	0.0580	0.0013	0.1597	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
153	0.00	0.000	0.000	0.0580	0.0011	0.1407	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
154	0.14	0.000	0.003	0.0580	0.0010	0.1300	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
155	0.00	0.000	0.000	0.0580	0.0009	0.1125	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
156	0.00	0.000	0.000	0.0580	0.0012	0.1461	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
157	0.00	0.000	0.000	0.0580	0.0011	0.1332	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
158	0.17	0.000	0.008	0.0580	0.0010	0.1214	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
159	0.00	0.000	0.000	0.0580	0.0007	0.0919	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
160	0.00	0.000	0.000	0.0580	0.0010	0.1282	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
161	0.00	0.000	0.000	0.0580	0.0009	0.1176	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
162	0.00	0.000	0.000	0.0580	0.0008	0.1034	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
163	0.01	0.000	0.002	0.0580	0.0007	0.0941	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
164	0.25	0.000	0.007	0.0640	0.0007	0.0926	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
165	0.02	0.000	0.002	0.0625	0.0005	0.0677	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
166	0.09	0.000	0.002	0.0633	0.0008	0.1011	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
167	0.07	0.000	0.002	0.0632	0.0006	0.0795	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
168	0.05	0.000	0.013	0.0628	0.0007	0.0864	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
169	0.00	0.000	0.001	0.0613	0.0008	0.1051	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
170	0.00	0.000	0.001	0.0609	0.0009	0.1147	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
171	0.02	0.000	0.002	0.0620	0.0008	0.1025	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
172	0.01	0.000	0.002	0.0618	0.0007	0.0871	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

173	0.00	0.000	0.001	0.0611	0.0005	0.0672	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
174	0.00	0.000	0.001	0.0608	0.0005	0.0575	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
175	0.00	0.000	0.001	0.0606	0.0004	0.0546	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
176	0.00	0.000	0.001	0.0604	0.0004	0.0538	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
177	0.48	0.000	0.006	0.0645	0.0005	0.0621	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
178	0.12	0.000	0.081	0.0634	0.0002	0.0239	4.95E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
179	0.04	0.000	0.028	0.0622	0.0006	0.0726	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
180	0.01	0.000	0.012	0.0609	0.0007	0.0940	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
181	0.00	0.000	0.006	0.0606	0.0007	0.0892	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
182	0.21	0.000	0.019	0.0639	0.0007	0.0909	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
183	0.00	0.000	0.003	0.0612	0.0002	0.0219	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
184	0.28	0.000	0.014	0.0641	0.0006	0.0763	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
185	0.01	0.000	0.013	0.0613	0.0001	0.0074	3.45E-09	0.0000	0.0000	1.72E-10	0.0000	0.0000	0.00E+00
186	0.00	0.000	0.002	0.0607	0.0003	0.0438	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
187	0.00	0.000	0.002	0.0603	0.0006	0.0721	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
188	0.00	0.000	0.002	0.0599	0.0005	0.0680	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
189	0.00	0.000	0.002	0.0596	0.0004	0.0540	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
190	0.00	0.000	0.002	0.0593	0.0003	0.0393	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
191	0.00	0.000	0.002	0.0590	0.0002	0.0276	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
192	0.00	0.000	0.002	0.0588	0.0002	0.0211	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
193	0.17	0.000	0.009	0.0638	0.0002	0.0299	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
194	0.02	0.000	0.003	0.0623	0.0001	0.0101	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
195	0.00	0.000	0.001	0.0612	0.0002	0.0268	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
196	0.00	0.000	0.001	0.0608	0.0004	0.0514	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
197	0.00	0.000	0.001	0.0605	0.0005	0.0654	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
198	0.01	0.000	0.003	0.0608	0.0005	0.0688	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
199	0.00	0.000	0.001	0.0605	0.0006	0.0698	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
200	0.00	0.000	0.001	0.0603	0.0005	0.0666	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
201	0.10	0.000	0.003	0.0634	0.0006	0.0718	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
202	0.00	0.000	0.001	0.0613	0.0004	0.0524	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
203	0.00	0.000	0.001	0.0609	0.0005	0.0606	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
204	0.00	0.000	0.001	0.0606	0.0006	0.0710	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
205	0.76	0.000	0.007	0.0648	0.0006	0.0802	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
206	0.00	0.000	0.027	0.0580	0.0003	0.0396	6.66E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
207	0.00	0.000	0.000	0.0580	0.0007	0.0832	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
208	0.00	0.000	0.000	0.0580	0.0007	0.0940	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
209	0.00	0.000	0.000	0.0580	0.0008	0.0970	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
210	0.00	0.000	0.002	0.0580	0.0007	0.0820	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
211	0.77	0.000	0.016	0.0649	0.0006	0.0733	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
212	0.10	0.000	0.039	0.0633	0.0000	0.0056	3.59E-09	0.0000	0.0000	1.73E-10	0.0000	0.0000	0.00E+00
213	0.01	0.000	0.028	0.0596	0.0002	0.0310	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
214	0.23	0.000	0.099	0.0639	0.0006	0.0694	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
215	0.31	0.000	0.095	0.0642	0.0005	0.0582	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
216	0.00	0.000	0.011	0.0603	0.0001	0.0067	4.02E-09	0.0000	0.0000	1.74E-10	0.0000	0.0000	0.00E+00
217	0.73	0.000	0.056	0.0648	0.0004	0.0565	5.86E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00

218		0.00	0.000	0.019	0.0592	0.0001	0.0127	5.66E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
219		0.16	0.000	0.032	0.0637	0.0005	0.0653	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
220		0.12	0.000	0.058	0.0634	0.0004	0.0509	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
221		0.00	0.000	0.014	0.0599	0.0004	0.0442	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
222		0.00	0.000	0.010	0.0580	0.0004	0.0508	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
223		0.00	0.000	0.000	0.0580	0.0003	0.0349	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
224		0.00	0.000	0.000	0.0580	0.0001	0.0122	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
225		0.00	0.000	0.000	0.0580	0.0000	0.0001	7.79E-10	0.0000	0.0000	1.47E-10	0.0000	0.0000	0.00E+00
226		0.00	0.000	0.000	0.0580	0.0000	0.0036	3.93E-09	0.0000	0.0000	1.73E-10	0.0000	0.0000	0.00E+00
227		0.32	0.000	0.014	0.0580	0.0003	0.0326	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
228		0.03	0.000	0.004	0.0580	0.0004	0.0486	5.52E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
229		0.00	0.000	0.000	0.0580	0.0010	0.1200	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
230		0.00	0.000	0.000	0.0580	0.0010	0.1287	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
231		0.58	0.000	0.011	0.0646	0.0009	0.1164	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
232		0.28	0.000	0.067	0.0641	0.0004	0.0485	5.76E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
233		0.00	0.000	0.021	0.0590	0.0010	0.1310	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
234		0.00	0.000	0.005	0.0580	0.0012	0.1462	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
235		0.00	0.000	0.000	0.0580	0.0010	0.1279	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
236		0.00	0.000	0.000	0.0580	0.0006	0.0811	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
237		0.00	0.000	0.000	0.0580	0.0003	0.0407	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
238		0.04	0.000	0.005	0.0580	0.0002	0.0258	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
239		0.00	0.000	0.000	0.0580	0.0001	0.0131	4.31E-09	0.0000	0.0000	1.74E-10	0.0000	0.0000	0.00E+00
240		0.11	0.000	0.004	0.0580	0.0005	0.0653	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
241		0.00	0.000	0.000	0.0580	0.0006	0.0710	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
242		0.00	0.000	0.000	0.0580	0.0010	0.1276	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
243		0.00	0.000	0.000	0.0580	0.0010	0.1242	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
244		0.00	0.000	0.000	0.0580	0.0009	0.1137	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
245		0.00	0.000	0.000	0.0580	0.0008	0.1066	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
246		0.00	0.000	0.000	0.0580	0.0008	0.1032	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
247		0.27	0.000	0.009	0.0641	0.0008	0.1068	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
248		0.00	0.000	0.002	0.0613	0.0007	0.0834	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
249		0.01	0.000	0.003	0.0621	0.0009	0.1169	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
250		0.09	0.000	0.003	0.0633	0.0010	0.1233	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
251		0.01	0.000	0.003	0.0618	0.0006	0.0783	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
252		0.00	0.000	0.001	0.0611	0.0008	0.1028	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
253		0.00	0.000	0.001	0.0607	0.0008	0.1044	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
254		0.00	0.000	0.001	0.0604	0.0008	0.0963	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
255		0.00	0.000	0.001	0.0602	0.0007	0.0868	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
256		0.00	0.000	0.001	0.0600	0.0006	0.0793	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
257		0.00	0.000	0.001	0.0598	0.0006	0.0745	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
258		0.14	0.000	0.006	0.0636	0.0006	0.0785	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
259		0.53	0.000	0.007	0.0646	0.0005	0.0638	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
260		0.22	0.000	0.025	0.0640	0.0003	0.0375	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
261		0.97	0.000	0.072	0.0650	0.0008	0.0948	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
262	*	0.00	0.000	0.005	0.0610	0.0007	0.0917	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

263			0.00	0.000	0.004	0.0603	0.0008	0.0984	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
264	*		0.00	0.000	0.000	0.0603	0.0009	0.1137	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
265			0.00	0.000	0.011	0.0584	0.0007	0.0889	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
266			0.00	0.000	0.001	0.0580	0.0005	0.0591	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
267			0.00	0.000	0.000	0.0580	0.0002	0.0281	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
268			1.82	0.000	0.074	0.0654	0.0002	0.0206	4.97E-09	0.0000	0.0000	1.75E-10	0.0000	0.0000	0.00E+00
269	*		0.00	0.000	0.004	0.0611	0.0000	0.0027	1.62E-09	0.0000	0.0000	1.63E-10	0.0000	0.0000	0.00E+00
270	*		0.00	0.000	0.000	0.0609	0.0007	0.0878	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
271			0.34	0.000	0.027	0.0643	0.0007	0.0897	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
272	*		0.11	0.000	0.035	0.0624	0.0001	0.0136	2.79E-09	0.0000	0.0000	1.70E-10	0.0000	0.0000	0.00E+00
273	*		0.00	0.000	0.058	0.0614	0.0006	0.0717	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
274	*		0.11	0.000	0.035	0.0624	0.0004	0.0534	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
275	*		0.04	0.000	0.055	0.0624	0.0003	0.0388	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
276	*		0.01	0.000	0.000	0.0624	0.0007	0.0853	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
277			0.01	0.000	0.019	0.0617	0.0012	0.1455	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
278	*		0.00	0.000	0.000	0.0612	0.0014	0.1823	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
279	*		0.60	0.000	0.027	0.0624	0.0015	0.1885	7.00E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
280			0.45	0.000	0.000	0.0650	0.0014	0.1727	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
281			0.03	0.000	0.009	0.0624	0.0014	0.1792	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
282			0.00	0.000	0.005	0.0610	0.0020	0.2458	7.05E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
283	*		0.00	0.000	0.000	0.0609	0.0013	0.1694	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
284			0.07	0.000	0.008	0.0632	0.0008	0.0990	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
285			0.00	0.000	0.014	0.0599	0.0002	0.0262	6.35E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
286			0.38	0.000	0.025	0.0643	0.0007	0.0905	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
287			0.04	0.000	0.009	0.0627	0.0009	0.1177	6.03E-09	0.0000	0.0000	1.76E-10	0.0000	0.0000	0.00E+00
288			0.45	0.000	0.022	0.0645	0.0015	0.1833	6.99E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
289	*		0.04	0.000	0.027	0.0624	0.0010	0.1226	6.79E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
290	*		0.00	0.000	0.000	0.0614	0.0016	0.2078	7.02E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
291	*		0.00	0.000	0.004	0.0605	0.0011	0.1416	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
292	*		0.00	0.000	0.000	0.0605	0.0006	0.0773	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
293	*		0.00	0.000	0.000	0.0604	0.0005	0.0571	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
294	*		0.00	0.000	0.000	0.0604	0.0006	0.0751	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
295			0.00	0.000	0.005	0.0595	0.0009	0.1092	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
296			0.00	0.000	0.007	0.0580	0.0011	0.1363	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
297			0.00	0.000	0.000	0.0580	0.0012	0.1539	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
298			0.00	0.000	0.000	0.0580	0.0013	0.1619	6.98E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
299	*		0.00	0.000	0.000	0.0580	0.0013	0.1579	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
300	*		0.00	0.000	0.000	0.0580	0.0012	0.1524	6.97E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
301	*		0.00	0.000	0.000	0.0580	0.0012	0.1470	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
302	*	*	0.01	0.000	0.007	0.0580	0.0011	0.1418	6.96E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
303	*	*	0.29	0.000	0.015	0.0580	0.0011	0.1369	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
304	*	*	0.14	0.000	0.000	0.0580	0.0010	0.1321	6.95E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
305		*	0.21	0.000	0.000	0.0898	0.0010	0.1274	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
306		*	0.00	0.000	0.008	0.1069	0.0010	0.1229	6.94E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
307	*	*	0.00	0.000	0.018	0.1069	0.0009	0.1186	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

308	*	*	0.00	0.000	0.014	0.1069	0.0009	0.1145	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
309	*	*	0.20	0.000	0.023	0.1069	0.0009	0.1105	6.93E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
310		*	0.00	0.000	0.037	0.1185	0.0008	0.1068	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
311		*	0.01	0.000	0.001	0.1195	0.0008	0.1032	6.92E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
312		*	0.01	0.000	0.001	0.1206	0.0008	0.0998	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
313		*	0.16	0.000	0.001	0.1340	0.0008	0.0966	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
314		*	0.05	0.000	0.001	0.1379	0.0007	0.0936	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
315		*	0.00	0.000	0.000	0.1379	0.0007	0.0907	6.91E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
316		*	0.00	0.000	0.000	0.1379	0.0007	0.0879	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
317		*	0.00	0.000	0.000	0.1379	0.0007	0.0853	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
318		*	0.27	0.000	0.001	0.1600	0.0007	0.0828	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
319		*	0.00	0.000	0.000	0.1600	0.0006	0.0805	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
320			0.00	0.000	0.111	0.1415	0.0006	0.0805	6.90E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
321			0.00	0.000	0.064	0.1289	0.0006	0.0742	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
322			0.00	0.000	0.032	0.1229	0.0006	0.0708	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
323	*		0.00	0.000	0.028	0.1184	0.0005	0.0690	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
324			0.21	0.000	0.055	0.1299	0.0006	0.0698	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
325			0.00	0.000	0.038	0.1244	0.0006	0.0733	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
326			0.00	0.000	0.041	0.1196	0.0005	0.0668	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
327			0.00	0.000	0.072	0.1122	0.0006	0.0716	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
328			0.00	0.000	0.078	0.1052	0.0005	0.0652	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
329			0.00	0.000	0.039	0.1019	0.0006	0.0710	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
330	*		0.00	0.000	0.000	0.1017	0.0006	0.0720	6.89E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
331	*		0.24	0.000	0.018	0.1032	0.0005	0.0660	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
332	*		0.00	0.000	0.018	0.1047	0.0005	0.0601	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
333	*		0.25	0.000	0.021	0.1061	0.0004	0.0549	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
334			0.01	0.000	0.000	0.1390	0.0004	0.0509	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
335	*		0.08	0.000	0.024	0.1405	0.0004	0.0462	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
336			0.16	0.000	0.011	0.1546	0.0004	0.0474	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
337	*		0.05	0.000	0.028	0.1499	0.0004	0.0454	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
338	*		0.00	0.000	0.025	0.1404	0.0003	0.0409	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
339	*		0.15	0.000	0.027	0.1378	0.0003	0.0352	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
340	*		0.29	0.000	0.022	0.1358	0.0003	0.0317	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
341			0.00	0.000	0.000	0.1368	0.0002	0.0281	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
342			0.04	0.000	0.010	0.1633	0.0003	0.0319	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
343			0.11	0.000	0.065	0.1538	0.0005	0.0625	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
344			0.05	0.000	0.061	0.1454	0.0003	0.0436	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
345			0.00	0.000	0.058	0.1357	0.0002	0.0313	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
346			0.00	0.000	0.056	0.1280	0.0004	0.0443	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
347			0.00	0.000	0.052	0.1215	0.0004	0.0515	6.86E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
348			0.18	0.000	0.052	0.1311	0.0004	0.0529	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
349			0.47	0.000	0.055	0.1640	0.0005	0.0574	6.87E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
350			0.00	0.000	0.045	0.1462	0.0005	0.0620	6.88E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
351			0.00	0.000	0.039	0.1353	0.0003	0.0346	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
352			0.00	0.000	0.031	0.1288	0.0002	0.0259	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

353	*	0.13	0.000	0.029	0.1281	0.0002	0.0304	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
354	*	0.01	0.000	0.024	0.1278	0.0003	0.0326	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
355		0.01	0.000	0.046	0.1270	0.0003	0.0358	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
356	*	0.00	0.000	0.000	0.1256	0.0003	0.0408	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
357		0.00	0.000	0.043	0.1204	0.0003	0.0412	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
358		0.00	0.000	0.044	0.1157	0.0003	0.0354	6.85E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
359		0.00	0.000	0.066	0.1093	0.0002	0.0297	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
360		0.00	0.000	0.055	0.1047	0.0002	0.0238	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
361		0.02	0.000	0.056	0.1020	0.0002	0.0254	6.84E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
362		0.02	0.000	0.058	0.0979	0.0002	0.0246	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
363		0.02	0.000	0.041	0.0950	0.0002	0.0216	6.83E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
364	*	0.00	0.000	0.000	0.0946	0.0001	0.0106	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00
365		0.05	0.000	0.039	0.0950	0.0001	0.0094	6.82E-09	0.0000	0.0000	1.77E-10	0.0000	0.0000	0.00E+00

* = Frozen (air or soil)

Annual Totals for Year 5			
	inches	cubic feet	percent
Precipitation	31.32	113,706.2	100.00
Runoff	0.000	0.0000	0.00
Evapotranspiration	8.373	30,394.8	26.73
Drainage Collected from Layer 3	24.6053	89,317.3	78.55
Percolation/Leakage through Layer 5	0.000002	0.0088	0.00
Average Head on Top of Layer 4	0.0005	---	---
Drainage Collected from Layer 7	0.0000	0.0085	0.00
Percolation/Leakage through Layer 9	0.000000	0.0002	0.00
Average Head on Top of Layer 8	0.0000	---	---
Percolation/Leakage through Layer 10	0.000000	0.0000	0.00
Change in Water Storage	-1.6545	-6,005.9	-5.28
Soil Water at Start of Year	60.4704	219,507.6	193.05
Soil Water at End of Year	59.2157	214,953.2	189.04
Snow Water at Start of Year	0.3998	1,451.4	1.28
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	0.0000	0.0000	0.00

Average Annual Totals Summary

Title: Wayne Disposal-Initial Lift-Sideslope
Simulated on: 3/10/2021 13:00

	Average Annual Totals for Years 1 - 5*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	30.21	[4.26]	109,651.5	100.00
Runoff	0.000	[0]	0.0000	0.00
Evapotranspiration	8.183	[1.48]	29,705.0	27.09
Subprofile1				
Lateral drainage collected from Layer 3	22.2894	[3.6595]	80,910.7	73.79
Percolation/leakage through Layer 5	0.000002	[0]	0.0087	0.00
Average Head on Top of Layer 4	0.0005	[0.0001]	---	---
Subprofile2				
Lateral drainage collected from Layer 7	0.0000	[0]	0.0085	0.00
Percolation/leakage through Layer 9	0.000000	[0]	0.0002	0.00
Average Head on Top of Layer 8	0.0000	[0]	---	---
Subprofile3				
Percolation/leakage through Layer 10	0.000000	[0]	0.0000	0.00
Water storage				
Change in water storage	-0.2656	[1.1065]	-964.2	-0.88

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: Wayne Disposal-Initial Lift-Sideslope
Simulated on: 3/10/2021 13:00

	Peak Values for Years 1 - 5*		
	(inches)		(cubic feet)
Precipitation	2.00		7,253.1
Runoff	0.000		0.0000
Subprofile1			
Drainage collected from Layer 3	0.2458		892.2
Percolation/leakage through Layer 5	0.000000		0.0000
Average head on Layer 4	0.0020		---
Maximum head on Layer 4	0.0039		---
Location of maximum head in Layer 3	0.00	(feet from drain)	
Subprofile2			
Drainage collected from Layer 7	0.0000		0.0000
Percolation/leakage through Layer 9	0.000000		0.0000
Average head on Layer 8	0.0000		---
Maximum head on Layer 8	0.0000		---
Location of maximum head in Layer 7	0.00	(feet from drain)	
Subprofile3			
Percolation/leakage through Layer 10	0.000000		0.0000
Other Parameters			
Snow water	1.8054		6,553.5
Maximum vegetation soil water	0.4570	(vol/vol)	
Minimum vegetation soil water	0.0580	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: Wayne Disposal-Initial Lift-Sideslope
Simulated on: 3/10/2021 13:00
Simulation period: 5 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	25.4912	0.2124
2	1.6853	0.1404
3	0.0021	0.0103
4	0.0000	0.0000
5	0.3750	0.7500
6	22.3800	0.3730
7	0.0050	0.0100
8	0.0000	0.0000
9	0.3750	0.7500
10	8.9022	0.3709
Snow water	0.0000	---

CALCULATION SHEET

Client: US Ecology – Wayne Disposal
Project: WDI MC VI-G4 - G7 Liner and Final Cover Grading Modification
Calculation: Leachate Generation (HELP Model) Analysis

Project No.: 1218070017
Calculated By: LEH Date: 06/01/2021
Checked By: NSG Date: 10/4/2021
Approved By: XZ Date: 10/5/21

ATTACHMENT 5.2.2

HELP Model Analysis - Floor

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: Wayne Disposal - Initial Lift **Simulated On:** 3/23/2021 12:59

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
Sandy Waste Material
Material Texture Number 83

Thickness	=	120	inches
Porosity	=	0.457	vol/vol
Field Capacity	=	0.131	vol/vol
Wilting Point	=	0.058	vol/vol
Initial Soil Water Content	=	0.1887	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-03	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
Custom Soil 1
Material Texture Number 43

Thickness	=	12	inches
Porosity	=	0.417	vol/vol
Field Capacity	=	0.045	vol/vol
Wilting Point	=	0.018	vol/vol
Initial Soil Water Content	=	0.0477	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-03	cm/sec

Layer 3

Type 2 - Lateral Drainage Layer
Drainage Net (0.5 cm)
Material Texture Number 20

Thickness	=	0.2	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	5	%
Drainage Length	=	390	ft

Layer 4

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.08	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5

Type 3 - Barrier Soil Liner
Bentonite (High)
Material Texture Number 17

Thickness	=	0.5	inches
Porosity	=	0.75	vol/vol
Field Capacity	=	0.747	vol/vol
Wilting Point	=	0.4	vol/vol
Initial Soil Water Content	=	0.75	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-09	cm/sec

Layer 6

Type 1 - Vertical Percolation Layer
CL - Clay Loam (Moderate)
Material Texture Number 25

Thickness	=	60	inches
Porosity	=	0.437	vol/vol
Field Capacity	=	0.373	vol/vol
Wilting Point	=	0.266	vol/vol
Initial Soil Water Content	=	0.373	vol/vol
Effective Sat. Hyd. Conductivity	=	3.60E-06	cm/sec

Layer 7

Type 2 - Lateral Drainage Layer
Drainage Net (0.5 cm)
Material Texture Number 20

Thickness	=	0.5	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	5	%
Drainage Length	=	390	ft

Layer 8

Type 4 - Flexible Membrane Liner

HDPE Membrane

Material Texture Number 35

Thickness	=	0.08	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 9

Type 3 - Barrier Soil Liner

Bentonite (High)

Material Texture Number 17

Thickness	=	0.5	inches
Porosity	=	0.75	vol/vol
Field Capacity	=	0.747	vol/vol
Wilting Point	=	0.4	vol/vol
Initial Soil Water Content	=	0.75	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-09	cm/sec

Layer 10

Type 1 - Vertical Percolation Layer

SiC - Silty Clay

Material Texture Number 14

Thickness	=	24	inches
Porosity	=	0.479	vol/vol
Field Capacity	=	0.371	vol/vol
Wilting Point	=	0.251	vol/vol
Initial Soil Water Content	=	0.3709	vol/vol
Effective Sat. Hyd. Conductivity	=	2.50E-05	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	96.9	
Fraction of Area Allowing Runoff	=	0	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	12	inches
Initial Water in Evaporative Zone	=	2.638	inches
Upper Limit of Evaporative Storage	=	5.484	inches
Lower Limit of Evaporative Storage	=	0.696	inches

Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	55.252	inches
Total Initial Water	=	55.252	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	42.18	Degrees
Maximum Leaf Area Index	=	0	
Start of Growing Season (Julian Date)	=	100	days
End of Growing Season (Julian Date)	=	260	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	72	%
Average 2nd Quarter Relative Humidity	=	68	%
Average 3rd Quarter Relative Humidity	=	73	%
Average 4th Quarter Relative Humidity	=	74	%

Note: Evapotranspiration data was obtained for Belleville, Michigan

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.727469	1.491737	2.04112	2.196136	3.069454	3.054674
3.434996	2.908791	3.528608	1.797602	1.974739	2.783078

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
33.1	33.8	37.3	60.7	63.6	77.2
82.8	79.7	75.8	60.9	36.2	33.9

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Daily Output for Year 1

Column key: Head #1: drainage from Layer 4 | Head #2: drainage from Layer 8
Drain #1: drainage from Layer 3 | Drain #2: drainage from Layer 7
Leak #1: leakage thru Layer 5 | Leak #2: leakage thru Layer 9 | Leak #3: leakage thru Layer 10

Title: Wayne Disposal - Initial Lift
Simulated On: 3/23/2021 13:00

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1	Head #2	Drain #2	Leak #2	Head #3	Drain #3	Leak #3
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1	*		0.00	0.000	0.000	0.2159	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
2	*		0.01	0.000	0.005	0.2133	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
3	*		0.03	0.000	0.024	0.2109	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
4	*		0.11	0.000	0.028	0.2099	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
5	*	*	0.06	0.000	0.029	0.2099	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
6		*	0.07	0.000	0.000	0.2150	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
7	*	*	0.00	0.000	0.026	0.2150	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
8	*	*	0.00	0.000	0.021	0.2150	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
9		*	0.44	0.000	0.000	0.2568	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
10		*	0.02	0.000	0.000	0.2584	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
11	*	*	0.42	0.000	0.025	0.2584	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
12	*	*	0.35	0.000	0.010	0.2584	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
13		*	0.00	0.000	0.030	0.2584	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
14		*	0.00	0.000	0.000	0.2882	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
15		*	0.00	0.000	0.000	0.3169	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
16		*	0.02	0.000	0.000	0.3186	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
17	*	*	0.01	0.000	0.006	0.3186	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
18		*	0.23	0.000	0.000	0.3375	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
19		*	0.00	0.000	0.000	0.3377	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
20	*	*	0.03	0.000	0.030	0.3377	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
21		*	0.01	0.000	0.000	0.3386	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
22		*	0.08	0.000	0.000	0.3456	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
23		*	0.00	0.000	0.000	0.3456	0.0000	0.0000	4.76E-09	0.0000	0.0000	1.90E-09	0.0000	0.0000	0.00E+00
24		*	0.00	0.000	0.000	0.3456	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
25		*	0.03	0.000	0.000	0.3480	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
26		*	0.00	0.000	0.000	0.3480	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
27	*	*	0.45	0.000	0.026	0.3480	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
28		*	0.04	0.000	0.000	0.3694	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
29		*	0.01	0.000	0.056	0.3823	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
30			0.00	0.000	0.080	0.2405	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
31	*		0.00	0.000	0.044	0.2231	0.0000	0.0000	5.87E-11	0.0000	0.0000	5.76E-11	0.0000	0.0000	0.00E+00
32			0.35	0.000	0.054	0.2400	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
33			0.04	0.000	0.071	0.2329	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
34	*		0.00	0.000	0.038	0.2256	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
35			0.00	0.000	0.084	0.2161	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
36	*		0.03	0.000	0.033	0.2118	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
37			0.16	0.000	0.070	0.2155	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00

38			0.07	0.000	0.065	0.2133	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
39			0.43	0.000	0.058	0.2416	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
40	*		0.04	0.000	0.024	0.2409	0.0000	0.0000	2.04E-09	0.0000	0.0000	1.24E-09	0.0000	0.0000	0.00E+00
41	*		0.00	0.000	0.000	0.2373	0.0000	0.0000	2.04E-09	0.0000	0.0000	1.24E-09	0.0000	0.0000	0.00E+00
42	*		0.00	0.000	0.000	0.2286	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
43	*		0.00	0.000	0.000	0.2225	0.0000	0.0000	2.81E-09	0.0000	0.0000	1.49E-09	0.0000	0.0000	0.00E+00
44	*		0.00	0.000	0.047	0.2138	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
45	*		0.06	0.000	0.038	0.2116	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
46	*		0.15	0.000	0.000	0.2099	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
47	*		0.02	0.000	0.031	0.2087	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
48			0.05	0.000	0.044	0.2154	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
49			0.00	0.000	0.093	0.2053	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
50			0.00	0.000	0.082	0.1972	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
51	*		0.09	0.000	0.038	0.1973	0.0000	0.0000	2.72E-09	0.0000	0.0000	1.46E-09	0.0000	0.0000	0.00E+00
52	*		0.13	0.000	0.000	0.1973	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
53			0.09	0.000	0.042	0.2111	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
54			0.00	0.000	0.091	0.2018	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
55	*		0.01	0.000	0.008	0.2009	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
56			0.17	0.000	0.066	0.2085	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
57			0.02	0.000	0.148	0.1967	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
58	*		0.12	0.000	0.059	0.1976	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
59			0.00	0.000	0.117	0.1907	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
60			0.12	0.000	0.054	0.1949	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
61			0.57	0.000	0.061	0.2368	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
62			0.00	0.000	0.092	0.2284	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
63			0.00	0.000	0.065	0.2231	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
64			0.00	0.000	0.056	0.2132	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
65	*		0.00	0.000	0.072	0.2019	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
66	*		0.00	0.000	0.000	0.1980	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
67	*		0.00	0.000	0.000	0.1948	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
68	*		0.00	0.000	0.058	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
69	*	*	0.00	0.000	0.000	0.1877	0.0000	0.0000	2.15E-09	0.0000	0.0000	1.28E-09	0.0000	0.0000	0.00E+00
70	*	*	0.08	0.000	0.032	0.1877	0.0000	0.0000	4.08E-09	0.0000	0.0000	1.78E-09	0.0000	0.0000	0.00E+00
71		*	0.00	0.000	0.053	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
72	*	*	0.00	0.000	0.000	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
73	*	*	0.00	0.000	0.000	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
74	*	*	0.00	0.000	0.000	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
75	*	*	0.00	0.000	0.000	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
76	*	*	0.00	0.000	0.000	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
77	*	*	0.00	0.000	0.000	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
78	*	*	0.03	0.000	0.029	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
79	*	*	0.07	0.000	0.040	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
80	*	*	0.69	0.000	0.010	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
81	*	*	0.00	0.000	0.013	0.1877	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
82		*	0.08	0.000	0.000	0.2523	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00

83		*	0.00	0.000	0.000	0.2523	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
84	*	*	0.00	0.000	0.000	0.2523	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
85	*	*	0.10	0.000	0.045	0.2523	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
86	*	*	0.00	0.000	0.024	0.2523	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
87		*	0.00	0.000	0.036	0.2523	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
88		*	0.00	0.000	0.000	0.2523	0.0000	0.0000	6.80E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
89	*	*	0.05	0.000	0.045	0.2523	0.0000	0.0000	1.51E-09	0.0000	0.0000	1.02E-09	0.0000	0.0000	0.00E+00
90	*	*	0.00	0.000	0.000	0.2523	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
91		*	0.03	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
92		*	0.00	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
93		*	0.00	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
94		*	0.00	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
95		*	0.00	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
96		*	0.00	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
97		*	0.00	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
98		*	0.00	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
99		*	0.00	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
100		*	0.00	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
101		*	0.00	0.000	0.000	0.2547	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
102			0.00	0.000	0.305	0.2272	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
103			0.00	0.000	0.137	0.2046	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
104			0.15	0.000	0.153	0.1979	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
105			0.22	0.000	0.153	0.1990	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
106			0.00	0.000	0.288	0.1717	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
107			0.00	0.000	0.130	0.1591	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
108			0.00	0.000	0.054	0.1531	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
109			0.01	0.000	0.042	0.1498	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
110			0.00	0.000	0.035	0.1457	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
111			0.00	0.000	0.031	0.1417	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
112			0.05	0.000	0.028	0.1423	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
113			0.05	0.000	0.026	0.1429	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
114			0.07	0.000	0.024	0.1454	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
115			0.01	0.000	0.023	0.1431	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
116			0.00	0.000	0.021	0.1406	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
117			0.00	0.000	0.020	0.1381	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
118			0.00	0.000	0.019	0.1356	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
119			0.00	0.000	0.018	0.1333	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
120			0.03	0.000	0.018	0.1336	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
121			0.03	0.000	0.017	0.1342	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
122			0.32	0.000	0.017	0.1587	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
123			0.06	0.000	0.016	0.1619	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
124			0.52	0.000	0.016	0.2033	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
125			0.00	0.000	0.108	0.1937	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
126			0.00	0.000	0.259	0.1718	0.0000	0.0003	2.05E-09	0.0000	0.0000	1.24E-09	0.0000	0.0000	0.00E+00
127			0.00	0.000	0.241	0.1517	0.0000	0.0000	2.77E-09	0.0000	0.0000	1.47E-09	0.0000	0.0000	0.00E+00

128		0.02	0.000	0.130	0.1421	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
129		0.20	0.000	0.054	0.1537	0.0000	0.0000	1.36E-09	0.0000	0.0000	9.51E-10	0.0000	0.0000	0.00E+00
130		0.01	0.000	0.042	0.1503	0.0000	0.0000	2.04E-09	0.0000	0.0000	1.24E-09	0.0000	0.0000	0.00E+00
131		0.03	0.000	0.035	0.1498	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
132		0.56	0.000	0.031	0.1933	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
133		0.00	0.000	0.106	0.1843	0.0000	0.0002	4.77E-09	0.0000	0.0000	1.90E-09	0.0000	0.0000	0.00E+00
134	*	0.01	0.000	0.059	0.1799	0.0000	0.0000	6.87E-10	0.0000	0.0000	5.64E-10	0.0000	0.0000	0.00E+00
135		0.63	0.000	0.116	0.2228	0.0000	0.0003	6.13E-09	0.0000	0.0000	2.08E-09	0.0000	0.0000	0.00E+00
136		0.04	0.000	0.288	0.2019	0.0004	0.0031	6.86E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
137		0.00	0.000	0.266	0.1789	0.0006	0.0045	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
138		0.00	0.000	0.242	0.1583	0.0002	0.0014	6.83E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
139		0.00	0.000	0.130	0.1475	0.0000	0.0000	1.06E-09	0.0000	0.0000	7.96E-10	0.0000	0.0000	0.00E+00
140		0.00	0.000	0.054	0.1430	0.0002	0.0012	5.47E-09	0.0000	0.0000	2.00E-09	0.0000	0.0000	0.00E+00
141		0.01	0.000	0.042	0.1405	0.0007	0.0050	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
142		0.05	0.000	0.035	0.1421	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
143		0.03	0.000	0.031	0.1416	0.0013	0.0092	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
144		0.00	0.000	0.028	0.1393	0.0015	0.0110	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
145		0.00	0.000	0.025	0.1368	0.0022	0.0159	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
146		0.00	0.000	0.024	0.1340	0.0024	0.0173	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
147		0.00	0.000	0.020	0.1312	0.0021	0.0151	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
148		0.40	0.000	0.022	0.1616	0.0017	0.0124	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
149		0.12	0.000	0.021	0.1692	0.0014	0.0100	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
150		0.04	0.000	0.020	0.1704	0.0014	0.0102	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
151		0.00	0.000	0.019	0.1682	0.0016	0.0113	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
152		0.05	0.000	0.019	0.1702	0.0018	0.0127	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
153		0.24	0.000	0.018	0.1883	0.0020	0.0142	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
154		0.11	0.000	0.229	0.1770	0.0027	0.0193	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
155		0.16	0.000	0.297	0.1649	0.0018	0.0128	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
156		0.00	0.000	0.130	0.1540	0.0019	0.0136	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
157		0.04	0.000	0.055	0.1525	0.0029	0.0209	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
158		0.00	0.000	0.041	0.1486	0.0032	0.0232	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
159		0.00	0.000	0.035	0.1453	0.0031	0.0228	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
160		0.04	0.000	0.032	0.1458	0.0032	0.0231	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
161		0.00	0.000	0.028	0.1431	0.0032	0.0233	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
162		0.00	0.000	0.025	0.1407	0.0032	0.0229	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
163		0.32	0.000	0.025	0.1650	0.0031	0.0223	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
164		0.00	0.000	0.022	0.1629	0.0031	0.0224	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
165		0.00	0.000	0.021	0.1609	0.0031	0.0223	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
166		0.06	0.000	0.021	0.1636	0.0030	0.0221	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
167		0.00	0.000	0.020	0.1621	0.0030	0.0219	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
168		0.63	0.000	0.019	0.2125	0.0030	0.0215	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
169		0.35	0.000	0.265	0.2195	0.0027	0.0196	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
170		0.00	0.000	0.148	0.2066	0.0035	0.0255	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
171		0.00	0.000	0.137	0.1946	0.0030	0.0219	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
172		0.00	0.000	0.200	0.1777	0.0024	0.0176	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

173	0.00	0.000	0.360	0.1474	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
174	0.19	0.000	0.131	0.1523	0.0028	0.0201	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
175	0.00	0.000	0.054	0.1477	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
176	0.00	0.000	0.041	0.1443	0.0024	0.0171	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
177	0.00	0.000	0.035	0.1414	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
178	0.00	0.000	0.031	0.1387	0.0028	0.0202	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
179	0.00	0.000	0.028	0.1358	0.0034	0.0243	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
180	0.07	0.000	0.027	0.1385	0.0031	0.0224	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
181	0.10	0.000	0.025	0.1438	0.0027	0.0196	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
182	0.03	0.000	0.024	0.1435	0.0024	0.0176	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
183	0.45	0.000	0.022	0.1785	0.0022	0.0159	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
184	0.06	0.000	0.191	0.1670	0.0018	0.0129	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
185	0.67	0.000	0.021	0.2204	0.0019	0.0138	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
186	0.00	0.000	0.171	0.2059	0.0017	0.0126	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
187	0.00	0.000	0.115	0.1954	0.0025	0.0180	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
188	0.00	0.000	0.253	0.1730	0.0027	0.0194	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
189	0.00	0.000	0.261	0.1508	0.0019	0.0135	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
190	0.00	0.000	0.130	0.1394	0.0023	0.0165	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
191	0.00	0.000	0.054	0.1347	0.0021	0.0150	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
192	0.03	0.000	0.043	0.1333	0.0020	0.0145	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
193	1.04	0.000	0.036	0.2167	0.0025	0.0180	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
194	0.11	0.000	0.142	0.2137	0.0029	0.0208	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
195	0.14	0.000	0.302	0.1999	0.0031	0.0228	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
196	0.75	0.000	0.320	0.2339	0.0037	0.0266	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
197	0.00	0.000	0.126	0.2224	0.0032	0.0233	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
198	0.22	0.000	0.357	0.2107	0.0023	0.0170	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
199	0.01	0.000	0.306	0.1852	0.0026	0.0192	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
200	0.45	0.000	0.131	0.2113	0.0023	0.0167	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
201	0.00	0.000	0.267	0.1858	0.0030	0.0217	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
202	0.00	0.000	0.201	0.1661	0.0027	0.0193	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
203	0.02	0.000	0.131	0.1560	0.0018	0.0131	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
204	0.00	0.000	0.054	0.1509	0.0015	0.0106	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
205	0.05	0.000	0.043	0.1504	0.0027	0.0195	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
206	0.21	0.000	0.036	0.1638	0.0021	0.0154	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
207	0.80	0.000	0.032	0.2272	0.0017	0.0126	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
208	0.00	0.000	0.112	0.2172	0.0017	0.0123	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
209	0.54	0.000	0.193	0.2449	0.0029	0.0207	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
210	0.00	0.000	0.256	0.2229	0.0019	0.0136	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
211	0.00	0.000	0.250	0.1998	0.0019	0.0136	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
212	0.00	0.000	0.303	0.1688	0.0034	0.0244	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
213	0.00	0.000	0.130	0.1555	0.0027	0.0196	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
214	0.00	0.000	0.054	0.1496	0.0013	0.0095	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
215	0.37	0.000	0.043	0.1730	0.0031	0.0221	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
216	0.28	0.000	0.037	0.1902	0.0024	0.0175	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
217	0.00	0.000	0.128	0.1770	0.0010	0.0071	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00

218	0.00	0.000	0.031	0.1727	0.0010	0.0071	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
219	0.00	0.000	0.028	0.1688	0.0015	0.0110	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
220	0.00	0.000	0.025	0.1653	0.0019	0.0139	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
221	0.00	0.000	0.024	0.1622	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
222	0.05	0.000	0.024	0.1631	0.0024	0.0174	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
223	0.00	0.000	0.021	0.1605	0.0025	0.0182	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
224	0.00	0.000	0.020	0.1580	0.0026	0.0187	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
225	0.00	0.000	0.019	0.1558	0.0026	0.0189	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
226	0.14	0.000	0.020	0.1651	0.0026	0.0189	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
227	0.14	0.000	0.020	0.1742	0.0026	0.0188	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
228	0.32	0.000	0.273	0.1775	0.0032	0.0232	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
229	0.00	0.000	0.158	0.1642	0.0023	0.0164	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
230	0.20	0.000	0.123	0.1704	0.0025	0.0180	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
231	0.35	0.000	0.138	0.1877	0.0026	0.0190	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
232	0.25	0.000	0.149	0.1953	0.0026	0.0190	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
233	0.39	0.000	0.411	0.1932	0.0027	0.0194	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
234	0.15	0.000	0.127	0.1947	0.0028	0.0203	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
235	0.16	0.000	0.143	0.1952	0.0025	0.0180	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
236	0.00	0.000	0.331	0.1665	0.0024	0.0176	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
237	0.00	0.000	0.238	0.1460	0.0018	0.0134	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
238	0.00	0.000	0.130	0.1348	0.0015	0.0107	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
239	0.02	0.000	0.056	0.1313	0.0012	0.0087	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
240	0.00	0.000	0.041	0.1277	0.0013	0.0091	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
241	0.02	0.000	0.037	0.1262	0.0013	0.0095	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
242	0.50	0.000	0.033	0.1646	0.0014	0.0099	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
243	0.18	0.000	0.390	0.1464	0.0017	0.0126	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
244	0.33	0.000	0.030	0.1713	0.0012	0.0086	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
245	0.28	0.000	0.248	0.1741	0.0012	0.0085	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
246	0.07	0.000	0.299	0.1553	0.0010	0.0076	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
247	0.06	0.000	0.132	0.1497	0.0011	0.0080	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
248	0.00	0.000	0.056	0.1453	0.0011	0.0082	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
249	0.00	0.000	0.041	0.1419	0.0011	0.0082	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
250	0.26	0.000	0.037	0.1602	0.0011	0.0080	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
251	0.00	0.000	0.087	0.1530	0.0011	0.0080	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
252	0.18	0.000	0.033	0.1654	0.0010	0.0075	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
253	0.32	0.000	0.153	0.1790	0.0010	0.0071	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
254	0.19	0.000	0.185	0.1794	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
255	0.00	0.000	0.212	0.1617	0.0009	0.0066	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
256	0.00	0.000	0.207	0.1445	0.0008	0.0056	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
257	0.08	0.000	0.132	0.1406	0.0007	0.0053	6.91E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
258	0.08	0.000	0.056	0.1430	0.0007	0.0050	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
259	0.00	0.000	0.041	0.1395	0.0007	0.0047	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
260	0.00	0.000	0.035	0.1366	0.0006	0.0045	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
261	0.00	0.000	0.032	0.1341	0.0006	0.0043	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
262	0.42	0.000	0.029	0.1664	0.0006	0.0042	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00

263		0.09	0.000	0.133	0.1625	0.0006	0.0043	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
264		0.00	0.000	0.067	0.1568	0.0005	0.0039	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
265	*	0.00	0.000	0.083	0.1499	0.0005	0.0039	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
266		0.18	0.000	0.055	0.1607	0.0006	0.0040	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
267		0.00	0.000	0.167	0.1468	0.0006	0.0042	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
268		0.00	0.000	0.041	0.1433	0.0006	0.0044	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
269	*	0.00	0.000	0.035	0.1404	0.0006	0.0046	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
270	*	0.00	0.000	0.000	0.1404	0.0007	0.0049	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
271		0.00	0.000	0.031	0.1379	0.0007	0.0053	6.91E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
272		0.00	0.000	0.028	0.1356	0.0008	0.0057	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
273		0.00	0.000	0.025	0.1335	0.0008	0.0061	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
274		0.00	0.000	0.024	0.1315	0.0009	0.0065	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
275		0.00	0.000	0.022	0.1296	0.0010	0.0069	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
276		0.00	0.000	0.021	0.1279	0.0010	0.0074	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
277		0.00	0.000	0.020	0.1262	0.0011	0.0079	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
278		0.00	0.000	0.019	0.1246	0.0012	0.0084	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
279		0.08	0.000	0.020	0.1297	0.0013	0.0091	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
280	*	0.01	0.000	0.011	0.1297	0.0013	0.0092	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
281		0.13	0.000	0.019	0.1393	0.0013	0.0098	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
282		0.00	0.000	0.017	0.1379	0.0014	0.0101	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
283		0.00	0.000	0.016	0.1365	0.0014	0.0104	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
284		0.01	0.000	0.017	0.1359	0.0015	0.0109	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
285		0.01	0.000	0.017	0.1353	0.0016	0.0113	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
286		0.00	0.000	0.015	0.1340	0.0016	0.0117	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
287		0.00	0.000	0.015	0.1328	0.0017	0.0121	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
288		0.00	0.000	0.014	0.1316	0.0017	0.0124	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
289		0.00	0.000	0.014	0.1304	0.0018	0.0127	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
290		0.00	0.000	0.014	0.1293	0.0018	0.0130	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
291		0.00	0.000	0.013	0.1282	0.0018	0.0133	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
292		0.00	0.000	0.013	0.1271	0.0019	0.0135	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
293		0.04	0.000	0.014	0.1295	0.0019	0.0137	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
294		0.00	0.000	0.013	0.1284	0.0019	0.0139	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
295		0.00	0.000	0.012	0.1274	0.0019	0.0140	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
296		0.00	0.000	0.012	0.1264	0.0020	0.0143	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
297		0.00	0.000	0.012	0.1254	0.0020	0.0143	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
298		0.00	0.000	0.012	0.1244	0.0020	0.0144	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
299		0.00	0.000	0.012	0.1234	0.0020	0.0145	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
300		0.00	0.000	0.011	0.1225	0.0020	0.0146	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
301		0.00	0.000	0.012	0.1217	0.0020	0.0147	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
302		0.00	0.000	0.011	0.1208	0.0020	0.0147	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
303		0.00	0.000	0.011	0.1199	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
304		0.00	0.000	0.011	0.1190	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
305		0.63	0.000	0.011	0.1702	0.0020	0.0148	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
306	*	0.02	0.000	0.045	0.1677	0.0020	0.0149	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
307		0.00	0.000	0.089	0.1602	0.0021	0.0150	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

308	*	0.12	0.000	0.038	0.1619	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
309	*	0.01	0.000	0.015	0.1635	0.0020	0.0148	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
310	*	0.13	0.000	0.019	0.1652	0.0020	0.0148	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
311	*	0.39	0.000	0.007	0.1668	0.0020	0.0148	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
312	*	0.06	0.000	0.000	0.1684	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
313	*	0.04	0.000	0.000	0.1701	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
314	*	0.28	0.000	0.008	0.1717	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
315		0.15	0.000	0.000	0.2028	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
316		0.18	0.000	0.000	0.2664	0.0020	0.0147	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
317	*	0.00	0.000	0.000	0.2500	0.0022	0.0158	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
318	*	0.00	0.000	0.034	0.2328	0.0022	0.0159	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
319		0.00	0.000	0.043	0.2207	0.0021	0.0151	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
320	*	0.00	0.000	0.036	0.2119	0.0020	0.0145	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
321	*	0.00	0.000	0.000	0.2075	0.0019	0.0140	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
322	*	0.07	0.000	0.025	0.2056	0.0018	0.0130	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
323	*	0.01	0.000	0.022	0.2041	0.0007	0.0049	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
324	*	0.00	0.000	0.036	0.1987	0.0009	0.0068	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
325		0.00	0.000	0.069	0.1907	0.0015	0.0109	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
326		0.00	0.000	0.089	0.1814	0.0020	0.0142	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
327		0.00	0.000	0.076	0.1739	0.0022	0.0161	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
328		0.00	0.000	0.049	0.1685	0.0024	0.0176	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
329		0.41	0.000	0.072	0.1952	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
330		0.32	0.000	0.036	0.2168	0.0026	0.0190	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
331		0.06	0.000	0.073	0.2143	0.0027	0.0193	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
332		0.45	0.000	0.094	0.2433	0.0027	0.0193	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
333		0.00	0.000	0.076	0.2363	0.0026	0.0191	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
334		0.00	0.000	0.065	0.2265	0.0033	0.0239	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
335		0.00	0.000	0.105	0.2101	0.0037	0.0269	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
336		0.00	0.000	0.040	0.2015	0.0030	0.0216	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
337	*	0.05	0.000	0.017	0.1989	0.0015	0.0108	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
338		0.00	0.000	0.048	0.1929	0.0015	0.0110	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
339		0.13	0.000	0.072	0.1961	0.0016	0.0118	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
340		0.05	0.000	0.060	0.1933	0.0017	0.0124	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
341		0.01	0.000	0.047	0.1882	0.0018	0.0128	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
342	*	0.00	0.000	0.000	0.1863	0.0018	0.0130	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
343	*	0.19	0.000	0.008	0.1866	0.0018	0.0131	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
344		0.00	0.000	0.011	0.1985	0.0018	0.0132	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
345		0.00	0.000	0.040	0.1942	0.0018	0.0132	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
346		0.11	0.000	0.068	0.1962	0.0018	0.0132	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
347		0.01	0.000	0.100	0.1886	0.0018	0.0129	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
348		0.35	0.000	0.133	0.2057	0.0021	0.0152	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
349		0.05	0.000	0.047	0.2051	0.0018	0.0133	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
350		0.00	0.000	0.048	0.2005	0.0016	0.0115	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
351	*	0.00	0.000	0.000	0.2003	0.0016	0.0114	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
352	*	0.02	0.000	0.011	0.2003	0.0017	0.0121	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

353	*	0.36	0.000	0.005	0.2012	0.0022	0.0157	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
354	*	0.14	0.000	0.007	0.2021	0.0022	0.0161	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
355	*	0.01	0.000	0.009	0.2031	0.0019	0.0140	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
356	*	0.07	0.000	0.005	0.2044	0.0016	0.0119	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
357	*	0.07	0.000	0.006	0.2060	0.0012	0.0086	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
358	*	0.14	0.000	0.000	0.2077	0.0014	0.0104	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
359		0.00	0.000	0.012	0.2195	0.0017	0.0120	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
360		0.28	0.000	0.000	0.2816	0.0017	0.0122	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
361		0.08	0.000	0.065	0.2529	0.0015	0.0112	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
362		0.00	0.000	0.059	0.2338	0.0015	0.0111	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
363	*	0.01	0.000	0.029	0.2244	0.0002	0.0017	6.84E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
364		0.00	0.000	0.036	0.2163	0.0002	0.0016	6.84E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
365		0.14	0.000	0.041	0.2198	0.0003	0.0024	6.85E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00

* = Frozen (air or soil)

Annual Totals for Year 1			
	inches	cubic feet	percent
Precipitation	29.83	108,269.8	100.00
Runoff	0.000	0.0000	0.00
Evapotranspiration	22.896	83,111.3	76.76
Drainage Collected from Layer 3	3.1287	11,357.3	10.49
Percolation/Leakage through Layer 5	0.000002	0.0071	0.00
Average Head on Top of Layer 4	0.0012	---	---
Drainage Collected from Layer 7	0.0000	0.0048	0.00
Percolation/Leakage through Layer 9	0.000001	0.0022	0.00
Average Head on Top of Layer 8	0.0000	---	---
Percolation/Leakage through Layer 10	0.000000	0.0000	0.00
Change in Water Storage	3.8020	13,801.2	12.75
Soil Water at Start of Year	55.2523	200,565.8	185.25
Soil Water at End of Year	59.0543	214,367.0	197.99
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	0.0000	0.0000	0.00

Daily Output for Year 2

Column key: Head #1: drainage from Layer 4 | Head #2: drainage from Layer 8
Drain #1: drainage from Layer 3 | Drain #2: drainage from Layer 7
Leak #1: leakage thru Layer 5 | Leak #2: leakage thru Layer 9 | Leak #3: leakage thru Layer 10

Title: Wayne Disposal - Initial Lift
Simulated On: 3/23/2021 13:00

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1	Head #2	Drain #2	Leak #2	Head #3	Drain #3	Leak #3
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1	*		0.01	0.000	0.005	0.2159	0.0004	0.0032	6.87E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
2	*		0.00	0.000	0.030	0.2108	0.0005	0.0039	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
3	*		0.00	0.000	0.028	0.2056	0.0006	0.0046	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
4	*		0.00	0.000	0.033	0.2002	0.0007	0.0051	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
5	*	*	0.06	0.000	0.025	0.2002	0.0008	0.0055	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
6	*	*	0.14	0.000	0.012	0.2002	0.0008	0.0059	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
7	*	*	0.07	0.000	0.010	0.2002	0.0009	0.0063	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
8	*	*	0.02	0.000	0.010	0.2002	0.0009	0.0066	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
9	*	*	0.01	0.000	0.010	0.2002	0.0012	0.0090	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
10	*	*	0.14	0.000	0.000	0.2002	0.0017	0.0125	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
11		*	0.09	0.000	0.000	0.2392	0.0017	0.0121	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
12		*	0.33	0.000	0.000	0.2664	0.0016	0.0114	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
13		*	0.13	0.000	0.000	0.2774	0.0015	0.0108	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
14	*	*	0.11	0.000	0.019	0.2774	0.0014	0.0102	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
15	*	*	0.03	0.000	0.026	0.2774	0.0013	0.0097	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
16		*	0.00	0.000	0.048	0.2810	0.0013	0.0092	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
17		*	0.16	0.000	0.000	0.2943	0.0012	0.0088	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
18		*	0.00	0.000	0.000	0.2943	0.0012	0.0084	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
19		*	0.01	0.000	0.000	0.2952	0.0011	0.0081	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
20		*	0.00	0.000	0.000	0.2952	0.0011	0.0077	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
21	*	*	0.00	0.000	0.000	0.2952	0.0010	0.0074	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
22	*	*	0.00	0.000	0.000	0.2952	0.0010	0.0072	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
23	*	*	0.09	0.000	0.020	0.2952	0.0009	0.0069	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
24		*	0.00	0.000	0.034	0.2984	0.0009	0.0066	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
25	*	*	0.00	0.000	0.000	0.2984	0.0006	0.0045	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
26		*	0.15	0.000	0.000	0.3105	0.0003	0.0019	6.84E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
27		*	0.11	0.000	0.000	0.3193	0.0000	0.0001	4.72E-09	0.0000	0.0000	1.89E-09	0.0000	0.0000	0.00E+00
28	*	*	0.10	0.000	0.021	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
29	*	*	0.36	0.000	0.019	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
30	*	*	0.21	0.000	0.000	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
31	*	*	0.02	0.000	0.024	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
32	*	*	0.00	0.000	0.011	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
33	*	*	0.00	0.000	0.011	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
34	*	*	0.18	0.000	0.016	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
35	*	*	0.07	0.000	0.007	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
36	*	*	0.06	0.000	0.000	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
37	*	*	0.00	0.000	0.000	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00

38	*	*	0.00	0.000	0.020	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
39	*	*	0.05	0.000	0.008	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
40	*	*	0.11	0.000	0.004	0.3193	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
41	*	*	0.13	0.000	0.000	0.3193	0.0000	0.0002	2.73E-09	0.0000	0.0000	1.46E-09	0.0000	0.0000	0.00E+00
42	*	*	0.14	0.000	0.006	0.3193	0.0003	0.0022	6.85E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
43	*	*	0.02	0.000	0.000	0.3193	0.0006	0.0047	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
44	*	*	0.11	0.000	0.000	0.3193	0.0010	0.0071	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
45		*	0.00	0.000	0.000	0.3508	0.0013	0.0094	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
46		*	0.00	0.000	0.000	0.4070	0.0016	0.0116	7.01E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
47		*	0.00	0.000	0.025	0.4361	0.0019	0.0135	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
48		*	0.00	0.000	0.000	0.4361	0.0021	0.0153	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
49		*	0.00	0.000	0.000	0.4361	0.0023	0.0168	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
50	*	*	0.08	0.000	0.032	0.4361	0.0025	0.0182	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
51	*	*	0.00	0.000	0.044	0.4361	0.0027	0.0193	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
52		*	0.17	0.000	0.053	0.4466	0.0028	0.0202	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
53	*	*	0.00	0.000	0.000	0.4466	0.0029	0.0210	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
54	*	*	0.00	0.000	0.000	0.4466	0.0030	0.0217	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
55		*	0.00	0.000	0.000	0.4466	0.0031	0.0222	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
56	*	*	0.21	0.000	0.014	0.4466	0.0031	0.0226	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
57		*	0.00	0.000	0.035	0.4570	0.0032	0.0236	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
58		*	0.00	0.000	0.000	0.4570	0.0031	0.0224	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
59	*	*	0.00	0.000	0.000	0.4570	0.0031	0.0227	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
60	*	*	0.00	0.000	0.000	0.4570	0.0032	0.0233	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
61	*	*	0.00	0.000	0.000	0.4570	0.0033	0.0236	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
62	*	*	0.02	0.000	0.016	0.4570	0.0033	0.0238	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
63	*	*	0.00	0.000	0.000	0.4570	0.0033	0.0239	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
64	*	*	0.00	0.000	0.000	0.4570	0.0033	0.0238	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
65	*	*	0.00	0.000	0.000	0.4570	0.0033	0.0237	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
66	*	*	0.14	0.000	0.018	0.4570	0.0033	0.0236	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
67		*	0.15	0.000	0.049	0.4570	0.0036	0.0258	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
68	*	*	1.22	0.000	0.029	0.4570	0.0024	0.0171	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
69	*	*	0.17	0.000	0.026	0.4570	0.0028	0.0203	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
70	*	*	0.00	0.000	0.024	0.4570	0.0032	0.0232	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
71	*	*	0.00	0.000	0.011	0.4570	0.0034	0.0247	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
72		*	0.00	0.000	0.000	0.4570	0.0035	0.0253	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
73		*	0.00	0.000	0.000	0.4570	0.0043	0.0311	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
74		*	0.00	0.000	0.000	0.4570	0.0018	0.0128	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
75		*	0.00	0.000	0.000	0.4570	0.0024	0.0171	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
76		*	0.00	0.000	0.000	0.4570	0.0030	0.0217	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
77		*	0.04	0.000	0.000	0.4570	0.0034	0.0245	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
78		*	0.07	0.000	0.000	0.4570	0.0051	0.0372	7.40E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
79		*	0.00	0.000	0.000	0.4570	0.0029	0.0209	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
80		*	0.00	0.000	0.000	0.4570	0.0030	0.0218	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
81		*	0.11	0.000	0.000	0.4570	0.0051	0.0369	7.40E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
82		*	0.01	0.000	0.000	0.4570	0.0023	0.0168	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

83	*	*	0.00	0.000	0.000	0.4570	0.0023	0.0168	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
84	*	*	0.00	0.000	0.000	0.4570	0.0026	0.0186	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
85	*	*	0.00	0.000	0.000	0.4570	0.0029	0.0208	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
86	*	*	0.01	0.000	0.012	0.4570	0.0036	0.0260	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
87	*	*	0.68	0.000	0.016	0.4570	0.0039	0.0281	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
88	*	*	0.00	0.000	0.007	0.4570	0.0038	0.0278	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
89	*	*	0.00	0.000	0.020	0.4570	0.0035	0.0253	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
90	*	*	0.01	0.000	0.010	0.4570	0.0031	0.0227	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
91		*	0.07	0.000	0.000	0.4570	0.0028	0.0206	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
92		*	0.32	0.000	0.000	0.4570	0.0006	0.0042	6.01E-09	0.0000	0.0000	2.07E-09	0.0000	0.0000	0.00E+00
93		*	0.00	0.000	0.000	0.4570	0.0000	0.0001	1.36E-09	0.0000	0.0000	9.51E-10	0.0000	0.0000	0.00E+00
94		*	0.01	0.000	0.000	0.4570	0.0004	0.0029	6.86E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
95		*	0.13	0.000	0.000	0.4570	0.0030	0.0220	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
96		*	0.03	0.000	0.000	0.4570	0.0004	0.0030	6.86E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
97	*	*	0.05	0.000	0.049	0.4570	0.0007	0.0054	6.91E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
98	*	*	0.00	0.000	0.000	0.4570	0.0012	0.0090	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
99	*	*	0.00	0.000	0.000	0.4570	0.0029	0.0213	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
100	*	*	0.00	0.000	0.000	0.4570	0.0035	0.0254	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
101	*	*	0.00	0.000	0.000	0.4570	0.0031	0.0228	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
102		*	0.01	0.000	0.000	0.4570	0.0028	0.0206	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
103	*	*	0.00	0.000	0.000	0.4570	0.0026	0.0188	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
104	*	*	0.00	0.000	0.000	0.4570	0.0024	0.0173	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
105	*	*	0.00	0.000	0.000	0.4570	0.0021	0.0155	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
106		*	0.00	0.000	0.000	0.4570	0.0012	0.0088	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
107		*	0.03	0.000	0.000	0.4570	0.0017	0.0122	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
108		*	0.56	0.000	0.000	0.4570	0.0002	0.0012	5.86E-09	0.0000	0.0000	2.05E-09	0.0000	0.0000	0.00E+00
109		*	0.04	0.000	0.000	0.4570	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
110		*	0.25	0.000	0.000	0.4570	0.0016	0.0113	6.32E-09	0.0000	0.0000	2.10E-09	0.0000	0.0000	0.00E+00
111		*	0.07	0.000	0.000	0.4570	0.0000	0.0000	2.72E-09	0.0000	0.0000	1.46E-09	0.0000	0.0000	0.00E+00
112		*	0.65	0.000	0.000	0.4570	0.0022	0.0160	6.39E-09	0.0000	0.0000	2.11E-09	0.0000	0.0000	0.00E+00
113		*	0.00	0.000	0.000	0.4570	0.0000	0.0000	1.96E-09	0.0000	0.0000	1.21E-09	0.0000	0.0000	0.00E+00
114		*	0.00	0.000	0.000	0.4570	0.0004	0.0027	4.13E-09	0.0000	0.0000	1.79E-09	0.0000	0.0000	0.00E+00
115	*	*	0.00	0.000	0.001	0.4570	0.0031	0.0226	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
116		*	0.35	0.000	0.000	0.4570	0.0067	0.0482	7.56E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
117	*	*	0.00	0.000	0.000	0.4570	0.0007	0.0053	6.18E-09	0.0000	0.0000	2.09E-09	0.0000	0.0000	0.00E+00
118	*	*	0.00	0.000	0.000	0.4570	0.0027	0.0197	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
119		*	0.00	0.000	0.000	0.4570	0.0068	0.0496	7.58E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
120	*	*	0.61	0.000	0.052	0.4570	0.0060	0.0438	7.50E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
121		*	0.05	0.000	0.000	0.4570	0.0051	0.0370	7.40E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
122	*	*	0.01	0.000	0.037	0.4570	0.0005	0.0039	5.44E-09	0.0000	0.0000	2.00E-09	0.0000	0.0000	0.00E+00
123		*	0.00	0.000	0.128	0.4570	0.0045	0.0324	6.64E-09	0.0000	0.0000	2.14E-09	0.0000	0.0000	0.00E+00
124		*	0.00	0.000	0.000	0.4570	0.0004	0.0031	6.86E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
125			0.09	0.000	0.099	0.2463	0.0027	0.0194	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
126			0.05	0.000	0.150	0.2246	0.0020	0.0147	5.72E-09	0.0000	0.0000	2.03E-09	0.0000	0.0000	0.00E+00
127			0.00	0.000	0.252	0.1959	0.0105	0.0759	7.94E-09	0.0000	0.0000	2.26E-09	0.0000	0.0000	0.00E+00

128	0.00	0.000	0.246	0.1724	0.0080	0.0579	7.70E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
129	0.00	0.000	0.130	0.1580	0.0013	0.0097	6.72E-09	0.0000	0.0000	2.15E-09	0.0000	0.0000	0.00E+00
130	0.00	0.000	0.054	0.1509	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
131	0.00	0.000	0.041	0.1459	0.0037	0.0268	3.81E-09	0.0000	0.0000	1.73E-09	0.0000	0.0000	0.00E+00
132	0.00	0.000	0.035	0.1420	0.0233	0.1688	9.15E-09	0.0000	0.0000	2.34E-09	0.0000	0.0000	0.00E+00
133	1.21	0.000	0.031	0.2389	0.0313	0.2269	9.87E-09	0.0000	0.0000	2.39E-09	0.0000	0.0000	0.00E+00
134	0.31	0.000	0.126	0.2535	0.0333	0.2416	1.01E-08	0.0000	0.0000	2.40E-09	0.0000	0.0000	0.00E+00
135	0.06	0.000	0.182	0.2419	0.0325	0.2357	9.98E-09	0.0000	0.0000	2.40E-09	0.0000	0.0000	0.00E+00
136	0.03	0.000	0.193	0.2173	0.0294	0.2134	9.71E-09	0.0000	0.0000	2.38E-09	0.0000	0.0000	0.00E+00
137	0.10	0.000	0.227	0.2000	0.0289	0.2092	9.66E-09	0.0000	0.0000	2.38E-09	0.0000	0.0000	0.00E+00
138	0.00	0.000	0.221	0.1765	0.0312	0.2264	9.87E-09	0.0000	0.0000	2.39E-09	0.0000	0.0000	0.00E+00
139	0.00	0.000	0.114	0.1639	0.0290	0.2100	9.67E-09	0.0000	0.0000	2.38E-09	0.0000	0.0000	0.00E+00
140	0.00	0.000	0.054	0.1584	0.0265	0.1920	9.44E-09	0.0000	0.0000	2.36E-09	0.0000	0.0000	0.00E+00
141	0.00	0.000	0.041	0.1538	0.0225	0.1630	9.08E-09	0.0000	0.0000	2.34E-09	0.0000	0.0000	0.00E+00
142	0.00	0.000	0.035	0.1497	0.0186	0.1349	8.72E-09	0.0000	0.0000	2.32E-09	0.0000	0.0000	0.00E+00
143	0.08	0.000	0.031	0.1531	0.0169	0.1224	8.56E-09	0.0000	0.0000	2.30E-09	0.0000	0.0000	0.00E+00
144	0.00	0.000	0.028	0.1497	0.0165	0.1195	8.52E-09	0.0000	0.0000	2.30E-09	0.0000	0.0000	0.00E+00
145	0.00	0.000	0.025	0.1467	0.0163	0.1184	8.51E-09	0.0000	0.0000	2.30E-09	0.0000	0.0000	0.00E+00
146	0.00	0.000	0.024	0.1440	0.0168	0.1217	8.55E-09	0.0000	0.0000	2.30E-09	0.0000	0.0000	0.00E+00
147	0.01	0.000	0.023	0.1420	0.0167	0.1210	8.54E-09	0.0000	0.0000	2.30E-09	0.0000	0.0000	0.00E+00
148	0.01	0.000	0.022	0.1402	0.0165	0.1193	8.52E-09	0.0000	0.0000	2.30E-09	0.0000	0.0000	0.00E+00
149	0.16	0.000	0.021	0.1510	0.0162	0.1178	8.50E-09	0.0000	0.0000	2.30E-09	0.0000	0.0000	0.00E+00
150	0.00	0.000	0.019	0.1488	0.0159	0.1154	8.47E-09	0.0000	0.0000	2.30E-09	0.0000	0.0000	0.00E+00
151	0.11	0.000	0.019	0.1560	0.0158	0.1148	8.46E-09	0.0000	0.0000	2.30E-09	0.0000	0.0000	0.00E+00
152	0.15	0.000	0.018	0.1669	0.0155	0.1121	8.43E-09	0.0000	0.0000	2.29E-09	0.0000	0.0000	0.00E+00
153	0.00	0.000	0.017	0.1650	0.0150	0.1086	8.38E-09	0.0000	0.0000	2.29E-09	0.0000	0.0000	0.00E+00
154	0.72	0.000	0.017	0.2234	0.0145	0.1050	8.33E-09	0.0000	0.0000	2.29E-09	0.0000	0.0000	0.00E+00
155	0.00	0.000	0.139	0.2116	0.0139	0.1011	8.28E-09	0.0000	0.0000	2.28E-09	0.0000	0.0000	0.00E+00
156	0.00	0.000	0.128	0.1999	0.0140	0.1013	8.28E-09	0.0000	0.0000	2.28E-09	0.0000	0.0000	0.00E+00
157	0.36	0.000	0.122	0.2195	0.0124	0.0901	8.13E-09	0.0000	0.0000	2.27E-09	0.0000	0.0000	0.00E+00
158	0.00	0.000	0.119	0.2093	0.0132	0.0954	8.21E-09	0.0000	0.0000	2.28E-09	0.0000	0.0000	0.00E+00
159	0.00	0.000	0.119	0.1995	0.0128	0.0931	8.18E-09	0.0000	0.0000	2.28E-09	0.0000	0.0000	0.00E+00
160	0.00	0.000	0.301	0.1733	0.0128	0.0927	8.17E-09	0.0000	0.0000	2.27E-09	0.0000	0.0000	0.00E+00
161	0.00	0.000	0.130	0.1618	0.0119	0.0862	8.08E-09	0.0000	0.0000	2.27E-09	0.0000	0.0000	0.00E+00
162	0.39	0.000	0.054	0.1883	0.0115	0.0836	8.05E-09	0.0000	0.0000	2.27E-09	0.0000	0.0000	0.00E+00
163	0.07	0.000	0.306	0.1676	0.0105	0.0759	7.94E-09	0.0000	0.0000	2.26E-09	0.0000	0.0000	0.00E+00
164	0.08	0.000	0.042	0.1701	0.0106	0.0766	7.95E-09	0.0000	0.0000	2.26E-09	0.0000	0.0000	0.00E+00
165	0.09	0.000	0.035	0.1740	0.0109	0.0788	7.98E-09	0.0000	0.0000	2.26E-09	0.0000	0.0000	0.00E+00
166	0.00	0.000	0.177	0.1584	0.0116	0.0839	8.05E-09	0.0000	0.0000	2.27E-09	0.0000	0.0000	0.00E+00
167	0.00	0.000	0.031	0.1559	0.0106	0.0771	7.96E-09	0.0000	0.0000	2.26E-09	0.0000	0.0000	0.00E+00
168	0.19	0.000	0.028	0.1696	0.0111	0.0804	8.00E-09	0.0000	0.0000	2.26E-09	0.0000	0.0000	0.00E+00
169	0.28	0.000	0.126	0.1823	0.0108	0.0786	7.98E-09	0.0000	0.0000	2.26E-09	0.0000	0.0000	0.00E+00
170	0.37	0.000	0.176	0.1979	0.0098	0.0709	7.88E-09	0.0000	0.0000	2.25E-09	0.0000	0.0000	0.00E+00
171	0.34	0.000	0.305	0.2007	0.0088	0.0639	7.78E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
172	0.00	0.000	0.282	0.1773	0.0087	0.0633	7.77E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00

173	0.00	0.000	0.171	0.1628	0.0090	0.0651	7.80E-09	0.0000	0.0000	2.25E-09	0.0000	0.0000	0.00E+00
174	0.83	0.000	0.131	0.2205	0.0086	0.0626	7.76E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
175	0.10	0.000	0.301	0.2033	0.0081	0.0584	7.70E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
176	0.05	0.000	0.327	0.1791	0.0082	0.0593	7.72E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
177	0.02	0.000	0.178	0.1650	0.0069	0.0498	7.58E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
178	0.09	0.000	0.131	0.1612	0.0068	0.0495	7.58E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
179	0.22	0.000	0.055	0.1749	0.0074	0.0539	7.64E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
180	0.26	0.000	0.337	0.1676	0.0083	0.0600	7.73E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
181	0.00	0.000	0.041	0.1641	0.0074	0.0539	7.64E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
182	0.00	0.000	0.035	0.1611	0.0075	0.0546	7.65E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
183	0.00	0.000	0.031	0.1585	0.0074	0.0536	7.64E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
184	0.00	0.000	0.028	0.1561	0.0072	0.0522	7.62E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
185	0.00	0.000	0.025	0.1538	0.0071	0.0516	7.61E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
186	0.00	0.000	0.024	0.1518	0.0067	0.0484	7.56E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
187	0.48	0.000	0.023	0.1899	0.0065	0.0469	7.54E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
188	0.08	0.000	0.128	0.1859	0.0066	0.0480	7.56E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
189	0.00	0.000	0.229	0.1663	0.0062	0.0451	7.52E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
190	0.00	0.000	0.130	0.1554	0.0056	0.0409	7.46E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
191	0.00	0.000	0.054	0.1509	0.0057	0.0417	7.47E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
192	0.41	0.000	0.042	0.1816	0.0059	0.0429	7.49E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
193	0.00	0.000	0.375	0.1502	0.0060	0.0435	7.49E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
194	0.02	0.000	0.036	0.1488	0.0059	0.0426	7.48E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
195	0.00	0.000	0.032	0.1465	0.0058	0.0418	7.47E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
196	0.07	0.000	0.029	0.1494	0.0057	0.0412	7.46E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
197	0.09	0.000	0.027	0.1548	0.0056	0.0405	7.45E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
198	0.00	0.000	0.024	0.1527	0.0055	0.0398	7.44E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
199	0.00	0.000	0.022	0.1507	0.0054	0.0389	7.43E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
200	0.08	0.000	0.022	0.1553	0.0053	0.0383	7.42E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
201	0.00	0.000	0.020	0.1535	0.0052	0.0378	7.41E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
202	0.00	0.000	0.019	0.1518	0.0052	0.0374	7.41E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
203	0.00	0.000	0.018	0.1501	0.0051	0.0370	7.40E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
204	0.01	0.000	0.019	0.1492	0.0051	0.0366	7.39E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
205	0.01	0.000	0.018	0.1481	0.0050	0.0363	7.39E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
206	0.11	0.000	0.018	0.1558	0.0050	0.0360	7.38E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
207	0.00	0.000	0.016	0.1544	0.0049	0.0357	7.38E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
208	0.00	0.000	0.016	0.1530	0.0049	0.0353	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
209	0.04	0.000	0.017	0.1552	0.0048	0.0350	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
210	0.23	0.000	0.016	0.1732	0.0048	0.0347	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
211	0.32	0.000	0.287	0.1750	0.0050	0.0362	7.39E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
212	0.01	0.000	0.179	0.1605	0.0048	0.0350	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
213	0.06	0.000	0.111	0.1556	0.0043	0.0315	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
214	0.00	0.000	0.054	0.1509	0.0042	0.0303	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
215	0.00	0.000	0.041	0.1473	0.0043	0.0313	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
216	0.00	0.000	0.035	0.1443	0.0044	0.0322	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
217	0.05	0.000	0.032	0.1454	0.0045	0.0324	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00

218	0.42	0.000	0.029	0.1777	0.0046	0.0331	7.34E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
219	0.52	0.000	0.314	0.1938	0.0049	0.0353	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
220	0.00	0.000	0.315	0.1675	0.0041	0.0299	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
221	0.00	0.000	0.312	0.1414	0.0043	0.0310	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
222	0.00	0.000	0.130	0.1306	0.0043	0.0314	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
223	0.08	0.000	0.055	0.1329	0.0043	0.0313	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
224	0.00	0.000	0.041	0.1295	0.0043	0.0313	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
225	0.00	0.000	0.035	0.1266	0.0043	0.0309	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
226	0.00	0.000	0.029	0.1242	0.0042	0.0305	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
227	0.00	0.000	0.028	0.1219	0.0041	0.0299	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
228	0.00	0.000	0.019	0.1203	0.0040	0.0293	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
229	0.29	0.000	0.026	0.1427	0.0040	0.0287	7.28E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
230	0.00	0.000	0.022	0.1408	0.0039	0.0281	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
231	0.02	0.000	0.023	0.1408	0.0038	0.0275	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
232	0.21	0.000	0.022	0.1564	0.0037	0.0271	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
233	0.08	0.000	0.021	0.1617	0.0037	0.0265	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
234	0.00	0.000	0.018	0.1602	0.0036	0.0261	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
235	0.00	0.000	0.018	0.1587	0.0035	0.0257	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
236	0.44	0.000	0.019	0.1940	0.0035	0.0253	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
237	0.00	0.000	0.253	0.1729	0.0034	0.0250	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
238	0.19	0.000	0.224	0.1699	0.0034	0.0247	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
239	0.52	0.000	0.317	0.1865	0.0034	0.0245	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
240	0.28	0.000	0.239	0.1900	0.0033	0.0239	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
241	0.00	0.000	0.290	0.1658	0.0033	0.0237	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
242	0.00	0.000	0.130	0.1550	0.0033	0.0236	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
243	0.00	0.000	0.054	0.1505	0.0032	0.0232	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
244	0.00	0.000	0.041	0.1471	0.0032	0.0231	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
245	0.03	0.000	0.037	0.1466	0.0032	0.0229	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
246	0.06	0.000	0.033	0.1490	0.0031	0.0227	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
247	0.01	0.000	0.030	0.1475	0.0031	0.0226	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
248	0.02	0.000	0.028	0.1465	0.0031	0.0224	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
249	0.01	0.000	0.026	0.1453	0.0031	0.0222	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
250	0.00	0.000	0.022	0.1434	0.0030	0.0220	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
251	0.00	0.000	0.021	0.1417	0.0030	0.0219	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
252	0.21	0.000	0.022	0.1574	0.0030	0.0217	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
253	0.29	0.000	0.021	0.1799	0.0030	0.0215	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
254	0.13	0.000	0.234	0.1713	0.0029	0.0214	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
255	0.03	0.000	0.240	0.1537	0.0029	0.0212	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
256	0.04	0.000	0.132	0.1456	0.0029	0.0211	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
257	0.00	0.000	0.054	0.1411	0.0029	0.0209	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
258	0.00	0.000	0.041	0.1377	0.0029	0.0207	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
259	0.00	0.000	0.035	0.1348	0.0028	0.0206	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
260	0.00	0.000	0.031	0.1322	0.0028	0.0204	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
261	0.00	0.000	0.028	0.1299	0.0028	0.0203	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
262	0.08	0.000	0.027	0.1341	0.0028	0.0202	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00

263		0.23	0.000	0.025	0.1511	0.0028	0.0200	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
264		0.00	0.000	0.022	0.1492	0.0027	0.0199	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
265		0.00	0.000	0.021	0.1475	0.0027	0.0197	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
266		0.10	0.000	0.021	0.1538	0.0027	0.0196	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
267		0.02	0.000	0.020	0.1540	0.0027	0.0195	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
268		0.00	0.000	0.018	0.1525	0.0027	0.0197	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
269		0.00	0.000	0.018	0.1510	0.0027	0.0192	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
270		0.00	0.000	0.017	0.1495	0.0026	0.0190	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
271		0.00	0.000	0.016	0.1481	0.0026	0.0187	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
272		0.00	0.000	0.016	0.1468	0.0026	0.0186	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
273		0.00	0.000	0.016	0.1455	0.0025	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
274		0.00	0.000	0.015	0.1442	0.0025	0.0184	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
275		0.04	0.000	0.016	0.1461	0.0025	0.0183	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
276	*	0.00	0.000	0.000	0.1461	0.0025	0.0183	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
277	*	0.00	0.000	0.000	0.1461	0.0025	0.0182	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
278	*	0.01	0.000	0.006	0.1461	0.0025	0.0181	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
279		0.00	0.000	0.014	0.1449	0.0025	0.0180	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
280		0.00	0.000	0.014	0.1437	0.0025	0.0179	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
281		0.00	0.000	0.014	0.1425	0.0025	0.0179	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
282		0.00	0.000	0.014	0.1415	0.0024	0.0177	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
283		1.06	0.000	0.014	0.2286	0.0024	0.0175	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
284	*	0.22	0.000	0.025	0.2302	0.0024	0.0174	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
285		0.09	0.000	0.087	0.2449	0.0024	0.0173	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
286		0.00	0.000	0.056	0.2379	0.0025	0.0179	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
287	*	0.03	0.000	0.030	0.2315	0.0025	0.0181	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
288		0.29	0.000	0.055	0.2429	0.0024	0.0175	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
289		0.00	0.000	0.067	0.2317	0.0023	0.0168	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
290	*	0.00	0.000	0.039	0.2252	0.0022	0.0156	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
291		0.00	0.000	0.065	0.2151	0.0022	0.0163	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
292	*	0.00	0.000	0.000	0.2099	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
293	*	0.00	0.000	0.000	0.2057	0.0022	0.0157	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
294		0.00	0.000	0.099	0.1941	0.0021	0.0155	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
295	*	0.00	0.000	0.055	0.1875	0.0019	0.0135	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
296	*	0.00	0.000	0.055	0.1804	0.0023	0.0164	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
297	*	0.00	0.000	0.000	0.1782	0.0017	0.0126	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
298	*	0.00	0.000	0.000	0.1763	0.0012	0.0091	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
299		0.00	0.000	0.071	0.1691	0.0015	0.0112	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
300	*	0.00	0.000	0.000	0.1684	0.0019	0.0141	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
301		0.00	0.000	0.100	0.1589	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
302		0.00	0.000	0.131	0.1468	0.0025	0.0184	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
303		0.03	0.000	0.055	0.1436	0.0028	0.0203	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
304		0.16	0.000	0.042	0.1526	0.0028	0.0200	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
305		0.06	0.000	0.036	0.1543	0.0028	0.0204	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
306		0.02	0.000	0.032	0.1526	0.0028	0.0205	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
307		0.00	0.000	0.028	0.1501	0.0028	0.0204	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00

308		0.20	0.000	0.026	0.1640	0.0028	0.0201	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
309		0.00	0.000	0.041	0.1602	0.0027	0.0197	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
310		0.27	0.000	0.095	0.1744	0.0028	0.0203	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
311	*	0.10	0.000	0.029	0.1760	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
312		0.33	0.000	0.009	0.2069	0.0027	0.0194	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
313		0.15	0.000	0.091	0.2116	0.0031	0.0221	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
314		0.04	0.000	0.048	0.2109	0.0024	0.0175	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
315	*	0.14	0.000	0.019	0.2121	0.0026	0.0191	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
316	*	0.00	0.000	0.013	0.2130	0.0028	0.0204	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
317	*	0.00	0.000	0.025	0.2140	0.0024	0.0171	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
318		0.03	0.000	0.059	0.2138	0.0016	0.0117	7.01E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
319		0.00	0.000	0.070	0.2080	0.0014	0.0105	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
320		0.03	0.000	0.055	0.2060	0.0018	0.0130	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
321	*	0.19	0.000	0.023	0.2066	0.0024	0.0174	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
322	*	0.02	0.000	0.013	0.2064	0.0022	0.0161	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
323	*	0.13	0.000	0.012	0.2063	0.0021	0.0150	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
324		0.00	0.000	0.017	0.2227	0.0019	0.0138	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
325		0.00	0.000	0.059	0.2161	0.0016	0.0118	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
326		0.05	0.000	0.067	0.2135	0.0011	0.0077	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
327	*	0.01	0.000	0.030	0.2092	0.0017	0.0123	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
328	*	0.00	0.000	0.029	0.2056	0.0007	0.0053	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
329	*	0.00	0.000	0.000	0.2054	0.0000	0.0000	1.29E-09	0.0000	0.0000	9.16E-10	0.0000	0.0000	0.00E+00
330	*	0.00	0.000	0.000	0.2040	0.0010	0.0073	6.26E-09	0.0000	0.0000	2.10E-09	0.0000	0.0000	0.00E+00
331	*	0.00	0.000	0.027	0.1997	0.0017	0.0123	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
332		0.44	0.000	0.036	0.2312	0.0008	0.0061	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
333		0.06	0.000	0.045	0.2312	0.0006	0.0044	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
334		0.06	0.000	0.038	0.2309	0.0011	0.0077	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
335		0.00	0.000	0.039	0.2275	0.0000	0.0000	3.26E-09	0.0000	0.0000	1.60E-09	0.0000	0.0000	0.00E+00
336	*	0.20	0.000	0.029	0.2249	0.0017	0.0122	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
337		0.12	0.000	0.020	0.2416	0.0015	0.0112	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
338		0.00	0.000	0.057	0.2330	0.0008	0.0056	6.91E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
339		0.00	0.000	0.091	0.2232	0.0005	0.0037	6.87E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
340		0.00	0.000	0.084	0.2101	0.0015	0.0109	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
341		0.00	0.000	0.073	0.1990	0.0006	0.0040	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
342		0.00	0.000	0.052	0.1906	0.0000	0.0000	1.55E-10	0.0000	0.0000	1.48E-10	0.0000	0.0000	0.00E+00
343	*	0.05	0.000	0.023	0.1895	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
344		0.32	0.000	0.054	0.2100	0.0001	0.0004	4.77E-09	0.0000	0.0000	1.90E-09	0.0000	0.0000	0.00E+00
345	*	0.20	0.000	0.021	0.2097	0.0003	0.0023	6.85E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
346	*	0.00	0.000	0.021	0.2094	0.0006	0.0041	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
347	*	0.04	0.000	0.020	0.2098	0.0008	0.0055	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
348		0.06	0.000	0.017	0.2213	0.0009	0.0068	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
349		0.14	0.000	0.066	0.2260	0.0012	0.0086	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
350		0.78	0.000	0.062	0.2847	0.0012	0.0087	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
351		0.00	0.000	0.038	0.2488	0.0023	0.0165	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
352	*	0.00	0.000	0.000	0.2339	0.0014	0.0099	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00

353	*	0.11	0.000	0.008	0.2268	0.0010	0.0071	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
354	*	0.02	0.000	0.000	0.2222	0.0011	0.0079	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
355		0.00	0.000	0.034	0.2217	0.0012	0.0085	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
356		0.08	0.000	0.040	0.2208	0.0013	0.0091	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
357		0.04	0.000	0.039	0.2180	0.0013	0.0095	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
358		0.00	0.000	0.063	0.2100	0.0014	0.0098	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
359		0.00	0.000	0.078	0.2008	0.0014	0.0100	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
360		0.00	0.000	0.072	0.1922	0.0014	0.0102	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
361		0.04	0.000	0.083	0.1862	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
362		0.01	0.000	0.080	0.1796	0.0014	0.0104	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
363		0.09	0.000	0.068	0.1801	0.0014	0.0104	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
364		0.00	0.000	0.033	0.1768	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
365		0.12	0.000	0.041	0.1823	0.0017	0.0122	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

* = Frozen (air or soil)

Annual Totals for Year 2			
	inches	cubic feet	percent
Precipitation	29.49	107,053.6	100.00
Runoff	0.000	0.0000	0.00
Evapotranspiration	18.094	65,681.8	61.35
Drainage Collected from Layer 3	11.5467	41,914.7	39.15
Percolation/Leakage through Layer 5	0.000003	0.0091	0.00
Average Head on Top of Layer 4	0.0044	---	---
Drainage Collected from Layer 7	0.0000	0.0063	0.00
Percolation/Leakage through Layer 9	0.000001	0.0028	0.00
Average Head on Top of Layer 8	0.0000	---	---
Percolation/Leakage through Layer 10	0.000000	0.0000	0.00
Change in Water Storage	-0.1496	-542.9	-0.51
Soil Water at Start of Year	59.0543	214,367.0	200.24
Soil Water at End of Year	58.9047	213,824.1	199.74
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	0.0000	0.0000	0.00

Daily Output for Year 3

Column key: Head #1: drainage from Layer 4 | Head #2: drainage from Layer 8
Drain #1: drainage from Layer 3 | Drain #2: drainage from Layer 7
Leak #1: leakage thru Layer 5 | Leak #2: leakage thru Layer 9 | Leak #3: leakage thru Layer 10

Title: Wayne Disposal - Initial Lift
Simulated On: 3/23/2021 13:00

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1	Head #2	Drain #2	Leak #2	Head #3	Drain #3	Leak #3
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1			0.15	0.000	0.068	0.1884	0.0019	0.0141	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
2			0.00	0.000	0.067	0.1826	0.0018	0.0131	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
3			0.00	0.000	0.052	0.1776	0.0020	0.0144	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
4			0.05	0.000	0.039	0.1779	0.0018	0.0134	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
5			0.12	0.000	0.045	0.1834	0.0017	0.0126	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
6			0.01	0.000	0.066	0.1787	0.0016	0.0118	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
7	*		0.03	0.000	0.023	0.1784	0.0015	0.0112	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
8	*		0.05	0.000	0.012	0.1797	0.0015	0.0106	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
9	*		0.10	0.000	0.017	0.1811	0.0014	0.0100	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
10	*		0.00	0.000	0.025	0.1825	0.0013	0.0095	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
11	*		0.00	0.000	0.010	0.1840	0.0013	0.0091	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
12	*		0.13	0.000	0.007	0.1854	0.0012	0.0087	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
13	*		0.01	0.000	0.014	0.1867	0.0011	0.0083	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
14	*		0.00	0.000	0.008	0.1880	0.0011	0.0080	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
15	*		0.00	0.000	0.027	0.1894	0.0011	0.0076	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
16			0.00	0.000	0.064	0.1848	0.0010	0.0073	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
17			0.34	0.000	0.094	0.2054	0.0006	0.0043	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
18			0.32	0.000	0.113	0.2219	0.0006	0.0044	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
19			0.00	0.000	0.073	0.2156	0.0000	0.0003	3.94E-09	0.0000	0.0000	1.75E-09	0.0000	0.0000	0.00E+00
20	*		0.00	0.000	0.034	0.2123	0.0001	0.0004	5.29E-09	0.0000	0.0000	1.98E-09	0.0000	0.0000	0.00E+00
21	*		0.00	0.000	0.002	0.2122	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
22			0.00	0.000	0.058	0.2074	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
23			0.00	0.000	0.046	0.2019	0.0001	0.0008	4.78E-09	0.0000	0.0000	1.90E-09	0.0000	0.0000	0.00E+00
24			0.00	0.000	0.047	0.1949	0.0000	0.0000	2.56E-09	0.0000	0.0000	1.41E-09	0.0000	0.0000	0.00E+00
25	*		0.00	0.000	0.041	0.1889	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
26			0.02	0.000	0.043	0.1849	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
27	*		0.00	0.000	0.039	0.1797	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
28			0.07	0.000	0.043	0.1803	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
29			0.07	0.000	0.053	0.1812	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
30			0.04	0.000	0.057	0.1793	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
31			0.00	0.000	0.096	0.1700	0.0001	0.0007	5.08E-09	0.0000	0.0000	1.95E-09	0.0000	0.0000	0.00E+00
32	*		0.02	0.000	0.045	0.1665	0.0002	0.0015	6.16E-09	0.0000	0.0000	2.08E-09	0.0000	0.0000	0.00E+00
33	*		0.31	0.000	0.011	0.1672	0.0002	0.0017	6.84E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
34	*		0.08	0.000	0.018	0.1682	0.0007	0.0047	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
35	*		0.00	0.000	0.018	0.1693	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
36	*	*	0.00	0.000	0.023	0.1693	0.0016	0.0118	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
37		*	0.19	0.000	0.000	0.2072	0.0025	0.0181	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

38		*	0.00	0.000	0.000	0.2072	0.0031	0.0222	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
39		*	0.00	0.000	0.000	0.2072	0.0033	0.0242	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
40		*	0.06	0.000	0.000	0.2118	0.0034	0.0249	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
41		*	0.04	0.000	0.000	0.2147	0.0034	0.0247	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
42		*	0.02	0.000	0.000	0.2162	0.0033	0.0241	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
43		*	0.01	0.000	0.000	0.2166	0.0032	0.0233	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
44		*	0.00	0.000	0.000	0.2166	0.0031	0.0223	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
45		*	0.00	0.000	0.000	0.2166	0.0029	0.0213	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
46	*	*	0.11	0.000	0.037	0.2166	0.0028	0.0204	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
47	*	*	0.00	0.000	0.018	0.2166	0.0027	0.0196	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
48	*	*	0.16	0.000	0.016	0.2166	0.0026	0.0189	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
49	*	*	0.04	0.000	0.000	0.2166	0.0025	0.0183	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
50		*	0.02	0.000	0.028	0.2357	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
51		*	0.21	0.000	0.000	0.2529	0.0024	0.0174	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
52		*	0.00	0.000	0.000	0.2529	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
53		*	0.00	0.000	0.000	0.2529	0.0024	0.0171	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
54	*	*	0.05	0.000	0.025	0.2529	0.0024	0.0171	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
55		*	0.15	0.000	0.020	0.2653	0.0024	0.0171	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
56		*	0.04	0.000	0.000	0.2689	0.0024	0.0173	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
57		*	0.01	0.000	0.000	0.2697	0.0024	0.0175	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
58			0.08	0.000	0.175	0.2353	0.0029	0.0212	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
59			0.04	0.000	0.225	0.2111	0.0028	0.0201	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
60			0.00	0.000	0.182	0.1899	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
61			0.00	0.000	0.127	0.1752	0.0009	0.0068	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
62			0.00	0.000	0.130	0.1623	0.0007	0.0048	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
63			0.00	0.000	0.054	0.1554	0.0021	0.0154	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
64			0.02	0.000	0.042	0.1520	0.0031	0.0227	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
65			0.00	0.000	0.035	0.1477	0.0037	0.0271	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
66			0.01	0.000	0.031	0.1451	0.0041	0.0294	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
67			0.01	0.000	0.028	0.1427	0.0042	0.0304	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
68			0.01	0.000	0.026	0.1402	0.0048	0.0349	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
69	*		0.08	0.000	0.071	0.1405	0.0039	0.0280	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
70	*		0.00	0.000	0.024	0.1382	0.0038	0.0278	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
71	*		0.00	0.000	0.000	0.1375	0.0044	0.0322	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
72	*		0.00	0.000	0.000	0.1370	0.0041	0.0295	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
73	*		0.00	0.000	0.025	0.1348	0.0037	0.0272	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
74			0.00	0.000	0.021	0.1325	0.0038	0.0273	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
75	*		0.00	0.000	0.020	0.1300	0.0037	0.0267	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
76			0.00	0.000	0.019	0.1278	0.0031	0.0228	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
77			0.00	0.000	0.018	0.1257	0.0027	0.0198	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
78			0.91	0.000	0.018	0.1994	0.0028	0.0203	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
79			0.00	0.000	0.155	0.1857	0.0025	0.0181	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
80			0.00	0.000	0.159	0.1722	0.0012	0.0090	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
81			0.49	0.000	0.244	0.1927	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
82			0.00	0.000	0.196	0.1762	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00

83		0.00	0.000	0.188	0.1602	0.0015	0.0110	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
84		0.00	0.000	0.227	0.1412	0.0011	0.0078	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
85		0.23	0.000	0.130	0.1492	0.0016	0.0115	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
86		0.00	0.000	0.054	0.1443	0.0016	0.0114	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
87		0.00	0.000	0.041	0.1404	0.0013	0.0091	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
88	*	0.00	0.000	0.000	0.1400	0.0011	0.0083	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
89	*	0.00	0.000	0.000	0.1396	0.0010	0.0069	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
90	*	0.00	0.000	0.000	0.1393	0.0009	0.0062	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
91	*	0.00	0.000	0.000	0.1390	0.0008	0.0062	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
92	*	0.01	0.000	0.049	0.1359	0.0008	0.0060	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
93		0.08	0.000	0.031	0.1395	0.0010	0.0071	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
94		0.18	0.000	0.028	0.1516	0.0011	0.0081	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
95		0.60	0.000	0.026	0.1989	0.0012	0.0090	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
96		0.00	0.000	0.121	0.1886	0.0014	0.0100	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
97		0.36	0.000	0.065	0.2125	0.0017	0.0126	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
98		0.22	0.000	0.110	0.2216	0.0017	0.0124	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
99		0.00	0.000	0.147	0.2090	0.0017	0.0122	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
100		0.00	0.000	0.371	0.1774	0.0018	0.0131	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
101		0.00	0.000	0.427	0.1413	0.0015	0.0111	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
102		0.00	0.000	0.130	0.1303	0.0015	0.0109	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
103		0.00	0.000	0.054	0.1258	0.0017	0.0122	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
104		0.00	0.000	0.041	0.1224	0.0022	0.0157	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
105		0.00	0.000	0.035	0.1195	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
106		0.84	0.000	0.031	0.1866	0.0032	0.0231	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
107		0.00	0.000	0.241	0.1650	0.0033	0.0242	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
108		0.16	0.000	0.028	0.1743	0.0029	0.0208	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
109		0.11	0.000	0.239	0.1624	0.0026	0.0187	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
110		0.82	0.000	0.026	0.2273	0.0024	0.0175	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
111		0.10	0.000	0.093	0.2269	0.0022	0.0159	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
112		0.03	0.000	0.086	0.2211	0.0022	0.0159	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
113		0.31	0.000	0.224	0.2283	0.0017	0.0121	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
114		0.02	0.000	0.063	0.2245	0.0024	0.0174	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
115	*	0.45	0.000	0.029	0.2229	0.0041	0.0297	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
116		0.12	0.000	0.006	0.2641	0.0035	0.0254	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
117		0.00	0.000	0.200	0.2376	0.0032	0.0230	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
118		0.05	0.000	0.091	0.2211	0.0039	0.0280	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
119		0.05	0.000	0.137	0.2069	0.0034	0.0250	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
120		0.28	0.000	0.191	0.2098	0.0013	0.0095	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
121		0.00	0.000	0.194	0.1900	0.0020	0.0146	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
122		0.00	0.000	0.348	0.1591	0.0031	0.0226	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
123		0.00	0.000	0.130	0.1462	0.0038	0.0273	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
124		0.54	0.000	0.054	0.1858	0.0041	0.0298	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
125		0.00	0.000	0.221	0.1666	0.0042	0.0308	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
126		0.00	0.000	0.041	0.1629	0.0043	0.0308	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
127		0.00	0.000	0.035	0.1591	0.0042	0.0305	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00

128	0.00	0.000	0.031	0.1556	0.0044	0.0320	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
129	0.00	0.000	0.028	0.1523	0.0043	0.0314	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
130	0.62	0.000	0.026	0.2008	0.0041	0.0296	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
131	0.00	0.000	0.130	0.1888	0.0042	0.0302	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
132	0.00	0.000	0.329	0.1612	0.0029	0.0208	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
133	0.00	0.000	0.130	0.1498	0.0033	0.0240	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
134	0.00	0.000	0.054	0.1447	0.0035	0.0251	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
135	0.00	0.000	0.041	0.1407	0.0031	0.0227	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
136	0.14	0.000	0.035	0.1491	0.0028	0.0205	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
137	0.03	0.000	0.031	0.1487	0.0026	0.0187	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
138	0.00	0.000	0.028	0.1461	0.0024	0.0174	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
139	0.00	0.000	0.025	0.1436	0.0021	0.0154	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
140	0.00	0.000	0.024	0.1413	0.0020	0.0143	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
141	0.09	0.000	0.023	0.1466	0.0018	0.0132	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
142	0.35	0.000	0.022	0.1738	0.0017	0.0121	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
143	0.00	0.000	0.178	0.1589	0.0012	0.0090	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
144	0.00	0.000	0.020	0.1568	0.0018	0.0127	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
145	0.00	0.000	0.019	0.1549	0.0014	0.0104	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
146	0.00	0.000	0.018	0.1530	0.0012	0.0087	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
147	0.37	0.000	0.018	0.1820	0.0010	0.0074	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
148	0.01	0.000	0.210	0.1648	0.0014	0.0104	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
149	1.01	0.000	0.132	0.2377	0.0003	0.0023	6.85E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
150	0.25	0.000	0.277	0.2350	0.0012	0.0087	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
151	0.02	0.000	0.260	0.2148	0.0002	0.0011	6.83E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
152	0.00	0.000	0.245	0.1937	0.0009	0.0062	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
153	0.00	0.000	0.197	0.1744	0.0017	0.0126	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
154	0.00	0.000	0.130	0.1613	0.0012	0.0091	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
155	0.00	0.000	0.054	0.1554	0.0008	0.0057	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
156	0.00	0.000	0.041	0.1500	0.0007	0.0048	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
157	0.00	0.000	0.035	0.1459	0.0002	0.0018	6.60E-09	0.0000	0.0000	2.13E-09	0.0000	0.0000	0.00E+00
158	0.00	0.000	0.031	0.1416	0.0008	0.0061	6.24E-09	0.0000	0.0000	2.09E-09	0.0000	0.0000	0.00E+00
159	0.00	0.000	0.028	0.1371	0.0012	0.0087	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
160	0.00	0.000	0.025	0.1330	0.0009	0.0069	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
161	0.00	0.000	0.024	0.1294	0.0006	0.0045	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
162	0.00	0.000	0.022	0.1261	0.0008	0.0059	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
163	0.00	0.000	0.021	0.1229	0.0015	0.0105	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
164	0.00	0.000	0.020	0.1201	0.0018	0.0130	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
165	0.00	0.000	0.019	0.1183	0.0017	0.0126	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
166	0.00	0.000	0.018	0.1163	0.0031	0.0225	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
167	0.00	0.000	0.018	0.1137	0.0043	0.0313	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
168	0.00	0.000	0.017	0.1111	0.0040	0.0290	7.28E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
169	0.00	0.000	0.016	0.1087	0.0035	0.0257	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
170	0.00	0.000	0.016	0.1064	0.0032	0.0235	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
171	0.00	0.000	0.016	0.1043	0.0031	0.0223	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
172	0.00	0.000	0.015	0.1024	0.0030	0.0219	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00

173	0.00	0.000	0.015	0.1005	0.0030	0.0217	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
174	0.06	0.000	0.016	0.1039	0.0030	0.0216	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
175	0.01	0.000	0.015	0.1026	0.0029	0.0212	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
176	0.06	0.000	0.015	0.1062	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
177	0.00	0.000	0.013	0.1049	0.0029	0.0213	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
178	0.24	0.000	0.014	0.1229	0.0031	0.0227	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
179	0.44	0.000	0.014	0.1577	0.0030	0.0220	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
180	0.00	0.000	0.013	0.1560	0.0031	0.0223	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
181	0.00	0.000	0.012	0.1541	0.0028	0.0206	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
182	0.00	0.000	0.012	0.1525	0.0023	0.0167	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
183	0.00	0.000	0.012	0.1509	0.0020	0.0143	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
184	0.00	0.000	0.012	0.1495	0.0018	0.0133	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
185	0.00	0.000	0.012	0.1482	0.0018	0.0130	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
186	0.00	0.000	0.011	0.1469	0.0018	0.0131	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
187	0.00	0.000	0.011	0.1457	0.0018	0.0134	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
188	0.59	0.000	0.013	0.1931	0.0019	0.0136	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
189	0.34	0.000	0.353	0.1913	0.0028	0.0199	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
190	0.00	0.000	0.355	0.1609	0.0021	0.0154	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
191	0.09	0.000	0.329	0.1399	0.0019	0.0140	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
192	0.14	0.000	0.131	0.1402	0.0011	0.0081	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
193	0.36	0.000	0.055	0.1655	0.0011	0.0081	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
194	0.05	0.000	0.115	0.1596	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
195	0.16	0.000	0.183	0.1575	0.0017	0.0120	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
196	0.59	0.000	0.140	0.1946	0.0020	0.0143	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
197	0.01	0.000	0.134	0.1846	0.0022	0.0158	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
198	0.00	0.000	0.186	0.1691	0.0023	0.0166	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
199	0.00	0.000	0.202	0.1522	0.0024	0.0171	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
200	0.00	0.000	0.130	0.1414	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
201	0.16	0.000	0.055	0.1498	0.0024	0.0171	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
202	0.04	0.000	0.043	0.1492	0.0023	0.0169	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
203	0.26	0.000	0.036	0.1677	0.0023	0.0167	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
204	0.11	0.000	0.141	0.1651	0.0023	0.0164	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
205	0.17	0.000	0.269	0.1566	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
206	0.22	0.000	0.277	0.1516	0.0022	0.0157	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
207	0.31	0.000	0.132	0.1662	0.0021	0.0155	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
208	0.00	0.000	0.226	0.1474	0.0021	0.0152	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
209	1.05	0.000	0.056	0.2301	0.0021	0.0153	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
210	0.00	0.000	0.331	0.2026	0.0020	0.0147	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
211	0.37	0.000	0.128	0.2228	0.0020	0.0146	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
212	0.00	0.000	0.122	0.2126	0.0020	0.0146	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
213	0.07	0.000	0.120	0.2081	0.0020	0.0146	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
214	0.62	0.000	0.250	0.2377	0.0025	0.0183	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
215	0.02	0.000	0.098	0.2294	0.0023	0.0166	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
216	0.03	0.000	0.093	0.2233	0.0016	0.0115	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
217	0.05	0.000	0.116	0.2137	0.0021	0.0150	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

218	0.20	0.000	0.105	0.2169	0.0021	0.0151	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
219	0.02	0.000	0.124	0.2048	0.0019	0.0140	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
220	0.06	0.000	0.333	0.1795	0.0019	0.0135	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
221	0.00	0.000	0.167	0.1639	0.0015	0.0108	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
222	0.00	0.000	0.129	0.1521	0.0016	0.0115	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
223	0.00	0.000	0.054	0.1464	0.0019	0.0136	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
224	0.97	0.000	0.043	0.2218	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
225	0.00	0.000	0.219	0.2024	0.0016	0.0118	7.01E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
226	0.00	0.000	0.207	0.1841	0.0021	0.0152	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
227	0.00	0.000	0.209	0.1652	0.0030	0.0215	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
228	0.00	0.000	0.130	0.1534	0.0022	0.0161	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
229	0.70	0.000	0.056	0.2063	0.0023	0.0168	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
230	0.05	0.000	0.237	0.1898	0.0030	0.0215	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
231	0.00	0.000	0.112	0.1804	0.0024	0.0177	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
232	0.00	0.000	0.108	0.1714	0.0030	0.0214	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
233	0.00	0.000	0.102	0.1629	0.0033	0.0240	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
234	0.01	0.000	0.128	0.1529	0.0036	0.0263	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
235	0.05	0.000	0.056	0.1519	0.0038	0.0274	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
236	0.00	0.000	0.041	0.1480	0.0037	0.0267	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
237	0.00	0.000	0.035	0.1448	0.0034	0.0244	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
238	0.00	0.000	0.031	0.1420	0.0031	0.0225	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
239	0.12	0.000	0.030	0.1493	0.0027	0.0197	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
240	0.81	0.000	0.028	0.2145	0.0028	0.0204	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
241	0.00	0.000	0.120	0.2041	0.0027	0.0198	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
242	0.00	0.000	0.205	0.1864	0.0027	0.0195	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
243	0.00	0.000	0.194	0.1694	0.0030	0.0219	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
244	0.00	0.000	0.234	0.1493	0.0020	0.0144	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
245	0.00	0.000	0.130	0.1380	0.0018	0.0130	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
246	0.10	0.000	0.056	0.1416	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
247	0.16	0.000	0.044	0.1509	0.0012	0.0085	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
248	0.03	0.000	0.037	0.1508	0.0013	0.0096	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
249	0.10	0.000	0.033	0.1566	0.0015	0.0111	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
250	0.00	0.000	0.028	0.1543	0.0017	0.0122	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
251	0.00	0.000	0.025	0.1522	0.0018	0.0128	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
252	0.00	0.000	0.024	0.1500	0.0021	0.0150	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
253	0.00	0.000	0.022	0.1477	0.0022	0.0162	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
254	0.07	0.000	0.023	0.1507	0.0021	0.0154	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
255	0.37	0.000	0.022	0.1793	0.0019	0.0139	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
256	0.11	0.000	0.123	0.1771	0.0020	0.0144	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
257	0.01	0.000	0.210	0.1601	0.0012	0.0086	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
258	0.70	0.000	0.132	0.2071	0.0012	0.0087	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
259	0.00	0.000	0.091	0.1994	0.0007	0.0050	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
260	0.00	0.000	0.123	0.1889	0.0012	0.0086	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
261	0.00	0.000	0.110	0.1792	0.0016	0.0118	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
262	0.00	0.000	0.099	0.1705	0.0015	0.0109	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00

263		0.08	0.000	0.073	0.1708	0.0017	0.0127	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
264		0.03	0.000	0.071	0.1671	0.0015	0.0110	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
265		0.41	0.000	0.091	0.1936	0.0013	0.0097	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
266		0.01	0.000	0.088	0.1863	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
267		0.00	0.000	0.100	0.1777	0.0014	0.0105	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
268		0.78	0.000	0.093	0.2347	0.0013	0.0096	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
269		0.00	0.000	0.117	0.2246	0.0016	0.0118	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
270		0.14	0.000	0.289	0.2125	0.0013	0.0094	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
271		0.75	0.000	0.092	0.2663	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
272		0.00	0.000	0.128	0.2429	0.0022	0.0158	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
273		0.03	0.000	0.158	0.2190	0.0024	0.0176	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
274		0.18	0.000	0.237	0.2064	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
275		0.00	0.000	0.221	0.1838	0.0008	0.0059	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
276		0.00	0.000	0.197	0.1654	0.0005	0.0037	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
277		0.00	0.000	0.081	0.1564	0.0011	0.0082	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
278		0.00	0.000	0.054	0.1500	0.0017	0.0122	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
279		0.00	0.000	0.041	0.1452	0.0021	0.0151	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
280	*	0.00	0.000	0.035	0.1412	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
281	*	0.00	0.000	0.000	0.1398	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
282		0.00	0.000	0.031	0.1366	0.0027	0.0193	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
283		0.00	0.000	0.028	0.1338	0.0027	0.0197	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
284		0.00	0.000	0.025	0.1311	0.0027	0.0198	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
285		0.94	0.000	0.025	0.2065	0.0027	0.0197	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
286		0.36	0.000	0.118	0.2260	0.0031	0.0224	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
287		0.01	0.000	0.116	0.2164	0.0025	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
288		0.00	0.000	0.115	0.2055	0.0036	0.0265	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
289		0.06	0.000	0.189	0.1945	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
290		0.00	0.000	0.088	0.1874	0.0019	0.0140	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
291		0.00	0.000	0.108	0.1772	0.0032	0.0230	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
292		0.00	0.000	0.128	0.1656	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
293		0.00	0.000	0.054	0.1593	0.0026	0.0187	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
294		0.48	0.000	0.042	0.1937	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
295		0.00	0.000	0.092	0.1847	0.0019	0.0135	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
296		0.00	0.000	0.077	0.1771	0.0015	0.0106	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
297	*	0.00	0.000	0.000	0.1761	0.0011	0.0083	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
298	*	0.00	0.000	0.002	0.1755	0.0006	0.0046	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
299	*	0.00	0.000	0.000	0.1750	0.0010	0.0069	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
300	*	0.00	0.000	0.000	0.1744	0.0014	0.0098	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
301	*	0.00	0.000	0.000	0.1737	0.0016	0.0115	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
302	*	0.00	0.000	0.049	0.1690	0.0015	0.0112	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
303		0.00	0.000	0.062	0.1627	0.0019	0.0139	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
304	*	0.00	0.000	0.000	0.1620	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
305	*	0.00	0.000	0.000	0.1614	0.0011	0.0083	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
306		0.00	0.000	0.076	0.1542	0.0014	0.0100	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
307		0.00	0.000	0.047	0.1500	0.0007	0.0052	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00

308			0.00	0.000	0.041	0.1463	0.0008	0.0061	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
309	*		0.00	0.000	0.000	0.1458	0.0014	0.0102	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
310	*		0.00	0.000	0.000	0.1452	0.0013	0.0093	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
311	*		0.00	0.000	0.000	0.1448	0.0012	0.0085	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
312	*		0.00	0.000	0.035	0.1414	0.0012	0.0085	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
313			0.00	0.000	0.031	0.1383	0.0011	0.0082	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
314			0.00	0.000	0.028	0.1356	0.0009	0.0066	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
315			0.20	0.000	0.026	0.1500	0.0008	0.0059	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
316	*		0.11	0.000	0.030	0.1515	0.0007	0.0049	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
317	*		0.13	0.000	0.012	0.1529	0.0008	0.0057	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
318	*		0.00	0.000	0.026	0.1543	0.0009	0.0062	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
319	*		0.00	0.000	0.025	0.1557	0.0009	0.0065	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
320	*	*	0.00	0.000	0.012	0.1557	0.0006	0.0043	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
321	*	*	0.00	0.000	0.005	0.1557	0.0007	0.0050	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
322	*	*	0.19	0.000	0.002	0.1557	0.0008	0.0058	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
323	*	*	0.00	0.000	0.002	0.1557	0.0009	0.0063	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
324	*	*	0.00	0.000	0.004	0.1557	0.0009	0.0067	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
325	*	*	0.00	0.000	0.002	0.1557	0.0009	0.0069	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
326	*	*	0.00	0.000	0.004	0.1557	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
327	*	*	0.00	0.000	0.002	0.1557	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
328	*	*	0.00	0.000	0.004	0.1557	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
329	*	*	0.36	0.000	0.000	0.1557	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
330	*	*	0.18	0.000	0.000	0.1557	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
331		*	0.17	0.000	0.000	0.1858	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
332		*	0.00	0.000	0.027	0.1859	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
333	*	*	0.00	0.000	0.012	0.1859	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
334		*	0.00	0.000	0.000	0.2235	0.0010	0.0071	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
335		*	0.12	0.000	0.017	0.2392	0.0010	0.0073	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
336		*	0.00	0.000	0.000	0.2392	0.0010	0.0075	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
337		*	0.16	0.000	0.001	0.2527	0.0011	0.0077	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
338		*	0.00	0.000	0.000	0.2527	0.0011	0.0080	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
339		*	0.18	0.000	0.001	0.2675	0.0011	0.0083	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
340		*	0.34	0.000	0.001	0.2958	0.0012	0.0087	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
341		*	0.00	0.000	0.000	0.2958	0.0012	0.0090	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
342		*	0.00	0.000	0.000	0.2958	0.0013	0.0094	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
343		*	0.00	0.000	0.000	0.2958	0.0014	0.0099	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
344			0.00	0.000	0.037	0.2362	0.0018	0.0133	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
345	*		0.00	0.000	0.000	0.2284	0.0004	0.0030	6.86E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
346			0.00	0.000	0.043	0.2175	0.0002	0.0012	5.86E-09	0.0000	0.0000	2.05E-09	0.0000	0.0000	0.00E+00
347			0.10	0.000	0.037	0.2171	0.0010	0.0071	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
348			0.15	0.000	0.037	0.2221	0.0017	0.0120	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
349	*		0.24	0.000	0.026	0.2207	0.0021	0.0155	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
350	*		0.05	0.000	0.011	0.2203	0.0025	0.0179	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
351	*		0.13	0.000	0.005	0.2187	0.0027	0.0195	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
352	*		0.00	0.000	0.012	0.2180	0.0028	0.0204	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00

353			0.00	0.000	0.000	0.2400	0.0029	0.0209	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
354			0.06	0.000	0.036	0.2404	0.0032	0.0231	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
355			0.02	0.000	0.043	0.2366	0.0031	0.0227	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
356			0.69	0.000	0.033	0.2843	0.0040	0.0292	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
357			0.00	0.000	0.061	0.2474	0.0034	0.0249	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
358			0.38	0.000	0.057	0.2600	0.0016	0.0114	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
359			0.09	0.000	0.042	0.2552	0.0016	0.0112	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
360	*		0.06	0.000	0.017	0.2429	0.0018	0.0127	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
361	*		0.09	0.000	0.009	0.2365	0.0019	0.0138	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
362	*		0.01	0.000	0.012	0.2309	0.0020	0.0145	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
363	*		0.00	0.000	0.006	0.2268	0.0021	0.0150	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
364	*		0.09	0.000	0.003	0.2239	0.0021	0.0153	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
365	*	*	0.30	0.000	0.000	0.2239	0.0021	0.0154	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

* = Frozen (air or soil)

Annual Totals for Year 3			
	inches	cubic feet	percent
Precipitation	33.26	120,745.0	100.00
Runoff	0.000	0.0000	0.00
Evapotranspiration	26.041	94,527.5	78.29
Drainage Collected from Layer 3	5.2285	18,979.6	15.72
Percolation/Leakage through Layer 5	0.000003	0.0091	0.00
Average Head on Top of Layer 4	0.0020	---	---
Drainage Collected from Layer 7	0.0000	0.0063	0.00
Percolation/Leakage through Layer 9	0.000001	0.0028	0.00
Average Head on Top of Layer 8	0.0000	---	---
Percolation/Leakage through Layer 10	0.000000	0.0000	0.00
Change in Water Storage	1.9939	7,237.9	5.99
Soil Water at Start of Year	58.9047	213,824.1	177.09
Soil Water at End of Year	60.4915	219,584.1	181.86
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.4071	1,477.9	1.22
Annual Water Budget Balance	0.0000	0.0000	0.00

Daily Output for Year 4

Column key: Head #1: drainage from Layer 4 | Head #2: drainage from Layer 8
Drain #1: drainage from Layer 3 | Drain #2: drainage from Layer 7
Leak #1: leakage thru Layer 5 | Leak #2: leakage thru Layer 9 | Leak #3: leakage thru Layer 10

Title: Wayne Disposal - Initial Lift
Simulated On: 3/23/2021 13:00

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1	Head #2	Drain #2	Leak #2	Head #3	Drain #3	Leak #3
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1		*	0.00	0.000	0.030	0.2239	0.0021	0.0154	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
2		*	0.00	0.000	0.000	0.2553	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
3	*	*	0.00	0.000	0.000	0.2553	0.0031	0.0228	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
4		*	0.00	0.000	0.000	0.2553	0.0030	0.0215	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
5		*	0.03	0.000	0.000	0.2577	0.0027	0.0196	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
6		*	0.00	0.000	0.000	0.2577	0.0025	0.0179	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
7	*	*	0.05	0.000	0.029	0.2577	0.0023	0.0165	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
8		*	0.00	0.000	0.022	0.2577	0.0021	0.0153	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
9		*	0.07	0.000	0.000	0.2632	0.0020	0.0143	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
10		*	0.05	0.000	0.000	0.2675	0.0018	0.0133	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
11	*	*	0.08	0.000	0.028	0.2675	0.0017	0.0125	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
12	*	*	0.00	0.000	0.013	0.2675	0.0016	0.0118	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
13	*	*	0.03	0.000	0.006	0.2675	0.0013	0.0092	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
14	*	*	0.05	0.000	0.004	0.2675	0.0003	0.0024	6.85E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
15	*	*	0.00	0.000	0.007	0.2675	0.0000	0.0000	1.99E-09	0.0000	0.0000	1.22E-09	0.0000	0.0000	0.00E+00
16	*	*	0.18	0.000	0.000	0.2675	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
17	*	*	0.11	0.000	0.000	0.2675	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
18		*	0.00	0.000	0.000	0.3005	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
19		*	0.00	0.000	0.000	0.3005	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
20		*	0.00	0.000	0.000	0.3005	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
21		*	0.00	0.000	0.000	0.3005	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
22	*	*	0.00	0.000	0.000	0.3005	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
23	*	*	0.05	0.000	0.031	0.3005	0.0000	0.0001	1.36E-09	0.0000	0.0000	9.51E-10	0.0000	0.0000	0.00E+00
24	*	*	0.00	0.000	0.020	0.3005	0.0006	0.0042	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
25		*	0.00	0.000	0.000	0.3005	0.0015	0.0105	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
26		*	0.00	0.000	0.000	0.3005	0.0023	0.0165	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
27		*	0.24	0.000	0.000	0.3201	0.0030	0.0219	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
28		*	0.08	0.000	0.000	0.3269	0.0036	0.0264	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
29		*	0.00	0.000	0.000	0.3269	0.0041	0.0300	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
30	*	*	0.00	0.000	0.000	0.3269	0.0045	0.0328	7.34E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
31	*	*	0.00	0.000	0.000	0.3269	0.0048	0.0350	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
32	*	*	0.00	0.000	0.000	0.3269	0.0050	0.0365	7.39E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
33	*	*	0.04	0.000	0.021	0.3269	0.0052	0.0376	7.41E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
34		*	0.00	0.000	0.020	0.3269	0.0053	0.0383	7.42E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
35		*	0.12	0.000	0.000	0.3365	0.0053	0.0388	7.43E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
36		*	0.18	0.000	0.000	0.3512	0.0054	0.0390	7.43E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
37		*	0.17	0.000	0.000	0.3652	0.0054	0.0390	7.43E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00

38		*	0.10	0.000	0.000	0.3738	0.0054	0.0389	7.43E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
39		*	0.01	0.000	0.000	0.3749	0.0053	0.0388	7.43E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
40		*	0.00	0.000	0.000	0.3749	0.0053	0.0385	7.42E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
41		*	0.00	0.000	0.000	0.3749	0.0053	0.0382	7.42E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
42	*	*	0.00	0.000	0.000	0.3749	0.0052	0.0379	7.41E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
43	*	*	0.13	0.000	0.032	0.3749	0.0052	0.0375	7.41E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
44	*	*	0.00	0.000	0.038	0.3749	0.0051	0.0371	7.40E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
45	*	*	0.00	0.000	0.039	0.3749	0.0051	0.0368	7.40E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
46	*	*	0.00	0.000	0.000	0.3749	0.0050	0.0364	7.39E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
47	*	*	0.00	0.000	0.028	0.3749	0.0050	0.0360	7.38E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
48		*	0.00	0.000	0.000	0.3749	0.0049	0.0355	7.38E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
49		*	0.00	0.000	0.000	0.3749	0.0048	0.0351	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
50		*	0.00	0.000	0.000	0.3749	0.0048	0.0347	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
51		*	0.00	0.000	0.000	0.3749	0.0047	0.0343	7.36E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
52		*	0.00	0.000	0.000	0.3749	0.0047	0.0339	7.36E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
53		*	0.00	0.000	0.000	0.3752	0.0046	0.0335	7.35E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
54	*	*	0.07	0.000	0.022	0.3752	0.0046	0.0332	7.34E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
55	*	*	0.59	0.000	0.000	0.3752	0.0045	0.0328	7.34E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
56	*	*	0.15	0.000	0.011	0.3752	0.0045	0.0324	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
57	*	*	0.00	0.000	0.021	0.3752	0.0044	0.0320	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
58	*	*	0.00	0.000	0.011	0.3752	0.0044	0.0317	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
59	*	*	0.00	0.000	0.015	0.3752	0.0043	0.0313	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
60	*	*	0.00	0.000	0.008	0.3752	0.0043	0.0309	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
61	*	*	0.00	0.000	0.010	0.3752	0.0042	0.0306	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
62	*	*	0.00	0.000	0.011	0.3752	0.0042	0.0302	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
63	*	*	0.00	0.000	0.006	0.3752	0.0041	0.0299	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
64	*	*	0.17	0.000	0.000	0.3752	0.0041	0.0296	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
65	*	*	0.00	0.000	0.015	0.3752	0.0040	0.0293	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
66	*	*	0.01	0.000	0.007	0.3752	0.0040	0.0289	7.28E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
67	*	*	0.00	0.000	0.028	0.3752	0.0039	0.0286	7.28E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
68	*	*	0.00	0.000	0.025	0.3752	0.0039	0.0283	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
69		*	0.21	0.000	0.000	0.3925	0.0039	0.0280	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
70		*	0.01	0.000	0.013	0.4570	0.0038	0.0277	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
71	*	*	0.00	0.000	0.000	0.4570	0.0038	0.0272	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
72		*	0.00	0.000	0.000	0.4570	0.0037	0.0269	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
73	*	*	0.00	0.000	0.000	0.4570	0.0037	0.0269	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
74		*	0.00	0.000	0.000	0.4570	0.0037	0.0267	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
75		*	0.00	0.000	0.000	0.4570	0.0037	0.0265	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
76		*	0.34	0.000	0.000	0.4570	0.0039	0.0281	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
77		*	0.03	0.000	0.000	0.4570	0.0037	0.0265	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
78		*	0.02	0.000	0.000	0.4570	0.0035	0.0251	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
79		*	0.03	0.000	0.000	0.4570	0.0033	0.0243	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
80	*	*	0.10	0.000	0.034	0.4570	0.0014	0.0104	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
81	*	*	0.00	0.000	0.035	0.4570	0.0028	0.0202	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
82		*	0.00	0.000	0.035	0.4570	0.0038	0.0274	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00

83		*	0.00	0.000	0.000	0.4570	0.0043	0.0308	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
84		*	0.00	0.000	0.000	0.4570	0.0044	0.0320	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
85		*	0.00	0.000	0.000	0.4570	0.0044	0.0322	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
86	*	*	0.04	0.000	0.037	0.4570	0.0042	0.0307	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
87	*	*	0.00	0.000	0.000	0.4570	0.0041	0.0294	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
88		*	0.03	0.000	0.000	0.4570	0.0050	0.0363	7.39E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
89		*	0.00	0.000	0.000	0.4570	0.0029	0.0209	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
90		*	0.00	0.000	0.000	0.4570	0.0028	0.0205	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
91		*	0.17	0.000	0.000	0.4570	0.0041	0.0295	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
92			0.00	0.000	0.116	0.2378	0.0021	0.0156	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
93	*		0.04	0.000	0.099	0.2200	0.0011	0.0083	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
94			0.03	0.000	0.095	0.2072	0.0018	0.0129	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
95			0.00	0.000	0.134	0.1908	0.0022	0.0161	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
96			0.10	0.000	0.162	0.1827	0.0025	0.0184	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
97	*		0.17	0.000	0.041	0.1817	0.0035	0.0256	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
98	*		0.00	0.000	0.084	0.1806	0.0046	0.0330	7.34E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
99			0.00	0.000	0.195	0.1632	0.0039	0.0286	7.28E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
100			0.01	0.000	0.130	0.1514	0.0035	0.0255	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
101			0.00	0.000	0.050	0.1468	0.0032	0.0230	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
102			0.05	0.000	0.042	0.1468	0.0029	0.0208	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
103			0.01	0.000	0.035	0.1436	0.0026	0.0190	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
104			0.00	0.000	0.031	0.1406	0.0019	0.0140	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
105			0.01	0.000	0.028	0.1388	0.0012	0.0084	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
106			0.17	0.000	0.026	0.1503	0.0000	0.0003	5.41E-09	0.0000	0.0000	1.99E-09	0.0000	0.0000	0.00E+00
107			0.00	0.000	0.024	0.1480	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
108			0.00	0.000	0.023	0.1457	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
109			0.00	0.000	0.021	0.1431	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
110			0.00	0.000	0.020	0.1405	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
111			0.00	0.000	0.019	0.1381	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
112			0.00	0.000	0.018	0.1357	0.0000	0.0003	1.37E-09	0.0000	0.0000	9.53E-10	0.0000	0.0000	0.00E+00
113			0.19	0.000	0.018	0.1492	0.0016	0.0116	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
114			0.00	0.000	0.017	0.1472	0.0037	0.0268	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
115			0.00	0.000	0.016	0.1453	0.0055	0.0400	7.44E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
116			0.00	0.000	0.016	0.1434	0.0068	0.0495	7.58E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
117			0.00	0.000	0.016	0.1417	0.0077	0.0555	7.66E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
118			0.00	0.000	0.015	0.1400	0.0081	0.0588	7.71E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
119			0.05	0.000	0.015	0.1427	0.0083	0.0603	7.73E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
120			0.18	0.000	0.015	0.1558	0.0084	0.0608	7.74E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
121			0.14	0.000	0.076	0.1604	0.0085	0.0615	7.75E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
122			0.00	0.000	0.142	0.1478	0.0083	0.0599	7.72E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
123	*		0.00	0.000	0.000	0.1478	0.0076	0.0553	7.66E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
124			0.00	0.000	0.121	0.1374	0.0084	0.0611	7.74E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
125			0.00	0.000	0.054	0.1329	0.0083	0.0603	7.73E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
126			0.00	0.000	0.041	0.1292	0.0084	0.0606	7.73E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00
127			0.09	0.000	0.035	0.1332	0.0080	0.0582	7.70E-09	0.0000	0.0000	2.24E-09	0.0000	0.0000	0.00E+00

128	0.00	0.000	0.031	0.1302	0.0078	0.0563	7.67E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
129	0.00	0.000	0.028	0.1277	0.0074	0.0535	7.64E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
130	0.03	0.000	0.026	0.1274	0.0071	0.0517	7.61E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
131	0.66	0.000	0.024	0.1797	0.0072	0.0520	7.61E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
132	0.22	0.000	0.157	0.1849	0.0071	0.0511	7.60E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
133	0.00	0.000	0.160	0.1714	0.0072	0.0525	7.62E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
134	0.00	0.000	0.194	0.1549	0.0072	0.0520	7.61E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
135	0.14	0.000	0.408	0.1316	0.0073	0.0531	7.63E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
136	0.49	0.000	0.131	0.1615	0.0062	0.0453	7.52E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
137	0.00	0.000	0.145	0.1489	0.0063	0.0456	7.52E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
138	0.00	0.000	0.113	0.1391	0.0063	0.0459	7.53E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
139	0.08	0.000	0.131	0.1348	0.0065	0.0474	7.55E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
140	0.18	0.000	0.055	0.1446	0.0064	0.0466	7.54E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
141	0.01	0.000	0.042	0.1421	0.0066	0.0477	7.55E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
142	0.00	0.000	0.035	0.1390	0.0066	0.0479	7.56E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
143	0.00	0.000	0.031	0.1364	0.0065	0.0474	7.55E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
144	0.00	0.000	0.028	0.1339	0.0064	0.0464	7.54E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
145	0.07	0.000	0.026	0.1379	0.0062	0.0453	7.52E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
146	0.01	0.000	0.025	0.1362	0.0061	0.0440	7.50E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
147	0.66	0.000	0.023	0.1894	0.0059	0.0429	7.49E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
148	0.02	0.000	0.459	0.1519	0.0059	0.0429	7.49E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
149	0.04	0.000	0.147	0.1434	0.0053	0.0383	7.42E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
150	0.01	0.000	0.120	0.1340	0.0054	0.0394	7.43E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
151	0.28	0.000	0.055	0.1531	0.0054	0.0393	7.43E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
152	0.18	0.000	0.325	0.1414	0.0054	0.0390	7.43E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
153	0.19	0.000	0.042	0.1538	0.0053	0.0385	7.42E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
154	0.00	0.000	0.210	0.1362	0.0052	0.0378	7.41E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
155	0.50	0.000	0.036	0.1749	0.0051	0.0370	7.40E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
156	0.09	0.000	0.164	0.1690	0.0050	0.0363	7.39E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
157	0.34	0.000	0.144	0.1851	0.0049	0.0357	7.38E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
158	0.01	0.000	0.119	0.1756	0.0048	0.0351	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
159	0.02	0.000	0.266	0.1550	0.0048	0.0350	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
160	0.79	0.000	0.118	0.2107	0.0046	0.0335	7.35E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
161	0.00	0.000	0.224	0.1921	0.0046	0.0333	7.35E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
162	0.00	0.000	0.331	0.1645	0.0046	0.0330	7.34E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
163	0.00	0.000	0.130	0.1537	0.0045	0.0327	7.34E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
164	0.24	0.000	0.055	0.1687	0.0045	0.0324	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
165	0.00	0.000	0.279	0.1455	0.0044	0.0321	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
166	0.18	0.000	0.043	0.1569	0.0044	0.0318	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
167	0.00	0.000	0.035	0.1540	0.0043	0.0315	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
168	0.00	0.000	0.031	0.1514	0.0043	0.0312	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
169	0.00	0.000	0.028	0.1491	0.0043	0.0309	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
170	0.00	0.000	0.025	0.1470	0.0042	0.0306	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
171	0.44	0.000	0.025	0.1814	0.0042	0.0304	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
172	0.04	0.000	0.153	0.1719	0.0042	0.0301	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00

173	0.46	0.000	0.267	0.1873	0.0044	0.0320	7.33E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
174	0.40	0.000	0.125	0.2098	0.0038	0.0275	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
175	0.00	0.000	0.253	0.1888	0.0039	0.0280	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
176	0.01	0.000	0.311	0.1634	0.0040	0.0292	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
177	0.00	0.000	0.130	0.1526	0.0039	0.0280	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
178	0.00	0.000	0.054	0.1480	0.0039	0.0286	7.28E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
179	0.00	0.000	0.041	0.1443	0.0042	0.0304	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
180	0.00	0.000	0.035	0.1412	0.0039	0.0282	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
181	0.00	0.000	0.031	0.1384	0.0037	0.0271	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
182	0.00	0.000	0.028	0.1359	0.0037	0.0266	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
183	0.01	0.000	0.027	0.1346	0.0035	0.0254	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
184	0.21	0.000	0.025	0.1499	0.0038	0.0276	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
185	0.24	0.000	0.024	0.1676	0.0037	0.0272	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
186	0.03	0.000	0.148	0.1573	0.0039	0.0283	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
187	0.00	0.000	0.021	0.1555	0.0034	0.0246	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
188	0.00	0.000	0.020	0.1538	0.0035	0.0256	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
189	0.00	0.000	0.019	0.1523	0.0037	0.0265	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
190	0.00	0.000	0.018	0.1507	0.0037	0.0269	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
191	0.00	0.000	0.018	0.1492	0.0037	0.0270	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
192	0.00	0.000	0.017	0.1478	0.0037	0.0269	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
193	0.00	0.000	0.016	0.1465	0.0037	0.0267	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
194	0.00	0.000	0.017	0.1452	0.0036	0.0263	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
195	0.12	0.000	0.017	0.1538	0.0036	0.0260	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
196	0.25	0.000	0.017	0.1732	0.0036	0.0258	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
197	0.18	0.000	0.286	0.1634	0.0037	0.0271	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
198	0.00	0.000	0.339	0.1352	0.0031	0.0228	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
199	0.00	0.000	0.130	0.1243	0.0032	0.0231	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
200	0.15	0.000	0.056	0.1317	0.0034	0.0246	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
201	0.00	0.000	0.041	0.1281	0.0033	0.0243	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
202	0.00	0.000	0.035	0.1249	0.0032	0.0229	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
203	0.00	0.000	0.031	0.1222	0.0031	0.0223	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
204	0.00	0.000	0.028	0.1197	0.0030	0.0218	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
205	0.42	0.000	0.027	0.1522	0.0030	0.0215	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
206	0.23	0.000	0.026	0.1691	0.0029	0.0213	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
207	0.00	0.000	0.374	0.1372	0.0029	0.0211	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
208	0.38	0.000	0.024	0.1668	0.0030	0.0215	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
209	0.13	0.000	0.183	0.1613	0.0030	0.0219	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
210	0.54	0.000	0.201	0.1889	0.0030	0.0214	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
211	0.92	0.000	0.143	0.2533	0.0029	0.0209	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
212	0.00	0.000	0.133	0.2401	0.0026	0.0191	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
213	0.19	0.000	0.212	0.2268	0.0030	0.0214	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
214	0.01	0.000	0.180	0.2063	0.0029	0.0209	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
215	0.00	0.000	0.264	0.1801	0.0028	0.0206	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
216	0.00	0.000	0.131	0.1667	0.0028	0.0204	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
217	0.36	0.000	0.056	0.1891	0.0028	0.0202	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00

218	0.01	0.000	0.271	0.1649	0.0027	0.0196	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
219	0.04	0.000	0.043	0.1626	0.0026	0.0187	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
220	0.00	0.000	0.035	0.1585	0.0015	0.0111	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
221	0.00	0.000	0.031	0.1554	0.0020	0.0147	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
222	0.00	0.000	0.028	0.1526	0.0028	0.0200	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
223	0.00	0.000	0.025	0.1499	0.0032	0.0235	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
224	0.00	0.000	0.024	0.1473	0.0036	0.0262	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
225	0.00	0.000	0.022	0.1449	0.0038	0.0273	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
226	0.09	0.000	0.023	0.1495	0.0039	0.0284	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
227	0.40	0.000	0.022	0.1802	0.0036	0.0260	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
228	0.00	0.000	0.195	0.1630	0.0041	0.0299	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
229	0.21	0.000	0.021	0.1789	0.0028	0.0201	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
230	0.08	0.000	0.075	0.1792	0.0031	0.0225	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
231	0.00	0.000	0.082	0.1723	0.0032	0.0231	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
232	0.00	0.000	0.089	0.1647	0.0030	0.0214	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
233	0.25	0.000	0.132	0.1744	0.0027	0.0196	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
234	0.00	0.000	0.091	0.1665	0.0030	0.0218	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
235	0.00	0.000	0.137	0.1546	0.0033	0.0238	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
236	0.07	0.000	0.132	0.1491	0.0026	0.0187	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
237	0.00	0.000	0.054	0.1442	0.0026	0.0189	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
238	0.02	0.000	0.044	0.1423	0.0023	0.0168	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
239	0.59	0.000	0.037	0.1880	0.0022	0.0157	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
240	0.59	0.000	0.238	0.2169	0.0017	0.0124	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
241	0.00	0.000	0.226	0.1973	0.0024	0.0177	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
242	0.06	0.000	0.166	0.1874	0.0023	0.0166	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
243	0.00	0.000	0.248	0.1659	0.0021	0.0153	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
244	0.68	0.000	0.132	0.2116	0.0012	0.0087	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
245	0.10	0.000	0.115	0.2099	0.0010	0.0070	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
246	0.65	0.000	0.312	0.2374	0.0013	0.0094	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
247	0.04	0.000	0.352	0.2107	0.0016	0.0118	7.01E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
248	0.45	0.000	0.377	0.2167	0.0006	0.0044	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
249	0.00	0.000	0.160	0.2033	0.0009	0.0066	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
250	0.04	0.000	0.248	0.1847	0.0016	0.0114	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
251	1.38	0.000	0.132	0.2871	0.0018	0.0131	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
252	0.00	0.000	0.216	0.2358	0.0017	0.0125	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
253	0.00	0.000	0.146	0.2125	0.0016	0.0114	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
254	0.00	0.000	0.214	0.1876	0.0000	0.0002	4.30E-09	0.0000	0.0000	1.82E-09	0.0000	0.0000	0.00E+00
255	0.00	0.000	0.130	0.1725	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
256	0.00	0.000	0.054	0.1658	0.0001	0.0008	4.78E-09	0.0000	0.0000	1.90E-09	0.0000	0.0000	0.00E+00
257	0.00	0.000	0.041	0.1609	0.0005	0.0036	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
258	0.04	0.000	0.037	0.1590	0.0008	0.0060	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
259	0.00	0.000	0.026	0.1550	0.0011	0.0080	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
260	0.00	0.000	0.028	0.1507	0.0013	0.0095	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
261	0.00	0.000	0.025	0.1465	0.0015	0.0108	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
262	0.00	0.000	0.024	0.1431	0.0016	0.0117	7.01E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

263		0.00	0.000	0.022	0.1403	0.0017	0.0124	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
264		0.00	0.000	0.021	0.1378	0.0018	0.0129	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
265		1.16	0.000	0.021	0.2322	0.0018	0.0132	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
266		0.33	0.000	0.288	0.2351	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
267		0.15	0.000	0.225	0.2273	0.0026	0.0186	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
268		0.19	0.000	0.166	0.2281	0.0020	0.0144	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
269		0.00	0.000	0.097	0.2199	0.0017	0.0120	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
270		0.00	0.000	0.121	0.2064	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
271		0.00	0.000	0.139	0.1925	0.0021	0.0156	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
272		0.00	0.000	0.154	0.1779	0.0021	0.0154	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
273		0.03	0.000	0.097	0.1702	0.0018	0.0131	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
274		0.19	0.000	0.055	0.1800	0.0017	0.0124	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
275		0.00	0.000	0.067	0.1738	0.0005	0.0036	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
276	*	0.00	0.000	0.041	0.1697	0.0006	0.0046	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
277		0.00	0.000	0.035	0.1659	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
278		0.04	0.000	0.032	0.1660	0.0018	0.0128	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
279		0.07	0.000	0.029	0.1681	0.0018	0.0130	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
280		0.00	0.000	0.025	0.1649	0.0017	0.0126	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
281		0.00	0.000	0.024	0.1620	0.0013	0.0097	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
282		0.00	0.000	0.022	0.1593	0.0013	0.0096	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
283		0.00	0.000	0.021	0.1567	0.0014	0.0099	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
284		0.00	0.000	0.020	0.1542	0.0013	0.0093	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
285		0.02	0.000	0.020	0.1538	0.0012	0.0083	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
286		0.00	0.000	0.018	0.1514	0.0012	0.0084	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
287		0.18	0.000	0.019	0.1646	0.0008	0.0055	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
288		0.00	0.000	0.017	0.1626	0.0008	0.0060	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
289		0.00	0.000	0.016	0.1606	0.0010	0.0071	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
290		0.00	0.000	0.016	0.1587	0.0008	0.0056	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
291		0.00	0.000	0.016	0.1570	0.0006	0.0046	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
292		0.00	0.000	0.015	0.1553	0.0006	0.0044	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
293		0.46	0.000	0.016	0.1920	0.0006	0.0044	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
294		0.32	0.000	0.203	0.2013	0.0012	0.0090	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
295		0.00	0.000	0.072	0.1950	0.0002	0.0015	6.83E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
296		0.00	0.000	0.078	0.1885	0.0000	0.0000	4.69E-09	0.0000	0.0000	1.88E-09	0.0000	0.0000	0.00E+00
297		0.00	0.000	0.091	0.1809	0.0002	0.0017	6.84E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
298		0.00	0.000	0.096	0.1726	0.0007	0.0047	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
299		0.00	0.000	0.087	0.1651	0.0006	0.0043	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
300		0.00	0.000	0.108	0.1557	0.0008	0.0055	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
301		0.00	0.000	0.088	0.1481	0.0005	0.0036	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
302		0.00	0.000	0.054	0.1430	0.0008	0.0059	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
303		0.00	0.000	0.041	0.1391	0.0005	0.0033	6.87E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
304		0.00	0.000	0.035	0.1358	0.0003	0.0020	6.85E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
305		0.00	0.000	0.031	0.1329	0.0002	0.0016	6.84E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
306	*	0.00	0.000	0.000	0.1327	0.0002	0.0013	6.83E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
307	*	0.00	0.000	0.000	0.1325	0.0003	0.0023	6.85E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00

308			0.00	0.000	0.028	0.1302	0.0003	0.0019	6.84E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
309	*		0.00	0.000	0.000	0.1300	0.0008	0.0056	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
310			0.00	0.000	0.025	0.1276	0.0009	0.0068	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
311	*		0.00	0.000	0.024	0.1254	0.0010	0.0072	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
312	*		0.23	0.000	0.014	0.1270	0.0009	0.0063	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
313	*		0.14	0.000	0.007	0.1287	0.0010	0.0073	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
314			0.16	0.000	0.000	0.1483	0.0012	0.0090	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
315			0.30	0.000	0.000	0.1923	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
316			0.00	0.000	0.063	0.1869	0.0017	0.0127	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
317			0.00	0.000	0.051	0.1826	0.0016	0.0116	7.01E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
318			0.07	0.000	0.103	0.1796	0.0019	0.0139	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
319			0.19	0.000	0.089	0.1878	0.0017	0.0121	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
320			0.00	0.000	0.163	0.1743	0.0017	0.0125	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
321			0.00	0.000	0.129	0.1635	0.0019	0.0135	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
322			0.02	0.000	0.175	0.1502	0.0027	0.0194	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
323			0.00	0.000	0.129	0.1395	0.0016	0.0116	7.01E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
324			0.00	0.000	0.053	0.1349	0.0020	0.0142	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
325	*		0.14	0.000	0.022	0.1364	0.0019	0.0136	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
326	*		0.26	0.000	0.016	0.1380	0.0021	0.0149	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
327	*		0.00	0.000	0.023	0.1395	0.0022	0.0157	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
328	*		0.00	0.000	0.022	0.1410	0.0023	0.0164	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
329	*		0.00	0.000	0.021	0.1425	0.0023	0.0169	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
330	*		0.00	0.000	0.021	0.1441	0.0024	0.0173	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
331	*		0.00	0.000	0.023	0.1456	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
332	*		0.00	0.000	0.023	0.1471	0.0025	0.0179	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
333	*		0.00	0.000	0.022	0.1486	0.0025	0.0181	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
334	*		0.00	0.000	0.011	0.1501	0.0025	0.0183	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
335	*		0.01	0.000	0.006	0.1511	0.0025	0.0183	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
336	*		0.04	0.000	0.004	0.1526	0.0026	0.0186	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
337	*		0.00	0.000	0.012	0.1529	0.0026	0.0189	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
338	*		0.00	0.000	0.000	0.1528	0.0026	0.0190	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
339	*	*	0.46	0.000	0.012	0.1528	0.0025	0.0180	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
340	*	*	0.11	0.000	0.012	0.1528	0.0026	0.0187	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
341		*	0.14	0.000	0.000	0.1769	0.0027	0.0192	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
342	*	*	0.00	0.000	0.011	0.1769	0.0027	0.0196	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
343	*	*	0.00	0.000	0.006	0.1769	0.0027	0.0198	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
344	*	*	0.01	0.000	0.013	0.1769	0.0027	0.0198	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
345	*	*	0.20	0.000	0.007	0.1769	0.0027	0.0198	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
346	*	*	0.00	0.000	0.015	0.1769	0.0027	0.0197	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
347	*	*	0.00	0.000	0.008	0.1769	0.0027	0.0196	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
348		*	0.00	0.000	0.020	0.1825	0.0027	0.0195	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
349		*	0.00	0.000	0.000	0.2212	0.0027	0.0193	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
350	*	*	0.05	0.000	0.026	0.2212	0.0026	0.0192	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
351	*	*	0.56	0.000	0.022	0.2212	0.0026	0.0190	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
352	*	*	0.00	0.000	0.023	0.2212	0.0026	0.0188	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00

353		*	0.00	0.000	0.000	0.2252	0.0026	0.0187	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
354		*	0.08	0.000	0.000	0.2578	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
355	*	*	0.12	0.000	0.016	0.2578	0.0025	0.0184	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
356		*	0.57	0.000	0.000	0.3289	0.0025	0.0182	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
357		*	0.00	0.000	0.000	0.3293	0.0025	0.0181	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
358		*	0.32	0.000	0.000	0.3555	0.0025	0.0180	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
359		*	0.00	0.000	0.000	0.3555	0.0025	0.0179	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
360	*	*	0.00	0.000	0.000	0.3555	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
361		*	0.00	0.000	0.000	0.3555	0.0024	0.0177	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
362		*	0.08	0.000	0.000	0.3622	0.0024	0.0176	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
363		*	0.20	0.000	0.000	0.3792	0.0024	0.0175	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
364		*	0.70	0.000	0.000	0.4371	0.0024	0.0174	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
365		*	0.14	0.000	0.000	0.4491	0.0024	0.0173	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

* = Frozen (air or soil)

Annual Totals for Year 4			
	inches	cubic feet	percent
Precipitation	30.39	110,318.2	100.00
Runoff	0.000	0.0000	0.00
Evapotranspiration	22.245	80,750.8	73.20
Drainage Collected from Layer 3	8.2670	30,009.3	27.20
Percolation/Leakage through Layer 5	0.000003	0.0091	0.00
Average Head on Top of Layer 4	0.0031	---	---
Drainage Collected from Layer 7	0.0000	0.0063	0.00
Percolation/Leakage through Layer 9	0.000001	0.0028	0.00
Average Head on Top of Layer 8	0.0000	---	---
Percolation/Leakage through Layer 10	0.000000	0.0000	0.00
Change in Water Storage	-0.1218	-442.0	-0.40
Soil Water at Start of Year	60.4915	219,584.1	199.05
Soil Water at End of Year	60.7769	220,620.0	199.99
Snow Water at Start of Year	0.4071	1,477.9	1.34
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	0.0000	0.0000	0.00

Daily Output for Year 5

Column key: Head #1: drainage from Layer 4 | Head #2: drainage from Layer 8
Drain #1: drainage from Layer 3 | Drain #2: drainage from Layer 7
Leak #1: leakage thru Layer 5 | Leak #2: leakage thru Layer 9 | Leak #3: leakage thru Layer 10

Title: Wayne Disposal - Initial Lift
Simulated On: 3/23/2021 13:00

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1	Head #2	Drain #2	Leak #2	Head #3	Drain #3	Leak #3
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1		*	0.00	0.000	0.000	0.4491	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
2		*	0.00	0.000	0.000	0.4491	0.0024	0.0171	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
3		*	0.00	0.000	0.000	0.4491	0.0023	0.0170	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
4	*	*	0.00	0.000	0.000	0.4491	0.0023	0.0169	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
5		*	0.34	0.000	0.000	0.4570	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
6			0.00	0.000	0.078	0.2403	0.0015	0.0107	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
7			0.00	0.000	0.041	0.2235	0.0011	0.0077	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
8			0.00	0.000	0.041	0.2126	0.0018	0.0130	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
9	*		0.19	0.000	0.018	0.2090	0.0023	0.0168	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
10	*		0.00	0.000	0.024	0.2066	0.0027	0.0193	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
11			0.00	0.000	0.039	0.2095	0.0029	0.0209	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
12			0.00	0.000	0.043	0.2032	0.0030	0.0218	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
13	*		0.01	0.000	0.033	0.1991	0.0034	0.0249	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
14			0.03	0.000	0.053	0.1951	0.0043	0.0310	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
15			0.05	0.000	0.041	0.1943	0.0042	0.0307	7.31E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
16			0.01	0.000	0.042	0.1903	0.0037	0.0270	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
17			0.00	0.000	0.074	0.1824	0.0033	0.0241	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
18			0.00	0.000	0.054	0.1762	0.0030	0.0217	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
19			0.00	0.000	0.056	0.1699	0.0027	0.0197	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
20	*		0.00	0.000	0.000	0.1692	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
21	*		0.06	0.000	0.023	0.1702	0.0020	0.0144	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
22	*		0.05	0.000	0.026	0.1713	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
23	*		0.11	0.000	0.015	0.1723	0.0007	0.0053	6.91E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
24	*		0.29	0.000	0.006	0.1733	0.0001	0.0007	6.53E-09	0.0000	0.0000	2.13E-09	0.0000	0.0000	0.00E+00
25	*		0.08	0.000	0.000	0.1744	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
26	*		0.05	0.000	0.000	0.1754	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
27			0.00	0.000	0.011	0.1957	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
28			0.01	0.000	0.028	0.2087	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
29			0.04	0.000	0.051	0.2069	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
30	*		0.03	0.000	0.019	0.2072	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
31	*		0.00	0.000	0.000	0.2067	0.0007	0.0050	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
32	*	*	0.00	0.000	0.000	0.2067	0.0013	0.0093	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
33	*	*	0.02	0.000	0.010	0.2067	0.0027	0.0197	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
34	*	*	0.17	0.000	0.000	0.2067	0.0038	0.0278	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
35		*	0.00	0.000	0.045	0.2182	0.0046	0.0334	7.35E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
36		*	0.00	0.000	0.000	0.2182	0.0051	0.0371	7.40E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
37		*	0.00	0.000	0.000	0.2182	0.0055	0.0397	7.44E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00

38		*	0.01	0.000	0.000	0.2192	0.0057	0.0416	7.47E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
39		*	0.00	0.000	0.000	0.2192	0.0059	0.0429	7.49E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
40	*	*	0.00	0.000	0.000	0.2192	0.0061	0.0439	7.50E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
41		*	0.00	0.000	0.000	0.2192	0.0062	0.0447	7.51E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
42	*	*	0.00	0.000	0.000	0.2192	0.0062	0.0452	7.52E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
43	*	*	0.04	0.000	0.030	0.2192	0.0063	0.0456	7.52E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
44	*	*	0.00	0.000	0.006	0.2192	0.0063	0.0459	7.53E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
45	*	*	0.00	0.000	0.000	0.2192	0.0064	0.0460	7.53E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
46		*	0.00	0.000	0.000	0.2192	0.0064	0.0461	7.53E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
47		*	0.00	0.000	0.000	0.2192	0.0064	0.0460	7.53E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
48		*	0.33	0.000	0.000	0.2471	0.0063	0.0459	7.53E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
49	*	*	0.15	0.000	0.035	0.2471	0.0063	0.0457	7.53E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
50		*	0.00	0.000	0.040	0.2478	0.0063	0.0455	7.52E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
51		*	0.00	0.000	0.063	0.2478	0.0062	0.0452	7.52E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
52		*	0.09	0.000	0.000	0.2555	0.0062	0.0448	7.51E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
53		*	0.00	0.000	0.000	0.2555	0.0061	0.0445	7.51E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
54		*	0.00	0.000	0.000	0.2555	0.0061	0.0441	7.50E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
55		*	0.00	0.000	0.000	0.2555	0.0060	0.0436	7.50E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
56		*	0.05	0.000	0.000	0.2598	0.0060	0.0432	7.49E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
57		*	0.00	0.000	0.000	0.2598	0.0059	0.0427	7.48E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
58			0.00	0.000	0.150	0.2355	0.0061	0.0443	7.51E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
59			0.02	0.000	0.098	0.2164	0.0058	0.0423	7.48E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
60			0.13	0.000	0.102	0.2121	0.0054	0.0394	7.43E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
61			0.03	0.000	0.104	0.2011	0.0053	0.0382	7.42E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
62			0.00	0.000	0.172	0.1836	0.0049	0.0356	7.38E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
63			0.00	0.000	0.140	0.1693	0.0046	0.0336	7.35E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
64			0.00	0.000	0.130	0.1571	0.0046	0.0332	7.34E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
65			0.67	0.000	0.054	0.2068	0.0067	0.0488	7.57E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
66			0.01	0.000	0.062	0.2011	0.0067	0.0484	7.56E-09	0.0000	0.0000	2.23E-09	0.0000	0.0000	0.00E+00
67			0.00	0.000	0.172	0.1857	0.0063	0.0457	7.52E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
68			0.00	0.000	0.161	0.1714	0.0066	0.0478	7.56E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
69			0.22	0.000	0.156	0.1760	0.0065	0.0469	7.54E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
70			0.01	0.000	0.127	0.1661	0.0058	0.0417	7.47E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
71			0.10	0.000	0.133	0.1623	0.0062	0.0453	7.52E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
72			0.00	0.000	0.110	0.1522	0.0056	0.0408	7.45E-09	0.0000	0.0000	2.22E-09	0.0000	0.0000	0.00E+00
73			0.00	0.000	0.054	0.1468	0.0049	0.0352	7.37E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
74	*		0.00	0.000	0.000	0.1460	0.0044	0.0315	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
75	*		0.00	0.000	0.000	0.1454	0.0038	0.0275	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
76			0.05	0.000	0.041	0.1453	0.0035	0.0254	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
77			0.00	0.000	0.035	0.1419	0.0033	0.0240	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
78			0.00	0.000	0.031	0.1390	0.0030	0.0219	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
79	*		0.00	0.000	0.028	0.1364	0.0030	0.0218	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
80	*		0.21	0.000	0.037	0.1377	0.0031	0.0222	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
81			0.08	0.000	0.047	0.1535	0.0029	0.0207	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
82			0.16	0.000	0.026	0.1641	0.0028	0.0203	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00

83		0.16	0.000	0.121	0.1665	0.0028	0.0204	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
84		0.00	0.000	0.318	0.1398	0.0021	0.0154	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
85		0.00	0.000	0.110	0.1306	0.0021	0.0151	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
86		0.00	0.000	0.054	0.1260	0.0025	0.0182	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
87		0.62	0.000	0.041	0.1745	0.0026	0.0190	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
88	*	0.47	0.000	0.017	0.1759	0.0027	0.0195	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
89		0.07	0.000	0.060	0.2125	0.0026	0.0189	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
90	*	0.00	0.000	0.000	0.2123	0.0026	0.0187	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
91	*	0.00	0.000	0.000	0.2121	0.0026	0.0188	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
92	*	0.00	0.000	0.102	0.2033	0.0027	0.0199	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
93		0.00	0.000	0.131	0.1924	0.0023	0.0169	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
94		0.00	0.000	0.233	0.1729	0.0026	0.0191	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
95		0.00	0.000	0.210	0.1549	0.0032	0.0233	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
96		0.03	0.000	0.130	0.1454	0.0036	0.0260	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
97		0.00	0.000	0.054	0.1398	0.0030	0.0219	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
98		0.00	0.000	0.041	0.1359	0.0022	0.0156	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
99		0.00	0.000	0.023	0.1335	0.0024	0.0176	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
100		0.00	0.000	0.031	0.1309	0.0025	0.0182	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
101		0.00	0.000	0.028	0.1275	0.0038	0.0276	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
102		0.00	0.000	0.025	0.1235	0.0038	0.0277	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
103		0.08	0.000	0.024	0.1252	0.0035	0.0254	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
104		0.00	0.000	0.022	0.1211	0.0033	0.0240	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
105		0.17	0.000	0.021	0.1319	0.0031	0.0226	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
106		0.17	0.000	0.020	0.1435	0.0029	0.0213	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
107		0.23	0.000	0.019	0.1600	0.0032	0.0231	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
108		0.00	0.000	0.098	0.1511	0.0034	0.0248	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
109		0.00	0.000	0.157	0.1368	0.0041	0.0300	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
110		0.11	0.000	0.129	0.1345	0.0034	0.0248	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
111		0.00	0.000	0.054	0.1291	0.0046	0.0335	7.35E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
112		0.00	0.000	0.041	0.1247	0.0046	0.0335	7.35E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
113		0.00	0.000	0.032	0.1214	0.0041	0.0296	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
114		0.00	0.000	0.025	0.1185	0.0043	0.0314	7.32E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
115		0.00	0.000	0.028	0.1161	0.0038	0.0275	7.26E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
116		0.08	0.000	0.026	0.1201	0.0046	0.0332	7.34E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
117		0.21	0.000	0.024	0.1352	0.0042	0.0305	7.30E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
118		0.00	0.000	0.022	0.1329	0.0040	0.0289	7.28E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
119		0.12	0.000	0.021	0.1406	0.0040	0.0289	7.28E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
120		0.00	0.000	0.020	0.1385	0.0037	0.0267	7.25E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
121	*	0.00	0.000	0.019	0.1365	0.0035	0.0253	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
122	*	0.00	0.000	0.000	0.1362	0.0034	0.0246	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
123	*	0.33	0.000	0.055	0.1376	0.0033	0.0241	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
124		0.21	0.000	0.000	0.1762	0.0032	0.0235	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
125		0.00	0.000	0.141	0.1642	0.0032	0.0231	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
126	*	0.06	0.000	0.038	0.1656	0.0033	0.0239	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
127		0.00	0.000	0.216	0.1470	0.0035	0.0257	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00

128		0.00	0.000	0.151	0.1340	0.0028	0.0200	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
129	*	0.08	0.000	0.078	0.1339	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
130	*	0.00	0.000	0.130	0.1227	0.0027	0.0198	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
131		0.00	0.000	0.054	0.1180	0.0025	0.0183	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
132		0.38	0.000	0.042	0.1457	0.0025	0.0180	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
133		0.25	0.000	0.135	0.1546	0.0028	0.0201	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
134		0.00	0.000	0.169	0.1400	0.0027	0.0197	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
135	*	0.00	0.000	0.100	0.1314	0.0023	0.0170	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
136		0.50	0.000	0.130	0.1622	0.0024	0.0176	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
137		0.00	0.000	0.079	0.1553	0.0023	0.0165	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
138		0.01	0.000	0.227	0.1368	0.0022	0.0161	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
139		0.30	0.000	0.130	0.1510	0.0022	0.0163	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
140		0.49	0.000	0.114	0.1825	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
141		0.22	0.000	0.185	0.1854	0.0026	0.0187	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
142		0.00	0.000	0.111	0.1761	0.0027	0.0192	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
143	*	0.20	0.000	0.112	0.1778	0.0027	0.0194	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
144		0.03	0.000	0.113	0.1768	0.0027	0.0194	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
145		0.00	0.000	0.229	0.1578	0.0027	0.0193	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
146		0.17	0.000	0.210	0.1548	0.0026	0.0191	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
147		0.01	0.000	0.091	0.1484	0.0026	0.0189	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
148		0.01	0.000	0.132	0.1379	0.0027	0.0194	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
149		0.13	0.000	0.130	0.1375	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
150		0.00	0.000	0.054	0.1334	0.0025	0.0179	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
151		0.02	0.000	0.042	0.1316	0.0024	0.0175	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
152		0.00	0.000	0.035	0.1287	0.0024	0.0175	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
153		0.00	0.000	0.031	0.1261	0.0024	0.0174	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
154		0.00	0.000	0.028	0.1238	0.0024	0.0173	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
155		0.10	0.000	0.026	0.1299	0.0024	0.0173	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
156		0.01	0.000	0.024	0.1286	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
157		0.00	0.000	0.022	0.1267	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
158		0.08	0.000	0.022	0.1316	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
159		0.29	0.000	0.021	0.1538	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
160		0.02	0.000	0.199	0.1390	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
161		0.96	0.000	0.020	0.2176	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
162		0.91	0.000	0.138	0.2816	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
163		0.11	0.000	0.160	0.2460	0.0028	0.0201	7.15E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
164		0.02	0.000	0.421	0.2023	0.0026	0.0189	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
165		0.22	0.000	0.287	0.1913	0.0020	0.0144	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
166		0.02	0.000	0.308	0.1629	0.0012	0.0090	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
167		0.15	0.000	0.131	0.1611	0.0010	0.0076	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
168		0.19	0.000	0.055	0.1709	0.0018	0.0133	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
169		0.05	0.000	0.042	0.1702	0.0025	0.0183	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
170		0.06	0.000	0.036	0.1713	0.0030	0.0216	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
171		0.00	0.000	0.031	0.1680	0.0032	0.0235	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
172		0.01	0.000	0.029	0.1662	0.0034	0.0245	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00

173	0.21	0.000	0.026	0.1811	0.0034	0.0249	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
174	0.07	0.000	0.360	0.1555	0.0041	0.0299	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
175	0.00	0.000	0.024	0.1532	0.0030	0.0220	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
176	0.14	0.000	0.023	0.1627	0.0033	0.0237	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
177	0.00	0.000	0.021	0.1606	0.0034	0.0250	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
178	0.00	0.000	0.020	0.1585	0.0034	0.0249	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
179	0.00	0.000	0.019	0.1564	0.0033	0.0240	7.21E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
180	0.00	0.000	0.018	0.1545	0.0031	0.0227	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
181	0.00	0.000	0.018	0.1526	0.0029	0.0213	7.17E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
182	0.00	0.000	0.017	0.1508	0.0027	0.0198	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
183	0.00	0.000	0.018	0.1494	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
184	0.13	0.000	0.017	0.1584	0.0025	0.0181	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
185	0.00	0.000	0.016	0.1567	0.0023	0.0165	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
186	0.00	0.000	0.015	0.1551	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
187	0.11	0.000	0.016	0.1626	0.0018	0.0133	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
188	0.00	0.000	0.015	0.1612	0.0017	0.0121	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
189	0.03	0.000	0.015	0.1622	0.0015	0.0110	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
190	0.06	0.000	0.015	0.1655	0.0014	0.0098	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
191	0.01	0.000	0.015	0.1650	0.0012	0.0086	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
192	0.00	0.000	0.013	0.1637	0.0012	0.0086	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
193	0.00	0.000	0.013	0.1624	0.0011	0.0083	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
194	0.00	0.000	0.013	0.1612	0.0011	0.0079	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
195	0.00	0.000	0.012	0.1599	0.0010	0.0074	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
196	0.03	0.000	0.014	0.1608	0.0010	0.0069	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
197	0.16	0.000	0.013	0.1726	0.0009	0.0065	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
198	0.00	0.000	0.355	0.1430	0.0006	0.0043	6.89E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
199	0.00	0.000	0.012	0.1416	0.0011	0.0080	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
200	0.22	0.000	0.013	0.1584	0.0010	0.0069	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
201	0.01	0.000	0.013	0.1582	0.0008	0.0059	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
202	0.04	0.000	0.013	0.1600	0.0007	0.0054	6.91E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
203	0.02	0.000	0.013	0.1603	0.0007	0.0053	6.91E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
204	0.00	0.000	0.011	0.1591	0.0008	0.0055	6.91E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
205	0.00	0.000	0.011	0.1580	0.0008	0.0058	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
206	0.00	0.000	0.011	0.1569	0.0009	0.0068	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
207	0.00	0.000	0.010	0.1558	0.0010	0.0071	6.94E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
208	0.00	0.000	0.010	0.1547	0.0010	0.0075	6.95E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
209	0.00	0.000	0.010	0.1537	0.0011	0.0081	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
210	0.00	0.000	0.010	0.1527	0.0012	0.0088	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
211	0.00	0.000	0.010	0.1517	0.0013	0.0095	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
212	0.00	0.000	0.010	0.1507	0.0014	0.0103	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
213	0.38	0.000	0.011	0.1809	0.0015	0.0110	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
214	0.05	0.000	0.268	0.1624	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
215	0.11	0.000	0.011	0.1706	0.0013	0.0096	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
216	0.00	0.000	0.251	0.1490	0.0021	0.0154	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
217	0.25	0.000	0.011	0.1691	0.0013	0.0093	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00

218	0.01	0.000	0.123	0.1590	0.0017	0.0124	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
219	0.03	0.000	0.011	0.1606	0.0016	0.0119	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
220	0.14	0.000	0.011	0.1711	0.0019	0.0135	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
221	0.00	0.000	0.319	0.1441	0.0023	0.0164	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
222	0.00	0.000	0.009	0.1433	0.0021	0.0151	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
223	0.00	0.000	0.009	0.1425	0.0022	0.0156	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
224	0.00	0.000	0.009	0.1417	0.0023	0.0166	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
225	0.00	0.000	0.009	0.1409	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
226	0.00	0.000	0.009	0.1401	0.0024	0.0176	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
227	0.00	0.000	0.009	0.1394	0.0024	0.0176	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
228	0.00	0.000	0.009	0.1387	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
229	0.00	0.000	0.009	0.1379	0.0025	0.0180	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
230	0.00	0.000	0.009	0.1372	0.0025	0.0180	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
231	0.17	0.000	0.010	0.1501	0.0025	0.0180	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
232	0.00	0.000	0.008	0.1494	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
233	0.00	0.000	0.008	0.1487	0.0024	0.0177	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
234	0.00	0.000	0.008	0.1480	0.0024	0.0175	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
235	0.00	0.000	0.008	0.1474	0.0024	0.0174	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
236	0.00	0.000	0.008	0.1467	0.0024	0.0172	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
237	0.00	0.000	0.008	0.1460	0.0023	0.0170	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
238	0.00	0.000	0.008	0.1453	0.0023	0.0169	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
239	0.00	0.000	0.008	0.1447	0.0023	0.0167	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
240	0.00	0.000	0.008	0.1440	0.0023	0.0166	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
241	0.00	0.000	0.008	0.1434	0.0023	0.0165	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
242	0.00	0.000	0.008	0.1427	0.0023	0.0165	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
243	0.00	0.000	0.008	0.1421	0.0022	0.0162	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
244	0.04	0.000	0.010	0.1446	0.0022	0.0161	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
245	0.00	0.000	0.008	0.1440	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
246	0.39	0.000	0.010	0.1755	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
247	0.00	0.000	0.228	0.1566	0.0022	0.0159	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
248	0.00	0.000	0.008	0.1559	0.0022	0.0159	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
249	0.00	0.000	0.007	0.1553	0.0022	0.0159	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
250	0.26	0.000	0.010	0.1760	0.0022	0.0158	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
251	0.00	0.000	0.176	0.1613	0.0022	0.0158	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
252	0.43	0.000	0.010	0.1962	0.0022	0.0158	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
253	0.01	0.000	0.138	0.1854	0.0022	0.0157	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
254	0.06	0.000	0.375	0.1592	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
255	0.95	0.000	0.132	0.2277	0.0021	0.0155	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
256	0.63	0.000	0.260	0.2583	0.0021	0.0156	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
257	0.00	0.000	0.251	0.2339	0.0022	0.0161	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
258	0.00	0.000	0.240	0.2017	0.0024	0.0177	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
259	0.00	0.000	0.265	0.1732	0.0023	0.0165	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
260	0.00	0.000	0.130	0.1599	0.0021	0.0155	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
261	0.00	0.000	0.054	0.1527	0.0020	0.0145	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
262	0.00	0.000	0.041	0.1476	0.0019	0.0135	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00

263		0.00	0.000	0.035	0.1416	0.0021	0.0149	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
264		0.00	0.000	0.031	0.1363	0.0020	0.0146	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
265		0.00	0.000	0.028	0.1318	0.0020	0.0143	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
266		0.00	0.000	0.025	0.1278	0.0014	0.0104	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
267	*	0.00	0.000	0.000	0.1264	0.0012	0.0084	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
268		0.24	0.000	0.025	0.1429	0.0015	0.0108	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
269		0.74	0.000	0.024	0.2014	0.0018	0.0128	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
270		0.95	0.000	0.149	0.2675	0.0023	0.0165	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
271		0.00	0.000	0.066	0.2453	0.0036	0.0259	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
272	*	0.00	0.000	0.069	0.2259	0.0038	0.0279	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
273		0.00	0.000	0.090	0.2105	0.0019	0.0141	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
274		0.10	0.000	0.084	0.2064	0.0018	0.0128	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
275		0.05	0.000	0.105	0.1977	0.0021	0.0153	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
276		0.01	0.000	0.105	0.1865	0.0024	0.0170	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
277		0.22	0.000	0.289	0.1787	0.0025	0.0182	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
278		0.00	0.000	0.197	0.1605	0.0026	0.0188	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
279		0.00	0.000	0.081	0.1523	0.0026	0.0192	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
280		0.03	0.000	0.055	0.1492	0.0027	0.0192	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
281		0.11	0.000	0.042	0.1547	0.0026	0.0191	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
282		0.00	0.000	0.035	0.1514	0.0026	0.0189	7.13E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
283		0.00	0.000	0.031	0.1484	0.0026	0.0185	7.12E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
284		0.00	0.000	0.028	0.1453	0.0025	0.0182	7.12E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
285		0.33	0.000	0.026	0.1700	0.0027	0.0194	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
286		0.00	0.000	0.253	0.1475	0.0032	0.0231	7.19E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
287		0.00	0.000	0.024	0.1456	0.0020	0.0147	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
288		0.05	0.000	0.023	0.1479	0.0020	0.0147	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
289		0.18	0.000	0.022	0.1606	0.0025	0.0178	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
290		0.00	0.000	0.104	0.1512	0.0029	0.0208	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
291		0.66	0.000	0.021	0.2043	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
292		0.00	0.000	0.067	0.1987	0.0023	0.0164	7.09E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
293		0.01	0.000	0.057	0.1940	0.0024	0.0173	7.10E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
294	*	0.04	0.000	0.025	0.1951	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
295		0.00	0.000	0.063	0.1893	0.0021	0.0149	7.07E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
296		0.00	0.000	0.102	0.1800	0.0019	0.0139	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
297	*	0.00	0.000	0.050	0.1754	0.0018	0.0129	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
298		0.00	0.000	0.061	0.1702	0.0014	0.0102	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
299		1.64	0.000	0.066	0.3013	0.0013	0.0096	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
300		0.00	0.000	0.112	0.2403	0.0013	0.0096	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
301		0.00	0.000	0.063	0.2222	0.0004	0.0030	6.16E-09	0.0000	0.0000	2.09E-09	0.0000	0.0000	0.00E+00
302		0.00	0.000	0.074	0.2088	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
303		0.00	0.000	0.080	0.1971	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
304		0.00	0.000	0.112	0.1838	0.0001	0.0004	4.77E-09	0.0000	0.0000	1.90E-09	0.0000	0.0000	0.00E+00
305		0.00	0.000	0.168	0.1673	0.0003	0.0020	6.85E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
306		0.00	0.000	0.074	0.1585	0.0005	0.0034	6.87E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
307		0.27	0.000	0.054	0.1750	0.0006	0.0047	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00

308		0.09	0.000	0.072	0.1756	0.0008	0.0058	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
309		0.00	0.000	0.056	0.1699	0.0009	0.0067	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
310		0.01	0.000	0.053	0.1657	0.0011	0.0082	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
311		0.00	0.000	0.093	0.1570	0.0017	0.0125	7.03E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
312		0.00	0.000	0.054	0.1512	0.0022	0.0160	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
313		0.00	0.000	0.041	0.1471	0.0020	0.0146	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
314		0.00	0.000	0.035	0.1436	0.0019	0.0140	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
315		0.04	0.000	0.031	0.1436	0.0018	0.0131	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
316		0.35	0.000	0.028	0.1701	0.0017	0.0123	7.02E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
317		0.00	0.000	0.054	0.1649	0.0016	0.0116	7.01E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
318		0.09	0.000	0.065	0.1659	0.0015	0.0110	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
319	*	0.00	0.000	0.031	0.1629	0.0014	0.0104	6.99E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
320	*	0.00	0.000	0.000	0.1624	0.0014	0.0099	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
321	*	0.00	0.000	0.000	0.1619	0.0013	0.0094	6.98E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
322	*	0.00	0.000	0.000	0.1614	0.0012	0.0089	6.97E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
323	*	0.07	0.000	0.026	0.1625	0.0011	0.0082	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
324		0.00	0.000	0.065	0.1582	0.0009	0.0062	6.92E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
325		0.00	0.000	0.125	0.1470	0.0007	0.0050	6.90E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
326		0.02	0.000	0.130	0.1377	0.0002	0.0011	6.83E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
327		0.00	0.000	0.054	0.1331	0.0000	0.0000	4.22E-10	0.0000	0.0000	3.72E-10	0.0000	0.0000	0.00E+00
328		0.00	0.000	0.041	0.1294	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
329		0.00	0.000	0.035	0.1262	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
330		0.00	0.000	0.031	0.1234	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
331		0.03	0.000	0.028	0.1229	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
332		0.35	0.000	0.026	0.1493	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
333		0.02	0.000	0.024	0.1486	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
334		0.02	0.000	0.023	0.1479	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
335		0.05	0.000	0.021	0.1498	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
336		0.02	0.000	0.020	0.1492	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
337		0.15	0.000	0.019	0.1597	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
338		0.18	0.000	0.066	0.1690	0.0001	0.0004	3.41E-09	0.0000	0.0000	1.64E-09	0.0000	0.0000	0.00E+00
339	*	0.01	0.000	0.029	0.1675	0.0005	0.0039	6.88E-09	0.0000	0.0000	2.16E-09	0.0000	0.0000	0.00E+00
340	*	0.00	0.000	0.000	0.1672	0.0009	0.0064	6.93E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
341	*	0.01	0.000	0.008	0.1670	0.0012	0.0086	6.96E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
342	*	0.00	0.000	0.000	0.1668	0.0015	0.0110	7.00E-09	0.0000	0.0000	2.17E-09	0.0000	0.0000	0.00E+00
343	*	0.02	0.000	0.015	0.1672	0.0018	0.0133	7.04E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
344	*	0.00	0.000	0.000	0.1670	0.0021	0.0156	7.08E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
345	*	0.35	0.000	0.007	0.1685	0.0024	0.0177	7.11E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
346	*	0.00	0.000	0.014	0.1700	0.0027	0.0195	7.14E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
347	*	0.00	0.000	0.014	0.1714	0.0029	0.0211	7.16E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
348		0.00	0.000	0.005	0.1926	0.0031	0.0224	7.18E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
349	*	0.00	0.000	0.034	0.1897	0.0032	0.0233	7.20E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
350	*	0.00	0.000	0.000	0.1896	0.0034	0.0247	7.22E-09	0.0000	0.0000	2.19E-09	0.0000	0.0000	0.00E+00
351	*	0.00	0.000	0.000	0.1895	0.0035	0.0254	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
352	*	0.63	0.000	0.026	0.1910	0.0036	0.0259	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00

353	*	0.32	0.000	0.024	0.1925	0.0036	0.0263	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
354		0.02	0.000	0.000	0.2647	0.0036	0.0262	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
355		0.28	0.000	0.042	0.2711	0.0039	0.0285	7.27E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
356		0.00	0.000	0.066	0.2459	0.0041	0.0294	7.29E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
357		0.00	0.000	0.085	0.2256	0.0036	0.0265	7.24E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
358		0.13	0.000	0.139	0.2172	0.0020	0.0148	7.06E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
359		0.00	0.000	0.045	0.2084	0.0020	0.0142	7.05E-09	0.0000	0.0000	2.18E-09	0.0000	0.0000	0.00E+00
360		0.01	0.000	0.039	0.2029	0.0035	0.0254	7.23E-09	0.0000	0.0000	2.20E-09	0.0000	0.0000	0.00E+00
361	*	0.01	0.000	0.029	0.1986	0.0045	0.0329	7.34E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
362	*	0.00	0.000	0.000	0.1958	0.0050	0.0364	7.39E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
363		0.00	0.000	0.044	0.1896	0.0052	0.0375	7.41E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
364	*	0.00	0.000	0.001	0.1877	0.0051	0.0372	7.40E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00
365	*	0.00	0.000	0.000	0.1862	0.0050	0.0361	7.39E-09	0.0000	0.0000	2.21E-09	0.0000	0.0000	0.00E+00

* = Frozen (air or soil)

Annual Totals for Year 5			
	inches	cubic feet	percent
Precipitation	27.07	98,265.9	100.00
Runoff	0.000	0.0000	0.00
Evapotranspiration	21.355	77,517.8	78.89
Drainage Collected from Layer 3	6.9638	25,278.6	25.72
Percolation/Leakage through Layer 5	0.000002	0.0090	0.00
Average Head on Top of Layer 4	0.0026	---	---
Drainage Collected from Layer 7	0.0000	0.0062	0.00
Percolation/Leakage through Layer 9	0.000001	0.0027	0.00
Average Head on Top of Layer 8	0.0000	---	---
Percolation/Leakage through Layer 10	0.000000	0.0000	0.00
Change in Water Storage	-1.2481	-4,530.5	-4.61
Soil Water at Start of Year	60.7769	220,620.0	224.51
Soil Water at End of Year	59.5288	216,089.6	219.90
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	0.0000	0.0000	0.00

Average Annual Totals Summary

Title: Wayne Disposal - Initial Lift
Simulated on: 3/23/2021 13:00

	Average Annual Totals for Years 1 - 5*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	30.01	[2.22]	108,930.5	100.00
Runoff	0.000	[0]	0.0000	0.00
Evapotranspiration	22.126	[2.863]	80,317.8	73.73
Subprofile1				
Lateral drainage collected from Layer 3	7.0270	[3.1781]	25,507.9	23.42
Percolation/leakage through Layer 5	0.000002	[0]	0.0087	0.00
Average Head on Top of Layer 4	0.0027	[0.0012]	---	---
Subprofile2				
Lateral drainage collected from Layer 7	0.0000	[0]	0.0060	0.00
Percolation/leakage through Layer 9	0.000001	[0]	0.0027	0.00
Average Head on Top of Layer 8	0.0000	[0]	---	---
Subprofile3				
Percolation/leakage through Layer 10	0.000000	[0]	0.0000	0.00
Water storage				
Change in water storage	0.8553	[2.0229]	3,104.8	2.85

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: Wayne Disposal - Initial Lift
Simulated on: 3/23/2021 13:00

	Peak Values for Years 1 - 5*		
	(inches)		(cubic feet)
Precipitation	1.64		5,960.5
Runoff	0.000		0.0000
Subprofile1			
Drainage collected from Layer 3	0.2416		876.9
Percolation/leakage through Layer 5	0.000000		0.0000
Average head on Layer 4	0.0333		---
Maximum head on Layer 4	0.0665		---
Location of maximum head in Layer 3	0.00	(feet from drain)	
Subprofile2			
Drainage collected from Layer 7	0.0000		0.0000
Percolation/leakage through Layer 9	0.000000		0.0000
Average head on Layer 8	0.0000		---
Maximum head on Layer 8	0.0000		---
Location of maximum head in Layer 7	0.00	(feet from drain)	
Subprofile3			
Percolation/leakage through Layer 10	0.000000		0.0000
Other Parameters			
Snow water	1.4263		5,177.4
Maximum vegetation soil water	0.4570	(vol/vol)	
Minimum vegetation soil water	0.1005	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: Wayne Disposal - Initial Lift
Simulated on: 3/23/2021 13:00
Simulation period: 5 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	25.5927	0.2133
2	1.8928	0.1577
3	0.0061	0.0305
4	0.0000	0.0000
5	0.3750	0.7500
6	22.3800	0.3730
7	0.0050	0.0100
8	0.0000	0.0000
9	0.3750	0.7500
10	8.9022	0.3709
Snow water	0.0000	---

Attachment A-6

Surface **Water Calculations**

ATTACHMENT A-6

SURFACE WATER MANAGEMENT SYSTEM DESIGN CALCULATIONS

Attachment

A-6.1 Surface Water Management System Design Approach
A-6.2 Surface Water Diversion Berm Analysis
A-6.3 Surface Water Downslope Channel Analysis
A-6.4 Surface Water Ditch Analysis
A-6.5 Culvert Analysis
A-6.6 Storm Sewer Analysis
A-6.7 Sedimentation Basin Analysis
A-6.8 Final Cover Drainage Layer Flow Capacity Analysis
A-6.9 Final Cover Erosion Potential Analysis

ATTACHMENT A-6.1

SURFACE WATER MANAGEMENT SYSTEM DESIGN APPROACH

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Management System Design Approach

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Surface Water Management System Design Approach

Objective

Summarize the surface water management system design approach, assumptions, and hydrologic parameters to be used in the analysis of the Wayne Disposal Inc. (WDI) surface water management system.

Design Criteria, Assumptions, and Methodology

1. The WDI surface water management system will consist of diversion berms, downslope channels, ditches, culverts, storm sewers, surface water infiltration, the North Sedimentation Basin (NSB), and the South Sedimentation Basin (SSB).
2. The surface water management system is designed in accordance with Rule 299.9619(6)(b).
3. The channels and basin are designed to collect and control the 25-yr, 24-hr storm event and to manage the 100-yr, 24-hr storm event with no off-site flooding.
4. Use rainfall data from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 8, Version 2. The 25-yr, 24-hour storm event is 3.95 inches, and the 100-yr, 24-hr storm event is 5.12 inches, see Attachment 6.1.1.
5. Conservatively assume hydrologic soil group D to calculate the run-off curve number. Hydrologic soil group D soils have a high runoff potential when thoroughly wet and typically have clayey textures and less than 50 percent sand.
6. Use storm distribution MSE-3 from the Atlas 14 rainfall for Midwest and Southeast States. See Attachment 6.1.2.
7. Run-off curve numbers will be chosen using Table 2-2 of Technical Release 55 (TR-55) Assume a cover type of “Fair Pasture”, CN of 84, for existing and proposed final cover areas as well as adjacent areas except MC I. Assume a cover type of “Good Pasture”, CN of 80, represents the existing established final cover vegetation on MC I. A curve number of 98 represents pond areas. See Attachment 6.1.3
8. Use HydroCAD to evaluate the surface water run-off and management features including the diversion berms, channels, and culverts. HydroCAD is based largely on hydrologic techniques developed by the SCS combined with other hydrologic and hydraulic calculations. For a given rainfall event, these techniques are used to generate hydrographs throughout a watershed. Storage-Indication-Translation Method routing techniques were used to route surface water through the surface water management system. The antecedent moisture condition specifies the moisture level in the ground immediately prior to the storm. A value of "2" for normal conditions is used in the analyses.
9. Use the Storm Water Management Model (SWMM) to evaluate the performance of storm sewers in the SSB watershed. SWMM is a dynamic rainfall-runoff simulation model developed by USEPA used for single event or long-term simulation of runoff quantity and quality from primarily urban areas. SWMM contains a flexible set of hydraulic modeling capabilities used to route runoff and external inflows through a drainage system network of pipes, channels, storage/treatment units and diversion structures. It has been widely used throughout the world

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Management System Design Approach

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Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

for planning, analysis, and design related to storm water runoff, combined and sanitary sewers, and other drainage systems.

10. Times of concentration were computed by HydroCAD using methodology developed by the SCS. A maximum sheet flow length of 200 ft was used prior to transitioning to shallow concentrated flow.
11. Surface water management system design is based on future final closure conditions.

Calculation

The North Sedimentation Basin (NSB) receives runoff from portions of MC IV, MC VI, MC VII, MC IX, MC X and MC XI consisting of a watershed area of approximately 272.7 acres. The conveyance structures in the NSB watershed include a detention pond, ditches, diversion berms and culverts.

The South Sedimentation Basin (SSB) receives runoff from portions of MC VI, MC I, MC VII, MC X, and MC XI, and portions of the entrance area, and the wastewater treatment plant. The total area of the SSB watershed is approximately 117.1 acres. The storm water conveyance structures in the SSB watershed include a detention pond, ditches, culverts, catch basins, and storm sewers.

The lined pond receives runoff from primarily of paved areas. The conveyance structures in the lined pond watershed consist of a storage basin, catch basins and storm sewers. The watershed area draining to the Lined Pond is reduced from conditions during site operations, therefore, the Lined Pond is anticipated to continue to provide adequate capacity to manage the runoff as originally designed and permitted. The lined pond was not reanalyzed in these calculations.

The proposed subbasin delineations and surface water management feature labels are provided in Attachment A-6.1.4. HydroCAD analyses were done separately for the NSB and the SSB watersheds. HydroCAD and SWMM model outputs are provided in Attachment A-6.1.5. Additional model inputs and output are discussed in the calculations related to the surface water management system components identified below.

Diversion Berms: Diversion berms are used to collect and route surface water run-off from landfill sideslopes to downslope channels. Design calculations are provided in Attachment A-6.2

Downslope Channels: Downslope channels are designed to route surface water from diversion berms down the steeper landfill sideslopes with no erosion. Design calculations are provided in Attachment A-6.3

Ditches: Ditches are used to route surface water run-off around the landfill and to sedimentation basins. Design calculations are provided in Attachment A-6.4

Culverts: Culverts are required to convey surface water run-off under access roads and through berms within the site. Existing and proposed culverts are evaluated in Attachment A-6.5

Storm Sewer: A network of storm sewers, catch basins, and manholes is used to route surface water run-off from a portion of the site the SSB. The storm sewer analysis is discussed in Attachment A-6.6

Sedimentation Basins: – Sedimentation basins on site will contain surface water prior to discharge off-site. The sedimentation basin analysis is provided in Attachment A-6.7

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Management System Design Approach

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

The Attachments to A-6.1 are summarized as follows:

A-6.1.1 Rainfall Data
A-6.1.2 Storm Distribution Data
A-6.1.3 Curve Number Data
A-6.1.4 Surface Water Management Figures
A-6.1.5 Surface Water Model Output

Conclusion

The model outputs and above information is used in the design of the surface water management features in the following surface water management system calculations.

Reference

1. "Precipitation-Frequency Atlas of the United States", NOAA Atlas 14, volume 2, Version 3, G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley, National Weather Service, Silver Spring, Maryland, 2004. Location: Van Buren Twp, Michigan, Lat. 42.223, Long. -83.5226.
2. Urban Hydrology for Small Watersheds, TR-55. June 1986, United States Department of Agriculture (USDA).

ATTACHMENT A-6.1.1

RAINFALL DATA

NOAA Atlas 14, Volume 8, Version 2
Location name: Van Buren Twp, Michigan, USA*
Latitude: 42.223°, Longitude: -83.5226°
Elevation: 699.8 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.321 (0.267-0.392)	0.379 (0.314-0.464)	0.475 (0.393-0.582)	0.556 (0.457-0.684)	0.670 (0.532-0.844)	0.759 (0.589-0.965)	0.850 (0.637-1.10)	0.943 (0.677-1.24)	1.07 (0.738-1.44)	1.17 (0.783-1.59)
10-min	0.470 (0.390-0.575)	0.555 (0.460-0.679)	0.696 (0.575-0.853)	0.814 (0.670-1.00)	0.981 (0.779-1.24)	1.11 (0.863-1.41)	1.24 (0.932-1.61)	1.38 (0.992-1.82)	1.57 (1.08-2.11)	1.71 (1.15-2.32)
15-min	0.573 (0.476-0.701)	0.676 (0.561-0.828)	0.848 (0.702-1.04)	0.993 (0.817-1.22)	1.20 (0.951-1.51)	1.36 (1.05-1.72)	1.52 (1.14-1.96)	1.68 (1.21-2.22)	1.91 (1.32-2.57)	2.08 (1.40-2.83)
30-min	0.767 (0.638-0.938)	0.907 (0.752-1.11)	1.14 (0.942-1.40)	1.34 (1.10-1.64)	1.61 (1.28-2.04)	1.83 (1.42-2.33)	2.06 (1.54-2.66)	2.29 (1.64-3.02)	2.60 (1.80-3.50)	2.84 (1.91-3.87)
60-min	0.970 (0.806-1.19)	1.15 (0.950-1.40)	1.44 (1.19-1.77)	1.70 (1.40-2.09)	2.07 (1.65-2.61)	2.36 (1.83-3.01)	2.66 (2.00-3.46)	2.98 (2.15-3.94)	3.42 (2.36-4.61)	3.76 (2.53-5.12)
2-hr	1.17 (0.980-1.42)	1.38 (1.16-1.68)	1.75 (1.45-2.12)	2.06 (1.70-2.52)	2.52 (2.02-3.17)	2.89 (2.26-3.66)	3.27 (2.47-4.22)	3.68 (2.66-4.84)	4.24 (2.95-5.69)	4.68 (3.17-6.33)
3-hr	1.30 (1.09-1.58)	1.53 (1.28-1.85)	1.93 (1.61-2.34)	2.28 (1.89-2.77)	2.79 (2.25-3.51)	3.21 (2.53-4.06)	3.66 (2.78-4.70)	4.13 (3.00-5.41)	4.79 (3.35-6.40)	5.31 (3.61-7.14)
6-hr	1.55 (1.30-1.85)	1.79 (1.51-2.15)	2.23 (1.87-2.68)	2.62 (2.19-3.16)	3.21 (2.61-4.01)	3.70 (2.93-4.66)	4.22 (3.23-5.41)	4.79 (3.52-6.25)	5.59 (3.94-7.44)	6.24 (4.27-8.33)
12-hr	1.81 (1.53-2.15)	2.06 (1.74-2.45)	2.51 (2.12-2.99)	2.92 (2.45-3.50)	3.55 (2.91-4.41)	4.08 (3.26-5.11)	4.66 (3.59-5.93)	5.28 (3.90-6.85)	6.17 (4.39-8.16)	6.89 (4.75-9.15)
24-hr	2.07 (1.77-2.45)	2.35 (2.00-2.77)	2.83 (2.41-3.36)	3.28 (2.77-3.90)	3.95 (3.26-4.87)	4.52 (3.63-5.60)	5.12 (3.97-6.47)	5.78 (4.30-7.43)	6.71 (4.80-8.80)	7.46 (5.18-9.83)
2-day	2.35 (2.02-2.76)	2.68 (2.30-3.15)	3.25 (2.78-3.82)	3.75 (3.19-4.43)	4.49 (3.71-5.46)	5.09 (4.11-6.25)	5.73 (4.46-7.15)	6.40 (4.79-8.15)	7.34 (5.28-9.54)	8.09 (5.65-10.6)
3-day	2.58 (2.22-3.01)	2.92 (2.51-3.41)	3.51 (3.01-4.11)	4.03 (3.43-4.73)	4.78 (3.97-5.79)	5.40 (4.37-6.59)	6.05 (4.73-7.51)	6.73 (5.05-8.53)	7.68 (5.55-9.94)	8.44 (5.92-11.0)
4-day	2.78 (2.40-3.23)	3.13 (2.70-3.64)	3.73 (3.21-4.35)	4.26 (3.64-4.99)	5.03 (4.18-6.07)	5.66 (4.59-6.88)	6.31 (4.95-7.82)	7.01 (5.27-8.86)	7.97 (5.77-10.3)	8.74 (6.15-11.4)
7-day	3.29 (2.85-3.80)	3.68 (3.19-4.26)	4.34 (3.75-5.03)	4.92 (4.22-5.72)	5.74 (4.79-6.87)	6.41 (5.22-7.74)	7.10 (5.60-8.74)	7.83 (5.92-9.83)	8.84 (6.43-11.3)	9.63 (6.82-12.4)
10-day	3.75 (3.26-4.32)	4.17 (3.63-4.81)	4.89 (4.23-5.64)	5.50 (4.74-6.38)	6.38 (5.34-7.59)	7.08 (5.79-8.51)	7.81 (6.17-9.55)	8.56 (6.50-10.7)	9.60 (7.01-12.2)	10.4 (7.40-13.4)
20-day	5.09 (4.46-5.82)	5.61 (4.90-6.41)	6.46 (5.63-7.40)	7.17 (6.22-8.24)	8.17 (6.86-9.61)	8.95 (7.35-10.6)	9.74 (7.74-11.8)	10.6 (8.06-13.1)	11.7 (8.56-14.7)	12.5 (8.94-16.0)
30-day	6.26 (5.50-7.12)	6.87 (6.03-7.82)	7.86 (6.87-8.96)	8.67 (7.54-9.92)	9.77 (8.23-11.4)	10.6 (8.75-12.5)	11.5 (9.13-13.8)	12.3 (9.42-15.1)	13.4 (9.88-16.8)	14.2 (10.2-18.1)
45-day	7.79 (6.87-8.83)	8.55 (7.53-9.69)	9.75 (8.56-11.1)	10.7 (9.35-12.2)	12.0 (10.1-13.9)	12.9 (10.7-15.1)	13.8 (11.0-16.5)	14.7 (11.3-17.9)	15.8 (11.6-19.7)	16.5 (11.9-21.0)
60-day	9.14 (8.08-10.3)	10.0 (8.87-11.3)	11.5 (10.1-13.0)	12.6 (11.0-14.3)	14.0 (11.8-16.1)	15.0 (12.4-17.5)	15.9 (12.7-18.9)	16.8 (12.9-20.4)	17.9 (13.2-22.2)	18.6 (13.5-23.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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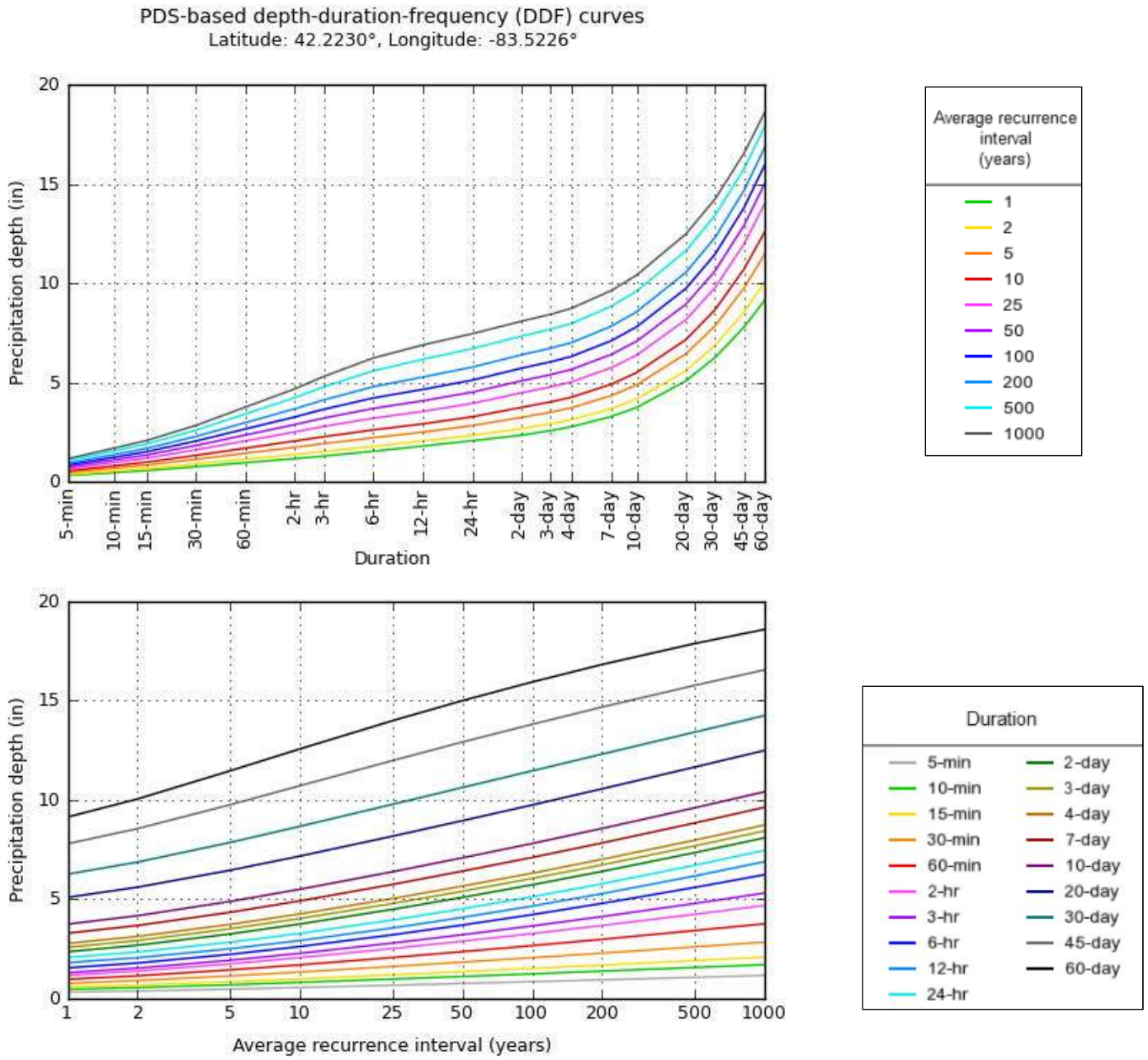
PF graphical



NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Fri Sep 18 16:15:02 2020

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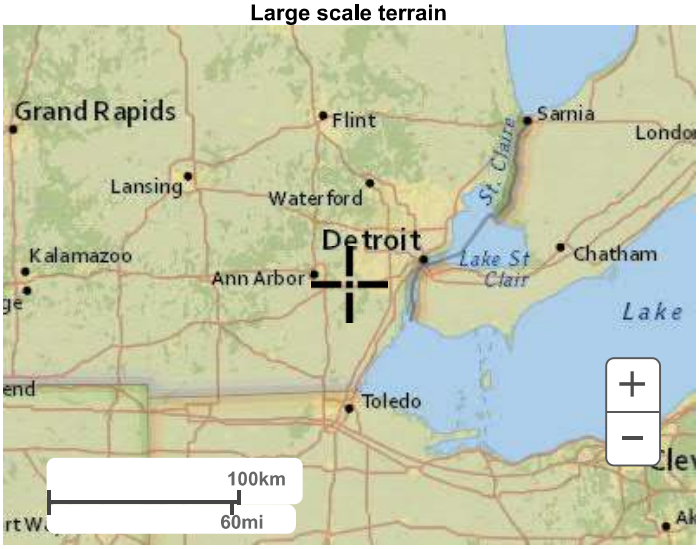
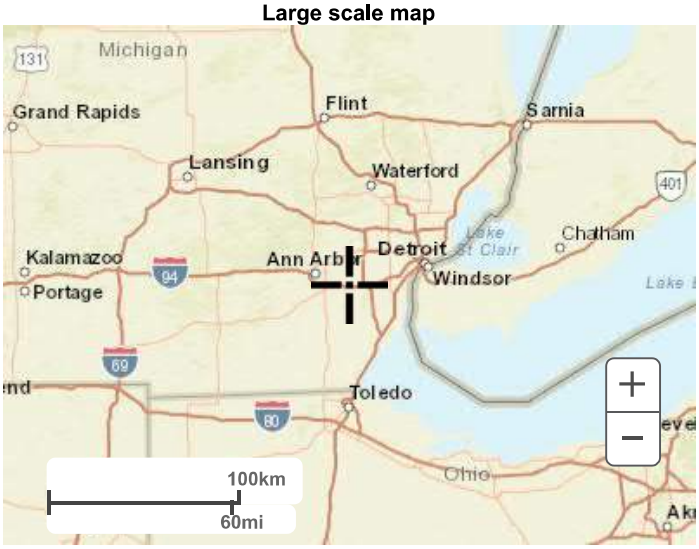
Maps & aerials

Small scale terrain

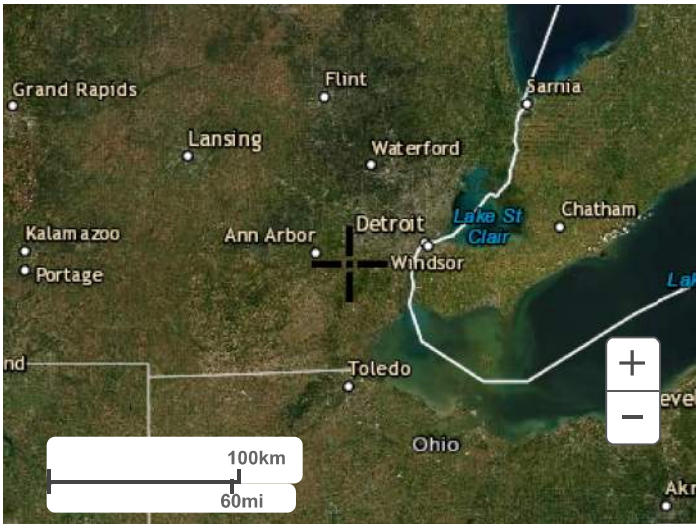
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

ATTACHMENT A-6.1.2

STORM DISTRIBUTION DATA

NOAA Atlas 14 rainfall for Midwest and Southeast states

Compiled by William Merkel and Helen Fox Moody, updated April 29, 2015

Statistics for NOAA Atlas 14 100-year 24-hour rainfall by state and county

Background

NOAA released volumes 8 and 9 of Atlas 14 for the midwest and southeast United States respectively on Monday April 22, 2013. Precipitation-frequency data are available from NOAA Atlas 14 for both annual and partial duration series at the NWS website http://hdsc.nws.noaa.gov/hdsc/pfds/. GIS data for the 100-year 24-hour partial duration rainfall were downloaded and prepared. State and county maps were overlayed on the GIS to derive statistics on a county basis. The GIS Spatial Analyst command Zonal Statistics as Table was used to generate minimum, maximum, range (difference between maximum and minimum), mean, and standard deviation of the 100-year 24-hour rainfall.

Considerable study of the NOAA 14 data (2006) for the Ohio Valley and neighboring states has been completed both by the Water Quality and Quantity Technology Development Team and by hydraulic engineers in the respective state offices and some procedures have been developed to prepare rainfall databases for the WinTR-55 and EFH-2 computer programs and for developing rainfall distributions to replace the Types II and III which were used in the past. Similar procedures are expected to be used in the midwest and southeast states (which border the Ohio Valley NOAA 14 area) due to similar climatic and topographic characteristics.

Instructions

Preparation of rainfall databases

The midwest and southeast states covered by NOAA Atlas 14 volumes 8 and 9 (except for Colorado) have rainfall data included in the WinTR-55 rainfall database by county or by parish in Louisiana. These same data are also included in rainfall data files used with the EFH-2 computer program. One option for users of these computer programs is to visit the NOAA 14 web site and download data at specific project sites. To save user's time and considering that users may not have internet access at all times, rainfall databases and data files are expected to be developed for these states. Whereas the current files are generally based on TP-40 (1961), data from NOAA Atlas 14 will be substituted.

The first step in this process is to develop maximum, minimum, range, and mean of the 100-year 24-hour rainfall by state and county or parish. This has been done by Bill Merkel and Helen Fox Moody . In states where there is enough topographic relief to product orographic effects in the rainfall amounts, such as Virginia, 100-year 24-hour rainfall could vary by up to 5 inches in a single county. To address this situation, if the rainfall varied more than 1.5 inches within a county, the county was split in two or more parts, each having a set of rainfall values in the rainfall database.

Some of the midwest and southeast states have all counties with less than 1.5 inch variation. Other states have several counties with more than 1.5 inches of variation.

If a county is to be split, use the following procedure:

- Split the county along some boundary such that the range of the 100-year 24-hour rainfall of each part is less than 1.5 inches.
- Start with a state/county GIS shapefile and digitize the boundary.
- In split counties, generate the statistics for each part (min, max, range, and mean).
- Select a representative point location in each county or part of split counties. Find a point in the county (or part of county) where the 100-year 24-hour rainfall is equal (or within 0.05 inch) of the mean county value. Record this latitude and longitude.
- Open the NOAA Atlas 14 web site and download the csv (comma separated variable) file for that location. Use the 1-year through 100-year 24-hour rainfall values at this location in the WinTR-55 rainfall database and the EFH-2 rainfall data file. A GIS layer will be developed with the set of locations in each state.
- Bill and Helen will assist any state with these steps if requested.

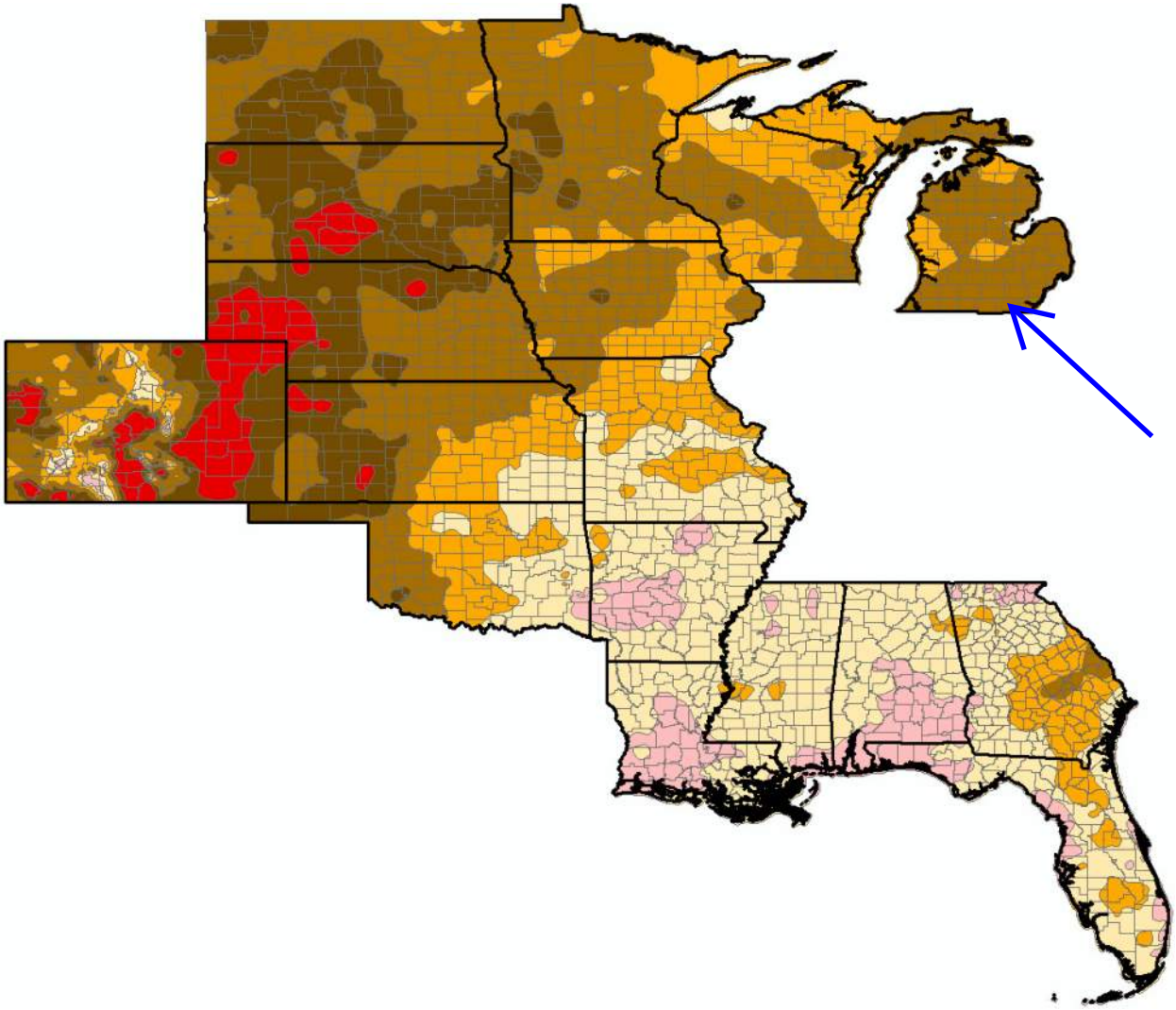
Development of rainfall distributions

The latest draft of Part 630 Chapter 4 Storm Rainfall and Distribution includes the procedures that will be used to develop rainfall distributions for the midwest and southeast states. The purpose of the rainfall distribution is to include all the rainfall amounts at shorter durations in the 24-hour rainfall distribution. For example, for a 25-year 24-hour storm, the 25-year 5-minute rainfall, 25-year 10-minute, rainfall, etc are included within the 24-hour distribution. This is accomplished by placing the 5-minute rainfall in the center (12 hours) and each larger duration being centered at 12 hours. The 60-minute rainfall is located between 11.5 and 12.5 hours. The 2-hour rainfall is located from 10 to 12 hours, etc.

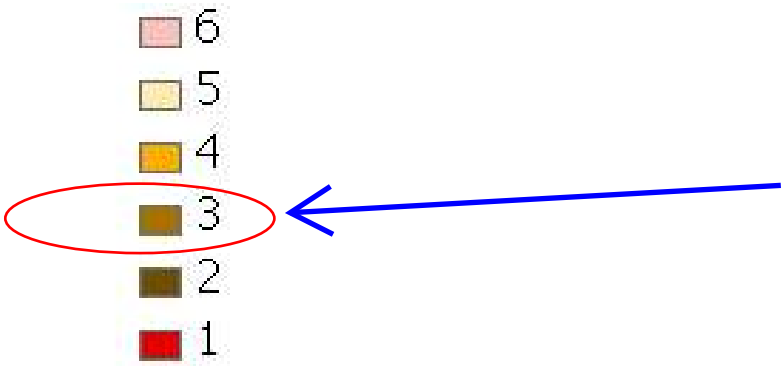
A map has been generated with the ratio of the 60-minute rainfall to the 24-hour rainfall for the 25-year values. In preliminary analyses, this ratio varies from a low value of 0.32 to a high value of 0.75. A rainfall distribution map has 6 rainfall distributions. Based on this ratio, areas within a range of values will be included as a rainfall distribution region. They are named MSE 1, MSE 2, through MSE 6 (MSE is abbreviated from midwest/southeast states). The range of ratio of 60-minute to 24-hour rainfall is in the following table.

Rainfall Distribution Name	Minimum 60-min/24-hour	Maximum 60-min/24-hour
MSE 1	0.58	0.75
MSE 2	0.53	0.58
MSE 3	0.48	0.53
MSE 4	0.43	0.48
MSE 5	0.38	0.43
MSE 6	0.32	0.38

For reference, the 60-minute to 24-hour ratio for the Type II rainfall distribution is 0.45 and the ratio for the Type III is 0.40. Based on the NOAA Atlas 14 data, rainfall distributions less intense, of similar intensity, and more intense than the Types II and III are being used.



Tentative rainfall distribution regions (based on GIS analysis).



Distribution region 1 has the most intense rainfall distribution and region 6 has the least intense rainfall distribution. In preliminary tests, regions 1 and 2 have peak discharges similar to the New Mexico 60 and 65 rainfall distributions (significantly higher than the Type II). Region 4 has peak discharges similar to the Type II rainfall distributions. Region 5 has peak discharges similar to the Type III rainfall distribution. Region 6 has peak discharges less than the Type III rainfall distribution.

Some may question whether to drop the Type II, Type III, and New Mexico rainfall distributions based on these preliminary conclusions. The Type II does not have any documentation remaining on specifically how it was developed and what data were used to develop it. We do not have documentation on the New Mexico rainfall distributions (there may be some documentation saved in the New Mexico state office). The Type III has significant documentation remaining and is based on data from TP-40 and NWS Hydro-35 report. The tentative rainfall distributions (map above) above are based on NOAA 14 data and similar procedures were used to develop rainfall distributions for the Ohio Valley and New York/New England states.

The map above is based entirely on the GIS data and does not consider state or county boundaries. When adjusting the map to fit state desires, the boundaries may be adjusted to follow county/parish boundaries. It is simpler for the field office staff to use a single rainfall distribution in a county. Two general choices have been used in states. One is to select the rainfall distribution that makes up the largest percentage of land area. The other choice is to select the more conservative rainfall distribution that is present in a county. For example, if a county is divided between rainfall distribution MSE 3 and MSE 4, then assign rainfall distribution MSE 3. Whichever choice is made, it is recommended to be consistent for all counties in a state.

Yet several states have chosen to follow the rainfall distributions as defined on the map above. This means that a single county may have more than one rainfall distribution and the user must read the map to determine which rainfall distribution to use.

ATTACHMENT A-6.1.3

CURVE NUMBER DATA

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a, = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

ATTACHMENT A-6.1.4

SURFACEWATER MANGEMENT FIGURES

SUBWATERSHED MAP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI - REV I
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

AIRPORT SERVICE RD.

WEST BOUND I-94

N. I-94 SERVICE DRIVE

MASTER CELL IV

MASTER CELL VI

MASTER CELL VII

MASTER CELL IX

MASTER CELL XI

MASTER CELL X

DB-1 DB-2 DB-3 DB-4 DB-5 DB-6 DB-7 DB-8 DB-9 DB-10 DB-11 DB-12 DB-14 DB-15 DB-16 DB-17 DB-18 DB-19 DB-20 DB-21 DB-22 DB-23 DB-24 DB-25 DB-26 DB-27 DB-28 DB-29 DB-30 DB-31 DB-32 DB-33 DB-34 DB-35 DB-36 DB-37 DB-38 DB-39 DB-40 DB-41 DB-42 DB-43 DB-44 DB-45 DB-46

DOWNSLOPE CHANNEL DS-1
DOWNSLOPE CHANNEL DS-2
DOWNSLOPE CHANNEL DS-3
DOWNSLOPE CHANNEL DS-4
DOWNSLOPE CHANNEL DS-5
DOWNSLOPE CHANNEL DS-6

TYPICAL DIVERSION BERM SLOPE -2%
TYPICAL DIVERSION BERM SLOPE- 2%

CONTAINMENT BERM
TOPO/CONTAINMENT BERM

NWD/MC VII CULVERT
2-12" HDPE
2-18" HDPE

N-MC VII CULVERT,
54" RCP
36" RCP

N-MC VII DITCH
N-MC IX DITCH
NE-MC IX DITCH
MCVII/IX CULVERT
3-24" CMP
MC VII/IX DITCH
MC VII/XI CULVERT
24" RCP
MC VII/XI DITCH
N-MC VI DITCH
S-MC VI DITCH
MC VI/11 DITCH
EXISTING 30-INCH CMP CULVERT, OVERFLOW REMAINS IN CHANNEL
MC X/XI CULVERT
30" HDPE (MIN)
MC X/XI DITCH
S-MC XI DV (DIVERSION BERM)
SSB EAST INLET CULVERT 30" RCP
E-MC IX DITCH
E-MC IX CULVERT
36" HDPE
NSB NORTH INLET CULVERT
54" RCP/HDPE
3-30" CMP
NSB SOUTH INLET CULVERT
3-30" HDPE
NSB-NORTH
LOWER TO ELEV. 693
NSB-SOUTH
E-MC X DV (DIVERSION BERM)
E-MC X DITCH
W-MC X DITCH
W-MC X DV (DIVERSION BERM)
S-MC X DITCH
SSB-NORTH
SSB-SOUTH
LINED POND SEE NOTE 5.
E-MCI CULVERT
E-MC I DITCH
TDU
PROPOSED JUNCTION MANHOLE
PROPOSED STORM SEWER
REST AREA

S1 S2 S3 S4 S4A S5 S6 S7 S8 S9 S10 S11 S12 S12.1 S12.2 S12.3 S13 S14 S15 S16 S17 S18 S19 S20

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN DECEMBER, 2020 BY WDI.
2. THE DESIGN SURFACE SHOWN REPRESENTS THE MCVI FINAL GRADES – 2021 REDESIGN BY CTI.
3. CONVEYANCE SYSTEMS ARE DESIGNED TO COLLECT AND CONTROL THE RUNOFF FROM AT LEAST A 25-YR, 24-HR STORM AND MANAGE A 100-YR, 24-HR STORM.
4. SURFACE WATER MANAGEMENT SYSTEM DESIGN INFORMATION PROVIDED IN APPENDIX A. ALTERNATE CONFIGURATIONS AND MATERIALS THAT MEET DESIGN CRITERIA MAY BE UTILIZED..
5. THIS EXPANSION REDUCES THE DRAINAGE AREA TO THE LINED POND. THEREFORE THE DESIGN OF THE LINED POND, LINED POND SEWER, AND ASSOCIATED DRAINAGE AREA WILL CONTINUE TO FUNCTION AS ORIGINALLY DESIGNED AND IS NOT PART OF THE SSB DRAINAGE AREA.

N

0 200 400

SCALE IN FEET

LEGEND

- 500 EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- DIVERSION BERM
- WATERSHED BOUNDARY
- DITCH FLOW PATH
- DIVERSION BERM
- DOWNSLOPE CHANNEL
- SOUTH SEDIMENTATION BASIN STORM SEWER
- LINED POND STORM SEWER
- CULVERT
- CATCH BASIN, CURB STYLE
- CATCH BASIN INLET
- STORM MANHOLE COVER
- LINED POND WATERSHED (NOT MODELED)
- CONTAINMENT BERM
- PROPOSED STORM SEWER
- PROPOSED CATCH BASIN/MANHOLE

REVISIONS			
REV	DATE	REVISION DESCRIPTION	APP
			DRN

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	LEH
CHECKED BY:	TCR
APPROVED BY:	XZ

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PROJECT NUMBER	1218070017
SCALE	1" = 200'
DRAWING NO	A-6.1.4 FIGURE 1

DB-35
DB-37
DB-36
DB-34
DB-42
DB-43
DB-44
DB-45
S16
S5
S4A
S12.1
S12.2
S12.3
S6
S8
S12
S15
S13
S14
S17
S18
S19
S9
S10
S7
S2
S20
TDU
SECURITY
I-94 SERVICE DRIVE
WEST BOUND I-94
12" RCP
24" RCP
42" RCP
12" CMP
5.4%
1%

NOTES:

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N

0 80 160

SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- WATERSHED BOUNDARY
- DITCH FLOW PATH
- DIVERSION BERM
- DOWNSLOPE CHANNEL
- SOUTH SEDIMENTATION BASIN STORM SEWER
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- STORM MANHOLE COVER
- LINED POND WATERSHED (NOT MODELED)
- CONTAINMENT BERM
- PROPOSED STORM SEWER
- PROPOSED CATCH BASIN/MANHOLE

REVISIONS			
REV	DATE	DESCRIPTION	
			APP
			DRN

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	LEH
CHECKED BY:	TCR
APPROVED BY:	XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI - REV I
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

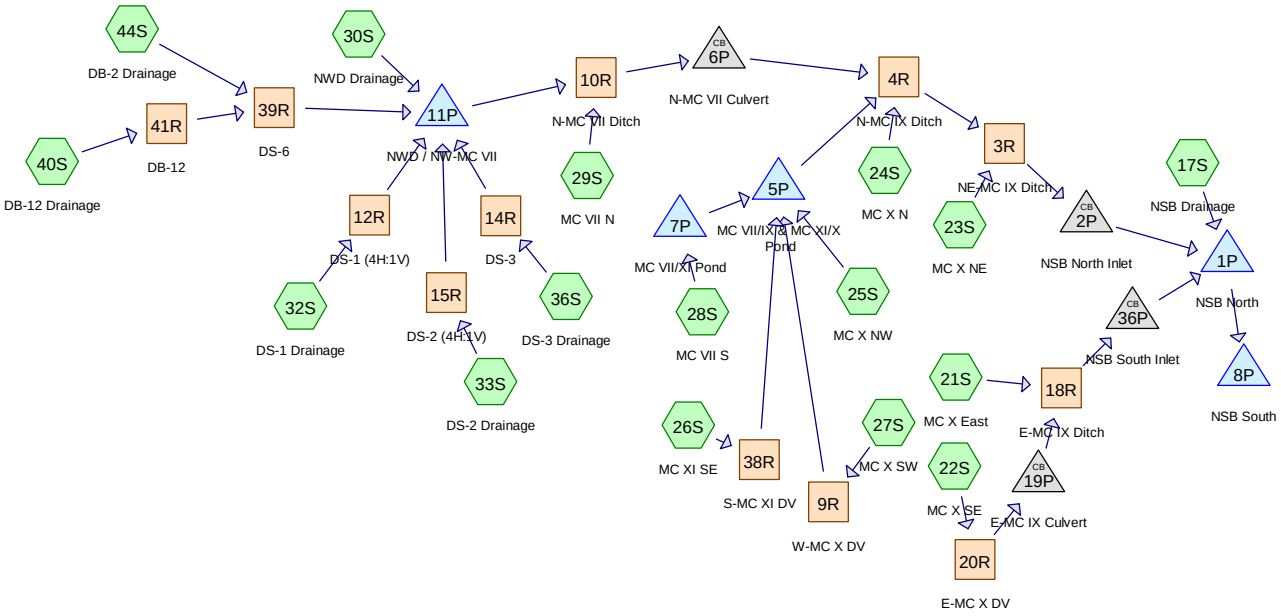
STORM SEWER SYSTEM PLAN

PROJECT NUMBER 1218070017
SCALE 1" = 80'
DRAWING NO A-6.1.4 FIGURE 2

ATTACHMENT A-6.1.5

SURFACE WATER MODEL OUTPUT

North Sedimentation Basin (NSB) HYDROCAD OUTPUT – 25-yr, 24-hr



Routing Diagram for WDI Vert Exp NSB 10-04-21
Prepared by {enter your company name here}, Printed 10/7/2021
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Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 17S: NSB Drainage Runoff Area=483,100 sf 0.00% Impervious Runoff Depth=3.38"
Tc=0.0 min CN=95 Runoff=76.09 cfs 3.125 af

Subcatchment 21S: MC X East Runoff Area=443,100 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=650' Slope=0.0370 '/' Tc=21.2 min CN=84 Runoff=25.66 cfs 1.973 af

Subcatchment 22S: MC X SE Runoff Area=527,091 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=240' Slope=0.0540 '/' Tc=15.5 min CN=84 Runoff=35.62 cfs 2.347 af

Subcatchment 23S: MC X NE Runoff Area=435,600 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=440' Slope=0.0590 '/' Tc=15.3 min CN=84 Runoff=29.79 cfs 1.939 af

Subcatchment 24S: MC X N Runoff Area=282,100 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=310' Slope=0.0930 '/' Tc=11.7 min CN=84 Runoff=21.63 cfs 1.256 af

Subcatchment 25S: MC X NW Runoff Area=2,437,500 sf 8.04% Impervious Runoff Depth=2.41"
Flow Length=820' Slope=0.0380 '/' Tc=23.0 min CN=85 Runoff=139.97 cfs 11.253 af

Subcatchment 26S: MC XI SE Runoff Area=95,200 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=405' Slope=0.0770 '/' Tc=13.4 min CN=84 Runoff=6.90 cfs 0.424 af

Subcatchment 27S: MC X SW Runoff Area=600,400 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=240' Slope=0.0400 '/' Tc=17.5 min CN=84 Runoff=38.28 cfs 2.673 af

Subcatchment 28S: MC VII S Runoff Area=998,400 sf 3.90% Impervious Runoff Depth=2.41"
Flow Length=1,070' Tc=20.9 min CN=85 Runoff=60.13 cfs 4.609 af

Subcatchment 29S: MC VII N Runoff Area=349,700 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=560' Slope=0.0390 '/' Tc=19.5 min CN=84 Runoff=21.14 cfs 1.557 af

Subcatchment 30S: NWD Drainage Runoff Area=1,229,971 sf 16.38% Impervious Runoff Depth=2.50"
Tc=0.0 min CN=86 Runoff=159.29 cfs 5.885 af

Subcatchment 32S: DS-1 Drainage Runoff Area=1,563,637 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=2,073' Tc=9.9 min CN=84 Runoff=128.87 cfs 6.961 af

Subcatchment 33S: DS-2 Drainage Runoff Area=922,087 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=1,697' Tc=8.4 min CN=84 Runoff=80.78 cfs 4.105 af

Subcatchment 36S: DS-3 Drainage Runoff Area=1,400,534 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=1,993' Tc=8.8 min CN=84 Runoff=120.53 cfs 6.235 af

Subcatchment 40S: DB-12 Drainage Runoff Area=77,446 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=777' Tc=3.2 min CN=84 Runoff=8.38 cfs 0.345 af

Subcatchment 44S: DB-2 Drainage Runoff Area=33,395 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=540' Tc=3.0 min CN=84 Runoff=3.55 cfs 0.149 af

Reach 3R: NE-MC IX Ditch Avg. Flow Depth=1.36' Max Vel=2.55 fps Inflow=125.65 cfs 46.355 af
n=0.025 L=1,090.0' S=0.0014 '/' Capacity=1,435.24 cfs Outflow=124.53 cfs 46.355 af

Reach 4R: N-MC IX Ditch Avg. Flow Depth=2.37' Max Vel=1.90 fps Inflow=123.14 cfs 44.416 af
n=0.025 L=950.0' S=0.0004 '/' Capacity=458.97 cfs Outflow=120.53 cfs 44.416 af

Reach 9R: W-MC X DV Avg. Flow Depth=1.37' Max Vel=3.22 fps Inflow=38.28 cfs 2.673 af
n=0.025 L=1,400.0' S=0.0050 '/' Capacity=165.41 cfs Outflow=33.14 cfs 2.673 af

Reach 10R: N-MC VII Ditch Avg. Flow Depth=0.97' Max Vel=2.42 fps Inflow=62.78 cfs 25.237 af
n=0.025 L=920.0' S=0.0020 '/' Capacity=424.80 cfs Outflow=60.69 cfs 25.237 af

Reach 12R: DS-1 (4H:1V) Avg. Flow Depth=0.58' Max Vel=16.60 fps Inflow=128.87 cfs 6.961 af
n=0.029 L=764.0' S=0.2500 '/' Capacity=1,087.59 cfs Outflow=125.56 cfs 6.961 af

Reach 14R: DS-3 Avg. Flow Depth=0.62' Max Vel=17.09 fps Inflow=120.53 cfs 6.235 af
n=0.029 L=712.0' S=0.2500 '/' Capacity=930.83 cfs Outflow=116.31 cfs 6.235 af

Reach 15R: DS-2 (4H:1V) Avg. Flow Depth=0.49' Max Vel=14.86 fps Inflow=80.78 cfs 4.105 af
n=0.029 L=616.0' S=0.2500 '/' Capacity=930.83 cfs Outflow=77.93 cfs 4.105 af

Reach 18R: E-MC IX Ditch Avg. Flow Depth=1.04' Max Vel=3.40 fps Inflow=53.67 cfs 4.319 af
n=0.025 L=585.0' S=0.0068 '/' Capacity=457.74 cfs Outflow=52.37 cfs 4.319 af

Reach 20R: E-MC X DV Avg. Flow Depth=1.49' Max Vel=4.71 fps Inflow=35.62 cfs 2.347 af
n=0.025 L=1,780.0' S=0.0100 '/' Capacity=68.87 cfs Outflow=30.87 cfs 2.347 af

Reach 38R: S-MC XI DV Avg. Flow Depth=0.66' Max Vel=3.70 fps Inflow=6.90 cfs 0.424 af
n=0.025 L=750.0' S=0.0180 '/' Capacity=57.72 cfs Outflow=6.40 cfs 0.424 af

Reach 39R: DS-6 Avg. Flow Depth=0.26' Max Vel=4.26 fps Inflow=11.60 cfs 0.493 af
n=0.078 L=78.0' S=0.3333 '/' Capacity=399.61 cfs Outflow=11.33 cfs 0.493 af

Reach 41R: DB-12 Avg. Flow Depth=0.69' Max Vel=5.80 fps Inflow=8.38 cfs 0.345 af
n=0.025 L=191.5' S=0.0430 '/' Capacity=142.25 cfs Outflow=8.03 cfs 0.345 af

Pond 1P: NSB North Peak Elev=693.39' Storage=2,163,542 cf Inflow=147.48 cfs 53.799 af
Outflow=27.48 cfs 8.777 af

Pond 2P: NSB North Inlet Peak Elev=698.30' Inflow=124.53 cfs 46.355 af
Outflow=124.53 cfs 46.355 af

Pond 5P: MC VII/IX & MC XI/X Pond Peak Elev=702.40' Storage=316,954 cf Inflow=197.15 cfs 18.817 af
24.0" Round Culvert x 3.00 n=0.025 L=30.0' S=0.0033 '/' Outflow=62.08 cfs 17.923 af

Pond 6P: N-MC VII Culvert Peak Elev=699.89' Inflow=60.69 cfs 25.237 af
Outflow=60.69 cfs 25.237 af

Pond 7P: MC VII/XI Pond Peak Elev=707.14' Storage=49,037 cf Inflow=60.13 cfs 4.609 af
Outflow=30.71 cfs 4.468 af

Pond 8P: NSB South Peak Elev=683.41' Storage=897,067 cf Inflow=27.48 cfs 8.777 af
Outflow=0.00 cfs 0.000 af

Pond 11P: NWD / NW-MC VII Peak Elev=710.23' Storage=512,970 cf Inflow=366.38 cfs 23.680 af
Outflow=44.48 cfs 23.680 af

Pond 19P: E-MC IX Culvert Peak Elev=704.16' Inflow=30.87 cfs 2.347 af
36.0" Round Culvert n=0.012 L=72.0' S=0.0365 '/' Outflow=30.87 cfs 2.347 af

Pond 36P: NSB South Inlet Peak Elev=697.13' Inflow=52.37 cfs 4.319 af
30.0" Round Culvert x 3.00 n=0.012 L=110.0' S=0.0091 '/' Outflow=52.37 cfs 4.319 af

Total Runoff Area = 272.710 ac Runoff Volume = 54.835 af Average Runoff Depth = 2.41"
96.33% Pervious = 262.692 ac 3.67% Impervious = 10.018 ac

Summary for Subcatchment 17S: NSB Drainage

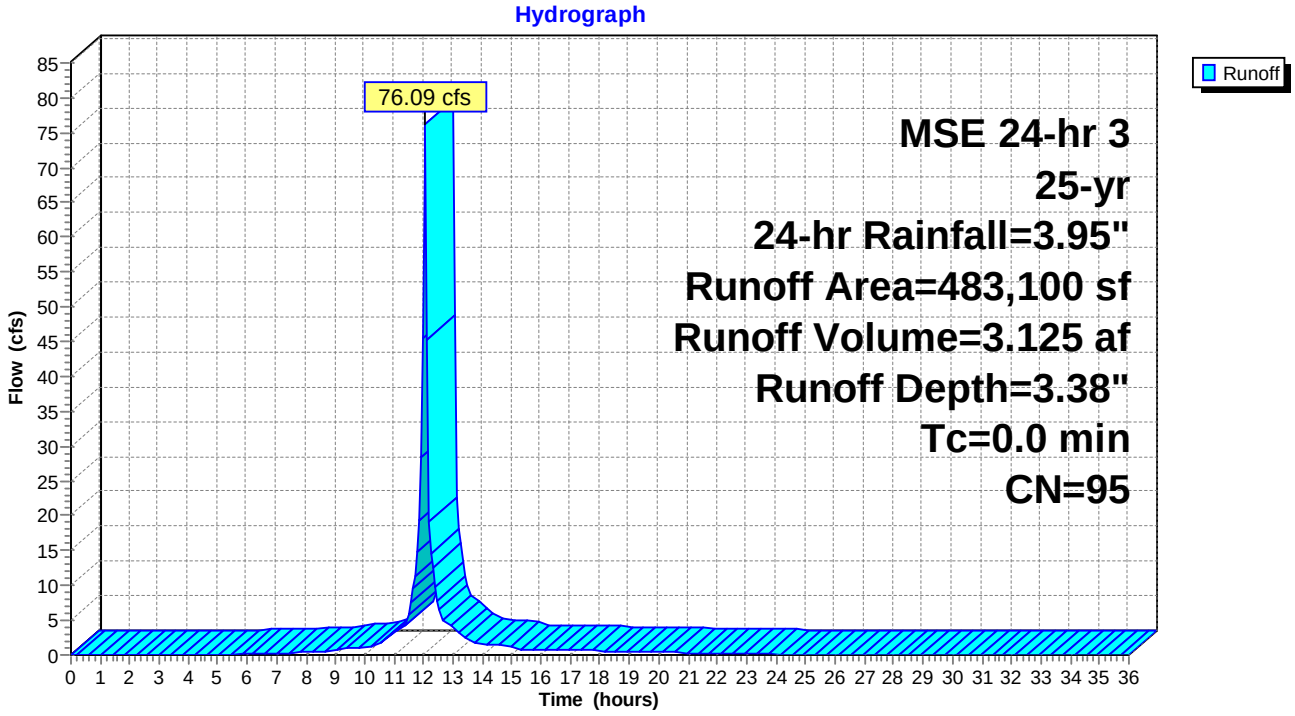
Drainage area is pond area and land area
Land area = 483,100 - 111,900 = 371,200

Runoff = 76.09 cfs @ 12.06 hrs, Volume= 3.125 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
111,900	84	50-75% Grass cover, Fair, HSG D
371,200	98	Water Surface, 0% imp, HSG D
483,100	95	Weighted Average
483,100		100.00% Pervious Area

Subcatchment 17S: NSB Drainage



Summary for Subcatchment 21S: MC X East

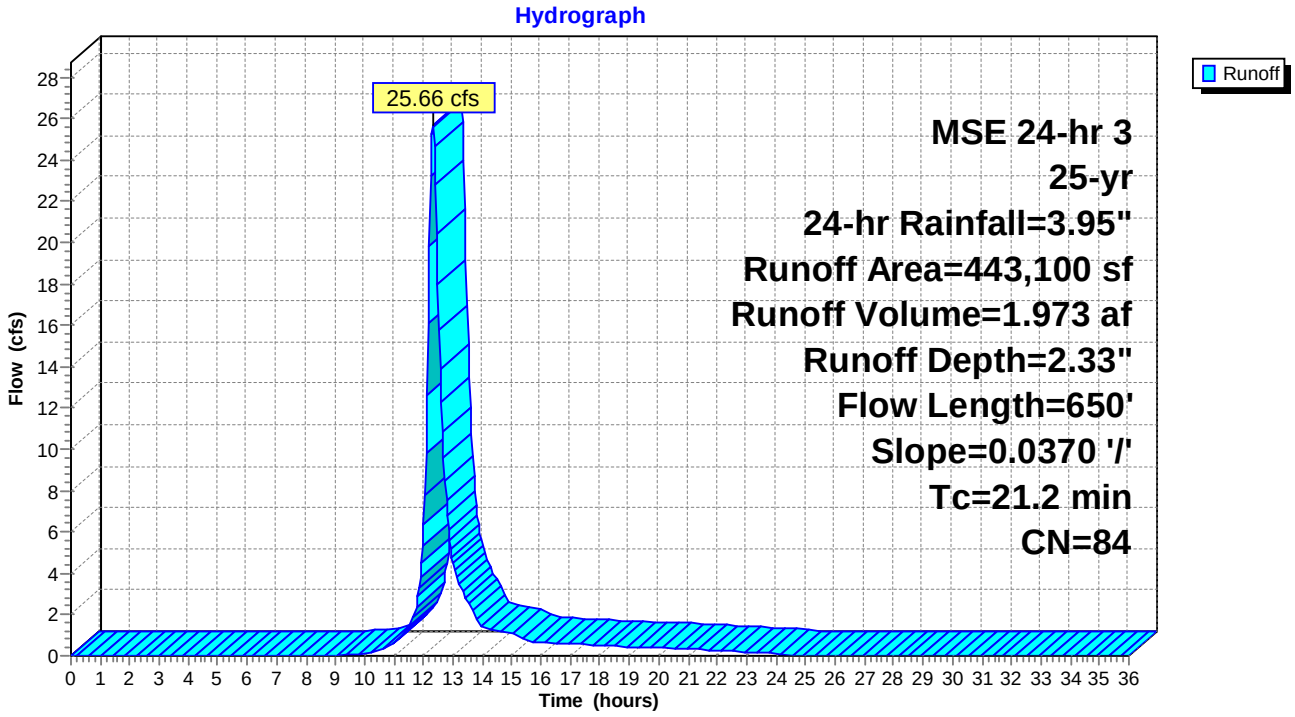
Runoff = 25.66 cfs @ 12.31 hrs, Volume= 1.973 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
443,100	84	50-75% Grass cover, Fair, HSG D
443,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	200	0.0370	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
5.6	450	0.0370	1.35		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.2	650	Total			

Subcatchment 21S: MC X East



Summary for Subcatchment 22S: MC X SE

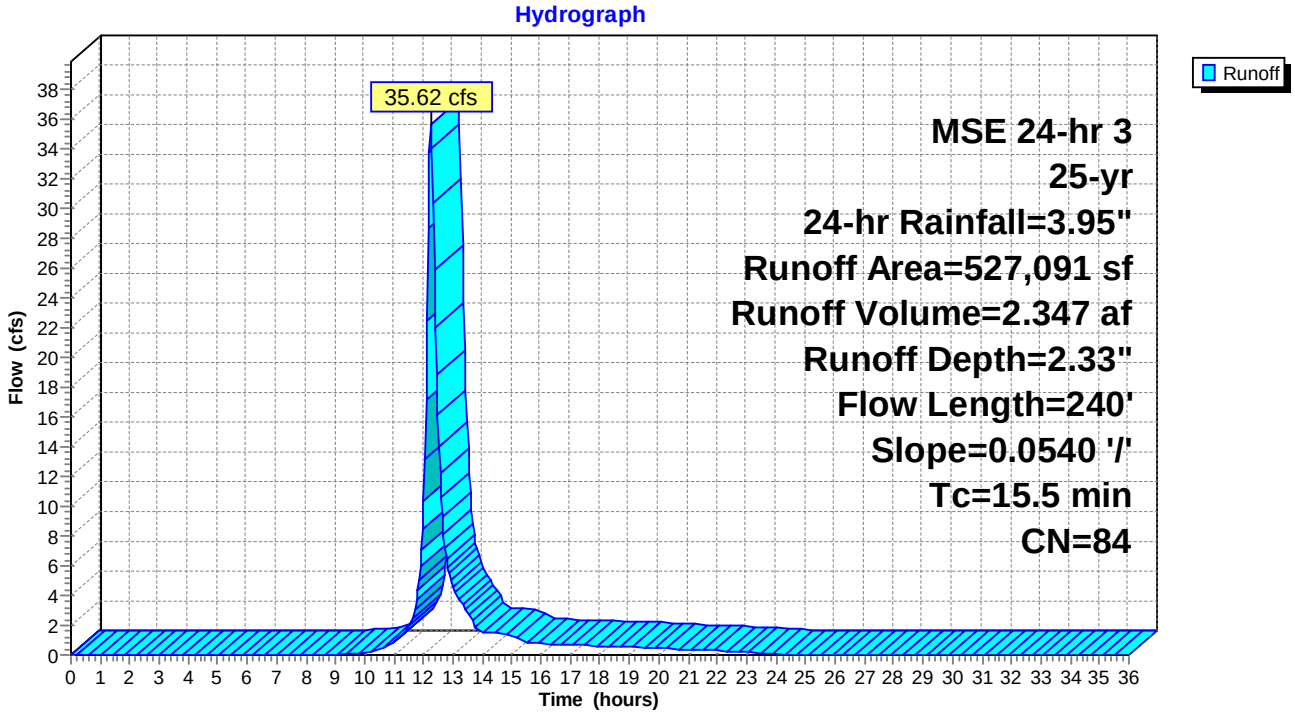
Runoff = 35.62 cfs @ 12.24 hrs, Volume= 2.347 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
527,091	84	50-75% Grass cover, Fair, HSG D
527,091		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	240	0.0540	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 22S: MC X SE



Summary for Subcatchment 23S: MC X NE

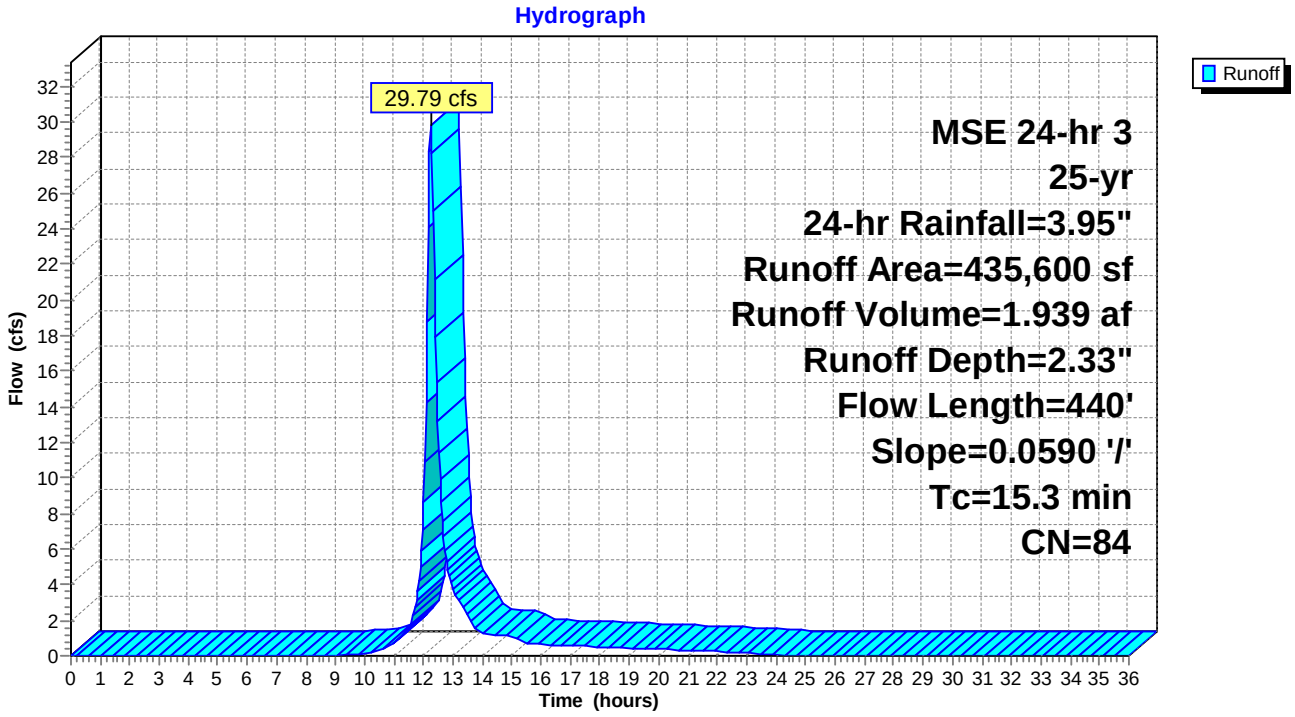
Runoff = 29.79 cfs @ 12.24 hrs, Volume= 1.939 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
435,600	84	50-75% Grass cover, Fair, HSG D
435,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	200	0.0590	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.4	240	0.0590	1.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.3	440	Total			

Subcatchment 23S: MC X NE



Summary for Subcatchment 24S: MC X N

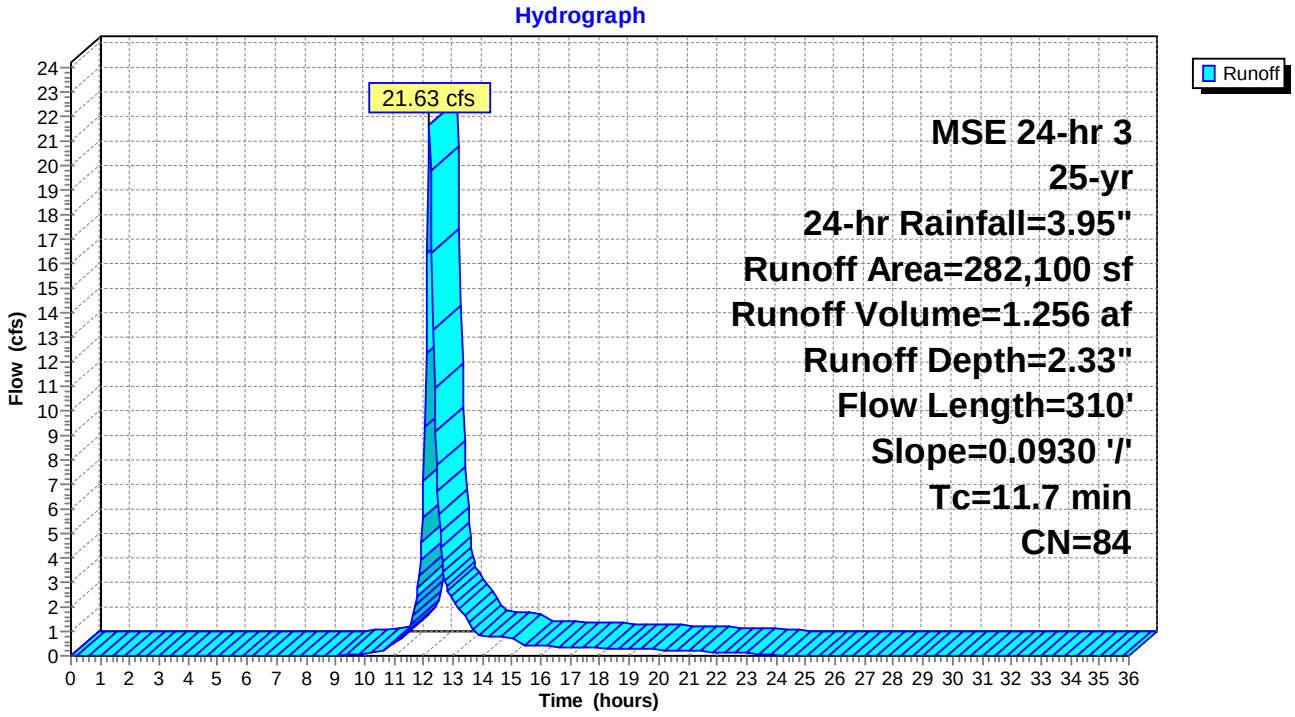
Runoff = 21.63 cfs @ 12.20 hrs, Volume= 1.256 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
282,100	84	50-75% Grass cover, Fair, HSG D
282,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	200	0.0930	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
0.9	110	0.0930	2.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.7	310	Total			

Subcatchment 24S: MC X N



Summary for Subcatchment 25S: MC X NW

Drainage area is pond area and land area
Land area = 2,437,500 - 196,000 = 2,241,500

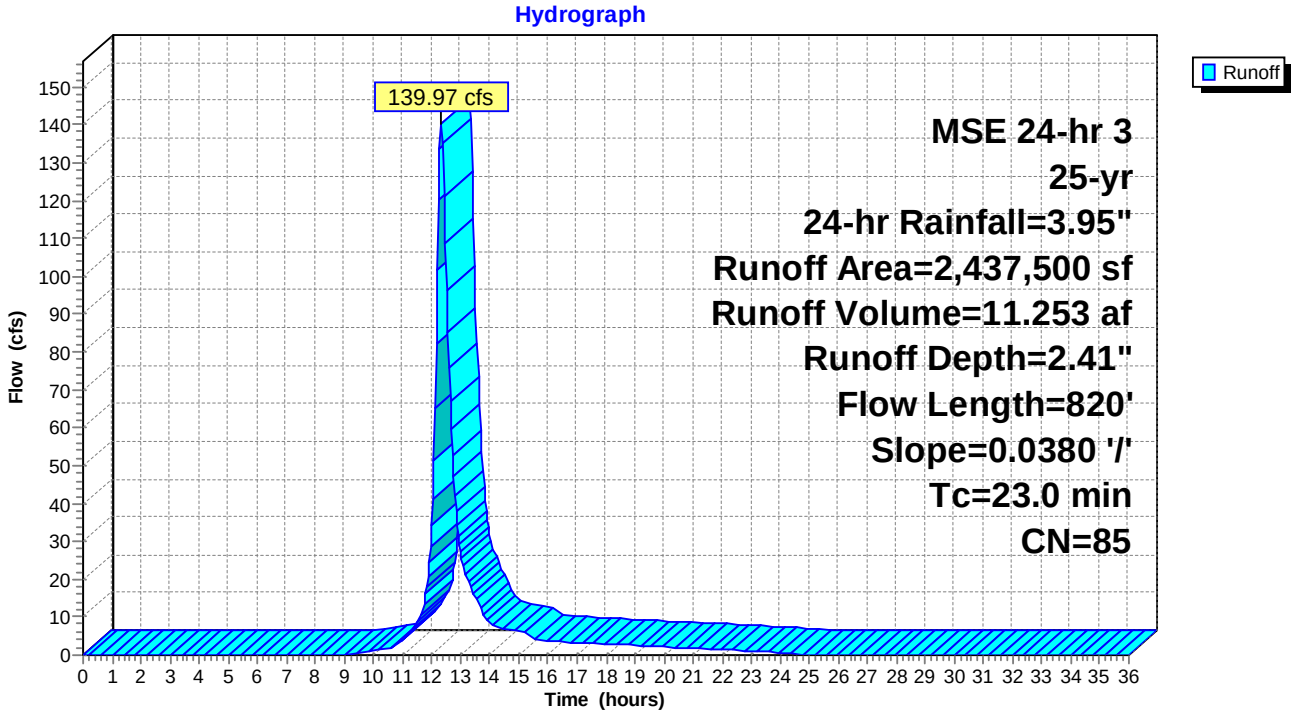
Runoff = 139.97 cfs @ 12.33 hrs, Volume= 11.253 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
196,000	98	Water Surface, HSG D
2,241,500	84	50-75% Grass cover, Fair, HSG D
2,437,500	85	Weighted Average
2,241,500		91.96% Pervious Area
196,000		8.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	200	0.0380	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
7.6	620	0.0380	1.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
23.0	820	Total			

Subcatchment 25S: MC X NW



Summary for Subcatchment 26S: MC XI SE

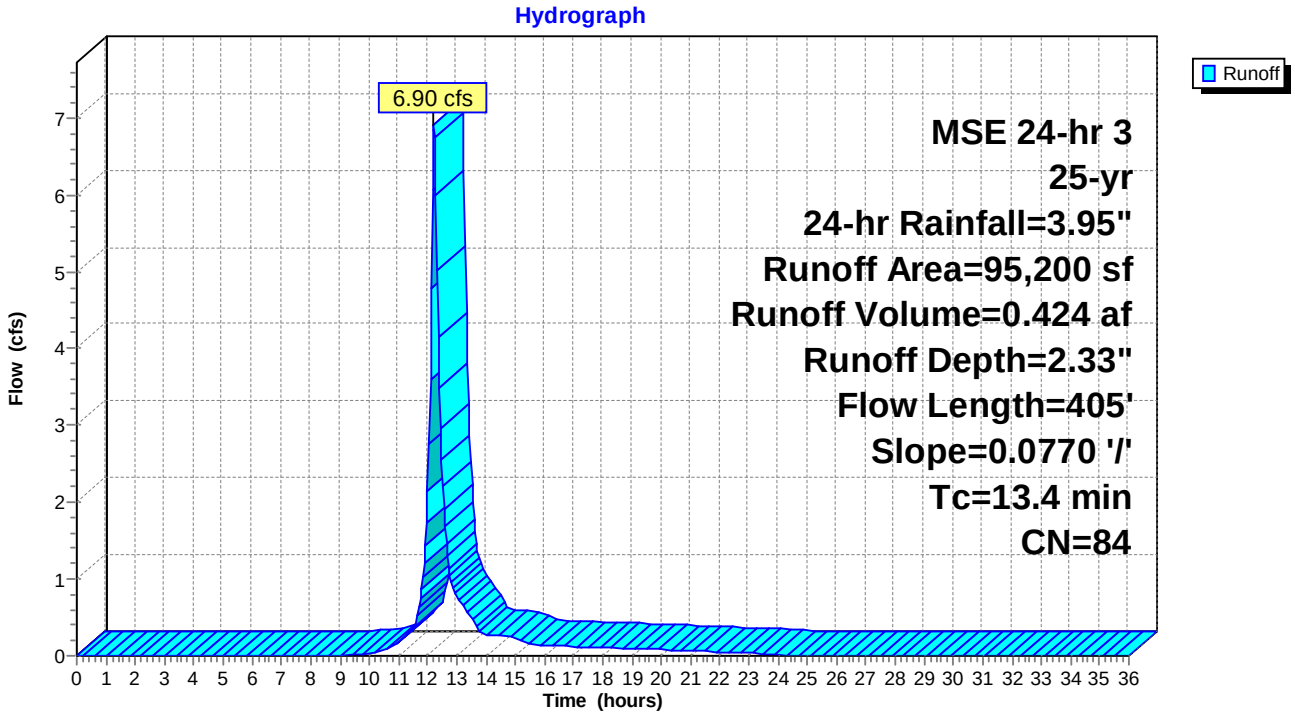
Runoff = 6.90 cfs @ 12.22 hrs, Volume= 0.424 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
95,200	84	50-75% Grass cover, Fair, HSG D
95,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	200	0.0770	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.8	205	0.0770	1.94		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.4	405	Total			

Subcatchment 26S: MC XI SE



Summary for Subcatchment 27S: MC X SW

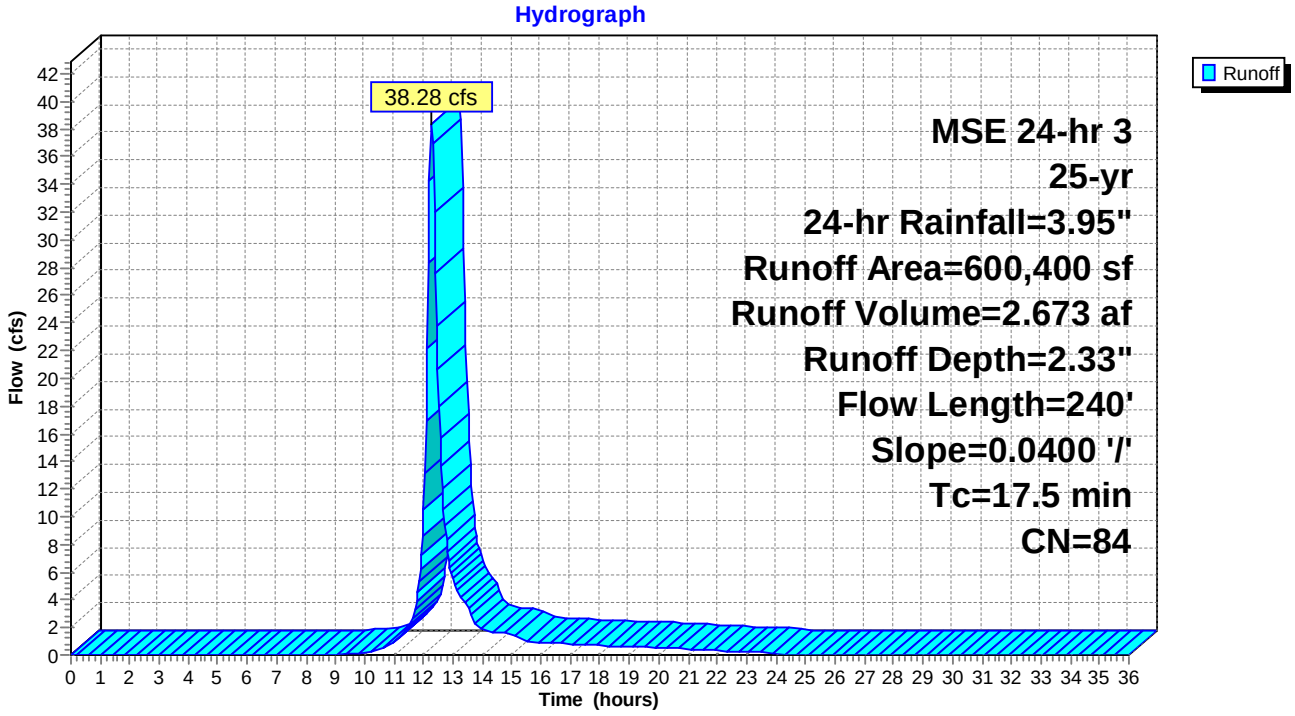
Runoff = 38.28 cfs @ 12.26 hrs, Volume= 2.673 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
600,400	84	50-75% Grass cover, Fair, HSG D
600,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.5	240	0.0400	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 27S: MC X SW



Summary for Subcatchment 28S: MC VII S

Drainage area is pond area and land area
Land area = 998,400 - 38,900 = 959,500

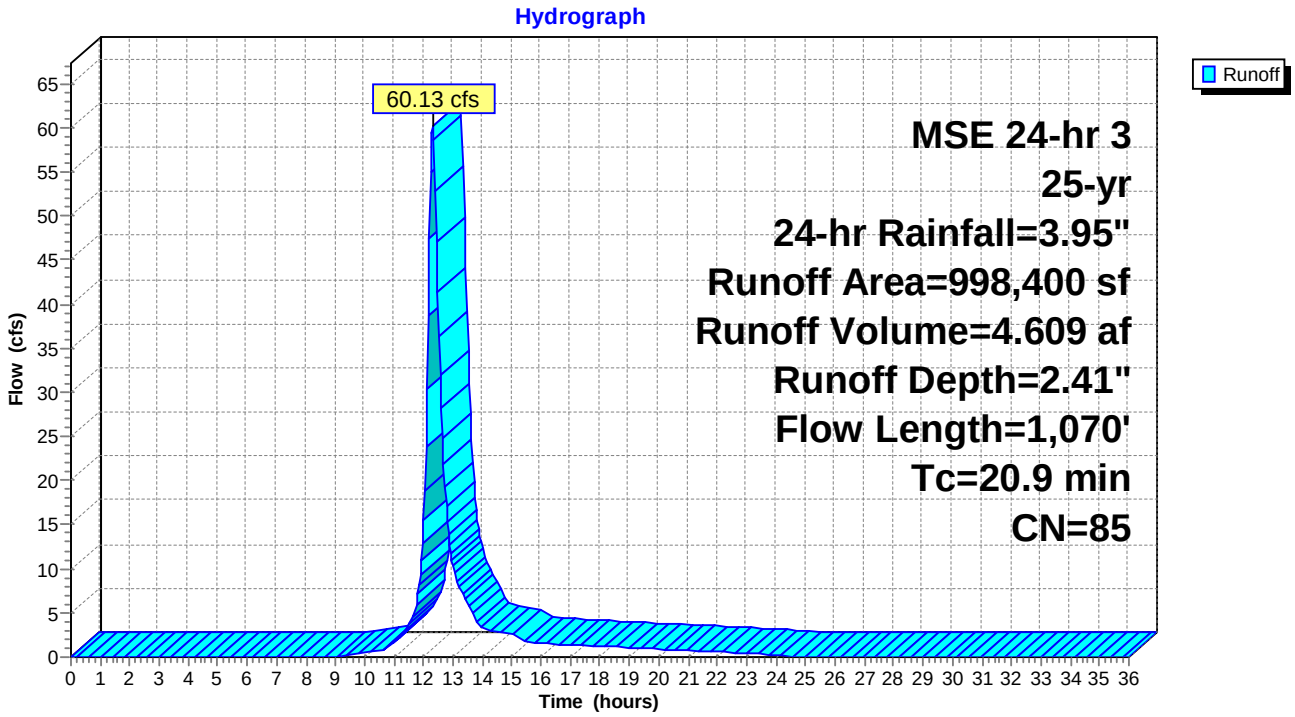
Runoff = 60.13 cfs @ 12.31 hrs, Volume= 4.609 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
38,900	98	Water Surface, HSG D
959,500	84	50-75% Grass cover, Fair, HSG D
998,400	85	Weighted Average
959,500		96.10% Pervious Area
38,900		3.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	200	0.0300	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.3	170	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	700	0.0140	7.03	84.40	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
20.9	1,070	Total			

Subcatchment 28S: MC VII S



Summary for Subcatchment 29S: MC VII N

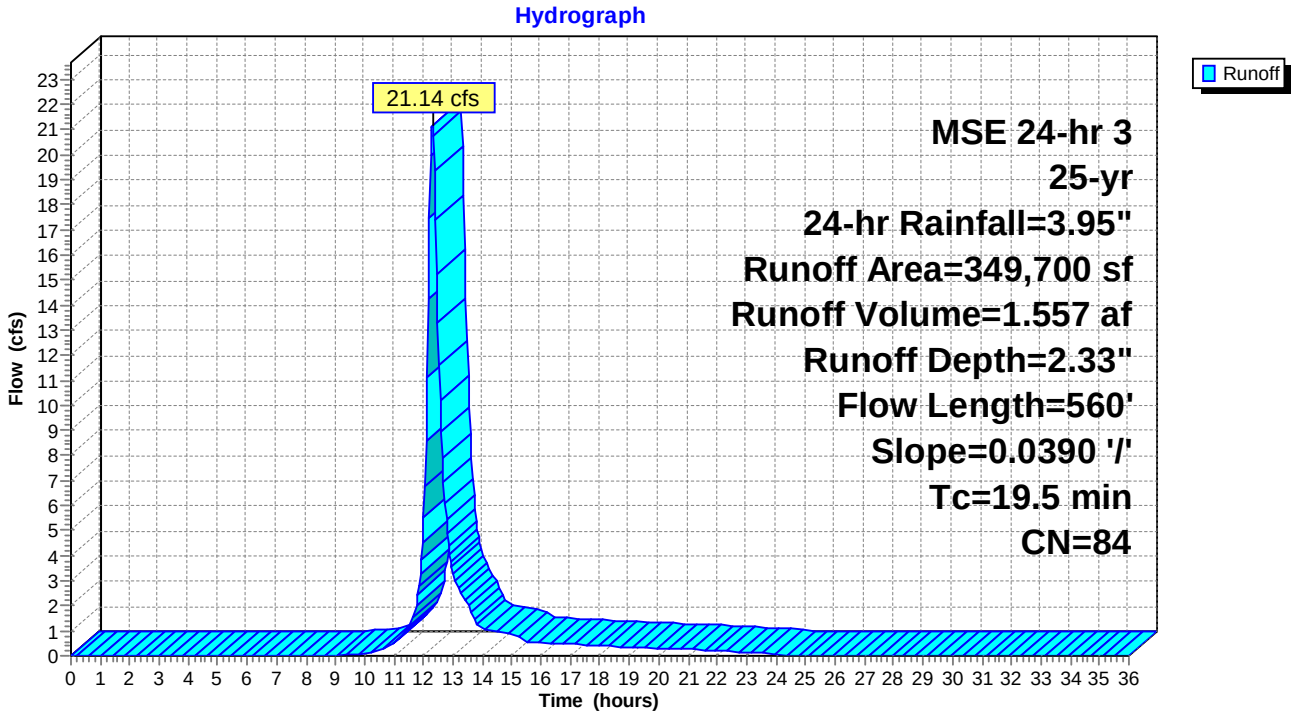
Runoff = 21.14 cfs @ 12.29 hrs, Volume= 1.557 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
349,700	84	50-75% Grass cover, Fair, HSG D
349,700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	200	0.0390	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
4.3	360	0.0390	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.5	560	Total			

Subcatchment 29S: MC VII N



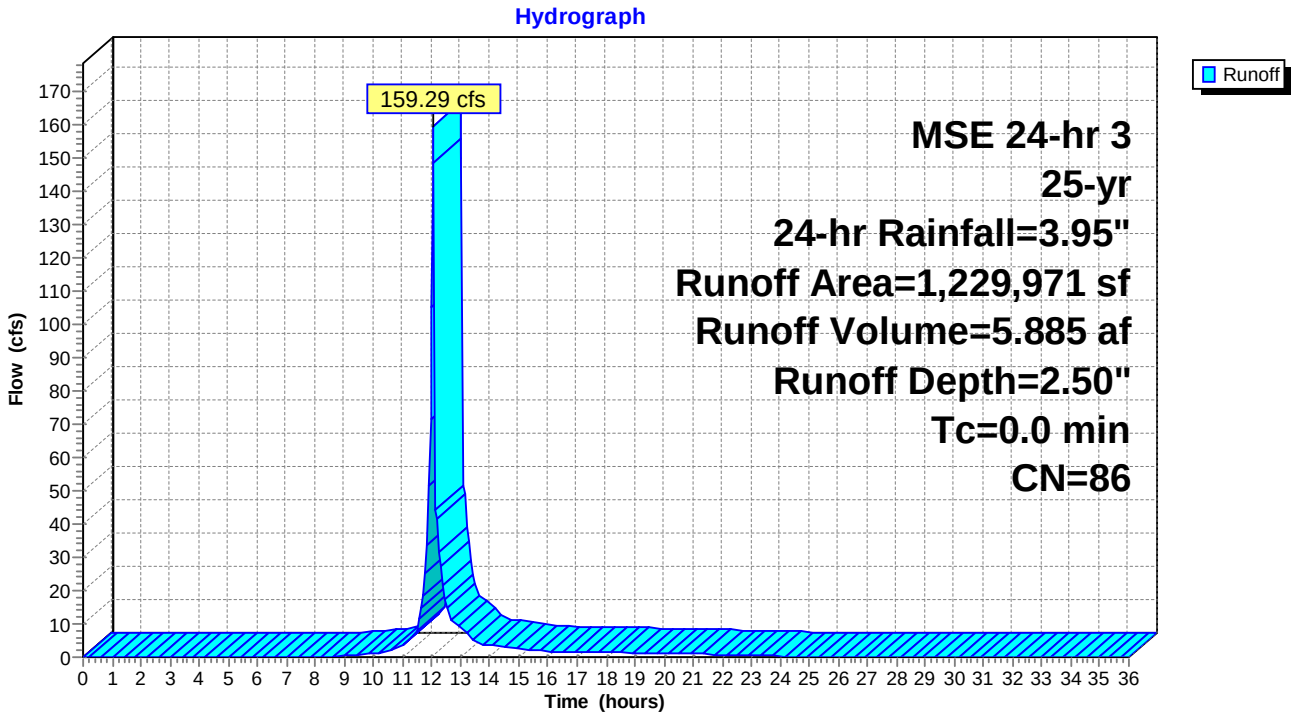
Summary for Subcatchment 30S: NWD Drainage

Runoff = 159.29 cfs @ 12.06 hrs, Volume= 5.885 af, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
201,500	98	Water Surface, HSG D
1,028,471	84	50-75% Grass cover, Fair, HSG D
1,229,971	86	Weighted Average
1,028,471		83.62% Pervious Area
201,500		16.38% Impervious Area

Subcatchment 30S: NWD Drainage



Summary for Subcatchment 32S: DS-1 Drainage

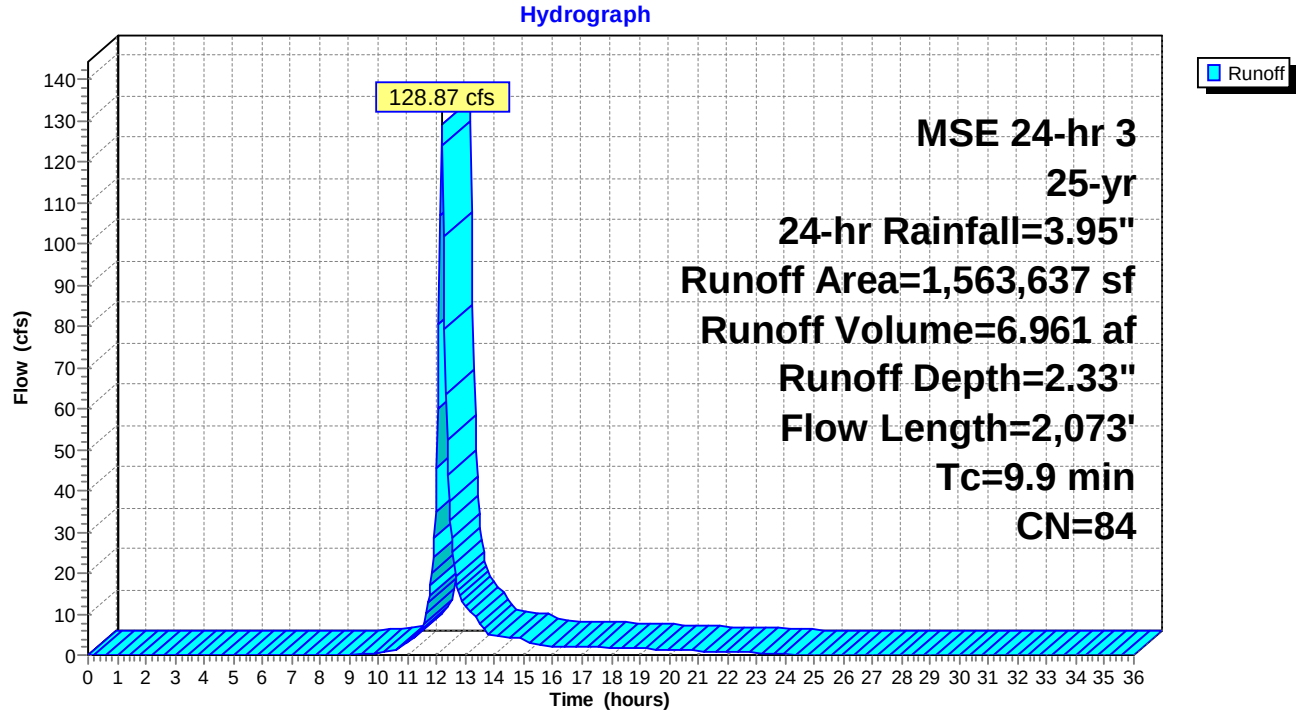
Runoff = 128.87 cfs @ 12.17 hrs, Volume= 6.961 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
1,563,637	84	50-75% Grass cover, Fair, HSG D
1,563,637		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	160	0.2500	0.44		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
3.8	1,913	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
9.9	2,073	Total			

Subcatchment 32S: DS-1 Drainage



Summary for Subcatchment 33S: DS-2 Drainage

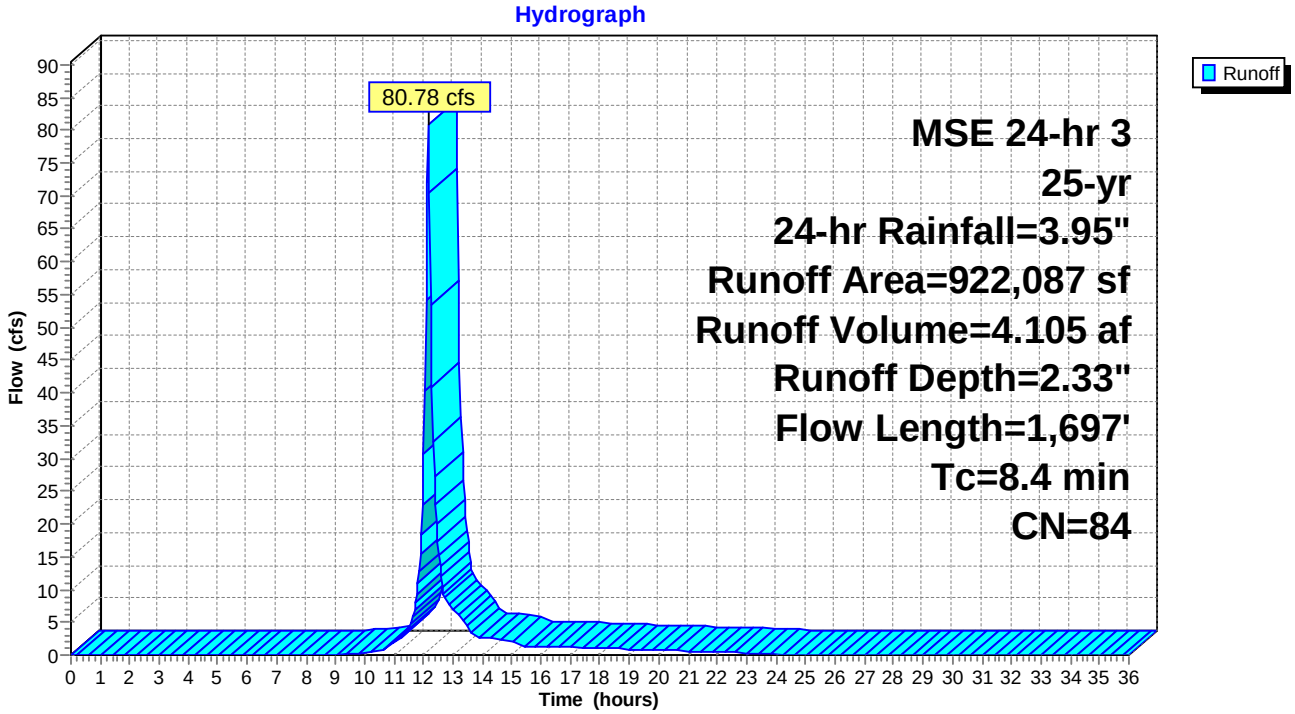
Runoff = 80.78 cfs @ 12.16 hrs, Volume= 4.105 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
922,087	84	50-75% Grass cover, Fair, HSG D
922,087		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	135	0.2500	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
3.1	1,562	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
8.4	1,697	Total			

Subcatchment 33S: DS-2 Drainage



Summary for Subcatchment 36S: DS-3 Drainage

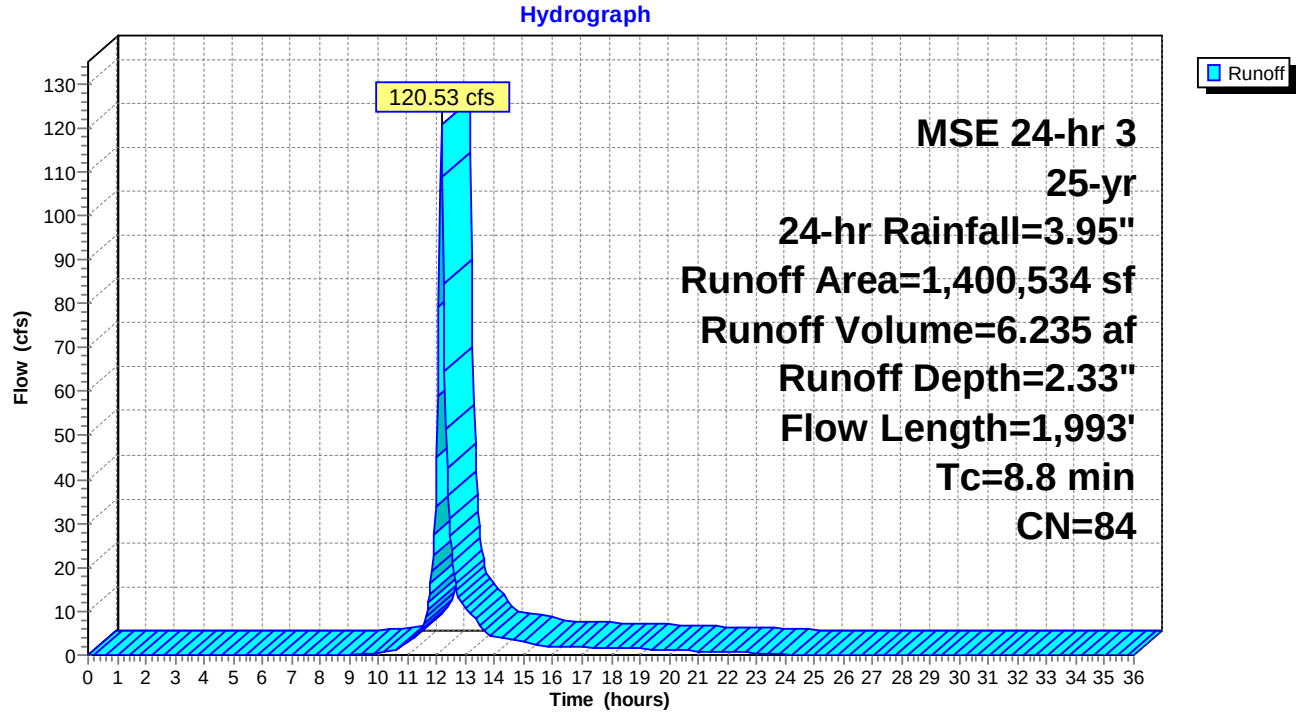
Runoff = 120.53 cfs @ 12.16 hrs, Volume= 6.235 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
1,400,534	84	50-75% Grass cover, Fair, HSG D
1,400,534		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	128	0.2500	0.42		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
3.7	1,865	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
8.8	1,993	Total			

Subcatchment 36S: DS-3 Drainage



Summary for Subcatchment 40S: DB-12 Drainage

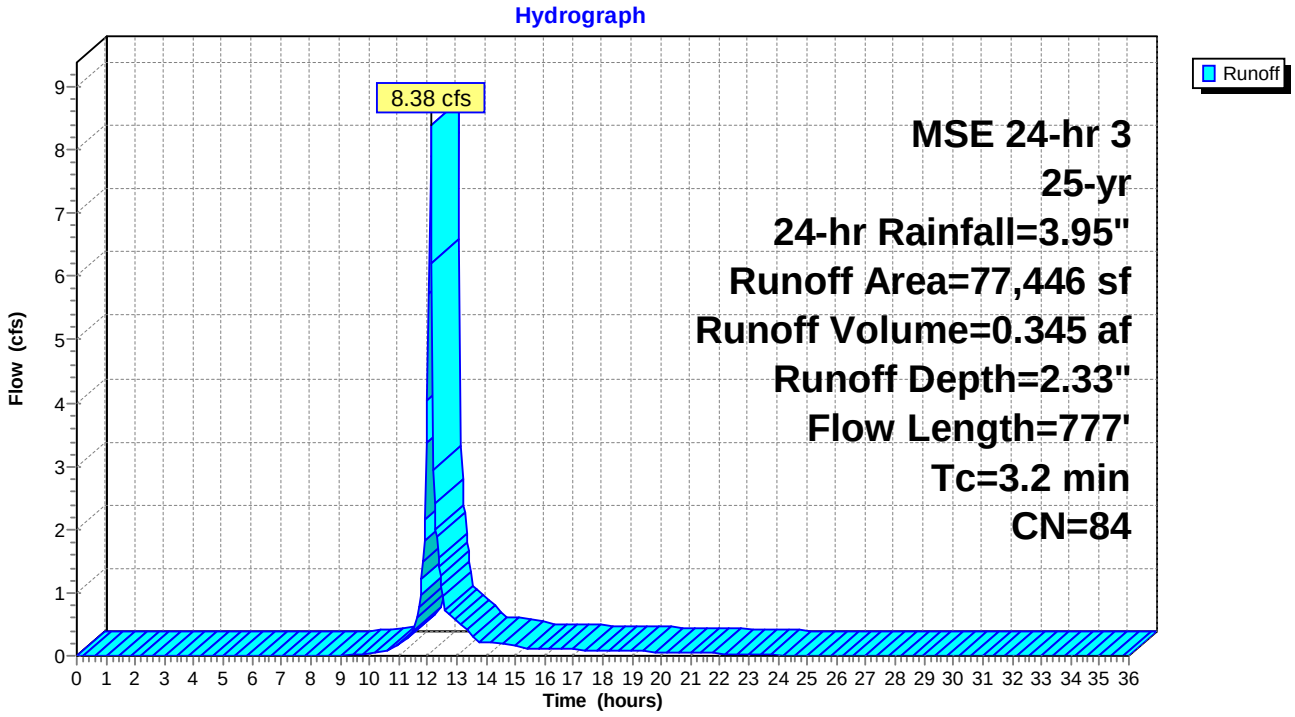
Runoff = 8.38 cfs @ 12.10 hrs, Volume= 0.345 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
77,446	84	50-75% Grass cover, Fair, HSG D
77,446		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	20	0.2500	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.1	757	0.0100	5.94	71.33	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025
3.2	777	Total			

Subcatchment 40S: DB-12 Drainage



Summary for Subcatchment 44S: DB-2 Drainage

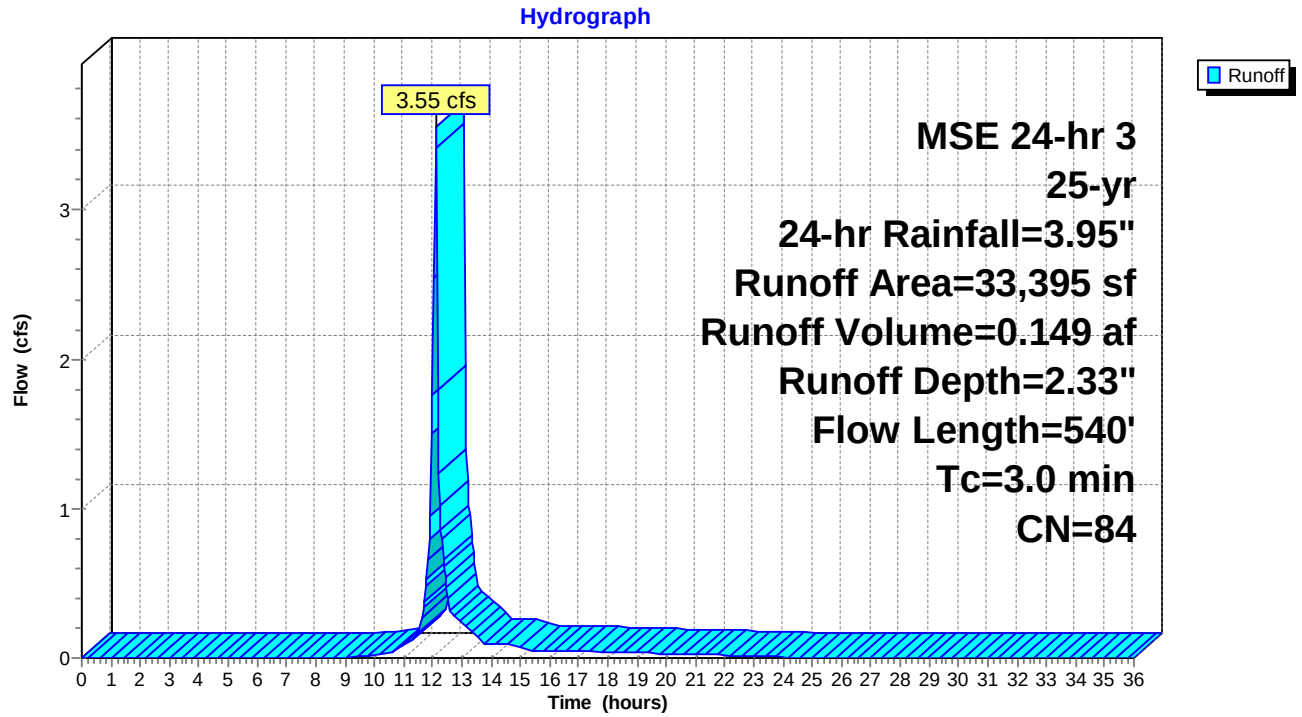
Runoff = 3.55 cfs @ 12.10 hrs, Volume= 0.149 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
33,395	84	50-75% Grass cover, Fair, HSG D
33,395		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	35	0.2500	0.32		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.1	403	0.0100	5.94	71.33	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025
0.1	102	0.0430	12.33	147.91	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025
3.0	540	Total			

Subcatchment 44S: DB-2 Drainage



Summary for Reach 3R: NE-MC IX Ditch

NSB Culvert backs up (free draining channel assumption is not true), therefore additional freeboard is needed in NE-MC IX Ditch

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Inflow Area = 239.347 ac, 4.19% Impervious, Inflow Depth = 2.32" for 25-yr, 24-hr event
Inflow = 125.65 cfs @ 12.76 hrs, Volume= 46.355 af
Outflow = 124.53 cfs @ 12.97 hrs, Volume= 46.355 af, Atten= 1%, Lag= 12.9 min

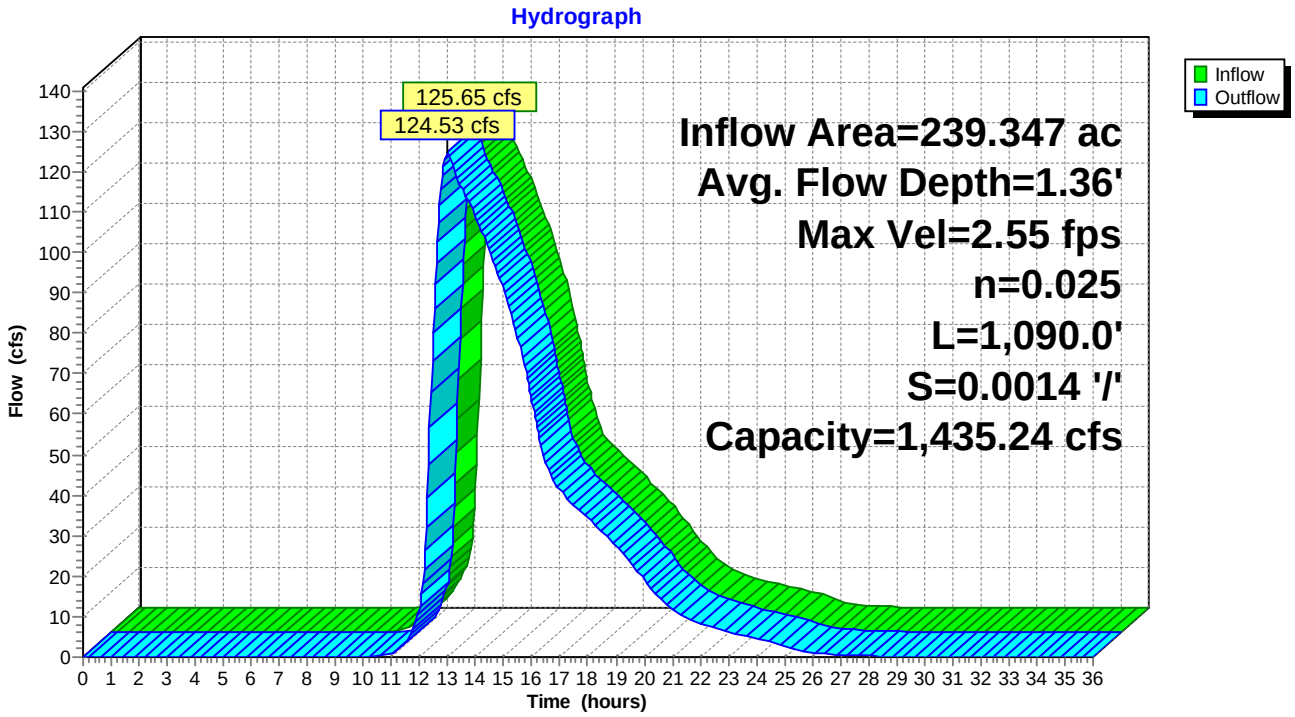
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 2.55 fps, Min. Travel Time= 7.1 min
Avg. Velocity = 0.91 fps, Avg. Travel Time= 19.9 min

Peak Storage= 53,137 cf @ 12.85 hrs
Average Depth at Peak Storage= 1.36' , Surface Width= 38.46'
Bank-Full Depth= 5.60' Flow Area= 247.5 sf, Capacity= 1,435.24 cfs

33.00' x 5.60' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 55.40'
Length= 1,090.0' Slope= 0.0014 '/'
Inlet Invert= 696.40', Outlet Invert= 694.90'

‡

Reach 3R: NE-MC IX Ditch



Summary for Reach 4R: N-MC IX Ditch

Inflow Area = 229.347 ac, 4.37% Impervious, Inflow Depth = 2.32" for 25-yr, 24-hr event
Inflow = 123.14 cfs @ 12.53 hrs, Volume= 44.416 af
Outflow = 120.53 cfs @ 12.80 hrs, Volume= 44.416 af, Atten= 2%, Lag= 16.2 min

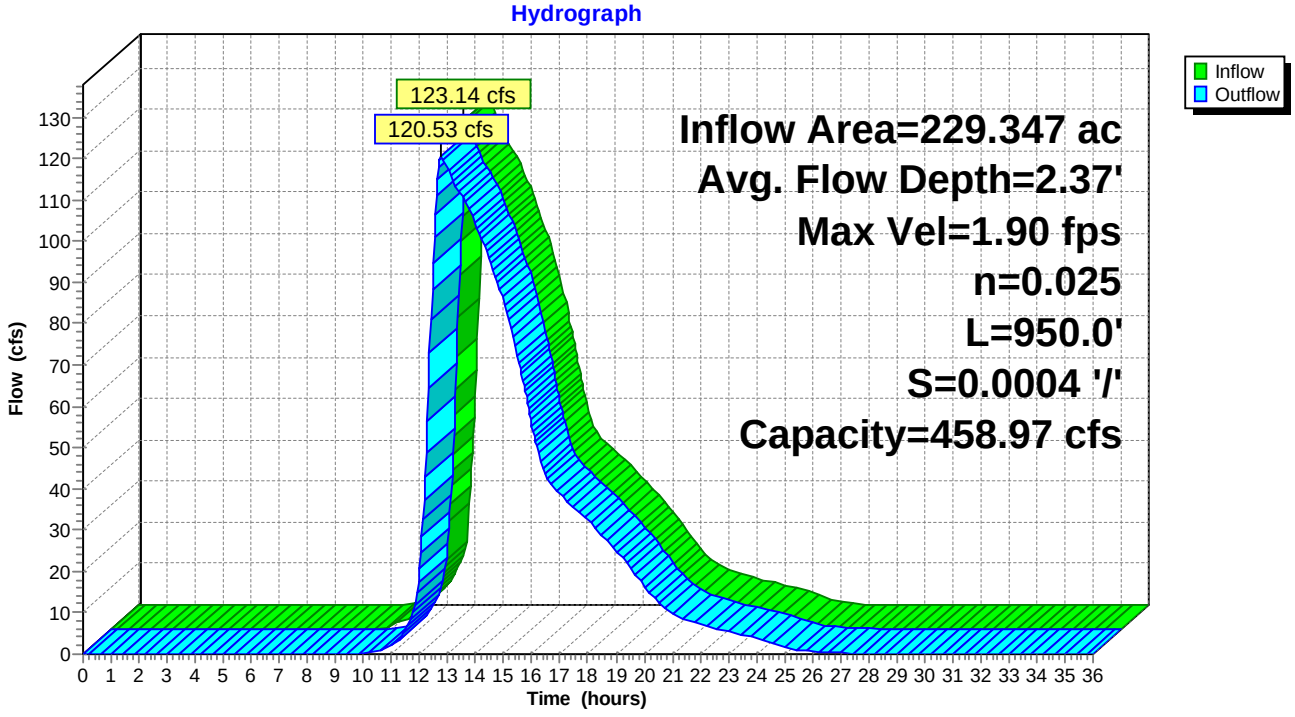
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 1.90 fps, Min. Travel Time= 8.3 min
Avg. Velocity = 0.66 fps, Avg. Travel Time= 24.1 min

Peak Storage= 60,272 cf @ 12.65 hrs
Average Depth at Peak Storage= 2.37' , Surface Width= 31.49'
Bank-Full Depth= 5.00' Flow Area= 160.0 sf, Capacity= 458.97 cfs

22.00' x 5.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 42.00'
Length= 950.0' Slope= 0.0004 '/'
Inlet Invert= 696.80', Outlet Invert= 696.40'

‡

Reach 4R: N-MC IX Ditch



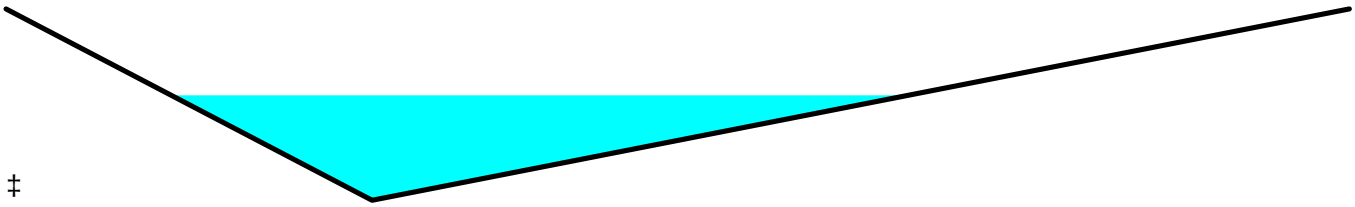
Summary for Reach 9R: W-MC X DV

Inflow Area = 13.783 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 38.28 cfs @ 12.26 hrs, Volume= 2.673 af
Outflow = 33.14 cfs @ 12.47 hrs, Volume= 2.673 af, Atten= 13%, Lag= 12.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.22 fps, Min. Travel Time= 7.2 min
Avg. Velocity = 0.91 fps, Avg. Travel Time= 25.7 min

Peak Storage= 14,416 cf @ 12.35 hrs
Average Depth at Peak Storage= 1.37' , Surface Width= 15.05'
Bank-Full Depth= 2.50' Flow Area= 34.4 sf, Capacity= 165.41 cfs

0.00' x 2.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 3.0 8.0 '/' Top Width= 27.50'
Length= 1,400.0' Slope= 0.0050 '/'
Inlet Invert= 713.00', Outlet Invert= 706.00'



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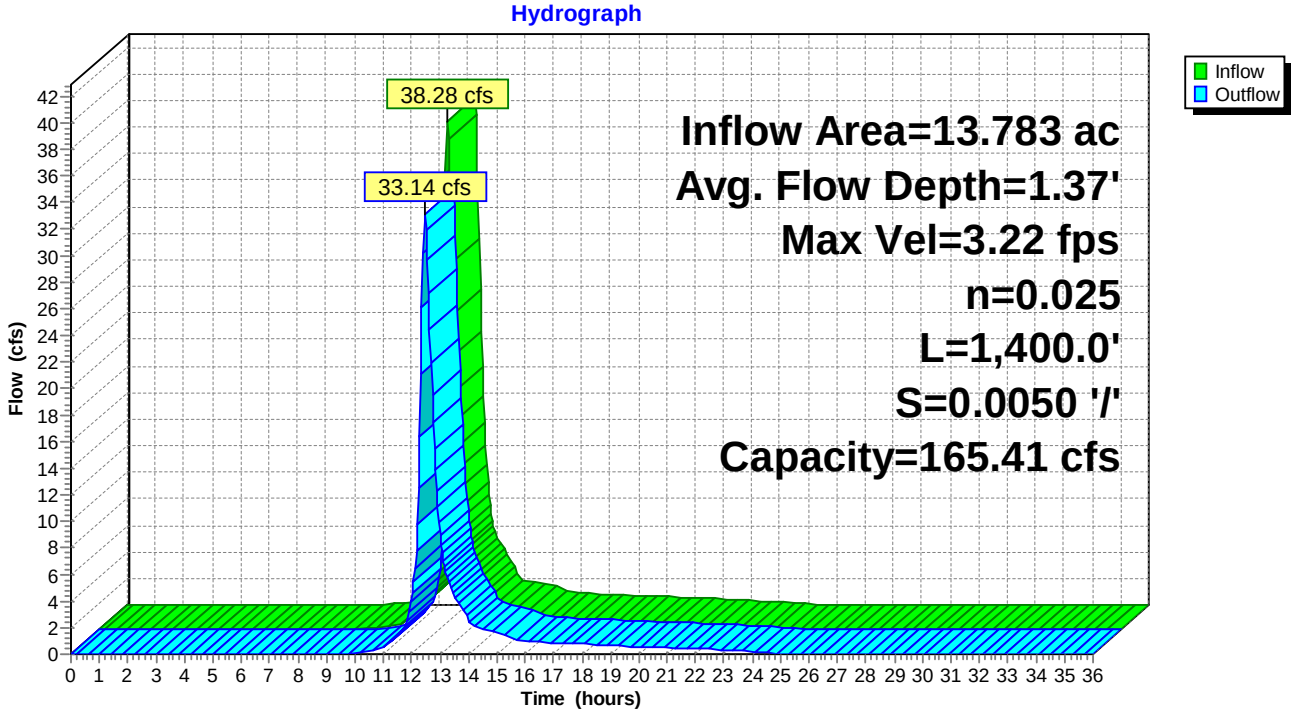
Reach 9R: W-MC X DV



Summary for Reach 10R: N-MC VII Ditch

Inflow Area = 128.025 ac, 3.61% Impervious, Inflow Depth = 2.37" for 25-yr, 24-hr event
Inflow = 62.78 cfs @ 12.32 hrs, Volume= 25.237 af
Outflow = 60.69 cfs @ 12.50 hrs, Volume= 25.237 af, Atten= 3%, Lag= 11.1 min

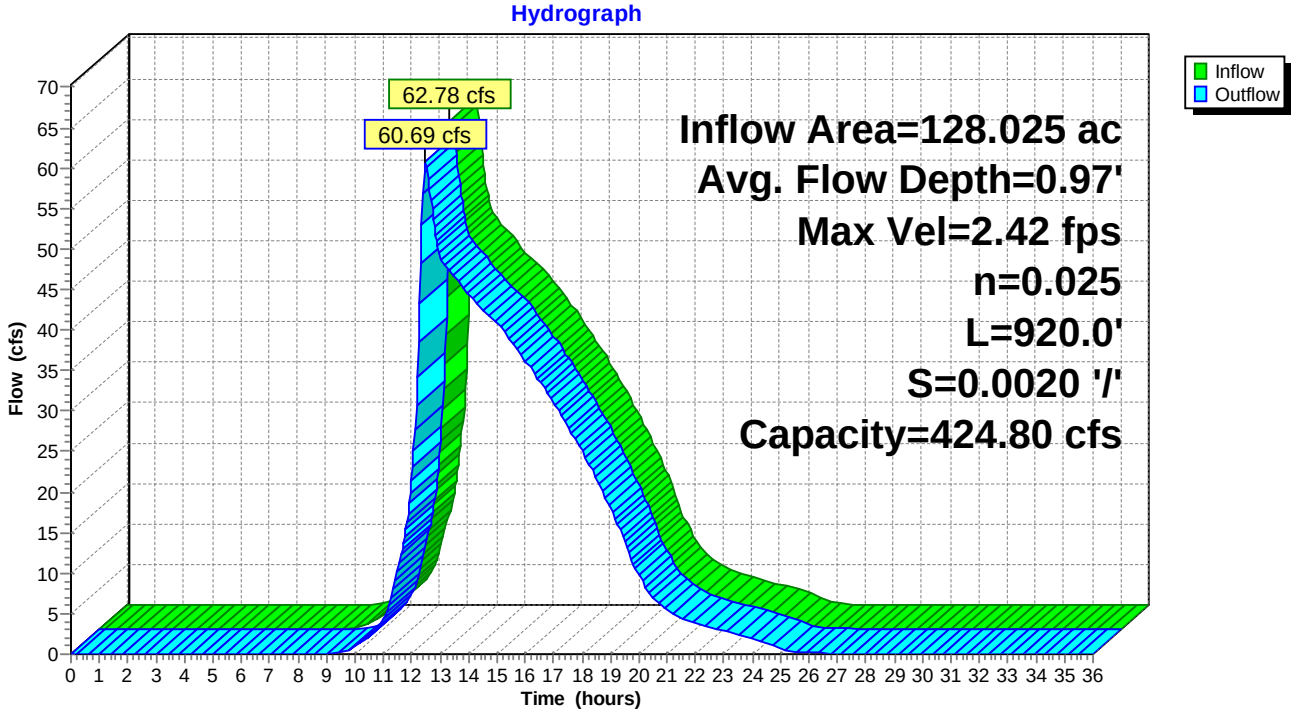
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 2.42 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 0.91 fps, Avg. Travel Time= 16.8 min

Peak Storage= 23,075 cf @ 12.40 hrs
Average Depth at Peak Storage= 0.97' , Surface Width= 27.87'
Bank-Full Depth= 3.00' Flow Area= 90.0 sf, Capacity= 424.80 cfs

24.00' x 3.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 36.00'
Length= 920.0' Slope= 0.0020 '/'
Inlet Invert= 698.80', Outlet Invert= 697.00'

‡

Reach 10R: N-MC VII Ditch



Summary for Reach 12R: DS-1 (4H:1V)

Inflow Area = 35.896 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 128.87 cfs @ 12.17 hrs, Volume= 6.961 af
Outflow = 125.56 cfs @ 12.20 hrs, Volume= 6.961 af, Atten= 3%, Lag= 1.4 min

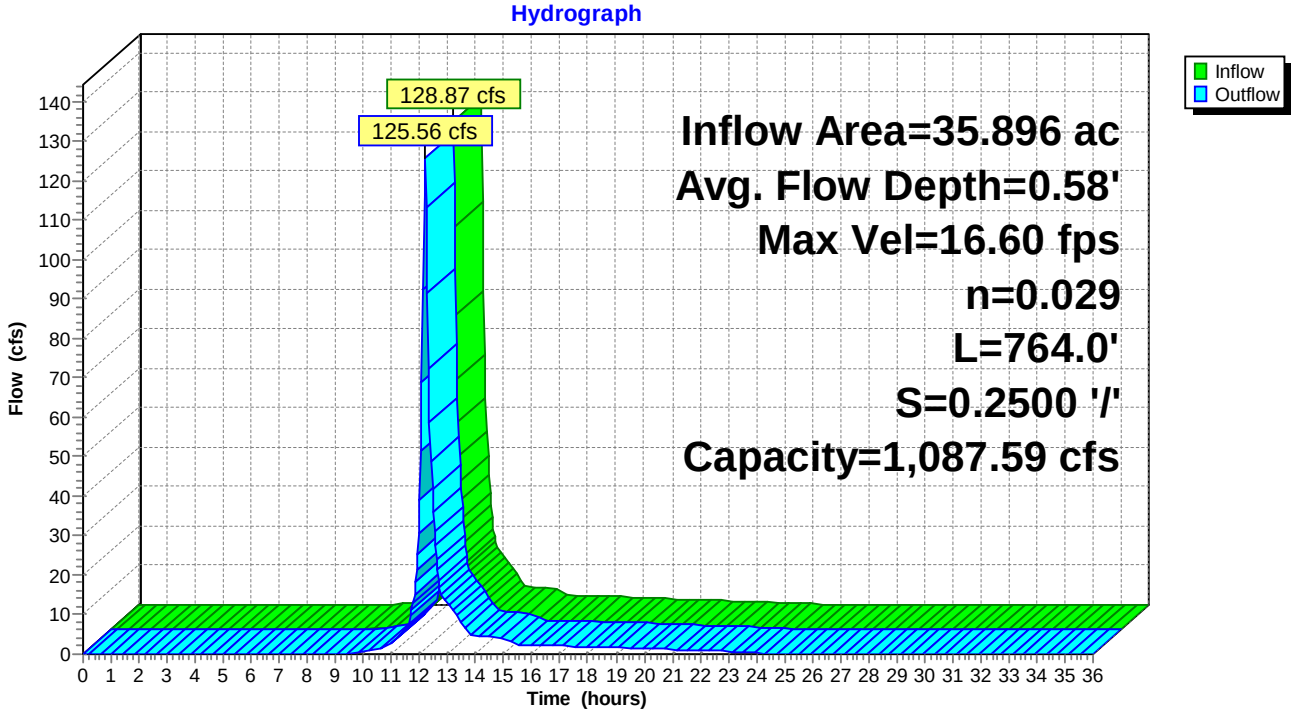
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 16.60 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.77 fps, Avg. Travel Time= 3.4 min

Peak Storage= 5,860 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.58' , Surface Width= 14.33'
Bank-Full Depth= 2.00' Flow Area= 32.0 sf, Capacity= 1,087.59 cfs

12.00' x 2.00' deep channel, n= 0.029
Side Slope Z-value= 2.0 '/' Top Width= 20.00'
Length= 764.0' Slope= 0.2500 '/'
Inlet Invert= 906.00', Outlet Invert= 715.00'

‡

Reach 12R: DS-1 (4H:1V)



Summary for Reach 14R: DS-3

Inflow Area = 32.152 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 120.53 cfs @ 12.16 hrs, Volume= 6.235 af
Outflow = 116.31 cfs @ 12.18 hrs, Volume= 6.235 af, Atten= 4%, Lag= 1.2 min

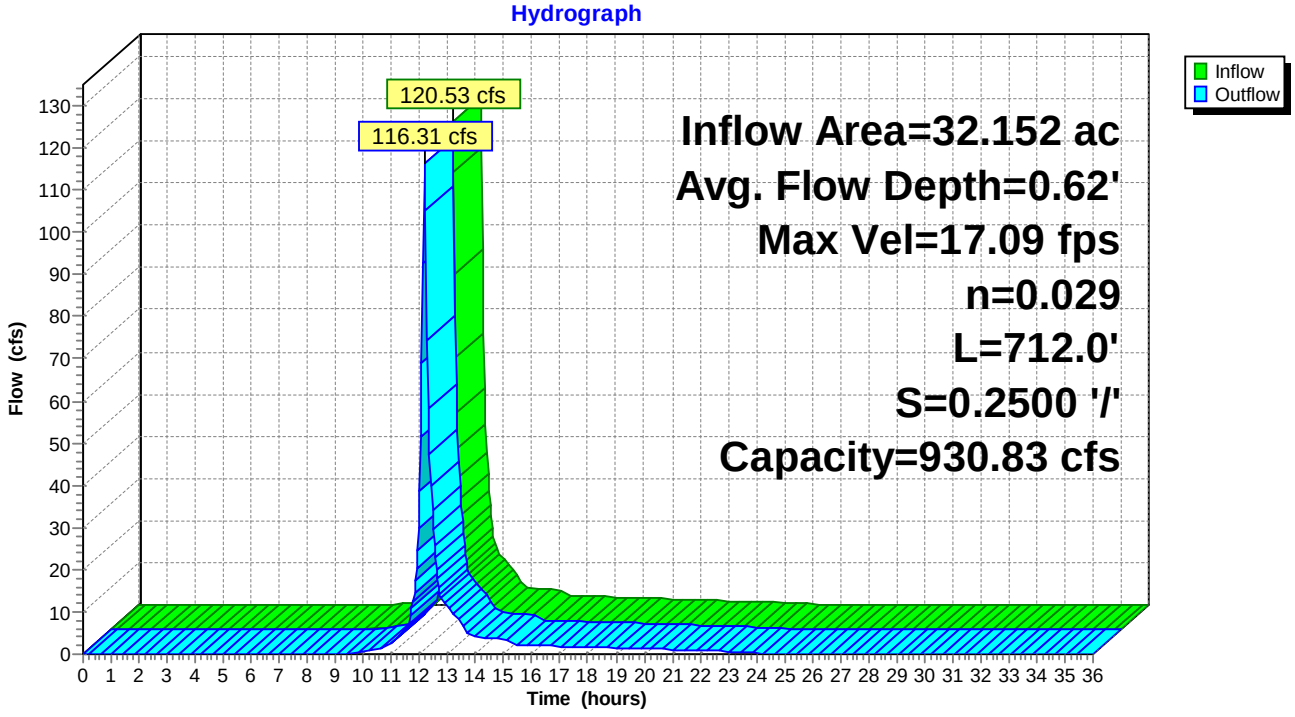
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 17.09 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 3.86 fps, Avg. Travel Time= 3.1 min

Peak Storage= 4,973 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.62' , Surface Width= 12.49'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 930.83 cfs

10.00' x 2.00' deep channel, n= 0.029
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 712.0' Slope= 0.2500 '/'
Inlet Invert= 900.00', Outlet Invert= 722.00'

‡

Reach 14R: DS-3



Summary for Reach 15R: DS-2 (4H:1V)

Inflow Area = 21.168 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 80.78 cfs @ 12.16 hrs, Volume= 4.105 af
Outflow = 77.93 cfs @ 12.18 hrs, Volume= 4.105 af, Atten= 4%, Lag= 1.1 min

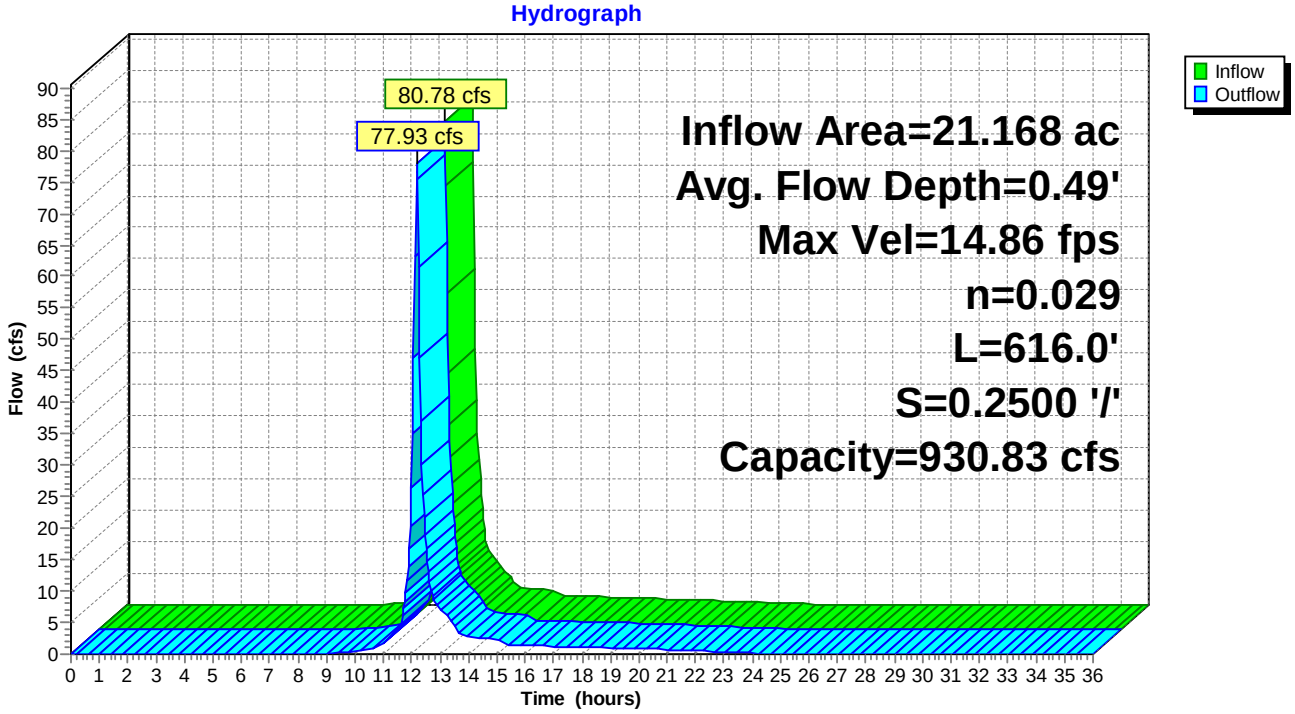
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 14.86 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 3.34 fps, Avg. Travel Time= 3.1 min

Peak Storage= 3,323 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.49' , Surface Width= 11.96'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 930.83 cfs

10.00' x 2.00' deep channel, n= 0.029
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 616.0' Slope= 0.2500 '/'
Inlet Invert= 900.00', Outlet Invert= 746.00'

‡

Reach 15R: DS-2 (4H:1V)



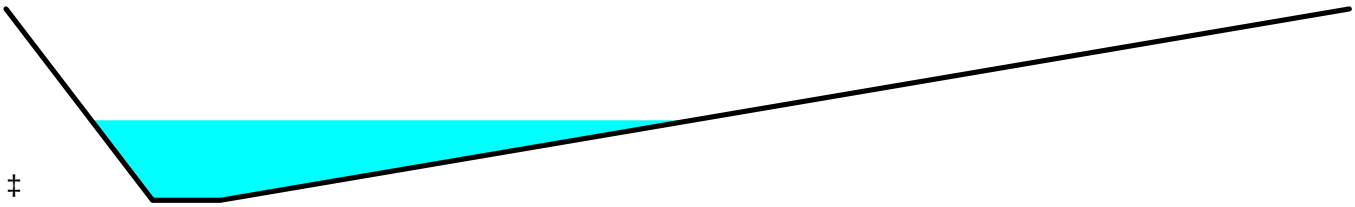
Summary for Reach 18R: E-MC IX Ditch

Inflow Area = 22.273 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 53.67 cfs @ 12.38 hrs, Volume= 4.319 af
Outflow = 52.37 cfs @ 12.47 hrs, Volume= 4.319 af, Atten= 2%, Lag= 5.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.40 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 1.00 fps, Avg. Travel Time= 9.7 min

Peak Storage= 9,036 cf @ 12.42 hrs
Average Depth at Peak Storage= 1.04' , Surface Width= 26.59'
Bank-Full Depth= 2.50' Flow Area= 78.1 sf, Capacity= 457.74 cfs

3.00' x 2.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.6 20.0 '/' Top Width= 59.50'
Length= 585.0' Slope= 0.0068 '/'
Inlet Invert= 699.00', Outlet Invert= 695.00'



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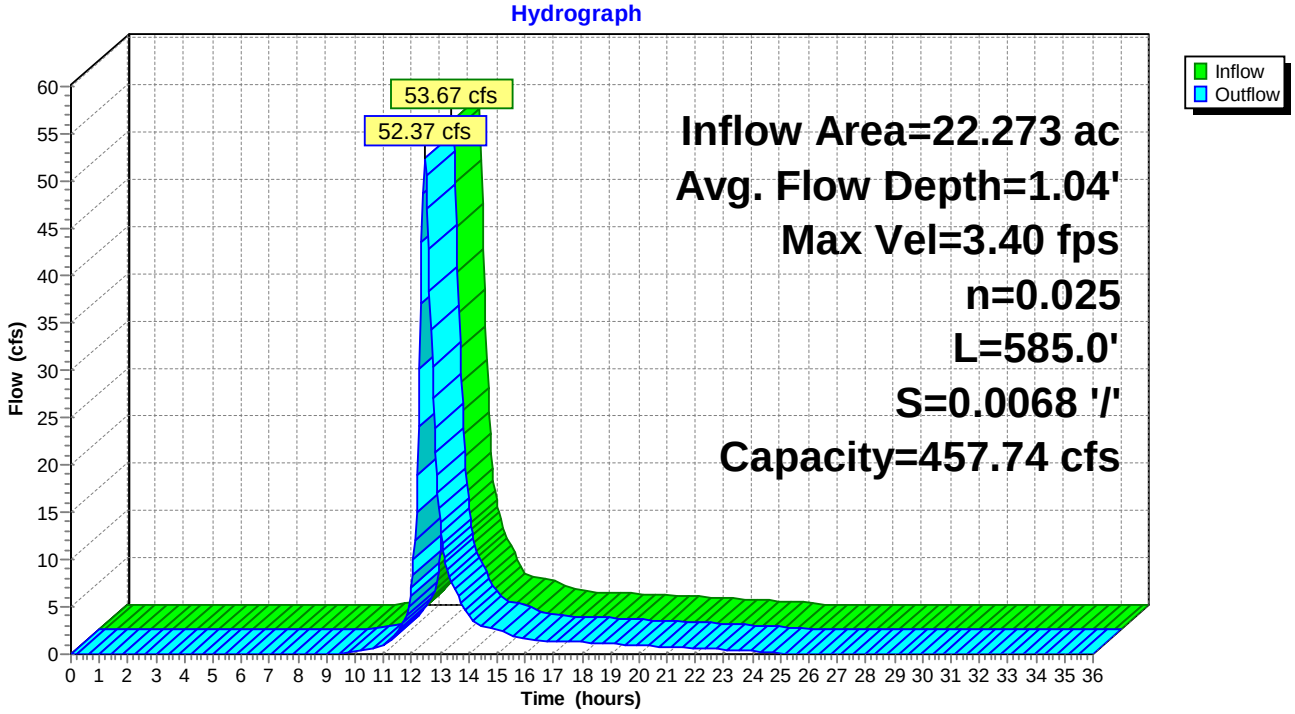
Reach 18R: E-MC IX Ditch



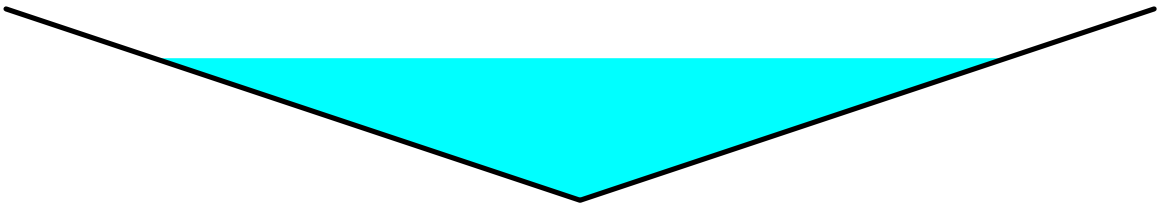
Summary for Reach 20R: E-MC X DV

Inflow Area = 12.100 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 35.62 cfs @ 12.24 hrs, Volume= 2.347 af
Outflow = 30.87 cfs @ 12.42 hrs, Volume= 2.347 af, Atten= 13%, Lag= 10.7 min

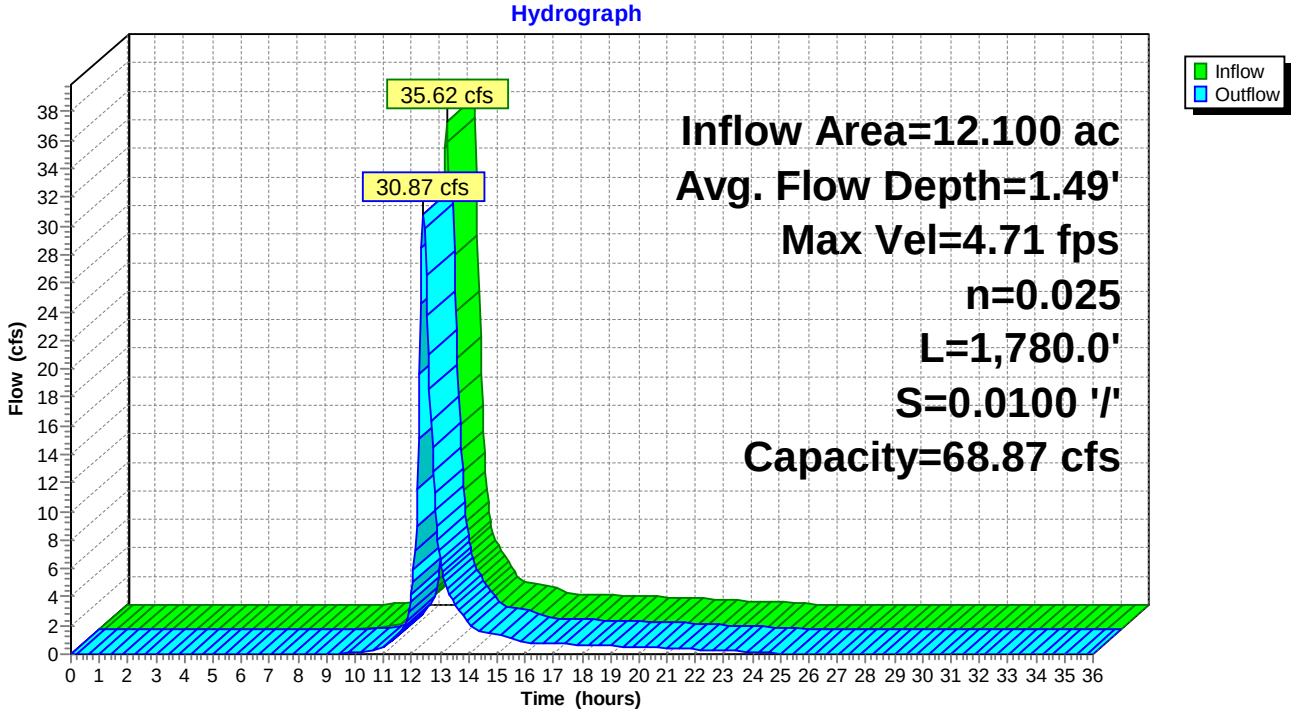
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 4.71 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 22.3 min

Peak Storage= 11,776 cf @ 12.32 hrs
Average Depth at Peak Storage= 1.49' , Surface Width= 8.91'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.87 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 1,780.0' Slope= 0.0100 '/'
Inlet Invert= 723.00', Outlet Invert= 705.20'



Reach 20R: E-MC X DV



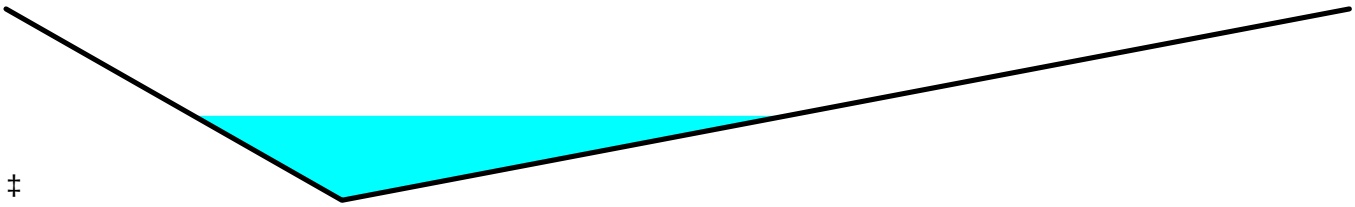
Summary for Reach 38R: S-MC XI DV

Inflow Area = 2.185 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 6.90 cfs @ 12.22 hrs, Volume= 0.424 af
Outflow = 6.40 cfs @ 12.32 hrs, Volume= 0.424 af, Atten= 7%, Lag= 6.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.70 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 1.26 fps, Avg. Travel Time= 9.9 min

Peak Storage= 1,310 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.66' , Surface Width= 5.29'
Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 57.72 cfs

0.00' x 1.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 6.0 '/' Top Width= 12.00'
Length= 750.0' Slope= 0.0180 '/'
Inlet Invert= 719.00', Outlet Invert= 705.50'



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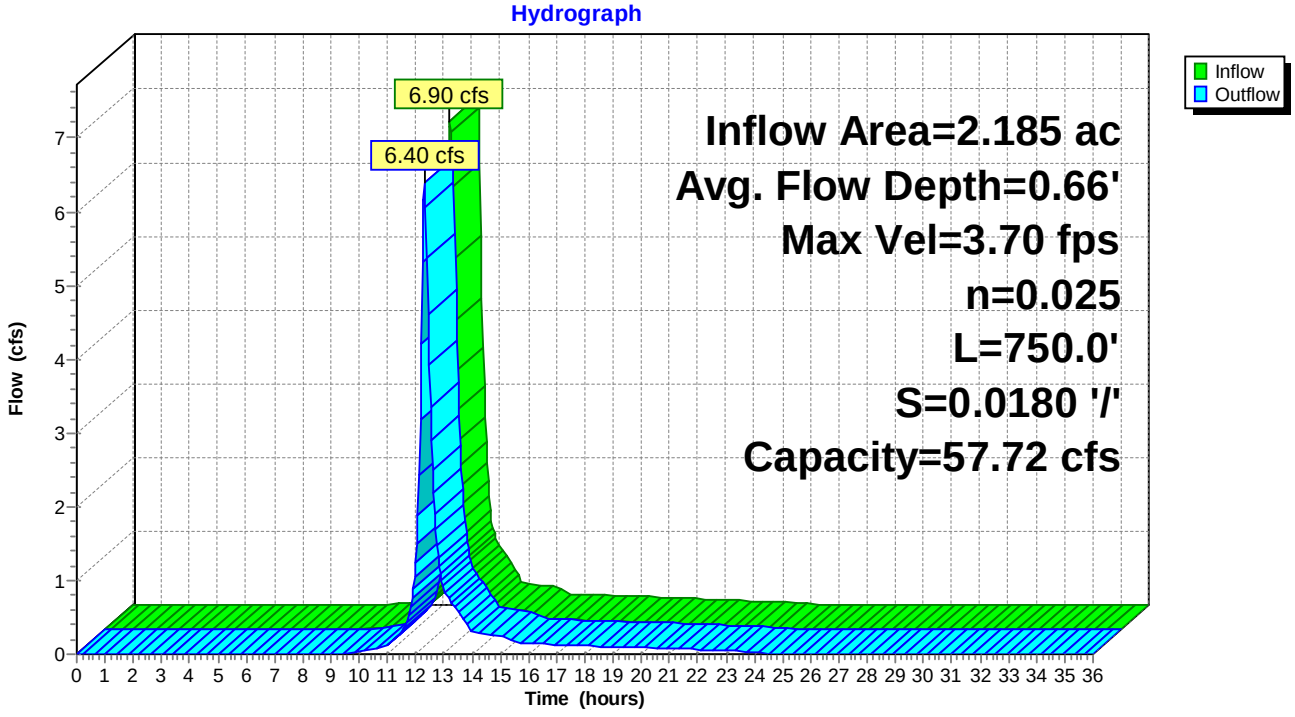
Reach 38R: S-MC XI DV



Summary for Reach 39R: DS-6

Inflow Area = 2.545 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 11.60 cfs @ 12.11 hrs, Volume= 0.493 af
Outflow = 11.33 cfs @ 12.11 hrs, Volume= 0.493 af, Atten= 2%, Lag= 0.4 min

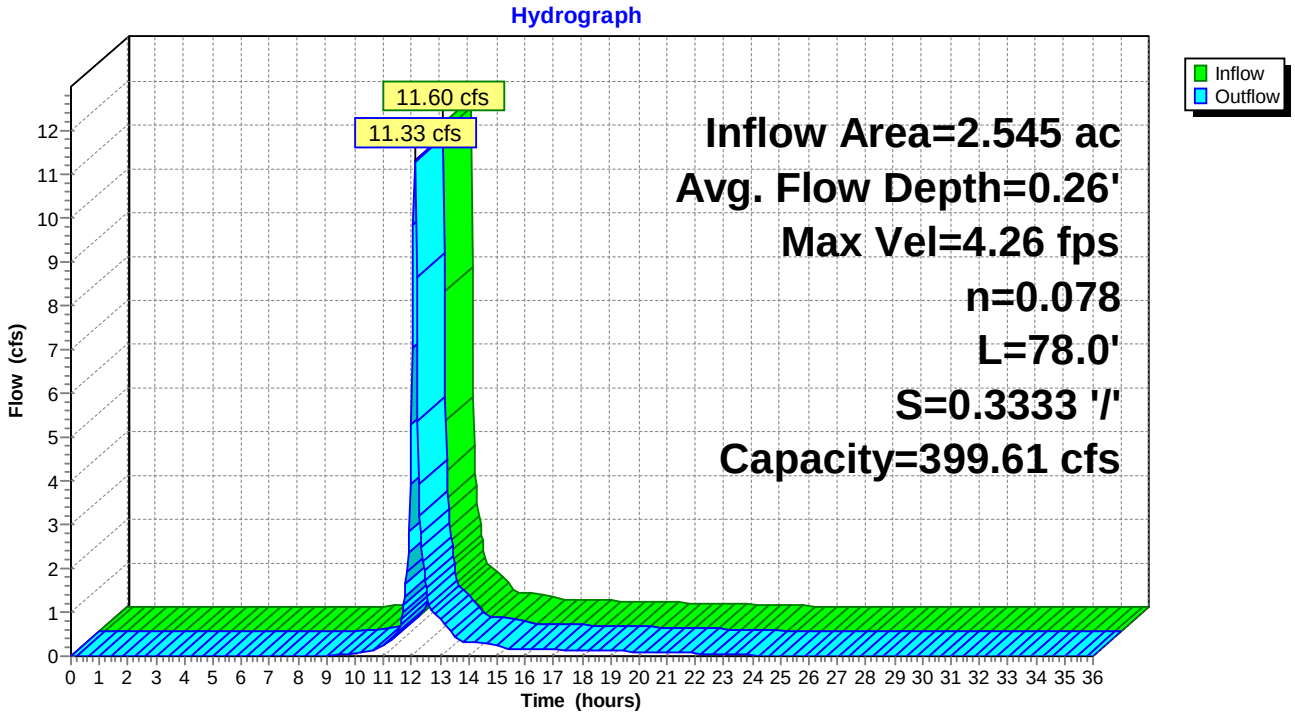
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 4.26 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.00 fps, Avg. Travel Time= 1.3 min

Peak Storage= 211 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.26' , Surface Width= 11.03'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 399.61 cfs

10.00' x 2.00' deep channel, n= 0.078 Riprap, 12-inch
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 78.0' Slope= 0.3333 '/'
Inlet Invert= 742.00', Outlet Invert= 716.00'

‡

Reach 39R: DS-6



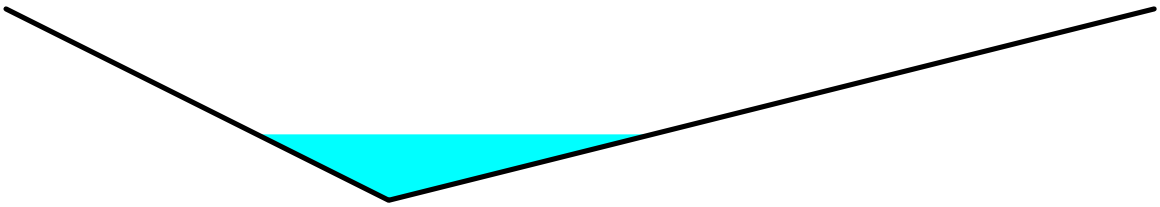
Summary for Reach 41R: DB-12

Inflow Area = 1.778 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 8.38 cfs @ 12.10 hrs, Volume= 0.345 af
Outflow = 8.03 cfs @ 12.11 hrs, Volume= 0.345 af, Atten= 4%, Lag= 0.7 min

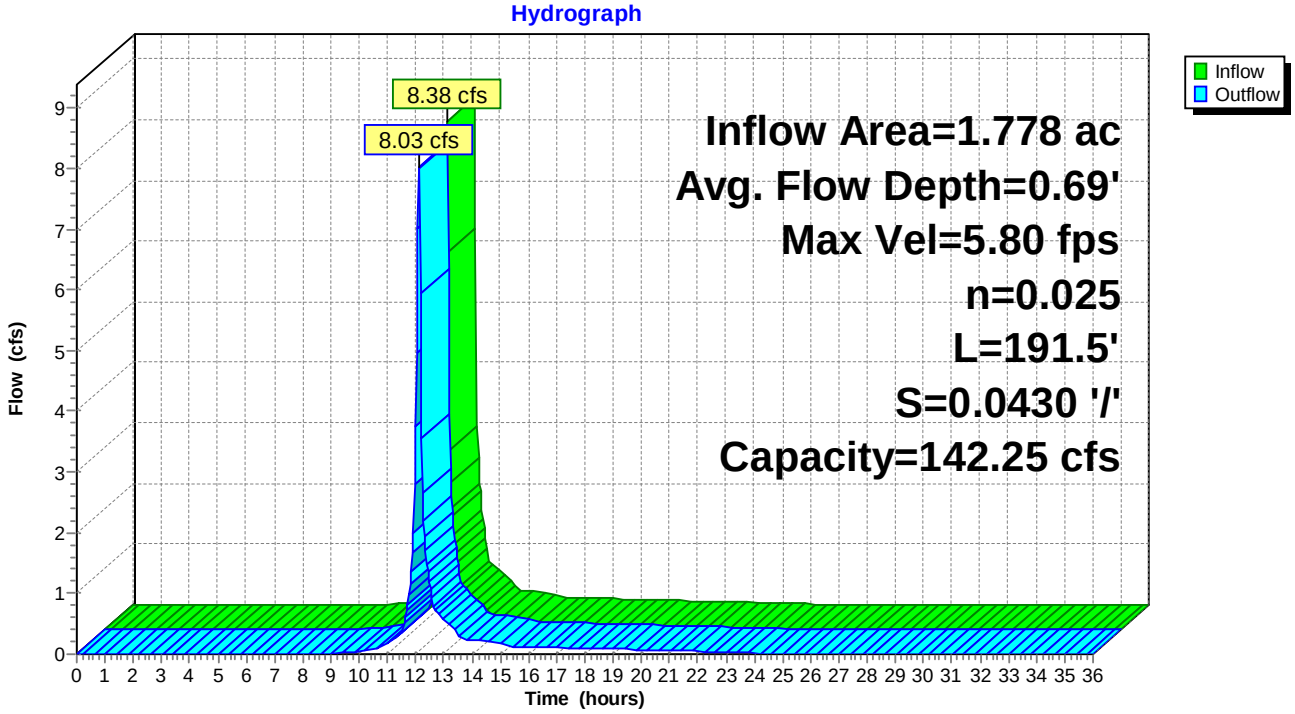
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 5.80 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.97 fps, Avg. Travel Time= 1.6 min

Peak Storage= 273 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.69' , Surface Width= 4.14'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 142.25 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 4.0 '/' Top Width= 12.00'
Length= 191.5' Slope= 0.0430 '/'
Inlet Invert= 749.23', Outlet Invert= 741.00'



Reach 41R: DB-12



Summary for Pond 1P: NSB North

Inflow Area = 272.710 ac, 3.67% Impervious, Inflow Depth = 2.37" for 25-yr, 24-hr event
Inflow = 147.48 cfs @ 12.79 hrs, Volume= 53.799 af
Outflow = 27.48 cfs @ 19.20 hrs, Volume= 8.777 af, Atten= 81%, Lag= 384.9 min
Primary = 27.48 cfs @ 19.20 hrs, Volume= 8.777 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 674.00' Surf.Area= 53,100 sf Storage= 144,600 cf
Peak Elev= 693.39' @ 19.20 hrs Surf.Area= 149,858 sf Storage= 2,163,542 cf (2,018,942 cf above start)

Plug-Flow detention time= 622.1 min calculated for 5.457 af (10% of inflow)
Center-of-Mass det. time= 349.5 min (1,264.5 - 914.9)

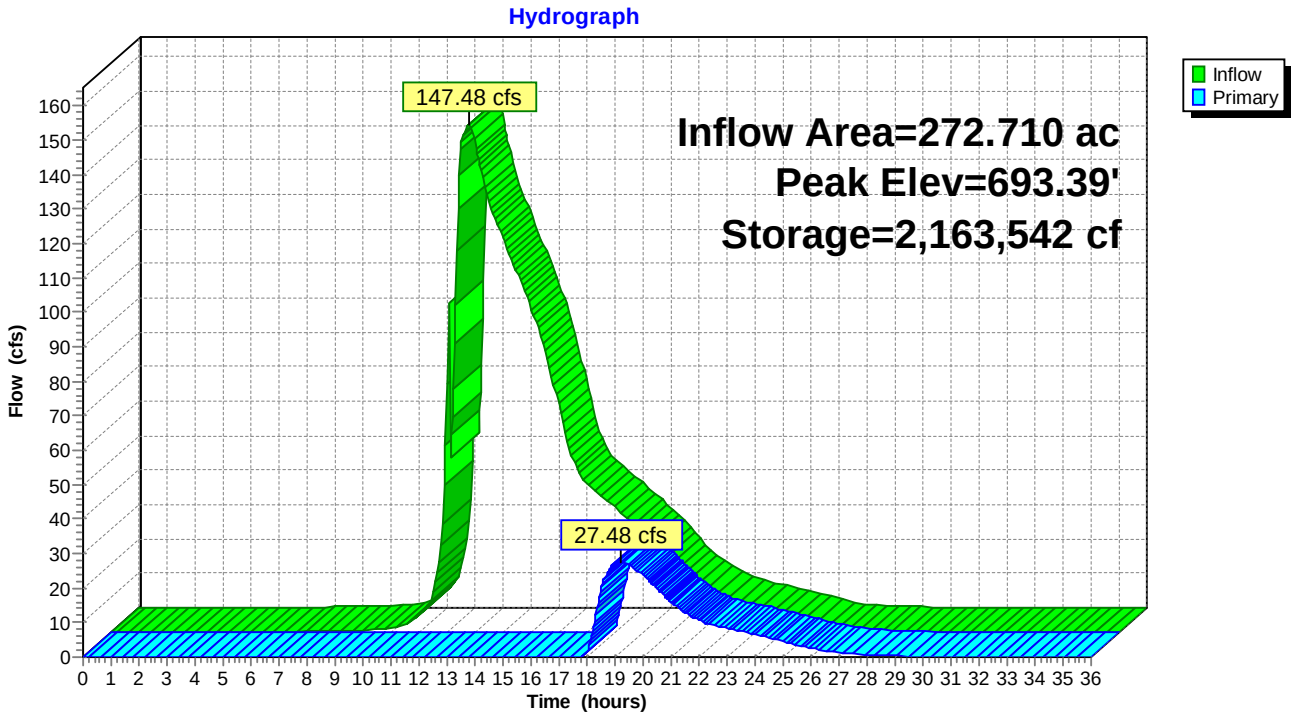
Volume	Invert	Avail.Storage	Storage Description
#1	668.00'	2,910,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
668.00	1,200	0	0
670.00	12,400	13,600	13,600
674.00	53,100	131,000	144,600
680.00	87,600	422,100	566,700
690.00	135,200	1,114,000	1,680,700
694.00	152,508	575,416	2,256,116
695.00	158,400	155,454	2,411,570
698.00	174,100	498,750	2,910,320

Device	Routing	Invert	Outlet Devices
#1	Primary	693.00'	**40.0' long x 20.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=26.06 cfs @ 19.20 hrs HW=693.39' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 26.06 cfs @ 1.68 fps)

Pond 1P: NSB North



Summary for Pond 2P: NSB North Inlet

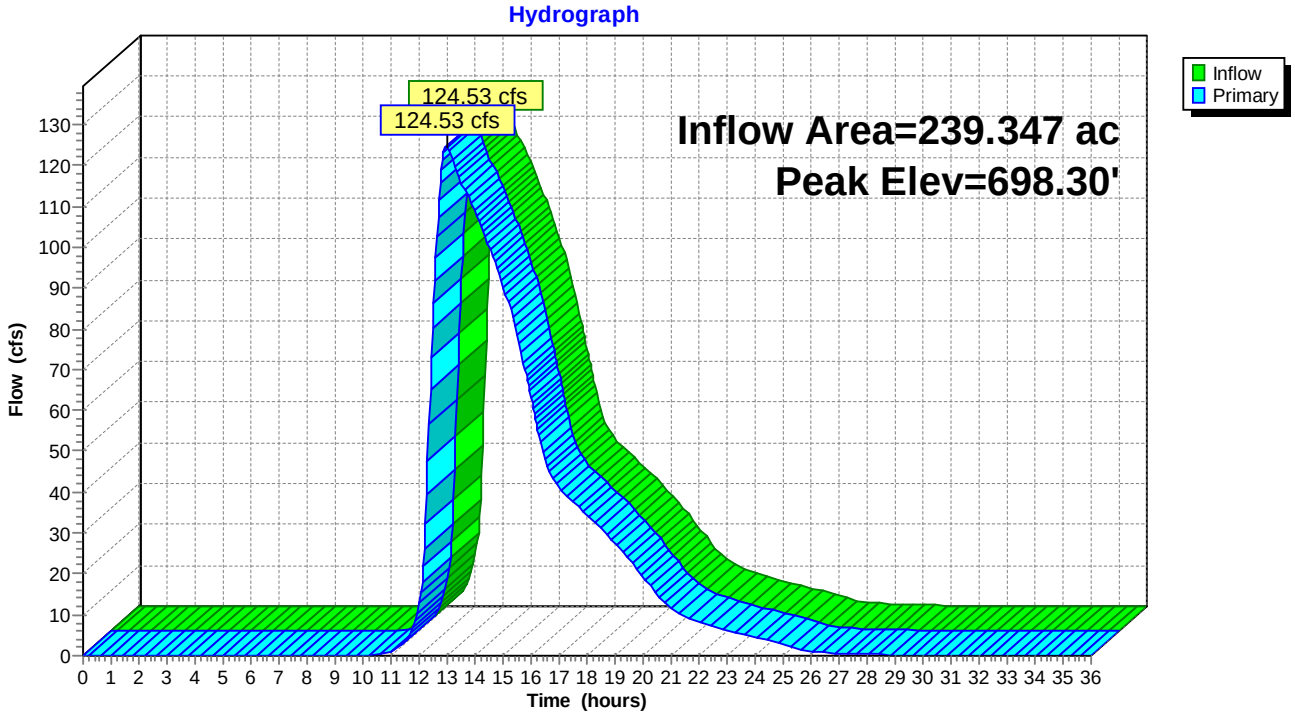
Inflow Area = 239.347 ac, 4.19% Impervious, Inflow Depth = 2.32" for 25-yr, 24-hr event
Inflow = 124.53 cfs @ 12.97 hrs, Volume= 46.355 af
Outflow = 124.53 cfs @ 12.97 hrs, Volume= 46.355 af, Atten= 0%, Lag= 0.0 min
Primary = 124.53 cfs @ 12.97 hrs, Volume= 46.355 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 698.30' @ 12.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	694.96'	**30.0" Round 30" Culverts X 3.00** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 694.96' / 694.96' S= 0.0000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf
#2	Primary	694.96'	**54.0" Round 54" Culvert** L= 110.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 694.96' / 690.50' S= 0.0405 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 15.90 sf

Primary OutFlow Max=124.09 cfs @ 12.97 hrs HW=698.30' TW=693.90' (Fixed TW Elev= 693.90')
└─**1=30" Culverts** (Barrel Controls 45.43 cfs @ 3.08 fps)
└─**2=54" Culvert** (Inlet Controls 78.66 cfs @ 6.22 fps)

Pond 2P: NSB North Inlet



Summary for Pond 5P: MC VII/IX & MC XI/X Pond

MC X/XI Culverts do not restrict flow in ditch (have more capacity than outlet on north end) therefore they are not modeled.

Inflow Area = 94.846 ac, 5.69% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 197.15 cfs @ 12.37 hrs, Volume= 18.817 af
Outflow = 62.08 cfs @ 13.01 hrs, Volume= 17.923 af, Atten= 69%, Lag= 38.5 min
Primary = 62.08 cfs @ 13.01 hrs, Volume= 17.923 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 697.10' Storage= 0 cf
Peak Elev= 702.40' @ 13.01 hrs Surf.Area= 142,840 sf Storage= 316,954 cf

Plug-Flow detention time= 76.1 min calculated for 17.923 af (95% of inflow)
Center-of-Mass det. time= 51.8 min (869.6 - 817.9)

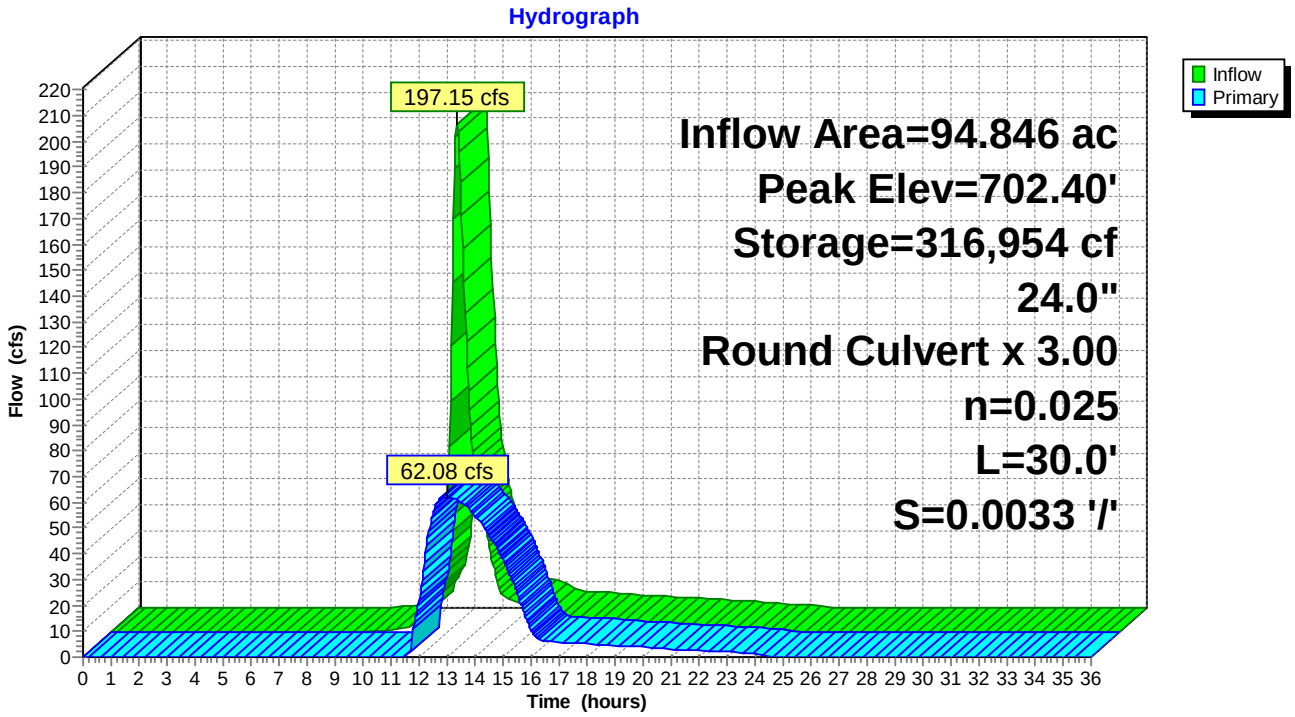
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	925,600 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
698.00	13,000	0	0
700.00	55,300	68,300	68,300
702.00	137,000	192,300	260,600
704.00	166,000	303,000	563,600
706.00	196,000	362,000	925,600

Device	Routing	Invert	Outlet Devices
#1	Primary	697.10'	**24.0" Round Culvert X 3.00** L= 30.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 697.10' / 697.00' S= 0.0033 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=62.08 cfs @ 13.01 hrs HW=702.40' TW=699.40' (Fixed TW Elev= 699.40')
↑**1=Culvert** (Inlet Controls 62.08 cfs @ 6.59 fps)

Pond 5P: MC VII/IX & MC XI/X Pond



Summary for Pond 6P: N-MC VII Culvert

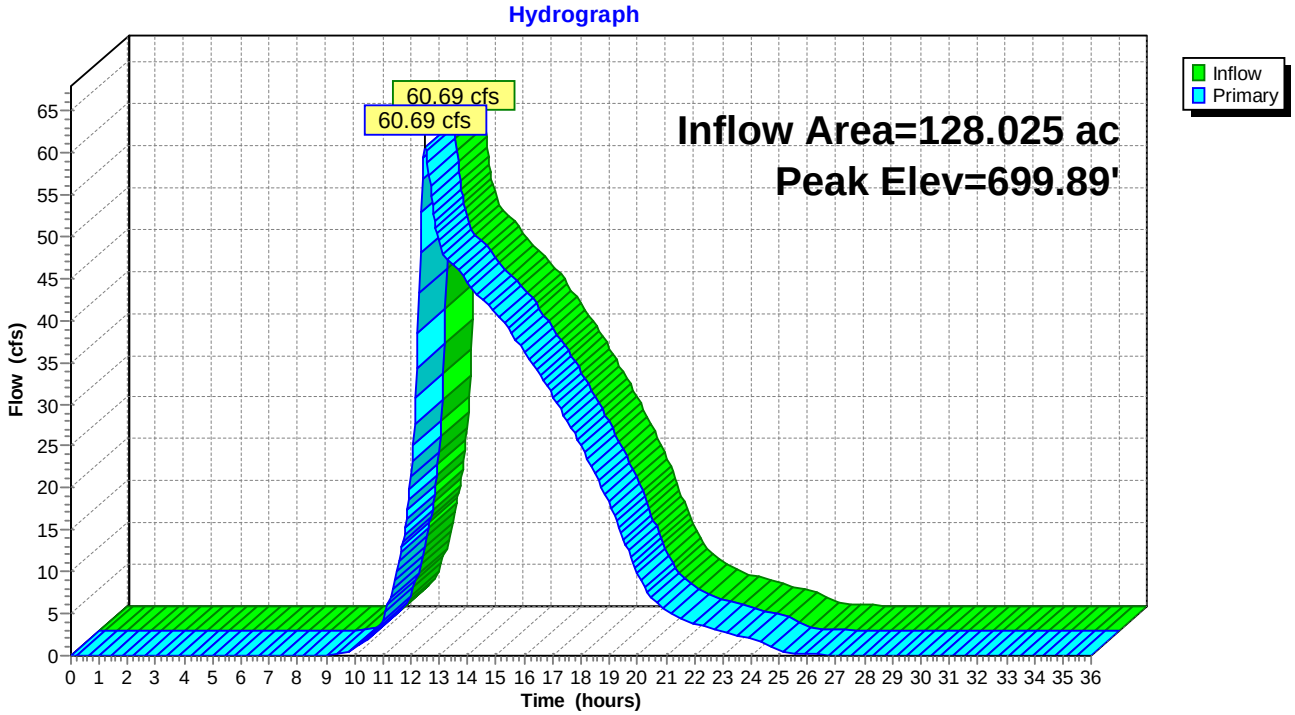
Inflow Area = 128.025 ac, 3.61% Impervious, Inflow Depth = 2.37" for 25-yr, 24-hr event
Inflow = 60.69 cfs @ 12.50 hrs, Volume= 25.237 af
Outflow = 60.69 cfs @ 12.50 hrs, Volume= 25.237 af, Atten= 0%, Lag= 0.0 min
Primary = 60.69 cfs @ 12.50 hrs, Volume= 25.237 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 699.89' @ 12.50 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	696.77'	**54.0" Round 54" Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 696.77' / 696.61' S= 0.0038 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 15.90 sf
#2	Primary	696.77'	**36.0" Round 36" Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 696.77' / 696.61' S= 0.0038 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf

Primary OutFlow Max=60.59 cfs @ 12.50 hrs HW=699.89' TW=699.40' (Fixed TW Elev= 699.40')
└─**1=54" Culvert** (Outlet Controls 36.71 cfs @ 4.39 fps)
└─**2=36" Culvert** (Inlet Controls 23.88 cfs @ 3.38 fps)

Pond 6P: N-MC VII Culvert



Summary for Pond 7P: MC VII/XI Pond

Inflow Area = 22.920 ac, 3.90% Impervious, Inflow Depth = 2.41" for 25-yr, 24-hr event
Inflow = 60.13 cfs @ 12.31 hrs, Volume= 4.609 af
Outflow = 30.71 cfs @ 12.57 hrs, Volume= 4.468 af, Atten= 49%, Lag= 16.1 min
Primary = 30.71 cfs @ 12.57 hrs, Volume= 4.468 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 707.14' @ 12.58 hrs Surf.Area= 27,634 sf Storage= 49,037 cf

Plug-Flow detention time= 33.5 min calculated for 4.463 af (97% of inflow)
Center-of-Mass det. time= 17.1 min (827.1 - 810.0)

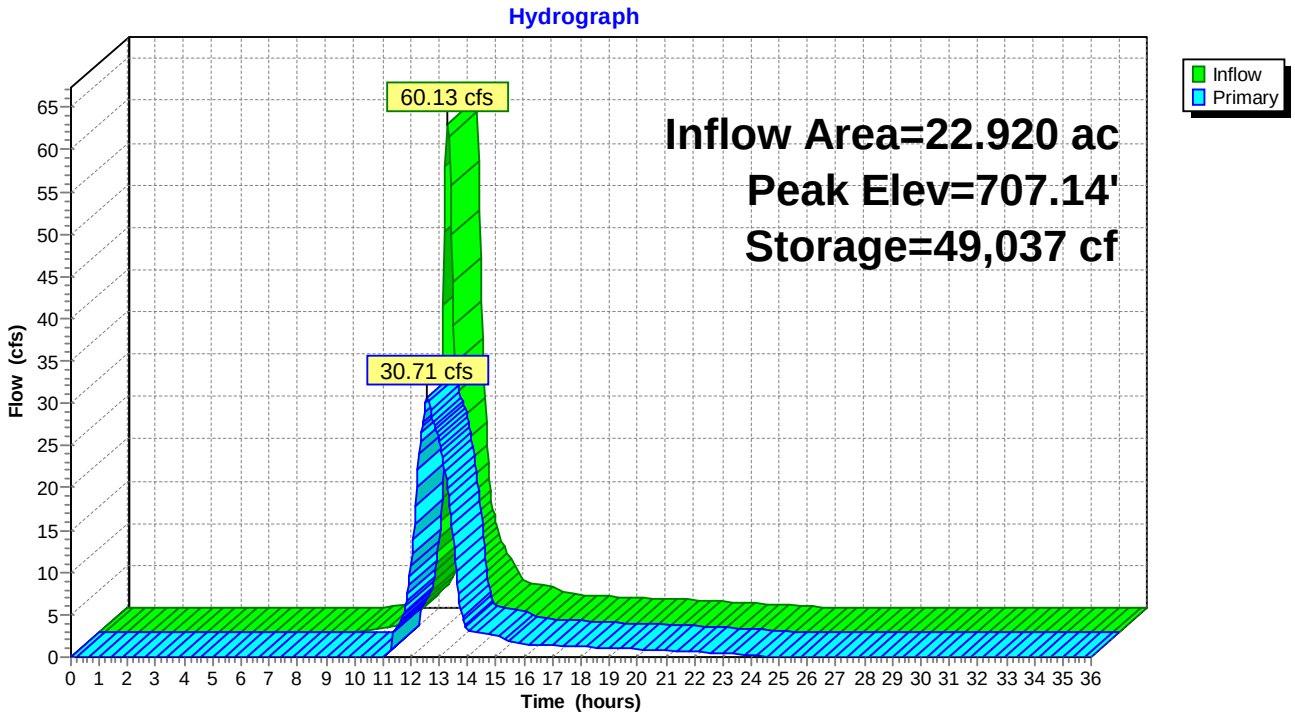
Volume	Invert	Avail.Storage	Storage Description
#1	700.00'	77,700 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
700.00	0	0	0
702.00	1,450	1,450	1,450
704.00	5,200	6,650	8,100
706.00	12,750	17,950	26,050
708.00	38,900	51,650	77,700

Device	Routing	Invert	Outlet Devices
#1	Primary	700.30'	**24.0" Round Culvert** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 700.30' / 699.40' S= 0.0225 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Primary	707.00'	**16.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=30.59 cfs @ 12.57 hrs HW=707.14' TW=703.60' (Fixed TW Elev= 703.60')
1=Culvert (Inlet Controls 28.44 cfs @ 9.05 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 2.15 cfs @ 0.99 fps)

Pond 7P: MC VII/XI Pond



Summary for Pond 8P: NSB South

Inflow Area = 272.710 ac, 3.67% Impervious, Inflow Depth > 0.39" for 25-yr, 24-hr event
Inflow = 27.48 cfs @ 19.20 hrs, Volume= 8.777 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

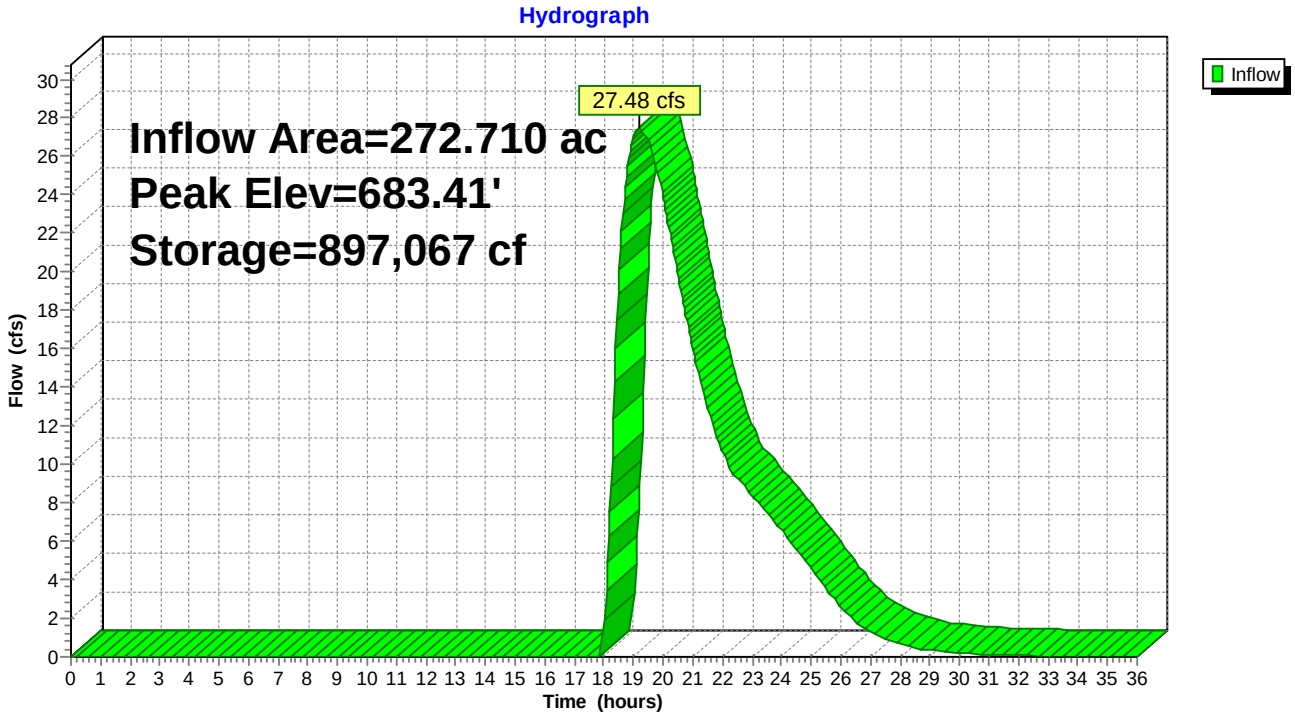
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 680.00' Surf.Area= 98,500 sf Storage= 514,800 cf
Peak Elev= 683.41' @ 36.00 hrs Surf.Area= 125,528 sf Storage= 897,067 cf (382,267 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	672.00'	2,867,350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
672.00	30,200	0	0
680.00	98,500	514,800	514,800
690.00	177,700	1,381,000	1,895,800
694.00	203,900	763,200	2,659,000
695.00	212,800	208,350	2,867,350

Pond 8P: NSB South



Summary for Pond 11P: NWD / NW-MC VII

Inflow Area = 119.997 ac, 3.85% Impervious, Inflow Depth = 2.37" for 25-yr, 24-hr event
Inflow = 366.38 cfs @ 12.18 hrs, Volume= 23.680 af
Outflow = 44.48 cfs @ 12.88 hrs, Volume= 23.680 af, Atten= 88%, Lag= 42.0 min
Primary = 44.48 cfs @ 12.88 hrs, Volume= 23.680 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 710.23' @ 12.88 hrs Surf.Area= 153,658 sf Storage= 512,970 cf

Plug-Flow detention time= 121.6 min calculated for 23.653 af (100% of inflow)
Center-of-Mass det. time= 121.5 min (921.3 - 799.8)

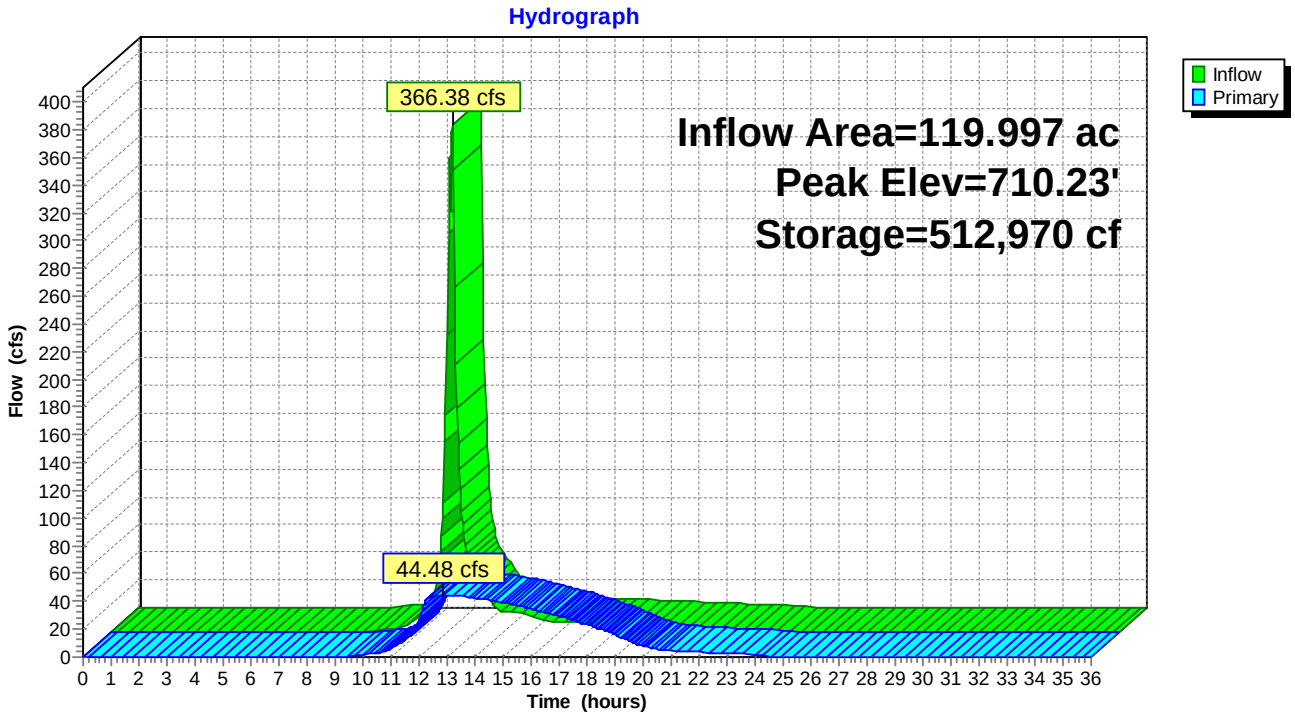
Volume	Invert	Avail.Storage	Storage Description
#1	704.30'	827,625 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
704.30	0	0	0
706.00	68,500	58,225	58,225
708.00	102,200	170,700	228,925
710.00	147,500	249,700	478,625
712.00	201,500	349,000	827,625

Device	Routing	Invert	Outlet Devices
#1	Primary	704.30'	**12.0" Round 12" HDPE Culverts X 2.00** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 704.30' / 699.00' S= 0.0424 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Primary	704.30'	**18.0" Round 18" HDPE Culverts X 2.00** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 704.30' / 699.00' S= 0.0424 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=44.48 cfs @ 12.88 hrs HW=710.23' TW=699.86' (Fixed TW Elev= 699.86')
1=12" HDPE Culverts (Inlet Controls 13.91 cfs @ 8.86 fps)
2=18" HDPE Culverts (Inlet Controls 30.57 cfs @ 8.65 fps)

Pond 11P: NWD / NW-MC VII



Summary for Pond 19P: E-MC IX Culvert

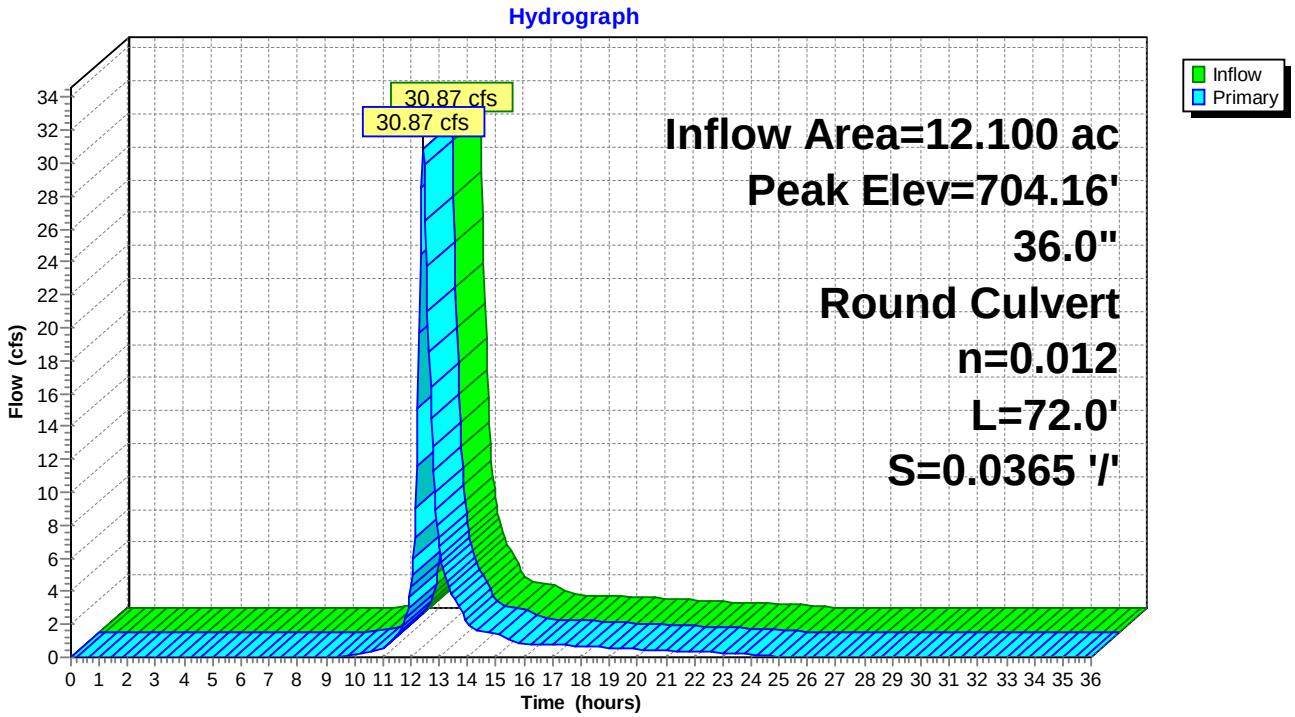
Inflow Area = 12.100 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 30.87 cfs @ 12.42 hrs, Volume= 2.347 af
Outflow = 30.87 cfs @ 12.42 hrs, Volume= 2.347 af, Atten= 0%, Lag= 0.0 min
Primary = 30.87 cfs @ 12.42 hrs, Volume= 2.347 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 704.16' @ 12.42 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	701.82'	**36.0" Round Culvert** L= 72.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 701.82' / 699.19' S= 0.0365 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=30.66 cfs @ 12.42 hrs HW=704.15' TW=700.23' (Fixed TW Elev= 700.23')
↑—**1=Culvert** (Inlet Controls 30.66 cfs @ 5.20 fps)

Pond 19P: E-MC IX Culvert



Summary for Pond 36P: NSB South Inlet

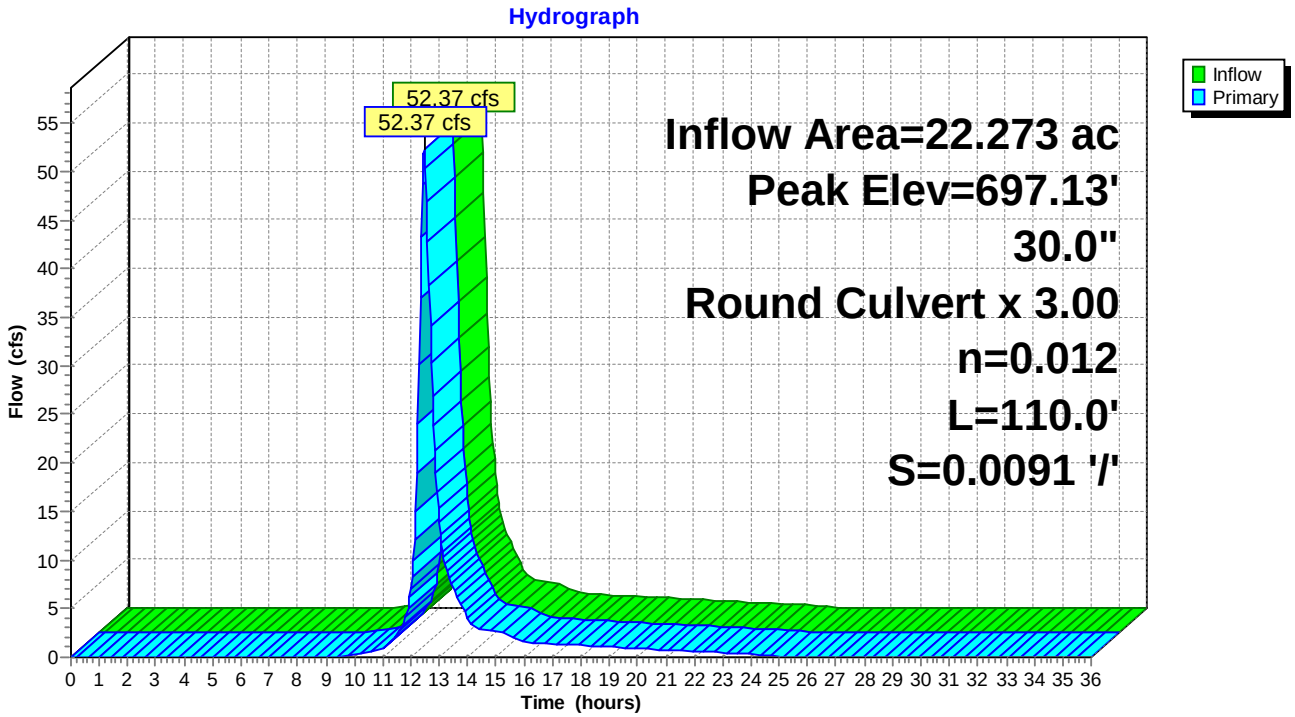
Inflow Area = 22.273 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 52.37 cfs @ 12.47 hrs, Volume= 4.319 af
Outflow = 52.37 cfs @ 12.47 hrs, Volume= 4.319 af, Atten= 0%, Lag= 0.0 min
Primary = 52.37 cfs @ 12.47 hrs, Volume= 4.319 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 697.13' @ 12.47 hrs

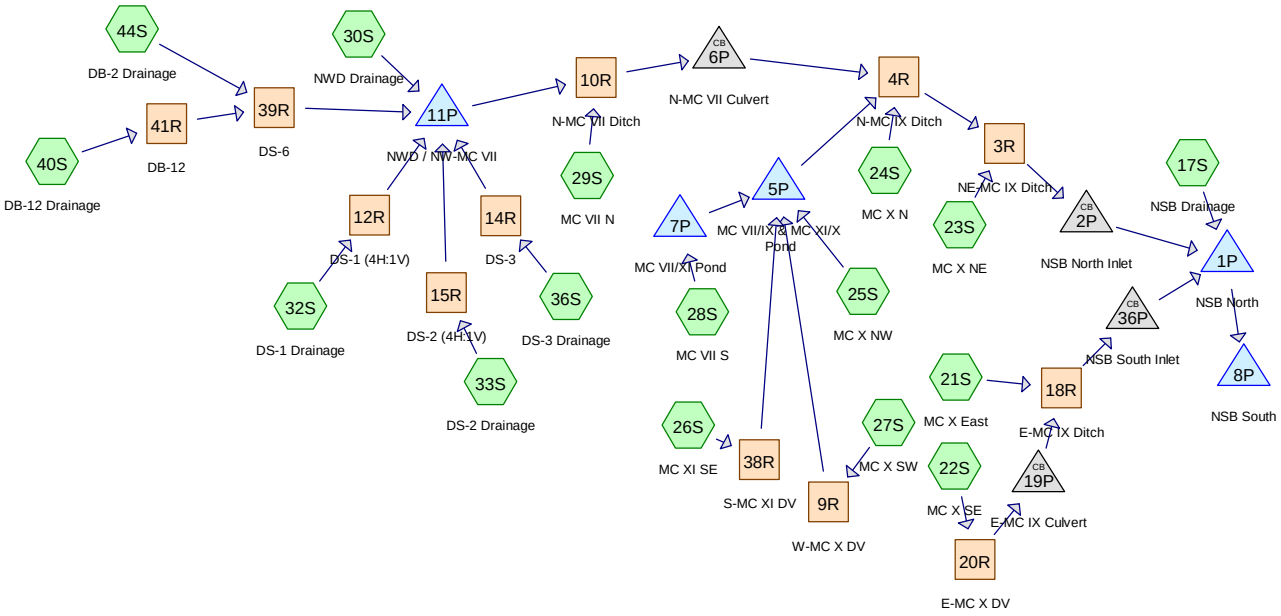
Device	Routing	Invert	Outlet Devices
#1	Primary	695.00'	**30.0" Round 30" Culverts X 3.00** L= 110.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 695.00' / 694.00' S= 0.0091 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf

Primary OutFlow Max=52.13 cfs @ 12.47 hrs HW=697.12' TW=693.90' (Fixed TW Elev= 693.90')
↑—**1=30" Culverts** (Inlet Controls 52.13 cfs @ 3.91 fps)

Pond 36P: NSB South Inlet



North Sedimentation Basin (NSB) HYDROCAD OUTPUT – 100-yr, 24-hr



Routing Diagram for WDI Vert Exp NSB 10-04-21
Prepared by {enter your company name here}, Printed 10/7/2021
HydroCAD® 10.10-5a s/n 11246 © 2020 HydroCAD Software Solutions LLC

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 17S: NSB Drainage Runoff Area=483,100 sf 0.00% Impervious Runoff Depth=4.54"
Tc=0.0 min CN=95 Runoff=100.06 cfs 4.194 af

Subcatchment 21S: MC X East Runoff Area=443,100 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=650' Slope=0.0370 '/' Tc=21.2 min CN=84 Runoff=37.02 cfs 2.865 af

Subcatchment 22S: MC X SE Runoff Area=527,091 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=240' Slope=0.0540 '/' Tc=15.5 min CN=84 Runoff=51.29 cfs 3.409 af

Subcatchment 23S: MC X NE Runoff Area=435,600 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=440' Slope=0.0590 '/' Tc=15.3 min CN=84 Runoff=42.88 cfs 2.817 af

Subcatchment 24S: MC X N Runoff Area=282,100 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=310' Slope=0.0930 '/' Tc=11.7 min CN=84 Runoff=31.08 cfs 1.824 af

Subcatchment 25S: MC X NW Runoff Area=2,437,500 sf 8.04% Impervious Runoff Depth=3.48"
Flow Length=820' Slope=0.0380 '/' Tc=23.0 min CN=85 Runoff=200.20 cfs 16.224 af

Subcatchment 26S: MC XI SE Runoff Area=95,200 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=405' Slope=0.0770 '/' Tc=13.4 min CN=84 Runoff=9.92 cfs 0.616 af

Subcatchment 27S: MC X SW Runoff Area=600,400 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=240' Slope=0.0400 '/' Tc=17.5 min CN=84 Runoff=55.18 cfs 3.883 af

Subcatchment 28S: MC VII S Runoff Area=998,400 sf 3.90% Impervious Runoff Depth=3.48"
Flow Length=1,070' Tc=20.9 min CN=85 Runoff=85.95 cfs 6.645 af

Subcatchment 29S: MC VII N Runoff Area=349,700 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=560' Slope=0.0390 '/' Tc=19.5 min CN=84 Runoff=30.49 cfs 2.261 af

Subcatchment 30S: NWD Drainage Runoff Area=1,229,971 sf 16.38% Impervious Runoff Depth=3.58"
Tc=0.0 min CN=86 Runoff=222.37 cfs 8.422 af

Subcatchment 32S: DS-1 Drainage Runoff Area=1,563,637 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=2,073' Tc=9.9 min CN=84 Runoff=185.01 cfs 10.112 af

Subcatchment 33S: DS-2 Drainage Runoff Area=922,087 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=1,697' Tc=8.4 min CN=84 Runoff=115.79 cfs 5.963 af

Subcatchment 36S: DS-3 Drainage Runoff Area=1,400,534 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=1,993' Tc=8.8 min CN=84 Runoff=172.84 cfs 9.057 af

Subcatchment 40S: DB-12 Drainage Runoff Area=77,446 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=777' Tc=3.2 min CN=84 Runoff=11.69 cfs 0.501 af

Subcatchment 44S: DB-2 Drainage Runoff Area=33,395 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=540' Tc=3.0 min CN=84 Runoff=5.07 cfs 0.216 af

Reach 3R: NE-MC IX Ditch Avg. Flow Depth=1.54' Max Vel=2.76 fps Inflow=154.98 cfs 67.505 af
n=0.025 L=1,090.0' S=0.0014 '/' Capacity=1,435.24 cfs Outflow=153.57 cfs 67.505 af

Reach 4R: N-MC IX Ditch Avg. Flow Depth=2.65' Max Vel=2.02 fps Inflow=149.49 cfs 64.688 af
n=0.025 L=950.0' S=0.0004 '/' Capacity=458.97 cfs Outflow=146.34 cfs 64.688 af

Reach 9R: W-MC X DV Avg. Flow Depth=1.58' Max Vel=3.54 fps Inflow=55.18 cfs 3.883 af
n=0.025 L=1,400.0' S=0.0050 '/' Capacity=165.41 cfs Outflow=48.58 cfs 3.883 af

Reach 10R: N-MC VII Ditch Avg. Flow Depth=1.10' Max Vel=2.62 fps Inflow=78.05 cfs 36.532 af
n=0.025 L=920.0' S=0.0020 '/' Capacity=424.80 cfs Outflow=75.49 cfs 36.532 af

Reach 12R: DS-1 (4H:1V) Avg. Flow Depth=0.72' Max Vel=18.84 fps Inflow=185.01 cfs 10.112 af
n=0.029 L=764.0' S=0.2500 '/' Capacity=1,087.59 cfs Outflow=180.58 cfs 10.112 af

Reach 14R: DS-3 Avg. Flow Depth=0.77' Max Vel=19.38 fps Inflow=172.84 cfs 9.057 af
n=0.029 L=712.0' S=0.2500 '/' Capacity=930.83 cfs Outflow=167.54 cfs 9.057 af

Reach 15R: DS-2 (4H:1V) Avg. Flow Depth=0.61' Max Vel=16.90 fps Inflow=115.79 cfs 5.963 af
n=0.029 L=616.0' S=0.2500 '/' Capacity=930.83 cfs Outflow=112.25 cfs 5.963 af

Reach 18R: E-MC IX Ditch Avg. Flow Depth=1.23' Max Vel=3.76 fps Inflow=79.16 cfs 6.274 af
n=0.025 L=585.0' S=0.0068 '/' Capacity=457.74 cfs Outflow=77.59 cfs 6.274 af

Reach 20R: E-MC X DV Avg. Flow Depth=1.71' Max Vel=5.17 fps Inflow=51.29 cfs 3.409 af
n=0.025 L=1,780.0' S=0.0100 '/' Capacity=68.87 cfs Outflow=45.35 cfs 3.409 af

Reach 38R: S-MC XI DV Avg. Flow Depth=0.76' Max Vel=4.07 fps Inflow=9.92 cfs 0.616 af
n=0.025 L=750.0' S=0.0180 '/' Capacity=57.72 cfs Outflow=9.30 cfs 0.616 af

Reach 39R: DS-6 Avg. Flow Depth=0.32' Max Vel=4.86 fps Inflow=16.60 cfs 0.717 af
n=0.078 L=78.0' S=0.3333 '/' Capacity=399.61 cfs Outflow=16.28 cfs 0.717 af

Reach 41R: DB-12 Avg. Flow Depth=0.79' Max Vel=6.33 fps Inflow=11.69 cfs 0.501 af
n=0.025 L=191.5' S=0.0430 '/' Capacity=142.25 cfs Outflow=11.51 cfs 0.501 af

Pond 1P: NSB North Peak Elev=693.91' Storage=2,241,647 cf Inflow=209.95 cfs 77.973 af
Outflow=91.12 cfs 32.951 af

Pond 2P: NSB North Inlet Peak Elev=698.79' Inflow=153.57 cfs 67.505 af
Outflow=153.57 cfs 67.505 af

Pond 5P: MC VII/IX & MC XI/X Pond Peak Elev=703.60' Storage=498,329 cf Inflow=291.33 cfs 27.225 af
24.0" Round Culvert x 3.00 n=0.025 L=30.0' S=0.0033 '/' Outflow=73.42 cfs 26.332 af

Pond 6P: N-MC VII Culvert Peak Elev=700.09' Inflow=75.49 cfs 36.532 af
Outflow=75.49 cfs 36.532 af

Pond 7P: MC VII/XI Pond Peak Elev=707.70' Storage=66,581 cf Inflow=85.95 cfs 6.645 af
Outflow=55.60 cfs 6.504 af

Pond 8P: NSB South Peak Elev=690.30' Storage=1,950,085 cf Inflow=91.12 cfs 32.951 af
Outflow=0.00 cfs 0.000 af

Pond 11P: NWD / NW-MC VII Peak Elev=711.86' Storage=799,970 cf Inflow=525.99 cfs 34.271 af
Outflow=50.93 cfs 34.271 af

Pond 19P: E-MC IX Culvert Peak Elev=705.10' Inflow=45.35 cfs 3.409 af
36.0" Round Culvert n=0.012 L=72.0' S=0.0365 '/' Outflow=45.35 cfs 3.409 af

Pond 36P: NSB South Inlet Peak Elev=698.17' Inflow=77.59 cfs 6.274 af
30.0" Round Culvert x 3.00 n=0.012 L=110.0' S=0.0091 '/' Outflow=77.59 cfs 6.274 af

Total Runoff Area = 272.710 ac Runoff Volume = 79.009 af Average Runoff Depth = 3.48"
96.33% Pervious = 262.692 ac 3.67% Impervious = 10.018 ac

Summary for Subcatchment 17S: NSB Drainage

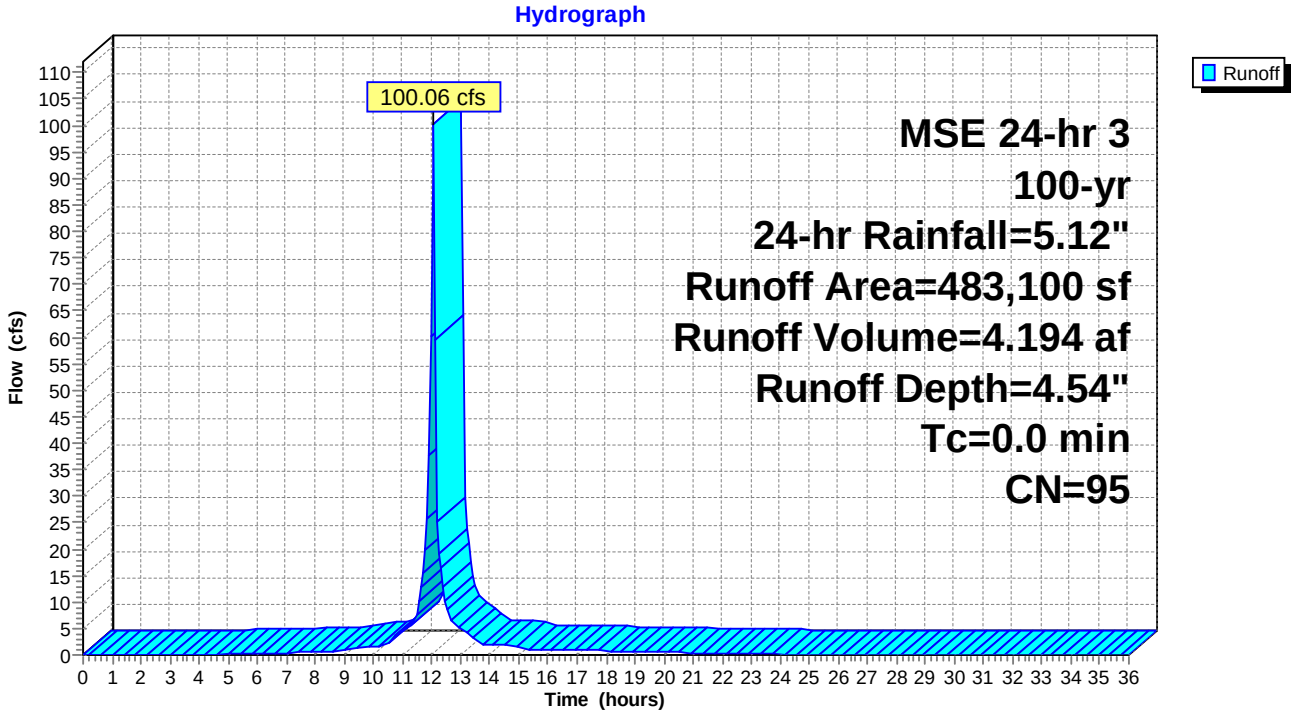
Drainage area is pond area and land area
Land area = 483,100 - 111,900 = 371,200

Runoff = 100.06 cfs @ 12.06 hrs, Volume= 4.194 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
111,900	84	50-75% Grass cover, Fair, HSG D
371,200	98	Water Surface, 0% imp, HSG D
483,100	95	Weighted Average
483,100		100.00% Pervious Area

Subcatchment 17S: NSB Drainage



Summary for Subcatchment 21S: MC X East

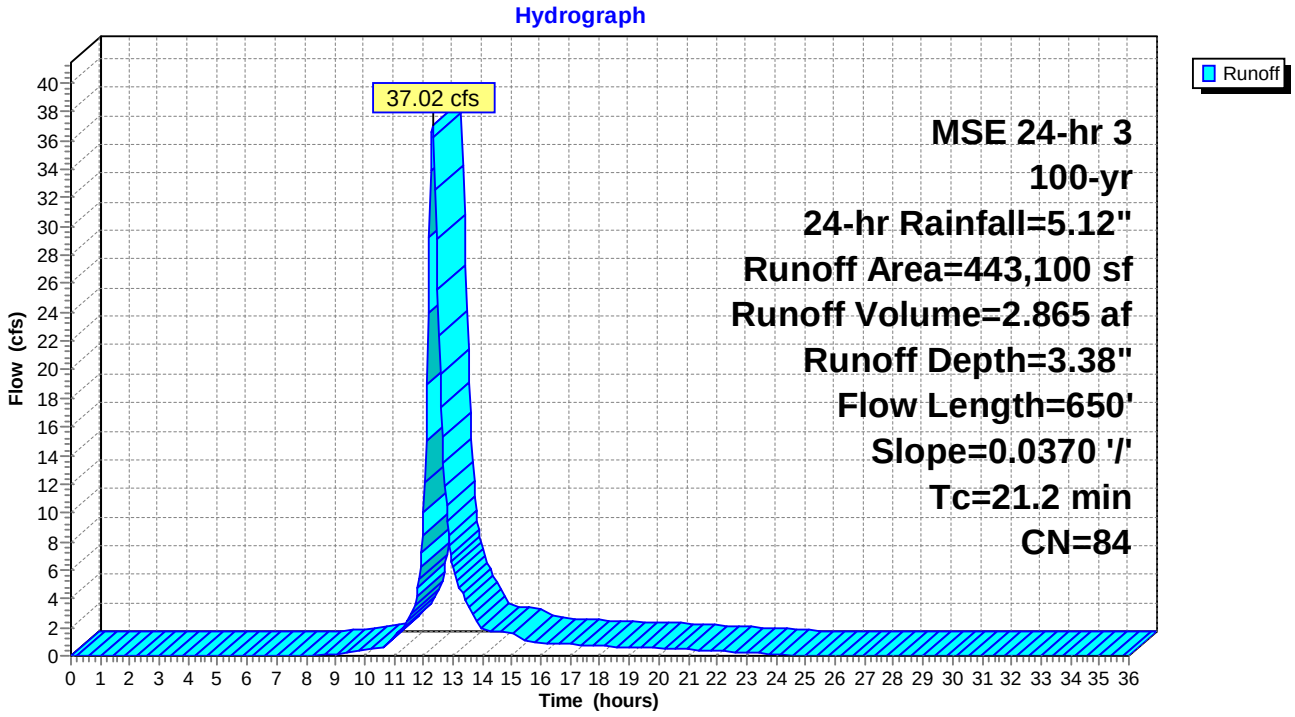
Runoff = 37.02 cfs @ 12.31 hrs, Volume= 2.865 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
443,100	84	50-75% Grass cover, Fair, HSG D
443,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	200	0.0370	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
5.6	450	0.0370	1.35		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.2	650	Total			

Subcatchment 21S: MC X East



Summary for Subcatchment 22S: MC X SE

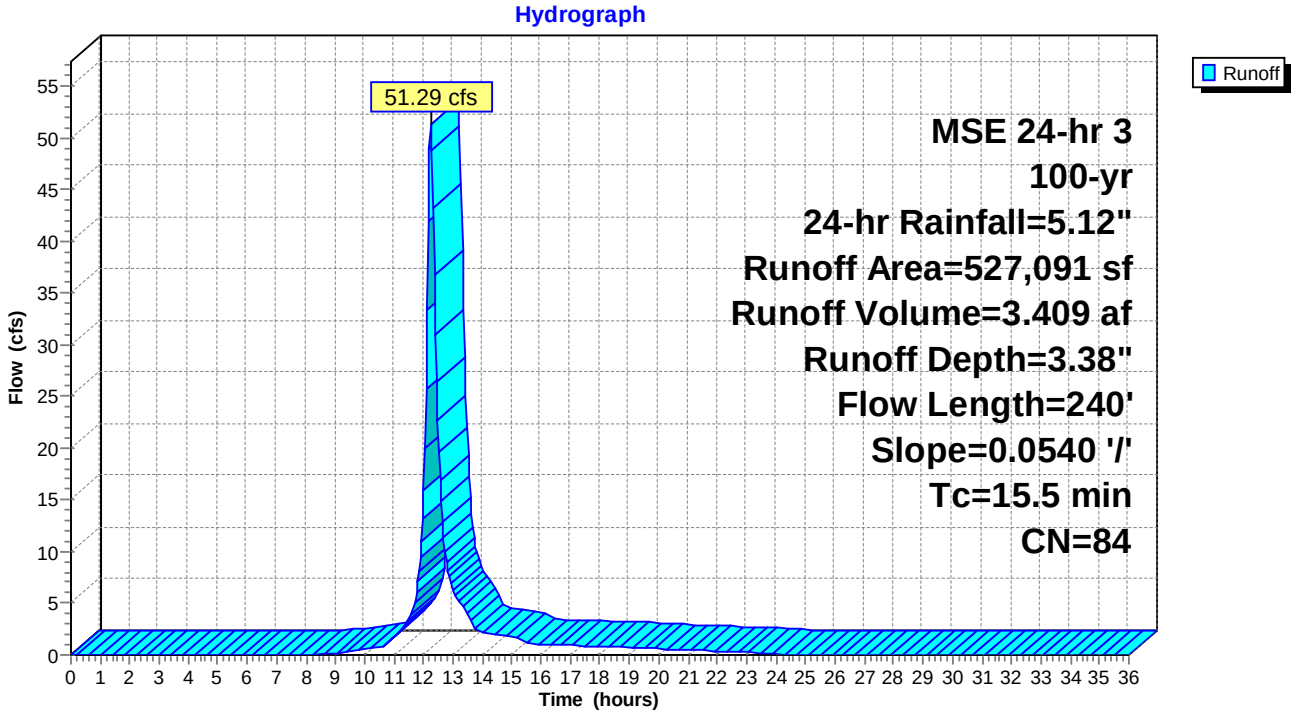
Runoff = 51.29 cfs @ 12.24 hrs, Volume= 3.409 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
527,091	84	50-75% Grass cover, Fair, HSG D
527,091		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	240	0.0540	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 22S: MC X SE



Summary for Subcatchment 23S: MC X NE

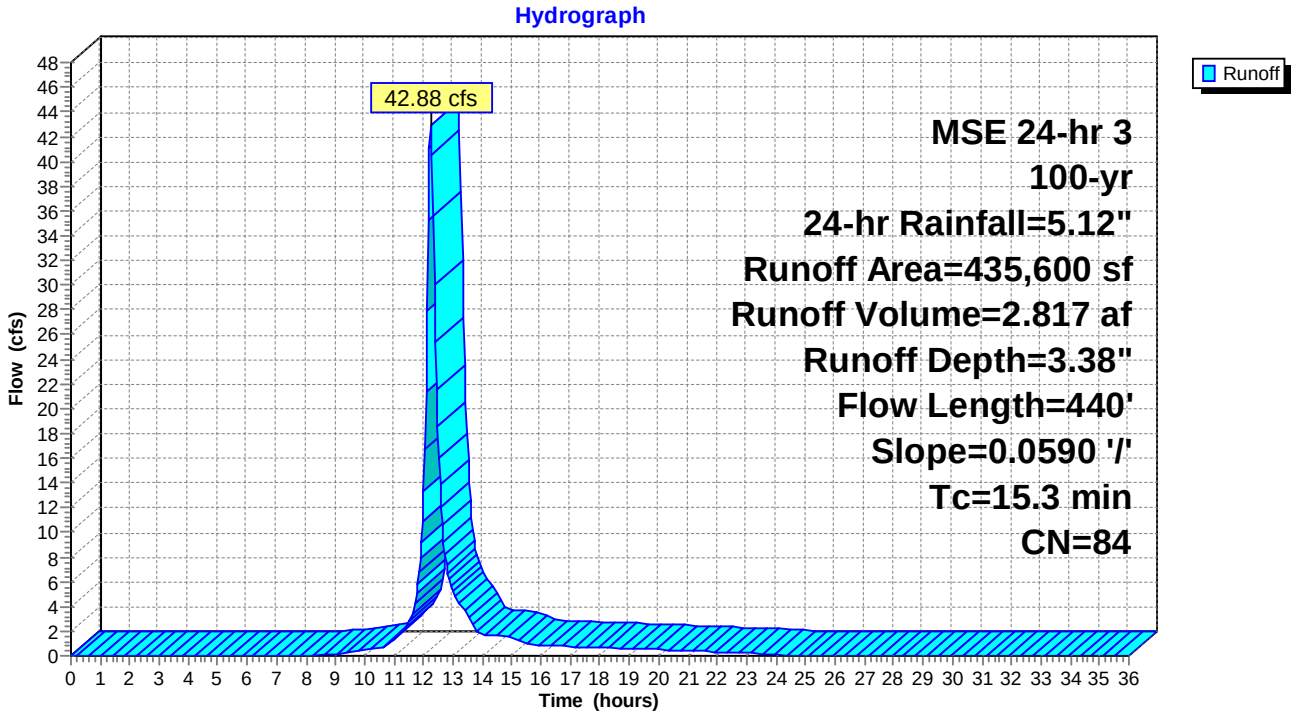
Runoff = 42.88 cfs @ 12.24 hrs, Volume= 2.817 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
435,600	84	50-75% Grass cover, Fair, HSG D
435,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	200	0.0590	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.4	240	0.0590	1.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.3	440	Total			

Subcatchment 23S: MC X NE



Summary for Subcatchment 24S: MC X N

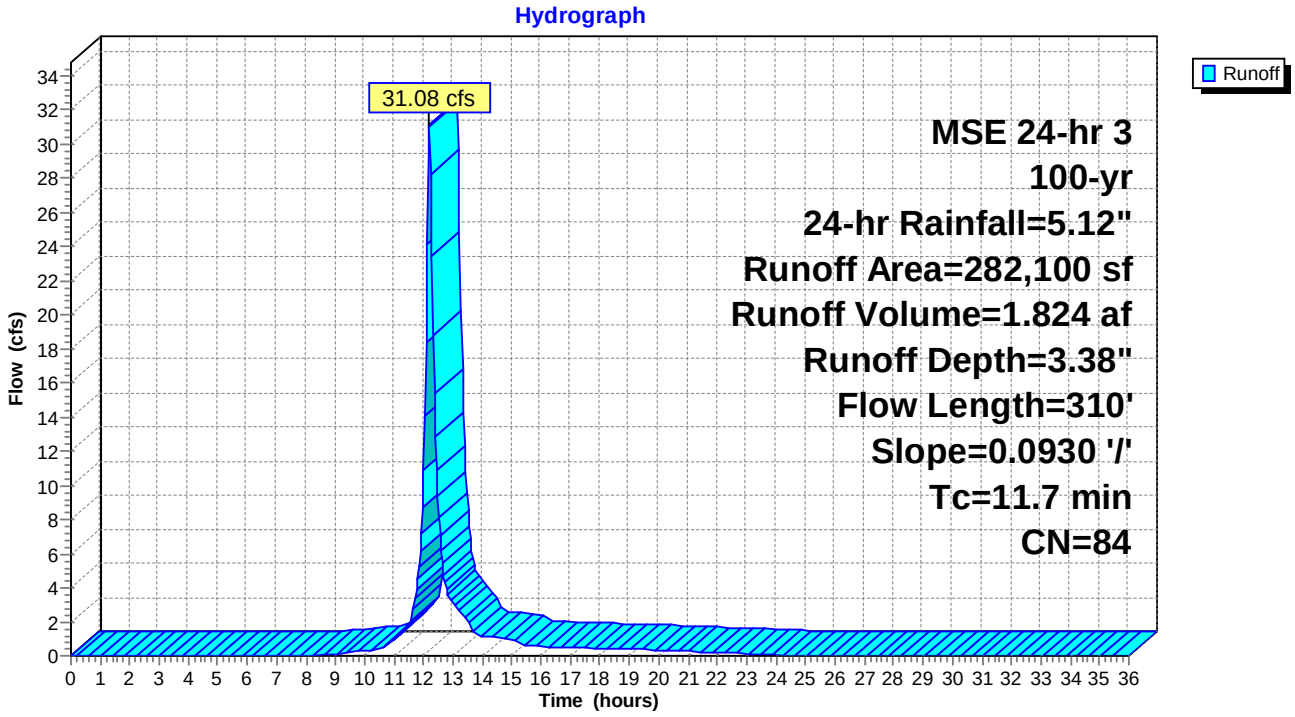
Runoff = 31.08 cfs @ 12.19 hrs, Volume= 1.824 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
282,100	84	50-75% Grass cover, Fair, HSG D
282,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	200	0.0930	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
0.9	110	0.0930	2.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.7	310	Total			

Subcatchment 24S: MC X N



Summary for Subcatchment 25S: MC X NW

Drainage area is pond area and land area
Land area = 2,437,500 - 196,000 = 2,241,500

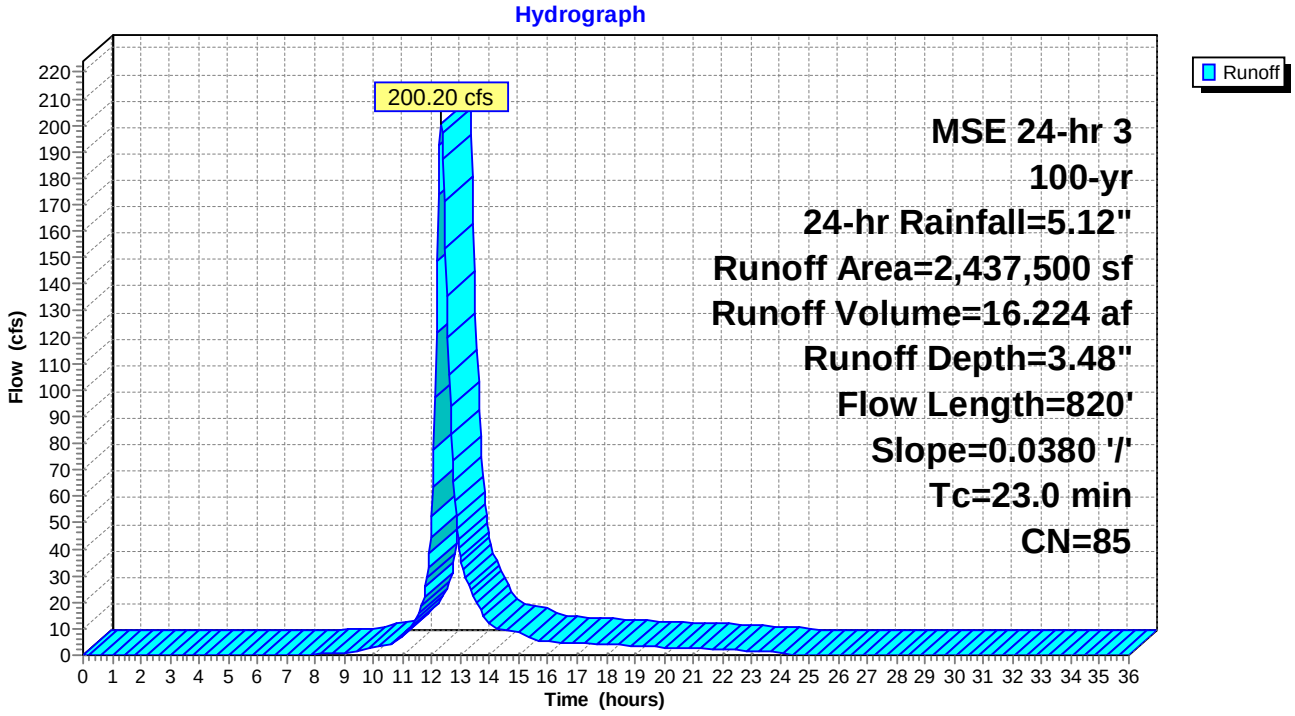
Runoff = 200.20 cfs @ 12.33 hrs, Volume= 16.224 af, Depth= 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
196,000	98	Water Surface, HSG D
2,241,500	84	50-75% Grass cover, Fair, HSG D
2,437,500	85	Weighted Average
2,241,500		91.96% Pervious Area
196,000		8.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	200	0.0380	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
7.6	620	0.0380	1.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
23.0	820	Total			

Subcatchment 25S: MC X NW



Summary for Subcatchment 26S: MC XI SE

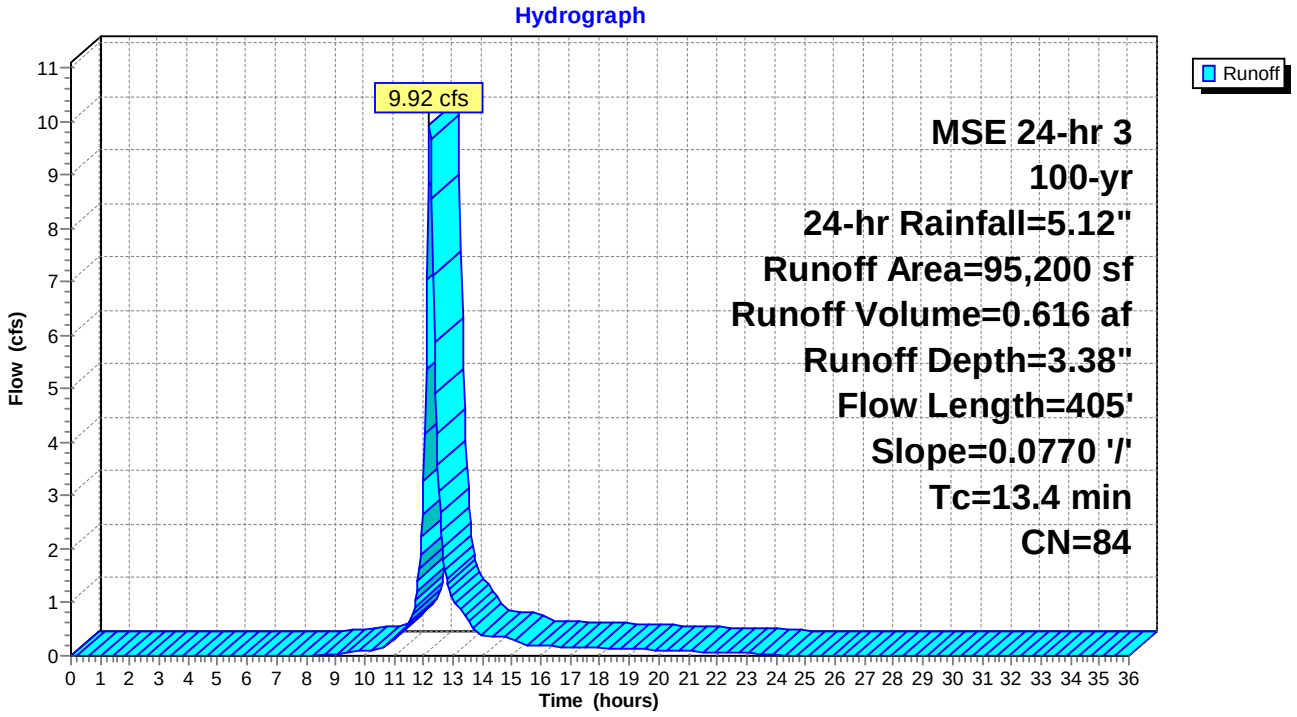
Runoff = 9.92 cfs @ 12.21 hrs, Volume= 0.616 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
95,200	84	50-75% Grass cover, Fair, HSG D
95,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	200	0.0770	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.8	205	0.0770	1.94		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.4	405	Total			

Subcatchment 26S: MC XI SE



Summary for Subcatchment 27S: MC X SW

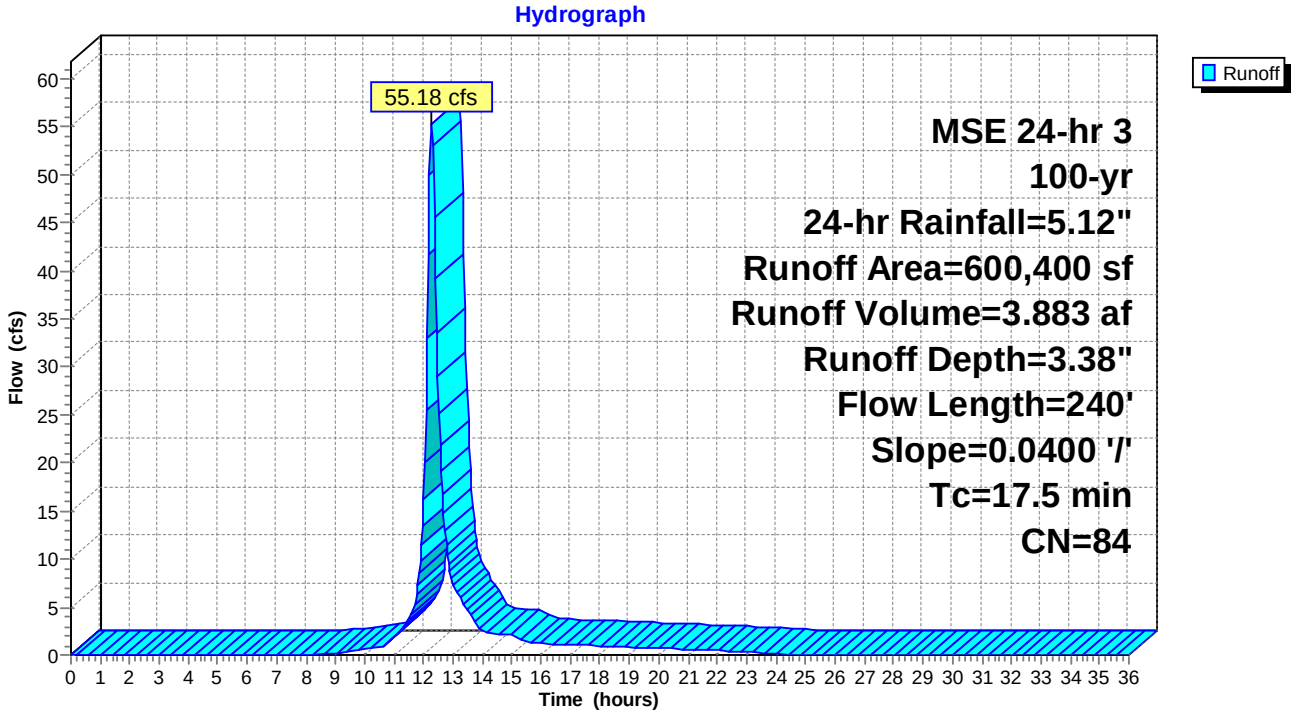
Runoff = 55.18 cfs @ 12.26 hrs, Volume= 3.883 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
600,400	84	50-75% Grass cover, Fair, HSG D
600,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.5	240	0.0400	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 27S: MC X SW



Summary for Subcatchment 28S: MC VII S

Drainage area is pond area and land area
Land area = 998,400 - 38,900 = 959,500

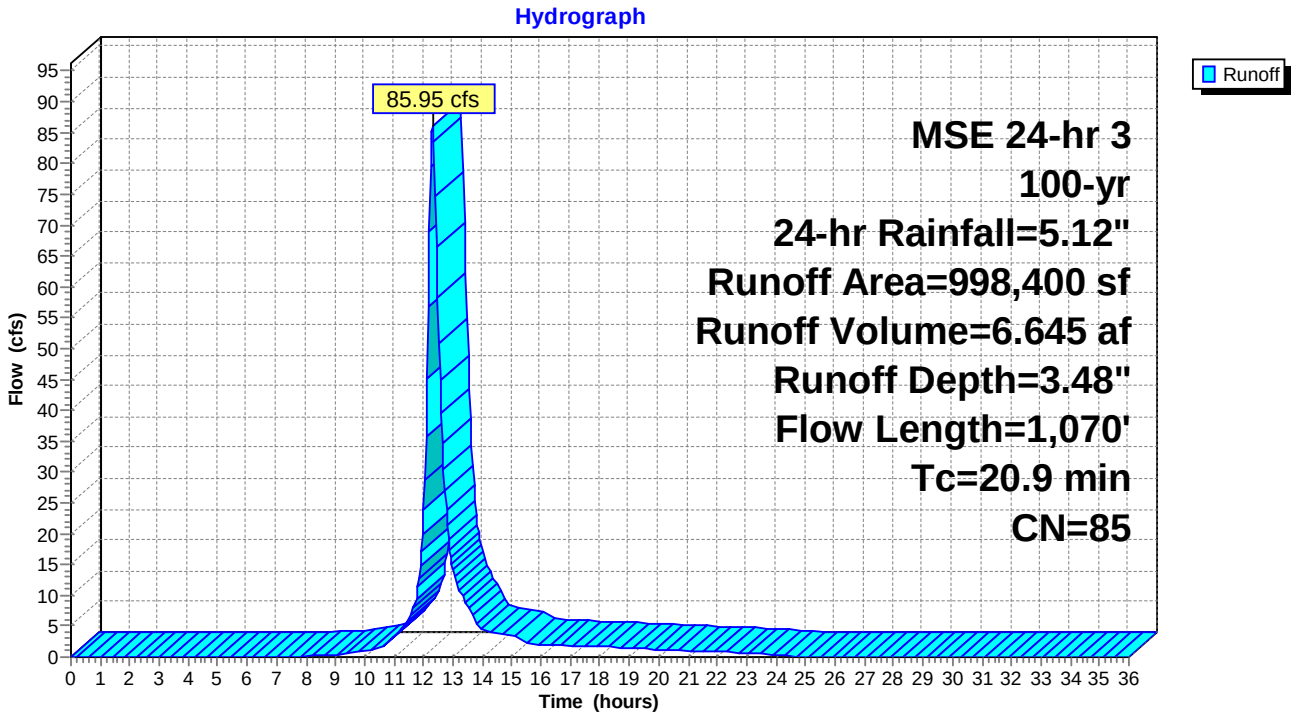
Runoff = 85.95 cfs @ 12.30 hrs, Volume= 6.645 af, Depth= 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
38,900	98	Water Surface, HSG D
959,500	84	50-75% Grass cover, Fair, HSG D
998,400	85	Weighted Average
959,500		96.10% Pervious Area
38,900		3.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	200	0.0300	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.3	170	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	700	0.0140	7.03	84.40	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
20.9	1,070	Total			

Subcatchment 28S: MC VII S



Summary for Subcatchment 29S: MC VII N

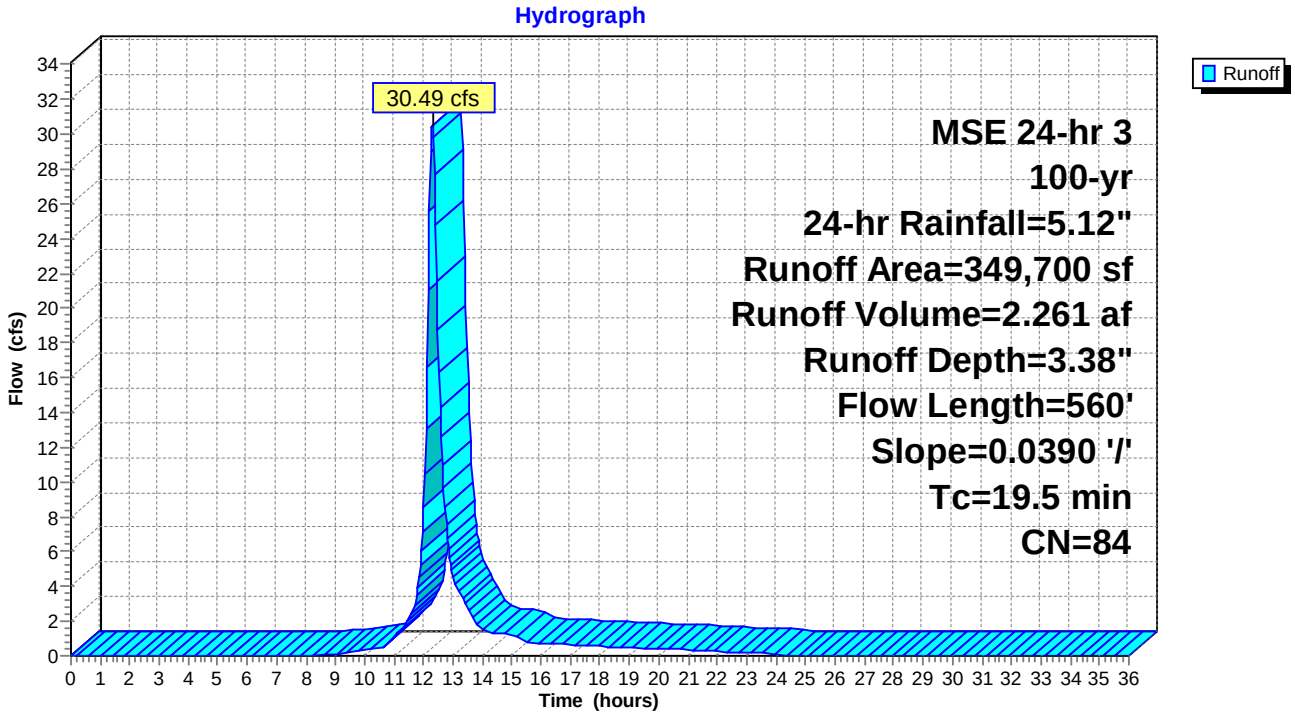
Runoff = 30.49 cfs @ 12.29 hrs, Volume= 2.261 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
349,700	84	50-75% Grass cover, Fair, HSG D
349,700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	200	0.0390	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
4.3	360	0.0390	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.5	560	Total			

Subcatchment 29S: MC VII N



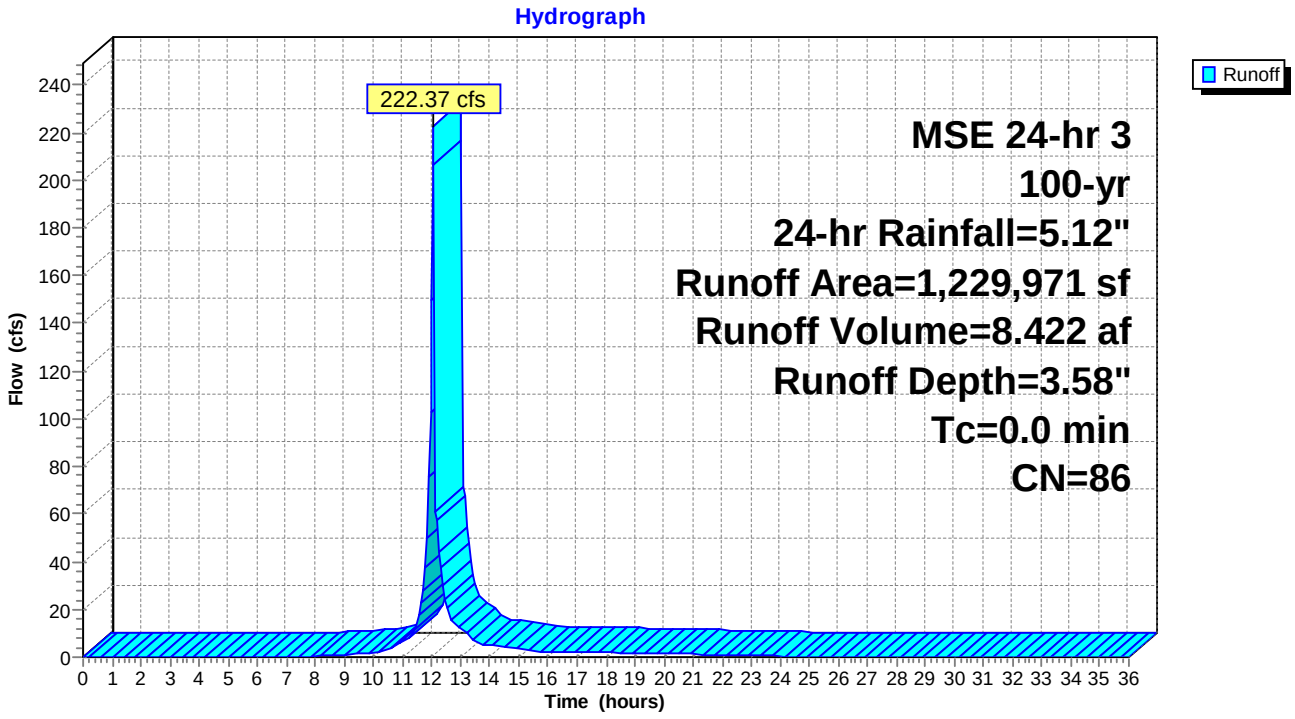
Summary for Subcatchment 30S: NWD Drainage

Runoff = 222.37 cfs @ 12.06 hrs, Volume= 8.422 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
201,500	98	Water Surface, HSG D
1,028,471	84	50-75% Grass cover, Fair, HSG D
1,229,971	86	Weighted Average
1,028,471		83.62% Pervious Area
201,500		16.38% Impervious Area

Subcatchment 30S: NWD Drainage



Summary for Subcatchment 32S: DS-1 Drainage

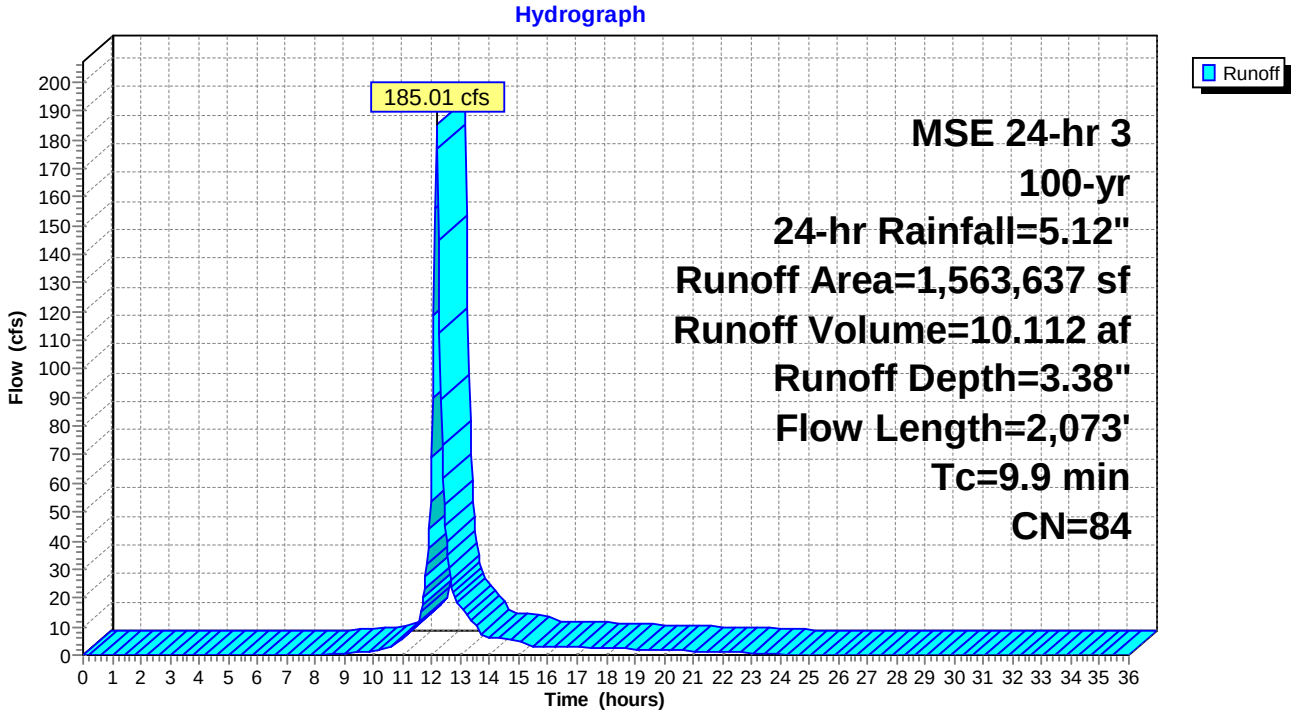
Runoff = 185.01 cfs @ 12.17 hrs, Volume= 10.112 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
1,563,637	84	50-75% Grass cover, Fair, HSG D
1,563,637		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	160	0.2500	0.44		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
3.8	1,913	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
9.9	2,073	Total			

Subcatchment 32S: DS-1 Drainage



Summary for Subcatchment 33S: DS-2 Drainage

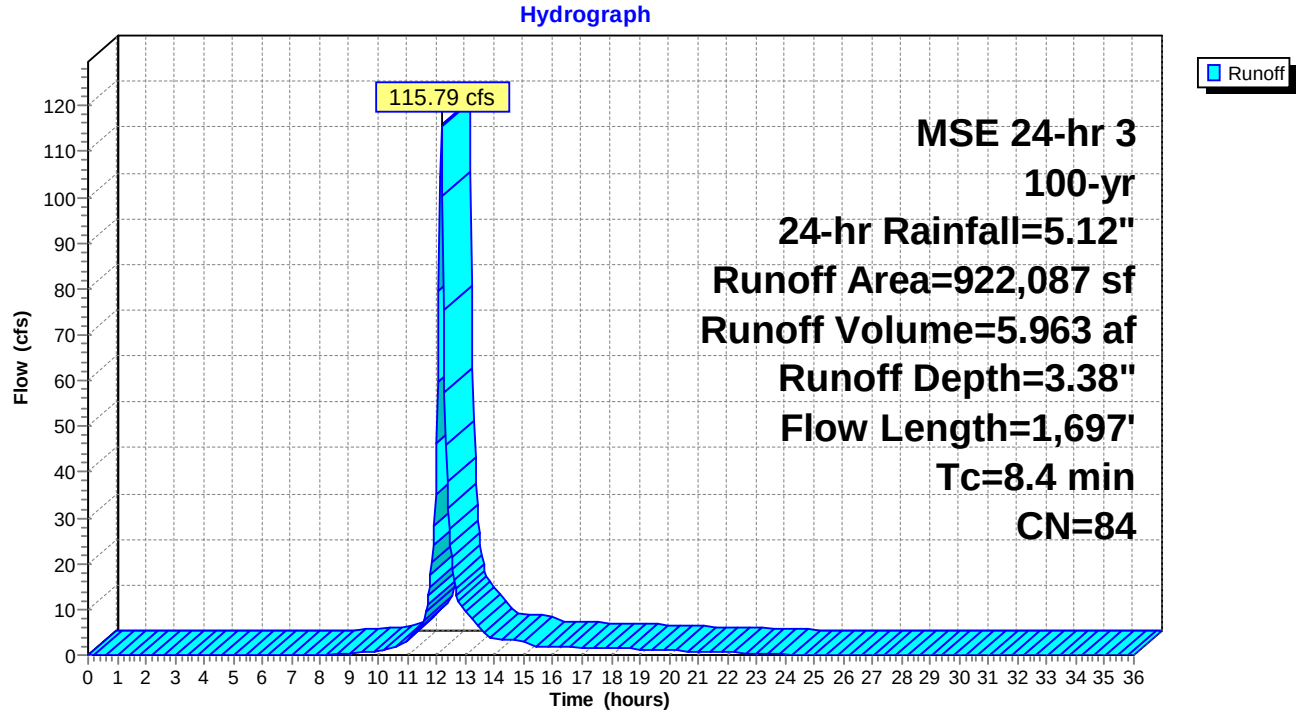
Runoff = 115.79 cfs @ 12.16 hrs, Volume= 5.963 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
922,087	84	50-75% Grass cover, Fair, HSG D
922,087		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	135	0.2500	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
3.1	1,562	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
8.4	1,697	Total			

Subcatchment 33S: DS-2 Drainage



Summary for Subcatchment 36S: DS-3 Drainage

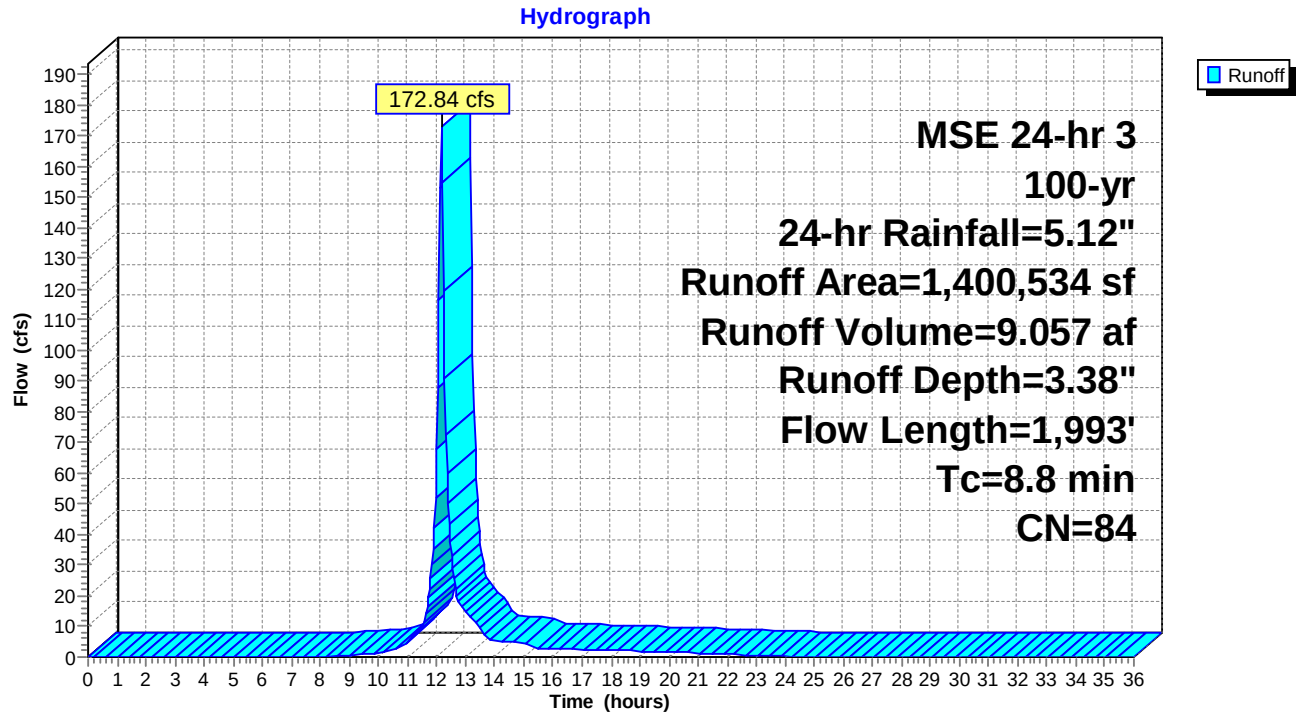
Runoff = 172.84 cfs @ 12.16 hrs, Volume= 9.057 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
1,400,534	84	50-75% Grass cover, Fair, HSG D
1,400,534		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	128	0.2500	0.42		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
3.7	1,865	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
8.8	1,993	Total			

Subcatchment 36S: DS-3 Drainage



Summary for Subcatchment 40S: DB-12 Drainage

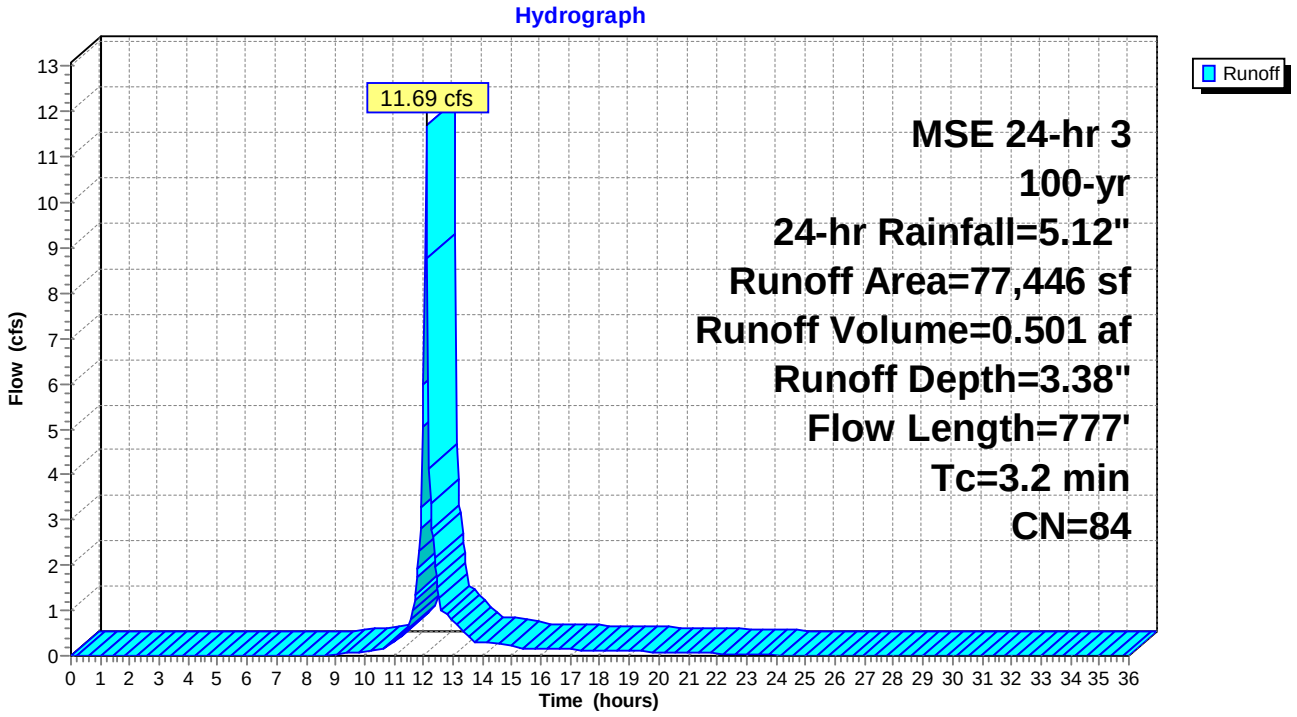
Runoff = 11.69 cfs @ 12.10 hrs, Volume= 0.501 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
77,446	84	50-75% Grass cover, Fair, HSG D
77,446		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	20	0.2500	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.1	757	0.0100	5.94	71.33	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025
3.2	777	Total			

Subcatchment 40S: DB-12 Drainage



Summary for Subcatchment 44S: DB-2 Drainage

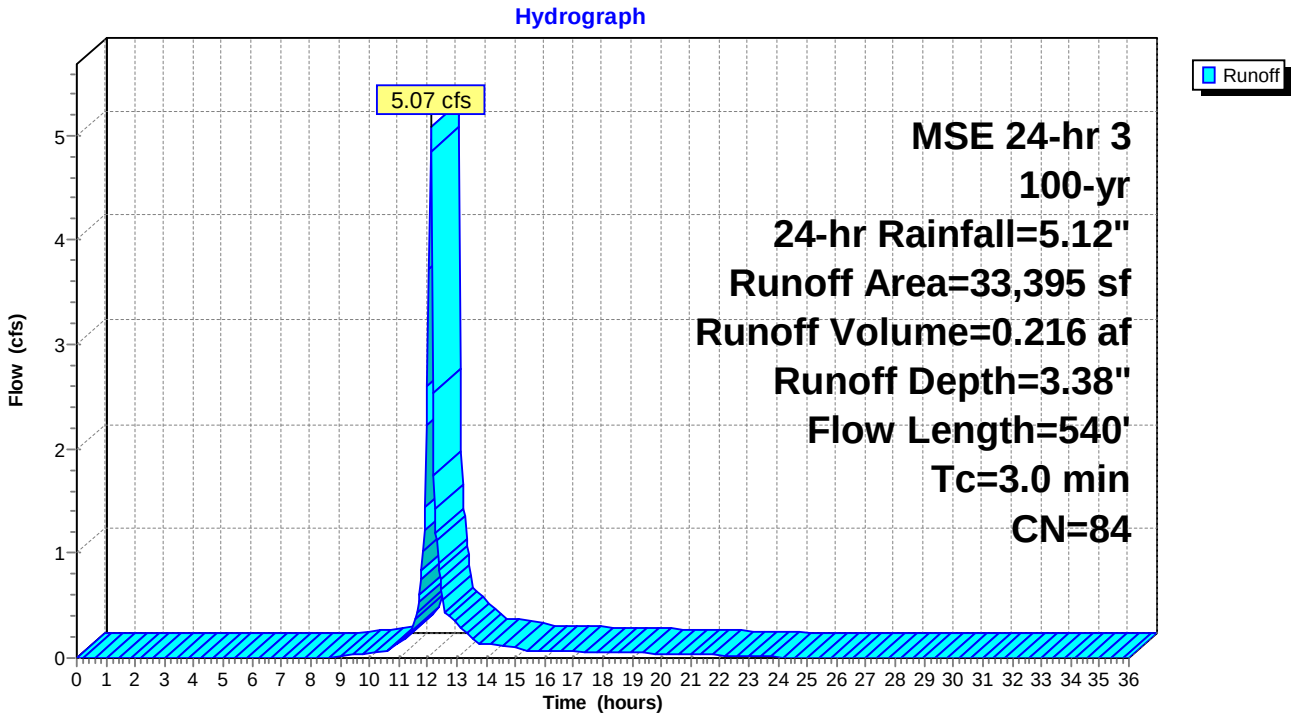
Runoff = 5.07 cfs @ 12.10 hrs, Volume= 0.216 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
33,395	84	50-75% Grass cover, Fair, HSG D
33,395		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	35	0.2500	0.32		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.1	403	0.0100	5.94	71.33	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025
0.1	102	0.0430	12.33	147.91	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025
3.0	540	Total			

Subcatchment 44S: DB-2 Drainage



Summary for Reach 3R: NE-MC IX Ditch

NSB Culvert backs up (free draining channel assumption is not true), therefore additional freeboard is needed in NE-MC IX Ditch

---

Inflow Area = 239.347 ac, 4.19% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 154.98 cfs @ 12.68 hrs, Volume= 67.505 af
Outflow = 153.57 cfs @ 12.87 hrs, Volume= 67.505 af, Atten= 1%, Lag= 11.2 min

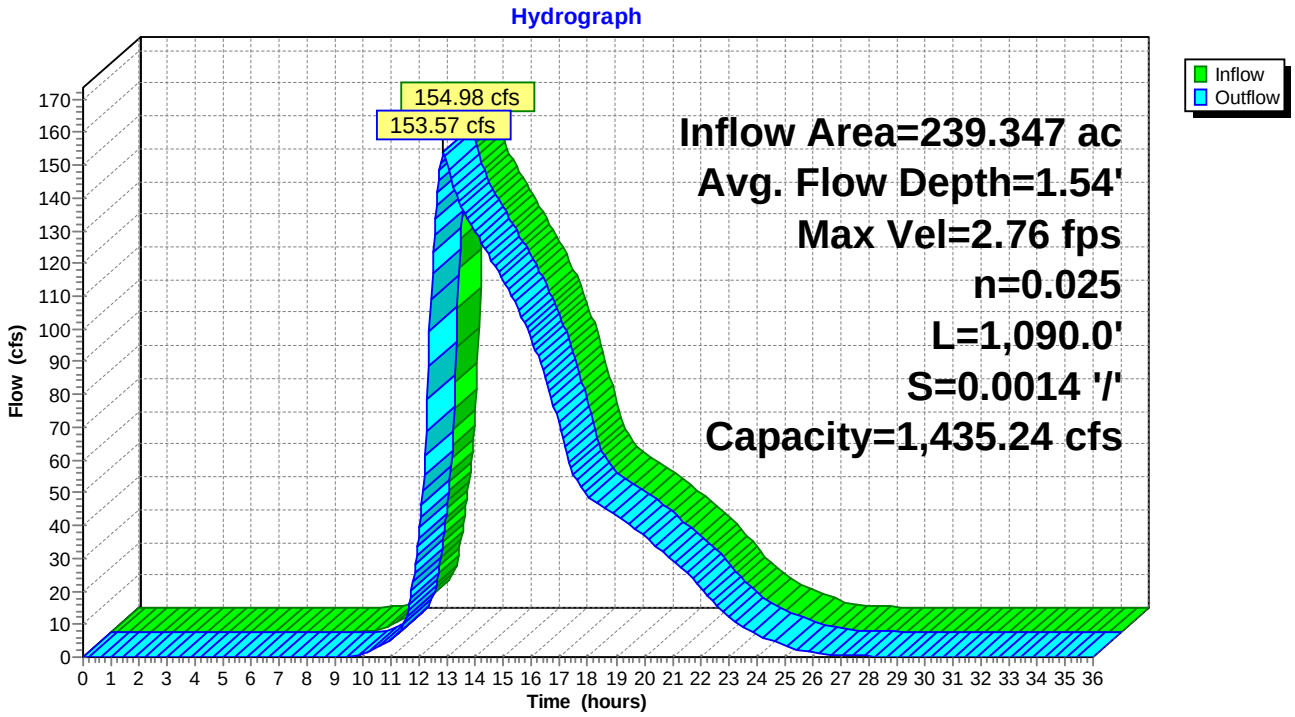
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 2.76 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 1.04 fps, Avg. Travel Time= 17.4 min

Peak Storage= 60,767 cf @ 12.75 hrs
Average Depth at Peak Storage= 1.54' , Surface Width= 39.18'
Bank-Full Depth= 5.60' Flow Area= 247.5 sf, Capacity= 1,435.24 cfs

33.00' x 5.60' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 55.40'
Length= 1,090.0' Slope= 0.0014 '/'
Inlet Invert= 696.40', Outlet Invert= 694.90'

‡

Reach 3R: NE-MC IX Ditch



Summary for Reach 4R: N-MC IX Ditch

Inflow Area = 229.347 ac, 4.37% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 149.49 cfs @ 12.49 hrs, Volume= 64.688 af
Outflow = 146.34 cfs @ 12.73 hrs, Volume= 64.688 af, Atten= 2%, Lag= 14.3 min

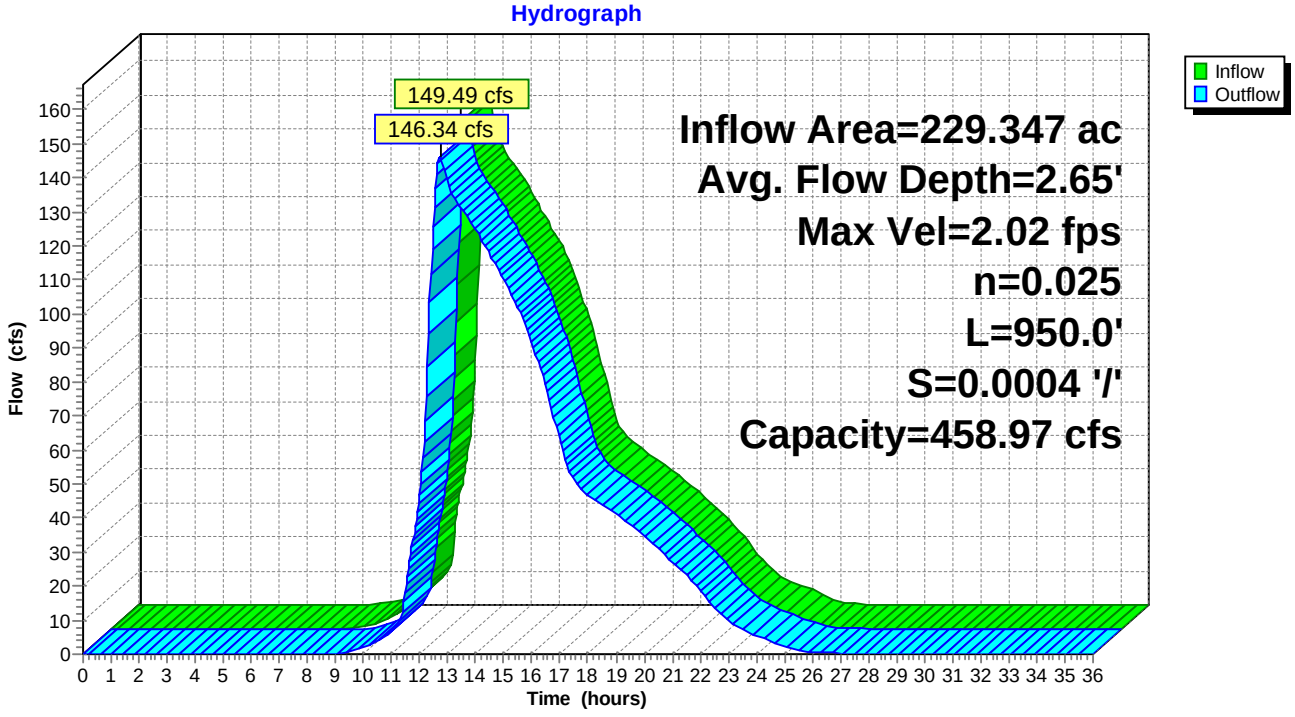
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 2.02 fps, Min. Travel Time= 7.8 min
Avg. Velocity = 0.75 fps, Avg. Travel Time= 21.0 min

Peak Storage= 68,731 cf @ 12.60 hrs
Average Depth at Peak Storage= 2.65' , Surface Width= 32.60'
Bank-Full Depth= 5.00' Flow Area= 160.0 sf, Capacity= 458.97 cfs

22.00' x 5.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 42.00'
Length= 950.0' Slope= 0.0004 '/'
Inlet Invert= 696.80', Outlet Invert= 696.40'

‡

Reach 4R: N-MC IX Ditch



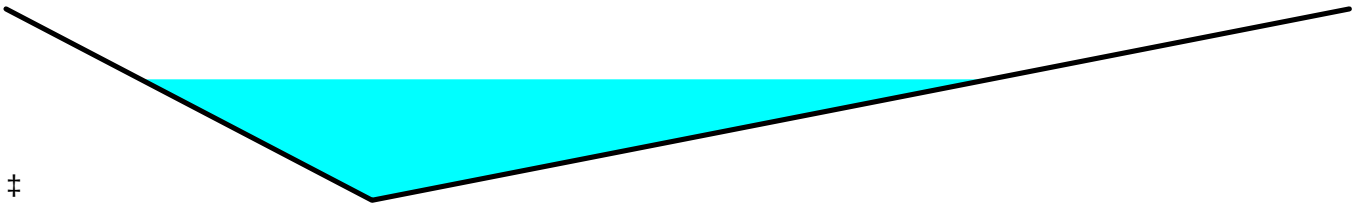
Summary for Reach 9R: W-MC X DV

Inflow Area = 13.783 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 55.18 cfs @ 12.26 hrs, Volume= 3.883 af
Outflow = 48.58 cfs @ 12.45 hrs, Volume= 3.883 af, Atten= 12%, Lag= 11.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.54 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 23.9 min

Peak Storage= 19,274 cf @ 12.34 hrs
Average Depth at Peak Storage= 1.58' , Surface Width= 17.40'
Bank-Full Depth= 2.50' Flow Area= 34.4 sf, Capacity= 165.41 cfs

0.00' x 2.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 3.0 8.0 '/' Top Width= 27.50'
Length= 1,400.0' Slope= 0.0050 '/'
Inlet Invert= 713.00', Outlet Invert= 706.00'



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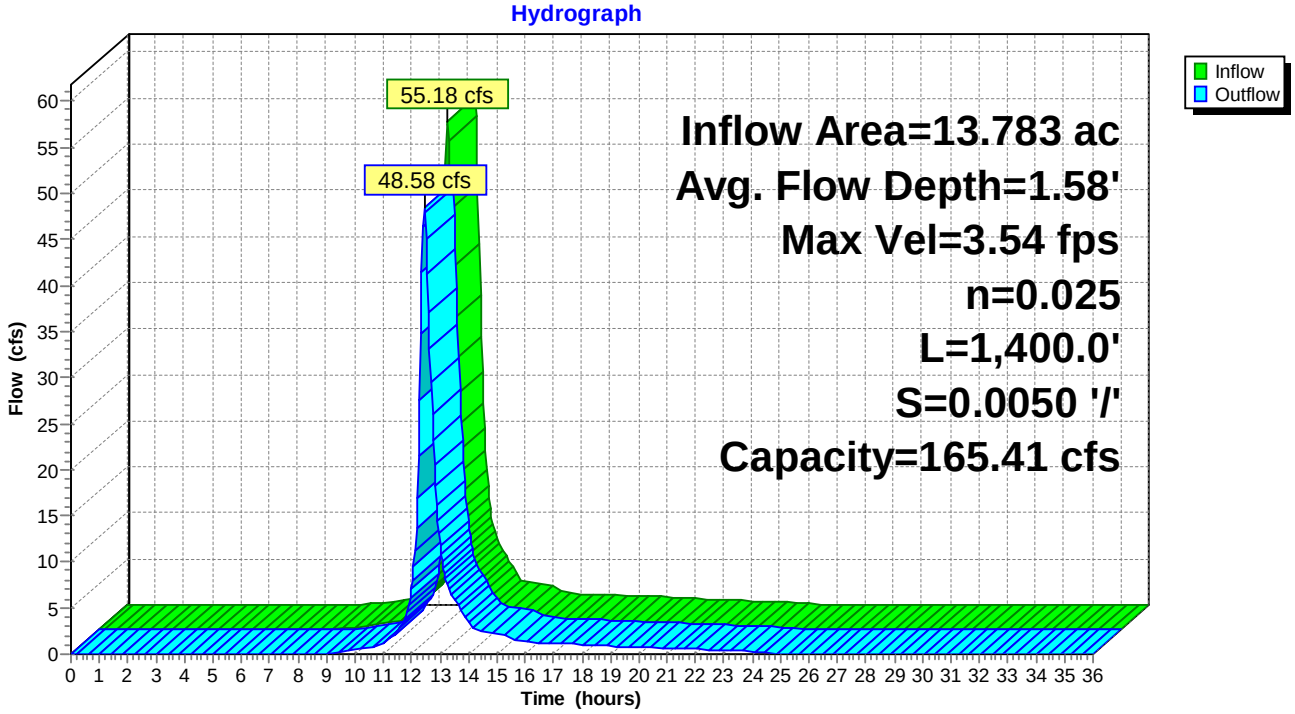
Reach 9R: W-MC X DV



Summary for Reach 10R: N-MC VII Ditch

Inflow Area = 128.025 ac, 3.61% Impervious, Inflow Depth = 3.42" for 100-yr, 24-hr event
Inflow = 78.05 cfs @ 12.30 hrs, Volume= 36.532 af
Outflow = 75.49 cfs @ 12.48 hrs, Volume= 36.532 af, Atten= 3%, Lag= 10.3 min

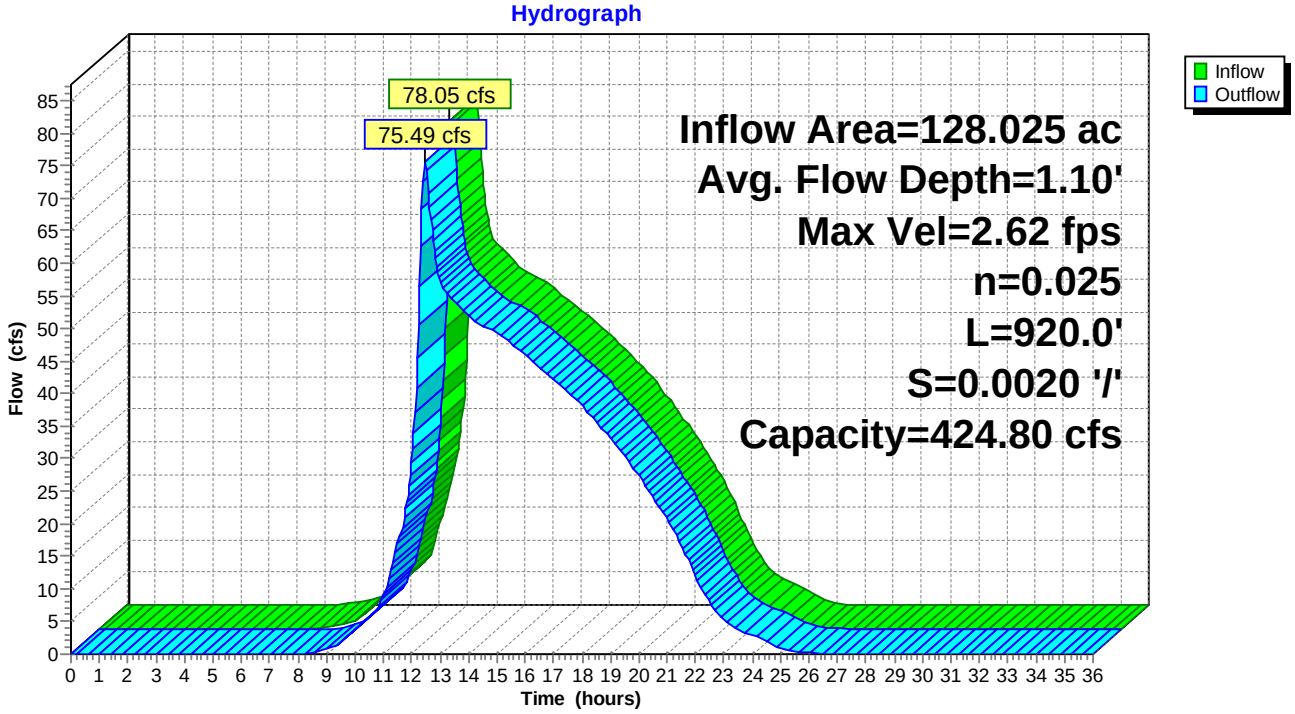
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 2.62 fps, Min. Travel Time= 5.8 min
Avg. Velocity = 1.05 fps, Avg. Travel Time= 14.6 min

Peak Storage= 26,540 cf @ 12.38 hrs
Average Depth at Peak Storage= 1.10' , Surface Width= 28.40'
Bank-Full Depth= 3.00' Flow Area= 90.0 sf, Capacity= 424.80 cfs

24.00' x 3.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 36.00'
Length= 920.0' Slope= 0.0020 '/'
Inlet Invert= 698.80', Outlet Invert= 697.00'

‡

Reach 10R: N-MC VII Ditch



Summary for Reach 12R: DS-1 (4H:1V)

Inflow Area = 35.896 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 185.01 cfs @ 12.17 hrs, Volume= 10.112 af
Outflow = 180.58 cfs @ 12.19 hrs, Volume= 10.112 af, Atten= 2%, Lag= 1.2 min

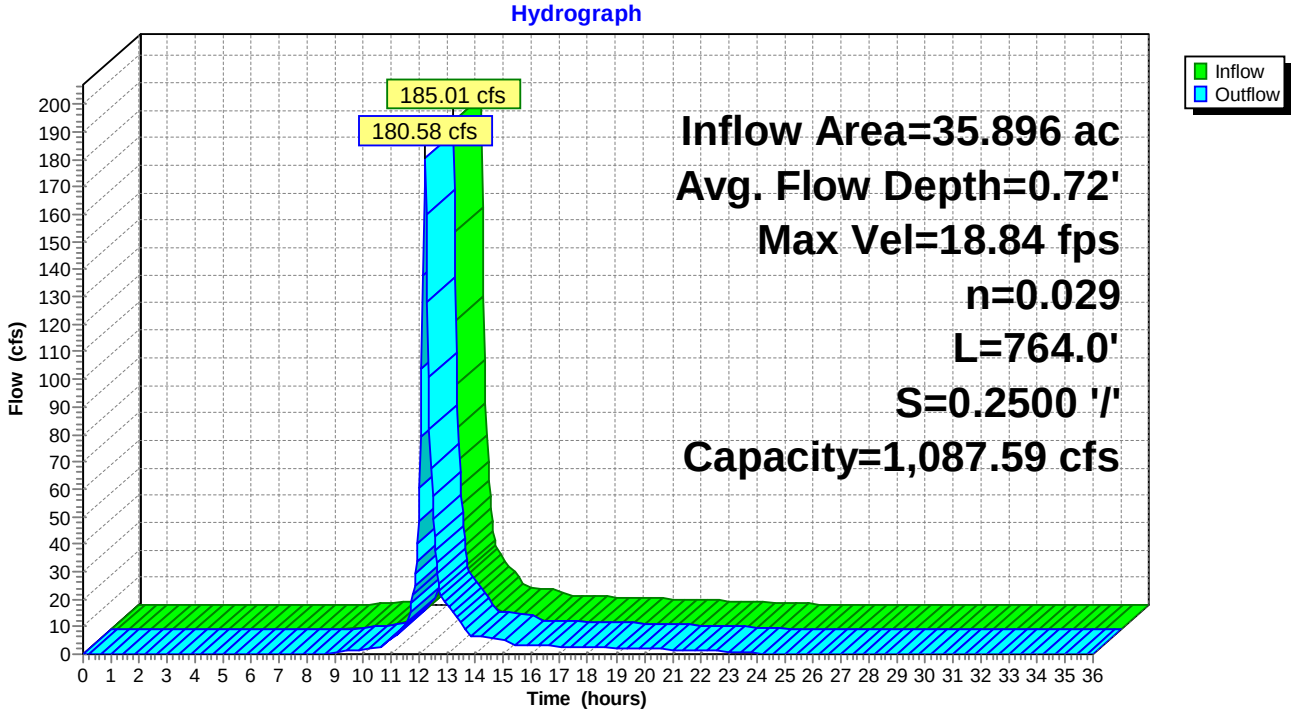
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 18.84 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 4.16 fps, Avg. Travel Time= 3.1 min

Peak Storage= 7,403 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.72' , Surface Width= 14.88'
Bank-Full Depth= 2.00' Flow Area= 32.0 sf, Capacity= 1,087.59 cfs

12.00' x 2.00' deep channel, n= 0.029
Side Slope Z-value= 2.0 '/' Top Width= 20.00'
Length= 764.0' Slope= 0.2500 '/'
Inlet Invert= 906.00', Outlet Invert= 715.00'

‡

Reach 12R: DS-1 (4H:1V)



Summary for Reach 14R: DS-3

Inflow Area = 32.152 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 172.84 cfs @ 12.16 hrs, Volume= 9.057 af
Outflow = 167.54 cfs @ 12.18 hrs, Volume= 9.057 af, Atten= 3%, Lag= 1.0 min

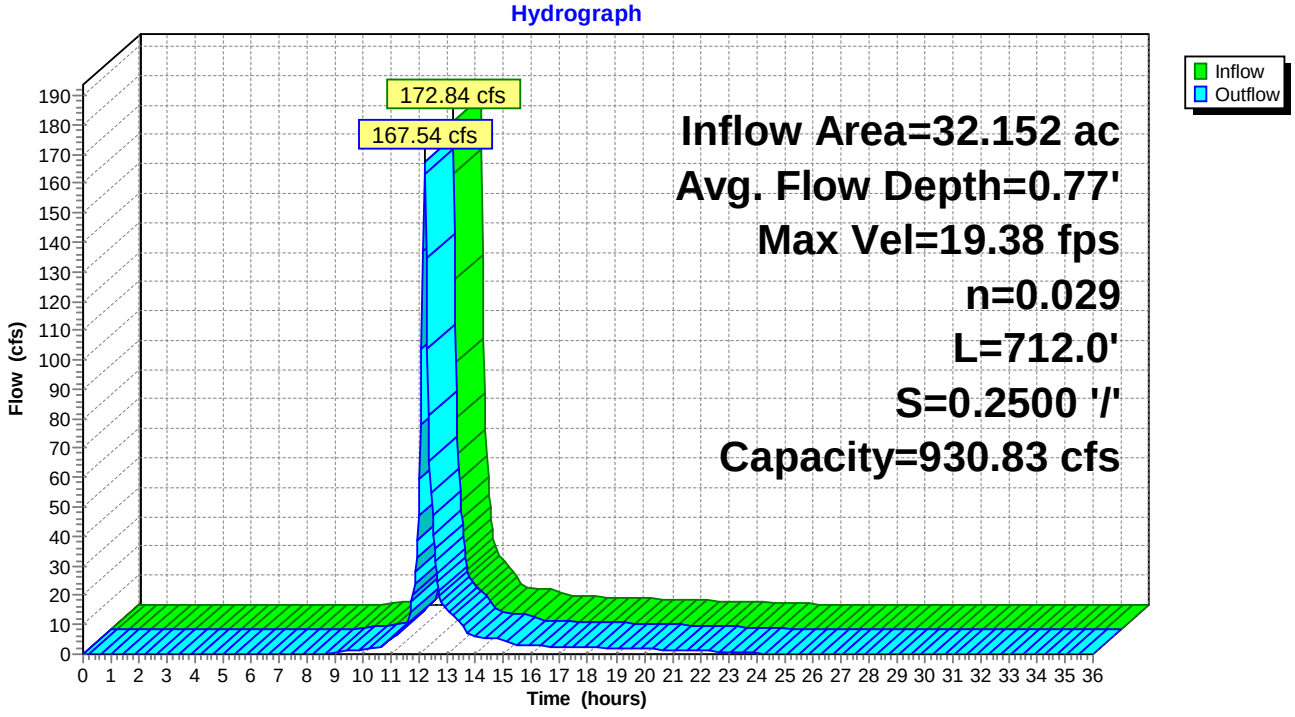
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 19.38 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 4.25 fps, Avg. Travel Time= 2.8 min

Peak Storage= 6,303 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.77' , Surface Width= 13.07'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 930.83 cfs

10.00' x 2.00' deep channel, n= 0.029
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 712.0' Slope= 0.2500 '/'
Inlet Invert= 900.00', Outlet Invert= 722.00'

‡

Reach 14R: DS-3



Summary for Reach 15R: DS-2 (4H:1V)

Inflow Area = 21.168 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 115.79 cfs @ 12.16 hrs, Volume= 5.963 af
Outflow = 112.25 cfs @ 12.17 hrs, Volume= 5.963 af, Atten= 3%, Lag= 0.9 min

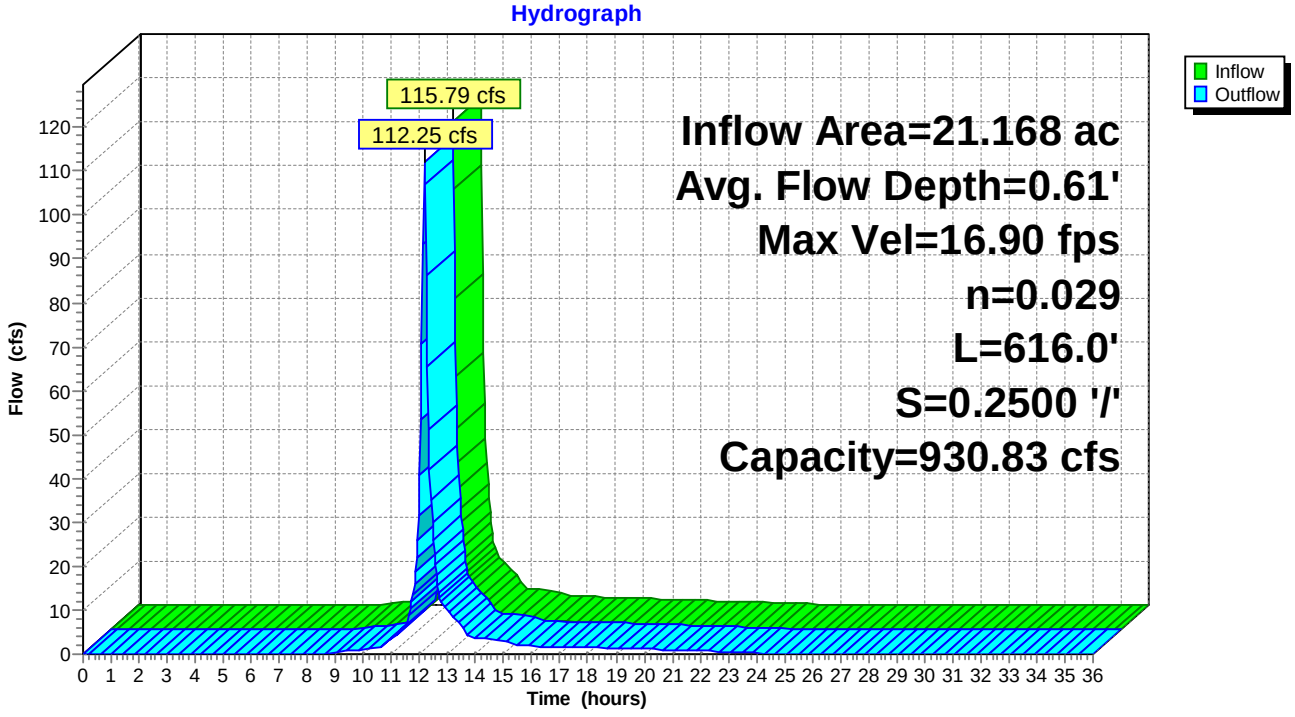
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 16.90 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 3.69 fps, Avg. Travel Time= 2.8 min

Peak Storage= 4,198 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.61' , Surface Width= 12.43'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 930.83 cfs

10.00' x 2.00' deep channel, n= 0.029
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 616.0' Slope= 0.2500 '/'
Inlet Invert= 900.00', Outlet Invert= 746.00'

‡

Reach 15R: DS-2 (4H:1V)



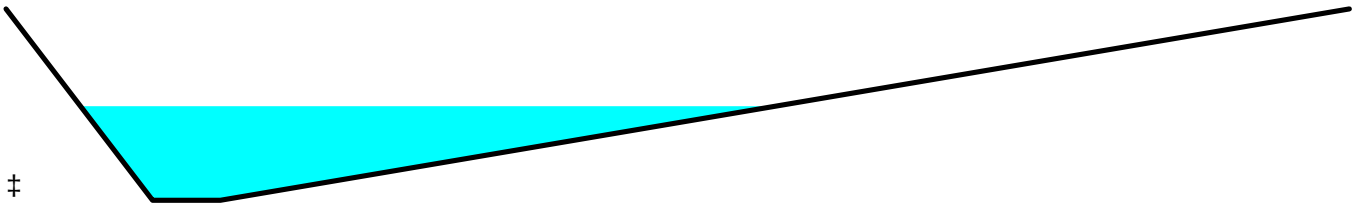
Summary for Reach 18R: E-MC IX Ditch

Inflow Area = 22.273 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 79.16 cfs @ 12.37 hrs, Volume= 6.274 af
Outflow = 77.59 cfs @ 12.45 hrs, Volume= 6.274 af, Atten= 2%, Lag= 4.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.76 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 9.1 min

Peak Storage= 12,109 cf @ 12.40 hrs
Average Depth at Peak Storage= 1.23' , Surface Width= 30.73'
Bank-Full Depth= 2.50' Flow Area= 78.1 sf, Capacity= 457.74 cfs

3.00' x 2.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.6 20.0 '/' Top Width= 59.50'
Length= 585.0' Slope= 0.0068 '/'
Inlet Invert= 699.00', Outlet Invert= 695.00'



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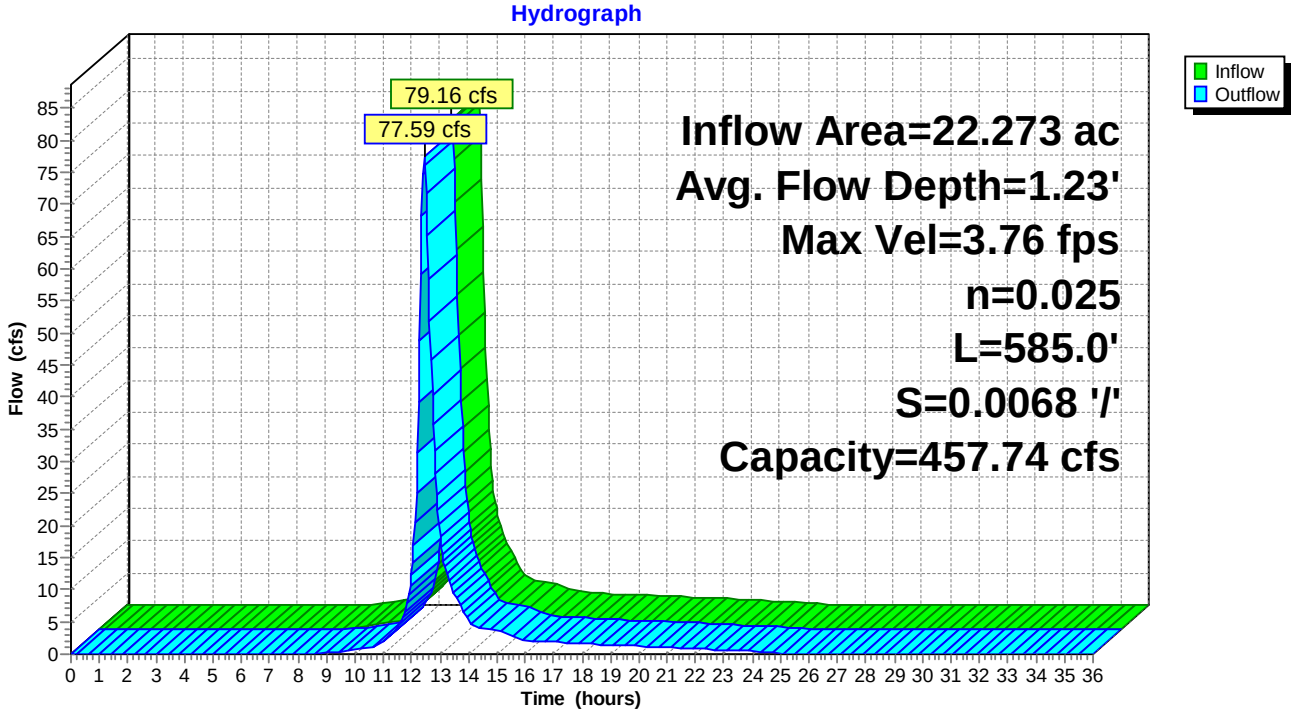
Reach 18R: E-MC IX Ditch



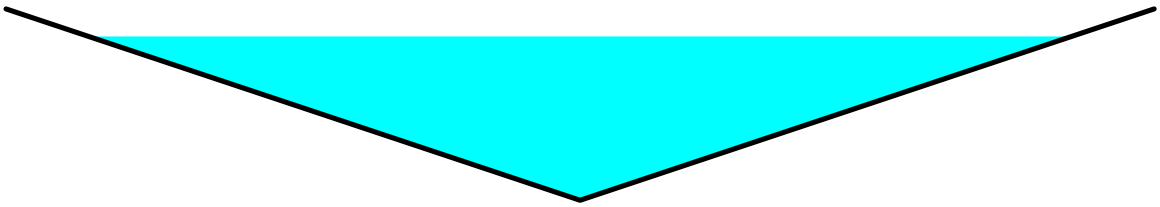
Summary for Reach 20R: E-MC X DV

Inflow Area = 12.100 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 51.29 cfs @ 12.24 hrs, Volume= 3.409 af
Outflow = 45.35 cfs @ 12.40 hrs, Volume= 3.409 af, Atten= 12%, Lag= 9.8 min

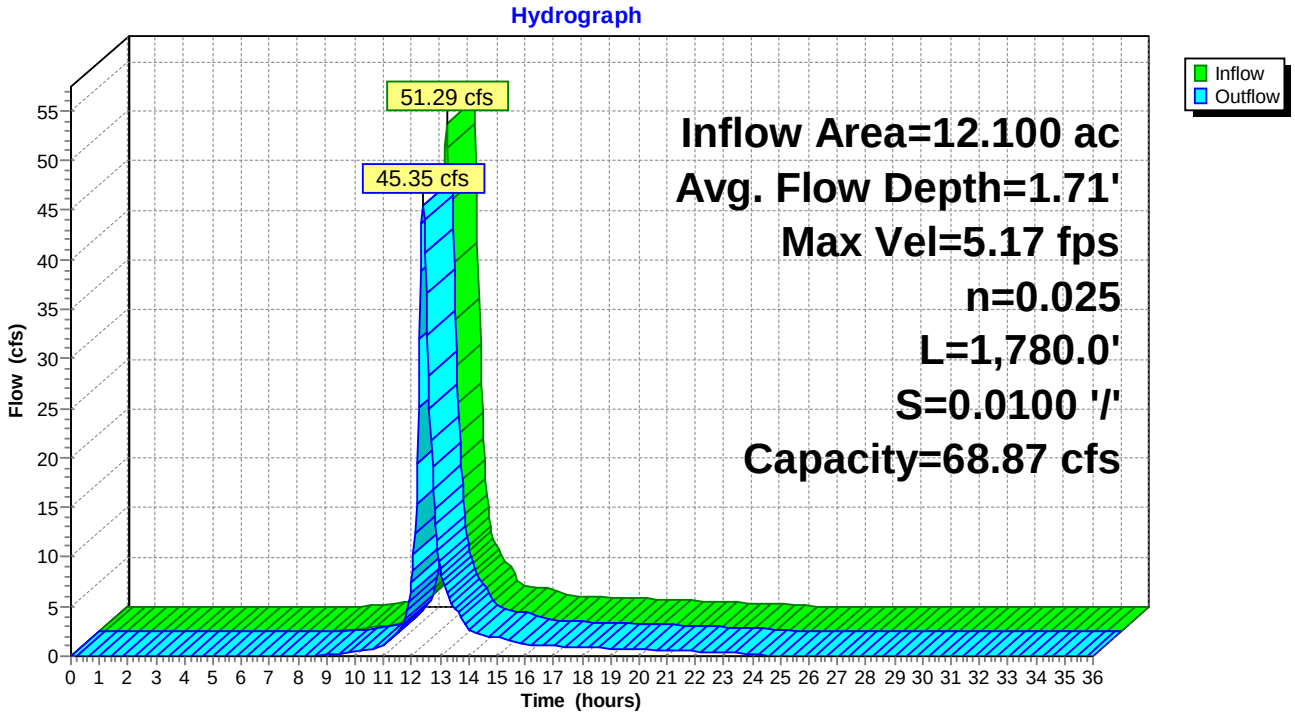
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 5.17 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 20.7 min

Peak Storage= 15,697 cf @ 12.31 hrs
Average Depth at Peak Storage= 1.71' , Surface Width= 10.29'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.87 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 1,780.0' Slope= 0.0100 '/'
Inlet Invert= 723.00', Outlet Invert= 705.20'



Reach 20R: E-MC X DV



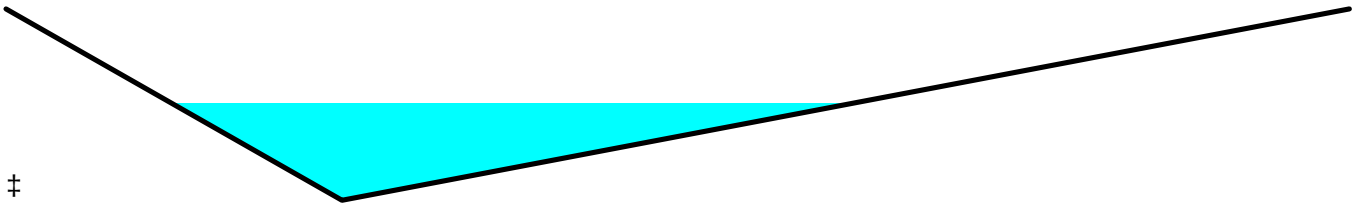
Summary for Reach 38R: S-MC XI DV

Inflow Area = 2.185 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 9.92 cfs @ 12.21 hrs, Volume= 0.616 af
Outflow = 9.30 cfs @ 12.30 hrs, Volume= 0.616 af, Atten= 6%, Lag= 5.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 4.07 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 1.35 fps, Avg. Travel Time= 9.3 min

Peak Storage= 1,733 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.76' , Surface Width= 6.08'
Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 57.72 cfs

0.00' x 1.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 6.0 '/' Top Width= 12.00'
Length= 750.0' Slope= 0.0180 '/'
Inlet Invert= 719.00', Outlet Invert= 705.50'



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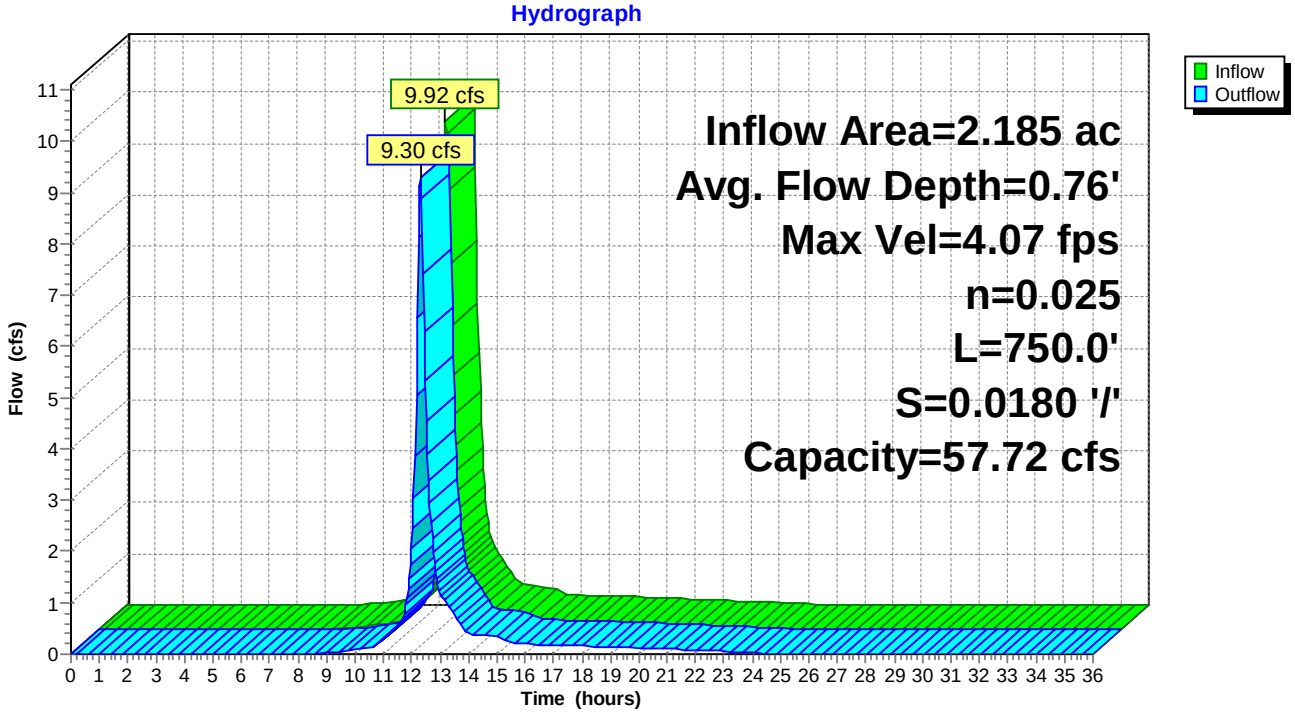
Reach 38R: S-MC XI DV



Summary for Reach 39R: DS-6

Inflow Area = 2.545 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 16.60 cfs @ 12.11 hrs, Volume= 0.717 af
Outflow = 16.28 cfs @ 12.11 hrs, Volume= 0.717 af, Atten= 2%, Lag= 0.3 min

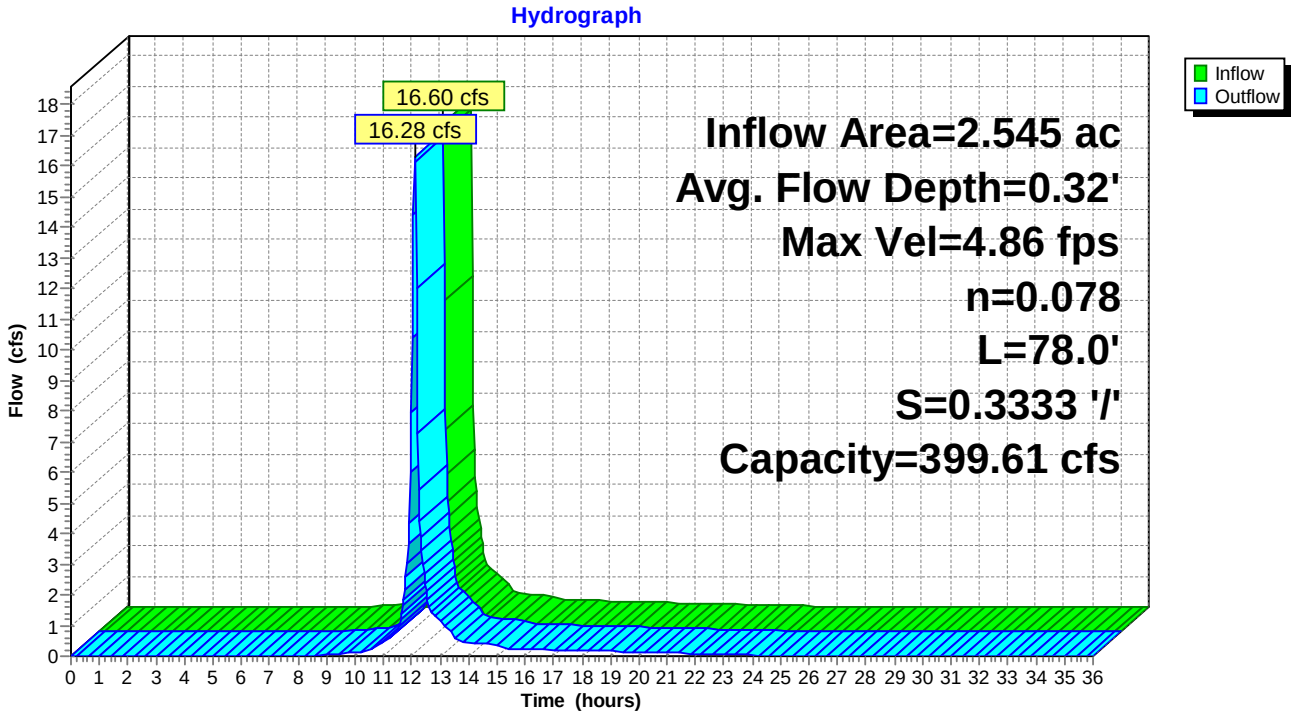
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 4.86 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 1.2 min

Peak Storage= 264 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.32' , Surface Width= 11.27'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 399.61 cfs

10.00' x 2.00' deep channel, n= 0.078 Riprap, 12-inch
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 78.0' Slope= 0.3333 '/'
Inlet Invert= 742.00', Outlet Invert= 716.00'

‡

Reach 39R: DS-6



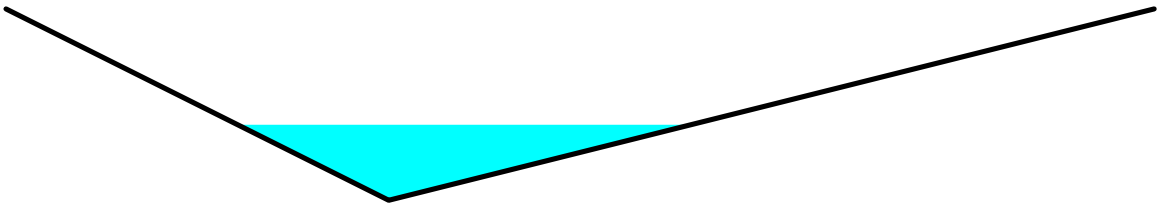
Summary for Reach 41R: DB-12

Inflow Area = 1.778 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 11.69 cfs @ 12.10 hrs, Volume= 0.501 af
Outflow = 11.51 cfs @ 12.11 hrs, Volume= 0.501 af, Atten= 2%, Lag= 0.7 min

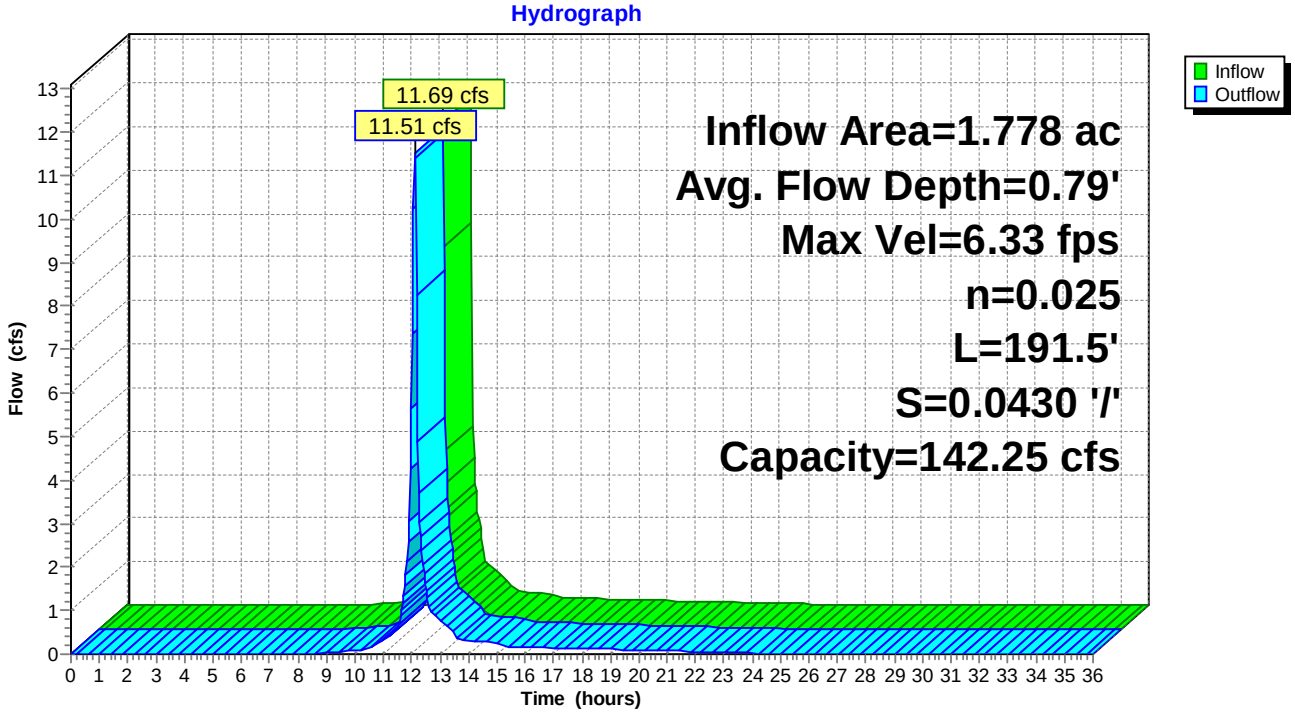
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 6.33 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.10 fps, Avg. Travel Time= 1.5 min

Peak Storage= 357 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.79' , Surface Width= 4.74'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 142.25 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 4.0 '/' Top Width= 12.00'
Length= 191.5' Slope= 0.0430 '/'
Inlet Invert= 749.23', Outlet Invert= 741.00'



Reach 41R: DB-12



Summary for Pond 1P: NSB North

Inflow Area = 272.710 ac, 3.67% Impervious, Inflow Depth = 3.43" for 100-yr, 24-hr event
Inflow = 209.95 cfs @ 12.49 hrs, Volume= 77.973 af
Outflow = 91.12 cfs @ 16.36 hrs, Volume= 32.951 af, Atten= 57%, Lag= 232.5 min
Primary = 91.12 cfs @ 16.36 hrs, Volume= 32.951 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 674.00' Surf.Area= 53,100 sf Storage= 144,600 cf
Peak Elev= 693.91' @ 16.36 hrs Surf.Area= 152,097 sf Storage= 2,241,647 cf (2,097,047 cf above start)

Plug-Flow detention time= 392.0 min calculated for 29.631 af (38% of inflow)
Center-of-Mass det. time= 204.8 min (1,134.6 - 929.8)

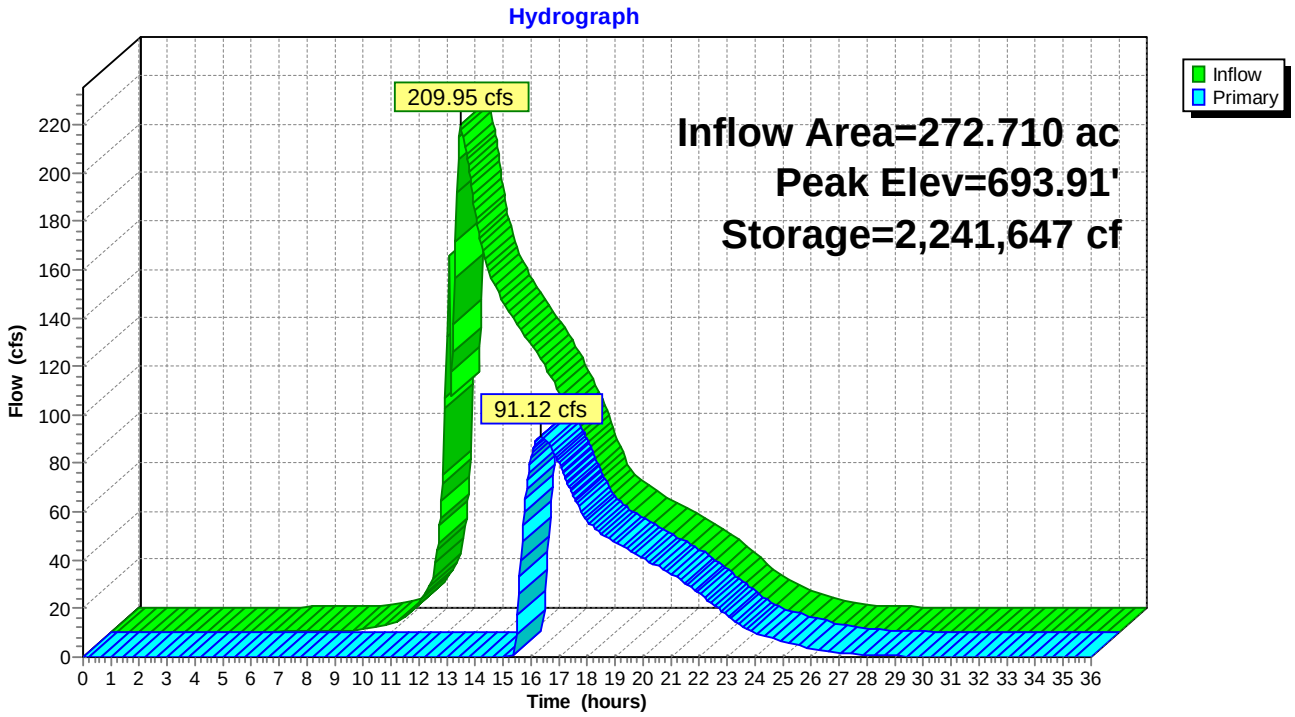
Volume	Invert	Avail.Storage	Storage Description
#1	668.00'	2,910,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
668.00	1,200	0	0
670.00	12,400	13,600	13,600
674.00	53,100	131,000	144,600
680.00	87,600	422,100	566,700
690.00	135,200	1,114,000	1,680,700
694.00	152,508	575,416	2,256,116
695.00	158,400	155,454	2,411,570
698.00	174,100	498,750	2,910,320

Device	Routing	Invert	Outlet Devices
#1	Primary	693.00'	**40.0' long x 20.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=90.73 cfs @ 16.36 hrs HW=693.90' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 90.73 cfs @ 2.51 fps)

Pond 1P: NSB North



Summary for Pond 2P: NSB North Inlet

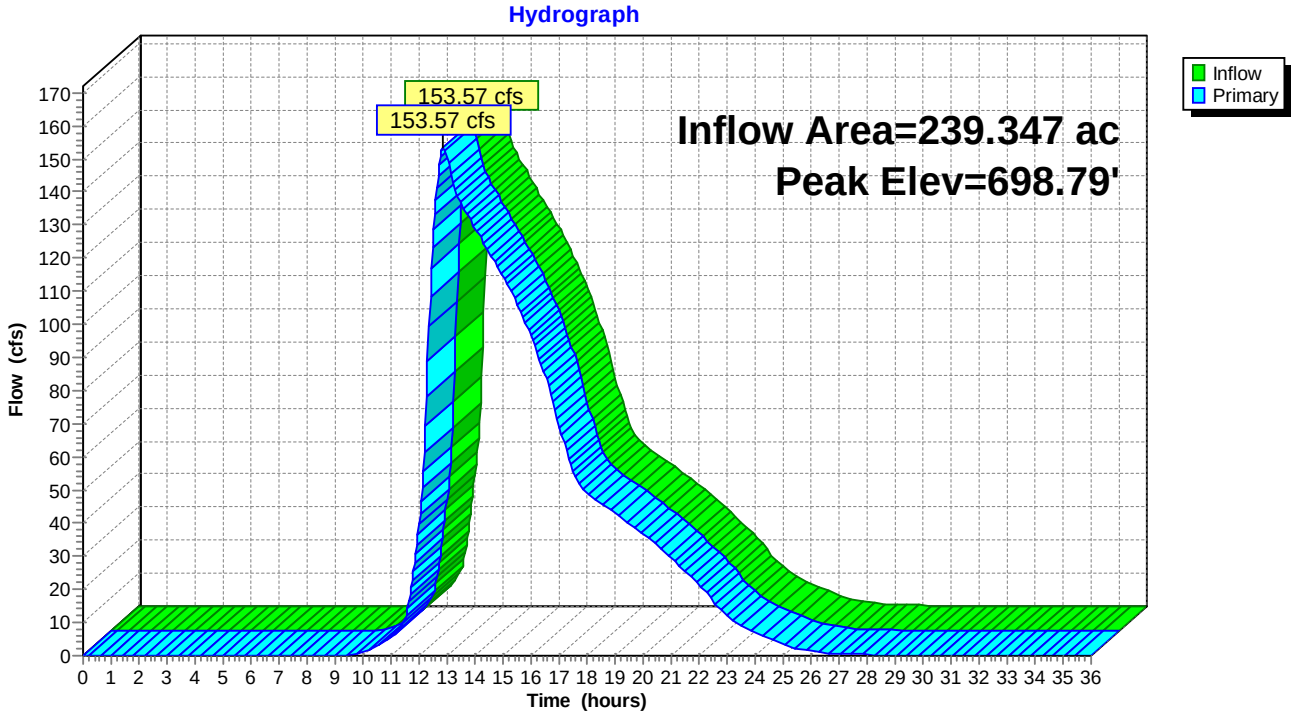
Inflow Area = 239.347 ac, 4.19% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 153.57 cfs @ 12.87 hrs, Volume= 67.505 af
Outflow = 153.57 cfs @ 12.87 hrs, Volume= 67.505 af, Atten= 0%, Lag= 0.0 min
Primary = 153.57 cfs @ 12.87 hrs, Volume= 67.505 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 698.79' @ 12.87 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	694.96'	**30.0" Round 30" Culverts X 3.00** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 694.96' / 694.96' S= 0.0000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf
#2	Primary	694.96'	**54.0" Round 54" Culvert** L= 110.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 694.96' / 690.50' S= 0.0405 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 15.90 sf

Primary OutFlow Max=153.50 cfs @ 12.87 hrs HW=698.79' TW=693.90' (Fixed TW Elev= 693.90')
└─**1=30" Culverts** (Barrel Controls 57.31 cfs @ 3.89 fps)
└─**2=54" Culvert** (Inlet Controls 96.19 cfs @ 6.67 fps)

Pond 2P: NSB North Inlet



Summary for Pond 5P: MC VII/IX & MC XI/X Pond

MC X/XI Culverts do not restrict flow in ditch (have more capacity than outlet on north end) therefore they are not modeled.

Inflow Area = 94.846 ac, 5.69% Impervious, Inflow Depth = 3.44" for 100-yr, 24-hr event
Inflow = 291.33 cfs @ 12.38 hrs, Volume= 27.225 af
Outflow = 73.42 cfs @ 13.05 hrs, Volume= 26.332 af, Atten= 75%, Lag= 40.2 min
Primary = 73.42 cfs @ 13.05 hrs, Volume= 26.332 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 697.10' Storage= 0 cf
Peak Elev= 703.60' @ 13.05 hrs Surf.Area= 160,197 sf Storage= 498,329 cf

Plug-Flow detention time= 86.4 min calculated for 26.332 af (97% of inflow)
Center-of-Mass det. time= 68.5 min (878.9 - 810.3)

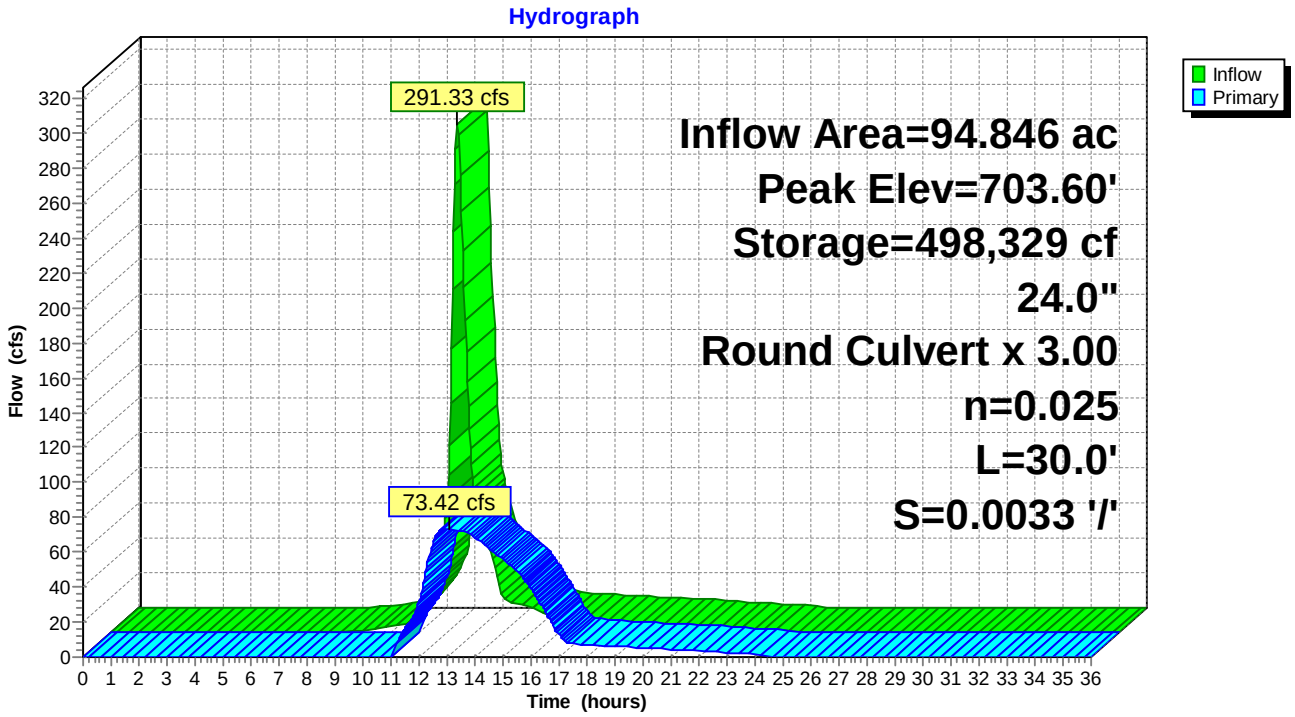
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	925,600 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
698.00	13,000	0	0
700.00	55,300	68,300	68,300
702.00	137,000	192,300	260,600
704.00	166,000	303,000	563,600
706.00	196,000	362,000	925,600

Device	Routing	Invert	Outlet Devices
#1	Primary	697.10'	**24.0" Round Culvert X 3.00** L= 30.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 697.10' / 697.00' S= 0.0033 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=73.42 cfs @ 13.05 hrs HW=703.60' TW=699.40' (Fixed TW Elev= 699.40')
↑—**1=Culvert** (Inlet Controls 73.42 cfs @ 7.79 fps)

Pond 5P: MC VII/IX & MC XI/X Pond



Summary for Pond 6P: N-MC VII Culvert

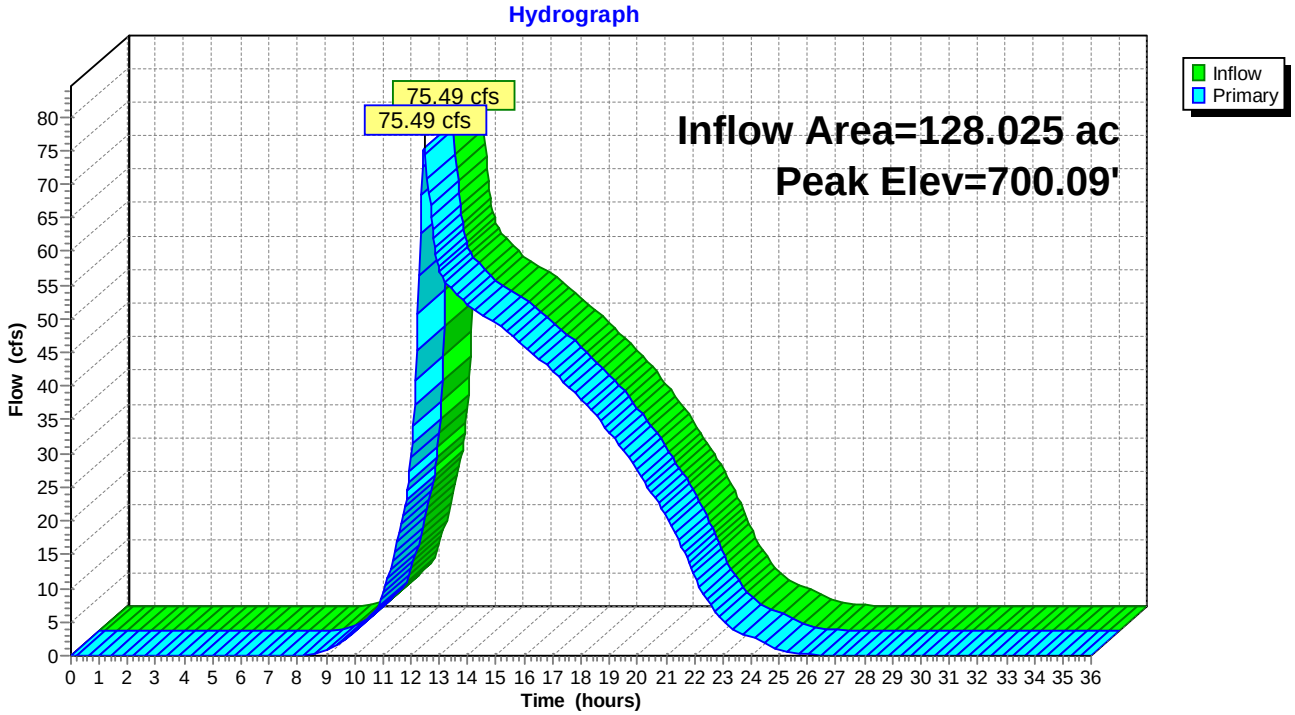
Inflow Area = 128.025 ac, 3.61% Impervious, Inflow Depth = 3.42" for 100-yr, 24-hr event
Inflow = 75.49 cfs @ 12.48 hrs, Volume= 36.532 af
Outflow = 75.49 cfs @ 12.48 hrs, Volume= 36.532 af, Atten= 0%, Lag= 0.0 min
Primary = 75.49 cfs @ 12.48 hrs, Volume= 36.532 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 700.09' @ 12.48 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	696.77'	**54.0" Round 54" Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 696.77' / 696.61' S= 0.0038 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 15.90 sf
#2	Primary	696.77'	**36.0" Round 36" Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 696.77' / 696.61' S= 0.0038 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf

Primary OutFlow Max=75.43 cfs @ 12.48 hrs HW=700.09' TW=699.40' (Fixed TW Elev= 699.40')
└─**1=54" Culvert** (Outlet Controls 47.11 cfs @ 5.21 fps)
└─**2=36" Culvert** (Inlet Controls 28.31 cfs @ 4.01 fps)

Pond 6P: N-MC VII Culvert



Summary for Pond 7P: MC VII/XI Pond

Inflow Area = 22.920 ac, 3.90% Impervious, Inflow Depth = 3.48" for 100-yr, 24-hr event
Inflow = 85.95 cfs @ 12.30 hrs, Volume= 6.645 af
Outflow = 55.60 cfs @ 12.50 hrs, Volume= 6.504 af, Atten= 35%, Lag= 11.6 min
Primary = 55.60 cfs @ 12.50 hrs, Volume= 6.504 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 707.70' @ 12.50 hrs Surf.Area= 34,963 sf Storage= 66,581 cf

Plug-Flow detention time= 29.0 min calculated for 6.496 af (98% of inflow)
Center-of-Mass det. time= 17.2 min (819.9 - 802.7)

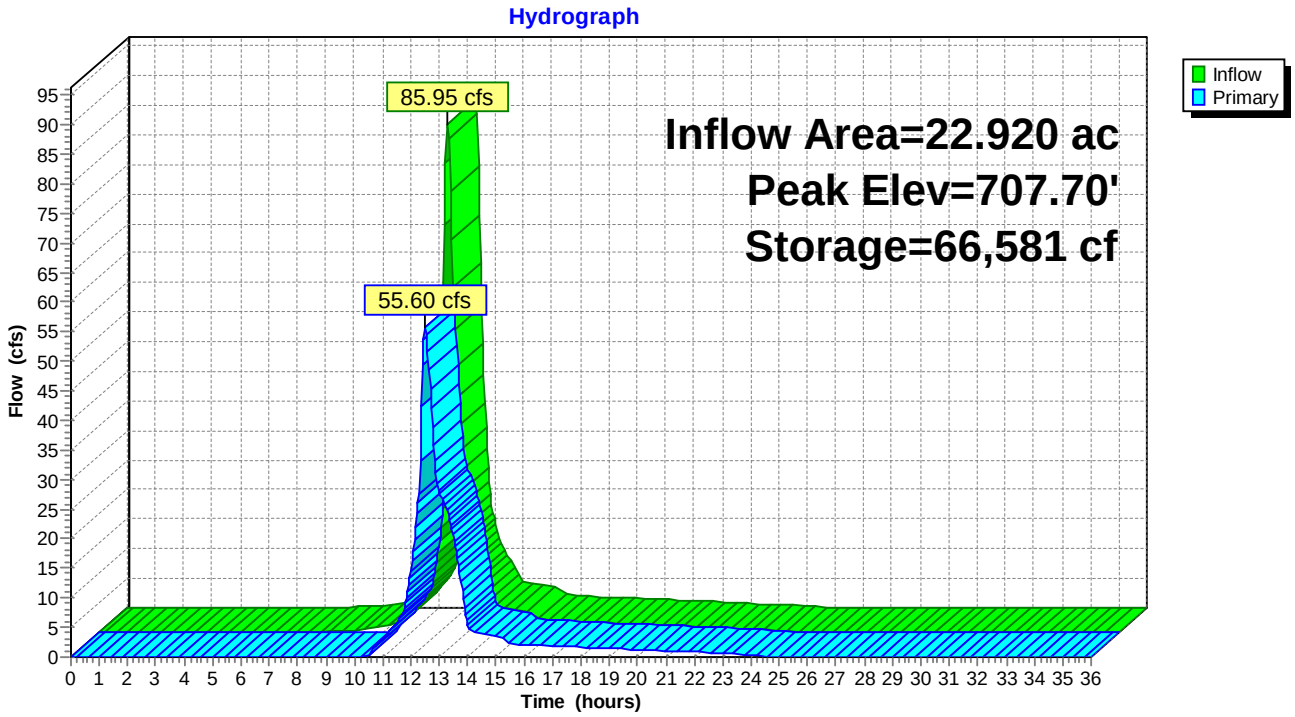
Volume	Invert	Avail.Storage	Storage Description
#1	700.00'	77,700 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
700.00	0	0	0
702.00	1,450	1,450	1,450
704.00	5,200	6,650	8,100
706.00	12,750	17,950	26,050
708.00	38,900	51,650	77,700

Device	Routing	Invert	Outlet Devices
#1	Primary	700.30'	**24.0" Round Culvert** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 700.30' / 699.40' S= 0.0225 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Primary	707.00'	**16.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=55.36 cfs @ 12.50 hrs HW=707.69' TW=703.60' (Fixed TW Elev= 703.60')
1=Culvert (Inlet Controls 30.61 cfs @ 9.74 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 24.75 cfs @ 2.23 fps)

Pond 7P: MC VII/XI Pond



Summary for Pond 8P: NSB South

Inflow Area = 272.710 ac, 3.67% Impervious, Inflow Depth = 1.45" for 100-yr, 24-hr event
Inflow = 91.12 cfs @ 16.36 hrs, Volume= 32.951 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

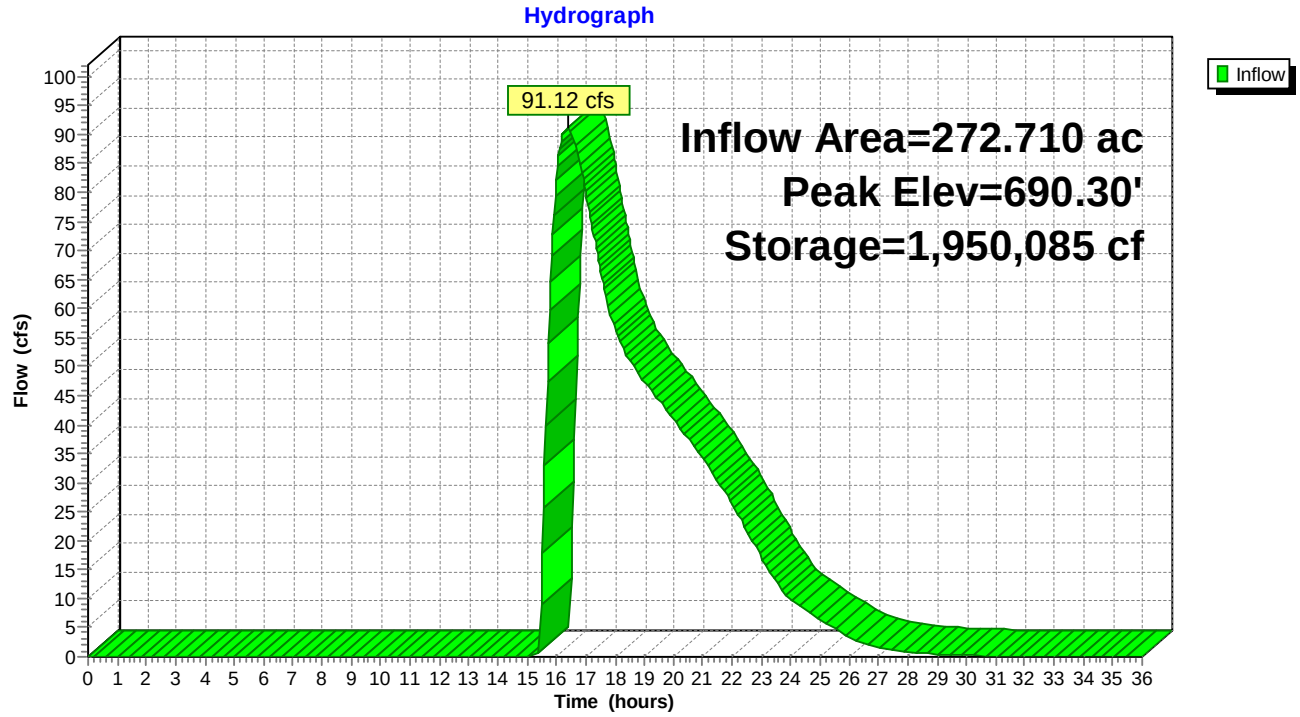
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 680.00' Surf.Area= 98,500 sf Storage= 514,800 cf
Peak Elev= 690.30' @ 36.00 hrs Surf.Area= 179,690 sf Storage= 1,950,085 cf (1,435,285 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	672.00'	2,867,350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
672.00	30,200	0	0
680.00	98,500	514,800	514,800
690.00	177,700	1,381,000	1,895,800
694.00	203,900	763,200	2,659,000
695.00	212,800	208,350	2,867,350

Pond 8P: NSB South



Summary for Pond 11P: NWD / NW-MC VII

Inflow Area = 119.997 ac, 3.85% Impervious, Inflow Depth = 3.43" for 100-yr, 24-hr event
Inflow = 525.99 cfs @ 12.18 hrs, Volume= 34.271 af
Outflow = 50.93 cfs @ 13.12 hrs, Volume= 34.271 af, Atten= 90%, Lag= 56.5 min
Primary = 50.93 cfs @ 13.12 hrs, Volume= 34.271 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 711.86' @ 13.12 hrs Surf.Area= 197,760 sf Storage= 799,970 cf

Plug-Flow detention time= 165.6 min calculated for 34.271 af (100% of inflow)
Center-of-Mass det. time= 165.4 min (957.7 - 792.3)

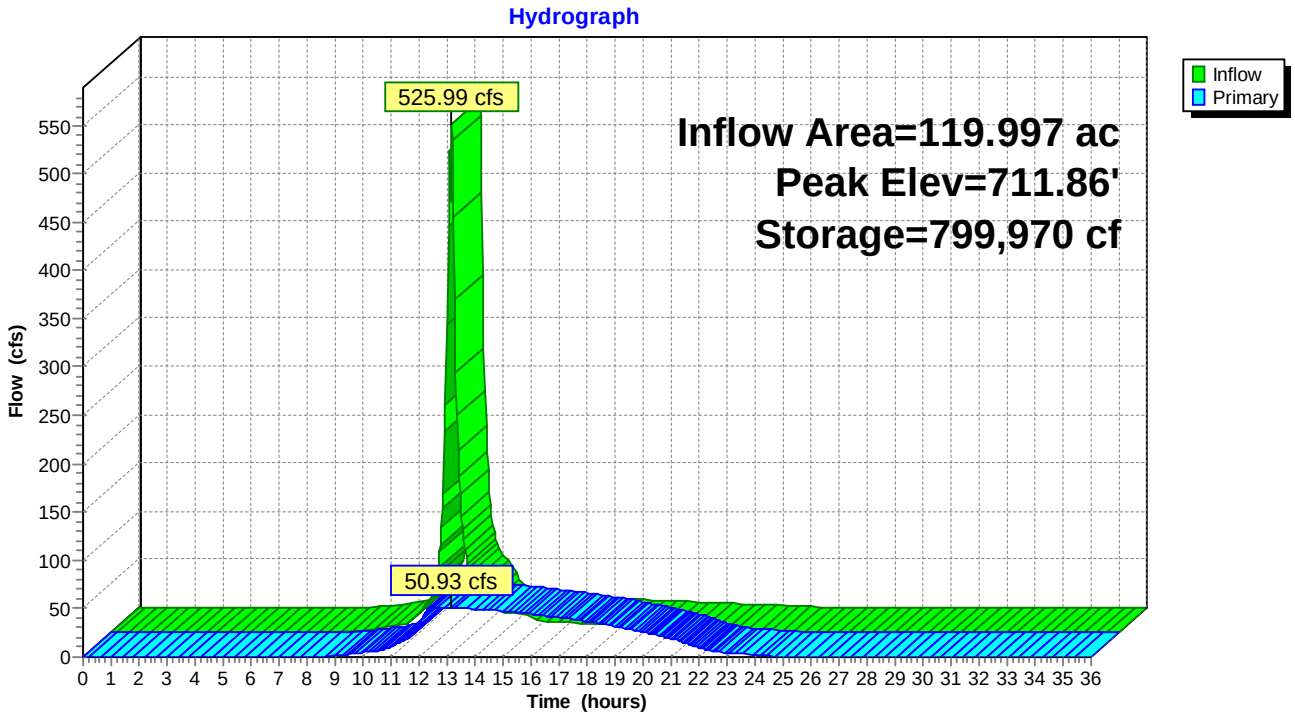
Volume	Invert	Avail.Storage	Storage Description
#1	704.30'	827,625 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
704.30	0	0	0
706.00	68,500	58,225	58,225
708.00	102,200	170,700	228,925
710.00	147,500	249,700	478,625
712.00	201,500	349,000	827,625

Device	Routing	Invert	Outlet Devices
#1	Primary	704.30'	**12.0" Round 12" HDPE Culverts X 2.00** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 704.30' / 699.00' S= 0.0424 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Primary	704.30'	**18.0" Round 18" HDPE Culverts X 2.00** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 704.30' / 699.00' S= 0.0424 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=50.93 cfs @ 13.12 hrs HW=711.86' TW=699.86' (Fixed TW Elev= 699.86')
1=12" HDPE Culverts (Inlet Controls 15.87 cfs @ 10.10 fps)
2=18" HDPE Culverts (Inlet Controls 35.06 cfs @ 9.92 fps)

Pond 11P: NWD / NW-MC VII



Summary for Pond 19P: E-MC IX Culvert

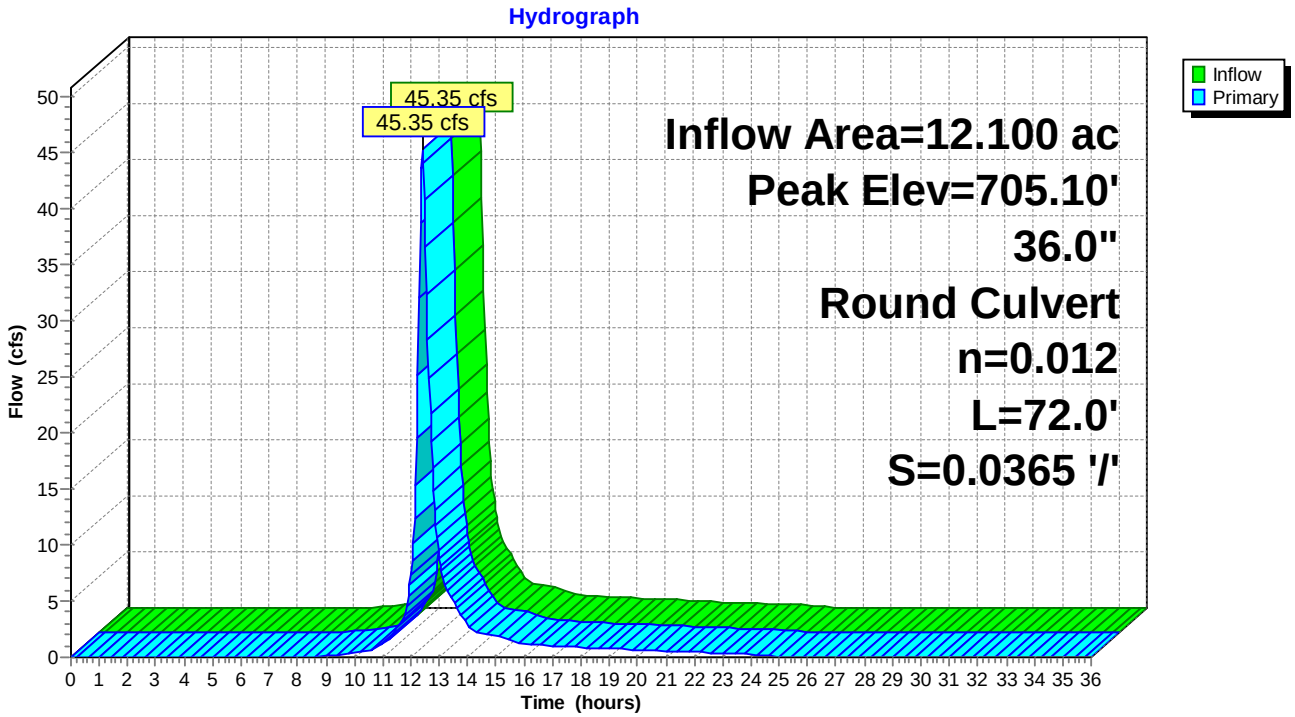
Inflow Area = 12.100 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 45.35 cfs @ 12.40 hrs, Volume= 3.409 af
Outflow = 45.35 cfs @ 12.40 hrs, Volume= 3.409 af, Atten= 0%, Lag= 0.0 min
Primary = 45.35 cfs @ 12.40 hrs, Volume= 3.409 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 705.10' @ 12.40 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	701.82'	**36.0" Round Culvert** L= 72.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 701.82' / 699.19' S= 0.0365 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=45.25 cfs @ 12.40 hrs HW=705.09' TW=700.23' (Fixed TW Elev= 700.23')
1=Culvert (Inlet Controls 45.25 cfs @ 6.40 fps)

Pond 19P: E-MC IX Culvert



Summary for Pond 36P: NSB South Inlet

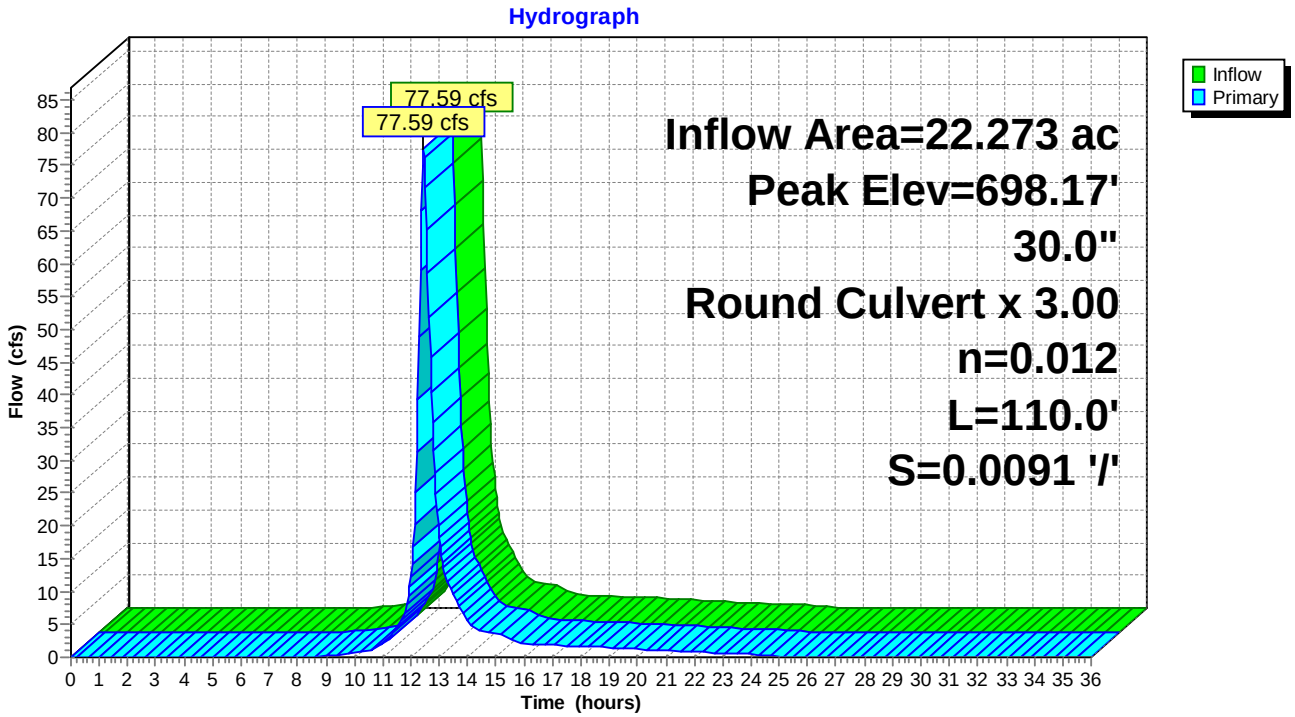
Inflow Area = 22.273 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 77.59 cfs @ 12.45 hrs, Volume= 6.274 af
Outflow = 77.59 cfs @ 12.45 hrs, Volume= 6.274 af, Atten= 0%, Lag= 0.0 min
Primary = 77.59 cfs @ 12.45 hrs, Volume= 6.274 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 698.17' @ 12.45 hrs

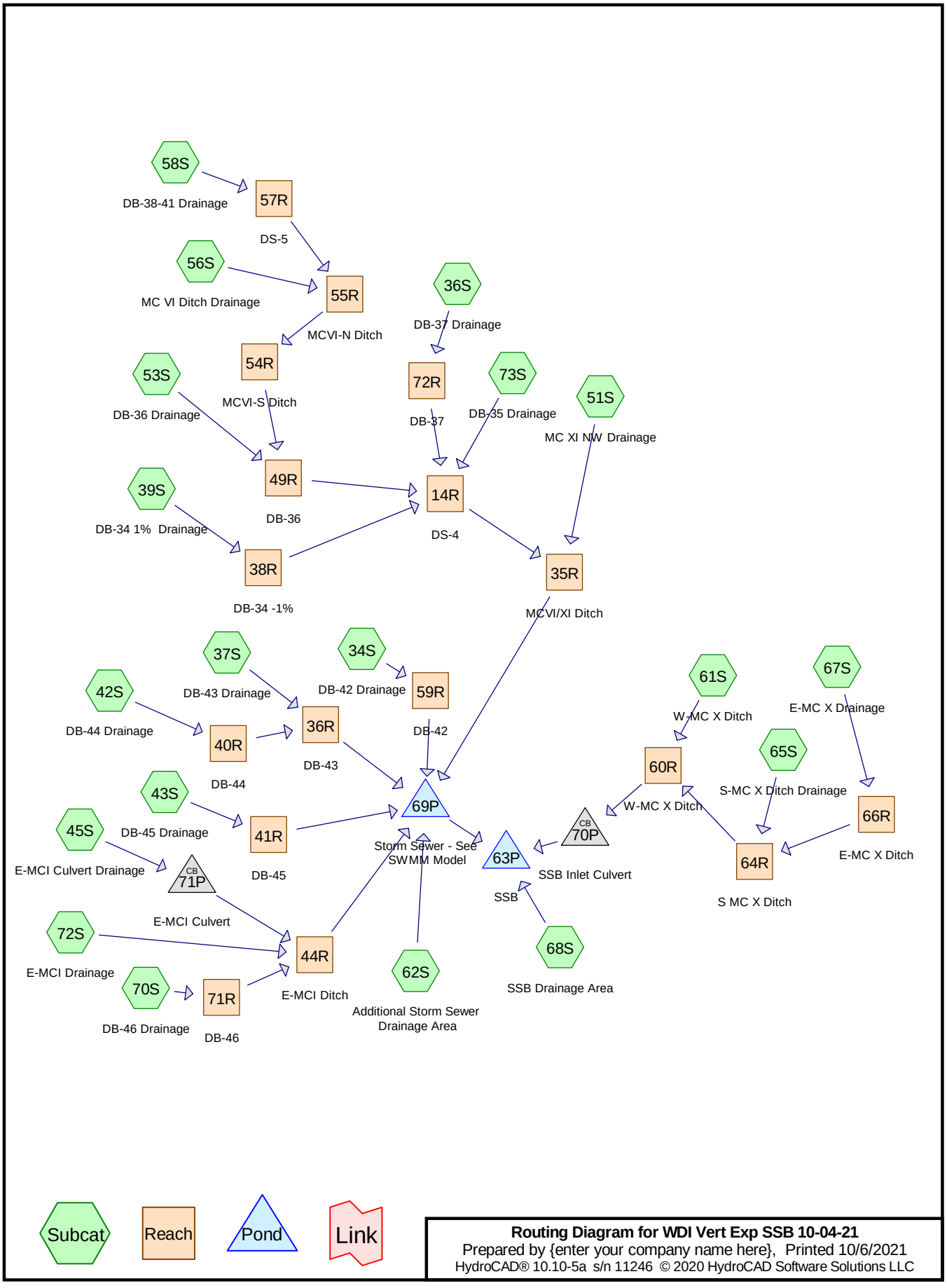
Device	Routing	Invert	Outlet Devices
#1	Primary	695.00'	**30.0" Round 30" Culverts X 3.00** L= 110.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 695.00' / 694.00' S= 0.0091 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf

Primary OutFlow Max=77.30 cfs @ 12.45 hrs HW=698.16' TW=693.90' (Fixed TW Elev= 693.90')
↑—**1=30" Culverts** (Inlet Controls 77.30 cfs @ 5.25 fps)

Pond 36P: NSB South Inlet



South Sedimentation Basin (SSB) HYDROCAD OUTPUT – 25-yr, 24-hr



Routing Diagram for WDI Vert Exp SSB 10-04-21

Prepared by {enter your company name here}, Printed 10/6/2021

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Time span=0.00-36.00 hrs, dt=0.02 hrs, 1801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 34S: DB-42 Drainage Runoff Area=86,500 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=476' Tc=4.1 min CN=84 Runoff=9.22 cfs 0.385 af

Subcatchment 36S: DB-37 Drainage Runoff Area=393,872 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=691' Tc=19.8 min CN=84 Runoff=23.75 cfs 1.753 af

Subcatchment 37S: DB-43 Drainage Runoff Area=63,437 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=280' Tc=10.1 min CN=84 Runoff=5.23 cfs 0.282 af

Subcatchment 39S: DB-34 1% Drainage Runoff Area=320,470 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=130' Slope=0.2500 '/' Tc=5.1 min CN=84 Runoff=32.56 cfs 1.427 af

Subcatchment 42S: DB-44 Drainage Runoff Area=67,882 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=291' Tc=18.1 min CN=84 Runoff=4.28 cfs 0.302 af

Subcatchment 43S: DB-45 Drainage Runoff Area=8,958 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=77' Tc=7.7 min CN=84 Runoff=0.82 cfs 0.040 af

Subcatchment 45S: E-MCI Culvert Drainage Runoff Area=136,608 sf 0.00% Impervious Runoff Depth=2.00"
Flow Length=667' Tc=20.2 min CN=80 Runoff=6.97 cfs 0.523 af

Subcatchment 51S: MC XI NW Drainage Runoff Area=649,178 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=480' Slope=0.0520 '/' Tc=16.5 min CN=84 Runoff=42.93 cfs 2.890 af

Subcatchment 53S: DB-36 Drainage Runoff Area=181,100 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=495' Tc=7.0 min CN=84 Runoff=17.01 cfs 0.806 af

Subcatchment 56S: MC VI Ditch Drainage Runoff Area=297,466 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=367' Tc=6.9 min CN=84 Runoff=28.08 cfs 1.324 af

Subcatchment 58S: DB-38-41 Drainage Runoff Area=335,816 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=933' Tc=3.8 min CN=84 Runoff=36.23 cfs 1.495 af

Subcatchment 61S: W-MC X Ditch Runoff Area=141,400 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=150' Slope=0.2500 '/' Tc=5.8 min CN=84 Runoff=14.01 cfs 0.629 af

Subcatchment 62S: Additional Storm Sewer Runoff Area=237,200 sf 100.00% Impervious Runoff Depth=3.72"
Tc=0.0 min CN=98 Runoff=35.48 cfs 1.686 af

Subcatchment 65S: S-MC X Ditch Drainage Runoff Area=205,200 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=160' Slope=0.3300 '/' Tc=5.4 min CN=84 Runoff=20.59 cfs 0.914 af

Subcatchment 67S: E-MC X Drainage Runoff Area=253,500 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=110' Slope=0.2500 '/' Tc=4.5 min CN=84 Runoff=26.56 cfs 1.129 af

Subcatchment 68S: SSB Drainage Area Runoff Area=900,800 sf 23.12% Impervious Runoff Depth=2.59"
Flow Length=400' Slope=0.0730 '/' Tc=13.7 min CN=87 Runoff=71.50 cfs 4.465 af

Subcatchment 70S: DB-46 Drainage Runoff Area=455,500 sf 0.00% Impervious Runoff Depth=2.00"
Flow Length=450' Slope=0.0350 '/' Tc=19.1 min CN=80 Runoff=24.00 cfs 1.743 af

Subcatchment 72S: E-MCI Drainage Runoff Area=177,527 sf 0.00% Impervious Runoff Depth=2.00"
Flow Length=1,086' Tc=33.4 min CN=80 Runoff=6.83 cfs 0.679 af

Subcatchment 73S: DB-35 Drainage Runoff Area=188,838 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=1,373' Tc=6.3 min CN=84 Runoff=18.29 cfs 0.841 af

Reach 14R: DS-4 Avg. Flow Depth=0.59' Max Vel=16.59 fps Inflow=109.24 cfs 7.646 af
n=0.029 L=230.0' S=0.2500 '/' Capacity=930.83 cfs Outflow=108.99 cfs 7.646 af

Reach 35R: MCVI/XI Ditch Avg. Flow Depth=1.79' Max Vel=6.44 fps Inflow=151.77 cfs 10.536 af
n=0.025 L=290.0' S=0.0100 '/' Capacity=898.54 cfs Outflow=150.84 cfs 10.536 af

Reach 36R: DB-43 Avg. Flow Depth=0.88' Max Vel=3.30 fps Inflow=7.80 cfs 0.585 af
n=0.025 L=402.0' S=0.0100 '/' Capacity=68.62 cfs Outflow=7.64 cfs 0.585 af

Reach 38R: DB-34 -1% Avg. Flow Depth=1.30' Max Vel=4.28 fps Inflow=32.56 cfs 1.427 af
n=0.025 L=2,391.0' S=0.0100 '/' Capacity=68.62 cfs Outflow=21.45 cfs 1.427 af

Reach 40R: DB-44 Avg. Flow Depth=0.51' Max Vel=5.36 fps Inflow=4.28 cfs 0.302 af
n=0.025 L=610.0' S=0.0540 '/' Capacity=159.45 cfs Outflow=4.21 cfs 0.302 af

Reach 41R: DB-45 Avg. Flow Depth=0.38' Max Vel=1.88 fps Inflow=0.82 cfs 0.040 af
n=0.025 L=127.1' S=0.0100 '/' Capacity=68.59 cfs Outflow=0.80 cfs 0.040 af

Reach 44R: E-MCI Ditch Avg. Flow Depth=1.86' Max Vel=3.49 fps Inflow=36.31 cfs 2.945 af
n=0.025 L=250.0' S=0.0041 '/' Capacity=129.69 cfs Outflow=36.16 cfs 2.945 af

Reach 49R: DB-36 Avg. Flow Depth=1.77' Max Vel=7.46 fps Inflow=75.20 cfs 3.626 af
n=0.025 L=1,140.0' S=0.0200 '/' Capacity=175.94 cfs Outflow=69.89 cfs 3.626 af

Reach 54R: MCVI-S Ditch Avg. Flow Depth=1.32' Max Vel=8.62 fps Inflow=61.13 cfs 2.819 af
n=0.025 L=370.0' S=0.0380 '/' Capacity=181.62 cfs Outflow=59.88 cfs 2.819 af

Reach 55R: MCVI-N Ditch Avg. Flow Depth=0.61' Max Vel=4.42 fps Inflow=62.51 cfs 2.819 af
n=0.025 L=265.0' S=0.0270 '/' Capacity=230.14 cfs Outflow=61.13 cfs 2.819 af

Reach 57R: DS-5 Avg. Flow Depth=0.76' Max Vel=10.94 fps Inflow=36.23 cfs 1.495 af
n=0.029 L=304.0' S=0.1697 '/' Capacity=476.49 cfs Outflow=35.30 cfs 1.495 af

Reach 59R: DB-42 Avg. Flow Depth=0.90' Max Vel=3.37 fps Inflow=9.22 cfs 0.385 af
n=0.025 L=576.5' S=0.0100 '/' Capacity=68.65 cfs Outflow=8.15 cfs 0.385 af

Reach 60R: W-MC X Ditch Avg. Flow Depth=1.02' Max Vel=2.42 fps Inflow=22.31 cfs 2.672 af
n=0.025 L=833.0' S=0.0024 '/' Capacity=326.61 cfs Outflow=21.03 cfs 2.672 af

Reach 64R: S MC X Ditch Avg. Flow Depth=2.07' Max Vel=2.77 fps Inflow=23.26 cfs 2.042 af
n=0.025 L=1,110.0' S=0.0027 '/' Capacity=103.29 cfs Outflow=17.73 cfs 2.042 af

Reach 66R: E-MC X Ditch Avg. Flow Depth=1.26' Max Vel=1.81 fps Inflow=26.56 cfs 1.129 af
n=0.030 L=1,500.0' S=0.0025 '/' Capacity=145.10 cfs Outflow=14.40 cfs 1.129 af

Reach 71R: DB-46 Avg. Flow Depth=1.00' Max Vel=3.70 fps Inflow=24.00 cfs 1.743 af
n=0.025 L=200.0' S=0.0100 '/' Capacity=152.89 cfs Outflow=23.88 cfs 1.743 af

Reach 72R: DB-37 Avg. Flow Depth=1.17' Max Vel=5.66 fps Inflow=23.75 cfs 1.753 af
n=0.025 L=804.0' S=0.0200 '/' Capacity=97.04 cfs Outflow=23.29 cfs 1.753 af

Pond 63P: SSB Inflow=282.99 cfs 23.314 af
Primary=282.99 cfs 23.314 af

Pond 69P: Storm Sewer - See SWMM Model Inflow=202.39 cfs 16.177 af
Primary=202.39 cfs 16.177 af

Pond 70P: SSB Inlet Culvert Peak Elev=690.92' Inflow=21.03 cfs 2.672 af
30.0" Round Culvert n=0.012 L=113.0' S=-0.0012 '/' Outflow=21.03 cfs 2.672 af

Pond 71P: E-MCI Culvert Peak Elev=705.44' Inflow=6.97 cfs 0.523 af
24.0" Round Culvert n=0.012 L=80.0' S=0.0025 '/' Outflow=6.97 cfs 0.523 af

Total Runoff Area = 117.109 ac Runoff Volume = 23.314 af Average Runoff Depth = 2.39"
91.27% Pervious = 106.881 ac 8.73% Impervious = 10.227 ac

Summary for Subcatchment 34S: DB-42 Drainage

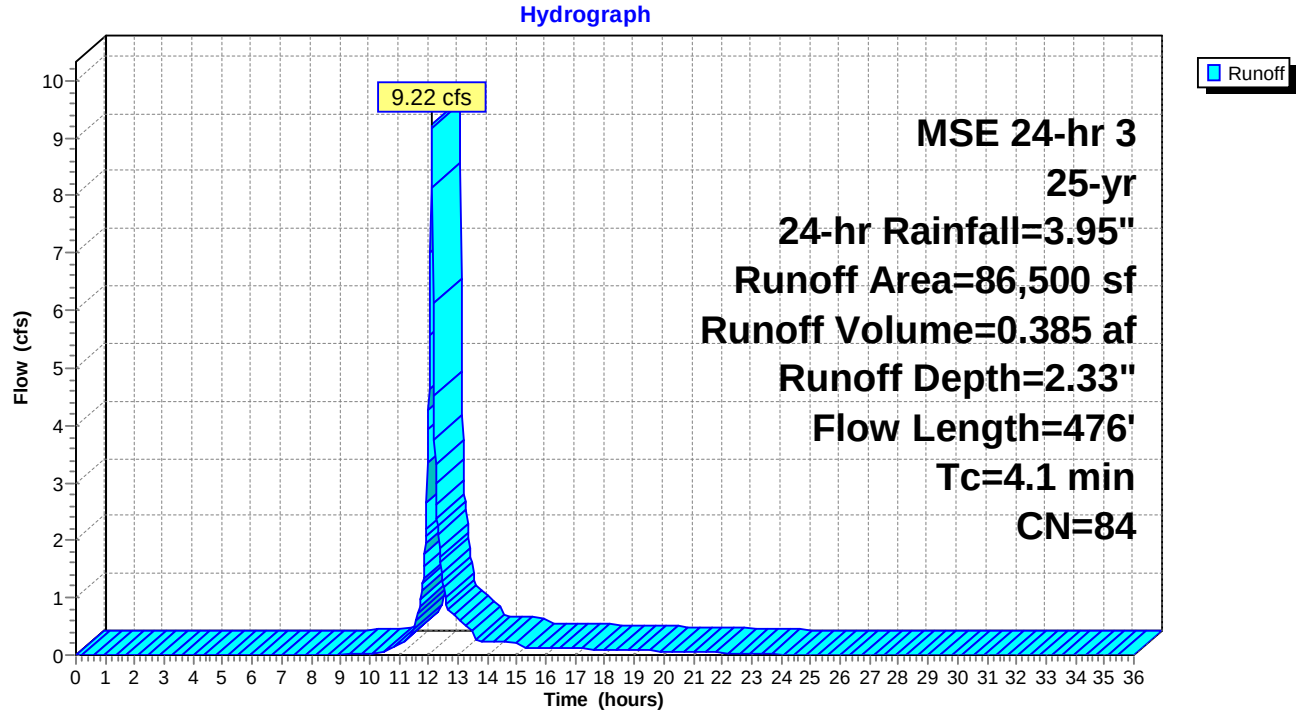
Runoff = 9.22 cfs @ 12.11 hrs, Volume= 0.385 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
86,500	84	50-75% Grass cover, Fair, HSG D
86,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	66	0.2500	0.37		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.1	410	0.0100	5.94	71.33	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
4.1	476	Total			

Subcatchment 34S: DB-42 Drainage



Summary for Subcatchment 36S: DB-37 Drainage

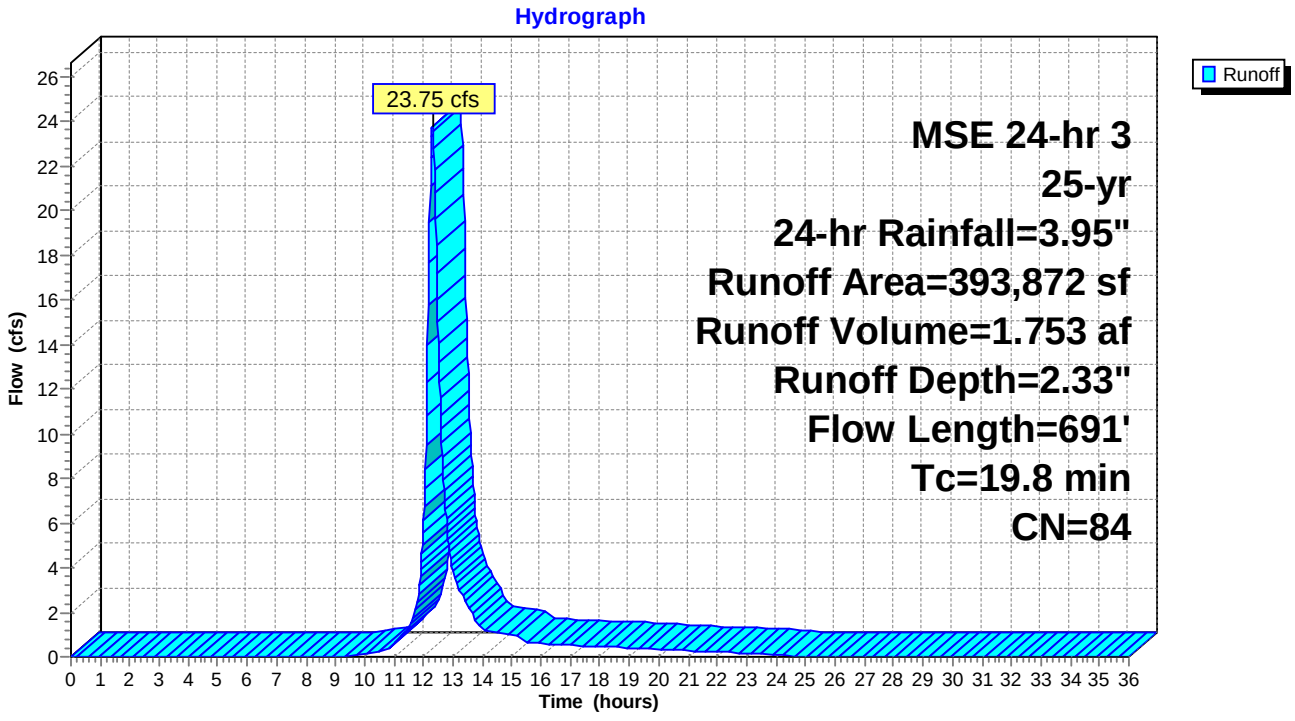
Runoff = 23.75 cfs @ 12.29 hrs, Volume= 1.753 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
393,872	84	50-75% Grass cover, Fair, HSG D
393,872		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	59	0.2500	0.36		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
11.4	141	0.0400	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
5.6	474	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	17	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.8	691	Total			

Subcatchment 36S: DB-37 Drainage



Summary for Subcatchment 37S: DB-43 Drainage

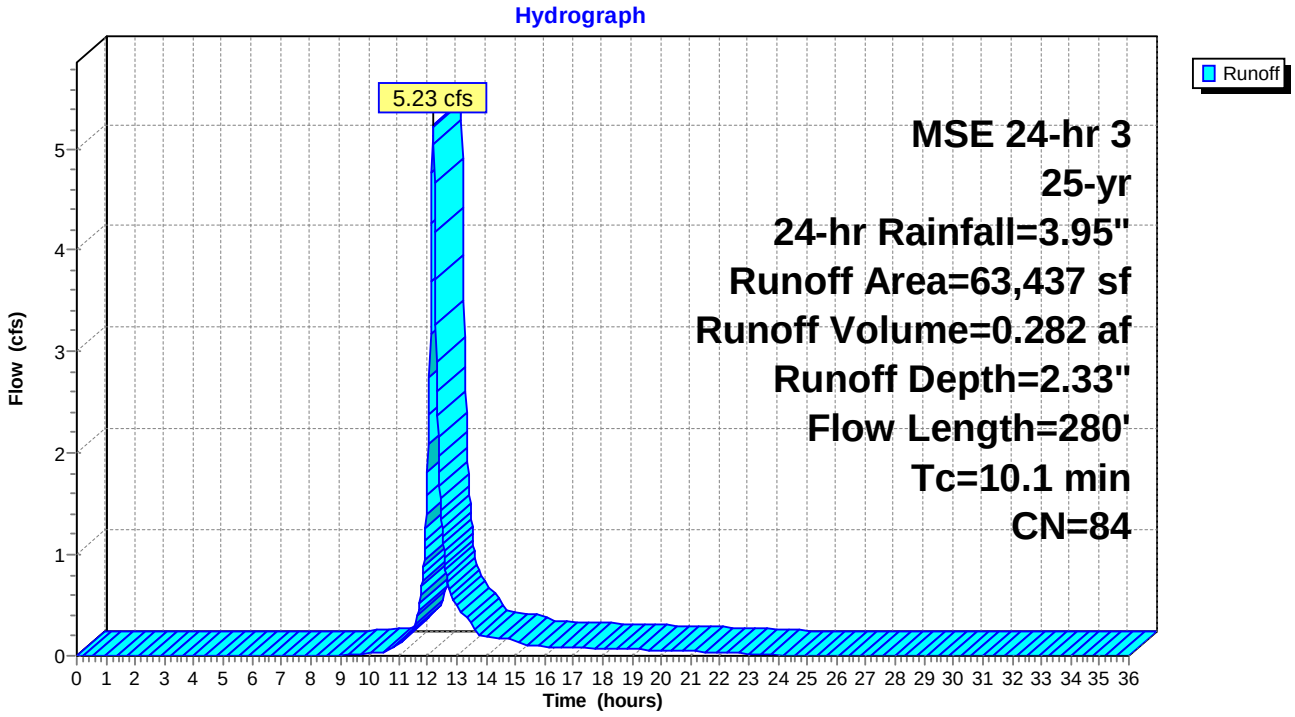
Runoff = 5.23 cfs @ 12.18 hrs, Volume= 0.282 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
63,437	84	50-75% Grass cover, Fair, HSG D
63,437		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	65	0.2500	0.37		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
7.2	215	0.0050	0.49		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.1	280	Total			

Subcatchment 37S: DB-43 Drainage



Summary for Subcatchment 39S: DB-34 1% Drainage

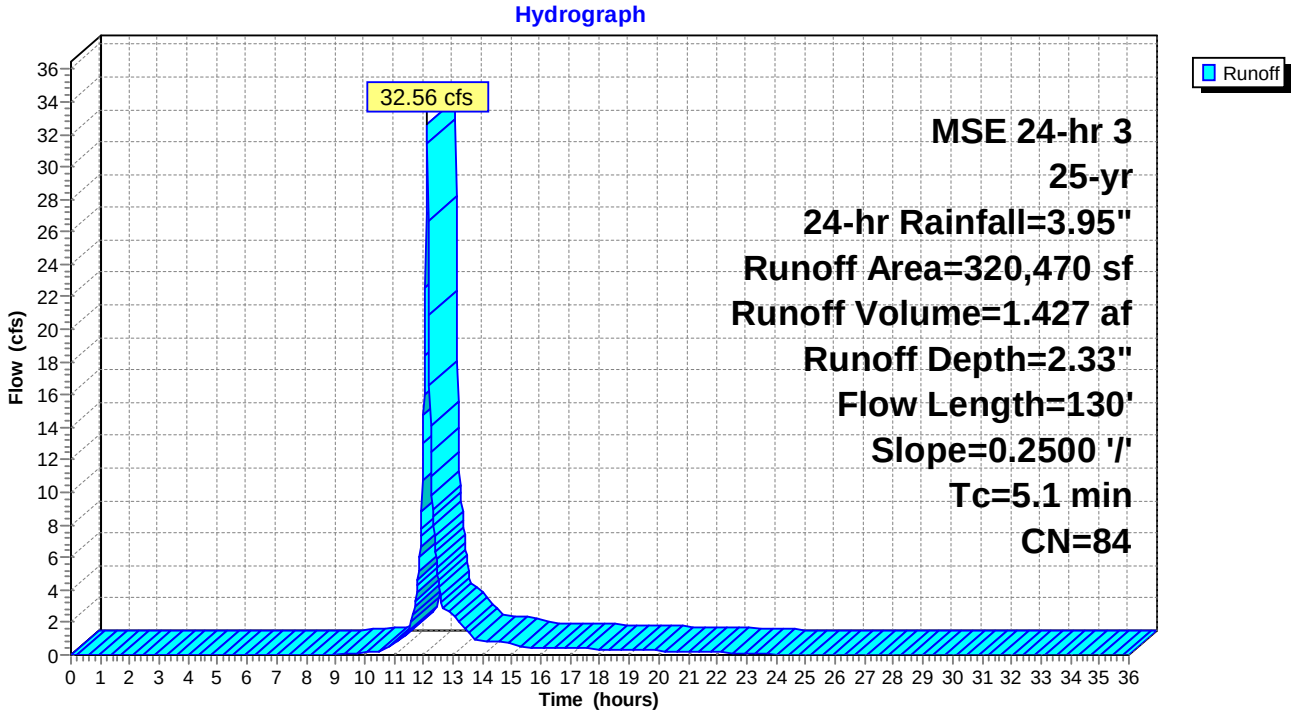
Runoff = 32.56 cfs @ 12.12 hrs, Volume= 1.427 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
320,470	84	50-75% Grass cover, Fair, HSG D
320,470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	130	0.2500	0.42		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 39S: DB-34 1% Drainage



Summary for Subcatchment 42S: DB-44 Drainage

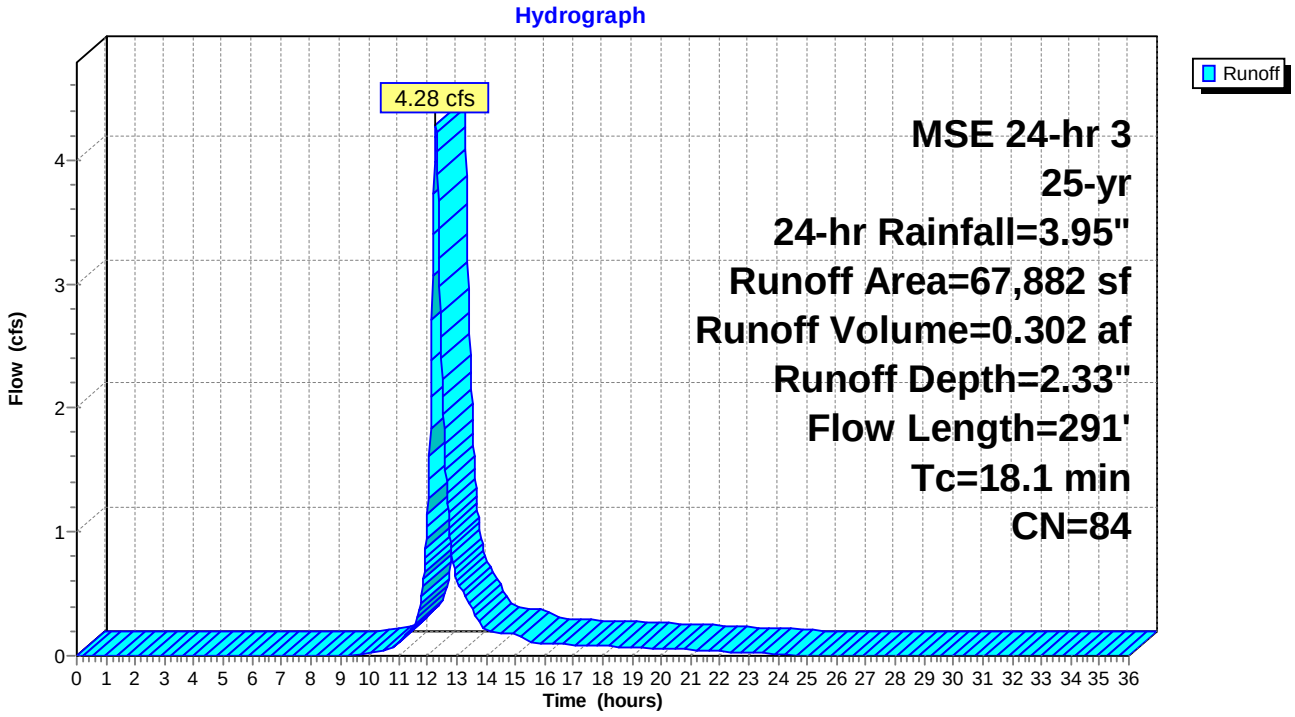
Runoff = 4.28 cfs @ 12.27 hrs, Volume= 0.302 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
67,882	84	50-75% Grass cover, Fair, HSG D
67,882		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	199	0.0260	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
0.2	92	0.2500	7.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
18.1	291	Total			

Subcatchment 42S: DB-44 Drainage



Summary for Subcatchment 43S: DB-45 Drainage

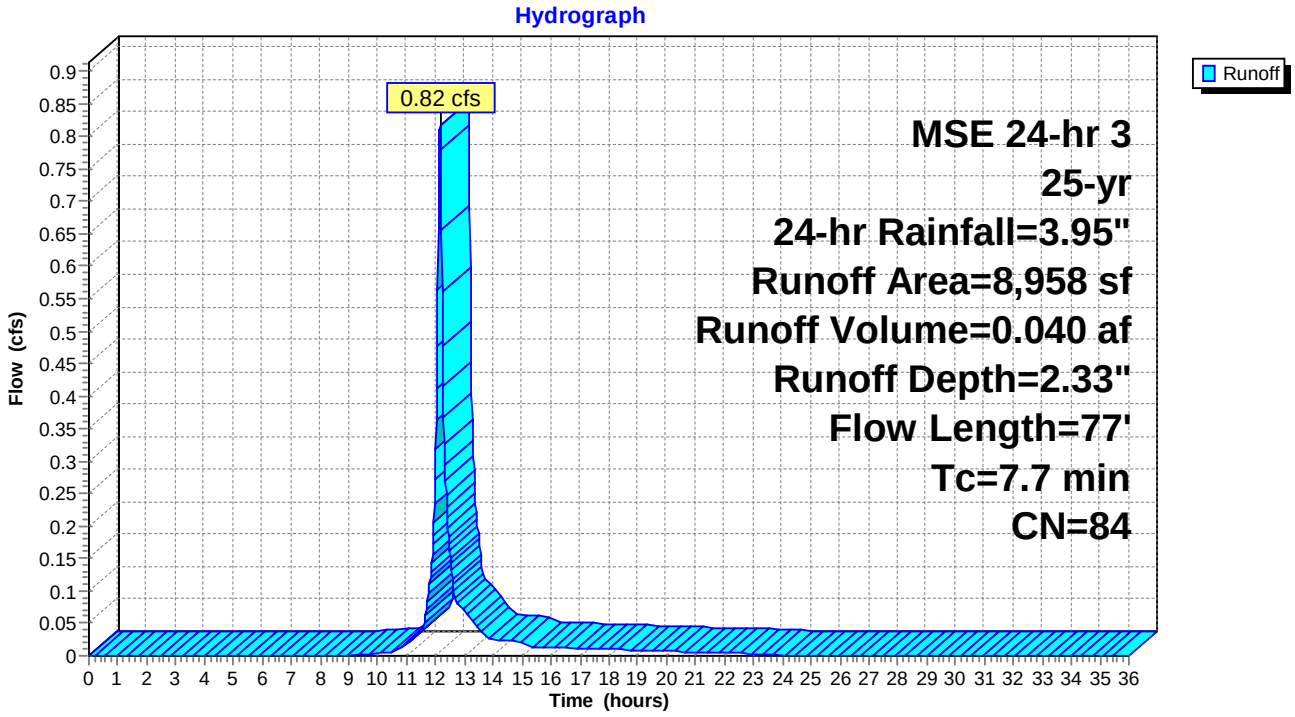
Runoff = 0.82 cfs @ 12.15 hrs, Volume= 0.040 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
8,958	84	50-75% Grass cover, Fair, HSG D
8,958		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	29	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.1	48	0.3300	0.39		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
7.7	77	Total			

Subcatchment 43S: DB-45 Drainage



Summary for Subcatchment 45S: E-MCI Culvert Drainage

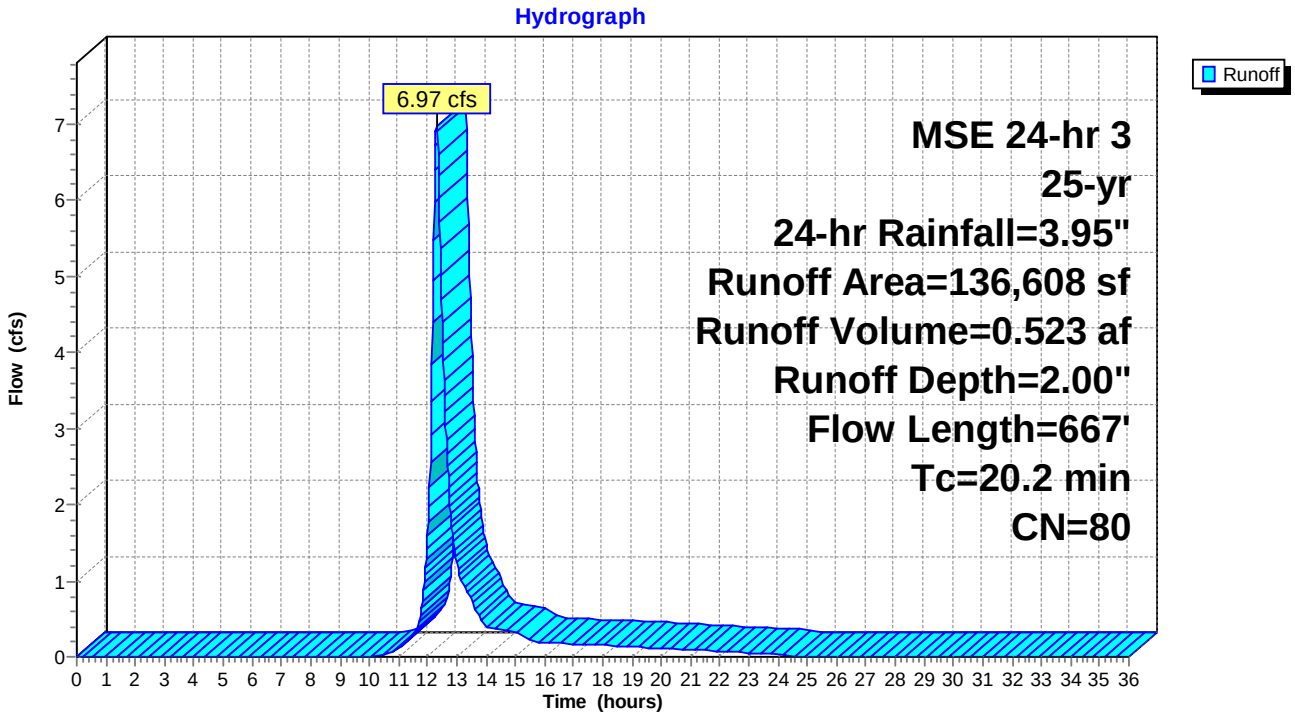
Runoff = 6.97 cfs @ 12.30 hrs, Volume= 0.523 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
136,608	80	>75% Grass cover, Good, HSG D
136,608		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	32	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.6	35	0.3300	0.36		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
8.2	133	0.0800	0.27		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
4.3	467	0.0670	1.81		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
20.2	667	Total			

Subcatchment 45S: E-MCI Culvert Drainage



Summary for Subcatchment 51S: MC XI NW Drainage

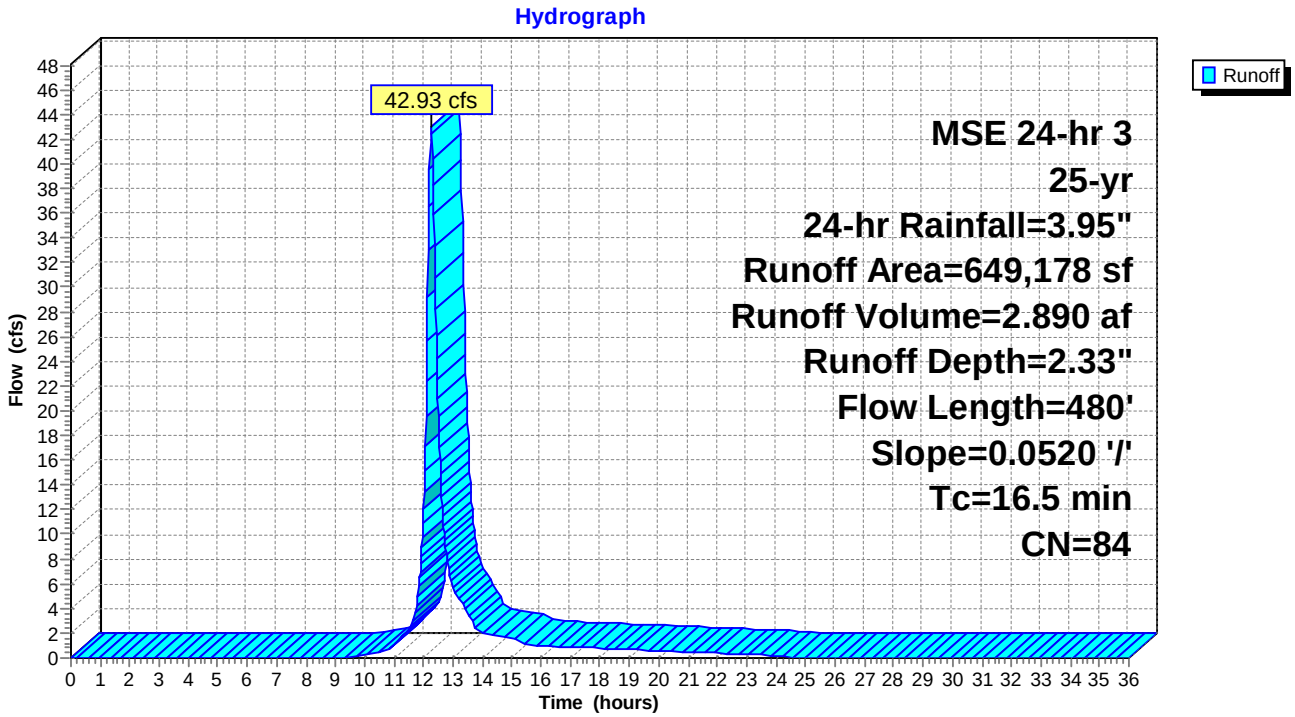
Runoff = 42.93 cfs @ 12.25 hrs, Volume= 2.890 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
475,309	84	50-75% Grass cover, Fair, HSG D
173,869	84	50-75% Grass cover, Fair, HSG D
649,178	84	Weighted Average
649,178		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	200	0.0520	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.9	280	0.0520	1.60		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.5	480	Total			

Subcatchment 51S: MC XI NW Drainage



Summary for Subcatchment 53S: DB-36 Drainage

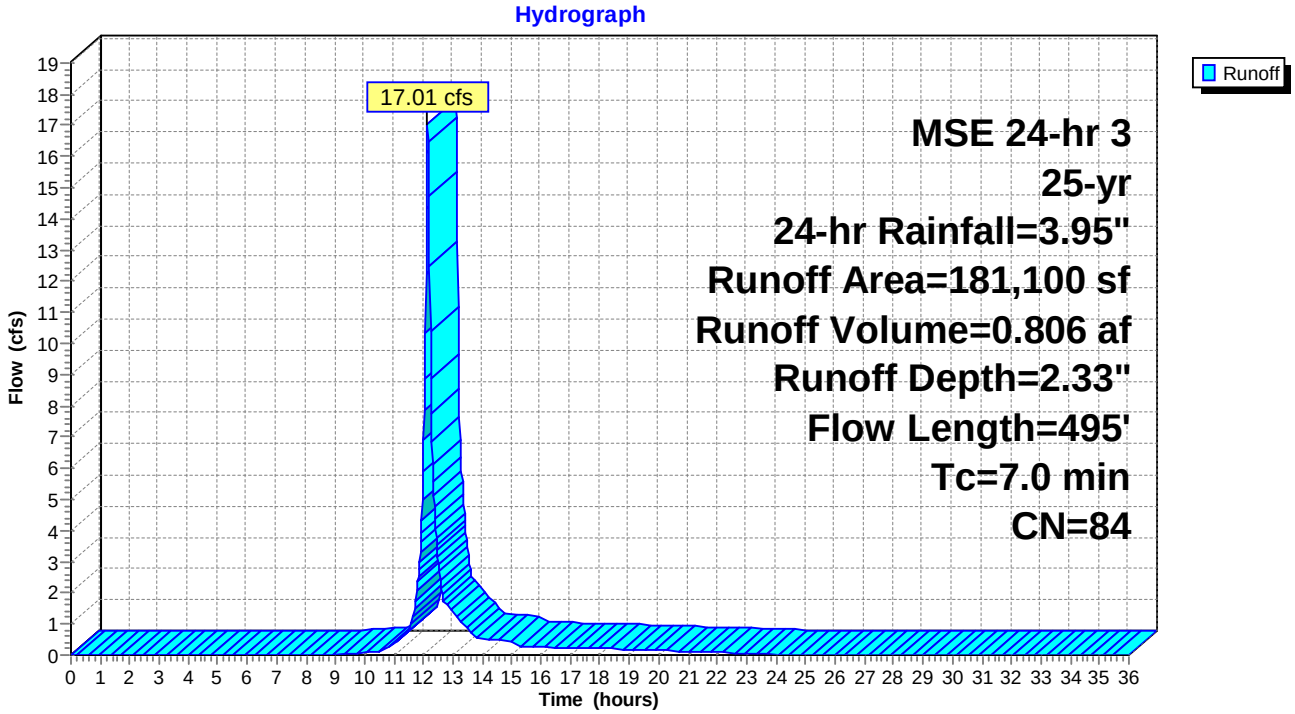
Runoff = 17.01 cfs @ 12.14 hrs, Volume= 0.806 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
181,100	84	50-75% Grass cover, Fair, HSG D
181,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	170	0.2500	0.45		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
0.6	325	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
7.0	495	Total			

Subcatchment 53S: DB-36 Drainage



Summary for Subcatchment 56S: MC VI Ditch Drainage

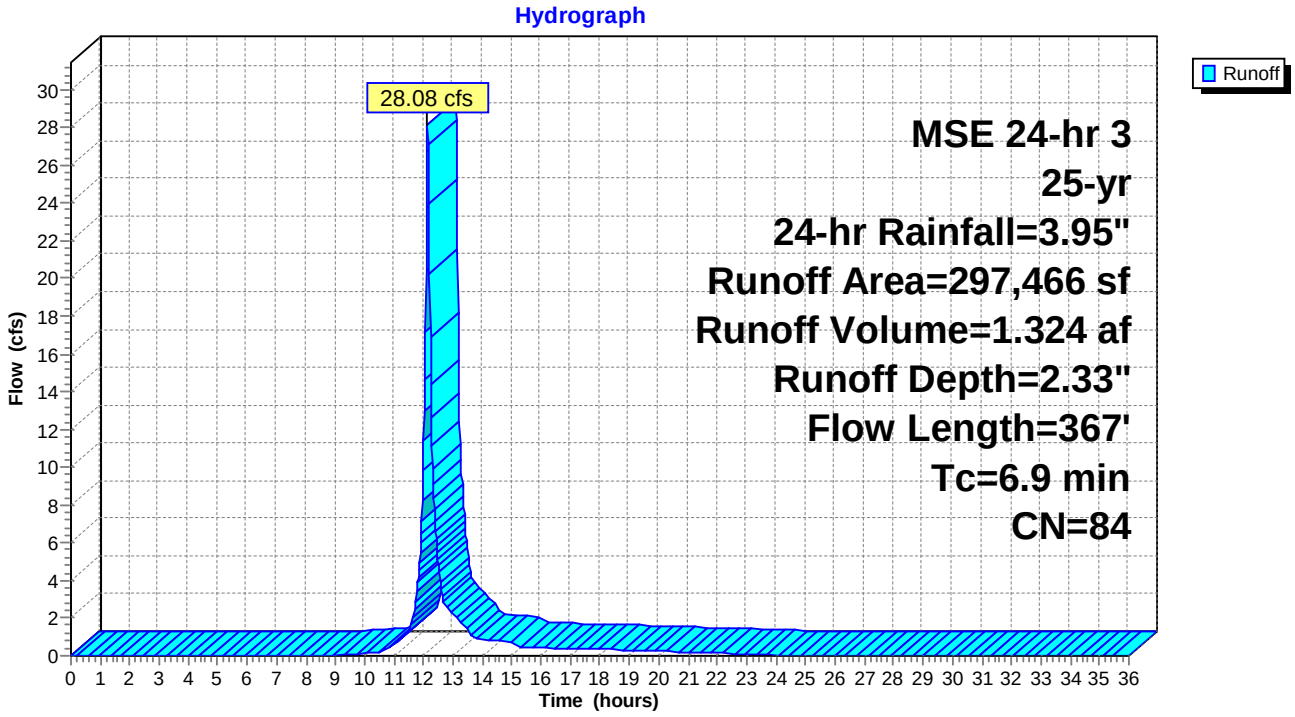
Runoff = 28.08 cfs @ 12.14 hrs, Volume= 1.324 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
297,466	84	50-75% Grass cover, Fair, HSG D
297,466		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	59	0.2500	0.36		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
4.2	308	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.9	367	Total			

Subcatchment 56S: MC VI Ditch Drainage



Summary for Subcatchment 58S: DB-38-41 Drainage

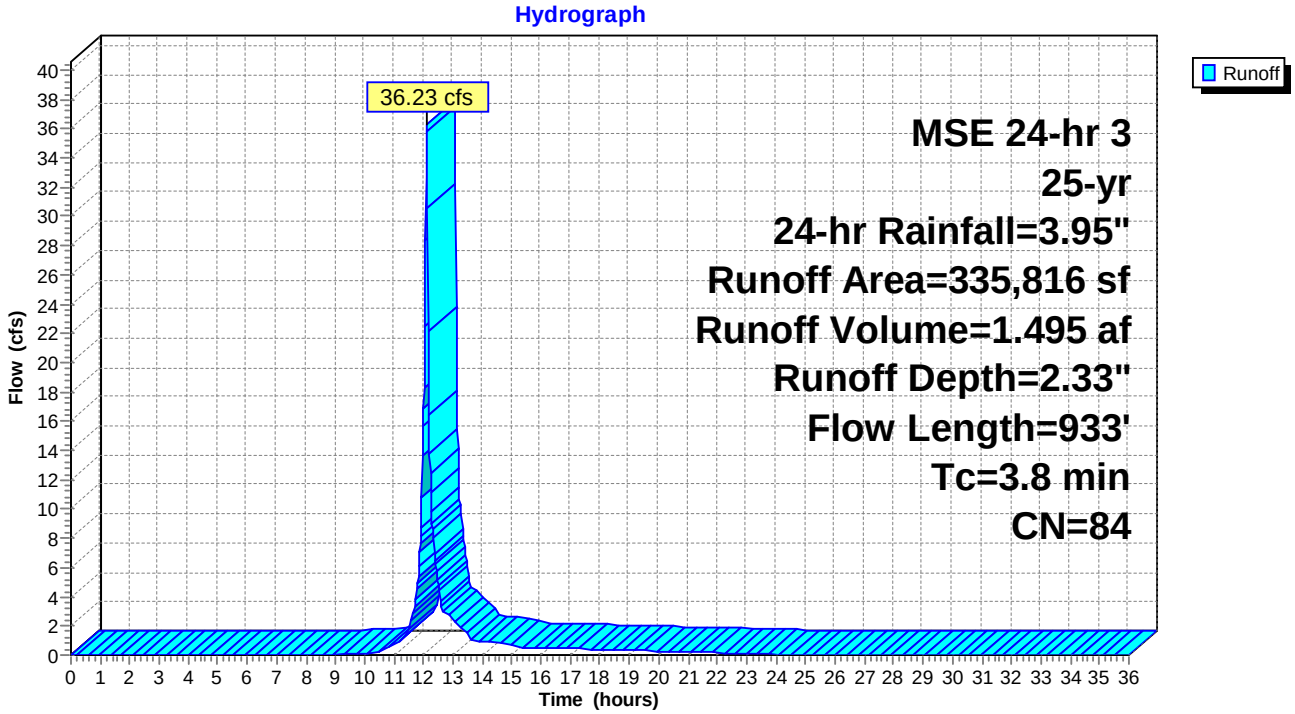
Runoff = 36.23 cfs @ 12.11 hrs, Volume= 1.495 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
335,816	84	50-75% Grass cover, Fair, HSG D
335,816		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	39	0.2500	0.33		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.8	894	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
3.8	933	Total			

Subcatchment 58S: DB-38-41 Drainage



Summary for Subcatchment 61S: W-MC X Ditch

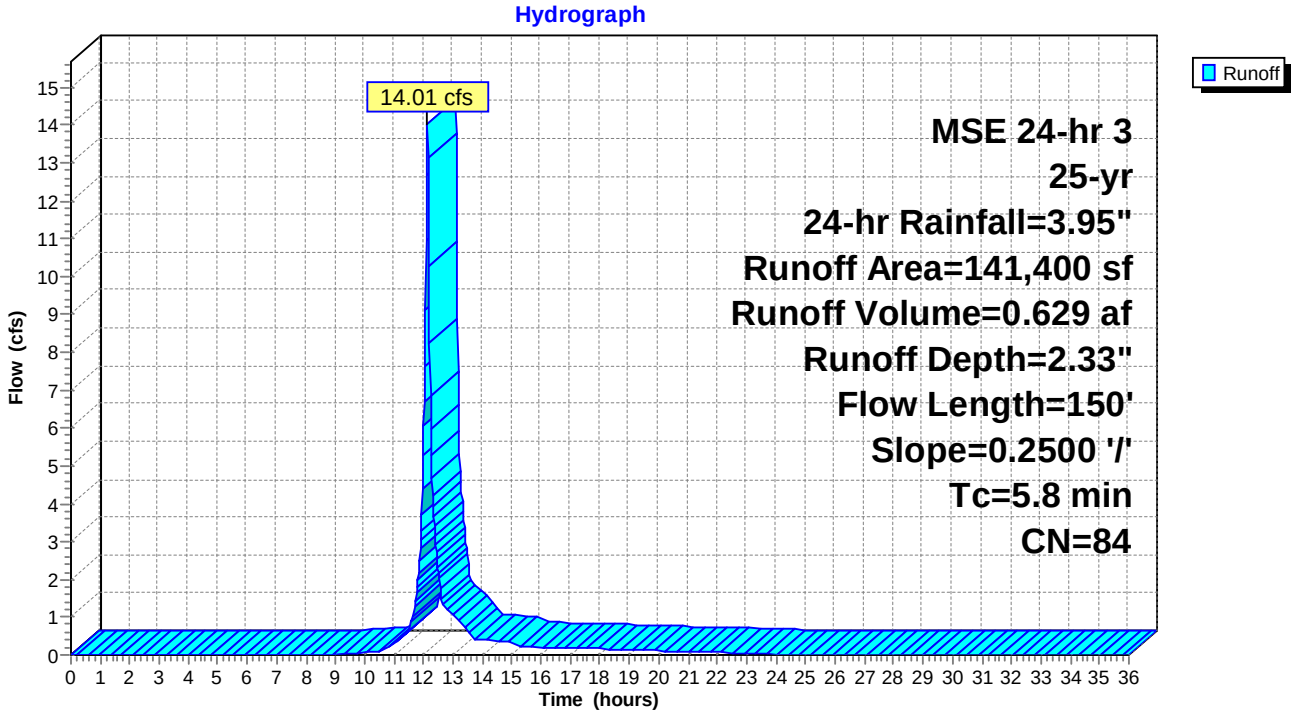
Runoff = 14.01 cfs @ 12.13 hrs, Volume= 0.629 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
141,400	84	50-75% Grass cover, Fair, HSG D
141,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	150	0.2500	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 61S: W-MC X Ditch



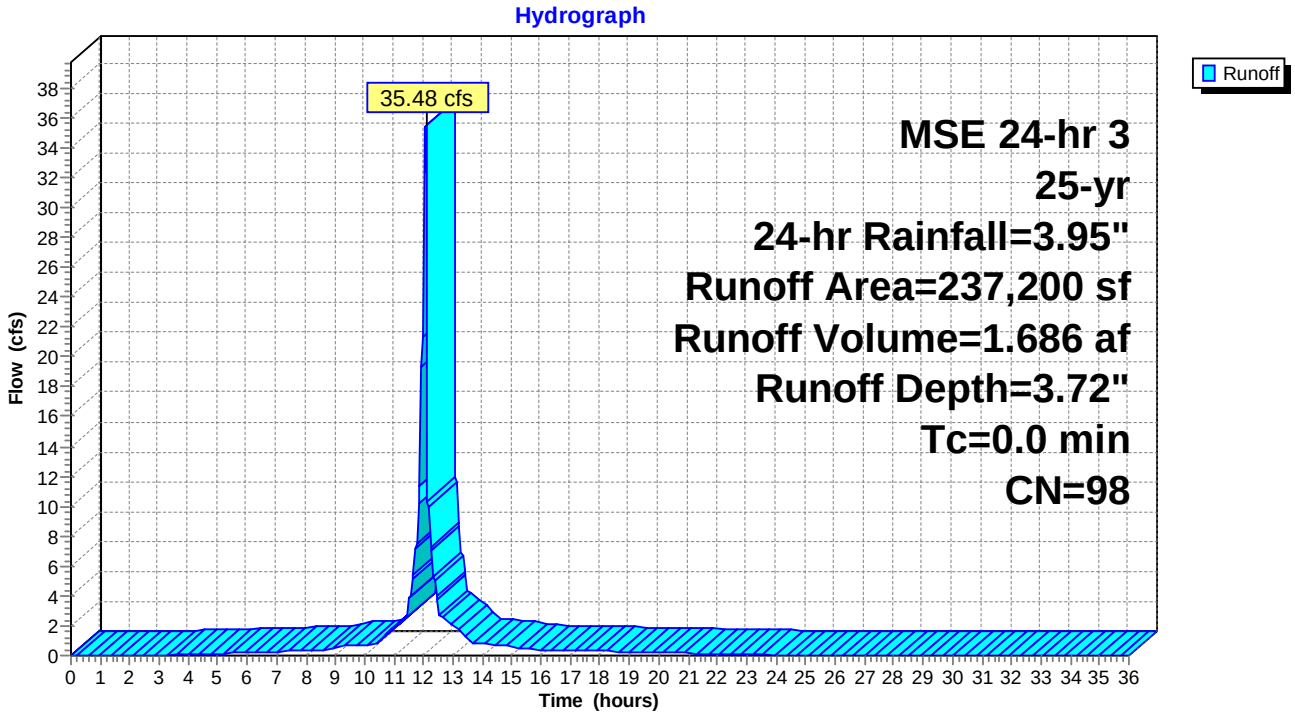
Summary for Subcatchment 62S: Additional Storm Sewer Drainage Area

Runoff = 35.48 cfs @ 12.08 hrs, Volume= 1.686 af, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
237,200	98	Paved parking, HSG D
237,200		100.00% Impervious Area

Subcatchment 62S: Additional Storm Sewer Drainage Area



Summary for Subcatchment 65S: S-MC X Ditch Drainage

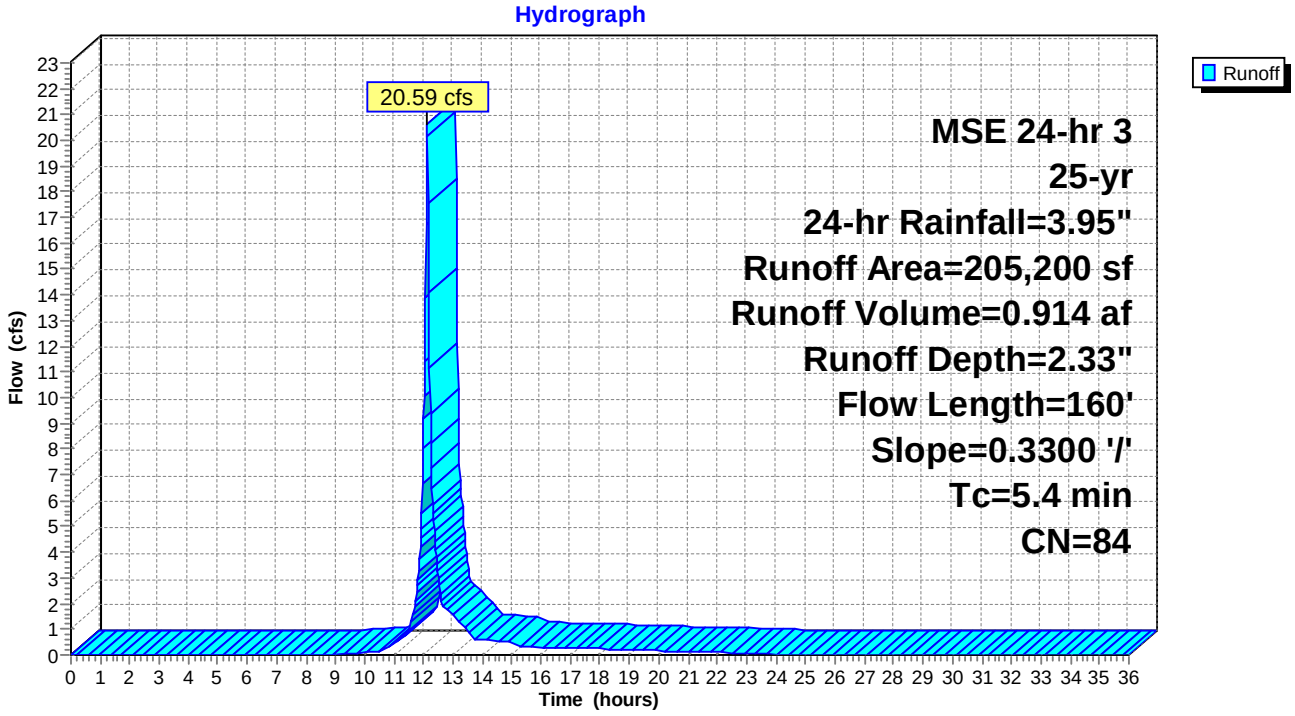
Runoff = 20.59 cfs @ 12.13 hrs, Volume= 0.914 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
205,200	84	50-75% Grass cover, Fair, HSG D
205,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	160	0.3300	0.49		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 65S: S-MC X Ditch Drainage



Summary for Subcatchment 67S: E-MC X Drainage

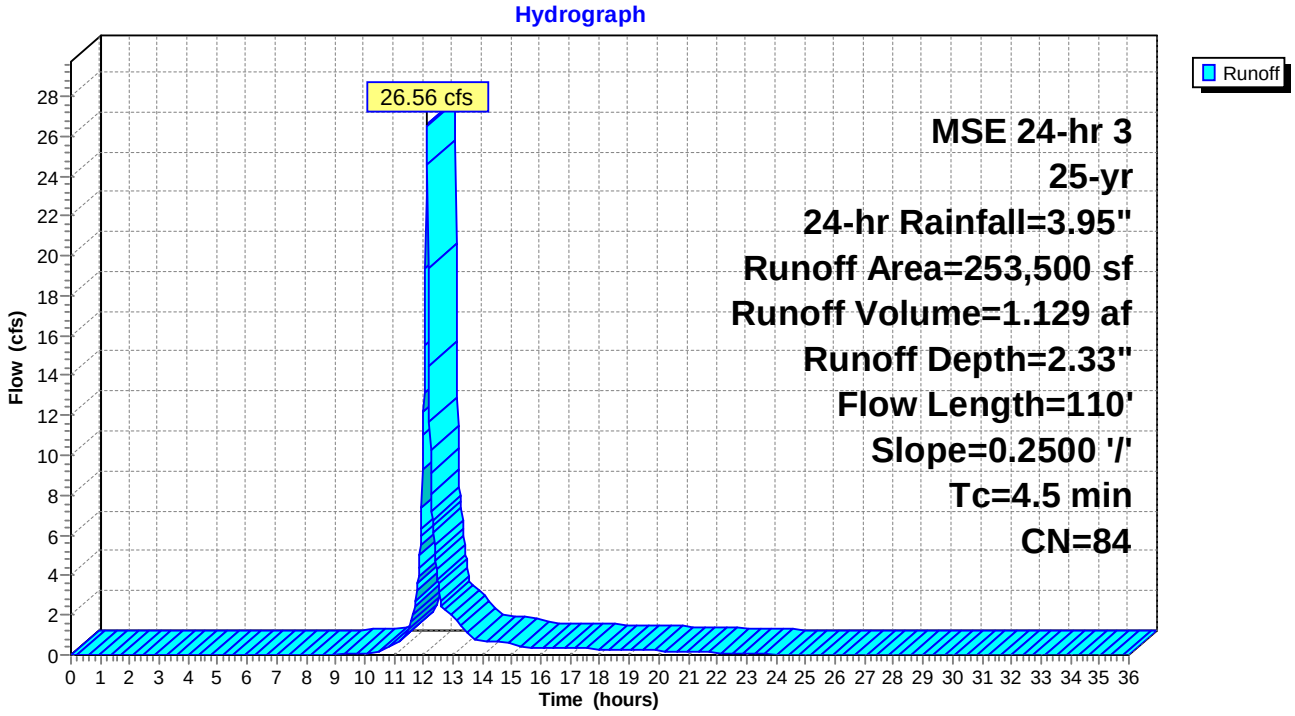
Runoff = 26.56 cfs @ 12.12 hrs, Volume= 1.129 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
253,500	84	50-75% Grass cover, Fair, HSG D
253,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	110	0.2500	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 67S: E-MC X Drainage



Summary for Subcatchment 68S: SSB Drainage Area

Total area is 900,800 sf
Pond area is 208,300 sf
Therefore, surrounding area is 692,500 sf (900,800 - 208,300)

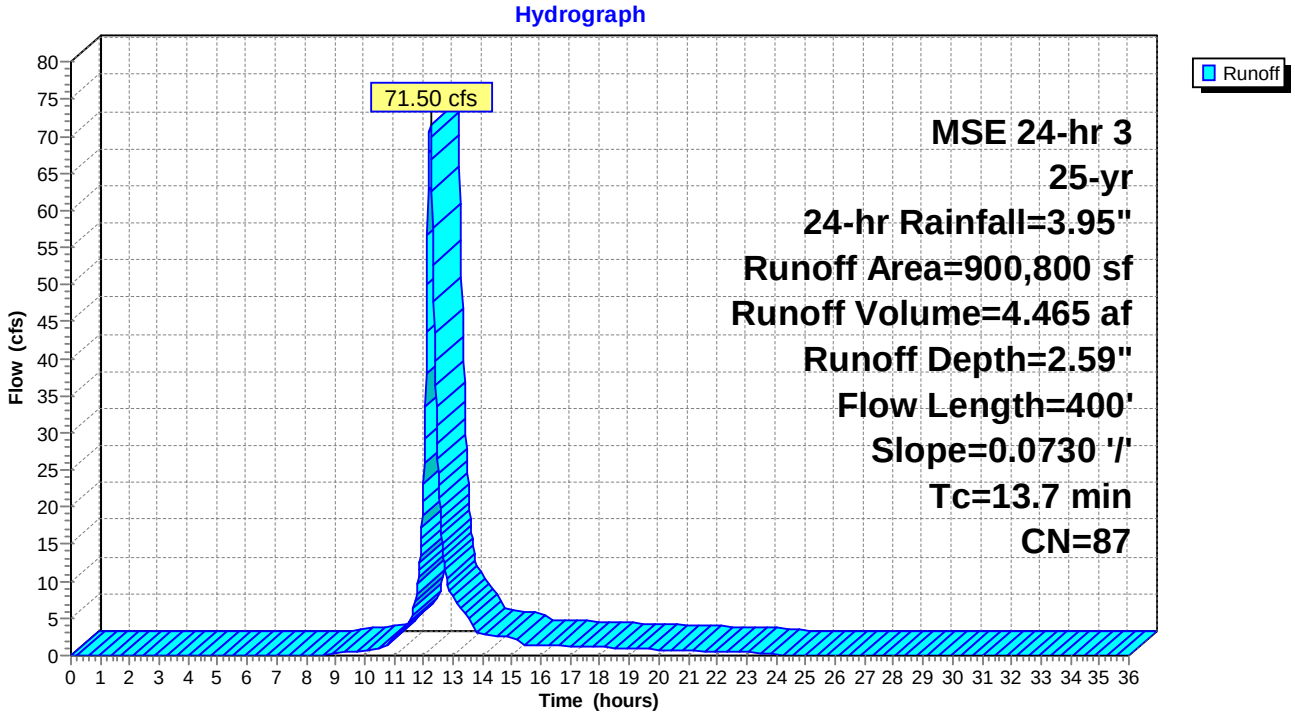
Runoff = 71.50 cfs @ 12.22 hrs, Volume= 4.465 af, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
692,500	84	50-75% Grass cover, Fair, HSG D
208,300	98	Water Surface, HSG D
900,800	87	Weighted Average
692,500		76.88% Pervious Area
208,300		23.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	200	0.0730	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.8	200	0.0730	1.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.7	400	Total			

Subcatchment 68S: SSB Drainage Area



Summary for Subcatchment 70S: DB-46 Drainage

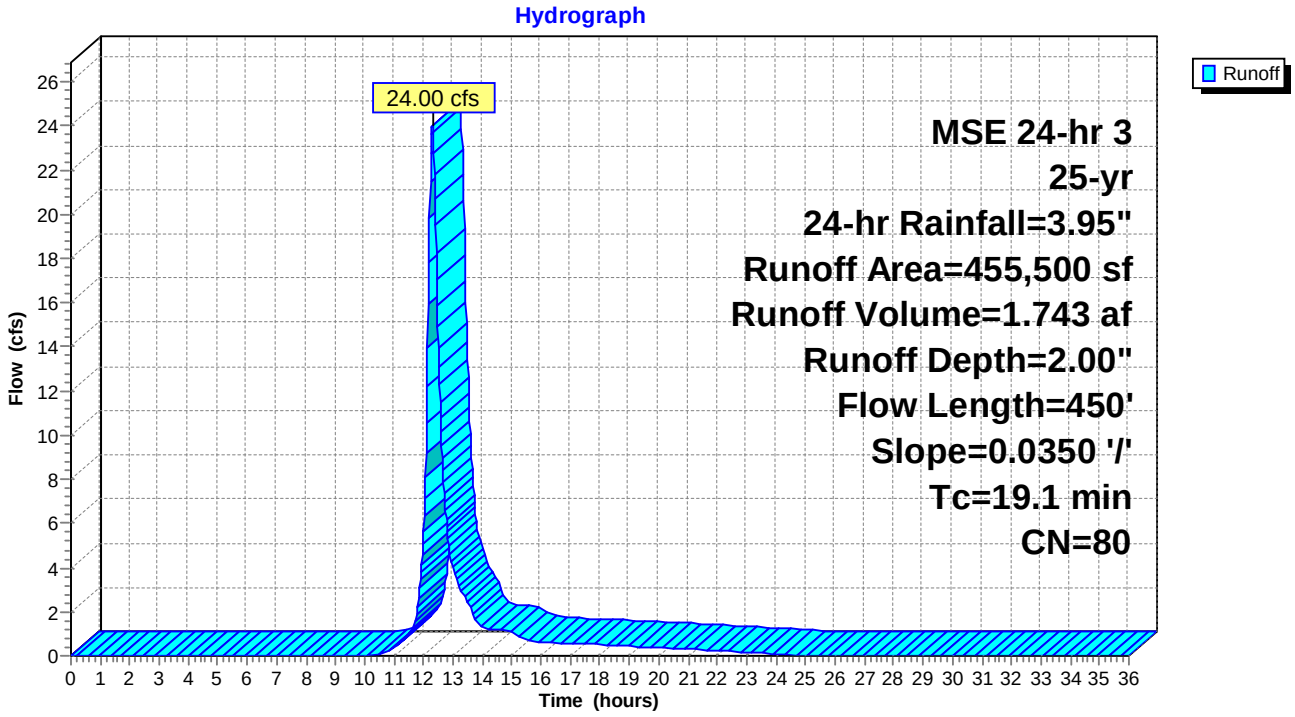
Runoff = 24.00 cfs @ 12.29 hrs, Volume= 1.743 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
455,500	80	>75% Grass cover, Good, HSG D
455,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	200	0.0350	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
3.2	250	0.0350	1.31		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.1	450	Total			

Subcatchment 70S: DB-46 Drainage



Summary for Subcatchment 72S: E-MCI Drainage

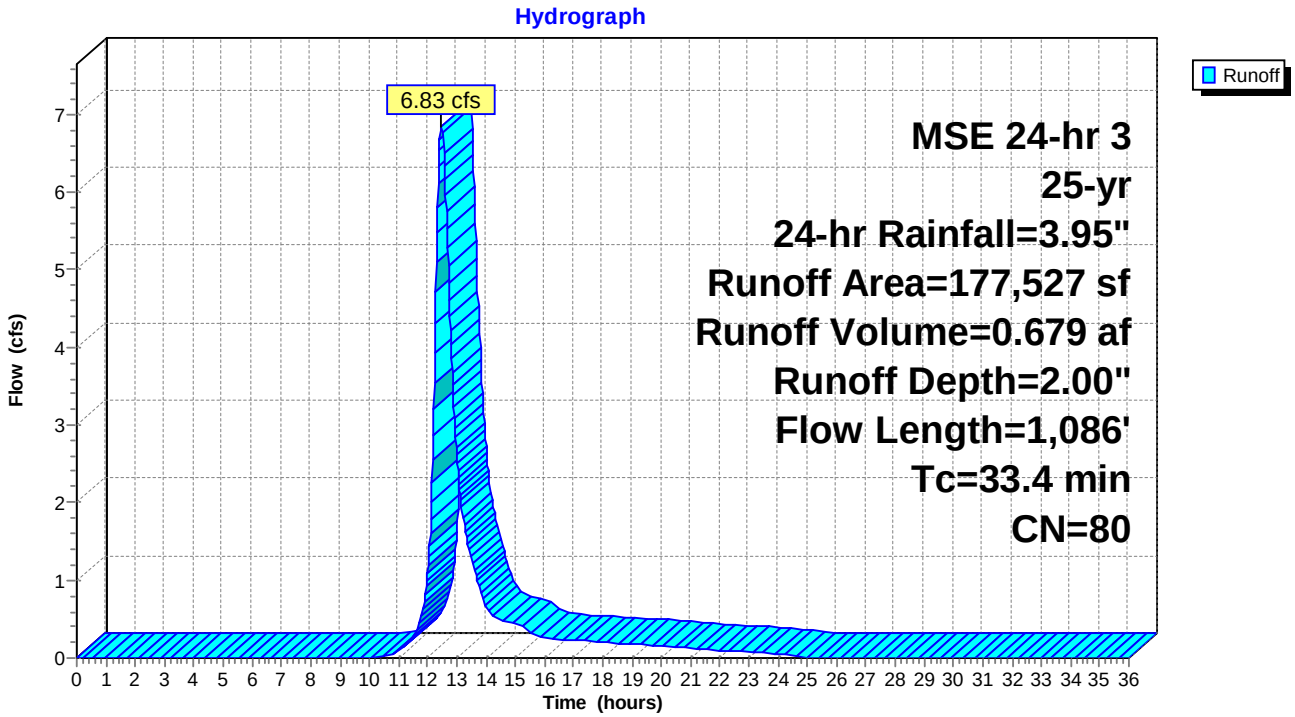
Runoff = 6.83 cfs @ 12.48 hrs, Volume= 0.679 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
177,527	80	>75% Grass cover, Good, HSG D
177,527		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	200	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
10.8	640	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.7	246	0.0488	1.55		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.4	1,086	Total			

Subcatchment 72S: E-MCI Drainage



Summary for Subcatchment 73S: DB-35 Drainage

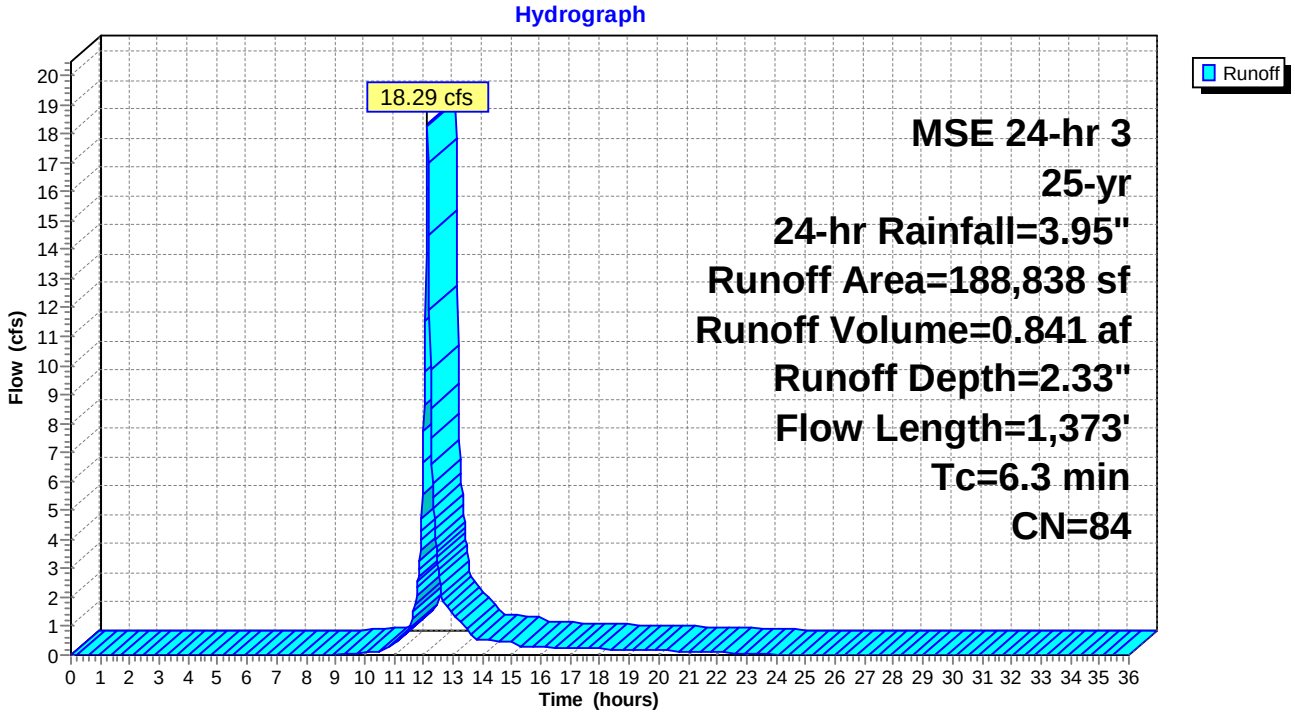
Runoff = 18.29 cfs @ 12.14 hrs, Volume= 0.841 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
188,838	84	50-75% Grass cover, Fair, HSG D
188,838		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	86	0.2500	0.39		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.6	1,287	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
6.3	1,373	Total			

Subcatchment 73S: DB-35 Drainage



Summary for Reach 14R: DS-4

Inflow Area = 39.430 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 109.24 cfs @ 12.26 hrs, Volume= 7.646 af
Outflow = 108.99 cfs @ 12.26 hrs, Volume= 7.646 af, Atten= 0%, Lag= 0.4 min

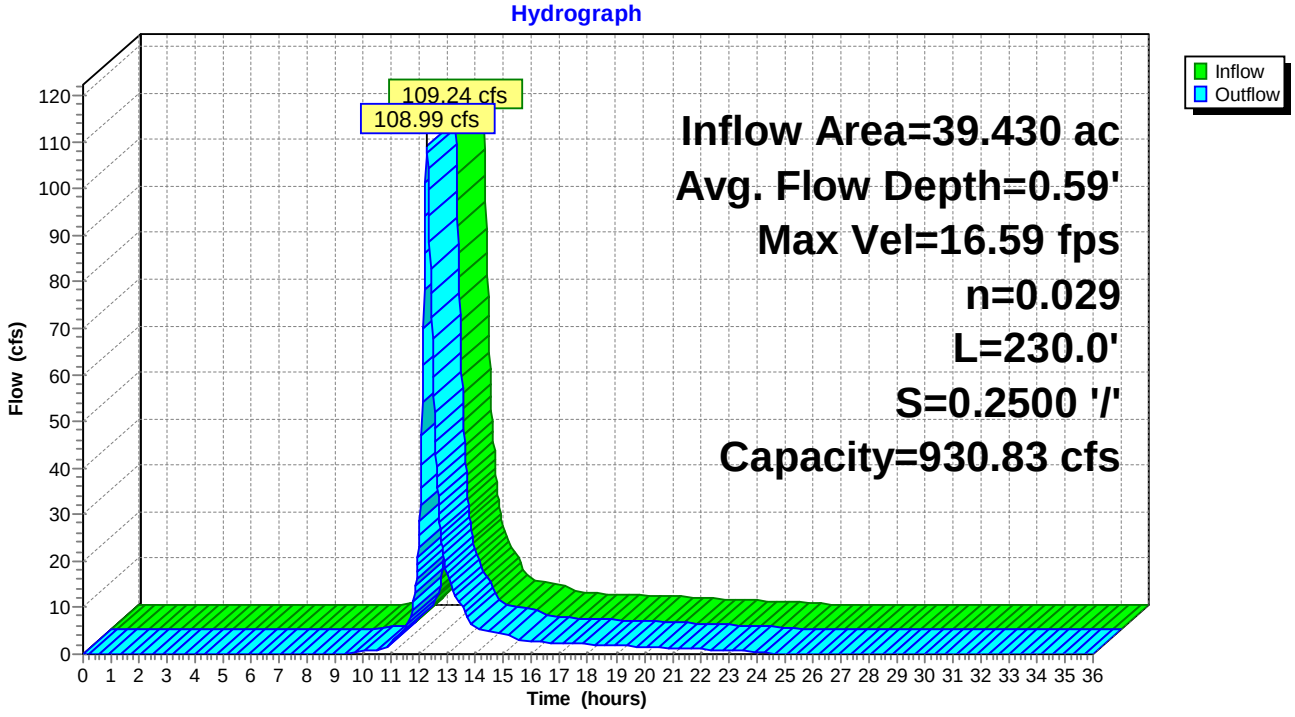
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 16.59 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.55 fps, Avg. Travel Time= 1.1 min

Peak Storage= 1,514 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.59' , Surface Width= 12.36'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 930.83 cfs

10.00' x 2.00' deep channel, n= 0.029
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 230.0' Slope= 0.2500 '/'
Inlet Invert= 763.50', Outlet Invert= 706.00'

‡

Reach 14R: DS-4



Summary for Reach 35R: MCVI/XI Ditch

Inflow Area = 54.333 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 151.77 cfs @ 12.26 hrs, Volume= 10.536 af
Outflow = 150.84 cfs @ 12.28 hrs, Volume= 10.536 af, Atten= 1%, Lag= 1.4 min

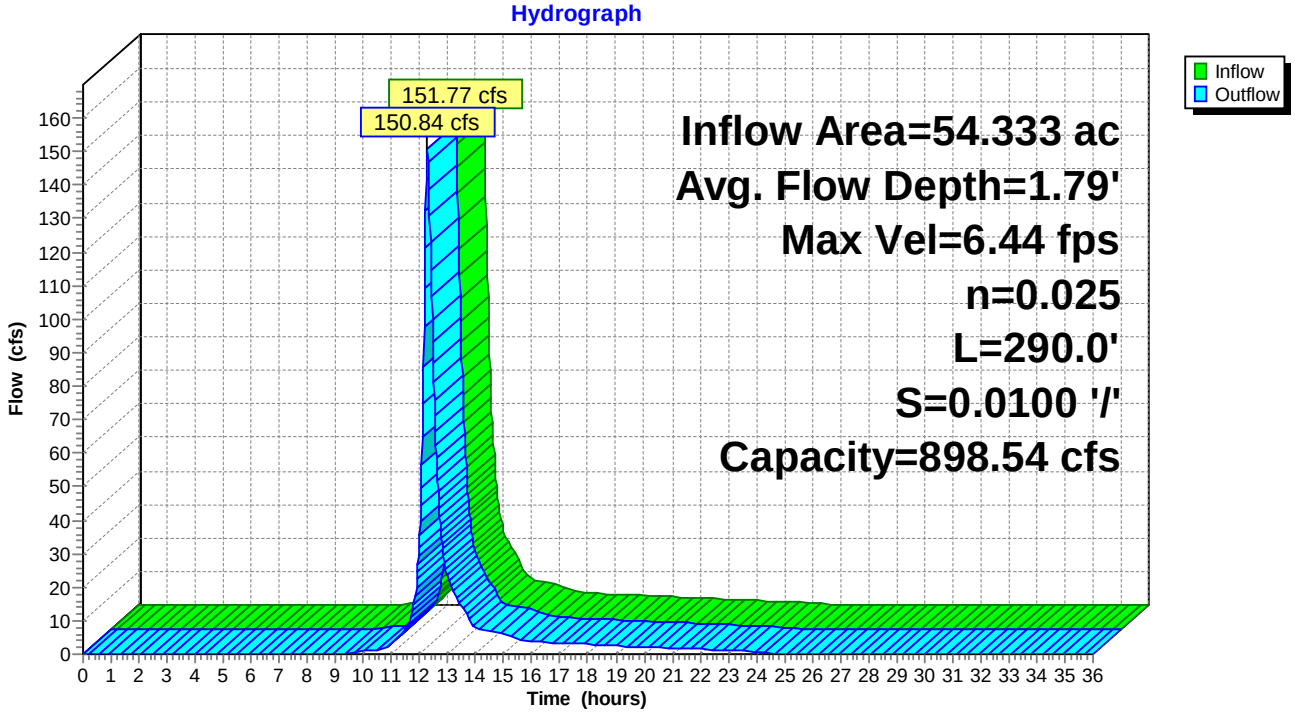
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 6.44 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.57 fps, Avg. Travel Time= 3.1 min

Peak Storage= 6,807 cf @ 12.27 hrs
Average Depth at Peak Storage= 1.79' , Surface Width= 20.29'
Bank-Full Depth= 4.00' Flow Area= 88.0 sf, Capacity= 898.54 cfs

6.00' x 4.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 '/' Top Width= 38.00'
Length= 290.0' Slope= 0.0100 '/'
Inlet Invert= 700.15', Outlet Invert= 697.26'

‡

Reach 35R: MCVI/XI Ditch



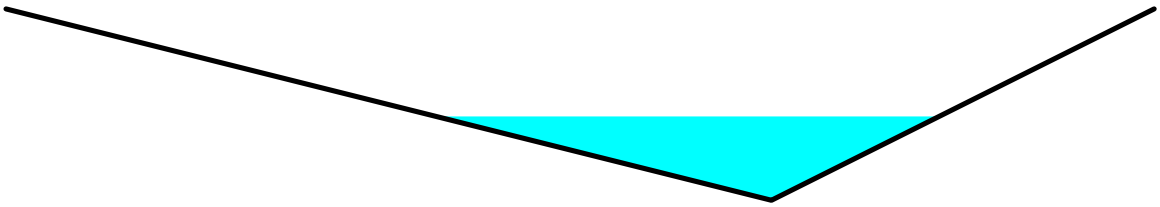
Summary for Reach 36R: DB-43

Inflow Area = 3.015 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 7.80 cfs @ 12.21 hrs, Volume= 0.585 af
Outflow = 7.64 cfs @ 12.27 hrs, Volume= 0.585 af, Atten= 2%, Lag= 4.0 min

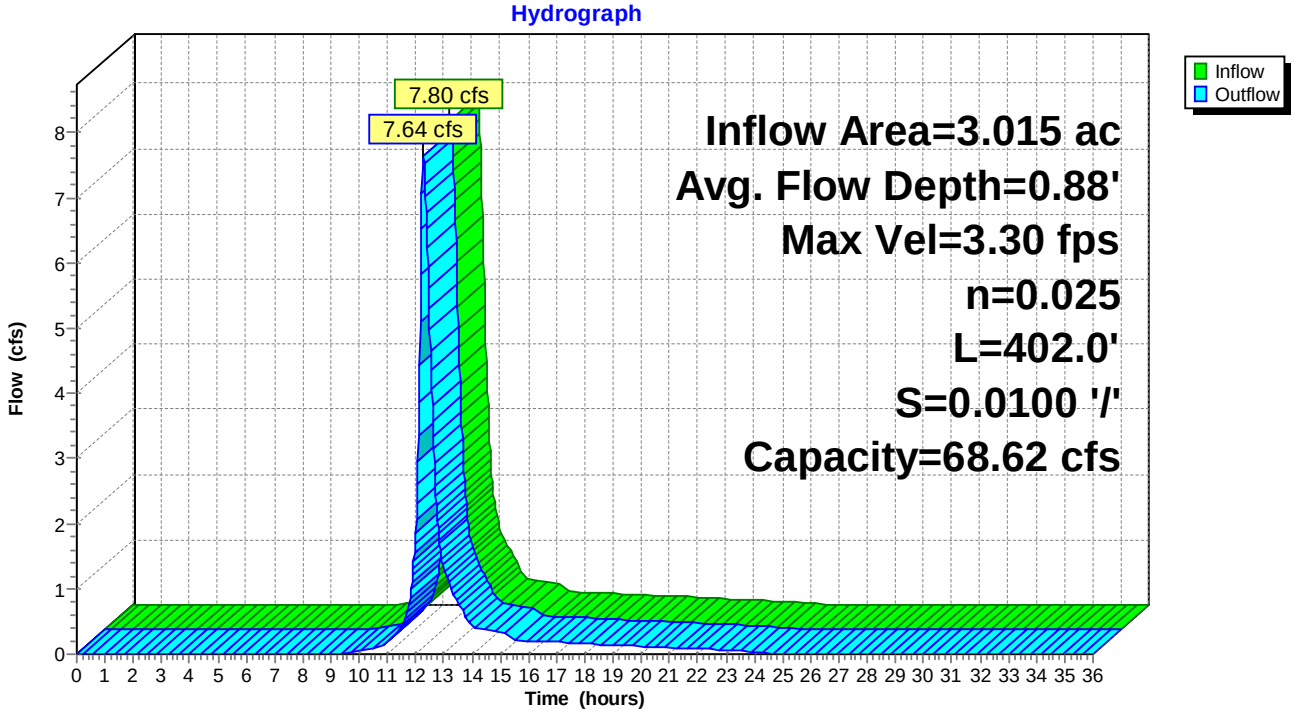
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.30 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 1.19 fps, Avg. Travel Time= 5.6 min

Peak Storage= 931 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.88' , Surface Width= 5.27'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.62 cfs

0.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 402.0' Slope= 0.0100 '/'
Inlet Invert= 712.02', Outlet Invert= 708.00'



Reach 36R: DB-43



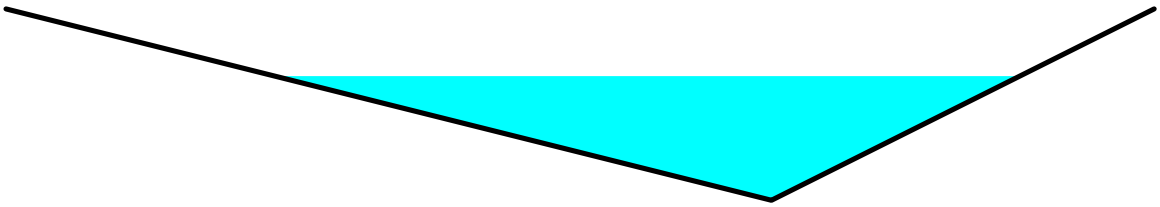
Summary for Reach 38R: DB-34 -1%

Inflow Area = 7.357 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 32.56 cfs @ 12.12 hrs, Volume= 1.427 af
Outflow = 21.45 cfs @ 12.34 hrs, Volume= 1.427 af, Atten= 34%, Lag= 12.8 min

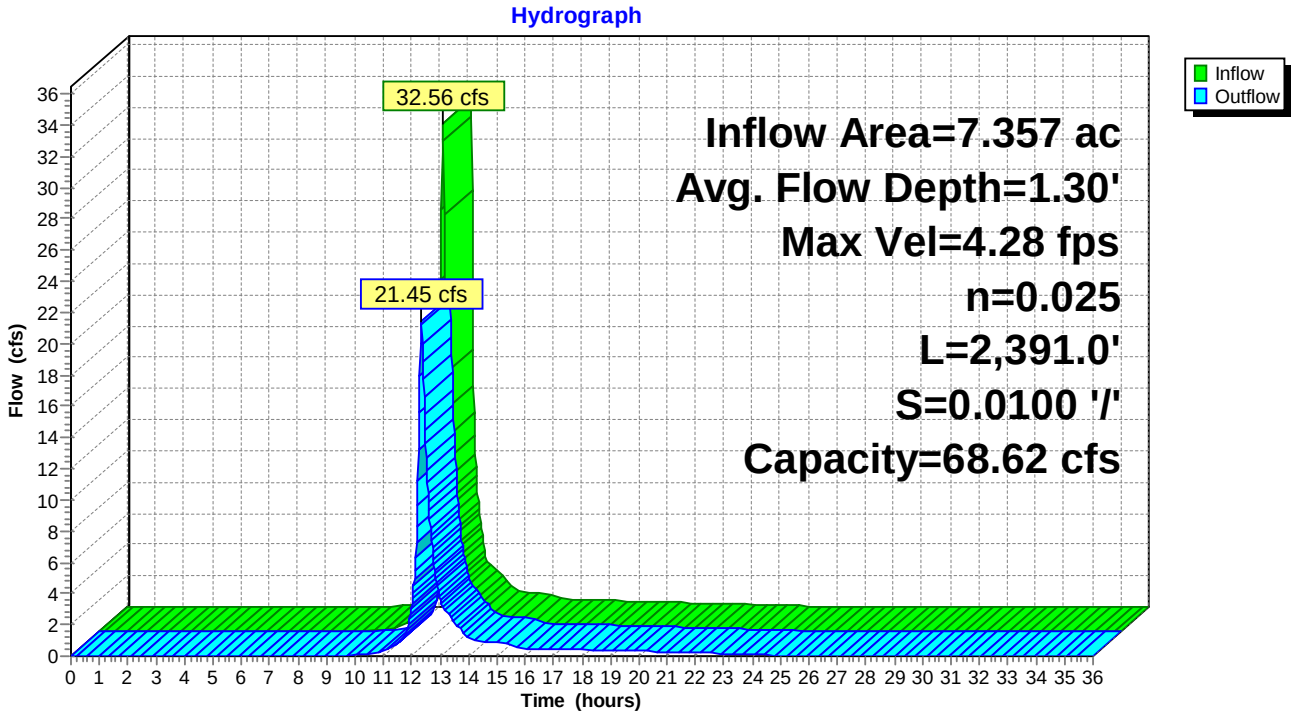
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.28 fps, Min. Travel Time= 9.3 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 36.2 min

Peak Storage= 12,033 cf @ 12.18 hrs
Average Depth at Peak Storage= 1.30' , Surface Width= 7.77'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.62 cfs

0.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 2,391.0' Slope= 0.0100 '/'
Inlet Invert= 745.91', Outlet Invert= 722.00'



Reach 38R: DB-34 -1%



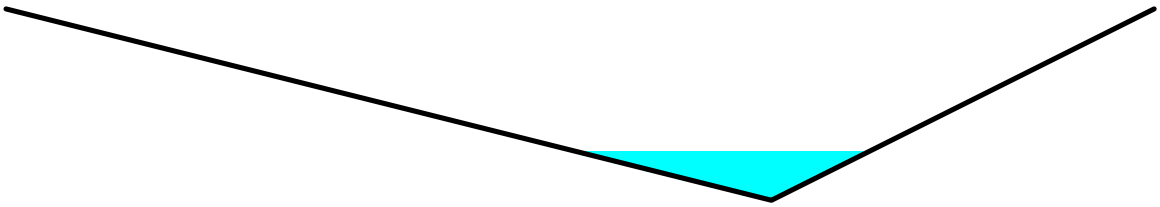
Summary for Reach 40R: DB-44

Inflow Area = 1.558 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 4.28 cfs @ 12.27 hrs, Volume= 0.302 af
Outflow = 4.21 cfs @ 12.33 hrs, Volume= 0.302 af, Atten= 2%, Lag= 3.4 min

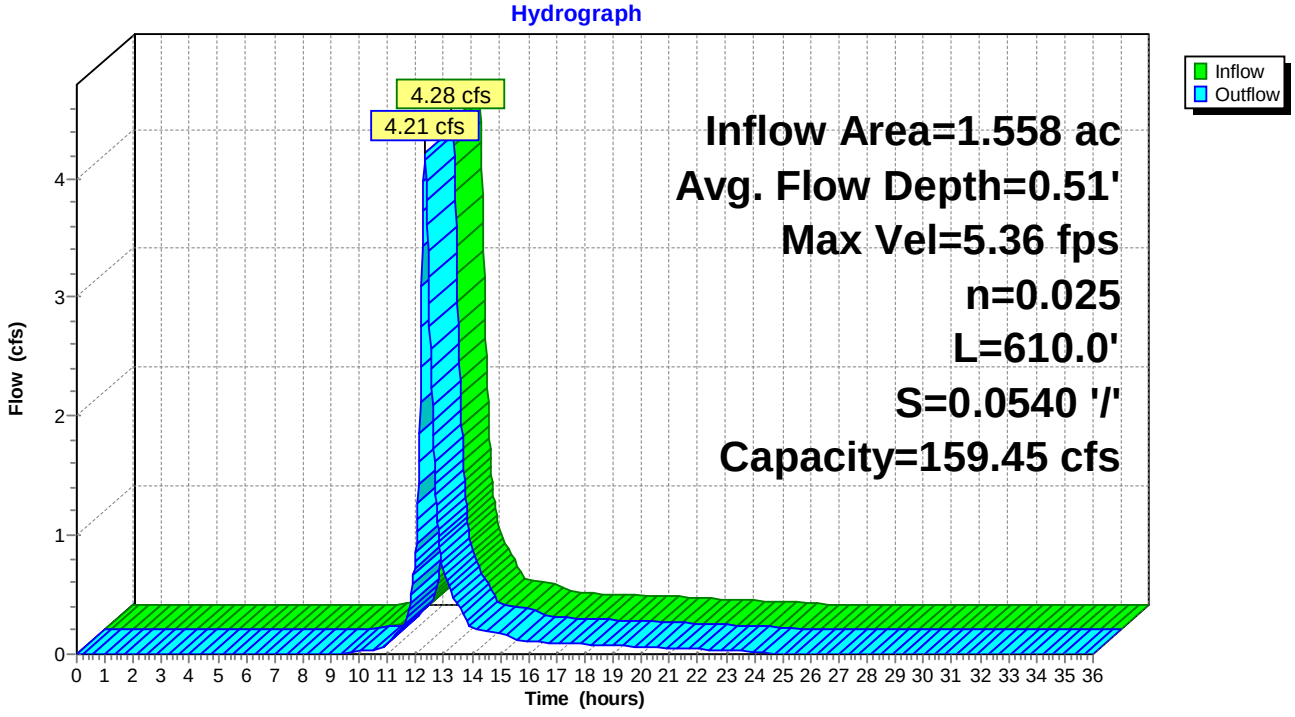
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 5.36 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 2.02 fps, Avg. Travel Time= 5.0 min

Peak Storage= 480 cf @ 12.30 hrs
Average Depth at Peak Storage= 0.51' , Surface Width= 3.07'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 159.45 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 610.0' Slope= 0.0540 '/'
Inlet Invert= 762.04', Outlet Invert= 729.10'



Reach 40R: DB-44



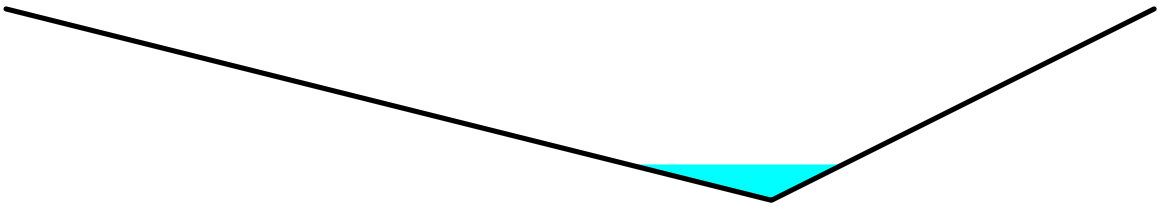
Summary for Reach 41R: DB-45

Inflow Area = 0.206 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 0.82 cfs @ 12.15 hrs, Volume= 0.040 af
Outflow = 0.80 cfs @ 12.18 hrs, Volume= 0.040 af, Atten= 2%, Lag= 1.9 min

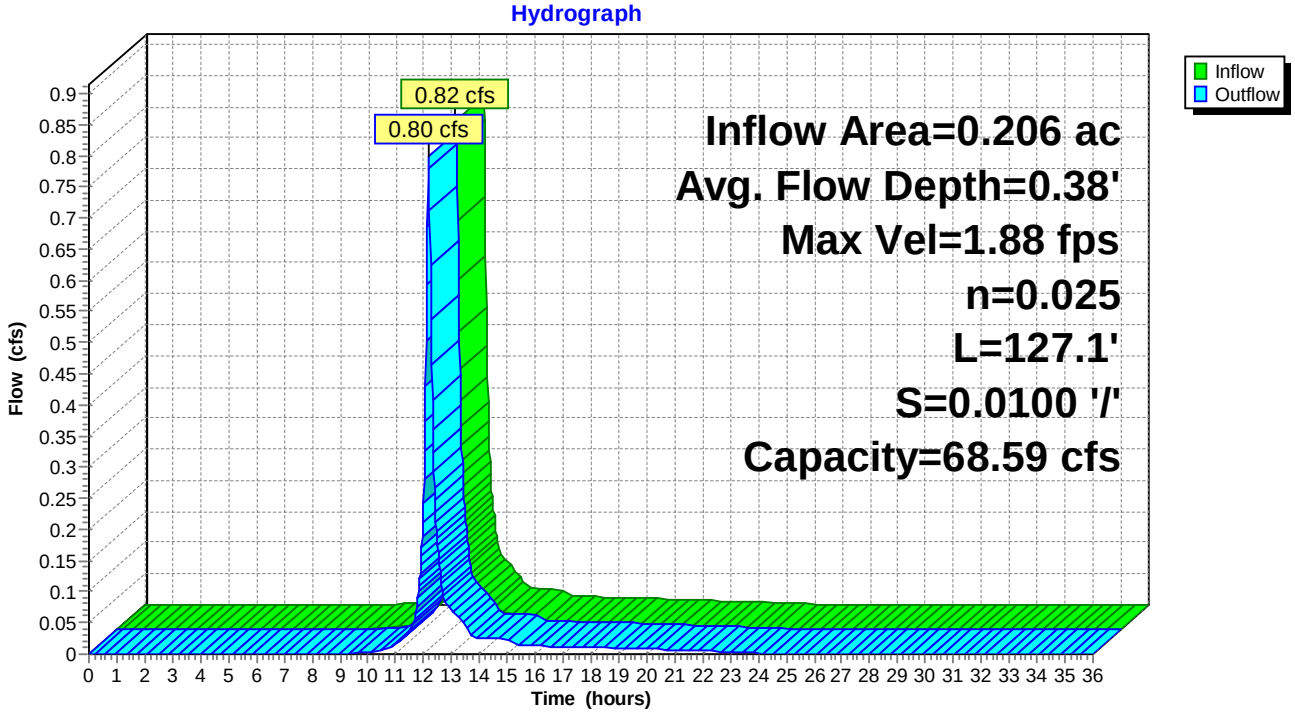
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 1.88 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.67 fps, Avg. Travel Time= 3.2 min

Peak Storage= 54 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.38' , Surface Width= 2.26'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.59 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 127.1' Slope= 0.0100 '/'
Inlet Invert= 707.69', Outlet Invert= 706.42'



Reach 41R: DB-45



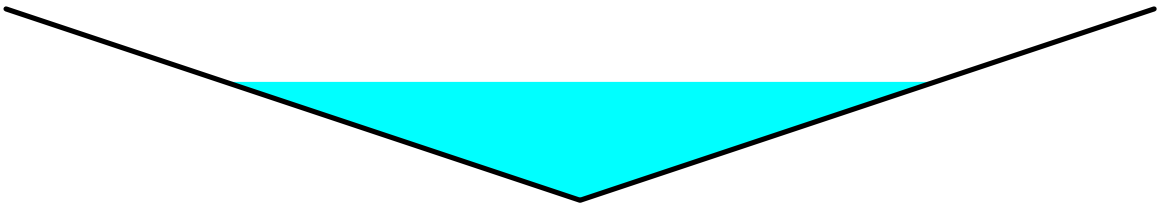
Summary for Reach 44R: E-MCI Ditch

Inflow Area = 17.668 ac, 0.00% Impervious, Inflow Depth = 2.00" for 25-yr, 24-hr event
Inflow = 36.31 cfs @ 12.33 hrs, Volume= 2.945 af
Outflow = 36.16 cfs @ 12.36 hrs, Volume= 2.945 af, Atten= 0%, Lag= 2.2 min

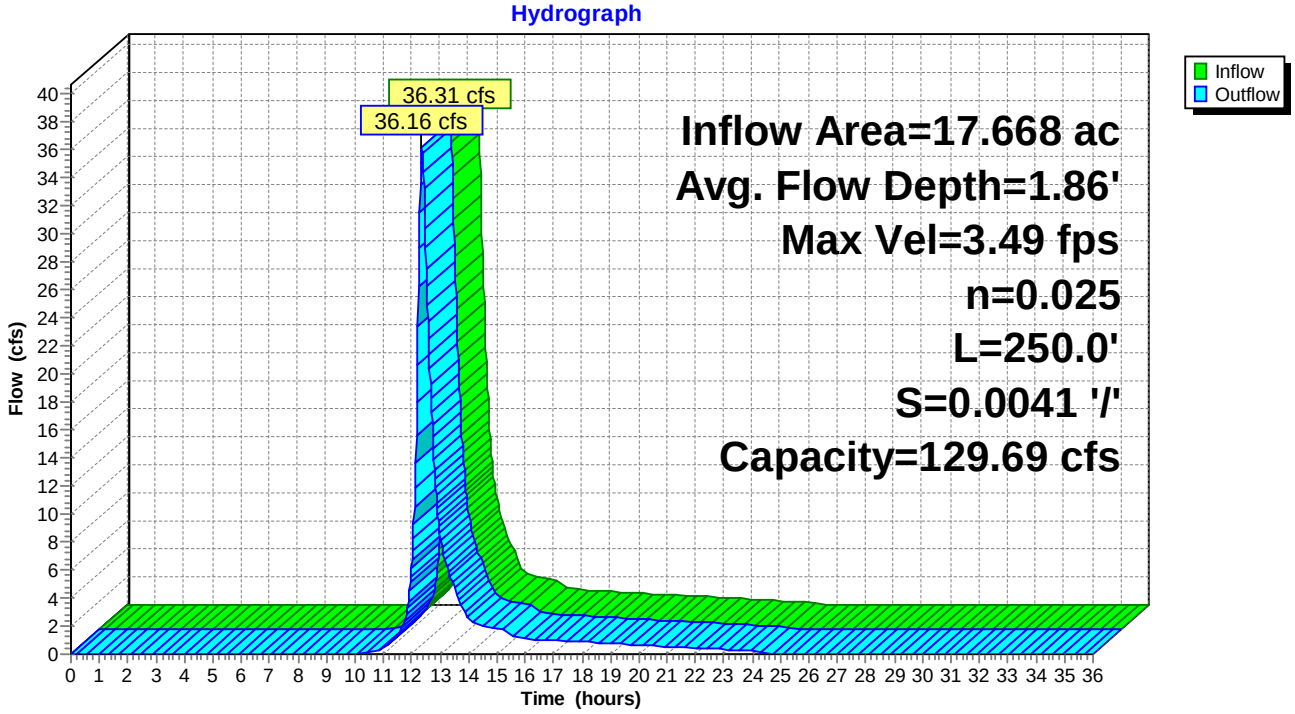
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.49 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 1.30 fps, Avg. Travel Time= 3.2 min

Peak Storage= 2,590 cf @ 12.34 hrs
Average Depth at Peak Storage= 1.86' , Surface Width= 11.15'
Bank-Full Depth= 3.00' Flow Area= 27.0 sf, Capacity= 129.69 cfs

0.00' x 3.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 18.00'
Length= 250.0' Slope= 0.0041 '/'
Inlet Invert= 702.00', Outlet Invert= 700.98'



Reach 44R: E-MCI Ditch



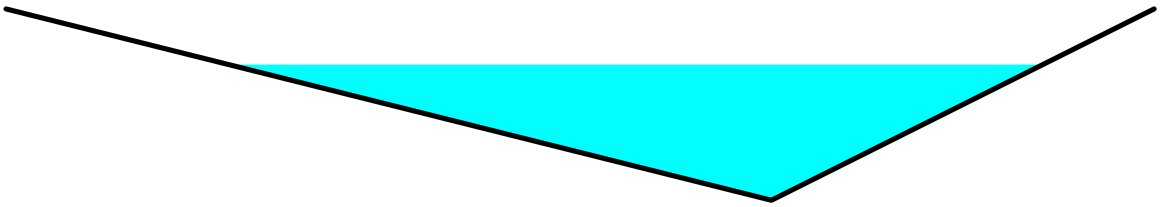
Summary for Reach 49R: DB-36

Inflow Area = 18.696 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 75.20 cfs @ 12.17 hrs, Volume= 3.626 af
Outflow = 69.89 cfs @ 12.24 hrs, Volume= 3.626 af, Atten= 7%, Lag= 4.2 min

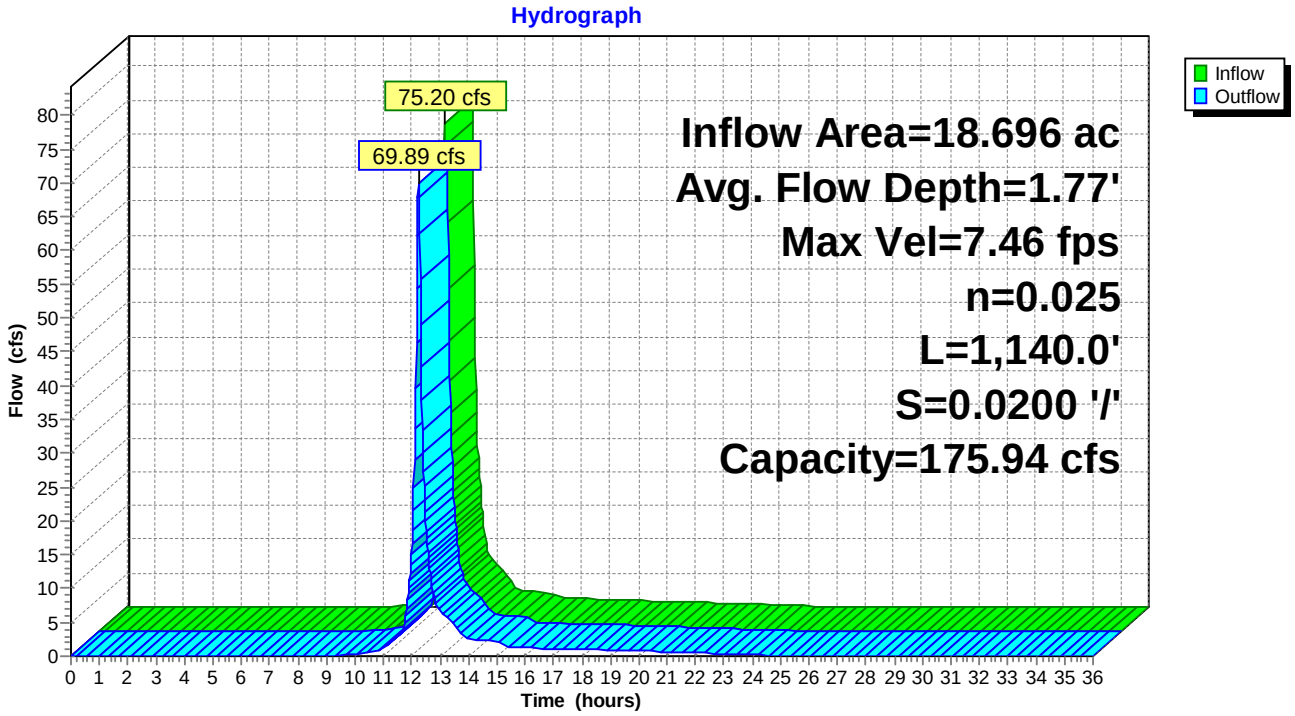
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 7.46 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 2.27 fps, Avg. Travel Time= 8.4 min

Peak Storage= 10,721 cf @ 12.20 hrs
Average Depth at Peak Storage= 1.77' , Surface Width= 10.62'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 175.94 cfs

0.00' x 2.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 2.0 '/' Top Width= 15.00'
Length= 1,140.0' Slope= 0.0200 '/'
Inlet Invert= 780.00', Outlet Invert= 757.20'



Reach 49R: DB-36



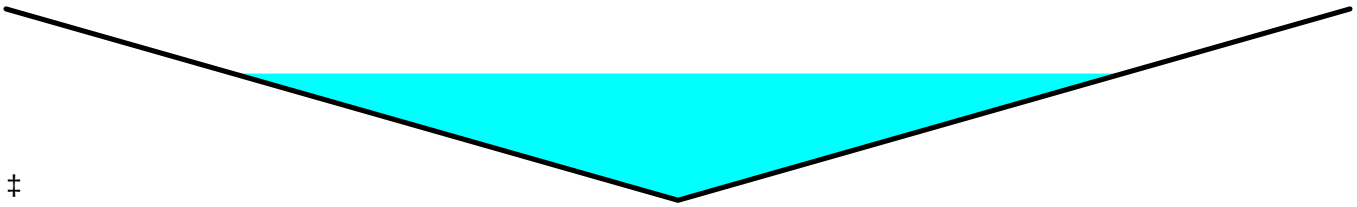
Summary for Reach 54R: MCVI-S Ditch

Inflow Area = 14.538 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 61.13 cfs @ 12.16 hrs, Volume= 2.819 af
Outflow = 59.88 cfs @ 12.18 hrs, Volume= 2.819 af, Atten= 2%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 8.62 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 2.82 fps, Avg. Travel Time= 2.2 min

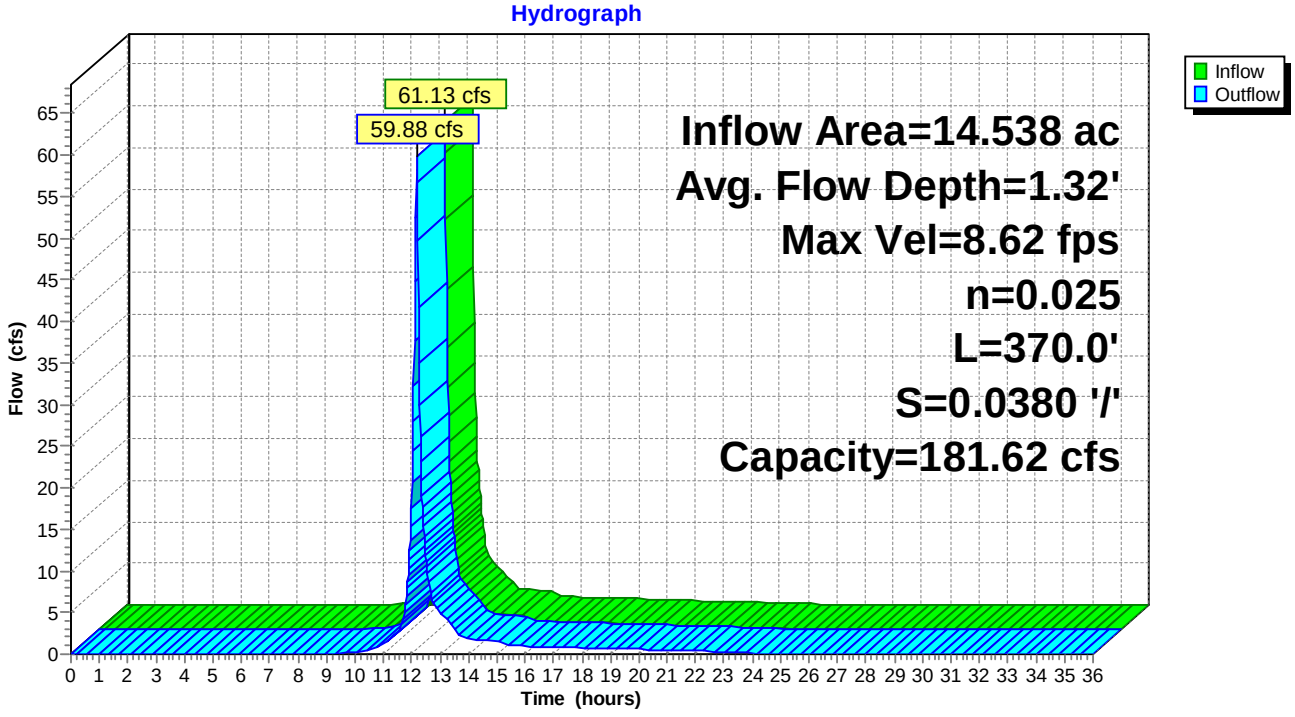
Peak Storage= 2,595 cf @ 12.17 hrs
Average Depth at Peak Storage= 1.32' , Surface Width= 10.59'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 181.62 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 370.0' Slope= 0.0380 '/'
Inlet Invert= 794.05', Outlet Invert= 780.00'



‡

Reach 54R: MCVI-S Ditch



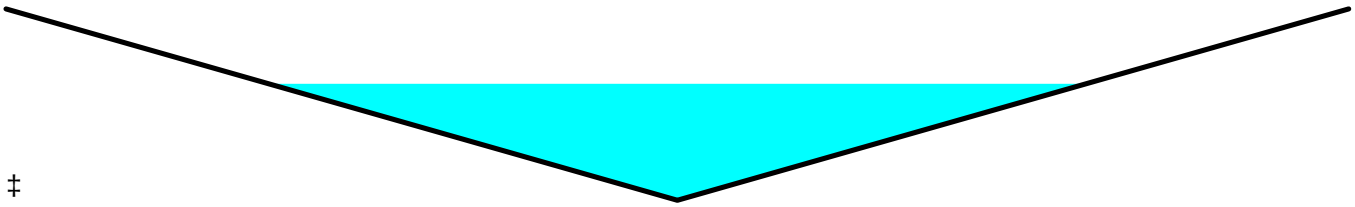
Summary for Reach 55R: MCVI-N Ditch

Inflow Area = 14.538 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 62.51 cfs @ 12.13 hrs, Volume= 2.819 af
Outflow = 61.13 cfs @ 12.16 hrs, Volume= 2.819 af, Atten= 2%, Lag= 1.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.42 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.45 fps, Avg. Travel Time= 3.0 min

Peak Storage= 3,685 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.61' , Surface Width= 45.61'
Bank-Full Depth= 1.00' Flow Area= 37.4 sf, Capacity= 230.14 cfs

0.00' x 1.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 37.4 '/' Top Width= 74.80'
Length= 265.0' Slope= 0.0270 '/'
Inlet Invert= 801.21', Outlet Invert= 794.05'



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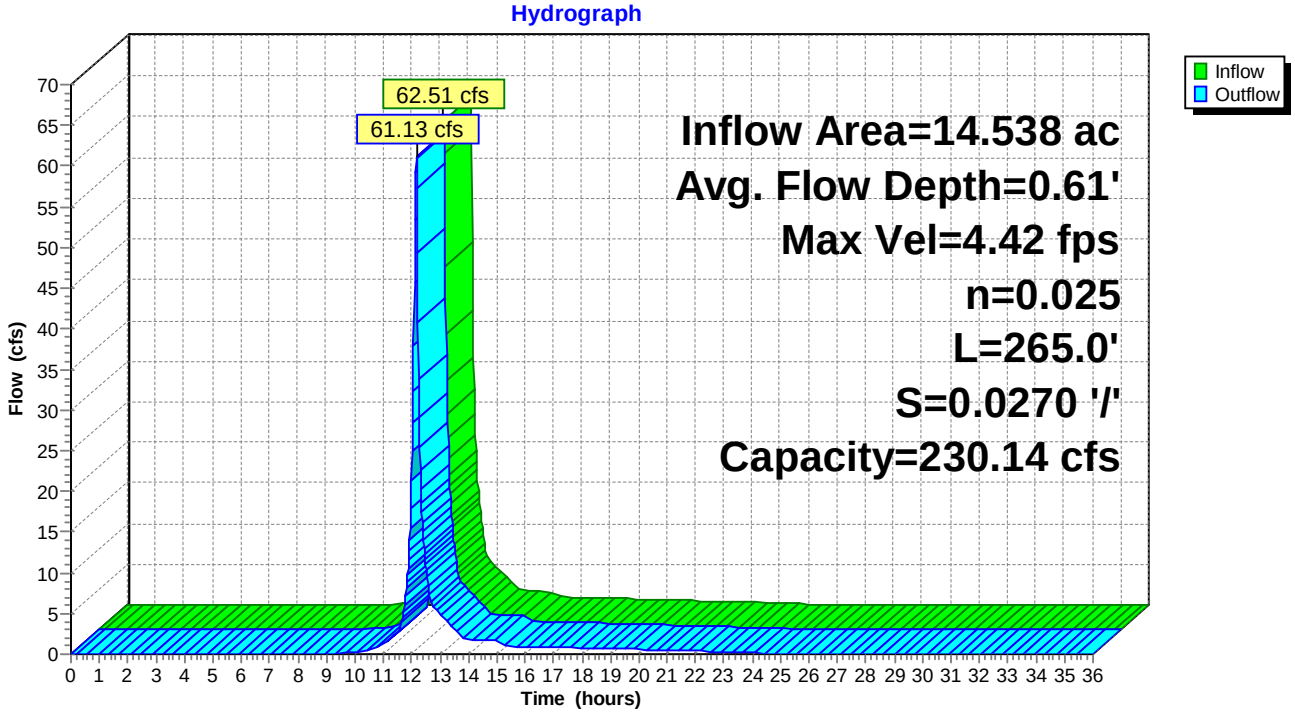
Reach 55R: MCVI-N Ditch



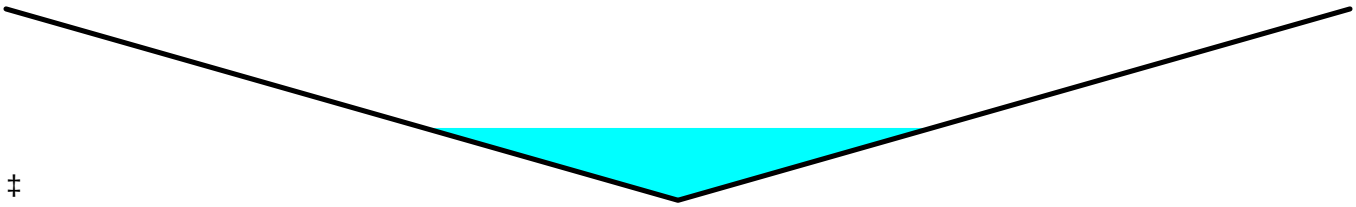
Summary for Reach 57R: DS-5

Inflow Area = 7.709 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 36.23 cfs @ 12.11 hrs, Volume= 1.495 af
Outflow = 35.30 cfs @ 12.12 hrs, Volume= 1.495 af, Atten= 3%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 10.94 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.70 fps, Avg. Travel Time= 1.4 min

Peak Storage= 996 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.76' , Surface Width= 8.64'
Bank-Full Depth= 2.00' Flow Area= 22.8 sf, Capacity= 476.49 cfs

0.00' x 2.00' deep channel, n= 0.029
Side Slope Z-value= 5.7 '/' Top Width= 22.80'
Length= 304.0' Slope= 0.1697 '/'
Inlet Invert= 854.00', Outlet Invert= 802.40'



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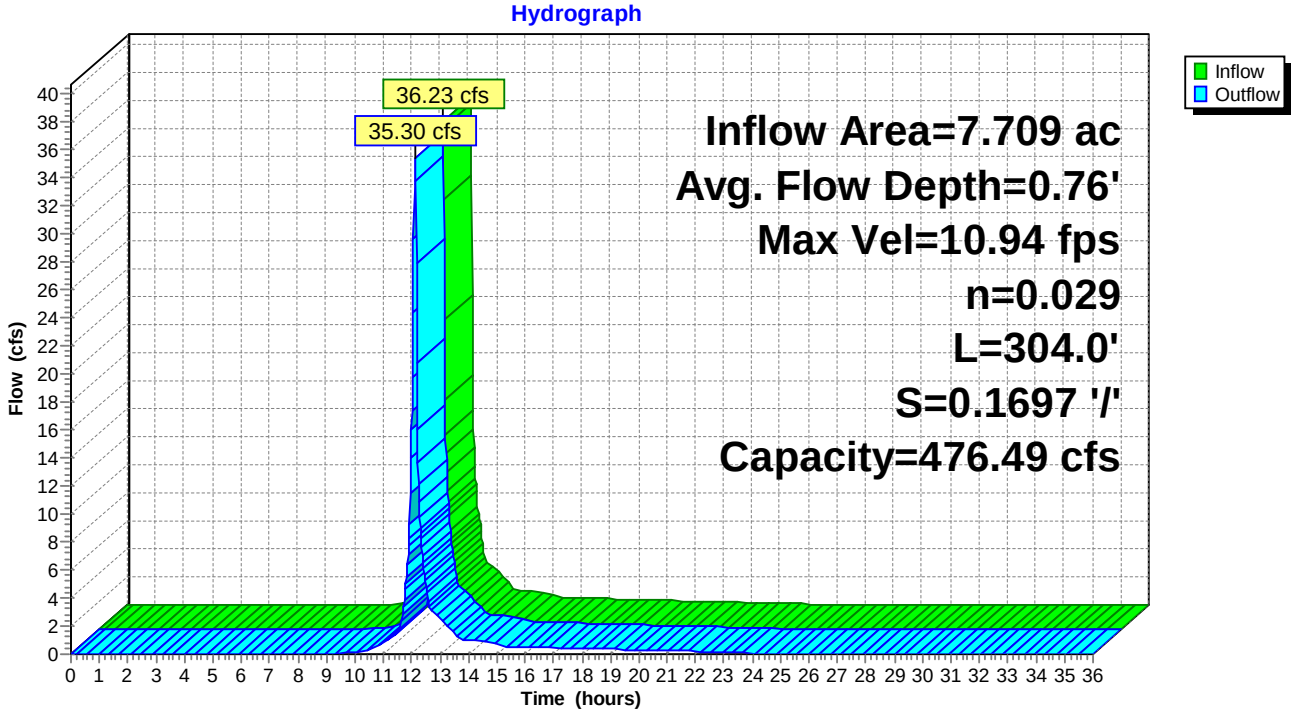
Reach 57R: DS-5



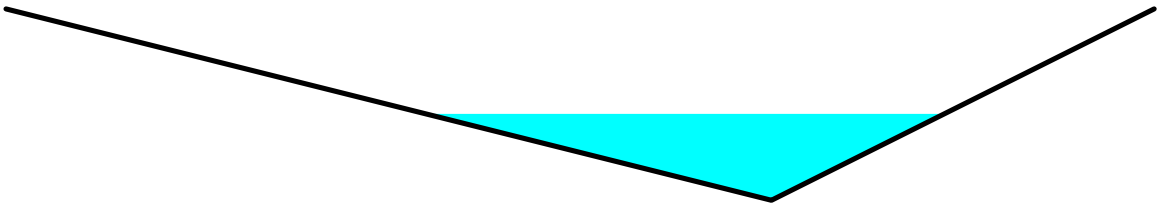
Summary for Reach 59R: DB-42

Inflow Area = 1.986 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 9.22 cfs @ 12.11 hrs, Volume= 0.385 af
Outflow = 8.15 cfs @ 12.18 hrs, Volume= 0.385 af, Atten= 12%, Lag= 4.2 min

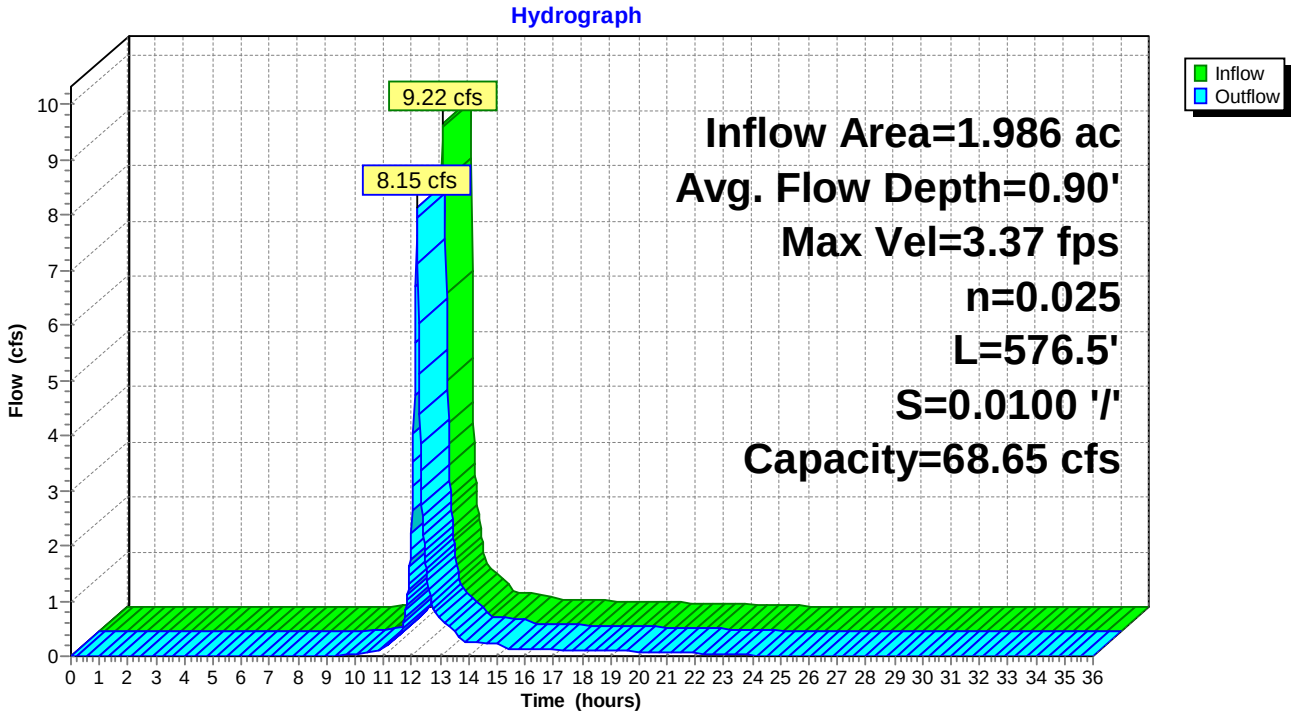
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.37 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 9.0 min

Peak Storage= 1,412 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.90' , Surface Width= 5.42'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.65 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 576.5' Slope= 0.0100 '/'
Inlet Invert= 718.00', Outlet Invert= 712.23'



Reach 59R: DB-42



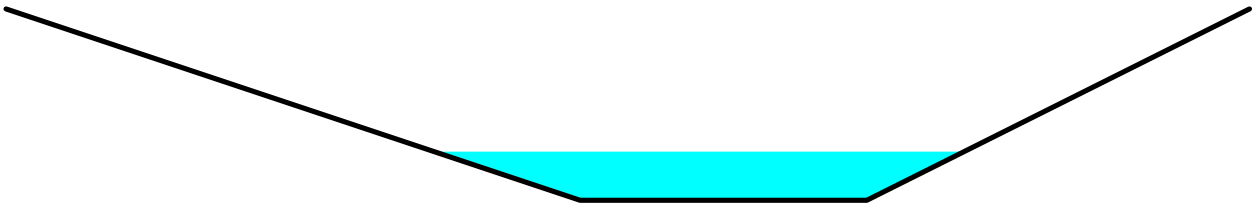
Summary for Reach 60R: W-MC X Ditch

Inflow Area = 13.776 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 22.31 cfs @ 12.28 hrs, Volume= 2.672 af
Outflow = 21.03 cfs @ 12.42 hrs, Volume= 2.672 af, Atten= 6%, Lag= 8.5 min

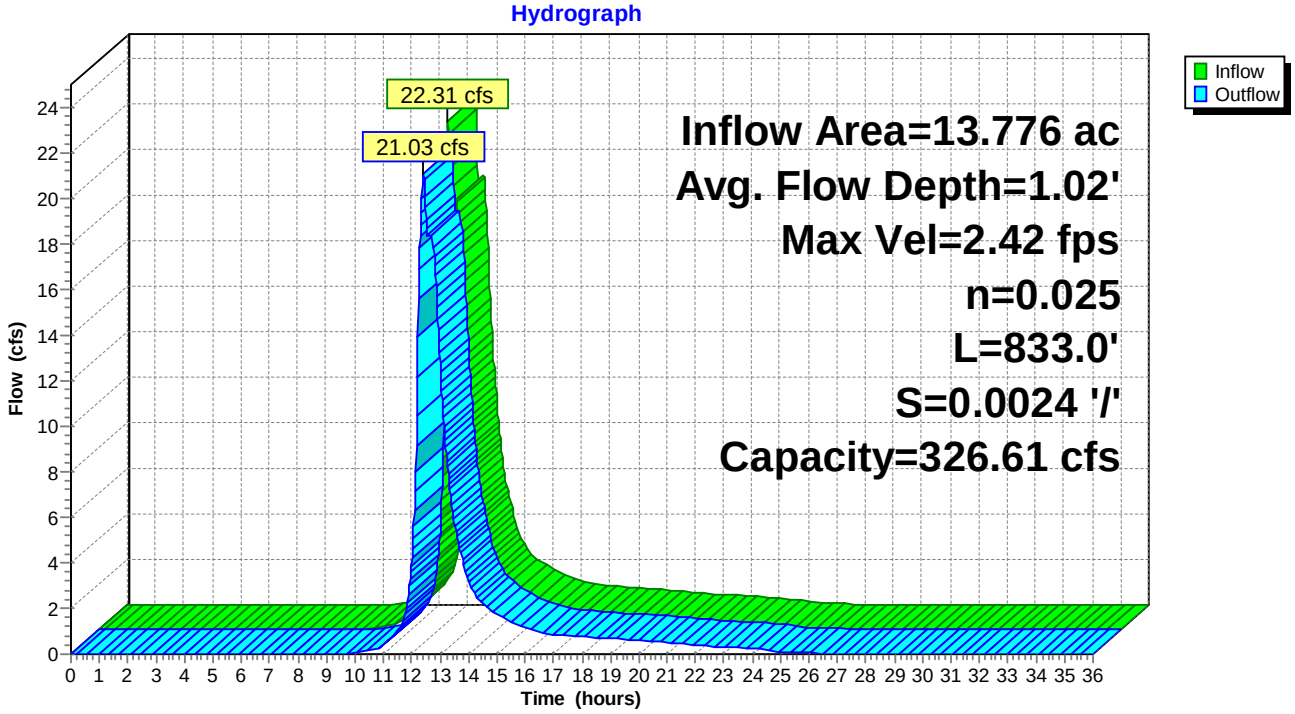
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.42 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 0.65 fps, Avg. Travel Time= 21.5 min

Peak Storage= 7,250 cf @ 12.32 hrs
Average Depth at Peak Storage= 1.02' , Surface Width= 11.09'
Bank-Full Depth= 4.00' Flow Area= 64.0 sf, Capacity= 326.61 cfs

6.00' x 4.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 2.0 '/' Top Width= 26.00'
Length= 833.0' Slope= 0.0024 '/'
Inlet Invert= 691.00', Outlet Invert= 689.00'



Reach 60R: W-MC X Ditch



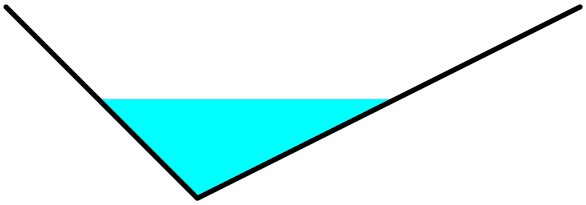
Summary for Reach 64R: S MC X Ditch

Inflow Area = 10.530 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 23.26 cfs @ 12.13 hrs, Volume= 2.042 af
Outflow = 17.73 cfs @ 12.29 hrs, Volume= 2.042 af, Atten= 24%, Lag= 9.8 min

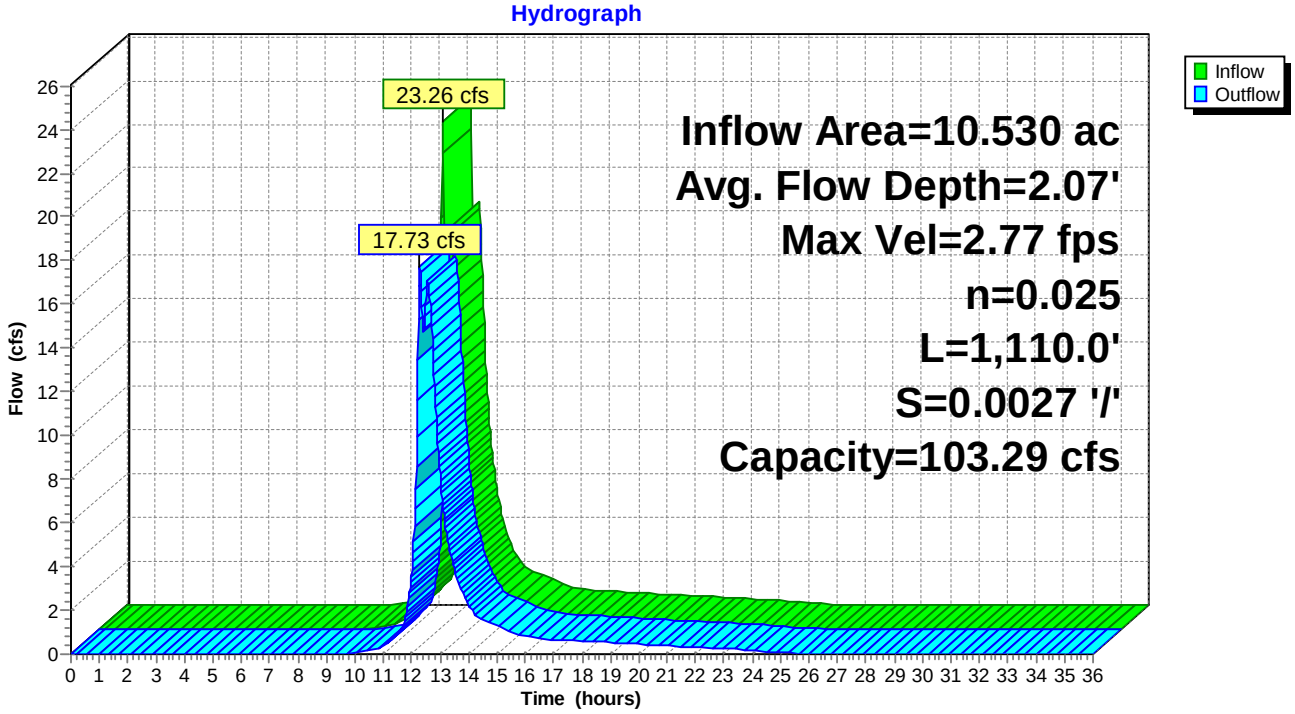
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.77 fps, Min. Travel Time= 6.7 min
Avg. Velocity = 0.84 fps, Avg. Travel Time= 22.1 min

Peak Storage= 7,133 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.07' , Surface Width= 6.21'
Bank-Full Depth= 4.00' Flow Area= 24.0 sf, Capacity= 103.29 cfs

0.00' x 4.00' deep channel, n= 0.025
Side Slope Z-value= 1.0 2.0 '/' Top Width= 12.00'
Length= 1,110.0' Slope= 0.0027 '/'
Inlet Invert= 694.00', Outlet Invert= 691.00'



Reach 64R: S MC X Ditch



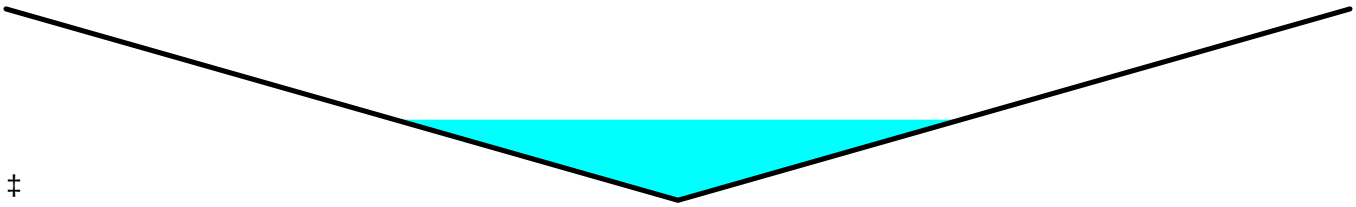
Summary for Reach 66R: E-MC X Ditch

Inflow Area = 5.820 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 26.56 cfs @ 12.12 hrs, Volume= 1.129 af
Outflow = 14.40 cfs @ 12.41 hrs, Volume= 1.129 af, Atten= 46%, Lag= 17.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 1.81 fps, Min. Travel Time= 13.8 min
Avg. Velocity = 0.50 fps, Avg. Travel Time= 50.2 min

Peak Storage= 11,979 cf @ 12.18 hrs
Average Depth at Peak Storage= 1.26' , Surface Width= 12.64'
Bank-Full Depth= 3.00' Flow Area= 45.0 sf, Capacity= 145.10 cfs

0.00' x 3.00' deep channel, n= 0.030 Stream, clean & straight
Side Slope Z-value= 5.0 '/' Top Width= 30.00'
Length= 1,500.0' Slope= 0.0025 '/'
Inlet Invert= 697.80', Outlet Invert= 694.00'



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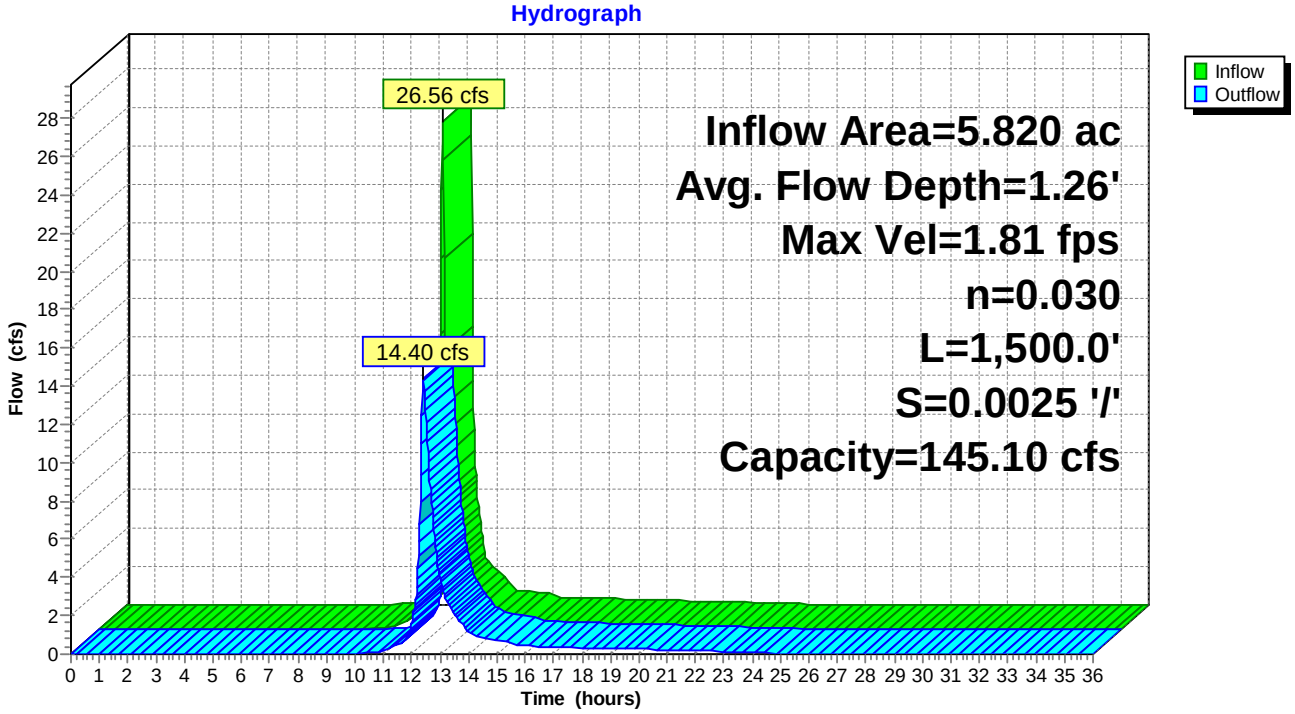
Reach 66R: E-MC X Ditch



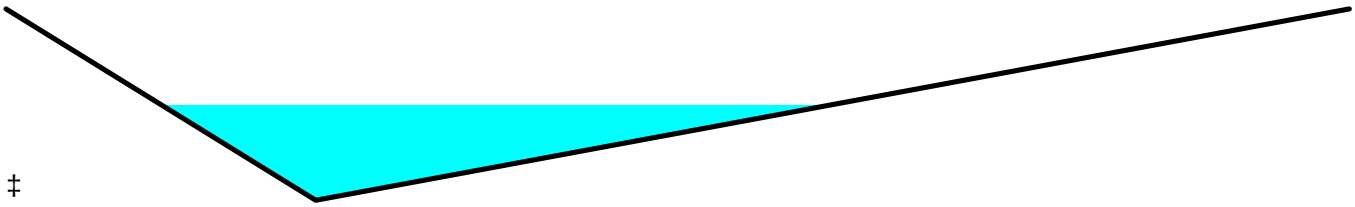
Summary for Reach 71R: DB-46

Inflow Area = 10.457 ac, 0.00% Impervious, Inflow Depth = 2.00" for 25-yr, 24-hr event
Inflow = 24.00 cfs @ 12.29 hrs, Volume= 1.743 af
Outflow = 23.88 cfs @ 12.31 hrs, Volume= 1.743 af, Atten= 0%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.70 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.40 fps, Avg. Travel Time= 2.4 min

Peak Storage= 1,294 cf @ 12.30 hrs
Average Depth at Peak Storage= 1.00' , Surface Width= 12.97'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 152.89 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 10.0 '/' Top Width= 26.00'
Length= 200.0' Slope= 0.0100 '/'
Inlet Invert= 703.00', Outlet Invert= 701.00'



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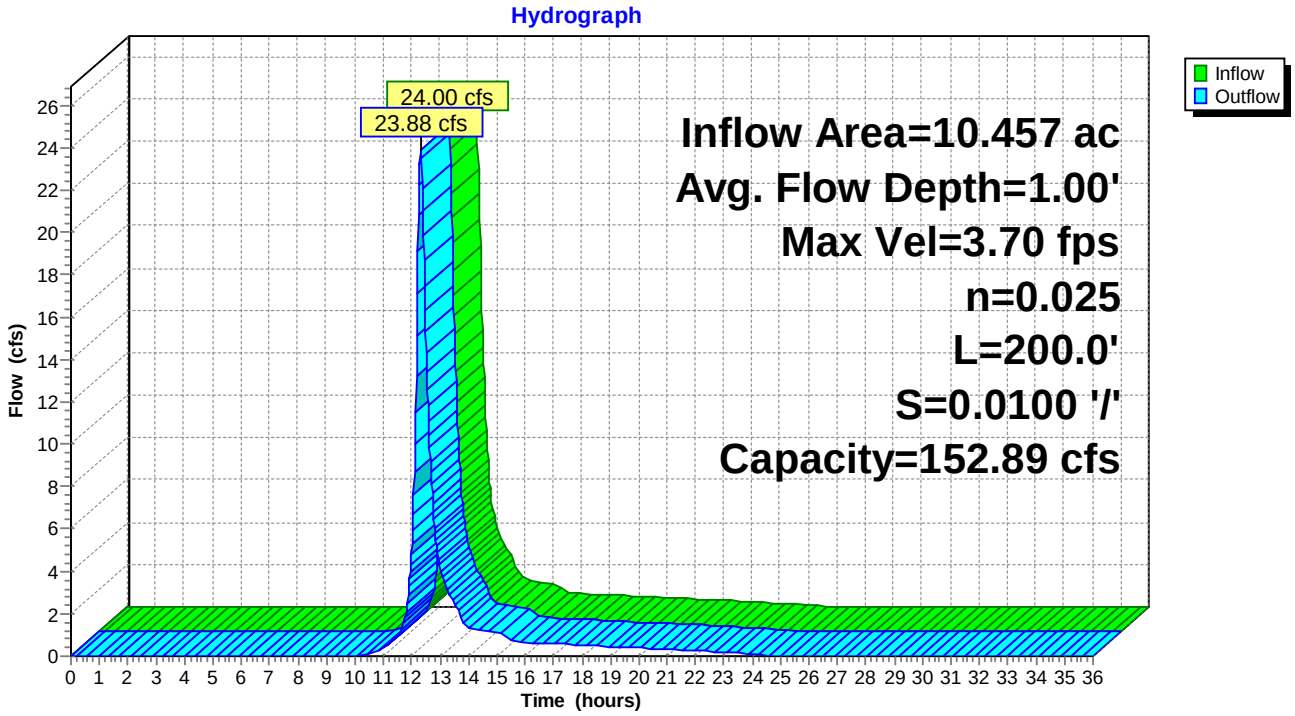
Reach 71R: DB-46



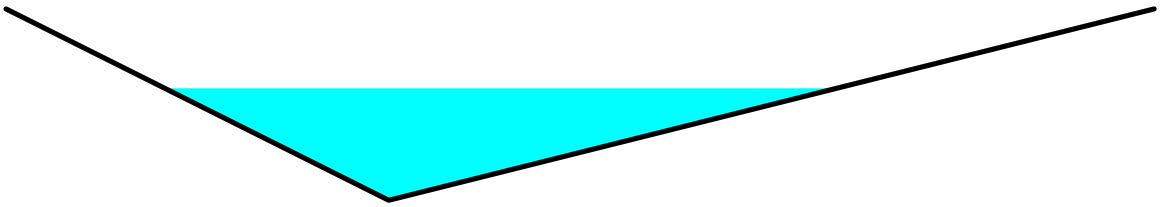
Summary for Reach 72R: DB-37

Inflow Area = 9.042 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 23.75 cfs @ 12.29 hrs, Volume= 1.753 af
Outflow = 23.29 cfs @ 12.36 hrs, Volume= 1.753 af, Atten= 2%, Lag= 4.2 min

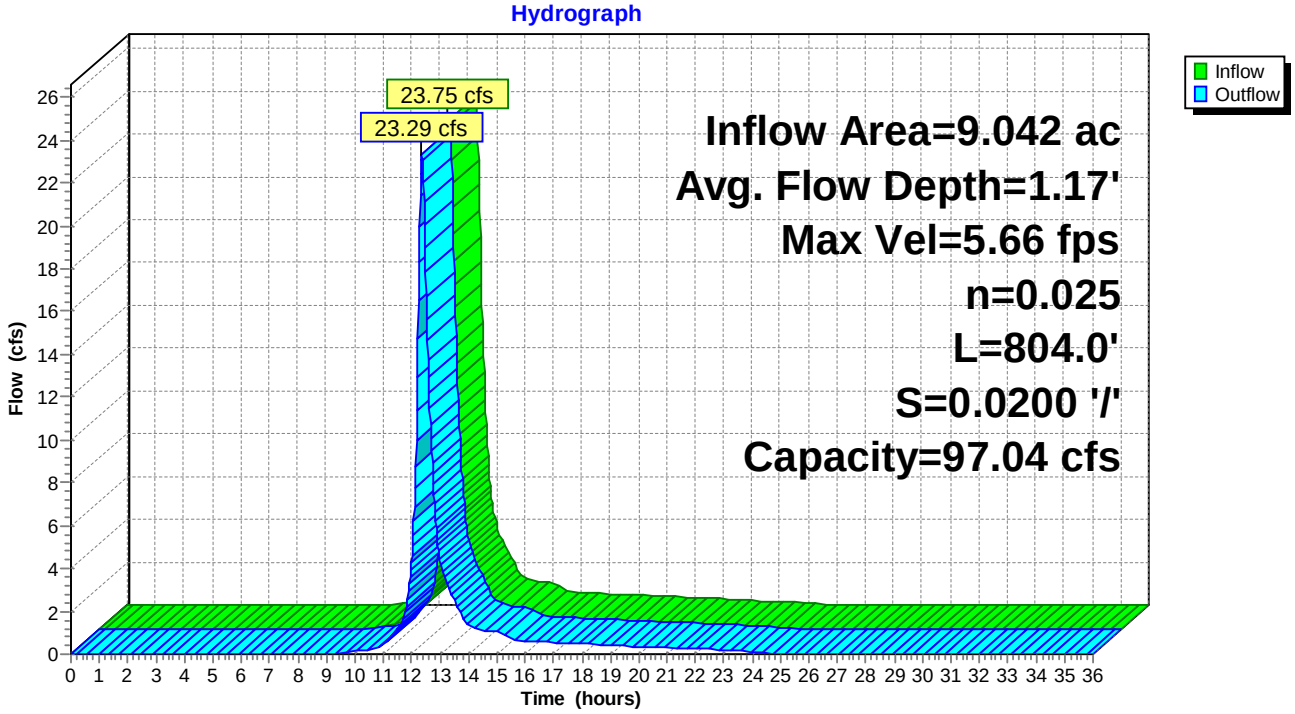
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 5.66 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.98 fps, Avg. Travel Time= 6.8 min

Peak Storage= 3,309 cf @ 12.32 hrs
Average Depth at Peak Storage= 1.17' , Surface Width= 7.03'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 97.04 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 4.0 '/' Top Width= 12.00'
Length= 804.0' Slope= 0.0200 '/'
Inlet Invert= 776.08', Outlet Invert= 760.00'



Reach 72R: DB-37

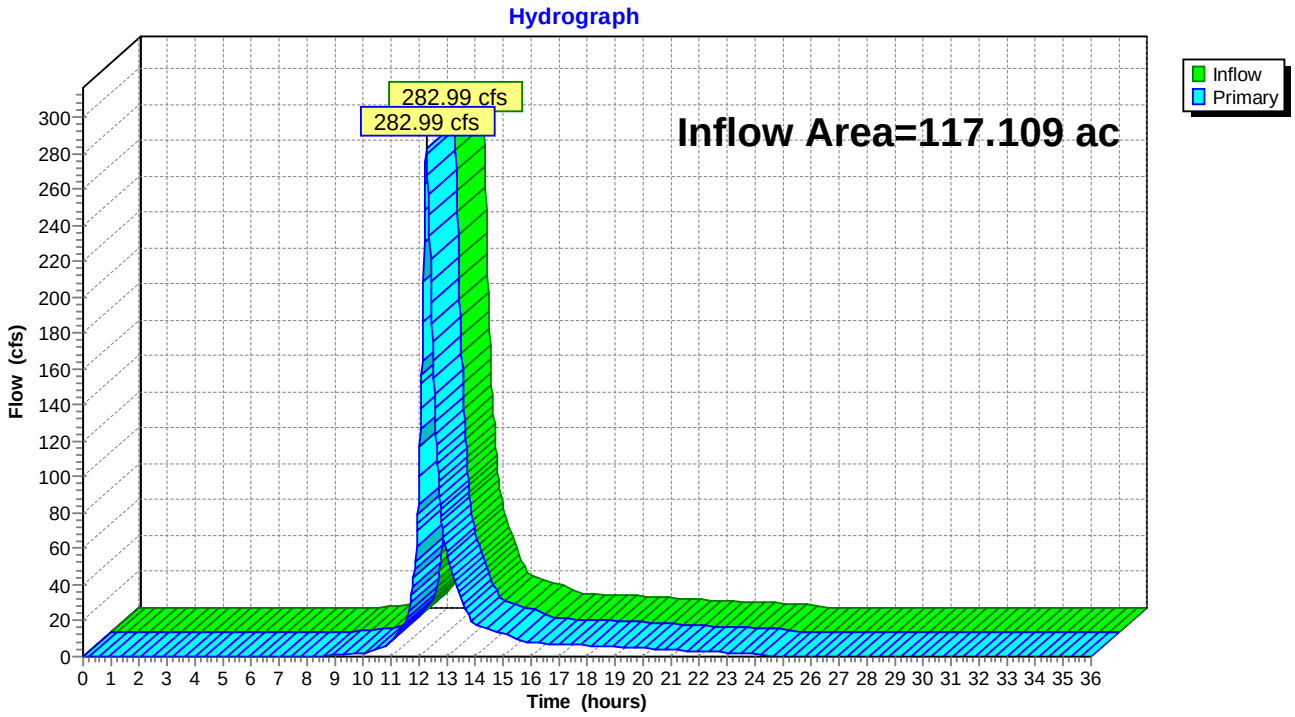


Summary for Pond 63P: SSB

Inflow Area = 117.109 ac, 8.73% Impervious, Inflow Depth = 2.39" for 25-yr, 24-hr event
Inflow = 282.99 cfs @ 12.27 hrs, Volume= 23.314 af
Primary = 282.99 cfs @ 12.27 hrs, Volume= 23.314 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

Pond 63P: SSB

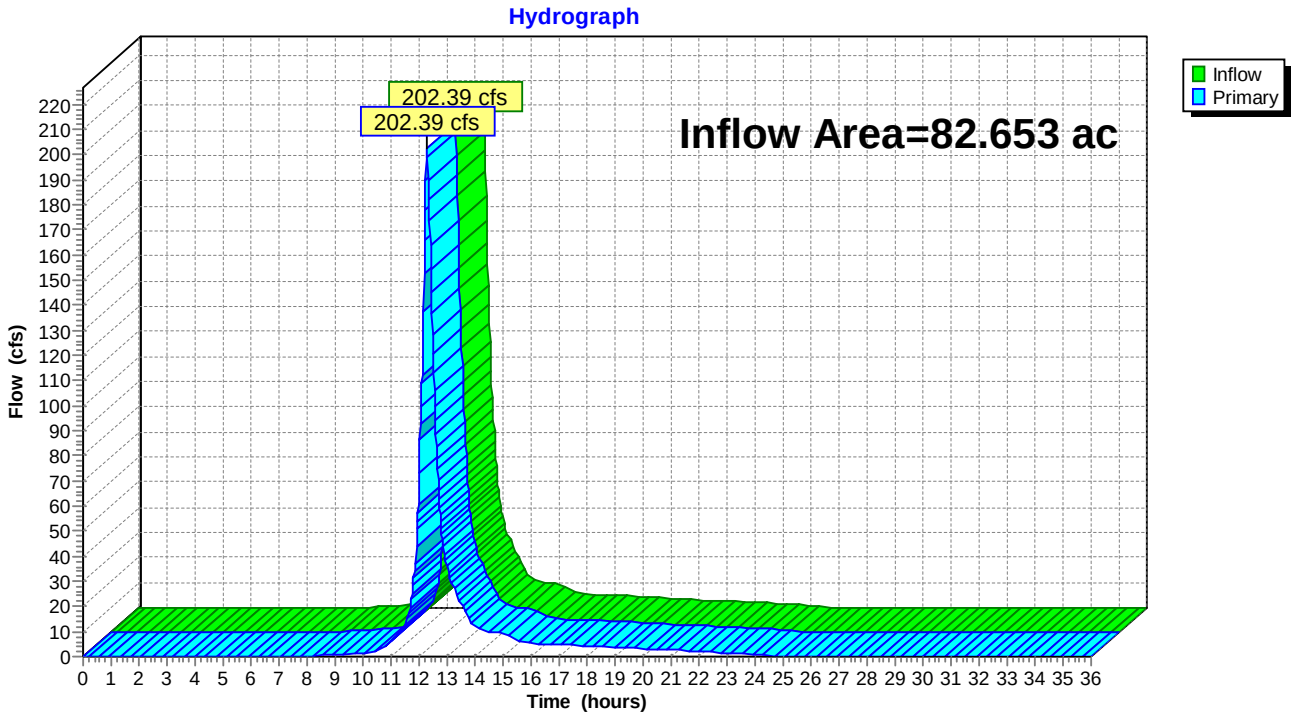


Summary for Pond 69P: Storm Sewer - See SWMM Model

Inflow Area = 82.653 ac, 6.59% Impervious, Inflow Depth = 2.35" for 25-yr, 24-hr event
Inflow = 202.39 cfs @ 12.29 hrs, Volume= 16.177 af
Primary = 202.39 cfs @ 12.29 hrs, Volume= 16.177 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

Pond 69P: Storm Sewer - See SWMM Model



Summary for Pond 70P: SSB Inlet Culvert

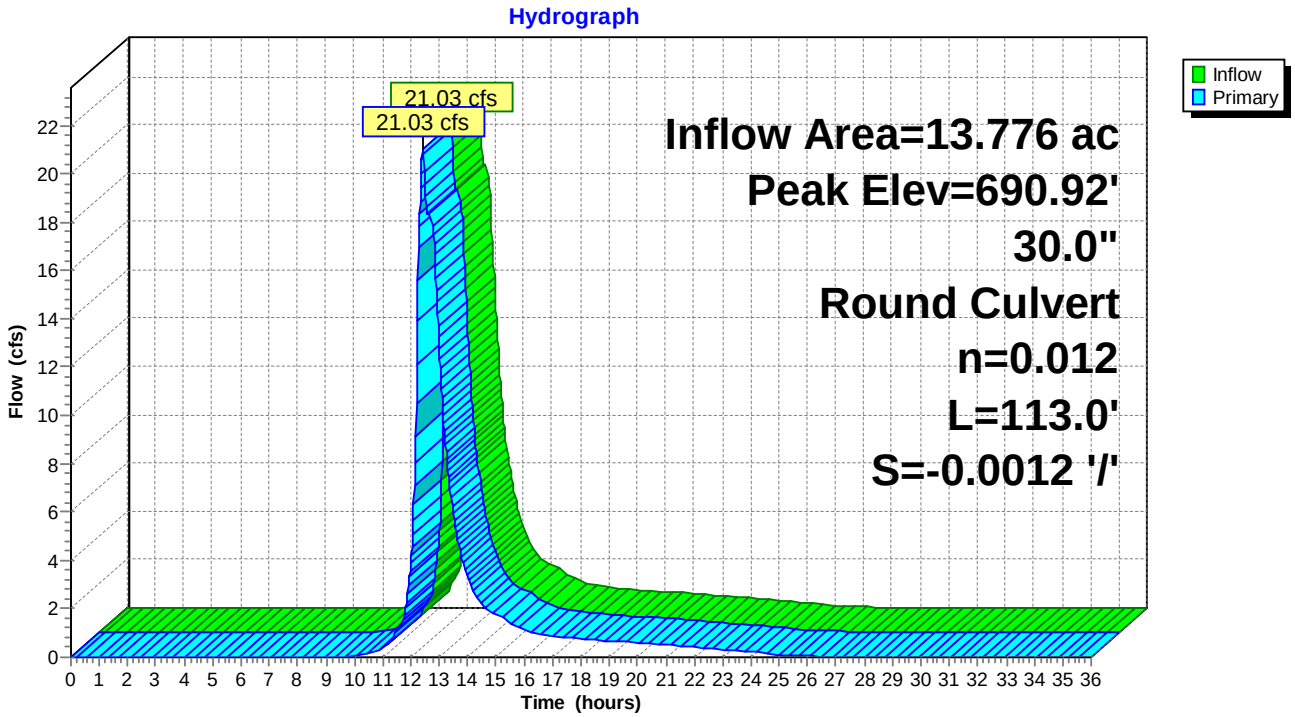
Inflow Area = 13.776 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 21.03 cfs @ 12.42 hrs, Volume= 2.672 af
Outflow = 21.03 cfs @ 12.42 hrs, Volume= 2.672 af, Atten= 0%, Lag= 0.0 min
Primary = 21.03 cfs @ 12.42 hrs, Volume= 2.672 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 690.92' @ 12.42 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	688.14'	**30.0" Round Culvert** L= 113.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 688.01' / 688.14' S= -0.0012 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf

Primary OutFlow Max=21.03 cfs @ 12.42 hrs HW=690.92' (Free Discharge)
1=Culvert (Barrel Controls 21.03 cfs @ 4.62 fps)

Pond 70P: SSB Inlet Culvert



Summary for Pond 71P: E-MCI Culvert

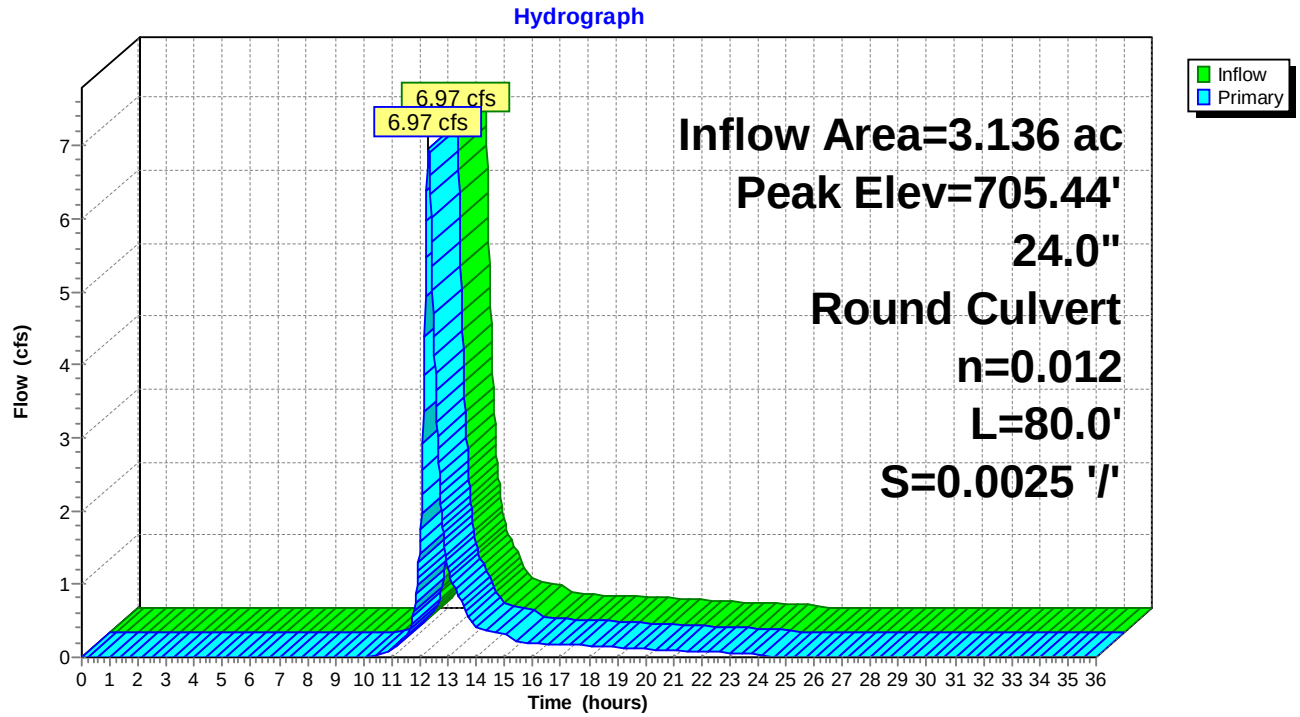
Inflow Area = 3.136 ac, 0.00% Impervious, Inflow Depth = 2.00" for 25-yr, 24-hr event
Inflow = 6.97 cfs @ 12.30 hrs, Volume= 0.523 af
Outflow = 6.97 cfs @ 12.30 hrs, Volume= 0.523 af, Atten= 0%, Lag= 0.0 min
Primary = 6.97 cfs @ 12.30 hrs, Volume= 0.523 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 705.44' @ 12.30 hrs

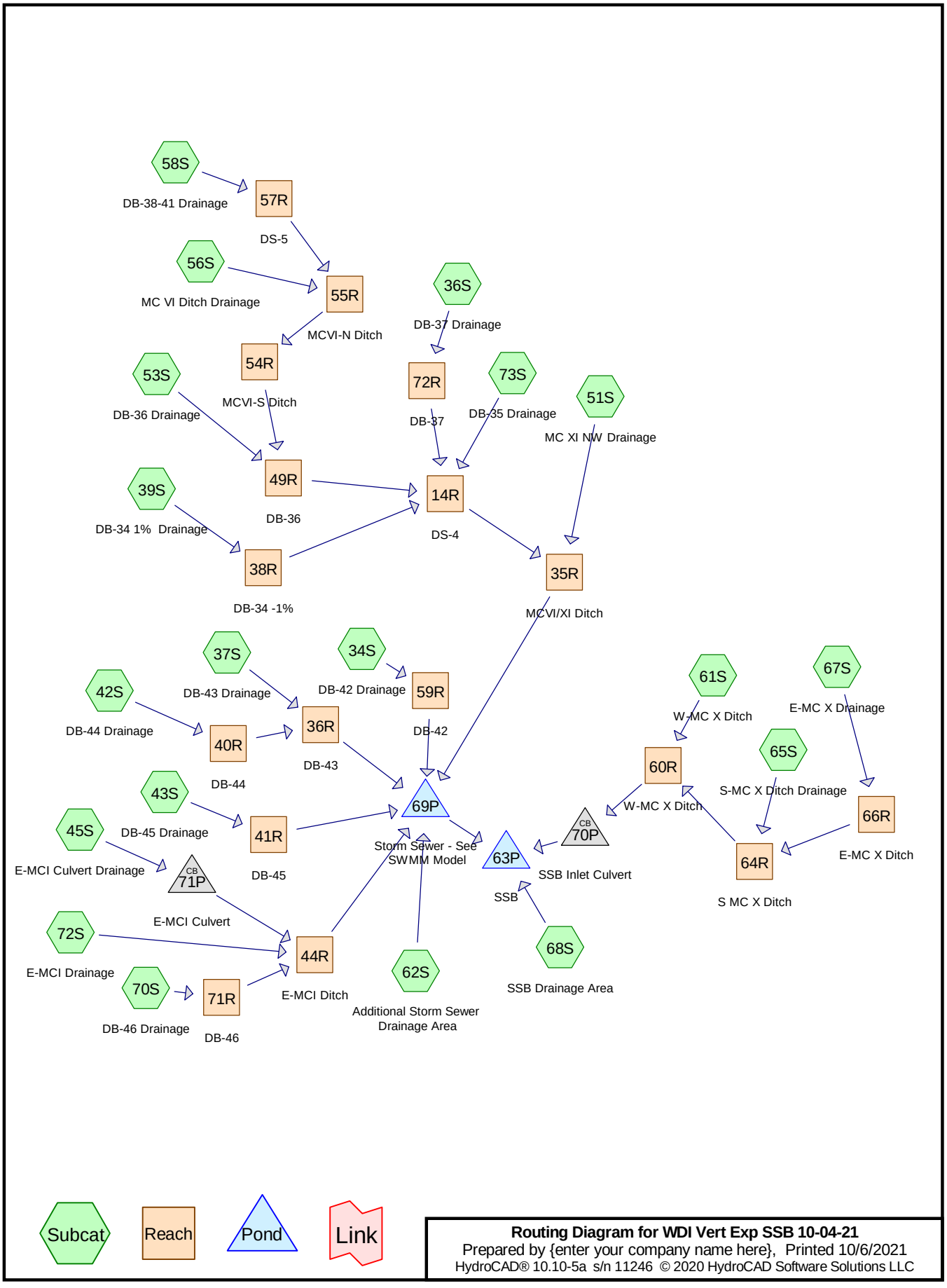
Device	Routing	Invert	Outlet Devices
#1	Primary	703.00'	**24.0" Round Culvert** L= 80.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 703.00' / 702.80' S= 0.0025 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=6.96 cfs @ 12.30 hrs HW=705.44' TW=705.10' (Fixed TW Elev= 705.10')
1=Culvert (Inlet Controls 6.96 cfs @ 2.22 fps)

Pond 71P: E-MCI Culvert



South Sedimentation Basin (SSB) HYDROCAD OUTPUT – 100-yr, 24-hr



Routing Diagram for WDI Vert Exp SSB 10-04-21

Prepared by {enter your company name here}, Printed 10/6/2021

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Time span=0.00-36.00 hrs, dt=0.02 hrs, 1801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 34S: DB-42 Drainage Runoff Area=86,500 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=476' Tc=4.1 min CN=84 Runoff=13.15 cfs 0.559 af

Subcatchment 36S: DB-37 Drainage Runoff Area=393,872 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=691' Tc=19.8 min CN=84 Runoff=34.24 cfs 2.547 af

Subcatchment 37S: DB-43 Drainage Runoff Area=63,437 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=280' Tc=10.1 min CN=84 Runoff=7.51 cfs 0.410 af

Subcatchment 39S: DB-34 1% Drainage Runoff Area=320,470 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=130' Slope=0.2500 '/' Tc=5.1 min CN=84 Runoff=46.50 cfs 2.072 af

Subcatchment 42S: DB-44 Drainage Runoff Area=67,882 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=291' Tc=18.1 min CN=84 Runoff=6.16 cfs 0.439 af

Subcatchment 43S: DB-45 Drainage Runoff Area=8,958 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=77' Tc=7.7 min CN=84 Runoff=1.17 cfs 0.058 af

Subcatchment 45S: E-MCI Culvert Drainage Runoff Area=136,608 sf 0.00% Impervious Runoff Depth=3.00"
Flow Length=667' Tc=20.2 min CN=80 Runoff=10.44 cfs 0.783 af

Subcatchment 51S: MC XI NW Drainage Runoff Area=649,178 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=480' Slope=0.0520 '/' Tc=16.5 min CN=84 Runoff=61.87 cfs 4.198 af

Subcatchment 53S: DB-36 Drainage Runoff Area=181,100 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=495' Tc=7.0 min CN=84 Runoff=24.34 cfs 1.171 af

Subcatchment 56S: MC VI Ditch Drainage Runoff Area=297,466 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=367' Tc=6.9 min CN=84 Runoff=40.19 cfs 1.924 af

Subcatchment 58S: DB-38-41 Drainage Runoff Area=335,816 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=933' Tc=3.8 min CN=84 Runoff=51.61 cfs 2.172 af

Subcatchment 61S: W-MC X Ditch Runoff Area=141,400 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=150' Slope=0.2500 '/' Tc=5.8 min CN=84 Runoff=19.95 cfs 0.914 af

Subcatchment 62S: Additional Storm Sewer Runoff Area=237,200 sf 100.00% Impervious Runoff Depth=4.88"
Tc=0.0 min CN=98 Runoff=46.10 cfs 2.216 af

Subcatchment 65S: S-MC X Ditch Drainage Runoff Area=205,200 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=160' Slope=0.3300 '/' Tc=5.4 min CN=84 Runoff=29.42 cfs 1.327 af

Subcatchment 67S: E-MC X Drainage Runoff Area=253,500 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=110' Slope=0.2500 '/' Tc=4.5 min CN=84 Runoff=37.89 cfs 1.639 af

Subcatchment 68S: SSB Drainage Area Runoff Area=900,800 sf 23.12% Impervious Runoff Depth=3.68"
Flow Length=400' Slope=0.0730 '/' Tc=13.7 min CN=87 Runoff=100.19 cfs 6.342 af

Subcatchment 70S: DB-46 Drainage Runoff Area=455,500 sf 0.00% Impervious Runoff Depth=3.00"
Flow Length=450' Slope=0.0350 '/' Tc=19.1 min CN=80 Runoff=35.98 cfs 2.612 af

Subcatchment 72S: E-MCI Drainage Runoff Area=177,527 sf 0.00% Impervious Runoff Depth=3.00"
Flow Length=1,086' Tc=33.4 min CN=80 Runoff=10.27 cfs 1.018 af

Subcatchment 73S: DB-35 Drainage Runoff Area=188,838 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=1,373' Tc=6.3 min CN=84 Runoff=26.16 cfs 1.221 af

Reach 14R: DS-4 Avg. Flow Depth=0.74' Max Vel=18.98 fps Inflow=161.36 cfs 11.107 af
n=0.029 L=230.0' S=0.2500 '/' Capacity=930.83 cfs Outflow=160.94 cfs 11.107 af

Reach 35R: MCVI/XI Ditch Avg. Flow Depth=2.14' Max Vel=7.13 fps Inflow=222.80 cfs 15.305 af
n=0.025 L=290.0' S=0.0100 '/' Capacity=898.54 cfs Outflow=221.46 cfs 15.305 af

Reach 36R: DB-43 Avg. Flow Depth=1.01' Max Vel=3.64 fps Inflow=11.41 cfs 0.849 af
n=0.025 L=402.0' S=0.0100 '/' Capacity=68.62 cfs Outflow=11.21 cfs 0.849 af

Reach 38R: DB-34 -1% Avg. Flow Depth=1.51' Max Vel=4.74 fps Inflow=46.50 cfs 2.072 af
n=0.025 L=2,391.0' S=0.0100 '/' Capacity=68.62 cfs Outflow=32.32 cfs 2.072 af

Reach 40R: DB-44 Avg. Flow Depth=0.59' Max Vel=5.87 fps Inflow=6.16 cfs 0.439 af
n=0.025 L=610.0' S=0.0540 '/' Capacity=159.45 cfs Outflow=6.08 cfs 0.439 af

Reach 41R: DB-45 Avg. Flow Depth=0.43' Max Vel=2.06 fps Inflow=1.17 cfs 0.058 af
n=0.025 L=127.1' S=0.0100 '/' Capacity=68.59 cfs Outflow=1.15 cfs 0.058 af

Reach 44R: E-MCI Ditch Avg. Flow Depth=2.16' Max Vel=3.86 fps Inflow=54.49 cfs 4.414 af
n=0.025 L=250.0' S=0.0041 '/' Capacity=129.69 cfs Outflow=54.27 cfs 4.414 af

Reach 49R: DB-36 Avg. Flow Depth=2.04' Max Vel=8.17 fps Inflow=108.34 cfs 5.267 af
n=0.025 L=1,140.0' S=0.0200 '/' Capacity=175.94 cfs Outflow=101.78 cfs 5.267 af

Reach 54R: MCVI-S Ditch Avg. Flow Depth=1.52' Max Vel=9.43 fps Inflow=87.40 cfs 4.095 af
n=0.025 L=370.0' S=0.0380 '/' Capacity=181.62 cfs Outflow=85.74 cfs 4.095 af

Reach 55R: MCVI-N Ditch Avg. Flow Depth=0.70' Max Vel=4.84 fps Inflow=89.31 cfs 4.095 af
n=0.025 L=265.0' S=0.0270 '/' Capacity=230.14 cfs Outflow=87.40 cfs 4.095 af

Reach 57R: DS-5 Avg. Flow Depth=0.87' Max Vel=11.95 fps Inflow=51.61 cfs 2.172 af
n=0.029 L=304.0' S=0.1697 '/' Capacity=476.49 cfs Outflow=50.45 cfs 2.172 af

Reach 59R: DB-42 Avg. Flow Depth=1.04' Max Vel=3.69 fps Inflow=13.15 cfs 0.559 af
n=0.025 L=576.5' S=0.0100 '/' Capacity=68.65 cfs Outflow=11.88 cfs 0.559 af

Reach 60R: W-MC X Ditch Avg. Flow Depth=1.29' Max Vel=2.75 fps Inflow=34.54 cfs 3.881 af
n=0.025 L=833.0' S=0.0024 '/' Capacity=326.61 cfs Outflow=32.84 cfs 3.881 af

Reach 64R: S MC X Ditch Avg. Flow Depth=2.44' Max Vel=3.09 fps Inflow=34.39 cfs 2.966 af
n=0.025 L=1,110.0' S=0.0027 '/' Capacity=103.29 cfs Outflow=27.51 cfs 2.966 af

Reach 66R: E-MC X Ditch Avg. Flow Depth=1.48' Max Vel=2.01 fps Inflow=37.89 cfs 1.639 af
n=0.030 L=1,500.0' S=0.0025 '/' Capacity=145.10 cfs Outflow=22.01 cfs 1.639 af

Reach 71R: DB-46 Avg. Flow Depth=1.16' Max Vel=4.09 fps Inflow=35.98 cfs 2.612 af
n=0.025 L=200.0' S=0.0100 '/' Capacity=152.89 cfs Outflow=35.82 cfs 2.612 af

Reach 72R: DB-37 Avg. Flow Depth=1.35' Max Vel=6.21 fps Inflow=34.24 cfs 2.547 af
n=0.025 L=804.0' S=0.0200 '/' Capacity=97.04 cfs Outflow=33.66 cfs 2.547 af

Pond 63P: SSB Inflow=416.34 cfs 33.625 af
Primary=416.34 cfs 33.625 af

Pond 69P: Storm Sewer - See SWMM Model Inflow=296.87 cfs 23.402 af
Primary=296.87 cfs 23.402 af

Pond 70P: SSB Inlet Culvert Peak Elev=692.17' Inflow=32.84 cfs 3.881 af
30.0" Round Culvert n=0.012 L=113.0' S=-0.0012 '/' Outflow=32.84 cfs 3.881 af

Pond 71P: E-MCI Culvert Peak Elev=705.87' Inflow=10.44 cfs 0.783 af
24.0" Round Culvert n=0.012 L=80.0' S=0.0025 '/' Outflow=10.44 cfs 0.783 af

Total Runoff Area = 117.109 ac Runoff Volume = 33.625 af Average Runoff Depth = 3.45"
91.27% Pervious = 106.881 ac 8.73% Impervious = 10.227 ac

Summary for Subcatchment 34S: DB-42 Drainage

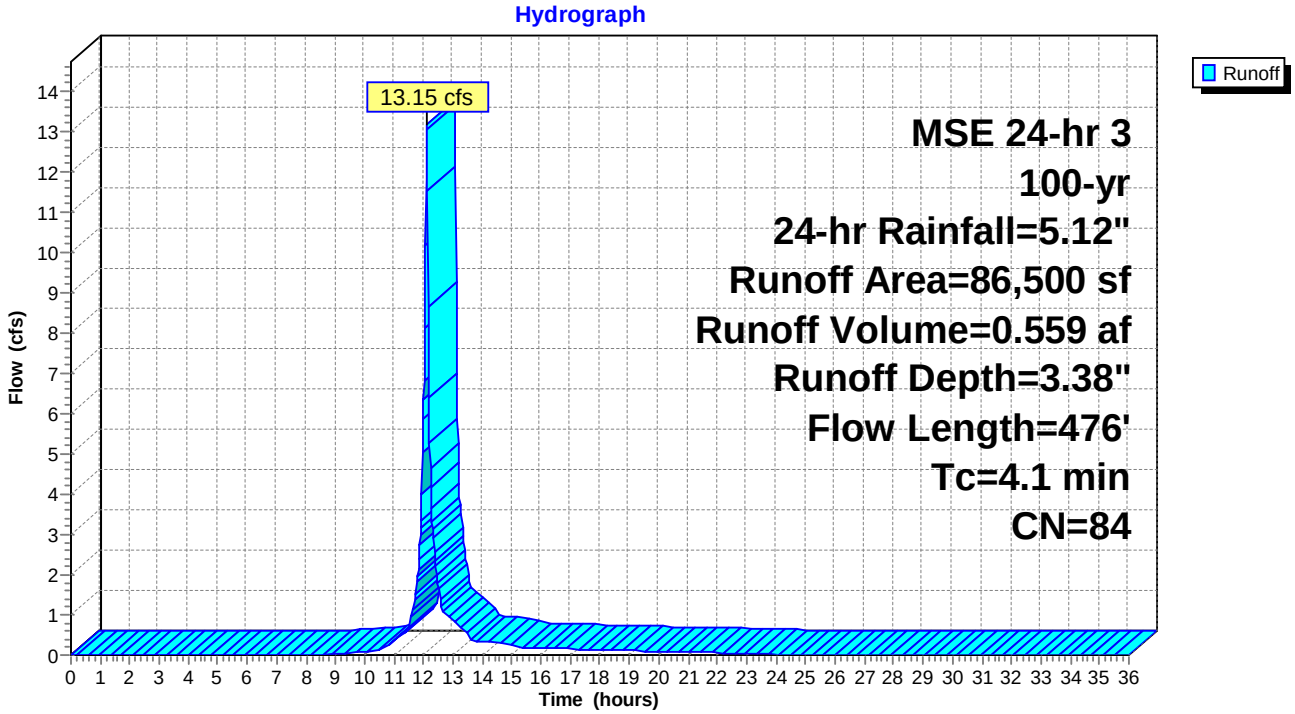
Runoff = 13.15 cfs @ 12.11 hrs, Volume= 0.559 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
86,500	84	50-75% Grass cover, Fair, HSG D
86,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	66	0.2500	0.37		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.1	410	0.0100	5.94	71.33	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
4.1	476	Total			

Subcatchment 34S: DB-42 Drainage



Summary for Subcatchment 36S: DB-37 Drainage

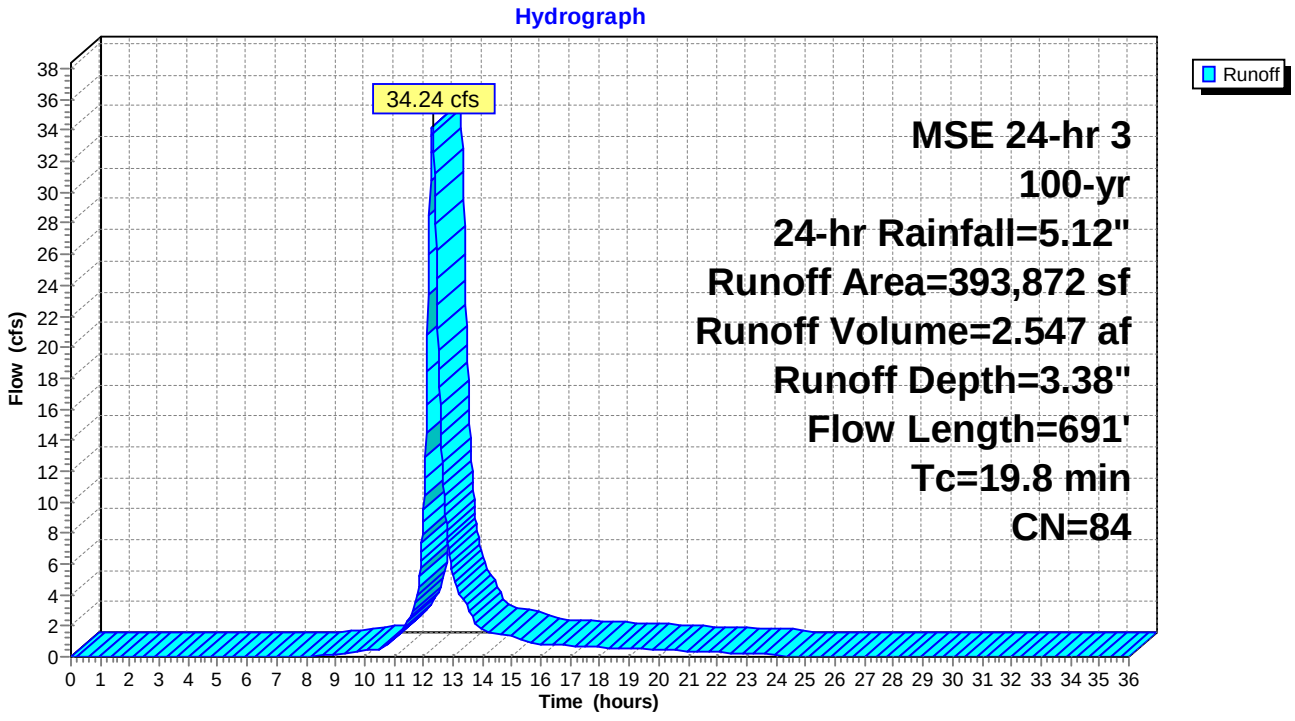
Runoff = 34.24 cfs @ 12.29 hrs, Volume= 2.547 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
393,872	84	50-75% Grass cover, Fair, HSG D
393,872		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	59	0.2500	0.36		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
11.4	141	0.0400	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
5.6	474	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	17	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.8	691	Total			

Subcatchment 36S: DB-37 Drainage



Summary for Subcatchment 37S: DB-43 Drainage

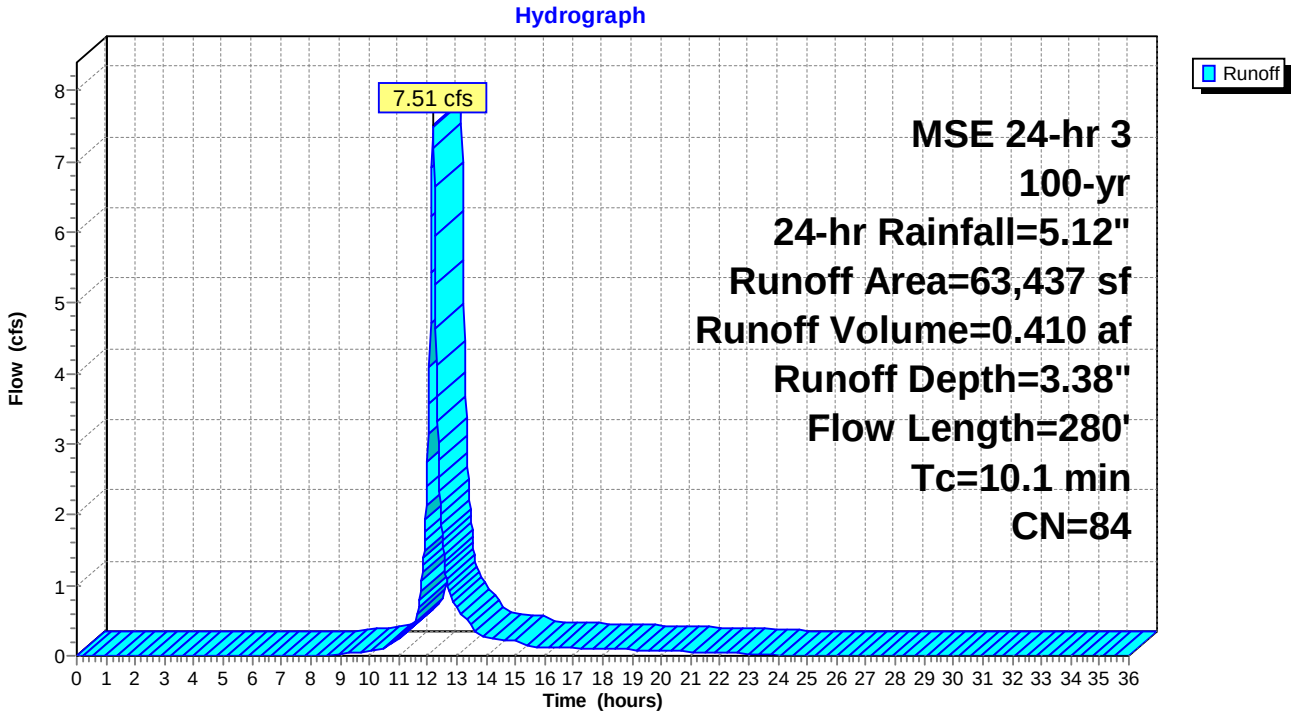
Runoff = 7.51 cfs @ 12.18 hrs, Volume= 0.410 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
63,437	84	50-75% Grass cover, Fair, HSG D
63,437		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	65	0.2500	0.37		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
7.2	215	0.0050	0.49		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.1	280	Total			

Subcatchment 37S: DB-43 Drainage



Summary for Subcatchment 39S: DB-34 1% Drainage

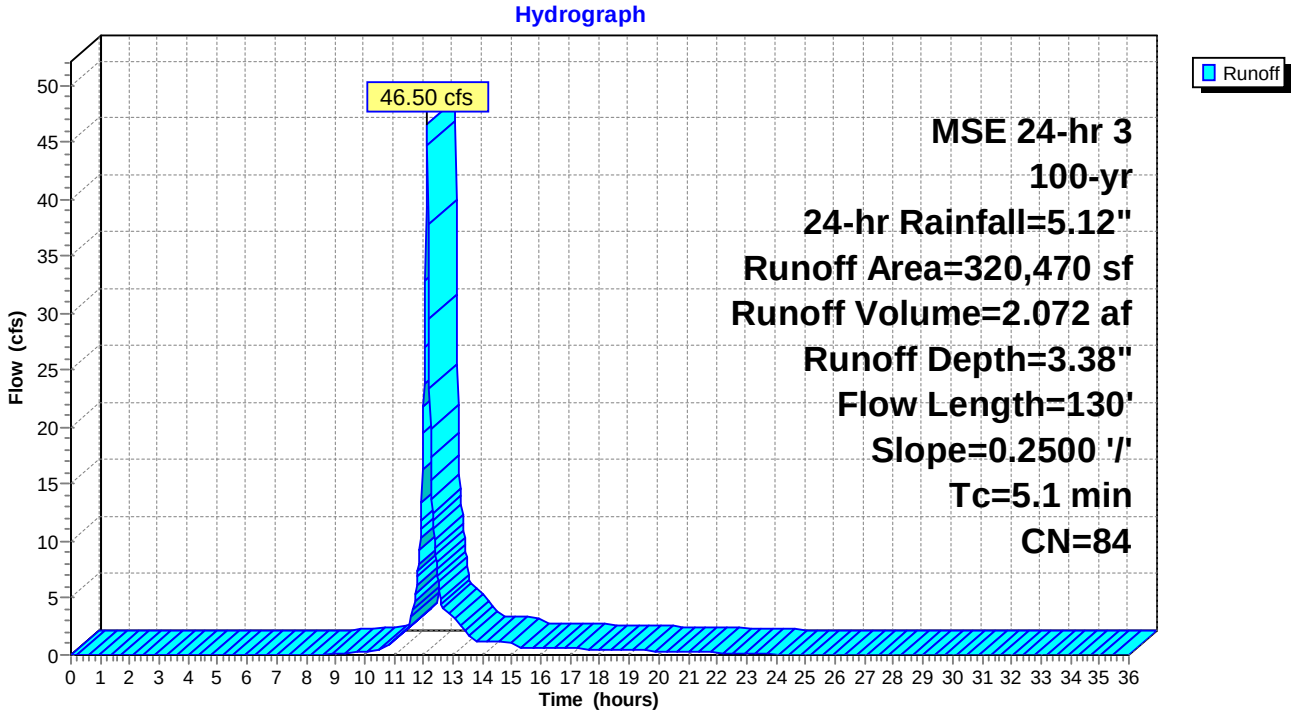
Runoff = 46.50 cfs @ 12.12 hrs, Volume= 2.072 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
320,470	84	50-75% Grass cover, Fair, HSG D
320,470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	130	0.2500	0.42		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 39S: DB-34 1% Drainage



Summary for Subcatchment 42S: DB-44 Drainage

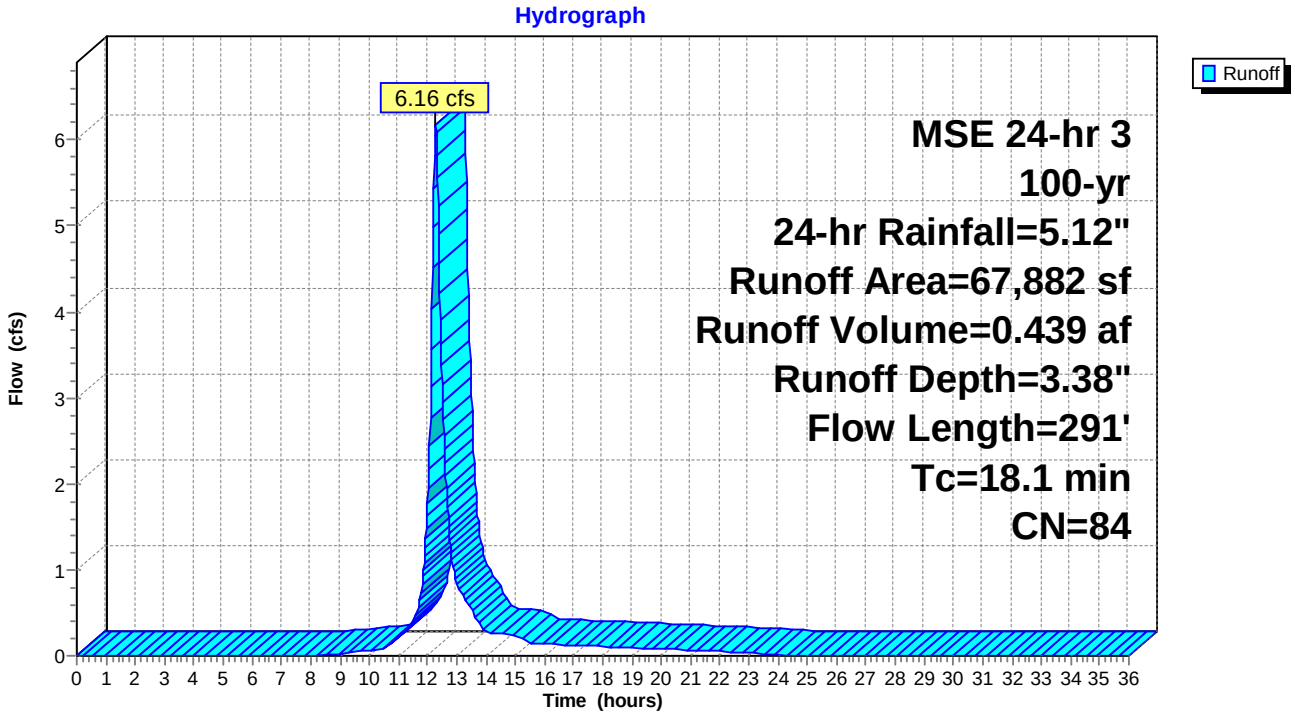
Runoff = 6.16 cfs @ 12.27 hrs, Volume= 0.439 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
67,882	84	50-75% Grass cover, Fair, HSG D
67,882		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	199	0.0260	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
0.2	92	0.2500	7.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
18.1	291	Total			

Subcatchment 42S: DB-44 Drainage



Summary for Subcatchment 43S: DB-45 Drainage

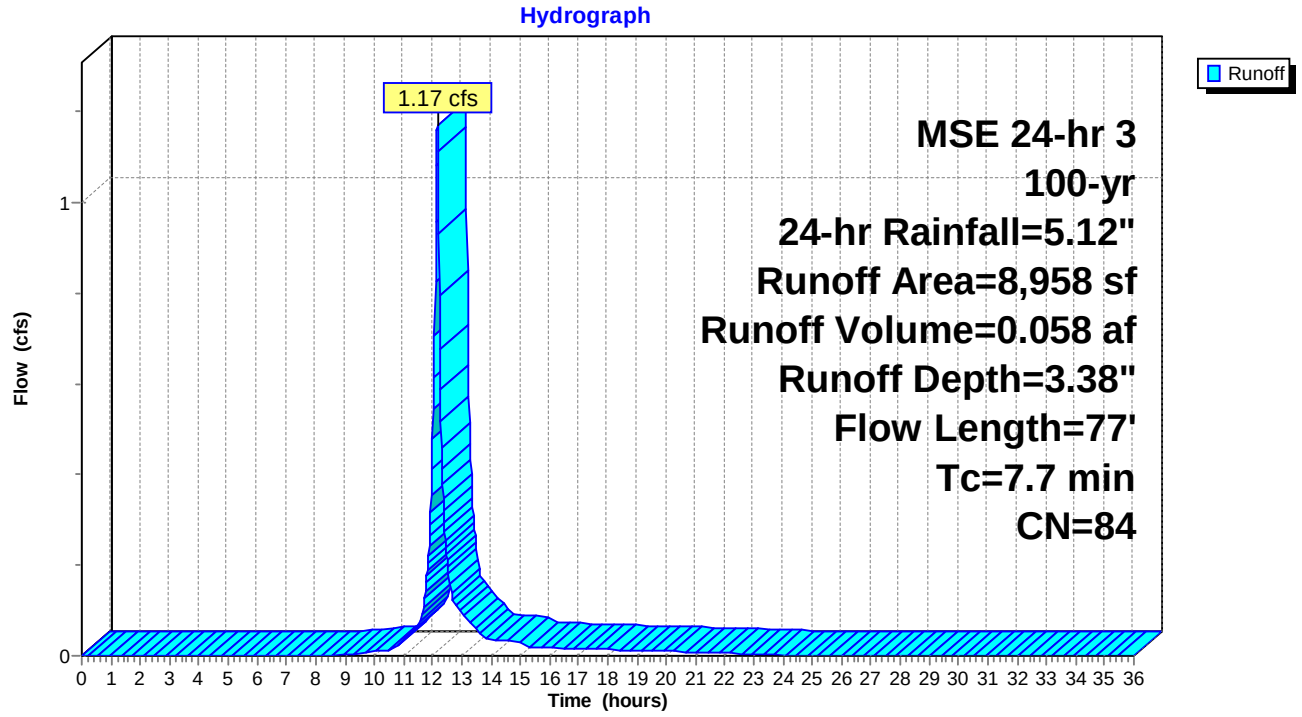
Runoff = 1.17 cfs @ 12.15 hrs, Volume= 0.058 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
8,958	84	50-75% Grass cover, Fair, HSG D
8,958		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	29	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.1	48	0.3300	0.39		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
7.7	77	Total			

Subcatchment 43S: DB-45 Drainage



Summary for Subcatchment 45S: E-MCI Culvert Drainage

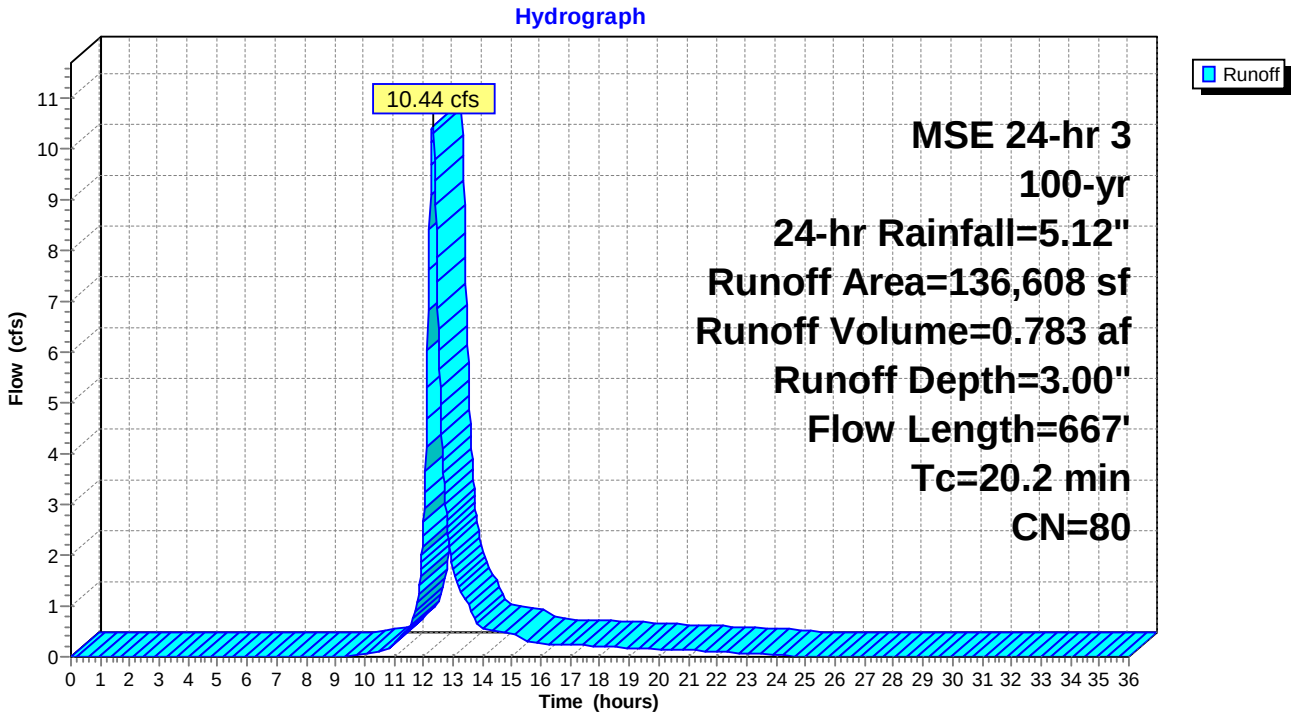
Runoff = 10.44 cfs @ 12.30 hrs, Volume= 0.783 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
136,608	80	>75% Grass cover, Good, HSG D
136,608		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	32	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.6	35	0.3300	0.36		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
8.2	133	0.0800	0.27		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
4.3	467	0.0670	1.81		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
20.2	667	Total			

Subcatchment 45S: E-MCI Culvert Drainage



Summary for Subcatchment 51S: MC XI NW Drainage

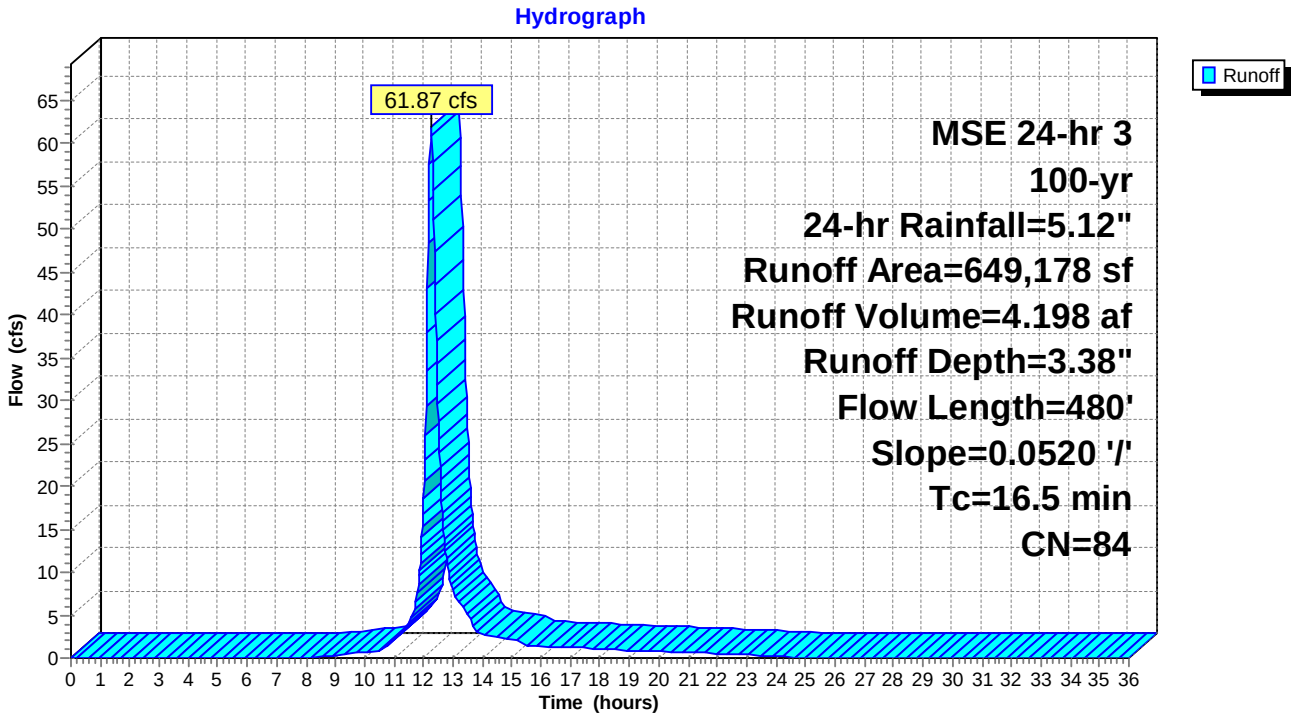
Runoff = 61.87 cfs @ 12.25 hrs, Volume= 4.198 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
475,309	84	50-75% Grass cover, Fair, HSG D
173,869	84	50-75% Grass cover, Fair, HSG D
649,178	84	Weighted Average
649,178		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	200	0.0520	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.9	280	0.0520	1.60		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.5	480	Total			

Subcatchment 51S: MC XI NW Drainage



Summary for Subcatchment 53S: DB-36 Drainage

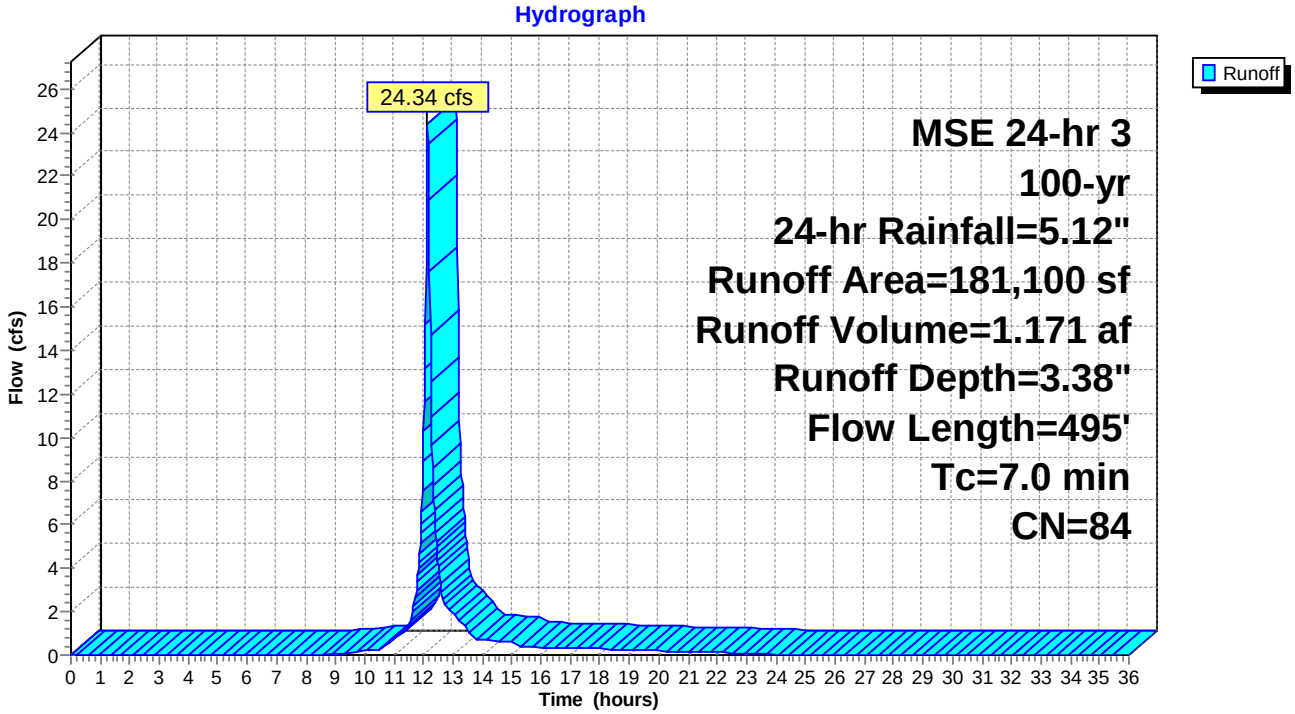
Runoff = 24.34 cfs @ 12.14 hrs, Volume= 1.171 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
181,100	84	50-75% Grass cover, Fair, HSG D
181,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	170	0.2500	0.45		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
0.6	325	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
7.0	495	Total			

Subcatchment 53S: DB-36 Drainage



Summary for Subcatchment 56S: MC VI Ditch Drainage

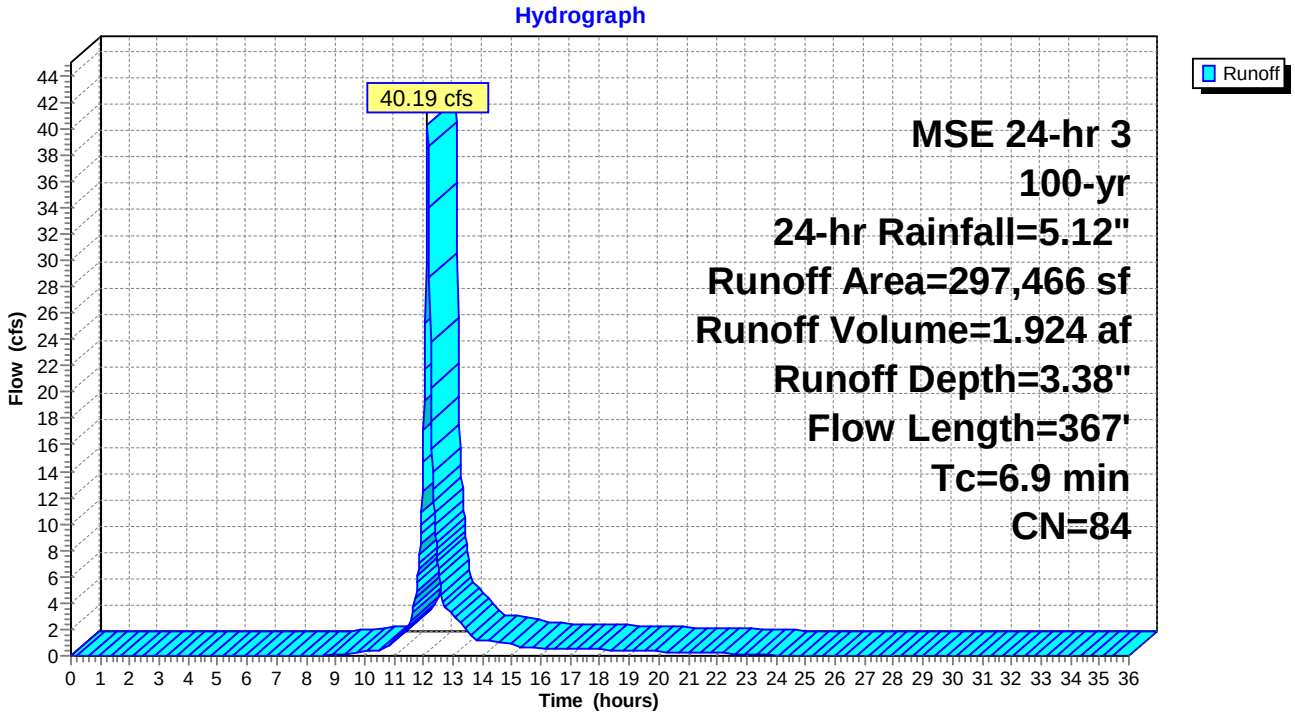
Runoff = 40.19 cfs @ 12.14 hrs, Volume= 1.924 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
297,466	84	50-75% Grass cover, Fair, HSG D
297,466		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	59	0.2500	0.36		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
4.2	308	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.9	367	Total			

Subcatchment 56S: MC VI Ditch Drainage



Summary for Subcatchment 58S: DB-38-41 Drainage

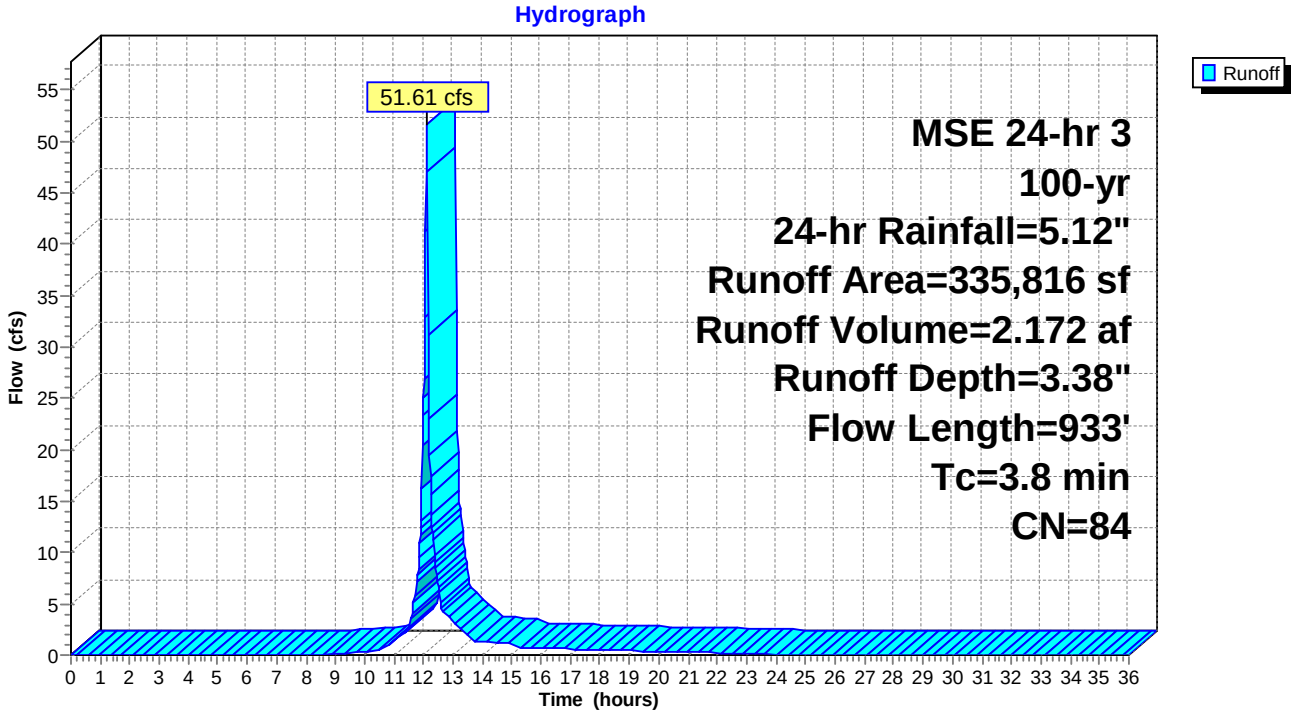
Runoff = 51.61 cfs @ 12.11 hrs, Volume= 2.172 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
335,816	84	50-75% Grass cover, Fair, HSG D
335,816		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	39	0.2500	0.33		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.8	894	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
3.8	933	Total			

Subcatchment 58S: DB-38-41 Drainage



Summary for Subcatchment 61S: W-MC X Ditch

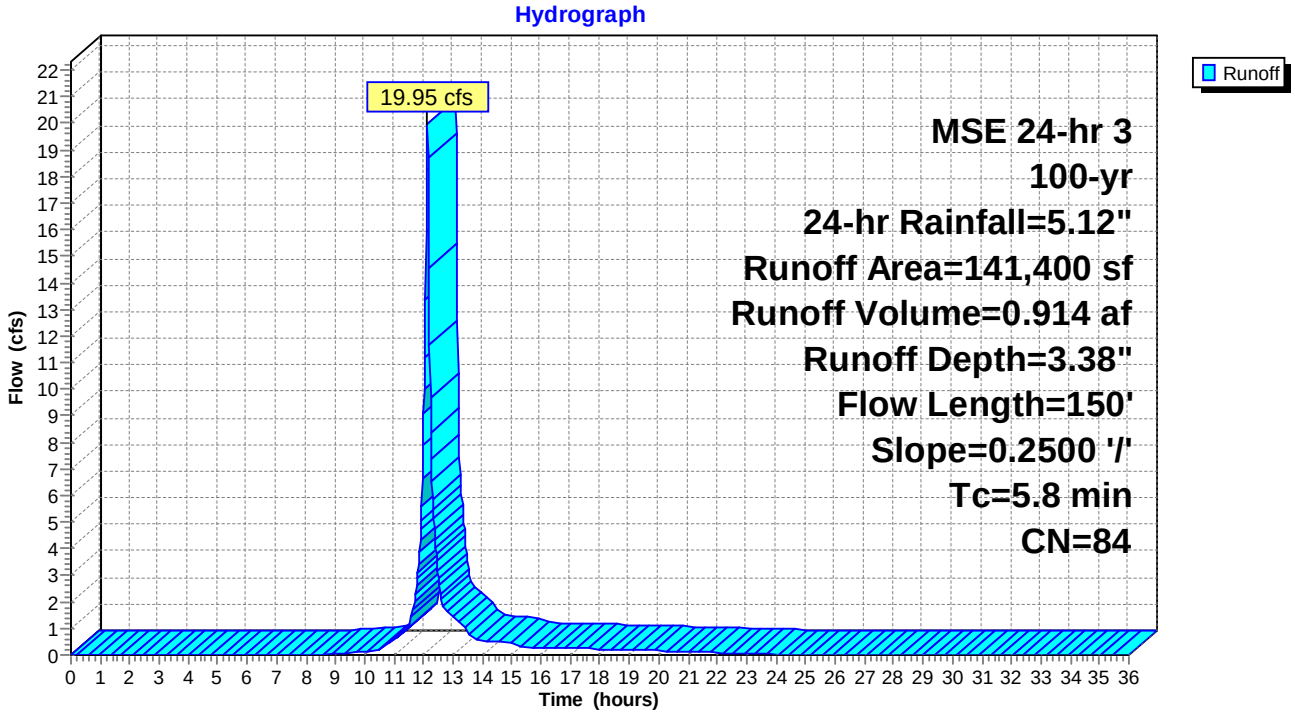
Runoff = 19.95 cfs @ 12.13 hrs, Volume= 0.914 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
141,400	84	50-75% Grass cover, Fair, HSG D
141,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	150	0.2500	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 61S: W-MC X Ditch



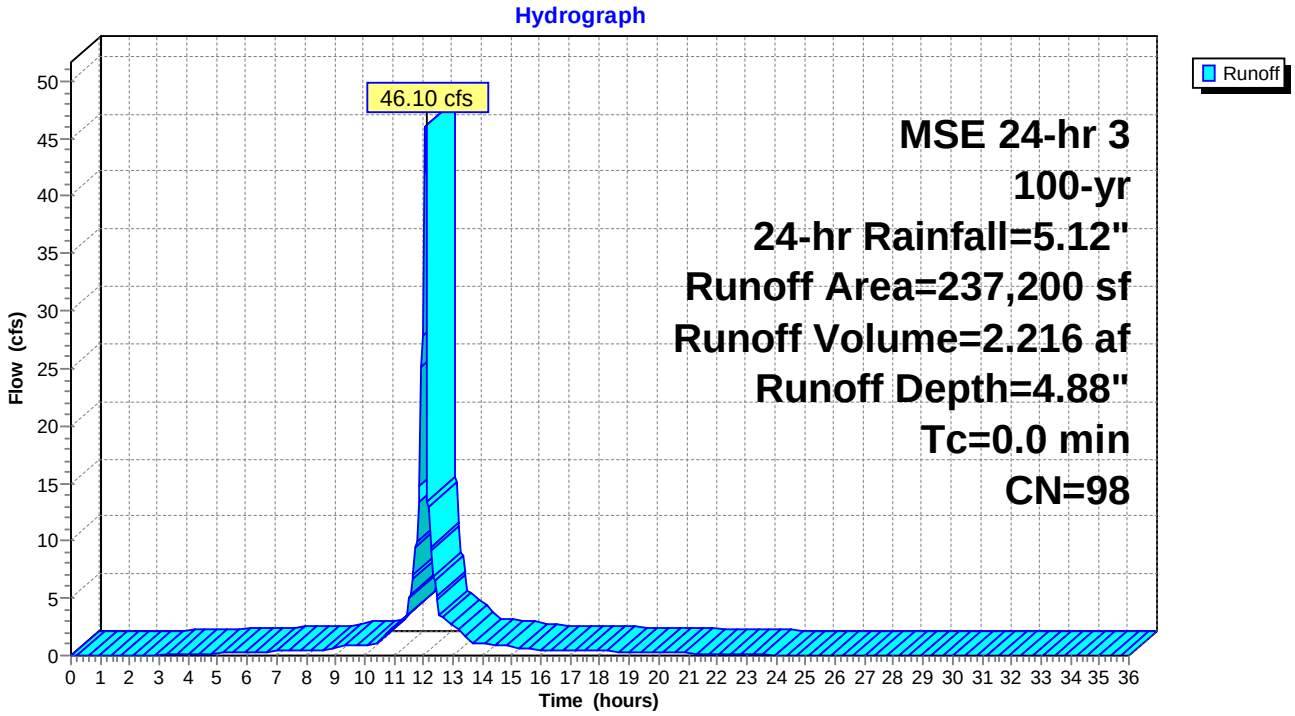
Summary for Subcatchment 62S: Additional Storm Sewer Drainage Area

Runoff = 46.10 cfs @ 12.08 hrs, Volume= 2.216 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
237,200	98	Paved parking, HSG D
237,200		100.00% Impervious Area

Subcatchment 62S: Additional Storm Sewer Drainage Area



Summary for Subcatchment 65S: S-MC X Ditch Drainage

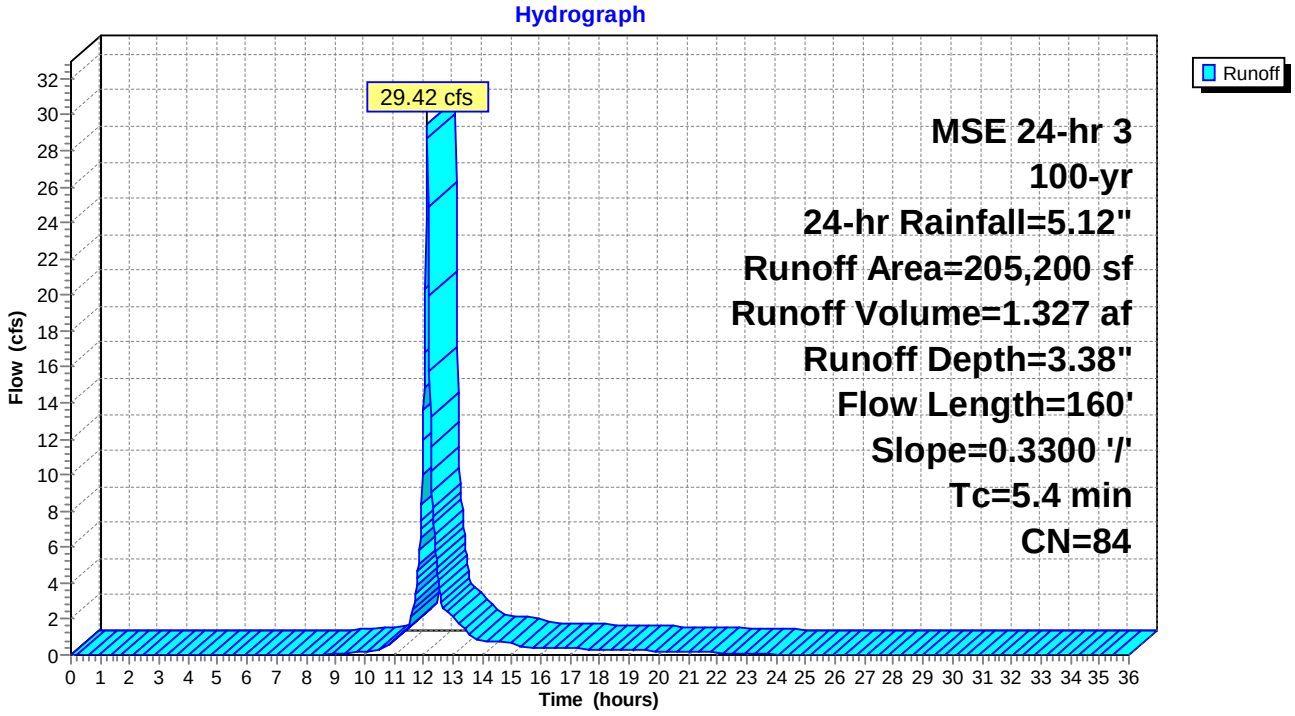
Runoff = 29.42 cfs @ 12.12 hrs, Volume= 1.327 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
205,200	84	50-75% Grass cover, Fair, HSG D
205,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	160	0.3300	0.49		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 65S: S-MC X Ditch Drainage



Summary for Subcatchment 67S: E-MC X Drainage

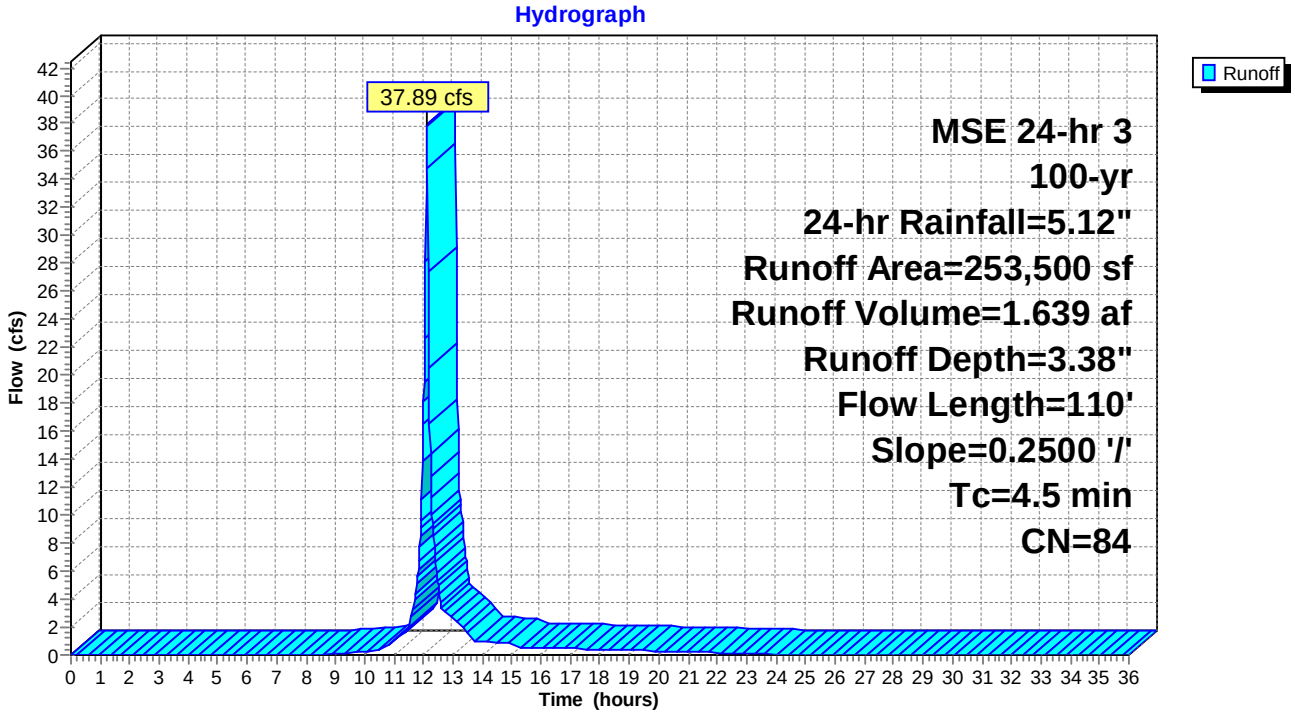
Runoff = 37.89 cfs @ 12.12 hrs, Volume= 1.639 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
253,500	84	50-75% Grass cover, Fair, HSG D
253,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	110	0.2500	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 67S: E-MC X Drainage



Summary for Subcatchment 68S: SSB Drainage Area

Total area is 900,800 sf
Pond area is 208,300 sf
Therefore, surrounding area is 692,500 sf (900,800 - 208,300)

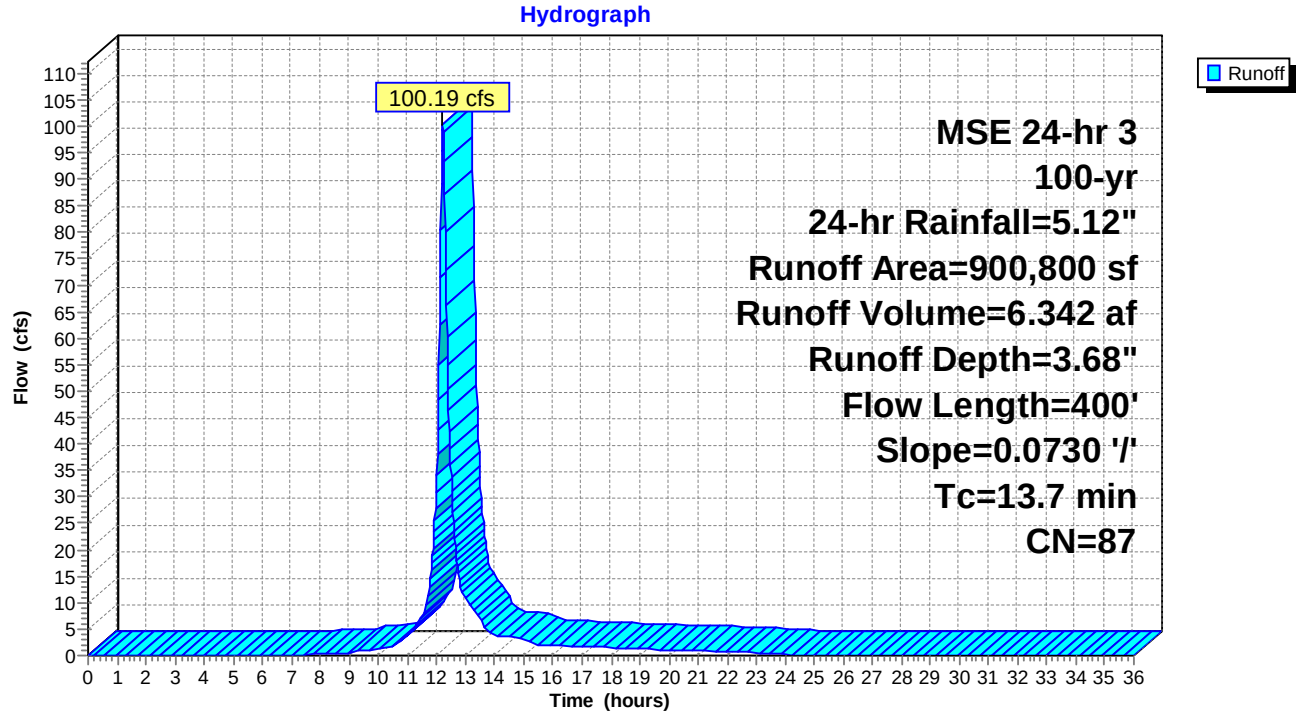
Runoff = 100.19 cfs @ 12.22 hrs, Volume= 6.342 af, Depth= 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
692,500	84	50-75% Grass cover, Fair, HSG D
208,300	98	Water Surface, HSG D
900,800	87	Weighted Average
692,500		76.88% Pervious Area
208,300		23.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	200	0.0730	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.8	200	0.0730	1.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.7	400	Total			

Subcatchment 68S: SSB Drainage Area



Summary for Subcatchment 70S: DB-46 Drainage

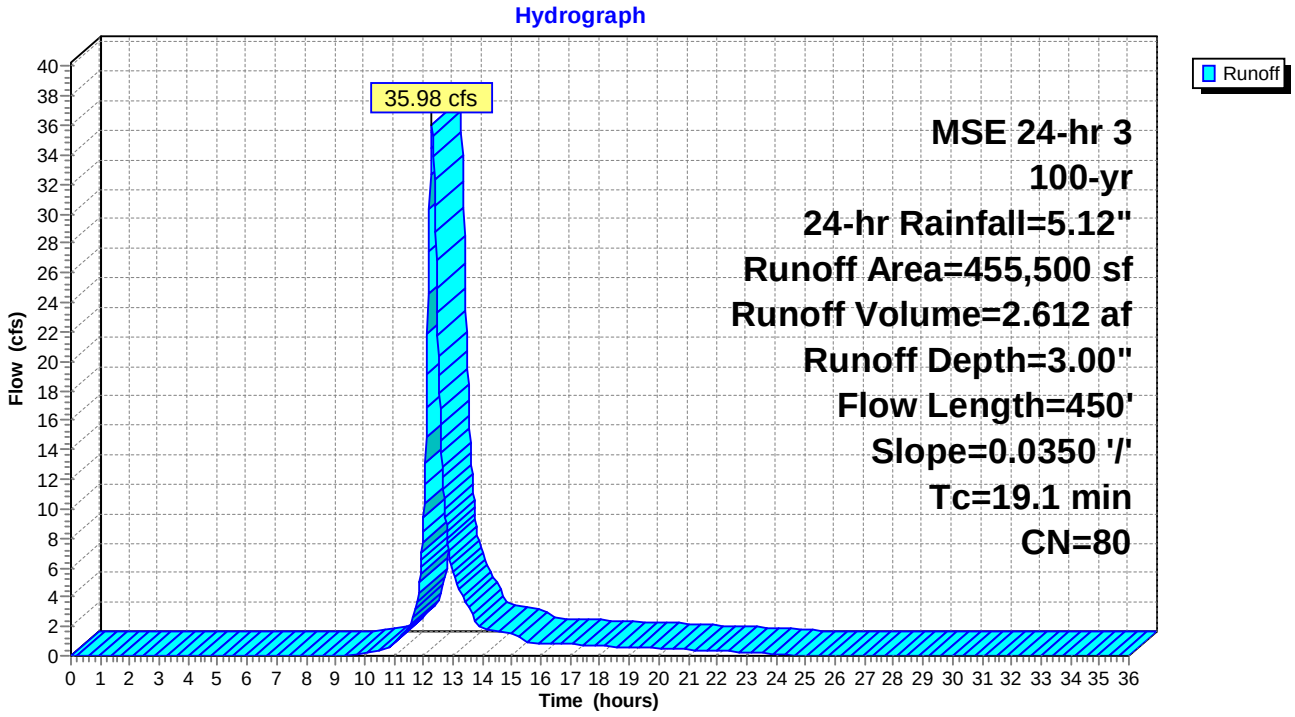
Runoff = 35.98 cfs @ 12.28 hrs, Volume= 2.612 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
455,500	80	>75% Grass cover, Good, HSG D
455,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	200	0.0350	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
3.2	250	0.0350	1.31		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.1	450	Total			

Subcatchment 70S: DB-46 Drainage



Summary for Subcatchment 72S: E-MCI Drainage

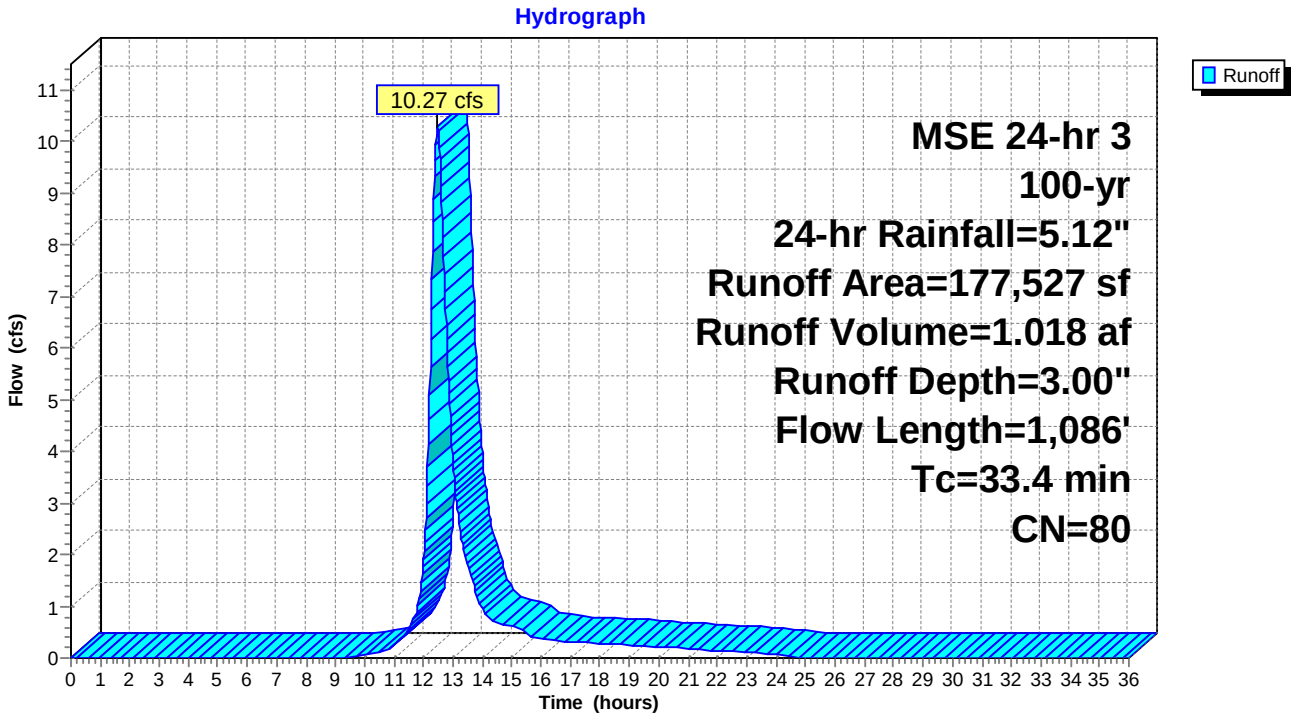
Runoff = 10.27 cfs @ 12.46 hrs, Volume= 1.018 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
177,527	80	>75% Grass cover, Good, HSG D
177,527		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	200	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
10.8	640	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.7	246	0.0488	1.55		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.4	1,086	Total			

Subcatchment 72S: E-MCI Drainage



Summary for Subcatchment 73S: DB-35 Drainage

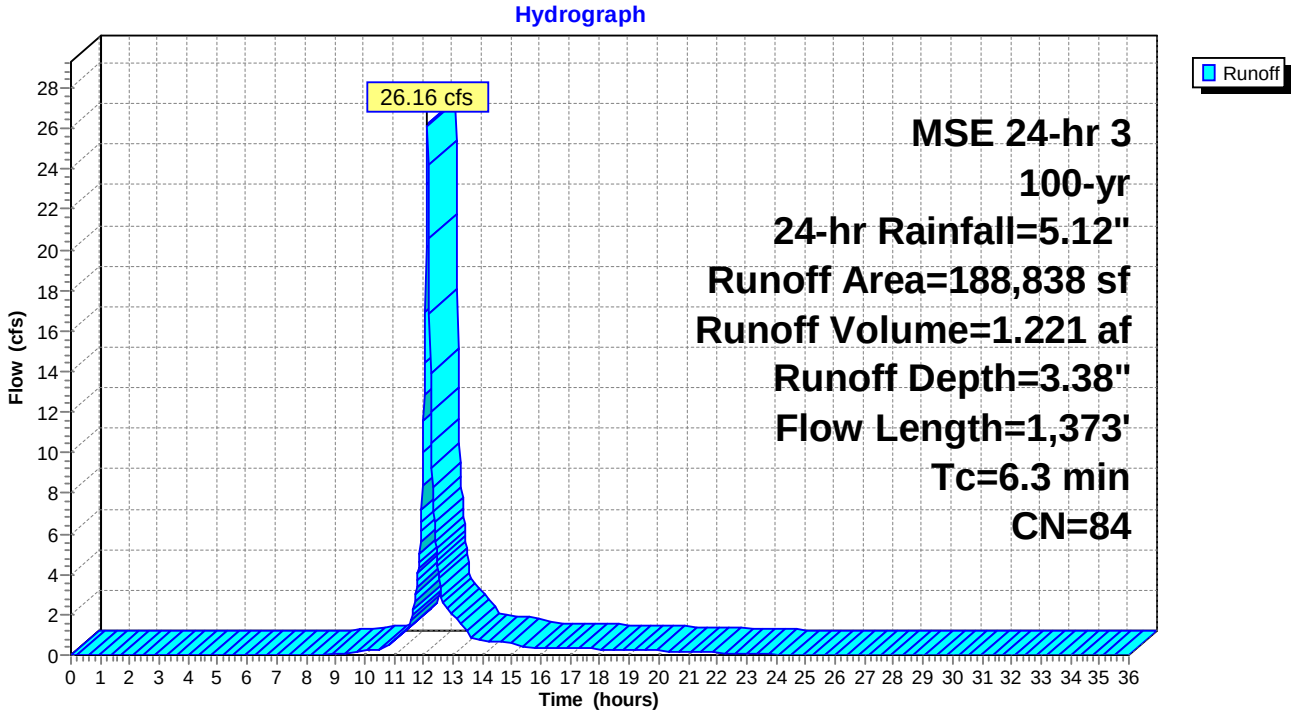
Runoff = 26.16 cfs @ 12.13 hrs, Volume= 1.221 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
188,838	84	50-75% Grass cover, Fair, HSG D
188,838		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	86	0.2500	0.39		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.6	1,287	0.0200	8.41	100.87	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
6.3	1,373	Total			

Subcatchment 73S: DB-35 Drainage



Summary for Reach 14R: DS-4

Inflow Area = 39.430 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 161.36 cfs @ 12.24 hrs, Volume= 11.107 af
Outflow = 160.94 cfs @ 12.25 hrs, Volume= 11.107 af, Atten= 0%, Lag= 0.3 min

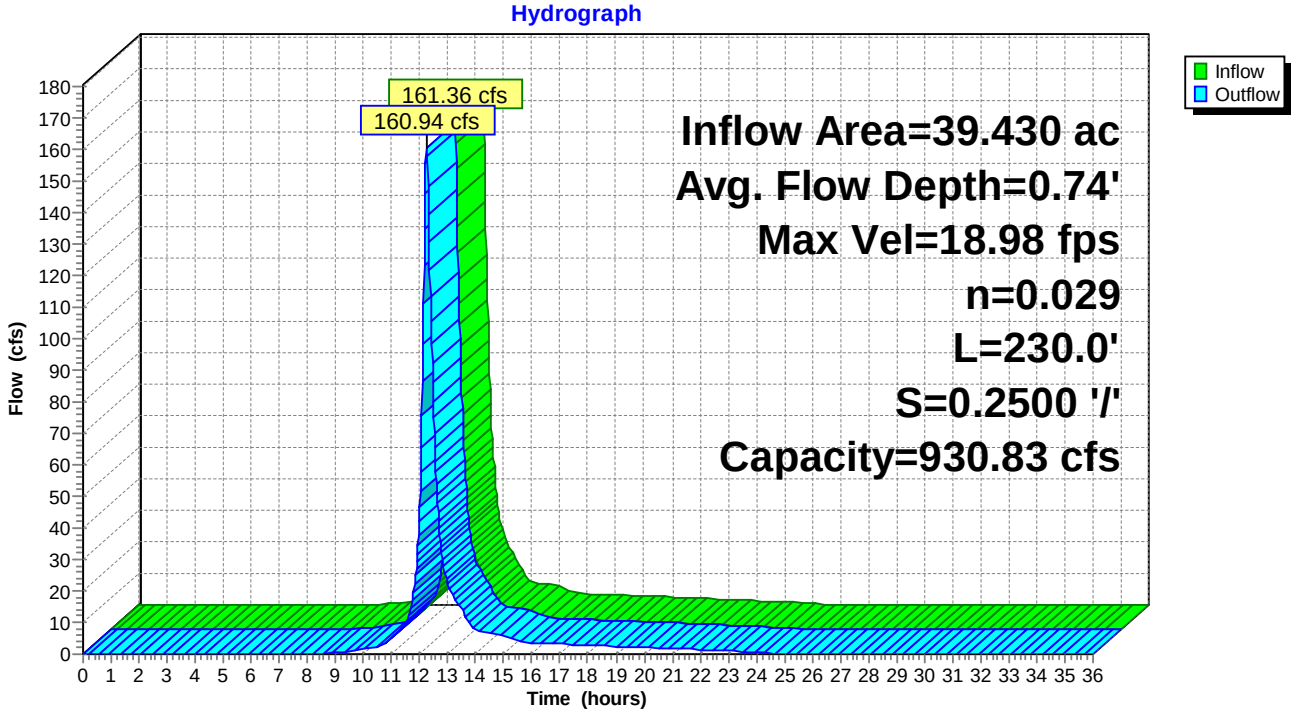
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 18.98 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.89 fps, Avg. Travel Time= 1.0 min

Peak Storage= 1,954 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.74' , Surface Width= 12.96'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 930.83 cfs

10.00' x 2.00' deep channel, n= 0.029
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 230.0' Slope= 0.2500 '/'
Inlet Invert= 763.50', Outlet Invert= 706.00'

‡

Reach 14R: DS-4



Summary for Reach 35R: MCVI/XI Ditch

Inflow Area = 54.333 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 222.80 cfs @ 12.25 hrs, Volume= 15.305 af
Outflow = 221.46 cfs @ 12.27 hrs, Volume= 15.305 af, Atten= 1%, Lag= 1.2 min

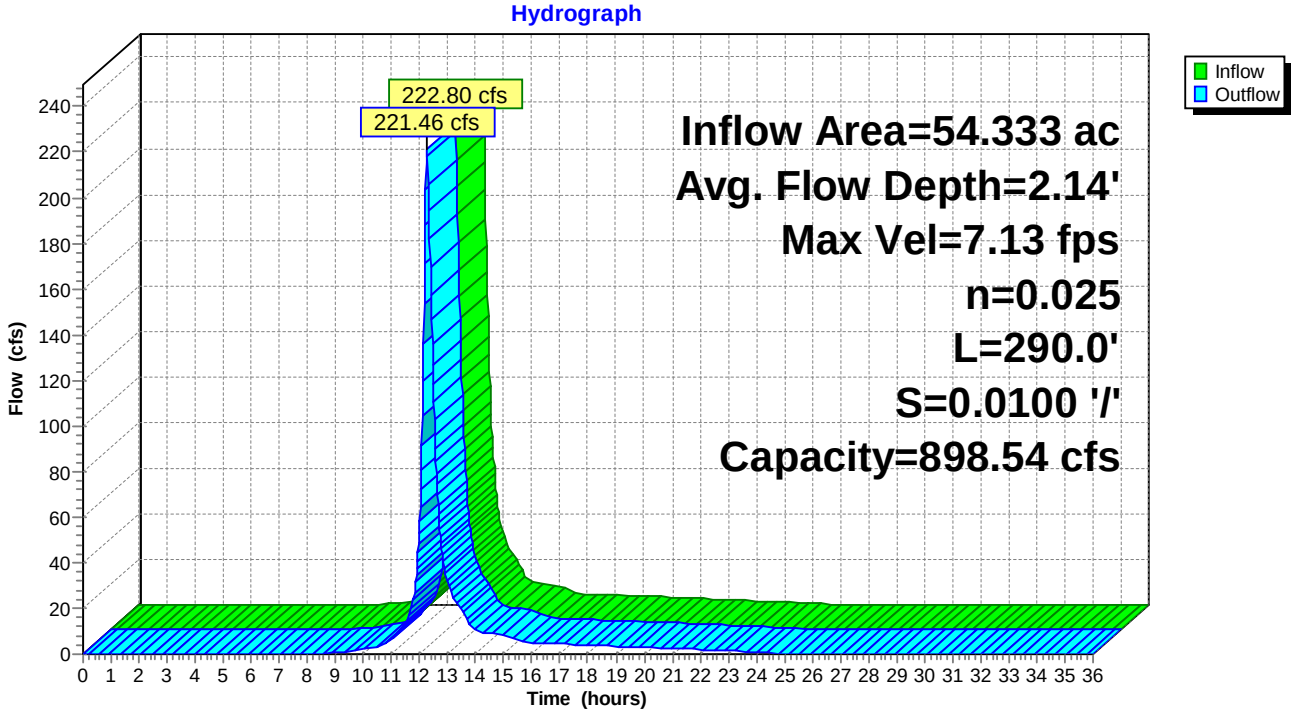
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 7.13 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 2.8 min

Peak Storage= 9,036 cf @ 12.26 hrs
Average Depth at Peak Storage= 2.14' , Surface Width= 23.12'
Bank-Full Depth= 4.00' Flow Area= 88.0 sf, Capacity= 898.54 cfs

6.00' x 4.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 '/' Top Width= 38.00'
Length= 290.0' Slope= 0.0100 '/'
Inlet Invert= 700.15', Outlet Invert= 697.26'

‡

Reach 35R: MCVI/XI Ditch



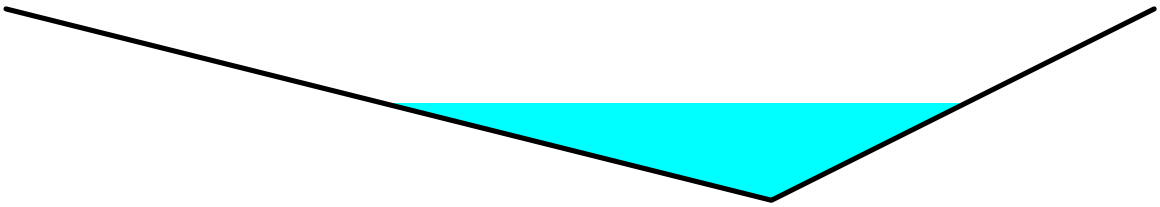
Summary for Reach 36R: DB-43

Inflow Area = 3.015 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 11.41 cfs @ 12.20 hrs, Volume= 0.849 af
Outflow = 11.21 cfs @ 12.26 hrs, Volume= 0.849 af, Atten= 2%, Lag= 3.6 min

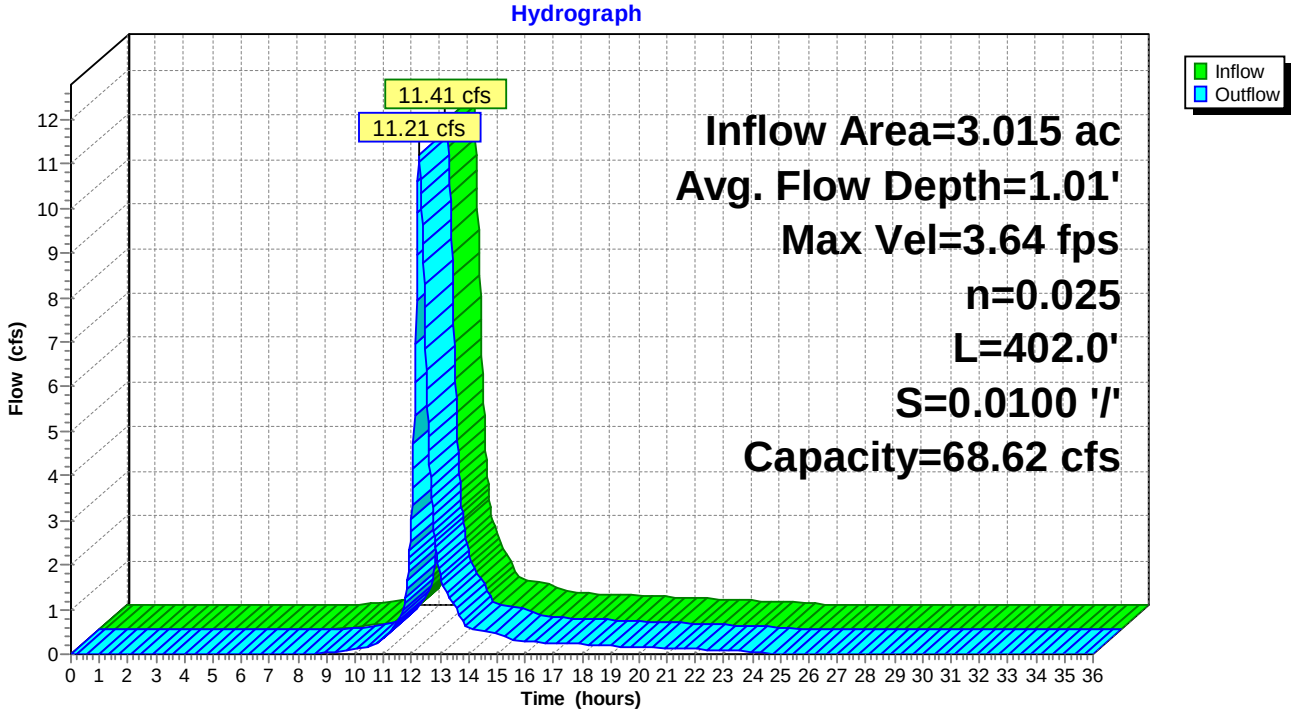
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.64 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 5.3 min

Peak Storage= 1,241 cf @ 12.23 hrs
Average Depth at Peak Storage= 1.01' , Surface Width= 6.09'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.62 cfs

0.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 402.0' Slope= 0.0100 '/'
Inlet Invert= 712.02', Outlet Invert= 708.00'



Reach 36R: DB-43



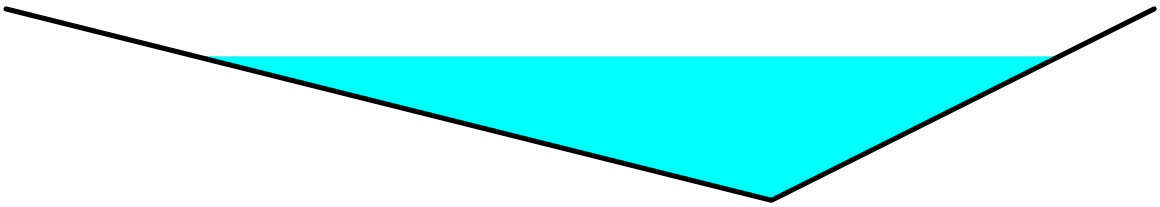
Summary for Reach 38R: DB-34 -1%

Inflow Area = 7.357 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 46.50 cfs @ 12.12 hrs, Volume= 2.072 af
Outflow = 32.32 cfs @ 12.31 hrs, Volume= 2.072 af, Atten= 31%, Lag= 11.6 min

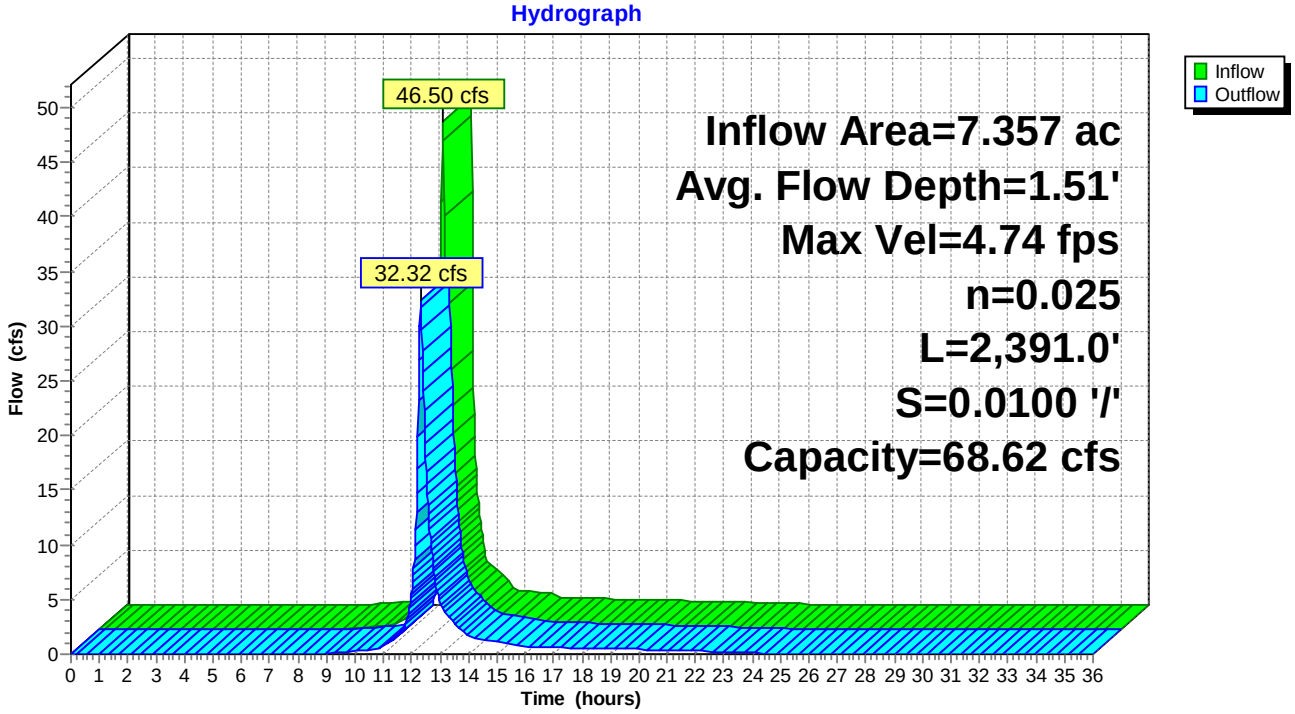
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.74 fps, Min. Travel Time= 8.4 min
Avg. Velocity = 1.18 fps, Avg. Travel Time= 33.7 min

Peak Storage= 16,315 cf @ 12.17 hrs
Average Depth at Peak Storage= 1.51' , Surface Width= 9.05'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.62 cfs

0.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 2,391.0' Slope= 0.0100 '/'
Inlet Invert= 745.91', Outlet Invert= 722.00'



Reach 38R: DB-34 -1%



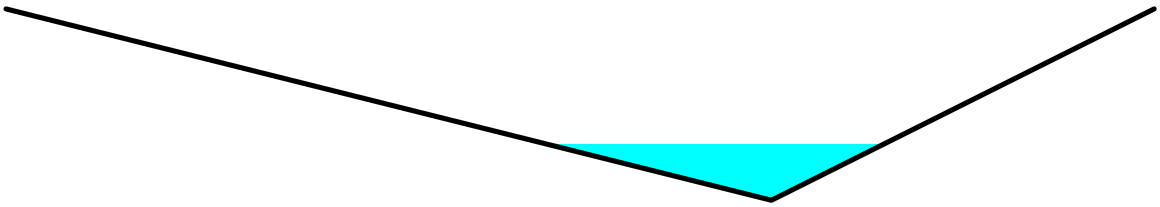
Summary for Reach 40R: DB-44

Inflow Area = 1.558 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 6.16 cfs @ 12.27 hrs, Volume= 0.439 af
Outflow = 6.08 cfs @ 12.32 hrs, Volume= 0.439 af, Atten= 1%, Lag= 3.1 min

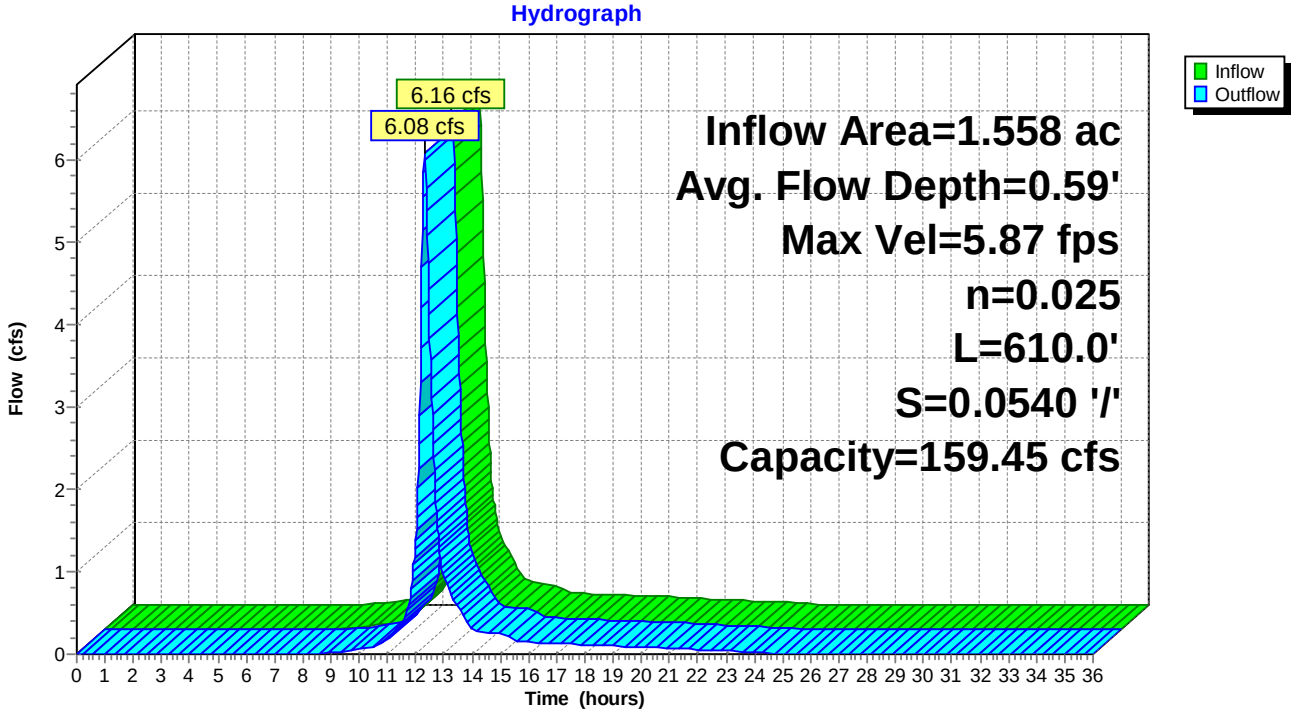
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 5.87 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 2.15 fps, Avg. Travel Time= 4.7 min

Peak Storage= 632 cf @ 12.29 hrs
Average Depth at Peak Storage= 0.59' , Surface Width= 3.53'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 159.45 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 610.0' Slope= 0.0540 '/'
Inlet Invert= 762.04', Outlet Invert= 729.10'



Reach 40R: DB-44



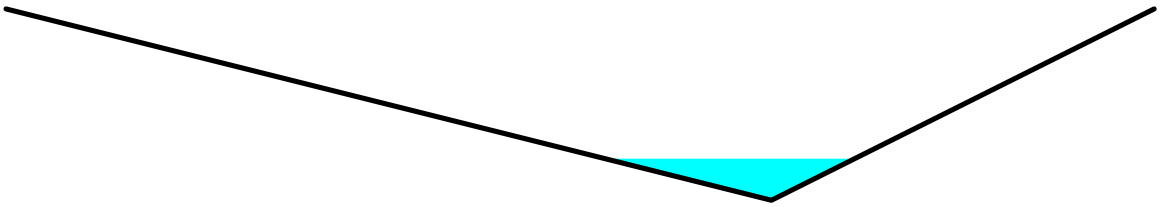
Summary for Reach 41R: DB-45

Inflow Area = 0.206 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 1.17 cfs @ 12.15 hrs, Volume= 0.058 af
Outflow = 1.15 cfs @ 12.18 hrs, Volume= 0.058 af, Atten= 2%, Lag= 1.8 min

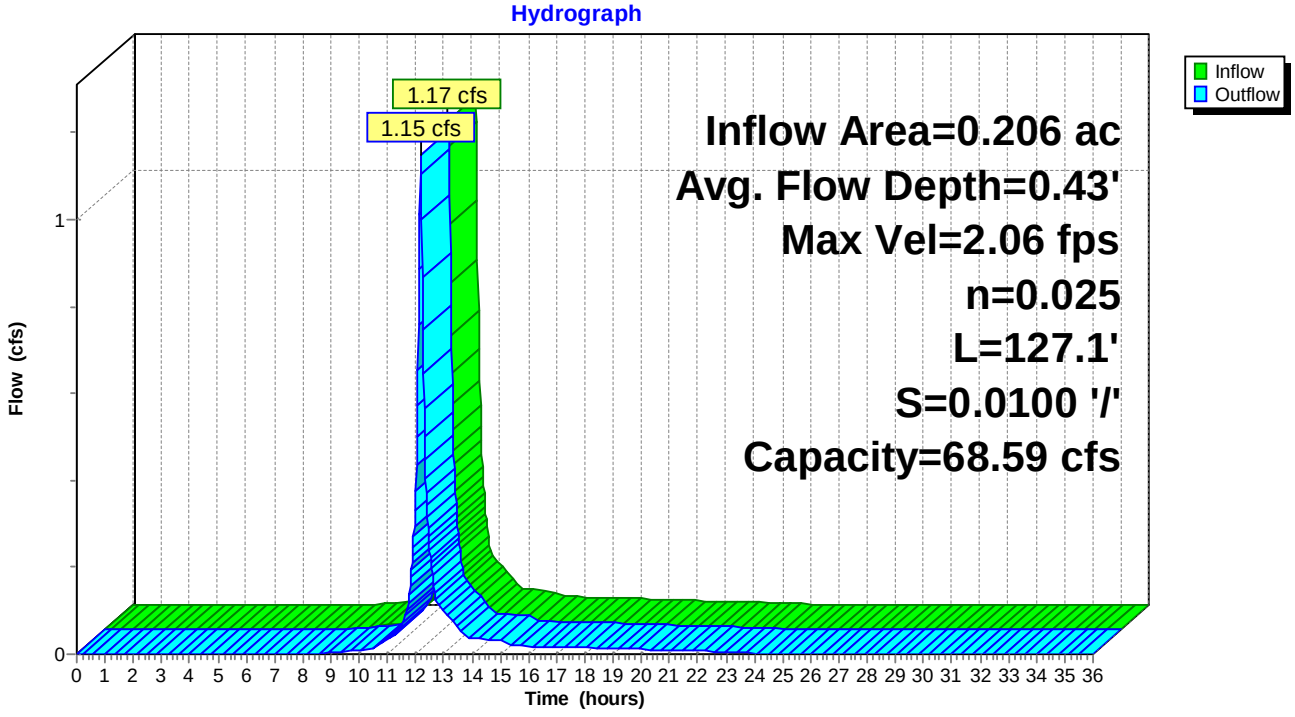
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.06 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.71 fps, Avg. Travel Time= 3.0 min

Peak Storage= 71 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.43' , Surface Width= 2.59'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.59 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 127.1' Slope= 0.0100 '/'
Inlet Invert= 707.69', Outlet Invert= 706.42'



Reach 41R: DB-45



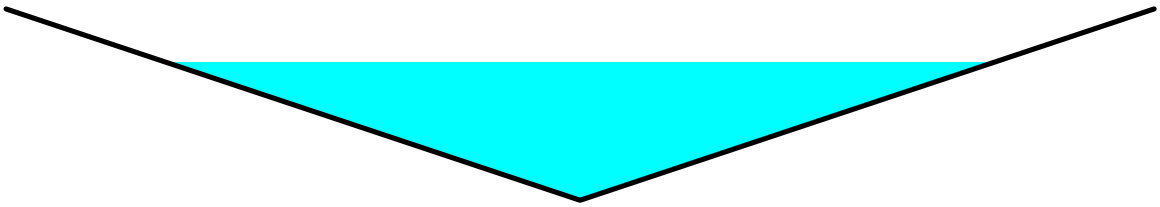
Summary for Reach 44R: E-MCI Ditch

Inflow Area = 17.668 ac, 0.00% Impervious, Inflow Depth = 3.00" for 100-yr, 24-hr event
Inflow = 54.49 cfs @ 12.32 hrs, Volume= 4.414 af
Outflow = 54.27 cfs @ 12.35 hrs, Volume= 4.414 af, Atten= 0%, Lag= 1.9 min

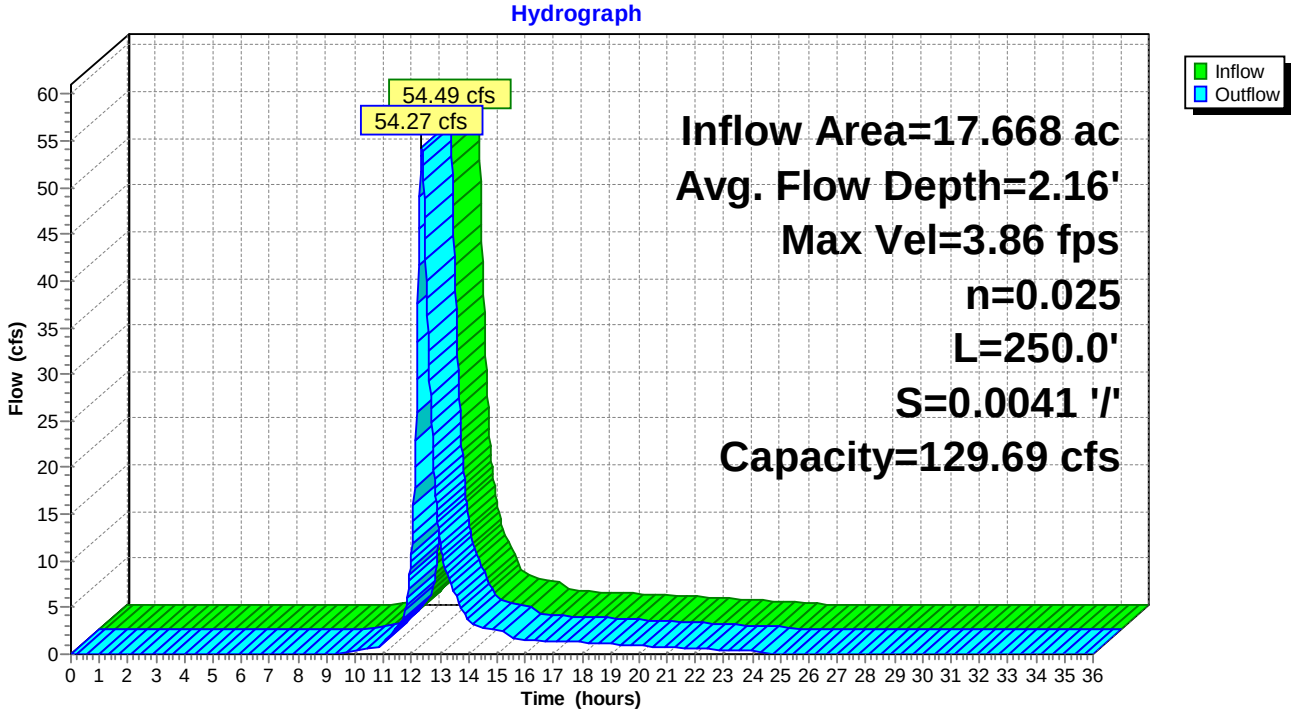
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.86 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.41 fps, Avg. Travel Time= 3.0 min

Peak Storage= 3,513 cf @ 12.33 hrs
Average Depth at Peak Storage= 2.16' , Surface Width= 12.99'
Bank-Full Depth= 3.00' Flow Area= 27.0 sf, Capacity= 129.69 cfs

0.00' x 3.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 18.00'
Length= 250.0' Slope= 0.0041 '/'
Inlet Invert= 702.00', Outlet Invert= 700.98'



Reach 44R: E-MCI Ditch



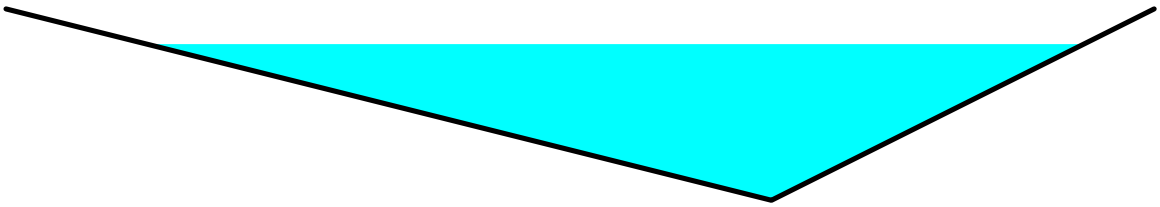
Summary for Reach 49R: DB-36

Inflow Area = 18.696 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 108.34 cfs @ 12.16 hrs, Volume= 5.267 af
Outflow = 101.78 cfs @ 12.23 hrs, Volume= 5.267 af, Atten= 6%, Lag= 3.9 min

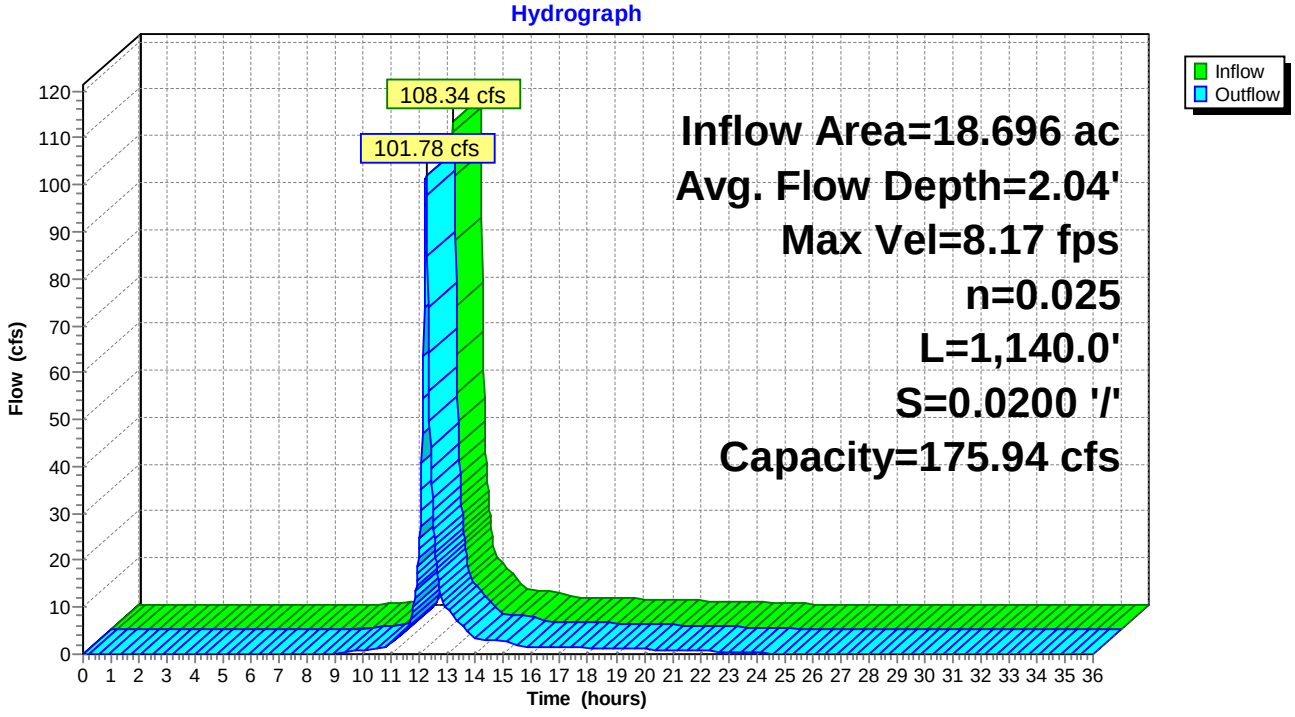
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 8.17 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 2.44 fps, Avg. Travel Time= 7.8 min

Peak Storage= 14,197 cf @ 12.19 hrs
Average Depth at Peak Storage= 2.04' , Surface Width= 12.22'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 175.94 cfs

0.00' x 2.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 2.0 '/' Top Width= 15.00'
Length= 1,140.0' Slope= 0.0200 '/'
Inlet Invert= 780.00', Outlet Invert= 757.20'



Reach 49R: DB-36



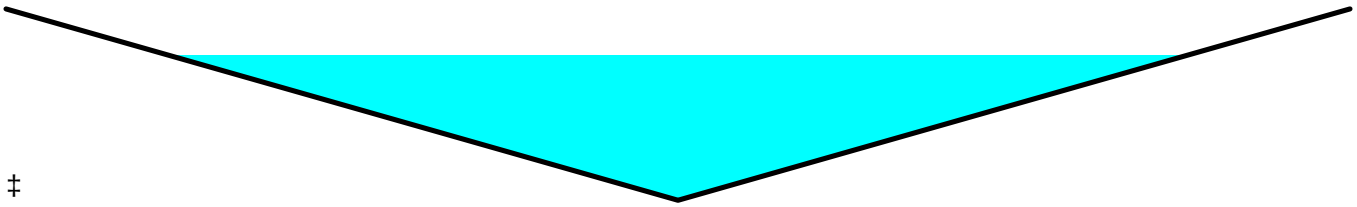
Summary for Reach 54R: MCVI-S Ditch

Inflow Area = 14.538 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 87.40 cfs @ 12.15 hrs, Volume= 4.095 af
Outflow = 85.74 cfs @ 12.17 hrs, Volume= 4.095 af, Atten= 2%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 9.43 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 3.02 fps, Avg. Travel Time= 2.0 min

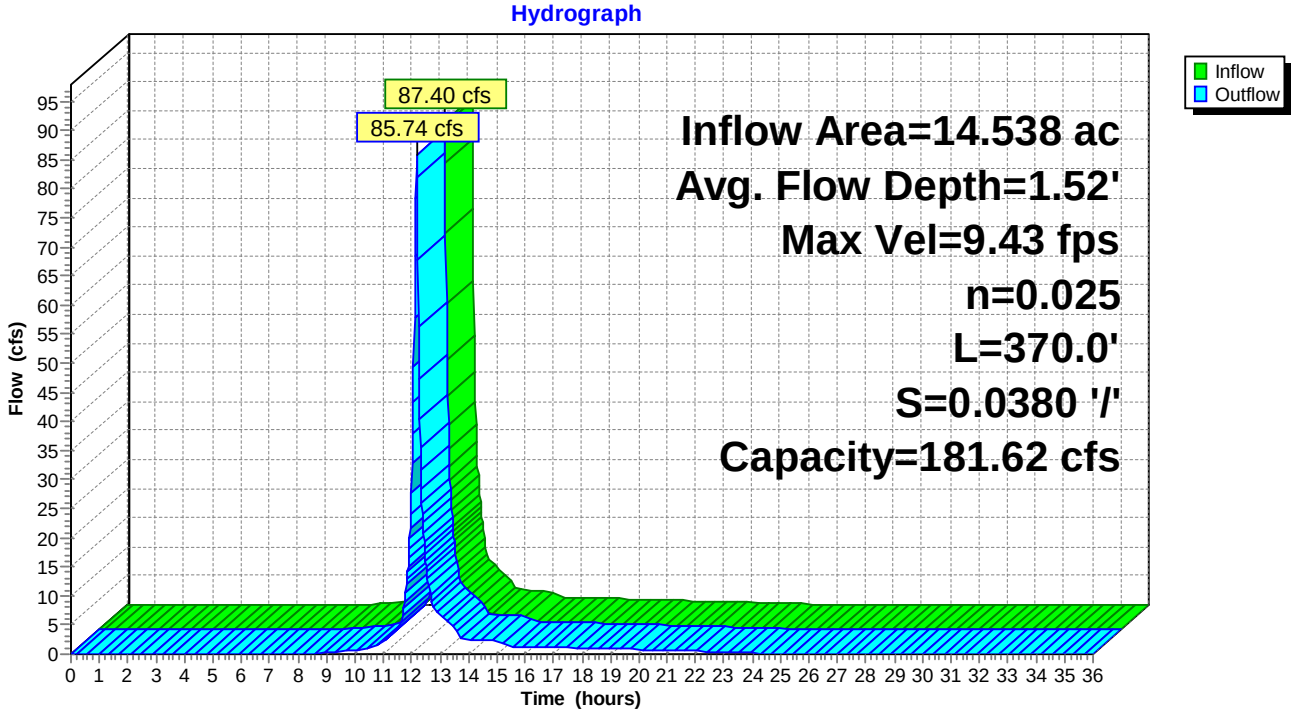
Peak Storage= 3,399 cf @ 12.16 hrs
Average Depth at Peak Storage= 1.52' , Surface Width= 12.12'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 181.62 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 370.0' Slope= 0.0380 '/'
Inlet Invert= 794.05', Outlet Invert= 780.00'



‡

Reach 54R: MCVI-S Ditch



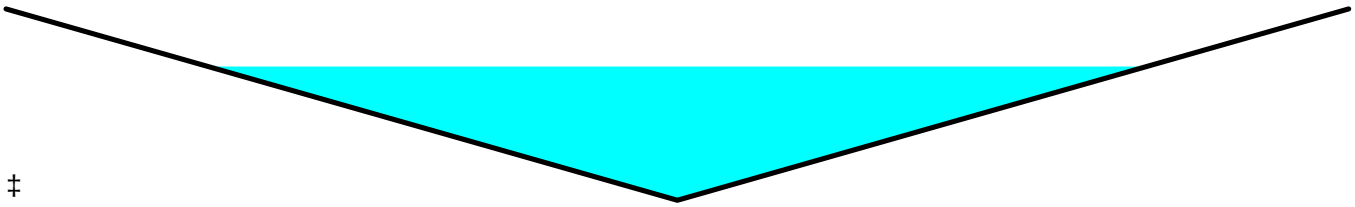
Summary for Reach 55R: MCVI-N Ditch

Inflow Area = 14.538 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 89.31 cfs @ 12.13 hrs, Volume= 4.095 af
Outflow = 87.40 cfs @ 12.15 hrs, Volume= 4.095 af, Atten= 2%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.84 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.55 fps, Avg. Travel Time= 2.9 min

Peak Storage= 4,827 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.70' , Surface Width= 52.20'
Bank-Full Depth= 1.00' Flow Area= 37.4 sf, Capacity= 230.14 cfs

0.00' x 1.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 37.4 '/' Top Width= 74.80'
Length= 265.0' Slope= 0.0270 '/'
Inlet Invert= 801.21', Outlet Invert= 794.05'



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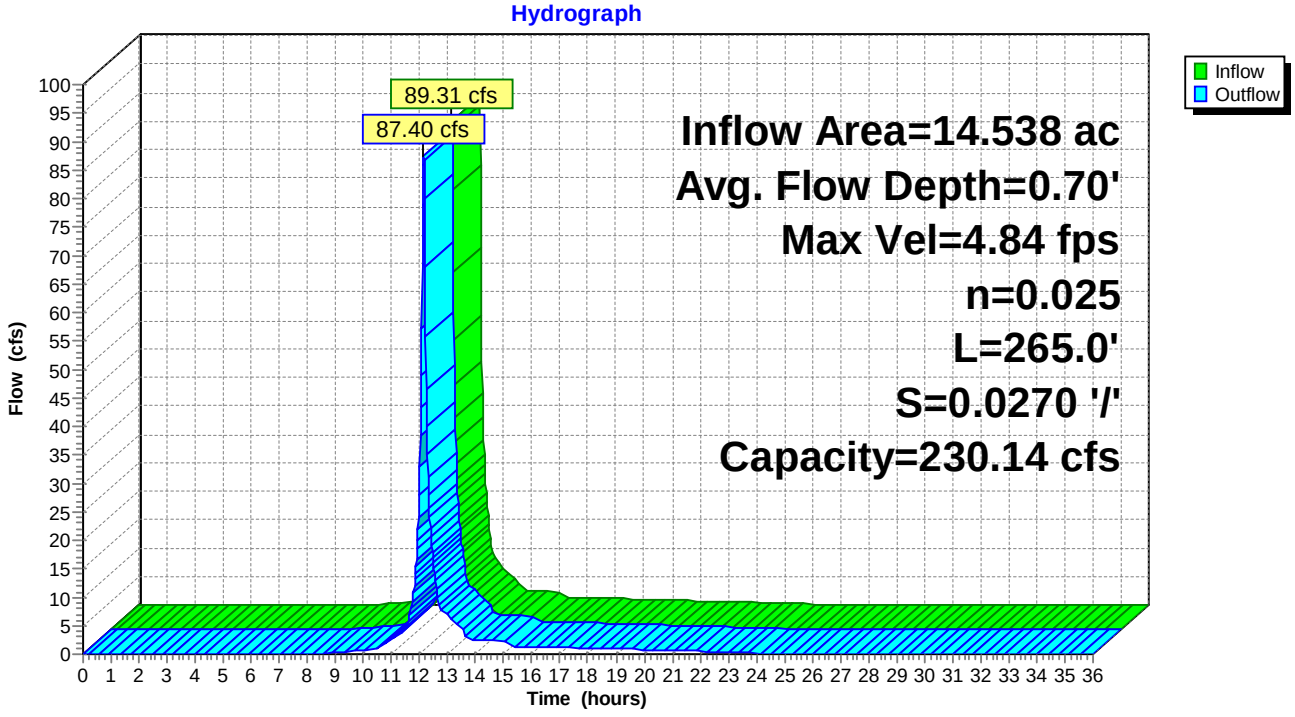
Reach 55R: MCVI-N Ditch



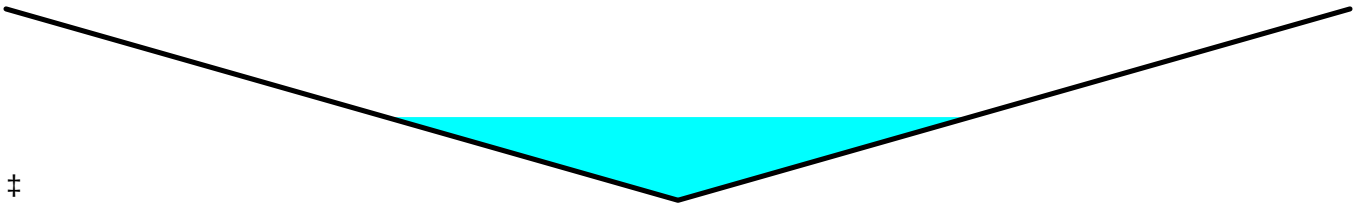
Summary for Reach 57R: DS-5

Inflow Area = 7.709 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 51.61 cfs @ 12.11 hrs, Volume= 2.172 af
Outflow = 50.45 cfs @ 12.12 hrs, Volume= 2.172 af, Atten= 2%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 11.95 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.94 fps, Avg. Travel Time= 1.3 min

Peak Storage= 1,300 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.87' , Surface Width= 9.88'
Bank-Full Depth= 2.00' Flow Area= 22.8 sf, Capacity= 476.49 cfs

0.00' x 2.00' deep channel, n= 0.029
Side Slope Z-value= 5.7 '/' Top Width= 22.80'
Length= 304.0' Slope= 0.1697 '/'
Inlet Invert= 854.00', Outlet Invert= 802.40'



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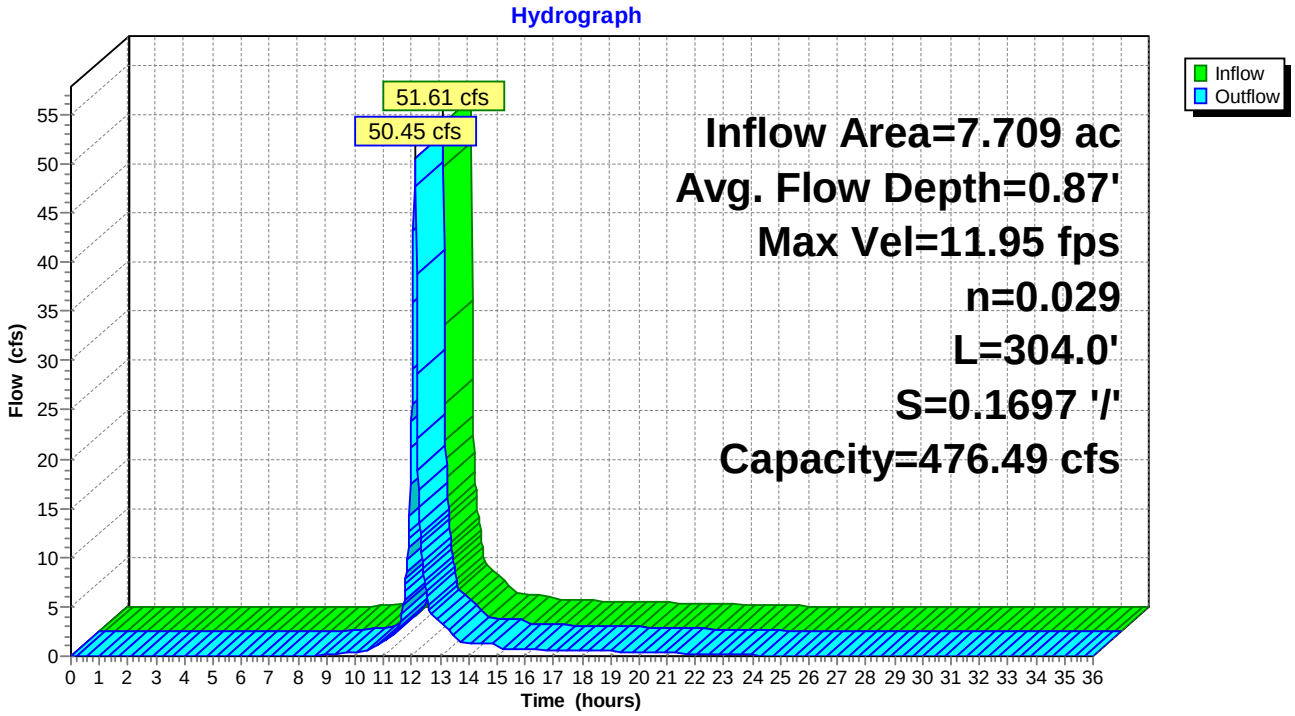
Reach 57R: DS-5



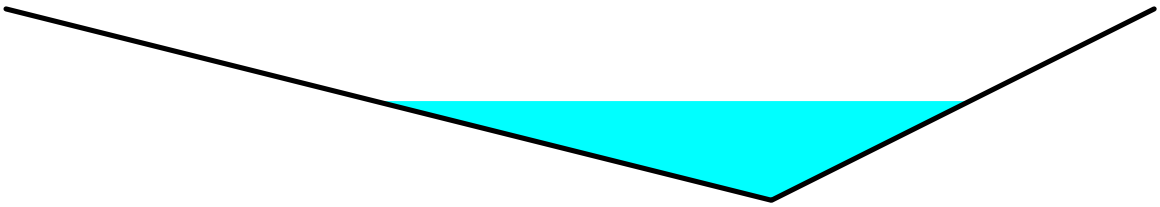
Summary for Reach 59R: DB-42

Inflow Area = 1.986 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 13.15 cfs @ 12.11 hrs, Volume= 0.559 af
Outflow = 11.88 cfs @ 12.18 hrs, Volume= 0.559 af, Atten= 10%, Lag= 3.9 min

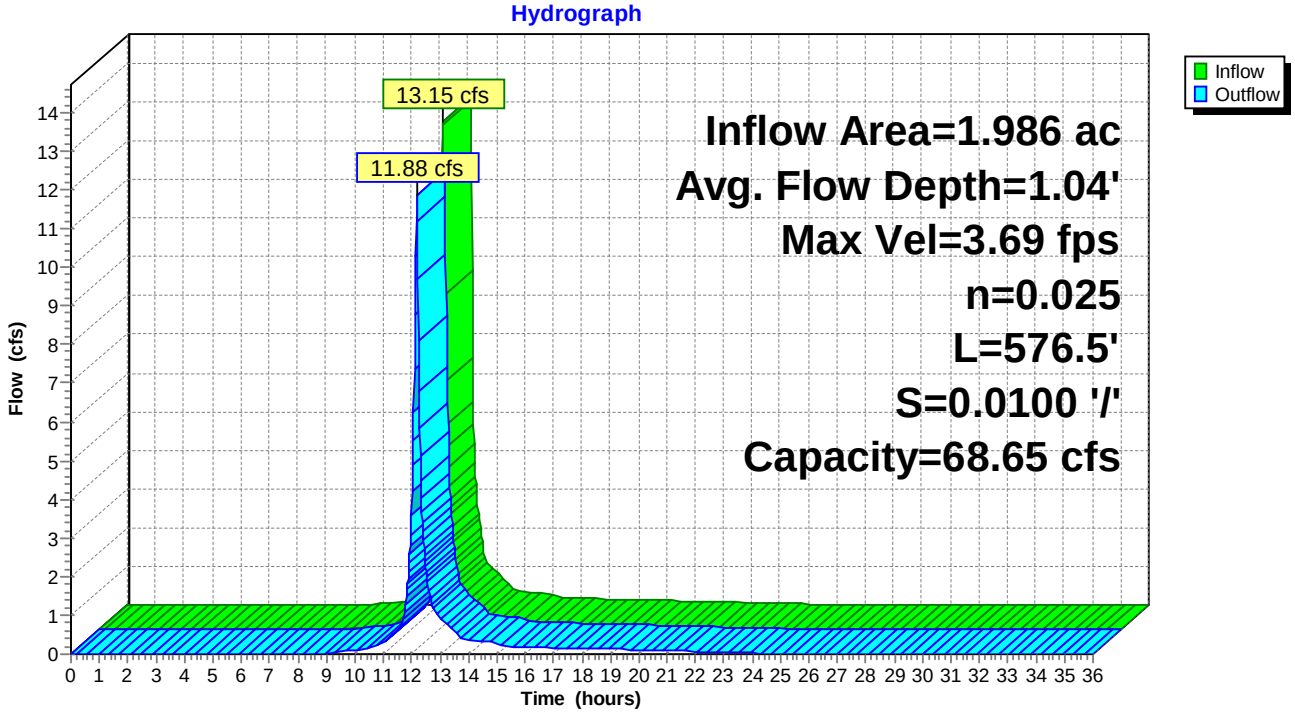
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.69 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 1.14 fps, Avg. Travel Time= 8.4 min

Peak Storage= 1,866 cf @ 12.14 hrs
Average Depth at Peak Storage= 1.04' , Surface Width= 6.23'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.65 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 576.5' Slope= 0.0100 '/'
Inlet Invert= 718.00', Outlet Invert= 712.23'



Reach 59R: DB-42



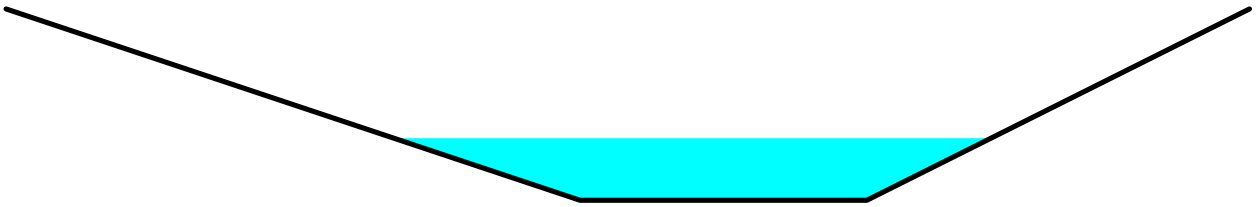
Summary for Reach 60R: W-MC X Ditch

Inflow Area = 13.776 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 34.54 cfs @ 12.26 hrs, Volume= 3.881 af
Outflow = 32.84 cfs @ 12.38 hrs, Volume= 3.881 af, Atten= 5%, Lag= 7.4 min

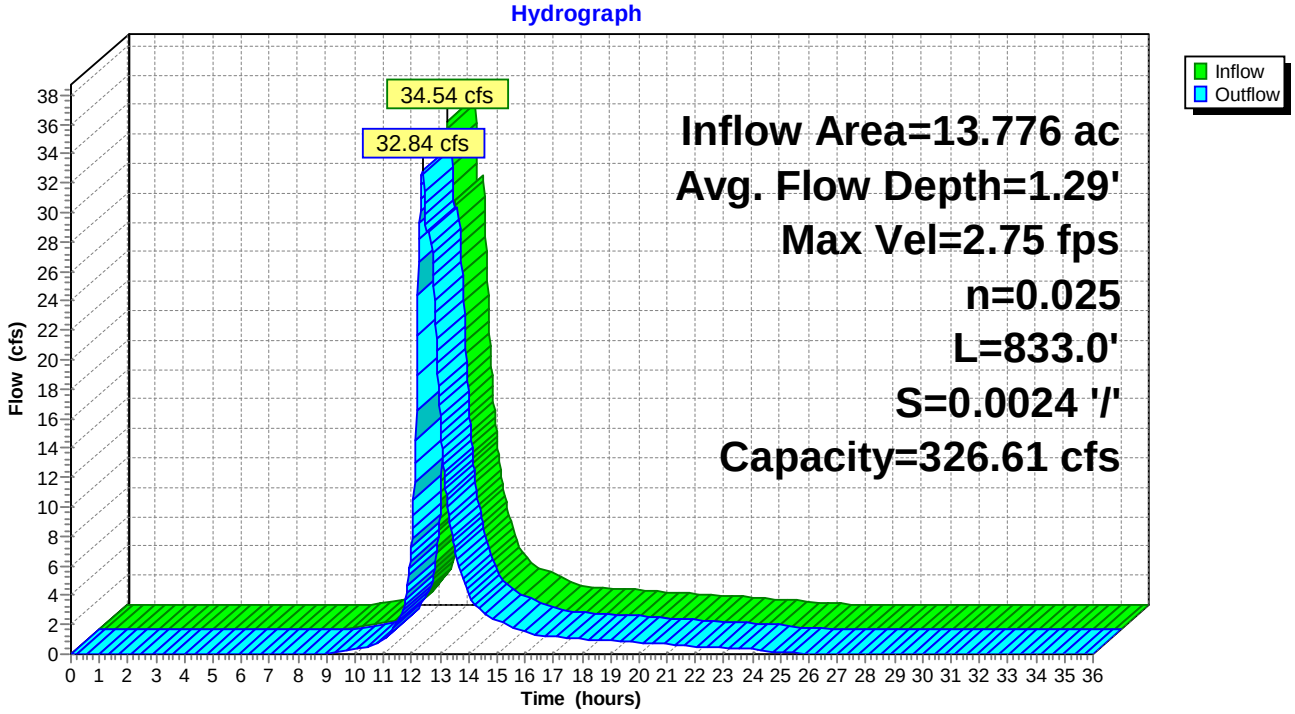
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.75 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 19.8 min

Peak Storage= 9,941 cf @ 12.30 hrs
Average Depth at Peak Storage= 1.29' , Surface Width= 12.46'
Bank-Full Depth= 4.00' Flow Area= 64.0 sf, Capacity= 326.61 cfs

6.00' x 4.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 2.0 '/' Top Width= 26.00'
Length= 833.0' Slope= 0.0024 '/'
Inlet Invert= 691.00', Outlet Invert= 689.00'



Reach 60R: W-MC X Ditch



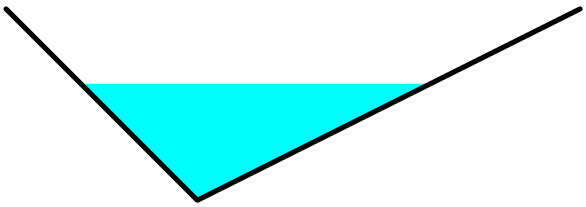
Summary for Reach 64R: S MC X Ditch

Inflow Area = 10.530 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 34.39 cfs @ 12.13 hrs, Volume= 2.966 af
Outflow = 27.51 cfs @ 12.28 hrs, Volume= 2.966 af, Atten= 20%, Lag= 8.9 min

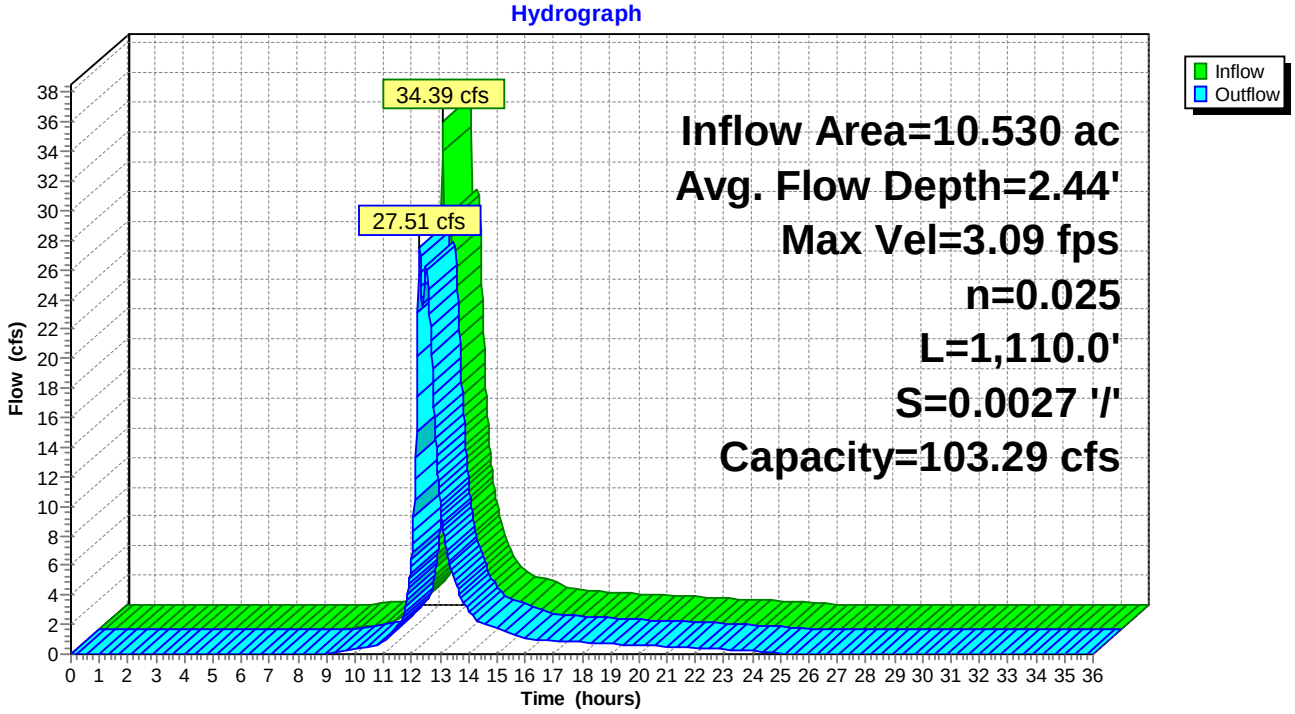
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.09 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 0.90 fps, Avg. Travel Time= 20.5 min

Peak Storage= 9,877 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.44' , Surface Width= 7.31'
Bank-Full Depth= 4.00' Flow Area= 24.0 sf, Capacity= 103.29 cfs

0.00' x 4.00' deep channel, n= 0.025
Side Slope Z-value= 1.0 2.0 '/' Top Width= 12.00'
Length= 1,110.0' Slope= 0.0027 '/'
Inlet Invert= 694.00', Outlet Invert= 691.00'



Reach 64R: S MC X Ditch



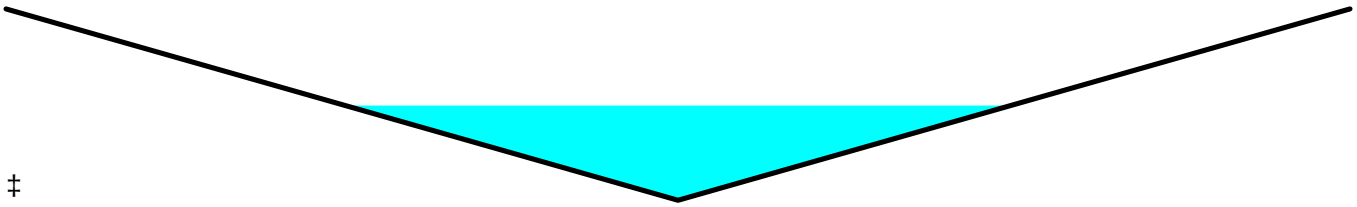
Summary for Reach 66R: E-MC X Ditch

Inflow Area = 5.820 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 37.89 cfs @ 12.12 hrs, Volume= 1.639 af
Outflow = 22.01 cfs @ 12.39 hrs, Volume= 1.639 af, Atten= 42%, Lag= 16.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.01 fps, Min. Travel Time= 12.4 min
Avg. Velocity = 0.54 fps, Avg. Travel Time= 46.6 min

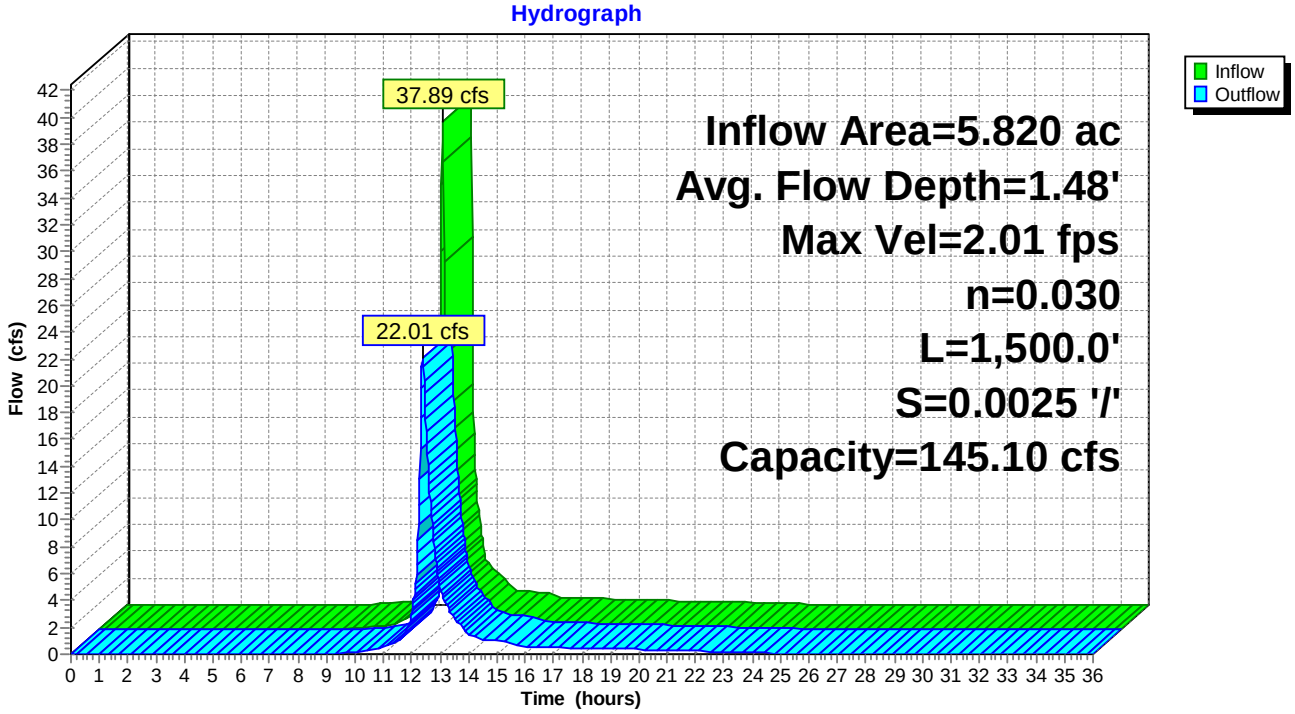
Peak Storage= 16,442 cf @ 12.18 hrs
Average Depth at Peak Storage= 1.48' , Surface Width= 14.81'
Bank-Full Depth= 3.00' Flow Area= 45.0 sf, Capacity= 145.10 cfs

0.00' x 3.00' deep channel, n= 0.030 Stream, clean & straight
Side Slope Z-value= 5.0 '/' Top Width= 30.00'
Length= 1,500.0' Slope= 0.0025 '/'
Inlet Invert= 697.80', Outlet Invert= 694.00'



‡

Reach 66R: E-MC X Ditch



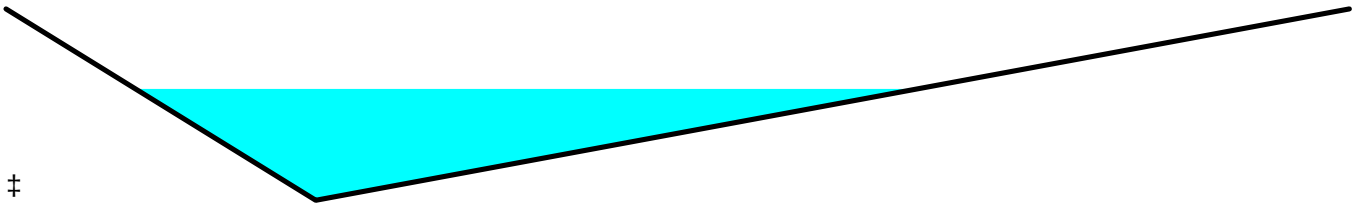
Summary for Reach 71R: DB-46

Inflow Area = 10.457 ac, 0.00% Impervious, Inflow Depth = 3.00" for 100-yr, 24-hr event
Inflow = 35.98 cfs @ 12.28 hrs, Volume= 2.612 af
Outflow = 35.82 cfs @ 12.31 hrs, Volume= 2.612 af, Atten= 0%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.09 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.52 fps, Avg. Travel Time= 2.2 min

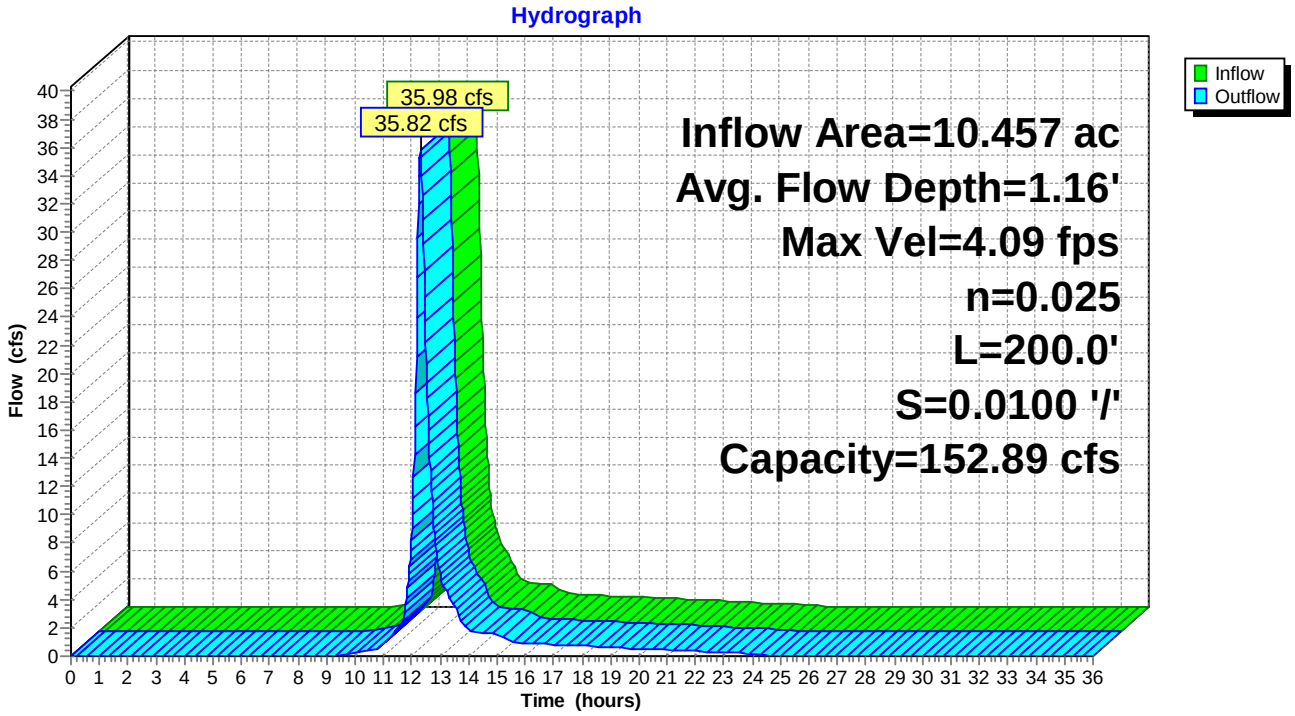
Peak Storage= 1,753 cf @ 12.29 hrs
Average Depth at Peak Storage= 1.16' , Surface Width= 15.10'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 152.89 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 10.0 '/' Top Width= 26.00'
Length= 200.0' Slope= 0.0100 '/'
Inlet Invert= 703.00', Outlet Invert= 701.00'



‡

Reach 71R: DB-46



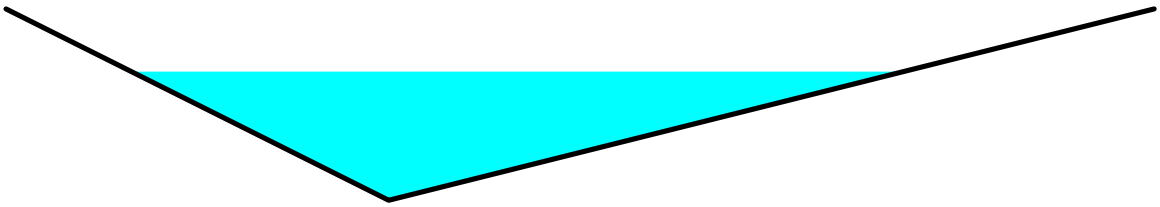
Summary for Reach 72R: DB-37

Inflow Area = 9.042 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 34.24 cfs @ 12.29 hrs, Volume= 2.547 af
Outflow = 33.66 cfs @ 12.35 hrs, Volume= 2.547 af, Atten= 2%, Lag= 3.8 min

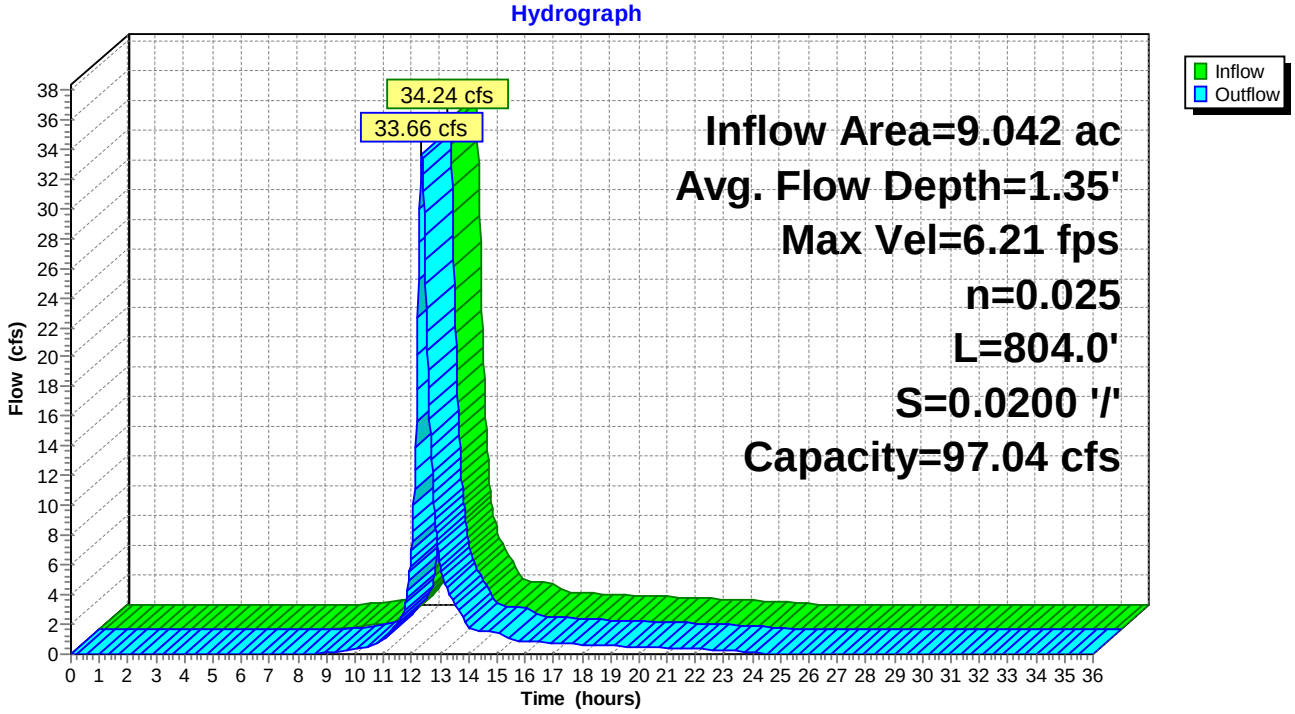
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 6.21 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 2.12 fps, Avg. Travel Time= 6.3 min

Peak Storage= 4,365 cf @ 12.32 hrs
Average Depth at Peak Storage= 1.35' , Surface Width= 8.07'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 97.04 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 4.0 '/' Top Width= 12.00'
Length= 804.0' Slope= 0.0200 '/'
Inlet Invert= 776.08', Outlet Invert= 760.00'



Reach 72R: DB-37

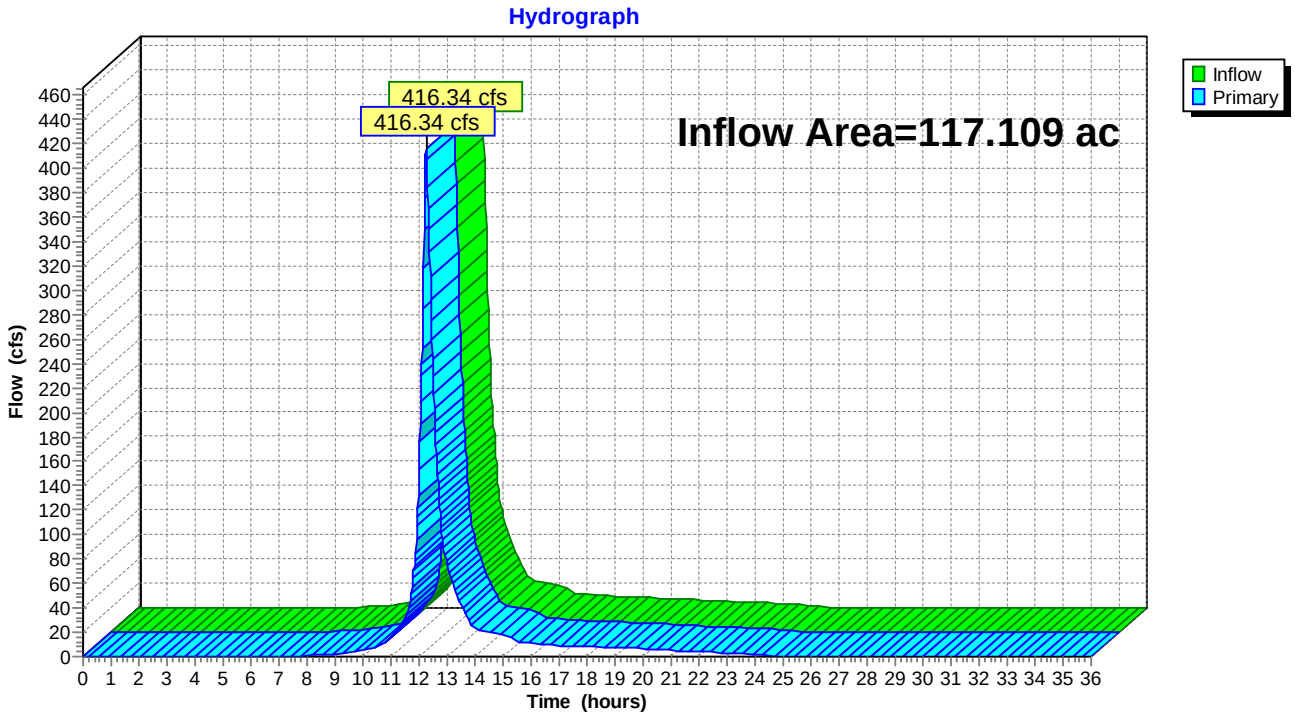


Summary for Pond 63P: SSB

Inflow Area = 117.109 ac, 8.73% Impervious, Inflow Depth = 3.45" for 100-yr, 24-hr event
Inflow = 416.34 cfs @ 12.26 hrs, Volume= 33.625 af
Primary = 416.34 cfs @ 12.26 hrs, Volume= 33.625 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

Pond 63P: SSB

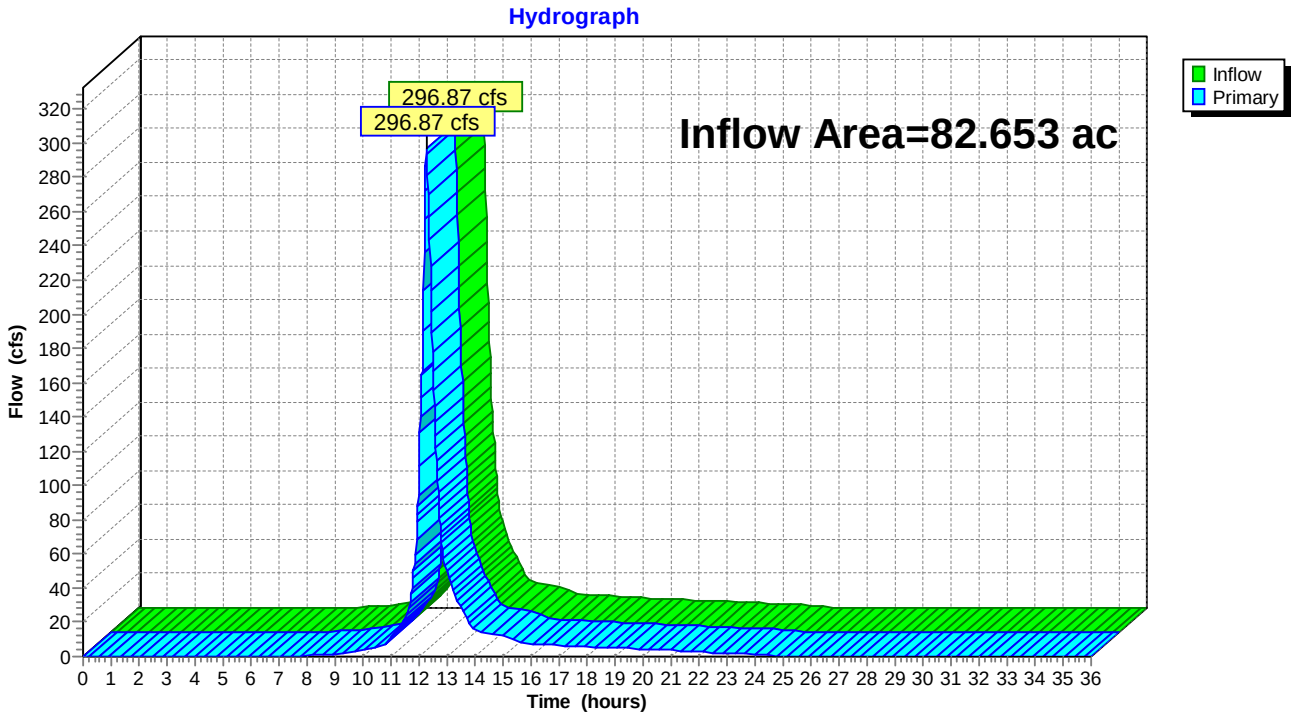


Summary for Pond 69P: Storm Sewer - See SWMM Model

Inflow Area = 82.653 ac, 6.59% Impervious, Inflow Depth = 3.40" for 100-yr, 24-hr event
Inflow = 296.87 cfs @ 12.28 hrs, Volume= 23.402 af
Primary = 296.87 cfs @ 12.28 hrs, Volume= 23.402 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

Pond 69P: Storm Sewer - See SWMM Model



Summary for Pond 70P: SSB Inlet Culvert

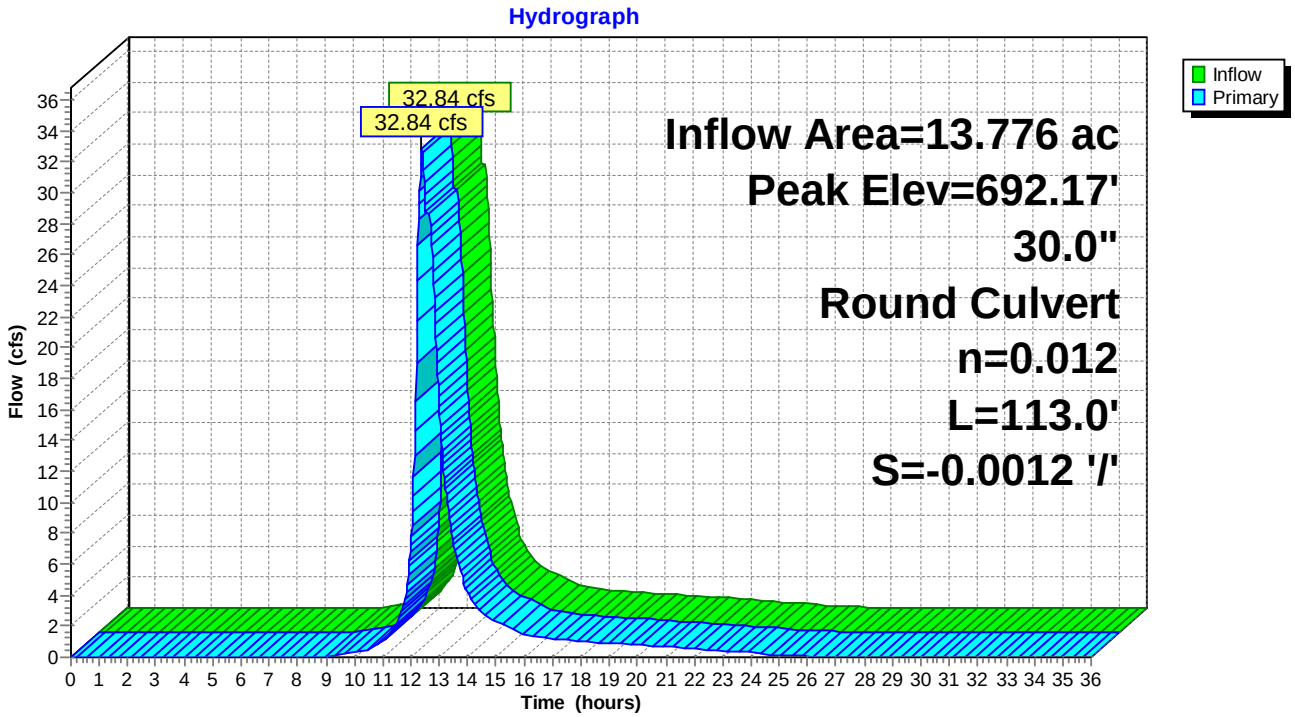
Inflow Area = 13.776 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 32.84 cfs @ 12.38 hrs, Volume= 3.881 af
Outflow = 32.84 cfs @ 12.38 hrs, Volume= 3.881 af, Atten= 0%, Lag= 0.0 min
Primary = 32.84 cfs @ 12.38 hrs, Volume= 3.881 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 692.17' @ 12.38 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	688.14'	**30.0" Round Culvert** L= 113.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 688.01' / 688.14' S= -0.0012 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf

Primary OutFlow Max=32.80 cfs @ 12.38 hrs HW=692.17' (Free Discharge)
1=Culvert (Barrel Controls 32.80 cfs @ 6.68 fps)

Pond 70P: SSB Inlet Culvert



Summary for Pond 71P: E-MCI Culvert

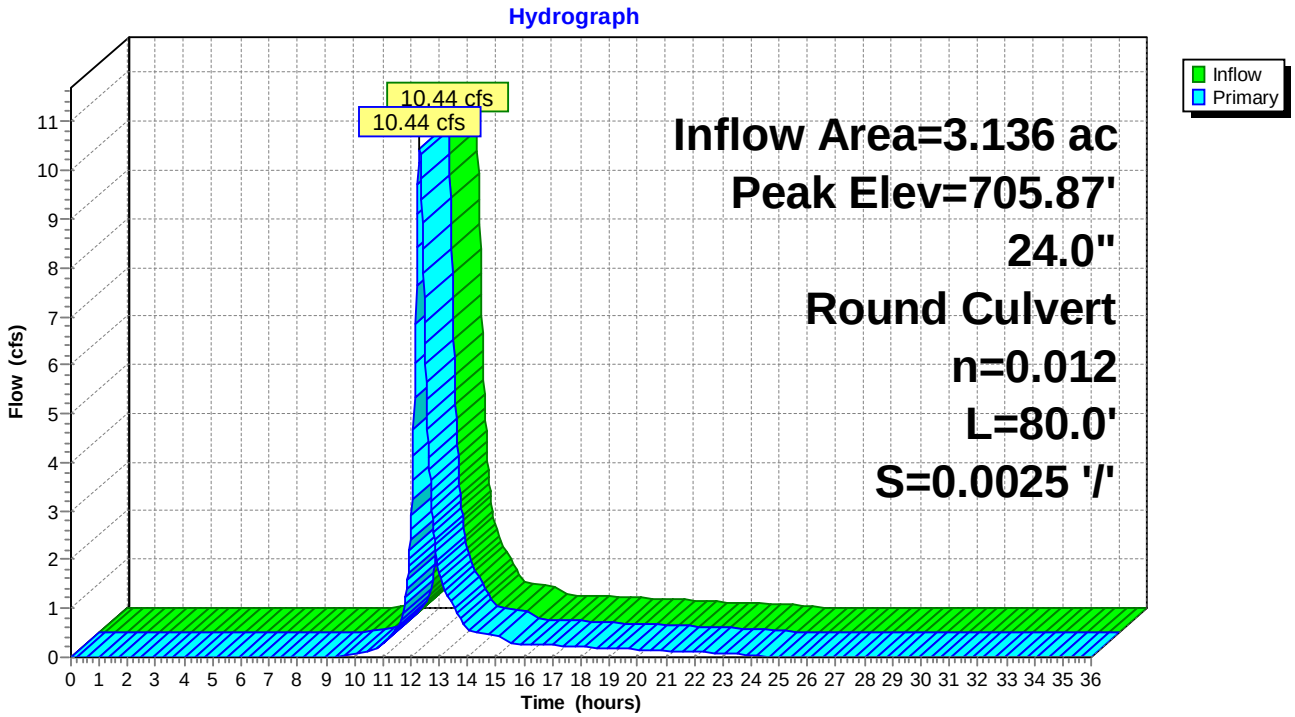
Inflow Area = 3.136 ac, 0.00% Impervious, Inflow Depth = 3.00" for 100-yr, 24-hr event
Inflow = 10.44 cfs @ 12.30 hrs, Volume= 0.783 af
Outflow = 10.44 cfs @ 12.30 hrs, Volume= 0.783 af, Atten= 0%, Lag= 0.0 min
Primary = 10.44 cfs @ 12.30 hrs, Volume= 0.783 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 705.87' @ 12.30 hrs

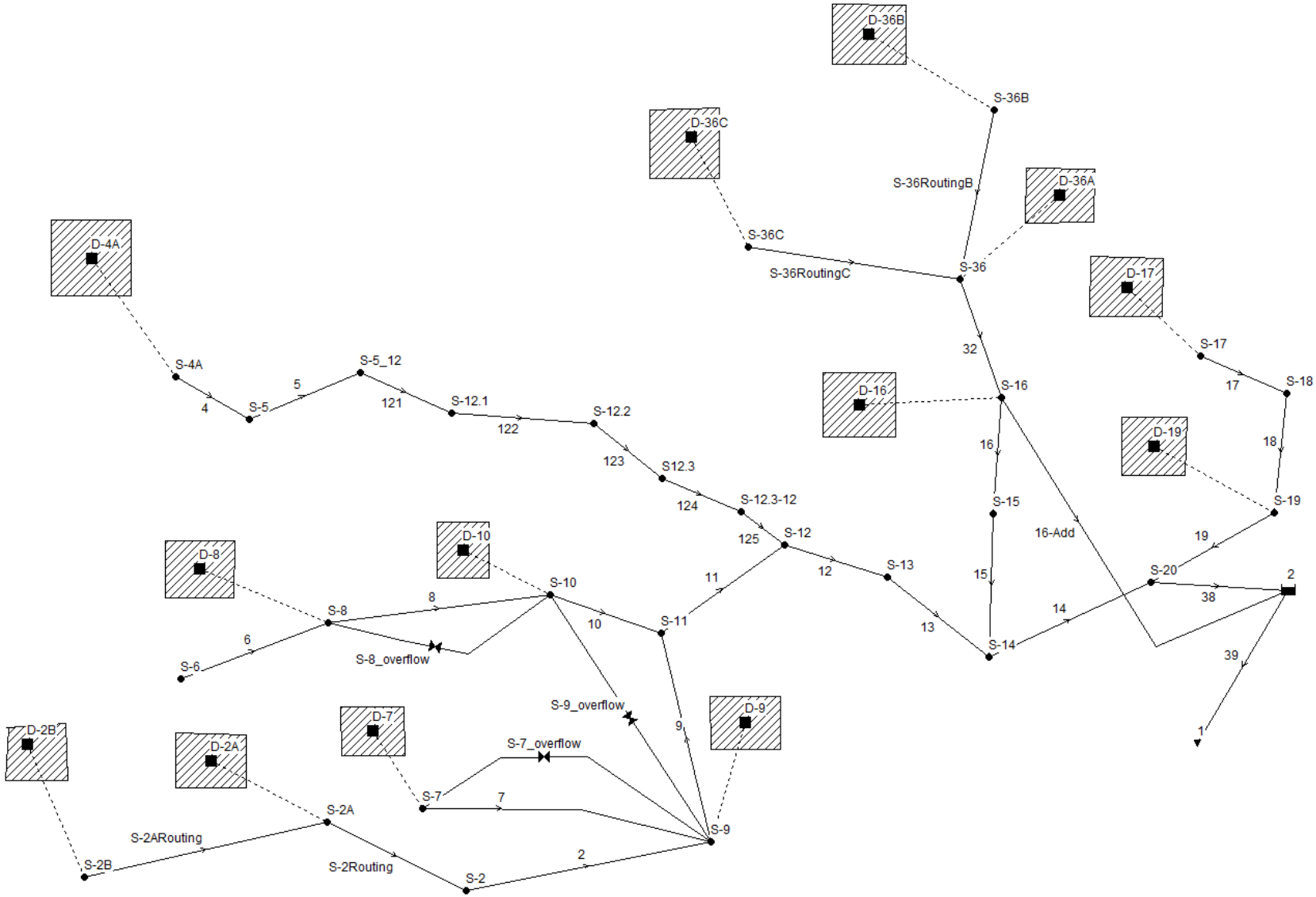
Device	Routing	Invert	Outlet Devices
#1	Primary	703.00'	**24.0" Round Culvert** L= 80.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 703.00' / 702.80' S= 0.0025 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=10.44 cfs @ 12.30 hrs HW=705.86' TW=705.10' (Fixed TW Elev= 705.10')
1=Culvert (Inlet Controls 10.44 cfs @ 3.32 fps)

Pond 71P: E-MCI Culvert



South Sedimentation Basin (SSB) SWMM OUTPUT – 25-yr, 24-hr


D-36B
S-36B
D-36C
S-36RoutingB
D-36A
S-36C
S-36RoutingC
S-36
D-4A
D-17
S-4A
S-17
S-18
5
17
S-5_12
32
S-16
D-16
4
S-5
121
S-12.1
122
S-12.2
16
D-19
18
123
S12.3
S-15
124
S-12.3-12
S-19
125
S-12
16-Add
19
D-8
D-10
12
S-13
S-20
2
S-10
11
15
8
38
S-8
14
10
S-11
13
6
S-14
S-6
S-8_overflow
39
S-9_overflow
D-9
D-7
9
D-2B
D-2A
S-7_overflow
S-7
7
S-2A
S-9
1
S-2ARouting
S-2B
S-2Routing
2
S-2

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

WARNING 02: maximum depth increased for Node S-7
WARNING 02: maximum depth increased for Node S-8
WARNING 02: maximum depth increased for Node S-9
WARNING 02: maximum depth increased for Node S-36
WARNING 02: maximum depth increased for Node S-5_12
WARNING 02: maximum depth increased for Node S-36B

****
Element Count
****

Number of rain gages 2
Number of subcatchments ... 13
Number of nodes 30
Number of links 33
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
TS1	MSE3-100yr,24hr	INTENSITY	6 min.
MSE3	MSE-25yr,24hr	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
D-16	6.00	670.00	0.00	5.0000	MSE3	S-16
D-10	0.51	17.00	100.00	2.6000	MSE3	S-10
D-17	2.11	1200.00	0.00	5.8100	MSE3	S-17
D-19	0.38	600.00	0.00	1.5000	MSE3	S-19
D-2A	6.80	1050.00	0.00	5.0000	MSE3	S-2A
D-4A	3.20	940.00	0.00	15.0000	MSE3	S-4A
D-7	1.09	40.00	100.00	2.0000	MSE3	S-7
D-8	0.51	115.00	100.00	0.0700	MSE3	S-8
D-9	0.32	13.00	100.00	1.6000	MSE3	S-9

D-36B	24.90	1280.00	0.00	25.0000	MSE3	S-36B
D-36A	10.90	960.00	0.00	5.0000	MSE3	S-36
D-36C	16.30	1150.00	0.00	25.0000	MSE3	S-36C
D-2B	10.90	1340.00	0.00	4.1000	MSE3	S-2B

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
S-2	JUNCTION	686.25	16.20	100.0	
S-4A	JUNCTION	693.34	15.00	0.0	
S-5	JUNCTION	692.01	7.50	0.0	
S-6	JUNCTION	695.71	3.20	0.0	
S-7	JUNCTION	694.09	5.45	0.0	
S-8	JUNCTION	694.73	5.00	0.0	
S-9	JUNCTION	684.57	14.00	660.0	
S-10	JUNCTION	691.90	4.80	2100.0	
S-11	JUNCTION	685.67	15.65	0.0	
S-12	JUNCTION	686.18	16.25	0.0	
S-13	JUNCTION	685.57	15.90	0.0	
S-14	JUNCTION	685.88	16.34	0.0	
S-15	JUNCTION	687.52	14.09	0.0	
S-16	JUNCTION	697.26	10.74	100.0	
S-17	JUNCTION	695.46	4.70	0.0	
S-18	JUNCTION	694.60	5.40	0.0	
S-19	JUNCTION	690.98	9.26	0.0	
S-20	JUNCTION	685.98	10.00	0.0	
S-36	JUNCTION	709.00	22.50	0.0	
S-5_12	JUNCTION	691.07	4.50	0.0	
S-12.1	JUNCTION	688.83	16.84	0.0	
S-12.2	JUNCTION	688.47	17.98	0.0	
S12.3	JUNCTION	688.30	14.93	0.0	
S-12.3-12	JUNCTION	686.56	4.00	0.0	
S-36C	JUNCTION	777.60	2.00	0.0	
S-36B	JUNCTION	755.80	2.50	0.0	
S-2A	JUNCTION	700.20	3.00	0.0	
S-2B	JUNCTION	710.90	2.00	0.0	
1	OUTFALL	690.00	1.00	0.0	
2	STORAGE	671.00	25.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
2	S-2	S-9	CONDUIT	855.0	0.0211	0.0130
4	S-4A	S-5	CONDUIT	100.0	0.1800	0.0130
5	S-5	S-5_12	CONDUIT	147.0	0.6395	0.0130
6	S-6	S-8	CONDUIT	275.0	0.3564	0.0130
7	S-7	S-9	CONDUIT	163.0	2.1600	0.0130
8	S-8	S-10	CONDUIT	205.0	1.3562	0.0130
9	S-9	S-11	CONDUIT	122.0	0.2049	0.0130
10	S-10	S-11	CONDUIT	19.0	0.6842	0.0130
11	S-11	S-12	CONDUIT	107.0	-0.4766	0.0130
12	S-12	S-13	CONDUIT	165.0	0.3697	0.0130
13	S-13	S-14	CONDUIT	226.0	-0.3009	0.0130
14	S-14	S-20	CONDUIT	166.0	0.0602	0.0130
15	S-15	S-14	CONDUIT	35.0	0.7715	0.0130
16	S-16	S-15	CONDUIT	210.0	2.9775	0.0130
17	S-17	S-18	CONDUIT	49.0	0.0204	0.0130
18	S-18	S-19	CONDUIT	14.0	0.3571	0.0130
19	S-19	S-20	CONDUIT	43.0	12.5869	0.0130
32	S-36	S-16	CONDUIT	900.0	0.9712	0.0250
38	S-20	2	CONDUIT	414.0	0.0725	0.0130
39	2	1	CONDUIT	400.0	0.1250	0.0130
121	S-5_12	S-12.1	CONDUIT	350.0	0.6400	0.0130
122	S-12.1	S-12.2	CONDUIT	110.0	0.3273	0.0120
123	S-12.2	S12.3	CONDUIT	100.0	0.1700	0.0120
124	S12.3	S-12.3-12	CONDUIT	120.0	1.4502	0.0120
125	S-12.3-12	S-12	CONDUIT	26.0	1.4617	0.0130
S-36RoutingC	S-36C	S-36	CONDUIT	2430.0	2.0004	0.0250
S-36RoutingB	S-36B	S-36	CONDUIT	1340.0	2.0004	0.0250
S-2Routing	S-2A	S-2	CONDUIT	250.0	0.3000	0.0250
S-2ARouting	S-2B	S-2A	CONDUIT	1340.0	0.7985	0.0250
16-Add	S-16	2	CONDUIT	500.0	0.2520	0.0130
S-9_overflow	S-9	S-10	WEIR			
S-8_overflow	S-8	S-10	WEIR			
S-7_overflow	S-7	S-9	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
2	CIRCULAR	3.00	7.07	0.75	3.00	1	9.68
4	CIRCULAR	3.00	7.07	0.75	3.00	1	28.30
5	CIRCULAR	3.50	9.62	0.88	3.50	1	80.45
6	CIRCULAR	1.00	0.79	0.25	1.00	1	2.13
7	CIRCULAR	1.00	0.79	0.25	1.00	1	5.24
8	CIRCULAR	1.00	0.79	0.25	1.00	1	4.15
9	CIRCULAR	3.00	7.07	0.75	3.00	1	30.19
10	CIRCULAR	1.00	0.79	0.25	1.00	1	2.95
11	CIRCULAR	3.00	7.07	0.75	3.00	1	46.05
12	CIRCULAR	3.50	9.62	0.88	3.50	1	61.17
13	CIRCULAR	3.50	9.62	0.88	3.50	1	55.19
14	CIRCULAR	3.50	9.62	0.88	3.50	1	24.69
15	CIRCULAR	2.00	3.14	0.50	2.00	1	19.87
16	CIRCULAR	2.00	3.14	0.50	2.00	1	39.04
17	CIRCULAR	1.50	1.77	0.38	1.50	1	1.50
18	CIRCULAR	1.50	1.77	0.38	1.50	1	6.28
19	CIRCULAR	1.50	1.77	0.38	1.50	1	37.27
32	TRAPEZOIDAL	7.74	334.00	4.08	80.30	1	4993.90
38	CIRCULAR	3.50	9.62	0.88	3.50	1	27.08
39	CIRCULAR	1.00	0.79	0.25	1.00	1	1.26
121	CIRCULAR	4.50	15.90	1.13	4.50	1	157.32
122	CIRCULAR	3.00	7.07	0.75	3.00	1	41.34
123	CIRCULAR	3.00	7.07	0.75	3.00	1	29.79
124	CIRCULAR	4.00	12.57	1.00	4.00	1	187.39
125	CIRCULAR	3.00	7.07	0.75	3.00	1	80.64
S-36RoutingC	TRIANGULAR	2.00	14.00	0.96	14.00	1	114.66
S-36RoutingB	TRIANGULAR	2.50	17.50	1.18	14.00	1	164.02
S-2Routing	TRIANGULAR	3.00	39.00	1.46	26.00	1	163.53
S-2ARouting	TRIANGULAR	2.00	26.00	0.99	26.00	1	137.03
16-Add	CIRCULAR	2.50	4.91	0.63	2.50	1	20.59

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

```
****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 06/14/2019 00:00:00
Ending Date .............. 06/16/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:02:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.005000 ft

*********************
Control Actions Taken
*********************
```

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	27.624	3.950
Evaporation Loss	0.000	0.000
Infiltration Loss	9.146	1.308
Surface Runoff	18.166	2.598
Final Storage	0.339	0.048
Continuity Error (%)	-0.098	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	18.190	5.928
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.000	0.000
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	18.198	5.930
Continuity Error (%)	-0.040	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

Link 125 (1)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	1.00 sec
Maximum Time Step	:	1.00 sec
Percent in Steady State	:	0.21
Average Iterations per Step	:	2.01
Percent Not Converging	:	0.11
Time Step Frequencies	:	
1.000 - 0.871 sec	:	99.78 %
0.871 - 0.758 sec	:	0.16 %
0.758 - 0.660 sec	:	0.01 %
0.660 - 0.574 sec	:	0.02 %
0.574 - 0.500 sec	:	0.03 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
D-16	3.95	0.00	0.00	1.29	0.00	2.61	2.61	0.43	19.55	0.661
D-10	3.95	0.00	0.00	0.00	3.96	0.00	3.96	0.05	2.88	1.003
D-17	3.95	0.00	0.00	1.29	0.00	2.62	2.62	0.15	10.27	0.663
D-19	3.95	0.00	0.00	1.29	0.00	2.62	2.62	0.03	1.90	0.663
D-2A	3.95	0.00	0.00	1.54	0.00	2.36	2.36	0.44	22.06	0.599
D-4A	3.95	0.00	0.00	1.29	0.00	2.62	2.62	0.23	15.24	0.663
D-7	3.95	0.00	0.00	0.00	3.96	0.00	3.96	0.12	6.11	1.002
D-8	3.95	0.00	0.00	0.00	3.96	0.00	3.96	0.05	2.93	1.003
D-9	3.95	0.00	0.00	0.00	3.96	0.00	3.96	0.03	1.79	1.002
D-36B	3.95	0.00	0.00	1.29	0.00	2.61	2.61	1.76	82.07	0.661
D-36A	3.95	0.00	0.00	1.30	0.00	2.61	2.61	0.77	32.19	0.660
D-36C	3.95	0.00	0.00	1.29	0.00	2.61	2.61	1.16	60.11	0.661
D-2B	3.95	0.00	0.00	1.54	0.00	2.36	2.36	0.70	31.20	0.598

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Feet
S-2	JUNCTION	0.50	12.25	698.50	0	12:22	12.25
S-4A	JUNCTION	0.08	1.60	694.94	0	12:23	1.56
S-5	JUNCTION	0.07	2.92	694.93	0	12:22	2.86
S-6	JUNCTION	0.00	0.00	695.71	0	00:00	0.00
S-7	JUNCTION	0.21	3.25	697.34	0	12:13	3.11
S-8	JUNCTION	0.04	0.77	695.50	0	12:23	0.77
S-9	JUNCTION	2.06	11.20	695.77	0	12:22	11.18
S-10	JUNCTION	0.09	3.47	695.37	0	12:22	3.45
S-11	JUNCTION	0.98	9.64	695.31	0	12:23	9.63

S-12	JUNCTION	0.48	8.70	694.88	0	12:23	8.68
S-13	JUNCTION	1.05	8.94	694.51	0	12:23	8.93
S-14	JUNCTION	0.67	8.14	694.02	0	12:23	8.13
S-15	JUNCTION	0.71	8.03	695.55	0	12:23	8.03
S-16	JUNCTION	0.24	7.71	704.97	0	12:29	7.71
S-17	JUNCTION	0.63	2.39	697.85	0	12:12	2.39
S-18	JUNCTION	1.17	2.67	697.27	0	12:12	2.67
S-19	JUNCTION	0.34	1.60	692.58	0	12:22	1.59
S-20	JUNCTION	0.48	6.58	692.56	0	12:22	6.57
S-36	JUNCTION	0.11	1.69	710.69	0	12:15	1.69
S-5_12	JUNCTION	0.08	3.83	694.90	0	12:23	3.81
S-12.1	JUNCTION	0.13	8.65	697.48	0	12:14	6.05
S-12.2	JUNCTION	0.14	7.89	696.36	0	12:14	6.40
S12.3	JUNCTION	0.12	6.72	695.02	0	12:14	6.57
S-12.3-12	JUNCTION	0.29	8.32	694.88	0	12:23	8.31
S-36C	JUNCTION	0.14	1.42	779.02	0	12:15	1.42
S-36B	JUNCTION	0.18	1.85	757.65	0	12:14	1.85
S-2A	JUNCTION	0.22	1.80	702.00	0	12:19	1.80
S-2B	JUNCTION	0.11	1.09	711.99	0	12:15	1.08
1	OUTFALL	0.00	0.00	690.00	0	00:00	0.00
2	STORAGE	8.36	11.52	682.52	2	00:00	11.52

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent	
S-2	JUNCTION	0.00	38.98	0	12:19	0	1.14	0.006	
S-4A	JUNCTION	15.24	15.24	0	12:12	0.228	0.228	0.190	
S-5	JUNCTION	0.00	15.17	0	12:12	0	0.228	-0.231	
S-6	JUNCTION	0.00	0.00	0	00:00	0	0	0.000	gal
S-7	JUNCTION	6.11	6.11	0	12:12	0.117	0.117	0.311	
S-8	JUNCTION	2.93	2.93	0	12:12	0.0549	0.0549	0.005	
S-9	JUNCTION	1.79	41.31	0	12:20	0.0344	1.29	-0.011	
S-10	JUNCTION	2.88	5.73	0	12:12	0.0549	0.11	-0.044	
S-11	JUNCTION	0.00	42.66	0	12:22	0	1.4	0.040	
S-12	JUNCTION	0.00	47.19	0	12:23	0	1.74	-0.019	

S-13	JUNCTION	0.00	47.20	0	12:23	0	1.63	0.097	
S-14	JUNCTION	0.00	94.43	0	12:24	0	4.29	-0.007	
S-15	JUNCTION	0.00	49.72	0	12:38	0	2.66	0.003	
S-16	JUNCTION	19.55	161.66	0	12:15	0.426	4.12	-0.178	
S-17	JUNCTION	10.27	10.27	0	12:12	0.15	0.15	0.043	
S-18	JUNCTION	0.00	10.27	0	12:12	0	0.15	0.085	
S-19	JUNCTION	1.90	12.17	0	12:12	0.0271	0.177	0.017	
S-20	JUNCTION	0.00	97.71	0	12:23	0	4.46	-0.007	
S-36	JUNCTION	32.19	147.02	0	12:14	0.773	3.7	0.198	
S-5_12	JUNCTION	0.00	15.64	0	12:12	0	0.228	-0.126	
S-12.1	JUNCTION	0.00	12.96	0	12:10	0	0.23	-0.005	
S-12.2	JUNCTION	0.00	7.87	0	12:58	0	0.232	-0.035	
S12.3	JUNCTION	0.00	9.78	0	12:58	0	0.236	-0.059	
S-12.3-12	JUNCTION	0.00	13.11	0	12:03	0	0.348	0.025	
S-36C	JUNCTION	60.11	60.11	0	12:12	1.16	1.16	-0.011	
S-36B	JUNCTION	82.07	82.07	0	12:12	1.77	1.77	-0.006	
S-2A	JUNCTION	22.06	46.25	0	12:13	0.437	1.14	0.219	
S-2B	JUNCTION	31.20	31.20	0	12:12	0.7	0.7	-0.355	
1	OUTFALL	0.00	0.00	0	00:00	0	0	0.000	gal
2	STORAGE	0.00	145.28	0	12:24	0	5.93	0.001	

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
S-11	JUNCTION	0.50	2.543	6.007
S-12	JUNCTION	0.92	5.199	7.551
S-13	JUNCTION	1.04	5.445	6.955
S-14	JUNCTION	0.90	4.267	8.203
S-15	JUNCTION	0.67	2.537	6.063
S-17	JUNCTION	0.07	0.245	2.305
S-20	JUNCTION	0.88	3.076	3.424
S-12.1	JUNCTION	0.38	4.151	8.189
S-12.2	JUNCTION	0.70	4.890	10.090
S12.3	JUNCTION	0.55	2.720	8.210
S-12.3-12	JUNCTION	0.82	4.321	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
2	562.984	18	0	0	792.267	26	2 00:00	0.00

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
1	0.00	0.00	0.00	0.000
System	0.00	0.00	0.00	0.000

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
2	CONDUIT	37.89	0	12:21	5.36	3.92	1.00
4	CONDUIT	15.17	0	12:12	5.12	0.54	0.55
5	CONDUIT	15.64	0	12:12	6.73	0.19	0.92
6	CONDUIT	0.00	0	00:00	0.00	0.00	0.39
7	CONDUIT	5.59	0	12:12	7.55	1.07	1.00
8	CONDUIT	2.87	0	12:12	4.23	0.69	0.89
9	CONDUIT	40.67	0	12:22	5.75	1.35	1.00
10	CONDUIT	5.63	0	12:11	7.22	1.91	1.00
11	CONDUIT	42.66	0	12:22	6.03	0.93	1.00
12	CONDUIT	47.20	0	12:23	4.91	0.77	1.00
13	CONDUIT	47.20	0	12:23	4.91	0.86	1.00
14	CONDUIT	94.43	0	12:24	9.82	3.82	1.00
15	CONDUIT	49.72	0	12:38	15.83	2.50	1.00
16	CONDUIT	49.72	0	12:38	15.83	1.27	1.00
17	CONDUIT	10.27	0	12:12	6.08	6.85	0.91
18	CONDUIT	10.27	0	12:12	6.42	1.64	0.85
19	CONDUIT	12.21	0	12:12	8.03	0.33	0.91
32	CONDUIT	145.33	0	12:15	5.41	0.03	0.39
38	CONDUIT	97.71	0	12:23	10.45	3.61	0.93
39	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
121	CONDUIT	12.96	0	12:10	4.05	0.08	0.93
122	CONDUIT	7.87	0	12:58	3.53	0.19	1.00
123	CONDUIT	9.78	0	12:58	4.42	0.33	1.00
124	CONDUIT	10.67	0	12:58	2.06	0.06	1.00
125	CONDUIT	12.95	0	12:03	2.42	0.16	1.00
S-36RoutingC	CONDUIT	45.72	0	12:16	6.51	0.40	0.71
S-36RoutingB	CONDUIT	73.17	0	12:14	7.66	0.45	0.74
S-2Routing	CONDUIT	38.98	0	12:19	3.56	0.24	0.53
S-2ARouting	CONDUIT	26.93	0	12:15	2.14	0.20	0.72
16-Add	CONDUIT	48.35	0	12:29	10.01	2.35	0.95
S-9_overflow	WEIR	0.00	0	00:00			0.00
S-8_overflow	WEIR	0.00	0	00:00			0.00
S-7_overflow	WEIR	0.00	0	00:00			0.00

****
Flow Classification Summary
****

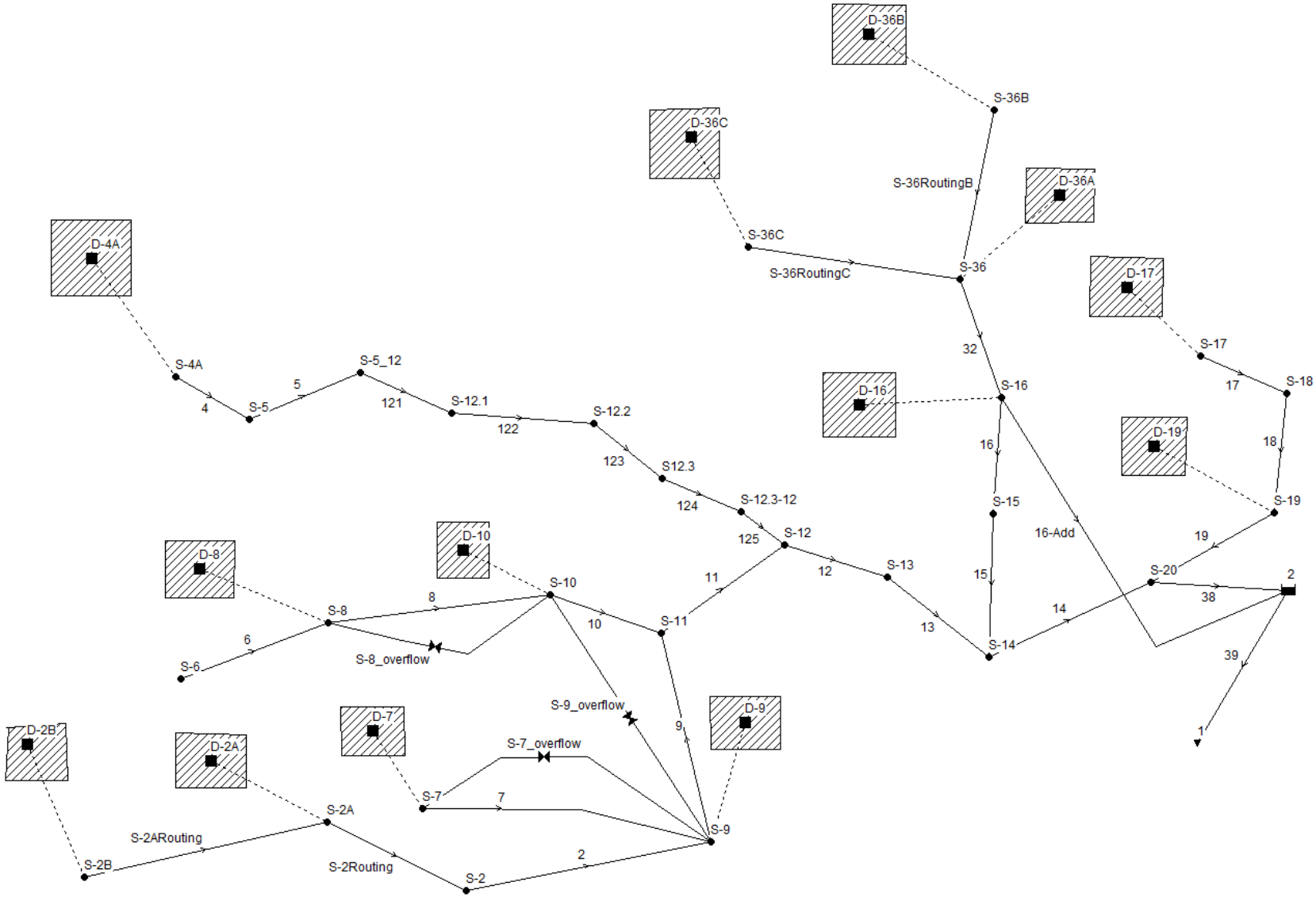
Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
2	1.00	0.04	0.04	0.00	0.91	0.00	0.00	0.00	0.47	0.00
4	1.00	0.17	0.00	0.00	0.01	0.00	0.00	0.82	0.00	0.00
5	1.00	0.17	0.00	0.00	0.52	0.31	0.00	0.00	0.30	0.00
6	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.97	0.01	0.00
8	1.00	0.00	0.00	0.00	0.02	0.11	0.00	0.87	0.12	0.00
9	1.00	0.01	0.02	0.00	0.97	0.00	0.00	0.00	0.01	0.00
10	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
11	1.00	0.01	0.04	0.00	0.96	0.00	0.00	0.00	0.00	0.00
12	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.03	0.00
13	1.00	0.04	0.03	0.00	0.38	0.00	0.55	0.00	0.00	0.00
14	1.00	0.07	0.00	0.00	0.93	0.00	0.00	0.00	0.41	0.00
15	1.00	0.18	0.00	0.00	0.02	0.00	0.00	0.80	0.00	0.00
16	1.00	0.17	0.00	0.00	0.01	0.00	0.00	0.82	0.00	0.00
17	1.00	0.18	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00
18	1.00	0.18	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00
19	1.00	0.07	0.52	0.00	0.40	0.00	0.00	0.00	0.81	0.00
32	1.00	0.17	0.00	0.00	0.02	0.00	0.00	0.81	0.02	0.00
38	1.00	0.07	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00
39	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
121	1.00	0.30	0.00	0.00	0.70	0.00	0.00	0.00	0.81	0.00
122	1.00	0.17	0.13	0.00	0.70	0.00	0.00	0.00	0.80	0.00
123	1.00	0.17	0.00	0.00	0.75	0.08	0.00	0.00	0.30	0.00
124	1.00	0.17	0.00	0.00	0.79	0.04	0.00	0.00	0.37	0.00
125	1.00	0.04	0.56	0.00	0.40	0.00	0.00	0.00	0.53	0.00
S-36RoutingC	1.00	0.17	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00
S-36RoutingB	1.00	0.17	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00
S-2Routing	1.00	0.18	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00
S-2ARouting	1.00	0.18	0.00	0.00	0.82	0.00	0.00	0.00	0.81	0.00
16-Add	1.00	0.17	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
2	1.04	1.04	1.05	0.99	0.99
5	0.01	0.01	0.16	0.01	0.01
7	0.33	0.33	0.68	0.05	0.04
8	0.01	0.01	0.53	0.01	0.01
9	1.13	1.13	1.27	0.34	0.35
10	0.49	0.54	0.50	0.18	0.08
11	1.02	1.02	1.27	0.01	0.01
12	0.92	0.92	1.04	0.01	0.01
13	0.90	0.90	1.04	0.01	0.01
14	0.88	0.92	0.88	1.49	0.88
15	0.92	0.98	0.92	1.22	0.92
16	0.82	0.82	0.84	0.84	0.82
17	0.01	0.07	0.01	0.71	0.01
18	0.01	0.01	0.01	0.13	0.01
19	0.01	0.01	2.63	0.01	0.01
38	0.01	0.88	0.01	1.42	0.01
121	0.01	0.01	0.38	0.01	0.01
122	0.63	0.63	0.70	0.01	0.01
123	0.70	0.70	0.72	0.01	0.01
124	0.55	0.55	0.82	0.01	0.01
125	0.94	0.94	1.02	0.01	0.01
16-Add	0.01	0.80	0.01	0.82	0.01

Analysis begun on: Wed Oct 6 22:13:47 2021
Analysis ended on: Wed Oct 6 22:13:53 2021
Total elapsed time: 00:00:06

South Sedimentation Basin (SSB) SWMM OUTPUT – 100-yr, 24-hr


D-36B
S-36B
D-36C
S-36RoutingB
D-36A
S-36C
S-36RoutingC
S-36
D-4A
D-17
S-4A
S-17
S-18
5
17
S-5_12
32
S-16
D-16
4
S-5
121
S-12.1
122
S-12.2
16
D-19
18
123
S12.3
S-15
124
S-12.3-12
S-19
125
S-12
16-Add
19
D-8
D-10
12
S-13
S-20
2
S-10
11
15
8
38
S-8
14
10
S-11
13
6
S-14
S-6
S-8_overflow
39
S-9_overflow
D-9
D-7
9
D-2B
D-2A
S-7_overflow
S-7
7
S-2A
S-9
1
S-2ARouting
S-2B
S-2Routing
2
S-2

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

```
WARNING 02: maximum depth increased for Node S-7
WARNING 02: maximum depth increased for Node S-8
WARNING 02: maximum depth increased for Node S-9
WARNING 02: maximum depth increased for Node S-36
WARNING 02: maximum depth increased for Node S-5_12
WARNING 02: maximum depth increased for Node S-36B
```

****
Element Count
****

```
Number of rain gages ...... 2
Number of subcatchments ... 13
Number of nodes ........... 30
Number of links ........... 33
Number of pollutants ...... 0
Number of land uses ....... 0
```

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
TS1	MSE3-100yr,24hr	INTENSITY	6 min.
MSE3	MSE3-100yr,24hr	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
D-16	6.00	670.00	0.00	5.0000	MSE3	S-16
D-10	0.51	17.00	100.00	2.6000	MSE3	S-10
D-17	2.11	1200.00	0.00	5.8100	MSE3	S-17
D-19	0.38	600.00	0.00	1.5000	MSE3	S-19
D-2A	6.80	1050.00	0.00	5.0000	MSE3	S-2A
D-4A	3.20	940.00	0.00	15.0000	MSE3	S-4A
D-7	1.09	40.00	100.00	2.0000	MSE3	S-7
D-8	0.51	115.00	100.00	0.0700	MSE3	S-8
D-9	0.32	13.00	100.00	1.6000	MSE3	S-9

D-36B	24.90	1280.00	0.00	25.0000	MSE3	S-36B
D-36A	10.90	960.00	0.00	5.0000	MSE3	S-36
D-36C	16.30	1150.00	0.00	25.0000	MSE3	S-36C
D-2B	10.90	1340.00	0.00	4.1000	MSE3	S-2B

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
S-2	JUNCTION	686.25	16.20	100.0	
S-4A	JUNCTION	693.34	15.00	0.0	
S-5	JUNCTION	692.01	7.50	0.0	
S-6	JUNCTION	695.71	3.20	0.0	
S-7	JUNCTION	694.09	5.45	0.0	
S-8	JUNCTION	694.73	5.00	0.0	
S-9	JUNCTION	684.57	14.00	660.0	
S-10	JUNCTION	691.90	4.80	2100.0	
S-11	JUNCTION	685.67	15.65	0.0	
S-12	JUNCTION	686.18	16.25	0.0	
S-13	JUNCTION	685.57	15.90	0.0	
S-14	JUNCTION	685.88	16.34	0.0	
S-15	JUNCTION	687.52	14.09	0.0	
S-16	JUNCTION	697.26	10.74	100.0	
S-17	JUNCTION	695.46	4.70	0.0	
S-18	JUNCTION	694.60	5.40	0.0	
S-19	JUNCTION	690.98	9.26	0.0	
S-20	JUNCTION	685.98	10.00	0.0	
S-36	JUNCTION	709.00	22.50	0.0	
S-5_12	JUNCTION	691.07	4.50	0.0	
S-12.1	JUNCTION	688.83	16.84	0.0	
S-12.2	JUNCTION	688.47	17.98	0.0	
S12.3	JUNCTION	688.30	14.93	0.0	
S-12.3-12	JUNCTION	686.56	4.00	0.0	
S-36C	JUNCTION	777.60	2.00	0.0	
S-36B	JUNCTION	755.80	2.50	0.0	
S-2A	JUNCTION	700.20	3.00	0.0	
S-2B	JUNCTION	710.90	2.00	0.0	
1	OUTFALL	690.00	1.00	0.0	
2	STORAGE	671.00	25.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
2	S-2	S-9	CONDUIT	855.0	0.0211	0.0130
4	S-4A	S-5	CONDUIT	100.0	0.1800	0.0130
5	S-5	S-5_12	CONDUIT	147.0	0.6395	0.0130
6	S-6	S-8	CONDUIT	275.0	0.3564	0.0130
7	S-7	S-9	CONDUIT	163.0	2.1600	0.0130
8	S-8	S-10	CONDUIT	205.0	1.3562	0.0130
9	S-9	S-11	CONDUIT	122.0	0.2049	0.0130
10	S-10	S-11	CONDUIT	19.0	0.6842	0.0130
11	S-11	S-12	CONDUIT	107.0	-0.4766	0.0130
12	S-12	S-13	CONDUIT	165.0	0.3697	0.0130
13	S-13	S-14	CONDUIT	226.0	-0.3009	0.0130
14	S-14	S-20	CONDUIT	166.0	0.0602	0.0130
15	S-15	S-14	CONDUIT	35.0	0.7715	0.0130
16	S-16	S-15	CONDUIT	210.0	2.9775	0.0130
17	S-17	S-18	CONDUIT	49.0	0.0204	0.0130
18	S-18	S-19	CONDUIT	14.0	0.3571	0.0130
19	S-19	S-20	CONDUIT	43.0	12.5869	0.0130
32	S-36	S-16	CONDUIT	900.0	0.9712	0.0250
38	S-20	2	CONDUIT	414.0	0.0725	0.0130
39	2	1	CONDUIT	400.0	0.1250	0.0130
121	S-5_12	S-12.1	CONDUIT	350.0	0.6400	0.0130
122	S-12.1	S-12.2	CONDUIT	110.0	0.3273	0.0120
123	S-12.2	S12.3	CONDUIT	100.0	0.1700	0.0120
124	S12.3	S-12.3-12	CONDUIT	120.0	1.4502	0.0120
125	S-12.3-12	S-12	CONDUIT	26.0	1.4617	0.0130
S-36RoutingC	S-36C	S-36	CONDUIT	2430.0	2.0004	0.0250
S-36RoutingB	S-36B	S-36	CONDUIT	1340.0	2.0004	0.0250
S-2Routing	S-2A	S-2	CONDUIT	250.0	0.3000	0.0250
S-2ARouting	S-2B	S-2A	CONDUIT	1340.0	0.7985	0.0250
16-Add	S-16	2	CONDUIT	500.0	0.2520	0.0130
S-9_overflow	S-9	S-10	WEIR			
S-8_overflow	S-8	S-10	WEIR			
S-7_overflow	S-7	S-9	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
2	CIRCULAR	3.00	7.07	0.75	3.00	1	9.68
4	CIRCULAR	3.00	7.07	0.75	3.00	1	28.30
5	CIRCULAR	3.50	9.62	0.88	3.50	1	80.45
6	CIRCULAR	1.00	0.79	0.25	1.00	1	2.13
7	CIRCULAR	1.00	0.79	0.25	1.00	1	5.24
8	CIRCULAR	1.00	0.79	0.25	1.00	1	4.15
9	CIRCULAR	3.00	7.07	0.75	3.00	1	30.19
10	CIRCULAR	1.00	0.79	0.25	1.00	1	2.95
11	CIRCULAR	3.00	7.07	0.75	3.00	1	46.05
12	CIRCULAR	3.50	9.62	0.88	3.50	1	61.17
13	CIRCULAR	3.50	9.62	0.88	3.50	1	55.19
14	CIRCULAR	3.50	9.62	0.88	3.50	1	24.69
15	CIRCULAR	2.00	3.14	0.50	2.00	1	19.87
16	CIRCULAR	2.00	3.14	0.50	2.00	1	39.04
17	CIRCULAR	1.50	1.77	0.38	1.50	1	1.50
18	CIRCULAR	1.50	1.77	0.38	1.50	1	6.28
19	CIRCULAR	1.50	1.77	0.38	1.50	1	37.27
32	TRAPEZOIDAL	7.74	334.00	4.08	80.30	1	4993.90
38	CIRCULAR	3.50	9.62	0.88	3.50	1	27.08
39	CIRCULAR	1.00	0.79	0.25	1.00	1	1.26
121	CIRCULAR	4.50	15.90	1.13	4.50	1	157.32
122	CIRCULAR	3.00	7.07	0.75	3.00	1	41.34
123	CIRCULAR	3.00	7.07	0.75	3.00	1	29.79
124	CIRCULAR	4.00	12.57	1.00	4.00	1	187.39
125	CIRCULAR	3.00	7.07	0.75	3.00	1	80.64
S-36RoutingC	TRIANGULAR	2.00	14.00	0.96	14.00	1	114.66
S-36RoutingB	TRIANGULAR	2.50	17.50	1.18	14.00	1	164.02
S-2Routing	TRIANGULAR	3.00	39.00	1.46	26.00	1	163.53
S-2ARouting	TRIANGULAR	2.00	26.00	0.99	26.00	1	137.03
16-Add	CIRCULAR	2.50	4.91	0.63	2.50	1	20.59

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

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****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 06/14/2019 00:00:00
Ending Date .............. 06/16/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:02:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.005000 ft


*********************
Control Actions Taken
*********************

**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......        35.806         5.120
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         9.913         1.417
Surface Runoff ...........        25.600         3.661
Final Storage ............         0.339         0.049
Continuity Error (%) .....        -0.128
```

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	25.633	8.353
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.000	0.000
Flooding Loss	0.001	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	25.639	8.355
Continuity Error (%)	-0.026	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

Link 125 (2)
Link 11 (1)

Routing Time Step Summary

Minimum Time Step	:	0.04 sec
Average Time Step	:	1.00 sec
Maximum Time Step	:	1.00 sec
Percent in Steady State	:	0.21
Average Iterations per Step	:	2.02
Percent Not Converging	:	0.18
Time Step Frequencies	:	
1.000 - 0.871 sec	:	99.53 %
0.871 - 0.758 sec	:	0.13 %
0.758 - 0.660 sec	:	0.10 %
0.660 - 0.574 sec	:	0.19 %
0.574 - 0.500 sec	:	0.05 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
D-16	5.12	0.00	0.00	1.40	0.00	3.68	3.68	0.60	29.71	0.719
D-10	5.12	0.00	0.00	0.00	5.13	0.00	5.13	0.07	3.84	1.003
D-17	5.12	0.00	0.00	1.39	0.00	3.69	3.69	0.21	14.53	0.721
D-19	5.12	0.00	0.00	1.39	0.00	3.69	3.69	0.04	2.67	0.721
D-2A	5.12	0.00	0.00	1.69	0.00	3.39	3.39	0.63	33.90	0.662
D-4A	5.12	0.00	0.00	1.39	0.00	3.69	3.69	0.32	21.69	0.721
D-7	5.12	0.00	0.00	0.00	5.13	0.00	5.13	0.15	8.16	1.003
D-8	5.12	0.00	0.00	0.00	5.13	0.00	5.13	0.07	3.90	1.003
D-9	5.12	0.00	0.00	0.00	5.13	0.00	5.13	0.04	2.39	1.003
D-36B	5.12	0.00	0.00	1.40	0.00	3.68	3.68	2.49	124.50	0.719
D-36A	5.12	0.00	0.00	1.40	0.00	3.68	3.68	1.09	49.52	0.718
D-36C	5.12	0.00	0.00	1.40	0.00	3.68	3.68	1.63	89.74	0.719
D-2B	5.12	0.00	0.00	1.69	0.00	3.38	3.38	1.00	48.82	0.661

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Feet
S-2	JUNCTION	0.67	16.13	702.38	0	12:23	16.12
S-4A	JUNCTION	0.12	9.59	702.93	0	12:12	3.78
S-5	JUNCTION	0.12	7.50	699.51	0	12:12	5.11
S-6	JUNCTION	0.02	3.20	698.91	0	12:13	2.60
S-7	JUNCTION	0.26	5.09	699.18	0	12:13	5.08
S-8	JUNCTION	0.08	3.58	698.31	0	12:19	3.58
S-9	JUNCTION	2.21	13.80	698.37	0	12:20	13.79
S-10	JUNCTION	0.14	6.08	697.98	0	12:22	6.07
S-11	JUNCTION	1.12	12.07	697.74	0	12:20	12.06
S-12	JUNCTION	0.61	11.08	697.26	0	12:13	10.92

S-13	JUNCTION	1.18	11.03	696.60	0	12:13	10.96
S-14	JUNCTION	0.80	9.88	695.76	0	12:20	9.87
S-15	JUNCTION	0.83	9.88	697.40	0	12:25	9.88
S-16	JUNCTION	0.37	10.70	707.96	0	12:33	10.70
S-17	JUNCTION	0.66	3.03	698.49	0	12:12	3.03
S-18	JUNCTION	1.21	2.97	697.57	0	12:12	2.97
S-19	JUNCTION	0.38	3.86	694.84	0	12:12	3.60
S-20	JUNCTION	0.59	7.99	693.97	0	12:14	7.94
S-36	JUNCTION	0.13	2.06	711.06	0	12:15	2.05
S-5_12	JUNCTION	0.13	10.29	701.36	0	12:12	6.04
S-12.1	JUNCTION	0.21	10.78	699.61	0	12:12	8.28
S-12.2	JUNCTION	0.23	9.56	698.03	0	12:12	8.64
S12.3	JUNCTION	0.20	9.29	697.59	0	12:13	8.80
S-12.3-12	JUNCTION	0.41	10.83	697.39	0	12:13	10.54
S-36C	JUNCTION	0.17	1.66	779.26	0	12:15	1.65
S-36B	JUNCTION	0.21	2.17	757.97	0	12:13	2.17
S-2A	JUNCTION	0.26	2.26	702.46	0	12:22	2.26
S-2B	JUNCTION	0.13	1.29	712.19	0	12:14	1.29
1	OUTFALL	0.00	0.00	690.00	0	00:00	0.00
2	STORAGE	10.30	14.12	685.12	2	00:00	14.12

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
S-2	JUNCTION	0.00	61.76	0	12:14	0	1.62	-0.274
S-4A	JUNCTION	21.69	21.69	0	12:12	0.321	0.321	0.339
S-5	JUNCTION	0.00	21.08	0	12:11	0	0.32	-0.393
S-6	JUNCTION	0.00	1.66	0	12:13	0	0.000872	0.519
S-7	JUNCTION	8.16	8.16	0	12:12	0.152	0.152	0.187
S-8	JUNCTION	3.90	3.90	0	12:12	0.0711	0.072	0.333
S-9	JUNCTION	2.39	51.03	0	12:16	0.0446	1.83	-0.011
S-10	JUNCTION	3.84	10.12	0	12:14	0.0711	0.156	-0.164
S-11	JUNCTION	0.00	52.72	0	12:29	0	1.97	0.024
S-12	JUNCTION	0.00	59.28	0	12:18	0	2.43	-0.018
S-13	JUNCTION	0.00	59.28	0	12:17	0	2.29	0.068

S-14	JUNCTION	0.00	107.61	0	12:26	0	5.84	-0.003	
S-15	JUNCTION	0.00	53.90	0	12:52	0	3.55	0.004	
S-16	JUNCTION	29.71	246.72	0	12:14	0.6	5.84	0.382	
S-17	JUNCTION	14.53	14.53	0	12:12	0.212	0.212	0.031	
S-18	JUNCTION	0.00	14.53	0	12:12	0	0.212	0.060	
S-19	JUNCTION	2.67	17.20	0	12:12	0.0381	0.25	0.012	
S-20	JUNCTION	0.00	113.19	0	12:15	0	6.09	0.003	
S-36	JUNCTION	49.52	225.18	0	12:13	1.09	5.21	-0.436	
S-5_12	JUNCTION	0.00	21.22	0	12:12	0	0.321	-0.163	
S-12.1	JUNCTION	0.00	21.50	0	12:12	0	0.323	-0.049	
S-12.2	JUNCTION	0.00	21.50	0	12:12	0	0.325	-0.032	
S12.3	JUNCTION	0.00	21.49	0	12:12	0	0.327	-0.058	
S-12.3-12	JUNCTION	0.00	21.47	0	12:12	0	0.462	-0.004	
S-36C	JUNCTION	89.74	89.74	0	12:12	1.63	1.63	-0.012	
S-36B	JUNCTION	124.50	124.50	0	12:12	2.49	2.49	-0.007	
S-2A	JUNCTION	33.90	72.73	0	12:12	0.627	1.63	0.570	
S-2B	JUNCTION	48.82	48.82	0	12:12	1	1	-0.345	
1	OUTFALL	0.00	0.00	0	00:00	0	0	0.000	gal
2	STORAGE	0.00	168.25	0	12:27	0	8.35	0.001	

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
S-4A	JUNCTION	0.43	6.594	5.406
S-5	JUNCTION	0.47	3.350	0.000
S-6	JUNCTION	0.50	2.200	0.000
S-11	JUNCTION	0.77	4.966	3.584
S-12	JUNCTION	1.35	7.584	5.166
S-13	JUNCTION	1.46	7.530	4.870
S-14	JUNCTION	1.30	6.006	6.464
S-15	JUNCTION	1.03	4.387	4.213
S-17	JUNCTION	0.15	0.882	1.668
S-20	JUNCTION	1.28	4.492	2.008
S-5_12	JUNCTION	0.51	5.787	0.000
S-12.1	JUNCTION	0.67	6.275	6.065

S-12.2	JUNCTION	1.01	6.564	8.416
S12.3	JUNCTION	0.83	5.293	5.637
S-12.3-12	JUNCTION	1.23	6.825	0.000

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Depth Feet
S-5	0.01	6.45	0 12:12	0.000	0.000
S-6	0.01	1.58	0 12:13	0.000	0.000
S-10	0.51	10.12	0 12:14	0.020	1.277

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
2	795.532	26	0	0	1116.438	37	2 00:00	0.00

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
1	0.00	0.00	0.00	0.000
System	0.00	0.00	0.00	0.000

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
2	CONDUIT	46.03	0	12:27	6.51	4.76	1.00
4	CONDUIT	21.08	0	12:11	5.64	0.74	1.00
5	CONDUIT	21.22	0	12:12	6.38	0.26	1.00
6	CONDUIT	1.66	0	12:13	2.18	0.78	1.00
7	CONDUIT	6.16	0	12:10	7.84	1.18	1.00
8	CONDUIT	2.97	0	12:09	4.34	0.72	1.00
9	CONDUIT	49.61	0	12:16	7.02	1.64	1.00
10	CONDUIT	7.38	0	12:42	9.40	2.51	1.00
11	CONDUIT	52.72	0	12:29	7.46	1.14	1.00
12	CONDUIT	59.28	0	12:17	6.16	0.97	1.00
13	CONDUIT	59.29	0	12:17	6.16	1.07	1.00
14	CONDUIT	107.61	0	12:26	11.18	4.36	1.00
15	CONDUIT	53.90	0	12:52	17.16	2.71	1.00
16	CONDUIT	53.90	0	12:52	17.16	1.38	1.00
17	CONDUIT	14.53	0	12:12	8.24	9.68	0.99
18	CONDUIT	14.53	0	12:12	8.32	2.32	0.96
19	CONDUIT	17.08	0	12:12	9.66	0.46	1.00
32	CONDUIT	221.90	0	12:15	5.34	0.04	0.59
38	CONDUIT	113.19	0	12:15	11.95	4.18	0.96
39	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
121	CONDUIT	21.50	0	12:12	3.70	0.14	1.00
122	CONDUIT	21.50	0	12:12	3.28	0.52	1.00
123	CONDUIT	21.49	0	12:12	4.13	0.72	1.00
124	CONDUIT	21.47	0	12:12	1.90	0.11	1.00
125	CONDUIT	21.69	0	12:12	3.07	0.27	1.00
S-36RoutingC	CONDUIT	69.67	0	12:15	7.23	0.61	0.83
S-36RoutingB	CONDUIT	112.05	0	12:13	8.52	0.68	0.87
S-2Routing	CONDUIT	61.76	0	12:14	3.86	0.38	0.86
S-2ARouting	CONDUIT	42.45	0	12:14	2.42	0.31	0.82
16-Add	CONDUIT	57.72	0	12:33	11.85	2.80	0.97
S-9_overflow	WEIR	1.93	0	12:20			0.60
S-8_overflow	WEIR	0.00	0	00:00			0.00

S-7_overflow WEIR 3.49 0 12:13 0.55

****
Flow Classification Summary
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Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
2	1.00	0.03	0.04	0.00	0.93	0.00	0.00	0.00	0.46	0.00
4	1.00	0.15	0.00	0.00	0.01	0.00	0.00	0.84	0.00	0.00
5	1.00	0.15	0.00	0.00	0.52	0.33	0.00	0.00	0.00	0.00
6	1.00	0.00	0.92	0.00	0.07	0.00	0.00	0.00	0.73	0.00
7	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.96	0.01	0.00
8	1.00	0.00	0.00	0.00	0.03	0.12	0.00	0.85	0.13	0.00
9	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.01	0.00
10	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
11	1.00	0.00	0.03	0.00	0.96	0.00	0.00	0.00	0.00	0.00
12	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.03	0.00
13	1.00	0.04	0.03	0.00	0.41	0.00	0.53	0.00	0.00	0.00
14	1.00	0.06	0.00	0.00	0.94	0.00	0.00	0.00	0.40	0.00
15	1.00	0.16	0.00	0.00	0.03	0.00	0.00	0.81	0.00	0.00
16	1.00	0.15	0.00	0.00	0.02	0.00	0.00	0.83	0.00	0.00
17	1.00	0.15	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00
18	1.00	0.16	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00
19	1.00	0.06	0.50	0.00	0.43	0.00	0.00	0.00	0.83	0.00
32	1.00	0.15	0.00	0.00	0.03	0.00	0.00	0.83	0.02	0.00
38	1.00	0.06	0.00	0.00	0.00	0.00	0.00	0.94	0.00	0.00
39	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
121	1.00	0.57	0.00	0.00	0.42	0.00	0.00	0.00	0.83	0.00
122	1.00	0.15	0.43	0.00	0.43	0.00	0.00	0.00	0.81	0.00
123	1.00	0.15	0.00	0.00	0.72	0.14	0.00	0.00	0.42	0.00
124	1.00	0.15	0.00	0.00	0.82	0.04	0.00	0.00	0.39	0.00
125	1.00	0.04	0.54	0.00	0.43	0.00	0.00	0.00	0.53	0.00
S-36RoutingC	1.00	0.15	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00
S-36RoutingB	1.00	0.15	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00
S-2Routing	1.00	0.16	0.00	0.00	0.01	0.00	0.00	0.83	0.00	0.00
S-2ARouting	1.00	0.16	0.00	0.00	0.84	0.00	0.00	0.00	0.83	0.00
16-Add	1.00	0.15	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
2	1.46	1.46	1.47	1.39	1.38
4	0.43	0.43	0.47	0.01	0.01
5	0.52	0.52	0.57	0.01	0.01
6	0.50	0.50	0.57	0.01	0.01
7	0.63	0.63	0.97	0.06	0.06
8	0.57	0.57	0.77	0.01	0.01
9	1.54	1.54	1.69	0.56	0.57
10	0.75	0.78	0.77	0.61	0.48
11	1.44	1.44	1.69	0.44	0.01
12	1.35	1.35	1.46	0.01	0.01
13	1.30	1.30	1.46	0.36	0.01
14	1.28	1.35	1.28	1.91	1.28
15	1.32	1.40	1.32	1.61	1.32
16	1.25	1.25	1.28	1.28	1.25
17	0.01	0.15	0.01	0.90	0.01
18	0.01	0.06	0.01	0.21	0.01
19	0.55	0.55	3.70	0.01	0.01
38	0.01	1.28	0.01	1.84	0.01
121	0.51	0.51	0.67	0.01	0.01
122	0.92	0.92	1.01	0.01	0.01
123	1.01	1.01	1.05	0.01	0.01
124	0.83	0.83	1.23	0.01	0.01
125	1.37	1.37	1.44	0.01	0.01
S-2ARouting	0.01	0.01	0.32	0.01	0.01
16-Add	0.01	1.23	0.01	1.25	0.01

Analysis begun on: Wed Oct 6 22:15:13 2021
Analysis ended on: Wed Oct 6 22:15:18 2021
Total elapsed time: 00:00:05

ATTACHMENT A-6.2

SURFACE WATER DIVERSION BERM ANALYSIS

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Diversion Berm Analysis

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Surface Water Diversion Berm Analysis

Objective

Design the diversion berms to collect and route surface water run-off from landfill slopes to downslope channels. Diversion berms are designed to a depth and slope to provide sufficient capacity and to minimize flow velocity.

Design Criteria, Assumptions, and Methodology

1. Diversion berm locations are shown on the Figure provided in Attachment A-6.1.5.
2. Diversion berms will collect and control flow from the 25-yr, 24-hr storm event with a minimum of 0.5 ft of freeboard. The berms will manage flow from the 100-yr, 24-hr storm event with no offsite flooding.
3. Diversion berms will be spaced a maximum of approximately 50 vertical feet.
4. Diversion berm slopes will typically be sloped at 2 percent, but will vary at certain locations due to site conditions.
5. Diversion berm channels will be triangular in shape.
6. Diversion berm channel sideslopes will be a maximum of 4H:1V on the landfill side and 2H:1V on the exterior of the berm. The interior-side channel slope will vary depending on the final cover slope. Conservatively use the typical maximum slope for the diversion berms modeled.
7. Diversion berms will be grass lined. Diversion berm locations where the velocity is calculated to exceed 5.0 feet/second ("ft/sec") will be provided with additional erosion control measures.
8. The design of the diversion berms is based on the berms at each slope with largest drainage area. This will result in a standard berm sized for the maximum design flow for each channel slope. Unique diversion berm locations and configurations are also modeled.

Calculation

The critical diversion berms considered in this analysis are as follows:

- DB-12, Berm at 4.3% slope with the largest immediate drainage area.
- DB-34, Berm at 1% slope with largest immediate drainage area.
- DB-36, Berm at 2% slope with largest flow due to inflow channel.
- DB-37, Berm at 2% slope with largest immediate drainage area.
- DB-42, Berm with unique drainage configuration.
- DB-44, Berm at 5.4% slope with the largest immediate drainage area.
- DB-46, Berm with unique drainage configuration.
- W-MC X DV, existing berm with unique drainage configuration.
- E-MC X DV, existing berm with unique drainage configuration.
- S-MC X DV, existing berm with unique drainage configuration.

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Diversion Berm Analysis

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Diversion berm designs are based on the HydroCAD model output provided in Attachment A-6.1.5. Diversion berm designs are summarized in Table A-6.2.1 below.

Conclusion

The proposed diversion berms, described above, will safely collect and control the design storm event. Diversion berm locations and cross sections may be modified depending on site conditions at closure, as long as design requirements are met.

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Diversion Berm Analysis

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Table A-6.2.1: Diversion Berm Summary

Diversion Berm Modeled	Additional Diversion Berms Represented in Design	Diversion Berm Design					Peak Flow (25-yr, 24-hr Storm)		
		Watershed Drainage Area (ac.)	Design Slope (%)	Channel Sideslopes <Max> (H:V)	Design Depth (ft)	Channel Lining	Flow Rate (cfs)	Flow Depth (ft)	Flow Velocity (ft/sec)
DB-12	DB-2; See note 3.	1.8	4.3%	4:1 / 2:1	2.0	TRM	8.4	0.69	5.80
DB-37	DB-1 thru 33, DB-35, and DB-38 thru 41	9.1	2.0%	4:1 / 2:1	2.0	TRM	23.8	1.17	5.66
DB-34	DB-43, DB-45, DB-12, and DB-2; See Note 3.	7.4	1.0%	4:1 / 2:1	2.0	Grass	32.56	1.30	4.28
DB-36	--	18.7	2.0%	4:1 / 2:1	2.5	TRM	75.2	1.77	7.46
DB-42	--	2.0	1.0%	4:1 / 2:1	2.0	Grass	9.2	0.90	3.37
DB-44	--	1.6	5.4%	4:1 / 2:1	2.0	TRM	4.3	0.51	5.36
DB-46	--	10.5	1.0%	10:1 / 3:1	2.0	Grass (existing)	24.0	1.00	3.70
W-MC X DV	--	13.8	Varies (0.5% min)	3:1 / 8:1	2.0	Grass (existing)	38.3	1.37	3.22
E-MC X DV	--	12.1	1.0%	3:1 / 3:1	2.0	Grass (existing)	35.6	1.49	4.71
S-MC XI DV	--	2.2	1.8%	6:1 / 2:1	1.5	Grass (existing)	6.9	0.66	3.70

Notes:
1. All diversion channels are triangular in shape and formed by the construction of a berm on the final cover grades.
2. Diversion berms that manage flows at a velocity of less than 5 fps will be grass lined. When the flow velocity is greater than 5 fps, permanent turf reinforcement mat (TRM) or other erosion control measures will be implemented.
3. The DB-12 analysis applies to the portions of DB-12 and DB-2 at 4.3% slope. The DB-34 analysis applies to the portions of DB-12 and DB-2 at 1.0% slope.
4. Diversion berm locations, cross section, and slopes may be modified based on site conditions at time of construction, as long as design requirements are met.

ATTACHMENT A-6.3

SURFACE WATER DOWNSLOPE CHANNEL ANALYSIS

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Downslope Channel Analysis

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Surface Water Downslope Channel Analysis

Objective

Design downslope channels and related outlet energy dissipators to convey surface water run-off from diversion berms down the steeper landfill sideslopes.

Design Criteria, Assumptions, and Methodology

1. Downslope channel locations are shown on the Figure provided in Attachment A-6.1.4.
2. Downslope channels will collect and control run-off from the 25-yr, 24-hr storm event and manage run-off from the 100-yr, 24-hr storm event with no offsite flooding.
3. Downslope channels will provide erosion protection at peak design flow.
4. Energy dissipators at the outlet of each downslope channel will be designed to safely manage peak design flows without damage to the dissipator or receiving ditch.
5. Except for DS-5, downslope channels will be created by constructing two berms on top of the final cover or other means that preserve the minimum cover thickness and other final cover design requirements in the area of the downslope channels. Downslope channel DS-5 is located in a topographic valley, so no additional berms are needed.
6. Downslope channels DS-1 through DS-4, and DS-6 are assumed to be trapezoidal in shape with 2H:1V sideslopes and a bottom width of 10 ft. Downslope channel DS-5 is a triangular channel with 5.7H:1V sideslopes.
7. Cable concrete will be used for erosion protection in downslope channels DS-1 through DS-5. Erosion protection in downslope channel DS-6 will be riprap with a 12” D50.

Calculation

The downslope channels were evaluated based on the configuration and erosion protection stated above. Key downslope channel parameters are summarized in Table A-6.3.1, below.

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Downslope Channel Analysis

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Table A-6.3.1: Downslope Channel and Energy Dissipator Design Summary

Downslope Channel Label	Watershed Area	Design Slope (See Note 1)	25-yr, 24-hr Storm		
			Peak Flow Rate (cfs)	Flow Depth (ft)	Flow Velocity (ft/sec)
DS-1	35.9 ac	25.0% / 33.0%	128.9	0.58	16.60
DS-2	21.2ac	25.0% / 33.0%	80.8	0.49	14.86
DS-3	32.2 ac	25.0%	120.5	0.62	17.09
DS-4	39.4 ac	25.0%	109.2	0.59	16.59
DS-5	7.7 ac	17.0%	36.2	0.76	10.94
DS-6	2.6 ac	33.0%	11.6	0.26	4.26

Notes:

1. Downslope Channels DS-1 and DS-2 transition from a 25% slope to a 33% slope as they cross the final cover bench.

Conclusion

The proposed downslope channels, described above, will safely collect and control the design storm event. Downslope channel locations, cross sections, and lining material may be modified depending on site conditions at closure, as long as design requirements are met.

ATTACHMENT A-6.4

SURFACE WATER DITCH ANALYSIS

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Ditch Analysis

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Surface Water Ditch Analysis

Objective

Design ditches to convey surface water run-off at the site.

Design Criteria, Assumptions, and Methodology

1. Ditch locations are shown on the Figure provided in Attachment A-6.1.4.
2. Ditch labels describe the ditch location with respect to the Master Cell (MC) locations.
3. Ditches will collect and control the run-off from the 25-yr, 24-hr storm event and manage run-off from the 100-yr, 24-hr storm event with no offsite flooding.
4. Ditch cross section and slopes will vary depending on the location within the site.
5. Ditches will be vegetated.
6. Erosion protection will be provided, as needed, at:
    a. Energy dissipator outlets,
    b. Locations where the ditch changes directions,
    c. Locations where the maximum flow velocity is greater than 5.0 fps, and
    d. Culvert inlet and outlet locations.
7. Ditch label typically indicates the location, e.g., ditch MC VII/XI is located between MC VII and MC XI.
8. Ditches that are restricted by downstream culverts are modeled as ponds to account for water storage during storm events. This affects the following ditches:
    a. NWD restricted by culvert NWD/MC VII Culvert,
    b. MC VII/XI ditch restricted by culvert MC VII/XI,
    c. MC VII/IX and MC X/XI ditches restricted by culvert MC VII/IX
9. All but two of the ditches are existing on-site ditches. Only ditches S-MC VI and N-MC VI are new proposed ditches. Some ditches include grading modifications in the form of containment berms, as shown in the drawings.

Calculation

Ditch design is based on the HydroCAD model output provided in Attachment A-6.1.5. Ditch designs are summarized in Table A-6.4.1 below. Ditches along the perimeter of the site that need to maintain containment on the outbound edge of the site have a minimum containment berm elevation identified in the table.

Conclusion

The proposed ditches, described above and in the table below, will safely transmit the design storm event. Ditch cross sections and slopes may be modified depending on site conditions at closure as long as design requirements are met.

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Ditch Analysis

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Table A-6.4.1: Ditch Design Summary

Drainage Ditch Label	Channel Design							Peak Flow (25-yr, 24-hr)			
	Design Slope (%)	Channel Shape	Channel Sideslopes (H:V)	Req. Berm Elev. (ft)	Channel Bottom Width (ft)	Design Depth <Min.> (ft)	Channel Lining	Flow Rate (cfs)	Flow Depth (ft)	Peak Elev. (ft)	Flow Velocity (ft/sec)
North Sedimentation Basin (NSB) Subwatershed											
NWD (north & west of MC IV and VI) -Modeled as pond	Varies	Trapezoidal	2:1	712.0	Varies	Varies	Grass	366.8	5.9 (max)	710.2	NA
N-MC VII	0.2%	Trapezoidal	2:1	--	24.0	3.0	Grass	62.8	0.97	--	2.42
MC VII/XI -Modeled as pond	Varies	Triangular	2:1	707.0 (spillway)	--	Varies	Grass	60.1	7.1 (max)	707.1	NA
MC X/XI and MC VII/IX Modeled as pond	Varies	Trapezoidal	2:1	706.0	Varies	Varies	Grass	197.2	4.4 (max)	702.4	NA
N-MC IX	0.04%	Trapezoidal	2:1	--	22.0	5.0	Grass	123.1	2.37	--	1.90
NE-MC IX	0.14%	Trapezoidal	2:1	--	33.0	5.6	Grass	125.6	1.36	--	2.55
E-MC IX	0.68%	Trapezoidal	2.6:1 / 20:1	--	3.0	2.5	Grass	53.7	1.04	--	3.40
South Sedimentation Basin (SSB) Subwatershed											
E-MC X	0.25%	Triangular	5:1 / 5:1	--	--	3.0	Grass	26.6	1.26	--	1.81
S-MC X	0.27%	Triangular	1:1 / 2:1	--	--	4.0	Grass	23.3	2.07	--	2.77
W- MC X	0.24%	Trapezoidal	3:1 / 2:1	--	6.0	4.0	Grass	22.3	1.02	--	2.42
E-MC I	0.41%	Triangular	3:1	--	--	3.0	Grass	36.3	1.86	--	3.49
MC VI/XI	1.0%	Trapezoidal	4:1	--	6.0	4.0	TRM	151.8	1.79	--	6.44
S-MC VI	3.8%	Triangular	4:1	--	--	2.0	TRM	61.2	1.32	--	8.62
N-MC VI	2.7%	Triangular	37.4:1	--	--	1.0	TRM	62.5	0.61	--	4.42

Notes:
1 Ditches modeled as ponds do not include flow velocity.
2 Ditch slopes that vary are, at a minimum, sloped to drain.
3 Ditches that manage flows at a velocity of less than 5 fps will be grass lined. When the flow velocity is greater than 5 fps permanent turf reinforcement mat (TRM) or other erosion control measures will be implemented.
4 Ditch configuration may be changed as long as design criteria are met.

ATTACHMENT A-6.5

CULVERT ANALYSIS

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Culvert Analysis

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Culvert Analysis

Objective

Analyze existing culverts to remain in place and proposed culverts for final cover conditions to convey surface water through ditches and into sedimentation basins.

Design Criteria, Assumptions, and Methodology

1. This analysis is primarily of existing culvert pipes, changes from existing conditions are noted.
2. Culvert locations are shown on the Figure provided in Attachment A-6.1.4.
3. Culvert labels describe the ditch location with respect to the Master Cell (MC) locations.
4. South Sedimentation Basin storm sewer pipes and inlets are addressed in Appendix A-6.6.
5. Culverts will collect and control flow from the 25-yr, 24-hr storm event and manage run-off from the 100-yr, 24-hr storm event with no offsite flooding.
6. Culverts will consist or Reinforced Concrete Pipe (RCP), Corrugated Metal Pipe (CMP), or Smooth Lined Corrugated HDPE Pipe (CPP). A Manning's No. of 0.012 is used to represent RCP and CPP, while a value of 0.025 is used to represent CMP.
7. The tailwater depth input for each culvert was based on the downstream channel flow depth for the design storm event.
8. Riprap or other materials, such as permanent turf reinforcement mat, will be used at culvert inlets and outlets.
9. Alternate culvert pipe materials, sizes, and configurations that meet design criteria may be used.
10. Culverts NW-MC VII, MC VII/IX, and E-MC VI/XI restrict flow, and are modeled as ponds to account for water storage during storm events.

Calculation

Culvert design is based on the HydroCAD model output provided in Attachment A-6.1.5. Culvert designs are summarized in Table A-6.5.1 below.

Conclusion

The culverts described in the table below, will safely transmit the design storm event. Alternate culvert slopes, materials, and dimensions that meet design requirements may be used.

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Culvert Analysis

Project No.: 1218070017
Calculated By: LEH Date: 10/08/2021
Checked By: TCR Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Table A-6.5.2
Culvert Summary

Culvert Label (new/existing)	Number and Type of Culvert	Min. Pipe Dia. (in.)	Design Slope (%)	Approx. Design Length (ft)	Approx. Inlet Invert Elev. (ft)	Total Watershed Area (ac.)	Peak Flow Rate <25-yr, 24-hr> (cfs)	Head-water Elev. (ft)
North Sedimentation Basin (NSB) Watershed								
NWD / MC VII (see note 1)	2/CPP 2/CPP	12” 18”	4.24	125.0	704.3	120.0	44.48	710.23
N-MC VII (existing)	1/RCP 1/RCP	54” 36”	0.38	42	696.8	128.0	60.68	699.89
MC VII/IX (existing)	3/CMP	24”	0.33	30	697.1	94.8	62.08	702.4
MC VII/XI (existing see note 3)	1/RCP	24”	2.25	40	700.3	22.9	30.71	707.14
NSB North Inlet (existing)	1/RCP 3/CMP	54” 30”	4.05 0.0	110.0	695.0	239.4	124.53	698.30
E-MC IX (existing)	1/CPP	36”	3.65	72	701.8	12.1	30.87	704.16
NSB South Inlet (New)	3/CPP	30”	0.91	110	695.0	22.3	52.37	697.13
South Sedimentation Basin (SSB) Watershed								
E-MC I (new, see note 4)	1/CCP	24”	0.25	80	703.0	3.1	6.97	705.44
SSB East Inlet (existing)	1/RCP	30”	0.00	113	688.0	13.8	21.03	690.92

Notes:
1. Culvert MC VII to include existing and proposed pipes. Two existing 12-inch CMP culvert pipes to be removed and replaced with two 18” CCP culvert pipes).
2. Culvert MC X/XI was not modeled due to the location upstream of the restrictive MC VII/IX culvert.
3. Under existing conditions at culvert MC VII/XI, if the upstream ditch overtops containment berm, the flow will route to the same location as the culvert output. This is an acceptable flow path, the model indicates the overflow velocity is less than 2 fps, therefore vegetation will prevent erosion.
4. The existing culvert for the access road to MC I will be replaced with the designed culvert.
5. Alternate culvert pipe materials, sizes, and configurations that meet design criteria may be used.

ATTACHMENT A-6.6

STORM SEWER ANALYSIS

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Storm Sewer Analysis

Project No.: 1218070017
Calculated By: TCR Date: 10/08/2021
Checked By: WL Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Storm Sewer Analysis

Objective

Evaluate the capacity of the existing South Sedimentation Basin (SSB) storm sewer to collect and control the design storm event under final closure conditions.

Design Criteria, Assumptions, and Methodology

1. Storm Sewer routes surface water run-off to the SSB. The layout is shown on the Figure provided in Attachment A-6.1.4.
2. The storm sewer will collect and control run-off from the 25-yr, 24-hr storm event and manage the 100-yr, 24-hr storm event with no offsite flooding.
3. The existing storm sewer layout is reflected in the "Storm Water Management System Evaluation Report" prepared by CTI, Revised February 2021. Changes to the existing storm sewer layout are identified below.
4. Grading as shown in the drawings.

Calculation

The existing storm sewer includes revisions to accommodate the surface water flows from the expansion. The changes include the following:

A. S-1 Inlet: Remove the existing inlet
B. S-3 Inlet: Remove the existing inlet
C. S-4A Inlet: Extend the existing S-4 inlet vertically to new design grades.
D. Install a new 30-inch storm sewer pipe from the S-16 inlet location to the SSB. Inlet invert 697.26, slope 0.25% minimum. Alternate configuration, piping, or channels with sufficient flow capacity may be used.

The SWMM model was used to evaluate the revised storm sewer system for final cover conditions. SWMM model inputs and outputs are provided in Attachment A-6.1.5. A summary of flooding output is provided in Table A-6.6.1 below.

Conclusion

The revised storm sewer will safely collect and control the 25-yr, 24-hour storm event with no flooding and will manage the 100-yr, 24-hr storm event with no offsite flooding.

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Storm Sewer Analysis

Project No.: 1218070017
Calculated By: TCR Date: 10/08/2021
Checked By: WL Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Table A-6.6.1: Storm Sewer Summary 100-yr, 24-hr Flooding/Overflow

Junction	Description	Drainage Area	Flooding Depth	Comments
S-5, & S-6	Manholes	MC-1 and Expansion	None	Incidental volume, does not exceed manhole.
S-10	Drop Inlet	Site Entrance Area	1.28 ft (20,000 gal)	Flood volume will be contained within S-10 inlet drainage area, See Note 1.

Notes:

1. Flooding at S-10 up to approximately elev. 698.4 (1.7 ft above inlet) will remain on-site within the S-10 drainage area. The flooding depth at S-10 is based on a 2,100 sf area to model increased storage depths in the area of S-10. At elev. 698.4, there is approx. 3,670 cf (27,450 gal) of surface water storage in the area of S-10.

ATTACHMENT A-6.7

SEDIMENTATION BASIN ANALYSIS

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Sedimentation Basin Analysis

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Sedimentation Basin Analysis

Objective

Evaluate the storage capacity of the existing North Sedimentation Basin (NSB) and South Sedimentation Basin (SSB) for final landfill cover conditions.

Design Criteria, Assumptions, and Methodology

1. The site includes three storm water sedimentation basins, NSB, SSB, and the Lined Pond. After a storm event, the NSB storm water is pumped to the SSB. The storm water in SSB and the Lined Pond are treated separately prior to discharge off-site.
2. The subwatershed draining to the existing EGLE approved Lined Pond and related storm sewer system is reduced under final conditions. Therefore, the Lined Pond has sufficient capacity for the design storm event, and revised calculations are not included herein.
3. At WDI the Sedimentation Basins are design to store the entire 100-yr, 24-hr storm event with no discharge off site. From Attachment A-6.1.1 the 100-yr, 24-hr storm rainfall is 5.12 inches.
4. Both NSB and SSB consist of two separate areas connected by a spillway for the NSB and culvert for the SSB. The NSB South area is divided into two parts by a berm within the basin. The spillway between NSB north and NSB south will be made deeper for final conditions, as shown in Attachment A-6.1.4.
5. From the HydroCAD output provided in Attachment A-6.1.5, the total design storm run-off volume is as follows:
    a. 77.97 ac-ft for the NSB, use 78.0 ac-ft
    b. 33.63 ac-ft for the SSB, use 33.6 ac-ft
6. The NSB and SSB locations are shown in Attachment A-6.1.4.

Calculation

Sedimentation basin volumes are estimated using topography and as-built data. Sedimentation Basin design information is summarized in Table A-6.7.1, below.

Conclusion

The North Sedimentation Basin (NSB) and the South Sedimentation Basin (SSB) have sufficient capacity to store the entire 100-yr, 24-hr design storm event with over 1 ft of freeboard.

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Sedimentation Basin Analysis

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Table A-6.7.1: Sedimentation Basin Design Summary (at assumed final site conditions)

Location	NSB North	NSB South	SSB North	SSB South
Top of Berm (no freeboard) Elev.	695		695	
Basin Bottom Elev.	670	672/668	673	670
Pond Connection / Elev.	Spillway / 693.0		60” Dia. Culvert / 684	
Total Storage Volume Available (with 1-ft freeboard)	115.9 ac-ft		53.8 ac-ft	
100-yr, 24-hr Storm Run-off Vol.	78.0 ac-ft		33.6 ac-ft	

ATTACHMENT A-6.8

FINAL COVER DRAINAGE LAYER FLOW CAPACITY ANALYSIS

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Final Cover Drainage Layer Capacity Analysis

Project No.: 1218070017
Calculated By: TCR Date: 10/08/2021
Checked By: WL Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Final Cover Drainage Layer Capacity Analysis

Objective

Estimate the required drainage layer capacity of the geocomposite drainage layer component of the final cover for various slopes and slope lengths to minimize the buildup of pore water pressure within the cover system and maintain stability.

Design Criteria, Assumptions, and Methodology

1. The landfill has varying slopes for the final cover system. Maximum (25%), minimum (4%) and intermediate (7%) slopes are considered in this analysis.
2. The final cover soil, consistent with the HELP model analysis, is assumed to have a hydraulic conductivity of $2x10^{-4}$ cm/sec.
3. From Attachment A-6.1.1 the 100-yr, 1-hr storm rainfall is 2.66 inches.

Calculation

Using the methodology presented in References 2, 3, and 4:

1. Calculate the percolation rate to the geocomposite.

$$PERC = P\left(1 - RC\right)$$

Where:
- PERC = Percolation rate of the storm event (m/hr)
- P = Probable Maximum (hourly) Precipitation
- RC = Runoff Coefficient, varies with site conditions, see Attachment A-6.8.1 obtained from Reference 3.

PERC =
- $k_{cover\ soil}$; when $P(1 - RC) > k_{cover\ soil}$
- $P(1 - RC)$; when $P(1 - RC) \leq k_{cover\ soil}$

2. Calculate the required transmissivity, θ_{reqd}:

$$\theta_{reqd} = \frac{PERC \times (L)}{(\sin \beta)}$$

Where:
- θ_{reqd} = required transmissivity (m^2/sec)
- PERC = Infiltration or percolation rate (m/sec)
- L = Slope length (m)
- β = Slope angle

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Final Cover Drainage Layer Capacity Analysis

Project No.: 1218070017
Calculated By: TCR Date: 10/08/2021
Checked By: WL Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

3. Calculate the allowable long term geocomposite transmissivity, θ_{all}, based on the design Factor of Safety, FS, and reduction factors.

$$\theta_{all} = \theta_{reqd} \text{x } (RF_{CR} \text{ x } RF_{CC} \text{ x } RF_{BC}) \text{ x FS}$$

Where:
- θ_{all} = Allowable long term geocomposite transmissivity (m^2/sec)
- RF_{CR} = reduction factor for creep to account for long-term behavior, 1.1; (varies with stress; 1.1 to 1.2 for low stress (<50 kPa, 1,044 psf), up to 2 for higher pressures (> 700 kPa, 14,619 psf) (Reference 4)
- RF_{CC} = reduction factor for chemical clogging, 1.2; typically 1.0 to 1.2 for landfill covers (Reference 4)
- RF_{BC} = reduction factor for biological clogging, 3.0; typically 1.2 to 3.5 for landfill covers (Reference 4)

A spreadsheet, utilizing the above methodology, is used to solve the calculations for the allowable long term geocomposite transmissivity using assumed cover soil type, slopes, and slope lengths. The spreadsheet calculations are provided in Attachment A-6.8.2.

The allowable long term geocomposite transmissivity for FS = 2 at various slopes and slope lengths are summarized in Table A-6.8.1.

Table A-6.8.1: Geocomposite Drainage Capacity Summary

Slope	Maximum Allowable Slope Length	Min. Allowable Long Term Geocomposite Transmissivity
Slope = 25%	200 ft.	3.98E-03 m^2/sec
Slope = 25%	160 ft.	3.18E-03 m^2/sec
7% =< Slope < 25%	120 ft	8.31E-03 m^2/sec
4% =< Slope < 7%	600 ft	7.25E-02 m^2/sec
4% =< Slope < 7%	300 ft	3.62E-02 m^2/sec
4% =< Slope < 7%	200 ft	2.42E-02 m^2/sec

Notes:
1. Minimum long term geocomposite allowable transmissivity based on a FS = 2 to maintain head build-up on geomembrane less than geocomposite thickness. Long term geocomposite transmissivity testing to be performed at 500 psf (based on 3 ft of soil cover at 166 pcf) with a 100 hour load duration or based on specific site conditions.
2. Alternate soil types, slopes and slope lengths may be analyzed to further refine geocomposite requirements.

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Final Cover Drainage Layer Capacity Analysis

Project No.: 1218070017
Calculated By: TCR Date: 10/08/2021
Checked By: WL Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Conclusion

The allowable long term geocomposite is dependent on cover soil type, slope, and slope length. The long-term allowable transmissivity for various parameters is provided in Table A-6.8.1, above. The actual geocomposite chosen will be evaluated to determine that design criteria are met.

References

1. Haan, C.T., Barfield, B.J. Hayes, J.C., "Design Hydrology and Sedimentology for Small Catchments", Academic Press, 1994.

2. Soong, T.Y., Koerner, R.M., "The Design of Drainage Systems over Geosynthetically Lined Slopes," GRI Report #19, 1997.

3. Giroud, J.P., Zornberg, J.G., and Zhao, A., "Hydraulic Design of Geosynthetic and Granular Liquid Collection Layers", Geosynthetics International, Special Issue on Liquid Collection Systems, 2000, Vol. 7, Nos. 4-6, pp. 285-380,

4. Narejo, Dhani, "Long-term Performance Considerations for Geonet Drainage Geocomposites", 57th Canadian Geotechnical Conference, GSE Lining Technology, Inc., October 24-27, 2004.

ATTACHMENT A-6.8.1

RUN-OFF RATE FACTOR

Table 3.24 Runoff Coefficients

Urban areas The use of average coefficients for various surface types, which are assumed not to vary through the duration of the storm, is common. The range of coefficients, classified with respect to the general character of the tributary reported in use is:

Description of area	Runoff coefficients
Business	
Downtown areas	0.70 to 0.95
Neighborhood areas	0.50 to 0.70
Residential	
Single-family areas	0.30 to 0.50
Multiunits, detached	0.40 to 0.60
Multiunits, attached	0.60 to 0.75
Residential (suburban)	0.25 to 0.40
Apartment dwelling areas	0.50 to 0.70
Industrial	
Light areas	0.50 to 0.80
Heavy areas	0.60 to 0.90
Parks, cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.35
Railroad yard areas	0.20 to 0.35
Unimproved areas	0.10 to 0.30

Note: It is often desirable to develop a composite runoff coefficient based on the percentage of different types of surface in the drainage area. This procedure is often applied to typical 'sample' blocks as a guide to selection of reasonable values of the coefficient for an entire area. Coefficients with respect to surface type currently in use are:

Character of surface	Runoff coefficients
Streets	
Asphaltic and concrete	0.70 to 0.95
Brick	0.70 to 0.85
Roofs	0.75 to 0.95
Lawns; sandy soil	
Flat, 2%	0.05 to 0.10
Average, 2 to 7%	0.10 to 0.15
Steep, 7%	0.15 to 0.20
Lawns, heavy soil	
Flat, 2%	0.13 to 0.17
Average, 2 to 7%	0.18 to 0.22
Steep, 7%	0.25 to 0.35

Note: The coefficients in these two tabulations are applicable for storms of 5-year to 10-year frequencies. Less frequent higher intensity storms will require the use of higher coefficients because infiltration and other losses have a proportionally smaller effect on runoff. The coefficients are based on the assumption that the design storm does not occur when the ground surface is frozen.

Table 3.24—*Continued*

Rural areas

Topography and vegetation	Soil texture: Open sandy loam	Soil texture: Clay and silt loam	Soil texture: Tight clay
Woodland			
Flat 0–5% slope	0.10	0.30	0.40
Rolling 5–10% slope	0.25	0.35	0.50
Hilly 10–30% slope	0.30	0.50	0.60
Pasture			
Flat	0.10	0.30	0.40
Rolling	0.16	0.36	0.55
Hilly	0.22	0.42	0.60
Cultivated			
Flat	0.30	0.50	0.60
Rolling	0.40	0.60	0.70
Hilly	0.52	0.72	0.82

Source:
Haan, C.T., Barfield, B.J., Hayes, J.C., "Design Hydrology and Sedimentology for Small Catchments", Academic Press, 1994

ATTACHMENT A-6.8.2

SPREADSHEET CALCULATIONS

.

Geocomposite Drainage Design transmissivity

25% Slope, 200 ft Slope Length

Slope Information		
Allowable slope length, L	200	ft, maximum
	61.0	m
Slope, V:H	0.250	
Slope angle, β	14.04	degree
Water Infiltration Information		
Hourly precipitation, P	2.66	in./hr
Hourly precipitation, P	0.0676	m/hr
Runoff Coefficient, RC	0.42	Conservatively chosen for hilly pasture with clay and silt loam soil
P(1-RC)	1.1E-05	m/sec
Cover Soil Hydraulic Conductivity, $k_{cover\ soil}$	2.0E-06	m/sec
Rate of percolation of cover soil, PERC	2.0E-06	m/sec, PERC = $k_{cover\ soil}$; when P(1-RC) > $k_{cover\ soil}$ PERC = P(1-RC); when P(1-RC) ≤ $k_{cover\ soil}$
Required Transmissivity, θ_{reqd}	5.03E-04	m^2/sec
Allowable Geocomposite Transmissivity		
Allowable geocomposite transmissivity, θ_{allow}	**3.98E-03**	m^2/sec
Reduction factor for creep deformation, RF_{CR}	1.1	Low stress in final cover situation
Reduction factor for chemical clogging, RF_{CC}	1.2	Conservatively chosen from GRI-GC8 range
Reduction factor for biological clogging, RF_{BC}	3	Conservatively chosen from GRI-GC8 range
Drainage Layer Factor of Safety, FS	2.0	

Geocomposite Drainage Design transmissivity

25% Slope, 160 ft Slope Length

Slope Information		
Allowable slope length, L	160	ft, maximum
	48.8	m
Slope, V:H	0.250	
Slope angle, β	14.04	degree
Water Infiltration Information		
Hourly precipitation, P	2.66	in./hr
Hourly precipitation, P	0.0676	m/hr
Runoff Coefficient, RC	0.42	Conservatively chosen for hilly pasture with clay and silt loam soil
P(1-RC)	1.1E-05	m/sec
Cover Soil Hydraulic Conductivity, $k_{cover\ soil}$	2.0E-06	m/sec
Rate of percolation of cover soil, PERC	2.0E-06	m/sec, PERC = $k_{cover\ soil}$; when P(1-RC) > $k_{cover\ soil}$ PERC = P(1-RC); when P(1-RC) ≤ $k_{cover\ soil}$
Required Transmissivity, θ_{reqd}	4.02E-04	m^2/sec
Allowable Geocomposite Transmissivity		
Allowable geocomposite transmissivity, θ_{allow}	**3.18E-03**	m^2/sec
Reduction factor for creep deformation, RF_{CR}	1.1	Low stress in final cover situation
Reduction factor for chemical clogging, RF_{CC}	1.2	Conservatively chosen from GRI-GC8 range
Reduction factor for biological clogging, RF_{BC}	3	Conservatively chosen from GRI-GC8 range
Drainage Layer Factor of Safety, FS	2.0	

Geocomposite Drainage Design transmissivity

7% =< Slope <25%, 120 ft Slope Length

Slope Information		
Allowable slope length, L	120	ft, maximum
	36.6	m
Slope, V:H	0.070	minimum
Slope angle, β	4.00	degree
Water Infiltration Information		
Hourly precipitation, P	2.66	in./hr
Hourly precipitation, P	0.0676	m/hr
Runoff Coefficient, RC	0.36	Conservatively chosen for rolling pasture with clay and silt loam soil
P(1-RC)	1.2E-05	m/sec
Cover Soil Hydraulic Conductivity, $k_{cover\ soil}$	2.0E-06	m/sec
Rate of percolation of cover soil, PERC	2.0E-06	m/sec, PERC = $k_{cover\ soil}$; when P(1-RC) > $k_{cover\ soil}$ PERC = P(1-RC); when P(1-RC) ≤ $k_{cover\ soil}$
Required Transmissivity, θ_{reqd}	1.05E-03	m^2/sec
Allowable Geocomposite Transmissivity		
Allowable geocomposite transmissivity, θ_{allow}	**8.31E-03**	m^2/sec
Reduction factor for creep deformation, RF_{CR}	1.1	Low stress in final cover situation
Reduction factor for chemical clogging, RF_{CC}	1.2	Conservatively chosen from GRI-GC8 range
Reduction factor for biological clogging, RF_{BC}	3	Conservatively chosen from GRI-GC8 range
Drainage Layer Factor of Safety, FS	2.0	

Geocomposite Drainage Design transmissivity

4% =< Slope < 7%, 600 ft Slope Length

Slope Information		
Allowable slope length, L	600	ft, maximum
	182.9	m
Slope, V:H	0.040	minimum
Slope angle, β	2.29	degree
Water Infiltration Information		
Hourly precipitation, P	2.66	in./hr
Hourly precipitation, P	0.0676	m/hr
Runoff Coefficient, RC	0.30	Conservatively chosen for flat pasture with clay and silt loam soil
P(1-RC)	1.3E-05	m/sec
Cover Soil Hydraulic Conductivity, $k_{cover\ soil}$	2.0E-06	m/sec
Rate of percolation of cover soil, PERC	2.0E-06	m/sec, PERC = $k_{cover\ soil}$; when P(1-RC) > $k_{cover\ soil}$ PERC = P(1-RC); when P(1-RC) ≤ $k_{cover\ soil}$
Required Transmissivity, θ_{reqd}	9.15E-03	m^2/sec
Allowable Geocomposite Transmissivity		
Allowable geocomposite transmissivity, θ_{allow}	**7.25E-02**	m^2/sec
Reduction factor for creep deformation, RF_{CR}	1.1	Low stress in final cover situation
Reduction factor for chemical clogging, RF_{CC}	1.2	Conservatively chosen from GRI-GC8 range
Reduction factor for biological clogging, RF_{BC}	3	Conservatively chosen from GRI-GC8 range
Drainage Layer Factor of Safety, FS	2.0	

Geocomposite Drainage Design transmissivity

4% =< Slope < 7%, 300 ft Slope Length

Slope Information		
Allowable slope length, L	300	ft, maximum
	91.4	m
Slope, V:H	0.040	minimum
Slope angle, β	2.29	degree
Water Infiltration Information		
Hourly precipitation, P	2.66	in./hr
Hourly precipitation, P	0.0676	m/hr
Runoff Coefficient, RC	0.30	Conservatively chosen for flat pasture with clay and silt loam soil
P(1-RC)	1.3E-05	m/sec
Cover Soil Hydraulic Conductivity, $k_{cover\ soil}$	2.0E-06	m/sec
Rate of percolation of cover soil, PERC	2.0E-06	m/sec, PERC = $k_{cover\ soil}$; when P(1-RC) > $k_{cover\ soil}$ PERC = P(1-RC); when P(1-RC) ≤ $k_{cover\ soil}$
Required Transmissivity, θ_{reqd}	4.58E-03	m^2/sec
Allowable Geocomposite Transmissivity		
Allowable geocomposite transmissivity, θ_{allow}	**3.62E-02**	m^2/sec
Reduction factor for creep deformation, RF_{CR}	1.1	Low stress in final cover situation
Reduction factor for chemical clogging, RF_{CC}	1.2	Conservatively chosen from GRI-GC8 range
Reduction factor for biological clogging, RF_{BC}	3	Conservatively chosen from GRI-GC8 range
Drainage Layer Factor of Safety, FS	2.0	

Geocomposite Drainage Design transmissivity

4% =< Slope < 7%, 200 ft Slope Length

Slope Information		
Allowable slope length, L	200	ft, maximum
	61.0	m
Slope, V:H	0.040	minimum
Slope angle, β	2.29	degree
Water Infiltration Information		
Hourly precipitation, P	2.66	in./hr
Hourly precipitation, P	0.0676	m/hr
Runoff Coefficient, RC	0.10	Conservatively chosen for flat pasture with clay and silt loam soil
P(1-RC)	1.7E-05	m/sec
Cover Soil Hydraulic Conductivity, $k_{cover\ soil}$	2.0E-06	m/sec
Rate of percolation of cover soil, PERC	2.0E-06	m/sec, PERC = $k_{cover\ soil}$; when P(1-RC) > $k_{cover\ soil}$ PERC = P(1-RC); when P(1-RC) ≤ $k_{cover\ soil}$
Required Transmissivity, θ_{reqd}	3.05E-03	m^2/sec
Allowable Geocomposite Transmissivity		
Allowable geocomposite transmissivity, θ_{allow}	**2.42E-02**	m^2/sec
Reduction factor for creep deformation, RF_{CR}	1.1	Low stress in final cover situation
Reduction factor for chemical clogging, RF_{CC}	1.2	Conservatively chosen from GRI-GC8 range
Reduction factor for biological clogging, RF_{BC}	3	Conservatively chosen from GRI-GC8 range
Drainage Layer Factor of Safety, FS	2.0	

ATTACHMENT A-6.9

FINAL COVER EROSION POTENTIAL ANALYSIS

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Final Cover Erosion Potential Analysis

Project No.: 1218070017
Calculated By: TCR Date: 10/08/2021
Checked By: WL Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Final Cover Erosion Potential Analysis

Objective

Evaluate the potential soil erosion of the final cover to determine if erosion is properly controlled by the diversion berms.

Design Criteria, Assumptions, and Methodology

1. Estimate the erosion potential of the final cover using the Universal Soil Loss Equation and maintain less than 2.0 tons/acre-year of soil loss per R299.9619(6)(iv)(b). The Universal Soil Loss Equation accounts for long term average annual soil loss based on specific land slopes and land management systems.
2. Consider three slopes and slopes lengths to represent the site conditions;
    a. 25%, 200 ft
    b. 4%, 300 ft
    c. 4%, 600 ft

Calculation

Calculate soil loss per unit area.

$$A = R \times C \times LS \times K \times P$$

Where:
A = Computed soil loss (tons/acre-year)
R = Rainfall energy factor
C = Crop/vegetation and management factor
LS = Slope length factor
K = Soil erodibility factor
P = Erosion control practice factor

The following values were obtained from the guidance provided in Attachment A-6.9.1.

R = 95, for Wayne County, from Attachment 1 of the guidance.
C = 0.007 to represent grass on entire final cover, from page 3 of the guidance.
LS = Varies depending on slope and length, see Attachment 2 of guidance.
K = 0.25 from Attachment 3 of the guidance, for a mixture of clay, sand, and loam with approximately 2.0% organic content.
P = 1.0 represents areas with no vegetation, conservatively used for landfill design.

Inputs and results are summarized in Table A-6.9.1, below.

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Final Cover Erosion Potential Analysis

Project No.: 1218070017
Calculated By: TCR Date: 10/08/2021
Checked By: WL Date: 10/08/2021
Approved By: XZ Date: 10/08/2021

Table A-6.9.1: Unified Soil Loss Equation Inputs and Results

Slope/Length	R	C	LS	K	P	A
25% / 200 ft	95	0.007	7.88	0.25	1.0	1.3 tons/acre-year
4% / 300 ft	95	0.007	0.98	0.25	1.0	0.2 tons/acre-year
4% / 600 ft	95	0.007	1.42	0.25	1.0	0.2 tons/acre-year

Conclusion

Soil erosion is estimated to be less than 2 tons/acre-year, therefore, erosion is properly controlled by the proposed diversion berm spacing. An alternate diversion berm layout may be used as long as maximum allowable soil loss criteria is met.

References

1. Michigan Department of Environmental Quality – Waste Management Division, Final Cover Erosion Control Design Guidance, 1995.

ATTACHMENT A-6.9.1

UNIFIED SOIL LOSS EQUATION GUIDANCE

Waste Management Division
Final Cover Erosion Control Design Guidance

The Part 115 rules of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended require the final cover on Type II landfills be designed to control erosion. Rule 425 states that the slopes of the final cover shall not exceed those necessary to prevent erosion and maintain slope stability. Rule 425(8) further states that the final slope shall not be more than 1 vertical to 4 horizontal at any location and if the final slope is more than 15%, the slope shall include either of the following:

(a) A horizontal terrace which is not less than 15 feet wide on the slope and which is spaced and designed as necessary to control erosion and allow vehicle access to the top of the final cover. The gradient of the terrace shall not be more than 6%.

(b) Other controls that the applicant demonstrates are sufficient to maintain slope stability, prevent erosion, and allow access. The controls shall be sufficient to limit erosion to not more than 2 tons per acre per year based on the Universal Soil Loss Equation (USLE) or other method approved by the director.

U.S. Environmental Protection Agency guidance on landfill final cover design recommends breaking the slope every 20 vertical feet and collecting the accumulated stormwater for erosion-proof transport down the remaining slope in order to meet the performance criteria of not more than 2 tons/acre-year of soil erosion as predicted by the USLE. The Waste Management Division (WMD) will accept using horizontal terraces spaced every 20 vertical feet as meeting the soil loss requirement without demonstration provided that appropriate shallow rooted vegetation is selected, established and maintained. An agronomist/soil scientist should be consulted for the selection, establishment, and care of appropriate shallow rooted vegetation. The drainage swales can be horizontal terraces or stormwater diversion berms that have a backslope of greater than 25%. In order to establish appropriate shallow rooted vegetation, the backslope should not be too steep to mow and otherwise maintain. The WMD has agreed to accept stormwater diversion/control berms as providing equivalent protection to horizontal terraces. The stormwater diversion berms shall be sized so that the flow channel has the capacity to handle the stormwater that is expected to be generated by the area it drains.

If a facility elects a design other than horizontal terraces or stormwater diversion berms spaced on a maximum vertical spacing of 20 feet, the facility must demonstrate, using the USLE, that the performance criteria of not more than 2 tons/acre-year of soil erosion is met. If the design meets the soil loss criteria of not more than 2 tons/acre-year of soil erosion the alternate design may be approved pursuant to Rule 425(8)(b). Guidance on using the USLE and some recommendations on the design variables are included below.

Regardless of which option the facility elects, Rule 921(2)(d) requires that observations and tests of the other layers of the final cover to ensure that the design specifications are met shall accompany the construction records and an engineer's certification of a unit, or portion of a unit that has received final cover. Further, these activities shall include inspection of the completed cover slope, vegetation, and drainage conduits to ensure that they are in compliance with the specified design. All of the components of the final cover, except the vegetation, can be verified during or immediately after installation of the final cover. Since the vegetation may take a period of time to become established to the level that was assumed in the design, it will be necessary for the owner to conduct periodic inspections during the post-closure period. If the assumed vegetative cover is not achieved after three full growing seasons, the owner shall institute additional measures to

establish the intended vegetative cover. The final closure certification may be submitted prior to establishment of the vegetative cover. The post-closure period shall begin as specified in Rule 448(7).

The Michigan Department of Environmental Quality (DEQ) feels that the most effective ways to establish effective vegetative cover are ensuring that the slopes have the most ideal growing conditions possible and providing extra care for the vegetation until it thrives. This will minimize future maintenance activities and provide the best long-term erosion control for the final cover. The proper establishment of landfill cover vegetation is impacted by site preparation, material selection, planting techniques, and maintenance. Proper seedbed preparation is critical to establishing healthy vigorous vegetation. The growing medium must be high quality with an adequate supply of nutrients and good water holding capacity. The seeds that are sown must be appropriate for the anticipated site conditions. The application rate should be large enough so that the seedlings can become adequately established. Mulch should be used to protect the seedbed from erosion before the vegetation is established. The mulch should be applied at a high enough rate to protect the soil surface from rain splash. The mulch should be anchored in place with crimping, mulch tackifiers, or erosion control netting. Proper nutrient balance is essential to establish vegetation as quickly as possible. Fertilization and soil amendments are two excellent ways to provide essential nutrients to landfill cap vegetation. Mowing is vitally important in establishing grass cover systems. Mowing will reduce the amount of volunteer and woody vegetation in a landfill cap. Mowing will help to self sow seeds of the vegetation that is thriving on a landfill cap. Mowing encourages lateral growth of sod forming grasses that propagate by rhizomes. To prevent stressing the vegetation, care should be taken so that mowing will remove no more than 1/3 of the grass height each time that it is mowed. A higher frequency of mowing in the first few growing seasons is usually very effective in establishing the maximum amount of ground cover in the shortest possible time.

There is a Revised Universal Soil Loss Equation (RUSLE) that the Natural Resources Conservation Service (NRCS) has started working with. It still remains to be demonstrated that this revision will prove more applicable to landfill design than the USLE. The RUSLE uses subfactors to calculate many of the different factors described below. The RUSLE has the same basic limitations as the USLE and predicting erosion potential for long steep slopes begins to stretch the method beyond its usefulness. Pursuant to Rule 425(8)(b) the RUSLE method must be approved by the director before use. This approval has not been made. Until the effectiveness of the USLE vs. RUSLE can be gauged, the factors for the USLE that are described below appear to be the best tool that we have to judge the effectiveness of a final cover system with regard to soil erosion.

Using the USLE to Demonstrate Soil Erosion Control

The USLE, as follows, expresses soil loss rate per unit area :

$$A = (R)\ (C)\ (LS)\ (K)\ (P)$$

Where:

A	=	Computed Soil Loss in tons/acre-year	
R	=	Rainfall Energy factor	**[Picked by Michigan County]**
C	=	Cropping Management factor	**[Picked from Table]**
LS	=	Slope-Length factor	**[Calculated with RUSLE or Equations]**
K	=	Soil Erodibility factor	**[Picked from Table or Nomograph]**
P	=	Erosion Control Practice factor	**[Value of 1.0 is used]**

The Rainfall Energy factor (R) has been calculated for all of the Michigan counties by the NRCS. A map of these factors calculated by county has been included in attachment 1. The R factors are based on recent rainfall data.

The DEQ suggests that a sound approach to estimating the C factor would be to use a value corresponding to 80%, 90%, or 95% - 100% soil surface coverage (depending on seeding rates, mulching rates, fertilization, mowing and topsoil organic content) with an adjustment for the weed component. The corresponding C factor would range from 0.007, at a minimum, to a possible higher number based upon local conditions and vegetative care plans. The table below summarizes recommended care and preparation steps to achieve each C factor and the maximum swale separation to be used for design purposes. The care and preparation steps summarized with each C factor are efforts that the DEQ believes will achieve the corresponding ground cover estimates. There are so many different permutations of site preparation, materials utilized and vegetative care that it is not practical to enumerate all of them. Different combinations may be approved as long as the facility is able to demonstrate equivalent erosion protection and that the design assumptions made are achieved.

DEQ Design Recommendations

Ground Cover Estimate		Suggested C value	Maximum Separation
95% - 100%			
Topsoil :	organic matter ≥ 2.5%		
Seeding :	NRCS Critical Area Planting Guide		
Mulching :	NRCS Critical Area Planting Guide	0.007	60' vertical if A ≤ 2.0
Fertilization :	NRCS Critical Area Planting Guide		
Mowing :	Minimum of two annually		
90%			
Topsoil :	1.25% ≤ organic matter < 2.5%		
Seeding :	NRCS Critical Area Planting Guide		
Mulching :	NRCS Critical Area Planting Guide	0.014	60' vertical if A ≤ 2.0
Fertilization :	None Prescribed		
Mowing :	Minimum of one annually		
80% or Less			
Topsoil :	organic matter < 1.25%		
Seeding :	NRCS Critical Area Planting Guide	0.028 or higher depending on local conditions	60' vertical if A ≤ 2.0
Mulching :	NRCS Critical Area Planting Guide		
Fertilization :	None Prescribed		
Mowing :	None Prescribed		

The actual level of coverage of the vegetation will need to be measured on the final cover to ensure that the design assumptions are being met. It may be advisable to include a provision for repairing the final cover vegetation if the level of growth does not correspond with the design assumptions after a reasonable time period. If the level of coverage is not being achieved, extra care for the vegetation should be considered before the final cover is repaired. The facility should consult with an agronomist/soil scientist to pursue the most appropriate measures to remedy inadequate growth.

The Length/Slope factor (LS) is a rough measure of the available potential energy for runoff. The previous method for calculating the LS factor has been found through experimental data to over predict erosion on control plots. The new method for calculating the LS factor is based on research by D. K. McCool et al. LS can be read from the table in attachment 2 for simple slopes. LS can also be calculated using the following equations :

$$LF = (0.0138\,\lambda)^m \quad \text{or} \quad (\lambda / 72.6)^m \quad \text{for uniform slopes} \tag{1}$$

$$m = (2(11.16 \sin\theta / 3(\sin\theta)^{0.8} + 0.56)) / (1 + (2(11.16 \sin\theta / 3(\sin\theta)^{0.8} + 0.56))) \tag{2}$$

$$SF = 16.8 \sin\theta - 0.5 \quad \text{for slopes} > 15' \quad \text{or} \quad 3(\sin\theta)0.8 + 0.56 \quad \text{for slopes} < 15' \tag{3}$$

$$LS = (LF)(SF) \quad \text{for uniform slopes} \tag{4}$$

$$LS_i = \frac{SF_i\,(\lambda_i^{m+1} - \lambda_{i-1}^{m+1})}{(\lambda_i - \lambda_{i-1})(72.6)^m} \tag{5}$$

$$LS = \frac{\sum[LS_i\,(\lambda_i - \lambda_{i-1})]}{\lambda_{total}} \tag{6}$$

Where :

λ	=	Horizontal length of slope in feet (e.g. Slope Length·cos (atan (Slope %)))
θ	=	Slope Angle (e.g. atan (Slope %))
LF	=	Length factor
SF	=	Slope factor
λ_{total}	=	Total horizontal length of complex slope
LS_i	=	Effective LS factor for each slope segment
λ_i	=	Horizontal length from the top of the slope to the bottom of the segment
λ_{i-1}	=	Horizontal length from the top of the slope to the top of the segment

Note 1: *Equation 1 is valid for slopes greater than 9%. Values for slopes greater than 18% and/or 300 feet in length are extrapolations from experimental data.*

Note 2: *These equations make for easier calculation since precise LS factors can be calculated from design slopes and lengths easily with a spreadsheet or calculator.*

Note 3: *The LS factor for complex slopes can be calculated from design slopes and lengths using equations 2, 3, 5, & 6.*

Note 4: *At slope lengths longer than approx. 200 - 300' the primary erosional process is gully erosion due to channelized flow. The USLE does not account for gully erosion. It is recommended that design slope lengths should be less than 200' - 300' long.*

The Soil Erodibility factor (K) is dependent on the soil's properties, both physical and chemical. This factor can be estimated based on the U.S. Department of Agriculture (USDA) Textural Classification or it can be estimated from a soil erodibility nomograph. The K factor that is most appropriate for the on-site soils should be obtained from either the approximation of K values based on the USDA Textural Classification and the organic content or the K factor nomograph. Both of these methods are included in attachment 3. Adequate topsoil testing should be provided to ensure that the K value is appropriate for the site.

The Erosion Control Practice factor (*P*) is based on surface preparation on the slopes. This factor is primarily applied to tilling practices on a farm field. *P* would be more applicable if the USLE were calculated for a facility using a C factor = 1.0 (e.g. no vegetative cover). *P* = 1.0 should be used for landfill design.

Waste Management Division
Final Cover Erosion Control Design Guidance
Attachment 1

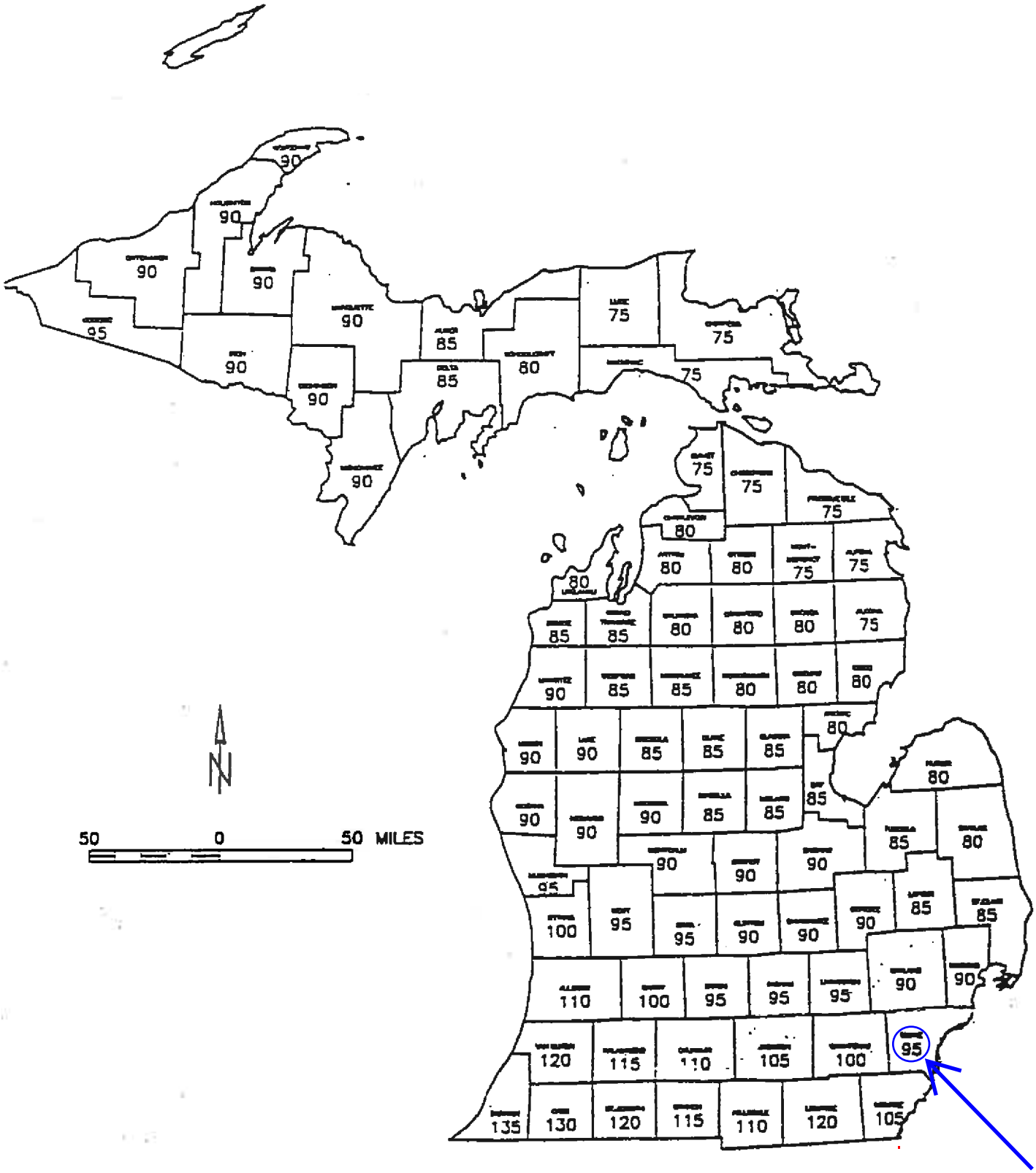


Table 4-3.
Values for topographic factor, LS, for high ratio of rill to interrill erosion.[1]

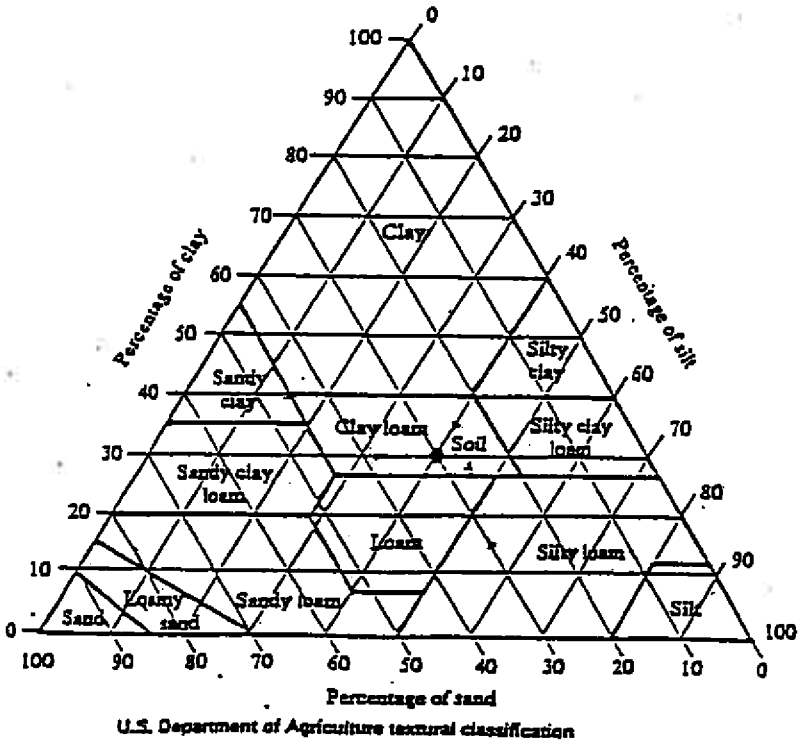
Slope (%)	Horizontal slope length (ft)																
	<3	6	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.5	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.12	0.13
1.0	0.09	0.09	0.09	0.09	0.09	0.10	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.24	0.26	0.27
2.0	0.13	0.13	0.13	0.13	0.13	0.16	0.21	0.25	0.28	0.33	0.37	0.40	0.43	0.48	0.56	0.63	0.69
3.0	0.17	0.17	0.17	0.17	0.17	0.21	0.30	0.36	0.41	0.50	0.57	0.64	0.69	0.80	0.96	1.10	1.23
4.0	0.20	0.20	0.20	0.20	0.20	0.26	0.38	0.47	0.55	0.68	0.79	0.89	0.98	1.14	1.42	1.65	1.86
5.0	0.23	0.23	0.23	0.23	0.23	0.31	0.46	0.58	0.68	0.86	1.02	1.16	1.28	1.51	1.91	2.25	2.55
6.0	0.26	0.26	0.26	0.26	0.26	0.36	0.54	0.69	0.82	1.05	1.25	1.43	1.60	1.90	2.43	2.89	3.30
8.0	0.32	0.32	0.32	0.32	0.32	0.45	0.70	0.91	1.10	1.43	1.72	1.99	2.24	2.70	3.52	4.24	4.91
10.0	0.35	0.37	0.38	0.39	0.40	0.57	0.91	1.20	1.46	1.92	2.34	2.72	3.09	3.75	4.95	6.03	7.02
12.0	0.36	0.41	0.45	0.47	0.49	0.71	1.15	1.54	1.88	2.51	3.07	3.60	4.09	5.01	6.67	8.17	9.57
14.0	0.38	0.45	0.51	0.55	0.58	0.85	1.40	1.87	2.31	3.09	3.81	4.48	5.11	6.30	8.45	10.40	12.23
16.0	0.39	0.49	0.56	0.62	0.67	0.98	1.64	2.21	2.73	3.68	4.56	5.37	6.15	7.60	10.26	12.69	14.96
20.0	0.41	0.56	0.67	0.76	0.84	1.24	2.10	2.86	3.57	4.85	6.04	7.16	8.23	10.24	13.94	17.35	20.57
25.0	0.45	0.64	0.80	0.93	1.04	1.56	2.67	3.67	4.59	6.30	7.88	9.38	10.81	13.53	18.57	23.24	27.66
30.0	0.48	0.72	0.91	1.08	1.24	1.86	3.22	4.44	5.58	7.70	9.67	11.55	13.35	16.77	23.14	29.07	34.71
40.0	0.53	0.85	1.13	1.37	1.59	2.41	4.24	5.89	7.44	10.35	13.07	15.67	18.17	22.95	31.89	40.29	48.29
50.0	0.58	0.97	1.31	1.62	1.91	2.91	5.16	7.20	9.13	12.75	16.16	19.42	22.57	28.60	39.95	50.63	60.84
60.0	0.63	1.07	1.47	1.84	2.19	3.36	5.97	8.37	10.63	14.89	18.92	22.78	26.51	33.67	47.18	59.93	72.15

[1]Such as for freshly prepared construction and other highly disturbed soil conditions with little or no cover (not applicable to thawing soil)

APPROXIMATE VALUES OF FACTOR K FOR USDA TEXTURAL CLASSES

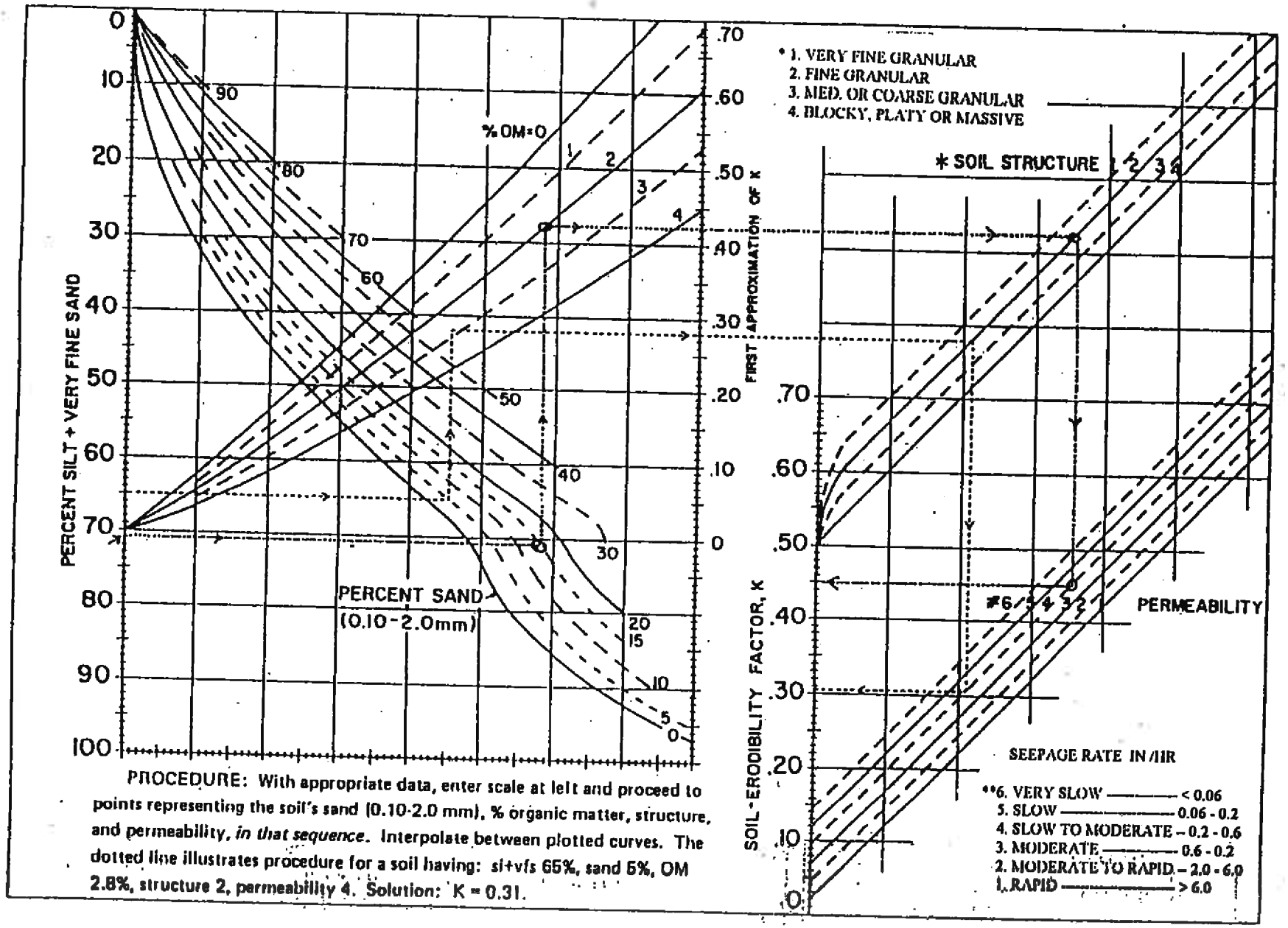
Texture class	Organic matter content <0.5% K	2% K	4% K
Sand	0.05	0.03	0.02
Fine sand	.16	.14	.10
Very fine sand	.42	.36	.28
Loamy sand	.12	.10	.08
Loamy fine sand	.24	.20	.16
Loamy very fine sand	.44	.38	.30
Sandy loam	.27	.24	.19
Fine sandy loam	.35	.30	.24
Very fine sandy loam	.47	.41	.33
Loam	.38	.34	.29
Silt loam	.48	.42	.33
Silt	.60	.52	.42
Sandy clay loam	.27	.25	.21
Clay loam	.28	.25	.21
Silty clay loam	.37	.32	.26
Sandy clay	.14	.13	.12
Silty clay	.25	.23	.19
Clay		0.13-0.29	

The values shown are estimated averages of broad ranges of specific-soil values. When a texture is near the borderline of two texture classes, use the average of the two K values.



U.S. Department of Agriculture textural classification

Figure 1. Soil-erodibility nomograph.



PROCEDURE: With appropriate data, enter scale at left and proceed to points representing the soil's sand (0.10-2.0 mm), % organic matter, structure, and permeability, *in that sequence*. Interpolate between plotted curves. The dotted line illustrates procedure for a soil having: si+vfs 65%, sand 5%, OM 2.8%, structure 2, permeability 4. Solution: K = 0.31.

ATTACHMENT B

ENGINEERED ARTIFICIAL TURF
LANDFILL FINAL COVER ALTERNATE

US Ecology
Wayne Disposal, Inc.
Belleville, Michigan

Engineered Artificial Turf Landfill Cover Equivalency Demonstration

November 2021

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1.0 PURPOSE

CTI and Associates, Inc. has prepared this report to demonstrate the equivalency of Engineered Artificial Turf Landfill Cover (EATLC) system to the traditional cover system as shown in the permitted drawings titled "Wayne Disposal, Inc. Site No. 2 Master Cell VI-F&G". Final cover requirements specified by Code of Federal Regulations (CFR) §264.310 require the final cover to in part:

- Provide long-term minimization of migration of liquids through the closed landfill
- Promote drainage of the cover
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

In addition to prescriptive requirements for the final cover over a hazardous waste landfill, Michigan Administrative Code R 299.9619(6)(a) also states the owner or operator can: Substitute an equivalent design which shall include a flexible membrane liner component with a minimum thickness of 1 mm (40 mil), depending on the type of material selected, and demonstrates to the director that it provides equivalent environmental protection.

The following sections will demonstrate that EATLC provides similar or better performance to the current prescribed final cover system. This demonstration compares the following key characteristics:

- Minimizing Maintenance
- Minimizing Infiltration
- Minimizing Erosion Potential
- Promotion of Surface Water Runoff
- Resisting Damage from Settlement
- Promoting Slope Stability

2.0 CONFIGURATION OF THE FINAL COVER SYSTEM

2.1 PERMITTED COVER SYSTEM

The current cover system that has been permitted for the site consists of the following components (from bottom to top):

- Leveling Layer - 1-ft (min)
- Geosynthetic clay liner (GCL)
- HDPE geomembrane - 40-mil textured
- Double-Sided Geocomposite
- Protective Soil - 2.5-ft
- Topsoil - 0.5-ft
- Vegetation

Figure 1 below depicts the details of the final cover system based on the permit design.

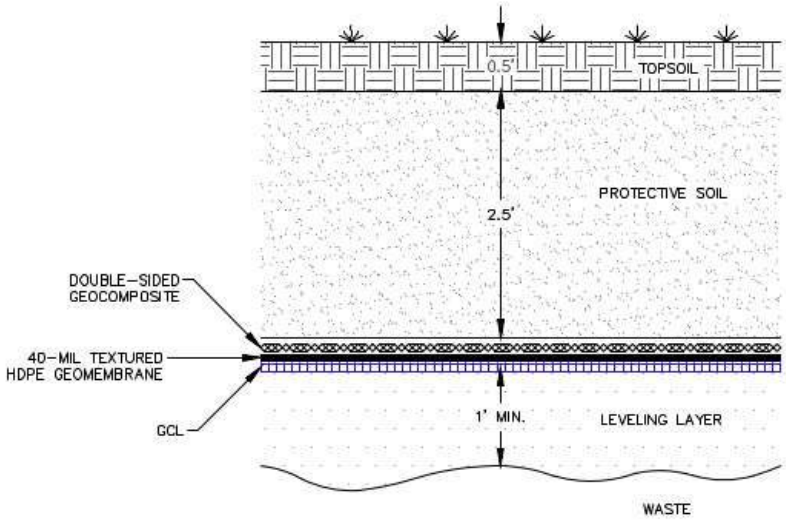


Figure 1 - Permitted Final Cover System

2.2 Engineered Artificial Turf Landfill Cover System

The Engineered Artificial Turf Landfill Cover system will consist of the following components (from bottom to top):

- Leveling Layer - 1-ft (min)
- Geosynthetic Clay Liner (Two layers)
- HDPE Geomembrane - 40-mil textured
- Engineered Artificial Turf
- Sand Infill - 0.5-inch

Figure 2 below depicts the details of the final cover system based on the proposed EATLC design. Additional details of the EATLC system as part of the final cover system are included in **Attachment A**. Photos of the top and underside of the EATLC are presented in **Figure 3 and 4**, respectively.

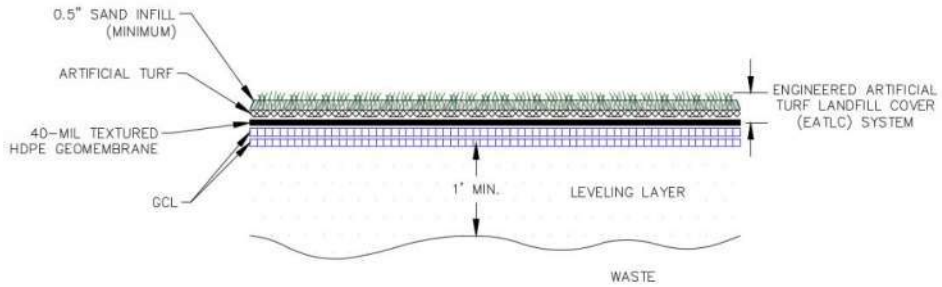


Figure 2 – Engineered Artificial Turf Landfill Cover System

Figure 3 - View of engineered artificial turf with sand infill and textured geomembrane

Figure 4 - Underside view of engineered artificial turf and textured geomembrane

3.0 EQUIVALENCY DEMONSTRATION

3.1 SUMMARY

This demonstration generally applies to alternative covers consisting of engineered artificial turf. However, all the specific data cited is reflective of ClosureTurf, a commercially available product manufactured by WatershedGeo designed specifically for landfill cover systems. It is to date perhaps the best known and best studied system. Other similar systems exist and as they are developed and come to market are likely to behave similarly and have similar properties. WDI will evaluate other similar systems at the time of the final cover installation based on specifications and the data provided by manufacturers. The selected products shall provide equivalent functions and performance as demonstrated in this report.

This demonstration shows that based on all the key and relevant criteria evaluated, engineered artificial turf landfill cover systems have been demonstrated to perform at least as well as traditional cover systems. **Table 1** below shows a summary of these specific criteria. The remainder of the document provides detail to support the conclusions in **Table 1**. Drawings and details depicting EATLC used in the final cover system at WDI are contained in **Attachment A**.

Table 1 – Comparison of Engineered Artificial Turf Landfill Cover to Conventional Cover

Category		Criterion for Evaluation	Equivalency of **EATLC** to Conventional Cover			
				EATLC		Conventional Cover
Incl. 40 mil min Geomembrane [per R 299.9619(6)(a)]			✓	40 mil		40 mil (typ)
Minimize	Maint-enance	Turf resilience	✓	Permanent, no mowing, no reseeding		Continual mowing and upkeep
		Slope stability	✓	Critical interface is FML/GCL/GCL/Soil		Critical interface is FML/GCL/Soil
		Static factor of safety (sat. cond)	✓	1.9-2.4 (typ) – slope 4:1		1.3 – 1.5 (typ) - max. slope 4:1
	Erosion	Annual estimated erosion amount	✓	<0.5 tons per acre per year		Up to 2 tons per acre per year
		Resistance to shear forces	✓	Limiting flow velocity is >11 ft/s		Limiting flow velocity 5 ft/s (without turf reinforcement mats)
	Infiltra-tion	Storm water leakage into landfill	✓	0.000 in/day (per HELP Model)		0.000 in/day (per HELP model)
		Reduce ponding potential	✓	Min. slopes ≥ 4% (easy to observe ponding)		Min. slopes ≥ 4%
Promote Runoff		Subsurface drainage capacity	✓	No need (all drainage managed on surface)		Limited by geocomposite capacity
		Runoff curve number	✓	92-95 (typ)		<90 (typ)
		Cover retains water	✓	Infiltration layer eliminated		Infiltration layer holds water
Resist Damage from Settlement		Rutting and deformation of cover	✓	Low potential, subgrade stays dry		Higher potential, subgrade retains water
		Time to complete repairs	✓	Hours		Days to repair/ weeks for new media

3.2 MAINTENANCE

The vegetative/infiltration layer in traditional cover systems typically requires a number of significant maintenance activities through closure and post-closure of the landfill. These can include:

- Mowing/excess vegetation removal
- Establishment/reestablishment of vegetation
- Erosion protection/repair
- Desiccation repair
- Addressing burrowing animals/burrow repair
- Settlement/Ponding
- Silt/sedimentation removal from drainage channels

By contrast, one of the biggest advantages of engineered artificial turf landfill cover systems is it greatly reduces the maintenance efforts making for a more protective barrier because it is more likely to remain intact throughout the closure/post-closure period.

EATLC has the following maintenance related properties:

- It does not require mowing
- Panels can be replaced more easily and within a matter of hours
- Resistance to erosion
- Resistance to damage from animals
- Settlement is more easily spotted and repaired
- Negligible sedimentation runoff

The technical aspects of these items are detailed more fully below.

3.2.1 Design Life

The engineered turf blades of engineered turf are specifically designed to resist the damaging effects of prolonged ultraviolet exposure. The design lifetime of the complete cover system is represented by the half-life of when half of the tensile strength of the synthetic turf fibers is reached from UV degradation. For ClosureTurf, Watershed Geo has conducted UV performance testing over the past several years at a testing facility in New River, Arizona and at some of the original closure turf installation locations (Pensacola, Florida and Jena, Louisiana). Independent performance assessments indicate that the half-life (50% retained tensile strength) of the UV exposed HDPE grass blades is in excess of 100 years. See Figure 7 of the report included as part of **Attachment B**. The extrapolated service life is expected to be on the order of 200 years or greater, based upon the minimum required tensile strength.

The other components of the EATLC system also have design lives well over 100 years. Both the geomembrane and the geotextile backing component of engineered turf are shielded from UV exposure by the turf fibers and the infill sand and resist degradation. This results in extending the design life in comparison to exposed materials, so those protected components are expected to have a design life of several hundred years.

3.2.2 Veneer Stability

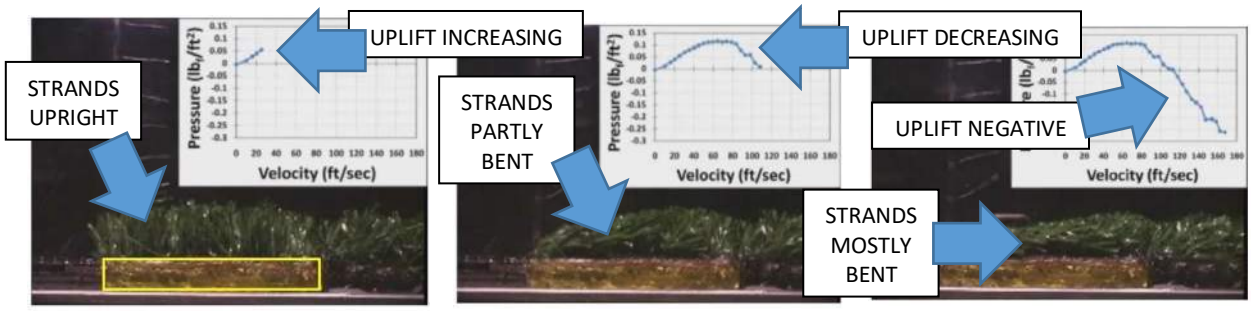
Sliding of the soil cover on top of the geomembrane in a traditional cover system is a potential design concern. This is especially true after major storm events if the drainage system between the soil and geomembrane is not properly designed. For EATLC, the thick soil component is removed, eliminating the potential for seepage forces to build up providing for greater stability. For the proposed design at WDI, the critical interfaces are the same for both systems, that is FML/GCL, GCL/GCL, and GCL/Soil. By eliminating the soil veneer, greater stability and steeper slopes with the same factor of safety are achievable.

Veneer stability analyses were performed to compare each cover system by determining the required interface friction angle for the critical interface(s) and demonstrate the stability of the final cover soils over the cap/cover system geosynthetics. The longest and steepest slope was chosen to be analyzed for minimum interface shear strength requirements, and the following two conditions were checked: Static Unsaturated and Static Saturated. The results of this analysis are given in **Attachment C**. The analyses indicate that the factors of safety are well above the minimum required values for both conditions.

3.2.3 Wind Uplift

A related concern for EATLC is wind uplift. The geotextile/turf layer is designed to be installed on top of the geomembrane and remain in place without anchoring it to the geomembrane below. It relies on interface friction and overlying sand ballast to remain immobile.

The Georgia Tech Research Institute conducted 2D, full scale wind tunnel tests to evaluate ClosureTurf under several wind speeds to evaluate aerodynamic properties and potential for uplift. The experiment measured the aerodynamic forces acting on the permeable upper turf layer and evaluated the wind speed in relation to the sand ballast. The purpose of the ballast is twofold: 1) Prevent liftoff and 2) Prevent tangential motion along the interface between the turf material and the geomembrane underlayment resulting from aerodynamic lift and drag acting on the turf layer. The testing performed determined the sand ballast requirements needed to counteract the uplift pressure. Illustration of the test and the results are depicted in **Figure 5** below. Interestingly, maximum uplift occurs at around 50 mph before the uplift begins to drop and become negative. This is due to the grass blades bending over, breaking the suction force resulting in a downward force due to drag. The maximum uplift corresponds to approximately 0.12 psf. This is much less than the downward force created by 0.5 in of sand which is approximately 4.5 psf.



V_{inf} = 25 ft/sec = 17 mph V_{inf} = 110 ft/sec = 75 mph V_{inf} = 170 ft/sec = 115 mph

Figure 5 – Wind tunnel testing results

The wind tunnel testing compared uplift pressure at both the interior and along the edge of the samples. Maximum uplift pressure was observed along the edge. At 66 mph, which represents the historical peak wind gust for Detroit based on the available wind data from the National Climatic Data Center, the minimum sand ballast required was 0.2 in. Additional details are contained in **Attachment D.**

3.2.4 Rutting

For conventional soil covers, the soil infiltration layer holds water during the wetter portions of the year. When this occurs in areas that require routine access or areas along access road alignments can experience rutting from vehicles and possibly even foot traffic.

Engineered artificial turf was evaluated by another 3rd party consultant (SGI) for subgrade integrity where ground pressure from heavy equipment was evaluated in relation to maintaining the integrity of the engineered artificial turf landfill cover components. Results showed that when the subgrade is protected by EATLC, including the sand infill, the subgrade can handle equipment with tire pressures up to 60 psi on 3H:1V slopes and up to 90 psi on relatively flat slopes with no appreciable damage to the engineered turf of the subgrade. This evaluation is contained in **Attachment E**.

3.2.5 Ponding/Settlement Repairs

For a conventional cover system, settlement may lead to ponding on the surface and local saturation of infiltration layer. Because of the resulting soft subgrade, repairs may be delayed due to difficulties getting the necessary heavy equipment to the area and/or risking additional damage to the cover system from rutting and erosion from the equipment. As shown in **Figure 6**, excessive settlement can also affect the performance of the underlying geosynthetics which may or may not be apparent at the surface. Vegetated cover soils can obscure the ability to inspect for geosynthetic defects or anomalies resulting from excessive settlement. The presence of the vegetated soil layer also hinders the ability to implement repairs, in the event that the corrective measures are necessary since it must be fully over excavated to make repairs which can require significant effort and delay repairs even more. Finally, once the repairs are made, it may take several weeks to reestablish vegetation before the repair is fully implemented. Total time for repairs is likely measured in weeks perhaps to more than a month.

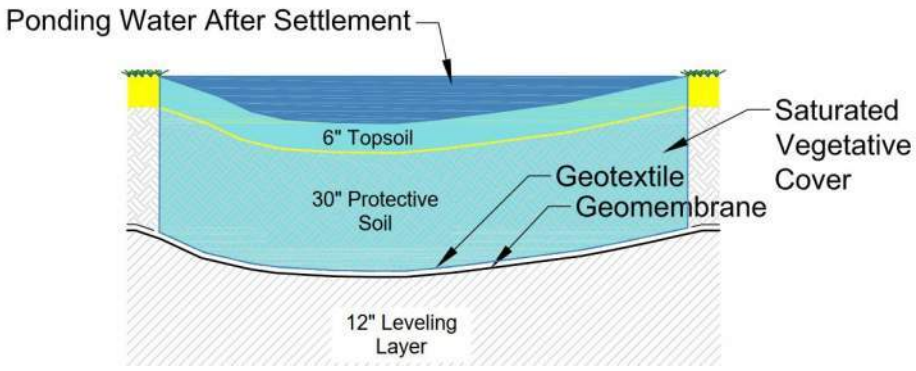


Figure 6 – Repairs to conventional cover

In contrast, repair of settlement in areas where engineered artificial turf landfill cover is utilized can be addressed much more quickly as depicted in **Figure 7**. Because there is no soil component, the potential for soft subgrade is minimized and the geosynthetic components can be readily accessed and inspected. Any ponded water can be pumped and removed, the geosynthetics removed to reveal the settlement area, the depressed area filled with soil to bring it back up to grade, and the area quickly seamed and repaired. There is no need to reseed the area. Total time for repair can likely be measured in hours.

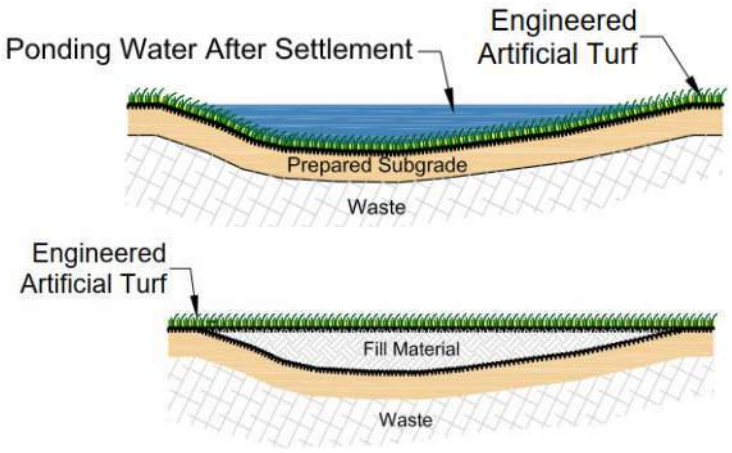


Figure 7 – Repairs to Engineered Artificial Turf Landfill Cover

3.3 EROSION

For a conventional cover system, the ability to resist erosion is primarily related to the establishment (and retention) of adequate vegetation. It can be difficult to establish and maintain adequate vegetation across the full extent of a landfill. Extended periods of drought can quickly transition to high intensity downpours.

The vegetative/infiltration soil layer is the primary component of the conventional cover system which is subject to erosion. On-site soils that are likely to be used for this layer consist primarily of a combination of silt, clay, and sand particles in various proportions. Erosional stability of these individual particles is influenced by soil adhesion, vegetative cover, and internal friction. Erosion of the vegetative soil layer cannot be entirely arrested since some of the stability parameters vary over time and various climatic conditions. Silt loams, loams, fine sands and sandy loams are the most detachable soil particles (Morgan, 2005) which make up a large percentage of vegetative soil.

Based on the current design, the estimated annual rate of soil erosion (discharge) from the conventional vegetative cover system is predicted to range up to 1.3 tons per acre, per year (USE 2021). Also, significant, additional erosion could occur during a single, extreme storm event potentially resulting in damage to the engineered soil components requiring and costly repairs. Additionally, perimeter channels within a conventional cover can become laden with sediments which can be detrimental to vegetation in that zone and can lead to water quality concerns, erosion rills, and an increasingly complex maintenance program to maintain adequate vegetation.

Engineered artificial turf landfill cover is designed to essentially eliminate this potential by eliminating the vegetative/infiltration soil layer. The EATLC system does have a 0.5-in thick specified infill sand layer that is spread within the engineered artificial turf layer which is used for ballast and for UV protection of the underlying geotextile backing of the engineered artificial turf components. However, in comparison to traditional cover, the sand infill is much less erodible. It consists of a coarse-grained sand meeting specific standards tested for resistance to erosion. Stability of the sand aggregates is influenced by internal friction and turf strand reinforcement which are static properties and allow for the potential for soil erosion to be minimized by design.

Watershed Geo has completed extensive hydraulic testing to evaluate the sand infill's performance under various surface water conditions. The summary of this testing program is included in **Attachment F** and the sand infill specifications developed from this testing is included in **Attachment G**. Sand infill that conforms to these specifications is expected to experience minimal sand movement under the design surface water conditions.

3.4 Infiltration Equivalency

By design, the vegetated soil layer is intended to act as a large sponge which soaks up precipitation during storm events and provides a moisture reservoir for the vegetation. However, one of the undesirable consequences of the sponge action is that each time the soil layer becomes saturated (during prolonged storm events), the soil layer will slowly release or seep a steady flow of water across the underlying cover membrane for several days after the storm event. Subsequently, the opportunity for water leakage through any cover membrane defects is extended. Therefore, the presence of the vegetated soil layer inadvertently prolongs an undesirable window of opportunity where leakage might occur.

Alternative engineered artificial turf landfill cover systems perform similar to or better than the prescribed traditional cover systems in terms of infiltration (Carlson, et al., 2019). The primary reasons for this are 1) The geomembrane material is itself designed to be essentially impermeable and 2) Because they don't have a soil component that could potentially hold water, synthetic turf cover systems like ClosureTurf have a much smaller hydraulic head over the geomembrane layer driving infiltration in comparison to traditional cover systems. The full technical paper cited is provided in **Attachment H**.

The final cover systems described in Section 2.0 were each modeled in the USEPA's Hydrologic Evaluation of Landfill Performance (HELP) Model. The results showed that EATLC compared to the current permitted traditional cover system produced similar rates and sheds much more water than a traditional cover system. The analysis shows that both cover systems allow for negligible flow through the geosynthetic composite cover. The EATLC system meets the criteria from a hydrologic standpoint of being at least as protective as the permitted cover system. Complete results for the entire simulation period are included in **Attachment I**.

3.5 Surface Water Considerations

The use of an engineered artificial turf landfill cover system allows the landfill to manage a larger volume of surface water with similar or smaller annual infiltration compared to a traditional cover system. For a traditional cover system, benches and berms are designed to intercept long flow paths of runoff and prevent rill erosion. With engineered artificial turf, the cover system isn't subjected to this same rill erosion even for long flow lengths. This allows for the removal of mid-slope features and the EATLC is then able to utilize surface flow as the primary means of conveyance. Without these intercept features and with the higher run-off coefficients, the cover system will discharge faster and minimize the time that surface water is flowing on the geomembrane liner. The complete technical paper that compares the hydrologic performance of engineered artificial turf to a traditional cover system is included in **Attachment J**.

A surface water analysis was performed for the use of EATLC. The currently permitted design was updated to account for the properties of EATLC. For example, the design run-off curve number for EATLC is 95, compared to 84 for the traditional cover system. Compared to the traditional final cover system the downslope channels and almost all of the diversion berms in the landfill expansion area were removed. The only berms that remain are along select locations of the perimeter of the landfill to route runoff to

ditches and storm sewer inlets. Plans showing the location of the remaining berms are included in **Attachment A**. The runoff velocity and flow depths in some downstream ditches also increased. To handle this, the ditches receiving sheet flow from EATLC areas will be lined with engineered artificial turf. The height of the containment berms on the outside edge of the perimeter channels are being increased or channel lining modified, as necessary, to accommodate the higher runoff volumes. Also, some culverts increased in size to transmit the increased flows. The complete surface water analysis is included in **Attachment K**. The EATLC stormwater management system is shown on Figures 1 and 2 in Attachment K-1.5.

The run-off water quality characteristics, including turbidity (total suspended solids), for a traditional cover system tend to degrade during high intensity precipitation events, because of increased flow rates and increased erosional shear forces on the vegetative soils. The turbidity water quality related to an EATLC system remains clear throughout a wide spectrum of high intensity storm events since the manufactured sand infill lacks fine silt or clay particles and has been engineered to specifically resist the range of expected erosional forces.

Concerns regarding other potential water quality considerations (nitrates, BOD, fertilizers, etc.) are also eliminated with an EATLC system.

3.6 Additional Considerations

In addition to the technical considerations, there are other considerations for the use of engineered artificial turf landfill cover.

3.6.1 Aesthetics

Figure 8 – Engineered artificial turf options

The engineered artificial turf component is available in a variety of colors to better blend in with adjacent topography and vegetation. It can be installed with a random pattern to look more natural as shown in **Figure 8.**

3.6.2 Carbon Footprint

Based on a 2012 study, the CO_2 footprint of engineered artificial turf systems are only 20% of the traditional multilayered cover systems (Koerner, 2012). This is largely due to greatly reducing truck and equipment traffic and the ability to install engineered artificial turf approximately 50% faster than conventional cover. This process is depicted in **Figure 9**. This also increases safety for both onsite personnel and offsite motorists sharing the road with haul trucks.

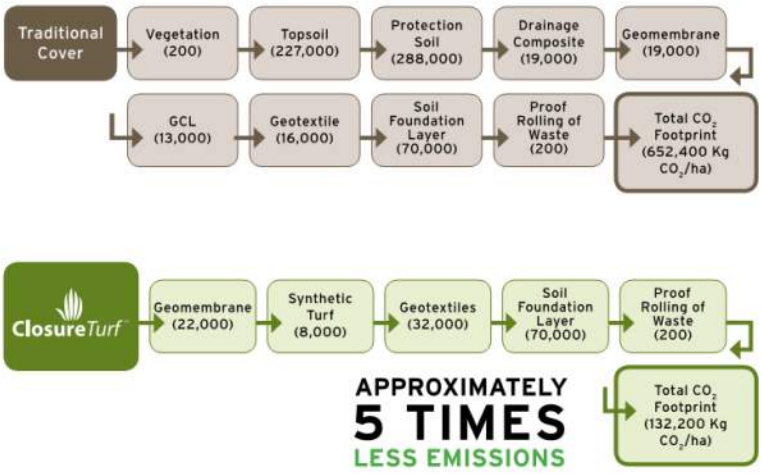


Figure 9 – CO_2 footprint traditional vs. ClosureTurf

3.6.3 Renewable Energy

Engineered artificial turf landfill cover systems can also be leveraged to be better locations for renewable energy projects. Lowered maintenance costs are perhaps the most noticeable advantage where mowing can be eliminated, erosion potential is very low, and repairs are more easily performed where needed. In some cases, maintenance requirements like mowing can make projects cost prohibitive.

Figure 10 – Example of renewable energy project where maintenance could be reduced using EATLC

4.0 REFERENCES

Carlson, C. P., Zhu, M. & Ebrahimi, A., 2019. *Hydrologic Performance of Synthetic Turf Cover Systems and Their Equivalency to Prescriptive Cover Systems.* Houston, Industrial Fabrics Association International, p. 8.

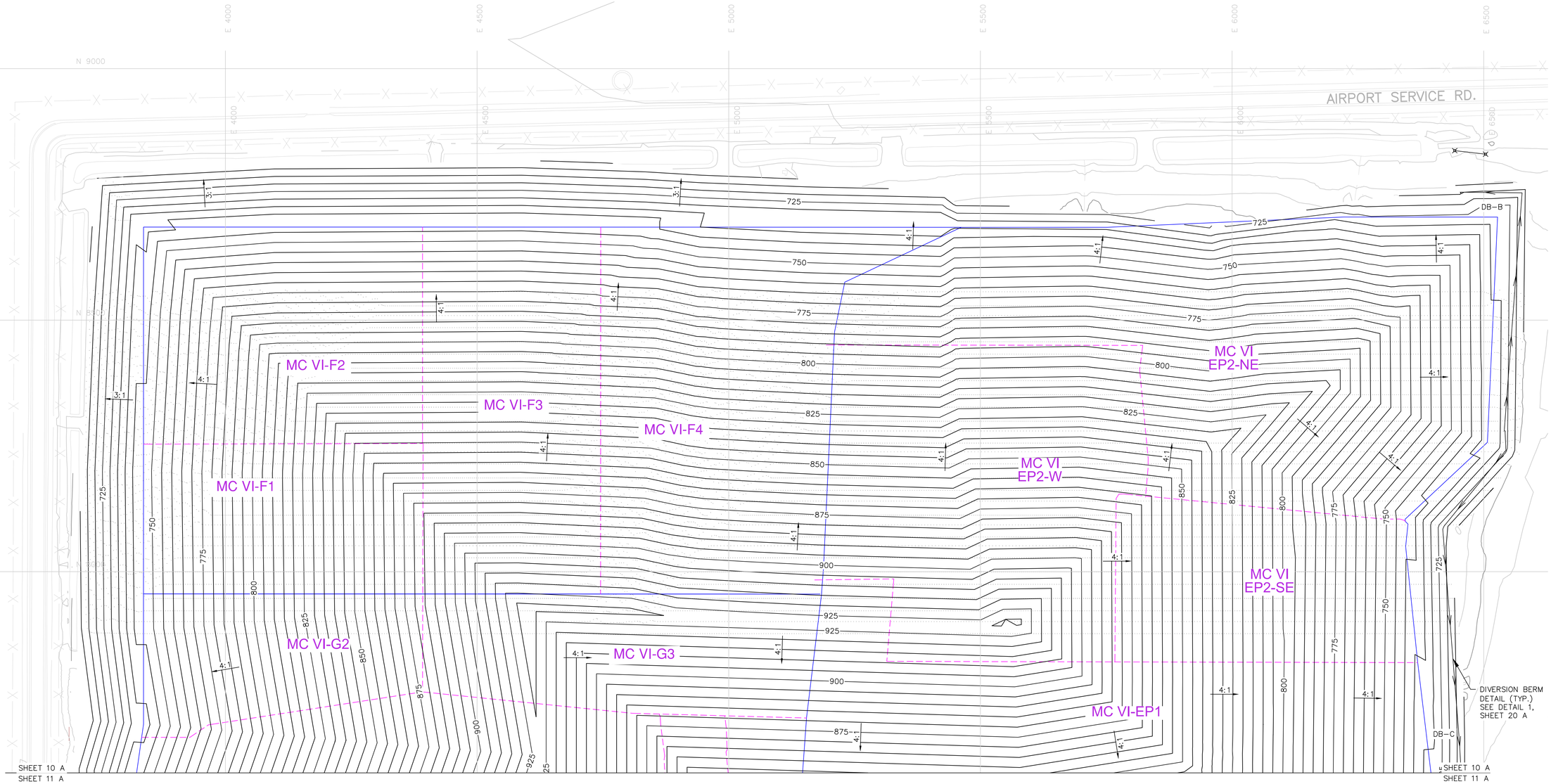
Koerner, R. M., 2012. Traditional vs. Exposed Geomembrane Landfill Covers. *Geosynthetics*, 1 October, pp. 34-41.

Morgan, R. P. C., 2005. *Soil Erosion and Conservation.* 3rd ed ed. Malden, MA: Blackwell Pub.

USE, 2021. 2021 WDI Permit Modification, Calculation A-6.9

Attachment A

Drawings



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- EXISTING VEGETATION
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (1 / 20 A)

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
10 A

SHEET 10 A
SHEET 11 A

MC VI-G1
MC VI-G1 EP2
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-B
MC VI A-N
MC VI-C
MC VI-D
MC VI A-S

DB-A-1
DB-A-2
DB-D-1
DB-D-2
DB-E
DB-F
DB-G
DB-H
DB-37
DB-39

DIVERSION BERM DETAIL (TYP.)
SEE DETAILS 1, SHEET 20 A

CATCH BASIN S4A

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- EXISTING VEGETATION
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (1 / 20 A)

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

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DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)

PROJECT NUMBER
1218070017

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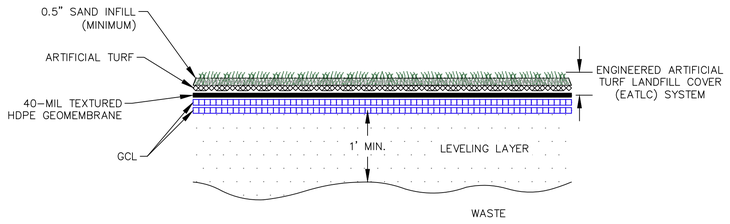

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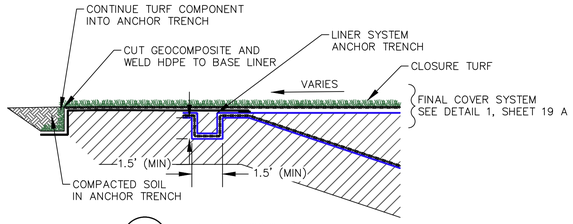

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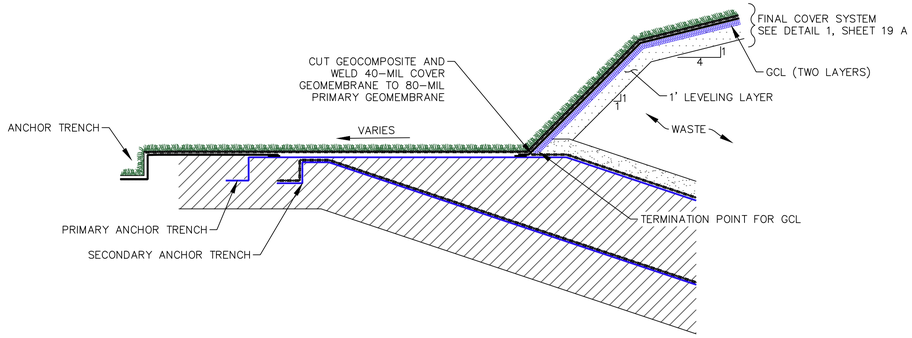

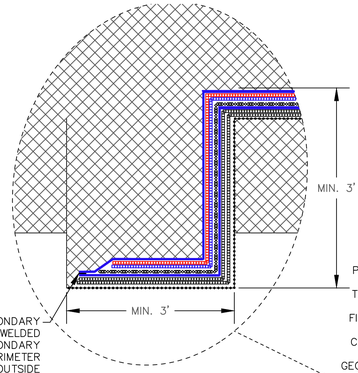

NOTE:
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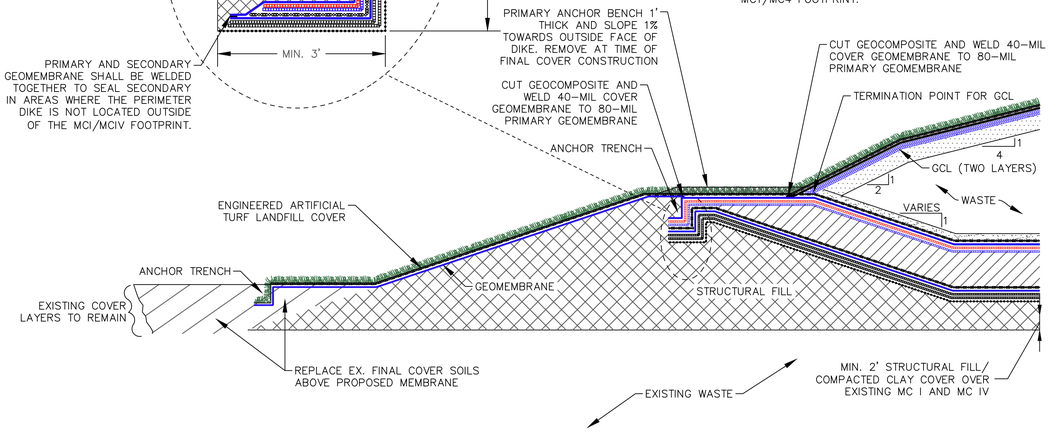

3 / 19 A **DIKE AND COVER TIE-IN DETAIL (TYP.) MC VI-F, MC VI-G, & EAST SIDE OF MC VI-E**
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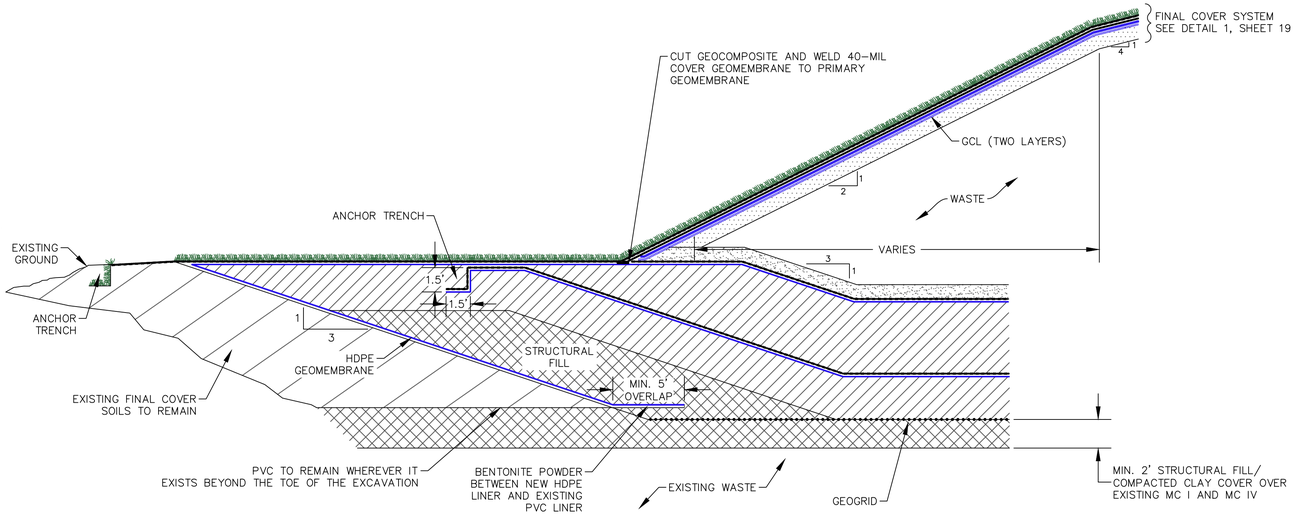
2 / 19 A **FINAL COVER TIE-IN DETAIL MC VI-AN, AS, C & D**
NOT TO SCALE



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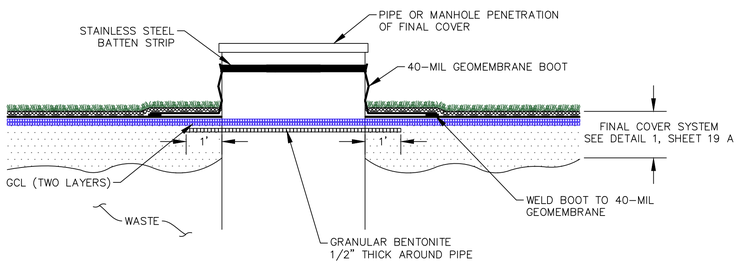

5 / 19 A **FINAL COVER PENETRATION DETAIL (TYP.)**
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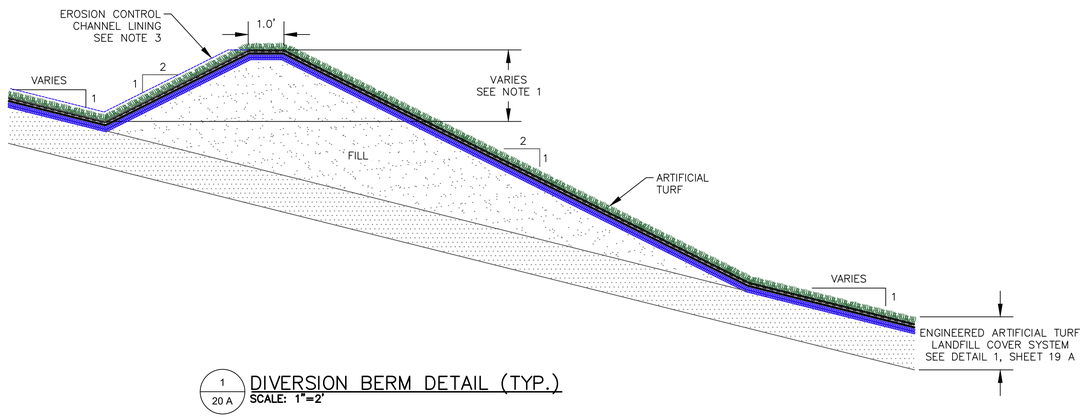
APPROVED BY:	XZ

REVISIONS			
REV	DATE	REVISION DESCRIPTION	
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG XZ
			DRN APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF FINAL COVER DETAILS

PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 19 A



1 / 20 A DIVERSION BERM DETAIL (TYP.)
SCALE: 1"=2'

NOTE:

1. ALL DIVERSION BERMS TO BE 2FT HIGH (MINIMUM).
2. DIVERSION BERM SLOPE TO BE 2% UNLESS NOTED OTHERWISE ON DRAWINGS.
3. DIMENSIONS AND CONFIGURATION OF DIVERSION BERMS WILL BE DETERMINED BY THE EROSION CONTROL CHANNEL LINING CHOSEN. CHANNEL AND OUTLET ENERGY DISSIPATER DESIGN TO BE COMPLETED PRIOR TO CONSTRUCTION.

REV	DATE	REVISION DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

DATE: 10/08/21
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CHECKED BY: CAB
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VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORMWATER MANAGEMENT SYSTEM DETAILS

PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 20 A

Attachment B

Design Life of ClosureTurf

Watershed Geo®
Unearthing Solutions

Technical Note

DESIGN LIFE OF CLOSURETURF®

The ClosureTurf® Final Cover System is projected to last well over one hundred (100) years, provided it is installed and maintained in accordance with Watershed Geosynthetics' standard specifications. This duration exceeds the current post-closure regulatory period of 30 years by more than 3 times. During that time, the average maintenance cost of the ClosureTurf system will be roughly 10 to 20% of the cost for maintenance of a traditional soil cover system.

CLOSURETURF COMPONENTS

To better understand system longevity, it is helpful to break down the system into its components and explain the function of each component. A cross-section of the ClosureTurf system is shown in Figure 1 to aid the discussion.

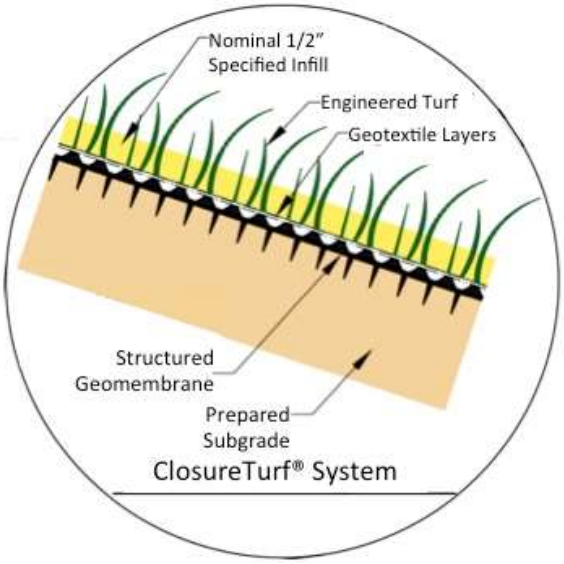

Figure 1. ClosureTurf® Cross-Section

Starting at the prepared subgrade and moving vertically through the cross-section of the system, the first component is the structured geomembrane. The structural geomembrane layer creates an impermeable hydraulic barrier providing the actual environmental containment. Moving upward through the cross-section, the second component is the engineered turf layer. The engineered turf layer is comprised of two distinct parts: (1) a double-layer woven geotextile backing with enhanced ultraviolet (UV) resistance; and (2) polyethylene turf fibers (or yarns) tufted into the woven

geotextiles. The third, and final, component of the ClosureTurf system is the specified infill. The specified infill is an angular, specifically graded sand resting on the geotextile backing and within the individual turf fibers of the engineered turf layer.

UV Protection

The geomembrane is covered by the engineered turf and sand protecting the geomembrane from UV exposure. Based upon research by Geosynthetic Institute (GSI) [Koerner et al., 2011 and Koerner et al., 2012], a covered geomembrane has an expected lifetime (i.e., a half-life) of several hundred years. The sand infill and turf fibers provide UV shielding of the geotextile backing of the engineered synthetic turf. With the sand infill in place, the geotextile backing will remain intact and in place covering the structured geomembrane, allowing the geomembrane to realize its full design life. The sole component of the ClosureTurf system exposed to UV is the turf fibers.

Longevity of Turf Fibers

Longevity of the turf fibers dictates the design life of the ClosureTurf system. UV longevity testing on the turf fibers indicates the half-life is projected to be over two hundred years, as presented in Attachment 1, Literature Review and Assessment of ClosureTurf UV Longevity prepared by Geosyntec Consultants. At year 100, the turf fibers are projected to have approximately 60% of the original tensile strength. The average tensile strength of virgin turf fibers is approximately 35 lbs per fiber. Therefore, the tensile strength at year 100 is projected to be approximately 20 lbs per fiber, which is significantly greater than the estimated minimum tensile strength necessary for the turf fibers to perform in application (i.e., approximately 2.5 to 3.5 lbs per fiber). Turf fiber tensile strength values over time compared to the required service value are presented in Figure 2.

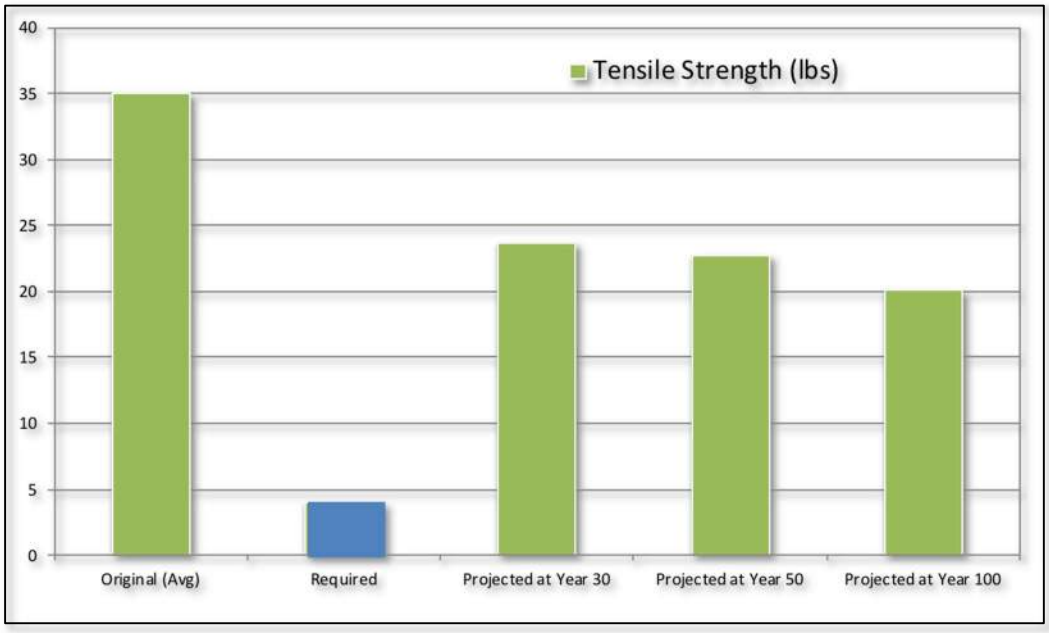

Figure 2. ClosureTurf® Fiber Tensile Strength

Field samples of turf fibers have been collected and tested for tensile strength at an independent laboratory. Samples were collected at two ClosureTurf installations, the LaSalle-Grant Landfill in Louisiana and the Saufley Field Road Landfill in Florida. The field sample turf exposure times ranged from five to eight years. The retained tensile strength of the turf field samples was compared with the laboratory UV testing results in New River, Arizona, as presented in Figure 3. Field performance of the engineered turf tensile strength matches or exceeds results from laboratory testing of UV exposure.

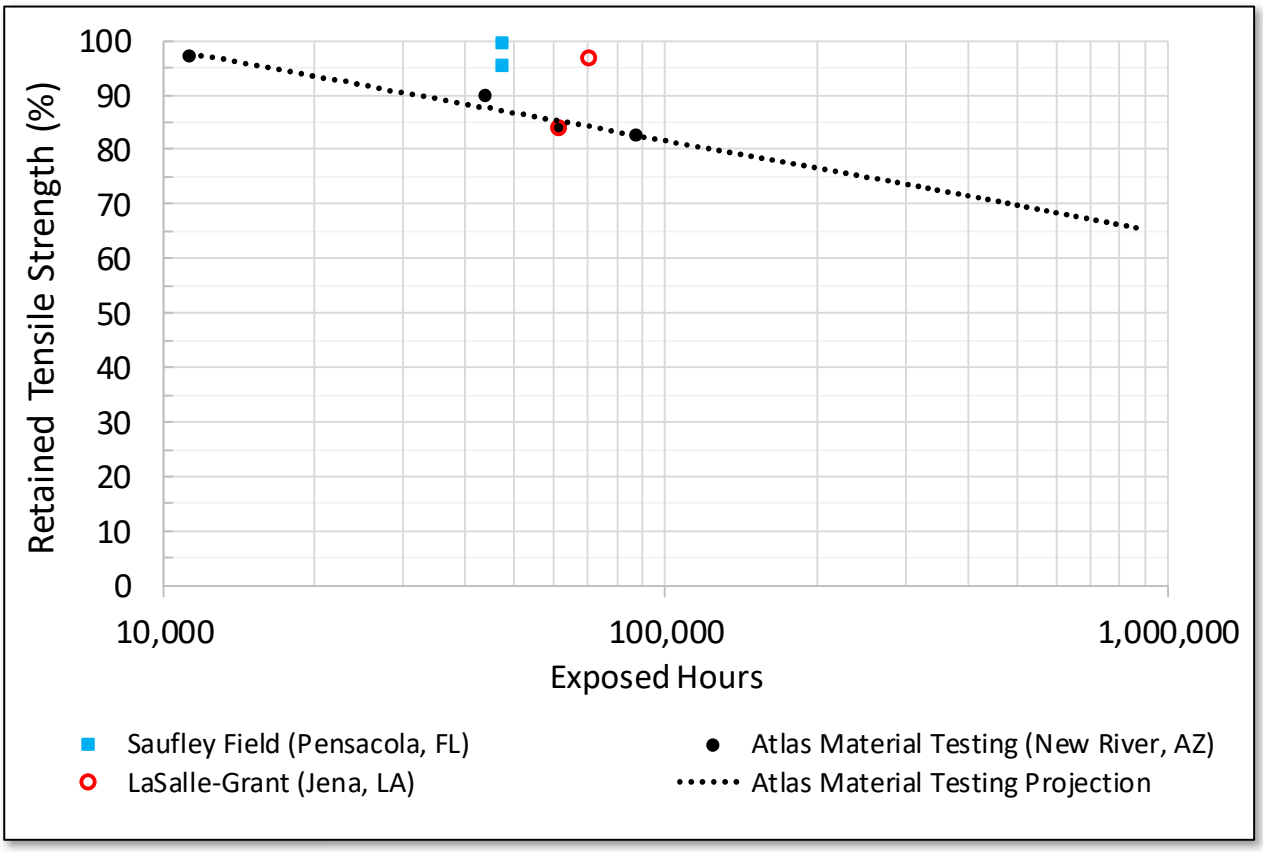

Figure 3. ClosureTurf® Fiber Tensile Strength, Field Performance

Maintenance Cost

As with any closure system, regular maintenance activities are required with the ClosureTurf system. Standard maintenance activities include, primarily, periodic visual inspection (e.g., once per quarter or once per year) and localized sand placement to cover exposed geotextile backing, as needed, at five-year intervals. The average maintenance cost for the system will typically be 10 to 20% of the cost for maintenance of a traditional soil cover system. Watershed Geosynthetic's experience with existing ClosureTurf installations suggests an average budgetary amount for maintenance is $150 to $250 per acre per year. As a comparison, a typical soil cover system has an estimated average maintenance cost of $1,200 to $1,500 per acre per year.

References

Koerner, R.M., Hsuan, G.Y., and Koerner G.R. (2011), "Geomembrane Lifetime Prediction: Unexposed and Exposed Conditions," GRI White Paper #6, Original: June 7, 2005 Updated: February 8, 2011.

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LIMITATIONS

ClosureTurf® is a U.S. registered trademark which designates a product from Watershed Geosynthetics LLC. This product is the subject of issued U.S. and foreign patents and/or pending U.S. and foreign patent applications. All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

Attachment 1

Literature Review and Assessment of ClosureTurf® UV Longevity

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15 May 2015

José Urrutia, P.E.
Vice President of Engineering
Watershed Geosynthetics
11400 Atlantis Place, Suite 200
Alpharetta, GA 30022

Subject: Literature Review and Assessment of ClosureTurf® UV Longevity

Dear Mr. Urrutia:

Watershed Geosynthetics, Inc. (Watershed) has patented an alternative landfill closure system termed, ClosureTurf®. ClosureTurf® consists of high-density polyethylene (HDPE) grass blades tufted through a polypropylene (PP) geotextile backing which overlies Super Gripnet®, an HDPE or linear low-density polyethylene (LLDPE) geomembrane manufactured by AGRU America Inc. The addition of a layer of sand ballast during installation completes the system. The sand ballast provides cover for the lower portion of the HDPE grass blades, the PP geotextile backing, and the Super Gripnet® (Figure 1). The ClosureTurf® system, therefore, is a "hybrid" closure system in the sense that it is neither a traditional soil cover or an exposed geomembrane. ClosureTurf® has been used to close a number of landfills throughout the United States. A select list of sites where it has been used is shown in Table 1. Applications extend to other facilities as well, such as capping of coal ash ponds.

Watershed has requested that Geosyntec Consultants, Inc. (Geosyntec) provide an assessment of the longevity of the ClosureTurf® system with regard to UV degradation. Since ClosureTurf® has elements (i.e., the HDPE grass blades) that are permanently exposed to UV radiation, this assessment will be particularly focused on the exposed portion of the system. However, the UV longevity of the PP geotextile backing and HDPE geomembrane will also be addressed by reference.

Geosyntec's approach to this assessment has been to conduct a literature review of pertinent documents available (journal papers, white papers, presentations, etc.), distill the results of the review, and perform limited analysis. This report concludes with a summary of the review and analysis along with brief discussion for recommendations.

EXECUTIVE SUMMARY

The UV longevity assessment of the ClosureTurf® system (Figure 1) began with a literature review. In general, relatively little published information was discovered regarding exposed HDPE grass blade degradation. The information that is available consists of retained tensile strength test results of HDPE grass blades after exposure (1, 5, 7 and 10 years) at a field test facility in New River, Arizona (Watershed, 2014). Extrapolation of this data by Watershed (2014) resulted in a prediction of 65% retained tensile strength after 100 years of service. In addition, Richgels *et al* (2015) published half-life (i.e., 50% retained tensile strength) predictions of exposed HDPE grass blades using a laboratory data release from the Geosynthetics Institute (GSI) on HDPE geomembrane strips exposed to UV lamp irradiation. Richgels *et al* (2015) obtains an upper bound and lower bound half-life predictions of 247 years and 176 years, respectively. Extrapolation of the field data from New River, Arizona yielded a half-life of 216 years.

Geosyntec checked the calculations shown in Richgels *et al* (2015) and obtained 277 years and 214 years for the upper and lower bound estimates of HDPE grass blade half-life. Differences in the results between Geosyntec and Richgels *et al* (2015) are attributed to rounding. Geosyntec attempted to repeat these calculations for actual performance requirements (i.e., 12.5% of original tensile strength) of the HDPE grass blades rather than a randomly assigned half-life, however the predictions resulted in service lives that were too lengthy to be reasonable. The most likely explanation is that the laboratory data has not degraded enough to allow for service life predictions using 12.5% retained tensile strength. Future data releases from GSI will aid in providing more accurate predictions below the half-life.

Based on Richgels *et al* (2015) predictions, as well as the prediction given in Watershed (2014) it appears that the half-life of the HDPE grass blades exposed to Arizona-like conditions is on the order of 100 years. These results are promising; however additional field test data is needed to improve the half-life predictions, particularly since half-life predictions for exposed HDPE geomembrane are also approximately 100 years (Koerner *et al*, 2015). Understanding the differences in weathering between HDPE grass blades in a synthetic turf and an HDPE geomembrane will provide additional insight into the similar half-life predictions of the two geosynthetics. Finally, the service life of the HDPE grass blades in the ClosureTurf® system should ideally be based on its performance requirements rather than a half-life which will result in a longer service life prediction.

In addition to the HDPE grass blades, there are two unexposed elements of the ClosureTurf® system: (i) the PP geotextile backing for turf component; and (ii) the Super Gripnet® which consist of a HDPE geomembrane (see Figure 1).

Watershed has incorporated UV degradation inhibitors into the PP geotextile backing which, according to Watershed has lead to an improvement in UV resistance by a factor of 14 over the original prediction of 65% retained tensile strength after 100 years (Watershed, 2014). Koerner (2011) has estimated that covered HDPE geomembrane will have a half-life of 446 years at 20 degrees Celsius and 265 years at 25 degrees Celsius.

Therefore, the most critical component of the ClosureTurf® appears to be the exposed HDPE grass blades when it comes to UV degradation. However, degradation of the HDPE grass blades to unserviceable levels can be remediated by replacement of the turf component of the ClosureTurf® system.

BACKGROUND AND LITERATURE REVIEW SUMMARY

In total, Geosyntec has reviewed approximately 40 technical documents to date. The database is a combination of documents provided to Geosyntec by Watershed as well as documents collected by Geosyntec. A complete reference list of the documents in the database can be made available upon request.

In general, relatively little information was found on the topic of exposed HDPE grass blades with respect to degradation due to UV radiation. The documents that were obtained and reviewed are listed below.

1. Field test data provided by Watershed from the New River, Arizona testing facility on the HDPE grass blades (Watershed, 2014).

2. Testing results (Atlas-MTS) discussing the UV longevity of polyethylene and polypropylene grass used for outdoor European athletic facilities.

3. Technical paper by Richgels, *et al*. (2015a) published in the conference proceedings for Geosynthetics 2015 in Portland, Oregon.

4. Presentation by Richgels., C. at the Geosynthetics Conference for 2015 in Portland, Oregon (Richgels, 2015b).

5. Presentation by Diguilio, D. at the Northern New England SWANA Conference on 25 September 2013 (Diguilio, 2013).

The following documents on the topic of HDPE Geomembrane degradation due to UV exposure were reviewed and found to contain useful information regarding this assessment.

1. Geosynthetic Research Institute (GRI) White Paper #6 (Koerner *et al*., 2011). This white paper contained degradation data (% retained strength and elongation) on laboratory aged samples of 1.5 mm HDPE geomembrane. Aging was completed using a UV Fluorescent device per ASTM D7238 at 70 degrees Celsius (°C).

2. Geosynthetic Institute (GSI) webinar presentation by Koerner *et al*., (2015). This presentation contained a slide that compared predicted (laboratory vs. field) half-life of geomembranes of various resins, including HDPE, as well as a suggestion for estimating lower bound half-life.

3. Journal paper authored by Rowe *et al*. (2010) published in the Journal of Geotechnical and Geoenvironmental Engineering.

DISCUSSION OF DOCUMENTS AND DATA

The data from the New River, AZ testing facility on the artificial grass component of ClosureTurf® (Watershed, 2014) appears to be the only data set of its kind in our compiled database. The data consists of tensile property testing from field samples exposed to the Arizona environment at approximate exposure periods of 1, 5, 7 and 10 years. At each of the four exposure periods, 20 samples were tested for a total of 80 tests. The average values for tensile strength retained at each corresponding time period is 97%, 90%, 84% and 83%, respectively (Figure 2).

One additional data point was found in the Atlas-MTS document. That data point indicated that approximately 90% of tensile strength of polyethylene grass would be available after 20 years of field exposure assuming average European climatic conditions (temperature, irradiance, etc.). However, the average European irradiance is approximately one-half to one-third that of Arizona (Figure 3) notwithstanding temperature effects. Therefore, the Atlas-MTS data point will be consistent with the data from the New River, AZ facility in the 7 to 10 year time frame once adjusted for the relative levels of exposure and temperature between Europe and Arizona. As such, this data point will not extend the exposure duration covered by the New River, AZ data.

The paper and corresponding presentation by Richgels (2015a, 2015b) utilized the laboratory data released from the GSI on UV degradation of HDPE samples to make upper and lower bound estimates of the field half-life of the HDPE grass blades. The upper bound method utilizes Arrhenius

modeling of lab data to project exposure times at half-life to site temperatures combined with ratios of UV irradiance between the laboratory lamp and monthly average irradiance at New River, AZ to develop half-life loss per month. A similar procedure using a linear extrapolation (rather than Arrhenius) was demonstrated for a lower bound estimate. The Watershed (2014) field data set was plotted in between the upper and lower bound estimates. This method is further discussed in the section below titled, "HDPE Grass Blade Service Life Calculations".

Koerner *et al*. (2011) discusses the UV longevity of both exposed and unexposed geomembranes made from various resins, including HDPE based on GSI's laboratory testing program. This document is particularly useful in regard to the ClosureTurf® elements that are considered non-exposed (i.e., the PP geotextile backing for the turf component and the underlying HDPE geomembrane).

The presentation by Koerner *et al*. (2015) includes estimates of half-life of exposed HDPE geomembranes as well as a recommendation for linear data extrapolation as a lower bound limit that was implemented by Richgels (2015b).

PERFORMANCE REQUIREMENTS

The definition of service life of an HDPE (or other resin) geosynthetic (grass blades and geotextiles/geomembranes) typically invokes the half-life criteria. However, the half-life criteria is arbitrary and while useful as a general indicator for comparison it does not directly relate to any aspect of field performance for ClosureTurf® or any other geosynthetic. Therefore it is more appropriate to define the service life in terms of field requirements placed on the material.

HDPE Grass Blades

For the case of the HDPE grass blades on the ClosureTurf® system, tensile strength requirements fall in the range of 2.5 to 3.5 lbs, based on applied loads of pullout forces from equipment operation and water runoff forces (Diguilo, 2013). The ClosureTurf® HDPE grass blades are manufactured with 20 lbs. of tensile strength immediately following the process (Diguilo, 2013). Therefore, without considering a factor of safety, the required tensile strength of the HDPE grass blade is equal to approximately 12.5% to 17.5% of original strength capacity.

PP Geotextile Backing and HDPE Geomembrane

Performance requirements for the PP geotextile backing and HDPE geomembrane depend on more site-specific parameters (e.g., steepness of slopes, seismicity, etc.) than the HDPE grass blades. Therefore until a parametric study is completed which will define the performance requirements over a range of expected conditions, the half-life will have to be used as a benchmark for degradation of the PP geotextile and HDPE geomembrane.

HDPE GRASS BLADE SERVICE LIFE CALCULATIONS

In order to develop a prediction for the longevity of the HDPE grass blades with respect to UV degradation, Geosyntec implemented the method found in Richgels (2015a, 2015b) for two levels of retained tensile strength. The first level is the 50% of tensile strength, or half-life, criterion that is commonly used as a benchmark for geosynthetic service life. Geosyntec performed this calculation to compare our results with the results presented by Richgels (2015a, 2015b). Once the half-life estimates were calculated, Geosyntec attempted to repeat the calculations using a retained tensile strength of 12.5% of an HPDE grass blade.

Half-Life Estimation (50% of Retained Strength)

The assessment utilized by Richgels (2015a, 2015b) begins with a laboratory data release from GSI (Figure 4). The data includes retained tensile strength of HDPE samples that have been incubated under a UV lamp at elevated temperatures, which accelerates the UV weathering process in accordance with ASTM D7238.

As mentioned, the GSI data includes samples tested at three elevated temperatures: (i) 80 degrees Celsius (ºC); (ii) 70ºC; and (iii) 60ºC. The testing program appears to have originally included only the 70ºC data, with the 80 ºC and 60ºC testing added at a later date (therefore, weathering is not as advanced). The 70ºC data set has reached approximately 66%, while the 80ºC and 60ºC data sets have reached approximately 78% and 86%, respectively. Nonetheless, logarithmic extrapolations to 50% retained strength were performed for each data set. The amount of exposure time (on a log scale) corresponding to the 50% retained strength plotted vs. the inverse of the corresponding temperature (80ºC, 70ºC and 60ºC) is shown in Figure 5. Figure 5 allows for extrapolation to find the laboratory exposure time required to achieve 50% retained strength at temperatures lower than the test temperatures (i.e., actual field temperatures).

Once the curve is defined relating any temperature to a level of laboratory lamp exposure, the remaining task is to develop a relationship between laboratory exposure and field exposure for a

particular site. In this case, the testing site in New River, AZ where Watershed has performed tests on HDPE grass blades, was selected.

Richgels (2015a, 2015b) presents monthly averages at the site for: (i) peak turf temperature; and (ii) irradiance as a fraction of the laboratory lamp irradiance. Using these two values for a given month combined with the Arrhenius model, an estimate of half-life loss per month is obtained. Summation of the half-life lost per month over a year yields the annual half-life loss. The inverse of the annual half-life loss is the predicted half-life in years. Using this method, Richgels obtains a half-life of approximately 247 years, while Geosyntec obtained a half-life of 277 years using the same data (Table 2). The difference is attributable to rounding errors in the logarithmic projections.

Following the suggestion of Koerner *et al*. (2015), Richgels (2015b) treated the results of the half-life mentioned above as an upper bound estimate. For the lower bound estimate, Koerner *et al*. (2015) suggests performing a linear extrapolation of the laboratory data to lower field temperatures, rather than using the Arrhenius model.

With the linear extrapolation, the ratio of monthly irradiance to laboratory lamp irradiance is scaled linearly to calculate the number of months required to reach half-life at 80C, 70C and 60C. Linear extrapolations per month are made from the elevated temperatures to the corresponding peak turf temperature in that month. The resulting half-life loss per month is summed to obtained half-life loss per year. The inverse of that result is the half-life in years. Richgels (2015b) calculates a half-life of 176 years using this linear model. Geosyntec's calculation using the same data resulted in a half-life of 214 years (Table 3 and Figure 6). The difference in the calculations is approximately the same as with the calculation using the Arrhenius (logarithmic) model.

Figure 7 shows the calculated upper (Arrhenius - logarithmic) and lower (linear) bound curves calculated by Richgels (2015b) along with the field data on the HDPE grass blades provided by Watershed (2014). As shown in Figure 7, the trend line fit to the field data falls in between the upper and lower bound curves produced by Richgels (2015b). Note that the first point from the field data at approximately 1 year is omitted from the trend line. This is because the first data point is assumed to be within the anti-oxidant phase of degradation rather than the polymer oxidation stage as suggested by Rowe *et al*. (2010). Additional discussion regarding the stages of degradation for polyolefin materials can be found in CUR 243 (2012).

Service Life Estimation Based on Performance Requirements (12.5% of Retained Strength)

Geosyntec repeated the calculations discussed above for the estimation of half-life, but extrapolated the GSI laboratory data down to 12.5% rather than 50% at 80C, 70C and 60C. Upper bound

(Arrhenius – logarithmic) and lower bound (linear) estimates were 2,500 years and 2,043 years, respectively.

These estimates of service life are simply too large to be reasonable. A likely explanation is that the samples tested at 80C, 70C and 60C have not degraded enough to produce accurate predictions at 12.5% retained strength. As previously mentioned, the data for 80C has reached 78% retained strength; the data for 70C has reached 66% retained strength; and the data for 60C has reached 86% retained strength. Therefore, the extrapolation for each of these data sets to 50% retained strength will be much more accurate than extrapolations to 12.5%. In addition, small uncertainties in log-based extrapolations will greatly influence results.

For these reasons, it is not practical or useful at this time to quantitatively assess service life in terms of actual performance requirements when those requirements are substantially below the half-life. There is some value, however in a qualitative use of performance requirements in comparisons with half-life estimates (i.e., to establish the factor of safety remaining at 50% degradation).

SUMMARY AND CONCLUSIONS

Geosyntec's literature review of approximately 40 documents yielded few sources of UV degradation data for exposed HDPE grass blades. Relevant data that was found included the field test data from the New River, AZ testing facility provided by Watershed (2014) and one data point from Atlas-MTS. The Atlas-MTS data point indicated that HDPE grass blades in average European climatic conditions would retain approximately 90% of its original strength after 20 years of field exposure. Taking into account the differences in temperature and UV irradiance between New River, AZ and European averages, the data point is consistent with the New River, AZ test data in the 7 to 10 year range.

Following the method presented in Richgels (2015a, 2015b) for HDPE grass blades, Geosyntec calculated an upper bound half-life of 277 years compared with Richgels 247 years using the Arrhenius (semi-log) extrapolations to site temperatures and ratio of laboratory lamp to field irradiance. Geosyntec calculated a lower bound half-life based on linear temperature extrapolations, as suggested by Koerner *et al*. (2015), of 214 years compared with 176 years obtained by Richgels (2015b). The differences between Geosyntec and Richgels calculations were attributed to rounding. As shown in Figure 7, the field data from New River, AZ suggests a half-life of 216 years when considering only the last three data points (i.e., polymer oxidation stage).

Another prediction of HDPE grass blade degradation is included in Watershed (2014) using the same (New River, AZ) field data. That prediction of retained tensile strength at 100 years of service life is 65%.

Therefore, it appears that the half-life of the HDPE grass blades will be on the order of 100 years based on the existing field data set and extrapolation methods found in the literature and presented herein. The results are promising; however additional field test data is needed to improve the half-life prediction, particularly since the half-life predictions for exposed HDPE geomembranes are also approximately 100 years (Koerner, 2015). Half-life predictions presented herein will also need to be revisited when additional labratory data is released from the GSI testing program.

Geosyntec attempted to calculate the service life of the HDPE grass blades using 12.5% of retained strength, rather than an arbitrarily assigned half-life. However, the calculation resulted in unreasonably long service life. This result is likely due to uncertainties in extrapolating the laboratory data released from GSI down to the 12.5% retained strength level. The data release has degraded to 78%, 66% and 86% for the 80 ^{o}C, 70 ^{o}C, and 60 ^{o}C test temperatures. Therefore, extrapolations to 50% may be warranted while extrapolations to 12.5% may not be until additional lab data is available. That being said, it should be recognized that half-life, or 50% of retained strength, has a factor of safety of 2.8 to 4.0 when considering the tensile capacity performance requirements of HDPE grass blades.

With regard to the unexposed elements of the ClosureTurf® system, Watershed (2014) indicates that the retained tensile strength of the PP geotextile backing prior to the addition of UV inhibitors is 65% after 100 years. This estimate is based on exhumed samples of the geotextile from the LaSalle-Grant Landfill in Louisiana. According to Watershed (2014), the addition of proprietary UV inhibitors to the PP geotextile backing has led to an improvement in UV resistance by a factor of 14. The final geosynthetic in the ClosureTurf® system is the covered HDPE geomembrane. Koerner (2011) estimates that the half-life of a covered HDPE geomembrane is 446 years at 20C, and 265 years at 25C. Furthermore, the degradation of the unexposed elements of the ClosureTurf® system invoke the half-life criteria. As discussed with regard the exposed HPDE grass blades, actual performance requirements should ideally be used to determine system longevity. However, the existing testing programs need to be allowed to degrade further before projections to lower values are made.

It is worth reiterating that applications of ClosureTurf® in areas of the United States where the UV irradiance and the temperatures are lower will result in longer half-life predictions than discussed above. In some cases (e.g., the Northeastern States), the differences will likely be quite large when compared with Arizona.

Finally, once UV degradation of the most susceptible component of ClosureTurf® (i.e., the exposed HDPE grass blades) does result in a tensile break, replacement of the HDPE grass and PP geotextile backing can be performed.

CLOSING

Geosyntec appreciates the opportunity to assist Watershed in the development of its ClosureTurf® products. Questions and comments may be directed to either of the undersigned at 678-202-9500.

Sincerely,

Will Tanner, P.E.
Project Engineer

Ming Zhu, Ph.D., P.E.
Senior Engineer

Attachments: References
Tables
Figures

Copies to: Bill Gaffigan (Geosyntec)
Mike Ayers (Watershed)

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Rowe, K., Islam, M., Hsuan, Y., (2010) "Effects of Thickness of the Aging of HDPE Geomembranes". Journal of Geotechnical and Geoenvironmental Engineering, ASCE, 136(2), p.299-309.

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TABLES

Table 1. Selected Sites where ClosureTurf® has been Installed.

Select ClosureTurf® Installations				
Installation	**Type**	**Acres**	**State**	**Year**
Progressive - Weatherford	Public – MSW	8.5	Texas	2010
Progressive - Timberland	Public - MSW	4	Louisiana	2011
Crazy Horse (Salinas SWA – Monterey)	City – MSW	65	California	2012
Saufley Landfill (Escambia)	Public – C&D	22.5	Florida	2012
Georgia Pacific	Independent	70	Georgia	2013
Berkeley County Landfill	City - MSW	12	South Carolina	2013
Lanchester Landfill (Chester)	City - MSW	7	Pennsylvania	2013
Tangipahoa Parish	City – MSW	22	Louisiana	2013
Sandtown – (Berkeley County)	City – MSW	4	Delaware	2013
Si-County Landfill	EPA – Region 6	5	Texas	2014
Holcim Cement Landfill (Kiln Dust)	Independent	46	New York	2015

Table 2. HDPE Grass Blade Upper Bound Half-Life Calculations (Geosyntec)

Month	UV Lamp On[1] (hrs/day)	Peak Turf Temp[2] (C)	Peak Turf Temp (K)	Peak Turf Temp (1/K)	Reaction Rate[3]	Lab Half-Life[4] (lamp hrs)	Field Equivalent[5] (days)	Field Equivalent[6] (months)	Half Life Loss per Month[7]
January	4.00	27.99	301.14	0.0033	-15.67	6385286	1596322	51494	1.94196E-05
February	4.94	27.96	301.11	0.0033	-15.67	6401982	1296604	46307	2.15949E-05
March	6.13	33.94	307.09	0.0033	-15.11	3632197	593012	19129	5.22755E-05
April	6.94	40.58	313.73	0.0032	-14.50	1983742	285945	9531	0.000104915
May	7.25	51.21	324.36	0.0031	-13.58	792646	109330	3527	0.000283544
June	7.31	61.52	334.67	0.0030	-12.75	344593	47124	1571	0.00063662
July	6.94	66.82	339.97	0.0029	-12.34	228887	32993	1064	0.000939599
August	7.00	64.80	337.95	0.0030	-12.50	267230	38176	1273	0.000785841
September	6.94	59.43	332.58	0.0030	-12.91	406208	58553	1889	0.000529439
October	5.88	47.74	320.89	0.0031	-13.88	1062504	180852	5834	0.000171411
November	4.56	36.38	309.53	0.0032	-14.88	2899472	635501	21183	4.72069E-05
December	3.69	24.68	297.83	0.0034	-15.99	8826208	2393548	77211	1.29515E-05
Lab	20							**Yearly Half-life Loss[8]**	0.003604818
								Half-life[9] (years)	277.41

Notes:

(1) UV Lamp On (hours per day) is given in Richgels (2015a, 2015b).
(2) Peak Turf Temps for New River, AZ given in Richgels (2015a, 2015b).
(3) Reaction Rate is calculated from the regression curve shown in Figure 4 for the upper bound (logarithmic) case.
(4) Lab half-life in hours is equal to 1/e^(Reaction Rate).
(5) Field equivalent (days) is calculated by dividing the lab half-life in hours by the UV lamp on hours per day.
(6) Field equivalent in days is converted to months using the given days in that particular month.
(7) Half-life loss per month is the inverse of the corresponding field equivalent in months.
(8) The yearly half-life loss is the sum of each individual months half-life loss.
(9) The half-life in years is the inverse of the yearly half-life loss.

Table 3. HDPE Grass Blade Lower Bound Half-Life Calculations (Geosyntec)

Month	UV Lamp On[(1)] (hours/day)	Months @ 80 C[(2)]	Months @ 70 C[(2)]	Months @ 60 C[(2)]	Peak Turf Temp[(3)] (C.)	Half-life Months (from Regression)	Half-life Loss per month
January	4.00	692	1507	3078	27.99	6948	0.000143933
February	4.94	620	1352	2761	27.96	6256	0.000159849
March	6.13	452	984	2010	33.94	4059	0.00024637
April	6.94	412	898	1834	40.58	3213	0.000311281
May	7.25	382	832	1698	51.21	2248	0.000444747
June	7.31	391	852	1740	61.52	1580	0.000633027
July	6.94	399	869	1775	66.82	1237	0.00080834
August	7.00	395	861	1759	64.80	1371	0.000729293
September	6.94	412	898	1834	59.43	1826	0.000547629
October	5.88	471	1026	2095	47.74	3070	0.000325779
November	4.56	627	1365	2788	36.38	5321	0.000187929
December	3.69	750	1635	3339	24.68	7945	0.000125871
Lab	20					**Yearly Half-life Loss**	0.00466405
						Half-life (years)	214.41

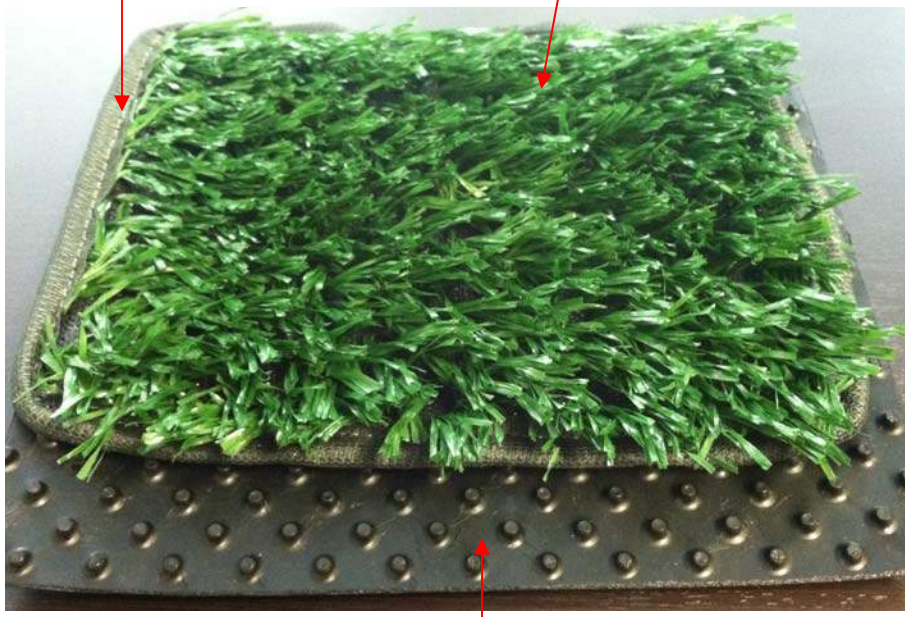
Notes:

(1) UV Lamp On (hours per day) is given in Richgels (2015a, 2015b).

(2) The months required at each temperature is calculated using the regressions from Figure 4 for each temperature, projected down to half-life, then dividing the lamp-hours at half-life by the UV lamp on hours per day for a given month. Once this calculation is done for 80, 70 and 60 C, a linear regression (as shown in Figure 5) is used to obtain the half-life months at the corresponding peak turf temp.

(3) Peak turf temperatures given in Richgels (2015a, 2015b).

FIGURES



Note: The sand ballast infill is not shown in the sample photo on the left, but is shown in a field application photo on the right.

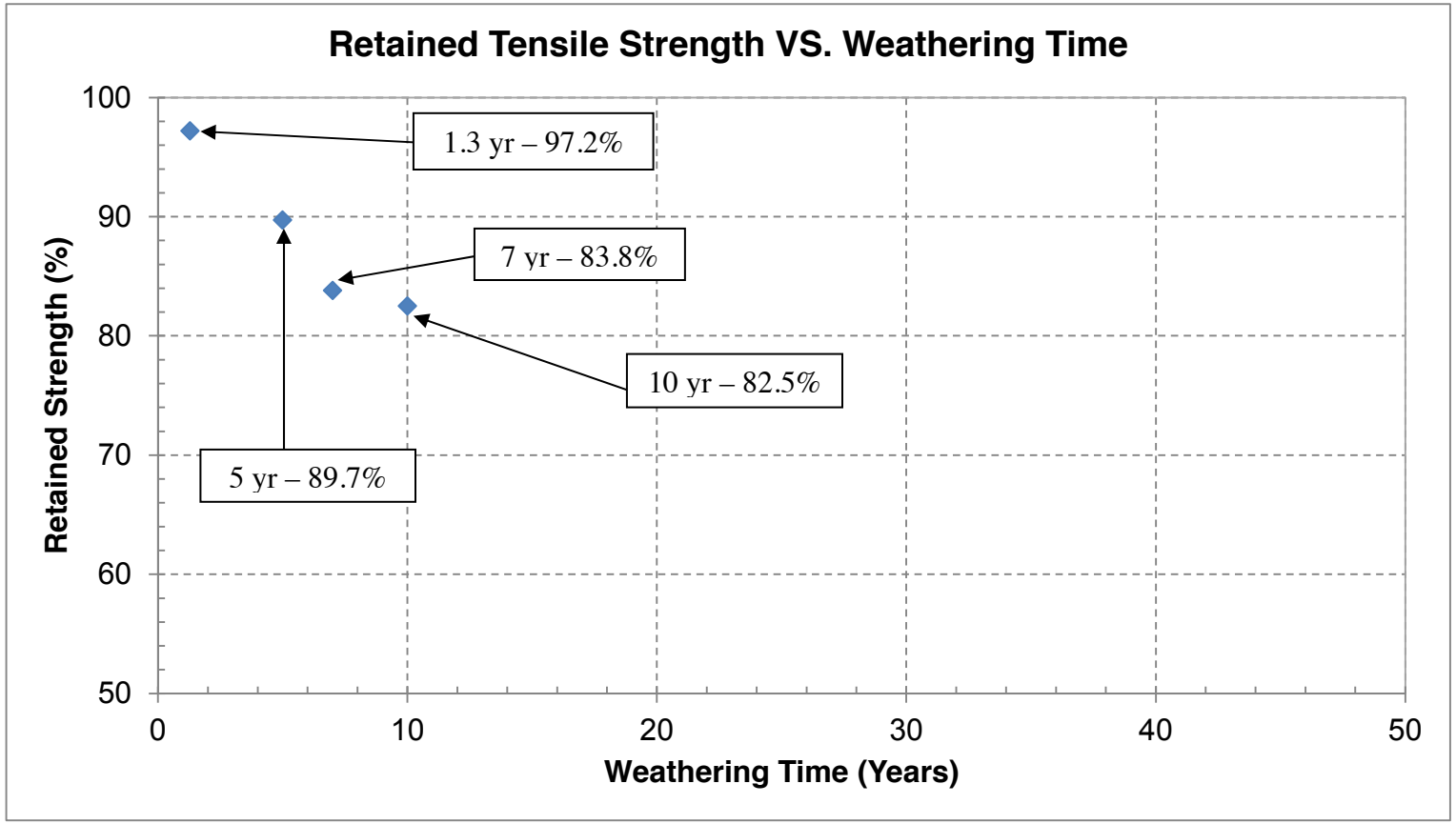
ClosureTurf®Components

Watershed Geosynthetics – ClosureTurf® UV Assessment

Geosyntec consultants

Figure **1**

Kennesaw, GA | 23-April-2015



Notes:

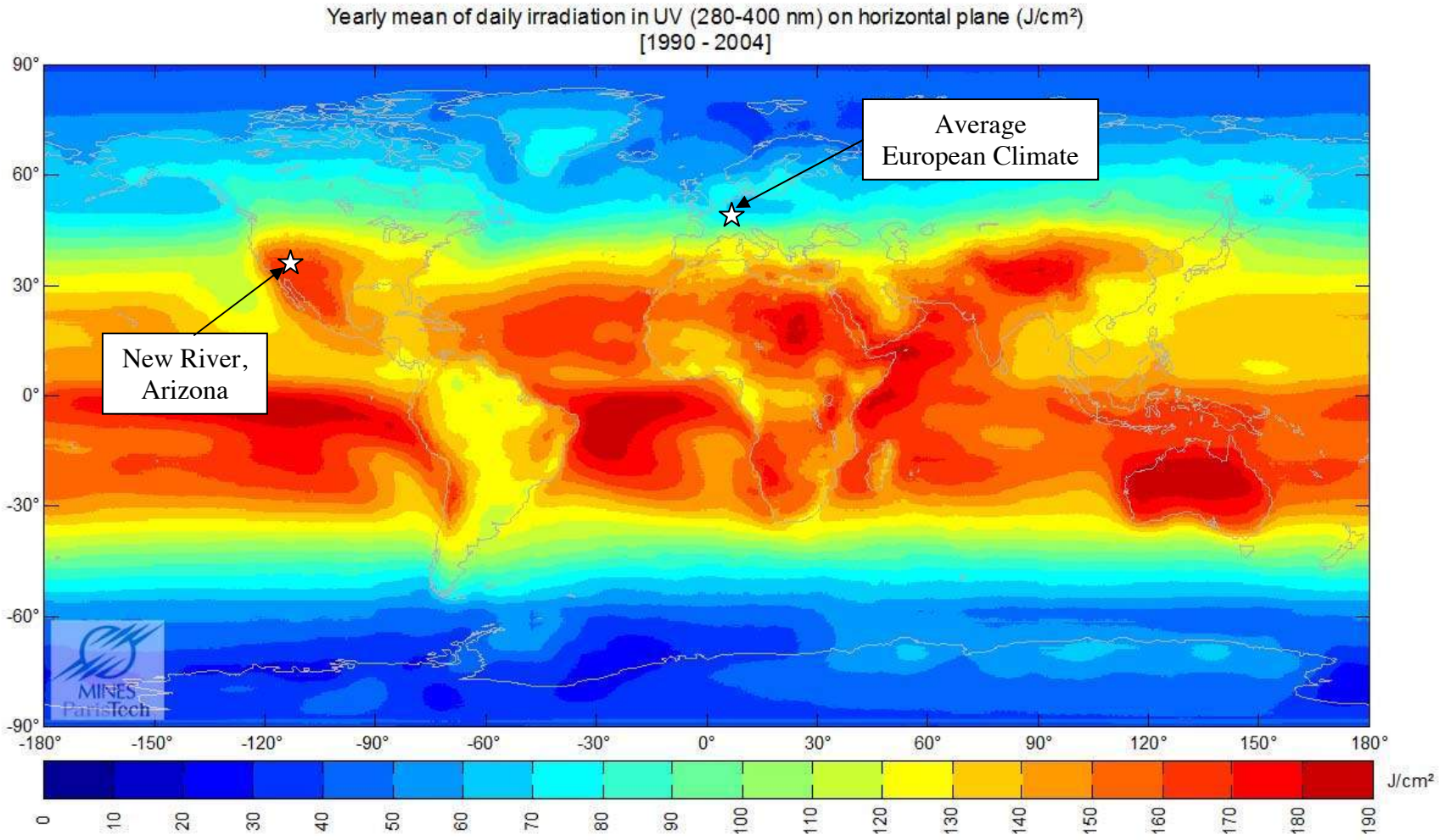
1. The first data point at Weathering Time of 1.3 years is considered to be within the initial stage of UV degradation (i.e., anti-oxidant depletion), rather than polymer oxidation which is represented by the final three data points.
2. Each data point represents the average result of 20 tensile break tests.

Field Test Data (Watershed, 2014)
New River, AZ Atlas Testing Facility
Watershed Geosynthetics – ClosureTurf® UV Assessment

Geosyntec consultants

Figure **2**

Kennesaw, GA | 25-April-2015



$1\ J/cm^2 = 4.755\ ft\text{-}lbs/in^2$

Yearly Irradiation in the Ultraviolet Range

Watershed Geosynthetics – ClosureTurf® UV Assessment

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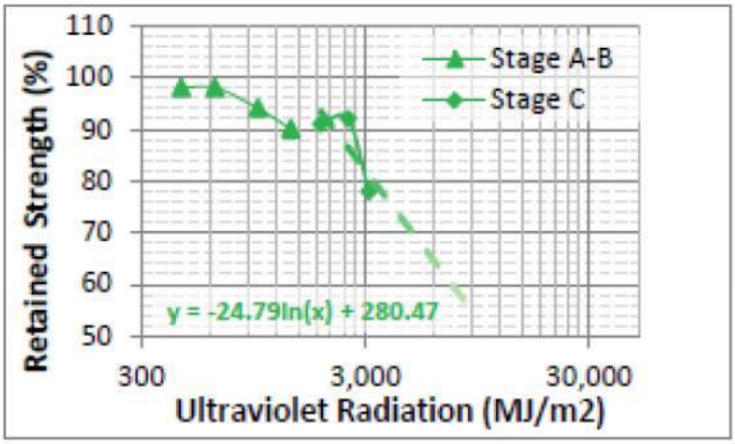
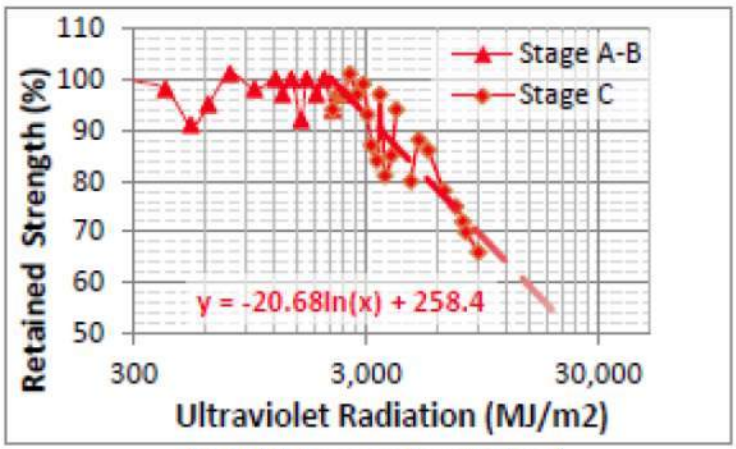
Figure 3

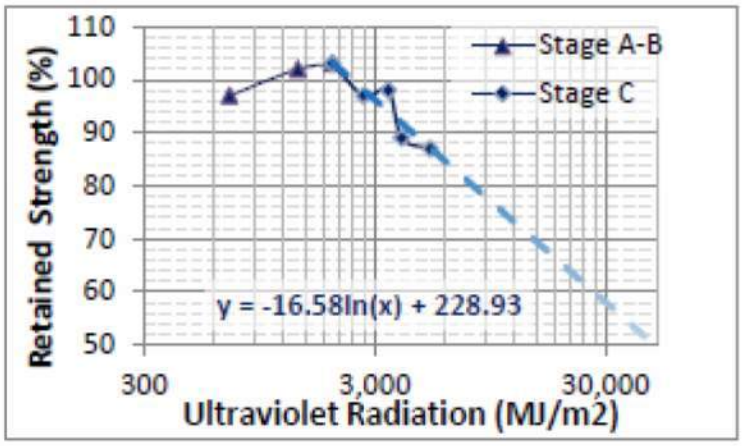
Kennesaw, GA | 23-April-2015



a) 80°C Temperature Dataset



b) 70°C Temperature Dataset



c) 60°C Temperature Dataset

GSI Data Release - Three Stage Oxidation of HDPE for Different Temperatures

Watershed Geosynthetics – ClosureTurf® UV Assessment

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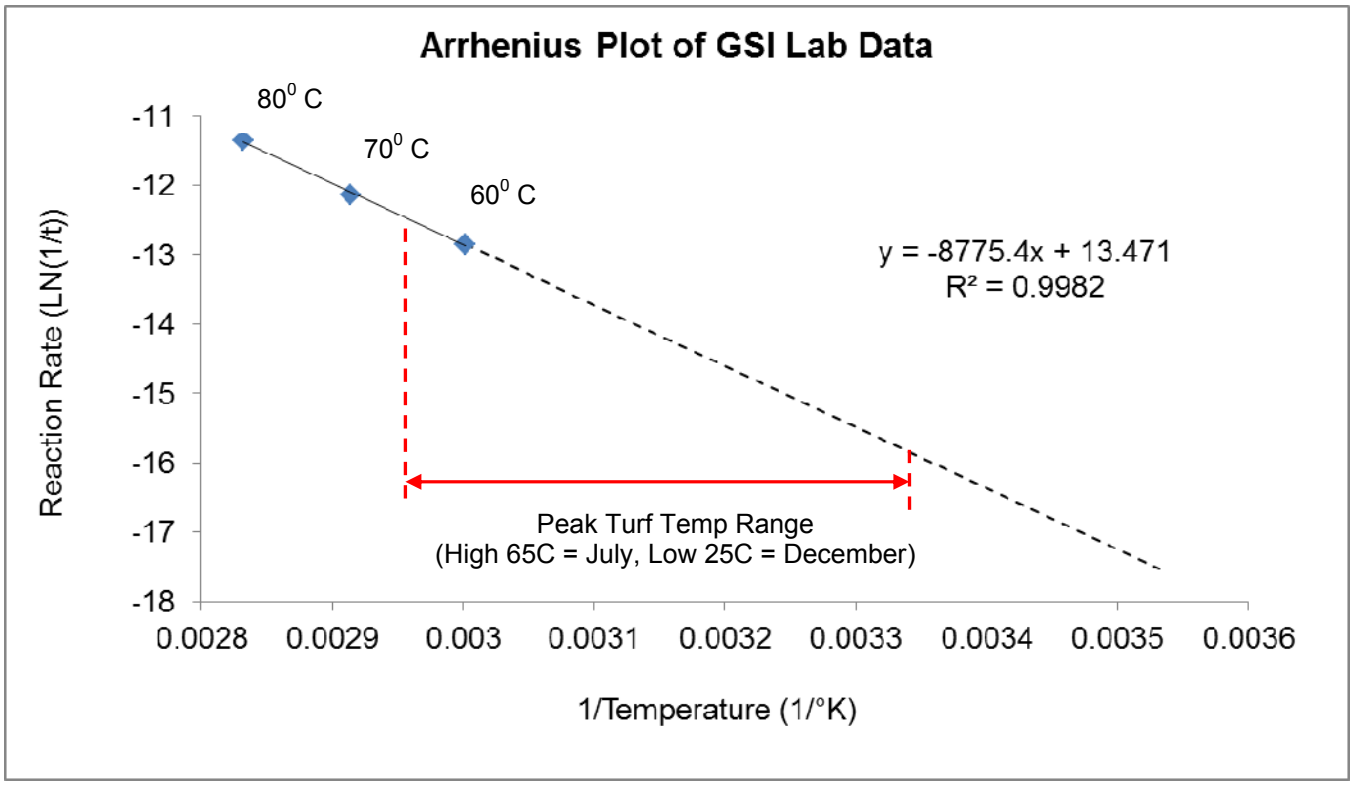
Figure 4

Kennesaw, GA | 23-April-2015



Note: Richgels (2015b) mentions that the use of peak turf temperature is conservative since it only occurs for approximately one hour per day.

Arrhenius Plot of Lab Data
Watershed Geosynthetics – ClosureTurf® UV Assessment

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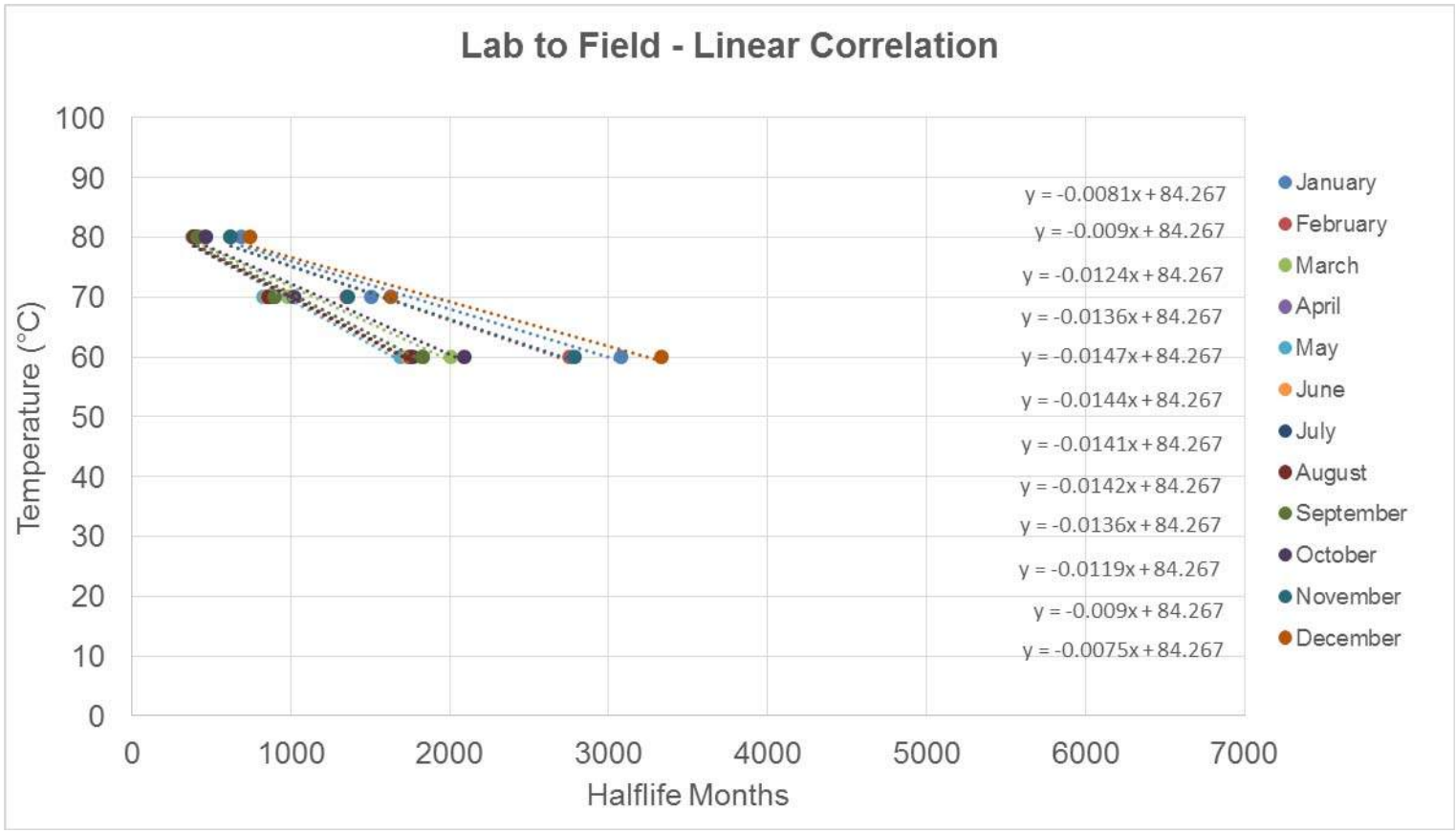
Figure 5

Kennesaw, GA | 23-April-2015



Note: Each month was projected down to the peak turf temperature given in Table 3 to get the half-life months. The inverse of half-life months is half-life loss per month. The sum of all the half-life losses for each month in a year is the yearly half-life loss, the inverse of which is the half-life.

Linear Extrapolations for Half-life Months

Watershed Geosythetics – ClosureTurf® UV Assessment

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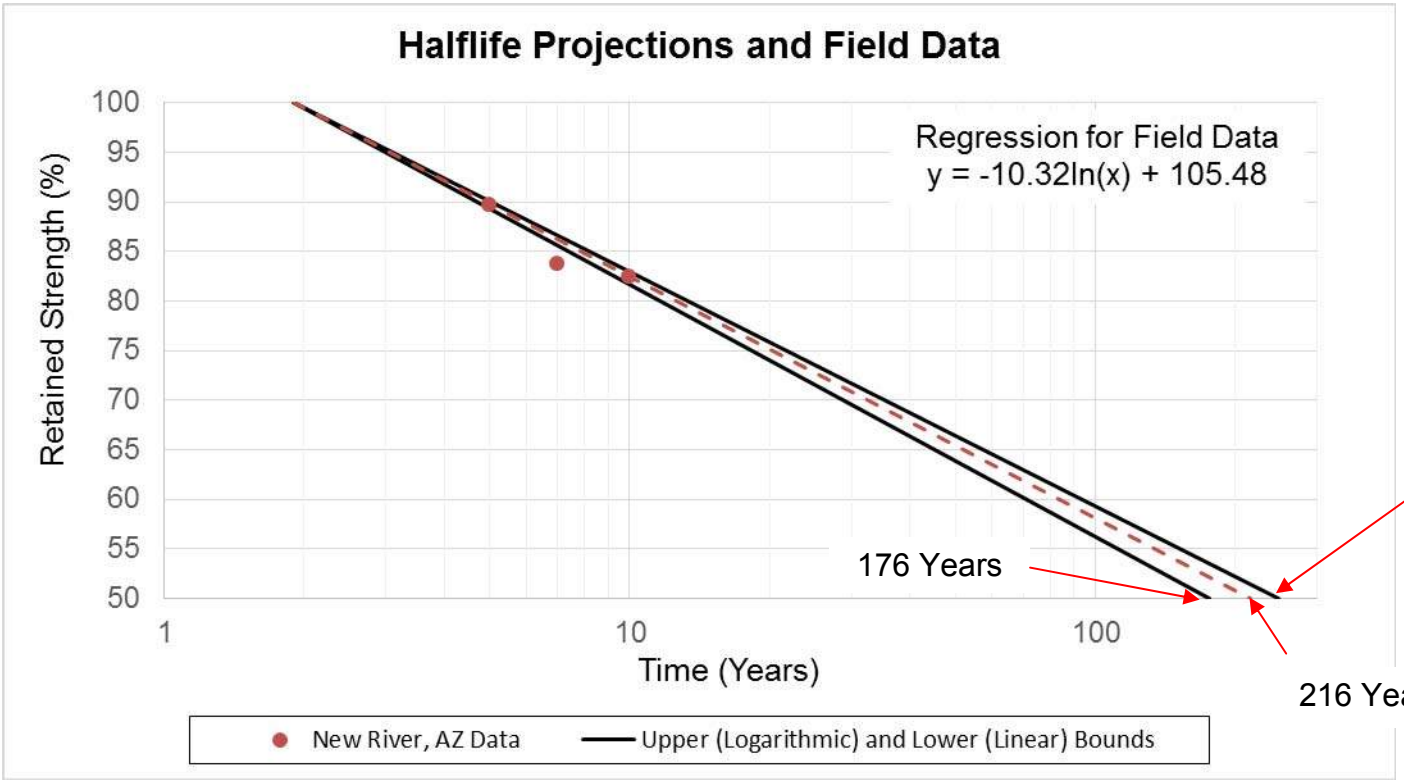
Kennesaw, GA | 23-April-2015

Figure 6



Note: Geosyntec calculated an upper bound half-life of 277 years and a lower bound half-life of 214 years using the same data and method. Difference between Geosyntec and Richgels calculations are attributed to rounding.

Halflife Projections (Richgels, 2015a, 2015b)
Upper and Lower Bound Estimates
Watershed Geosythetics – ClosureTurf® UV Assessment

Geosyntec consultants

Figure **7**

Kennesaw, GA | 23-March-2015

Attachment C

Veneer Stability Analysis

cti 28001 Cabot Dr. Novi, MI 48377 Tel. (248) 486-5100	US Ecology, Wayne Disposal Veneer Stability Calculation 2021 Permit Modification	JOB	1208070066		
		SHEET NO	1	OF	3
		CALCULATED BY	APM	DATE	07/07/21
		CHECKED BY	JLM	DATE	10/05/21
		SCALE	NA		

Objective:

Determine the minimum drained and undrained strength parameters (friction angle and cohesion/adhesion), necessary to obtain the appropriate factors of safety for cover system stability, specifically for the proposed engineered turf system.

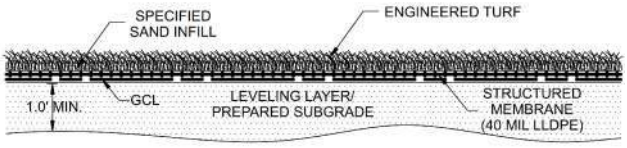


Figure 1. Cross Section (Typical ClosureTurf Cover)

Method:

Use methods outlined in journal paper *Influence Of Water Flow On The Stability Of Geosynthetic-Soil Layered Systems On Slopes* by Giroud et. al. for calculations of static stability. Seismic conditions are not evaluated because the facility is not located in a historically seismic active area.

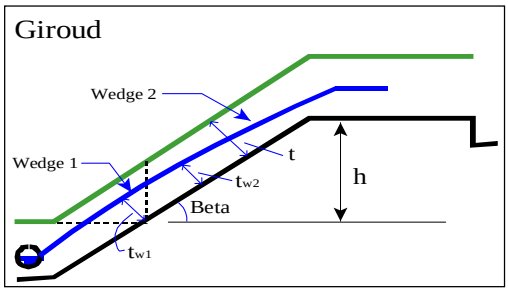


Figure 2. Variable Definitions

Figure 1 depicts Wayne Disposal proposed cover system design using engineered turf
Figure 2 shows variables assumed in Giroud's method

Calculations: Condition 1 - Static Unsaturated

Assume: the following conditions:

- No geosynthetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- Geotextile/turf thickness is 0.5 mm
- GCL is two (2) 0.25 mm layers
- ClosureTurf and sand infill are fully interlocked and do not represent a critical interface.

Given: Soil conditions, liner system design, and slope geometry

Slope Geometry

Slope Angle (b)		4 :1 =	14.04	degrees
Slope Height (h)	205	ft		

Engineered Turf Material Properties

	Turf/GTX	Sand Infill	Wt. Avg.	
Thickness (t)	0.002	0.042	0.043	ft (GTX is 0.5 mm (assumed)/sand infill is 0.5 in typ.)
Dry Unit Weight (γ_d)	135.5	105.0	106.2	pcf (turf based on vendor info, sand is conservatively assumed)
field cond. (w_F)	N/A	15.0	15.0	% (field moisture of sand conservatively assumed)
Unit Weight - field cond. (γ_T)	135.5	120.8	121.3	pcf
Specific Gravity (G_S)	N/A	2.65	2.65	(sand conservatively assumed)
Saturated Moisture (w_{SAT})	N/A	21.7	21.7	%
Saturated Unit Weight (γ_{SAT})	135.5	127.8	128.1	pcf
Buoyant Unit Weight (γ_B)	73.1	65.4	65.7	pcf
Total Normal Stress (σ)	0.22	5.03	5.25	pcf (total normal stress of ClosureTurf)
Shear Strength - both (ϕ) , (c)	25	deg,	0	psf (internal friction angle for sand, conservatively assumed)

Determine: The factor of safety (FS_A) against sliding of the engineered components along interfaces between materials above FML

where:

$$FS_A = \frac{\gamma_t (t - t_w) + \gamma_b t_w}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{\tan\delta_A}{\tan\beta} + \frac{a_A / \sin\beta}{\gamma_t (t - t_w) + \gamma_{sat} t_w} + \frac{\gamma_t (t - t^*_w) + \gamma_b t^*_w}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{t}{h} \frac{\sin\phi}{2\sin\beta \cos\beta \cos(\beta + \phi)}$$
$$+ \frac{c\, t/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{\cos\phi}{\sin\beta \cos(\beta + \phi)} + \frac{T/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w}$$

δ_A = interface friction angle between engineered components above FML
a_A = adhesion between engineered components above FML
T = geosynthetic tension above the slip surface
t_w = thickness of flow in Wedge 2 (see Figure 2)
t^*_w = thickness of flow in Wedge 1 (see Figure 2)
(All other variables previously defined)

Determine: The factor of safety (FS_B) against sliding of the engineered components along interfaces between materials below FML

where:

$$FS_B = \frac{\tan\delta_B}{\tan\beta} + \frac{a_B / \sin\beta}{\gamma_t (t - t_w) + \gamma_{sat} t_w} + \frac{\gamma_t (t - t^*_w) + \gamma_b t^*_w}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{t}{h} \frac{\sin\phi}{2\sin\beta \cos\beta \cos(\beta + \phi)}$$
$$+ \frac{ct/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{\cos\phi}{\sin\beta \cos(\beta + \phi)} + \frac{T/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w}$$

δ_B = interface friction angle between engineered components above FML
a_B = adhesion between engineered components above FML
(All other variables previously defined)

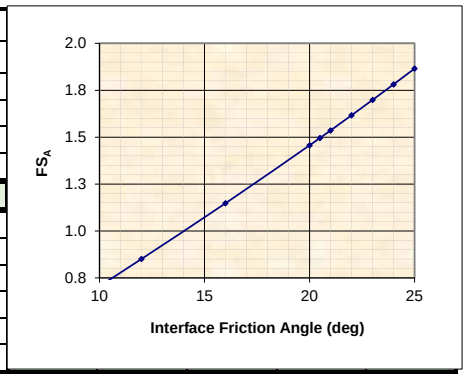
Calculations: Cover Condition 1 - Static Unsaturated (continued)

The first term quantifies the contribution of the interface friction angle to stability. The second term quantifies the contribution of the interface adhesion to stability. The third and fourth terms quantify the contribution of the toe buttressing effect, which results from the shear strength of the soil located at the toe of the slope above the slip surface. Both terms depend on the soil internal friction angle, whereas only the fourth term depends on the soil cohesion. The fifth term quantifies the contribution to the factor of safety of any tension in the geosynthetics located above the slip surface (which may include one or more geosynthetics specifically used as reinforcement).

Required angle of friction (δ) to obtain a FS_A and FS_B equal to 1.5 under unsaturated conditions is tabulated as follows:

Factor of Safety Above FML (FS_A)

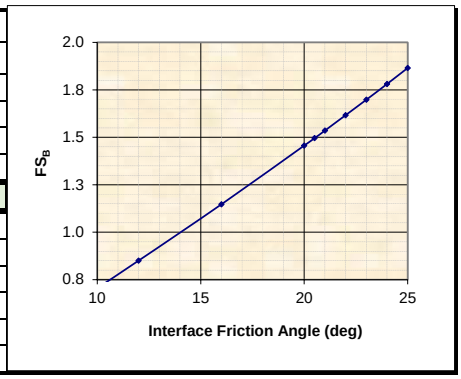
Interface Strength Param.		Water on slope		
δ_A (deg)	a_A (psf)	t_w (ft)	t^*_w (ft)	FS_A
10	0	0	0	0.71
12	0	0	0	0.85
16	0	0	0	1.15
20	0	0	0	1.46
20.5	0	0	0	1.50
21	0	0	0	1.54
22	0	0	0	1.62
23	0	0	0	1.70
24	0	0	0	1.78
25	0	0	0	1.87
26	0	0	0	1.95



► δ_A @ FS=1.5 20.5 deg ==> use 20.5 deg for spec. (check against other conditions)

Factor of Safety Below FML (FS_B)

Interface Strength Param.		Water on slope		
δ_B (deg)	a_B (psf)	t_w (ft)	t^*_w (ft)	FS_B
10	0	0	0	0.71
12	0	0	0	0.85
16	0	0	0	1.15
20	0	0	0	1.46
20.5	0	0	0	1.50
21	0	0	0	1.54
22	0	0	0	1.62
23	0	0	0	1.70
24	0	0	0	1.78
25	0	0	0	1.87
26	0	0	0	1.95



► δ_B @ FS=1.5 20.5 deg ==> use 20.5 deg for spec. (check against other conditions)

Calculations: Cover Condition 2 - Static Saturated

Determine: The static factor of safety for $FS_{A\&B}$ assuming varying depth of surface water on top of the engineered turf modeling surface water depths from sheet and/or shalllow concentrated flow on top of the cover system. ClosureTurf does not have a subsurface drainage layer; therefore, evaluation of seepage induced pressure in the cover system is not applicable. The manufacturer of ClosureTurf has demonstrated that erosion of the sand infill is very unlikely under the anticipated flow conditions (See Attachment A) and flow will generally occur on top of the sand infill where relative permeability is much higher. Because of the shallow depth of sand infill, flow characteristics, and resistance to erosion, seepage forces within the sand can be neglected. Under these conditions, the first two terms in the stability equation reduce to:

$$FS_{A\&B} = \frac{a}{(\gamma_t - \gamma_w)z}\frac{2}{\sin(2\beta)} + [cot\beta]tan\delta + \ldots.$$

The factor of safety should meet or exceed 1.1 under saturated conditions. Because seepage forces are neglected, there is no need to distiguish between the interfaces above or below the impermeable membrane. Assume minimum shear strength parameters δ and a are equal to values from analysis for Cover Condition 1. It should be noted that this analysis also assumes no apparent adhesion is present in the interface. This assumption is extremely conservative because each of the critical interfaces (GM/GCL/GCL/soil) all involve cohesive materials which likley will be present under wet conditoins. Any appreciable measureable apparent adhesion will make the materials inherently stable under their own

28001 Cabot Dr. Novi, MI 48377 Tel. (248) 486-5100	US Ecology, Wayne Disposal Veneer Stability Calculation 2021 Permit Modification	JOB	1208070066	
		SHEET NO	3 OF	3
		CALCULATED BY	APM DATE	07/07/21
		CHECKED BY	JLM DATE	10/05/21
		SCALE	NA	

Assume: The following conditions:

- No geosynthetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- Geotextile/turf thickness is 0.5 mm
- GCL is two (2) 0.25 mm layers
- ClosureTurf and sand infill are fully interlocked and do not represent a critical interface.
- Critical interface(s) are between the GM/GCL/GCL/subgrade soil
- Seepage forces are negligible and are not considered

Given: Soil conditions, liner system design, and slope geometry

Slope Geometry

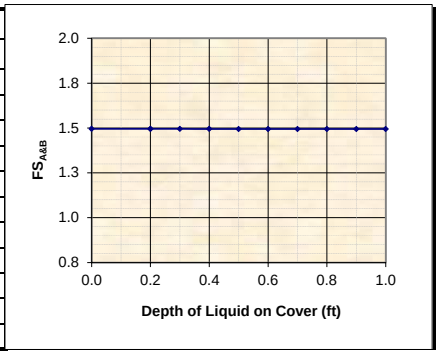
Slope Angle (b)	4 :1 =	14.04	degrees
Slope Height (h)	205 ft		

ClosureTurf Material Properties

	Turf/GTX	Sand Infill	Wtd. Avg.	
Thickness (t)	0.002	0.042	0.043	ft (GTX is 0.5 mm (assumed)/sand infill is 0.5 in typ.)
Dry Unit Weight (γ_d)	135.5	105.0	106.2	pcf (turf based on vendor info, sand is conservatively assumed)
Moisture - field cond. (w_F)	N/A	15.00	15.0	% (field moisture of sand conservatively assumed)
Unit Weight - field cond. (γ_T)	135.5	120.8	121.3	
Specific Gravity (G_S)	N/A	2.65	2.65	(sand conservatively assumed)
Saturated Moisture (w_{SAT})	N/A	21.7	21.7	%
Saturated Unit Weight (γ_{SAT})	135.5	127.8	128.1	pcf
Buoyant Unit Weight (γ_B)	73.1	65.4	65.7	pcf
Shear Strength - both (ϕ) , (c)	25 deg,		0	psf (internal friction angle for sand, conservatively assumed)

Factor of Safety Above FML ($FS_{A\&B}$)

Interface Strength Param.		Water on slope		
δ_A (deg)	a_A (psf)	t_w (ft)	t^*_w (ft)	FS_B
20.5	0	0.00	0.00	1.50
20.5	0	0.20	0.20	1.50
20.5	0	0.20	0.20	1.50
20.5	0	0.30	0.30	1.50
20.5	0	0.40	0.40	1.50
20.5	0	0.50	0.50	1.49
20.5	0	0.60	0.60	1.49
20.5	0	0.70	0.70	1.49
20.5	0	0.80	0.80	1.49
20.5	0	0.90	0.90	1.49
20.5	0	1.00	1.00	1.49



► $FS_{A\&B}$ reqd≥ 1.1 ==> minimum $FS_{A\&B}$ equals 1.49 with saturated sand infill ==> OK

Results: Tabular Summary of Analyses

Component	Controlling Analysis	Minimum Interface Shear Strength Parameters (Peak)*				
		ϕ (deg)	c (psf)	δ_A (deg)	δ_B (deg)	a (psf)
Sand Infill	Static Unsaturated, Minimum FS = 1.5	25	0	-	-	-
All geosynthetic and soil interfaces above FML	Static Unsaturated, Minimum FS = 1.5	-	-	20.5	-	0
All geosynthetic and soil interfaces below FML	Static Unsaturated, Minimum FS = 1.5	-	-	-	20.5	0

*Minimum specifications assume no cohesion/adhesion. Laboratory testing of the components over the range of normal stresses to be encountered in the field may result in a Mohr-Coloumb failure envelope suggesting a nonzero value for cohesion/adhesion. In such cases, the friction angle may be lower than that specified and still be acceptable as long as the actual shear strength for the materials is greater than the envelop developed with the minimum specification noted above.

Conclusions:

The proposed engineered turf cover system for WDI was evaluated for shallow translational/veneer failures along the geosynthetic components parallel to the slope. Worst case cross sections were utilized as noted in the analyses. Minimum factors of safety are based on typical industry standard values which were used to develop minimum strength parameters for each of the components. The minimum specifications noted above are within the range of reasonable characteristics for the materials involved. Therefore, the minimum specifications calculated are acceptable.

Attachment D
Wind Uplift Evaluation

July 8, 2010

Mr. Michael R. Ayres, P.E.
Closure Turf, LCC
3005 Breckinridge Blvd.
Duluth, GA 30096

Subject: **Aerodynamic Evaluations of Closure Turf Ground Cover Materials**

References: **1: Contract # AGR DTD 5/14/10**

Dear Mr. Ayres and Closure Turf LCC affiliates:

The Georgia Tech Research Institute is pleased to submit the attached Report, covering the period from May 14 to July 8, 2010, in fulfillment of Reference. This document details the tasks and analysis made on contracted work performed by the GTRI Aerospace, Transportation and Advanced Systems Laboratory and its team members on Phase I of the Project entitled "Aerodynamic Evaluations of Closure Turf Ground Cover Materials".

We look forward to continuation of this work for/with Closure Turf, LCC upon the adoption of Phase II activities related to aerodynamic investigation of Closure Turf Material or other desired evaluations.

Sincerely,

Graham M. Blaylock
Principal Investigator

Aerodynamic Evaluations of Closure Turf Ground Cover

Phase I REPORT
May 14 – July 8, 2010

Project Expires: August 14, 2010

Contract No. AGR DTD 5/14/10
Proposal No. ATASL-AATD-10-1119

GTRI Project No. D-6244

Prepared for:
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Introduction

GTRI has been contracted by Closure Turf, LCC to **experimentally evaluate the aerodynamic properties and ballast requirements** of a novel synthetic ground-cover system under a range of wind speed conditions (V_{inf}). The Closure Turf Material was tested full-scale in **GTRI's subsonic Model Test Facility (MTF) wind tunnel** wherein the normal force loading (lb_f/ft^2) and the shear stress (lb_f/ft^2) were determined for a suitable section of the material. The turf material was tested in two configurations, one representing the perimeter of the turf installation (Fig 5) and the 2nd at a representative interior section (Fig 6). Both installations were evaluated on a **flat level surface**. The installation is shown in Figures 1a-d below.

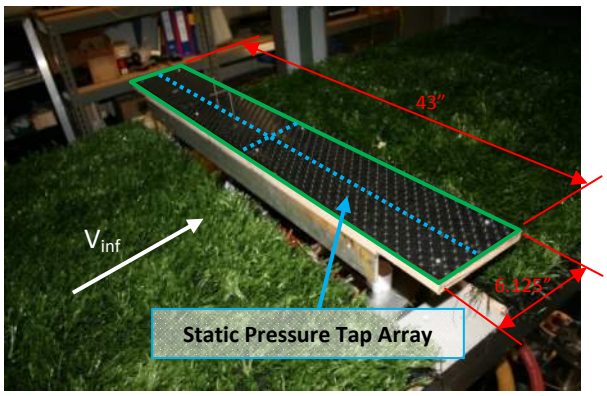


Figure 1a – Model Before Final Turf Layer

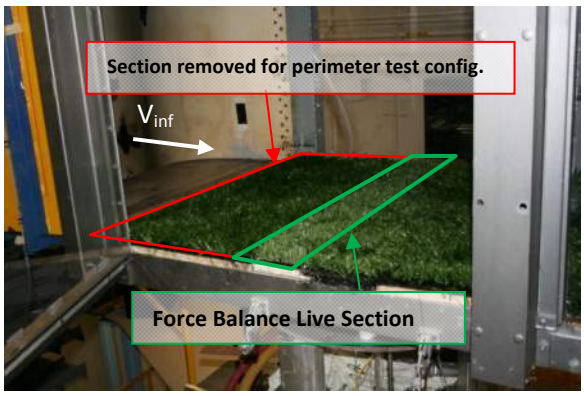


Figure 1b – Turf Installed & Model Lowered

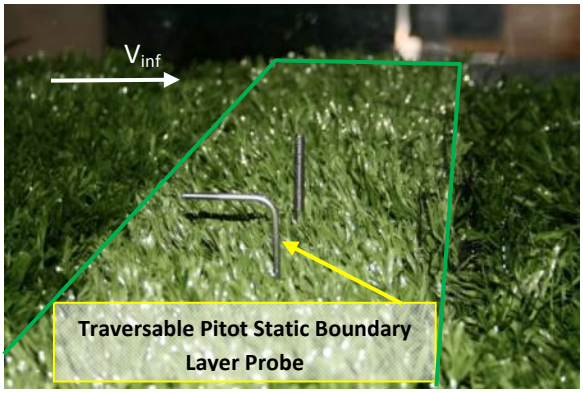


Figure 1c - Pitot Static Boundary Layer Probe

Figure 1d – Full Installation Looking Downstream

Program Description

Closure Turf system - The Closure Turf ground cover system consists of two independent layers. The first layer is a **geomembrane** to cap the upper soil layer. This is then covered with a **geotextile** turf layer (Fig 2a and 2b)

Geomembrane Layer -The impermeable geomembrane is made from Agru 50-mil LLDPE Super Gripnet® material and is used to cap the terrain being covered. It has an array of spikes to interface to the soil below and an array of studs to interface with the turf covering above. Throughout the testing and subsequent analysis of the Closure Turf system, **it was assumed that the geomembrane will be sufficiently installed to prevent movement of that layer.**

Geotextile Turf Layer – This component is designed to be installed on top of the geomembrane. The turf is intended to remain in place without an anchoring system linking it to the geomembrane below. It relies on the interface friction and sand ballast added on top of the turf to ensure that it remains immobile under all environmental conditions. It is constructed of two permeable sheets of woven HDPE mesh material which are linked together with synthetic blades of grass that are looped through the two HDPE substrates (Fig 2a).

Figure 2a – Closure Turf Synthetic Ground Cover System

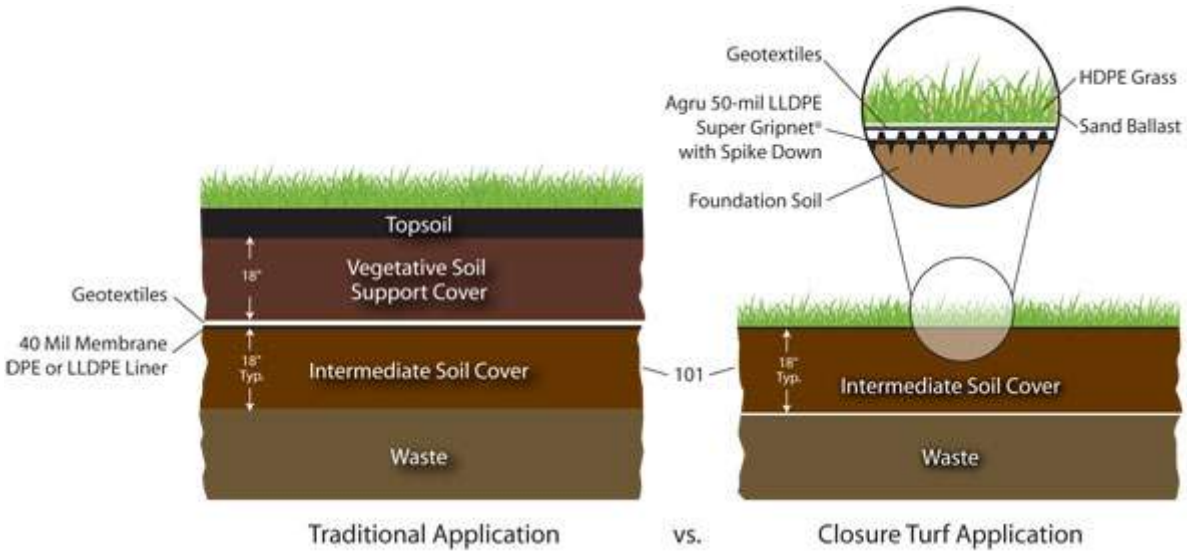


Figure 2b – Installation of Closure Turf

Purpose – The scope of this program was to conduct a full-scale wind tunnel test and experimentally isolate and measure the aerodynamic forces acting on a section of the permeable upper geotextile turf layer alone as installed above the impermeable geomembrane. The wind tunnel install configuration would simulate a wide range of wind speeds flowing over a **flat and level terrain installation** of the Closure Turf ground cover system (Fig 1a-d). The sand ballast requirements needed to counteract the resulting aerodynamic forces could then be determined. The purpose of the ballast is twofold. It serves to prevent both lift-off and tangential motion of the turf material along the geomembrane underlayment **resulting from aerodynamic lift and drag acting on the turf layer**.

Methodology

Model Design – The model represented a full-scale 2D section of the Closure Turf material with a 6.125" chord (stream-wise dimension) with a width of 43" that spanned the tunnel wall to wall. This area constituted the live balance section upon which the total sum of all aerodynamic forces could be measured by a 6 component force balance located under the test section. The model consisted of 4 layers listed below from the lower to uppermost turf layer

1) ¾" Furniture grade plywood support base – This incorporated several pressure taps on the underside in order to measure the ambient pressure (P_{amb}) to determine the vertical force (F_{amb}) due to pressure acting upward on the lower surface of the model.
2) Foam Filler Layer – This represented the soil layer surrounding the lower geomembrane spikes.
3) Impermeable Goemembrane Layer – This was fixed rigidly to the base. An array of static pressure taps was installed on the upper side of this layer, shown schematically in Fig. 1a. These

pressures were integrated numerically to determine the force (F_{geo}) due to pressure acting down on the membrane.

4) Geotextile Turf Layer – The turf was first mounted to a thin wire support frame to maintain the geometry and to provide a safety measure to prevent material from dislodging in the tunnel. The frame was then mounted rigidly on top of the lower construction flush with the top of the geomembrane upper surface studs.

Pitot Static Boundary Layer Probe – In general, pressure variation through the height of the boundary layer is due to viscous forces which cause deficits in the total pressure as the bounding flat and level surface is approached. The static pressure remains constant. However, the unique characteristics of the flexible and permeable turf layer warranted investigating the boundary layer formation on the Closure Turf system. To accomplish this, a traverse system was built into the model to actuate a Pitot static probe vertically through the boundary layer (Fig 1c). This allows the measurement of the total and static pressure as a function of the probe height, defined as h = 0" at the upper surface of the turf HDPE woven mesh. From these measurements the flow velocity distribution was determined. This characterizes the shape of the boundary layer which is by its nature a transition from the no slip condition at the surface ($V = 0$) to free stream conditions ($V = V_{inf}$). The characteristics of this boundary layer profile such as the BL thickness, the height required for the flow to reach free stream velocity, provide valuable insight into the observed results.

Force Balance – An under floor 6 component force balance was utilized to measure the aerodynamic lift (L) and the total drag (D) of the model. These forces were transmitted to the balance through a vertical strut which mounted to the underside of the model base. It should be noted that these forces represent the total sum of all pressure distributions acting on the model resolved vertically and tangentially. As such the isolated vertical force acting on just the turf layer (L_{turf}) is found by Equation 1.

$$L_{turf} = L - L_{amb} + L_{geo} \quad \text{(Eq 1)}$$

Under the confines of this program, it was not feasible to separate the drag acting on just the turf from skin friction and pressure drag acting on the geomembrane. That being the case, the total drag as measured from the force balance was taken as the drag acting on the turf. This results in a conservative overestimation of the actual turf drag force present.

Installation Conditions – Two installation conditions were examined separately. To more accurately simulate the actual installation conditions, both geomembrane and turf layers were installed upstream and downstream of the balance live model (Fig 1b and 1d). This represents an **interior** condition and in this case the model was located approximately 18" inboard of the **perimeter**. It was also suspected that the perimeter, if unaccounted for, could lead to a worse case situation. To determine the nature of this the upstream turf was removed leaving just the geomembrane as a stand in for a typical surface soil roughness that could be expected at the edge of a real world installation. This left the model mounted turf exposed at the leading edge.

Results and Discussion

These results represent the required thickness of sand for the Closure Turf system as installed on **flat and level terrain**. The density of the sand was provided by Closure Turf. If a different material density is to be used as ballast, the results can be recalculated via Equation 2.

In all cases, **the driving parameter for the depth of the sand is tangential slip due to the aerodynamic formation of shear stress**. The sand ballast requirements have been illustrated in Figures 5 and 6 for several assumed representative interface coefficients of static friction (μ_s). The **minimum** required sand ballast height is found by Equation 2.

$$h_{sand}(in) = \frac{1}{\rho_{sand}}\left(\frac{\tau}{\mu_s} + P\right)\frac{12in}{ft} \quad \text{(Eq 2)}$$

Where:

$$\rho_{sand} = Weight\ Density\ of\ Ballast(sand) = 110\ \frac{lb_f}{ft^3}$$

$$\tau = \frac{D}{Area} = Shear\ Stress, \frac{lb_f}{ft^2}$$

$$P = \frac{L_{turf}}{Area} = Normal\ Force\ Loading, \frac{lb_f(+tve\ up)}{ft^2}$$

The measured data for determining the sand depth are shown in Table I and Table II and plotted in Figures 5 and 6 for the perimeter and interior configurations respectively. The last column of each table gives the resulting sand height requirement, based on Equation 2, for μ_s = 0.93. This value was determined independently from the efforts of this program by Closure Turf affiliates and supplied for use in this analysis.

Perimeter Condition (PC) – The ballast requirement resulting from this configuration are substantially greater than the interior condition. For the given μ_s =0.93 a **minimum** sand height of 0.4" or 3.6 lb_f/ft^2 is needed to provide the ballast based on the resulting shear at 175 ft/s. The lifting pressure will be satisfied by this loading as shown in Figure 4. It should be noted that the required ballast height due to uplift goes from positive to negative at around 115 ft/s. There are several factors contributing to these results.

PC Boundary Layer (BL) – The profile for the perimeter condition is shown in Figure 4 (Red Curve). One characteristic to note is that the boundary layer thickness reaches 99% of free stream velocity at a height of approximately 2". This subjects the turf to up to 89% of the total free stream based on a max vertical blade height of 1.25". This has several resulting effects which can be followed in Figures 3a to 3f. The cascade of effects proceeds as follows.

The blades are subject to higher velocities and thus higher increasing drag as the wind speed increases. The higher drag increases the bending of the blades back onto the mesh substrate. The effect of this has 2 **counteracting effects on the net lift**. At lower velocities (Fig3a-b) the blades are bent slightly with the

flow being deflected and accelerated of over the perimeter as shown by the tufts. This flow acceleration increases the **local** velocity and lowers the local static pressure **below** that of free stream static which creates the pressure differential building up in 3a and b Additionally, in this installation, the perimeter exposes the gap between the turf and the geomembrane which allows for some uplift pressure recovery beneath the turf. However, as the free stream velocity increases, the drag is increased further by virtue of greater velocity exposure in the relatively thin boundary layer, the bending angle of the turf also increases (Fig 3b-c). This bending produces an increasing down force reaction which starts to counteract the suction created by the local flow acceleration. Simultaneously, the slightly reduced turf profile geometry (caused by the increased bending) shown in Figure 3c-d begins to reduce the relative local flow acceleration and thus also reduces the suction. This continues until the net vertical force becomes zero at about 110 ft/s (Fig 3d) and continues to decrease through Figure 3f.

Interior Condition (IC) – This condition owes its behavior to the formation of a drastically different boundary layer than the perimeter as shown by the blue profile in Figure 4. Compared to the Perimeter profile it is 25% thicker with no measurable velocity until the height is greater than 50% of the turf length (0.75”). The blades thusly experience a maximum velocity of 45% of free stream. This reduces the drag acting on the turf layer. Furthermore, the static pressure remains constant as a function of height through the BL which effectively prevents the formation of a pressure differential on the flat and level permeable turf membrane.

The cause for the deficient boundary layer is created by longer flow paths over a given surface and all boundaries grow in thickness and increase in turbulence with increasing distance. In the case of Closure Turf, the interaction of the flow with the flexible blades causes this growth to occur quite rapidly. The distance producing the profile in Fig 4 was 18” however, the effect of the growing boundary layer can be seen even in the perimeter condition development in Figures 3a –f. The Model section (highlighted in yellow) is 6.125” wide. It is clearly seen that little to no defection occurs in the turf at a distance just over 6 inches behind the perimeter edge. Thus the boundary layer at further distances than 18” and greater from the perimeter can be expected to have minimal interaction with the turf. Figure 6 shows these results by producing measurements requiring minimal ballast.

Final Comments and Executive Summary

GTRI was contracted by Closure Turf to determine the effective required ballast in terms of sand thickness needed to counteract the aerodynamic forces versus wind velocity acting on a permeable geotextile synthetic turf ground covering material that is to be overlaid onto an impermeable geomembrane underlayment. *It was found that in both perimeter and interior loading conditions, the shear acting on the material serves as the more demanding factor for determining the ballast.*

- **The resulting measurements represent the forces acting on the permeable Turf Layer *only*. The impermeable geomembrane layer was to be assumed immobile as a founding assumption of this program**

- **If it is determined that the static interface friction coefficient (μ_s) between the soil and the lower side of the membrane is lower than that occurring between the turf and the membrane upper surface studs, the lower μ_s should be used in Equation 2 to recalculate the sand depth required by shear. The same shear data given in Tables I & II will apply because, as discussed within the methodology section, the measured shear could not be feasibly separated between the two layers independently and thus represents their combined effect.**
- **The sand ballast depths represented in Figures 5 & 6 and Tables I & II are the Minimum depths required, the proper factor of safety has been left to be determined by Closure Turf, LCC and the authorized building permit issuing agencies.**
- **The perimeter of the turf installation is much more demanding than interior sections.**
- **All measurements were made on a rigidly constrained system. It was not within the scope of this investigation to determine what dynamic effects might occur, including gusts or erosion of sand ballast or any possible unstable perturbations.**
- **All configurations consisted of flat and level terrain installation.**
- **All calculations and measurements assume that the blade length is increased to account for any added ballast material. This is to ensure that the installation matches the conditions as tested.**

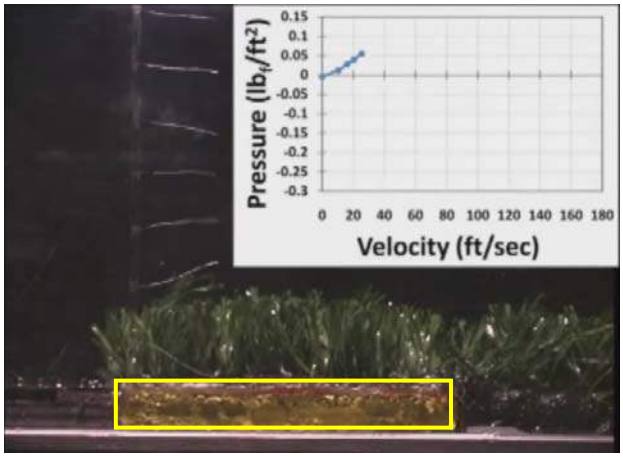


Figure 3a: Vinf = 25 ft/sec

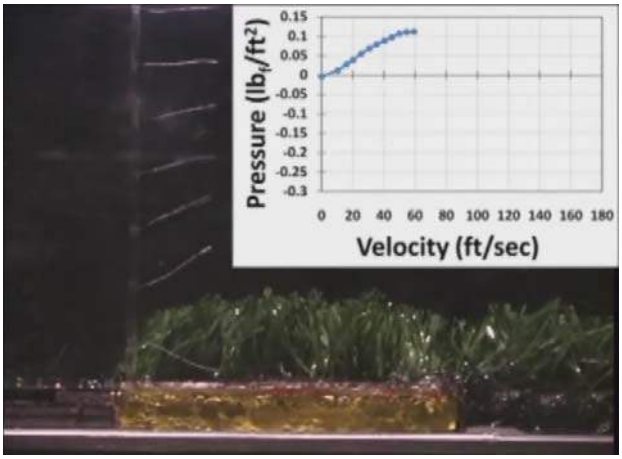


Figure 3b: Vinf = 60 ft/sec

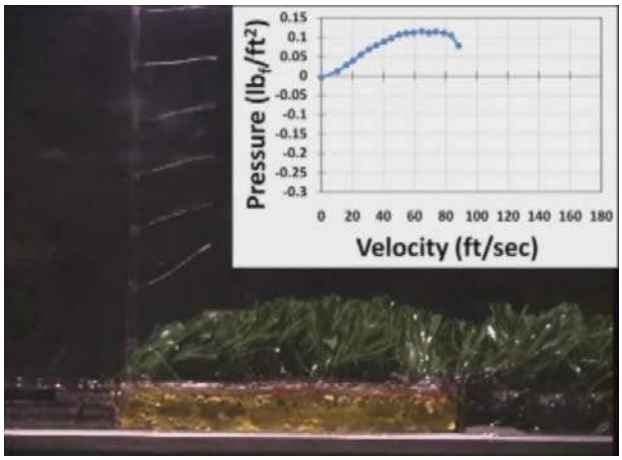


Figure 3c: Vinf = 90 ft/sec

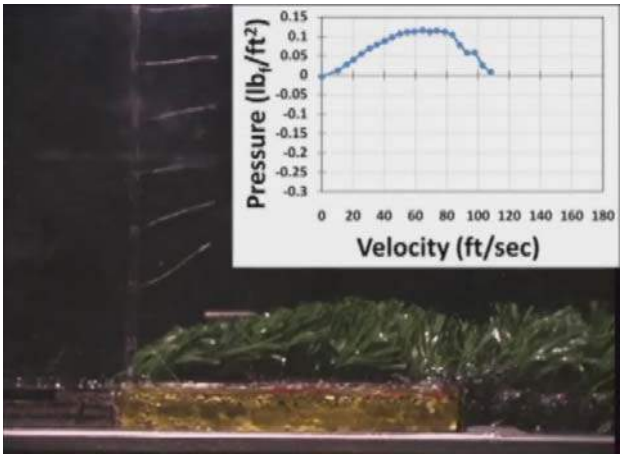


Figure 3d: Vinf = 110 ft/sec

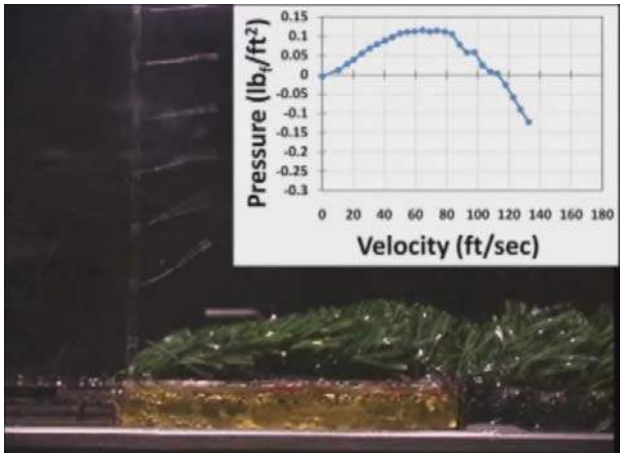


Figure 3e: Vinf = 135 ft/sec

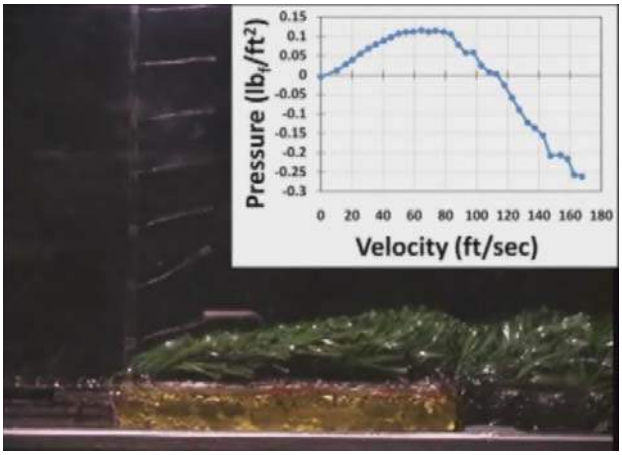


Figure 3f: Vinf = 170 ft/sec

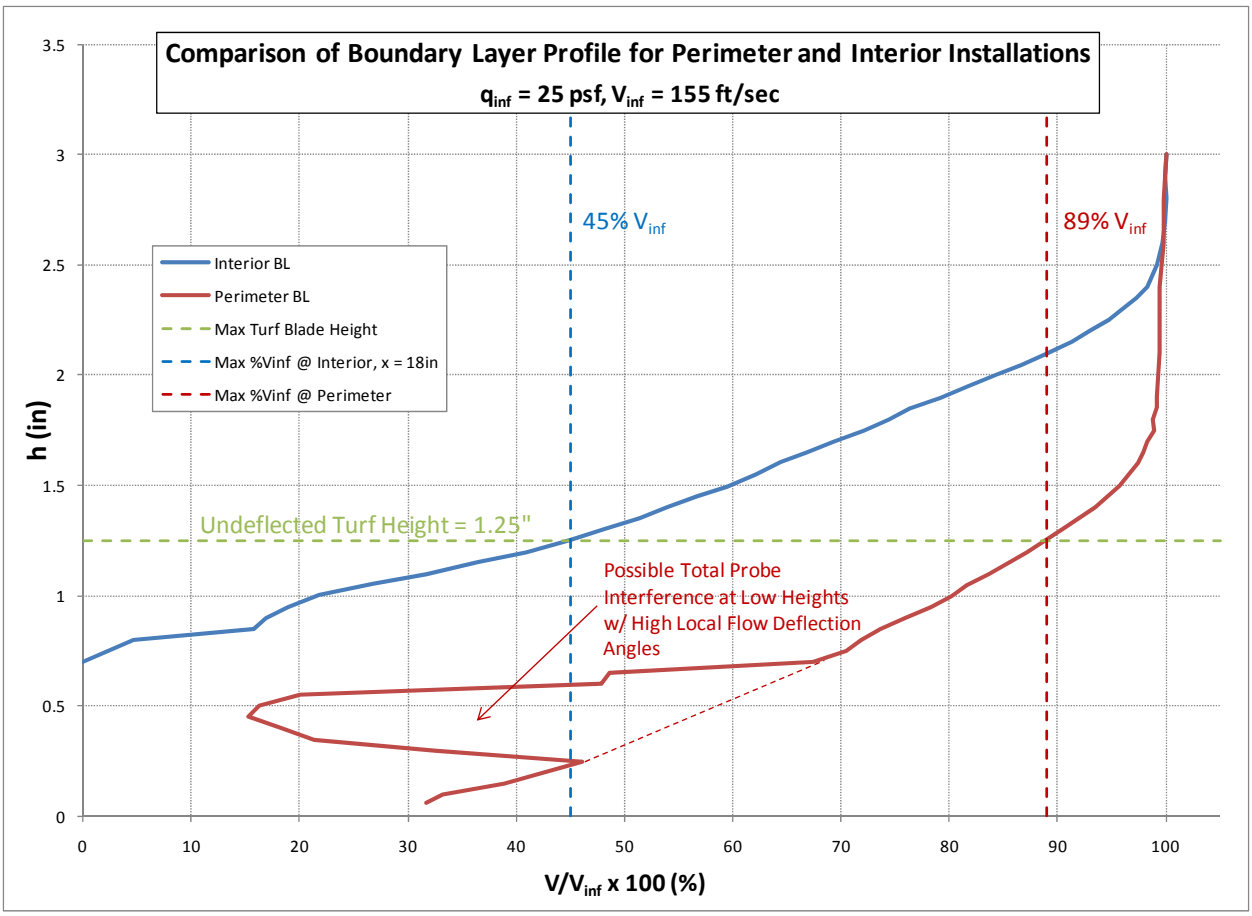


Figure 4 – Non-Dimensional Boundary Layer Profiles for Perimeter and Interior Installations

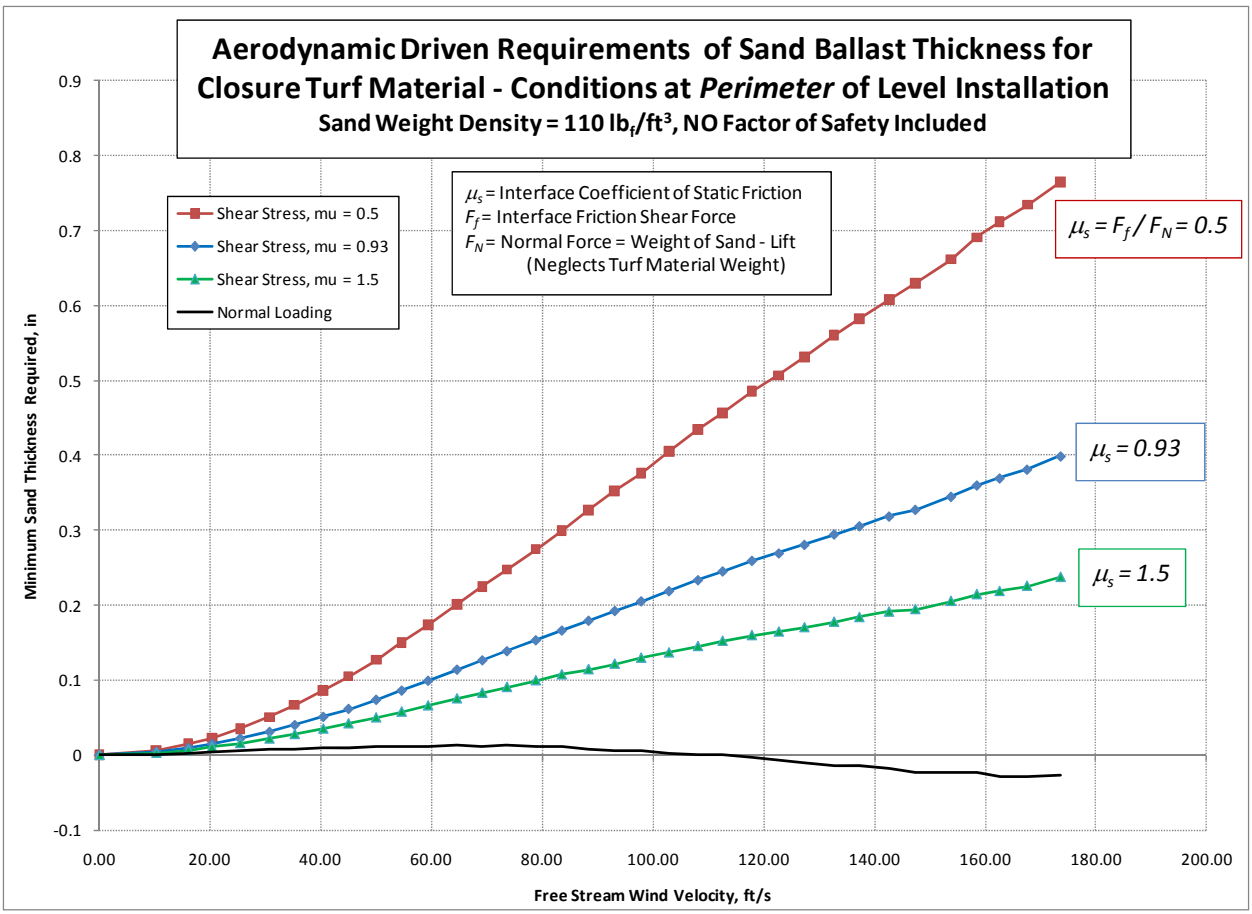


Figure 5 – Sand Ballast Minimum Requirement at the *Perimeter* of Turf Installation

Table I - Perimeter Installation				
Wind Speed (*ft/s*)	Wind Speed (*mi/hr*)	Turf Normal Force Loading (lb_f/ft^2)	Turf Shear Stress (lb_f/ft^2)	Sand Height Due to Shear (*in*)
0.00	0.00	0	0	0
10.26	6.99	0.011689	0.023784	0.0040651
16.06	10.95	0.027798	0.053106	0.009262
20.31	13.84	0.039396	0.086922	0.0144939
25.40	17.32	0.054936	0.136103	0.0219582
30.70	20.93	0.06927	0.198423	0.0308322
35.26	24.04	0.078777	0.266915	0.0399035
40.42	27.56	0.088429	0.351918	0.0509275
44.97	30.66	0.096783	0.434606	0.0615383
49.97	34.07	0.10646	0.529776	0.0737576
54.57	37.21	0.110561	0.630469	0.0860165
59.36	40.47	0.111817	0.741903	0.099225
64.58	44.03	0.115373	0.865046	0.1140578
69.15	47.15	0.111526	0.975305	0.1265718
73.60	50.18	0.114496	1.076528	0.1387694
78.82	53.74	0.111457	1.204017	0.1533926
83.52	56.94	0.104976	1.320714	0.1663744
88.34	60.23	0.077354	1.458158	0.1794835
93.08	63.46	0.057303	1.588598	0.192597
97.86	66.72	0.058201	1.697814	0.2055063
102.89	70.15	0.024978	1.844449	0.2190825
108.12	73.72	0.007601	1.985703	0.2337562
112.58	76.76	0.002646	2.090641	0.2455251
117.87	80.37	-0.026041	2.237684	0.2596441
122.74	83.69	-0.058742	2.352732	0.2695721
127.36	86.84	-0.089852	2.479185	0.2810115
132.72	90.49	-0.122289	2.627843	0.2949108
137.29	93.61	-0.135769	2.734267	0.305924
142.65	97.26	-0.155489	2.863465	0.3189279
147.40	100.50	-0.208034	2.98848	0.3278602
153.84	104.89	-0.206002	3.134988	0.3452676
158.51	108.08	-0.21588	3.274285	0.3605298
162.63	110.88	-0.256805	3.392572	0.3699406
167.59	114.26	-0.261535	3.496667	0.3816351
173.66	118.41	-0.23928	3.626641	0.3993092

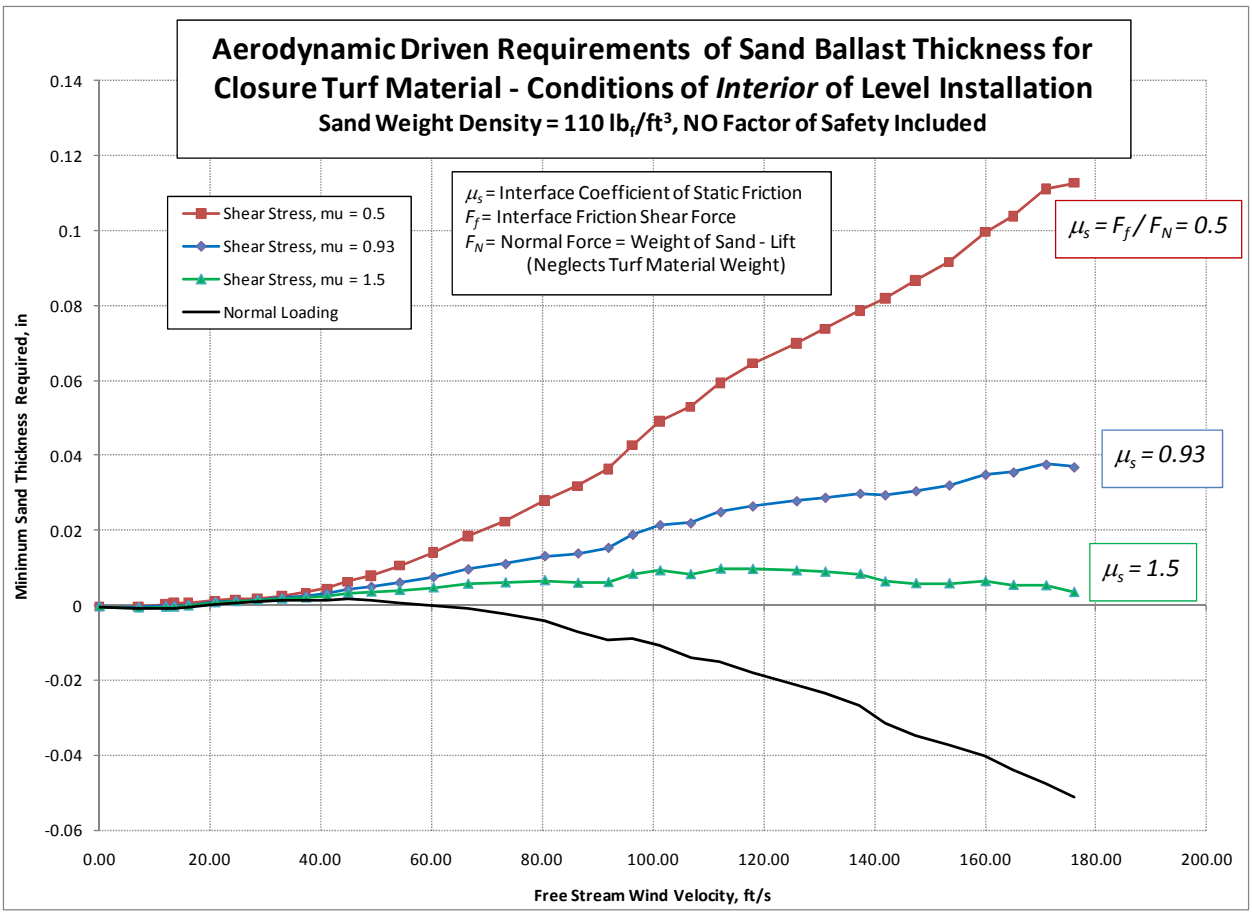


Figure 6 – Minimum Sand Ballast Requirement in the *Interior* of Turf Installation

Table I - Interior Installation				
Wind Speed (ft/s)	Wind Speed (mi/hr)	Turf Normal Force Loading (lb_f/ft^2)	Turf Sheer Stress (lb_f/ft^2)	Sand Height Due to Shear (*in*)
0.00	0.00	-0.00419	0.000471	0
7.07	4.82	-0.00858	0.002819	-0.000605326
12.02	8.20	-0.00858	0.005658	-0.000272305
13.47	9.18	-0.009201	0.006927	-0.000191194
16.05	10.94	-0.005314	0.005174	2.72117E-05
20.91	14.26	0.003753	0.0034	0.000808245
24.64	16.80	0.006062	0.004099	0.00114213
28.56	19.47	0.009925	0.003388	0.001480147
32.94	22.46	0.011669	0.005393	0.001905592
37.27	25.41	0.011221	0.009767	0.002369798
41.09	28.01	0.013608	0.013502	0.003068321
44.90	30.61	0.015886	0.02088	0.004182285
49.08	33.47	0.011842	0.03072	0.004895374
54.21	36.96	0.006407	0.045273	0.006009561
60.31	41.12	-0.000648	0.064883	0.007540218
66.57	45.39	-0.006394	0.087581	0.009575904
73.32	49.99	-0.019878	0.112271	0.01100111
80.43	54.84	-0.037311	0.146631	0.013129826
86.42	58.92	-0.06477	0.178237	0.013841748
91.90	62.66	-0.083261	0.208285	0.01534924
96.30	65.66	-0.081403	0.236369	0.018846242
101.24	69.02	-0.097454	0.273298	0.021427071
106.76	72.79	-0.129489	0.30751	0.021945482
112.17	76.48	-0.138401	0.341067	0.024909568
117.97	80.43	-0.163997	0.378085	0.026459565
125.89	85.83	-0.193612	0.417441	0.027845377
131.07	89.36	-0.215792	0.445855	0.028758761
137.38	93.67	-0.245542	0.482763	0.029842691
141.88	96.73	-0.289393	0.520185	0.029448623
147.46	100.54	-0.317409	0.555461	0.030530279
153.47	104.64	-0.340708	0.59023	0.032067045
159.99	109.08	-0.369093	0.641021	0.034928388
165.05	112.53	-0.4029	0.677722	0.035545455
170.96	116.56	-0.437374	0.727691	0.037646121
176.00	120.00	-0.469865	0.751682	0.036915842

Attachment E

ClosureTurf Integrity Study

SGI TESTING SERVICES
A GEORGIA LIMITED LIABILITY COMPANY

8 July 2010

Mr. Jose Urrutia
Closure Turf, LLC
3005 Breckinridge Blvd., Suite 240
Duluth, Georgia 3096

Subject: Evaluation of Drivability
Light Weight Construction Equipment on
Closure Turf™ System

Dear Mr. Urrutia,

DEFINITION OF CLOSURE TURF™ SYSTEM

As shown in Figure 1, the installed Closure Turf™ system from top to bottom consists of:

- A thin sand layer;
- Artificial grass with geotextile down;
- Agru 50-mil Super Gripnet with spike sides down; and
- Subgarde (foundation) soil.

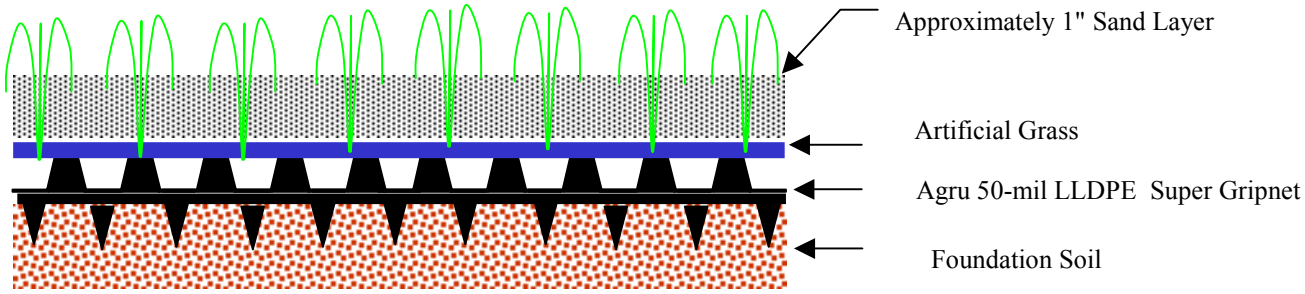


Figure 1. Cross-section of the Closure Turf system

SGI10007.REPORT.2010.04

MAIL TO: SGI TESTING SERVICES, LLC
P.O. BOX 2427
LILBURN, GA 30048-2427

FACILITY LOCATION
4405 INTERNATIONAL BLVD., SUITE B-117
NORCROSS, GA 30093

WEB SITE: WWW.INTERACTIONSPECIALISTS.COM

PHONE: 770.931.8222 FAX: 770.931.8240

DEFINITION OF POST-CONSTRUCTION DRIVABILITY

Drivability of rubber-tired construction equipment (RTCE) on the Closure Turf™ system is a rather broad subject including: (i) stability - potential sliding (shear failure) within the Turf Closure system; (ii) bearing capacity of the subgrade soil; (iii) localized settlement after construction due to waste decomposing and compression under gravity force; and (iv) rut depth. The purpose of this report is to evaluate the stability within the Turf Closure system and bearing capacity of the subgrade soil.

STABILITY

As shown in Figure 2, when a RTCE moves at a constant speed on the Closure Turf system, its gravity load is transferred to the Closure Turf system through the tire-soil contact.

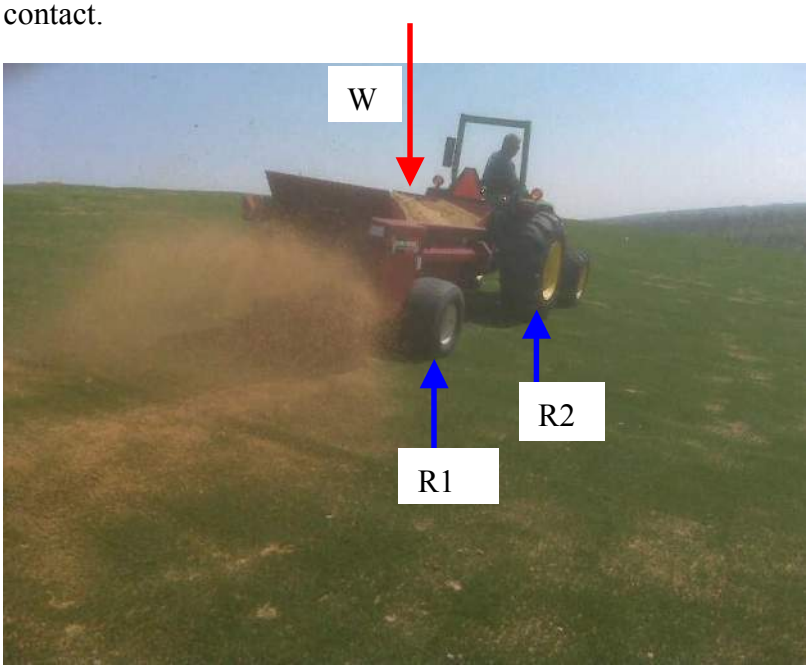


Figure 2. Rubber-tired construction equipment on the Closure Turf system.

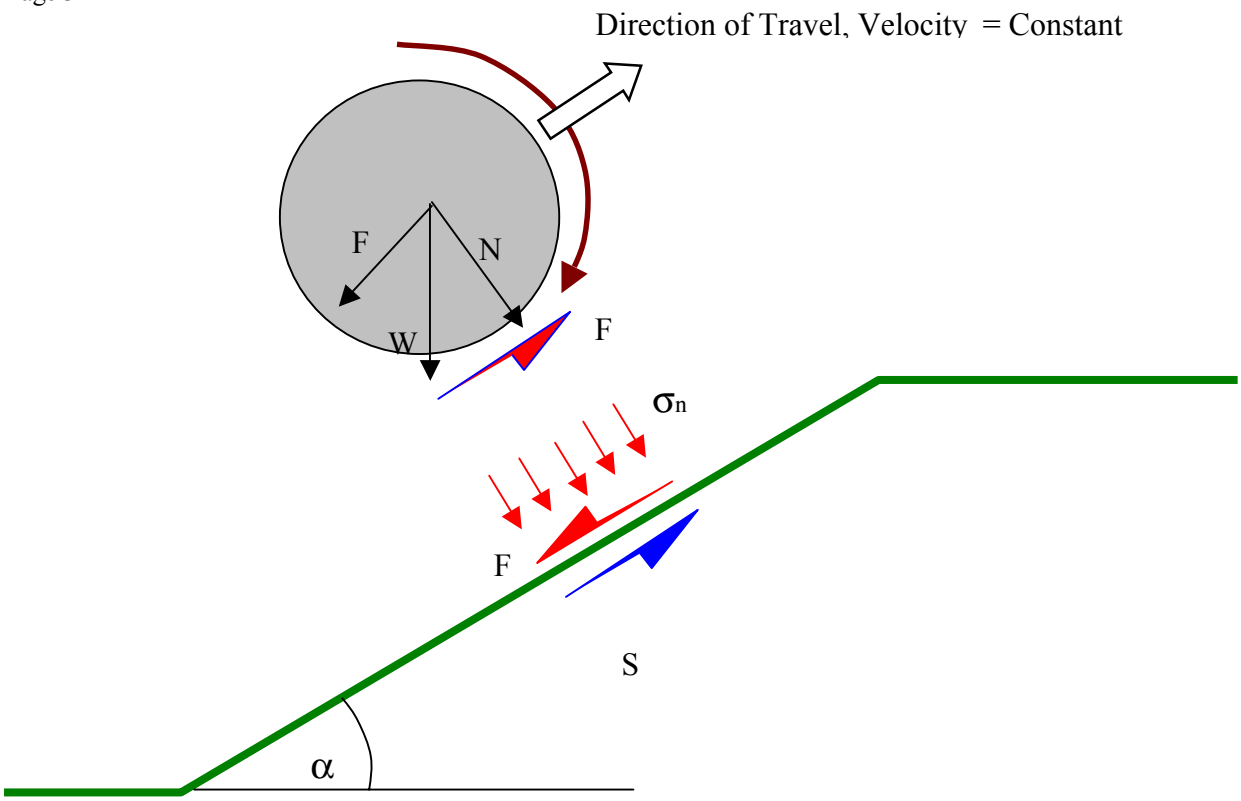


Figure 3. Tire-soil contact loading conditions on a slope. (NOTE: not to scale).

Assuming the gravity force of RTCE is evenly distributed to four tires, the contact normal stress at the tire-sand contact area as shown in Figure 3 can be estimated by the following equation:

$$\sigma_n = \frac{W \cos\alpha}{4A} \qquad (1)$$

where:

α = the slope angle;

σ_n = contact normal stress between the tire and sand;

W = total gravity force of equipment; and

A = contact area between a tire and sand layer.

Assuming: (i) the tire-soil contact area is approximately equivalent to a 10 inch diameter circular area and (ii) the total weight of a RTCE is 8000 lbs, then the contact normal stress in the unit of psi is:

$$\sigma_n = \frac{8000\cos\alpha}{4(3.14)(5^2)} = 25.5\cos\alpha \qquad (2)$$

Equation (2) is also applicable to a level surface by setting α = 0. This gives the maximum contact normal stress of 25.5 psi. It is noted that the tire-sand contact normal stress over a 10-inch diameter area is much higher than the overburden pressure of 1 inch thick cover sand. Therefore, it is necessary to evaluate the stability of the Closure Turf system in the tire-sand contact area under the high normal stress conditions. The shear strength parameters for this localized stability analysis should be determined from the interface direct shear tests at high normal stresses (2000 to 5000 psf). Based on the test results in Attachment 1, the peak friction angle and adhesion of the sand/artificial grass/Agru 50-mil Super Gripnet LLDPE geomemebrane system is 34 degree and 39 psf, respectively for the normal stress range of 2000 to 5000 psf. Under the drained conditions (i.e., no pore pressure induced by RTCE), neglecting the adhesion for the conservative reason, the safety factor (FS) against the localized shear failure within the tire-soil contact area is:

$$FS = \frac{A\sigma_n \tan\delta}{0.25(W)\sin\alpha} \qquad (3)$$

where:

α = the slope angle;

σ_n = contact normal stress between the tire and sand;

δ = the peak friction angle of the Closure Turf system;

W = total gravity force of equipment; and

A = contact area between a tire and sand layer.

Substituting Equation (1) into (3), Equation (3) is reduced to:

$$FS = \frac{\tan \delta}{\tan \alpha} \tag{4}$$

For the given Closure Turf system, the peak friction angle is constant. It is obvious that FS decreases with increasing the slope angle. Based on the information provided by Closure Turf LLC, the maximum allowable slope angle is 18 degree (3:1 slope).

At $\alpha = 18.4$ degree,

$$FS = \frac{\tan 34}{\tan 18} = 2.0 \tag{5}$$

This indicates that there is sufficient shear resistance in the Closure Turf system against the localized shear failure within the tire-soil area. It is not expected the localized internal shear failure to occur within the tire-soil contact area of Closure Turf system when it subjected to the gravity force from a typical lightweight RTCE traveling at a constant velocity.

BEARING CAPACITY

For a given RTCE, W and A are constant, therefore the maximum contact normal stress occurs when the RTCE travels on the level surface (Equation 1). The contact normal stress is transferred to the subgade soil as shown in Figure 4.

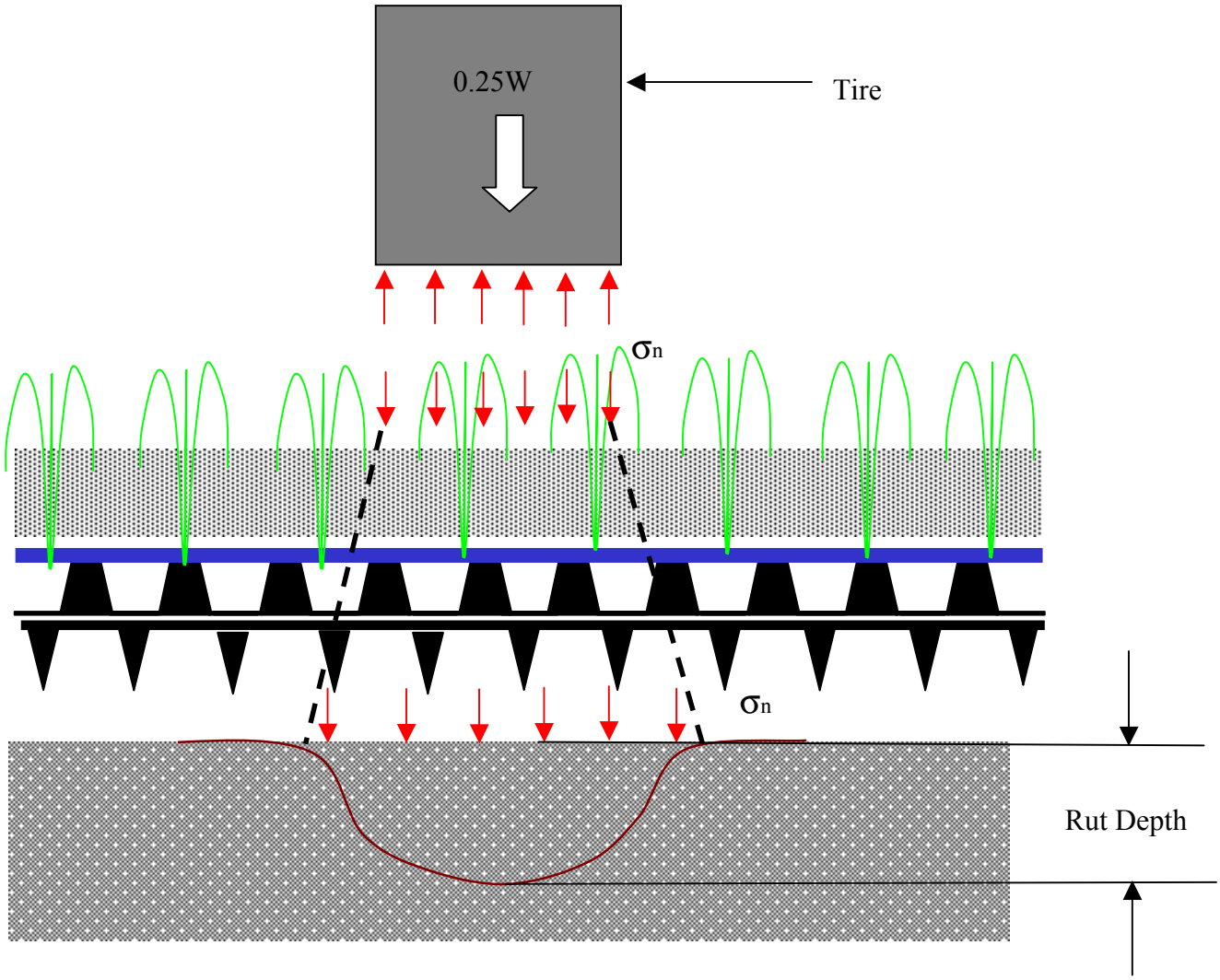


Figure 4. Normal stress acting on top of the subgrade (foundation) soil

Based on soil mechanics, the contact load (0.25W) distributes to a larger area as depth increases (depth starting from the top surface of the cover sand). However, due to the fact that the cover sand layer is only 1 inch thick, and the artificial grass and geomembrane are flexible, the load spreading angle (factor) is insignificant. The normal stress transferred to the top of subgrade soil is considered the same as the tire-sand contact stress for the conservative reason.

As shown previously (Equation 2), assuming (i) the tire-soil contact area is approximately a 10 inch diameter circular area and (ii) the total weight of a RTCE is 8000 lbs, then the maximum contact normal stress is:

$$\sigma_n = \frac{8000\cos\alpha}{4(3.14)(5^2)} = 25.5\,psi \qquad (6)$$

Under the action of tire-sand contact normal stress over the contact area (10 in diameter), there are two major concerns:

- Excessive rut depth, which is not defined for the Closure Turf system at the present time. Generally speaking, the subgrade soil settles and rut forms when it is subjected a normal stress. As number of vehicle passes increases, the rut depth increases. Eventually the surface may reach such a condition that driving is difficult if the accumulated pass is larger than some critical number. Therefore, for the given type of equipment (W and A are fixed), one way to reduce rut depth is to limit the number of passes. This may be achieved by not driving over the same area when a significant rut depth is already developed. The other way is to compact subgrade soil to high density to improve the stiffness for the subgrade soil.

- Bearing capacity failure because the contact normal stress is greater than the bearing capacity of the subgrade soil.

In the case of soft subgrade soil (worst case), the bearing capacity is estimated by the following equation:

$$q_u = c_u N_C \qquad (7)$$

where:

c_u = undrained shear strength of soft subgrade soil

N_c = bearing capacity factor (6.2 for a circular loading area)

$$q_u = 6.2c_u \tag{8}$$

For the soft subgrade soil, the safety factor against bearing capacity failure is:

$$FS = \frac{6.2c_u}{\sigma_n} \tag{9}$$

Typically, the acceptable bearing capacity safety factor is 2.0. The required undrained shear strength for the subgrade soil is,

$$c_u \geq \frac{2(25.5)}{6.2} = 8.2\,psi \tag{10}$$

The value of c_u can be estimated from the widely used CBR value for soft subgrade soil with CBR < 5 using the following equation (Giroud and Noiray 1981):

$$c_u = 4.3CBR \tag{11}$$

Substituting Equation 11 into 10 gives the following equation:

$$CBR \geq 1.9 \tag{12}$$

Therefore, under the action of the gravity force from a typical RTCE (W = 8000 lbs, A = 79 square inch), the required minimum CBR value for the subgrade is 2. In reality, a well-compacted subgarde soil for the Closure Turf system should have a CBR value significantly higher than 2. It is expected that a well-compacted subgarde soil layer (SM or SC, typically used as subgarde soil for the landfill cover system) should have sufficient bearing capacity to support the lightweight RTCE.

CLOSURE

SGI appreciates the opportunity to provide technical services to Closure Turf, LLC. Should you have any questions regarding the attached document(s), or if you require additional information, please do not hesitate to contact the undersigned.

Sincerely,

Zehong Yuan, Ph.D., P.E.
Laboratory Manager

REFERENCES

Giroud, J.P., and Noiray, L. (1981) "Geotextile-reinforced unpaved road design." Journal of Geotechnical Engineering 107(9), 1233-1254.

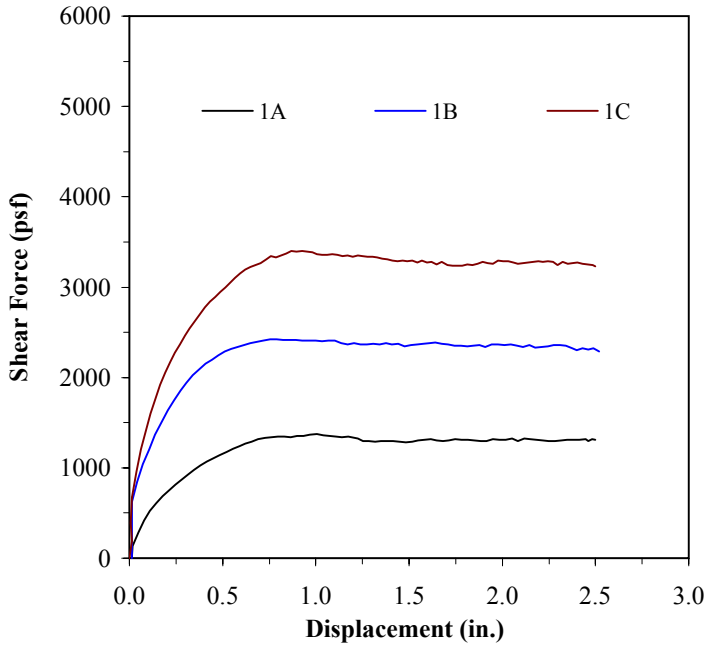
NOTES:
(1) Unless otherwise noted in the test results the sample(s)/specimen(s) were prepared in accordance with the applicable test standards or generally accepted sampling procedures.
(2) Contaminated/chemical samples and all related laboratory generated waste (i.e., test liquids, PPE, absorbents, etc.) will be returned to the client or designated representative(s), at the client's cost, within 60 days following the completion of the testing program, unless special arrangements for proper disposal are made with SGI.
(3) Materials that are not contaminated will be discarded after test specimens and archived specimens are obtained. Archived specimens will be discarded 30 days after the completion of the testing program, unless long-term storage arrangements are specifically made with SGI.
(4) The reported results apply only to the materials and test conditions used in the laboratory testing program. The results do not necessarily apply to other materials or test conditions. The test results should not be used in engineering analysis unless the test conditions model the anticipated field conditions. The testing was performed in accordance with general engineering testing standards and requirements. The reported results are submitted for the exclusive use of the client to whom they are addressed.

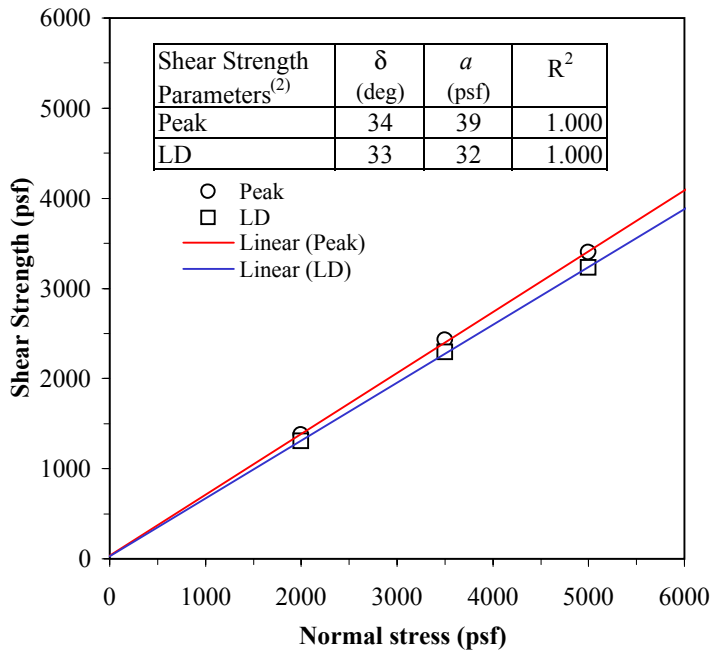
ATTACHMENT 1

INTERFACE DIRECT SHEAR TEST RESULTS

CLOSURETURF LLC -LANDFILL COVER SYSTEM
INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Concrete sand nominally compacted
Artificial grass with grass side (green yarns) up/
Agru 50 mil LLDPE Super Gripnet geomembrane with studs side up/
Lower Shear Box: Concrete sand





Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	Soaking		Consolidation		Lower Soil			Upper Soil			GCL		Shear Strengths		Failure Mode
				Stress (psf)	Time (hour)	Stress (psf)	Time (hour)	γ_d (pcf)	ω_i (%)	ω_f (%)	γ_d (pcf)	ω_i (%)	ω_f (%)	ω_i (%)	ω_f (%)	τ_P (psf)	τ_{LD} (psf)	
1A	12 x 12	2000	0.04	10	24	-	-	-	-	-	-	-	-	-	-	1376	1308	(1)
1B	12 x 12	3500	0.04	20	24	-	-	-	-	-	-	-	-	-	-	2425	2291	(1)
1C	12 x 12	5000	0.04	50	24	-	-	-	-	-	-	-	-	-	-	3400	3233	(1)

NOTES:
(1) Sliding (i.e., shear failure) occurred at the interface between the cover (upper) sand and artificial grass.
(2) The reported total-stress parameters of friction angle and adhesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

DATE OF TEST: 6/21/2010

SGI TESTING SERVICES, LLC

FIGURE NO.	C-1
PROJECT NO.	SGI10007
DOCUMENT NO.	
FILE NO.	

Attachment F
Evaluation of Sand Infill Criteria for ClosureTurf

Technical Note

EVALUATION OF SAND INFILL CRITERIA FOR CLOSURETURF®

Fine aggregate infill (sand) is one component of the ClosureTurf® three component system. An extensive testing program was implemented to evaluate the criteria and performance properties for the sand infill in the ClosureTurf system. The program included large scale performance testing by an independent third party laboratory, TRI Environmental (TRI) at the Denver Downs Research facility in Greeneville, South Carolina. A description of the testing procedures and results are provided in this document.

SAND INFILL FUNCTION

The sand infill component of ClosureTurf is utilized as a protective layer for the geotextile backing of the engineered turf component. The polypropylene geotextile backing material contains ultraviolet (UV) radiation degradation inhibitors protecting it against UV damage. Sand infill functions as an additional protective layer against UV degradation of the geotextile backing. Optimal sand infill performance occurs with minimal sand movement.

TRI tested sand infill mobilization in ClosureTurf in general accordance with ASTM D 6460, *Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion* and ASTM D 6459 *Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Hillslopes from Rainfall-Induced Erosion*. The results of the testing were also analyzed in accordance with each Standard to quantify infill mobilization during tested conditions. Photographs of tested sands are provided as Attachment A.

SAND INFILL LARGE SCALE HYDRAULICS TESTING

The TRI large-scale hydraulic testing (ASTM D 6460) was conducted in a rectangular flume having a 0.10 ft/ft slope. The subgrade was a loamy soil over which ClosureTurf with a ½ inch sand infill was installed following installation guidelines. Water is supplied to the facility by gravity flow and controlled and measured through upstream sluice gates as presented in Figure 1.

A test consists of measuring infill thickness, opening the sluice gates a predetermined amount allowing overtopping flow on the ClosureTurf for a period of 30 minutes, closing the sluice gate to stop overtopping flow and measuring infill depth to evaluate sand loss. The test procedure is repeated a minimum of four times with increasing overtopping flow amounts or until enough sand infill has been removed to expose the majority of the geotextile backing.

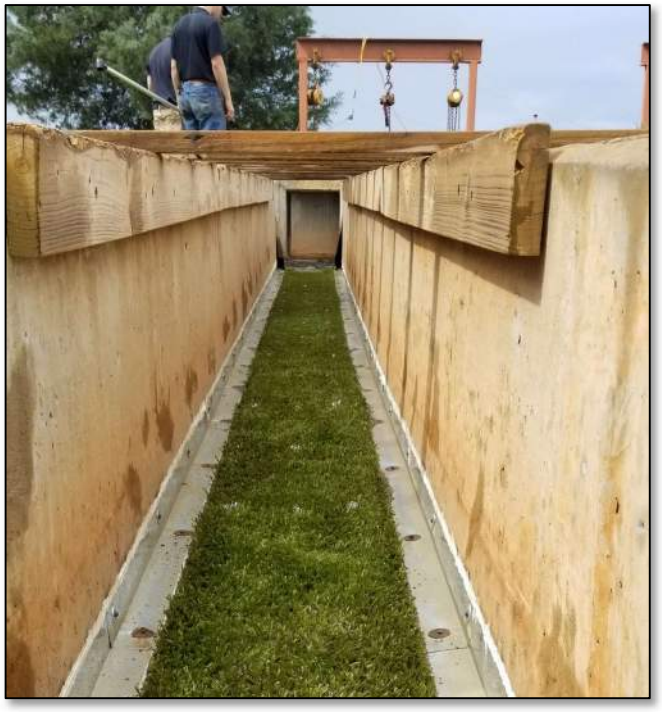


Figure 1. ClosureTurf® TRI Flume Test Installation

Reported test results include sand infill loss during each 30-minute overtopping period and the corresponding hydraulic shear stress during the 30-minute test period. The testing was conducted on six different sand infills having a range of grain size distributions, fine aggregate angularities and specific gravities. Sand infill angularity and specific gravity are presented in Table 1. Tested sand infill grain size distributions are presented in Figure 2. Hydraulic shear stress results are presented in Figure 3.

Table 1. Tested Sand Infill Angularity and Specific Gravity

Test Sand No.	Fine Aggregate Angularity (FAA) (%) (ASTM C 1252 / AASHTO T 304) (Method A)	Bulk Specific Gravity, Dry (SG) (ASTM C 128 / AASHTO T 84)
1	47.2	2.64
2	40.5	2.60
3	43.1	2.59
4	45.7	2.64
5	47.1	2.85
6	43.7	1.96

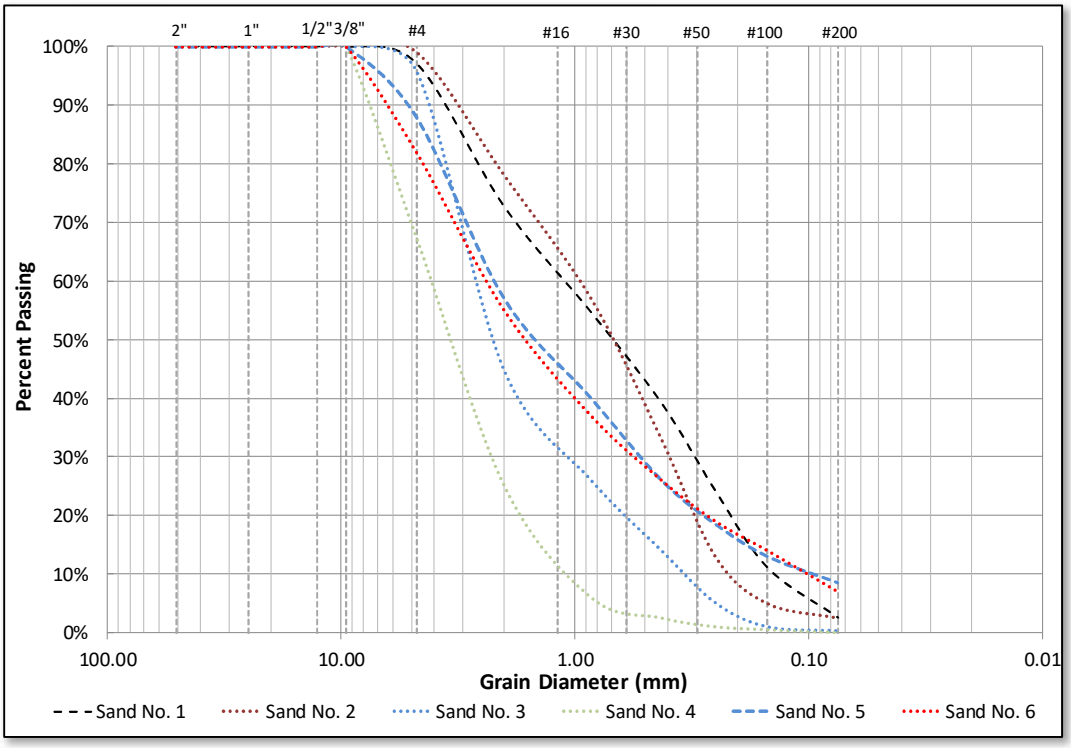


Figure 2. Tested Sand Infill Grain Size Distributions (ASTM C 136 / AASHTO T 27)

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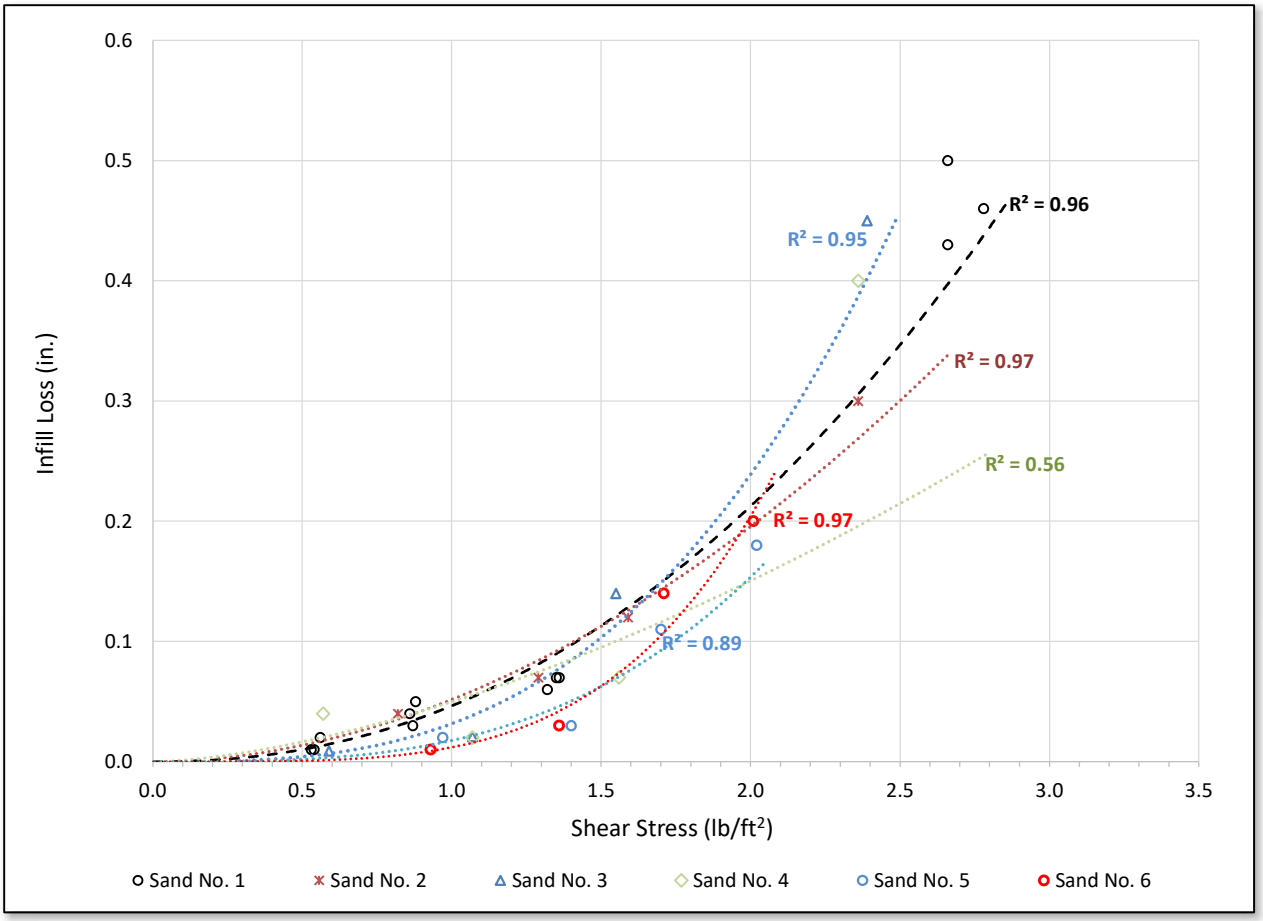

Figure 3. Infill Loss Due to Hydraulic Shear

SAND INFILL LARGE SCALE RAINFALL EROSION TESTING

The TRI large-scale rainfall erosion testing (ASTM D 6459) was conducted on a rectangular plot measuring 40 feet by 8 feet (length x width) and having a 0.33 ft/ft slope. The subgrade was a loamy soil over which ClosureTurf with a ½ inch sand infill was installed following installation guidelines as presented in Figure 4a. Artificial rainfall is produced by ten "rain trees" arranged around the perimeter of the test slope. Each rain tree has four sprinkler heads atop a 15 ft. riser pipe. The rainfall system produces target rainfall intensities of 2-, 4-and 6-inches per hour at pre-calibrated rain drop size distributions for a period of 20 minutes per intensity resulting in a one hour test. Testing in progress is presented in Figure 4b. All runoff was collected during testing to quantify sediment mobilization. Incremental infill losses are presented in Table 2.

(a) Infill Installation **(b) Testing in Progress**

Figure 4. ClosureTurf® TRI Rainfall Erosion Testing

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Table 2. Tested Sand Infill Rainfall Erosion Results

Test Sand No.	Rainfall Intensity (in./hr)	Incremental Infill Loss (%)
1	2.0	0.01
1	4.0	0.02
1	6.1	0.04
3	2.0	0.00
3	4.2	0.00
3	6.1	0.00
4	2.1	0.00
4	4.1	0.00
4	6.0	0.00

Based on the TRI large scale rainfall erosion and hydraulic shear test results and sand infill material properties, a sand infill specification was developed as summarized in Figure 5 and as appears in the WatershedGeo CSI specification, SECTION 31 05 16, *ClosureTurf® SAND INFILL COMPONENT*.

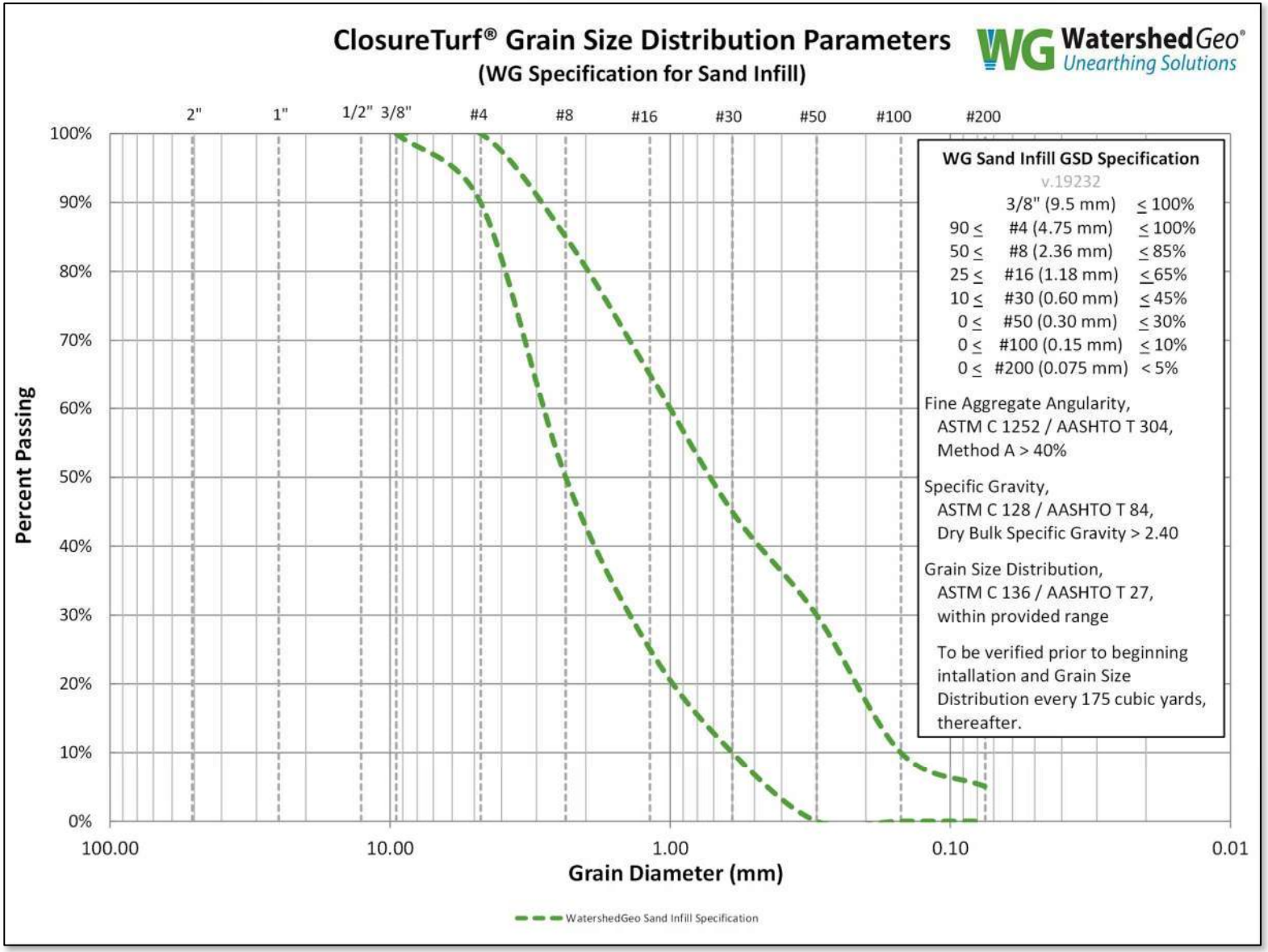

Figure 5. ClosureTurf® Sand Infill Specification

Attachment A

Figure A1. Tested Sand No. 1

Figure A2. Tested Sand No. 2

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Figure A3. Tested Sand No. 3

Figure A4. Tested Sand No. 4

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Figure A5. Tested Sand No. 5

Figure A6. Tested Sand No. 6

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LIMITATIONS

ClosureTurf® is a U.S. registered trademark which designates a product from Watershed Geosynthetics LLC. This product is the subject of issued U.S. and foreign patents and/or pending U.S. and foreign patent applications. All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

Attachment G
ClosureTurf Sand Infill Component Specification

This ClosureTurf® Specification document has been prepared to provide the Owner, Design Engineer, Construction Quality Assurance Professional of Record, and the Contractor / Installer with a general guidance specification. All information, recommendations and suggestions appearing in this specification concerning the use of our products are based upon experience, tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. The independent professional shall edit this document to suit the site-specific project design criteria. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. ClosureTurf® is a U.S. registered trademark which designates a product from Watershed Geosynthetics LLC. This product is the subject of issued U.S. and foreign patents and/or pending U.S. and foreign patent applications. Nothing herein is to be construed as permission to grant license or as a recommendation to infringe any patent.

SECTION 31 05 16

ClosureTurf® SAND INFILL COMPONENT

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes:

Specifications for approved Sand Infill Component of the patented ClosureTurf® System.

1.02 RELATED SECTIONS

Section 31 23 13 - Subgrade preparation (Upper 6 inches of subgrade only)

Section 01 42 00 - References and Definitions

Section 01 60 00 - ClosureTurf® Product Specification

Section 01 60 00 - ClosureTurf® MicroDrain® Product Specification

Section 01 60 01 - ClosureTurf® MicroSpike® Product Specification

Section 01 73 19 - ClosureTurf® Installation Specification

Section 31 05 16 - ClosureTurf® Sand Infill Specification

Section 03 49 01 - Alternate HydroBinder® Infill Specification

Section 23 51 23 - ClosureTurf® HDPE Pressure Relief Valve Specification

PART 2: PRODUCTS

2.01 DESCRIPTION

Sand Infill Component of the ClosureTurf® System shall meet the fine aggregate angularity, specific gravity and grain size distribution as specified by WatershedGeo in this Specification.

A. Fine aggregate angularity shall be tested in accordance with ASTM C 1252 / AASHTO T 304, *Standard Test Methods for Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading). Method A.* Method A uncompacted void content shall be greater than or equal to 40%.

B. Sand infill specific gravity shall be tested in accordance with ASTM C 128 / AASHTO T 84, *Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate.* Bulk oven-dry specific gravity shall be greater than or equal to 2.40.

C. Sand infill grain size distribution shall be tested in accordance with ASTM C 136 / AASHTO T 27, *Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.* The grain size distribution shall be as prescribed in Table 1 and presented in Figure 1.

Table 1. Sand Infill Grain Size Distribution

		3/8" (9.5 mm)	≤	100%
90%	≤	#4 (4.75 mm)	≤	100%
50%	≤	#8 (2.36 mm)	≤	85%
25%	≤	#16 (1.18 mm)	≤	65%
10%	≤	#30 (0.60 mm)	≤	45%
0	≤	#50 (0.30 mm)	≤	30%
0	≤	#100 (0.15 mm)	≤	10%
0	≤	#200 (0.075 mm)	≤	5%

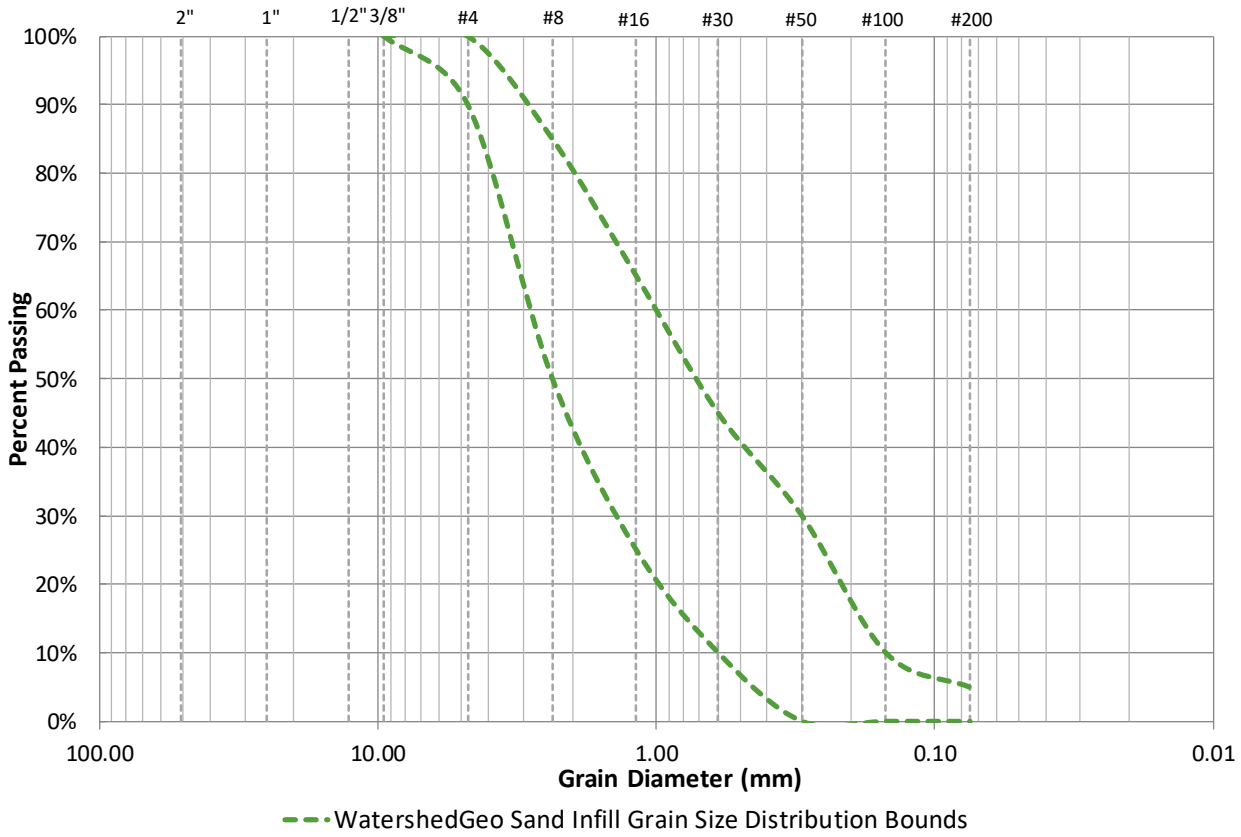

Figure 1: ClosureTurf® Specified Infill Grain Size Distribution

D. Documentation of sand infill conformance with ASTM C 136 / AASHTO T 27, ASTM C 128 / AASHTO T 84 and ASTM C 1252 / AASHTO T 304 shall be submitted to the specified CQA personnel.

E. Subsequent to initial verification of specification conformance, sand infill shall have grain size distribution conformance verified and documented for each 175 cubic yards to be installed.

PART 3: EXECUTION:

Not Used. See Section 01 73 19 ClosureTurf® Installation Specifications.

END OF SECTION

Attachment H

ClosureTurf Case Study

DESIGN AND INSTALLATION OF A GEOSYNTHETIC FINAL COVER UTILIZING ARTIFICIAL TURF IN LOUISIANA

R. C. de Abreu[1], and J. Franklin[2],

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ABSTRACT

The Tangipahoa Regional Solid Waste Facility (Tangipahoa RSWF), located in Independence, Louisiana, U.S.A., has recently installed a relatively new type of geosynthetic final cover consisting of a linear low-density polyethylene (LLDPE) structured geomembrane and an artificial turf tufted into geotextiles. This system, branded as ClosureTurf™, was utilized to close two disposal cells of the Municipal Solid Waste (MSW) landfill. The two closed cells occupy an area of approximately 8 hectares. A geosynthetic final cover was selected for closing the cells instead of the more traditional earthen cover due to the poor quality of the available local soils: highly erodible silty clays and low pH topsoils. The synthetic cover system consisted of two layers of woven geotextiles with tufted UV-resistant polyethylene grass that was laid over a 50-mil LLDPE structured drainage geomembrane and in-filled with sand. The role of the sand was to act as ballast to the system. The design of the final cover system considered the acting forces on the geosynthetic materials such as self-weight, ballast pressure, wind suction, and landfill gas pressure. The system has some advantages over other types of synthetic covers such as the minimization of the necessity for anchoring and a more natural and pleasant look. The authors of this paper, who evaluated, designed, and provided quality control services during installation the final cover for the facility, are currently evaluating the performance of both, the synthetic final cover and the surficial gas system (SGS) installed in 2013..

Keywords: landfill, geosynthetics, landfill cover, final cover, synthetic cover, gas system

1 INTRODUCTION

Conventional landfills are designed throughout the world under the premise of encapsulating solid wastes within a contained and controlled space in order to avoid the migration of potential contaminants from the waste to the environment (de Abreu 2003). Under this concept, low-permeability barriers are constructed on the bottom and on the top of the landfill to minimize the release of contaminants to the water, air, and natural soils. The top barrier, known as the final cover, is designed to minimize the infiltration of rain and snow as well as to avoid the uncontrolled escape of gases generated by the biological and chemical decomposition of the refuse, while being resistant to weathering and other internal and external elements.

Final cover systems for municipal solid waste landfills in the United States are regulated under Subtitle D of the Resource Conservation and Recovery Act (RCRA) and specific regulations from each state. The State of Louisiana regulations (ERC 2014) require that final cover systems for municipal solid waste landfills be composed of a recompacted clay layer with thickness of at least 60 cm and hydraulic conductivity lower than $1x10^{-7}$ cm/s, overlain with a geomembrane approved by the environmental state agency (the Louisiana Department of Environmental Quality - LDEQ). In areas where slopes are steeper than 1(V):4(H), the geomembrane is not required. A minimum of 15 cm of topsoil capable of support vegetative grow is required to be placed as the top part of the cover. Alternative design for landfill final covers, including the utilization of exposed geomembranes, is also considered by the LDEQ as long as the alternative cover is capable of providing equivalent or superior performance when compared to the traditional cover. It is important to note that, although regulations often prescribe the minimum component layers that the final cover must have, it is usually necessary to design additional layers for the successful installation and performance of the cover. According to Koerner (1998) and Qian et al. (2002), additional components of a final cover may include a gas collection layer, a surface water drainage layer, and a protection layer.

Exposed geomembranes have been used as landfill cover in the United States for more than 15 years. The use of exposed geomembranes as final cover offers several advantages when compared to traditional covers, including easier installation, less maintenance, airspace savings, and overall cost savings (de Abreu and Franklin 2014). Main concerns regarding the use of exposed geomembranes by environmental regulatory agencies are weathering and wind uplift. Others concerns may include aesthetics, increase in surface water run-off, potential for physical damage, and eventual seepages more difficult to be detected. On the other hand, traditional covers may suffer from stability issues, such as differential settlement causing cracks and increasing the hydraulic conductivity of the low-permeability clay layer, soil erosion, and veneer sliding of layers. Figure 1 presents a visual comparison between the components of a traditional and an exposed geomembrane final cover. The figure depicts the minimum layers thicknesses as required by the State of Louisiana.

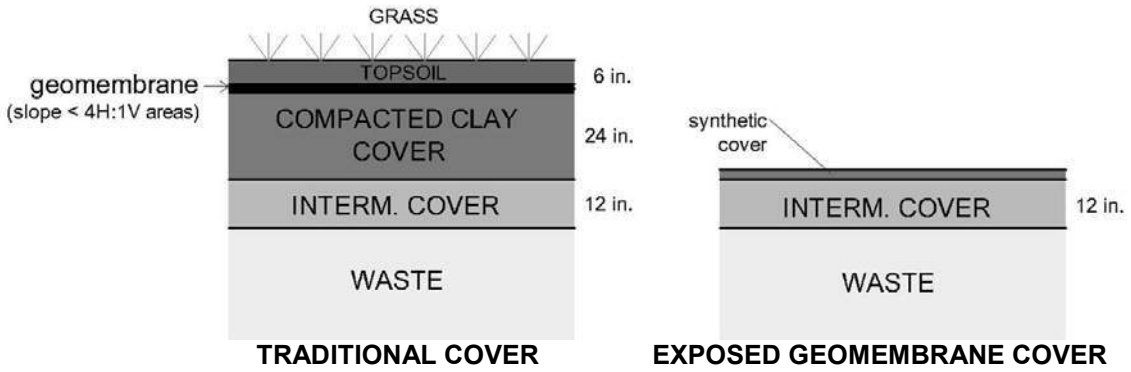

Figure 1. Comparison between components of traditional and exposed geomembrane final covers as regulated by the State of Louisiana

2 FINAL COVER FOR THE TANGIPAHOA REGIONAL SOLID WASTE FACILITY

2.1 Description of the Artificial Turf Final Cover System (Richgels et al. 2012)

The final design of the final cover system for the Tangipahoa RSWF utilized a "hybrid" final cover system, branded as "ClosureTurf™". This system consists of a structured geomembrane protected from the effects of weathering by an artificial grass component. The artificial grass "mechanically erosion-resistant" layer is manufactured with high density polyethylene (HDPE) artificial grass tufts sewn into a double layer 203 g/m^2 polypropylene (PP) woven geotextile. This artificial turf layer is placed over a 1.27 mm linear low density polyethylene (LLDPE) structured geomembrane (SGM) with raised 3.3 mm studs on the top surface and 4.4 mm spikes on the bottom surface. Both the stud and spike components are built into the structured geomembrane sheet using a calendared flat die extrusion process versus a blown film process for textured geomembrane.

The artificial turf component is anchored in place over the structured geomembrane with ballasting sand. Use of anchoring trenches is limited to final cover terminations and those required for the convenience of the installation in contrast to the extensive anchoring required for regular exposed geomembranse.

Figure 2 presents a schematic of the artificial turf system used at the Tangipahoa RSWF.

2.2 The Facility

The Tangipahoa RSWF is a permitted municipal solid waste landfill located in south Louisiana, approximately 90 km northwest of the city of New Orleans. The landfill is owned by the Tangipahoa Parish Government and has been in operation by the municipality since 1987. It currently disposes of approximately 550 t of waste daily. Twelve disposal cells were constructed for waste disposal along the years. Cells 1 through 9 were closed according the regulations of the time. Cells 10 and 11 were closed in November 2013 using the artificial turf final cover system described in the previous section. The total area of Cells 10 and 11 is approximately 9 hectares.

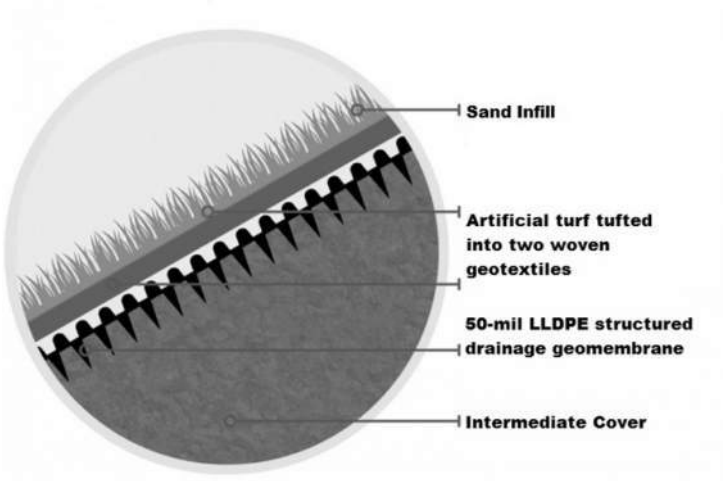

Figure 2. Schematic of the artificial turf final cover system utilized at the Tangipahoa RSWF

Several considerations were made to utilize an alternative final cover system for Cells 10 and 11 of the facility, including the limited availability of in-situ soils required for a low-permeability traditional cover, poor in-situ topsoils with low pH, steep slopes (1V:3H), and the high costs and difficulty maintaining the existing cover. The engineering consultants and local government officials performed a cost-benefit analysis, while considering different types of alternative final covers. The artificial turf system was selected as the best alternative for closing the two cells. Approval for the facility to install the artificial turf final cover system was granted by the Louisiana Department of Environmental Quality in August 2011. The main construction and installation activities occurred between August and November 2013.

3 DESIGN CONSIDERATIONS

3.1 Weathering

Weathering is one of the main concerns when utilizing an exposed geomembrane as the final cover. Exposure to ultraviolet light can reduce the service life of the geoemembrane by reducing the strength resistance and other mechanical properties. It is important to note that in the final cover system utilized for the Tangipahoa RSWF, the geomembrane is protected from weathering since it is overlaid with the artificial grass component and the sand. Nevertheless, the artificial grass component, which is made of HDPE, would be exposed to precipitation, erosional forces, and ultraviolet light.

According to Koerner (2012), all geosynthetics have made great progress in their formulations and manufacturing in the last 25 years and exposed lifetime of 30 years or greater is currently achievable, even in hot climates, in accordance with laboratory studies conducted by the Geosynthetic Institute (GSI). It is interesting to note that artificial turf has been used in soccer and football fields exposed to elements throughout the world for decades with success.

Tensile strength testing was performed on the artificial grass yarns by SGI Testing Services of Georgia (SGI 2009). Samples were weathered under field conditions in the Arizona Desert for 5 and 7 years in accordance with ASTM G147/2002 and ASTM G7/2005. According to the tensile strength results of the SGI report, the average retained strength for the 5-year and 7-year samples were equal to 89.7% and 83.8%, respectively. Preliminary extrapolated data for 30 year-exposure would result in a retained tensile strength equal to 58.7%, according to SGI. This would correspond to a tensile strength of 53 N per yarn, which is 3 to 4 times greater than the tensile strength indicated by the manufacturer to resist run-off and equipment forces.

3.2 Wind Uplift

Another valid concern regarding the use of exposed geomembranes is wind uplift due to development of suction forces at the geomembrane surface, as explained by Giroud (1995). These suction forces

are directly proportional to the wind speed and must be counterbalanced to prevent the failure of the geomembrane. This consideration was extremely important since the facility is located in an area prone to hurricanes, known as the Atlantic Hurricane Belt. However, as discussed by Jones Edmunds (2010), the artificial turf final cover system is "a three-dimensional structure that alters the boundary layer forces at the surface". This alteration of forces occurs due to the porous nature of the material and the increase in the aerodynamic conditions due to the turf blades, which bend and react against the wind. Therefore, the standard uplift conditions and calculations for exposed geomembranes clearly do not apply.

The forces generated at the surface of the artificial turf system were evaluated by the Georgia Tech Research Institute through aerodynamic testing (GTRI 2010). The artificial turf cover system was full-scaled tested in a subsonic wind tunnel wherein the normal force loading and the shear stress for different wind speeds were determined under two different conditions: one representing the perimeter of turf installation (without anchoring) and the other representing an interior section. Both configurations were tested under a flat horizontal surface. The results have shown that 1.0 cm of sand with unit weight equal to 17 kN/m^3 would be enough to counteract the uplift forces of wind speeds of approximately 190 km/h (no safety factor included). The perimeter installation configuration represented the worst condition.

In accordance with ASCE Standard 7-10 (2010), "Minimum Design Loads for Buildings and Other Structures", the wind speed correspondent to a recurrence interval of 50 years is approximately 150 km/h at the site location. For a recurrence interval of 100 years, the wind speed is approximately 170 km/h. A wind speed of 185 km/h was utilized for the wind uplift verification of the artificial turf cover system during the design phase. The safety factor for wind uplift was calculated by using the data generated from the wind tunnel testing and for the site conditions and cell configurations of the facility. The calculated safety factor against wind uplift was equal to approximately 1.6, when a sand thickness of 1.3 cm was considered.

3.3 Cover Veneer Slope Stability

The analysis of cover veneer stability for the artificial turf final cover system basically follows the equations of limit equilibrium forces involved in a finite length slope of uniform cover soil with horizontal seepage buildup as presented by Koerner (1998) and Qian et al. (2002). Three interfaces were analysed against imminent failure: the interface between sand and the artificial turf, the interface between the geotextile of the artificial turf and the LLDPE geomembrane, and the interface between the LLDPE geomembrane and underneath intermediate cover. The friction angles between interfaces assumed for design were obtained based on product-specific interface friction laboratory testing performed by SGI Testing Services, LLC.

Interface friction angles obtained through testing were approximately 35° (peak) /33° (residual) for the interface between the sand and the artificial turf component, 43° (peak)/38° (residual) for the interface between the geotextile of the artificial turf component and the LLDPE geomembrane, and 38° (peak)/34° (residual) for the interface between the spiked side of the LLDPE geomembrane and the soil.

All three analysed cases resulted in safety factors greater than 2.0, with the interface between the geomembrane and soil representing the weakest interface for the project.

3.4 Erosion

One of the main goals of utilizing a synthetic final cover in the project was to reduce the erosion, since the in-situ clayey soils available at the facility were very silty and sandy in nature. However, despite the fact that the artificial turf system used in the project was primarily composed of synthetic components, it requires a sand layer to act as ballast against uplift. This sand layer would be subject to weather conditions, including severe precipitation events, which are not uncommon in Louisiana. Therefore, the capability of this sand layer to resist erosion forces also required verification for the project.

An analysis using the Universal Soil Loss Equation – USLE (Qing et al. 2002) was performed for a critical section of the project, showing that the average annual soil loss would be 2.7 t/ha, which is

approximately 4 times lower than the maximum acceptable annual soil loss rate of 11 t/ha. The results indicate that minor erosion may occur along time and post-closure care may likely be needed regarding replacing the lost sand, since its function as ballast is vital part of the stability of the cover as presented on Section 3.3 of this article.

3.5 Surface Water Drainage Design

Another concern regarding the use of a synthetic final cover was that the volume and flow of surface water run-off were expected to increase significantly since storm water infiltration would be practically negligible. In addition, the designers aimed to significantly decrease the surface water run-off velocities in order to minimize the loss of sand.

The surface water drainage design limited sheet flow run-off to lengths equal or lower than 60 m. Diversion and perimeter berms were constructed on the existing slopes in order to limit the sheet flow run-off to that distance. Diversion and perimeter berms were typically 1 m tall and routed the surface water to let-down channels typically 3 to 5 m wide.

A hydraulic shear analysis was conducted to verify if the sand component would be removed at places where concentrated flow would occur (typically at the diversion/perimeter berms and let-down channels). The results showed that sand would be removed at relatively low shear stress values (as low as 29 Pa), which would be acceptable for the locations under sheet flow and diversion berms, but not at the perimeter berms and let-down channels. A cemented sand mix (3 sand:1 cement) was then utilized instead of sand at the perimeter berms and let-down channels in order to improve the shear strength of those drainage components. It was proven that the cemented sand mix utilized would be capable of resisting shear stresses as high as 700 Pa, which is much greater than the shear stresses at perimeter berms and let-downs.

3.6 Gas System Design

The gas system design concept utilized at the Tangipahoa RSWF has been coined as “Surficial Gas System” (SGS) design. This concept was specially developed for use with the artificial turf system. In a traditional gas system design, vertical extraction wells (VEWs) are drilled or horizontal gas collectors (HGCs) are installed into the waste mass to extract gas. VEW depths can vary greatly. They can be as shallow as 6 m and as deep as 60 m. HGCs are typically installed to depths that can vary anywhere from 2 to 6 m deep. In a traditional gas system, the purpose of the extraction devices is to capture the landfill gas within the waste mass.

The SGS design employs a slightly different approach to gas extraction. For the SGS design, perforated pipes are installed underneath the surface of the artificial turf system and near the surface of the intermediate cover to induce a vacuum. These gas extraction devices are referred to as surficial gas collectors (SGCs). In this approach, vacuum is induced underneath the geomembrane for the purpose of collecting the LFG using preferential pathways. Since the SGS is near the surface of the landfill, the vacuum induced within the waste mass is minimal; therefore, landfill gas will travel preferential pathways to the surface and eventually encounter the vacuum produced by the SGCs. At the Tangipahoa RSWF, perforated HDPE pipes were installed underneath the surface of the artificial turf system and on top of the intermediate cover. Since the facility already had a traditional gas system in place at certain areas, the gas system design was slightly modified for those areas. Perforated HDPE pipes with 10-cm diameter were utilized as collectors in the areas where a gas system was not in place, but 5-cm diameter pipes were used in areas where typical gas system components were already installed. The SGS is a very new gas system design concept, so the designers conservatively opted for larger pipes in areas without an existing gas system in place. The spacing of the SGCs was approximately 30 to 60 m apart, which is very similar to the spacing of extraction devices installed as part of a traditional gas system.

In order to monitor the vacuum distribution underneath the artificial turf system, sample ports were installed in key locations. These sample ports do not necessarily need to be included in the artificial turf system design; however, the designers felt that the vacuum distribution information obtained through the installation and monitoring of those sample ports would be beneficial to future design considerations.

The final component of the SGS design is the installation of pressure relief valves (PRVs). The purpose of the PRVs is to relieve gas pressure build-up beneath the artificial turf system that may occur during an unexpected outage of the blower/flare skid. This is a very important component of the gas system design because unanticipated high gas pressures can cause stability failure of the artificial turf system.

4 PERFORMANCE EVALUATION

The facility and the designers are currently evaluating the performance of the installed artificial turf final cover system. At the time this article was written, five months passed since installation of the system at the Tangipahoa RSWF.

4.1 Visual Performance

The facility is currently performing visual inspections to evaluate if any additional measures regarding extra maintenance or minor repairs are needed in the first months immediately following installation of the system. So far, no major problems have been observed.

The sand infill has been resisting erosion throughout the area even after intense precipitation events. The exception is the locations where the sand infill layer was deliberated installed with more than 2 cm in thickness. However, in those areas, the remaining sand thickness was at least greater than 1 cm, which is required by the design.

It has been also observed that there is a propensity for birds to peck the yarns of the artificial turf. Although the artificial turf does not naturally attract birds, the existence of birds at the facility or at the facility's adjacencies can pose a risk to the integrity of the turf component and shall be managed under the permitted bird control practices. In the specific case of the Tangipahoa RSWF, sound guns have been effectively used as bird control measure.

The only minor issue observed so far at the recently completed project, was that in a small area at the top of the landfill (approximately 20 m^2 in size), some water was found to be trapped inside an overlap seam of the geomembrane component. The facility, designers, and product representatives have been closely monitoring that area. It appears that the area with water has not increased in size along time even after intense rainfall events, which suggests that the water is not due to a leakage in the geomembrane. Other possible explanations for the presence of water at that location are the evapotranspitration of the clay and storm water trapped during construction migrating to that area.

4.2 Surface Water Run-Off Quality Performance

The designed surface water drainage system appears to be effectively handling rainfall flows by adequately routing precipitation run-off to its final destination. In addition, the designers intend to monitor the quality of the water run-off to verify if any modifications can be made to the storm water treatment system of the facility. The facility, which is located near a tributary of Lake Pontchartrain, have been for several years required to treat run-off storm water in order to reduce its turbidity before discharging off-site.

It seems intuitive that the water quality of an area with a synthetic cover would be superior that an area with clay cover, especially regarding turbidity. In order to quantify the beneficial effect of the installation of the artificial turf cover system installed at Tangipahoa RSWF, the writers developed a water monitoring program in which storm water run-off samples would be collected and analyzed from two distinct areas: one with only artificial turf cover system installed and, the other, with only intermediate cover. Other than the type of cover installed, both areas are approximately 2 hectares in size, have similar characteristics, and are located at the Tangipahoa RSWF. The analysed parameters include Turbidity, Total Suspended Solids (TSS), pH, Total Organic Carbon (TOC), and Total Recorable Iron (TRI).

Only one sampling event has been performed so far, so a final conclusion cannot be drawn at the present time. Table 1 presents the result of the first sampling event. As it can be seen, a preliminary

comparison of the results shows that the artificial turf system cover lead to better water quality than a clayey intermediate cover for the parameters analysed.

Table 1: Water Quality Results for First Sampling Event

Parameter	Area with Intermediate Cover	Area with Artificial Turf System
Turbidity (NTU)	371	11
TSS (mg/L)	349	< 4
pH	6.5	7.3
TOC (mg/L)	174	1
TRI (mg/L)	16	0.5

4.3 Gas System Monitoring Performance

The Tangipahoa RSWF is the only landfill in the country with a surficial gas system (SGS) and a typical gas system in place in a same area. For this reason, the writers performed a 3-month evaluation of the gas system under three different operational scenarios. For the first month the system was evaluated with both the typical gas system and the SGS operating at the same time (Full Gas Collection and Control System - GCCS). In the second month, only the extraction capability of the SGS was evaluated by turning off the typical GCCS (SGS Only). In the third month the extraction capability of the typical gas system was evaluated operating by itself (Typical GCCS Only). The criteria that we used to evaluate the performance of the gas system in each operating scenario were the landfill gas extraction rate and the pressure distribution observed at the sample ports.

Figure 3 displays the Landfill Gas Extraction Rate Comparison Chart with each operating scenario. It should be noted that the first reading obtained in the Full-GCCS Scenario appears to be low because field personnel were able to increase the gas extraction rates due to the presence of the geomembrane that limits air intrusion. It can also be inferred that the first reading from the Typical-GCCS Only Scenario appeared to be higher than normal because this scenario followed the SGS-Only Scenario. It is expected that the SGS-Only operational scenario will typically lead to lower vacuum distribution throughout the pipe network in accordance with the standard operating parameters that would be used in a typical gas collection and control system.

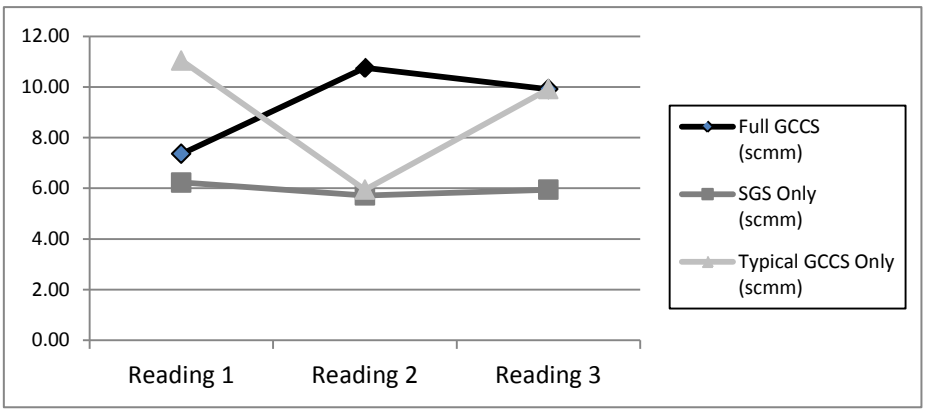

Figure 3. Landfill Gas Extraction Comparison Chart

As can be seen from Figure 3, the Typical-GCCS Only and Full-GCCS operating scenarios have similar flow rates at the end of the evaluation period; while, in the SGS-Only scenarios, LFG extraction rates were lower than both. We believe that there is the possibility that the gas extraction rate could more closely reflect the extraction rates of the other operational scenarios if more time was allowed. We believe that it could possibly take more time for the gas to establish preferential pathways to the SGS for extraction.

Figure 4 includes information on the second criterion, pressure distribution that was assessed as part of this evaluation. As expected, the vacuum distribution underneath the artificial turf system was lower

than the other operating scenarios. As previously mentioned, this design premise includes preferential pathways; therefore, the amount of positive pressure throughout the network will be greater. It should be noted that the positive pressures were relatively small (0.4 cm·H_2O or less). For this reason, it may be inferred that these pressures might not to be a major concern.

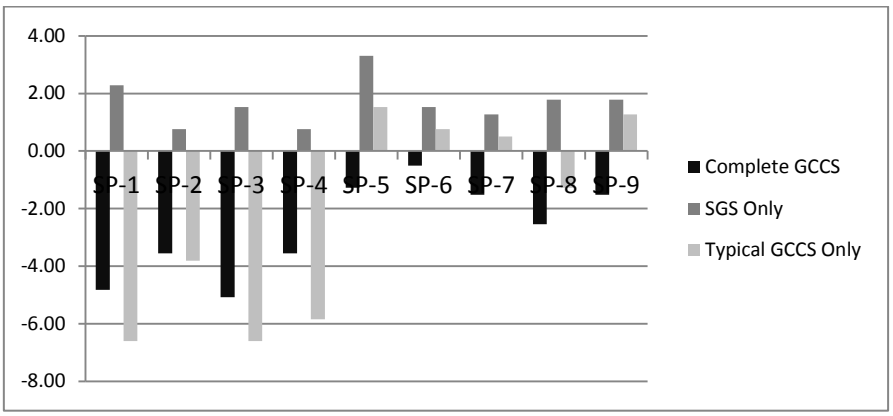

Figure 4. Landfill Gas Pressure Comparison Chart (in cm·H_2O units)

5 CONCLUSION

Based on the investigation performed during the design phase, visual observations conducted during installation, and performance evaluation of the final cover installed at the Tangipahoa Regional Solid Waste Facility, the writers believe that the artificial turf cover system is a viable technology for utilization as final cover system for solid waste landfills. Specifically, it is a strong option for landfills that only have available highly erodible soils or poor topsoils.

Regarding the gas system installed at the facility, based on the data shown, the writers believe that the Surficial Gas System (SGS) is also a viable design concept to employ when high demand or mitigation of landfill gas migration is not a requirement. However, the need for additional data is warranted. The writers plan to perform a more long-term evaluation of all of the operational scenarios to obtain more definitive results on the performance of the SGS design concept.

6 ACKNOWLEDGEMENTS

The writers would like to thank the Tangipahoa Parish Government for allowing the publication of the information contained in this article and to Watershed Geosynthetics for their support in the design, installation, and post-construction phases of the project.

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Attachment I

Hydrologic Evaluation of Landfill

Performance (HELP) Model Analysis

HELP Model Comparison
Engineered Turf / Traditional Cover
November 2021

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CALCULATION SHEET

Project No.:					
Client:	US Ecology – Wayne Disposal	Calculated By:	JLM	Date:	10/01/21
Project:	Engineered Turf Equivalency Demonstration Report	Checked By:	XZ	Date:	10/06/21
Calculation	HELP Model – Cover Comparison	Approved By:		Date:	

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2.0 Final Cover Comparison Methodology 1
2.1. HELP Model Parameters 1
2.2. Model Assumptions 2
2.3. Standard Soil Cover System Material Textures 3
2.4. Engineered Turf Cover System Material Textures 3
3.0 Results 3
4.0 Conclusions 4

Attachments

Attachment A: Final Cover Comparison Calculations
Attachment B1: Standard Permitted Cover System HELP Model Output
Attachment B2: Engineered Turf Cover System HELP Model Output
Attachment C: Climate Data Information

CALCULATION SHEET

Project No.:					
Client:	US Ecology – Wayne Disposal	Calculated By:	JLM	Date:	10/01/21
Project:	Engineered Turf Equivalency Demonstration Report	Checked By:	XZ	Date:	10/06/21
Calculation	HELP Model – Cover Comparison	Approved By:		Date:	

1.0 OBJECTIVE

CTI & Associates has prepared this report to demonstrate the hydrologic equivalency of engineered turf to the traditional cover system requirements specified by Code of Federal Regulations (CFR) §264.310 which in part requires the final cover to in part

- Provide long-term minimization of migration of liquids through the closed landfill
- Promote drainage of the cover
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

In addition to prescriptive requirements for the final cover over a hazardous waste landfill, Michigan Administrative Code R 299.9619(6)(a) also states the owner or operator can: Substitute an equivalent design which shall include a flexible membrane liner component with a minimum thickness of 1 mm (40 mil), depending on the type of material selected, and demonstrates to the director that it provides equivalent environmental protection.

ClosureTurf, which is an engineered turf designed to be used for landfill cover systems, already includes the 40 mil minimum geomembrane. It is the most developed and tested of the commercially available engineered turf products and is the subject of this comparison. Other aspects of environmental protection can be demonstrated through various performance demonstrations. To demonstrate the hydrologic performance of ClosureTurf, the Hydrologic Evaluation of Landfill Performance (HELP) Model, was used to compare the amount of percolation through the cover system expected for each system.

2.0 FINAL COVER COMPARISON METHODOLOGY

The HELP Model was developed by USEPA specifically to compare the hydrologic performance of different cover designs while considering a variety of environmental, soil, and design variables (Schroeder et al., 1994). Version 4.0.1 was used for this evaluation. The results of the HELP Model provide a detailed look at daily, monthly, and annual contact water amounts expected to be generated for a given cover design. Therefore, the efficacy of each cover evaluated can be directly compared by the amount of contact water generated. A detailed engineering manual discussing the basis for the model is available online at the following location: https://www.epa.gov/land-research/hydrologic-evaluation-landfill-performance-help-model. Updated information on version 4.0 from USEPA used in this analysis can be found here: https://www.epa.gov/land-research/hydrologic-evaluation-landfill-performance-help-model.

2.1. HELP MODEL PARAMETERS

The HELP Model requires four different types of climate data to execute including: evapotranspiration, precipitation, temperature, and solar radiation. Each data group is based on a specific location and can

either be synthetically generated using the HELP Model or manually entered. For this analysis, the most important parameter is precipitation because it directly correlates to the amount of contact water generated. For all four groups, the program was used to generate 100 years of synthetic data based on the default database associated with the closest weather station to the site, Detroit Metro Airport, which is approximately 12 miles east of the site. The synthetic precipitation data was back checked with the National Oceanic and Atmospheric Administration's (NOAA) Summary of Monthly Normals for precipitation to determine if the actual climate values were consistent with the model data. It was determined that they were in good agreement for purposes of this analysis. This comparison is included in the calculations in **Attachment A**.

The remaining model parameters included site geometry and material characteristics. A standard of one acre was used for each analysis. Representavie slope lengths and grades were also used as depicted in the summary Tables 1 and 2. With the exception of the cover system materials modeled, all other inputs into the model were held constant to facilitate a fair comparison. For purposes of the comparison, each final cover system was input into the model and the amount of contact water measured after 100 years was compared. The model presents peak daily results and average annual results over the 100-year simulation period. Input parameters are included in the output files contained in **Attachments B1** and **B2**. Climate data are included in **Attachment C**.

2.2. MODEL ASSUMPTIONS

The following assumptions were made in performing the HELP Model Analysis. For reference, the HELP Model User's Guide For Version 4 can be found online at: https://www.epa.gov/land-research/help-40-user-manual.

- The geosynthetics materials are assumed to be constructed with good quality workmanship and in accordance with the project CQA Plan. An industry standard defect area of 0.0001 m^2 was assumed in the analysis with a placement quality of "good". This represents one pinhole-type defect and four pinhole installation defects per acre. Both designs include a 40 mil geomembrane underlain by a GCL. Geomembrane hydraulic conductivity was modeled as 4.0×10^{-13} cm/sec while GCL hydraulic conductivity was modeled as 3.0×10^{-9} cm/sec

- The initial water contents of all layers were manually set equal to the default HELP specified field capacity of the material, which represents the water content of the material after a prolonged period of gravity drainage. However, it should be noted that for the purpose of calculating hydraulic flow through the landfill system, the HELP Model conservatively assumes that all barrier layers (final cover barrier layer) are saturated.

- The HELP Model was utilized to synthetically generate temperature, precipitation, evapotranspiration, and solar radiation data based on Detroit Metro, Michigan. The evaporative zone depth was conservatively reduced from the default value based on the given cover system.

- The HELP Model results are independent of the landfill area. A one acre area was considered for the analysis. Therefore, cover system leakage results are presented as cubic feet per acre per time period (annual or daily). Results were converted to gallons per acre per time period using the conversion factor listed below:

$$\frac{ft^3}{time\ period} \times \frac{7.48\ gallons}{ft^3} \times \frac{time\ period}{\#\ of\ days}$$

2.3. STANDARD SOIL COVER SYSTEM MATERIAL TEXTURES

Cover materials for the OAC prescribed Standard Soil Cover System used in the HELP Model were modeled as follows:

- The Infiltration Layer was modeled consistent with past analyses as follows:
  - Porosity: 0.471
  - Wilting Point: 0.21
  - Saturated Hydraulic Conductivity: 5.0×10^{-4} cm/sec.
- The geocomposite drainage Layer was modeled as HELP default texture 20 with effective saturated hydraulic conductivity of 10 cm/s.

2.4. ENGINEERED TURF COVER SYSTEM MATERIAL TEXTURES

The engineered turf was modeled as recommended by the manufacturer of ClosureTurf and based on the published characteristics of the materials.

- The sand infill material was modeled as follows:
  - Porosity: 0.437
  - Wilting Point: 0.024
  - Saturated Hydraulic Conductivity: 2.5×10^{-2} cm/sec
- The lateral drainage characteristics were modeled with an effective Saturated Hydraulic Conductivity of 31.6 cm/s.

3.0 RESULTS

The HELP model output files for the required and proposed cover systems are provided in Appendix B. The key results of the HELP Model comparison depicting the hydraulic performance of each cover system are included in Table 1 and Table 2 below. Note that these results are presented for comparative purposes and may not represent accurate estimates of actual leakage through the constructed cover system.

CALCULATION SHEET

Project No.:

Client: US Ecology – Wayne Disposal | Calculated By: JLM | Date: 10/01/21

Project: Engineered Turf Equivalency Demonstration Report | Checked By: XZ | Date: 10/06/21

Calculation: HELP Model – Cover Comparison | Approved By: | Date:

Table 1: Rainfall/Runoff/Infiltration of standard cover system versus Engineered Turf Cover System

Final Cover Systems	Slope	Slope Length (ft)	Average Annual Precipitation (in)	Average Annual Runoff (in)	Average Annual Perc. Through Membrane (in)
Permitted Cover System	4%	625	31.7	2.6	1E-6
Engineered Turf	4%	625	31.7	8.0	1E-6
Permitted Cover System	25%	200	31.7	3.1	5E-7
Engineered Turf	25%	820	31.7	7.9	1E-6

Table 2: Hydraulic Performance of Permitted Cover System versus Engineered Turf Cover System

Final Cover Systems	Slope	Slope Length (ft)	Average Daily Leakage Rate (Gal/Acre/Day)	Peak Daily Leakage Rate (Gal/Acre/Day)	Average Annual Leakage Rate (Gal/Acre/Year)
Permitted Cover System	4%	625	7.2E-5	7.1E-4	0.03
Engineered Turf	4%	625	8.1E-5	4.4E-4	0.03
Permitted Cover System	25%	200	3.8E-5	2.6E-4	0.02
Engineered Turf	25%	820	8.6E-5	2.3E-4	0.03

4.0 CONCLUSIONS

The results in Table 1 and Table 2 provide a side-by-side comparison of the §264.310 traditional permitted design standard versus engineered turf which shows that the proposed alternate cover system will result in similar rates and sheds much more water than a traditional cover system. Although percolation rates are mathematically different, this likely is due to limitations in the model for handling such small values relative to the overall resolution of the model. In any case, it shows that both cover systems allow for negligible flow through the geosynthetic composite cover. From a hydrologic standpoint, the proposed alternate material meets the criteria for being at least as protective to the environment as the permitted cover system.

Attachment A
Final Cover Comparison Calculations

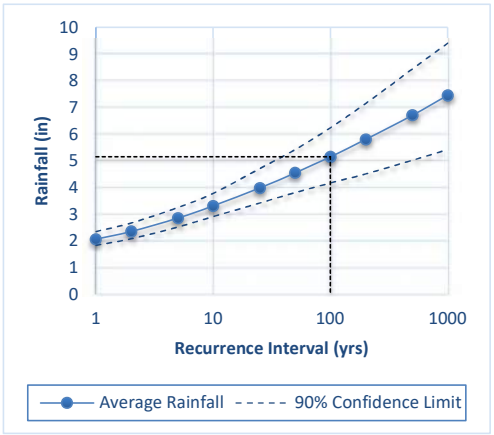
28001 Cabot Dr. Novi, MI 48377 **Tel. (248) 486-5100**	**USE/WDI** Final Cover Comparison 2021 WDI Permit Mod	JOB **1208070066** SHT NO **1** OF **3** CALC BY **JLM** DATE **10/03/21** CHK BY **XZ** DATE

Review climate data for the site and determine total normal precip, monthly extreme values, and 100 yr/24 hr storm based on local NOAA Data

National Environmental Satellite, Data, and Information Service: Climate Normals 1981-2010
Station Data: DETROIT MET. AIRPORT, MI US USW00094847 Lat 42.2313° N Long -83.3308° W

Normal Precipitation

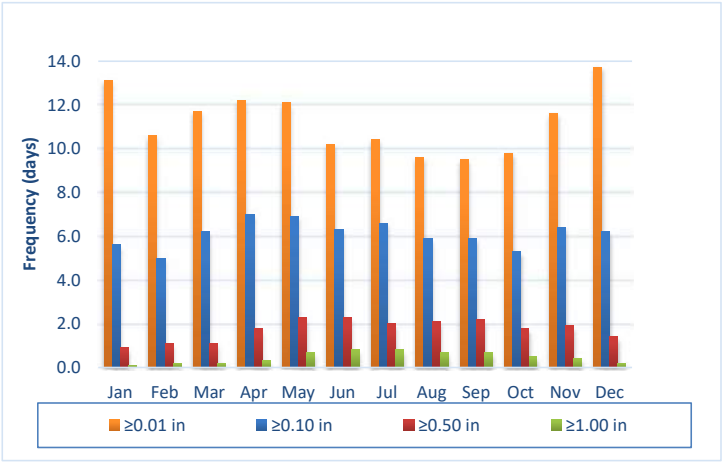
Month	Rainfall (in)	Snowfall (in)	Extreme Daily Rainfall.* (in)	Year	24-hr Storm Duration Rainfall Recurrence Interval (yr)	Precip. (in)
Jan	1.96	12.5	2.06	11/2020		0
Feb	2.02	10.2	2.41	09/1876	1	2.06
Mar	2.28	6.9	1.97	30/2017	2	2.35
Apr	2.90	1.7	3.58	20/2000	5	2.85
May	3.38	0.0	2.56	26/1968	10	3.31
Jun	3.52	0.0	3.07	06/1903	25	3.98
Jul	3.37	0.0	4.74	31/1925	50	4.55
Aug	3.00	0.0	4.57	11/2014	100	5.15
Sep	3.27	0.0	3.71	11/2000	200	5.8
Oct	2.52	0.1	3.29	Mar-54	500	6.71
Nov	2.79	1.5	2.59	22/1909	1000	7.45
Dec	2.46	9.6	2.17	21/1967		
Year	33.47	42.50				



*Extreme data from 1874 through 2021

Frequency Distribution for Daily Precipitation (1981-2010)

Mth/Rain	≥0.01 in	≥0.10 in	≥0.50 in	≥1.00 in
Jan	13.1	5.6	0.9	0.1
Feb	10.6	5.0	1.1	0.2
Mar	11.7	6.2	1.1	0.2
Apr	12.2	7.0	1.8	0.3
May	12.1	6.9	2.3	0.7
Jun	10.2	6.3	2.3	0.8
Jul	10.4	6.6	2.0	0.8
Aug	9.6	5.9	2.1	0.7
Sep	9.5	5.9	2.2	0.7
Oct	9.8	5.3	1.8	0.5
Nov	11.6	6.4	1.9	0.4
Dec	13.7	6.2	1.4	0.2
Year	134.5	73.3	20.9	5.6



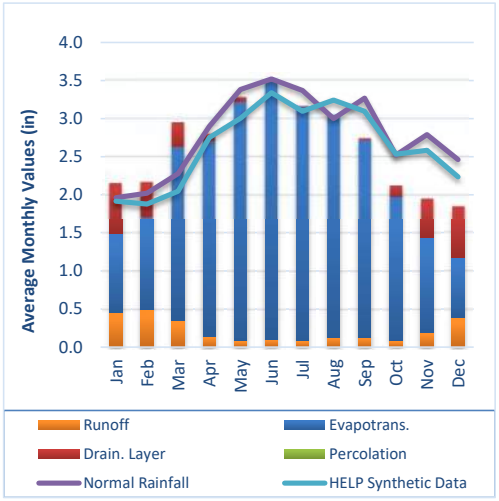
28001 Cabot Dr. Novi, MI 48377 **Tel. (248) 486-5100**	**USE/WDI** Final Cover Comparison 2021 WDI Permit Mod	JOB **1208070066** SHT NO **2** OF **3** CALC BY **JLM** DATE **10/03/21** CHK BY **XZ** DATE

Compare climate data and HELP model results. Determine average daily precipitation, stormwater runoff, and leachate generation due to percolation through the infiltration layer based on HELP model data.

HELP Model Average Monthly Precipitation & Leachate Data

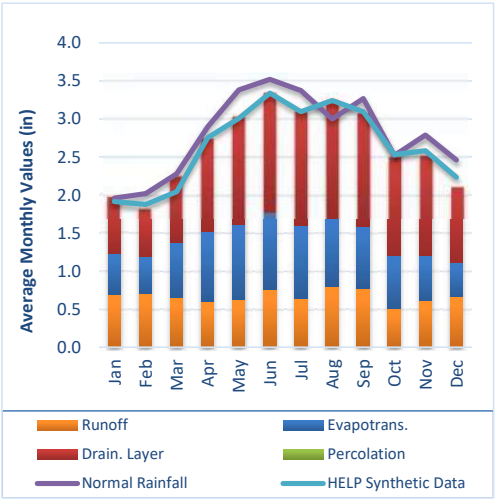
HELP Model - 100 yrs of Synthetic Weather Data - (Permitted Cover System, 1 Acre, 625 ft/4% slope, SCS Curve No. 90.0)

Average Month	Rainfall in	Runoff in	Evapotrans. in	Evap. Zone in	Drain. Layer in	Percolation in
Jan	1.91	0.457	1.038	0.344	0.660	0.000
Feb	1.88	0.488	1.217	0.332	0.464	0.000
Mar	2.05	0.350	2.274	0.305	0.327	0.000
Apr	2.76	0.137	2.564	0.283	0.092	0.000
May	3.01	0.083	3.125	0.275	0.067	0.000
Jun	3.34	0.101	3.386	0.268	0.013	0.000
Jul	3.10	0.084	3.059	0.258	0.016	0.000
Aug	3.24	0.124	2.912	0.267	0.007	0.000
Sep	3.10	0.128	2.582	0.280	0.030	0.000
Oct	2.53	0.084	1.890	0.293	0.149	0.000
Nov	2.58	0.196	1.245	0.322	0.514	0.000
Dec	2.24	0.387	0.790	0.340	0.678	0.000
Year	31.73	2.62	26.08		3.02	0.000
Peak Daily	2.40	2.20			0.342	0.000



HELP Model - 100 yrs of Synthetic Weather Data - (CT Cover System, 1 Acre, 625 ft/4% slope, SCS Curve No. 96.7)

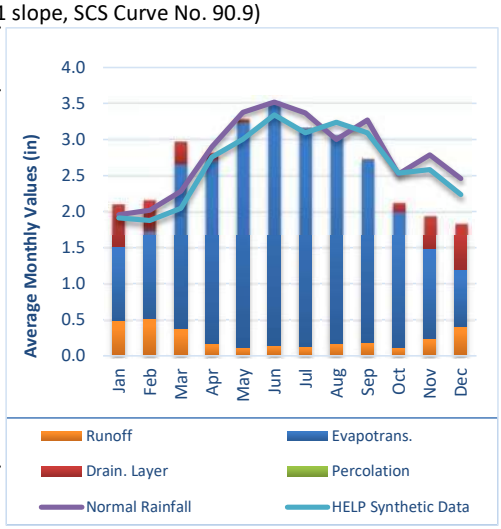
Average Month	Rainfall in	Runoff in	Evapotrans. in	Evap. Zone in	Drain. Layer in	Percolation in
Jan	1.91	0.698	0.536	0.130	0.750	0.000
Feb	1.88	0.707	0.481	0.100	0.637	0.000
Mar	2.05	0.655	0.726	0.088	0.871	0.000
Apr	2.76	0.597	0.923	0.080	1.223	0.000
May	3.01	0.624	0.986	0.076	1.419	0.000
Jun	3.34	0.762	1.008	0.079	1.569	0.000
Jul	3.10	0.640	0.964	0.076	1.496	0.000
Aug	3.24	0.800	0.894	0.075	1.550	0.000
Sep	3.10	0.777	0.811	0.072	1.487	0.000
Oct	2.53	0.505	0.697	0.073	1.299	0.000
Nov	2.58	0.612	0.586	0.081	1.320	0.000
Dec	2.24	0.664	0.449	0.111	0.998	0.000
Year	31.73	8.04	9.06		14.62	0.000
Peak Daily	2.4	2.44			0.591	0.000



28001 Cabot Dr. Novi, MI 48377 **Tel. (248) 486-5100**	**USE/WDI** Final Cover Comparison 2021 WDI Permit Mod	JOB **1208070066** SHT NO **3** OF **3** CALC BY **JLM** DATE **10/03/21** CHK BY **XZ** DATE

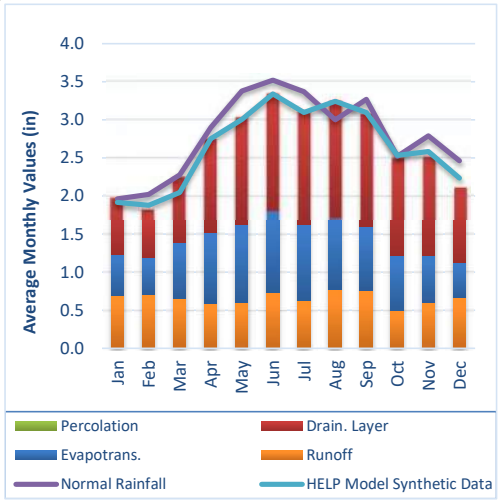
HELP Model - 100 yrs of Synthetic Weather Data - (Permit Cover System, 1 Acre, 200 ft/4:1 slope, SCS Curve No. 90.9)

Average Month	Rainfall in	Runoff in	Evapotrans. in	Evap. Zone in	Drain. Layer in	Percolation in
Jan	1.91	0.486	1.037	0.350	0.585	0.000
Feb	1.88	0.519	1.217	0.339	0.430	0.000
Mar	2.05	0.383	2.272	0.311	0.316	0.000
Apr	2.76	0.169	2.552	0.288	0.090	0.000
May	3.01	0.122	3.105	0.279	0.052	0.000
Jun	3.34	0.149	3.357	0.272	0.009	0.000
Jul	3.10	0.123	3.030	0.262	0.010	0.000
Aug	3.24	0.177	2.881	0.269	0.001	0.000
Sep	3.10	0.186	2.535	0.283	0.013	0.000
Oct	2.53	0.119	1.880	0.296	0.126	0.000
Nov	2.58	0.242	1.241	0.325	0.461	0.000
Dec	2.24	0.415	0.790	0.344	0.635	0.000
Year	31.73	3.09	25.90		2.73	0.000
Peak Daily	2.40	2.21			0.250	0.000



HELP Model - 100 yrs of Synthetic Weather Data - (CT Cover System, 1 Acre, 820 ft/4:1 slope, SCS Curve No. 96.8)

Average Month	Rainfall in	Runoff in	Evapotrans. in	Evap. Zone in	Drain. Layer in	Percolation in
Jan	1.91	0.693	0.542	0.344	0.749	0.000
Feb	1.88	0.705	0.486	0.332	0.632	0.000
Mar	2.05	0.653	0.736	0.305	0.867	0.000
Apr	2.76	0.586	0.939	0.283	1.222	0.000
May	3.01	0.602	1.020	0.275	1.407	0.000
Jun	3.34	0.733	1.068	0.268	1.537	0.000
Jul	3.10	0.622	1.001	0.258	1.477	0.000
Aug	3.24	0.768	0.945	0.267	1.531	0.000
Sep	3.10	0.754	0.848	0.280	1.473	0.000
Oct	2.53	0.496	0.721	0.293	1.283	0.000
Nov	2.58	0.603	0.609	0.322	1.300	0.000
Dec	2.24	0.663	0.461	0.340	0.990	0.000
Year	31.73	7.88	9.38		14.47	0.000
Peak Daily	2.40	2.44			0.642	0.000



Conclusions:

Overall, the HELP synthetic data correlates well with the available monthly climate normals data from NOAA. It underpredicts rainfall by a little over an inch. As the primary objective of the HELP model is to demonstrate the Engineered Turf cover system has an equivalent or better hydrologic performance compared to the permitted soil cover system, this HELP model is sufficient for comparison purposes.

The final cover comparison shows that the Engineered Turf barrier used in the alternate cover system prevents infiltration as effectively as the permitted cover which is to say the both effectively prevent infiltration when installed properly. The biggest difference as illustrated by the results is the soil component of the traditional cover holds a large portion of the surface water while the engineered turf sheds that water.

R 299.9619(6)(a) states the owner or operator can substitute an equivalent design which shall include a flexible membrane liner component with a minimum thickness of 1 mm (40 mil), depending on the type of material selected, and demonstrates to the director that it provides equivalent environmental protection. ClosureTurf includes the geomembrane, it also offers equivalent environmental protection as it relates surface water infiltration and percolation through the cover system.

Attachment B1
Standard Permitted Cover System HELP Model Output

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: MC Cell VI-F&G Permit Cover **Simulated On:** 10/7/2021 9:02

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
WDI Veg/Infiltration Layer
Material Texture Number 43

Thickness	=	36	inches
Porosity	=	0.471	vol/vol
Field Capacity	=	0.342	vol/vol
Wilting Point	=	0.21	vol/vol
Initial Soil Water Content	=	0.3422	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-04	cm/sec

Layer 2

Type 2 - Lateral Drainage Layer
Drainage Net (0.5 cm)
Material Texture Number 20

Thickness	=	0.2	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	25	%
Drainage Length	=	200	ft

Layer 3

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 4

Type 3 - Barrier Soil Liner

Bentonite (High)
Material Texture Number 17

Thickness	=	0.25	inches
Porosity	=	0.75	vol/vol
Field Capacity	=	0.747	vol/vol
Wilting Point	=	0.4	vol/vol
Initial Soil Water Content	=	0.75	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-09	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	90.9	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	5.958	inches
Upper Limit of Evaporative Storage	=	8.478	inches
Lower Limit of Evaporative Storage	=	3.78	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	12.509	inches
Total Initial Water	=	12.509	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	42.18	Degrees
Maximum Leaf Area Index	=	1	
Start of Growing Season (Julian Date)	=	90	days
End of Growing Season (Julian Date)	=	216	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	72	%
Average 3rd Quarter Relative Humidity	=	80	%
Average 4th Quarter Relative Humidity	=	77	%

Note: Evapotranspiration data was obtained for Belleville, Michigan

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.913949	1.878746	2.045516	2.755274	3.005731	3.34107
3.096216	3.243099	3.096181	2.533399	2.583786	2.235743

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.7	30.4	42.7	54.8	68.5	78.1
81.5	79	68.8	56.2	44	31.5

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Average Annual Totals Summary

Title: MC Cell VI-F&G Permit Cover
Simulated on: 10/7/2021 9:08

	Average Annual Totals for Years 1 - 100*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	31.73	[3.35]	115,175.2	100.00
Runoff	3.091	[1.284]	11,219.0	9.74
Evapotranspiration	25.898	[2.765]	94,009.5	81.62
Subprofile1				
Lateral drainage collected from Layer 2	2.7348	[1.3]	9,927.5	8.62
Percolation/leakage through Layer 4	0.000001	[0]	0.0018	0.00
Average Head on Top of Layer 3	0.0001	[0.0001]	---	---
Water storage				
Change in water storage	0.0053	[0.8627]	19.2	0.02

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: MC Cell VI-F&G Permit Cover
Simulated on: 10/7/2021 9:08

	Peak Values for Years 1 - 100*		
	(inches)		(cubic feet)
Precipitation	2.40		8,721.4
Runoff	2.208		8,016.0
Subprofile1			
Drainage collected from Layer 2	0.2504		909.1
Percolation/leakage through Layer 4	0.000000		0.0000
Average head on Layer 3	0.0038		---
Maximum head on Layer 3	0.0075		---
Location of maximum head in Layer 2	0.00	(feet from drain)	
Other Parameters			
Snow water	4.1439		15,042.2
Maximum vegetation soil water	0.4231	(vol/vol)	
Minimum vegetation soil water	0.2100	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: MC Cell VI-F&G Permit Cover
Simulated on: 10/7/2021 9:08
Simulation period: 100 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	12.8479	0.3569
2	0.0024	0.0120
3	0.0000	0.0000
4	0.1875	0.7500
Snow water	0.0000	---

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: MC Cell VI-F&G Permit Cover **Simulated On:** 10/7/2021 13:59

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
WDI Veg/Infiltration Layer
Material Texture Number 43

Thickness	=	36	inches
Porosity	=	0.471	vol/vol
Field Capacity	=	0.342	vol/vol
Wilting Point	=	0.21	vol/vol
Initial Soil Water Content	=	0.3368	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-04	cm/sec

Layer 2

Type 2 - Lateral Drainage Layer
Drainage Net (0.5 cm)
Material Texture Number 20

Thickness	=	0.2	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	4	%
Drainage Length	=	625	ft

Layer 3

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 4

Type 3 - Barrier Soil Liner

Bentonite (High)
Material Texture Number 17

Thickness	=	0.25	inches
Porosity	=	0.75	vol/vol
Field Capacity	=	0.747	vol/vol
Wilting Point	=	0.4	vol/vol
Initial Soil Water Content	=	0.75	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-09	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	90	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	5.842	inches
Upper Limit of Evaporative Storage	=	8.478	inches
Lower Limit of Evaporative Storage	=	3.78	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	12.315	inches
Total Initial Water	=	12.315	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	42.18	Degrees
Maximum Leaf Area Index	=	1	
Start of Growing Season (Julian Date)	=	90	days
End of Growing Season (Julian Date)	=	216	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	72	%
Average 3rd Quarter Relative Humidity	=	80	%
Average 4th Quarter Relative Humidity	=	77	%

Note: Evapotranspiration data was obtained for Belleville, Michigan

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.913949	1.878746	2.045516	2.755274	3.005731	3.34107
3.096216	3.243099	3.096181	2.533399	2.583786	2.235743

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.7	30.4	42.7	54.8	68.5	78.1
81.5	79	68.8	56.2	44	31.5

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Average Annual Totals Summary

Title: MC Cell VI-F&G Permit Cover
Simulated on: 10/7/2021 14:03

	Average Annual Totals for Years 1 - 100*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	31.73	[3.35]	115,175.2	100.00
Runoff	2.619	[1.205]	9,507.1	8.25
Evapotranspiration	26.082	[2.845]	94,677.7	82.20
Subprofile1				
Lateral drainage collected from Layer 2	3.0205	[1.3803]	10,964.5	9.52
Percolation/leakage through Layer 4	0.000001	[0]	0.0035	0.00
Average Head on Top of Layer 3	0.0023	[0.001]	---	---
Water storage				
Change in water storage	0.0071	[0.8521]	25.9	0.02

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: MC Cell VI-F&G Permit Cover
Simulated on: 10/7/2021 14:03

	Peak Values for Years 1 - 100*		
	(inches)		(cubic feet)
Precipitation	2.40		8,721.4
Runoff	2.198		7,978.9
Subprofile1			
Drainage collected from Layer 2	0.3421		1,241.6
Percolation/leakage through Layer 4	0.000000		0.0001
Average head on Layer 3	0.0944		---
Maximum head on Layer 3	0.1881		---
Location of maximum head in Layer 2	1.51	(feet from drain)	
Other Parameters			
Snow water	4.1439		15,042.2
Maximum vegetation soil water	0.4108	(vol/vol)	
Minimum vegetation soil water	0.2100	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: MC Cell VI-F&G Permit Cover
Simulated on: 10/7/2021 14:03
Simulation period: 100 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	12.8297	0.3564
2	0.0106	0.0530
3	0.0000	0.0000
4	0.1875	0.7500
Snow water	0.0000	---

Attachment B2
Engineered Turf Cover System HELP Model Output

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: MC Cell VI-F&G Engineered Turf **Simulated On:** 10/7/2021 16:03

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
Engineered Turf
Material Texture Number 44

Thickness	=	0.5	inches
Porosity	=	0.437	vol/vol
Field Capacity	=	0.062	vol/vol
Wilting Point	=	0.024	vol/vol
Initial Soil Water Content	=	0.024	vol/vol
Effective Sat. Hyd. Conductivity	=	2.50E-02	cm/sec

Layer 2

Type 2 - Lateral Drainage Layer
Studded Drainage Layer
Material Texture Number 123

Thickness	=	0.13	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	3.16E+01	cm/sec
Slope	=	25	%
Drainage Length	=	820	ft

Layer 3

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 4

Type 3 - Barrier Soil Liner

Bentonite (High)
Material Texture Number 17

Thickness	=	0.5	inches
Porosity	=	0.75	vol/vol
Field Capacity	=	0.747	vol/vol
Wilting Point	=	0.4	vol/vol
Initial Soil Water Content	=	0.75	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-09	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	96.8	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	0.5	inches
Initial Water in Evaporative Zone	=	0.012	inches
Upper Limit of Evaporative Storage	=	0.218	inches
Lower Limit of Evaporative Storage	=	0.012	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	0.388	inches
Total Initial Water	=	0.388	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	42.18	Degrees
Maximum Leaf Area Index	=	1	
Start of Growing Season (Julian Date)	=	90	days
End of Growing Season (Julian Date)	=	216	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	72	%
Average 3rd Quarter Relative Humidity	=	80	%
Average 4th Quarter Relative Humidity	=	77	%

Note: Evapotranspiration data was obtained for Belleville, Michigan

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.913949	1.878746	2.045516	2.755274	3.005731	3.34107
3.096216	3.243099	3.096181	2.533399	2.583786	2.235743

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.7	30.4	42.7	54.8	68.5	78.1
81.5	79	68.8	56.2	44	31.5

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Average Annual Totals Summary

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:09

	Average Annual Totals for Years 1 - 100*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	31.73	[3.35]	115,175.2	100.00
Runoff	7.879	[1.761]	28,601.5	24.83
Evapotranspiration	9.378	[1.156]	34,041.5	29.56
Subprofile1				
Lateral drainage collected from Layer 2	14.4711	[1.3463]	52,530.2	45.61
Percolation/leakage through Layer 4	0.000001	[0]	0.0042	0.00
Average Head on Top of Layer 3	0.0008	[0.0001]	---	---
Water storage				
Change in water storage	0.0006	[0.5254]	2.1126	0.00

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:10

	Peak Values for Years 1 - 100*		
	(inches)		(cubic feet)
Precipitation	2.40		8,721.4
Runoff	2.440		8,855.5
Subprofile1			
Drainage collected from Layer 2	0.6423		2,331.7
Percolation/leakage through Layer 4	0.000000		0.0000
Average head on Layer 3	0.0125		---
Maximum head on Layer 3	0.0250		---
Location of maximum head in Layer 2	0.00	(feet from drain)	
Other Parameters			
Snow water	4.1439		15,042.2
Maximum vegetation soil water	0.4370	(vol/vol)	
Minimum vegetation soil water	0.0240	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:10
Simulation period: 100 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	0.0702	0.1404
2	0.0013	0.0100
3	0.0000	0.0000
4	0.3749	0.7499
Snow water	0.0000	---

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: MC Cell VI-F&G Engineered Turf **Simulated On:** 10/7/2021 16:47

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
Engineered Turf
Material Texture Number 44

Thickness	=	0.5	inches
Porosity	=	0.437	vol/vol
Field Capacity	=	0.062	vol/vol
Wilting Point	=	0.024	vol/vol
Initial Soil Water Content	=	0.024	vol/vol
Effective Sat. Hyd. Conductivity	=	2.50E-02	cm/sec

Layer 2

Type 2 - Lateral Drainage Layer
Studded Drainage Layer
Material Texture Number 123

Thickness	=	0.13	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	3.16E+01	cm/sec
Slope	=	4	%
Drainage Length	=	625	ft

Layer 3

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 4

Type 3 - Barrier Soil Liner

Bentonite (High)
Material Texture Number 17

Thickness	=	0.5	inches
Porosity	=	0.75	vol/vol
Field Capacity	=	0.747	vol/vol
Wilting Point	=	0.4	vol/vol
Initial Soil Water Content	=	0.75	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-09	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	96.7	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	0.5	inches
Initial Water in Evaporative Zone	=	0.012	inches
Upper Limit of Evaporative Storage	=	0.218	inches
Lower Limit of Evaporative Storage	=	0.012	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	0.388	inches
Total Initial Water	=	0.388	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	42.18	Degrees
Maximum Leaf Area Index	=	1	
Start of Growing Season (Julian Date)	=	90	days
End of Growing Season (Julian Date)	=	216	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	72	%
Average 3rd Quarter Relative Humidity	=	80	%
Average 4th Quarter Relative Humidity	=	77	%

Note: Evapotranspiration data was obtained for Belleville, Michigan

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.913949	1.878746	2.045516	2.755274	3.005731	3.34107
3.096216	3.243099	3.096181	2.533399	2.583786	2.235743

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.7	30.4	42.7	54.8	68.5	78.1
81.5	79	68.8	56.2	44	31.5

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Average Annual Totals Summary

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:52

	Average Annual Totals for Years 1 - 100*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	31.73	[3.35]	115,175.2	100.00
Runoff	8.042	[1.78]	29,191.4	25.35
Evapotranspiration	9.064	[1.106]	32,901.7	28.57
Subprofile1				
Lateral drainage collected from Layer 2	14.6223	[1.3618]	53,078.9	46.09
Percolation/leakage through Layer 4	0.000001	[0]	0.0040	0.00
Average Head on Top of Layer 3	0.0036	[0.0003]	---	---
Water storage				
Change in water storage	0.0009	[0.5232]	3.2043	0.00

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:53

	Peak Values for Years 1 - 100*		
	(inches)		(cubic feet)
Precipitation	2.40		8,721.4
Runoff	2.440		8,855.5
Subprofile1			
Drainage collected from Layer 2	0.5917		2,147.8
Percolation/leakage through Layer 4	0.000000		0.0001
Average head on Layer 3	0.0517		---
Maximum head on Layer 3	0.1032		---
Location of maximum head in Layer 2	0.50	(feet from drain)	
Other Parameters			
Snow water	4.1439		15,042.2
Maximum vegetation soil water	0.4370	(vol/vol)	
Minimum vegetation soil water	0.0240	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:53
Simulation period: 100 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	0.1003	0.2005
2	0.0013	0.0100
3	0.0000	0.0000
4	0.3750	0.7500
Snow water	0.0000	---

Attachment C
Climate Data Information

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Summary of Monthly Normals
1981-2010

Generated on 10/03/2021

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 631 ft. Lat: 42.2313° N Lon: -83.3308° W
Station: **DETROIT METROPOLITAN AIRPORT, MI US USW00094847**

Temperature (°F)

	Mean						Cooling Degree Days Base (above)						Heating Degree Days Base (above)				Mean Number of Days					
Month	Daily Max	Daily Min	Mean	Long Term Max Std Dev	Long Term Min Std Dev	Long Term Avg Std Dev	55	57	60	65	70	72	55	57	60	65	Max >= 100	Max >= 90	Max >= 50	Max <= 32	Min <= 32	Min <= 0
01	32.0	19.1	25.6	4.7	5.7	5.1	-7777	-7777	0	0	0	0	913	975	1068	1223	0.0	0.0	1.6	15.7	26.7	2.0
02	35.2	21.0	28.1	4.1	4.3	4.1	-7777	-7777	-7777	-7777	0	0	753	809	893	1033	0.0	0.0	2.0	10.6	24.3	0.8
03	45.8	28.6	37.2	3.8	3.0	3.3	6	4	2	-7777	-7777	0	558	618	709	862	0.0	0.0	10.3	3.5	20.3	-7777
04	59.1	39.4	49.2	3.1	2.4	2.6	47	34	20	6	1	-7777	220	266	342	479	0.0	0.0	23.8	0.1	5.6	0.0
05	69.9	49.4	59.7	3.8	3.4	3.5	186	145	97	42	13	7	42	63	108	208	0.0	0.4	30.7	0.0	0.2	0.0
06	79.3	59.5	69.4	2.7	2.4	2.4	434	376	291	167	75	50	2	4	9	35	-7777	2.4	30.0	0.0	0.0	0.0
07	83.4	63.9	73.6	2.7	2.3	2.3	578	516	423	271	137	95	0	-7777	-7777	2	-7777	4.5	31.0	0.0	0.0	0.0
08	81.4	62.6	72.0	2.7	2.6	2.6	527	465	373	225	103	68	-7777	-7777	1	8	0.0	2.5	31.0	0.0	0.0	0.0
09	74.0	54.7	64.4	2.8	1.9	2.2	294	244	175	84	29	16	14	23	44	104	0.0	0.5	30.0	0.0	0.0	0.0
10	61.6	43.3	52.4	3.0	2.8	2.8	69	49	27	8	2	1	148	190	261	397	0.0	0.0	27.3	0.0	1.9	0.0
11	48.8	34.3	41.5	3.7	2.9	3.1	8	4	1	-7777	0	0	412	468	555	704	0.0	0.0	13.2	0.9	12.5	0.0
12	36.1	24.1	30.1	5.1	5.2	5.0	1	-7777	-7777	0	0	0	773	834	927	1082	0.0	0.0	2.6	10.5	23.9	0.7
Summary	58.9	41.7	50.3	3.5	3.2	3.2	2150	1837	1409	803	360	237	3835	4250	4917	6137	0.0	10.3	233.5	41.3	115.4	3.5

-7777: a non-zero value that would round to zero

Empty or blank cells indicate data is missing or insufficient occurrences to compute value

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Summary of Monthly Normals
1981-2010

Generated on 10/03/2021

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 631 ft. Lat: 42.2313° N Lon: -83.3308° W
Station: **DETROIT METROPOLITAN AIRPORT, MI US USW00094847**

Precipitation (in.)								
	Totals	Mean Number of Days				Precipitation Probabilities Probability that precipitation will be equal to or less than the indicated amount		
	Means	Daily Precipitation				Monthly Precipitation vs. Probability Levels		
Month	Mean	>= 0.01	>= 0.10	>= 0.50	>= 1.00	0.25	0.50	0.75
01	1.96	13.1	5.6	0.9	0.1	1.28	1.80	2.80
02	2.02	10.6	5.0	1.1	0.2	0.89	1.83	3.02
03	2.28	11.7	6.2	1.1	0.2	1.46	2.15	3.18
04	2.90	12.2	7.0	1.8	0.3	2.11	2.72	3.85
05	3.38	12.1	6.9	2.3	0.7	2.20	3.00	4.61
06	3.52	10.2	6.3	2.3	0.8	2.35	3.37	4.91
07	3.37	10.4	6.6	2.0	0.8	2.43	3.22	4.38
08	3.00	9.6	5.9	2.1	0.7	1.60	3.07	4.19
09	3.27	9.5	5.9	2.2	0.7	1.74	2.86	4.28
10	2.52	9.8	5.3	1.8	0.5	1.56	2.15	3.54
11	2.79	11.6	6.4	1.9	0.4	1.78	2.68	3.31
12	2.46	13.7	6.2	1.4	0.2	1.61	2.39	2.91
Summary	33.47	134.5	73.3	20.9	5.6	21.01	31.24	44.98

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U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Summary of Monthly Normals
1981-2010

Generated on 10/03/2021

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 631 ft. Lat: 42.2313° N Lon: -83.3308° W
Station: **DETROIT METROPOLITAN AIRPORT, MI US USW00094847**

Snow (in.)													
	Totals	Mean Number of Days									Snow Probabilities Probability that snow will be equal to or less than the indicated amount		
	Means	Snowfall >= Thresholds					Snow Depth >= Thresholds				Monthly Snow vs. Probability Levels Values derived from the incomplete gamma distribution.		
Month	Snowfall Mean	0.01	1.0	3.0	5.00	10.00	1	3	5	10	.25	.50	.75
01	12.5	10.4	3.7	1.1	0.4	0.2	17.4	11.0	5.9	1.3	7.0	9.9	17.9
02	10.2	8.3	3.2	1.2	0.4	0.0	12.7	7.5	3.7	0.9	4.9	9.0	14.6
03	6.9	5.4	2.1	0.7	0.3	0.0	5.6	3.1	1.6	0.0	3.4	5.8	9.7
04	1.7	1.6	0.4	0.2	0.1	0.0	0.5	0.3	0.1	0.0	0.0	0.6	2.0
05	-7777	-7777	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.1	0.2	-7777	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	1.5	2.3	0.5	-7777	0.0	0.0	1.0	0.2	0.0	0.0	0.1	0.9	2.2
12	9.6	8.5	3.2	0.9	0.4	0.0	8.7	5.4	3.4	0.3	4.9	7.8	13.2
Summary	42.5	36.7	13.1	4.1	1.6	0.2	45.9	27.5	14.7	2.5	20.3	34.0	59.6

-7777: a non-zero value that would round to zero

Empty or blank cells indicate data is missing or insufficient occurrences to compute value

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Summary of Monthly Normals
1981-2010

Generated on 10/03/2021

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 631 ft. Lat: 42.2313° N Lon: -83.3308° W
Station: **DETROIT METROPOLITAN AIRPORT, MI US USW00094847**

Growing Degree Units (Monthly)

Base	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
40	10	12	84	298	609	882	1043	992	731	390	132	21
45	3	3	41	185	456	732	888	837	581	254	66	9
50	1	1	17	100	310	582	733	682	433	144	26	3
55	-7777	-7777	6	47	186	434	578	527	294	69	8	1
60	0	-7777	2	20	97	291	423	373	175	27	1	-7777
Growing Degree Units for Corn (Monthly)												
50/86	3	6	48	163	352	576	713	671	449	202	57	8

Growing Degree Units (Accumulated Monthly)

Base	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
40	10	22	106	404	1013	1895	2938	3930	4661	5051	5183	5204
45	3	6	47	232	688	1420	2308	3145	3726	3980	4046	4055
50	1	2	19	119	429	1011	1744	2426	2859	3003	3029	3032
55	0	0	6	53	239	673	1251	1778	2072	2141	2149	2150
60	0	0	2	22	119	410	833	1206	1381	1408	1409	1409
Growing Degree Units for Corn (Monthly Accumulated)												
50/86	3	9	57	220	572	1148	1861	2532	2981	3183	3240	3248

Note: For corn, temperatures below 50 are set to 50, and temperatures above 86 are set to 86.

-7777: a non-zero value that would round to zero.

Empty or blank cells indicate data is missing or insufficient occurrences to compute value.

NOAA Atlas 14, Volume 8, Version 2 DETROIT METRO AP
Station ID: 20-2103
Location name: Detroit, Michigan, USA*
Latitude: 42.2314°, Longitude: -83.3308°
Elevation:
Elevation (station metadata): 631 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.312 (0.271-0.367)	0.369 (0.319-0.434)	0.463 (0.400-0.545)	0.543 (0.466-0.642)	0.656 (0.544-0.794)	0.745 (0.604-0.909)	0.835 (0.654-1.04)	0.929 (0.698-1.18)	1.06 (0.763-1.36)	1.15 (0.812-1.50)
10-min	0.457 (0.396-0.537)	0.540 (0.468-0.635)	0.678 (0.585-0.799)	0.795 (0.682-0.939)	0.960 (0.797-1.16)	1.09 (0.884-1.33)	1.22 (0.958-1.52)	1.36 (1.02-1.72)	1.55 (1.12-1.99)	1.69 (1.19-2.20)
15-min	0.557 (0.483-0.655)	0.658 (0.570-0.774)	0.827 (0.714-0.974)	0.970 (0.832-1.15)	1.17 (0.972-1.42)	1.33 (1.08-1.62)	1.49 (1.17-1.85)	1.66 (1.25-2.10)	1.88 (1.36-2.43)	2.06 (1.45-2.68)
30-min	0.764 (0.662-0.898)	0.902 (0.781-1.06)	1.13 (0.979-1.34)	1.33 (1.14-1.57)	1.61 (1.34-1.95)	1.83 (1.48-2.24)	2.05 (1.61-2.55)	2.29 (1.72-2.90)	2.60 (1.88-3.36)	2.85 (2.01-3.71)
60-min	0.974 (0.844-1.14)	1.15 (0.996-1.35)	1.45 (1.25-1.71)	1.70 (1.46-2.01)	2.07 (1.72-2.51)	2.36 (1.92-2.89)	2.66 (2.09-3.31)	2.97 (2.24-3.77)	3.40 (2.46-4.39)	3.73 (2.63-4.87)
2-hr	1.18 (1.03-1.38)	1.40 (1.22-1.63)	1.76 (1.53-2.06)	2.08 (1.79-2.44)	2.53 (2.11-3.05)	2.89 (2.36-3.51)	3.26 (2.58-4.04)	3.66 (2.77-4.61)	4.20 (3.06-5.39)	4.62 (3.28-5.98)
3-hr	1.31 (1.15-1.53)	1.55 (1.35-1.80)	1.95 (1.69-2.27)	2.29 (1.98-2.68)	2.80 (2.35-3.37)	3.20 (2.63-3.89)	3.63 (2.88-4.48)	4.08 (3.10-5.12)	4.70 (3.44-6.01)	5.19 (3.69-6.69)
6-hr	1.55 (1.36-1.79)	1.80 (1.58-2.08)	2.24 (1.96-2.60)	2.64 (2.29-3.06)	3.21 (2.72-3.85)	3.69 (3.05-4.45)	4.19 (3.35-5.14)	4.73 (3.63-5.91)	5.48 (4.04-6.97)	6.07 (4.36-7.78)
12-hr	1.80 (1.59-2.07)	2.06 (1.82-2.37)	2.53 (2.22-2.90)	2.94 (2.57-3.39)	3.57 (3.05-4.26)	4.09 (3.41-4.92)	4.65 (3.75-5.68)	5.26 (4.06-6.53)	6.11 (4.54-7.74)	6.80 (4.91-8.65)
24-hr	2.06 (1.83-2.35)	2.35 (2.08-2.67)	2.85 (2.52-3.25)	3.31 (2.91-3.78)	3.98 (3.42-4.71)	4.55 (3.81-5.42)	5.15 (4.17-6.24)	5.80 (4.51-7.15)	6.71 (5.02-8.44)	7.45 (5.42-9.41)
2-day	2.35 (2.10-2.66)	2.69 (2.40-3.04)	3.27 (2.90-3.70)	3.78 (3.34-4.29)	4.52 (3.89-5.29)	5.12 (4.30-6.04)	5.75 (4.68-6.90)	6.42 (5.02-7.85)	7.35 (5.54-9.16)	8.09 (5.93-10.2)
3-day	2.58 (2.31-2.90)	2.93 (2.62-3.30)	3.54 (3.15-3.99)	4.06 (3.60-4.60)	4.82 (4.16-5.61)	5.44 (4.58-6.38)	6.08 (4.96-7.25)	6.75 (5.30-8.21)	7.69 (5.81-9.53)	8.42 (6.20-10.5)
4-day	2.78 (2.49-3.12)	3.14 (2.82-3.53)	3.76 (3.36-4.23)	4.30 (3.82-4.85)	5.07 (4.38-5.88)	5.70 (4.81-6.66)	6.34 (5.19-7.55)	7.03 (5.53-8.52)	7.97 (6.04-9.85)	8.71 (6.43-10.9)
7-day	3.29 (2.97-3.67)	3.69 (3.32-4.12)	4.36 (3.91-4.88)	4.94 (4.41-5.54)	5.77 (5.00-6.64)	6.43 (5.45-7.46)	7.11 (5.84-8.40)	7.82 (6.18-9.41)	8.79 (6.70-10.8)	9.55 (7.09-11.8)
10-day	3.75 (3.39-4.17)	4.18 (3.77-4.65)	4.90 (4.41-5.46)	5.51 (4.93-6.16)	6.39 (5.55-7.31)	7.08 (6.02-8.18)	7.79 (6.42-9.15)	8.52 (6.76-10.2)	9.52 (7.28-11.6)	10.3 (7.68-12.7)
20-day	5.10 (4.63-5.62)	5.61 (5.09-6.19)	6.46 (5.84-7.14)	7.16 (6.44-7.95)	8.15 (7.11-9.23)	8.91 (7.62-10.2)	9.69 (8.02-11.3)	10.5 (8.35-12.4)	11.5 (8.87-14.0)	12.3 (9.26-15.1)
30-day	6.27 (5.71-6.89)	6.87 (6.25-7.56)	7.86 (7.13-8.65)	8.66 (7.82-9.57)	9.75 (8.53-11.0)	10.6 (9.07-12.0)	11.4 (9.47-13.2)	12.2 (9.78-14.4)	13.3 (10.3-16.0)	14.1 (10.6-17.2)
45-day	7.79 (7.12-8.53)	8.56 (7.81-9.37)	9.76 (8.88-10.7)	10.7 (9.70-11.8)	12.0 (10.5-13.4)	12.9 (11.1-14.6)	13.8 (11.5-15.8)	14.6 (11.7-17.2)	15.7 (12.1-18.8)	16.5 (12.5-20.0)
60-day	9.13 (8.36-9.96)	10.1 (9.20-11.0)	11.5 (10.5-12.6)	12.6 (11.4-13.8)	14.0 (12.3-15.6)	15.0 (12.9-16.9)	16.0 (13.3-18.2)	16.8 (13.5-19.6)	17.9 (13.8-21.3)	18.6 (14.1-22.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

Attachment J

Hydraulic Performance of **Synthetic Turf Cover Systems**

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Hydrologic Performance of Synthetic Turf Cover Systems and Their Equivalency to Prescriptive Cover Systems

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ABSTRACT

Synthetic turf cover systems have gained popularity as a viable final cover system alternative to traditional soil-geosynthetic cover systems for various reasons (e.g., less material required, quicker installation, and less maintenance). Federal and state regulations commonly require that the design engineers demonstrate alternative cover systems perform equivalently with the prescribed traditional cover system. This paper presents a comparison between the calculated hydrologic performance of traditional and synthetic turf cover systems for two state regulations; one for municipal solid waste (MSW) landfills and one for hazardous waste landfills. The results of these analyses showed that synthetic turf cover systems have larger annual runoff and drainage collection with similar or smaller annual infiltration through the geomembrane when compared to the traditional cover systems. Therefore, the synthetic turf cover systems perform similar to or better than the prescribed traditional cover systems in terms of infiltration.

INTRODUCTION

Synthetic turf cover systems are a relatively new geosynthetic product that typically consist of the following layers (from bottom to top) [WatershedGeo, 2018]: (i) a structured linear-low density polyethylene (LLDPE) or high density polyethylene (HDPE) geomembrane, which includes studs on the top to act as a drainage layer and spikes on the bottom to increase the interface shear strength of the system; (ii) an engineered turf protective layer, consisting of HDPE grass blades attached to woven geotextiles; and (iii) a thin layer (12.5-mm. thick minimum) of specified infill, which is usually clean sand primarily used for ballasting and protecting the engineered turf and the structured geomembrane. Figure 1 shows a typical detail for a synthetic turf cover system.

Because synthetic turf cover systems typically require less material, are generally quicker to install, and are expected to require less maintenance after installation [WatershedGeo, 2018], they have gained popularity as a viable alternative to the traditional soil-geosynthetic cover system. Federal and state regulations commonly require that the design engineers demonstrate alternative cover systems perform equivalently in terms of infiltration compared to the prescribed traditional cover system. This paper presents a comparison between the calculated hydrologic performance

of prescribed traditional cover systems and alternative synthetic turf cover systems to evaluate the hydrologic equivalency of the synthetic turf cover systems for two case studies.

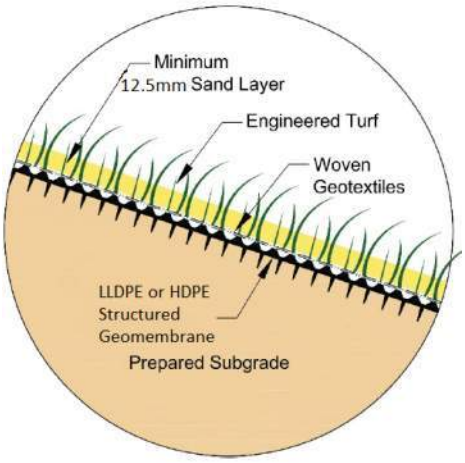

Figure 1. Typical synthetic turf cover system detail [WatershedGeo, 2018]

CASE STUDIES

The case studies examined in this paper represent two state regulations for MSW and hazardous waste landfills with varying slope angles and lengths.

Case Study 1: Indiana MSW Landfill. The first case study examines the Indiana state regulations for MSW landfills. A generic site in Indianapolis, Indiana was considered for this case study. As per Section 22-6(b)(8) of the 329 IAC 10 regulations [Indiana General Assembly, 2004], the slopes of the final cover system must not be less than 4 percent nor greater than 33 percent. Therefore, a 33-percent slope with a 18.3-m slope length and a 4-percent slope with 30.5-m slope length, were considered. Figure 2 shows a comparison between the prescribed traditional soil-geosynthetic cover system and the alternative synthetic turf cover systems for Case Study 1.

As per Section 22-6(b) of the 329 IAC 10 regulations [Indiana General Assembly, 2004], the final cover system for new or existing MSW landfills that have a composite bottom liner and a leachate collection system must consist of the following layers (from bottom to top): (i) a 0.3-m thick methane gas venting layer with a hydraulic conductivity of 1×10^{-3} cm/sec or more; (ii) a 0.6-m thick soil barrier layer with a hydraulic conductivity of 1×10^{-6} cm/sec or less; (iii) a 1.5-mm thick HDPE geomembrane; (iv) a 0.3-m thick drainage layer with a hydraulic conductivity of 1×10^{-3} cm/sec or more; (v) a 0.45-m thick protective layer consisting of earthen material; and (vi) a 0.15-m thick vegetative layer consisting of earthen material that is capable of sustaining vegetation.

For this case study, two alternative synthetic turf cover systems were considered: (i) a synthetic turf cover system that replaces all layers above the soil barrier layer; and (ii) a synthetic turf cover system that replaces all layers above the methane gas venting layer. For both alternatives, the synthetic turf cover system was modeled with the following layers (from bottom to top): (i) a 1.5-mm thick HDPE textured geomembrane; (ii) a 3.3-mm thick studded drainage layer that is part of the HDPE geomembrane; and (iii) 25-mm thick sand infill and engineered turf.

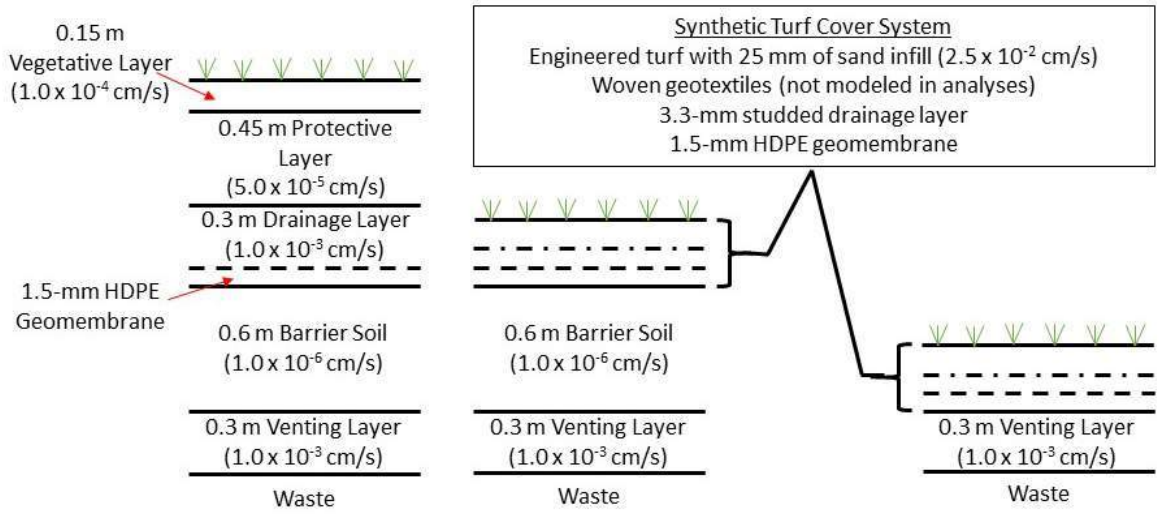

Figure 2. Prescriptive soil-geosynthetic cover system (left) and alternative synthetic turf cover systems with (center) and without (right) a barrier soil for Case Study 1

Case Study 2: Texas Hazardous Waste Landfill. The second case study examines the Texas state and federal regulations for hazardous waste landfills. A generic site in Houston, Texas was considered for this case study. The Texas Commission on Environmental Quality (TCEQ) in Section 335.174(a) of the Texas Administrative Code [TCEQ, 1996] and the U.S. Environmental Protection Agency (USEPA) in Section 264.310(a) of Subpart N of Title 40 [USEPA, 2017] provide design-based requirements for the design of final cover systems of industrial solid waste and municipal hazardous waste landfills. Details for final cover systems that satisfy these design-based requirements are provided by the USEPA [1989]. Maximum and minimum slopes of 33 percent and 3 percent with slope lengths of 19.8 m and 30.5 to 152.4 m, respectively, were considered for Case Study 2. Figure 3 shows a comparison between the prescribed traditional soil-geosynthetic cover system and the alternative synthetic turf cover systems considered for Case Study 2.

As per USEPA [1989], the prescribed traditional soil-geosynthetic cover system for Case Study 2 was modeled with the following layers (from bottom to top): (i) a 0.6-m thick compacted clay liner with a hydraulic conductivity of 1×10^{-7} cm/sec or less; (ii) a 1.5-mm thick HDPE geomembrane; (iii) a 7.6-mm thick geocomposite drainage layer, equivalent in hydraulic conductivity to a 0.3-m thick granular drainage layer with a hydraulic conductivity of 1×10^{-2} cm/sec or more; (iv) a 0.45-m thick protective layer consisting of earthen material; and (vi) a 0.15-m thick vegetative layer consisting of earthen material that is capable of sustaining vegetation. An intermediate/daily cover layer with a thickness of 0.15 m was also modeled below the compacted clay liner.

For this case study, two alternatives were considered for the synthetic turf cover system: (i) the synthetic turf cover system that replaces all layers above the compacted clay liner; and (ii) the synthetic turf cover system that replaces all layers above the compacted clay liner and replaces the compacted clay liner with a 7.6-mm thick geosynthetic clay liner. For both alternatives, the synthetic turf cover system was modeled with the following layers (from bottom to top): (i) a 1.5-mm thick HDPE textured geomembrane; (ii) a 3.3-mm thick studded drainage layer that is part of the HDPE geomembrane; and (iii) 12.5-mm thick sand infill and engineered turf.

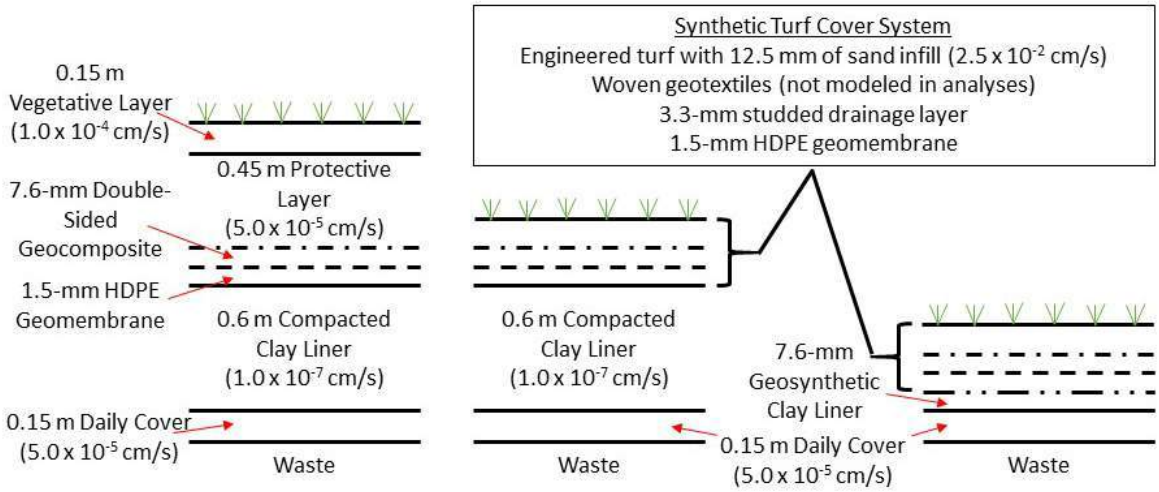

Figure 3. Prescriptive soil-geosynthetic cover system (left) and alternative synthetic turf cover systems with a compacted clay liner (center) and geosynthetic clay liner (right) for Case Study 2

ANALYSIS METHODOLOGY

The calculations for the hydrologic evaluation of the cover systems presented in this paper were modeled using the Hydrologic Evaluation of Landfill Performance (HELP) software, Version 3.07, developed for the USEPA [Schroeder et al., 1994a and 1994b]. The HELP program is a quasi-two-dimensional hydrologic model of water movement across, into, through, and out of a landfill's cover and/or liner systems. The program accepts climate, soil, and design data, and uses a solution technique that accounts for the effects of surface storage, runoff, infiltration, percolation, evaporation, soil moisture storage, and lateral drainage.

Climatic Data. The evaporative zone depth is defined as the maximum depth from which water may be removed by evapotranspiration. This depth affects the storage of water near the surface and directly impacts the computations for evapotranspiration and runoff [Schroeder et al., 1994a and 1994b]. For vegetated surfaces, the evaporative zone depth should be equal to the expected average depth of root penetration. For the traditional cover systems, the evaporative zone depths were selected as approximately 0.5 and 0.6 m for Case Studies 1 and 2 respectively, using the HELP default values. The evaporative zone depth for the alternative synthetic turf cover systems were selected as the combined thickness of the sand infill, engineered turf, and studded drainage layers (i.e., 28.3 and 15.8 mm for Case Studies 1 and 2, respectively).

Synthetic precipitation data for a 100-year modeling period were generated using the synthetic weather generator in HELP and site specific precipitation data from the National Oceanic and Atmospheric Administration (NOAA) precipitation frequency data server. Synthetic daily temperature, solar radiation, and relative humidity data were also generated for a 100-year modeling period for the closest default locations available in the HELP program.

Cover System Properties. Table 1 shows the properties used for the cover system components for Case Studies 1 and 2. The default properties available in the HELP database were used for porosity, field capacity, and wilting point. As noted in Table 1, the hydraulic conductivities of the

cover system components correspond to either prescribed limits, typical values, or manufacturer-specified values. Case Study 2 considers long-term site conditions and thus, the hydraulic conductivities of the drainage layers are expected to decrease due to degradation, clogging, and/or creep of the drainage layers. Therefore, the hydraulic conductivities in Case Study 2 have been reduced by a factor of 2.4 to account for some creep, delayed intrusion, particulate clogging, and biological clogging and a factor of safety of 1.5. The reduction factor of 2.4 was developed from available technical literature [Giroud et al., 2000] and is typical for cover systems. Although a reduction factor could also be used for the granular drainage layer in Case Study 1, it was not considered for the analyses presented in this paper.

The geomembrane components of the prescribed and alternative cover systems were modeled to contain one hole per 0.004 km^2 and have good installation quality. For the calculations, each hole was modeled with an area of 1 cm^2 as recommended by Giroud and Bonaparte [1989]. A 100 percent runoff from precipitation on the cover systems was allowed in the HELP models; however, it should be controlled to prevent excessive erosion of the final cover system.

Table 1. Cover system properties used in HELP models

Component	Case Study (1)	Layer Thickness	Total Porosity (2)	Field Capacity (2)	Wilting Point (2)	Saturated Hydraulic Conductivity (cm/sec)	HELP Material Texture # (2)	HELP Layer Type
Vegetative Cover Layer	1, 2	0.15 m	0.471	0.342	0.210	1.0×10^{-4} (3)	12	Vertical Percolation
Protective Soil Layer	1, 2	0.45 m	0.471	0.342	0.210	5.0×10^{-5} (3)	12	Vertical Percolation
Granular Drainage Layer (4)	1	0.3 m	0.457	0.083	0.033	1.0×10^{-3} (5)	3	Drainage Layer
Double-Sided Geocomposite Drainage Layer	2	7.6 mm	0.850	0.010	0.005	11.84 (4.93) (6)(7)	20	Drainage Layer
HDPE Geomembrane	1, 2	1.5 mm	-	-	-	2.0×10^{-13} (7)	35	Geomembrane
Engineered Turf (8)	1	25 mm	0.437	0.062	0.024	2.5×10^{-2}	2	Vertical Percolation
	2	12.5 mm						
Woven Geotextile (8)	1, 2	-	-	-	-	-	-	Not Modeled
Studded Drainage Layer for Textured HDPE Geomembrane (8)	1, 2	3.3 mm	0.850	0.010	0.005	75.76 (31.57) (6)	20	Drainage Layer
Textured HDPE Geomembrane (with spike down) (8)	1, 2	1.5 mm	-	-	-	2.0×10^{-13} (7)	35	Geomembrane
Soil Barrier Layer (9)	1	0.6 m	0.427	0.418	0.367	1.0×10^{-6} (5)	16	Barrier Soil
Methane Gas Venting Layer (4)	1	0.3 m	0.457	0.083	0.033	1.0×10^{-3} (5)	3	Vertical Percolation
Compacted Clay Liner	2	0.6 m	0.427	0.418	0.367	1.0×10^{-7} (5)	16	Barrier Soil
Geosynthetic Clay Liner	2	7.6 mm	0.750	0.747	0.400	5.0×10^{-9} (7)	17	Barrier Soil
Daily/Intermediate Cover (9)	2	0.15 m	0.427	0.418	0.367	5.0×10^{-5} (3)	16	Vertical Percolation

Notes:
(1) Case study identifies for which case study or studies the cover system component was used.
(2) Values shown for total porosity, field capacity, and wilting point correspond to the default values for the selected HELP material texture number.
(3) Hydraulic conductivity values selected based on typical values.
(4) Drainage and methane gas venting layers are modeled with properties typical of filter sands.
(5) Hydraulic conductivity values selected based on minimum design requirements.
(6) Hydraulic conductivity values within the parentheses represent the long-term hydraulic conductivities with a reduction factor of 2.4 applied.
(7) Hydraulic conductivity values selected based on typical values from manufacturers.
(8) Properties for synthetic turf cover system layers were selected based on manufacturers design guidelines [WatershedGeo, 2018].
(9) Soil barrier layer and daily/intermediate cover are modeled with properties typical of compacted clays.

Output Data. The HELP program calculated and output the average annual rates for surface runoff, stormwater collected through the drainage layer, and infiltration through the geomembrane and the average hydraulic head over the geomembrane during the peak daily rainfall event. The

average annual rates were calculated for a modeled area of 0.004 km^2 while the average hydraulic head over the geomembrane was calculated for the specified drainage lengths. All calculations considered a 100-yr modeling period. The values calculated for these parameters in the alternative synthetic turf cover systems were compared to the calculated values for the prescribed traditional cover systems and used to evaluate the equivalency of the alternative synthetic turf cover systems.

ANALYSIS RESULTS

Case Study 1. Table 2 presents the calculated average annual rates for runoff, drainage collected, and infiltration and the average hydraulic head over the geomembrane for the traditional and alternative cover systems examined in Case Study 1.

The calculated average annual rates for runoff and drainage collected for both alternative synthetic turf cover systems are approximately 3,000 L/day and 5,600 L/day for the modeled area, respectively, which are larger than the calculated rates for the traditional soil-geosynthetic cover system (i.e., approximately 2,200 L/day and 1,600 L/day for the modeled area, respectively). The alternative synthetic turf cover systems have much less material above the drainage layer (0.03 m) and a higher hydraulic conductivity for the drainage layer (approximately 76 cm/sec) than the traditional cover system (0.6 m and 1.0×10^{-3} cm/sec) and thus, store less water, have a shorter path to the drainage layer, and are able to more quickly convey water collected on the drainage layer. The average annual infiltration rates calculated for both alternative synthetic turf cover systems in this case study are less than the rates calculated for the traditional soil-geosynthetic cover system for both slopes modeled. This observation can predominantly be attributed to the significantly larger calculated hydraulic head over the geomembrane for the traditional soil-geosynthetic cover system (i.e., approximately 18 to 91 cm) compared to the calculated values for the alternative synthetic turf cover systems (i.e., less than 0.1 cm). The use of a barrier soil layer beneath the synthetic turf cover system does not affect the calculated average annual rates for runoff and drainage collected, as expected, but does reduce the calculated average annual infiltration rates by approximately two orders of magnitude.

Table 2. Results for Case Study 1 (reported values are for the modeled area of 0.004 km^2)

Final Cover Alternative	Slope (%)	Slope Length (m)	Barrier Soil Layer	Average Annual Runoff Rate (L/day)	Average Annual Rate of Drainage Collected (L/day)	Average Annual Infiltration Rate through Cover (cm/day)	Average Hydraulic Head over Geomembrane (cm)
Soil-Geosynthetic	33.0	18.3	Yes	2,277	1,623	4.5E-06	18.39
	4.0	30.5	Yes	2,183	1,682	5.3E-05	91.29
Synthetic Turf	33.0	18.3	Yes	2,997	5,634	1.9E-09	0.01
			No	2,997	5,634	1.9E-07	0.02
	4.0	30.5	Yes	3,006	5,568	1.3E-08	0.03
			No	3,006	5,567	2.0E-06	0.03

Case Study 2. The calculated average annual rates for runoff, drainage collected, and infiltration and the average hydraulic head over the geomembrane for the traditional and alternative cover systems examined in Case Study 2 are presented in Table 3.

Like Case Study 1, the alternative synthetic turf cover systems have larger calculated average annual rates for runoff (approximately 2,700 to 2,900 L/day for the modeled area) and drainage collected (approximately 7,600 to 7,800 L/day for the modeled area) than the rates calculated for the soil-geosynthetic cover system (approximately 1,500 to 2,100 L/day and approximately 1,600 to 2,000 L/day for the modeled area, respectively). However, for slope angles of 33 and 3 percent with slope lengths of 19.8 and 30.5 m, respectively, the calculated average

annual infiltration rates for the alternative synthetic turf and traditional soil-geosynthetic cover systems are approximately equal. If the slope length for the slope with an angle of 3 percent is increased to 152.4 m, the calculated average annual infiltration rate for the traditional soil-geosynthetic cover system increases by approximately an order of magnitude while the calculated rates for the alternative synthetic turf cover systems do not significantly change. This increase in the calculated average annual infiltration rate for the traditional cover system with the increase in the slope length is likely the result of the drainage layer being unable to convey the water in the cover system for the longer drainage path, as evident by the much larger calculated average hydraulic head (increase from 0.23 cm to 39.46 cm). The use of a geosynthetic clay liner with the alternative synthetic turf cover system in place of the compacted clay liner does not affect the calculated average annual rates for runoff and drainage collected, as expected, but does slightly reduce the calculated average annual infiltration rates because of the lower hydraulic conductivity for the geosynthetic clay liner.

Table 3. Results for Case Study 2 (reported values are for the modeled area of 0.004 km^2)

Final Cover Alternative	Slope (%)	Slope Length (m)	Barrier Soil Layer	Average Annual Runoff Rate (L/day)	Average Annual Rate of Drainage Collected (L/day)	Average Annual Infiltration Rate through Cover (cm/day)	Average Hydraulic Head over Geomembrane (cm)
Soil-Geosynthetic	33.0	19.8	Compacted Clay	2,052	1,585	1.9E-09	0.04
	3.0	30.5	Compacted Clay	1,770	1,785	9.6E-09	0.23
		152.4	Compacted Clay	1,467	2,037	9.4E-08	39.46
Synthetic Turf	33.0	19.8	Compacted Clay	2,708	7,760	1.9E-09	0.01
			GCL	2,708	7,760	1.9E-09	0.01
	3.0	30.5	Compacted Clay	2,736	7,715	7.7E-09	0.08
			GCL	2,736	7,715	3.8E-09	0.08
		152.4	Compacted Clay	2,940	7,599	1.9E-08	1.30
			GCL	2,940	7,599	5.8E-09	1.30

SUMMARY AND CONCLUSIONS

The calculated hydrologic performance of synthetic turf cover systems and traditional soil-geosynthetic cover systems were compared for two case studies that considered different state regulations, landfill types, and slope angles and lengths. Average annual rates for surface runoff, stormwater collected through the drainage layer, and infiltration through the geomembrane and the average hydraulic head over the geomembrane during the peak daily rainfall event were calculated and output by the HELP computer program. The hydrologic equivalency of alternative synthetic turf cover systems to the prescribed traditional soil-geosynthetic cover systems was evaluated by comparing the output data from HELP for the cover systems.

For the two case studies presented in this paper, the alternative synthetic turf cover systems had greater calculated average annual runoff and drainage collection compared to the prescribed traditional cover system because they have a thinner layer for infiltration into the drainage layer and a drainage layer with a higher hydraulic conductivity. The average annual rates of infiltration calculated for the alternative synthetic turf cover systems were approximately equal to or less than the rates calculated for the corresponding prescribed traditional cover systems as a result of the lower calculated average hydraulic heads over the geomembrane components in the alternative synthetic turf cover systems. For Case Study 1, where a granular drainage layer is prescribed for the traditional soil-geosynthetic cover system, or Case Study 2, with the longer drainage slope length, the calculated average hydraulic heads over the geomembrane component in the alternative synthetic turf cover systems are much lower. Based on the results of analyses presented in this

paper, the synthetic turf cover systems are considered equivalent compared to the prescribed traditional cover systems in terms of infiltration.

REFERENCES

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Attachment K

Surface Water Analysis

ATTACHMENT K

SURFACE WATER MANAGEMENT SYSTEM DESIGN CALCULATIONS

Attachment

K-1	**Surface Water Management System Design Approach**
K-2	**Surface Water Diversion Berm Analysis**
K-3	**Surface Water Ditch Analysis**
K-4	**Culvert Analysis**
K-5	**Storm Sewer Analysis**
K-6	**Sedimentation Basin Analysis**

ATTACHMENT K-1

SURFACE WATER MANAGEMENT SYSTEM DESIGN APPROACH

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: SW Management System Design Approach -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Surface Water Management System Design Approach -Engineered Turf

Objective

Summarize the surface water management system design approach, assumptions, and hydrologic parameters to be used in the analysis of the Wayne Disposal Inc. (WDI) surface water management system.

Design Criteria, Assumptions, and Methodology

1. The WDI surface water management system will consist of diversion berms, ditches, culverts, storm sewers, surface water infiltration, the North Sedimentation Basin (NSB), and the South Sedimentation Basin (SSB).
2. The surface water management system is designed in accordance with Rule 299.9619(6)(b).
3. The channels and basin are designed to collect and control the 25-yr, 24-hr storm event and to manage the 100-yr, 24-hr storm event with no off-site flooding.
4. Use rainfall data from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 8, Version 2. The 25-yr, 24-hour storm event is 3.95 inches, and the 100-yr, 24-hr storm event is 5.12 inches, see Attachment K-1.1.
5. Use storm distribution MSE-3 from the Atlas 14 rainfall for Midwest and Southeast States. See Attachment K-1.2.
6. Conservatively assume hydrologic soil group D to calculate the run-off curve number for existing areas outside of MC VI and perimeter berms without the engineered turf cover. Hydrologic soil group D soils have a high runoff potential when thoroughly wet and typically have clayey textures and less than 50 percent sand.
7. Run-off curve numbers for existing areas will be chosen using Table 2-2 of Technical Release 55 (TR-55) Assume a cover type of “Fair Pasture”, CN of 84, for existing areas without engineered turf as well as adjacent areas except MC I. Assume a cover type of “Good Pasture”, CN of 80, represents the existing established final cover vegetation on MC I. A curve number of 98 represents pond areas. See Attachment K-1.3.
8. Run-off curve number for engineered artificial turf landfill cover, such as Closure Turf, areas will be taken from Watershed Geo’s design guideline Table 2, CN of 95 represents normal rainfall events. See Attachment K-1.4.
9. Use HydroCAD to evaluate the surface water run-off and management features including the diversion berms, channels, and culverts. HydroCAD is based largely on hydrologic techniques developed by the SCS combined with other hydrologic and hydraulic calculations. For a given rainfall event, these techniques are used to generate hydrographs throughout a watershed. Storage-Indication-Translation Method routing techniques were used to route surface water through the surface water management system. The antecedent moisture condition specifies the moisture level in the ground immediately prior to the storm. A value of "2" for normal conditions is used in the analyses.
10. Times of concentration were computed by HydroCAD using methodology developed by the SCS. A maximum sheet flow length of 200 ft was used prior to transitioning to shallow

CALCULATION SHEET

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concentrated flow.

11. Use the Storm Water Management Model (SWMM) to evaluate the performance of storm sewers in the SSB watershed. SWMM is a dynamic rainfall-runoff simulation model developed by USEPA used for single event or long-term simulation of runoff quantity and quality from primarily urban areas. SWMM contains a flexible set of hydraulic modeling capabilities used to route runoff and external inflows through a drainage system network of pipes, channels, storage/treatment units and diversion structures. It has been widely used throughout the world for planning, analysis, and design related to storm water runoff, combined and sanitary sewers, and other drainage systems.
12. Surface water management system design is based on future final closure conditions with the use of engineered artificial turf on MC VI.

Calculation

The North Sedimentation Basin (NSB) receives runoff from portions of MC IV, MC VI, MC VII, MC IX, MC X and MC XI consisting of a watershed area of approximately 287.6 acres. The conveyance structures in the NSB watershed include a detention pond, ditches, diversion berms and culverts.

The South Sedimentation Basin (SSB) receives runoff from portions of MC VI, MC I, MC X, and MC XI, and portions of the entrance area, and the wastewater treatment plant. The total area of the SSB watershed is approximately 102.3 acres. The storm water conveyance structures in the SSB watershed include a detention pond, ditches, culverts, catch basins, and storm sewers.

The lined pond receives runoff from primarily paved areas. The conveyance structures in the lined pond watershed consist of a storage basin, catch basins and storm sewers. The watershed area draining to the Lined Pond is reduced from conditions during site operations, therefore, the Lined Pond is anticipated to continue to provide adequate capacity to manage the runoff as originally designed and permitted. The lined pond was not reanalyzed in these calculations.

The proposed subbasin delineations and surface water management feature labels are provided in Attachment K-1.5. HydroCAD analyses were done separately for the NSB and the SSB watersheds. HydroCAD and SWMM model outputs are provided in Attachment K-1.6. Additional model inputs and output are discussed in the calculations related to the surface water management system components identified below.

Diversion Berms: Diversion berms are used to direct surface water run-off from landfill sideslopes to perimeter ditches. Design calculations are provided in Attachment K-2

Ditches: Ditches are used to route surface water run-off around the landfill and to sedimentation basins. Design calculations are provided in Attachment K-3

Culverts: Culverts are required to convey surface water run-off under access roads and through berms within the site. Existing and proposed culverts are evaluated in Attachment K-4

Storm Sewer: A network of storm sewers, catch basins, and manholes is used to route surface water run-off from a portion of the site to the SSB. The storm sewer analysis is discussed in Attachment K-5

CALCULATION SHEET

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Sedimentation Basins: – Sedimentation basins on site will contain surface water prior to discharge off-site. The sedimentation basin analysis is provided in Attachment K-6

The Attachments to K-1 are summarized as follows:

K-1.1	Rainfall Data
K-1.2	Storm Distribution Data
K-1.3	Curve Number Data
K-1.4	Closure Turf Design Guide Excerpts
K-1.5	Surface Water Management Figures
K-1.6	Surface Water Model Output

Conclusion

The model outputs and above information is used in the design of the surface water management features in the following surface water management system calculations.

Reference

1. "Precipitation-Frequency Atlas of the United States", NOAA Atlas 14, volume 2, Version 3, G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley, National Weather Service, Silver Spring, Maryland, 2004. Location: Van Buren Twp, Michigan, Lat. 42.223, Long. -83.5226.
2. Urban Hydrology for Small Watersheds, TR-55. June 1986, United States Department of Agriculture (USDA).

ATTACHMENT K-1.1

RAINFALL DATA

NOAA Atlas 14, Volume 8, Version 2
Location name: Van Buren Twp, Michigan, USA*
Latitude: 42.223°, Longitude: -83.5226°
Elevation: 699.8 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.321** (0.267-0.392)	**0.379** (0.314-0.464)	**0.475** (0.393-0.582)	**0.556** (0.457-0.684)	**0.670** (0.532-0.844)	**0.759** (0.589-0.965)	**0.850** (0.637-1.10)	**0.943** (0.677-1.24)	**1.07** (0.738-1.44)	**1.17** (0.783-1.59)
10-min	**0.470** (0.390-0.575)	**0.555** (0.460-0.679)	**0.696** (0.575-0.853)	**0.814** (0.670-1.00)	**0.981** (0.779-1.24)	**1.11** (0.863-1.41)	**1.24** (0.932-1.61)	**1.38** (0.992-1.82)	**1.57** (1.08-2.11)	**1.71** (1.15-2.32)
15-min	**0.573** (0.476-0.701)	**0.676** (0.561-0.828)	**0.848** (0.702-1.04)	**0.993** (0.817-1.22)	**1.20** (0.951-1.51)	**1.36** (1.05-1.72)	**1.52** (1.14-1.96)	**1.68** (1.21-2.22)	**1.91** (1.32-2.57)	**2.08** (1.40-2.83)
30-min	**0.767** (0.638-0.938)	**0.907** (0.752-1.11)	**1.14** (0.942-1.40)	**1.34** (1.10-1.64)	**1.61** (1.28-2.04)	**1.83** (1.42-2.33)	**2.06** (1.54-2.66)	**2.29** (1.64-3.02)	**2.60** (1.80-3.50)	**2.84** (1.91-3.87)
60-min	**0.970** (0.806-1.19)	**1.15** (0.950-1.40)	**1.44** (1.19-1.77)	**1.70** (1.40-2.09)	**2.07** (1.65-2.61)	**2.36** (1.83-3.01)	**2.66** (2.00-3.46)	**2.98** (2.15-3.94)	**3.42** (2.36-4.61)	**3.76** (2.53-5.12)
2-hr	**1.17** (0.980-1.42)	**1.38** (1.16-1.68)	**1.75** (1.45-2.12)	**2.06** (1.70-2.52)	**2.52** (2.02-3.17)	**2.89** (2.26-3.66)	**3.27** (2.47-4.22)	**3.68** (2.66-4.84)	**4.24** (2.95-5.69)	**4.68** (3.17-6.33)
3-hr	**1.30** (1.09-1.58)	**1.53** (1.28-1.85)	**1.93** (1.61-2.34)	**2.28** (1.89-2.77)	**2.79** (2.25-3.51)	**3.21** (2.53-4.06)	**3.66** (2.78-4.70)	**4.13** (3.00-5.41)	**4.79** (3.35-6.40)	**5.31** (3.61-7.14)
6-hr	**1.55** (1.30-1.85)	**1.79** (1.51-2.15)	**2.23** (1.87-2.68)	**2.62** (2.19-3.16)	**3.21** (2.61-4.01)	**3.70** (2.93-4.66)	**4.22** (3.23-5.41)	**4.79** (3.52-6.25)	**5.59** (3.94-7.44)	**6.24** (4.27-8.33)
12-hr	**1.81** (1.53-2.15)	**2.06** (1.74-2.45)	**2.51** (2.12-2.99)	**2.92** (2.45-3.50)	**3.55** (2.91-4.41)	**4.08** (3.26-5.11)	**4.66** (3.59-5.93)	**5.28** (3.90-6.85)	**6.17** (4.39-8.16)	**6.89** (4.75-9.15)
24-hr	**2.07** (1.77-2.45)	**2.35** (2.00-2.77)	**2.83** (2.41-3.36)	**3.28** (2.77-3.90)	**3.95** (3.26-4.87)	**4.52** (3.63-5.60)	**5.12** (3.97-6.47)	**5.78** (4.30-7.43)	**6.71** (4.80-8.80)	**7.46** (5.18-9.83)
2-day	**2.35** (2.02-2.76)	**2.68** (2.30-3.15)	**3.25** (2.78-3.82)	**3.75** (3.19-4.43)	**4.49** (3.71-5.46)	**5.09** (4.11-6.25)	**5.73** (4.46-7.15)	**6.40** (4.79-8.15)	**7.34** (5.28-9.54)	**8.09** (5.65-10.6)
3-day	**2.58** (2.22-3.01)	**2.92** (2.51-3.41)	**3.51** (3.01-4.11)	**4.03** (3.43-4.73)	**4.78** (3.97-5.79)	**5.40** (4.37-6.59)	**6.05** (4.73-7.51)	**6.73** (5.05-8.53)	**7.68** (5.55-9.94)	**8.44** (5.92-11.0)
4-day	**2.78** (2.40-3.23)	**3.13** (2.70-3.64)	**3.73** (3.21-4.35)	**4.26** (3.64-4.99)	**5.03** (4.18-6.07)	**5.66** (4.59-6.88)	**6.31** (4.95-7.82)	**7.01** (5.27-8.86)	**7.97** (5.77-10.3)	**8.74** (6.15-11.4)
7-day	**3.29** (2.85-3.80)	**3.68** (3.19-4.26)	**4.34** (3.75-5.03)	**4.92** (4.22-5.72)	**5.74** (4.79-6.87)	**6.41** (5.22-7.74)	**7.10** (5.60-8.74)	**7.83** (5.92-9.83)	**8.84** (6.43-11.3)	**9.63** (6.82-12.4)
10-day	**3.75** (3.26-4.32)	**4.17** (3.63-4.81)	**4.89** (4.23-5.64)	**5.50** (4.74-6.38)	**6.38** (5.34-7.59)	**7.08** (5.79-8.51)	**7.81** (6.17-9.55)	**8.56** (6.50-10.7)	**9.60** (7.01-12.2)	**10.4** (7.40-13.4)
20-day	**5.09** (4.46-5.82)	**5.61** (4.90-6.41)	**6.46** (5.63-7.40)	**7.17** (6.22-8.24)	**8.17** (6.86-9.61)	**8.95** (7.35-10.6)	**9.74** (7.74-11.8)	**10.6** (8.06-13.1)	**11.7** (8.56-14.7)	**12.5** (8.94-16.0)
30-day	**6.26** (5.50-7.12)	**6.87** (6.03-7.82)	**7.86** (6.87-8.96)	**8.67** (7.54-9.92)	**9.77** (8.23-11.4)	**10.6** (8.75-12.5)	**11.5** (9.13-13.8)	**12.3** (9.42-15.1)	**13.4** (9.88-16.8)	**14.2** (10.2-18.1)
45-day	**7.79** (6.87-8.83)	**8.55** (7.53-9.69)	**9.75** (8.56-11.1)	**10.7** (9.35-12.2)	**12.0** (10.1-13.9)	**12.9** (10.7-15.1)	**13.8** (11.0-16.5)	**14.7** (11.3-17.9)	**15.8** (11.6-19.7)	**16.5** (11.9-21.0)
60-day	**9.14** (8.08-10.3)	**10.0** (8.87-11.3)	**11.5** (10.1-13.0)	**12.6** (11.0-14.3)	**14.0** (11.8-16.1)	**15.0** (12.4-17.5)	**15.9** (12.7-18.9)	**16.8** (12.9-20.4)	**17.9** (13.2-22.2)	**18.6** (13.5-23.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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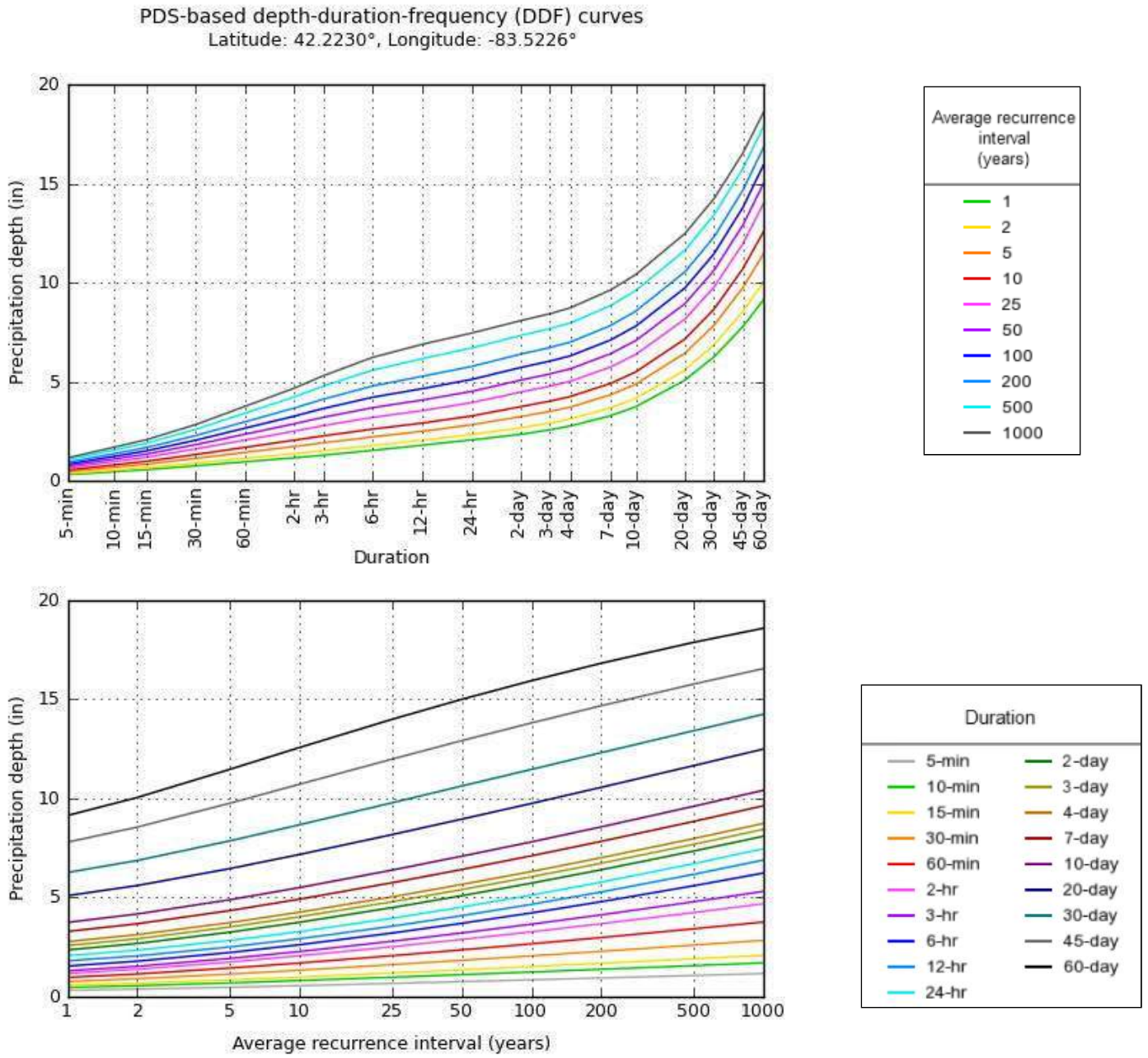
PF graphical



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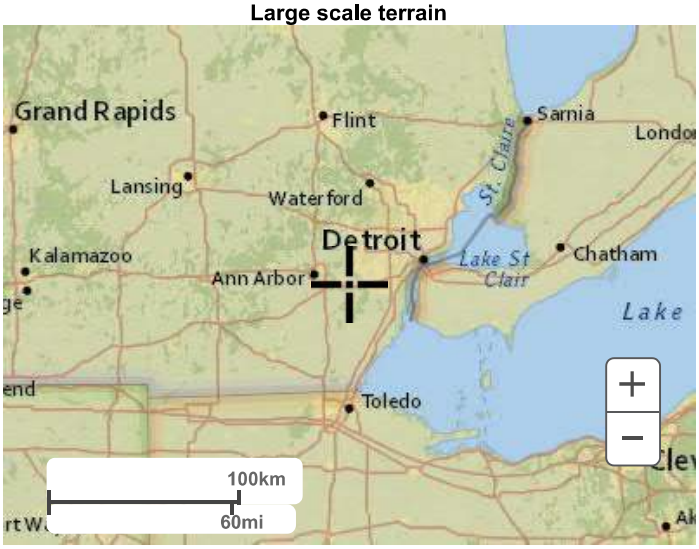
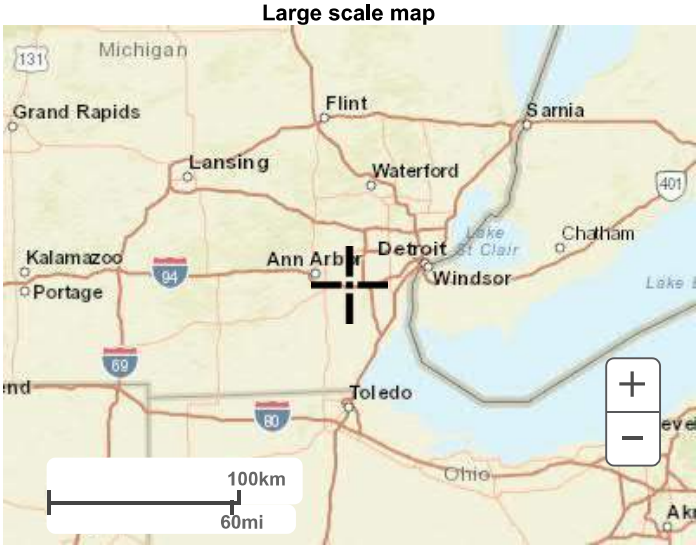
Maps & aerials

Small scale terrain

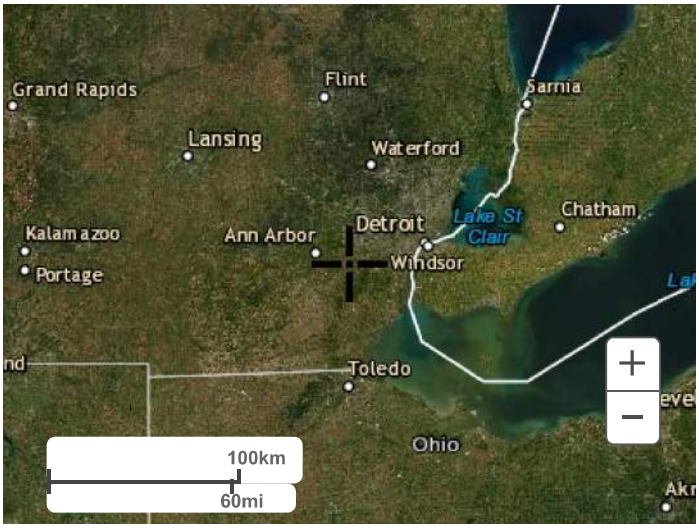
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

ATTACHMENT K-1.2

STORM DISTRIBUTION DATA

NOAA Atlas 14 rainfall for Midwest and Southeast states

Compiled by William Merkel and Helen Fox Moody, updated April 29, 2015

Statistics for NOAA Atlas 14 100-year 24-hour rainfall by state and county

Background

NOAA released volumes 8 and 9 of Atlas 14 for the midwest and southeast United States respectively on Monday April 22, 2013. Precipitation-frequency data are available from NOAA Atlas 14 for both annual and partial duration series at the NWS website http://hdsc.nws.noaa.gov/hdsc/pfds/. GIS data for the 100-year 24-hour partial duration rainfall were downloaded and prepared. State and county maps were overlayed on the GIS to derive statistics on a county basis. The GIS Spatial Analyst command Zonal Statistics as Table was used to generate minimum, maximum, range (difference between maximum and minimum), mean, and standard deviation of the 100-year 24-hour rainfall.

Considerable study of the NOAA 14 data (2006) for the Ohio Valley and neighboring states has been completed both by the Water Quality and Quantity Technology Development Team and by hydraulic engineers in the respective state offices and some procedures have been developed to prepare rainfall databases for the WinTR-55 and EFH-2 computer programs and for developing rainfall distributions to replace the Types II and III which were used in the past. Similar procedures are expected to be used in the midwest and southeast states (which border the Ohio Valley NOAA 14 area) due to similar climatic and topographic characteristics.

Instructions

Preparation of rainfall databases

The midwest and southeast states covered by NOAA Atlas 14 volumes 8 and 9 (except for Colorado) have rainfall data included in the WinTR-55 rainfall database by county or by parish in Louisiana. These same data are also included in rainfall data files used with the EFH-2 computer program. One option for users of these computer programs is to visit the NOAA 14 web site and download data at specific project sites. To save user's time and considering that users may not have internet access at all times, rainfall databases and data files are expected to be developed for these states. Whereas the current files are generally based on TP-40 (1961), data from NOAA Atlas 14 will be substituted.

The first step in this process is to develop maximum, minimum, range, and mean of the 100-year 24-hour rainfall by state and county or parish. This has been done by Bill Merkel and Helen Fox Moody . In states where there is enough topographic relief to product orographic effects in the rainfall amounts, such as Virginia, 100-year 24-hour rainfall could vary by up to 5 inches in a single county. To address this situation, if the rainfall varied more than 1.5 inches within a county, the county was split in two or more parts, each having a set of rainfall values in the rainfall database.

Some of the midwest and southeast states have all counties with less than 1.5 inch variation. Other states have several counties with more than 1.5 inches of variation.

If a county is to be split, use the following procedure:

- Split the county along some boundary such that the range of the 100-year 24-hour rainfall of each part is less than 1.5 inches.
- Start with a state/county GIS shapefile and digitize the boundary.
- In split counties, generate the statistics for each part (min, max, range, and mean).
- Select a representative point location in each county or part of split counties. Find a point in the county (or part of county) where the 100-year 24-hour rainfall is equal (or within 0.05 inch) of the mean county value. Record this latitude and longitude.
- Open the NOAA Atlas 14 web site and download the csv (comma separated variable) file for that location. Use the 1-year through 100-year 24-hour rainfall values at this location in the WinTR-55 rainfall database and the EFH-2 rainfall data file. A GIS layer will be developed with the set of locations in each state.
- Bill and Helen will assist any state with these steps if requested.

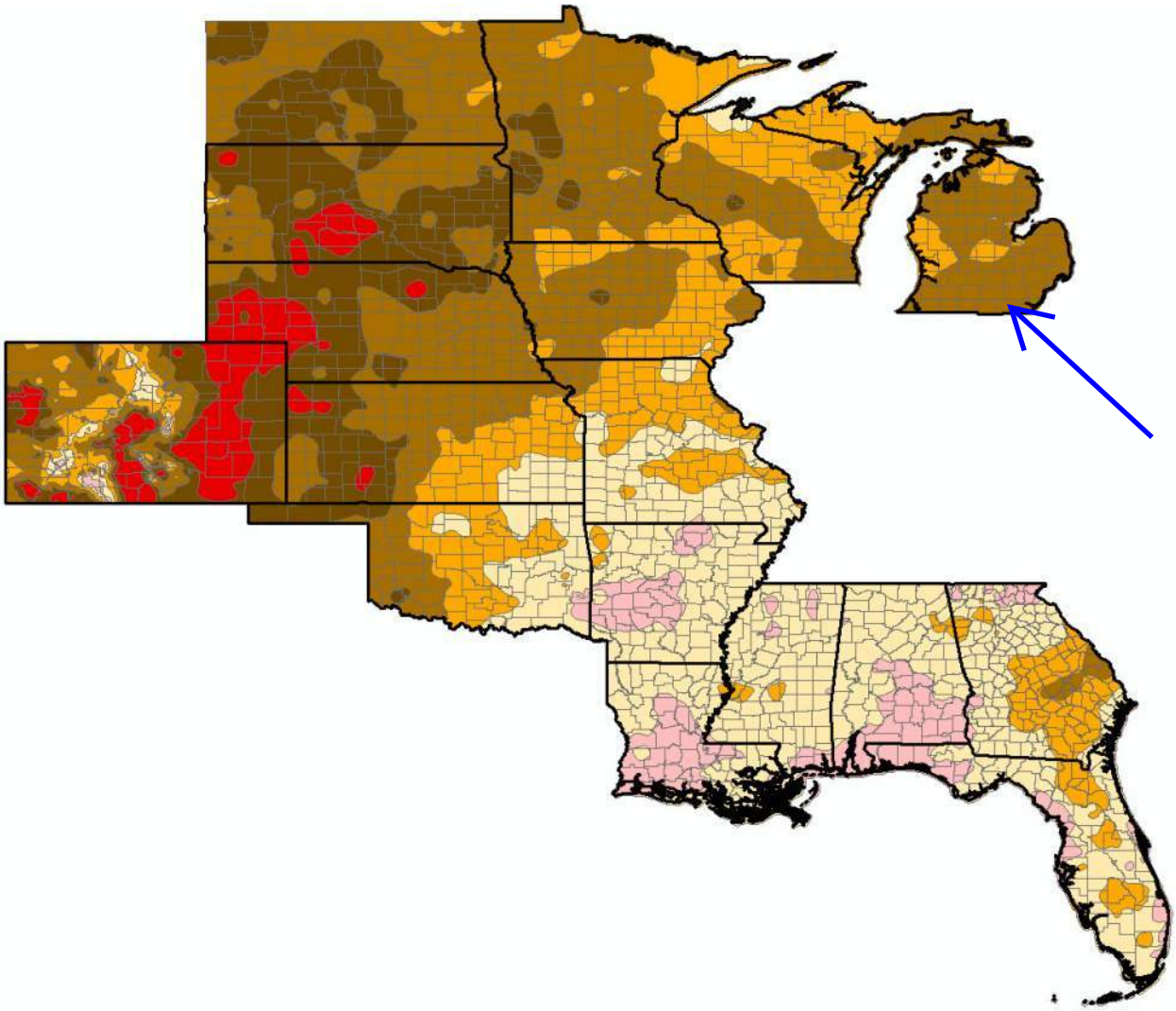
Development of rainfall distributions

The latest draft of Part 630 Chapter 4 Storm Rainfall and Distribution includes the procedures that will be used to develop rainfall distributions for the midwest and southeast states. The purpose of the rainfall distribution is to include all the rainfall amounts at shorter durations in the 24-hour rainfall distribution. For example, for a 25-year 24-hour storm, the 25-year 5-minute rainfall, 25-year 10-minute, rainfall, etc are included within the 24-hour distribution. This is accomplished by placing the 5-minute rainfall in the center (12 hours) and each larger duration being centered at 12 hours. The 60-minute rainfall is located between 11.5 and 12.5 hours. The 2-hour rainfall is located from 10 to 12 hours, etc.

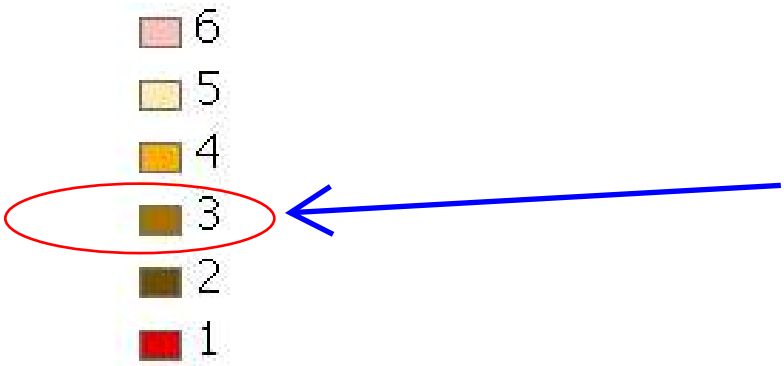
A map has been generated with the ratio of the 60-minute rainfall to the 24-hour rainfall for the 25-year values. In preliminary analyses, this ratio varies from a low value of 0.32 to a high value of 0.75. A rainfall distribution map has 6 rainfall distributions. Based on this ratio, areas within a range of values will be included as a rainfall distribution region. They are named MSE 1, MSE 2, through MSE 6 (MSE is abbreviated from midwest/southeast states). The range of ratio of 60-minute to 24-hour rainfall is in the following table.

Rainfall Distribution Name	Minimum 60-min/24-hour	Maximum 60-min/24-hour
MSE 1	0.58	0.75
MSE 2	0.53	0.58
MSE 3	0.48	0.53
MSE 4	0.43	0.48
MSE 5	0.38	0.43
MSE 6	0.32	0.38

For reference, the 60-minute to 24-hour ratio for the Type II rainfall distribution is 0.45 and the ratio for the Type III is 0.40. Based on the NOAA Atlas 14 data, rainfall distributions less intense, of similar intensity, and more intense than the Types II and III are being used.



Tentative rainfall distribution regions (based on GIS analysis).



Distribution region 1 has the most intense rainfall distribution and region 6 has the least intense rainfall distribution. In preliminary tests, regions 1 and 2 have peak discharges similar to the New Mexico 60 and 65 rainfall distributions (significantly higher than the Type II). Region 4 has peak discharges similar to the Type II rainfall distributions. Region 5 has peak discharges similar to the Type III rainfall distribution. Region 6 has peak discharges less than the Type III rainfall distribution.

Some may question whether to drop the Type II, Type III, and New Mexico rainfall distributions based on these preliminary conclusions. The Type II does not have any documentation remaining on specifically how it was developed and what data were used to develop it. We do not have documentation on the New Mexico rainfall distributions (there may be some documentation saved in the New Mexico state office). The Type III has significant documentation remaining and is based on data from TP-40 and NWS Hydro-35 report. The tentative rainfall distributions (map above) above are based on NOAA 14 data and similar procedures were used to develop rainfall distributions for the Ohio Valley and New York/New England states.

The map above is based entirely on the GIS data and does not consider state or county boundaries. When adjusting the map to fit state desires, the boundaries may be adjusted to follow county/parish boundaries. It is simpler for the field office staff to use a single rainfall distribution in a county. Two general choices have been used in states. One is to select the rainfall distribution that makes up the largest percentage of land area. The other choice is to select the more conservative rainfall distribution that is present in a county. For example, if a county is divided between rainfall distribution MSE 3 and MSE 4, then assign rainfall distribution MSE 3. Whichever choice is made, it is recommended to be consistent for all counties in a state.

Yet several states have chosen to follow the rainfall distributions as defined on the map above. This means that a single county may have more than one rainfall distribution and the user must read the map to determine which rainfall distribution to use.

ATTACHMENT K-1.3

CURVE NUMBER DATA

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a, = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

ATTACHMENT K-1.4

CLOSURE TURF DESIGN GUIDE EXCERPTS

5.0 Hydrology

5.1 ClosureTurf® Hydrology Parameters

Currently, many regulatory agencies are requiring run-off curve numbers (RCN) of 95-98 of a typical landfill closure. ClosureTurf's RCN should be calculated between 92 and 95. This number was derived by TRI Environmental, Inc. and Colorado State University Hydraulics Laboratory in separate tests. Table 2 below shows the typical TR-55 design parameters for Hydrology using ClosureTurf®.

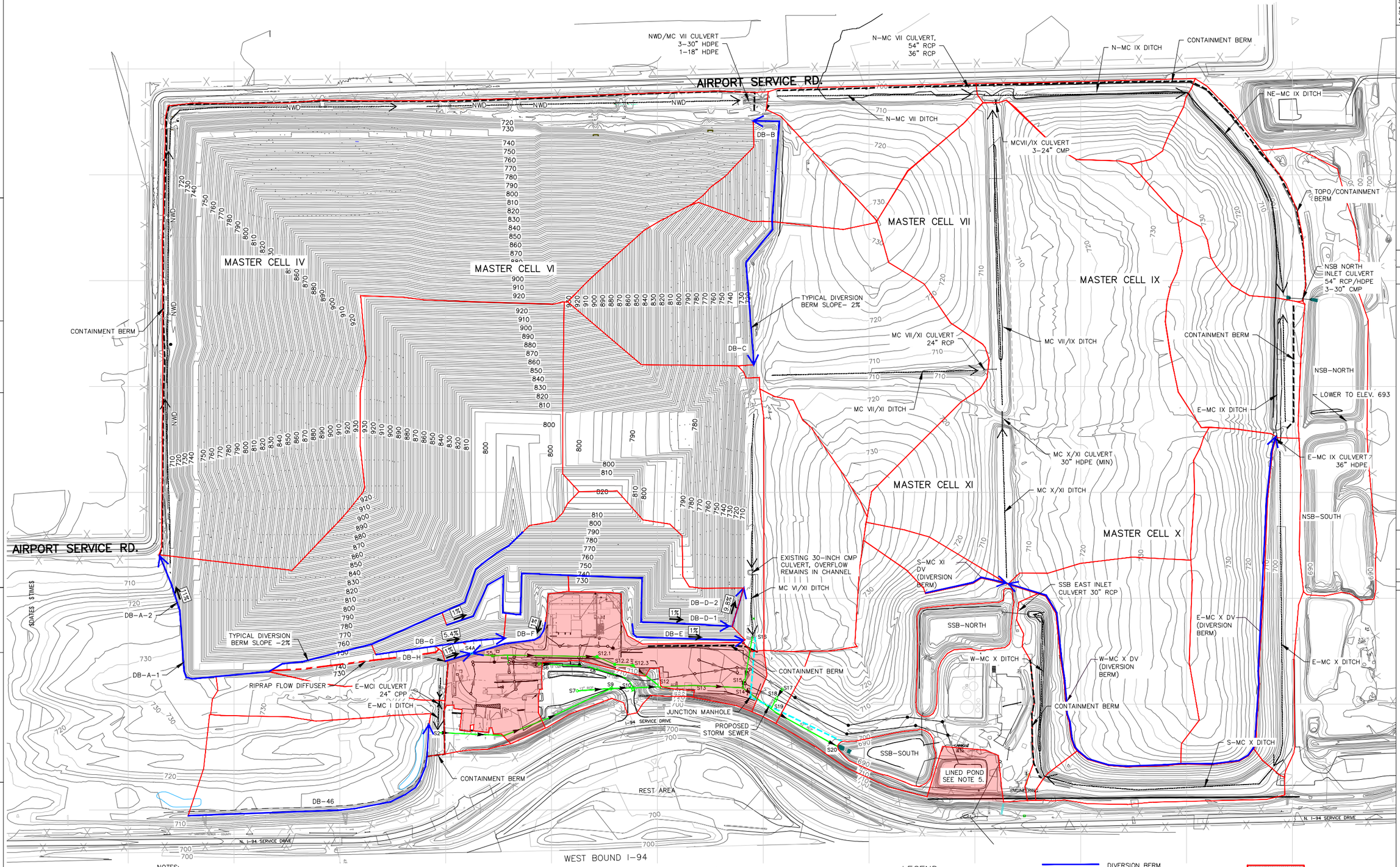
Closure Turf® Hydrology		
	TR-55 Data	
	Curve Number Depends on Rain Intensity	92[1] - 95
Sheet Flow	Manning's n	
	Slopes >10%	0.12
	Slopes <10%	0.22
	Flow Length	100'-300' dependent on Manning's n until a depth of not more than 0.1 foot is attained in the 2yr 24hr rainfall
	2yr-24hr Rain	SCS
	Land Slope	design
Shallow Concentrated Flow	Flow Length	design
	Slope	design
	Surface (paved/unpaved)	Paved
	X-Sect Area	ft^2
Channel Flow	Wetted Perimeter	Linear Feet
	Channel Slope	ft/ft
	Manning's n	0.03[2]
	Flow Length	design

1. RCN ranging from 92 in High Intensity Rainfalls to 95 in normal rainfall events.
2. Manning's n for channel flow will vary with depth of flow.

Table 2: ClosureTurf® TR-55 Data

ATTACHMENT K-1.5

SURFACE WATER MANAGEMENT FIGURES



NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN DECEMBER, 2020 BY WDI.
2. THE DESIGN SURFACE SHOWN REPRESENTS THE MCVI FINAL GRADES – 2021 REDESIGN BY CTI.
3. CONVEYANCE SYSTEMS ARE DESIGNED TO COLLECT AND CONTROL THE RUNOFF FROM AT LEAST A 25-YR, 24-HR STORM AND MANAGE A 100-YR, 24-HR STORM.
4. SURFACE WATER MANAGEMENT SYSTEM DESIGN INFORMATION FOR ENGINEERED TURF FINAL COVER PROVIDED IN APPENDIX K. ALTERNATE CONFIGURATIONS AND MATERIALS THAT MEET DESIGN CRITERIA MAY BE UTILIZED.
5. THIS EXPANSION REDUCES THE DRAINAGE AREA TO THE LINED POND. THEREFORE THE DESIGN OF THE LINED POND, LINED POND SEWER, AND ASSOCIATED DRAINAGE AREA WILL CONTINUE TO FUNCTION AS ORIGINALLY DESIGNED AND IS NOT PART OF THE SSB DRAINAGE AREA.

N

0 200 400

SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- DIVERSION BERM
- WATERSHED BOUNDARY
- DITCH FLOW PATH
- DIVERSION BERM
- RIPRAP FLOW DIFFUSER
- SOUTH SEDIMENTATION BASIN STORM SEWER (S19)
- LINED POND STORM SEWER
- CULVERT
- CATCH BASIN, CURB STYLE
- CATCH BASIN INLET
- STORM MANHOLE COVER
- LINED POND WATERSHED (NOT MODELED)
- CONTAINMENT BERM
- PROPOSED STORM SEWER
- PROPOSED CATCH BASIN/MANHOLE

REVISIONS						
REV	DATE	REVISION DESCRIPTION	DRN	APP		

DATE:	10/28/21
DESIGNED BY:	LEH
DRAWN BY:	LEH
CHECKED BY:	TCR
APPROVED BY:	XZ

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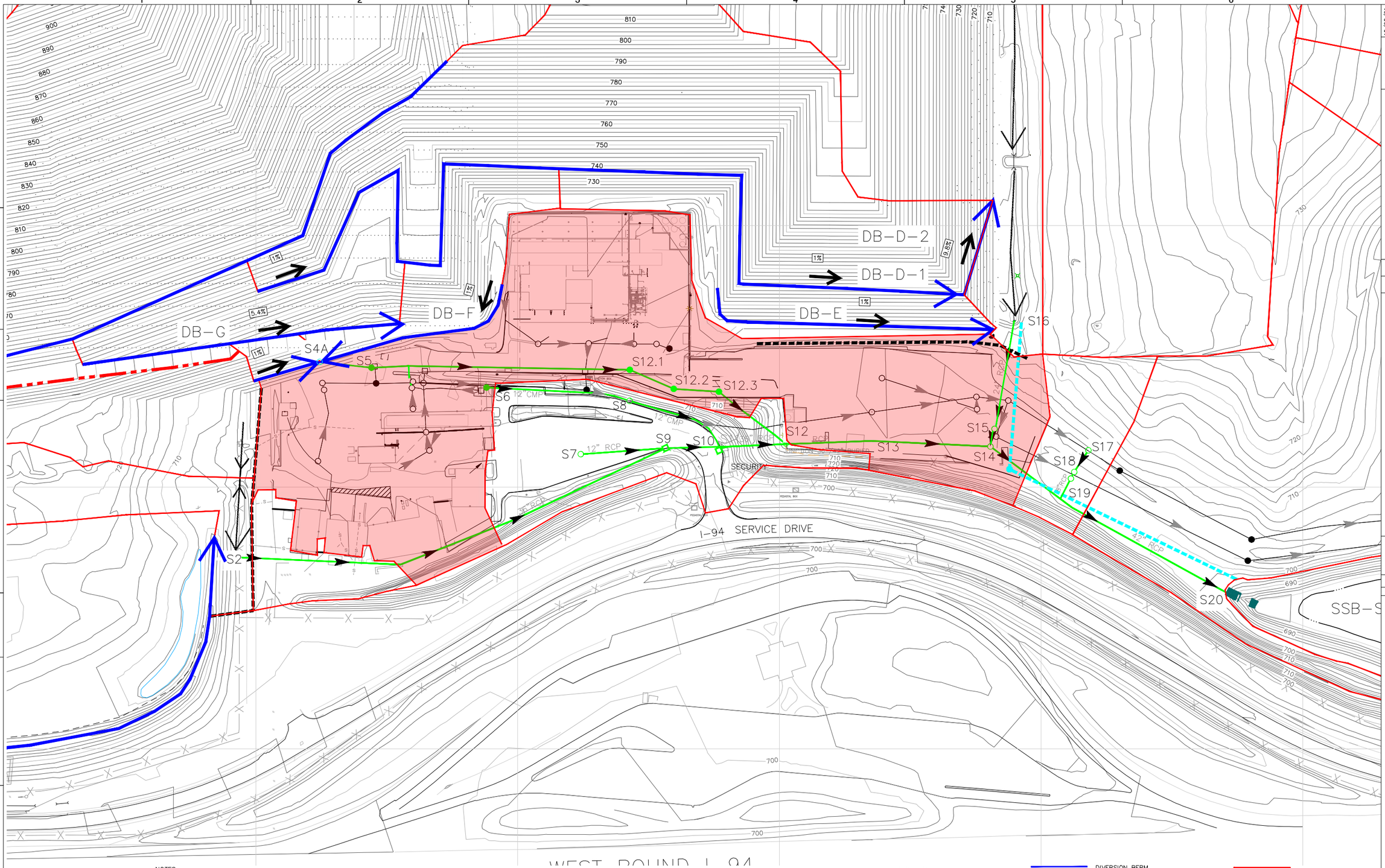
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI,F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

SUBWATERSHED MAP - ENGINEERED TURF

PROJECT NUMBER
1218070017

SCALE
AS NOTED

DRAWING NO
K-1.5
FIGURE 1



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N

0 80 160

SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- WATERSHED BOUNDARY
- DITCH FLOW PATH
- DIVERSION BERM
- DOWNSLOPE CHANNEL
- SOUTH SEDIMENTATION BASIN STORM SEWER
- LINED POND STORM SEWER
- CULVERT
- CATCH BASIN, CURB STYLE
- CATCH BASIN INLET
- STORM MANHOLE COVER
- LINED POND WATERSHED (NOT MODELED)
- CONTAINMENT BERM
- PROPOSED STORM SEWER
- PROPOSED CATCH BASIN/MANHOLE

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DATE:	10/28/21
DESIGNED BY:	LEH
DRAWN BY:	LEH
CHECKED BY:	TCR
APPROVED BY:	XZ

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REVISIONS REV	DATE	DESCRIPTION

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORM SEWER SYSTEM PLAN - ENGINEERED TURF

PROJECT NUMBER 1218070017

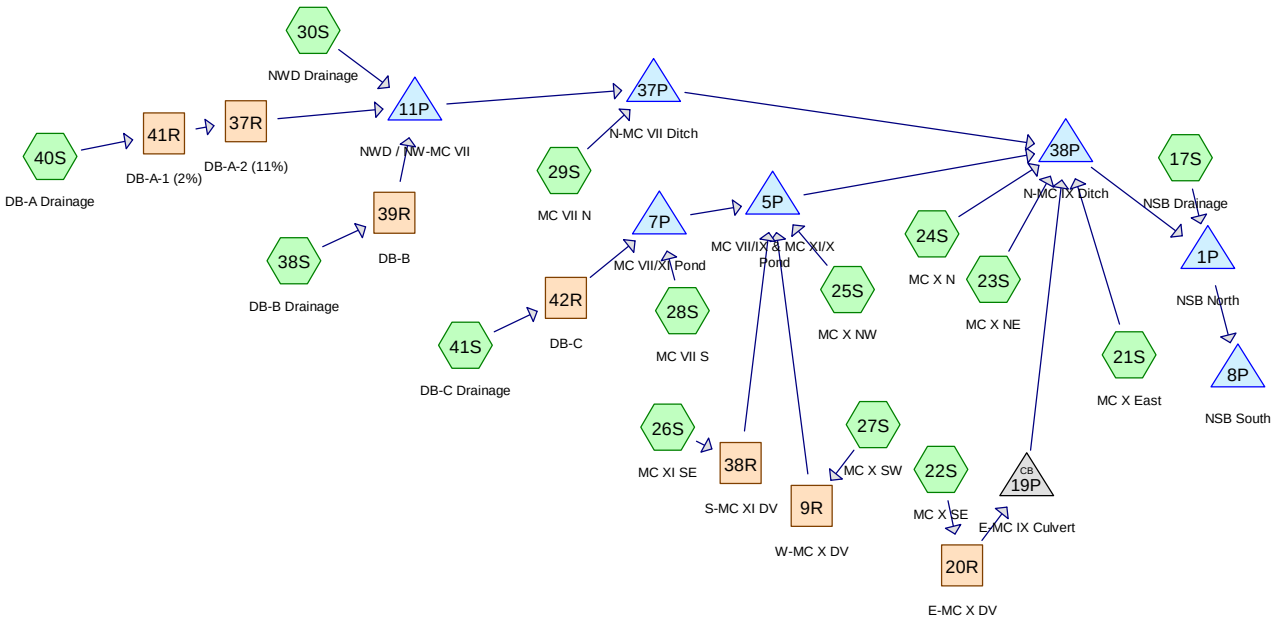
SCALE AS SHOWN

DRAWING NO K-1.5 FIGURE 2

ATTACHMENT K-1.6

SURFACE WATER MODEL OUTPUT

North Sedimentation Basin (NSB) HYDROCAD OUTPUT – 25-yr, 24-hr



Subcat Reach Pond Link

Routing Diagram for WDI Vert Exp NSB
Prepared by CTI, Printed 11/3/2021
HydroCAD® 10.10-5a s/n 11246 © 2020 HydroCAD Software Solutions LLC

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 17S: NSB Drainage Runoff Area=483,100 sf 0.00% Impervious Runoff Depth=3.38"
Tc=0.0 min CN=95 Runoff=76.09 cfs 3.125 af

Subcatchment 21S: MC X East Runoff Area=443,100 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=650' Slope=0.0370 '/' Tc=21.2 min CN=84 Runoff=25.66 cfs 1.973 af

Subcatchment 22S: MC X SE Runoff Area=527,091 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=240' Slope=0.0540 '/' Tc=15.5 min CN=84 Runoff=35.62 cfs 2.347 af

Subcatchment 23S: MC X NE Runoff Area=435,600 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=440' Slope=0.0590 '/' Tc=15.3 min CN=84 Runoff=29.79 cfs 1.939 af

Subcatchment 24S: MC X N Runoff Area=282,100 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=310' Slope=0.0930 '/' Tc=11.7 min CN=84 Runoff=21.63 cfs 1.256 af

Subcatchment 25S: MC X NW Runoff Area=2,437,500 sf 8.04% Impervious Runoff Depth=2.41"
Flow Length=820' Slope=0.0380 '/' Tc=23.0 min CN=85 Runoff=139.97 cfs 11.253 af

Subcatchment 26S: MC XI SE Runoff Area=95,200 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=405' Slope=0.0770 '/' Tc=13.4 min CN=84 Runoff=6.90 cfs 0.424 af

Subcatchment 27S: MC X SW Runoff Area=600,400 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=240' Slope=0.0400 '/' Tc=17.5 min CN=84 Runoff=38.28 cfs 2.673 af

Subcatchment 28S: MC VII S Runoff Area=923,419 sf 4.21% Impervious Runoff Depth=2.41"
Flow Length=1,070' Tc=20.9 min CN=85 Runoff=55.61 cfs 4.263 af

Subcatchment 29S: MC VII N Runoff Area=349,700 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=560' Slope=0.0390 '/' Tc=19.5 min CN=84 Runoff=21.14 cfs 1.557 af

Subcatchment 30S: NWD Drainage Runoff Area=3,609,746 sf 5.58% Impervious Runoff Depth=3.38"
Flow Length=886' Slope=0.2500 '/' Tc=7.2 min CN=95 Runoff=438.24 cfs 23.354 af

Subcatchment 38S: DB-B Drainage Runoff Area=96,773 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=378' Slope=0.2500 '/' Tc=6.4 min CN=95 Runoff=12.09 cfs 0.626 af

Subcatchment 40S: DB-A Drainage Runoff Area=1,755,927 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=1,150' Tc=7.8 min CN=95 Runoff=209.40 cfs 11.360 af

Subcatchment 41S: DB-C Drainage Runoff Area=487,859 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=381' Slope=0.2500 '/' Tc=6.4 min CN=95 Runoff=60.97 cfs 3.156 af

Reach 9R: W-MC X DV Avg. Flow Depth=1.37' Max Vel=3.22 fps Inflow=38.28 cfs 2.673 af
n=0.025 L=1,400.0' S=0.0050 '/' Capacity=91.23 cfs Outflow=33.14 cfs 2.673 af

Reach 20R: E-MC X DV Avg. Flow Depth=1.49' Max Vel=4.71 fps Inflow=35.62 cfs 2.347 af
n=0.025 L=1,780.0' S=0.0100 '/' Capacity=68.87 cfs Outflow=30.87 cfs 2.347 af

Reach 37R: DB-A-2 (11%) Avg. Flow Depth=1.71' Max Vel=21.33 fps Inflow=187.20 cfs 11.360 af
n=0.020 L=125.2' S=0.1097 '/' Capacity=837.73 cfs Outflow=186.68 cfs 11.360 af

Reach 38R: S-MC XI DV Avg. Flow Depth=0.66' Max Vel=3.70 fps Inflow=6.90 cfs 0.424 af
n=0.025 L=750.0' S=0.0180 '/' Capacity=57.72 cfs Outflow=6.40 cfs 0.424 af

Reach 39R: DB-B Avg. Flow Depth=0.89' Max Vel=5.83 fps Inflow=12.09 cfs 0.626 af
n=0.020 L=598.0' S=0.0200 '/' Capacity=99.84 cfs Outflow=11.29 cfs 0.626 af

Reach 41R: DB-A-1 (2%) Avg. Flow Depth=2.37' Max Vel=11.26 fps Inflow=209.40 cfs 11.360 af
n=0.020 L=2,146.0' S=0.0200 '/' Capacity=357.63 cfs Outflow=187.20 cfs 11.360 af

Reach 42R: DB-C Avg. Flow Depth=1.65' Max Vel=8.75 fps Inflow=60.97 cfs 3.156 af
n=0.020 L=724.0' S=0.0200 '/' Capacity=99.84 cfs Outflow=57.27 cfs 3.156 af

Pond 1P: NSB North Peak Elev=693.90' Storage=2,241,101 cf Inflow=198.30 cfs 65.232 af
Outflow=90.59 cfs 20.210 af

Pond 5P: MC VII/IX & MC XI/X Pond Peak Elev=703.18' Storage=433,061 cf Inflow=235.45 cfs 21.504 af
24.0" Round Culvert x 3.00 n=0.025 L=30.0' S=0.0033 '/' Outflow=59.68 cfs 19.337 af

Pond 7P: MC VII/XI Pond Peak Elev=707.93' Storage=74,866 cf Inflow=98.14 cfs 7.419 af
Outflow=65.39 cfs 7.155 af

Pond 8P: NSB South Peak Elev=686.98' Storage=1,395,115 cf Inflow=90.59 cfs 20.210 af
Outflow=0.00 cfs 0.000 af

Pond 11P: NWD / NW-MC VII Peak Elev=710.46' Storage=549,996 cf Inflow=580.45 cfs 35.340 af
Outflow=139.72 cfs 35.340 af

Pond 19P: E-MC IX Culvert Peak Elev=704.16' Inflow=30.87 cfs 2.347 af
36.0" Round Culvert n=0.012 L=72.0' S=0.0365 '/' Outflow=30.87 cfs 2.347 af

Pond 37P: N-MC VII Ditch Peak Elev=702.15' Storage=132,671 cf Inflow=157.63 cfs 36.897 af
Outflow=145.32 cfs 35.255 af

Pond 38P: N-MC IX Ditch Peak Elev=699.67' Storage=362,060 cf Inflow=263.71 cfs 62.107 af
Outflow=195.50 cfs 62.107 af

Total Runoff Area = 287.592 ac Runoff Volume = 69.305 af Average Runoff Depth = 2.89"
96.52% Pervious = 277.574 ac 3.48% Impervious = 10.018 ac

Summary for Subcatchment 17S: NSB Drainage

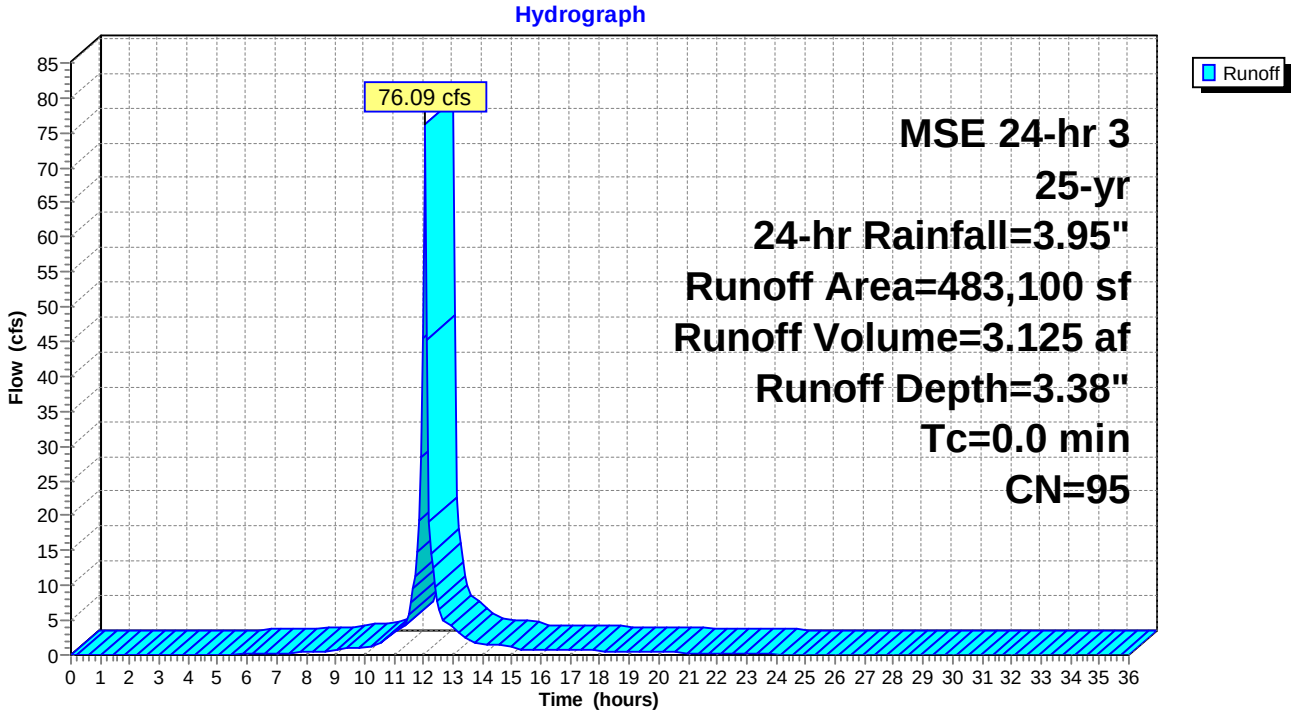
Drainage area is pond area and land area
Land area = 483,100 - 111,900 = 371,200

Runoff = 76.09 cfs @ 12.06 hrs, Volume= 3.125 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
111,900	84	50-75% Grass cover, Fair, HSG D
371,200	98	Water Surface, 0% imp, HSG D
483,100	95	Weighted Average
483,100		100.00% Pervious Area

Subcatchment 17S: NSB Drainage



Summary for Subcatchment 21S: MC X East

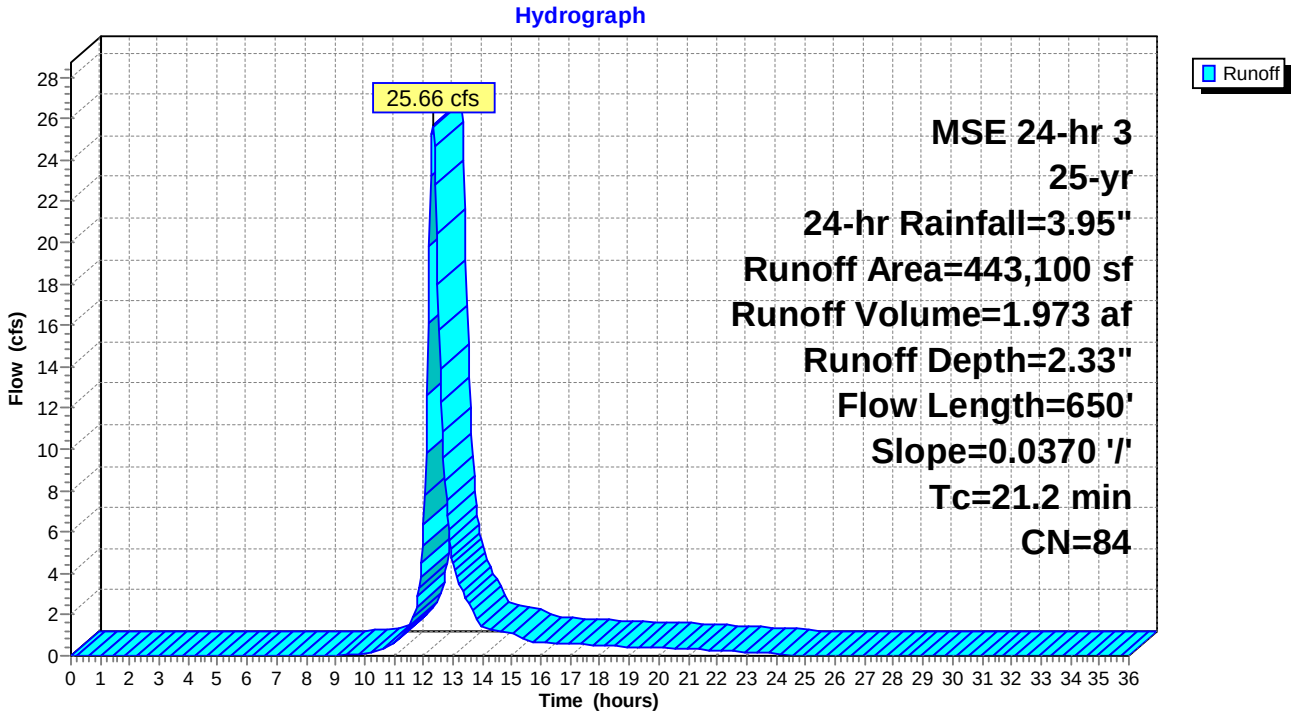
Runoff = 25.66 cfs @ 12.31 hrs, Volume= 1.973 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
443,100	84	50-75% Grass cover, Fair, HSG D
443,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	200	0.0370	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
5.6	450	0.0370	1.35		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.2	650	Total			

Subcatchment 21S: MC X East



Summary for Subcatchment 22S: MC X SE

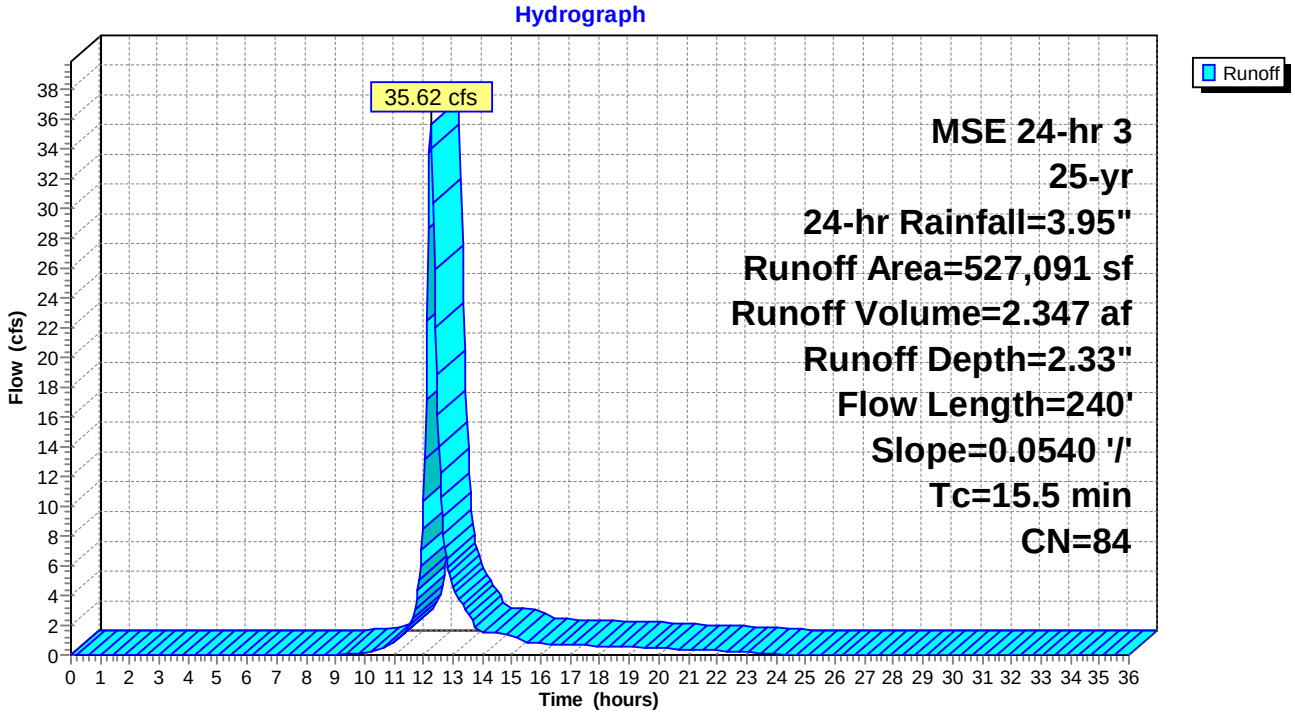
Runoff = 35.62 cfs @ 12.24 hrs, Volume= 2.347 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
527,091	84	50-75% Grass cover, Fair, HSG D
527,091		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	240	0.0540	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 22S: MC X SE



Summary for Subcatchment 23S: MC X NE

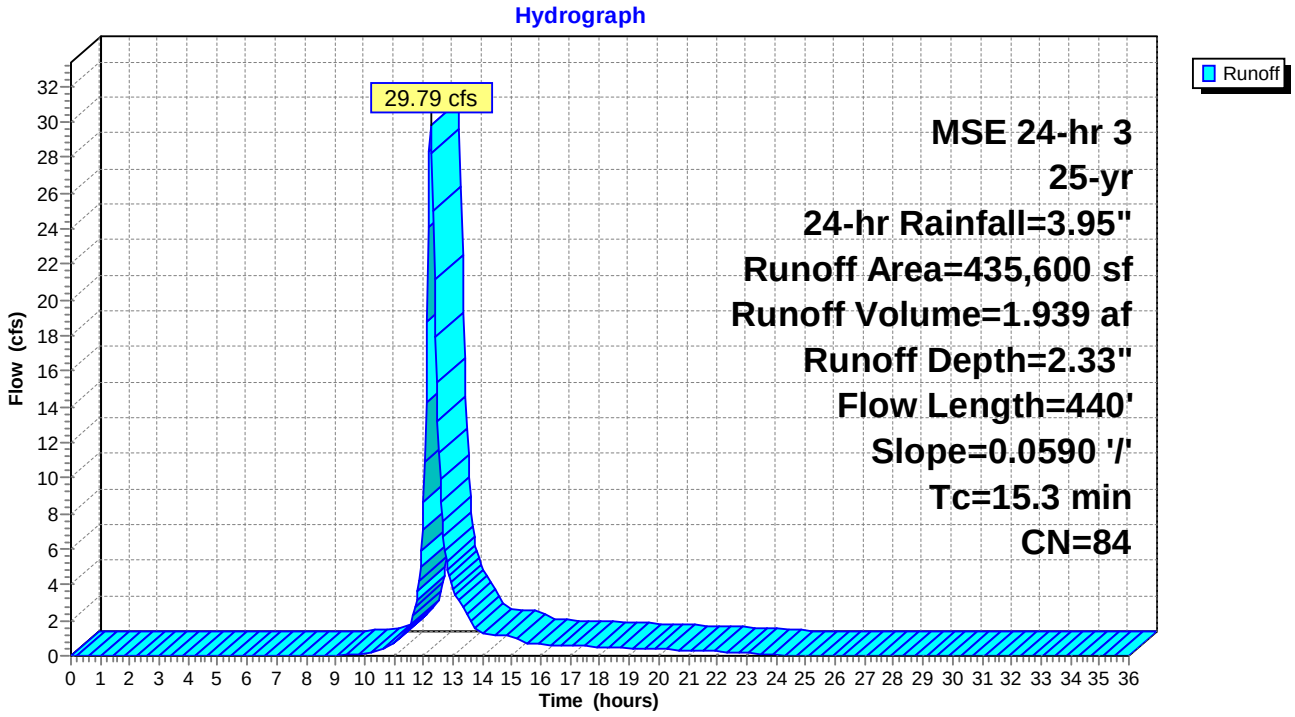
Runoff = 29.79 cfs @ 12.24 hrs, Volume= 1.939 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
435,600	84	50-75% Grass cover, Fair, HSG D
435,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	200	0.0590	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.4	240	0.0590	1.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.3	440	Total			

Subcatchment 23S: MC X NE



Summary for Subcatchment 24S: MC X N

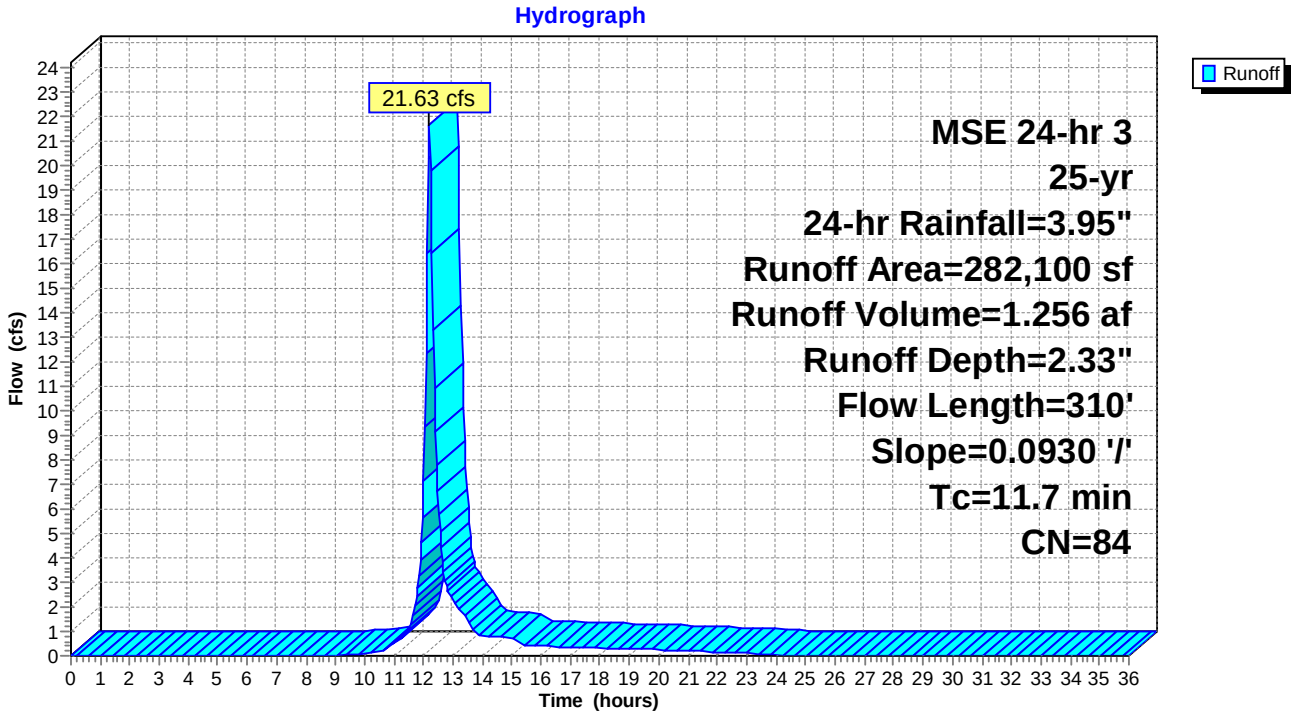
Runoff = 21.63 cfs @ 12.20 hrs, Volume= 1.256 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
282,100	84	50-75% Grass cover, Fair, HSG D
282,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	200	0.0930	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
0.9	110	0.0930	2.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.7	310	Total			

Subcatchment 24S: MC X N



Summary for Subcatchment 25S: MC X NW

Drainage area is pond area and land area
Land area = 2,437,500 - 196,000 = 2,241,500

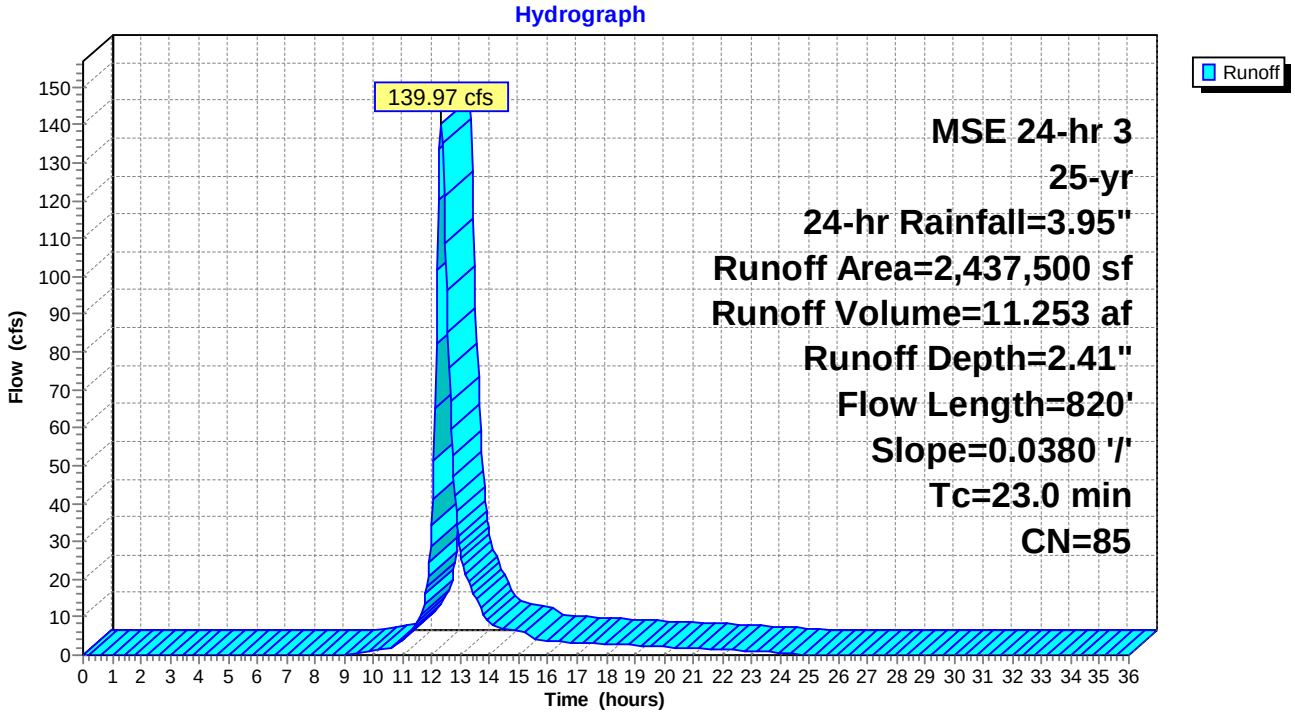
Runoff = 139.97 cfs @ 12.33 hrs, Volume= 11.253 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
196,000	98	Water Surface, HSG D
2,241,500	84	50-75% Grass cover, Fair, HSG D
2,437,500	85	Weighted Average
2,241,500		91.96% Pervious Area
196,000		8.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	200	0.0380	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
7.6	620	0.0380	1.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
23.0	820	Total			

Subcatchment 25S: MC X NW



Summary for Subcatchment 26S: MC XI SE

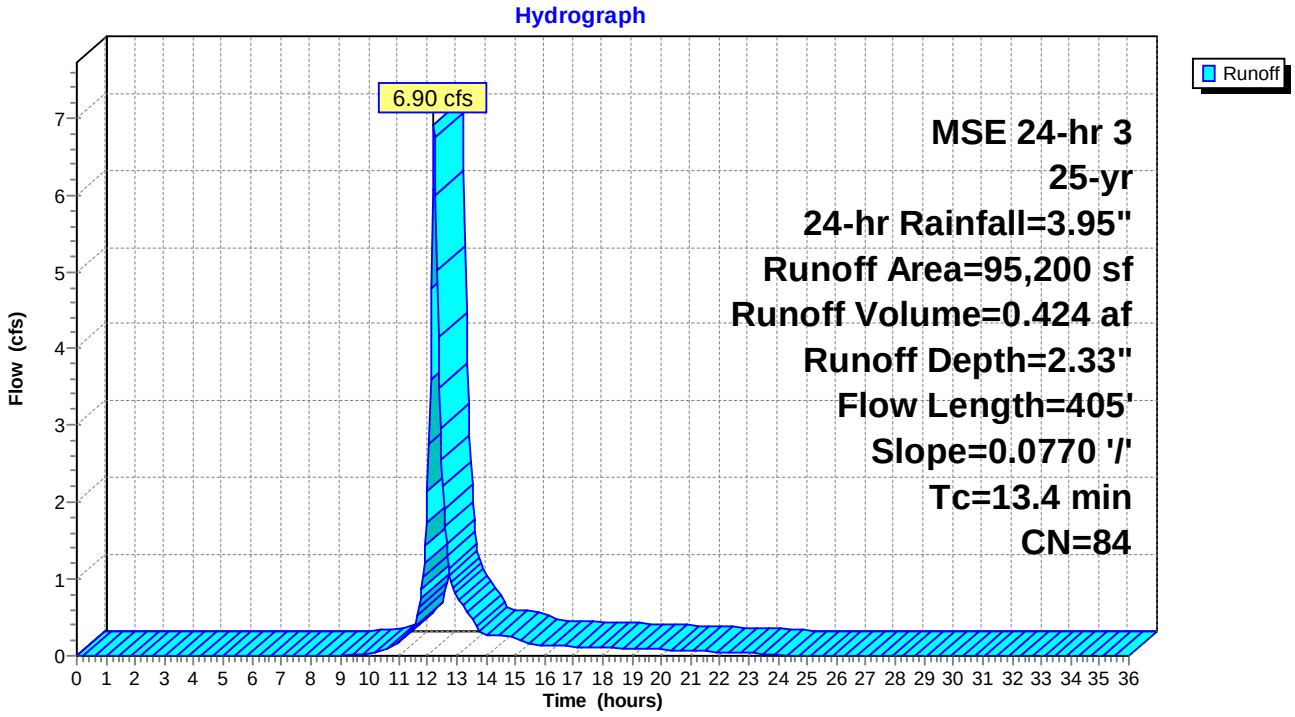
Runoff = 6.90 cfs @ 12.22 hrs, Volume= 0.424 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
95,200	84	50-75% Grass cover, Fair, HSG D
95,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	200	0.0770	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.8	205	0.0770	1.94		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.4	405	Total			

Subcatchment 26S: MC XI SE



Summary for Subcatchment 27S: MC X SW

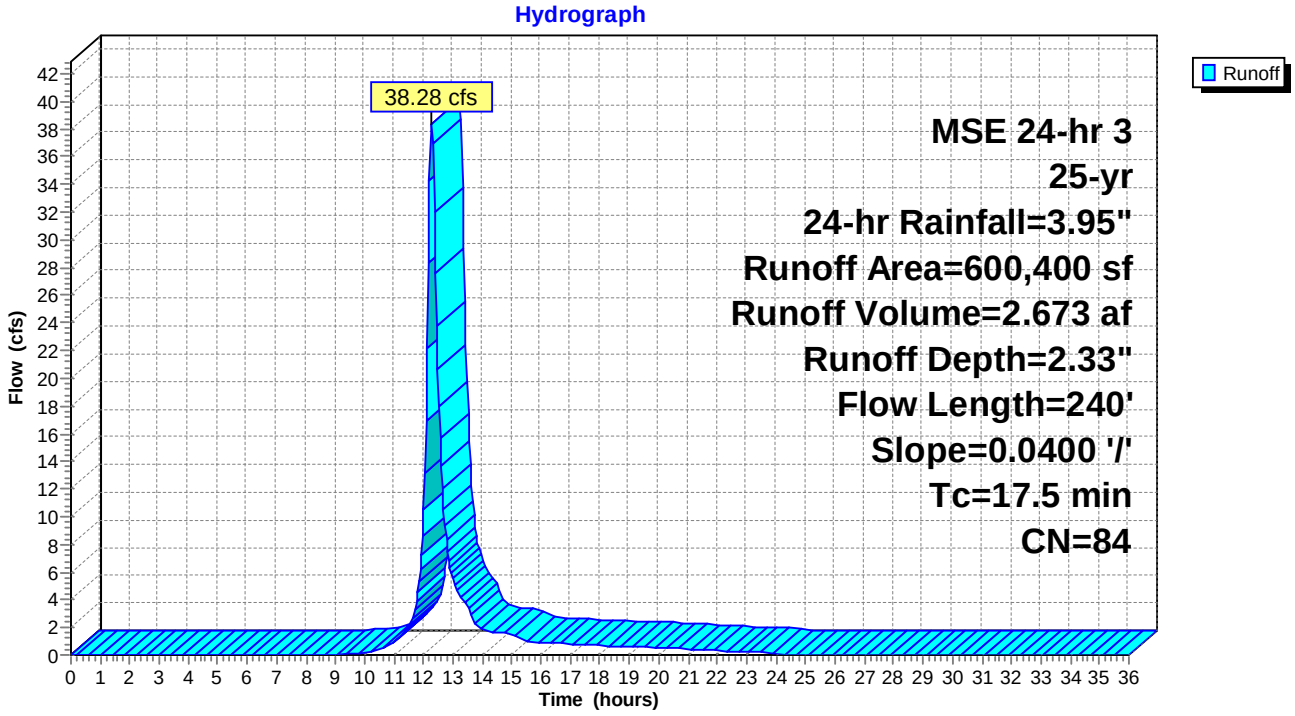
Runoff = 38.28 cfs @ 12.26 hrs, Volume= 2.673 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
600,400	84	50-75% Grass cover, Fair, HSG D
600,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.5	240	0.0400	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 27S: MC X SW



Summary for Subcatchment 28S: MC VII S

Drainage area is pond area and land area
Land area = 998,400 - 38,900 = 959,500

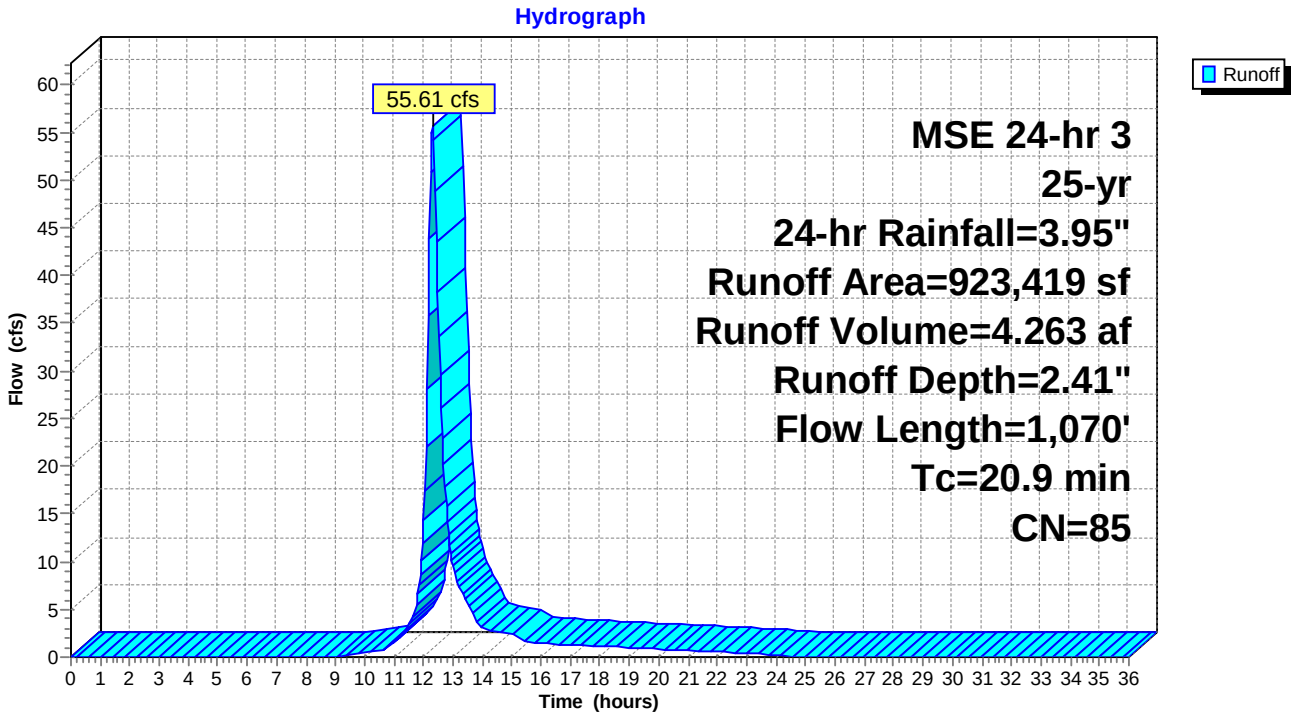
Runoff = 55.61 cfs @ 12.31 hrs, Volume= 4.263 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
38,900	98	Water Surface, HSG D
884,519	84	50-75% Grass cover, Fair, HSG D
923,419	85	Weighted Average
884,519		95.79% Pervious Area
38,900		4.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	200	0.0300	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.3	170	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	700	0.0140	7.03	84.40	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
20.9	1,070	Total			

Subcatchment 28S: MC VII S



Summary for Subcatchment 29S: MC VII N

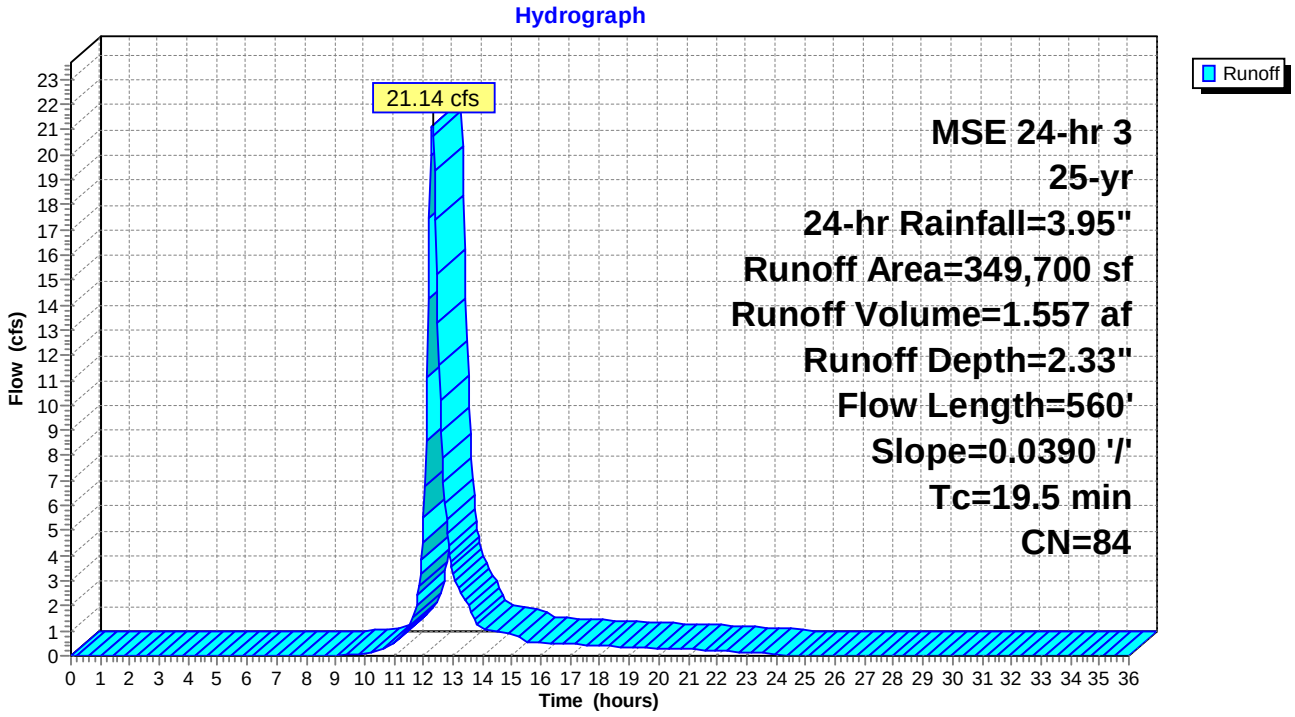
Runoff = 21.14 cfs @ 12.29 hrs, Volume= 1.557 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
349,700	84	50-75% Grass cover, Fair, HSG D
349,700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	200	0.0390	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
4.3	360	0.0390	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.5	560	Total			

Subcatchment 29S: MC VII N



Summary for Subcatchment 30S: NWD Drainage

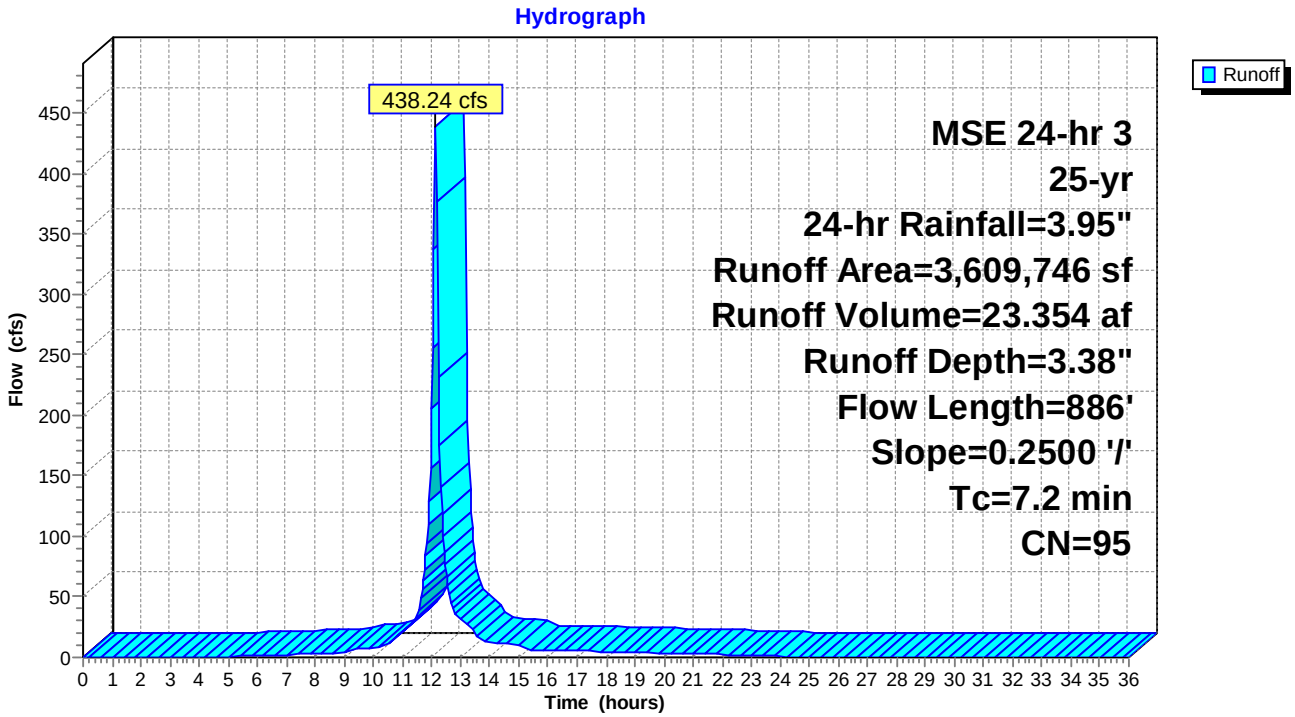
Runoff = 438.24 cfs @ 12.14 hrs, Volume= 23.354 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
	201,500	98	Water Surface, HSG D
*	3,408,246	95	Closure Turf
	3,609,746	95	Weighted Average
	3,408,246		94.42% Pervious Area
	201,500		5.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	200	0.2500	0.55		**Sheet Flow,** n= 0.120 P2= 2.35"
1.1	686	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.2	886	Total			

Subcatchment 30S: NWD Drainage



Summary for Subcatchment 38S: DB-B Drainage

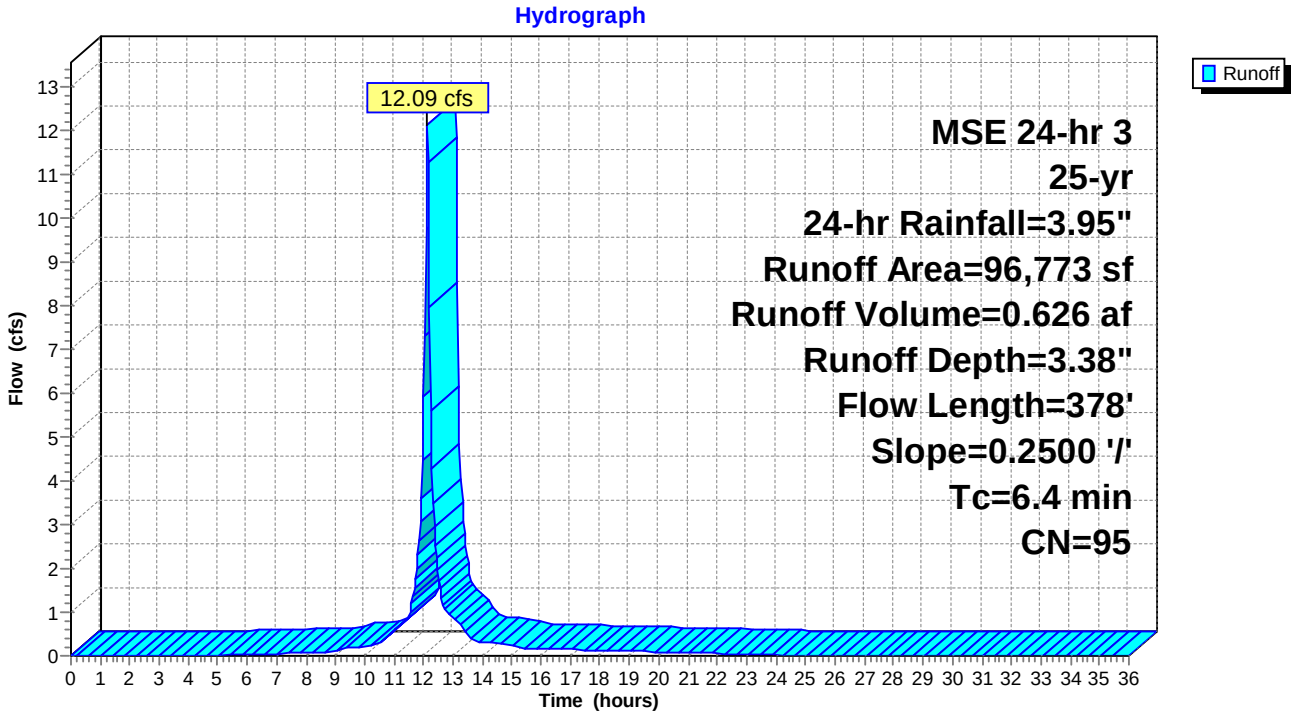
Runoff = 12.09 cfs @ 12.13 hrs, Volume= 0.626 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
*	96,773	95	Closure Turf
	96,773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	200	0.2500	0.55		**Sheet Flow,** n= 0.120 P2= 2.35"
0.3	178	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.4	378	Total			

Subcatchment 38S: DB-B Drainage



Summary for Subcatchment 40S: DB-A Drainage

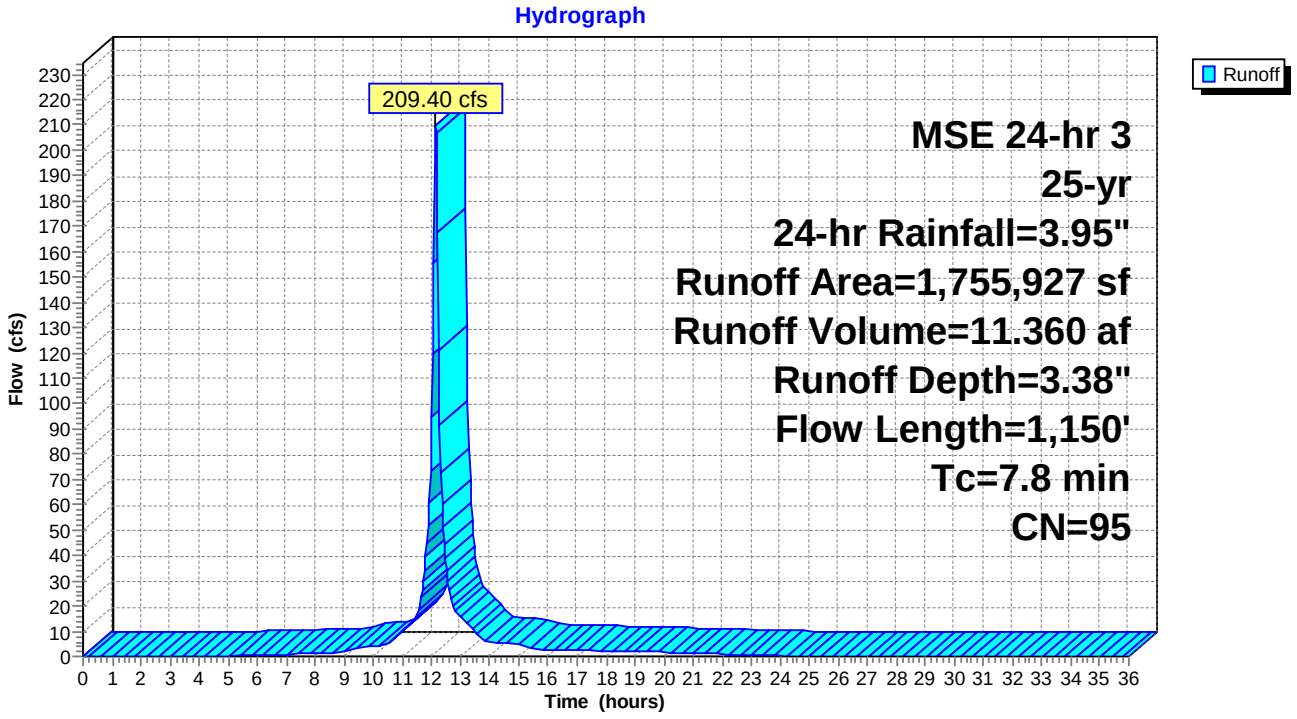
Runoff = 209.40 cfs @ 12.15 hrs, Volume= 11.360 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
*	1,755,927	95	Closure Turf
	1,755,927		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	200	0.2500	0.55		**Sheet Flow,** n= 0.120 P2= 2.35"
0.5	313	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	189	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	400	0.0400	14.86	178.32	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.020
0.0	48	0.1600	29.72	356.64	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.020
7.8	1,150	Total			

Subcatchment 40S: DB-A Drainage



Summary for Subcatchment 41S: DB-C Drainage

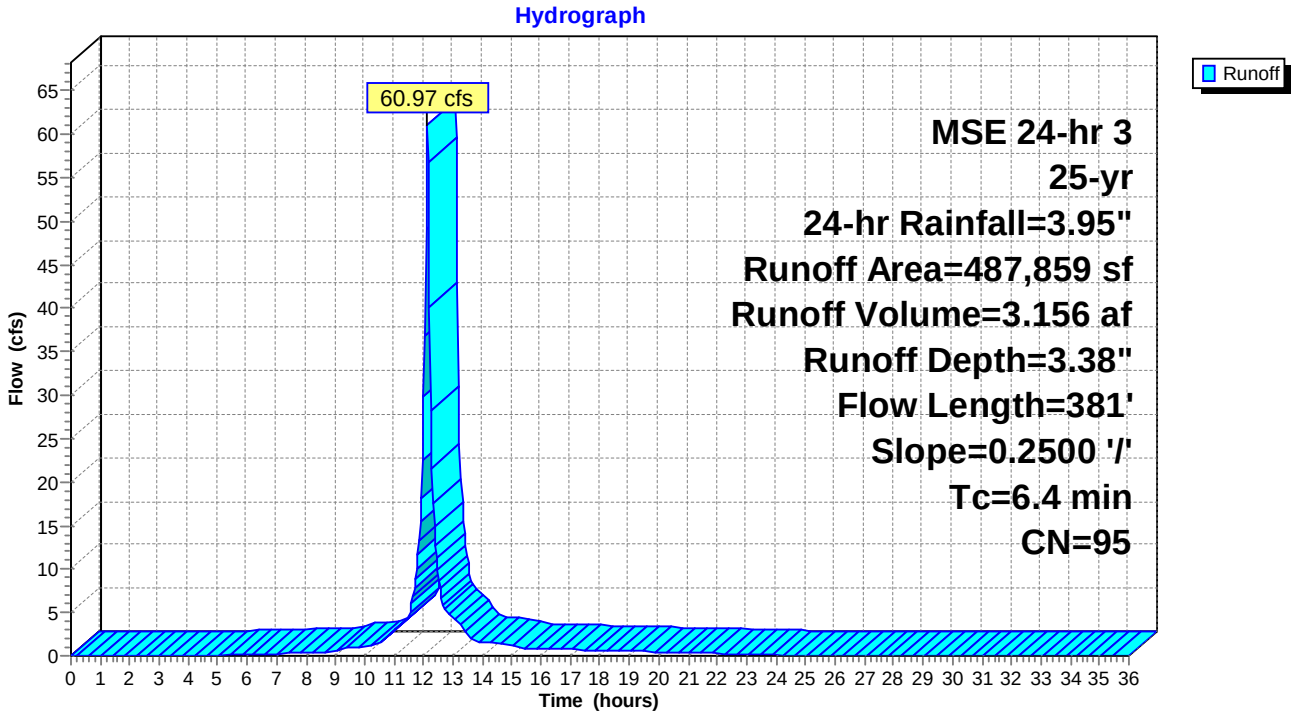
Runoff = 60.97 cfs @ 12.13 hrs, Volume= 3.156 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
*	487,859	95	Closure Turf
	487,859		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	200	0.2500	0.55		**Sheet Flow,** n= 0.120 P2= 2.35"
0.3	181	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.4	381	Total			

Subcatchment 41S: DB-C Drainage



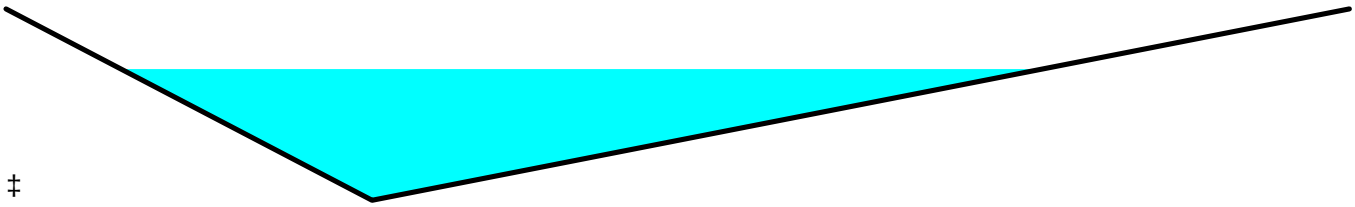
Summary for Reach 9R: W-MC X DV

Inflow Area = 13.783 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 38.28 cfs @ 12.26 hrs, Volume= 2.673 af
Outflow = 33.14 cfs @ 12.47 hrs, Volume= 2.673 af, Atten= 13%, Lag= 12.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.22 fps, Min. Travel Time= 7.2 min
Avg. Velocity = 0.88 fps, Avg. Travel Time= 26.6 min

Peak Storage= 14,417 cf @ 12.35 hrs
Average Depth at Peak Storage= 1.37' , Surface Width= 15.05'
Bank-Full Depth= 2.00' Flow Area= 22.0 sf, Capacity= 91.23 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 3.0 8.0 '/' Top Width= 22.00'
Length= 1,400.0' Slope= 0.0050 '/'
Inlet Invert= 713.00', Outlet Invert= 706.00'



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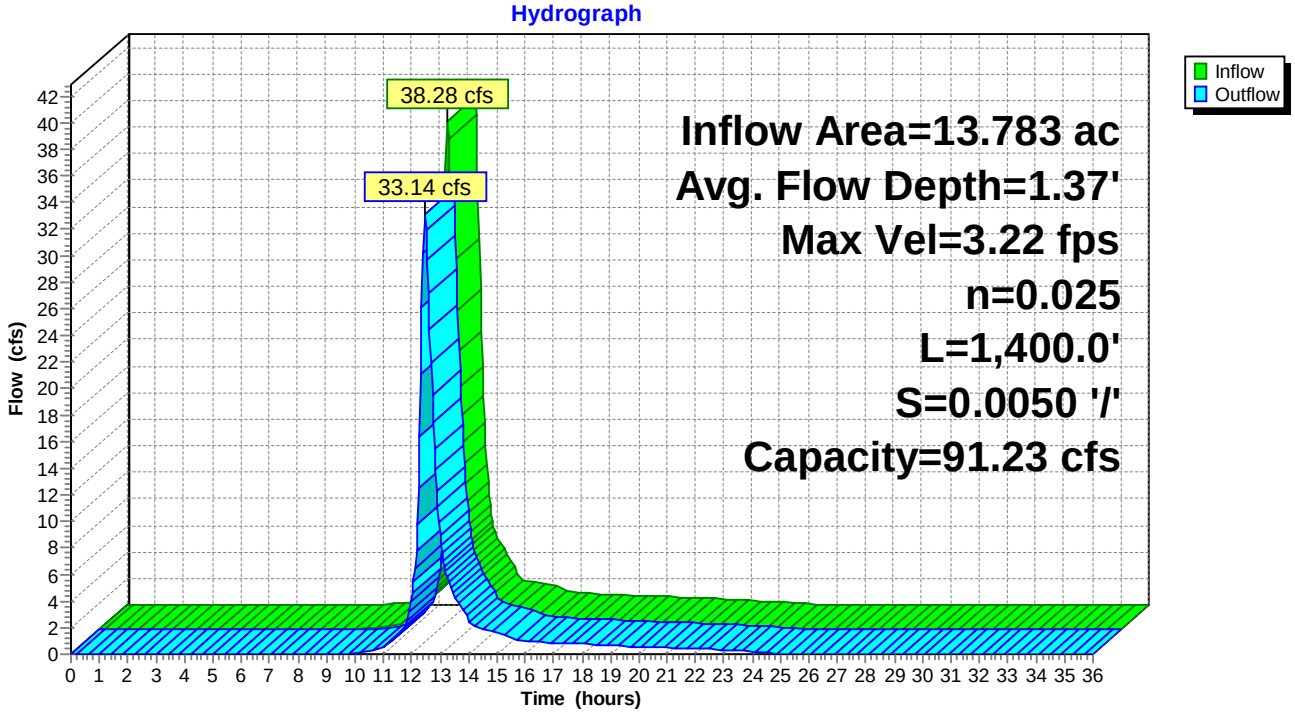
Reach 9R: W-MC X DV



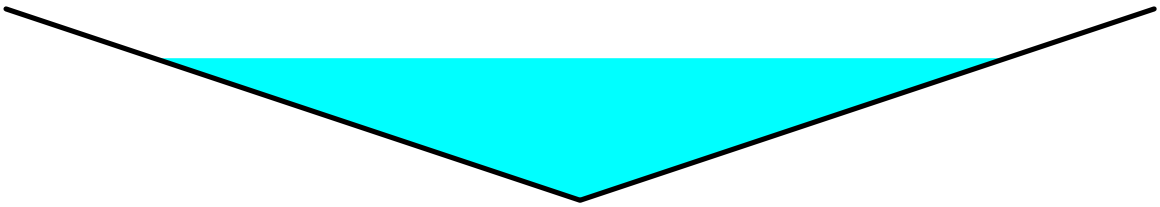
Summary for Reach 20R: E-MC X DV

Inflow Area = 12.100 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 35.62 cfs @ 12.24 hrs, Volume= 2.347 af
Outflow = 30.87 cfs @ 12.42 hrs, Volume= 2.347 af, Atten= 13%, Lag= 10.7 min

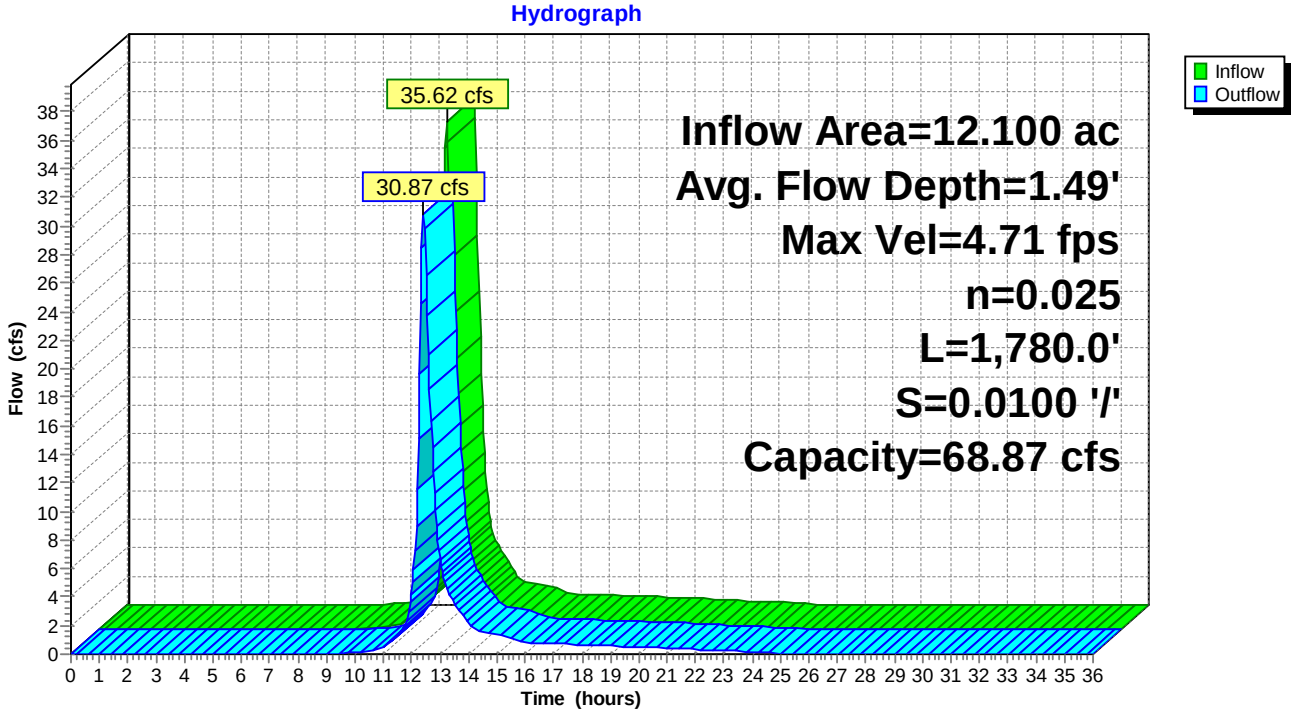
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 4.71 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 22.3 min

Peak Storage= 11,776 cf @ 12.32 hrs
Average Depth at Peak Storage= 1.49' , Surface Width= 8.91'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.87 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 1,780.0' Slope= 0.0100 '/'
Inlet Invert= 723.00', Outlet Invert= 705.20'



Reach 20R: E-MC X DV



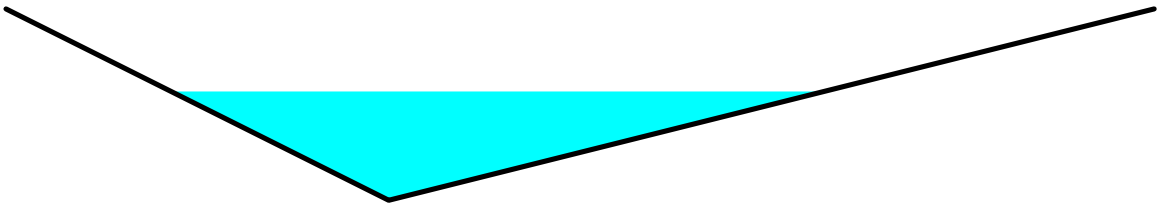
Summary for Reach 37R: DB-A-2 (11%)

Inflow Area = 40.311 ac, 0.00% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 187.20 cfs @ 12.23 hrs, Volume= 11.360 af
Outflow = 186.68 cfs @ 12.24 hrs, Volume= 11.360 af, Atten= 0%, Lag= 0.2 min

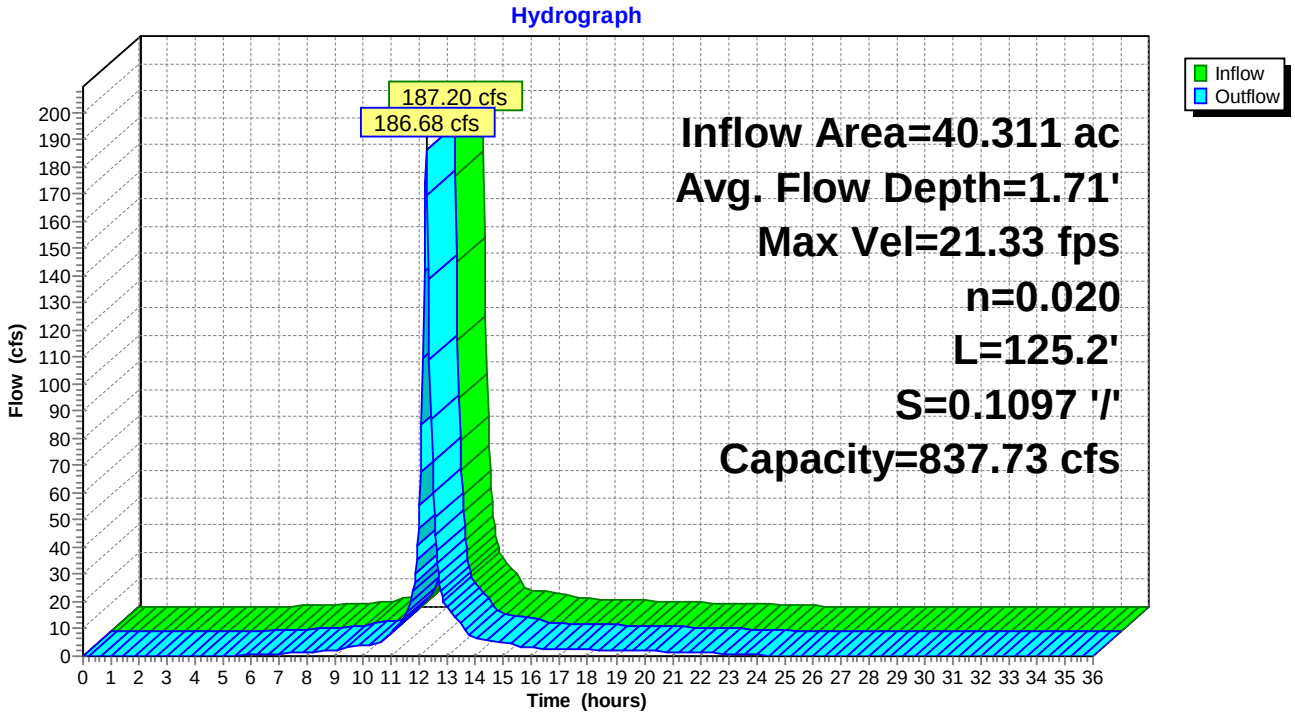
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 21.33 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 6.40 fps, Avg. Travel Time= 0.3 min

Peak Storage= 1,099 cf @ 12.24 hrs
Average Depth at Peak Storage= 1.71' , Surface Width= 10.26'
Bank-Full Depth= 3.00' Flow Area= 27.0 sf, Capacity= 837.73 cfs

0.00' x 3.00' deep channel, n= 0.020
Side Slope Z-value= 2.0 4.0 '/' Top Width= 18.00'
Length= 125.2' Slope= 0.1097 '/'
Inlet Invert= 728.00', Outlet Invert= 714.26'



Reach 37R: DB-A-2 (11%)



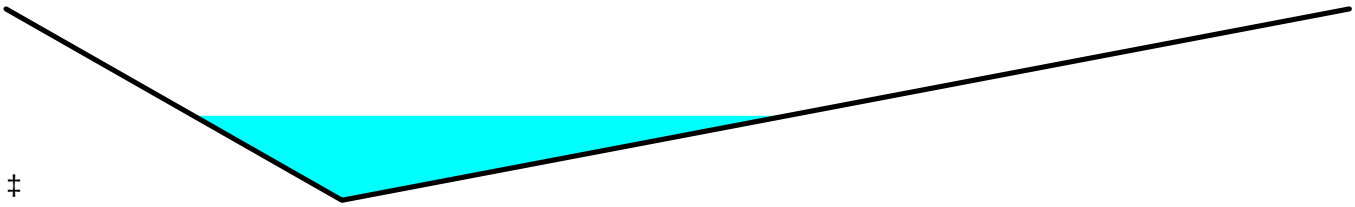
Summary for Reach 38R: S-MC XI DV

Inflow Area = 2.185 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 6.90 cfs @ 12.22 hrs, Volume= 0.424 af
Outflow = 6.40 cfs @ 12.32 hrs, Volume= 0.424 af, Atten= 7%, Lag= 6.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.70 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 1.26 fps, Avg. Travel Time= 9.9 min

Peak Storage= 1,310 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.66' , Surface Width= 5.29'
Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 57.72 cfs

0.00' x 1.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 6.0 '/' Top Width= 12.00'
Length= 750.0' Slope= 0.0180 '/'
Inlet Invert= 719.00', Outlet Invert= 705.50'



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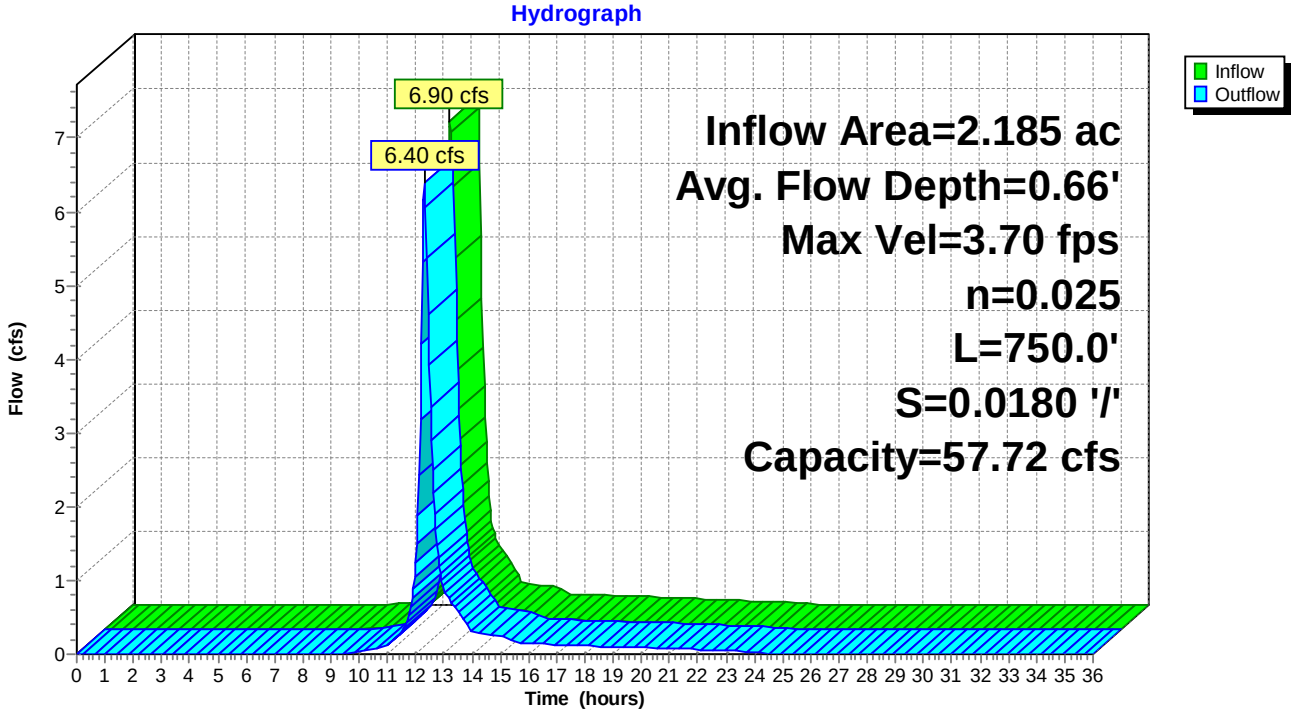
Reach 38R: S-MC XI DV



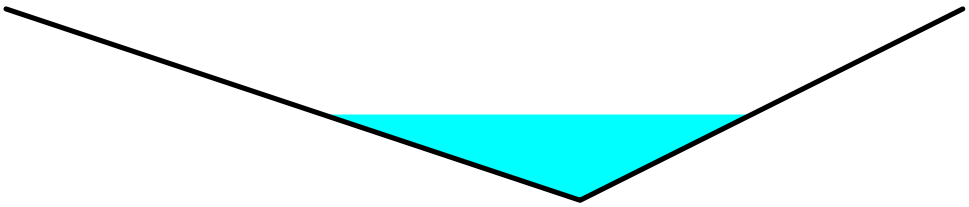
Summary for Reach 39R: DB-B

Inflow Area = 2.222 ac, 0.00% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 12.09 cfs @ 12.13 hrs, Volume= 0.626 af
Outflow = 11.29 cfs @ 12.18 hrs, Volume= 0.626 af, Atten= 7%, Lag= 3.1 min

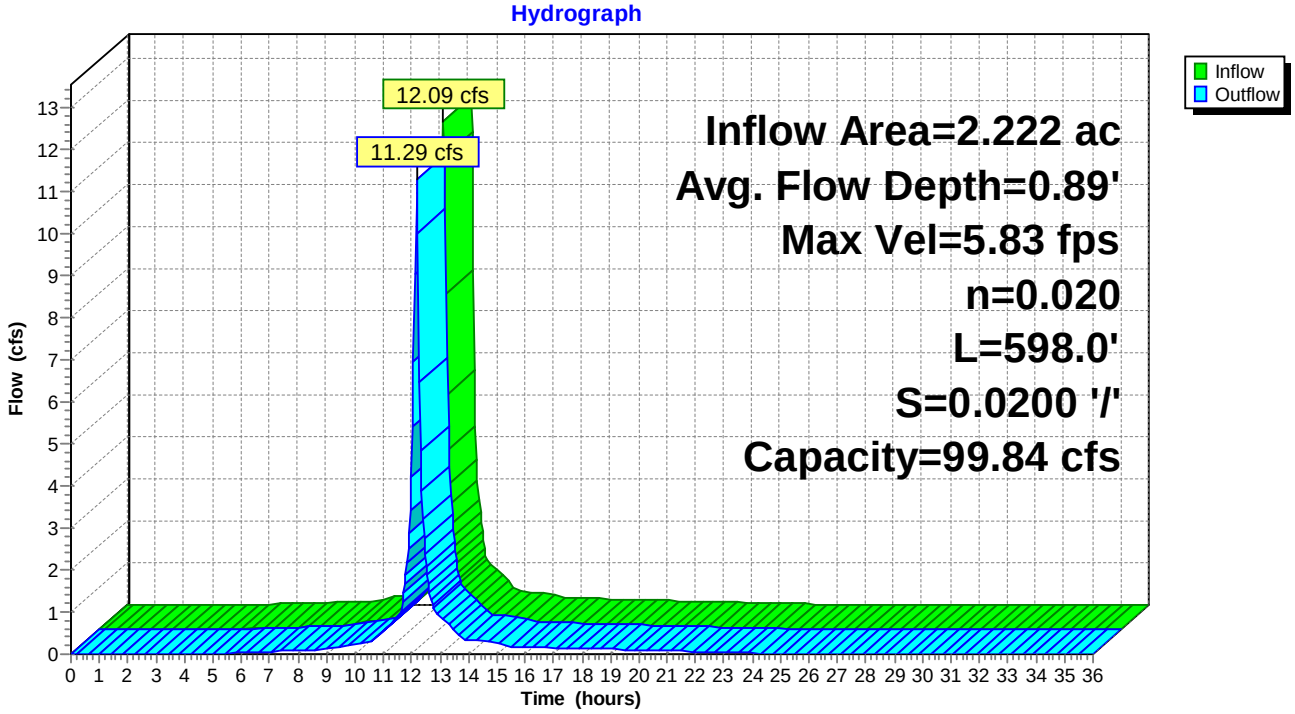
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 5.83 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.88 fps, Avg. Travel Time= 5.3 min

Peak Storage= 1,194 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.89' , Surface Width= 4.47'
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 99.84 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 3.0 2.0 '/' Top Width= 10.00'
Length= 598.0' Slope= 0.0200 '/'
Inlet Invert= 725.96', Outlet Invert= 714.00'



Reach 39R: DB-B



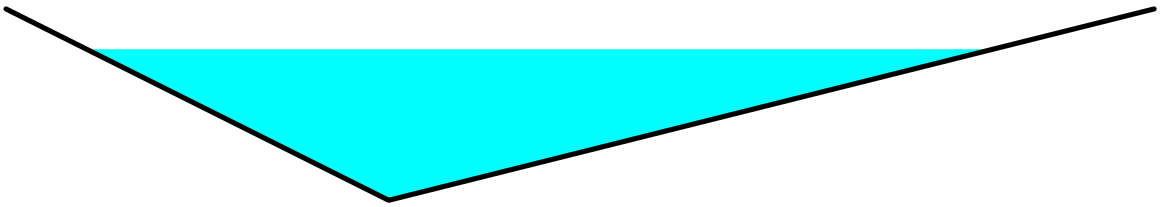
Summary for Reach 41R: DB-A-1 (2%)

Inflow Area = 40.311 ac, 0.00% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 209.40 cfs @ 12.15 hrs, Volume= 11.360 af
Outflow = 187.20 cfs @ 12.23 hrs, Volume= 11.360 af, Atten= 11%, Lag= 5.2 min

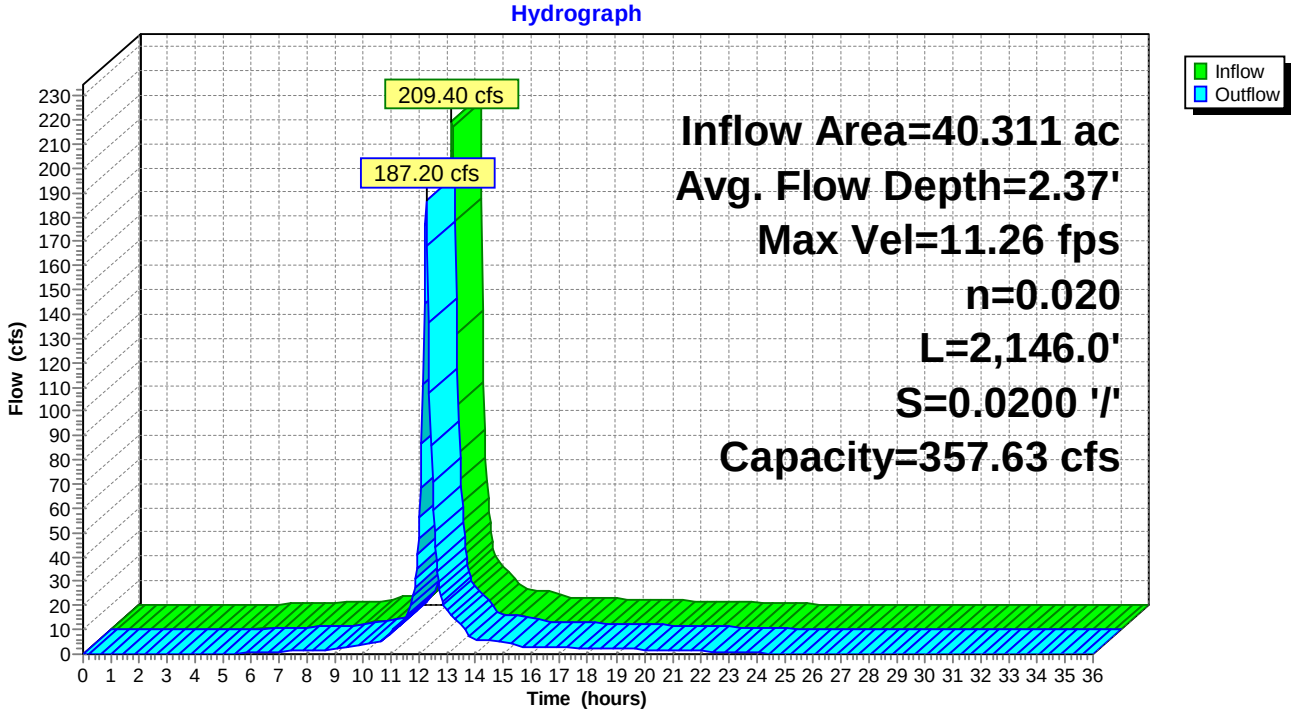
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 11.26 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 3.27 fps, Avg. Travel Time= 10.9 min

Peak Storage= 36,121 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.37' , Surface Width= 14.22'
Bank-Full Depth= 3.00' Flow Area= 27.0 sf, Capacity= 357.63 cfs

0.00' x 3.00' deep channel, n= 0.020
Side Slope Z-value= 2.0 4.0 '/' Top Width= 18.00'
Length= 2,146.0' Slope= 0.0200 '/'
Inlet Invert= 770.92', Outlet Invert= 728.00'



Reach 41R: DB-A-1 (2%)



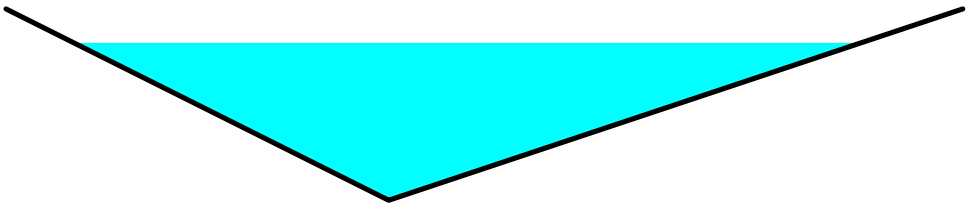
Summary for Reach 42R: DB-C

Inflow Area = 11.200 ac, 0.00% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 60.97 cfs @ 12.13 hrs, Volume= 3.156 af
Outflow = 57.27 cfs @ 12.17 hrs, Volume= 3.156 af, Atten= 6%, Lag= 2.4 min

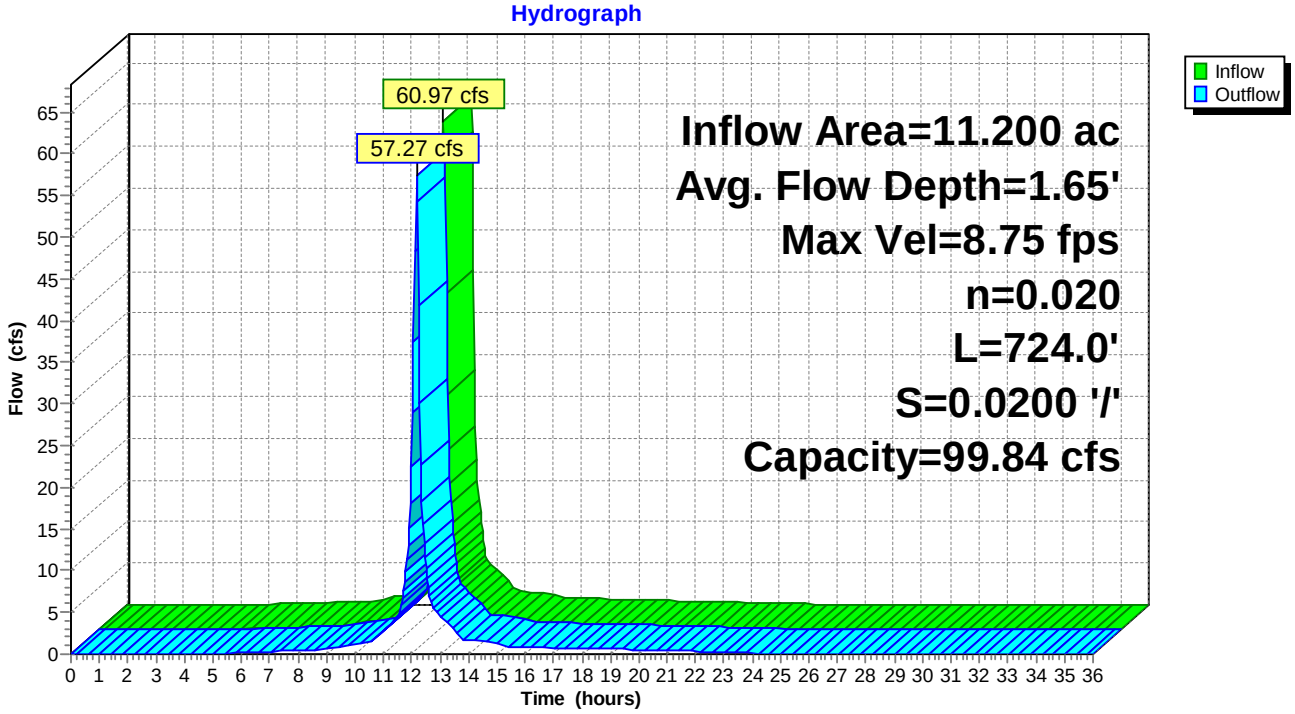
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 8.75 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 2.75 fps, Avg. Travel Time= 4.4 min

Peak Storage= 4,904 cf @ 12.15 hrs
Average Depth at Peak Storage= 1.65' , Surface Width= 8.23'
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 99.84 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 2.0 3.0 '/' Top Width= 10.00'
Length= 724.0' Slope= 0.0200 '/'
Inlet Invert= 726.48', Outlet Invert= 712.00'



Reach 42R: DB-C



Summary for Pond 1P: NSB North

Inflow Area = 287.592 ac, 3.48% Impervious, Inflow Depth = 2.72" for 25-yr, 24-hr event
Inflow = 198.30 cfs @ 13.28 hrs, Volume= 65.232 af
Outflow = 90.59 cfs @ 15.44 hrs, Volume= 20.210 af, Atten= 54%, Lag= 129.6 min
Primary = 90.59 cfs @ 15.44 hrs, Volume= 20.210 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 674.00' Surf.Area= 53,100 sf Storage= 144,600 cf
Peak Elev= 693.90' @ 15.44 hrs Surf.Area= 152,081 sf Storage= 2,241,101 cf (2,096,501 cf above start)

Plug-Flow detention time= 359.0 min calculated for 16.871 af (26% of inflow)
Center-of-Mass det. time= 195.9 min (1,059.6 - 863.7)

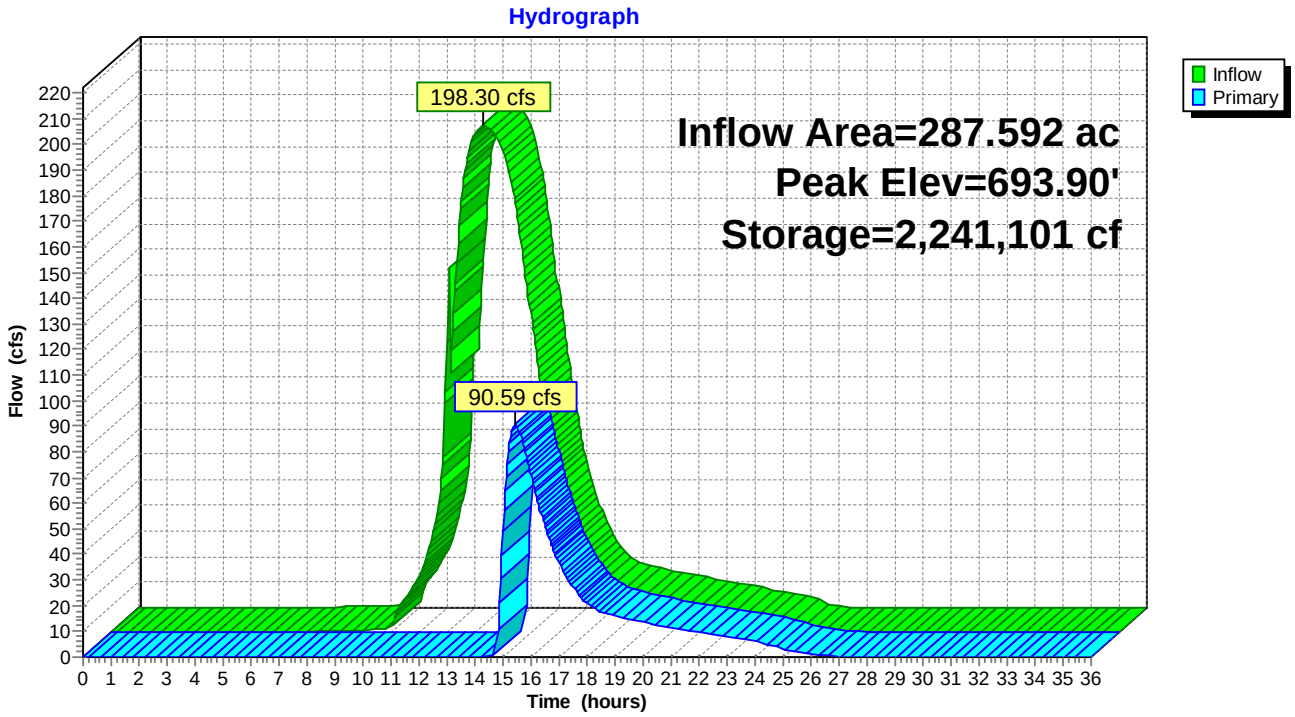
Volume	Invert	Avail.Storage	Storage Description
#1	668.00'	2,910,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
668.00	1,200	0	0
670.00	12,400	13,600	13,600
674.00	53,100	131,000	144,600
680.00	87,600	422,100	566,700
690.00	135,200	1,114,000	1,680,700
694.00	152,508	575,416	2,256,116
695.00	158,400	155,454	2,411,570
698.00	174,100	498,750	2,910,320

Device	Routing	Invert	Outlet Devices
#1	Primary	693.00'	**40.0' long x 20.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=90.20 cfs @ 15.44 hrs HW=693.90' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 90.20 cfs @ 2.50 fps)

Pond 1P: NSB North



Summary for Pond 5P: MC VII/IX & MC XI/X Pond

MC X/XI Culverts do not restrict flow in ditch (have more capacity than outlet on north end) therefore they are not modeled.

Inflow Area = 104.325 ac, 5.17% Impervious, Inflow Depth = 2.47" for 25-yr, 24-hr event
Inflow = 235.45 cfs @ 12.37 hrs, Volume= 21.504 af
Outflow = 59.68 cfs @ 13.02 hrs, Volume= 19.337 af, Atten= 75%, Lag= 39.1 min
Primary = 59.68 cfs @ 13.02 hrs, Volume= 19.337 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 697.10' Storage= 0 cf
Peak Elev= 703.18' @ 13.02 hrs Surf.Area= 154,176 sf Storage= 433,061 cf

Plug-Flow detention time= 117.6 min calculated for 19.337 af (90% of inflow)
Center-of-Mass det. time= 74.9 min (890.0 - 815.1)

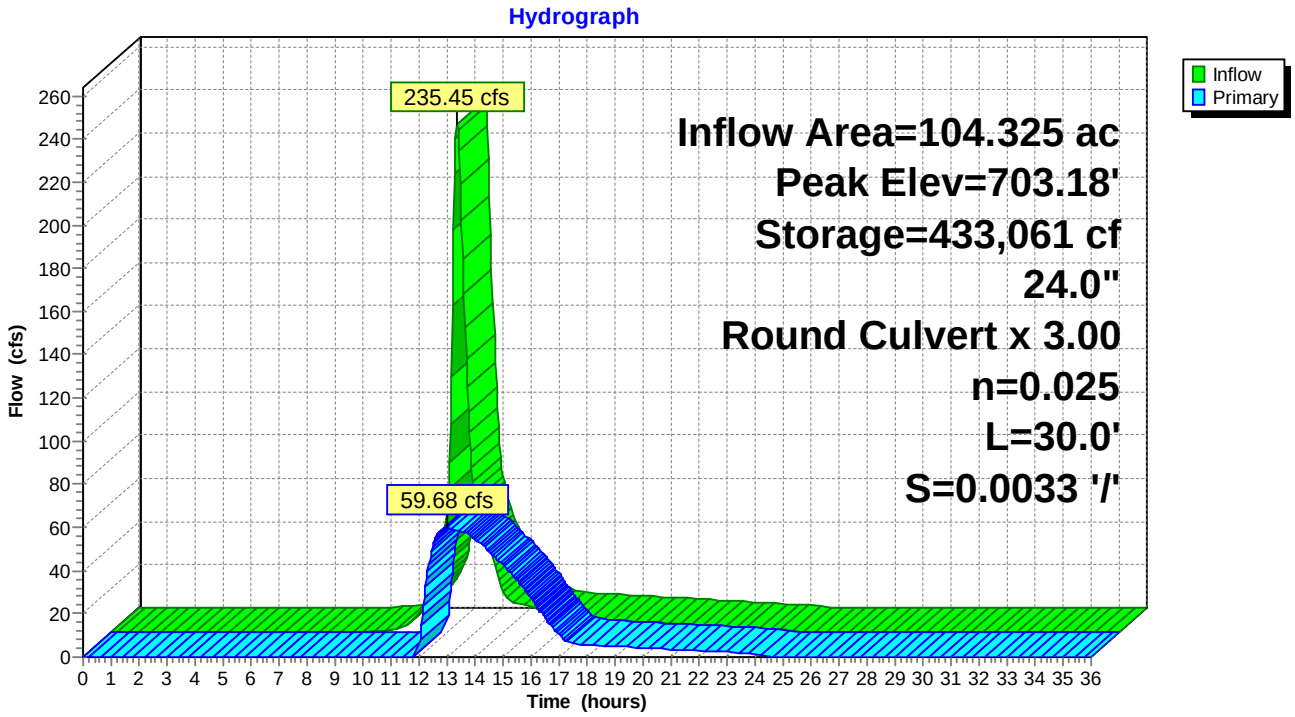
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	925,600 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
698.00	13,000	0	0
700.00	55,300	68,300	68,300
702.00	137,000	192,300	260,600
704.00	166,000	303,000	563,600
706.00	196,000	362,000	925,600

Device	Routing	Invert	Outlet Devices
#1	Primary	697.10'	**24.0" Round Culvert X 3.00** L= 30.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 697.10' / 697.00' S= 0.0033 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=59.67 cfs @ 13.02 hrs HW=703.18' TW=700.41' (Fixed TW Elev= 700.41')
↑**1=Culvert** (Inlet Controls 59.67 cfs @ 6.33 fps)

Pond 5P: MC VII/IX & MC XI/X Pond



Summary for Pond 7P: MC VII/XI Pond

Inflow Area = 32.398 ac, 2.76% Impervious, Inflow Depth = 2.75" for 25-yr, 24-hr event
Inflow = 98.14 cfs @ 12.20 hrs, Volume= 7.419 af
Outflow = 65.39 cfs @ 12.40 hrs, Volume= 7.155 af, Atten= 33%, Lag= 11.8 min
Primary = 65.39 cfs @ 12.40 hrs, Volume= 7.155 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 707.93' @ 12.40 hrs Surf.Area= 37,935 sf Storage= 74,866 cf

Plug-Flow detention time= 41.0 min calculated for 7.147 af (96% of inflow)
Center-of-Mass det. time= 22.3 min (815.3 - 793.0)

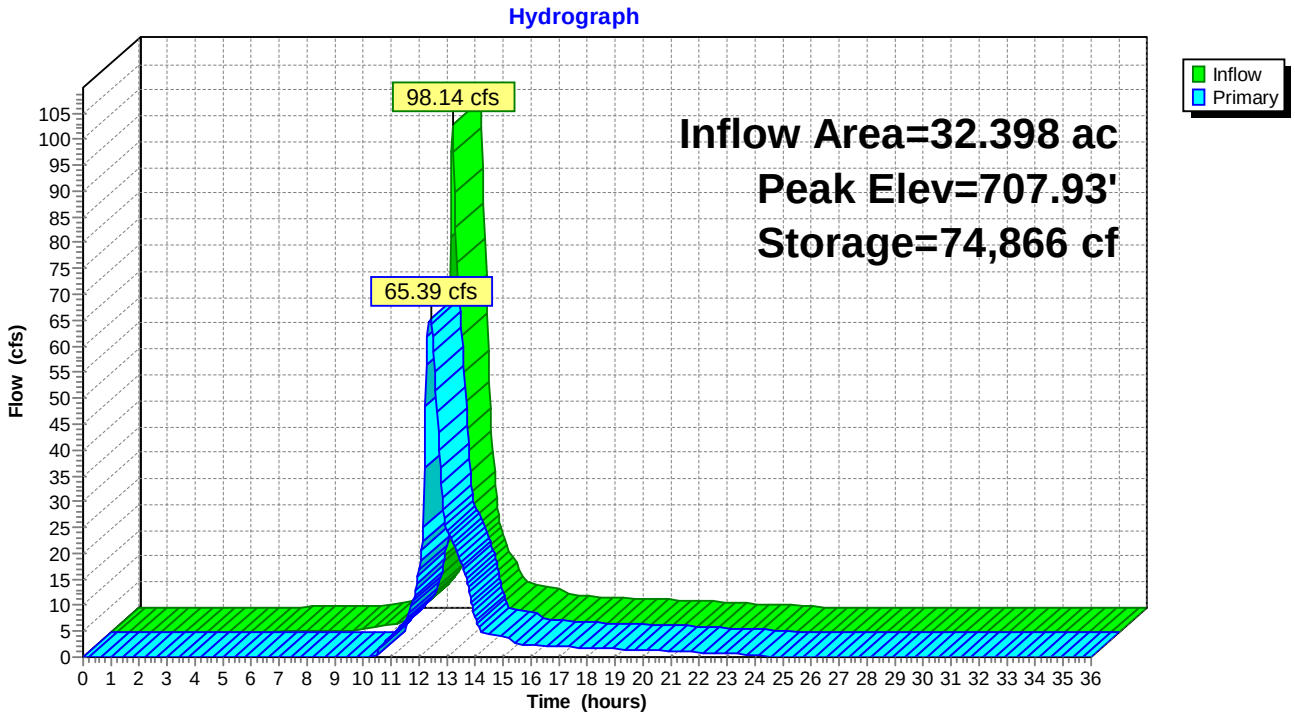
Volume	Invert	Avail.Storage	Storage Description
#1	700.00'	200,200 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
700.00	0	0	0
702.00	1,450	1,450	1,450
704.00	5,200	6,650	8,100
706.00	12,750	17,950	26,050
708.00	38,900	51,650	77,700
710.00	83,600	122,500	200,200

Device	Routing	Invert	Outlet Devices
#1	Primary	700.30'	**24.0" Round Culvert** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 700.30' / 699.40' S= 0.0225 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Primary	707.00'	**16.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=65.28 cfs @ 12.40 hrs HW=707.93' TW=704.55' (Fixed TW Elev= 704.55')
1=Culvert (Inlet Controls 27.79 cfs @ 8.85 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 37.49 cfs @ 2.53 fps)

Pond 7P: MC VII/XI Pond



Summary for Pond 8P: NSB South

Inflow Area = 287.592 ac, 3.48% Impervious, Inflow Depth = 0.84" for 25-yr, 24-hr event
Inflow = 90.59 cfs @ 15.44 hrs, Volume= 20.210 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

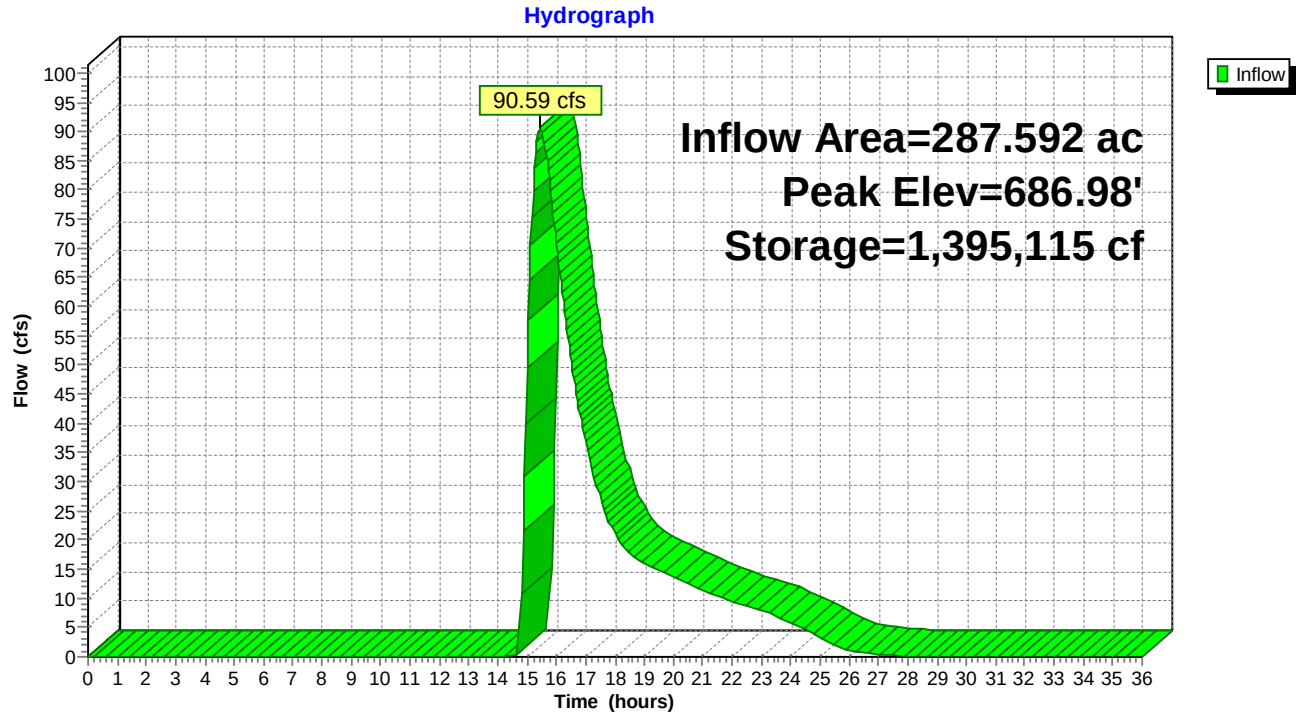
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 680.00' Surf.Area= 98,500 sf Storage= 514,800 cf
Peak Elev= 686.98' @ 36.00 hrs Surf.Area= 153,774 sf Storage= 1,395,115 cf (880,315 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	672.00'	2,867,350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
672.00	30,200	0	0
680.00	98,500	514,800	514,800
690.00	177,700	1,381,000	1,895,800
694.00	203,900	763,200	2,659,000
695.00	212,800	208,350	2,867,350

Pond 8P: NSB South



Summary for Pond 11P: NWD / NW-MC VII

Inflow Area = 125.401 ac, 3.69% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 580.45 cfs @ 12.15 hrs, Volume= 35.340 af
Outflow = 139.72 cfs @ 12.48 hrs, Volume= 35.340 af, Atten= 76%, Lag= 19.6 min
Primary = 139.72 cfs @ 12.48 hrs, Volume= 35.340 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 710.46' @ 12.48 hrs Surf.Area= 160,032 sf Storage= 549,996 cf

Plug-Flow detention time= 38.5 min calculated for 35.340 af (100% of inflow)
Center-of-Mass det. time= 38.5 min (808.6 - 770.1)

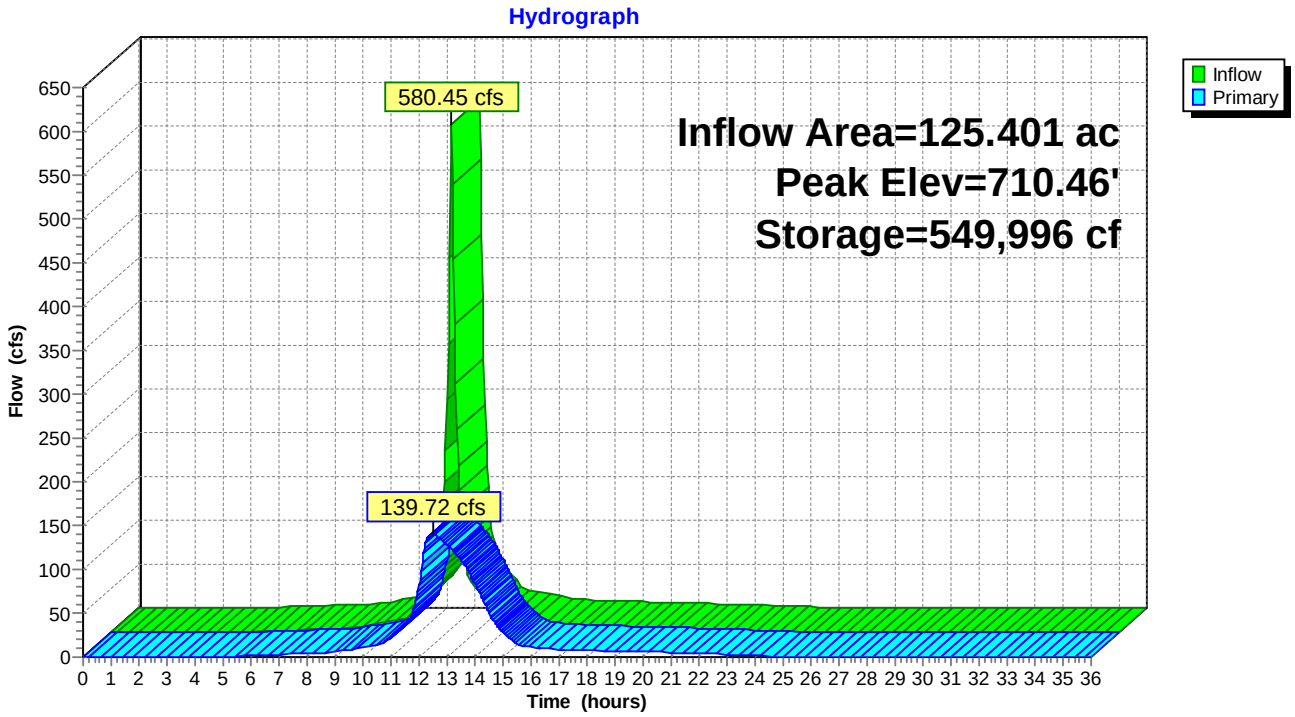
Volume	Invert	Avail.Storage	Storage Description
#1	704.30'	827,625 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
704.30	0	0	0
706.00	68,500	58,225	58,225
708.00	102,200	170,700	228,925
710.00	147,500	249,700	478,625
712.00	201,500	349,000	827,625

Device	Routing	Invert	Outlet Devices
#1	Primary	704.30'	**30.0" Round 30" HDPE Culverts X 3.00** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 704.30' / 699.00' S= 0.0424 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#2	Primary	704.30'	**18.0" Round 18" HDPE Culverts** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 704.30' / 699.00' S= 0.0424 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=139.72 cfs @ 12.48 hrs HW=710.46' TW=702.65' (Fixed TW Elev= 702.65')
1=30" HDPE Culverts (Inlet Controls 124.09 cfs @ 8.43 fps)
2=18" HDPE Culverts (Inlet Controls 15.63 cfs @ 8.84 fps)

Pond 11P: NWD / NW-MC VII



Summary for Pond 19P: E-MC IX Culvert

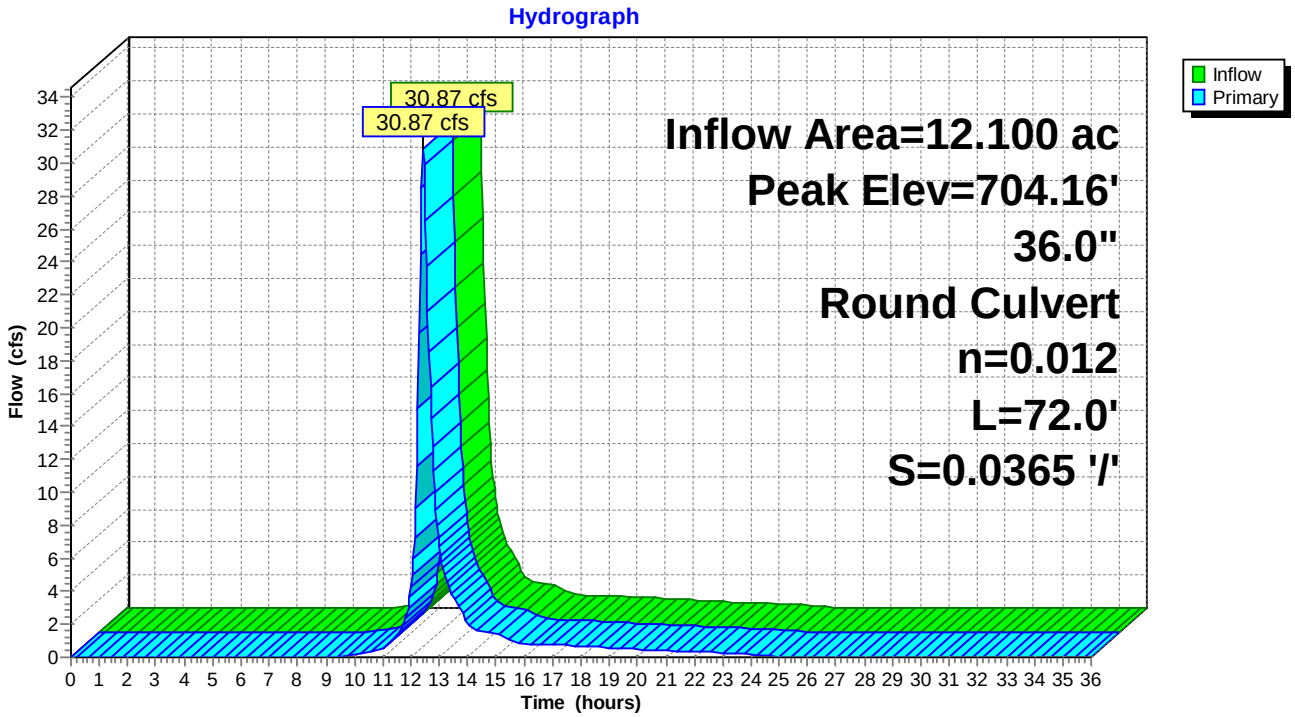
Inflow Area = 12.100 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 30.87 cfs @ 12.42 hrs, Volume= 2.347 af
Outflow = 30.87 cfs @ 12.42 hrs, Volume= 2.347 af, Atten= 0%, Lag= 0.0 min
Primary = 30.87 cfs @ 12.42 hrs, Volume= 2.347 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 704.16' @ 12.42 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	701.82'	**36.0" Round Culvert** L= 72.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 701.82' / 699.19' S= 0.0365 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=30.66 cfs @ 12.42 hrs HW=704.15' TW=698.17' (Fixed TW Elev= 698.17')
1=Culvert (Inlet Controls 30.66 cfs @ 5.20 fps)

Pond 19P: E-MC IX Culvert



Summary for Pond 37P: N-MC VII Ditch

Inflow Area = 133.429 ac, 3.47% Impervious, Inflow Depth = 3.32" for 25-yr, 24-hr event
Inflow = 157.63 cfs @ 12.35 hrs, Volume= 36.897 af
Outflow = 145.32 cfs @ 12.66 hrs, Volume= 35.255 af, Atten= 8%, Lag= 18.5 min
Primary = 145.32 cfs @ 12.66 hrs, Volume= 35.255 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 702.15' @ 12.66 hrs Surf.Area= 38,774 sf Storage= 132,671 cf

Plug-Flow detention time= 40.8 min calculated for 35.255 af (96% of inflow)
Center-of-Mass det. time= 18.4 min (827.2 - 808.7)

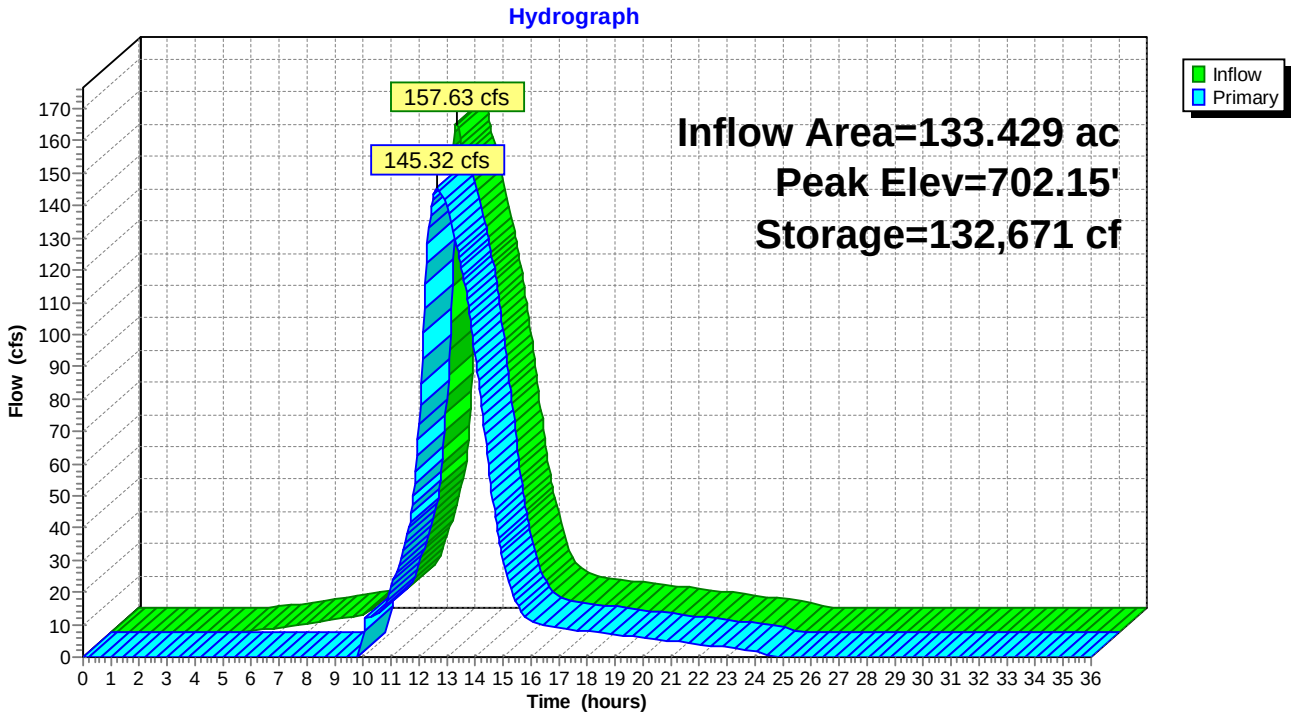
Volume	Invert	Avail.Storage	Storage Description
#1	696.77'	167,201 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
696.77	0	0	0
697.00	2,561	295	295
698.00	14,817	8,689	8,984
699.00	26,696	20,757	29,740
700.00	30,510	28,603	58,343
701.00	34,346	32,428	90,771
702.00	38,204	36,275	127,046
703.00	42,106	40,155	167,201

Device	Routing	Invert	Outlet Devices
#1	Primary	696.77'	**54.0" Round 54" Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 696.77' / 696.61' S= 0.0038 '/' Cc= 0.900 n= 0.012, Flow Area= 15.90 sf
#2	Primary	696.77'	**36.0" Round 36" Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 696.77' / 696.61' S= 0.0038 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf

Primary OutFlow Max=145.29 cfs @ 12.66 hrs HW=702.15' TW=700.42' (Fixed TW Elev= 700.42')
1=54" Culvert (Inlet Controls 100.59 cfs @ 6.32 fps)
2=36" Culvert (Inlet Controls 44.71 cfs @ 6.32 fps)

Pond 37P: N-MC VII Ditch



Summary for Pond 38P: N-MC IX Ditch

Inflow Area = 276.502 ac, 3.62% Impervious, Inflow Depth = 2.70" for 25-yr, 24-hr event
Inflow = 263.71 cfs @ 12.41 hrs, Volume= 62.107 af
Outflow = 195.50 cfs @ 13.40 hrs, Volume= 62.107 af, Atten= 26%, Lag= 59.4 min
Primary = 195.50 cfs @ 13.40 hrs, Volume= 62.107 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 699.67' @ 13.40 hrs Surf.Area= 156,098 sf Storage= 362,060 cf

Plug-Flow detention time= 23.9 min calculated for 62.107 af (100% of inflow)
Center-of-Mass det. time= 23.9 min (868.9 - 845.0)

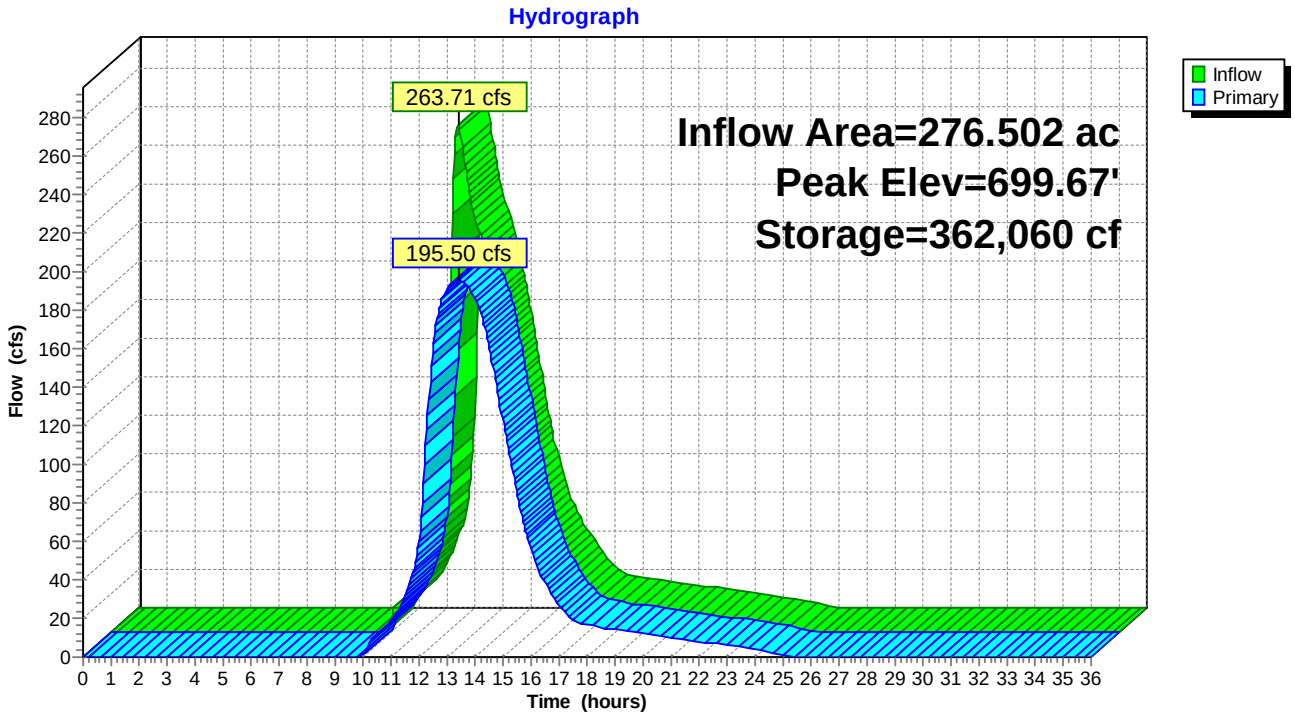
Volume	Invert	Avail.Storage	Storage Description
#1	694.90'	799,720 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
694.90	0	0	0
695.00	350	18	18
696.00	27,524	13,937	13,955
698.00	103,447	130,971	144,926
700.00	166,382	269,829	414,755
702.00	218,583	384,965	799,720

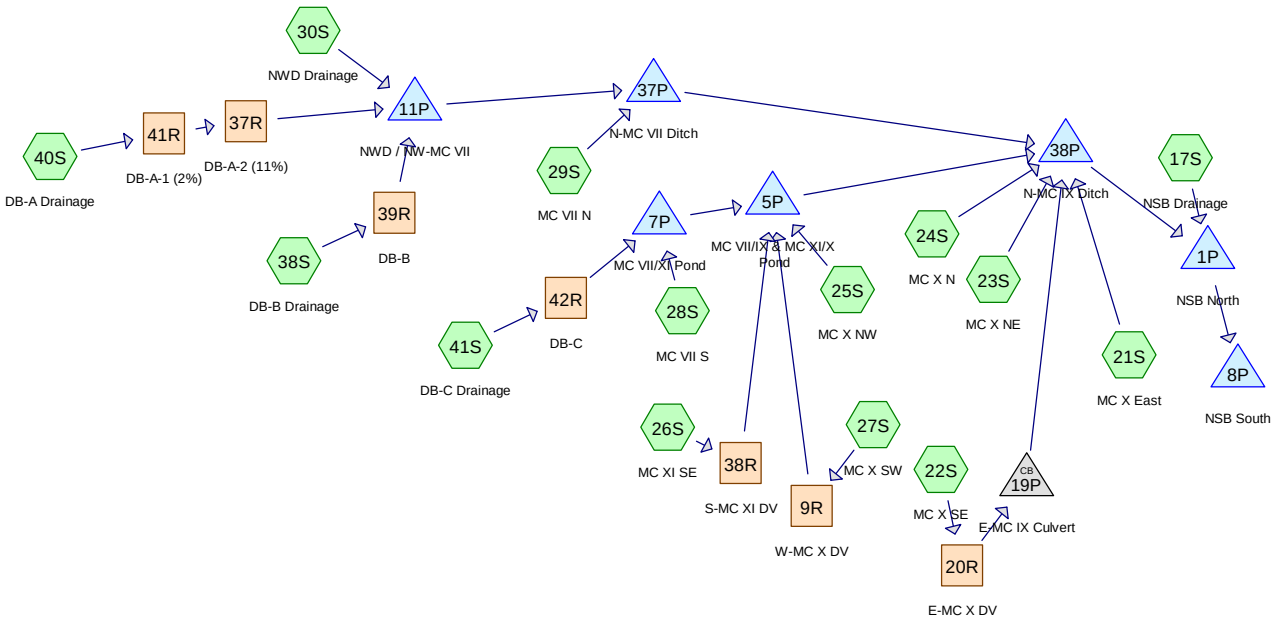
Device	Routing	Invert	Outlet Devices
#1	Primary	694.96'	**30.0" Round 30" Culvert X 3.00** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 694.96' / 694.96' S= 0.0000 '/' Cc= 0.900 n= 0.025, Flow Area= 4.91 sf
#2	Primary	694.90'	**54.0" Round 54" Culvert** L= 110.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 694.90' / 690.50' S= 0.0400 '/' Cc= 0.900 n= 0.012, Flow Area= 15.90 sf

Primary OutFlow Max=195.50 cfs @ 13.40 hrs HW=699.67' TW=694.18' (Fixed TW Elev= 694.18')
↑—**1=30" Culvert** (Barrel Controls 73.86 cfs @ 5.02 fps)
└—**2=54" Culvert** (Inlet Controls 121.64 cfs @ 7.65 fps)

Pond 38P: N-MC IX Ditch



North Sedimentation Basin (NSB) HYDROCAD OUTPUT – 100-yr, 24-hr



Subcat Reach Pond Link

Routing Diagram for WDI Vert Exp NSB
Prepared by CTI, Printed 11/3/2021
HydroCAD® 10.10-5a s/n 11246 © 2020 HydroCAD Software Solutions LLC

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 17S: NSB Drainage Runoff Area=483,100 sf 0.00% Impervious Runoff Depth=4.54"
Tc=0.0 min CN=95 Runoff=100.06 cfs 4.194 af

Subcatchment 21S: MC X East Runoff Area=443,100 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=650' Slope=0.0370 '/' Tc=21.2 min CN=84 Runoff=37.02 cfs 2.865 af

Subcatchment 22S: MC X SE Runoff Area=527,091 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=240' Slope=0.0540 '/' Tc=15.5 min CN=84 Runoff=51.29 cfs 3.409 af

Subcatchment 23S: MC X NE Runoff Area=435,600 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=440' Slope=0.0590 '/' Tc=15.3 min CN=84 Runoff=42.88 cfs 2.817 af

Subcatchment 24S: MC X N Runoff Area=282,100 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=310' Slope=0.0930 '/' Tc=11.7 min CN=84 Runoff=31.08 cfs 1.824 af

Subcatchment 25S: MC X NW Runoff Area=2,437,500 sf 8.04% Impervious Runoff Depth=3.48"
Flow Length=820' Slope=0.0380 '/' Tc=23.0 min CN=85 Runoff=200.20 cfs 16.224 af

Subcatchment 26S: MC XI SE Runoff Area=95,200 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=405' Slope=0.0770 '/' Tc=13.4 min CN=84 Runoff=9.92 cfs 0.616 af

Subcatchment 27S: MC X SW Runoff Area=600,400 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=240' Slope=0.0400 '/' Tc=17.5 min CN=84 Runoff=55.18 cfs 3.883 af

Subcatchment 28S: MC VII S Runoff Area=923,419 sf 4.21% Impervious Runoff Depth=3.48"
Flow Length=1,070' Tc=20.9 min CN=85 Runoff=79.50 cfs 6.146 af

Subcatchment 29S: MC VII N Runoff Area=349,700 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=560' Slope=0.0390 '/' Tc=19.5 min CN=84 Runoff=30.49 cfs 2.261 af

Subcatchment 30S: NWD Drainage Runoff Area=3,609,746 sf 5.58% Impervious Runoff Depth=4.54"
Flow Length=886' Slope=0.2500 '/' Tc=7.2 min CN=95 Runoff=577.59 cfs 31.341 af

Subcatchment 38S: DB-B Drainage Runoff Area=96,773 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=378' Slope=0.2500 '/' Tc=6.4 min CN=95 Runoff=15.94 cfs 0.840 af

Subcatchment 40S: DB-A Drainage Runoff Area=1,755,927 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=1,150' Tc=7.8 min CN=95 Runoff=276.01 cfs 15.245 af

Subcatchment 41S: DB-C Drainage Runoff Area=487,859 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=381' Slope=0.2500 '/' Tc=6.4 min CN=95 Runoff=80.36 cfs 4.236 af

Reach 9R: W-MC X DV Avg. Flow Depth=1.58' Max Vel=3.54 fps Inflow=55.18 cfs 3.883 af
n=0.025 L=1,400.0' S=0.0050 '/' Capacity=91.23 cfs Outflow=48.58 cfs 3.883 af

Reach 20R: E-MC X DV Avg. Flow Depth=1.71' Max Vel=5.17 fps Inflow=51.29 cfs 3.409 af
n=0.025 L=1,780.0' S=0.0100 '/' Capacity=68.87 cfs Outflow=45.35 cfs 3.409 af

Reach 37R: DB-A-2 (11%) Avg. Flow Depth=1.91' Max Vel=22.89 fps Inflow=249.56 cfs 15.245 af
n=0.020 L=125.2' S=0.1097 '/' Capacity=837.73 cfs Outflow=248.96 cfs 15.245 af

Reach 38R: S-MC XI DV Avg. Flow Depth=0.76' Max Vel=4.07 fps Inflow=9.92 cfs 0.616 af
n=0.025 L=750.0' S=0.0180 '/' Capacity=57.72 cfs Outflow=9.30 cfs 0.616 af

Reach 39R: DB-B Avg. Flow Depth=0.99' Max Vel=6.25 fps Inflow=15.94 cfs 0.840 af
n=0.020 L=598.0' S=0.0200 '/' Capacity=99.84 cfs Outflow=14.87 cfs 0.840 af

Reach 41R: DB-A-1 (2%) Avg. Flow Depth=2.64' Max Vel=12.10 fps Inflow=276.01 cfs 15.245 af
n=0.020 L=2,146.0' S=0.0200 '/' Capacity=357.63 cfs Outflow=249.56 cfs 15.245 af

Reach 42R: DB-C Avg. Flow Depth=1.83' Max Vel=9.38 fps Inflow=80.36 cfs 4.236 af
n=0.020 L=724.0' S=0.0200 '/' Capacity=99.84 cfs Outflow=75.77 cfs 4.236 af

Pond 1P: NSB North Peak Elev=694.52' Storage=2,335,715 cf Inflow=231.01 cfs 91.828 af
Outflow=197.60 cfs 46.806 af

Pond 5P: MC VII/IX & MC XI/X Pond Peak Elev=704.55' Storage=656,914 cf Inflow=344.55 cfs 30.839 af
24.0" Round Culvert x 3.00 n=0.025 L=30.0' S=0.0033 '/' Outflow=72.88 cfs 28.672 af

Pond 7P: MC VII/XI Pond Peak Elev=708.37' Storage=93,554 cf Inflow=134.54 cfs 10.382 af
Outflow=97.21 cfs 10.117 af

Pond 8P: NSB South Peak Elev=693.48' Storage=2,553,632 cf Inflow=197.60 cfs 46.806 af
Outflow=0.00 cfs 0.000 af

Pond 11P: NWD / NW-MC VII Peak Elev=711.78' Storage=784,815 cf Inflow=773.35 cfs 47.427 af
Outflow=157.20 cfs 47.427 af

Pond 19P: E-MC IX Culvert Peak Elev=705.10' Inflow=45.35 cfs 3.409 af
36.0" Round Culvert n=0.012 L=72.0' S=0.0365 '/' Outflow=45.35 cfs 3.409 af

Pond 37P: N-MC VII Ditch Peak Elev=702.65' Storage=152,731 cf Inflow=183.24 cfs 49.688 af
Outflow=165.20 cfs 48.047 af

Pond 38P: N-MC IX Ditch Peak Elev=700.54' Storage=507,634 cf Inflow=330.31 cfs 87.634 af
Outflow=227.98 cfs 87.634 af

Total Runoff Area = 287.592 ac Runoff Volume = 95.902 af Average Runoff Depth = 4.00"
96.52% Pervious = 277.574 ac 3.48% Impervious = 10.018 ac

Summary for Subcatchment 17S: NSB Drainage

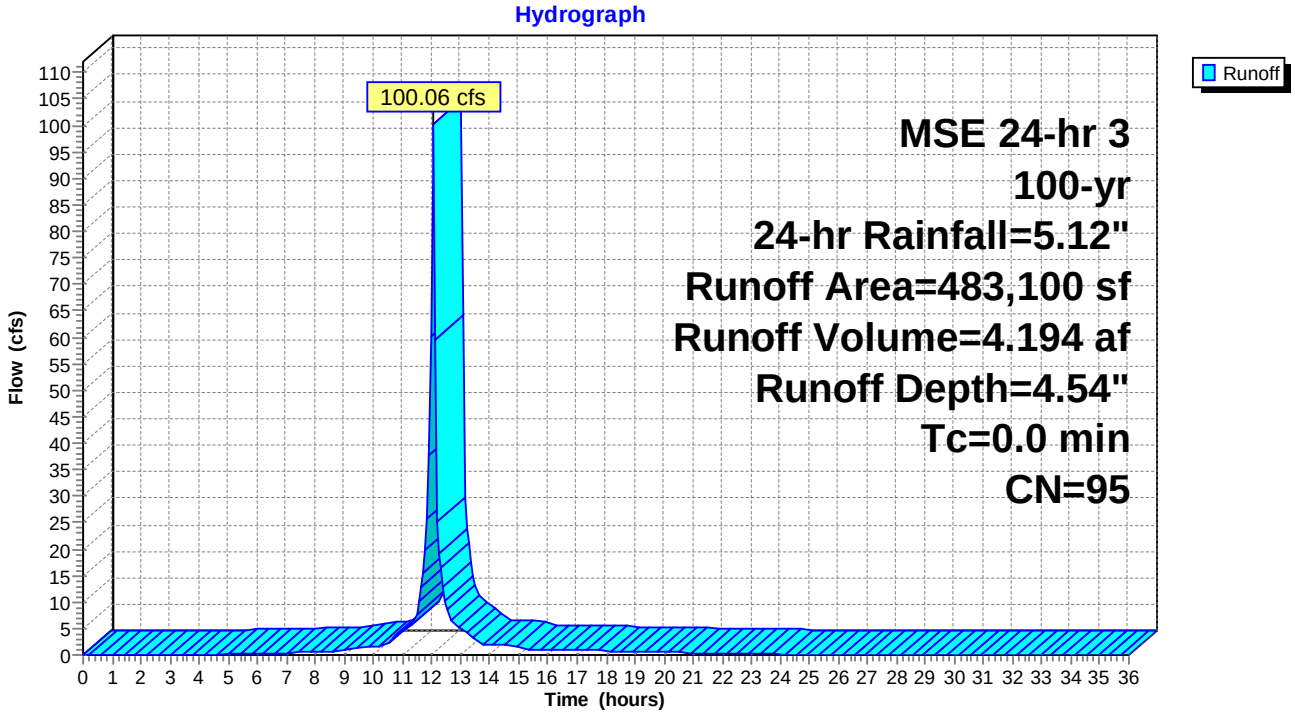
Drainage area is pond area and land area
Land area = 483,100 - 111,900 = 371,200

Runoff = 100.06 cfs @ 12.06 hrs, Volume= 4.194 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
111,900	84	50-75% Grass cover, Fair, HSG D
371,200	98	Water Surface, 0% imp, HSG D
483,100	95	Weighted Average
483,100		100.00% Pervious Area

Subcatchment 17S: NSB Drainage



Summary for Subcatchment 21S: MC X East

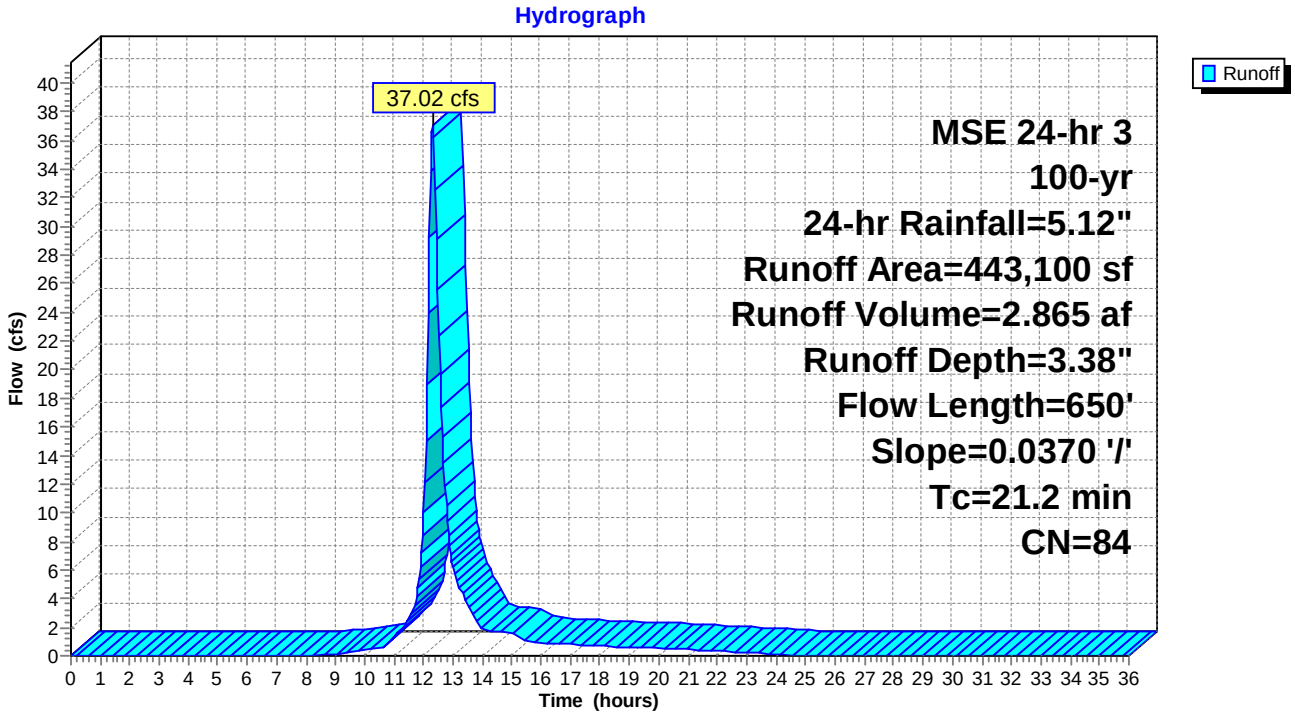
Runoff = 37.02 cfs @ 12.31 hrs, Volume= 2.865 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
443,100	84	50-75% Grass cover, Fair, HSG D
443,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	200	0.0370	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
5.6	450	0.0370	1.35		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.2	650	Total			

Subcatchment 21S: MC X East



Summary for Subcatchment 22S: MC X SE

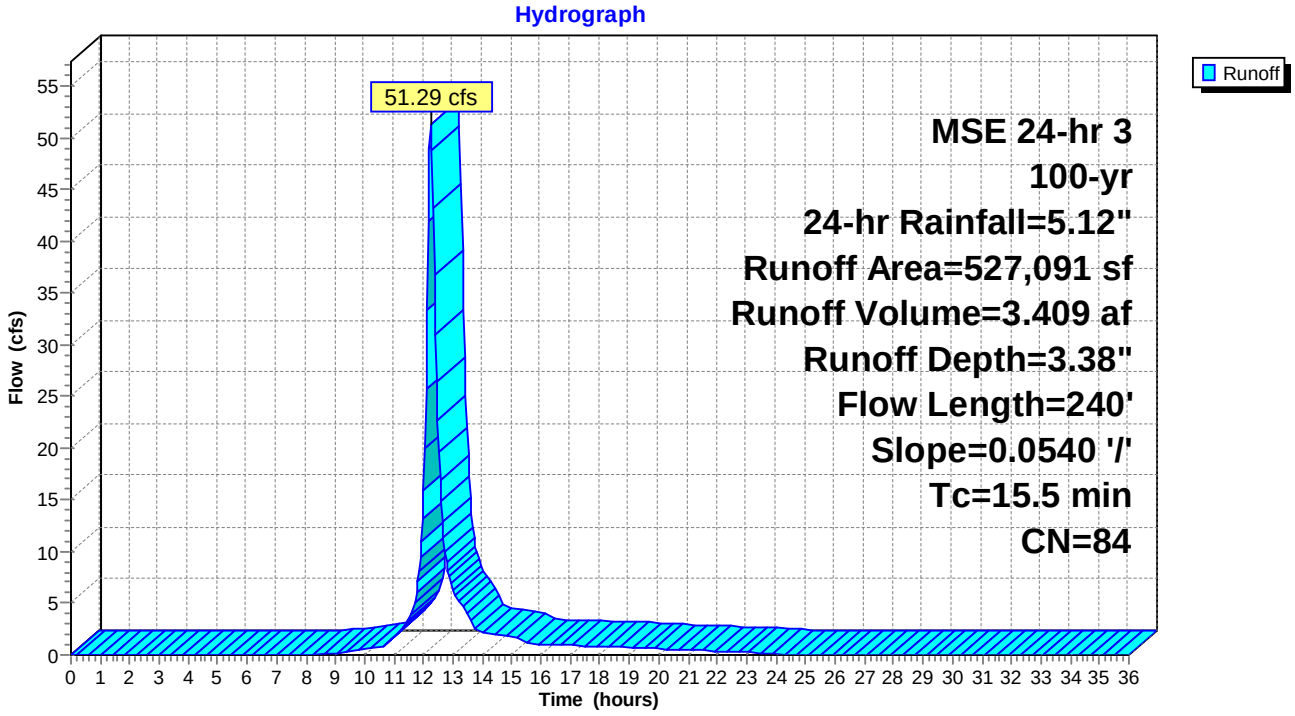
Runoff = 51.29 cfs @ 12.24 hrs, Volume= 3.409 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
527,091	84	50-75% Grass cover, Fair, HSG D
527,091		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	240	0.0540	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 22S: MC X SE



Summary for Subcatchment 23S: MC X NE

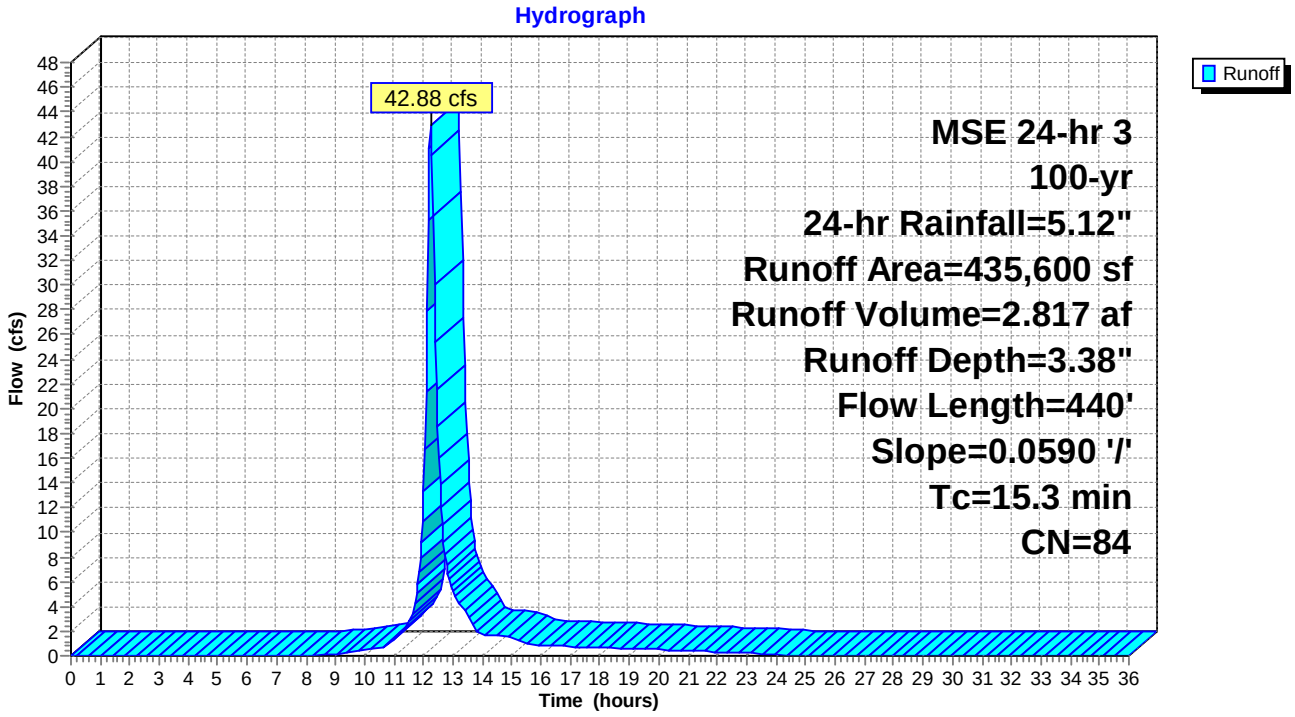
Runoff = 42.88 cfs @ 12.24 hrs, Volume= 2.817 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
435,600	84	50-75% Grass cover, Fair, HSG D
435,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	200	0.0590	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.4	240	0.0590	1.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.3	440	Total			

Subcatchment 23S: MC X NE



Summary for Subcatchment 24S: MC X N

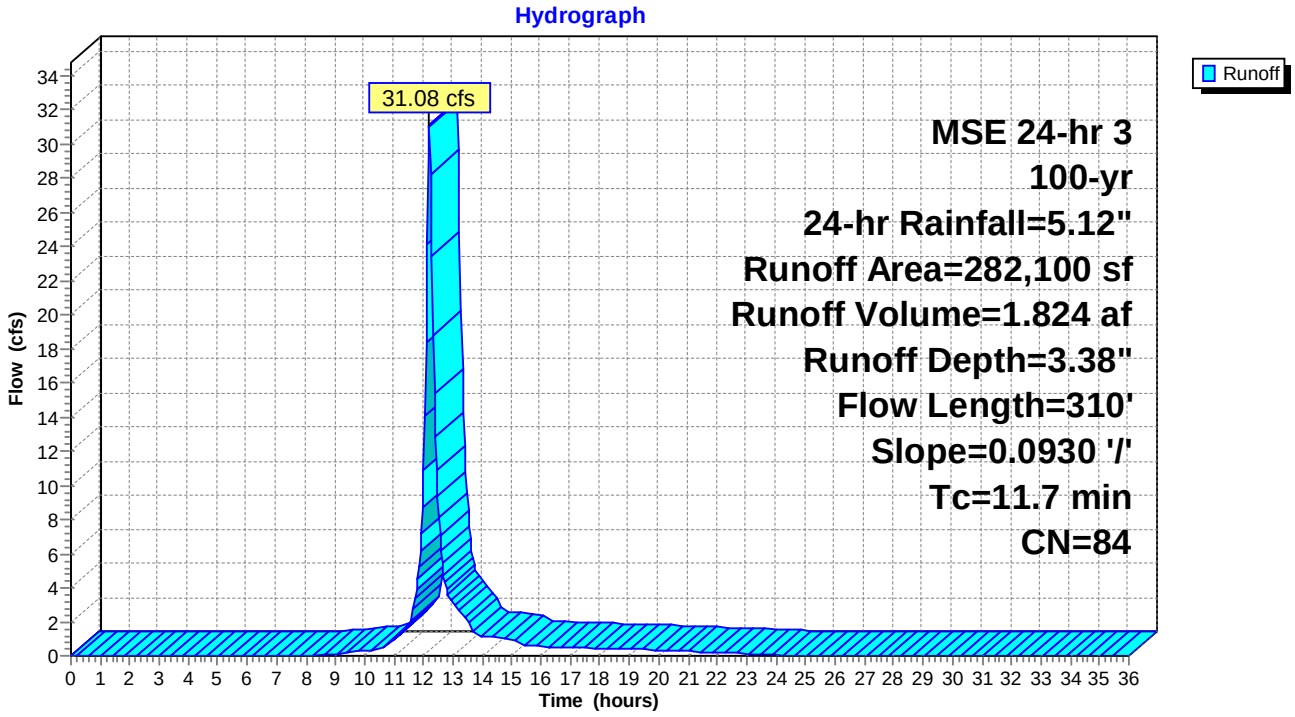
Runoff = 31.08 cfs @ 12.19 hrs, Volume= 1.824 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
282,100	84	50-75% Grass cover, Fair, HSG D
282,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	200	0.0930	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
0.9	110	0.0930	2.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.7	310	Total			

Subcatchment 24S: MC X N



Summary for Subcatchment 25S: MC X NW

Drainage area is pond area and land area
Land area = 2,437,500 - 196,000 = 2,241,500

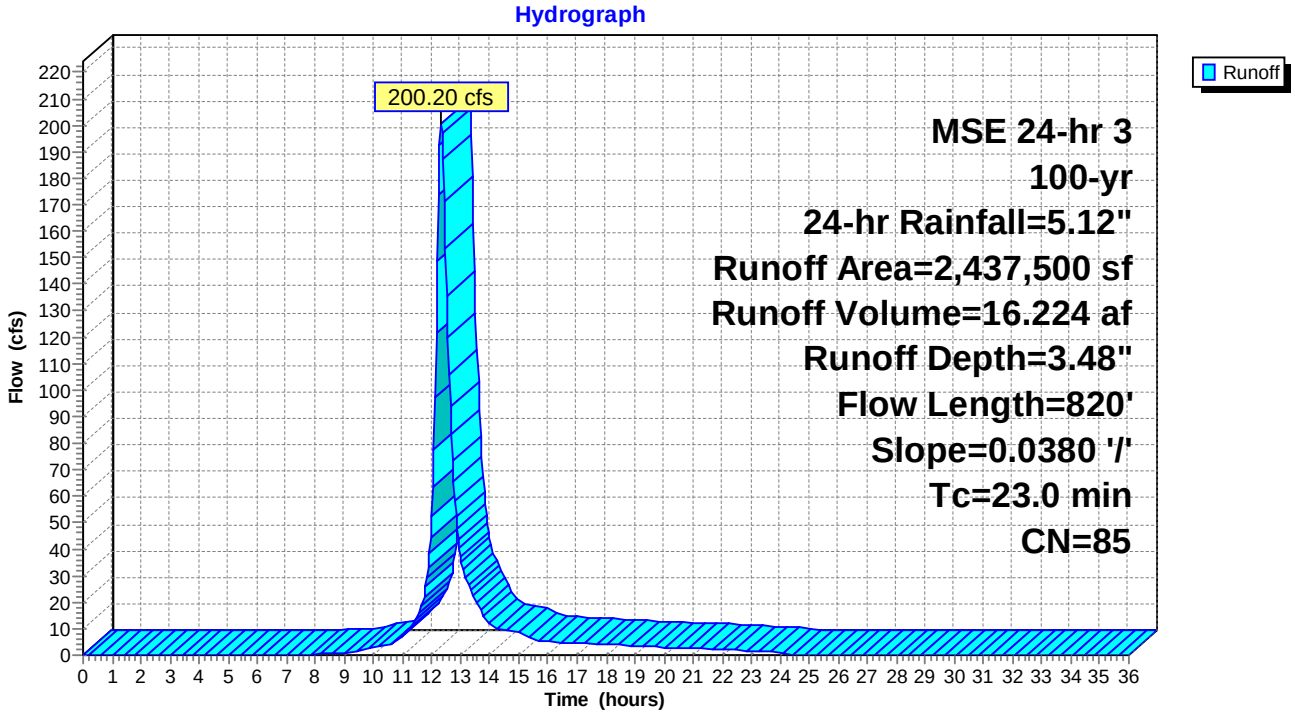
Runoff = 200.20 cfs @ 12.33 hrs, Volume= 16.224 af, Depth= 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
196,000	98	Water Surface, HSG D
2,241,500	84	50-75% Grass cover, Fair, HSG D
2,437,500	85	Weighted Average
2,241,500		91.96% Pervious Area
196,000		8.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	200	0.0380	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
7.6	620	0.0380	1.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
23.0	820	Total			

Subcatchment 25S: MC X NW



Summary for Subcatchment 26S: MC XI SE

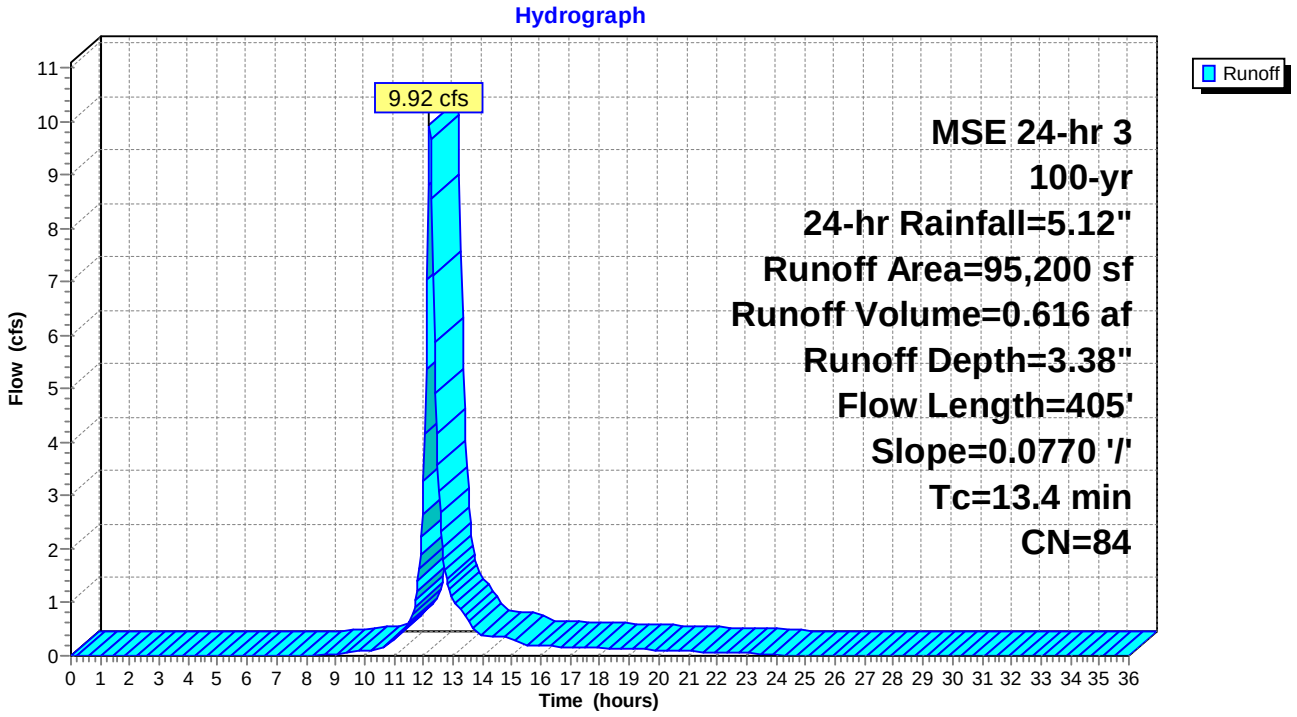
Runoff = 9.92 cfs @ 12.21 hrs, Volume= 0.616 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
95,200	84	50-75% Grass cover, Fair, HSG D
95,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	200	0.0770	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.8	205	0.0770	1.94		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.4	405	Total			

Subcatchment 26S: MC XI SE



Summary for Subcatchment 27S: MC X SW

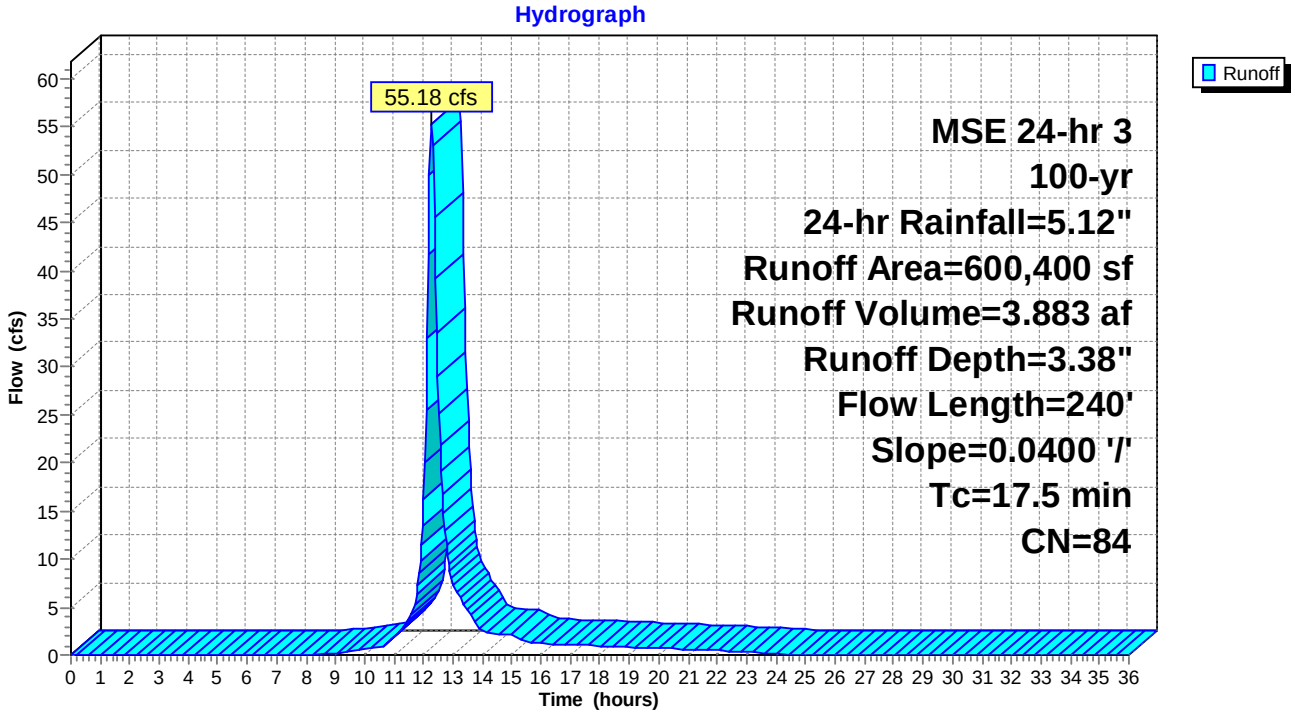
Runoff = 55.18 cfs @ 12.26 hrs, Volume= 3.883 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
600,400	84	50-75% Grass cover, Fair, HSG D
600,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.5	240	0.0400	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 27S: MC X SW



Summary for Subcatchment 28S: MC VII S

Drainage area is pond area and land area
Land area = 998,400 - 38,900 = 959,500

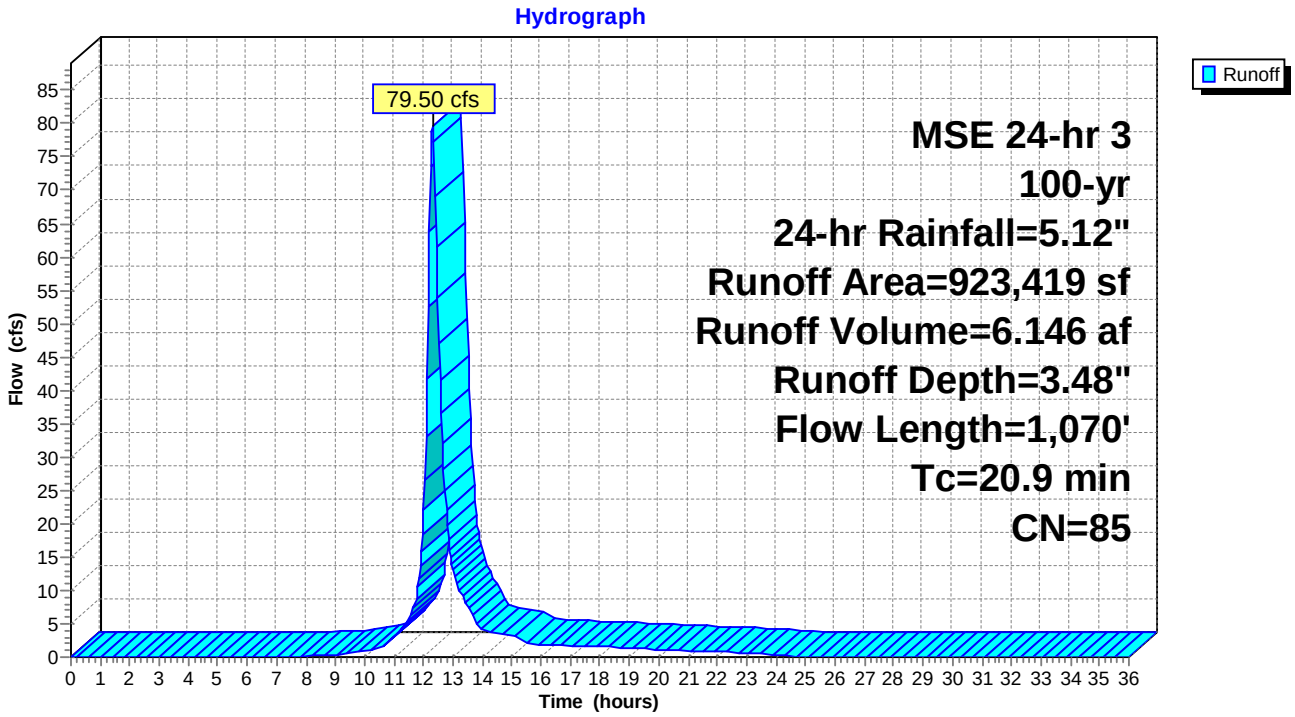
Runoff = 79.50 cfs @ 12.30 hrs, Volume= 6.146 af, Depth= 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
38,900	98	Water Surface, HSG D
884,519	84	50-75% Grass cover, Fair, HSG D
923,419	85	Weighted Average
884,519		95.79% Pervious Area
38,900		4.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	200	0.0300	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.3	170	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	700	0.0140	7.03	84.40	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.025 Earth, clean & winding
20.9	1,070	Total			

Subcatchment 28S: MC VII S



Summary for Subcatchment 29S: MC VII N

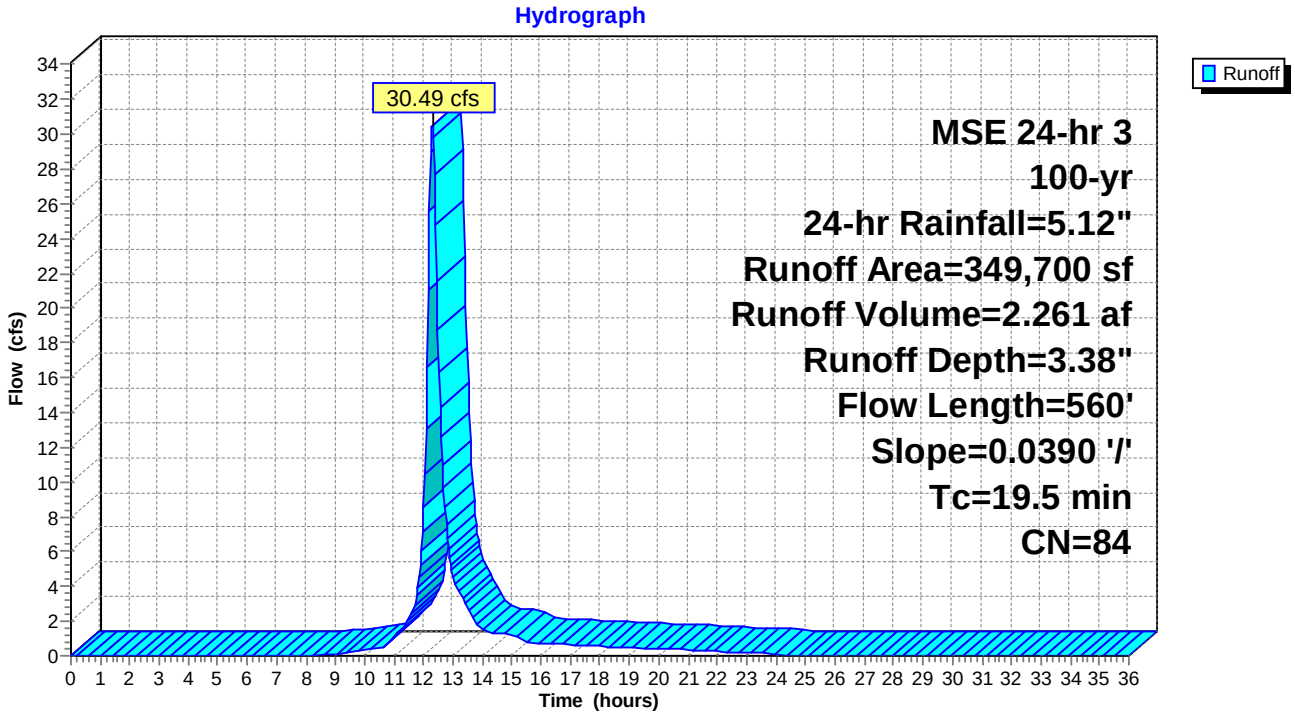
Runoff = 30.49 cfs @ 12.29 hrs, Volume= 2.261 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
349,700	84	50-75% Grass cover, Fair, HSG D
349,700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	200	0.0390	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
4.3	360	0.0390	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.5	560	Total			

Subcatchment 29S: MC VII N



Summary for Subcatchment 30S: NWD Drainage

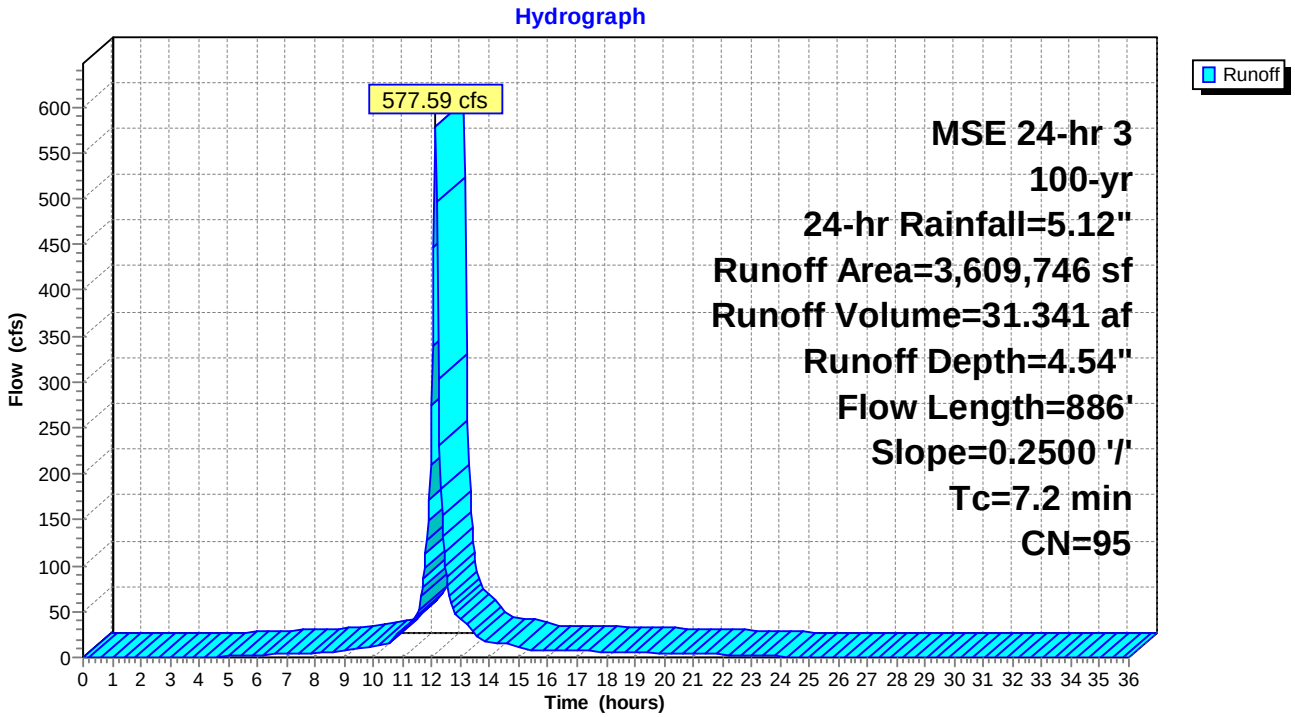
Runoff = 577.59 cfs @ 12.14 hrs, Volume= 31.341 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
	201,500	98	Water Surface, HSG D
*	3,408,246	95	Closure Turf
	3,609,746	95	Weighted Average
	3,408,246		94.42% Pervious Area
	201,500		5.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	200	0.2500	0.55		**Sheet Flow,** n= 0.120 P2= 2.35"
1.1	686	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.2	886	Total			

Subcatchment 30S: NWD Drainage



Summary for Subcatchment 38S: DB-B Drainage

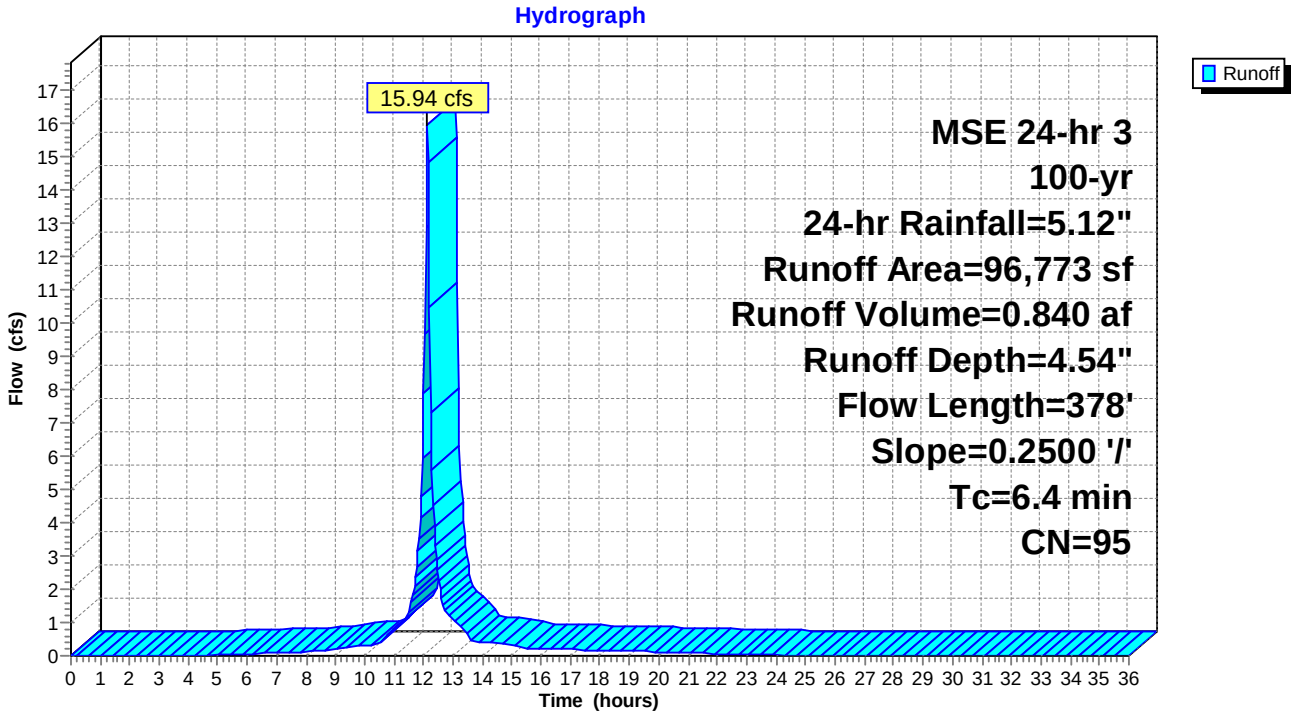
Runoff = 15.94 cfs @ 12.13 hrs, Volume= 0.840 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
*	96,773	95	Closure Turf
	96,773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	200	0.2500	0.55		**Sheet Flow,** n= 0.120 P2= 2.35"
0.3	178	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.4	378	Total			

Subcatchment 38S: DB-B Drainage



Summary for Subcatchment 40S: DB-A Drainage

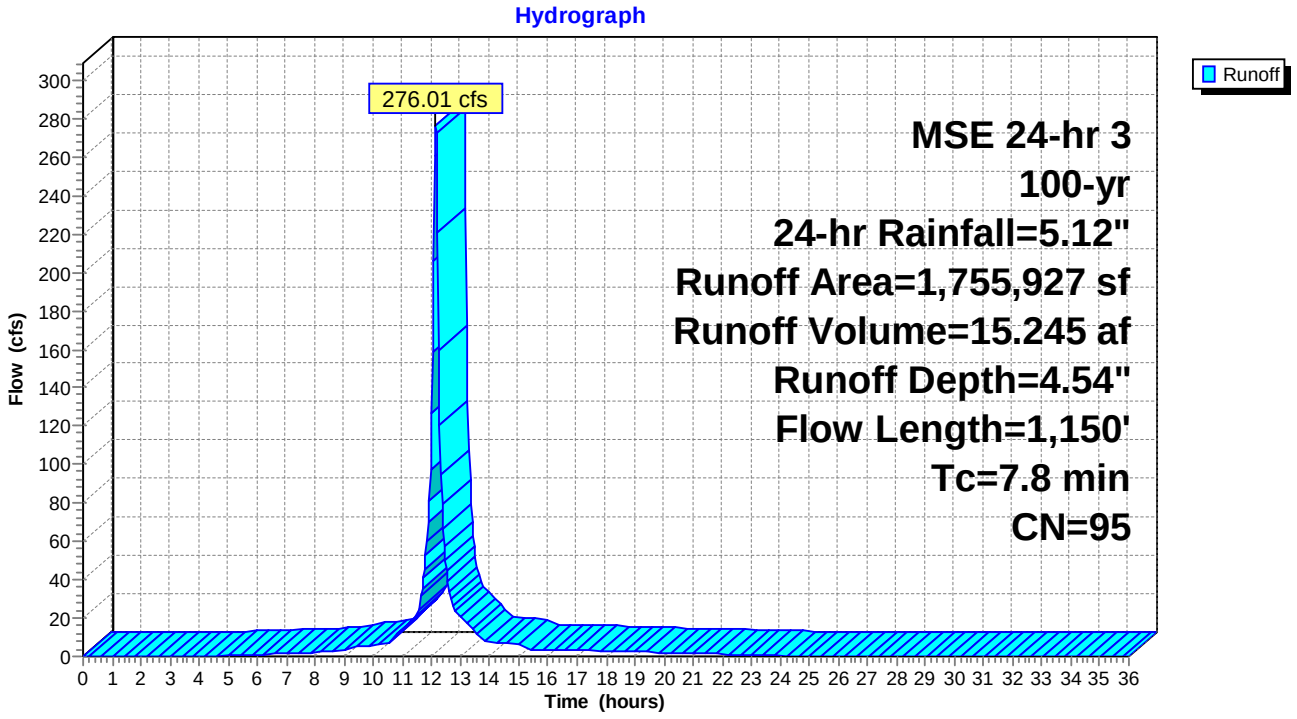
Runoff = 276.01 cfs @ 12.15 hrs, Volume= 15.245 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
*	1,755,927	95	Closure Turf
	1,755,927		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	200	0.2500	0.55		**Sheet Flow,** n= 0.120 P2= 2.35"
0.5	313	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	189	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	400	0.0400	14.86	178.32	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.020
0.0	48	0.1600	29.72	356.64	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.020
7.8	1,150	Total			

Subcatchment 40S: DB-A Drainage



Summary for Subcatchment 41S: DB-C Drainage

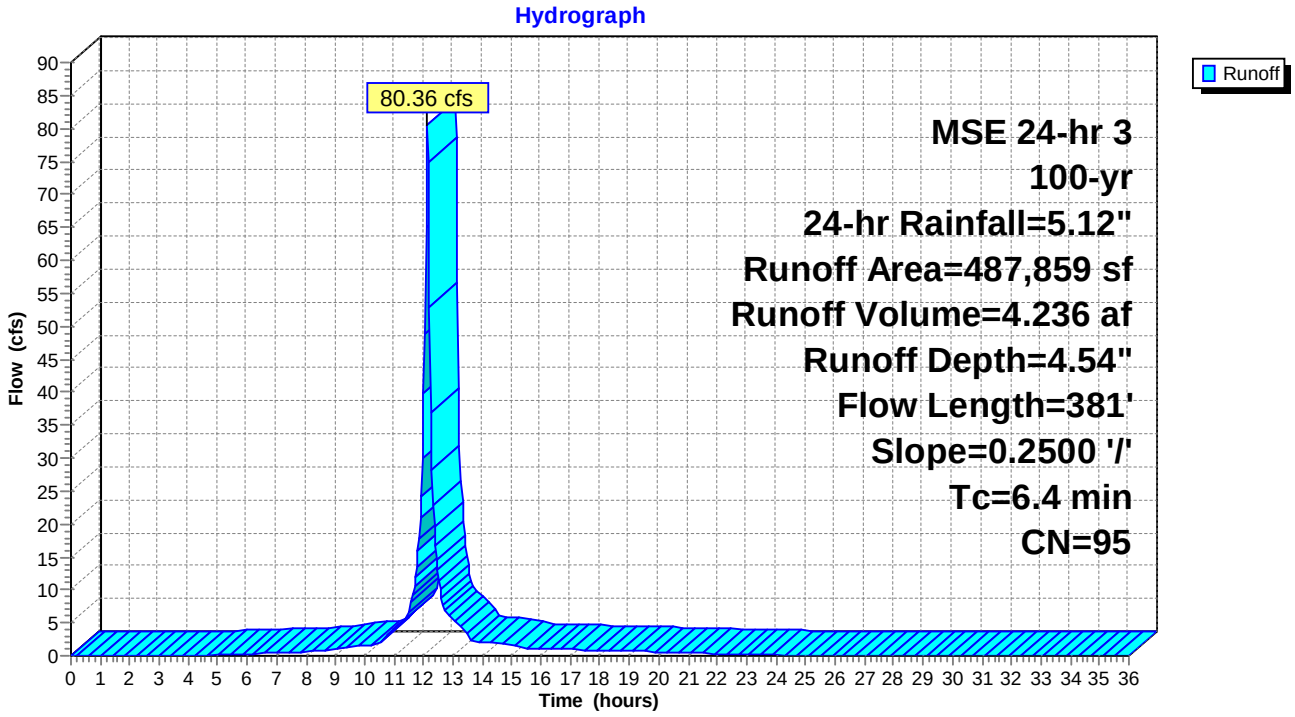
Runoff = 80.36 cfs @ 12.13 hrs, Volume= 4.236 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
*	487,859	95	Closure Turf
	487,859		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	200	0.2500	0.55		**Sheet Flow,** n= 0.120 P2= 2.35"
0.3	181	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.4	381	Total			

Subcatchment 41S: DB-C Drainage



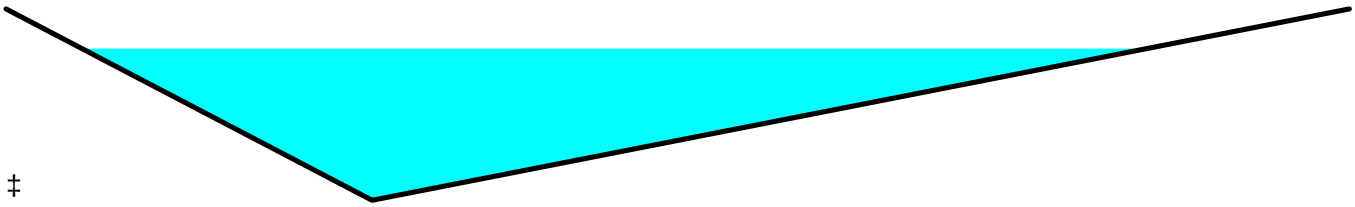
Summary for Reach 9R: W-MC X DV

Inflow Area = 13.783 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 55.18 cfs @ 12.26 hrs, Volume= 3.883 af
Outflow = 48.58 cfs @ 12.45 hrs, Volume= 3.883 af, Atten= 12%, Lag= 11.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.54 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 0.94 fps, Avg. Travel Time= 24.7 min

Peak Storage= 19,274 cf @ 12.34 hrs
Average Depth at Peak Storage= 1.58' , Surface Width= 17.40'
Bank-Full Depth= 2.00' Flow Area= 22.0 sf, Capacity= 91.23 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 3.0 8.0 '/' Top Width= 22.00'
Length= 1,400.0' Slope= 0.0050 '/'
Inlet Invert= 713.00', Outlet Invert= 706.00'



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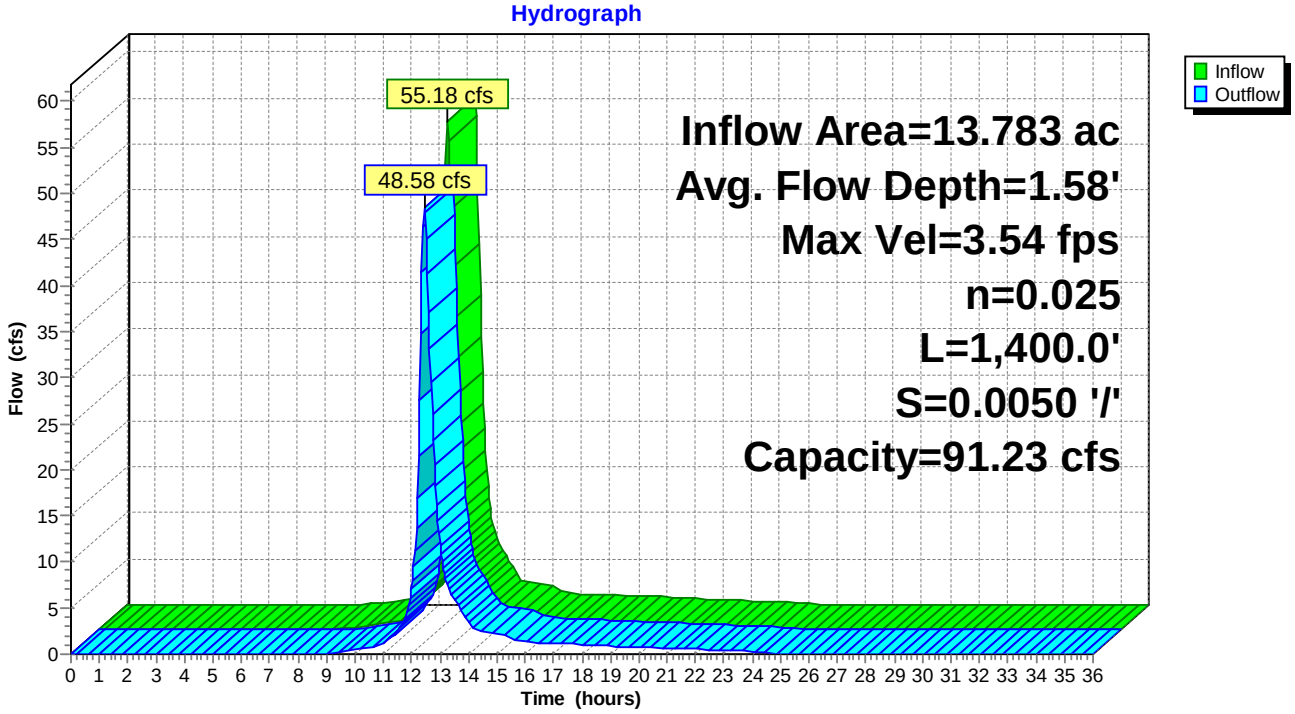
Reach 9R: W-MC X DV



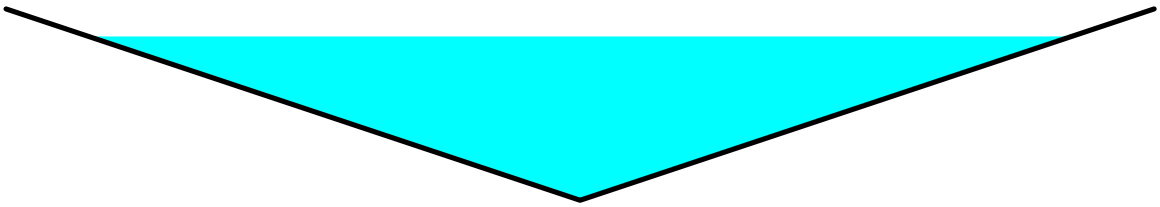
Summary for Reach 20R: E-MC X DV

Inflow Area = 12.100 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 51.29 cfs @ 12.24 hrs, Volume= 3.409 af
Outflow = 45.35 cfs @ 12.40 hrs, Volume= 3.409 af, Atten= 12%, Lag= 9.8 min

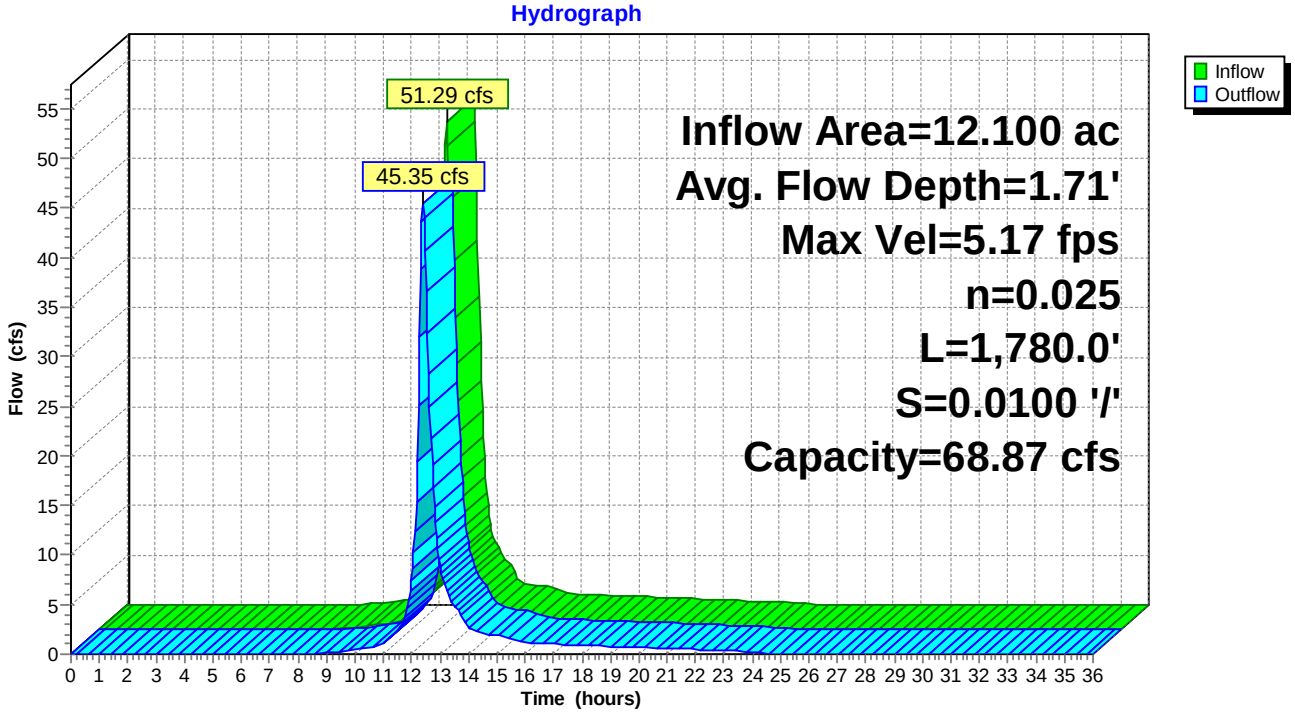
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 5.17 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 20.7 min

Peak Storage= 15,697 cf @ 12.31 hrs
Average Depth at Peak Storage= 1.71' , Surface Width= 10.29'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 68.87 cfs

0.00' x 2.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 1,780.0' Slope= 0.0100 '/'
Inlet Invert= 723.00', Outlet Invert= 705.20'



Reach 20R: E-MC X DV



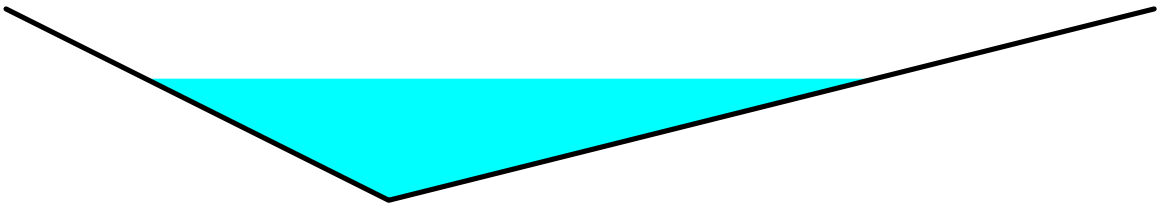
Summary for Reach 37R: DB-A-2 (11%)

Inflow Area = 40.311 ac, 0.00% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 249.56 cfs @ 12.23 hrs, Volume= 15.245 af
Outflow = 248.96 cfs @ 12.23 hrs, Volume= 15.245 af, Atten= 0%, Lag= 0.2 min

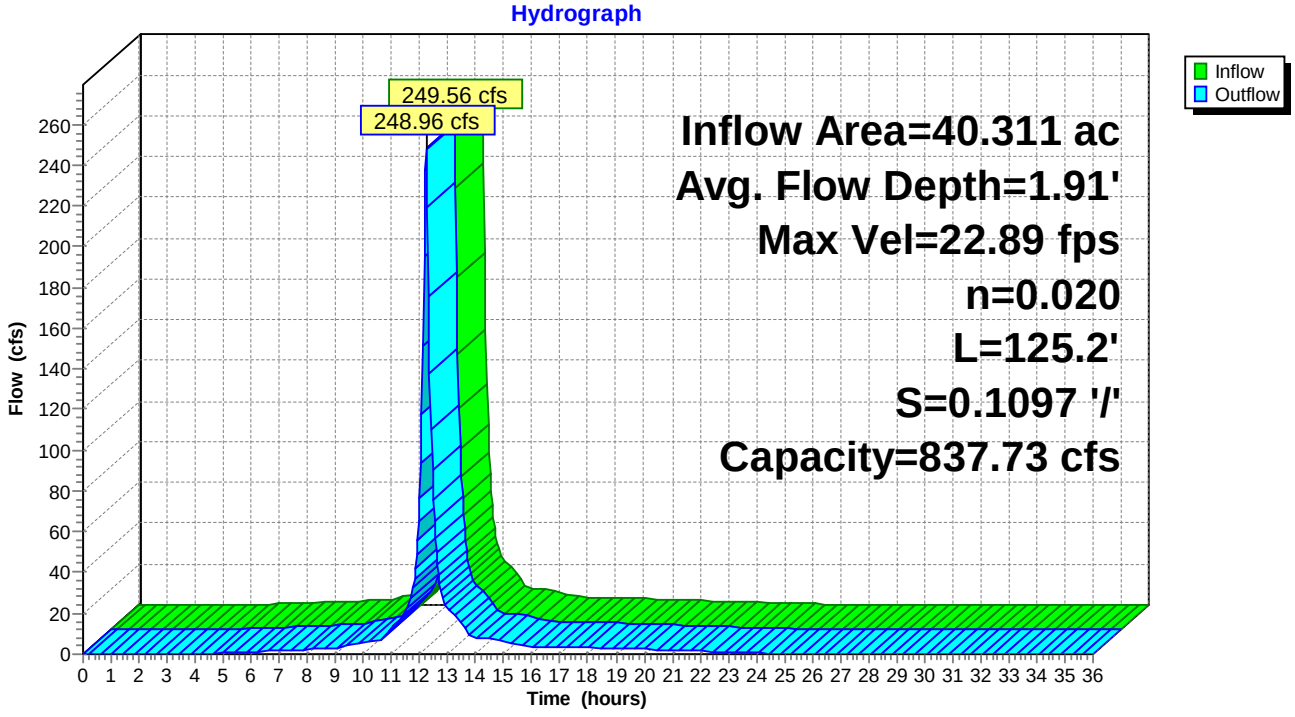
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 22.89 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 6.86 fps, Avg. Travel Time= 0.3 min

Peak Storage= 1,364 cf @ 12.23 hrs
Average Depth at Peak Storage= 1.91' , Surface Width= 11.43'
Bank-Full Depth= 3.00' Flow Area= 27.0 sf, Capacity= 837.73 cfs

0.00' x 3.00' deep channel, n= 0.020
Side Slope Z-value= 2.0 4.0 '/' Top Width= 18.00'
Length= 125.2' Slope= 0.1097 '/'
Inlet Invert= 728.00', Outlet Invert= 714.26'



Reach 37R: DB-A-2 (11%)



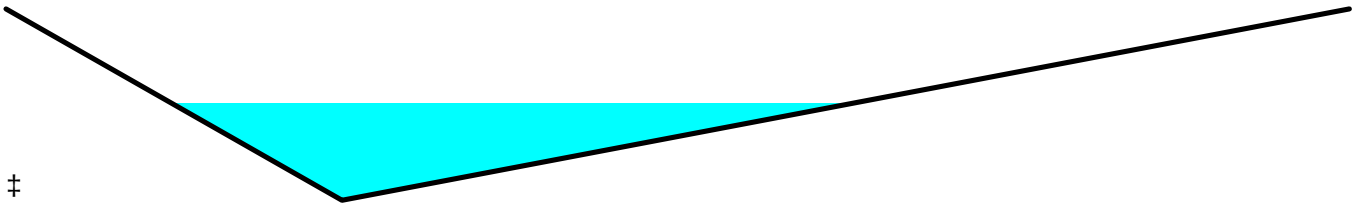
Summary for Reach 38R: S-MC XI DV

Inflow Area = 2.185 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 9.92 cfs @ 12.21 hrs, Volume= 0.616 af
Outflow = 9.30 cfs @ 12.30 hrs, Volume= 0.616 af, Atten= 6%, Lag= 5.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 4.07 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 1.35 fps, Avg. Travel Time= 9.3 min

Peak Storage= 1,733 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.76' , Surface Width= 6.08'
Bank-Full Depth= 1.50' Flow Area= 9.0 sf, Capacity= 57.72 cfs

0.00' x 1.50' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 6.0 '/' Top Width= 12.00'
Length= 750.0' Slope= 0.0180 '/'
Inlet Invert= 719.00', Outlet Invert= 705.50'



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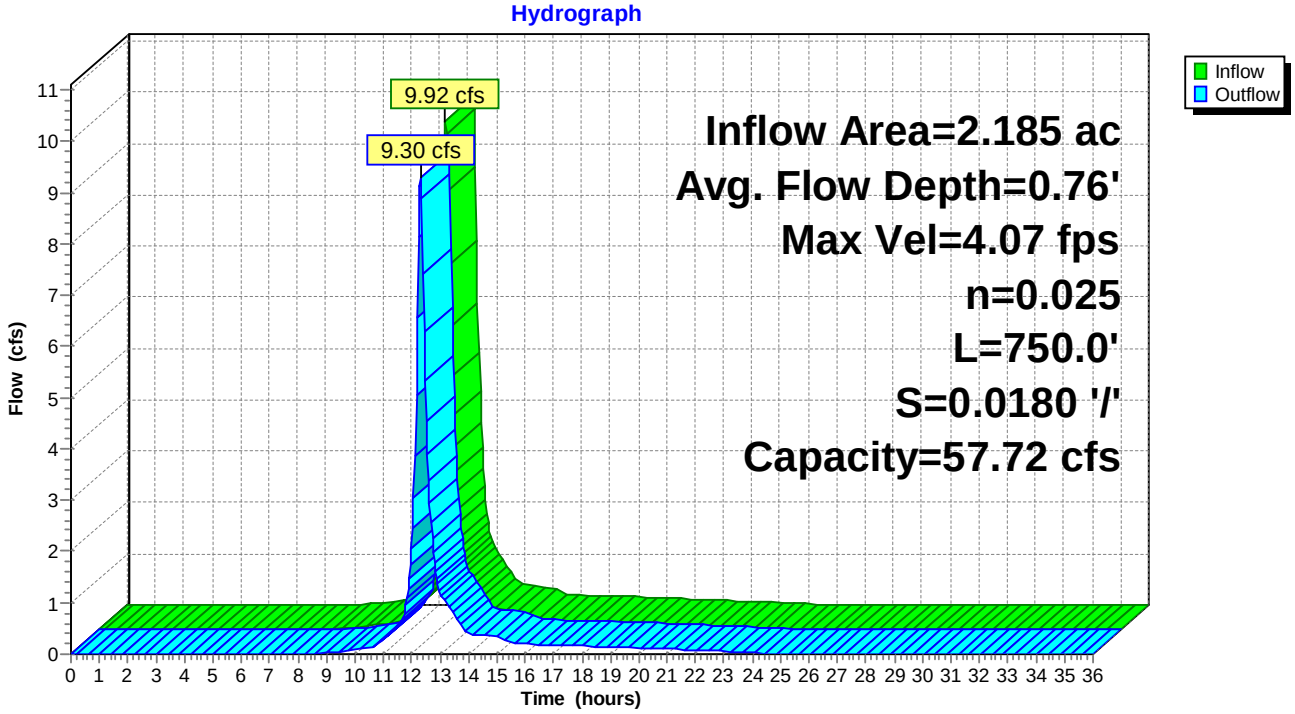
Reach 38R: S-MC XI DV



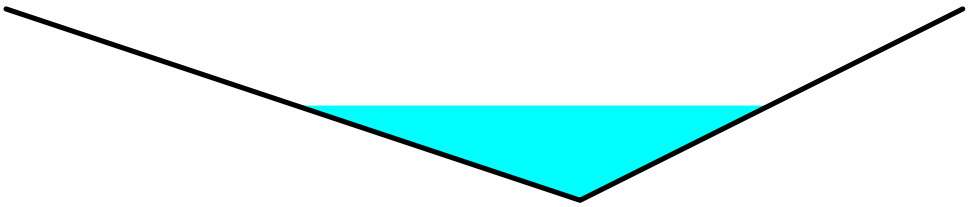
Summary for Reach 39R: DB-B

Inflow Area = 2.222 ac, 0.00% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 15.94 cfs @ 12.13 hrs, Volume= 0.840 af
Outflow = 14.87 cfs @ 12.18 hrs, Volume= 0.840 af, Atten= 7%, Lag= 2.8 min

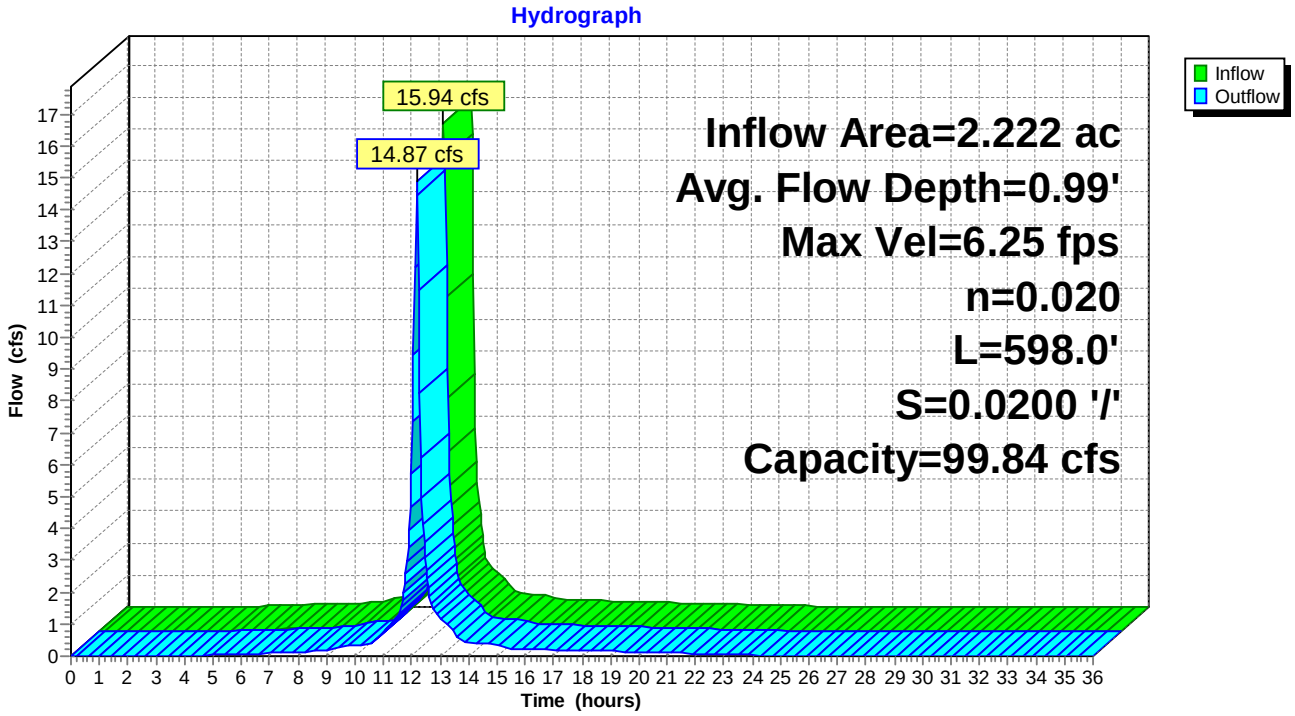
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 6.25 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 2.01 fps, Avg. Travel Time= 5.0 min

Peak Storage= 1,473 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.99' , Surface Width= 4.96'
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 99.84 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 3.0 2.0 '/' Top Width= 10.00'
Length= 598.0' Slope= 0.0200 '/'
Inlet Invert= 725.96', Outlet Invert= 714.00'



Reach 39R: DB-B



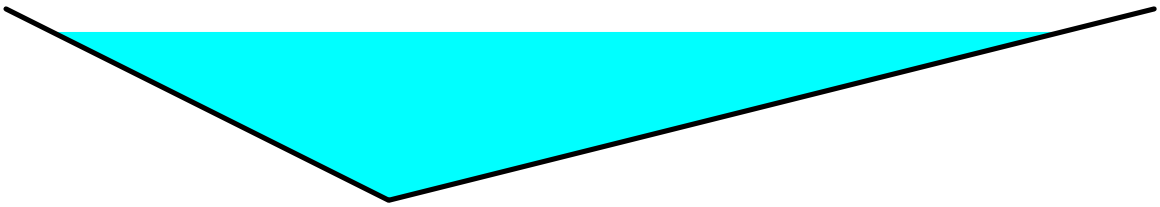
Summary for Reach 41R: DB-A-1 (2%)

Inflow Area = 40.311 ac, 0.00% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 276.01 cfs @ 12.15 hrs, Volume= 15.245 af
Outflow = 249.56 cfs @ 12.23 hrs, Volume= 15.245 af, Atten= 10%, Lag= 4.8 min

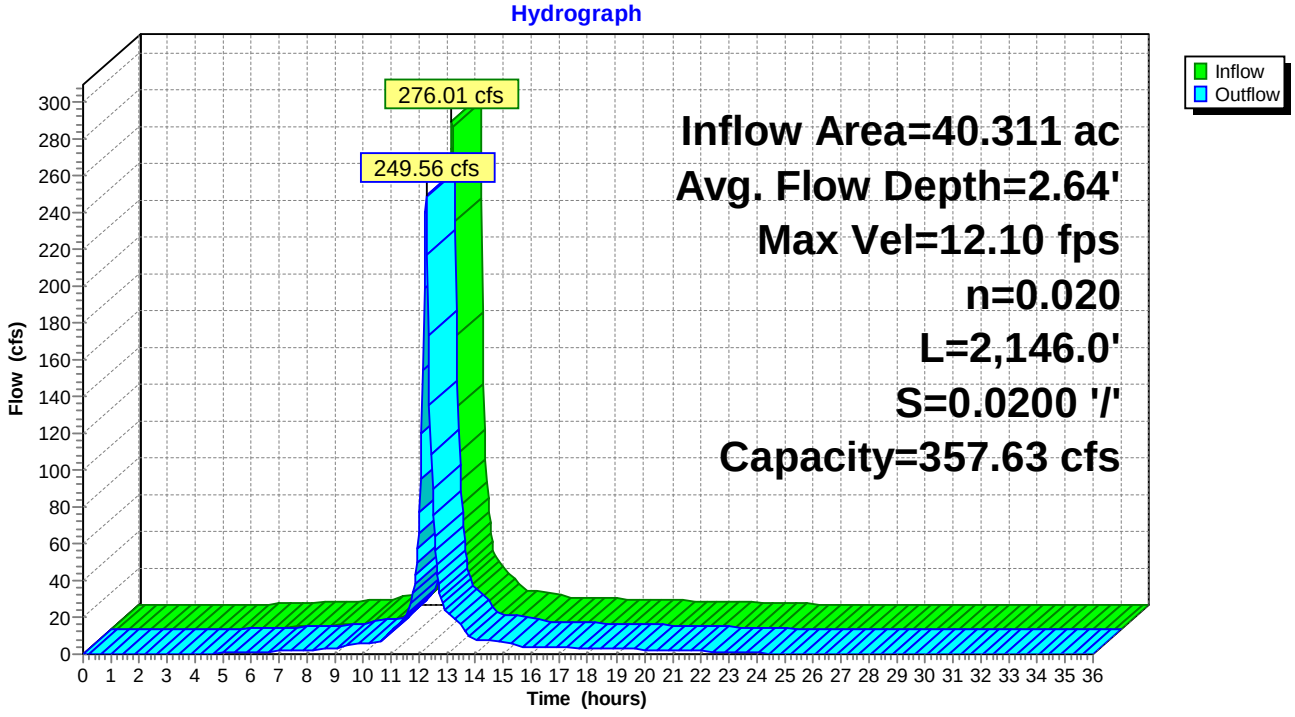
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 12.10 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 3.51 fps, Avg. Travel Time= 10.2 min

Peak Storage= 44,774 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.64' , Surface Width= 15.83'
Bank-Full Depth= 3.00' Flow Area= 27.0 sf, Capacity= 357.63 cfs

0.00' x 3.00' deep channel, n= 0.020
Side Slope Z-value= 2.0 4.0 '/' Top Width= 18.00'
Length= 2,146.0' Slope= 0.0200 '/'
Inlet Invert= 770.92', Outlet Invert= 728.00'



Reach 41R: DB-A-1 (2%)



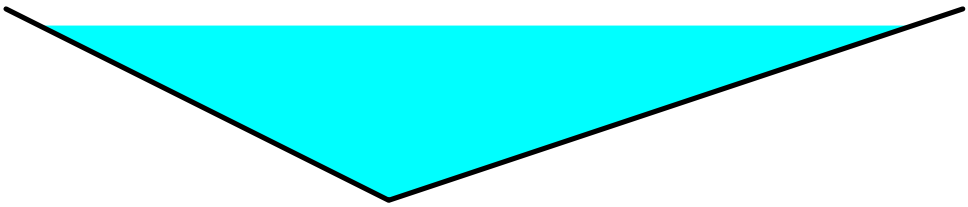
Summary for Reach 42R: DB-C

Inflow Area = 11.200 ac, 0.00% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 80.36 cfs @ 12.13 hrs, Volume= 4.236 af
Outflow = 75.77 cfs @ 12.17 hrs, Volume= 4.236 af, Atten= 6%, Lag= 2.2 min

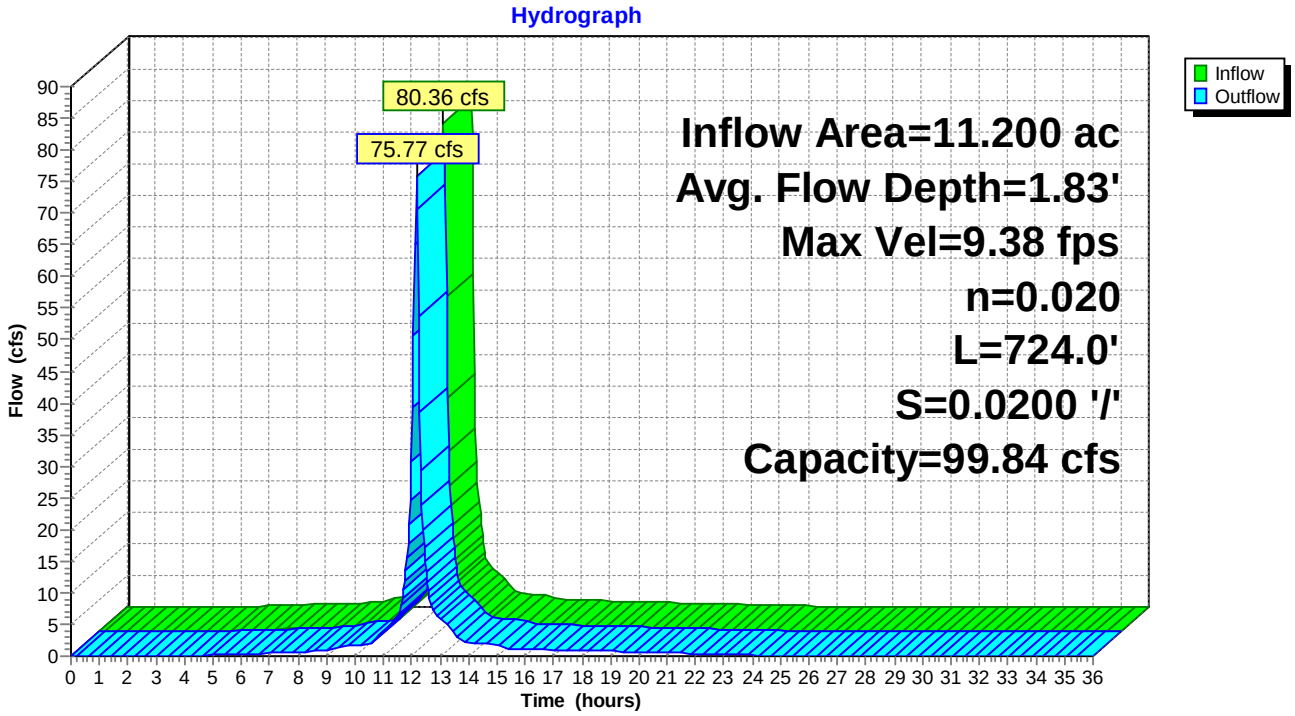
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Max. Velocity= 9.38 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 2.95 fps, Avg. Travel Time= 4.1 min

Peak Storage= 6,046 cf @ 12.15 hrs
Average Depth at Peak Storage= 1.83' , Surface Width= 9.14'
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 99.84 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 2.0 3.0 '/' Top Width= 10.00'
Length= 724.0' Slope= 0.0200 '/'
Inlet Invert= 726.48', Outlet Invert= 712.00'



Reach 42R: DB-C



Summary for Pond 1P: NSB North

Inflow Area = 287.592 ac, 3.48% Impervious, Inflow Depth = 3.83" for 100-yr, 24-hr event
Inflow = 231.01 cfs @ 13.47 hrs, Volume= 91.828 af
Outflow = 197.60 cfs @ 14.93 hrs, Volume= 46.806 af, Atten= 14%, Lag= 87.6 min
Primary = 197.60 cfs @ 14.93 hrs, Volume= 46.806 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 674.00' Surf.Area= 53,100 sf Storage= 144,600 cf
Peak Elev= 694.52' @ 14.93 hrs Surf.Area= 155,553 sf Storage= 2,335,715 cf (2,191,115 cf above start)

Plug-Flow detention time= 251.0 min calculated for 43.438 af (47% of inflow)
Center-of-Mass det. time= 130.0 min (1,002.1 - 872.1)

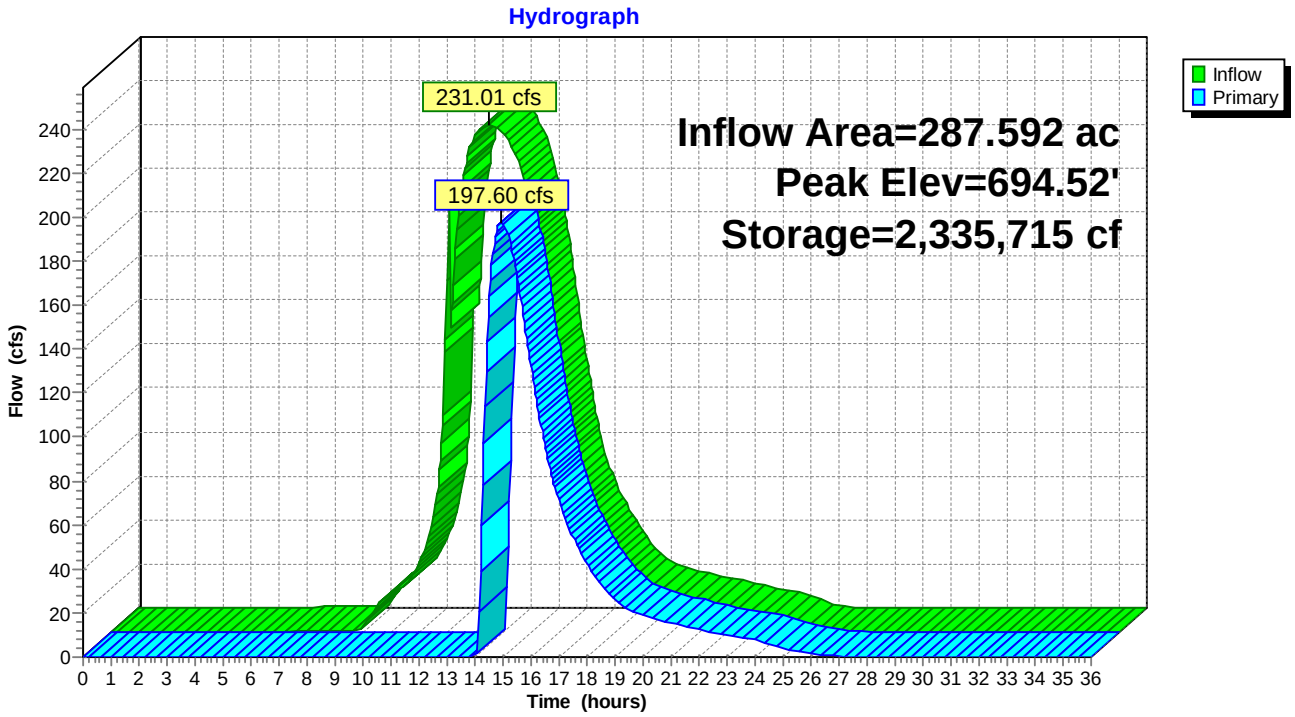
Volume	Invert	Avail.Storage	Storage Description
#1	668.00'	2,910,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
668.00	1,200	0	0
670.00	12,400	13,600	13,600
674.00	53,100	131,000	144,600
680.00	87,600	422,100	566,700
690.00	135,200	1,114,000	1,680,700
694.00	152,508	575,416	2,256,116
695.00	158,400	155,454	2,411,570
698.00	174,100	498,750	2,910,320

Device	Routing	Invert	Outlet Devices
#1	Primary	693.00'	**40.0' long x 20.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=196.80 cfs @ 14.93 hrs HW=694.52' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 196.80 cfs @ 3.24 fps)

Pond 1P: NSB North



Summary for Pond 5P: MC VII/IX & MC XI/X Pond

MC X/XI Culverts do not restrict flow in ditch (have more capacity than outlet on north end) therefore they are not modeled.

Inflow Area = 104.325 ac, 5.17% Impervious, Inflow Depth = 3.55" for 100-yr, 24-hr event
Inflow = 344.55 cfs @ 12.36 hrs, Volume= 30.839 af
Outflow = 72.88 cfs @ 13.06 hrs, Volume= 28.672 af, Atten= 79%, Lag= 42.2 min
Primary = 72.88 cfs @ 13.06 hrs, Volume= 28.672 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 697.10' Storage= 0 cf
Peak Elev= 704.55' @ 13.06 hrs Surf.Area= 174,228 sf Storage= 656,914 cf

Plug-Flow detention time= 126.8 min calculated for 28.640 af (93% of inflow)
Center-of-Mass det. time= 94.6 min (902.1 - 807.5)

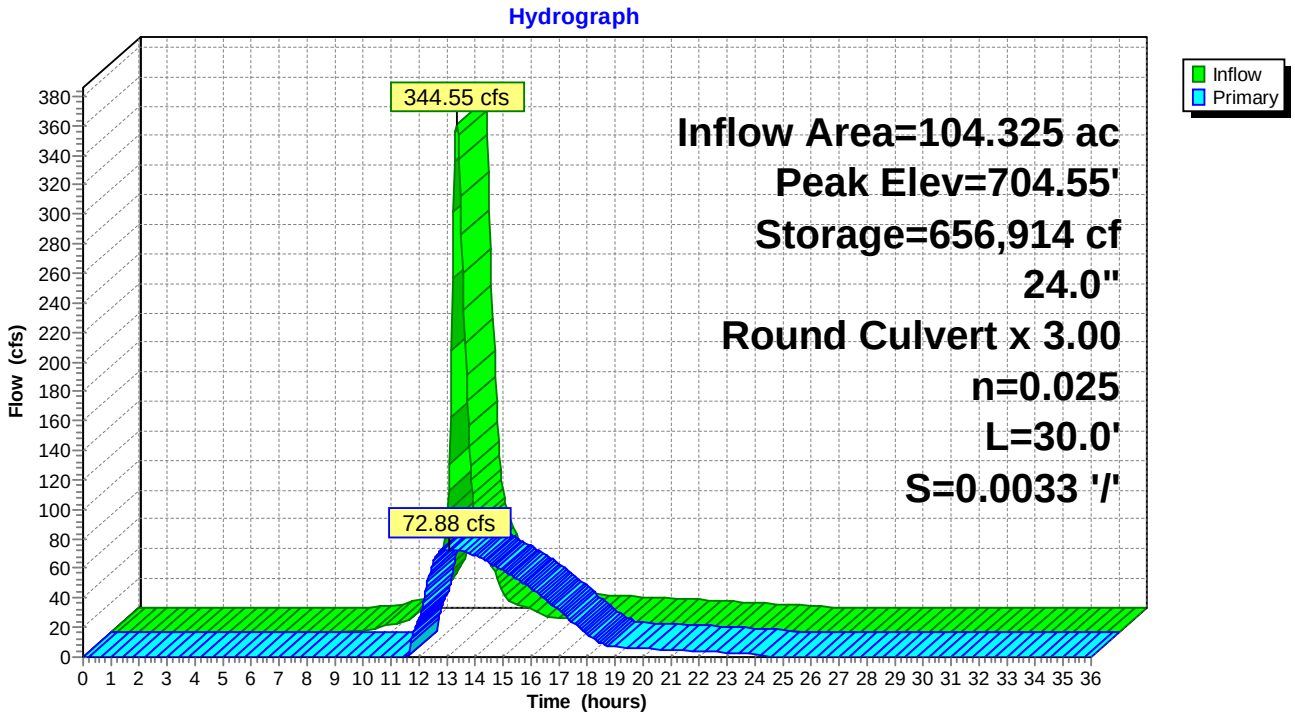
Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	925,600 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
698.00	13,000	0	0
700.00	55,300	68,300	68,300
702.00	137,000	192,300	260,600
704.00	166,000	303,000	563,600
706.00	196,000	362,000	925,600

Device	Routing	Invert	Outlet Devices
#1	Primary	697.10'	**24.0" Round Culvert X 3.00** L= 30.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 697.10' / 697.00' S= 0.0033 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=72.88 cfs @ 13.06 hrs HW=704.55' TW=700.41' (Fixed TW Elev= 700.41')
↑**1=Culvert** (Inlet Controls 72.88 cfs @ 7.73 fps)

Pond 5P: MC VII/IX & MC XI/X Pond



Summary for Pond 7P: MC VII/XI Pond

Inflow Area = 32.398 ac, 2.76% Impervious, Inflow Depth = 3.85" for 100-yr, 24-hr event
Inflow = 134.54 cfs @ 12.20 hrs, Volume= 10.382 af
Outflow = 97.21 cfs @ 12.37 hrs, Volume= 10.117 af, Atten= 28%, Lag= 10.2 min
Primary = 97.21 cfs @ 12.37 hrs, Volume= 10.117 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 708.37' @ 12.37 hrs Surf.Area= 47,137 sf Storage= 93,554 cf

Plug-Flow detention time= 34.6 min calculated for 10.106 af (97% of inflow)
Center-of-Mass det. time= 20.6 min (807.7 - 787.1)

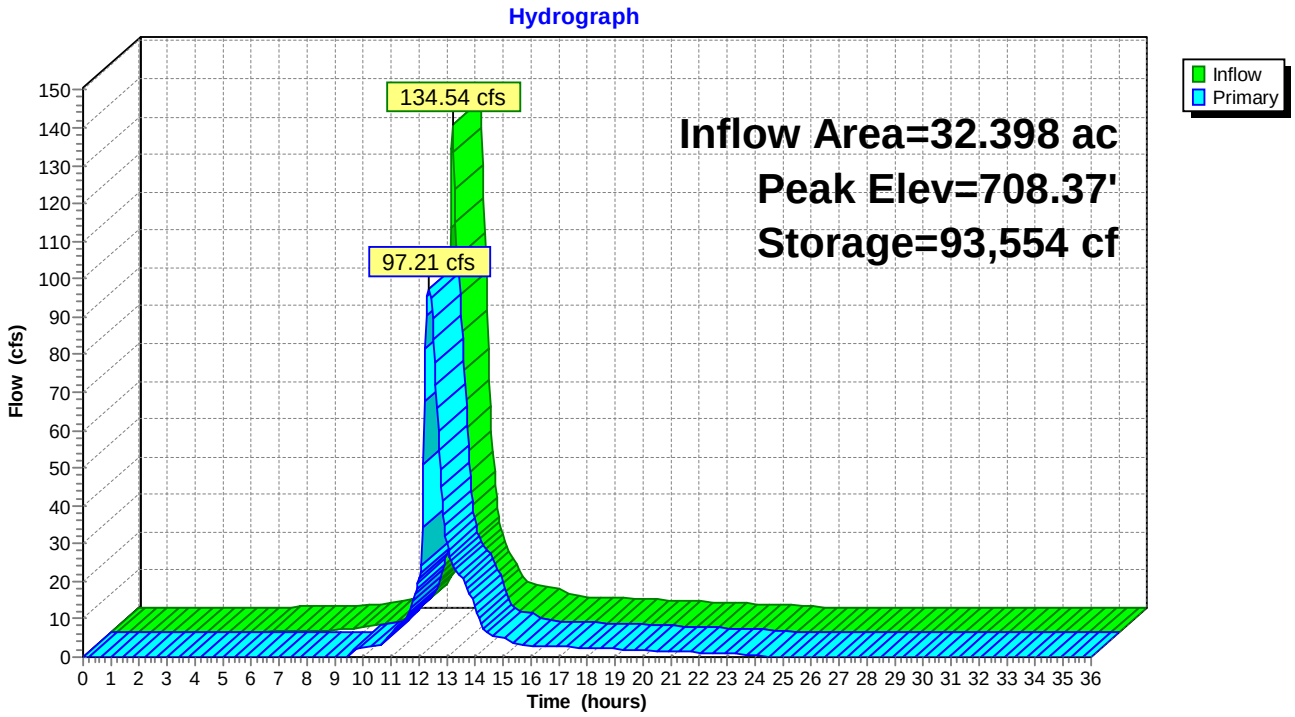
Volume	Invert	Avail.Storage	Storage Description
#1	700.00'	200,200 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
700.00	0	0	0
702.00	1,450	1,450	1,450
704.00	5,200	6,650	8,100
706.00	12,750	17,950	26,050
708.00	38,900	51,650	77,700
710.00	83,600	122,500	200,200

Device	Routing	Invert	Outlet Devices
#1	Primary	700.30'	**24.0" Round Culvert** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 700.30' / 699.40' S= 0.0225 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Primary	707.00'	**16.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=96.96 cfs @ 12.37 hrs HW=708.37' TW=704.55' (Fixed TW Elev= 704.55')
1=Culvert (Inlet Controls 29.55 cfs @ 9.41 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 67.41 cfs @ 3.09 fps)

Pond 7P: MC VII/XI Pond



Summary for Pond 8P: NSB South

Inflow Area = 287.592 ac, 3.48% Impervious, Inflow Depth = 1.95" for 100-yr, 24-hr event
Inflow = 197.60 cfs @ 14.93 hrs, Volume= 46.806 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

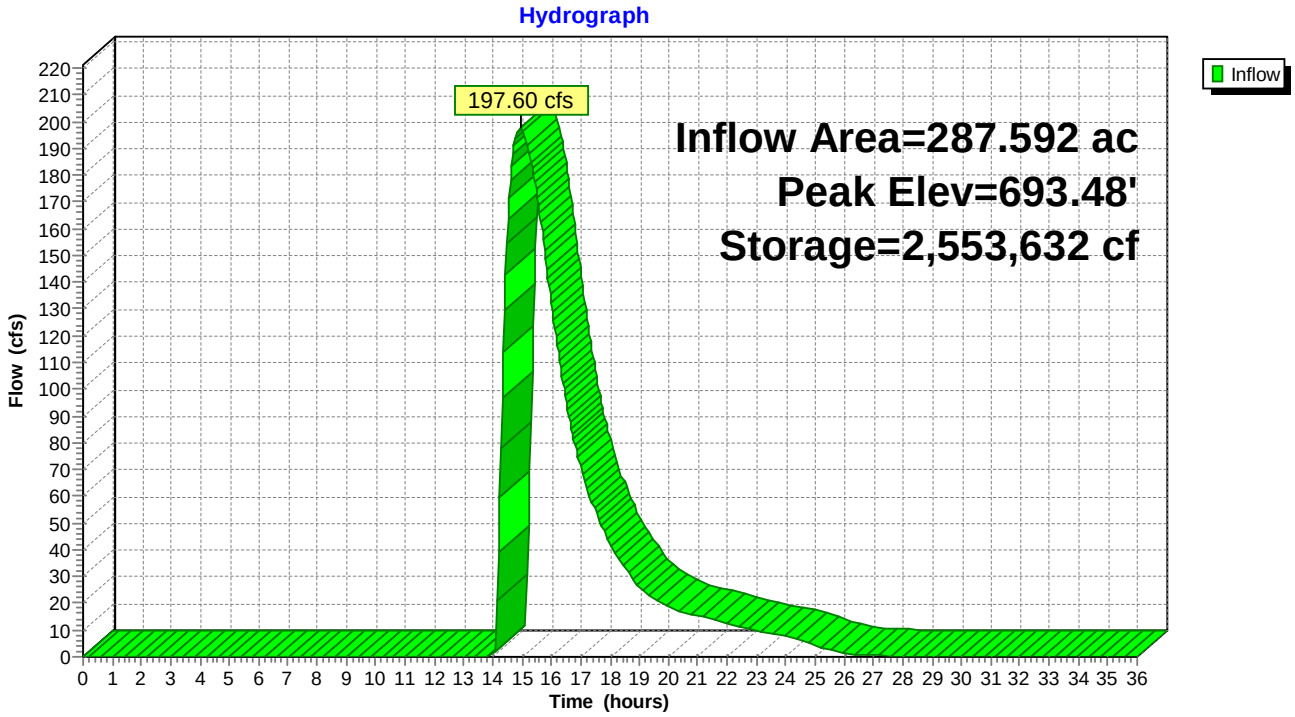
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Starting Elev= 680.00' Surf.Area= 98,500 sf Storage= 514,800 cf
Peak Elev= 693.48' @ 36.00 hrs Surf.Area= 200,487 sf Storage= 2,553,632 cf (2,038,832 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	672.00'	2,867,350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
672.00	30,200	0	0
680.00	98,500	514,800	514,800
690.00	177,700	1,381,000	1,895,800
694.00	203,900	763,200	2,659,000
695.00	212,800	208,350	2,867,350

Pond 8P: NSB South



Summary for Pond 11P: NWD / NW-MC VII

Inflow Area = 125.401 ac, 3.69% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 773.35 cfs @ 12.15 hrs, Volume= 47.427 af
Outflow = 157.20 cfs @ 12.52 hrs, Volume= 47.427 af, Atten= 80%, Lag= 21.9 min
Primary = 157.20 cfs @ 12.52 hrs, Volume= 47.427 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 711.78' @ 12.52 hrs Surf.Area= 195,680 sf Storage= 784,815 cf

Plug-Flow detention time= 47.1 min calculated for 47.374 af (100% of inflow)
Center-of-Mass det. time= 47.0 min (811.6 - 764.6)

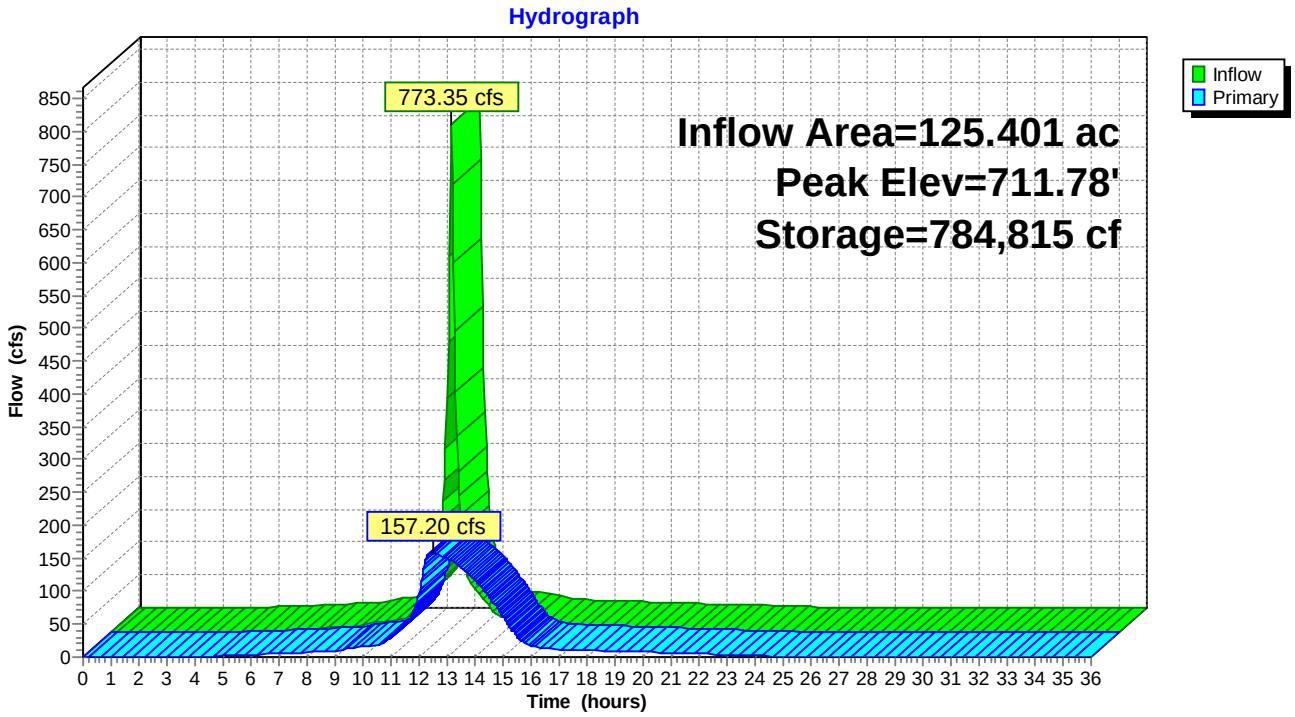
Volume	Invert	Avail.Storage	Storage Description
#1	704.30'	827,625 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
704.30	0	0	0
706.00	68,500	58,225	58,225
708.00	102,200	170,700	228,925
710.00	147,500	249,700	478,625
712.00	201,500	349,000	827,625

Device	Routing	Invert	Outlet Devices
#1	Primary	704.30'	**30.0" Round 30" HDPE Culverts X 3.00** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 704.30' / 699.00' S= 0.0424 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#2	Primary	704.30'	**18.0" Round 18" HDPE Culverts** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 704.30' / 699.00' S= 0.0424 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=157.20 cfs @ 12.52 hrs HW=711.78' TW=702.65' (Fixed TW Elev= 702.65')
1=30" HDPE Culverts (Inlet Controls 139.77 cfs @ 9.49 fps)
2=18" HDPE Culverts (Inlet Controls 17.43 cfs @ 9.86 fps)

Pond 11P: NWD / NW-MC VII



Summary for Pond 19P: E-MC IX Culvert

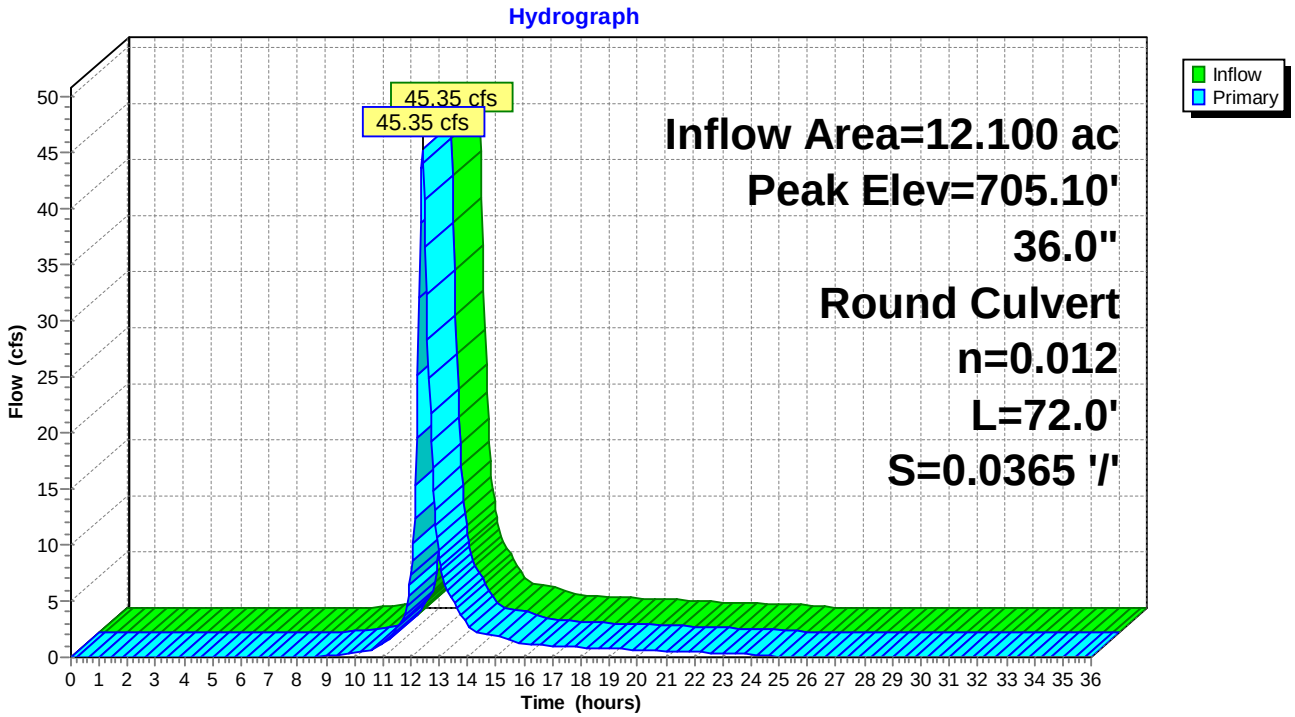
Inflow Area = 12.100 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 45.35 cfs @ 12.40 hrs, Volume= 3.409 af
Outflow = 45.35 cfs @ 12.40 hrs, Volume= 3.409 af, Atten= 0%, Lag= 0.0 min
Primary = 45.35 cfs @ 12.40 hrs, Volume= 3.409 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 705.10' @ 12.40 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	701.82'	**36.0" Round Culvert** L= 72.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 701.82' / 699.19' S= 0.0365 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=45.25 cfs @ 12.40 hrs HW=705.09' TW=698.17' (Fixed TW Elev= 698.17')
↑—**1=Culvert** (Inlet Controls 45.25 cfs @ 6.40 fps)

Pond 19P: E-MC IX Culvert



Summary for Pond 37P: N-MC VII Ditch

Inflow Area = 133.429 ac, 3.47% Impervious, Inflow Depth = 4.47" for 100-yr, 24-hr event
Inflow = 183.24 cfs @ 12.33 hrs, Volume= 49.688 af
Outflow = 165.20 cfs @ 12.69 hrs, Volume= 48.047 af, Atten= 10%, Lag= 21.4 min
Primary = 165.20 cfs @ 12.69 hrs, Volume= 48.047 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 702.65' @ 12.69 hrs Surf.Area= 40,743 sf Storage= 152,731 cf

Plug-Flow detention time= 34.4 min calculated for 47.993 af (97% of inflow)
Center-of-Mass det. time= 17.7 min (828.9 - 811.3)

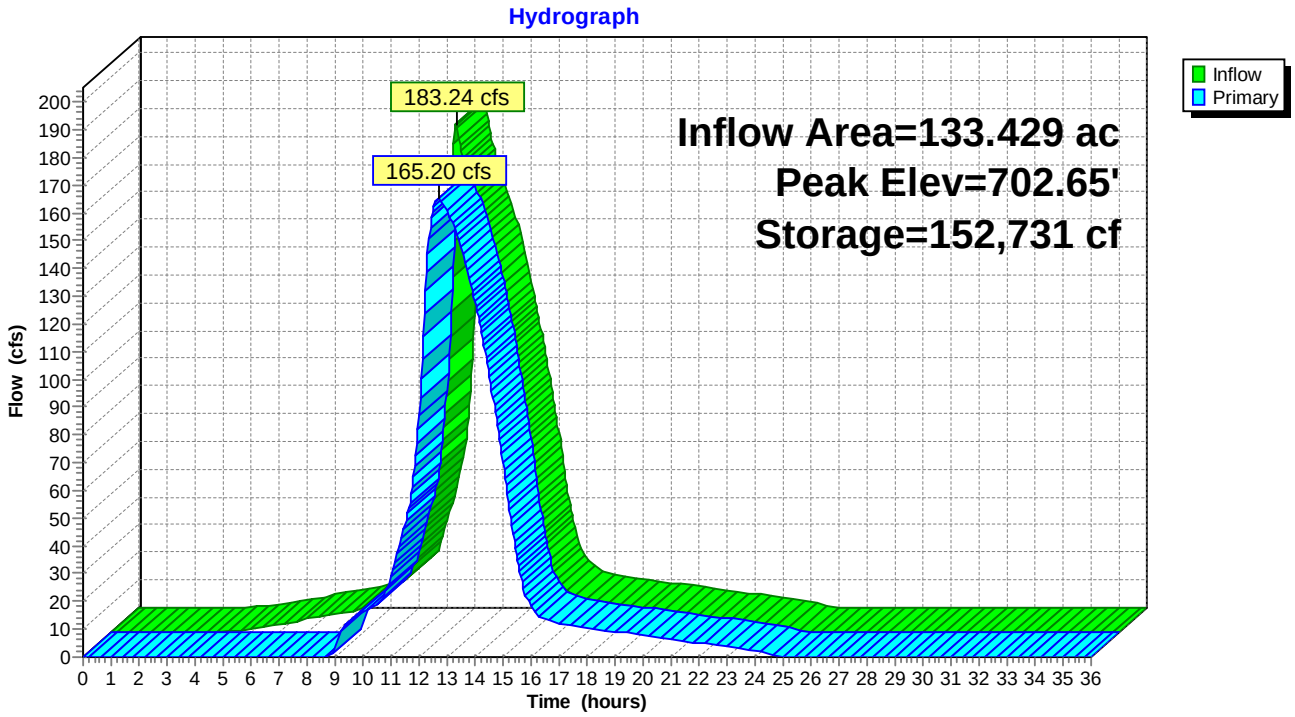
Volume	Invert	Avail.Storage	Storage Description
#1	696.77'	167,201 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
696.77	0	0	0
697.00	2,561	295	295
698.00	14,817	8,689	8,984
699.00	26,696	20,757	29,740
700.00	30,510	28,603	58,343
701.00	34,346	32,428	90,771
702.00	38,204	36,275	127,046
703.00	42,106	40,155	167,201

Device	Routing	Invert	Outlet Devices
#1	Primary	696.77'	**54.0" Round 54" Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 696.77' / 696.61' S= 0.0038 '/' Cc= 0.900 n= 0.012, Flow Area= 15.90 sf
#2	Primary	696.77'	**36.0" Round 36" Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 696.77' / 696.61' S= 0.0038 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf

Primary OutFlow Max=165.18 cfs @ 12.69 hrs HW=702.65' TW=700.42' (Fixed TW Elev= 700.42')
1=54" Culvert (Inlet Controls 114.36 cfs @ 7.19 fps)
2=36" Culvert (Inlet Controls 50.83 cfs @ 7.19 fps)

Pond 37P: N-MC VII Ditch



Summary for Pond 38P: N-MC IX Ditch

Inflow Area = 276.502 ac, 3.62% Impervious, Inflow Depth = 3.80" for 100-yr, 24-hr event
Inflow = 330.31 cfs @ 12.37 hrs, Volume= 87.634 af
Outflow = 227.98 cfs @ 13.60 hrs, Volume= 87.634 af, Atten= 31%, Lag= 74.0 min
Primary = 227.98 cfs @ 13.60 hrs, Volume= 87.634 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Peak Elev= 700.54' @ 13.60 hrs Surf.Area= 180,365 sf Storage= 507,634 cf

Plug-Flow detention time= 27.8 min calculated for 87.634 af (100% of inflow)
Center-of-Mass det. time= 27.8 min (877.7 - 849.9)

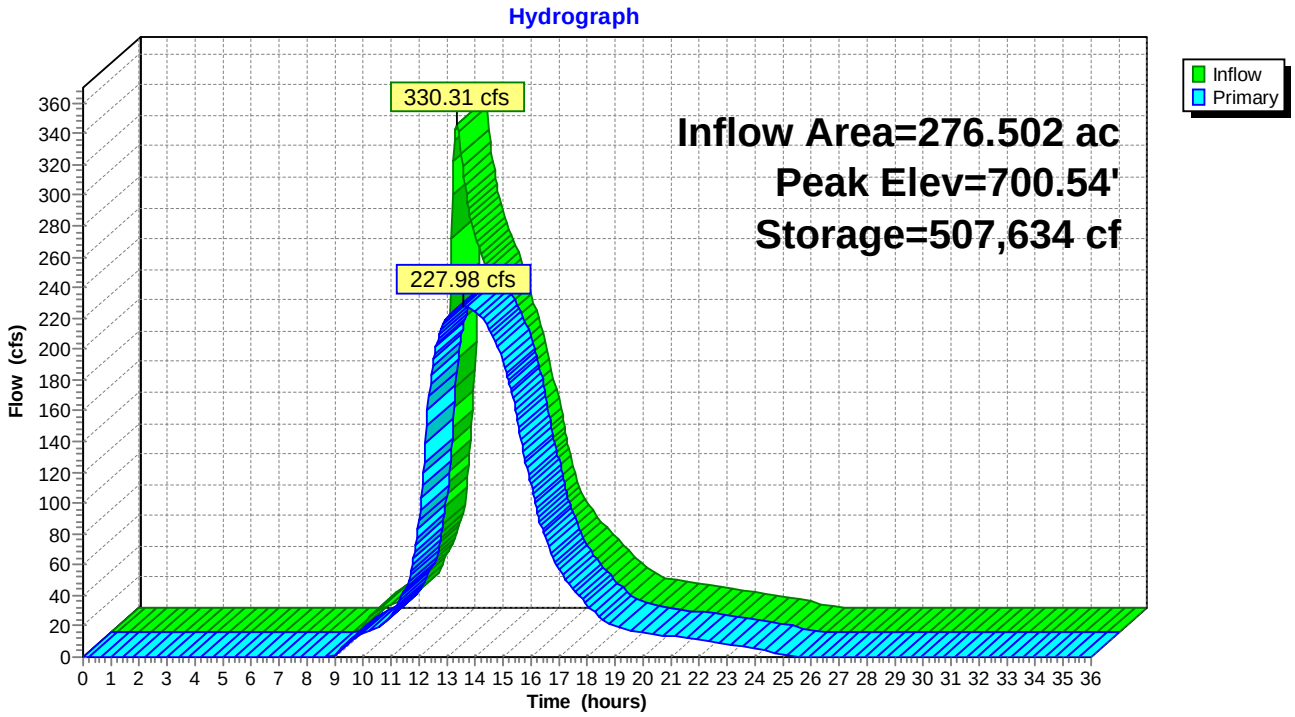
Volume	Invert	Avail.Storage	Storage Description
#1	694.90'	799,720 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
694.90	0	0	0
695.00	350	18	18
696.00	27,524	13,937	13,955
698.00	103,447	130,971	144,926
700.00	166,382	269,829	414,755
702.00	218,583	384,965	799,720

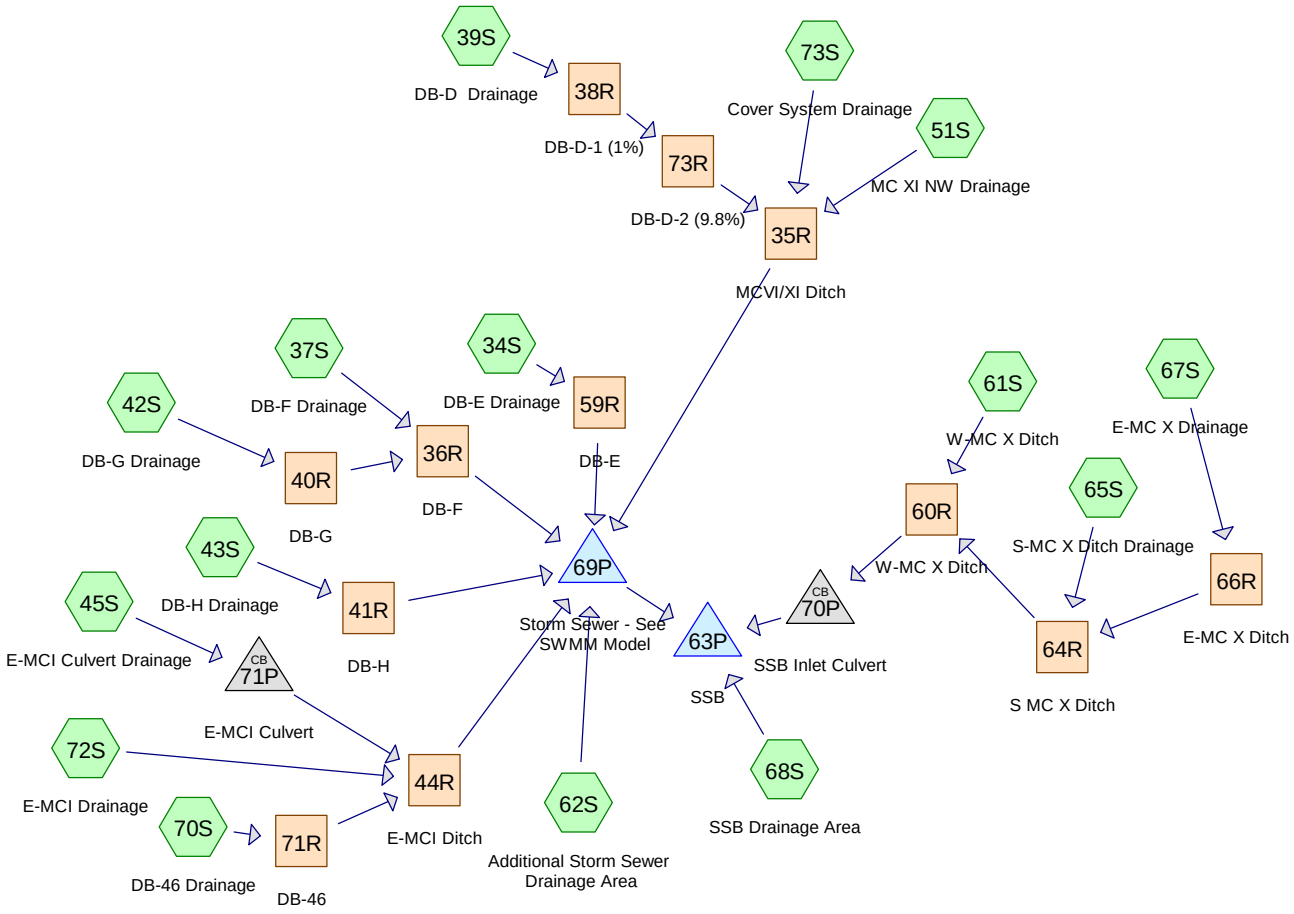
Device	Routing	Invert	Outlet Devices
#1	Primary	694.96'	**30.0" Round 30" Culvert X 3.00** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 694.96' / 694.96' S= 0.0000 '/' Cc= 0.900 n= 0.025, Flow Area= 4.91 sf
#2	Primary	694.90'	**54.0" Round 54" Culvert** L= 110.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 694.90' / 690.50' S= 0.0400 '/' Cc= 0.900 n= 0.012, Flow Area= 15.90 sf

Primary OutFlow Max=227.98 cfs @ 13.60 hrs HW=700.54' TW=694.18' (Fixed TW Elev= 694.18')
1=30" Culvert (Barrel Controls 87.07 cfs @ 5.91 fps)
2=54" Culvert (Inlet Controls 140.91 cfs @ 8.86 fps)

Pond 38P: N-MC IX Ditch



South Sedimentation Basin (SSB) HYDROCAD OUTPUT – 25-yr, 24-hr



Routing Diagram for WDI Vert Exp SSB
Prepared by CTI, Printed 10/28/2021
HydroCAD® 10.10-5a s/n 11246 © 2020 HydroCAD Software Solutions LLC

Time span=0.00-36.00 hrs, dt=0.02 hrs, 1801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 34S: DB-E Drainage Runoff Area=86,500 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=476' Tc=3.4 min CN=95 Runoff=12.17 cfs 0.560 af

Subcatchment 37S: DB-F Drainage Runoff Area=63,437 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=280' Tc=5.0 min CN=95 Runoff=8.55 cfs 0.410 af

Subcatchment 39S: DB-D Drainage Runoff Area=384,155 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=62' Slope=0.2500 '/' Tc=2.4 min CN=95 Runoff=55.79 cfs 2.485 af

Subcatchment 42S: DB-G Drainage Runoff Area=82,915 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=52' Slope=0.2500 '/' Tc=2.1 min CN=95 Runoff=12.16 cfs 0.536 af

Subcatchment 43S: DB-H Drainage Runoff Area=8,958 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=77' Tc=9.3 min CN=95 Runoff=1.01 cfs 0.058 af

Subcatchment 45S: E-MCI Culvert Drainage Runoff Area=136,608 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=667' Tc=22.3 min CN=84 Runoff=7.72 cfs 0.608 af

Subcatchment 51S: MC XI NW Drainage Runoff Area=464,875 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=480' Slope=0.0520 '/' Tc=16.5 min CN=84 Runoff=30.74 cfs 2.070 af

Subcatchment 61S: W-MC X Ditch Runoff Area=141,400 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=150' Slope=0.2500 '/' Tc=5.8 min CN=84 Runoff=14.01 cfs 0.629 af

Subcatchment 62S: Additional Storm Sewer Runoff Area=237,200 sf 100.00% Impervious Runoff Depth=3.72"
Tc=0.0 min CN=98 Runoff=35.48 cfs 1.686 af

Subcatchment 65S: S-MC X Ditch Drainage Runoff Area=205,200 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=160' Slope=0.3300 '/' Tc=5.4 min CN=84 Runoff=20.59 cfs 0.914 af

Subcatchment 67S: E-MC X Drainage Runoff Area=253,500 sf 0.00% Impervious Runoff Depth=2.33"
Flow Length=110' Slope=0.2500 '/' Tc=4.5 min CN=84 Runoff=26.56 cfs 1.129 af

Subcatchment 68S: SSB Drainage Area Runoff Area=900,800 sf 23.12% Impervious Runoff Depth=2.59"
Flow Length=400' Slope=0.0730 '/' Tc=13.7 min CN=87 Runoff=71.50 cfs 4.465 af

Subcatchment 70S: DB-46 Drainage Runoff Area=455,500 sf 0.00% Impervious Runoff Depth=2.00"
Flow Length=450' Slope=0.0350 '/' Tc=19.1 min CN=80 Runoff=24.00 cfs 1.743 af

Subcatchment 72S: E-MCI Drainage Runoff Area=177,527 sf 0.00% Impervious Runoff Depth=2.00"
Flow Length=1,086' Tc=33.4 min CN=80 Runoff=6.83 cfs 0.679 af

Subcatchment 73S: Cover System Drainage Runoff Area=858,183 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=1,385' Tc=9.7 min CN=95 Runoff=95.79 cfs 5.552 af

Reach 35R: MCVI/XI Ditch Avg. Flow Depth=1.66' Max Vel=7.73 fps Inflow=162.49 cfs 10.107 af
n=0.020 L=290.0' S=0.0100 '/' Capacity=1,123.17 cfs Outflow=161.20 cfs 10.107 af

Reach 36R: DB-F Avg. Flow Depth=1.15' Max Vel=4.95 fps Inflow=20.35 cfs 0.947 af
n=0.020 L=402.0' S=0.0100 '/' Capacity=85.77 cfs Outflow=19.72 cfs 0.947 af

Reach 38R: DB-D-1 (1%) Avg. Flow Depth=1.58' Max Vel=6.10 fps Inflow=55.79 cfs 2.485 af
n=0.020 L=1,851.0' S=0.0100 '/' Capacity=155.51 cfs Outflow=45.12 cfs 2.485 af

Reach 40R: DB-G Avg. Flow Depth=0.69' Max Vel=8.20 fps Inflow=12.16 cfs 0.536 af
n=0.020 L=610.0' S=0.0540 '/' Capacity=199.31 cfs Outflow=11.80 cfs 0.536 af

Reach 41R: DB-H Avg. Flow Depth=0.38' Max Vel=2.35 fps Inflow=1.01 cfs 0.058 af
n=0.020 L=127.1' S=0.0100 '/' Capacity=85.74 cfs Outflow=1.00 cfs 0.058 af

Reach 44R: E-MCI Ditch Avg. Flow Depth=1.87' Max Vel=3.51 fps Inflow=37.12 cfs 3.031 af
n=0.025 L=250.0' S=0.0041 '/' Capacity=129.69 cfs Outflow=36.98 cfs 3.031 af

Reach 59R: DB-E Avg. Flow Depth=0.94' Max Vel=4.32 fps Inflow=12.17 cfs 0.560 af
n=0.020 L=576.5' S=0.0100 '/' Capacity=85.81 cfs Outflow=11.41 cfs 0.560 af

Reach 60R: W-MC X Ditch Avg. Flow Depth=1.02' Max Vel=2.42 fps Inflow=22.31 cfs 2.672 af
n=0.025 L=833.0' S=0.0024 '/' Capacity=326.61 cfs Outflow=21.03 cfs 2.672 af

Reach 64R: S MC X Ditch Avg. Flow Depth=2.07' Max Vel=2.77 fps Inflow=23.26 cfs 2.042 af
n=0.025 L=1,110.0' S=0.0027 '/' Capacity=103.29 cfs Outflow=17.73 cfs 2.042 af

Reach 66R: E-MC X Ditch Avg. Flow Depth=1.26' Max Vel=1.81 fps Inflow=26.56 cfs 1.129 af
n=0.030 L=1,500.0' S=0.0025 '/' Capacity=145.10 cfs Outflow=14.40 cfs 1.129 af

Reach 71R: DB-46 Avg. Flow Depth=1.00' Max Vel=3.70 fps Inflow=24.00 cfs 1.743 af
n=0.025 L=200.0' S=0.0100 '/' Capacity=152.89 cfs Outflow=23.88 cfs 1.743 af

Reach 73R: DB-D-2 (9.8%) Avg. Flow Depth=1.02' Max Vel=14.29 fps Inflow=45.12 cfs 2.485 af
n=0.020 L=187.0' S=0.0980 '/' Capacity=486.88 cfs Outflow=44.84 cfs 2.485 af

Pond 63P: SSB Inflow=298.73 cfs 23.524 af
Primary=298.73 cfs 23.524 af

Pond 69P: Storm Sewer - See SWMM Model Inflow=215.54 cfs 16.388 af
Primary=215.54 cfs 16.388 af

Pond 70P: SSB Inlet Culvert Peak Elev=690.92' Inflow=21.03 cfs 2.672 af
30.0" Round Culvert n=0.012 L=113.0' S=-0.0012 '/' Outflow=21.03 cfs 2.672 af

Pond 71P: E-MCI Culvert Peak Elev=705.52' Inflow=7.72 cfs 0.608 af
24.0" Round Culvert n=0.012 L=80.0' S=0.0025 '/' Outflow=7.72 cfs 0.608 af

Total Runoff Area = 102.313 ac Runoff Volume = 23.524 af Average Runoff Depth = 2.76"
90.00% Pervious = 92.086 ac 10.00% Impervious = 10.227 ac

Summary for Subcatchment 34S: DB-E Drainage

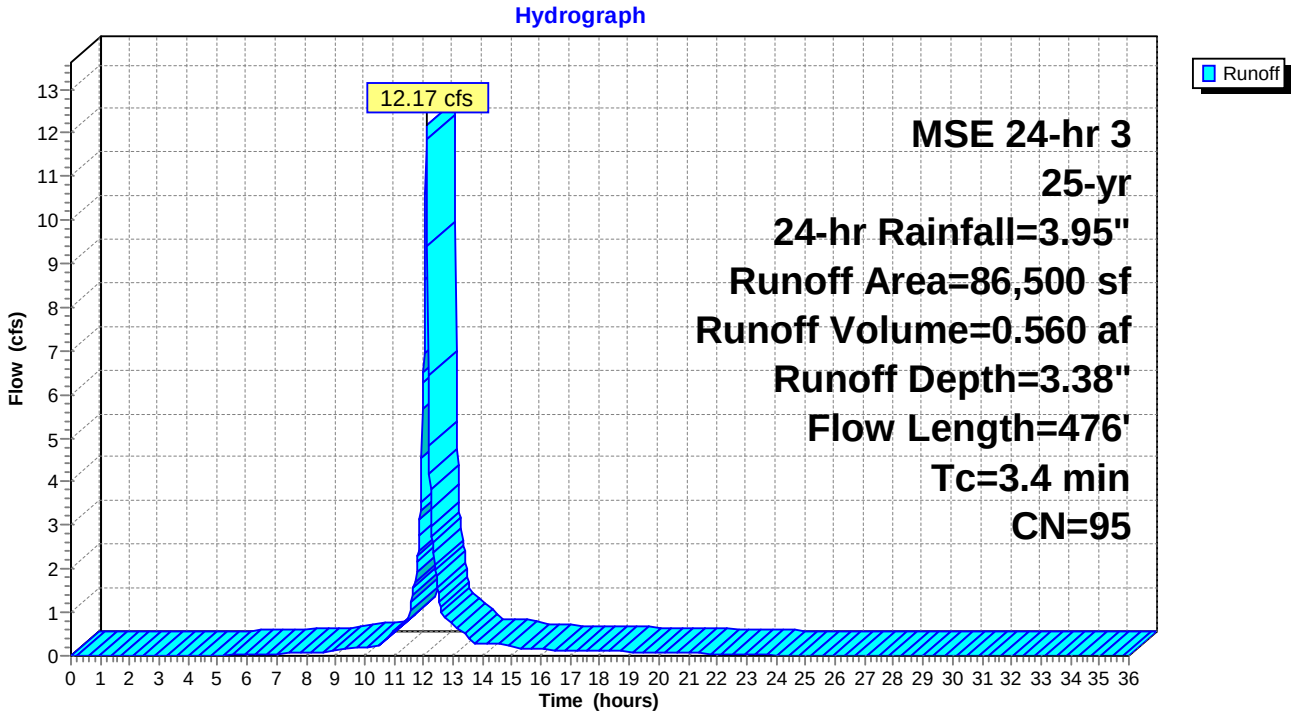
Runoff = 12.17 cfs @ 12.10 hrs, Volume= 0.560 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
*	86,500	95	Closure Turf
	86,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	66	0.2500	0.44		**Sheet Flow,** n= 0.120 P2= 2.35"
0.9	410	0.0100	7.43	89.16	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.020
3.4	476	Total			

Subcatchment 34S: DB-E Drainage



Summary for Subcatchment 37S: DB-F Drainage

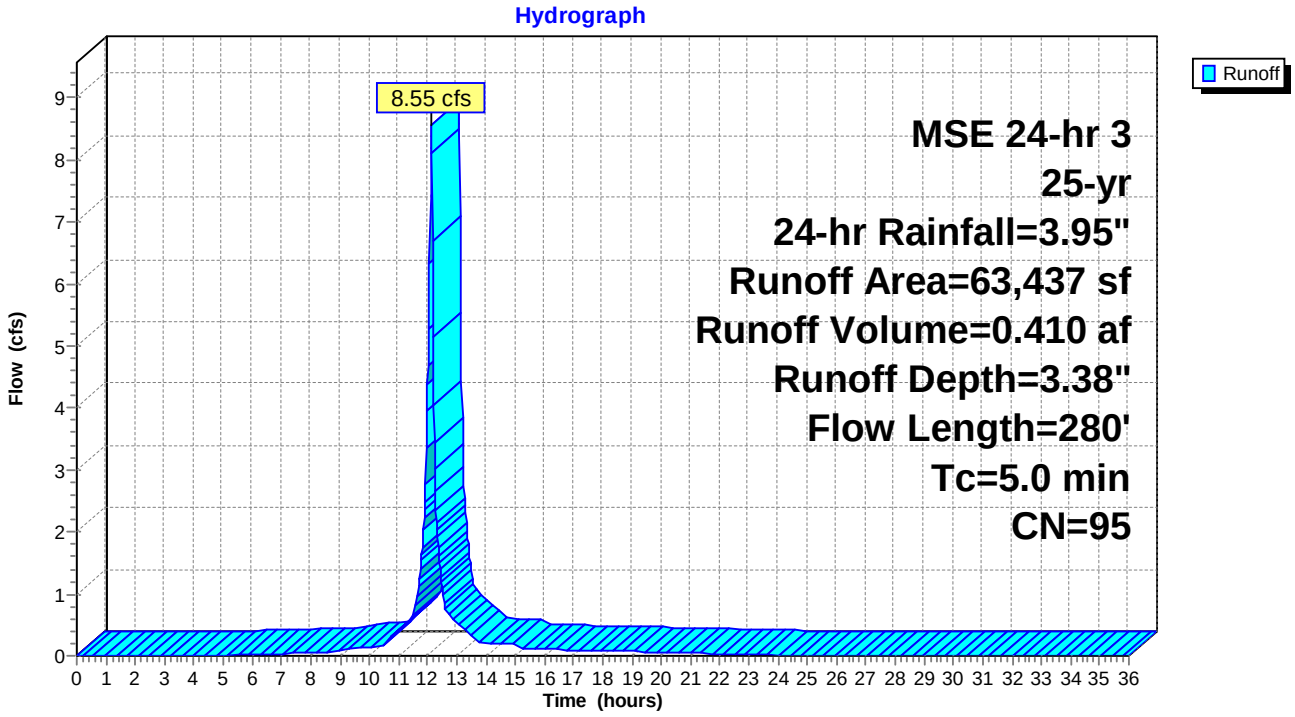
Runoff = 8.55 cfs @ 12.12 hrs, Volume= 0.410 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
*	63,437	95	Closure Turf
	63,437		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	65	0.2500	0.44		**Sheet Flow,** n= 0.120 P2= 2.35"
2.5	215	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.0	280	Total			

Subcatchment 37S: DB-F Drainage



Summary for Subcatchment 39S: DB-D Drainage

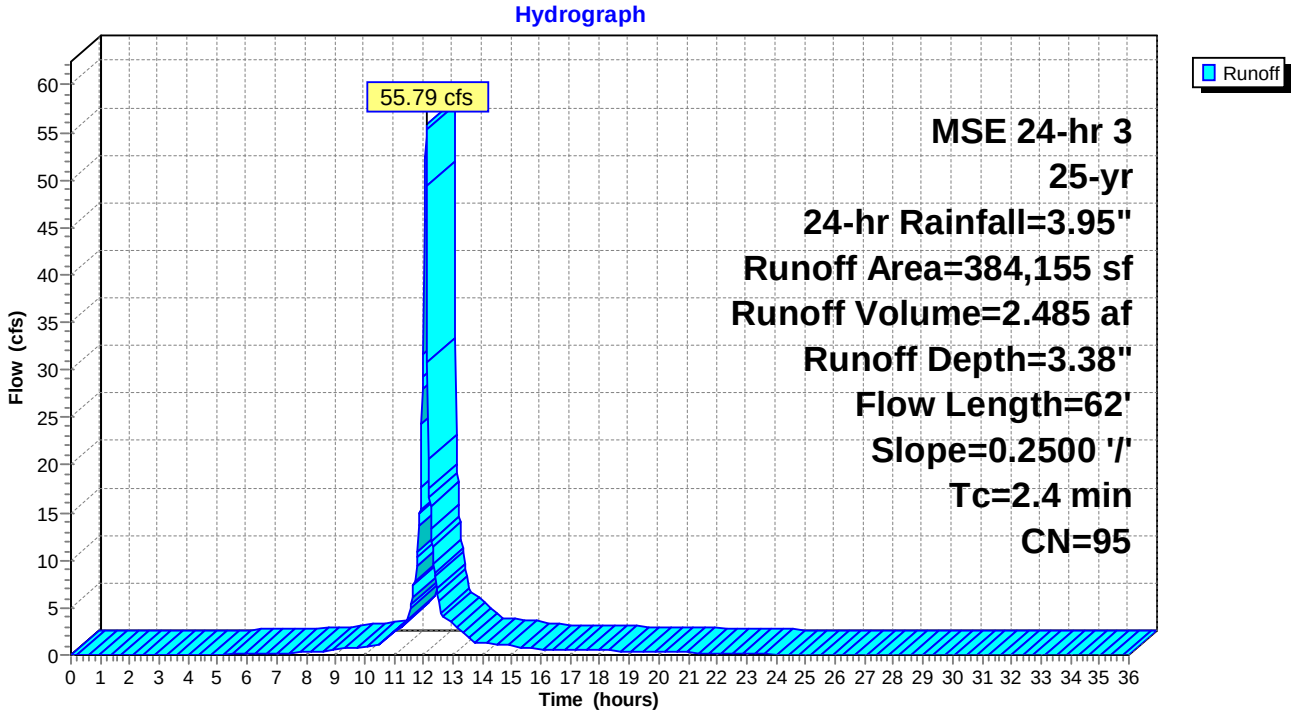
Runoff = 55.79 cfs @ 12.09 hrs, Volume= 2.485 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
*	384,155	95	Closure Turf
	384,155		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	62	0.2500	0.43		**Sheet Flow,** n= 0.120 P2= 2.35"

Subcatchment 39S: DB-D Drainage



Summary for Subcatchment 42S: DB-G Drainage

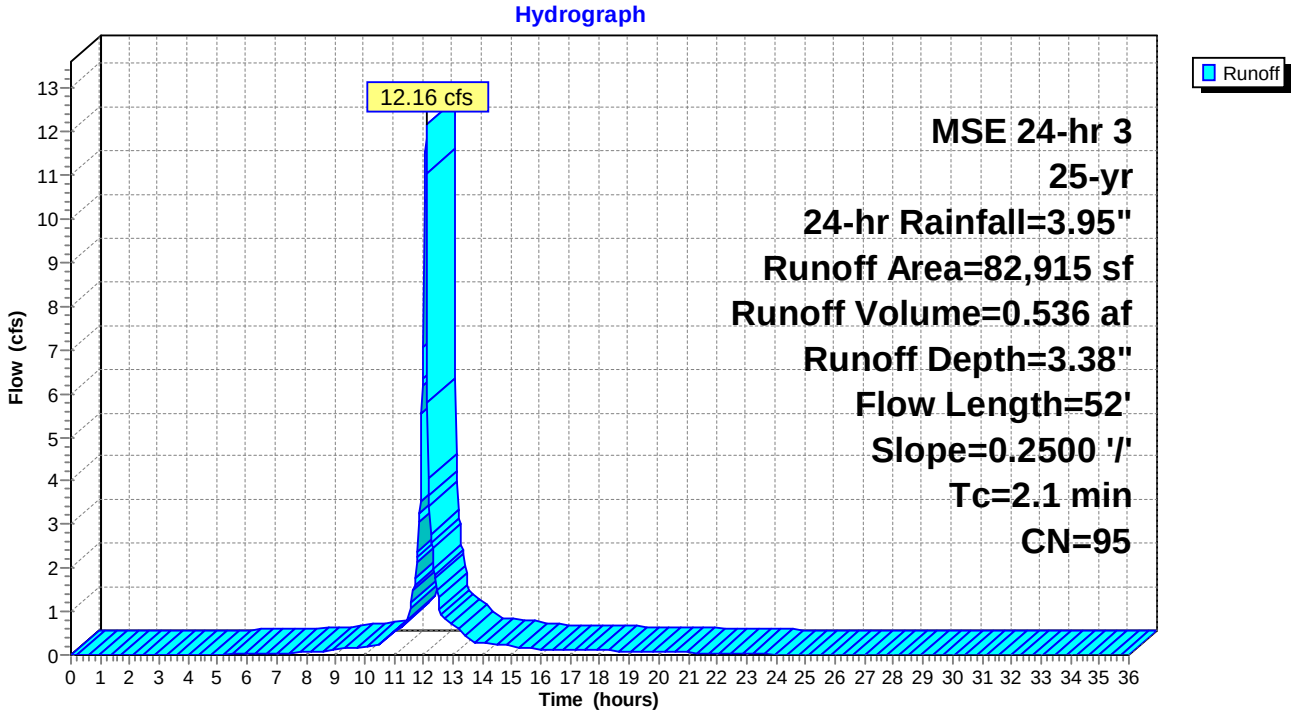
Runoff = 12.16 cfs @ 12.09 hrs, Volume= 0.536 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
*	82,915	95	Closure Turf
	82,915		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	52	0.2500	0.42		**Sheet Flow,** n= 0.120 P2= 2.35"

Subcatchment 42S: DB-G Drainage



Summary for Subcatchment 43S: DB-H Drainage

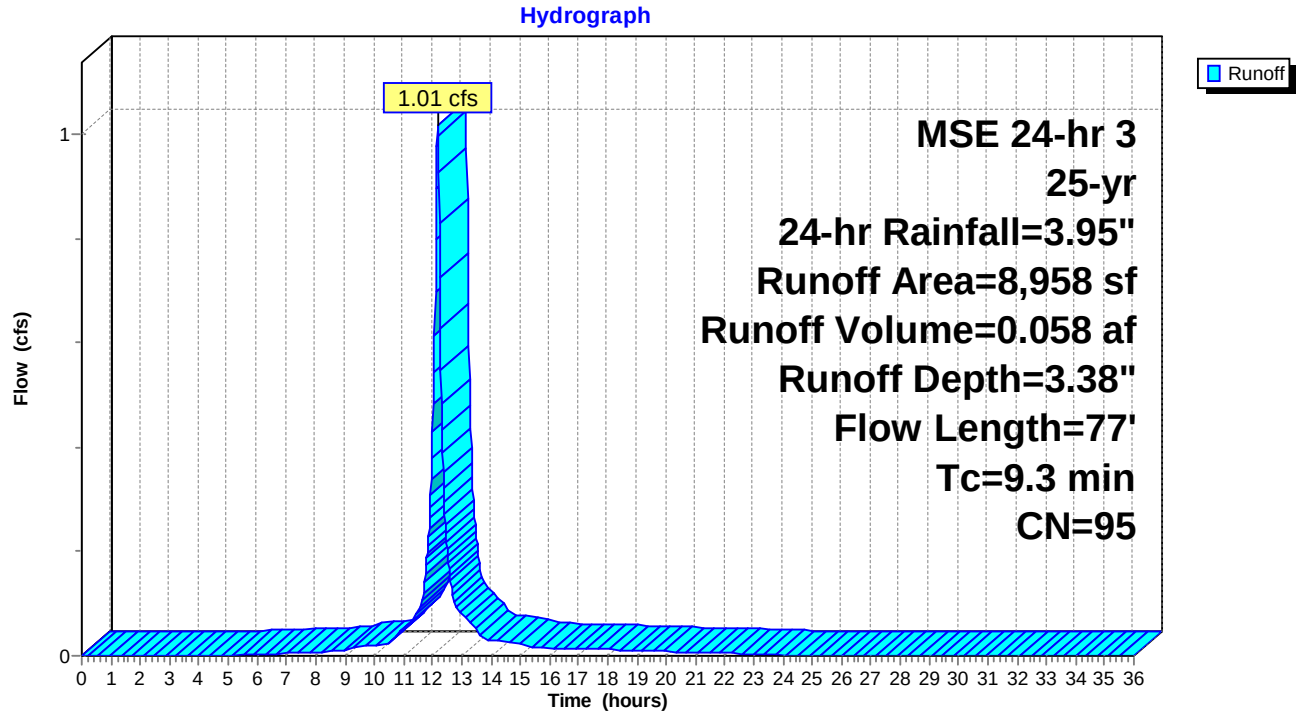
Runoff = 1.01 cfs @ 12.16 hrs, Volume= 0.058 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
*	8,958	95	Closure Turf
	8,958		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	29	0.0100	0.06		**Sheet Flow,** n= 0.220 P2= 2.35"
1.7	48	0.3300	0.46		**Sheet Flow,** n= 0.120 P2= 2.35"
9.3	77	Total			

Subcatchment 43S: DB-H Drainage



Summary for Subcatchment 45S: E-MCI Culvert Drainage

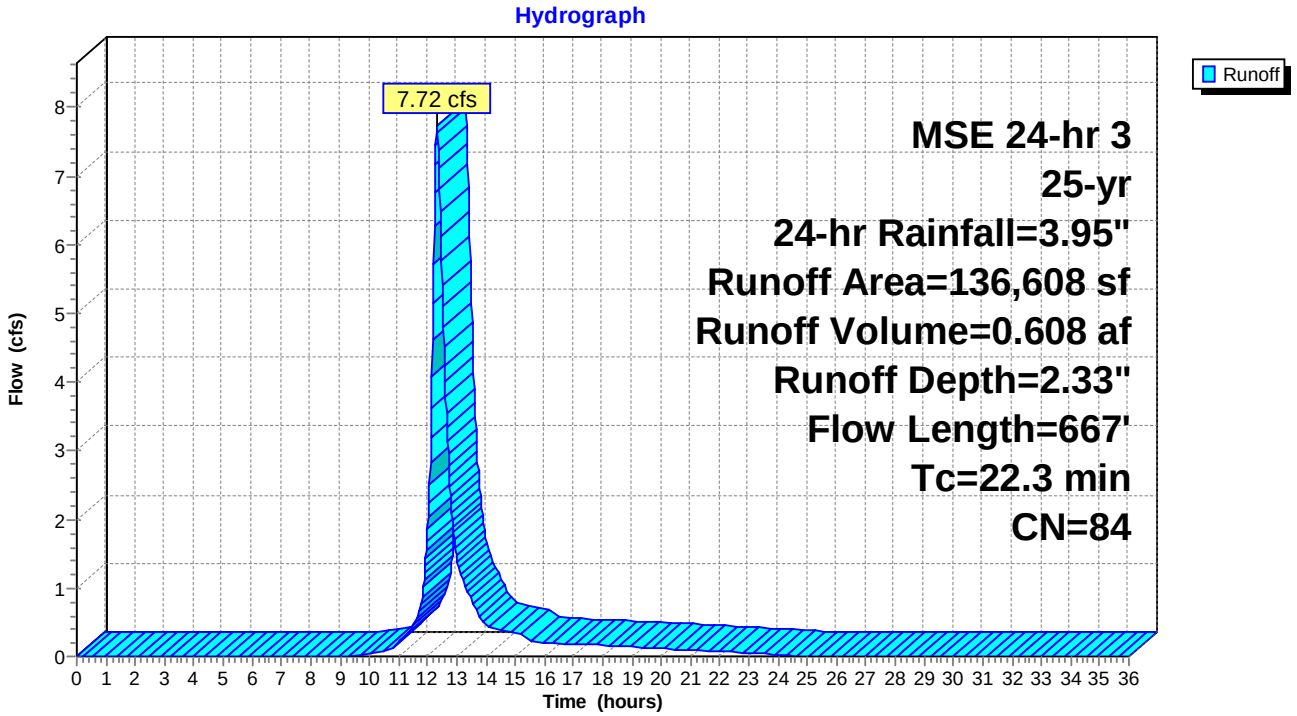
Runoff = 7.72 cfs @ 12.32 hrs, Volume= 0.608 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
	104,100	80	>75% Grass cover, Good, HSG D
*	32,508	95	Closure Turf
	136,608	84	Weighted Average
	136,608		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	32	0.0100	0.06		**Sheet Flow, Closure turf** n= 0.220 P2= 2.35"
1.6	35	0.3300	0.36		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
8.2	133	0.0800	0.27		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
4.3	467	0.0670	1.81		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
22.3	667	Total			

Subcatchment 45S: E-MCI Culvert Drainage



Summary for Subcatchment 51S: MC XI NW Drainage

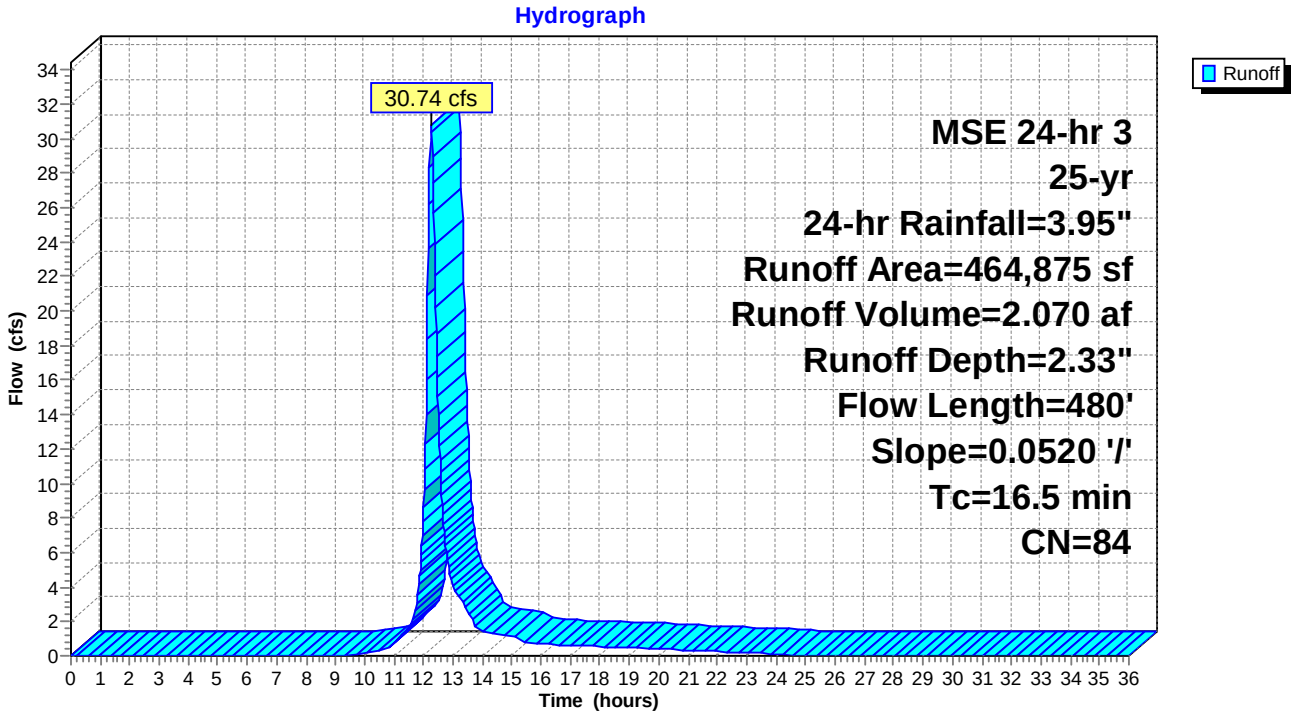
Runoff = 30.74 cfs @ 12.25 hrs, Volume= 2.070 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
464,875	84	50-75% Grass cover, Fair, HSG D
464,875		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	200	0.0520	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.9	280	0.0520	1.60		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.5	480	Total			

Subcatchment 51S: MC XI NW Drainage



Summary for Subcatchment 61S: W-MC X Ditch

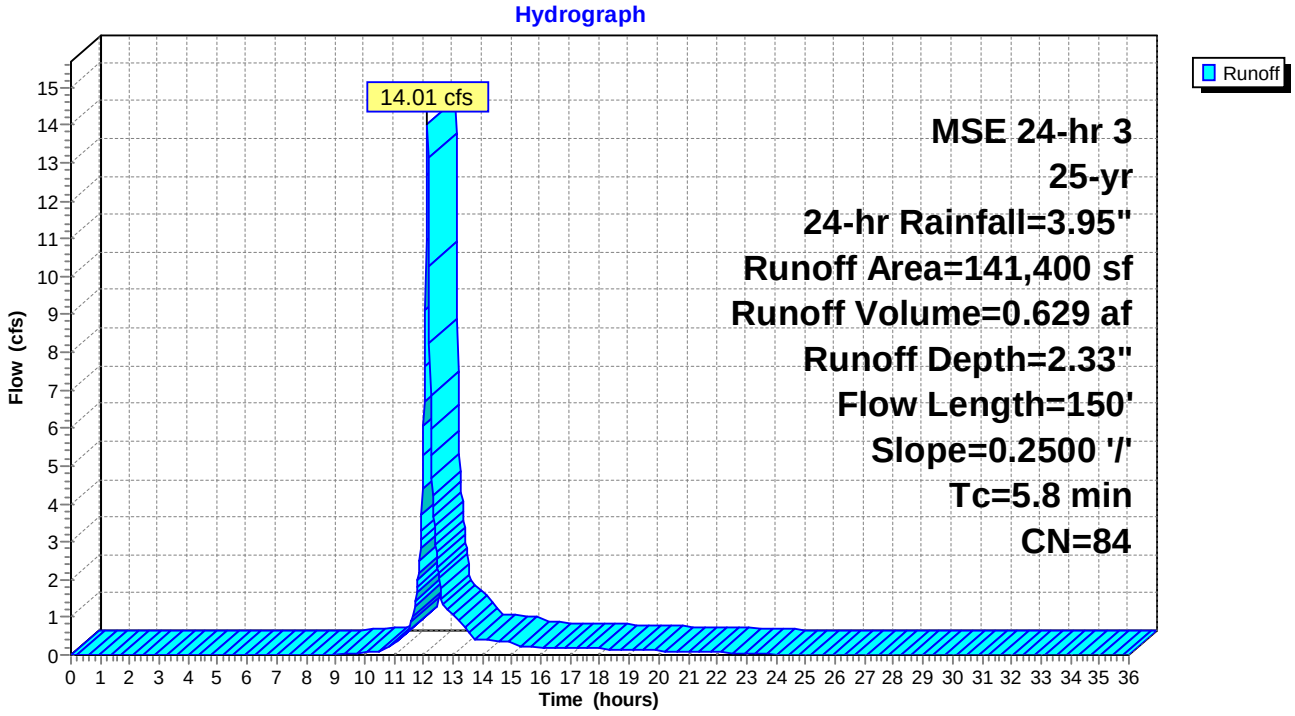
Runoff = 14.01 cfs @ 12.13 hrs, Volume= 0.629 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
141,400	84	50-75% Grass cover, Fair, HSG D
141,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	150	0.2500	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 61S: W-MC X Ditch



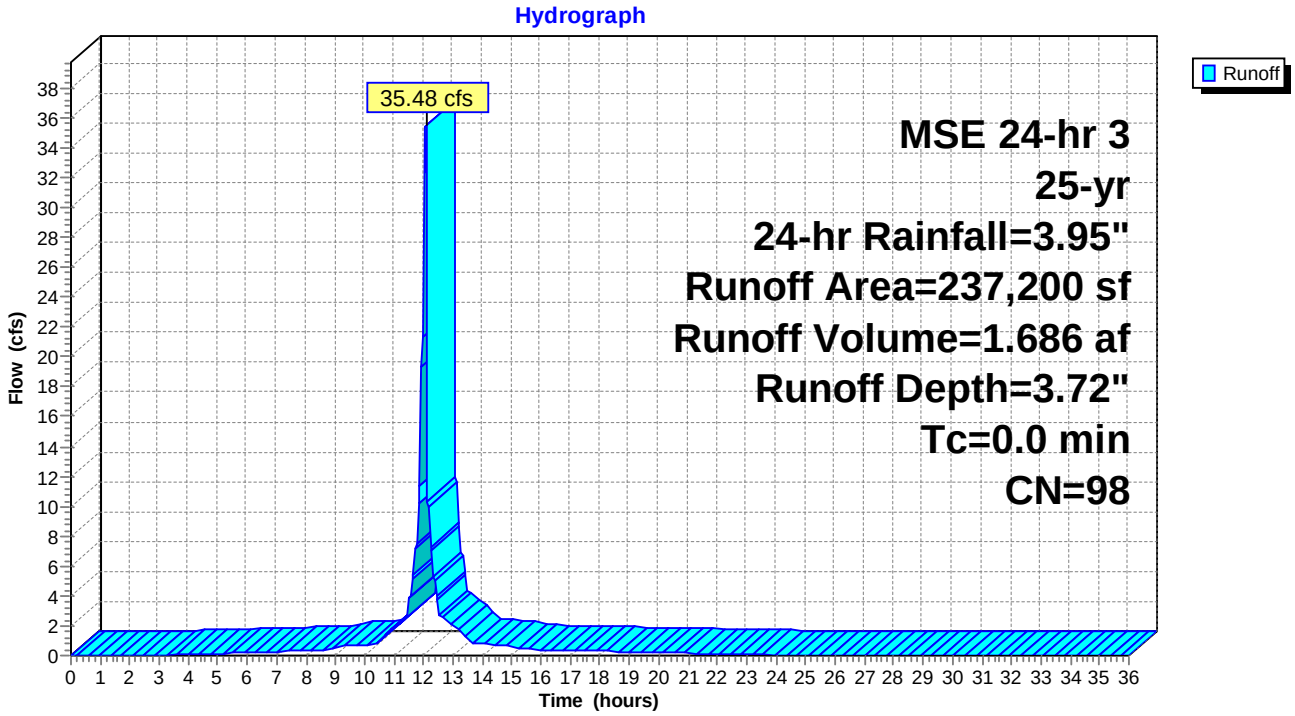
Summary for Subcatchment 62S: Additional Storm Sewer Drainage Area

Runoff = 35.48 cfs @ 12.08 hrs, Volume= 1.686 af, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
237,200	98	Paved parking, HSG D
237,200		100.00% Impervious Area

Subcatchment 62S: Additional Storm Sewer Drainage Area



Summary for Subcatchment 65S: S-MC X Ditch Drainage

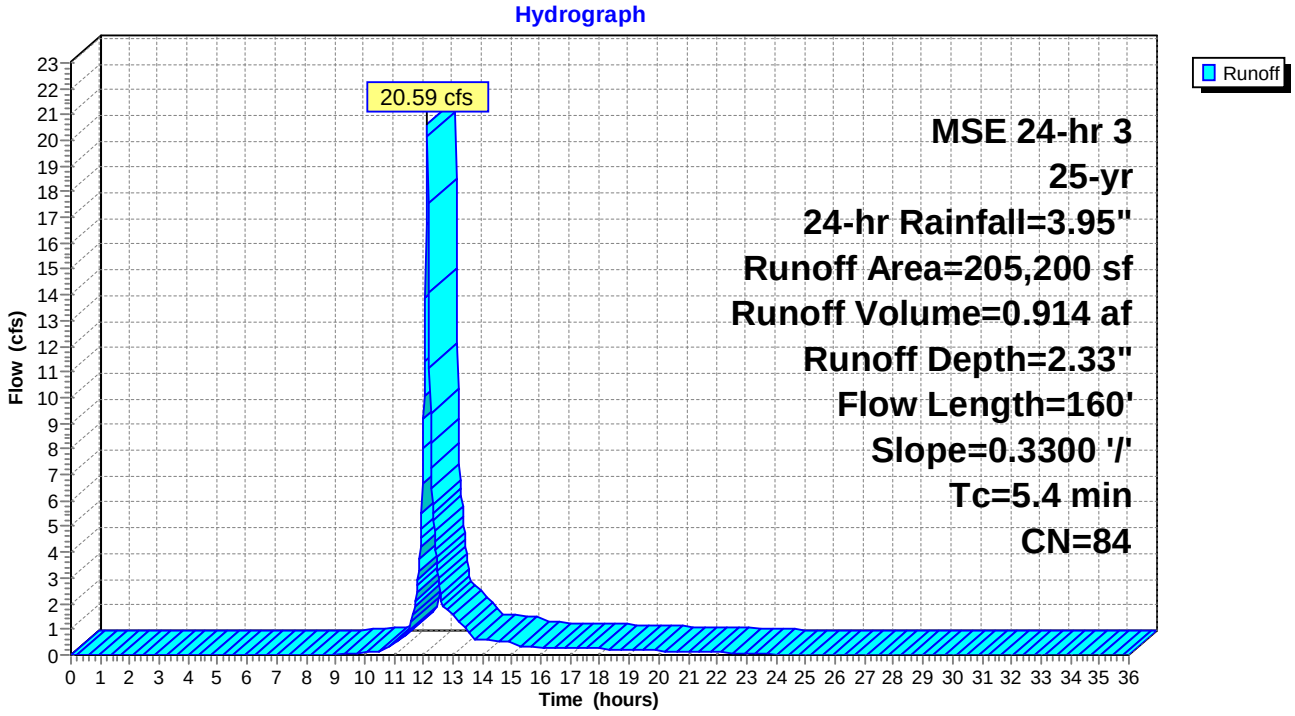
Runoff = 20.59 cfs @ 12.13 hrs, Volume= 0.914 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
205,200	84	50-75% Grass cover, Fair, HSG D
205,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	160	0.3300	0.49		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 65S: S-MC X Ditch Drainage



Summary for Subcatchment 67S: E-MC X Drainage

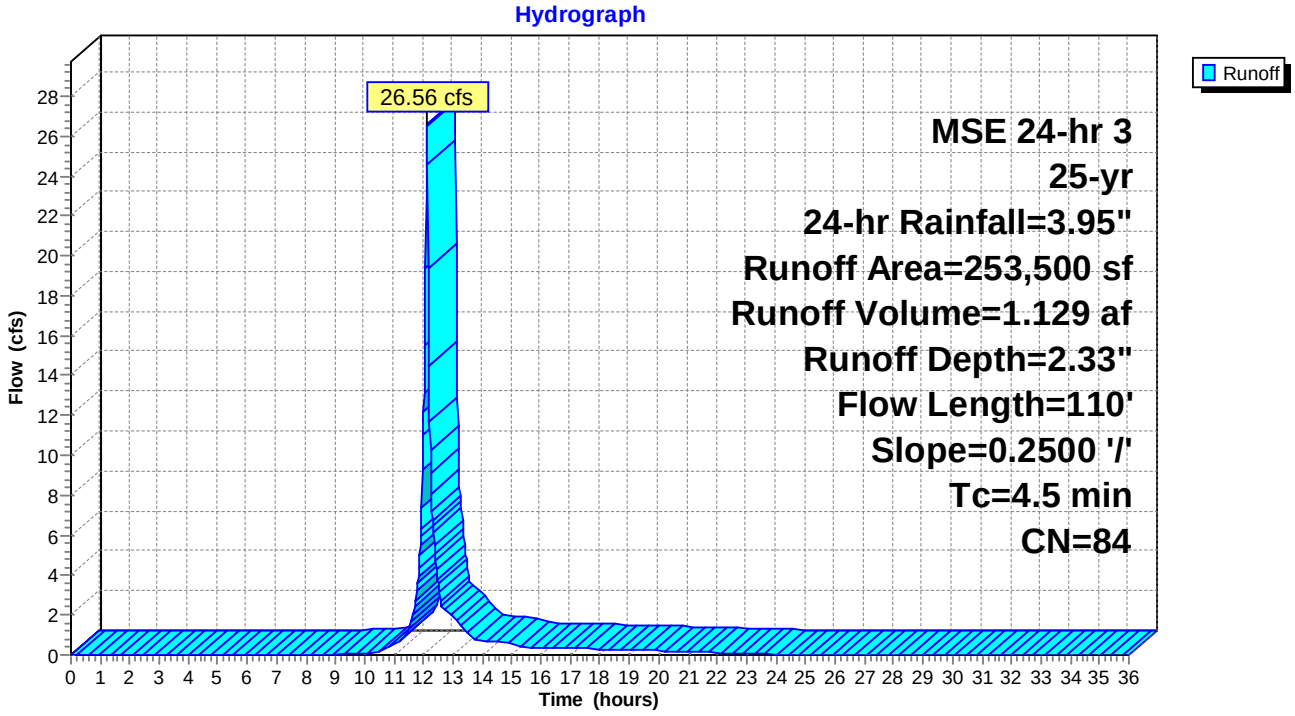
Runoff = 26.56 cfs @ 12.12 hrs, Volume= 1.129 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
253,500	84	50-75% Grass cover, Fair, HSG D
253,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	110	0.2500	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 67S: E-MC X Drainage



Summary for Subcatchment 68S: SSB Drainage Area

Total area is 900,800 sf
Pond area is 208,300 sf
Therefore, surrounding area is 692,500 sf (900,800 - 208,300)

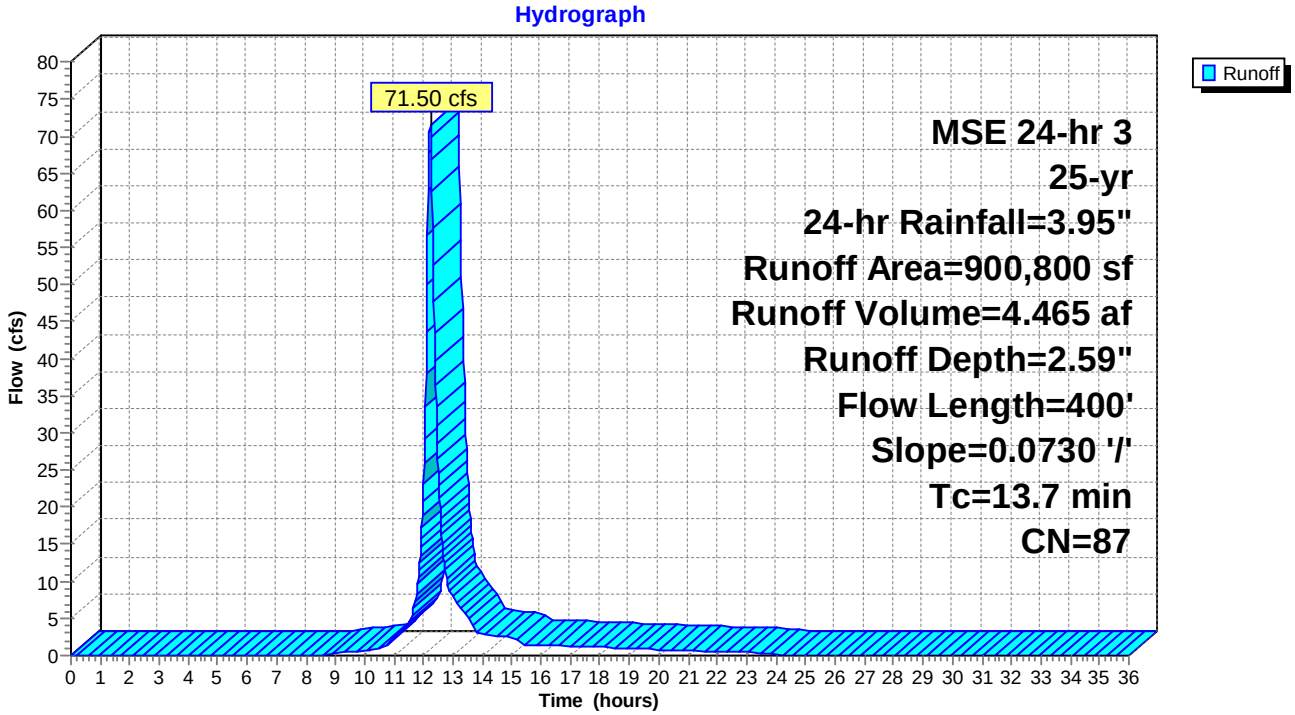
Runoff = 71.50 cfs @ 12.22 hrs, Volume= 4.465 af, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
692,500	84	50-75% Grass cover, Fair, HSG D
208,300	98	Water Surface, HSG D
900,800	87	Weighted Average
692,500		76.88% Pervious Area
208,300		23.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	200	0.0730	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.8	200	0.0730	1.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.7	400	Total			

Subcatchment 68S: SSB Drainage Area



Summary for Subcatchment 70S: DB-46 Drainage

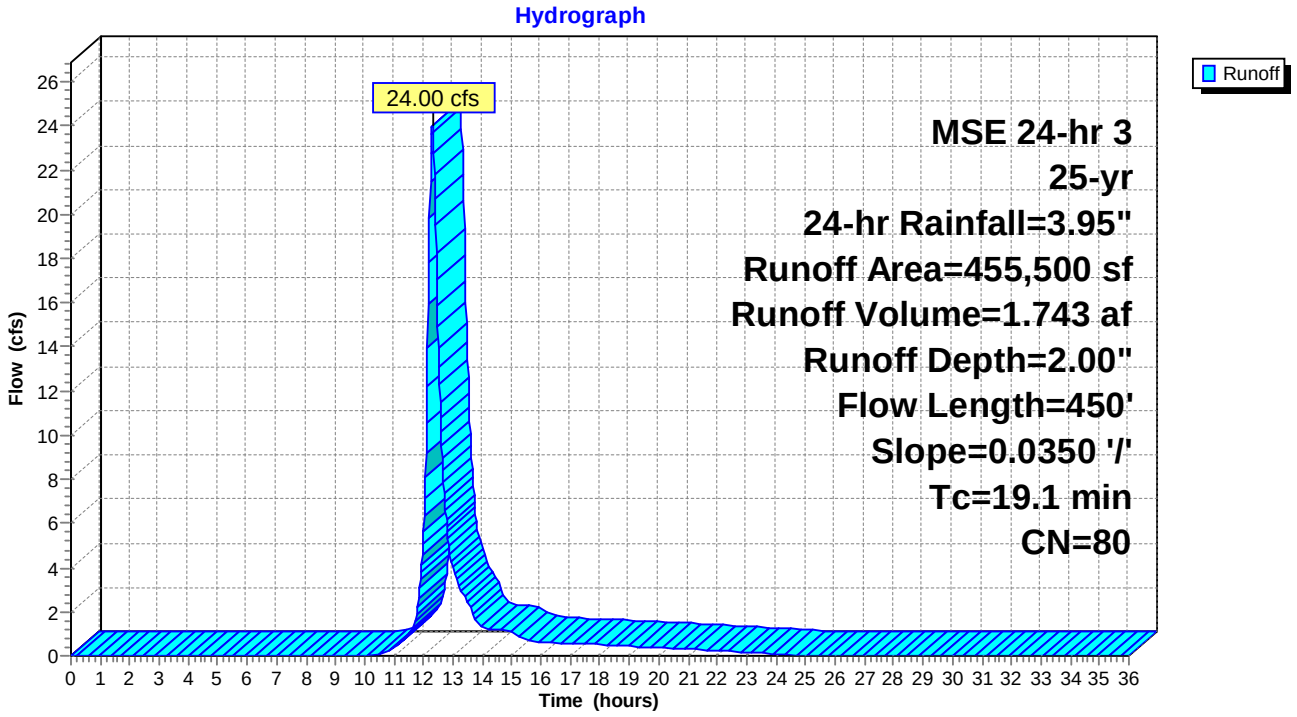
Runoff = 24.00 cfs @ 12.29 hrs, Volume= 1.743 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
455,500	80	>75% Grass cover, Good, HSG D
455,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	200	0.0350	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
3.2	250	0.0350	1.31		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.1	450	Total			

Subcatchment 70S: DB-46 Drainage



Summary for Subcatchment 72S: E-MCI Drainage

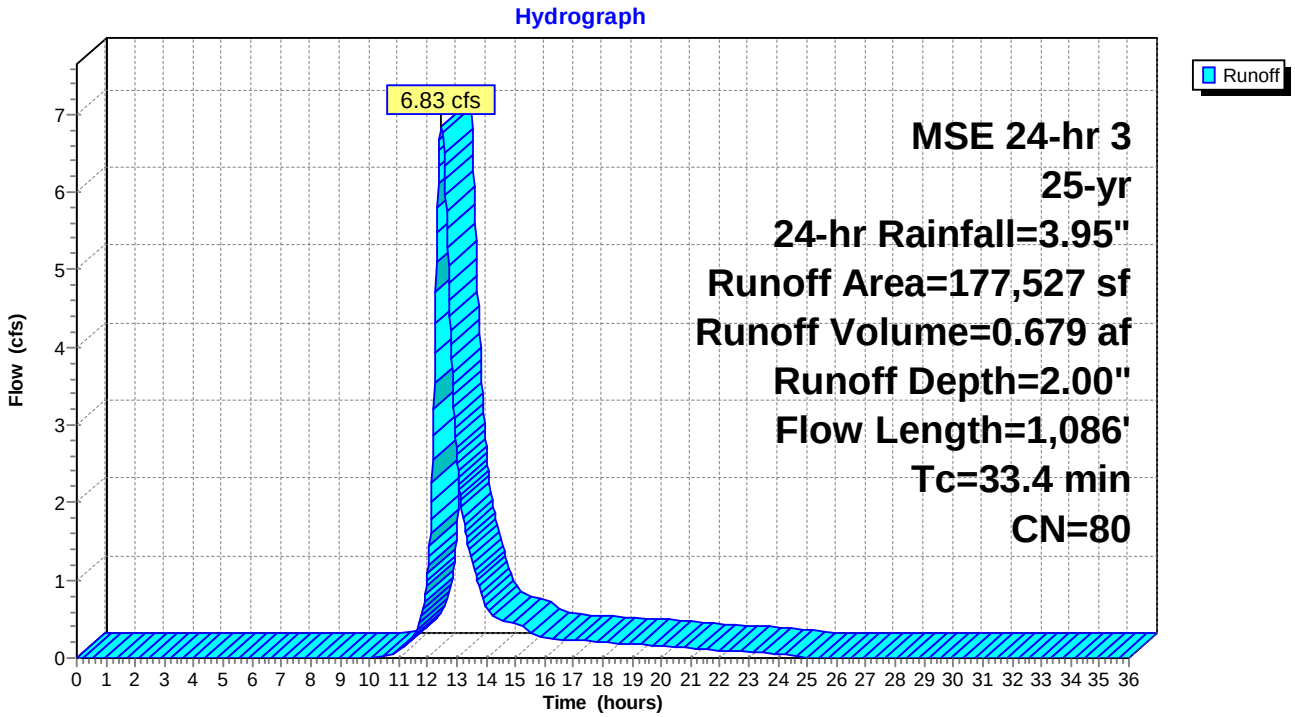
Runoff = 6.83 cfs @ 12.48 hrs, Volume= 0.679 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

Area (sf)	CN	Description
177,527	80	>75% Grass cover, Good, HSG D
177,527		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	200	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
10.8	640	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.7	246	0.0488	1.55		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.4	1,086	Total			

Subcatchment 72S: E-MCI Drainage



Summary for Subcatchment 73S: Cover System Drainage

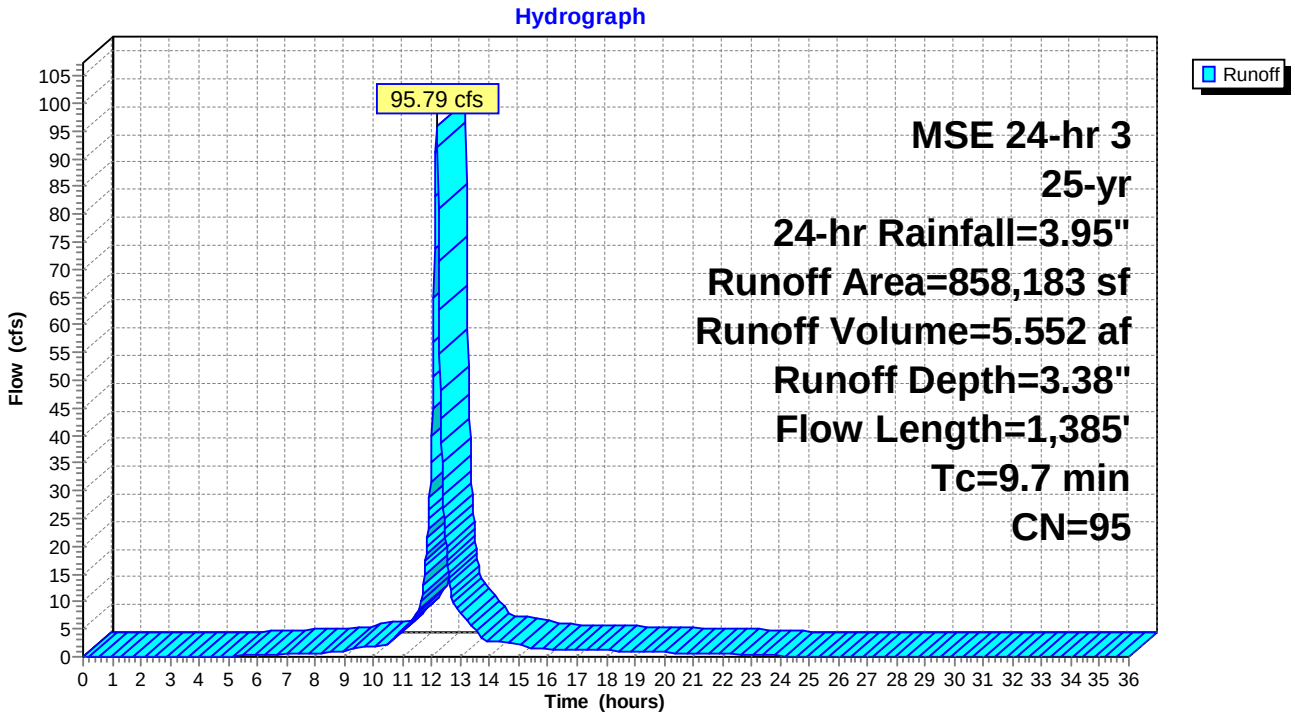
Runoff = 95.79 cfs @ 12.17 hrs, Volume= 5.552 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 25-yr, 24-hr Rainfall=3.95"

	Area (sf)	CN	Description
*	858,183	95	Closure Turf
	858,183		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	200	0.2500	0.55		**Sheet Flow,** n= 0.120 P2= 2.35"
0.5	321	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.7	626	0.0360	3.85		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	238	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.7	1,385	Total			

Subcatchment 73S: Cover System Drainage



Summary for Reach 35R: MCVI/XI Ditch

Inflow Area = 39.192 ac, 0.00% Impervious, Inflow Depth = 3.09" for 25-yr, 24-hr event
Inflow = 162.49 cfs @ 12.19 hrs, Volume= 10.107 af
Outflow = 161.20 cfs @ 12.21 hrs, Volume= 10.107 af, Atten= 1%, Lag= 1.1 min

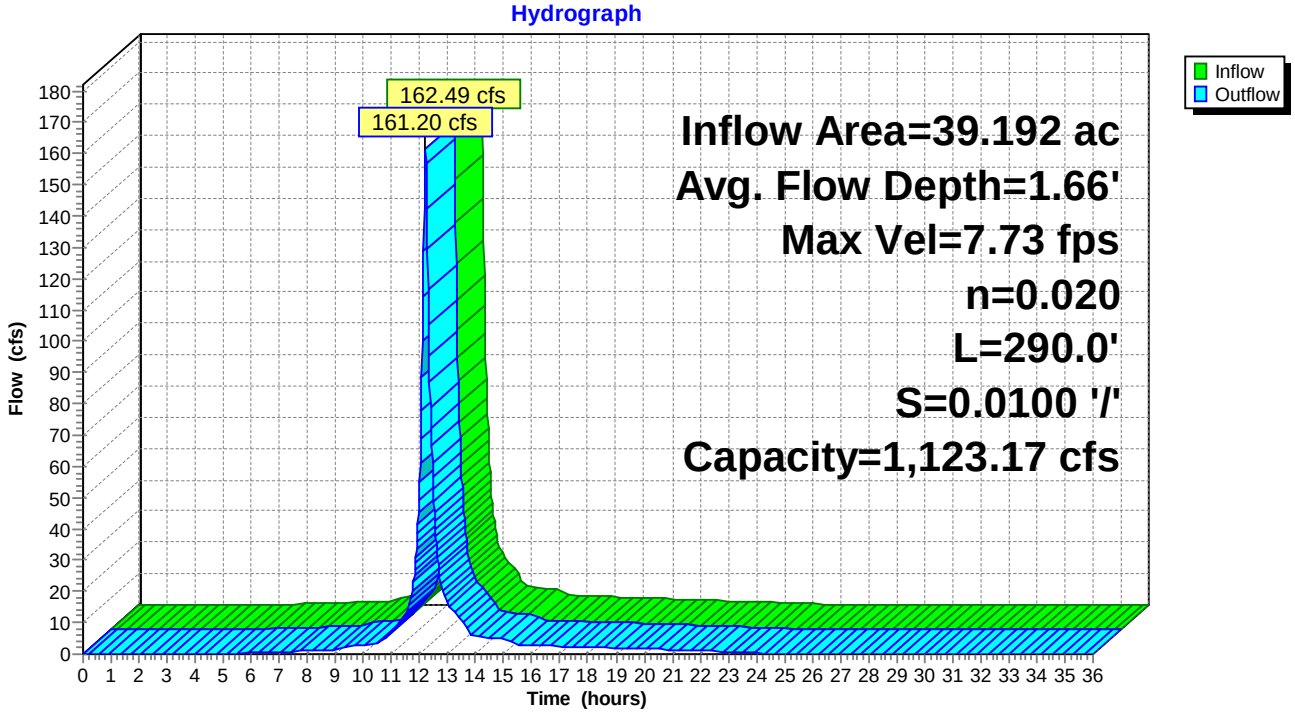
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 7.73 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.88 fps, Avg. Travel Time= 2.6 min

Peak Storage= 6,075 cf @ 12.20 hrs
Average Depth at Peak Storage= 1.66' , Surface Width= 19.27'
Bank-Full Depth= 4.00' Flow Area= 88.0 sf, Capacity= 1,123.17 cfs

6.00' x 4.00' deep channel, n= 0.020
Side Slope Z-value= 4.0 '/' Top Width= 38.00'
Length= 290.0' Slope= 0.0100 '/'
Inlet Invert= 700.15', Outlet Invert= 697.26'

‡

Reach 35R: MCVI/XI Ditch



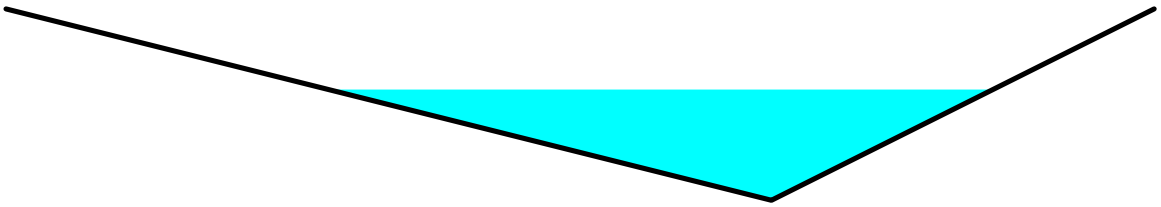
Summary for Reach 36R: DB-F

Inflow Area = 3.360 ac, 0.00% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 20.35 cfs @ 12.12 hrs, Volume= 0.947 af
Outflow = 19.72 cfs @ 12.16 hrs, Volume= 0.947 af, Atten= 3%, Lag= 2.2 min

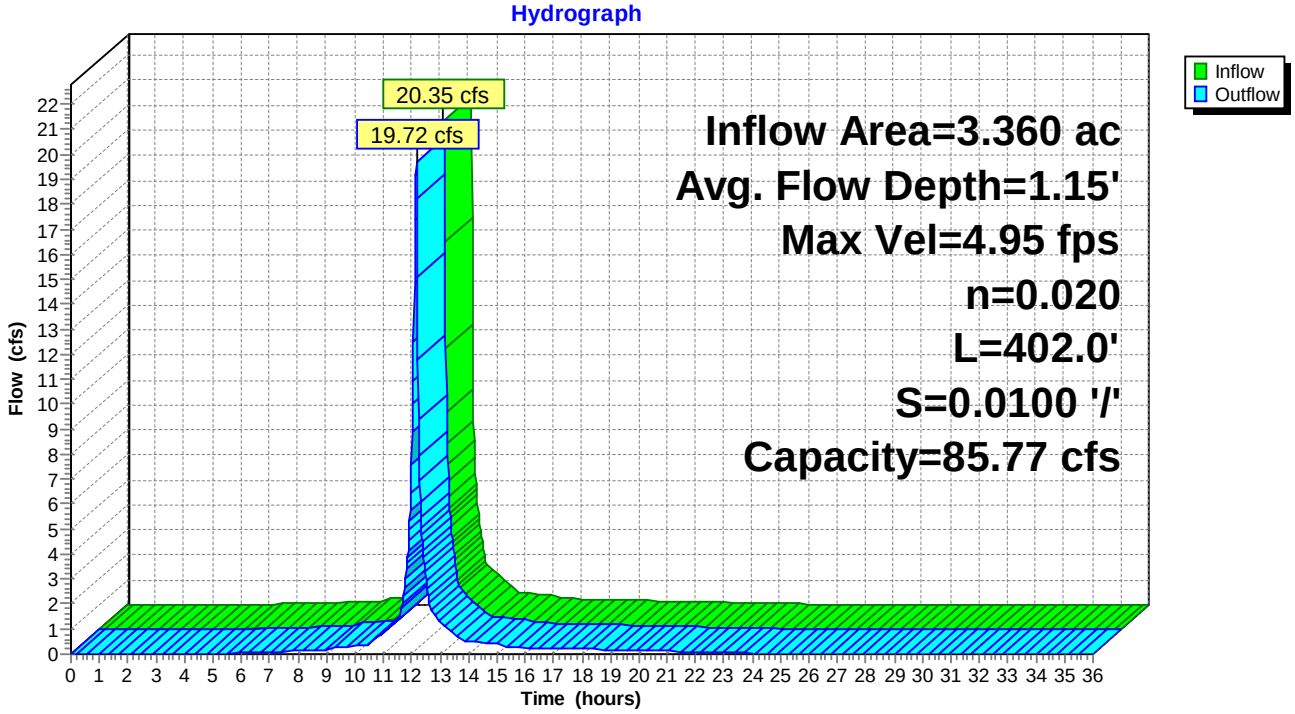
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.95 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.53 fps, Avg. Travel Time= 4.4 min

Peak Storage= 1,608 cf @ 12.13 hrs
Average Depth at Peak Storage= 1.15' , Surface Width= 6.93'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 85.77 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 402.0' Slope= 0.0100 '/'
Inlet Invert= 712.02', Outlet Invert= 708.00'



Reach 36R: DB-F



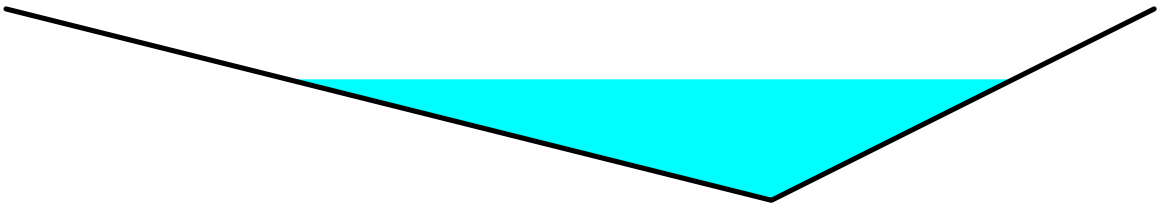
Summary for Reach 38R: DB-D-1 (1%)

Inflow Area = 8.819 ac, 0.00% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 55.79 cfs @ 12.09 hrs, Volume= 2.485 af
Outflow = 45.12 cfs @ 12.21 hrs, Volume= 2.485 af, Atten= 19%, Lag= 6.9 min

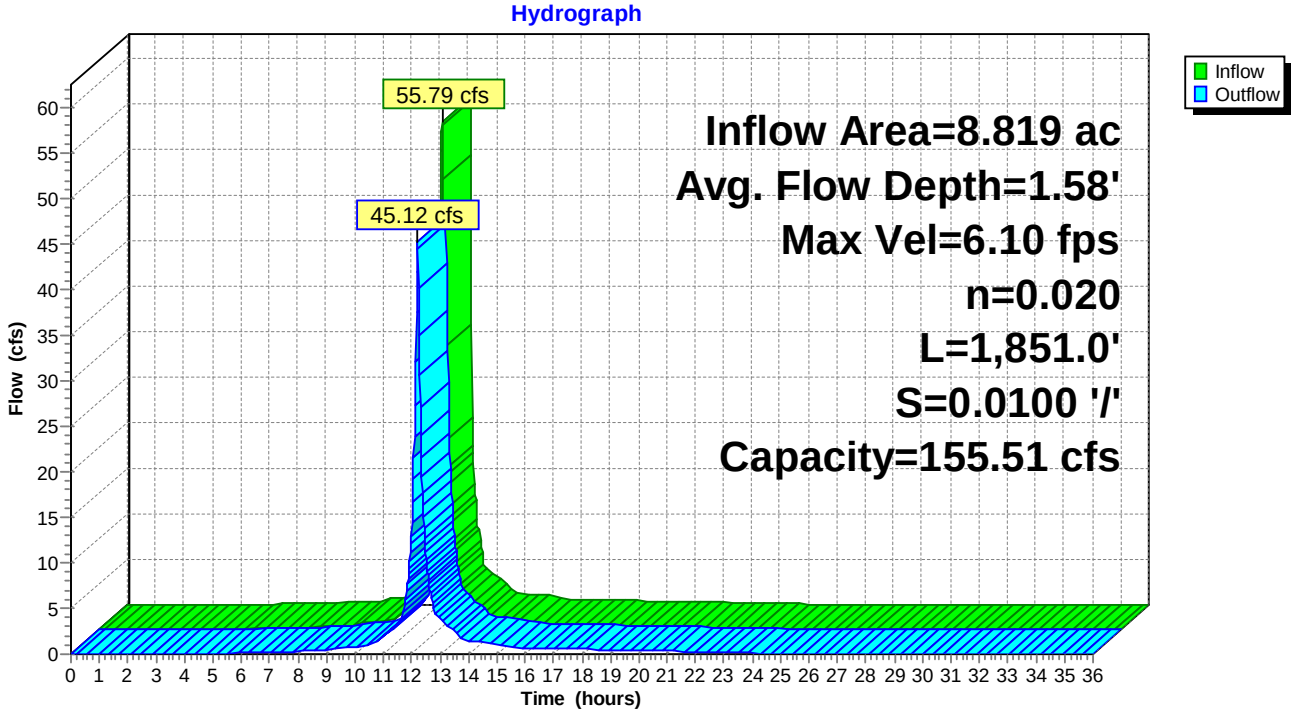
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 6.10 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 18.4 min

Peak Storage= 13,810 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.58' , Surface Width= 9.46'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 155.51 cfs

0.00' x 2.50' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 15.00'
Length= 1,851.0' Slope= 0.0100 '/'
Inlet Invert= 744.85', Outlet Invert= 726.34'



Reach 38R: DB-D-1 (1%)



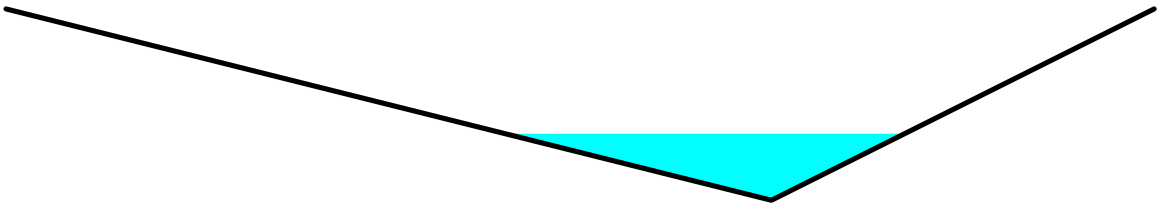
Summary for Reach 40R: DB-G

Inflow Area = 1.903 ac, 0.00% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 12.16 cfs @ 12.09 hrs, Volume= 0.536 af
Outflow = 11.80 cfs @ 12.12 hrs, Volume= 0.536 af, Atten= 3%, Lag= 1.7 min

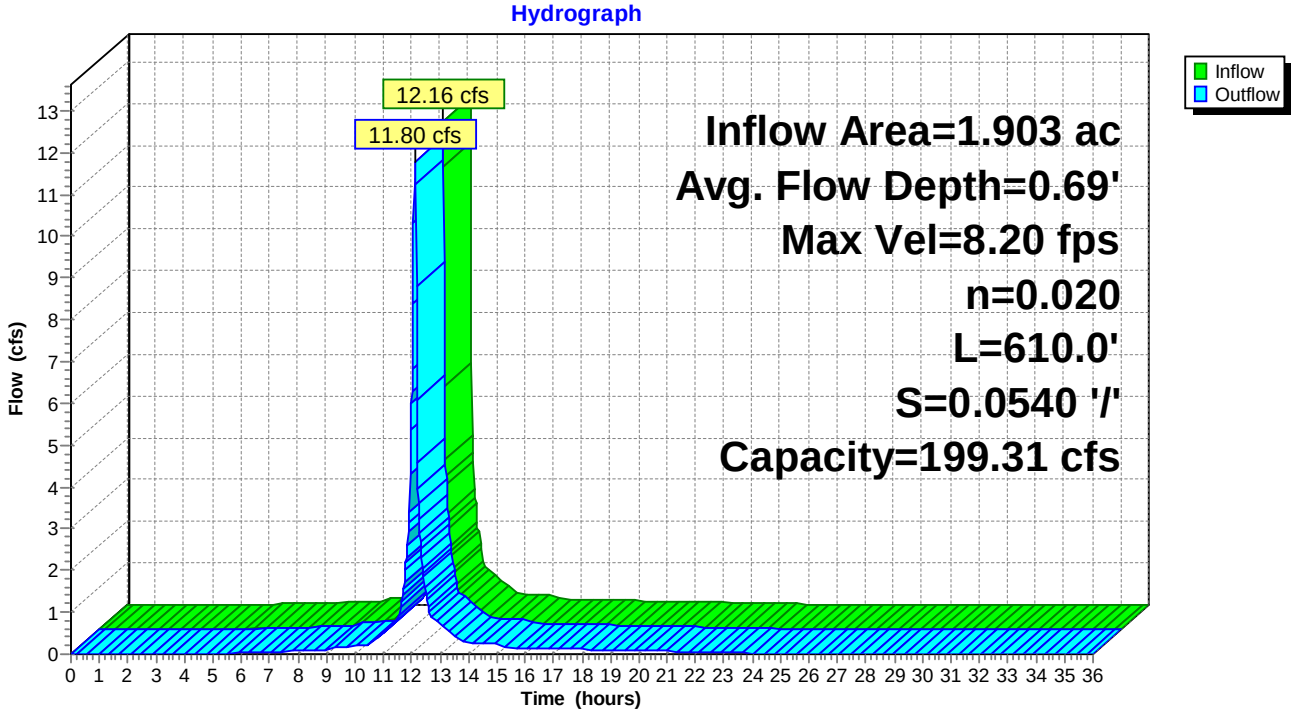
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 8.20 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 2.60 fps, Avg. Travel Time= 3.9 min

Peak Storage= 879 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.69' , Surface Width= 4.16'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 199.31 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 610.0' Slope= 0.0540 '/'
Inlet Invert= 762.04', Outlet Invert= 729.10'



Reach 40R: DB-G



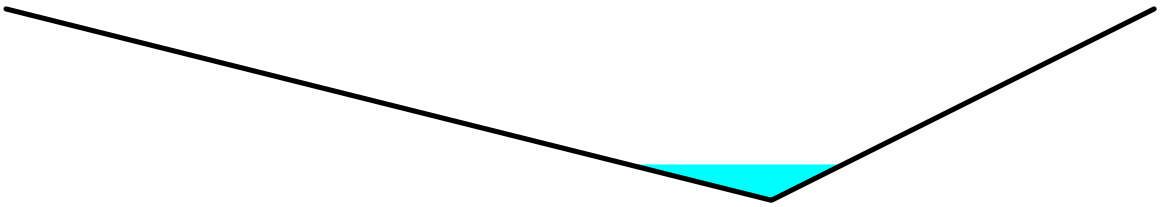
Summary for Reach 41R: DB-H

Inflow Area = 0.206 ac, 0.00% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 1.01 cfs @ 12.16 hrs, Volume= 0.058 af
Outflow = 1.00 cfs @ 12.19 hrs, Volume= 0.058 af, Atten= 1%, Lag= 1.6 min

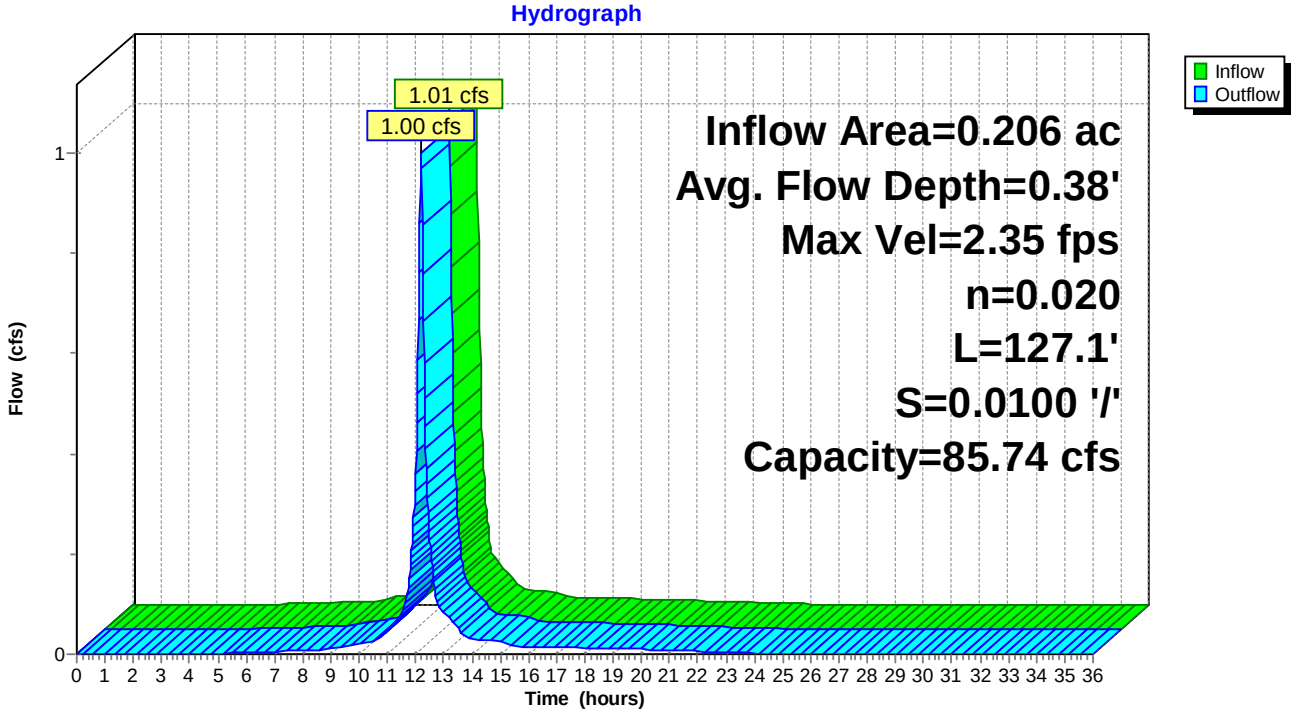
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.35 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.81 fps, Avg. Travel Time= 2.6 min

Peak Storage= 54 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.38' , Surface Width= 2.26'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 85.74 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 127.1' Slope= 0.0100 '/'
Inlet Invert= 707.69', Outlet Invert= 706.42'



Reach 41R: DB-H



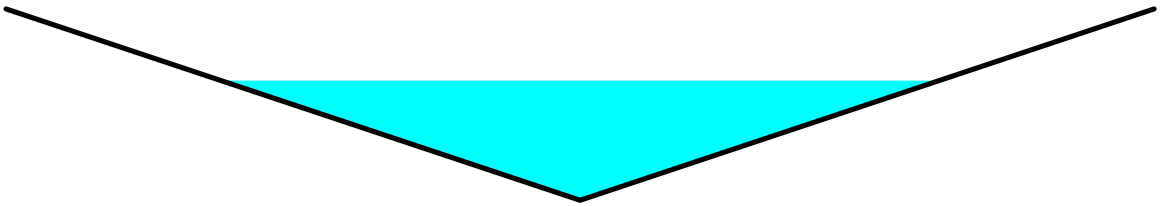
Summary for Reach 44R: E-MCI Ditch

Inflow Area = 17.668 ac, 0.00% Impervious, Inflow Depth = 2.06" for 25-yr, 24-hr event
Inflow = 37.12 cfs @ 12.33 hrs, Volume= 3.031 af
Outflow = 36.98 cfs @ 12.37 hrs, Volume= 3.031 af, Atten= 0%, Lag= 2.2 min

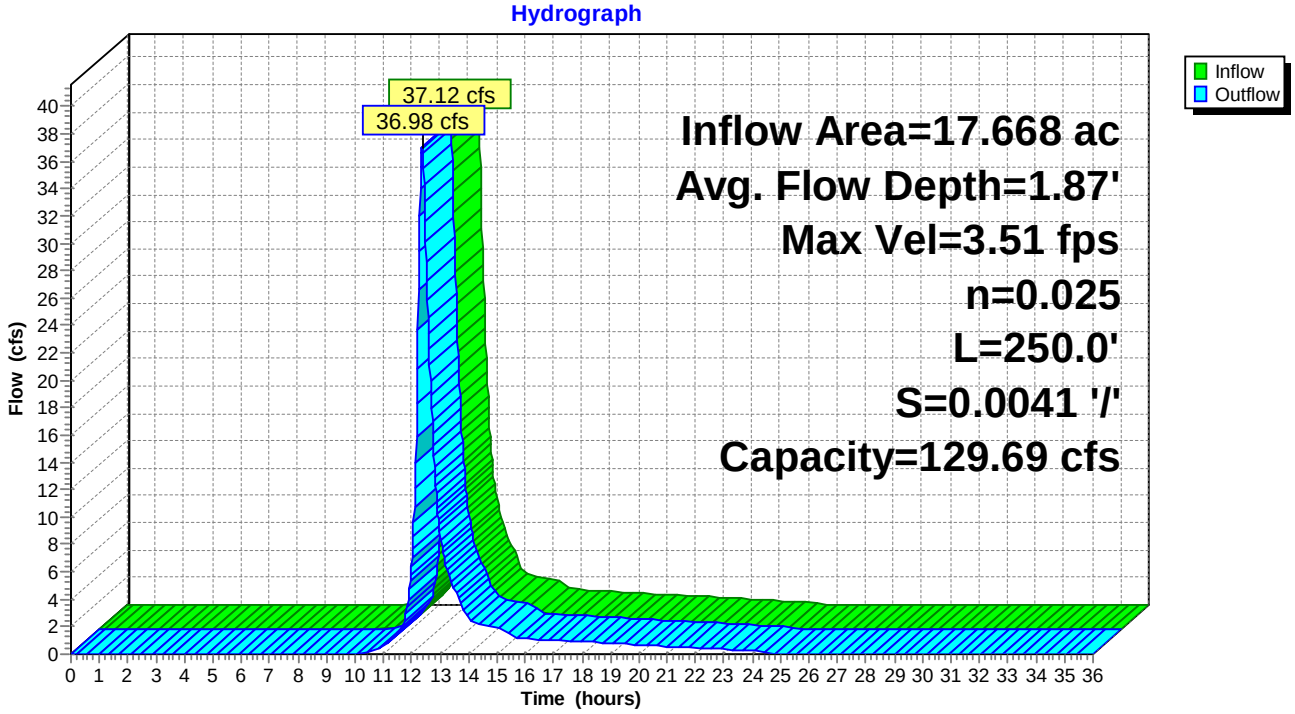
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.51 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 3.3 min

Peak Storage= 2,634 cf @ 12.35 hrs
Average Depth at Peak Storage= 1.87' , Surface Width= 11.24'
Bank-Full Depth= 3.00' Flow Area= 27.0 sf, Capacity= 129.69 cfs

0.00' x 3.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 18.00'
Length= 250.0' Slope= 0.0041 '/'
Inlet Invert= 702.00', Outlet Invert= 700.98'



Reach 44R: E-MCI Ditch



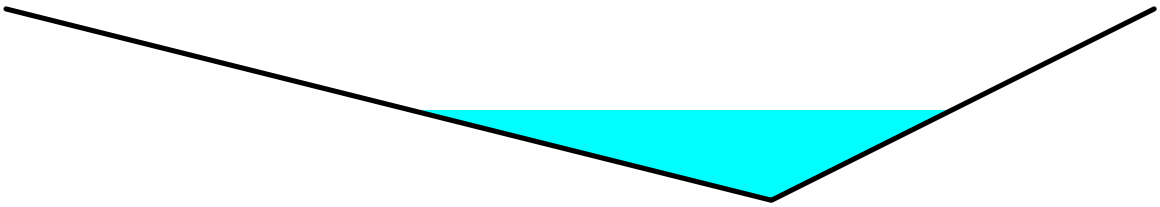
Summary for Reach 59R: DB-E

Inflow Area = 1.986 ac, 0.00% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 12.17 cfs @ 12.10 hrs, Volume= 0.560 af
Outflow = 11.41 cfs @ 12.16 hrs, Volume= 0.560 af, Atten= 6%, Lag= 3.4 min

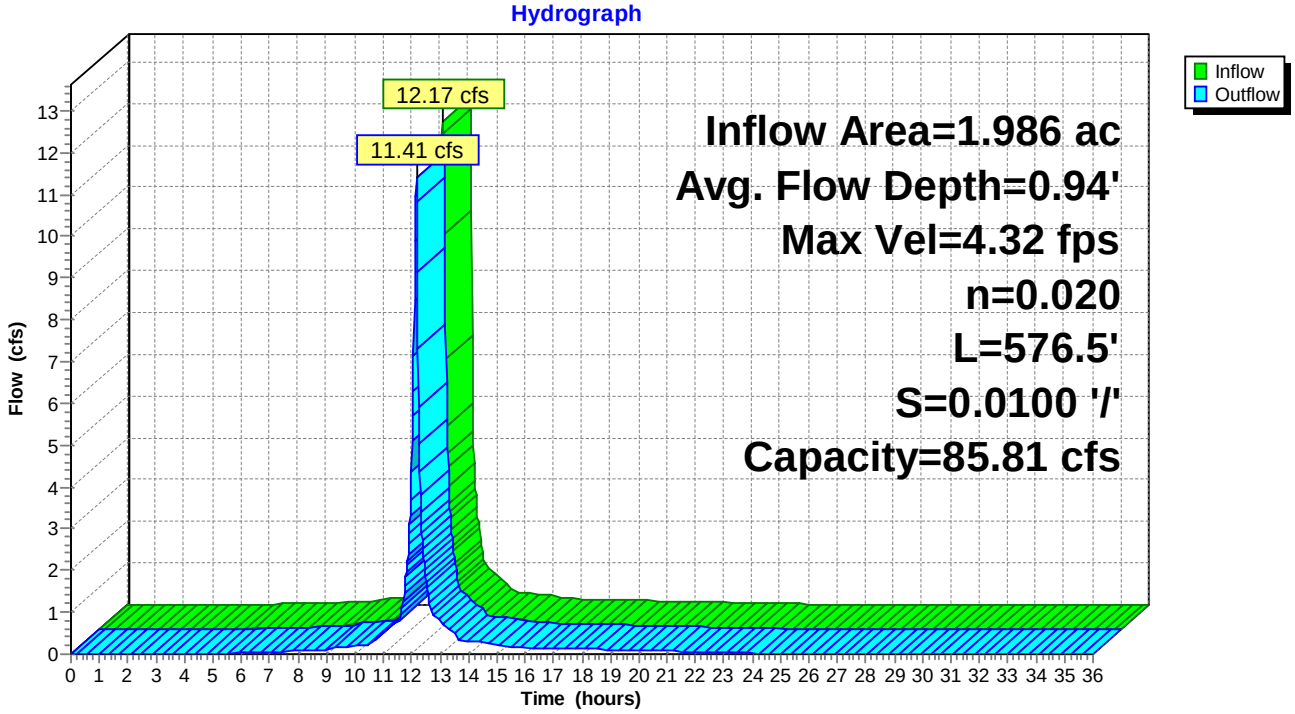
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.32 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.34 fps, Avg. Travel Time= 7.2 min

Peak Storage= 1,530 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.94' , Surface Width= 5.64'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 85.81 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 576.5' Slope= 0.0100 '/'
Inlet Invert= 718.00', Outlet Invert= 712.23'



Reach 59R: DB-E



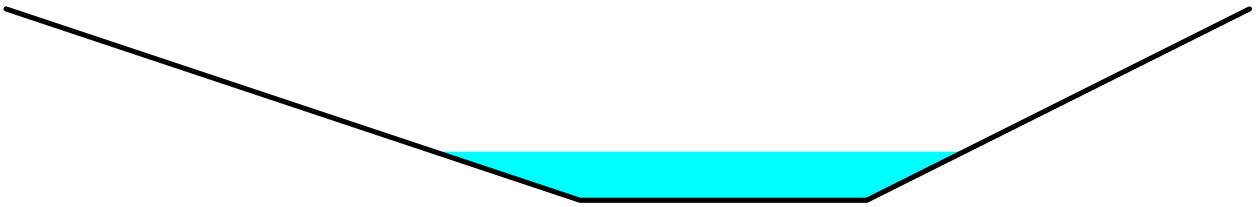
Summary for Reach 60R: W-MC X Ditch

Inflow Area = 13.776 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 22.31 cfs @ 12.28 hrs, Volume= 2.672 af
Outflow = 21.03 cfs @ 12.42 hrs, Volume= 2.672 af, Atten= 6%, Lag= 8.5 min

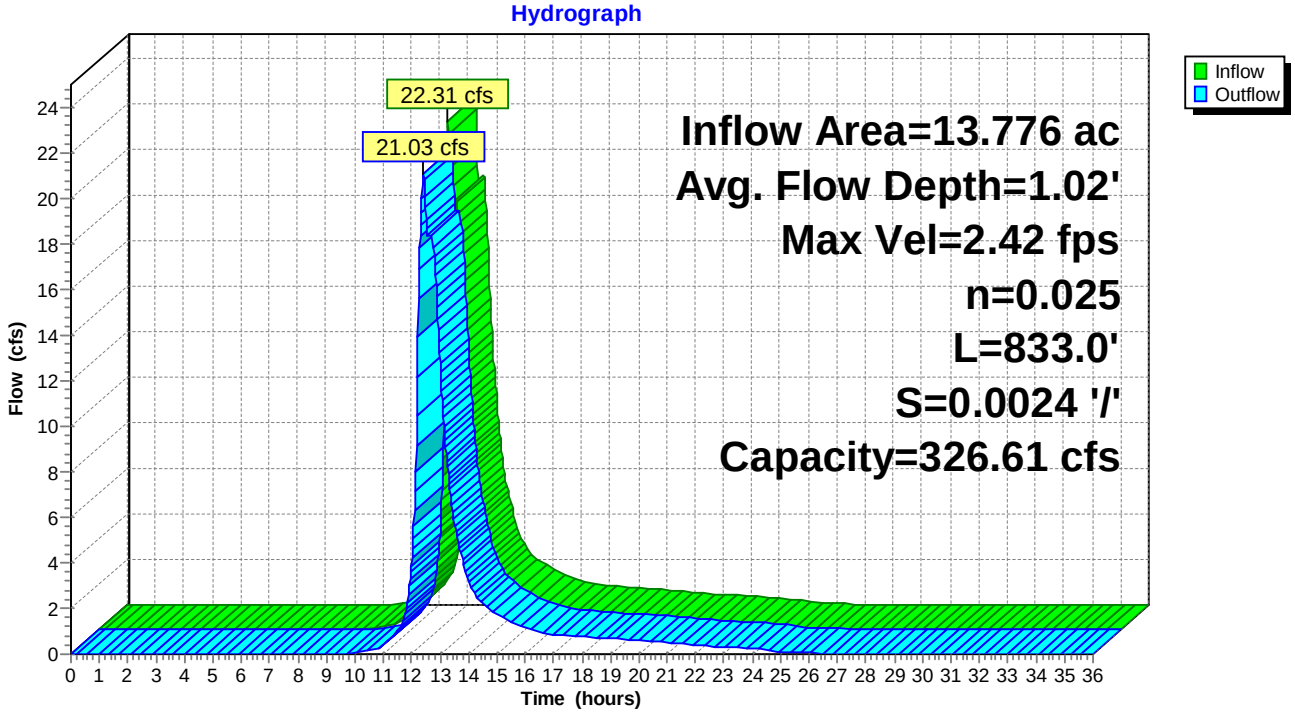
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.42 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 0.65 fps, Avg. Travel Time= 21.5 min

Peak Storage= 7,250 cf @ 12.32 hrs
Average Depth at Peak Storage= 1.02' , Surface Width= 11.09'
Bank-Full Depth= 4.00' Flow Area= 64.0 sf, Capacity= 326.61 cfs

6.00' x 4.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 2.0 '/' Top Width= 26.00'
Length= 833.0' Slope= 0.0024 '/'
Inlet Invert= 691.00', Outlet Invert= 689.00'



Reach 60R: W-MC X Ditch



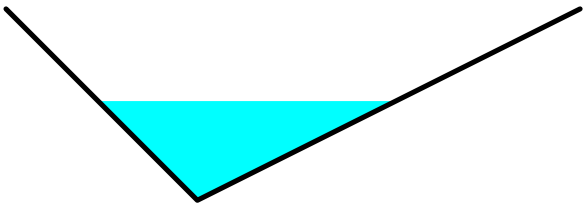
Summary for Reach 64R: S MC X Ditch

Inflow Area = 10.530 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 23.26 cfs @ 12.13 hrs, Volume= 2.042 af
Outflow = 17.73 cfs @ 12.29 hrs, Volume= 2.042 af, Atten= 24%, Lag= 9.8 min

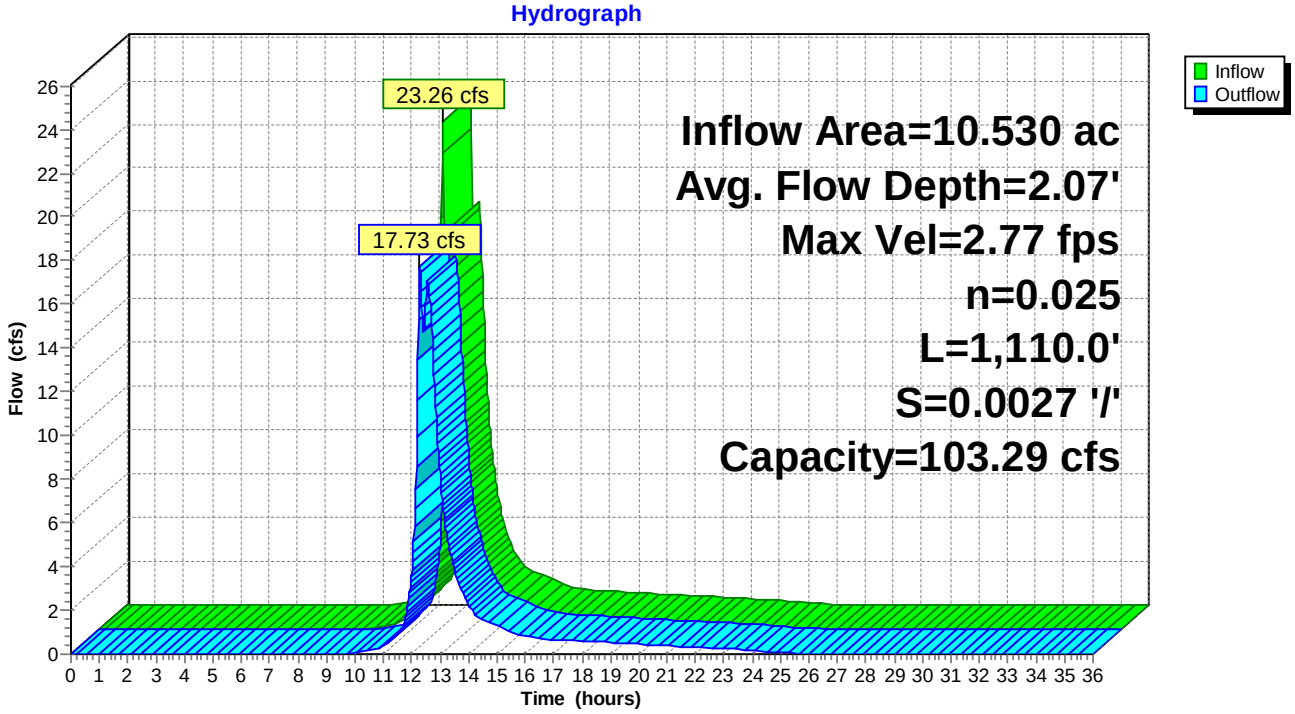
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.77 fps, Min. Travel Time= 6.7 min
Avg. Velocity = 0.84 fps, Avg. Travel Time= 22.1 min

Peak Storage= 7,133 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.07' , Surface Width= 6.21'
Bank-Full Depth= 4.00' Flow Area= 24.0 sf, Capacity= 103.29 cfs

0.00' x 4.00' deep channel, n= 0.025
Side Slope Z-value= 1.0 2.0 '/' Top Width= 12.00'
Length= 1,110.0' Slope= 0.0027 '/'
Inlet Invert= 694.00', Outlet Invert= 691.00'



Reach 64R: S MC X Ditch



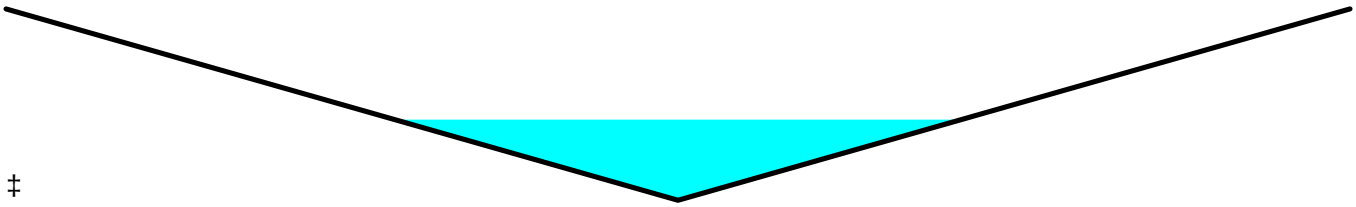
Summary for Reach 66R: E-MC X Ditch

Inflow Area = 5.820 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 26.56 cfs @ 12.12 hrs, Volume= 1.129 af
Outflow = 14.40 cfs @ 12.41 hrs, Volume= 1.129 af, Atten= 46%, Lag= 17.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 1.81 fps, Min. Travel Time= 13.8 min
Avg. Velocity = 0.50 fps, Avg. Travel Time= 50.2 min

Peak Storage= 11,979 cf @ 12.18 hrs
Average Depth at Peak Storage= 1.26' , Surface Width= 12.64'
Bank-Full Depth= 3.00' Flow Area= 45.0 sf, Capacity= 145.10 cfs

0.00' x 3.00' deep channel, n= 0.030 Stream, clean & straight
Side Slope Z-value= 5.0 '/' Top Width= 30.00'
Length= 1,500.0' Slope= 0.0025 '/'
Inlet Invert= 697.80', Outlet Invert= 694.00'



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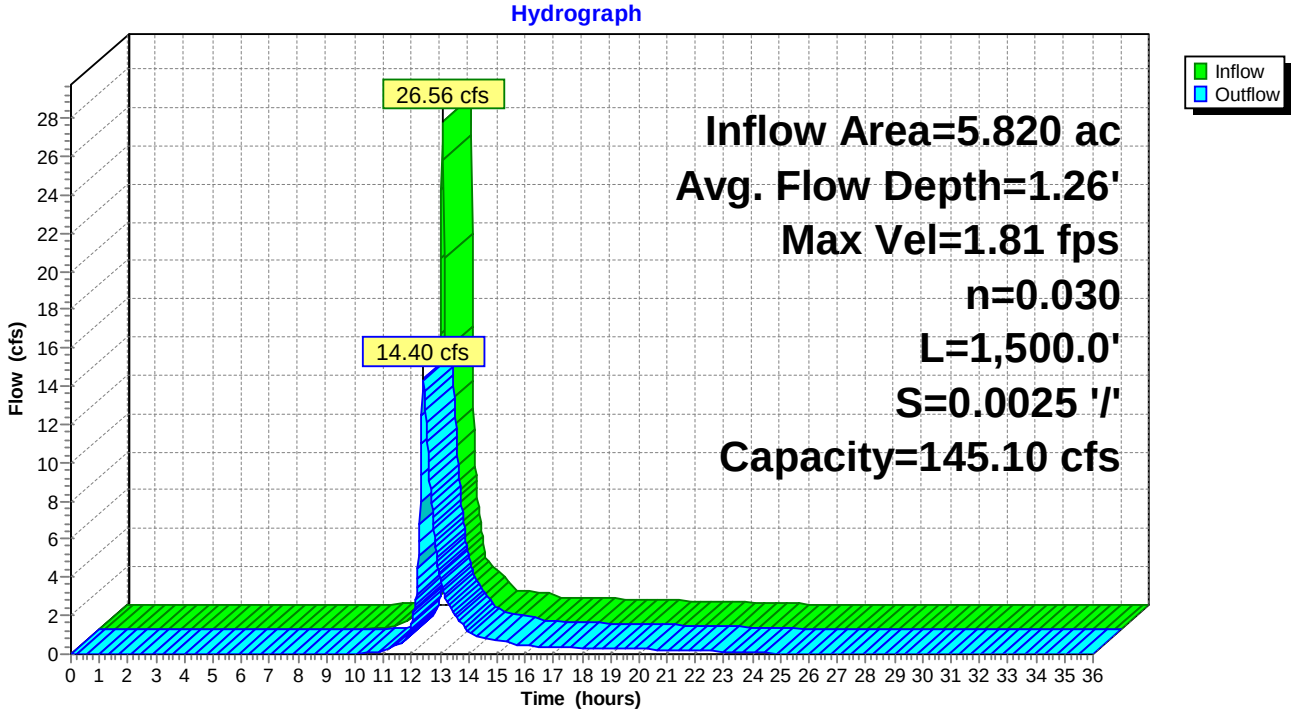
Reach 66R: E-MC X Ditch



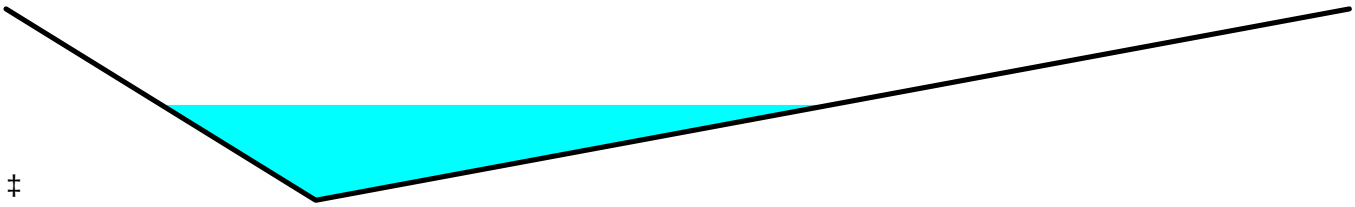
Summary for Reach 71R: DB-46

Inflow Area = 10.457 ac, 0.00% Impervious, Inflow Depth = 2.00" for 25-yr, 24-hr event
Inflow = 24.00 cfs @ 12.29 hrs, Volume= 1.743 af
Outflow = 23.88 cfs @ 12.31 hrs, Volume= 1.743 af, Atten= 0%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.70 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.40 fps, Avg. Travel Time= 2.4 min

Peak Storage= 1,294 cf @ 12.30 hrs
Average Depth at Peak Storage= 1.00' , Surface Width= 12.97'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 152.89 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 10.0 '/' Top Width= 26.00'
Length= 200.0' Slope= 0.0100 '/'
Inlet Invert= 703.00', Outlet Invert= 701.00'



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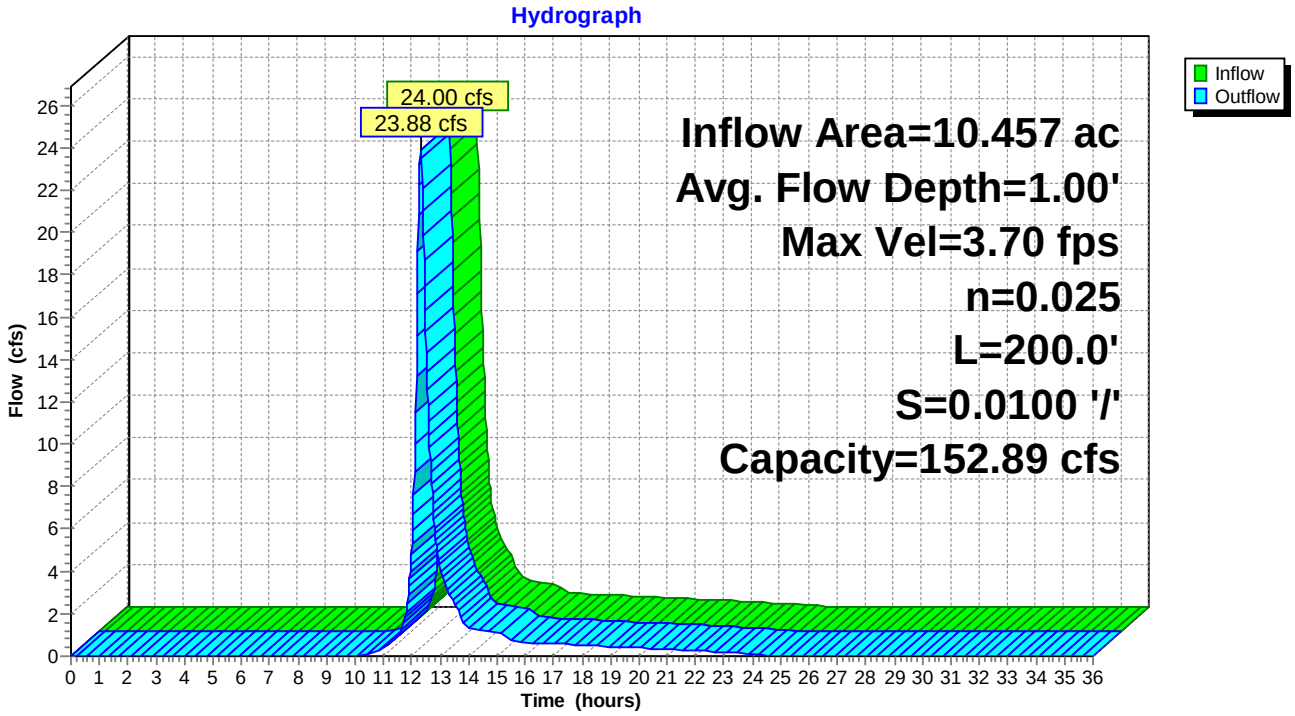
Reach 71R: DB-46



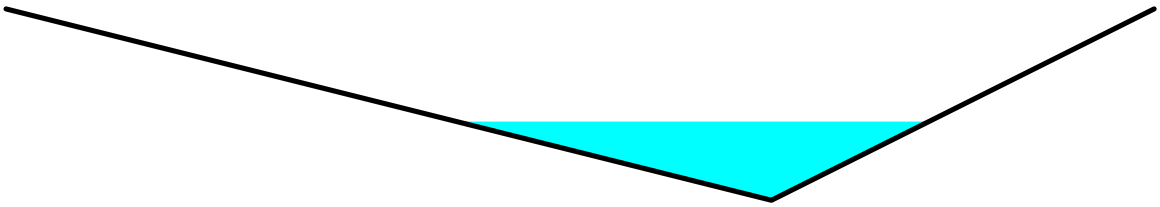
Summary for Reach 73R: DB-D-2 (9.8%)

Inflow Area = 8.819 ac, 0.00% Impervious, Inflow Depth = 3.38" for 25-yr, 24-hr event
Inflow = 45.12 cfs @ 12.21 hrs, Volume= 2.485 af
Outflow = 44.84 cfs @ 12.21 hrs, Volume= 2.485 af, Atten= 1%, Lag= 0.4 min

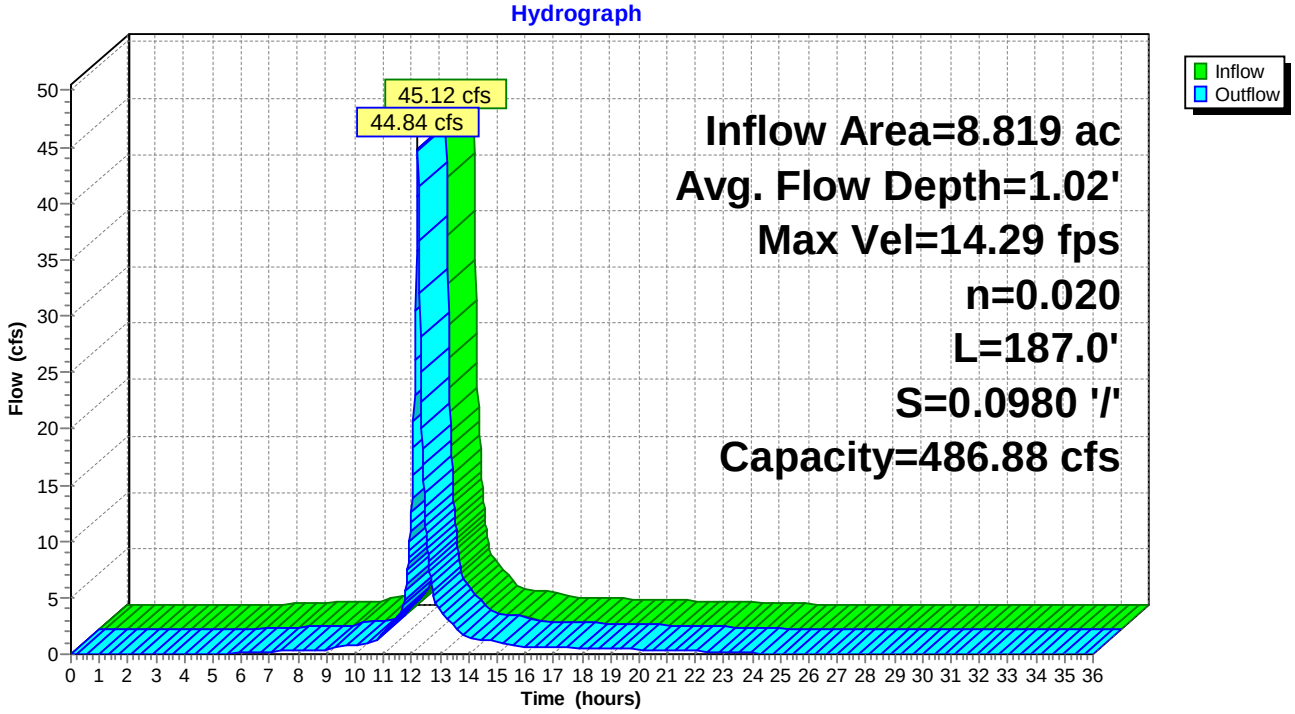
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 14.29 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.18 fps, Avg. Travel Time= 0.7 min

Peak Storage= 589 cf @ 12.21 hrs
Average Depth at Peak Storage= 1.02' , Surface Width= 6.15'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 486.88 cfs

0.00' x 2.50' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 15.00'
Length= 187.0' Slope= 0.0980 '/'
Inlet Invert= 726.33', Outlet Invert= 708.00'



Reach 73R: DB-D-2 (9.8%)

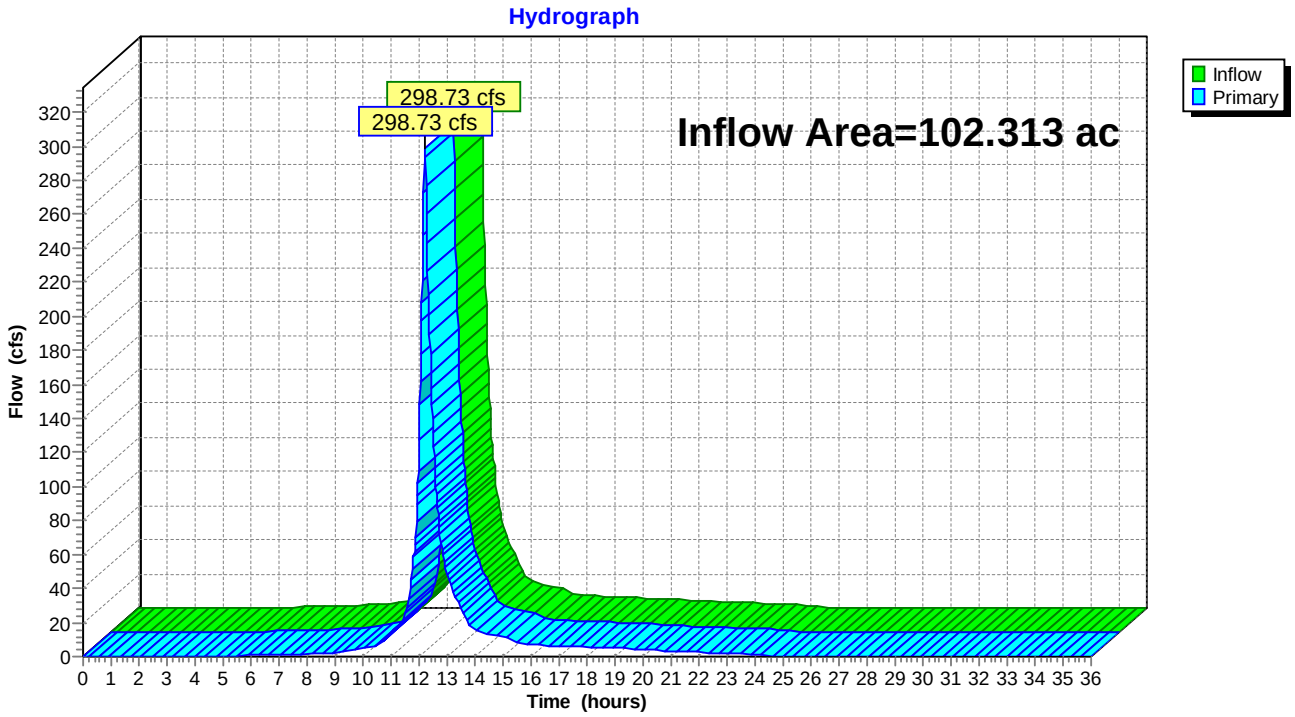


Summary for Pond 63P: SSB

Inflow Area = 102.313 ac, 10.00% Impervious, Inflow Depth = 2.76" for 25-yr, 24-hr event
Inflow = 298.73 cfs @ 12.21 hrs, Volume= 23.524 af
Primary = 298.73 cfs @ 12.21 hrs, Volume= 23.524 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

Pond 63P: SSB

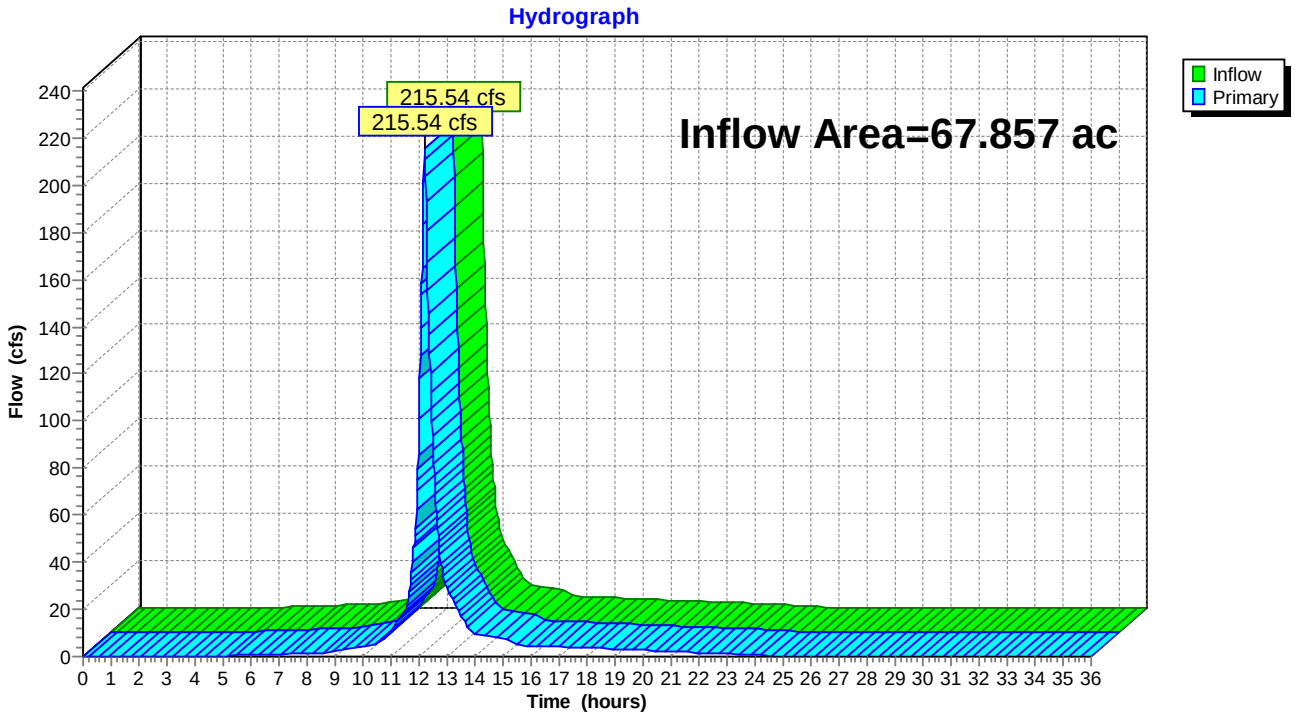


Summary for Pond 69P: Storm Sewer - See SWMM Model

Inflow Area = 67.857 ac, 8.02% Impervious, Inflow Depth = 2.90" for 25-yr, 24-hr event
Inflow = 215.54 cfs @ 12.20 hrs, Volume= 16.388 af
Primary = 215.54 cfs @ 12.20 hrs, Volume= 16.388 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

Pond 69P: Storm Sewer - See SWMM Model



Summary for Pond 70P: SSB Inlet Culvert

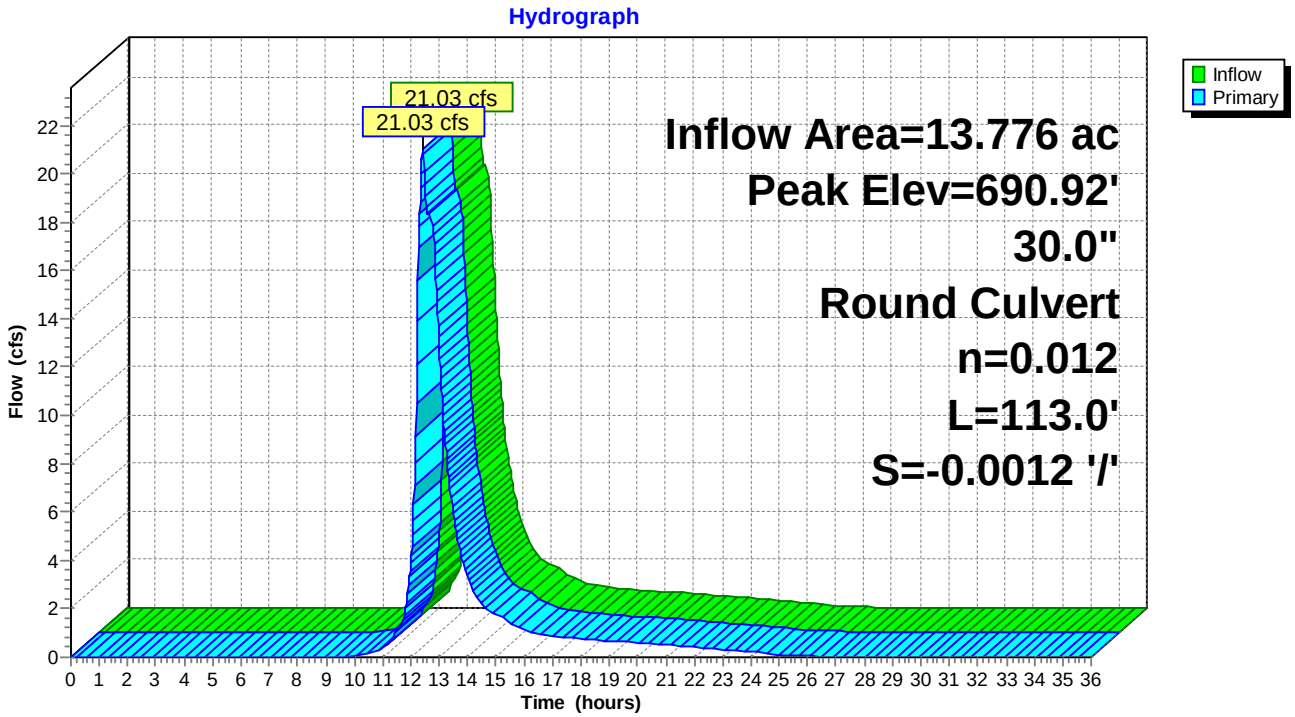
Inflow Area = 13.776 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 21.03 cfs @ 12.42 hrs, Volume= 2.672 af
Outflow = 21.03 cfs @ 12.42 hrs, Volume= 2.672 af, Atten= 0%, Lag= 0.0 min
Primary = 21.03 cfs @ 12.42 hrs, Volume= 2.672 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 690.92' @ 12.42 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	688.14'	**30.0" Round Culvert** L= 113.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 688.01' / 688.14' S= -0.0012 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf

Primary OutFlow Max=21.03 cfs @ 12.42 hrs HW=690.92' (Free Discharge)
1=Culvert (Barrel Controls 21.03 cfs @ 4.62 fps)

Pond 70P: SSB Inlet Culvert



Summary for Pond 71P: E-MCI Culvert

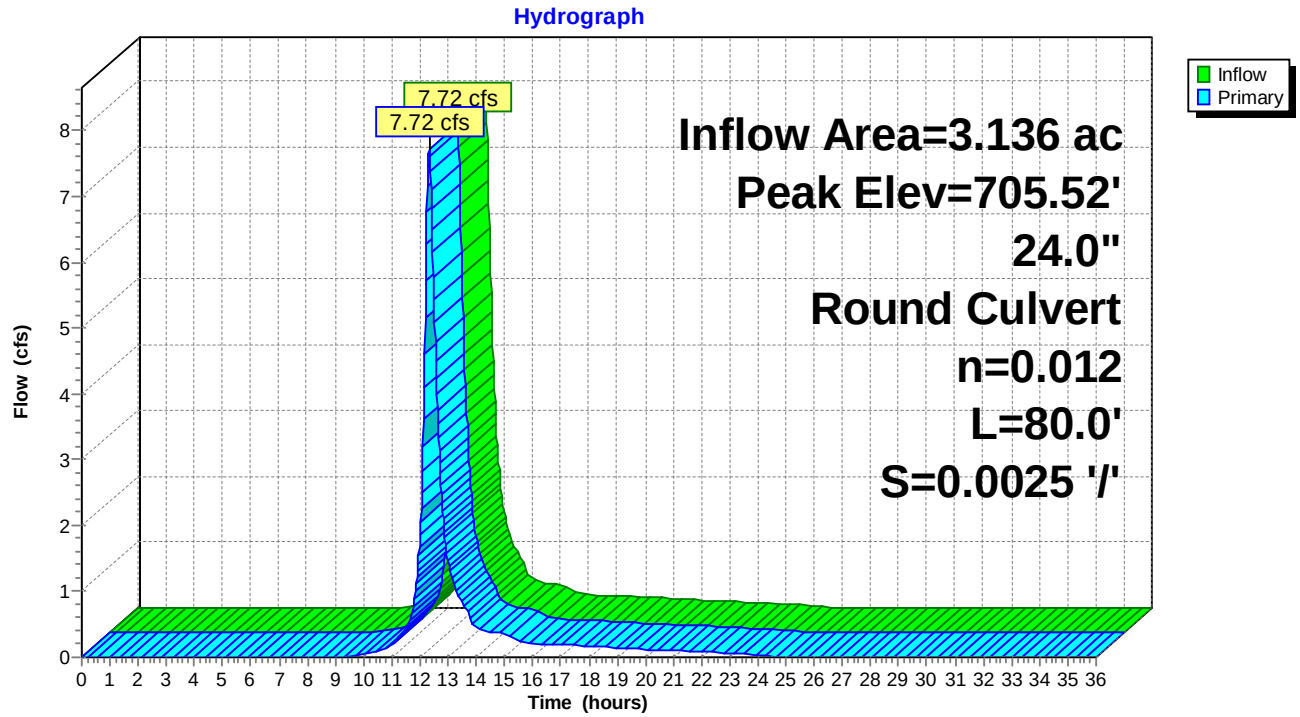
Inflow Area = 3.136 ac, 0.00% Impervious, Inflow Depth = 2.33" for 25-yr, 24-hr event
Inflow = 7.72 cfs @ 12.32 hrs, Volume= 0.608 af
Outflow = 7.72 cfs @ 12.32 hrs, Volume= 0.608 af, Atten= 0%, Lag= 0.0 min
Primary = 7.72 cfs @ 12.32 hrs, Volume= 0.608 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 705.52' @ 12.32 hrs

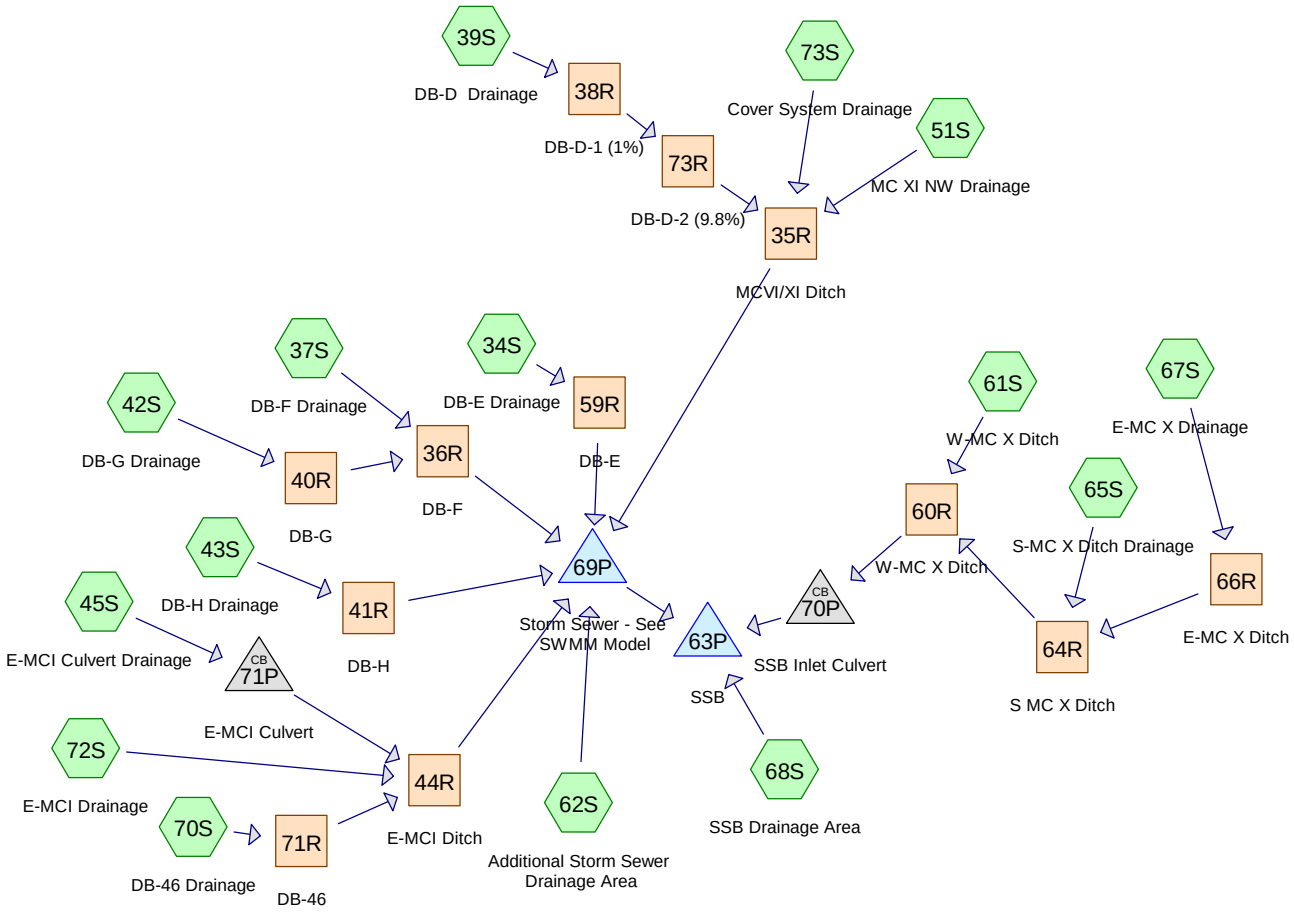
Device	Routing	Invert	Outlet Devices
#1	Primary	703.00'	**24.0" Round Culvert** L= 80.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 703.00' / 702.80' S= 0.0025 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=7.72 cfs @ 12.32 hrs HW=705.52' TW=705.10' (Fixed TW Elev= 705.10')
1=Culvert (Inlet Controls 7.72 cfs @ 2.46 fps)

Pond 71P: E-MCI Culvert



South Sedimentation Basin (SSB) HYDROCAD OUTPUT – 100-yr, 24-hr



Routing Diagram for WDI Vert Exp SSB
Prepared by CTI, Printed 10/28/2021
HydroCAD® 10.10-5a s/n 11246 © 2020 HydroCAD Software Solutions LLC

Time span=0.00-36.00 hrs, dt=0.02 hrs, 1801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 34S: DB-E Drainage Runoff Area=86,500 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=476' Tc=3.4 min CN=95 Runoff=16.02 cfs 0.751 af

Subcatchment 37S: DB-F Drainage Runoff Area=63,437 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=280' Tc=5.0 min CN=95 Runoff=11.26 cfs 0.551 af

Subcatchment 39S: DB-D Drainage Runoff Area=384,155 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=62' Slope=0.2500 '/' Tc=2.4 min CN=95 Runoff=73.42 cfs 3.335 af

Subcatchment 42S: DB-G Drainage Runoff Area=82,915 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=52' Slope=0.2500 '/' Tc=2.1 min CN=95 Runoff=16.00 cfs 0.720 af

Subcatchment 43S: DB-H Drainage Runoff Area=8,958 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=77' Tc=9.3 min CN=95 Runoff=1.34 cfs 0.078 af

Subcatchment 45S: E-MCI Culvert Drainage Runoff Area=136,608 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=667' Tc=22.3 min CN=84 Runoff=11.15 cfs 0.883 af

Subcatchment 51S: MC XI NW Drainage Runoff Area=464,875 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=480' Slope=0.0520 '/' Tc=16.5 min CN=84 Runoff=44.30 cfs 3.006 af

Subcatchment 61S: W-MC X Ditch Runoff Area=141,400 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=150' Slope=0.2500 '/' Tc=5.8 min CN=84 Runoff=19.95 cfs 0.914 af

Subcatchment 62S: Additional Storm Sewer Runoff Area=237,200 sf 100.00% Impervious Runoff Depth=4.88"
Tc=0.0 min CN=98 Runoff=46.10 cfs 2.216 af

Subcatchment 65S: S-MC X Ditch Drainage Runoff Area=205,200 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=160' Slope=0.3300 '/' Tc=5.4 min CN=84 Runoff=29.42 cfs 1.327 af

Subcatchment 67S: E-MC X Drainage Runoff Area=253,500 sf 0.00% Impervious Runoff Depth=3.38"
Flow Length=110' Slope=0.2500 '/' Tc=4.5 min CN=84 Runoff=37.89 cfs 1.639 af

Subcatchment 68S: SSB Drainage Area Runoff Area=900,800 sf 23.12% Impervious Runoff Depth=3.68"
Flow Length=400' Slope=0.0730 '/' Tc=13.7 min CN=87 Runoff=100.19 cfs 6.342 af

Subcatchment 70S: DB-46 Drainage Runoff Area=455,500 sf 0.00% Impervious Runoff Depth=3.00"
Flow Length=450' Slope=0.0350 '/' Tc=19.1 min CN=80 Runoff=35.98 cfs 2.612 af

Subcatchment 72S: E-MCI Drainage Runoff Area=177,527 sf 0.00% Impervious Runoff Depth=3.00"
Flow Length=1,086' Tc=33.4 min CN=80 Runoff=10.27 cfs 1.018 af

Subcatchment 73S: Cover System Drainage Runoff Area=858,183 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=1,385' Tc=9.7 min CN=95 Runoff=126.33 cfs 7.451 af

Reach 35R: MCVI/XI Ditch Avg. Flow Depth=1.92' Max Vel=8.39 fps Inflow=220.71 cfs 13.793 af
n=0.020 L=290.0' S=0.0100 '/' Capacity=1,123.17 cfs Outflow=218.94 cfs 13.793 af

Reach 36R: DB-F Avg. Flow Depth=1.28' Max Vel=5.30 fps Inflow=26.83 cfs 1.271 af
n=0.020 L=402.0' S=0.0100 '/' Capacity=85.77 cfs Outflow=26.17 cfs 1.271 af

Reach 38R: DB-D-1 (1%) Avg. Flow Depth=1.76' Max Vel=6.57 fps Inflow=73.42 cfs 3.335 af
n=0.020 L=1,851.0' S=0.0100 '/' Capacity=155.51 cfs Outflow=60.90 cfs 3.335 af

Reach 40R: DB-G Avg. Flow Depth=0.77' Max Vel=8.78 fps Inflow=16.00 cfs 0.720 af
n=0.020 L=610.0' S=0.0540 '/' Capacity=199.31 cfs Outflow=15.58 cfs 0.720 af

Reach 41R: DB-H Avg. Flow Depth=0.42' Max Vel=2.52 fps Inflow=1.34 cfs 0.078 af
n=0.020 L=127.1' S=0.0100 '/' Capacity=85.74 cfs Outflow=1.32 cfs 0.078 af

Reach 44R: E-MCI Ditch Avg. Flow Depth=2.18' Max Vel=3.88 fps Inflow=55.28 cfs 4.514 af
n=0.025 L=250.0' S=0.0041 '/' Capacity=129.69 cfs Outflow=55.06 cfs 4.514 af

Reach 59R: DB-E Avg. Flow Depth=1.05' Max Vel=4.64 fps Inflow=16.02 cfs 0.751 af
n=0.020 L=576.5' S=0.0100 '/' Capacity=85.81 cfs Outflow=15.09 cfs 0.751 af

Reach 60R: W-MC X Ditch Avg. Flow Depth=1.29' Max Vel=2.75 fps Inflow=34.54 cfs 3.881 af
n=0.025 L=833.0' S=0.0024 '/' Capacity=326.61 cfs Outflow=32.84 cfs 3.881 af

Reach 64R: S MC X Ditch Avg. Flow Depth=2.44' Max Vel=3.09 fps Inflow=34.39 cfs 2.966 af
n=0.025 L=1,110.0' S=0.0027 '/' Capacity=103.29 cfs Outflow=27.51 cfs 2.966 af

Reach 66R: E-MC X Ditch Avg. Flow Depth=1.48' Max Vel=2.01 fps Inflow=37.89 cfs 1.639 af
n=0.030 L=1,500.0' S=0.0025 '/' Capacity=145.10 cfs Outflow=22.01 cfs 1.639 af

Reach 71R: DB-46 Avg. Flow Depth=1.16' Max Vel=4.09 fps Inflow=35.98 cfs 2.612 af
n=0.025 L=200.0' S=0.0100 '/' Capacity=152.89 cfs Outflow=35.82 cfs 2.612 af

Reach 73R: DB-D-2 (9.8%) Avg. Flow Depth=1.15' Max Vel=15.43 fps Inflow=60.90 cfs 3.335 af
n=0.020 L=187.0' S=0.0980 '/' Capacity=486.88 cfs Outflow=60.36 cfs 3.335 af

Pond 63P: SSB Inflow=416.80 cfs 32.845 af
Primary=416.80 cfs 32.845 af

Pond 69P: Storm Sewer - See SWMM Model Inflow=295.86 cfs 22.622 af
Primary=295.86 cfs 22.622 af

Pond 70P: SSB Inlet Culvert Peak Elev=692.17' Inflow=32.84 cfs 3.881 af
30.0" Round Culvert n=0.012 L=113.0' S=-0.0012 '/' Outflow=32.84 cfs 3.881 af

Pond 71P: E-MCI Culvert Peak Elev=705.97' Inflow=11.15 cfs 0.883 af
24.0" Round Culvert n=0.012 L=80.0' S=0.0025 '/' Outflow=11.15 cfs 0.883 af

Total Runoff Area = 102.313 ac Runoff Volume = 32.845 af Average Runoff Depth = 3.85"
90.00% Pervious = 92.086 ac 10.00% Impervious = 10.227 ac

Summary for Subcatchment 34S: DB-E Drainage

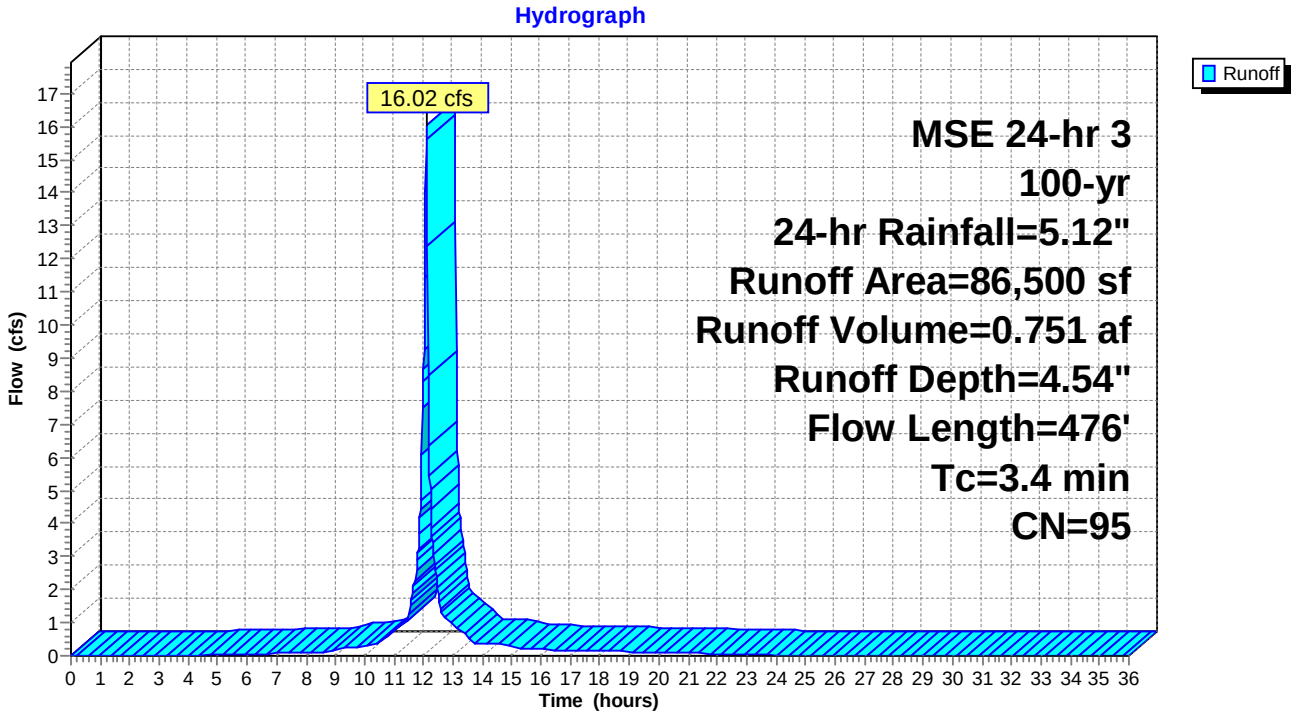
Runoff = 16.02 cfs @ 12.10 hrs, Volume= 0.751 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
*	86,500	95	Closure Turf
	86,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	66	0.2500	0.44		**Sheet Flow,** n= 0.120 P2= 2.35"
0.9	410	0.0100	7.43	89.16	**Channel Flow,** Area= 12.0 sf Perim= 12.0' r= 1.00' n= 0.020
3.4	476	Total			

Subcatchment 34S: DB-E Drainage



Summary for Subcatchment 37S: DB-F Drainage

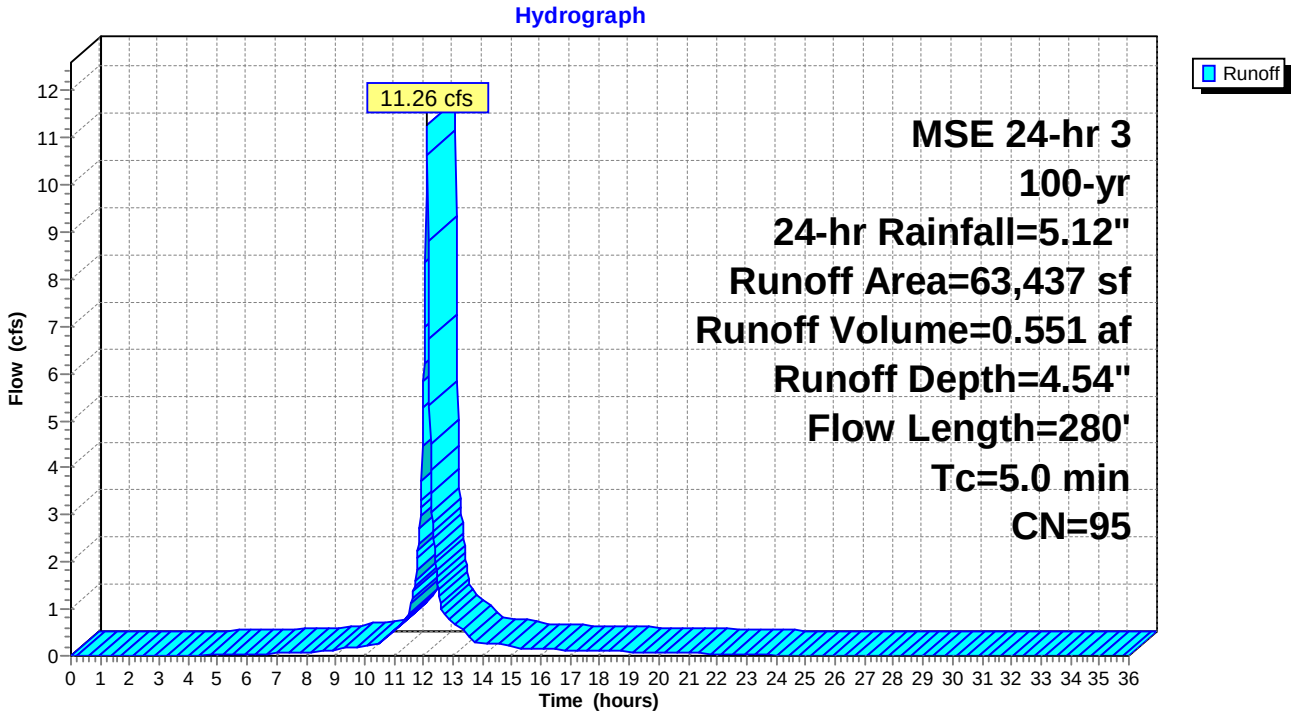
Runoff = 11.26 cfs @ 12.12 hrs, Volume= 0.551 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
*	63,437	95	Closure Turf
	63,437		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	65	0.2500	0.44		**Sheet Flow,** n= 0.120 P2= 2.35"
2.5	215	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.0	280	Total			

Subcatchment 37S: DB-F Drainage



Summary for Subcatchment 39S: DB-D Drainage

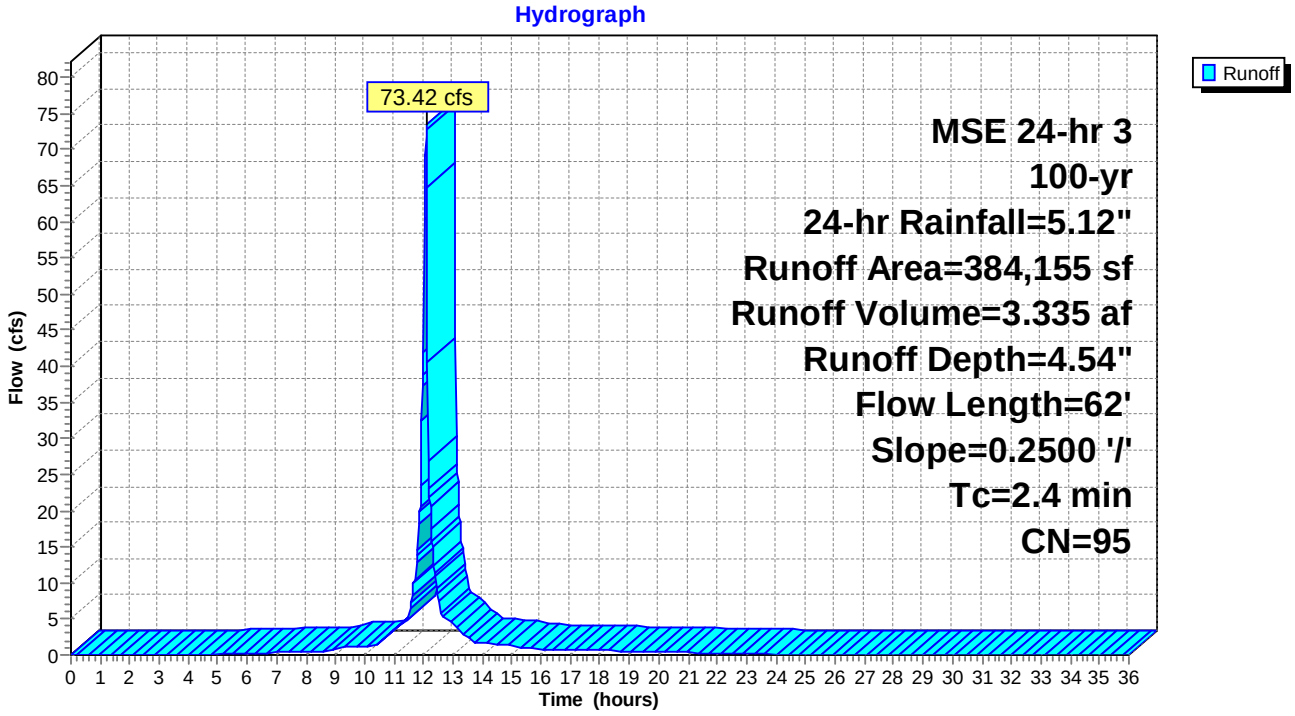
Runoff = 73.42 cfs @ 12.09 hrs, Volume= 3.335 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
*	384,155	95	Closure Turf
	384,155		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	62	0.2500	0.43		**Sheet Flow,** n= 0.120 P2= 2.35"

Subcatchment 39S: DB-D Drainage



Summary for Subcatchment 42S: DB-G Drainage

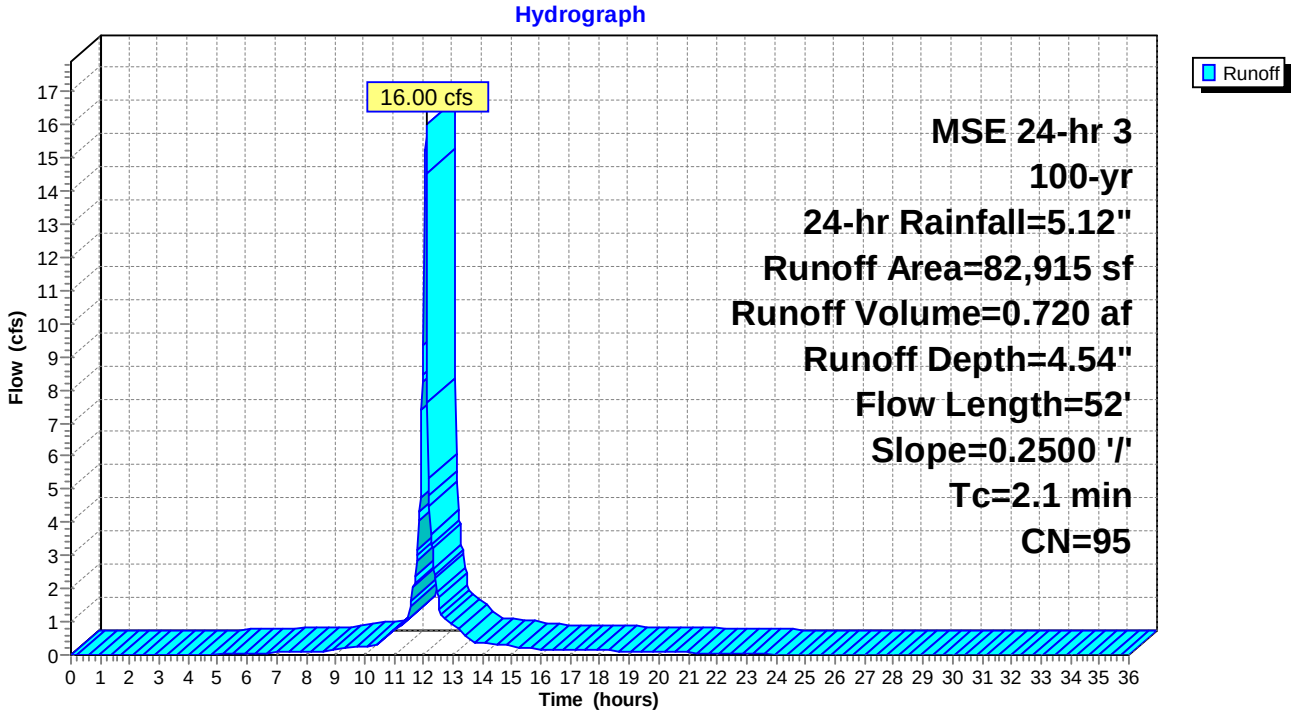
Runoff = 16.00 cfs @ 12.09 hrs, Volume= 0.720 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
*	82,915	95	Closure Turf
	82,915		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	52	0.2500	0.42		**Sheet Flow,** n= 0.120 P2= 2.35"

Subcatchment 42S: DB-G Drainage



Summary for Subcatchment 43S: DB-H Drainage

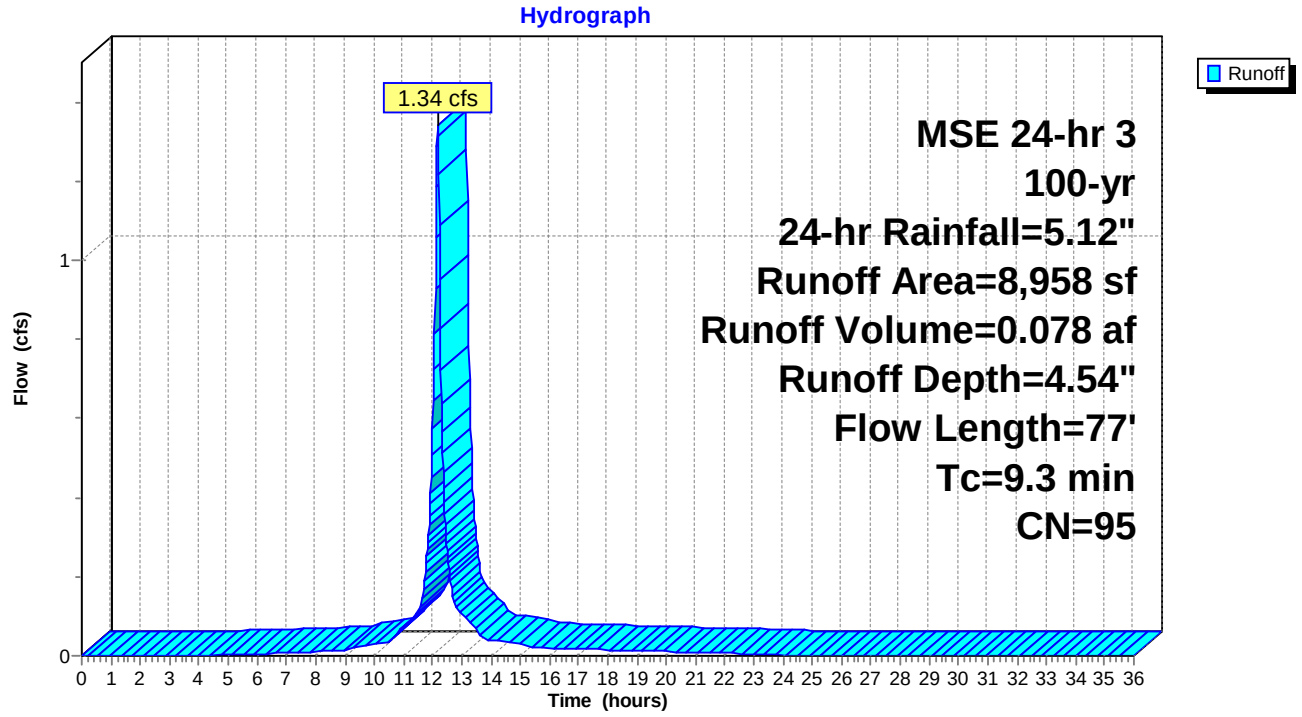
Runoff = 1.34 cfs @ 12.16 hrs, Volume= 0.078 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
*	8,958	95	Closure Turf
	8,958		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	29	0.0100	0.06		**Sheet Flow,** n= 0.220 P2= 2.35"
1.7	48	0.3300	0.46		**Sheet Flow,** n= 0.120 P2= 2.35"
9.3	77	Total			

Subcatchment 43S: DB-H Drainage



Summary for Subcatchment 45S: E-MCI Culvert Drainage

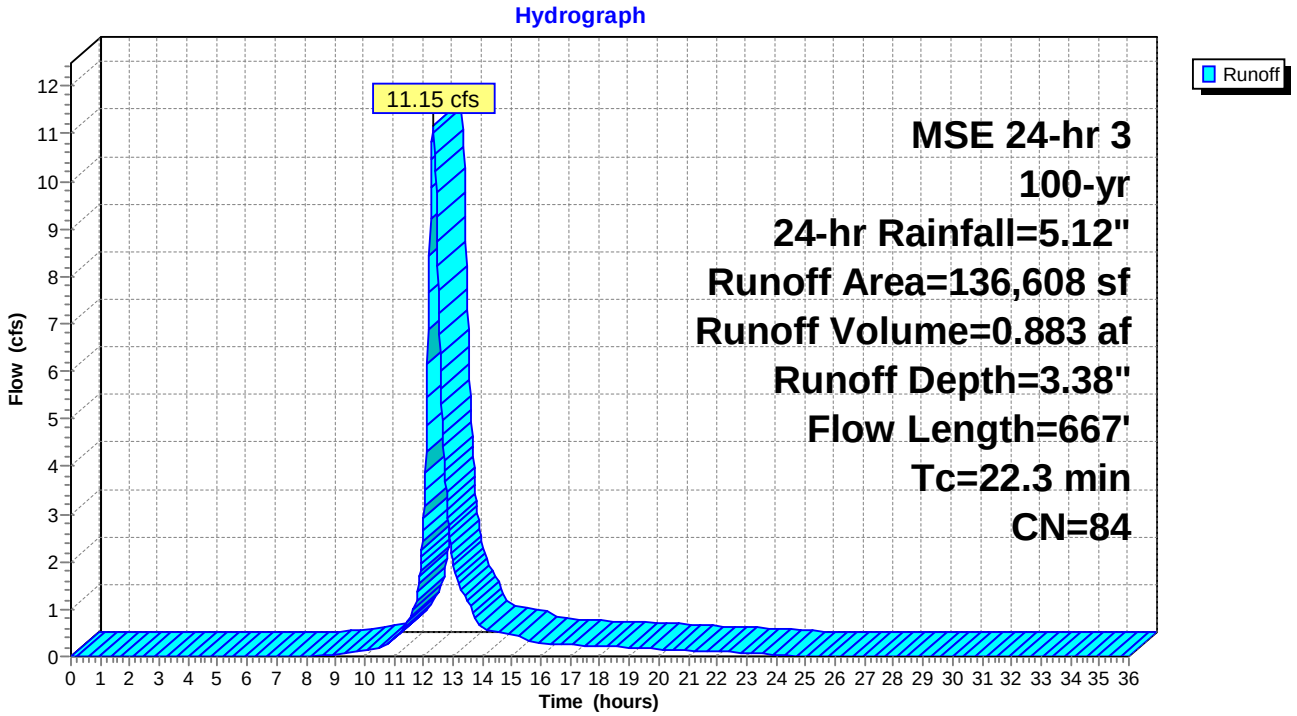
Runoff = 11.15 cfs @ 12.32 hrs, Volume= 0.883 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
	104,100	80	>75% Grass cover, Good, HSG D
*	32,508	95	Closure Turf
	136,608	84	Weighted Average
	136,608		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	32	0.0100	0.06		**Sheet Flow, Closure turf** n= 0.220 P2= 2.35"
1.6	35	0.3300	0.36		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
8.2	133	0.0800	0.27		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
4.3	467	0.0670	1.81		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
22.3	667	Total			

Subcatchment 45S: E-MCI Culvert Drainage



Summary for Subcatchment 51S: MC XI NW Drainage

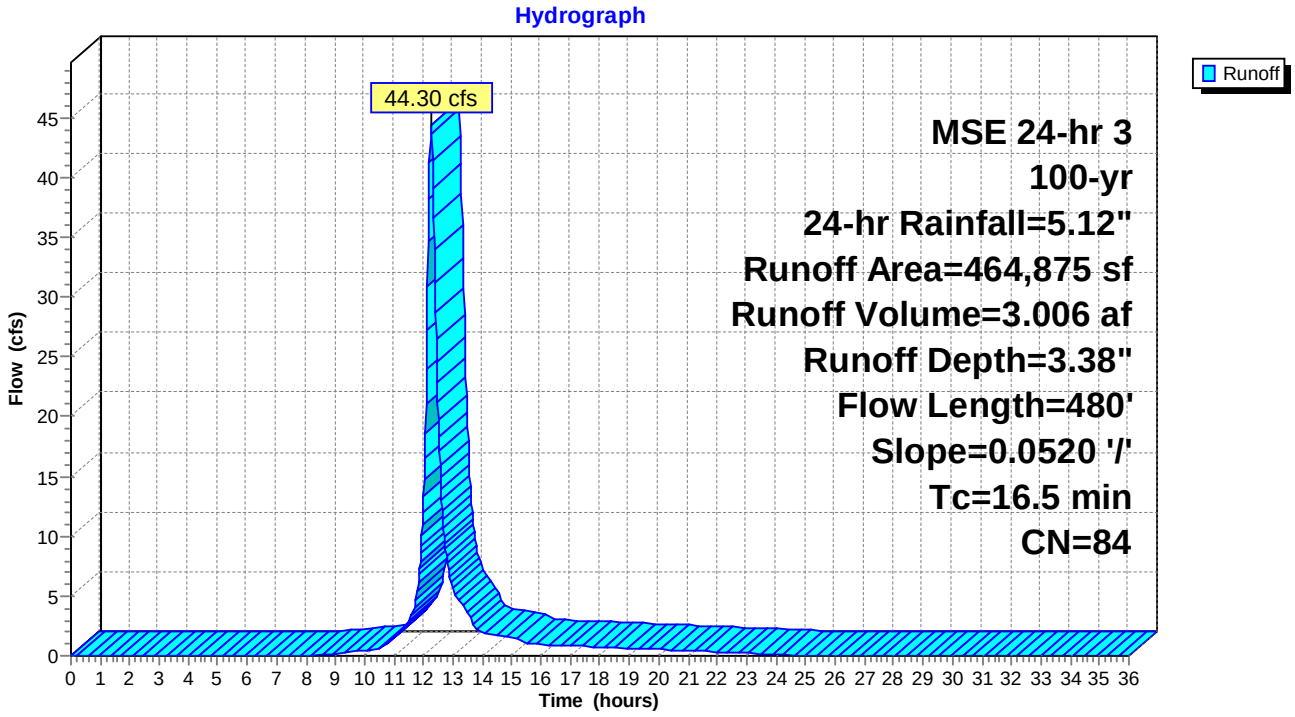
Runoff = 44.30 cfs @ 12.25 hrs, Volume= 3.006 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
464,875	84	50-75% Grass cover, Fair, HSG D
464,875		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	200	0.0520	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
2.9	280	0.0520	1.60		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.5	480	Total			

Subcatchment 51S: MC XI NW Drainage



Summary for Subcatchment 61S: W-MC X Ditch

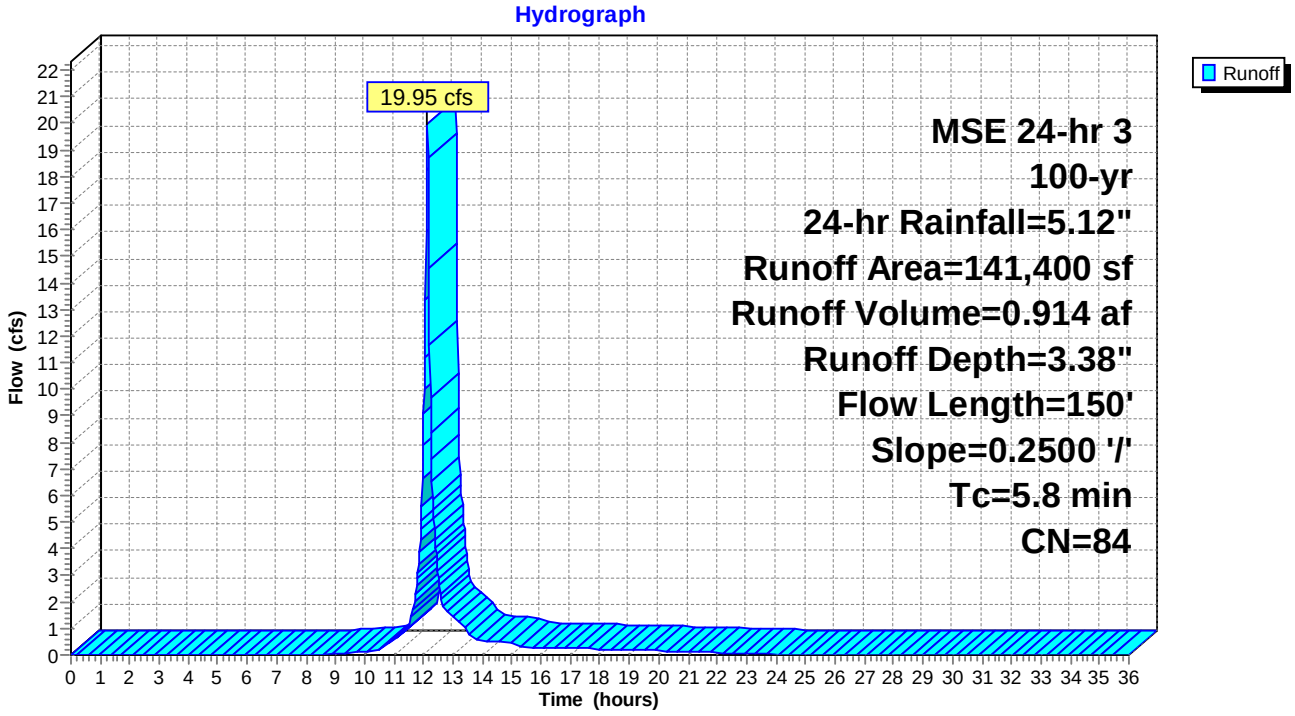
Runoff = 19.95 cfs @ 12.13 hrs, Volume= 0.914 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
141,400	84	50-75% Grass cover, Fair, HSG D
141,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	150	0.2500	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 61S: W-MC X Ditch



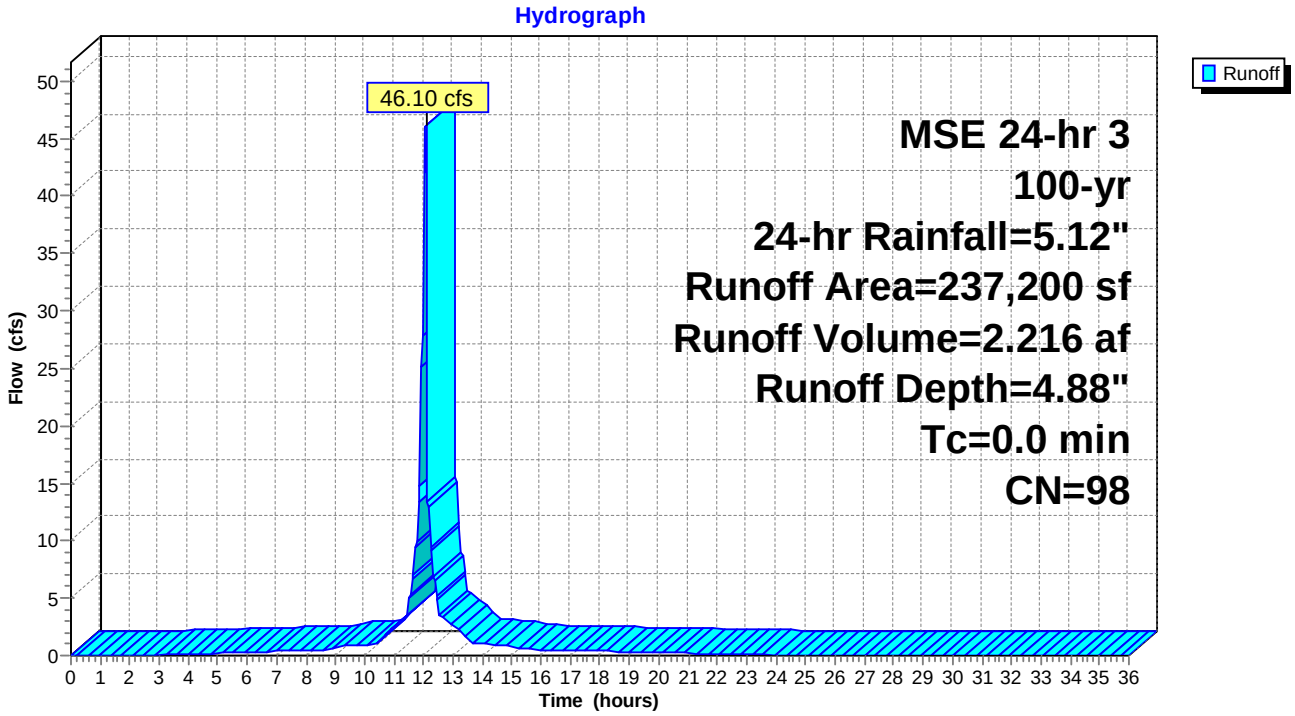
Summary for Subcatchment 62S: Additional Storm Sewer Drainage Area

Runoff = 46.10 cfs @ 12.08 hrs, Volume= 2.216 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
237,200	98	Paved parking, HSG D
237,200		100.00% Impervious Area

Subcatchment 62S: Additional Storm Sewer Drainage Area



Summary for Subcatchment 65S: S-MC X Ditch Drainage

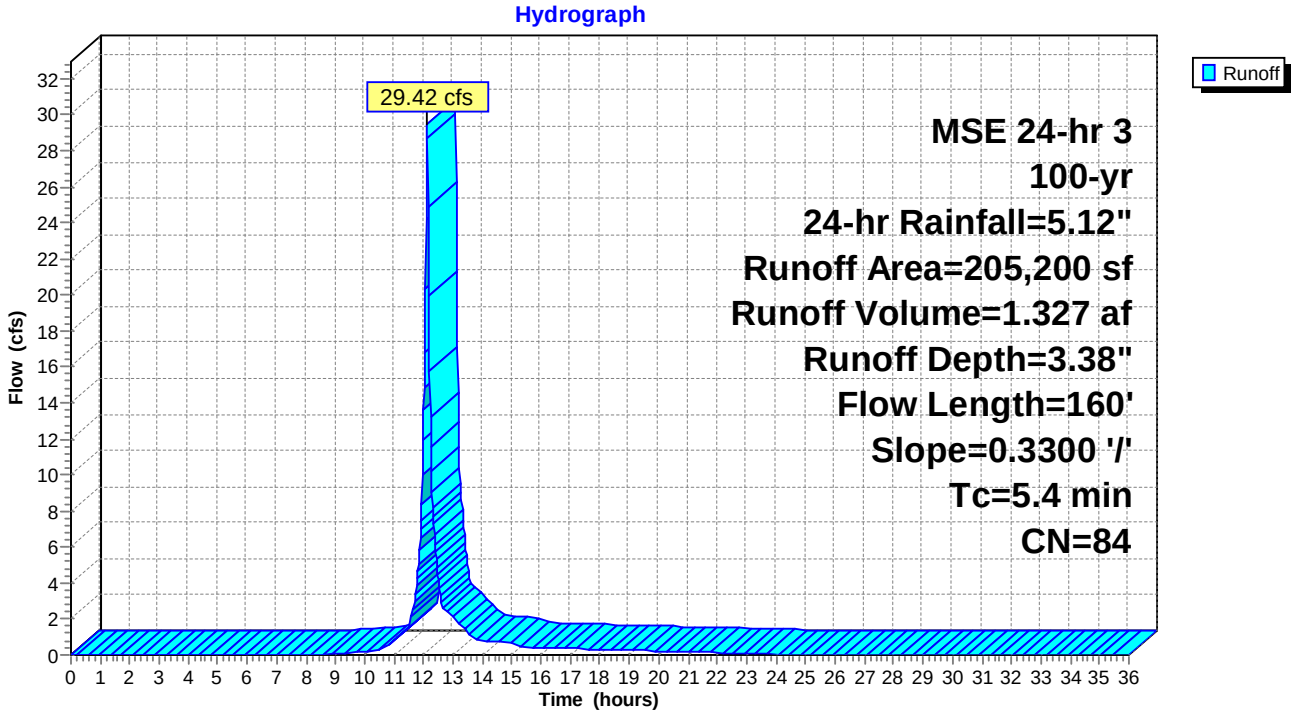
Runoff = 29.42 cfs @ 12.12 hrs, Volume= 1.327 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
205,200	84	50-75% Grass cover, Fair, HSG D
205,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	160	0.3300	0.49		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 65S: S-MC X Ditch Drainage



Summary for Subcatchment 67S: E-MC X Drainage

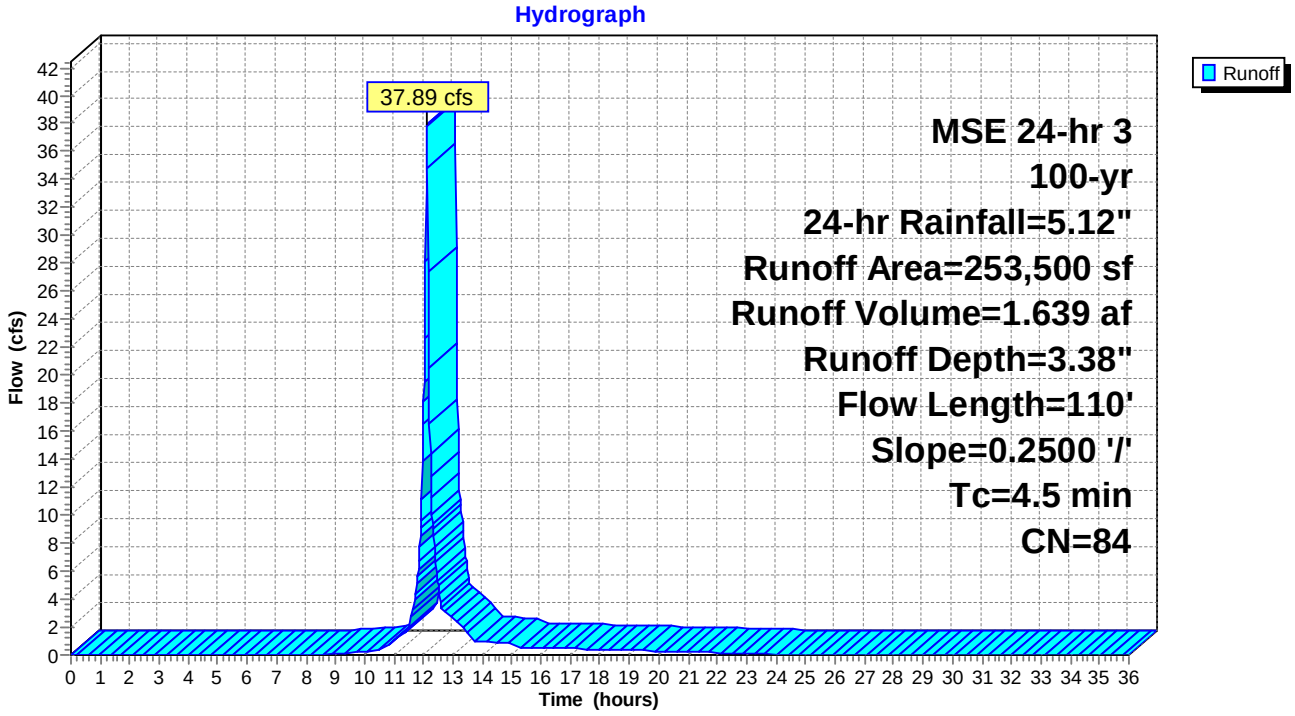
Runoff = 37.89 cfs @ 12.12 hrs, Volume= 1.639 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
253,500	84	50-75% Grass cover, Fair, HSG D
253,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	110	0.2500	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"

Subcatchment 67S: E-MC X Drainage



Summary for Subcatchment 68S: SSB Drainage Area

Total area is 900,800 sf
Pond area is 208,300 sf
Therefore, surrounding area is 692,500 sf (900,800 - 208,300)

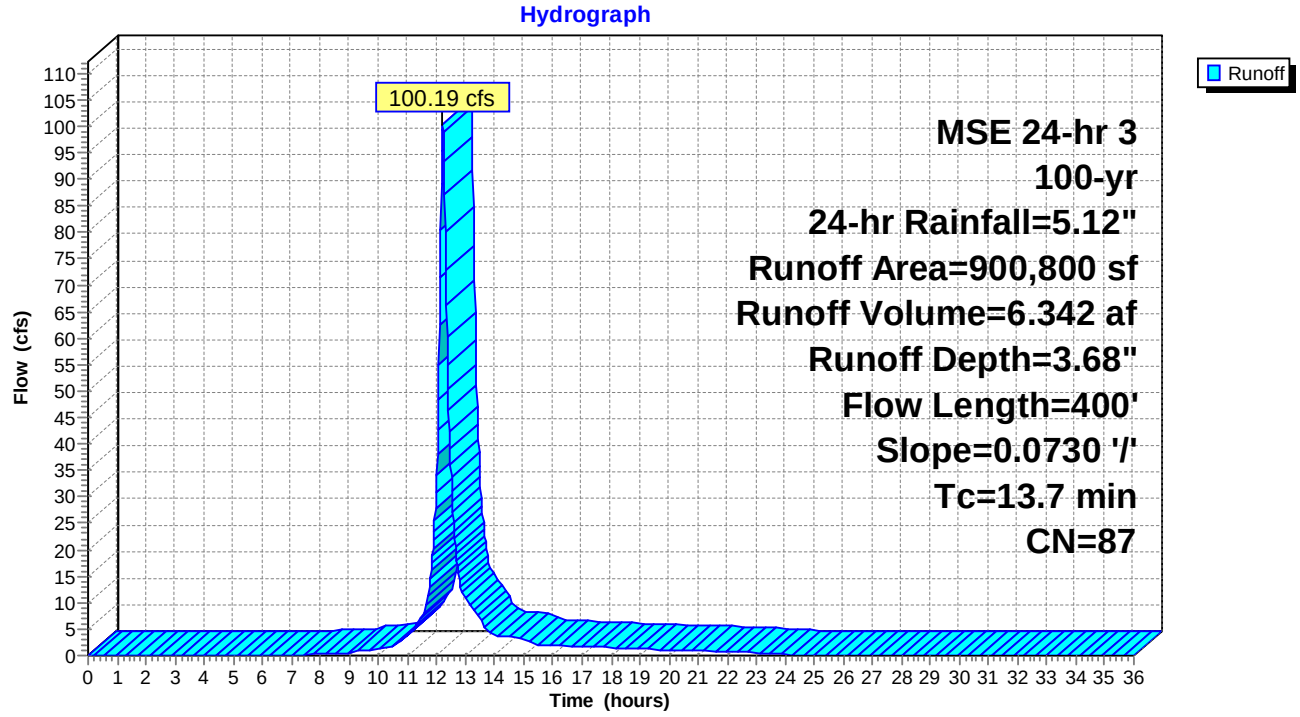
Runoff = 100.19 cfs @ 12.22 hrs, Volume= 6.342 af, Depth= 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
692,500	84	50-75% Grass cover, Fair, HSG D
208,300	98	Water Surface, HSG D
900,800	87	Weighted Average
692,500		76.88% Pervious Area
208,300		23.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	200	0.0730	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
1.8	200	0.0730	1.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.7	400	Total			

Subcatchment 68S: SSB Drainage Area



Summary for Subcatchment 70S: DB-46 Drainage

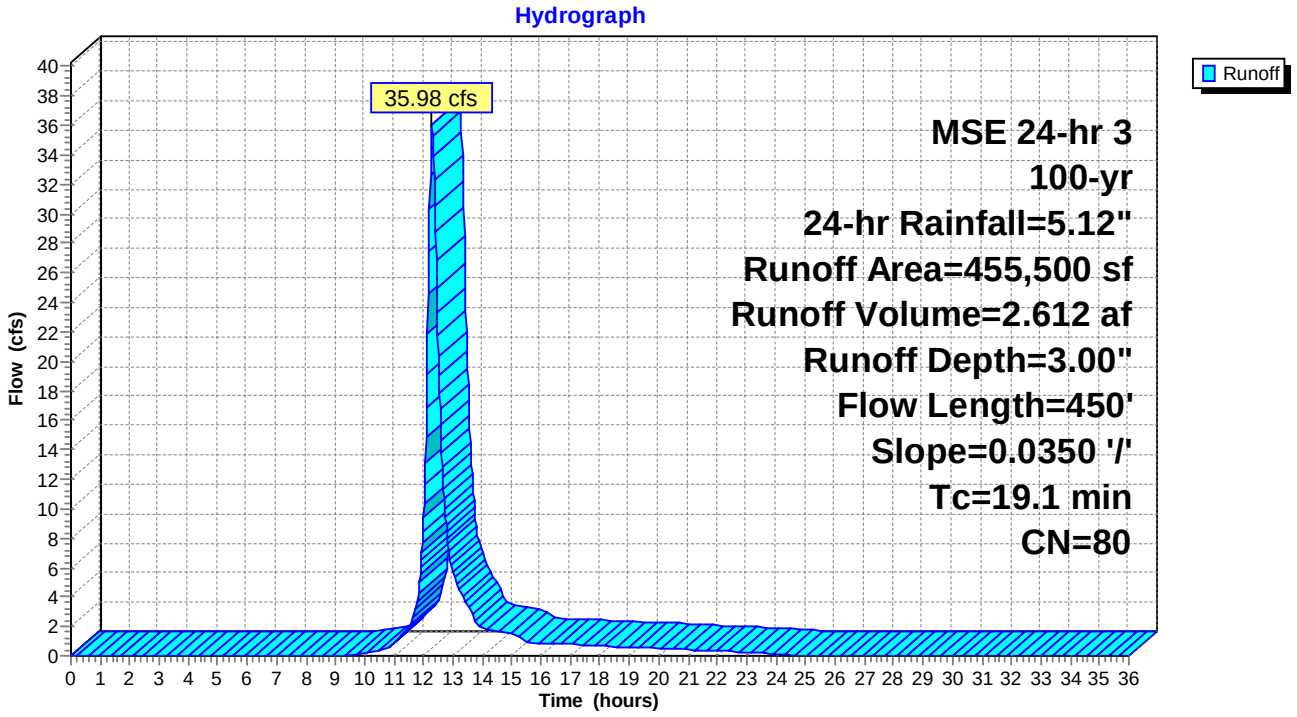
Runoff = 35.98 cfs @ 12.28 hrs, Volume= 2.612 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
455,500	80	>75% Grass cover, Good, HSG D
455,500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	200	0.0350	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
3.2	250	0.0350	1.31		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.1	450	Total			

Subcatchment 70S: DB-46 Drainage



Summary for Subcatchment 72S: E-MCI Drainage

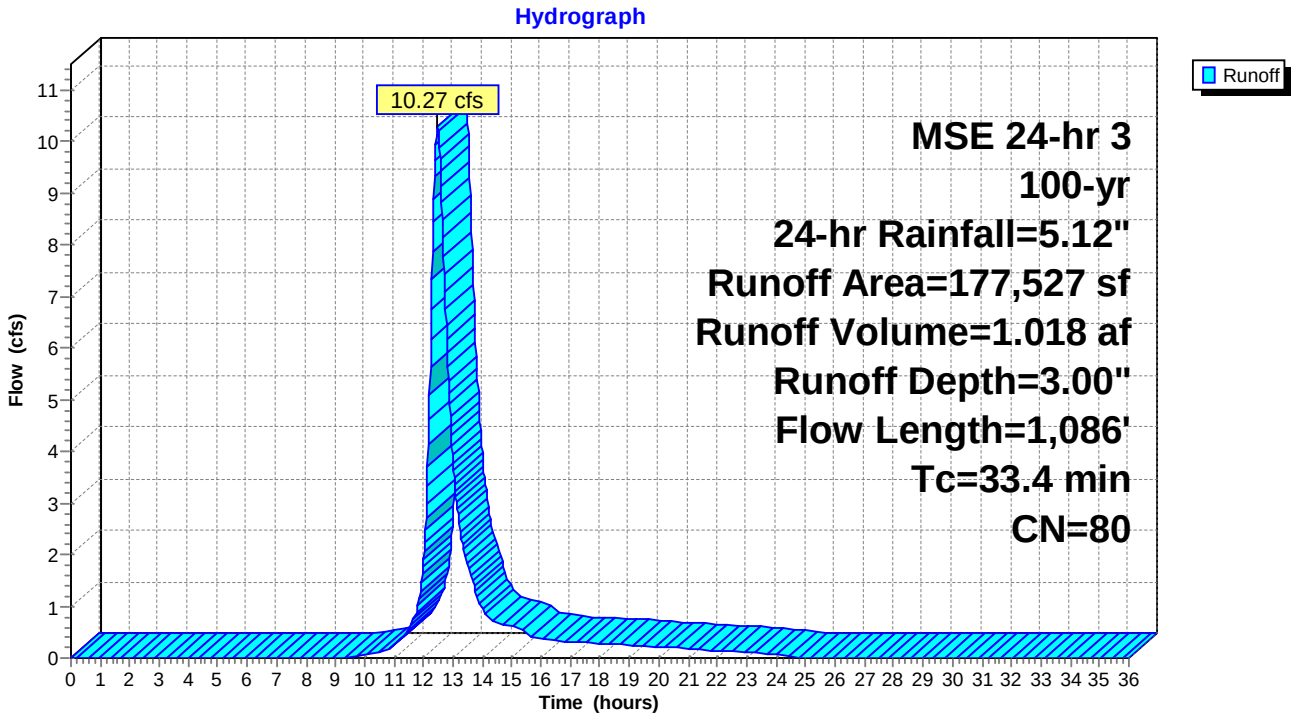
Runoff = 10.27 cfs @ 12.46 hrs, Volume= 1.018 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

Area (sf)	CN	Description
177,527	80	>75% Grass cover, Good, HSG D
177,527		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	200	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.35"
10.8	640	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.7	246	0.0488	1.55		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.4	1,086	Total			

Subcatchment 72S: E-MCI Drainage



Summary for Subcatchment 73S: Cover System Drainage

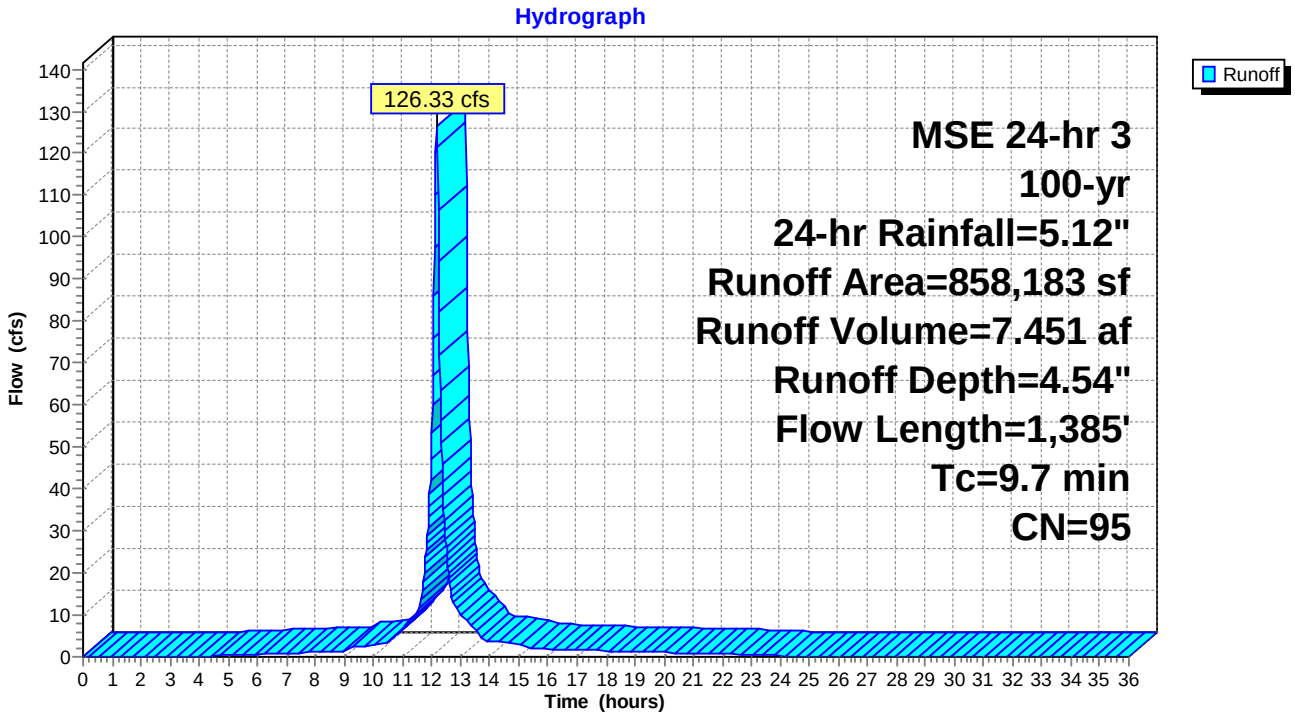
Runoff = 126.33 cfs @ 12.17 hrs, Volume= 7.451 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.12"

	Area (sf)	CN	Description
*	858,183	95	Closure Turf
	858,183		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	200	0.2500	0.55		**Sheet Flow,** n= 0.120 P2= 2.35"
0.5	321	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.7	626	0.0360	3.85		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	238	0.2500	10.15		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.7	1,385	Total			

Subcatchment 73S: Cover System Drainage



Summary for Reach 35R: MCVI/XI Ditch

Inflow Area = 39.192 ac, 0.00% Impervious, Inflow Depth = 4.22" for 100-yr, 24-hr event
Inflow = 220.71 cfs @ 12.19 hrs, Volume= 13.793 af
Outflow = 218.94 cfs @ 12.21 hrs, Volume= 13.793 af, Atten= 1%, Lag= 1.0 min

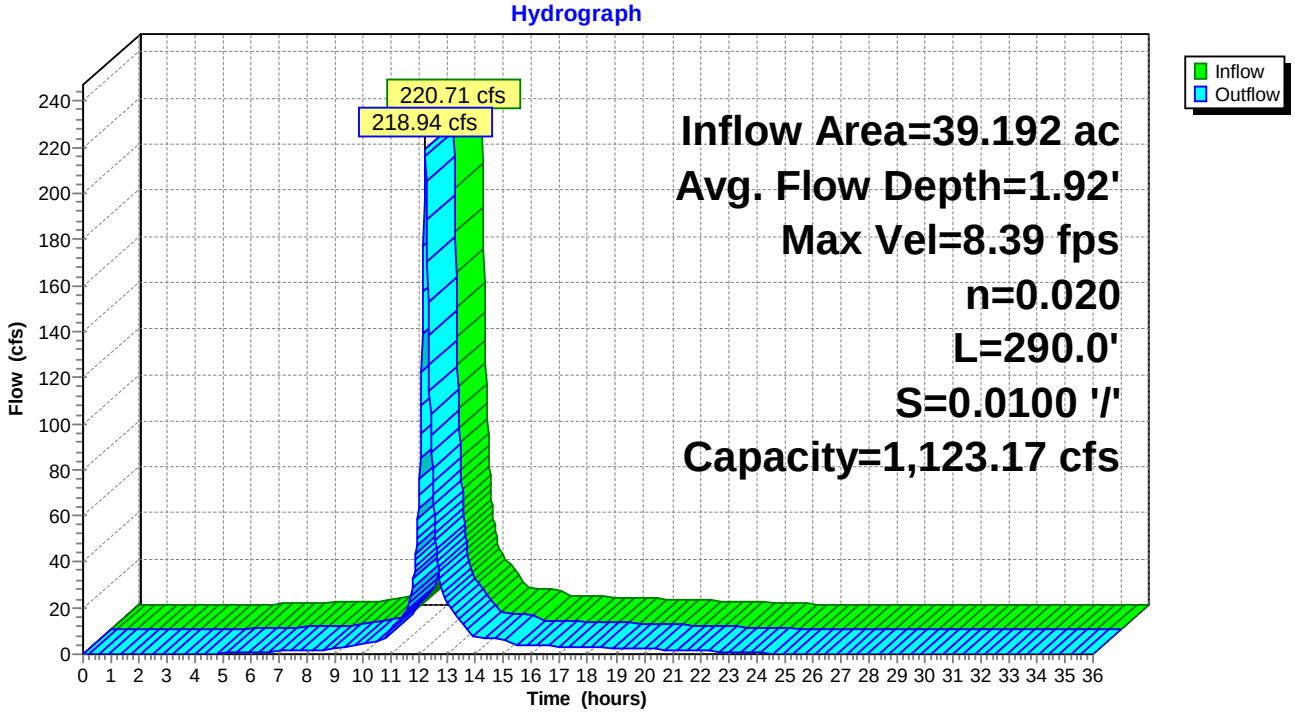
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 8.39 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.05 fps, Avg. Travel Time= 2.4 min

Peak Storage= 7,611 cf @ 12.20 hrs
Average Depth at Peak Storage= 1.92' , Surface Width= 21.35'
Bank-Full Depth= 4.00' Flow Area= 88.0 sf, Capacity= 1,123.17 cfs

6.00' x 4.00' deep channel, n= 0.020
Side Slope Z-value= 4.0 '/' Top Width= 38.00'
Length= 290.0' Slope= 0.0100 '/'
Inlet Invert= 700.15', Outlet Invert= 697.26'

‡

Reach 35R: MCVI/XI Ditch



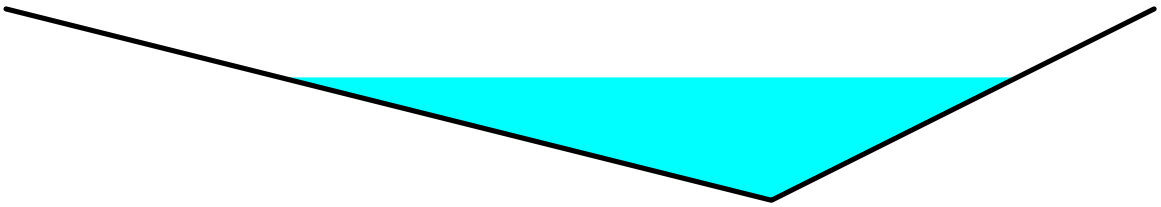
Summary for Reach 36R: DB-F

Inflow Area = 3.360 ac, 0.00% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 26.83 cfs @ 12.12 hrs, Volume= 1.271 af
Outflow = 26.17 cfs @ 12.15 hrs, Volume= 1.271 af, Atten= 2%, Lag= 2.1 min

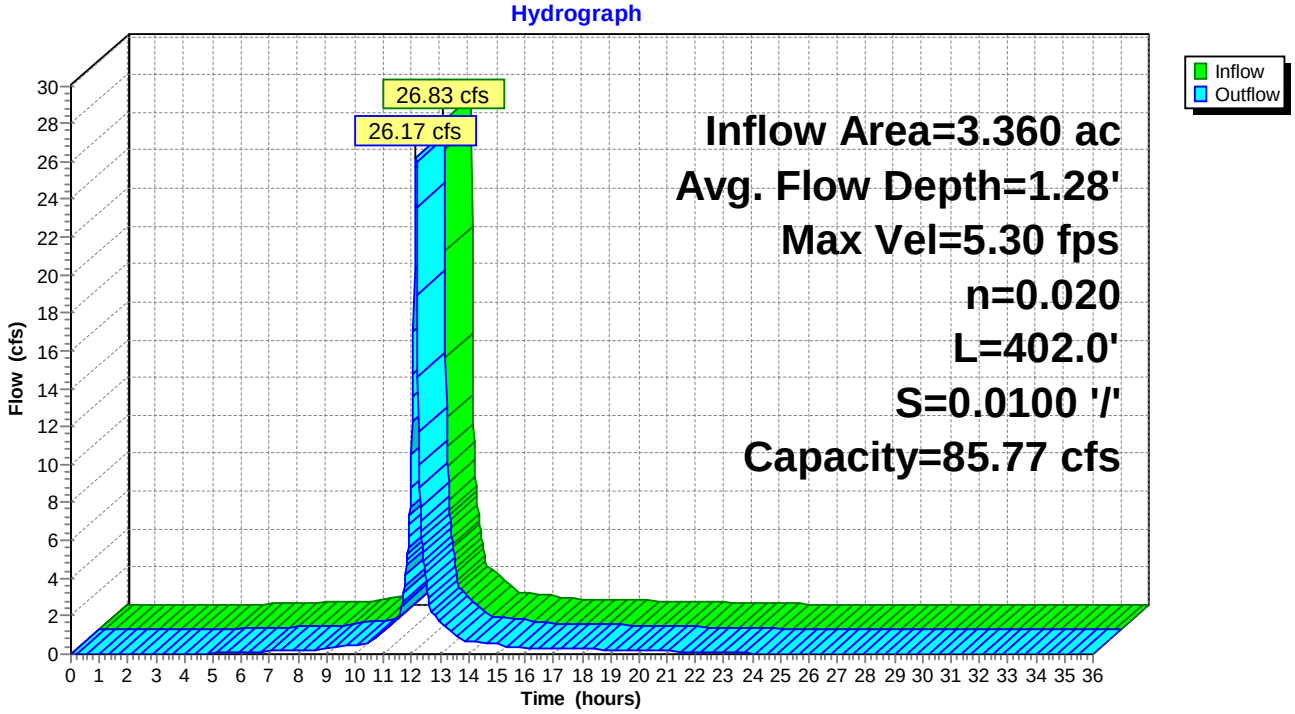
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 5.30 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 1.64 fps, Avg. Travel Time= 4.1 min

Peak Storage= 1,984 cf @ 12.13 hrs
Average Depth at Peak Storage= 1.28' , Surface Width= 7.70'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 85.77 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 402.0' Slope= 0.0100 '/'
Inlet Invert= 712.02', Outlet Invert= 708.00'



Reach 36R: DB-F



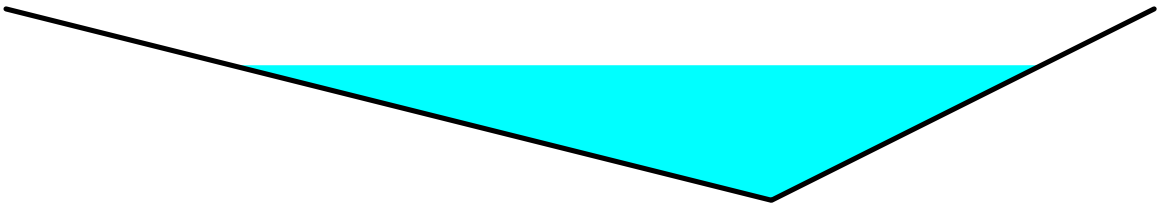
Summary for Reach 38R: DB-D-1 (1%)

Inflow Area = 8.819 ac, 0.00% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 73.42 cfs @ 12.09 hrs, Volume= 3.335 af
Outflow = 60.90 cfs @ 12.20 hrs, Volume= 3.335 af, Atten= 17%, Lag= 6.5 min

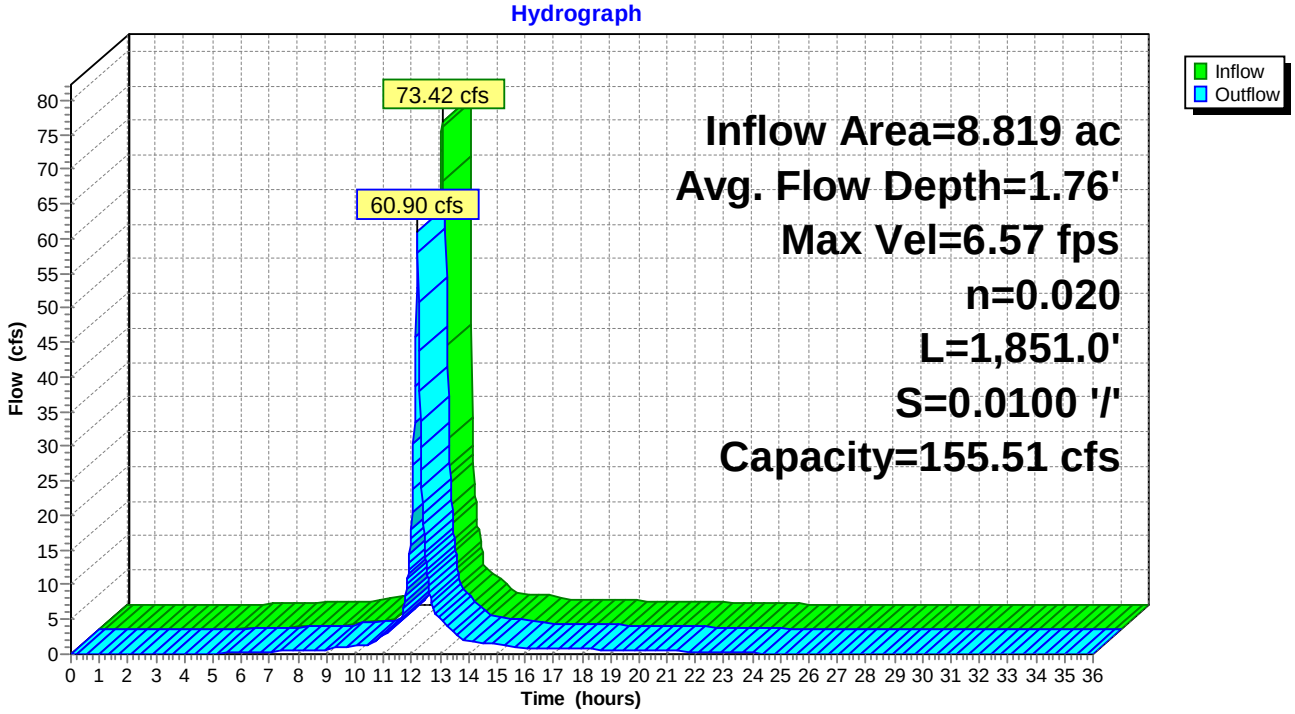
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 6.57 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 1.80 fps, Avg. Travel Time= 17.2 min

Peak Storage= 17,225 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.76' , Surface Width= 10.57'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 155.51 cfs

0.00' x 2.50' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 15.00'
Length= 1,851.0' Slope= 0.0100 '/'
Inlet Invert= 744.85', Outlet Invert= 726.34'



Reach 38R: DB-D-1 (1%)



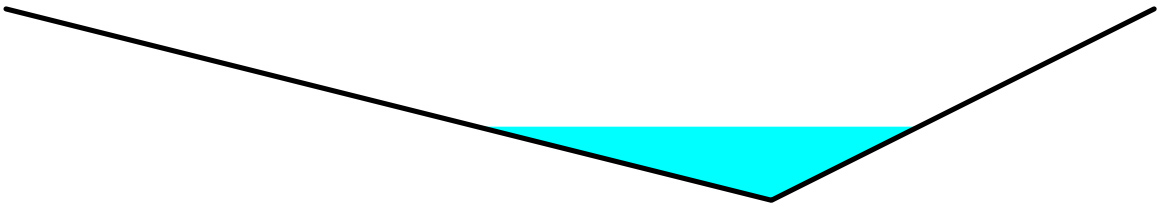
Summary for Reach 40R: DB-G

Inflow Area = 1.903 ac, 0.00% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 16.00 cfs @ 12.09 hrs, Volume= 0.720 af
Outflow = 15.58 cfs @ 12.12 hrs, Volume= 0.720 af, Atten= 3%, Lag= 1.5 min

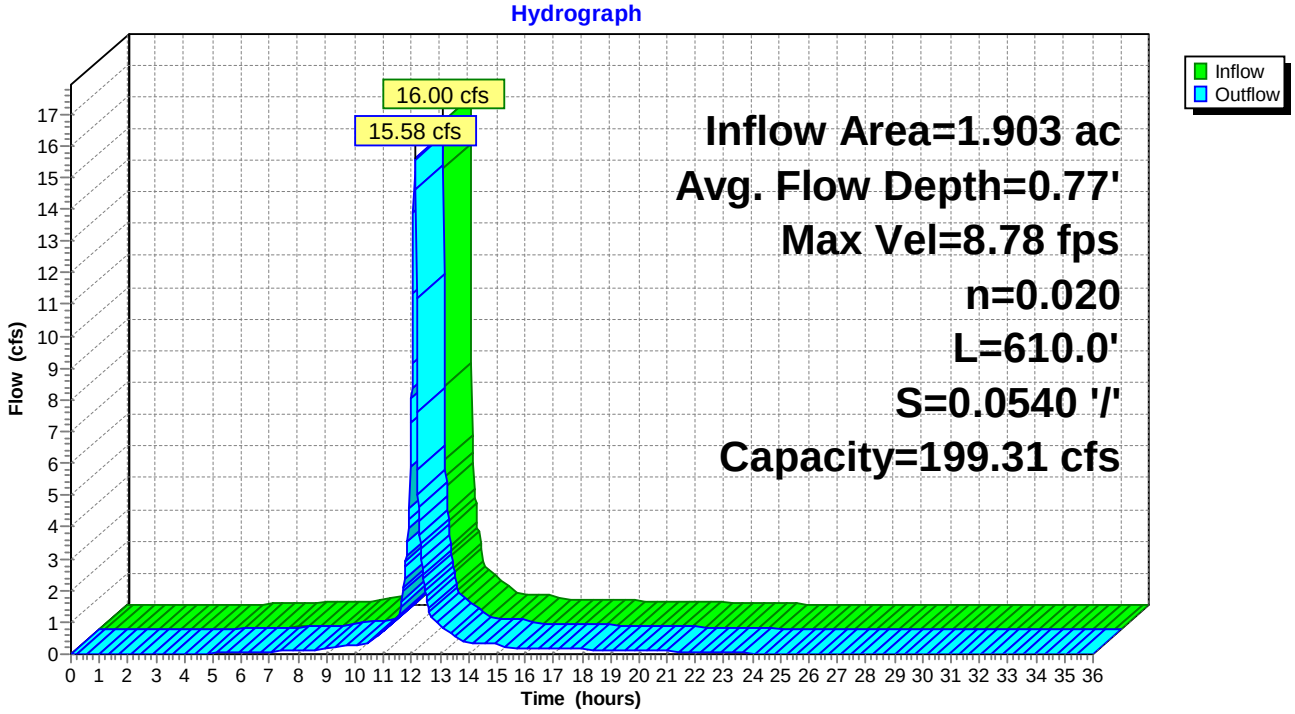
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 8.78 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 2.78 fps, Avg. Travel Time= 3.7 min

Peak Storage= 1,083 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.77' , Surface Width= 4.62'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 199.31 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 610.0' Slope= 0.0540 '/'
Inlet Invert= 762.04', Outlet Invert= 729.10'



Reach 40R: DB-G



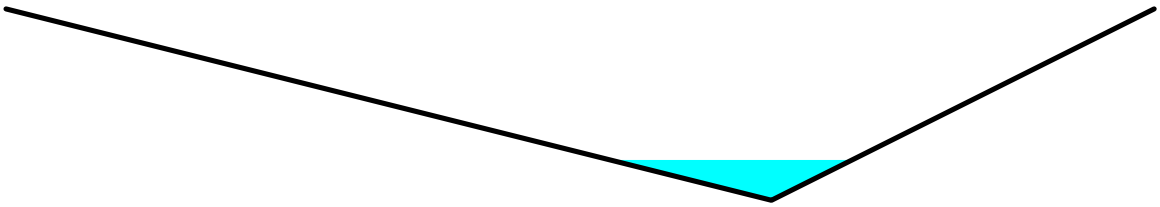
Summary for Reach 41R: DB-H

Inflow Area = 0.206 ac, 0.00% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 1.34 cfs @ 12.16 hrs, Volume= 0.078 af
Outflow = 1.32 cfs @ 12.19 hrs, Volume= 0.078 af, Atten= 1%, Lag= 1.5 min

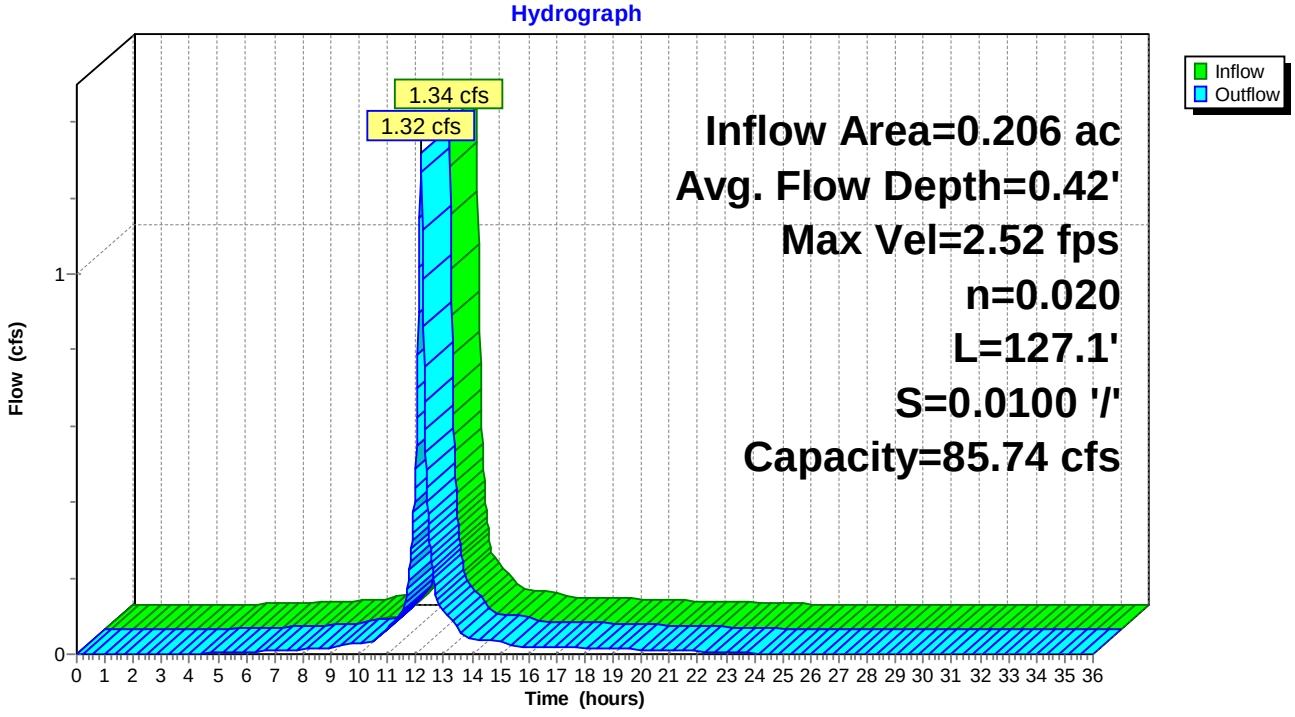
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.52 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.87 fps, Avg. Travel Time= 2.4 min

Peak Storage= 67 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.42' , Surface Width= 2.51'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 85.74 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 127.1' Slope= 0.0100 '/'
Inlet Invert= 707.69', Outlet Invert= 706.42'



Reach 41R: DB-H



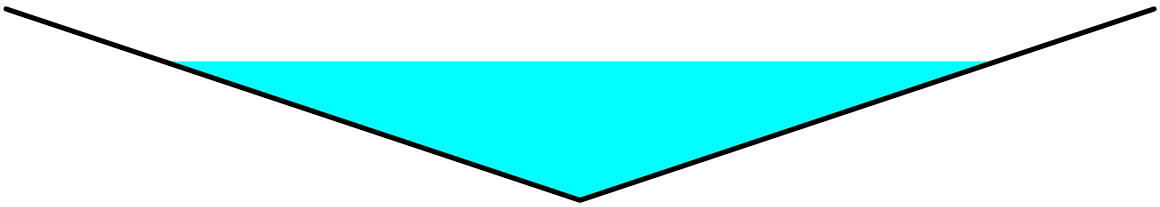
Summary for Reach 44R: E-MCI Ditch

Inflow Area = 17.668 ac, 0.00% Impervious, Inflow Depth = 3.07" for 100-yr, 24-hr event
Inflow = 55.28 cfs @ 12.32 hrs, Volume= 4.514 af
Outflow = 55.06 cfs @ 12.36 hrs, Volume= 4.514 af, Atten= 0%, Lag= 2.0 min

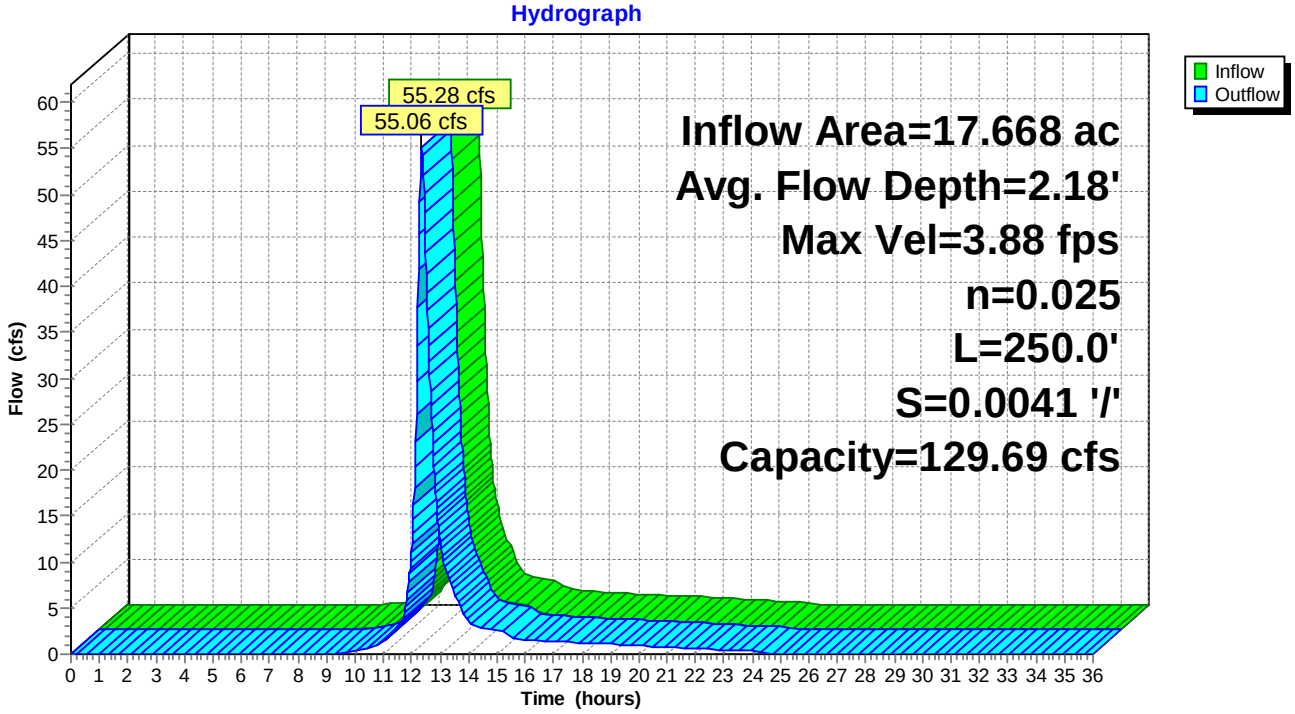
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.88 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.36 fps, Avg. Travel Time= 3.1 min

Peak Storage= 3,552 cf @ 12.34 hrs
Average Depth at Peak Storage= 2.18' , Surface Width= 13.06'
Bank-Full Depth= 3.00' Flow Area= 27.0 sf, Capacity= 129.69 cfs

0.00' x 3.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/' Top Width= 18.00'
Length= 250.0' Slope= 0.0041 '/'
Inlet Invert= 702.00', Outlet Invert= 700.98'



Reach 44R: E-MCI Ditch



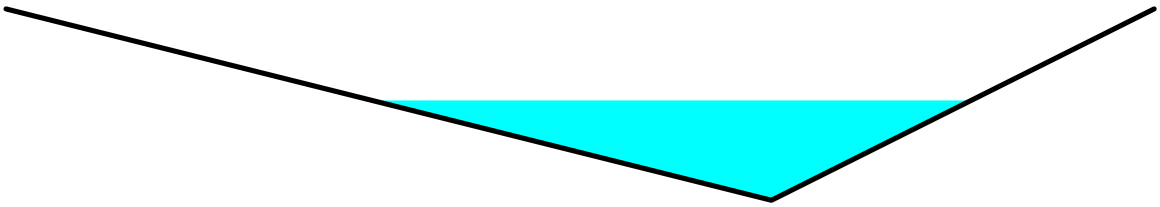
Summary for Reach 59R: DB-E

Inflow Area = 1.986 ac, 0.00% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 16.02 cfs @ 12.10 hrs, Volume= 0.751 af
Outflow = 15.09 cfs @ 12.15 hrs, Volume= 0.751 af, Atten= 6%, Lag= 3.2 min

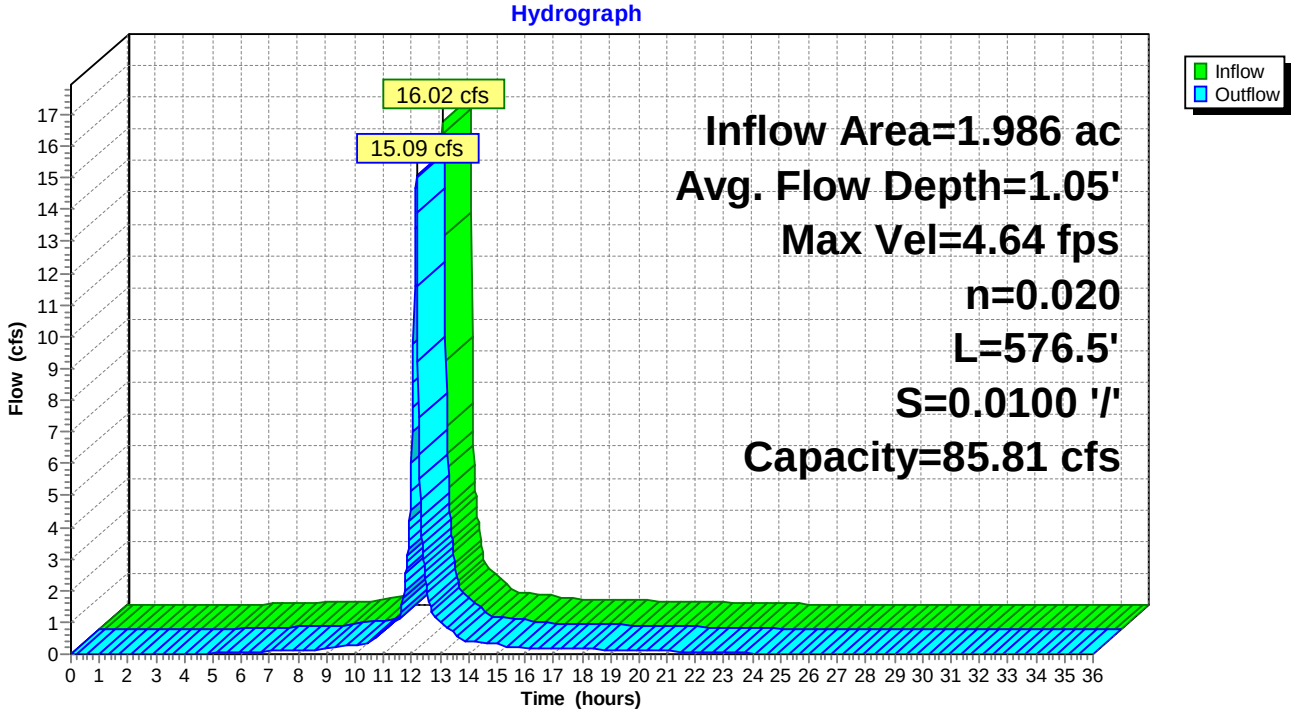
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.64 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 6.7 min

Peak Storage= 1,891 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.05' , Surface Width= 6.27'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 85.81 cfs

0.00' x 2.00' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 12.00'
Length= 576.5' Slope= 0.0100 '/'
Inlet Invert= 718.00', Outlet Invert= 712.23'



Reach 59R: DB-E



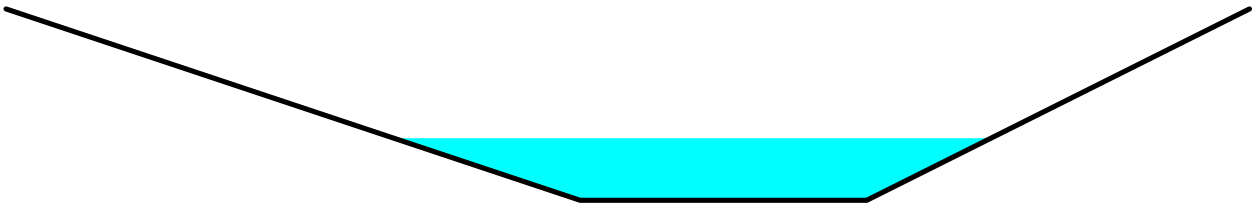
Summary for Reach 60R: W-MC X Ditch

Inflow Area = 13.776 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 34.54 cfs @ 12.26 hrs, Volume= 3.881 af
Outflow = 32.84 cfs @ 12.38 hrs, Volume= 3.881 af, Atten= 5%, Lag= 7.4 min

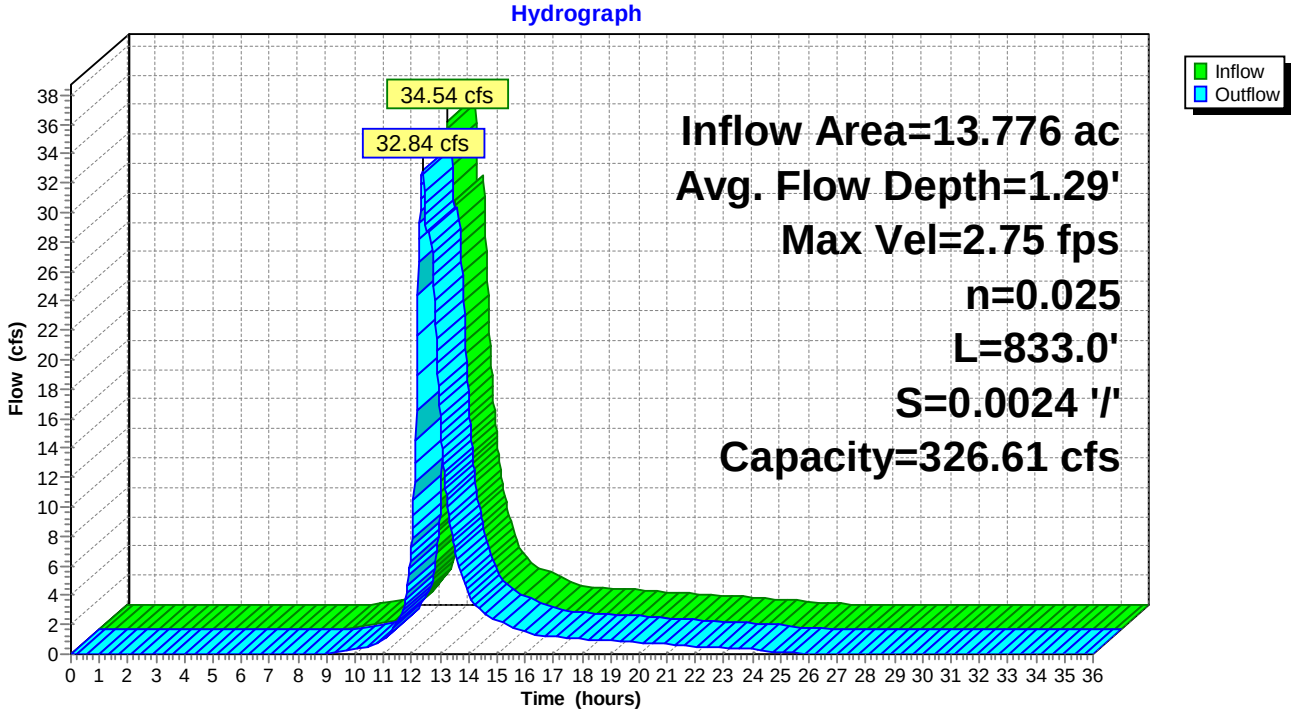
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.75 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 19.8 min

Peak Storage= 9,941 cf @ 12.30 hrs
Average Depth at Peak Storage= 1.29' , Surface Width= 12.46'
Bank-Full Depth= 4.00' Flow Area= 64.0 sf, Capacity= 326.61 cfs

6.00' x 4.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 2.0 '/' Top Width= 26.00'
Length= 833.0' Slope= 0.0024 '/'
Inlet Invert= 691.00', Outlet Invert= 689.00'



Reach 60R: W-MC X Ditch



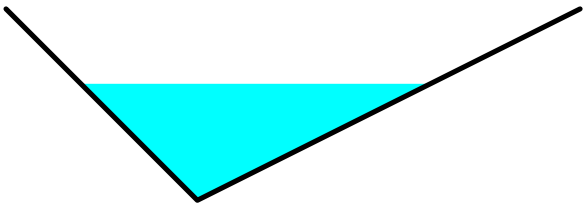
Summary for Reach 64R: S MC X Ditch

Inflow Area = 10.530 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 34.39 cfs @ 12.13 hrs, Volume= 2.966 af
Outflow = 27.51 cfs @ 12.28 hrs, Volume= 2.966 af, Atten= 20%, Lag= 8.9 min

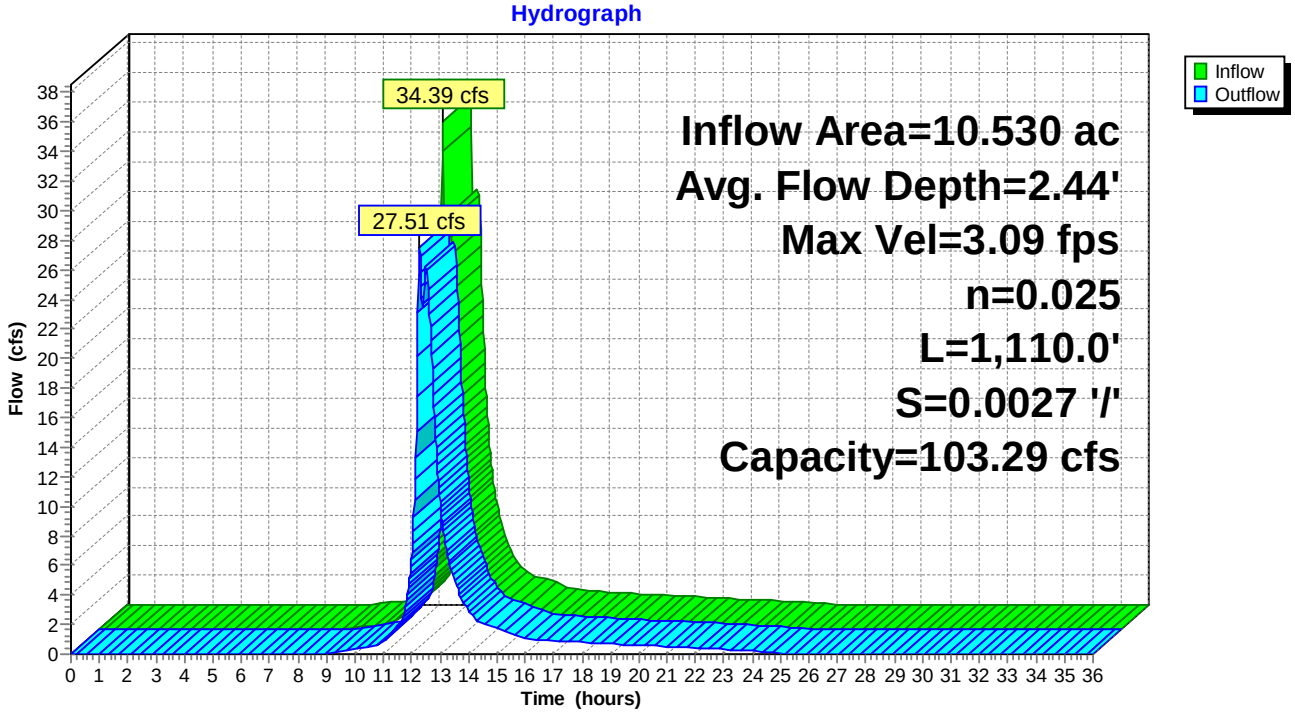
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.09 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 0.90 fps, Avg. Travel Time= 20.5 min

Peak Storage= 9,877 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.44' , Surface Width= 7.31'
Bank-Full Depth= 4.00' Flow Area= 24.0 sf, Capacity= 103.29 cfs

0.00' x 4.00' deep channel, n= 0.025
Side Slope Z-value= 1.0 2.0 '/' Top Width= 12.00'
Length= 1,110.0' Slope= 0.0027 '/'
Inlet Invert= 694.00', Outlet Invert= 691.00'



Reach 64R: S MC X Ditch



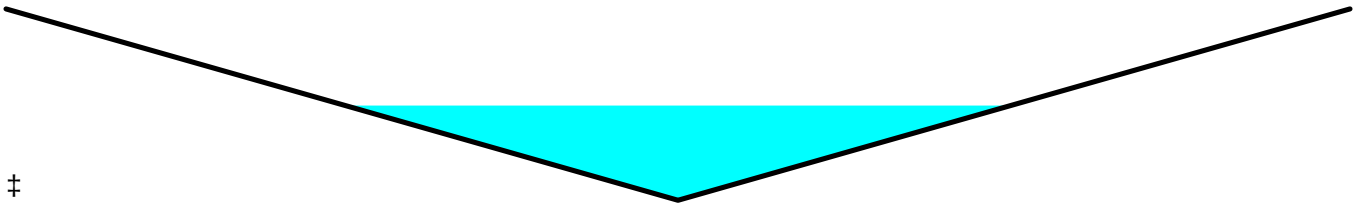
Summary for Reach 66R: E-MC X Ditch

Inflow Area = 5.820 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 37.89 cfs @ 12.12 hrs, Volume= 1.639 af
Outflow = 22.01 cfs @ 12.39 hrs, Volume= 1.639 af, Atten= 42%, Lag= 16.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.01 fps, Min. Travel Time= 12.4 min
Avg. Velocity = 0.54 fps, Avg. Travel Time= 46.6 min

Peak Storage= 16,442 cf @ 12.18 hrs
Average Depth at Peak Storage= 1.48' , Surface Width= 14.81'
Bank-Full Depth= 3.00' Flow Area= 45.0 sf, Capacity= 145.10 cfs

0.00' x 3.00' deep channel, n= 0.030 Stream, clean & straight
Side Slope Z-value= 5.0 '/' Top Width= 30.00'
Length= 1,500.0' Slope= 0.0025 '/'
Inlet Invert= 697.80', Outlet Invert= 694.00'



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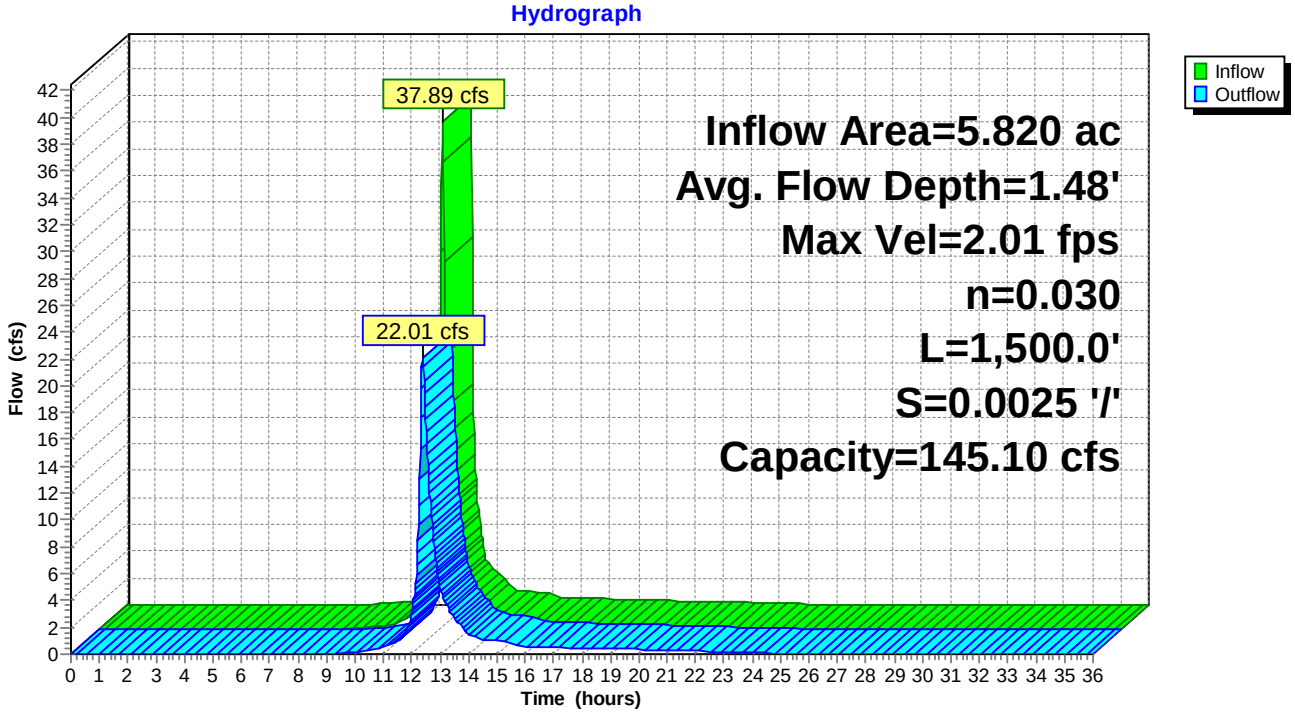
Reach 66R: E-MC X Ditch



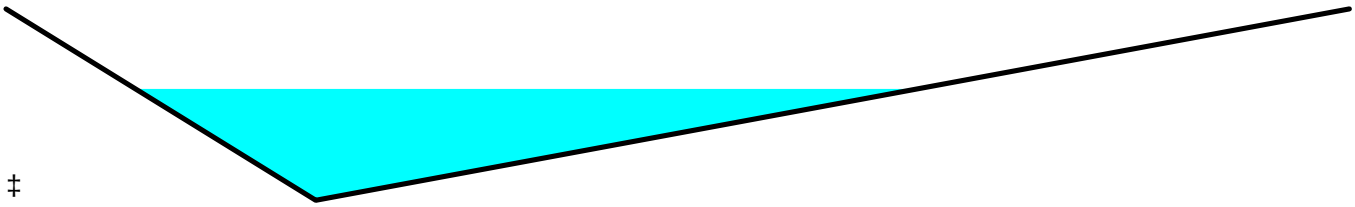
Summary for Reach 71R: DB-46

Inflow Area = 10.457 ac, 0.00% Impervious, Inflow Depth = 3.00" for 100-yr, 24-hr event
Inflow = 35.98 cfs @ 12.28 hrs, Volume= 2.612 af
Outflow = 35.82 cfs @ 12.31 hrs, Volume= 2.612 af, Atten= 0%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.09 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.52 fps, Avg. Travel Time= 2.2 min

Peak Storage= 1,753 cf @ 12.29 hrs
Average Depth at Peak Storage= 1.16' , Surface Width= 15.10'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 152.89 cfs

0.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 10.0 '/' Top Width= 26.00'
Length= 200.0' Slope= 0.0100 '/'
Inlet Invert= 703.00', Outlet Invert= 701.00'



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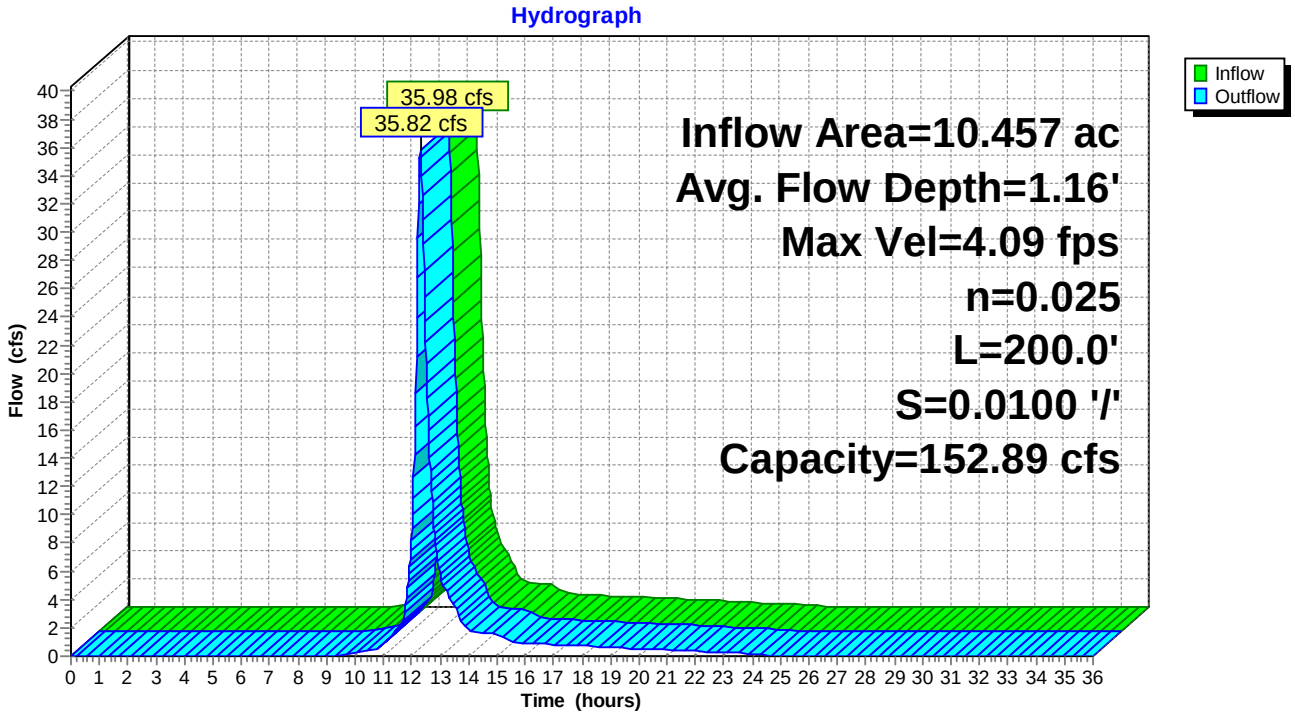
Reach 71R: DB-46



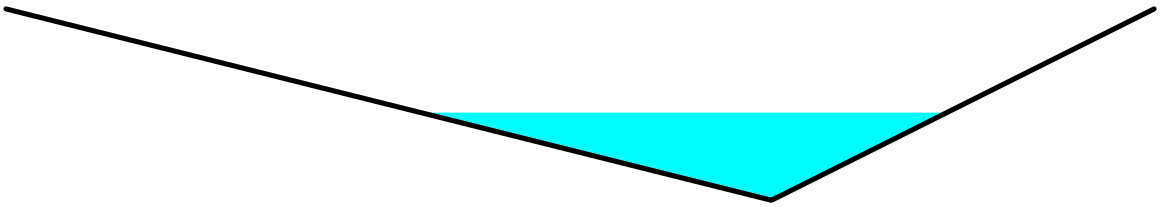
Summary for Reach 73R: DB-D-2 (9.8%)

Inflow Area = 8.819 ac, 0.00% Impervious, Inflow Depth = 4.54" for 100-yr, 24-hr event
Inflow = 60.90 cfs @ 12.20 hrs, Volume= 3.335 af
Outflow = 60.36 cfs @ 12.21 hrs, Volume= 3.335 af, Atten= 1%, Lag= 0.3 min

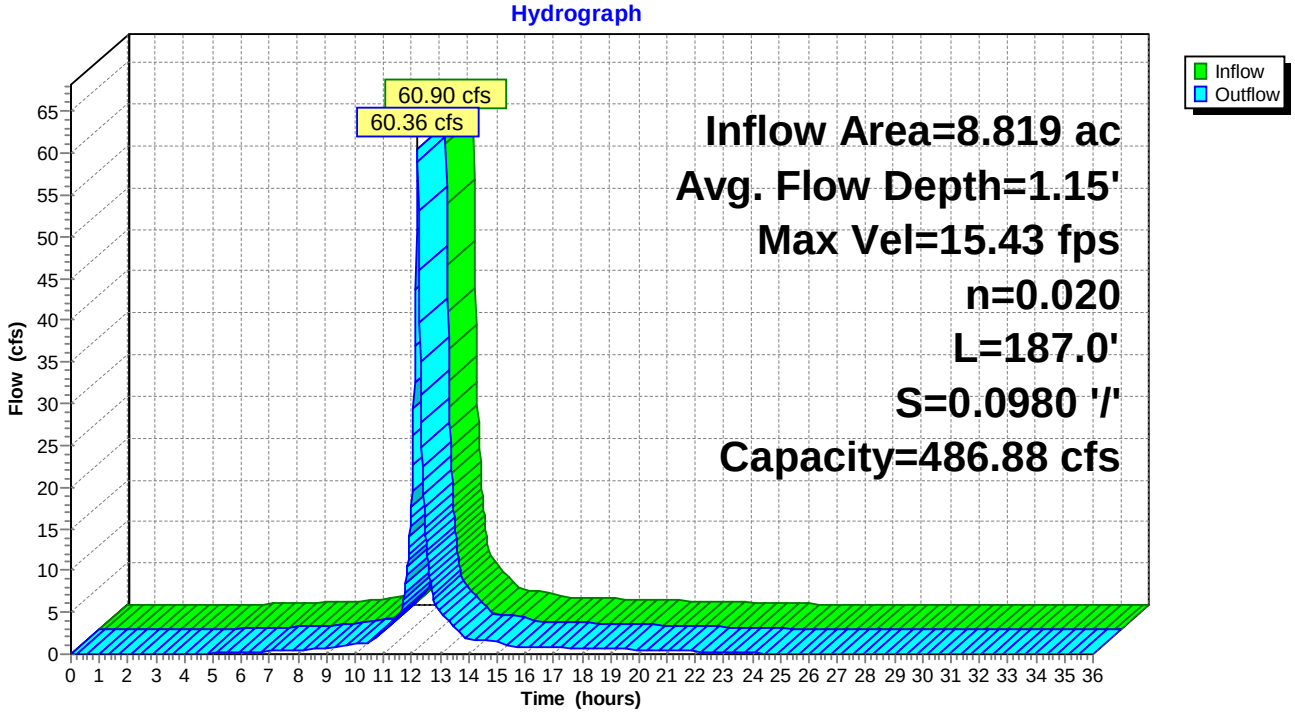
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Max. Velocity= 15.43 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.47 fps, Avg. Travel Time= 0.7 min

Peak Storage= 736 cf @ 12.20 hrs
Average Depth at Peak Storage= 1.15' , Surface Width= 6.87'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 486.88 cfs

0.00' x 2.50' deep channel, n= 0.020
Side Slope Z-value= 4.0 2.0 '/' Top Width= 15.00'
Length= 187.0' Slope= 0.0980 '/'
Inlet Invert= 726.33', Outlet Invert= 708.00'



Reach 73R: DB-D-2 (9.8%)

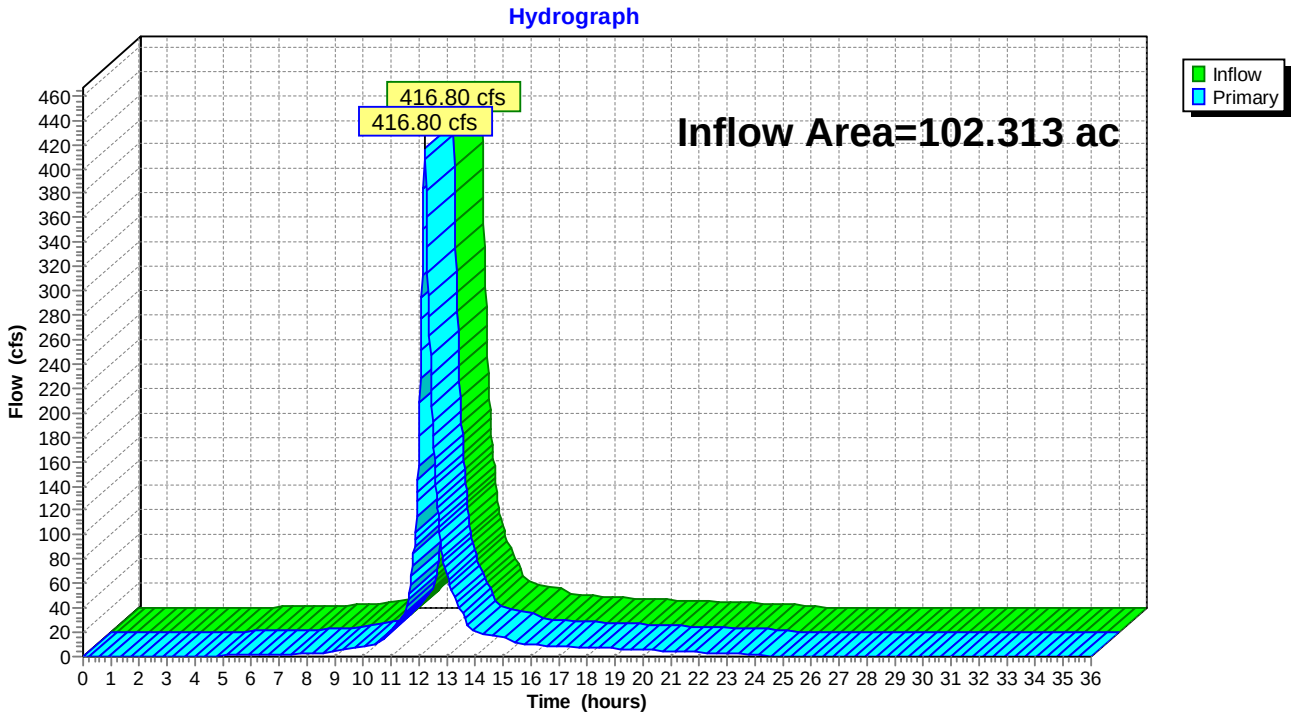


Summary for Pond 63P: SSB

Inflow Area = 102.313 ac, 10.00% Impervious, Inflow Depth = 3.85" for 100-yr, 24-hr event
Inflow = 416.80 cfs @ 12.20 hrs, Volume= 32.845 af
Primary = 416.80 cfs @ 12.20 hrs, Volume= 32.845 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

Pond 63P: SSB

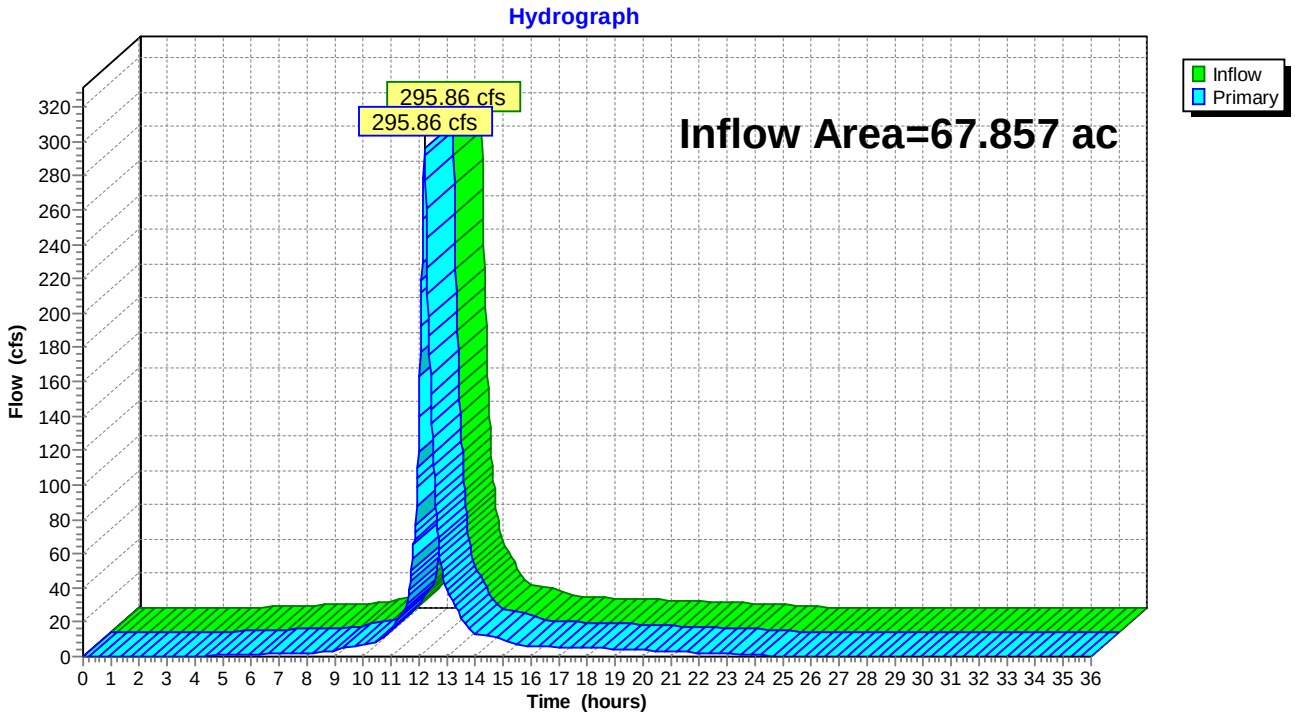


Summary for Pond 69P: Storm Sewer - See SWMM Model

Inflow Area = 67.857 ac, 8.02% Impervious, Inflow Depth = 4.00" for 100-yr, 24-hr event
Inflow = 295.86 cfs @ 12.19 hrs, Volume= 22.622 af
Primary = 295.86 cfs @ 12.19 hrs, Volume= 22.622 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

Pond 69P: Storm Sewer - See SWMM Model



Summary for Pond 70P: SSB Inlet Culvert

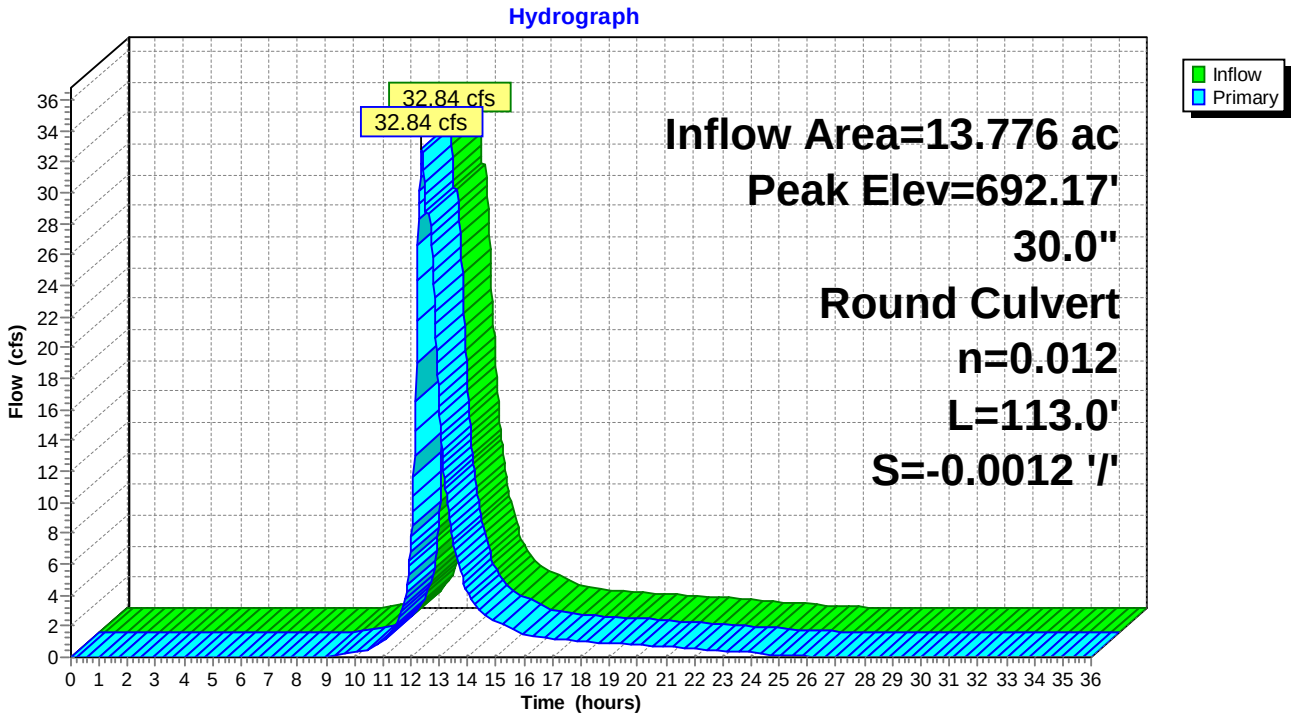
Inflow Area = 13.776 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 32.84 cfs @ 12.38 hrs, Volume= 3.881 af
Outflow = 32.84 cfs @ 12.38 hrs, Volume= 3.881 af, Atten= 0%, Lag= 0.0 min
Primary = 32.84 cfs @ 12.38 hrs, Volume= 3.881 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 692.17' @ 12.38 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	688.14'	**30.0" Round Culvert** L= 113.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 688.01' / 688.14' S= -0.0012 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf

Primary OutFlow Max=32.80 cfs @ 12.38 hrs HW=692.17' (Free Discharge)
1=Culvert (Barrel Controls 32.80 cfs @ 6.68 fps)

Pond 70P: SSB Inlet Culvert



Summary for Pond 71P: E-MCI Culvert

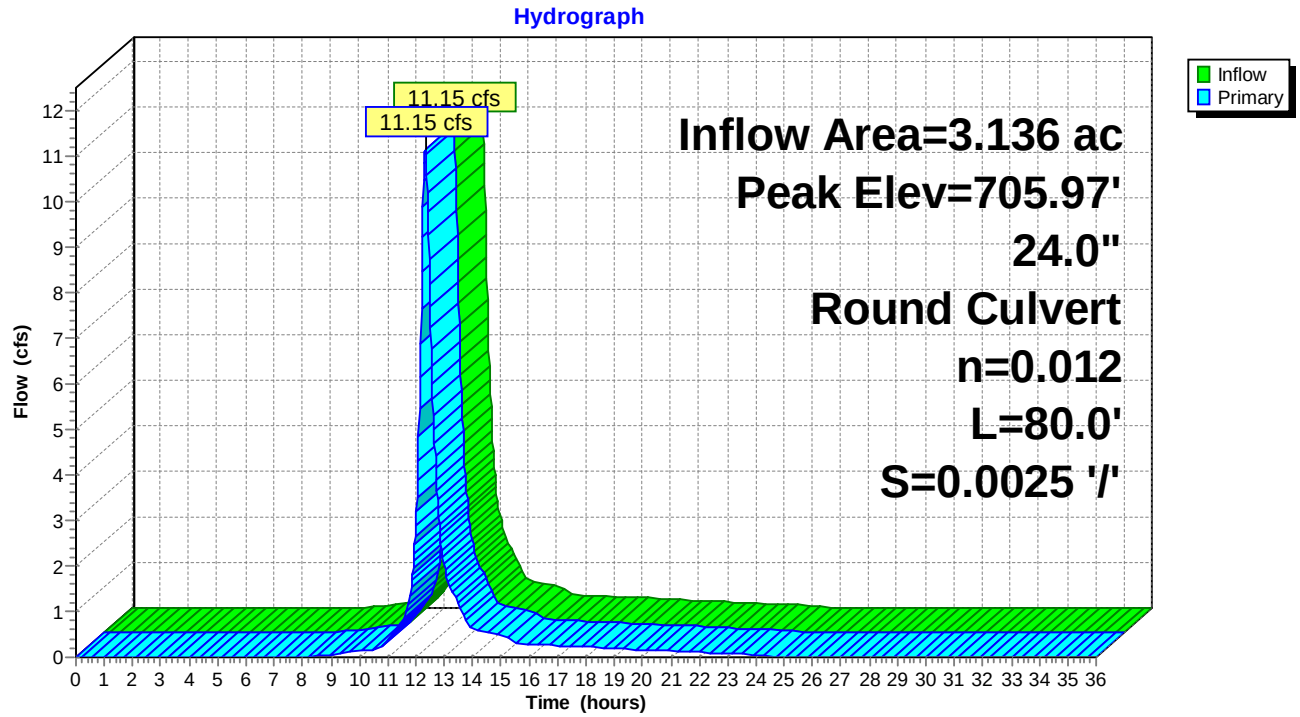
Inflow Area = 3.136 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-yr, 24-hr event
Inflow = 11.15 cfs @ 12.32 hrs, Volume= 0.883 af
Outflow = 11.15 cfs @ 12.32 hrs, Volume= 0.883 af, Atten= 0%, Lag= 0.0 min
Primary = 11.15 cfs @ 12.32 hrs, Volume= 0.883 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 705.97' @ 12.32 hrs

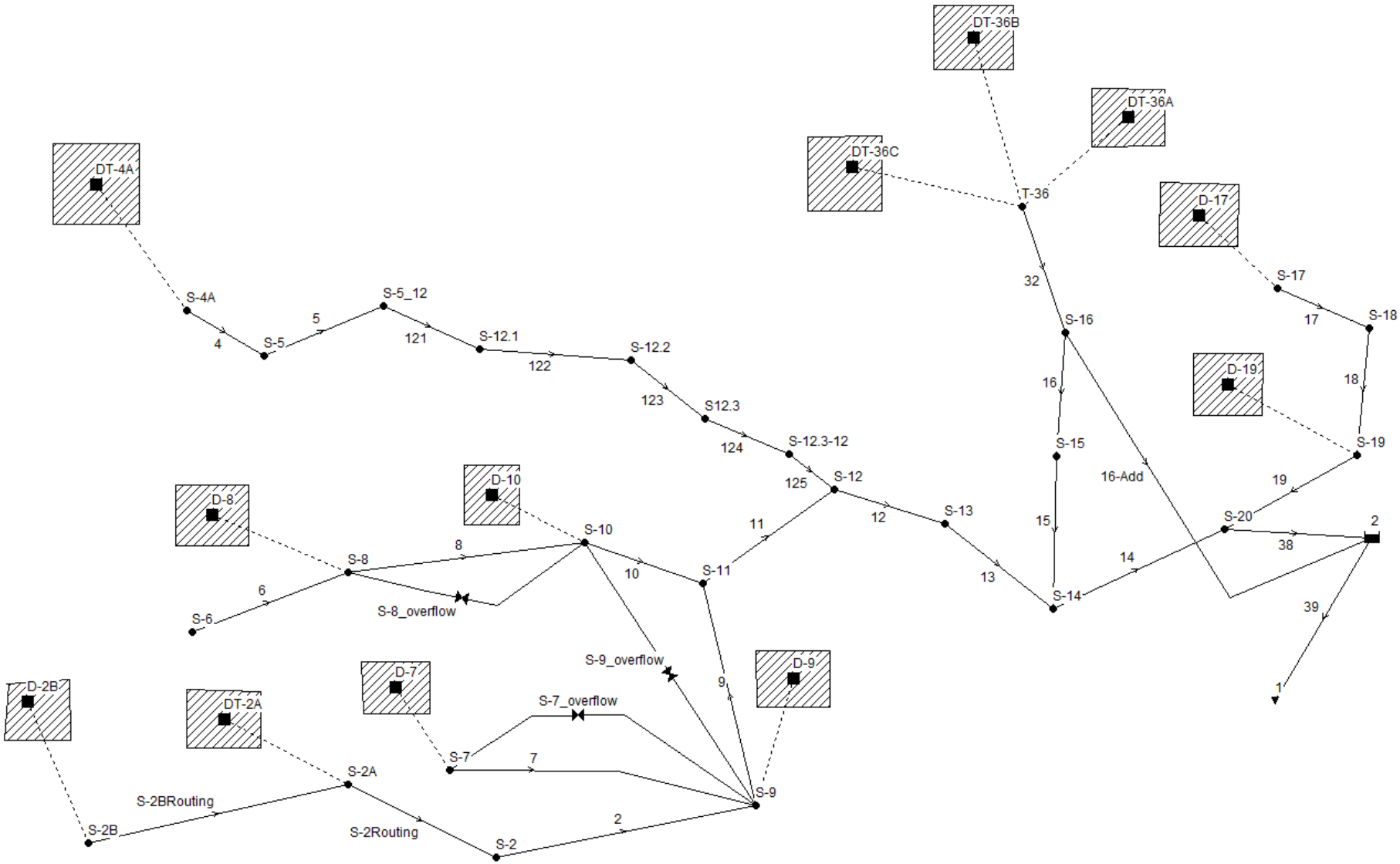
Device	Routing	Invert	Outlet Devices
#1	Primary	703.00'	**24.0" Round Culvert** L= 80.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 703.00' / 702.80' S= 0.0025 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=11.15 cfs @ 12.32 hrs HW=705.97' TW=705.10' (Fixed TW Elev= 705.10')
1=Culvert (Inlet Controls 11.15 cfs @ 3.55 fps)

Pond 71P: E-MCI Culvert



South Sedimentation Basin (SSB) SWMM OUTPUT – 25-yr, 24-hr


DT-36B
DT-36A
DT-36C
T-36
DT-4A
D-17
S-4A
S-5_12
S-17
S-18
S-5
S-12.1
S-12.2
S-16
D-19
S12.3
S-12.3-12
S-15
S-19
D-10
D-8
S-12
16-Add
S-13
S-20
S-10
S-8
S-11
S-14
S-6
S-8_overflow
S-9_overflow
D-7
D-9
D-2B
DT-2A
S-7_overflow
S-7
S-2A
S-9
S-2BRouting
S-2B
S-2Routing
S-2
1
2
4
5
121
122
123
124
125
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EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

WARNING 02: maximum depth increased for Node S-7
WARNING 02: maximum depth increased for Node S-8
WARNING 02: maximum depth increased for Node S-9
WARNING 02: maximum depth increased for Node T-36
WARNING 02: maximum depth increased for Node S-5_12

****
Element Count
****
Number of rain gages 2
Number of subcatchments ... 12
Number of nodes 28
Number of links 31
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
TS1	MSE3-100yr,24hr	INTENSITY	6 min.
MSE3	MSE-25yr,24hr	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
D-10	0.51	17.00	100.00	2.6000	MSE3	S-10
D-17	2.11	1200.00	0.00	5.8100	MSE3	S-17
D-19	0.38	600.00	0.00	1.5000	MSE3	S-19
DT-2A	6.80	250.00	13.00	7.0000	MSE3	S-2A
DT-4A	3.60	1100.00	100.00	25.0000	MSE3	S-4A
D-7	1.09	40.00	100.00	2.0000	MSE3	S-7
D-8	0.51	115.00	100.00	0.0700	MSE3	S-8
D-9	0.32	13.00	100.00	1.6000	MSE3	S-9
DT-36B	19.70	1265.00	100.00	25.0000	MSE3	T-36
DT-36A	10.60	1180.00	0.00	5.0000	MSE3	T-36
DT-36C	10.80	2240.00	100.00	25.0000	MSE3	T-36
D-2B	10.90	1340.00	0.00	4.1000	MSE3	S-2B

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
S-2	JUNCTION	686.25	16.20	100.0	
S-4A	JUNCTION	693.34	15.00	0.0	
S-5	JUNCTION	692.01	7.50	0.0	
S-6	JUNCTION	695.71	3.20	0.0	
S-7	JUNCTION	694.09	5.45	0.0	
S-8	JUNCTION	694.73	5.00	0.0	
S-9	JUNCTION	684.57	14.00	660.0	
S-10	JUNCTION	691.90	4.80	2100.0	
S-11	JUNCTION	685.67	15.65	0.0	
S-12	JUNCTION	686.18	16.25	0.0	
S-13	JUNCTION	685.57	15.90	0.0	
S-14	JUNCTION	685.88	16.34	0.0	
S-15	JUNCTION	687.52	14.09	0.0	
S-16	JUNCTION	697.26	10.74	100.0	
S-17	JUNCTION	695.46	4.70	0.0	
S-18	JUNCTION	694.60	5.40	0.0	
S-19	JUNCTION	690.98	9.26	0.0	
S-20	JUNCTION	685.98	10.00	0.0	
T-36	JUNCTION	709.00	7.74	0.0	
S-5_12	JUNCTION	691.07	4.50	0.0	
S-12.1	JUNCTION	688.83	16.84	0.0	
S-12.2	JUNCTION	688.47	17.98	0.0	
S12.3	JUNCTION	688.30	14.93	0.0	
S-12.3-12	JUNCTION	686.56	4.00	0.0	
S-2A	JUNCTION	700.20	3.00	0.0	
S-2B	JUNCTION	710.90	2.00	0.0	
1	OUTFALL	690.00	1.00	0.0	
2	STORAGE	671.00	25.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
2	S-2	S-9	CONDUIT	855.0	0.0211	0.0130

4	S-4A	S-5	CONDUIT	100.0	0.1800	0.0130
5	S-5	S-5_12	CONDUIT	147.0	0.6395	0.0130
6	S-6	S-8	CONDUIT	275.0	0.3564	0.0130
7	S-7	S-9	CONDUIT	163.0	2.1600	0.0130
8	S-8	S-10	CONDUIT	205.0	1.3562	0.0130
9	S-9	S-11	CONDUIT	122.0	0.2049	0.0130
10	S-10	S-11	CONDUIT	19.0	0.6842	0.0130
11	S-11	S-12	CONDUIT	107.0	-0.4766	0.0130
12	S-12	S-13	CONDUIT	165.0	0.3697	0.0130
13	S-13	S-14	CONDUIT	226.0	-0.3009	0.0130
14	S-14	S-20	CONDUIT	166.0	0.0602	0.0130
15	S-15	S-14	CONDUIT	35.0	0.7715	0.0130
16	S-16	S-15	CONDUIT	210.0	2.9775	0.0130
17	S-17	S-18	CONDUIT	49.0	0.0204	0.0130
18	S-18	S-19	CONDUIT	14.0	0.3571	0.0130
19	S-19	S-20	CONDUIT	43.0	12.5869	0.0130
32	T-36	S-16	CONDUIT	900.0	0.9712	0.0250
38	S-20	2	CONDUIT	414.0	0.0725	0.0130
39	2	1	CONDUIT	400.0	0.1250	0.0130
121	S-5_12	S-12.1	CONDUIT	350.0	0.6400	0.0130
122	S-12.1	S-12.2	CONDUIT	110.0	0.3273	0.0120
123	S-12.2	S12.3	CONDUIT	100.0	0.1700	0.0120
124	S12.3	S-12.3-12	CONDUIT	120.0	1.4502	0.0120
125	S-12.3-12	S-12	CONDUIT	26.0	1.4617	0.0130
S-2Routing	S-2A	S-2	CONDUIT	250.0	0.3000	0.0250
S-2BRouting	S-2B	S-2A	CONDUIT	1340.0	0.7985	0.0250
16-Add	S-16	2	CONDUIT	500.0	0.2520	0.0130
S-9_overflow	S-9	S-10	WEIR			
S-8_overflow	S-8	S-10	WEIR			
S-7_overflow	S-7	S-9	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
2	CIRCULAR	3.00	7.07	0.75	3.00	1	9.68
4	CIRCULAR	3.00	7.07	0.75	3.00	1	28.30
5	CIRCULAR	3.50	9.62	0.88	3.50	1	80.45
6	CIRCULAR	1.00	0.79	0.25	1.00	1	2.13
7	CIRCULAR	1.00	0.79	0.25	1.00	1	5.24
8	CIRCULAR	1.00	0.79	0.25	1.00	1	4.15

9	CIRCULAR	3.00	7.07	0.75	3.00	1	30.19
10	CIRCULAR	1.00	0.79	0.25	1.00	1	2.95
11	CIRCULAR	3.00	7.07	0.75	3.00	1	46.05
12	CIRCULAR	3.50	9.62	0.88	3.50	1	61.17
13	CIRCULAR	3.50	9.62	0.88	3.50	1	55.19
14	CIRCULAR	3.50	9.62	0.88	3.50	1	24.69
15	CIRCULAR	2.00	3.14	0.50	2.00	1	19.87
16	CIRCULAR	2.00	3.14	0.50	2.00	1	39.04
17	CIRCULAR	1.50	1.77	0.38	1.50	1	1.50
18	CIRCULAR	1.50	1.77	0.38	1.50	1	6.28
19	CIRCULAR	1.50	1.77	0.38	1.50	1	37.27
32	TRAPEZOIDAL	7.74	334.00	4.08	80.30	1	4993.90
38	CIRCULAR	3.50	9.62	0.88	3.50	1	27.08
39	CIRCULAR	1.00	0.79	0.25	1.00	1	1.26
121	CIRCULAR	4.50	15.90	1.13	4.50	1	157.32
122	CIRCULAR	3.00	7.07	0.75	3.00	1	41.34
123	CIRCULAR	3.00	7.07	0.75	3.00	1	29.79
124	CIRCULAR	4.00	12.57	1.00	4.00	1	187.39
125	CIRCULAR	3.00	7.07	0.75	3.00	1	80.64
S-2Routing	TRIANGULAR	3.00	39.00	1.46	26.00	1	163.53
S-2BRouting	TRIANGULAR	2.00	26.00	0.99	26.00	1	137.03
16-Add	CIRCULAR	2.50	4.91	0.63	2.50	1	20.59

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... YES
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE

```
Surcharge Method ......... EXTRAN
Starting Date ............ 06/14/2019 00:00:00
Ending Date .............. 06/16/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:02:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.005000 ft

**********
Control Actions Taken
**********
```

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	22.160	3.950
Evaporation Loss	0.000	0.000
Infiltration Loss	3.573	0.637
Surface Runoff	18.497	3.297
Final Storage	0.126	0.022
Continuity Error (%)	-0.165	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	18.512	6.032
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.000	0.000
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	18.513	6.033
Continuity Error (%)	-0.007	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
Link 125 (2)
Link 11 (1)

****
Routing Time Step Summary
****
Minimum Time Step   :   0.50 sec
Average Time Step   :   1.00 sec
Maximum Time Step   :   1.00 sec
Percent in Steady State   :   0.21
Average Iterations per Step :   2.01
Percent Not Converging   :   0.09
Time Step Frequencies   :
    1.000 - 0.871 sec   :   99.79 %
    0.871 - 0.758 sec   :   0.16 %
    0.758 - 0.660 sec   :   0.01 %
    0.660 - 0.574 sec   :   0.01 %
    0.574 - 0.500 sec   :   0.03 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
D-10	3.95	0.00	0.00	0.00	3.96	0.00	3.96	0.05	2.88	1.003
D-17	3.95	0.00	0.00	1.29	0.00	2.62	2.62	0.15	10.27	0.663
D-19	3.95	0.00	0.00	1.29	0.00	2.62	2.62	0.03	1.90	0.663
DT-2A	3.95	0.00	0.00	1.35	0.51	2.05	2.56	0.47	16.49	0.649
DT-4A	3.95	0.00	0.00	0.00	3.96	0.00	3.96	0.39	22.64	1.003
D-7	3.95	0.00	0.00	0.00	3.96	0.00	3.96	0.12	6.11	1.002
D-8	3.95	0.00	0.00	0.00	3.96	0.00	3.96	0.05	2.93	1.003

D-9	3.95	0.00	0.00	0.00	3.96	0.00	3.96	0.03	1.79	1.002
DT-36B	3.95	0.00	0.00	0.00	3.96	0.00	3.96	2.12	93.93	1.001
DT-36A	3.95	0.00	0.00	1.29	0.00	2.61	2.61	0.75	34.50	0.661
DT-36C	3.95	0.00	0.00	0.00	3.96	0.00	3.96	1.16	65.43	1.003
D-2B	3.95	0.00	0.00	1.54	0.00	2.36	2.36	0.70	31.20	0.598

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
S-2	JUNCTION	0.56	12.05	698.30	0 12:21	12.05
S-4A	JUNCTION	0.13	1.73	695.07	0 12:21	1.72
S-5	JUNCTION	0.10	3.05	695.06	0 12:21	3.03
S-6	JUNCTION	0.00	0.00	695.71	0 12:22	0.00
S-7	JUNCTION	0.22	3.95	698.04	0 12:13	3.88
S-8	JUNCTION	0.04	0.98	695.71	0 12:21	0.97
S-9	JUNCTION	2.12	11.28	695.85	0 12:21	11.28
S-10	JUNCTION	0.09	3.61	695.51	0 12:21	3.61
S-11	JUNCTION	1.04	9.77	695.44	0 12:21	9.76
S-12	JUNCTION	0.53	8.85	695.03	0 12:21	8.84
S-13	JUNCTION	1.12	9.08	694.65	0 12:21	9.08
S-14	JUNCTION	0.76	8.26	694.14	0 12:21	8.25
S-15	JUNCTION	0.83	8.14	695.66	0 12:21	8.13
S-16	JUNCTION	0.26	7.53	704.79	0 12:22	7.52
S-17	JUNCTION	0.63	2.39	697.85	0 12:12	2.39
S-18	JUNCTION	1.17	2.67	697.27	0 12:12	2.67
S-19	JUNCTION	0.34	1.72	692.70	0 12:20	1.72
S-20	JUNCTION	0.56	6.68	692.66	0 12:21	6.67
T-36	JUNCTION	0.13	1.89	710.89	0 12:12	1.88
S-5_12	JUNCTION	0.11	3.98	695.05	0 12:21	3.97
S-12.1	JUNCTION	0.16	9.88	698.71	0 12:11	6.21
S-12.2	JUNCTION	0.18	8.32	696.79	0 12:11	6.56
S12.3	JUNCTION	0.14	6.85	695.15	0 12:11	6.73
S-12.3-12	JUNCTION	0.31	8.47	695.03	0 12:21	8.47
S-2A	JUNCTION	0.26	1.75	701.95	0 12:20	1.75
S-2B	JUNCTION	0.11	1.09	711.99	0 12:15	1.08
1	OUTFALL	0.00	0.00	690.00	0 00:00	0.00
2	STORAGE	8.70	11.64	682.64	2 00:00	11.64

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent	
S-2	JUNCTION	0.00	35.93	0 12:20	0	1.17	-0.004	
S-4A	JUNCTION	22.64	22.64	0 12:12	0.388	0.388	0.214	
S-5	JUNCTION	0.00	22.56	0 12:12	0	0.387	-0.236	
S-6	JUNCTION	0.00	0.00	0 12:21	0	1.16e-06	0.480	gal
S-7	JUNCTION	6.11	6.11	0 12:12	0.117	0.117	0.239	
S-8	JUNCTION	2.93	2.93	0 12:12	0.0549	0.0549	0.004	
S-9	JUNCTION	1.79	38.81	0 12:21	0.0344	1.33	0.156	
S-10	JUNCTION	2.88	5.71	0 12:11	0.0549	0.11	-0.108	
S-11	JUNCTION	0.00	41.29	0 12:23	0	1.44	0.039	
S-12	JUNCTION	0.00	47.97	0 12:22	0	2	-0.034	
S-13	JUNCTION	0.00	47.97	0 12:22	0	1.82	0.060	
S-14	JUNCTION	0.00	95.18	0 12:22	0	4.49	-0.000	
S-15	JUNCTION	0.00	47.50	0 12:31	0	2.66	0.007	
S-16	JUNCTION	0.00	185.26	0 12:12	0	4.02	-0.302	
S-17	JUNCTION	10.27	10.27	0 12:12	0.15	0.15	0.046	
S-18	JUNCTION	0.00	10.27	0 12:12	0	0.15	0.084	
S-19	JUNCTION	1.90	12.17	0 12:12	0.0271	0.177	0.019	
S-20	JUNCTION	0.00	98.93	0 12:21	0	4.66	0.000	
T-36	JUNCTION	193.86	193.86	0 12:12	4.03	4.03	0.293	
S-5_12	JUNCTION	0.00	22.95	0 12:12	0	0.388	-0.060	
S-12.1	JUNCTION	0.00	17.40	0 12:09	0	0.388	-0.025	
S-12.2	JUNCTION	0.00	13.36	0 12:48	0	0.388	-0.016	
S12.3	JUNCTION	0.00	13.90	0 12:48	0	0.388	-0.024	
S-12.3-12	JUNCTION	0.00	20.79	0 11:59	0	0.562	0.070	
S-2A	JUNCTION	16.49	41.86	0 12:14	0.474	1.18	0.245	
S-2B	JUNCTION	31.20	31.20	0 12:12	0.7	0.7	-0.409	
1	OUTFALL	0.00	0.00	0 00:00	0	0	0.000	gal
2	STORAGE	0.00	146.55	0 12:21	0	6.03	0.000	

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
S-11	JUNCTION	0.52	2.665	5.885
S-12	JUNCTION	0.86	5.349	7.401
S-13	JUNCTION	0.98	5.584	6.816
S-14	JUNCTION	0.82	4.389	8.081
S-15	JUNCTION	0.62	2.648	5.952
S-17	JUNCTION	0.07	0.245	2.305
S-20	JUNCTION	0.79	3.179	3.321
S-12.1	JUNCTION	0.41	5.384	6.956
S-12.2	JUNCTION	0.66	5.317	9.663
S12.3	JUNCTION	0.57	2.846	8.084
S-12.3-12	JUNCTION	0.74	4.471	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
2	584.124	19	0	0	805.992	26	2 00:00	0.00

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
1	0.00	0.00	0.00	0.000
System	0.00	0.00	0.00	0.000

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
2	CONDUIT	35.69	0	12:22	5.05	3.69	1.00
4	CONDUIT	22.56	0	12:12	5.83	0.80	0.60
5	CONDUIT	22.95	0	12:12	7.35	0.29	0.94
6	CONDUIT	0.00	0	12:21	0.01	0.00	0.49
7	CONDUIT	5.63	0	12:12	7.31	1.08	1.00
8	CONDUIT	2.84	0	12:11	4.20	0.69	0.99
9	CONDUIT	39.10	0	12:23	5.53	1.30	1.00
10	CONDUIT	5.37	0	12:12	6.84	1.82	1.00
11	CONDUIT	41.30	0	12:23	5.84	0.90	1.00
12	CONDUIT	47.97	0	12:22	4.99	0.78	1.00
13	CONDUIT	47.97	0	12:22	4.99	0.87	1.00
14	CONDUIT	95.18	0	12:22	9.89	3.85	1.00
15	CONDUIT	47.50	0	12:30	15.12	2.39	1.00
16	CONDUIT	47.50	0	12:31	15.12	1.22	1.00
17	CONDUIT	10.27	0	12:12	6.08	6.85	0.91
18	CONDUIT	10.27	0	12:12	6.42	1.64	0.85
19	CONDUIT	12.33	0	12:12	7.55	0.33	0.95
32	CONDUIT	185.26	0	12:12	5.64	0.04	0.38
38	CONDUIT	98.93	0	12:21	10.57	3.65	0.94
39	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
121	CONDUIT	17.40	0	12:09	4.28	0.11	0.94

122	CONDUIT	13.36	0	12:48	3.92	0.32	1.00
123	CONDUIT	13.90	0	12:48	4.90	0.47	1.00
124	CONDUIT	15.52	0	12:48	2.19	0.08	1.00
125	CONDUIT	22.16	0	11:59	3.75	0.27	1.00
S-2Routing	CONDUIT	35.93	0	12:20	3.48	0.22	0.51
S-2BRouting	CONDUIT	26.99	0	12:15	2.28	0.20	0.70
16-Add	CONDUIT	47.70	0	12:22	9.89	2.32	0.95
S-9_overflow	WEIR	0.00	0	00:00			0.00
S-8_overflow	WEIR	0.00	0	00:00			0.00
S-7_overflow	WEIR	0.00	0	00:00			0.00

****
Flow Classification Summary
****

	Adjusted	Fraction of Time in Flow Class								
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
2	1.00	0.02	0.00	0.00	0.97	0.00	0.00	0.01	0.49	0.00
4	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
5	1.00	0.00	0.00	0.00	0.53	0.47	0.00	0.00	0.00	0.00
6	1.00	0.00	0.95	0.00	0.04	0.00	0.00	0.00	0.74	0.00
7	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.97	0.01	0.00
8	1.00	0.00	0.00	0.00	0.02	0.11	0.00	0.87	0.12	0.00
9	1.00	0.01	0.02	0.00	0.97	0.00	0.00	0.00	0.00	0.00
10	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
11	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.03	0.00
12	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.04	0.00
13	1.00	0.01	0.02	0.00	0.53	0.00	0.45	0.00	0.02	0.00
14	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.39	0.00
15	1.00	0.02	0.00	0.00	0.02	0.00	0.00	0.96	0.00	0.00
16	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
17	1.00	0.18	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00
18	1.00	0.18	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00
19	1.00	0.02	0.58	0.00	0.40	0.00	0.00	0.00	0.81	0.00
32	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.98	0.01	0.00
38	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
39	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
121	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.98	0.00
122	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.96	0.00
123	1.00	0.00	0.00	0.00	0.80	0.19	0.00	0.00	0.01	0.00

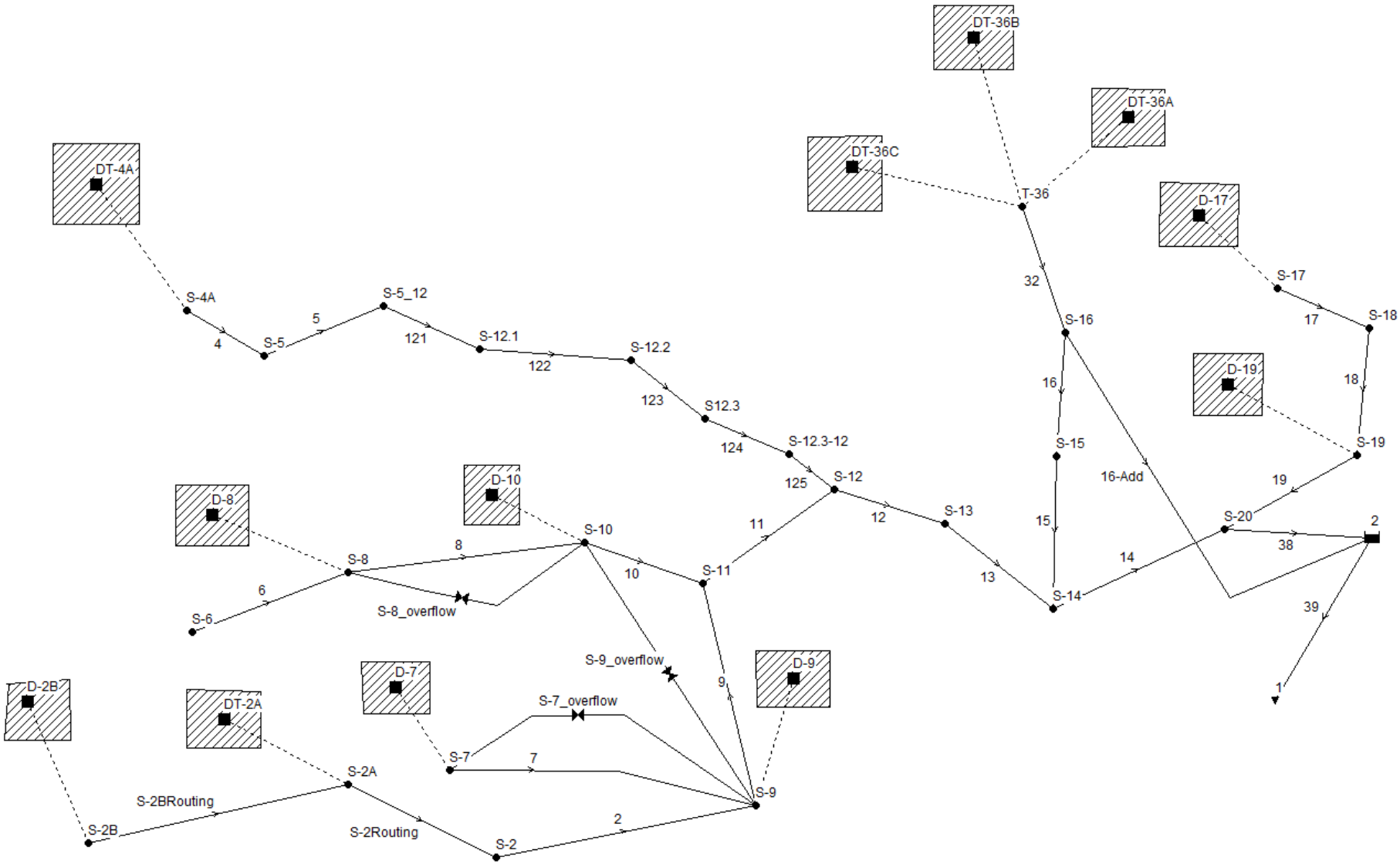
124	1.00	0.00	0.00	0.00	0.83	0.17	0.00	0.00	0.86	0.00
125	1.00	0.01	0.00	0.00	0.96	0.03	0.00	0.00	0.62	0.00
S-2Routing	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
S-2BRouting	1.00	0.00	0.18	0.00	0.82	0.00	0.00	0.00	0.82	0.00
16-Add	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00

****
Conduit Surcharge Summary
****

	Hours Full			Hours Above Full	Hours Capacity
Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
2	1.00	1.01	1.01	1.04	0.89
5	0.01	0.01	0.23	0.01	0.01
7	0.34	0.34	0.65	0.04	0.04
8	0.01	0.01	0.52	0.01	0.01
9	1.08	1.08	1.23	0.34	0.34
10	0.50	0.53	0.52	0.18	0.11
11	0.97	0.97	1.23	0.01	0.01
12	0.86	0.86	0.98	0.01	0.01
13	0.82	0.82	0.98	0.01	0.01
14	0.79	0.85	0.79	1.42	0.79
15	0.85	0.93	0.85	1.03	0.85
16	0.71	0.71	0.74	0.74	0.71
17	0.01	0.07	0.01	0.71	0.01
18	0.01	0.01	0.01	0.13	0.01
19	0.01	0.01	2.71	0.01	0.01
38	0.01	0.79	0.01	1.35	0.01
121	0.01	0.01	0.41	0.01	0.01
122	0.64	0.64	0.66	0.01	0.01
123	0.66	0.66	0.68	0.01	0.01
124	0.57	0.57	0.74	0.01	0.01
125	0.88	0.88	0.97	0.01	0.01
16-Add	0.01	0.69	0.01	0.71	0.01

Analysis begun on: Sat Oct 9 15:20:26 2021
Analysis ended on: Sat Oct 9 15:20:32 2021
Total elapsed time: 00:00:06

South Sedimentation Basin (SSB) SWMM OUTPUT – 100-yr, 24-hr


DT-36B
DT-36A
DT-36C
T-36
DT-4A
D-17
S-4A
S-5_12
S-17
S-18
S-5
S-12.1
S-12.2
S-16
D-19
S12.3
S-12.3-12
S-15
S-19
D-10
D-8
S-12
16-Add
S-13
S-20
S-10
S-8
S-11
S-14
S-6
S-8_overflow
S-9_overflow
D-7
D-9
D-2B
DT-2A
S-7_overflow
S-7
S-2A
S-9
S-2BRouting
S-2B
S-2Routing
S-2
1
2
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123
124
125
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EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

WARNING 02: maximum depth increased for Node S-7
WARNING 02: maximum depth increased for Node S-8
WARNING 02: maximum depth increased for Node S-9
WARNING 02: maximum depth increased for Node T-36
WARNING 02: maximum depth increased for Node S-5_12

****
Element Count
****

Number of rain gages 2
Number of subcatchments ... 12
Number of nodes 28
Number of links 31
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
TS1	MSE3-100yr,24hr	INTENSITY	6 min.
MSE3	MSE3-100yr,24hr	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
D-10	0.51	17.00	100.00	2.6000	MSE3	S-10
D-17	2.11	1200.00	0.00	5.8100	MSE3	S-17
D-19	0.38	600.00	0.00	1.5000	MSE3	S-19
DT-2A	6.80	250.00	13.00	7.0000	MSE3	S-2A
DT-4A	3.60	1100.00	100.00	25.0000	MSE3	S-4A
D-7	1.09	40.00	100.00	2.0000	MSE3	S-7
D-8	0.51	115.00	100.00	0.0700	MSE3	S-8
D-9	0.32	13.00	100.00	1.6000	MSE3	S-9

DT-36B	19.70	1265.00	100.00	25.0000	MSE3	T-36
DT-36A	10.60	1180.00	0.00	5.0000	MSE3	T-36
DT-36C	10.80	2240.00	100.00	25.0000	MSE3	T-36
D-2B	10.90	1340.00	0.00	4.1000	MSE3	S-2B

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
S-2	JUNCTION	686.25	16.20	100.0	
S-4A	JUNCTION	693.34	15.00	0.0	
S-5	JUNCTION	692.01	7.50	0.0	
S-6	JUNCTION	695.71	3.20	0.0	
S-7	JUNCTION	694.09	5.45	0.0	
S-8	JUNCTION	694.73	5.00	0.0	
S-9	JUNCTION	684.57	14.00	660.0	
S-10	JUNCTION	691.90	4.80	2100.0	
S-11	JUNCTION	685.67	15.65	0.0	
S-12	JUNCTION	686.18	16.25	0.0	
S-13	JUNCTION	685.57	15.90	0.0	
S-14	JUNCTION	685.88	16.34	0.0	
S-15	JUNCTION	687.52	14.09	0.0	
S-16	JUNCTION	697.26	10.74	100.0	
S-17	JUNCTION	695.46	4.70	0.0	
S-18	JUNCTION	694.60	5.40	0.0	
S-19	JUNCTION	690.98	9.26	0.0	
S-20	JUNCTION	685.98	10.00	0.0	
T-36	JUNCTION	709.00	7.74	0.0	
S-5_12	JUNCTION	691.07	4.50	0.0	
S-12.1	JUNCTION	688.83	16.84	0.0	
S-12.2	JUNCTION	688.47	17.98	0.0	
S12.3	JUNCTION	688.30	14.93	0.0	
S-12.3-12	JUNCTION	686.56	4.00	0.0	
S-2A	JUNCTION	700.20	3.00	0.0	
S-2B	JUNCTION	710.90	2.00	0.0	
1	OUTFALL	690.00	1.00	0.0	
2	STORAGE	671.00	25.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
2	S-2	S-9	CONDUIT	855.0	0.0211	0.0130
4	S-4A	S-5	CONDUIT	100.0	0.1800	0.0130
5	S-5	S-5_12	CONDUIT	147.0	0.6395	0.0130
6	S-6	S-8	CONDUIT	275.0	0.3564	0.0130
7	S-7	S-9	CONDUIT	163.0	2.1600	0.0130
8	S-8	S-10	CONDUIT	205.0	1.3562	0.0130
9	S-9	S-11	CONDUIT	122.0	0.2049	0.0130
10	S-10	S-11	CONDUIT	19.0	0.6842	0.0130
11	S-11	S-12	CONDUIT	107.0	-0.4766	0.0130
12	S-12	S-13	CONDUIT	165.0	0.3697	0.0130
13	S-13	S-14	CONDUIT	226.0	-0.3009	0.0130
14	S-14	S-20	CONDUIT	166.0	0.0602	0.0130
15	S-15	S-14	CONDUIT	35.0	0.7715	0.0130
16	S-16	S-15	CONDUIT	210.0	2.9775	0.0130
17	S-17	S-18	CONDUIT	49.0	0.0204	0.0130
18	S-18	S-19	CONDUIT	14.0	0.3571	0.0130
19	S-19	S-20	CONDUIT	43.0	12.5869	0.0130
32	T-36	S-16	CONDUIT	900.0	0.9712	0.0250
38	S-20	2	CONDUIT	414.0	0.0725	0.0130
39	2	1	CONDUIT	400.0	0.1250	0.0130
121	S-5_12	S-12.1	CONDUIT	350.0	0.6400	0.0130
122	S-12.1	S-12.2	CONDUIT	110.0	0.3273	0.0120
123	S-12.2	S12.3	CONDUIT	100.0	0.1700	0.0120
124	S12.3	S-12.3-12	CONDUIT	120.0	1.4502	0.0120
125	S-12.3-12	S-12	CONDUIT	26.0	1.4617	0.0130
S-2Routing	S-2A	S-2	CONDUIT	250.0	0.3000	0.0250
S-2BRouting	S-2B	S-2A	CONDUIT	1340.0	0.7985	0.0250
16-Add	S-16	2	CONDUIT	500.0	0.2520	0.0130
S-9_overflow	S-9	S-10	WEIR			
S-8_overflow	S-8	S-10	WEIR			
S-7_overflow	S-7	S-9	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
2	CIRCULAR	3.00	7.07	0.75	3.00	1	9.68
4	CIRCULAR	3.00	7.07	0.75	3.00	1	28.30
5	CIRCULAR	3.50	9.62	0.88	3.50	1	80.45
6	CIRCULAR	1.00	0.79	0.25	1.00	1	2.13
7	CIRCULAR	1.00	0.79	0.25	1.00	1	5.24
8	CIRCULAR	1.00	0.79	0.25	1.00	1	4.15
9	CIRCULAR	3.00	7.07	0.75	3.00	1	30.19
10	CIRCULAR	1.00	0.79	0.25	1.00	1	2.95
11	CIRCULAR	3.00	7.07	0.75	3.00	1	46.05
12	CIRCULAR	3.50	9.62	0.88	3.50	1	61.17
13	CIRCULAR	3.50	9.62	0.88	3.50	1	55.19
14	CIRCULAR	3.50	9.62	0.88	3.50	1	24.69
15	CIRCULAR	2.00	3.14	0.50	2.00	1	19.87
16	CIRCULAR	2.00	3.14	0.50	2.00	1	39.04
17	CIRCULAR	1.50	1.77	0.38	1.50	1	1.50
18	CIRCULAR	1.50	1.77	0.38	1.50	1	6.28
19	CIRCULAR	1.50	1.77	0.38	1.50	1	37.27
32	TRAPEZOIDAL	7.74	334.00	4.08	80.30	1	4993.90
38	CIRCULAR	3.50	9.62	0.88	3.50	1	27.08
39	CIRCULAR	1.00	0.79	0.25	1.00	1	1.26
121	CIRCULAR	4.50	15.90	1.13	4.50	1	157.32
122	CIRCULAR	3.00	7.07	0.75	3.00	1	41.34
123	CIRCULAR	3.00	7.07	0.75	3.00	1	29.79
124	CIRCULAR	4.00	12.57	1.00	4.00	1	187.39
125	CIRCULAR	3.00	7.07	0.75	3.00	1	80.64
S-2Routing	TRIANGULAR	3.00	39.00	1.46	26.00	1	163.53
S-2BRouting	TRIANGULAR	2.00	26.00	0.99	26.00	1	137.03
16-Add	CIRCULAR	2.50	4.91	0.63	2.50	1	20.59

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

```
****************
Analysis Options
****************
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... YES
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date ..... 06/14/2019 00:00:00
Ending Date ..... 06/16/2019 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:02:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 01:00:00
Routing Time Step ..... 1.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.005000 ft


*********************
Control Actions Taken
*********************
```

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	28.723	5.120
Evaporation Loss	0.000	0.000
Infiltration Loss	3.894	0.694
Surface Runoff	24.756	4.413
Final Storage	0.126	0.022
Continuity Error (%)	-0.186	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	24.776	8.074
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.000	0.000
Flooding Loss	0.001	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	24.777	8.074
Continuity Error (%)	-0.006	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

Link 125 (2)
Link 11 (1)
Link 12 (1)

Routing Time Step Summary

Minimum Time Step	:	0.49 sec
Average Time Step	:	1.00 sec
Maximum Time Step	:	1.00 sec
Percent in Steady State	:	0.21
Average Iterations per Step	:	2.02
Percent Not Converging	:	0.18

Time Step Frequencies :

1.000 - 0.871 sec	:	99.53 %
0.871 - 0.758 sec	:	0.13 %
0.758 - 0.660 sec	:	0.10 %
0.660 - 0.574 sec	:	0.19 %
0.574 - 0.500 sec	:	0.05 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
D-10	5.12	0.00	0.00	0.00	5.13	0.00	5.13	0.07	3.84	1.003
D-17	5.12	0.00	0.00	1.39	0.00	3.69	3.69	0.21	14.53	0.721
D-19	5.12	0.00	0.00	1.39	0.00	3.69	3.69	0.04	2.67	0.721
DT-2A	5.12	0.00	0.00	1.48	0.67	2.94	3.60	0.67	25.47	0.704
DT-4A	5.12	0.00	0.00	0.00	5.14	0.00	5.14	0.50	29.68	1.003
D-7	5.12	0.00	0.00	0.00	5.13	0.00	5.13	0.15	8.16	1.003
D-8	5.12	0.00	0.00	0.00	5.13	0.00	5.13	0.07	3.90	1.003
D-9	5.12	0.00	0.00	0.00	5.13	0.00	5.13	0.04	2.39	1.003
DT-36B	5.12	0.00	0.00	0.00	5.13	0.00	5.13	2.74	127.89	1.002
DT-36A	5.12	0.00	0.00	1.40	0.00	3.68	3.68	1.06	52.43	0.719
DT-36C	5.12	0.00	0.00	0.00	5.14	0.00	5.14	1.51	86.41	1.003
D-2B	5.12	0.00	0.00	1.69	0.00	3.38	3.38	1.00	48.82	0.661

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
S-2	JUNCTION	0.73	16.03	702.28	0 12:23	16.03
S-4A	JUNCTION	0.17	13.39	706.73	0 12:11	4.37
S-5	JUNCTION	0.15	7.50	699.51	0 12:11	5.54
S-6	JUNCTION	0.03	3.20	698.91	0 12:12	2.93

S-7	JUNCTION	0.26	5.13	699.22	0	12:12	5.12
S-8	JUNCTION	0.08	3.93	698.66	0	12:16	3.91
S-9	JUNCTION	2.26	13.91	698.48	0	12:18	13.91
S-10	JUNCTION	0.15	6.37	698.27	0	12:21	6.37
S-11	JUNCTION	1.17	12.24	697.91	0	12:18	12.23
S-12	JUNCTION	0.66	11.20	697.38	0	12:14	11.14
S-13	JUNCTION	1.24	11.23	696.80	0	12:14	11.17
S-14	JUNCTION	0.87	10.12	696.00	0	12:14	10.07
S-15	JUNCTION	0.92	9.90	697.42	0	12:18	9.89
S-16	JUNCTION	0.35	9.68	706.94	0	12:25	9.67
S-17	JUNCTION	0.66	3.04	698.50	0	12:11	3.03
S-18	JUNCTION	1.21	2.98	697.58	0	12:12	2.97
S-19	JUNCTION	0.38	4.16	695.14	0	12:12	4.15
S-20	JUNCTION	0.66	8.24	694.22	0	12:14	8.23
T-36	JUNCTION	0.16	2.19	711.19	0	12:12	2.18
S-5_12	JUNCTION	0.16	9.43	700.50	0	12:11	6.43
S-12.1	JUNCTION	0.23	10.01	698.84	0	12:11	8.66
S-12.2	JUNCTION	0.26	9.32	697.79	0	12:11	8.95
S12.3	JUNCTION	0.22	9.10	697.40	0	12:14	9.04
S-12.3-12	JUNCTION	0.43	10.84	697.40	0	12:14	10.78
S-2A	JUNCTION	0.29	2.18	702.38	0	12:23	2.18
S-2B	JUNCTION	0.13	1.29	712.19	0	12:14	1.29
1	OUTFALL	0.00	0.00	690.00	0	00:00	0.00
2	STORAGE	10.37	13.84	684.84	2	00:00	13.84

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
S-2	JUNCTION	0.00	56.45	0	12:16	0	1.67	-0.201
S-4A	JUNCTION	29.68	29.68	0	12:12	0.502	0.502	0.260
S-5	JUNCTION	0.00	29.70	0	12:11	0	0.501	-0.395
S-6	JUNCTION	0.00	1.91	0	12:12	0	0.00089	0.421
S-7	JUNCTION	8.16	8.16	0	12:12	0.152	0.152	0.158
S-8	JUNCTION	3.90	3.90	0	12:12	0.0711	0.072	0.401
S-9	JUNCTION	2.39	49.04	0	12:17	0.0446	1.87	0.108

S-10	JUNCTION	3.84	12.09	0	12:14	0.0711	0.163	-0.033	
S-11	JUNCTION	0.00	53.23	0	12:29	0	2.02	0.025	
S-12	JUNCTION	0.00	60.41	0	12:17	0	2.74	-0.030	
S-13	JUNCTION	0.00	60.41	0	12:17	0	2.51	0.040	
S-14	JUNCTION	0.00	107.78	0	12:22	0	5.87	-0.002	
S-15	JUNCTION	0.00	49.09	0	12:48	0	3.37	0.005	
S-16	JUNCTION	0.00	255.03	0	12:12	0	5.32	0.192	
S-17	JUNCTION	14.53	14.53	0	12:12	0.212	0.212	0.027	
S-18	JUNCTION	0.00	14.53	0	12:12	0	0.212	0.060	
S-19	JUNCTION	2.67	17.20	0	12:12	0.0381	0.25	0.013	
S-20	JUNCTION	0.00	115.83	0	12:14	0	6.12	-0.000	
T-36	JUNCTION	266.74	266.74	0	12:12	5.31	5.31	-0.192	
S-5_12	JUNCTION	0.00	30.02	0	12:11	0	0.503	-0.106	
S-12.1	JUNCTION	0.00	30.31	0	12:11	0	0.503	0.004	
S-12.2	JUNCTION	0.00	30.31	0	12:11	0	0.503	-0.023	
S12.3	JUNCTION	0.00	30.33	0	12:11	0	0.503	-0.043	
S-12.3-12	JUNCTION	0.00	30.40	0	12:11	0	0.732	0.068	
S-2A	JUNCTION	25.47	65.88	0	12:13	0.666	1.67	0.486	
S-2B	JUNCTION	48.82	48.82	0	12:12	1	1	-0.416	
1	OUTFALL	0.00	0.00	0	00:00	0	0	0.000	gal
2	STORAGE	0.00	167.17	0	12:20	0	8.07	0.000	

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
S-4A	JUNCTION	0.43	10.392	1.608
S-5	JUNCTION	0.47	3.350	0.000
S-6	JUNCTION	0.51	2.200	0.000
S-11	JUNCTION	0.77	5.137	3.413
S-12	JUNCTION	1.17	7.699	5.051
S-13	JUNCTION	1.30	7.726	4.674
S-14	JUNCTION	1.13	6.248	6.222
S-15	JUNCTION	0.90	4.405	4.195
S-17	JUNCTION	0.15	0.886	1.664
S-20	JUNCTION	1.11	4.740	1.760

S-5_12	JUNCTION	0.52	4.927	0.000
S-12.1	JUNCTION	0.69	5.509	6.831
S-12.2	JUNCTION	0.96	6.315	8.665
S12.3	JUNCTION	0.82	5.098	5.832
S-12.3-12	JUNCTION	1.05	6.836	0.000

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Depth Feet
S-5	0.01	10.57	0 12:11	0.000	0.000
S-6	0.01	1.83	0 12:12	0.000	0.000
S-10	0.51	12.09	0 12:14	0.025	1.571

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
2	782.511	26	0	0	1078.843	35	2 00:00	0.00

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
1	0.00	0.00	0.00	0.000

System	0.00	0.00	0.00	0.000

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
2	CONDUIT	45.74	0	12:34	6.47	4.73	1.00
4	CONDUIT	29.70	0	12:11	6.16	1.05	1.00
5	CONDUIT	30.02	0	12:11	6.94	0.37	1.00
6	CONDUIT	1.91	0	12:12	2.50	0.90	1.00
7	CONDUIT	5.96	0	12:09	7.58	1.14	1.00
8	CONDUIT	2.75	0	12:08	4.09	0.66	1.00
9	CONDUIT	48.55	0	12:32	6.87	1.61	1.00
10	CONDUIT	7.20	0	12:42	9.17	2.44	1.00
11	CONDUIT	53.23	0	12:29	7.53	1.16	1.00
12	CONDUIT	60.41	0	12:17	6.28	0.99	1.00
13	CONDUIT	60.41	0	12:17	6.28	1.09	1.00
14	CONDUIT	107.78	0	12:22	11.20	4.36	1.00
15	CONDUIT	49.09	0	12:48	15.63	2.47	1.00
16	CONDUIT	49.09	0	12:48	15.62	1.26	1.00
17	CONDUIT	14.53	0	12:12	8.24	9.68	0.99
18	CONDUIT	14.54	0	12:12	8.32	2.32	0.96
19	CONDUIT	17.36	0	12:11	9.82	0.47	1.00
32	CONDUIT	255.03	0	12:12	5.56	0.05	0.53
38	CONDUIT	115.83	0	12:14	12.21	4.28	0.96
39	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
121	CONDUIT	30.31	0	12:11	3.98	0.19	1.00
122	CONDUIT	30.31	0	12:11	4.29	0.73	1.00
123	CONDUIT	30.33	0	12:11	4.69	1.02	1.00
124	CONDUIT	30.40	0	12:11	2.42	0.16	1.00
125	CONDUIT	30.59	0	12:11	4.33	0.38	1.00
S-2Routing	CONDUIT	56.45	0	12:16	3.72	0.35	0.83
S-2BRouting	CONDUIT	42.55	0	12:14	2.56	0.31	0.82
16-Add	CONDUIT	54.67	0	12:25	11.25	2.65	0.97
S-9_overflow	WEIR	3.13	0	12:18			0.82
S-8_overflow	WEIR	0.00	0	00:00			0.00

S-7_overflow WEIR 4.04 0 12:12 0.61

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Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
2	1.00	0.02	0.00	0.00	0.97	0.00	0.00	0.01	0.48	0.00
4	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
5	1.00	0.00	0.00	0.00	0.53	0.47	0.00	0.00	0.00	0.00
6	1.00	0.00	0.92	0.00	0.07	0.00	0.00	0.00	0.73	0.00
7	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.97	0.01	0.00
8	1.00	0.00	0.00	0.00	0.03	0.12	0.00	0.85	0.13	0.00
9	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.00	0.00
10	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
11	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.03	0.00
12	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.03	0.00
13	1.00	0.01	0.02	0.00	0.54	0.00	0.44	0.00	0.02	0.00
14	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.38	0.00
15	1.00	0.02	0.00	0.00	0.03	0.00	0.00	0.96	0.00	0.00
16	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.00
17	1.00	0.15	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00
18	1.00	0.16	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00
19	1.00	0.02	0.55	0.00	0.43	0.00	0.00	0.00	0.83	0.00
32	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.02	0.00
38	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
39	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
121	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.97	0.00
122	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.95	0.00
123	1.00	0.00	0.00	0.00	0.73	0.26	0.00	0.00	0.01	0.00
124	1.00	0.00	0.00	0.00	0.87	0.12	0.00	0.00	0.86	0.00
125	1.00	0.01	0.00	0.00	0.96	0.03	0.00	0.00	0.58	0.00
S-2Routing	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
S-2BRouting	1.00	0.00	0.16	0.00	0.84	0.00	0.00	0.00	0.84	0.00
16-Add	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00

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Conduit Surcharge Summary
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Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
2	1.31	1.33	1.33	1.37	1.19
4	0.43	0.43	0.47	0.02	0.01
5	0.52	0.52	0.58	0.01	0.01
6	0.51	0.51	0.57	0.01	0.01
7	0.63	0.63	0.94	0.05	0.05
8	0.57	0.57	0.76	0.01	0.01
9	1.41	1.41	1.59	0.58	0.58
10	0.75	0.76	0.77	0.63	0.51
11	1.29	1.29	1.59	0.43	0.01
12	1.17	1.17	1.30	0.01	0.01
13	1.13	1.13	1.30	0.45	0.01
14	1.11	1.16	1.11	1.82	1.11
15	1.16	1.25	1.16	1.30	1.11
16	1.02	1.02	1.07	1.07	1.02
17	0.01	0.15	0.01	0.90	0.01
18	0.01	0.06	0.01	0.21	0.01
19	0.55	0.55	3.42	0.01	0.01
38	0.01	1.11	0.01	1.74	0.01
121	0.52	0.52	0.69	0.01	0.01
122	0.90	0.90	0.96	0.01	0.01
123	0.96	0.96	0.97	0.01	0.01
124	0.82	0.82	1.05	0.01	0.01
125	1.20	1.20	1.29	0.01	0.01
S-2BRouting	0.01	0.01	0.28	0.01	0.01
16-Add	0.01	1.00	0.01	1.02	0.01

Analysis begun on: Sat Oct 9 15:15:01 2021
Analysis ended on: Sat Oct 9 15:15:07 2021
Total elapsed time: 00:00:06

ATTACHMENT K-2

SURFACE WATER DIVERSION BERM ANALYSIS

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Diversion Berm Analysis -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Surface Water Diversion Berm Analysis -Engineered Turf

Objective

Design the diversion berms to direct surface water run-off from landfill slopes to perimeter ditches. Diversion berms are designed to a depth and slope to provide sufficient capacity.

Design Criteria, Assumptions, and Methodology

1. Diversion berm locations are shown on the Figure provided in Attachment K-1.5.
2. Diversion berms will collect and control the run-off from the 25-yr, 24-hr storm event with a minimum of 0.5 ft of freeboard. The berms will manage flow from the 100-yr, 24-hr storm event with no offsite flooding.
3. Diversion berm slopes will typically be sloped at 2 percent, but will vary at certain locations due to site conditions.
4. Diversion berm channels will be triangular in shape.
5. The interior-side channel slope of the diversion berm channel will vary depending on the final cover slope. Conservatively use the typical maximum slope for the diversion berms modeled.
6. Diversion berms will be lined with engineered artificial turf landfill cover, such as Closure Turf.
7. The design of the diversion berms is based on the berms at each slope with largest drainage area. This will result in a standard berm sized for the maximum design flow for each channel slope. Unique diversion berm locations and configurations are also modeled.

Calculation

The critical diversion berms considered in this analysis are as follows:

- DB-A-1, Berm at 2% slope with largest immediate drainage area.
- DB-A-2, Berm at 11% slope with largest immediate drainage area.
- DB-D-1, Berm at 1% slope with largest immediate drainage area.
- DB-D-2, Berm at 9.8% slope with largest immediate drainage area.
- DB-G, Berm at 5.4% slope with largest immediate drainage area.
- DB-46, Existing berm with unique drainage configuration.
- W-MC X DV, existing berm with unique drainage configuration.
- E-MC X DV, existing berm with unique drainage configuration.
- S-MC X DV, existing berm with unique drainage configuration.

Diversion berm designs are based on the HydroCAD model output provided in Attachment K-1.6. Diversion berm designs are summarized in Table K-2.1 below.

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Diversion Berm Analysis -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Conclusion

The proposed diversion berms, described above, will safely collect and control the design storm event. Diversion berm locations and cross sections may be modified depending on site conditions at closure, as long as design requirements are met.

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Diversion Berm Analysis -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Table K-2.1: Diversion Berm Summary

Diversion Berm Modeled	Additional Diversion Berms Represented in Design	Diversion Berm Design					Peak Flow (25-yr, 24-hr Storm)		
		Watershed Drainage Area (ac.)	Design Slope (%)	Channel Sideslopes <Max> (H:V)	Design Depth (ft)	Channel Lining	Flow Rate (cfs)	Flow Depth (ft)	Flow Velocity (ft/sec)
DB-A-1	DB-B and DB-C	40.3; See Note 3	2.0%	4:1 / 2:1	3.0	Engineered Turf	209.4	2.37	11.26
DB-A-2	--	40.3	11.0%	4:1 / 2:1	3.0	Engineered Turf	187.2	1.71	21.33
DB-D-1	DB-E, DB-F, and DB-H	8.8; See Note 4	1.0%	4:1 / 2:1	2.5	Engineered Turf	55.8	1.58	6.10
DB-D-2	--	8.8	9.8%	4:1 / 2:1	2.5	Engineered Turf	45.1	1.02	14.29
DB-G	--	1.9	5.4%	4:1 / 2:1	2.0	Engineered Turf	12.2	0.69	8.20
DB-46	--	10.5	1.0%	10:1 / 3:1	2.0	Grass (existing)	24.0	1.00	3.70
W-MC X DV	--	13.8	Varies (0.5% min)	3:1 / 8:1	2.0	Grass (existing)	38.3	1.37	3.22
E-MC X DV	--	12.1	1.0%	3:1 / 3:1	2.0	Grass (existing)	35.6	1.49	4.71
S-MC XI DV	--	2.2	1.8%	6:1 / 2:1	1.5	Grass (existing)	6.9	0.66	3.70

Notes:
1. All diversion channels are triangular in shape and formed by the construction of a berm on the final cover grades.
2. Diversion berm locations, cross section, and slopes may be modified based on site conditions at time of construction, as long as design requirements are met.
3. Actual watershed drainage area for DB-A-1 is 37.8 ac.
4. Actual watershed drainage area for DB-D-1 is 8.3 ac.

ATTACHMENT K-3

SURFACE WATER DITCH ANALYSIS

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Ditch Analysis -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Surface Water Ditch Analysis -Engineered Turf

Objective

Design ditches to convey surface water run-off at the site.

Design Criteria, Assumptions, and Methodology

1. Ditch locations are shown on the Figure provided in Attachment K-1.5.
2. Ditch labels describe the ditch location with respect to the Master Cell (MC) locations.
3. Ditches will collect and control the run-off from the 25-yr, 24-hr storm event with a minimum freeboard of 0.5 feet and manage run-off from the 100-yr, 24-hr storm event with no offsite flooding.
4. Ditch cross section and slopes will vary depending on the location within the site.
5. Ditches around the perimeter of MC VI will be lined with engineered artificial turf landfill cover, such as closure turf or hydroturf. Other ditches will be vegetated.
6. Erosion protection will be provided, as needed, at:
    a. Locations where the ditch changes directions,
    b. Locations with grass ditch lining where the maximum flow velocity is greater than 5.0 fps, and
    c. Culvert inlet and outlet locations with grass ditch lining.
7. Ditch label typically indicates the location, e.g., ditch MC VII/XI is located between MC VII and MC XI.
8. Ditches that are restricted by downstream culverts are modeled as ponds to account for water storage during storm events. This affects the following ditches:
    a. NWD restricted by culvert NWD/MC VII Culvert,
    b. N-MC VII ditch restricted by culvert N-MC VII;
    c. N-MV IX and NE MC-IX ditches restricted by the NSB North Inlet culvert;
    d. MC VII/XI ditch restricted by culvert MC VII/XI,
    e. MC VII/IX and MC X/XI ditches restricted by culvert MC VII/IX
9. All but two of the ditches are existing on-site ditches. Only ditches S-MC VI and N-MC VI are new proposed ditches. Some ditches include grading modifications in the form of containment berms, as shown in the drawings. The lining of ditch MC VI/XI will be changed to engineered turf.

Calculation

Ditch design is based on the HydroCAD model output provided in Attachment K-1.6. Ditch designs are summarized in Table K-3.1 below. Ditches along the perimeter of the site that need to maintain containment on the outbound edge of the site have a minimum containment berm elevation identified in the table.

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Ditch Analysis -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Conclusion

The proposed ditches, described above and in the table below, will safely transmit the design storm event. Ditch cross sections and slopes may be modified depending on site conditions at closure as long as design requirements are met.

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Ditch Analysis -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Table K-3.1: Ditch Design Summary

Drainage Ditch Label	Channel Design							Peak Flow (25-yr, 24-hr)			
	Design Slope (%)	Channel Shape	Channel Sideslopes (H:V)	Req. Berm Elev. (ft)	Channel Bottom Width (ft)	Design Depth <Min.> (ft)	Channel Lining	Flow Rate (cfs)	Flow Depth (ft)	Peak Elev. (ft)	Flow Velocity (ft/sec)
North Sedimentation Basin (NSB) Subwatershed											
NWD (north & west of MC IV and VI) - Modeled as pond	Varies	Trapezoidal	2:1 (max)	712.0	Varies	Varies	Engineered Turf	580.5	6.2 (max)	710.5	NA
N-MC VII – Modeled as pond	Varies	Trapezoidal	2:1 (max)	703.0	Varies	Varies	Engineered Turf	157.6	5.4 (max)	702.2	NA
MC VII/XI -Modeled as pond	Varies	Triangular	2:1 (max)	707.0 (spillway)	--	Varies	Grass	98.1	7.9 (max)	707.9	NA
MC X/XI and MC VII/IX Modeled as pond	Varies	Trapezoidal	2:1 (max)	706.0	Varies	Varies	Grass	235.5	6.1 (max)	703.2	NA
N-MC IX , NE-MC-IX, and E-MC IX– Modeled as pond	Varies	Trapezoidal	2:1 (max)	702.0	Varies	Varies	Grass	263.7	4.8 (max)	699.7	NA
South Sedimentation Basin (SSB) Subwatershed											
E-MC X	0.25%	Triangular	5:1 / 5:1	--	--	3.0	Grass	26.6	1.26	--	1.81
S-MC X	0.27%	Triangular	1:1 / 2:1	--	--	4.0	Grass	23.3	2.07	--	2.77
W- MC X	0.24%	Trapezoidal	3:1 / 2:1	--	6.0	4.0	Grass	22.3	1.02	--	2.42
E-MC I	0.41%	Triangular	3:1	--	--	3.0	Grass	37.1	1.87	--	3.51
MC VI/XI	1.0%	Trapezoidal	4:1	--	6.0	4.0	Engineered Turf	162.5	1.66	--	7.73

Notes:
1 Ditches modeled as ponds do not include flow velocity.
2 Ditch slopes that vary are, at a minimum, sloped to drain.
3 Ditch configuration may be changed as long as design criteria are met.

ATTACHMENT K-4

CULVERT ANALYSIS

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Culvert Analysis -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Culvert Analysis -Engineered Turf

Objective

Analyze existing culverts to remain in place and proposed culverts for final cover conditions to convey surface water through ditches and into sedimentation basins.

Design Criteria, Assumptions, and Methodology

1. This analysis is primarily of existing culvert pipes, changes from existing conditions are noted.
2. Culvert locations are shown on the Figure provided in Attachment K-1.5.
3. Culvert labels describe the ditch location with respect to the Master Cell (MC) locations.
4. South Sedimentation Basin storm sewer pipes and inlets are addressed in Appendix K-5.
5. Culverts will collect and control flow from the 25-yr, 24-hr storm event and manage run-off from the 100-yr, 24-hr storm event with no offsite flooding.
6. Culverts will consist or Reinforced Concrete Pipe (RCP), Corrugated Metal Pipe (CMP), or Smooth Lined Corrugated HDPE Pipe (CPP). A Manning's No. of 0.012 is used to represent RCP and CPP, while a value of 0.025 is used to represent CMP.
7. The tailwater depth input for each culvert was based on the downstream channel flow depth for the design storm event.
8. Riprap or other materials, such as permanent turf reinforcement mat, will be used at culvert inlets and outlets.
9. Alternate culvert pipe materials, sizes, and configurations that meet design criteria may be used.
10. Culverts NWD-MC VII, MC VII/IX, and E-MC VI/XI restrict flow, and are modeled as ponds to account for water storage during storm events.

Calculation

Culvert design is based on the HydroCAD model output provided in Attachment K-1.6. Culvert designs are summarized in Table K-4.1 below.

Conclusion

The culverts described in the table below, will safely transmit the design storm event. Alternate culvert slopes, materials, and dimensions that meet design requirements may be used.

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Culvert Analysis -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Table K-4.2
Culvert Summary

Culvert Label (new/existing)	Number and Type of Culvert	Min. Pipe Dia. (in.)	Design Slope (%)	Approx. Design Length (ft)	Approx. Inlet Invert Elev. (ft)	Total Watershed Area (ac.)	Peak Flow Rate <25-yr, 24-hr> (cfs)	Head-water Elev. (ft)
North Sedimentation Basin (NSB) Watershed								
NWD / MC VII (new)	3/CPP 1/CPP	30” 18”	4.24	125.0	704.3	125.4	139.72	710.46
N-MC VII (existing)	1/RCP 1/RCP	54” 36”	0.38	42	696.8	133.4	145.32	702.15
MC VII/IX (existing)	3/CMP	24”	0.33	30	697.1	104.3	59.68	703.18
MC VII/XI (existing see note 2)	1/RCP	24”	2.25	40	700.3	32.4	65.39	707.93
N-MC IX (existing)	1/RCP 3/CMP	54” 30”	4.00 0.0	110.0	695.0	276.5	194.51	699.65
E-MC IX (existing)	1/CPP	36”	3.65	72	701.8	12.1	30.87	704.16
South Sedimentation Basin (SSB) Watershed								
E-MC I (new, see note 3)	1/CPP	24”	0.25	80	703.0	3.1	7.72	705.52
SSB East Inlet (existing)	1/RCP	30”	0.12	113	688.1	13.8	21.03	690.92

Notes:

1. Culvert MC X/XI was not modeled due to the location upstream of the restrictive MC VII/IX culvert.
2. Under existing conditions at culvert MC VII/XI, if the upstream ditch overtops the containment berm, the flow will route to the same location as the culvert output. This is an acceptable flow path, the model indicates the overflow velocity is less than 3 fps, therefore vegetation will prevent erosion.
3. The existing culvert for the access road to MC I will be replaced with the designed culvert.
4. Alternate culvert pipe materials, sizes, and configurations that meet design criteria may be used.

ATTACHMENT K-5

STORM SEWER ANALYSIS

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Storm Sewer Analysis

Project No.: 1218070017
Calculated By: TCR Date: 11/04/2021
Checked By: WL Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Storm Sewer Analysis

Objective

Evaluate the capacity of the existing South Sedimentation Basin (SSB) storm sewer to collect and control the design storm event under final closure conditions with an engineered artificial turf cover.

Design Criteria, Assumptions, and Methodology

1. Storm Sewer routes surface water run-off to the SSB. The layout is shown on the Figure provided in Attachment K-1.5.
2. The storm sewer will collect and control run-off from the 25-yr, 24-hr storm event and manage the 100-yr, 24-hr storm event with no offsite flooding.
3. The existing storm sewer layout is reflected in the "Storm Water Management System Evaluation Report" prepared by CTI, Revised February 2021. Changes to the existing storm sewer layout are identified below.
4. Grading as shown in the drawings.

Calculation

The existing storm sewer includes revisions to accommodate the surface water flows from the expansion. The changes include the following:

A. S-1 Inlet: Remove the existing inlet
B. S-3 Inlet: Remove the existing inlet
C. S-4A Inlet: Extend the existing S-4 inlet vertically to new design grades.
D. Install a new 30-inch storm sewer pipe from the S-16 inlet location to the SSB. Inlet invert 697.26, slope 0.25% minimum. Alternate configuration, piping, or channels with sufficient flow capacity may be used.

The SWMM model was used to evaluate the revised storm sewer system for final cover conditions. SWMM model inputs and outputs are provided in Attachment K-1.6. A summary of flooding output is provided in Table K-6.6.1 below.

Conclusion

The revised storm sewer will safely collect and control the 25-yr, 24-hour storm event with no flooding and will manage the 100-yr, 24-hr storm event with no offsite flooding.

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Storm Sewer Analysis

Project No.: 1218070017
Calculated By: TCR Date: 11/04/2021
Checked By: WL Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Table K-6.6.1: Storm Sewer Summary 100-yr, 24-hr Flooding/Overflow

Junction	Description	Drainage Area	Flooding Depth/Volume	Comments
S-5, & S-6	Manholes	MC-1 and Expansion	None	Incidental volume, does not exceed manhole.
S-10	Drop Inlet	Site Entrance Area	1.57 ft (25,000 gal)	Flood volume will be contained within S-10 inlet drainage area, See Note 1.

Notes:

1. Flooding at S-10 up to approximately elev. 698.4 (1.7 ft above inlet) will remain on-site within the S-10 drainage area. The flooding depth at S-10 is based on a 2,100 sf area to model increased storage depths in the area of S-10. At elev. 698.4, there is approx. 3,670 cf (27,450 gal) of surface water storage in the area of S-10.

ATTACHMENT K-6

SEDIMENTATION BASIN ANALYSIS

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Sedimentation Basin Analysis -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Sedimentation Basin Analysis -Engineered Turf

Objective

Evaluate the storage capacity of the existing North Sedimentation Basin (NSB) and South Sedimentation Basin (SSB) for final landfill cover conditions with engineered turf.

Design Criteria, Assumptions, and Methodology

1. The site includes three storm water sedimentation basins, NSB, SSB, and the Lined Pond. After a storm event, the NSB storm water is pumped to the SSB. The storm water in SSB and the Lined Pond are treated separately prior to discharge off-site.
2. The subwatershed draining to the existing EGLE approved Lined Pond and related storm sewer system is reduced under final conditions. Therefore, the Lined Pond has sufficient capacity for the design storm event, and revised calculations are not included herein.
3. At WDI the Sedimentation Basins are design to store the entire 100-yr, 24-hr storm event with no discharge off site. From Attachment K-1.1 the 100-yr, 24-hr storm rainfall is 5.12 inches.
4. Both NSB and SSB consist of two separate areas connected by a spillway for the NSB and culvert for the SSB. The NSB South area is divided into two parts by a berm within the basin. The spillway between NSB north and NSB south will be made deeper for final conditions, as shown in Attachment K-1.5.
5. From the HydroCAD output provided in Attachment K-1.6, the total design storm run-off volume is as follows:
    a. 91.83 ac-ft for the NSB, use 91.8 ac-ft
    b. 32.85 ac-ft for the SSB, use 32.9 ac-ft
6. The NSB and SSB locations are shown in Attachment K-1.5.

Calculation

Sedimentation basin volumes are estimated using topography and as-built data. Sedimentation Basin design information is summarized in Table K-6.1, below.

Conclusion

The North Sedimentation Basin (NSB) and the South Sedimentation Basin (SSB) have sufficient capacity to store the entire 100-yr, 24-hr design storm event with over 1 ft of freeboard.

CALCULATION SHEET

Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Sedimentation Basin Analysis -Engineered Turf

Project No.: 1218070017
Calculated By: LEH Date: 11/04/2021
Checked By: TCR Date: 11/04/2021
Approved By: XZ Date: 11/04/2021

Table K-6.1: Sedimentation Basin Design Summary (at assumed final site conditions)

Location	NSB North	NSB South	SSB North	SSB South
Top of Berm (no freeboard) Elev.	695		695	
Basin Bottom Elev.	670	672/668	673	670
Pond Connection / Elev.	Spillway / 693.0		60” Dia. Culvert / 684	
Total Storage Volume Available (with 1-ft freeboard)	115.9 ac-ft		53.8 ac-ft	
100-yr, 24-hr Storm Run-off Vol.	91.8 ac-ft		32.9 ac-ft	

ATTACHMENT C
PERMIT ENGINEERING DRAWINGS REVISION I

WAYNE DISPOSAL, INC. SITE NO. 2
MASTER CELL VI-F&G

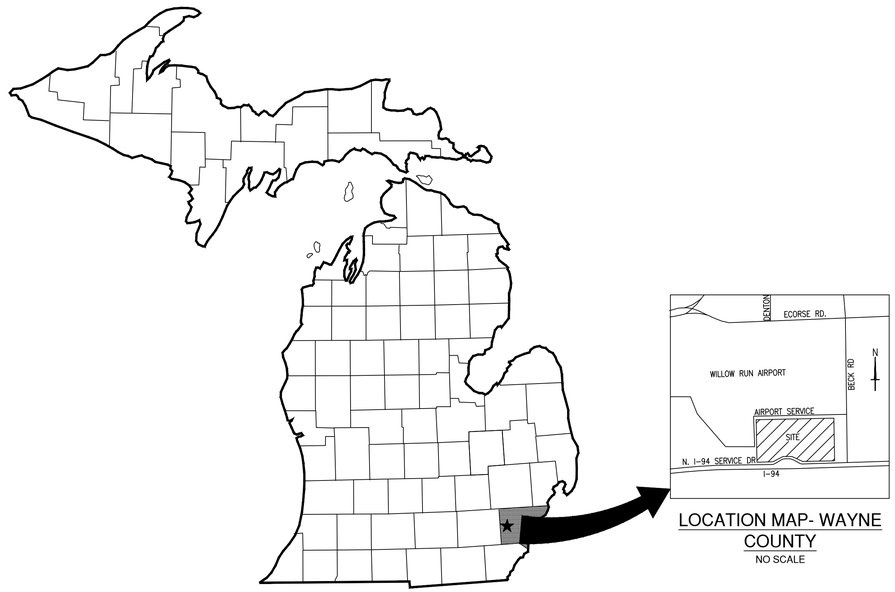
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CTI PROJECT NO.1218070017

FEBRUARY 2011
REVISED: SEPTEMBER 2011
REVISED: MAY 2018
REVISED: MAY 2021
REVISED: JULY 2021
REVISED: NOVEMBER 2021

OWNER:
Wayne Disposal, Inc.
49350 N. I-94 Service Drive
Belleville, Michigan 48111

ENGINEER:
CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377



MICHIGAN
APPROX. SCALE: 1"=50 MILES

LOCATION MAP- WAYNE COUNTY
NO SCALE

SHEET INDEX

01	TITLE SHEET
02	GENERAL SITE PLAN
03	CONSTRUCTION PHASING
04	TOP OF SUBGRADE GRADING PLAN
05	TOP OF SECONDARY LINER GRADING PLAN
06	TOP OF PRIMARY LINER GRADING PLAN
07	LEACHATE MANAGEMENT PLAN
08	FINAL COVER GRADING PLAN (1 OF 2)
09	FINAL COVER GRADING PLAN (2 OF 2)
10	STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)
10 A	ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)
11	STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)
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12	CROSS SECTION (1 OF 3)
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14	CROSS SECTION (3 OF 3)
15	LINER SYSTEM DETAILS (1 OF 2)
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17	GEOSYNTHETIC MATERIALS REQUIREMENTS
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19 A	ENGINEERED TURF FINAL COVER DETAILS
20	STORMWATER MANAGEMENT SYSTEM DETAILS
20 A	ENGINEERED TURF STORMWATER MANAGEMENT SYSTEM DETAILS
21	CONCEPTUAL GAS VENTING SYSTEM

STATE OF MICHIGAN
XIANDA ZHAO
ENGINEER
No. 43923
LICENSED PROFESSIONAL ENGINEER

REV	DATE	REVISION DESCRIPTION	DRN	APP
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	5/28/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
E	5/29/18	ADDENDUM 1	PAA	XZ
D	5/08/18	REV. BASED ON MDEQ'S COMMENTS	PAA	XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS		DRL
B	9/23/11	PER MDEQ COMMENTS		DRL
A	6/10/11	PHASING DESIGNATIONS	DRN	APP

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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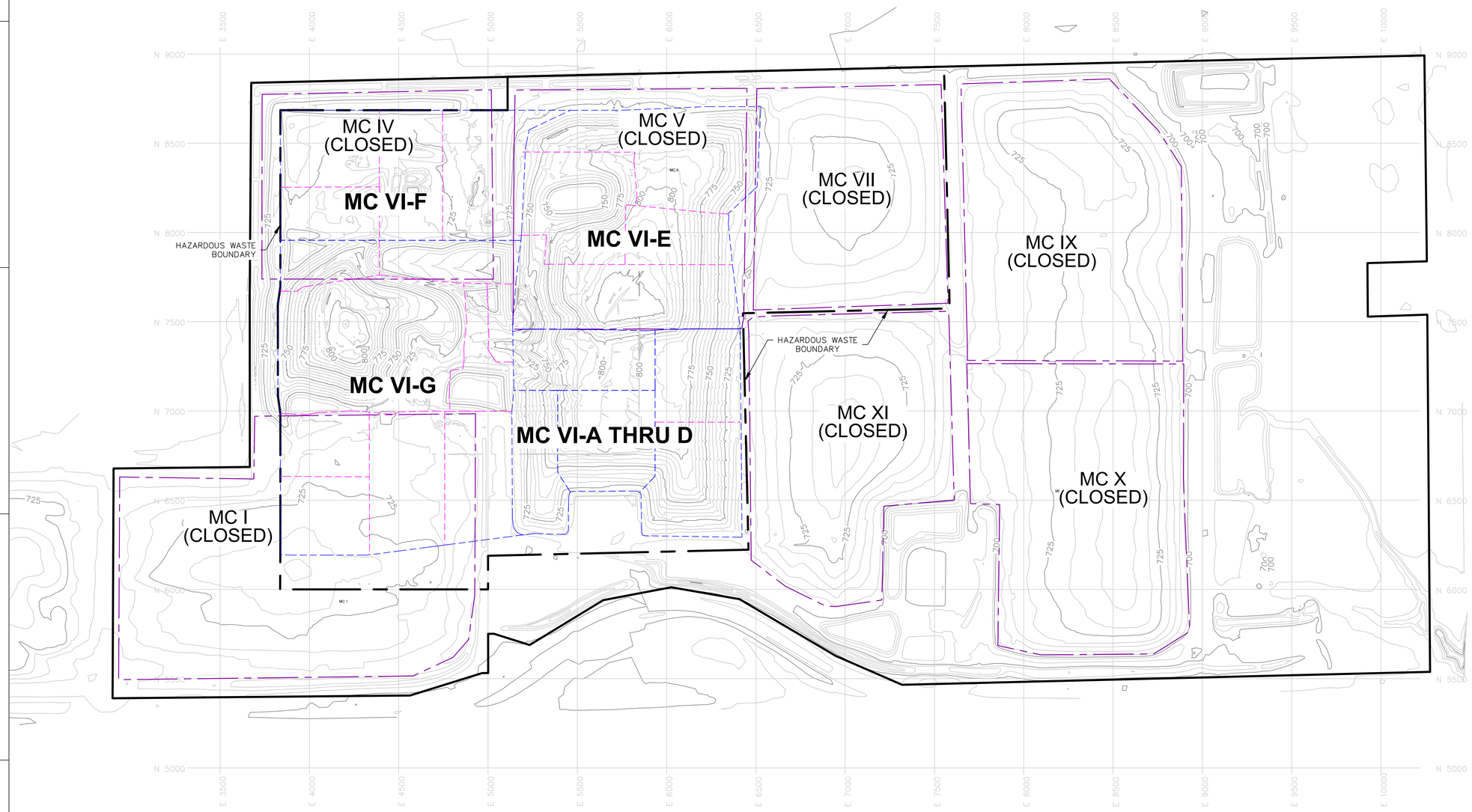
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

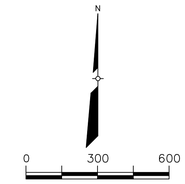
TITLE SHEET

PROJECT NUMBER
1218070017

SCALE
NONE

DRAWING NO
01





LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- PREVIOUSLY PERMITTED HAZARDOUS WASTE BOUNDARY
- PROPERTY BOUNDARY
- SUBCELL BOUNDARY
- CELL BOUNDARY
- CELL BOUNDARY (CLOSED)

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.

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DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN	APP
F	05/17/21	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ

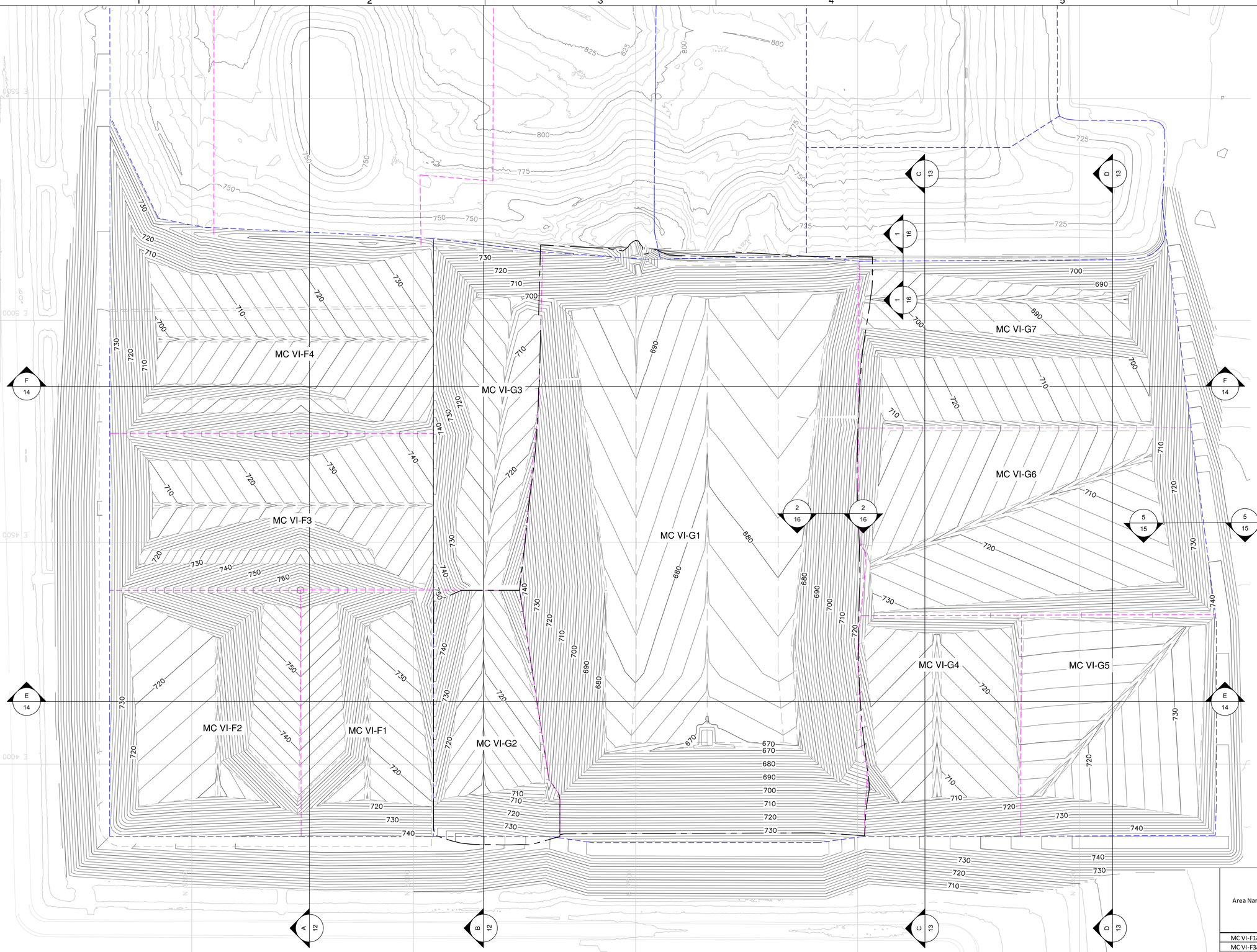
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

GENERAL SITE PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 300'

DRAWING NO
02



NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES DEPICTED IN MC VI G4–G7 REPRESENT REDESIGN TOP OF PRIMARY LINER. GRADES DEPICTED IN MC VI G3 AND MC VI F1–F4 REPRESENT PERMITTED TOP OF PRIMARY LINER. GRADES DEPICTED IN MC VI G1 AND G2 REPRESENT AS–BUILT TOP OF PRIMARY LINER.

Area Name	Footprint Area (AC)	2018 Permit Incremental Volume (CY)	2021 Proposed Revised Incremental Volume (CY)	2021 Volume Adjustment (CY)**
MC VI-F1&F2	9.3	810,822	779,386	-31,436
MC VI-F3&F4	12.9	1,865,000	1,854,314	-10,686
MC VI-G1	19.9	2,354,444	2,354,444	0
MC VI-G2&G3	7.2	796,778	785,806	-10,972
MC VI-G4	5.3	694,662	678,662	-16,000
MC VI-G5	5.5	490,000	564,000	74,000
MC VI-G6	7.4	3,598,173	3,650,173	52,000
MC VI-G7	5.5	1,120,000	1,213,000	93,000
Final Grade Changes	-	-	3,871,240	3,871,240
ClosureTurf	-	-	687,764	687,764
Total	73	11,729,879	16,438,789	4,708,910

REV	DATE	DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG	XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PJA	XZ
B	9/23/11	PER MDEQ COMMENTS		DRL
A	6/10/11	PHASING DESIGNATIONS		DRL
REV	DATE	REVISION DESCRIPTION	DRN	APP

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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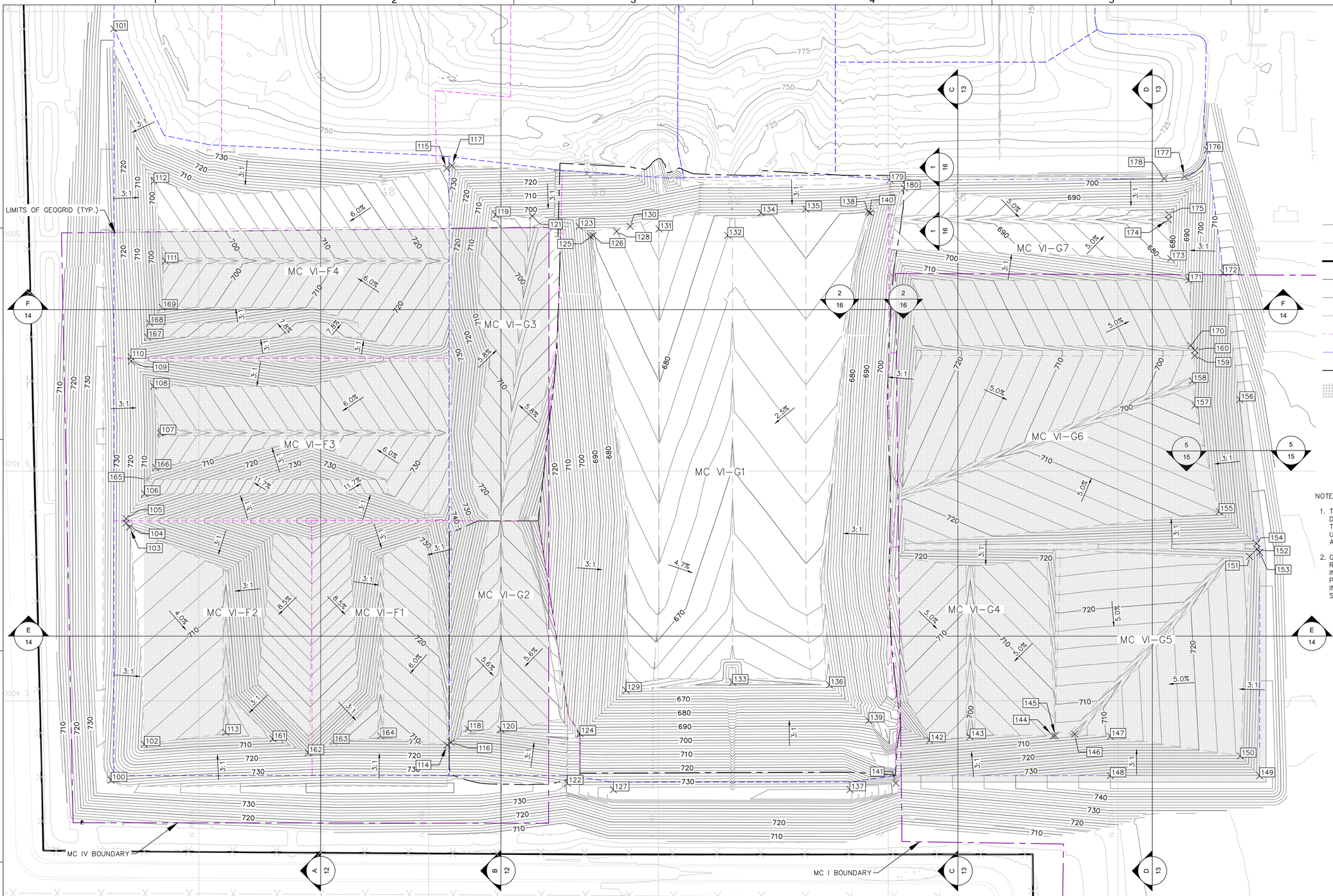
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CONSTRUCTION PHASING

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
03



NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES DEPICTED IN MC VI G4–G7 REPRESENT REDESIGN TOP OF SUBGRADE. GRADES DEPICTED IN MC VI G3 AND MC VI F1–F4 REPRESENT PERMITTED TOP OF SUBGRADE. GRADES DEPICTED IN MC VI G1–G2 REPRESENT AS–BUILT TOP OF SUBGRADE.

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
100	8690.50	3827.42	734.59
101	8685.01	5462.64	720.71
102	8618.55	3905.51	705.52
103	8651.01	4377.72	720.55
104	8658.02	4387.32	722.90
105	8657.98	4396.41	722.90
106	8617.74	4450.87	709.61
107	8583.70	4583.16	698.51
108	8598.25	4684.50	702.46
109	8647.15	4739.42	718.12
110	8647.41	4748.52	718.10

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
111	8573.16	4957.47	690.00
112	8597.34	5131.53	698.08
113	8441.35	3931.51	700.30
114	7959.71	3904.14	712.08
115	7960.81	5158.83	731.11
116	7951.05	3909.68	712.00
117	7949.45	5164.97	732.77
118	7913.92	3939.16	705.45
119	7853.52	5057.82	696.85
120	7842.73	3938.19	702.00
121	7774.33	5054.99	702.31

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
122	7697.89	3821.03	730.74
123	7672.54	5032.68	686.26
124	7670.81	3928.84	694.50
125	7647.66	5010.45	678.68
126	7641.99	5012.71	680.19
127	7597.89	3806.80	735.60
128	7591.06	5021.51	682.01
129	7570.41	4023.20	663.24
130	7561.67	5032.75	683.13
131	7498.71	5027.05	685.09
132	7349.00	5012.85	678.14

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
133	7338.74	4040.41	658.10
134	7276.06	5062.38	679.69
135	7179.18	5070.45	681.75
136	7127.70	4034.87	660.23
137	7083.24	3807.01	736.24
138	7043.49	5064.48	678.89
139	7042.16	3957.20	684.60
140	7039.03	5062.00	677.47
141	6983.25	3821.03	729.35
142	6909.78	3914.02	702.00
143	6821.94	3921.89	702.00

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
144	6641.59	3923.81	706.62
145	6636.63	3924.19	706.64
146	6594.37	3927.75	706.70
147	6516.74	3922.88	710.56
148	6516.74	3837.32	738.70
149	6191.88	3837.32	738.70
150	6233.58	3880.28	724.57
151	6214.04	4314.26	726.79
152	6197.41	4330.56	732.43
153	6191.88	4323.06	733.99
154	6198.61	4342.06	732.41

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
155	6280.17	4412.07	708.00
156	6235.08	4655.62	730.74
157	6332.61	4642.95	698.40
158	6337.83	4696.24	696.04
159	6333.17	4751.42	696.96
160	6332.82	4762.92	696.95
161	8338.55	3917.48	706.54
162	8261.82	3887.03	717.74
163	8206.84	3910.54	710.69
164	8104.44	3923.96	705.92
165	8613.32	4481.85	708.19

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
166	8593.98	4508.02	701.81
167	8611.51	4791.69	705.67
168	8607.53	4822.70	704.00
169	8579.88	4856.23	694.33
170	6341.76	4773.54	693.85
171	6345.63	4915.50	690.93
172	6270.86	4931.07	715.66
173	6385.28	4962.52	677.18
174	6390.87	5047.34	674.35
175	6389.40	5058.83	674.71
176	6305.65	5198.88	701.00

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
177	6355.11	5141.16	700.60
178	6399.40	5136.66	700.50
179	6996.47	5133.58	702.89
180	6964.50	5115.83	696.87

REVISIONS				
REV	DATE	DESCRIPTION		APP
A	6/10/11	PHASING DESIGNATIONS	DRL	
B	9/23/11	PER MDEQ COMMENTS	DRL	
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG	XZ
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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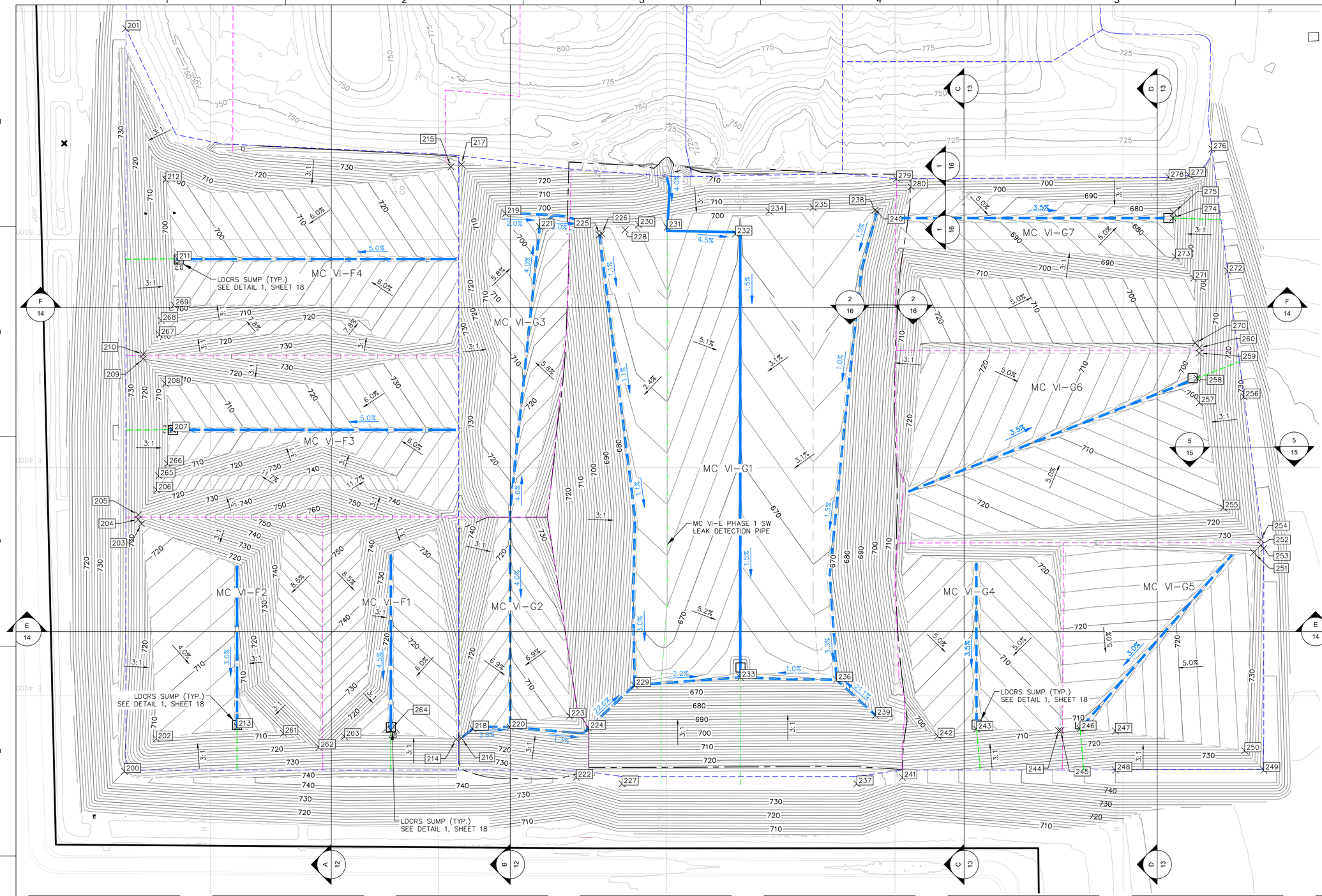
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF SUBGRADE GRADING PLAN (BOTTOM OF STRUCTURAL FILL)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
04



LEGEND

- EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- PROPERTY BOUNDARY
- MASTER CELL VI–F & G MAJOR CONTOURS
- MASTER CELL VI–F & G MINOR CONTOURS
- GRADE BREAK
- AS–BUILT BOUNDARY
- COORDINATE POINT NO.
- SLOPE
- 2 EXTRA LAYERS OF GEONET 7.5' WIDE BENEATH GEOCOMPOSITE WITH FLOW DIRECTION
- 5 EXTRA LAYERS OF GEONET, 11.5' WIDE, BENEATH GEOCOMPOSITE WITH FLOW DIRECTION
- SUBCELL BOUNDARY
- CELL BOUNDARY
- SOLID SUMP RISER PIPE
- LEAK DETECTION SUMP

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES, PIPING, AND GEOCOMPOSITE DEPICTED IN MC VI–G SUBCELLS G1–G2 REPRESENT AS–BUILT TOP OF SECONDARY LINER.

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
200	8688.12	3834.75	734.54
201	8685.01	5462.64	722.82
202	8618.20	3905.87	707.73
203	8650.61	4377.11	722.72
204	8657.79	4386.96	725.14
205	8657.75	4396.77	725.14
206	8617.41	4451.36	711.82
207	8582.14	4583.16	700.86
208	8597.91	4684.10	704.67
209	8646.85	4739.06	720.34
210	8647.14	4748.88	720.32

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
211	8571.60	4957.47	692.34
212	8597.34	5131.53	698.08
213	8441.35	3933.09	702.62
214	7961.13	3904.60	714.25
215	7972.65	5159.77	730.25
216	7949.91	3907.03	713.51
217	7949.45	5164.97	732.77
218	7924.24	3927.69	706.53
219	7853.05	5057.35	696.67
220	7842.87	3931.37	703.56
221	7778.32	5028.27	695.84

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
222	7697.85	3821.52	733.74
223	7712.50	3955.68	716.00
224	7670.78	3929.03	697.65
225	7647.54	5010.47	681.80
226	7641.99	5012.71	683.24
227	7597.85	3807.29	738.60
228	7591.06	5021.51	685.01
229	7570.29	4023.33	666.36
230	7561.67	5032.75	686.20
231	7498.71	5027.05	688.09
232	7349.00	5012.85	681.14

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
233	7338.74	4040.54	661.22
234	7275.80	5061.92	682.69
235	7179.18	5070.45	684.75
236	7127.83	4034.99	663.35
237	7083.28	3807.50	739.24
238	7043.49	5064.48	681.99
239	7042.34	3957.36	687.71
240	7039.01	5061.89	680.59
241	6983.25	3821.03	729.35
242	6905.54	3911.96	704.93
243	6821.02	3927.03	702.43

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
244	6641.59	3923.81	708.72
245	6636.63	3924.19	708.74
246	6594.37	3927.75	708.80
247	6516.74	3922.88	712.66
248	6516.74	3837.32	740.80
249	6191.88	3837.32	740.80
250	6233.58	3880.28	726.67
251	6214.04	4314.26	728.89
252	6197.41	4330.56	734.53
253	6191.88	4323.06	736.09
254	6198.61	4342.06	734.51

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
255	6280.17	4412.07	710.10
256	6235.08	4655.62	732.84
257	6332.61	4642.95	700.50
258	6337.83	4696.24	698.14
259	6333.17	4751.42	699.06
260	6332.82	4762.92	699.05
261	8339.62	3917.89	708.70
262	8261.82	3887.03	720.06
263	8205.80	3910.98	712.87
264	8104.44	3925.52	708.25
265	8612.99	4482.34	710.40

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
266	8593.61	4508.90	704.00
267	8611.29	4791.97	707.91
268	8607.34	4822.95	706.25
269	8579.58	4856.63	696.54
270	6341.76	4773.54	695.95
271	6345.63	4915.50	693.03
272	6270.86	4931.07	717.76
273	6385.28	4962.52	679.28
274	6390.87	5047.34	676.45
275	6389.40	5058.83	676.81
276	6305.65	5198.88	703.10

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
277	6355.11	5141.16	702.70
278	6399.40	5136.66	702.60
279	6996.47	5133.58	704.99
280	6964.50	5115.83	698.97

REVISIONS					
REV	DATE		DRN	APP
A	6/10/11	REVISION DESCRIPTION	DRL	
B	9/23/11	PHASING DESIGNATIONS	DRL	
C	5/02/18	PER MDEQ COMMENTS	DRL	
F	11/20/20	SUBCELLS G2 AND G3 REVISIONS	XZ	
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	XZ	
H	8/25/21	RESPONSE TO EGLE COMMENTS	XZ	
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	XZ	

DATE:	10/08/21	
DESIGNED BY:	LEH	WRG
DRAWN BY:	WRG	LEH
CHECKED BY:	CAB	XZ
APPROVED BY:	XZ	PAA

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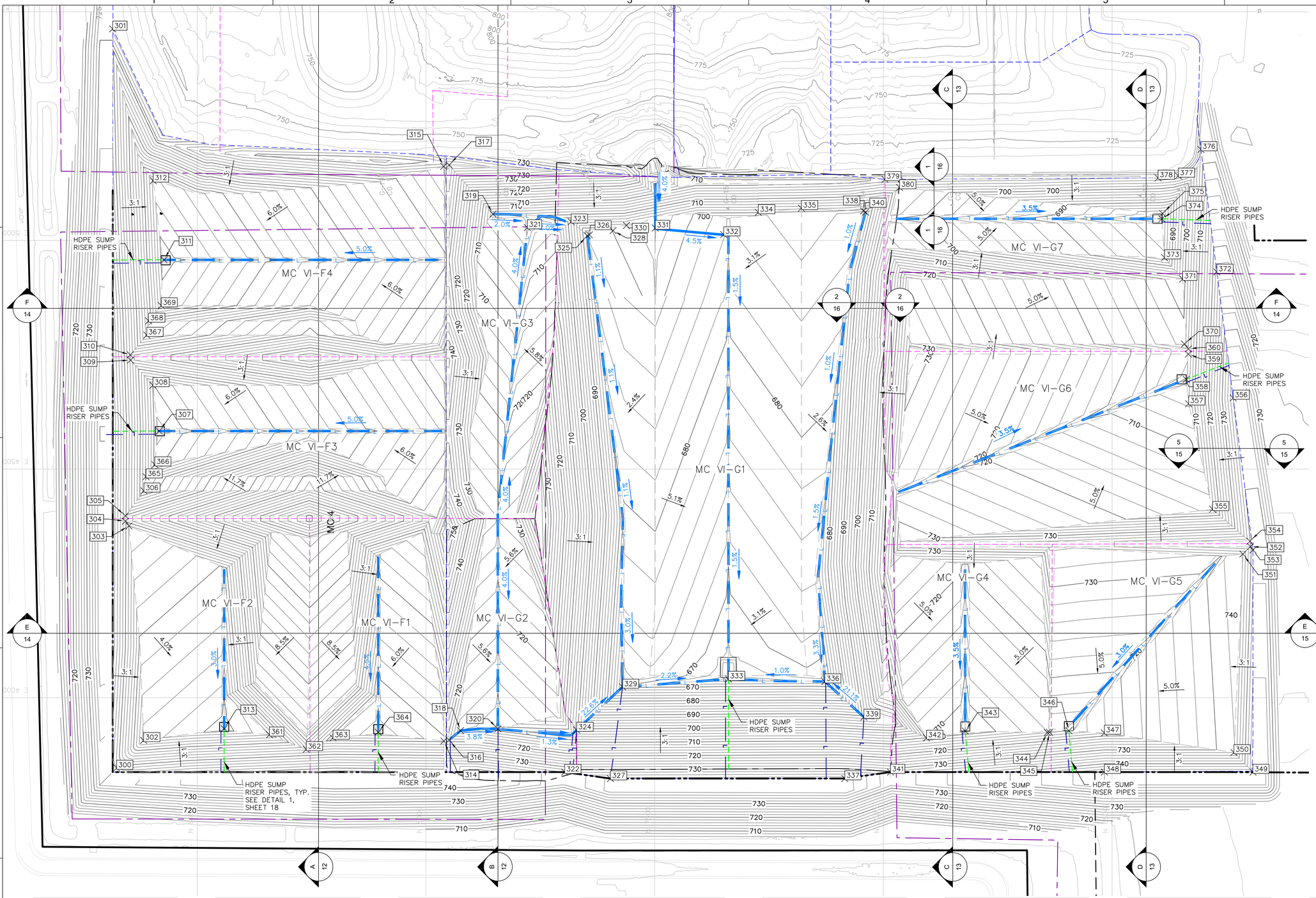
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF SECONDARY LINER GRADING PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
05



NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES, PIPING, AND GEOCOMPOSITE DEPICTED IN MC VI-G SUBCELLS G1-G2 REPRESENT AS-BUILT TOP OF PRIMARY LINER.

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
300	8676.40	3846.28	734.54
301	8685.01	5462.64	728.25
302	8617.38	3906.71	712.94
303	8649.60	4375.66	727.86
304	8657.24	4386.11	730.42
305	8657.19	4397.62	730.43
306	8616.71	4452.40	717.06
307	8583.27	4583.16	706.16
308	8597.12	4683.16	709.89
309	8646.14	4738.22	725.58
310	8646.48	4749.72	725.56

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
311	8572.76	4957.47	697.64
312	8596.51	5130.39	703.29
313	8441.35	3932.29	707.95
314	7960.91	3905.27	719.50
315	7961.26	5161.96	736.10
316	7949.75	3907.70	718.61
317	7949.45	5164.97	738.31
318	7924.50	3928.02	711.75
319	7853.52	5057.82	702.31
320	7842.87	3931.97	708.82
321	7778.32	5028.27	701.20

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
322	7696.73	3837.32	733.74
323	7682.58	5040.91	697.50
324	7670.57	3929.29	702.88
325	7647.35	5010.49	687.00
326	7642.85	5012.25	688.18
327	7596.74	3823.09	738.60
328	7591.06	5021.51	690.24
329	7570.10	4023.55	671.56
330	7561.67	5032.75	691.59
331	7498.71	5027.05	693.52
332	7349.00	5012.85	686.42

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
333	7338.74	4040.74	666.42
334	7273.49	5061.28	687.73
335	7179.18	5070.45	689.94
336	7128.04	4035.19	668.55
337	7084.38	3823.30	739.24
338	7043.49	5064.48	687.10
339	7042.63	3957.62	692.90
340	7038.96	5061.69	685.79
341	6984.38	3837.32	732.38
342	6905.54	3911.96	710.13
343	6821.02	3927.03	707.63

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
344	6641.59	3923.81	713.92
345	6636.63	3924.19	713.94
346	6594.37	3927.75	714.00
347	6516.74	3922.88	717.86
348	6516.74	3837.32	746.00
349	6191.88	3837.32	746.00
350	6233.58	3880.28	731.87
351	6214.04	4314.26	734.09
352	6197.41	4330.56	739.73
353	6191.88	4323.06	741.29
354	6198.61	4342.06	739.71

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
355	6280.17	4412.07	715.30
356	6235.08	4655.62	738.04
357	6332.61	4642.95	705.70
358	6337.83	4696.24	703.34
359	6333.17	4751.42	704.26
360	6332.82	4762.92	704.25
361	8342.16	3918.88	713.80
362	8261.82	3887.00	725.54
363	8203.29	3912.03	718.03
364	8104.44	3924.55	713.57
365	8612.28	4483.38	715.64

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
366	8592.85	4509.67	709.22
367	8610.47	4793.01	713.10
368	8606.52	4823.99	711.44
369	8578.86	4857.57	701.75
370	6341.76	4773.54	701.15
371	6345.63	4915.50	698.23
372	6270.86	4931.07	722.96
373	6385.28	4962.52	684.48
374	6390.87	5047.34	681.65
375	6389.40	5058.83	682.01
376	6305.65	5198.88	708.30

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
377	6355.11	5141.16	707.90
378	6399.40	5136.66	707.80
379	6996.47	5133.58	710.19
380	6964.50	5115.83	704.17

REVISIONS					
REV	DATE	REVISION DESCRIPTION			
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ	
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ	
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR COMMENTS	LEH	XZ	
F	05/28/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ	
E	5/29/18	ADDENDUM 4	PAA	XZ	
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ	
B	9/23/11	PER MDEQ COMMENTS		DRL	
A	6/10/11	PHASING DESIGNATIONS		DRL	
REV	DATE	REVISION DESCRIPTION	DRN	APP	

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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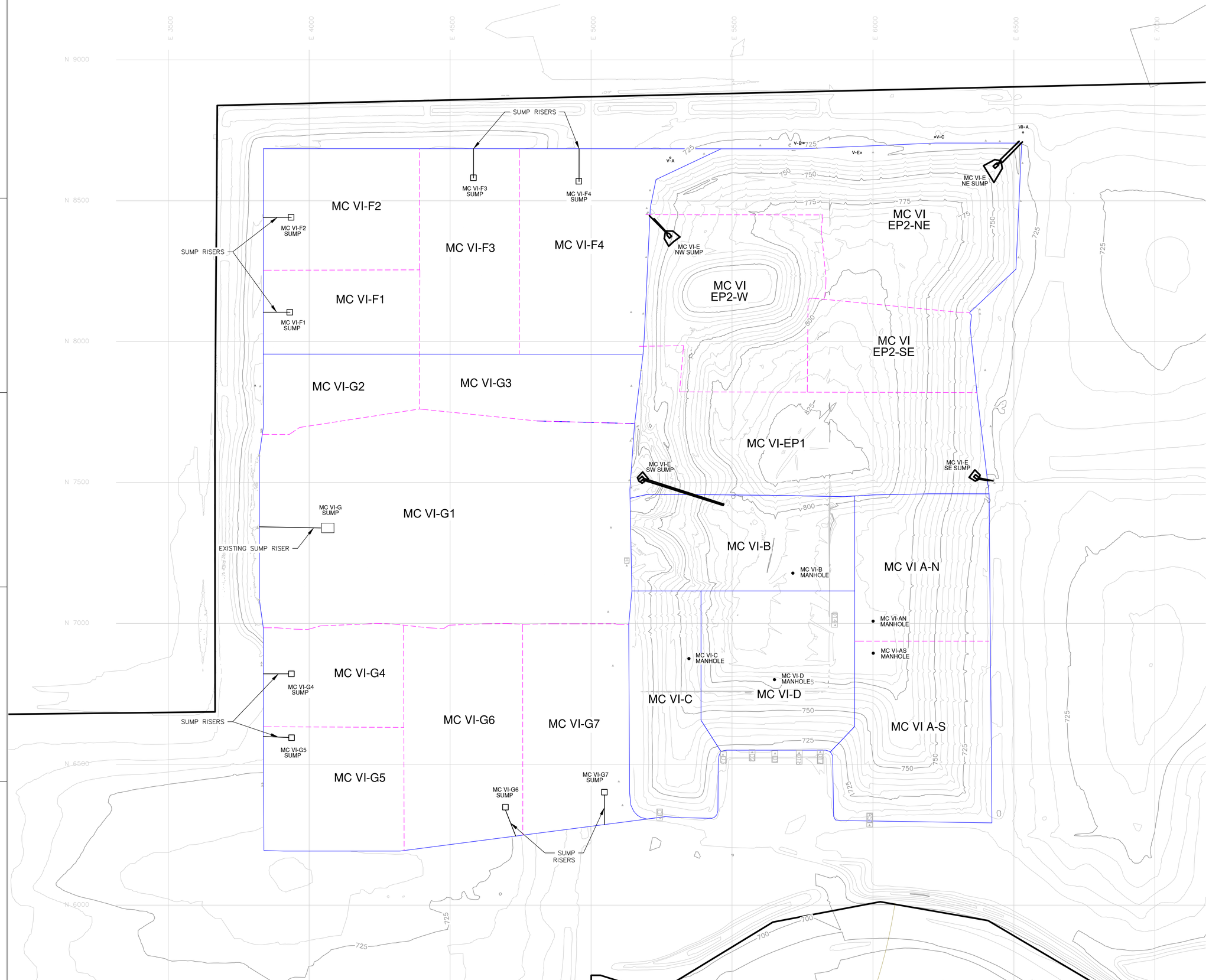
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF PRIMARY LINER GRADING PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
06



N

0 150 300

SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- SUBCELL BOUNDARIES
- CELL BOUNDARIES
- PROPERTY BOUNDARY

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN	APP
A	6/10/11	PHASING DESIGNATIONS	WRG	XZ
F	11/20/20	SUBCELLS F1–F4 REVISIONS	LEH	XZ
C	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR COMMENTS	WRG	XZ
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEACHATE MANAGEMENT PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 150'

DRAWING NO
07

AIRPORT SERVICE RD.

MC VI-F1

MC VI-F2

MC VI-F3

MC VI- F4

MC VI-G2

MC VI-G3

MC VI-EP1

MC VI EP2-NE

MC VI EP2-SE

MC VI EP2-W

MC VI-F1 SUMP

MC VI-F2 SUMP

MC VI-F3 SUMP

MC VI-F4 SUMP

MC VI-E NE SUMP

MC VI-E NW SUMP

FINAL COVER PENETRATION DETAIL SEE DETAIL 5, SHEET 19

EXTEND CLEANOUT NORTH ALONG TOP OF CELL DIKE AND DAYLIGHT AT NORTH PERIMETER DIKE

PROTECT ALL MC V MANHOLES WITH 3' RETAINING WALL/CONCRETE MH SECTION (TYP.)

SHEET 08

SHEET 09

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAKLINES
- SUBCELL BOUNDARY
- CELL BOUNDARY
- G-6 CO — LEACHATE COLLECTION SYSTEM CLEANOUTS
- V-A — EXISTING MANHOLES
- SUMP LOCATION AND COVER PENETRATION

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. CLEANOUTS IN MC VI-AN, AS, B, C, AND D ARE TO BE ABANDONED EXCEPT B1, C1, D1 THROUGH D3, D14, D17, D18, AND AS1.
3. BEFORE PLACING WASTE AROUND MC VI-C SUMP RISER, A MONITORING PROGRAM SHOULD BE IMPLEMENTED TO MONITOR ITS FUNCTIONALITY.
4. PRIOR TO PLACING WASTE AROUND CLEANOUTS E-22 THROUGH E-26, THE CLEANOUTS SHOULD BE EVALUATED TO DETERMINE IF THE LEACHATE COLLECTION LINE CAN BE CLEANED BY A SINGLE ACCESS POINT. IF NOT, THE CLEANOUT SHOULD BE EXTENDED.

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DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION	DRN	APP
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	06/17/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
08

SHEET 08
SHEET 09

MC VI-G1 EP2
MC VI-G1
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-C
MC VI-D
MC VI-B
MC VI A-N
MC VI A-S

MC VI-G SUMP
MC VI-G4 SUMP
MC VI-G5 SUMP
MC VI-G6 SUMP
MC VI-G7 SUMP
MC VI-E SW SUMP
MC VI-E SE SUMP
MC VI-C MANHOLE (SEE NOTE 3)
MC VI-B MANHOLE
MC VI-AN MANHOLE
MC VI-AS MANHOLE
MC VI-B LEAK DETECTION RISER
MC VI-AN LEAK DETECTION RISER
MC VI-C LEAK DETECTION RISER
MC VI-D MANHOLE
MC VI-AS LEAK DETECTION RISER
MC VI-D LEAK DETECTION RISER

FINAL COVER PENETRATION DETAIL SEE DETAIL 5, SHEET 19
EXTEND CLEANOUT NORTH ALONG TOP OF CELL DIKE AND DAYLIGHT AT NORTH PERIMETER DIKE
PIPING DETAIL SEE DETAIL 5, SHEET 19

N 6600
N 6800

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAKLINES
- SUBCELL BOUNDARY
- CELL BOUNDARY
- GEOCOMPOSITE (TRANSMISSIVITY 5.0 X 10^{-4} M^2/S)
- G-6 CO — LEACHATE COLLECTION SYSTEM CLEANOUTS
- EXISTING LEAK DETECTION OR SUMP RISERS
- SUMP LOCATION AND COVER PENETRATION

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. CLEANOUTS IN MC VI-AN, AS, B, C, AND D ARE TO BE ABANDONED EXCEPT B1, C1, D1 THROUGH D3, D14, D17, D18, AND AS1.
3. BEFORE PLACING WASTE AROUND MC VI-C SUMP RISER, A MONITORING PROGRAM SHOULD BE IMPLEMENTED TO MONITOR ITS FUNCTIONALITY.
4. PRIOR TO PLACING WASTE AROUND CLEANOUTS E-22 THROUGH E-26, THE CLEANOUTS SHOULD BE EVALUATED TO DETERMINE IF THE LEACHATE COLLECTION LINE CAN BE CLEANED BY A SINGLE ACCESS POINT. IF NOT, THE CLEANOUT SHOULD BE EXTENDED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	05/28/21	SUBCELLS G2 AND G3 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
C	5/02/18	PHASING DESIGNATIONS	PAA	XZ
A	6/10/11	REVISION DESCRIPTION	DRL	

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (2 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
09

AIRPORT SERVICE RD.

MC VI-F1
MC VI-F2
MC VI-F3
MC VI-F4
MC VI-G2
MC VI-G3
MC VI-EP1
MC VI EP2-W
MC VI EP2-NE
MC VI EP2-SE

DB-2, DB-12, DB-14, DB-15, DB-16, DB-17, DB-18, DB-19, DB-20, DB-21, DB-22, DB-23, DB-24, DB-25, DB-26, DB-27, DB-28, DB-29, DB-30, DB-31, DB-32, DB-33, DB-41

DIVERSION BERM DETAIL (TYP.) SEE DETAIL 3, SHEET 20

DOWNSLOPE CHANNEL DS-2 SEE DETAIL 1, SHEET 20

DOWNSLOPE CHANNEL DS-3 SEE DETAIL 1, SHEET 20

DOWNSLOPE CHANNEL DS-6 SEE DETAIL 1, SHEET 20

SHEET 10
SHEET 11

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (3/20)
- DOWNSLOPE CHANNELS (1/20)

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

REVISIONS	REV	DATE	REVISION DESCRIPTION	DRN	APP
	I	10/08/21	SUBCELLS C4-C7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
	H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
	G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR COMMENTS	LEH	XZ
	F	01/20/21	SUBCELLS F1-F4 REVISIONS	WRG	XZ

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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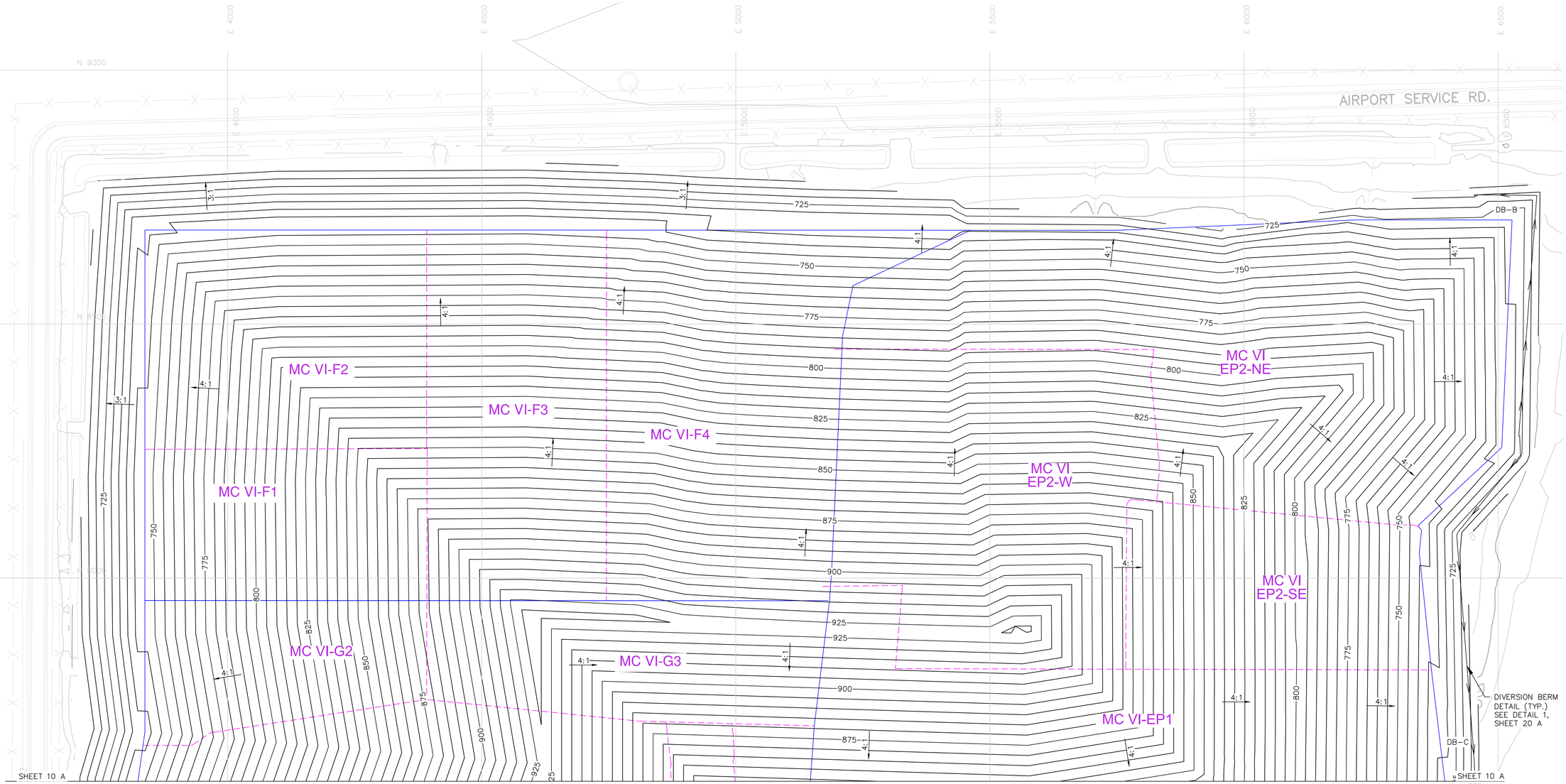
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
10



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (1 / 20 A)

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	
1	10/08/21	SUBCELLS C4-C7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG XZ
			DRN APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
10 A

SHEET 10
SHEET 11

MC VI-G1
MC VI-G1 EP2
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-B
MC VI A-N
MC VI-C
MC VI-D
MC VI A-S

DOWNSLOPE CHANNEL DS-5
SEE DETAIL 1 SHEET 20

DOWNSLOPE CHANNEL DS-1
SEE DETAIL 1, SHEET 20

DOWNSLOPE CHANNEL DS-4
SEE DETAIL 1, SHEET 20

DIVERSION BERM
DETAIL (TYP.). SEE
DETAILS 3, SHEET 20

CATCH BASIN S4A

DB-1 DB-2 DB-3 DB-4 DB-5 DB-6 DB-7 DB-8 DB-9 DB-10 DB-11 DB-12 DB-34 DB-35 DB-36 DB-37 DB-38 DB-39 DB-40 DB-42 DB-43 DB-44 DB-45

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (3/20)
- DOWNSLOPE CHANNELS (1/20)

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

REV	DATE	REVISION DESCRIPTION
F	01/20/21	SUBCELLS T1-4 REVISIONS
G	7/14/21	REVISED LINER GRADES IN T1-T4 AND OTHER MINOR COMMENTS
H	8/25/21	RESPONSE TO EGLE COMMENTS
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES

	DATE:	10/08/21
	DESIGNED BY:	LEH
	DRAWN BY:	WRG
	CHECKED BY:	CAB
	APPROVED BY:	XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
11

SHEET 10 A
SHEET 11 A

SHEET 10 A
SHEET 11 A

MC VI-G1
MC VI-G1 EP2
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-B
MC VI A-N
MC VI-C
MC VI-D
MC VI A-S

DB-A-1
DB-A-2
DB-D-1
DB-D-2
DB-E
DB-F
DB-G
DB-H

DIVERSION BERM DETAIL (TYP.)
SEE DETAILS 1, SHEET 20 A

CATCH BASIN S4A

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (1 / 20 A)

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
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DATE:	10/08/21
DESIGNED BY:	LEH
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APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	WRG	XZ
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	DRN	APP

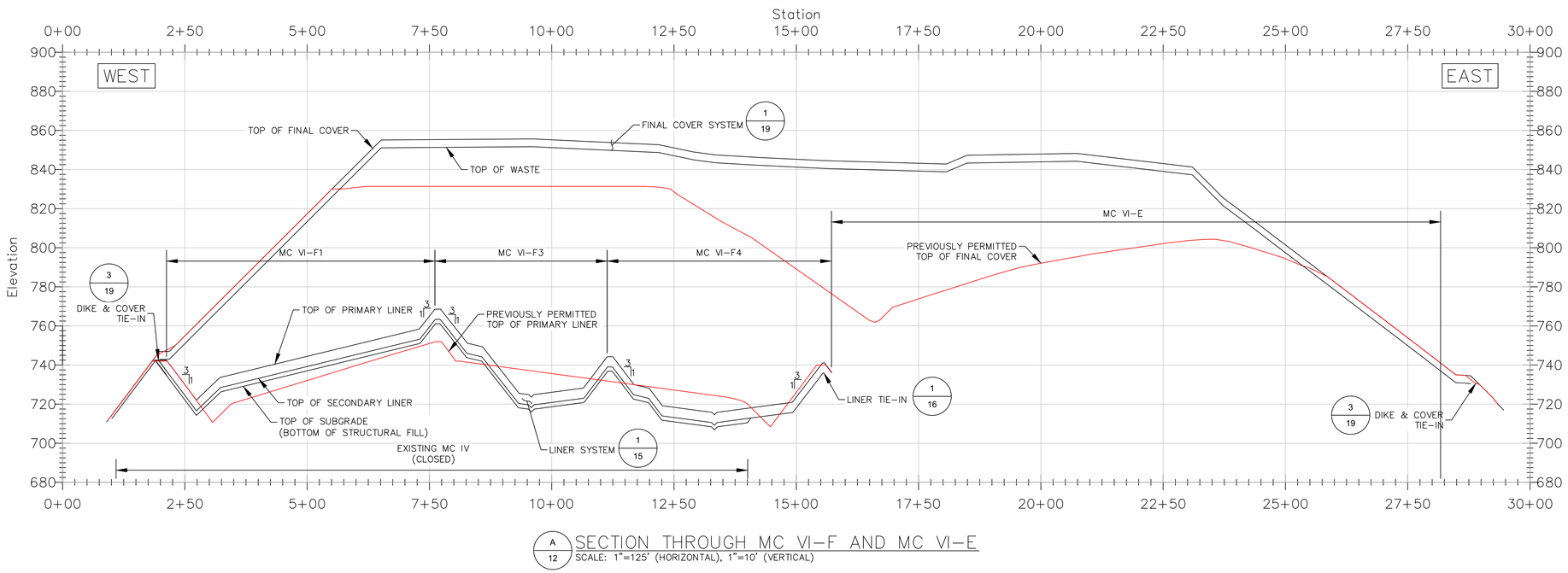
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)

PROJECT NUMBER
1218070017

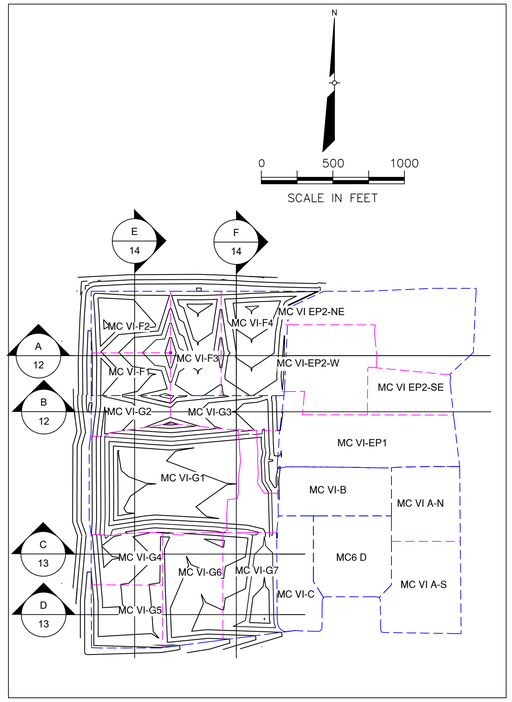
SCALE
1" = 100'

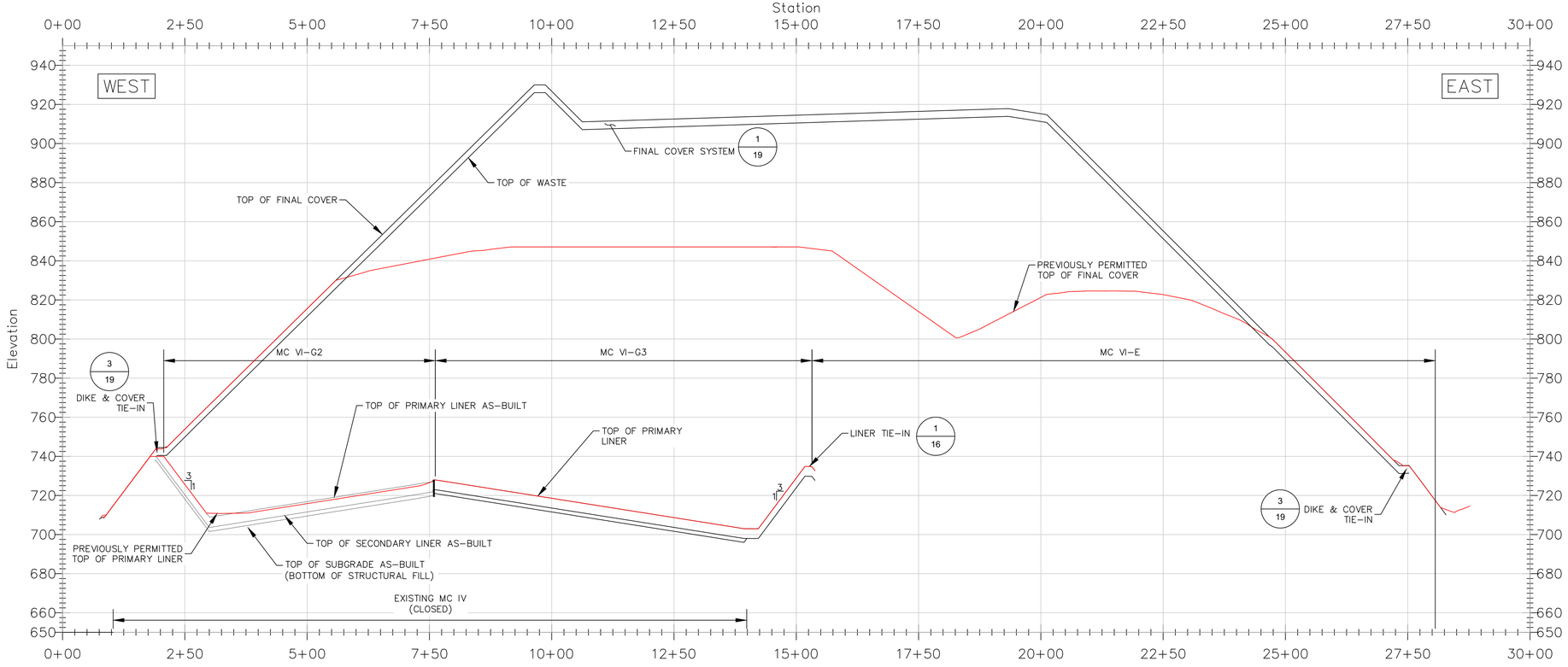
DRAWING NO
11 A



A 12 SECTION THROUGH MC VI–F AND MC VI–E

SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)





B 12 SECTION THROUGH MC VI–G2, G3, AND MC VI–E

SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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WRG	XZ	DRL	
LEH	XZ		
WRG	XZ		
	XZ	DRL	
			DRN APP

REVISIONS			
REV	DATE	REVISION DESCRIPTION	
I	10/08/21	SUBCELLS G4–G7 REVISIONS; MISCELLANEOUS CHANGES	
G	07/14/21	REVISED LINER GRADES IN F1–F2 AND OTHER MINOR CORRECTIONS	
F	05/17/21	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	
B	9/23/11	PER MDEQ COMMENTS	
A	6/10/11	PHASING DESIGNATIONS	

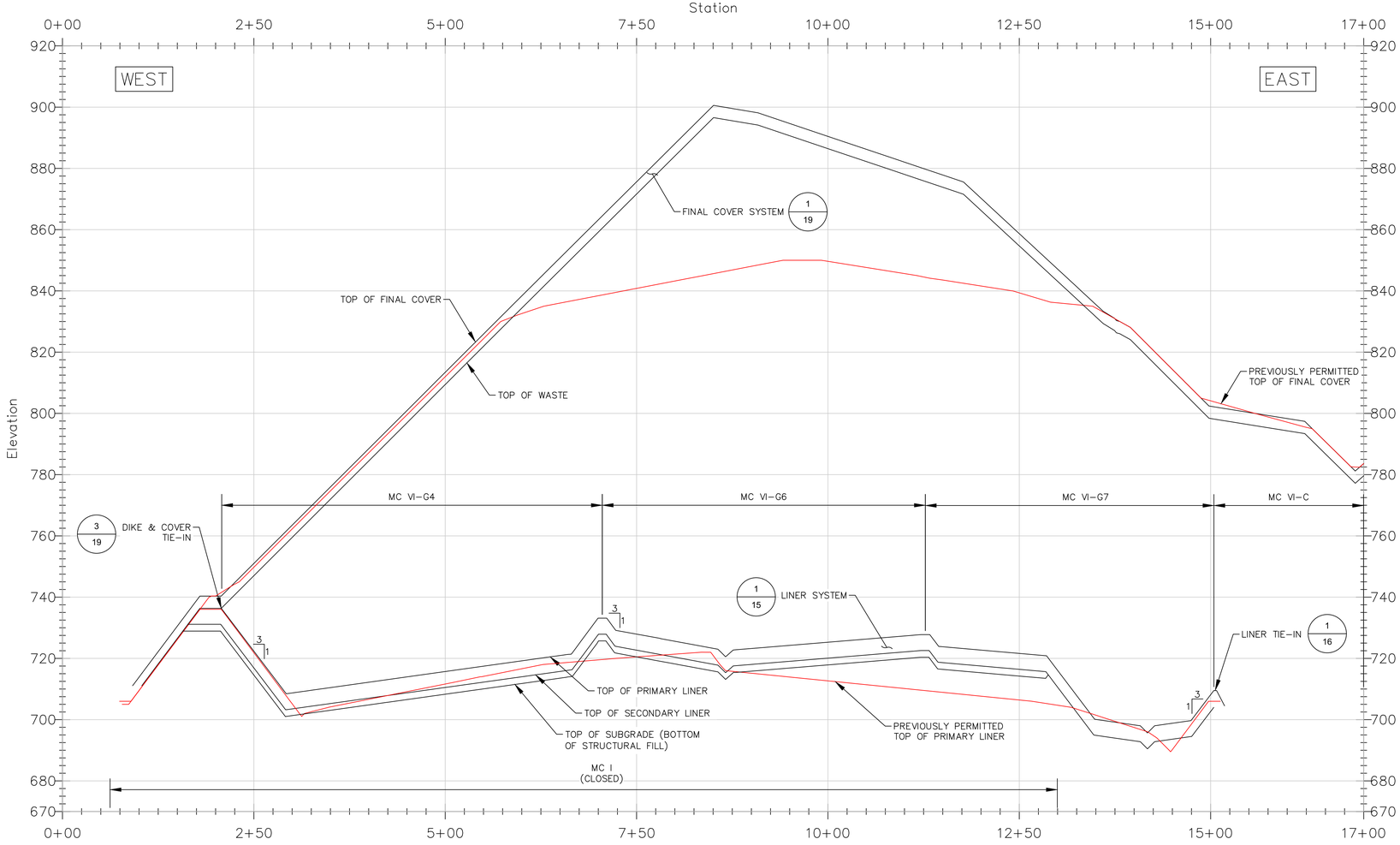
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (1 OF 3)

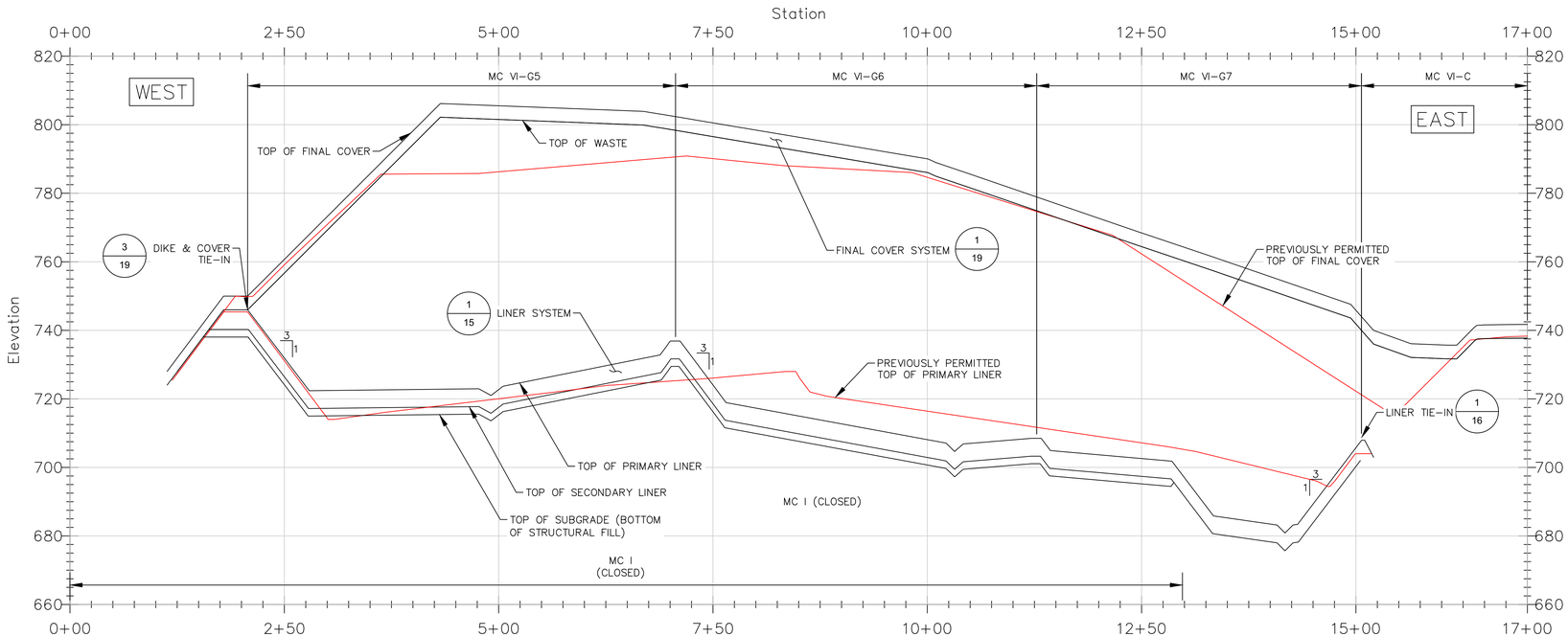
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

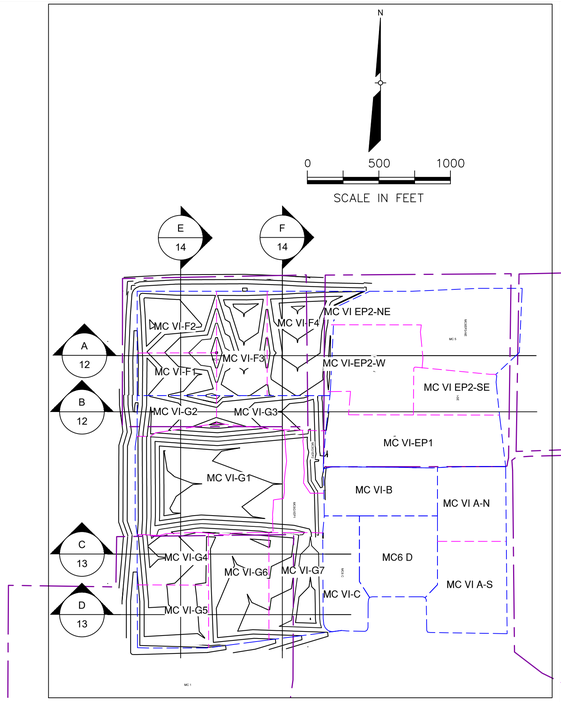
DRAWING NO
12



C/13 SECTION THROUGH MC VI–G4, G6, G7
SCALE: 1"=80' (HORIZONTAL), 1"=10' (VERTICAL)



D/13 SECTION THROUGH MC VI–G5, G6, G7
SCALE: 1"=80' (HORIZONTAL), 1"=10' (VERTICAL)



DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
G	07/14/21	REVISED LINER GRADES IN F1–F2 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG	XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ

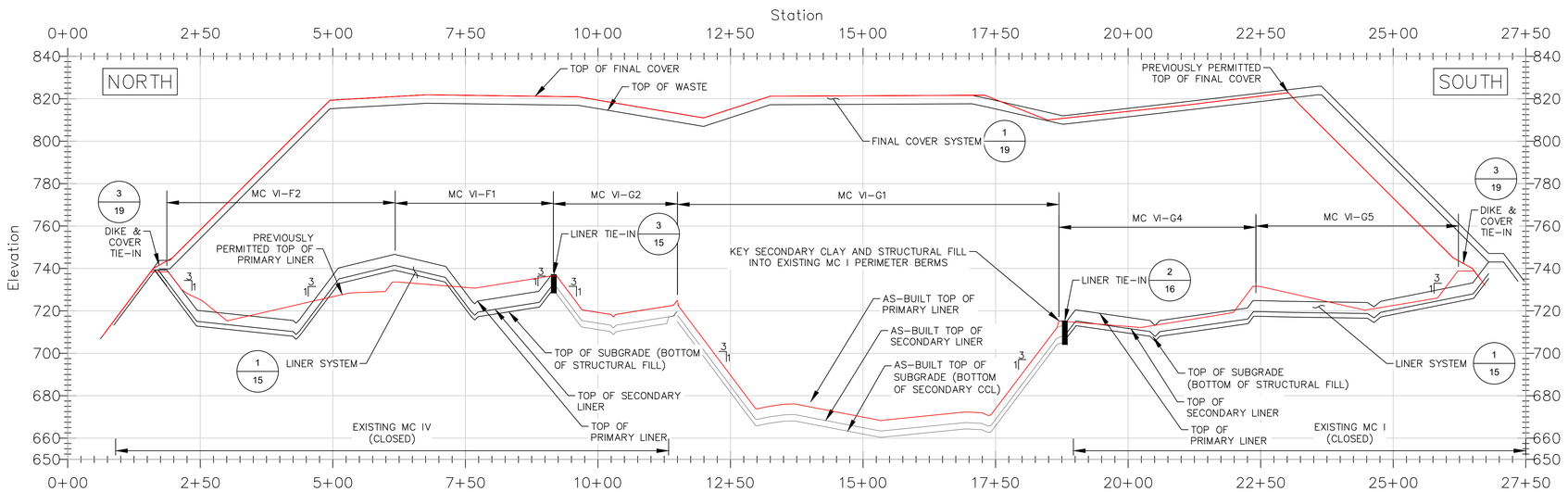
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (2 OF 3)

PROJECT NUMBER
1218070017

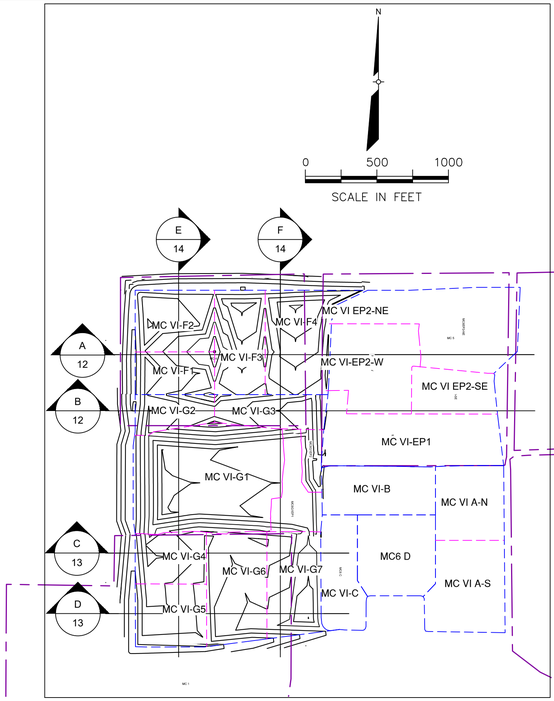
SCALE
AS SHOWN

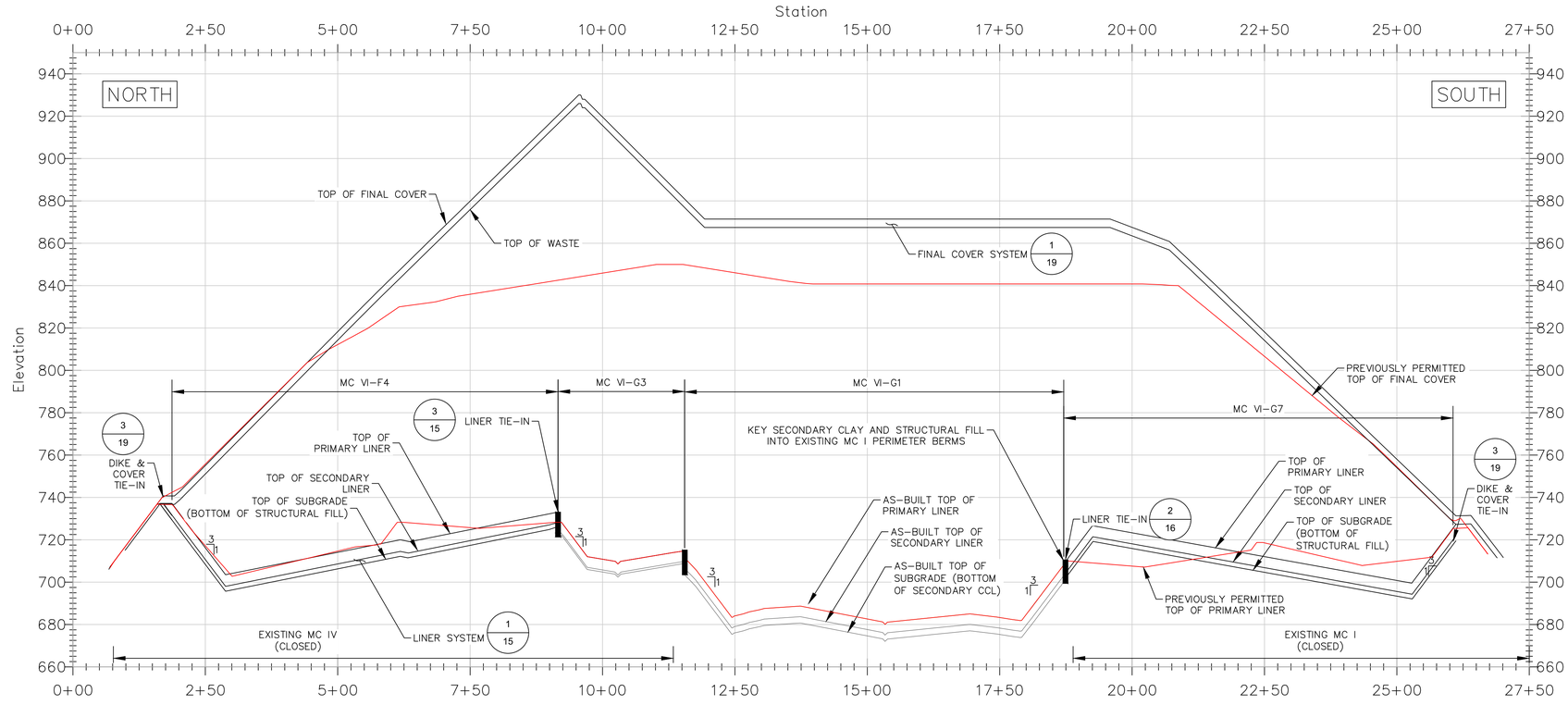
DRAWING NO
13



E 14 SECTION THROUGH PROPOSED MC VI–F AND MC VI–G

SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)





F 14 SECTION THROUGH PROPOSED MC VI–F AND MC VI–G

SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	P.AA	XZ
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG	XZ
G	07/14/21	REVISED LINER GRADES IN F1–F2 AREA	LEH	XZ
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

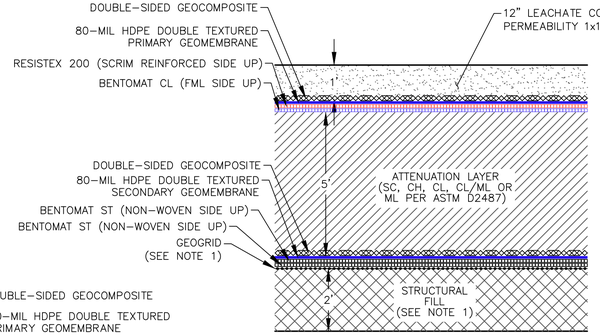
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (3 OF 3)

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

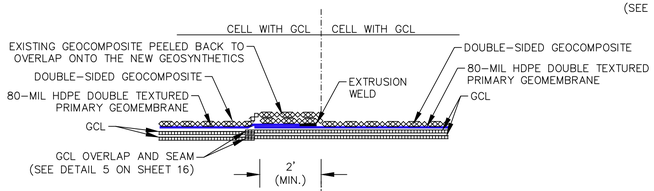
DRAWING NO
14



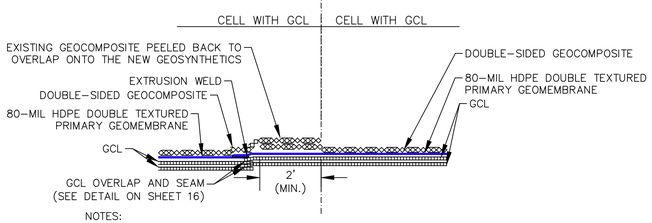
1/15 FLOOR LINER SYSTEM USING GCL
NOT TO SCALE

NOTE:

1. STRUCTURAL FILL AND GEOGRID NOT REQUIRED OUTSIDE OF MC I AND MC VI. SEE LIMITS ON SHEET 04
2. SEE DETAIL 5 SHEET 16 FOR GCL OVERLAP



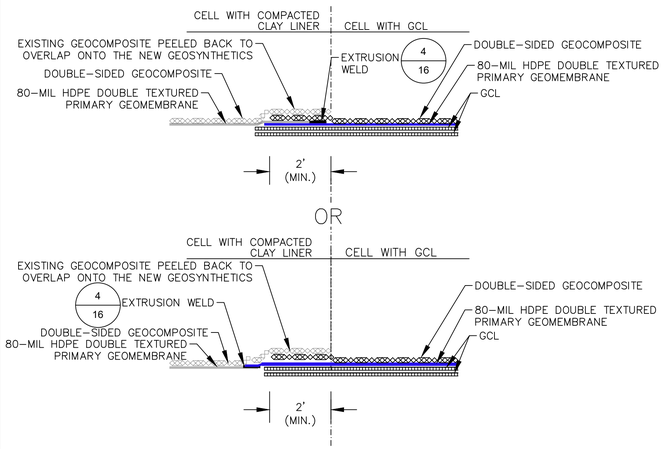
OR



NOTES:

A. NEW AND EXISTING GEOCOMPOSITE LAYERS SHALL BE CONNECTED AS FOLLOWS:
   – GEONET CORES SHALL BE JOINED BY PLASTIC FASTENERS.
   – TOP GEOTEXTILE SHALL BE SEWN TOGETHER OR COVERED WITH EXTRA NON-WOVEN GEOTEXTILE (MINIMUM 24" WIDE) HEAT BONDED TO THE EXISTING GEOTEXTILE.
B. AT GCL SEAMS, DRY BENTONITE POWDER SHALL BE APPLIED PER MANUFACTURER'S INSTALLATION GUIDELINES.
C. SEAMS SHOULD BE CONSTRUCTED SUCH THAT THEY ARE SHINGLED IN THE DIRECTION OF THE GRADE TO PREVENT FLOW FROM ENTERING THE OVERLAP ZONE.

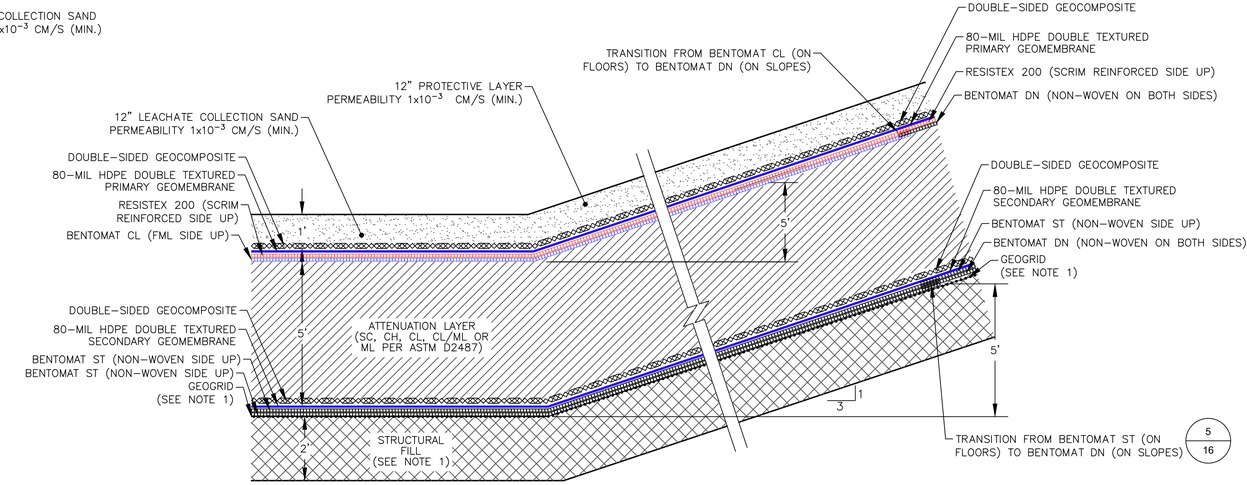
3/15 LINER TIE-IN DETAIL I
NOT TO SCALE



NOTES:

A. NEW AND EXISTING GEOCOMPOSITE LAYERS SHALL BE CONNECTED AS FOLLOWS:
   – GEONET CORES SHALL BE JOINED BY PLASTIC FASTENERS.
   – TOP GEOTEXTILE SHALL BE SEWN TOGETHER OR COVERED WITH EXTRA NON-WOVEN GEOTEXTILE (MINIMUM 24" WIDE) HEAT BONDED TO THE EXISTING GEOTEXTILE.
B. SEAMS SHOULD BE CONSTRUCTED SUCH THAT THEY ARE SHINGLED IN THE DIRECTION OF THE GRADE TO PREVENT FLOW FROM ENTERING THE OVERLAP ZONE.

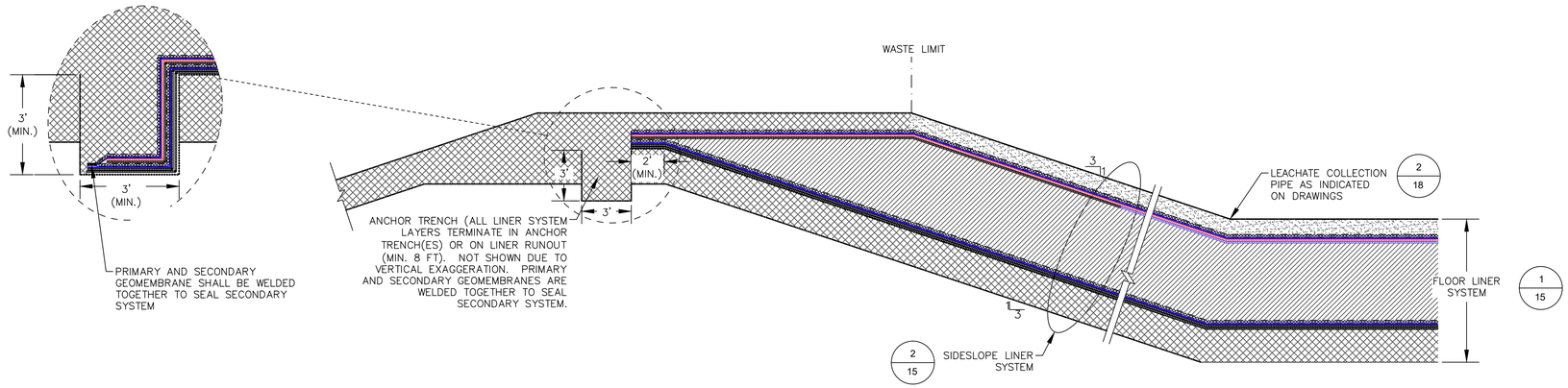
4/15 LINER TIE-IN DETAIL II
NOT TO SCALE



2/15 SIDESLOPE LINER SYSTEM USING GCL
NOT TO SCALE

NOTE:

1. STRUCTURAL FILL AND GEOGRID NOT REQUIRED OUTSIDE OF MC I AND MC IV. SEE LIMITS ON SHEET 04
2. SEE DETAIL 5 SHEET 16 FOR GCL OVERLAP REQUIREMENT.



5/15 G CELLS PERIMETER DIKE
NOT TO SCALE

REVISIONS			
REV	DATE	REVISION DESCRIPTION	
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	XZ
F	11/20/20	SUBCELLS F1-F4 REVISIONS	LEH
B	9/23/11	PER MDEQ COMMENTS	WRG
A	6/10/11	PHASING DESIGNATIONS	XZ
			DRL
			DRN
			APP

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

CTI and Associates, Inc.
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Novi, Michigan 48377
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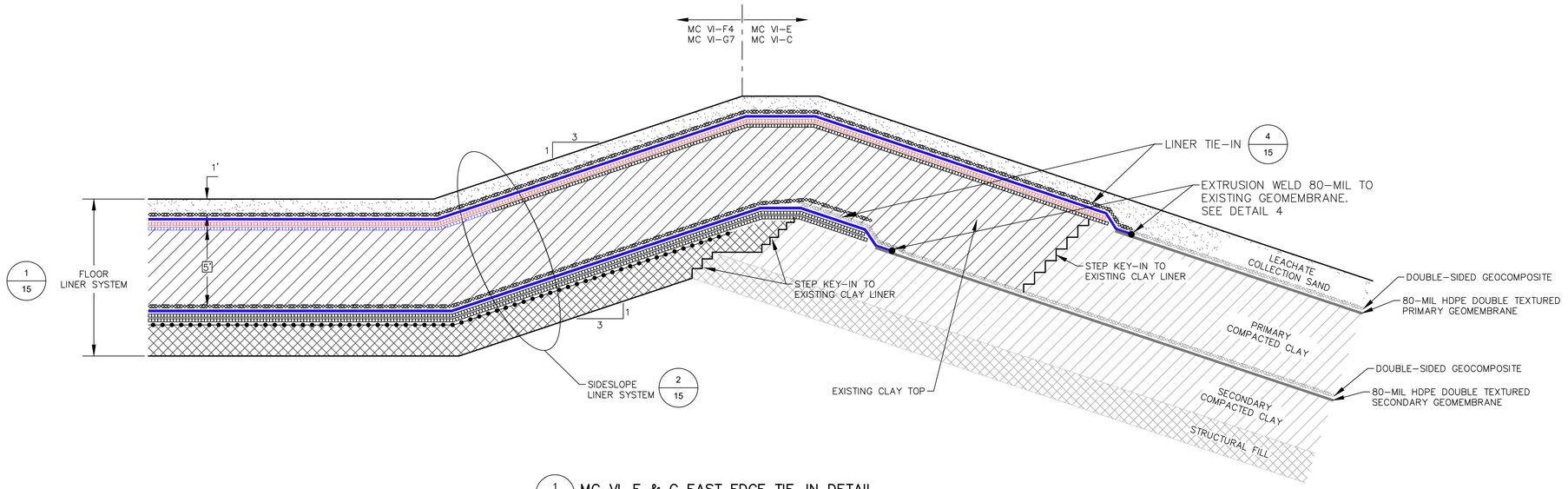
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (1 OF 2)

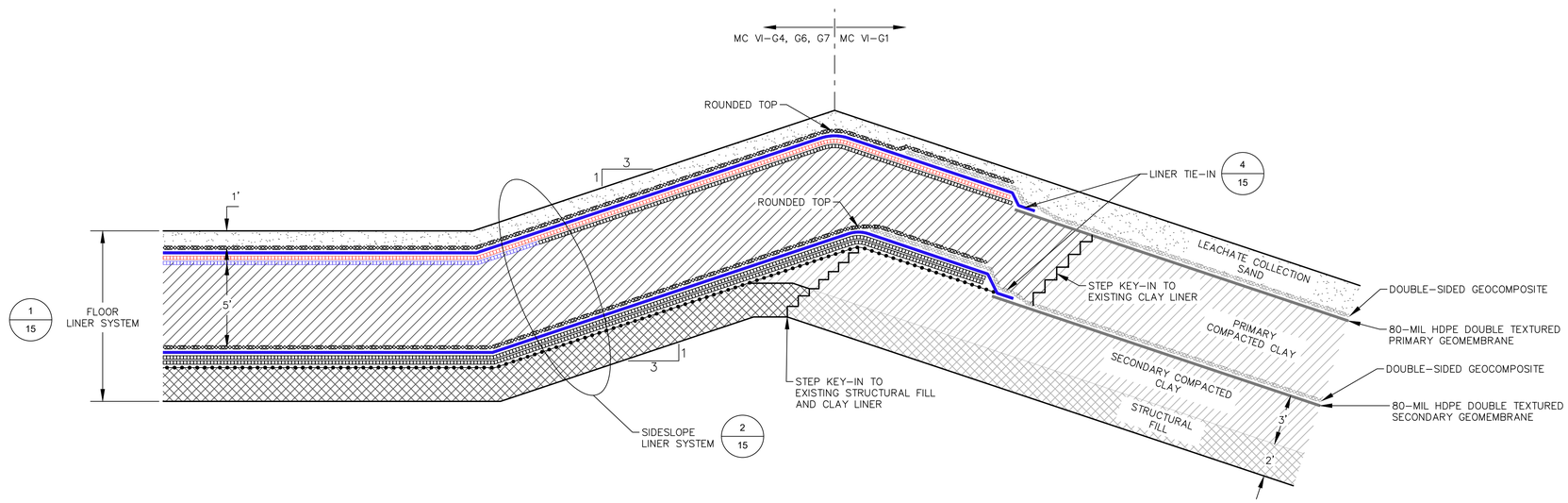
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

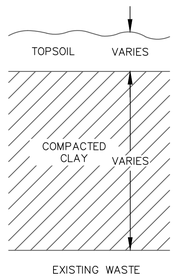
DRAWING NO
15



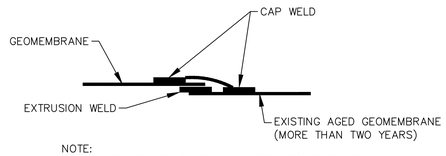
1/16 MC VI-F & G EAST EDGE TIE-IN DETAIL
NOT TO SCALE



2/16 MC VI-G1 TO MC VI-G4, G6, AND G7 TIE-IN DETAIL
NOT TO SCALE

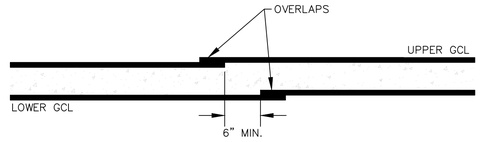


3/16 MC I & MC IV COVER DETAIL
NOT TO SCALE



NOTE:
DETAIL APPLIES AT LOCATIONS WHERE GEOMEMBRANE
TIES INTO EXISTING GEOMEMBRANE

4/16 GEOMEMBRANE WELDING DETAIL
NOT TO SCALE



5/16 GCL OVERLAPS SEPARATION REQUIREMENT
NOT TO SCALE

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DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION	BY	CHK	APP
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ	XZ
F	11/20/20	SUBCELLS F1-F4 REVISIONS	WRG	XZ	XZ
E	5/29/18	ADDENDUM 1 REVISIONS	PAA	XZ	XZ
D	5/08/18	REVISION BASED ON MDEQ'S COMMENTS	PAA	XZ	XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ	XZ
B			DRN	APP	

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
LINER SYSTEM DETAILS (2 OF 2)
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (2 OF 2)

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

DRAWING NO
16

Geosynthetic Materials

Material	Location	Description	Product	Additional Requirements
80-mil Geomembrane	Primary and secondary liners	80-mil HDPE, textured both sides	GSE HD textured, or equivalent	The CQA Consultant shall manage the direct shear testing of the geomembrane samples, as needed, per the direction of the Design Engineer and in accordance with the design requirements of the project.
40-mil Geomembrane	Final cover	40-mil HDPE, textured both sides	GSE HD textured, or equivalent	
Geosynthetic Clay Liner	Final cover and secondary liner	Sodium bentonite encapsulated between two geotextiles that are needle-punched or stitch-bonded together	CETCO Bentomat ST, or equivalent	The CQA Consultant shall manage the direct shear testing of the GCL samples, as needed, per the direction of the Design Engineer and in accordance with the design requirements of the project.
Geosynthetic Clay Liner	Primary and secondary liners	Sodium bentonite encapsulated between two geotextiles that are needle-punched together	CETCO Bentomat DN, or equivalent	
Geosynthetic Clay Liner	Primary liner	Sodium bentonite encapsulated between two geotextiles that are needle-punched and laminated to a geofilm	CETCO Bentomat CL, or equivalent	
Geosynthetic Clay Liner	Primary Liner	Polymer-modified bentonite	CETCO Resistex 200 FLW9, or equivalent	
Geocomposite	LCS	HDPE, bonded top and bottom to geotextile meeting requirements of geotextile; geocomposite transmissivity* (minimum): MC VI-F1, F3, and F4: 3.2E-04 m2/sec MC VI- F2: 4.1E-04 m2/sec MC VI-G4, G5, and G6: 4.2E-04 m2/sec MC VI-G7: 7.4E-04 m2/sec	GSE FABRINET, or equivalent	Geonet and geotextile shall meet the requirements of the project plans and drawings.
Geocomposite	LDCRS	200-mil HDPE, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET, or equivalent	
Cover Geocomposite	Final cover	Refer to Stormwater Calculation (A.6.8) for minimum geocomposite transmisssivity, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET, or equivalent	
Geonet	LCS and LDCRS sumps, and LDCRS collectors	200-mil HDPE	GSE HYPERNET, or equivalent	Transmissivity requirements per the direction of the Design Engineer and in accordance with the design requirements of the project.
Geotextile	All geocomposites, gravel/geotextile envelopes for LCS, and final cover perimeter drain	Nominal 8 oz/yd^2, needle-punched, non-woven polypropylene	Amoco 4508, Synthetic Industries Geotex 801, or equivalent	AASHTO M288-96 requirements for Separation Geotextile (Class 2)
Geogrid	Above structural fill	Biaxial Polymeric Grid	Huesker Fortrac 80-80, or equivalent	None

LCS denotes leachate collection system
LDCRS denotes leak detection, collection, and removal system.
*Geocomposite Transmissivity Test Requirements:
Per ASTM 4716 with a gradient of 0.1, confining pressure of 10,000 psf, boundary conditions of geomembrane/sand;transmissivity test should be run until the sample reaches equilibrium (becomes asymptotic) or 100 hours, whichever comes first.

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REV	DATE	DRN	APP
1	10/08/21	WRG	XZ
F	11/10/20	WRG	XZ
E	5/29/18	PAA	XZ
D	5/09/18	PAA	XZ

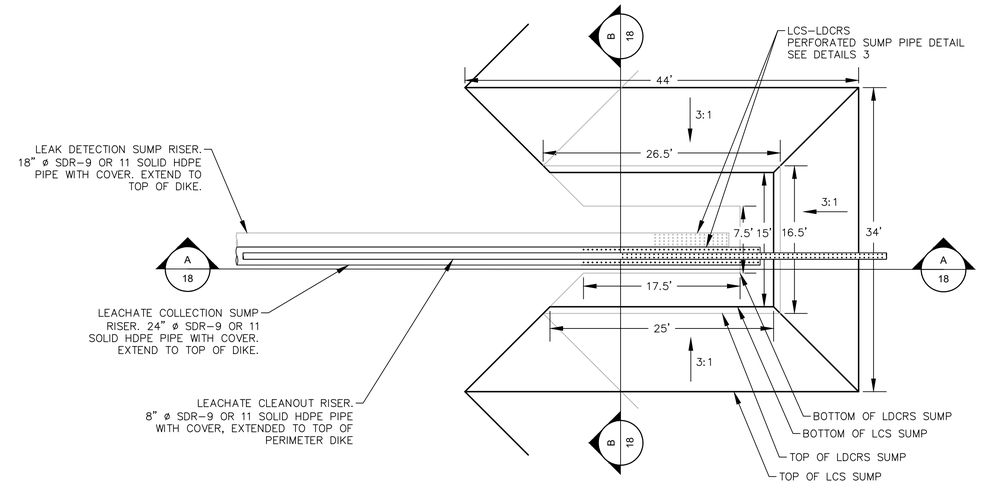
DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

1 10/08/21 SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES
F 11/10/20 SUBCELLS F1-F4 REVISIONS
E 5/29/18 ADDENDUM 1
D 5/09/18 REVISION BASED ON MDEQ'S COMMENTS
REV DATE REVISION DESCRIPTION

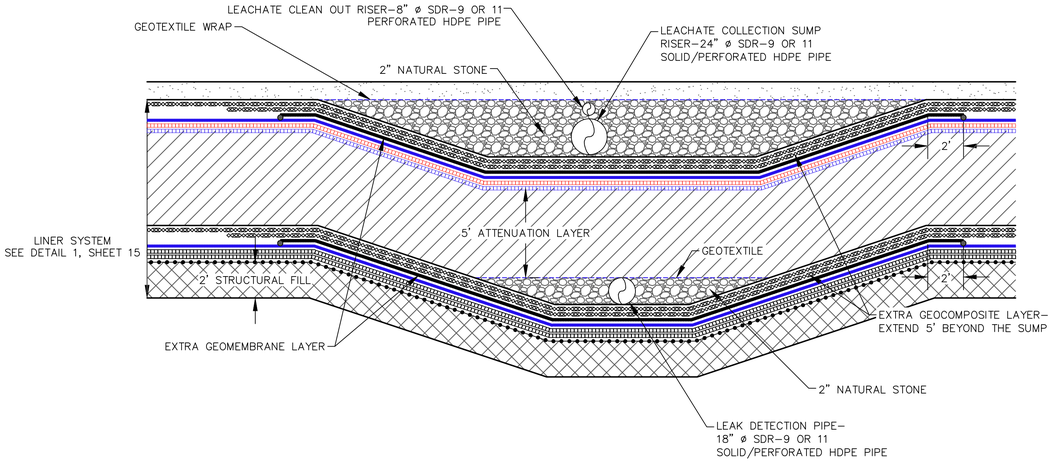
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

GEOSYNTHETIC MATERIALS REQUIREMENTS

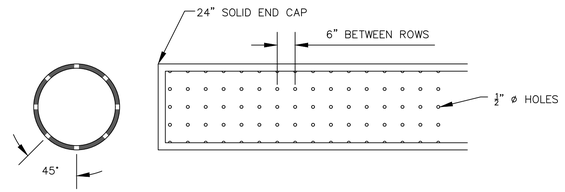
PROJECT NUMBER 12180700017
SCALE AS SHOWN
DRAWING NO 17



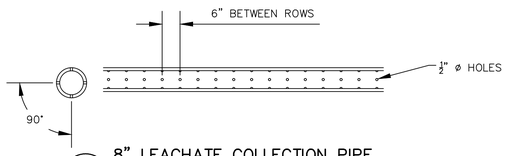
1/18 LCS-LDCRS SUMP (TYP.)
NOT TO SCALE



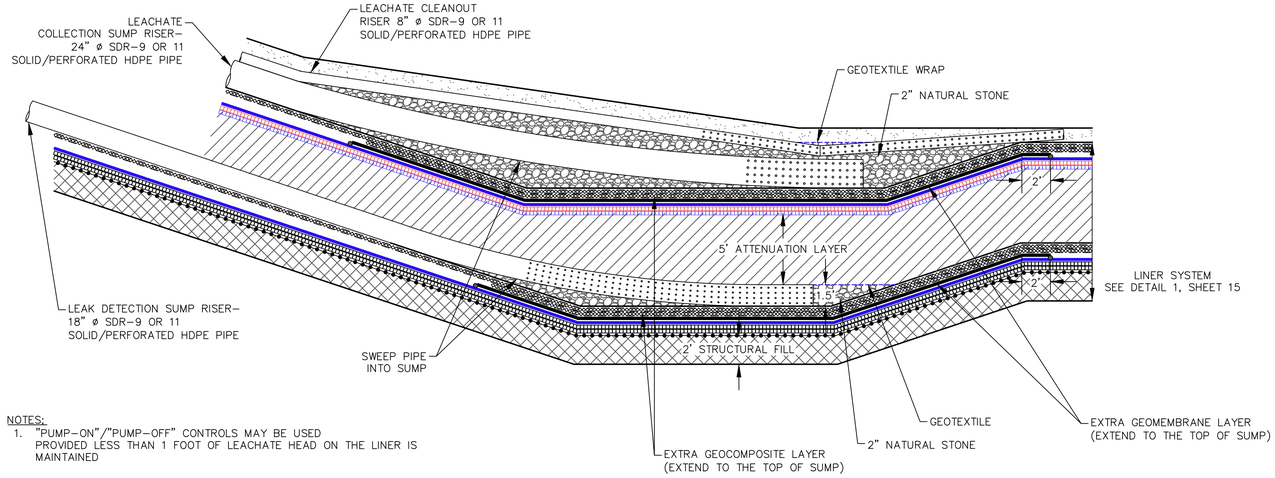
B/18 SUMP CROSS-SECTION B
NOT TO SCALE



3/18 SUMP PERFORATION SPACING DETAIL
NOT TO SCALE

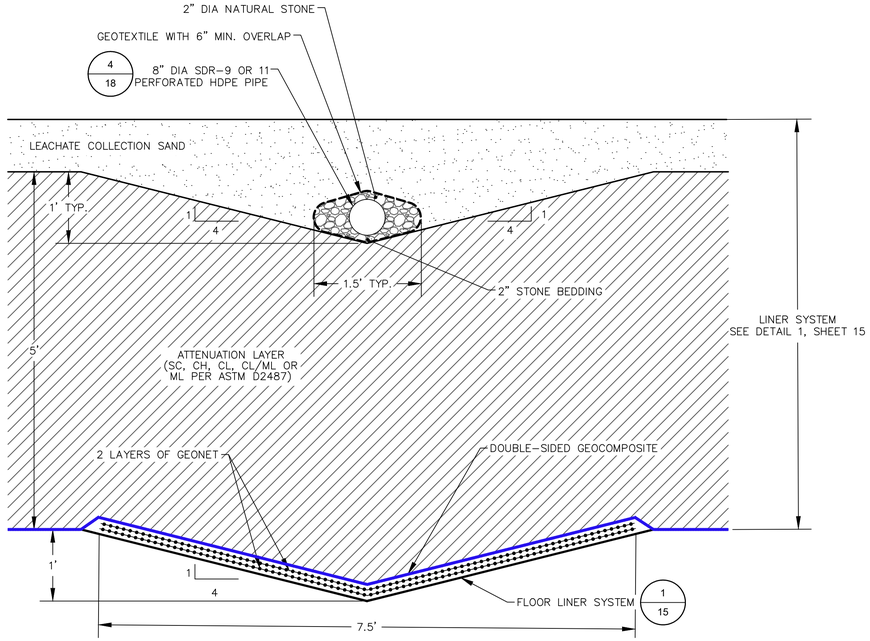


4/18 8" LEACHATE COLLECTION PIPE PERFORATION SPACING DETAIL
NOT TO SCALE



NOTES:
1. "PUMP-ON"/"PUMP-OFF" CONTROLS MAY BE USED PROVIDED LESS THAN 1 FOOT OF LEACHATE HEAD ON THE LINER IS MAINTAINED

A/18 SUMP CROSS-SECTION A
NOT TO SCALE



2/18 CELL FLOOR LEACHATE COLLECTION PIPE AND LEAK DETECTION GEONET (TYP.)
NOT TO SCALE

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION		
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN T-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	11/20/20	SUBCELLS T-H4 REVISIONS	WRG	XZ
B	9/23/11	PER MDEQ COMMENTS	DRL	
			DRN	APP

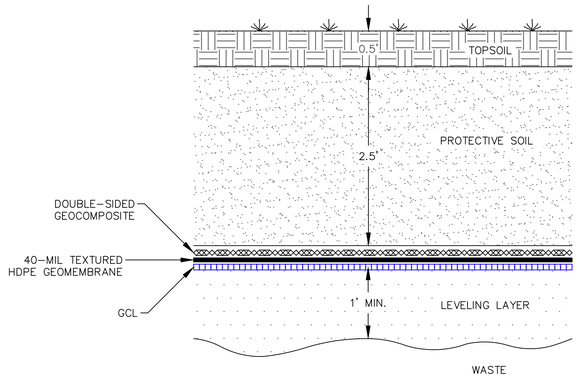
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEACHATE COLLECTION SYSTEM DETAILS

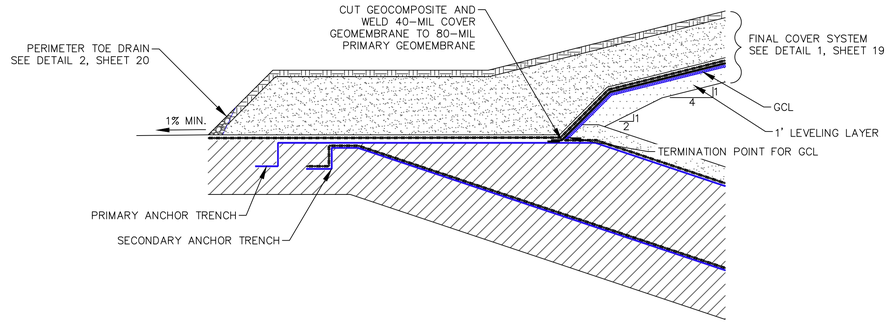
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

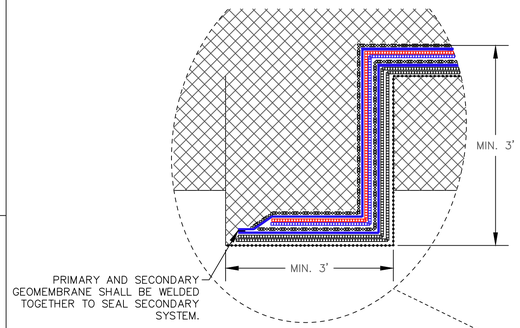
DRAWING NO
18



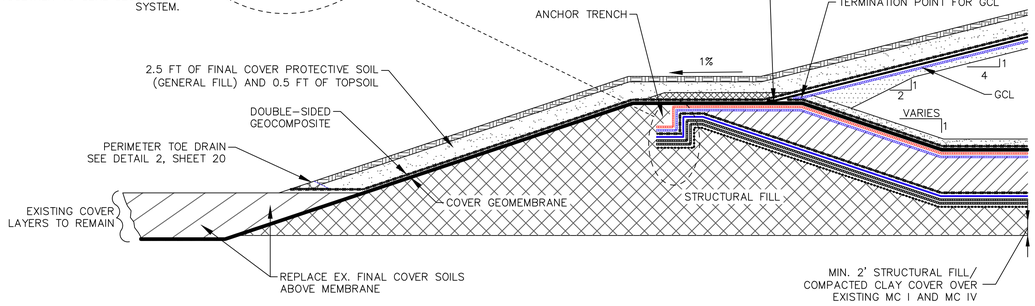
1/19 FINAL COVER SYSTEM
1"=2'



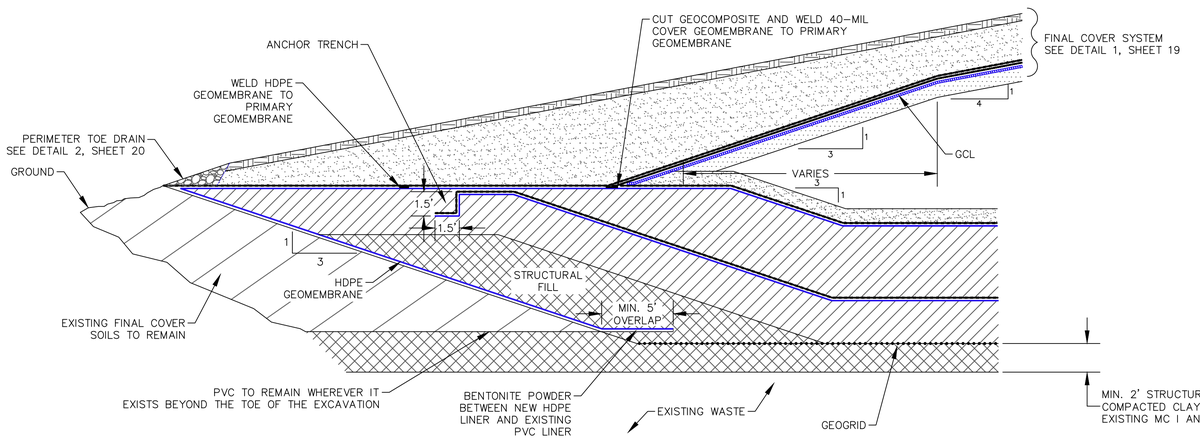
2/19 FINAL COVER TIE-IN DETAIL
MC VI-AN, AS, C & D
NOT TO SCALE



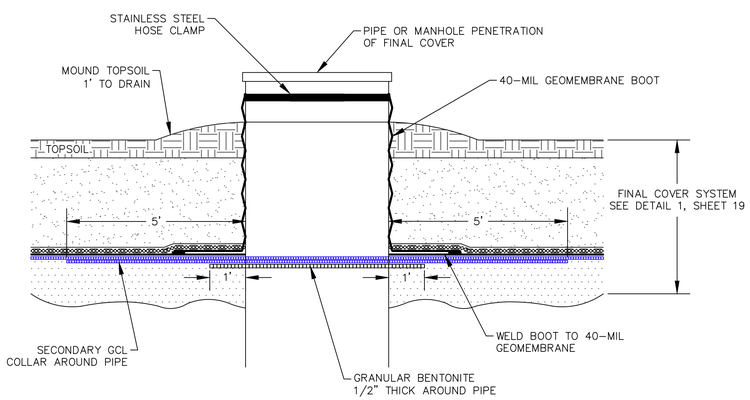
NOTE:
THE GEOMEMBRANE DOES NOT EXTEND TO THE OUTSIDE FACE OF THE PERIMETER DIKE WHERE IT IS LOCATED OUTSIDE OF THE MC I/MC IV FOOTPRINT.



3/19 DIKE AND COVER TIE-IN DETAIL (TYP.)
MC VI-F, MC VI-G, & EAST SIDE OF MC VI-E
NOT TO SCALE



4/19 DIKE AND COVER TIE-IN DETAIL
NORTH SIDE OF MC VI-E
NOT TO SCALE



5/19 FINAL COVER PENETRATION DETAIL (TYP.)
NOT TO SCALE

REVISIONS	REV	DATE	DESCRIPTION	DRN	APP
1	F	11/20/20	SUBCELLS T1-4 REVISIONS	WRG	XZ
H	G	7/14/21	REVISED LINER GRADES IN T1-4	LEH	XZ
I	H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
	I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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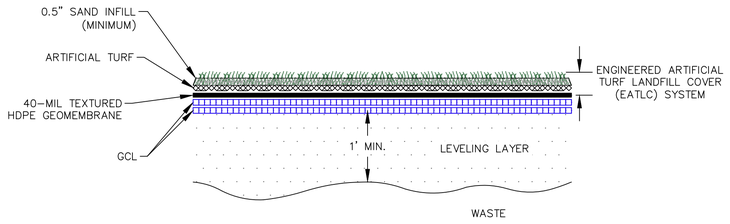
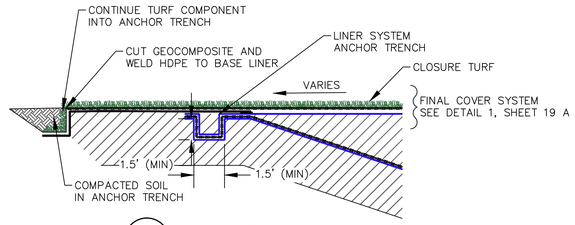
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER DETAILS

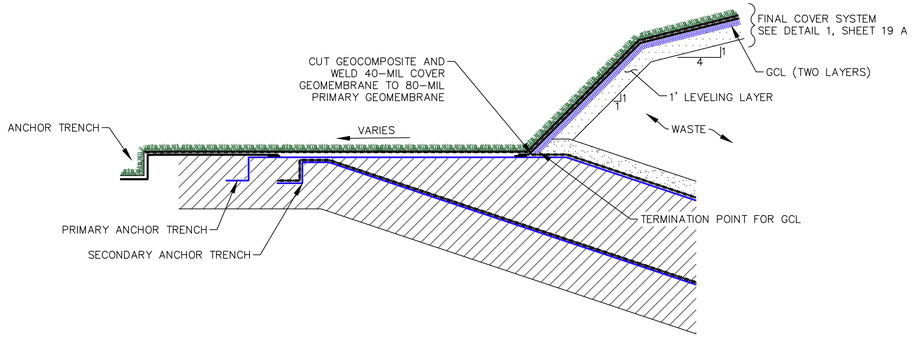
PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 19

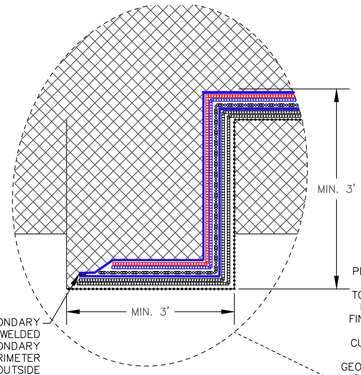


1 / 19 A **FINAL COVER SYSTEM**
NOT TO SCALE

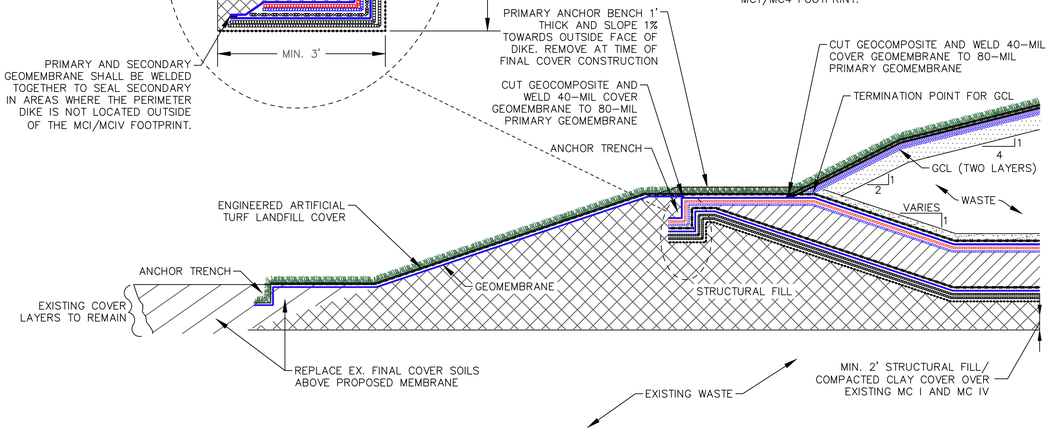


2 / 19 A **ANCHOR TRENCH**
NOT TO SCALE



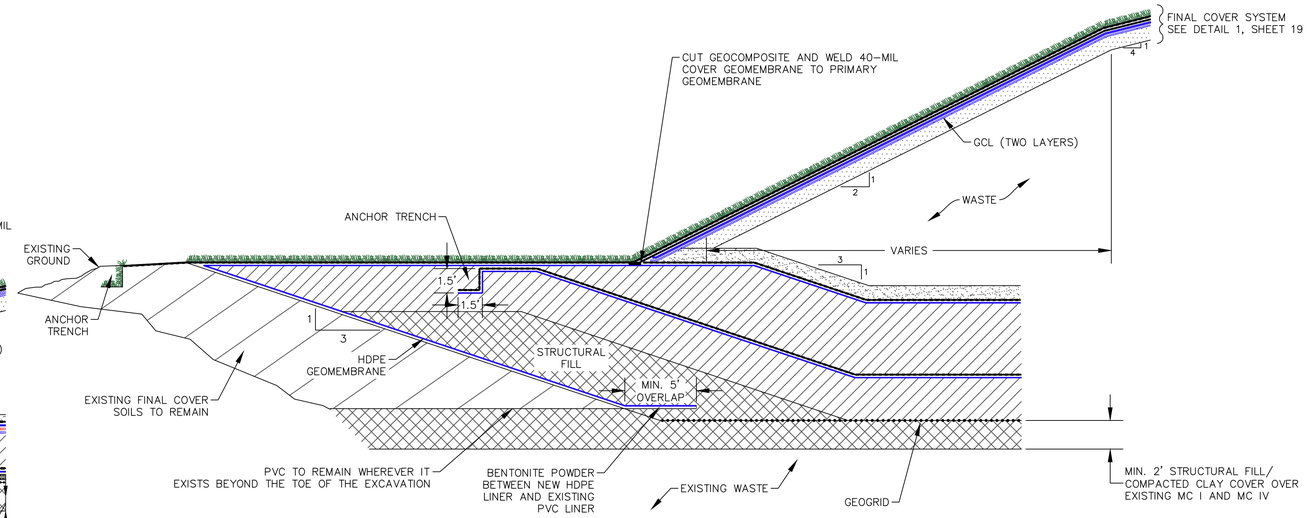


NOTE:
THE GEOMEMBRANE DOES NOT EXTEND TO THE OUTSIDE FACE OF THE PERIMETER DIKE WHERE IT IS LOCATED OUTSIDE OF THE MC1/MC4 FOOTPRINT.

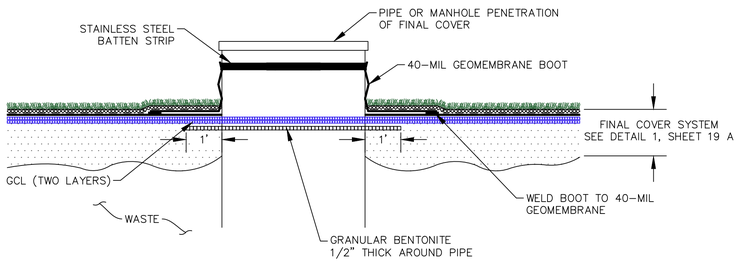


3 / 19 A **DIKE AND COVER TIE-IN DETAIL (TYP.) MC VI-F, MC VI-G, & EAST SIDE OF MC VI-E**
NOT TO SCALE

2 / 19 A **FINAL COVER TIE-IN DETAIL MC VI-AN, AS, C & D**
NOT TO SCALE



4 / 19 A **DIKE AND COVER TIE-IN DETAIL NORTH SIDE OF MC VI-E**
NOT TO SCALE



5 / 19 A **FINAL COVER PENETRATION DETAIL (TYP.)**
NOT TO SCALE

REVISIONS	REV	DATE	REVISION DESCRIPTION
	1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: C4B
APPROVED BY: XZ

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377
(248.486.5100 (fax)248.486.5050
www.ctiomponies.com

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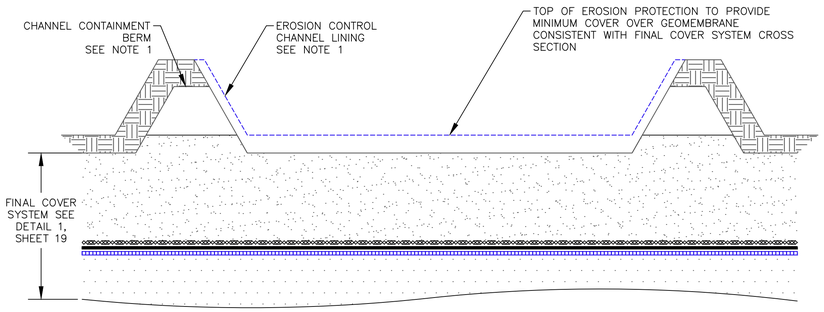
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF FINAL COVER DETAILS

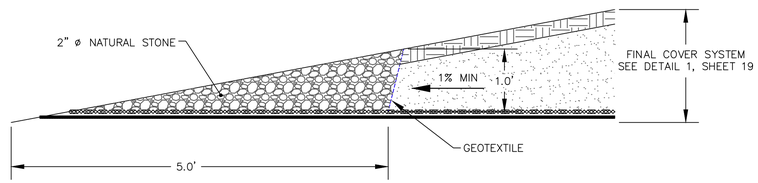
PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 19 A



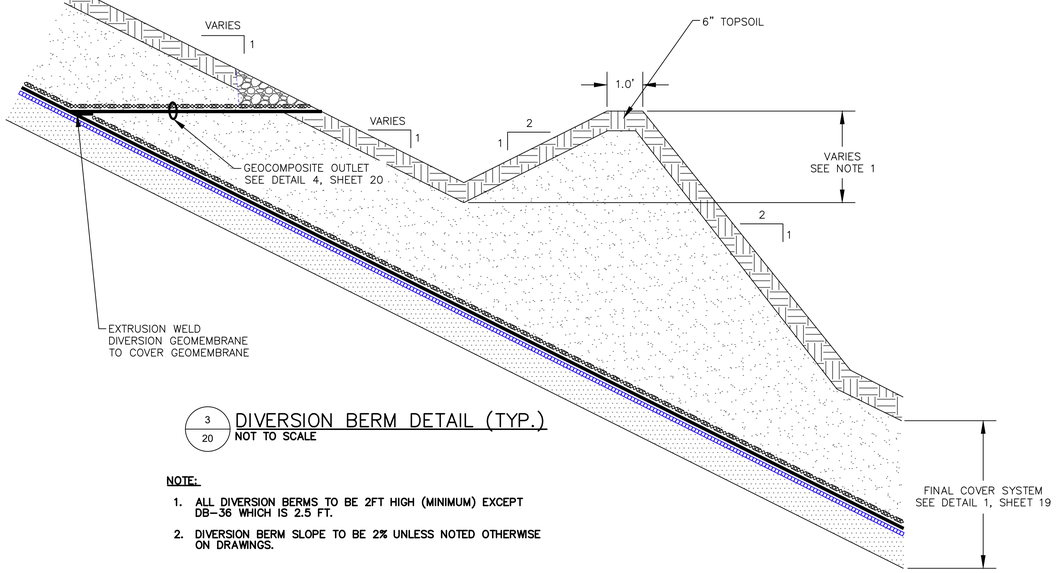
1/20 TYPICAL DOWNSLOPE CHANNEL DETAIL
NOT TO SCALE

NOTE:

1. DIMENSIONS AND CONFIGURATION OF DOWNSLOPE CHANNEL CONTAINMENT BERMS AND CHANNEL WILL BE DETERMINED BY THE EROSION CONTROL CHANNEL LINING CHOSEN. CHANNEL AND OUTLET ENERGY DISSIPATER DESIGN TO BE COMPLETED PRIOR TO CONSTRUCTION.



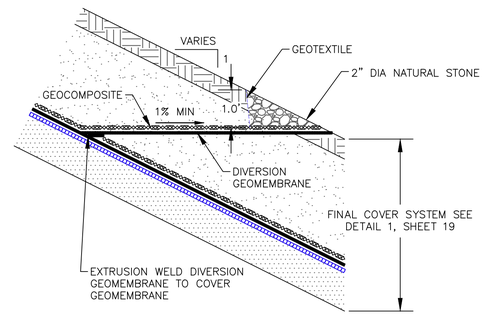
2/20 PERIMETER TOE DRAIN
NOT TO SCALE



3/20 DIVERSION BERM DETAIL (TYP.)
NOT TO SCALE

NOTE:

1. ALL DIVERSION BERMS TO BE 2FT HIGH (MINIMUM) EXCEPT DB-36 WHICH IS 2.5 FT.
2. DIVERSION BERM SLOPE TO BE 2% UNLESS NOTED OTHERWISE ON DRAWINGS.



4/20 GEOCOMPOSITE OUTLET DETAIL (TYP.)
NOT TO SCALE

NOTE:

1. ALTERNATE GEOCOMPOSITE OUTLETS SUCH AS PIPE MAY BE USED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
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REVISIONS			
REV.	DATE	REVISION DESCRIPTION	
F	11/20/20	SUBCELLS F1-F4 REVISIONS	DRN
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
			WRG
			DRN
			XZ
			XZ
			APP

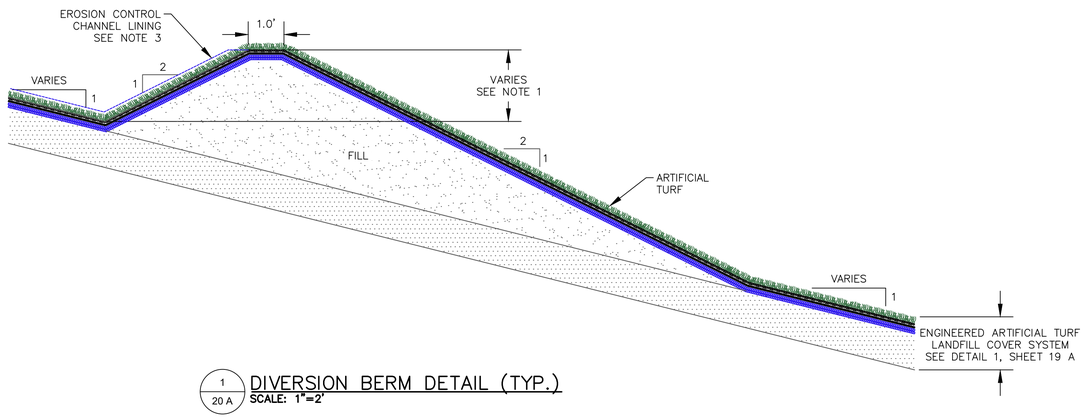
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORMWATER MANAGEMENT SYSTEM DETAILS

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

DRAWING NO
20



1 / 20 A DIVERSION BERM DETAIL (TYP.)
SCALE: 1"=2'

NOTE:

1. ALL DIVERSION BERMS TO BE 2FT HIGH (MINIMUM).
2. DIVERSION BERM SLOPE TO BE 2% UNLESS NOTED OTHERWISE ON DRAWINGS.
3. DIMENSIONS AND CONFIGURATION OF DIVERSION BERMS WILL BE DETERMINED BY THE EROSION CONTROL CHANNEL LINING CHOSEN. CHANNEL AND OUTLET ENERGY DISSIPATER DESIGN TO BE COMPLETED PRIOR TO CONSTRUCTION.

REVISIONS				
REV	DATE	REVISION DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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Novi, Michigan 48377
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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORMWATER MANAGEMENT SYSTEM DETAILS

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

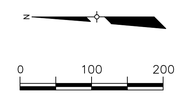
DRAWING NO
20 A

GAS VENTING LINE (TYP) — 1/21

MC VI-F4 | MC VI-G3 | MC VI-G7 | MC VI-G6 | MC VI-F3 | MC VI-G1 | MC VI-F2 | MC VI-F1 | MC VI-G2 | MC VI-G4 | MC VI-G5

450' (MAX)

5000 E | 4500 E | 4000 E

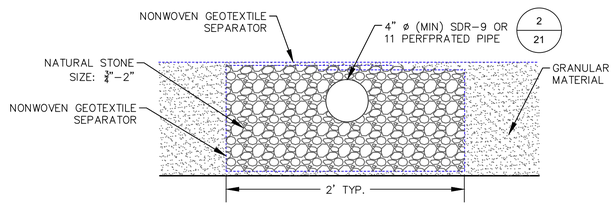


LEGEND

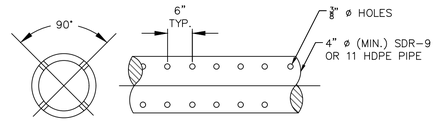
- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — MASTER CELL VI–F & G MAJOR CONTOURS
- MASTER CELL VI–F & G MINOR CONTOURS
- GAS VENTING LINE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.



1/21 VENTING LINE DETAIL FOR SUBCELLS F1–4 AND G4–7 OVER EXISTING MC I AND MC IV
NOT TO SCALE



2/21 VENTING PIPE DETAIL
NOT TO SCALE

REVISIONS			
REV	DATE	DESCRIPTION	
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	
H	8/25/21	RESPONSE TO EGLE COMMENTS	
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	
F	11/10/20	SUBCELLS F1–F4 REVISIONS	
E	5/29/18	ADDENDUM 1	
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	
REV	DATE	REVISION DESCRIPTION	

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
CONCEPTUAL GAS VENTING SYSTEM
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CONCEPTUAL GAS VENTING SYSTEM

PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 21

ORIGINAL SUBMITTAL
2021 PERMIT APPLICATION

WDI RECORD DRAWINGS
MC VI A-E AND G1-G3

WAYNE DISPOSAL SITE NO. 2

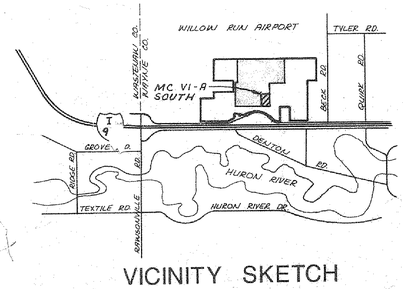
MASTER CELL VI CELL A

RECORD PLAN

WAYNE DISPOSAL

SHEET INDEX

SHEET VI A-2	CLAY SUBGRADE / SECONDARY LINER ELEVATIONS
SHEET VI A-3	PRIMARY LINER ELEVATIONS & LEACHATE COLLECTION SYSTEM
SHEET VI A-5	LINER SYSTEM DETAILS
SHEET VI A-6	LEACHATE & MONITOR SYSTEM DETAILS
SHEET VI A-7	LEACHATE COLLECTION SUMP DETAILS (CELL VI-A NORTH)



VICINITY SKETCH

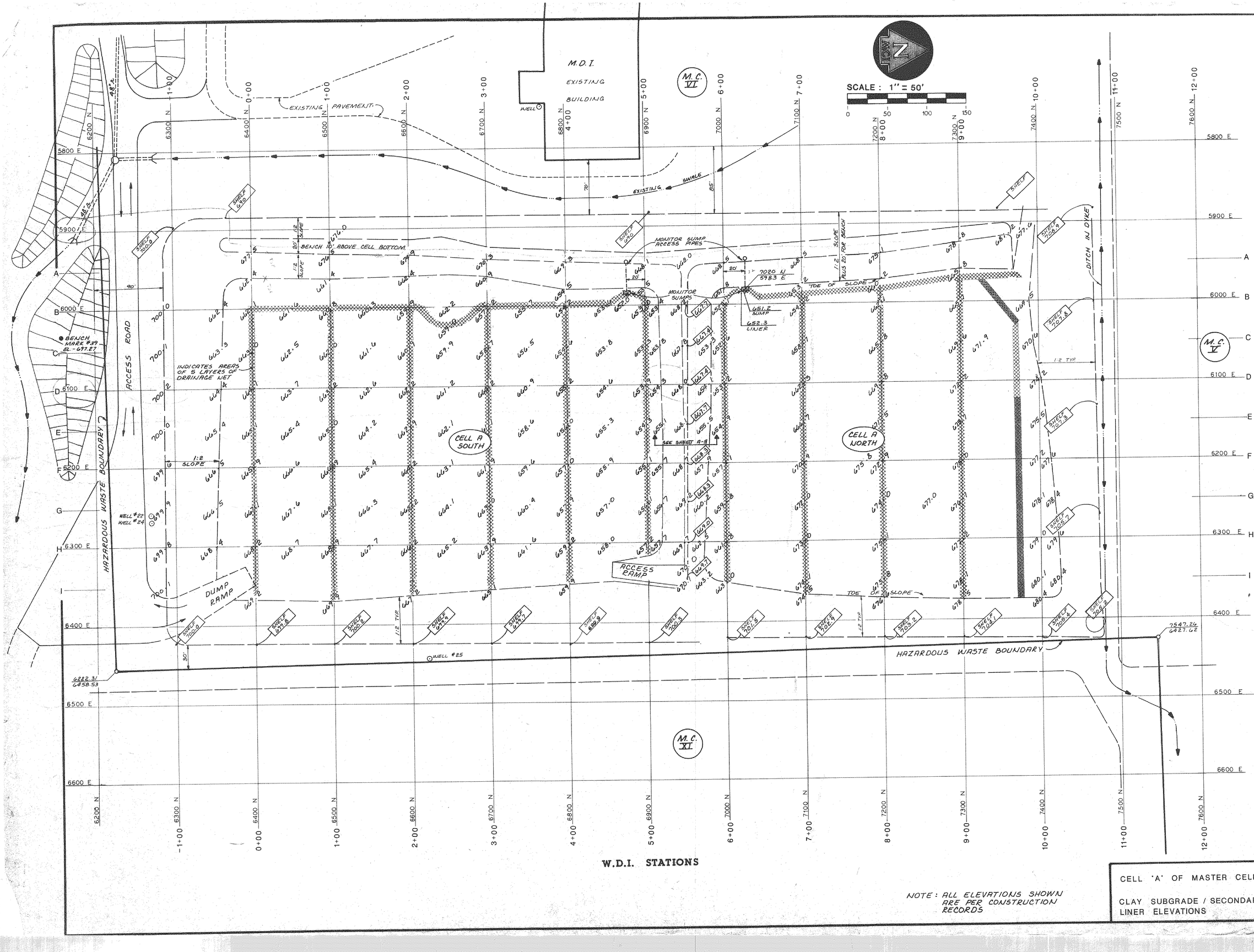
CONSTRUCTION CERTIFICATION PLAN

MASTER CELL VI - CELL "A"
DATE: NOVEMBER 7, 1986 - SOUTH
DECEMBER 9, 1987 - NORTH
PROJECT #82018

MIDWESTERN CONSULTING INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800

PREPARED BY:
MIDWESTERN CONSULTING, INC.

H. CHARLES CREMIN, P.E. #13662



NOTE : ALL ELEVATIONS SHOWN ARE PER CONSTRUCTION RECORDS

CELL 'A' OF MASTER CELL VI

CLAY SUBGRADE / SECONDARY LINER ELEVATIONS

VI A-2

RESISTIVITY SURVEY LINES

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

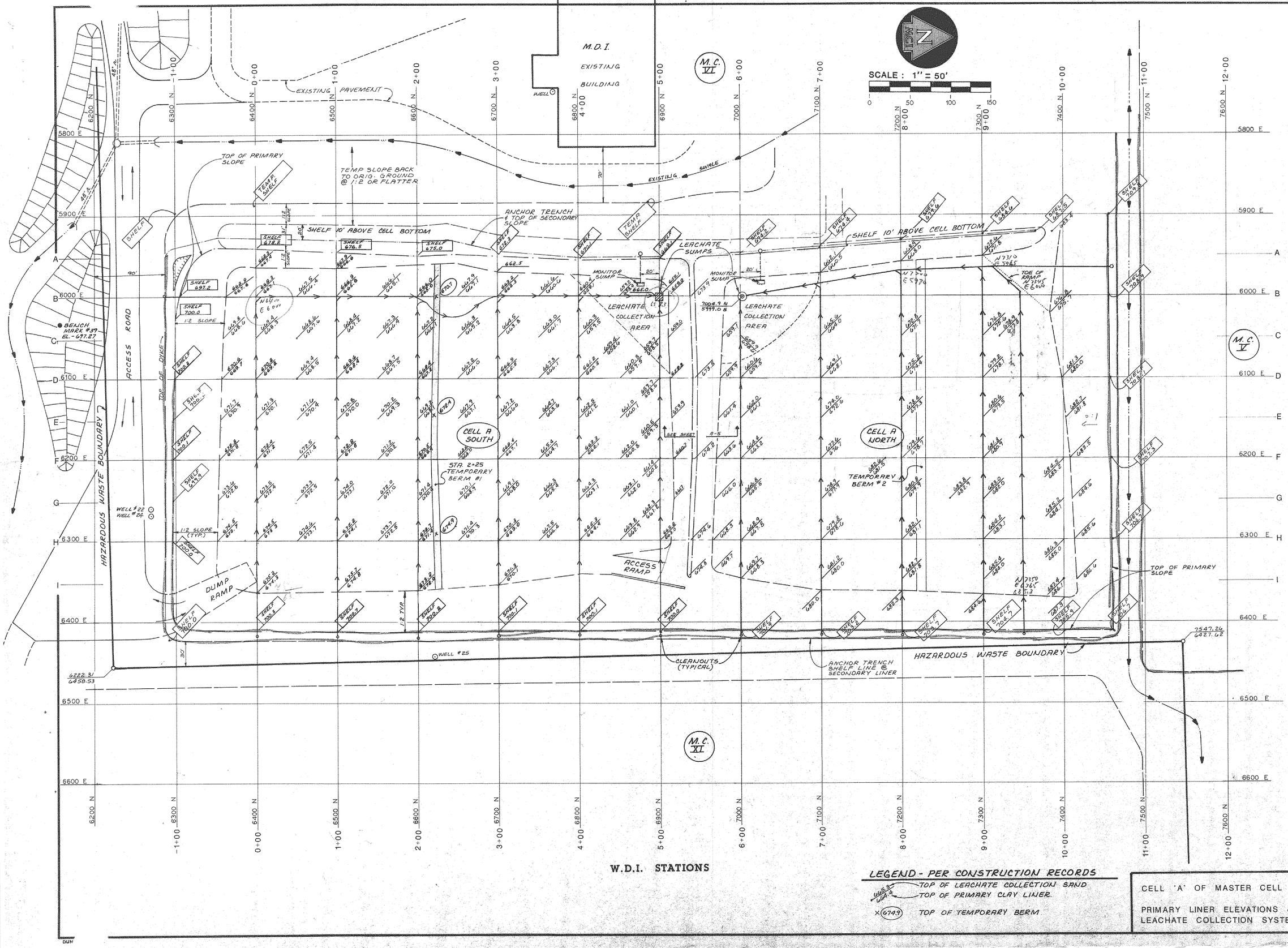
1986 CONSTRUCTION CERTIFICATION SET

DATE: JAN. 1986
SHEET OF
BY:

JOB No. 82018

REVISIONS:
5-12-86 - SOUTH
11-7-86 - NORTH
12-19-87 CONSTRUCTION RECORDS

MIDWESTERN CONSULTING INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800



CELL 'A' OF MASTER CELL VI

PRIMARY LINER ELEVATIONS & LEACHATE COLLECTION SYSTEM

VI A-3

RESISTIVITY SURVEY LINES

MIDWESTERN CONSULTING INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800

WAYNE DISPOSAL

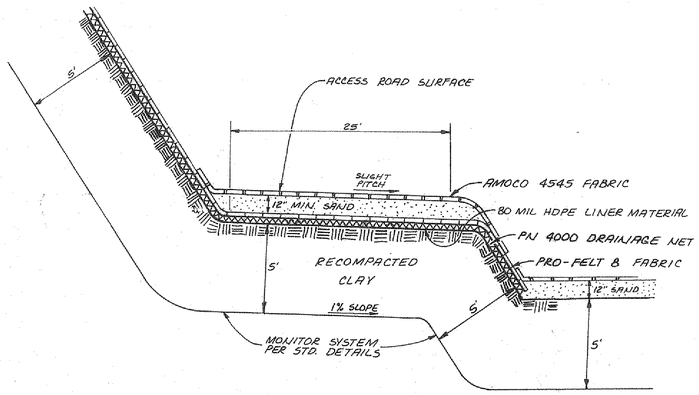
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

1986 CONSTRUCTION CERTIFICATION SET

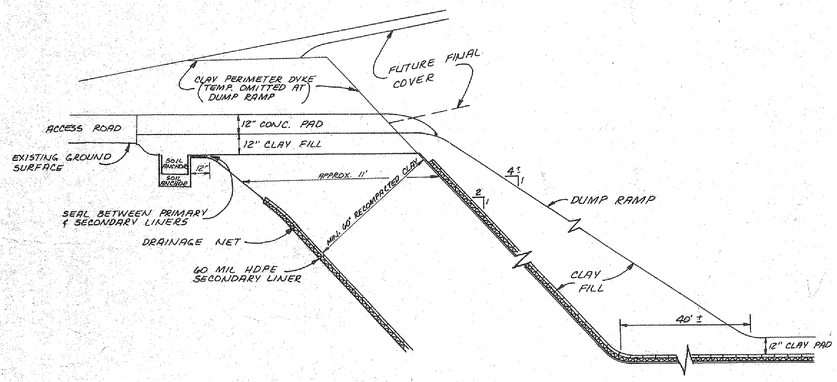
DATE: JAN. 1986
SHEET OF
SET:

JOB NO. 82018

REVISIONS:
REV. CELL ELEVATIONS 5-20-86
REV. CONSTRUCTION RECORDS 12-9-87
- SOUTH
- NORTH

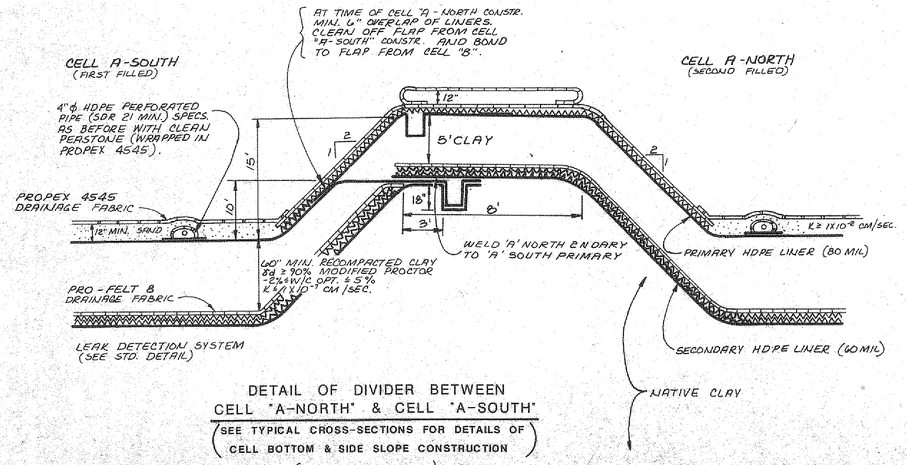


DETAIL FOR FABRIC CROSSING AT ACCESS RAMP IN SIDE SLOPE



SIDEWALL SECTION THRU DUMP RAMP AT S.E. COR. CELL VI-A SOUTH

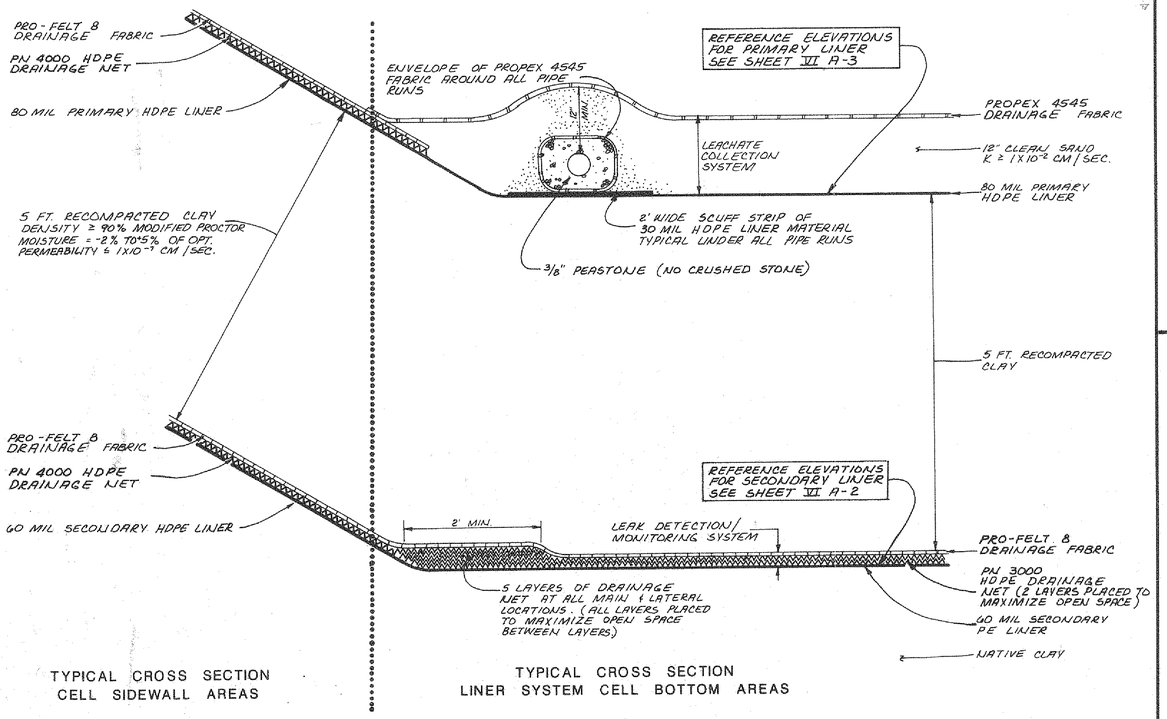
(SEE SHEET III-A-2 FOR PLAN VIEW)



DETAIL OF DIVIDER BETWEEN CELL "A-NORTH" & CELL "A-SOUTH"

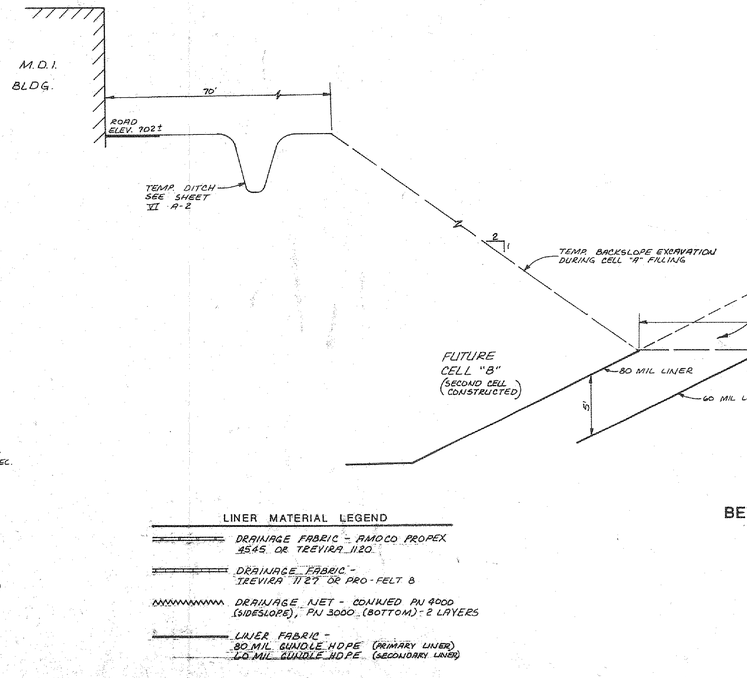
(SEE TYPICAL CROSS-SECTIONS FOR DETAILS OF CELL BOTTOM & SIDE SLOPE CONSTRUCTION)

(NOT TO SCALE)



TYPICAL CROSS SECTION CELL SIDEWALL AREAS

TYPICAL CROSS SECTION LINER SYSTEM CELL BOTTOM AREAS



DETAIL OF DIVIDER BETWEEN CELLS "A" & "B" OF MC VI

(SEE TYPICAL CROSS-SECTIONS FOR DETAILS OF CELL BOTTOM & SIDE SLOPE CONSTRUCTION)

LINER MATERIAL LEGEND

- DRAINAGE FABRIC - AMOCO PROPEX 4545 OR TREVIRA 1120
- DRAINAGE FABRIC - TREVIRA 1127 OR PRO-FELT B
- DRAINAGE NET - CONNED PN 4000 (SIDESLOPE), PN 3000 (BOTTOM) - 2 LAYERS
- LINER FABRIC - 80 MIL GUNDLE HDPE (PRIMARY LINER) 60 MIL GUNDLE HDPE (SECONDARY LINER)

LINER SYSTEM DETAILS

VI A-5

MIDWESTERN CONSULTING INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2043 WOODWICK
ANN ARBOR, MICHIGAN 48104
TELEPHONE 313-971-8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

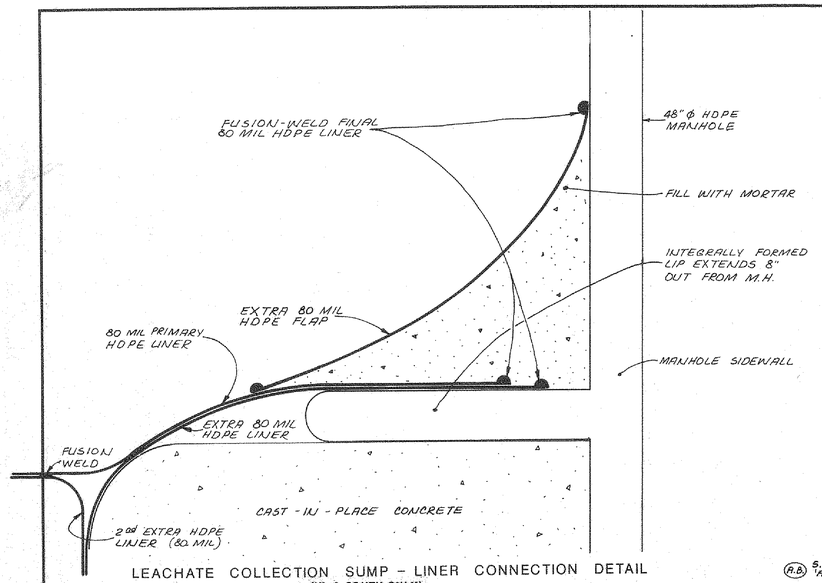
1986 CONSTRUCTION CERTIFICATION SET

DATE MARCH 1986
SHEET OF
BY D. SCHULTZ

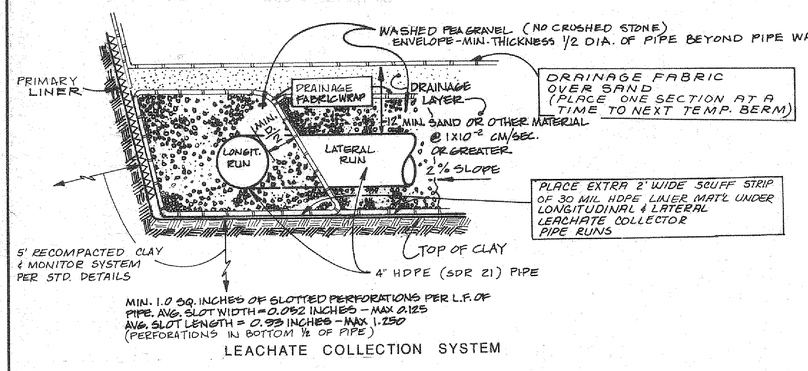
JOB NO. 82018

REVISIONS:
- 5-12-86 - SOUTH
- 11-7-86 - NORTH
- PRV. DIVIDERS
- PRE CONSTRUCTION RECORDS
- PRE CONSTRUCTION RECORDS 12-9-87

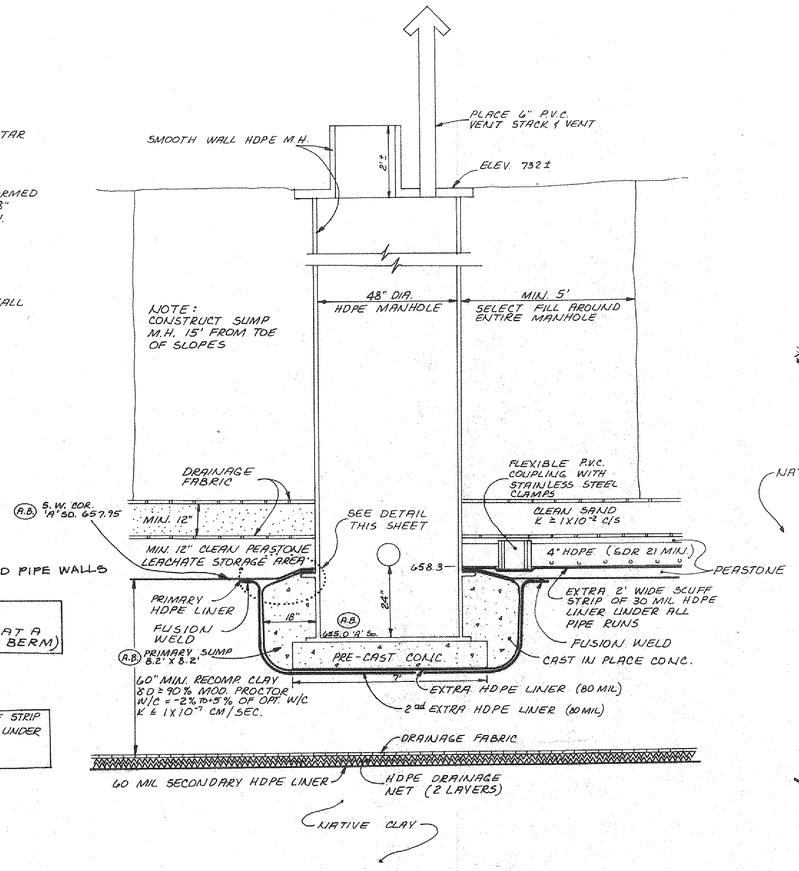
DUNN 500 4-79 70404



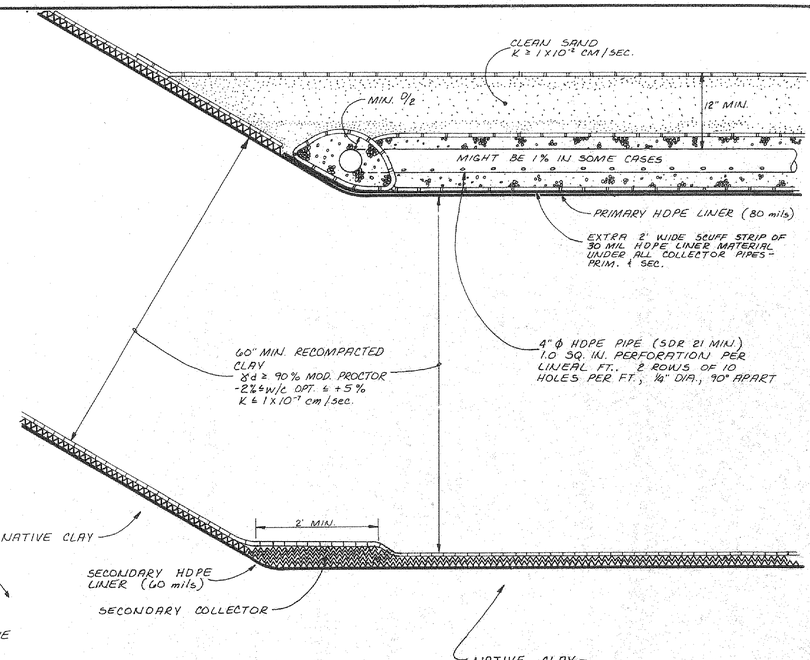
LEACHATE COLLECTION SUMP - LINER CONNECTION DETAIL
(VI-A SOUTH ONLY)



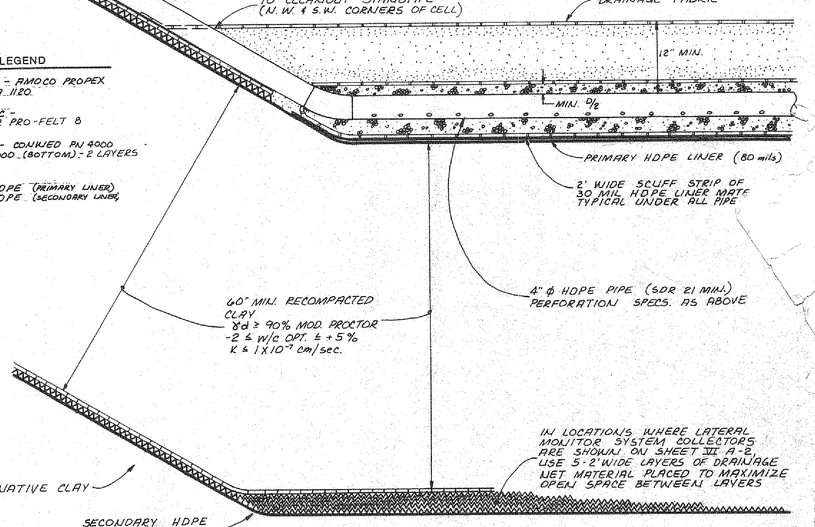
LEACHATE COLLECTION SYSTEM



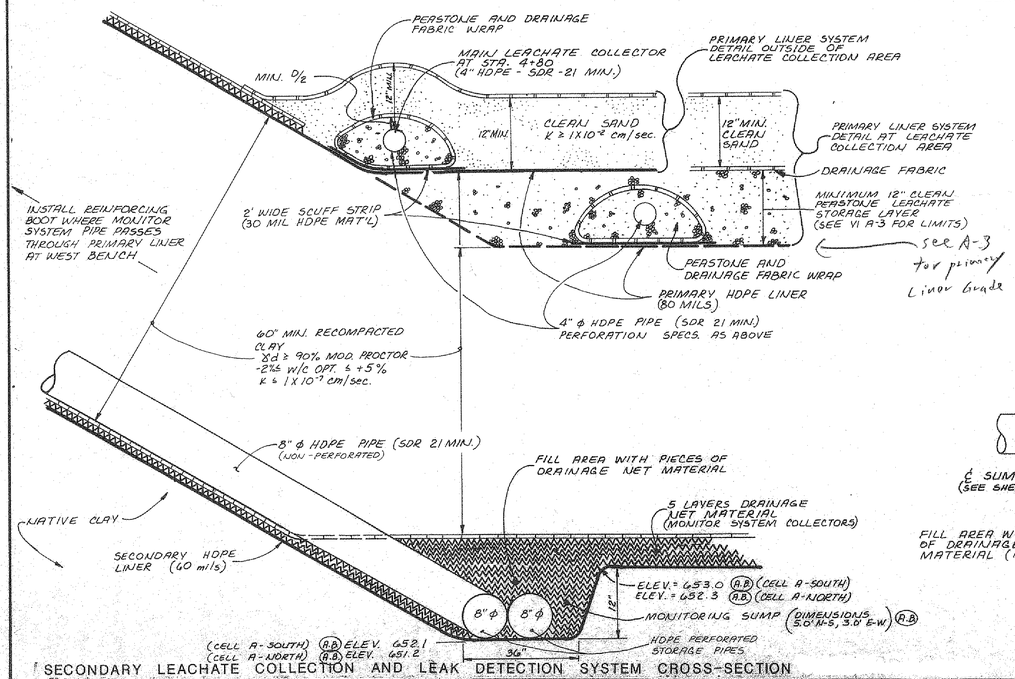
LEACHATE COLLECTION SUMP DETAIL
(VI-A SOUTH ONLY)



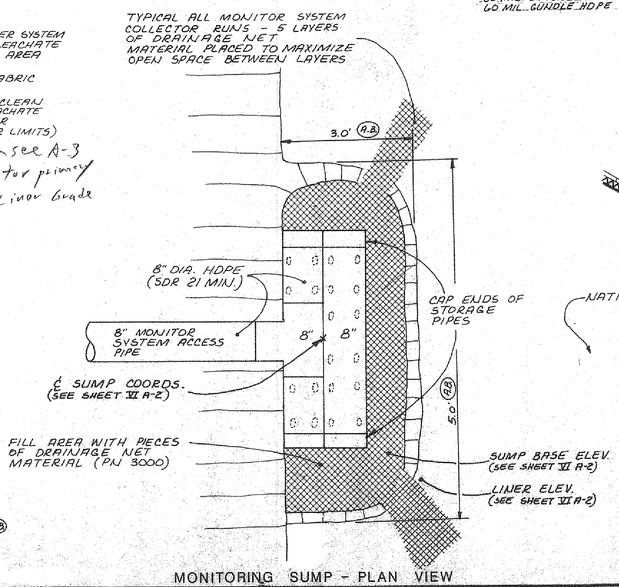
CELL BOTTOM DRAINAGE DETAIL



END OF CELL CLEANOUT DETAIL (N.W. & S.W. CORNERS)



SECONDARY LEACHATE COLLECTION AND LEAK DETECTION SYSTEM CROSS-SECTION



MONITORING SUMP - PLAN VIEW

LINER MATERIAL LEGEND

- DRAINAGE FABRIC - AMOCO PROPEX 4545 OR TREVIRA 1120.
- DRAINAGE FABRIC - TREVIRA 1127 OR PRO-FELT 8
- DRAINAGE NET - CONNED PN 4000 (SIDESLOPE), PN 3000 (BOTTOM) - 2 LAYERS
- LINER FABRIC - 80 MIL GUNDLE HDPE (PRIMARY LINER) 60 MIL GUNDLE HDPE (SECONDARY LINER)

(A-B) = AS BUILT

LEACHATE & MONITOR SYSTEM DETAILS

VI A-6

MIDWESTERN CONSULTING INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2675 JACKSON ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800
MCI

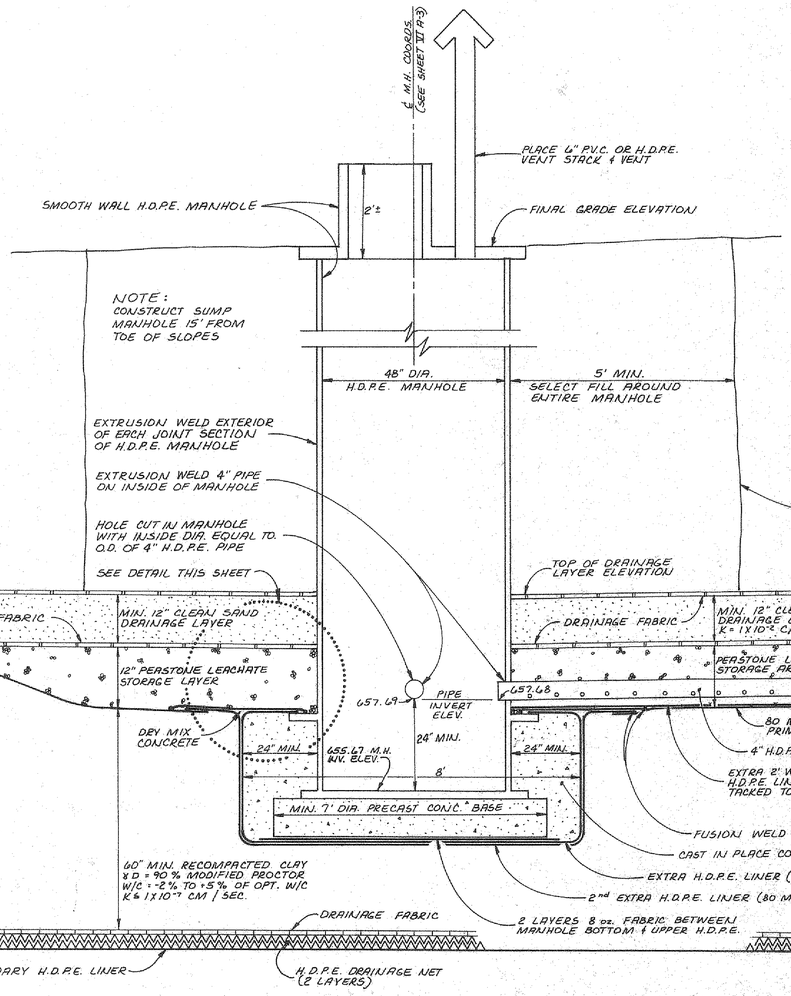
SITE
COUNTY, MICHIGAN

SP

FICATION SET

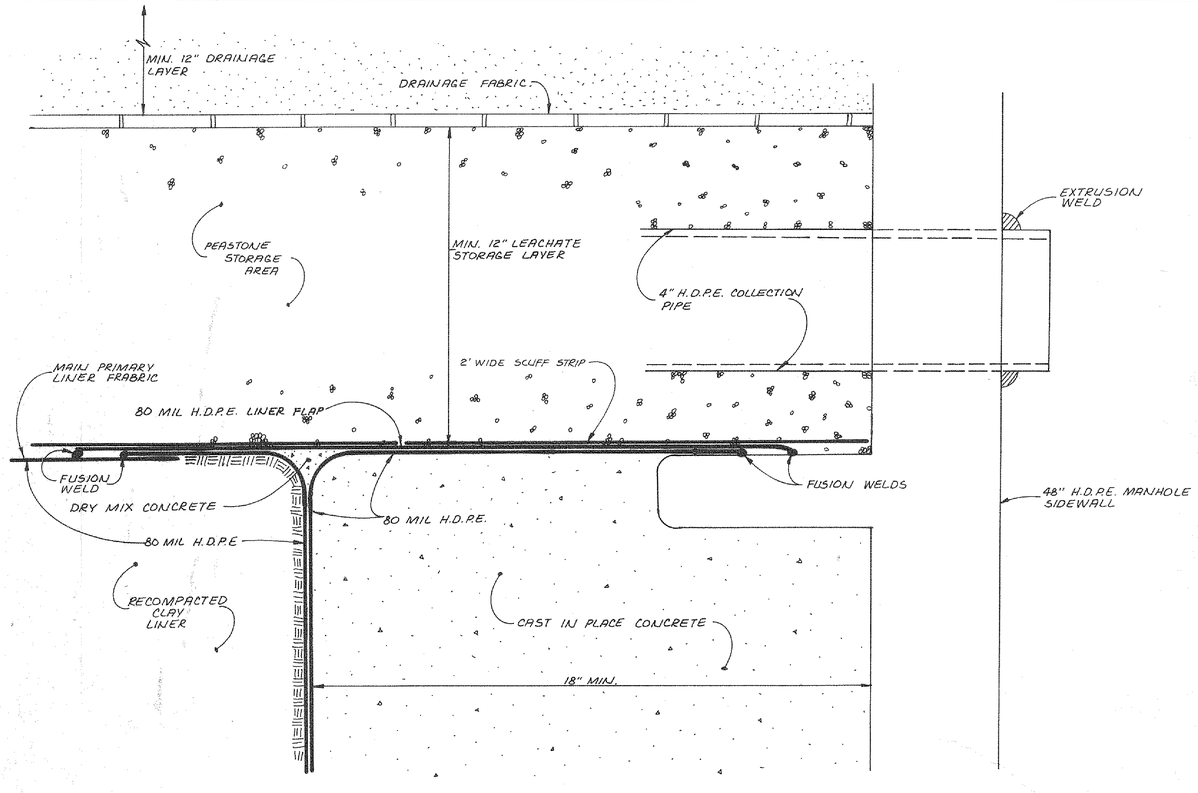
JOB NO. 82018	DATE MARCH 1986
REVISIONS:	SHEET: OF
REV. LEACHATE M.H.	5-12-86
REV. LINER CONNECTION DETAIL	11-3-86
CERT. CONSTRUCTION RECORDS	12-2-87 - SOUTH
CERT. CONSTRUCTION RECORDS	12-2-87 - NORTH

DUNN 500 4-79 10424



LEACHATE COLLECTION SUMP - LINER CONNECTION DETAIL

NOT TO SCALE



LEACHATE COLLECTION SUMP DETAIL

NOT TO SCALE

MIDWESTERN CONSULTING, INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR MICHIGAN 48105
TELEPHONE (313) 971-8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

1986 CONSTRUCTION CERTIFICATION SET

LEACHATE COLLECTION SUMP DETAILS CELL VI-A NORTH

VI A-7

JOB NO. 82018

DATE: 9-15-87
SHEET OF
BY: -KOAT-

REVISIONS:
EV. PER WAYNE DISPOSAL REVIEW
TE CONSTRUCTION RECORDS 12-9-87

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL B

RECORD PLAN

WAYNE DISPOSAL

SITE NO. 2 LANDFILL

SHEET INDEX

SHEET VI-B 101	CLAY SUBGRADE / SECONDARY LINER ELEVATIONS
SHEET VI-B 102	PRIMARY LINER ELEVATIONS & LEACHATE COLLECTION SYSTEM
SHEET VI-B 103	LINER SYSTEM DETAILS
SHEET VI-B 104	LEACHATE & LEAK DETECTION SYSTEM DETAILS
SHEET VI-B 105	LEACHATE COLLECTION SUMP DETAILS

CONSTRUCTION CERTIFICATION PLAN

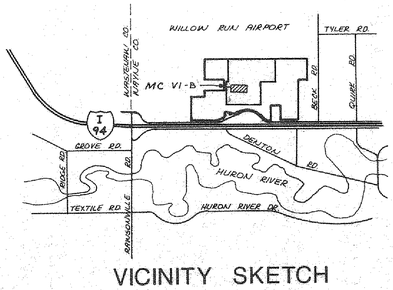
MASTER CELL VI - CELL "B"

DATE: DEC. 9, 1988

PROJECT #88237

MIDWESTERN CONSULTING INC.

MCI CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800



VICINITY SKETCH

PREPARED BY:
MIDWESTERN CONSULTING, INC.

H. CHARLES CREMIN, P.E. #13662

Note: The purpose of this drawing is to represent As Built Conditions for Cell B. Any information shown in Cells C and D and in the new plant area represents proposed conditions and does not reflect As Built Status.

SCALE: 1" = 50'

5000 E
5200 E
5400 E
5600 E
5800 E
6000 E
7200 N
7300 N
7400 N
6200 N
6400 N
6600 N
6800 N
7000 N

6189.05
5032.92

CURBED - PAVED ROAD WITH STORM WATER COLLECTION SYSTEM (REFERENCE ISD/MPS DRAWING "STORM WATER & LEACHATE COLLECTION/TRANSPORT SYSTEM", SHEET 1 OF 6

BITUMINOUS PAVED AREA

WHEEL WASH

WELL #21

WELL #23

10" MONITOR SUMP ACCESS

MONITOR ACCESS

FINAL CELL BOTTOM ELEVATIONS ARE SUBJECT TO REVISION BASED ON RESISTIVITY TESTS

CELL C

CELL D

CELL B

CELL A SOUTH EXIST.

CELL A NORTH EXIST.

M.C. V

M.C. VI

LEACHATE COLLECTION MANHOLE

TEMPORARY 20' SHELF DURING CELL 'C' CONSTRUCTION

CELL 'B' TEMPORARY SHELF @ 702 ±

CELL "C" TEMP SHELF @ 702 ±

LEACHATE COLLECTION MANHOLE

10" MONITOR SUMP ACCESS

MONITOR SUMP

6148

6525 N
5830 E

EXISTING M.D.I. PLANT

REMOVE PRIOR TO CELL "C" CONSTRUCTION

LEAK DETECTION SUMP ACCESS PIPE

LEAK DETECTION SUMP

SEE SHEET VI-B 104 & 105 FOR LEAK DETECTION SYSTEM SUMP DETAILS

FOR DETAILS OF SECONDARY LINER AND LEAK DETECTION SYSTEMS SEE SHEETS 103 & 104

1:2 SLOPE TYPICAL

25'±

T/SLOPE M.C. V

EXISTING

SHELF 673.1 675.4 677.3 679.0 680.7 682.5

LEGEND

LOCATION FOR 3 ADDITIONAL LAYERS OF DRAINAGE NET

MASTER CELL VI, CELL "B"
CLAY SUBGRADE &
SECONDARY LINER ELEVATIONS
AS-BUILT CONDITIONS

VI-B
101

MIDWESTERN CONSULTING, INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

1988 CONSTRUCTION CERTIFICATION SET

JOB NO. 88237
DATE: SEPT. 1988
SHEET OF
BY: D. SCHULTZ
REVISIONS:
2. COUSTRUCTED CELL "B" 12-1-88 D. SCHULTZ

Note: The purpose of this drawing is to represent As Built Conditions for Cell B. Any information shown in Cells C and D and in the new plant area represents proposed conditions and does not reflect As Built Status.

SCALE: 1" = 50'

5000 E
5200 E
5400 E
5600 E
5800 E
6000 E
6200 N
6400 N
6600 N
6800 N
7000 N
7200 N
7300 N
7400 N

6189.05
5032.92

CURBED - PAVED ROAD WITH STORM WATER COLLECTION SYSTEM (REFERENCE: ISD/MPS DRAWING "STORM WATER & LEACHATE COLLECTION/TRANSPORT SYSTEM", SHEET 1 OF 6

WHEEL WASH

DIRECTION OF DRAINAGE (TYP.)

PRIMARY LINER ANCHOR TRENCH M.C. VI

TEMP. RAMP

RAMP

CLAY

CLAY PAD 1' THICK

CELL C

CELL D

CELL B

CELL A SOUTH EXIST.

CELL A NORTH

LEACHATE COLLECTION MANHOLE

TEMPORARY SECONDARY 20' SHELF DURING CELL 'C' CONSTRUCTION

CELL 'B' TEMPORARY SHELF @ 702 ±

TOP OF PRIMARY LINER SLOPE

M.C. VI

M.C. V

EXISTING M.D.I. PLANT

REMOVE PRIOR TO CELL "C" CONSTRUCTION

CLEANOUTS (TYPICAL)

4" LEACHATE COLLECTION PIPES (TYPICAL)

PROPOSED DITCH NOT YET BUILT

T/SLOPE M.C. V

FOR DETAILS OF PRIMARY LINER AND LEACHATE COLLECTION SYSTEM SEE SHEETS 103 + 104

LEACHATE COLLECTION SUMP N 7145 E 5710 (SEE DETAIL OF SUMP ON SHEET VI-B 105)

1:2 SLOPE TYPICAL VARIES

PRIMARY LINER ANCHOR TRENCH M.C. VI

SHELF LINE AT SECONDARY LINER

LIMITS OF LEACHATE STORAGE LAYER (PLOT PER SURVEY)

TOP OF PRIMARY LINER SLOPE

FINAL PRIMARY SHELF

EXISTING SHELF

WALL

6525 N 5830 E

BENCH MARK

BENCH MARK
N.E. COR. CONC. TRANSFORMER PAD ELEV. - 706.26

LEGEND
- 4" LEACHATE COLLECTION PIPE
- TOP/SAND ELEV.
- PRIMARY LINER ELEV.
- TOP/SAND ELEV.
- TOP/LEACHATE STORAGE LAYER
- PRIMARY LINER ELEV.

MASTER CELL VI, CELL "B"
PRIMARY LINER ELEVATIONS
& LEACHATE COLLECTION
AS-BUILT CONDITIONS

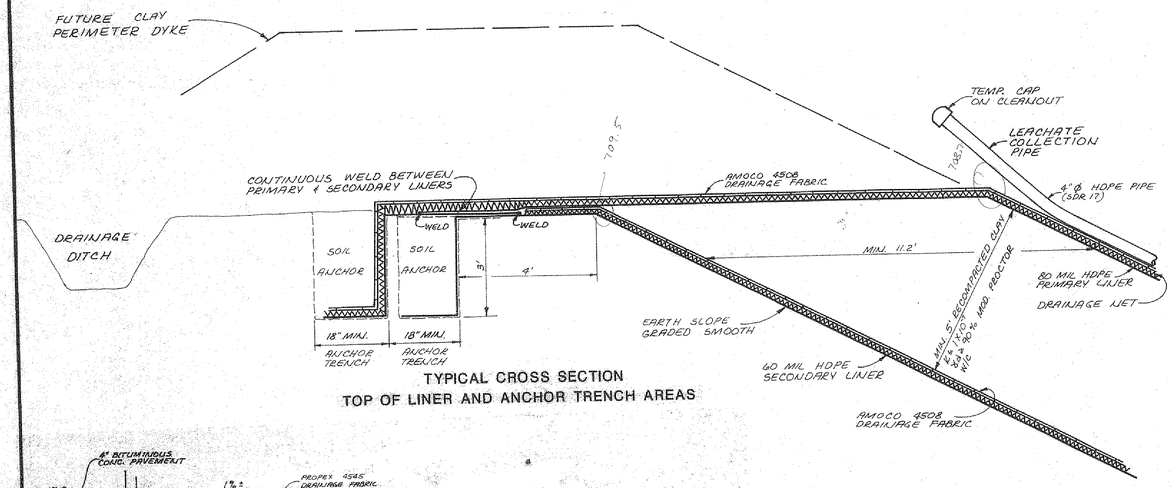
VI-B
102

MIDWESTERN CONSULTING, INC.
CIVIL ENGINEERS • PLANNERS • SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800

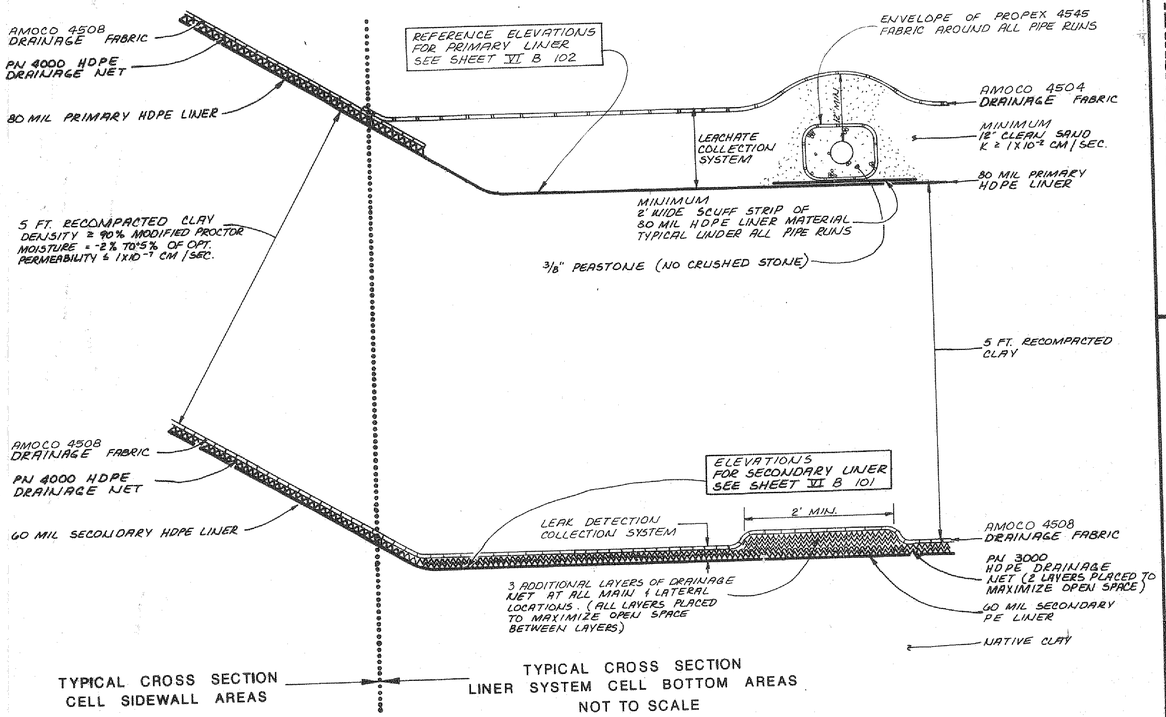
WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

1988 CONSTRUCTION CERTIFICATION SET

JOB NO. 88237
DATE: SEPT. 1988
SHEET OF
BY: D. SCHMUTZ
CHK'D: J. SCHMUTZ
REVISIONS:
1) CONSTRUCTED CELL "B" 12-9-88

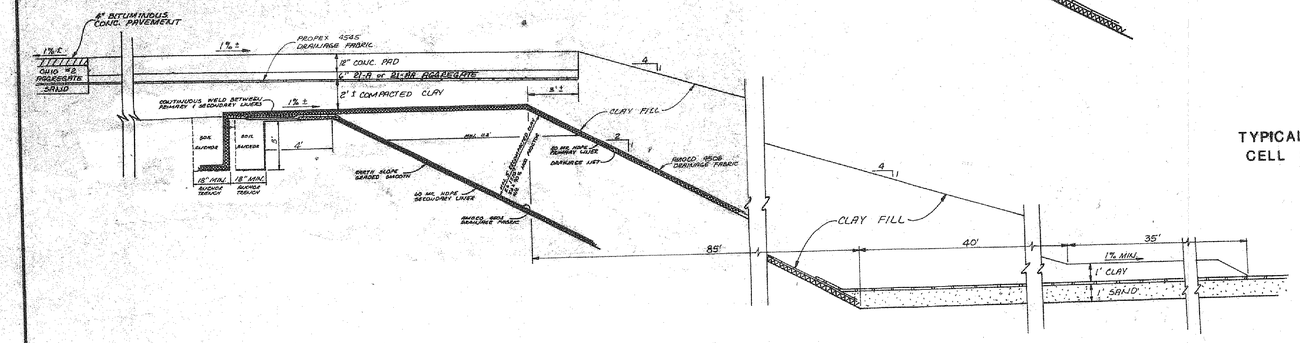


TYPICAL CROSS SECTION
TOP OF LINER AND ANCHOR TRENCH AREAS



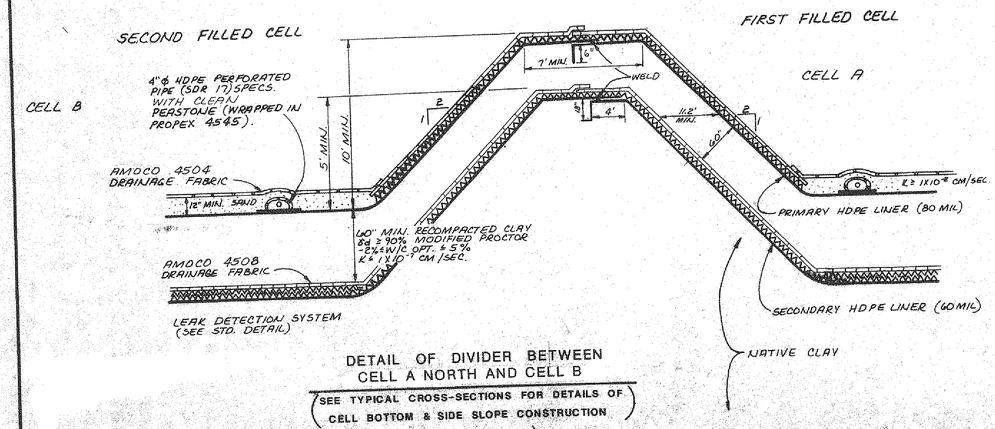
TYPICAL CROSS SECTION
CELL SIDEWALL AREAS

TYPICAL CROSS SECTION
LINER SYSTEM CELL BOTTOM AREAS
NOT TO SCALE



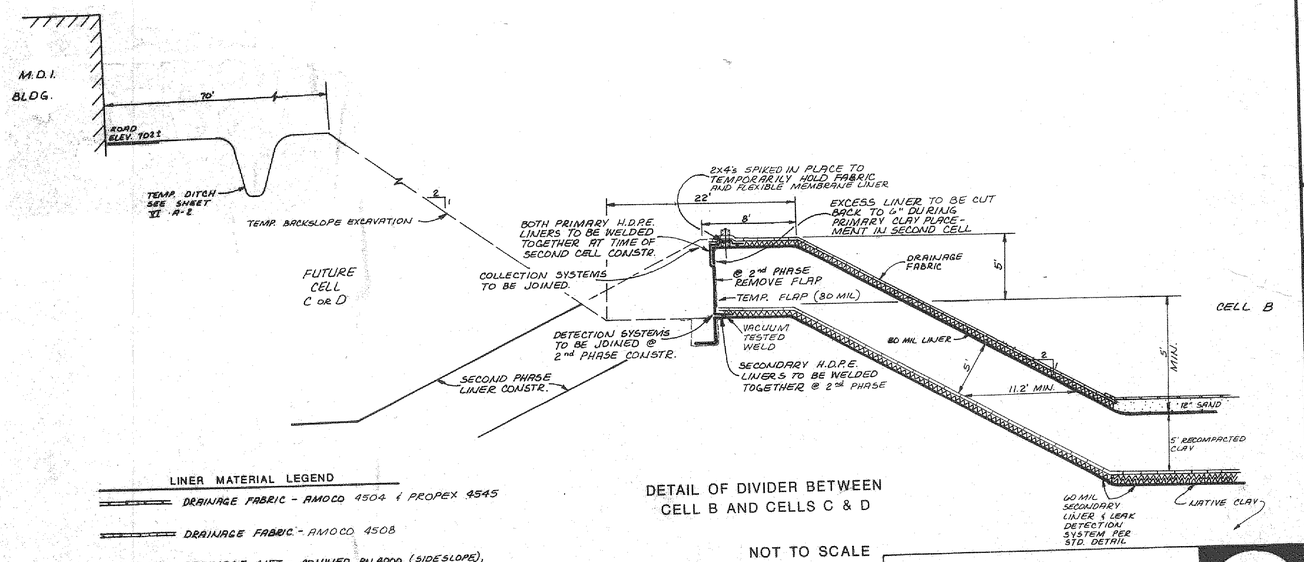
SIDEWALL SECTION THRU ACCESS RAMP

(SEE SHEET VI B 102 FOR PLAN VIEW)
NOT TO SCALE



DETAIL OF DIVIDER BETWEEN
CELL A NORTH AND CELL B

(SEE TYPICAL CROSS-SECTIONS FOR DETAILS OF CELL BOTTOM & SIDE SLOPE CONSTRUCTION)
(NOT TO SCALE)



LINER MATERIAL LEGEND

- DRAINAGE FABRIC - AMOCO 4504 & PROPEX 4545
- DRAINAGE FABRIC - AMOCO 4508
- DRAINAGE NET - CONJUED PN 4000 (SIDESLOPE), PN 3000 (BOTTOM) - 2 LAYERS, OR EQUAL
- LINER GEOMEMBRANE - 80 MIL SINGLE HDPE (PRIMARY LINER), 60 MIL SINGLE HDPE (SECONDARY LINER)

DETAIL OF DIVIDER BETWEEN
CELL B AND CELLS C & D

NOT TO SCALE

LINER SYSTEM DETAILS

AS-BUILT CONDITIONS

VI-B
103

MIDWESTERN CONSULTING INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48105
TELEPHONE: 313 971 8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

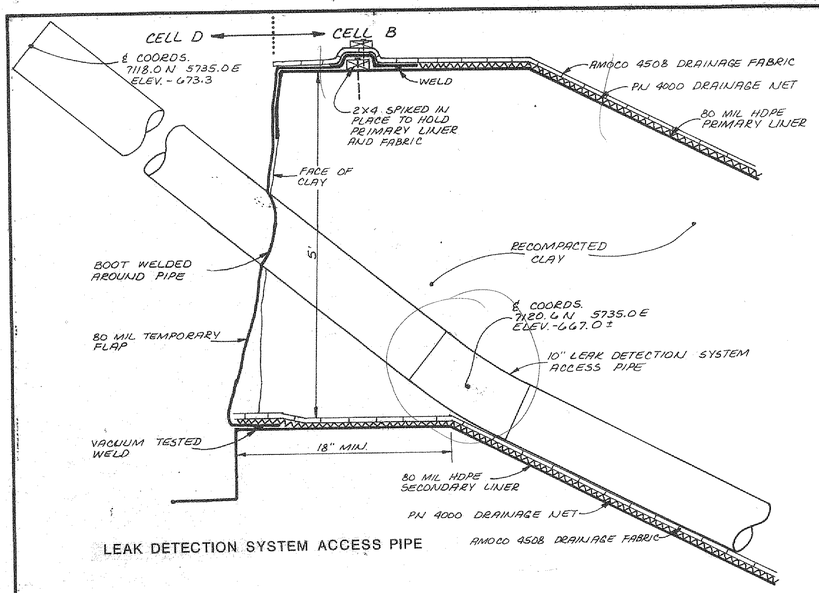
1988 CONSTRUCTION CERTIFICATION SET

DATE SEPT. 1988
SHEET 01
BY D. SCHULTZ D. Schultz

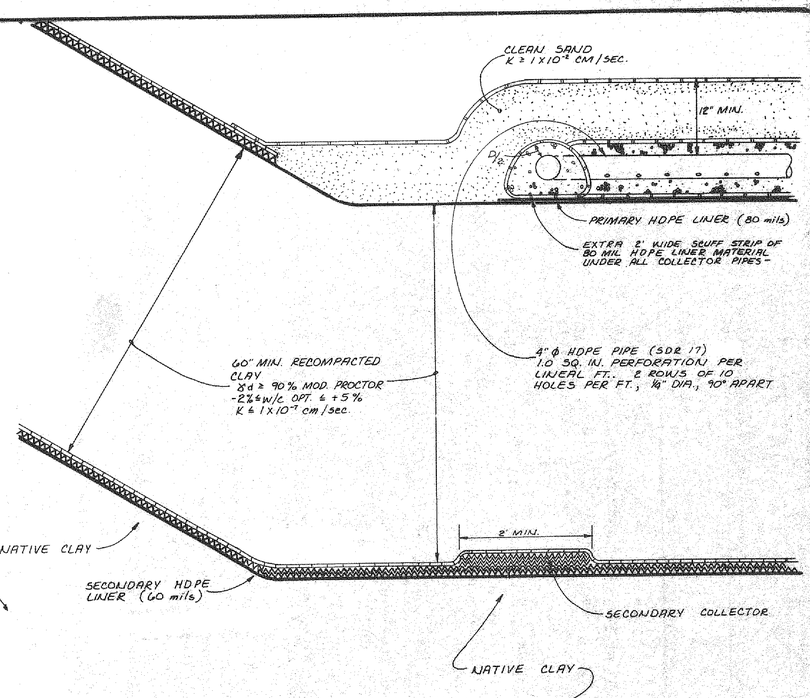
JOB NO. 88237

REVISIONS
FOR CONSTRUCTED CELL B 12-9-88

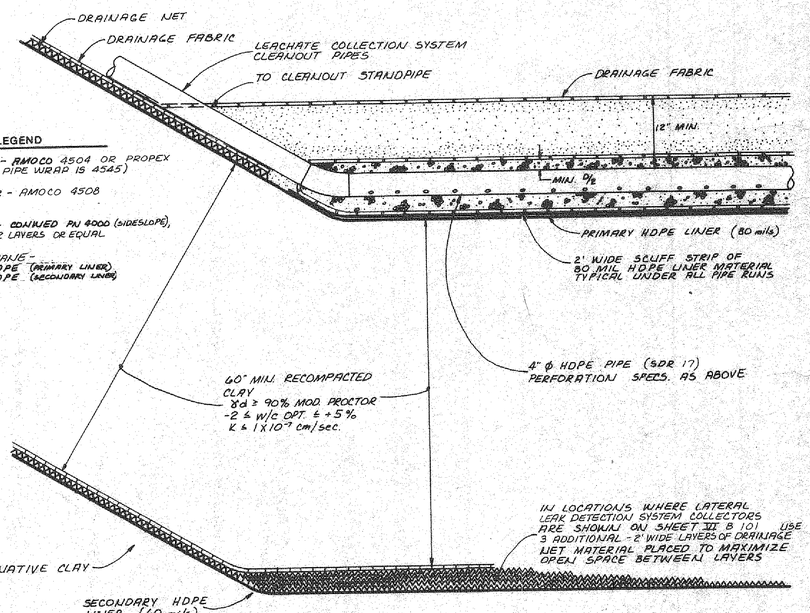
DUNN 500 4-79 78494



LEAK DETECTION SYSTEM ACCESS PIPE



CELL BOTTOM DRAINAGE DETAIL
NOT TO SCALE



END OF CELL CLEANOUT DETAIL
NOT TO SCALE

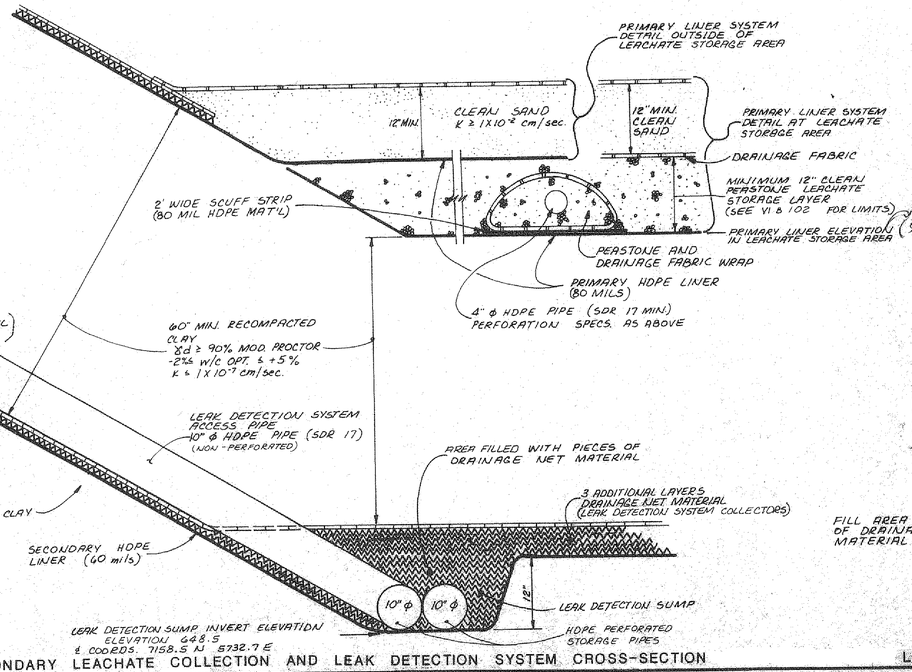
LINER MATERIAL LEGEND

DRAINAGE FABRIC - AMOCO 4504 OR PROPEX 4545 (NOTE: ALL PIPE WRAP IS 4545)

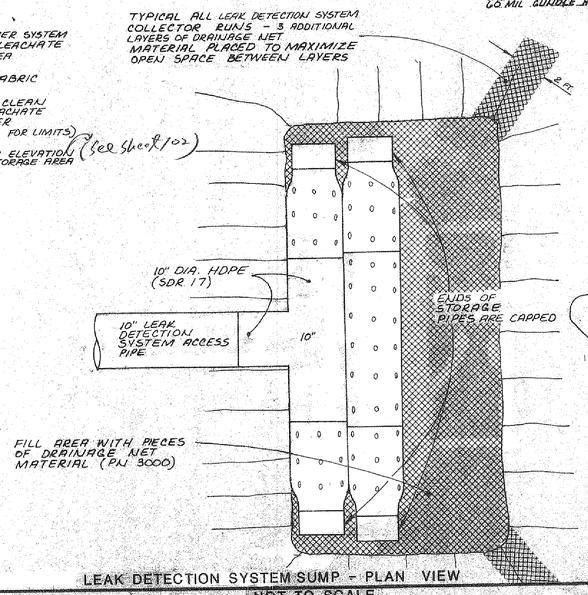
DRAINAGE FABRIC - AMOCO 4508

DRAINAGE NET - CONNED PJ 4000 (SIDESLOPE), PJ 3000 (BOTTOM) - 2 LAYERS OR EQUAL

LINER GEOMEMBRANE - 80 MIL SUNDLE HDPE (PRIMARY LINER) 60 MIL SUNDLE HDPE (SECONDARY LINER)



SECONDARY LEACHATE COLLECTION AND LEAK DETECTION SYSTEM CROSS-SECTION
NOT TO SCALE



LEAK DETECTION SYSTEM SUMP - PLAN VIEW
NOT TO SCALE

DUNN 500 4 79 704044

MIDWESTERN CONSULTING INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
3045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

1988 CONSTRUCTION CERTIFICATION SET

DATE SEPT. 1988
SHEET OF
BY D. SCHULTZ
CHECKED BY

JOB NO. 88237

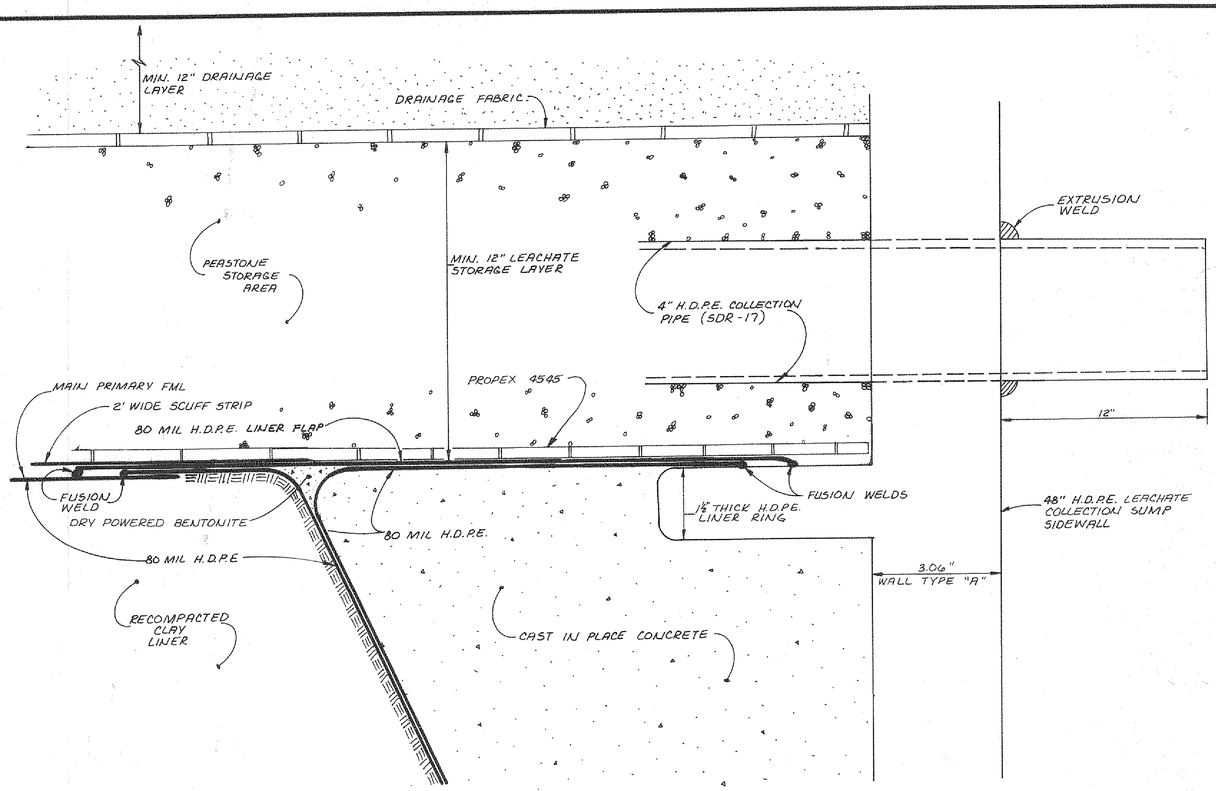
REVISIONS:
10-3-88 CONSTRUCTED CELL 2

LEACHATE & LEAK DETECTION SYSTEM DETAILS

AS-BUILT CONDITIONS

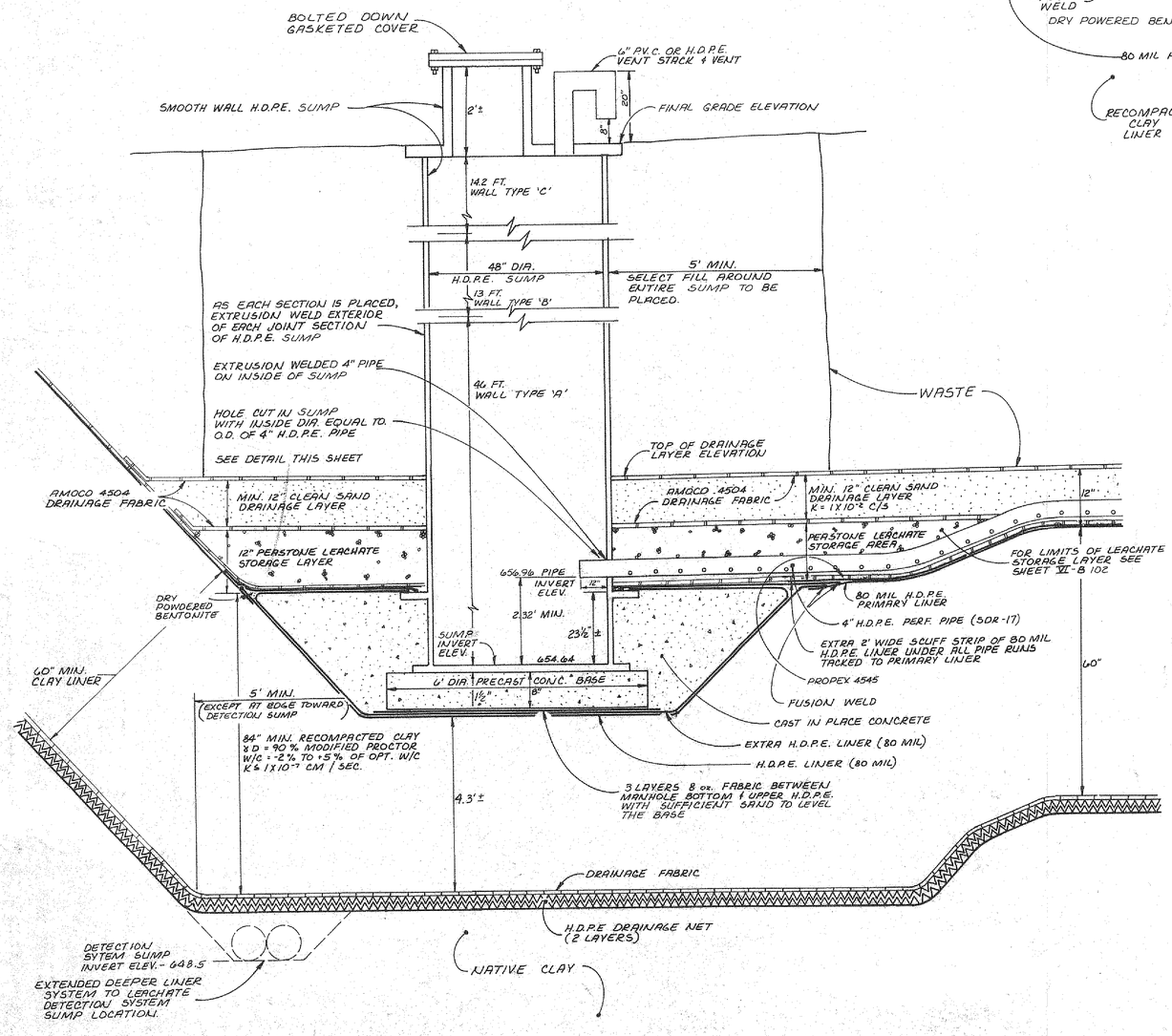
VI-B
104

LEACHATE COLLECTION SUMP ELEVATION SCHEDULE						LOCATION	
CELL	FINAL GRADE	TOP OF DRAINAGE LAYER AT SUMP	PIPE INV. ELEV.	LEACHATE SUMP INV.	DETECTION SUMP INV.	NORTH COORDINATE	EAST COORDINATE
VI-B		658.8	656.96	654.64	648.5	7165	5710
VI-C							
VI-D							



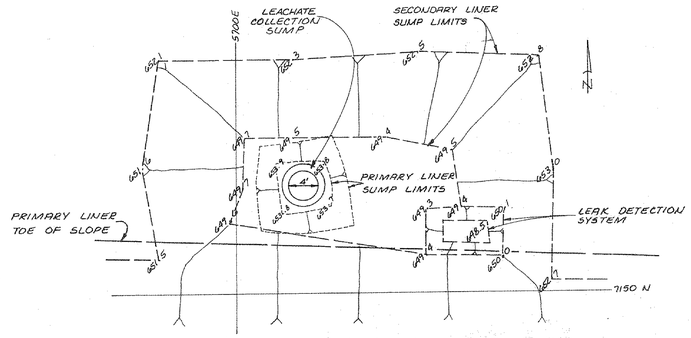
LEACHATE COLLECTION SUMP DETAIL

NOT TO SCALE



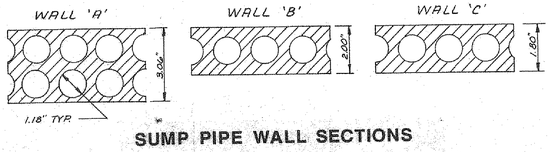
LEACHATE COLLECTION SUMP - LINER CONNECTION DETAIL

NOT TO SCALE



PRIMARY & SECONDARY LINER SUMP DETAIL

SCALE: 1" = 10'



SUMP PIPE WALL SECTIONS

NOT TO SCALE

MASTER CELL VI CELL 'B'
AS-BUILT CONDITIONS

LEACHATE COLLECTION SUMP DETAILS

PRIMARY & SECONDARY LINER SUMP DETAILS

VI-B
105

MIDWESTERN CONSULTING, INC.
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2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

1986 CONSTRUCTION CERTIFICATION SET

DATE: SEPT. 1988
SHEET OF
BY: D. SCHULTZ
CK

JOB No. 88237

REVISIONS:
AS CONSTRUCTED CELL B 12-9-88

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL C

RECORD PLAN

WAYNE DISPOSAL

SITE NO. 2 LANDFILL

SHEET INDEX

SHEET VI-C 2A SECONDARY AND PRIMARY LINER ELEVATIONS WITH LEAK DETECTION SYSTEM AND LEACHATE COLLECTION SYSTEM

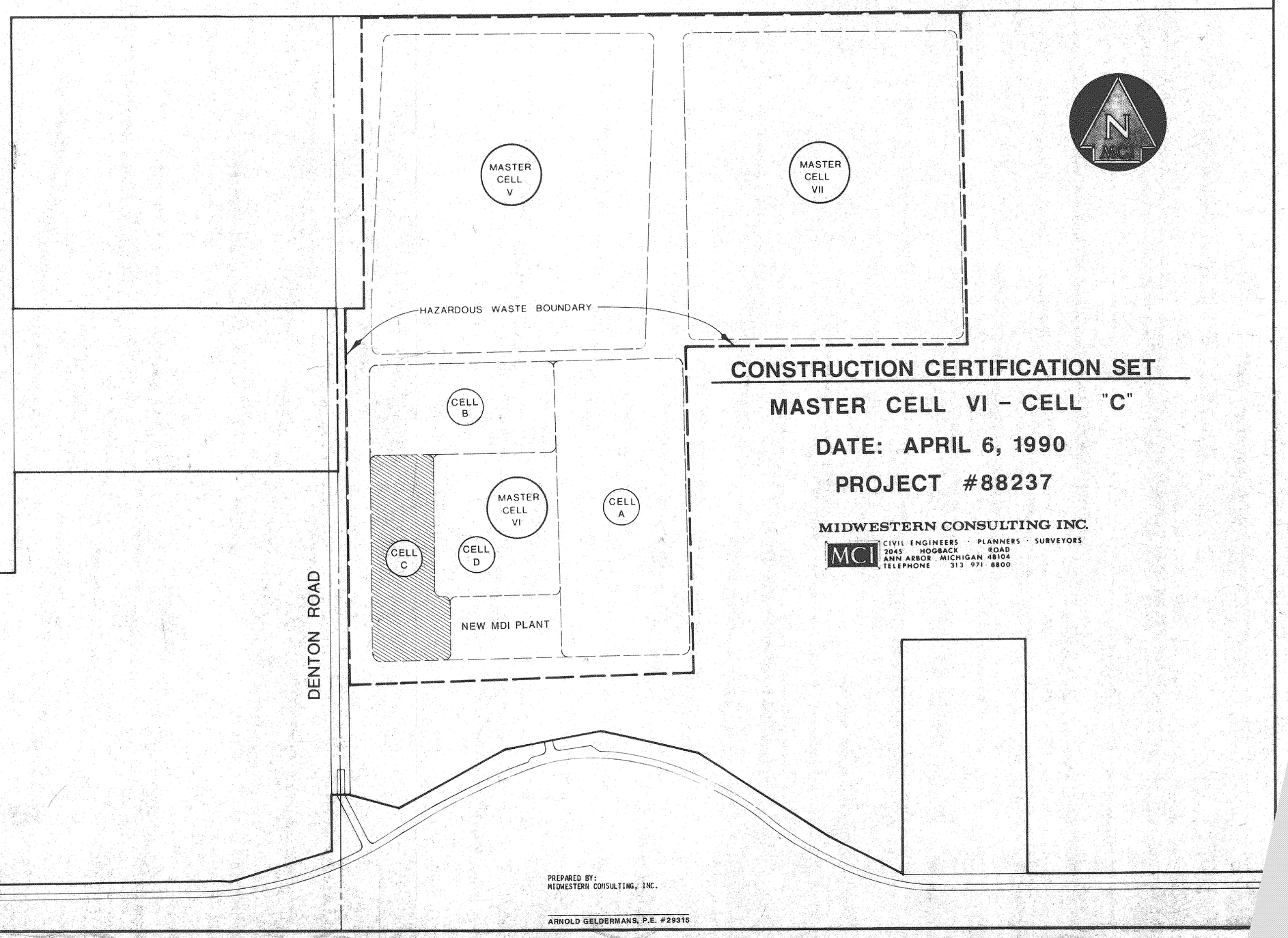
SHEET VI-C 3A LINER SYSTEM DETAILS

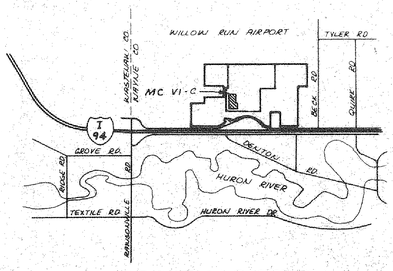
SHEET VI-C 4A LEACHATE COLLECTION SYSTEM AND LEAK DETECTION SYSTEM DETAILS

SHEET VI-C 5A LEACHATE COLLECTION SUMP/ LEAK DETECTION SUMP DETAILS

SHEET VI-C 6A FINAL COVER AND TOP/DIKE DETAILS

NOTE : 'A' DENOTES AS-BUILT CONFIGURATION





VICINITY SKETCH

CONSTRUCTION CERTIFICATION SET

MASTER CELL VI - CELL "C"

DATE: APRIL 6, 1990

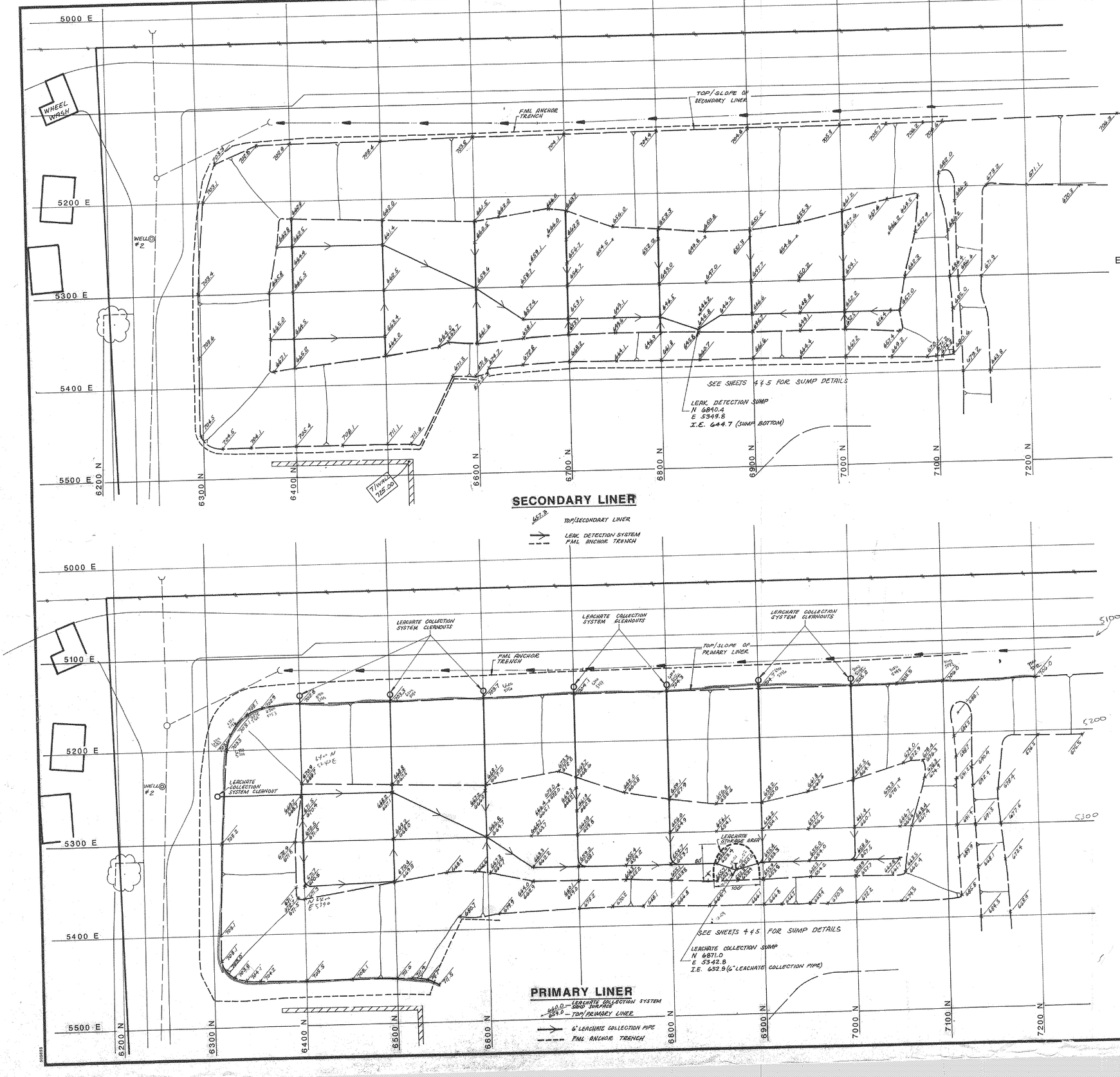
PROJECT #88237

MIDWESTERN CONSULTING INC.

MCI CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE 313 971-8800

PREPARED BY:
MIDWESTERN CONSULTING, INC.

ARNOLD GELDERMANS, P.E. #29315



SCALE : 1" = 50'

EXISTING CELL B

SCALE : 1" = 50'

EXISTING CELL B

SECONDARY AND PRIMARY LINER ELEVATIONS WITH LEAK DETECTION SYSTEM & LEACHATE COLLECTION SYSTEM AS-BUILT CONDITIONS

VI-C
2A

MIDWESTERN CONSULTING, INC.
CIVIL ENGINEERS • PLANNERS • SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48105
TELEPHONE (313) 971-8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

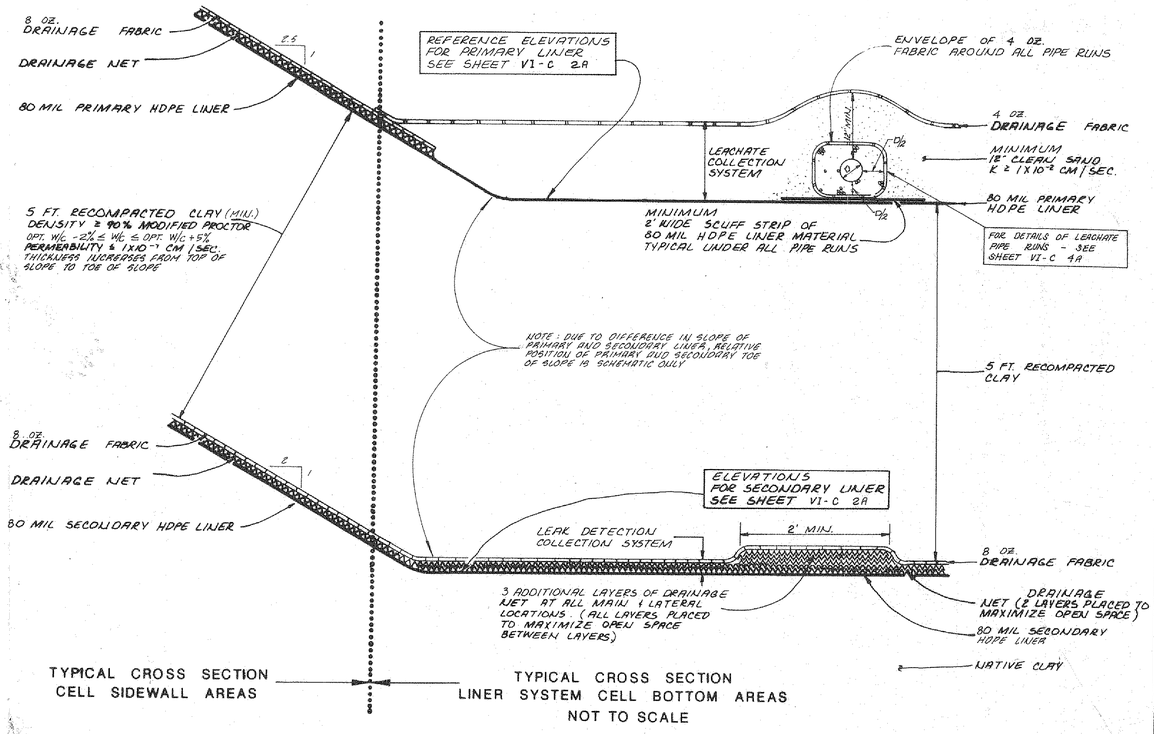
1989
CONSTRUCTION CERTIFICATION SET

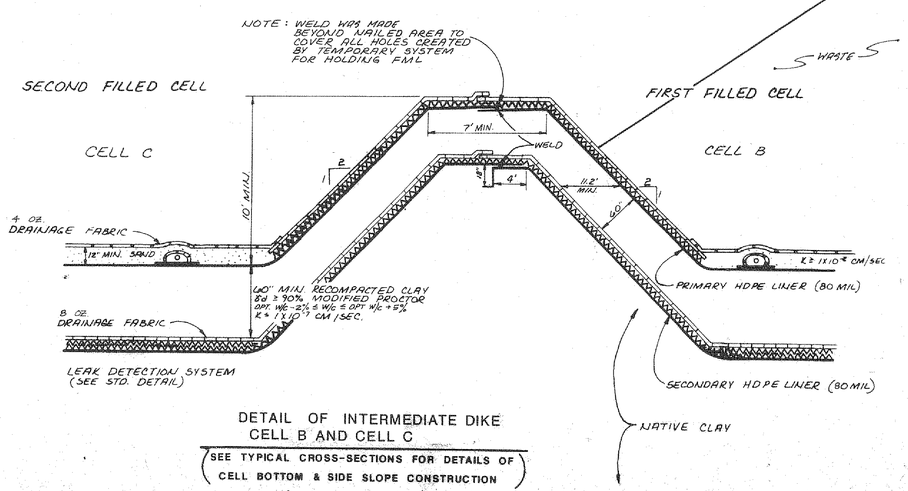
DATE: 4/5/89
SHEET 2 OF 6
BY:

JOB No. 88237

REVISIONS:
REVISED TO REFLECT AS-BUILT CONDITIONS 3-26-90

103885

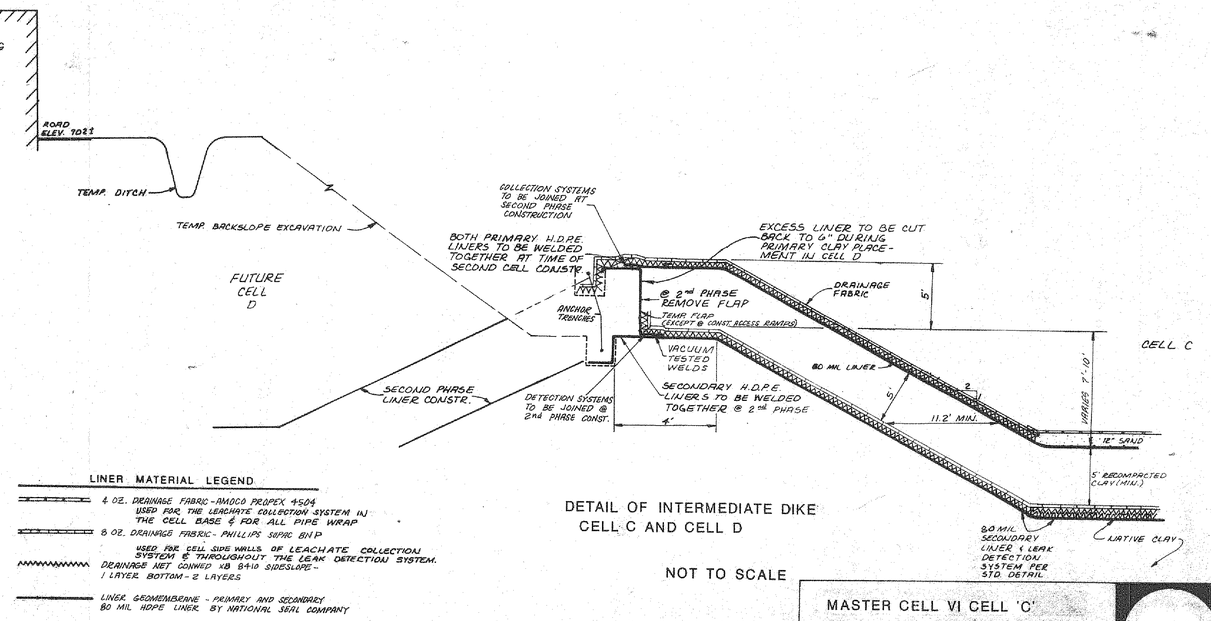




DETAIL OF INTERMEDIATE DIKE
CELL B AND CELL C

(SEE TYPICAL CROSS-SECTIONS FOR DETAILS OF CELL BOTTOM & SIDE SLOPE CONSTRUCTION)

(NOT TO SCALE)



LINER MATERIAL LEGEND

- 4 OZ. DRAINAGE FABRIC - AMOCO PROPEX 4504 USED FOR THE LEACHATE COLLECTION SYSTEM IN THE CELL BASE & FOR ALL PIPE WRAP
- 8 OZ. DRAINAGE FABRIC - PHILLIPS SUPAC 8NP USED FOR CELL SIDE WALLS OF LEACHATE COLLECTION SYSTEM & THROUGHOUT THE LEAK DETECTION SYSTEM.
- DRAINAGE NET CONWED #3 8410 SIDESLOPE - 1 LAYER BOTTOM - 2 LAYERS
- LINER, GEOMEMBRANE - PRIMARY AND SECONDARY 80 MIL HDPE LINER BY NATIONAL SEAL COMPANY

DETAIL OF INTERMEDIATE DIKE
CELL C AND CELL D

NOT TO SCALE

MASTER CELL VI CELL 'C'
LINER SYSTEM DETAILS
AS-BUILT CONDITIONS

VI-C
3A

MIDWESTERN CONSULTING INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
4676 OKEMOS ROAD
ANN ARBOR, MICHIGAN 48105
TELEPHONE: 313-971-8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

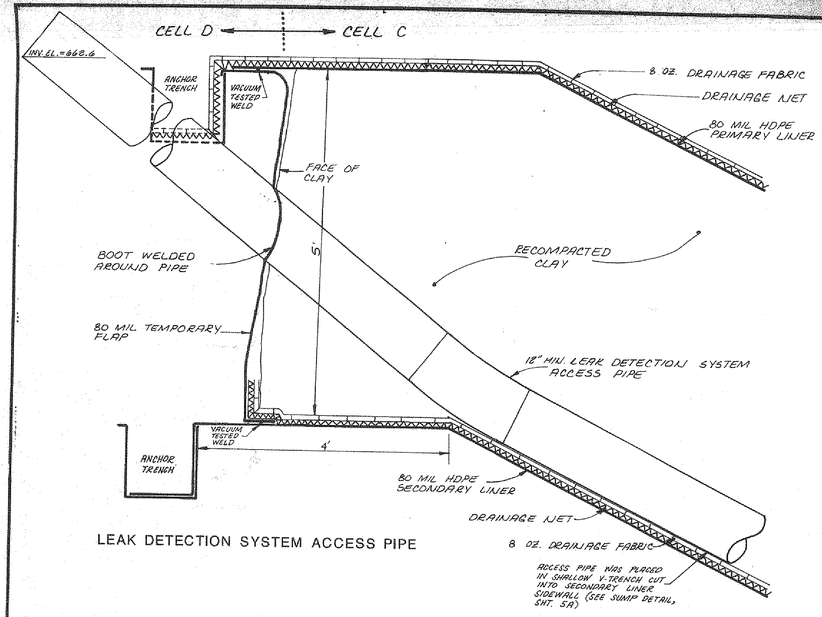
1989
CONSTRUCTION CERTIFICATION SET

DATE	4/8/89
SHEET	5 OF 6
BY	D. SCHULTZ
	3-24-90

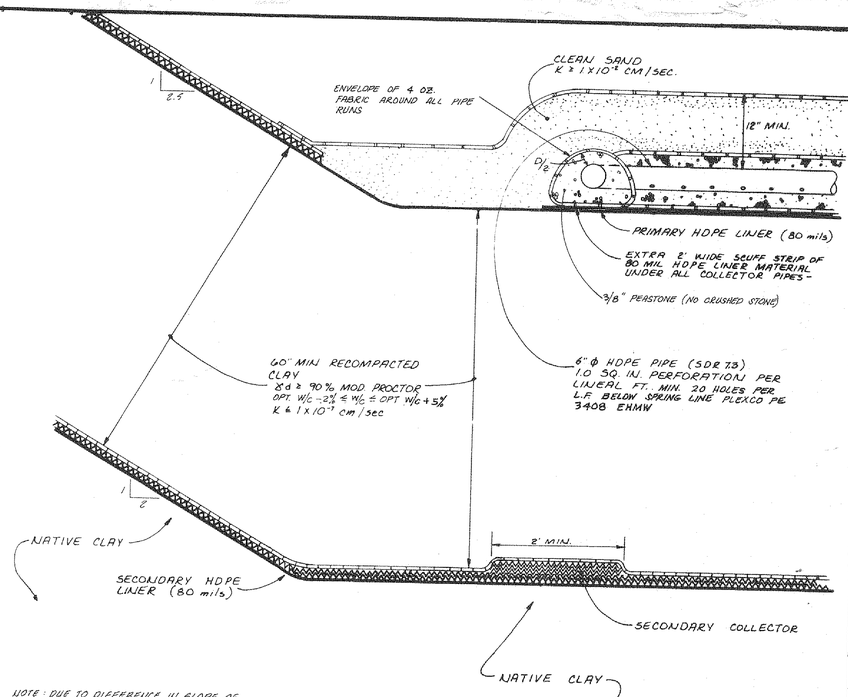
JOB NO. 88237

REVISIONS: REVISED TO REFLECT AS-BUILT CONDITIONS

DUNN 500 4-78 7940-4

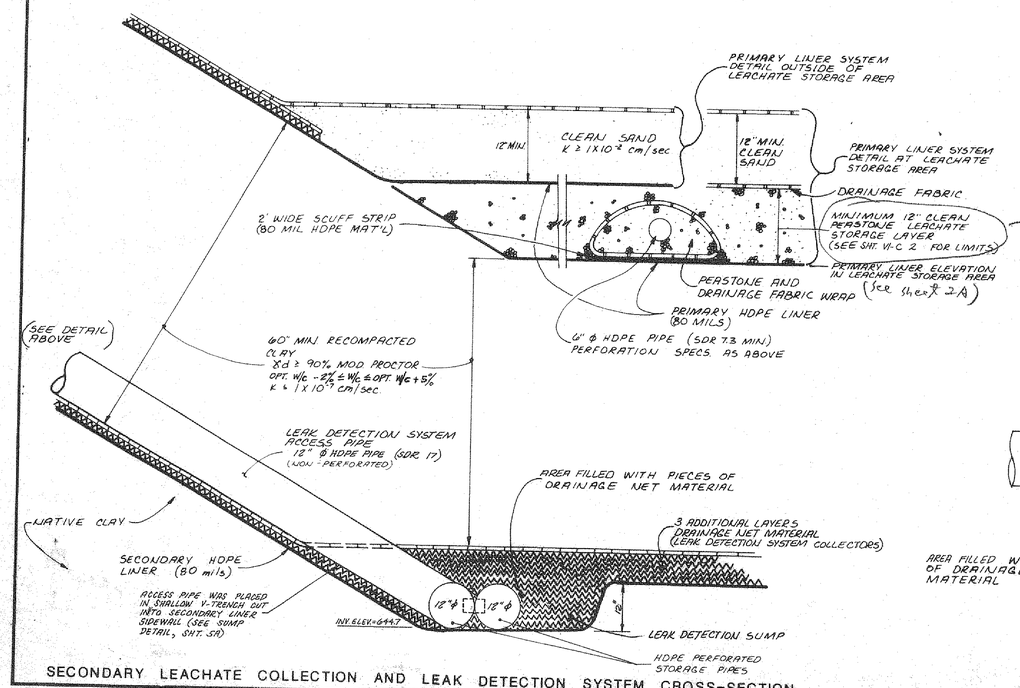


LEAK DETECTION SYSTEM ACCESS PIPE



NOTE: DUE TO DIFFERENCE IN SLOPE OF PRIMARY AND SECONDARY LINER, RELATIVE POSITION OF PRIMARY AND SECONDARY TOE OF SLOPE IS SCHEMATIC ONLY.

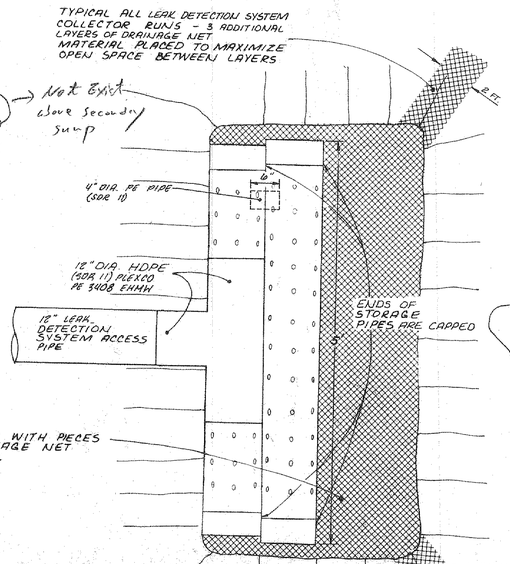
CELL BOTTOM DRAINAGE DETAIL
NOT TO SCALE

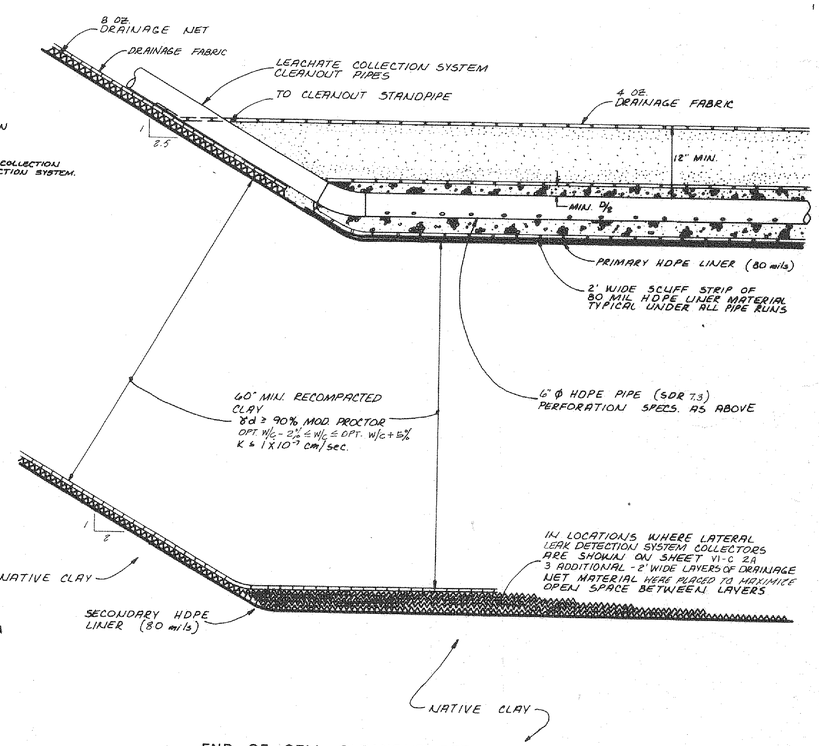


SECONDARY LEACHATE COLLECTION AND LEAK DETECTION SYSTEM CROSS-SECTION

LINER MATERIAL LEGEND

- 4 OZ. DRAINAGE FABRIC - AMOCO PROPEX 4504 USED FOR THE LEACHATE COLLECTION SYSTEM IN THE CELL BASE & FOR ALL PIPE WRAP
- 8 OZ. DRAINAGE FABRIC - PHILLIPS GUNDA BUP USED FOR CELL SIDE WALLS OF LEACHATE COLLECTION SYSTEM & THROUGHOUT THE LEAK DETECTION SYSTEM.
- DRAINAGE NET GONWED XB 8410 SIDESLOPE - 1 LAYER BOTTOM - 2 LAYERS
- LINER GEOMEMBRANE - PRIMARY AND SECONDARY 80 MIL HDPE LINER BY NATIONAL SEAL COMPANY





END OF CELL CLEANOUT DETAIL
NOT TO SCALE

MASTER CELL VI CELL 'C'
LEACHATE COLLECTION SYSTEM &

VI-C

MIDWESTERN CONSULTING INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

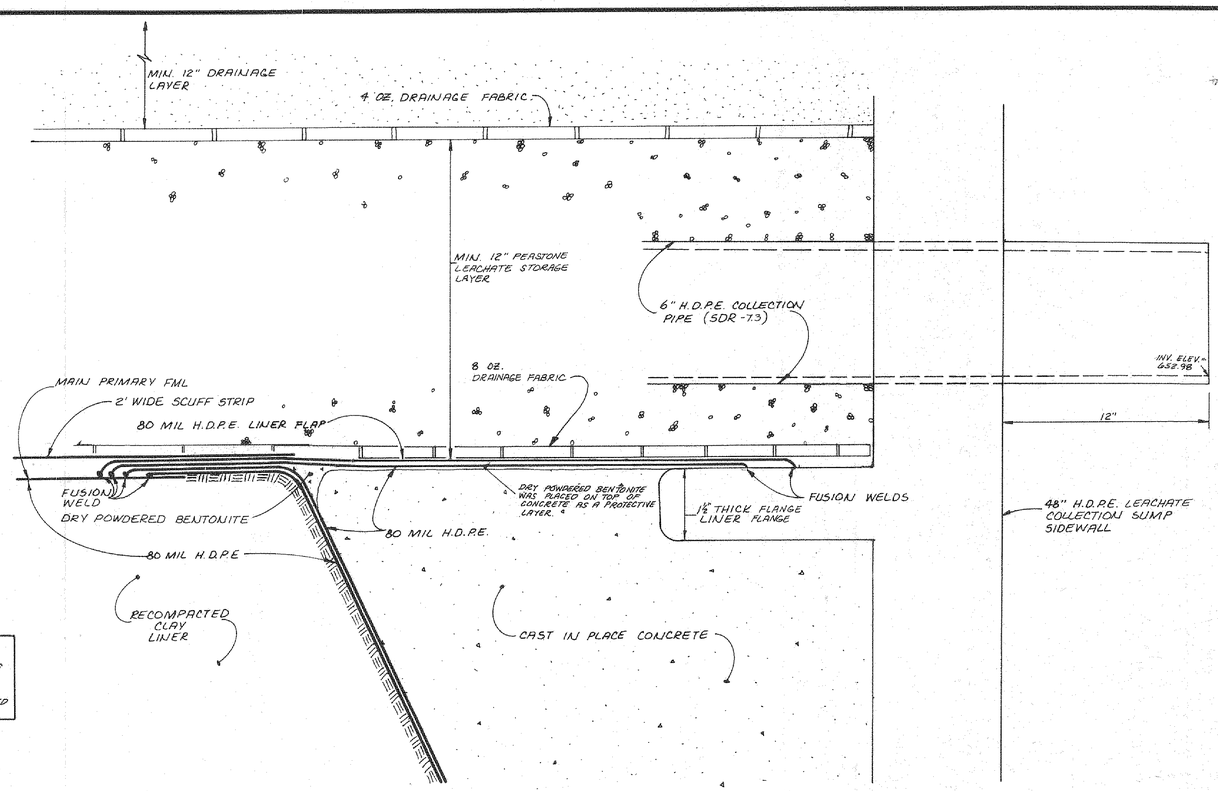
1989
CONSTRUCTION CERTIFICATION SET

DATE 4/5/89
SHEET 1 OF 6
BY D. SCHULTZ
3-26-90

88237

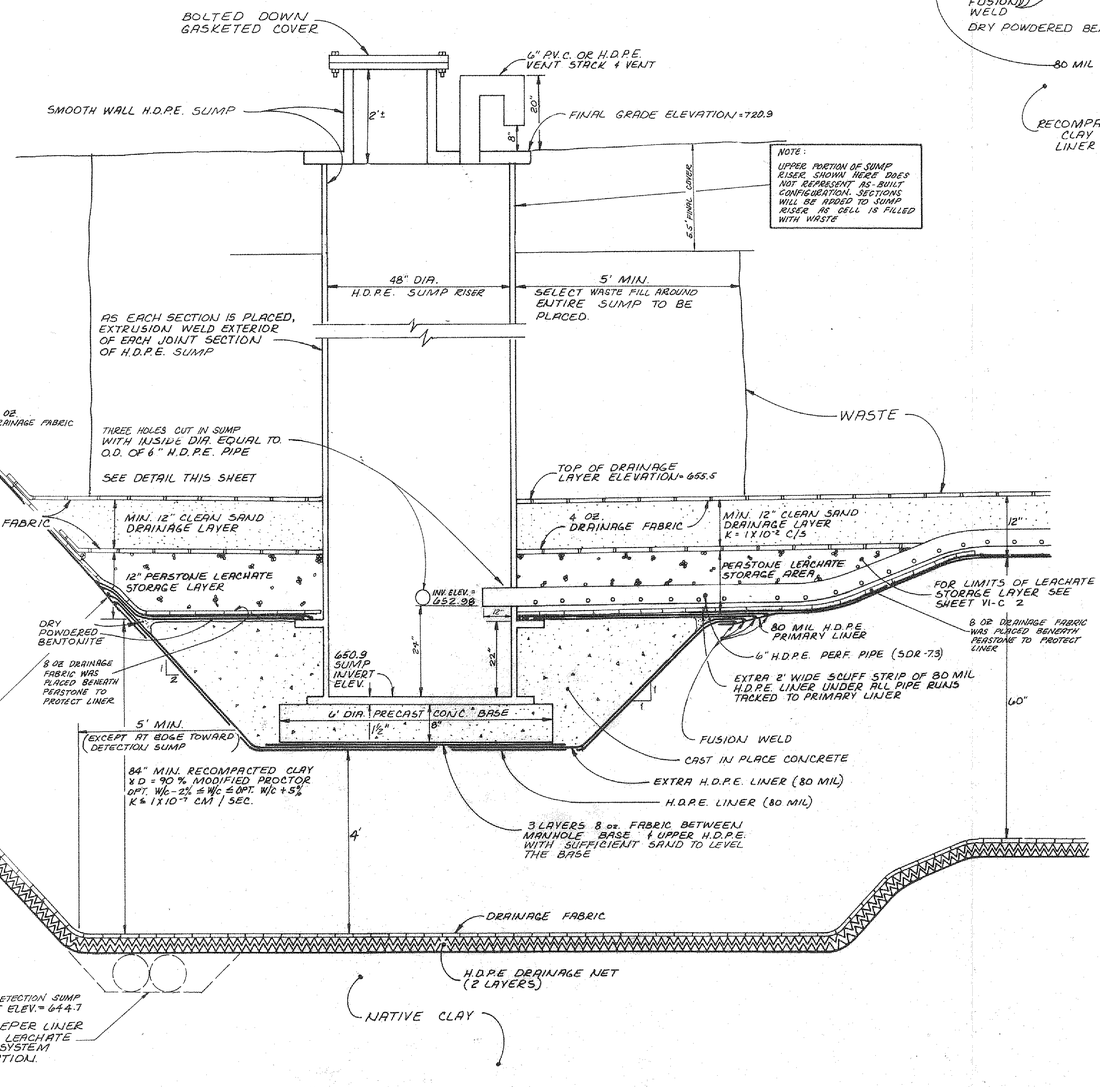
PROJECT AS-BUILT CONDITIONS

DUMM 580 4 78 78464



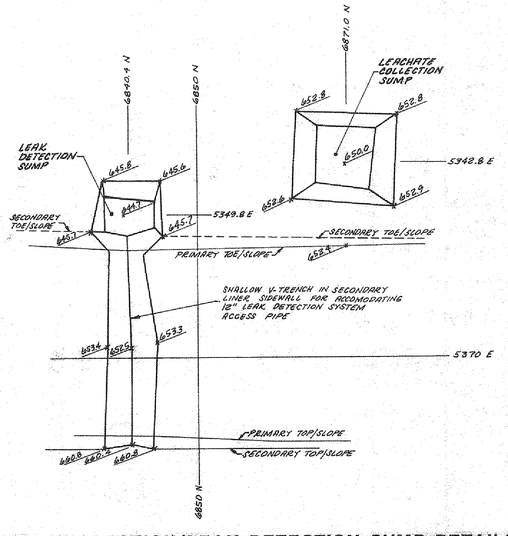
LEACHATE COLLECTION SUMP DETAIL

NOT TO SCALE



LEACHATE COLLECTION SUMP - LINER CONNECTION DETAIL

NOT TO SCALE



LEACHATE COLLECTION/LEAK DETECTION SUMP DETAILS

SCALE: 1" = 10'

MASTER CELL VI CELL 'C'

LEACHATE COLLECTION SUMP/ LEAK DETECTION SUMP DETAILS

AS-BUILT CONDITIONS

VI-C 5A

MIDWESTERN CONSULTING, INC.
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE: 313-971-8800
MCI

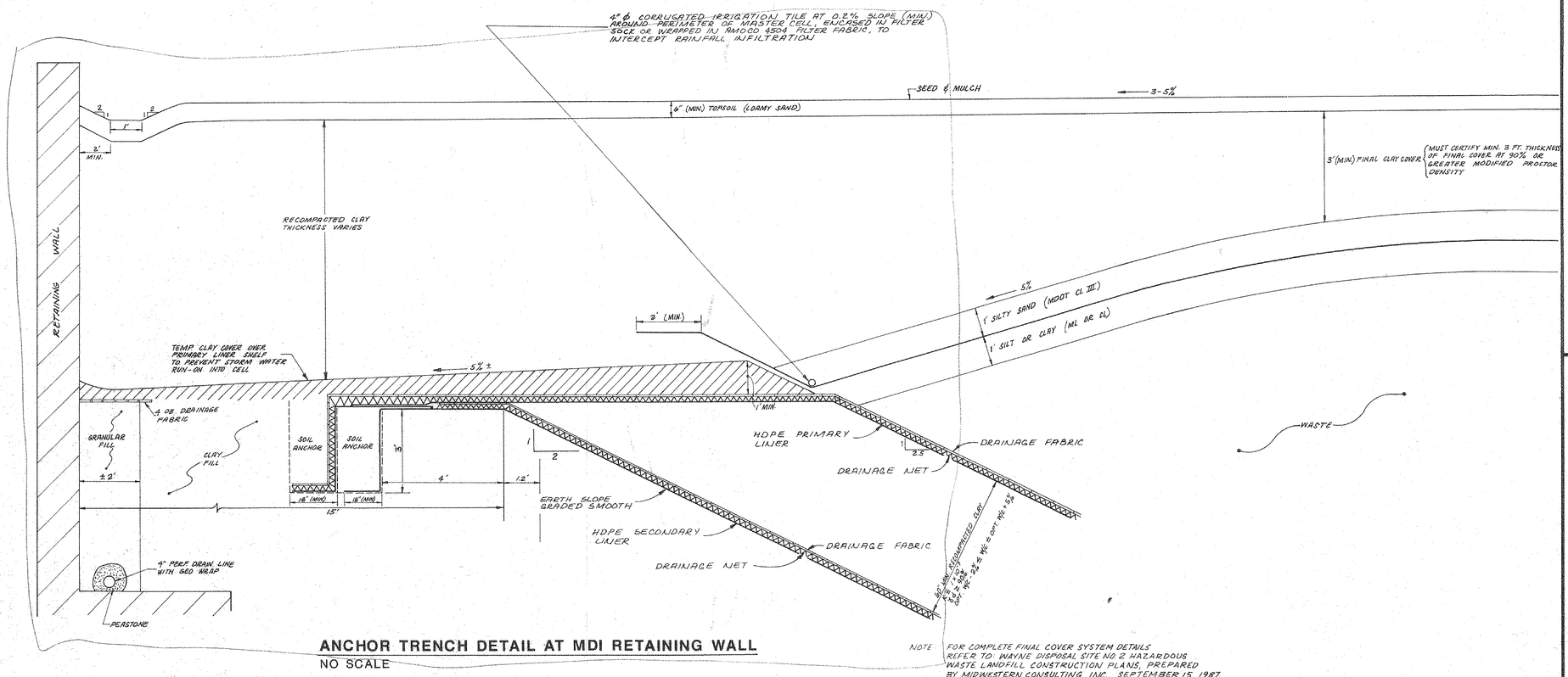
WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

1989 CONSTRUCTION CERTIFICATION SET

DATE: 4/5/89	
SHEET 7 OF 0	
BY: D. SCHMUTZ	3-28-90

JOB No. 88237

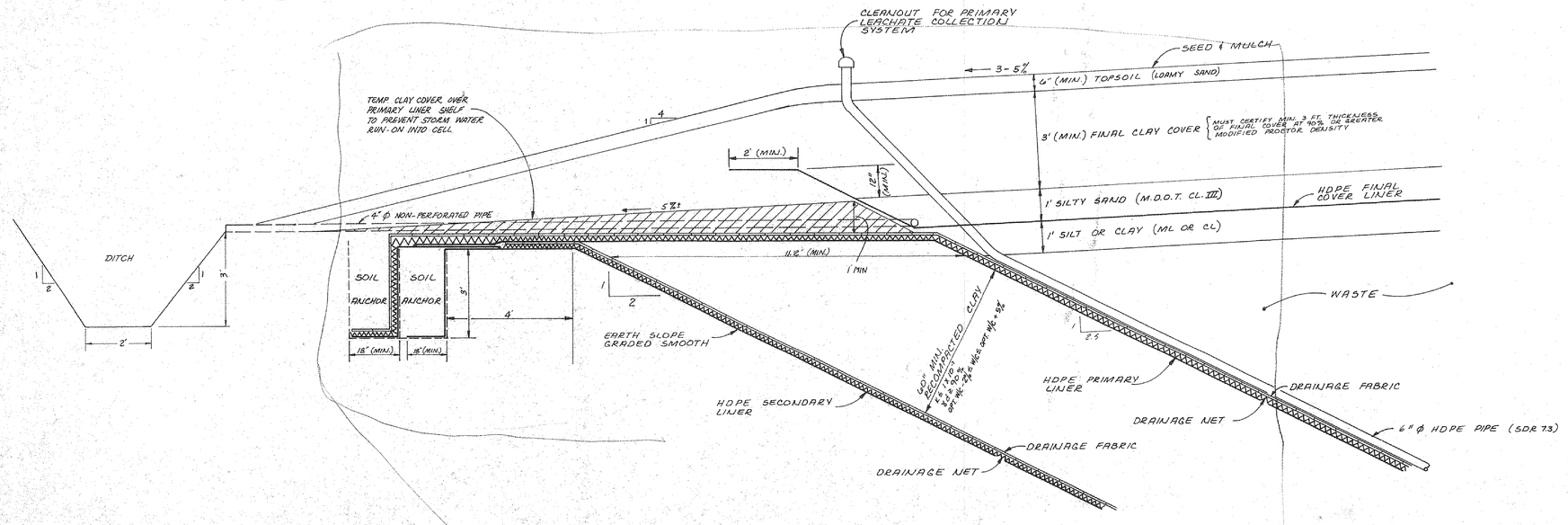
REVISED TO REFLECT AS-BUILT CONDITIONS



ANCHOR TRENCH DETAIL AT MDI RETAINING WALL

NO SCALE

NOTE: FOR COMPLETE FINAL COVER SYSTEM DETAILS REFER TO: WAYNE DISPOSAL SITE NO. 2 HAZARDOUS WASTE LANDFILL CONSTRUCTION PLANS, PREPARED BY MIDWESTERN CONSULTING, INC., SEPTEMBER 15, 1987.



FINAL COVER AND ANCHOR TRENCH DETAIL

NO SCALE

FINAL COVER SYSTEM DETAILS SHOWN HERE ARE PLANS ONLY AND DO NOT REPRESENT AS-BUILT CONFIGURATIONS

MASTER CELL VI CELL 'C'

FINAL COVER AND

TOP/DIKE DETAILS

AS-BUILT CONDITIONS

VI-C

6A

MIDWESTERN CONSULTING, INC.

CIVIL ENGINEERS • PLANNERS • SURVEYORS

2675 JACKO ROAD

ANN ARBOR, MICHIGAN 48105

TELEPHONE (313) 971-8800

WAYNE DISPOSAL

HAZARDOUS WASTE DISPOSAL SITE

VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

1989

CONSTRUCTION CERTIFICATION SET

DATE: 4/6/89

SHEET 6 OF 6

BY: S-RA-RD

JOB NO. 88237

REVISIONS: REVISED TO REFLECT AS-BUILT CONDITIONS

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL D

RECORD PLAN

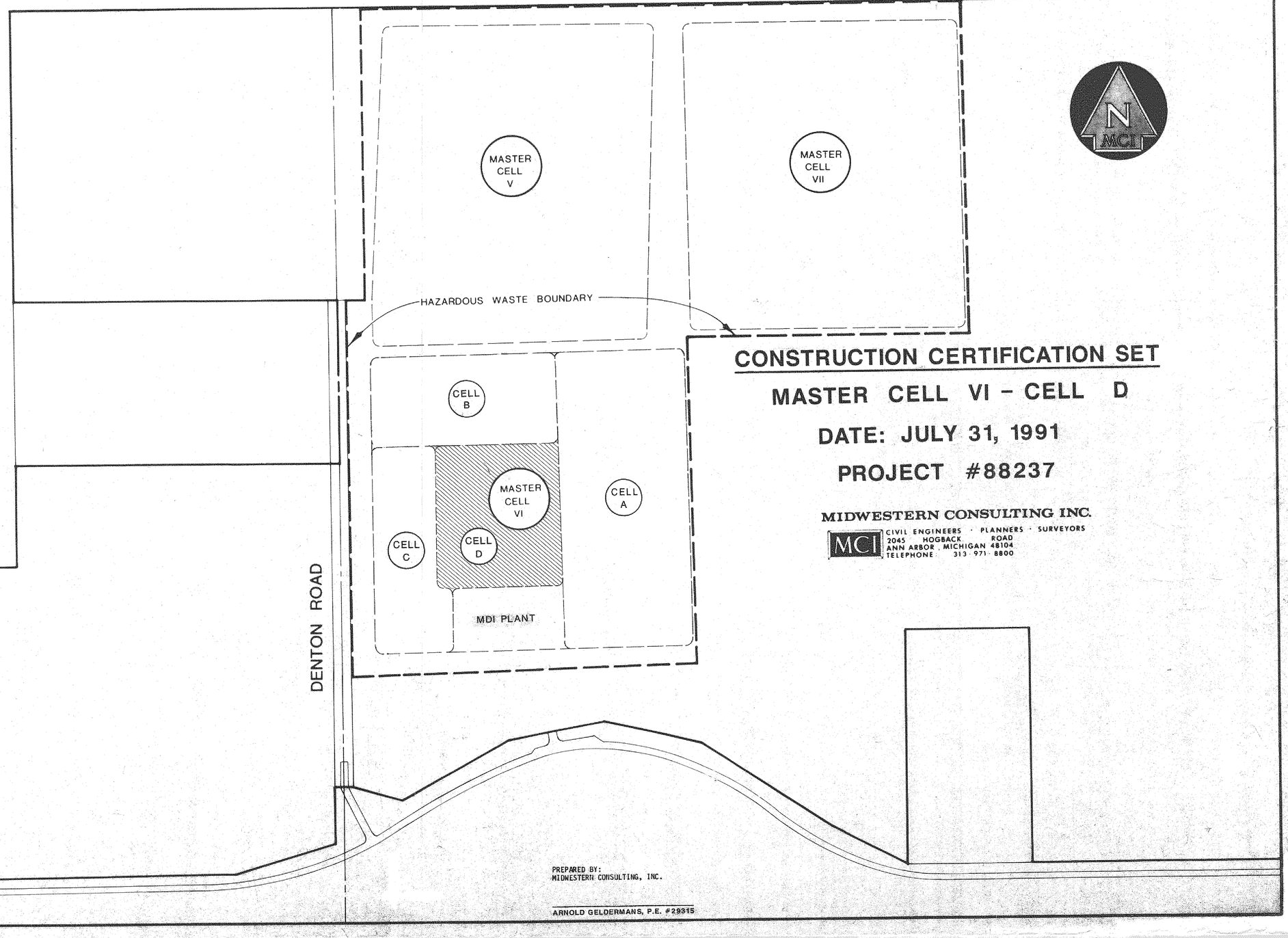
WAYNE DISPOSAL

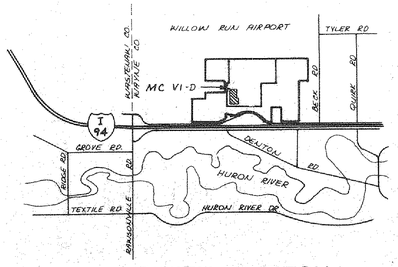
SITE NO. 2 LANDFILL

SHEET INDEX

SHEET VI-D 3A	SECONDARY LINER ELEVATIONS WITH LEAK DETECTION SYSTEM
SHEET VI-D 4A	PRIMARY LINER ELEVATIONS WITH LEACHATE COLLECTION SYSTEM
SHEET VI-D 5A	LINER SYSTEM DETAILS
SHEET VI-D 6A	LEACHATE COLLECTION SYSTEM AND LEAK DETECTION SYSTEM DETAILS
SHEET VI-D 7A	LEACHATE COLLECTION SUMP/ LEAK DETECTION SUMP DETAILS
SHEET VI-D 8A	TOP/DIKE DETAILS

NOTE: "A" DENOTES AS-BUILT CONFIGURATION





VICINITY SKETCH

CONSTRUCTION CERTIFICATION SET

MASTER CELL VI - CELL D

DATE: JULY 31, 1991

PROJECT #88237

MIDWESTERN CONSULTING INC.

CIVIL ENGINEERS · PLANNERS · SURVEYORS
2045 HOGBACK ROAD
ANN ARBOR, MICHIGAN 48104
TELEPHONE 313·971·8800

PREPARED BY:
MIDWESTERN CONSULTING, INC.

ARNOLD GELDERMANS, P.E. #29315

CELL B
(AS-BUILT)

CELL A - NORTH
(AS-BUILT)

CELL A - SOUTH
(AS-BUILT)

CELL C
(AS-BUILT)

CELL D
(AS-BUILT)

MDI PLANT

LEAK DETECTION SUMP INV.=648.5

LEAK DETECTION SUMP INV.=651.2

LEAK DETECTION SUMP INV.=652.1

LEAK DETECTION SUMP INV.=644.7

3 ADDITIONAL LAYERS OF DRAINAGE NET

LEAK DETECTION SYSTEM SUMP
TOP/SUMP = 641.3
INV. SUMP = 641.3
(6488.1N, 5650 E).
(SEE DETAIL SHT. VI-D 6R)

12" DIA. R-DOD
PE 3408 HDPE
(SDR. 11) LEAK
DETECTION SYSTEM
ACCESS PIPE

CONSTRUCTION ACCESS RAMP

SLOPE 2:1

SLOPE 2:1

VI-D

VI-C

4' ANCHOR TRENCH

7200N
7100N
7000N
6900N
6800N
6700N
6600N
6500N
6400N
6300N

5100E
5200E
5300E
5400E
5500E
5600E
5700E
5800E
5900E
6000E
6100E
6200E

SCALE : 1" = 50'

LEGEND

- 654.2 — CELL D AS-BUILT ELEVATIONS
- 649.2 — CELLS A, B & C AS-BUILT ELEVATIONS
- ——— — AS-BUILT TOE/SLOPE & TOP/DIKE
- ▨ — AS-BUILT LEAK DETECTION SYSTEM COLLECTORS

MASTER CELL VI, CELL D

SECONDARY LINER ELEVATIONS
WITH LEAK DETECTION SYSTEM

AS-BUILT CONFIGURATION

VI-D
3A

MIDWESTERN CONSULTING
Civil Engineers
Environmental Engineers
Planners, Surveyors
2045 Hogback Road
Ann Arbor, Michigan 48105
313.971.8800 Fax 313.971.1583

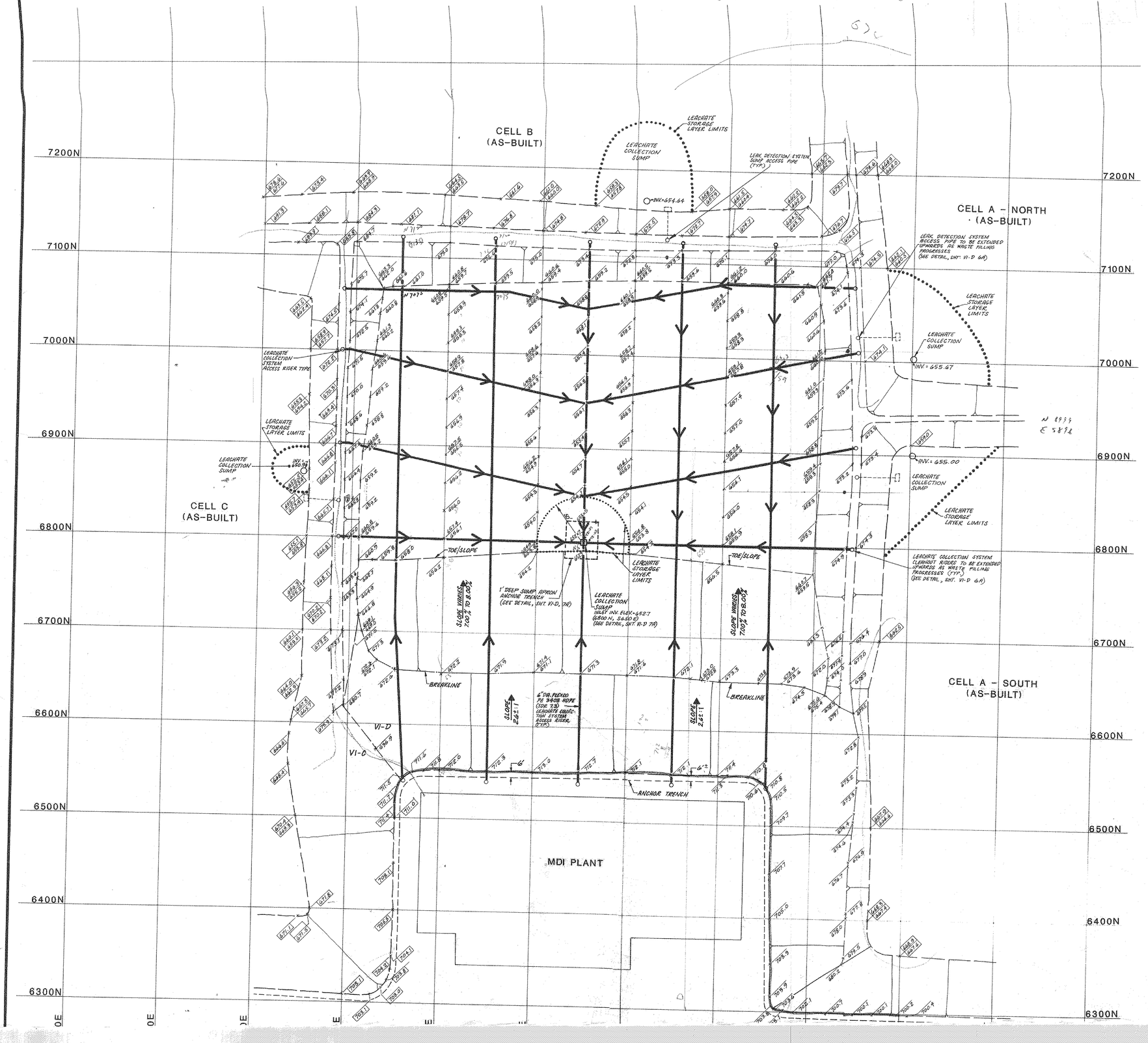
WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

1991
CONSTRUCTION
CERTIFICATION
SET

JOB No. 88237

DATE: 6-31-91
SHEET 2 OF 7
BY: T.J.O.

REVISIONS:
AS-BUILT CONFIGURATION 8-31-91



SCALE : 1" = 50'

LEGEND

- 660.2 / 659.2 — CELL D AS-BUILT TOP/SAND ELEV. / CELL D AS-BUILT TOP/CLAY ELEV.
- 661.5 / 660.4 — CELLS A,B & C AS-BUILT TOP/SAND ELEV. / CELLS A,B & C AS-BUILT TOP/CLAY ELEV.
- AS-BUILT TOP/DIKE & TOE/SLOPE
- AS-BUILT BREAKLINE
- AS-BUILT 6" DIA. HDPE (SDR 7.3) PERFORATED LEACHATE COLLECTION PIPES (PLEXCO PE 3408)

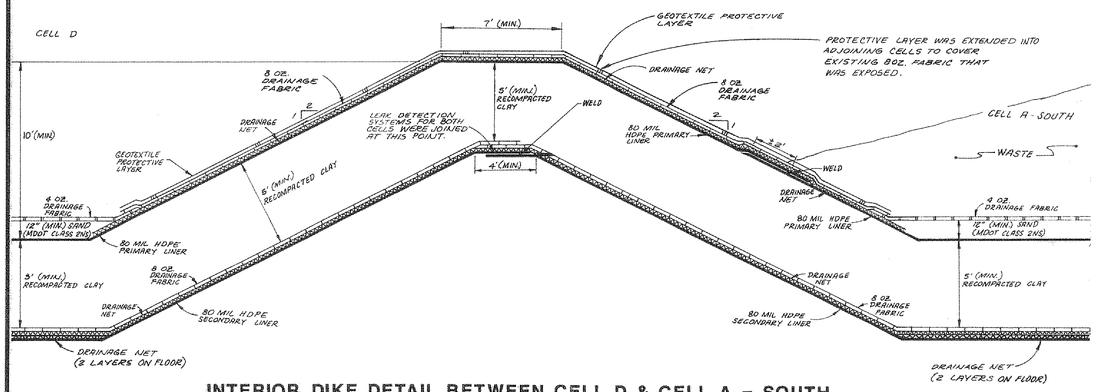
MIDWESTERN CONSULTING
Civil Engineers
Environmental Engineers
Planners, Surveyors
2045 Hogback Road
Ann Arbor, Michigan 48105
313.971.8800 Fax 313.971.1915

DISPOSAL
WASTE DISPOSAL SITE
TOWNSHIP, WAYNE COUNTY, MICHIGAN.

CONSTRUCTION CERTIFICATION SET

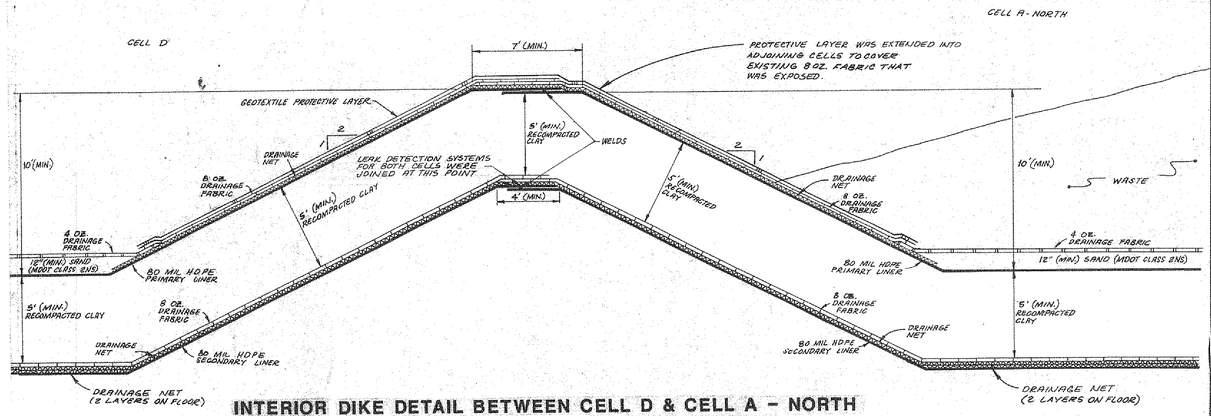
DATE: 8-31-91
SHEET 3 OF 7
BY: D.J.O.
8-31-91

8237



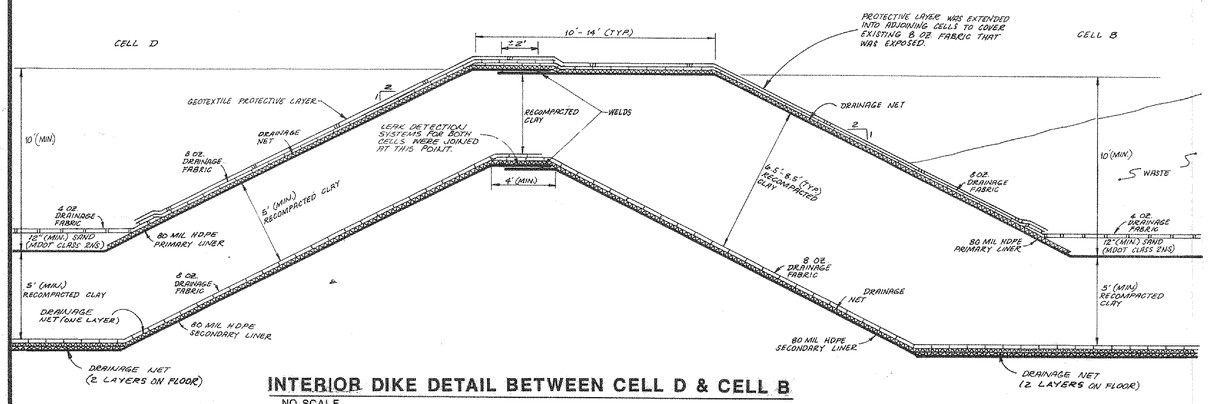
INTERIOR DIKE DETAIL BETWEEN CELL D & CELL A – SOUTH

NO SCALE



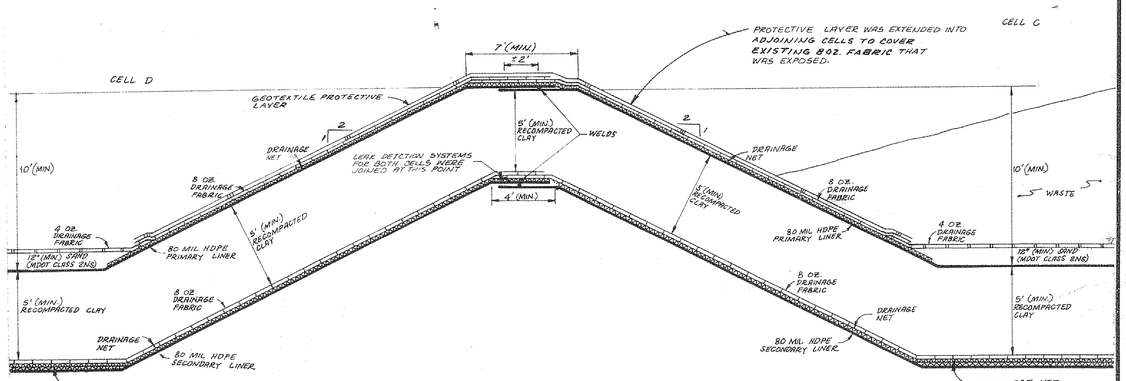
INTERIOR DIKE DETAIL BETWEEN CELL D & CELL A – NORTH

NO SCALE



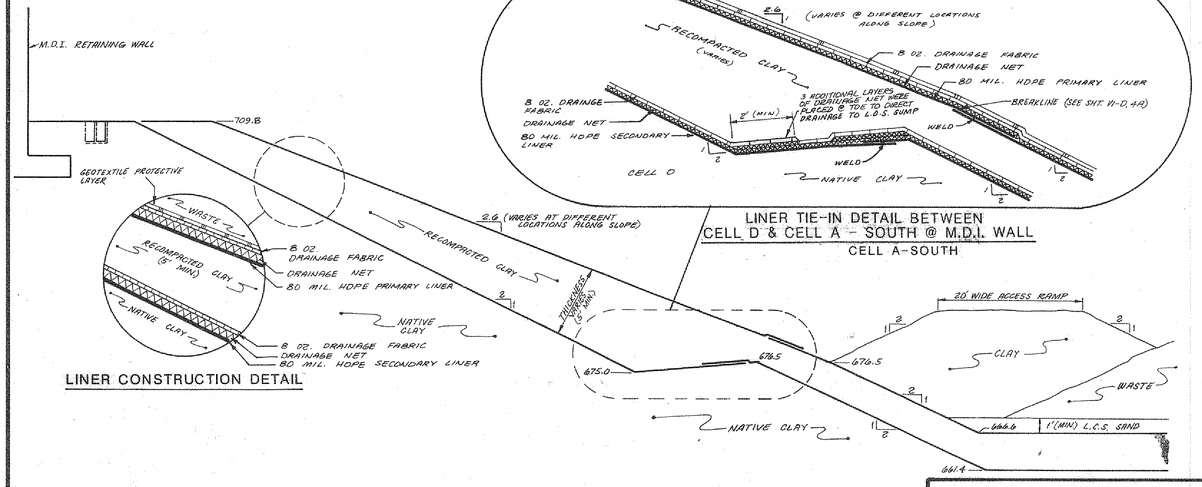
INTERIOR DIKE DETAIL BETWEEN CELL D & CELL B

NO SCALE



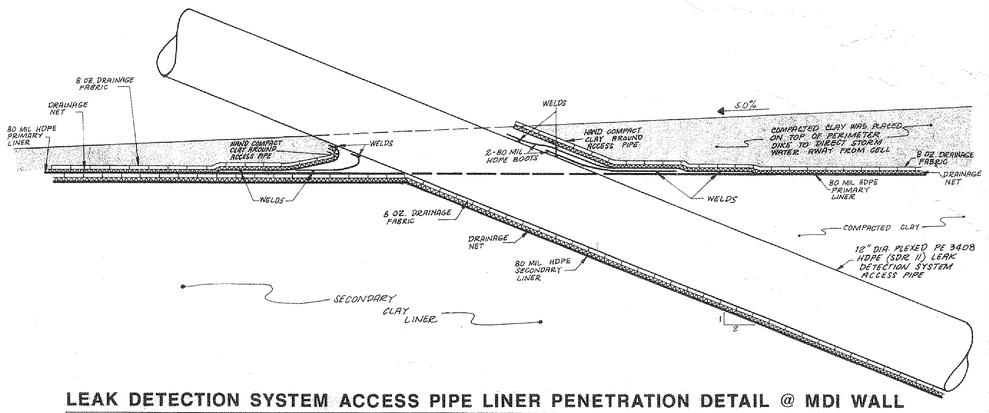
INTERIOR DIKE DETAIL BETWEEN CELL D & CELL C

NO SCALE



SECTION @ 6500 N BETWEEN M.D.I. PLANT & CELL A – SOUTH

SCALE: 1" = 10'



LEAK DETECTION SYSTEM ACCESS PIPE LINER PENETRATION DETAIL @ MDI WALL

LEGEND

- 4 OZ. DRAINAGE FABRIC – EMOCO PROPEX 4504 (USED FOR THE LEACHATE COLLECTION SYSTEM IN THE CELL BASE & RIP RAP PIPE WRAP).
- 8 OZ. DRAINAGE FABRIC – PHILLIPS SUPAC 8UP (USED FOR CELL SIDE WALLS OF LEACHATE COLLECTION SYSTEM & THROUGHOUT LEAK DETECTION SYSTEM)
- 4 OZ. GEOTEXTILE PROTECTIVE LAYER – WELLMAN GUILINE Q40W NON-WOVEN, POLYESTER, NEEDLEPUNCHED GEOTEXTILE
- DRAINAGE NET CONWED X8 8410 SIDESLOPE – 1 LAYER, BOTTOM – 2 LAYERS
- LINER GEOMEMBRANE – PRIMARY & SECONDARY 80 MIL HDPE LINER BY NATIONAL SEAL COMPANY OR GUNDLE LINING SYSTEM

MASTER CELL VI, CELL D

LINER SYSTEM DETAILS

AS-BUILT CONFIGURATION

VI-D 5 A

MIDWESTERN CONSULTING
Civil Engineers
Environmental Engineers
Planners, Surveyors
2345 Hogback Road
Ann Arbor, Michigan 48105
313.971.8800 Fax 313.971.1582

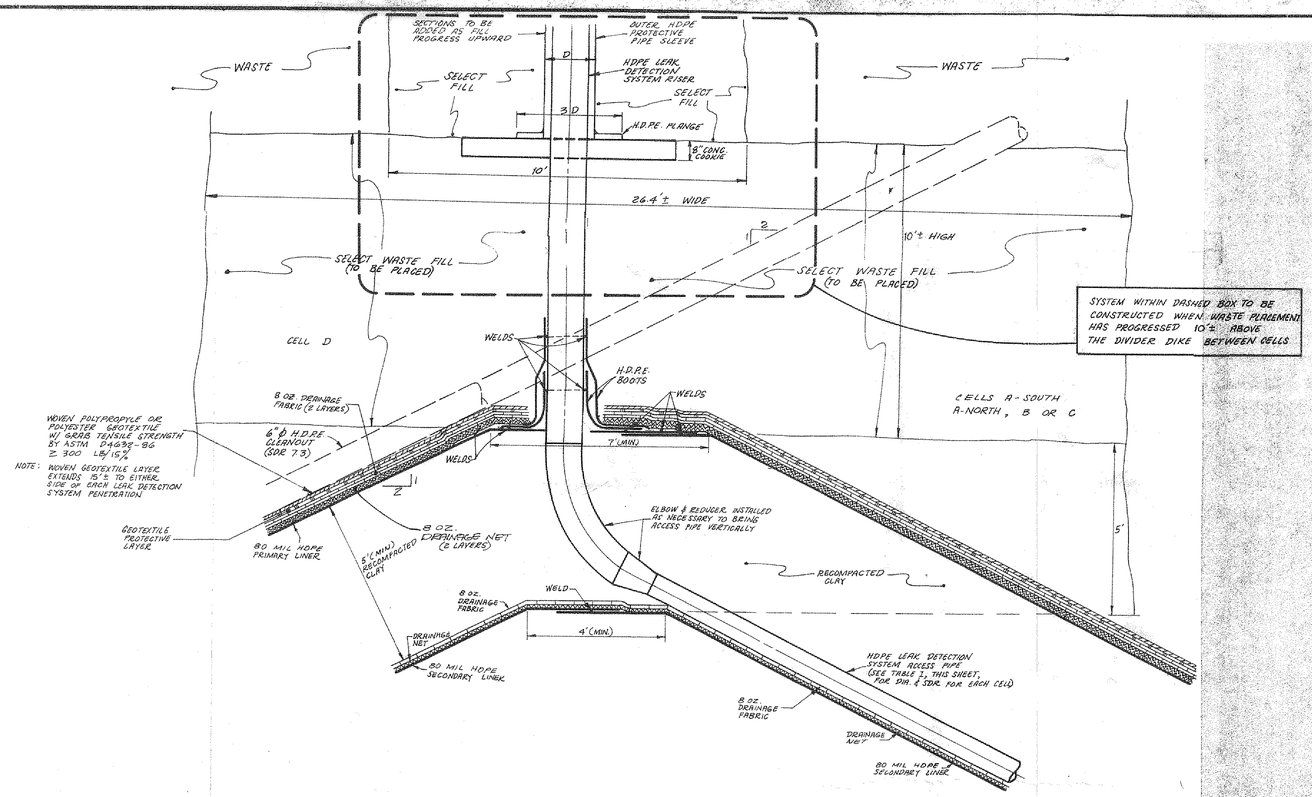
WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

1991 CERTIFICATION SET

DATE 8-31-91
SHEET 4 OF 7
BY D.J.O.

JOB No. 88237

REVISIONS:
RE-AS-BUILT CONFIGURATION 8-31-91



TYPICAL LEAK DETECTION SYSTEM ACCESS PIPE PENETRATIONS OF PRIMARY LINER

NO SCALE

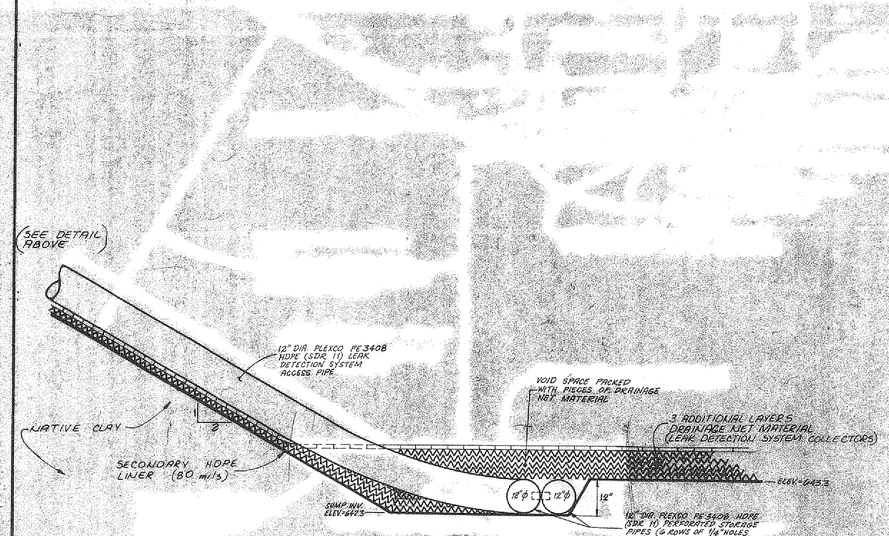
TABLE I

VI-D LEAK DETECTION SYSTEM ACCESS PIPE PENETERTIONS THROUGH PRIMARY LINER

EXISTING PIPE			VERTICAL EXTENSION	
CELL	DIA.	SDR	DIA.	SDR.
VI-A-S	8"	17	10"	17
VI-A-N	8"	17	10"	17
VI-B	10"	17	12"	17
VI-C	12"	11	12"	17
V-D	18"	11	N/A	N/A

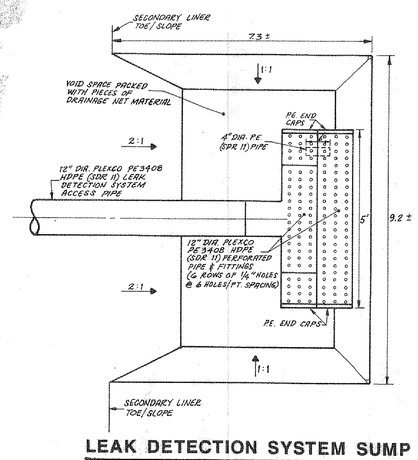
LINER MATERIAL LEGEND

- 4 OZ. DRAINAGE FABRIC - AMOCO PROPEX 4504 USED FOR THE LEACHATE COLLECTION SYSTEM IN THE CELL BASE & FOR ALL PIPE WRAP
- 8 OZ. DRAINAGE FABRIC - PHILLIPS SUPAC 8NP USED FOR CELL SIDE WALLS OF LEACHATE COLLECTION SYSTEM & THROUGHOUT THE LEAK DETECTION SYSTEM.
- DRAINAGE NET CONNED X8 B-610 DIPSLAVE - 1 LAYER BOTTOM - 2 LAYERS
- LINER GEOMEMBRANE - PRIMARY AND SECONDARY 80 MIL HDPE LINER BY NATIONAL SEAL COMPANY OR GUNDLE LINING SYSTEM
- 4 OZ. GEOTEXTILE PROTECTIVE LAYER - WELLMAN QUILINE Q40W NON-WOVEN, POLYESTER, NEEDLE PUNCHED GEOTEXTILE
- EXXON GTF 300 WOVEN GEOTEXTILE



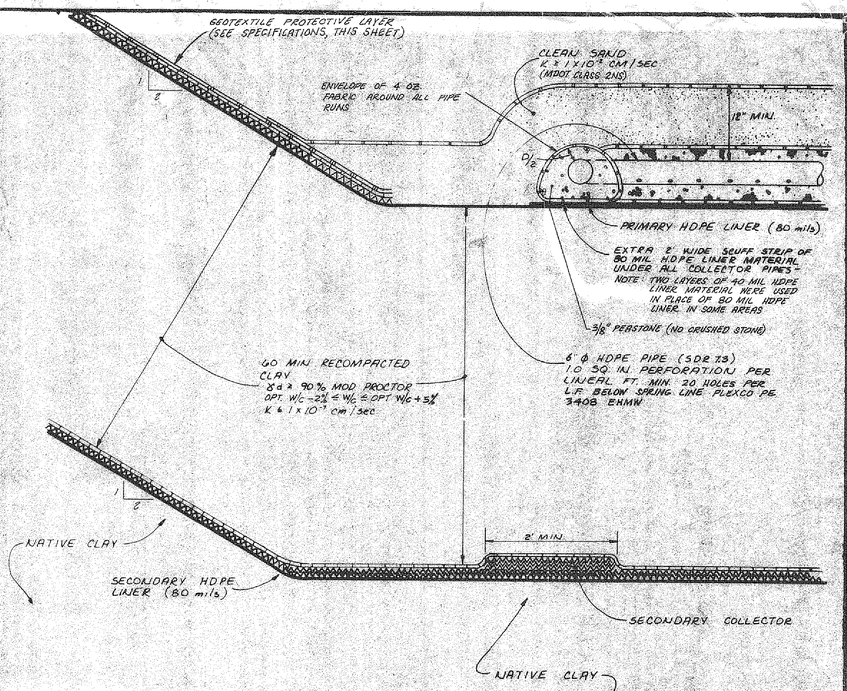
LEAK DETECTION SUMP SYSTEM CROSS SECTION

NO SCALE



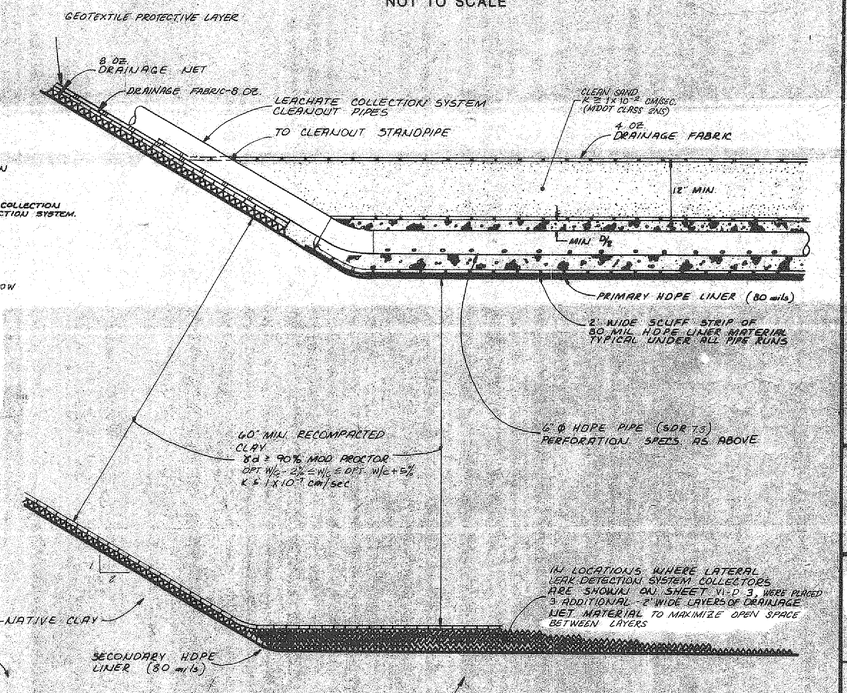
LEAK DETECTION SYSTEM SUMP

NO SCALE



CELL BOTTOM DRAINAGE DETAIL

NOT TO SCALE



END OF CELL CLEANOUT DETAIL

NOT TO SCALE

MASTER CELL VI, CELL D

LEACHATE COLLECTION SYSTEM & LEAK DETECTION SYSTEM DETAILS

AS-BUILT CONFIGURATION

VI-D 6A

MIDWESTERN CONSULTING INC
CIVIL ENGINEERS PLANNERS SURVEYORS
ANN ARBOR, MICHIGAN 48103
TELEPHONE - 313-971-8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

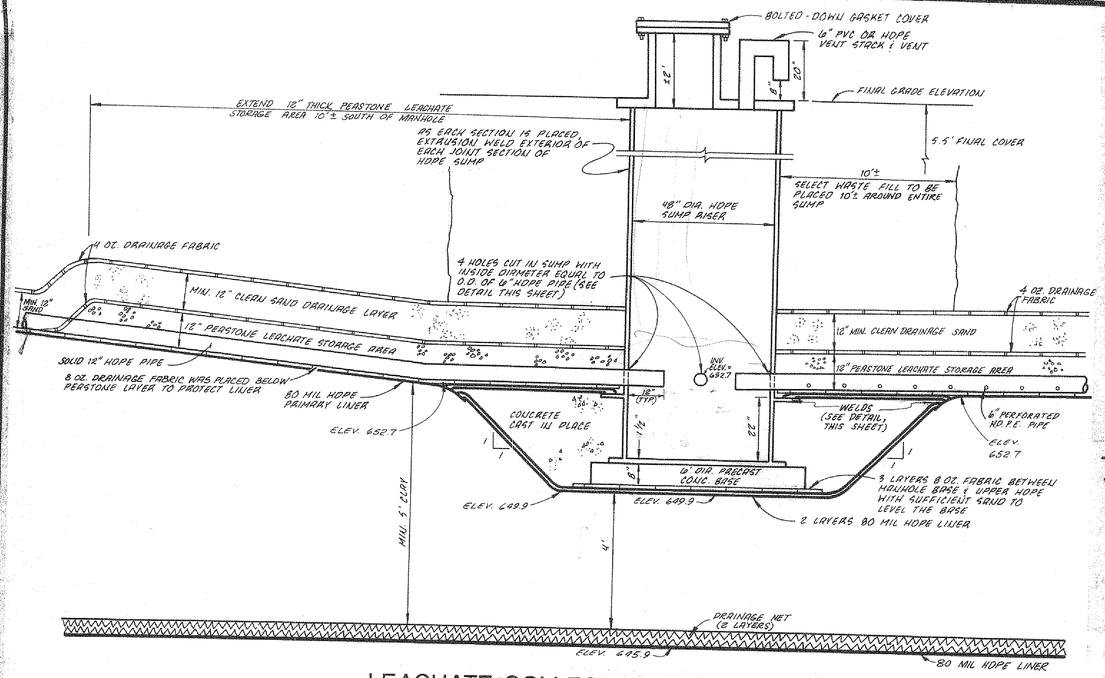
1991 CONSTRUCTION CERTIFICATION SET

REVISIONS:	BY	DATE
AS-BUILT CONFIGURATION	D.L.G.	8-31-91

DATE 8-31-91
SHEET 5 OF 7
BY D.L.G.

JOB NO. 88237

Dura-100 x 79 /6404

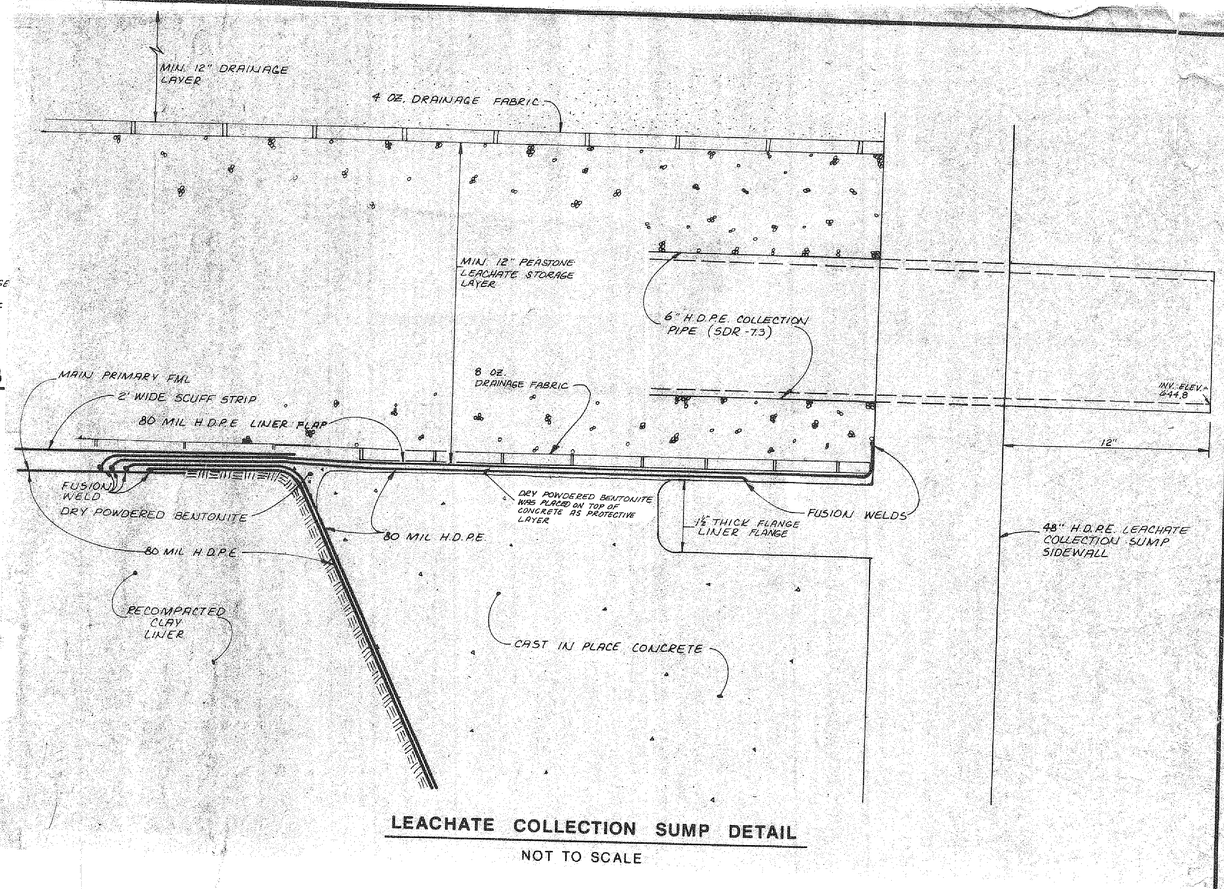


LEACHATE COLLECTION SUMP DETAIL

NO SCALE

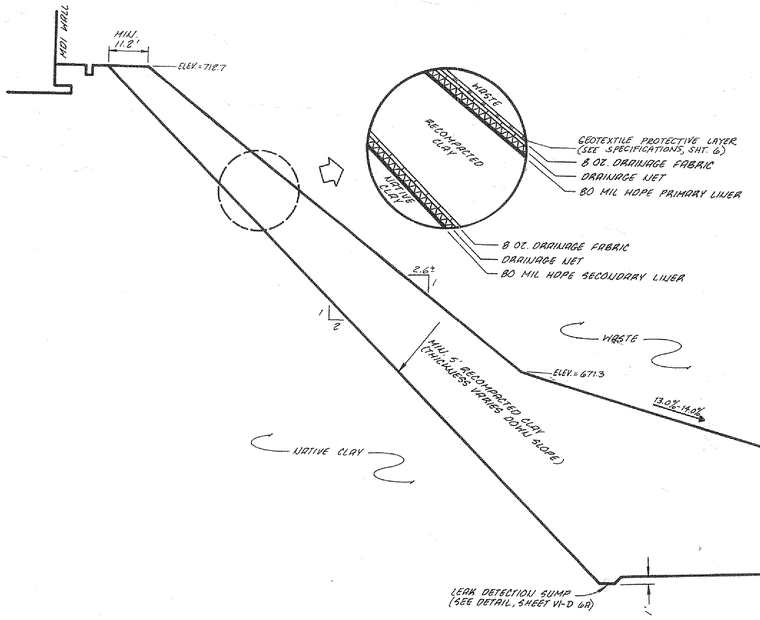
	LEACHATE COLLECTION SUMP ELEV. SCHEDULE				LEAK DETECTION SUMP ELEV. SCHEDULE		
CELL	PIPE INV. ELEV.	LEACHATE SUMP INV.	NORTH COORD.	EAST COORD.	DETECTION SUMP INV.	NORTH COORD.	EAST COORD.
VI-AN	657.69	655.67	7004.9	5999.0	651.2	7020.0	5983.0
VI-AS	658.3	655.0	6900.0	6000.0	652.1	6877±	5985±
VI-B	656.96	654.64	7165	5710	648.5	7158.5	5732.7
VI-C	652.9	650.9	6871	5342.8	644.7	6840.4	5349.8
VI-D	652.7	649.7	6800	5650	648.3	6684.1	5650.0

649.9 ± 8" ± @ 1.5"



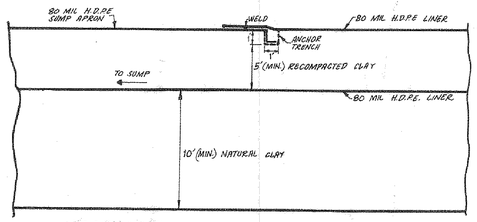
LEACHATE COLLECTION SUMP DETAIL

NOT TO SCALE



CROSS SECTION AT 5650 E

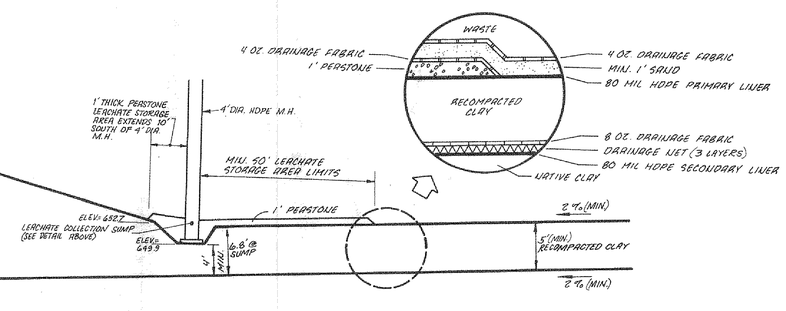
SCALE: 1" = 20' HORIZ.
1" = 10' VERT.

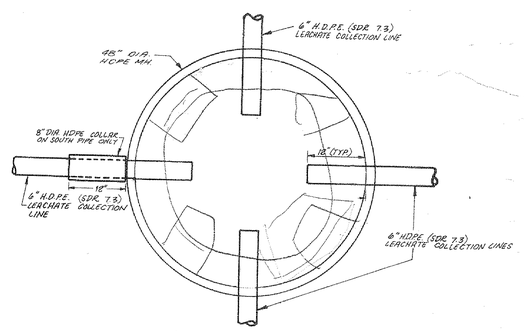


NOTE:
THIS DETAIL IS TO SHOW HOW THE PRIMARY SUMP GEOMEMBRANE APRON WAS ANCHORED. REFER TO LINER SYSTEMS DETAILS FOR PROPER LINER CONSTRUCTION AND MATERIAL REQUIREMENTS.

ANCHOR TRENCH DETAIL FOR SUMP GEOMEMBRANE APRON

NO SCALE





LEACHATE COLLECTION SUMP PLAN VIEW

NO SCALE

MASTER CELL VI, CELL D

LEACHATE COLLECTION SUMP/ LEAK DETECTION SUMP DETAILS

VI-D

MIDWESTERN CONSULTING, INC
CIVIL ENGINEERS · PLANNERS · SURVEYORS
2016 S. HIGBIE ROAD
ANN ARBOR, MICHIGAN 48105
TELEPHONE: 313-971-8800

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

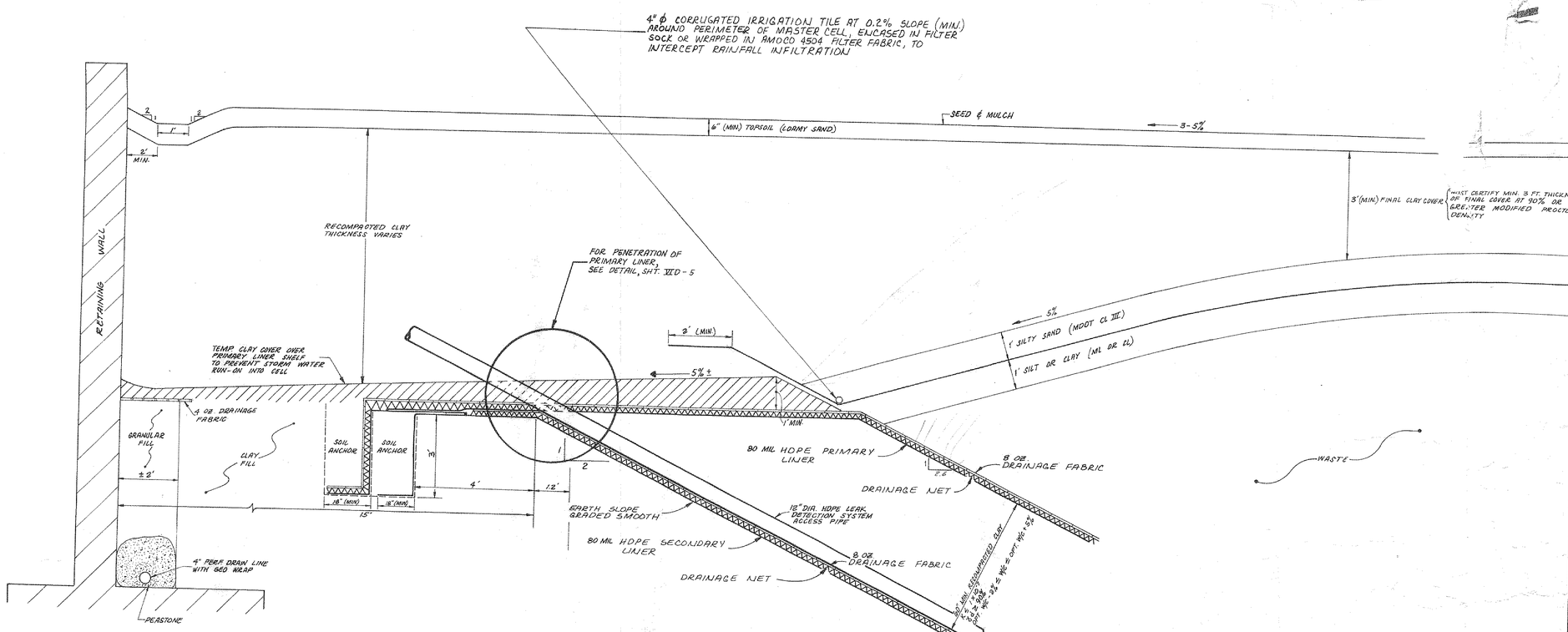
1991 CERTIFICATION SET

DATE: 8-31-91
SHEET 6 OF 7
BY: D.J.C.

88237

8-31-91

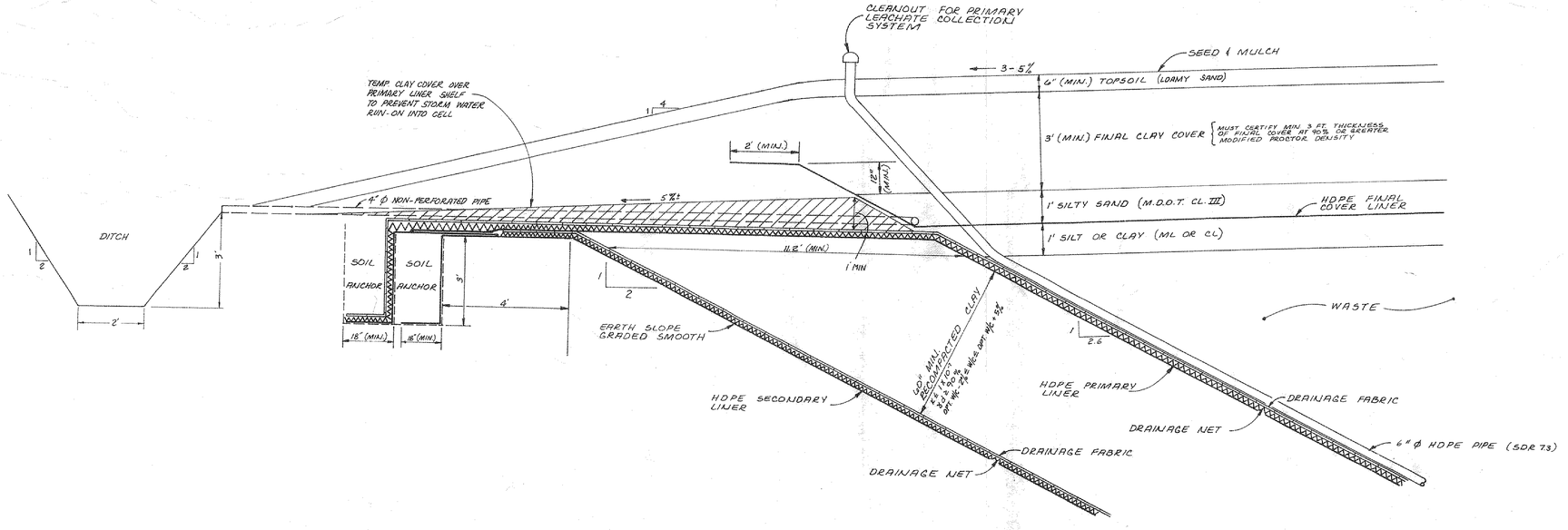
DRAWING SHEET.DGN



ANCHOR TRENCH DETAIL AT MDI RETAINING WALL
NO SCALE

NOTE:
FOR COMPLETE FINAL COVER SYSTEM DETAILS, REFER TO: WAYNE DISPOSAL SITE NO. 2 HAZARDOUS WASTE LANDFILL CONSTRUCTION PLANS, PREPARED BY MIDWESTERN CONSULTING, INC., SEPTEMBER 15, 1987.

NOTE:
FINAL COVER SYSTEM DETAILS ARE NOT AS-BUILT. FINAL COVER SYSTEM TO BE CONSTRUCTED UPON COMPLETION OF WASTE PLACEMENT.



FINAL COVER AND ANCHOR TRENCH DETAIL
NO SCALE

MASTER CELL VI, CELLD
FINAL COVER AND TOP/DIKE DETAILS
VI-D

MIDWESTERN CONSULTING
CIVIL ENGINEERS • PLANNERS
2045 ROSE ST. • P.O. BOX 1
ANN ARBOR, MICHIGAN 48107
TELEPHONE: (313) 971-7080

WAYNE DISPOSAL
HAZARDOUS WASTE DISPOSAL SITE
VAN BUREN TOWNSHIP, WAYNE CO.

1991 CERTIFICATION SET

DATE: 8-31-91
SHEET 7 OF 7
BY: DJD

8237

8-31-91

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL E PHASE 1

RECORD PLAN

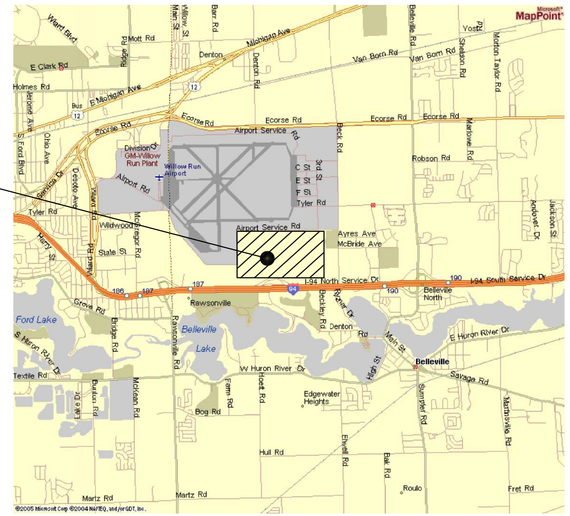
MASTER CELL VI-E PHASE 1 CONSTRUCTION RECORD PLAN
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

PREPARED FOR: WAYNE DISPOSAL, INC.
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

PREPARED BY: NTH CONSULTANTS, LTD.
FARMINGTON HILLS, MICHIGAN

DATE: OCTOBER 2006

SITE LOCATION



VICINITY SKETCH

N

INDEX

SHEET NO.	SHEET TITLE
0	TITLE/INDEX SHEET
1	STRUCTURAL FILL RECORD DRAWING
2	SECONDARY CLAY LINER & LDCRS RECORD DRAWING
3	PRIMARY CLAY LINER ELEVATIONS & LIMITS RECORD DRAWING
4	LEACHATE COLLECTION SYSTEM AS-BUILT ELEVATIONS AND LIMITS
5	DETAILS RECORD DRAWING
6	PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING
7	PANEL LAYOUT PRIMARY GEOMEMBRANE RECORD DRAWING
8	MC VI EXISTING WASTE TOPOGRAPHICAL MAP (8/31/06)
9	MC VI A-NORTH, A-SOUTH, B, AND C LEAK DETECTION RISER SLIPLINING DETAILS

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Cleveland, OH	216.334.4040

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 1 CONSTRUCTION
RECORD PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC
SITE NO. 2
BELLEVILLE, MICHIGAN

NTH PROJECT NO.: 13-060944-01	CAD FILE NAME: J:\Cad-13\WCII E Phase 1\Sheet 0.dwg
DESIGNED BY: KRO	INCEP DATE: 9/26/06
DRAWN BY: KRO	DRAWING SCALE: NONE
CHECKED BY: JHL	PLOT DATE: 9/26/06

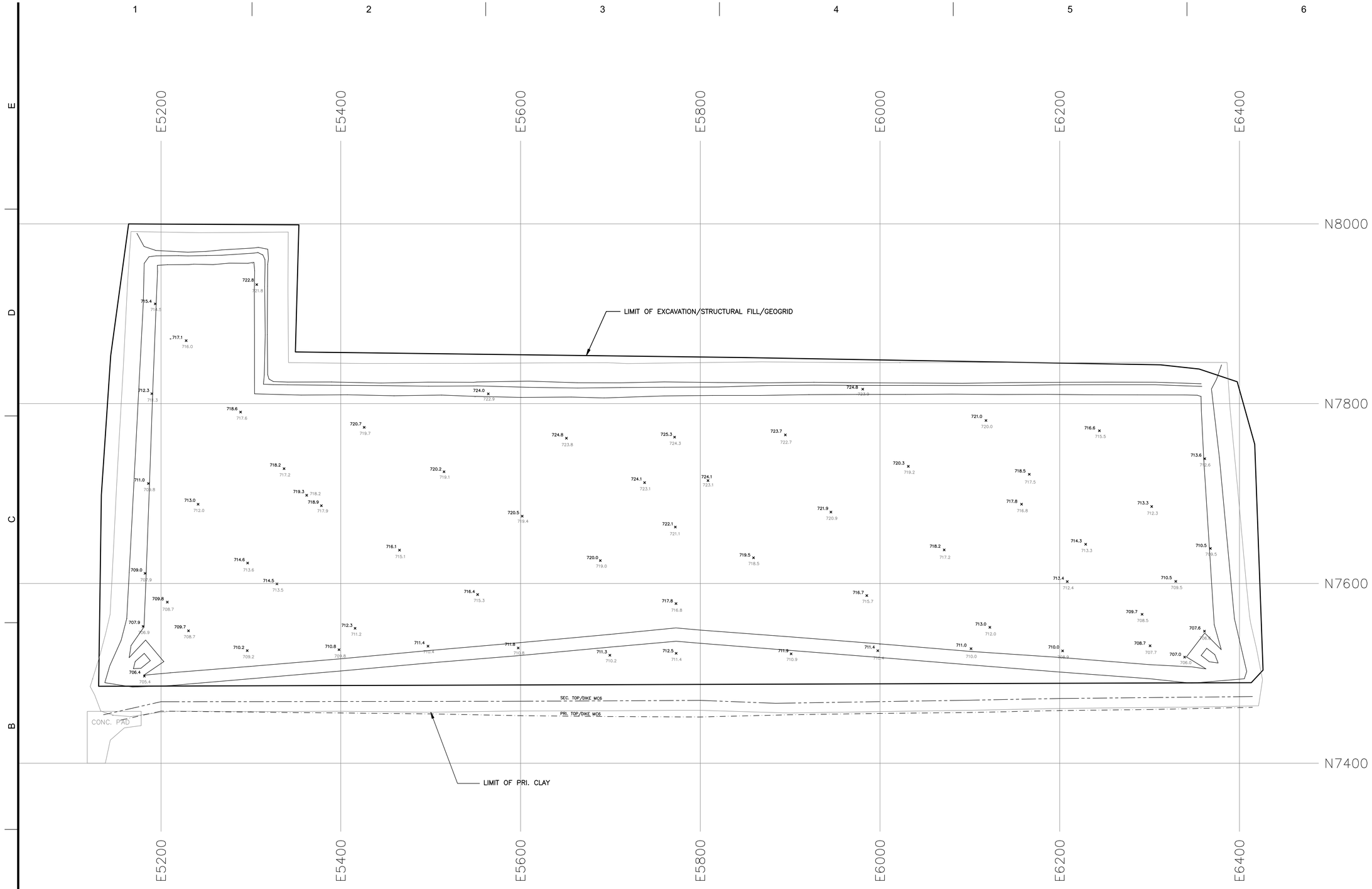
SHEET TITLE:

TITLE/INDEX SHEET

SHEET REFERENCE NUMBER:

0

SHEET 001 OF 010



NOTE:

THIS RECORD DRAWING WAS ADOPTED FROM CONSTRUCTION DOCUMENTATION REPORT PHASE 1, CELL 6E (MASTER CELL VI DESIGN MODIFICATION) SITE 2 LANDFILL WAYNE DISPOSAL, INC. (MID 048 090 633) DATED: OCTOBER 24, 2003.

LEGEND:

713.0 –TOP OF STRUCTURAL FILL

712.0 –SUBGRADE ELEVATION

N

GRAPHIC SCALE

50 0 50

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Cleveland, OH	216.334.4040

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 1 CONSTRUCTION
RECORD PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC
SITE NO. 2
BELLEVILLE, MICHIGAN

NTH PROJECT NO.:	CAD FILE NAME:
13-060944-01	J:\Cad\13\WC6 6E Phase 1\Sheet 1.dwg
DESIGNED BY: KRO	INCEP DATE: 9/26/06
DRAWN BY: KRO	DRAWING SCALE: AS SHOWN
CHECKED BY: JHL	PLOT DATE: 9/26/06

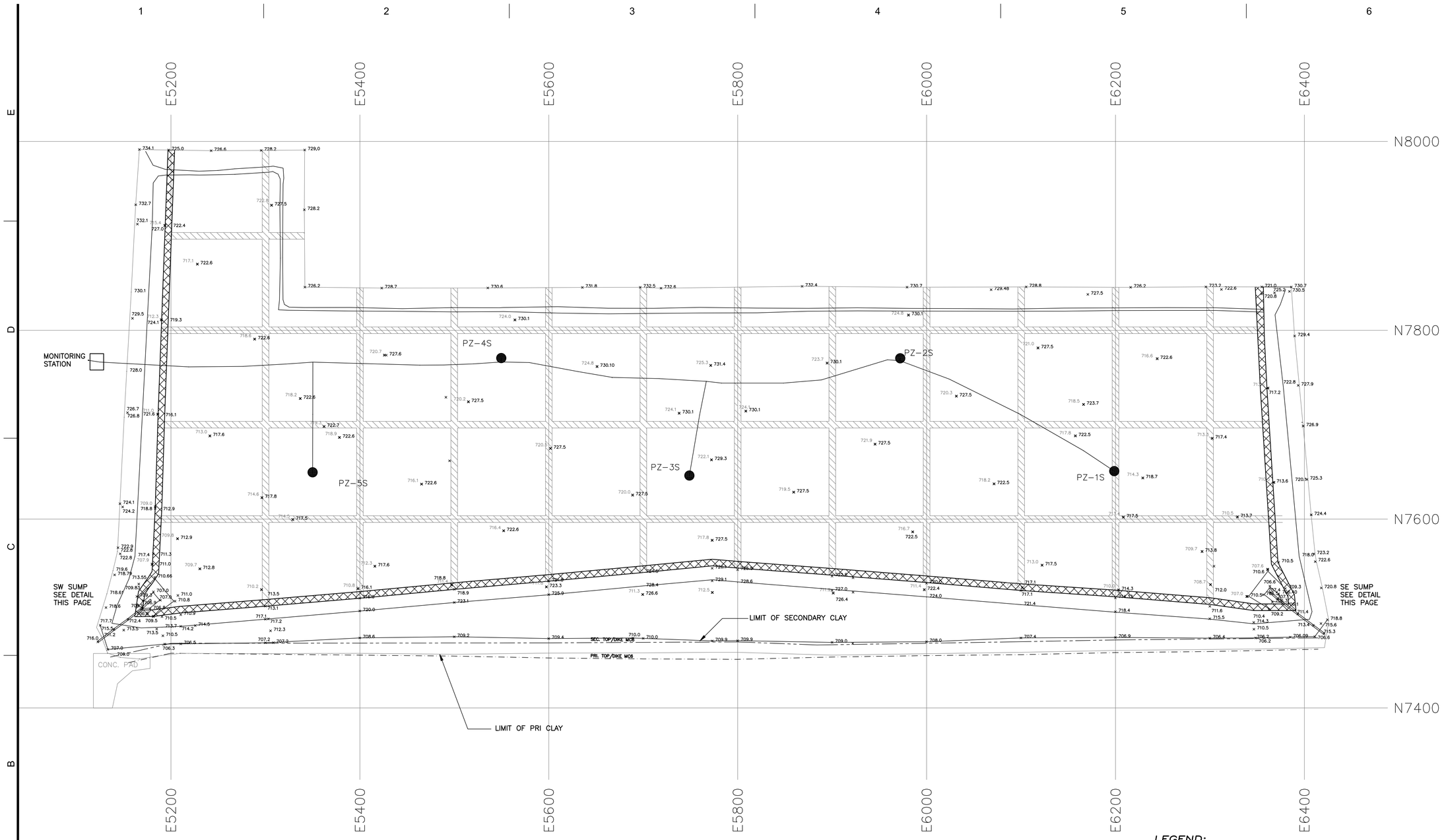
SHEET TITLE:

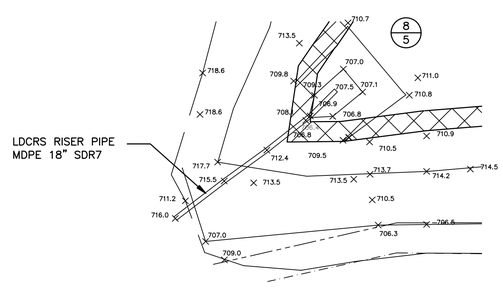
STRUCTURAL FILL
RECORD DRAWING

SHEET REFERENCE NUMBER:

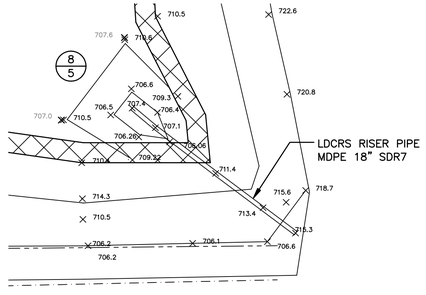
1

SHEET 002 OF 010





DETAIL AT SW SUMP



DETAIL AT SE SUMP

LEGEND:

- 713.0 – TOP OF SECONDARY
- 710.0 – TOP OF STRUCTURAL FILL
- –5–LAYERS GEONET
- –3–LAYERS GEONET

INSTRUMENTATION

- PZ-3S – PIEZOMETER

N

GRAPHIC SCALE
50 0 50

NOTE:

THIS RECORD DRAWING WAS ADOPTED FROM CONSTRUCTION DOCUMENTATION REPORT PHASE 1, CELL 6E (MASTER CELL VI DESIGN MODIFICATION) SITE 2 LANDFILL WAYNE DISPOSAL, INC. (MID 048 090 633) DATED: OCTOBER 24, 2003.

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Cleveland, OH	216.334.4040

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 1 CONSTRUCTION RECORD PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC
SITE NO. 2
BELLEVILLE, MICHIGAN

NTH PROJECT NO.: 13-060944-01	CAD FILE NAME: J:\Cad\13WC6 6E Phase 1\Sheet 2.dwg
DESIGNED BY: KRO	INCEP DATE: 9/26/06
DRAWN BY: KRO	DRAWING SCALE: AS SHOWN
CHECKED BY: JHL	PLOT DATE: 9/26/06

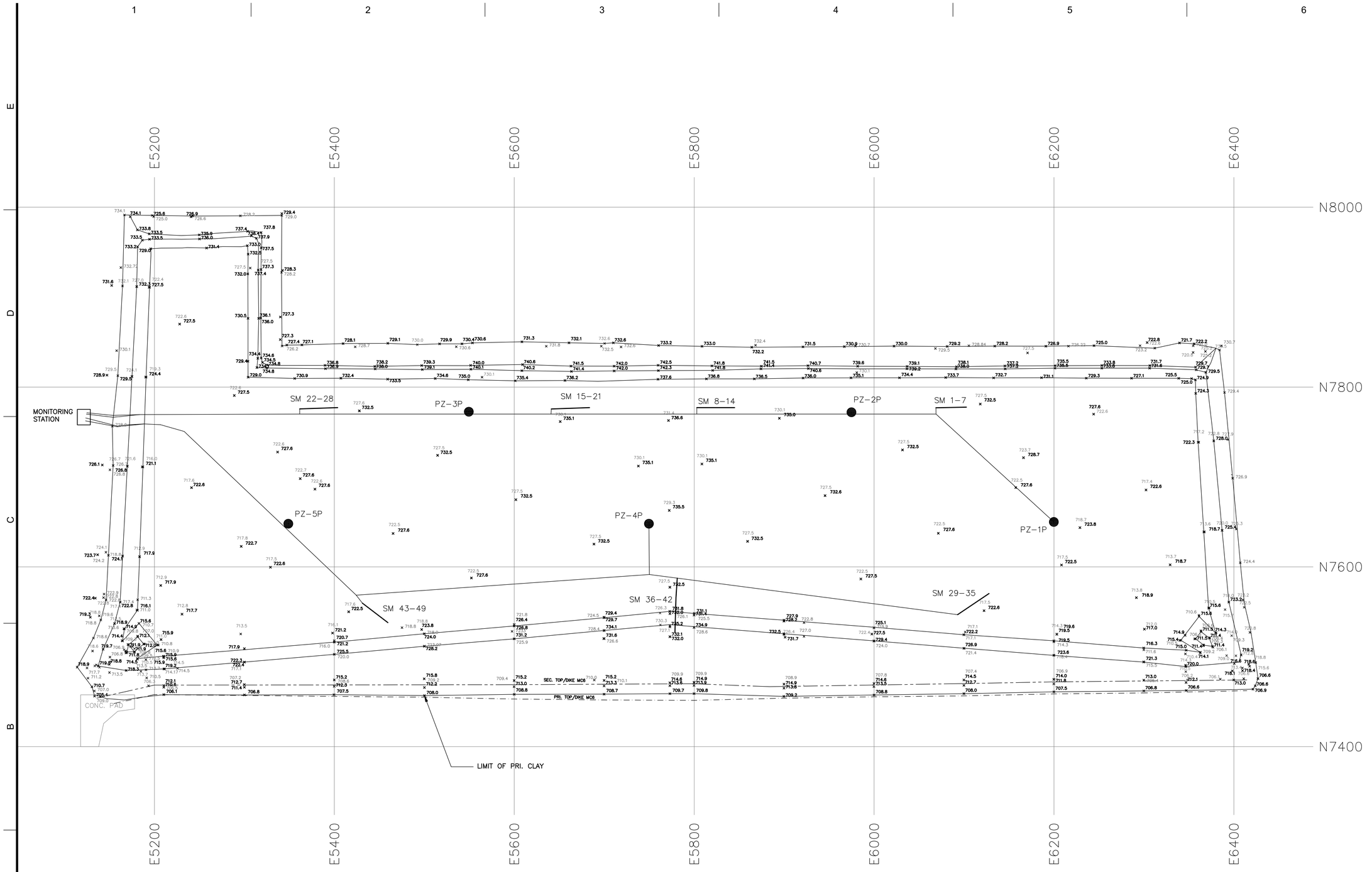
SHEET TITLE:

SECONDARY CLAY LINER & LDCRS RECORD DRAWING

SHEET REFERENCE NUMBER:

2

SHEET 003 OF 010



NOTE:

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LEGEND:

718.0 –TOP OF PRIMARY

713.0 –TOP OF SECONDARY

INSTRUMENTATION

PZ–1P ● –PIEZOMETER

SM 29–35 –STRAINMETER

N

GRAPHIC SCALE

50 0 50

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Detroit, MI	313.237.3900
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Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Cleveland, OH	216.334.4040

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 1 CONSTRUCTION
RECORD PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC
SITE NO. 2
BELLEVILLE, MICHIGAN

NTH PROJECT NO.: 13-060944-01	CAD FILE NAME: 2rCad-13WDI 6E Phase 1\Sheet 3.dwg
DESIGNED BY: KRO	INCEP DATE: 9/26/06
DRAWN BY: KRO	DRAWING SCALE: AS SHOWN
CHECKED BY: JHL	PLOT DATE: 9/26/06

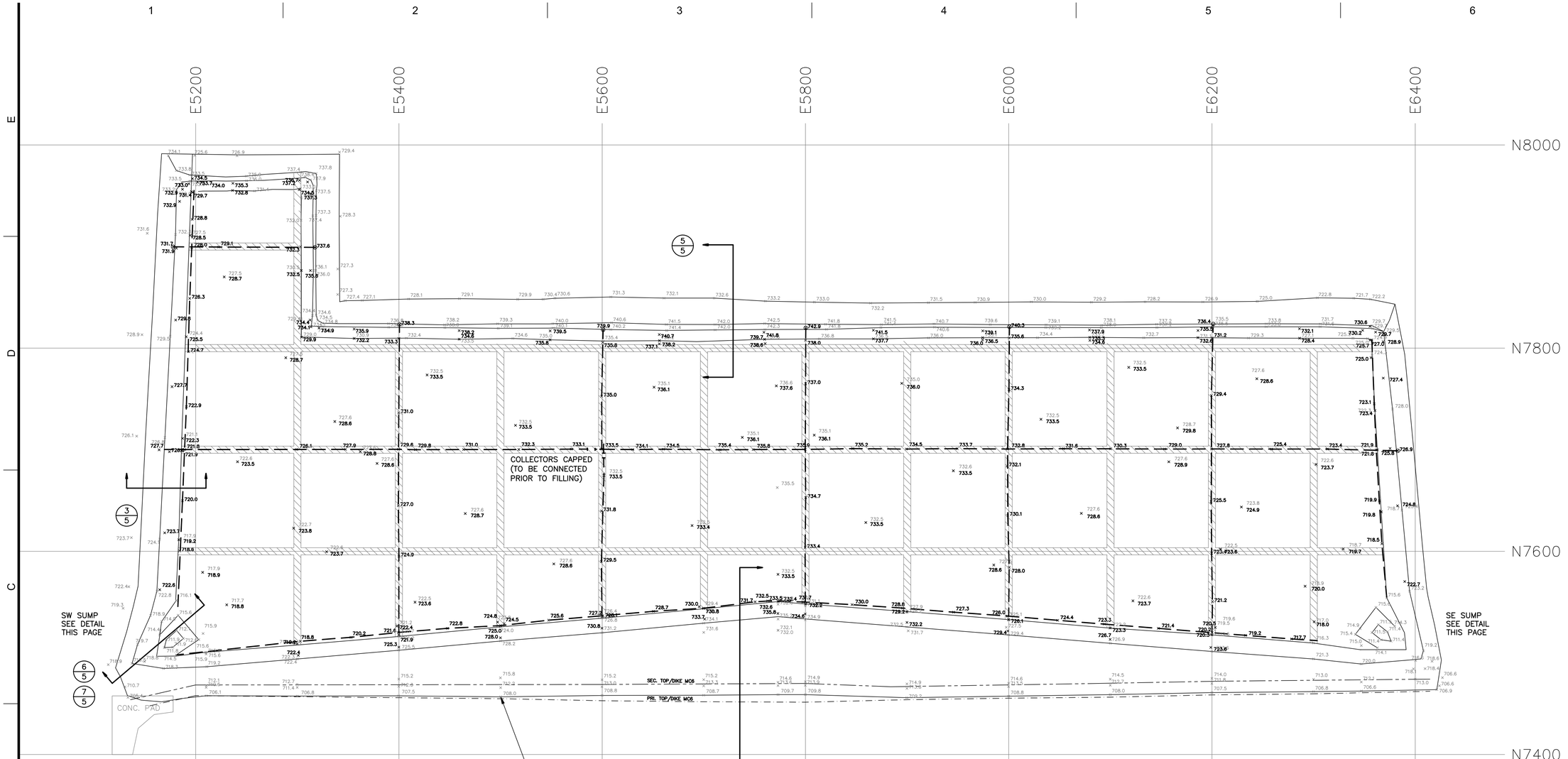
SHEET TITLE:

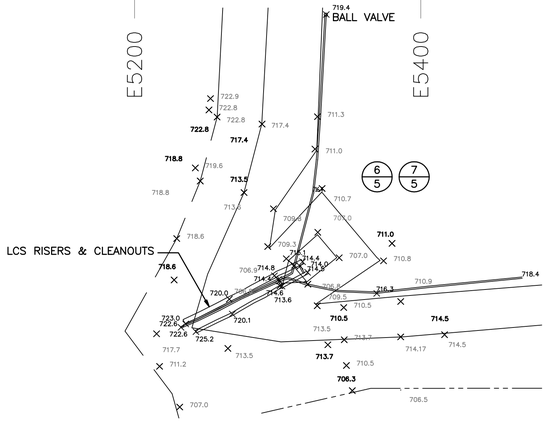
PRIMARY CLAY LINER
ELEVATIONS & LIMITS
RECORD DRAWING

SHEET REFERENCE NUMBER:

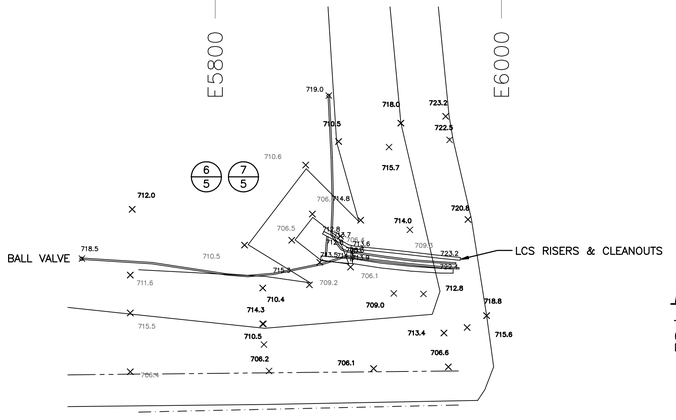
3

SHEET 004 OF 010





DETAIL MAT SW SUMP



DETAIL MAT SE SUMP

LEGEND:

718.0	–TOP OF PRIMARY
	–3 LAYERS GEONET
719.0	–TOP OF SAND
— — —	–LCS PIPE
718.8	–TOP OF PIPE

N

GRAPHIC SCALE

50 0 50

NOTE:

THIS RECORD DRAWING WAS ADOPTED FROM CONSTRUCTION DOCUMENTATION REPORT PHASE 1, CELL 6E (MASTER CELL VI DESIGN MODIFICATION) SITE 2 LANDFILL WAYNE DISPOSAL, INC. (MID 048 090 633) DATED: OCTOBER 24, 2003.

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Cleveland, OH	216.334.4040

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 1 CONSTRUCTION RECORD PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC
SITE NO. 2
BELLEVILLE, MICHIGAN

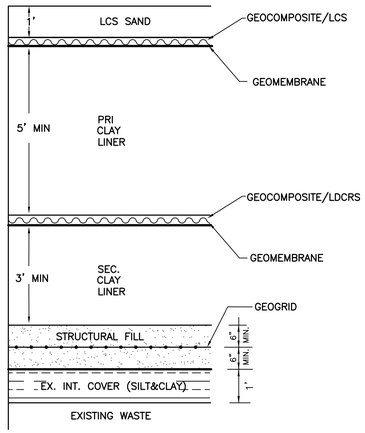
NTH PROJECT NO.: 13-060944-01	CAD FILE NAME: J:\Cad\13WDI 6E Phase 1\Sheet 4.dwg
DESIGNED BY: KRO	INCEP DATE: 9/26/06
DRAWN BY: KRO	DRAWING SCALE: AS SHOWN
CHECKED BY: JHL	PLOT DATE: 9/26/06

SHEET TITLE:

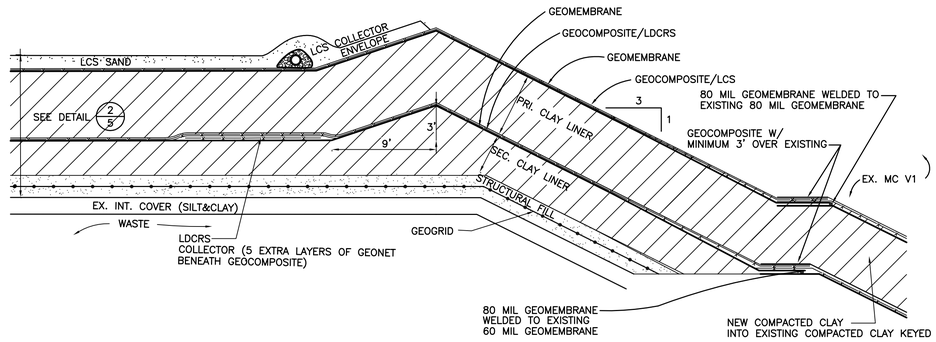
LEACHATE COLLECTION SYSTEM AS-BUILT ELEVATIONS AND LIMITS

SHEET REFERENCE NUMBER:

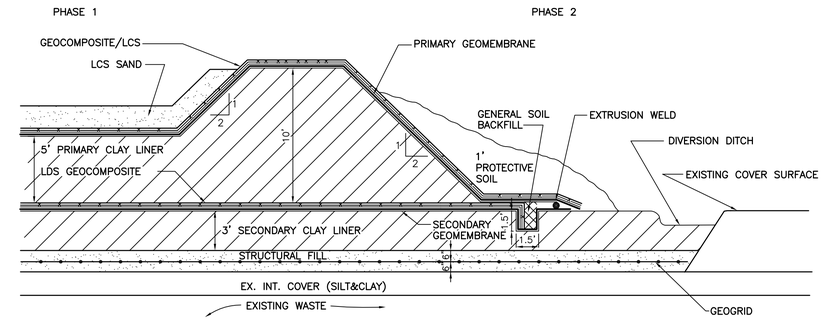
4



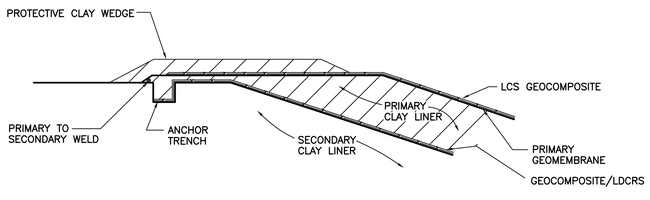
2/5 SECTION THROUGH FLOOR
NOT TO SCALE



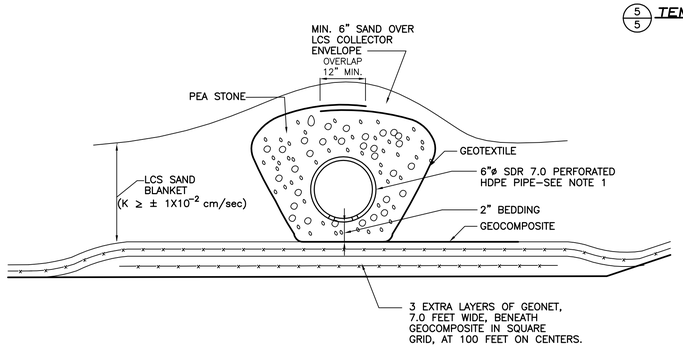
1/5 SECTION THROUGH SOUTH DIKE



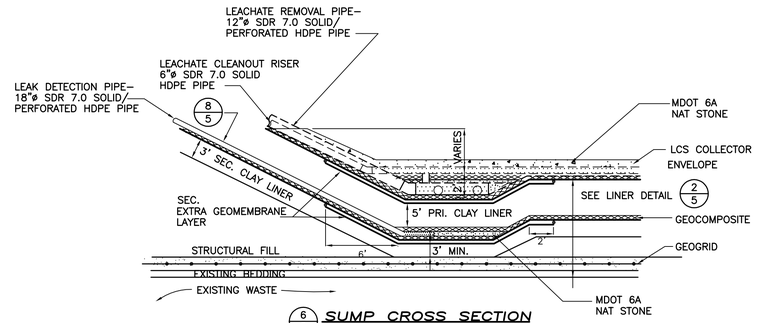
5/5 TEMPORARY LINER TERMINATION (FOR PHASED CONSTRUCTION)
NOT TO SCALE



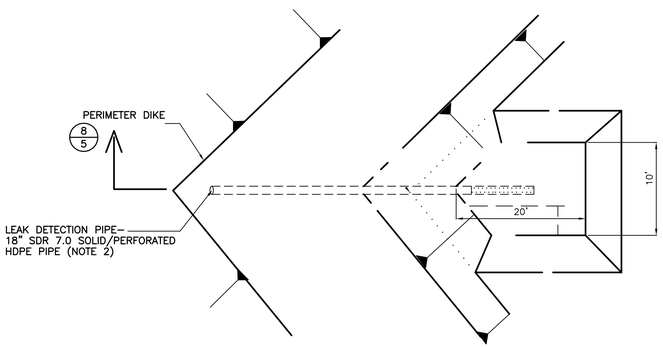
3/5 SECTION THROUGH WEST & EAST PIKES
N.T.S.



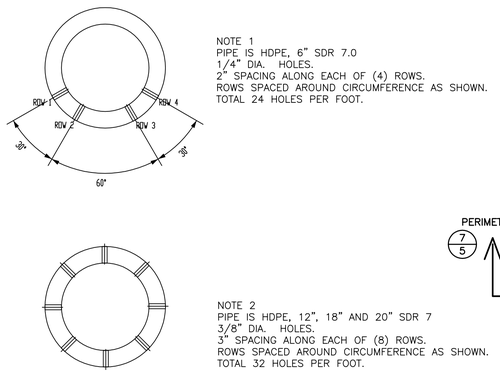
4/5 LCS COLLECTOR ENVELOPE AND COLLETOR STRIPS
N.T.S.



6/5 SUMP CROSS SECTION
N.T.S.

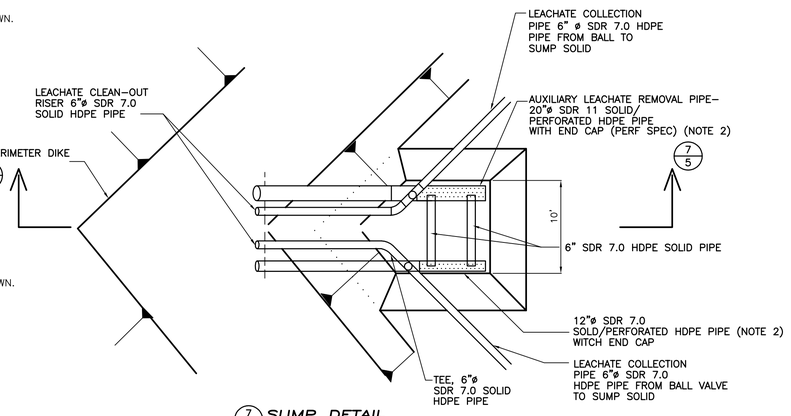


8/5 SECONDARY SUMP DETAIL
N.T.S.



NOTE 1
PIPE IS HDPE, 6" SDR 7.0
1/4" DIA. HOLES.
2" SPACING ALONG EACH OF (4) ROWS.
ROWS SPACED AROUND CIRCUMFERENCE AS SHOWN.
TOTAL 24 HOLES PER FOOT.

NOTE 2
PIPE IS HDPE, 12", 18" AND 20" SDR 7
3/8" DIA. HOLES.
3" SPACING ALONG EACH OF (8) ROWS.
ROWS SPACED AROUND CIRCUMFERENCE AS SHOWN.
TOTAL 32 HOLES PER FOOT.



7/5 SUMP DETAIL

NOTE:

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NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Cleveland, OH	216.334.4040

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 1 CONSTRUCTION RECORD PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC
SITE NO. 2
BELLEVILLE, MICHIGAN

NTH PROJECT NO.:	CAD FILE NAME:
13-060944-01	J:\Cad\13\WCR 6E Phase 1\Sheet 5.dwg
DESIGNED BY: KRO	INCEP DATE: 9/26/06
DRAWN BY: KRO	DRAWING SCALE: NONE
CHECKED BY: JHL	PLOT DATE: 9/26/06

SHEET TITLE:

DETAILS RECORD DRAWING

SHEET REFERENCE NUMBER:

5

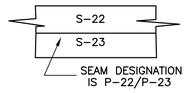
SHEET 006 OF 010

LEGEND:

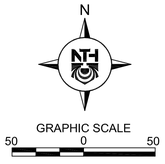
- △ PATCH
- XXX EXTRUSION WELD
- CAP
- SDS-1 ■ DESTRUCTIVE SAMPLE
- LIMIT OF PRI. CLAY LINER
- SECONDARY ANCHOR TRENCH

NOTES:

1. SEAM NUMBERS ARE DESIGNATED BY ADJACENT PANELS. FOR EXAMPLE:



2. THIS RECORD DRAWING WAS ADOPTED FROM CONSTRUCTION DOCUMENTATION REPORT PHASE 1, CELL 6E (MASTER CELL VI DESIGN MODIFICATION) SITE 2 LANDFILL WAYNE DISPOSAL, INC. (MID 048 090 633) DATED: OCTOBER 24, 2003.



NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Cleveland, OH	216.334.4040

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 1 CONSTRUCTION RECORD PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC
SITE NO. 2
BELLEVILLE, MICHIGAN

NTH PROJECT NO.: 13-060944-01	CAD FILE NAME: J:\Cad\13\WDI 6E Phase 1\Sheet 6.dwg
DESIGNED BY: KRO	INCEP DATE: 9/26/06
DRAWN BY: KRO	DRAWING SCALE: AS SHOWN
CHECKED BY: JHL	PLOT DATE: 9/26/06

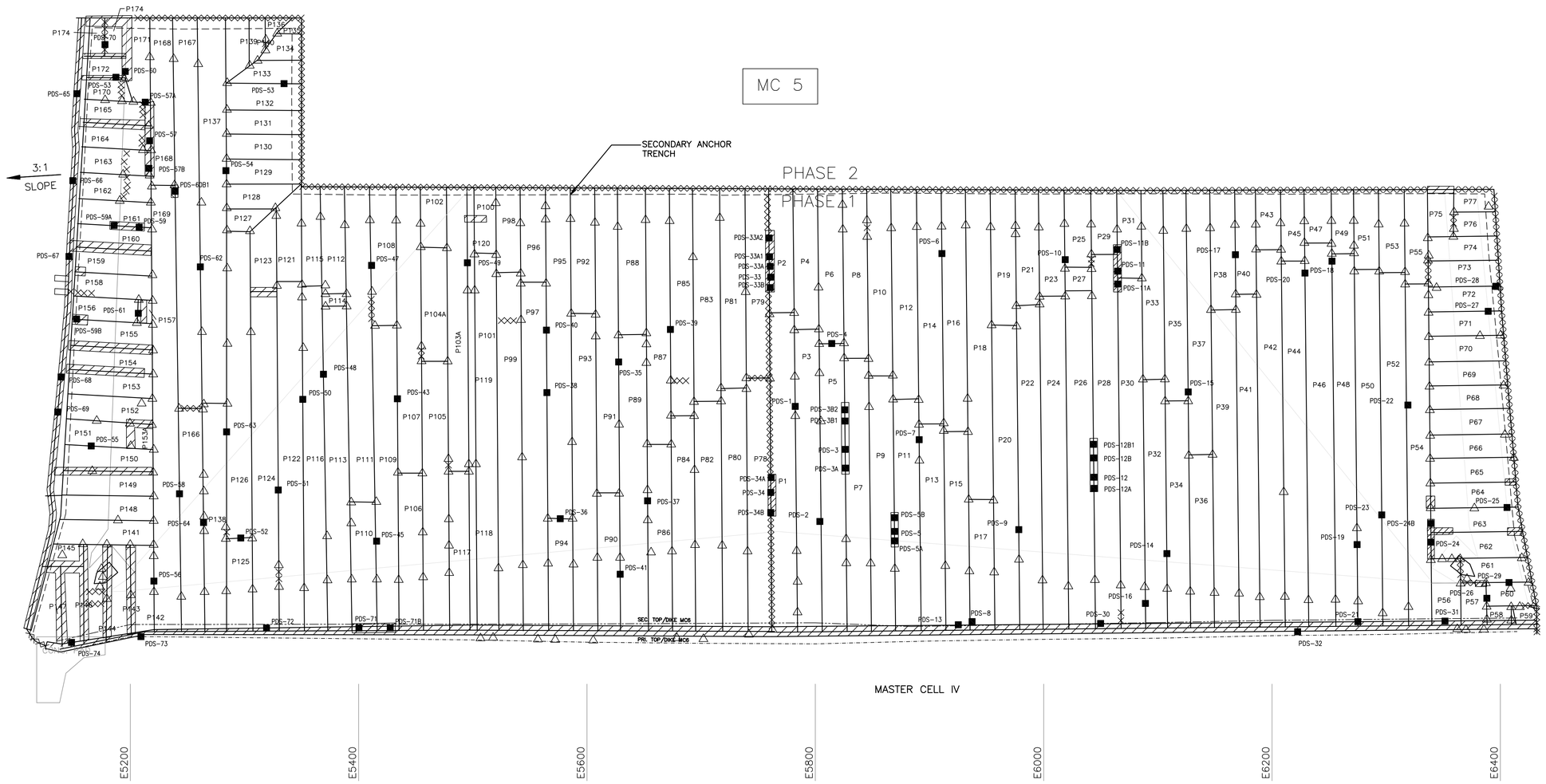
SHEET TITLE:

PANEL LAYOUT
SECONDARY
GEOMEMBRANE
RECORD
DRAWING

SHEET REFERENCE NUMBER:

6

SHEET 007 OF 010

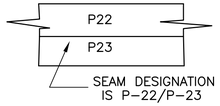


LEGEND:

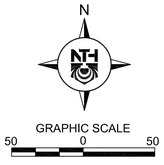
- PATCH
- EXTRUSION WELD
- CAP
- PDS-1 DESTRUCTIVE SAMPLE
- LIMIT OF PRI. CLAY LINER
- SECONDARY ANCHOR TRENCH

NOTES:

1. SEAM NUMBERS ARE DESIGNATED BY ADJACENT PANELS. FOR EXAMPLE:



2. THIS RECORD DRAWING WAS ADOPTED FROM CONSTRUCTION DOCUMENTATION REPORT PHASE 1, CELL 6E (MASTER CELL VI DESIGN MODIFICATION) SITE 2 LANDFILL WAYNE DISPOSAL, INC. (MID 048 090 633) DATED: OCTOBER 24, 2003.



NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Cleveland, OH	216.334.4040

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 1 CONSTRUCTION RECORD PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC
SITE NO. 2
BELLEVILLE, MICHIGAN

NTH PROJECT NO.:	CAD FILE NAME:
13-060944-01	J:\Cad\13WDI 6E Phase 1\Sheet 7.dwg
DESIGNED BY: KRO	INCEP DATE: 9/26/06
DRAWN BY: KRO	DRAWING SCALE: AS SHOWN
CHECKED BY: JHL	PLOT DATE: 9/26/06

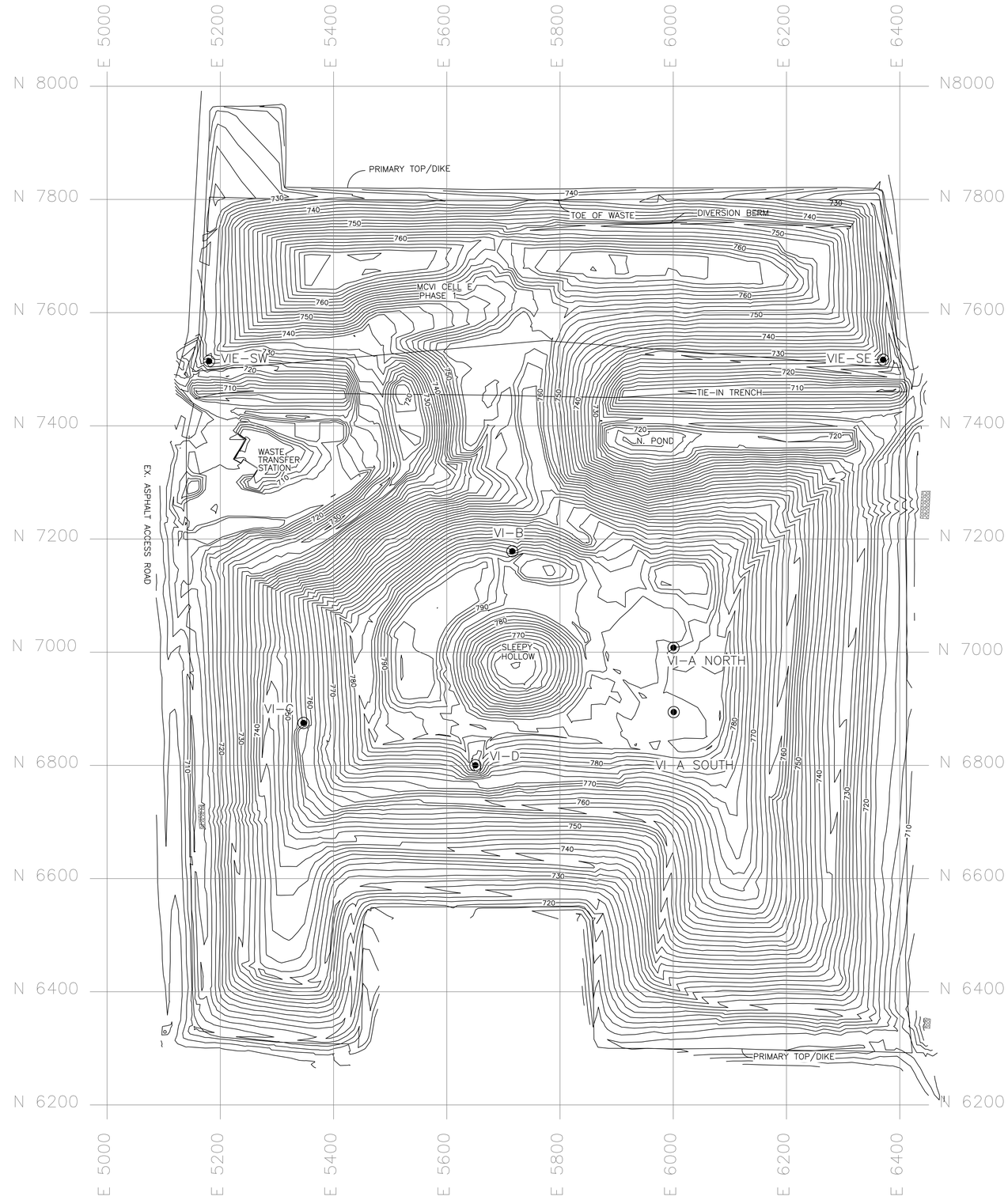
SHEET TITLE:

PANEL LAYOUT
PRIMARY
GEOMEMBRANE
RECORD DRAWING

SHEET REFERENCE NUMBER:

7

SHEET 008 OF 010



N

GRAPHIC SCALE
100 0 100

LEGEND:

760 — EXIST. WASTE CONTOUR

◉ LEACHATE COLLECTION SUMP

NOTE:
THE TOPOGRAPHICAL MAP WAS PROVIDED BY MIDWESTERN CONSULTING BASED ON A SURVEY COMPLETED BY WDI ON 8/31/06.

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Cleveland, OH	216.334.4040

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 1 CONSTRUCTION
RECORD PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC
SITE NO. 2
BELLEVILLE, MICHIGAN

NTH PROJECT NO.:	CAD FILE NAME:
13-060944-01	J:\Cad\13\NCII E Phase 1\Sheet 8.dwg
DESIGNED BY: KRO	INCEP DATE: 9/26/06
DRAWN BY: KRO	DRAWING SCALE: AS SHOWN
CHECKED BY: JHL	PLOT DATE: 9/26/06

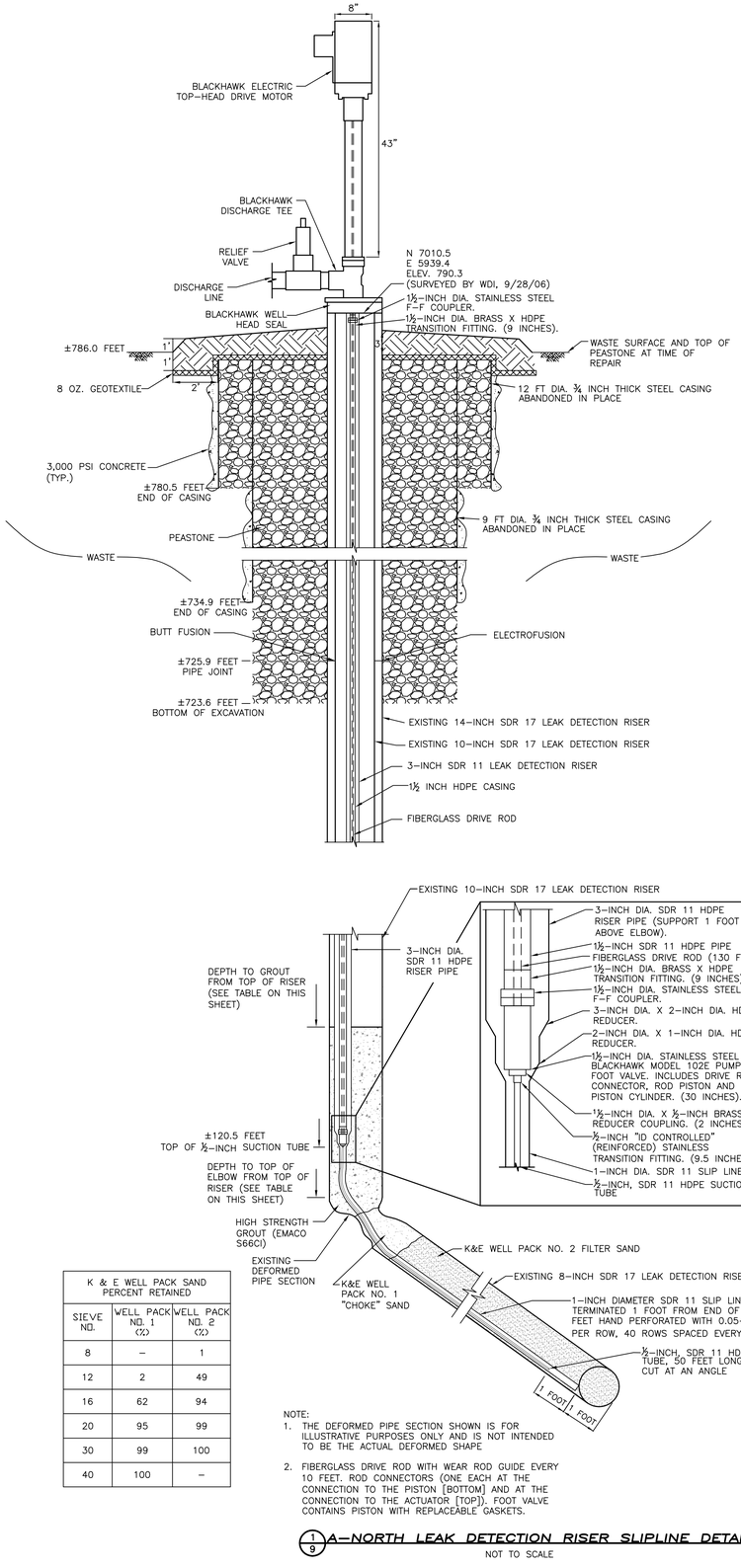
SHEET TITLE:

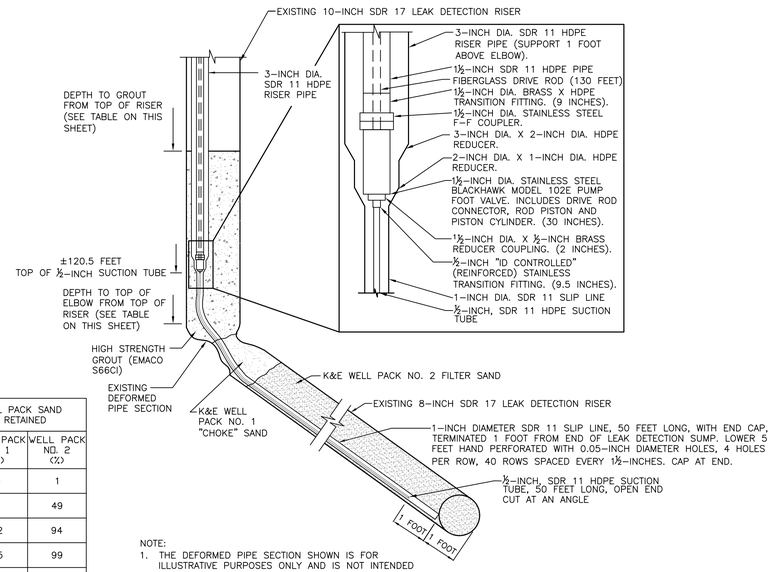
MC VI EXISTING
WASTE
TOPOGRAPHICAL
MAP (8/31/06)

SHEET REFERENCE NUMBER:

8

SHEET 009 OF 010



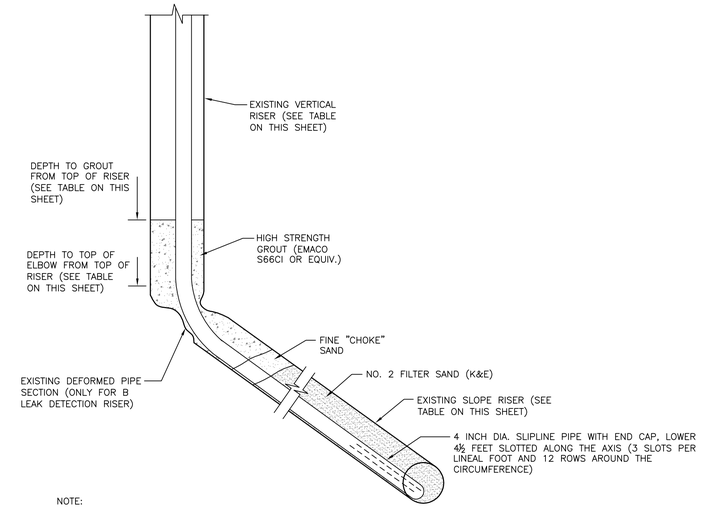


K & E WELL PACK SAND PERCENT RETAINED		
SIEVE NO.	WELL PACK NO. 1 (%)	WELL PACK NO. 2 (%)
8	–	1
12	2	49
16	62	94
20	95	99
30	99	100
40	100	–

NOTE:
1. THE DEFORMED PIPE SECTION SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND IS NOT INTENDED TO BE THE ACTUAL DEFORMED SHAPE
2. FIBERGLASS DRIVE ROD WITH WEAR ROD GUIDE EVERY 10 FEET. ROD CONNECTORS (ONE EACH AT THE CONNECTION TO THE PISTON [BOTTOM] AND AT THE CONNECTION TO THE ACTUATOR [TOP]). FOOT VALVE CONTAINS PISTON WITH REPLACEABLE GASKETS.

(1/9) A–NORTH LEAK DETECTION RISER SLIPLINE DETAIL (A)

NOT TO SCALE



NOTE:
THE DEFORMED PIPE SECTION SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND IS NOT INTENDED TO BE THE ACTUAL DEFORMED SHAPE

(2/9) A–SOUTH, B, AND C LEAK DETECTION RISER SLIPLINE DETAIL

NOT TO SCALE

	SLOPE RISER		VERTICAL RISER		TOP OF RISER	DEPTH TO GROUT	DEPTH TO ELBOW
	DIA.	SDR	DIA	SDR			
A–NORTH	8"	17	10"	17	790.3' (9/28/06)	±106.5'	±121.5'
A–SOUTH	8"	17	10"	17	789.6' (11/17/04)	±111.0'	±127.0'
B	10"	17	12"	17	792.0' (11/16/05)	±106.0'	±127.0'
C	12"	11	12"	17	772.7' (4/30/05)	±96.0'	±110.0'

NOTES:
1. INFORMATION REGARDING RISER PIPE SIZES AND SDR WAS ADOPTED FROM "CONSTRUCTION CERTIFICATION SET, MASTER CELL VI–CELL D," DATED JULY 31, 1991 AND PREPARED BY MIDWESTERN CONSULTING INC.
2. TOP OF RISER ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI.
3. DEPTH TO GROUT FOR A–NORTH AND B SECONDARY RISERS WAS PROVIDED BY WDI.

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Cleveland, OH	216.334.4040

REVISIONS

REV	DESCRIPTION	DATE	BY
A	UPDATE A–N INFORMATION	8/27/09	CWS

PROJECT NAME:

MASTER CELL VI-E
PHASE 1 CONSTRUCTION RECORD PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC
SITE NO. 2
BELLEVILLE, MICHIGAN

NTH PROJECT NO.: 13-060944-01	CAD FILE NAME: 2/Cad-13/WDI E/E Phase 1/Sheet 9.dwg
DESIGNED BY: KRO	INCEP DATE: 9/26/06
DRAWN BY: KRO	DRAWING SCALE: NONE
CHECKED BY: JHL	PLOT DATE: 9/26/06

SHEET TITLE:

MC VI A-NORTH, A-SOUTH, B, AND C LEAK DETECTION RISER SLIPLINING DETAILS

SHEET REFERENCE NUMBER:

9

SHEET 010 OF 010

MICHIGAN DISPOSAL WASTE TREATMENT PLANT

MC VI

MC VI-E PHASE I CERTIFIED IN 2003

MC VI-E PHASE 2 SE (TO BE CERTIFIED BASED ON THIS DOCUMENT)

WASTE TRANSFER STATION

TOWER

GRAPHIC SCALE

200 0 200

1" = 200

N

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

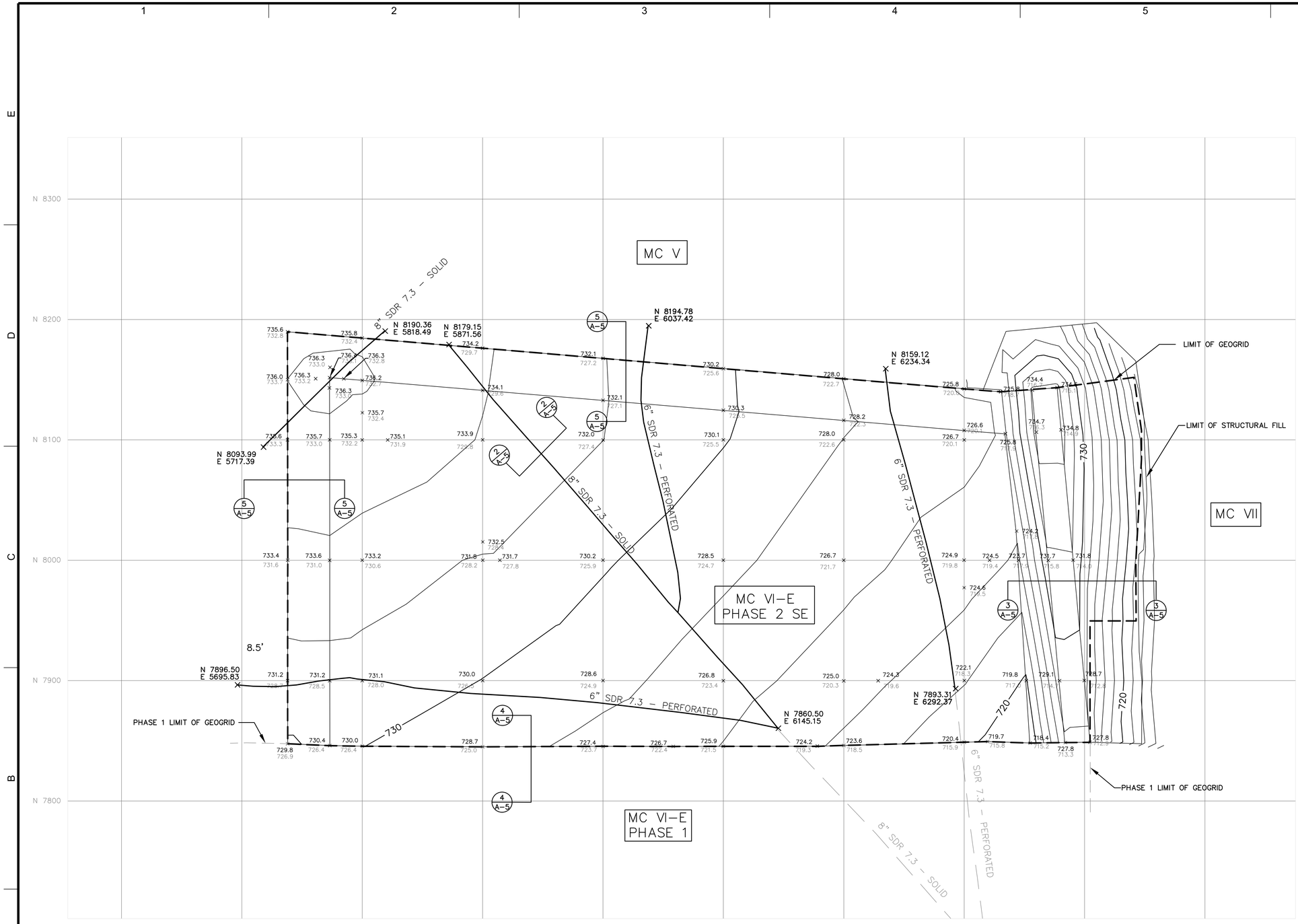
NTH PROJECT No.: 13-060370-07	CAD FILE NAME:
DESIGNED BY: RBM	PLOT DATE: 12-13-06
DRAWN BY: RBM	DRAWING SCALE: AS SHOWN
CHECKED BY: ISA	INCEPTION DATE: 12-13-06

AREA OF CERTIFICATION
MC VI-E PHASE 2 SE

WDI, SITE No. 2
BELLEVILLE, MI

PLATE

A1



N

GRAPHIC SCALE
40 0 40
1" = 40'

LEGEND:

731.8	TOP OF STRUCTURAL FILL
728.2	SUBGRADE ELEVATION
– – – –	LIMIT OF GEOGRID
	GAS COLLECTION PIPE INSTALLED DURING PHASE 1 CONSTRUCTION
———	GAS COLLECTION PIPE INSTALLED DURING PHASE 2 SE CONSTRUCTION

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 SE
WAYNE DISPOSAL INC.
SITE # 2

PROJECT LOCATION:

BELLEVILLE, MICHIGAN

NTH PROJECT NO.: 13-060370-07	CAD FILE NAME: z:\13#Di 6E Phase II SE\As-Built\Sheet 1
DESIGNED BY: DRL	PLOT DATE: 09/06/06
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY: RBM	INCEPTION DATE: 08/29/06

SHEET TITLE:

STRUCTURAL FILL
RECORD DRAWING

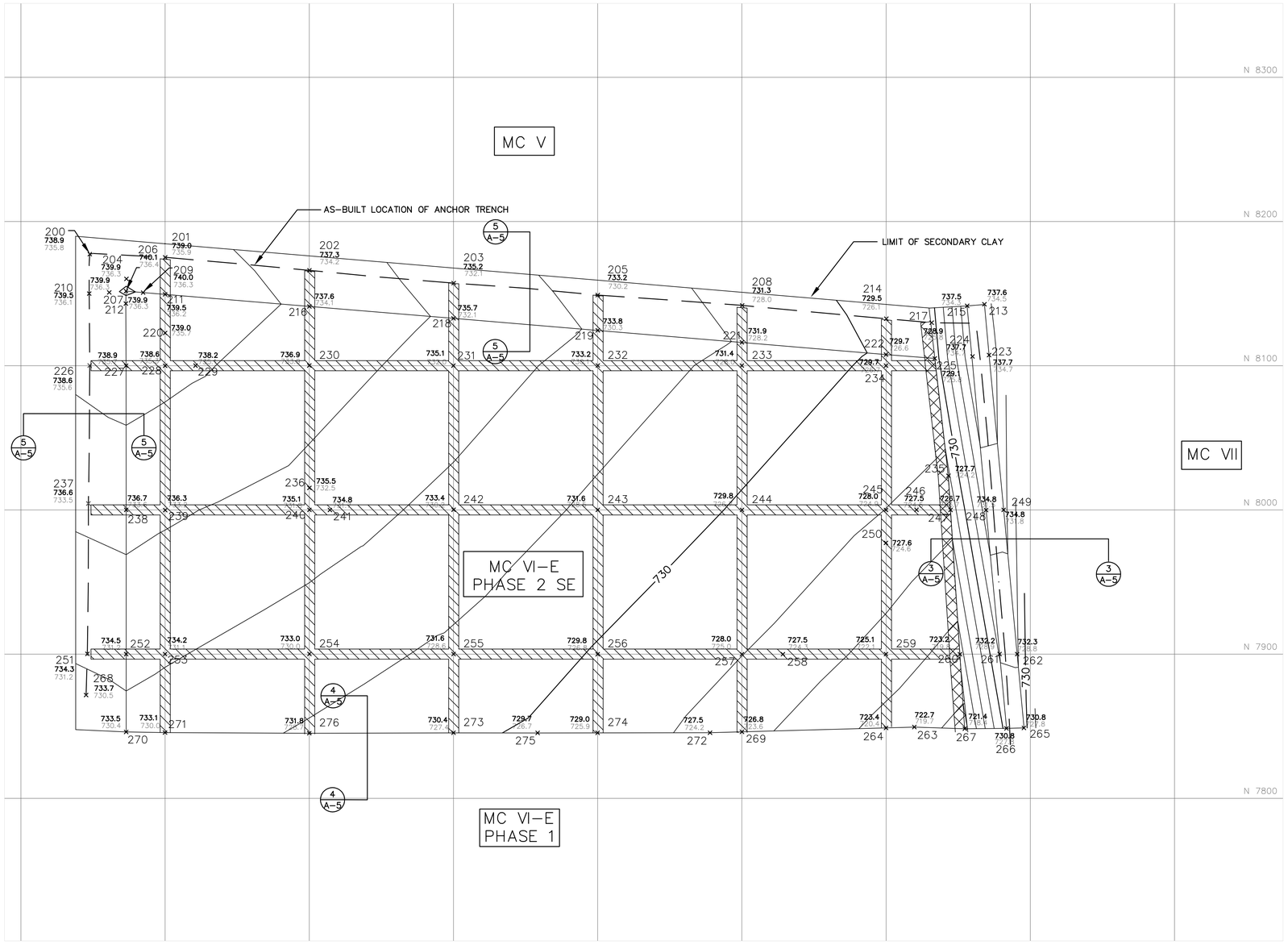
SHEET REFERENCE NUMBER:

A-2

SHEET 1 OF 1

Point	Northing	Easting	Structural Fill As-Built Elevation	Secondary Clay As-Built Elevation	As-Built Clay Thickness (ft)	Deviation From Proposed Thickness (ft)
200	8177.35	5747.76	735.8	738.9	3.1	0.1
201	8175.15	5800.08	735.9	739.0	3.1	0.1
202	8166.13	5900.10	734.2	737.3	3.1	0.1
203	8157.27	6000.10	732.1	735.2	3.1	0.1
204	8160.25	5773.23	736.3	739.9	3.6	0.6
205	8148.98	6100.03	730.2	733.2	3.0	0.0
206	8151.68	5772.92	736.4	740.1	3.7	0.7
207	8150.84	5761.29	736.3	739.9	3.6	0.6
208	8141.82	6200.20	728.0	731.3	3.3	0.3
209	8150.74	5784.71	736.3	740.0	3.7	0.7
210	8150.02	5747.36	736.1	739.5	3.4	0.4
211	8149.39	5799.99	736.2	739.5	3.3	0.3
212	8143.15	5772.72	736.3	739.9	3.6	0.6
213	8143.41	6377.19	734.5	737.6	3.1	0.1
214	8132.56	6300.18	726.1	729.5	3.4	0.4
215	8141.39	6356.57	734.3	737.5	3.2	0.2
216	8141.15	5899.98	734.1	737.6	3.5	0.5
217	8129.85	6331.62	725.8	728.9	3.1	0.1
218	8132.85	6000.00	732.1	735.7	3.6	0.6
219	8124.57	6099.94	730.3	733.8	3.5	0.5
220	8122.60	5800.05	735.7	739.0	3.3	0.3
221	8116.22	6200.01	728.2	731.9	3.7	0.7
222	8107.84	6299.98	726.6	729.7	3.1	0.1
223	8108.32	6371.42	734.7	737.7	3.0	0.0
224	8106.47	6359.88	734.7	737.7	3.0	0.0
225	8105.12	6334.21	725.8	729.1	3.3	0.3
226	8100.08	5727.78	735.6	738.6	3.0	0.0
227	8100.06	5772.97	735.7	738.9	3.2	0.2
228	8099.96	5799.96	735.3	738.6	3.3	0.3
229	8099.96	5821.16	735.1	738.2	3.1	0.1
230	8100.04	5900.00	733.9	736.9	3.0	0.0
231	8099.95	6000.06	732.0	735.1	3.1	0.1
232	8100.03	6099.96	730.1	733.2	3.1	0.1
233	8100.01	6199.95	728.0	731.4	3.4	0.4
234	8099.97	6300.07	726.7	729.7	3.0	0.0
235	8024.24	6343.60	724.2	727.7	3.5	0.5
236	8015.28	5900.07	732.5	735.5	3.0	0.0
237	8004.55	5746.90	733.5	736.6	3.1	0.1
238	7999.94	5772.95	733.6	736.7	3.1	0.1
239	8000.02	5799.98	733.2	736.3	3.1	0.1
240	8000.02	5900.07	731.8	735.1	3.3	0.3
241	8000.02	5914.30	731.7	734.8	3.1	0.1
242	8000.08	5999.96	730.2	733.4	3.2	0.2
243	8000.05	6099.92	728.5	731.6	3.1	0.1
244	7999.99	6199.95	726.7	729.8	3.1	0.1
245	8000.08	6299.93	724.9	728.0	3.1	0.1
246	8000.04	6321.12	724.5	727.5	3.0	0.0
247	8000.02	6345.13	723.7	726.7	3.0	0.0
248	7999.94	6369.87	731.5	734.8	3.3	0.3
249	8000.09	6381.53	731.8	734.8	3.0	0.0
250	7977.23	6300.00	724.6	727.6	3.0	0.0
251	7900.18	5746.09	731.2	734.3	3.1	0.1
252	7899.98	5772.98	731.2	734.5	3.3	0.3
253	7899.98	5799.97	731.1	734.2	3.1	0.1
254	7900.03	5900.00	730.0	733.0	3.0	0.0
255	7900.08	6000.01	728.6	731.6	3.0	0.0
256	7899.95	6099.94	726.8	729.8	3.0	0.0
257	7899.81	6200.01	725.0	728.0	3.0	0.0
258	7899.95	6228.55	724.3	727.5	3.2	0.2
259	7900.07	6300.11	722.1	725.1	3.0	0.0
260	7899.96	6351.64	719.8	723.2	3.4	0.4
261	7899.96	6379.23	728.9	732.2	3.3	0.3
262	7900.14	6390.91	728.8	732.3	3.5	0.5
263	7849.38	6319.57	719.7	722.7	3.0	0.0
264	7848.87	6300.04	720.4	723.4	3.0	0.0
265	7848.88	6395.58	727.8	730.8	3.0	0.0
266	7848.59	6384.06	727.8	730.8	3.0	0.0
267	7848.20	6354.83	718.4	721.4	3.0	0.0
268	7871.61	5745.20	730.5	733.7	3.2	0.2
269	7846.14	6200.05	723.6	726.8	3.2	0.2
270	7846.09	5773.00	730.4	733.5	3.1	0.1
271	7845.63	5800.05	730.0	733.1	3.1	0.1
272	7845.69	6177.99	724.2	727.5	3.3	0.3
273	7845.35	6000.05	727.4	730.4	3.0	0.0
274	7845.48	6099.90	725.9	729.0	3.1	0.1
275	7845.37	6058.37	726.7	729.7	3.0	0.0
276	7845.05	5899.98	728.7	731.8	3.1	0.1

S:\Waste\Engineering\Site # 2\WDI MC VII\Phase 2 SE\Clay Thickness Newest.xls



LEGEND:

- 249 — POINT NUMBER
- 734.8 — TOP OF SECONDARY
- 731.8 — TOP OF STRUCTURAL FILL
- 2 EXTRA LAYERS OF GEONET, 7.5' WIDE BENEATH GEOCOMPOSITE
- 4 EXTRA LAYERS OF GEONET, 7.5' WIDE BENEATH GEOCOMPOSITE

N

GRAPHIC SCALE
40 0 40
1" = 40'

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 SE
WAYNE DISPOSAL INC.
SITE # 2

PROJECT LOCATION:

BELLEVILLE, MICHIGAN

NTH PROJECT NO.: 13-030060370-07	CAD FILE NAME: z:\13WDI 6E Phase II SE\As-Built\Sheet A3
DESIGNED BY: DRL	PLOT DATE: 9/06/06
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY: RBM	INCEPTION DATE: 08/29/06

SHEET TITLE:

SECONDARY CLAY LINER
RECORD DRAWING

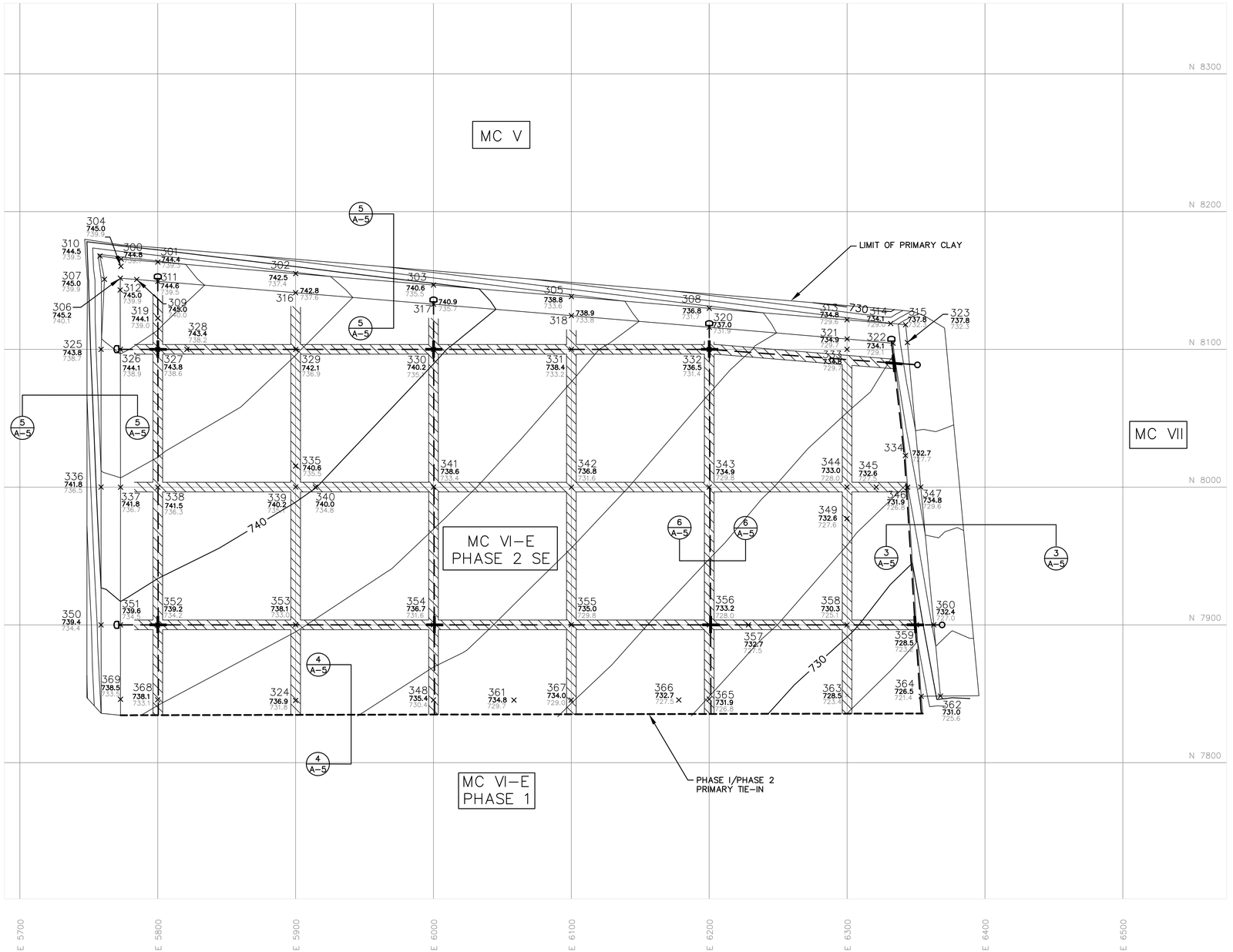
SHEET REFERENCE NUMBER:

A-3

SHEET 1 OF 1

Point	Northing	Easting	Primary Clay As-Built Elevation	Secondary Clay As-Built Elevation	As-Built Clay Thickness (ft)	Deviation From Proposed Thickness (ft)
300	8165.47	5773.47	744.8	739.7	5.1	0.1
301	8163.35	5800.08	744.4	739.3	5.1	0.1
302	8154.97	5900.04	742.5	737.4	5.1	0.1
303	8146.72	5999.99	740.6	735.5	5.1	0.1
304	8160.21	5773.29	745.0	739.9	5.1	0.1
305	8138.21	6100.04	738.8	733.6	5.2	0.2
306	8151.63	5772.87	745.2	740.1	5.1	0.1
307	8150.84	5761.30	745.0	739.9	5.1	0.1
308	8129.75	6200.06	736.8	731.7	5.1	0.1
309	8150.73	5784.75	745.0	740.0	5.0	0.0
310	8167.79	5758.07	744.5	739.5	5.0	0.0
311	8149.39	5800.03	744.6	739.5	5.1	0.1
312	8143.12	5772.72	745.0	739.9	5.1	0.1
313	8121.47	6299.99	734.7	729.6	5.1	0.1
314	8118.69	6331.65	734.1	729.0	5.1	0.1
315	8117.86	6342.43	737.8	732.3	5.5	0.5
316	8141.12	5900.01	742.8	737.6	5.2	0.2
317	8132.79	6000.05	740.9	735.7	5.2	0.2
318	8124.42	6100.05	738.9	733.8	5.1	0.1
319	8122.58	5799.97	744.1	739.0	5.1	0.1
320	8116.05	6200.06	737.0	731.9	5.1	0.1
321	8107.53	6300.00	734.9	729.7	5.2	0.2
322	8104.45	6333.27	734.1	729.1	5.0	0.0
323	8104.99	6343.78	737.8	732.3	5.5	0.5
324	7845.05	5899.98	736.9	731.8	5.1	0.1
325	8099.97	5758.89	743.8	738.7	5.1	0.1
326	8100.06	5772.90	744.1	738.9	5.2	0.2
327	8099.96	5800.02	743.8	738.6	5.2	0.2
328	8099.95	5821.11	743.4	738.2	5.2	0.2
329	8099.97	5900.04	742.1	736.9	5.2	0.2
330	8099.93	6000.04	740.2	735.1	5.1	0.1
331	8100.07	6100.07	738.4	733.2	5.2	0.2
332	8099.97	6199.99	736.5	731.4	5.1	0.1
333	8099.99	6299.97	734.8	729.7	5.1	0.1
334	8022.92	6342.32	732.7	727.7	5.0	0.0
335	8015.23	5899.96	740.6	735.5	5.1	0.1
336	8000.03	5758.83	741.8	736.5	5.3	0.3
337	7999.94	5773.01	741.8	736.7	5.1	0.1
338	7999.91	5800.05	741.5	736.3	5.2	0.2
339	8000.02	5900.05	740.2	735.1	5.1	0.1
340	7999.96	5914.34	740.0	734.8	5.2	0.2
341	7999.97	6000.02	738.6	733.4	5.2	0.2
342	8000.01	6100.03	736.8	731.6	5.2	0.2
343	7999.96	6199.96	734.9	729.8	5.1	0.1
344	8000.07	6299.97	733.0	728.0	5.0	0.0
345	7999.97	6321.19	732.6	727.5	5.1	0.1
346	7999.93	6343.81	731.9	726.8	5.1	0.1
347	8000.06	6353.43	734.8	729.6	5.2	0.2
348	7845.35	6000.05	735.4	730.4	5.0	0.0
349	7977.18	6299.97	732.6	727.6	5.0	0.0
350	7899.97	5758.87	739.4	734.4	5.0	0.0
351	7899.96	5772.96	739.6	734.5	5.1	0.1
352	7899.93	5800.02	739.2	734.2	5.0	0.0
353	7899.97	5900.00	738.1	733.0	5.1	0.1
354	7900.04	5999.99	736.7	731.6	5.1	0.1
355	7900.08	6099.94	735.0	729.8	5.2	0.2
356	7900.05	6200.01	733.2	728.0	5.2	0.2
357	7899.96	6228.42	732.7	727.5	5.2	0.2
358	7899.99	6299.99	730.3	725.1	5.2	0.2
359	7900.06	6350.27	728.4	723.2	5.2	0.2
360	7900.03	6362.90	732.4	727.0	5.4	0.4
361	7845.37	6058.37	734.8	729.7	5.1	0.1
362	7848.32	6367.67	731.0	725.6	5.4	0.4
363	7848.87	6300.04	728.5	723.4	5.1	0.1
364	7848.20	6354.83	726.5	721.4	5.1	0.1
365	7846.14	6200.05	731.9	726.8	5.1	0.1
366	7845.69	6177.99	732.7	727.5	5.2	0.2
367	7845.48	6099.90	734.0	729.0	5.0	0.0
368	7845.63	5800.05	738.1	733.1	5.0	0.0
369	7846.09	5773.00	738.5	733.5	5.0	0.0

S:\Waste\Engineering\Site #2\WDI MC VI\Phase 2 SE\primary clay thickness.xls



LEGEND:

349	POINT NUMBER
732.6	TOP OF PRIMARY
727.6	TOP OF SECONDARY
O	CLEANOUT
D	TEMPORARY LEACHATE COLLECTION PIPE ACCESS (FUTURE TIE-IN CONNECTION)
▨	2 EXTRA LAYERS OF GEONET, 7.5' WIDE BENEATH GEOCOMPOSITE
— — —	PHASE II LEACHATE COLLECTION PIPE

GRAPHIC SCALE
40 0 40
1" = 40'

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI 248.553.6300
Exton, PA 610.524.2300
Philadelphia, PA 215.854.6359
Detroit, MI 313.965.0036
Lansing, MI 517.321.6900
Grand Rapids, MI 616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 SE
WAYNE DISPOSAL INC.
SITE # 2

PROJECT LOCATION:

BELLEVILLE, MICHIGAN

NTH PROJECT NO.:	CAD FILE NAME:
13-060370-07	J:\13WDI SE Phase II SE\As-Builts\Sheet A4.dwg
DESIGNED BY: KRO	PLOT DATE: 12/11/06
DRAWN BY: KRO	DRAWING SCALE: AS SHOWN
CHECKED BY:	INCEPTION DATE: 11/10/06

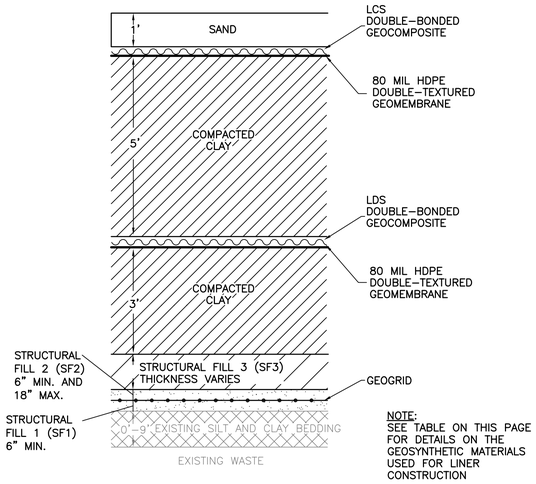
SHEET TITLE:

PRIMARY CLAY LINER
RECORD DRAWING

SHEET REFERENCE NUMBER:

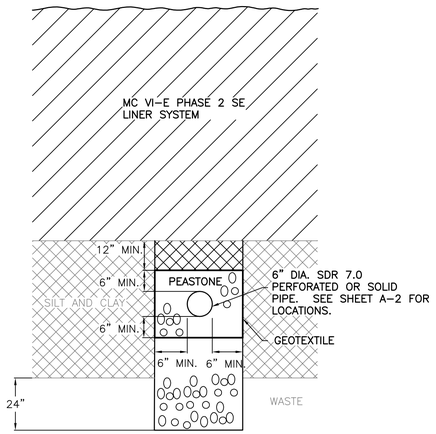
A-4

SHEET 1 OF 1

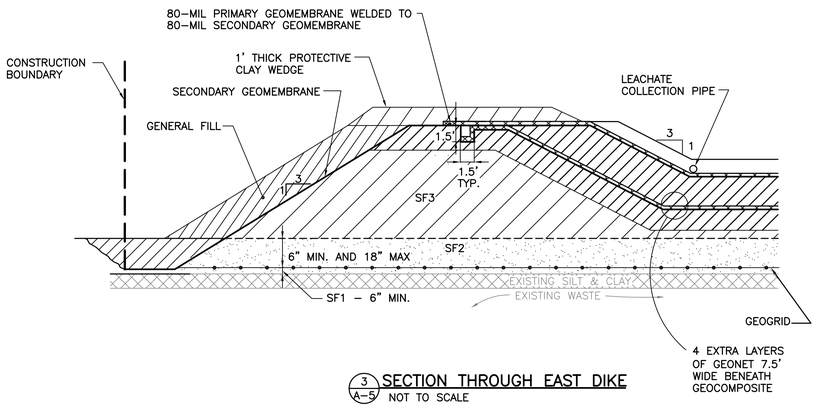


NOTE:
SEE TABLE ON THIS PAGE FOR DETAILS ON THE GEOSYNTHETIC MATERIALS USED FOR LINER CONSTRUCTION

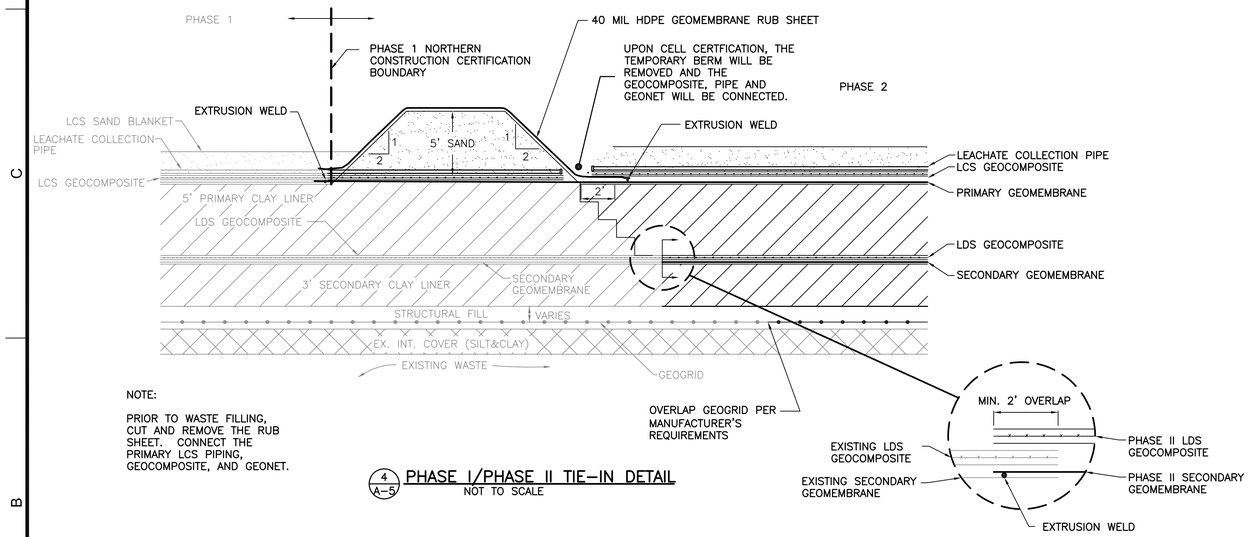
1/A-5 MC VI-E PHASE 2 SE LINER SYSTEM
NOT TO SCALE



2/A-5 MC-V GAS COLLECTION TRENCH
NOT TO SCALE



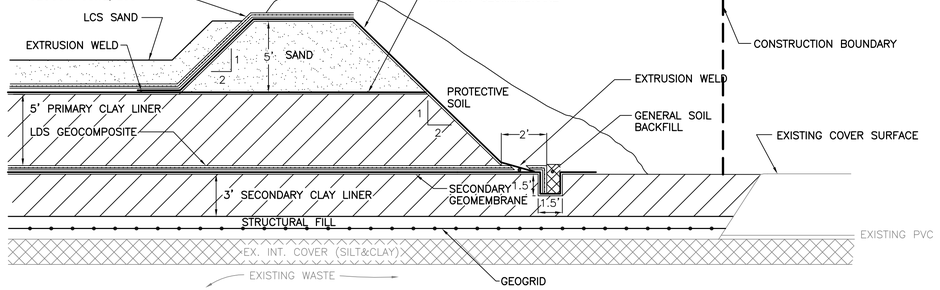
3/A-5 SECTION THROUGH EAST DIKE
NOT TO SCALE



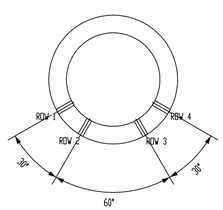
NOTE:

PRIOR TO WASTE FILLING, CUT AND REMOVE THE RUB SHEET. CONNECT THE PRIMARY LCS PIPING, GEOCOMPOSITE, AND GEONET.

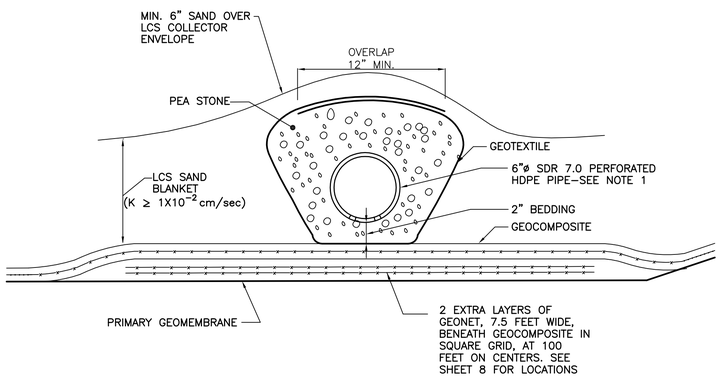
4/A-5 PHASE I/PHASE II TIE-IN DETAIL
NOT TO SCALE



5/A-5 TEMPORARY LINER TERMINATION (NORTH AND WEST BERMS)
NOT TO SCALE



NOTE 1
PIPE IS HDPE, 6" SDR 7.0 WITH 1/4" DIA. HOLES. 2" SPACING ALONG EACH OF (4) ROWS. ROWS SPACED AROUND CIRCUMFERENCE AS SHOWN. TOTAL 24 HOLES PER FOOT.



6/A-5 LCS COLLECTOR ENVELOPE AND COLLECTOR STRIPS
N.T.S.

Geosynthetic Materials

Material	Location	Product
80-mil Geomembrane	Primary and secondary liners	GSE HD textured
Geocomposite	LCS and LDS	GSE FABRINET
Geonet	LCS and LDS collectors	GSE HYPERNET
Geotextile	All geocomposites and gravel/geotextile envelopes for LCS and gas management system	SKAPS GT-180
Geogrid	Structural Fill	UX1400-HS

LCS denotes leachate collection system
LDS denotes leak detection, collection, and removal system

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 SE
WAYNE DISPOSAL, INC.
SITE #2

PROJECT LOCATION:

BELLEVILLE, MICHIGAN

NTH PROJECT NO.: 13-060370-07	CAD FILE NAME:
DESIGNED BY: RBM	PLOT DATE: 12-11-06
DRAWN BY: KRO	DRAWING SCALE: AS SHOWN
CHECKED BY:	INCEPTION DATE: 11-20-06

SHEET TITLE:

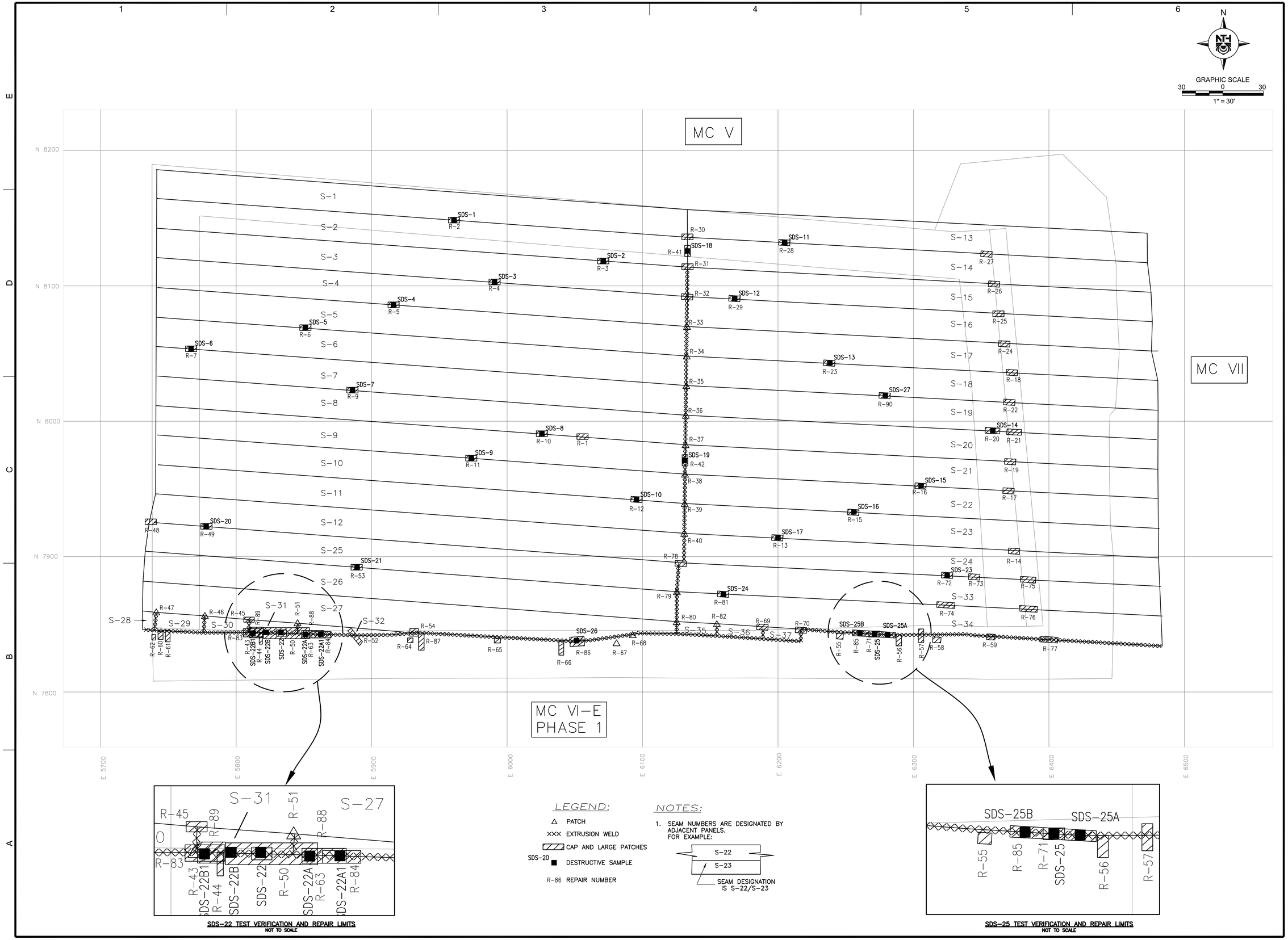
AS-BUILT DETAILS

SHEET REFERENCE NUMBER

A-5

SHEET 1 OF 1

J:\Cad\13\WDI 6E Phase II SE\As-Builts\Sheet A5.dwg
12-11-06



N

GRAPHIC SCALE
30 0 30
1" = 30'

SDS-22 TEST VERIFICATION AND REPAIR LIMITS
NOT TO SCALE

LEGEND:

- △ PATCH
- XXX EXTRUSION WELD
- ▨ CAP AND LARGE PATCHES
- SDS-20 ■ DESTRUCTIVE SAMPLE
- R-86 REPAIR NUMBER

NOTES:

1. SEAM NUMBERS ARE DESIGNATED BY ADJACENT PANELS. FOR EXAMPLE:

SDS-25 TEST VERIFICATION AND REPAIR LIMITS
NOT TO SCALE

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

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Exton, PA	610.524.2300
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Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 SE
WAYNE DISPOSAL INC.
SITE # 2

PROJECT LOCATION:

BELLEVILLE, MICHIGAN

NTH PROJECT NO.:	CAD FILE NAME:
13-030060370-07	J:\13WD 6E Phase II SE As-Built\Sheet 6
DESIGNED BY: DRL	PLOT DATE: 09-25-06
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY: RBM	INCEPTION DATE: 08/30/06

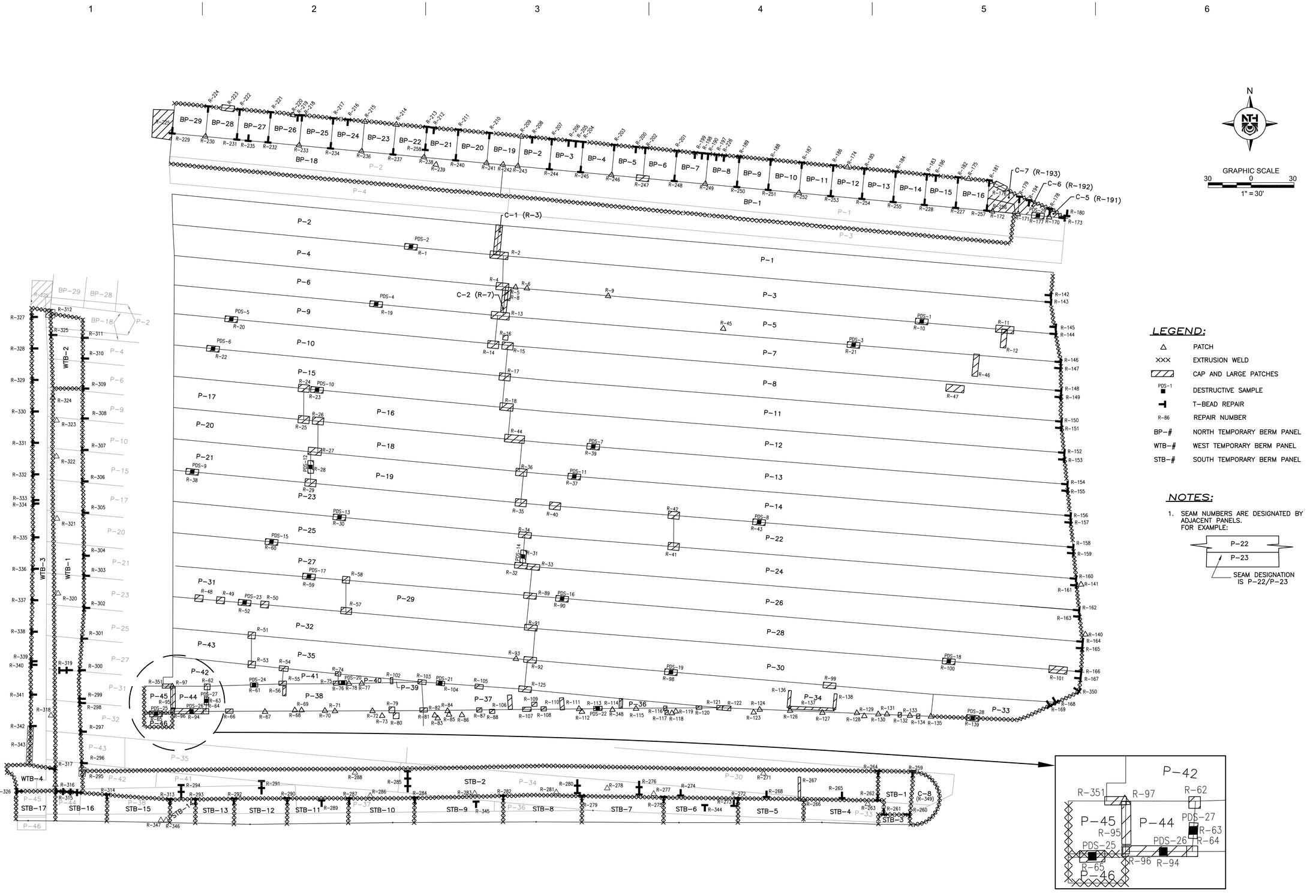
SHEET TITLE:

PANEL LAYOUT
SECONDARY GEOMEMBRANE
RECORD DRAWING

SHEET REFERENCE NUMBER:

G-1

SHEET 1 OF 1



PDS-26 TEST VERIFICATION AND REPAIR LIMITS
NOT TO SCALE

N

GRAPHIC SCALE
30 0 30
1" = 30'

LEGEND:

△	PATCH
XXX	EXTRUSION WELD
	CAP AND LARGE PATCHES
PDS-1	DESTRUCTIVE SAMPLE
	T-BEAD REPAIR
R-86	REPAIR NUMBER
BP-#	NORTH TEMPORARY BERM PANEL
WTB-#	WEST TEMPORARY BERM PANEL
STB-#	SOUTH TEMPORARY BERM PANEL

NOTES:

1. SEAM NUMBERS ARE DESIGNATED BY ADJACENT PANELS. FOR EXAMPLE:

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Infrastructure Engineering and Environmental Services

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Philadelphia, PA	215.854.6359
Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

WDI MC VI
PHASE 2 SE

PROJECT LOCATION:

BELLEVILLE, MICHIGAN

NTH PROJECT NO.: 13-060370-07	CAD FILE NAME:
DESIGNED BY: RBM	PLOT DATE: 11-20-06
DRAWN BY: JD	DRAWING SCALE: AS SHOWN
CHECKED BY: JHL	INCEPTION DATE: ORIG DATE

SHEET TITLE:

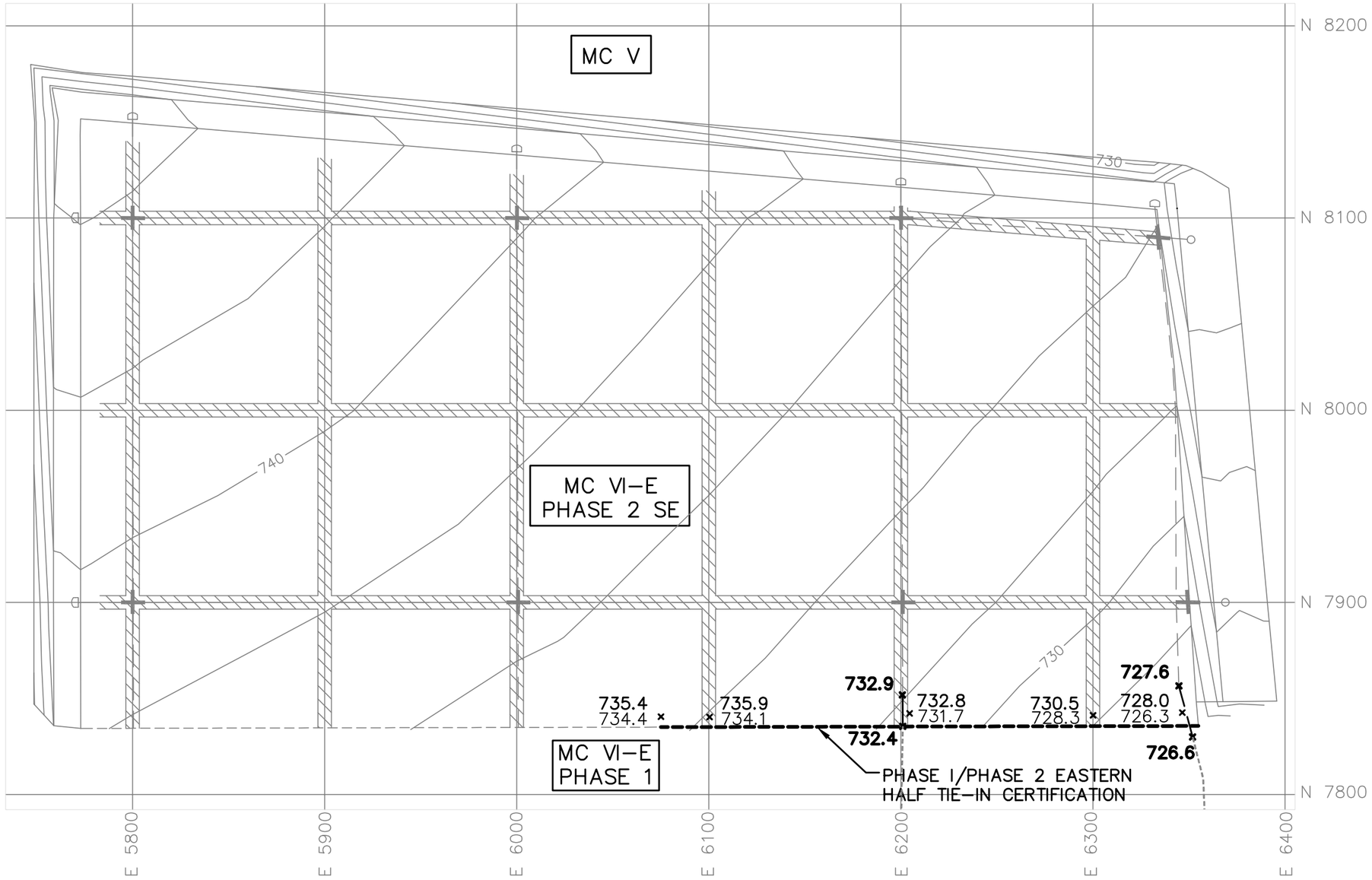
PRIMARY LINER GEOMEMBRANE RECORD DRAWING

PLATE:

G-2

SHEET 1 OF 1

J:\Cad\13\WDI 6E Phase II SE\As-builts\Sheet G2.dwg
11-20-06



N

GRAPHIC SCALE

60' 0 60'

1" = 60'

LEGEND:

732.6	AS–BUILT TOP OF LEACHATE COLLECTION PIPE	D	TEMPORARY LEACHATE COLLECTION PIPE ACCESS (FUTURE TIE–IN CONNECTION)
732.6	TOP OF SAND		
727.6	TOP OF GEOCOMPOSITE		2 EXTRA LAYERS OF GEONET, 7.5' WIDE BENEATH GEOCOMPOSITE
○	CLEANOUT		PHASE II LEACHATE COLLECTION PIPE

NTH Consultants, Ltd.
Infrastructure Engineering
and Environmental Services

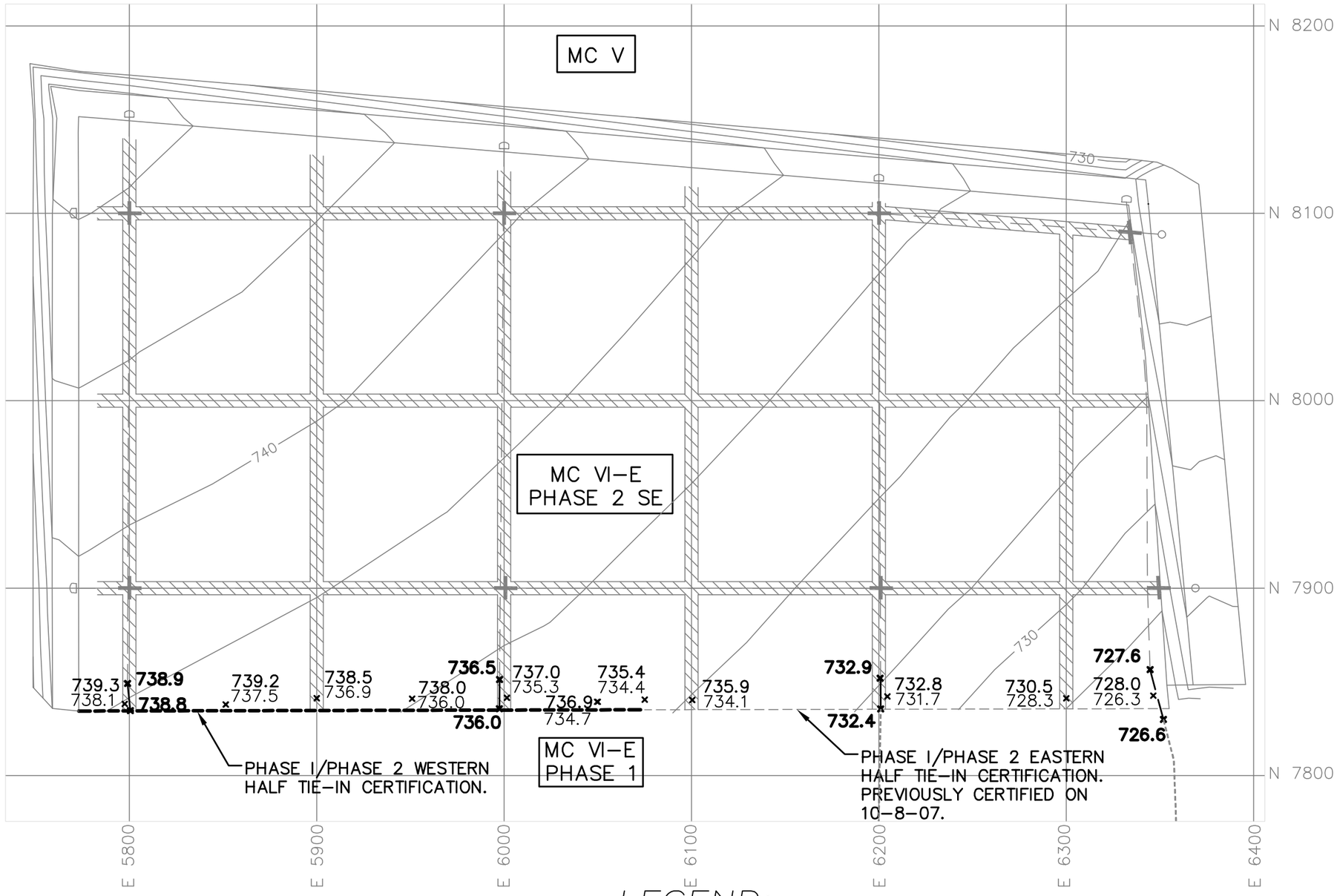
NTH PROJECT No.: 13-070341-07	CAD FILE NAME: XX0000000000
DESIGNED BY: RBM	PLOT DATE: 10/08/07
DRAWN BY: RBM	DRAWING SCALE: AS SHOWN
CHECKED BY: JHL	INCEPTION DATE: 10/08/07

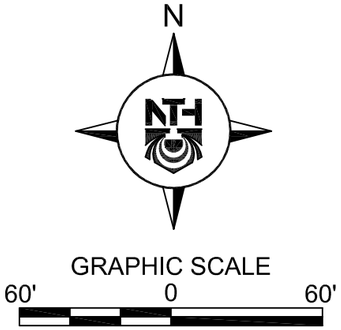
EASTERN HALF TIE-IN CERTIFICATION
MC VI-E PHASE 2 SE

WAYNE DISPOSAL, INC. SITE No. 2
BELLEVILLE, MICHIGAN

FIGURE
1

J:\Cad\13\WDI 6E Phase II SE\As-Builts\Tie-In Cert.dwg; 10/20/2008 1:51:23 PM; ROBB MOORE





LEGEND:

732.6	AS–BUILT TOP OF LEACHATE COLLECTION PIPE
732.6	TOP OF SAND
727.6	TOP OF GEOCOMPOSITE
○	CLEANOUT
D	TEMPORARY LEACHATE COLLECTION PIPE ACCESS (FUTURE TIE–IN CONNECTION)
	2 EXTRA LAYERS OF GEONET, 7.5' WIDE BENEATH GEOCOMPOSITE
— — — — —	PHASE II LEACHATE COLLECTION PIPE

NTH Consultants, Ltd.
Infrastructure Engineering
and Environmental Services

NTH PROJECT No.: 13-070341-07	CAD FILE NAME: XX000000000
DESIGNED BY: RBM	PLOT DATE: 11/26/07
DRAWN BY: KRO	DRAWING SCALE: AS SHOWN
CHECKED BY: JHL	INCEPTION DATE: 11/26/07

WESTERN HALF TIE-IN CERTIFICATION MC VI-E PHASE 2 SE

WAYNE DISPOSAL, INC. SITE No. 2
BELLEVILLE, MICHIGAN

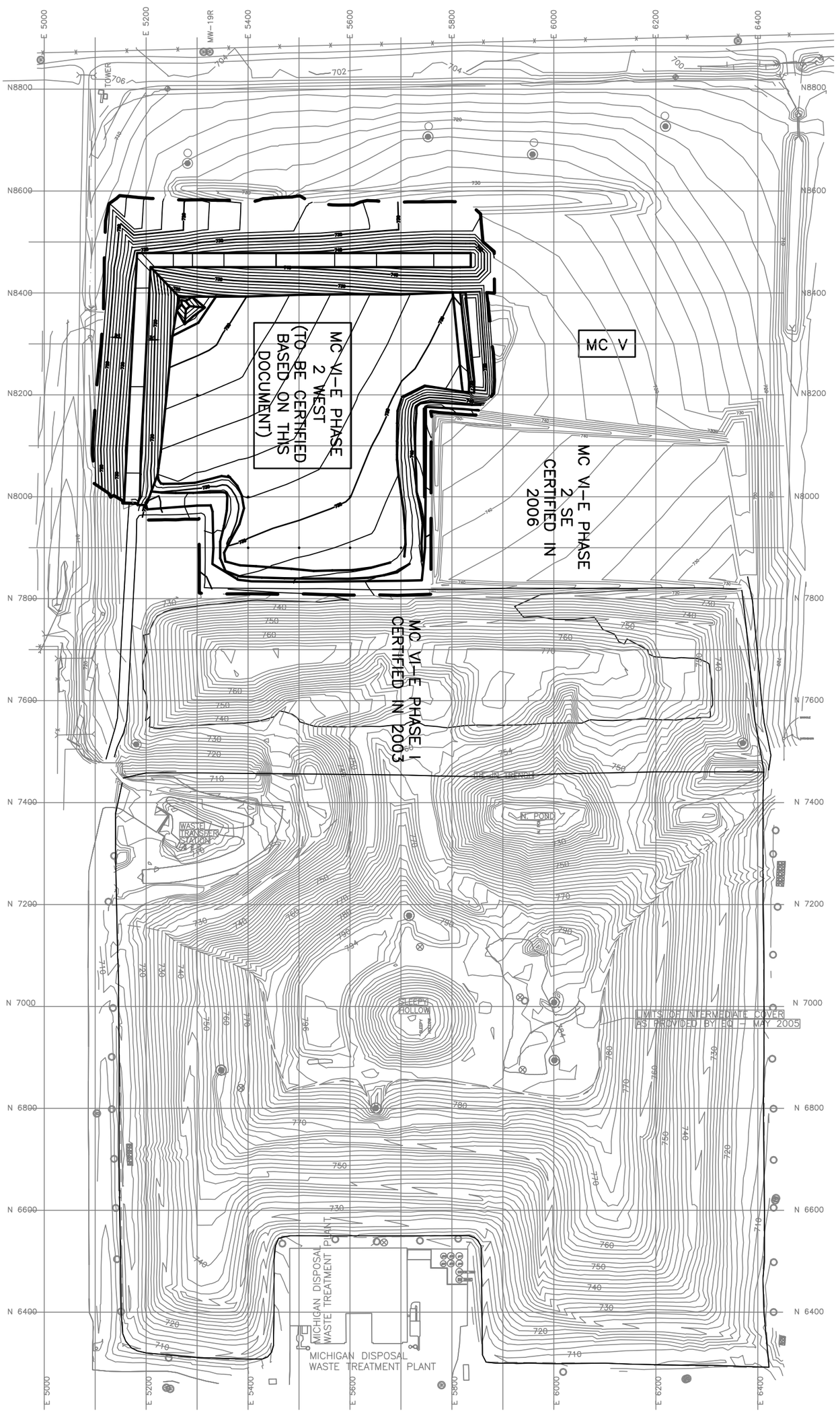
FIGURE
1

J:\Cad\13\WDI 6E Phase II SE\As-Builts\West Tie-In Cert.dwg; 10/20/2008 1:51:56 PM; ROBB MOORE

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL E PHASE 2 WEST

RECORD PLAN

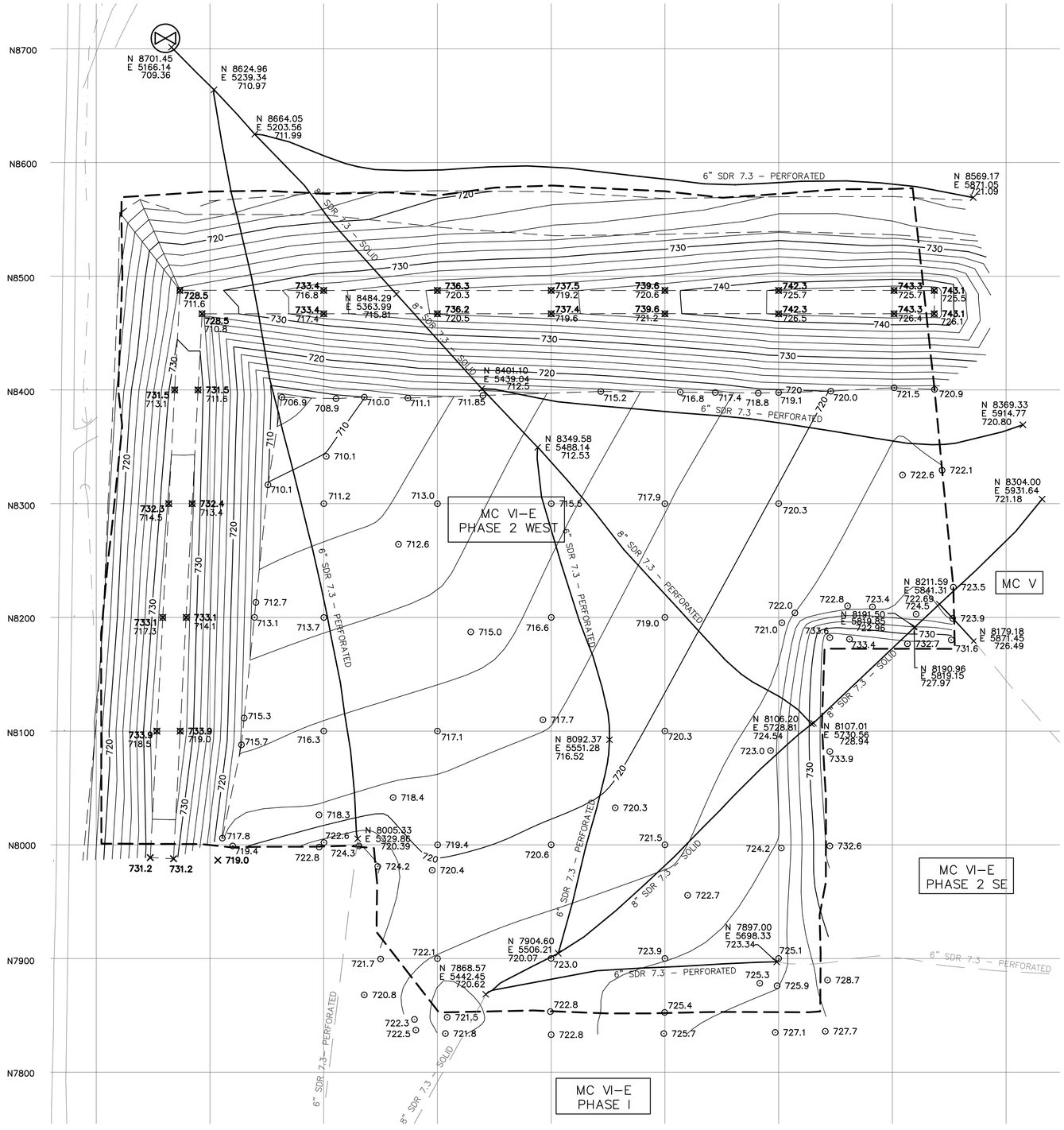


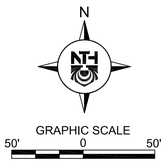
GRAPHIC SCALE
200' 0 200'

N

PLATE A-1	AREA OF CERTIFICATION MC VI-E PHASE 2 WEST WDI, SITE No. 2 BELLEVILLE, MI	NTH PROJECT No.: 13-070431-07 DESIGNED BY: RBM DRAWN BY: RBM CHECKED BY:	CAD FILE NAME: Sheet A-1.dwg PLOT DATE: 3/14/08 DRAWING SCALE: AS SHOWN INCEPTION DATE: 9/24/07

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services





LEGEND:

- 720 — TOP OF STRUCTURAL FILL/SUBGRADE 2–FOOT CONTOUR
- 743.3 × — STRUCTURAL FILL STAKING POINT
- 725.7 ⊙ — SUBGRADE STAKING POINT
- LIMIT OF GEOGRID
- AS–BUILT PHASE I/II SE GAS COLLECTION SYSTEM
- AS–BUILT PHASE II WEST GAS COLLECTION SYSTEM
- CONTROL VALVE

NOTES:

1. AS–BUILT ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI.
2. ELEVATIONS FOR GAS COLLECTION SYSTEM ARE TOP OF PIPE AND WERE SURVEYED BY WDI.

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 WEST

PROJECT LOCATION:

WAYNE DISPOSAL, INC.
SITE NO. 2
VAN BUREN TOWNSHIP,
WAYNE COUNTY,
MICHIGAN

NTH PROJECT NO.: 13-070341-07	CAD FILE NAME: Sheet A-2.dwg
DESIGNED BY: RBM	PLOT DATE: 3/14/08
DRAWN BY: RBM	DRAWING SCALE: AS SHOWN
CHECKED BY:	INCEPTION DATE: 9/20/07

SHEET TITLE:

AS-BUILT
SUBGRADE/
STRUCTURAL FILL
RECORD DRAWING

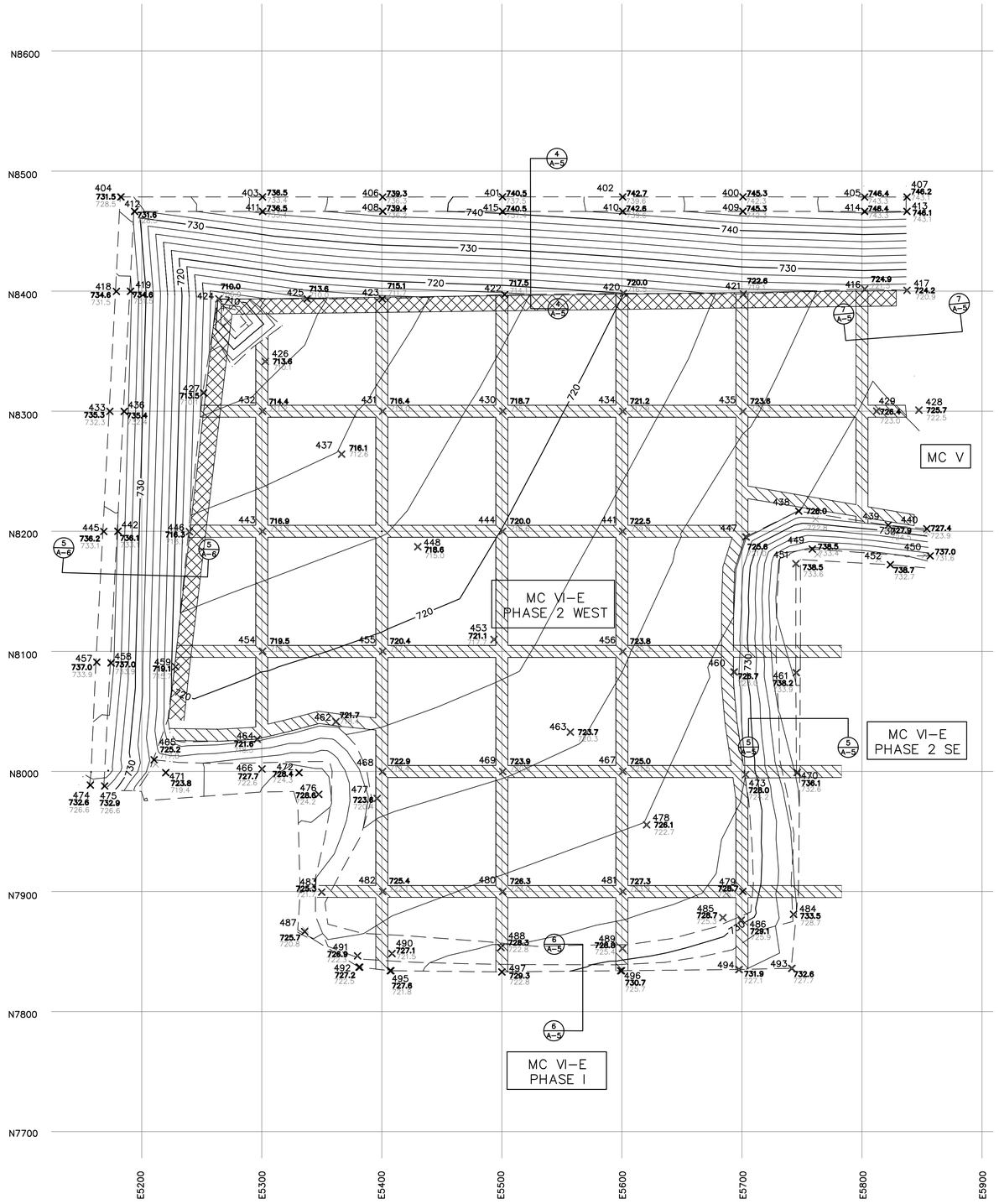
SHEET REFERENCE NUMBER:

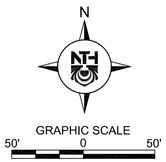
A-2

SHEET 1 OF 1

S:\CAD\13\SITE 2 MCE-E PH2 MOD\Phase 2 West\As-built\Sheet A-2.dwg
3/14/08

Point	Northing	Easting	Secondary Clay As-Built Elevations (ft)	Subgrade/Structural Fill As-Built Elevation (ft)	As-Built Clay Thickness (ft)	Deviation From Proposed Thickness (ft)
400	8478.62	5700.12	745.3	742.3	3.0	0.0
401	8478.61	5400.06	740.5	737.5	3.0	0.0
402	8478.54	5599.98	742.7	739.6	3.1	0.1
403	8478.54	5299.95	736.5	733.4	3.1	0.1
404	8478.52	5182.10	731.5	728.5	3.0	0.0
405	8478.49	5801.49	746.4	743.3	3.1	0.1
406	8478.45	5400.06	739.3	736.3	3.0	0.0
407	8478.44	5836.82	746.2	743.1	3.1	0.1
408	8466.56	5400.06	739.4	736.2	3.2	0.2
409	8466.53	5700.13	745.3	742.3	3.0	0.0
410	8466.51	5599.98	742.6	739.6	3.0	0.0
414	8466.45	5300.09	736.5	733.4	3.1	0.1
412	8466.47	5193.48	731.6	728.5	3.1	0.1
413	8466.47	5836.75	746.1	743.1	3.0	0.0
414	8466.45	5801.52	746.4	743.3	3.1	0.1
415	8466.45	5499.97	740.5	737.4	3.1	0.1
416	8401.89	5801.61	724.9	721.5	3.4	0.4
441	8400.67	5836.83	724.2	720.9	3.3	0.3
418	8400.00	5168.99	734.6	731.5	3.1	0.1
419	8399.96	5190.04	734.6	731.5	3.1	0.1
420	8398.25	5600.50	720.0	716.5	3.5	0.5
421	8397.70	5700.32	722.6	719.1	3.5	0.5
422	8397.22	5501.72	717.5	714.1	3.4	0.4
423	8393.63	5399.73	715.1	711.7	3.4	0.4
421	8393.60	5263.49	710.0	706.9	3.1	0.1
426	8393.60	5337.11	713.6	710.0	3.6	0.6
426	8341.58	5302.26	713.6	710.1	3.5	0.5
421	8315.32	5250.85	713.5	710.1	3.4	0.4
428	8300.99	5846.65	725.7	722.5	3.2	0.2
429	8300.16	5811.51	726.4	723.0	3.4	0.4
430	8300.11	5500.09	718.7	715.5	3.2	0.2
431	8300.05	5400.04	716.4	713.0	3.4	0.4
452	8300.01	5299.95	714.4	711.2	3.2	0.2
433	8300.99	5172.84	735.3	732.3	3.0	0.0
431	8299.99	5600.01	721.2	717.9	3.3	0.3
436	8299.98	5700.08	723.6	720.3	3.3	0.3
436	8299.86	5184.75	735.4	732.4	3.5	0.0
431	8264.28	5365.76	716.1	712.6	3.5	0.5
438	8216.88	5746.63	726.0	722.8	3.2	0.2
439	8205.10	5821.17	727.9	724.5	3.4	0.4
440	8202.16	5853.36	727.4	723.9	3.5	0.5
441	8200.02	5599.93	722.5	719.0	3.5	0.5
442	8200.01	5179.57	736.1	733.1	3.0	0.0
405	8199.99	5299.97	716.9	713.7	3.2	0.2
441	8199.99	5499.98	720.0	716.6	3.4	0.4
406	8199.87	5167.71	736.2	733.1	3.1	0.1
406	8199.90	5239.09	716.3	713.1	3.2	0.2
441	8195.27	5702.86	725.6	721.0	4.5	1.6
409	8187.15	5429.30	718.6	715.0	3.6	0.6
409	8185.24	5758.64	738.5	733.4	5.1	2.1
410	8179.57	5856.07	737.0	731.6	5.4	2.4
441	8173.00	5745.00	738.5	733.6	4.9	1.9
452	8172.20	5822.97	738.7	732.7	6.0	3.0
453	8109.93	5492.80	721.1	717.7	3.4	0.4
454	8100.10	5300.09	719.5	716.3	3.2	0.2
455	8100.08	5400.01	720.4	717.1	3.3	0.3
406	8099.95	5600.02	723.8	720.3	3.5	0.5
454	8091.08	5161.87	737.0	733.9	3.1	0.1
488	8090.41	5173.84	737.0	733.9	3.1	0.1
489	8087.28	5227.59	719.1	715.7	3.4	0.4
460	8082.85	5692.93	726.7	723.0	3.7	0.7
451	8082.24	5744.80	738.2	733.9	4.4	1.4
492	8041.44	5361.01	728.7	718.4	3.3	0.3
468	8032.67	5556.37	723.7	720.3	3.4	0.4
469	8026.81	5295.65	721.6	718.3	3.3	0.3
470	8009.74	5209.64	725.2	717.8	7.4	4.4
456	8002.03	5300.24	727.7	722.6	5.1	2.1
467	8000.04	5600.06	725.0	721.5	3.5	0.5
468	7999.97	5399.96	728.9	719.4	3.5	0.5
469	7999.89	5500.03	723.9	720.6	3.3	0.3
470	7999.08	5745.45	736.1	732.6	3.5	0.5
471	7999.00	5220.00	728.8	719.4	4.4	1.4
472	7999.00	5331.00	728.7	725.3	4.4	1.1
473	7997.28	5702.40	728.0	724.1	3.9	0.9
474	7988.59	5156.53	732.6	729.6	3.0	0.0
475	7987.88	5168.51	732.9	725.9	3.3	0.3
478	7999.66	5347.48	728.6	724.2	4.4	1.4
477	7977.55	5395.46	728.6	720.4	3.2	0.2
478	7955.51	5619.91	726.1	722.7	3.4	0.4
479	7900.07	5700.05	728.7	728.4	3.9	0.6
480	7999.06	5500.08	726.3	723.0	3.3	0.3
481	7899.97	5500.03	727.3	723.9	3.4	0.4
482	7899.95	5400.04	725.4	722.1	3.9	0.3
480	7899.45	5350.00	725.0	721.8	3.5	0.6
480	7881.00	5743.00	733.5	722.7	4.6	1.8
480	7878.23	5683.45	728.7	725.3	3.1	0.4
486	7876.06	5698.66	729.1	725.9	3.2	0.2
487	7866.60	5335.80	725.8	720.8	5.0	2.0
488	7853.31	5499.35	728.0	722.3	5.5	2.5
489	7852.55	5599.77	728.8	725.4	3.4	0.4
490	7848.32	5408.51	727.1	721.5	5.6	2.6
491	7846.38	5379.82	726.9	722.3	4.6	1.6
492	7837.00	5381.00	727.1	722.5	4.6	1.6
493	7835.00	5741.00	732.6	727.7	4.9	1.9
490	7835.00	5697.00	731.9	727.1	4.8	1.8
494	7834.00	5407.00	727.5	721.8	5.7	2.7
496	7834.00	5599.00	730.6	725.7	4.9	1.9
497	7833.00	5500.00	729.3	722.8	6.5	3.5





LEGEND:

- 720 — TOP OF SECONDARY COMPACTED CLAY LINER 2-FOOT CONTOUR
- 400 — POINT NUMBER
- 725.7 — TOP OF SECONDARY
- 722.5 — TOP OF STRUCTURAL FILL/SUBGRADE
- 2 EXTRA LAYERS OF GEONET, 7.5' WIDE BENEATH GEOCOMPOSITE
- 4 EXTRA LAYERS OF GEONET, 7.5' WIDE BENEATH GEOCOMPOSITE

NOTE:

1. AS-BUILT ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI.

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 WEST

PROJECT LOCATION:

WAYNE DISPOSAL, INC.
SITE NO. 2
VAN BUREN TOWNSHIP,
WAYNE COUNTY,
MICHIGAN

NTH PROJECT NO.: 13-070341-07	CAD FILE NAME: Sheet A-3.dwg
DESIGNED BY: RBM	PLOT DATE: 3/14/08
DRAWN BY: RBM	DRAWING SCALE: AS SHOWN
CHECKED BY:	INCEPTION DATE: 9/24/07

SHEET TITLE:

SECONDARY
CLAY LINER
RECORD DRAWING

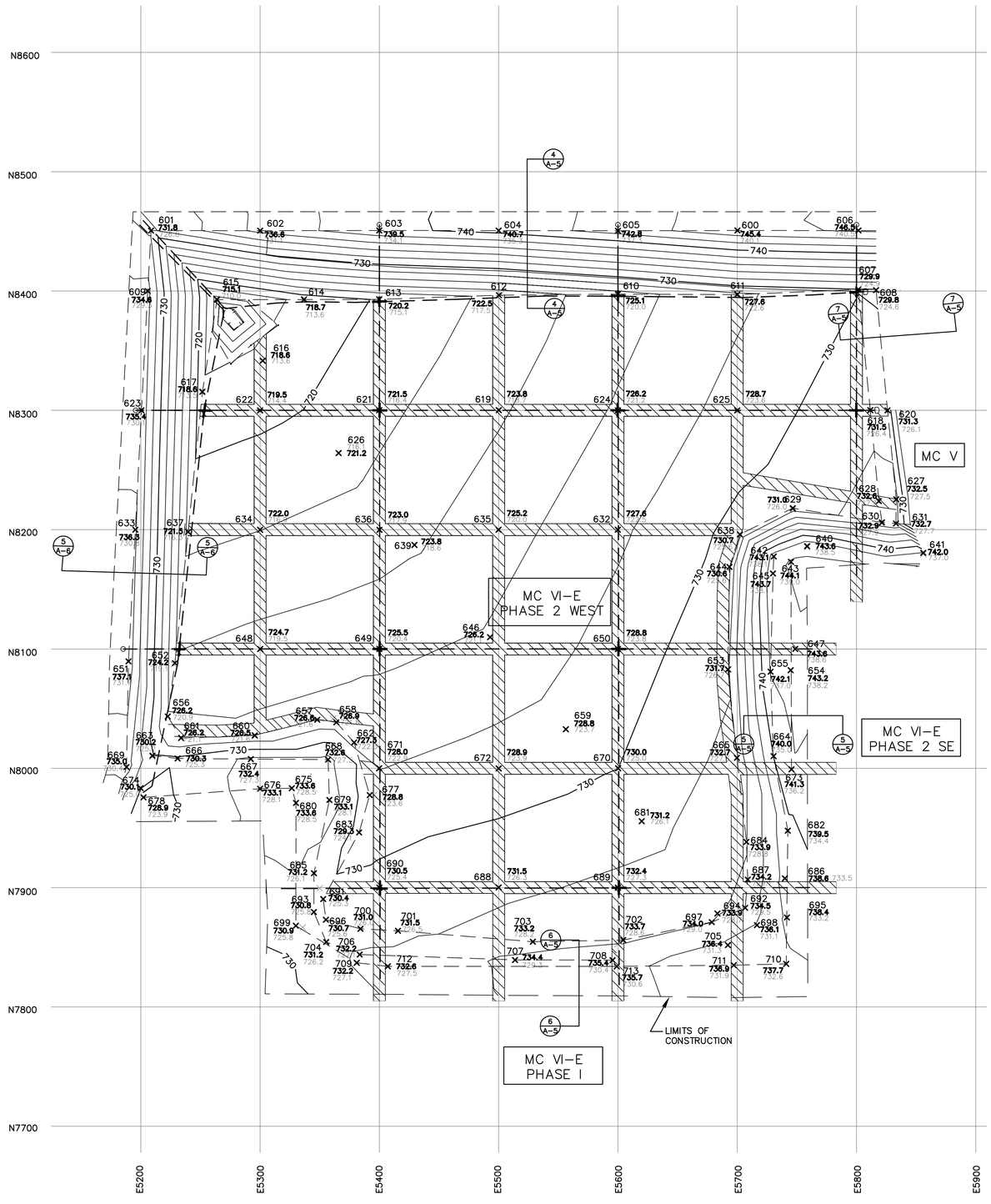
SHEET REFERENCE NUMBER:

A-3

SHEET 1 OF 1

S:\CAD\SITE 2 MCE-E PH2 MCD\Phase 2 West\As-built\Sheet A3.dwg

Point	Northing	Easting	Primary Clay As-Built Elevations (ft)	Secondary Clay As-Built Elevations (ft)	As-Built Clay Thickness (ft)	Deviation From Proposed Thickness (ft)
600	8450.77	5700.15	745.4	740.1	5.3	0.3
601	8450.71	5208.63	731.8	726.8	5.0	0.0
602	8450.62	5308.08	736.6	731.1	5.5	0.5
603	8450.79	5399.94	739.5	734.1	5.4	0.4
604	8450.70	5499.99	740.7	735.3	5.4	0.4
605	8450.56	5600.02	742.8	737.3	5.5	0.5
606	8450.82	5801.66	746.5	740.5	6.0	1.0
607	8401.33	5801.48	729.9	724.9	5.1	0.1
608	8400.83	5816.40	729.8	724.6	5.2	0.2
609	8400.02	5205.82	734.6	729.3	5.3	0.3
610	8397.43	5599.95	725.1	720.0	5.2	0.2
611	8397.07	5699.99	727.6	722.6	5.0	0.0
612	8396.54	5500.23	722.8	717.5	5.1	0.1
613	8393.01	5399.91	720.2	715.1	5.1	0.1
614	8392.91	5336.73	718.7	713.6	5.1	0.1
615	8392.84	5263.96	715.1	710.0	5.1	0.1
616	8341.60	5302.19	718.6	713.6	5.0	0.0
617	8315.59	5251.67	718.6	713.5	5.1	0.1
618	8300.21	5811.52	731.5	726.4	5.1	0.1
619	8300.18	5500.12	723.8	718.7	5.1	0.1
620	8300.02	5826.01	731.3	726.1	5.2	0.2
621	8300.13	5399.91	721.5	716.4	5.1	0.1
622	8299.95	5300.00	719.5	714.4	5.1	0.1
623	8300.02	5200.56	735.4	730.1	5.3	0.3
624	8299.97	5600.03	726.2	721.2	5.0	0.0
625	8299.98	5699.99	728.7	723.6	5.1	0.1
626	8264.21	5365.81	721.2	716.1	5.1	0.1
627	8225.47	5833.33	732.5	727.5	5.0	0.0
628	8223.99	5818.77	732.6	727.3	5.3	0.3
629	8218.03	5746.55	731.0	726.0	5.1	0.1
630	8206.09	5821.29	732.9	727.9	5.0	0.0
631	8205.23	5833.04	732.7	727.7	5.0	0.0
632	8199.97	5599.94	727.6	722.5	5.1	0.1
633	8199.97	5195.46	736.3	730.8	5.5	0.5
634	8199.97	5299.99	722.0	716.9	5.1	0.1
635	8199.99	5499.94	725.2	720.0	5.1	0.1
636	8199.89	5400.11	723.0	717.5	5.1	0.1
637	8198.12	5239.66	721.5	716.3	5.2	0.2
638	8196.06	5702.23	730.7	725.6	5.0	0.0
639	8187.19	5429.40	723.8	718.6	5.2	0.2
640	8186.18	5758.60	743.6	738.6	5.1	0.1
641	8180.66	5855.94	742.0	737.0	5.0	0.0
642	8177.52	5730.67	743.1	738.1	5.0	0.0
643	8173.05	5745.04	744.1	738.9	5.2	0.2
644	8168.81	5693.51	730.6	725.6	5.0	0.0
645	8163.29	5730.03	743.7	738.1	5.6	0.6
646	8199.89	5492.81	726.2	721.1	5.1	0.1
647	8100.06	5748.66	743.6	738.6	5.1	0.1
648	8099.98	5300.12	724.7	719.5	5.2	0.2
649	8100.10	5400.00	725.5	720.4	5.1	0.1
650	8099.96	5600.01	728.8	723.8	5.0	0.0
651	8089.62	5189.67	737.1	731.7	5.4	0.4
652	8088.10	5228.58	724.2	719.1	5.1	0.1
653	8082.85	5692.16	731.7	726.7	5.0	0.0
654	8082.18	5744.78	743.2	738.2	5.0	0.0
655	8080.98	5727.95	742.1	737.0	5.2	0.2
656	8043.46	5222.64	726.2	720.9	5.3	0.3
657	8040.73	5347.91	726.6	721.6	5.0	0.0
658	8038.54	5363.92	726.9	721.8	5.1	0.1
659	8032.69	5556.33	728.8	723.7	5.1	0.1
660	8027.64	5295.53	726.5	721.6	5.0	0.0
661	8025.42	5233.77	726.2	721.1	5.1	0.1
662	8021.63	5378.84	727.3	722.3	5.1	0.1
663	8010.59	5209.79	730.2	725.2	5.0	0.0
664	8010.18	5730.46	740.0	735.0	5.1	0.1
665	8008.82	5699.78	732.7	727.6	5.1	0.1
666	8008.24	5230.82	730.3	725.3	5.1	0.1
667	8007.74	5292.25	732.4	727.3	5.1	0.1
668	8007.33	5357.03	732.6	727.5	5.0	0.0
669	8001.05	5188.02	735.0	730.0	5.0	0.0
670	7999.98	5600.15	730.0	725.0	5.0	0.0
671	8000.01	5399.88	728.0	722.9	5.0	0.0
672	7999.89	5500.04	728.9	723.9	5.1	0.1
673	7999.13	5745.48	741.3	736.2	5.1	0.1
674	7983.37	5199.83	730.1	725.0	5.1	0.1
675	7983.28	5326.59	733.6	728.5	5.1	0.1
676	7982.87	5300.04	733.1	728.1	5.0	0.0
677	7977.51	5391.94	728.8	723.6	5.1	0.1
678	7975.64	5202.24	728.9	723.9	5.0	0.0
679	7973.47	5358.12	733.1	728.1	5.1	0.1
680	7970.94	5330.14	733.6	728.5	5.1	0.1
681	7955.61	5619.94	731.2	726.1	5.1	0.1
682	7947.68	5742.44	739.5	734.4	5.1	0.1
683	7946.24	5383.01	729.3	724.1	5.2	0.2
684	7938.26	5707.77	733.9	728.8	5.1	0.1
685	7912.04	5345.19	731.2	726.1	5.1	0.1
686	7907.74	5740.02	738.6	733.5	5.1	0.1
687	7906.70	5708.80	734.2	729.1	5.0	0.0
688	7900.14	5500.01	731.5	726.3	5.2	0.2
689	7899.92	5599.98	732.4	727.3	5.1	0.1
690	7899.94	5400.04	730.5	725.4	5.1	0.1
691	7890.35	5352.91	730.4	725.3	5.2	0.2
692	7883.05	5706.62	734.5	729.5	5.0	0.0
693	7879.51	5345.09	730.8	725.8	5.0	0.0
694	7878.27	5683.43	733.9	728.7	5.2	0.2
695	7874.99	5741.61	738.4	733.2	5.2	0.2
696	7873.05	5355.18	730.7	725.6	5.1	0.1
697	7871.07	5678.69	734.0	729.0	5.0	0.0
698	7868.56	5716.56	736.1	731.1	5.0	0.0
699	7868.08	5330.00	730.9	725.8	5.1	0.1
700	7865.45	5384.19	731.0	726.0	5.0	0.0
701	7863.78	5415.58	731.5	726.5	5.0	0.0
702	7856.04	5604.41	733.7	728.5	5.1	0.1
703	7854.63	5528.70	733.2	728.2	5.0	0.0
704	7854.39	5355.47	731.2	726.2	5.1	0.1
705	7851.81	5692.19	736.4	731.3	5.0	0.0
706	7843.88	5383.55	732.2	727.1	5.1	0.1
707	7839.31	5513.74	734.4	729.3	5.1	0.1
708	7839.24	5595.51	735.4	730.4	5.0	0.0
709	7836.92	5380.98	732.2	727.1	5.1	0.1
710	7836.02	5741.05	737.7	732.6	5.1	0.1
711	7834.98	5697.05	736.9	731.9	5.0	0.0
712	7833.99	5407.11	732.6	727.5	5.1	0.1
713	7833.95	5599.07	735.7	730.6	5.1	0.1



N

GRAPHIC SCALE
50' 0 50'

LEGEND:

- 720 — TOP OF PRIMARY COMPACTED CLAY LINER 2–FOOT CONTOUR
- 400 — POINT NUMBER
- 725.7 — TOP OF PRIMARY CLAY
- 725.7 — TOP OF SECONDARY CLAY
- 2 EXTRA LAYERS OF GEONET, 7.5' WIDE BENEATH GEOCOMPOSITE
- LEACHATE COLLECTION PIPE

NOTES:

1. AS–BUILT ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI.

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI 248.553.6300
Exton, PA 610.524.2300
Philadelphia, PA 215.854.6359
Detroit, MI 313.965.0036
Lansing, MI 517.321.6900
Grand Rapids, MI 616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 WEST

PROJECT LOCATION:

WAYNE DISPOSAL, INC.
SITE NO. 2
VAN BUREN TOWNSHIP,
WAYNE COUNTY,
MICHIGAN

NTH PROJECT NO.:	CAD FILE NAME:
13-070341-07	Sheet A-4.dwg
DESIGNED BY:	PLOT DATE:
RBM	3/14/08
DRAWN BY:	DRAWING SCALE:
RBM	AS SHOWN
CHECKED BY:	INCEPTION DATE:
	9/24/07

SHEET TITLE:

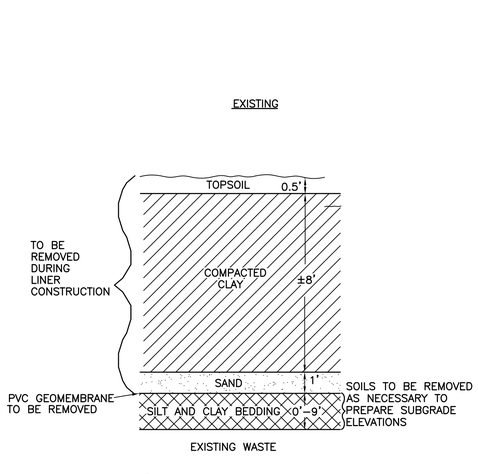
PRIMARY CLAY LINER
RECORD DRAWING

SHEET REFERENCE NUMBER:

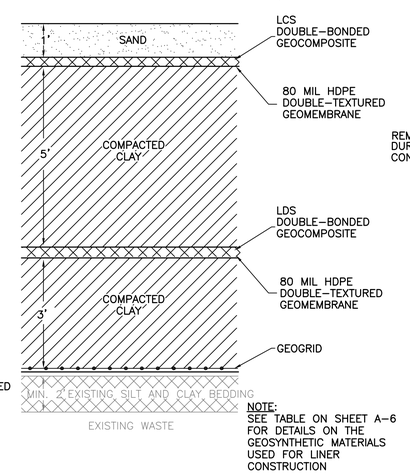
A-4

SHEET 1 OF 1

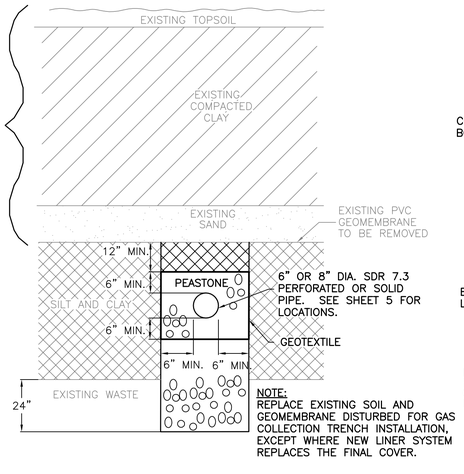
S:\CAD\13\SITE 2 MCE-E PH2 WDI\Phase 2 West\As-built\Sheet A-4.dwg
3/14/08



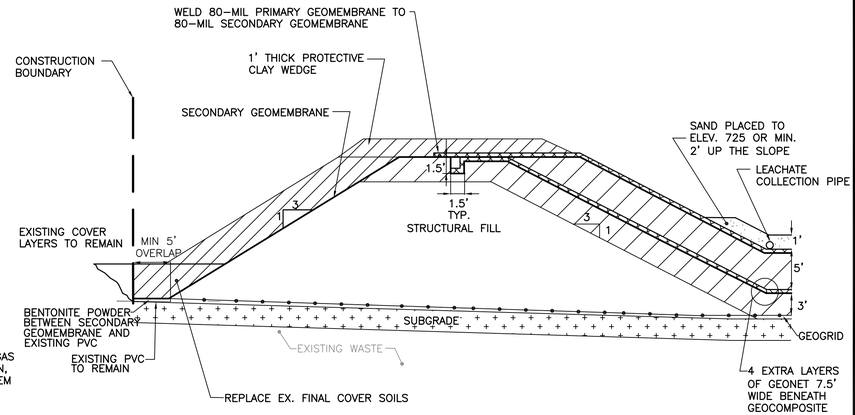
1 A–5 EXISTING MC–V COVER
NOT TO SCALE



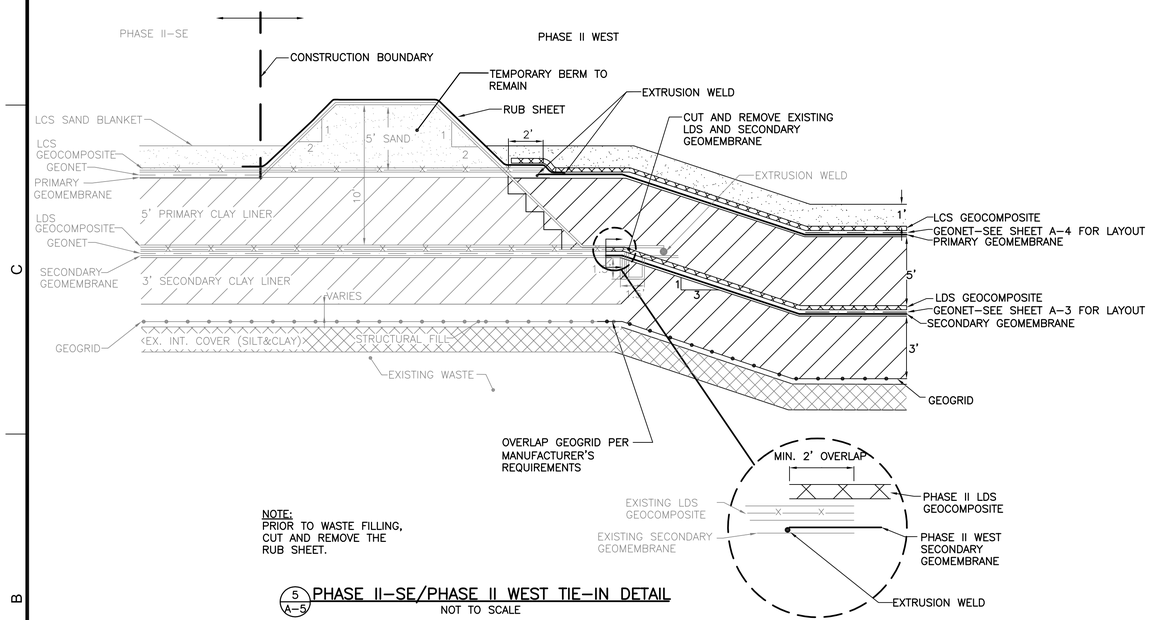
2 A–5 MC VI–E PHASE 2 WEST LINER SYSTEM
NOT TO SCALE



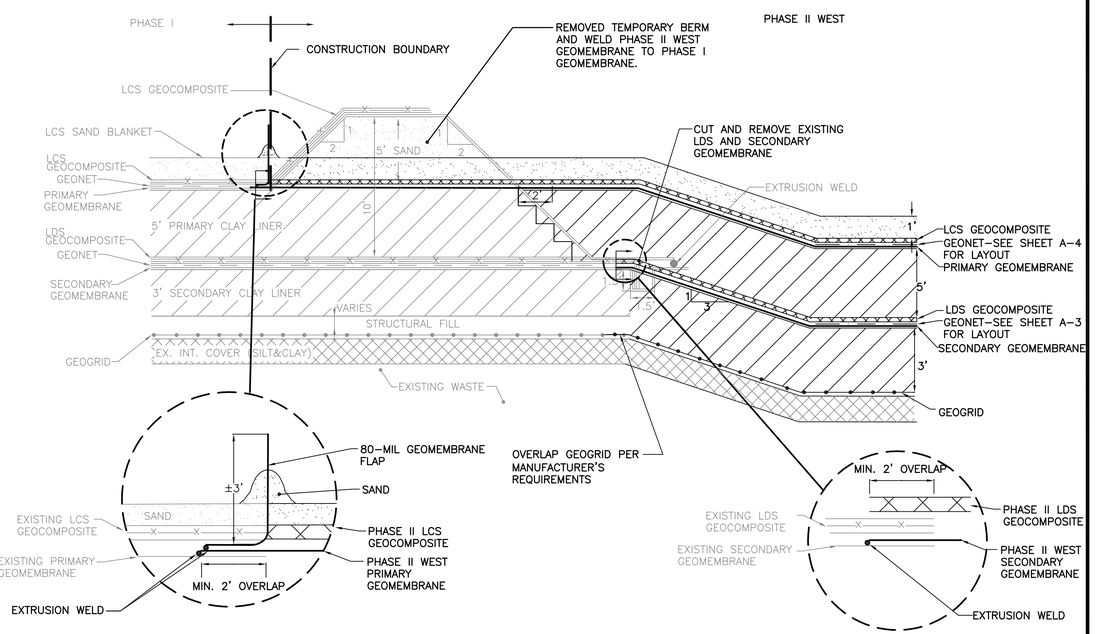
3 A–5 MC–V GAS COLLECTION TRENCH
NOT TO SCALE



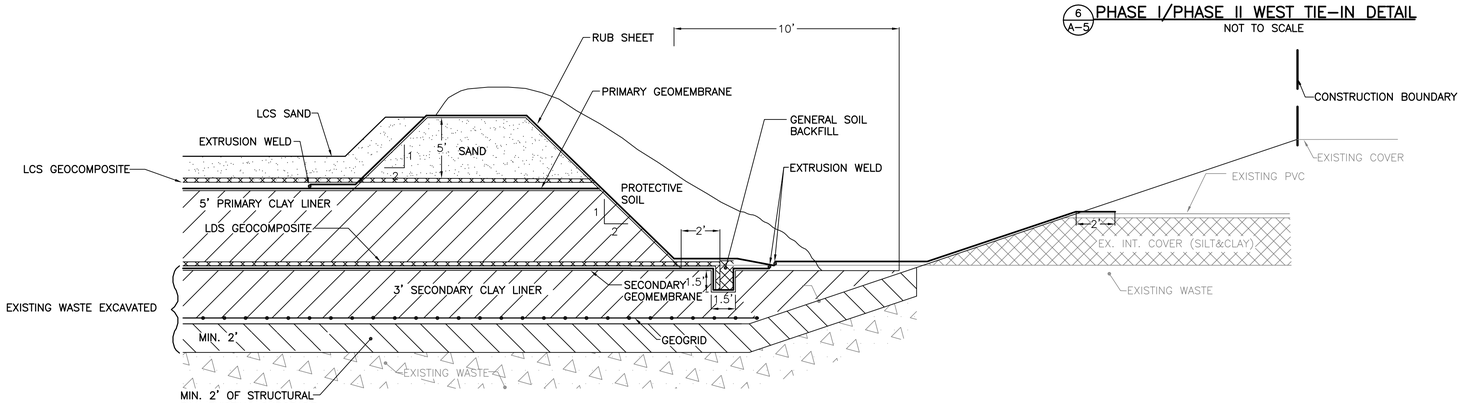
4 A–5 SECTION THROUGH NORTH DIKE
NOT TO SCALE



5 A–5 PHASE II–SE/PHASE II WEST TIE–IN DETAIL
NOT TO SCALE



6 A–5 PHASE I/PHASE II WEST TIE–IN DETAIL
NOT TO SCALE



7 A–5 TEMPORARY LINER TERMINATION (EAST BERM)
NOT TO SCALE

NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 WEST
CONSTRUCTION PLAN

PROJECT LOCATION:

WAYNE DISPOSAL, INC.
SITE NO. 2
VAN BUREN TOWNSHIP,
WAYNE COUNTY,
MICHIGAN

NTH PROJECT NO.: 13-070341-07	CAD FILE NAME:
DESIGNED BY: RBM	PLOT DATE: 3/14/08
DRAWN BY: RBM	DRAWING SCALE: AS SHOWN
CHECKED BY:	INCEPTION DATE: 02/13/08

SHEET TITLE:

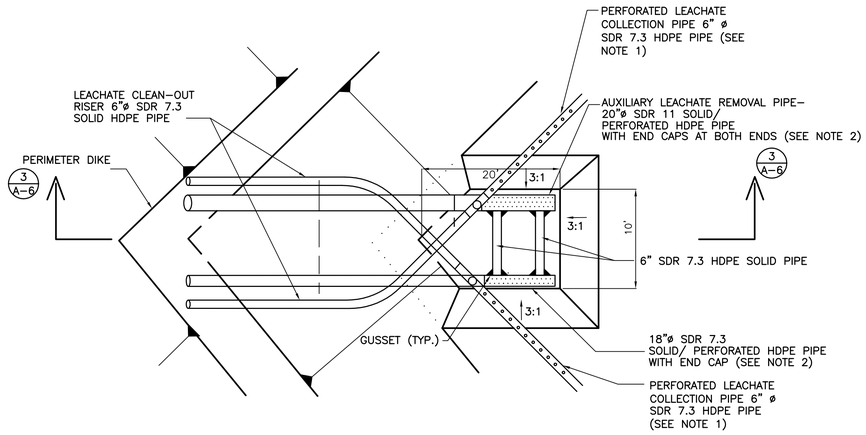
AS-BUILT DETAILS

SHEET REFERENCE NUMBER:

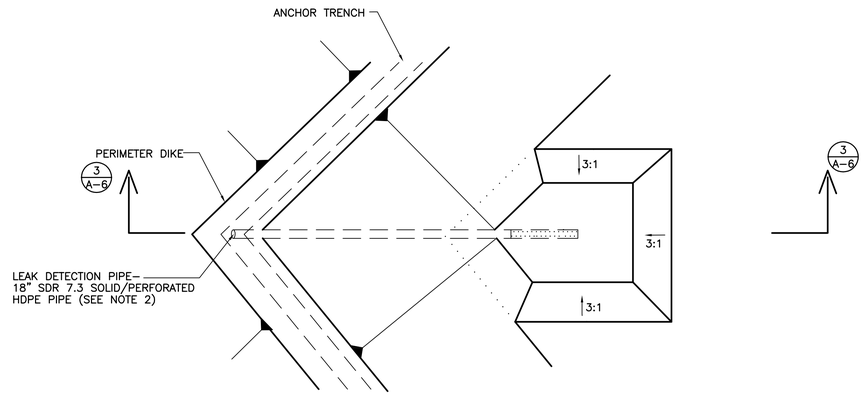
A-5

SHEET 1 OF 1

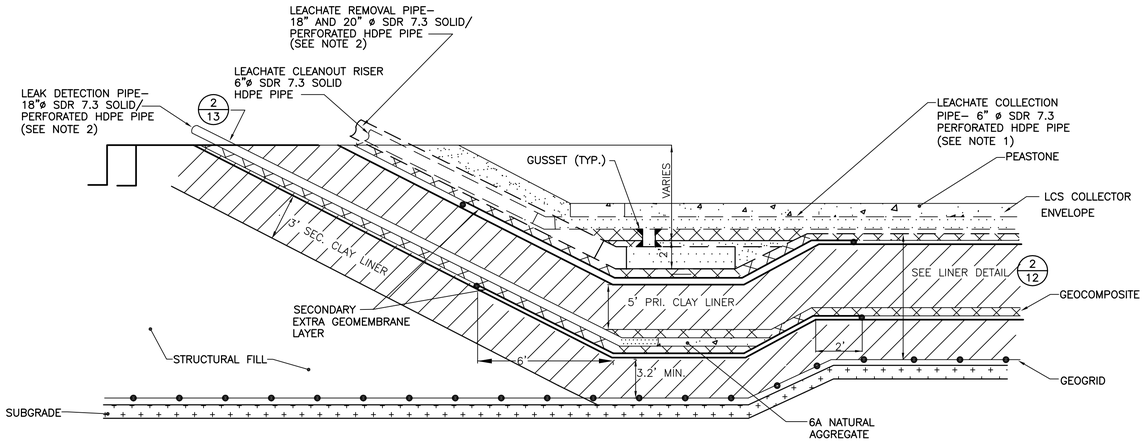
S:\CAD\13-SITE 2 MCE-E PH2 WDO\Phase 2 West\As-built\Sheet A-5.dwg
3/14/08



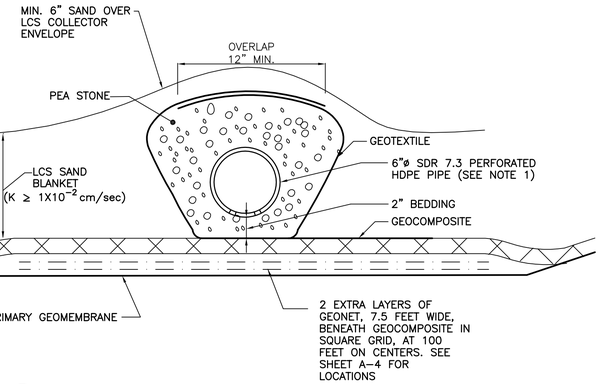
1 A-6 **SUMP DETAIL**
NOT TO SCALE



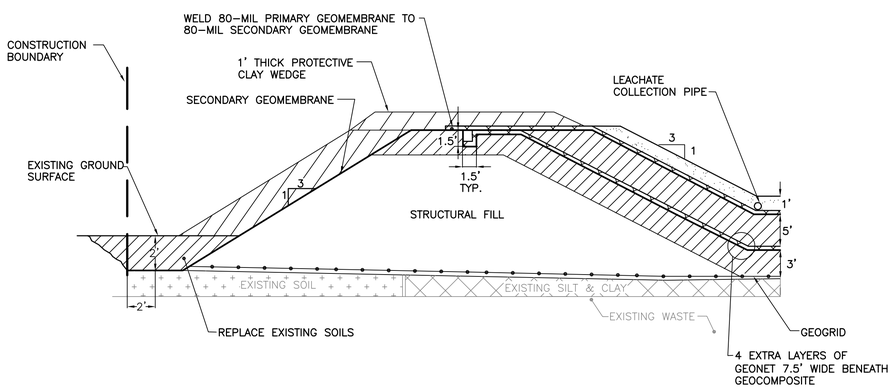
2 A-6 **SECONDARY SUMP DETAIL**
NOT TO SCALE



3 A-6 **SUMP CROSS SECTION**
NOT TO SCALE



4 A-6 **LCS COLLECTOR ENVELOPE AND COLLECTOR STRIPS**
NOT TO SCALE



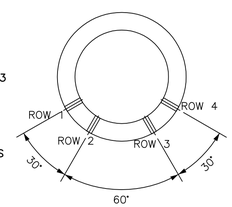
5 A-6 **SECTION THROUGH WEST DIKE**
NOT TO SCALE

Geosynthetic Materials

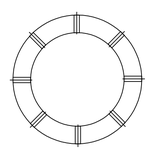
Material	Location	Description	Product	Additional Requirements
80-mil Geomembrane	Primary and secondary liners	80-mil HDPE, textured both sides	GSE HD textured	Interface friction requirements in CQA Plan
Geocomposite	LCS and LDS	200-mil HDPE geonet, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET	Transmissivity and interface friction requirements in CQA Plan
Geonet	LCS and LDS collectors	200-mil HDPE	GSE HYPERNET	Transmissivity requirements in CQA Plan
Geotextile	All geocomposites and gravel/geotextile envelopes for LCS and gas management system	Nominal 8 oz/yd^2, needle-punched, nonwoven polypropylene	SKAPS GT-180	None
Geogrid	Subgrade	Biaxial Polymeric Grid	Tensar UX1400-HS	None

LCS denotes leachate collection system
LDS denotes leak detection, collection, and removal system

NOTES:
1. PIPE IS HDPE, 6" SDR 7.3 WITH 1/4" DIA. HOLES. 2" SPACING ALONG EACH OF (4) ROWS. ROWS SPACED AROUND CIRCUMFERENCE AS SHOWN. TOTAL 24 HOLES PER FOOT.



2. PIPE IS HDPE, 18" OR 20" SDR 7.3 WITH 3/8" DIA. HOLES. 3" SPACING ALONG EACH OF (8) ROWS. ROWS SPACED AROUND CIRCUMFERENCE AS SHOWN. TOTAL 32 HOLES PER FOOT.



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Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 WEST

PROJECT LOCATION:

WAYNE DISPOSAL, INC.
SITE NO. 2
VAN BUREN TOWNSHIP,
WAYNE COUNTY,
MICHIGAN

NTH PROJECT NO.: 13-070341-07	CAD FILE NAME: Sheet A-6.dwg
DESIGNED BY: RBM	PLOT DATE: 3/14/08
DRAWN BY: RBM	DRAWING SCALE: AS SHOWN
CHECKED BY:	INCEPTION DATE: 02/13/08

SHEET TITLE:

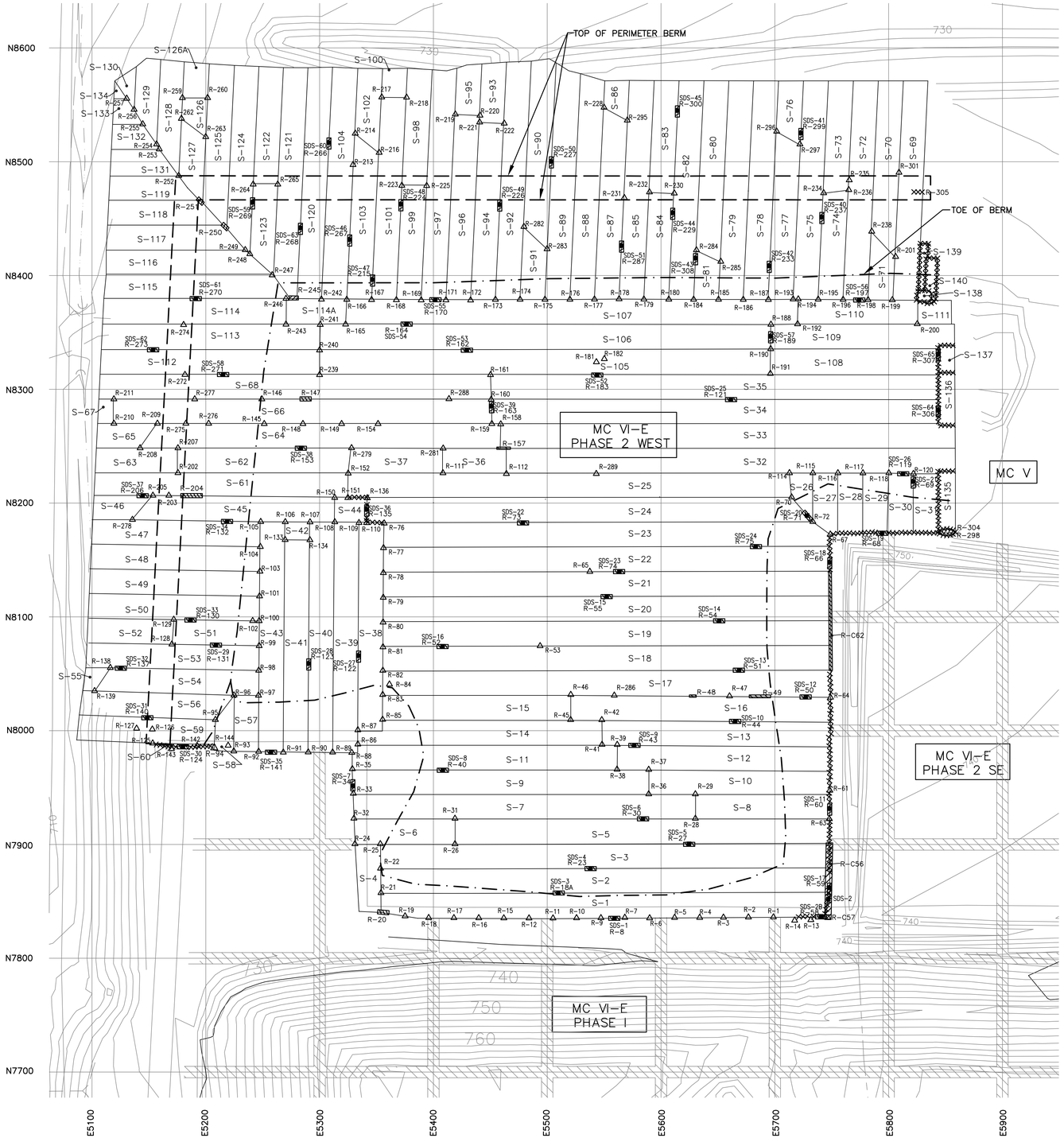
AS-BUILT DETAILS

SHEET REFERENCE NUMBER:

A-6

SHEET 1 OF 1

S:\VOL13\SITE 2 MCS-E PH2 WDD\Phase 2 West\CONSTRUCTION\As-built\Sheet A-6.dwg
3/14/08



NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

N

GRAPHIC SCALE
50' 0 50'

LEGEND:

- △ PATCH
- ××× EXTRUSION WELD
- CAP AND LARGE PATCHES
- SDS-20 ■ DESTRUCTIVE SAMPLE
- R-86 REPAIR NUMBER
- — — — TOP OF PERIMETER BERM
- —— · —— TOE OF BERM

NOTES:

1. SEAM NUMBERS ARE DESIGNATED BY ADJACENT PANELS. FOR EXAMPLE:

REVISIONS

REV	DESCRIPTION	DATE	BY
A	ADDED TOE AND TOP OF BERM	4/24/08	RBM

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 WEST
CONSTRUCTION

PROJECT LOCATION:

WAYNE DISPOSAL, INC.
SITE NO. 2
VAN BUREN TOWNSHIP,
WAYNE COUNTY,
MICHIGAN

NTH PROJECT NO.: 13-070341-04	CAD FILE NAME: SECONDARY LINER AB.DWG
DESIGNED BY: DRL	PLOT DATE: 4/24/08
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY:	INCEPTION DATE: 8/21/07

SHEET TITLE:

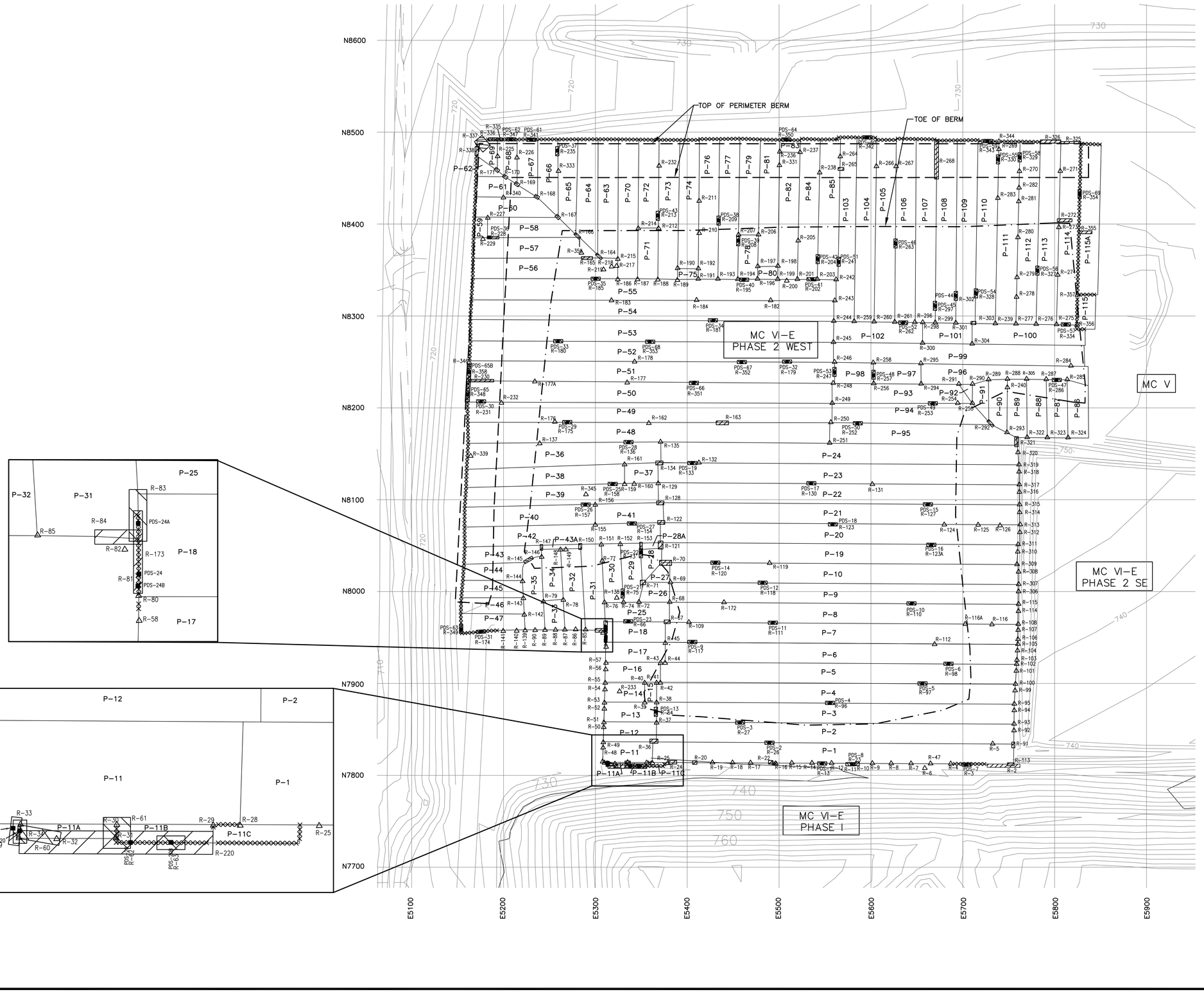
PANEL LAYOUT
SECONDARY GEOMEMBRANE
RECORD DRAWING

SHEET REFERENCE NUMBER:

G-1

SHEET 1 OF 1

S:\CAD\SITE 2 MCG-E PH2 W&S\Phase 2 West\AS-Built\SHEET G-1.DWG
4/24/08



N

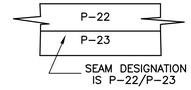
GRAPHIC SCALE
50' 0 50'

LEGEND:

- △ PATCH
- XXX EXTRUSION WELD
- CAP AND LARGE PATCHES
- PDS-20 ■ DESTRUCTIVE SAMPLE
- R-86 REPAIR NUMBER
- — — — TOP OF PERIMETER BERM
- —— · —— TOE OF BERM

NOTES:

1. SEAM NUMBERS ARE DESIGNATED BY ADJACENT PANELS. FOR EXAMPLE:



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Infrastructure Engineering and Environmental Services

Farmington Hills, MI	248.553.6300
Exton, PA	610.524.2300
Philadelphia, PA	215.854.6359
Detroit, MI	313.965.0036
Lansing, MI	517.321.6900
Grand Rapids, MI	616.957.3690

REVISIONS

REV	DESCRIPTION	DATE	BY
A	ADDED TOE AND TOP OF BERM	4/24/08	RBM

PROJECT NAME:

MASTER CELL VI-E
PHASE 2 WEST
CONSTRUCTION

PROJECT LOCATION:

WAYNE DISPOSAL, INC.
SITE NO. 2
VAN BUREN TOWNSHIP,
WAYNE COUNTY,
MICHIGAN

NTH PROJECT NO.: 13-070341-07	CAD FILE NAME:
DESIGNED BY: RBM	PLOT DATE: 04/24/08
DRAWN BY: JD	DRAWING SCALE: AS SHOWN
CHECKED BY:	INCEPTION DATE: 02/28/08

SHEET TITLE:

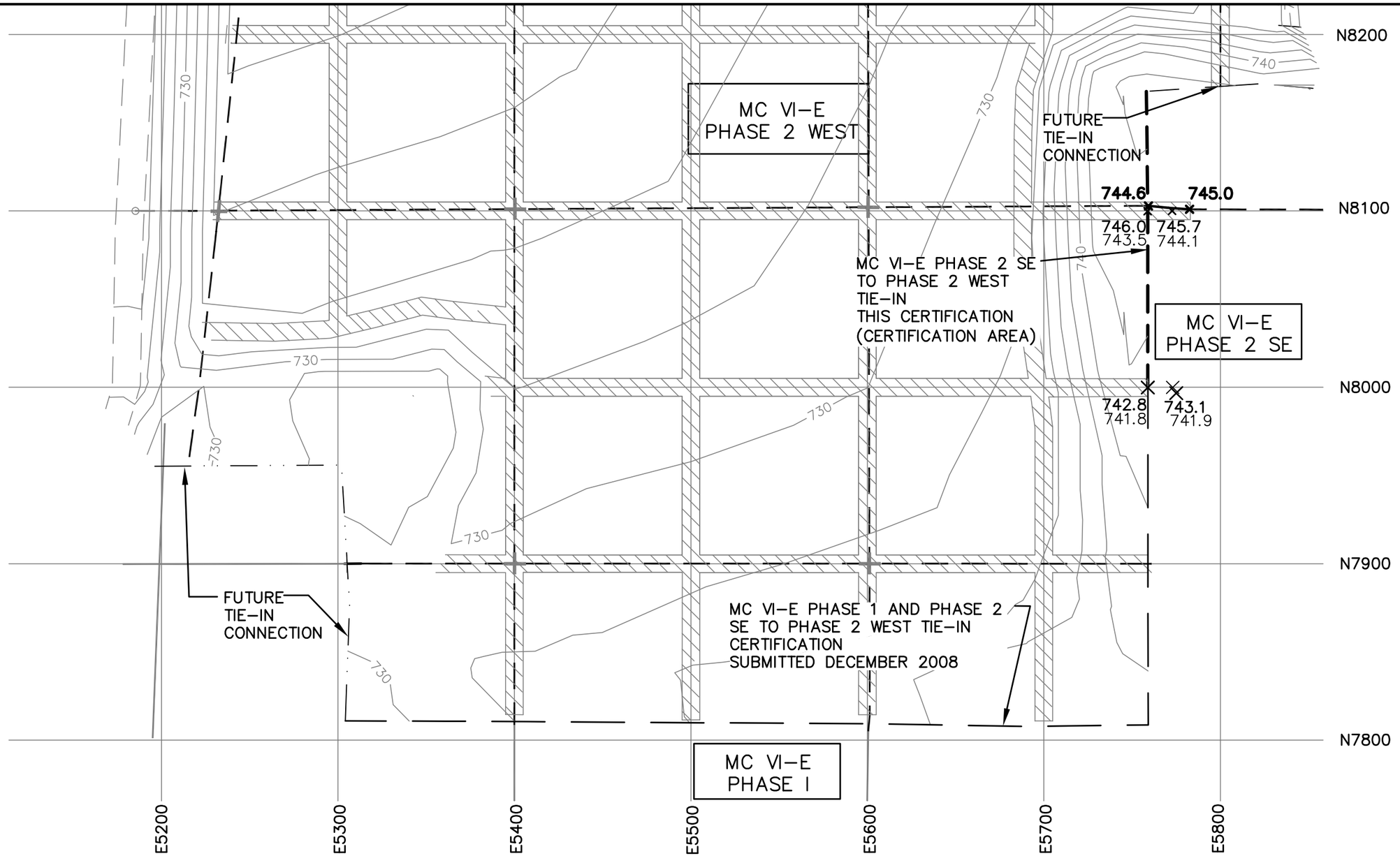
PANEL LAYOUT
PRIMARY GEOMEMBRANE
RECORD DRAWING

SHEET REFERENCE NUMBER:

G-2

SHEET 1 OF 1

J:\CAD\13\SITE 2 MC6-E PH2 M00\Phase 2 West\As-Built\Sheet G-2.dwg



GRAPHIC SCALE
60' 0 60'

N

LEGEND:

745.0	AS–BUILT TOP OF LEACHATE COLLECTION PIPE		2 EXTRA LAYERS OF GEONET, 7.5' WIDE BENEATH GEOCOMPOSITE
745.7	TOP OF SAND	— — — — —	PHASE II LEACHATE COLLECTION PIPE
744.1	TOP OF GEOCOMPOSITE		

NOTE: AS–BUILT ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI.

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Infrastructure Engineering
and Environmental Services

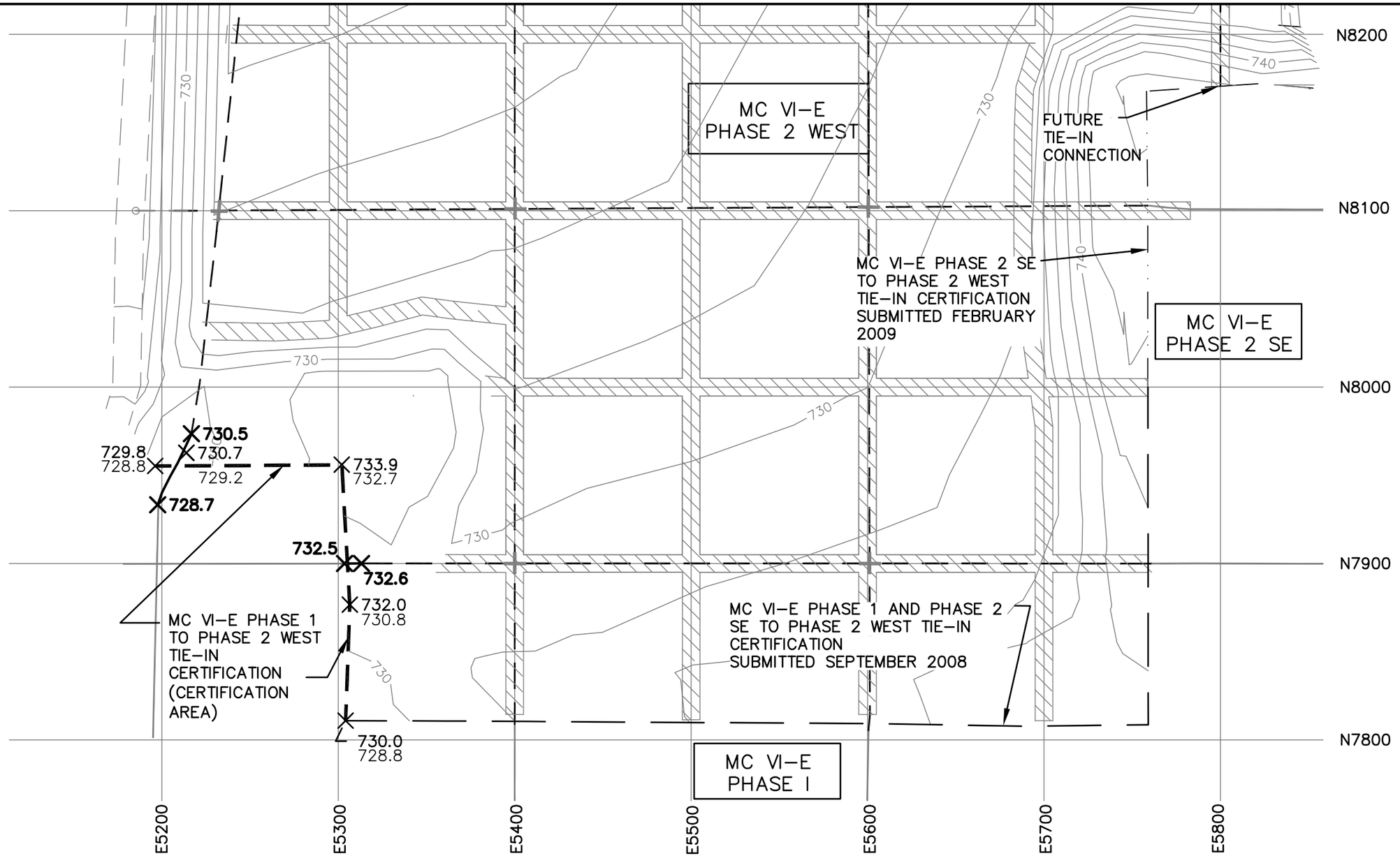
NTH PROJECT No.:	62-090048-00
DESIGNED BY:	RBM
DRAWN BY:	RBM
CHECKED BY:	
CAD FILE NAME:	
PLOT DATE:	01/29/08
DRAWING SCALE:	AS SHOWN
INCEPTION DATE:	01/29/09

TIE-IN CERTIFICATION - MC VI-E PHASE 2 WEST

WAYNE DISPOSAL, INC. SITE No. 2
BELLEVILLE, MICHIGAN

FIGURE
1

\\De-civil3d\archive\13\Site 2 MC6-E PH2 Mod\Phase 2 West\Tie-in Cert 09\FIG A-1.dwg; 2/23/2012 12:21:19 PM; DAVID LUTZ



GRAPHIC SCALE
60' 0 60'

N

LEGEND:

730.5	AS–BUILT TOP OF LEACHATE COLLECTION PIPE	2 EXTRA LAYERS OF GEONET, 7.5' WIDE BENEATH GEOCOMPOSITE
730.7	TOP OF SAND	
729.2	TOP OF GEOCOMPOSITE	PHASE 2 WEST LEACHATE COLLECTION PIPE

NOTE: AS–BUILT ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI.

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Infrastructure Engineering
and Environmental Services

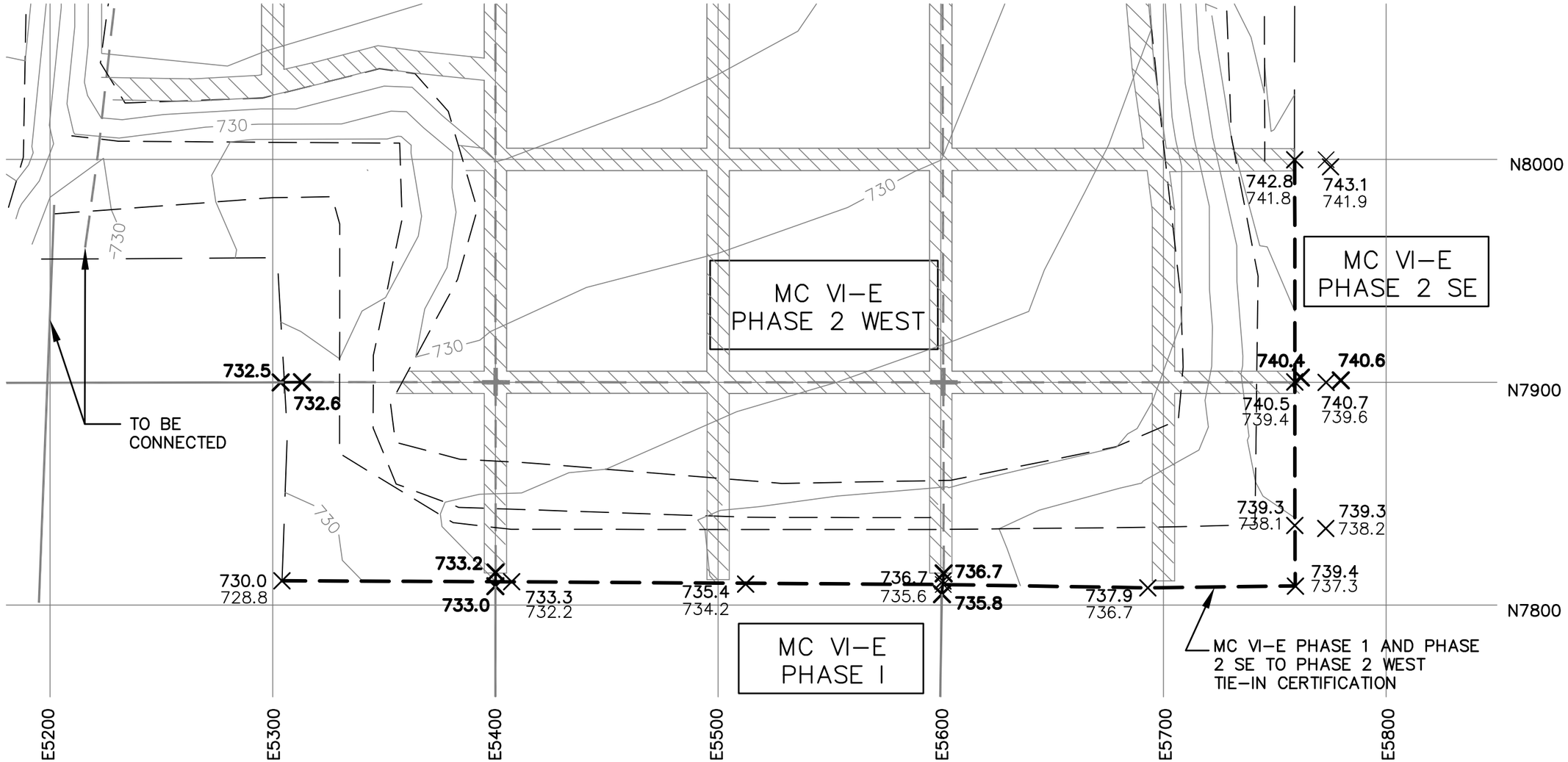
NTH PROJECT No.: 62-0910554-01	CAD FILE NAME:		
DESIGNED BY: RBM	PLOT DATE: 07/22/08	DRAWING SCALE: AS SHOWN	
DRAWN BY: RBM		CHECKED BY:	INCEPTION DATE: 07/22/09

TIE-IN CERTIFICATION
MC VI-E PHASE 1/PHASE 2 WEST

WAYNE DISPOSAL, INC. SITE No. 2
BELLEVILLE, MICHIGAN

FIGURE
1

\\De-civil3d\archive\13\Site 2 MC6-E PH2 Mod\Phase 2 West\Tie-in Cert July 09\FIG A-1.dwg; 2/23/2012 12:22:17 PM; DAVID LUTZ


730
730
730

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL E PHASE 2 NE

RECORD PLAN

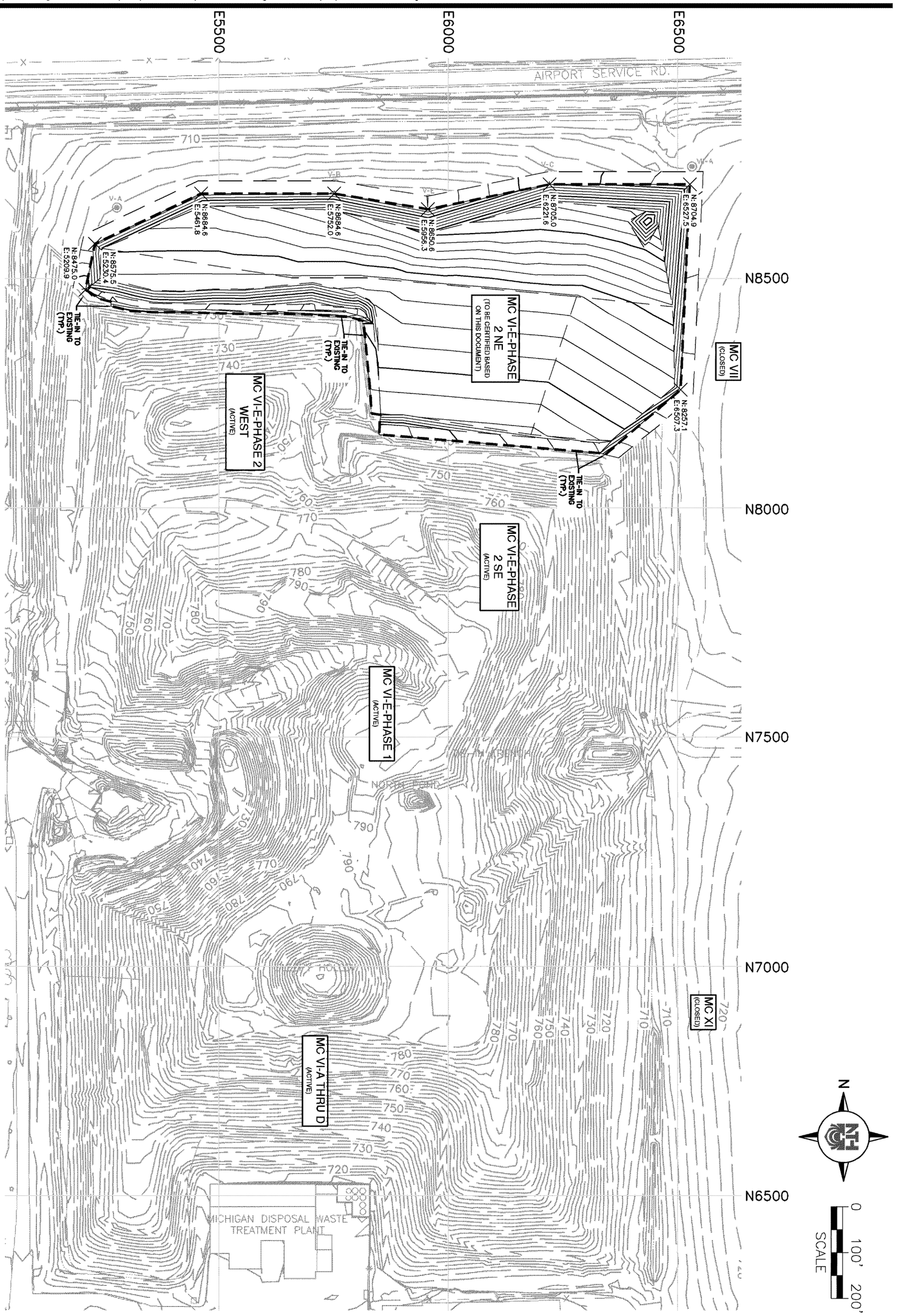


FIGURE: A1	AREA OF CERTIFICATION MC VI-E PHASE 2 NORTHEAST WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE BELLEVILLE, WAYNE, MI	NTH PROJECT No.: 62-101146 DESIGNED BY: DRL DRAWN BY: DRL CHECKED BY: ISS	CAD FILE NAME: 101146-AREA PLOT DATE: 12/19/2011 DRAWING SCALE: 1" = 200' INCEPTION DATE: 05/05/2011

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

NOTE:

1. AS-BUILT ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI. UTILITY ELEVATIONS ARE TOP OF PIPE, UNLESS NOTED OTHERWISE.

N

0 30' 60' 120'
SCALE

LEGEND

- EXISTING CONTOUR (2 FT INTERVAL)
- AS-BUILT TOP OF SUBGRADE/STRUCTURAL FILL CONTOUR (2 FT INTERVAL)
- STAGE BOUNDARY
- GRADE BREAK
- EXISTING LANDFILL GAS (LFG) LINE/STRUCTURE
- EXISTING STORM LINE/STRUCTURE
- EXISTING LEACHATE FORCEMAIN (LFM)
- EXISTING ELECTRICAL LINE AND JUNCTION BOX
- EXISTING LEACHATE SUMP RISER
- AS-BUILT LANDFILL GAS (LFG) LINE/STRUCTURE
- AS-BUILT LEACHATE FORCEMAIN (LFM)/STRUCTURE
- AS-BUILT ELECTRICAL LINE AND JUNCTION BOX
- AS-BUILT STORM LINE
- 710.6 AS-BUILT LFG LINE POINT
- 714.0 AS-BUILT LFM LINE POINT
- 711.3 AS-BUILT STORM LINE POINT

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE

PROJECT LOCATION:

49350 N. I-94 SERVICE DR
BELLEVILLE, WAYNE, MI

NTH PROJECT NO.:	CAD FILE NAME:
62-101146	101146-UTL
DESIGNED BY: DRL	INCEP DATE: 05/05/2011
DRAWN BY: DRL	DRAWING SCALE: 1" = 60'
CHECKED BY: ISS	SUBMITTED DATE: 12/19/2011

SHEET TITLE:

AS-BUILT SUBSURFACE UTILITY RECORD DRAWING

SHEET REFERENCE NUMBER:

A2

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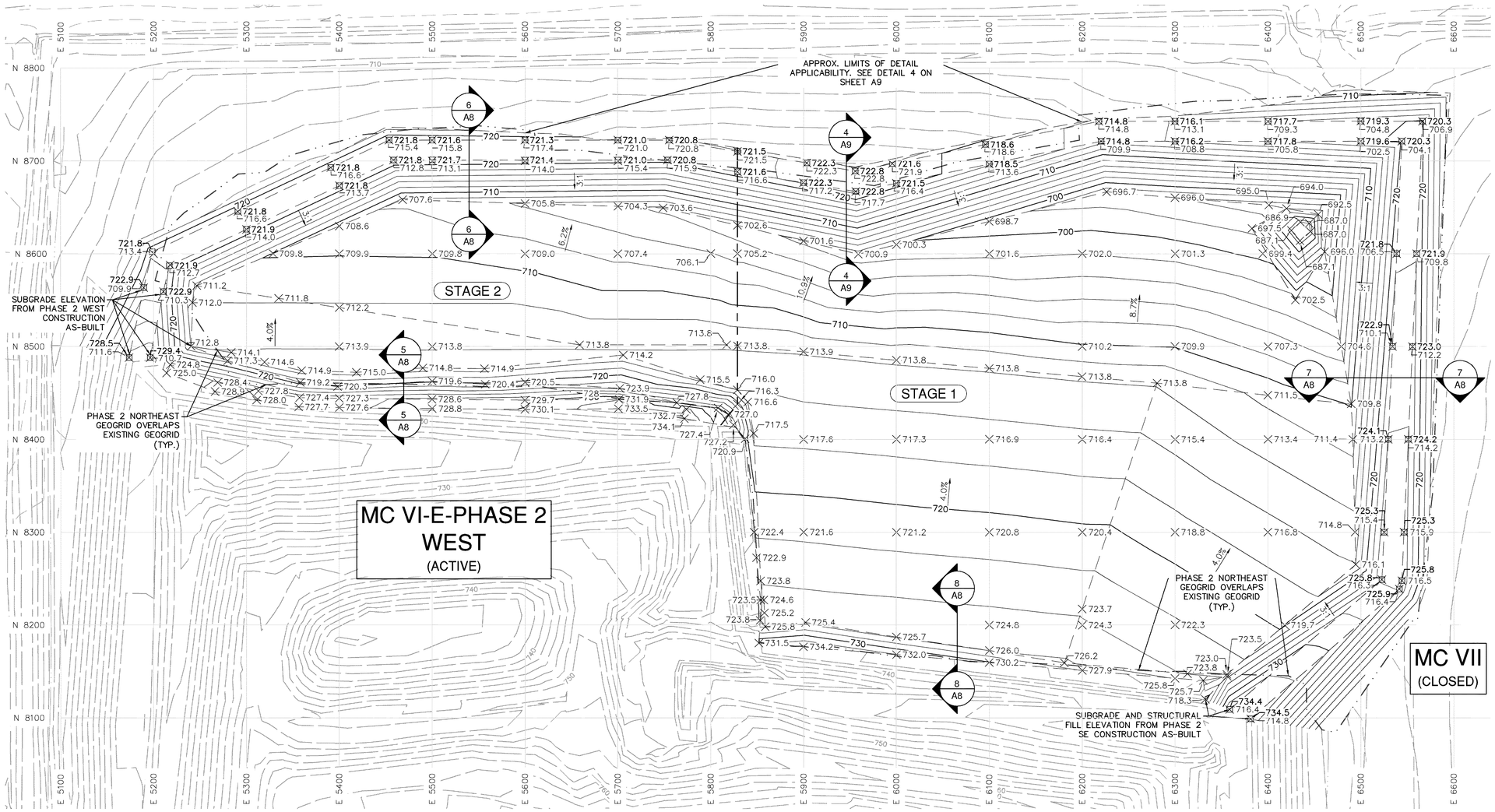

NOTE:

1. AS-BUILT ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI.

N

0 30' 60' 120'
SCALE

LEGEND

- 710 — EXISTING CONTOUR (2 FT INTERVAL)
- 710 — AS-BUILT TOP OF SUBGRADE/STRUCTURAL FILL CONTOUR (2 FT INTERVAL)
- STAGE BOUNDARY
- GRADE BREAK
- LIMITS OF GEOGRID
- × 714.8 — AS-BUILT SUBGRADE POINT
- ⊡ 734.5 — AS-BUILT STRUCTURAL FILL POINT

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE

PROJECT LOCATION:

49350 N. I-94 SERVICE DR BELLEVILLE, WAYNE, MI

NTH PROJECT NO.:	CAD FILE NAME:
62-101146	101146-STR
DESIGNED BY: DRL	INCEP DATE: 05/05/2011
DRAWN BY: DRL	DRAWING SCALE: 1" = 60'
CHECKED BY: ISS	SUBMITTED DATE: 12/19/2011

SHEET TITLE:

AS-BUILT SUBGRADE & STRUCTURAL FILL RECORD DRAWING

SHEET REFERENCE NUMBER:

A3

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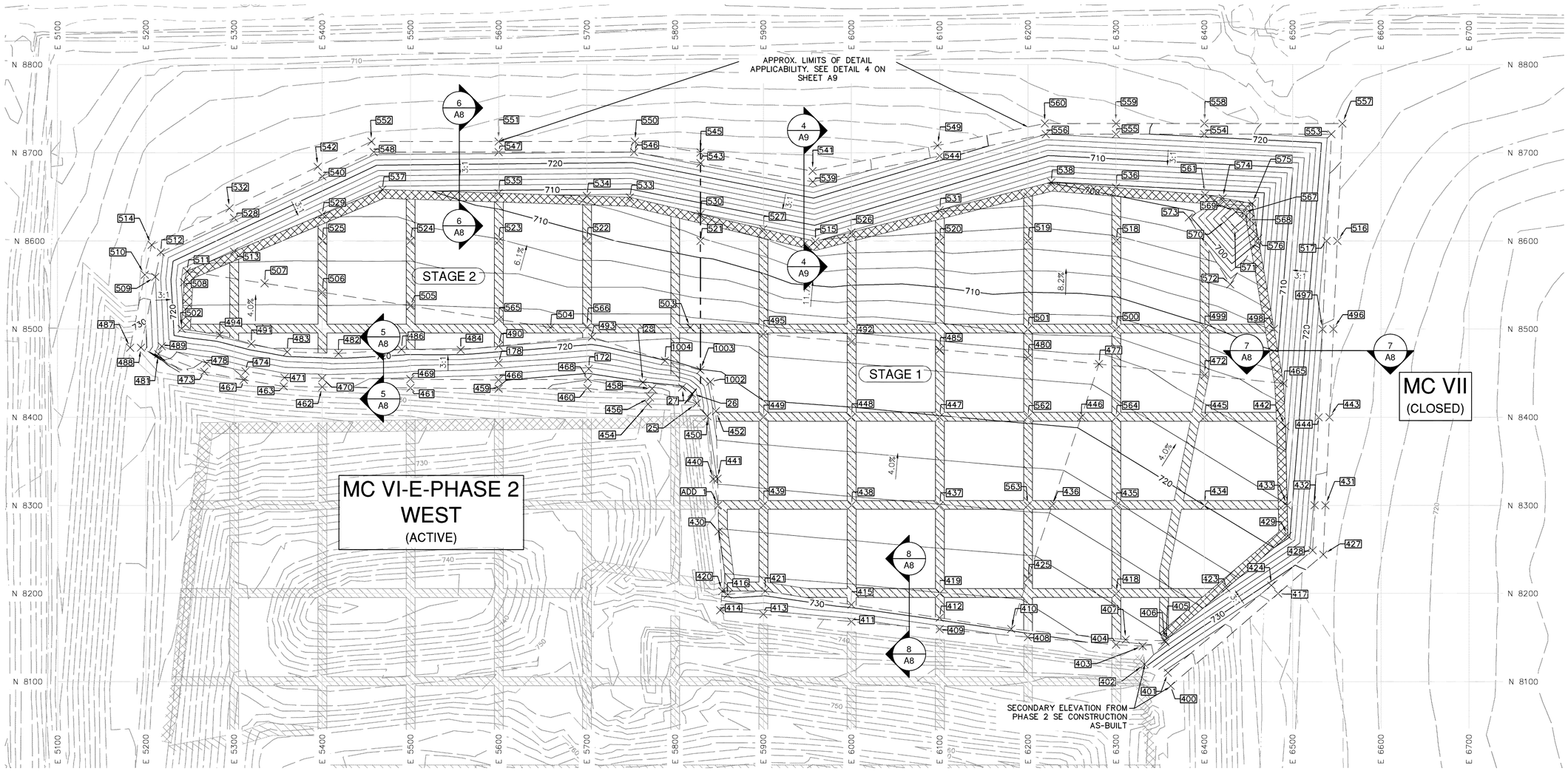

NOTES:

1. AS-BUILT ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI.
2. SEE SHEET A5 FOR AS-BUILT POINT COMPARISON.

N

0 30' 60' 120'
SCALE

LEGEND

- EXISTING CONTOUR (2 FT INTERVAL)
- AS-BUILT TOP OF SECONDARY CLAY LINER CONTOUR (2 FT INTERVAL)
- STAGE BOUNDARY
- GRADE BREAK
- AS-BUILT 2 EXTRA LAYERS OF GEONET, 7.5' WIDE, BENEATH GEOCOMPOSITE IN SQUARE GRID
- EXISTING 2 EXTRA LAYERS OF GEONET, 7.5' WIDE, BENEATH GEOCOMPOSITE IN SQUARE GRID
- AS-BUILT 4 EXTRA LAYERS OF GEONET, 7.5' WIDE, BENEATH GEOCOMPOSITE ALONG PERIMETER
- EXISTING 4 EXTRA LAYERS OF GEONET, 7.5' WIDE, BENEATH GEOCOMPOSITE ALONG PERIMETER
- 400 AS-BUILT SECONDARY CLAY POINT

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE

PROJECT LOCATION:

49350 N. I-94 SERVICE DR
BELLEVILLE, WAYNE, MI

NTH PROJECT NO.: 62-101146	CAD FILE NAME: 101146-SCL
DESIGNED BY: DRL	INCEP DATE: 05/05/2011
DRAWN BY: DRL	DRAWING SCALE: 1" = 60'
CHECKED BY: ISS	SUBMITTED DATE: 12/19/2011

SHEET TITLE:

SECONDARY CLAY LINER RECORD DRAWING

SHEET REFERENCE NUMBER:

A4

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SECONDARY CLAY LINER AS-BUILT POINT TABLE

POINT NO.	NORTHING	EASTING	AS-BUILT TOP OF SECONDARY CLAY ELEVATION(FT)	AS-BUILT SUBGRADE/ STRUCURAL FILL ELEVATION(FT)	AS-BUILT CLAY THICKNESS (FT)	NOTES
25	8415.3	5824.4	729.1	722.2	6.8	AB SUBGRADE FROM P2W CONSTRUCTION
26	8426.5	5818.8	730.2	723.2	7.0	AB SUBGRADE FROM P2W CONSTRUCTION
27	8433.4	5807.9	730.6	723.8	6.8	AB SUBGRADE FROM P2W CONSTRUCTION
28	8439.0	5763.3	730.3	723.8	6.5	AB SUBGRADE FROM P2W CONSTRUCTION
172	8454.4	5702.0	728.5	723.9	4.6	
178	8461.2	5599.8	724.3	720.5	3.8	
400	8094.8	6361.7	737.4	734.4	3.0	AB ELEVATIONS FROM P2SE CONSTRUCTION
401	8109.7	6358.5	737.4	734.2	3.2	
402	8119.3	6332.1	729.0	725.8	3.2	AB ELEVATIONS FROM P2SE CONSTRUCTION
403	8139.9	6329.9	728.8	725.8	3.0	
404	8141.5	6299.9	729.3	725.8	3.5	
405	8144.4	6356.0	726.7	723.6	3.2	
406	8146.0	6355.1	726.2	723.0	3.2	
407	8147.3	6310.7	727.0	723.8	3.2	
408	8150.1	6199.9	731.3	727.9	3.4	
409	8159.1	6099.8	733.2	730.2	3.0	
410	8159.3	6181.0	729.4	726.2	3.2	
411	8167.7	5999.8	735.1	732.0	3.1	
412	8172.1	6099.8	729.2	726.0	3.2	
413	8176.0	5900.0	737.3	734.2	3.2	
414	8180.5	5851.0	736.6	731.5	5.1	
415	8186.9	5999.8	728.9	725.7	3.2	
416	8198.4	5859.5	728.9	725.8	3.2	
417	8199.6	6483.4	731.5	728.5	3.0	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
418	8199.5	6299.9	725.5	722.3	3.3	
419	8199.7	6100.0	728.0	724.8	3.2	
420	8202.2	5853.4	727.6	724.5	3.0	
421	8202.4	5902.1	728.6	725.4	3.2	
423	8205.6	6424.9	722.7	719.4	3.3	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
424	8208.8	6475.8	731.3	728.1	3.2	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
425	8216.8	6200.1	727.0	723.7	3.4	
427	8243.8	6534.6	729.0	725.9	3.2	
428	8248.5	6522.6	729.0	725.8	3.2	
429	8264.8	6494.5	719.2	716.1	3.2	
430	8270.0	5849.2	726.1	722.9	3.3	
431	8299.6	6537.0	728.4	725.3	3.2	
432	8299.7	6524.9	728.4	725.3	3.1	
433	8299.6	6493.6	718.0	714.8	3.3	
434	8299.6	6400.0	720.0	716.8	3.2	
435	8299.6	6300.0	722.1	718.8	3.3	
436	8299.5	6227.3	723.7	720.3	3.3	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
437	8299.7	6099.9	724.0	720.8	3.2	
438	8299.6	5999.9	724.4	721.2	3.2	
439	8299.6	5899.9	724.8	721.6	3.2	
440	8329.4	5843.4	725.3	722.1	3.2	AB SUBGRADE FROM P2W CONSTRUCTION
441	8329.8	5848.1	723.8	720.5	3.2	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
442	8389.3	6491.8	715.0	711.4	3.7	
443	8399.6	6541.7	727.3	724.2	3.1	
444	8399.5	6529.4	727.2	724.1	3.2	
445	8399.6	6400.0	716.6	713.4	3.2	
446	8399.6	6260.3	719.5	716.3	3.2	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
447	8399.7	6099.7	720.1	716.9	3.2	
448	8399.6	5999.8	720.5	717.3	3.2	
449	8399.6	5899.8	720.8	717.6	3.2	
450	8400.7	5836.6	724.2	720.9	3.3	
452	8406.6	5846.2	720.7	717.5	3.2	
454	8414.4	5769.2	734.3	721.7	12.6	AB SUBGRADE FROM P2W CONSTRUCTION
456	8421.9	5771.6	734.1	722.4	11.8	AB SUBGRADE FROM P2W CONSTRUCTION
458	8431.9	5773.8	732.7	723.2	9.5	AB SUBGRADE FROM P2W CONSTRUCTION
459	8431.9	5599.8	730.1	718.8	11.3	AB SUBGRADE FROM P2W CONSTRUCTION
460	8432.6	5700.4	733.5	722.8	10.7	AB SUBGRADE FROM P2W CONSTRUCTION
461	8432.8	5499.9	728.8	716.9	11.9	AB SUBGRADE FROM P2W CONSTRUCTION
462	8433.9	5399.9	727.6	716.5	11.1	AB SUBGRADE FROM P2W CONSTRUCTION
463	8434.6	5356.1	727.7	715.4	12.3	AB SUBGRADE FROM P2W CONSTRUCTION
465	8438.0	6489.7	713.0	709.8	3.2	
466	8441.9	5599.9	729.7	719.5	10.2	AB SUBGRADE FROM P2W CONSTRUCTION
467	8441.9	5310.9	728.0	714.8	13.2	AB SUBGRADE FROM P2W CONSTRUCTION
468	8442.8	5701.1	731.9	723.9	8.0	AB SUBGRADE FROM P2W CONSTRUCTION
469	8442.8	5499.8	728.6	717.7	10.9	AB SUBGRADE FROM P2W CONSTRUCTION
470	8443.9	5399.8	727.3	717.7	9.6	AB SUBGRADE FROM P2W CONSTRUCTION
471	8444.6	5357.1	727.4	716.6	10.9	AB SUBGRADE FROM P2W CONSTRUCTION
472	8447.1	6399.9	714.8	711.5	3.3	AB SUBGRADE FROM P2W CONSTRUCTION
473	8451.1	5266.1	728.9	713.5	15.4	AB SUBGRADE FROM P2W CONSTRUCTION
474	8451.7	5312.8	727.8	716.0	11.8	AB SUBGRADE FROM P2W CONSTRUCTION
477	8460.0	6280.5	717.1	713.8	3.2	
478	8460.8	5268.9	728.4	714.8	13.6	AB SUBGRADE FROM P2W CONSTRUCTION
480	8467.2	6199.8	717.0	713.8	3.2	
481	8471.1	5213.9	725.0	712.0	13.0	AB SUBGRADE FROM P2W CONSTRUCTION
482	8471.9	5418.2	718.2	715.0	3.2	
483	8473.7	5360.2	718.2	714.9	3.2	
484	8475.9	5556.8	718.1	714.9	3.2	
485	8476.2	6099.9	717.0	713.8	3.2	
486	8476.5	5489.7	718.0	714.8	3.2	
487	8478.5	5182.1	731.5	728.5	3.0	AB SUBGRADE FROM P2W CONSTRUCTION
488	8478.5	5194.3	732.0	729.0	3.0	AB SUBGRADE FROM P2W CONSTRUCTION
489	8480.1	5218.0	724.8	712.0	12.8	AB SUBGRADE FROM P2W CONSTRUCTION
490	8480.3	5599.8	717.8	714.7	3.2	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
491	8482.8	5319.5	717.8	714.6	3.2	
492	8485.0	5999.9	717.0	713.8	3.3	
493	8490.6	5705.7	717.4	714.2	3.2	
494	8493.0	5283.5	717.4	714.1	3.3	
495	8493.9	5899.8	717.0	713.9	3.2	
496	8499.6	6546.1	726.1	723.0	3.1	
497	8499.5	6533.8	726.1	722.9	3.2	
498	8499.7	6478.9	707.8	704.6	3.2	
499	8499.5	6400.0	710.5	707.3	3.2	
500	8499.5	6299.9	713.2	709.9	3.3	
501	8499.5	6200.0	713.4	710.2	3.2	
502	8499.8	5240.4	717.1	712.9	4.2	AB SUBGRADE FROM P2W CONSTRUCTION
503	8501.3	5816.8	717.0	713.8	3.3	
504	8501.3	5658.7	717.0	713.8	3.2	
505	8525.8	5499.8	716.1	712.8	3.2	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
506	8541.4	5399.8	715.4	712.2	3.2	
507	8551.5	5334.5	715.0	711.8	3.2	
508	8552.7	5243.1	714.9	711.8	3.2	

SECONDARY CLAY LINER AS-BUILT POINT TABLE

POINT NO.	NORTHING	EASTING	AS-BUILT TOP OF SECONDARY CLAY ELEVATION(FT)	AS-BUILT SUBGRADE/ STRUCURAL FILL ELEVATION(FT)	AS-BUILT CLAY THICKNESS (FT)	NOTES
509	8558.8	5210.6	726.1	722.9	3.2	
510	8561.3	5198.7	726.1	722.9	3.2	
511	8565.2	5246.4	714.3	711.2	3.2	
512	8586.6	5216.8	725.0	721.9	3.2	
513	8587.6	5299.8	713.5	710.3	3.2	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
514	8595.1	5206.4	725.0	721.8	3.2	
515	8599.1	5958.9	704.1	700.9	3.2	
516	8599.5	6550.6	725.0	721.9	3.1	
517	8599.5	6538.5	724.9	721.8	3.1	
518	8599.6	6300.0	704.5	701.3	3.2	
519	8599.6	6200.0	705.2	702.0	3.3	
520	8599.5	6100.0	704.8	701.6	3.2	
521	8599.6	5828.7	708.3	705.2	3.1	
522	8599.7	5699.9	710.5	707.4	3.1	
523	8599.6	5600.0	712.1	709.0	3.2	
524	8599.7	5500.0	713.1	709.8	3.2	
525	8599.6	5400.1	713.1	709.9	3.2	
526	8609.4	5999.8	703.4	700.3	3.2	
527	8613.0	5899.8	704.9	701.6	3.3	
528	8625.7	5299.9	725.0	721.9	3.2	
529	8629.3	5399.9	711.9	708.6	3.2	
530	8630.0	5828.7	705.8	702.6	3.2	
531	8634.4	6099.8	701.9	698.7	3.2	
532	8636.6	5294.7	725.0	721.8	3.2	
533	8649.0	5748.7	706.9	703.6	3.3	
534	8650.6	5699.9	707.5	704.3	3.2	
535	8653.8	5599.8	708.9	705.8	3.2	
536	8660.2	6299.7	699.2	696.0	3.2	
537	8657.9	5468.0	710.8	707.6	3.2	
538	8666.1	6226.4	699.9	696.7	3.2	
539	8666.7	5956.0	726.0	722.8	3.2	
540	8672.8	5399.8	725.0	721.8	3.2	
541	8678.9	5955.8	726.0	722.8	3.1	
542	8683.7	5394.8	725.0	721.8	3.2	
543	8687.9	5828.7	724.7	721.6	3.1	
544	8696.0	6099.9	721.7	718.5	3.2	
545	8700.0	5828.6	724.8	721.5	3.2	
546	8700.3	5753.3	724.0	720.8	3.2	
547	8700.4	5599.8	724.5	721.4	3.1	
548	8700.4	5458.2	725.0	721.8	3.2	
549	8707.8	6097.5	721.7	718.6	3.1	
550	8712.4	5754.3	724.0	720.8	3.2	
551	8712.4	5599.9	724.5	721.3	3.2	
552	8712.3	5455.6	725.0	721.8	3.2	
553	8720.7	6543.9	723.5	720.3	3.2	
554	8720.7	6399.8	721.0	717.8	3.2	
555	8720.7	6299.7	719.4	716.2	3.2	
556	8720.7	6220.2	718.0	714.8	3.3	
557	8732.7	6556.5	723.5	720.3	3.2	
558	8732.8	6399.9	720.9	717.7	3.2	
559	8732.7	6299.9	719.3	716.1	3.2	
560	8732.8	6219.1	718.0	714.8	3.2	
561	8652.0	6400.9	698.2	695.0	3.2	
562	8399.6	6199.8	719.7	716.4	3.3	
563	8299.6	6199.8	723.7	720.4	3.3	
564	8399.5	6299.9	718.7	715.4	3.2	
565	8510.5	5599.9	716.7	713.4	3.2	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
566	8501.3	5699.8	717.0	713.8	3.2	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE
567	8631.4	6443.4	690.0	687.0	3.0	
568	8623.9	6444.5	690.0	687.0	3.0	
569	8632.5	6435.4	690.0	686.9	3.1	
570	8624.2	6426.1	690.2	687.1	3.0	
571	8614.8	6434.4	690.2	687.1	3.1	
572	8550.3	6429.2	705.6	702.5	3.2	
573	8626.3	6382.3	700.7	697.5	3.2	
574	8648.3	6420.6	697.2	694.0	3.2	
575	8642.0	6454.1	695.7	692.5	3.2	AB SECONDARY ELEVATION INCLUDES 2 FT LEAK DETECTION RISER TRENCH
576	8602.3	6460.9	699.1	696.0	3.1	
1002	8439.8	5839.8	720.8	716.6	4.2	
1003	8452.9	5828.5	720.1	716.0	4.1	
1004	8463.7	5788.5	720.2	715.5	4.6	
Add 1	8299.7	5848.7	724.9	721.7	3.2	SUBGRADE NOT SURVEYED AT THIS LOCATION-ESTIMATED FROM AB SURFACE

J:\62\62101146\Survey\[AB SEC COMPARISON.xls]Sheet1

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NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE

PROJECT LOCATION:

49350 N. I-94 SERVICE DR
BELLEVILLE, WAYNE, MI

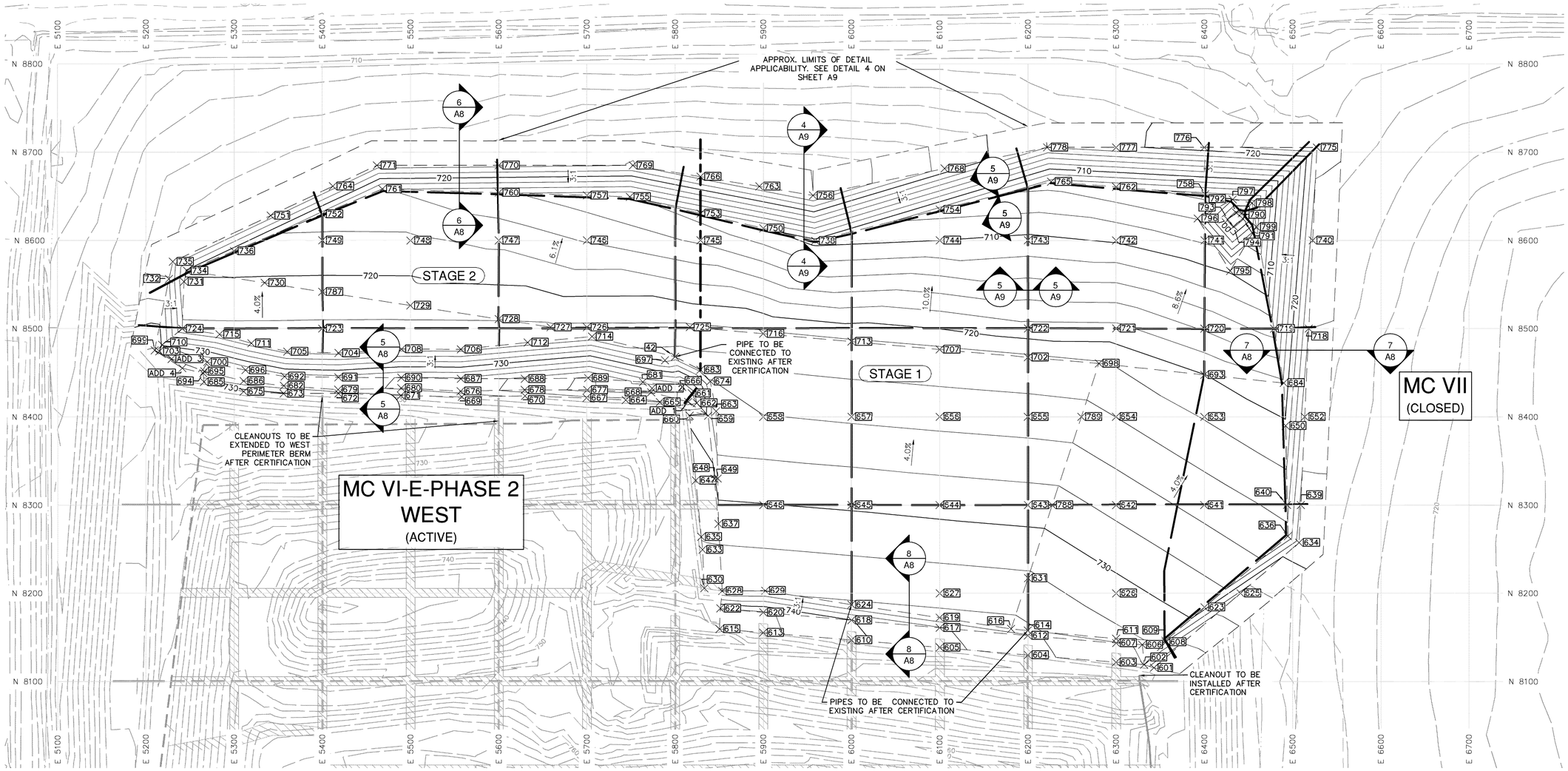
NTH PROJECT NO.: 62-101146	CAD FILE NAME: 101146-SCL
DESIGNED BY: DRL	INCEP DATE: 05/05/2011
DRAWN BY: DRL	DRAWING SCALE: ########
CHECKED BY: ISS	SUBMITTED DATE: 12/19/2011

SHEET TITLE:

AS-BUILT SECONDARY CLAY LINER POINT TABLE

SHEET REFERENCE NUMBER:

A5



NOTES:

1. AS-BUILT ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI.
2. SEE SHEET A7 FOR AS-BUILT POINT COMPARISON.

0 30' 60' 120'
SCALE

LEGEND

- EXISTING CONTOUR (2 FT INTERVAL)
- EXISTING LEACHATE COLLECTION PIPE
- EXISTING CLEANOUT
- EXISTING 2 EXTRA LAYERS OF GEONET, 7.5' WIDE, BENEATH GEOCOMPOSITE IN SQUARE GRID, 100 FEET ON CENTER
- 710 AS-BUILT TOP OF PRIMARY CLAY LINER CONTOUR (2 FT INTERVAL)
- STAGE BOUNDARY
- GRADE BREAK
- AS-BUILT LEACHATE COLLECTION PIPE
- AS-BUILT CLEANOUT
- 600 AS-BUILT PRIMARY CLAY POINT

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY
A	FINALIZE CERT. PACKAGE	1/6/12	DRL

PROJECT NAME:
WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE

PROJECT LOCATION:
49350 N. I-94 SERVICE DR BELLEVILLE, WAYNE, MI

NTH PROJECT NO.: 62-101146	CAD FILE NAME: 101146-PCL
DESIGNED BY: DRL	INCEP DATE: 05/05/2011
DRAWN BY: DRL	DRAWING SCALE: 1" = 60'
CHECKED BY: ISS	SUBMITTED DATE: 1/3/2012

SHEET TITLE:
PRIMARY CLAY LINER RECORD DRAWING

SHEET REFERENCE NUMBER:
A6

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PRIMARY CLAY LINER AS-BUILT POINT TABLE

POINT NO.	NORTHING	EASTING	AS-BUILT TOP OF PRIMARY CLAY ELEVATION (FT)	AS-BUILT TOP OF SECONDARY CLAY ELEVATION (FT)	AS-BUILT CLAY THICKNESS (FT)	NOTES
601	8115.2	6342.7	737.7	732.3	5.4	AB SECONDARY FROM P2SE CONSTRUCTION
602	8118.7	6331.6	734.0	729.0	5.0	AB SECONDARY FROM P2SE CONSTRUCTION
603	8121.5	6299.7	734.6	729.6	5.0	AB SECONDARY FROM P2SE CONSTRUCTION
604	8129.6	6199.8	736.7	731.7	5.0	AB SECONDARY FROM P2SE CONSTRUCTION
605	8138.3	6099.9	738.6	733.6	5.0	AB SECONDARY FROM P2SE CONSTRUCTION
606	8141.3	6329.6	733.8	728.8	5.0	
607	8143.3	6299.9	734.3	729.3	5.0	
608	8144.3	6356.1	732.1	726.7	5.4	
609	8146.0	6355.9	731.6	726.2	5.4	
610	8146.7	5999.9	740.4	735.4	5.0	AB SECONDARY FROM P2SE CONSTRUCTION
611	8148.2	6299.8	732.6	727.0	5.6	
612	8151.7	6199.8	736.3	731.3	5.0	
613	8155.0	5899.8	742.5	737.5	5.0	AB SECONDARY FROM P2SE CONSTRUCTION
614	8157.4	6199.8	734.3	729.0	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
615	8159.2	5850.3	743.5	738.5	5.0	AB SECONDARY FROM P2SE CONSTRUCTION
616	8159.2	6180.8	734.6	729.4	5.3	
617	8160.5	6099.9	738.2	733.2	5.0	
618	8169.2	5999.8	740.1	735.1	5.0	
619	8172.0	6099.9	734.4	729.2	5.2	
620	8178.0	5899.9	742.3	737.3	5.0	
622	8182.5	5851.2	741.9	736.6	5.3	
623	8183.8	6399.9	729.2	724.1	5.2	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
624	8186.8	5999.8	734.2	728.9	5.2	
625	8199.6	6440.7	732.6	727.3	5.2	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
626	8199.5	6300.0	730.8	725.5	5.2	
627	8199.5	6099.9	733.3	728.0	5.3	
628	8202.2	5853.3	734.1	727.6	6.5	
629	8202.5	5902.2	733.9	728.6	5.3	
630	8205.2	5833.0	733.3	727.7	5.6	AB SECONDARY FROM P2W CONSTRUCTION
631	8216.9	6200.0	732.3	727.0	5.3	
633	8249.1	5831.0	732.3	726.9	5.4	AB SECONDARY FROM P2W CONSTRUCTION
634	8257.1	6507.3	729.0	723.8	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
635	8263.7	5829.6	731.9	726.7	5.2	AB SECONDARY FROM P2W CONSTRUCTION
636	8264.4	6494.6	724.5	719.2	5.3	
637	8278.4	5849.1	731.1	725.8	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
639	8299.6	6509.3	728.5	723.2	5.2	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
640	8299.7	6493.6	723.4	718.0	5.3	
641	8299.6	6399.7	725.3	720.0	5.3	
642	8299.5	6299.9	727.4	722.1	5.3	
643	8299.7	6199.9	729.0	723.7	5.3	
644	8299.6	6099.8	729.3	724.0	5.3	
645	8299.7	6000.0	729.7	724.4	5.3	
646	8299.6	5899.9	730.1	724.8	5.3	
647	8327.5	5823.4	730.9	725.7	5.2	AB SECONDARY FROM P2W CONSTRUCTION
648	8329.5	5844.4	730.3	725.3	5.0	
649	8329.7	5848.3	729.0	723.8	5.3	
650	8389.5	6492.1	720.3	715.0	5.3	
652	8399.6	6513.7	727.3	722.0	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
653	8399.6	6399.8	721.9	716.6	5.3	
654	8399.7	6299.7	724.0	718.7	5.3	
655	8399.7	6199.8	725.0	719.7	5.3	
656	8399.6	6099.9	725.4	720.1	5.3	
657	8399.6	5999.9	725.7	720.5	5.2	
658	8399.6	5899.8	726.1	720.8	5.3	
659	8400.8	5837.4	729.2	724.2	5.0	
660	8400.9	5816.4	729.8	724.6	5.1	AB ELEVATIONS FROM P2 W CONSTRUCTION
661	8426.4	5818.7	735.2	730.2	5.0	
662	8415.3	5824.5	734.1	729.1	5.1	
663	8406.0	5846.4	726.1	720.7	5.4	
664	8418.6	5744.0	735.2	729.9	5.3	AB SECONDARY FROM P2W CONSTRUCTION
665	8416.4	5782.6	735.9	729.5	6.4	AB SECONDARY FROM P2W CONSTRUCTION
666	8433.4	5807.9	735.6	730.6	5.0	
667	8421.1	5699.5	735.6	730.3	5.3	AB SECONDARY FROM P2W CONSTRUCTION
668	8427.5	5772.8	738.4	733.2	5.1	
669	8422.3	5558.1	732.8	727.0	5.8	AB SECONDARY FROM P2W CONSTRUCTION
670	8423.3	5629.8	734.5	729.1	5.5	AB SECONDARY FROM P2W CONSTRUCTION
671	8423.8	5489.0	731.7	726.2	5.6	AB SECONDARY FROM P2W CONSTRUCTION
672	8426.1	5418.2	731.6	726.1	5.5	AB SECONDARY FROM P2W CONSTRUCTION
673	8426.1	5356.0	729.8	724.8	5.0	AB SECONDARY FROM P2W CONSTRUCTION
674	8439.8	5839.8	726.1	720.8	5.3	
675	8428.3	5310.8	729.1	724.1	5.1	AB SECONDARY FROM P2W CONSTRUCTION
676	8428.7	5556.8	734.7	729.6	5.1	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
677	8430.1	5700.3	738.5	733.5	5.0	
678	8430.2	5629.4	736.9	731.1	5.8	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
679	8430.5	5417.8	732.9	727.8	5.1	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
680	8432.2	5489.4	734.4	728.7	5.7	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
681	8439.0	5763.4	735.4	730.3	5.1	
682	8434.9	5356.3	733.1	727.7	5.4	
683	8452.9	5828.5	725.4	720.1	5.3	
684	8438.0	6489.9	718.3	713.0	5.3	
685	8439.1	5265.7	730.6	725.6	5.0	AB SECONDARY FROM P2W CONSTRUCTION
686	8440.3	5310.8	733.6	728.0	5.6	
687	8442.8	5557.0	734.4	729.0	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
688	8442.8	5629.4	736.6	730.1	6.5	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
689	8443.6	5701.3	738.4	731.9	6.5	
690	8443.9	5489.5	734.2	728.1	6.1	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
691	8444.4	5418.2	732.7	727.4	5.2	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
692	8445.3	5357.2	732.8	727.4	5.4	
693	8447.2	6399.8	720.0	714.8	5.3	
694	8449.1	5265.0	734.2	729.0	5.2	AB SECONDARY FROM P2W CONSTRUCTION
695	8451.2	5266.1	734.2	728.9	5.3	
696	8452.6	5312.8	733.3	727.8	5.5	
697	8463.7	5788.4	725.5	720.2	5.3	
698	8460.2	6280.3	722.3	717.1	5.2	
699	8475.0	5209.9	732.2	726.5	5.7	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
700	8461.8	5269.4	734.0	728.4	5.6	
702	8467.1	6199.9	722.4	717.0	5.3	
703	8474.0	5215.2	730.0	725.0	5.0	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
704	8472.0	5418.3	723.5	718.2	5.3	
705	8473.6	5360.2	723.4	718.2	5.2	
706	8476.1	5557.0	723.3	718.1	5.2	
707	8476.0	6099.8	722.3	717.0	5.3	
708	8476.4	5489.8	723.3	718.0	5.3	
710	8481.1	5218.3	729.8	724.8	5.0	
711	8483.0	5319.5	723.0	717.8	5.3	

PRIMARY CLAY LINER AS-BUILT POINT TABLE

POINT NO.	NORTHING	EASTING	AS-BUILT TOP OF PRIMARY CLAY ELEVATION (FT)	AS-BUILT TOP OF SECONDARY CLAY ELEVATION (FT)	AS-BUILT CLAY THICKNESS (FT)	NOTES
712	8483.9	5632.7	723.0	717.7	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
713	8484.9	5999.7	722.3	717.0	5.3	
714	8490.7	5705.7	722.7	717.4	5.3	
715	8493.2	5283.4	722.6	717.4	5.2	
716	8493.9	5899.7	722.4	717.0	5.4	
718	8499.7	6518.2	726.0	720.9	5.1	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
719	8499.5	6478.9	713.1	707.8	5.3	
720	8499.6	6399.9	715.8	710.5	5.3	
721	8499.8	6299.9	718.6	713.2	5.3	
722	8499.7	6200.0	718.7	713.4	5.3	
723	8499.7	5399.9	722.4	717.1	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
724	8499.5	5241.1	722.4	717.1	5.4	
725	8501.4	5816.7	722.3	717.0	5.3	
726	8501.3	5699.9	722.3	717.0	5.3	
727	8501.3	5658.7	722.3	717.0	5.2	
728	8510.5	5599.9	721.9	716.7	5.3	
729	8525.9	5499.8	721.4	716.1	5.3	
730	8551.6	5334.6	720.3	715.0	5.3	
731	8552.9	5243.1	720.3	714.9	5.3	
732	8555.8	5226.0	726.1	720.8	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
734	8565.1	5246.5	719.6	714.3	5.3	
735	8575.5	5230.4	725.1	720.1	5.0	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
736	8587.6	5299.8	718.8	713.5	5.3	
738	8599.1	5958.8	709.4	704.1	5.3	
740	8599.6	6522.6	724.8	719.6	5.1	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
741	8599.6	6400.1	707.7	702.1	5.6	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
742	8599.5	6299.8	709.8	704.5	5.3	
743	8599.8	6199.9	710.5	705.2	5.3	
744	8599.6	6100.0	710.0	704.8	5.2	
745	8599.6	5828.7	713.7	708.3	5.3	
746	8599.6	5700.0	715.8	710.5	5.3	
747	8599.7	5599.9	717.5	712.1	5.3	
748	8599.5	5499.9	718.4	713.1	5.3	
749	8599.6	5399.9	718.4	713.1	5.3	
750	8613.3	5899.9	710.1	704.9	5.2	
751	8627.8	5341.4	725.0	719.7	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
752	8629.4	5399.9	717.1	711.9	5.3	
753	8630.0	5828.8	711.1	705.8	5.3	
754	8634.5	6099.9	707.2	701.9	5.3	
755	8649.0	5748.6	712.1	706.9	5.3	
756	8650.6	5956.3	726.0	720.7	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
757	8650.6	5699.9	712.9	707.5	5.4	
758	8651.9	6400.9	703.5	698.2	5.3	
760	8653.8	5599.9	714.3	708.9	5.3	
761	8657.8	5468.0	716.1	710.8	5.3	
762	8660.2	6299.8	704.5	699.2	5.3	
763	8660.8	5895.4	725.4	720.2	5.2	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
764	8661.0	5411.8	725.0	719.7	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
765	8666.1	6226.2	705.2	699.9	5.3	
766	8671.8	5828.6	724.8	719.5	5.4	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
768	8681.1	6105.4	721.6	716.4	5.2	
769	8684.6	5752.0	724.0	718.8	5.2	
770	8684.7	5600.0	724.6	719.3	5.3	
771	8684.6	5461.8	725.0	719.7	5.3	
775	8704.9	6527.5	723.6	718.4	5.2	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
776	8705.0	6399.8	721.2	715.8	5.4	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
777	8705.0	6299.8	719.4	714.1	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
778	8705.0	6221.6	718.0	712.9	5.1	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
787	8541.4	5399.9	720.7	715.4	5.4	
788	8299.6	6227.4	728.9	723.7	5.3	
789	8399.6	6260.5	724.8	719.5	5.3	
790	8630.3	6442.3	697.6	692.5	5.1	AB SEC: SUMP STONE
791	8624.4	6443.2	697.6	692.5	5.1	AB SEC: SUMP STONE
792	8631.1	6435.8	697.6	692.5	5.1	AB SEC: SUMP STONE
793	8623.0	6426.5	697.7	692.6	5.1	AB SEC: SUMP STONE
794	8615.3	6433.1	697.7	692.7	5.0	AB SEC: SUMP STONE
795	8565.0	6429.1	709.8	702.4	7.4	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
796	8624.4	6392.3	705.9	700.7	5.2	
797	8646.1	6432.0	702.0	696.6	5.4	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
798	8642.0	6454.1	701.0	695.7	5.3	AB SEC INCLUDES 2 FT RISER TRENCH
799	8614.9	6458.7	703.4	698.0	5.4	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
Add 1	8416.5	5814.8	735.0	730.0	5.0	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
Add 2	8431.9	5773.7	737.7	732.7	5.0	
Add 3	8465.3	5229.1	731.3	726.2	5.2	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
Add 4	8454.8	5241.2	733.5	727.7	5.7	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE
42	8467.7	5799.9	724.9	719.7	5.3	SECONDARY NOT SURVEYED AT THIS LOCATION- ESTIMATED FROM AB SURFACE

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NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Northville, MI 248.553.6300
Detroit, MI 313.237.3900
Lansing, MI 517.484.6900
Grand Rapids, MI 616.957.3690
Exton, PA 610.524.2300
Lehigh Valley, PA 484.893.1440
Cleveland, OH 216.334.4040
Indianapolis, IN 317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY

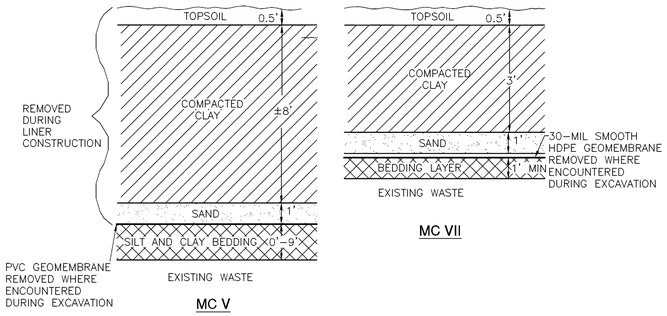
PROJECT NAME:
WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE

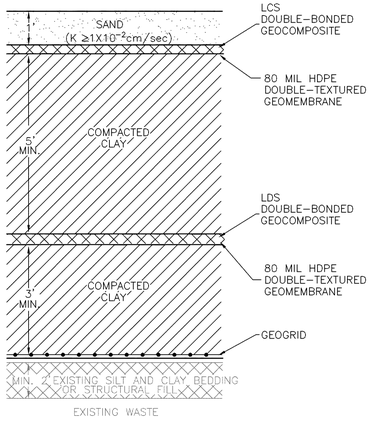
PROJECT LOCATION:
49350 N. I-94 SERVICE DR
BELLEVILLE, WAYNE, MI

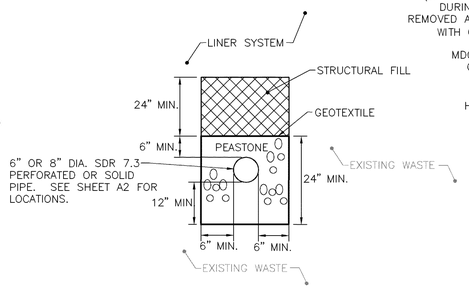
NTH PROJECT NO.: 62-101146	CAD FILE NAME: 101146-PCL
DESIGNED BY: DRL	INCEP DATE: 05/05/2011
DRAWN BY: DRL	DRAWING SCALE: NONE
CHECKED BY: ISS	SUBMITTED DATE: 12/19/2011

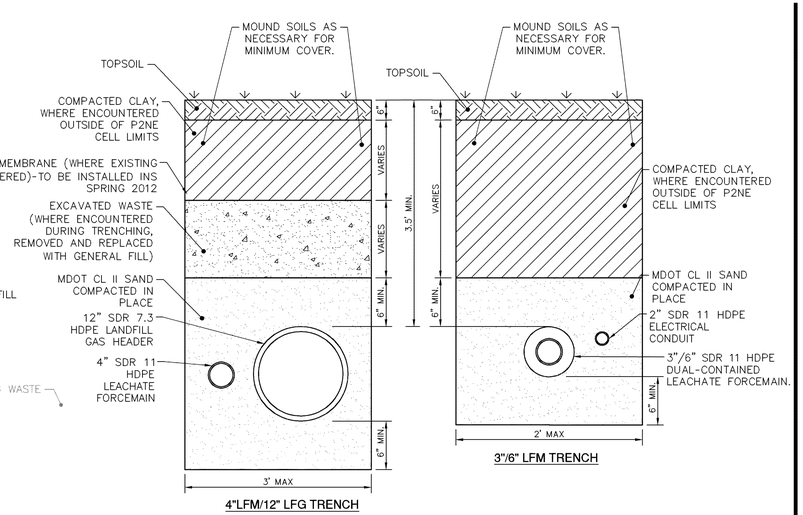
SHEET TITLE:
AS-BUILT PRIMARY CLAY LINER POINT TABLE

SHEET REFERENCE NUMBER:
A7







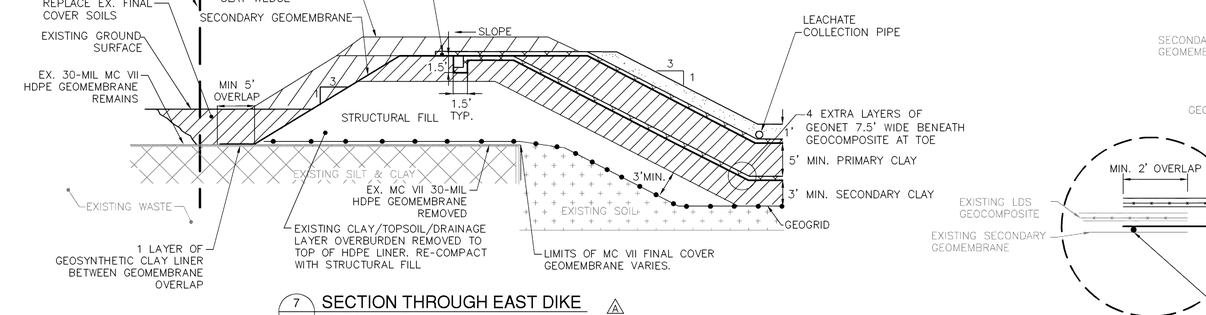


1 A8 **EXISTING COVER PROFILES**
NOT TO SCALE

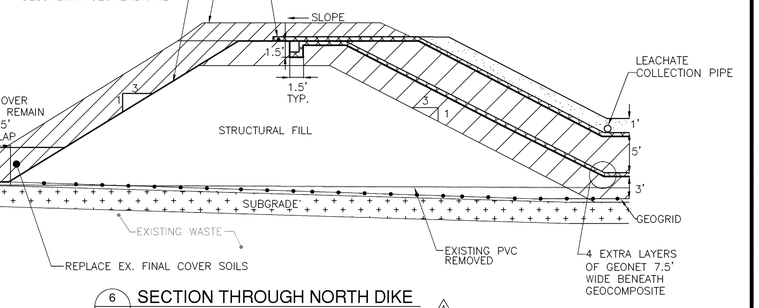
2 A8 **PROPOSED LINER SYSTEM** △A
NOT TO SCALE

3 A8 **MC-V PROPOSED GAS COLLECTION TRENCH**
NOT TO SCALE

4 A8 **UTILITY TRENCHES**
NOT TO SCALE

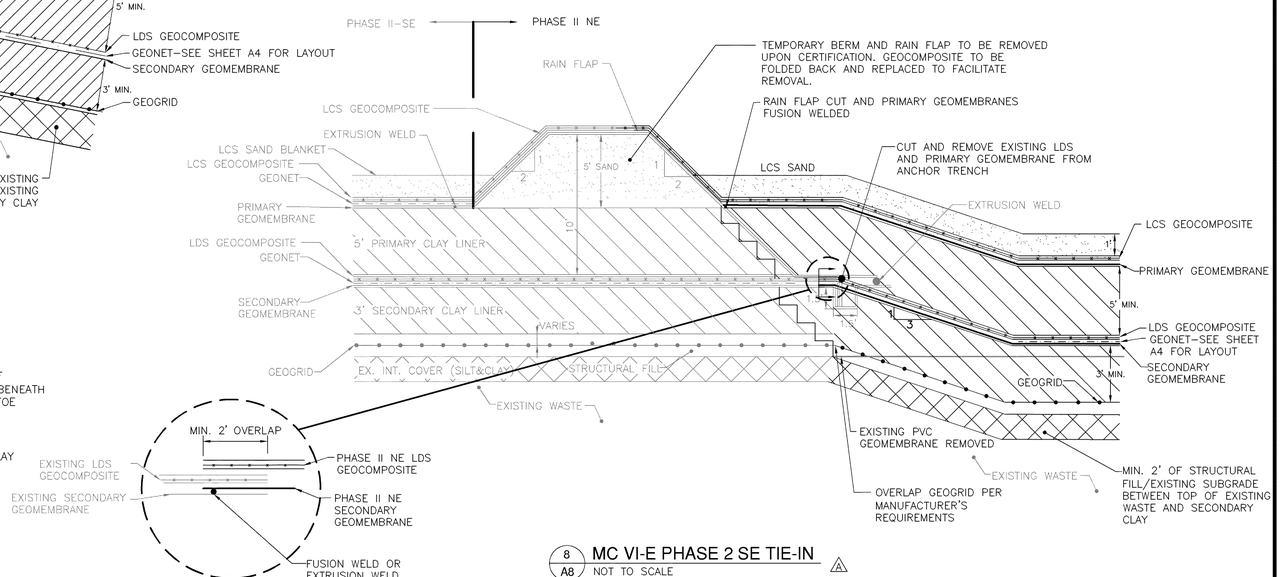


5 A8 **MC VI-E PHASE 2 WEST TIE-IN** △B
NOT TO SCALE



6 A8 **SECTION THROUGH NORTH DIKE** △A
NOT TO SCALE

7 A8 **SECTION THROUGH EAST DIKE** △A
NOT TO SCALE



8 A8 **MC VI-E PHASE 2 SE TIE-IN** △A
NOT TO SCALE

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Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
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Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY
A	FINALIZE CERT. PACKAGE	1/5/12	DRL
B	REVISED PER MDEQ	2/6/12	DRL

PROJECT NAME:
WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE

PROJECT LOCATION:
49350 N. I-94 SERVICE DR BELLEVILLE, WAYNE, MI

NTH PROJECT NO.: 62-101146	CAD FILE NAME: 101146-DET
DESIGNED BY: DRL	INCEP DATE: 05/05/2011
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY: ISS	SUBMITTED DATE: 2/6/2012

SHEET TITLE:
AS-BUILT DETAILS (1 OF 2)

SHEET REFERENCE NUMBER:
A8

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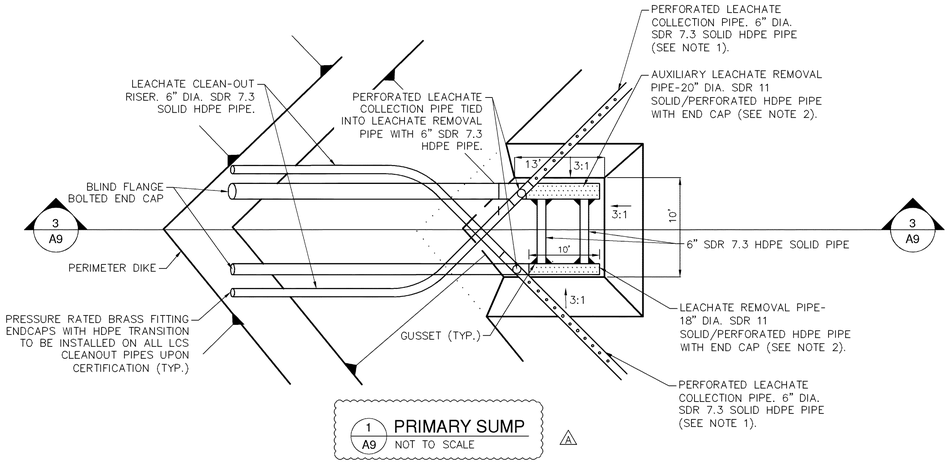
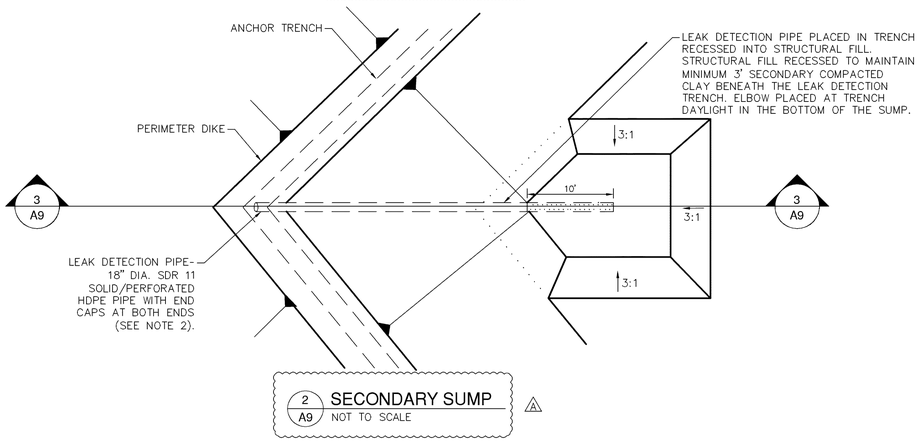
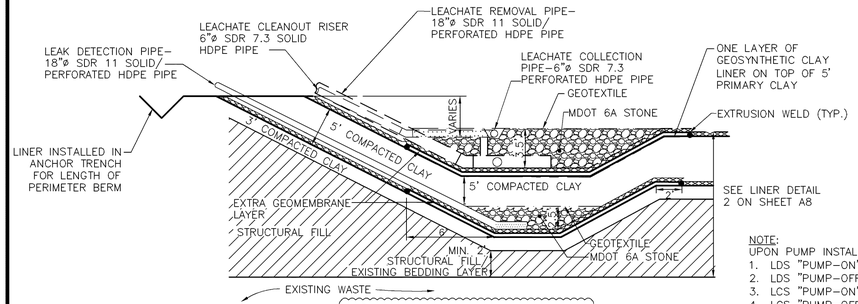


1 A9 PRIMARY SUMP
NOT TO SCALE



2 A9 SECONDARY SUMP
NOT TO SCALE



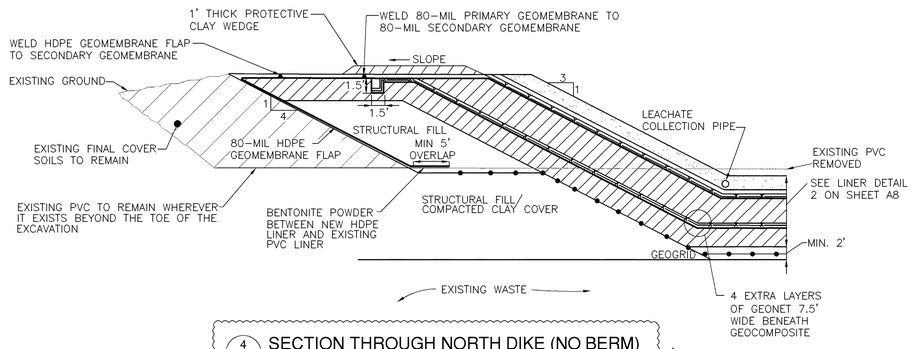
3 A9 SUMP CROSS SECTION
NOT TO SCALE

NOTE:
UPON PUMP INSTALLATION THE LCS AND LDS PUMP ELEVATIONS ARE TO BE SET AT:
1. LDS "PUMP-ON" ELEV= TOP OF LDS SUMP
2. LDS "PUMP-OFF" ELEV= 1 FOOT ABOVE LDS SUMP BOTTOM
3. LCS "PUMP-ON" ELEV= 0.67' BELOW TOP OF LCS SUMP
4. LCS "PUMP-OFF ELEV= 1 FOOT ABOVE LCS SUMP BOTTOM

Geosynthetic Materials

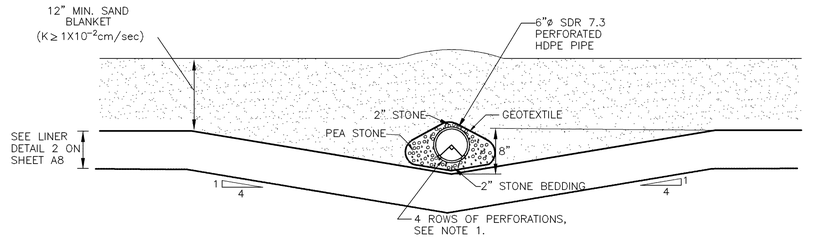
Material	Location	Description	Product	Additional Requirements
80-mil Geomembrane	Primary and secondary liners	80-mil HDPE, textured both sides	GSE HD textured, or equivalent	Interface friction requirements in CQA Plan
Geocomposite	LCS and LDS	200-mil HDPE geonet, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET, or equivalent	Transmissivity and interface friction requirements in CQA Plan
Geonet	LCS and LDS collectors	200-mil HDPE	GSE HYPERNET, or equivalent	Transmissivity requirements in CQA Plan
Geotextile	All geocomposites and gravel/geotextile envelopes for LCS and gas management system	Nominal 8 oz/yd^2, needle-punched, nonwoven polypropylene	SKAPS GT-180, or equivalent	None
Geogrid	Subgrade	Biaxial Polymeric Grid	Huesker Fortrac 80-80, or Tensar UX1400-HS	None

LCS denotes leachate collection system
LDS denotes leak detection, collection, and removal system

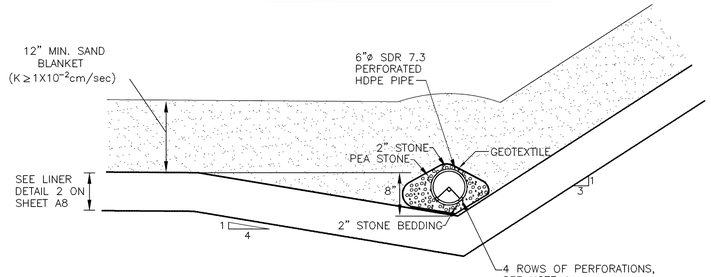


4 A9 SECTION THROUGH NORTH DIKE (NO BERM)
NOT TO SCALE

CELL FLOOR LEACHATE COLLECTION PIPE

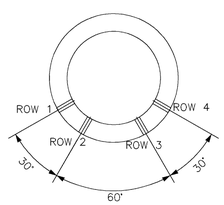


CELL FLOOR LEACHATE COLLECTION TOE PIPE

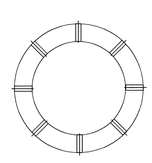


5 A9 LCS COLLECTION PIPE AND COLLECTOR STRIPS
NOT TO SCALE

NOTES:
1. PIPE IS HDPE, 6" SDR 7.3 WITH 1/4" DIA. HOLES. 2" SPACING ALONG EACH OF (4) ROWS. ROWS SPACED AROUND CIRCUMFERENCE AS SHOWN. TOTAL 24 HOLES PER FOOT.



2. PIPE IS 18" HDPE SDR 11 WITH 3/8" DIA. HOLES. 3" SPACING ALONG EACH OF (8) ROWS. ROWS SPACED AROUND CIRCUMFERENCE AS SHOWN. TOTAL 32 HOLES PER FOOT.



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Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY
A	FINALIZE CERT. PACKAGE	1/5/12	DRL

PROJECT NAME:
WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE

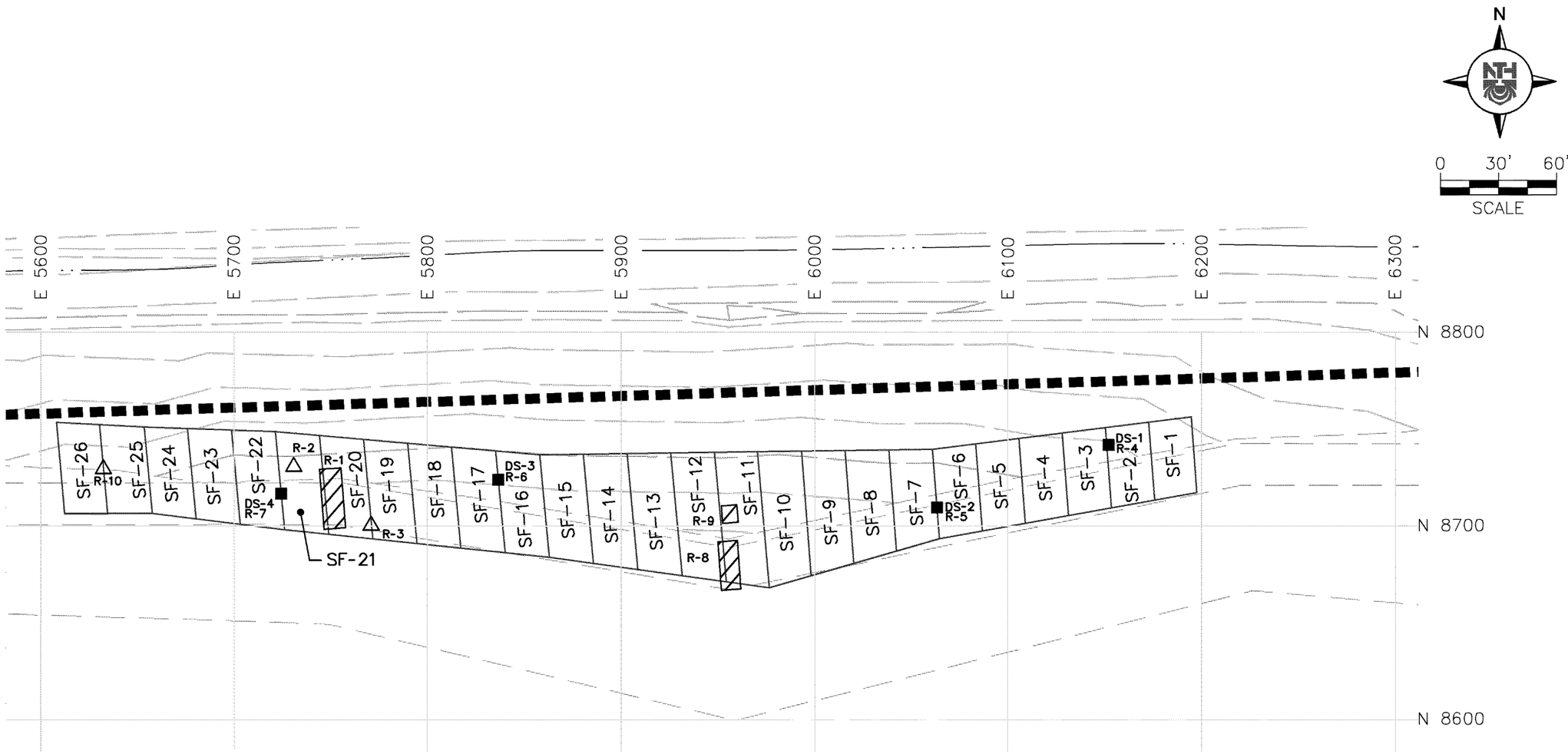
PROJECT LOCATION:
49350 N. I-94 SERVICE DR BELLEVILLE, WAYNE, MI

NTH PROJECT NO.: 62-101146	CAD FILE NAME: 101146-DET2
DESIGNED BY: DRL	INCEP DATE: 05/05/2011
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY: ISS	SUBMITTED DATE: ----

SHEET TITLE:
AS-BUILT DETAILS (2 OF 2)

SHEET REFERENCE NUMBER:
A9

J:\X2\X2101146\production nath\civil\certification\101146-det2.dwg Plotted: ----- by dlutz

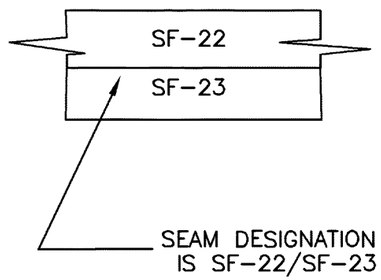


LEGEND

- △ PATCH
- ××× EXTRUSION WELD
- ▨ CAP
- DS-2 ■ DESTRUCT
- R-1 REPAIR NUMBER

NOTES:

1. SEAM NUMBERS ARE DESIGNATED BY ADJACENT PANELS.
   FOR EXAMPLE:



A 2. REFER TO DETAIL 4 ON SHEET A9 FOR MORE INFORMATION ON GEOMEMBRANE SUBGRADE FLAP.

NTH Consultants, Ltd.
Infrastructure Engineering
and Environmental Services

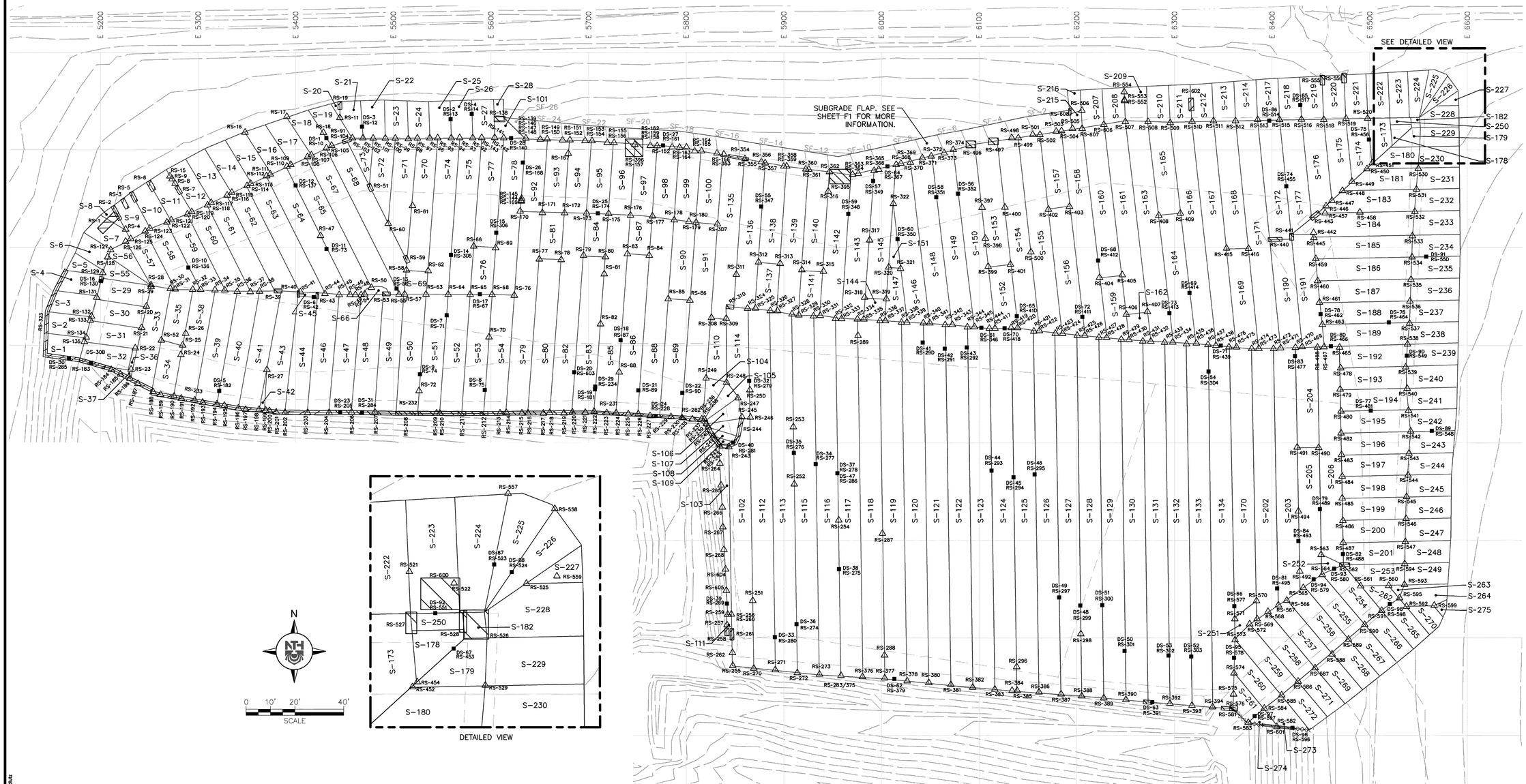
NTH PROJECT No.: 62-101146	CAD FILE NAME: 101146-SFGM
DESIGNED BY: DRL	PLOT DATE: 2/6/2012
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY: ISS	INCEPTION DATE: 05/05/2011

PANEL LAYOUT SUBGRADE GEOMEMBRANE
RECORD DRAWING

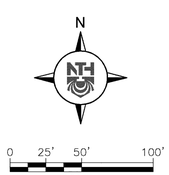
WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE
BELLEVILLE, WAYNE, MI

FIGURE:
F1

j:\62\62101146\production sets\civil\certification\101146-sfgm.dwg Plotted: 2/6/2012 2:50 PM by dlutz



DETAILED VIEW

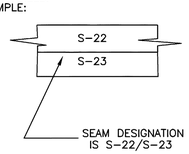


LEGEND

- PATCH
- EXTRUSION WELD
- CAP
- DS-20 DESTRUCT
- RS-86 REPAIR NUMBER

NOTES:

1. SEAM NUMBERS ARE DESIGNATED BY ADJACENT PANELS. FOR EXAMPLE:



NTH Consultants, Ltd.

Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE

PROJECT LOCATION:

49350 N. I-94 SERVICE DR
BELLEVILLE, WAYNE, MI

NTH PROJECT NO.: 62-101146	CAD FILE NAME: 101146-SGM
DESIGNED BY: DRL	INCEP DATE: 05/05/2011
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY: ISS	SUBMITTED DATE: 12/19/2011

SHEET TITLE:

PANEL LAYOUT
SECONDARY
GEOMEMBRANE
RECORD DRAWING

SHEET REFERENCE NUMBER:

F2

SHEET F2 OF X

J:\GE\62101146\production sets\civil\certification\101146-sgm.dwg Plotted: 12/19/2011 11:27 AM by dutz

N

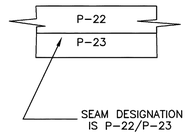
0 25' 50' 100'
SCALE

LEGEND

- PATCH
- EXTRUSION WELD
- CAP
- DS-2D DESTRUCT
- RP-86 REPAIR NUMBER

NOTES:

1. SEAM NUMBERS ARE DESIGNATED BY ADJACENT PANELS. FOR EXAMPLE:



2. T-BEAD REPAIRS COMPLETED AT PANEL INTERSECTIONS FOR EXTRUSION TIE-IN WELDING.

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Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
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Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

WAYNE DISPOSAL INC.,
SITE NO. 2 MC VI-P2 NE

PROJECT LOCATION:

49350 N. I-94 SERVICE DR
BELLEVILLE, WAYNE, MI

NTH PROJECT NO.:	CAD FILE NAME:
62-101146	101146-PGM
DESIGNED BY: DRL	INCEP DATE: 05/05/2011
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY: ISS	SUBMITTED DATE: 1/6/2012

SHEET TITLE:

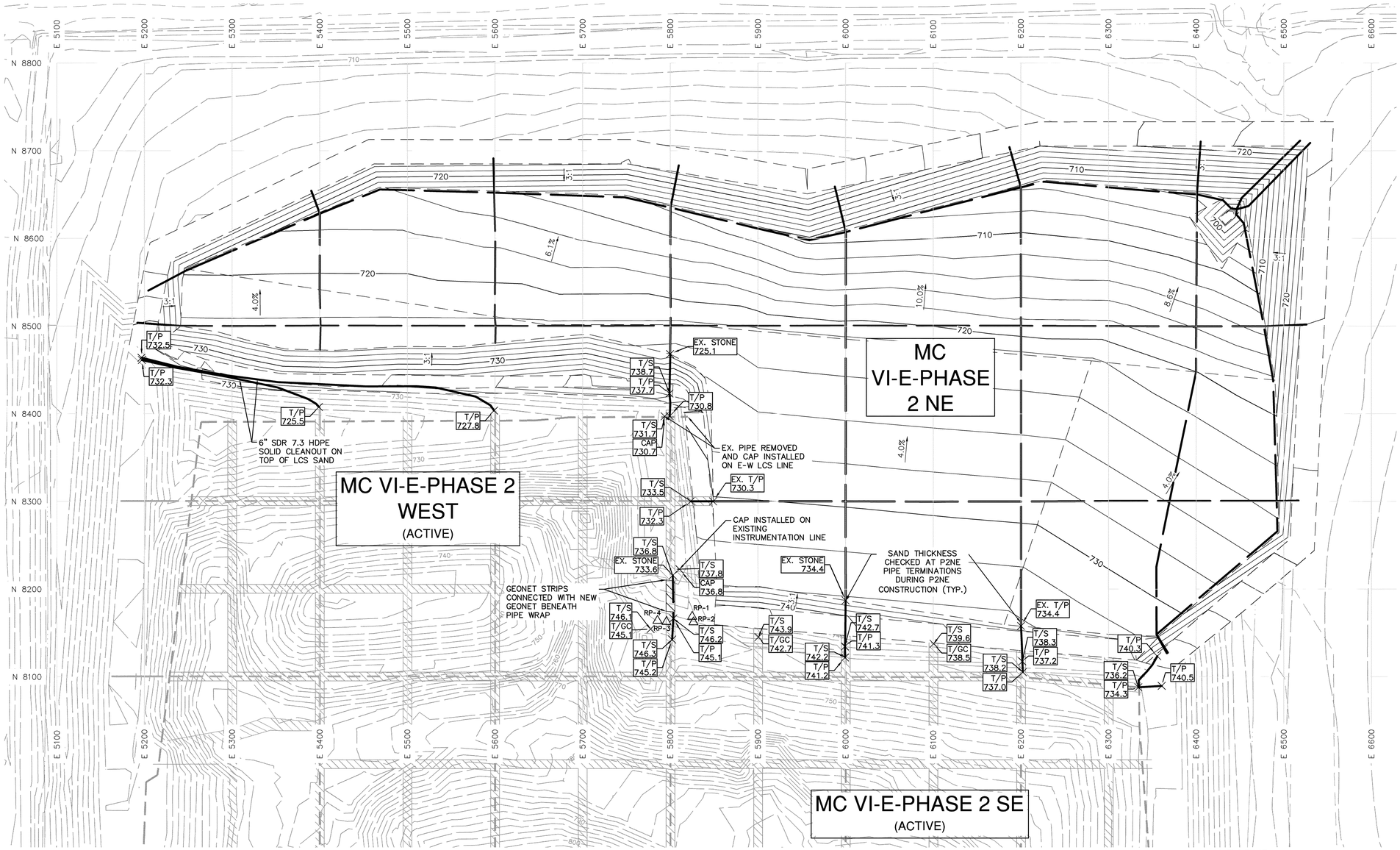
PANEL LAYOUT
PRIMARY
GEOMEMBRANE
RECORD DRAWING

SHEET REFERENCE NUMBER:

F3

SHEET F3 OF X

J:\GET\62101146\production web\civil\certification\101146-pgm.dwg Plotted: 1/9/2012 10:25 AM by dlutz



NOTES:

1. RECORD ELEVATIONS WERE SURVEYED AND PROVIDED BY WDI.

N

0 30' 60' 120'
SCALE

LEGEND

- EXISTING CONTOUR (2 FT INTERVAL)
- EXISTING LEACHATE COLLECTION PIPE
- EXISTING CLEANOUT
- EXISTING 2 EXTRA LAYERS OF GEONET, 7.5' WIDE, BENEATH GEOCOMPOSITE IN SQUARE GRID, 100 FEET ON CENTER
- RECORD TOP OF PRIMARY CLAY LINER CONTOUR (2 FT INTERVAL)
- GRADE BREAK
- RECORD LEACHATE COLLECTION PIPE
- RECORD CLEANOUT
- RECORD POINT
- T/P 730.7 — TOP OF PIPE ELEVATION
- T/GC 738.5 — TOP OF GEOCOMPOSITE ELEVATION
- T/S 739.6 — TOP OF LCS SAND ELEVATION
- RP-1 — GEOMEMBRANE REPAIR

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

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Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY

PROJECT NAME:

WAYNE DISPOSAL INC., SITE NO. 2 MC VI-P2 NE

PROJECT LOCATION:

49350 N. I-94 SERVICE DR
BELLEVILLE, WAYNE, MI

NTH PROJECT NO.:	CAD FILE NAME:
62-120048-02	120048-CRT
DESIGNED BY:	INCEP DATE:
DRL	02/22/2012
DRAWN BY:	DRAWING SCALE:
DRL	1" = 60'
CHECKED BY:	SUBMITTED DATE:
ISS	2/28/2012

SHEET TITLE:

LEACHATE COLLECTION SYSTEM TIE-IN RECORD DRAWING

SHEET REFERENCE NUMBER:

1

J:\2012\GEN\120048\reports\p2ne tie-in\120048-crt.dwg Plotted: 2/28/2012 2:31 PM by dlutz

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL E PHASE 1 SW SUMP

RECORD PLAN

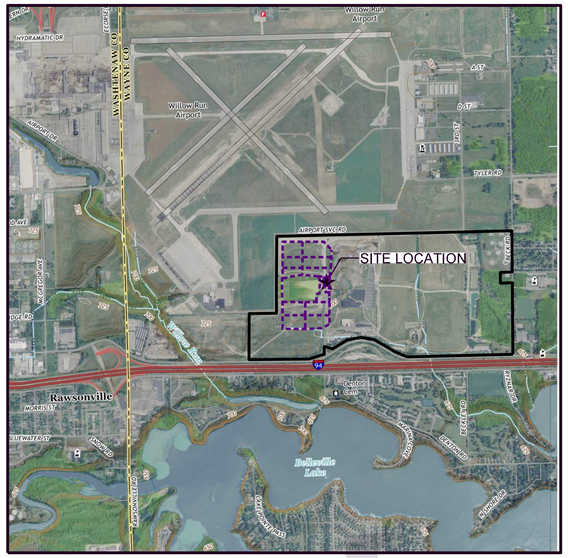
WAYNE DISPOSAL, INC. SITE NO. 2
MASTER CELL VI-E SW SUMP
RECORD DRAWINGS

VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CTI PROJECT NO. 1198070047

JUNE 2021

WAYNE COUNTY, MICHIGAN
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

LIST OF DRAWINGS

1 COVER SHEET
2 SITE PLAN
3 PLAN VIEW
4 LINER AND SUMP DESIGN DETAILS

OWNER:
US Ecology
49350 N. I-94 Service Drive
Belleville, Michigan 48111

ENGINEER:
CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377

REV00

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiomplanies.com

DATE: 6-24-21
DESIGNED BY: RB
DRAWN BY: BDA
CHECKED BY: RB
APPROVED BY: XZ

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REVISION DESCRIPTION | DATE | REV | DRN | APP

REVISIONS

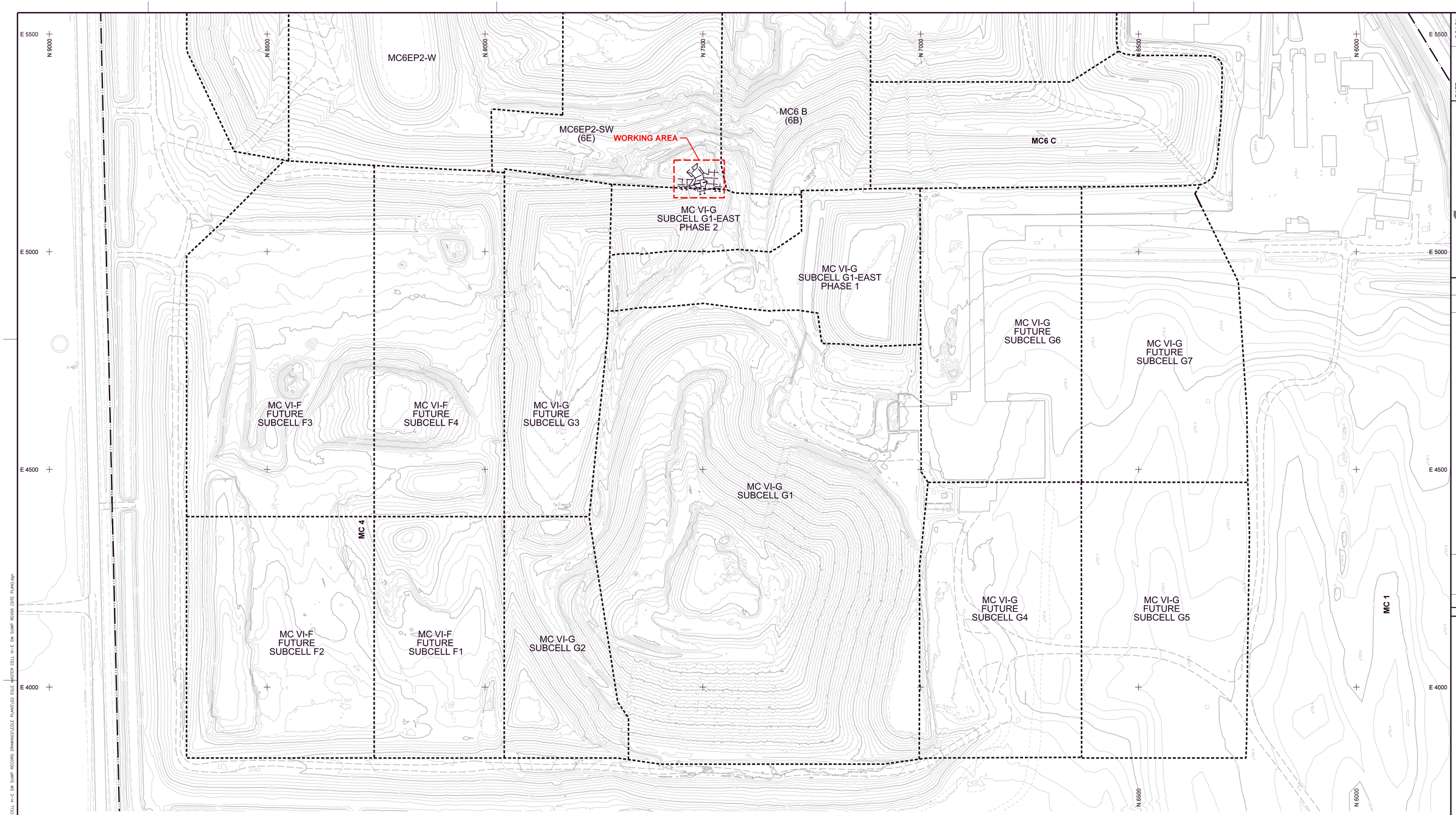
WAYNE DISPOSAL SITE NO. 2
MASTER CELL VI-E SW SUMP RECORD DRAWINGS

COVER SHEET

PROJECT NUMBER 1198070047
SCALE NONE
DRAWING NO **1**

TIME PLOTTED: 3:16:19 PM
DATE PLOTTED: 6/24/2021
FILENAME: Z:\shared\proj\Projects\Commercial\US Ecology\WDI\CAD\Construction-Cell\MASTER CELL VI-E SW SUMP RECORD DRAWINGS\EGLE PLANS\01 EGLE MASTER CELL VI-E SW SUMP REV00 (TITLE).dgn

DRAWING SIZE: 24" X 36"



N

NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH FIELD SURVEY DATED APRIL 2, 2021 AND JUNE 1, 2021.

REV00

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 EXISTING CONTOUR (2' INTERVAL)
- N 6500 GRID COORDINATES
- EXISTING STRUCTURE/ BUILDING
- GRADE BREAK

0 50' 100' 200'
SCALE

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiomplanies.com

DATE:	6-24-21
DESIGNED BY:	RB
DRAWN BY:	BDA
CHECKED BY:	RB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP

WAYNE DISPOSAL SITE NO. 2
MASTER CELL VI-E SW SUMP RECORD DRAWINGS

SITE PLAN

PROJECT NUMBER 1198070047

SCALE 1" = 100'

DRAWING NO **2**

TIME PLOTTED: 3:27:04 PM
DATE PLOTTED: 6/24/2021
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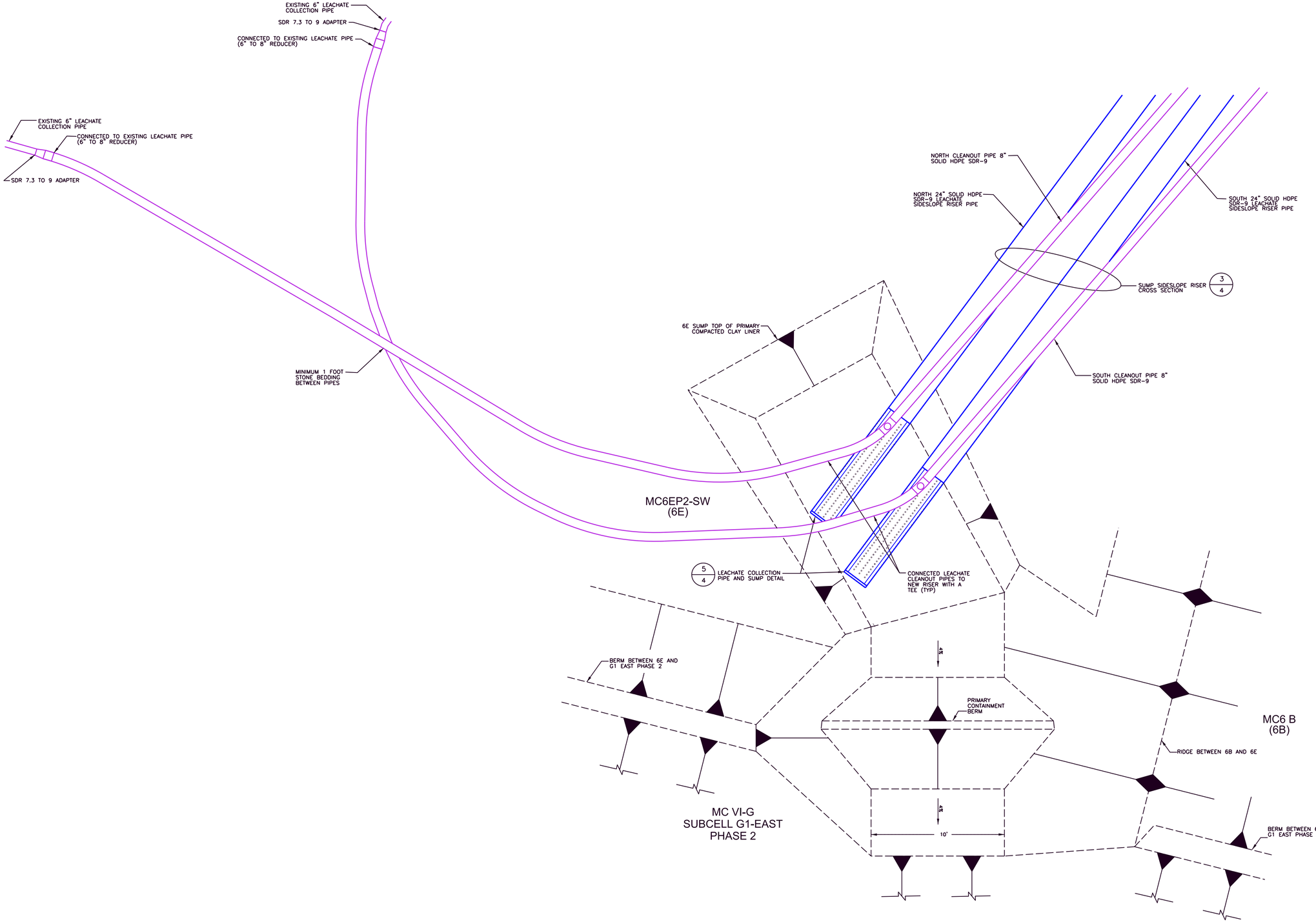
DRAWING SIZE: 24" X 36"



MC VI-E SW SUMP PLAN VIEW 1
NOT TO SCALE

REV00

DATE:	6-24-21
DESIGNED BY:	RB
DRAWN BY:	BDA
CHECKED BY:	RB
APPROVED BY:	XZ

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REVISIONS				
REV.	DATE	REVISION DESCRIPTION	DRN	APP

WAYNE DISPOSAL SITE NO. 2
MASTER CELL VI-E SW SUMP RECORD DRAWINGS

PLAN VIEW

PROJECT NUMBER 1198070047
SCALE NONE
DRAWING NO **3**

TIME PLOTTED: 2:22:13 PM
DATE PLOTTED: 6/24/2021
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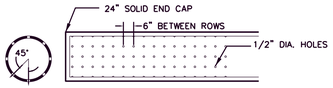
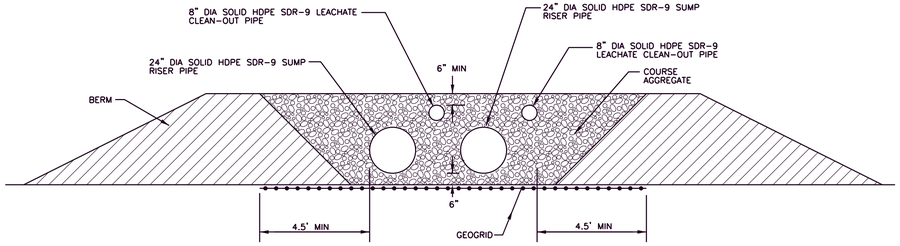
DRAWING SIZE: 24" X 36"

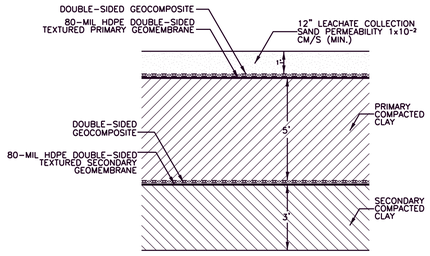


MC VI-E SW SUMP PERFORATION SPACING DETAIL 1
NOT TO SCALE

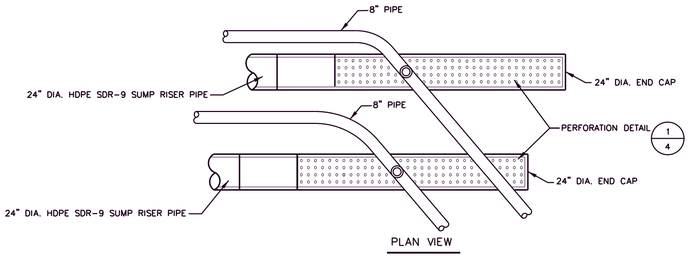


MC VI-E SW SUMP SIDE-SLOPE RISER CROSS SECTION 3
NOT TO SCALE

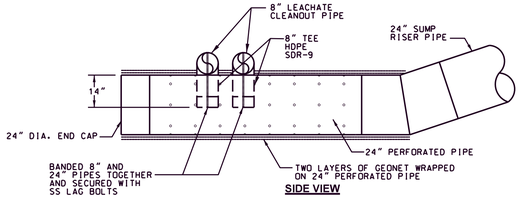
NOTES:
1. GEOGRID IS HUESKER BASETRAC GRID PET 80T.



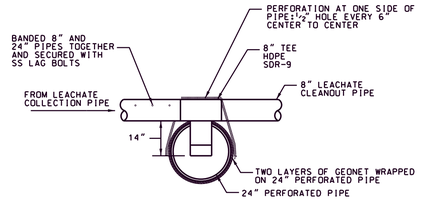
EXISTING LINER SYSTEM 2
NOT TO SCALE



PLAN VIEW

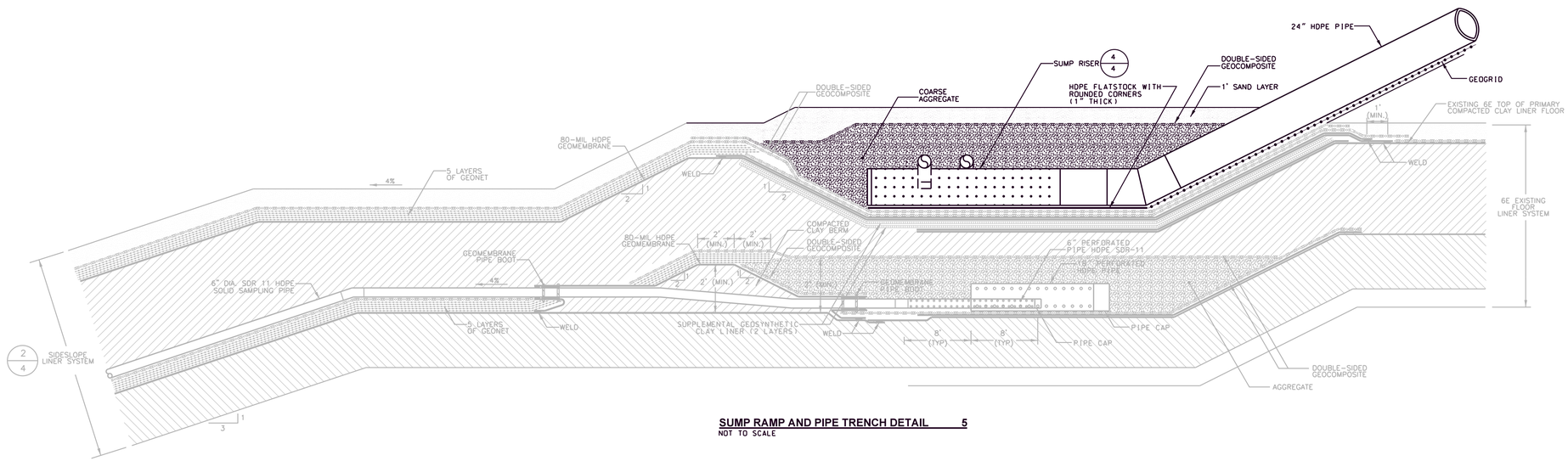


SIDE VIEW



FRONT VIEW
NOT TO SCALE

LEACHATE COLLECTION PIPE AND SUMP RISER CONNECTION DETAIL 4
NOT TO SCALE



SUMP RAMP AND PIPE TRENCH DETAIL 5
NOT TO SCALE

REV00

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiomplanies.com

DATE:	6-24-21
DESIGNED BY:	RB
DRAWN BY:	BDA
CHECKED BY:	RB
APPROVED BY:	XZ

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REVISIONS	REV	DATE	REVISION DESCRIPTION	DRN	APP

WAYNE DISPOSAL SITE NO. 2
MASTER CELL VI-E SW SUMP RECORD DRAWINGS

LINER AND SUMP DESIGN DETAILS

PROJECT NUMBER
1198070047

SCALE
NONE

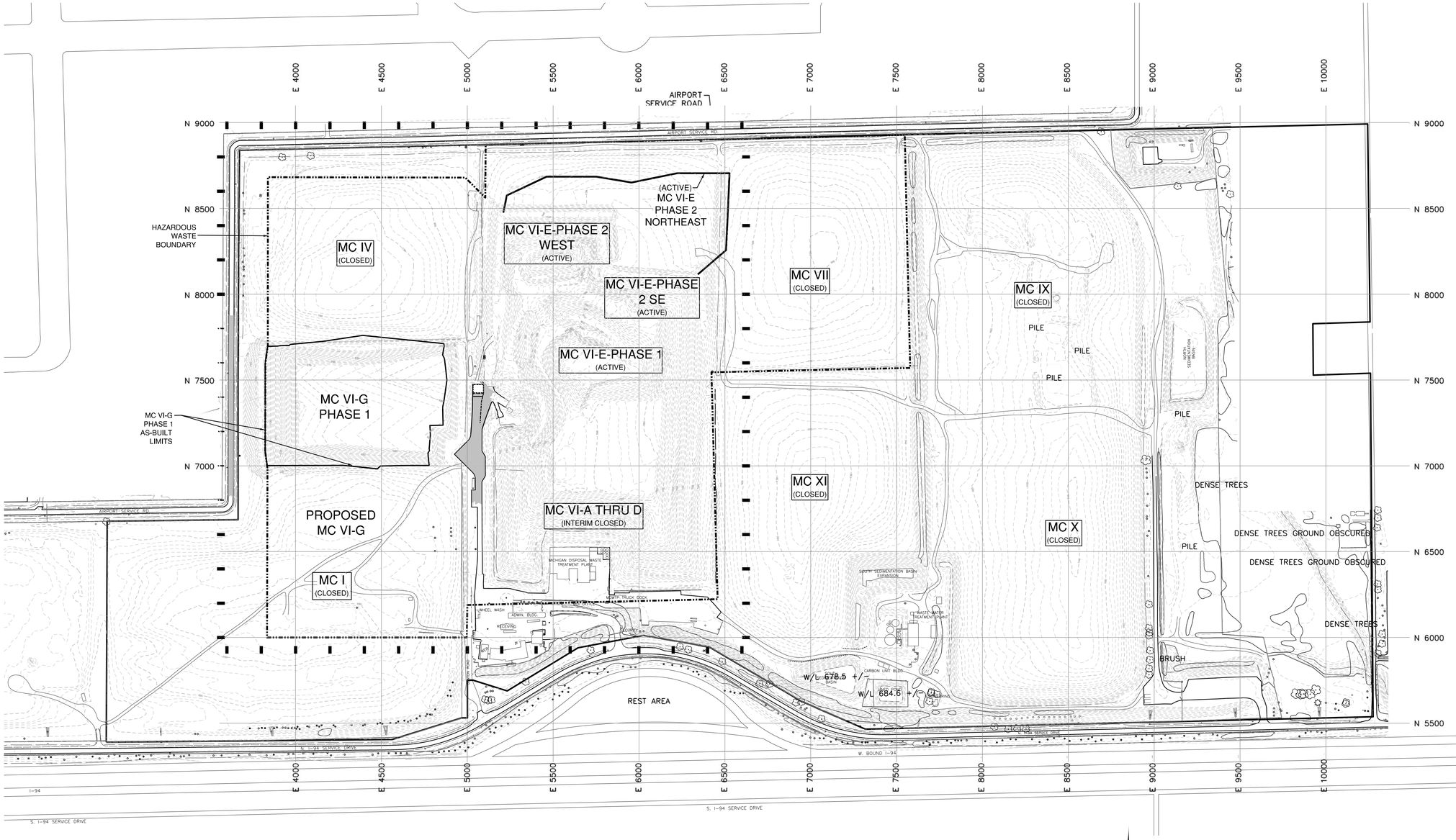
DRAWING NO
4

TIME PLOTTED: 3:26:01 PM
DATE PLOTTED: 6/24/2021
FILENAME: Z:\Shared\proj\Projects\Commercial\US Ecology\WDI\CAD\Construction-Cert\MASTER CELL VI-E SW SUMP RECORD DRAWINGS\EGLE PLANS\04 EGLE MASTER CELL VI-E SW SUMP REV00 (LINER AND SUMP DETAILS).dgn
DRAWING SIZE: 24" x 36"

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL G1

RECORD PLAN



NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN 2001 BY AIR-LAND SURVEY AND PROVIDED BY WDI, A SURVEY BY MCLLC IN OCTOBER 2007, AND A GROUND SURVEY BY WDI IN OCTOBER 2008.

2. BASE MAP WAS OBTAINED FROM PLANS PREPARED BY NTH CONSULTANTS AND DATED SEPTEMBER 2011.

0 150' 300' 600'
SCALE

LEGEND

- 710 — EXISTING CONTOUR (2 FT INTERVAL)
- PERMITTED HAZARDOUS WASTE BOUNDARY
- EXISTING SITE ROAD
- PROPERTY BOUNDARY

NO.	DESCRIPTION	DATE	BY

DRAWN RAR DATE 11/30/12
CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

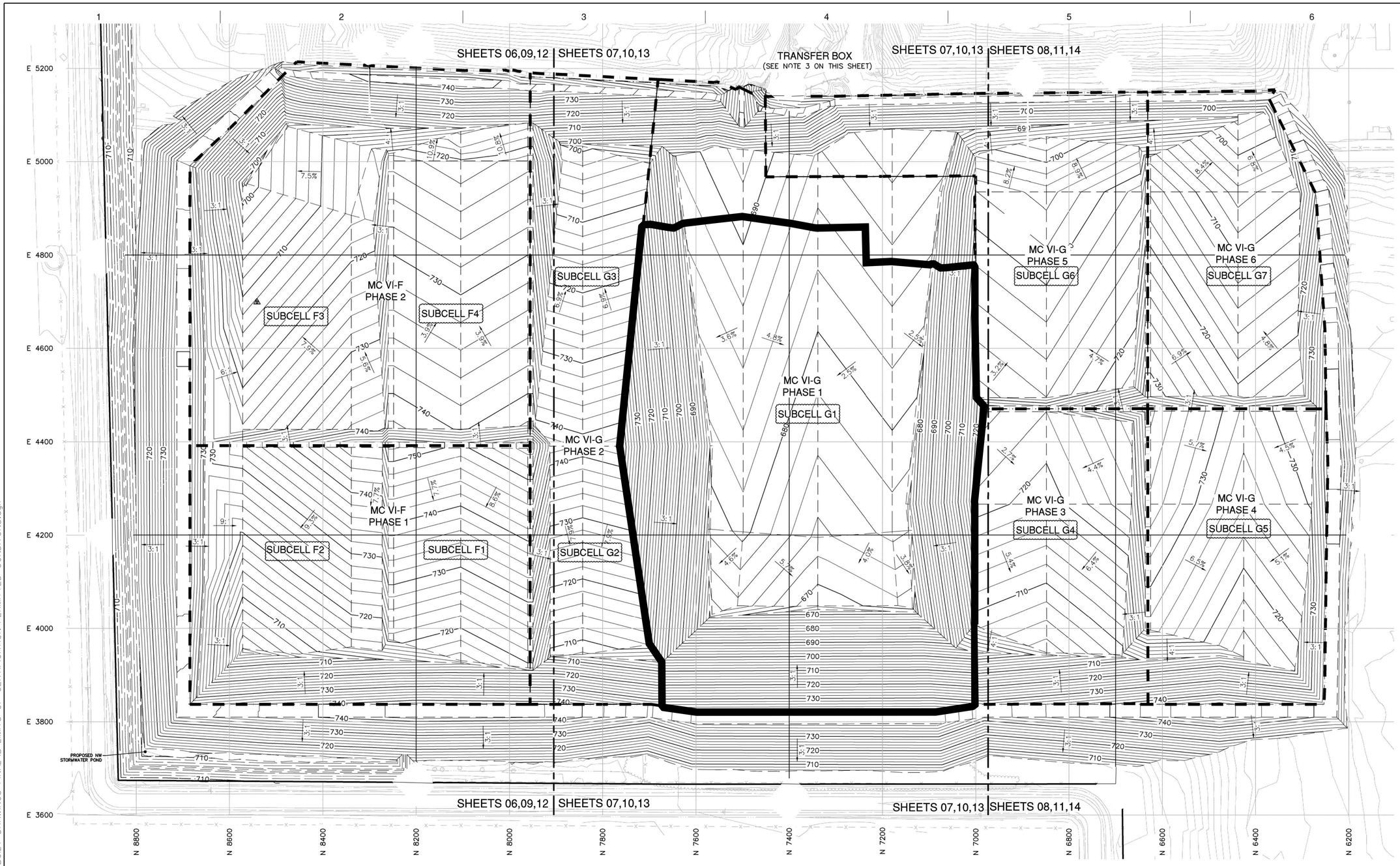
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

LIMITS OF CERTIFICATION
EXISTING CONDITIONS
MASTER CELL VI-G - PHASE I

A

1/21/2013

W:\Projects\Projects A-E\156001\CAD\AS-BUILT DRAWINGS FINAL\A-LIMITS OF CERTIFICATION-EXISTING CONDITIONS.dgn



PHASE DESIGNATION	PHASE FOOTPRINT AREA (AC.)	PHASE INCREMENTAL VOLUME (C.Y.)
MC VI-F PHASE 1	9.3	812,000
MC VI-F PHASE 2	12.9	1,865,000
MC VI-G PHASE 1	19.9	2,370,000
MC VI-G PHASE 2	7.2	773,000
MC VI-G PHASE 3	5.3	700,000
MC VI-G PHASE 4	5.5	490,000
MC VI-G PHASE 5	7.4	3,600,000
MC VI-G PHASE 6	5.5	1,120,000
TOTAL	73.0	11,730,000

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN 2001 BY AIR-LAND SURVEY AND PROVIDED BY WDI, A SURVEY BY MCLLC IN OCTOBER 2007, AND A GROUND SURVEY BY WDI IN OCTOBER 2008.
2. BASE MAP WAS OBTAINED FROM PLANS PREPARED BY NTH CONSULTANTS AND DATED SEPTEMBER 2011.
3. THE TRANSFER BOX WILL BE MOVED TO VARIOUS LOCATIONS BASED ON CELL DEVELOPMENT AND FILLING OPERATIONS. SEE TRANSFER BOX DETAIL ON SHEETS 26 AND 27.
2. A MINIMUM OF 5 YEARS PRIOR TO CONSTRUCTING MC VI-G PHASES 3 TO 6, WDI SHALL INVESTIGATE THE DIKE LOCATIONS AND NEED FOR DEWATERING FOR THE EXISTING MC I TO CONFIRM THE ASSUMPTIONS USED IN THE DESIGN. WDI SHALL INFORM THE MDEQ OF THE RESULTS OF THIS INVESTIGATION AND REVISE THE DESIGN, IF NECESSARY. THE REVISED DESIGN SHALL BE APPROVED BY THE MDEQ PRIOR TO CONSTRUCTION OF MC VI-G PHASES 3 TO 6. (A)

N

0 50' 100' 200'
SCALE

LEGEND

- 710 — EXISTING CONTOUR (2 FT INTERVAL)
- PROPERTY BOUNDARY
- PROPOSED GRADE BREAK
- 710 — PROPOSED TOP OF PRIMARY LINER CONTOUR (2 FT INTERVAL)
- 710 — PROPOSED NW STORMWATER POND CONTOUR (2 FT INTERVAL)
- PROPOSED PHASE BOUNDARY
- MC VI-G PHASE I ASBUILT LIMITS

NO.	DATE	BY	DESCRIPTION
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

DRAWN RAR DATE 11/30/12
CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

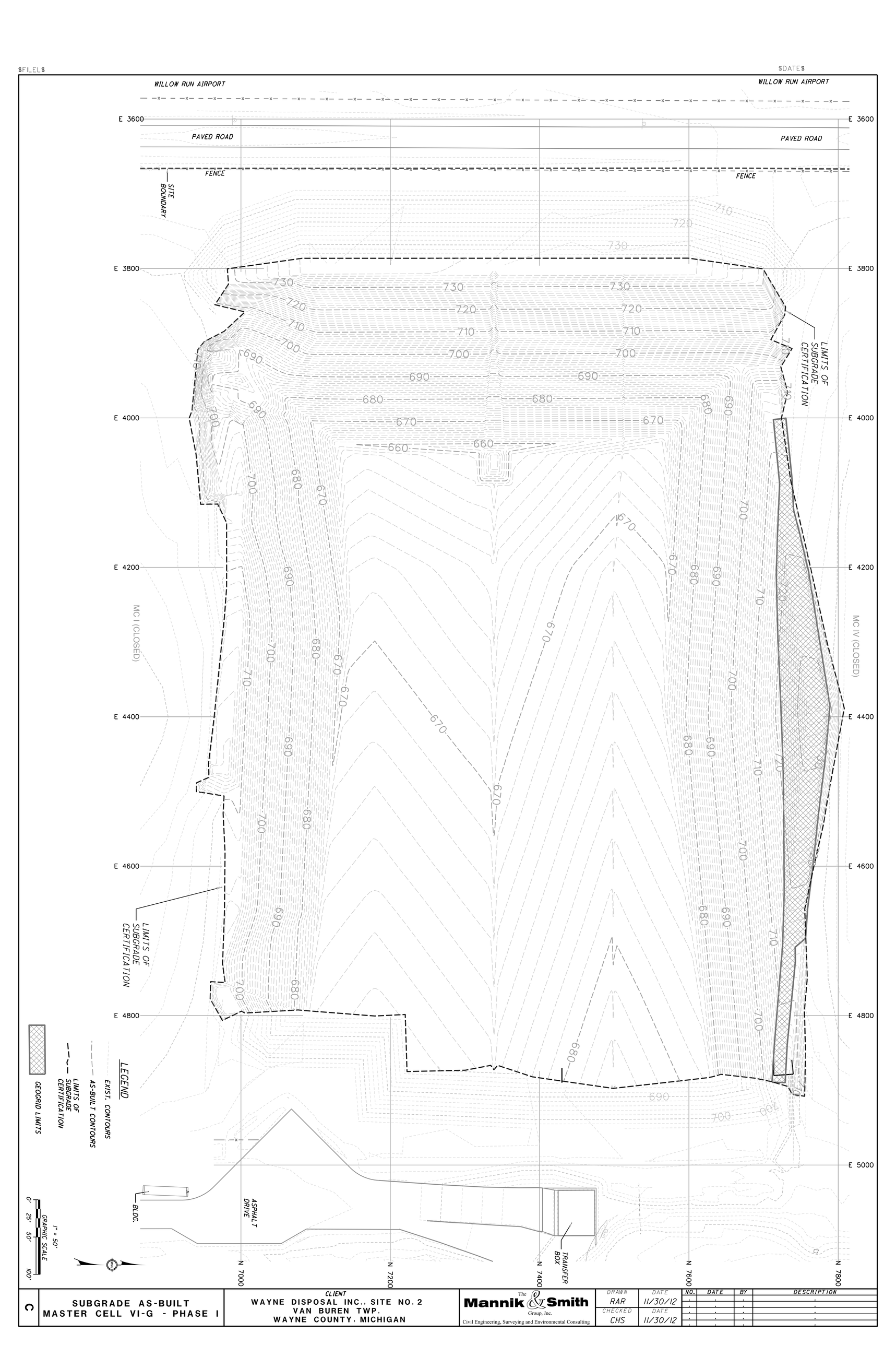
LIMITS OF CERTIFICATION
PERMITTED CONDITION
MASTER CELL VI-G - PHASE I

B

1/21/2013

W:\Projects\Projects A-E\E1560001\CAD\AS-BUILT DRAWINGS FINAL\B-LIMITS OF CERTIFICATION-PERMITTED CONDITIONS.dgn

$FILEL$ $DATE$



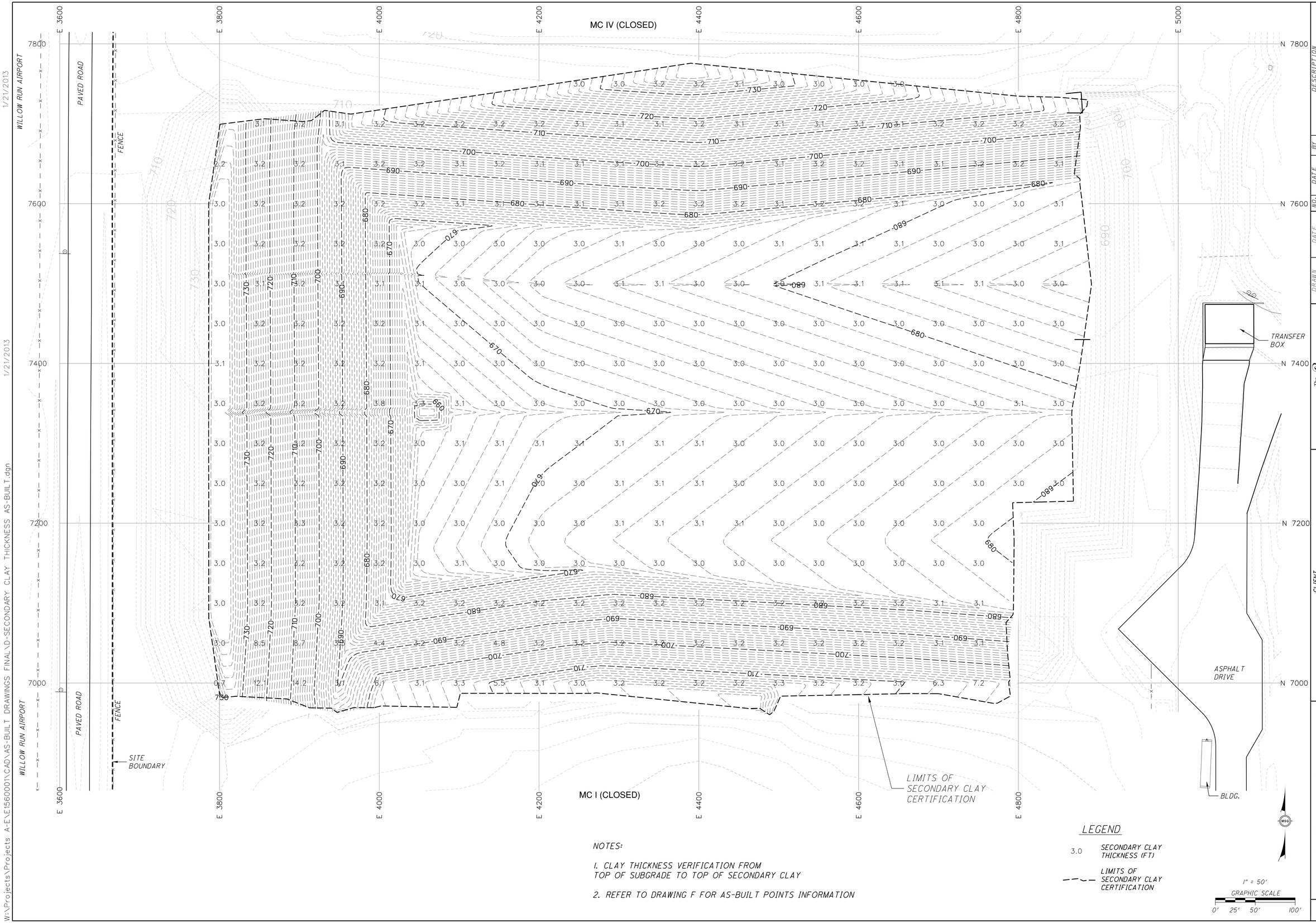
C

SUBGRADE AS-BUILT
MASTER CELL VI-G - PHASE I

CLIENT
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

The Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

DRAWN	DATE	NO.	DATE	BY	DESCRIPTION
RAR	11/30/12	.	.	.	.
CHECKED	DATE	.	.	.	.
CHS	11/30/12	.	.	.	.



NOTES:

1. CLAY THICKNESS VERIFICATION FROM TOP OF SUBGRADE TO TOP OF SECONDARY CLAY

2. REFER TO DRAWING F FOR AS-BUILT POINTS INFORMATION

LEGEND

3.0 SECONDARY CLAY THICKNESS (FT)

LIMITS OF SECONDARY CLAY CERTIFICATION

1" = 50'

GRAPHIC SCALE

0' 25' 50' 100'

NO.	DESCRIPTION	DATE	BY

DRAWN RAR DATE 11/30/12

CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

CLIENT
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

SECONDARY CLAY
AS-BUILT - PHASE I
MASTER CELL VI-G

D

1/21/2013

1/21/2013

W:\Projects\Projects A-E\E1560001\CAD\AS-BUILT DRAWINGS FINAL\D-SECONDARY CLAY THICKNESS AS-BUILT.dgn

MC IV (CLOSED)

MC I (CLOSED)

WILLOW RUN AIRPORT

PAVED ROAD

FENCE

SITE BOUNDARY

TRANSFER BOX

ASPHALT DRIVE

BLDG.

LIMITS OF PRIMARY CLAY CERTIFICATION

E 3600 E 3800 E 4000 E 4200 E 4400 E 4600 E 4800

N 7800 N 7600 N 7400 N 7200 N 7000

NOTES:

1. CLAY THICKNESS VERIFICATION FROM TOP OF SECONDARY LINER TO TOP OF PRIMARY CLAY

2. REFER TO DRAWING F FOR AS-BUILT POINTS INFORMATION

LEGEND

5.0 PRIMARY CLAY THICKNESS (FT)

LIMITS OF PRIMARY CLAY CERTIFICATION

1" = 50'

GRAPHIC SCALE

0' 25' 50' 100'

NO.	DATE	BY	DESCRIPTION

DRAWN RAR DATE 11/30/12

CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

CLIENT
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

PRIMARY CLAY
AS-BUILT
MASTER CELL VI-G - PHASE I

E

1/21/2013

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$DATE:$

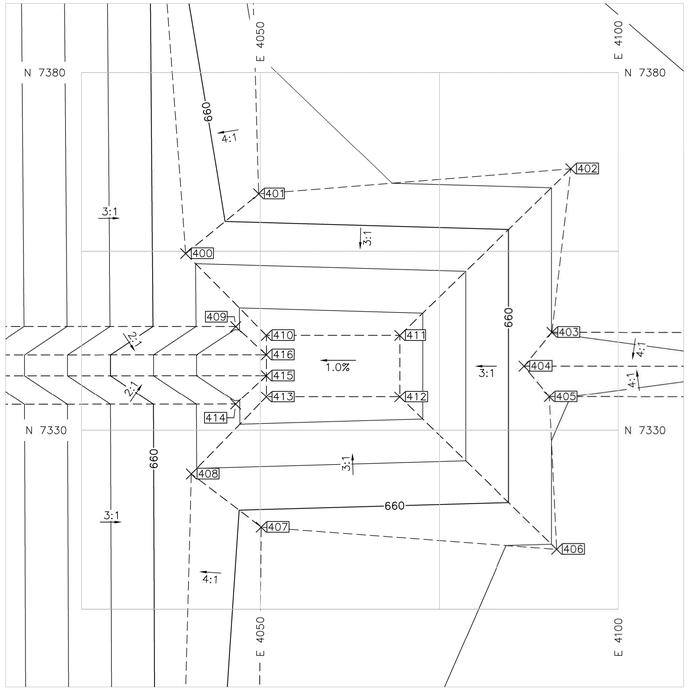
AS-BUILT SUBGRADE POINTS TABLE

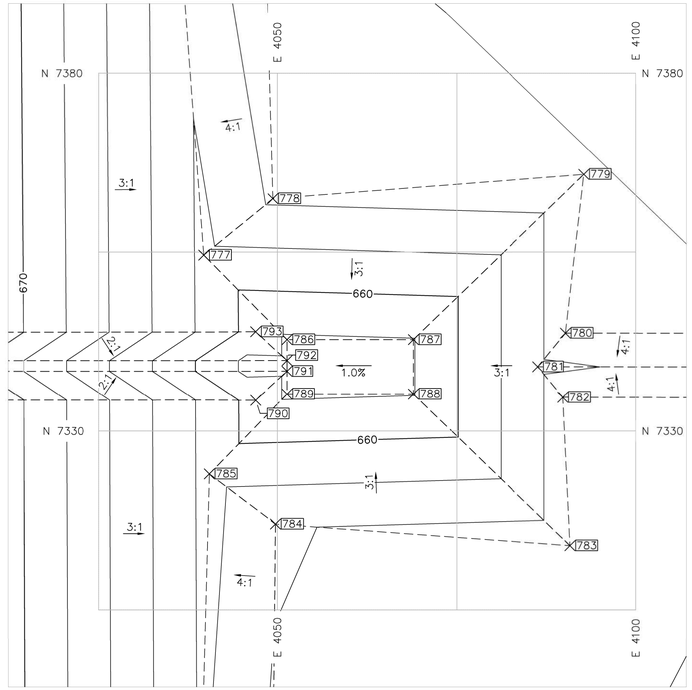
POINT NO.	NORTHING	EASTING	AS-BUILT ELEVATION
100	7808.17	4388.73	722.28
101	7787.52	4500.02	719.85
102	7784.95	4299.98	719.09
103	7782.05	4390.40	734.95
104	7780.03	4545.12	718.44
105	7778.01	3922.34	713.94
106	7771.11	4499.91	727.92
107	7768.80	4299.98	728.27
108	7767.45	4600.03	718.33
109	7762.82	4199.97	716.61
110	7761.11	4390.43	735.38
111	7760.99	4600.03	721.47
112	7758.57	4749.55	718.19
113	7756.28	4848.87	715.32
114	7755.14	4657.33	717.83
115	7754.76	4792.94	715.76
116	7755.00	4907.95	713.60
117	7753.81	4200.04	720.94
118	7751.03	4699.90	715.06
119	7750.00	4499.89	728.36
120	7747.32	4299.99	728.73
121	7740.97	4799.96	708.64
122	7740.05	4599.96	721.97
123	7738.40	4905.40	712.20
124	7738.14	3907.21	711.40
125	7736.42	4083.83	712.42
126	7732.68	4894.89	702.47
127	7732.41	4199.96	721.36
128	7732.20	3965.40	710.50
129	7729.94	4700.06	715.46
130	7729.42	3851.35	710.34
131	7728.34	3861.90	710.16
132	7723.95	4000.07	706.20
133	7723.03	3931.62	695.48
134	7719.73	4800.08	709.08
135	7718.56	3963.95	703.57
136	7717.36	4099.95	714.04
137	7715.89	3903.48	707.72
138	7712.40	3856.60	719.65
139	7710.76	4888.39	703.38
140	7709.73	3895.24	706.87
141	7709.27	3914.06	700.80
142	7708.64	3908.47	702.53
143	7702.30	4000.02	706.68
144	7699.98	4200.04	710.62
145	7699.91	4300.01	713.00
146	7699.99	4399.98	714.71
147	7699.96	4499.91	711.72
148	7700.02	4600.10	708.63
149	7700.07	4699.95	705.58
150	7700.01	4799.98	702.48
151	7699.30	3800.50	730.70
152	7697.96	3820.97	730.74
153	7697.25	3967.19	704.31
154	7688.91	4883.85	696.22
155	7670.80	3928.79	694.50
156	7670.80	3928.79	694.50
157	7643.00	4878.64	681.18
158	7631.50	4881.90	677.20
159	7625.34	4883.05	678.80
160	7614.81	4800.00	677.84
161	7608.51	4699.97	675.20
162	7602.06	4700.05	676.79
163	7599.98	3899.93	704.35
164	7600.01	3995.46	672.45
165	7600.11	4099.97	674.98
166	7600.03	4199.87	677.35
167	7600.02	4299.95	679.70
168	7600.05	4399.93	681.50
169	7599.99	4886.04	679.58
170	7599.30	3786.20	735.60
171	7597.92	3806.83	735.58
172	7596.09	4600.07	674.05
173	7589.59	4599.92	675.59
174	7583.38	4500.07	673.00
175	7576.65	4499.99	674.53
176	7573.86	4212.30	668.96
177	7571.87	4299.92	670.26
178	7571.81	4100.01	665.55
179	7570.30	4023.25	663.21
180	7569.58	4391.16	671.72
181	7567.33	4212.51	670.56
182	7565.38	4100.01	667.19
183	7565.21	4299.93	671.92
184	7564.24	4031.70	664.99
185	7563.24	4391.97	673.44
186	7514.06	4027.59	662.03
187	7513.87	3900.02	704.48
188	7513.74	3806.90	735.71
189	7512.37	4027.57	661.26
190	7512.35	3900.13	703.87
191	7512.36	3804.82	735.71
192	7512.40	4049.62	667.34
193	7510.99	4027.52	662.00
194	7511.06	3806.97	735.72
195	7511.01	3900.04	704.51
196	7510.77	4049.89	666.82
197	7509.45	4049.87	667.34
198	7508.14	4100.24	669.06
199	7506.86	4100.07	668.46
200	7505.45	4099.91	669.04
201	7500.00	3786.23	735.70
202	7499.76	4206.70	672.69
203	7499.91	4300.00	674.04
204	7499.86	4400.03	675.57
205	7499.91	4500.08	677.08
206	7499.80	4600.05	678.55
207	7499.96	4700.01	680.02
208	7499.90	4800.09	681.59
209	7499.99	4897.21	683.05
210	7498.54	4206.74	672.03
211	7498.57	4299.94	673.49
212	7498.64	4400.10	674.93
213	7498.52	4500.04	676.44
214	7498.57	4600.14	677.94
215	7498.56	4699.94	679.44
216	7498.55	4799.99	680.93
217	7498.58	4897.27	682.37
218	7497.26	4206.72	672.61
219	7497.32	4299.95	673.99
220	7497.21	4400.03	675.53
221	7497.23	4499.98	677.01
222	7497.25	4599.94	678.62
223	7497.24	4700.01	680.09
224	7497.30	4800.05	681.59
225	7497.23	4897.19	683.05
226	7400.01	3786.30	735.83
227	7399.95	3807.14	735.77
228	7400.01	3899.99	704.75
229	7399.97	4035.88	659.45
230	7399.88	4100.07	664.44
231	7400.04	4199.49	668.20
232	7400.00	4299.97	669.66
233	7399.99	4399.90	671.20
234	7400.03	4500.00	672.72
235	7399.98	4600.04	674.21
236	7399.91	4700.06	675.71
237	7400.00	4800.06	677.26
238	7398.58	4048.53	662.45
239	7390.28	4881.94	678.02
240	7344.49	3899.88	704.88
241	7344.45	3806.97	735.91
242	7343.84	4195.25	665.61
243	7343.83	4300.01	667.13
244	7343.70	4400.01	668.66
245	7343.78	4500.03	670.11
246	7343.87	4600.04	671.70
247	7343.69	4699.93	673.18
248	7343.84	4799.93	674.65
249	7343.82	4866.60	675.70
250	7343.62	4100.12	662.26
251	7340.48	3899.94	702.91
252	7340.46	3800.91	735.91
253	7338.98	4100.04	661.17
254	7338.90	4194.81	664.32
255	7338.87	4299.92	665.91
256	7338.76	4399.96	667.42
257	7338.79	4499.92	668.84
258	7338.82	4600.00	670.50
259	7338.78	4699.98	672.00
260	7338.99	4799.94	673.47
261	7338.80	4872.38	674.85
262	7337.49	3900.03	702.86
263	7337.44	3800.96	735.96
264	7334.63	4100.06	662.24
265	7334.50	4195.23	665.37
266	7334.38	4299.99	667.03
267	7334.51	4400.05	668.54
268	7334.52	4500.04	670.02
269	7334.46	4600.03	671.57
270	7334.43	4700.04	673.06
271	7334.52	4799.94	674.52
272	7334.51	4866.60	675.54
273	7333.54	3899.93	704.88
274	7333.50	3806.83	735.88
275	7300.30	4873.10	676.34
276	7299.97	4039.44	658.43
277	7299.89	3899.97	704.89
278	7300.15	4049.70	661.06
279	7299.90	4099.97	662.64
280	7299.93	4197.89	666.12
281	7299.97	4300.11	667.64
282	7300.05	4399.99	669.14
283	7300.03	4499.99	670.71
284	7299.97	4600.05	672.20
285	7299.93	4700.07	673.73
286	7299.93	4800.07	675.24
287	7300.01	3786.40	736.00
288	7222.45	4874.87	677.90
289	7219.97	4798.51	676.85
290	7199.99	4050.03	662.79
291	7200.02	3786.40	736.10
292	7200.01	3806.82	736.10
293	7199.95	3899.92	705.00
294	7199.89	4000.03	671.73
295	7199.94	4036.84	659.45
296	7179.10	4700.01	676.19
297	7179.05	4600.06	674.60
298	7179.18	4500.14	673.11
299	7179.15	4399.91	671.55
300	7179.13	4300.00	670.02
301	7179.11	4207.01	668.72
302	7179.26	4800.57	677.61
303	7170.72	4100.10	665.15
304	7166.80	4050.46	663.39
305	7150.70	4266.62	669.05
306	7147.20	4300.01	669.50
307	7145.11	4209.80	668.12
308	7142.33	4265.94	666.94
309	7139.42	4100.07	664.36
310	7138.91	4300.01	667.40
311	7136.80	4400.04	670.81
312	7136.66	4210.04	665.98
313	7136.49	4045.10	662.63
314	7131.10	4099.96	662.39
315	7129.11	4400.00	668.90
316	7127.65	4034.74	660.18
317	7126.33	4499.99	672.05
318	7119.26	4500.01	670.40
319	7115.90	4600.06	673.40
320	7109.80	4665.53	674.27
321	7109.56	4600.03	671.81
322	7103.47	4664.58	672.70
323	7099.93	3899.93	705.14
324	7099.97	4009.68	668.12
325	7100.00	4099.99	672.57
326	7100.04	4200.06	677.52
327	7100.03	4299.98	680.34
328	7099.94	4400.04	678.62
329	7099.97	4499.93	676.81
330	7095.26	4794.01	675.88
331	7089.00	4793.54	674.30
332	7083.26	3806.95	736.26
333	7081.80	3786.40	736.20
334	7076.54	4792.40	678.48
335	7041.94	3957.15	684.51
336	7005.10	4796.57	702.16
337	7001.83	4272.44	713.51
338	7001.45	4009.65	700.61
339	7001.38	4100.06	705.08
340	7001.11	4200.04	710.12
341	7001.21	4265.92	713.49
342	7000.82	4794.00	703.56
343	7000.87	4657.66	707.01
344	6999.59	4600.17	708.41
345	6998.29	3948.64	686.37
346	6997.33	4493.13	711.01
347	6988.74	4400.00	715.60
348	6983.46	3999.21	699.68
349	6983.29	3820.97	729.32
350	6982.15	4465.48	716.60
351	6981.80	3800.50	729.35
352	6981.53	4475.46	716.59
353	6981.16	4271.62	713.12
354	6980.88	4103.99	704.92
355	6980.83	4199.98	709.71
356	6980.73	4227.61	711.11
357	6980.71	4265.99	712.99
358	6980.41	4761.40	704.01
359	6980.41	4659.15	706.53
360	6979.89	4796.48	703.12
361	6978.65	4581.42	708.48
362	6978.76	4755.75	706.90
363	6978.09	4271.52	711.60
364	6977.96	4658.86	707.79
365	6977.80	4266.30	711.66
366	6977.46	3884.18	708.50
367	6977.32	4506.08	710.31
368	6976.05	4529.28	708.85
369	6975.32	4730.96	707.40
370	6975.08	4806.43	707.56
371	6968.88	4115.28	711.59
372	6968.36	4775.34	703.34
373	6968.42	4763.12	703.64
374	6968.16	4400.04	715.21
375	6965.86	4000.76	699.50
376	6964.10	4399.92	713.24
377	6963.50	3991.80	699.03
378	6963.46	3967.48	692.93
379	6963.16	4099.61	704.37
380	6962.80	3912.77	699.27
381	6962.62	3940.12	690.15
382	6962.22	4475.47	716.26
383	6961.92	4465.42	716.26
384	6959.43	4754.58	708.44
385	6958.76	4777.46	708.22
386	6957.11	3946.91	688.21
387	6956.97	4481.12	713.31
388	6956.57	4462.26	713.65
389	6950.99	3897.78	710.30
390	6950.47	4493.93	710.06
391	6946.04	4115.61	713.71
392	6942.30	3908.31	711.10
393	6940.62	4488.36	715.22
394	6940.35	4500.13	714.92
395	6939.91	4049.19	713.58
396	6939.25	4010.36	713.07
397	6934.41	3990.23	713.16
398	6930.67	4000.35	713.40
399	6884.02	3931.75	713.30
417	7782.10	4390.40	731.94
418	7761.13	4390.32	732.40
419	7761.00	4600.01	718.50
420	7753.82	4199.95	717.94
421	7732.60	4894.91	699.55
422	7740.00	4600.03	718.91
423	7732.30	4200.02	718.40
424	7725.50	4010.22	704.00
425	7711.41	4888.52	700.33
426	7716.99	4832.51	704.01
427	7702.84	4004.19	704.01
428	7695.84	4599.83	704.01
429	7689.91	4199.94	704.04
430	7677.48	4391.51	703.95
431	7714.12	3881.21	707.31
432	7700.03	3791.44	727.68
433	7697.90	3820.53	727.73
434	7621.62	3888.07	705.11
435	7599.93	3777.23	732.59
436	7597.86	3806.43	732.54
437	7513.73	3889.89	704.75
438	7513.71	3806.44	732.71
439	7512.45	3889.97	704.05
440	7512.37	3804.39	732.72
441	7510.95	3806.40	732.73
442	7511.03	3889.93	704.71
443	7400.02	3806.26	732.88
444	7399.96	3777.44	732.79
445	7399.90	3891.27	704.52
446	7344.53	3890.51	704.87
447	7344.50	3806.51	732.97
448	7340.50	3890.54	702.79
449	7340.44	3800.39	732.92
450	7337.49	3890.68	702.87
451	7337.49	3800.40	732.96
452	7333.57	3890.60	704.87
453	7333.57	3806.44	732.95
454	7200.10	3777.43	733.07
455	7200.01	3806.54	733.10
456	7199.87	3888.84	705.69
457	7105.92	3888.52	705.88
458	7083.23	3806.50	733.20
459	7081.19	3777.43	733.23
460	7046.70	3884.56	705.91
461	7006.18	3880.47	706.46
462	6983.16	3820.46	726.38
463	6961.70	3940.95	690.00
488	6963.57	3908.98	690.03
489	6964.01	4033.16	698.04
490	6963.52	3991.72	696.00
491	6960.96	3967.50	690.04
492	6961.05	3954.84	689.98
493	6961.70	3940.95	690.00

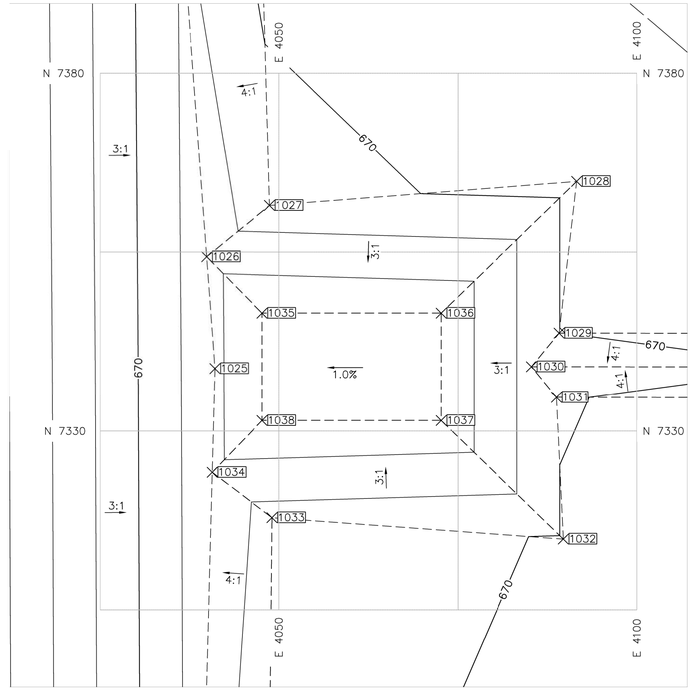
AS-BUILT SECONDARY CLAY POINTS TABLE

POINT NO.	NORTHING	EASTING	AS-BUILT ELEVATION	SECONDARY CLAY THICKNESS
500	7775.91	4389.83	738.03	> 3.0'
501	7764.76	4499.88	731.05	> 3.0'
502	7762.29	4299.91	731.45	> 3.0'
503	7760.64	4390.34	738.40	> 3.0'
504	7754.62	4600.06	724.62	> 3.0'
505	7749.70	4499.96	731.34	> 3.0'
506	7747.31	4200.09	724.10	> 3.0'
507	7746.95	4299.99	731.75	> 3.0'
508	7744.57	4699.92	718.23	> 3.0'
509	7739.61	4599.99	724.94	> 3.0'
510	7734.62	4800.00	711.79	> 3.0'
511	7733.28	4850.67	708.47	> 3.0'
512	7732.38	4100.07	716.74	> 3.0'
513	7731.75	4200.02	724.41	> 3.0'
514	7730.08	4886.71	706.13	> 3.0'
515	7730.09	4848.11	708.70	> 3.0'
516	7729.47	4699.95	718.51	> 3.0'
517	7722.31	4885.67	706.36	> 3.0'
518	7719.39	4799.99	712.10	> 3.0'
519	7717.52	4000.01	709.39	> 3.0'
520	7716.85	3931.46	698.55	> 3.0'
521	7716.88	4100.08	717.05	> 3.0'
522	7712.19	3964.30	706.77	> 3.0'
523	7711.67	4876.54	707.20	> 3.0'
524	7706.42	3856.21	722.72	> 3.0'
525	7704.03	3914.94	703.47	> 3.0'
526	7702.93	3904.21	706.91	> 3.0'
527	7701.76	4000.03	709.69	> 3.0'
528	7700.05	4200.05	713.81	> 3.0'
529	7700.00	4300.06	716.12	> 3.0'
530	7700.09	4400.03	717.92	> 3.0'
531	7700.04	4499.92	714.86	> 3.0'
532	7700.10	4599.93	711.79	> 3.0'
533	7700.10	4700.01	708.74	> 3.0'
534	7700.02	4800.08	705.69	> 3.0'
535	7699.42	3800.46	730.75	> 3.0'
536	7698.71	3809.38	733.74	> 3.0'
537	7697.84	3821.41	733.73	> 3.0'
538	7696.93	3966.66	707.25	> 3.0'
539	7695.77	4877.55	701.88	> 3.0'
540	7670.86	3929.05	697.64	> 3.0'
541	7637.38	4869.89	682.70	> 3.0'
542	7630.79	4877.16	680.32	> 3.0'
543	7625.10	4876.83	681.72	> 3.0'
544	7621.02	4800.11	679.45	> 3.0'
545	7615.19	4800.02	680.87	> 3.0'
546	7608.54	4699.99	678.33	> 3.0'
547	7602.60	4700.12	679.77	> 3.0'
548	7600.03	3899.95	707.56	> 3.0'
549	7599.99	3995.53	675.62	> 3.0'
550	7600.03	4100.00	678.09	> 3.0'
551	7600.00	4200.05	680.48	> 3.0'
552	7600.14	4300.02	682.84	> 3.0'
553	7600.01	4400.02	684.71	> 3.0'
554	7599.97	4879.85	682.57	> 3.0'
555	7599.30	3786.28	735.59	> 3.0'
556	7598.65	3795.16	738.59	> 3.0'
557	7597.81	3807.37	738.59	> 3.0'
558	7595.90	4599.93	677.20	> 3.0'
559	7589.95	4600.08	678.67	> 3.0'
560	7583.30	4500.05	676.09	> 3.0'
561	7577.23	4500.03	677.60	> 3.0'
562	7573.74	4212.22	672.05	> 3.0'
563	7571.71	4299.99	673.44	> 3.0'
564	7571.68	4099.90	668.67	> 3.0'
565	7570.35	4023.24	666.36	> 3.0'
566	7569.47	4391.26	674.88	> 3.0'
567	7567.84	4212.41	673.54	> 3.0'
568	7565.78	4100.00	670.14	> 3.0'
569	7565.62	4300.07	674.94	> 3.0'
570	7564.48	4031.13	668.05	> 3.0'
571	7563.48	4391.95	676.38	> 3.0'
572	7513.95	4027.67	665.15	> 3.0'
573	7513.78	3899.89	707.73	> 3.0'
574	7513.81	3807.18	738.70	> 3.0'
575	7512.45	4027.66	664.41	> 3.0'
576	7512.34	3900.04	707.04	> 3.0'
577	7512.46	4049.04	670.36	> 3.0'
578	7512.35	3805.36	738.70	> 3.0'
579	7511.07	4027.56	665.08	> 3.0'
580	7511.02	3899.95	707.72	> 3.0'
581	7511.05	3807.29	738.70	> 3.0'
582	7510.78	4049.58	669.78	> 3.0'
583	7509.43	4049.60	670.38	> 3.0'
584	7508.15	4100.07	672.08	> 3.0'
585	7506.93	4100.02	671.46	> 3.0'
586	7505.59	4099.94	672.08	> 3.0'
587	7500.01	3795.24	738.73	> 3.0'
588	7500.01	3807.31	738.72	> 3.0'
589	7499.95	3786.38	735.72	> 3.0'
590	7499.84	4206.87	675.67	> 3.0'
591	7499.95	4299.95	677.12	> 3.0'
592	7499.88	4399.90	678.59	> 3.0'
593	7499.92	4499.98	680.10	> 3.0'
594	7499.95	4599.90	681.64	> 3.0'
595	7499.98	4699.96	683.11	> 3.0'
596	7500.06	4800.06	684.62	> 3.0'
597	7499.82	4891.32	686.00	> 3.0'
598	7498.69	4206.76	675.04	> 3.0'
599	7498.54	4300.02	676.45	> 3.0'
600	7498.57	4399.87	677.97	> 3.0'
601	7498.60	4500.01	679.49	> 3.0'
602	7498.62	4599.96	680.99	> 3.0'
603	7498.71	4700.00	682.50	> 3.0'
604	7498.57	4800.01	684.00	> 3.0'
605	7498.58	4891.27	685.39	> 3.0'
606	7497.39	4206.67	675.66	> 3.0'
607	7497.20	4299.99	677.06	> 3.0'
608	7497.35	4400.08	678.60	> 3.0'
609	7497.34	4500.00	680.08	> 3.0'
610	7497.40	4599.98	681.61	> 3.0'
611	7497.37	4699.97	683.10	> 3.0'
612	7497.40	4799.96	684.65	> 3.0'
613	7497.28	4891.21	685.98	> 3.0'
614	7399.98	3786.35	735.85	> 3.0'
615	7399.96	3795.29	738.85	> 3.0'
616	7400.09	3807.42	738.84	> 3.0'
617	7400.02	3900.01	707.93	> 3.0'
618	7400.08	4036.00	662.63	> 3.0'
619	7399.95	4099.96	667.48	> 3.0'
620	7399.97	4199.34	671.18	> 3.0'
621	7400.10	4300.01	672.67	> 3.0'
622	7399.88	4400.11	674.19	> 3.0'
623	7400.10	4500.03	675.70	> 3.0'
624	7400.02	4599.89	677.22	> 3.0'
625	7400.01	4700.05	678.71	> 3.0'
626	7399.99	4800.09	680.24	> 3.0'
627	7399.91	4877.44	681.40	> 3.0'
628	7398.70	4048.04	665.52	> 3.0'
629	7343.92	4195.35	668.56	> 3.0'
630	7343.86	4299.94	670.14	> 3.0'
631	7343.96	4400.02	671.66	> 3.0'
632	7343.74	4500.14	673.16	> 3.0'
633	7343.78	4599.98	674.67	> 3.0'
634	7343.78	4699.93	676.19	> 3.0'
635	7343.85	4799.96	677.71	> 3.0'
636	7343.90	4867.21	678.70	> 3.0'
637	7343.71	3900.00	708.05	> 3.0'
638	7343.89	3807.44	738.92	> 3.0'
639	7343.87	4100.06	665.35	> 3.0'
640	7339.97	3899.92	706.07	> 3.0'
641	7339.98	3801.31	738.94	> 3.0'
642	7338.96	4100.04	664.17	> 3.0'
643	7338.76	4194.97	667.35	> 3.0'
644	7338.84	4299.96	668.96	> 3.0'
645	7338.89	4400.03	670.46	> 3.0'
646	7338.84	4500.05	671.97	> 3.0'
647	7338.84	4599.87	673.46	> 3.0'
648	7338.87	4700.02	674.97	> 3.0'
649	7338.91	4800.02	676.47	> 3.0'
650	7338.83	4866.70	677.49	> 3.0'
651	7338.23	3900.04	706.06	> 3.0'
652	7338.34	3801.39	738.93	> 3.0'
653	7334.65	4100.03	665.24	> 3.0'
654	7334.31	4195.38	668.45	> 3.0'
655	7334.42	4299.95	670.02	> 3.0'
656	7334.55	4400.01	671.56	> 3.0'
657	7334.41	4499.99	673.03	> 3.0'
658	7334.40	4600.09	674.54	> 3.0'
659	7334.35	4700.05	676.09	> 3.0'
660	7334.47	4800.03	677.56	> 3.0'
661	7334.57	4866.74	678.57	> 3.0'
662	7334.34	3900.00	708.10	> 3.0'
663	7334.26	3807.42	738.93	> 3.0'
664	7300.05	3795.29	738.99	> 3.0'
665	7299.99	3807.42	738.97	> 3.0'
666	7299.91	3899.91	708.12	> 3.0'
667	7299.93	4039.54	661.62	> 3.0'
668	7299.90	4049.21	664.04	> 3.0'
669	7299.98	4099.95	665.73	> 3.0'
670	7299.98	4197.90	669.17	> 3.0'
671	7299.94	4299.89	670.70	> 3.0'
672	7300.20	4399.94	672.21	> 3.0'
673	7299.96	4500.15	673.72	> 3.0'
674	7299.94	4599.91	675.23	> 3.0'
675	7299.93	4699.93	676.76	> 3.0'
676	7299.97	4799.94	678.26	> 3.0'
677	7300.00	4867.44	679.26	> 3.0'
678	7300.07	3786.28	736.00	> 3.0'
679	7227.65	4868.84	680.75	> 3.0'
680	7225.68	4792.66	679.62	> 3.0'
681	7199.93	3786.53	736.09	> 3.0'
682	7200.00	3795.39	739.09	> 3.0'
683	7199.99	3807.46	739.11	> 3.0'
684	7200.09	3899.95	708.25	> 3.0'
685	7199.95	3999.97	674.92	> 3.0'
686	7199.94	4036.93	662.65	> 3.0'
687	7200.07	4049.77	665.82	> 3.0'
688	7179.12	4206.95	671.74	> 3.0'
689	7179.15	4299.98	673.11	> 3.0'
690	7179.12	4399.94	674.63	> 3.0'
691	7178.99	4500.00	676.16	> 3.0'
692	7178.95	4600.12	677.66	> 3.0'
693	7179.00	4699.99	679.15	> 3.0'
694	7178.75	4794.60	680.59	> 3.0'
695	7170.65	4099.93	668.13	> 3.0'
696	7166.84	4050.13	666.44	> 3.0'
697	7150.23	4266.61	672.04	> 3.0'
698	7146.78	4300.04	672.48	> 3.0'
699	7144.75	4209.91	671.07	> 3.0'
700	7142.29	4266.02	670.05	> 3.0'
701	7139.06	4299.96	670.57

$DATE$







AS-BUILT SUBGRADE SUMP

POINT NO.	NORTHING	EASTING	AS-BUILT ELEVATION
400	7354.67	4039.24	658.37
401	7363.05	4049.44	661.34
402	7366.49	4093.00	662.90
403	7343.72	4090.42	661.98
404	7338.91	4086.43	660.68
405	7334.62	4090.07	661.92
406	7313.45	4091.06	662.21
407	7316.39	4049.82	660.80
408	7323.95	4040.03	658.17
409	7344.50	4046.24	656.19
410	7343.30	4050.61	654.65
411	7343.23	4069.01	654.91
412	7334.69	4069.16	654.96
413	7334.58	4050.64	654.80
414	7333.62	4046.22	656.21
415	7337.65	4050.52	654.73
416	7340.56	4050.50	654.65

AS-BUILT SECONDARY SUMP

POINT NO.	NORTHING	EASTING	AS-BUILT ELEVATION	SECONDARY CLAY THICKNESS
777	7354.45	4039.41	661.57	> 3.0'
778	7362.45	4049.08	664.30	> 3.0'
779	7365.89	4092.45	665.86	> 3.0'
780	7343.72	4089.88	665.01	> 3.0'
781	7339.02	4085.98	663.73	> 3.0'
782	7334.84	4089.46	664.89	> 3.0'
783	7313.96	4090.51	665.23	> 3.0'
784	7317.02	4049.40	663.81	> 3.0'
785	7324.16	4040.12	661.36	> 3.0'
786	7342.73	4051.10	657.78	> 3.0'
787	7342.73	4068.61	657.93	> 3.0'
788	7335.20	4068.65	657.93	> 3.0'
789	7335.17	4050.98	657.75	> 3.0'
790	7334.29	4046.64	659.21	> 3.0'
791	7338.32	4050.97	657.76	> 3.0'
792	7339.86	4050.99	657.75	> 3.0'
793	7343.89	4046.63	659.23	> 3.0'

AS-BUILT PRIMARY SUMP

POINT NO.	NORTHING	EASTING	AS-BUILT ELEVATION	PRIMARY CLAY THICKNESS
1025	7338.6975	4040.6801	666.4848	> 5.0'
1026	7354.416	4039.5217	666.8372	> 5.0'
1027	7361.469	4048.3379	669.3355	> 5.0'
1028	7364.7821	4091.2966	670.8299	> 5.0'
1029	7343.6843	4088.8583	669.9901	> 5.0'
1030	7339.0199	4084.9395	668.6882	> 5.0'
1031	7334.811	4088.4726	669.8514	> 5.0'
1032	7314.9787	4089.4972	670.2524	> 5.0'
1033	7317.9809	4048.7875	668.8203	> 5.0'
1034	7324.2228	4040.4612	666.5639	> 5.0'
1035	7346.5355	4047.3344	664.2459	> 5.0'
1036	7346.5064	4072.305	664.4882	> 5.0'
1037	7331.3962	4072.2467	664.5759	> 5.0'
1038	7331.478	4047.3197	664.2508	> 5.0'

MSG

GRAPHIC SCALE
0' 5' 10' 20'

NO.	DATE	BY	DESCRIPTION

DRAWN RAR DATE 11/30/12
CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

CLIENT
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

SUMP
AS-BUILT DRAWING
MASTER CELL VI-G - PHASE I

G

$FILE$

1/21/2013

W:\Projects\Projects A-E\E1560001\CAD\AS-BUILT DRAWINGS FINAL\H-SECONDARY PANEL AS-BUILT.dgn

MC IV (CLOSED)

MC I (CLOSED)

WILLOW RUN AIRPORT

PAVED ROAD

FENCE

SITE BOUNDARY

TRANSFER BOX

ASPHALT DRIVE

BLDG.

E 3600 E 3800 E 4000 E 4200 E 4400 E 4600 E 4800

N 7800 N 7600 N 7400 N 7200 N 7000

LEGEND

S-85 PANEL NUMBER

DP-71 ■ DESTRUCT NUMBER AND LOCATION

R175 ▲ REPAIR NUMBER AND LOCATION

1" = 50'

GRAPHIC SCALE

0' 25' 50' 100'

NO.	DATE	BY	DESCRIPTION
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

DRAWN RAR DATE 11/30/12

CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.

Civil Engineering, Surveying and Environmental Consulting

CLIENT

WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

SECONDARY GEOMEMBRANE
RECORD DRAWING
MASTER CELL VI-G - PHASE I

H

MC IV (CLOSED)

MC I (CLOSED)

WILLOW RUN AIRPORT

PAVED ROAD

FENCE

SITE BOUNDARY

E 3600 E 3800 E 4000 E 4200 E 4400 E 4600 E 4800 E 5000

N 7800 N 7600 N 7400 N 7200 N 7000

P-70 P-71 P-72 P-73 P-74 P-75 P-76 P-77 P-78 P-79 P-80 P-81 P-82 P-165 P-166 P-164 P-163 P-162 P-161 P-160 P-105 P-104 P-103 P-102 P-101 P-100 P-99 P-98 P-97 P-96 P-95 P-94 P-93 P-92 P-91

P-63 P-62 P-61 P-60 P-59 P-58 P-57 P-56 P-55 P-54 P-53 P-52 P-51 P-50 P-49 P-48 P-37 P-36 P-35 P-34 P-33 P-32 P-31 P-30 P-29 P-28 P-27 P-26 P-25 P-24 P-23 P-22 P-21 P-106 P-107 P-108 P-109 P-110 P-111 P-112 P-154 P-155 P-157 P-158 P-156 P-159

P-84 P-83 P-47 P-46 P-45 P-44 P-43 P-42 P-41 P-40 P-39 P-38 P-20 P-19 P-18 P-17 P-16 P-15 P-14 P-13 P-12 P-11 P-10 P-9 P-8 P-7 P-6 P-5 P-4 P-3 P-2 P-1

P-90 P-89 P-88 P-87 P-86 P-85 P-174 P-172 P-170 P-168 P-167 P-153 P-152 P-151 P-150 P-149 P-147 P-148 P-146 P-145 P-144 P-143 P-142 P-141 P-169 P-171 P-139 P-140 P-138 P-136 P-134 P-131 P-129 P-128 P-126 P-124 P-122 P-120 P-118 P-116 P-115 P-113 P-111 P-117 P-119 P-121 P-123 P-125 P-127 P-130 P-133 P-135 P-137

LEGEND

P-85 PANEL NUMBER

DP-4 R10 DESTRUCT NUMBER AND LOCATION

R17 REPAIR NUMBER AND LOCATION

CAP STRIP

1" = 50'

GRAPHIC SCALE

0' 25' 50' 100'

NO.	DATE	BY	DESCRIPTION
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

DRAWN RAR DATE 11/30/12

CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

CLIENT
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

PRIMARY GEOMEMBRANE
RECORD DRAWING
MASTER CELL VI-G - PHASE I

I

1/21/2013

W:\Projects\Projects A-E\E1560001\CAD\AS-BUILT DRAWINGS FINAL\I-PRIMARY PANEL AS-BUILT.dgn

MC IV (CLOSED)

E 3600 E 3800 E 4000 E 4200 E 4400 E 4600 E 4800 E 5000

N 7800 N 7600 N 7400 N 7200 N 7000

WILLOW RUN AIRPORT

PAVED ROAD

FENCE

SITE BOUNDARY

6" SOLID LDS – SDR 11

18" SOLID LDS RISER – SDR 11

8 / M

6 / M

1 / K

TRANSFER BOX

ASPHALT DRIVE

BLDG.

MSG

1" = 50'
GRAPHIC SCALE
0' 25' 50' 100'

MOUND SAND OVER RISER PIPES TO MAINTAIN MIN. 1' THICKNESS

18" DIA. HDPE SDR 11 PRIMARY LEACHATE REMOVAL PIPE

8" DIA. HDPE SDR 7.3 LEACHATE CLEANOUT RISER

20" DIA. HDPE SDR 11 AUXILIARY LEACHATE REMOVAL PIPE

MIN. 1' LCS SAND

GEOCOMPOSITE

PRIMARY GEOMEMBRANE

MIN. 5' PRIMARY CLAY LINER

GEOCOMPOSITE

SECONDARY GEOMEMBRANE

MIN. 3.0' SECONDARY CLAY LINER

18" DIA. HDPE SDR 11 LEAK DETECTION PIPE

BACKFILL WITH MANUALLY COMPACTED CLAY

DEPRESS SUBGRADE AS REQUIRED TO PLACE LDS RISER PIPE

1 / J SECTION THROUGH SUMP RISER
NOT TO SCALE

LEGEND

AS-BUILT LEAK DETECTION PIPE

690 AS-BUILT SECONDARY CONTOUR (2' INTERVAL)

NO.	DATE	BY	DESCRIPTION

DRAWN RAR DATE 11/30/12
CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

CLIENT
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

LEAK DETECTION SYSTEM (LDS) AS-BUILT
MASTER CELL VI-G - PHASE I

J

1/21/2013

W:\Projects\Projects A-E\E156000\CAD\AS-BUILT DRAWINGS FINAL\K-LDS AS-BUILT PLAN.dgn

$DATE$

$FILE1$

MC IV (CLOSED)

MC I (CLOSED)

WILLOW RUN AIRPORT

PAVED ROAD

FENCE

SITE BOUNDARY

ASPHALT DRIVE

TRANSFER BOX

BLDG.

18" LCS AUXILIARY RISER

8" PERFORATED LCS PIPE - SDR 7.3

8" SOLID LEACHATE CLEANOUT PIPE

8" LEACHATE CLEANOUT - SDR

18" LCS SUMP RISER

20" AUXILIARY LEACHATE REMOVAL - SRR

E 3600 E 3800 E 4000 E 4200 E 4400 E 4600 E 4800

N 7800 N 7600 N 7400 N 7200 N 7000

LEGEND

- 8" PERFORATED LEACHATE COLLECTION PIPE
- 8" SOLID CLEANOUT
- 18" SOLID CLEANOUT
- 20" SOLID CLEANOUT
- 690 AS-BUILT PRIMARY CONTOUR (2' INTERVAL)

NO.	DATE	BY	DESCRIPTION

DRAWN RAR DATE 11/30/12

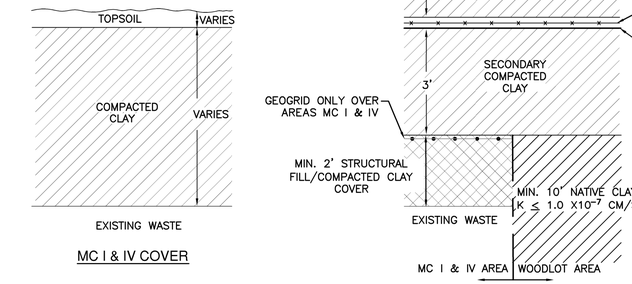
CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

CLIENT
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

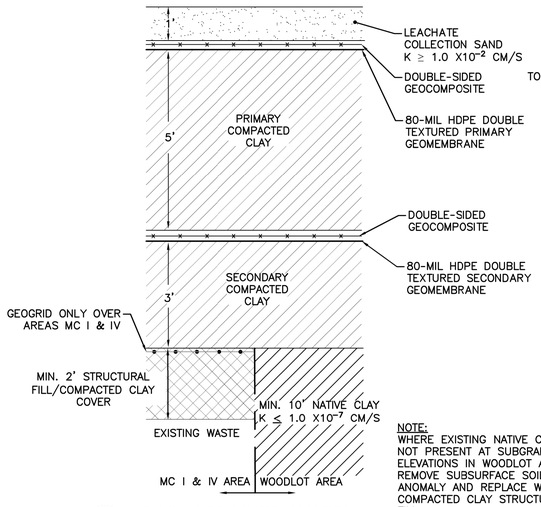
LEACHATE COLLECTION SYSTEM (LCS) AS-BUILT
MASTER CELL VI-G - PHASE I

K



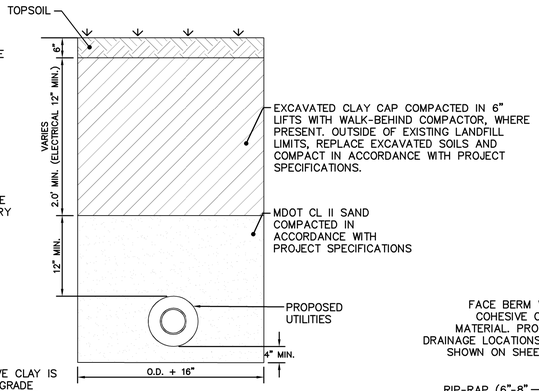
MC I & IV COVER

1 L EXISTING COVER DETAIL
NOT TO SCALE

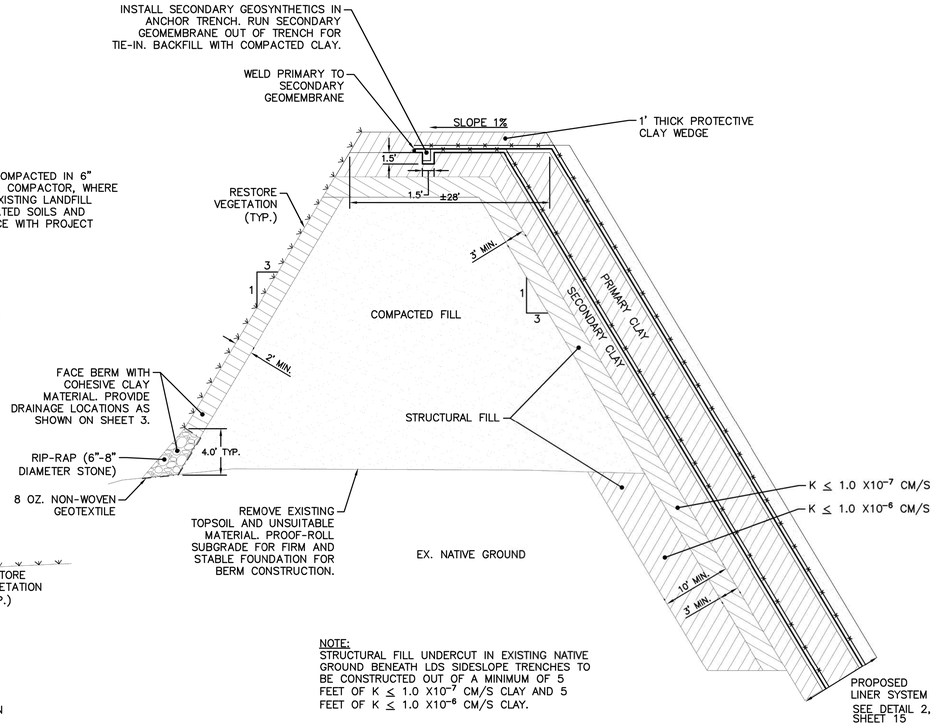


2 L PROPOSED LINER SYSTEM
NOT TO SCALE

NOTE:
WHERE EXISTING NATIVE CLAY IS NOT PRESENT AT SUBGRADE ELEVATIONS IN WOODLOT AREA, REMOVE SUBSURFACE SOIL ANOMALY AND REPLACE WITH COMPACTED CLAY STRUCTURAL FILL.

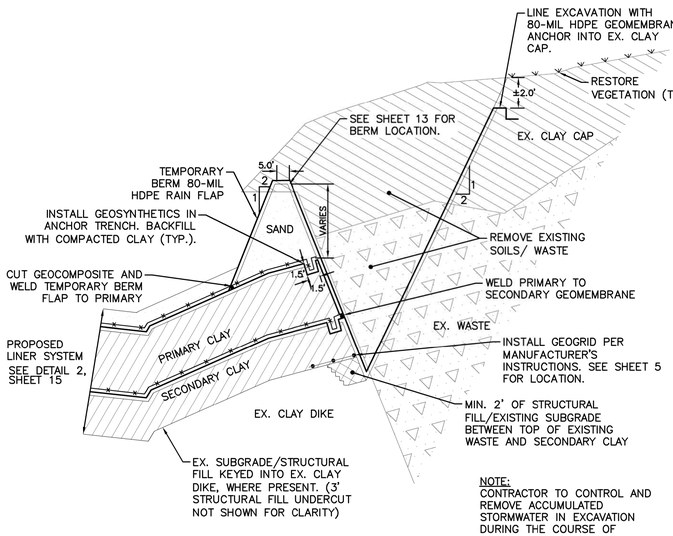


3 L UTILITY TRENCH
NOT TO SCALE



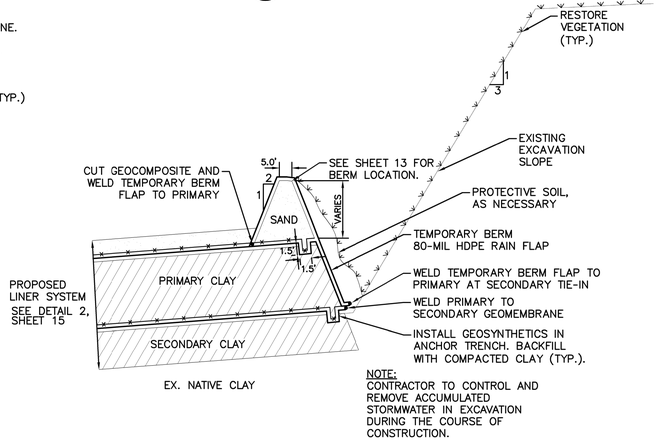
NOTE:
STRUCTURAL FILL UNDERCUT IN EXISTING NATIVE GROUND BENEATH LDS SIDESLOPE TRENCHES TO BE CONSTRUCTED OUT OF A MINIMUM OF 5 FEET OF K ≤ 1.0 X10⁻⁷ CM/S CLAY AND 5 FEET OF K ≤ 1.0 X10⁻⁶ CM/S CLAY.

4 L SECTION THROUGH WEST DIKE
NOT TO SCALE



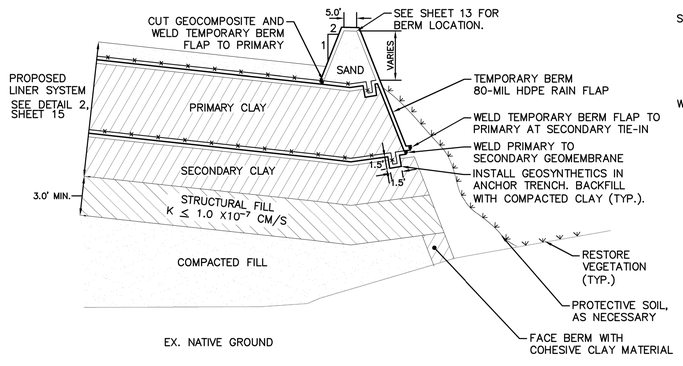
NOTE:
CONTRACTOR TO CONTROL AND REMOVE ACCUMULATED STORMWATER IN EXCAVATION DURING THE COURSE OF CONSTRUCTION.

5 L SECTION THROUGH TRANSFER TRENCH
NOT TO SCALE

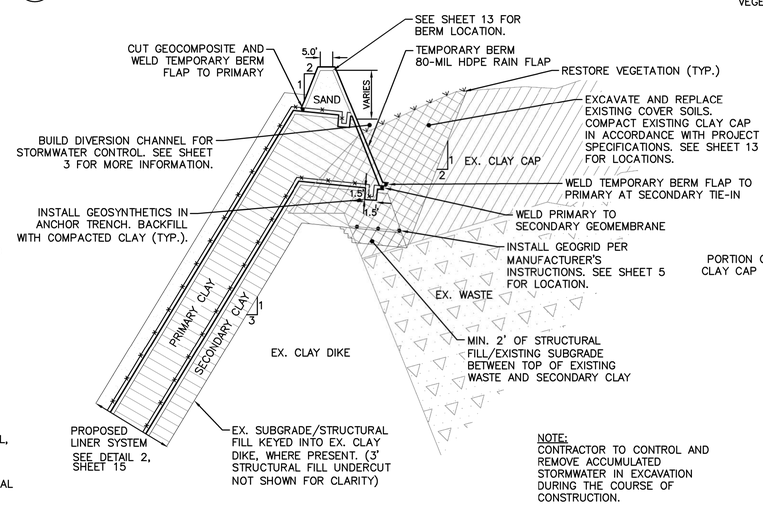


NOTE:
CONTRACTOR TO CONTROL AND REMOVE ACCUMULATED STORMWATER IN EXCAVATION DURING THE COURSE OF CONSTRUCTION.

6 L SECTION THROUGH EAST TEMPORARY BERM
NOT TO SCALE

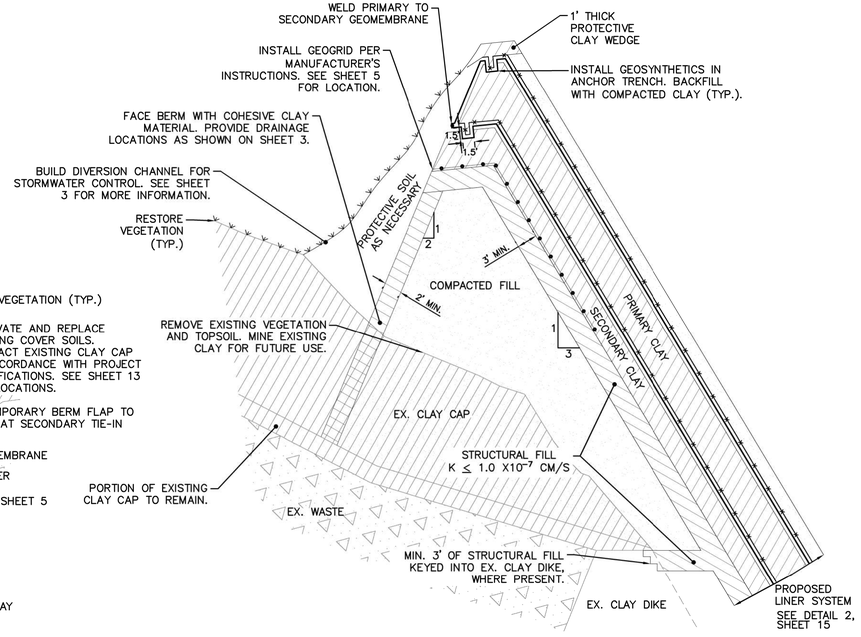


7 L SECTION THROUGH SIDESLOPE TEMPORARY BERM
NOT TO SCALE



NOTE:
CONTRACTOR TO CONTROL AND REMOVE ACCUMULATED STORMWATER IN EXCAVATION DURING THE COURSE OF CONSTRUCTION.

8 L SECTION THROUGH SOUTH LINER TERMINATION
NOT TO SCALE



9 L SECTION THROUGH NORTH-SOUTH LINER TERMINATION
NOT TO SCALE

NO.	DESCRIPTION	DATE	BY

DRAWN RAR DATE 11/30/12
CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.
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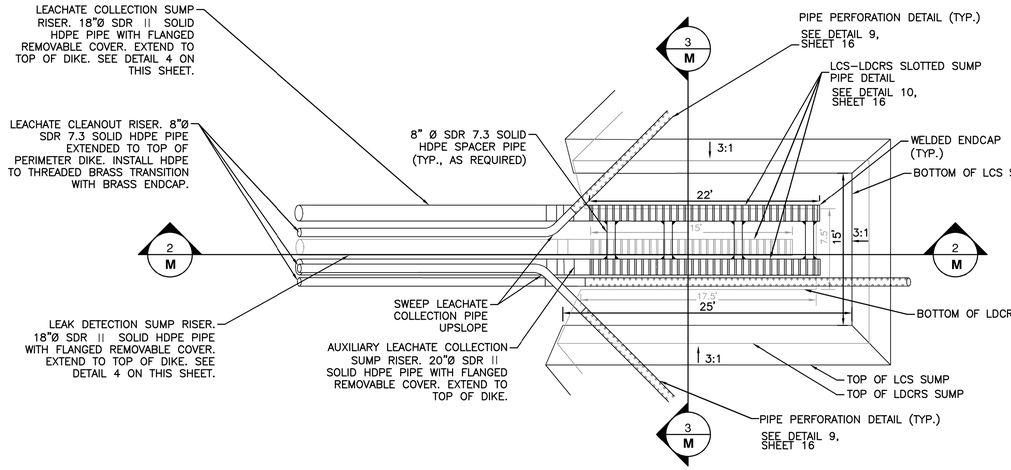
CLIENT
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

AS-BUILT DETAILS (1 OF 2)
MASTER CELL VI-G - PHASE I

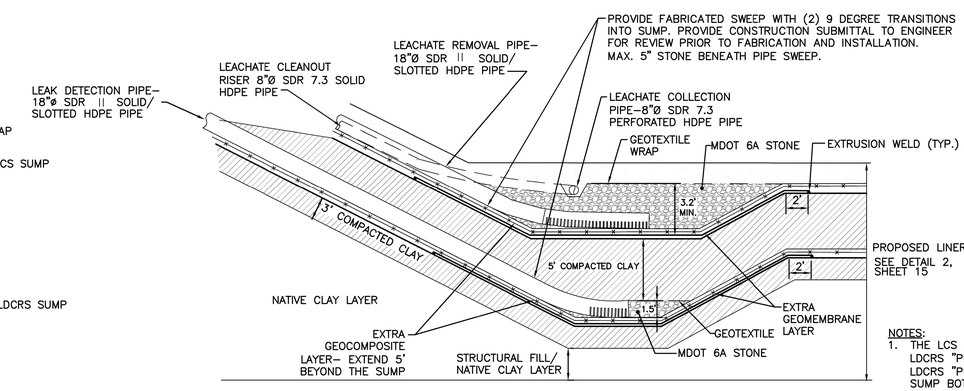
L

1/21/2013

W:\Projects\Projects A-E\E156001\CAD\AS-BUILT DRAWINGS FINAL\M-DETAILS (1 OF 2).dgn

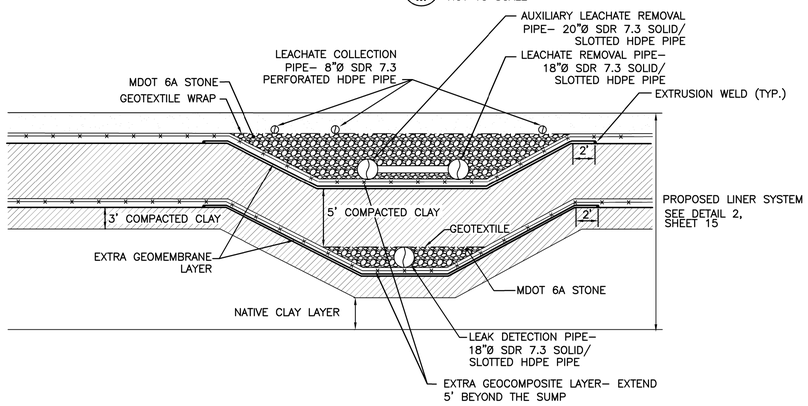


1 M LCS-LDCRS SUMP
NOT TO SCALE

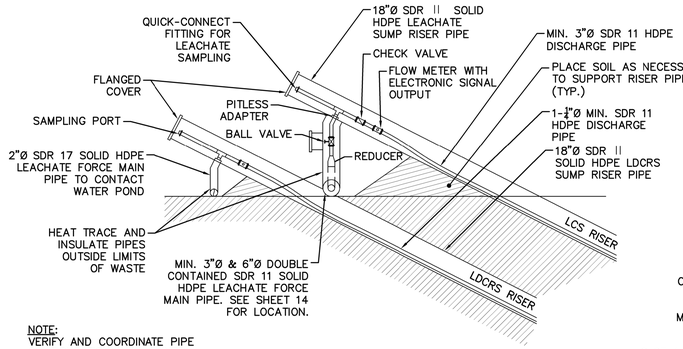


NOTES:
1. THE LCS AND LDCRS PUMP ELEVATIONS ARE:
   LDCRS "PUMP–ON" ELEV= TOP OF LDCRS SUMP
   LDCRS "PUMP–OFF" ELEV= 0.5 FOOT ABOVE LDCRS SUMP BOTTOM
   LCS "PUMP–ON" ELEV= AT LCS PIPE INVERT
   LCS "PUMP–OFF ELEV= 1 FOOT ABOVE LCS SUMP BOTTOM
2. OTHER "PUMP–ON"/"PUMP–OFF" CONTROLS MAY BE USED PROVIDED LESS THAN 1 FOOT OF LEACHATE HEAD ON THE LINER IS MAINTAINED.

2 M SUMP CROSS-SECTION
NOT TO SCALE

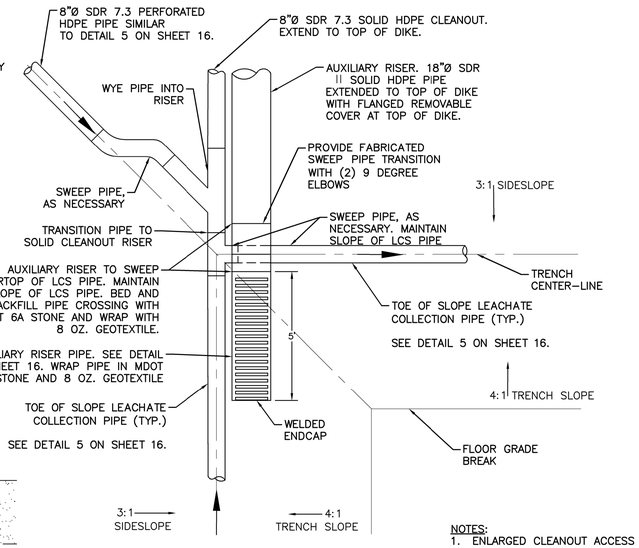


3 M SUMP CROSS-SECTION
NOT TO SCALE



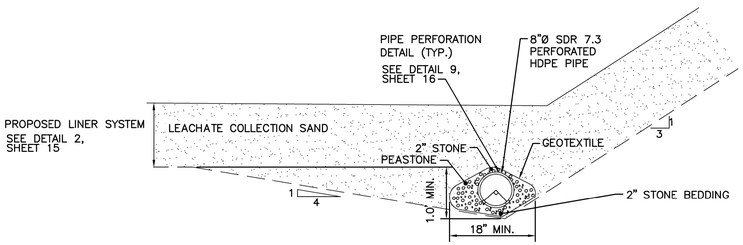
NOTE:
VERIFY AND COORDINATE PIPE CONFIGURATION WITH OWNER PRIOR TO INSTALLATION.

4 M LCS AND LDCRS RISER DETAIL
NOT TO SCALE

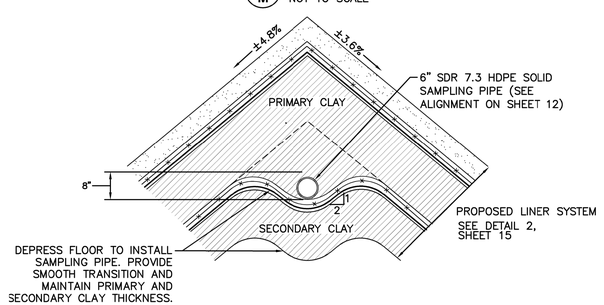


NOTES:
1. ENLARGED CLEANOUT ACCESS DETAIL IN NORTHWEST CORNER OF VI–G PHASE I IS MIRROR IMAGE.
2. CONTRACTOR SHALL PROVIDE CONSTRUCTION SUBMITTAL TO ENGINEER FOR REVIEW PRIOR TO FABRICATION AND INSTALLATION.

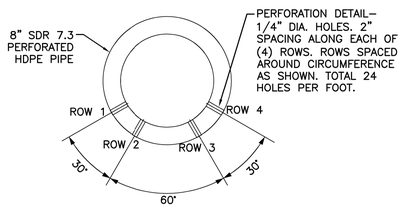
7 M ENLARGED CLEANOUT ACCESS
NOT TO SCALE



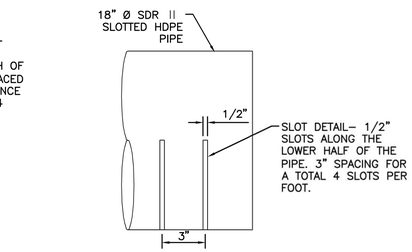
5 M TOE OF SLOPE LEACHATE COLLECTION PIPE (TYP.)
NOT TO SCALE



8 M MC VI-E PHASE I SAMPLING PIPE
NOT TO SCALE



9 M PIPE PERFORATION DETAIL (TYP.)
NOT TO SCALE



10 M LCS-LDCRS SLOTTED SUMP PIPE DETAIL
NOT TO SCALE

Geosynthetic Materials

Material	Location	Description	Product	Additional Requirements
80-mil Geomembrane	Primary and secondary liners	80-mil HDPE, textured both sides	GSE HD textured, or equivalent	Interface friction requirements in CQA Plan
Geocomposite	LCS and LDCRS	200-mil HDPE, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET, or equivalent	Transmissivity and interface friction requirements in CQA Plan
Geonet	LCS and LDCRS sumps, and LDCRS collectors	200-mil HDPE	GSE HYPERNET, or equivalent	Transmissivity requirements in CQA Plan
Geotextile	All geocomposites, gravel/geotextile envelopes for LCS	Nominal 8 oz/yd2, needle-punched, nonwoven polypropylene	Amoco 4508, Synthetic Industries Geotex 801, or equivalent	AASHTO M288-96 requirements for Drainage Geotextile (Class 2)
Geogrid	Above Subgrade	Biaxial Polymeric Grid	Huesker Fortrac 80-80, or equivalent	None

LCS denotes leachate collection system
LDCRS denotes leak detection, collection, and removal system

NO.	DATE	BY	DESCRIPTION

DRAWN RAR DATE 11/30/12
CHECKED CHS DATE 11/30/12

The Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

CLIENT
WAYNE DISPOSAL INC., SITE NO. 2
VAN BUREN TWP.
WAYNE COUNTY, MICHIGAN

AS-BUILT DETAILS (2 OF 2)
MASTER CELL VI-G - PHASE I

M

$DATE$
$FILE$

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL G1 EAST PHASE 1

RECORD PLAN

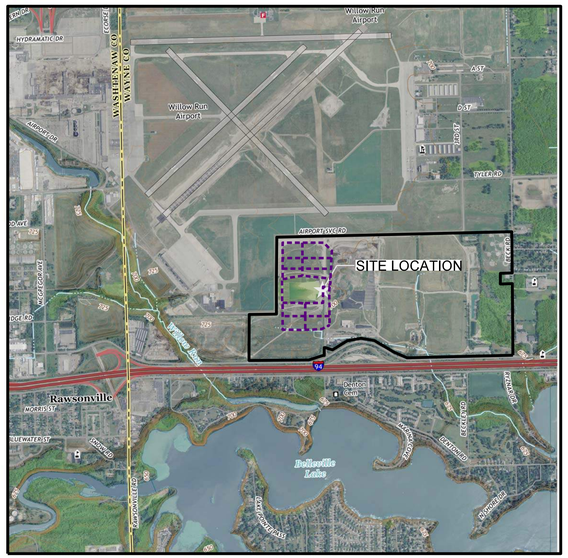
WAYNE DISPOSAL, INC. SITE NO. 2
MASTER CELL VI-G
SUBCELL G1-EAST PHASE I RECORD PLANS

VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CTI PROJECT NO. 1198070013

DECEMBER 2019

WAYNE COUNTY, MICHIGAN
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

LIST OF DRAWINGS

1	01	COVER SHEET
	02	SITE PLAN
	03	SUBGRADE RECORD CONTROL POINT PLAN
1	04	TOP OF SECONDARY COMPACTED CLAY LINER RECORD CONTROL POINT PLAN
1	05	SECONDARY GEOMEMBRANE LINER AND LEAK DETECTION GEONET RECORD PLAN
	06	TOP OF PRIMARY COMPACTED CLAY LINER RECORD CONTROL POINT PLAN
	07	PRIMARY GEOMEMBRANE LINER RECORD PLAN
	08	TOP OF PRIMARY GRADE RAIN FLAP BERM RECORD CONTROL POINT PLAN
1	09	TOP OF LEACHATE COLLECTION SAND LAYER AND LEACHATE COLLECTION PIPE RECORD CONTROL POINT PLAN
	10	LINER SYSTEM DETAILS (1 OF 4)
	11	LINER SYSTEM DETAILS (2 OF 4)
1	12	LINER SYSTEM DETAILS (3 OF 4)
	13	LINER SYSTEM DETAILS (4 OF 4)

OWNER:
US Ecology
49350 N. I-94 Service Drive
Belleville, Michigan 48111

ENGINEER:
CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiomnplanies.com

DATE: 12-05-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN. APP
0	12-05-19	ISSUED FOR RECORD DRAWINGS	PAA XZ
1	2-12-20	G1 TO G1 EAST PHASE 1 LEACHATE COLLECTION SYSTEM CONNECTION	PAA XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

COVER SHEET

PROJECT NUMBER
1198070013

SCALE

DRAWING NO
01

001 WDI G1E RECORD COV 02-12-20 R1.dgn 2/13/2020 10:47:13 AM C:\Users\pab\Documents\CTI-2018\CTI\WDI\G1 EAST PHASE I RECORD DRAWINGS 10-10-19\001 WDI G1E RECORD COV 02-12-20 R1.dgr

MC6EP2-NE
MC6EP2-W
MC6EP2-SW
MC6 B
MC6 C
EDGE OF EGC COVER
6ESW LEACHATE SUMP AND CLEANOUT RISER CONTAINMENT BERM
6ESW LEAK DETECTION SUMP RISER
MC VI-G FUTURE SUBCELL G1-EAST PHASE 2
MC VI-G SUBCELL G1-EAST PHASE 1
MC VI-F FUTURE SUBCELL F3
MC VI-F FUTURE SUBCELL F4
MC VI-G FUTURE SUBCELL G3
MC VI-G EXISTING SUBCELL G1
MC VI-G FUTURE SUBCELL G6
MC VI-G FUTURE SUBCELL G7
MC VI-F FUTURE SUBCELL F2
MC VI-F FUTURE SUBCELL F1
MC VI-G EXISTING SUBCELL G2
MC VI-G FUTURE SUBCELL G4
MC VI-G FUTURE SUBCELL G5
N 9000
N 8500
N 8000
N 7500
N 7000
N 6500
N 6000
E 5000
E 4500
E 4000
E 3500

N

0 50' 100' 200'
SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED JANUARY 4, 2019, UPDATED WITH FIELD SURVEY DATED FEBRUARY 1, 2019, MARCH 4, 2019, APRIL 1, 2019, AND MAY 1, 2019.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS, PROVIDED BY NTH CONSULTANTS, LTD. ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING, SHEET 6, DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS". PROVIDED BY MIDWESTERN CONSULTING, INC. DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- N 6500 + GRID COORDINATES
- EXISTING STRUCTURE/ BUILDING
- PAVED GRAVEL EXISTING ROAD
- EXISTING FENCE
- APPROXIMATE 6B TOP OF PRIMARY LINER CREST OF SLOPE
- APPROXIMATE 6B TOP OF SECONDARY LINER CREST OF SLOPE
- G1 EAST PHASE 1 TOP OF SECONDARY LINER BREAK IN SLOPE
- 710 G1 EAST PHASE 1 TOP OF SECONDARY LINER CONTOUR (2 FT INTERVAL)
- G1 EAST PHASE 2 SUBGRADE/ SECONDARY BREAK IN SLOPE
- 710 G1 EAST PHASE 2 TOP OF SUBGRADE/ SECONDARY CONTOUR (2 FT INTERVAL)

CTI and Associates, Inc.
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Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiandassociates.com

DATE: 12-05-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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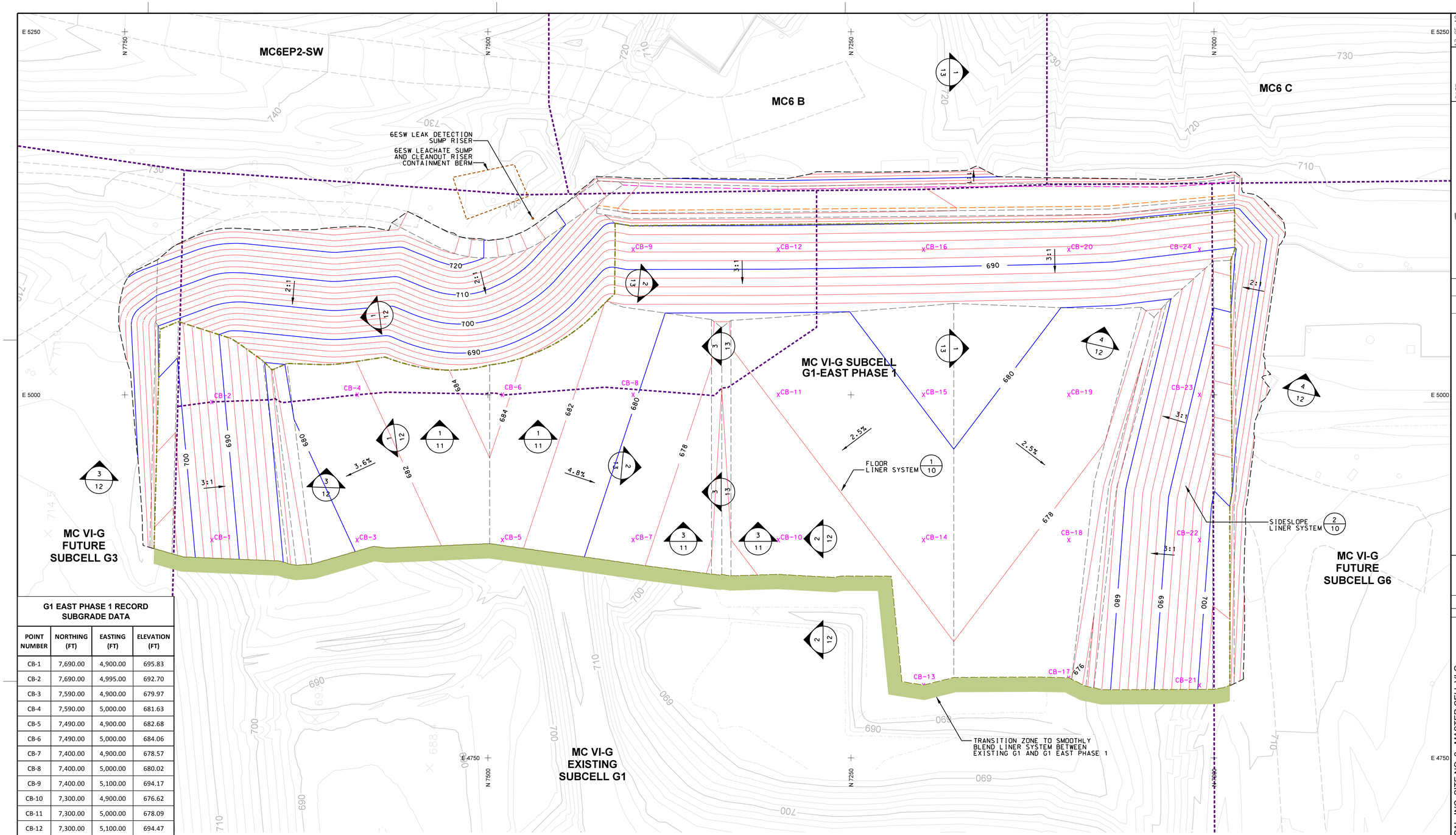
REVISIONS			
REV	DATE	REVISION DESCRIPTION	
0	12-05-19	ISSUED FOR RECORD DRAWINGS	PAA XZ
			DRN APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

SITE PLAN

PROJECT NUMBER 1198070013
SCALE 1" = 100'
DRAWING NO 02

002 WDI G1-EAST RECORD SITE PLAN 11-24-19.dgn 12/5/2019 5:58:11 PM C:\Users\pab\Documents\CTI-2018\CTI\WDI\G1 EAST PHASE I RECORD DRAWINGS 10-10-19\002 WDI G1-EAST RECORD SITE PLAN 11-24-19.dgn



G1 EAST PHASE 1 RECORD SUBGRADE DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
CB-1	7,690.00	4,900.00	695.83
CB-2	7,690.00	4,995.00	692.70
CB-3	7,590.00	4,900.00	679.97
CB-4	7,590.00	5,000.00	681.63
CB-5	7,490.00	4,900.00	682.68
CB-6	7,490.00	5,000.00	684.06
CB-7	7,400.00	4,900.00	678.57
CB-8	7,400.00	5,000.00	680.02
CB-9	7,400.00	5,100.00	694.17
CB-10	7,300.00	4,900.00	676.62
CB-11	7,300.00	5,000.00	678.09
CB-12	7,300.00	5,100.00	694.47
CB-13	7,200.00	4,800.00	677.02
CB-14	7,200.00	4,900.00	678.59
CB-15	7,200.00	5,000.00	680.10
CB-16	7,200.00	5,100.00	694.01
CB-17	7,100.00	4,805.00	675.95
CB-18	7,100.00	4,900.00	677.19
CB-19	7,100.00	5,000.00	678.66
CB-20	7,100.00	5,100.00	693.18
CB-21	7,010.00	4,800.00	700.25
CB-22	7,010.00	4,900.00	697.84
CB-23	7,010.00	5,000.00	691.45
CB-24	7,010.00	5,100.00	690.32

N

0 15' 30' 60'

SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED JANUARY 4, 2019, UPDATED WITH FIELD SURVEY DATED FEBRUARY 1, 2019, MARCH 4, 2019, APRIL 1, 2019, AND MAY 1, 2019.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS, PROVIDED BY NTH CONSULTANTS, LTD, ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING, SHEET 6, DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS". PROVIDED BY MIDWESTERN CONSULTING, INC. DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

LEGEND

- PHASE BOUNDARY
- N 6500 + GRID COORDINATES
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- EXISTING STRUCTURE/ BUILDING
- PAVED GRAVEL EXISTING ROAD
- EXISTING FENCE
- G1 EAST PHASE 1 SUBGRADE CERTIFICATION LIMIT
- G1 EAST PHASE 1 SUBGRADE EXCAVATION LIMITS
- G1 EAST PHASE 1 SUBGRADE BREAK IN SLOPE
- 710 G1 EAST PHASE 1 SUBGRADE CONTOUR (2 FT INTERVAL – WITHIN CERTIFICATION LIMITS)
- APPROXIMATE 6B TOP OF PRIMARY LINER CREST OF SLOPE
- APPROXIMATE 6B TOP OF SECONDARY LINER CREST OF SLOPE
- xCB-14 G1 EAST PHASE 1 SUBGRADE LINER RECORD POINT (SEE RECORD DATA)

cti
CTI and Associates, Inc.
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DATE: 12-05-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	
0	12-05-19	ISSUED FOR RECORD DRAWINGS	PAA XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

SUBGRADE RECORD CONTROL POINT PLAN

PROJECT NUMBER 1198070013

SCALE 1" = 30'

DRAWING NO 03

MC6EP2-SW

MC6 B

MC6 C

6ESW LEAK DETECTION SUMP RISER

6ESW LEACHATE SUMP AND CLEANOUT RISER CONTAINMENT BERM

MC VI-G SUBCELL G1-EAST PHASE 1

MC VI-G FUTURE SUBCELL G3

MC VI-G EXISTING SUBCELL G1

MC VI-G FUTURE SUBCELL G6

FLOOR LINER SYSTEM

SIDESLOPE LINER SYSTEM

TRANSITION ZONE TO SMOOTHLY BLEND LINER SYSTEM BETWEEN EXISTING G1 AND G1 EAST PHASE 1

CS-1 CS-2 CS-3 CS-4 CS-5 CS-6 CS-7 CS-8 CS-9 CS-10 CS-11 CS-14 CS-15 CS-16 CS-18 CS-19 CS-20 CS-21 CS-22 CS-23 CS-24 CB-13R CB-17R

G1 EAST PHASE 1 RECORD TOP OF SECONDARY COMPACTED CLAY LINER DATA			
POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
CS-1	7,690.00	4,900.00	699.00
CS-2	7,690.00	4,995.00	696.20
CS-3	7,590.00	4,900.00	683.29
CS-4	7,590.00	5,000.00	684.89
CS-5	7,490.00	4,900.00	685.84
CS-6	7,490.00	5,000.00	687.35
CS-7	7,400.00	4,900.00	681.70
CS-8	7,400.00	5,000.00	683.33
CS-9	NA	NA	NA
CS-10	7,300.00	4,900.00	679.85
CS-11	7,300.00	5,000.00	681.32
CS-12	NA	NA	NA
CB13R	7,200.00	4,800.00	680.28
CS-14	7,200.00	4,900.00	681.80
CS-15	7,200.00	5,000.00	683.30
CS-16	7,200.00	5,100.00	697.26
CB17R	7,100.00	4,805.00	679.18
CS-18	7,100.00	4,900.00	680.70
CS-19	7,100.00	5,000.00	682.10
CS-20	7,100.00	5,100.00	696.57
CS-21	7,010.00	4,800.00	703.58
CS-22	7,010.00	4,900.00	701.08
CS-23	7,010.00	5,000.00	694.69
CS-24	7,010.00	5,100.00	693.84

N

0 15' 30' 60'

SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED JANUARY 4, 2019, UPDATED WITH FIELD SURVEY DATED FEBRUARY 1, 2019, MARCH 4, 2019, APRIL 1, 2019, AND MAY 1, 2019.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS, PROVIDED BY NTH CONSULTANTS, LTD. ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING, SHEET 6, DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS". PROVIDED BY MIDWESTERN CONSULTING, INC. DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

LEGEND

- PHASE BOUNDARY
- N 6500 + GRID COORDINATES
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- EXISTING STRUCTURE/ BUILDING
- PAVED GRAVEL EXISTING ROAD
- x EXISTING FENCE
- G1 EAST PHASE 1 TOP OF SECONDARY COMPACTED CLAY LINER CERTIFICATION LIMIT
- G1 EAST PHASE 1 TOP OF SECONDARY LINER BREAK IN SLOPE
- 710 G1 EAST PHASE 1 TOP OF SECONDARY LINER CONTOUR (2 FT INTERVAL)
- G1 EAST PHASE 2 SUBGRADE/ SECONDARY LINER BREAK IN SLOPE
- 710 G1 EAST PHASE 2 TOP OF SUBGRADE/ SECONDARY LINER CONTOUR (2 FT INTERVAL)
- APPROXIMATE 6B TOP OF PRIMARY LINER CREST OF SLOPE
- APPROXIMATE 6B TOP OF SECONDARY LINER CREST OF SLOPE
- x CS-14 G1 EAST PHASE 1 TOP OF SECONDARY LINER RECORD POINT (SEE RECORD DATA)

REV	DATE	REVISION DESCRIPTION	DRN	APP
0	12-05-19	G1 TO G1 EAST PHASE 1 ISSUED FOR RECORD	PAA	XZ
1	2-12-20		PAA	XZ

DATE: 12-05-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC., SITE NO. 2, MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF SECONDARY COMPACTED CLAY LINER RECORD CONTROL POINT PLAN

PROJECT NUMBER 1198070013

SCALE 1" = 30'

DRAWING NO. 04

E 5250 | N 7750 | N 7500 | N 7250 | N 7000 | E 5250

MC6EP2-SW | MC6 B | MC6 C

E 5000 | E 5000

MC VI-G SUBCELL G1-EAST PHASE 1

MC VI-G FUTURE SUBCELL G3

MC VI-G FUTURE SUBCELL G6

MC VI-G EXISTING SUBCELL G1

E 4750 | N 7750 | N 7500 | N 7250 | N 7000 | E 4750

FUSION END CAP

6" DIA. SDR 11 SOLID HDPE PIPE LEAK DETECTION SAMPLING PIPE (1/11)

2 EXTRA LAYERS OF GEONET (4/11)

5 EXTRA LAYERS OF GEONET (3/11)

2 EXTRA LAYERS OF GEONET (4/11)

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 S16 S17 S18 S19 S20 S21 S22 S23 S24 S25 S26 S27 S28 S29 S30 S31 S32 S33 S34 S35 S36 S37 S38 S39 S40 S41 S42 S43 S44 S45 S46 S47 S48 S49 S50 S51 S52 S53 S54

G1 EAST PHASE 1 RECORD LEAK DETECTION SAMPLING PIPE DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	DESCRIPTION
1	7,498.58	4,881.16	685.95	6" SOILD PIPE
2	7,498.55	4,886.79	686.08	WELD
3	7,498.05	4,914.11	686.88	6" SOILD PIPE
4	7,498.02	4,914.12	686.91	6" SOILD PIPE
5	7,498.75	4,943.20	687.42	6" SOILD PIPE
6	7,499.38	4,972.92	688.04	6" SOILD PIPE
7	7,499.75	4,997.51	688.32	6" SOILD PIPE
8	7,501.05	5,016.54	687.65	6" CAP

N

0 15' 30' 60'

SCALE

LEGEND

- PHASE BOUNDARY
- N 6500 + GRID COORDINATES
- G1 EAST PHASE 1 TOP OF SECONDARY LINER BREAK IN SLOPE
- 710 G1 EAST PHASE 1 TOP OF SECONDARY LINER CONTOUR (2 FT INTERVAL)
- FUSION WELDED SEAM
- EXTRUSION WELDED SEAM
- R12 EXTRUSION REPAIR LOCATION
- X 5 TOP OF LEAK DETECTION SAMPLING PIPE RECORD POINT (SEE RECORD DATA)
- D510 DESTRUCTIVE SAMPLE LOCATION
- R25 CAP STRIP
- S33 SECONDARY LINER GEOMEMBRANE RECORD PANEL
- 5 EXTRA LAYERS OF GEONET
- 2 EXTRA LAYERS OF GEONET
- LIMIT OF ADDITIONAL CAP STRIP
- R12 EXTRUSION REPAIR COVERED BY CAP STRIP
- D510 DESTRUCTIVE SAMPLE COVERED BY CAP STRIP
- 6" DIA. SDR 11 SOLID HDPE PIPE LEAK DETECTION SAMPLING PIPE

DATE: 12-05-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

CTI and Associates, Inc.
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Novi, Michigan 48377
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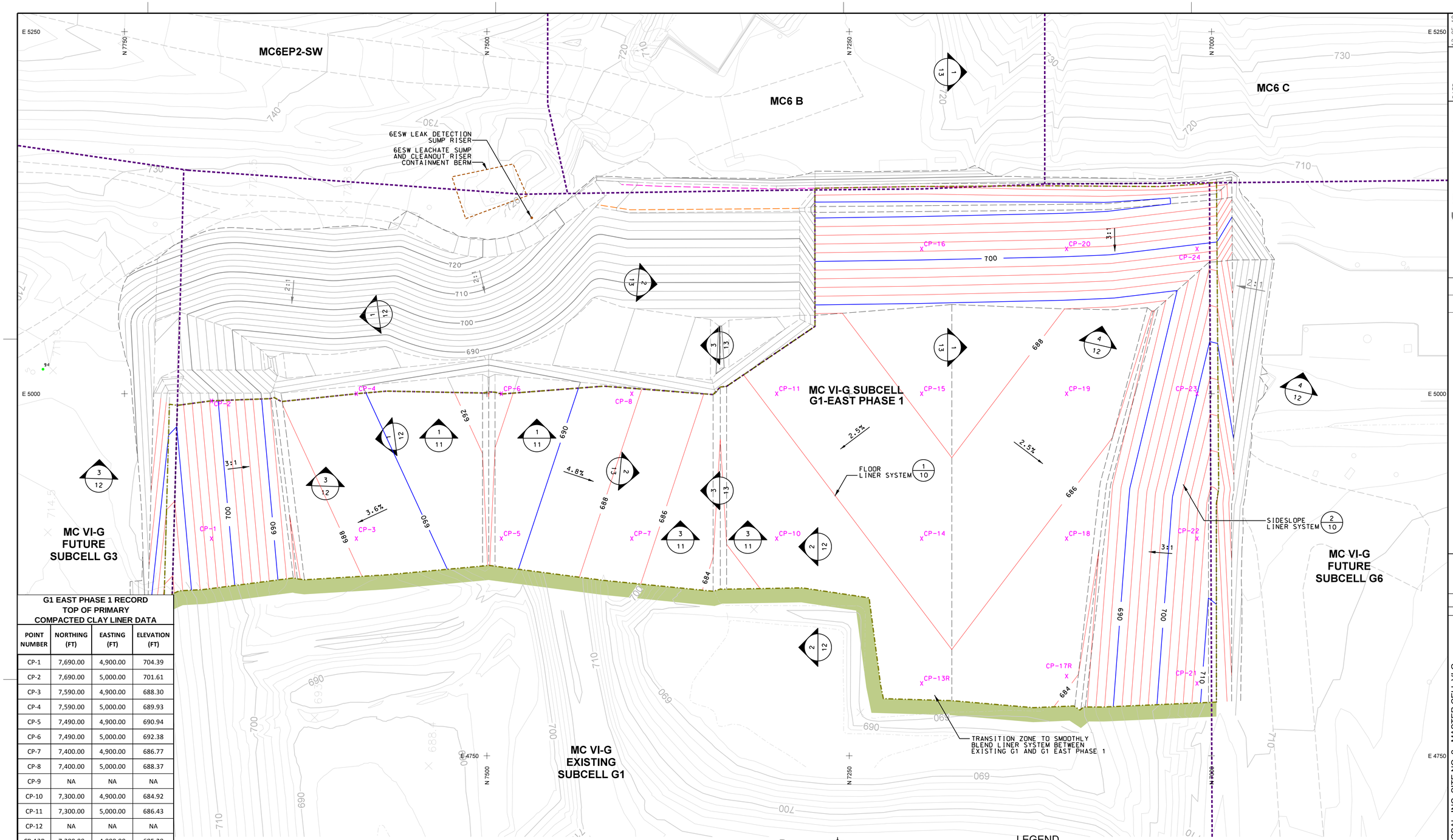
REV	DATE	REVISION DESCRIPTION	DRN	APP
0	12-05-19	G1 TO G1 EAST PHASE 1 LEACHATE COLLECTION SYSTEM CONNECTION	PAA	XZ
1	2-12-20	ISSUED FOR RECORD DRAWINGS	PAA	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

SECONDARY GEOMEMBRANE LINER AND LEAK DETECTION GEONET RECORD PLAN

PROJECT NUMBER 1198070013
SCALE 1" = 30'
DRAWING NO 05



G1 EAST PHASE 1 RECORD TOP OF PRIMARY COMPACTED CLAY LINER DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
CP-1	7,690.00	4,900.00	704.39
CP-2	7,690.00	5,000.00	701.61
CP-3	7,590.00	4,900.00	688.30
CP-4	7,590.00	5,000.00	689.93
CP-5	7,490.00	4,900.00	690.94
CP-6	7,490.00	5,000.00	692.38
CP-7	7,400.00	4,900.00	686.77
CP-8	7,400.00	5,000.00	688.37
CP-9	NA	NA	NA
CP-10	7,300.00	4,900.00	684.92
CP-11	7,300.00	5,000.00	686.43
CP-12	NA	NA	NA
CP-13R	7,200.00	4,800.00	685.29
CP-14	7,200.00	4,900.00	686.84
CP-15	7,200.00	5,000.00	688.33
CP-16	7,200.00	5,100.00	702.67
CP-17R	7,100.00	4,805.00	684.25
CP-18	7,100.00	4,900.00	685.71
CP-19	7,100.00	5,000.00	687.16
CP-20	7,100.00	5,100.00	701.85
CP-21	7,010.00	4,800.00	708.95
CP-22	7,010.00	4,900.00	706.43
CP-23	7,010.00	5,000.00	700.03
CP-24	7,010.00	5,100.00	699.12

N

0 15' 30' 60'

SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED JANUARY 4, 2019, UPDATED WITH FIELD SURVEY DATED FEBRUARY 1, 2019, MARCH 4, 2019, APRIL 1, 2019, AND MAY 1, 2019.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS, PROVIDED BY NTH CONSULTANTS, LTD, ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING, SHEET 6, DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS", PROVIDED BY MIDWESTERN CONSULTING, INC, DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

LEGEND

- PHASE BOUNDARY
- N 6500 + GRID COORDINATES
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- EXISTING STRUCTURE/ BUILDING
- PAVED GRAVEL EXISTING ROAD
- EXISTING FENCE
- G1 EAST PHASE 1 TOP OF PRIMARY COMPACTED CLAY LINER CERTIFICATION LIMIT
- G1 EAST PHASE 1 TOP OF PRIMARY LINER BREAK IN SLOPE
- 710 G1 EAST PHASE 1 TOP OF PRIMARY LINER CONTOUR (2 FT INTERVAL)
- 710 G1 EAST PHASE 2 TOP OF SUBGRADE/ SECONDARY LINER CONTOUR (2 FT INTERVAL)
- G1 EAST PHASE 2 SUBGRADE/ SECONDARY LINER BREAK IN SLOPE
- APPROXIMATE 6B TOP OF PRIMARY LINER CREST OF SLOPE
- APPROXIMATE 6B TOP OF SECONDARY LINER CREST OF SLOPE
- XCP-14 G1 EAST PHASE 1 TOP OF PRIMARY LINER RECORD POINT (SEE RECORD DATA)

DATE: 12-05-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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www.ctiomplanies.com

REVISIONS

REV	DATE	REVISION DESCRIPTION
0	12-05-19	ISSUED FOR RECORD DRAWINGS

PAA XZ
DRN APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF PRIMARY COMPACTED CLAY LINER RECORD CONTROL POINT PLAN

PROJECT NUMBER 1198070013
SCALE 1" = 30'
DRAWING NO 06

MC6EP2-SW

MC6 B

MC6 C

TIE-IN GEOMEMBRANE WELD 2/11

MC VI-G FUTURE SUBCELL G3

MC VI-G SUBCELL G1-EAST PHASE 1

MC VI-G FUTURE SUBCELL G6

MC VI-G EXISTING SUBCELL G1

N 7750 N 7500 N 7250 N 7000 E 5000

P1 P2 P3 P4 P5 P6 P7 P8 P9 P10 P11 P12 P13 P14 P15 P16 P17 P18 P19 P20 P21 P22 P23 P24 P25 P26 P27 P28 P29 P30 P31 P32 P33 P34 P35 P36 P37 P38 P39 P40 P41 P42 P43 P44 P45 P46 P47 P48 P49 P50 P51 P52 P53 P54 P55 P56 P57 P58

0 15' 30' 60'
SCALE

LEGEND

- PHASE BOUNDARY
- N 6500 GRID COORDINATES
- FUSION WELDED SEAM
- R12 EXTRUSION REPAIR LOCATION
- DSP10 DESTRUCTIVE SAMPLE LOCATION
- R25 EXTRUSION CAP STRIP
- P33 PRIMARY LINER GEOMEMBRANE RECORD PANEL
- LIMIT OF ADDITIONAL CAP STRIP
- PRIMARY AND SECONDARY EXTRUSION WELDED SEAM
- R16 EXTRUSION REPAIR COVERED BY CAP STRIP
- DSP9 R57 DESTRUCTIVE SAMPLE COVERED BY CAP STRIP

CTI and Associates, Inc.
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REV	DATE	REVISION DESCRIPTION	DR. RECORD DRAWINGS
0	12-05-19	ISSUED FOR RECORD DRAWINGS	

DATE: 12-05-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

PAA XZ
DRN. APP.

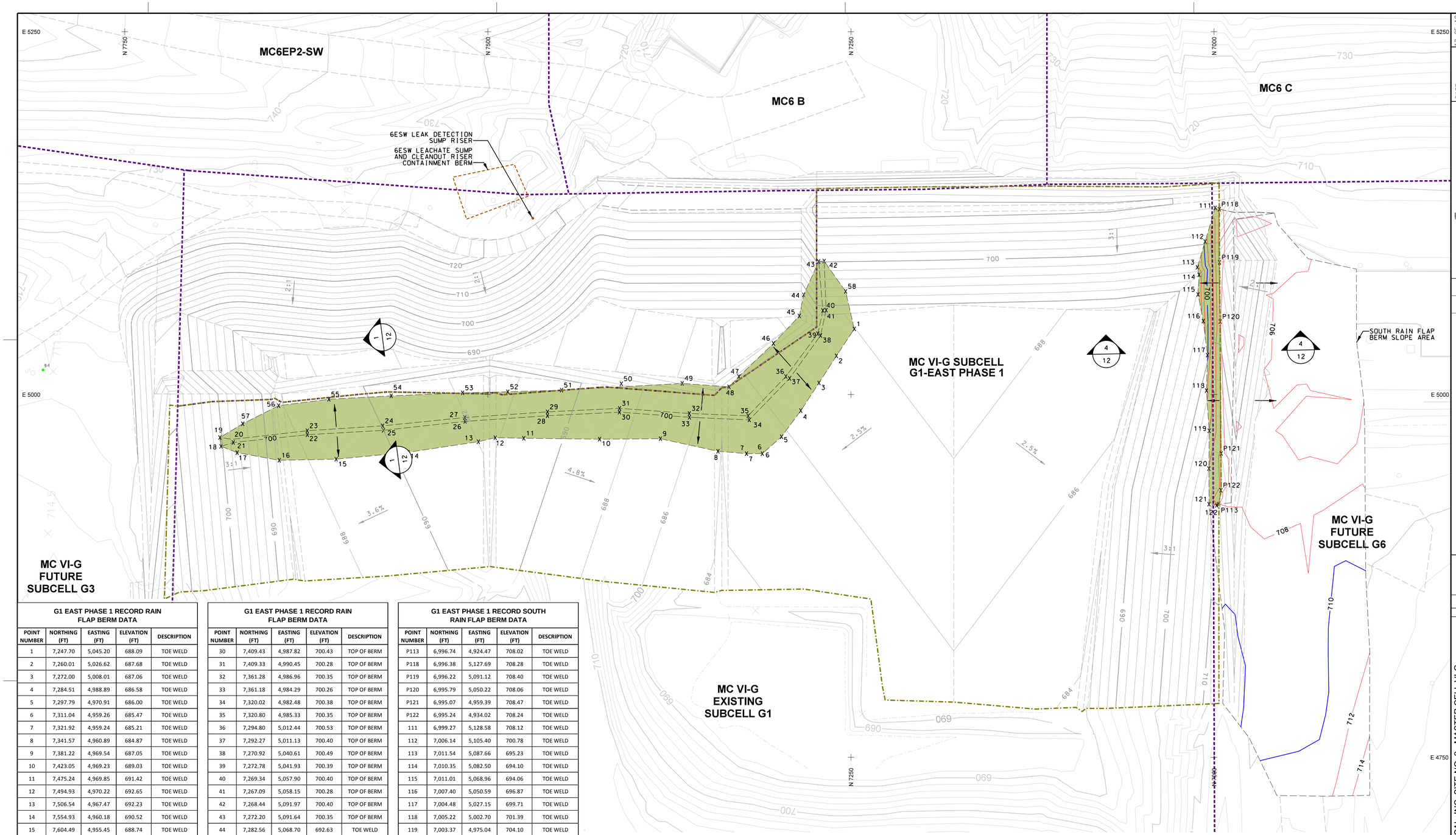
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

PRIMARY GEOMEMBRANE LINER RECORD PLAN

PROJECT NUMBER 1198070013
SCALE 1" = 30'
DRAWING NO 07

DRAWING VERIFIED:
TIME PLOTTED: $TIME$
DATE PLOTTED: $DATE$
DRAWN BY: $LOGIN$

DRAWING SIZE: $SHEETSIZE$



G1 EAST PHASE 1 RECORD RAIN FLAP BERM DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	DESCRIPTION
1	7,247.70	5,045.20	688.09	TOE WELD
2	7,260.01	5,026.62	687.68	TOE WELD
3	7,272.00	5,008.01	687.06	TOE WELD
4	7,284.51	4,988.89	686.58	TOE WELD
5	7,297.79	4,970.91	686.00	TOE WELD
6	7,311.04	4,959.26	685.47	TOE WELD
7	7,321.92	4,959.24	685.21	TOE WELD
8	7,341.57	4,960.89	684.87	TOE WELD
9	7,381.22	4,969.54	687.05	TOE WELD
10	7,423.05	4,969.23	689.03	TOE WELD
11	7,475.24	4,969.85	691.42	TOE WELD
12	7,494.93	4,970.22	692.65	TOE WELD
13	7,506.54	4,967.47	692.23	TOE WELD
14	7,554.93	4,960.18	690.52	TOE WELD
15	7,604.49	4,955.45	688.74	TOE WELD
16	7,643.63	4,954.67	687.32	TOE WELD
17	7,672.64	4,959.94	696.93	TOE WELD
18	7,683.76	4,964.30	700.33	TOP OF BERM
19	7,684.49	4,970.38	700.49	TOP OF BERM
20	7,675.90	4,969.13	700.85	TOP OF BERM
21	7,675.31	4,966.96	700.80	TOP OF BERM
22	7,624.37	4,972.29	700.21	TOP OF BERM
23	7,624.36	4,975.03	700.16	TOP OF BERM
24	7,572.40	4,978.42	700.37	TOP OF BERM
25	7,571.85	4,975.33	700.39	TOP OF BERM
26	7,515.67	4,981.47	700.46	TOP OF BERM
27	7,515.90	4,984.12	700.33	TOP OF BERM
28	7,458.98	4,985.40	700.26	TOP OF BERM
29	7,458.97	4,988.06	700.17	TOP OF BERM

G1 EAST PHASE 1 RECORD RAIN FLAP BERM DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	DESCRIPTION
30	7,409.43	4,987.82	700.43	TOP OF BERM
31	7,409.33	4,990.45	700.28	TOP OF BERM
32	7,361.28	4,986.96	700.35	TOP OF BERM
33	7,361.18	4,984.29	700.26	TOP OF BERM
34	7,320.02	4,982.48	700.38	TOP OF BERM
35	7,320.80	4,985.33	700.35	TOP OF BERM
36	7,294.80	5,012.44	700.53	TOP OF BERM
37	7,292.27	5,011.13	700.40	TOP OF BERM
38	7,270.92	5,040.61	700.49	TOP OF BERM
39	7,272.78	5,041.93	700.39	TOP OF BERM
40	7,269.34	5,057.90	700.40	TOP OF BERM
41	7,267.09	5,058.15	700.28	TOP OF BERM
42	7,268.44	5,091.97	700.40	TOP OF BERM
43	7,272.20	5,091.64	700.35	TOP OF BERM
44	7,282.56	5,068.70	692.63	TOE WELD
45	7,285.55	5,054.12	688.32	TOE WELD
46	7,303.33	5,035.25	686.54	TOE WELD
47	7,327.16	5,012.38	685.50	TOE WELD
48	7,333.94	5,005.27	685.63	TOE WELD
49	7,366.18	5,007.65	686.28	TOE WELD
50	7,408.09	5,007.43	688.72	TOE WELD
51	7,449.22	5,003.00	690.33	TOE WELD
52	7,486.27	5,001.88	691.76	TOE WELD
53	7,517.35	5,001.14	691.94	TOE WELD
54	7,566.57	4,999.07	690.43	TOE WELD
55	7,609.46	4,996.73	688.60	TOE WELD
56	7,644.01	4,992.33	687.25	TOE WELD
57	7,668.75	4,979.86	695.06	TOE WELD
58	7,253.66	5,071.05	693.20	TOE WELD

G1 EAST PHASE 1 RECORD SOUTH RAIN FLAP BERM DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	DESCRIPTION
P113	6,996.74	4,924.47	708.02	TOE WELD
P118	6,996.38	5,127.69	708.28	TOE WELD
P119	6,996.22	5,091.12	708.40	TOE WELD
P120	6,995.79	5,050.22	708.06	TOE WELD
P121	6,995.07	4,959.39	708.47	TOE WELD
P122	6,995.24	4,934.02	708.24	TOE WELD
111	6,999.27	5,128.58	708.12	TOE WELD
112	7,006.14	5,105.40	700.78	TOE WELD
113	7,011.54	5,087.66	695.23	TOE WELD
114	7,010.35	5,082.50	694.10	TOE WELD
115	7,011.01	5,068.96	694.06	TOE WELD
116	7,007.40	5,050.59	696.87	TOE WELD
117	7,004.48	5,027.15	699.71	TOE WELD
118	7,005.22	5,002.70	701.39	TOE WELD
119	7,003.37	4,975.04	704.10	TOE WELD
120	7,003.56	4,948.94	706.23	TOE WELD
121	7,003.46	4,924.44	707.88	TOE WELD
122	6,998.12	4,923.61	708.14	TOE WELD

N

0 15' 30' 60'

SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED JANUARY 4, 2019, UPDATED WITH FIELD SURVEY DATED FEBRUARY 1, 2019, MARCH 4, 2019, APRIL 1, 2019, AND MAY 1, 2019.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS, PROVIDED BY NTH CONSULTANTS, LTD, ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING, SHEET 6, DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS", PROVIDED BY MIDWESTERN CONSULTING, INC. DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

LEGEND

- PHASE BOUNDARY
- N 6500 + GRID COORDINATES
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- EXISTING STRUCTURE/ BUILDING
- PAVED GRAVEL EXISTING ROAD
- EXISTING FENCE
- G1 EAST PHASE 1 TOP OF PRIMARY COMPACTED CLAY LINER CERTIFICATION LIMIT
- 710 G1 EAST PHASE 1 TOP OF PRIMARY LINER CONTOUR (2 FT INTERVAL) / G1 EAST PHASE 2 TOP OF SUBGRADE/ SECONDARY LINER CONTOUR (2 FT INTERVAL)
- G1 EAST PHASE 1 TOP OF PRIMARY LINER LINER BREAK IN SLOPE / G1 EAST PHASE 2 TOP OF SUBGRADE/ SECONDARY LINER BREAK IN SLOPE
- RAIN FLAP BERM LINER AREA
- x10 RAIN FLAP BERM RECORD POINT (SEE RECORD DATA)
- 710 G1 EAST PHASE 1 SOUTH RAIN FLAP BERM SLOPE AREA CONTOURS (2 FT INTERVAL)

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DATE:	12-05-19
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION
0	12-05-19	ISSUED FOR RECORD DRAWINGS

PAA XZ
DRN. APP.

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF PRIMARY GRADE RAIN FLAP BERM RECORD CONTROL POINT PLAN

PROJECT NUMBER
1198070013

SCALE
1" = 30'

DRAWING NO
08

MC6EP2-SW

MC6 B

MC6 C

6ESW LEAK DETECTION SUMP RISER

6ESW LEACHATE SUMP AND CLEANOUT RISER CONTAINMENT BERM

LEACHATE COLLECTION PIPE TEMPORARY CLEANOUT (4/13)

SOUTH RAIN FLAP BERM SLOPE AREA

MC VI-G SUBCELL G1-EAST PHASE 1

TOP OF BERM AT 700'

LEACHATE COLLECTION PIPE TEMPORARY CLEANOUT (3/13)

8" DIA. SDR 11 PERFORATED HDPE PIPE TOE OF SLOPE LEACHATE COLLECTION PIPE (4/11)

8" DIA. SDR 11 PERFORATED HDPE PIPE LEACHATE COLLECTION PIPE (3/11)

MC VI-G FUTURE SUBCELL G3

MC VI-G FUTURE SUBCELL G6

MC VI-G EXISTING SUBCELL G1

E 5250 E 5000 E 4750 N 7750 N 7500 N 7250 N 7000

G1 EAST PHASE 1 RECORD LEACHATE COLLECTION SAND LAYER DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	THICKNESS (FT)
S1	7,086.66	4,815.69	1.00
S2	7,081.65	4,866.26	1.67
S3	7,076.23	4,916.28	1.00
S4	7,065.90	4,968.81	1.00
S5	7,053.77	5,018.99	1.25
S6	7,043.59	5,056.83	1.00
S7	7,016.17	5,056.89	1.00
S8	7,018.63	4,965.00	1.33
S9	7,027.73	4,912.52	1.00
S10	7,030.82	4,860.26	1.33
S11	7,033.37	4,814.03	1.33
S12	7,097.42	5,056.91	1.00
S13	7,097.88	5,108.67	1.08
S14	7,150.46	5,058.61	1.17
S15	7,151.75	5,108.50	1.00
S16	7,202.93	5,058.29	1.00
S17	7,203.30	5,109.24	1.25
S18	7,256.50	5,109.91	1.00
S19	7,242.82	5,057.39	1.08
S20	7,139.48	4,822.63	1.00
S21	7,136.45	4,875.89	1.08
S22	7,135.08	4,926.66	1.00
S23	7,135.04	4,977.12	1.00
S24	7,134.59	5,028.82	1.00
S25	7187.02	5031.75	1.25
S26	7188.81	4979.21	1.00
S27	7189.14	4922.37	1.00
S28	7191.23	4868.68	1.08
S29	7193.78	4830.31	1.25
S30	7252.52	4885.91	1.00
S31	7249.12	4938.06	1.00
S32	7252.23	4990.54	1.00

G1 EAST PHASE 1 RECORD LEACHATE COLLECTION SAND LAYER DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	THICKNESS (FT)
S33	7,303.85	4,957.36	1.00
S34	7,307.22	4,905.85	1.08
S35	7,361.41	4,908.83	1.08
S36	7,359.94	4,959.83	1.08
S37	7,411.22	4,962.33	1.00
S38	7,411.19	4,909.42	1.00
S39	7,463.61	4,909.14	1.00
S40	7,460.55	4,961.82	1.08
S41	7,512.27	4,958.52	1.00
S42	7,511.14	4,905.10	1.00
S43	7,565.80	4,901.10	1.00
S44	7,570.89	4,953.88	1.00
S45	7,636.97	4,948.72	1.25
S46	7,636.69	4,896.26	1.17
S47	7,686.07	4,898.93	1.33
S48	7,692.81	4,951.34	1.08
S49	7,051.12	5,108.67	1.08
S50	7,693.62	4,866.34	1.17
S51	7,632.21	4,869.72	1.17
S52	7,580.54	4,880.03	1.08
S53	7,524.97	4,890.03	1.08
S54	7,488.40	4,874.95	1.50
S55	7,431.96	4,885.40	1.00
S56	7,373.69	4,871.74	1.08
S57	7,331.43	4,862.13	1.50
S58	7,278.24	4,862.65	1.17
S59	7,234.77	4,865.78	1.25
S60	7,211.55	4,795.07	1.08
S61	7,144.45	4,790.16	1.33
S62	7,107.71	4,787.95	1.50
S63	7,047.79	4,783.42	1.17

G1 EAST PHASE 1 RECORD LEACHATE COLLECTION PIPE DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	DESCRIPTION
1	7,640.90	4,953.51	687.62	8" 45 ELBOW
2	7,637.18	4,925.92	687.50	8" PERFORATED PIPE
4	7,633.69	4,897.25	687.20	8" PERFORATED PIPE
7	7,084.72	4,830.56	684.82	8" PERFORATED PIPE
8	7,081.32	4,862.34	685.13	8" PERFORATED PIPE
9	7,076.15	4,905.82	685.47	8" PERFORATED PIPE
10	7,072.00	4,937.52	686.02	8" PERFORATED PIPE
11	7,060.51	4,986.19	686.49	8" PERFORATED PIPE
12	7,050.73	5,023.32	686.81	8" PERFORATED PIPE
13	7,041.75	5,050.65	687.42	8" PERFORATED PIPE
14	7,026.97	5,069.16	690.69	8" PERFORATED PIPE
15	7,013.50	5,080.45	693.67	8" SOLID PIPE
17	7,338.94	4,884.18	684.26	8" PERFORATED PIPE
18	7,338.50	4,919.70	684.59	8" PERFORATED PIPE
19	7,338.49	4,949.17	684.96	8" PERFORATED PIPE
20	6,998.91	5,132.00	711.29	MC 6 CO BRASS CAP
21	6,998.32	5,142.90	706.93	MC 6 CO TOP OF PIPE
22	6,998.14	5,146.93	705.63	MC 6 BOOT OVER CO
23	7,641.37	4,954.96	688.19	8" 45 ELBOW
24	7,338.54	4,958.97	684.94	8" 45 ELBOW
25	7,643.43	4,975.76	703.43	8" CAP
26	7,336.76	4,982.66	700.39	8" CAP
27	7,630.87	4,876.57	687.09	COUPLING
28	7,624.49	4,844.71	686.64	COUPLING
29	7,089.60	4,783.79	684.39	COUPLING
30	7,093.44	4,754.70	683.80	COUPLING
31	7,339.14	4,858.33	683.50	COUPLING
32	7,338.51	4,832.65	682.97	COUPLING

N

0 15' 30' 60'

SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES. DATED JANUARY 4, 2019. UPDATED WITH FIELD SURVEY DATED FEBRUARY 1, 2019. MARCH 4, 2019. APRIL 1, 2019. AND MAY 1, 2019.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS, PROVIDED BY NTH CONSULTANTS, LTD. ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING, SHEET 6, DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS", PROVIDED BY MIDWESTERN CONSULTING, INC. DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

LEGEND

- PHASE BOUNDARY
- OLD CELL BOUNDARIES
- N 6500 — GRID COORDINATES
- 710 — EXISTING CONTOUR (2 FT INTERVAL)
- EXISTING STRUCTURE/ BUILDING
- PAVED GRAVEL EXISTING ROAD
- VEGETATION/ TREES/ SHRUBS
- APPROXIMATE 6B TOP OF PRIMARY LINER CREST OF SLOPE
- APPROXIMATE 6B TOP OF SECONDARY LINER CREST OF SLOPE
- G1 EAST PHASE 1 TOP OF PRIMARY COMPACTED CLAY LINER CERTIFICATION LIMIT
- 710 — G1 EAST PHASE 1 TOP OF PRIMARY LINER CONTOUR (2 FT INTERVAL)
- 710 — G1 EAST PHASE 2 TOP OF SUBGRADE/ SECONDARY LINER CONTOUR (2 FT INTERVAL)
- G1 EAST PHASE 1 TOP OF PRIMARY LINER LINER BREAK IN SLOPE
- G1 EAST PHASE 2 TOP OF SUBGRADE/ SECONDARY LINER BREAK IN SLOPE
- PERFORATED — RECORD LEACHATE COLLECTION PIPE
- SOLID — RECORD LEACHATE COLLECTION PIPE
- x3 — TOP OF LEACHATE COLLECTION PIPE RECORD POINT (SEE RECORD DATA)
- x S1 — TOP OF LEACHATE COLLECTION SAND LAYER RECORD POINT (SEE RECORD DATA)
- 710 — G1 EAST PHASE 1 SOUTH RAIN FLAP BERM SLOPE AREA CONTOURS (2 FT INTERVAL)

REV	DATE	REVISION DESCRIPTION	DRN	APP
0	12-05-19	ISSUED FOR RECORD DRAWINGS	PAA	XZ
1	2-12-20	G1 TO G1 EAST PHASE 1 LEACHATE COLLECTION SYSTEM CONNECTION	PAA	XZ

DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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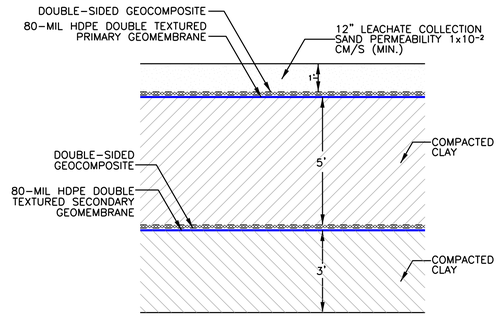
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF LEACHATE COLLECTION SAND LAYER AND LEACHATE COLLECTION PIPE RECORD CONTROL POINT PLAN

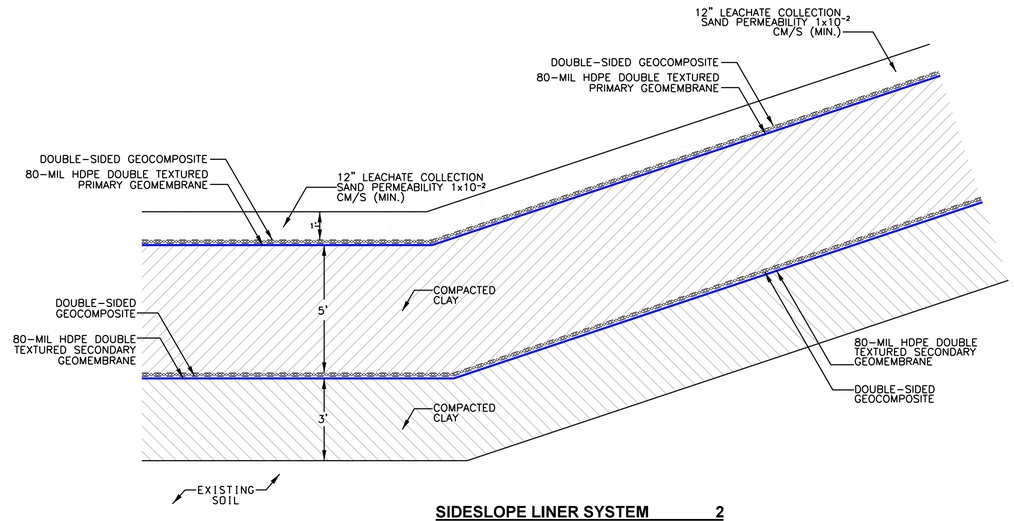
PROJECT NUMBER 1198070013

SCALE 1" = 30'

DRAWING NO 09



FLOOR LINER SYSTEM 1
NOT TO SCALE



SIDESLOPE LINER SYSTEM 2
NOT TO SCALE

DATE:	12-05-19
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	DRN
0	12-05-19	ISSUED FOR RECORD DRAWINGS	PAA XZ

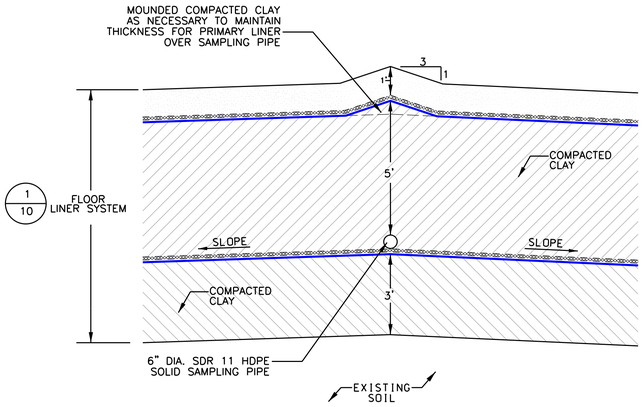
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (1 OF 4)

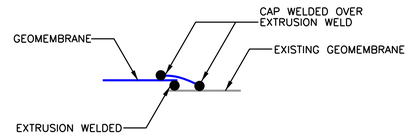
PROJECT NUMBER
1198070013

SCALE
NTS

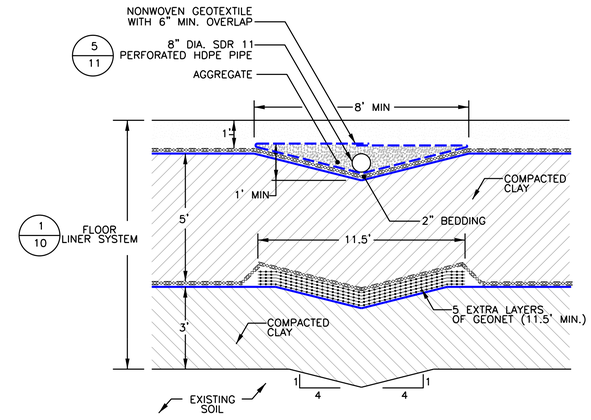
DRAWING NO
10



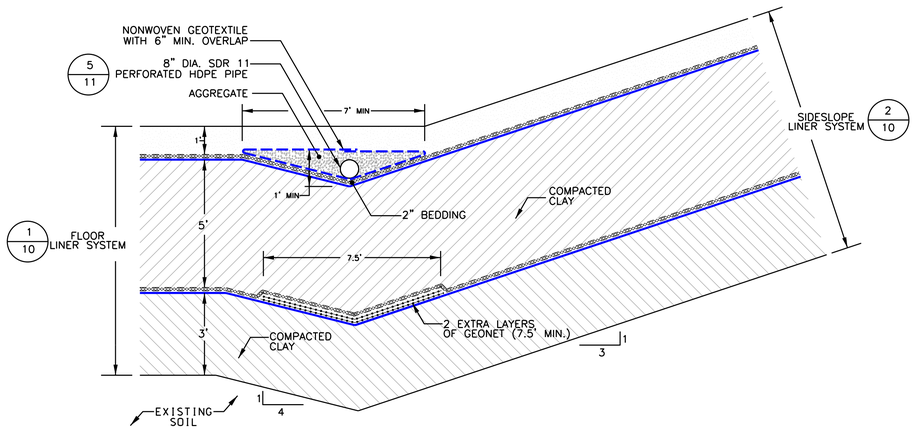
LEAK DETECTION SAMPLING PIPE 1
NOT TO SCALE



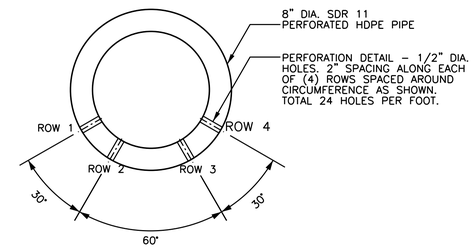
CELL 6B AND E TIE-IN GEOMEMBRANE WELDING DETAIL 2
NOT TO SCALE



CELL FLOOR LEAK DETECTION GEONET AND LEACHATE COLLECTION PIPE (TYP.) 3
NOT TO SCALE



TOE OF SLOPE LEAK DETECTION GEONET AND LEACHATE COLLECTION PIPE (TYP.) 4
NOT TO SCALE



PIPE PERFORATION DETAIL 5
NOT TO SCALE

DATE:	12-05-19
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

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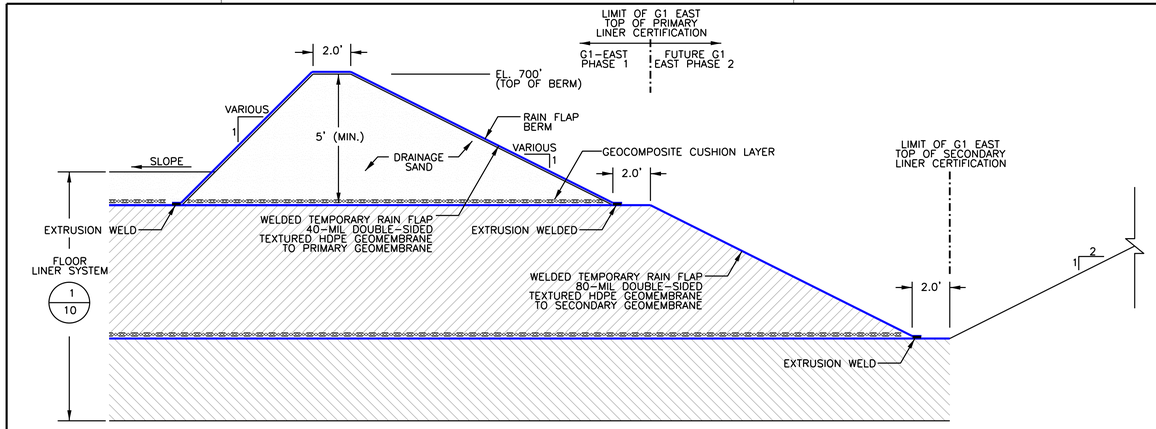
REV	DATE	REVISION DESCRIPTION
0	12-05-19	ISSUED FOR RECORD DRAWINGS

PAA XZ
DRN. APP

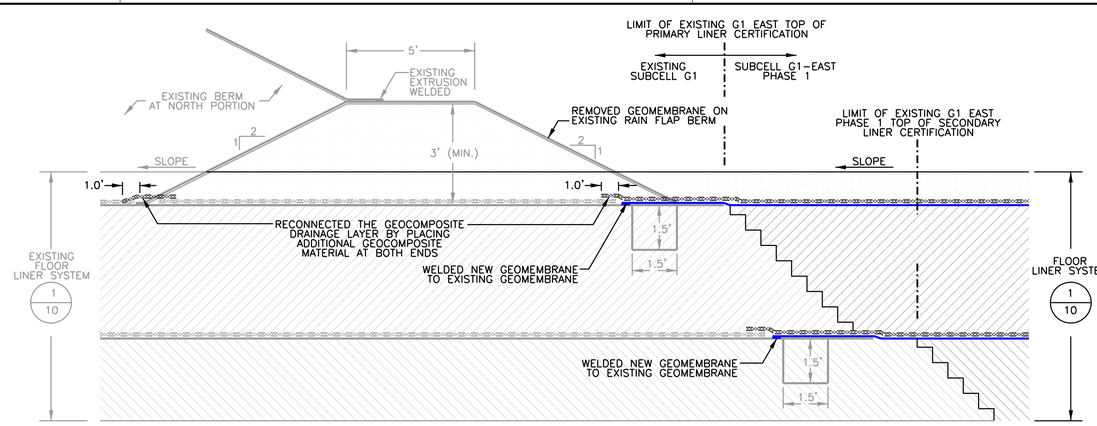
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (2 OF 4)

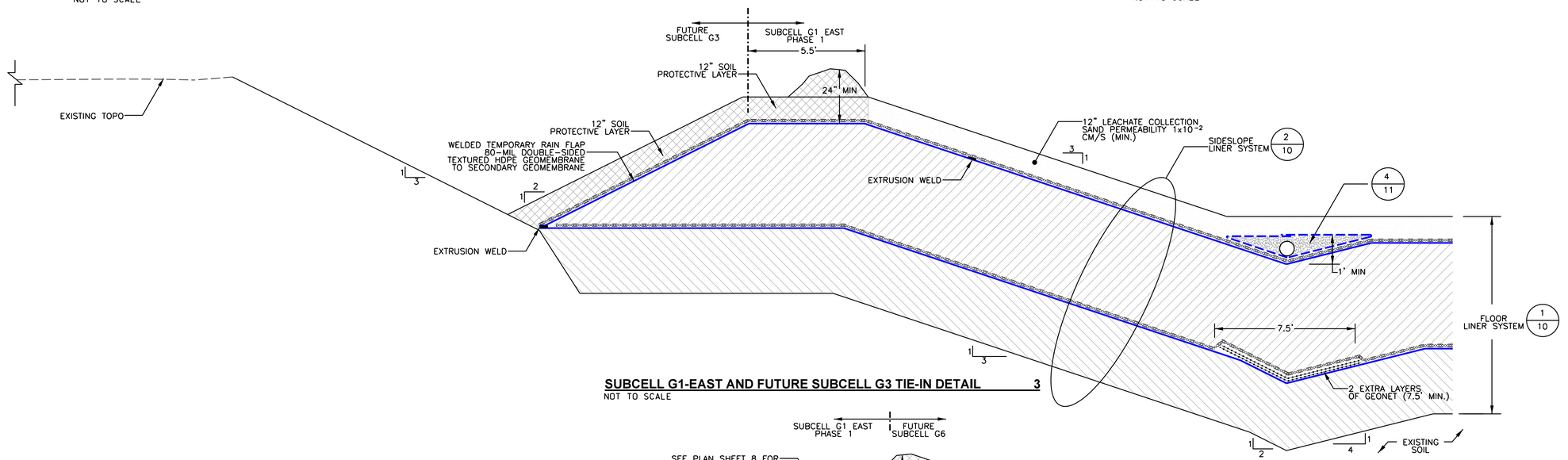
PROJECT NUMBER
1198070013
SCALE
NTS
DRAWING NO.
11



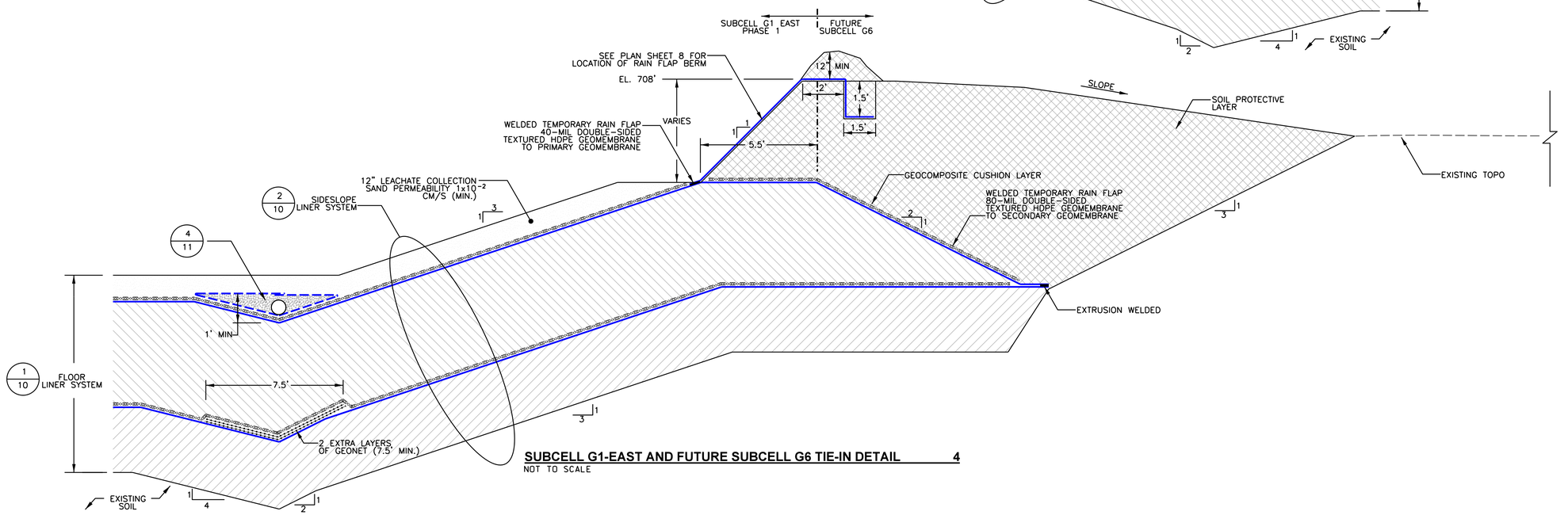
TEMPORARY TERMINATION 1
NOT TO SCALE



G1 TO G1 EAST PHASE 1 TIE-IN 2
NOT TO SCALE



SUBCELL G1-EAST AND FUTURE SUBCELL G3 TIE-IN DETAIL 3
NOT TO SCALE



SUBCELL G1-EAST AND FUTURE SUBCELL G6 TIE-IN DETAIL 4
NOT TO SCALE

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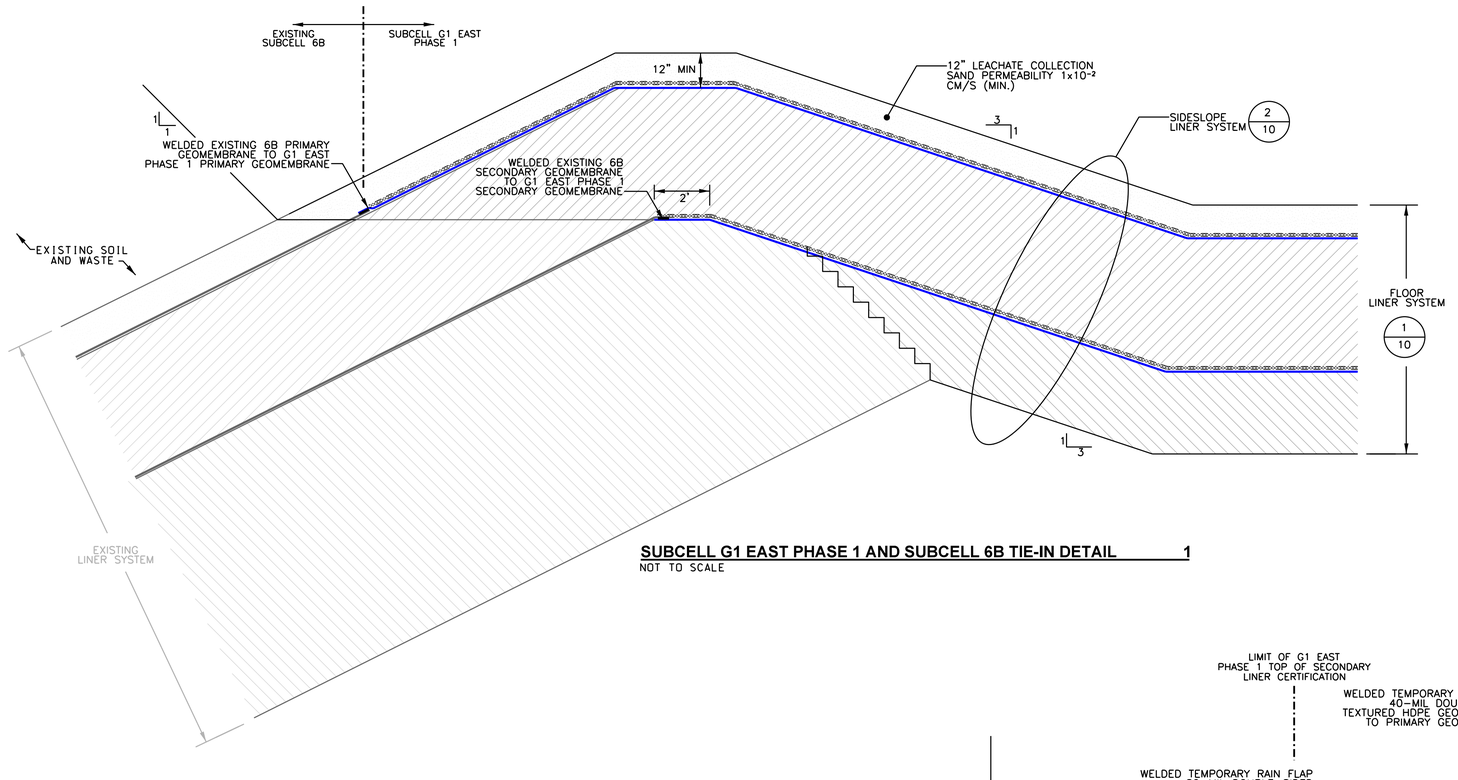
REV	DATE	REVISION DESCRIPTION	DRN	APP
0	12-05-19	G1 TO G1 EAST PHASE 1 ISSUED FOR RECORD DRAWINGS	PAA	XZ
1	2-12-20		PAA	XZ

DATE: 12-05-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

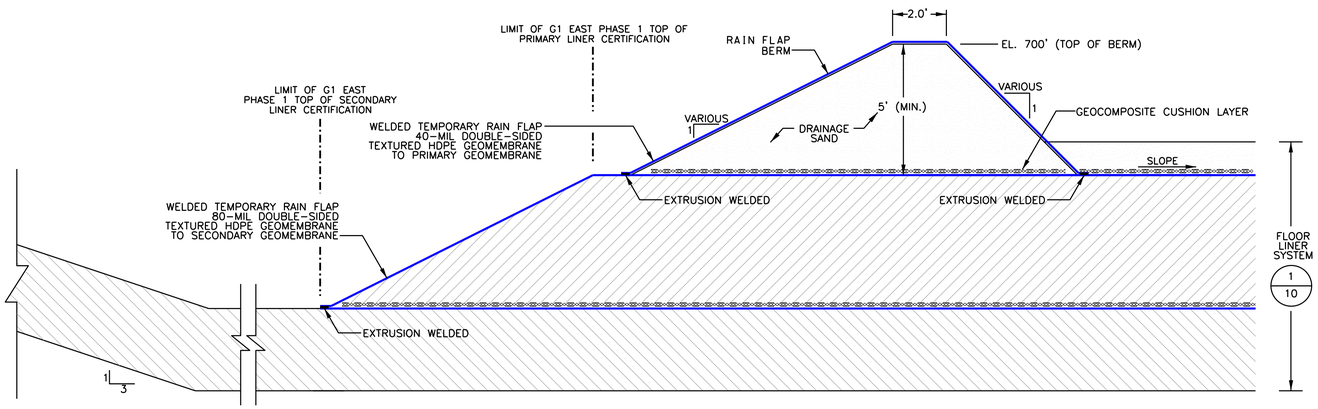
WAYNE DISPOSAL, INC. SITE NO. 2 MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (3 OF 4)

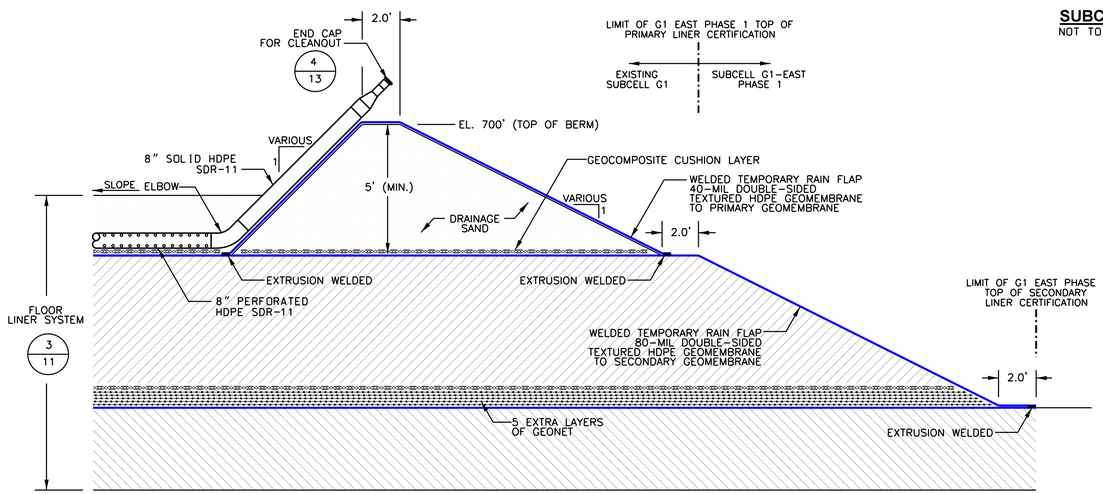
PROJECT NUMBER 1198070013
SCALE NTS
DRAWING NO. 12



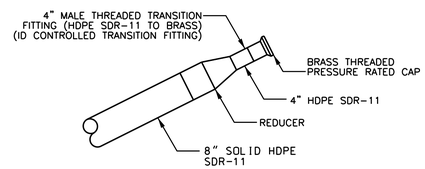
SUBCELL G1 EAST PHASE 1 AND SUBCELL 6B TIE-IN DETAIL 1
NOT TO SCALE



SUBCELL G1 EAST PHASE 1 AND FUTURE SUBCELL G1 EAST PHASE 2 TIE-IN DETAIL 2
NOT TO SCALE



TEMPORARY TERMINATION AT LEAK DETECTION GEONETS AND LEACHATE COLLECTION TRENCH 3
NOT TO SCALE



END CAP FOR CLEANOUT 4
NOT TO SCALE

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248.486.5100 (fax)248.486.5050
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DATE: 12-05-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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REVISIONS			
REV.	DATE	REVISION DESCRIPTION	
0	12-05-19	ISSUED FOR RECORD DRAWINGS	PAA XZ
			DRN. APP.

RECORD DRAWINGS

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G1 EAST PHASE I RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (4 OF 4)

PROJECT NUMBER 1198070013
SCALE NTS
DRAWING NO **13**

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL G1 EAST PHASE 2

RECORD PLAN

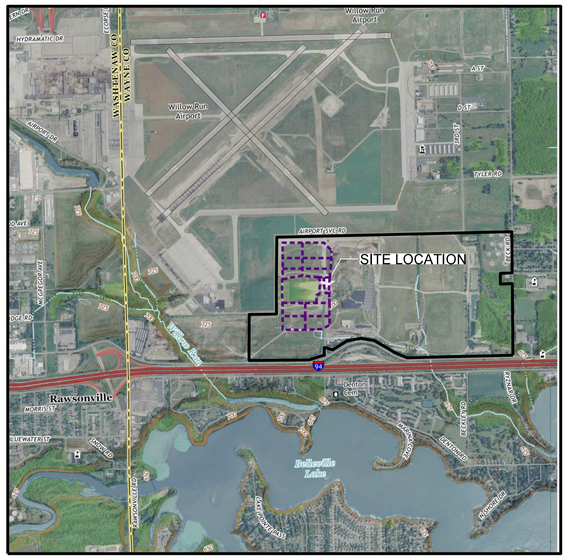
WAYNE DISPOSAL, INC. SITE NO. 2
MASTER CELL VI-G PHASE 1
SUBCELL G1-EAST PHASE 2 RECORD PLANS

VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CTI PROJECT NO. 1198070047

AUGUST 2020

WAYNE COUNTY, MICHIGAN
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

OWNER:
US Ecology
49350 N. I-94 Service Drive
Belleville, Michigan 48111

ENGINEER:
CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377

LIST OF DRAWINGS

3 2 1	G-01	COVER SHEET
	G-02	SITE PLAN
	P-01	SUBGRADE RECORD CONTROL POINT PLAN
	P-02	TOP OF SECONDARY COMPACTED CLAY LINER RECORD CONTROL POINT PLAN
2	P-03	SECONDARY GEOMEMBRANE LINER AND LEAK DETECTION RECORD PLAN
1	P-04	TOP OF PRIMARY COMPACTED CLAY LINER RECORD CONTROL POINT PLAN
2	P-05	PRIMARY GEOMEMBRANE LINER RECORD AND TOP OF PRIMARY GRADE RAIN FLAP BERM RECORD CONTROL POINT PLAN
3	P-06	TOP OF LEACHATE COLLECTION SAND LAYER AND LEACHATE COLLECTION PIPE RECORD CONTROL POINT PLAN
1	C-01	CROSS SECTIONS 1-1' AND 2-2'
3	D-01	LINER SYSTEM DETAILS (1 OF 6)
3 2	D-02	LINER SYSTEM DETAILS (2 OF 6)
2	D-03	LINER SYSTEM DETAILS (3 OF 6)
	D-04	LINER SYSTEM DETAILS (4 OF 6)
	D-05	LINER SYSTEM DETAILS (5 OF 6)
2	D-06	LINER SYSTEM DETAILS (6 OF 6)

REV 003

REVISIONS			
REV	DATE	DESCRIPTION	DRN.
3	09-21-20	MISC. REVISIONS TO SHEETS D-01, D-02 AND P-06	PAA XZ
2	08-26-20	MISC. REVISIONS TO SHEETS D-02, D-03, D-06, P-03 AND P-05	PAA XZ
1	08-21-20	MISC. REVISIONS TO SHEETS C-01, P-04 AND C-01	PAA XZ
0	08-10-20	ISSUED FOR RECORD DRAWINGS	PAA XZ

DATE: 08-10-20
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

COVER SHEET

PROJECT NUMBER: 1198070047
SCALE: NTS
DRAWING NO: **G-01**

MC6 D

MC6EP2-W

MC6EP2-SW
(6E)

MC6 B
(6B)

MC6 C

MC VI-G
SUBCELL G1-EAST
PHASE 2

MC VI-F
FUTURE
SUBCELL F4

MC VI-G
FUTURE
SUBCELL G3

MC VI-G
SUBCELL G1-EAST
PHASE 1

MC VI-G
FUTURE
SUBCELL G6

MC VI-G
FUTURE
SUBCELL G7

MC VI-F
FUTURE
SUBCELL F3

MC VI-G
SUBCELL G1

MC VI-G
FUTURE
SUBCELL G4

MC VI-G
FUTURE
SUBCELL G5

MC VI-F
FUTURE
SUBCELL F2

MC VI-F
FUTURE
SUBCELL F1

MC VI-G
SUBCELL G2

N

0 50' 100' 200'
SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 19, 2019, UPDATED JUNE 1, 2020.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS, PROVIDED BY NTH CONSULTANTS, LTD. ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING", SHEET 6, DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS" AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS". PROVIDED BY MIDWESTERN CONSULTING, INC. DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 EXISTING CONTOUR (2' INTERVAL)
- N 6500 GRID COORDINATES
- EXISTING STRUCTURE/ BUILDING
- EXISTING FENCE
- VEGETATION/ TREES/ SHRUBS
- TOP OF SECONDARY COMPACTED CLAY LINER GRADE BREAK IN SLOPE
- 710 G1 EAST PHASE 2 TOP OF SECONDARY COMPACTED CLAY LINER GRADE CONTOUR (2 FT INTERVAL)
- APPROXIMATE 6E/6B TOP OF PRIMARY LINER CREST OF SLOPE
- APPROXIMATE 6E/6B TOP OF SECONDARY LINER CREST OF SLOPE
- LIMIT OF EXISTING G1 EAST PHASE 2 TOP OF SECONDARY COMPACTED CLAY LINER CERTIFICATION LIMIT

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	
0	08-10-20	ISSUED FOR RECORD DRAWINGS	

DATE:	08-10-20		
DESIGNED BY:	XZ/PAA	PAA	XZ
DRAWN BY:	PAA	CHK	APP
CHECKED BY:	PH/RMB		
APPROVED BY:	XZ		

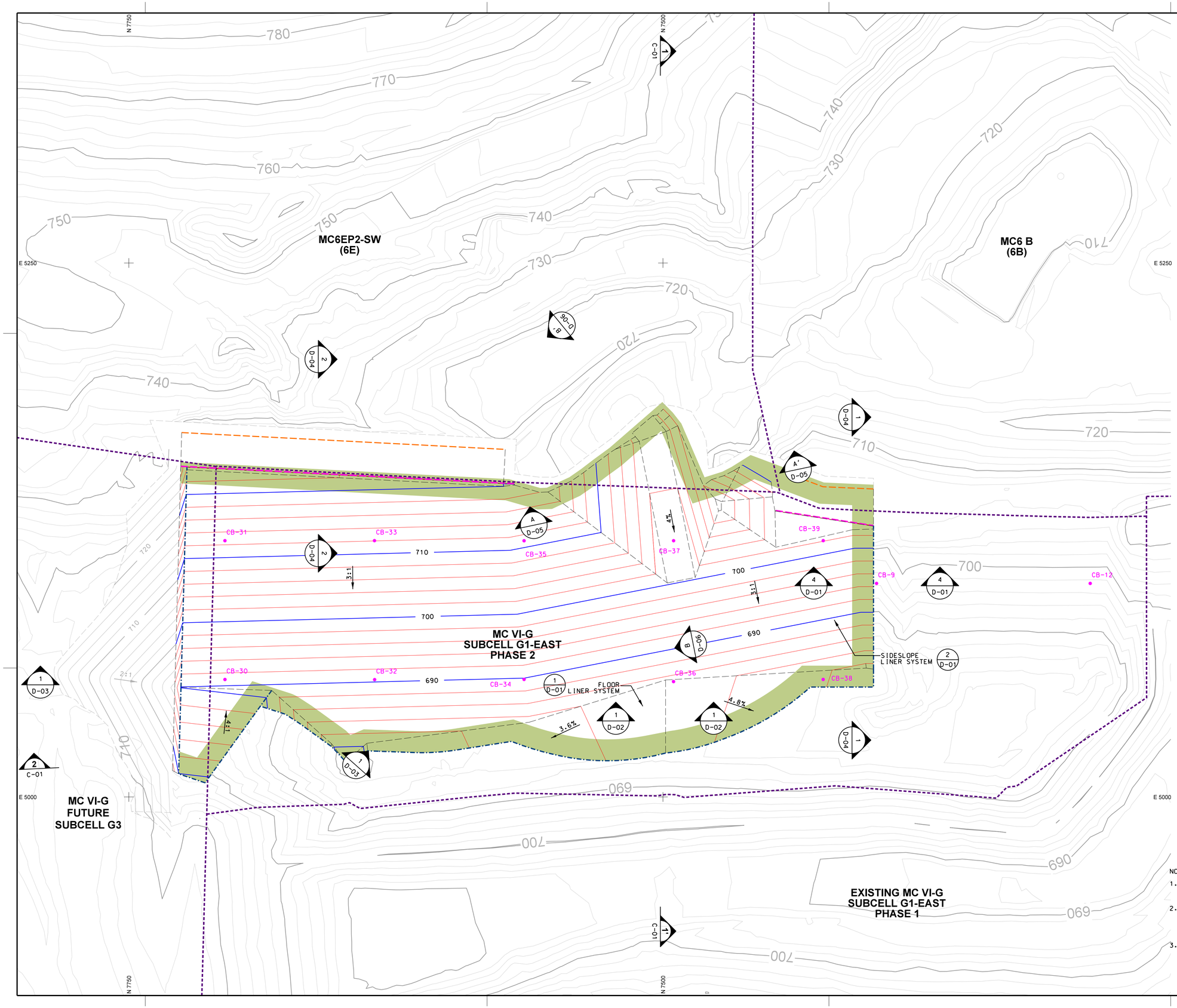
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

SITE PLAN

PROJECT NUMBER
1198070047

SCALE
1" = 100'

DRAWING NO.
G-02



LEGEND

- PHASE BOUNDARY
- N 6500 — GRID COORDINATES
- 710 — EXISTING CONTOUR (2 FT INTERVAL)
- APPROXIMATE 6E/6B TOP OF PRIMARY LINER CREST OF SLOPE
- APPROXIMATE 6E/6B TOP OF SECONDARY LINER CREST OF SLOPE
- LIMIT OF G1 EAST PHASE 2 SUBGRADE CERTIFICATION
- 710 — G1 EAST PHASE 2 SUBGRADE CONTOUR (2 FT INTERVAL)
- SUBGRADE BREAK IN SLOPE
- TRANSITION ZONE USED TO SMOOTHLY BLEND LINER SYSTEM BETWEEN G1 EAST PHASE 2 AND EXISTING G1 EAST PHASE 1, 6B, 6E
- CB-30 — G1 EAST PHASE 2 TOP OF SUBGRADE RECORD POINT (SEE RECORD DATA)

G1 EAST PHASE 2 RECORD SUBGRADE DATA

POINT NUMBER	NORTHING	EASTING	ELEVATION
*CB-9	7,400.00	5,100.00	694.17
*CB-12	7,300.00	5,100.00	694.47
CB-30	7,705.01	5,055.01	690.79
CB-31	7,705.02	5,120.00	712.58
CB-32	7,634.95	5,054.95	690.36
CB-33	7,635.03	5,120.01	711.93
CB-34	7,565.00	5,055.04	689.62
CB-35	7,565.00	5,119.96	711.01
CB-36	7,495.05	5,054.03	685.14
CB-37	7,495.02	5,119.99	701.05
CB-38	7,425.00	5,055.03	682.09
CB-39	7,424.98	5,120.01	701.99

* ASBUILT SURVEY FROM G1 EAST PHASE 1

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 19, 2019, UPDATED JUNE 1, 2020.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS, PROVIDED BY NTH CONSULTANTS, LTD. ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING", SHEET 6, DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS" AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS", PROVIDED BY MIDWESTERN CONSULTING, INC. DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

0 10' 20' 40'
SCALE

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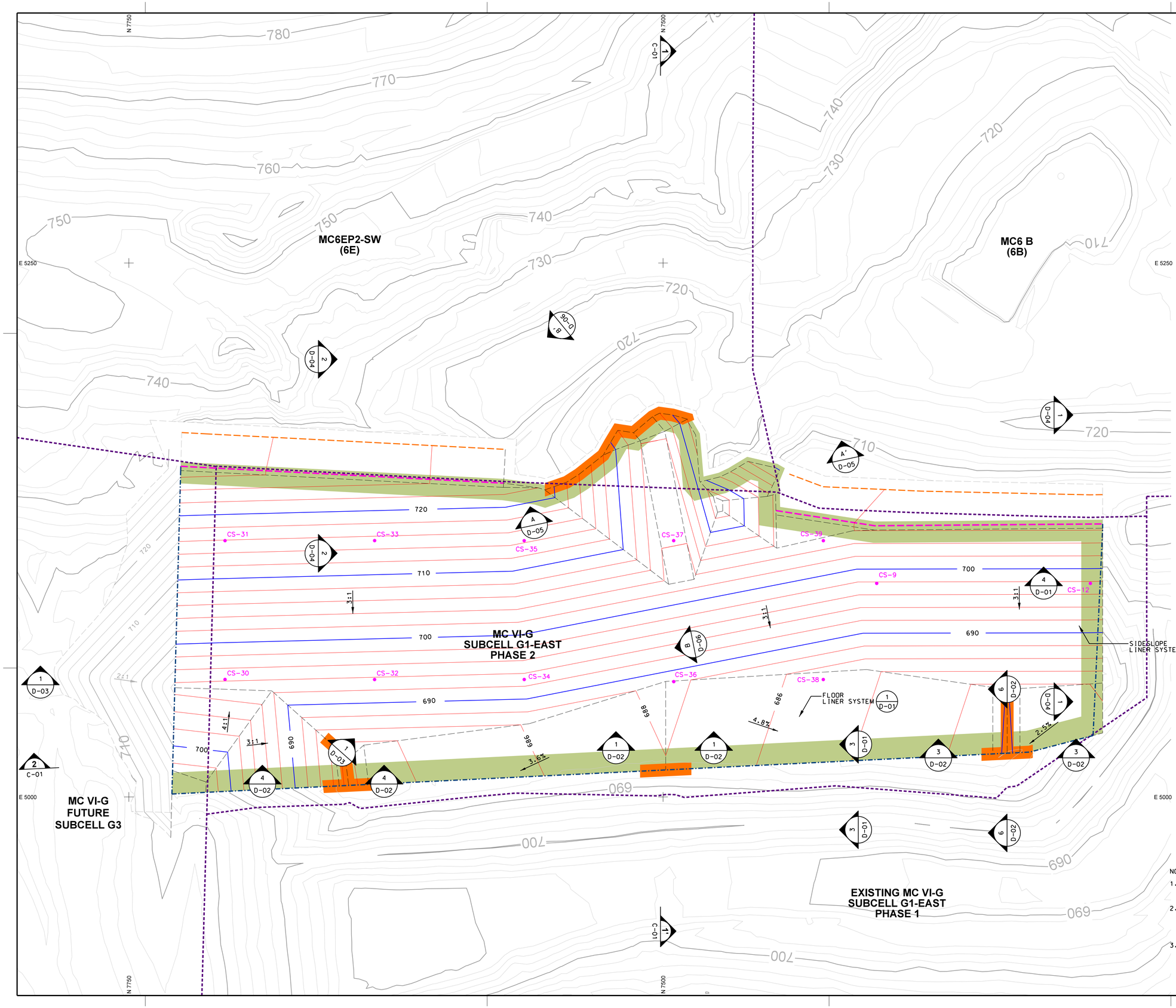
REVISIONS			
REV	DATE	ISSUED FOR REVISION DESCRIPTION	
0	08-10-20	ISSUED FOR	PAA XZ

DATE: 08-10-20
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

SUBGRADE RECORD CONTROL POINT PLAN

PROJECT NUMBER: 1198070047
SCALE: 1" = 20'
DRAWING NO: P-01



LEGEND

- PHASE BOUNDARY
- N 6500 — GRID COORDINATES
- 710 — EXISTING CONTOUR (2 FT INTERVAL)
- APPROXIMATE 6E/6B TOP OF PRIMARY LINER CREST OF SLOPE
- APPROXIMATE 6E/6B TOP OF SECONDARY LINER CREST OF SLOPE
- LIMIT OF EXISTING G1 EAST PHASE 2 TOP OF SECONDARY COMPACTED CLAY LINER CERTIFICATION
- 710 — G1 EAST PHASE 2 TOP OF SECONDARY COMPACTED CLAY LINER GRADE CONTOUR (2 FT INTERVAL)
- TOP OF SECONDARY COMPACTED CLAY LINER GRADE BREAK IN SLOPE
- TRANSITION ZONE USED TO SMOOTHLY BLEND LINER SYSTEM BETWEEN G1 EAST PHASE 2 AND EXISTING G1 EAST PHASE 1, 6B, 6E
- CS-30 — G1 EAST PHASE 2 TOP OF SECONDARY COMPACTED CLAY LINER RECORD POINT (SEE RECORD DATA BELOW)
- APPROXIMATE LOCATION OF SUPPLEMENTAL GEOSYNTHETIC CLAY LINER PLACED ON TOP OF CERTIFIED SECONDARY COMPACTED CLAY LINER

G1 EAST PHASE 2 RECORD TOP OF SECONDARY COMPACTED CLAY LINER DATA

POINT NUMBER	NORTHING	EASTING	ELEVATION
CS-9	7,400.00	5,100.01	697.78
CS-12	7,300.00	5,100.00	697.73
CS-30	7,705.00	5,055.03	694.28
CS-31	7,705.00	5,120.02	715.94
CS-32	7,635.00	5,055.00	693.74
CS-33	7,634.99	5,120.04	715.33
CS-34	7,564.97	5,055.01	693.05
CS-35	7,564.98	5,120.00	714.36
CS-36	7,494.99	5,054.01	688.37
CS-37	7,495.03	5,120.01	704.17
CS-38	7,425.00	5,055.00	685.19
CS-39	7,424.98	5,120.00	705.42

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 19, 2019, UPDATED JUNE 1, 2020.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS, PROVIDED BY NTH CONSULTANTS, LTD. ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING", SHEET 6, DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS" AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS", PROVIDED BY MIDWESTERN CONSULTING, INC. DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

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DATE: 08-10-20
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN
0	08-10-20	ISSUED FOR RECORD DRAWINGS	PAA

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF SECONDARY COMPACTED CLAY LINER RECORD CONTROL POINT PLAN

PROJECT NUMBER: 1198070047
SCALE: 1" = 20'
DRAWING NO: P-02

N 7750

N 7500

E 5250

E 5000

R125 DS-15 R103 R74 R115 DS-15A R105 R66 DS-15A2 R123 R114 R126 R124 R70 R60 R118 R102 CAP R61 R117 R116 DS-15A1 R107 R106 R119 DS-16 R127 DS-11 R69 R62 R63 R64 R65 R67 R68 R71 R72 R73 R88 DS-6 R7 R110 R75 R35 R58 R34 R33 R76 DS-15B R104 R128 R100 R52 R31 R30 R90 R91 R111 R112 R92 DS-14A R108 DS-14 R57 DS-14A1 R122 DS-14B R109 R94 R101 R98 R113 R99 R97 DS-13 R16 R120 DS-12 R93 R77 R79 R81 R82 R78 R80 R83 R84 R86 R87 R85 R89 R88 R32 R55-CAP R96 DS-3 R3 DS-9 R51 DS-5 R6 R21 R20 R43 R44 R45 R46 R47 R48 R49 R50 R121 R53 R5 R54 R95 R15 R14 R13 R11 R12 R10 DS-2 R2 DS-1 R1 R1 DS-4 R4 R17 R24 DS-8 R9 R23 R25 R26 R22 R18 R36 R29 R28 R27 R37 R38 R39 R40 R41 R42 DS-10 R59 DS-9B R56 R19

S12 S13 S14 S28 S27 S26 S25 S22 S21 S20 S19 S17 S16 S15 S11 S10 S8 S7 S6 S4 S3 S2 S1 S24 S23 S18 S9 S5

LEAK DETECTION CONTAINMENT BERM SEE SECTION B-B' ON SHEET D-06 AND SECTION 1-1' ON SHEET C-01

LEGEND

- PHASE BOUNDARY
- N 6500 — GRID COORDINATES
- 710 — G1 EAST PHASE 2 TOP OF SECONDARY COMPACTED CLAY LINER GRADE CONTOUR
- G1 EAST PHASE 1 TOP OF SECONDARY LINER BREAK IN SLOPE
- FUSION WELDED SEAM
- EXTRUSION WELDED SEAM
- R12 — EXTRUSION REPAIR LOCATION
- DS10 — DESTRUCTIVE SAMPLE LOCATION
- 5 EXTRA LAYERS OF GEONET
- 2 EXTRA LAYERS OF GEONET
- CAP STRIP
- LIMIT OF ADDITIONAL CAP STRIP
- LIMIT OF ADDITIONAL CAP STRIP
- R12 — EXTRUSION REPAIR COVERED BY CAP STRIP
- DS10 — DESTRUCTIVE SAMPLE COVERED BY CAP STRIP
- S33 — SECONDARY LINER GEOMEMBRANE RECORD PANEL
- 6" DIA. SDR 11 SOLID HDPE PIPE LEAK DETECTION SAMPLING PIPE
- 5 — TOP OF LEAK DETECTION SAMPLING PIPE RECORD POINT (SEE RECORD DATA)

N

SCALE 0' 10' 20' 40'

G1 EAST PHASE 2 RECORD LEAK DETECTION SAMPLING PIPE DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	DESCRIPTION
1	7493.55	5105.85	704.39	6" SOILD PIPE
2	7493.23	5099.43	703.55	6" SOILD PIPE
3	7493.62	5085.76	699.33	6" SOILD PIPE
4	7495.64	5068.34	693.71	6" SOILD PIPE
5	7497.54	5054.10	689.40	6" SOILD PIPE
6	7499.87	5041.14	688.85	6" SOILD PIPE
7	7501.16	5024.71	688.66	6" SOILD PIPE
8	7500.05	5008.38	688.06	6" SOILD PIPE
9	7498.32	5133.58	705.51	6" COUPLING
10	7501.05	5145.94	705.69	6" SOILD PIPE
12	7502.20	5152.53	705.87	6" SOILD PIPE
13	7502.82	5155.92	705.98	BOOT
*13A	7506.13	5169.95	NA	6" SOILD PIPE END
14	7499.33	5136.67	705.43	BOOT

* RECORD DATA TAKEN FROM 6E RECORD DRAWINGS.

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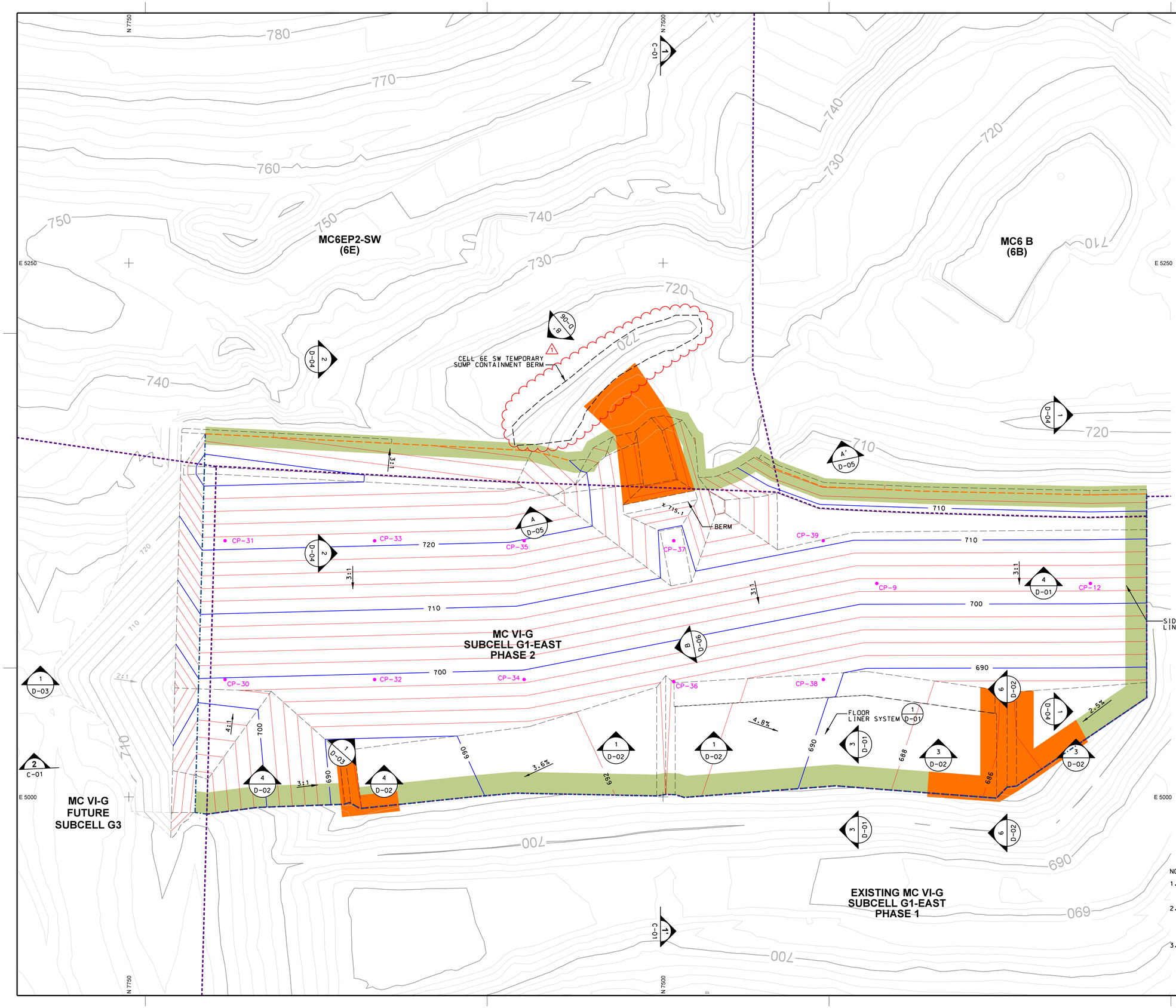
DATE:	08-10-20
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION	DRN	APP
2	08-26-20	ADDED LEAK DETECTION CONTAINMENT BERM CALLOUT	XZ	
1	08-10-20	ISSUED FOR RECORD DRAWINGS	XZ	
0			PAA	

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

SECONDARY GEOMEMBRANE LINER AND LEAK DETECTION RECORD PLAN

PROJECT NUMBER 1198070047
SCALE 1" = 20'
DRAWING NO **P-03**



LEGEND

- PHASE BOUNDARY
- N 6500 — GRID COORDINATES
- 710 — EXISTING CONTOUR (2 FT INTERVAL)
- APPROXIMATE 6E/6B TOP OF PRIMARY LINER CREST OF SLOPE
- LIMIT OF G1 EAST PHASE 2 TOP OF PRIMARY COMPACTED CLAY LINER CERTIFICATION
- 710 — G1 EAST PHASE 2 TOP OF PRIMARY COMPACTED CLAY CONTOUR (2 FT INTERVAL)
- TOP OF PRIMARY COMPACTED CLAY LINER GRADE BREAK IN SLOPE
- TRANSITION ZONE USED TO SMOOTHLY BLEND LINER SYSTEM BETWEEN G1 EAST PHASE 2 AND EXISTING G1 EAST PHASE 1, 6B, 6E
- CP-30 — G1 EAST PHASE 2 TOP OF PRIMARY COMPACTED CLAY LINER RECORD POINT (SEE RECORD DATA BELOW)
- APPROXIMATE LOCATION OF SUPPLEMENTAL GEOSYNTHETIC CLAY LINER PLACED ON TOP OF CERTIFIED PRIMARY COMPACTED CLAY LINER

G1 EAST PHASE 2 RECORD TOP OF PRIMARY COMPACTED CLAY LINER DATA

POINT NUMBER	NORTHING	EASTING	ELEVATION
CP-9	7,399.97	5,100.00	703.40
CP-12	7,299.98	5,099.99	703.25
CP-30	7,704.99	5,054.97	699.93
CP-31	7,704.98	5,120.00	721.56
CP-32	7,634.99	5,054.97	699.28
CP-33	7,634.99	5,119.97	720.96
CP-34	7,565.01	5,055.01	698.73
CP-35	7,565.00	5,120.01	719.97
CP-36	7,494.99	5,053.98	693.90
CP-37	7,494.99	5,119.98	709.46
CP-38	7,424.97	5,055.01	690.55
CP-39	7,425.04	5,120.00	711.00

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES. DATED DECEMBER 19, 2019. UPDATED JUNE 1, 2020.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS. PROVIDED BY NTH CONSULTANTS, LTD. ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING", SHEET 6, DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS" AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS", PROVIDED BY MIDWESTERN CONSULTING, INC. DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

0 10' 20' 40'
SCALE

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www.cticonsultants.com

DATE: 08-10-20
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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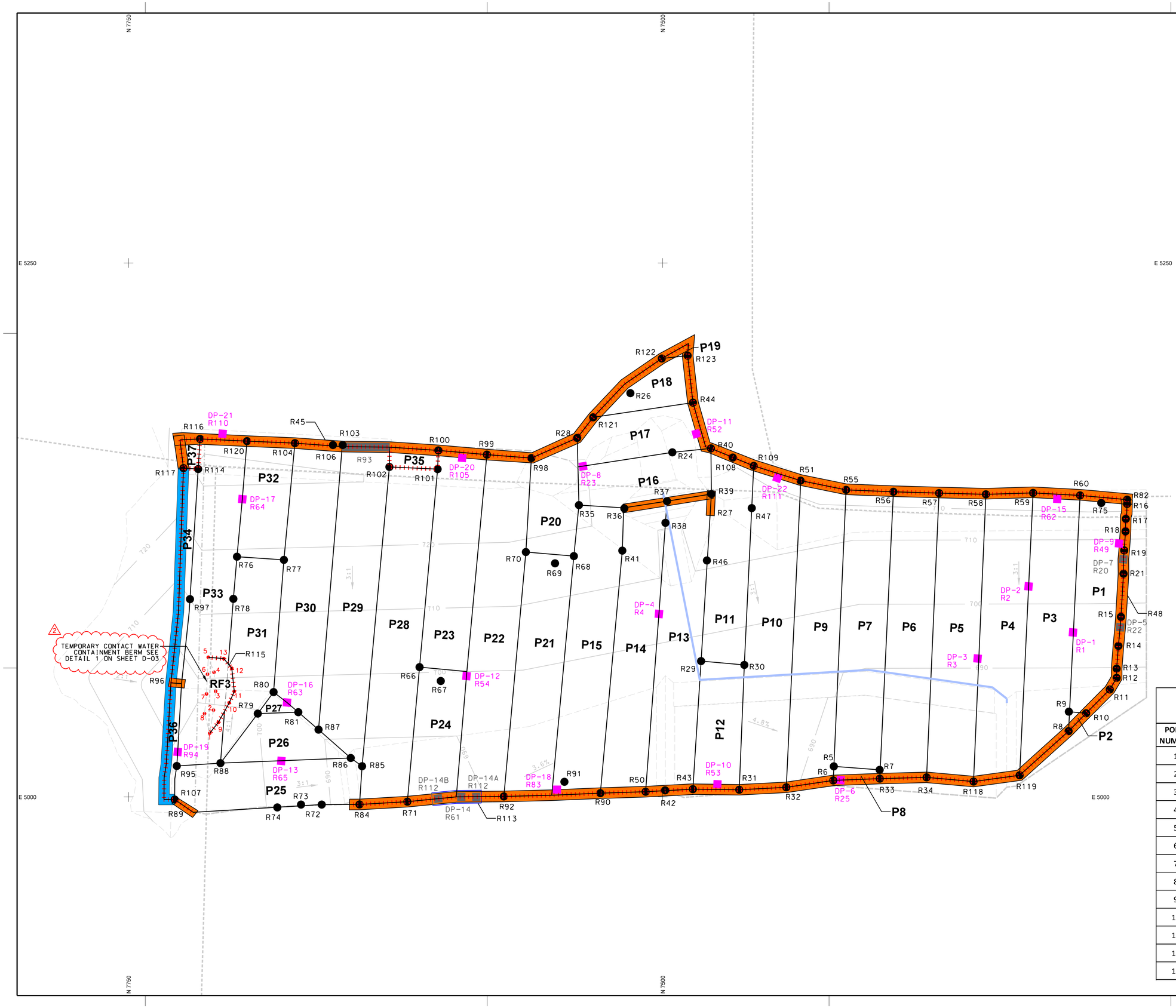
REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN. APP
0	08-10-20	ISSUED FOR RECORD DRAWINGS	PAA XZ
1	08-21-20	ADDED CELL 6E SW TEMPORARY SUMP CONTAINMENT BERM	PAA XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF PRIMARY COMPACTED CLAY LINER RECORD CONTROL POINT PLAN

PROJECT NUMBER 1198070047
SCALE 1" = 20'
DRAWING NO **P-04**



LEGEND

- PHASE BOUNDARY
- N 6500 — GRID COORDINATES
- 710 — G1 EAST PHASE 2 TOP OF PRIMARY COMPACTED CLAY CONTOUR
- G1 EAST PHASE 1 TOP OF PRIMARY LINER BREAK IN SLOPE
- FUSION WELDED SEAM
- EXTRUSION WELDED SEAM
- R12 — EXTRUSION REPAIR LOCATION
- DS10 — DESTRUCTIVE SAMPLE LOCATION
- CAP STRIP
- LIMIT OF ADDITIONAL CAP STRIP
- R12 — EXTRUSION REPAIR COVERED BY CAP STRIP
- DS10 — DESTRUCTIVE SAMPLE COVERED BY CAP STRIP
- S33 — PRIMARY LINER GEOMEMBRANE RECORD PANEL
- PRIMARY/SECONDARY EXTRUSION WELDED SEAM
- 5 — RAIN FLAP BERM RECORD POINT (SEE RECORD DATA)
- 5 EXTRA LAYERS OF GEONET

N

SCALE 0' 10' 20' 40'

G1 EAST PHASE 2 RECORD NORTH RAIN FLAP BERM DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	DESCRIPTION
1	7,711.99	5,029.88	703.66	TOP
2	7,710.23	5,040.68	703.50	TOP
3	7,709.22	5,049.50	703.57	TOP
4	7,709.99	5,058.40	703.70	TOP
5	7,712.66	5,065.42	703.73	TOP
6	7,713.03	5,057.49	703.58	TOP
7	7,713.49	5,048.26	703.51	TOP
8	7,714.41	5,039.04	703.49	TOP
9	7,707.98	5,034.91	702.41	TOE
10	7,702.85	5,044.09	699.71	TOE
11	7,700.50	5,049.41	698.60	TOE
12	7,701.67	5,060.27	701.71	TOE
13	7,705.40	5,064.79	703.30	TOE

REV	DATE	DESCRIPTION	DRN	APP
0	08-10-20	ISSUED FOR RECORD DRAWINGS	PAA	XZ
1	08-26-20	ADDED TEMPORARY CONTACT WATER CONTAINMENT BERM CALLOUT	PAA	XZ

DATE: 08-10-20
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

PRIMARY GEOMEMBRANE LINER RECORD PLAN

PROJECT NUMBER 1198070047
SCALE 1" = 20'
DRAWING NO **P-05**

G1 EAST PHASE 2 RECORD LEACHATE COLLECTION PIPE DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	DESCRIPTION
1	7,339.63	5,008.13	686.13	8" PERF. PIPE 4
2	7,337.70	5,028.12	686.23	8" PERF. PIPE
3	7,333.12	5,047.01	687.45	8" SOLID PIPE
4	7,324.34	5,060.87	691.32	8" SOLID PIPE
5	7,643.30	4,991.02	688.59	8" PERF. PIPE 4
7	7,647.87	5,016.89	688.77	8" PERF. PIPE
8	7,655.89	5,026.86	690.88	8" PERF. PIPE
13	7,663.20	5,031.47	692.63	8" PERF. PIPE
14	7,673.86	5,039.97	695.94	8" PERF. PIPE
15	7,684.14	5,047.73	698.94	8" PERF. PIPE
17	7,693.36	5,049.83	699.38	8" PERF. PIPE
18	7,699.75	5,050.67	699.33	8" SOLID PIPE
20	7,713.72	5,051.69	706.40	CO END
21	7,273.94	5,141.05	711.37	CO END
22	7,281.68	5,129.24	713.41	8" SOLID PIPE
23	7,294.33	5,105.68	707.20	8" SOLID PIPE
24	7,301.92	5,087.02	700.86	8" SOLID PIPE
25	7,305.96	5,079.27	697.73	8" SOLID PIPE
26	7,338.45	4,968.21	685.15	8" PERF. PIPE CONN.
27	7,338.43	4,957.80	685.02	8" PERF. PIPE CONN.
28	7,640.58	4,953.55	688.08	8" PERF. PIPE CONN.

G1 EAST PHASE 2 RECORD LEACHATE COLLECTION SAND LAYER DATA

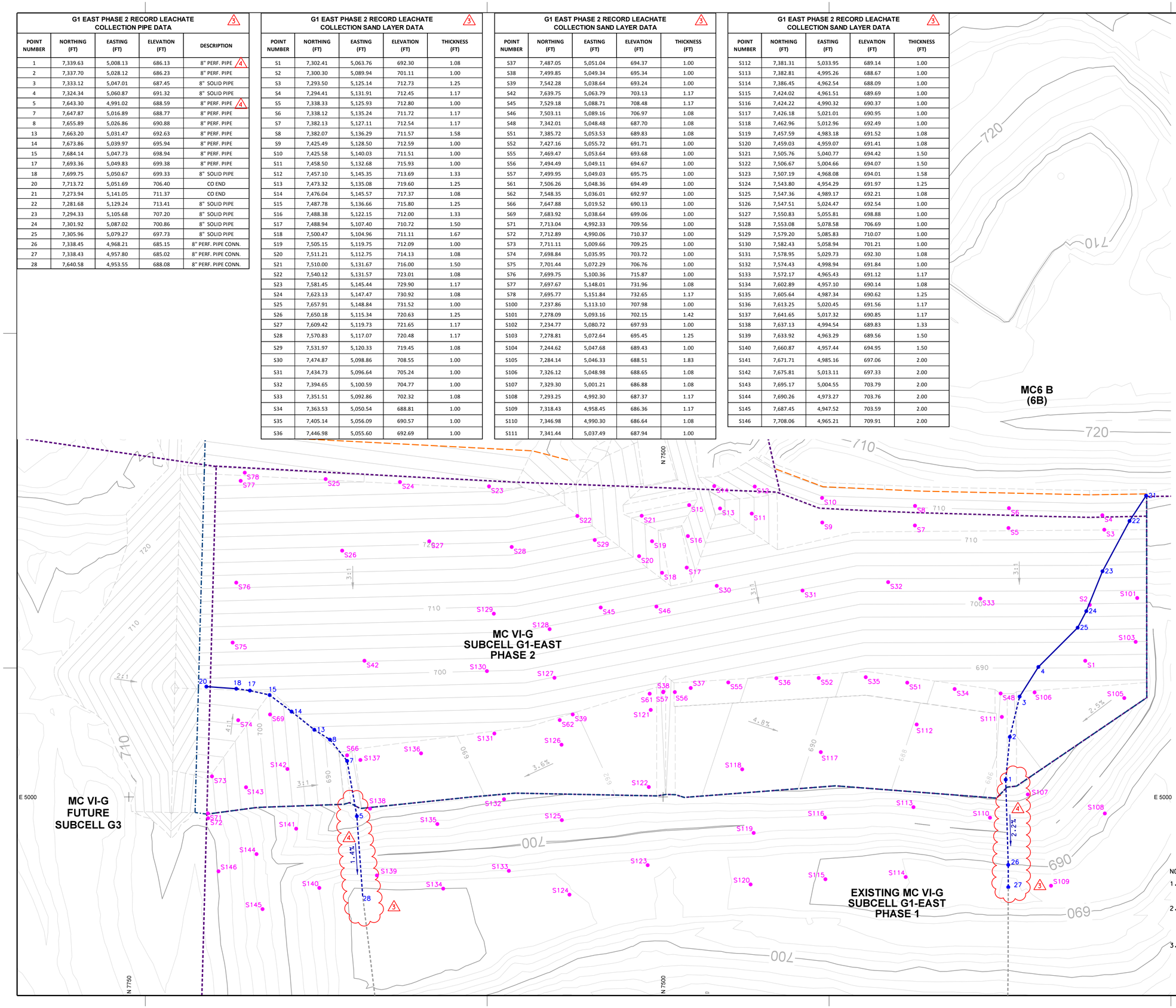
POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	THICKNESS (FT)
S1	7,302.41	5,063.76	692.30	1.08
S2	7,300.30	5,089.94	701.11	1.00
S3	7,293.50	5,125.14	712.73	1.25
S4	7,294.41	5,131.91	712.45	1.17
S5	7,338.33	5,125.93	712.80	1.00
S6	7,338.12	5,135.24	711.72	1.17
S7	7,382.13	5,127.11	712.54	1.17
S8	7,382.07	5,136.29	711.57	1.58
S9	7,425.49	5,128.50	712.59	1.00
S10	7,425.58	5,140.03	711.51	1.00
S11	7,458.50	5,132.68	715.93	1.00
S12	7,457.10	5,145.35	713.69	1.33
S13	7,473.32	5,135.08	719.60	1.25
S14	7,476.04	5,145.57	717.37	1.08
S15	7,487.78	5,136.66	715.80	1.25
S16	7,488.38	5,122.15	712.00	1.33
S17	7,488.94	5,107.40	710.72	1.50
S18	7,500.47	5,104.96	711.11	1.67
S19	7,505.15	5,119.75	712.09	1.00
S20	7,511.21	5,112.75	714.13	1.08
S21	7,510.00	5,131.67	716.00	1.50
S22	7,540.12	5,131.57	723.01	1.08
S23	7,581.45	5,145.44	729.90	1.17
S24	7,623.13	5,147.47	730.92	1.08
S25	7,657.91	5,148.84	731.52	1.00
S26	7,650.18	5,115.34	720.63	1.25
S27	7,609.42	5,119.73	721.65	1.17
S28	7,570.83	5,117.07	720.48	1.17
S29	7,531.97	5,120.33	719.45	1.08
S30	7,474.87	5,098.86	708.55	1.00
S31	7,434.73	5,096.64	705.24	1.00
S32	7,394.65	5,100.59	704.77	1.00
S33	7,351.51	5,092.86	702.32	1.08
S34	7,363.53	5,050.54	688.81	1.00
S35	7,405.14	5,056.09	690.57	1.00
S36	7,446.98	5,055.60	692.69	1.00

G1 EAST PHASE 2 RECORD LEACHATE COLLECTION SAND LAYER DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	THICKNESS (FT)
S37	7,487.05	5,051.04	694.37	1.00
S38	7,499.85	5,049.34	695.34	1.00
S39	7,542.28	5,038.64	693.24	1.00
S42	7,639.75	5,063.79	703.13	1.17
S45	7,529.18	5,088.71	708.48	1.17
S46	7,503.11	5,089.16	706.97	1.08
S48	7,342.01	5,048.48	687.70	1.08
S51	7,385.72	5,053.53	689.83	1.08
S52	7,427.16	5,055.72	691.71	1.00
S55	7,469.47	5,053.64	693.68	1.00
S56	7,494.49	5,049.11	694.67	1.00
S57	7,499.95	5,049.03	695.75	1.00
S61	7,506.26	5,048.36	694.49	1.00
S62	7,548.35	5,036.01	692.97	1.00
S66	7,647.88	5,019.52	690.13	1.00
S69	7,683.92	5,038.64	699.06	1.00
S71	7,713.04	4,992.33	709.56	1.00
S72	7,712.89	4,990.06	710.37	1.00
S73	7,711.11	5,009.66	709.25	1.00
S74	7,698.84	5,035.95	703.72	1.00
S75	7,701.44	5,072.29	706.76	1.00
S76	7,699.75	5,100.36	715.87	1.00
S77	7,697.67	5,148.01	731.96	1.08
S78	7,695.77	5,151.84	732.65	1.17
S100	7,237.86	5,113.10	707.98	1.00
S101	7,278.09	5,093.16	702.15	1.42
S102	7,234.77	5,080.72	697.93	1.00
S103	7,278.81	5,072.64	695.45	1.25
S104	7,244.62	5,047.68	689.43	1.00
S105	7,284.14	5,046.33	688.51	1.83
S106	7,326.12	5,048.98	688.65	1.08
S107	7,329.30	5,001.21	686.88	1.08
S108	7,293.25	4,992.30	687.37	1.17
S109	7,318.43	4,958.45	686.36	1.17
S110	7,346.98	4,990.30	686.64	1.08
S111	7,341.44	5,037.49	687.94	1.00

G1 EAST PHASE 2 RECORD LEACHATE COLLECTION SAND LAYER DATA

POINT NUMBER	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)	THICKNESS (FT)
S112	7,381.31	5,033.95	689.14	1.00
S113	7,382.81	4,995.26	688.67	1.00
S114	7,386.45	4,962.54	688.09	1.00
S115	7,424.02	4,961.51	689.69	1.00
S116	7,424.22	4,990.32	690.37	1.00
S117	7,426.18	5,021.01	690.95	1.00
S118	7,462.96	5,012.96	692.49	1.00
S119	7,457.59	4,983.18	691.52	1.08
S120	7,459.03	4,959.07	691.41	1.08
S121	7,505.76	5,040.77	694.42	1.50
S122	7,506.67	5,004.66	694.07	1.50
S123	7,507.19	4,968.08	694.01	1.58
S124	7,543.80	4,954.29	691.97	1.25
S125	7,547.36	4,989.17	692.21	1.08
S126	7,547.51	5,024.47	692.54	1.00
S127	7,550.83	5,055.81	698.88	1.00
S128	7,553.08	5,078.58	706.69	1.00
S129	7,579.20	5,085.83	710.07	1.00
S130	7,582.43	5,058.94	701.21	1.00
S131	7,578.95	5,029.73	692.30	1.08
S132	7,574.43	4,998.94	691.84	1.00
S133	7,572.17	4,965.43	691.12	1.17
S134	7,602.89	4,957.10	690.14	1.08
S135	7,605.64	4,987.34	690.62	1.25
S136	7,613.25	5,020.45	691.56	1.17
S137	7,641.65	5,017.32	690.85	1.17
S138	7,637.13	4,994.54	689.83	1.33
S139	7,633.92	4,963.29	689.56	1.50
S140	7,660.87	4,957.44	694.95	1.50
S141	7,671.71	4,985.16	697.06	2.00
S142	7,675.81	5,013.11	697.33	2.00
S143	7,695.17	5,004.55	703.79	2.00
S144	7,690.26	4,973.27	703.76	2.00
S145	7,687.45	4,947.52	703.59	2.00
S146	7,708.06	4,965.21	709.91	2.00



LEGEND

- PHASE BOUNDARY
- N 6500 + GRID COORDINATES
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- PAVED GRAVEL EXISTING ROAD
- APPROXIMATE 6E/6B TOP OF PRIMARY LINER CREST OF SLOPE
- LIMIT OF G1 EAST PHASE 2 TOP OF PRIMARY COMPACTED CLAY LINER CERTIFICATION
- 710 G1 EAST PHASE 2 TOP OF PRIMARY COMPACTED CLAY CONTOUR (2 FT INTERVAL)
- TOP OF PRIMARY COMPACTED CLAY LINER GRADE BREAK IN SLOPE
- PERFORATED RECORD G1EP1 LEACHATE COLLECTION PIPE 3
- PERFORATED RECORD LEACHATE COLLECTION PIPE 3
- SOLID RECORD LEACHATE COLLECTION PIPE
- 2 TOP OF LEACHATE COLLECTION PIPE RECORD POINT (SEE RECORD DATA) 3
- S34 TOP OF LEACHATE COLLECTION SAND LAYER RECORD POINT (SEE RECORD DATA) 3

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES. DATED DECEMBER 19, 2019. UPDATED JUNE 1, 2020.
2. EDGE OF 6E GEOMEMBRANE BASED ON RECORD DRAWINGS TAKEN FROM MASTER CELL 6E PHASE 1 CONSTRUCTION RECORD PLANS. PROVIDED BY NTH CONSULTANTS, LTD. ENTITLED "PANEL LAYOUT SECONDARY GEOMEMBRANE RECORD DRAWING", SHEET 6. DATED SEPTEMBER 26, 2006.
3. EDGE OF 6B GEOMEMBRANE APPROXIMATED AND DIGITIZED BASED ON RECORD CREST OF SLOPE FOR THE PRIMARY AND SECONDARY LINER AND ANCHOR TRENCH TAKEN FROM 1988 CONSTRUCTION CERTIFICATION SET, DRAWING VI-B 102, ENTITLED, "PRIMARY LINER ELEVATIONS AND LEACHATE AS-BUILT CONDITIONS" AND DRAWING VI-B 101, ENTITLED "SECONDARY LINER ELEVATIONS AS-BUILT CONDITIONS", PROVIDED BY MIDWESTERN CONSULTING, INC. DATED, SEPTEMBER 1988, REVISED DECEMBER 1988.

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REVISIONS	REV	DATE	DESCRIPTION
	4	09-22-20	ADDED SLOPES ON RECORD LEACHATE COLLECTION PIPE ON FLOOR AND ADDED LEACHATE COLLECTION SAND LAYER RECORD POINTS.
	3	09-21-20	ADDED LEACHATE COLLECTION SAND LAYER RECORD POINTS.
	0	08-10-20	ISSUED FOR REVIEW

DATE:	08-10-20
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

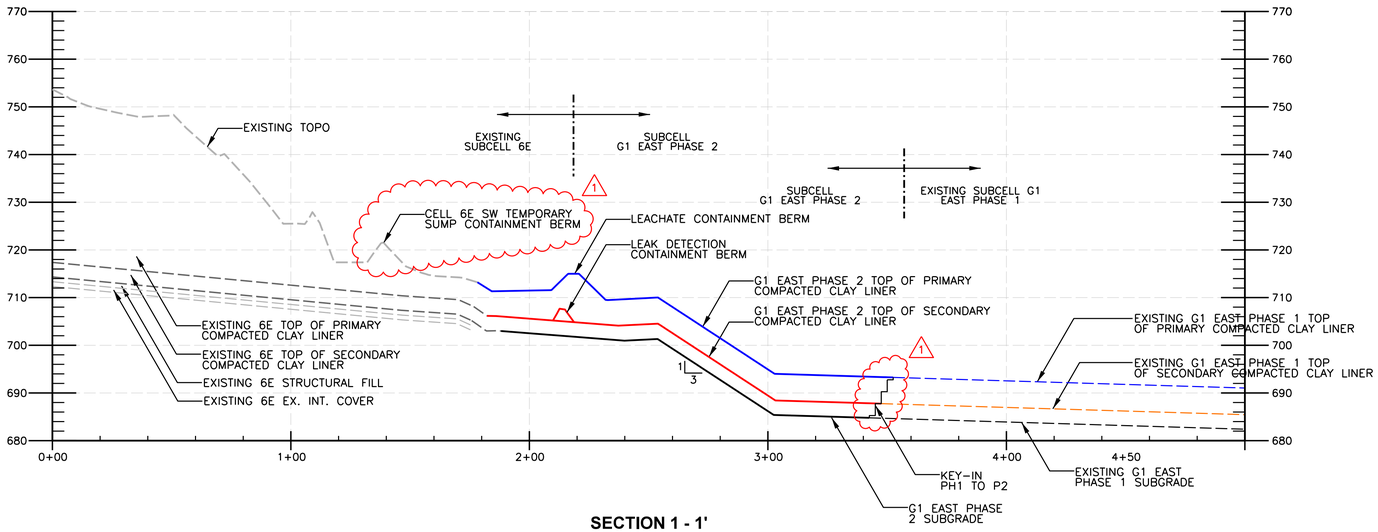
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF LEACHATE COLLECTION SAND LAYER AND LEACHATE COLLECTION PIPE RECORD CONTROL POINT PLAN

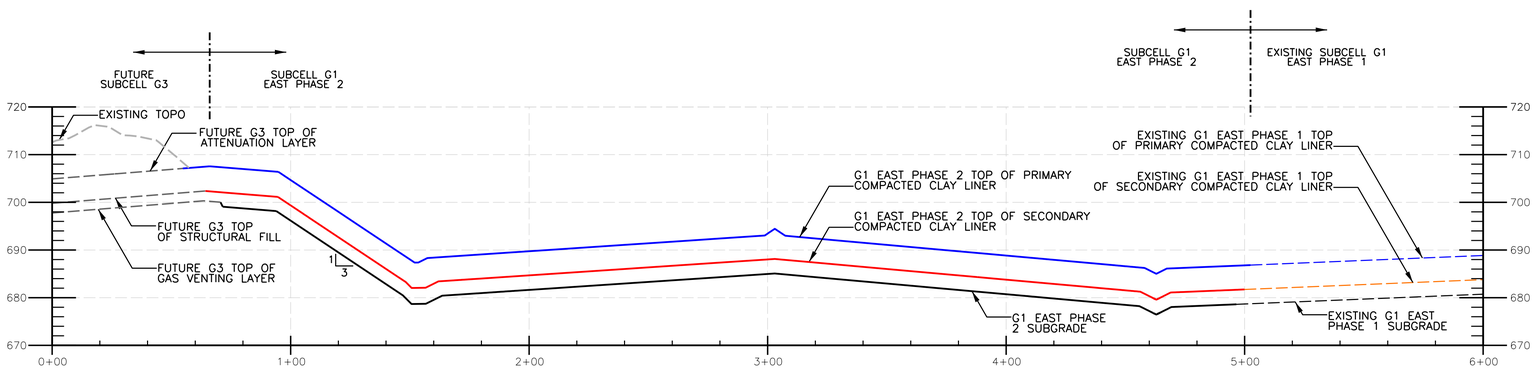
PROJECT NUMBER
1198070047

SCALE
1" = 20'

DRAWING NO
P-06



SECTION 1 - 1'



SECTION 2 - 2'

0 30' 60' 120'
VERTICAL SCALE

0 15' 30' 60'
HORIZONTAL SCALE

CTI and Associates, Inc.
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www.ctiomplanies.com

DATE: 08-10-20
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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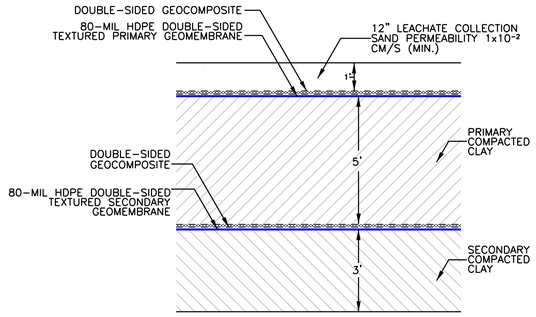
REV	DATE	DESCRIPTION	DRN	APP
0	08-10-20	ISSUED FOR RECORD DRAWINGS	PAA	XZ
1	08-21-20	ADDED CELL 6E SW TEMPORARY SUMP CONTAINMENT BERM AND P1 TO P2 KEY-IN	PAA	XZ

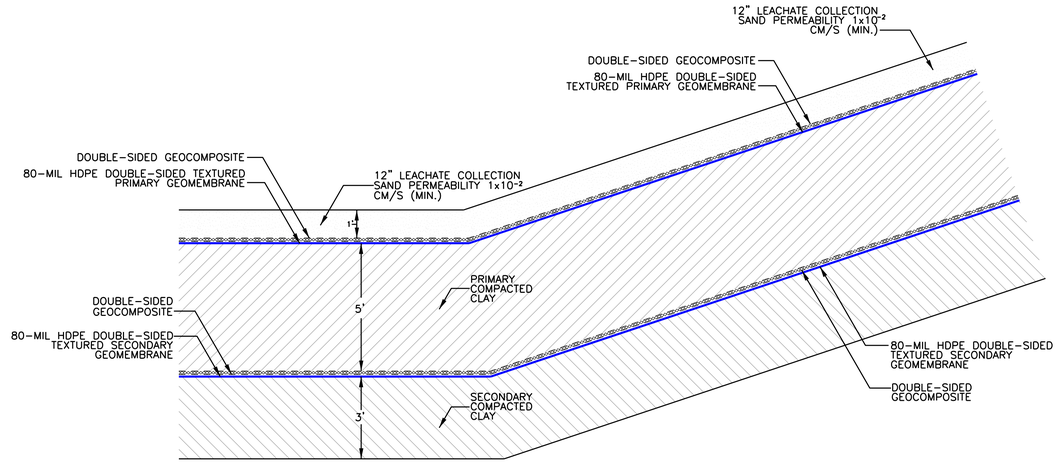
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTIONS 1-1' AND 2-2'

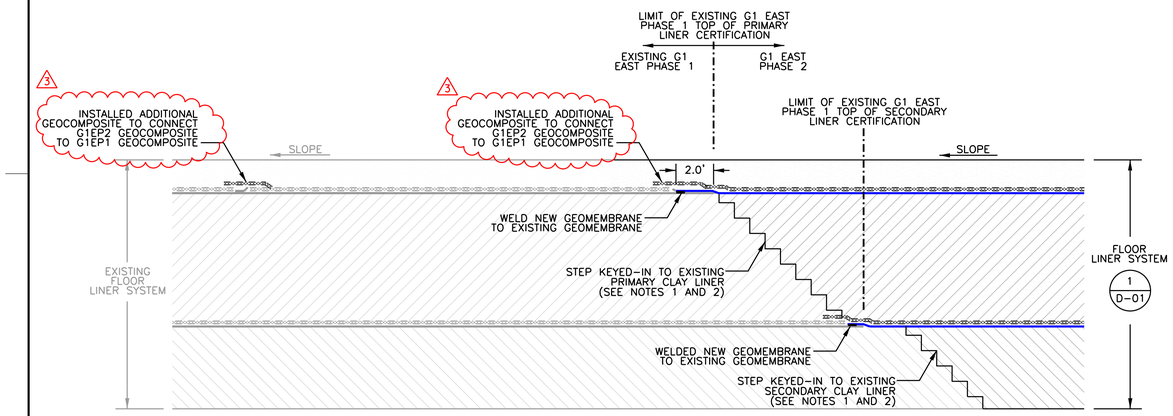
PROJECT NUMBER
1198070047
SCALE
1" = 30'
DRAWING NO.
C-01



FLOOR LINER SYSTEM 1
NOT TO SCALE



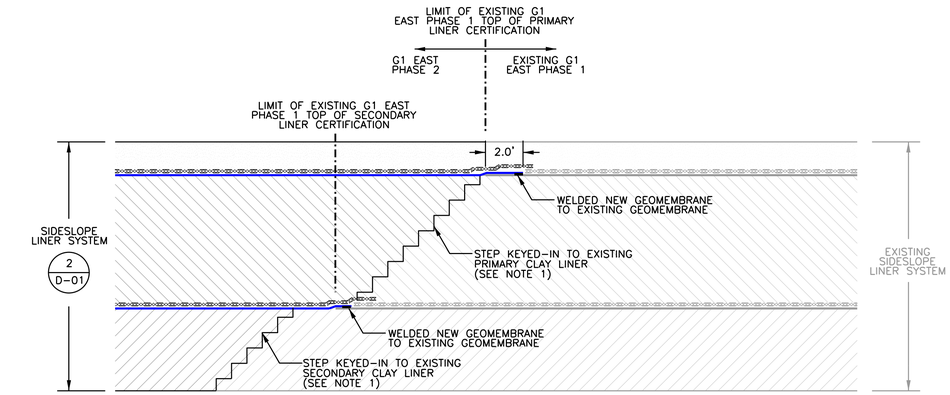
SIDESLOPE LINER SYSTEM 2
NOT TO SCALE



G1 EAST PHASE 1 TO G1 EAST PHASE 2 TIE-IN (FLOOR) 3
NOT TO SCALE

NOTES:

1. MINIMUM HORIZONTAL EXTENSION OF NEW CLAY LAYER WAS TWELVE (12) INCHES.
2. SEE SHEETS P-02 AND P-04 FOR LOCATIONS OF SUPPLEMENTAL GCL PLACED AT CLAY LINER TIE-INS.



G1 EAST PHASE 1 TO G1 EAST PHASE 2 TIE-IN (SIDESLOPE) 4
NOT TO SCALE

NOTE:

1. MINIMUM HORIZONTAL EXTENSION OF NEW CLAY LAYER WAS TWELVE (12) INCHES.

CTI and Associates, Inc.
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DATE:	08-10-20
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION	DRN	APP
0	08-10-20	ISSUED FOR RECORD DRAWINGS	PAA	XZ
3	09-21-20	ISSUED FOR RECORD DRAWINGS	PAA	XZ

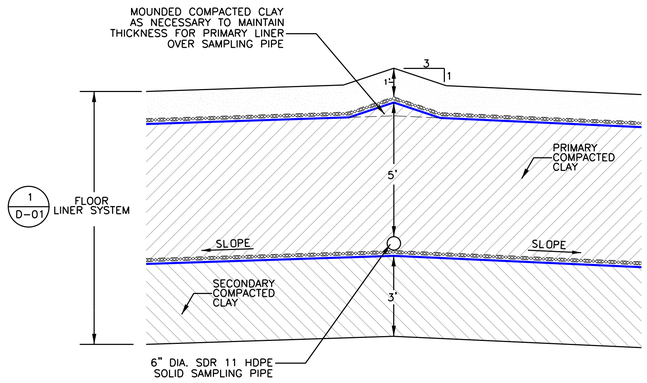
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (1 OF 6)

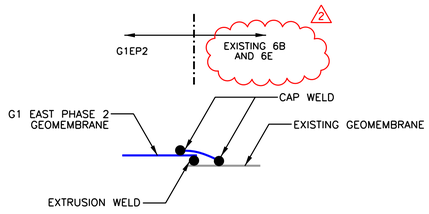
PROJECT NUMBER
1198070047

SCALE
NTS

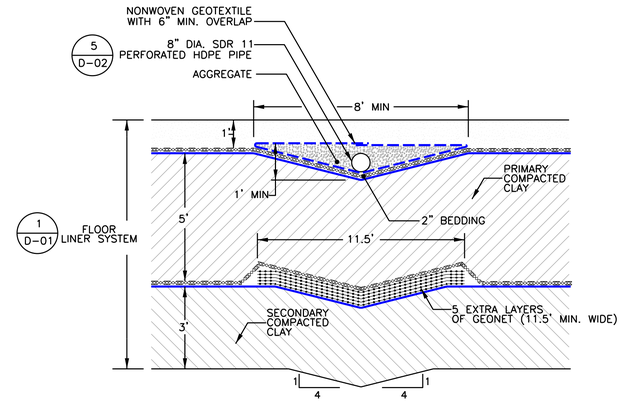
DRAWING NO.
D-01



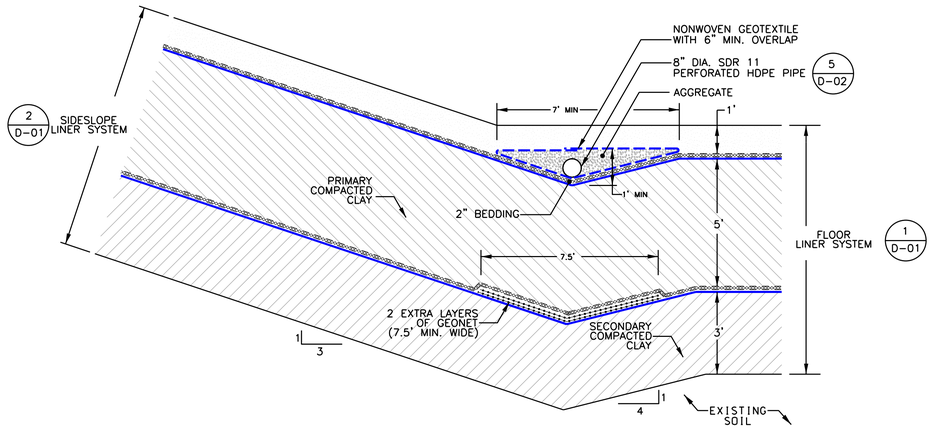
LEAK DETECTION SAMPLING PIPE 1
NOT TO SCALE



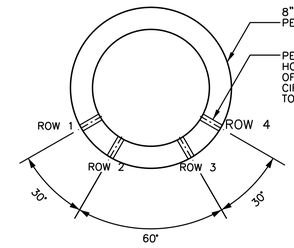
CELL 6B AND 6E TO G1EP2 TIE-IN GEOMEMBRANE WELDING DETAIL 2
NOT TO SCALE



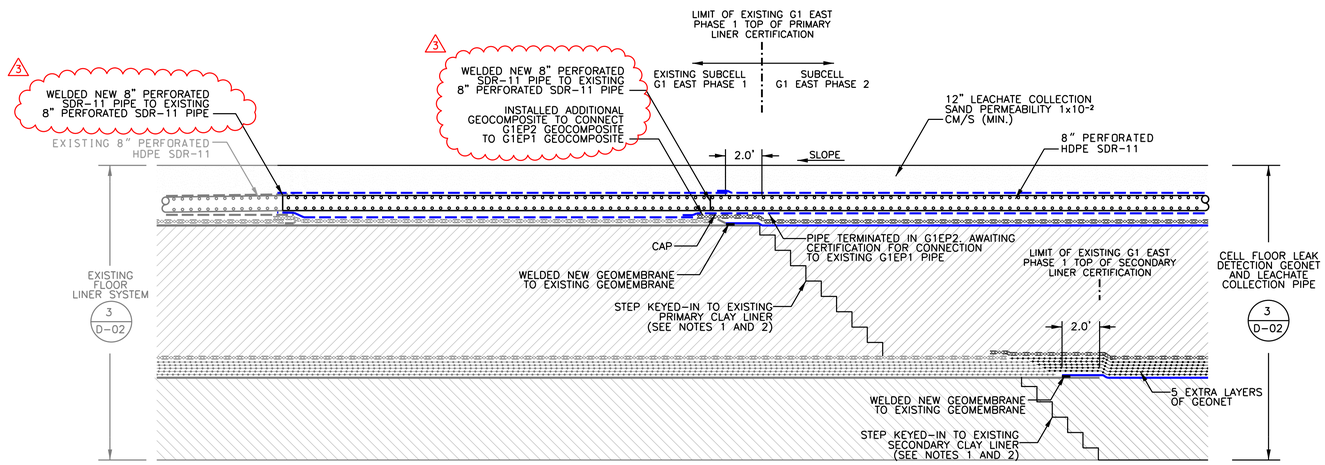
CELL FLOOR LEAK DETECTION GEONET AND LEACHATE COLLECTION PIPE (TYP.) 3
NOT TO SCALE



TOE OF SLOPE LEAK DETECTION GEONET AND LEACHATE COLLECTION PIPE (TYP.) 4
NOT TO SCALE



PIPE PERFORATION DETAIL 5
NOT TO SCALE



TIE-IN AT LEAK DETECTION GEONET AND LEACHATE COLLECTION TRENCH 6
NOT TO SCALE

NOTES:

1. MINIMUM HORIZONTAL EXTENSION OF NEW CLAY LAYER WAS TWELVE (12) INCHES.
2. SEE SHEETS P-02 AND P-04 FOR LOCATIONS OF SUPPLEMENTAL GCL PLACED AT CLAY LINER TIE-INS.

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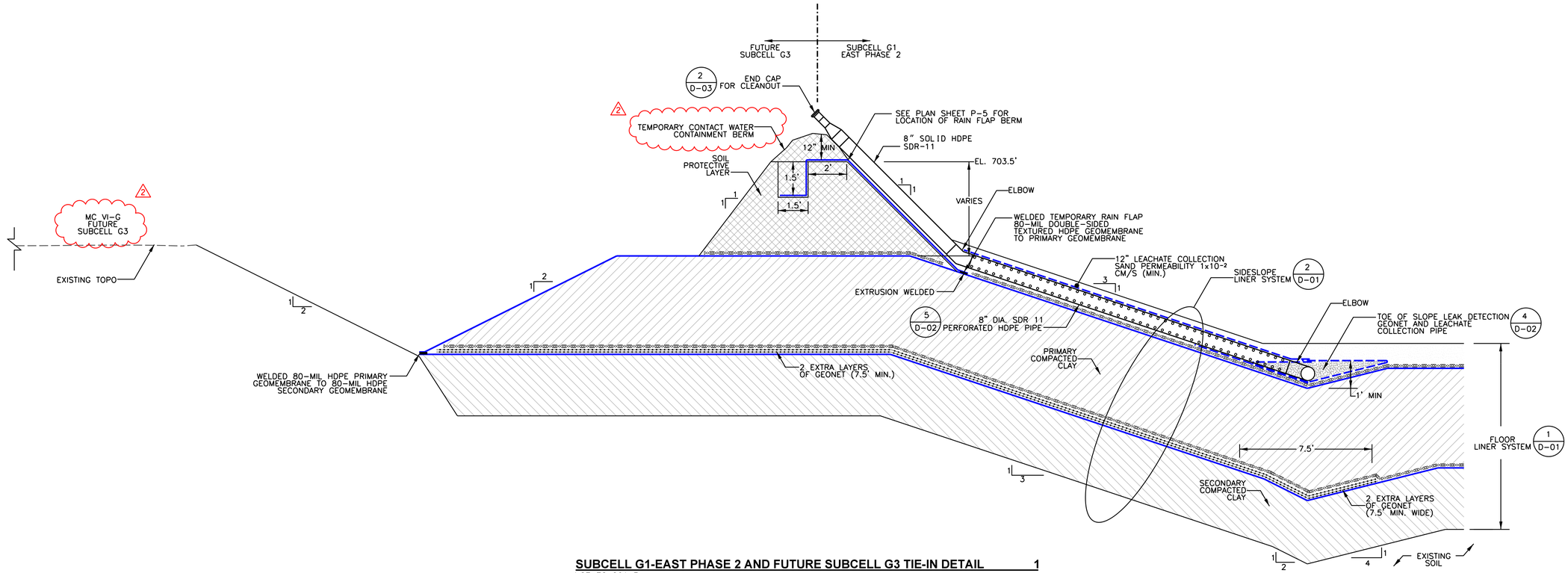
REV	DATE	REVISION DESCRIPTION	DRN.	APP.
3	09-21-20	UPDATED NOTES ON DETAIL 2	PAA	XZ
0	08-10-20	ISSUED FOR RECORD DRAWINGS	PAA	XZ

DATE: 08-10-20
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

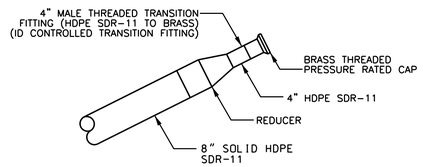
LINER SYSTEM DETAILS (2 OF 6)

PROJECT NUMBER 1198070047
SCALE NTS
DRAWING NO. **D-02**



SUBCELL G1-EAST PHASE 2 AND FUTURE SUBCELL G3 TIE-IN DETAIL 1

NOT TO SCALE



END CAP FOR CLEANOUT 2

NOT TO SCALE

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248.486.5100 (fax)248.486.5050
www.ctiengineering.com

DATE:	08-10-20
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

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REVISIONS			
REV	DATE	DSN.	APP
0	08-10-20	PAA	XZ
2	08-26-20	PAA	XZ

REVISION	DESCRIPTION
0	ISSUED FOR RECORD DRAWINGS
2	ADDED NOTES ON DETAIL 1

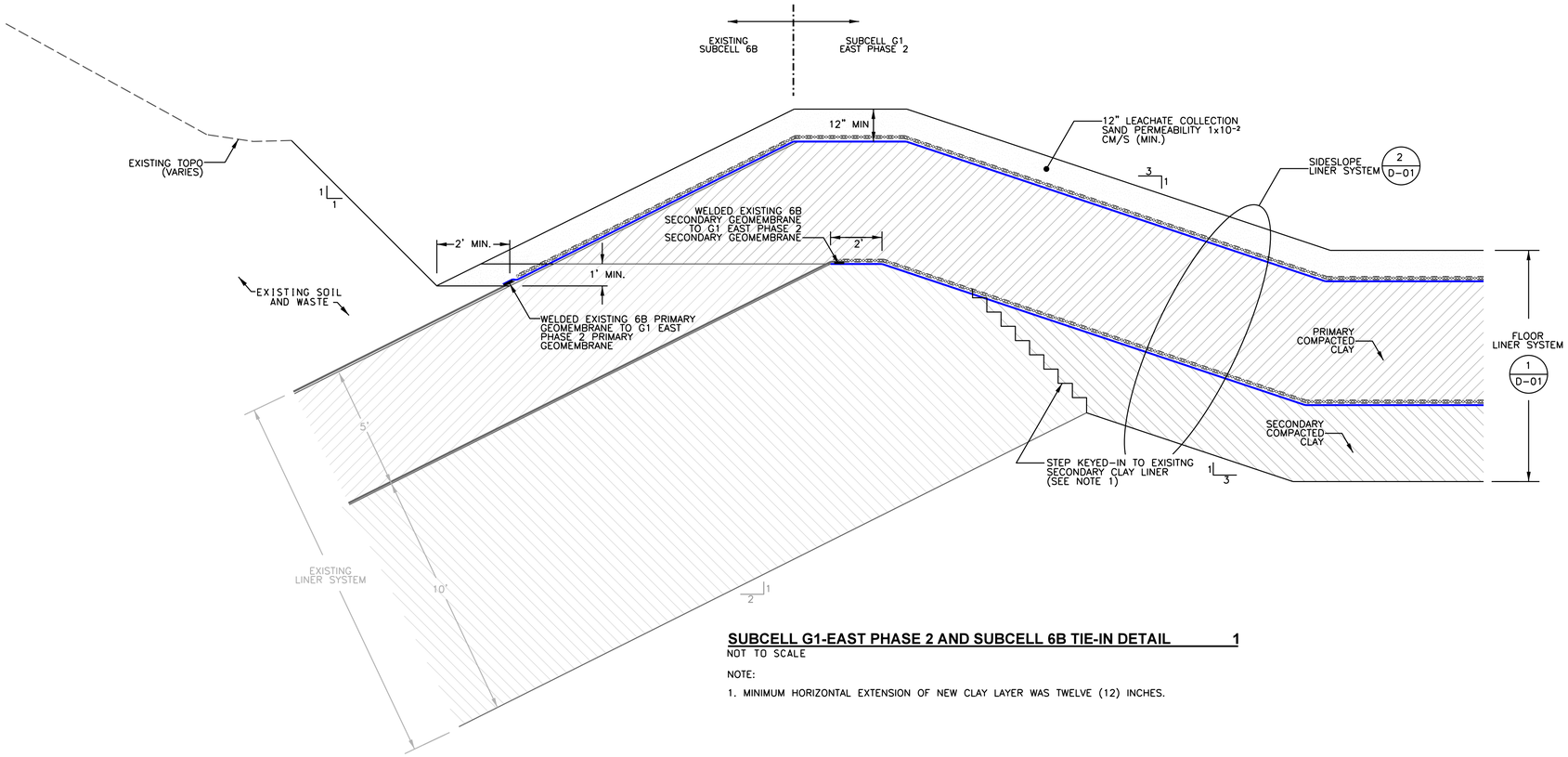
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (3 OF 6)

PROJECT NUMBER
1198070047

SCALE
NTS

DRAWING NO.
D-03

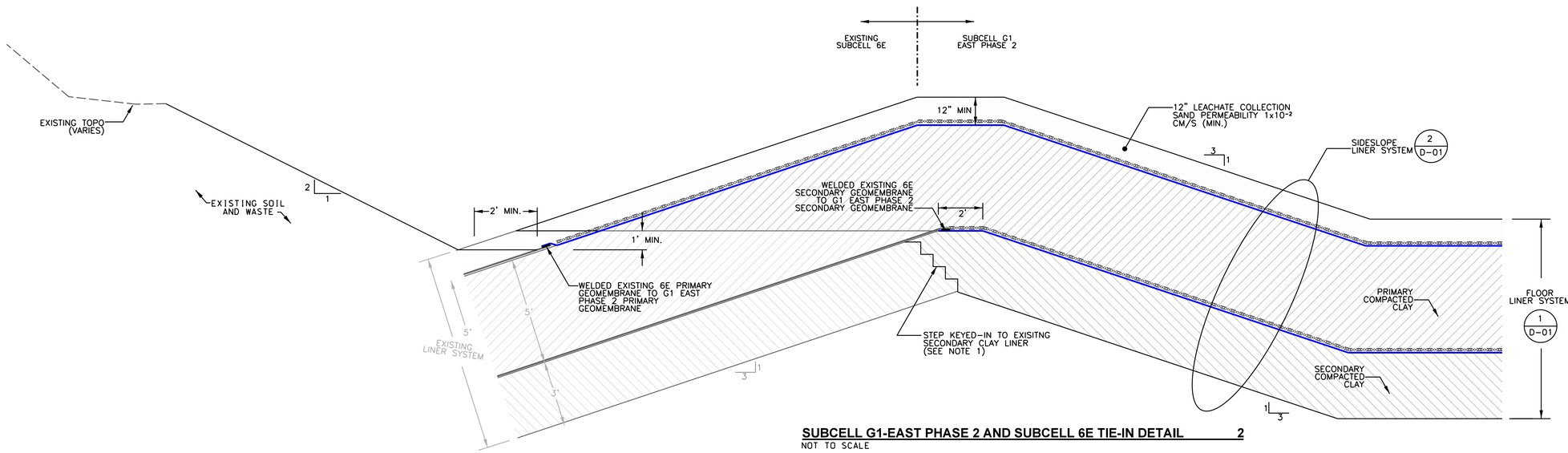


SUBCELL G1-EAST PHASE 2 AND SUBCELL 6B TIE-IN DETAIL 1

NOT TO SCALE

NOTE:

1. MINIMUM HORIZONTAL EXTENSION OF NEW CLAY LAYER WAS TWELVE (12) INCHES.



SUBCELL G1-EAST PHASE 2 AND SUBCELL 6E TIE-IN DETAIL 2

NOT TO SCALE

NOTE:

1. MINIMUM HORIZONTAL EXTENSION OF NEW CLAY LAYER WAS TWELVE (12) INCHES.

DATE: 08-10-20
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP
0	08-10-20	ISSUED FOR RECORD DRAWINGS	PAA	XZ

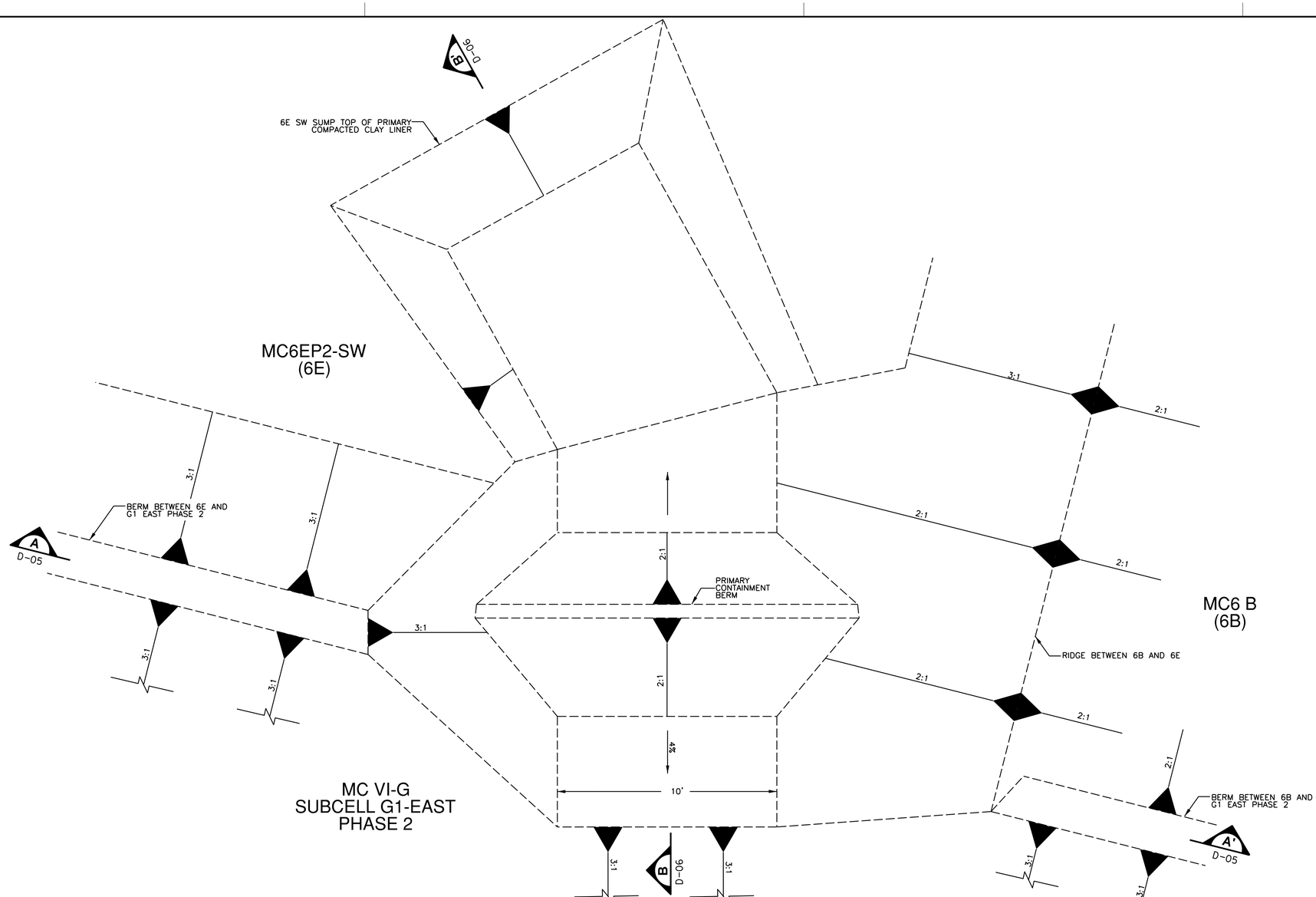
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (4 OF 6)

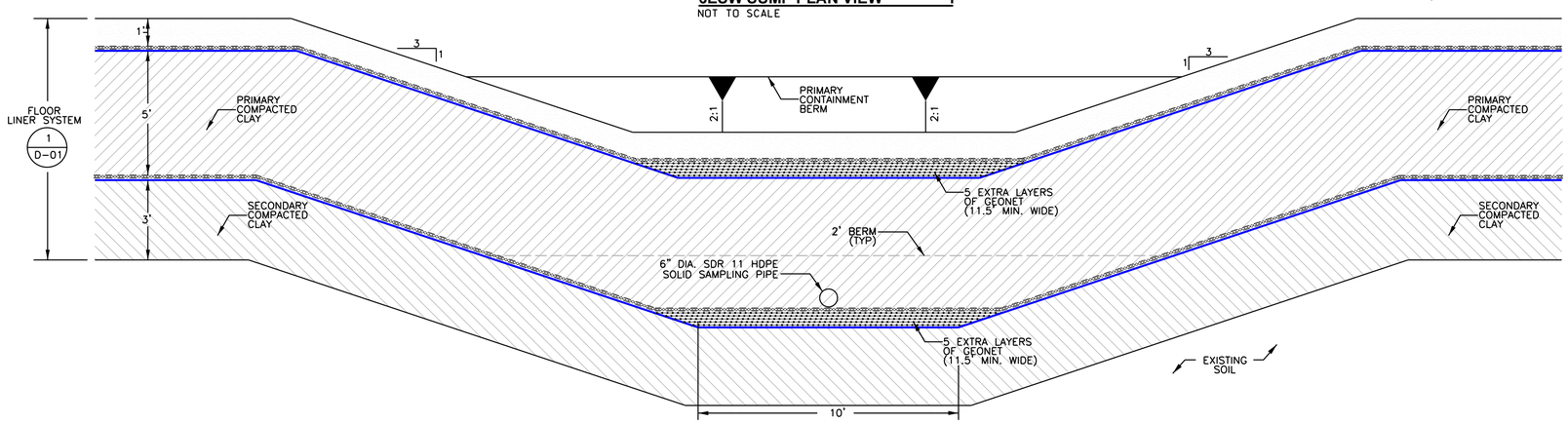
PROJECT NUMBER 1198070047

SCALE NTS

DRAWING NO. D-04



6ESW SUMP PLAN VIEW 1
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

CTI and Associates, Inc.
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DATE:	08-10-20
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION	DRN	APP
0	08-10-20	ISSUED FOR RECORD DRAWINGS	PAA	XZ

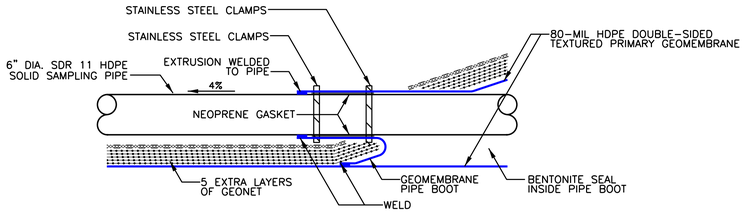
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (5 OF 6)

PROJECT NUMBER
1198070047

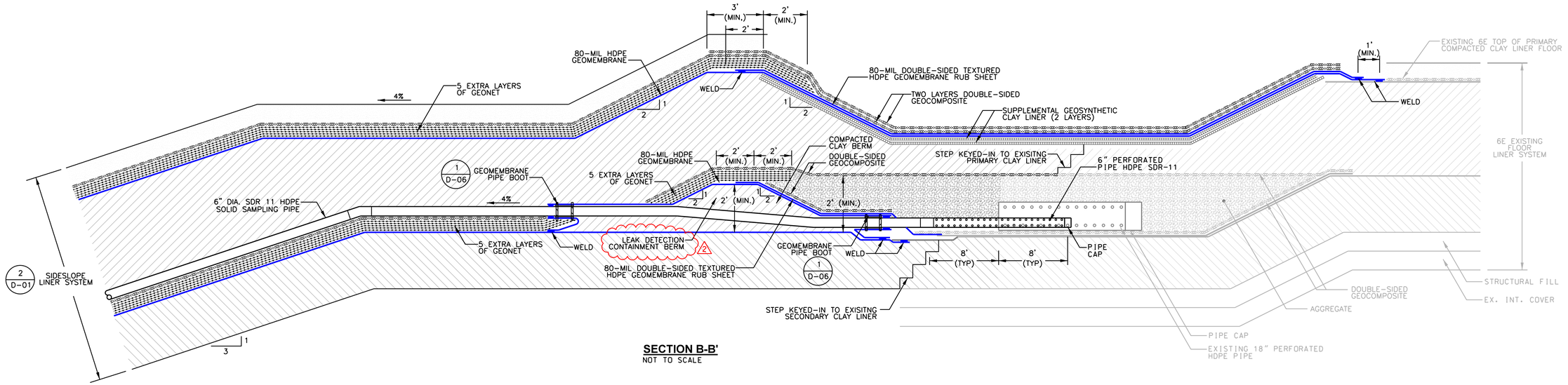
SCALE

DRAWING NO
D-05



TYPCIAL GEOMEMBRANE BOOT DETAIL 1

NOT TO SCALE



SECTION B-B'

NOT TO SCALE

DATE:	08-10-20
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN
1	08-26-20	ADDED LEAK DETECTION CONTAINMENT BERM	PAA
0	08-10-20	ISSUED FOR RECORD DRAWINGS	PAA

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G PHASE 1
SUBCELL G1 EAST PHASE 2 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (6 OF 6)

PROJECT NUMBER
1198070047

SCALE

DRAWING NO.
D-06

WAYNE DISPOSAL SITE NO. 2

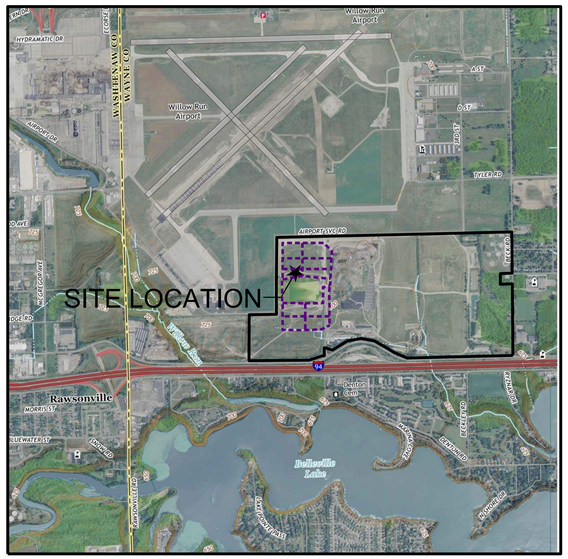
MASTER CELL VI CELL G2

RECORD PLAN

WAYNE DISPOSAL, INC. SITE NO. 2
MASTER CELL VI-G PHASE 2
SUBCELL G2 2019 RECORD CONSTRUCTION PLANS

VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

WAYNE COUNTY, MICHIGAN
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

LIST OF DRAWINGS

⚠2 ⚠1	01	COVER SHEET
	02	SITE PLAN
	03	SUBGRADE RECORD CONTROL POINT PLAN
	04	VENTING LAYER PIPE RECORD CONTROL POINT PLAN
	05	BOTTOM OF STRUCTURAL FILL LAYER RECORD CONTROL POINT PLAN
	06	TOP OF STRUCTURAL FILL RECORD CONTROL POINT PLAN
	07	SECONDARY LINER GEOMEMBRANE RECORD PLAN
⚠1	08	TOP OF ATTENUATION RECORD CONTROL POINT PLAN
	09	PRIMARY LINER GEOMEMBRANE RECORD PLAN
⚠2 ⚠1	09A	TOP OF LEACHATE COLLECTION SAND LAYER AND LEACHATE COLLECTION PIPE RECORD CONTROL POINT PLAN
	10	RECORD CONSTRUCTION CONTROL TABLES
	11	RECORD CONSTRUCTION CONTROL TABLES
⚠1	12	LINER SYSTEM DETAILS (1 OF 3)
⚠1	13	LINER SYSTEM DETAILS (2 OF 3)
⚠1	14	LINER SYSTEM DETAILS (3 OF 3)
⚠1	15	LEACHATE COLLECTION PIPE DETAILS

OWNER:
US ECOLOGY
Wayne Disposal, Inc.
49350 N. I-94 Service Drive
Belleville, Michigan 48111

ENGINEER:
CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377

CTI PROJECT NO. 1188070030

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DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

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MC VI-F
FUTURE
SUBCELL F3

MC VI-F
FUTURE
SUBCELL F4

MC VI-G
FUTURE
SUBCELL G3

MC VI-G
EXISTING
SUBCELL G1

MC VI-G
FUTURE
SUBCELL G6

MC VI-G
FUTURE
SUBCELL G7

MC VI-F
FUTURE
SUBCELL F2

MC VI-F
FUTURE
SUBCELL F1

MC VI-G
SUBCELL G2

MC VI-G
FUTURE
SUBCELL G4

MC VI-G
FUTURE
SUBCELL G5

N 9000 N 8500 N 8000 N 7500 N 7000 N 6500 N 6000

E 5000 E 4500 E 4000 E 3500

N

0 50' 100' 200'
SCALE

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- N 6500 GRID COORDINATES
- EXISTING STRUCTURE/ BUILDING
- PAVED / GRAVEL EXISTING ROAD
- EXISTING FENCE
- SUBCELL G2 CONSTRUCTION AREA

NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED JANUARY 4, 2019.

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DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

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REV	DATE	REVISION DESCRIPTION
00	6-28-19	ISSUED FOR RECORD DRAWINGS

PAA XZ
DRN. APP

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

SITE PLAN

PROJECT NUMBER
1188070030
SCALE
1" = 100'
DRAWING NO
02

MC VI-F
FUTURE SUBCELL F1

MC VI-F
FUTURE SUBCELL F4

MC VI-G
SUBCELL G2

MC VI-G
FUTURE SUBCELL G3

MC VI-G
EXISTING SUBCELL G1

N 8000
N 7750
E 3750
E 4000
E 4250
E 4500

NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN 2001 BY –AIR–LAND AND PROVIDED BY WDI, A SURVEY BY MCLLC IN OCTOBER 2007, AND A GROUND SURVEY BY WDI IN OCTOBER 2008.
2. SEE SHEETS 10 AND 11 FOR RECORD CONSTRUCTION CONTROL POINT DATA.

N

0 15' 30' 60'
SCALE

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- N 6500 + GRID COORDINATES
- GRADE BREAK
- 710 SUBGRADE CONTOURS
- x145 RECORD SUBGRADE CONTROL POINT
- RECORD SUBGREADE CERTIFICATION LIMIT
- VENTING LAYER AREA

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DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

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REV	DATE	REVISION DESCRIPTION
00	6-28-19	ISSUED FOR RECORD DRAWINGS

PAA XZ
DRN. APP

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

SUBGRADE RECORD CONTROL POINT PLAN

PROJECT NUMBER
1188070030
SCALE
1" = 30'
DRAWING NO
03

MC VI-F
FUTURE SUBCELL F1

MC VI-F
FUTURE SUBCELL F4

MC VI-G
FUTURE SUBCELL G3

MC VI-G
SUBCELL G2

MC VI-G
EXISTING SUBCELL G1

6" SOLID HDPE SDR-11

N: 7928.94
E: 3797.77
ELEV.:737.11

N: 7930.30
E: 3813.29
ELEV.:734.61

N: 7930.80
E: 3829.63
ELEV.:731.16

N: 7926.20
E: 3908.24
ELEV.:709.70

N: 7926.59
E: 3937.08
ELEV.:706.31

N: 7926.60
E: 3929.60
ELEV.:704.35

N: 7917.32
E: 3929.63
ELEV.:703.96

N: 7927.89
E: 3927.05
ELEV.:704.34

N: 7927.27
E: 3872.73
ELEV.:722.75

N: 7928.15
E: 3857.74
ELEV.:727.56

N: 7921.00
E: 3967.66
ELEV.:707.07

N: 7914.95
E: 4018.58
ELEV.:708.65

N: 7908.52
E: 4071.27
ELEV.:710.27

N: 7901.47
E: 4123.33
ELEV.:712.03

N: 7896.48
E: 4173.48
ELEV.:714.38

N: 7890.26
E: 4228.21
ELEV.:715.86

N: 7884.75
E: 4277.29
ELEV.:717.89

N: 7878.02
E: 4333.90
ELEV.:720.11

N: 7872.50
E: 4383.65
ELEV.:721.77

CAP 6" PERFORATED
HDPE PIPE
N: 7870.01
E: 4417.05
ELEV.:721.11

VENTING LINE (4/13)

N: 7884.03
E: 3930.21
ELEV.:701.81

N: 7843.38
E: 3931.42
ELEV.:700.58

N: 7806.10
E: 3928.24
ELEV.:699.96

N: 7770.72
E: 3926.70
ELEV.:700.30

N: 7752.28
E: 3924.73
ELEV.:699.73

N: 7750.64
E: 3924.92
ELEV.:700.25

N: 7748.39
E: 3935.45
ELEV.:696.90

N: 7747.91
E: 3940.64
ELEV.:696.95

N: 7758.71
E: 3861.56
ELEV.:720.83

N: 7752.62
E: 3911.98
ELEV.:704.30

N: 7765.84
E: 3802.29
ELEV.:738.20

N: 7761.49
E: 3839.26
ELEV.:725.48

N: 7757.22
E: 3877.64
ELEV.:717.33

N: 7754.81
E: 3895.54
ELEV.:710.79

12" SOLID
HDPE SDR 11 (B/13)

VENTING SUMP (3/13)

12" PERFORATED
HDPE SDR 11 (8/13)

N 8000
N 7750
E 3750
E 4000
E 4250
E 4500

NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN 2001 BY –AIR–LAND AND PROVIDED BY WDI, A SURVEY BY MCLLC IN OCTOBER 2007, AND A GROUND SURVEY BY WDI IN OCTOBER 2008.
2. SEE SHEETS 10 AND 11 FOR RECORD CONSTRUCTION CONTROL POINT DATA.

N

0 15' 30' 60'
SCALE

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- N 6500 GRID COORDINATES
- GRADE BREAK
- 710 SUBGRADE CONTOURS
- RECORD SUBGREADE CERTIFICATION LIMIT
- VENTING LAYER AREA

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DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP
00	6-28-19	ISSUED FOR RECORD DRAWINGS	PAA	XZ

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

VENTING LAYER PIPE RECORD CONTROL POINT PLAN

PROJECT NUMBER 1188070030
SCALE 1" = 30'
DRAWING NO 04

MC VI-F
FUTURE SUBCELL F1

MC VI-F
FUTURE SUBCELL F4

MC VI-G
FUTURE SUBCELL G3

MC VI-G
SUBCELL G2

MC VI-G
EXISTING SUBCELL G1

NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN 2001 BY –AIR–LAND AND PROVIDED BY WDI, A SURVEY BY MCLLC IN OCTOBER 2007, AND A GROUND SURVEY BY WDI IN OCTOBER 2008.

2. SEE SHEETS 10 AND 11 FOR CONSTRUCTION CONTROL POINT DATA.

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 — EXISTING CONTOUR (2 FT INTERVAL)
- N 6500 + GRID COORDINATES
- GRADE BREAK
- 710 — BOTTOM OF STRUCTURAL FILL LAYER CONTOURS
- BOTTOM OF STRUCTURAL FILL LAYER CERTIFICATION LIMIT
- 317 X BOTTOM OF STRUCTURAL FILL LAYER RECORD CONTROL POINT

N

0 15' 30' 60'
SCALE

DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

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REV	DATE	REVISION DESCRIPTION
00	6-28-19	ISSUED FOR RECORD DRAWINGS

PAA XZ
DRN APP

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

BOTTOM OF STRUCTURAL FILL LAYER RECORD CONTROL POINT PLAN

PROJECT NUMBER
1188070030
SCALE
1" = 30'
DRAWING NO
05

MC VI-F
FUTURE SUBCELL F1

MC VI-F
FUTURE SUBCELL F4

MC VI-G
FUTURE SUBCELL G3

MC VI-G
SUBCELL G2

MC VI-G
EXISTING SUBCELL G1

SIDESLOPE LINER SYSTEM (2/12)

FLOOR LINER SYSTEM (1/12)

E 3750 E 4000 E 4250 E 4500

N 8000 N 7750

NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN 2001 BY –AIR–LAND AND PROVIDED BY WDI, A SURVEY BY MCLLC IN OCTOBER 2007, AND A GROUND SURVEY BY WDI IN OCTOBER 2008.
2. SEE SHEETS 10 AND 11 FOR CONSTRUCTION CONTROL POINT DATA.

N

0 15' 30' 60'
SCALE

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- N 6500 + GRID COORDINATES
- GRADE BREAK
- 710 TOP OF STRUCTURAL FILL LINER CONTOURS
- TOP OF STRUCTURAL FILL RECORD CERTIFICATION LIMIT
- 317 X TOP OF STRUCTURAL FILL RECORD CONTROL POINT

DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

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Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiomplanies.com

REVISIONS

REV	DATE	REVISION DESCRIPTION
00	6-28-19	ISSUED FOR RECORD DRAWINGS

PAA XZ
DRN. APP

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

TOP OF STRUCTURAL FILL RECORD CONTROL POINT PLAN

PROJECT NUMBER
1188070030

SCALE
1" = 30'

DRAWING NO
06

MC VI-F
FUTURE SUBCELL F1

MC VI-F
FUTURE SUBCELL F4

MC VI-G
SUBCELL G2

MC VI-G
FUTURE SUBCELL G3

MC VI-G
EXISTING SUBCELL G1

SIDESLOPE LINER SYSTEM (2 FT)

FLOOR LINER SYSTEM (2 FT)

NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN 2001 BY –AIR–LAND AND PROVIDED BY WDI, A SURVEY BY MCLLC IN OCTOBER 2007, AND A GROUND SURVEY BY WDI IN OCTOBER 2008.

N

0 15' 30' 60'
SCALE

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- N 6500 GRID COORDINATES
- GRADE BREAK
- 710 TOP OF STRUCTURAL FILL LINER CONTOURS
- SECONDARY LINER ANCHOR TRENCH
- FUSION WELDED SEAM
- EXTRUSION WELDED SEAM
- R12 EXTRUSION REPAIR LOCATION
- DS-10 DESTRUCTIVE SAMPLE LOCATION
- R25 CAP STRIP
- 34 SECONDARY LINER GEOMEMBRANE RECORD PANEL

CTI and Associates, Inc.
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DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

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REV	DATE	REVISION DESCRIPTION
00	6-28-19	ISSUED FOR RECORD DRAWINGS

PAA XZ
DRN APP

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

SECONDARY LINER GEOMEMBRANE RECORD PLAN

PROJECT NUMBER
1188070030

SCALE
1" = 30'

DRAWING NO
07

MC VI-F
FUTURE SUBCELL F1

MC VI-F
FUTURE SUBCELL F4

MC VI-G
FUTURE SUBCELL G3

MC VI-G
SUBCELL G2

MC VI-G
EXISTING SUBCELL G1

SIDESLOPE LINER SYSTEM

FLOOR LINER SYSTEM

SIDESLOPE LINER SYSTEM

E 3750 E 4000 E 4250 E 4500

N 8000 N 7750

NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN 2001 BY –AIR–LAND AND PROVIDED BY WDI, A SURVEY BY MCLLC IN OCTOBER 2007, AND A GROUND SURVEY BY WDI IN OCTOBER 2008.
2. SEE SHEETS 10 AND 11 FOR CONSTRUCTION CONTROL POINT DATA.

N

0 15' 30' 60'
SCALE

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- N 6500 GRID COORDINATES
- GRADE BREAK
- 710 TOP OF ATTENUATION LAYER CONTOURS
- TOP OF ATTENUATION LAYER RECORD CERTIFICATION LIMIT
- 829 X TOP OF ATTENUATION LAYER RECORD CONTROL POINT

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REV	DATE	DESCRIPTION	DRN	APP
1	7-23-19	REMOVED LEACHATE PIPING SHOWN ON SHEET 08	PAA	XZ
00	6-28-19	ISSUED FOR RECORD DRAWINGS	PAA	XZ

DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

TOP OF ATTENUATION LAYER RECORD CONTROL POINT PLAN

PROJECT NUMBER 1188070030
SCALE 1" = 30'
DRAWING NO **08**

MC VI-F
FUTURE SUBCELL F1

MC VI-F
FUTURE SUBCELL F4

MC VI-G
FUTURE SUBCELL G3

MC VI-G
SUBCELL G2

MC VI-G
EXISTING SUBCELL G1

E 3750 E 4000 E 4250 E 4500

N 8000 N 7750

P-50 P-51 P-52 P-53 P-54 P-55 P-56 P-57 P-58 P-59 P-60 P-61 P-62

P-1 P-2 P-3 P-4 P-5 P-6 P-7 P-8 P-9 P-10 P-11 P-12 P-13 P-14 P-15 P-16 P-17 P-18 P-19

P-20 P-21 P-22 P-23 P-24 P-25 P-26 P-27 P-28 P-29 P-30 P-31 P-32 P-33 P-34 P-35 P-36 P-37 P-38

P-39 P-40 P-41 P-42 P-43 P-44 P-45 P-46 P-47 P-48 P-49

5.56%

NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN 2001 BY -AIR-LAND AND PROVIDED BY WDI, A SURVEY BY MCLLC IN OCTOBER 2007, AND A GROUND SURVEY BY WDI IN OCTOBER 2008.

N

0 15' 30' 60'
SCALE

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- N 6500 + GRID COORDINATES
- GRADE BREAK
- 710 TOP OF PRIMARY LINER CONTOURS
- PRIMARY LINER ANCHOR TRENCH
- FUSION WELDED SEAM
- EXTRUSION WELDED SEAM
- R12 EXTRUSION REPAIR LOCATION
- DS-10 DESTRUCTIVE SAMPLE LOCATION
- R25 CAP STRIP
- 34 RECORD PRIMARY GEOMEMBRANE PANEL
- COVER RAIN FLAP AREA
- NORTHWEST RAIN FLAP

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DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
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REV	DATE	REVISION DESCRIPTION	PAA	XZ
00	6-28-19	ISSUED FOR RECORD DRAWINGS	DRN	APP

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

PRIMARY LINER GEOMEMBRANE RECORD PLAN

PROJECT NUMBER 1188070030
SCALE 1" = 30'
DRAWING NO 09

RECORD LEACHATE COLLECTION SAND LAYER DATA

LEACHATE COLLECTION SAND LAYER POINT NUMBER	NORTHING	EASTING	RECORD LEACHATE COLLECTION SAND LAYER ELEVATION	RECORD LEACHATE COLLECTION SAND LAYER THICKNESS
905	7951.69	3857.51	736.59	1.1
914	7949.63	4070.09	732.13	1.0
915	7949.93	4012.80	728.00	1.2
916	7949.59	3955.27	723.49	1.1
917	7949.77	3933.20	721.90	1.2
918	7949.80	3907.68	720.34	1.5
919	7949.76	4127.69	736.64	1.1
920	7949.63	4185.09	741.03	1.1
921	7949.56	4242.54	745.60	1.2
922	7949.56	4300.02	749.89	1.1
924	7949.55	4362.89	754.41	1.0
925	7927.69	3933.32	714.82	1.5
926	7925.07	3955.36	715.31	1.2
927	7924.60	3928.01	714.71	2.8
928	7924.38	3848.97	739.49	1.3
930	7917.87	4012.78	717.35	1.2
931	7910.75	4070.21	719.86	1.7
932	7905.57	3936.02	713.68	1.1
933	7903.44	4127.54	721.75	1.6
934	7896.08	4185.16	723.45	1.3
935	7895.77	4386.04	738.47	1.2
936	7892.66	3987.37	715.17	1.0
937	7888.88	4242.69	725.60	1.4
938	7888.25	3937.87	713.20	1.2
939	7887.16	3931.79	712.54	2.0
940	7886.91	3837.36	743.01	1.0
942	7885.39	4044.81	717.44	1.3
943	7881.67	4299.95	727.34	1.2
944	7878.20	4102.15	719.34	1.2
946	7874.87	4357.14	729.46	1.3
948	7872.17	4391.34	730.86	1.5
951	7871.08	4159.86	721.30	1.1
952	7867.42	3962.06	713.38	1.2
953	7863.61	4217.17	723.14	1.0
954	7860.39	4019.34	715.43	1.3
955	7856.51	4274.56	725.27	1.1
959	7847.68	3936.83	711.64	1.2
962	7847.76	4006.78	714.43	1.3
964	7847.67	4071.49	716.89	1.2
966	7847.66	4132.67	719.23	1.1
969	7847.66	4201.12	721.95	1.1
971	7847.60	4265.81	724.59	1.2
974	7847.62	4333.77	727.30	1.1
976	7847.63	4390.37	729.70	1.3
991	7842.77	3837.13	741.26	1.2
995	7838.03	4003.56	714.53	1.5
998	7838.22	4096.73	717.99	1.3
1001	7837.97	4189.66	721.65	1.2
1003	7837.92	4283.40	725.44	1.3
1004	7838.09	4333.78	727.30	1.1
1007	7838.06	4390.53	729.48	1.1
1011	7833.10	3937.94	711.71	1.1
1012	7823.99	4370.13	729.34	1.2
1013	7823.65	4018.00	715.52	1.3
1014	7820.18	4114.86	719.46	1.3
1015	7816.27	4211.76	723.55	1.4
1016	7813.59	3957.49	714.33	2.2
1017	7812.51	4308.42	727.50	1.3
1018	7804.17	4390.04	730.90	1.0
1020	7802.98	4400.25	731.20	1.7
1023	7798.79	3942.89	713.18	1.1
1024	7798.92	3927.18	710.44	2.2
1025	7799.06	3837.24	739.57	1.3
1027	7798.64	4043.33	717.47	1.3
1028	7794.88	4140.06	721.33	1.2
1029	7791.24	4237.07	725.49	1.3
1030	7788.57	3982.77	715.51	1.3
1031	7787.58	4333.79	729.43	1.3
1032	7780.64	4389.65	738.26	1.1
1034	7779.36	4402.21	737.62	1.1
1035	7773.39	4068.68	719.41	1.2
1036	7772.57	4336.16	734.53	1.4
1037	7769.68	4165.32	723.34	1.2
1038	7768.64	3947.52	714.60	1.1
1039	7766.20	4262.31	727.38	1.2
1040	7763.34	4008.29	717.36	1.2
1045	7755.37	4227.49	726.59	1.4
1046	7754.85	3949.50	715.29	1.1
1047	7754.68	3923.57	709.63	2.0
1048	7754.75	3837.36	737.42	1.1
1053	7748.32	4093.93	721.50	1.3
1054	7744.60	4190.89	725.48	1.3
1056	7738.20	4033.57	719.55	1.4
1060	7735.50	3980.77	717.75	1.6
1065	7723.26	4119.34	723.58	1.4
1072	7712.98	4059.00	721.15	1.0
1073	7710.52	4006.11	719.36	1.3
1076	7709.21	3980.14	718.60	1.5
1077	7705.86	3956.66	717.43	1.0
1082	7699.92	3837.43	735.14	1.1

RECORD LEACHATE COLLECTION PIPE DATA

LEACHATE COLLECTION PIPE POINT NUMBER	NORTHING	EASTING	RECORD TOP OF LEACHATE COLLECTION PIPE ELEVATION	DESCRIPTION
1	7842.79	4345.41	726.63	8-INCH
2	7842.56	4292.04	724.24	8-INCH
3	7842.17	4238.60	722.24	8-INCH
4	7842.57	4186.62	720.04	8-INCH
5	7843.30	4127.03	717.54	8-INCH
6	7843.48	4085.24	715.99	8-INCH
7	7843.02	4031.00	713.72	8-INCH
8	7842.89	3982.24	712.85	TOP-STONE
9	7843.57	3931.93	710.41	8-INCH \ 16-INCH TEE
10	7894.25	3931.35	711.75	8-INCH
11	7932.14	3922.23	714.87	8-INCH
12	7932.83	3921.81	715.01	8-INCH
13	7934.57	3919.16	715.91	8-INCH
14	7934.44	3917.86	716.33	8-INCH
15	7843.76	3914.10	715.91	16-INCH
16	7845.33	3870.46	730.68	16-INCH
17	7782.57	3927.26	708.86	8-INCH
18	7730.87	3921.76	708.22	TOP-STONE
19	7706.90	3923.18	707.35	8IN-Y
20	7708.37	3918.03	708.70	8-INCH
21	7706.96	3888.68	717.70	8-INCH
22	7696.81	3925.17	706.84	8-INCH
23	7691.04	3927.15	706.13	G2-8-INCH
24	7842.21	4380.47	727.86	8-INCH
25	7841.72	4390.84	732.44	8IN-END
26	7933.51	3908.77	719.33	8-INCH
27	7932.29	3875.73	730.23	8-INCH
28	7932.07	3851.23	738.30	8-INCH
29	7931.13	3834.54	741.64	4-INCH-CAP
30	7845.93	3824.60	745.00	16-INCH-END
31	7845.65	3839.06	741.10	16-INCH
32	7706.21	3857.12	728.46	8-INCH
33	7706.90	3835.98	735.02	8-INCH
34	7707.03	3822.07	737.24	4-INCH-CAP
35	7689.40	3927.84	705.97	8 INCH EF-COUPLING
36	7687.49	3928.18	705.86	8 INCH EF-COUPLING
37	7685.63	3928.46	705.66	8 INCH EF-COUPLING
38	7684.48	3928.46	705.50	G1-8-INCH

MC VI-F
FUTURE SUBCELL F1

MC VI-F
FUTURE SUBCELL F4

MC VI-G
FUTURE SUBCELL G3

MC VI-G
SUBCELL G2

MC VI-G
EXISTING SUBCELL G1

SIDESLOPE LINER SYSTEM (2/12)

FLOOR LINER SYSTEM (1/12)

LEACHATE COLLECTION PIPE (1/15)

LEACHATE COLLECTION PIPE TEMPORARY CLEANOUT (6/15)

GREAT LAKE FUSION QUICK RELEASE COVER (4/15)

16" LEACHATE CLEANOUT RISER

ENLARGED CLEANOUT ACCESS (4/15, 5/15)

TOE OF SLOPE LEACHATE COLLECTION PIPE (2/15)

FUTURE TIE-IN TO EXISTING LEACHATE CLEANOUT RISER TO TOE OF SLOPE LEACHATE COLLECTION PIPE

EXISTING 8" SDR 7.3 HDPE TOE OF SLOPE LEACHATE COLLECTION PIPE

NOTE:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN 2001 BY -AIR-LAND AND PROVIDED BY WDI, A SURVEY BY MCLLC IN OCTOBER 2007, AND A GROUND SURVEY BY WDI IN OCTOBER 2008.
2. SEE TABLES ON THIS SHEET FOR CONSTRUCTION CONTROL POINT DATA.

0 15' 30' 60'
SCALE

LEGEND

- PROPERTY BOUNDARY
- PHASE BOUNDARY
- 710 — EXISTING CONTOUR (2 FT INTERVAL)
- N 6500 + GRID COORDINATES
- GRADE BREAK
- 710 — TOP OF ATTENUATION LAYER CONTOURS
- TOP OF ATTENUATION LAYER RECORD CERTIFICATION LIMIT
- PERFORATED — RECORD LEACHATE COLLECTION PIPE
- SOLID — RECORD LEACHATE COLLECTION PIPE
- X3 TOP OF LEACHATE COLLECTION PIPE RECORD CONTROL POINT
- X1029 TOP OF LEACHATE COLLECTION SAND LAYER RECORD CONTROL POINT

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DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

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REVISIONS	REV	DATE	DESCRIPTION	BY	APP
	2	7-31-19	REVISED POINT 23 AND ADDED POINTS 35-38 TO SHOW RECORD TOP OF LEACHATE COLLECTION PIPE AND ADDED NOTE 2	PAA	XZ
	1	7-23-19	ADDED MC VI-F SUBCELL F4 TO SHOW RECORD TOP OF LEACHATE COLLECTION PIPE AND ADDED NOTE 1	PAA	XZ
	00	6-28-19	ISSUED FOR RECORD DRAWINGS	PAA	XZ

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

TOP OF LEACHATE COLLECTION SAND LAYER AND PIPE RECORD CONTROL POINT PLAN

PROJECT NUMBER 1188070030
SCALE 1" = 30'
DRAWING NO **09A**

SUBCELL G2 RECORD CONTROL TABLES

RECORD SUBGRADE DATA				RECORD BOTTOM OF STRUCTURAL FILL LAYER DATA				RECORD TOP OF STRUCTURAL FILL LAYER DATA				RECORD TOP OF ATTENUATION LAYER DATA			
SUBGRADE POINT NUMBER	NORTHING	EASTING	RECORD SUBGRADE ELEVATION	BOTTOM OF STRUCTURAL FILL LAYER POINT NUMBER	NORTHING	EASTING	RECORD BOTTOM OF STRUCTURAL FILL LAYER ELEVATION	TOP OF STRUCTURAL FILL LAYER POINT NUMBER	NORTHING	EASTING	RECORD TOP OF STRUCTURAL FILL LAYER ELEVATION	TOP OF ATTENUATION LAYER POINT NUMBER	NORTHING	EASTING	RECORD TOP OF ATTENUATION LAYER ELEVATION
1	7,951.91	4,070.58	722.05	201	7,951.69	4,070.15	723.79	401	7,951.73	4,070.16	726.19	701	7,951.73	4,070.19	731.35
2	7,951.94	4,013.04	718.34	202	7,951.80	4,012.79	719.37	402	7,951.79	4,012.71	721.81	702	7,951.77	4,012.72	726.84
3	7,951.65	3,955.26	713.95	203	7,951.78	3,955.29	715.21	403	7,951.64	3,955.35	717.34	703	7,951.71	3,955.33	722.35
4	7,952.61	3,933.66	712.26	204	7,951.77	3,933.14	713.32	404	7,951.79	3,933.21	715.71	704	7,951.63	3,933.16	720.65
5	7,951.46	3,857.32	728.13	205	7,951.75	3,857.43	728.13	405	7,951.69	3,857.33	730.14	705	7,951.64	3,857.49	735.52
6	7,951.88	3,905.92	710.30	206	7,951.84	3,907.75	711.55	406	7,951.78	3,907.65	713.56	706	7,951.71	3,907.65	718.72
7	7,951.68	3,838.19	733.42	207	7,951.74	3,838.27	733.42	407	7,951.75	3,838.22	735.43	707	NA	NA	NA
8	7,951.91	4,127.37	727.29	208	7,951.76	4,127.59	728.29	408	7,951.71	4,127.53	730.47	708	7,951.76	4,127.65	735.57
9	7,951.73	4,185.08	731.57	209	7,951.73	4,185.07	732.58	409	7,951.69	4,185.18	734.77	709	7,951.69	4,185.04	740.04
10	7,951.66	4,242.78	736.09	210	7,951.52	4,242.66	737.17	410	7,951.73	4,242.65	739.20	710	7,951.58	4,242.58	744.40
11	7,951.39	4,300.13	740.51	211	7,951.59	4,299.99	741.54	411	7,951.36	4,300.01	743.57	711	7,951.56	4,299.99	748.75
12	7,951.47	4,357.05	744.60	212	7,951.35	4,357.03	745.61	412	7,951.42	4,356.99	747.74	712	7,951.42	4,356.99	752.96
13	7,951.38	4,363.74	745.05	213	7,951.32	4,363.82	746.06	413	7,951.52	4,363.85	748.31	713	7,951.48	4,363.83	753.40
14	7,949.81	4,070.19	721.98	214	7,949.85	4,070.08	723.37	414	7,949.79	4,070.05	725.77	714	7,949.70	4,070.05	731.13
15	7,949.66	4,012.86	717.82	215	7,949.65	4,012.59	719.08	415	7,949.74	4,012.65	721.39	715	7,949.82	4,012.73	726.82
16	7,949.84	3,955.40	713.50	216	7,949.68	3,955.37	714.69	416	7,949.72	3,955.42	716.94	716	7,949.72	3,955.37	722.43
17	7,949.70	3,933.33	711.36	217	7,949.85	3,933.20	712.93	417	7,949.77	3,933.24	715.31	717	7,949.75	3,933.22	720.72
18	7,948.66	3,907.60	710.09	218	7,949.66	3,907.69	711.13	418	7,949.75	3,907.71	713.45	718	7,949.83	3,907.60	718.79
19	7,949.66	4,127.58	726.51	219	7,949.73	4,127.62	727.82	419	7,949.64	4,127.62	730.30	719	7,949.72	4,127.66	735.58
20	7,949.69	4,185.05	731.28	220	7,949.62	4,184.99	732.36	420	7,949.62	4,185.10	734.54	720	7,949.71	4,185.07	739.96
21	7,949.57	4,242.74	735.71	221	7,949.65	4,242.63	736.74	421	7,949.59	4,242.67	738.93	721	7,949.53	4,242.58	744.42
22	7,949.48	4,300.00	739.99	222	7,949.62	4,300.11	741.13	422	7,949.59	4,300.11	743.37	722	7,949.53	4,300.04	748.77
23	7,949.49	4,357.12	744.18	223	7,949.64	4,357.13	745.19	423	7,949.40	4,356.98	747.65	723	7,949.46	4,356.91	752.99
24	7,949.50	4,362.86	744.56	224	7,949.50	4,362.86	745.66	424	7,949.50	4,362.89	748.00	724	7,949.52	4,362.76	753.37
25	7,927.76	3,933.24	704.19	225	7,927.72	3,933.30	705.92	425	7,927.81	3,933.25	708.05	725	7,927.73	3,933.35	713.31
26	7,924.99	3,955.20	705.71	226	7,925.01	3,955.30	706.94	426	7,925.11	3,955.41	708.94	726	7,925.10	3,955.35	714.14
27	7,924.41	3,928.21	703.10	227	7,924.53	3,928.00	704.41	427	7,924.50	3,928.11	706.63	727	7,924.61	3,927.99	711.93
28	7,924.48	3,848.97	730.76	228	7,924.48	3,848.97	730.76	428	7,924.43	3,848.95	732.77	728	7,924.38	3,848.95	738.22
30	7,917.78	4,012.76	707.65	230	7,917.87	4,012.60	708.91	430	7,917.79	4,012.70	711.00	730	7,917.86	4,012.85	716.15
31	7,910.40	4,070.23	709.79	231	7,910.57	4,070.25	710.96	431	7,910.71	4,070.24	713.22	731	7,910.74	4,070.16	718.18
32	7,905.73	3,935.87	703.78	232	7,905.63	3,935.84	704.97	432	7,905.49	3,935.82	707.26	732	7,905.56	3,935.89	712.54
33	7,903.53	4,127.68	711.75	233	7,903.45	4,127.61	712.94	433	7,903.25	4,127.70	715.11	733	7,903.45	4,127.64	720.14
34	7,896.14	4,185.30	713.76	234	7,896.17	4,185.11	714.82	434	7,896.18	4,185.11	716.96	734	7,896.07	4,185.14	722.14
35	7,895.82	4,386.14	728.41	235	7,895.85	4,386.02	729.49	435	7,895.87	4,386.15	731.79	735	7,895.73	4,386.01	737.22
36	7,892.67	3,987.39	705.49	236	7,892.79	3,987.32	706.82	436	7,892.70	3,987.31	709.11	736	7,892.76	3,987.37	714.15
37	7,888.94	4,242.70	715.59	237	7,888.93	4,242.70	716.88	437	7,888.95	4,242.65	718.96	737	7,888.86	4,242.72	724.18
38	7,888.23	3,937.71	703.32	238	7,888.15	3,937.90	704.47	438	7,888.19	3,937.77	706.64	738	7,888.26	3,937.89	712.03
39	7,887.02	3,931.95	700.98	239	7,887.14	3,931.84	703.06	439	7,887.06	3,931.96	705.17	739	7,887.07	3,931.84	710.50
40	7,887.02	3,837.35	734.40	240	7,887.02	3,837.35	734.40	440	7,886.90	3,837.37	736.65	740	7,886.84	3,837.36	741.96
42	7,885.51	4,044.68	708.80	242	7,885.55	4,044.75	709.80	442	7,885.57	4,044.83	711.80	742	7,885.43	4,044.79	716.13
43	7,881.62	4,300.19	717.82	243	7,881.61	4,300.14	718.86	443	7,881.54	4,300.08	721.01	743	7,881.63	4,300.00	726.14
44	7,878.36	4,102.17	709.74	244	7,878.28	4,102.28	710.77	444	7,878.20	4,102.24	713.15	744	7,878.25	4,102.19	718.17
45	7,877.43	4,396.16	722.16	245	7,877.37	4,396.21	723.30	445	7,877.37	4,395.99	725.59	745	7,877.42	4,396.21	731.09

SUBCELL G2 RECORD CONTROL TABLES

RECORD SUBGRADE DATA				RECORD BOTTOM OF STRUCTURAL FILL LAYER DATA				RECORD TOP OF STRUCTURAL FILL LAYER DATA				RECORD TOP OF ATTENUATION LAYER DATA			
SUBGRADE POINT NUMBER	NORTHING	EASTING	RECORD SUBGRADE ELEVATION	BOTTOM OF STRUCTURAL FILL LAYER POINT NUMBER	NORTHING	EASTING	RECORD BOTTOM OF STRUCTURAL FILL LAYER ELEVATION	TOP OF STRUCTURAL FILL LAYER POINT NUMBER	NORTHING	EASTING	RECORD TOP OF STRUCTURAL FILL LAYER ELEVATION	TOP OF ATTENUATION LAYER POINT NUMBER	NORTHING	EASTING	RECORD TOP OF ATTENUATION LAYER ELEVATION
46	7,875.01	4,356.92	719.91	246	7,875.01	4,357.06	720.91	446	7,875.05	4,356.96	722.98	746	7,874.91	4,356.99	728.19
47	7,874.41	4,398.90	720.91	247	7,874.19	4,398.83	721.96	447	7,874.42	4,398.96	724.16	747	NA	NA	NA
48	7,872.26	4,391.39	721.10	248	7,872.35	4,391.32	722.19	448	7,872.21	4,391.31	724.28	748	7,872.23	4,391.31	729.36
49	7,871.70	4,396.09	720.90	249	7,871.70	4,396.19	722.00	449	7,871.64	4,396.13	724.00	749	7,871.66	4,396.16	729.21
50	7,871.43	4,385.98	720.92	250	7,871.64	4,386.03	721.97	450	7,871.74	4,385.96	724.00	750	NA	NA	NA
51	7,870.90	4,159.77	711.65	251	7,870.96	4,159.67	712.88	451	7,871.01	4,159.79	714.95	751	7,871.06	4,159.77	720.15
52	7,867.65	3,961.95	703.54	252	7,867.55	3,962.04	704.90	452	7,867.47	3,962.04	706.98	752	7,867.40	3,961.97	712.19
53	7,863.77	4,217.10	713.70	253	7,863.66	4,217.13	714.82	453	7,863.78	4,217.36	716.99	753	7,863.62	4,217.19	722.09
54	7,860.33	4,019.35	705.42	254	7,860.38	4,019.49	706.89	454	7,860.44	4,019.47	709.04	754	7,860.39	4,019.41	714.13
55	7,856.53	4,274.71	715.72	255	7,856.53	4,274.75	716.79	455	7,856.49	4,274.76	719.14	755	7,856.56	4,274.62	724.16
56	7,847.71	4,390.50	719.87	256	7,847.71	4,390.50	720.88	456	7,847.73	4,390.53	722.89	756	7,847.77	4,390.62	728.38
57	7,847.68	4,396.99	719.63	257	7,847.75	4,396.85	720.64	457	7,847.76	4,396.95	723.01	757	NA	NA	NA
58	7,847.72	4,403.38	719.26	258	7,847.81	4,403.44	720.45	458	7,847.63	4,403.44	722.71	758	NA	NA	NA
59	7,847.99	3,936.89	700.78	259	7,847.66	3,936.85	702.72	459	7,847.68	3,936.69	705.07	759	7,847.67	3,936.81	710.41
60	7,847.77	3,941.89	701.61	260	7,847.73	3,942.08	702.94	460	7,847.68	3,941.99	705.28	760	7,847.62	3,942.06	710.61
61	7,847.75	3,981.70	703.25	261	7,847.56	3,981.76	704.58	461	7,847.67	3,981.68	706.99	761	7,847.69	3,981.80	712.14
62	7,847.72	4,006.60	704.23	262	7,847.69	4,006.63	705.66	462	7,847.69	4,006.65	707.79	762	7,847.74	4,006.73	713.14
63	7,847.57	4,032.02	705.33	263	7,847.62	4,032.06	706.73	463	7,847.74	4,031.99	708.80	763	7,847.68	4,032.12	714.17
64	7,847.61	4,071.53	706.76	264	7,847.63	4,071.41	708.25	464	7,847.69	4,071.32	710.39	764	7,847.61	4,071.45	715.68
65	7,847.84	4,082.28	707.44	265	7,847.65	4,082.26	708.60	465	7,847.66	4,082.28	710.79	765	7,847.64	4,082.26	716.15
66	7,847.65	4,132.55	709.15	266	7,847.57	4,132.56	710.72	466	7,847.62	4,132.62	712.84	766	7,847.62	4,132.62	718.17
67	7,847.77	4,136.26	709.50	267	7,847.62	4,136.19	710.85	467	7,847.67	4,136.32	713.00	767	7,847.71	4,136.29	718.31
68	7,847.67	4,182.83	711.62	268	7,847.69	4,182.82	712.69	468	7,847.69	4,182.86	714.81	768	7,847.75	4,182.95	720.16
69	7,847.70	4,200.97	712.32	269	7,847.79	4,201.14	713.41	469	7,847.61	4,201.10	715.52	769	7,847.59	4,201.21	720.85
70	7,847.64	4,233.27	713.55	270	7,847.58	4,233.12	714.70	470	7,847.69	4,233.20	716.79	770	7,847.61	4,233.32	722.12
71	7,847.62	4,265.69	714.95	271	7,847.65	4,265.72	716.00	471	7,847.61	4,265.77	718.28	771	7,847.58	4,265.87	723.40
72	7,847.73	4,283.59	715.58	272	7,847.66	4,283.50	716.69	472	7,847.67	4,283.36	718.84	772	7,847.66	4,283.40	724.15
73	7,847.64	4,329.62	717.23	273	7,847.55	4,329.42	718.51	473	7,847.72	4,329.37	720.81	773	7,847.71	4,329.36	725.99
74	7,847.71	4,333.76	717.36	274	7,847.66	4,333.61	718.65	474	7,847.78	4,333.82	720.98	774	7,847.67	4,333.83	726.18
75	7,847.73	4,384.06	719.60	275	7,847.68	4,384.02	720.61	475	7,847.64	4,384.01	722.88	775	7,847.74	4,384.10	728.16
76	7,847.58	4,390.35	719.83	276	7,847.68	4,390.36	720.88	476	7,847.77	4,390.46	723.15	776	7,847.63	4,390.38	728.36
77	7,842.82	3,931.79	700.03	277	7,842.71	3,931.78	701.49	477	7,842.96	3,931.73	703.59	777	7,842.88	3,931.87	708.99
78	7,843.04	3,981.82	702.48	278	7,842.84	3,981.62	703.55	478	7,842.78	3,981.77	705.78	778	7,842.95	3,981.61	710.99
79	7,842.79	4,032.12	704.17	279	7,842.83	4,031.89	705.51	479	7,842.87	4,032.06	707.79	779	7,842.76	4,032.10	712.97
80	7,842.99	4,082.31	706.43	280	7,842.91	4,082.20	707.51	480	7,842.78	4,082.26	709.72	780	7,842.83	4,082.31	714.98
81	7,842.78	4,132.55	708.41	281	7,842.79	4,132.52	709.42	481	7,842.96	4,132.58	711.78	781	7,842.81	4,132.51	716.97
82	7,842.87	4,182.88	710.46	282	7,842.90	4,182.84	711.52	482	7,842.88	4,182.87	713.77	782	7,842.85	4,182.86	718.98
83	7,843.00	4,233.25	712.43	283	7,842.76	4,233.28	713.51	483	7,842.83	4,233.18	715.78	783	7,842.97	4,233.12	720.99
84	7,842.93	4,283.28	714.39	284	7,842.76	4,283.50	715.50	484	7,842.89	4,283.42	717.78	784	7,842.99	4,283.45	722.97
85	7,842.76	4,333.73	716.34	285	7,842.78	4,333.73	717.51	485	7,842.74	4,333.87	719.77	785	7,842.79	4,333.73	724.97
86	7,842.42	4,383.46	718.43	286	7,842.80	4,383.96	719.51	486	7,842.81	4,384.04	721.81	786	7,842.88	4,384.05	726.96
87	7,842.81	4,390.46	718.59	287	7,842.94	4,390.37	719.68	487	7,842.70	4,390.31	721.96	787	7,842.84	4,390.44	727.25
88	7,842.67	4,397.24	718.40	288	7,842.89	4,397.16	719.51	488	7,842.73	4,397.08	721.77	788	7,842.84	4,396.91	726.93

NOTE:
1. SEE SHEETS 3, 5, 6 AND 8 FOR CONSTRUCTION CONTROL POINT LOCATIONS.

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RECORD DRAWINGS

DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

RECORD CONSTRUCTION CONTROL TABLES

PROJECT NUMBER 1188070030
SCALE NTS
DRAWING NO **10**

010 WDI G2 CONTROL TABLE 1.dgn 6/28/2019 11:06:57 AM C:\Users\pab\Documents\CTI-2018\CTI\WAYNE DISPOSAL G2 RECORD DRAWINGS\010 WDI G2 CONTROL TABLE 1.dgn

SUBCELL G2 RECORD CONTROL TABLES

RECORD SUBGRADE DATA				RECORD BOTTOM OF STRUCTURAL FILL LAYER DATA				RECORD TOP OF STRUCTURAL FILL LAYER DATA				RECORD TOP OF ATTENUATION LAYER DATA			
SUBGRADE POINT NUMBER	NORTHING	EASTING	RECORD SUBGRADE ELEVATION	BOTTOM OF STRUCTURAL FILL LAYER POINT NUMBER	NORTHING	EASTING	RECORD BOTTOM OF STRUCTURAL FILL LAYER ELEVATION	TOP OF STRUCTURAL FILL LAYER POINT NUMBER	NORTHING	EASTING	RECORD TOP OF STRUCTURAL FILL LAYER ELEVATION	TOP OF ATTENUATION LAYER POINT NUMBER	NORTHING	EASTING	RECORD TOP OF ATTENUATION LAYER ELEVATION
89	7,843.00	4,406.02	718.11	289	7,842.92	4,405.58	719.11	489	7,842.83	4,405.54	721.47	789	7,842.85	4,405.48	726.63
90	7,842.78	3,931.40	700.30	290	7,842.78	3,931.40	701.40	490	7,842.94	3,931.19	703.56	790	7,842.94	3,931.21	708.76
91	7,842.82	3,837.27	732.76	291	7,842.82	3,837.27	732.76	491	7,842.83	3,837.23	734.77	791	7,842.72	3,837.21	740.11
93	7,837.95	3,937.30	701.25	293	7,838.07	3,937.26	703.05	493	7,838.16	3,937.34	705.06	793	7,838.04	3,937.37	710.39
94	7,838.00	3,981.67	702.85	294	7,837.99	3,981.66	704.61	494	7,838.08	3,981.79	706.81	794	7,838.13	3,981.64	712.16
95	7,838.05	4,003.64	703.74	295	7,837.98	4,003.58	705.41	495	7,838.14	4,003.69	707.69	795	7,838.01	4,003.59	713.05
96	7,838.01	4,031.93	705.33	296	7,838.14	4,032.00	706.55	496	7,838.05	4,031.92	708.80	796	7,838.12	4,032.00	714.17
97	7,838.05	4,082.37	707.21	297	7,837.98	4,082.11	708.52	497	7,838.10	4,082.34	710.86	797	7,838.14	4,082.40	716.17
98	7,838.01	4,096.65	708.06	298	7,838.09	4,096.57	709.11	498	7,838.07	4,096.53	711.40	798	7,838.17	4,096.68	716.73
99	7,838.06	4,132.48	709.33	299	7,838.02	4,132.70	710.54	499	7,837.93	4,132.49	712.87	799	7,838.02	4,132.64	718.18
100	7,838.19	4,182.83	711.48	300	7,838.19	4,182.93	712.68	500	7,837.98	4,182.86	714.81	800	7,838.09	4,182.94	720.17
101	7,838.14	4,189.79	711.91	301	7,838.15	4,189.57	712.97	501	7,838.09	4,189.70	715.05	801	7,838.06	4,189.70	720.45
102	7,838.27	4,233.17	713.52	302	7,838.03	4,233.14	714.60	502	7,838.09	4,233.16	716.80	802	7,838.02	4,233.15	722.17
103	7,837.98	4,283.49	715.59	303	7,838.18	4,283.56	716.72	503	7,838.02	4,283.47	718.83	803	7,837.98	4,283.45	724.17
104	7,838.03	4,333.71	717.37	304	7,838.08	4,333.71	718.66	504	7,838.09	4,333.82	720.92	804	7,838.19	4,333.69	726.19
105	7,838.09	4,355.90	718.51	305	7,837.97	4,355.86	719.59	505	7,838.02	4,355.93	721.81	805	NA	NA	NA
106	7,838.16	4,384.00	719.67	306	7,838.05	4,384.17	720.66	506	7,838.09	4,384.03	722.89	806	7,838.05	4,384.08	728.17
107	7,837.96	4,390.37	719.82	307	7,837.96	4,390.37	720.83	507	7,837.99	4,390.30	723.11	807	7,838.04	4,390.46	728.39
108	7,838.05	4,390.54	719.88	308	7,838.01	4,390.53	721.09	508	7,837.97	4,390.53	723.10	808	7,837.95	4,390.43	728.43
109	7,838.00	4,397.07	719.62	309	7,837.96	4,397.17	720.66	509	7,837.96	4,396.92	723.02	809	7,838.08	4,397.04	728.17
110	7,838.23	4,403.15	719.40	310	7,837.92	4,403.51	720.45	510	7,838.01	4,403.52	722.75	810	7,838.10	4,403.50	727.92
111	7,833.00	3,938.13	701.60	311	7,833.03	3,938.00	703.20	511	7,833.07	3,938.06	705.21	811	7,833.13	3,937.94	710.58
112	7,823.89	4,370.06	719.63	312	7,823.97	4,370.15	720.84	512	7,824.04	4,370.04	723.06	812	7,823.99	4,370.09	728.17
113	7,823.92	4,017.88	705.75	313	7,823.83	4,017.94	706.92	513	7,823.75	4,017.85	708.94	813	7,823.78	4,018.00	714.18
114	7,820.13	4,114.75	709.69	314	7,820.07	4,114.90	710.95	514	7,819.99	4,114.74	713.09	814	7,820.10	4,114.87	718.18
115	7,816.18	4,211.74	713.74	315	7,816.30	4,211.70	714.94	515	7,816.37	4,211.65	717.02	815	7,816.26	4,211.73	722.16
116	7,813.61	3,957.59	703.77	316	7,813.61	3,957.59	704.87	516	7,813.84	3,957.57	707.03	816	7,813.66	3,957.45	712.15
117	7,812.70	4,308.49	717.78	317	7,812.60	4,308.52	718.91	517	7,812.54	4,308.52	720.98	817	7,812.50	4,308.43	726.18
118	7,804.26	4,389.90	721.13	318	7,804.31	4,390.06	722.47	518	7,804.23	4,390.04	724.53	818	7,804.17	4,390.03	729.85
119	7,803.48	4,391.63	721.27	319	7,803.36	4,391.69	722.50	519	7,803.45	4,391.53	724.83	819	7,803.40	4,391.64	729.83
120	7,802.87	4,400.32	721.10	320	7,802.94	4,400.34	722.18	520	7,802.87	4,400.23	724.51	820	7,802.93	4,400.22	729.53
121	7,801.35	4,401.38	721.14	321	7,801.50	4,401.07	722.33	521	7,801.48	4,401.18	724.50	821	7,801.31	4,401.00	729.54
122	7,799.43	4,402.55	721.14	322	7,799.40	4,402.30	722.42	522	7,799.47	4,402.35	724.77	822	7,799.36	4,402.30	730.07
123	7,798.79	3,943.14	702.35	323	7,799.03	3,943.06	704.58	523	7,798.92	3,943.07	706.92	823	7,798.93	3,942.99	712.13
124	7,799.42	3,928.87	699.54	324	7,799.14	3,927.41	700.80	524	7,798.99	3,927.24	702.95	824	7,798.93	3,927.28	708.28
125	7,799.00	3,837.29	730.90	325	7,799.00	3,837.29	730.90	525	7,798.89	3,837.44	732.91	825	7,799.03	3,837.22	738.26
127	7,798.74	4,043.21	707.65	327	7,798.64	4,043.22	708.93	527	7,798.65	4,043.27	711.00	827	7,798.71	4,043.28	716.18
128	7,794.98	4,140.16	711.88	328	7,794.81	4,140.00	712.84	528	7,794.85	4,140.02	715.12	828	7,794.89	4,140.09	720.17
129	7,791.07	4,236.93	715.89	329	7,791.22	4,237.18	716.91	529	7,791.03	4,237.02	719.11	829	7,791.22	4,237.03	724.18
130	7,788.44	3,982.86	705.60	330	7,788.55	3,982.88	706.93	530	7,788.51	3,982.97	708.94	830	7,788.52	3,982.85	714.17

SUBCELL G2 RECORD CONTROL TABLES

RECORD SUBGRADE DATA				RECORD BOTTOM OF STRUCTURAL FILL LAYER DATA				RECORD TOP OF STRUCTURAL FILL LAYER DATA				RECORD TOP OF ATTENUATION LAYER DATA			
SUBGRADE POINT NUMBER	NORTHING	EASTING	RECORD SUBGRADE ELEVATION	BOTTOM OF STRUCTURAL FILL LAYER POINT NUMBER	NORTHING	EASTING	RECORD BOTTOM OF STRUCTURAL FILL LAYER ELEVATION	TOP OF STRUCTURAL FILL LAYER POINT NUMBER	NORTHING	EASTING	RECORD TOP OF STRUCTURAL FILL LAYER ELEVATION	TOP OF ATTENUATION LAYER POINT NUMBER	NORTHING	EASTING	RECORD TOP OF ATTENUATION LAYER ELEVATION
131	7,787.36	4,333.14	719.86	331	7,787.36	4,333.94	720.87	531	7,787.42	4,333.71	723.07	831	7,787.51	4,333.83	728.16
132	7,780.73	4,389.71	728.71	332	7,780.73	4,389.71	729.72	532	7,780.59	4,389.65	731.73	832	7,780.71	4,389.68	737.18
133	7,780.63	4,389.95	728.79	333	7,780.63	4,390.75	729.80	533	7,780.64	4,390.62	731.81	833	7,780.53	4,390.78	737.34
134	7,779.46	4,402.33	728.03	334	7,779.46	4,402.33	729.04	534	7,779.34	4,402.20	731.05	834	7,779.40	4,402.27	736.50
135	7,773.41	4,068.59	709.54	335	7,773.56	4,068.62	711.01	535	7,773.68	4,068.67	713.02	835	7,773.45	4,068.64	718.18
136	7,772.62	4,336.11	724.81	336	7,772.62	4,336.11	725.82	536	7,772.66	4,336.09	727.83	836	7,772.53	4,336.07	733.15
137	7,769.72	4,165.60	713.74	337	7,769.73	4,165.52	714.91	537	7,769.82	4,165.50	717.05	837	7,769.71	4,165.39	722.14
138	7,768.63	3,947.25	704.68	338	7,768.88	3,947.39	706.08	538	7,768.65	3,947.49	708.29	838	7,768.76	3,947.42	713.54
139	7,766.03	4,262.33	718.05	339	7,766.03	4,262.33	719.06	539	7,766.05	4,262.47	721.07	839	7,766.14	4,262.30	726.16
140	7,763.61	4,008.20	707.49	340	7,763.43	4,008.36	708.96	540	7,763.20	4,008.26	710.96	840	7,763.40	4,008.25	716.18
141	7,761.60	4,263.01	719.26	341	7,761.60	4,263.01	720.27	541	7,761.53	4,263.00	722.28	841	7,761.64	4,263.05	727.65
143	7,760.72	3,955.43	705.58	343	7,761.04	3,955.51	706.89	543	7,760.75	3,955.55	708.96	843	NA	NA	NA
145	7,755.61	4,227.51	717.14	345	7,755.61	4,227.51	718.15	545	7,755.55	4,227.62	720.16	845	7,755.50	4,227.50	725.16
146	7,754.92	3,949.42	705.58	346	7,754.92	3,949.42	706.68	546	7,754.82	3,949.40	708.90	846	7,754.88	3,949.44	714.18
147	7,754.91	3,923.11	699.10	347	7,754.93	3,923.36	700.21	547	7,754.76	3,925.89	702.44	847	7,754.80	3,923.58	707.64
148	7,754.81	3,837.30	728.91	348	7,754.81	3,837.30	728.91	548	7,755.00	3,837.31	730.92	848	7,754.79	3,837.34	736.35
151	7,749.04	4,190.16	715.91	351	7,749.04	4,190.16	716.92	551	7,749.08	4,190.28	718.93	851	7,749.02	4,190.19	723.95
152	7,748.55	4,186.90	715.86	352	7,748.55	4,186.90	716.87	552	7,748.57	4,186.84	718.88	852	7,748.61	4,186.99	723.81
153	7,748.49	4,094.06	711.78	353	7,748.41	4,093.98	713.05	553	7,748.32	4,093.81	715.06	853	7,748.46	4,093.97	720.18
154	7,744.65	4,190.84	716.08	354	7,744.65	4,190.84	717.09	554	7,744.56	4,190.77	719.10	854	7,744.62	4,190.92	724.15
156	7,738.28	4,033.53	709.79	356	7,738.21	4,033.63	710.95	556	7,738.16	4,033.67	712.96	856	7,738.25	4,033.52	718.16
157	7,738.13	4,117.05	713.29	357	7,738.13	4,117.05	714.30	557	7,737.99	4,116.98	716.31	857	7,738.17	4,117.08	721.48
158	7,736.48	4,106.02	712.99	358	7,736.48	4,106.02	714.00	558	7,736.42	4,106.05	716.01	858	7,736.44	4,106.00	721.11
160	7,735.65	3,980.94	707.33	360	7,735.75	3,980.76	708.34	560	7,735.59	3,980.81	710.35	860	7,735.59	3,980.72	716.15
161	7,733.71	4,087.40	712.25	361	7,733.71	4,087.40	713.26	561	7,733.53	4,087.42	715.27	861	7,733.65	4,087.38	720.51
163	7,729.12	4,056.48	710.20	363	7,729.12	4,056.48	711.21	563	7,729.15	4,056.58	713.22	863	7,728.99	4,056.50	719.42
164	7,727.35	4,044.58	709.35	364	7,727.35	4,044.58	710.36	564	7,727.33	4,044.64	712.37	864	7,727.26	4,044.55	719.03
165	7,723.27	4,119.34	714.13	365	7,723.27	4,119.34	715.14	565	7,732.15	4,119.45	717.15	865	7,723.34	4,119.41	722.18
166	7,721.39	4,004.48	706.09	366	7,721.39	4,004.48	707.10	566	7,721.60	4,004.52	709.11	866	7,721.41	4,004.41	717.68
167	7,720.19	3,996.43	705.53	367	7,720.19	3,996.43	706.54	567	7,720.25	3,996.31	708.55	867	7,720.19	3,996.43	717.40
169	7,717.59	3,978.98	704.25	369	7,717.59	3,978.98	705.26	569	7,717.60	3,978.95	707.27	869	7,717.52	3,978.96	716.82
170	7,715.33	3,963.83	702.80	370	7,715.33	3,963.83	703.81	570	7,715.35	3,963.76	705.82	870	7,715.28	3,963.83	716.28
172	7,713.09	4,058.96	710.34	372	7,713.09	4,058.96	711.35	572	7,719.04	4,058.91	713.36	872	7,713.03	4,058.90	720.11
173	7,710.56	4,006.15	706.92	373	7,710.56	4,006.15	707.93	573	7,710.73	4,006.02	709.94	873	7,710.54	4,006.09	718.11
174	7,710.30	3,956.01	701.55	374	7,710.30	3,956.01	702.57	574	7,710.27	3,955.92	704.58	874	7,710.26	3,955.97	716.17
176	7,709.31	3,980.25	705.00	376	7,709.31	3,980.25	706.10	576	7,709.47	3,980.16	708.11	876	7,709.24	3,980.17	717.15
177	7,705.81	3,956.67	701.70	377	7,705.81	3,956.67	702.84	577	7,705.73	3,956.70	704.85	877	7,705.79	3,956.67	716.40
179	7,700.01	3,941.16	697.80	379	7,700.01	3,941.16	699.70	579	7,701.23	3,942.78	701.71	879	NA	NA	NA
181	7,699.90	3,918.66	698.90	381	7,699.90	3,918.66	700.52	581	7,699.59	3,918.37	702.53	881	NA	NA	NA
182	7,699.75	3,837.32	726	382	7,699.75	3,837.32	726.23	582	7,699.62	3,837.15	728.24	882	7,699.83	3,837.31	734.0484

NOTE:
1. SEE SHEETS 3, 5, 6 AND 8 FOR CONSTRUCTION CONTROL POINT LOCATIONS.

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PROFESSIONAL ENGINEER
I HEREBY CERTIFY THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER IN THE STATE OF MICHIGAN, AND THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.
ANDREW J. ZYCH
No. 6201054011
LICENSED PROFESSIONAL ENGINEER
6-28-19
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DATE:	6-28-19
DESIGNED BY:	AZ/PAA
DRAWN BY:	PAA
CHECKED BY:	RMB
APPROVED BY:	AZ

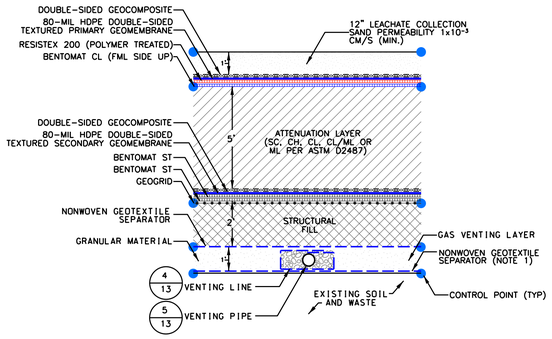
REV	DATE	REVISION DESCRIPTION
00	6-28-19	ISSUED FOR RECORD DRAWINGS

PAA XZ
DRN. APP

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

RECORD CONSTRUCTION CONTROL TABLES

PROJECT NUMBER
1188070030
SCALE
NTS
DRAWING NO
11

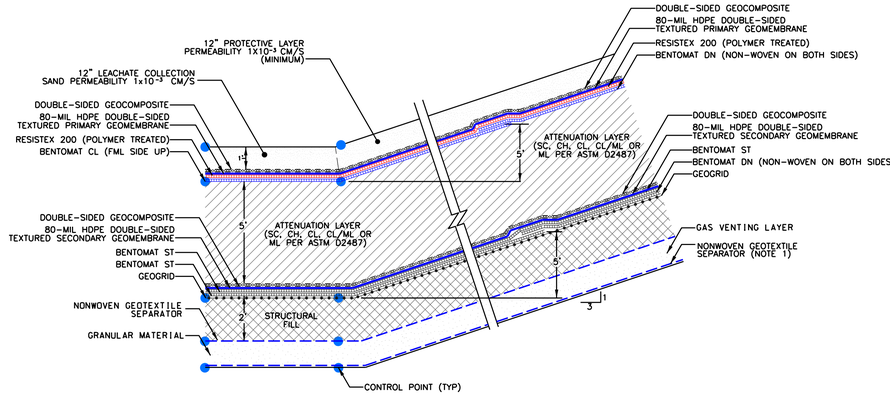


FLOOR LINER SYSTEM 1

NOT TO SCALE

NOTE:

1. NONWOVEN GEOTEXTILE SEPARATOR WAS INSTALLED BETWEEN GRANULAR MATERIAL AND EXISTING WASTE.

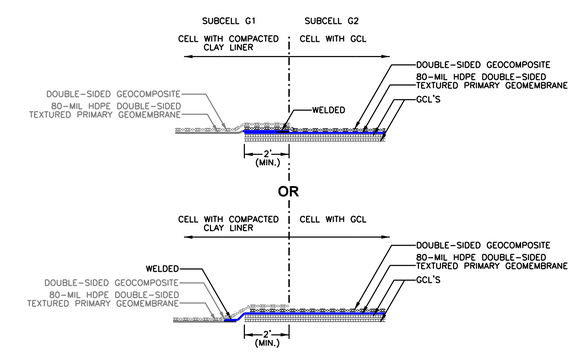


SIDESLOPE LINER SYSTEM 2

NOT TO SCALE

NOTE:

1. NONWOVEN GEOTEXTILE SEPARATOR WAS INSTALLED BETWEEN GRANULAR MATERIAL AND EXISTING WASTE.



PRIMARY LINER TIE-IN DETAIL 3

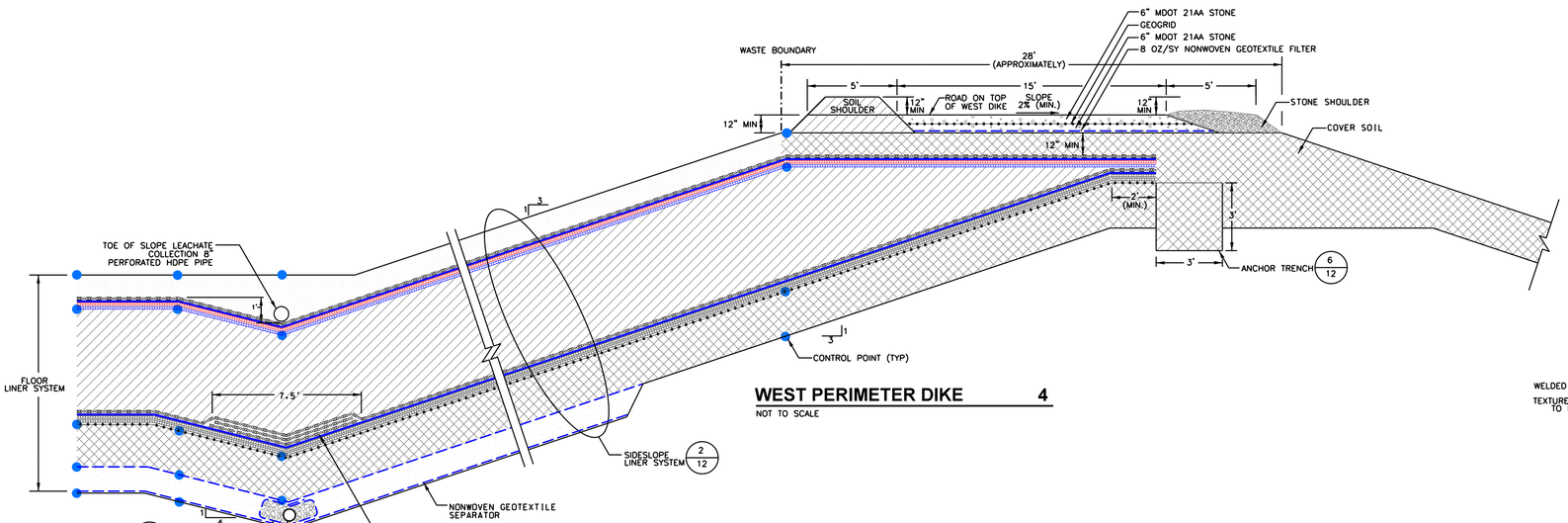
NOT TO SCALE

NOTES:

NEW AND EXISTING GEOCOMPOSITE LAYERS WERE CONNECTED AS:

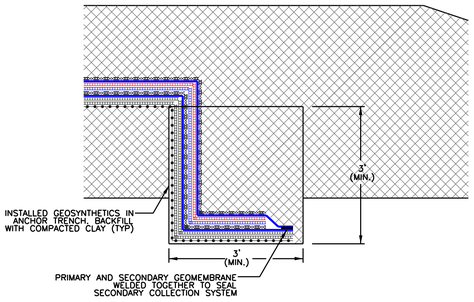
A. GEONET CORES JOINED BY PLASTIC FASTENERS.

B. TOP GEOTEXTILE SEWED TOGETHER.



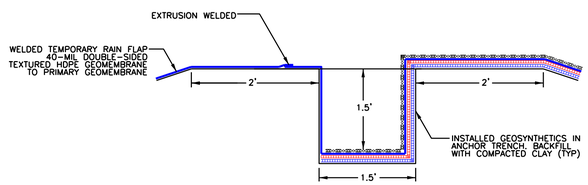
WEST PERIMETER DIKE 4

NOT TO SCALE



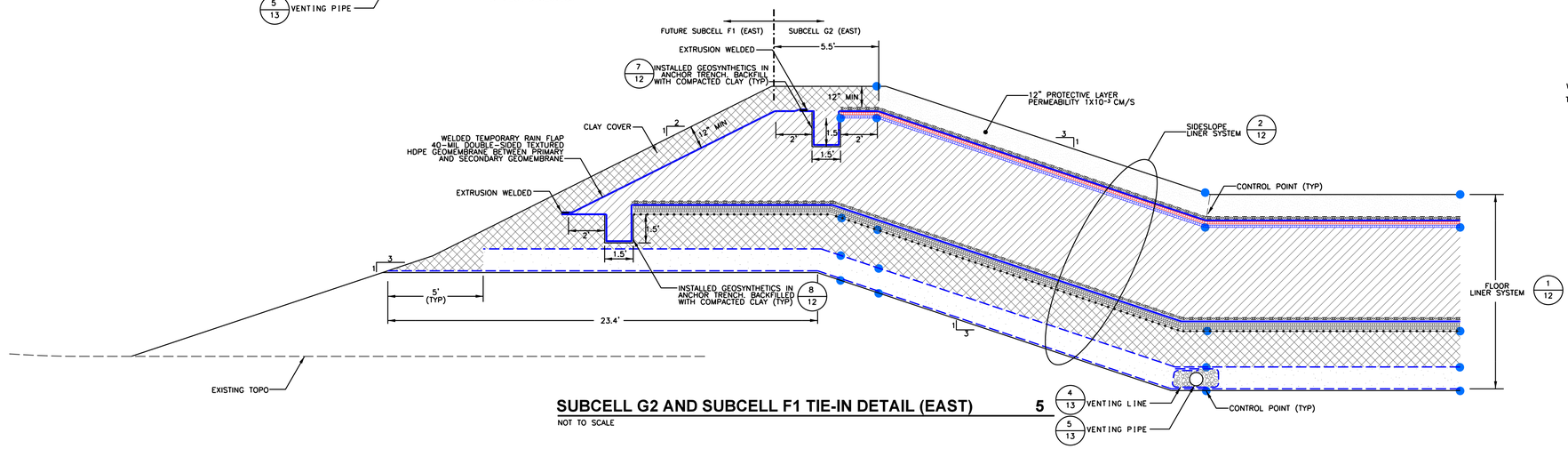
ANCHOR TRENCH DETAIL 6

NOT TO SCALE



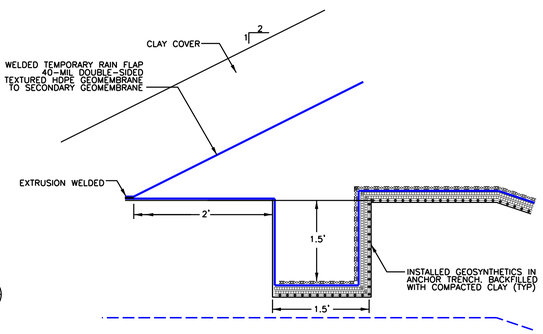
TEMPORARY PRIMARY ANCHOR TRENCH 7

NOT TO SCALE



SUBCELL G2 AND SUBCELL F1 TIE-IN DETAIL (EAST) 5

NOT TO SCALE



TEMPORARY SECONDARY ANCHOR TRENCH 8

NOT TO SCALE

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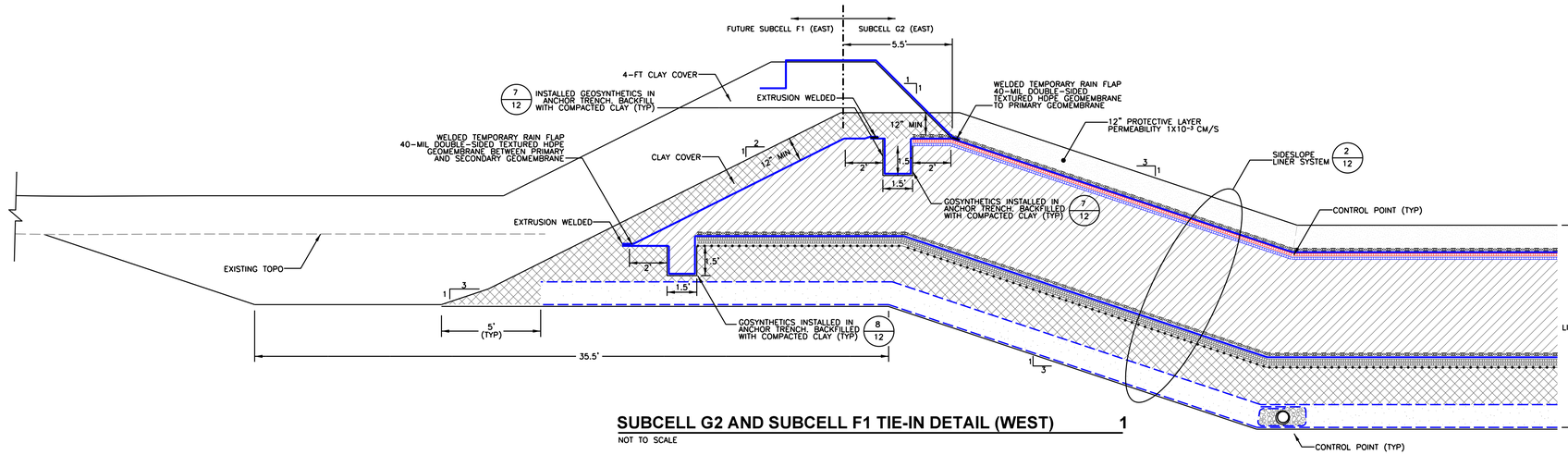
REVISIONS			
REV	DATE	REVISION DESCRIPTION	
00	6-28-19	ISSUED FOR REVIEW	PAA
1	7-23-19	ADDED LOCATIONS OF SAND LAYER RECORD CONTROL POINTS	XZ

DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

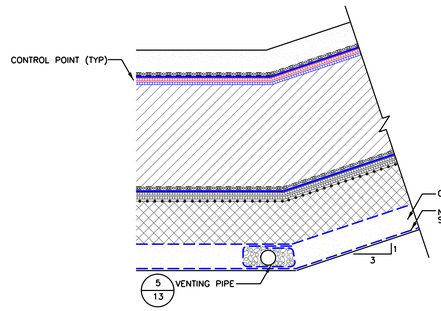
LINER SYSTEM DETAILS

PROJECT NUMBER 1188070030
SCALE NTS
DRAWING NO 12



SUBCELL G2 AND SUBCELL F1 TIE-IN DETAIL (WEST) 1

NOT TO SCALE

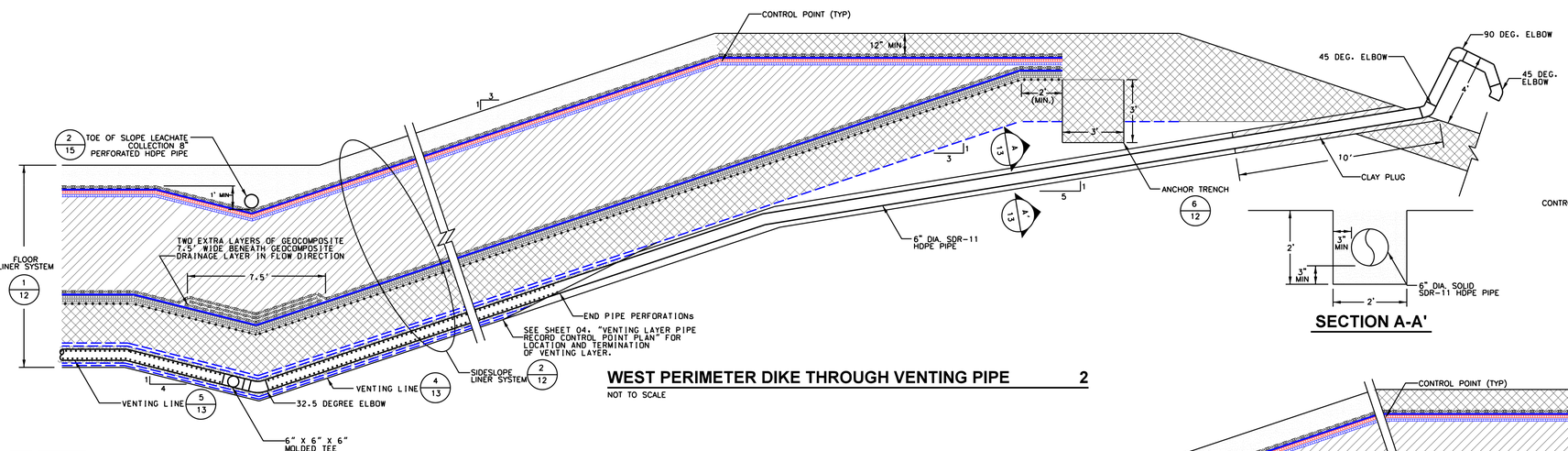


TOE OF NORTH SIDESLOPE 7

NOT TO SCALE

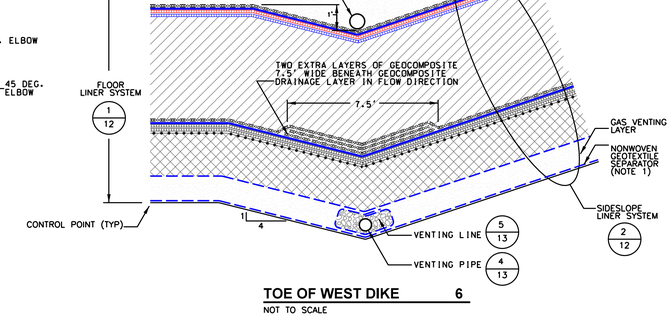
NOTE:

1. NONWOVEN GEOTEXTILE SEPARATOR WAS INSTALLED BETWEEN GRANULAR MATERIAL AND EXISTING WASTE.



WEST PERIMETER DIKE THROUGH VENTING PIPE 2

NOT TO SCALE



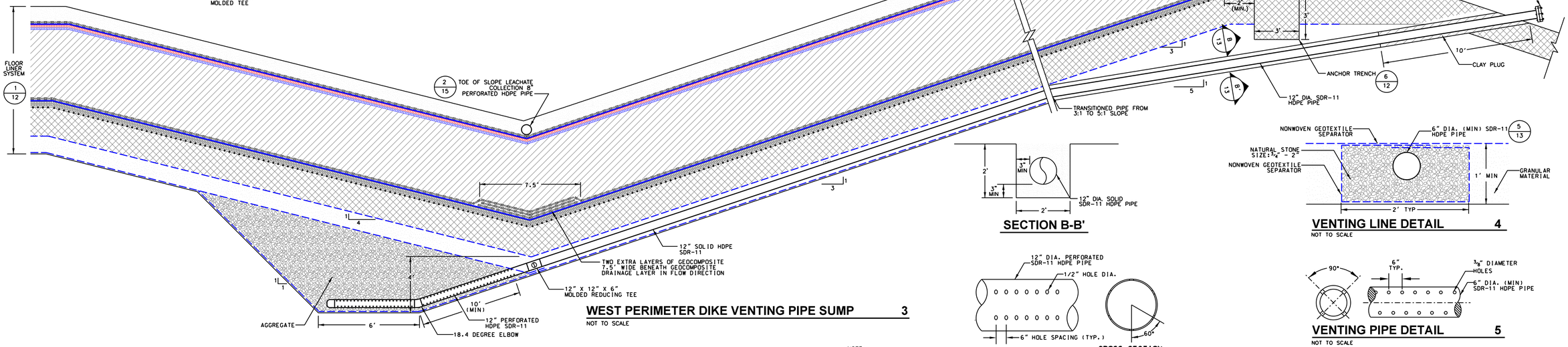
TOE OF WEST DIKE 6

NOT TO SCALE

NOTE:

1. NONWOVEN GEOTEXTILE SEPARATOR WAS INSTALLED BETWEEN GRANULAR MATERIAL AND EXISTING WASTE.

SECTION A-A'



WEST PERIMETER DIKE VENTING PIPE SUMP 3

NOT TO SCALE

SECTION B-B'

VENTING LINE DETAIL 4

NOT TO SCALE

NOTE:
PIPE PERFORATED WITH 6 ROWS OF 1/2" DIA. HOLES SPACED 6" APART AND WRAPPED WITH A DOUBLE LAYER OF GEONET.

12" VENTING LAYER COLLECTION PIPE PERFORATION DETAIL 8

NOT TO SCALE

VENTING PIPE DETAIL 5

NOT TO SCALE

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiomplanies.com

DATE: 6-28-19
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: RMB
APPROVED BY: XZ

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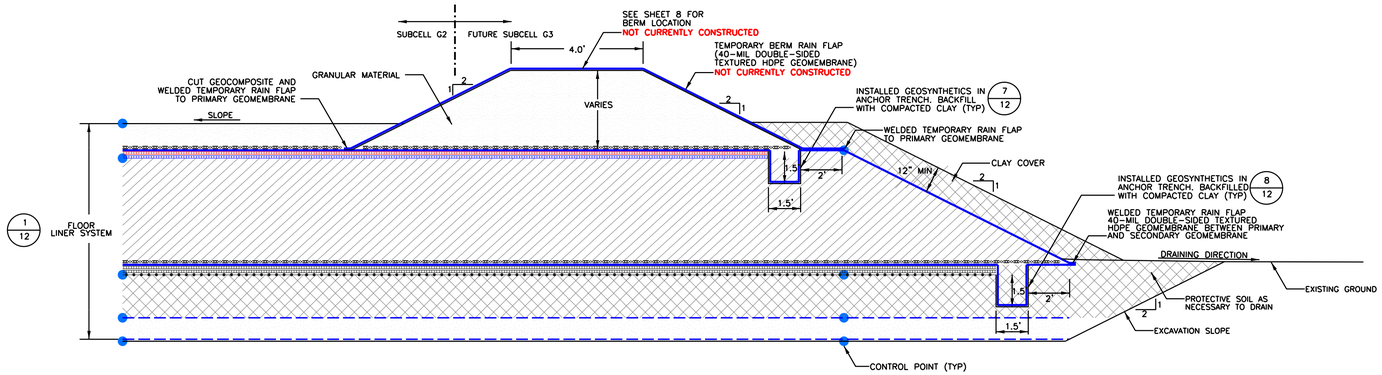
REVISIONS		
REV	DATE	DESCRIPTION
0	6-28-19	ISSUED FOR RECORD DRAWINGS
1	7-23-19	ADDED LOCATIONS OF SAND LAYER RECORD CONTROL POINTS

PAA XZ
DRN. APP

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

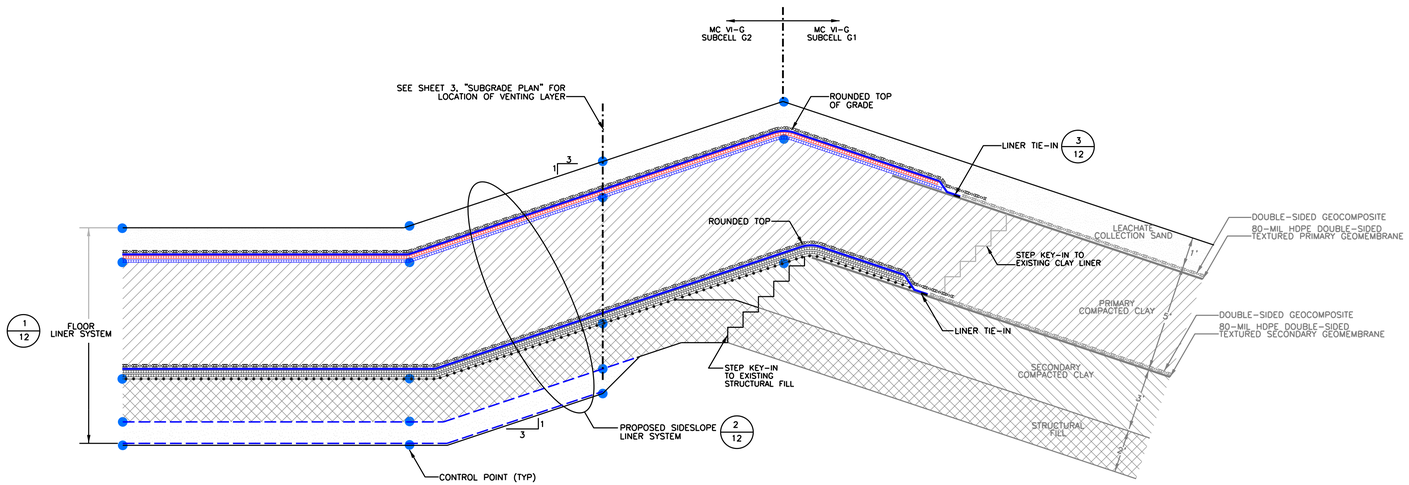
LINER SYSTEM DETAILS

PROJECT NUMBER 1188070030
SCALE NTS
DRAWING NO **13**



RAIN FLAP BERM DETAIL 1

NOT TO SCALE



SUBCELL G2 AND SUBCELL G1 TIE-IN DETAIL 2

NOT TO SCALE

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DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	RMB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION	DRN	APP
1	7-23-19	ADDED LOCATIONS OF SAND LAYER RECORD CONTROL POINTS	PAA	XZ
00	6-28-19	ISSUED FOR RECORD DRAWINGS		

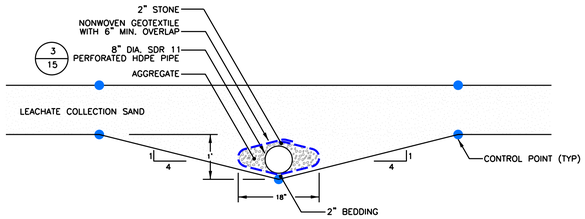
WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

LINER SYSTEM DETAILS

PROJECT NUMBER
1188070030

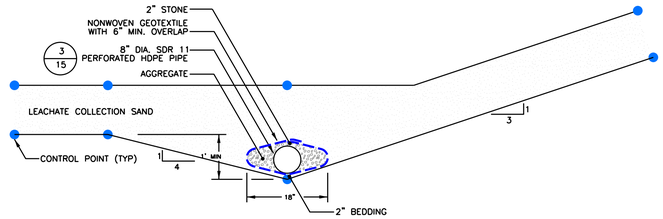
SCALE
NTS

DRAWING NO.
14



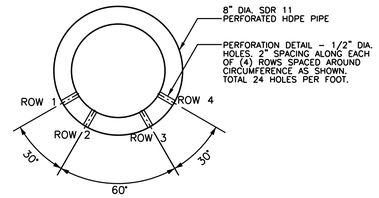
CELL FLOOR PRIMARY LEACHATE COLLECTION PIPE (TYP.) 1

NOT TO SCALE



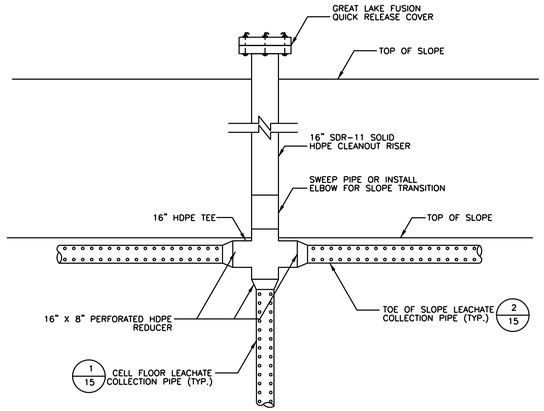
TOE OF SLOPE LEACHATE COLLECTION PIPE (TYP.) 2

NOT TO SCALE



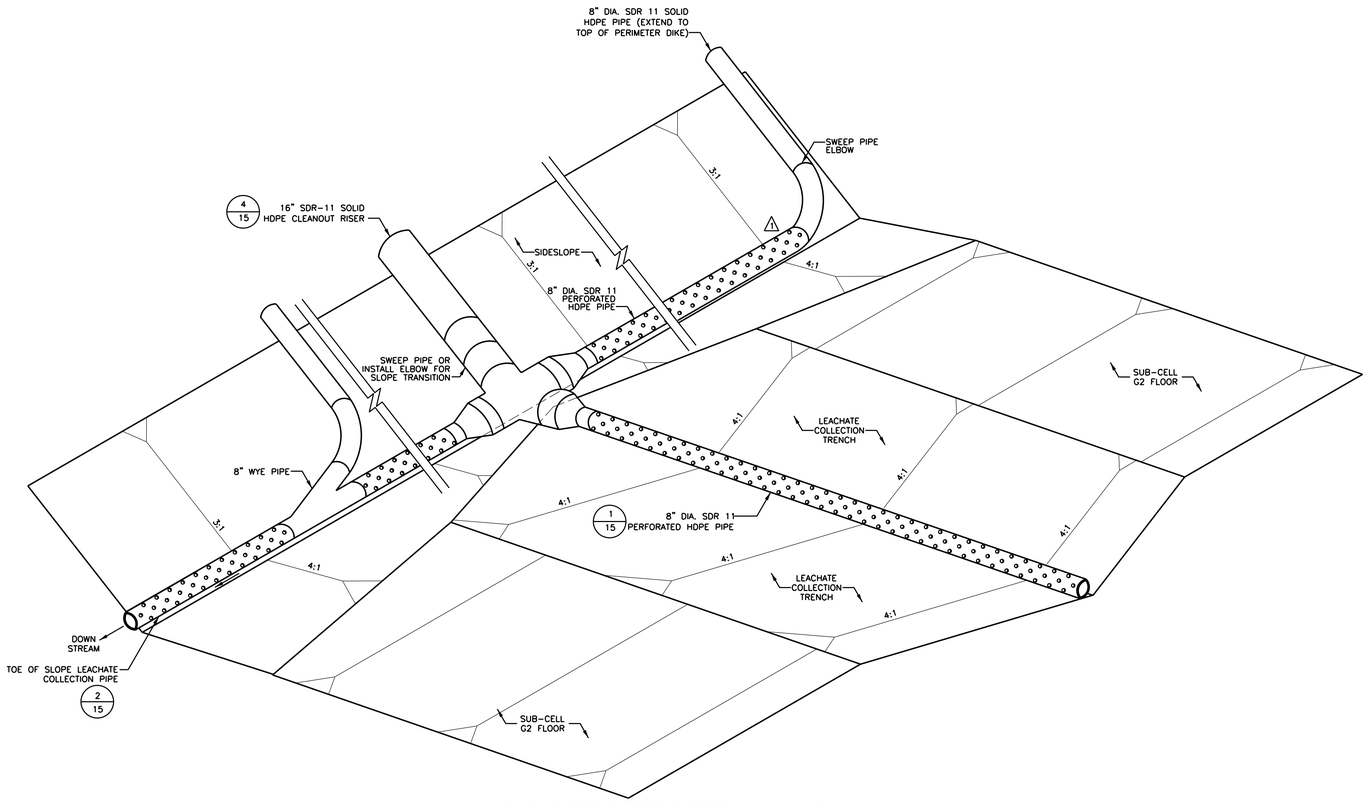
PIPE PERFORATION DETAIL 3

NOT TO SCALE



ENLARGED CLEANOUT ACCESS 4

NOT TO SCALE

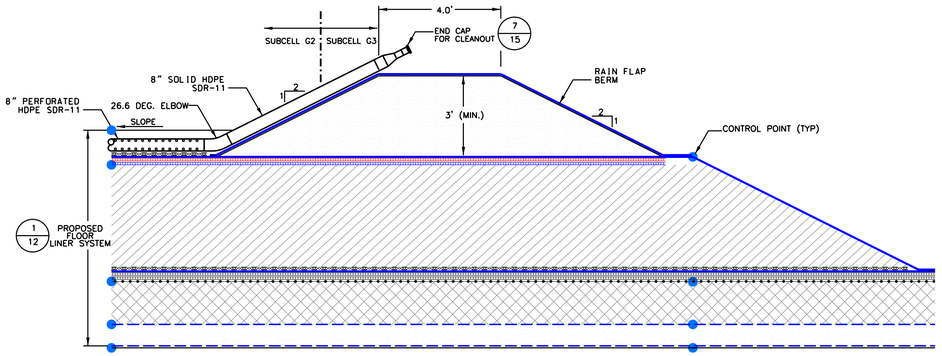


CLEANOUT ACCESS (TYP.) 5

NOT TO SCALE

NOTE:

CONTRACTOR SHALL PROVIDE CONSTRUCTION SUBMITTAL TO ENGINEER FOR REVIEW PRIOR TO FABRICATION AND INSTALLATION.

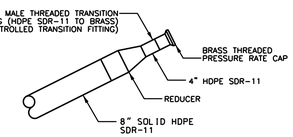


TEMPORARY CLEANOUT FOR LEACHATE COLLECTION PIPE 6

NOT TO SCALE

NOTE:

1. CONTRACTOR TO CONTROL AND REMOVE ACCUMULATED STORMWATER IN EXCAVATION DURING THE COURSE OF CONSTRUCTION



END CAP FOR CLEANOUT 7

NOT TO SCALE

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CHECKED BY: RMB
APPROVED BY: XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	
1	7-23-19	ADDED LOCATIONS OF SAND LAYER	PAA
00	6-28-19	ISSUED FOR RECORD DRAWINGS	XZ
			DRN
			APP

WAYNE DISPOSAL INC., SITE NO. 2 MASTER CELL VI-G PHASE 2
SUBCELL G2 RECORD CONSTRUCTION PLANS
BELLEVILLE, MICHIGAN

LEACHATE COLLECTION PIPE DETAILS

PROJECT NUMBER 118070030
SCALE NTS
DRAWING NO 15

WAYNE DISPOSAL SITE NO. 2

MASTER CELL VI CELL G3

RECORD PLAN

WAYNE DISPOSAL, INC. SITE NO. 2
MASTER CELL VI-G
SUBCELL G3 RECORD DRAWINGS

VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CTI PROJECT NO. 1208070046

JUNE 2021

WAYNE COUNTY, MICHIGAN
NOT TO SCALE

VICINITY MAP
NOT TO SCALE

REV		LIST OF DRAWINGS
01	G-01	TITLE SHEET
00	G-02	SITE PLAN
00	P-01	BOTTOM OF STRUCTURAL FILL LAYER RECORD CONTROL POINT PLAN
01	P-02	TOP OF STRUCTURAL FILL LAYER RECORD CONTROL POINT PLAN
01	P-03	SECONDARY GEOMEMBRANE LINER AND LEAK DETECTION RECORD PLAN
00	P-04	TOP OF ATTENUATION LAYER RECORD CONTROL POINT PLAN
01	P-05	PRIMARY GEOMEMBRANE LINER RECORD PLAN
01	P-06	TOP OF LEACHATE COLLECTION SAND LAYER AND LEACHATE COLLECTION PIPE RECORD CONTROL POINT PLAN
00	C-01	CROSS SECTIONS
01	D-01	LINER SYSTEM DETAILS (1 OF 3)
01	D-02	LINER SYSTEM DETAILS (2 OF 3)
01	D-03	LINER SYSTEM DETAILS (3 OF 3)
01	D-04	LEACHATE COLLECTION PIPE DETAILS

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Belleville, Michigan 48111

ENGINEER:
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CTI and Associates, Inc.
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DATE:	06-09-21
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

REVISIONS			
REV	DATE	REVISION DESCRIPTION	BY
0	06-09-21	ISSUED FOR RECORD DRAWINGS	PAA
1	07-09-21	REVISED SHEETS: G-01, P-02, P-03, P-05, P-06, D-01, D-02, D-03 AND D-04.	PAA

ISSUED FOR RECORD DRAWINGS

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TITLE SHEET

PROJECT NUMBER 1208070046
SCALE NTS
DRAWING NO **G-01**

REV. 01

TIME PLOTTED: $TIME$
DATE PLOTTED: $DATE$
FILENAME: $FILE$

DRAWING SIZE: 24" X 36"

MC6EP2-W

MC6EP1-SW

MC6 B

MC6 D

MC6 C

EXISTING MC VI-G SUBCELL G1-EAST PHASE 2

EXISTING MC VI-G SUBCELL G1-EAST PHASE 1

MC VI-G SUBCELL G3

MC VI-F FUTURE SUBCELL F3

MC VI-F FUTURE SUBCELL F4

MC VI-G FUTURE SUBCELL G6

MC VI-G FUTURE SUBCELL G7

EXISTING MC VI-G SUBCELL G1

MC VI-F FUTURE SUBCELL F2

MC VI-F FUTURE SUBCELL F1

MC VI-G SUBCELL G2

MC VI-G FUTURE SUBCELL G4

MC VI-G FUTURE SUBCELL G5

MC 4

MC 1

N 9000 N 8500 N 8000 N 7500 N 7000 N 6500 N 6000

E 5500 E 5000 E 4500 E 4000

REV. 00

N

0 50' 100' 200'

SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020, UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. LIMITS OF RECORD LINER SYSTEM IN G3 BASED ON RECORD DATA PROVIDED TO CTI AND ASSOCIATES, INC.

LEGEND

- PROPERTY BOUNDARY
- OLD CELL BOUNDARY
- 710 EXISTING CONTOUR (2' INTERVAL)
- N 6500 GRID COORDINATES
- EXISTING STRUCTURE/ BUILDING
- G3 AREA
- G3 TOP OF STRUCTURAL FILL LAYER BREAK IN SLOPE
- 710 G3 TOP OF STRUCTURAL FILL LAYER CONTOUR (2 FT INTERVAL)
- G3 TOP OF STRUCTURAL FILL LAYER CERTIFICATION LIMIT

ISSUED FOR RECORD DRAWINGS

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Novi, Michigan 48377
248-486-5100 (fax)248-486.5050
www.ctiandassociates.com

DATE: 06-09-21
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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REVISIONS		
REV	DATE	DESCRIPTION
0	06-09-21	ISSUED FOR RECORD DRAWINGS

PAA XZ
DRN APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

SITE PLAN

PROJECT NUMBER
1208070046

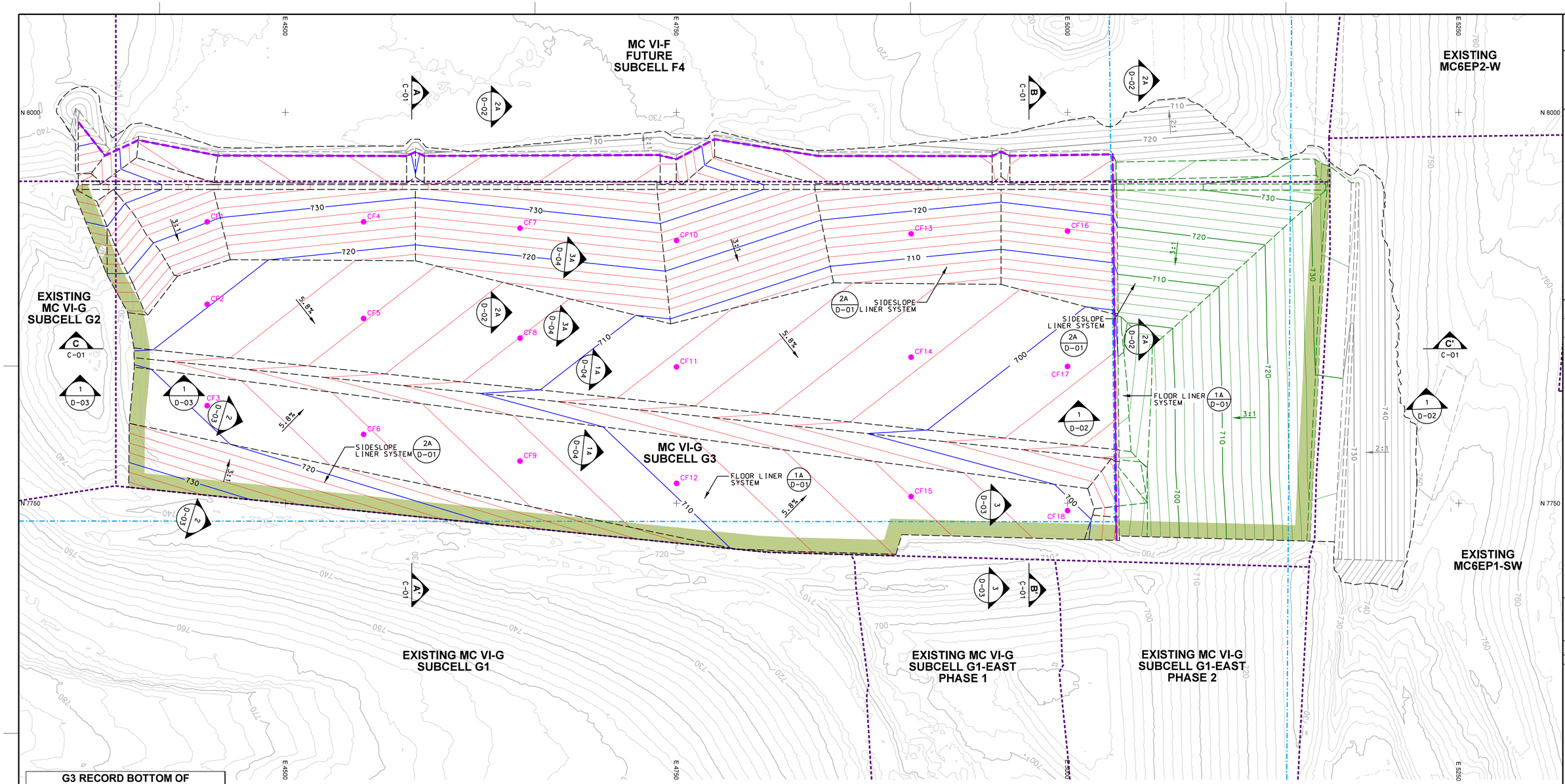
SCALE
1" = 100'

DRAWING NO
G-02

TIME PLOTTED: $TIME$
DATE PLOTTED: $DATE$
FILENAME: $FILE$

DRAWING SIZE: 24" x 36"

G-02_EGLE REC G3 SITE PLAN REV 00.dgn 7/9/2021 1:32:50 PM



G3 RECORD BOTTOM OF STRUCTURAL FILL LAYER CERTIFICATION

BOTTOM OF STRUCTURAL FILL PT. NO.	NORTHING (FT)	EASTING (FT)	BOTTOM OF STRUCTURAL ELEVATION (FT)
CF1	7,929.95	4,449.99	730.10
CF2	7,877.23	4,449.99	720.06
CF3	7,812.35	4,450.01	719.49
CF4	7,929.97	4,550.00	725.91
CF5	7,868.18	4,549.99	716.06
CF6	7,793.98	4,550.00	716.23
CF7	7,925.90	4,649.98	725.81
CF8	7,855.59	4,650.04	711.92
CF9	7,776.91	4,649.97	712.99
CF10	7,918.03	4,750.02	725.44
CF11	7,837.16	4,749.97	707.55
CF12	7,762.65	4,750.05	709.58
CF13	7,922.32	4,900.00	715.11
CF14	7,843.40	4,899.96	702.49
CF15	7,754.22	4,899.95	703.97
CF16	7,924.06	4,999.98	715.49
CF17	7,837.47	4,999.98	698.59
CF18	7,745.22	5,000.00	700.29

REV. 00

0 15' 30' 60'
SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020, UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. LIMITS OF RECORD LINER SYSTEM IN G3 BASED ON RECORD DATA PROVIDED TO CTI AND ASSOCIATES, INC.

LEGEND

- PHASE BOUNDARY
- OLD CELL BOUNDARY
- N 6500 + GRID COORDINATES
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- 710 G3 TOP OF TOP OF STRUCTURAL FILL LAYER CONTOUR (2 FT INTERVAL)
- G3 TOP OF STRUCTURAL FILL LAYER BREAK IN SLOPE
- 710 G3 BOTTOM OF STRUCTURAL FILL LAYER CONTOUR (2 FT INTERVAL)
- G3 BOTTOM OF STRUCTURAL FILL LAYER BREAK IN SLOPE
- TRANSITION ZONE USED TO SMOOTHLY BLEND LINER SYSTEM BETWEEN EXISTING 6E, G1, G1EP1, G1EP2, G2 TO G3
- LIMIT OF G3 BOTTOM OF STRUCTURAL FILL LAYER CERTIFICATION
- CF14 BOTTOM OF STRUCTURAL FILL LAYER RECORD CERTIFICATION CONTROL POINT (SEE RECORD DATA ON THIS SHEET)

ISSUED FOR RECORD DRAWINGS

REV	DATE	REVISION DESCRIPTION
0	06-09-21	ISSUED FOR RECORD DRAWINGS

DATE: 06-09-21
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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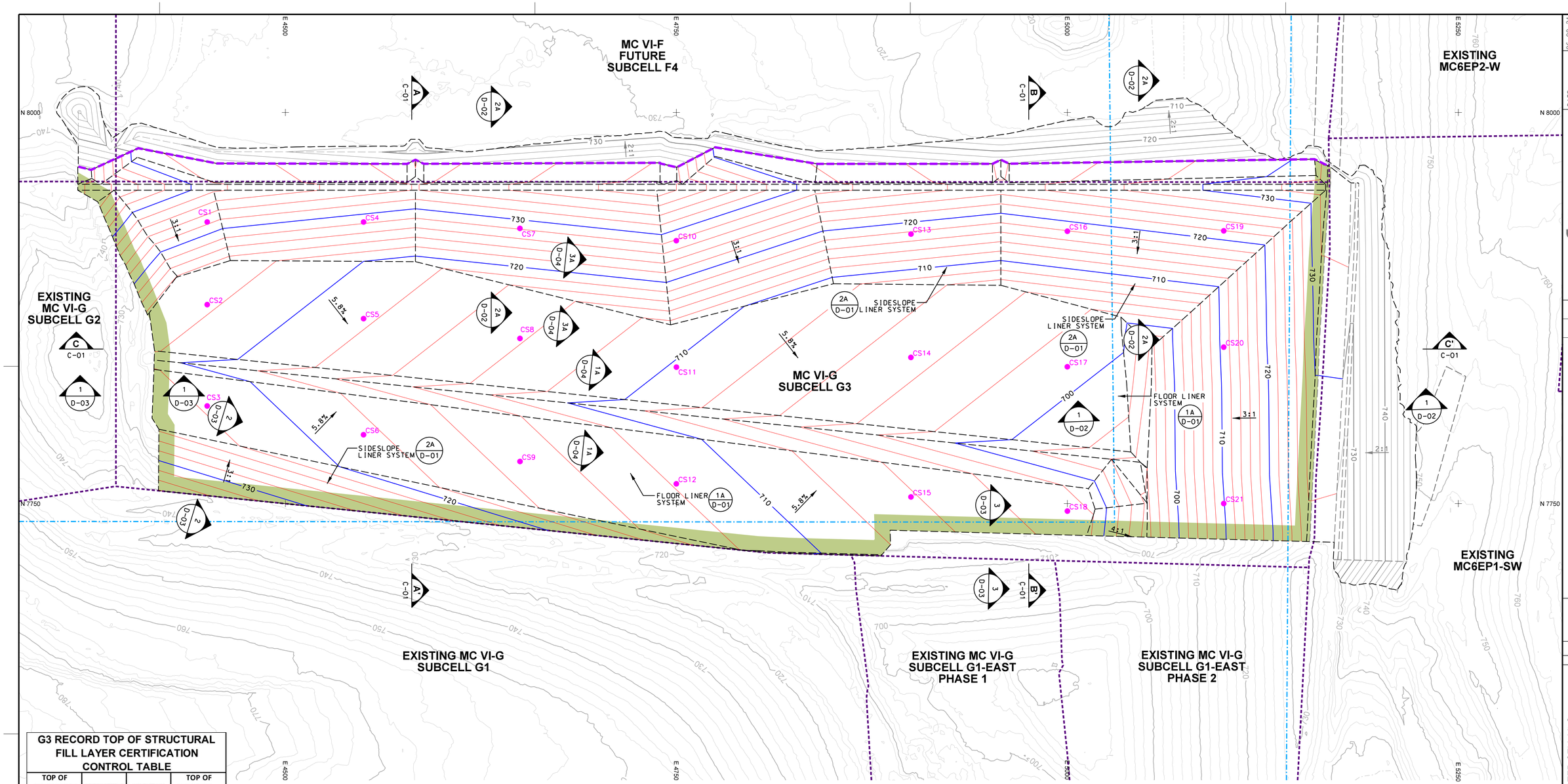
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

BOTTOM OF STRUCTURAL FILL LAYER RECORD CONTROL POINT PLAN

PROJECT NUMBER 1208070046
SCALE 1" = 30'
DRAWING NO **P-01**

PAA XZ DRN. APP

DRAWING SIZE: 24" X 36"



G3 RECORD TOP OF STRUCTURAL FILL LAYER CERTIFICATION CONTROL TABLE

TOP OF STRUCTURAL FILL LAYER PT. NO.	NORTHING (FT)	EASTING (FT)	TOP OF STRUCTURAL FILL LAYER ELEVATION (FT)
CS1	7,930.00	4,450.02	732.42
CS2	7,877.19	4,450.02	722.26
CS3	7,812.39	4,450.00	721.68
CS4	7,929.99	4,550.01	728.28
CS5	7,868.21	4,550.00	718.29
CS6	7,794.01	4,549.97	718.44
CS7	7,925.91	4,649.96	728.19
CS8	7,855.56	4,650.00	714.14
CS9	7,776.91	4,650.03	715.16
CS10	7,918.06	4,749.97	727.79
CS11	7,837.21	4,750.03	709.69
CS12	7,762.64	4,749.97	711.78
CS13	7,922.29	4,900.02	717.44
CS14	7,843.44	4,899.97	704.70
CS15	7,754.24	4,900.01	706.18
CS16	7,924.09	5,000.01	717.86
CS17	7,837.45	4,999.98	700.83
CS18	7,745.20	5,000.03	702.50
CS19	7,924.35	5,100.00	721.89
CS20	7,849.99	5,099.98	710.78
CS21	7,750.03	5,099.99	709.82

REV. 01

N

0 15' 30' 60'
SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020, UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. LIMITS OF RECORD LINER SYSTEM IN G3 BASED ON RECORD DATA PROVIDED TO CTI AND ASSOCIATES, INC.

LEGEND

- PHASE BOUNDARY
- OLD CELL BOUNDARY
- N 6500 + GRID COORDINATES
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- 710 G3 TOP OF STRUCTURAL FILL LAYER CONTOUR (2 FT INTERVAL)
- G3 TOP OF STRUCTURAL FILL LAYER BREAK IN SLOPE
- TRANSITION ZONE USED TO SMOOTHLY BLEND LINER SYSTEM BETWEEN EXISTING 6B, G1, G1EP1, G1EP2, G2 TO G3
- LIMIT OF G3 TOP OF STRUCTURAL FILL LAYER CERTIFICATION
- CS20 G3 TOP OF STRUCTURAL FILL LAYER RECORD CERTIFICATION CONTROL POINT (SEE RECORD DATA ON THIS SHEET)

ISSUED FOR RECORD DRAWINGS

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiompanies.com

DATE: 06-09-21
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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REVISIONS		
REV.	DATE	REVISION DESCRIPTION
0	06-09-21	ISSUED FOR RECORD DRAWINGS
1	07-09-21	REVISED LEGEND

PAA	XZ	EVISED LEGEND
PAA	XZ	SSUED FOR RECORD DRAWINGS
DRN.	APP	EVISION DESCRIPTION

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF STRUCTURAL FILL LAYER RECORD CONTROL POINT PLAN

PROJECT NUMBER
1208070046

SCALE
1" = 30'

DRAWING NO
P-02

TIME PLOTTED: $TIME$
DATE PLOTTED: $DATE$
FILENAME: $FILE$

DRAWING SIZE: 24" X 36"

MC VI-F
FUTURE
SUBCELL F4

EXISTING
MC6EP2-W

EXISTING
MC VI-G
SUBCELL G2

EXISTING
MC6EP1-SW

EXISTING MC VI-G
SUBCELL G1

EXISTING MC VI-G
SUBCELL G1-EAST
PHASE 1

EXISTING MC VI-G
SUBCELL G1-EAST
PHASE 2

N 8000
N 7750
E 4500
E 4750
E 5000
E 5250

2 EXTRA LAYERS OF GEONET
(WIDTH 7.5 FT MIN.)

REV. 01

0 15' 30' 60'
SCALE

LEGEND

- PHASE BOUNDARY
- OLD CELL BOUNDARY
- TOP OF STRUCTURAL FILL BREAK IN SLOPE
- N 6500 GRID COORDINATES
- 2 EXTRA LAYERS OF GEONET
- SECONDARY GEOMEMBRANE PANEL SEAM
- S43 SECONDARY GEOMEMBRANE PANEL NUMBER
- R190 SECONDARY GEOMEMBRANE REPAIR
- DS30 R195 SECONDARY GEOMEMBRANE DESTRUCTIVE SAMPLE
- SECONDARY GEOMEMBRANE CAP
- SECONDARY GEOMEMBRANE CAP OVER CAP
- SECONDARY GEOMEMBRANE EXTRUSION WELD

ISSUED FOR RECORD DRAWINGS

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiecompanies.com

DATE:	06-08-21
DESIGNED BY:	XZ/PAA
DRAWN BY:	PAA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP
1	07-09-21	ADDED PHASE/CELL BOUNDARIES	PAA	XZ
0	06-08-21	ISSUED FOR RECORD DRAWINGS	BA	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

SECONDARY GEOMEMBRANE LINER AND LEAK DETECTION RECORD PLAN

PROJECT NUMBER
1208070046

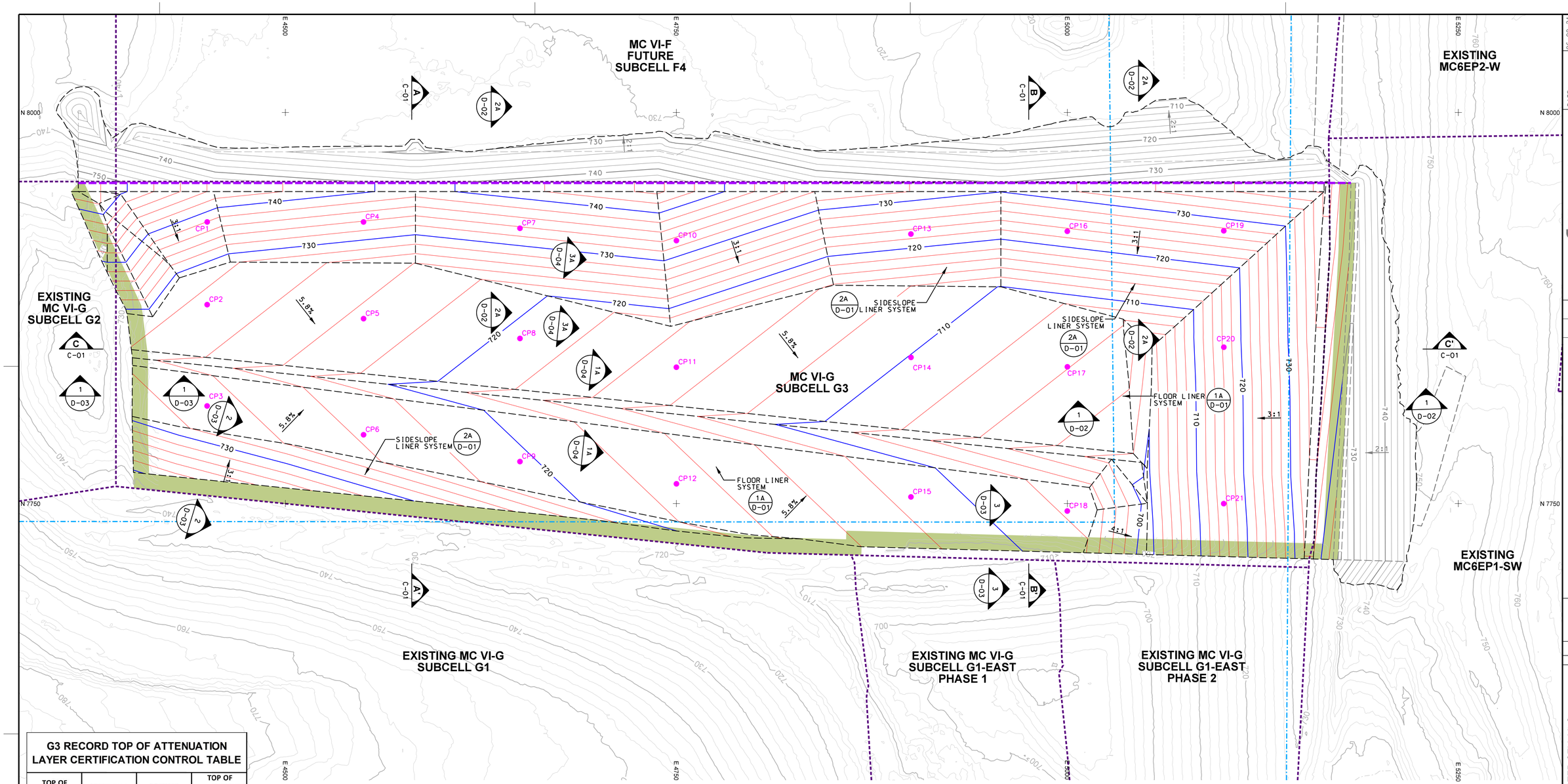
SCALE
1" = 30'

DRAWING NO
P-03

TIME PLOTTED: $TIME$
DATE PLOTTED: $DATE$
FILENAME: $FILE$

DRAWING SIZE: 24" X 36"

P-03_EGLE_TSL_LINER PLAN REV 01.dgn 7/9/2021 3:28:11 PM



G3 RECORD TOP OF ATTENUATION LAYER CERTIFICATION CONTROL TABLE

TOP OF ATTENUATION LAYER PT. NO.	NORTHING (FT)	EASTING (FT)	TOP OF ATTENUATION LAYER ELEV. (FT)
CP1	7,930.02	4,450.01	738.01
CP2	7,877.17	4,449.99	727.59
CP3	7,812.40	4,449.96	727.00
CP4	7,930.02	4,549.96	733.85
CP5	7,868.21	4,549.99	723.56
CP6	7,793.99	4,549.99	723.78
CP7	7,925.98	4,650.00	733.74
CP8	7,855.55	4,650.00	719.44
CP9	7,776.85	4,650.00	720.50
CP10	7,918.09	4,750.03	733.27
CP11	7,837.16	4,750.00	715.05
CP12	7,762.63	4,750.04	717.08
CP13	7,922.31	4,899.97	723.04
CP14	7,843.45	4,900.02	710.00
CP15	7,754.25	4,900.00	711.48
CP16	7,924.06	4,999.96	723.41
CP17	7,837.41	5,000.02	706.12
CP18	7,745.24	4,999.96	707.82
CP19	7,924.38	5,100.01	727.47
CP20	7,849.96	5,100.04	716.36
CP21	7,749.97	5,099.98	715.39

REV. 00

0 15' 30' 60'
SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020, UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. LIMITS OF RECORD LINER SYSTEM IN G3 BASED ON RECORD DATA PROVIDED TO CTI AND ASSOCIATES, INC.

LEGEND

- PHASE BOUNDARY
- OLD CELL BOUNDARY
- N 6500 + GRID COORDINATES
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- 710 G3 TOP OF ATTENUATION LAYER CONTOUR (2 FT INTERVAL)
- G3 TOP OF ATTENUATION LAYER BREAK IN SLOPE
- TRANSITION ZONE USED TO SMOOTHLY BLEND LINER SYSTEM BETWEEN EXISTING 6E, G1, G1EP1, G1EP2, G2 TO G3
- LIMIT OF G3 TOP OF ATTENUATION LAYER CERTIFICATION
- CP20 G3 TOP OF ATTENUATION LAYER RECORD CERTIFICATION CONTROL POINT (SEE RECORD DATA ON THIS SHEET)

ISSUED FOR RECORD DRAWINGS

CTI and Associates, Inc.
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Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiomaha.com

DATE: 06-09-21
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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PAA XZ
DRN. APP.

REVISIONS	REV.	DATE	REVISION DESCRIPTION
	0	06-09-21	ISSUED FOR RECORD DRAWINGS

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF ATTENUATION LAYER RECORD CONTROL POINT PLAN

PROJECT NUMBER
1208070046
SCALE
1" = 30'
DRAWING NO
P-04

TIME PLOTTED: $TIME$
DATE PLOTTED: $DATE$
FILENAME: $FILE$

DRAWING SIZE: 24" X 36"

MC VI-F
FUTURE
SUBCELL F4

EXISTING
MC6EP2-W

EXTRUSION WELDED TO
SECONDARY GEOMEMBRANE

EXISTING
MC VI-G
SUBCELL G2

MC VI-G
PROPOSED
SUBCELL G3

EXISTING
MC6EP1-SW

EXISTING MC VI-G
SUBCELL G1

EXISTING MC VI-G
SUBCELL G1-EAST
PHASE 1

EXISTING MC VI-G
SUBCELL G1-EAST
PHASE 2

REV. 01

SCALE
0 15' 30' 60'

LEGEND

- PHASE BOUNDARY 1
- OLD CELL BOUNDARY 1
- TOP OF ATTENUATION LAYER BREAK IN SLOPE
- N 6500 GRID COORDINATES
- PRIMARY GEOMEMBRANE PANEL SEAM
- S43 PRIMARY GEOMEMBRANE PANEL NUMBER
- R190 PRIMARY GEOMEMBRANE REPAIR
- DS30 R195 PRIMARY GEOMEMBRANE DESTRUCTIVE SAMPLE
- PRIMARY GEOMEMBRANE CAP
- PRIMARY GEOMEMBRANE CAP OVER PRIMARY CAP
- PRIMARY GEOMEMBRANE EXTRUSION WELD

CTI and Associates, Inc.
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www.ctiengineering.com

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DESIGNED BY:	XZ
DRAWN BY:	BA
CHECKED BY:	PH/RMB
APPROVED BY:	XZ

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REV.	DATE	REVISION DESCRIPTION	DRN.	APP.
1	07-09-21	ADDED PHASE/CELL BOUNDARIES	PAA	XZ
0	06-08-21	ISSUED FOR RECORD DRAWINGS	BA	XZ

ISSUED FOR RECORD DRAWINGS

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

PRIMARY GEOMEMBRANE LINER RECORD PLAN

PROJECT NUMBER
1208070046

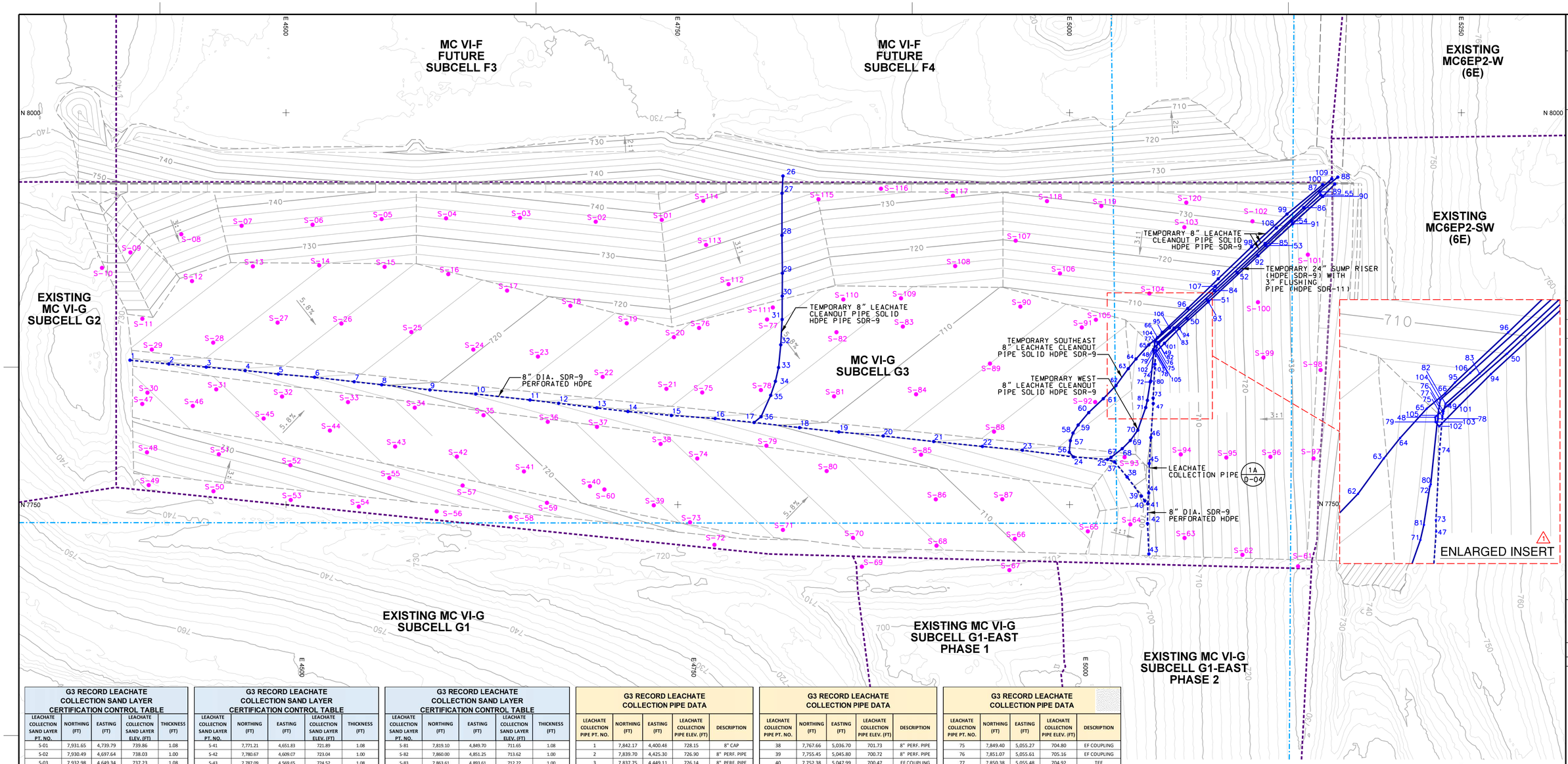
SCALE
1" = 30'

DRAWING NO
P-05

TIME PLOTTED: $TIME$
DATE PLOTTED: $DATE$
FILENAME: $FILE$

DRAWING SIZE: 24" x 36"

P-05_EGLE TPL LINER PLAN REV 01.dgn 7/9/2021 3:31:23 PM



G3 RECORD LEACHATE COLLECTION SAND LAYER CERTIFICATION CONTROL TABLE

LEACHATE COLLECTION SAND LAYER PT. NO.	NORTHING (FT)	EASTING (FT)	LEACHATE COLLECTION SAND LAYER ELEV. (FT)	THICKNESS (FT)
S-01	7,931.65	4,739.79	739.86	1.08
S-02	7,930.49	4,697.64	738.03	1.00
S-03	7,932.98	4,649.34	737.23	1.08
S-04	7,932.66	4,602.15	735.43	1.00
S-05	7,932.18	4,561.03	735.27	1.08
S-06	7,928.59	4,516.97	735.66	1.17
S-07	7,927.92	4,471.69	736.96	1.08
S-08	7,922.50	4,433.21	738.79	1.17
S-09	7,910.89	4,400.75	741.85	1.08
S-10	7,901.04	4,382.62	739.87	1.17
S-11	7,868.58	4,408.37	729.81	1.08
S-12	7,892.63	4,440.05	729.79	1.08
S-13	7,902.01	4,478.89	728.73	1.08
S-14	7,902.64	4,521.21	727.44	1.08
S-15	7,901.72	4,562.93	725.85	1.08
S-16	7,897.05	4,603.56	724.03	1.00
S-17	7,886.56	4,641.08	722.47	1.17
S-18	7,876.87	4,681.45	720.53	1.08
S-19	7,865.69	4,717.41	718.58	1.08
S-20	7,856.85	4,747.52	717.14	1.08
S-21	7,823.90	4,742.74	715.98	1.17
S-22	7,831.51	4,702.07	717.77	1.08
S-23	7,844.47	4,660.77	719.76	1.08
S-24	7,848.94	4,619.54	721.53	1.08
S-25	7,860.10	4,579.99	723.37	1.08
S-26	7,865.55	4,535.38	725.19	1.08
S-27	7,866.14	4,494.66	726.69	1.17
S-28	7,853.36	4,453.56	727.59	1.00
S-29	7,848.95	4,414.41	728.88	1.08
S-30	7,821.45	4,411.61	729.36	1.08
S-31	7,823.56	4,455.50	727.51	1.00
S-32	7,818.97	4,497.50	726.07	1.08
S-33	7,815.42	4,539.58	724.47	1.08
S-34	7,811.89	4,582.18	722.95	1.08
S-35	7,807.06	4,626.04	721.51	1.17
S-36	7,802.86	4,667.03	719.92	1.08
S-37	7,799.64	4,698.43	718.69	1.08
S-38	7,788.74	4,739.04	717.52	1.08
S-39	7,749.60	4,734.66	719.31	1.08
S-40	7,761.80	4,693.95	720.57	1.17

G3 RECORD LEACHATE COLLECTION SAND LAYER CERTIFICATION CONTROL TABLE

LEACHATE COLLECTION SAND LAYER PT. NO.	NORTHING (FT)	EASTING (FT)	LEACHATE COLLECTION SAND LAYER ELEV. (FT)	THICKNESS (FT)
S-41	7,771.21	4,651.83	721.89	1.08
S-42	7,780.67	4,609.67	723.04	1.00
S-43	7,787.09	4,569.65	724.52	1.08
S-44	7,797.28	4,528.02	725.83	1.17
S-45	7,804.95	4,485.76	727.04	1.08
S-46	7,812.98	4,440.56	728.49	1.00
S-47	7,814.25	4,408.30	729.78	1.00
S-48	7,783.37	4,411.31	736.63	1.08
S-49	7,762.48	4,412.42	742.43	1.50
S-50	7,758.58	4,453.73	739.78	1.67
S-51	7,782.15	4,457.16	733.03	1.17
S-52	7,775.20	4,502.83	731.26	1.17
S-53	7,753.00	4,503.03	736.96	1.67
S-54	7,748.79	4,546.45	734.40	1.83
S-55	7,767.02	4,565.94	727.94	1.17
S-56	7,745.71	4,596.17	730.80	1.42
S-57	7,762.22	4,612.71	724.97	1.08
S-58	7,742.11	4,643.30	727.63	1.00
S-59	7,751.18	4,666.51	723.37	1.08
S-60	7,759.69	4,703.17	720.13	1.00
S-61	7,710.64	5,145.76	731.31	1.08
S-62	7,718.00	5,110.28	719.64	1.17
S-63	7,728.75	5,073.36	707.30	1.08
S-64	7,737.44	5,038.76	703.01	1.08
S-65	7,732.99	5,011.63	708.97	1.00
S-66	7,728.18	4,965.06	711.09	1.00
S-67	7,708.25	4,961.58	710.48	1.42
S-68	7,723.85	4,915.07	713.30	1.42
S-69	7,710.46	4,867.46	712.78	1.08
S-70	7,728.86	4,861.84	715.10	1.00
S-71	7,733.91	4,817.09	716.71	1.00
S-72	7,724.37	4,773.39	719.61	1.08
S-73	7,738.74	4,757.80	719.19	1.17
S-74	7,779.45	4,762.43	717.02	1.08
S-75	7,821.55	4,765.60	714.89	1.00
S-76	7,862.73	4,763.57	716.75	1.00
S-77	7,868.13	4,806.94	715.54	1.08
S-78	7,823.11	4,803.02	713.55	1.08
S-79	7,787.61	4,806.55	714.83	1.17
S-80	7,771.46	4,844.99	714.01	1.00

G3 RECORD LEACHATE COLLECTION SAND LAYER CERTIFICATION CONTROL TABLE

LEACHATE COLLECTION SAND LAYER PT. NO.	NORTHING (FT)	EASTING (FT)	LEACHATE COLLECTION SAND LAYER ELEV. (FT)	THICKNESS (FT)
S-81	7,819.10	4,849.70	711.65	1.08
S-82	7,860.00	4,851.25	713.62	1.00
S-83	7,863.61	4,893.61	712.22	1.00
S-84	7,820.42	4,902.05	710.00	1.00
S-85	7,781.89	4,905.22	709.61	1.08
S-86	7,753.41	4,914.62	711.99	1.00
S-87	7,753.43	4,957.06	710.35	1.00
S-88	7,796.59	4,951.78	707.16	1.00
S-89	7,839.99	4,949.20	709.09	1.00
S-90	7,876.34	4,968.58	710.10	1.08
S-91	7,863.07	5,007.79	708.08	1.00
S-92	7,815.44	5,016.33	705.86	1.08
S-93	7,780.28	5,035.08	703.65	1.00
S-94	7,782.07	5,070.94	707.32	1.08
S-95	7,780.07	5,100.00	717.06	1.17
S-96	7,780.53	5,128.13	726.42	1.08
S-97	7,779.52	5,155.65	735.34	1.17
S-98	7,835.89	5,160.17	736.44	1.08
S-99	7,843.86	5,123.72	725.22	1.08
S-100	7,879.14	5,120.19	724.39	1.17
S-101	7,909.47	5,152.03	735.06	1.08
S-102	7,930.75	5,116.67	731.65	1.25
S-103	7,926.97	5,073.21	728.35	1.08
S-104	7,884.68	5,050.92	713.42	1.17
S-105	7,867.96	5,016.77	708.10	1.25
S-106	7,897.51	4,993.85	715.36	1.08
S-107	7,918.40	4,965.58	721.15	1.08
S-108	7,902.18	4,926.99	716.64	1.25
S-109	7,881.63	4,892.44	713.00	1.00
S-110	7,880.89	4,855.63	714.41	1.08
S-111	7,875.78	4,810.65	715.81	1.17
S-112	7,890.64	4,782.42	722.35	1.08
S-113	7,915.69	4,768.05	731.79	1.08
S-114	7,943.80	4,766.25	740.79	1.08
S-115	7,944.80	4,839.79	733.92	1.17
S-116	7,951.55	4,879.64	734.39	1.08
S-117	7,947.06	4,925.55	731.56	1.08
S-118	7,943.61	4,985.56	730.20	1.08
S-119	7,940.51	5,020.24	730.61	1.08
S-120	7,942.68	5,074.47	733.52	1.17

G3 RECORD LEACHATE COLLECTION PIPE DATA

LEACHATE COLLECTION PIPE PT. NO.	NORTHING (FT)	EASTING (FT)	LEACHATE COLLECTION PIPE ELEV. (FT)	DESCRIPTION
1	7,842.17	4,400.48	728.15	8" CAP
2	7,839.70	4,425.30	726.90	8" PERF. PIPE
3	7,837.75	4,449.11	726.14	8" PERF. PIPE
4	7,835.55	4,473.98	725.18	8" PERF. PIPE
5	7,833.31	4,495.07	724.14	8" PERF. PIPE
6	7,831.28	4,518.26	723.12	8" PERF. PIPE
7	7,828.41	4,543.56	721.88	8" PERF. PIPE
8	7,826.49	4,561.08	721.39	8" PERF. PIPE
9	7,823.20	4,591.82	720.25	8" PERF. PIPE
10	7,820.62	4,621.07	719.05	8" PERF. PIPE
11	7,816.76	4,655.69	717.62	8" PERF. PIPE
12	7,814.66	4,673.96	716.76	8" PERF. PIPE
13	7,811.71	4,698.29	715.80	8" PERF. PIPE
14	7,809.42	4,718.18	714.96	8" PERF. PIPE
15	7,806.91	4,745.90	714.00	8" PERF. PIPE
16	7,804.96	4,773.87	712.53	8" PERF. PIPE
17	7,802.42	4,798.67	711.58	8" Y
18	7,799.14	4,827.68	710.53	8" PERF. PIPE
19	7,796.36	4,852.72	709.57	8" PERF. PIPE
20	7,793.82	4,881.10	708.38	8" PERF. PIPE
21	7,790.28	4,913.25	707.05	8" PERF. PIPE
22	7,787.14	4,944.39	705.84	8" PERF. PIPE
23	7,784.73	4,969.91	704.79	8" PERF. PIPE
24	7,780.41	5,002.56	703.72	8" Y
25	7,778.79	5,024.20	702.51	8" Y
26	7,959.65	4,817.12	739.23	PIPE END
27	7,948.63	4,816.52	736.90	8" SOLID PIPE
28	7,921.79	4,816.47	728.25	8" SOLID PIPE
29	7,897.63	4,816.75	720.78	8" SOLID PIPE
30	7,883.08	4,816.64	716.52	8" SOLID PIPE
31	7,868.15	4,816.58	714.85	8" SOLID PIPE
32	7,851.97	4,815.70	714.17	8" SOLID PIPE
33	7,837.48	4,814.30	713.55	8" SOLID PIPE
34	7,828.67	4,812.29	713.17	8" SOLID PIPE
35	7,819.78	4,809.30	712.92	8" SOLID PIPE
36	7,806.09	4,803.14	712.43	8" SOLID PIPE
37	7,777.20	5,028.66	702.43	8" ELBOW

G3 RECORD LEACHATE COLLECTION PIPE DATA

LEACHATE COLLECTION PIPE PT. NO.	NORTHING (FT)	EASTING (FT)	LEACHATE COLLECTION PIPE ELEV. (FT)	DESCRIPTION
38	7,767.66	5,036.70	701.73	8" PERF. PIPE
39	7,755.45	5,045.80	700.72	8" PERF. PIPE
40	7,752.38	5,047.99	700.47	EF COUPLING
41	7,750.54	5,049.91	700.15	8" Y
42	7,737.96	5,049.73	699.91	8" PERF. PIPE
43	7,718.58	5,050.60	700.34	8" CAP
44	7,757.45	5,050.47	700.18	8" PERF. PIPE
45	7,776.29	5,050.84	700.95	8" PERF. PIPE
46	7,792.79	5,051.84	701.82	8" PERF. PIPE
47	7,814.50	5,053.39	701.94	8" PERF. PIPE
48	7,849.30	5,053.09	703.34	24" PERF. PIPE END
49	7,852.88	5,056.85	704.55	24" PERF. PIPE
50	7,868.67	5,074.99	710.50	24" SOLID PIPE
51	7,880.61	5,087.84	714.97	24" SOLID PIPE
52	7,898.02	5,106.90	721.46	24" SOLID PIPE
53	7,915.28	5,125.06	727.73	24" SOLID PIPE
54	7,931.01	5,141.64	733.49	24" SOLID PIPE
55	7,947.50	5,160.25	740.22	24" END
56	7,783.46	4,999.76	704.21	8" ELBOW
57	7,790.82	5,000.48	704.82	8" SOLID PIPE
58	7,795.67	5,002.17	704.98	8" SOLID PIPE
59	7,800.81	5,005.47	705.11	8" SOLID PIPE
60	7,808.73	5,012.21	705.15	8" SOLID PIPE
61	7,817.59	5,021.50	705.30	8" SOLID PIPE
62	7,825.98	5,029.58	705.31	8" SOLID PIPE
63	7,836.76	5,037.43	705.58	8" SOLID PIPE
64	7,842.95	5,042.39	705.29	8" SOLID PIPE
65	7,851.92	5,050.50	703.28	8" SOLID PIPE
66	7,856.59	5,056.10	704.09	8" SOLID PIPE
67	7,780.15	5,026.42	702.97	EF COUPLING
68	7,785.72	5,033.60	703.55	8" SOLID PIPE
69	7,790.93	5,038.76	703.54	8" SOLID PIPE
70	7,797.50	5,043.49	703.26	8" SOLID PIPE
71	7,811.95	5,048.58	702.64	8" SOLID PIPE
72	7,828.23	5,051.46	702.13	8" SOLID PIPE
73	7,817.98	5,053.31	702.14	8" PERF. PIPE
74	7,839.55	5,054.45	702.66	8" PERF. PIPE

G3 RECORD LEACHATE COLLECTION PIPE DATA

LEACHATE COLLECTION PIPE PT. NO.	NORTHING (FT)	EASTING (FT)	LEACHATE COLLECTION PIPE ELEV. (FT)	DESCRIPTION
75	7,849.40	5,055.27	704.80	EF COUPLING
76	7,851.07	5,055.61	705.16	EF COUPLING
77	7,850.38	5,055.48	704.92	TEE
78	7,848.88	5,053.91	704.47	TEE
79	7,847.84	5,053.71	704.31	EF COUPLING
80	7,828.86	5,051.73	702.25	8" SOLID PIPE
81	7,816.54	5,049.66	702.53	8" SOLID PIPE
82	7,853.40	5,056.23	705.34	8" ELBOW
83	7,862.59	5,066.62	706.86	8" SOLID PIPE
84	7,886.57	5,092.40	715.58	8" SOLID PIPE
85	7,916.56	5,124.71	726.81	8" SOLID PIPE
86	7,939.48	5,149.36	735.43	8" SOLID PIPE
87	7,949.52	5,159.64	738.77	8" SOLID PIPE
88	7,958.92	5,171.12	739.92	8" END
89	7,954.50	5,169.15	738.46	3" END
90	7,946.66	5,161.61	738.45	3"
91	7,929.16	5,142.31	731.73	3"
92	7,908.74	5,120.20	724.31	3"
93	7,879.35	5,088.50	713.58	3"
94	7,862.45	5,070.07	707.21	3"
95	7,859.88	5,059.12	705.46	8" SOLID PIPE
96	7,875.16	5,075.34	711.18	8" SOLID PIPE
97	7,894.10	5,094.88	718.11	8" SOLID PIPE
98	7,914.50	5,116.18	725.75	8" SOLID PIPE
99	7,935.34	5,138.70	733.65	8" SOLID PIPE
100	7,954.14	5,161.50	740.05	8" END
101	7,852.94	5,060.55	703.90	3"
102	7,846.54	5,054.28	702.10	3" ELBOW
103	7,847.87	5,053.20	701.99	3" ELBOW
104	7,854.62	5,054.66	705.18	8" ELBOW
105	7,849.90	5,053.88	704.75	EF COUPLING
106	7,862.80	5,063.77	706.90	8" SOLID PIPE
107	7,889.22	5,092.95	716.55	8" SOLID PIPE
108	7,926.47	5,131.90	730.39	8" SOLID PIPE
109	7,957.87	5,167.32	740.90	8" SOLID PIPE

LEGEND

- PHASE BOUNDARY
- OLD CELL BOUNDARY
- N 6500 + GRID COORDINATES
- 710 EXISTING CONTOUR (2 FT INTERVAL)
- 710 G3 TOP OF ATTENUATION LAYER CONTOUR (2 FT INTERVAL)
- TOP OF ATTENUATION LAYER BREAK IN SLOPE
- PERFORATED RECORD LEACHATE COLLECTION PIPE
- PERFORATED RECORD LEACHATE COLLECTION PIPE
- SOLID RECORD TEMPORARY LEACHATE CLEANOUT PIPE
- ●2 TOP OF LEACHATE COLLECTION PIPE RECORD POINT (SEE RECORD DATA ON THIS SHEET)
- S-34 TOP OF LEACHATE COLLECTION SAND LAYER RECORD POINT (SEE RECORD DATA ON THIS SHEET)

REV. 01

N

0 15' 30' 60'

SCALE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020, UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. LIMITS OF RECORD LINER SYSTEM IN G3 BASED ON RECORD DATA PROVIDED TO CTI AND ASSOCIATES, INC.

ISSUED FOR RECORD DRAWINGS

REV	DATE	REVISION DESCRIPTION
0	06-09-21	ISSUED FOR RECORD DRAWINGS
1	07-09-21	ADDED TOP OF LEACHATE COLLECTION PIPE RECORD POINT BLOW-UP

DATE: 06-09-21
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

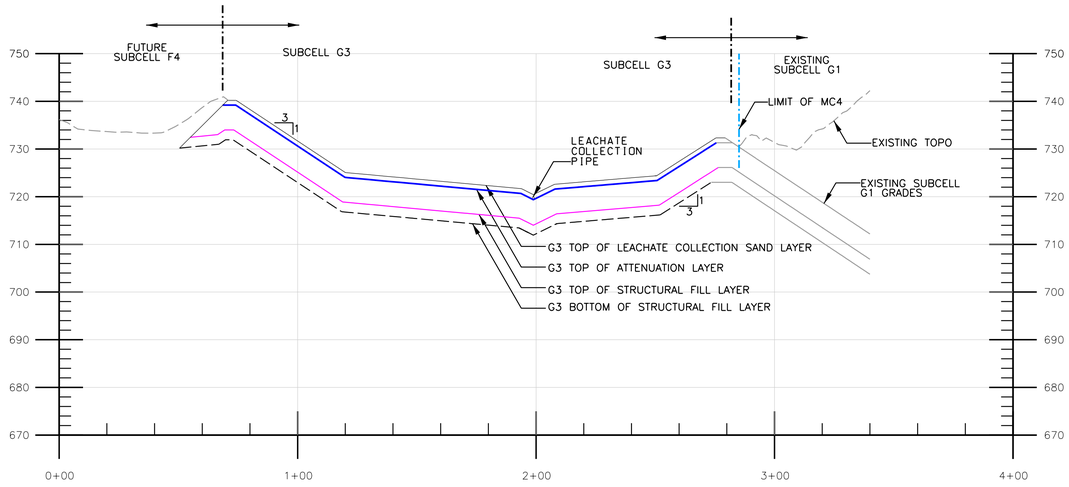
TOP OF LEACHATE COLLECTION SAND LAYER AND LEACHATE COLLECTION PIPE RECORD CONTROL POINT PLAN

PROJECT NUMBER: 1208070046
SCALE: 1" = 30'
DRAWING NO: P-06

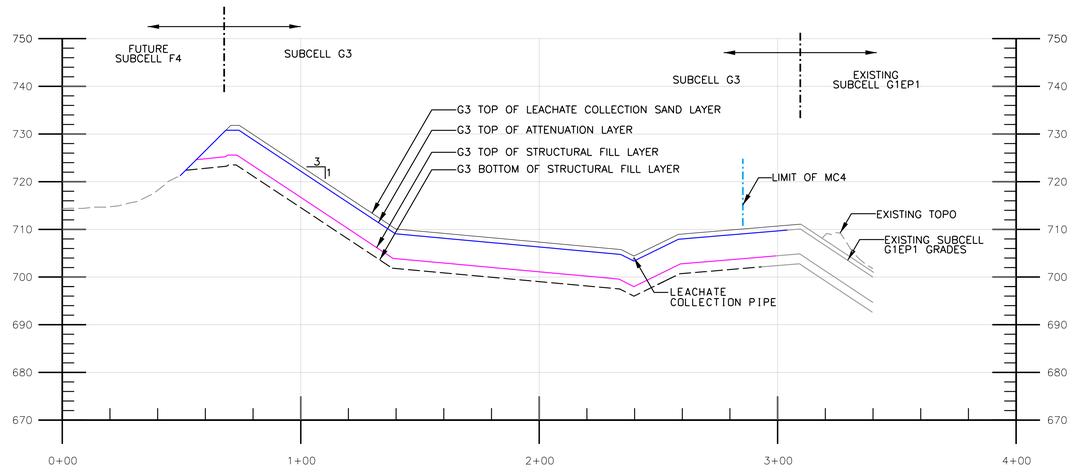
DRAWN: PAA XZ
DESIGNED: PAA XZ
CHECKED: DRN APP

TIME PLOTTED: $TIME$
DATE PLOTTED: $DATE$
FILENAME: $FILE$

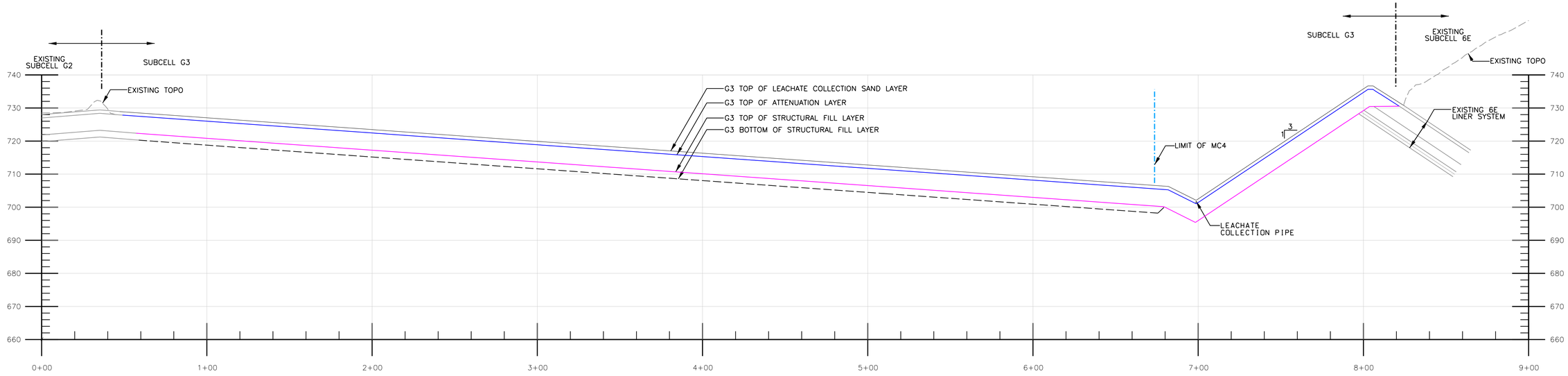
DRAWING SIZE: 24" X 36"



SECTION A-A'



SECTION B-B

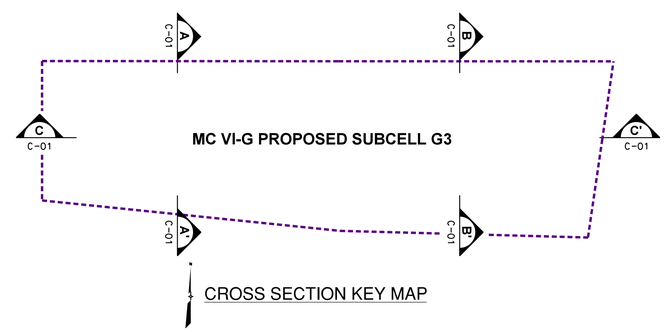


SECTION C-C'

0 15' 30' 60'
HORIZONTAL SCALE

0 7.5' 15' 30'
VERTICAL SCALE

REV. 00



CROSS SECTION KEY MAP

ISSUED FOR RECORD DRAWINGS

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTIONS

PROJECT NUMBER 1208070046
SCALE 1" = 30'
DRAWING NO **C-01**

REVISIONS			
REV	DATE	REVISION DESCRIPTION	
0	06-09-21	ISSUED FOR RECORD DRAWINGS	PAA XZ

DATE: 06-09-21
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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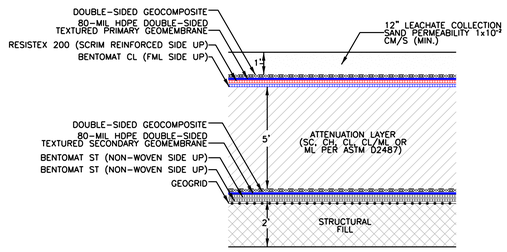
TIME PLOTTED: $TIME$
DATE PLOTTED: $DATE$
FILENAME: $FILE$

DRAWING SIZE: 24" x 36"

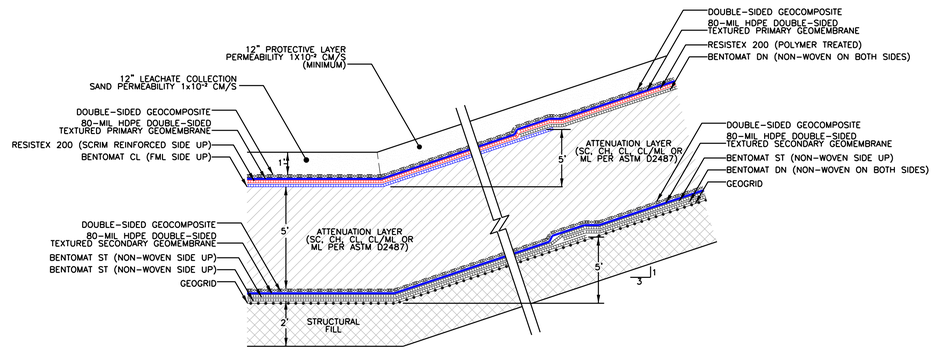


FLOOR LINER SYSTEM 1A

NOT TO SCALE

NOTE:

1. GEOGRID AND STRUCTURAL FILL ONLY REQUIRED WITHIN MASTER CELL IV BOUNDARY. 1

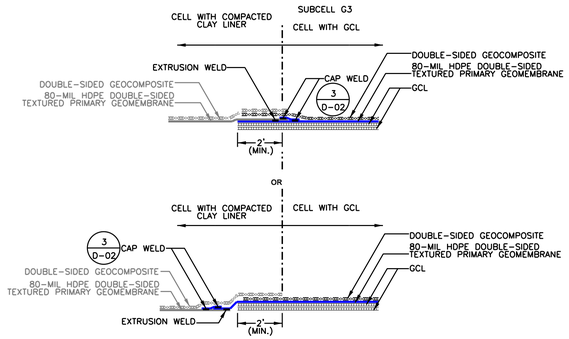


SIDESLOPE LINER SYSTEM 2A

NOT TO SCALE

NOTE:

1. GEOGRID AND STRUCTURAL FILL ONLY REQUIRED WITHIN MASTER CELL IV BOUNDARY. 1



LINER TIE-IN DETAIL 3

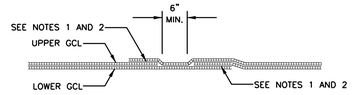
NOT TO SCALE

NOTES:

NEW AND EXISTING GEOCOMPOSITE LAYERS CONNECTED AS:

A. GEONET CORES JOINED BY PLASTIC FASTENERS.

B. GEOTEXTILE CAP HEAT BONDED OVER FASTENED TIE-IN SEAM.



GCL OVERLAP DETAIL 4

NOT TO SCALE

NOTES:

1. MINIMUM 6-INCH OVERLAP ON LONGITUDINAL PANEL EDGES OF GCL. 1
2. MINIMUM 12-INCH OVERLAP ON END OF ROLL GCL SEAMS.

REV. 01

ISSUED FOR RECORD DRAWINGS

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (1 OF 3)

PROJECT NUMBER 1208070046

SCALE NTS

DRAWING NO. **D-01**

REV	DATE	REVISION DESCRIPTION	DRN	APP
0	06-09-21	ISSUED FOR RECORD DRAWINGS	PAA	XZ
1	07-09-21	ADDED AND REVISED MISCELLANEOUS NOTES.	PAA	XZ

DATE: 06-09-21
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

CTI and Associates, Inc.
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DRAWING SIZE: 24" X 36"
TIME PLOTTED: $TIME$
DATE PLOTTED: $DATE$
FILENAME: $FILE$
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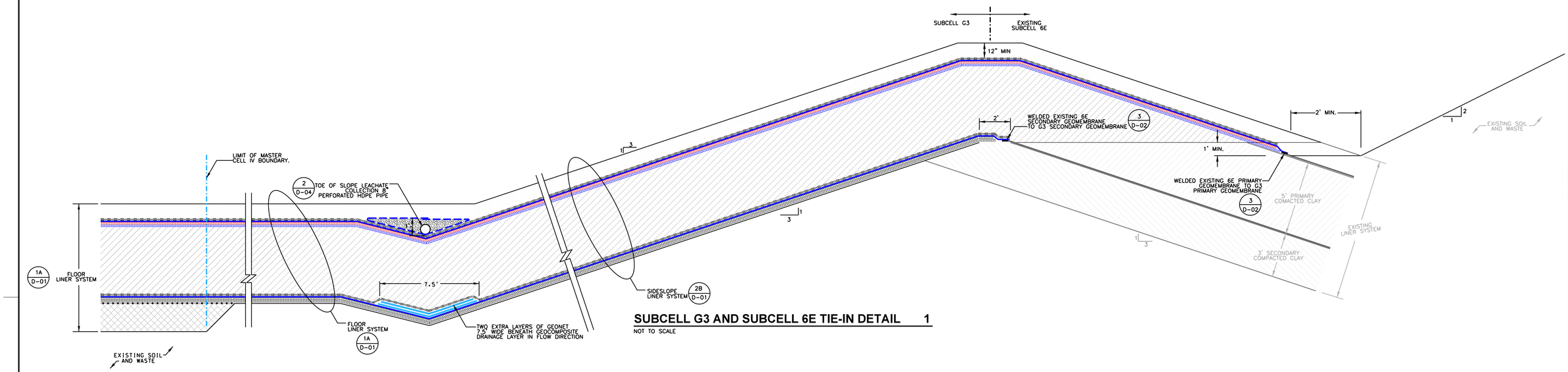
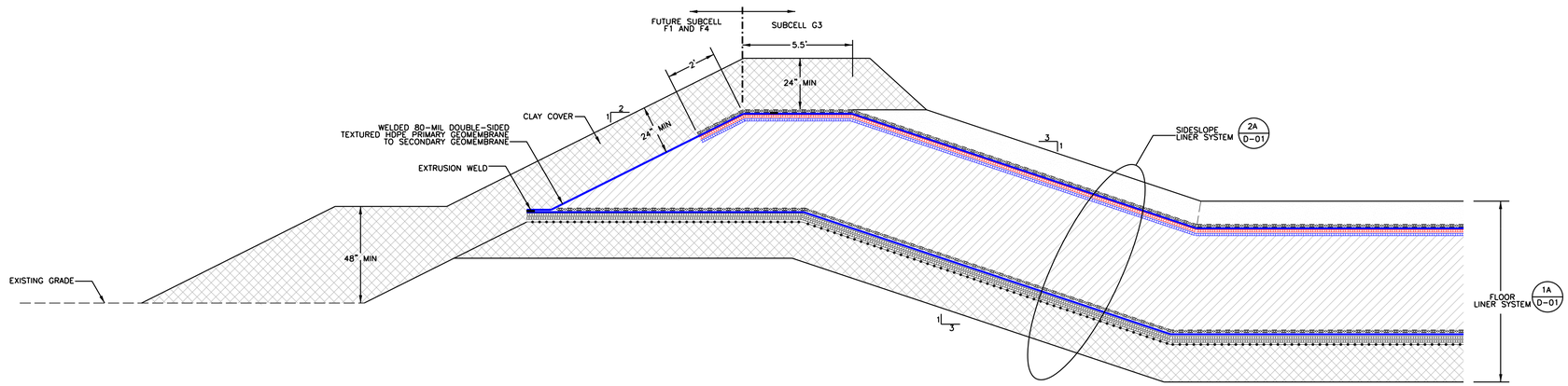


SUBCELL G3 AND SUBCELL 6E TIE-IN DETAIL 1

NOT TO SCALE

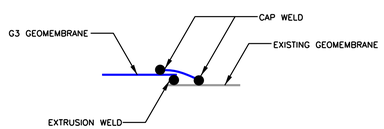


SUBCELL G3 AND SUBCELL F4 TIE-IN DETAIL 2A

NOT TO SCALE

NOTE:

1. GEOGRID AND STRUCTURAL FILL ONLY REQUIRED WITHIN MASTER CELL IV BOUNDARY. ⚠1



TIE-IN GEOMEMBRANE WELDING DETAIL 3

NOT TO SCALE

REV. 01

ISSUED FOR RECORD DRAWINGS

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (2 OF 3)

PROJECT NUMBER 1208070046

SCALE NTS

DRAWING NO **D-02**

REV	DATE	REVISION DESCRIPTION	DRN	APP
0	06-09-21	ISSUED FOR RECORD DRAWINGS	PAA	XZ
1	07-09-21	ADDED AND REVISED MISCELLANEOUS NOTES.	PAA	XZ

DATE: 06-09-21
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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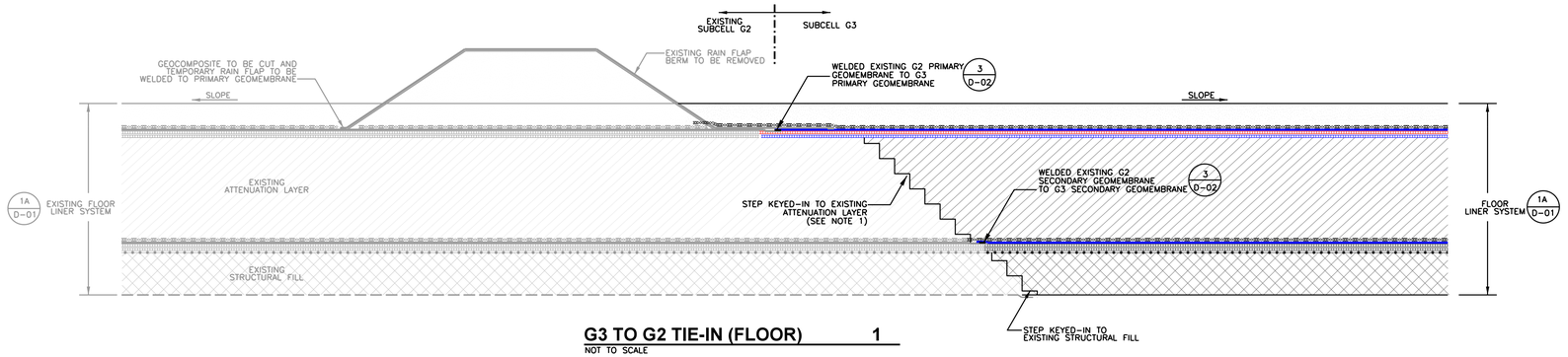

G3 TO G2 TIE-IN (FLOOR) 1

NOT TO SCALE

NOTE:

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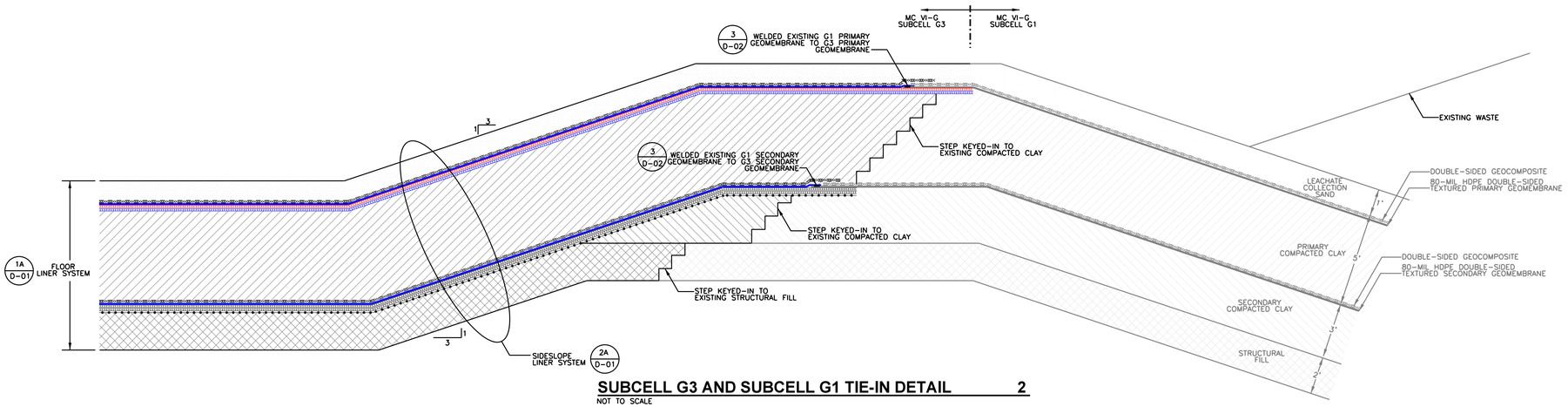

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NOT TO SCALE

NOTES:

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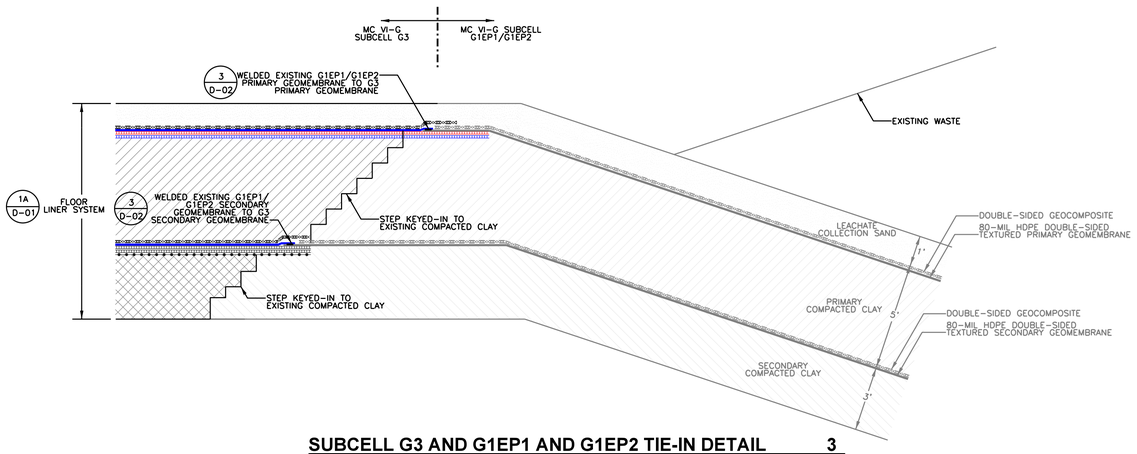

SUBCELL G3 AND G1EP1 AND G1EP2 TIE-IN DETAIL 3

NOT TO SCALE

NOTE:

1. THE MINIMUM HORIZONTAL EXTENSION OF NEW CLAY LAYER WAS TWELVE (12) INCHES AT EACH STEP KEYED-IN. 1

REV. 01

ISSUED FOR RECORD DRAWINGS

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (3 OF 3)

PROJECT NUMBER 1208070046

SCALE NTS

DRAWING NO **D-03**

REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN.	APP
0	06-09-21	ISSUED FOR RECORD DRAWINGS	PAA	XZ
1	07-09-21	ADDED AND REVISED MISCELLANEOUS NOTES.	PAA	XZ

DATE: 06-09-21
DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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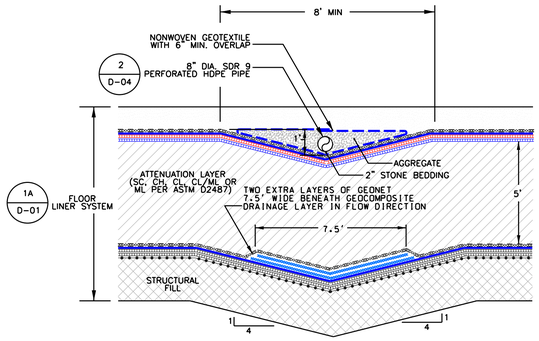
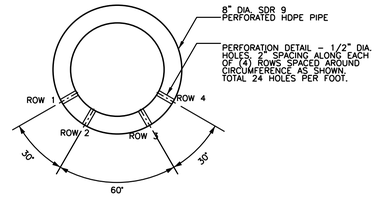


CELL FLOOR LEAK DETECTION GEONET AND LEACHATE COLLECTION PIPE (TYP.) 1 A

NOT TO SCALE

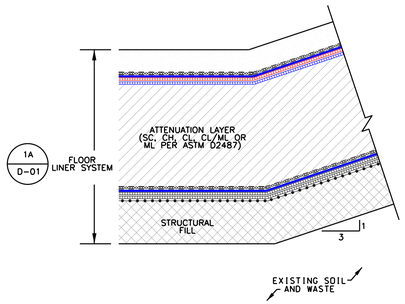
NOTE:

1. GEOGRID AND STRUCTURAL FILL ONLY REQUIRED WITHIN MASTER CELL IV BOUNDARY. 1



LEACHATE COLLECTION PIPE PERFORATION DETAIL 2

NOT TO SCALE



TOE OF NORTH SIDESLOPE 3A

NOT TO SCALE

NOTE:

1. GEOGRID AND STRUCTURAL FILL ONLY REQUIRED WITHIN MASTER CELL IV BOUNDARY. 1

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DESIGNED BY: XZ/PAA
DRAWN BY: PAA
CHECKED BY: PH/RMB
APPROVED BY: XZ

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REVISIONS			
REV	DATE		
0	06-09-21	ISSUED FOR RECORD DRAWINGS	PAA XZ
1	07-09-21	ADDED AND REVISED MISCELLANEOUS NOTES.	PAA XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-G
SUBCELL G3 RECORD PLANS
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEACHATE COLLECTION PIPE DETAILS

PROJECT NUMBER 1208070046

SCALE NTS

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RESPONSE TO COMMENTS ON ATTACHMENT B.6
May 25, 2022

2021 Permit Application
Attachment B6 Engineering Plan

Responses to EGLE Comments and Revisions of Calculations and Engineering Plan

Part 1 Stability, Settlement, Leachate Removal and Stormwater Management

Submitted May 25, 2022
by CTI and Associates, Inc.

TABLE OF CONTENT

1a. Responses to EGLE comments dated Feb. 24, 2022
1b. Responses to EGLE comments dated May 5, 2022
2. Attachment A-1.1 MC6_G4-G7 Slope Stability Analysis
3. Attachment A-1.2 MC6_E and F Slope Stability Analysis
4. Attachment A-2.1 MC6_G4-G7 Settlement Analysis
5. Attachment A-2.2 MC6_E_F_G1-G3 Settlement Analysis
6. Attachment A-2.3 Waste Compression Index Estimation
7. Engineering Plan Sheets Rev. J

1. Responses to EGLE comments dated Feb. 24, 2022

Technical Comments for
WDI 2021 Permit Application Attachment B6 Engineering Plans

Comments by EGLE on February 24, 2022
Responses by CTI on April 20, 2022

Attachment A-1 Slope Stability Analysis

1. The cross section name of C-C' or G-G' should be marked on the cross section locations shown on the plans of Page 2 of 4 in Attachment A-1.1, Page 2 of 4 in Attachment A-1.2, Page 2 of 4 in Attachment A-1.3, Page 2 of 4 in Attachment A-1.5, and Page 2 of 4 in Attachment A-1.7.

   Response:

   Revised per comment

   In the original submittal, the attachment IDs are very confusing. We streamlined the attachment IDs in this submittal. For you convenient for comparing the original IDs with new IDs, we prepared the attached spreadsheet.

2. By comparing Tables 1, 2, and 3 (i.e., Table 1 Material Properties in Attachment A-1 Slope Stability Analysis, Slope Stability Analysis Report Form in Attachment A-1.1 C-C' Foundation Stability, and Table 1 Soil Properties for Settlement Analysis in Attachment A-2.2 Sample Calculations), it can be found that some soils and waste were used different unit weight values in the slope stability analysis and settlement calculations, such as the unit weight of the final cover soil was 130 pcf in Tables 1 and 2 for the slope stability analysis and 135 pcf for the settlement calculations, the unit weight of the existing waste was 86 pcf in Table 1 and 91 pcf in Table 2 for the slope stability analysis and 82 pcf in Table 3 for the settlement calculations, and the unit weight of the lower clay was 133 pcf in Tables 1 and 2 for the slope stability analysis and 128 pcf in Table 3 for the settlement calculations. In addition, the unit weight of the upper clay was missed in Table 3 for the settlement calculations. These discrepancies also exist in Attachment A-1.2 to Attachment A-1.7. CTI must clarify these discrepancies and used the corrected values to conduct analysis and calculations.

Table 1 – Soil and waste properties for slope stability analysis (i.e., Table 1 Material properties on Page 2 of 3 in Attachment A-1 Slope Stability Analysis)

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103[A]	26[B]	300[B]
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0

Notes:
[A] unit weight of waste determined from site survey data reported in 2020.
[B] representative value of waste strength as reported by Qian et al. (2002)
All other properties obtained from NTH (2012)

Table 2 – Soil and waste properties for slope stability analysis (i.e., Slope Stability Analysis Report Form on Page 1 of 4 in Attachment A-1.1 C-C' Foundation Stability)

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	26	300
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0

Table 3 – Soil and waste properties for settlement calculations (i.e., Table 1 Soil properties for settlement analysis on Page 2 of 11 in Attachment A-2.2 Sample Calculations)

Soil Type	Thickness [ft]	Moist Unit Weight [pcf]
Final cover soil	4	135
New waste	Varies	103*
Existing cover soil	Varies	135
Existing waste	Varies	82
In-situ middle clay	Varies	136
In-situ lower clay (moist)	Varies	128
In-situ lower clay (saturated)	Varies	128
In-situ silt (saturated)	18	125
In-situ sand (saturated)	45	115

** New waste unit weight obtained from email correspondence with WDI dated 11/18/2020*

Response:

Properties of soil and waste were revised to be consistent per comment.

3. In the same Attachment A-1 Slope Stability Analysis document, there are two sets of sub-attachments used the same names, such as Attachment A-1.2 to Attachment A-1.7 for the foundation stability analysis and liner stability analysis under final condition with zero adhesion of the Cross-Sections C-C' and G-G', and Attachment A-1.2 to Attachment A-1.12 in the Slope Stability Analysis for WDI Final Cover Grading Modification that is the second part of Attachment A-1. It is suggested that CTI should revise the names of Attachment A-1.2 to Attachment A-1.12 to avoid confusion. Or CTI can divide Attachment A-1 into two sub-attachment documents. They are one for the foundation and liner stability analysis for new Subcells G4 to G7 and another for the slope stability analysis for WDI final cover grading modification.

Response:

Revised per comment

4. Stability of slopes can be analyzed using either effective stress or total stress methods. In effective stress analyses the interface and internal shear strengths of the liner materials and soils are related to the effective normal stress on the potential slip surface by means of effective stress shear strength parameters. Pore pressures within the liner and soils must be known and are part of the information required for analysis. In total stress analyses the interface and internal shear strengths of the liner materials and soils are related to the total normal stress on the potential slip surface by means of total stress shear strength parameters. Pore pressures within the liner and soil mass need not be known and are not required as input for analyses. In Attachments A-1.1, A-1.2, and A-1.6, both the "Effective Stress" and "Total Stress" are marked on Page 1 of 4 (Table 4). Does this mean that both the effective stress and total stress methods were used to conduct the slope stability analysis? If so, why were only the effective shear strengths without the total shear strengths shown on the calculation result sheets of Pages 3 of 4 and 4 of 4?

Table 4 – Slope Stability Analysis Report Form in Attachment A-1.1 C-C' Foundation Stability

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section C-C'. This case considers a west-facing slope, with fill to the final permitted grade elevations.		
☒ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The friction angle of the liner system was set equal to the required minimum interface friction angle determined from the liner stability analysis performed on Cross Section C. The groundwater level was set at elevation 655ft based on historical borings as documented in the Basis of Design Report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressure conditions may occur after loading. This is considered a conservative approach for this scenario.		

Table 5 – Slope Stability Analysis Report Form in Attachment A-1.5 C-C' Liner Stability under Final Condition with non-zero adhesion (previously tested values)

Purpose of Analysis:	To determine the minimum required liner interface friction angle to achieve an acceptable factor of safety of the proposed final waste grades using cross-section C-C'. This case considers a west-facing slope, with fill to the final permitted grade elevations under undrained conditions.		
☐ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The liner system was modeled in 2 sections (floor and sideslope) to allow use of Peak and Large-Displacement strength parameters appropriately. The liner interface strength properties are based on interface strength test results of a similar liner system installed on site. The required factor of safety of 1.5.		

Response:

For the analysis of the foundation global stability conditions, we have intentionally selected drained strength parameters for the sand layers and undrained strength parameters for the clay layers. The reason is that during a landslide event, shear-induced pore pressure increases within clays are not modeled by the slope stability analysis software and therefore the software will overestimate the available shear strength from these layers when using drained strength parameters. Accordingly, CTI has opted to model the stiff clay layers using constant values of undrained shear strength (thereby ignoring possible strength gain from overburden) and to model the soft clay layers using an undrained shear strength-to-vertical effective stress factor (s_u/σ'_v). The use of a strength factor is advocated by Ladd (1991) as a way to take credit for strength gain over time from overburden while also not overestimating resistance to shear during a landslide event. By using vertical effective stress to compute undrained shear strength, we are accounting for the effect of the piezometric surface on the shear strength of the soft clay layer. However, it is noted that the undrained shear strength values obtained from the use of the strength ratio are less than the shear strength values that are found using the drained strength parameters.

This explanation has been added to the calculation sheet per comment.

5. In Attachments A-1.5 and A-1.7, the "Total Stress" was marked on Page 1 of 4 (Table 5). Does this mean that a total stress method was used to conduct stability analysis? If so, why were the effective shear strength parameters of cohesion and friction angle without the total shear strengths shown on the calculation result sheets of Pages 3 of 4 and 4 of 4?

***Response**:*

See comment #4 – additional explanation regarding the material properties used in the analyses has been added to Attachment A-1

6. In Attachments A-1.2, A-1.3, A-1.4, and A-1.5 of the second section of "WDI Final Cover Grading Modification" (Table 6), both the "Effective Stress" and "Total Stress" were marked on Page 1 of 4. If so, why were only the effective shear strengths without the total shear strengths shown on the calculation result sheets of Pages 3 of 4 and 4 of 4?

Table 6 – Slope Stability Analysis Report Form in Attachment A-1.2 G-G' Foundation Stability of the Section of WDI Final Cover Grading Modification

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
☒ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. The groundwater level was set at elevation 655 based on historical borings as documented in the Basis of Design report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressure may accumulate after loading. This is considered a conservative approach for this scenario.		

7. Attachments A-1.12 of the second section of "WDI Final Cover Grading Modification" (Table 7), the "Total Stress" was marked on Page 1 of 4. Does this mean that a total stress method was used to conduct stability analysis? If so, why were the effective shear strength parameters of cohesion and friction angle without the total shear strengths shown on the calculation result sheets of Pages 3 of 4 and 4 of 4?

Table 7 – Slope Stability Analysis Report Form in Attachment A-1.2 J-J' Liner Stability under Interim Conditions (example interim stability calculation)

Purpose of Analysis:	To determine the required interface friction angle of the liner system to achieve an acceptable interim factor of safety of 1.3 using cross-section J-J'. This case considers a west-facing slope, with fill to the final permitted grade elevations at an interim slope of 3H:1V. The failure surface is defined such that failure occurs in the underlying liner in order to evaluate the stability of the liner system.		
☐ Effective Stress ☒ Total Stress	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The required factor of safety is 1.3 for temporary conditions.		

Response:

See comment #4 – additional explanation regarding the material properties used in the analyses has been added to Attachment A-1

8. CTI conducted a slope stability analysis for Cross-Section C-C' liner stability under

interim condition to obtain a factor of safety of 1.3 against the translational failure mode. The result is shown in Attachment A-1.7. CTI must explain why CTI did not conduct a slope stability analysis for Cross-Section G-G' liner stability under interim condition?

Response:

Cross-section C-C' was selected for this analysis since it represents the worst case for interim stability as follows: 1) steepest floor slope, sloping outward from the waste slope and 2) narrowest floor width. Based on the results of the analyses, interim slopes that are constructed no steeper than 3H:1V and with a bottom width no less than 370 feet shall be considered acceptable for waste filling operations. If tested values of the cell floor liner system interface strength vary from those presented, or the filling geometry deviates from this case, the interim slope shall be reevaluated according to this example.

Attachment A-2 Settlement Calculations

9. The moist unit weight of the new waste listed in Table 1 – Soil Properties for Settlement Analysis on Page 2 of 7 in Attachment A-2 Settlement Calculations is 103 pcf. A note shown at the bottom of this table is "*New waste unit weight obtained from email correspondence with WDI dated 11/18/2020*." Please provide this email and field testing data to indicate how WDI determine the unit weight of the new waste placed in the landfill of 103 pcf.

   Response:

   The data table developed from site survey data has been included with the revised calculation.

10. Some old existing landfill cells of WDI belong to the type of trench fill landfill as shown in Figure 1. The waste was filled in a series of deep and narrow trenches for this type of landfill. Did the existing landfill cells located beneath Subcells G4, G5, G6, and G7 also belong to the type of trench fill landfill? If so, were the distributions (including locations and directions) of the trenches and berms in the existing landfill cells beneath the Subcells G4, G5, G6, and G7 investigated? In the calculations of the foundation settlement of the expanded landfill cells over the existing landfill, has CTI considered non-uniformity of the compressibility of the waste and berm clay in the existing landfill underneath the new cells? A series of deep and narrow trenches and berms consisting of undisturbed natural clay may cause the differential settlement of the liner systems of the expanded landfill over the existing landfill.

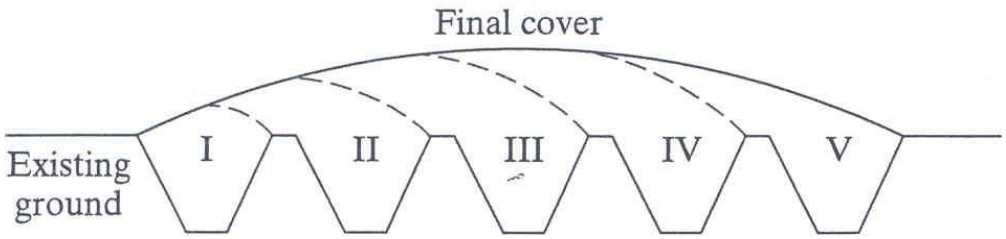


Figure 1 – Trench fill landfill

Response:

Existing information about the existing landfill below Subcells G4, G5, G6, and G7 indicate that it was a trench fill type of landfill. The precise configuration of the trenches is unknown. It is believed that each trench is bounded by intracell dikes. Using available subsurface information (MASW surveys and Geoprobe boring logs – see in the revised calculation sheet), CTI has considered the profile of known existing dikes in these settlement analyses by placing additional settlement calculation points at the estimated crests and toes of these dikes. Differential settlement estimates are accordingly greater at the transitions between these points than between points without a difference in subgrade. As a result, CTI proposes enhanced floor grades with steeper slopes in portions of the cell floor to counteract the effect of differential settlement on post-settlement slopes. CTI also proposes that the location of these enhanced floor grade zones be adjusted if MC VI- G4, G5, G6, and G7 construction activities reveal additional information about the location of the corresponding dikes.

Adjustment of the enhanced floor grade zones should proceed as follows:

a. *During excavation of the cell floor subgrade, the materials encountered at the bottom of excavation shall be logged.*
b. *The transition from waste to soil indicating the location of an intercell dike shall be surveyed across the width of the intersecting subgrade excavation bottom.*
c. *The waste-to-soil transition shall be potted in plan view and in cross section view and compared to the estimated dikes location figures in the calculation sheet.*
d. *If the waste-to-soil transition differs in horizontal location from that presented in the calculations, the corresponding zone of enhanced floor grade (applicable to G5 pipe flowline, G6 pipe flowline, G4 cross slope, and G5 cross slope – see conclusions) shall be moved so that its boundaries align with the projected toe of sideslope for the corresponding dike.*

This information has been added to the calculation sheet.

11. In the second paragraph of Design Criteria and Assumption on Page 1 of 7 of Leachate Collection System Settlement Analysis of Attachment A-2 Settlement Calculations, what does the sentence of "*In addition, points were selected at the top and bottom of existing below-grade subcell berms.*" mean? What and where are the "**top**" and "**bottom**" of existing "**below-grade subcell berms**"?

Response:

"Top" and "bottom refer to the crest and toe of dikes separating the existing waste trenches. The locations of these features have been estimated from available subgrade data as discussed in the response to comment #10.

12. By comparing Tables 8 and 9 (i.e., Table 1 Material properties in Attachment A-1 Slope Stability Analysis and Table 2 Compressibility parameters of waste and soils in Attachment A-2 Settlement Calculations), it can be found that there is a upper clay layer existing in the slope stability analysis (see Table 8). However, this soil layer was missed in the settlement calculations (see Table 9). What is the thickness of the upper clay layer used in the slope stability analysis? CTI must clarify these discrepancies and used the corrected values to conduct settlement calculations.

Table 8 – Soil and waste properties for slope stability analysis (i.e., Table 1 Material properties on Page 2 of 3 in Attachment A-1 Slope Stability Analysis)

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	130	0	1500
2	Existing Waste	Teal	86	34	0
3	New Waste	Light Green	103[A]	26[B]	300[B]
4	Upper Clay	Brown	131	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	133	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0

Notes:
[A] unit weight of waste determined from site survey data reported in 2020.
[B] representative value of waste strength as reported by Qian et al. (2002)
All other properties obtained from NTH (2012)

Table 9 – Compressibility parameters of waste and soils (i.e., Table 2 Compressibility parameters of waste and soils on Page 2 of 7 in Attachment A-2 Settlement Calculations)

Soil Type	Primary Compression Ratio $C_c/(1+e_0)$	Secondary Compression Ratio $C_\alpha/(1+e_0)$	Recompression Ratio $C_r/(1+e_0)$
Existing cover	0.102[B]	0.005[B]	0.017[A]
Existing waste	0.147	0	0.0245[A]
In-situ middle clay	0.102	0.005	0.017[A]
In-situ lower clay	0.171	0.009	0.0285[A]
In-situ silt	0.15[B]	0[B]	0[B]
In-situ sand	0.1[B]	0[B]	0[B]

[A] Estimated from $C_r = C_c/6$.
[B] Assumed values.

Response:

The upper clay is encountered outside the limits of waste or at the toe of the waste slopes. Accordingly, the upper clay has a significant effect on stability of the waste slopes because it forms part of the buttressing soil at the slope toe. However, this location is not significant for the settlement analyses since it occurs at the flowline low points and cell floor, which is lower (i.e. locations at which a more compressible subgrade would increase the slope and help the drainage). Accordingly, it is both accurate and conservative to ignore the upper clay in the settlement analyses.

13. It is difficult to see the exact locations of the settlement points shown in the plan of Attachment A-2.1 Settlement Analysis points (also see Figure 2). The settlement points located at the same settlement lines should be connected by drawing settlement lines.

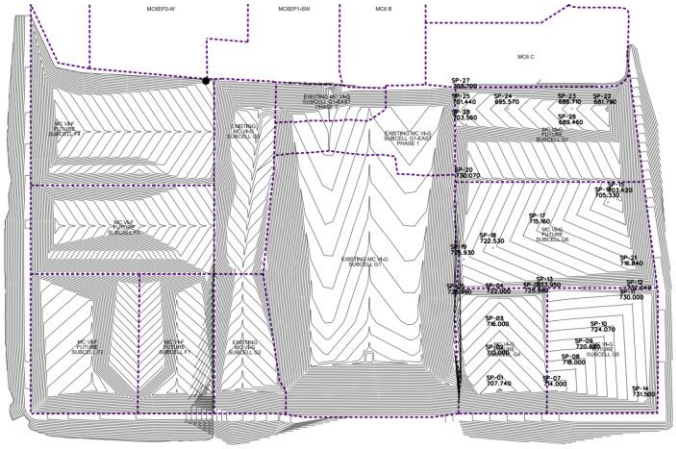


Figure 2 – Settlement analysis points

Response:

Revised per comment.

14. CTI should provide the load distribution diagram and the condition of the subsoil layers for each settlement line such as your Company did in "Application for Permit to Construct A Solid Waste Disposal Area, Pine Tree Acres, Inc. – East Development Area, Lenox Township, MI, January 2014" as shown in Figures 3 and 4.

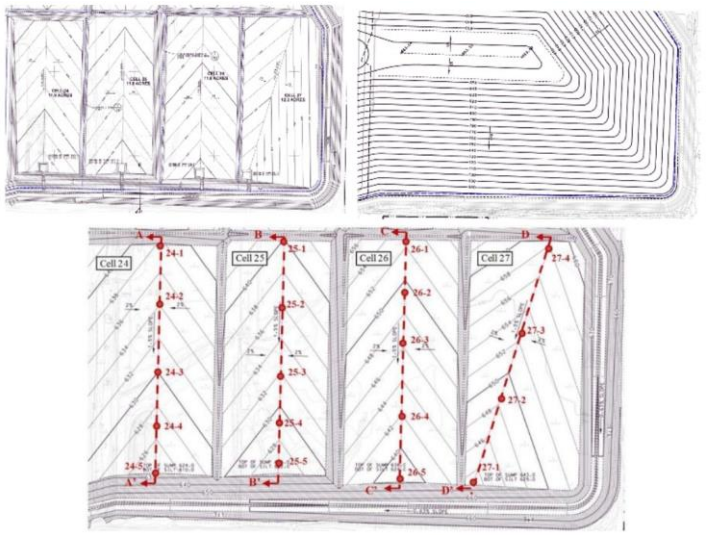
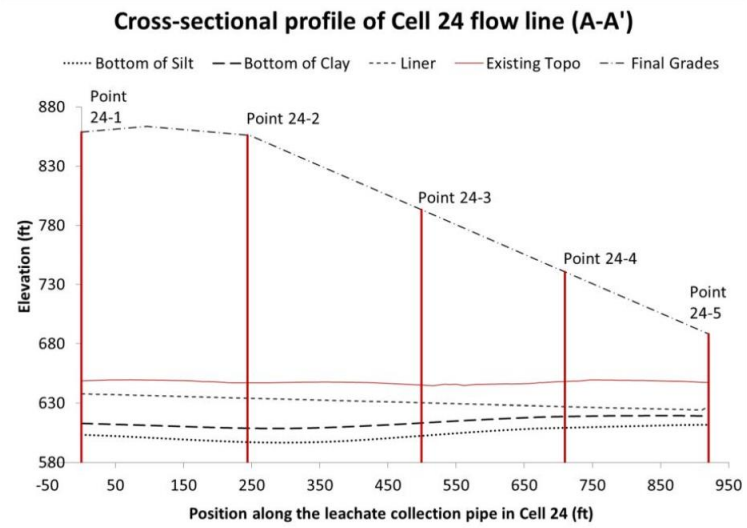
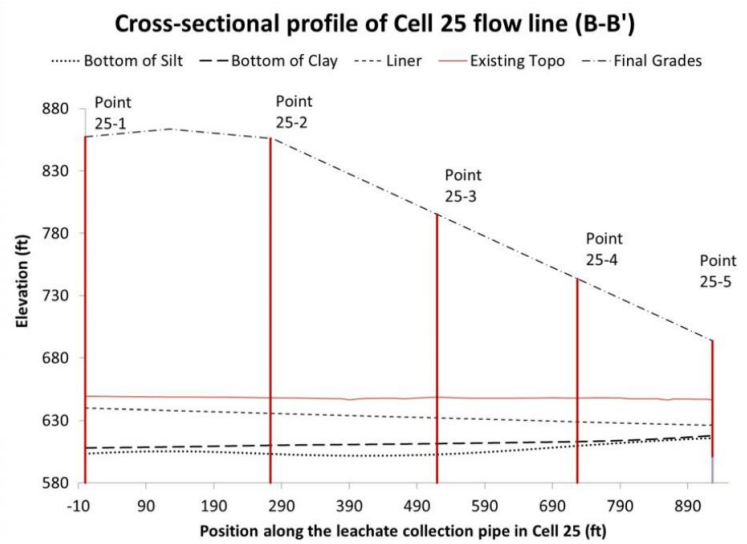


Figure 3 – Example of determination of settlement lines and calculations of overburden pressures at each settlement point





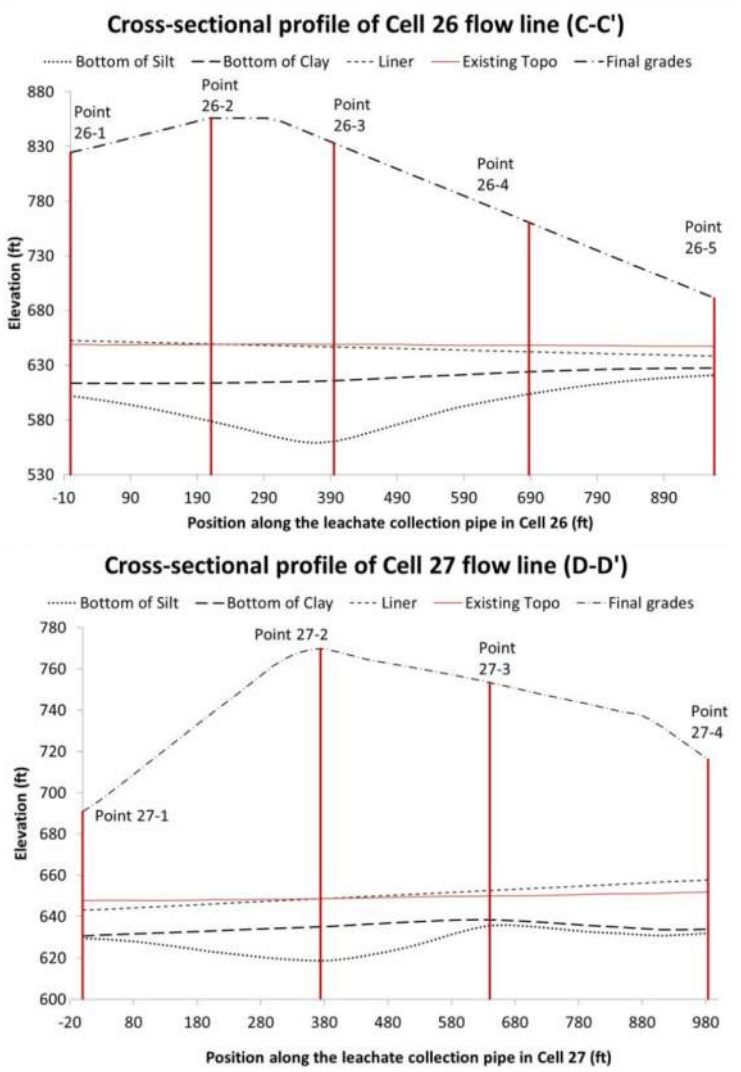


Figure 4 – Example of cross-section profile of foundation soil layers and overburden pressure along the Settlement Lines 24, 25, 26, and 27

Response:

Revised per comment

15. What type of leachate collection system in the existing landfill and what is the slope of the base floor of the existing landfill cell, MC I (Figure 5) under the new vertical expanded landfill? Is there any leachate collection pipes installed in the existing landfill? CTI should evaluate or explain whether the total or differential settlement caused by the new overburden pressure from the vertical expanded landfill will affect the gravity drain of the leachate collection system in the existing landfill (MC I).

Figure 5 – WDI landfill existing and vertical expanded cell layout map

Response:

There is no existing lateral leachate collection system in MC I. Therefore, CTI has not analyzed the effects of settlement on an existing leachate collection system.

16. There are two sub-attachment documents of Attachment A-2.1 Settlement Analysis Points and Attachment A-2.2 Sample Calculation included in Attachment A-2 Settlement Calculations. The second Attachment A-2.1 and Attachment A-2.2 look likely to be useless because there is no any settlement point shown on the cell plan and it is not known why a MC VI-E Phase II NE cell plan appears in Attachment A-2.1. In addition, only two result tables are included in Attachment A-2.2 without any explanation.

Response:

Lines and profiles are added to the plans per previous comments # 13 and 14.

Attachment A-3 Pipe Strength and Deflection Calculations

17. What type of leachate collection system was used in the existing landfill MC I (Figure 5)? What was the designed sub-grade slope for leachate drainage? Is it possible the new extra waste filling due to the vertical expansion will cause the slope reversal of the cell floor of

the existing landfill? Were some leachate collection pipes installed in the existing landfill? If so, the slope, strength, and deflection of the pipes must be re-evaluated under the new load due to the vertical expansion.

Response:

There is no existing lateral leachate collection system in MC I.

Attachment A-4 Leachate Collection System Flow Capacity Analysis

18. The calculations for the design of the sumps cannot be found in Attachment A-4 Leachate Collection System Flow Capacity Analysis. The design of the sumps include the sump sizing, the calculation of the effective storage volume of the sumps, determination of the pump-on and pump-off levels in the sumps, and calculation of the pump cycle time. The depth of the sump, elevation of the invert of the leachate collection pipe outlet at the sump, and actual elevations of the pump-on and pump-off at the sump were also not shown in the Engineering Drawings or indicated in the Engineering Report.

Response:

The typical sump dimension was provided in Detail 1 on Sheet 18 of the Engineering Drawings. The sump depth was 3.2 ft. Per your request, the calculation of the sump size, effective storage volume, and pump cycle time is performed and included in this response package. We will also include the following table on the Engineering Drawing (will be submitted in later time).

Parameter	Symbol	Value	Unit	Notes and Equations
Sump Length (Top)	L_T	44	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Width (Top)	W_T	34	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Top Area	A_T	1,496	ft^2	L X W
Sump Length (Bottom)	L_B	25	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Width (Bottom)	W_B	15	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Bottom Area	A_B	375	ft2	L X W
Depth of Sump	h_0	3.2	ft	Based on Slope 3:1 and Sump Dimensions
Porosity of Aggregates	n	0.3		assumption
Pump On from Bottom	h_1	36	inch	
Pump Off from Bottom	h_2	12	inch	
Pump On Area	A_1	1,419	ft^2	L=43 ft; W=33 ft
Pump Off Area	A_2	651	ft^2	L=31 ft; W=21 ft
Leachate Generation Rate	Q_{in}	47,693	GPD	Source: Attachment A-4_Leachate Collection System Flow Capacity Analysis
		33.1	GPM	
Leachate Pumping Rate	Q_{out}	37.0	GPM	typical pumping rate; minimum pumping rate is 34 gpm.
Effective Sump Storage Volume	V_{eff}	4,535	gal.	$V_{eff} = \frac{1}{3} n \frac{h_1 - h_2}{12} \left(A_1 + A_2 + \sqrt{A_1 A_2}\right) \times 7.481$
Pump Off Time	T_{off}	2.3	hr	$T_{off} = \frac{V_{eff}}{Q_{in}} \times 24$
Pump On Time	T_{on}	19.5	hr	$T_{on} = \frac{V_{eff}}{Q_{out} \times 60 - \frac{Q_{in}}{24}}$
Pump Cycle Time	T_{cycle}	21.8	hr	$T_{cycle} = T_{on} + T_{off}$
Pump Cycle	N	1.1		$N = \frac{24}{T_{cycle}}$

NOTES

1. Dimension of the sump used in this calculation is an example. The actual dimension of the sump can be varied.
2. The effective sump storage volume presented in this calculation is a minimum required volume.
3. The leachate pumping rate presented in this calculation is for illustration purpose. Other size of pump with different flow rate can be used as long as the leachate level above the primary liner can be maintained below 12-inch.

Attachment A-6 Surface Water Management System Design Calculations

19. It can be seen on Drawing No. 2B Revised Stormwater Management Systems dated April 21, 2020 prepared by CTI (also see Figure 6) that a diversion berm is located at the west boundary of MC VI-G4 and MC VI-G5 and a diversion berm is located at the south boundary of Master Cell I. There is no any diversion berm or drainage trench located at the south boundary of the new vertical expanded cells MC VI-G5, MC VI-G6, and MC VI-G7. CTI should explain whether a diversion berm or drainage trench is needed at the south boundary of MC VI-G5, MC VI-G6, and MC VI-G7 and a temporary diversion berm or drainage trench is also needed at the east boundary of MC VI-G7. If need, the new design for these diversion berms or drainage trenches should be added in Attachment A-6 Surface Water Management System Design Calculations. If not, CTI also need to provide the reasons.

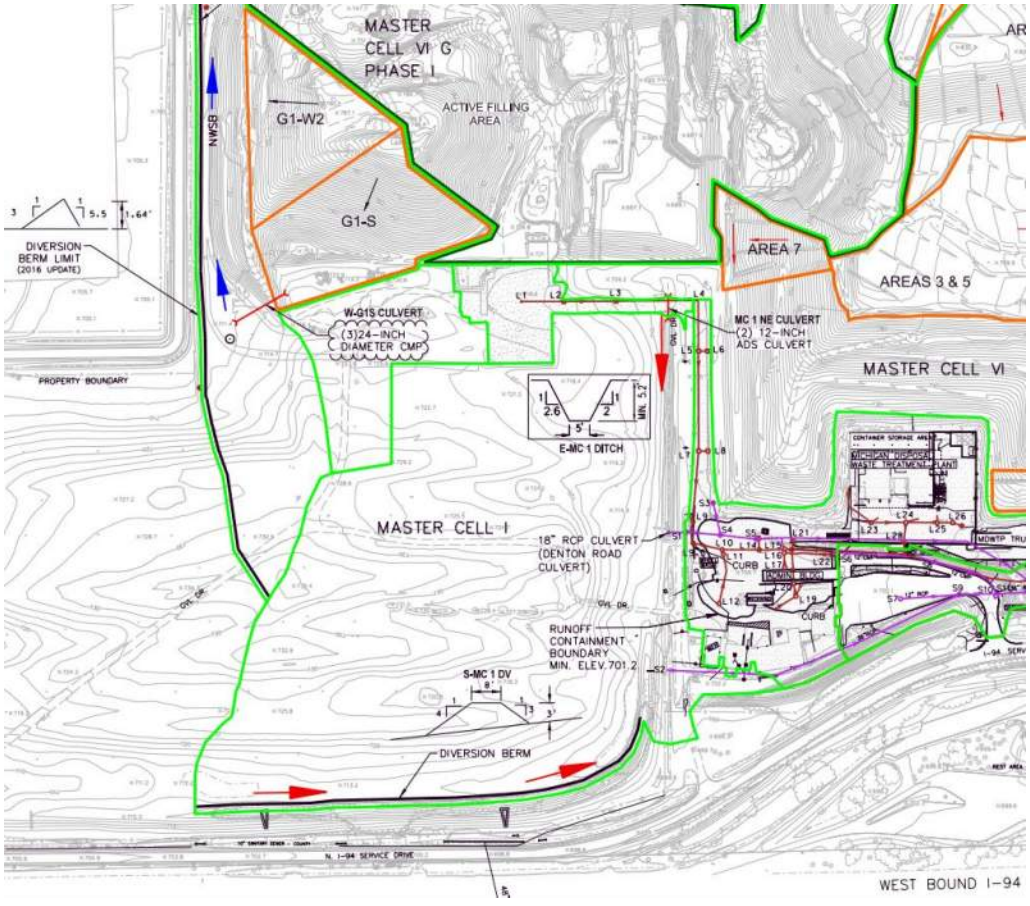


Figure 6 – Revised stormwater management systems dated on April 21, 2020

Response:

The Revised Stormwater Management Systems dated April 21, 2020 prepared by CTI is prepared for the current conditions at WDI. The design in this permit is for future conditions after all cells are completed and the final cover is installed.

All necessary stormwater management structures are included on Figures 1 and 2 provided in Attachment A-6.1.4 and these structures are included in the analysis as required to manage run-off from the final cover. The calculations provided in Attachment A-6, and Figures 1 and 2 provided in Attachment A 6.1.4, show the evaluation of the required surface water management structures south of the final cover. No additional surface water management structures beyond those discussed in Attachment A 6 are needed.

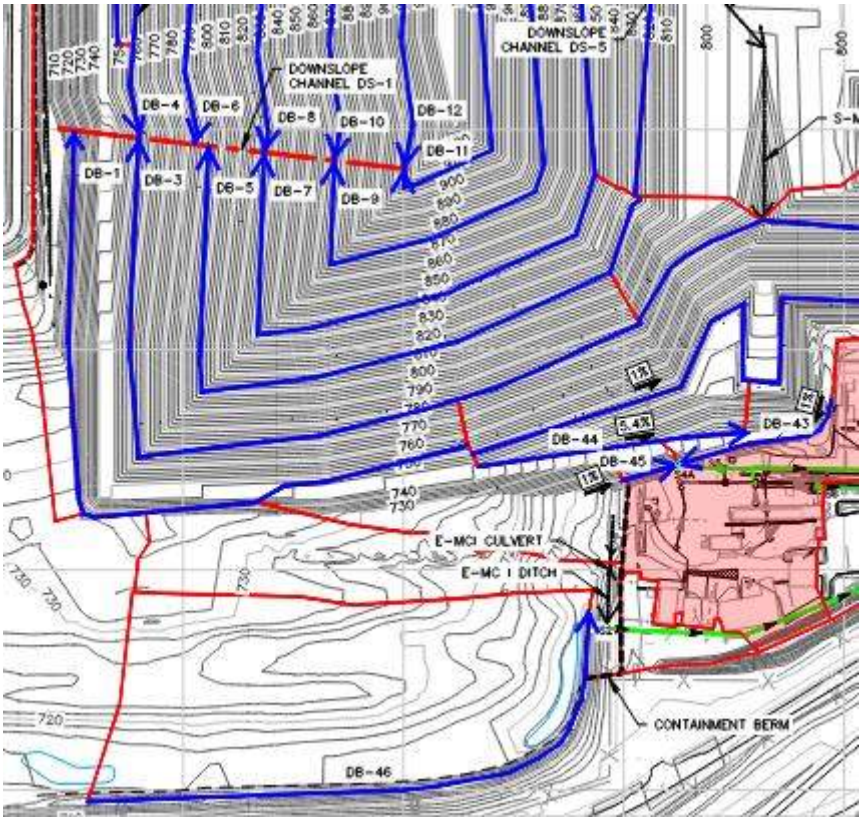


EXHIBIT 6A: Portion of Figure 1 of Attachment A-6.1.4

20. Only the diversion berms and downslope channels are shown on Drawing Nos. 10 and 11 for the traditional cover system. The peripheral drainage system at the boundaries of the new vertical expanded cells MC VI-G4, MC VI-G5, MC VI-G6, and MC VI-G7 are not marked on these stormwater management drawings.

Response:

Engineering Drawings 10 and 11 are intended to show the surface water management features directly associated with the final cover. The peripheral drainage system features are shown in Figures 1 and 2 provided in Attachment A-6.1.4. Calculations that discuss the evaluation of the North Sedimentation Basin, South Sedimentation Basin and related surface water control structures/features are provided in Attachment A-6. The North and South Sedimentation Basins and related surface water management features have sufficient capacity to manage surface water run-off flows under final conditions.

ATTACHMENTS

A-1.1 MC VI-G4 through G7 Slope Stability Analysis
A-1.2 MC VI-E and F Slope Stability Analysis
A-2.1 Settlement Analysis for MC VI-G4 to G7
A-2.2 Settlement Analysis for MC VI-E, F and G1 to G3

WDI Permit Cal List of Attachments for A-1 and A-2.xlsx

1. Responses to EGLE comments dated May 5, 2022

DRAFT

Comments on CTI's Responses for MMD's Technical Comments

May 5, 2022

Responded by CTI on May 18, 2022

Attachment A-2.1 Settlement Analysis for MC VI-G4 to G7

1. Figure 2 (Page 3 of 13 of Attachment A-2.1) is a north-south cross section. The north and south directions should be marked on the left or right side of Figure 2 or add the arrows on the north-south cross section line in Figure 1 (Page 2 of 13 of Attachment A-2.1). As the same, Figure 3 (Page 4 of 13 of Attachment A-2.1) is a west-east cross section. The west and east directions should be marked on the left or right side of Figure 1 or add the arrows on the west-east cross section line in Figure 1.
   Response: we have added these labels as requested.

2. The secondary compression ratio shown in Table 2 (as depicted below) is 0. Although the biodegardation of the old waste in the existing cells may be close to zero, the structural creep of the waste skeleton still exist like secondary compression of soils. Thus, theretically, the secondary compression ratio of the existing waste will not be zero and it will reduce to a value less than that of the new waste.

Table 2. Compressibility Parameters of Waste and Soils
(on Page 6 of 13 of Attachment A-2.1)

Soil Type	Primary Compression Ratio $C_c/(1+e_0)$	Secondary Compression Ratio $C_\alpha/(1+e_0)$	Recompression Ratio $C_r/(1+e_0)$
Existing cover	0.102[B]	0.005[B]	0.017[A]
Existing waste	0.147	0	0.0245[A]
In-situ middle clay	0.102	0.005	0.017[A]
In-situ lower clay	0.171	0.009	0.0285[A]
In-situ silt	0.15[B]	0[B]	0[B]
In-situ sand	0.1[B]	0[B]	0[B]

[A] Estimated from $C_r = C_c/6$.
[B] Assumed values.

Response: we have added secondary compression to the calculations.

3. The material of the intercell dikes should be the natural clay. It may be in-situ middle clay or in-situ lower clay shown in Table 2 (as depicted above). This clayey material should be the overconsolidated clay. The settlement of the intercell dikes in the existing cells should be calculated by using the method of the overconsolidated soils.

   Response: the preconsolidation pressure for the in-place clay layers has been calculated using the vertical overburden pressure due to the pre-development ground surface(elevation 705 – as determined from undeveloped portions of the site depicted in the permit topo maps). All subsequent changes (i.e., MC-I excavation, waste, placement, and cover soil placement) are subsequently modeled. Finally, weight from the proposed overlying waste cells are added to compute the final vertical stress. The net settlement due to the change from current conditions to proposed final conditions is calculated as either normally-consolidated (i.e., compression is calculated using C'_c) or overconsolidated (i.e., compression is calculated using C'_r and C'_c) depending on whether the current stress is greater than the preconsolidation stress or not, respectively.

4. Because the precise configuration of the intercell dikes is unknown, the locations of the intercell dikes shown in Figure 1 (Page 2 of 13 of Attachment A-2.1) and a figure in Attachment A-2.2.1 Settlement Analysis Points (Page 16/total page 70) are based on the estimation and assumption. If the precise profiles and locations of the intercell dikes can be determined after the excavation of the cell subgrade in MC VI-F1 to F4 and MC VI-G4 to G7, CTI should make comparisons of the profiles and locations between the estimated and actual intercell dikes to see whether or not the settlement calculations results based on the estimated intercell dikes are still acceptable at the conservative side. If not, the recalculations should be conducted based on the new information. The new drawings shown the precise profiles and locations of the intercell dikes in MC VI-F1 to F4 and MC VI-G4 to G7 should be developed to submit to MMD, Michigan EGLE.

   Response: Current design and calculations are prepared using best available information regarding the existing waste and configuration of the existing dikes. A procedure to evaluate additional information during construction has been provided. If an engineering evaluation of the additional information results in a recommendation to alter the liner grades, the construction quality assurance officer will evaluate the change to determine that it provides equivalent or better certainty that components meet the design specifications. The construction quality assurance officer will provide certification of this evaluation in the construction certification report submitted to EGLE.

2. Attachment A-1.1 MC6 G4-G7 Slope Stability Analysis

Original Submittal			
	Page	**Revised Submittal**	
A-1	10	A-1.1	MC VI-G4 through -G7 Slope Stability Analysis
A-1.1	14	A-1.1.1	C-C’ Foundation Stability
A-1.2	19	A-1.1.2	G-G’ Foundation Stability
A-1.3	24	A-1.1.3	C-C’ Liner Stability under Final Conditions with zero adhesion
A-1.4	29	A-1.1.4	G-G’ Liner Stability under Final Conditions with zero adhesion
A-1.5	34	A-1.1.5	C-C’ Liner Stability under Final Conditions with non-zero adhesion (previously tested values)
A-1.6	39	A-1.1.6	G-G’ Liner Stability under Final Conditions with non-zero adhesion (previously tested values)
A-1.7	44	A-1.1.7	C-C’ Liner Stability under Interim Conditions (example interim stability calculation)

Attachment A-1.1

MC VI-G4 through -G7 Slope Stability Analysis

Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification	Client:	Wayne Disposal, Inc.
Project Number:	1208070039.004	Project Manager:	Chris Backus
Project Location:	Belleville, Michigan	QA Manager:	

Calculation Sheet Information

Calculation Medium: ☒ Electronic
☐ Hard copy Number of pages (including cover sheet):

Title of Calculation:	Slope Stability Analyses
Calculation Originator:	Mohammad Kabalan
Calculation Contributors:	Kazuhisa Matsuda, Rajan Ramya
Calculation Checker:	James Moseley, Kevin Foye

Calculation Objective

This calculation evaluates the stability of the proposed MC-VI-G at Wayne Disposal, Inc. (WDI) Landfill. The analyses include consideration of global slope stability for failures through the waste mass, along the liner system, and/or through the foundation soils at interim and final conditions. The analyses also determined the minimum required interface friction angle to attain a satisfactory factor of safety against failure at the liner system interface. Cross sections that are the most critical for analysis and design include cross sections with the steepest slopes and highest embankment (waste or soil) heights. The following critical cross sections were examined:

1. Cross Section C-C' oriented East-West and going through Cell MC VI-G4.
2. Cross Section G-G' oriented North-South and going through Cell MC VI-G6.

Assumptions and Open Items

1. Representative total and effective stress shear strength parameters were used for all layers in the profile. Material properties were retrieved from existing site data (NTH 2012) and are presented in Table 1. For slow-draining clay soils, undrained shear strength (total stress analysis) was used because pore pressures accumulating during shear will not be able to dissipate in these soils. In contrast, drained strength parameters (effective stress analysis) were used for waste and granular soil layers because these materials will dissipate excess pore pressures during shear. Therefore, both undrained and drained shear strength parameters are used in the same slope stability analysis, depending on the layer being modeled. Strength properties for the lower clay were modeled as a relationship of undrained shear strength to vertical effective stress. An undrained shear strength to vertical effective stress ratio of 0.22 was used to calculate undrained shear strength for the lower clay in accordance with existing analyses (NTH 2012) to account for increases in clay shear strength resulting from increased overburden pressure.

Table 1: Material Properties

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover (total stress analysis)	Orange	135	0	1500
2	Existing Waste (effective stress analysis)	Teal	91	34	0
3	New Waste (effective stress analysis)	Light Green	103[A]	30	0
4	Upper Clay (total stress analysis)	Brown	130	0	1325
5	Middle Clay (total stress analysis)	Yellow	136	0	3000
6	Lower Clay (total stress analysis)	Maroon	128	$0.22\sigma_v$	
7	Silt (effective stress analysis)	Blue	125	28	0
8	Sand (effective stress analysis)	Red	115	32	0
9	Liner (floor) (effective stress analysis)	Magenta	120	13.2	0
10	Liner (sideslope) (effective stress analysis)	Magenta	120	9	0

Notes:
[A] conservative (high) value of unit weight of waste was estimated from site survey data (see table below). Note that higher values of waste unit weight result in a lower FS because newly-placed waste imposes a greater driving load.
All other properties obtained from NTH (2012)

2. For liner system stability cases, the domain of the slip surfaces are defined so that a portion of the failure surface conforms to the liner system.
3. Applicable data used in the analysis that was provided by third parties is assumed to be accurate.

Site Waste Survey Data

Survey Years	2014 to 2021
Tons received into the landfill	3,905,856
Cubic yards airspace consumed	2,869,499
Average Unit Weight (tons/cy)	1.36
Average Unit Weight (pcf)	100.83

Design Criteria/Design Basis

1. The minimum allowable factor-of-safety (FS) against slope stability failures is 1.50 for final conditions and 1.30 for interim conditions.
2. The analyses were conducted using the computer program SLOPE/W within the software package GeoStudio 2021 by GEOSLOPE International Ltd. This program performs an automatic search to identify a critical failure surface that has the lowest FS value.
3. The analyses were conducted using the Morgenstern-Price method, which considers both moment and force equilibrium.
4. The geometry of the cross sections was derived from the engineering drawing set submitted as part of the permit mod package.
5. The required/assumed interface friction angles shall be met by considering peak strength values for the cell floor and large-displacement strength values for the cell sideslopes.

Design Criteria/Design Basis
6. The required minimum interface friction angle for the liner system components is determined under the final conditions (after final cover is installed). 7. Due to the complex nature of the waste fill phasing during operation, the liner stability shall be evaluated based on the actual measurements of the interface friction angle for the liner system components and the design waste filling geometry for each phase. An example one such calculation was prepared to illustrate how to evaluate required minimum interface friction angle for the liner system components. This example analysis was performed on cross section C-C' assuming an interim waste slope of 3H:1V. 8. The example interim slope stability calculation performed for cross section C-C' is considered a worst-case for translational slides on the cell floor because the analysis does not take credit for the stabilizing effect of any cell side slope or toe buttress resisting movement along the liner system. Therefore, for the conditions presented, interim slopes that are constructed no steeper than 3H:1V and with a bottom width no less than 370 feet (measured from the toe of intercell berm to the interim face of the waste slope) shall be considered acceptable for waste filling operations. If tested values of the cell floor liner system interface strength vary from those presented, or the filling geometry deviates from this case, the interim slope shall be reevaluated according to this example to determine if the alternative waste filling geometry meets the stability criterion. Interim filling geometries that do meet the interim stability criterion shall be adjusted and reevaluated until acceptable FS values are obtained.

Results/Conclusions
1. Global slope stability analyses of the waste and foundation for each cross section determined that filling to proposed final grades yields acceptable factors of safety. a. Cross Section C-C': Factor of Safety =1.6 b. Cross Section G-G': Factor of Safety = 1.5 2. Under the final conditions (after installation of final cover, the liner system analyses determined the minimum required interface friction angle for geosynthetics in the floor and sideslope liner systems to yield a factor of safety = 1.5. These values are **13.2 degrees for the floor (peak) and 9 degrees for the sideslope (large-displacement) with zero adhesion** . a. Cross Section C-C': Factor of Safety = 1.5 (used to evaluate minimum friction angle) b. Cross Section G-G': Factor of Safety = 1.6 3. The above values are minimum acceptable secant friction angles. Any combination of adhesion and friction angle resulting in comparable shear strength under representative normal stresses to final site conditions are also acceptable. Stability analysis using lab interface shear strength tests results from previous products used on site show that a combination of **$C_{\alpha,peak}$=164 psf / ϕ_{peak}=11.1° and $C_{\alpha,large\ displacement}$=110 psf / $\phi_{large\ displacement}$=7.3°** achieves an acceptable factor of safety. **Conformance testing of the selected geosynthetics shall be performed to confirm that the interface shear strength of the actual liner system components is sufficient to ensure the stability of the liner system.** a. Cross Section C-C': Factor of Safety = 1.5 b. Cross Section G-G': Factor of Safety = 1.6 4. An example calculation of liner stability for an interim waste filling conditions is presented in Attachment A-1.1.7. The required interface friction angle for the floor liner system was determined to be 13 degrees (peak). Actual interim phasing plan slopes and tested liner system interface properties shall be evaluated for each phase of fill per this example. Cross-section C-C' was selected for this analysis since it represents the worst case for interim stability as follows: 1) steepest floor slope sloping outward from the waste slope and 2) narrowest floor width.

5. Interim slopes that are constructed no steeper than 3H:1V and with a bottom width no less than 370 feet shall be considered acceptable for waste filling operations. If tested values of the cell floor liner system interface strength vary from those presented, or the filling geometry deviates from this case, the interim slope shall be reevaluated according to this example.

Source Documents and References
NTH (2012). WDI Operating License Application Master Cells VI F & G Volume III – Basis of Design Report Qian, X., Gray, D.H., and Koerner, R.M. (2002) *Geotechnical Aspects of Landfill Design and Construction.*

Attachments
A-1.1.1. C-C' Foundation Stability A-1.1.2. G-G' Foundation Stability A-1.1.3. C-C' Liner Stability under Final Conditions with zero adhesion A-1.1.4. G-G' Liner Stability under Final Conditions with zero adhesion A-1.1.5. C-C' Liner Stability under Final Conditions with non-zero adhesion (previously tested values) A-1.1.6. G-G' Liner Stability under Final Conditions with non-zero adhesion (previously tested values) A-1.1.7. C-C' Liner Stability under Interim Conditions (example interim stability calculation)

Attachment A-1.1.1

C-C’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

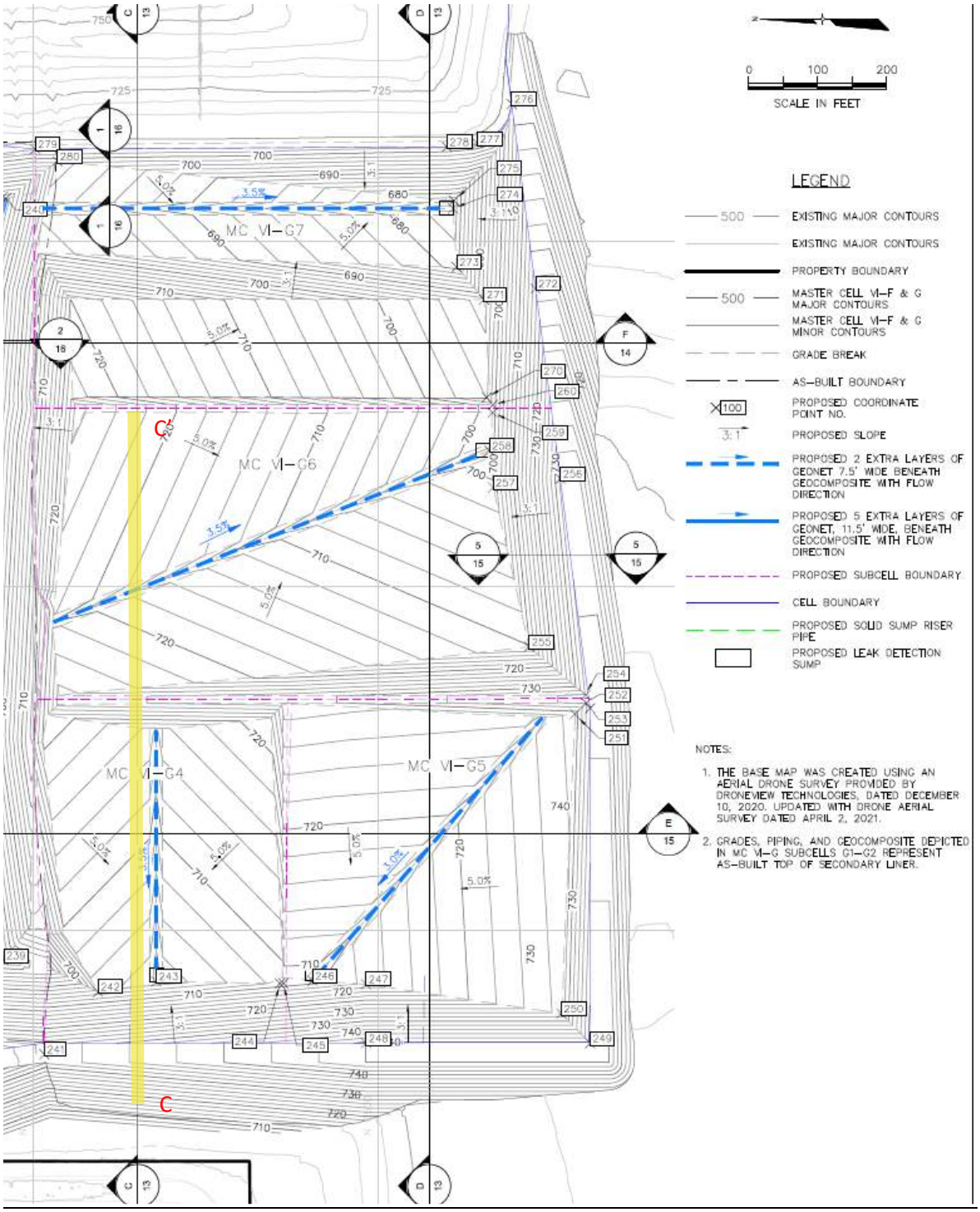
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	C-C' Foundation Stability				**File name:**	MC-VI-G_CrossSection_C_Foundation.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section C-C'. This case considers a west-facing slope, with fill to the final permitted grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The friction angle of the liner system was set equal to the required minimum interface friction angle determined from the liner stability analysis performed on Cross Section C. The groundwater level was set at elevation 655ft based on historical borings as documented in the Basis of Design Report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressure conditions may occur after loading. This is considered a conservative approach for this scenario.		

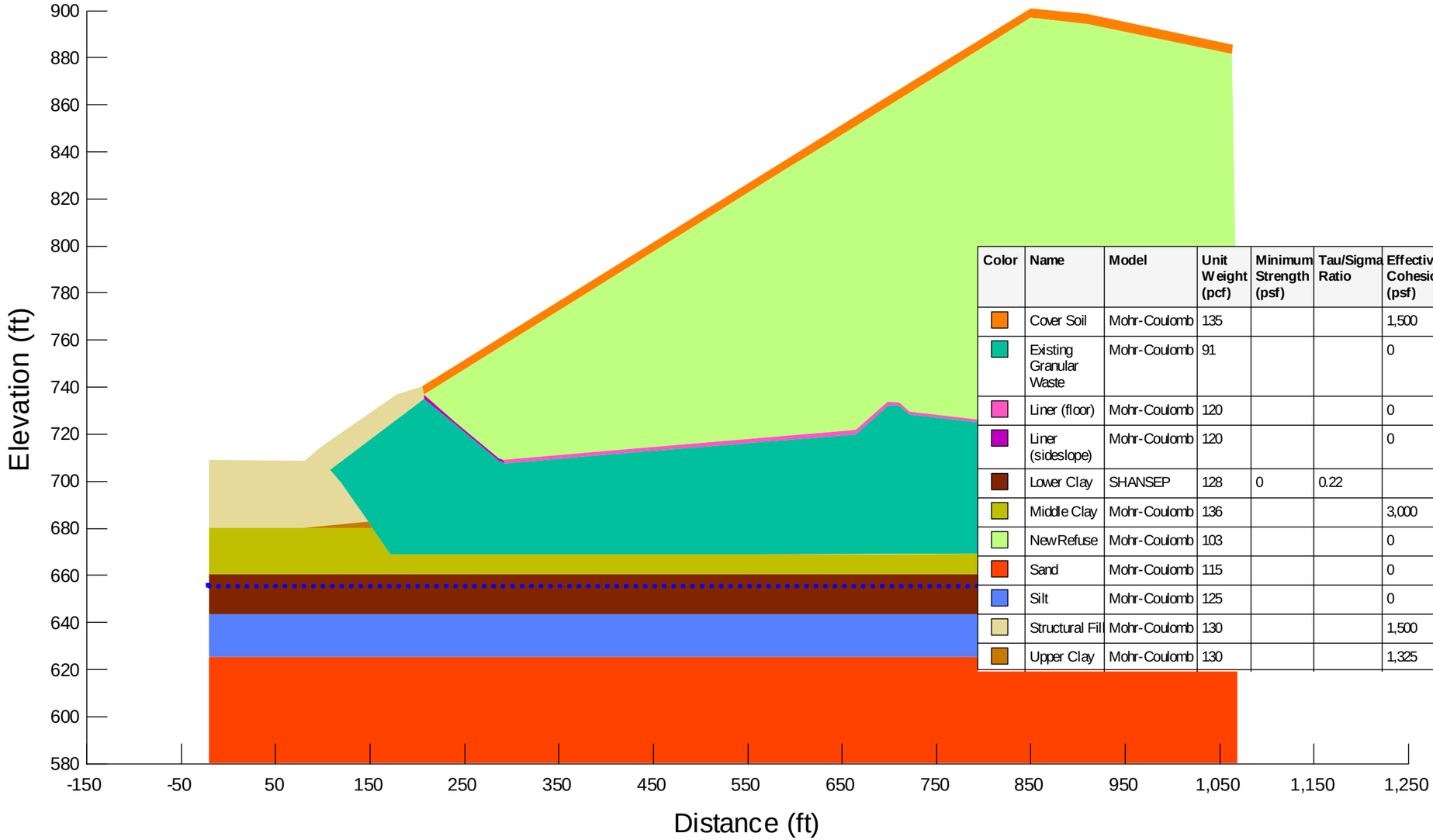
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0

Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section C-C'

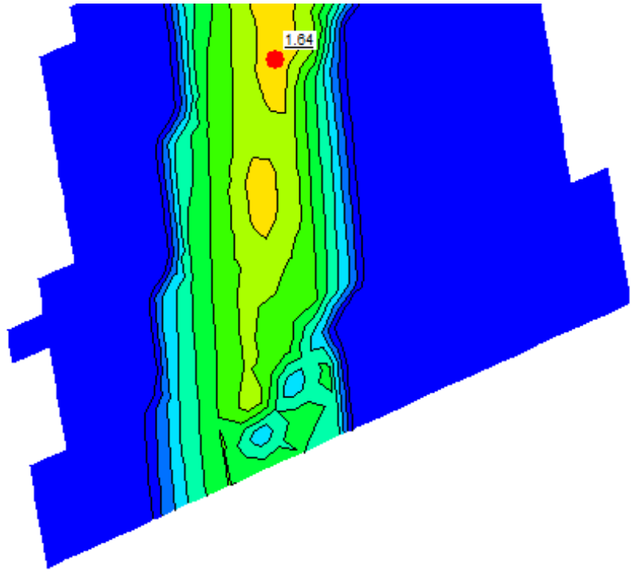
Plan View:

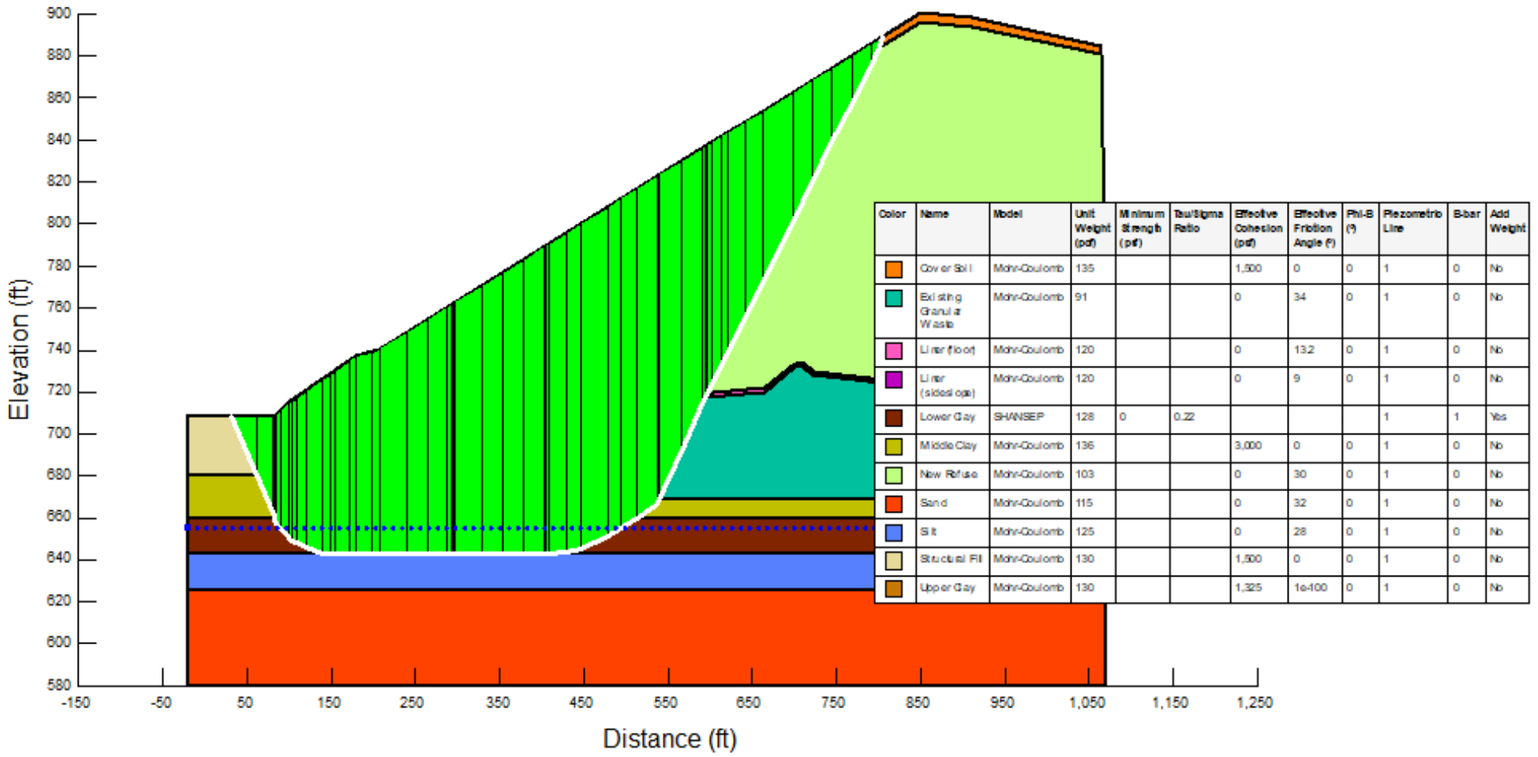


Factor of Safety:	1.6	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	1e-100	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	1e-100	0	1	0	No

Attachment A-1.1.2

G-G’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

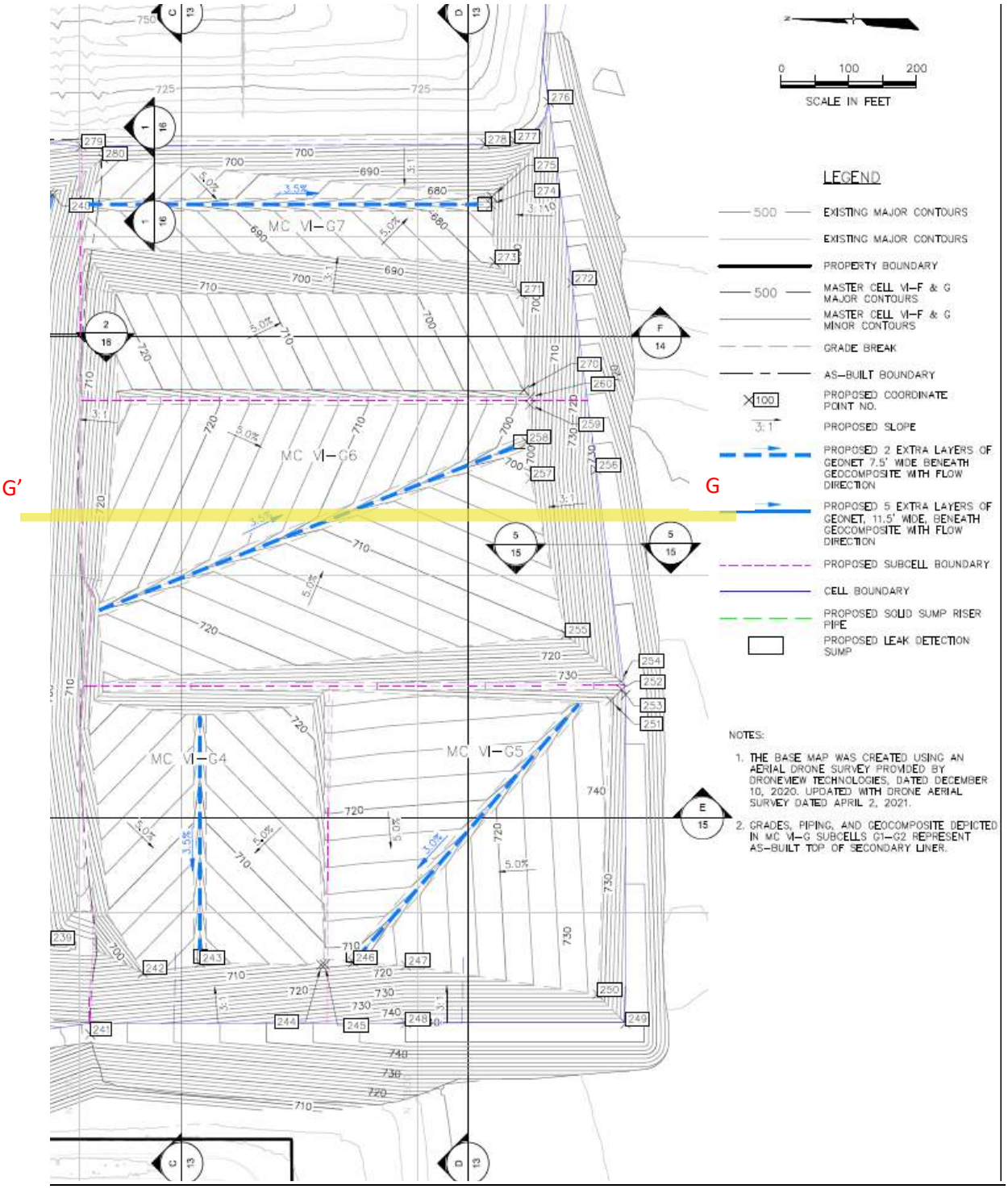
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	G-G' Foundation Stability				**File name:**	MC-VI-G_CrossSection_G_Foundation.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a south-facing slope, with fill to the final permitted grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The friction angle of the liner system was set equal to the required minimum interface friction angle determined from the liner stability analysis performed on Cross Section C. The groundwater level was set at elevation 655ft based on historical borings as documented in the Basis of Design Report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressure conditions may occur after loading. This is considered a conservative approach for this scenario.		

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0

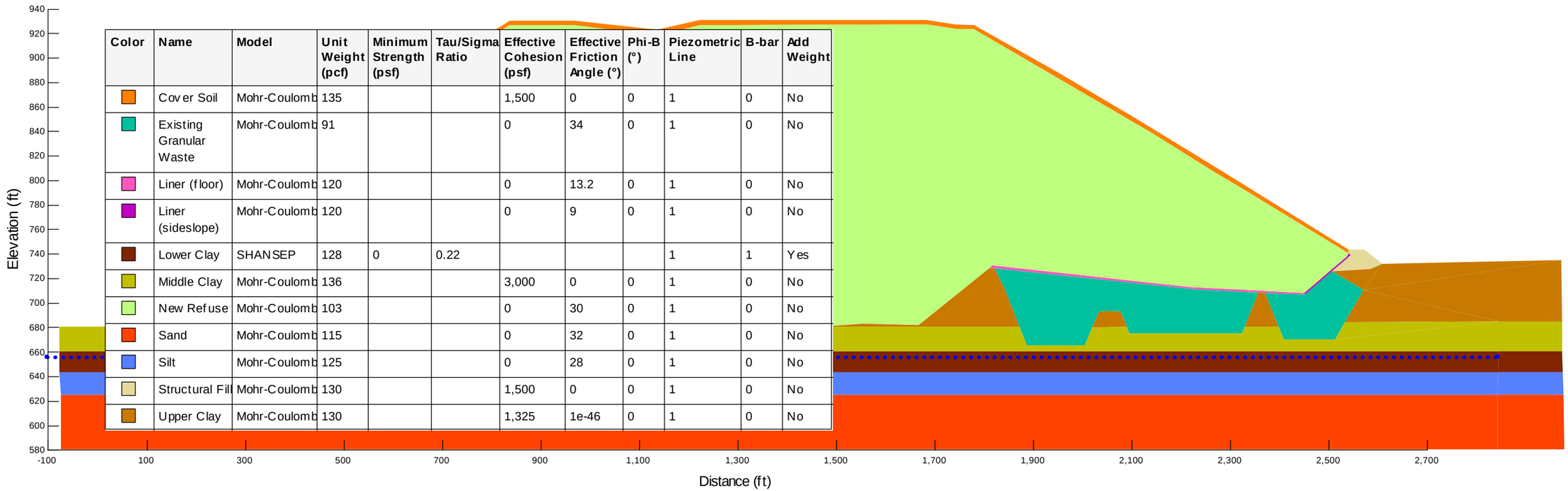
Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section G-G'

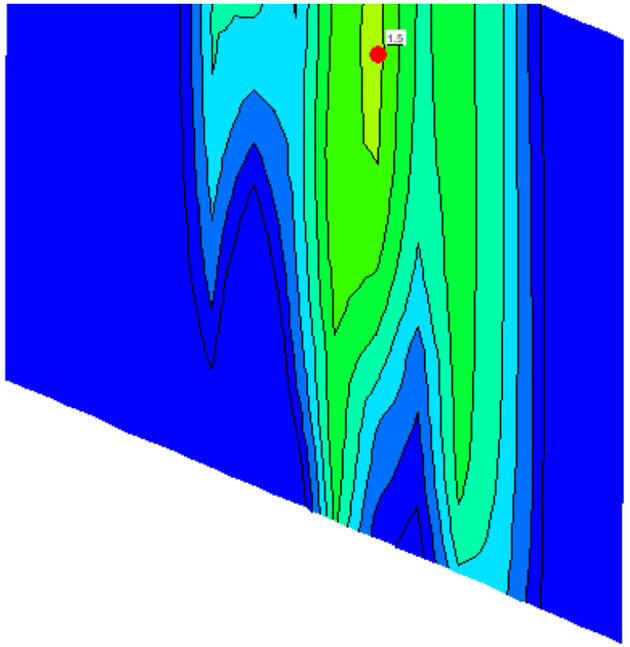
Plan View:



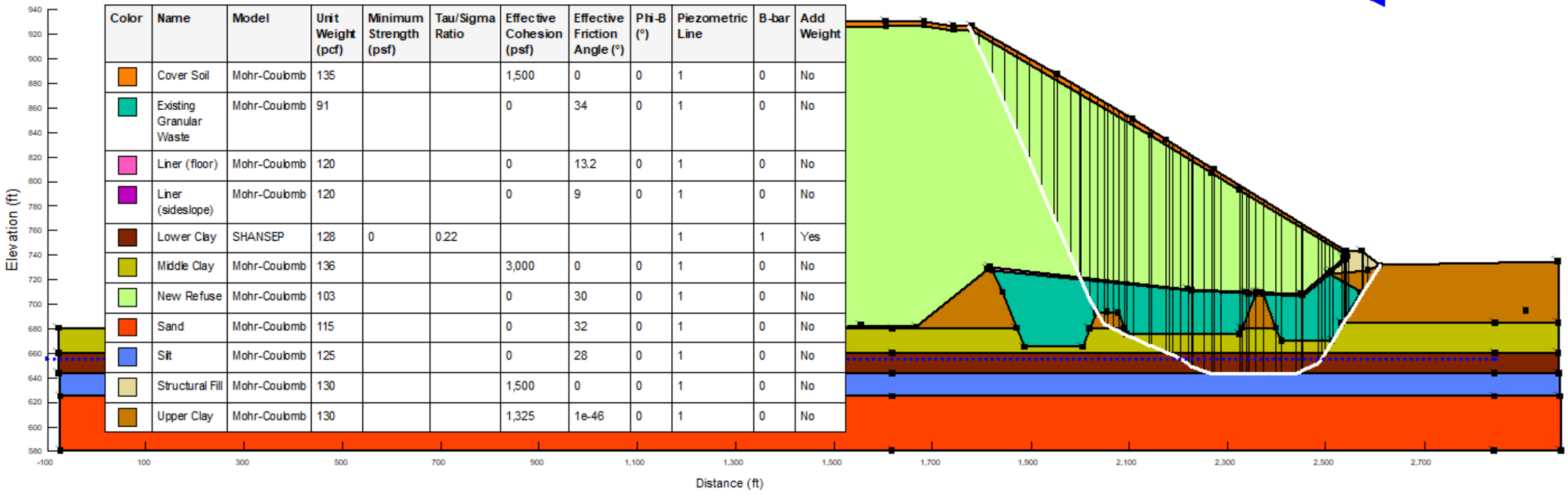
Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	

Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	1e-46	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	130			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	1e-46	0	1	0	No



Attachment A-1.1.3

C-C’ Liner Stability under Final Conditions with zero adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

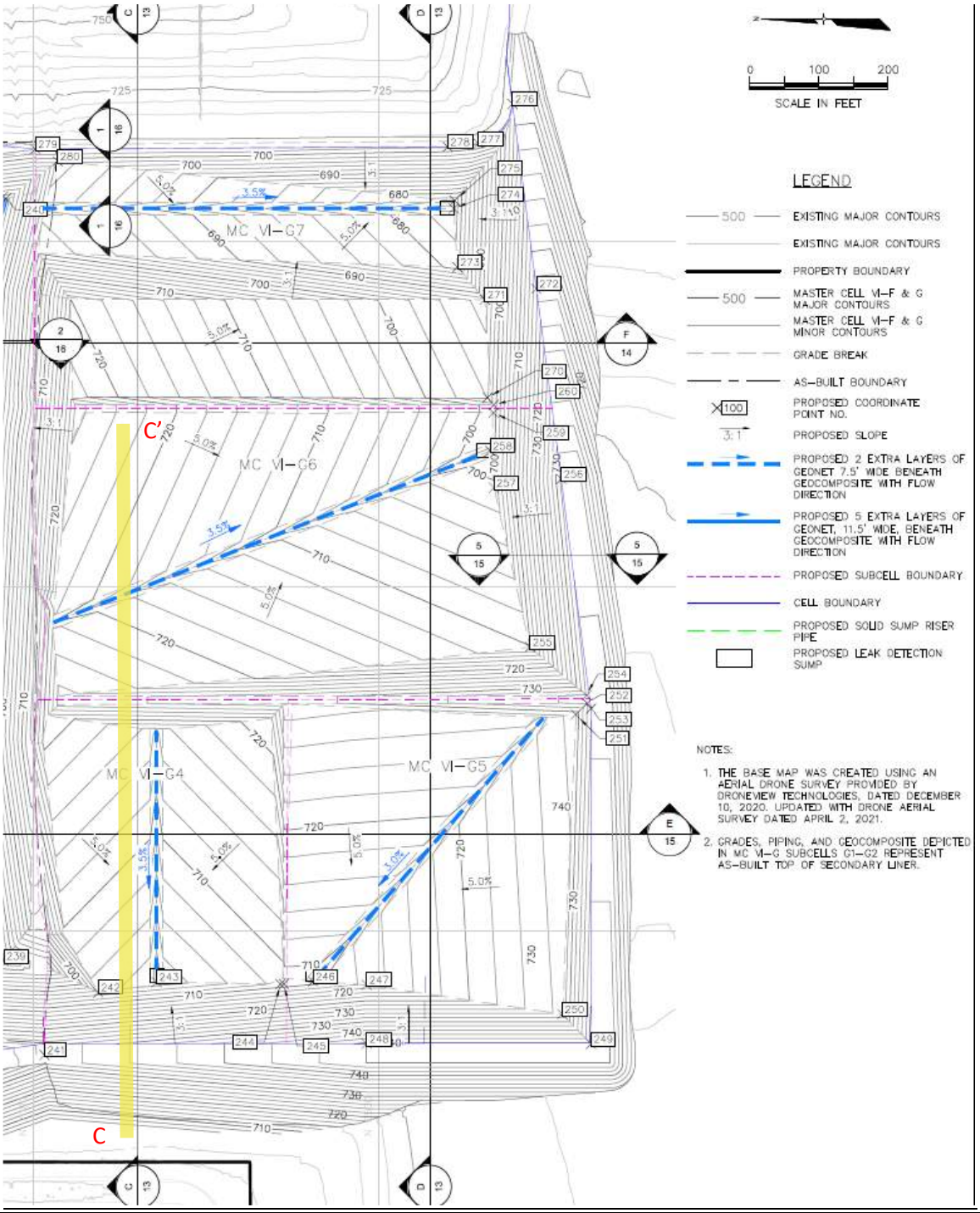
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	C-C' Liner Stability				**File name:**	MC-VI-G_CrossSection_C_Liner.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the minimum required liner interface friction angle to achieve an acceptable factor of safety of the proposed final waste grades using cross-section C-C'. This case considers a west-facing slope, with fill to the final permitted grade elevations under undrained conditions.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The liner system was modeled in 2 sections (floor and sideslope) to allow use of Peak and Large-Displacement strength parameters appropriately. The friction angle of the sideslope was set at 9° corresponding to commonly achievable large-displacement interface secant friction angle. The friction angle of the floor liner system was varied to determine the required peak interface secant friction angle to achieve the required factor of safety of 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

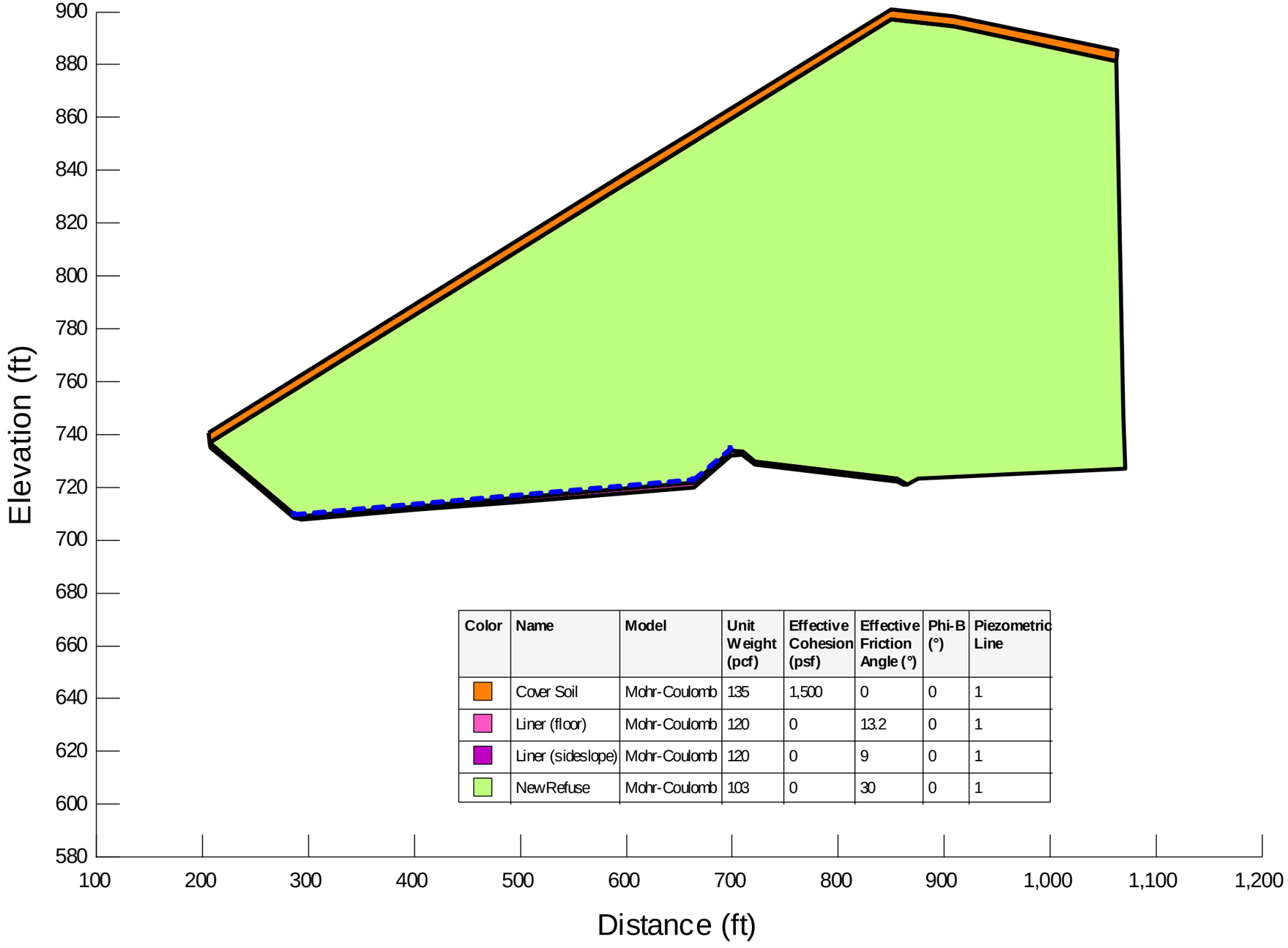
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	?	0
10	Liner (sideslope)	Magenta	120	9	0

Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section C-C'

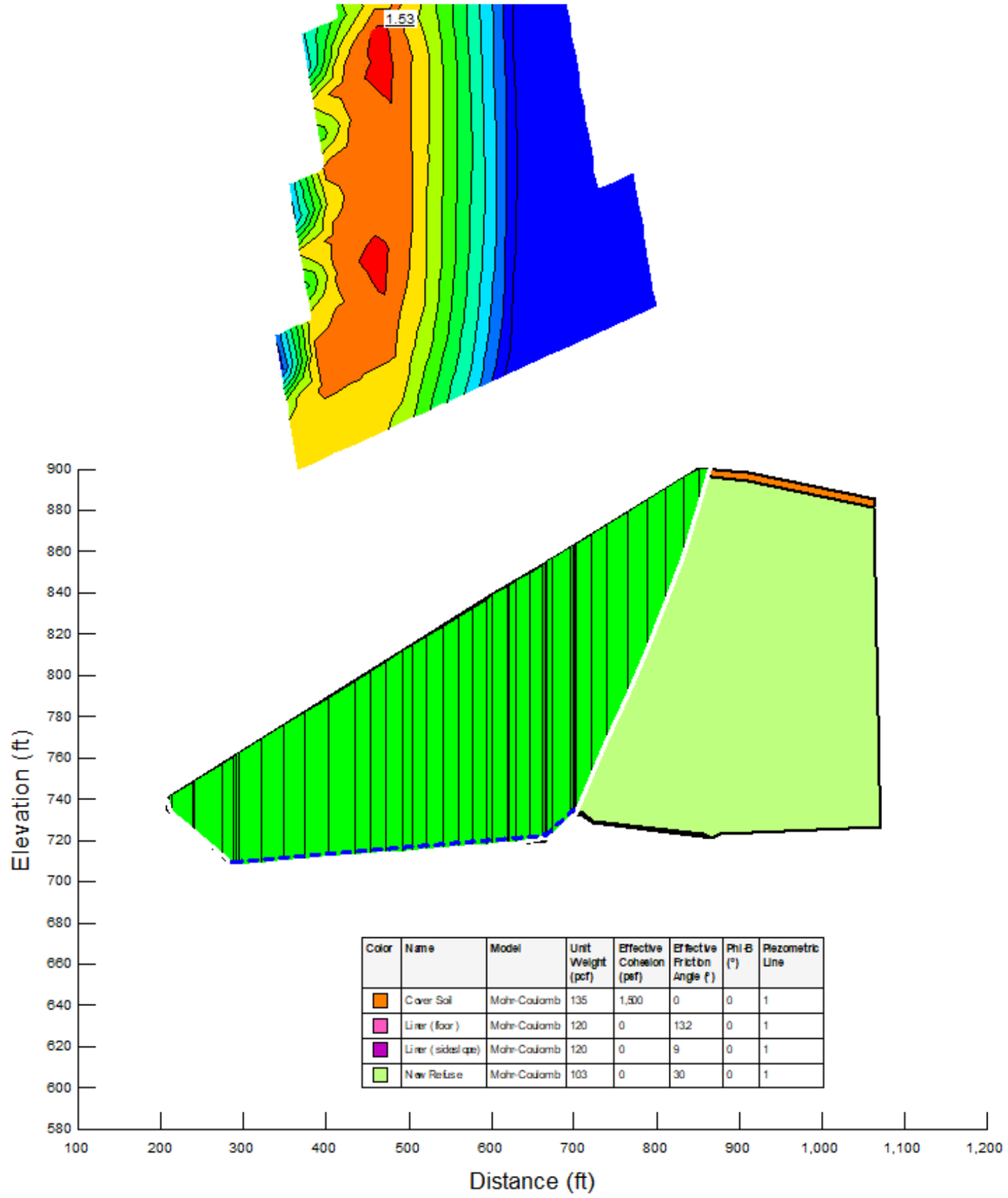
Plan View:



Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:	The required peak interface friction for the floor liner system was determined to be 13.2°.	
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1
	NewRefuse	Mohr-Coulomb	103	0	30	0	1



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1
	New Refuse	Mohr-Coulomb	103	0	30	0	1

Attachment A-1.1.4

G-G’ Liner Stability under Final Conditions with zero adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

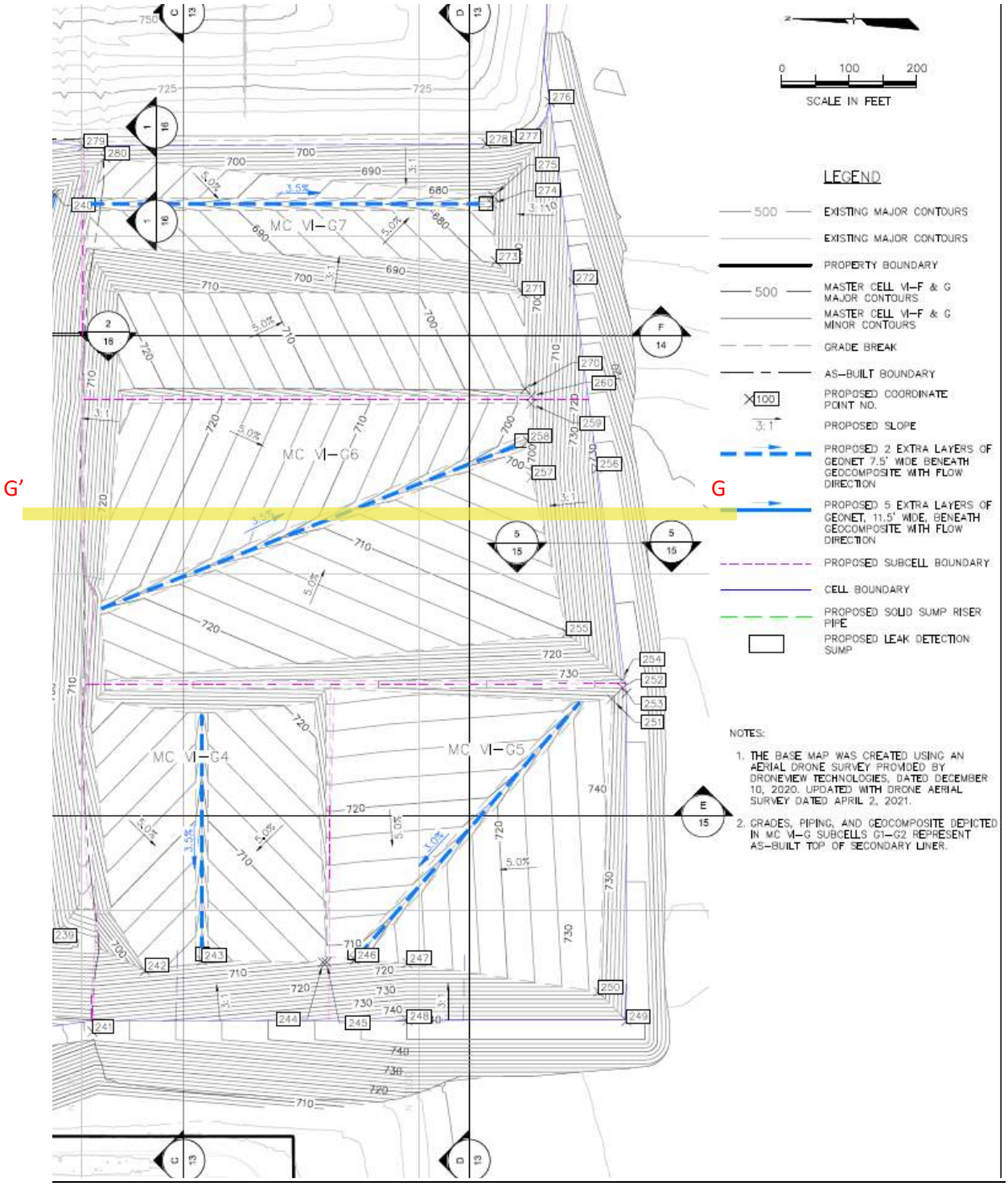
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	G-G' Liner Stability				**File name:**	MC-VI-G_CrossSection_G_Liner.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a south-facing slope, with fill to the final permitted grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The friction angle of the liner system was set equal to the required minimum interface friction angle determined from the liner stability analysis performed on Cross Section C. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

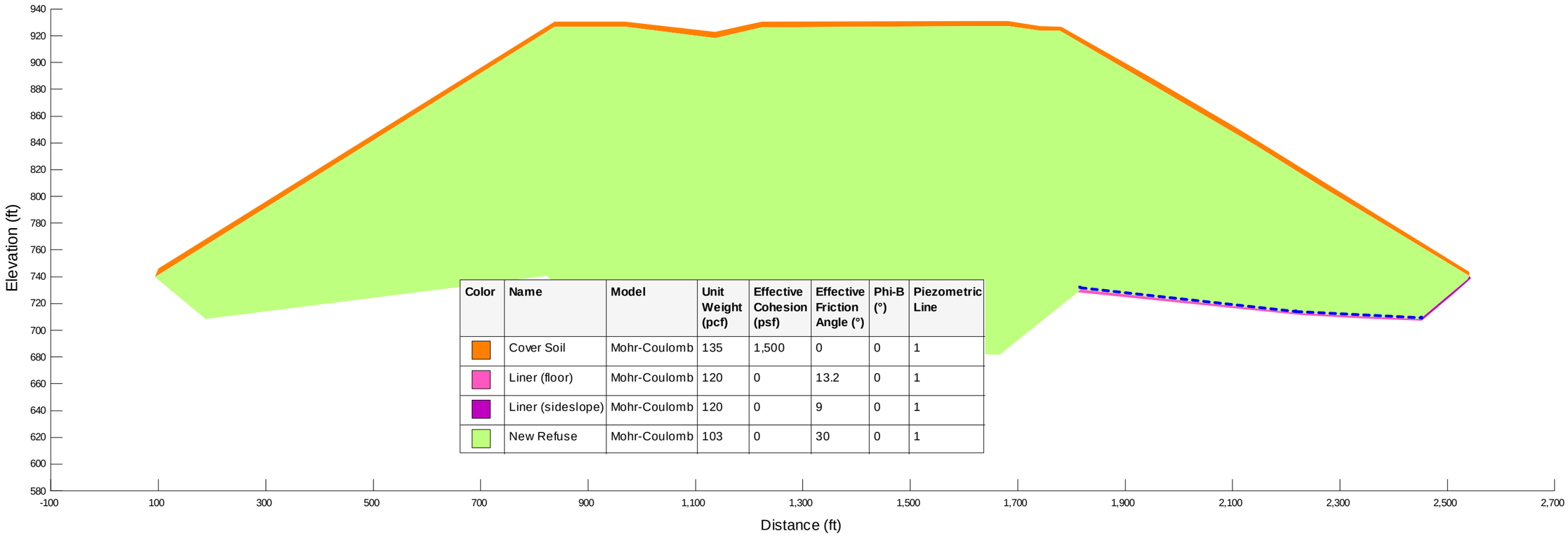
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0

Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section G-G'

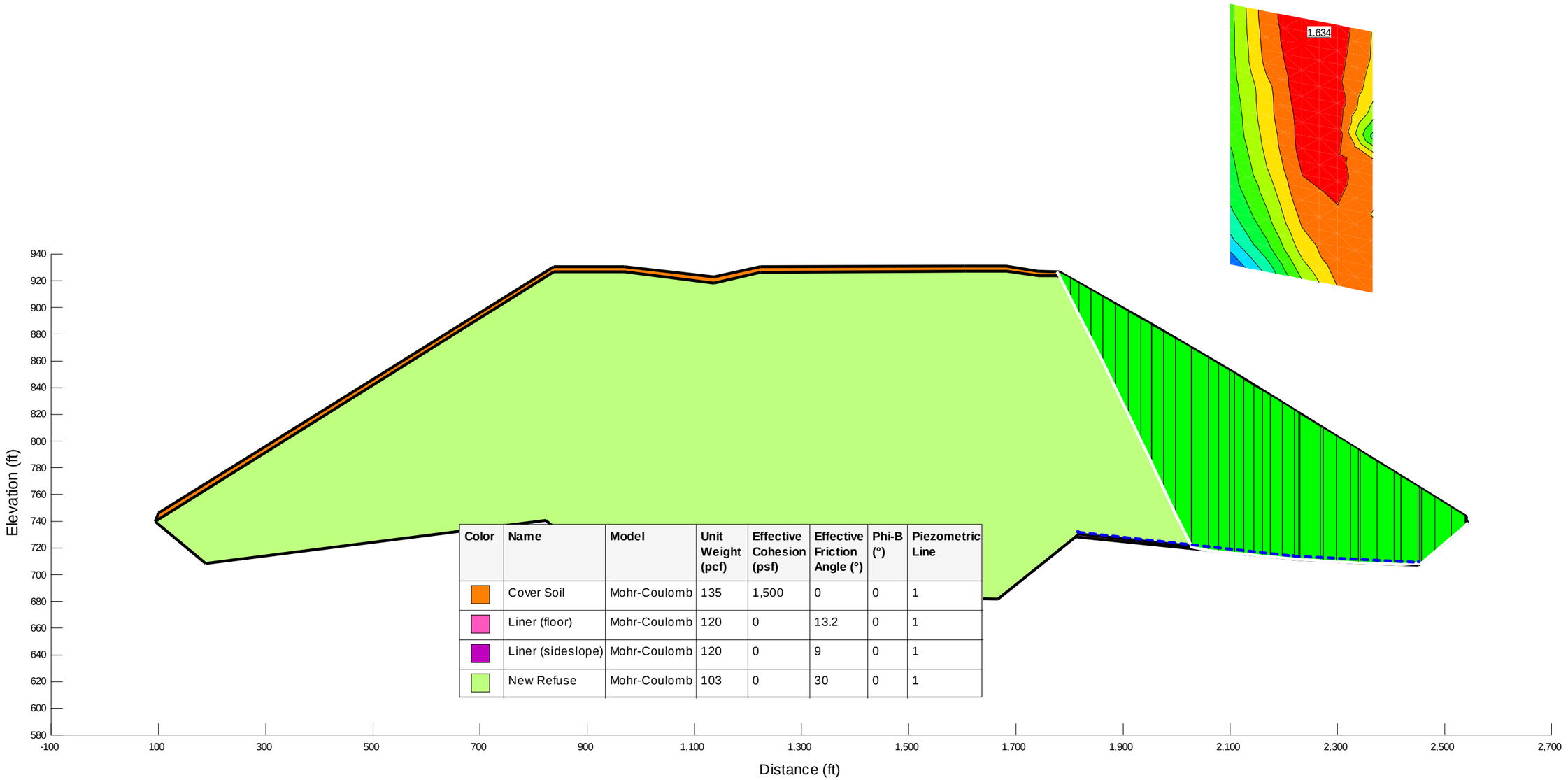
Plan View:



Factor of Safety:	1.6	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1
	New Refuse	Mohr-Coulomb	103	0	30	0	1



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1
	New Refuse	Mohr-Coulomb	103	0	30	0	1

Attachment A-1.1.5

C-C’ Liner Stability under Final Conditions with non-zero adhesion (previously tested values)

SLOPE STABILITY ANALYSIS REPORT FORM

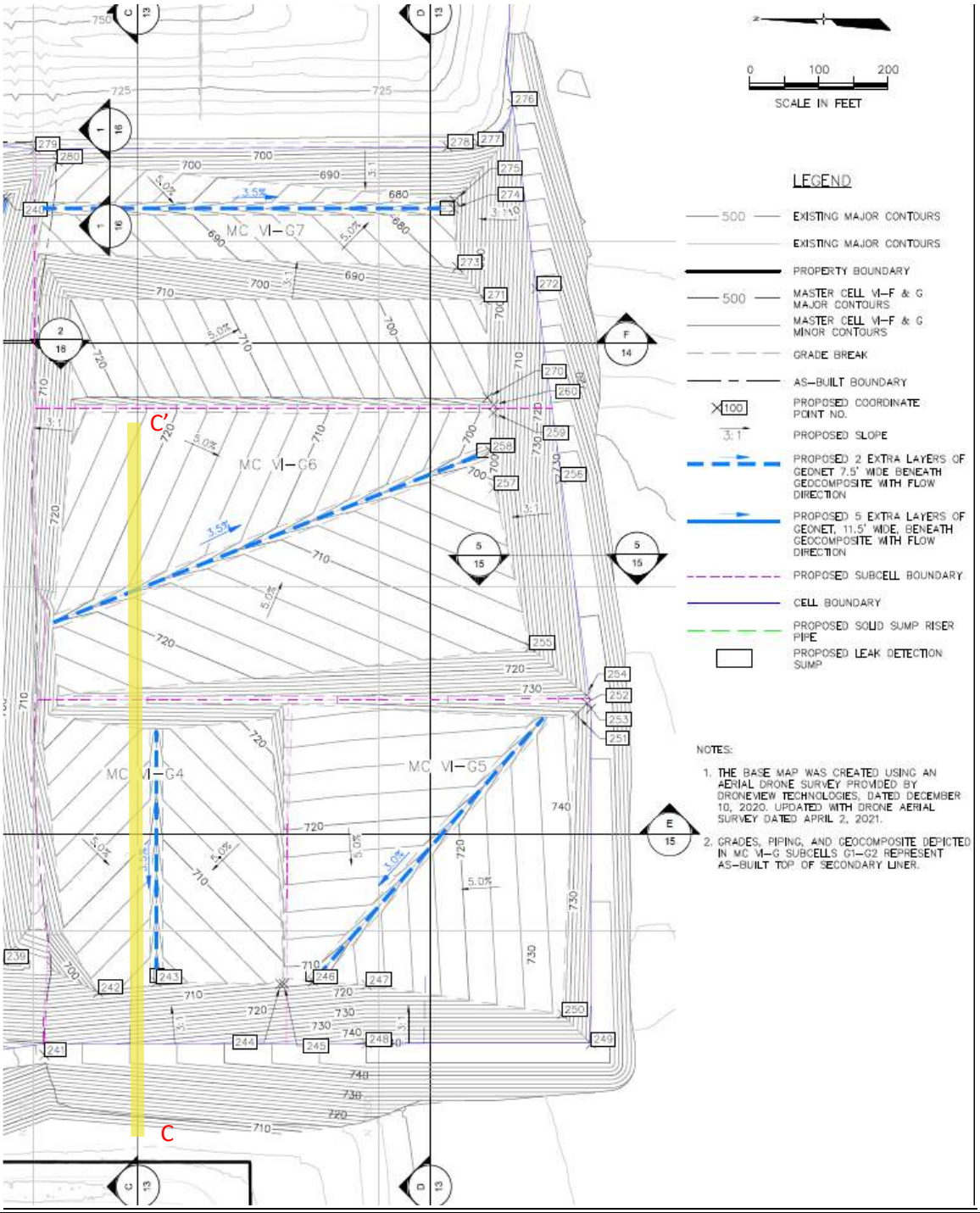
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	C-C' Liner Stability				**File name:**	MC-VI-G_CrossSection_C_Liner_tested_values.gsz	
Revision:	1	**Originated:**	MK	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the minimum required liner interface friction angle to achieve an acceptable factor of safety of the proposed final waste grades using cross-section C-C'. This case considers a west-facing slope, with fill to the final permitted grade elevations under undrained conditions.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The liner system was modeled in 2 sections (floor and sideslope) to allow use of Peak and Large-Displacement strength parameters appropriately. The liner interface strength properties are based on interface strength test results of a similar liner system installed on site. The required factor of safety of 1.5.		

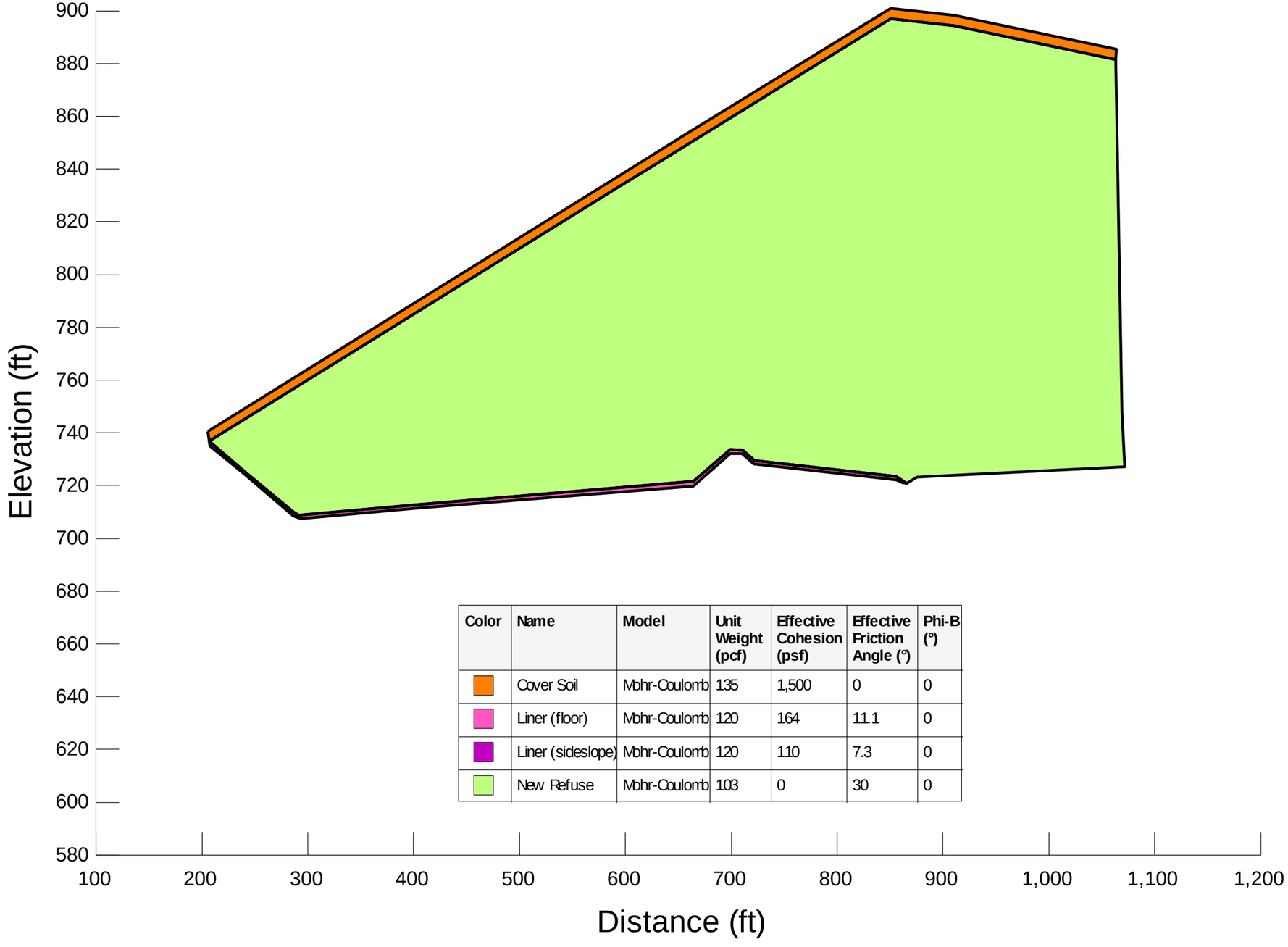
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	11.1	164
10	Liner (sideslope)	Magenta	120	7.3	110

Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section C-C'

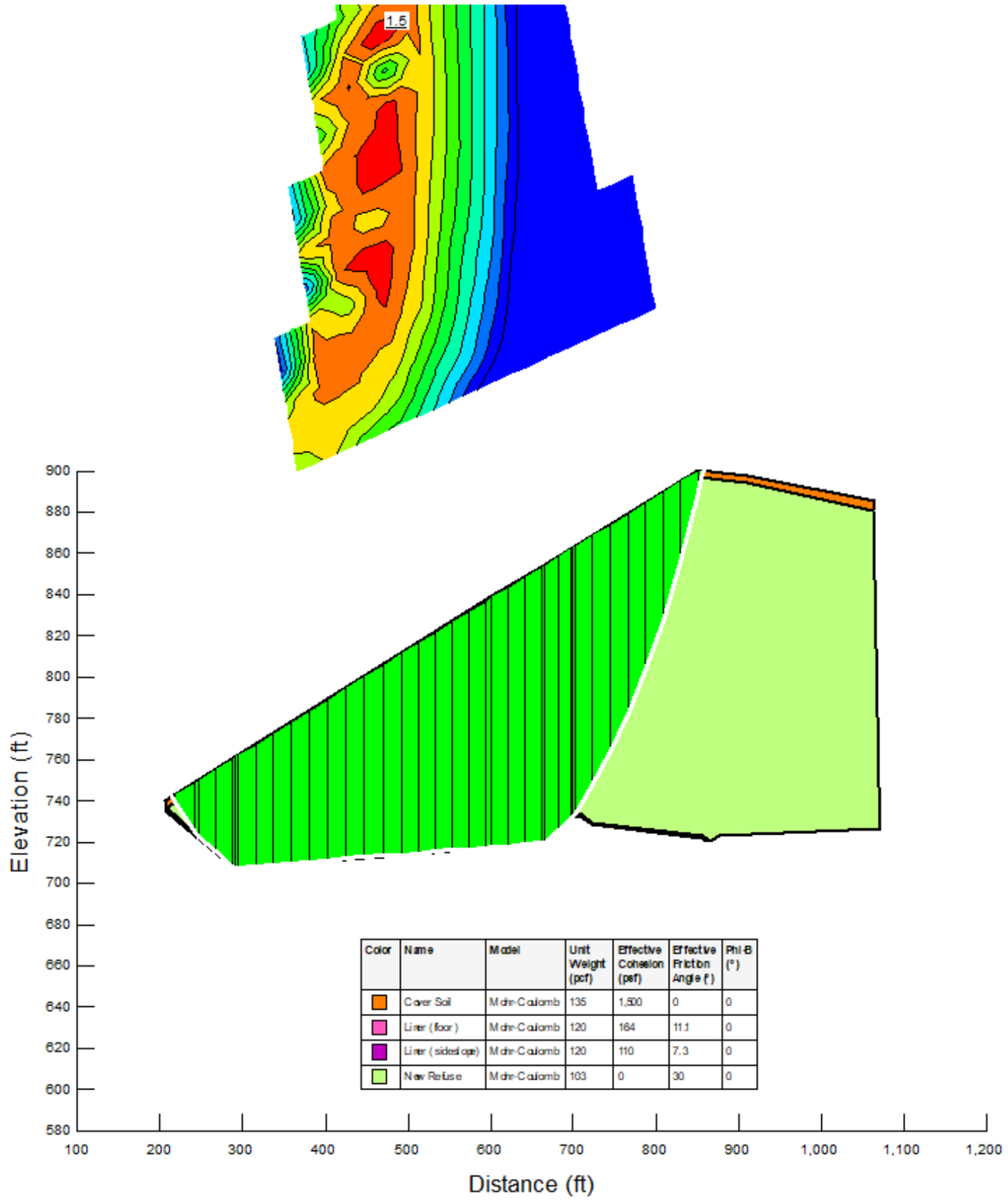
Plan View:



Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Cover Soil	Mohr-Coulomb	135	1,500	0	0
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0
	New Refuse	Mohr-Coulomb	103	0	30	0



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Cover Soil	Mohr-Coulomb	135	1,500	0	0
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0
	New Refuse	Mohr-Coulomb	103	0	30	0

Attachment A-1.1.6

G-G’ Liner Stability under Final Conditions with non-zero adhesion (previously tested values)

SLOPE STABILITY ANALYSIS REPORT FORM

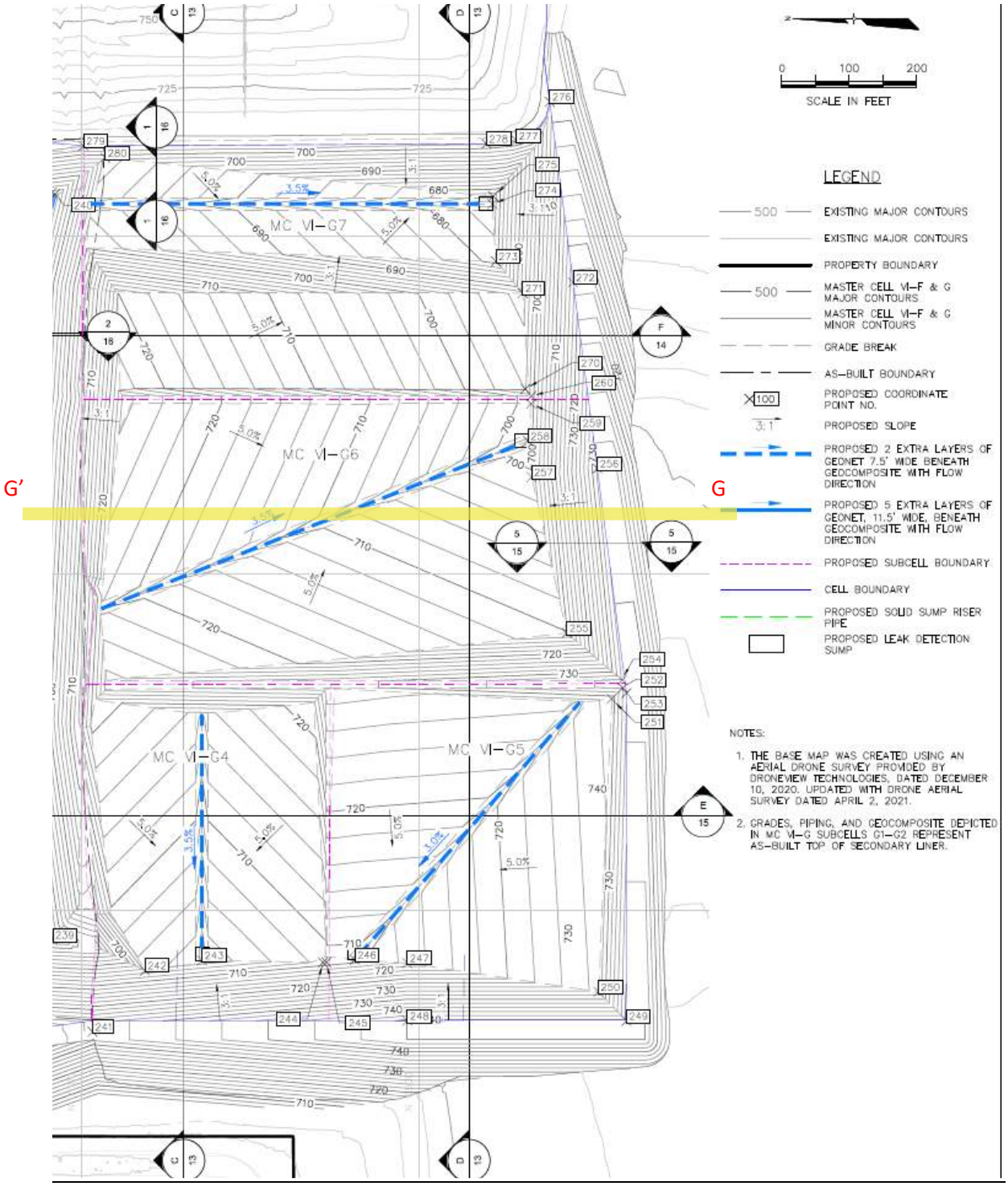
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	G-G' Liner Stability				**File name:**	MC-VI-G_CrossSection_G_Liner_tested_values.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a south-facing slope, with fill to the final permitted grade elevations.		
	☒ Static ☐ Seismic	☐ Pore Pressure	☒ Optimized Surface
Additional Details:	The liner system was modeled in 2 sections (floor and sideslope) to allow use of Peak and Large-Displacement strength parameters appropriately. The liner interface strength properties are based on interface strength test results of a similar liner system installed on site. The required factor of safety of 1.5.		

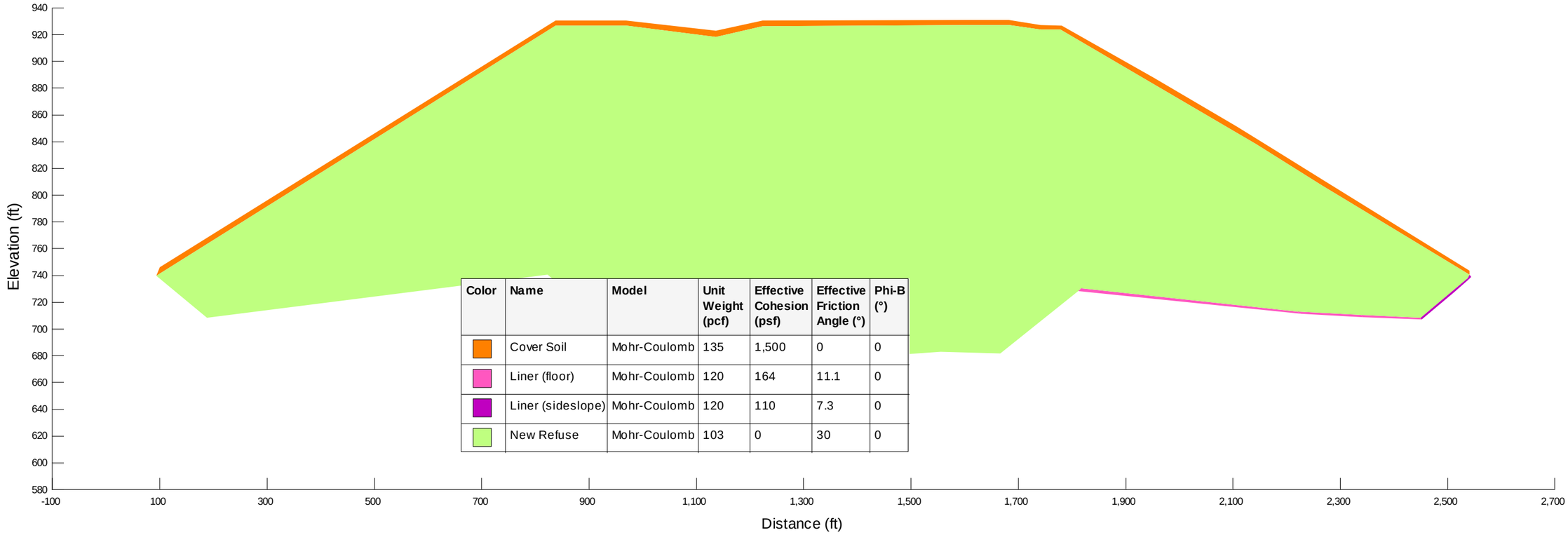
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	11.1	164
10	Liner (sideslope)	Magenta	120	7.3	110

Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section G-G'

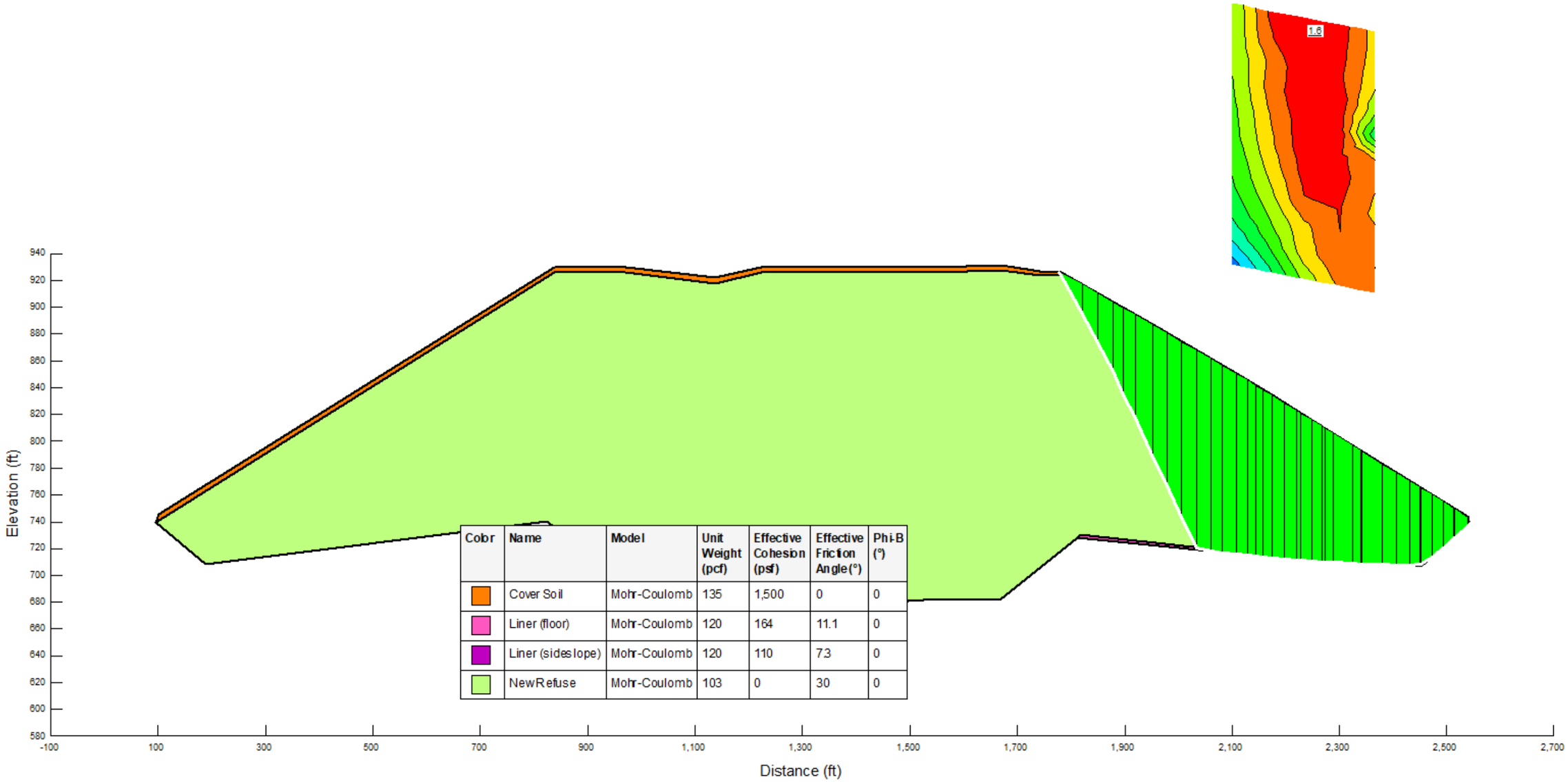
Plan View:



Factor of Safety:	1.6	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Cover Soil	Mohr-Coulomb	135	1,500	0	0
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0
	New Refuse	Mohr-Coulomb	103	0	30	0



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Cover Soil	Mohr-Coulomb	135	1,500	0	0
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0
	NewRefuse	Mohr-Coulomb	103	0	30	0

Attachment A-1.1.7

C-C’ Liner Stability under Interim Conditions (example interim stability calculation)

SLOPE STABILITY ANALYSIS REPORT FORM

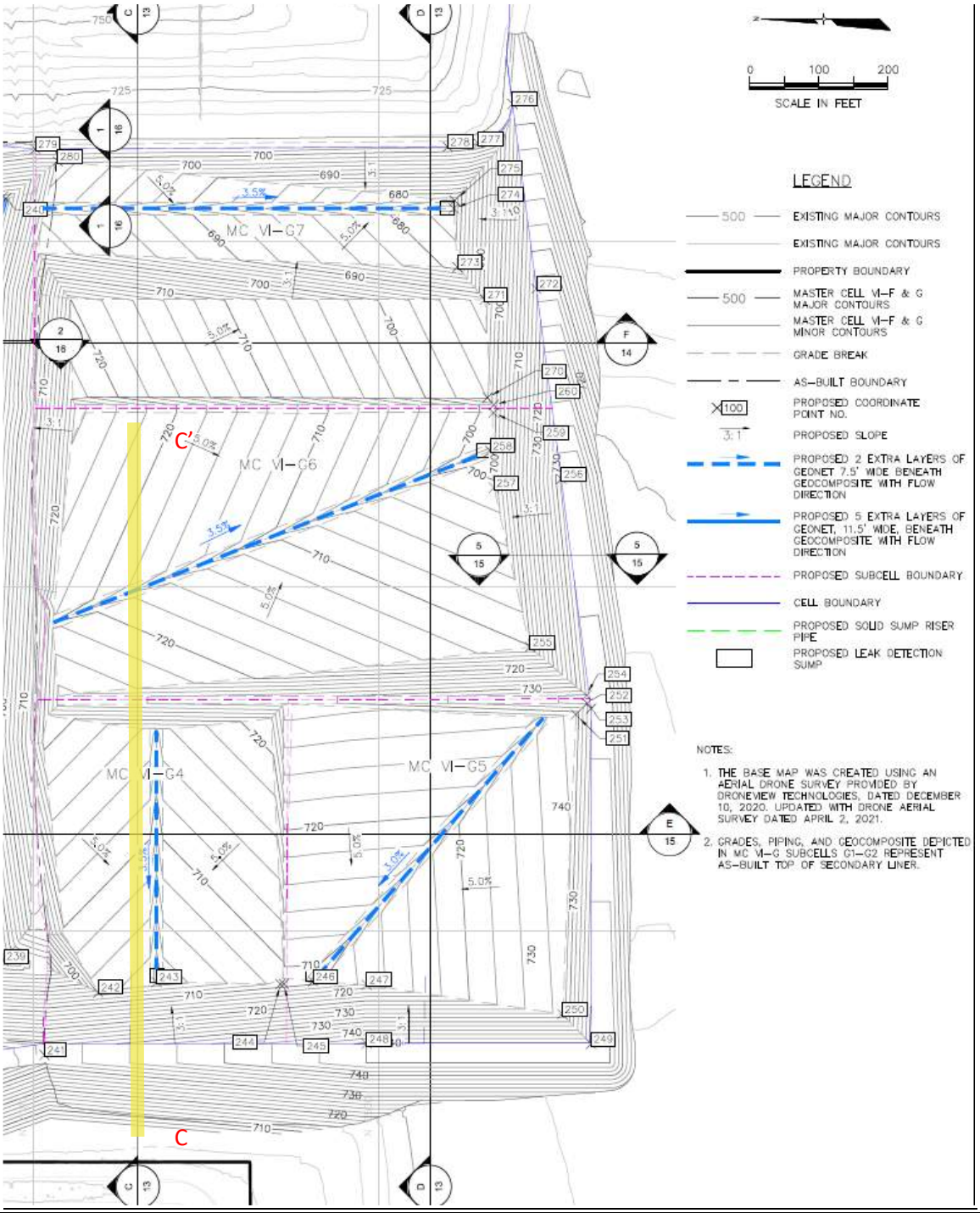
Project Name:	WDI MC-VI-G4 through G7 Liner Grade Modification						
Project Number:	1208070039.004			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	C-C' Liner Stability				**File name:**	MC-VI-G_CrossSection_C_InterimSlope.gsz	
Revision:	2	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the required interface friction angle of the liner system to achieve an acceptable interim factor of safety of 1.3 using cross-section C-C'. This case considers a west-facing slope, with fill to a design interim grade elevation of 840 ft at an interim slope of 3H:1V. The failure surface is defined such that failure occurs in the underlying liner in order to evaluate the stability of the liner system.		
	☒ Static ☐ Seismic	☐ Pore Pressure	☒ Optimized Surface
Additional Details:			

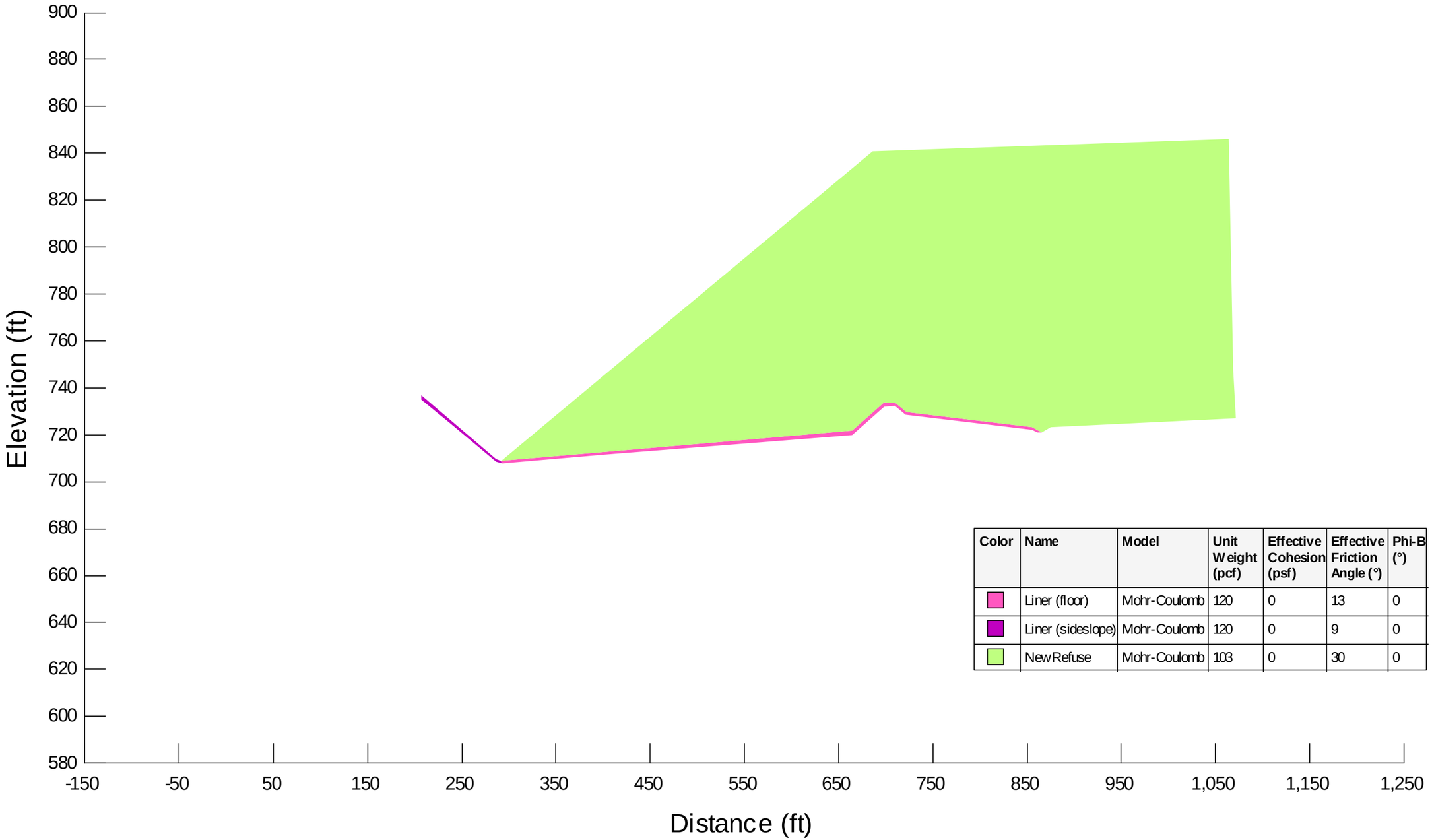
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	?	
10	Liner (sideslope)	Magenta	120		

Source of Geometry:	Engineering Drawing Set
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☒ Interim ☐ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Interim Waste Filling
Other Geometry Notes:	Cross Section C-C'

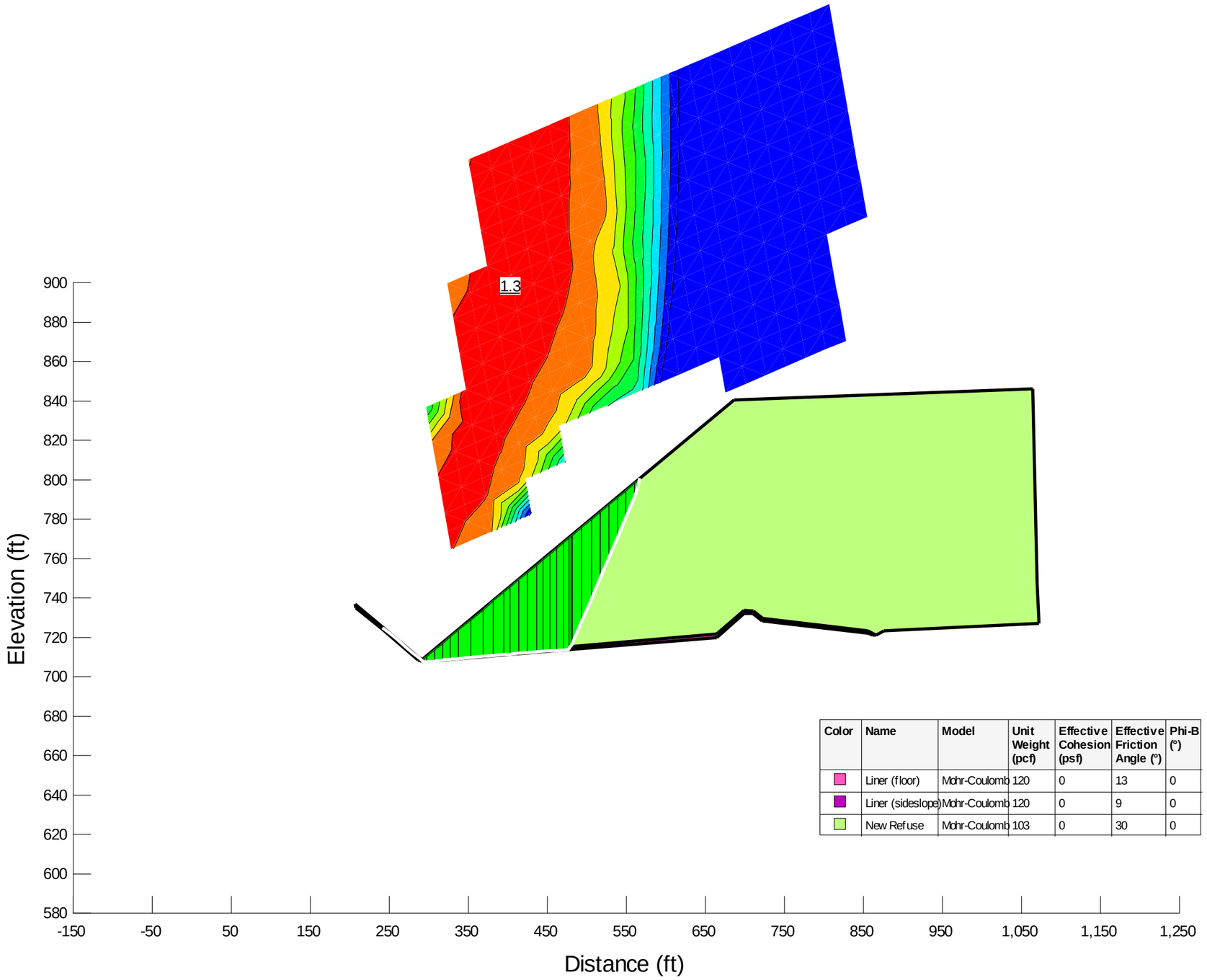
Plan View:



Factor of Safety:	1.3	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:	The required interface friction angle is 13 degrees (peak). Any combination of adhesion and friction angle that yields a comparable shear strength under modeled site conditions is acceptable.	
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Liner (floor)	Mohr-Coulomb	120	0	13	0
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0
	NewRefuse	Mohr-Coulomb	103	0	30	0



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)
	Liner (floor)	Mohr-Coulomb	120	0	13	0
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0
	New Refuse	Mohr-Coulomb	103	0	30	0

3. Attachment A-1.2 MC6 E and F Slope Stability Analysis

Original Submittal			
	Page	Revised Submittal	
		A-1.2	MC VI-E and -F Slope Stability Analysis
A-1.1	53	A-1.2.1	Traces of Cross Sections
A-1.2	57	A-1.2.2	G-G’ Foundation Stability
A-1.3	62	A-1.2.3	H-H’ Foundation Stability
A-1.4	67	A-1.2.4	I-I’ Foundation Stability
A-1.5	72	A-1.2.5	J-J’ Foundation Stability
A-1.6	77	A-1.2.6	G-G’ Liner Stability under Final Conditions with Zero Adhesion
A-1.7	82	A-1.2.7	H-H’ Liner Stability under Final Conditions with Zero Adhesion
A-1.8	87	A-1.2.8	I-I’ Liner Stability under Final Conditions with Zero Adhesion
A-1.9	92	A-1.2.9	J-J’ Liner Stability under Final Conditions with Zero Adhesion
A-1.10	97	A-1.2.10	I-I’ Liner Stability under Final Conditions with non-Zero Adhesion (previously tested values)
A-1.11	102	A-1.2.11	J-J’ Liner Stability under Final Conditions with non-Zero Adhesion (previously tested values)
A-1.12	107	A-1.2.12	I-I’ Liner Stability under Interim Conditions (example interim stability calculation)

Attachment A-1.2

MC VI-E and -F Slope Stability Analysis

Project Name:	WDI Final Cover Grading Modification	Client:	Wayne Disposal, Inc.
Project Number:	1208070017.003	Project Manager:	Chris Backus
Project Location:	Belleville, Michigan	QA Manager:	

Calculation Sheet Information

Calculation Medium: ☒ Electronic
☐ Hard copy Number of pages (including cover sheet):

Title of Calculation:	Slope Stability Analyses
Calculation Originator:	Mohammad Kabalan
Calculation Contributors:	Rajan Ramya, Kazuhisa Matsuda
Calculation Checker:	Kevin Foye

Calculation Objective

This calculation evaluates the stability of the Wayne Disposal, Inc. (WDI) landfill under the proposed modification to the final cover grading. The analyses include consideration of global slope stability for failures through the waste mass, along the liner system, and/or through the foundation soils at interim and final conditions. The analyses also determined the minimum required interface friction angle to attain a satisfactory factor of safety against failure at the liner system interface. Cross sections that are the most critical for analysis and design include cross sections with the steepest slopes and highest embankment (waste or soil) heights. The following critical cross sections were examined and traces of each cross section is provided in Attachment 1:

1. Cross Section G-G' oriented North-South passing through Cell MC-VI-F.
2. Cross Section H-H' oriented North-South at Easting 5300 and going through Cell MC VI-E and existing MC IV.
3. Cross Section I-I' oriented East-West and going through Cell MC VI-G, Sub Cell G1.
4. Cross Section J-J' oriented East-West and going through Cell MC VI-G, Sub Cell G2.

Assumptions and Open Items

1. Representative total and effective stress shear strength parameters were used for all layers in the profile. Material properties were retrieved from existing site data (NTH 2012) and are presented in Table 1. For slow-draining clay soils, undrained shear strength (total stress analysis) was used because pore pressures accumulating during shear will not be able to dissipate in these soils. In contrast, drained strength parameters (effective stress analysis) were used for waste and granular soil layers because these materials will dissipate excess pore pressures during shear. Therefore, both undrained and drained shear strength parameters are used in the same slope stability analysis, depending on the layer being modeled. Strength properties for the lower clay were modeled as a relationship of undrained shear strength to vertical effective stress. An undrained shear strength to vertical effective stress ratio of 0.22 was used to calculate undrained shear strength for the lower clay in accordance with existing analyses (NTH 2012) to account for increases in clay shear strength resulting from increased overburden pressure.

Table 1: Material Properties

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover (total stress analysis)	Orange	135	0	1500
2	Existing Waste (effective stress analysis)	Teal	91	34	0
3	New Waste (effective stress analysis)	Light Green	103[A]	30	0
4	Upper Clay (total stress analysis)	Brown	130	0	1325
5	Middle Clay (total stress analysis)	Yellow	136	0	3000
6	Lower Clay (total stress analysis)	Maroon	128	$0.22\sigma'_v$	
7	Silt (effective stress analysis)	Blue	125	28	0
8	Sand (effective stress analysis)	Red	115	32	0
9	Liner (floor) (effective stress analysis)	Magenta	120	13.2	0
10	Liner (sideslope) (effective stress analysis)	Magenta	120	9	0
11	Existing MC V Waste (effective stress analysis)	Teal	120	28[B]	0

Notes:
[A] conservative (high) value of unit weight of waste was estimated from site survey data (see table below). Note that higher values of waste unit weight result in a lower FS because newly-placed waste imposes a greater driving load.
[B] MC V waste properties as reported in NTH (2008).
All other properties obtained from NTH (2012).

2. For liner system stability cases, the domain of the slip surfaces are defined so that a portion of the failure surface conforms to the liner system.
3. Applicable data used in the analysis that was provided by third parties is assumed to be accurate.

Site Waste Survey Data

Survey Years	2014 to 2021
Tons received into the landfill	3,905,856
Cubic yards airspace consumed	2,869,499
Average Unit Weight (tons/cy)	1.36
Average Unit Weight (pcf)	100.83

Design Criteria/Design Basis

1. The minimum allowable factor-of-safety (FS) against slope stability failures is 1.5 for final conditions and 1.3 for interim conditions.
2. The analyses were conducted using the computer program SLOPE/W within the software package GeoStudio 2021 by GEOSLOPE International Ltd. This program performs an automatic search to identify a critical failure surface that has the lowest FS value.
3. The analyses were conducted using the Morgenstern-Price method, which considers both moment and force equilibrium.
4. The geometry of the cross sections was derived from the engineering drawing set submitted as part of the permit mod package.
5. The required/assumed interface friction angles shall be met by considering peak strength values for the cell floor and large-displacement strength values for the cell sideslopes.
6. The required minimum interface friction angle for the liner system components is determined under the final conditions (after final cover is installed).
7. Due to the complex nature of the waste fill phasing during operation, the liner stability shall be evaluated based on the actual measurements of the interface friction angle for the liner system components and the design waste filling geometry for each phase. An example one such calculation was prepared to illustrate how to evaluate required minimum interface friction angle for the liner system components. This example analysis was performed on cross section J-J' assuming an interim waste slope of 3H:1V.
8. The example interim slope stability calculation performed for cross section J-J' is considered a worst-case for translational slides on the cell floor because the analysis does not take credit for the stabilizing effect of any cell side slope or toe buttress resisting movement along the liner system. Therefore, for the conditions presented, interim slopes that are constructed no steeper than 3H:1V and with a bottom width no less than 450 feet (measured from the toe of intercell berm to the interim face of the waste slope) shall be considered acceptable for waste filling operations. If tested values of the cell floor liner system interface strength vary from those presented, or the filling geometry deviates from this case, the interim slope shall be reevaluated according to this example to determine if the alternative waste filling geometry meets the stability criterion. Interim filling geometries that do meet the interim stability criterion shall be adjusted and reevaluated until acceptable FS values are obtained.

Results/Conclusions

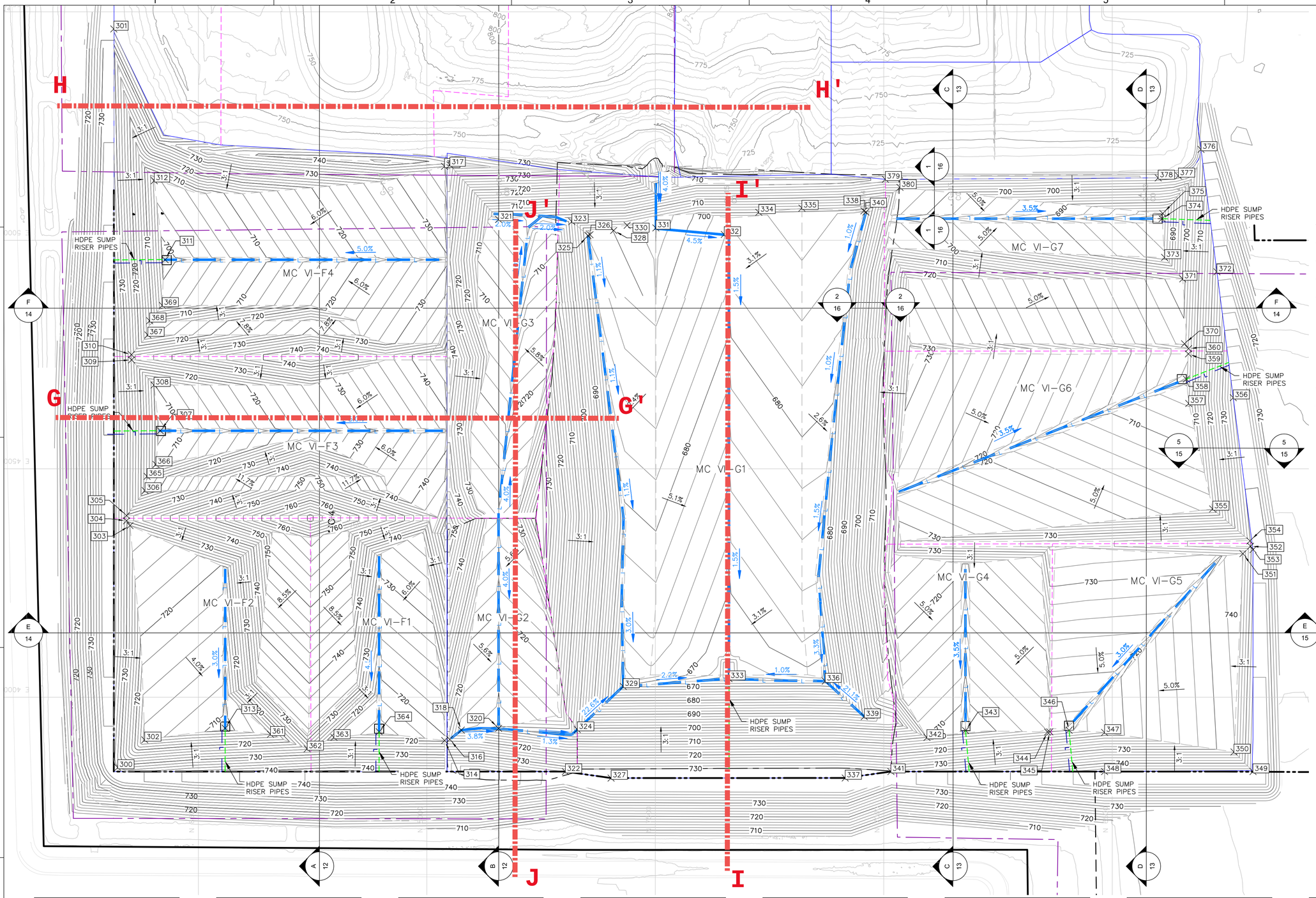
1. Global slope stability analyses of the waste and foundation for each cross section determined that filling to proposed final grades yields acceptable factors of safety.
    a. Cross Section G-G': Factor of Safety = 1.7
    b. Cross Section H-H': Factor of Safety = 1.6
    c. Cross Section I-I': Factor of Safety = 1.5
    d. Cross Section J-J': Factor of Safety = 1.5
2. Under the final conditions (after installation of final cover), the stability of the landfill along the liner system was analyzed. The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. These parameters are shown in Table 1 and are considered values that could be typically achieved with commercial geosynthetic products. Any combination of adhesion and friction angle resulting in comparable shear strength under representative normal stresses to final site conditions are also acceptable. Conformance testing of the selected geosynthetics shall be performed to confirm that the interface shear strength of the actual liner system components is sufficient to ensure the stability of the liner system.
    a. Cross Section G-G': Factor of Safety = 1.7
    b. Cross Section H-H': Factor of Safety = 1.8
    c. Cross Section I-I': Factor of Safety = 1.8
    d. Cross Section J-J': Factor of Safety = 1.7
3. For Cells that have already been constructed, A stability analysis using lab interface shear strength tests results from previous products used on site was performed. The analyses show that a combination of **$C_{\alpha,peak}$=164 psf / ϕ_{peak}=11.1° and $C_{\alpha,large\ displacement}$=110 psf / $\phi_{large\ displacement}$=7.3°** achieves an acceptable factor of safety.
    a. Cross Section I-I': Factor of Safety = 1.7
    b. Cross Section J-J'': Factor of Safety = 1.5
4. An example calculation of liner stability for an interim waste filling conditions is presented in Attachment A-1.2.12. The required interface friction angle for the floor liner system was determined to be 14 degrees (peak). Actual interim phasing plan slopes and tested liner system interface properties shall be evaluated for each phase of fill per this example.
5. Interim slopes that are constructed no steeper than 3H:1V and with a bottom width no less than 450 feet shall be considered acceptable for waste filling operations. If tested values of the cell floor liner system interface strength vary from those presented, or the filling geometry deviates from this case, the interim slope shall be reevaluated according to this example.

Source Documents and References
NTH (2008). Basis of Design Report. *Master Cell VI E Design Modification* NTH (2012). *WDI Operating License Application Master Cells VI F & G Volume III – Basis of Design Report* Qian, X., Gray, D.H., and Koerner, R.M. (2002) *Geotechnical Aspects of Landfill Design and Construction.*

Attachments
A-1.2.1. Traces of Cross Sections A-1.2.2. G-G' Foundation Stability A-1.2.3. H-H' Foundation Stability A-1.2.4. I-I' Foundation Stability A-1.2.5. J-J' Foundation Stability A-1.2.6. G-G' Liner Stability under Final Conditions with zero adhesion A-1.2.7. H-H' Liner Stability under Final Conditions with zero adhesion A-1.2.8. I-I' Liner Stability under Final Conditions with zero adhesion A-1.2.9. J-J' Liner Stability under Final Conditions with zero adhesion A-1.2.10. I-I' Liner Stability under Final Conditions with non-zero adhesion (previously tested values) A-1.2.11. J-J' Liner Stability under Final Conditions with non-zero adhesion (previously tested values) A-1.2.12. I-I' Liner Stability under Interim Conditions (example interim stability calculation)

Attachment A-1.2.1

Traces of Cross Sections



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — MASTER CELL VI–F & G MAJOR CONTOURS
- MASTER CELL VI–F & G MINOR CONTOURS
- GRADE BREAK
- 100 — PROPOSED DIKE COORDINATE POINT NO.
- 3:1 — PROPOSED SLOPE
- PROPOSED SUBCELL BOUNDARY
- CELL BOUNDARY
- AS–BUILT BOUNDARY
- PROPOSED LEACHATE COLLECTION PIPE AND FLOW DIRECTION
- PROPOSED LEACHATE CLEANOUT PIPE
- PROPOSED PRIMARY COLLECTION SUMP
- PROPOSED SOLID SUMP RISER PIPE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES, PIPING, AND GEOCOMPOSITE DEPICTED IN MC VI–G SUBCELLS G1–G2 REPRESENT AS–BUILT TOP OF SECONDARY LINER.

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
300	8676.40	3846.28	734.54
301	8685.01	5462.64	728.25
302	8617.38	3906.71	712.94
303	8649.60	4375.66	727.86
304	8657.24	4386.11	730.42
305	8657.19	4397.62	730.43
306	8616.71	4452.40	717.06
307	8583.27	4583.16	706.16
308	8597.12	4683.16	709.89
309	8646.14	4738.22	725.58
310	8646.48	4749.72	725.56

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
311	8572.76	4957.47	697.64
312	8596.51	5130.39	703.29
313	8441.35	3932.29	707.95
314	7960.91	3905.27	719.50
315	7961.26	5161.96	736.10
316	7949.75	3907.70	718.61
317	7949.45	5164.97	738.31
318	7924.50	3928.02	711.75
319	7904.56	5051.05	703.11
320	7842.87	3931.97	708.82
321	7842.87	5045.77	700.84

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
322	7696.73	3837.32	733.74
323	7682.58	5040.91	697.50
324	7670.57	3929.29	702.88
325	7647.35	5010.49	687.00
326	7642.85	5012.25	688.18
327	7596.74	3823.09	738.60
328	7591.06	5021.51	690.24
329	7570.10	4023.55	671.56
330	7561.67	5032.75	691.59
331	7498.71	5027.05	693.52
332	7349.00	5012.85	686.42

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
333	7338.74	4040.74	666.42
334	7273.49	5061.28	687.73
335	7179.18	5070.45	689.94
336	7128.04	4035.19	668.55
337	7084.38	3823.30	739.24
338	7043.49	5064.48	687.10
339	7042.63	3957.62	692.90
340	7038.96	5061.69	685.79
341	6984.38	3837.32	732.38
342	6905.54	3911.96	710.13
343	6821.02	3927.03	707.63

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
344	6641.59	3923.81	713.92
345	6636.63	3924.19	713.94
346	6594.37	3927.75	714.00
347	6516.74	3922.88	717.86
348	6516.74	3837.32	746.00
349	6191.88	3837.32	746.00
350	6233.58	3880.28	731.87
351	6214.04	4314.26	734.09
352	6197.41	4330.56	739.73
353	6191.88	4323.06	741.29
354	6198.61	4342.06	739.71

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
355	6280.17	4412.07	715.30
356	6235.08	4655.62	738.04
357	6332.61	4642.95	705.70
358	6337.83	4696.24	703.34
359	6333.17	4751.42	704.26
360	6332.82	4762.92	704.25
361	8342.16	3918.88	713.80
362	8261.82	3887.00	725.54
363	8203.29	3912.03	718.03
364	8104.44	3924.55	713.57
365	8612.28	4483.38	715.64

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
366	8592.85	4509.67	709.22
367	8610.47	4793.01	713.10
368	8606.52	4823.99	711.44
369	8578.86	4857.57	701.75
370	6341.76	4773.54	701.15
371	6345.63	4915.50	698.23
372	6270.86	4931.07	722.96
373	6385.28	4962.52	684.48
374	6390.87	5047.34	681.65
375	6389.40	5058.83	682.01
376	6305.65	5198.88	708.30

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
377	6355.11	5141.16	707.90
378	6399.40	5136.66	707.80
379	6996.47	5133.58	710.19
380	6964.50	5115.83	704.17

REVISIONS					
REV	DATE	DRN	APP		
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ	XZ
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR COMMENTS	LEH	XZ	XZ
F	05/28/21	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ	XZ
E	5/29/18	ADDENDUM 1	PAA	XZ	XZ
D	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ	XZ
C	9/23/11	PER MDEQ COMMENTS			DRL
B	6/10/11	PHASING DESIGNATIONS			DRL
A	6/10/11	REVISION DESCRIPTION	DRN	APP	

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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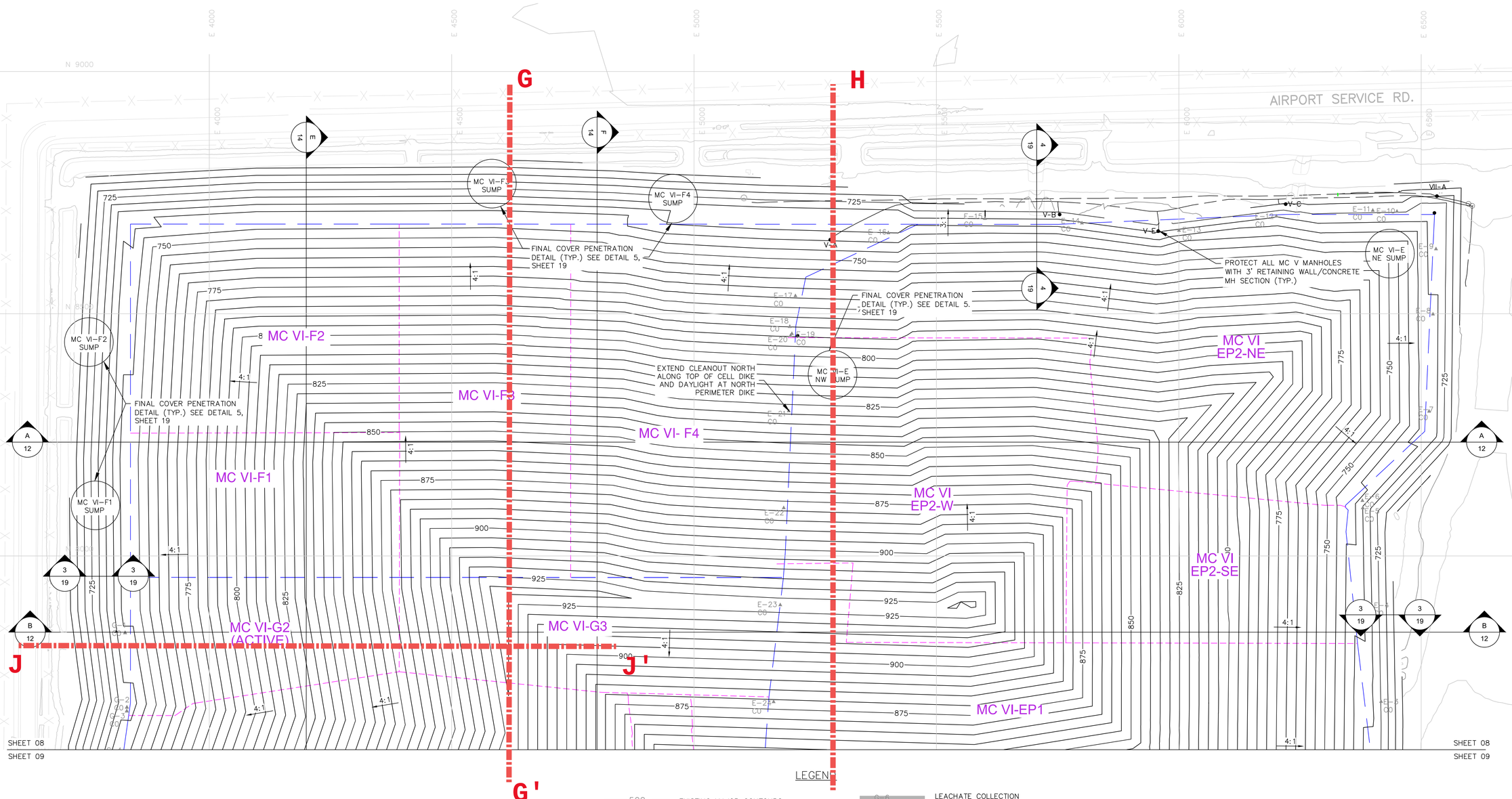
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI - REV I
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF PRIMARY LINER GRADING PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
06



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — PERMITTED TOP OF FINAL COVER MAJOR CONTOURS
- PERMITTED TOP OF FINAL COVER MINOR CONTOURS
- EXISTING GRADE BREAKLINES
- EXISTING LEACHATE FORCEMAIN
- SUBCELL BOUNDARY
- CELL BOUNDARY
- LEACHATE COLLECTION SYSTEM CLEANOUTS
- EXISTING MANHOLES
- PROPOSED SUMP LOCATION AND COVER PENETRATION

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.

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DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION		
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	06/17/21	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
E	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ
C		REVISION DESCRIPTION	DRN	APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI - REV I
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
08

SHEET 08
SHEET 09

MC VI-G1
MC VI-G1 EP2
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-B
MC VI A-N
MC VI-C
MC VI-D
MC VI A-S

MC VI-G4 SUMP
MC VI-G5 SUMP
MC VI-G6 SUMP
MC VI-G7 SUMP
MC VI-E SW SUMP
MC VI-E SE SUMP
MC VI-B SUMP RISER
MC VI-C SUMP RISER (SEE NOTE 3)
MC VI-B LEAK DETECTION RISER
MC VI-AN LEAK DETECTION RISER
MC VI-AN SUMP RISER
MC VI-AS SUMP RISER
MC VI-AS LEAK DETECTION RISER
MC VI-C LEAK DETECTION RISER
MC VI-D SUMP RISER
MC VI-D LEAK DETECTION RISER

FINAL COVER PENETRATION DETAIL (TYP.) SEE DETAIL 5, SHEET 19

CLEANOUT EXTENSION SEE DETAIL 7, SHEET 17

LEACHATE SUMP RISER PIPING DETAIL (TYP.) SEE DETAIL 5, SHEET 19

OUTLET SWALE CROSS SECTION (TYP.) SEE DETAIL 4, SHEET 20

N

0 100 200
SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — PERMITTED TOP OF FINAL COVER MAJOR CONTOURS
- PERMITTED TOP OF FINAL COVER MINOR CONTOURS
- EXISTING VEGETATION
- EXISTING GRADE BREAKLINES
- EXISTING LEACHATE FORCEMAIN
- SUBCELL BOUNDARY
- CELL BOUNDARY
- PROPOSED GEOCOMPOSITE (TRANSMISSIVITY 5.0 X 10^{-4} M^2/S)
- G-6 CO — LEACHATE COLLECTION SYSTEM CLEANOUTS
- EXISTING LEAK DETECTION OR SUMP RISERS
- PROPOSED SUMP LOCATION AND COVER PENETRATION

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. CLEANOUTS IN MC VI-AN, AS, B, C, AND D ARE TO BE ABANDONED EXCEPT B1, C1, D1 THROUGH D3, D14, D17, D18, AND AS1.
3. BEFORE PLACING WASTE AROUND MC VI-C SUMP RISER, A MONITORING PROGRAM SHOULD BE IMPLEMENTED TO MONITOR ITS FUNCTIONALITY.
4. PRIOR TO PLACING WASTE AROUND CLEANOUTS E-22 THROUGH E-26, THE CLEANOUTS SHOULD BE EVALUATED TO DETERMINE IF THE LEACHATE COLLECTION LINE CAN BE CLEANED BY A SINGLE ACCESS POINT. IF NOT, THE CLEANOUT SHOULD BE EXTENDED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	05/28/21	SUBCELLS G2 AND G3 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
C	5/02/18	F1-F4 REVISIONS AND G2 AND G3 REVISIONS	P.A.A.	DRL
A	6/10/11	PHASING DESIGNATIONS		

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI - REV I
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (2 OF 2)

PROJECT NUMBER 1218070017
SCALE 1" = 100'
DRAWING NO 09

Attachment A-1.2.2

G-G’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	G-G' Foundation Stability				**File name:**	MC-VI-F_CrossSection_G_Foundation.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. The groundwater level was set at elevation 655 based on historical borings as documented in the Basis of Design report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressure may accumulate after loading. This is considered a conservative approach for this scenario.		

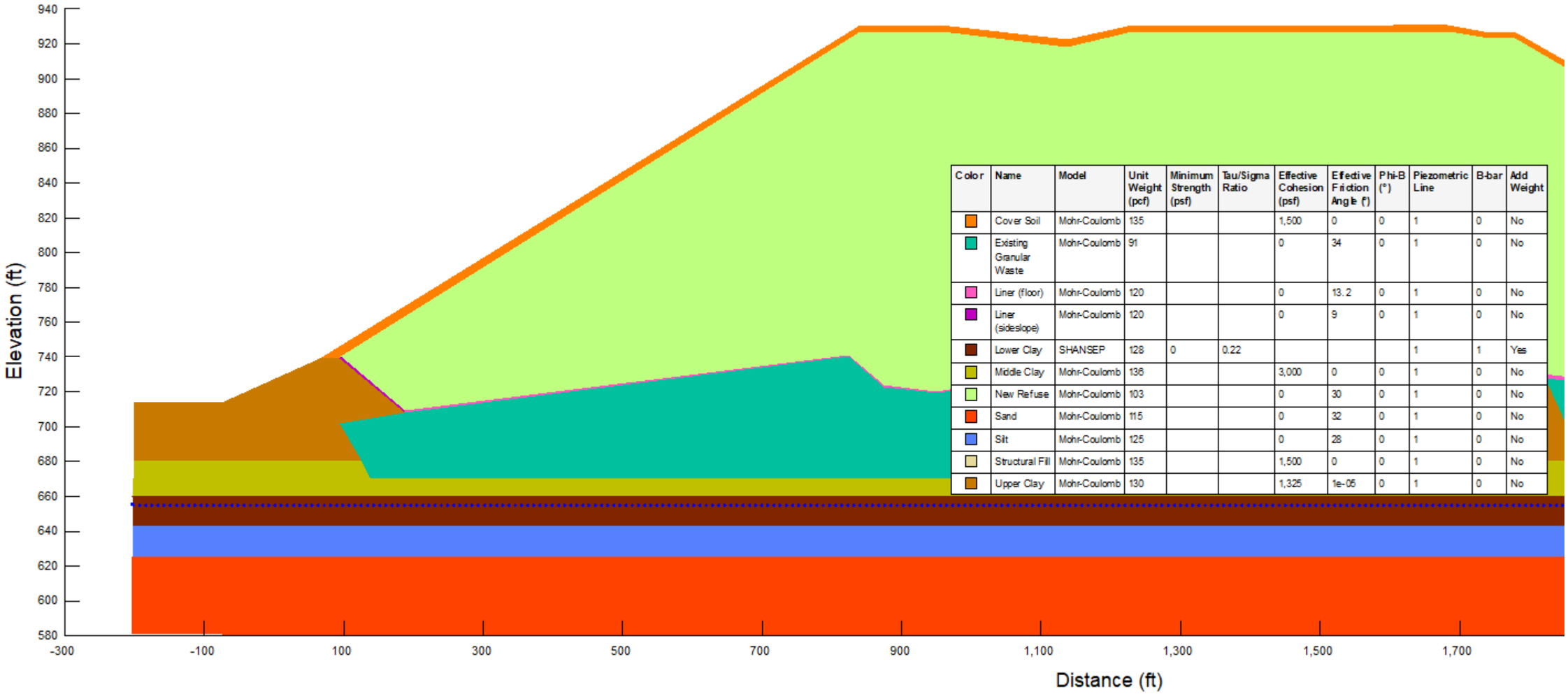
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	

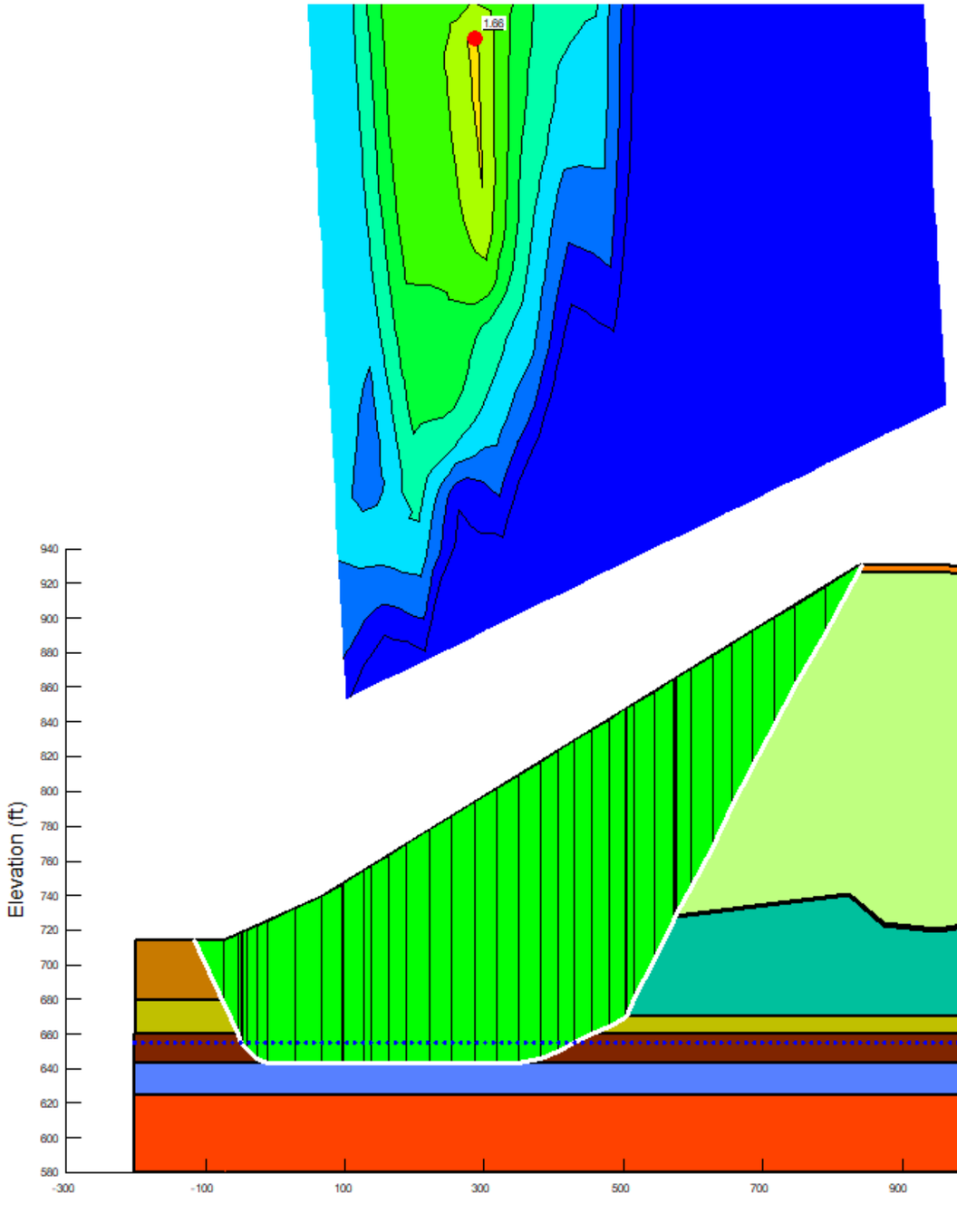
SLOPE STABILITY ANALYSIS REPORT FORM

Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section G-G’

Factor of Safety:	1.7	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	1e-05	0	1	0	No



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Structural Fill	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	1e-05	0	1	0	No

Attachment A-1.2.3

H-H’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	H-H' Foundation Stability				**File name:**	MC-VI-E_CrossSection_H_Foundation.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section H-H'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. The groundwater level was set at elevation 655 based on historical borings as documented in the Basis of Design report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressures may accumulate after loading. This is considered a conservative approach for this scenario.		

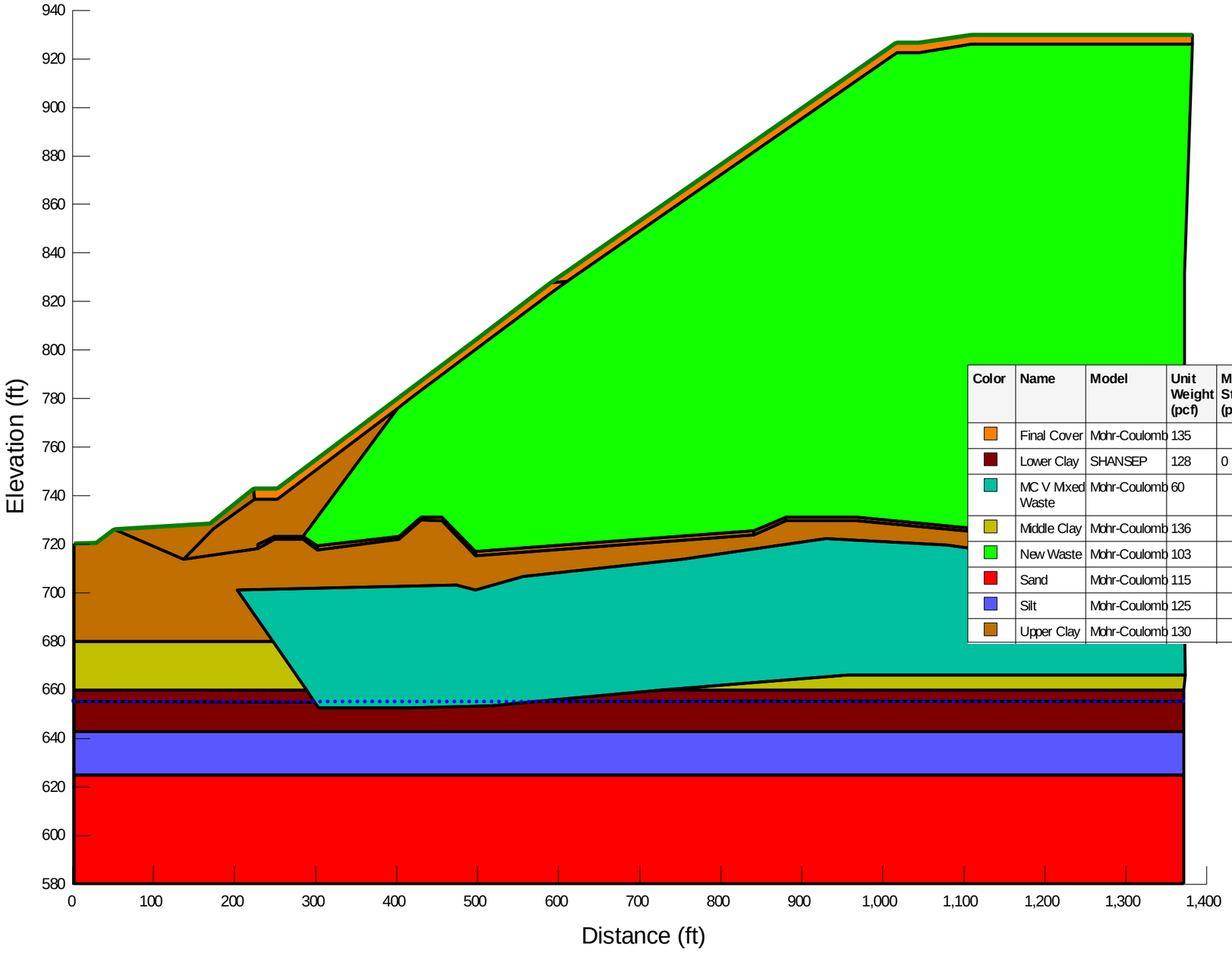
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The overfill liner elevations are from Master Cell VI-E Design Modification Plans, Wayne Disposal Inc., Site No. 2 by NTH Consultants (2011) and Master Cell VI Design Modification Plans. Wayne Disposal, Inc. Site No. 2 by NTH Consultants (2008).

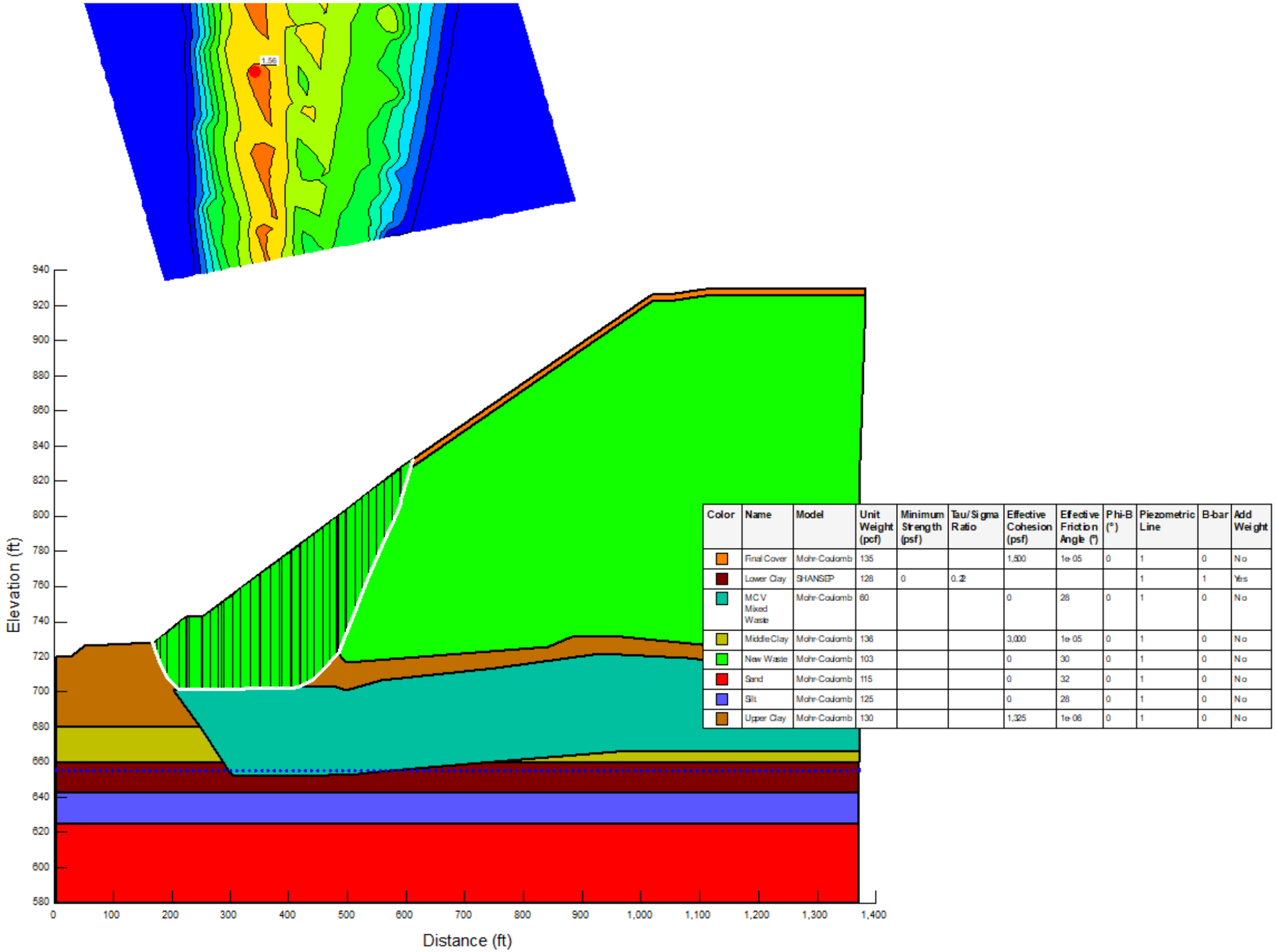
SLOPE STABILITY ANALYSIS REPORT FORM

	The elevations for bottom and top of existing waste are from Appendix A Settlement Analysis, WDI MC VI-E Major Design Modification by NTH Consultants (2008). The proposed final cover elevations are from WDI MCVI-E/F Final Cover Proposed Grading Plan by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section H-H'

Factor of Safety:	1.6	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Final Cover	Mohr-Coulomb	135			1,500	1e-05	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	MC V Mixed Waste	Mohr-Coulomb	60			0	28	0	1	0	No
	Middle Clay	Mohr-Coulomb	136			3,000	1e-05	0	1	0	No
	New Waste	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	1e-06	0	1	0	No



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Final Cover	Mohr-Coulomb	135			1,500	1e-05	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	MCV Mixed Waste	Mohr-Coulomb	60			0	28	0	1	0	No
	Middle Clay	Mohr-Coulomb	136			3,000	1e-05	0	1	0	No
	New Waste	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	1e-06	0	1	0	No

Attachment A-1.2.4

I-I’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	I-I' Foundation Stability				**File name:**	MC-VI-G1_CrossSection_I_Foundation.gsz	
Revision:	1	**Originated:**	MK	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section I-I'. This case considers a west-facing slope, with fill to the final proposed grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. The groundwater level was set at elevation 655 based on historical borings as documented in the Basis of Design report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressures may accumulate after loading. This is considered a conservative approach for this scenario.		

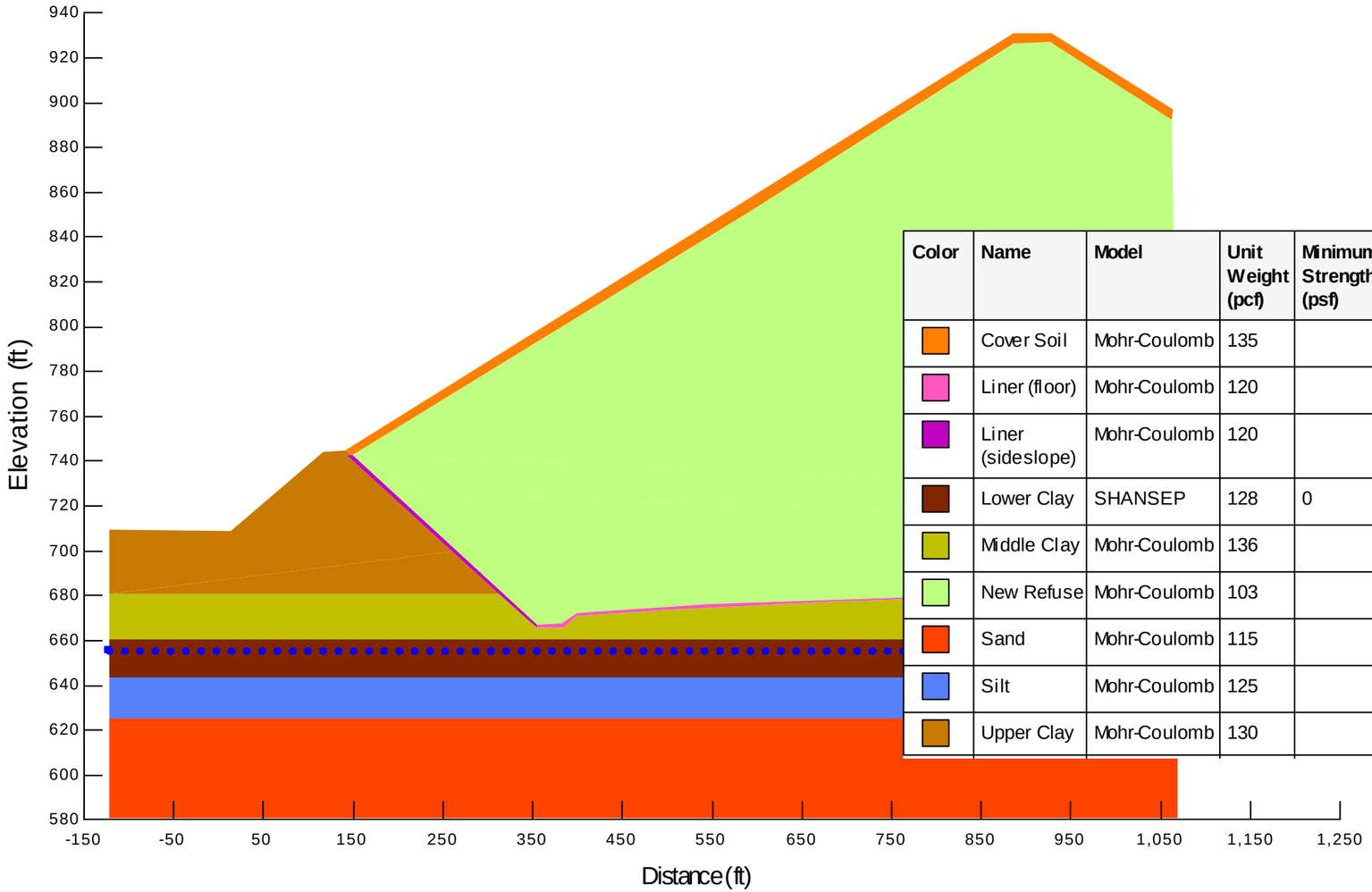
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	

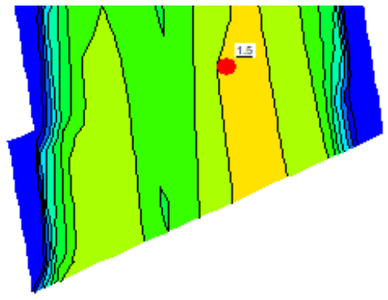
SLOPE STABILITY ANALYSIS REPORT FORM

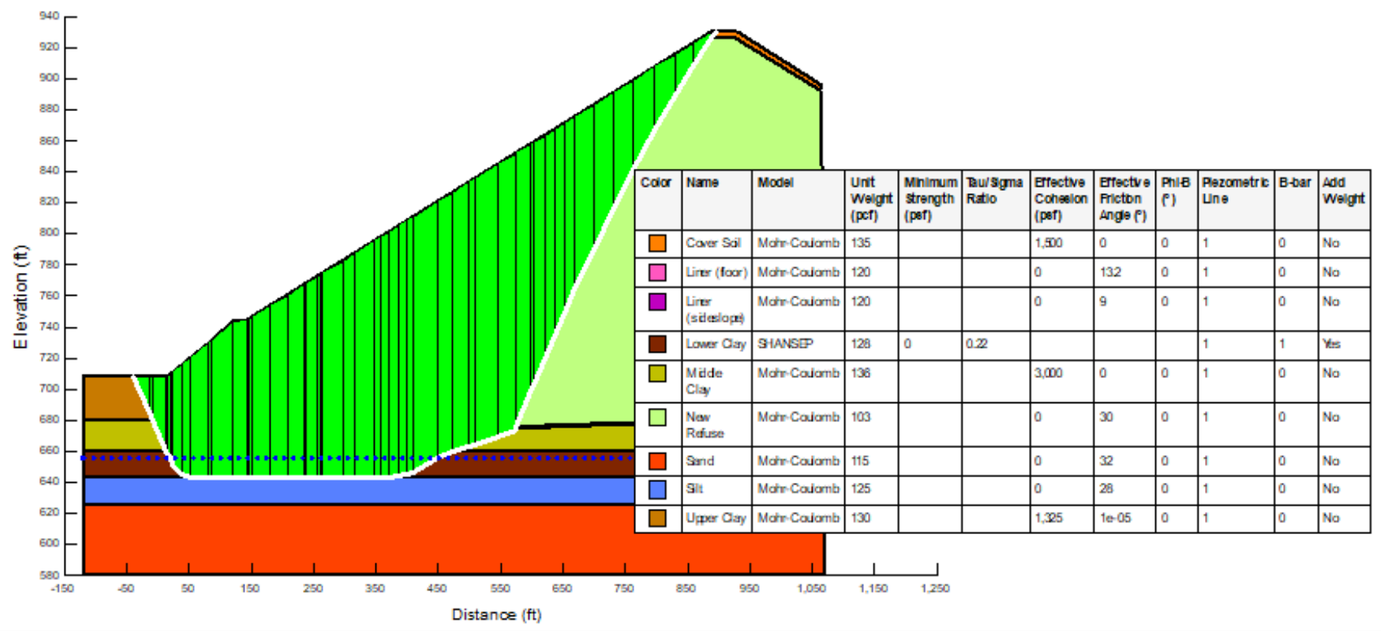
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section I-I’

Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	1e-05	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	1e-05	0	1	0	No

Attachment A-1.2.5

J-J’ Foundation Stability

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	J-J' Foundation Stability				**File name:**	MC-VI-G2_CrossSection_J_Foundation.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section J-J'. This case considers a west-facing slope, with fill to the final proposed grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. The groundwater level was set at elevation 655 based on historical borings as documented in the Basis of Design report (NTH 2012). Drained strength parameters were used for material with a relatively high permeability where excess pore-pressure conditions are not expected due to loading. Undrained strength parameters were used for low-permeability materials (clays) since excess pore pressures may accumulate after loading. This is considered a conservative approach for this scenario.		

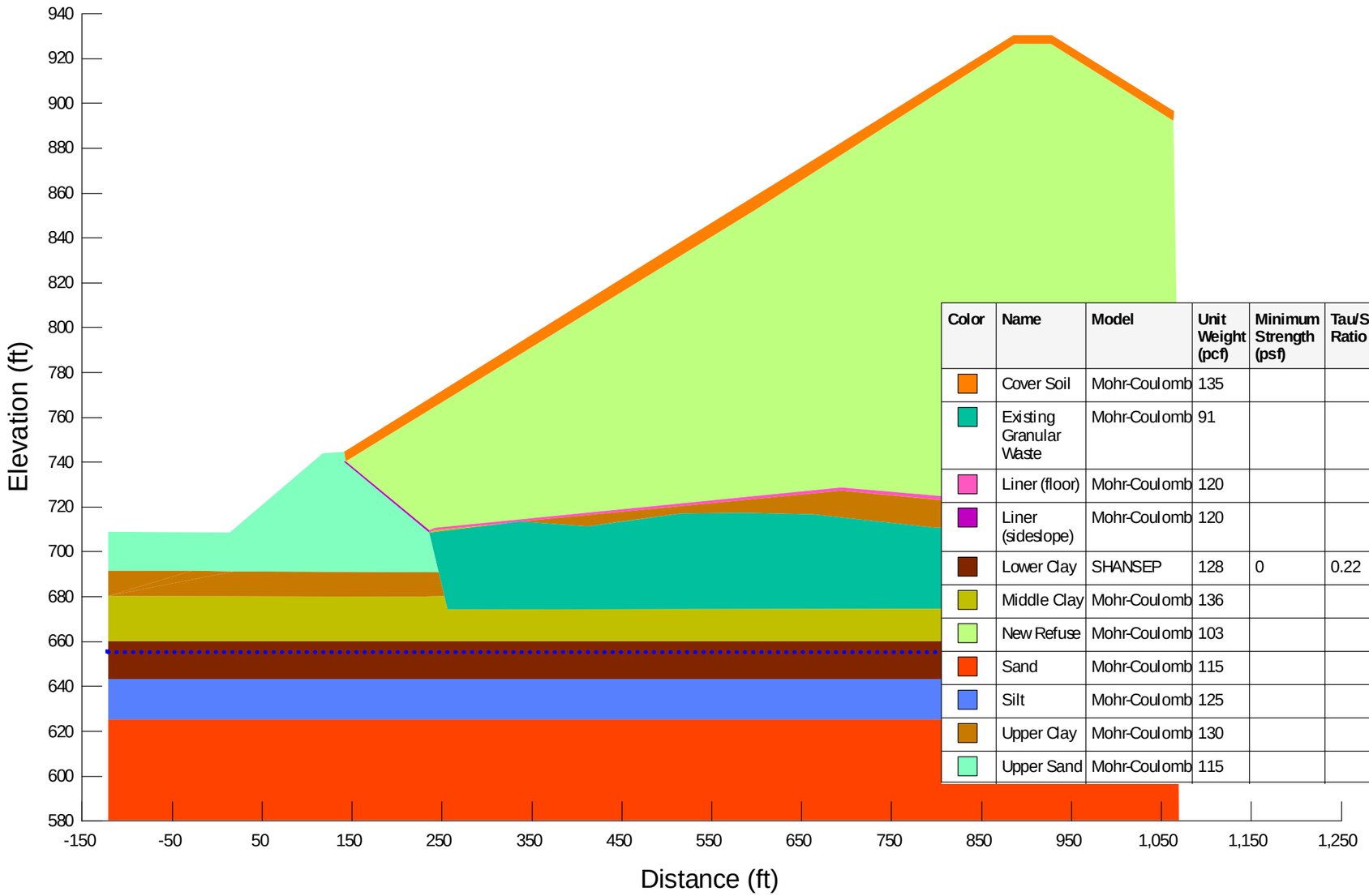
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand/aqua	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	

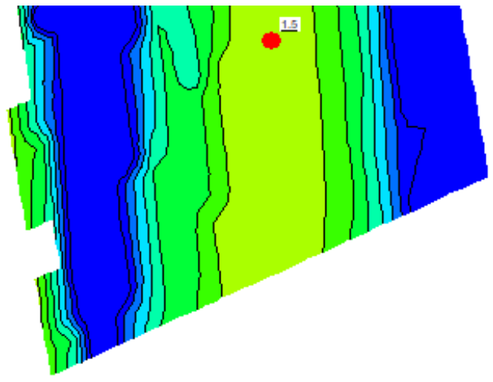
SLOPE STABILITY ANALYSIS REPORT FORM

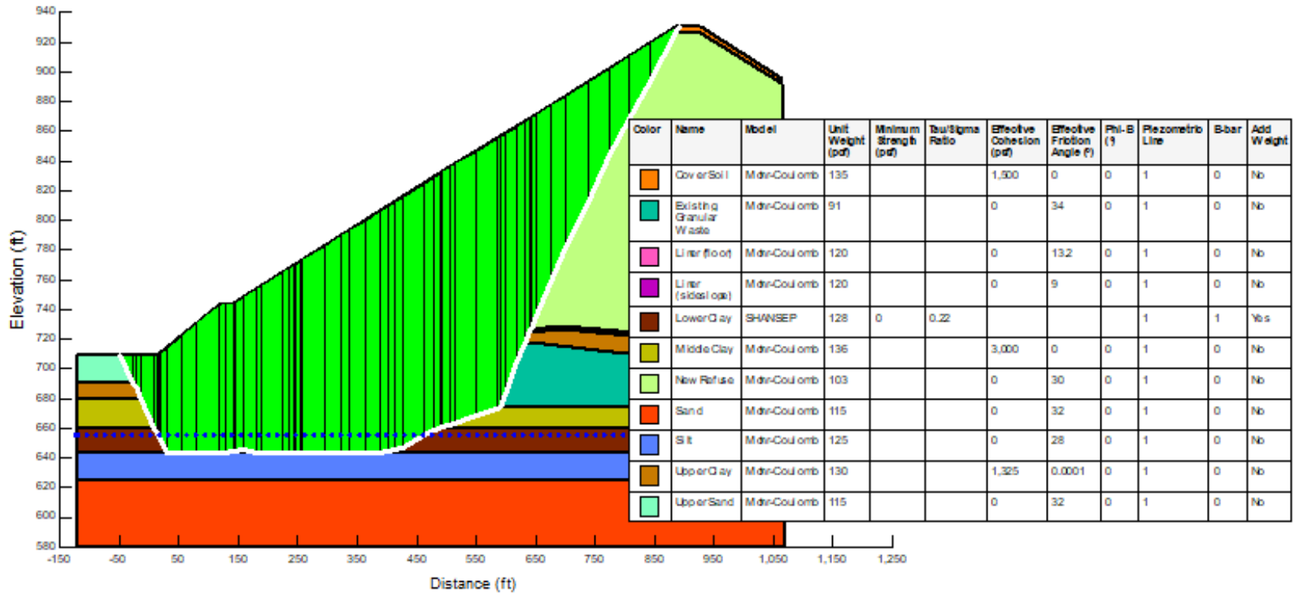
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section J-J'

Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	Lower Clay	SHANSEP	128	0	0.22				1	1	Yes
	Middle Clay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	Upper Clay	Mohr-Coulomb	130			1,325	0.0001	0	1	0	No
	Upper Sand	Mohr-Coulomb	115			0	32	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Minimum Strength (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	CoverSoil	Mohr-Coulomb	135			1,500	0	0	1	0	No
	Existing Granular Waste	Mohr-Coulomb	91			0	34	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120			0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120			0	9	0	1	0	No
	LowerClay	SHANSEP	128	0	0.22				1	1	Yes
	MiddleClay	Mohr-Coulomb	136			3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103			0	30	0	1	0	No
	Sand	Mohr-Coulomb	115			0	32	0	1	0	No
	Silt	Mohr-Coulomb	125			0	28	0	1	0	No
	UpperClay	Mohr-Coulomb	130			1,325	0.0001	0	1	0	No
	UpperSand	Mohr-Coulomb	115			0	32	0	1	0	No

Attachment A-1.2.6

G-G’ Liner Stability under Final Conditions with Zero Adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	G-G' Liner Stability				**File name:**	MC-VI-F_CrossSection_G_Liner.gsz	
Revision:	1	**Originated:**	MK	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section G-G'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. These values are achievable using available geosynthetic materials. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

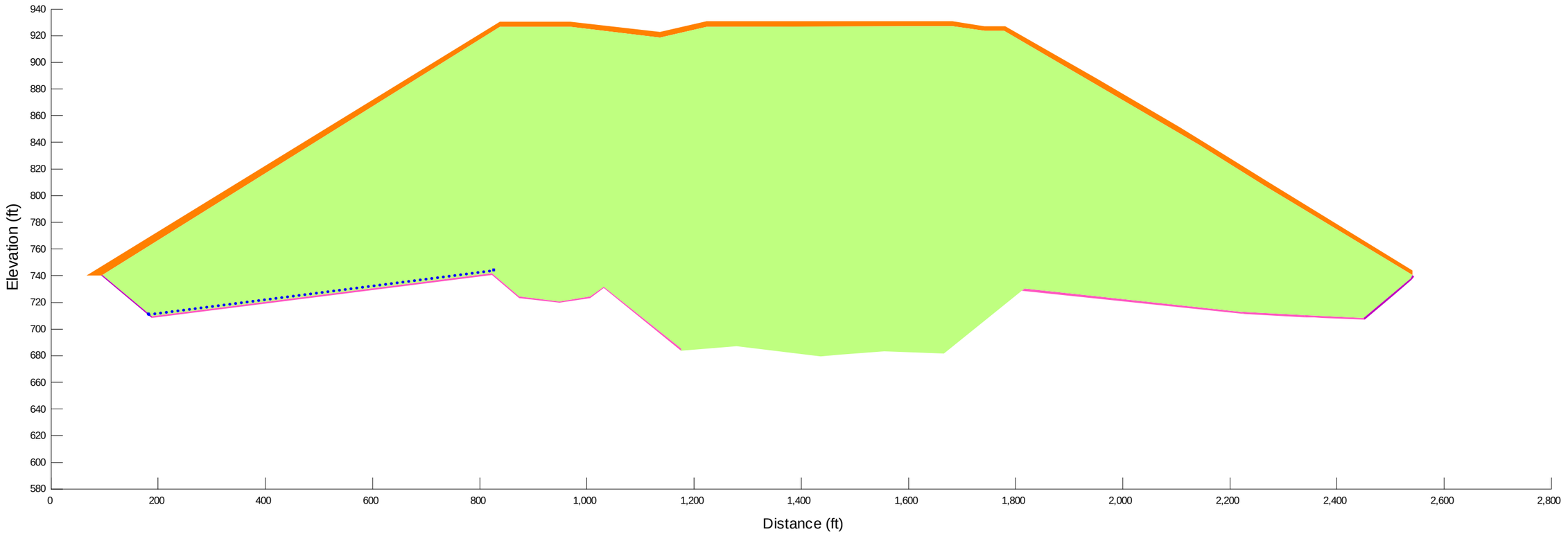
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

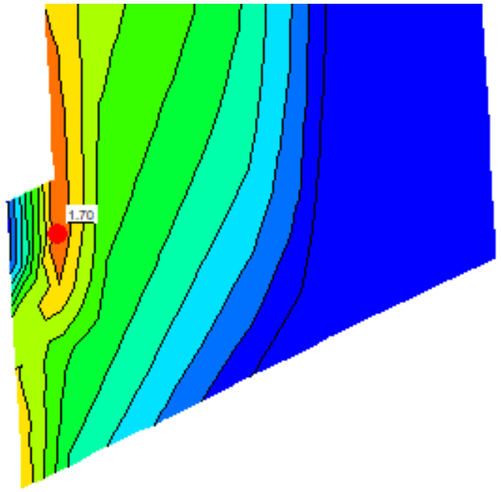
Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section G-G'

SLOPE STABILITY ANALYSIS REPORT FORM

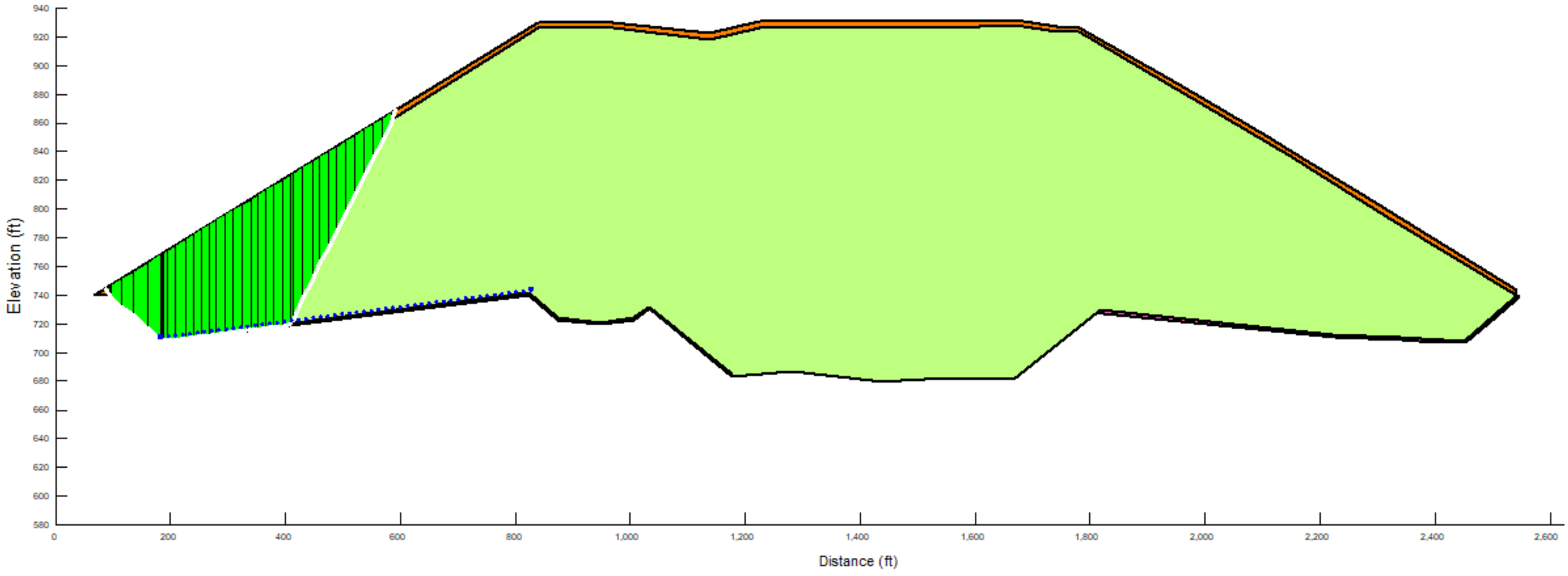
Factor of Safety:	1.7	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	New Refuse	Mohr-Coulomb	103	0	30	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	New Refuse	Mohr-Coulomb	103	0	30	0	1	0	No



Attachment A-1.2.7

H-H’ Liner Stability under Final Conditions with Zero Adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	H-H' Foundation Stability				**File name:**	MC-VI-E_CrossSection_H_Liner.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section H-H'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. These values are achievable using available geosynthetic materials. Available data from interface testing performed on the liner system during installation suggests the interface friction angle may be as high as 22.5 degrees. This analysis was performed using a lower value which is a conservative approach. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

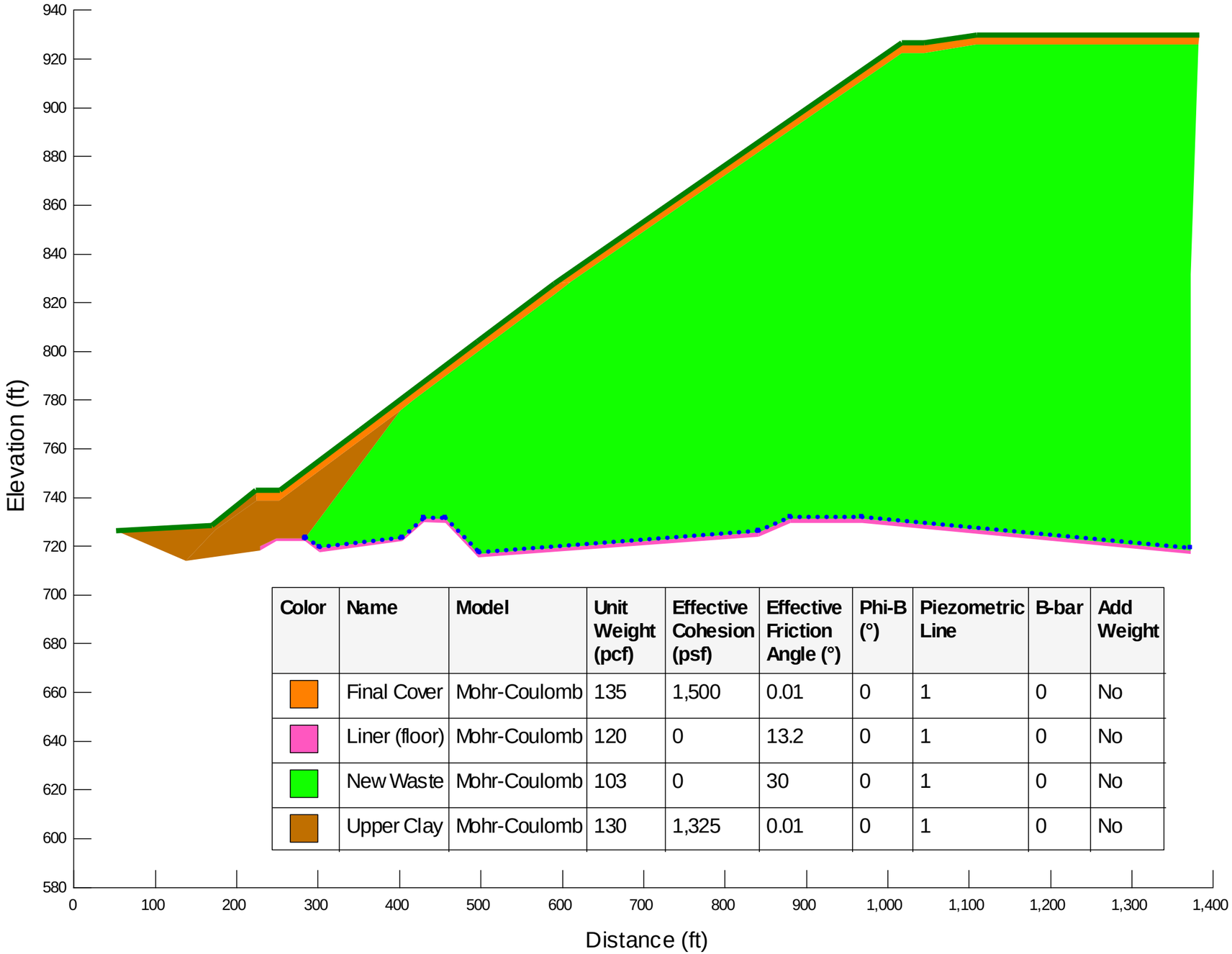
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The overfill liner elevations are from Master Cell VI-E Design Modification Plans, Wayne Disposal Inc., Site No. 2 by NTH Consultants (2011) and Master Cell VI Design Modification Plans. Wayne Disposal, Inc. Site No. 2 by NTH Consultants (2008).

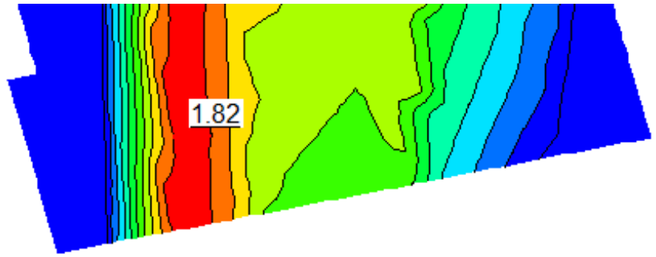
SLOPE STABILITY ANALYSIS REPORT FORM

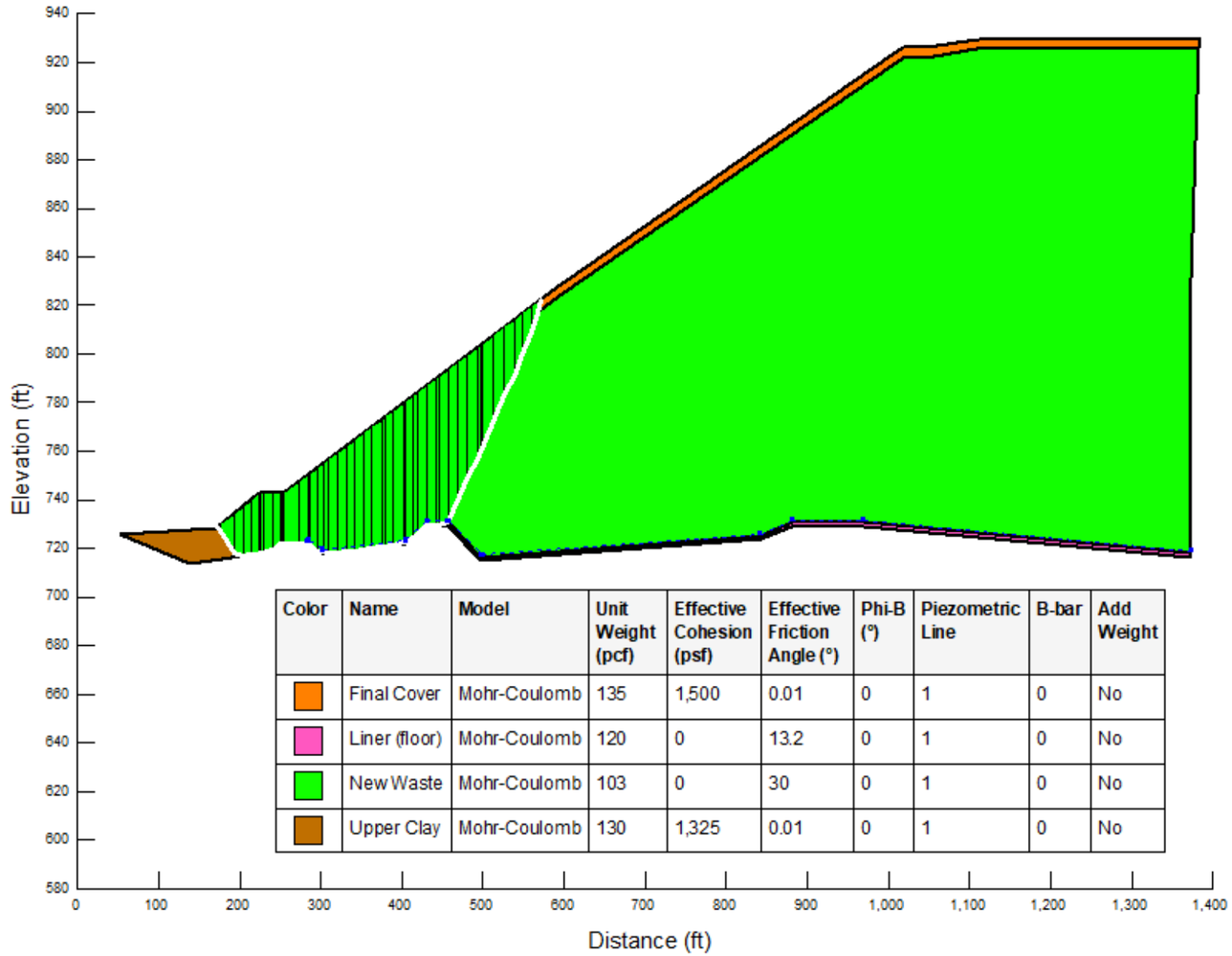
	The proposed final cover elevations are from WDI MCVI-E/F Final Cover Proposed Grading Plan by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section H-H’

Factor of Safety:	1.8	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Final Cover	Mohr-Coulomb	135	1,500	0.01	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	New Waste	Mohr-Coulomb	103	0	30	0	1	0	No
	Upper Clay	Mohr-Coulomb	130	1,325	0.01	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Final Cover	Mohr-Coulomb	135	1,500	0.01	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	New Waste	Mohr-Coulomb	103	0	30	0	1	0	No
	Upper Clay	Mohr-Coulomb	130	1,325	0.01	0	1	0	No

Attachment A-1.2.8

I-I’ Liner Stability under Final Conditions with Zero Adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	I-I' Liner Stability				**File name:**	MC-VI-G1_CrossSection_I_Liner.gsz	
Revision:	1	**Originated:**	MK	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section I-I'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. These values are achievable using available geosynthetic materials. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

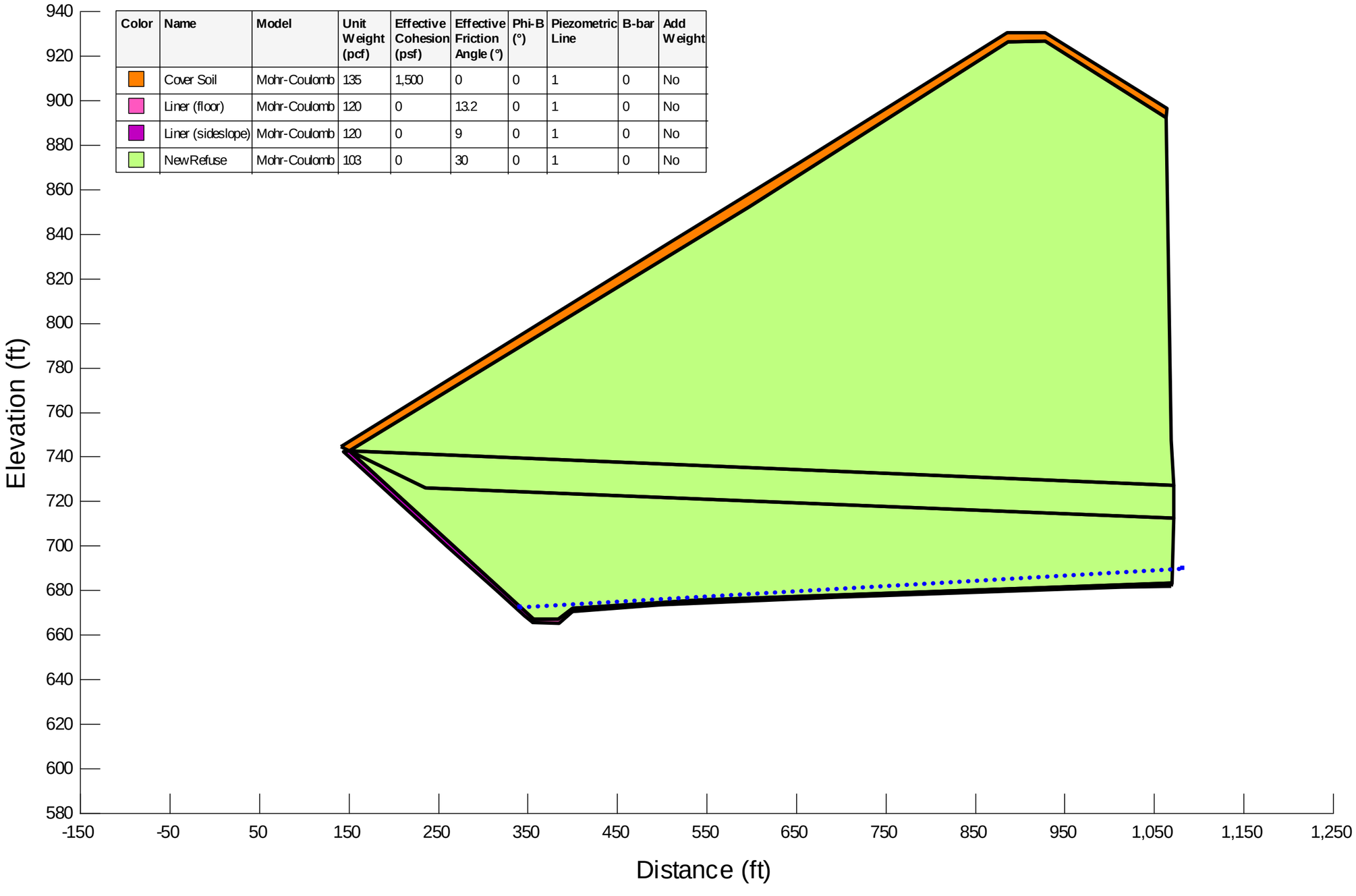
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

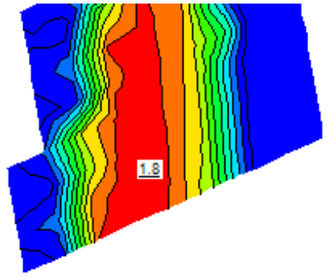
Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section I-I'

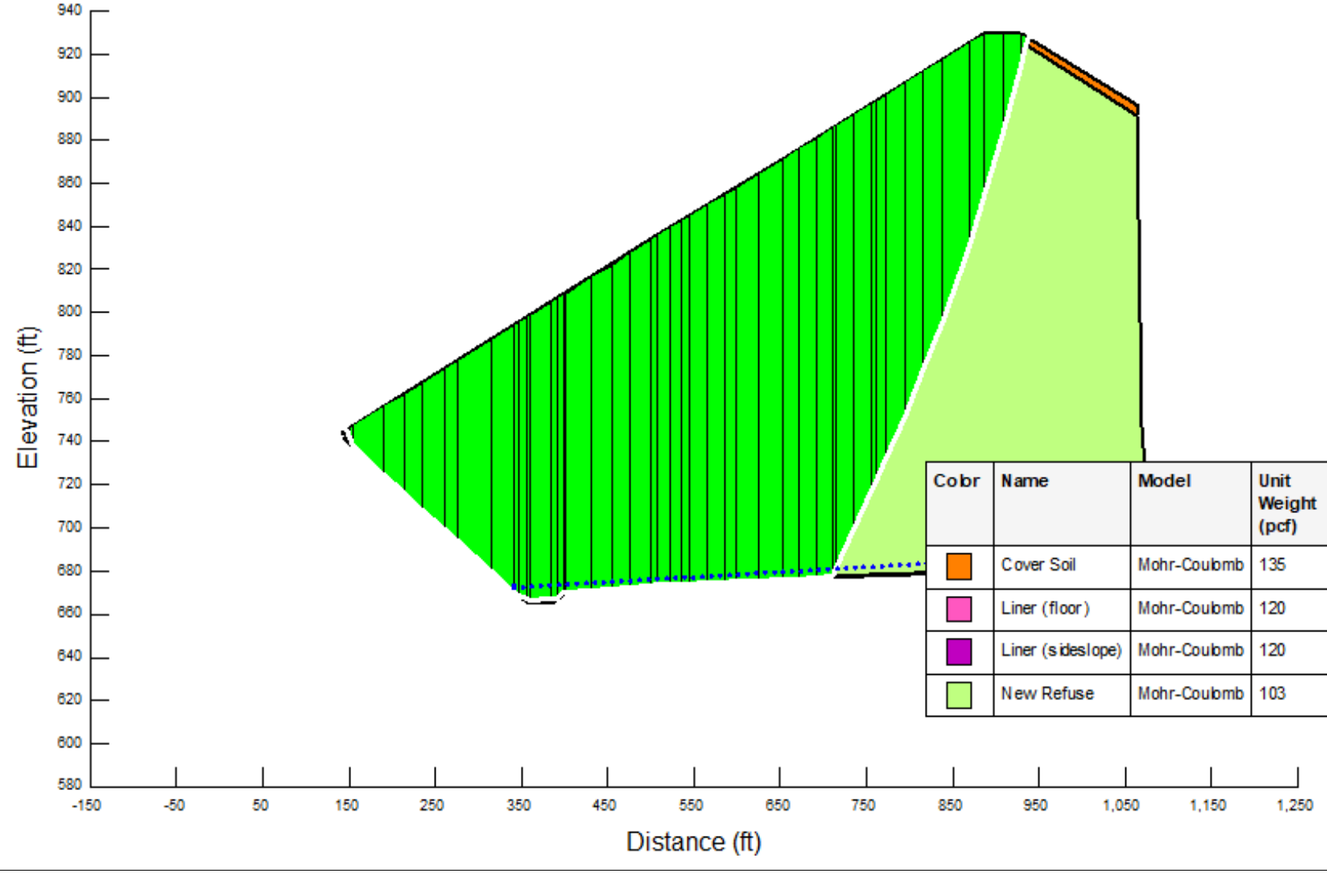
SLOPE STABILITY ANALYSIS REPORT FORM

Factor of Safety:	1.8	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	NewRefuse	Mohr-Coulomb	103	0	30	0	1	0	No







Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	New Refuse	Mohr-Coulomb	103	0	30	0	1	0	No

Attachment A-1.2.9

J-J’ Liner Stability under Final Conditions with Zero Adhesion

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	J-J' Liner Stability				**File name:**	MC-VI-G2_CrossSection_J_Liner.gsz	
Revision:	1	**Originated:**	MK	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

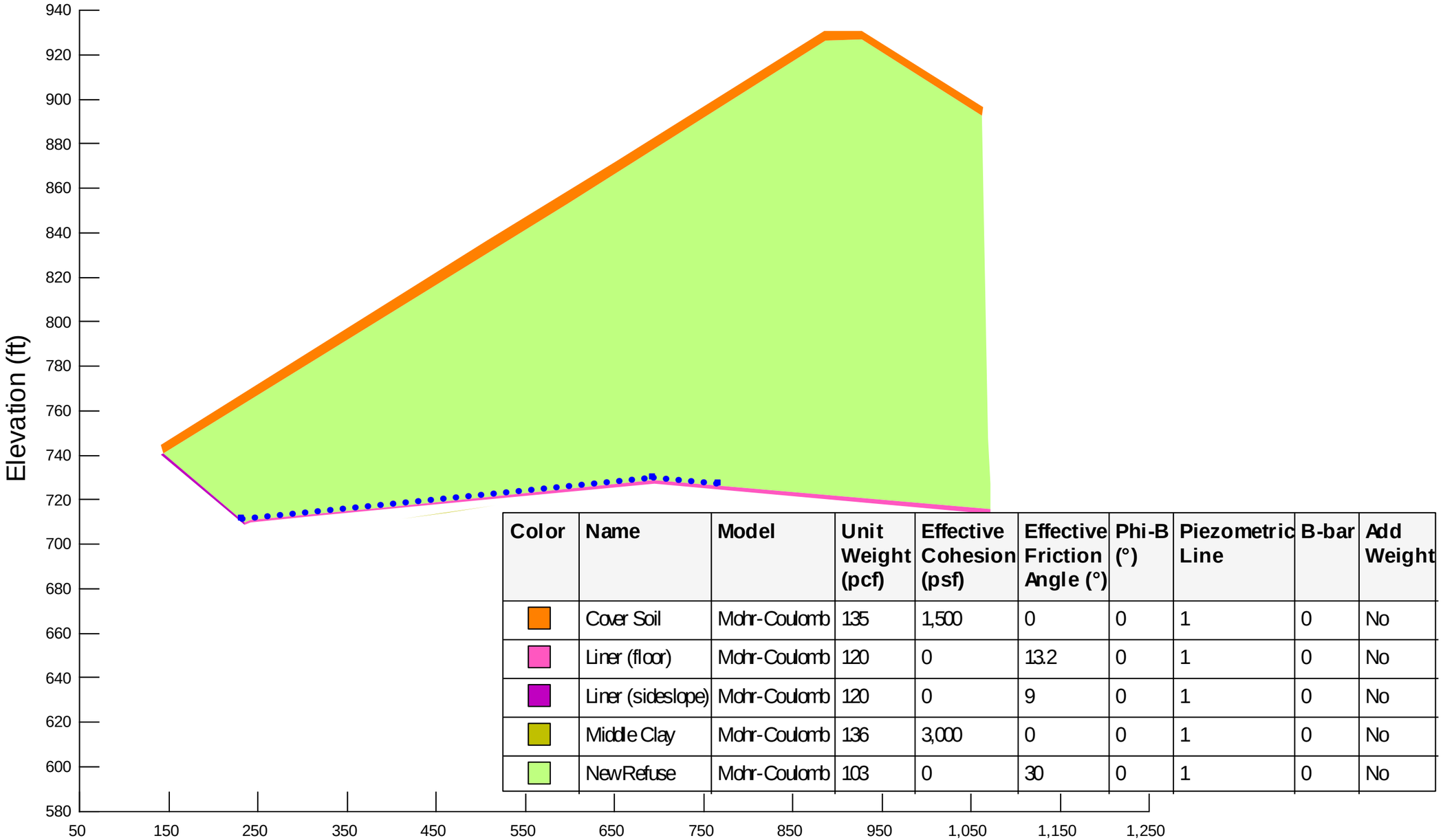
Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section J-J'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were those determined from the slope stability analysis of MC-VI-G, Sub Cell G4. These values are achievable using available geosynthetic material. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	13.2	0
10	Liner (sideslope)	Magenta	120	9	0
11	Existing MC V Waste	Teal	120	28	0

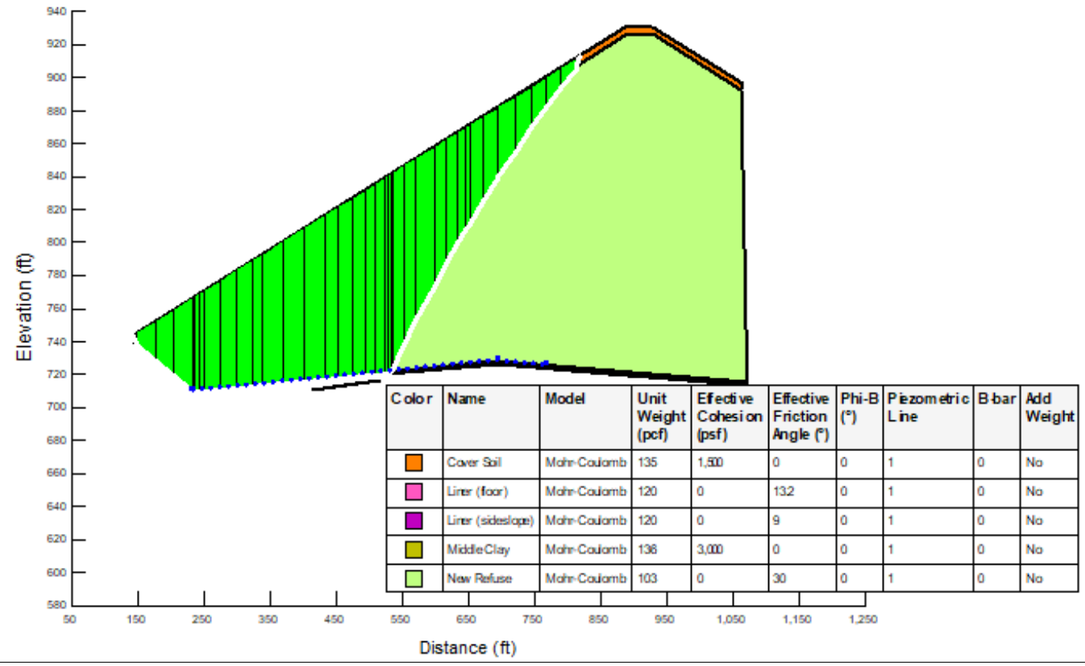
Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section J-J'

SLOPE STABILITY ANALYSIS REPORT FORM

Factor of Safety:	1.7	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	NewRefuse	Mohr-Coulomb	103	0	30	0	1	0	No



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	0	13.2	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	MiddleClay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103	0	30	0	1	0	No

Attachment A-1.2.10

I-I’ Liner Stability under Final Conditions with non-Zero Adhesion (previously tested values)

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	I-I' Liner Stability				**File name:**	MC-VI-G1_CrossSection_I_Liner_Tested_Values.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section I-I'. This case considers a west-facing slope, with fill to the final proposed grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were determined from existing interface strength testing performed on existing similar liner system materials at WDI. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

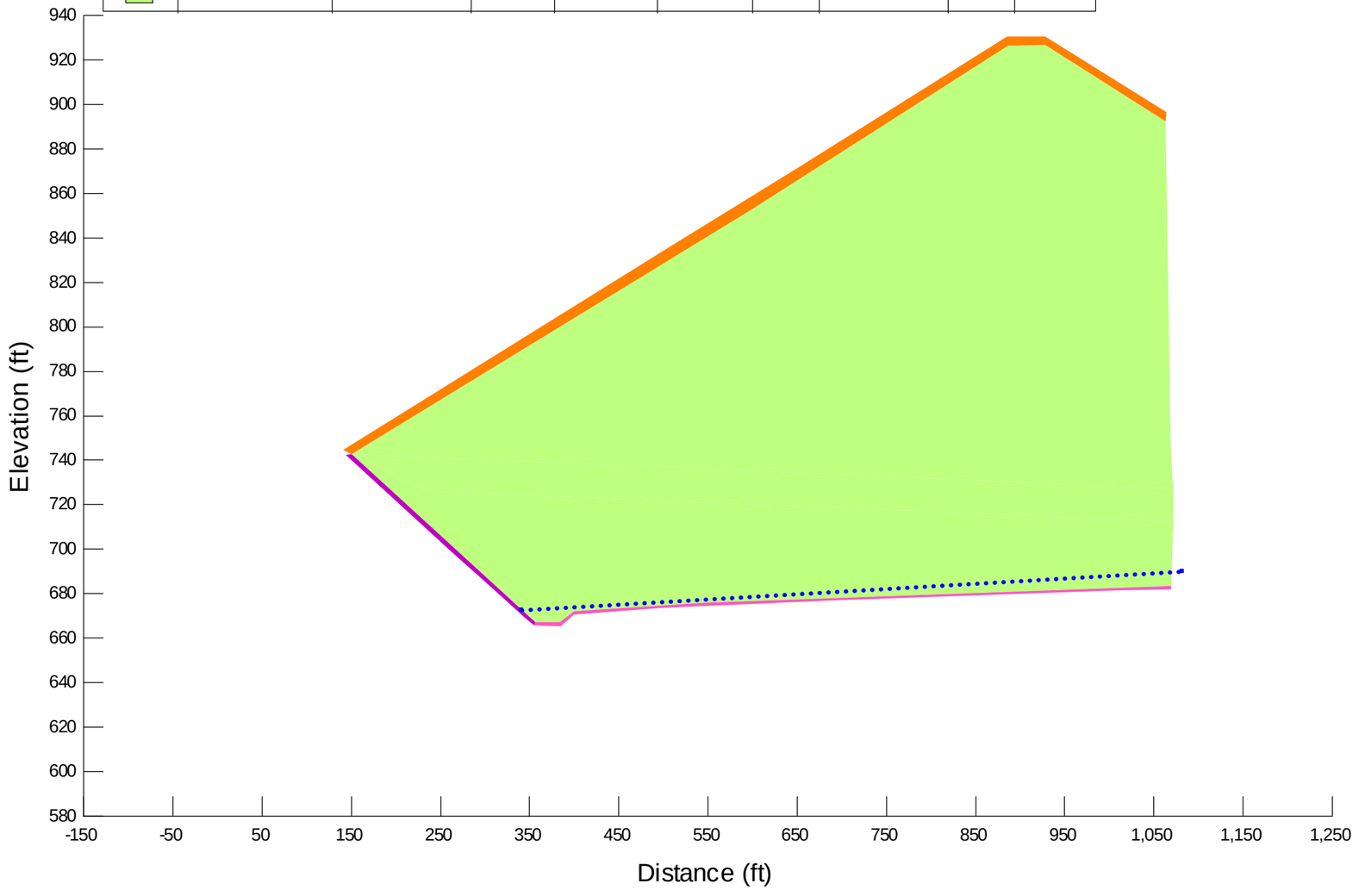
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	11.1	164
10	Liner (sideslope)	Magenta	120	7.3	110
11	Existing MC V Waste	Teal	120	28	0

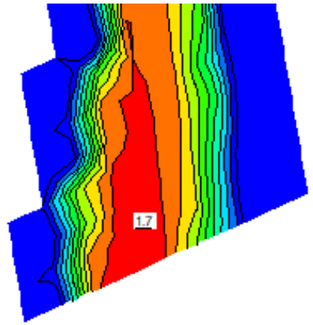
Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section I-I'

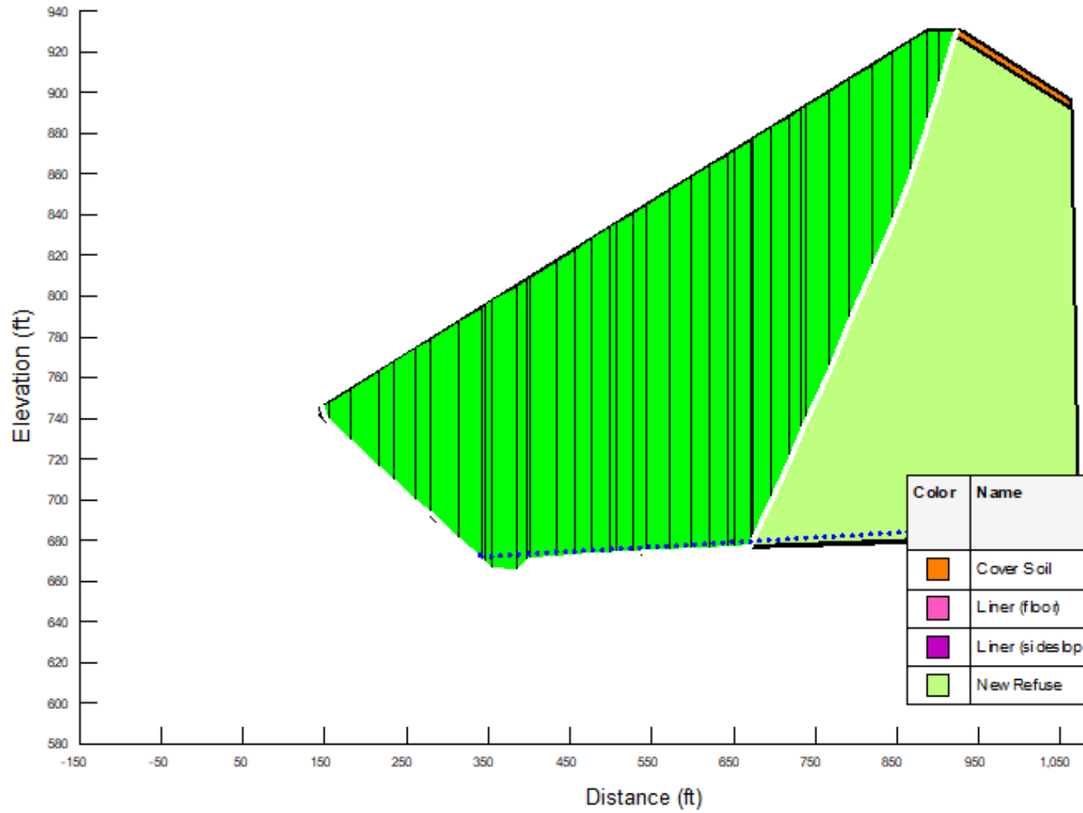
SLOPE STABILITY ANALYSIS REPORT FORM

Factor of Safety:	1.7	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0	1	0	No
	New Refuse	Mohr-Coulomb	103	0	30	0	1	0	No







Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0	1	0	No
	New Refuse	Mohr-Coulomb	103	0	30	0	1	0	No

Attachment A-1.2.11

J-J’ Liner Stability under Final Conditions with non-Zero Adhesion (previously tested values)

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	J-J' Liner Stability				**File name:**	MC-VI-G2_CrossSection_J_Liner_Tested_Values.gsz	
Revision:	1	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the factor of safety of the proposed final waste grades using cross-section J-J'. This case considers a north-facing slope, with fill to the final proposed grade elevations.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The strength parameters used to model the interface strength of the liner system were determined from existing interface strength testing performed on existing similar liner system materials at WDI. The required factor of safety is 1.5. A scenario of leachate build up in the leachate collection layer (to a height of 12 inches) is modeled in this analysis.		

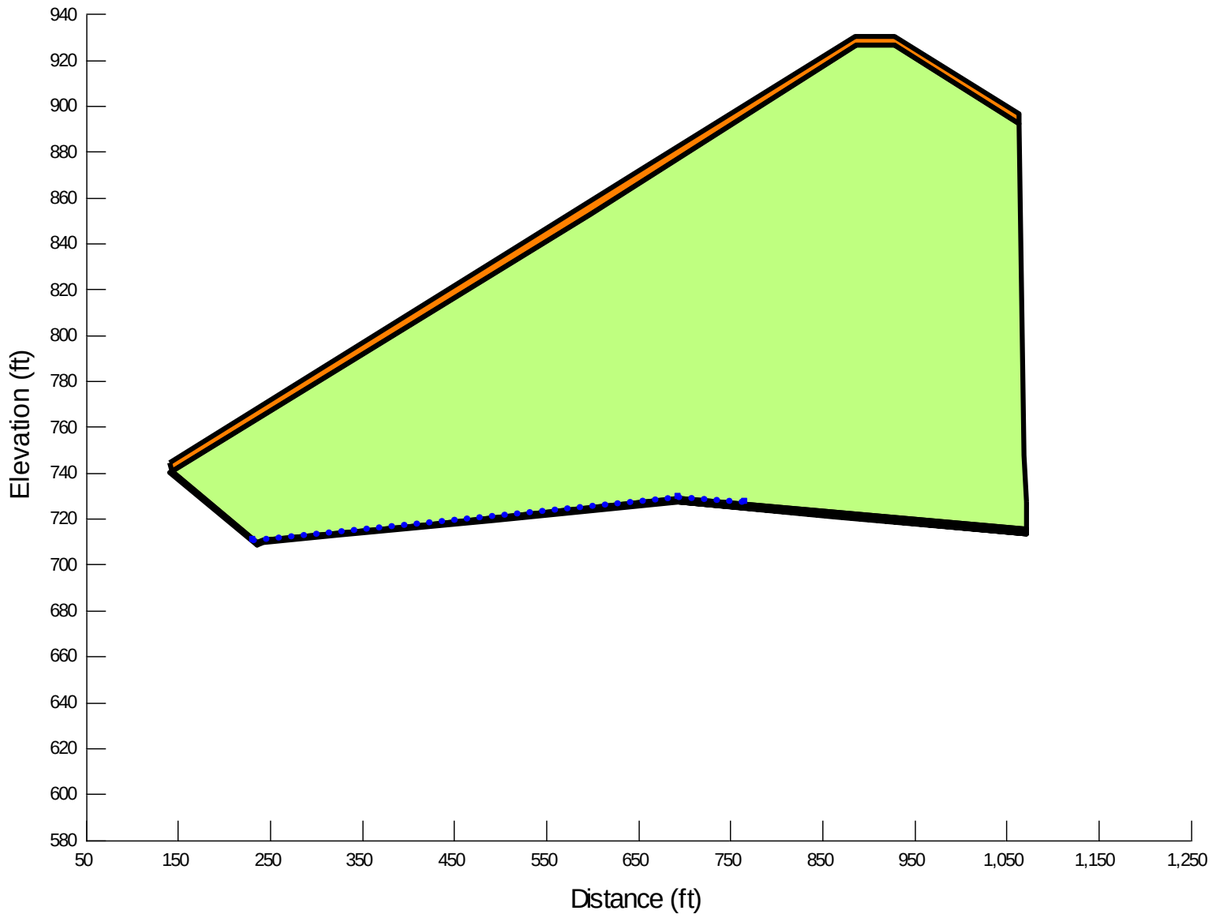
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	11.1	164
10	Liner (sideslope)	Magenta	120	7.3	110
11	Existing MC V Waste	Teal	120	28	0

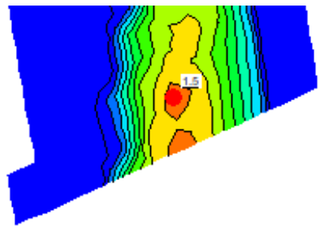
Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☐ Interim ☒ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Final Build out
Other Geometry Notes:	Cross Section J-J'

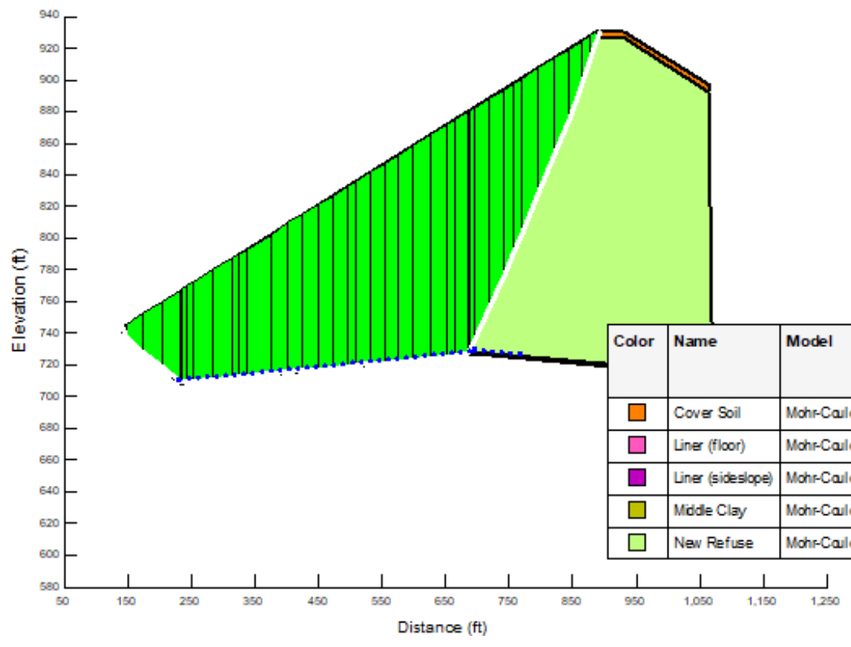
SLOPE STABILITY ANALYSIS REPORT FORM

Factor of Safety:	1.5	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded
Comments:		
Attachments:	Slope/W Cross Section and Results	

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	164	11.1	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103	0	30	0	1	0	No







Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Cover Soil	Mohr-Coulomb	135	1,500	0	0	1	0	No
	Liner (floor)	Mohr-Coulomb	120	184	11.1	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	110	7.3	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103	0	30	0	1	0	No

Attachment A-1.2.12

I-I’ Liner Stability under Interim Conditions (example interim stability calculation)

SLOPE STABILITY ANALYSIS REPORT FORM

Project Name:	WDI Final Cover Grading Modification						
Project Number:	1218070017.003			**Client:**	Wayne Disposal, Inc.		
Analysis Short Name:	J-J' Liner Stability				**File name:**	MC-VI-G2_CrossSection_J_Liner_Interim.gsz	
Revision:	2	**Originated:**	KM	**Checked:**	RR	**Approved:**	
Date:	3/28/22	**Date:**	3/28/22	**Date:**	3/29/22	**Date:**	

Purpose of Analysis:	To determine the required interface friction angle of the liner system to achieve an acceptable interim factor of safety of 1.3 using cross-section J-J'. This case considers a west-facing slope, with fill to the final permitted grade elevations at an interim slope of 3H:1V. The failure surface is defined such that failure occurs in the underlying liner in order to evaluate the stability of the liner system.		
	☒ Static ☐ Seismic	☒ Pore Pressure	☒ Optimized Surface
Additional Details:	The required factor of safety is 1.3 for temporary conditions.		

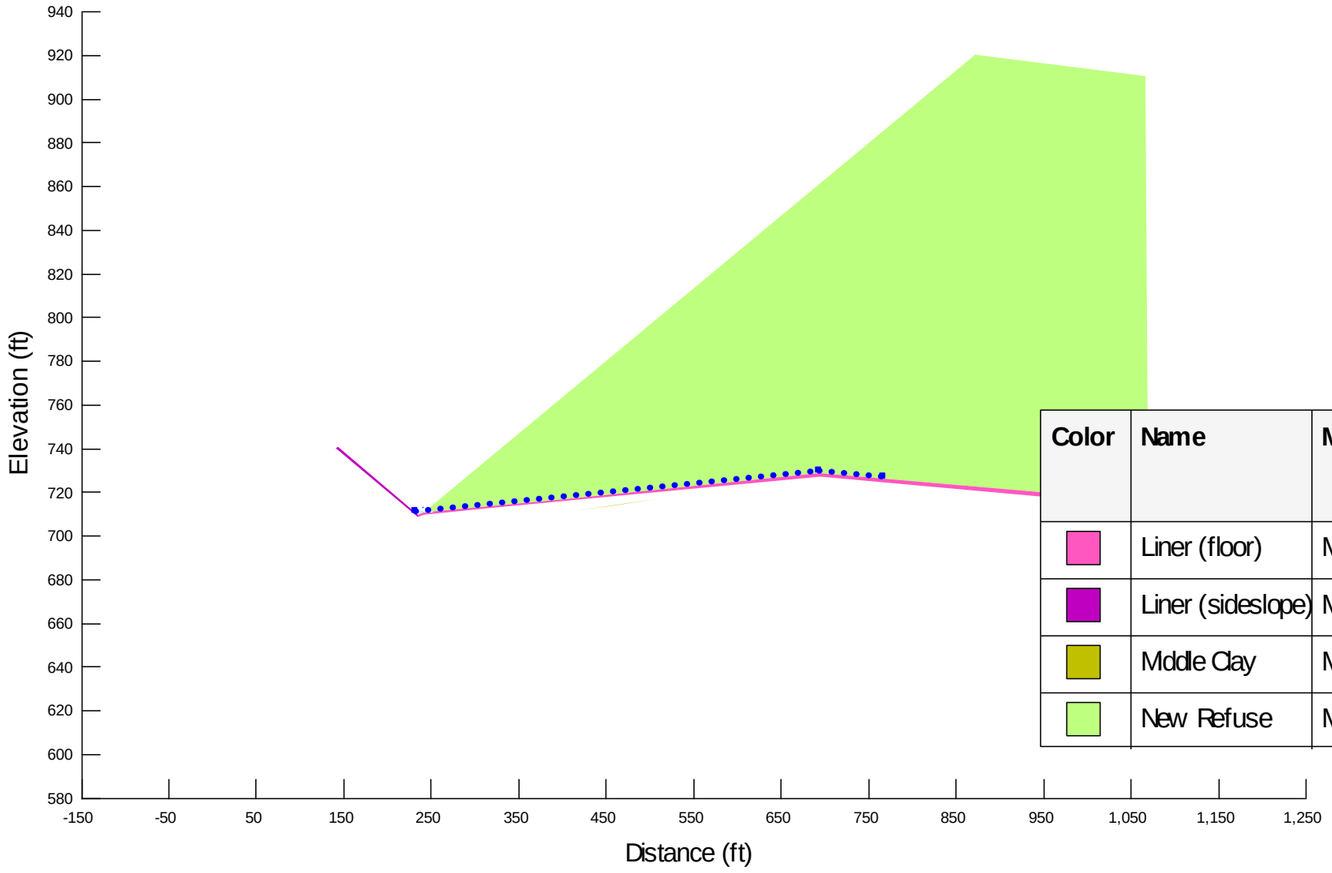
Material	Name	Color in Profile	Unit Wt(s) (pcf)	Strength ϕ or δ (deg.)	Strength C or Ca (psf)
1	Final Cover	Orange	135	0	1500
2	Existing Waste	Teal	91	34	0
3	New Waste	Light Green	103	30	0
4	Upper Clay	Brown	130	0	1325
5	Middle Clay	Yellow	136	0	3000
6	Lower Clay	Maroon	128	$0.22\sigma'_v$	
7	Silt	Blue	125	28	0
8	Sand	Red	115	32	0
9	Liner (floor)	Magenta	120	?	0
10	Liner (sideslope)	Magenta	120	n/a	n/a
11	Existing MC V Waste	Teal	120	28	0

Source of Geometry:	The proposed final cover elevations are from WDI Final Cover Grades Modification Engineering Drawings by CTI and Associates, Inc.
Source of Subsurface Profile:	Basis of Design Report - NTH (2012)
☐ Preconstruction ☐ Construction ☒ Interim ☐ Final ☐ Existing ☐ Back-Analysis	
Construction Phase Represented:	Interim Waste Filling to max height at 3H:1V
Other Geometry Notes:	Cross Section J-J'

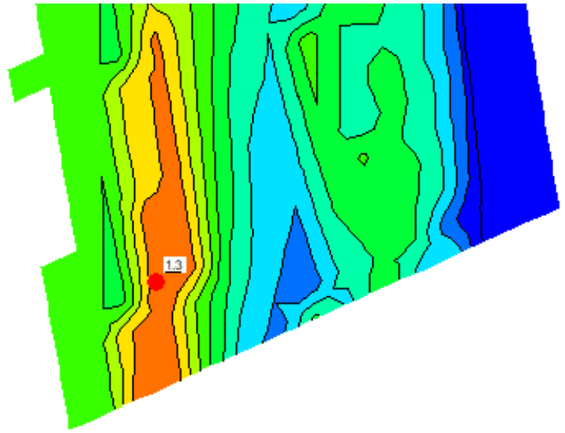
Factor of Safety:	1.3	☒ Acceptable ☐ Not Acceptable ☐ Follow-up ☐ Superseded

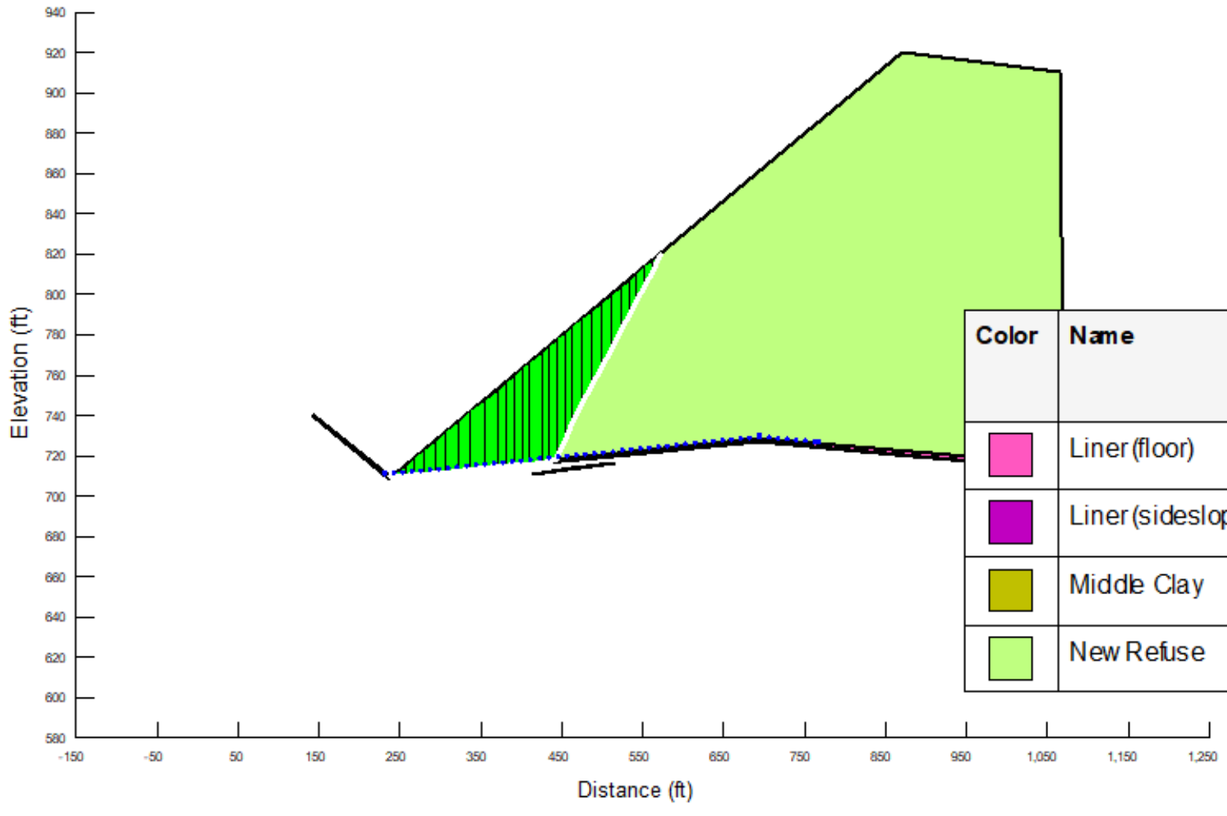
SLOPE STABILITY ANALYSIS REPORT FORM

Comments:	The required interface friction angle for the liner system is 14 degrees (Peak). Any combination of adhesion and friction angle that yields a comparable shear strength under modeled site conditions is acceptable.
Attachments:	Slope/W Cross Section and Results



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Liner (floor)	Mohr-Coulomb	120	0	14	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103	0	30	0	1	0	No





Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Liner (floor)	Mohr-Coulomb	120	0	14	0	1	0	No
	Liner (sideslope)	Mohr-Coulomb	120	0	9	0	1	0	No
	Middle Clay	Mohr-Coulomb	136	3,000	0	0	1	0	No
	New Refuse	Mohr-Coulomb	103	0	30	0	1	0	No

4. Attachment A-2.1 MC6_G4-G7 Settlement Analysis

Original Submittal			
	Page	**Revised Submittal**	
A-2	112	A-2.1	Settlement Analysis for MC VI-G4 to G7
A-2.1	120	A-2.1.1	Settlement Analysis Points
A-2.2	122	A-2.1.2	Cross-section Profiles and Settlement Calculation Spreadsheets

Attachment A-2.1

G4-G7 Liner Grade Modification Settlement Analysis

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. Calculated By: RR Date: 5/16/2022

Project: WDI MC VI-G4 through G7 Liner Grade Modification Checked By: KF Date: 5/17/2022

Calculation: Leachate Collection System Settlement Analysis Approved By: XZ Date: 5/17/2022

LEACHATE COLLECTION SYSTEM SETTLEMENT ANALYSIS

OBJECTIVE

This calculation evaluates the post-settlement slopes of the leachate collection pipe and cell floor cross slopes for proposed Master Cell VI-G (MC VI-G4 through G7), at Wayne Disposal, Inc. (WDI). This evaluation is based on the estimated settlement of the existing waste and soil underlying the proposed cells due to additional overburden stresses induced by waste placement and the impact of such settlement on the post settlement cell floor slopes. The purpose of this calculation is to determine the minimum required design slopes.

DESIGN CRITERIA AND ASSUMPTIONS

- The post-settlement slope of each leachate collection pipe should be at least 1% and each cell floor cross slope should be at least 2% per Rule 299.9620 (4) (EGLE 2020).
- Pipe flowline analysis points were selected along the leachate collection pipe flowlines within MC-VI-G (Attachment A-2.1.1). The specific locations of these points were selected to correspond to the cell floor high point, low point, changes in final cover slope, and locations of existing intracell dikes in the Master Cell I (MC-I). Total settlement is estimated for each point, allowing an assessment of the post-settlement slope(s) along the flowline.
- Cross slope analysis points (Attachment A-2.1.1) were selected at the location following the most critical post-settlement path including the impact of the existing dikes in MC-I.
- Maximum settlement is expected to occur at the completion of the cap construction when the foundation is subjected to the maximum overburden pressure. Under the worst-case scenario modeled, maximum load is applied (in full) to the foundation instantaneously during settlement analysis for a conservative (i.e., greater than anticipated) estimate of total settlement. In reality, loads would be applied incrementally as waste is placed gradually during the active life of the landfill. Additionally, the resulting settlement is assumed to occur immediately, conservatively accounting for the maximum settlement at the end of foundation soil consolidation.
- Existing information about the existing landfill below Subcells G4, G5, G6, and G7 indicate that it was a trench fill type of landfill. The precise configuration of the trenches is unknown. It is believed that each trench is bounded by an intracell dike. Using available subsurface information (MASW surveys and Geoprobe boring logs – see Figures 1 through 3), CTI has considered the profile of known existing dikes in these settlement analyses by placing additional settlement calculation points at the estimated crests and toes of these dikes. Differential settlement estimates are accordingly greater at the transitions between these points than between points without difference in subgrade. As a result, CTI proposes enhanced floor grades with steeper slopes in portions of the cell floor to counteract the effect of differential settlement on post-settlement slopes. CTI also proposes that the location of these enhanced floor grade zones be adjusted if MC VI- G4, G5, G6,

CALCULATION SHEET

Client:	Wayne Disposal, Inc.	Project No.:	1218070017.003		
Project:	WDI MC VI-G4 through G7 Liner Grade Modification	Calculated By:	RR	Date:	5/16/2022
Calculation:	Leachate Collection System Settlement Analysis	Checked By:	KF	Date:	5/17/2022
		Approved By:	XZ	Date:	5/17/2022

and G7 construction activities reveal additional information about the location of the corresponding dikes.

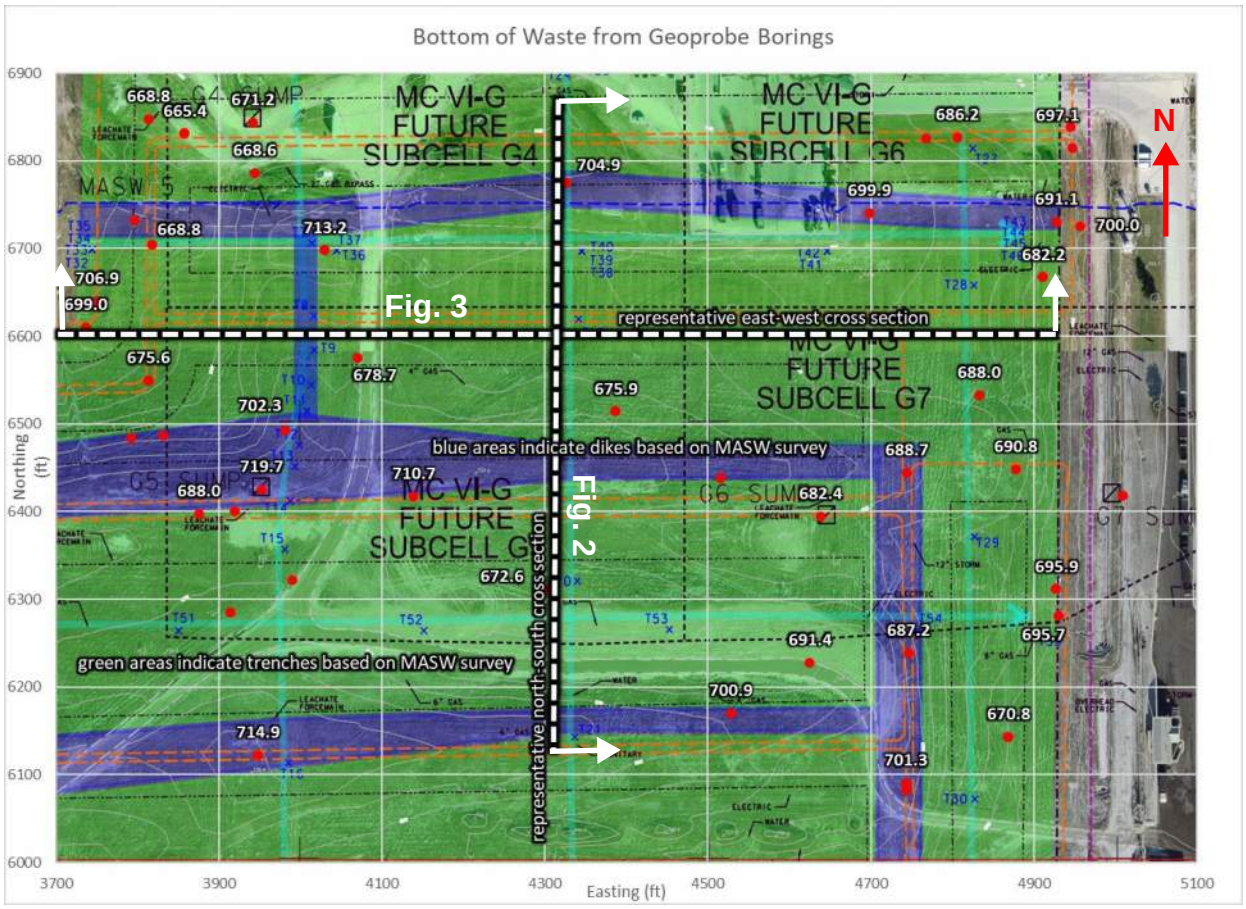


Figure 1. Map of Bottom of Existing Waste Elevations Below MC VI-G4 through G7 as Determined from Geoprobe Boring Logs. (blue areas indicate the approximate location of intracell dikes)

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: RR | Date: 5/16/2022

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: KF | Date: 5/17/2022

Calculation: Leachate Collection System Settlement Analysis | Approved By: XZ | Date: 5/17/2022

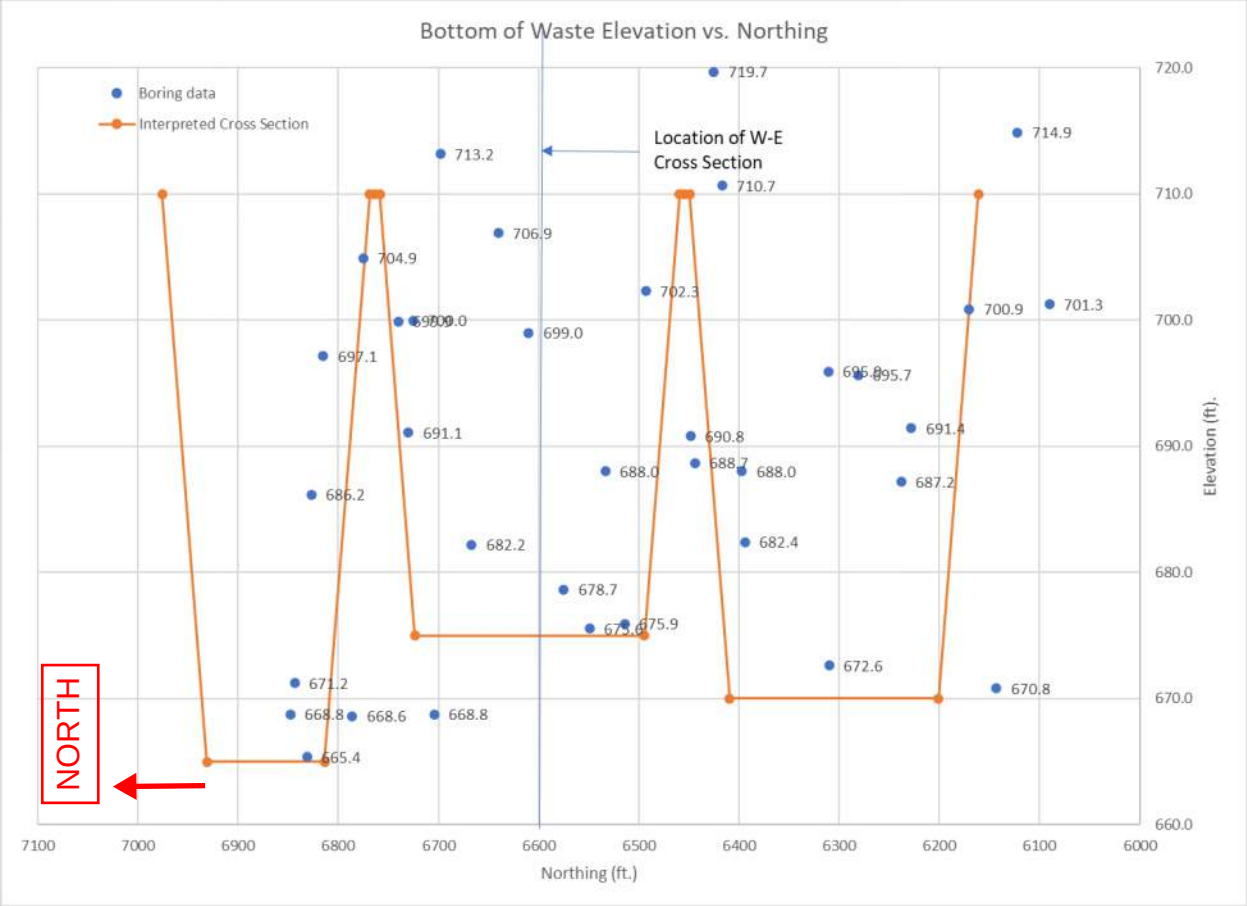


Figure 2. Interpreted North-South Cross Section Depicting Bottom of Existing Waste Elevations Below MC VI-G4 through G7 as Determined from Geoprobe Boring Logs.

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: RR | Date: 5/16/2022

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: KF | Date: 5/17/2022

Calculation: Leachate Collection System Settlement Analysis | Approved By: XZ | Date: 5/17/2022

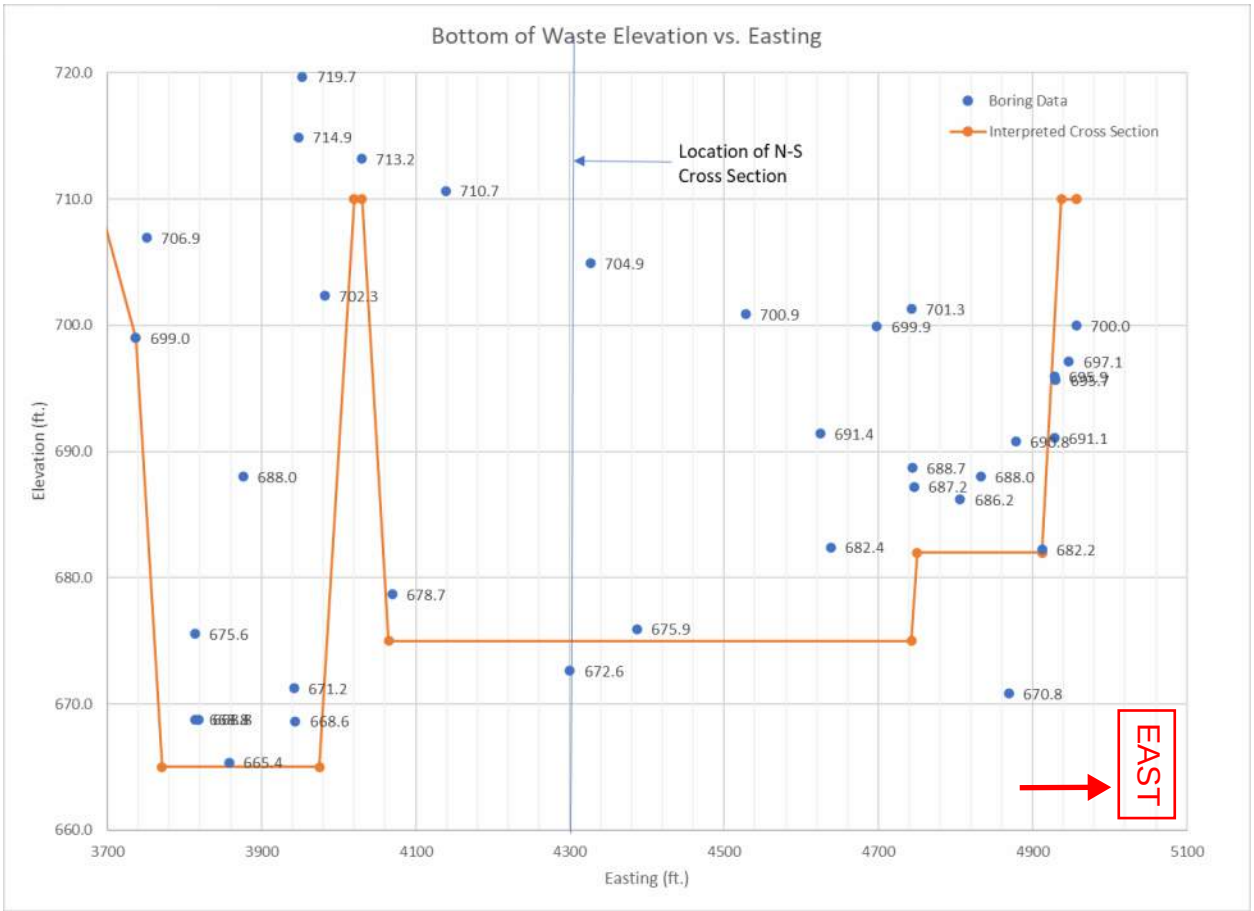


Figure 3. Interpreted West-East Cross Section Depicting Bottom of Existing Waste Elevations Below MC VI-G4 through G7 as Determined from Geoprobe Boring Logs.

- Table 1A lists the material typical thicknesses and unit weights used for the settlement analysis. Note that a value of 103 pounds per cubic foot (pcf) was conservatively selected for the unit weight of newly-placed waste. This value of unit weight is conservative because it is greater than the representative value obtained from survey records. Greater values of waste unit weight result in larger calculated settlement values. Table 1B provides supporting survey information used to evaluate the unit weight of newly placed waste.
- Table 2 summarizes the compressibility parameters used in the settlement analysis. The compacted clay liner is only very slightly compressible relative to the in-situ clay layer due to the much greater thickness of the insitu clay. Considering the insignificant magnitude of the settlement of the compacted clay liner, it was not included in the analysis.

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: RR | Date: 5/16/2022

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: KF | Date: 5/17/2022

Calculation: Leachate Collection System Settlement Analysis | Approved By: XZ | Date: 5/17/2022

Table 1A. Soil Properties for Settlement Analysis

Soil Type	Thickness [ft]	Moist Unit Weight [pcf]
Final cover soil	4	135
New waste	Varies	103*
Existing cover soil	Varies	135
Existing waste	Varies	91
In-situ middle clay	Varies	136
Attenuation Layer	5	135
Structural Fill	2	135
Venting Layer	1	135
Leachate Collection Sand	1	135
In-situ middle clay	Varies	136
In-situ lower clay (moist)	5	128
In-situ lower clay (saturated)	12	128
In-situ silt (saturated)	18	125
In-situ sand (saturated)	45	115

** Conservative (high) Value - see Table 1B.*

Table 1B. Supporting Survey Information Used to Evaluate the Unit Weight of Newly Placed Waste

Survey Years	2014 to 2021
Tons waste received into the landfill	3,905,856
Cubic yards airspace consumed	2,869,499
Average Unit Weight (tons/cy)	1.36
Average Unit Weight (pcf)	101

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: RR | Date: 5/16/2022

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: KF | Date: 5/17/2022

Calculation: Leachate Collection System Settlement Analysis | Approved By: XZ | Date: 5/17/2022

Table 2. Compressibility Parameters of Waste and Soils

Soil Type	Primary Compression Ratio $C_c/(1+e_0)$	Secondary Compression Ratio $C_\alpha/(1+e_0)$	Recompression Ratio $C_r/(1+e_0)$
Existing cover	0.102[B]	0.005[B]	0.017[A]
Existing waste	0.08[C]	0.024[C]	0.0133[A]
In-situ middle clay	0.102	0.005	0.017[A]
In-situ lower clay	0.171	0.009	0.0285[A]
In-situ silt	0.15[B]	0[B]	0[B]
In-situ sand	0.1[B]	0[B]	0[B]

[A] Estimated from $C_r = C_c/6$.

[B] Assumed values.

[C] From Attachment A-2.3

The information for subsurface soils is based on MCIV General Profiles (South), Appendix A Subsurface Soil/Waste Profiles & Corresponding Physical Properties, Volume III – WDI Operating License Application Master Cells VI F & G by NTH Consultants (2011a). Specifically, subsurface investigation boring logs, cross section profiles, and laboratory test results were used to assess the subgrade soil profile and its properties. Note that some uncertainty may exist in the interpretation of hydrogeological data due to natural soil's inherent variability, conservative assumptions have been applied to ensure a conservative estimate of settlement in this analysis.

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: RR | Date: 5/16/2022

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: KF | Date: 5/17/2022

Calculation: Leachate Collection System Settlement Analysis | Approved By: XZ | Date: 5/17/2022

METHODOLOGY

Total settlement is estimated using the 1-D consolidation equations (Coduto 1999), with primary consolidation being the critical component. Total settlement is calculated as:

$$S = S_c + S_s \quad (1)$$

Where:

S = total settlement [ft]
S_c = primary consolidation settlement due to load application [ft]
S_s = secondary compression settlement due to creep effects [ft]

Settlement caused by primary consolidation for a given layer of soil with uniform properties is calculated as:

$$S_c = \frac{h_0}{1+e_0}\left(C_r \log\frac{\sigma_c}{\sigma_0} + C_c \log\frac{\sigma_i}{\sigma_c}\right) \quad (2)$$

Where:

C_c = primary compression index
C_r = recompression index
h_0 = initial compressible layer thickness [ft]
e_0 = initial void ratio of the clay subgrade
σ_0 = initial overburden pressure acting on the compressible layer [psf]
σ_i = final overburden pressure acting on the compressible layer [psf]
σ_c = preconsolidation stress [psf], calculated using Equation 4.

Settlement due to secondary compression is calculated using Equation 3 below:

$$S_s = h_0 \frac{C_\alpha}{1+e_0} \log\left(\frac{t_2}{t_1}\right) \quad (3)$$

Where:

C_α = secondary compression index
H = layer thickness [ft]
t_2 = time after application of load (assumed 70 years)
t_1 = time required to complete primary consolidation (assumed 40 years)

- The elevations in this report are referenced to Mean Sea Level (MSL).
- The initial ground elevation (prior to initial development) was assumed to be approximately 705 ft. This value was inferred from the cross section profile from Engineering Drawings, Wayne Disposal, Inc. Site No.2 MC VI-F&G by NTH Consultants (2011b).

- The preconsolidation pressure of the middle clay and lower clay, the major contributing compressible layers below the existing waste, was set equal to the initial effective overburden pressure acting on them prior to development. This value is used in Equation 2 to estimate settlement resulting from an initial load less than the preconsolidation pressure. The net settlement between construction of the overfill liner and the proposed final conditions is calculated with the soils in either a normally-consolidated state (i.e., compression is calculated using C'_c) or over-consolidated state (i.e., compression is calculated using C'_r and C'_c) depending on whether the initial stress is greater than the preconsolidation stress or not, respectively. Note that in most cases, both layers of soil have experienced a higher overburden pressure since initial development of the site. This value is calculated using Equation 4.
- Calculation of settlement following MC-VI-G construction accounts for changes in overburden pressure resulting from construction activities and landfill operations.
- At each point selected along the leachate collection pipe system, the elevations for the existing ground, proposed MC-VI-G liner system, final cover, and the foundation soils are determined and used to compute the initial and final overburden pressures at each settlement point within the analysis using Equation 4 similarly to the preconsolidation pressure. Calculation spreadsheets for the settlement points in Cells MC-VI-G4 through MC-VI-G7 are presented in Attachment A-2.1.2.

$$\sigma_{c,0,f} = \sum_{i=0}^{n} \gamma_i \times h_i \qquad (4)$$

Where:

$\sigma_{c,0,f}$ = σ_c: preconsolidation stress [psf]
σ_0: initial stress [psf]
σ_f: final stress [psf]

γ_i = Unit weight of soil layer i [psf]

h_i = Thickness of layer i [ft] at settlement point as follows:
For σ_c use thicknesses of layers prior to development
For σ_0 use thicknesses of layers up to existing elevations
For σ_f use thicknesses of layers up to proposed final elevations

- Soil layers are identified using subsurface soil profiles provided in MCIV General Profiles (South), Appendix A Subsurface Soil/Waste Profiles & Corresponding Physical Properties, Volume III – WDI Operating License Application Master Cells VI F & G by NTH Consultants (2011a). These layers include in-situ clay with varying degrees of compressibility (see Table 2).
- The MC-VI-G liner system grades were determined from the design drawings. The respective pre-settlement slopes are shown in Tables 3 through 11 below.
- Attachment A-2.1.1 presents the plan locations of the settlement analysis points within MC-VI-G with respect to proposed cell floor grades.

CALCULATIONS:

Equations 1 through 4 were incorporated into a spreadsheet to conduct the settlement calculations. The settlement calculation output and resulting post-settlement slope(s) for the leachate collection pipes within MC-VI-G are presented in Table 3 through Table 6. The settlement calculation output and resulting post-settlement slope(s) for each analyzed cross slope within MC-VI-G are presented in Table 7 through Table 11. Attachment A-2.1.2 presents the cross-section profiles of the leachate collection pipe flowlines and cell floor cross slopes, and the settlement calculation spreadsheets for the individual points.

Table 3. MC-VI-G4 Leachate Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-01	6821.02	3927.03	707.63	3.77	125	703.87	3.5%	2.3%	1.0%
SP-02	6821.20	4051.75	712.00	5.27		706.73			
SP-02	6821.20	4051.75	712.00	5.27	114	706.73	3.5%	2.7%	1.0%
SP-03	6821.37	4166.03	716.00	6.19		709.81			
SP-03	6821.37	4166.03	716.00	6.19	123	709.81	3.5%	2.2%	1.0%
SP-04	6821.55	4289.37	720.32	7.81		712.51			

Table 4. MC-VI-G5 Leachate Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-07	6591.09	3931.50	712.86	3.69	109	709.17	3.5%	2.9%	1.0%
SP-08	6519.07	4013.94	716.69	4.36		712.33			
SP-08	6519.07	4013.94	716.69	4.36	86	712.33	3.5%	4.7%	1.0%
SP-09	6462.73	4078.42	719.69	3.37		716.32			
SP-09	6462.73	4078.42	719.69	3.37	87	716.32	5.0%	2.8%	1.0%
SP-10	6405.19	4144.28	724.06	5.29		718.77			
SP-10	6405.19	4144.28	724.06	5.29	170	718.77	3.5%	3.8%	1.0%
SP-11	6293.54	4272.06	730.00	4.77		725.23			
SP-11	6293.54	4272.06	730.00	4.77	48	725.23	3.5%	4.1%	1.0%
SP-12	6261.89	4308.31	731.68	4.49		727.19			

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: RR | Date: 5/16/2022

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: KF | Date: 5/17/2022

Calculation: Leachate Collection System Settlement Analysis | Approved By: XZ | Date: 5/17/2022

Table 5. MC-VI-G6 Leachate Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-15	6345.33	4693.30	700.88	2.99	47	697.89	3.5%	1.9%	1.0%
SP-16	6389.25	4676.09	702.53	3.75		698.77			
SP-16	6389.25	4676.09	702.53	3.75	70	698.77	3.5%	4.7%	1.0%
SP-16b	6454.30	4650.58	704.97	2.90		702.07			
SP-16b	6454.30	4650.58	704.97	2.90	55	702.07	9.5%	5.1%	1.0%
SP-16c	6505.08	4630.68	710.15	5.31		704.84			
SP-16c	6505.08	4630.68	710.15	5.31	215	704.84	3.5%	2.4%	1.0%
SP-17b	6704.95	4552.33	717.67	7.71		709.96			
SP-17b	6704.95	4552.33	717.67	7.71	65	709.96	3.5%	1.8%	1.0%
SP-17c	6765.08	4528.76	719.93	8.81		711.12			
SP-17c	6765.08	4528.76	719.93	8.81	89	711.12	3.5%	2.5%	1.0%
SP-18	6847.70	4496.37	723.03	9.68		713.35			
SP-18	6847.70	4496.37	723.03	9.68	63	713.35	3.5%	4.0%	1.0%
SP-18b	6906.30	4473.40	725.24	9.35		715.89			
SP-18b	6906.30	4473.40	725.24	9.35	69	715.89	3.5%	3.9%	1.0%
SP-19	6970.25	4448.33	727.64	9.07		718.57			

Table 6. MC-VI-G7 Leachate Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-22	6393.49	5048.84	681.79	2.14	141	679.65	3.5%	2.4%	1.0%
SP-23	6534.01	5048.84	686.71	3.72		682.99			
SP-23	6534.01	5048.84	686.71	3.72	253	682.99	3.5%	2.8%	1.0%
SP-24	6787.25	5048.84	695.57	5.42		690.15			
SP-24	6787.25	5048.84	695.57	5.42	168	690.15	3.5%	3.1%	1.0%
SP-25	6954.90	5048.84	701.44	6.12		695.32			

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: RR | Date: 5/16/2022

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: KF | Date: 5/17/2022

Calculation: Leachate Collection System Settlement Analysis | Approved By: XZ | Date: 5/17/2022

Table 7. MC-VI-G4 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	**Length**	Post-Settlement	Pre-Settlement	Post-Settlement	**Min. Slope**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-04	6821.55	4289.37	720.32	7.82	162	712.50	3.6%	4.4%	2.0%
SP-05	6983.40	4289.34	726.10	6.53		719.58			
SP-04	6821.55	4289.37	720.32	7.82	62	712.50	3.6%	7.2%	2.0%
SP-04b	6759.99	4289.38	722.51	5.55		716.96			
SP-04b	6759.99	4289.38	722.51	5.55	110	716.96	6.0%	3.1%	2.0%
SP-06	6649.78	4289.40	729.15	8.76		720.39			

Table 8. MC-VI-G5 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	**Length**	Post-Settlement	Pre-Settlement	Post-Settlement	**Min. Slope**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-09	6462.73	4078.42	719.69	3.36	297	716.33	3.6%	3.7%	2.0%
SP-14	6237.97	3884.80	730.38	2.97		727.42			
SP-10	6405.19	4144.28	724.06	5.47	64	718.60	4.0%	6.5%	2.0%
SP-10b	6453.73	4185.24	726.62	3.92		722.70			
SP-10b	6453.73	4185.24	726.62	3.92	51	722.70	8.9%	2.5%	2.0%
SP-10c	6491.13	4219.37	731.14	7.19		723.94			
SP-10c	6491.13	4219.37	731.14	7.19	174	723.94	3.9%	2.7%	2.0%
SP-13	6625.09	4329.82	737.83	9.16		728.68			

Table 9. MC-VI-G6 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	**Length**	Post-Settlement	Pre-Settlement	Post-Settlement	**Min. Slope**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-16	6389.25	4676.09	702.53	3.75	273	698.78	3.6%	3.7%	2.0%
SP-21	6290.21	4421.30	712.32	3.30		709.02			
SP-18	6847.70	4496.37	723.03	10.62	270	712.41	3.4%	3.5%	2.0%
SP-20	6937.43	4751.42	732.34	10.50		721.84			

Table 10. MC-VI-G7 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	**Length**	Post-Settlement	Pre-Settlement	Post-Settlement	**Min. Slope**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-23	6534.01	5048.84	686.71	3.72	81	682.99	3.4%	2.9%	2.0%
SP-26	6532.88	4967.83	689.46	4.08		685.38			
SP-25	6954.90	5048.84	701.44	6.12	62	695.32	3.6%	4.3%	2.0%
SP-27	6955.68	5111.30	703.70	5.68		698.02			
SP-25	6954.90	5048.84	701.44	6.12	63	695.32	3.4%	2.7%	2.0%
SP-28	6954.65	4986.17	703.56	6.52		697.04			

CALCULATION SHEET

Project No.: 1218070017.003

Client: Wayne Disposal, Inc. | Calculated By: RR | Date: 5/16/2022

Project: WDI MC VI-G4 through G7 Liner Grade Modification | Checked By: KF | Date: 5/17/2022

Calculation: Leachate Collection System Settlement Analysis | Approved By: XZ | Date: 5/17/2022

Table 11. MC-VI-G7 "Shelf" Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	**Length**	Post-Settlement	Pre-Settlement	Post-Settlement	**Min. Slope**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-20b	6944.94	4776.06	730.10	10.11	122	719.99	5.0%	4.0%	2.0%
SP-28b	6950.57	4897.93	724.00	8.94		715.06			

CONCLUSIONS

The post-settlement slope of the leachate collection pipe should be at least 1% and each cell floor cross slope should be at least 2% per Rule 299.9620 (4) (EGLE 2020). This calculation estimated the settlement at points along the leachate collection pipe and the cross slopes within MC-VI-G. The settlement of each of these points was used to calculate the post-settlement slopes of the MC-VI-G floor. This settlement analysis determined that all design leachate collection pipe slopes and resultant cross slopes within MC-VI-G meet the required minimum post-settlement slopes. Several zones along the pipe flowlines and cross slopes require steeper slopes than adjacent areas of the cell floors to meet the design criteria due to the influence of existing intracell dikes on differential settlement. These areas include:

- MCVI-G5 pipe flowline between SP-09 and SP-10
- MCVI-G6 pipe flowline between SP-16b and SP-16c
- MCVI-G4 cross slope between SP-04b and SP-06
- MCVI-G5 cross slope between SP-10b and SP-10c

The precise configuration of the intracell dikes is unknown. Using available subsurface information, CTI has considered the profile of known existing dikes in these settlement analyses. The location of these enhanced floor grade zones should be adjusted if MC VI- G4, G5, G6, and G7 construction activities reveal additional information about the location of the corresponding dikes. Adjustment of the enhanced floor grade zones should proceed as follows:

- During excavation of the cell floor subgrade, the materials encountered at the bottom of excavation within 30 feet of the mapped intracell dike locations shall be logged.
- Upon discovery of an intracell soil dike, its limits shall be surveyed across the width of the intersecting subgrade excavation bottom.
- The location of the discovered intracell dike shall be plotted in plan view and in cross section view and compared to Figures 1 to 3.
- If the waste-to-soil transition differs in horizontal location from that presented in Figures 1 to 3, the corresponding zone of enhanced floor grade (applicable to G5 pipe flowline, G6 pipe flowline, G4 cross slope, and G5 cross slope) shall be moved so that its boundaries align with the projected toe of sideslope for the corresponding dike.

REFERENCES

Coduto, D.P. (1999) *Geotechnical Engineering: Principles and Practices*, Prentice-Hall Inc., New Jersey

EGLE (2020) *Part 111 Administrative Rules,* Department of Environment, Great Lakes, and Energy *Hazardous Waste Management*, Materials Management Division.

NTH Consultants, Ltd. (2011a) *Volume III – WDI Operating License Application Master Cells VI F & G.*

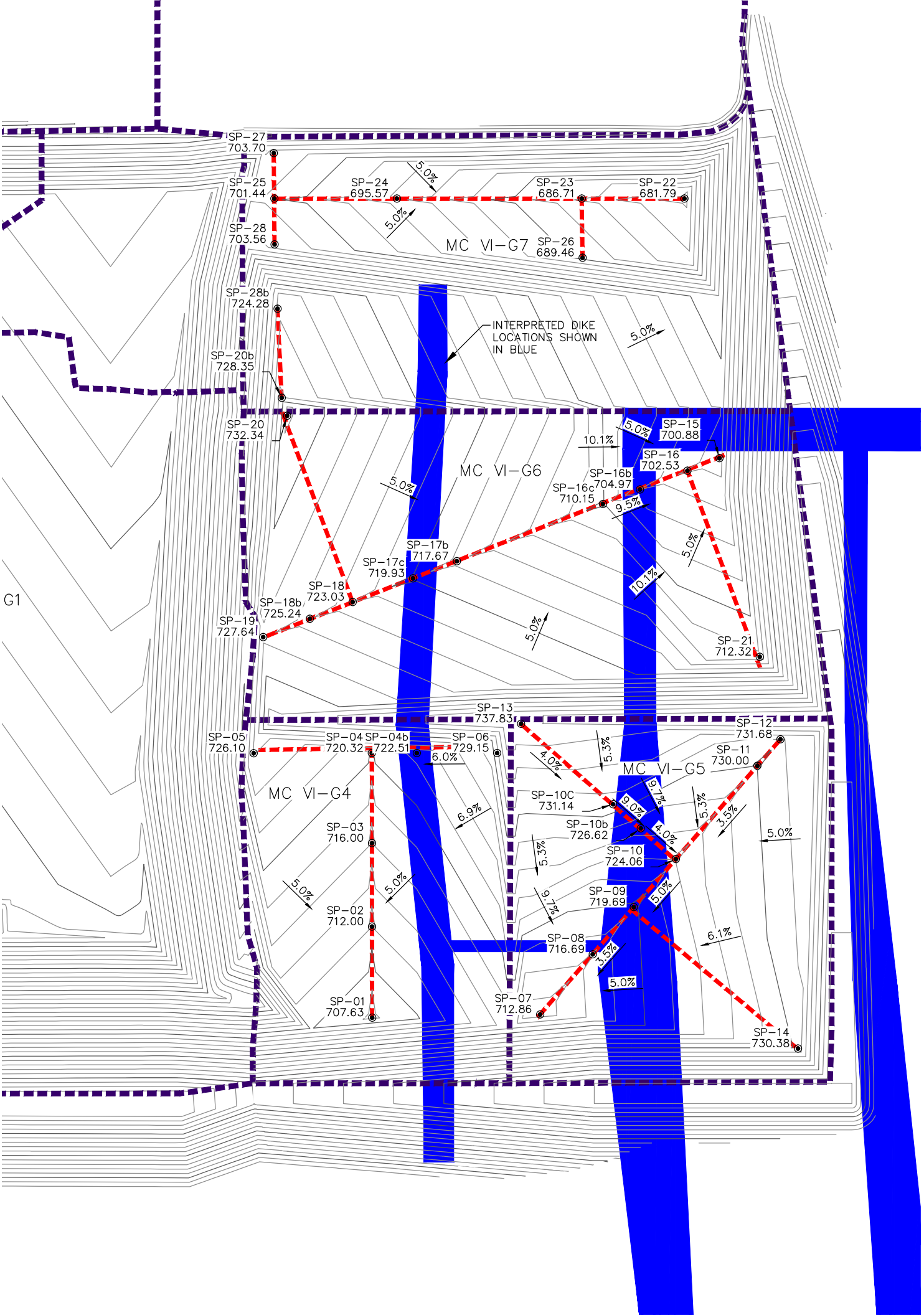
NTH Consultants, Ltd. (2011b) Engineering Drawings. *Wayne Disposal, Inc. Site No. 2 Master Cell VI-F&G.*

NTH Consultants, Ltd. (2008) Master Cell VI Design Modification Plans. *Wayne Disposal, Inc. Site No. 2.*

Attachment A-2.1.1

Settlement Analysis Points

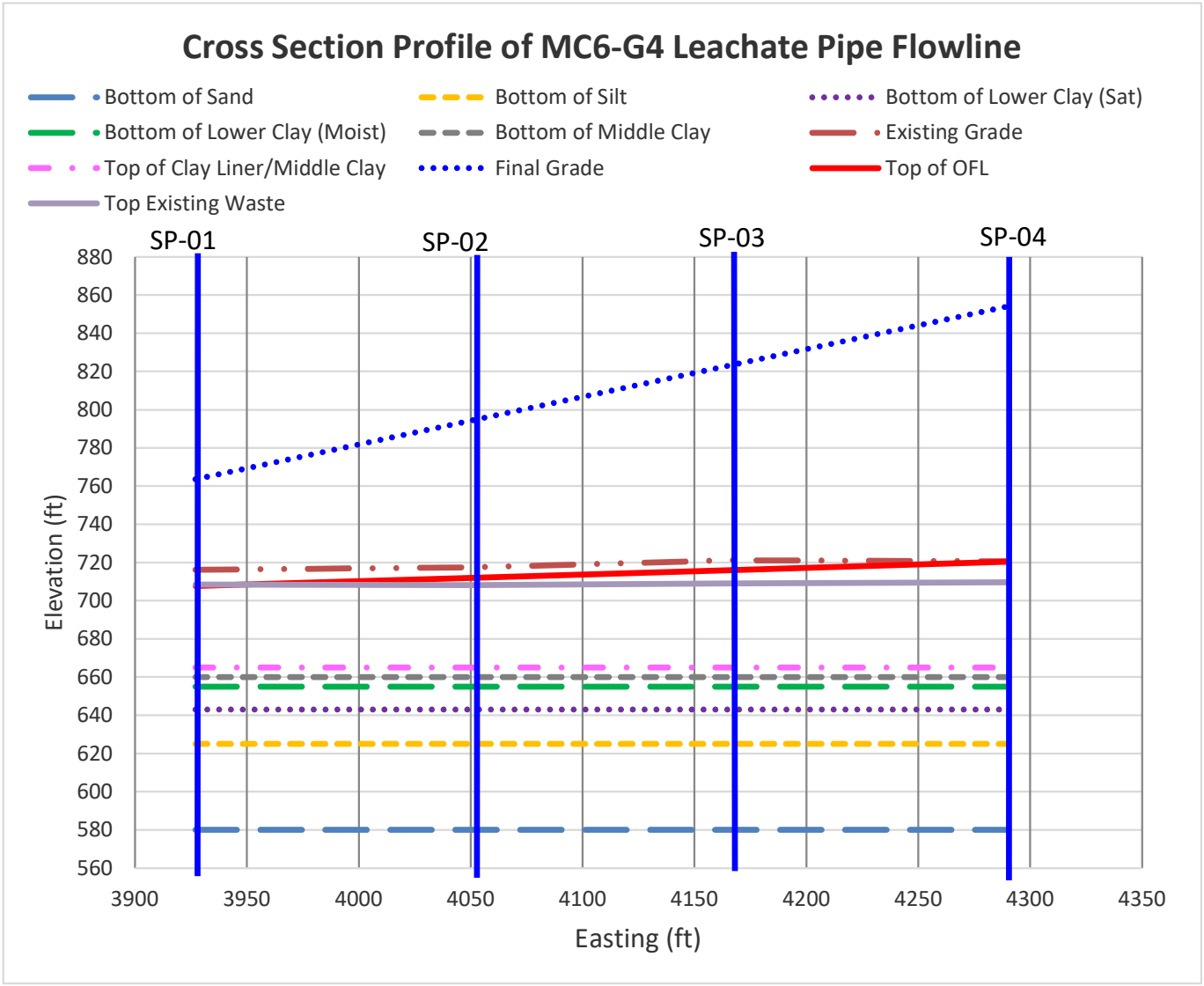
G4-G7 Liner Grade Modification


SP-27
703.70
SP-25
701.44
SP-24
695.57
SP-23
686.71
SP-22
681.79
SP-28
703.56
SP-26
689.46
MC VI-G7
SP-28b
724.28
INTERPRETED DIKE
LOCATIONS SHOWN
IN BLUE
SP-20b
728.35
SP-20
732.34
SP-15
700.88
SP-16
702.53
SP-16b
704.97
SP-16c
710.15
MC VI-G6
SP-17b
717.67
SP-17c
719.93
SP-18
723.03
SP-18b
725.24
SP-19
727.64
G1
SP-21
712.32
SP-13
737.83
SP-12
731.68
SP-11
730.00
SP-05
726.10
SP-04
720.32
SP-04b
722.51
SP-06
729.15
MC VI-G5
MC VI-G4
SP-10C
731.14
SP-10b
726.62
SP-10
724.06
SP-03
716.00
SP-09
719.69
SP-02
712.00
SP-08
716.69
SP-01
707.63
SP-07
712.86
SP-14
730.38
5.0%
10.1%
9.5%
6.0%
6.9%
4.0%
5.3%
3.5%
6.1%
9.7%

Attachment A-2.1.2

Cross-section Profiles and Settlement Calculation Spreadsheets

G4-G7 Liner Grade Modification


Cross Section Profile of MC6-G4 Leachate Pipe Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-01
SP-02
SP-03
SP-04
Elevation (ft)
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
3900
3950
4000
4050
4100
4150
4200
4250
4300
4350
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-01	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6821.02	3927.03	707.63	763.56	716.13	660.00	655.00	643.00	625.00	580.00	665.00	708.33

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	51.92	103.0	0	5348.0									
	3	OFL	7.80	135.0	1	-1053.0									
	4	Existing Waste	7.70	91.0	1	-700.3									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1753.3	1753.3	6833.0	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1753.3	1753.3	6833.0	NC	-	-
	4	Existing Waste	4.45	91.0	0	405.3	0.080	0.013	0.024	1956.0	1956.0	7035.7	NC	0.198	0.027
	4	Existing Waste	4.45	91.0	0	405.3	0.080	0.013	0.024	2361.3	2361.3	7441.1	NC	0.178	0.027
	4	Existing Waste	4.45	91.0	0	405.3	0.080	0.013	0.024	2766.7	2766.7	7846.4	NC	0.161	0.027
	4	Existing Waste	4.45	91.0	0	405.3	0.080	0.013	0.024	3172.0	3172.0	8251.7	NC	0.148	0.027
	4	Existing Waste	4.45	91.0	0	405.3	0.080	0.013	0.024	3577.4	3577.4	8657.1	NC	0.137	0.027
	4	Existing Waste	4.45	91.0	0	405.3	0.080	0.013	0.024	3982.7	3982.7	9062.4	NC	0.127	0.027
	4	Existing Waste	4.45	91.0	0	405.3	0.080	0.013	0.024	4388.1	4388.1	9467.8	NC	0.119	0.027
	4	Existing Waste	4.45	91.0	0	405.3	0.080	0.013	0.024	4793.4	4793.4	9873.1	NC	0.112	0.027
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5166.1	4780.0	10245.8	NC	0.076	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5506.1	5120.0	10585.8	NC	0.072	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5996.1	5610.0	11075.8	NC	0.228	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6512.9	6126.8	11592.6	NC	0.257	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6906.5	6520.4	11986.2	NC	0.246	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7385.0	6998.9	12464.7	NC	0.307	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7948.4	7562.3	13028.1	NC	0.290	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8466.8	8080.7	13546.5	NC	0.184	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8940.2	8554.1	14019.9	NC	0.176	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9413.6	9027.5	14493.3	NC	0.169	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9887.0	9500.9	14966.7	NC	0.162	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10360.4	9974.3	15440.1	NC	0.156	-
														3.501	0.264
											Total Settlement [ft]			**3.77**	

Variables & Constants	
Point Name	SP-01
Settlement Layer [ft]	120.6
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-02	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6821.20	4051.75	712.00	794.68	717.43	660.00	655.00	643.00	625.00	580.00	665.00	708.07

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	78.68	103.0	0	8104.0									
	3	OFL	9.36	135.0	1	-1263.2									
	4	Existing Waste	3.07	91.0	1	-279.4									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1542.5	1542.5	9589.0	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1542.5	1542.5	9589.0	NC	-	-
	4	Existing Waste	5.00	91.0	0	455.0	0.080	0.013	0.024	1770.0	1770.0	9816.5	NC	0.298	0.031
	4	Existing Waste	5.00	91.0	0	455.0	0.080	0.013	0.024	2225.0	2225.0	10271.5	NC	0.266	0.031
	4	Existing Waste	5.00	91.0	0	455.0	0.080	0.013	0.024	2680.0	2680.0	10726.5	NC	0.241	0.031
	4	Existing Waste	5.00	91.0	0	455.0	0.080	0.013	0.024	3135.0	3135.0	11181.5	NC	0.221	0.031
	4	Existing Waste	5.00	91.0	0	455.0	0.080	0.013	0.024	3590.0	3590.0	11636.5	NC	0.204	0.031
	4	Existing Waste	5.00	91.0	0	455.0	0.080	0.013	0.024	4045.0	4045.0	12091.5	NC	0.190	0.031
	4	Existing Waste	5.00	91.0	0	455.0	0.080	0.013	0.024	4500.0	4500.0	12546.5	NC	0.178	0.031
	4	Existing Waste	5.00	91.0	0	455.0	0.080	0.013	0.024	4955.0	4955.0	13001.5	NC	0.168	0.031
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5352.5	4780.0	13399.0	NC	0.102	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5692.5	5120.0	13739.0	NC	0.098	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6182.5	5610.0	14229.0	NC	0.310	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6699.3	6126.8	14745.8	NC	0.352	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7092.9	6520.4	15139.4	NC	0.338	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7571.4	6998.9	15617.9	NC	0.425	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8134.8	7562.3	16181.3	NC	0.403	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8653.2	8080.7	16699.7	NC	0.257	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9126.6	8554.1	17173.1	NC	0.247	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9600.0	9027.5	17646.5	NC	0.238	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10073.4	9500.9	18119.9	NC	0.229	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10546.8	9974.3	18593.3	NC	0.222	-
														4.984	0.291
											Total Settlement [ft]			**5.27**	

Variables & Constants	
Point Name	SP-02
Settlement Layer [ft]	125.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	OP EXISTING WASTE
SP-03	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6821.37	4166.03	716.00	823.22	721.16	660.00	655.00	643.00	625.00	580.00	665.00	709.13

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	103.22	103.0	0	10631.2									
	3	OFL	12.03	135.0	1	-1624.6									
	4	Existing Waste	0.13	91.0	1	-11.8									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1636.4	1636.4	12116.2	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1636.4	1636.4	12116.2	NC	-	-
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	1886.6	1886.6	12366.5	NC	0.359	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	2387.1	2387.1	12867.0	NC	0.322	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	2887.6	2887.6	13367.5	NC	0.293	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	3388.1	3388.1	13868.0	NC	0.269	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	3888.6	3888.6	14368.5	NC	0.250	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	4389.1	4389.1	14869.0	NC	0.233	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	4889.6	4889.6	15369.5	NC	0.219	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	5390.1	5390.1	15870.0	NC	0.206	0.034
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5810.4	4780.0	16290.2	NC	0.114	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	6150.4	5120.0	16630.2	NC	0.110	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6640.4	5610.0	17120.2	NC	0.352	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7157.2	6126.8	17637.0	NC	0.402	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7550.8	6520.4	18030.6	NC	0.388	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8029.3	6998.9	18509.1	NC	0.490	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8592.7	7562.3	19072.5	NC	0.467	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9111.1	8080.7	19590.9	NC	0.299	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9584.5	8554.1	20064.3	NC	0.289	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10057.9	9027.5	20537.7	NC	0.279	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10531.3	9500.9	21011.1	NC	0.270	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11004.7	9974.3	21484.5	NC	0.261	-
														5.873	0.315
													Total Settlement [ft]	**6.19**	

Variables & Constants	
Point Name	SP-03
Settlement Layer [ft]	129.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

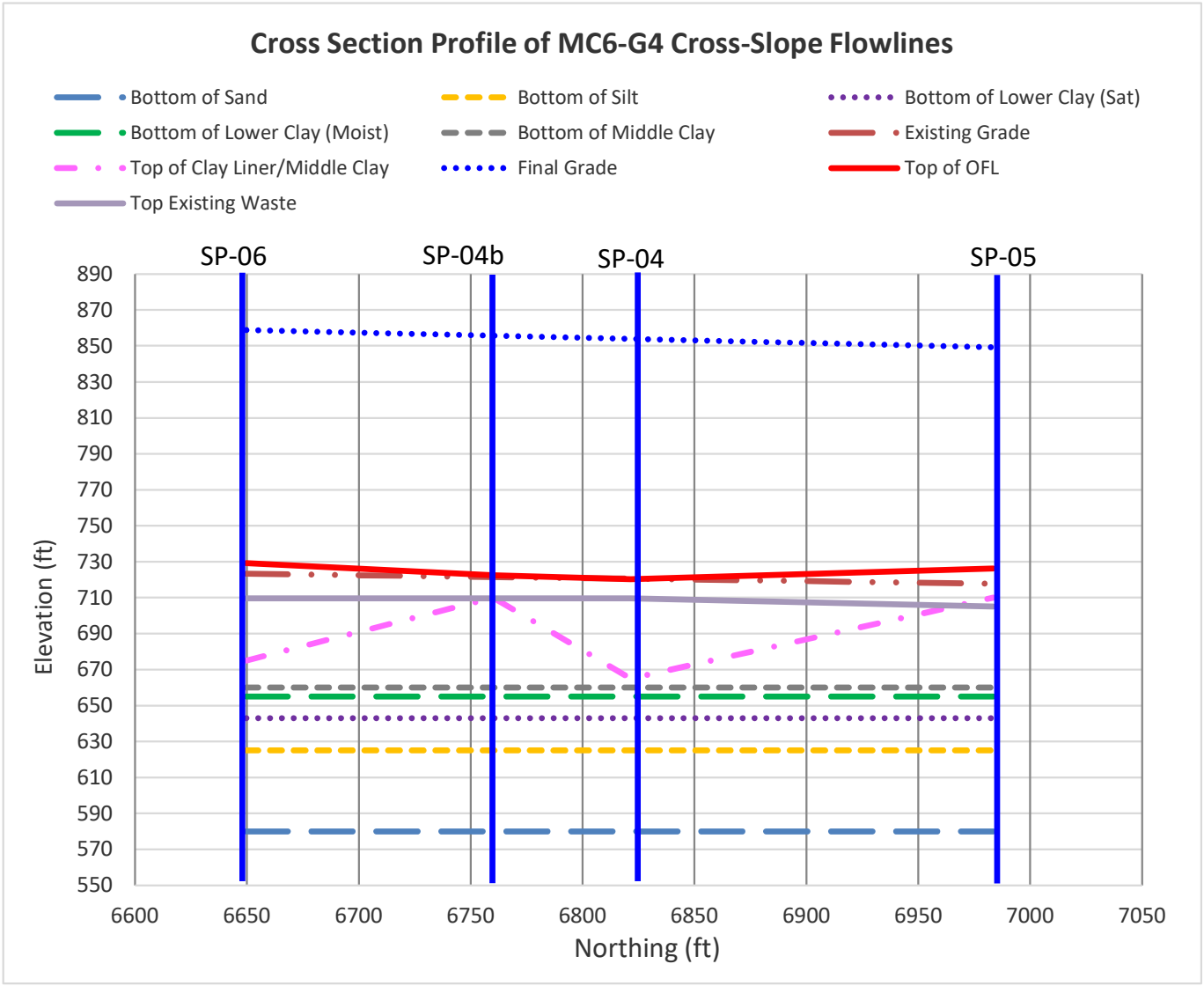
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	OP EXISTING WASTE
SP-04	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6821.55	4289.37	720.32	853.90	720.61	660.00	655.00	643.00	625.00	580.00	665.00	709.55

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	129.59	103.0	0	13347.4									
	3	OFL	7.30	135.0	1	-985.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	1.88	135.0	0	254.2	0.102	0.017	0.005	1112.2	1112.2	14959.5	NC	0.217	0.002
	3	OFL	1.88	135.0	0	254.2	0.102	0.017	0.005	1366.4	1366.4	15213.7	NC	0.201	0.002
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	1746.9	1746.9	15594.2	NC	0.424	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	2253.7	2253.7	16101.0	NC	0.380	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	2760.4	2760.4	16607.7	NC	0.347	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	3267.2	3267.2	17114.5	NC	0.320	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	3773.9	3773.9	17621.3	NC	0.298	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	4280.7	4280.7	18128.0	NC	0.279	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	4787.4	4787.4	18634.8	NC	0.263	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	5294.2	5294.2	19141.5	NC	0.249	0.034
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5717.6	4780.0	19564.9	NC	0.136	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	6057.6	5120.0	19904.9	NC	0.132	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6547.6	5610.0	20394.9	NC	0.422	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7064.4	6126.8	20911.7	NC	0.484	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7458.0	6520.4	21305.3	NC	0.468	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7936.5	6998.9	21783.8	NC	0.592	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8499.9	7562.3	22347.2	NC	0.567	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9018.3	8080.7	22865.6	NC	0.364	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9491.7	8554.1	23339.0	NC	0.352	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9965.1	9027.5	23812.4	NC	0.340	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10438.5	9500.9	24285.8	NC	0.330	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10911.9	9974.3	24759.2	NC	0.320	-
														7.484	0.323
												Total Settlement [ft]		7.81	

Variables & Constants	
Point Name	SP-04
Settlement Layer [ft]	133.3
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G4 Cross-Slope Flowlines
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-06
SP-04b
SP-04
SP-05
Elevation (ft)
890
870
850
830
810
790
770
750
730
710
690
670
650
630
610
590
570
550
6600
6650
6700
6750
6800
6850
6900
6950
7000
7050
Northing (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-04	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6821.55	4289.37	720.32	853.90	720.55	660.00	655.00	643.00	625.00	580.00	665.00	709.55

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	129.59	103.0	0	13347.4									
	3	OFL	7.23	135.0	1	-976.5									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	1.88	135.0	0	254.2	0.102	0.017	0.005	1103.6	1103.6	14959.5	NC	0.217	0.002
	3	OFL	1.88	135.0	0	254.2	0.102	0.017	0.005	1357.9	1357.9	15213.7	NC	0.202	0.002
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	1738.4	1738.4	15594.2	NC	0.424	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	2245.1	2245.1	16101.0	NC	0.381	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	2751.9	2751.9	16607.7	NC	0.348	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	3258.6	3258.6	17114.5	NC	0.321	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	3765.4	3765.4	17621.3	NC	0.299	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	4272.2	4272.2	18128.0	NC	0.280	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	4778.9	4778.9	18634.8	NC	0.263	0.034
	4	Existing Waste	5.57	91.0	0	506.8	0.080	0.013	0.024	5285.7	5285.7	19141.5	NC	0.249	0.034
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5709.1	4780.0	19564.9	NC	0.136	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	6049.1	5120.0	19904.9	NC	0.132	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6539.1	5610.0	20394.9	NC	0.422	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7055.9	6126.8	20911.7	NC	0.484	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7449.5	6520.4	21305.3	NC	0.468	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7928.0	6998.9	21783.8	NC	0.593	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8491.4	7562.3	22347.2	NC	0.567	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9009.8	8080.7	22865.6	NC	0.364	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9483.2	8554.1	23339.0	NC	0.352	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9956.6	9027.5	23812.4	NC	0.341	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10430.0	9500.9	24285.8	NC	0.330	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10903.4	9974.3	24759.2	NC	0.321	-
														7.495	0.323
													Total Settlement [ft]	**7.82**	

Variables & Constants	
Point Name	SP-04
Settlement Layer [ft]	133.3
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-04b	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6759.99	4289.38	722.51	855.67	721.53	660.00	655.00	643.00	625.00	580.00	710.00	709.55

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	129.16	103.0	0	13303.5									
	3	OFL	6.02	135.0	1	-812.2									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	2.98	135.0	0	402.4	0.102	0.017	0.005	1013.4	1013.4	14989.7	NC	0.356	0.004
	3	OFL	2.98	135.0	0	402.4	0.102	0.017	0.005	1415.9	1415.9	15392.2	NC	0.315	0.004
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1617.1	1617.1	15593.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1617.1	1617.1	15593.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1617.1	1617.1	15593.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1617.1	1617.1	15593.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1617.1	1617.1	15593.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1617.1	1617.1	15593.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1617.1	1617.1	15593.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1617.1	1617.1	15593.4	NC	-	-
	6	Middle Clay	24.78	136.0	0	3369.4	0.102	0.017	0.005	3301.8	6294.7	17278.1	OC-2	1.226	0.032
	6	Middle Clay	24.78	136.0	0	3369.4	0.102	0.017	0.005	6671.2	9664.1	20647.5	OC-2	0.901	0.032
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	8675.9	11668.8	22652.2	OC-2	0.265	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9192.7	12185.6	23169.0	OC-2	0.307	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9586.3	12579.2	23562.6	OC-2	0.300	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10064.8	13057.7	24041.1	OC-2	0.358	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10628.2	13621.1	24604.5	OC-2	0.347	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11146.6	14139.5	25122.9	OC-2	0.225	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11620.0	14612.9	25596.3	OC-2	0.219	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12093.4	15086.3	26069.7	OC-2	0.214	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12566.8	15559.7	26543.1	OC-2	0.209	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13040.2	16033.1	27016.5	OC-2	0.204	-
														5.445	0.110
													Total Settlement [ft]	**5.55**	

Variables & Constants	
Point Name	SP-04b
Settlement Layer [ft]	135.5
ERROR	0.0
# of Layers	14
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-05	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6983.40	4289.34	726.10	849.25	717.70	660.00	655.00	643.00	625.00	580.00	710.00	705.03

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	119.15	103.0	0	12272.2									
	3	OFL	8.40	135.0	0	1134.4									
	4	Existing Waste	0.00	91.0	1	-									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	6.34	135.0	0	855.2	0.102	0.017	0.005	427.6	427.6	14374.2	NC	0.986	0.008
	3	OFL	6.34	135.0	0	855.2	0.102	0.017	0.005	1282.8	1282.8	15229.4	NC	0.694	0.008
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1710.5	1710.5	15657.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1710.5	1710.5	15657.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1710.5	1710.5	15657.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1710.5	1710.5	15657.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1710.5	1710.5	15657.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1710.5	1710.5	15657.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1710.5	1710.5	15657.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	1710.5	1710.5	15657.0	NC	-	-
	6	Middle Clay	22.52	136.0	0	3062.0	0.102	0.017	0.005	3241.5	6141.0	17188.1	OC-2	1.133	0.029
	6	Middle Clay	22.52	136.0	0	3062.0	0.102	0.017	0.005	6303.5	9203.1	20250.1	OC-2	0.849	0.029
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	8154.5	11054.1	22101.1	OC-2	0.276	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8671.3	11570.9	22617.9	OC-2	0.320	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9064.9	11964.5	23011.5	OC-2	0.312	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9543.4	12443.0	23490.0	OC-2	0.373	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10106.8	13006.4	24053.4	OC-2	0.360	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10625.2	13524.8	24571.8	OC-2	0.233	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11098.6	13998.2	25045.2	OC-2	0.227	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11572.0	14471.6	25518.6	OC-2	0.222	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12045.4	14945.0	25992.0	OC-2	0.216	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12518.8	15418.4	26465.4	OC-2	0.211	-
														6.414	0.113
													Total Settlement [ft]	**6.53**	

Variables & Constants	
Point Name	SP-05
Settlement Layer [ft]	137.7
ERROR	0.0
# of Layers	14
t / t_p [ratio]	1.8

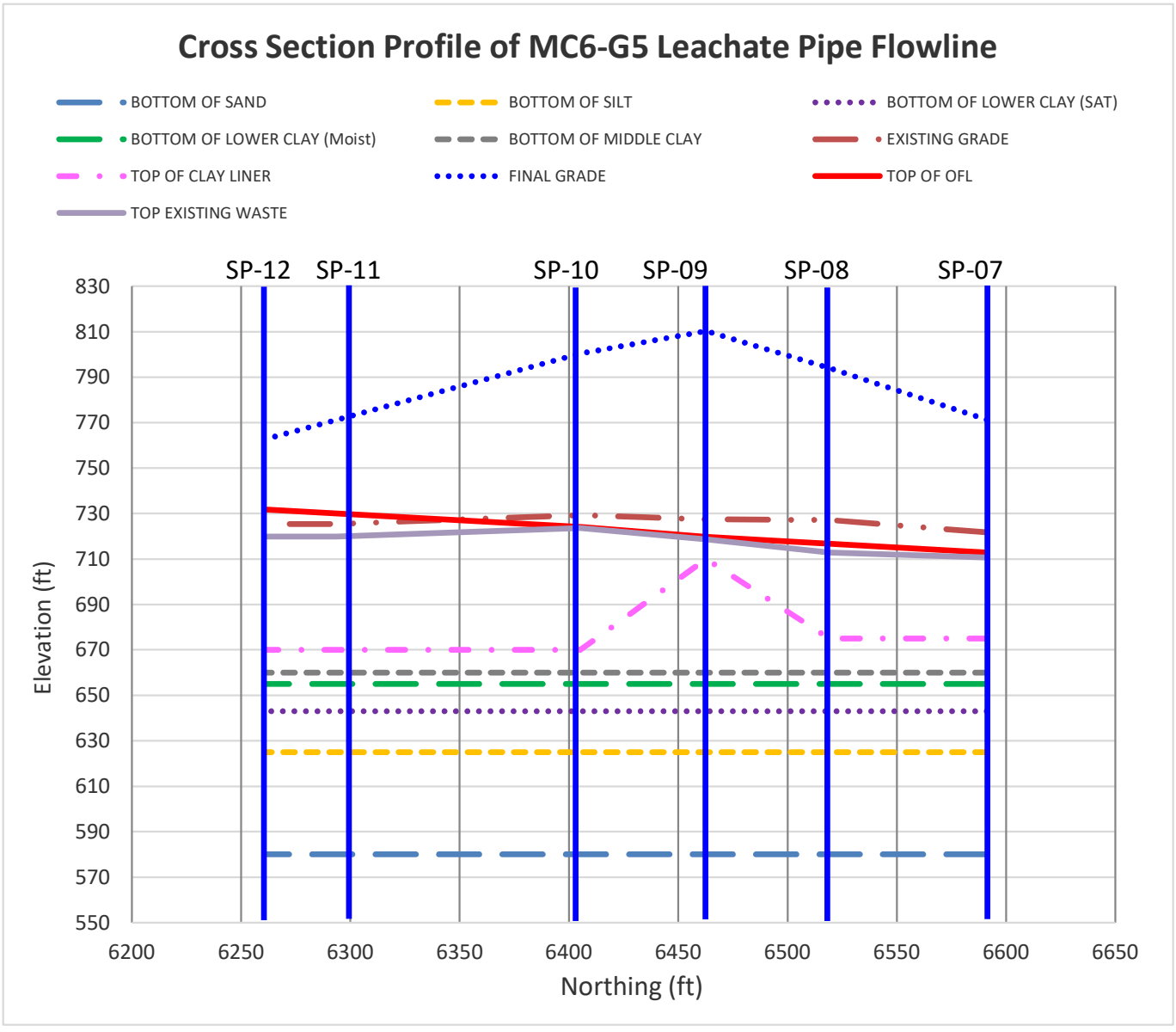
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-06	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6649.78	4289.40	729.15	858.84	723.28	660.00	655.00	643.00	625.00	580.00	675.00	709.56

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	125.69	103.0	0	12946.3									
	3	OFL	1.13	135.0	1	-152.7									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	6.29	135.0	0	849.8	0.102	0.017	0.005	577.6	577.6	14856.2	NC	0.905	0.008
	3	OFL	6.29	135.0	0	849.8	0.102	0.017	0.005	1427.3	1427.3	15706.0	NC	0.669	0.008
	4	Existing Waste	4.32	91.0	0	393.1	0.080	0.013	0.024	2048.8	2048.8	16327.4	NC	0.312	0.026
	4	Existing Waste	4.32	91.0	0	393.1	0.080	0.013	0.024	2441.9	2441.9	16720.5	NC	0.289	0.026
	4	Existing Waste	4.32	91.0	0	393.1	0.080	0.013	0.024	2835.0	2835.0	17113.7	NC	0.270	0.026
	4	Existing Waste	4.32	91.0	0	393.1	0.080	0.013	0.024	3228.1	3228.1	17506.8	NC	0.254	0.026
	4	Existing Waste	4.32	91.0	0	393.1	0.080	0.013	0.024	3621.2	3621.2	17899.9	NC	0.240	0.026
	4	Existing Waste	4.32	91.0	0	393.1	0.080	0.013	0.024	4014.4	4014.4	18293.0	NC	0.228	0.026
	4	Existing Waste	4.32	91.0	0	393.1	0.080	0.013	0.024	4407.5	4407.5	18686.1	NC	0.217	0.026
	4	Existing Waste	4.32	91.0	0	393.1	0.080	0.013	0.024	4800.6	4800.6	19079.3	NC	0.207	0.026
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	5507.2	5120.0	19785.8	NC	0.425	0.010
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	6527.2	6140.0	20805.8	NC	0.385	0.010
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7357.2	6970.0	21635.8	NC	0.401	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7874.0	7486.8	22152.6	NC	0.461	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8267.6	7880.4	22546.2	NC	0.447	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8746.1	8358.9	23024.7	NC	0.568	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9309.5	8922.3	23588.1	NC	0.545	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9827.9	9440.7	24106.5	NC	0.351	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10301.3	9914.1	24579.9	NC	0.340	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10774.7	10387.5	25053.3	NC	0.330	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11248.1	10860.9	25526.7	NC	0.320	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11721.5	11334.3	26000.1	NC	0.311	-
														8.473	0.286
													Total Settlement [ft]	**8.76**	

Variables & Constants	
Point Name	SP-06
Settlement Layer [ft]	142.1
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G5 Leachate Pipe Flowline
BOTTOM OF SAND
BOTTOM OF SILT
BOTTOM OF LOWER CLAY (SAT)
BOTTOM OF LOWER CLAY (Moist)
BOTTOM OF MIDDLE CLAY
EXISTING GRADE
TOP OF CLAY LINER
FINAL GRADE
TOP OF OFL
TOP EXISTING WASTE
SP-12
SP-11
SP-10
SP-09
SP-08
SP-07
830
810
790
770
750
730
710
690
670
650
630
610
590
570
550
Elevation (ft)
6200
6250
6300
6350
6400
6450
6500
6550
6600
6650
Northing (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-07	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6591.09	3931.50	712.86	771.35	721.72	660.00	655.00	643.00	625.00	580.00	675.00	710.70

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	54.49	103.0	0	5612.2									
	3	OFL	11.02	135.0	1	-1487.7									
	4	Exisitng Waste	4.84	91.0	1	-440.4									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1928.1	1928.1	7097.2	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1928.1	1928.1	7097.2	NC	-	-
	4	Existing Waste	3.86	91.0	0	351.0	0.080	0.013	0.024	2103.7	2103.7	7272.8	NC	0.166	0.024
	4	Existing Waste	3.86	91.0	0	351.0	0.080	0.013	0.024	2454.7	2454.7	7623.8	NC	0.152	0.024
	4	Existing Waste	3.86	91.0	0	351.0	0.080	0.013	0.024	2805.7	2805.7	7974.8	NC	0.140	0.024
	4	Existing Waste	3.86	91.0	0	351.0	0.080	0.013	0.024	3156.8	3156.8	8325.9	NC	0.130	0.024
	4	Existing Waste	3.86	91.0	0	351.0	0.080	0.013	0.024	3507.8	3507.8	8676.9	NC	0.121	0.024
	4	Existing Waste	3.86	91.0	0	351.0	0.080	0.013	0.024	3858.8	3858.8	9027.9	NC	0.114	0.024
	4	Existing Waste	3.86	91.0	0	351.0	0.080	0.013	0.024	4209.9	4209.9	9379.0	NC	0.107	0.024
	4	Existing Waste	3.86	91.0	0	351.0	0.080	0.013	0.024	4560.9	4560.9	9730.0	NC	0.102	0.024
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	5246.4	5120.0	10415.5	NC	0.228	0.010
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	6266.4	6140.0	11435.5	NC	0.200	0.010
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7096.4	6970.0	12265.5	NC	0.203	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7613.2	7486.8	12782.3	NC	0.231	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8006.8	7880.4	13175.9	NC	0.222	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8485.3	8358.9	13654.4	NC	0.279	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9048.7	8922.3	14217.8	NC	0.265	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9567.1	9440.7	14736.2	NC	0.169	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10040.5	9914.1	15209.6	NC	0.162	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10513.9	10387.5	15683.0	NC	0.156	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10987.3	10860.9	16156.4	NC	0.151	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11460.7	11334.3	16629.8	NC	0.146	-
														3.444	0.247
													Total Settlement [ft]	**3.69**	

Variables & Constants	
Point Name	SP-07
Settlement Layer [ft]	125.9
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-08	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6519.07	4013.94	716.69	794.05	727.13	660.00	655.00	643.00	625.00	580.00	675.00	712.76

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	73.36	103.0	0	7556.1									
	3	OFL	14.37	135.0	1	-1940.0									
	4	Existing Waste	3.07	91.0	1	-279.2									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2219.2	2219.2	9041.1	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2219.2	2219.2	9041.1	NC	-	-
	4	Existing Waste	4.34	91.0	0	394.6	0.080	0.013	0.024	2416.5	2416.5	9238.4	NC	0.202	0.027
	4	Existing Waste	4.34	91.0	0	394.6	0.080	0.013	0.024	2811.1	2811.1	9633.0	NC	0.186	0.027
	4	Existing Waste	4.34	91.0	0	394.6	0.080	0.013	0.024	3205.7	3205.7	10027.6	NC	0.172	0.027
	4	Existing Waste	4.34	91.0	0	394.6	0.080	0.013	0.024	3600.3	3600.3	10422.2	NC	0.160	0.027
	4	Existing Waste	4.34	91.0	0	394.6	0.080	0.013	0.024	3995.0	3995.0	10816.8	NC	0.150	0.027
	4	Existing Waste	4.34	91.0	0	394.6	0.080	0.013	0.024	4389.6	4389.6	11211.5	NC	0.141	0.027
	4	Existing Waste	4.34	91.0	0	394.6	0.080	0.013	0.024	4784.2	4784.2	11606.1	NC	0.134	0.027
	4	Existing Waste	4.34	91.0	0	394.6	0.080	0.013	0.024	5178.8	5178.8	12000.7	NC	0.127	0.027
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	5886.1	5120.0	12708.0	NC	0.256	0.010
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	6906.1	6140.0	13728.0	NC	0.228	0.010
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7736.1	6970.0	14558.0	NC	0.235	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8252.9	7486.8	15074.8	NC	0.268	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8646.5	7880.4	15468.4	NC	0.259	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9125.0	8358.9	15946.9	NC	0.327	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9688.4	8922.3	16510.3	NC	0.313	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10206.8	9440.7	17028.7	NC	0.200	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10680.2	9914.1	17502.1	NC	0.193	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11153.6	10387.5	17975.5	NC	0.187	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11627.0	10860.9	18448.9	NC	0.180	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12100.4	11334.3	18922.3	NC	0.175	-
														4.092	0.271
													Total Settlement [ft]	**4.36**	

Variables & Constants	
Point Name	SP-08
Settlement Layer [ft]	129.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-09	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6462.73	4078.42	719.69	810.28	727.41	660.00	655.00	643.00	625.00	580.00	710.00	718.59

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	86.59	103.0	0	8918.5									
	3	OFL	8.82	135.0	1	-1190.7									
	4	Existing Waste	5.90	91.0	1	-537.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1727.8	1727.8	10403.5	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1727.8	1727.8	10403.5	NC	-	-
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1743.1	1743.1	10418.8	NC	0.021	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1773.6	1773.6	10449.4	NC	0.021	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1804.2	1804.2	10479.9	NC	0.021	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1834.8	1834.8	10510.5	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1865.4	1865.4	10541.1	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1895.9	1895.9	10571.7	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1926.5	1926.5	10602.3	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1957.1	1957.1	10632.8	NC	0.020	0.002
	6	Middle Clay	25.00	136.0	0	3400.0	0.102	0.017	0.005	3672.4	6310.0	12348.1	OC-2	0.843	0.032
	6	Middle Clay	25.00	136.0	0	3400.0	0.102	0.017	0.005	7072.4	9710.0	15748.1	OC-2	0.594	0.032
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	9092.4	11730.0	17768.1	OC-2	0.170	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9609.2	12246.8	18284.9	OC-2	0.197	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	10002.8	12640.4	18678.5	OC-2	0.191	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10481.3	13118.9	19157.0	OC-2	0.222	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	11044.7	13682.3	19720.4	OC-2	0.214	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11563.1	14200.7	20238.8	OC-2	0.138	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12036.5	14674.1	20712.2	OC-2	0.135	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12509.9	15147.5	21185.6	OC-2	0.131	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12983.3	15620.9	21659.0	OC-2	0.128	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13456.7	16094.3	22132.4	OC-2	0.125	-
														3.251	0.119
													Total Settlement [ft]	**3.37**	

Variables & Constants	
Point Name	SP-09
Settlement Layer [ft]	132.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-10	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6405.19	4144.28	724.06	800.34	729.30	660.00	655.00	643.00	625.00	580.00	670.00	723.59

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	72.28	103.0	0	7445.1									
	3	OFL	5.71	135.0	1	-770.8									
	4	Exisitng Waste	6.53	91.0	1	-594.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1365.0	1365.0	8930.1	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1365.0	1365.0	8930.1	NC	-	-
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	1632.6	1632.6	9197.8	NC	0.353	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	2168.0	2168.0	9733.1	NC	0.307	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	2703.3	2703.3	10268.5	NC	0.273	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	3238.6	3238.6	10803.8	NC	0.246	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	3773.9	3773.9	11339.1	NC	0.225	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	4309.2	4309.2	11874.4	NC	0.207	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	4844.6	4844.6	12409.7	NC	0.192	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	5379.9	5379.9	12945.1	NC	0.179	0.036
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5987.5	4950.0	13552.7	NC	0.181	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6667.5	5630.0	14232.7	NC	0.168	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7327.5	6290.0	14892.7	NC	0.263	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7844.3	6806.8	15409.5	NC	0.301	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8237.9	7200.4	15803.1	NC	0.290	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8716.4	7678.9	16281.6	NC	0.366	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9279.8	8242.3	16845.0	NC	0.350	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9798.2	8760.7	17363.4	NC	0.224	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10271.6	9234.1	17836.8	NC	0.216	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10745.0	9707.5	18310.2	NC	0.208	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11218.4	10180.9	18783.6	NC	0.201	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11691.8	10654.3	19257.0	NC	0.195	-
														4.946	0.340
													Total Settlement [ft]	**5.29**	

Variables & Constants	
Point Name	SP-10
Settlement Layer [ft]	137.1
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-11	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6293.54	4272.06	730.00	771.20	725.40	660.00	655.00	643.00	625.00	580.00	670.00	719.82

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	37.20	103.0	0	3831.4									
	3	OFL	2.40	135.0	1	-323.9									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	1.59	135.0	0	214.7	0.102	0.017	0.005	431.3	431.3	5423.7	NC	0.178	0.002
	3	OFL	1.59	135.0	0	214.7	0.102	0.017	0.005	646.0	646.0	5638.4	NC	0.153	0.002
	4	Existing Waste	6.23	91.0	0	566.7	0.080	0.013	0.024	1036.7	1036.7	6029.1	NC	0.381	0.038
	4	Existing Waste	6.23	91.0	0	566.7	0.080	0.013	0.024	1603.4	1603.4	6595.8	NC	0.306	0.038
	4	Existing Waste	6.23	91.0	0	566.7	0.080	0.013	0.024	2170.1	2170.1	7162.5	NC	0.258	0.038
	4	Existing Waste	6.23	91.0	0	566.7	0.080	0.013	0.024	2736.8	2736.8	7729.2	NC	0.225	0.038
	4	Existing Waste	6.23	91.0	0	566.7	0.080	0.013	0.024	3303.5	3303.5	8295.9	NC	0.199	0.038
	4	Existing Waste	6.23	91.0	0	566.7	0.080	0.013	0.024	3870.2	3870.2	8862.6	NC	0.179	0.038
	4	Existing Waste	6.23	91.0	0	566.7	0.080	0.013	0.024	4436.9	4436.9	9429.3	NC	0.163	0.038
	4	Existing Waste	6.23	91.0	0	566.7	0.080	0.013	0.024	5003.6	5003.6	9996.0	NC	0.150	0.038
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5626.9	4950.0	10619.4	NC	0.141	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6306.9	5630.0	11299.4	NC	0.129	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6966.9	6290.0	11959.4	NC	0.201	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7483.7	6806.8	12476.2	NC	0.228	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7877.3	7200.4	12869.8	NC	0.219	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8355.8	7678.9	13348.3	NC	0.275	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8919.2	8242.3	13911.7	NC	0.261	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9437.6	8760.7	14430.1	NC	0.166	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9911.0	9234.1	14903.5	NC	0.159	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10384.4	9707.5	15376.9	NC	0.153	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10857.8	10180.9	15850.3	NC	0.148	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11331.2	10654.3	16323.7	NC	0.143	-
														4.414	0.361
													Total Settlement [ft]	**4.77**	

Variables & Constants	
Point Name	SP-11
Settlement Layer [ft]	143.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

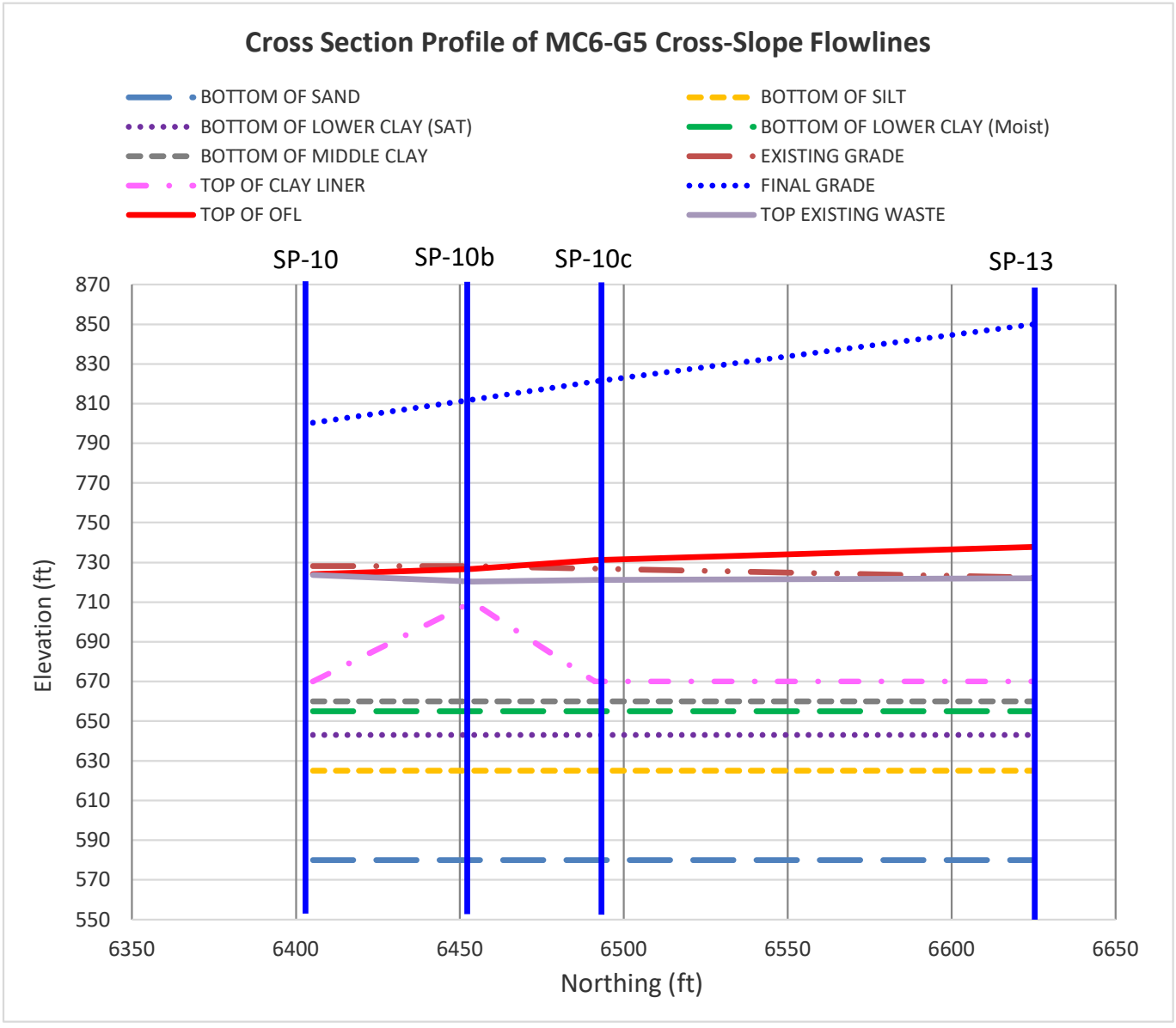
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-12	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6261.89	4308.31	731.68	762.93	725.44	660.00	655.00	643.00	625.00	580.00	670.00	719.91

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	27.25	103.0	0	2806.6									
	3	OFL	0.76	135.0	1	-102.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	2.39	135.0	0	322.3	0.102	0.017	0.005	263.1	263.1	4452.8	NC	0.299	0.003
	3	OFL	2.39	135.0	0	322.3	0.102	0.017	0.005	585.4	585.4	4775.1	NC	0.222	0.003
	4	Existing Waste	6.24	91.0	0	567.7	0.080	0.013	0.024	1030.4	1030.4	5220.1	NC	0.352	0.038
	4	Existing Waste	6.24	91.0	0	567.7	0.080	0.013	0.024	1598.1	1598.1	5787.8	NC	0.279	0.038
	4	Existing Waste	6.24	91.0	0	567.7	0.080	0.013	0.024	2165.9	2165.9	6355.5	NC	0.233	0.038
	4	Existing Waste	6.24	91.0	0	567.7	0.080	0.013	0.024	2733.6	2733.6	6923.2	NC	0.201	0.038
	4	Existing Waste	6.24	91.0	0	567.7	0.080	0.013	0.024	3301.3	3301.3	7491.0	NC	0.178	0.038
	4	Existing Waste	6.24	91.0	0	567.7	0.080	0.013	0.024	3869.0	3869.0	8058.7	NC	0.159	0.038
	4	Existing Waste	6.24	91.0	0	567.7	0.080	0.013	0.024	4436.8	4436.8	8626.4	NC	0.144	0.038
	4	Existing Waste	6.24	91.0	0	567.7	0.080	0.013	0.024	5004.5	5004.5	9194.1	NC	0.132	0.038
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5628.4	4950.0	9818.0	NC	0.123	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6308.4	5630.0	10498.0	NC	0.113	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6968.4	6290.0	11158.0	NC	0.175	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7485.2	6806.8	11674.8	NC	0.198	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7878.8	7200.4	12068.4	NC	0.190	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8357.3	7678.9	12546.9	NC	0.238	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8920.7	8242.3	13110.3	NC	0.226	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9439.1	8760.7	13628.7	NC	0.144	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9912.5	9234.1	14102.1	NC	0.138	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10385.9	9707.5	14575.5	NC	0.132	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10859.3	10180.9	15048.9	NC	0.128	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11332.7	10654.3	15522.3	NC	0.123	-
														4.126	0.364
													Total Settlement [ft]	**4.49**	

Variables & Constants	
Point Name	SP-12
Settlement Layer [ft]	144.7
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G5 Cross-Slope Flowlines
BOTTOM OF SAND
BOTTOM OF SILT
BOTTOM OF LOWER CLAY (SAT)
BOTTOM OF LOWER CLAY (Moist)
BOTTOM OF MIDDLE CLAY
EXISTING GRADE
TOP OF CLAY LINER
FINAL GRADE
TOP OF OFL
TOP EXISTING WASTE
SP-10
SP-10b
SP-10c
SP-13
Elevation (ft)
870
850
830
810
790
770
750
730
710
690
670
650
630
610
590
570
550
6350
6400
6450
6500
6550
6600
6650
Northing (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-09	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6462.73	4078.42	719.69	810.28	727.92	660.00	655.00	643.00	625.00	580.00	710.00	718.59

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	86.59	103.0	0	8918.5									
	3	OFL	9.33	135.0	1	-1259.0									
	4	Existing Waste	5.90	91.0	1	-537.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1796.1	1796.1	10403.5	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1796.1	1796.1	10403.5	NC	-	-
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1811.3	1811.3	10418.8	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1841.9	1841.9	10449.4	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1872.5	1872.5	10479.9	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1903.1	1903.1	10510.5	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1933.7	1933.7	10541.1	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1964.2	1964.2	10571.7	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	1994.8	1994.8	10602.3	NC	0.020	0.002
	4	Existing Waste	0.34	91.0	0	30.6	0.080	0.013	0.024	2025.4	2025.4	10632.8	NC	0.019	0.002
	6	Middle Clay	25.00	136.0	0	3400.0	0.102	0.017	0.005	3740.7	6310.0	12348.1	OC-2	0.840	0.032
	6	Middle Clay	25.00	136.0	0	3400.0	0.102	0.017	0.005	7140.7	9710.0	15748.1	OC-2	0.592	0.032
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	9160.7	11730.0	17768.1	OC-2	0.169	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9677.5	12246.8	18284.9	OC-2	0.196	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	10071.1	12640.4	18678.5	OC-2	0.191	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10549.6	13118.9	19157.0	OC-2	0.222	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	11113.0	13682.3	19720.4	OC-2	0.214	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11631.4	14200.7	20238.8	OC-2	0.138	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12104.8	14674.1	20712.2	OC-2	0.135	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12578.2	15147.5	21185.6	OC-2	0.131	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13051.6	15620.9	21659.0	OC-2	0.128	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13525.0	16094.3	22132.4	OC-2	0.125	-
														3.241	0.119
											Total Settlement [ft]			**3.36**	

Variables & Constants	
Point Name	SP-09
Settlement Layer [ft]	132.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-10	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6405.19	4144.28	724.06	800.34	728.10	660.00	655.00	643.00	625.00	580.00	670.00	723.59

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	72.28	103.0	0	7445.1									
	3	OFL	4.51	135.0	1	-609.4									
	4	Exisitng Waste	6.53	91.0	1	-594.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1203.5	1203.5	8930.1	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1203.5	1203.5	8930.1	NC	-	-
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	1471.1	1471.1	9197.8	NC	0.375	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	2006.5	2006.5	9733.1	NC	0.323	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	2541.8	2541.8	10268.5	NC	0.285	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	3077.1	3077.1	10803.8	NC	0.257	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	3612.4	3612.4	11339.1	NC	0.234	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	4147.8	4147.8	11874.4	NC	0.215	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	4683.1	4683.1	12409.7	NC	0.199	0.036
	4	Existing Waste	5.88	91.0	0	535.3	0.080	0.013	0.024	5218.4	5218.4	12945.1	NC	0.186	0.036
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5826.1	4950.0	13552.7	NC	0.187	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6506.1	5630.0	14232.7	NC	0.173	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7166.1	6290.0	14892.7	NC	0.272	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7682.9	6806.8	15409.5	NC	0.310	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8076.5	7200.4	15803.1	NC	0.299	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8555.0	7678.9	16281.6	NC	0.377	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9118.4	8242.3	16845.0	NC	0.360	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9636.8	8760.7	17363.4	NC	0.230	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10110.2	9234.1	17836.8	NC	0.222	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10583.6	9707.5	18310.2	NC	0.214	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11057.0	10180.9	18783.6	NC	0.207	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11530.4	10654.3	19257.0	NC	0.200	-
														5.125	0.340
														Total Settlement [ft]	**5.47**

Variables & Constants	
Point Name	SP-10
Settlement Layer [ft]	137.1
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-10b	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6453.73	4185.24	726.62	811.97	728.13	660.00	655.00	643.00	625.00	580.00	710.00	720.29

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	81.35	103.0	0	8379.5									
	3	OFL	7.85	135.0	1	-1059.5									
	4	Exisitng Waste	0.67	91.0	1	-60.9									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1120.4	1120.4	9864.5	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1120.4	1120.4	9864.5	NC	-	-
	4	Existing Waste	1.20	91.0	0	109.4	0.080	0.013	0.024	1175.1	1175.1	9919.2	NC	0.089	0.007
	4	Existing Waste	1.20	91.0	0	109.4	0.080	0.013	0.024	1284.5	1284.5	10028.6	NC	0.086	0.007
	4	Existing Waste	1.20	91.0	0	109.4	0.080	0.013	0.024	1393.9	1393.9	10138.0	NC	0.083	0.007
	4	Existing Waste	1.20	91.0	0	109.4	0.080	0.013	0.024	1503.3	1503.3	10247.4	NC	0.080	0.007
	4	Existing Waste	1.20	91.0	0	109.4	0.080	0.013	0.024	1612.7	1612.7	10356.8	NC	0.078	0.007
	4	Existing Waste	1.20	91.0	0	109.4	0.080	0.013	0.024	1722.0	1722.0	10466.2	NC	0.075	0.007
	4	Existing Waste	1.20	91.0	0	109.4	0.080	0.013	0.024	1831.4	1831.4	10575.6	NC	0.073	0.007
	4	Existing Waste	1.20	91.0	0	109.4	0.080	0.013	0.024	1940.8	1940.8	10685.0	NC	0.071	0.007
	6	Middle Clay	25.00	136.0	0	3400.0	0.102	0.017	0.005	3695.5	6310.0	12439.7	OC-2	0.850	0.032
	6	Middle Clay	25.00	136.0	0	3400.0	0.102	0.017	0.005	7095.5	9710.0	15839.7	OC-2	0.600	0.032
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	9115.5	11730.0	17859.7	OC-2	0.172	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9632.3	12246.8	18376.5	OC-2	0.199	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	10025.9	12640.4	18770.1	OC-2	0.193	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10504.4	13118.9	19248.6	OC-2	0.225	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	11067.8	13682.3	19812.0	OC-2	0.217	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11586.2	14200.7	20330.4	OC-2	0.140	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12059.6	14674.1	20803.8	OC-2	0.136	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12533.0	15147.5	21277.2	OC-2	0.133	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13006.4	15620.9	21750.6	OC-2	0.129	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13479.8	16094.3	22224.0	OC-2	0.126	-
														3.756	0.162
												Total Settlement [ft]		**3.92**	

Variables & Constants	
Point Name	SP-10b
Settlement Layer [ft]	139.6
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-10c	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6491.13	4219.37	731.14	821.11	726.85	660.00	655.00	643.00	625.00	580.00	670.00	721.14

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	85.97	103.0	0	8854.9									
	3	OFL	2.72	135.0	1	-366.6									
	4	Exisitng Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	1.50	135.0	0	202.1	0.102	0.017	0.005	467.6	467.6	10440.9	NC	0.206	0.002
	3	OFL	1.50	135.0	0	202.1	0.102	0.017	0.005	669.7	669.7	10643.0	NC	0.183	0.002
	4	Existing Waste	6.39	91.0	0	581.8	0.080	0.013	0.024	1061.6	1061.6	11034.9	NC	0.520	0.039
	4	Existing Waste	6.39	91.0	0	581.8	0.080	0.013	0.024	1643.4	1643.4	11616.7	NC	0.434	0.039
	4	Existing Waste	6.39	91.0	0	581.8	0.080	0.013	0.024	2225.2	2225.2	12198.4	NC	0.378	0.039
	4	Existing Waste	6.39	91.0	0	581.8	0.080	0.013	0.024	2806.9	2806.9	12780.2	NC	0.337	0.039
	4	Existing Waste	6.39	91.0	0	581.8	0.080	0.013	0.024	3388.7	3388.7	13361.9	NC	0.305	0.039
	4	Existing Waste	6.39	91.0	0	581.8	0.080	0.013	0.024	3970.4	3970.4	13943.7	NC	0.279	0.039
	4	Existing Waste	6.39	91.0	0	581.8	0.080	0.013	0.024	4552.2	4552.2	14525.4	NC	0.258	0.039
	4	Existing Waste	6.39	91.0	0	581.8	0.080	0.013	0.024	5133.9	5133.9	15107.2	NC	0.240	0.039
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5764.8	4950.0	15738.1	NC	0.222	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6444.8	5630.0	16418.1	NC	0.207	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7104.8	6290.0	17078.1	NC	0.326	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7621.6	6806.8	17594.9	NC	0.373	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8015.2	7200.4	17988.5	NC	0.360	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8493.7	7678.9	18467.0	NC	0.455	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9057.1	8242.3	19030.4	NC	0.435	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9575.5	8760.7	19548.8	NC	0.279	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10048.9	9234.1	20022.2	NC	0.269	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10522.3	9707.5	20495.6	NC	0.261	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10995.7	10180.9	20969.0	NC	0.252	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11469.1	10654.3	21442.4	NC	0.245	-
														6.824	0.369
											Total Settlement [ft]			**7.19**	

Variables & Constants	
Point Name	SP-10c
Settlement Layer [ft]	144.1
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-13	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6625.09	4329.82	737.83	850.00	722.36	660.00	655.00	643.00	625.00	580.00	670.00	722.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	108.17	103.0	0	11141.1									
	3	OFL	15.47	135.0	0	2089.1									
	4	Existing Waste	0.00	91.0	1	-									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.18	135.0	0	24.2	0.102	0.017	0.005	12.1	12.1	13782.3	NC	0.056	0.000
	3	OFL	0.18	135.0	0	24.2	0.102	0.017	0.005	36.3	36.3	13806.6	NC	0.047	0.000
	4	Existing Waste	6.50	91.0	0	591.5	0.080	0.013	0.024	344.2	344.2	14114.4	NC	0.839	0.040
	4	Existing Waste	6.50	91.0	0	591.5	0.080	0.013	0.024	935.7	935.7	14705.9	NC	0.622	0.040
	4	Existing Waste	6.50	91.0	0	591.5	0.080	0.013	0.024	1527.2	1527.2	15297.4	NC	0.520	0.040
	4	Existing Waste	6.50	91.0	0	591.5	0.080	0.013	0.024	2118.7	2118.7	15888.9	NC	0.455	0.040
	4	Existing Waste	6.50	91.0	0	591.5	0.080	0.013	0.024	2710.2	2710.2	16480.4	NC	0.408	0.040
	4	Existing Waste	6.50	91.0	0	591.5	0.080	0.013	0.024	3301.7	3301.7	17071.9	NC	0.371	0.040
	4	Existing Waste	6.50	91.0	0	591.5	0.080	0.013	0.024	3893.2	3893.2	17663.4	NC	0.342	0.040
	4	Existing Waste	6.50	91.0	0	591.5	0.080	0.013	0.024	4484.7	4484.7	18254.9	NC	0.317	0.040
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5120.5	4950.0	18890.7	NC	0.289	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5800.5	5630.0	19570.7	NC	0.269	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6460.5	6290.0	20230.7	NC	0.424	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6977.3	6806.8	20747.5	NC	0.486	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7370.9	7200.4	21141.1	NC	0.470	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7849.4	7678.9	21619.6	NC	0.594	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8412.8	8242.3	22183.0	NC	0.568	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8931.2	8760.7	22701.4	NC	0.365	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9404.6	9234.1	23174.8	NC	0.353	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9878.0	9707.5	23648.2	NC	0.341	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10351.4	10180.9	24121.6	NC	0.331	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10824.8	10654.3	24595.0	NC	0.321	-
														8.786	0.371
													Total Settlement [ft]	**9.16**	

Variables & Constants	
Point Name	SP-13
Settlement Layer [ft]	142.4
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

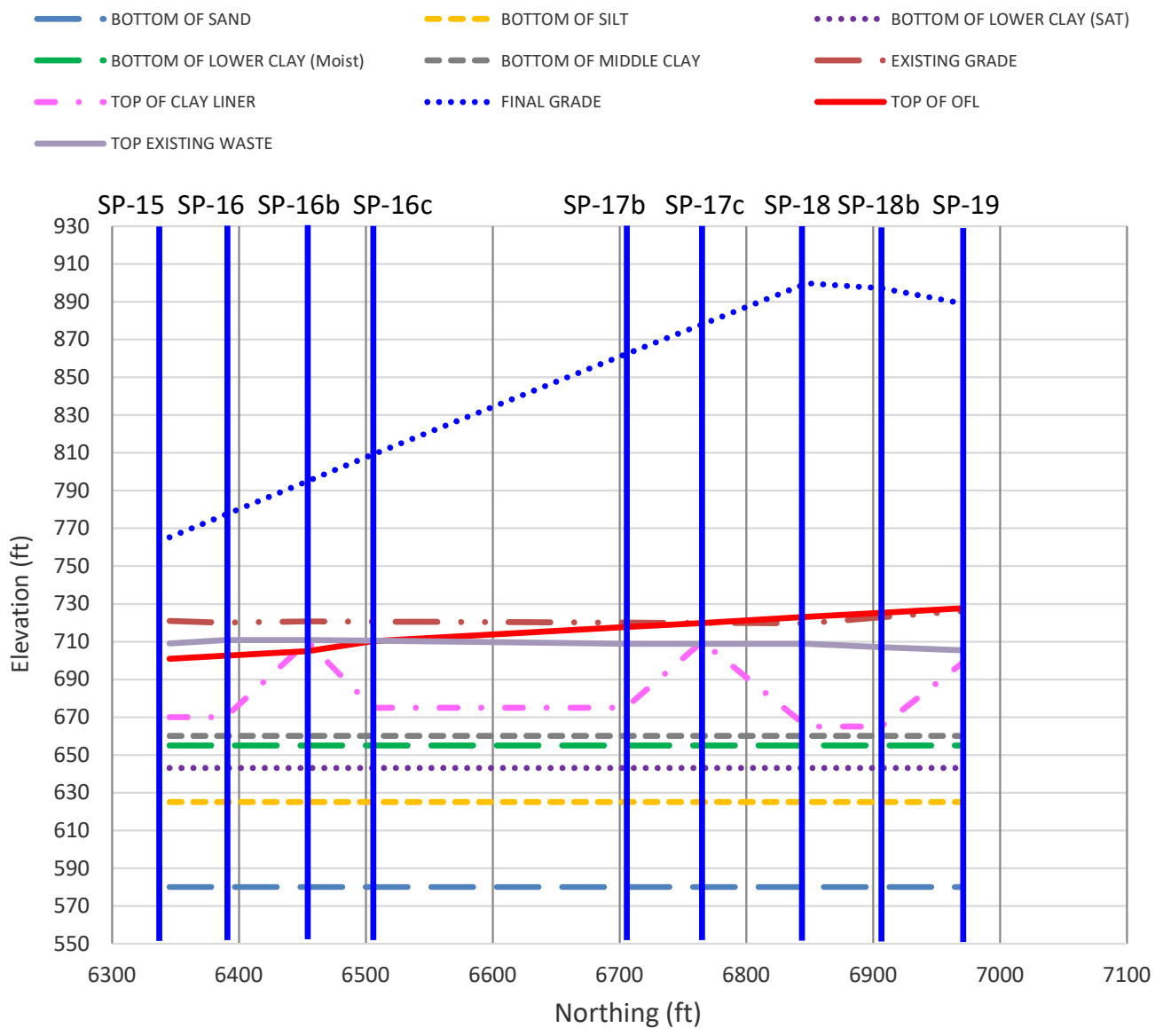
SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	OP EXISTING WASTE
SP-14	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6237.97	3884.80	730.38	761.06	731.36	660.00	655.00	643.00	625.00	580.00	670.00	708.76

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	26.68	103.0	0	2747.6									
	3	OFL	7.98	135.0	1	-1077.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	7.31	135.0	0	987.2	0.102	0.017	0.005	1570.7	1570.7	4726.1	NC	0.357	0.009
	3	OFL	7.31	135.0	0	987.2	0.102	0.017	0.005	2557.8	2557.8	5713.3	NC	0.260	0.009
	4	Existing Waste	4.85	91.0	0	440.9	0.080	0.013	0.024	3271.9	3271.9	6427.3	NC	0.114	0.030
	4	Existing Waste	4.85	91.0	0	440.9	0.080	0.013	0.024	3712.7	3712.7	6868.2	NC	0.104	0.030
	4	Existing Waste	4.85	91.0	0	440.9	0.080	0.013	0.024	4153.6	4153.6	7309.1	NC	0.095	0.030
	4	Existing Waste	4.85	91.0	0	440.9	0.080	0.013	0.024	4594.5	4594.5	7750.0	NC	0.088	0.030
	4	Existing Waste	4.85	91.0	0	440.9	0.080	0.013	0.024	5035.4	5035.4	8190.9	NC	0.082	0.030
	4	Existing Waste	4.85	91.0	0	440.9	0.080	0.013	0.024	5476.3	5476.3	8631.8	NC	0.077	0.030
	4	Existing Waste	4.85	91.0	0	440.9	0.080	0.013	0.024	5917.2	5917.2	9072.7	NC	0.072	0.030
	4	Existing Waste	4.85	91.0	0	440.9	0.080	0.013	0.024	6358.1	6358.1	9513.6	NC	0.068	0.030
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6918.6	4950.0	10074.0	NC	0.083	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	7598.6	5630.0	10754.0	NC	0.077	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	8258.6	6290.0	11414.0	NC	0.120	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8775.4	6806.8	11930.8	NC	0.137	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9169.0	7200.4	12324.4	NC	0.132	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9647.5	7678.9	12802.9	NC	0.166	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10210.9	8242.3	13366.3	NC	0.158	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10729.3	8760.7	13884.7	NC	0.101	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11202.7	9234.1	14358.1	NC	0.097	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11676.1	9707.5	14831.5	NC	0.094	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12149.5	10180.9	15304.9	NC	0.090	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12622.9	10654.3	15778.3	NC	0.087	-
														2.657	0.308
													Total Settlement [ft]	**2.97**	

Variables & Constants	
Point Name	SP-14
Settlement Layer [ft]	143.4
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

Cross Section Profile of MC6-G6 Leachate Pipe Flowline



SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-15	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6345.33	4693.30	700.88	765.25	720.96	660.00	655.00	643.00	625.00	580.00	670.00	708.90

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	60.37	103.0	0	6217.9									
	3	OFL	12.06	135.0	1	-1628.1									
	4	Exisitng Waste	15.02	91.0	1	-1367.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2995.2	2995.2	7702.9	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2995.2	2995.2	7702.9	NC	-	-
	4	Existing Waste	2.98	91.0	0	271.6	0.080	0.013	0.024	3131.0	3131.0	7838.7	NC	0.095	0.018
	4	Existing Waste	2.98	91.0	0	271.6	0.080	0.013	0.024	3402.6	3402.6	8110.3	NC	0.090	0.018
	4	Existing Waste	2.98	91.0	0	271.6	0.080	0.013	0.024	3674.2	3674.2	8381.9	NC	0.086	0.018
	4	Existing Waste	2.98	91.0	0	271.6	0.080	0.013	0.024	3945.8	3945.8	8653.5	NC	0.081	0.018
	4	Existing Waste	2.98	91.0	0	271.6	0.080	0.013	0.024	4217.4	4217.4	8925.1	NC	0.078	0.018
	4	Existing Waste	2.98	91.0	0	271.6	0.080	0.013	0.024	4489.0	4489.0	9196.7	NC	0.074	0.018
	4	Existing Waste	2.98	91.0	0	271.6	0.080	0.013	0.024	4760.6	4760.6	9468.3	NC	0.071	0.018
	4	Existing Waste	2.98	91.0	0	271.6	0.080	0.013	0.024	5032.2	5032.2	9739.9	NC	0.068	0.018
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5508.0	4950.0	10215.7	NC	0.137	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6188.0	5630.0	10895.7	NC	0.125	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6848.0	6290.0	11555.7	NC	0.194	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7364.8	6806.8	12072.5	NC	0.220	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7758.4	7200.4	12466.1	NC	0.211	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8236.9	7678.9	12944.6	NC	0.265	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8800.3	8242.3	13508.0	NC	0.251	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9318.7	8760.7	14026.4	NC	0.160	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9792.1	9234.1	14499.8	NC	0.153	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10265.5	9707.5	14973.2	NC	0.148	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10738.9	10180.9	15446.6	NC	0.142	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11212.3	10654.3	15920.0	NC	0.137	-
														2.788	0.198
													Total Settlement [ft]	**2.99**	

Variables & Constants	
Point Name	SP-15
Settlement Layer [ft]	113.9
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-16	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6389.25	4676.09	702.53	777.25	720.12	660.00	655.00	643.00	625.00	580.00	670.00	710.77

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	70.73	103.0	0	7284.8									
	3	OFL	9.35	135.0	1	-1262.3									
	4	Existing Waste	15.24	91.0	1	-1387.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2649.3	2649.3	8769.8	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2649.3	2649.3	8769.8	NC	-	-
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	2794.5	2794.5	8915.0	NC	0.129	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	3084.9	3084.9	9205.4	NC	0.121	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	3375.2	3375.2	9495.8	NC	0.115	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	3665.6	3665.6	9786.1	NC	0.109	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	3956.0	3956.0	10076.5	NC	0.104	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	4246.4	4246.4	10366.9	NC	0.099	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	4536.8	4536.8	10657.3	NC	0.095	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	4827.1	4827.1	10947.7	NC	0.091	0.020
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5312.3	4950.0	11432.9	NC	0.170	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5992.3	5630.0	12112.9	NC	0.156	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6652.3	6290.0	12772.9	NC	0.242	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7169.1	6806.8	13289.7	NC	0.275	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7562.7	7200.4	13683.3	NC	0.264	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8041.2	7678.9	14161.8	NC	0.332	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8604.6	8242.3	14725.2	NC	0.315	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9123.0	8760.7	15243.6	NC	0.201	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9596.4	9234.1	15717.0	NC	0.193	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10069.8	9707.5	16190.4	NC	0.186	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10543.2	10180.9	16663.8	NC	0.179	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11016.6	10654.3	17137.2	NC	0.173	-
														3.546	0.208
													Total Settlement [ft]	3.75	

Variables & Constants	
Point Name	SP-16
Settlement Layer [ft]	115.5
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-16b	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6454.30	4650.58	704.97	795.01	720.67	660.00	655.00	643.00	625.00	580.00	710.00	710.80

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	86.04	103.0	0	8862.2									
	3	OFL	9.87	135.0	1	-1331.9									
	4	Existing Waste	0.80	91.0	1	-72.8									
	6	Middle Clay	12.03	136.0	1	-1635.6									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3040.2	3040.2	10347.2	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3040.2	3040.2	10347.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3040.2	3040.2	10347.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3040.2	3040.2	10347.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3040.2	3040.2	10347.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3040.2	3040.2	10347.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3040.2	3040.2	10347.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3040.2	3040.2	10347.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3040.2	3040.2	10347.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3040.2	3040.2	10347.2	NC	-	-
	6	Middle Clay	18.99	136.0	0	2582.2	0.102	0.017	0.005	4331.3	5901.1	11638.3	OC-2	0.615	0.024
	6	Middle Clay	18.99	136.0	0	2582.2	0.102	0.017	0.005	6913.5	8483.3	14220.6	OC-2	0.463	0.024
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	8524.7	10094.4	15831.7	OC-2	0.178	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9041.5	10611.2	16348.5	OC-2	0.204	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9435.1	11004.8	16742.1	OC-2	0.198	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9913.6	11483.3	17220.6	OC-2	0.238	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10477.0	12046.7	17784.0	OC-2	0.228	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10995.4	12565.1	18302.4	OC-2	0.147	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11468.8	13038.5	18775.8	OC-2	0.143	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11942.2	13511.9	19249.2	OC-2	0.138	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12415.6	13985.3	19722.6	OC-2	0.134	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12889.0	14458.7	20196.0	OC-2	0.131	-
														2.817	0.088
													Total Settlement [ft]	**2.90**	

Variables & Constants	
Point Name	SP-16b
Settlement Layer [ft]	118.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-16c	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6505.08	4630.68	710.15	808.95	720.54	660.00	655.00	643.00	625.00	580.00	675.00	710.39

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	94.80	103.0	0	9764.3									
	3	OFL	10.15	135.0	1	-1370.1									
	4	Exisitng Waste	7.24	91.0	1	-658.4									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2028.5	2028.5	11249.3	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2028.5	2028.5	11249.3	NC	-	-
	4	Existing Waste	3.52	91.0	0	320.3	0.080	0.013	0.024	2188.6	2188.6	11409.4	NC	0.202	0.022
	4	Existing Waste	3.52	91.0	0	320.3	0.080	0.013	0.024	2508.9	2508.9	11729.7	NC	0.189	0.022
	4	Existing Waste	3.52	91.0	0	320.3	0.080	0.013	0.024	2829.2	2829.2	12050.0	NC	0.177	0.022
	4	Existing Waste	3.52	91.0	0	320.3	0.080	0.013	0.024	3149.4	3149.4	12370.2	NC	0.167	0.022
	4	Existing Waste	3.52	91.0	0	320.3	0.080	0.013	0.024	3469.7	3469.7	12690.5	NC	0.159	0.022
	4	Existing Waste	3.52	91.0	0	320.3	0.080	0.013	0.024	3789.9	3789.9	13010.7	NC	0.151	0.022
	4	Existing Waste	3.52	91.0	0	320.3	0.080	0.013	0.024	4110.2	4110.2	13331.0	NC	0.144	0.022
	4	Existing Waste	3.52	91.0	0	320.3	0.080	0.013	0.024	4430.4	4430.4	13651.2	NC	0.138	0.022
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	5100.6	5120.0	14321.4	OC-2	0.342	0.010
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	6120.6	6140.0	15341.4	OC-2	0.304	0.010
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6950.6	6970.0	16171.4	OC-2	0.313	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7467.4	7486.8	16688.2	OC-2	0.357	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7861.0	7880.4	17081.8	OC-2	0.345	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8339.5	8358.9	17560.3	OC-2	0.435	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8902.9	8922.3	18123.7	OC-2	0.415	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9421.3	9440.7	18642.1	OC-2	0.266	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9894.7	9914.1	19115.5	OC-2	0.257	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10368.1	10387.5	19588.9	OC-2	0.248	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10841.5	10860.9	20062.3	OC-2	0.240	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11314.9	11334.3	20535.7	OC-2	0.232	-
														5.080	0.231
													Total Settlement [ft]	**5.31**	

Variables & Constants	
Point Name	SP-16c
Settlement Layer [ft]	123.2
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-17b	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6704.95	4552.33	717.67	862.24	720.03	660.00	655.00	643.00	625.00	580.00	675.00	708.75

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	140.58	103.0	0	14479.3									
	3	OFL	9.36	135.0	1	-1264.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.96	135.0	0	129.5	0.102	0.017	0.005	1328.8	1328.8	16029.0	NC	0.106	0.001
	3	OFL	0.96	135.0	0	129.5	0.102	0.017	0.005	1458.3	1458.3	16158.5	NC	0.102	0.001
	4	Existing Waste	4.22	91.0	0	383.9	0.080	0.013	0.024	1715.0	1715.0	16415.2	NC	0.331	0.026
	4	Existing Waste	4.22	91.0	0	383.9	0.080	0.013	0.024	2098.9	2098.9	16799.1	NC	0.305	0.026
	4	Existing Waste	4.22	91.0	0	383.9	0.080	0.013	0.024	2482.8	2482.8	17183.0	NC	0.284	0.026
	4	Existing Waste	4.22	91.0	0	383.9	0.080	0.013	0.024	2866.7	2866.7	17566.9	NC	0.266	0.026
	4	Existing Waste	4.22	91.0	0	383.9	0.080	0.013	0.024	3250.6	3250.6	17950.8	NC	0.250	0.026
	4	Existing Waste	4.22	91.0	0	383.9	0.080	0.013	0.024	3634.5	3634.5	18334.8	NC	0.237	0.026
	4	Existing Waste	4.22	91.0	0	383.9	0.080	0.013	0.024	4018.4	4018.4	18718.7	NC	0.226	0.026
	4	Existing Waste	4.22	91.0	0	383.9	0.080	0.013	0.024	4402.3	4402.3	19102.6	NC	0.215	0.026
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	5104.3	5120.0	19804.5	OC-2	0.450	0.010
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	6124.3	6140.0	20824.5	OC-2	0.406	0.010
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6954.3	6970.0	21654.5	OC-2	0.421	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7471.1	7486.8	22171.3	OC-2	0.484	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7864.7	7880.4	22564.9	OC-2	0.469	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8343.2	8358.9	23043.4	OC-2	0.595	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8906.6	8922.3	23606.8	OC-2	0.570	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9425.0	9440.7	24125.2	OC-2	0.367	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9898.4	9914.1	24598.6	OC-2	0.355	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10371.8	10387.5	25072.0	OC-2	0.344	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10845.2	10860.9	25545.4	OC-2	0.334	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11318.6	11334.3	26018.8	OC-2	0.325	-
														7.441	0.267
												Total Settlement [ft]		7.71	

Variables & Constants	
Point Name	SP-17b
Settlement Layer [ft]	130.7
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-17c	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6765.08	4528.76	719.93	878.05	719.88	660.00	655.00	643.00	625.00	580.00	710.00	708.80

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	154.12	103.0	0	15874.9									
	3	OFL	6.95	135.0	1	-938.3									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	1.46	135.0	0	197.7	0.102	0.017	0.005	1037.2	1037.2	17458.7	NC	0.183	0.002
	3	OFL	1.46	135.0	0	197.7	0.102	0.017	0.005	1234.9	1234.9	17656.4	NC	0.173	0.002
	6	Middle Clay	8.33	136.0	0	1133.3	0.102	0.017	0.005	1900.4	1900.4	18321.9	NC	0.837	0.011
	6	Middle Clay	8.33	136.0	0	1133.3	0.102	0.017	0.005	3033.7	3033.7	19455.2	NC	0.686	0.011
	6	Middle Clay	8.33	136.0	0	1133.3	0.102	0.017	0.005	4167.1	4167.1	20588.6	NC	0.590	0.011
	6	Middle Clay	8.33	136.0	0	1133.3	0.102	0.017	0.005	5300.4	5300.4	21721.9	NC	0.521	0.011
	6	Middle Clay	8.33	136.0	0	1133.3	0.102	0.017	0.005	6433.7	6433.7	22855.2	NC	0.468	0.011
	6	Middle Clay	8.33	136.0	0	1133.3	0.102	0.017	0.005	7567.1	7567.1	23988.6	NC	0.426	0.011
	-		0.00		0	-	-	-	-	-	0.0	-	-	-	-
	-		0.00		0	-	-	-	-	-	0.0	-	-	-	-
	-		0.00		0	-	-	-	-	-	4610.0	-	-	-	-
	-		0.00		0	-	-	-	-	-	4610.0	-	-	-	-
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	320.0	4930.0	16741.5	OC-2	0.623	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	836.8	5446.8	17258.3	OC-2	0.653	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	1230.4	5840.4	17651.9	OC-2	0.609	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	1708.9	6318.9	18130.4	OC-2	0.618	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	2272.3	6882.3	18693.8	OC-2	0.586	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	2790.7	7400.7	19212.2	OC-2	0.373	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	3264.1	7874.1	19685.6	OC-2	0.358	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	3737.5	8347.5	20159.0	OC-2	0.345	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	4210.9	8820.9	20632.4	OC-2	0.332	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	4684.3	9294.3	21105.8	OC-2	0.321	-
														8.699	0.107
												Total Settlement [ft]		**8.81**	

Variables & Constants	
Point Name	SP-17c
Settlement Layer [ft]	132.9
ERROR	0.0
# of Layers	18
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-18	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6847.70	4496.37	723.03	899.78	719.67	660.00	655.00	643.00	625.00	580.00	665.00	708.85

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	172.74	103.0	0	17792.5									
	3	OFL	3.64	135.0	1	-490.8									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	3.59	135.0	0	485.0	0.102	0.017	0.005	733.2	733.2	19520.0	NC	0.522	0.005
	3	OFL	3.59	135.0	0	485.0	0.102	0.017	0.005	1218.2	1218.2	20005.0	NC	0.445	0.005
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	1710.1	1710.1	20496.9	NC	0.473	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	2208.9	2208.9	20995.6	NC	0.429	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	2707.7	2707.7	21494.4	NC	0.395	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	3206.5	3206.5	21993.2	NC	0.367	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	3705.3	3705.3	22492.0	NC	0.343	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	4204.1	4204.1	22990.8	NC	0.324	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	4702.9	4702.9	23489.6	NC	0.306	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	5201.7	5201.7	23988.4	NC	0.291	0.034
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5621.0	4780.0	24407.8	NC	0.163	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5961.0	5120.0	24747.8	NC	0.158	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6451.0	5610.0	25237.8	NC	0.507	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6967.8	6126.8	25754.6	NC	0.583	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7361.4	6520.4	26148.2	NC	0.565	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7839.9	6998.9	26626.7	NC	0.717	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8403.3	7562.3	27190.1	NC	0.688	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8921.7	8080.7	27708.5	NC	0.443	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9395.1	8554.1	28181.9	NC	0.429	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9868.5	9027.5	28655.3	NC	0.417	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10342.0	9500.9	29128.7	NC	0.405	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10815.4	9974.3	29602.1	NC	0.394	-
														9.362	0.323
												Total Settlement [ft]		9.68	

Variables & Constants	
Point Name	SP-18
Settlement Layer [ft]	136.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-18b	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6906.30	4473.40	725.24	897.18	722.93	660.00	655.00	643.00	625.00	580.00	665.00	707.13

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	167.94	103.0	0	17297.7									
	3	OFL	4.69	135.0	1	-632.8									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	5.55	135.0	0	749.8	0.102	0.017	0.005	1007.7	1007.7	19157.6	NC	0.725	0.007
	3	OFL	5.55	135.0	0	749.8	0.102	0.017	0.005	1757.4	1757.4	19907.3	NC	0.597	0.007
	4	Existing Waste	5.27	91.0	0	479.2	0.080	0.013	0.024	2371.9	2371.9	20521.8	NC	0.395	0.032
	4	Existing Waste	5.27	91.0	0	479.2	0.080	0.013	0.024	2851.2	2851.2	21001.0	NC	0.365	0.032
	4	Existing Waste	5.27	91.0	0	479.2	0.080	0.013	0.024	3330.4	3330.4	21480.3	NC	0.341	0.032
	4	Existing Waste	5.27	91.0	0	479.2	0.080	0.013	0.024	3809.6	3809.6	21959.5	NC	0.320	0.032
	4	Existing Waste	5.27	91.0	0	479.2	0.080	0.013	0.024	4288.9	4288.9	22438.7	NC	0.303	0.032
	4	Existing Waste	5.27	91.0	0	479.2	0.080	0.013	0.024	4768.1	4768.1	22917.9	NC	0.287	0.032
	4	Existing Waste	5.27	91.0	0	479.2	0.080	0.013	0.024	5247.3	5247.3	23397.2	NC	0.274	0.032
	4	Existing Waste	5.27	91.0	0	479.2	0.080	0.013	0.024	5726.5	5726.5	23876.4	NC	0.261	0.032
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	6136.2	4780.0	24286.0	NC	0.152	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	6476.2	5120.0	24626.0	NC	0.148	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6966.2	5610.0	25116.0	NC	0.476	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7483.0	6126.8	25632.8	NC	0.549	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7876.6	6520.4	26026.4	NC	0.533	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8355.1	6998.9	26504.9	NC	0.677	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8918.5	7562.3	27068.3	NC	0.651	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9436.9	8080.7	27586.7	NC	0.419	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9910.3	8554.1	28060.1	NC	0.407	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10383.7	9027.5	28533.5	NC	0.395	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10857.1	9500.9	29006.9	NC	0.384	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11330.5	9974.3	29480.3	NC	0.374	-
														9.033	0.318
													Total Settlement [ft]	**9.35**	

Variables & Constants	
Point Name	SP-18b
Settlement Layer [ft]	138.2
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

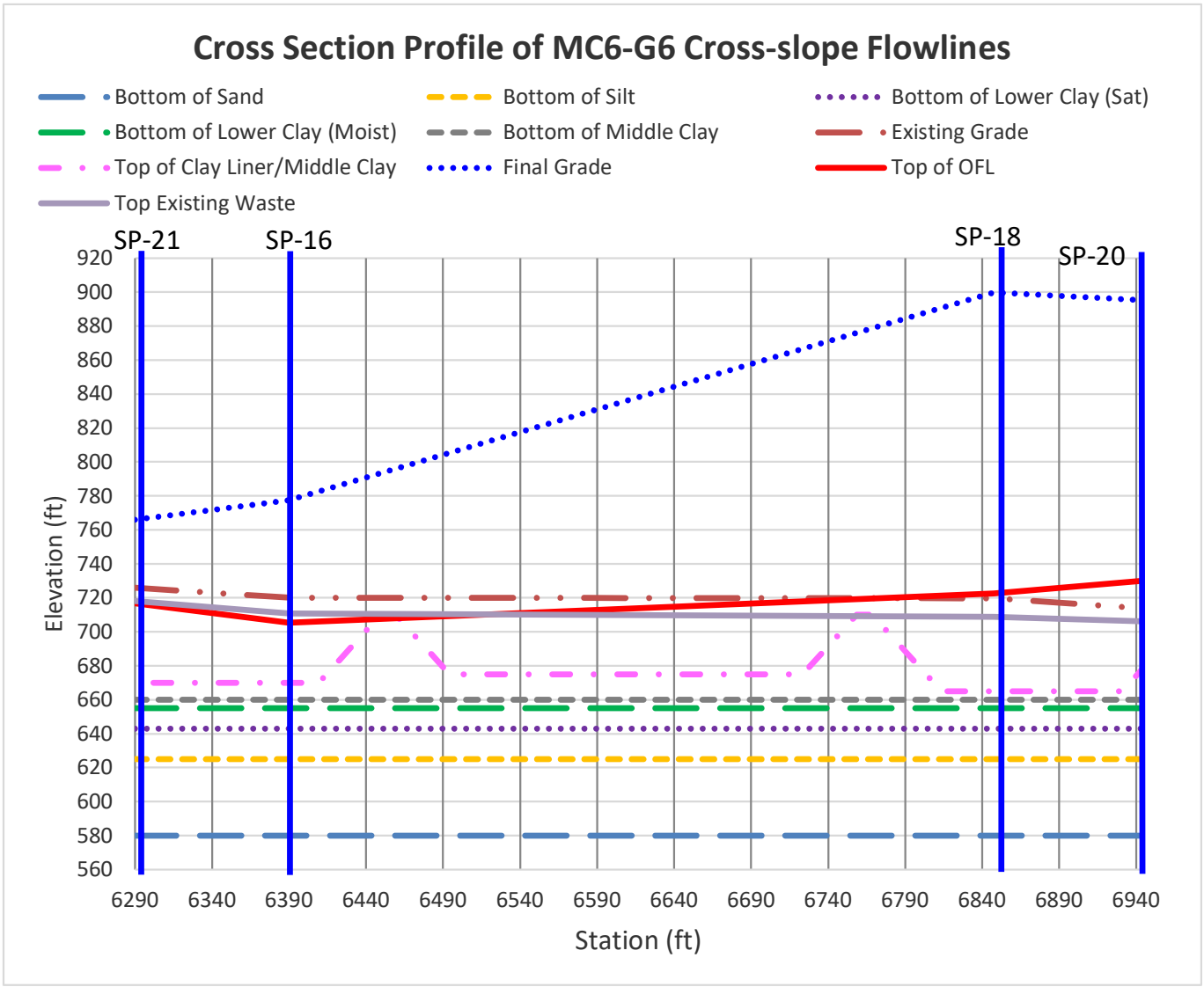
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-19	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6970.25	4448.33	727.64	889.11	726.18	660.00	655.00	643.00	625.00	580.00	698.74	705.41

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	157.47	103.0	0	16219.6									
	3	OFL	5.54	135.0	1	-747.6									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	7.62	135.0	0	1028.2	0.102	0.017	0.005	1261.7	1261.7	18218.7	NC	0.901	0.010
	3	OFL	7.62	135.0	0	1028.2	0.102	0.017	0.005	2289.9	2289.9	19246.9	NC	0.718	0.010
	4	Existing Waste	1.33	91.0	0	121.4	0.080	0.013	0.024	2864.6	2864.6	19821.7	NC	0.090	0.008
	4	Existing Waste	1.33	91.0	0	121.4	0.080	0.013	0.024	2986.0	2986.0	19943.0	NC	0.088	0.008
	4	Existing Waste	1.33	91.0	0	121.4	0.080	0.013	0.024	3107.4	3107.4	20064.4	NC	0.086	0.008
	4	Existing Waste	1.33	91.0	0	121.4	0.080	0.013	0.024	3228.8	3228.8	20185.8	NC	0.085	0.008
	4	Existing Waste	1.33	91.0	0	121.4	0.080	0.013	0.024	3350.2	3350.2	20307.2	NC	0.084	0.008
	6	Middle Clay	7.75	91.0	0	705.1	0.102	0.017	0.005	3763.5	3763.5	20720.5	NC	0.585	0.010
	6	Middle Clay	7.75	91.0	0	705.1	0.102	0.017	0.005	4468.5	4468.5	21425.5	NC	0.538	0.010
	6	Middle Clay	7.75	91.0	0	705.1	0.102	0.017	0.005	5173.6	5173.6	22130.6	NC	0.499	0.010
	6	Middle Clay	7.75	136.0	0	1053.7	0.102	0.017	0.005	6053.0	5136.9	23010.0	NC	0.458	0.010
	6	Middle Clay	7.75	136.0	0	1053.7	0.102	0.017	0.005	7106.7	6190.6	24063.7	NC	0.419	0.010
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7953.6	7037.5	24910.6	NC	0.424	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8470.4	7554.3	25427.4	NC	0.490	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8864.0	7947.9	25821.0	NC	0.476	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9342.5	8426.4	26299.5	NC	0.607	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9905.9	8989.8	26862.9	NC	0.585	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10424.3	9508.2	27381.3	NC	0.377	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10897.7	9981.6	27854.7	NC	0.367	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11371.1	10455.0	28328.1	NC	0.357	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11844.5	10928.4	28801.5	NC	0.347	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12317.9	11401.8	29274.9	NC	0.338	-
														8.919	0.149
												Total Settlement [ft]		9.07	

Variables & Constants	
Point Name	SP-19
Settlement Layer [ft]	140.6
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G6 Cross-slope Flowlines
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-21
SP-16
SP-18
SP-20
Elevation (ft)
920
900
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
6290
6340
6390
6440
6490
6540
6590
6640
6690
6740
6790
6840
6890
6940
Station (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-16	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6389.25	4676.09	702.53	777.25	720.13	660.00	655.00	643.00	625.00	580.00	670.00	710.77

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	70.73	103.0	0	7284.8									
	3	OFL	9.36	135.0	1	-1264.3									
	4	Existing Waste	15.24	91.0	1	-1387.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2651.3	2651.3	8769.8	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2651.3	2651.3	8769.8	NC	-	-
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	2796.5	2796.5	8915.0	NC	0.129	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	3086.9	3086.9	9205.4	NC	0.121	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	3377.2	3377.2	9495.8	NC	0.115	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	3667.6	3667.6	9786.1	NC	0.109	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	3958.0	3958.0	10076.5	NC	0.104	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	4248.4	4248.4	10366.9	NC	0.099	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	4538.8	4538.8	10657.3	NC	0.095	0.020
	4	Existing Waste	3.19	91.0	0	290.4	0.080	0.013	0.024	4829.1	4829.1	10947.7	NC	0.091	0.020
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5314.3	4950.0	11432.9	NC	0.170	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5994.3	5630.0	12112.9	NC	0.156	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6654.3	6290.0	12772.9	NC	0.242	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7171.1	6806.8	13289.7	NC	0.275	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7564.7	7200.4	13683.3	NC	0.264	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8043.2	7678.9	14161.8	NC	0.332	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8606.6	8242.3	14725.2	NC	0.315	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9125.0	8760.7	15243.6	NC	0.201	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9598.4	9234.1	15717.0	NC	0.193	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10071.8	9707.5	16190.4	NC	0.186	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10545.2	10180.9	16663.8	NC	0.179	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11018.6	10654.3	17137.2	NC	0.173	-
														3.544	0.208
													Total Settlement [ft]	**3.75**	

Variables & Constants	
Point Name	SP-16
Settlement Layer [ft]	115.5
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-18	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6847.70	4496.37	723.03	899.78	719.66	660.00	655.00	643.00	625.00	580.00	665.00	708.85

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	172.74	103.0	0	17792.5									
	3	OFL	3.62	135.0	FALSE	489.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	3.59	135.0	0	485.0	0.102	0.017	0.005	242.5	242.5	20009.0	NC	0.702	0.005
	3	OFL	3.59	135.0	0	485.0	0.102	0.017	0.005	727.5	727.5	20493.9	NC	0.531	0.005
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	1219.3	1219.3	20985.8	NC	0.542	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	1718.1	1718.1	21484.6	NC	0.481	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	2216.9	2216.9	21983.4	NC	0.437	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	2715.7	2715.7	22482.2	NC	0.403	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	3214.5	3214.5	22981.0	NC	0.375	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	3713.3	3713.3	23479.8	NC	0.351	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	4212.1	4212.1	23978.6	NC	0.331	0.034
	4	Existing Waste	5.48	91.0	0	498.8	0.080	0.013	0.024	4710.9	4710.9	24477.4	NC	0.314	0.034
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5130.3	4780.0	24896.8	NC	0.175	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5470.3	5120.0	25236.8	NC	0.169	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5960.3	5610.0	25726.8	NC	0.543	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6477.1	6126.8	26243.6	NC	0.623	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6870.7	6520.4	26637.2	NC	0.604	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7349.2	6998.9	27115.7	NC	0.765	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7912.6	7562.3	27679.1	NC	0.734	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8431.0	8080.7	28197.5	NC	0.472	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8904.4	8554.1	28670.9	NC	0.457	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9377.8	9027.5	29144.3	NC	0.443	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9851.2	9500.9	29617.7	NC	0.430	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10324.6	9974.3	30091.1	NC	0.418	-
														10.301	0.323
											Total Settlement [ft]			**10.62**	

Variables & Constants	
Point Name	SP-18
Settlement Layer [ft]	136.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-20	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6937.43	4751.42	732.34	896.46	713.90	660.00	655.00	643.00	625.00	580.00	665.00	706.12

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	160.12	103.0	0	16492.1									
	3	OFL	11.44	135.0	0	1544.7									
	4	Existing Waste	0.00	91.0	0	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	3.89	135.0	0	525.3	0.102	0.017	0.005	262.6	262.6	19784.4	NC	0.745	0.005
	3	OFL	3.89	135.0	0	525.3	0.102	0.017	0.005	787.9	787.9	20309.7	NC	0.560	0.005
	4	Existing Waste	5.14	91.0	0	467.7	0.080	0.013	0.024	1284.4	1284.4	20806.2	NC	0.497	0.031
	4	Existing Waste	5.14	91.0	0	467.7	0.080	0.013	0.024	1752.2	1752.2	21274.0	NC	0.446	0.031
	4	Existing Waste	5.14	91.0	0	467.7	0.080	0.013	0.024	2219.9	2219.9	21741.7	NC	0.407	0.031
	4	Existing Waste	5.14	91.0	0	467.7	0.080	0.013	0.024	2687.6	2687.6	22209.5	NC	0.377	0.031
	4	Existing Waste	5.14	91.0	0	467.7	0.080	0.013	0.024	3155.4	3155.4	22677.2	NC	0.352	0.031
	4	Existing Waste	5.14	91.0	0	467.7	0.080	0.013	0.024	3623.1	3623.1	23144.9	NC	0.331	0.031
	4	Existing Waste	5.14	91.0	0	467.7	0.080	0.013	0.024	4090.9	4090.9	23612.7	NC	0.313	0.031
	4	Existing Waste	5.14	91.0	0	467.7	0.080	0.013	0.024	4558.6	4558.6	24080.4	NC	0.297	0.031
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	4962.5	4780.0	24484.3	NC	0.177	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	5302.5	5120.0	24824.3	NC	0.171	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5792.5	5610.0	25314.3	NC	0.548	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6309.3	6126.8	25831.1	NC	0.628	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6702.9	6520.4	26224.7	NC	0.608	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7181.4	6998.9	26703.2	NC	0.770	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7744.8	7562.3	27266.6	NC	0.738	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8263.2	8080.7	27785.0	NC	0.474	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8736.6	8554.1	28258.4	NC	0.459	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9210.0	9027.5	28731.8	NC	0.445	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9683.4	9500.9	29205.2	NC	0.431	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10156.8	9974.3	29678.6	NC	0.419	-
														10.194	0.307
												Total Settlement [ft]		10.50	

Variables & Constants	
Point Name	SP-20
Settlement Layer [ft]	133.9
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

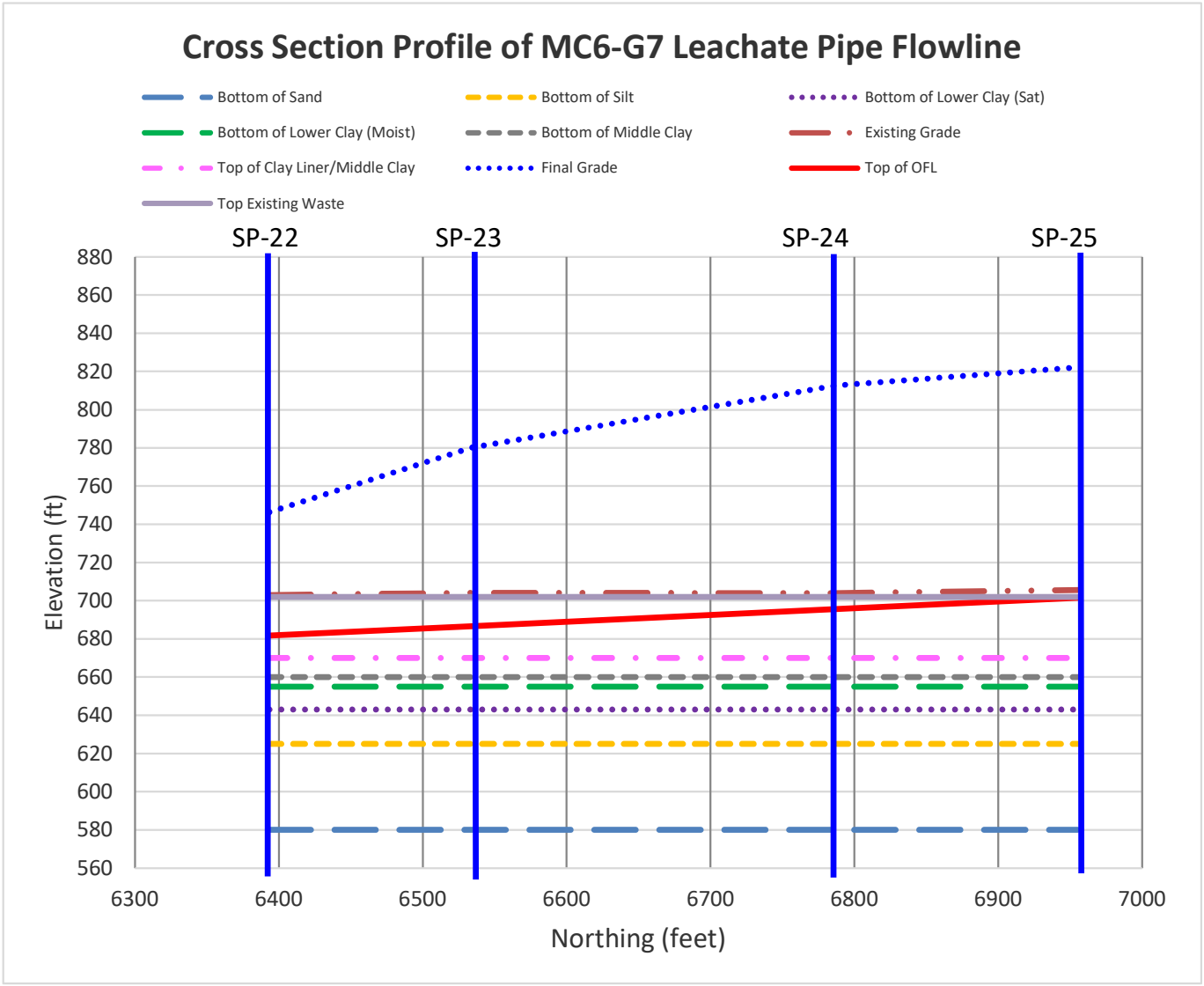
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	OP EXISTING WASTE
SP-21	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6290.21	4421.30	712.32	765.45	724.94	660.00	655.00	643.00	625.00	580.00	670.00	718.10

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	49.13	103.0	0	5060.8									
	3	OFL	6.84	135.0	TRUE	-922.9									
	4	Existing Waste	12.78	91.0	1	-1163.3									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2086.2	2086.2	6545.8	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2086.2	2086.2	6545.8	NC	-	-
	4	Existing Waste	4.41	91.0	0	401.7	0.080	0.013	0.024	2287.1	2287.1	6746.6	NC	0.166	0.027
	4	Existing Waste	4.41	91.0	0	401.7	0.080	0.013	0.024	2688.8	2688.8	7148.3	NC	0.150	0.027
	4	Existing Waste	4.41	91.0	0	401.7	0.080	0.013	0.024	3090.5	3090.5	7550.1	NC	0.137	0.027
	4	Existing Waste	4.41	91.0	0	401.7	0.080	0.013	0.024	3492.3	3492.3	7951.8	NC	0.126	0.027
	4	Existing Waste	4.41	91.0	0	401.7	0.080	0.013	0.024	3894.0	3894.0	8353.5	NC	0.117	0.027
	4	Existing Waste	4.41	91.0	0	401.7	0.080	0.013	0.024	4295.7	4295.7	8755.2	NC	0.109	0.027
	4	Existing Waste	4.41	91.0	0	401.7	0.080	0.013	0.024	4697.4	4697.4	9156.9	NC	0.102	0.027
	4	Existing Waste	4.41	91.0	0	401.7	0.080	0.013	0.024	5099.1	5099.1	9558.7	NC	0.096	0.027
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5640.0	4950.0	10099.5	NC	0.129	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6320.0	5630.0	10779.5	NC	0.118	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6980.0	6290.0	11439.5	NC	0.183	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7496.8	6806.8	11956.3	NC	0.208	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7890.4	7200.4	12349.9	NC	0.200	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8368.9	7678.9	12828.4	NC	0.250	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8932.3	8242.3	13391.8	NC	0.237	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9450.7	8760.7	13910.2	NC	0.151	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9924.1	9234.1	14383.6	NC	0.145	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10397.5	9707.5	14857.0	NC	0.140	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10870.9	10180.9	15330.4	NC	0.134	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11344.3	10654.3	15803.8	NC	0.130	-
														3.030	0.268
											Total Settlement [ft]			**3.30**	

Variables & Constants	
Point Name	SP-21
Settlement Layer [ft]	125.3
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G7 Leachate Pipe Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-22
SP-23
SP-24
SP-25
Elevation (ft)
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
6300
6400
6500
6600
6700
6800
6900
7000
Northing (feet)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-22	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6393.49	5048.84	681.79	746.37	702.92	660.00	655.00	643.00	625.00	580.00	670.00	702.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	60.58	103.0	0	6239.6									
	3	OFL	0.92	135.0	1	-123.6									
	4	Existing Waste	27.21	91.0	1	-2476.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2599.8	2599.8	7724.6	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2599.8	2599.8	7724.6	NC	-	-
	4	Existing Waste	0.60	91.0	0	54.5	0.080	0.013	0.024	2627.0	2627.0	7751.9	NC	0.023	0.004
	4	Existing Waste	0.60	91.0	0	54.5	0.080	0.013	0.024	2681.5	2681.5	7806.4	NC	0.022	0.004
	4	Existing Waste	0.60	91.0	0	54.5	0.080	0.013	0.024	2736.0	2736.0	7860.9	NC	0.022	0.004
	4	Existing Waste	0.60	91.0	0	54.5	0.080	0.013	0.024	2790.5	2790.5	7915.3	NC	0.022	0.004
	4	Existing Waste	0.60	91.0	0	54.5	0.080	0.013	0.024	2844.9	2844.9	7969.8	NC	0.021	0.004
	4	Existing Waste	0.60	91.0	0	54.5	0.080	0.013	0.024	2899.4	2899.4	8024.3	NC	0.021	0.004
	4	Existing Waste	0.60	91.0	0	54.5	0.080	0.013	0.024	2953.9	2953.9	8078.8	NC	0.021	0.004
	4	Existing Waste	0.60	91.0	0	54.5	0.080	0.013	0.024	3008.4	3008.4	8133.3	NC	0.021	0.004
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3375.6	4950.0	8500.5	OC-2	0.134	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4055.6	5630.0	9180.5	OC-2	0.120	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	4715.6	6290.0	9840.5	OC-2	0.184	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5232.4	6806.8	10357.3	OC-2	0.207	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5626.0	7200.4	10750.9	OC-2	0.197	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6104.5	7678.9	11229.4	OC-2	0.223	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6667.9	8242.3	11792.8	OC-2	0.210	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7186.3	8760.7	12311.2	OC-2	0.133	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7659.7	9234.1	12784.6	OC-2	0.127	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8133.1	9707.5	13258.0	OC-2	0.122	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8606.5	10180.9	13731.4	OC-2	0.117	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9079.9	10654.3	14204.8	OC-2	0.112	-
														2.059	0.081
													Total Settlement [ft]	**2.14**	

Variables & Constants	
Point Name	SP-22
Settlement Layer [ft]	94.8
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-23	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6534.01	5048.84	686.71	780.22	704.19	660.00	655.00	643.00	625.00	580.00	670.00	702.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	89.51	103.0	0	9219.9									
	3	OFL	2.19	135.0	1	-296.2									
	4	Existing Waste	22.29	91.0	1	-2028.4									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2324.6	2324.6	10704.9	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2324.6	2324.6	10704.9	NC	-	-
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2379.8	2379.8	10760.2	NC	0.064	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2490.2	2490.2	10870.6	NC	0.062	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2600.7	2600.7	10981.1	NC	0.061	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2711.1	2711.1	11091.5	NC	0.059	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2821.6	2821.6	11202.0	NC	0.058	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2932.0	2932.0	11312.4	NC	0.057	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	3042.5	3042.5	11422.9	NC	0.056	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	3152.9	3152.9	11533.3	NC	0.055	0.007
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3548.2	4950.0	11928.5	OC-2	0.207	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4228.2	5630.0	12608.5	OC-2	0.189	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	4888.2	6290.0	13268.5	OC-2	0.293	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5405.0	6806.8	13785.3	OC-2	0.332	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5798.6	7200.4	14178.9	OC-2	0.318	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6277.1	7678.9	14657.4	OC-2	0.379	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6840.5	8242.3	15220.8	OC-2	0.360	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7358.9	8760.7	15739.2	OC-2	0.229	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7832.3	9234.1	16212.6	OC-2	0.220	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8305.7	9707.5	16686.0	OC-2	0.212	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8779.1	10180.9	17159.4	OC-2	0.204	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9252.5	10654.3	17632.8	OC-2	0.197	-
														3.610	0.111
													Total Settlement [ft]	**3.72**	

Variables & Constants	
Point Name	SP-23
Settlement Layer [ft]	99.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-24	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6787.25	5048.84	695.57	812.70	703.99	660.00	655.00	643.00	625.00	580.00	670.00	702.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	113.13	103.0	0	11652.4									
	3	OFL	1.99	135.0	1	-268.6									
	4	Existing Waste	13.43	91.0	1	-1222.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1490.8	1490.8	13137.4	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1490.8	1490.8	13137.4	NC	-	-
	4	Existing Waste	2.32	91.0	0	211.2	0.080	0.013	0.024	1596.4	1596.4	13243.0	NC	0.171	0.014
	4	Existing Waste	2.32	91.0	0	211.2	0.080	0.013	0.024	1807.6	1807.6	13454.3	NC	0.162	0.014
	4	Existing Waste	2.32	91.0	0	211.2	0.080	0.013	0.024	2018.9	2018.9	13665.5	NC	0.154	0.014
	4	Existing Waste	2.32	91.0	0	211.2	0.080	0.013	0.024	2230.1	2230.1	13876.7	NC	0.147	0.014
	4	Existing Waste	2.32	91.0	0	211.2	0.080	0.013	0.024	2441.3	2441.3	14088.0	NC	0.141	0.014
	4	Existing Waste	2.32	91.0	0	211.2	0.080	0.013	0.024	2652.6	2652.6	14299.2	NC	0.136	0.014
	4	Existing Waste	2.32	91.0	0	211.2	0.080	0.013	0.024	2863.8	2863.8	14510.4	NC	0.131	0.014
	4	Existing Waste	2.32	91.0	0	211.2	0.080	0.013	0.024	3075.0	3075.0	14721.7	NC	0.126	0.014
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3520.6	4950.0	15167.3	OC-2	0.261	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4200.6	5630.0	15847.3	OC-2	0.240	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	4860.6	6290.0	16507.3	OC-2	0.374	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5377.4	6806.8	17024.1	OC-2	0.426	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5771.0	7200.4	17417.7	OC-2	0.410	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6249.5	7678.9	17896.2	OC-2	0.496	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6812.9	8242.3	18459.6	OC-2	0.473	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7331.3	8760.7	18978.0	OC-2	0.302	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7804.7	9234.1	19451.4	OC-2	0.291	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8278.1	9707.5	19924.8	OC-2	0.281	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8751.5	10180.9	20398.2	OC-2	0.272	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9224.9	10654.3	20871.6	OC-2	0.263	-
														5.257	0.166
													Total Settlement [ft]	**5.42**	

Variables & Constants	
Point Name	SP-24
Settlement Layer [ft]	108.6
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

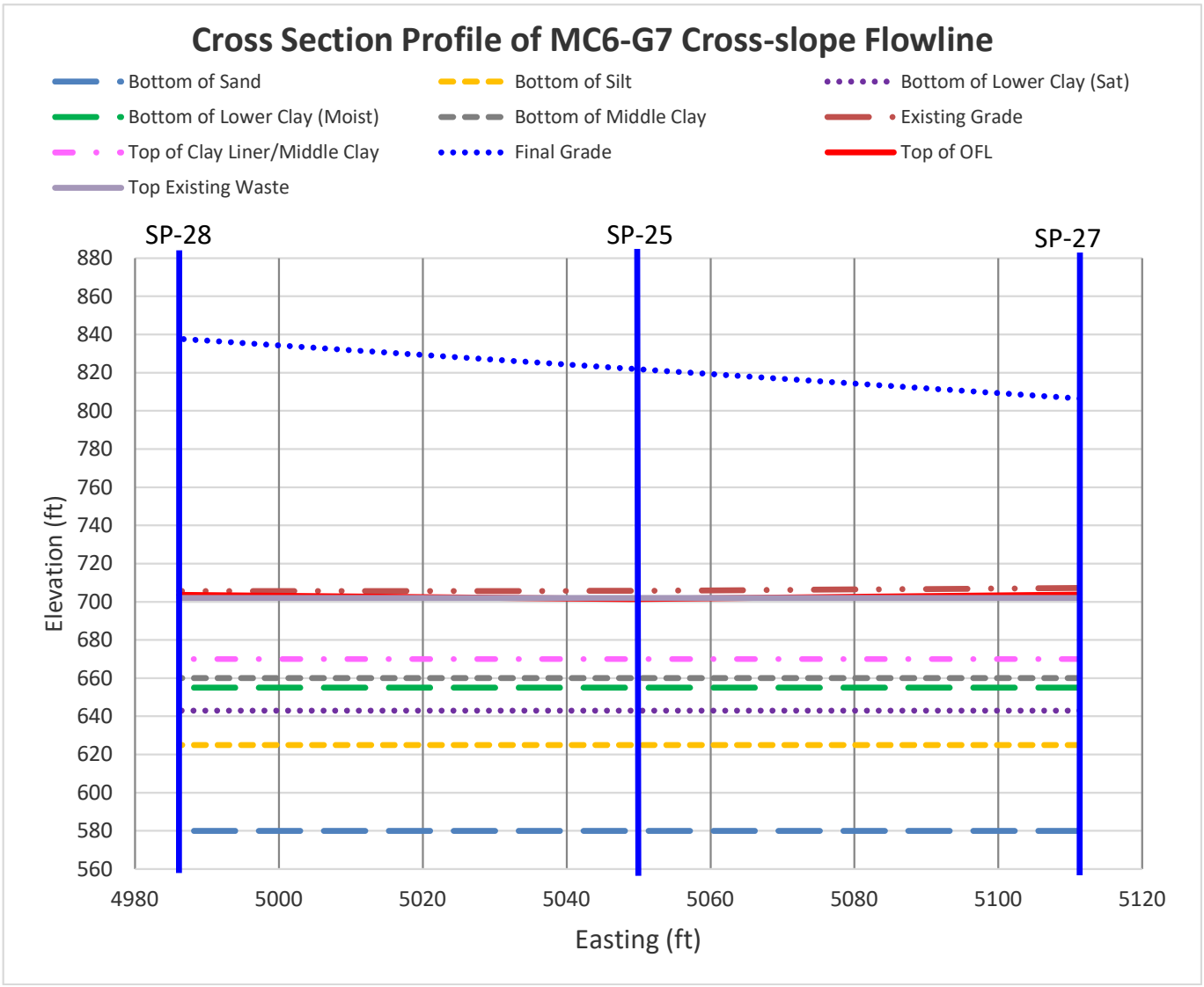
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

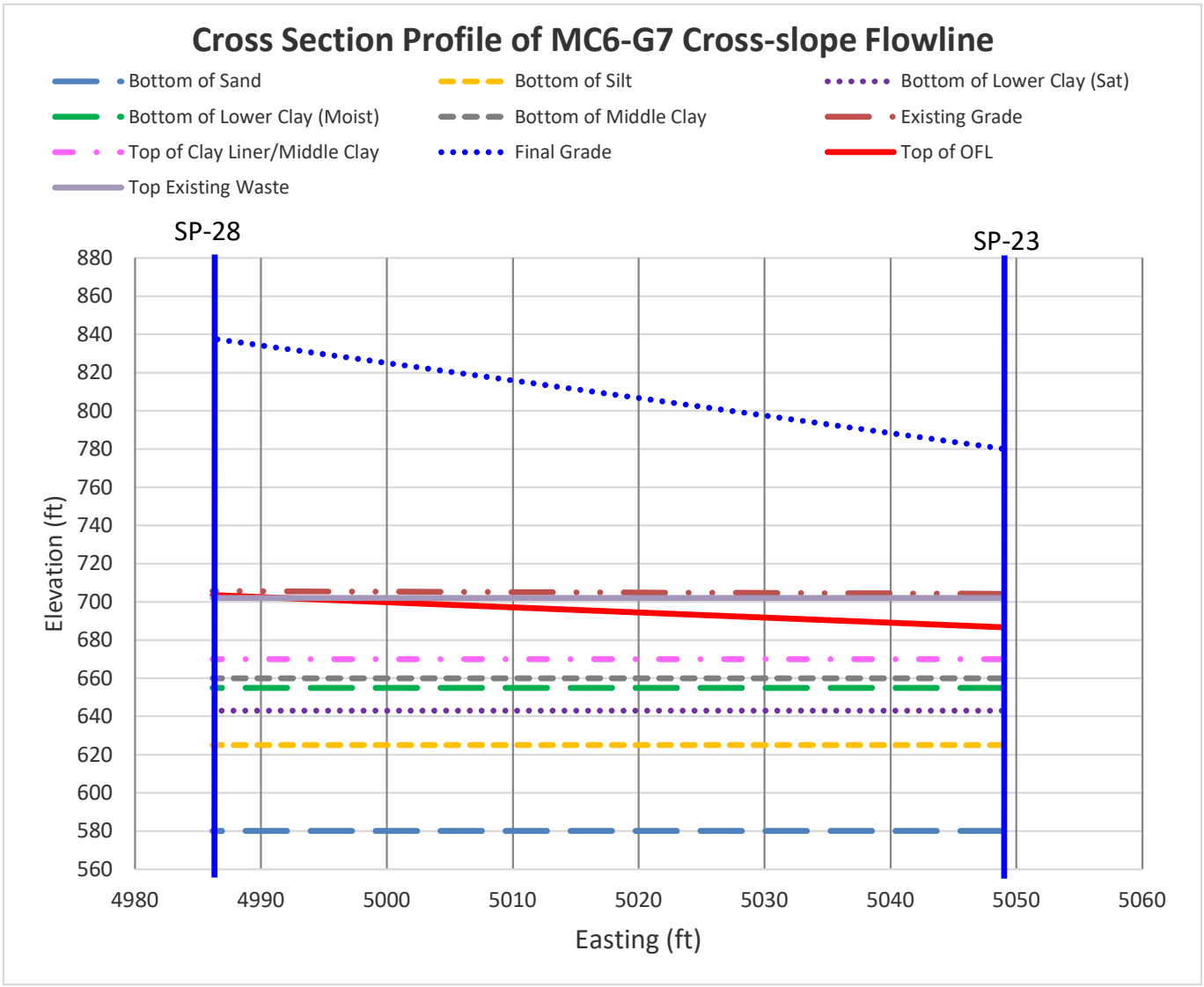
SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-25	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6954.90	5048.84	701.44	822.11	705.63	660.00	655.00	643.00	625.00	580.00	670.00	702.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	116.67	103.0	0	12016.7									
	3	OFL	3.63	135.0	1	-490.1									
	4	Existing Waste	7.56	91.0	1	-688.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1178.1	1178.1	13501.7	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1178.1	1178.1	13501.7	NC	-	-
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	1317.1	1317.1	13640.7	NC	0.248	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	1595.1	1595.1	13918.7	NC	0.230	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	1873.1	1873.1	14196.7	NC	0.215	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	2151.1	2151.1	14474.7	NC	0.202	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	2429.1	2429.1	14752.7	NC	0.191	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	2707.1	2707.1	15030.7	NC	0.182	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	2985.1	2985.1	15308.7	NC	0.174	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	3263.1	3263.1	15586.7	NC	0.166	0.019
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3742.1	4950.0	16065.8	OC-2	0.271	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4422.1	5630.0	16745.8	OC-2	0.250	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5082.1	6290.0	17405.8	OC-2	0.391	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5598.9	6806.8	17922.6	OC-2	0.446	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5992.5	7200.4	18316.2	OC-2	0.430	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6471.0	7678.9	18794.7	OC-2	0.525	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7034.4	8242.3	19358.1	OC-2	0.501	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7552.8	8760.7	19876.5	OC-2	0.320	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8026.2	9234.1	20349.9	OC-2	0.309	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8499.6	9707.5	20823.3	OC-2	0.298	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8973.0	10180.9	21296.7	OC-2	0.288	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9446.4	10654.3	21770.1	OC-2	0.279	-
														5.917	0.202
													Total Settlement [ft]	**6.12**	

Variables & Constants	
Point Name	SP-25
Settlement Layer [ft]	114.4
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G7 Cross-slope Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-28
SP-25
SP-27
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
Elevation (ft)
4980
5000
5020
5040
5060
5080
5100
5120
Easting (ft)


Cross Section Profile of MC6-G7 Cross-slope Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-28
SP-23
Elevation (ft)
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
4980
4990
5000
5010
5020
5030
5040
5050
5060
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-23	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6534.01	5048.84	686.71	780.22	704.20	660.00	655.00	643.00	625.00	580.00	670.00	702.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	89.51	103.0	0	9219.5									
	3	OFL	2.20	135.0	TRUE	-297.0									
	4	Existing Waste	22.29	91.0	1	-2028.4									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2325.4	2325.4	10704.5	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2325.4	2325.4	10704.5	NC	-	-
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2380.6	2380.6	10759.8	NC	0.064	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2491.1	2491.1	10870.2	NC	0.062	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2601.5	2601.5	10980.7	NC	0.061	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2712.0	2712.0	11091.1	NC	0.059	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2822.4	2822.4	11201.6	NC	0.058	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	2932.9	2932.9	11312.0	NC	0.057	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	3043.3	3043.3	11422.5	NC	0.056	0.007
	4	Existing Waste	1.21	91.0	0	110.5	0.080	0.013	0.024	3153.8	3153.8	11532.9	NC	0.055	0.007
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3549.0	4950.0	11928.1	OC-2	0.207	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4229.0	5630.0	12608.1	OC-2	0.189	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	4889.0	6290.0	13268.1	OC-2	0.293	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5405.8	6806.8	13784.9	OC-2	0.332	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5799.4	7200.4	14178.5	OC-2	0.318	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6277.9	7678.9	14657.0	OC-2	0.379	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6841.3	8242.3	15220.4	OC-2	0.360	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7359.7	8760.7	15738.8	OC-2	0.229	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7833.1	9234.1	16212.2	OC-2	0.220	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8306.5	9707.5	16685.6	OC-2	0.212	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8779.9	10180.9	17159.0	OC-2	0.204	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9253.3	10654.3	17632.4	OC-2	0.197	-
														3.610	0.111
											Total Settlement [ft]			**3.72**	

Variables & Constants	
Point Name	SP-23
Settlement Layer [ft]	99.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-25	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6954.90	5048.84	701.44	822.11	705.63	660.00	655.00	643.00	625.00	580.00	670.00	702.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	116.67	103.0	0	12017.0									
	3	OFL	3.63	135.0	TRUE	-490.0									
	4	Existing Waste	7.56	91.0	1	-688.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1178.0	1178.0	13502.0	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1178.0	1178.0	13502.0	NC	-	-
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	1317.0	1317.0	13641.0	NC	0.248	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	1595.0	1595.0	13919.0	NC	0.230	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	1873.0	1873.0	14197.0	NC	0.215	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	2151.0	2151.0	14475.0	NC	0.202	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	2429.0	2429.0	14753.0	NC	0.191	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	2707.0	2707.0	15031.0	NC	0.182	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	2985.0	2985.0	15309.0	NC	0.174	0.019
	4	Existing Waste	3.06	91.0	0	278.0	0.080	0.013	0.024	3263.0	3263.0	15587.0	NC	0.166	0.019
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3742.1	4950.0	16066.1	OC-2	0.271	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4422.1	5630.0	16746.1	OC-2	0.250	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5082.1	6290.0	17406.1	OC-2	0.391	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5598.9	6806.8	17922.9	OC-2	0.446	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5992.5	7200.4	18316.5	OC-2	0.430	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6471.0	7678.9	18795.0	OC-2	0.525	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7034.4	8242.3	19358.4	OC-2	0.501	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7552.8	8760.7	19876.8	OC-2	0.320	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8026.2	9234.1	20350.2	OC-2	0.309	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8499.6	9707.5	20823.6	OC-2	0.298	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8973.0	10180.9	21297.0	OC-2	0.288	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9446.4	10654.3	21770.4	OC-2	0.279	-
														5.917	0.202
												Total Settlement [ft]		6.12	

Variables & Constants	
Point Name	SP-25
Settlement Layer [ft]	114.4
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	OP EXISTING WASTE
SP-26	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6532.88	4967.83	689.46	786.92	705.55	660.00	655.00	643.00	625.00	580.00	670.00	702.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	93.46	103.0	0	9626.4									
	3	OFL	3.55	135.0	TRUE	-479.2									
	4	Existing Waste	19.54	91.0	1	-1778.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2257.4	2257.4	11111.4	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	2257.4	2257.4	11111.4	NC	-	-
	4	Existing Waste	1.56	91.0	0	141.7	0.080	0.013	0.024	2328.3	2328.3	11182.2	NC	0.085	0.010
	4	Existing Waste	1.56	91.0	0	141.7	0.080	0.013	0.024	2470.0	2470.0	11324.0	NC	0.082	0.010
	4	Existing Waste	1.56	91.0	0	141.7	0.080	0.013	0.024	2611.7	2611.7	11465.7	NC	0.080	0.010
	4	Existing Waste	1.56	91.0	0	141.7	0.080	0.013	0.024	2753.5	2753.5	11607.4	NC	0.078	0.010
	4	Existing Waste	1.56	91.0	0	141.7	0.080	0.013	0.024	2895.2	2895.2	11749.2	NC	0.076	0.010
	4	Existing Waste	1.56	91.0	0	141.7	0.080	0.013	0.024	3036.9	3036.9	11890.9	NC	0.074	0.010
	4	Existing Waste	1.56	91.0	0	141.7	0.080	0.013	0.024	3178.7	3178.7	12032.6	NC	0.072	0.010
	4	Existing Waste	1.56	91.0	0	141.7	0.080	0.013	0.024	3320.4	3320.4	12174.4	NC	0.070	0.010
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3731.2	4950.0	12585.2	OC-2	0.217	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4411.2	5630.0	13265.2	OC-2	0.199	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5071.2	6290.0	13925.2	OC-2	0.308	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5588.0	6806.8	14442.0	OC-2	0.350	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5981.7	7200.4	14835.6	OC-2	0.336	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6460.2	7678.9	15314.1	OC-2	0.405	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7023.5	8242.3	15877.5	OC-2	0.384	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7541.9	8760.7	16395.9	OC-2	0.245	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8015.3	9234.1	16869.3	OC-2	0.236	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8488.7	9707.5	17342.7	OC-2	0.227	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8962.1	10180.9	17816.1	OC-2	0.219	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9435.5	10654.3	18289.5	OC-2	0.211	-
														3.954	0.128
											Total Settlement [ft]			**4.08**	

Variables & Constants	
Point Name	SP-26
Settlement Layer [ft]	102.5
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-27	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6955.68	5111.30	703.70	806.49	707.17	660.00	655.00	643.00	625.00	580.00	670.00	702.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	98.79	103.0	0	10175.4									
	3	OFL	5.17	135.0	TRUE	-697.9									
	4	Existing Waste	5.30	91.0	1	-482.3									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1180.2	1180.2	11660.4	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1180.2	1180.2	11660.4	NC	-	-
	4	Existing Waste	3.34	91.0	0	303.7	0.080	0.013	0.024	1332.1	1332.1	11812.2	NC	0.253	0.020
	4	Existing Waste	3.34	91.0	0	303.7	0.080	0.013	0.024	1635.8	1635.8	12115.9	NC	0.232	0.020
	4	Existing Waste	3.34	91.0	0	303.7	0.080	0.013	0.024	1939.5	1939.5	12419.7	NC	0.215	0.020
	4	Existing Waste	3.34	91.0	0	303.7	0.080	0.013	0.024	2243.2	2243.2	12723.4	NC	0.201	0.020
	4	Existing Waste	3.34	91.0	0	303.7	0.080	0.013	0.024	2547.0	2547.0	13027.1	NC	0.189	0.020
	4	Existing Waste	3.34	91.0	0	303.7	0.080	0.013	0.024	2850.7	2850.7	13330.8	NC	0.179	0.020
	4	Existing Waste	3.34	91.0	0	303.7	0.080	0.013	0.024	3154.4	3154.4	13634.5	NC	0.170	0.020
	4	Existing Waste	3.34	91.0	0	303.7	0.080	0.013	0.024	3458.1	3458.1	13938.2	NC	0.162	0.020
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3949.9	4950.0	14430.1	OC-2	0.245	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4630.0	5630.0	15110.1	OC-2	0.226	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5290.0	6290.0	15770.1	OC-2	0.352	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5806.8	6806.8	16286.9	OC-2	0.401	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6200.4	7200.4	16680.5	OC-2	0.385	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6678.9	7678.9	17159.0	OC-2	0.471	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7242.3	8242.3	17722.4	OC-2	0.449	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7760.7	8760.7	18240.8	OC-2	0.287	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8234.1	9234.1	18714.2	OC-2	0.276	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8707.5	9707.5	19187.6	OC-2	0.266	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9180.8	10180.9	19661.0	OC-2	0.257	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9654.2	10654.3	20134.4	OC-2	0.249	-
														5.466	0.215
											Total Settlement [ft]			**5.68**	

Variables & Constants	
Point Name	SP-27
Settlement Layer [ft]	116.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

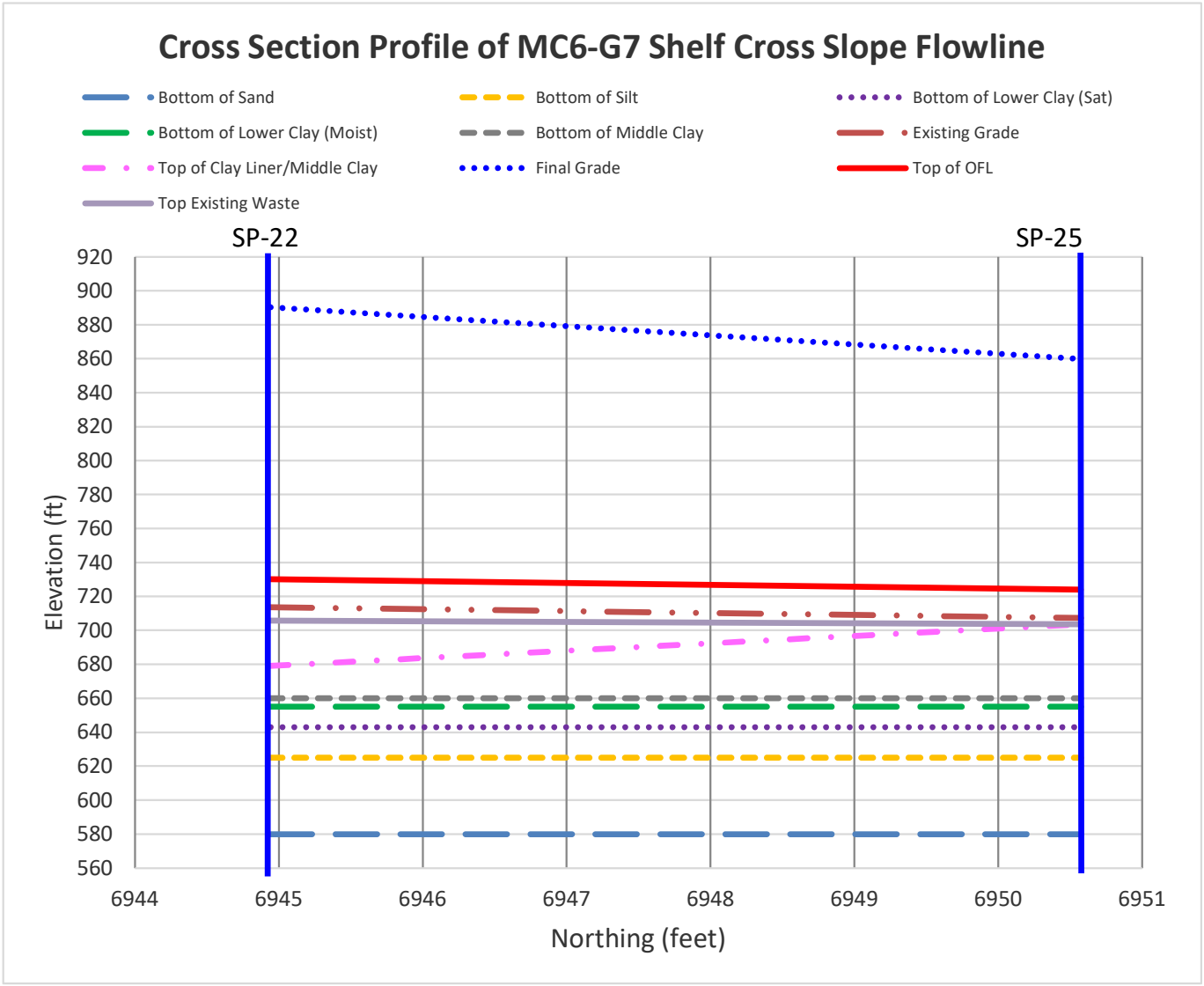
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	OP EXISTING WASTE
SP-28	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6954.65	4986.17	703.56	837.77	705.62	660.00	655.00	643.00	625.00	580.00	670.00	702.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress (midpoint of layer)	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	130.21	103.0	0	13411.6									
	3	OFL	3.62	135.0	TRUE	-488.7									
	4	Existing Waste	5.44	91.0	1	-495.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	983.7	983.7	13951.6	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	983.7	983.7	13951.6	NC	-	-
	4	Existing Waste	3.32	91.0	0	302.1	0.080	0.013	0.024	1134.8	1134.8	14102.7	NC	0.291	0.020
	4	Existing Waste	3.32	91.0	0	302.1	0.080	0.013	0.024	1436.9	1436.9	14404.8	NC	0.266	0.020
	4	Existing Waste	3.32	91.0	0	302.1	0.080	0.013	0.024	1739.0	1739.0	14706.9	NC	0.246	0.020
	4	Existing Waste	3.32	91.0	0	302.1	0.080	0.013	0.024	2041.2	2041.2	15009.1	NC	0.230	0.020
	4	Existing Waste	3.32	91.0	0	302.1	0.080	0.013	0.024	2343.3	2343.3	15311.2	NC	0.217	0.020
	4	Existing Waste	3.32	91.0	0	302.1	0.080	0.013	0.024	2645.4	2645.4	15613.3	NC	0.205	0.020
	4	Existing Waste	3.32	91.0	0	302.1	0.080	0.013	0.024	2947.5	2947.5	15915.4	NC	0.195	0.020
	4	Existing Waste	3.32	91.0	0	302.1	0.080	0.013	0.024	3249.6	3249.6	16217.5	NC	0.185	0.020
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3740.7	4950.0	16708.6	OC-2	0.280	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4420.7	5630.0	17388.6	OC-2	0.259	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5080.7	6290.0	18048.6	OC-2	0.405	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5597.5	6806.8	18565.4	OC-2	0.462	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5991.1	7200.4	18959.0	OC-2	0.445	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6469.6	7678.9	19437.5	OC-2	0.545	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7033.0	8242.3	20000.9	OC-2	0.520	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7551.4	8760.7	20519.3	OC-2	0.333	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8024.8	9234.1	20992.7	OC-2	0.321	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8498.2	9707.5	21466.1	OC-2	0.310	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8971.6	10180.9	21939.5	OC-2	0.300	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9445.0	10654.3	22412.9	OC-2	0.291	-
														6.303	0.215
											Total Settlement [ft]			**6.52**	

Variables & Constants	
Point Name	SP-28
Settlement Layer [ft]	116.6
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G7 Shelf Cross Slope Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-22
SP-25
Elevation (ft)
920
900
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
6944
6945
6946
6947
6948
6949
6950
6951
Northing (feet)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-20b	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6944.94	4776.06	730.10	890.30	713.68	660.00	655.00	643.00	625.00	580.00	670.00	705.76

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	156.20	103.0	0	16088.8									
	3	OFL	16.42	135.0	0	2217.0									
	4	Existing Waste	0.00	91.0	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	3.96	135.0	0	534.3	0.102	0.017	0.005	267.1	267.1	19113.0	NC	0.749	0.005
	3	OFL	3.96	135.0	0	534.3	0.102	0.017	0.005	801.4	801.4	19647.3	NC	0.561	0.005
	4	Existing Waste	4.47	91.0	0	406.8	0.080	0.013	0.024	1272.0	1272.0	20117.8	NC	0.429	0.027
	4	Existing Waste	4.47	91.0	0	406.8	0.080	0.013	0.024	1678.8	1678.8	20524.6	NC	0.389	0.027
	4	Existing Waste	4.47	91.0	0	406.8	0.080	0.013	0.024	2085.5	2085.5	20931.4	NC	0.358	0.027
	4	Existing Waste	4.47	91.0	0	406.8	0.080	0.013	0.024	2492.3	2492.3	21338.2	NC	0.334	0.027
	4	Existing Waste	4.47	91.0	0	406.8	0.080	0.013	0.024	2899.1	2899.1	21745.0	NC	0.313	0.027
	4	Existing Waste	4.47	91.0	0	406.8	0.080	0.013	0.024	3305.9	3305.9	22151.8	NC	0.295	0.027
	4	Existing Waste	4.47	91.0	0	406.8	0.080	0.013	0.024	3712.7	3712.7	22558.6	NC	0.280	0.027
	4	Existing Waste	4.47	91.0	0	406.8	0.080	0.013	0.024	4119.5	4119.5	22965.4	NC	0.267	0.027
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4662.9	4950.0	23508.8	OC-2	0.347	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5342.9	5630.0	24188.8	OC-2	0.325	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6002.9	6290.0	24848.8	OC-2	0.513	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6519.7	6806.8	25365.6	OC-2	0.589	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6913.3	7200.4	25759.2	OC-2	0.571	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7391.8	7678.9	26237.7	OC-2	0.720	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7955.2	8242.3	26801.1	OC-2	0.691	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8473.6	8760.7	27319.5	OC-2	0.445	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8947.0	9234.1	27792.9	OC-2	0.431	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9420.4	9707.5	28266.3	OC-2	0.418	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9893.8	10180.9	28739.7	OC-2	0.406	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10367.2	10654.3	29213.1	OC-2	0.394	-
														9.824	0.281
												Total Settlement [ft]		10.11	

Variables & Constants	
Point Name	SP-20b
Settlement Layer [ft]	133.7
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-28b	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	6950.57	4897.93	724.00	859.83	707.33	660.00	655.00	643.00	625.00	580.00	670.00	703.58

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	131.83	103.0	0	13579.0									
	3	OFL	16.67	135.0	0	2250.5									
	4	Existing Waste	0.00	91.0	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	1.87	135.0	0	253.1	0.102	0.017	0.005	126.5	126.5	16496.0	NC	0.404	0.002
	3	OFL	1.87	135.0	0	253.1	0.102	0.017	0.005	379.6	379.6	16749.1	NC	0.314	0.002
	4	Existing Waste	4.20	91.0	0	382.0	0.080	0.013	0.024	697.2	697.2	17066.7	NC	0.466	0.026
	4	Existing Waste	4.20	91.0	0	382.0	0.080	0.013	0.024	1079.1	1079.1	17448.6	NC	0.406	0.026
	4	Existing Waste	4.20	91.0	0	382.0	0.080	0.013	0.024	1461.1	1461.1	17830.6	NC	0.365	0.026
	4	Existing Waste	4.20	91.0	0	382.0	0.080	0.013	0.024	1843.1	1843.1	18212.6	NC	0.334	0.026
	4	Existing Waste	4.20	91.0	0	382.0	0.080	0.013	0.024	2225.1	2225.1	18594.6	NC	0.310	0.026
	4	Existing Waste	4.20	91.0	0	382.0	0.080	0.013	0.024	2607.0	2607.0	18976.5	NC	0.289	0.026
	4	Existing Waste	4.20	91.0	0	382.0	0.080	0.013	0.024	2989.0	2989.0	19358.5	NC	0.272	0.026
	4	Existing Waste	4.20	91.0	0	382.0	0.080	0.013	0.024	3371.0	3371.0	19740.5	NC	0.258	0.026
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3902.0	4950.0	20271.5	OC-2	0.321	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4582.0	5630.0	20951.5	OC-2	0.299	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5242.0	6290.0	21611.5	OC-2	0.470	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5758.8	6806.8	22128.3	OC-2	0.538	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6152.4	7200.4	22521.9	OC-2	0.520	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6630.9	7678.9	23000.4	OC-2	0.643	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7194.3	8242.3	23563.8	OC-2	0.616	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7712.7	8760.7	24082.2	OC-2	0.395	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8186.1	9234.1	24555.6	OC-2	0.382	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8659.5	9707.5	25029.0	OC-2	0.370	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9132.9	10180.9	25502.4	OC-2	0.359	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9606.3	10654.3	25975.8	OC-2	0.348	-
														8.680	0.262
													Total Settlement [ft]	**8.94**	

Variables & Constants	
Point Name	SP-28b
Settlement Layer [ft]	127.3
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

5. Attachment A-2.2 MC6_E_F_G1-G3 Settlement Analysis

Original Submittal			
	Page	**Revised Submittal**	
	125	A-2.2	Settlement Analysis for MC VI-E, F and G1 to G3
A-2.1	136	A-2.2.1	Settlement Analysis Points
A-2.2	139	A-2.2.2	Cross-section Profiles and Settlement Calculation Spreadsheets

Attachment A-2.2

Final Cover Grading Modification Settlement Analysis

CALCULATION SHEET

Client: Wayne Disposal, Inc.	Project No.:	1208070015.005			
Project: WDI Final Cover Grading Modification	Calculated By:	RR	Date:	5/16/2022	
Calculation: Settlement Analysis	Checked By:	KF	Date:	5/17/2022	
	Approved By:	XZ	Date:	5/17/2022	

LEACHATE COLLECTION PIPE SETTLEMENT ANALYSIS

OBJECTIVE

This calculation evaluates the post-settlement slopes of the leachate collection pipe and cell floor cross slopes for cells affected by the proposed Final Cover Grading Modification at Wayne Disposal, Inc. (WDI). This calculation evaluates the following Cells:

- Master Cell-VI-E (MC6E)
- Master Cell-VI-F (MC6F): Subcells F1, F2, F3, and F4
- Master Cell VI-G (MC6G): Subcells G1, G2, and G3

This evaluation is based on the estimated settlement of the existing waste and soil underlying the proposed cells due to additional overburden stresses induced by waste placement and the impact of such settlement on the post settlement cell floor slopes.

DESIGN CRITERIA AND ASSUMPTIONS

- The slope of each leachate collection pipe should be at least 1% and each cell floor cross slope should be at least 2% per Rule 299.9620 (4) (EGLE 2020).
- Maximum settlement is expected to occur at the completion of the cap construction when the foundation is subjected to the maximum overburden pressure. Under the worst-case scenario, maximum load is applied (in full) to the foundation instantaneously during settlement analysis for a conservative (i.e., greater than anticipated) estimate of total settlement. In reality, loads would be applied incrementally as waste is placed gradually during the active life of the landfill. Additionally, the resulting settlement is assumed to occur immediately, conservatively accounting for the maximum settlement at the end of foundation soil consolidation.
- Existing information about the existing landfill (MC-IV) below Subcells F1, F2, F3, F4, G2, and G3 indicate that it was a trench fill type of landfill. The precise configuration of the trenches is unknown. It is believed that each trench is bounded by an intracell dike. Using available subsurface information (Geoprobe boring logs and MC-IV construction drawings – see Attachment A-2.2.1 and Figure 1), CTI has considered the profile of existing dikes in these settlement analyses by placing additional settlement calculation points at the estimated crests and toes of these dikes in Subcells F1 through F4, G2 and G3.
- Pipe flowline analysis points were selected within the analyzed cells as shown in Attachment A-2.2.1. The specific locations of these points were selected to correspond to the cell floor high point, low point, changes in final cover slope, maximum fill height, the location of the existing dikes in MC-IV and additional points. Total settlement is estimated for each point, allowing an assessment of the post-settlement slope(s) along the flowline.
- Differential settlement estimates are greater at the dike crest-toe transitions than between points without much difference in subgrade.

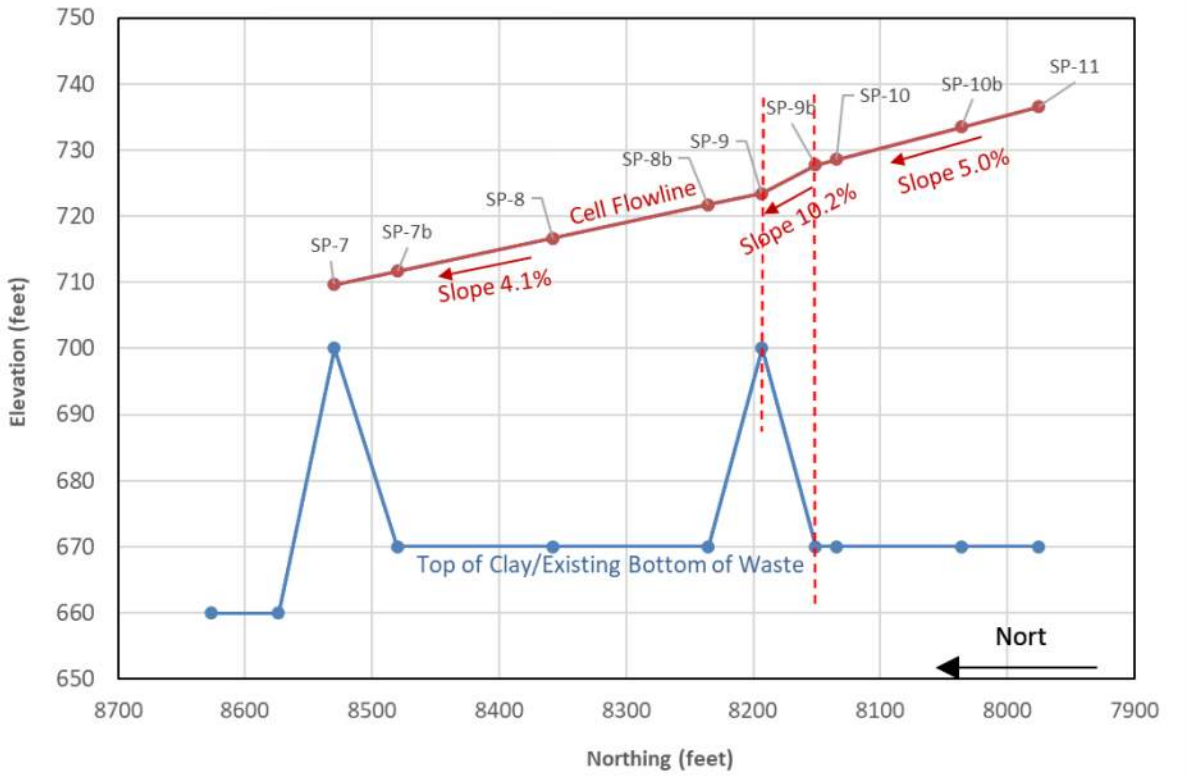


Figure 1. Estimated Cross-section Depicting Bottom of Existing Waste Elevations Below MC VI-F as Determined from Geoprobe Boring Logs and Proposed Cell Flowline in MCVI-F3

- Table 1A lists the material typical thicknesses and unit weights used for the settlement analysis. Note that a value of 103 pounds per cubic foot (pcf) was conservatively selected for the unit weight of newly-placed waste. This value of unit weight is conservative because it is greater than the representative value obtained from survey records. Greater values of waste unit weight result in larger calculated settlement values. Table 1B provides supporting survey information used to evaluate the unit weight of newly placed waste.
- Table 2 summarizes the compressibility parameters used in the settlement analysis. The compacted clay liner is only very slightly compressible relative to the in-situ clay layer due to the much greater thickness of the in-situ clay. Considering the insignificant magnitude of the settlement of the compacted clay liner, it was not included in the analysis. The methodology presented in Attachment A-2.3 was used to estimate a modified compression index (C'_c) and a modified secondary compression index (C'_α) suitable for calculating the settlement of the existing in-place waste at WDI under the effect of increasing overburden pressures.

CALCULATION SHEET

Project No.: 1208070015.005

Client: Wayne Disposal, Inc. | Calculated By: RR | Date: 5/16/2022

Project: WDI Final Cover Grading Modification | Checked By: KF | Date: 5/17/2022

Calculation: Settlement Analysis | Approved By: XZ | Date: 5/17/2022

Table 1A. Soil Properties for Settlement Analysis

Soil Type	Thickness [ft]	Moist Unit Weight [pcf]
Final cover soil	4	135
New waste	Varies	103*
Existing cover soil	Varies	135
Existing waste	Varies	91
In-situ middle clay	Varies	136
In-situ lower clay (moist)	Varies	128
In-situ lower clay (saturated)	Varies	128
In-situ silt (saturated)	18	125
In-situ sand (saturated)	45	115

** Conservative (high) Value - see Table 1B.*

Table 1B. Supporting Survey Information Used to Evaluate the Unit Weight of Newly Placed Waste

Survey Years	2014 to 2021
Tons waste received into the landfill	3,905,856
Cubic yards airspace consumed	2,869,499
Average Unit Weight (tons/cy)	1.36
Average Unit Weight (pcf)	101

Table 2. Compressibility Parameters of Waste and Soils

Soil Type	Primary Compression Ratio $C_c/(1+e_0)$	Secondary Compression Ratio $C_\alpha/(1+e_0)$	Recompression Ratio $C_r/(1+e_0)$
Existing cover	0.102[B]	0.005[B]	0.017[A]
Existing waste	0.08[C]	0.024[C]	0.0133[A]
In-situ middle clay	0.102	0.005	0.017[A]
In-situ lower clay	0.171	0.009	0.0285[A]
In-situ silt	0.15[B]	0[B]	0[B]
In-situ sand	0.1[B]	0[B]	0[B]

[A] Estimated from $C_r = C_c/6$.

[B] Assumed values.

[C] From Attachment A-2.3

- The information for subsurface soils is based on General Profiles presented in Appendix A, Subsurface Soil/Waste Profiles & Corresponding Physical Properties, Volume III – WDI Operating License Application Master Cells VI F & G by NTH Consultants (2011a). The same general profile

was used in the current MC VI permits for MC-VI-E, MC-VI-F, and MC-VI-G. Note that some uncertainty may exist in the interpretation of hydrogeological data due to natural soil's inherent variability, conservative assumptions have been applied to produce a conservative estimate of settlement in this analysis.

METHODOLOGY

Total settlement is estimated using the 1-D compression equations (Coduto 1999). Total settlement is calculated as:

$$S = S_c + S_s \quad (1)$$

Where:

S = total settlement [ft]
S_c = primary compression settlement due to load application [ft]
S_s = secondary compression settlement due to creep effects [ft]

Settlement caused by primary compression for a given layer of soil with uniform properties is calculated as:

$$S_c = \frac{h_0}{1+e_0}\left(C_r \log\frac{\sigma_c}{\sigma_0} + C_c \log\frac{\sigma_i}{\sigma_c}\right) \quad (2)$$

Where:

C_c = primary compression index
C_r = recompression index
h_0 = initial compressible layer thickness [ft]
e_0 = initial void ratio of the clay subgrade
σ_0 = initial overburden pressure acting on the compressible layer [psf]
σ_i = final overburden pressure acting on the compressible layer [psf]
σ_c = preconsolidation stress [psf], calculated using Equation 4.

Settlement due to secondary compression is calculated using Equation 3 below:

$$S_s = h_0 \frac{C_\alpha}{1+e_0} \log\left(\frac{t_2}{t_1}\right) \quad (3)$$

Where:

C_α = secondary compression index
H = layer thickness [ft]

t_2 = time after application of load (assumed 70 years)
t_1 = time required to complete primary consolidation (assumed 40 years)

- The elevations in this calculation sheet are referenced to Mean Sea Level (MSL).
- The initial ground elevation (prior to initial development) was assumed to be approximately 705 ft. This value was inferred from the cross section profile from Engineering Drawings, Wayne Disposal, Inc. Site No.2 MC VI-F&G by NTH Consultants (2011b).
- The preconsolidation pressure of the middle clay and lower clay, the major contributing compressible layers below the existing waste, was set equal to the initial effective overburden pressure acting on them prior to development. This value is used in Equation 2 to estimate settlement resulting from an initial load less than the preconsolidation pressure. The net settlement between construction of the overfill liner and the proposed final conditions is calculated with the soils in either a normally-consolidated state (i.e., compression is calculated using C'_c) or over-consolidated state (i.e., compression is calculated using C'_r and C'_c) depending on whether the initial stress is greater than the preconsolidation stress or not, respectively. Note that in most cases, both layers of soil have experienced a higher overburden pressure since initial development of the site. This value is calculated using Equation 4.
- When applicable, calculation of settlement following cell construction accounts for changes in overburden pressure resulting from construction activities and landfill operations.
- At each point selected along the leachate collection pipe system, the elevations for the existing ground, proposed or existing liner system, final cover, and the foundation soils are determined and used to compute the initial and final overburden pressures at each settlement point within the analysis using Equation 4 similarly to the preconsolidation pressure. Calculation spreadsheets for the settlement points in Cells MC-VI-E, MC-VI-F, MC-VI-G (Sub cells G1, G2, and G3) are presented in Attachment A-2.2.2.

$$\sigma_{c,0,f} = \sum_{i=0}^{n} \gamma_i \times h_i \qquad (4)$$

Where:

$\sigma_{c,0,f}$ = σ_c: preconsolidation stress [psf]; σ_0: initial stress [psf]; σ_f: final stress [psf]
γ_i = Unit weight of soil layer i [psf]
h_i = Thickness of layer i [ft] at settlement point as follows: For σ_c use thicknesses of layers prior to development; For σ_0 use thicknesses of layers up to existing elevations

For σ_f use thicknesses of layers up to proposed final elevations

- Soil layers are identified using subsurface soil profiles provided in "General Profiles" presented in Appendix A, Subsurface Soil/Waste Profiles & Corresponding Physical Properties, Volume III – WDI Operating License Application Master Cells VI F & G by NTH Consultants (2011a). These layers include in-situ clay with varying degrees of compressibility (see Table 2).
- Attachment A-2.2.1 presents the plan locations of the settlement analysis points within the cells. When the same point was used both for the leachate pipe flowline and cross-slope analyses, the liner elevation of the settlement point was raised by 1 foot in the cross-slope analysis to account for the leachate pipe trench depth in Subcells F1 through F4.

CALCULATIONS

Equations 1 through 4 were incorporated into a spreadsheet to conduct the settlement calculations. The settlement calculation output and resulting post-settlement slope(s) for the leachate collection pipes and cross slopes within the cells are presented in Tables 3 through 19 below. Attachment A-2.2.2 presents the cross-section profiles of the leachate collection pipe flowlines and cell floor cross slopes, and the settlement calculation spreadsheets for the individual points.

Table 3. MC6E Leachate Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	**Length**	Post-Settlement	Pre-Settlement	Post-Settlement	**Min. Slope**
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
P514	8641.95	6454.04	701.00	0.23	229	700.77	1.8%	1.7%	1.0%
P512	8666.18	6226.32	705.21	0.59		704.62			
P512	8666.18	6226.32	705.21	0.59	276	704.62	1.5%	1.6%	1.0%
P510	8599.09	5958.86	709.36	0.25		709.11			
P510	8599.09	5958.86	709.36	0.25	216	709.11	1.3%	1.0%	1.0%
P508	8649.05	5748.66	712.17	0.80		711.37			
P508	8649.05	5748.66	712.17	0.80	281	711.37	1.4%	1.3%	1.0%
P506	8657.89	5468.01	716.07	1.03		715.04			
P506	8657.89	5468.01	716.07	1.03	240	715.04	1.5%	1.0%	1.0%
P505	8565.19	5246.41	719.62	2.18		717.44			

CALCULATION SHEET

Client: Wayne Disposal, Inc.
Project: WDI Final Cover Grading Modification
Calculation: Settlement Analysis

Project No.: 1208070015.005
Calculated By: RR Date: 5/16/2022
Checked By: KF Date: 5/17/2022
Approved By: XZ Date: 5/17/2022

Table 4. MC6E E5300 Cross Slope Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-84	8581.38	5296.64	719.00	5.43	48	713.57	4.2%	6.7%	2.0%
SP-85	8533.44	5296.64	721.00	4.23		716.77			
SP-85	8533.44	5296.64	721.00	4.23	45	716.77	4.4%	3.6%	2.0%
SP-86	8488.08	5296.64	723.00	4.62		718.38			

Table 5. MC6E Phase II-NE Cross Slope Settlement Calculation Summary

			Elevation			Liner Grade	Cross Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
P-512	8666.18	6226.32	705.21	3.15	99	702.06	8.9%	9.9%	2.0%
SP-66	8566.99	6221.70	714.00	2.13		711.87			
SP-66	8566.99	6221.70	714.00	2.13	103	711.87	7.8%	5.8%	2.0%
SP-67	8464.52	6211.68	722.00	4.11		717.89			
SP-67	8464.52	6211.68	722.00	4.11	57	717.89	5.3%	4.2%	2.0%
SP-68	8408.01	6206.15	725.00	4.72		720.28			
SP-68	8408.01	6206.15	725.00	4.72	54	720.28	3.7%	5.7%	2.0%
SP-69	8354.03	6200.87	727.00	3.64		723.36			
SP-69	8354.03	6200.87	727.00	3.64	97	723.36	4.1%	2.3%	2.0%
SP-70	8257.04	6191.39	731.00	5.35		725.65			
SP-70	8257.04	6191.39	731.00	5.35	98	725.65	4.1%	5.5%	2.0%
SP-71	8159.20	6181.82	735.00	3.92		731.08			

Table 6. MC6G – G1 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-13	7339.00	4082.84	668.00	3.40	38	664.60	5.2%	4.3%	1.0%
SP-14	7339.00	4120.94	670.00	3.75		666.25			
SP-14	7339.00	4120.94	670.00	3.75	208	666.25	2.4%	2.0%	1.0%
SP-15	7339.00	4329.23	675.00	4.62		670.38			
SP-15	7339.00	4329.23	675.00	4.62	242	670.38	1.7%	1.4%	1.0%
SP-16	7339.00	4571.07	679.00	5.11		673.89			
SP-16	7339.00	4571.07	679.00	5.11	257	673.89	1.2%	1.2%	1.0%
SP-17	7338.93	4827.73	682.00	5.13		676.87			
SP-17	7338.93	4827.73	682.00	5.13	141	676.87	1.4%	1.4%	1.0%
SP-18	7338.96	4968.72	684.00	5.14		678.86			

Table 7. MC6G – G2 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-07	7843.09	4381.18	726.82	6.96	120	719.86	4.0%	1.5%	1.0%
SP-08	7842.87	4261.26	722.00	3.91		718.09			
SP-08	7842.87	4261.26	722.00	3.91	101	718.09	4.0%	3.2%	1.0%
SP-09	7842.87	4160.67	718.00	3.14		714.86			
SP-09	7842.87	4160.67	718.00	3.14	151	714.86	4.0%	4.1%	1.0%
SP-10	7842.87	4009.79	712.00	3.30		708.70			
SP-10	7842.87	4009.79	712.00	3.30	70	708.70	4.0%	4.7%	1.0%
SP-11	7842.87	3939.91	709.22	3.83		705.39			

Table 8. MC6G – G3 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-01	7842.77	4394.77	726.99	6.91	209	720.08	4.0%	4.2%	1.0%
SP-02	7822.70	4603.12	718.57	7.35		711.22			
SP-02	7822.70	4603.12	718.57	7.35	211	711.22	4.1%	4.2%	1.0%
SP-03	7800.62	4813.09	710.00	7.67		702.33			
SP-03	7800.62	4813.09	710.00	7.67	233	702.33	4.0%	4.2%	1.0%
SP-04	7776.87	5044.82	700.70	8.10		692.60			

Table 9. MC6G – G1 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-15	7339.00	4329.23	675.00	4.62	159	670.38	2.5%	2.3%	2.0%
SP-20	7180.19	4317.03	678.98	4.87		674.11			
SP-17	7338.93	4827.73	682.00	5.13	160	676.87	2.5%	2.3%	2.0%
SP-19	7179.21	4823.35	686.00	5.44		680.56			
SP-17	7338.93	4827.73	682.00	5.13	154	676.87	5.0%	4.6%	2.0%
SP-21	7493.33	4826.63	689.69	5.74		683.95			

Table 10. MC6G – G2 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-10	7842.87	4009.79	712.00	3.30	129	708.70	4.5%	6.8%	2.0%
SP-12	7714.37	4002.92	717.80	0.39		717.41			

CALCULATION SHEET

Project No.: 1208070015.005

Client: Wayne Disposal, Inc. | Calculated By: RR | Date: 5/16/2022

Project: WDI Final Cover Grading Modification | Checked By: KF | Date: 5/17/2022

Calculation: Settlement Analysis | Approved By: XZ | Date: 5/17/2022

Table 11. MC6G – G3 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-02	7822.70	4603.12	718.57	7.35	76	711.22	6.1%	5.9%	2.0%
SP-05	7898.60	4609.46	723.20	7.46		715.74			
SP-02	7822.70	4603.12	718.57	7.35	58	711.22	9.3%	9.2%	2.0%
SP-06	7764.39	4602.88	724.00	7.44		716.56			

Table 12. MC6F – F1 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-18	8104.44	3986.36	716.35	5.41	81	710.94	4.5%	3.4%	1.0%
SP-19	8104.44	4067.43	720.00	6.30		713.70			
SP-19	8104.44	4067.43	720.00	6.30	133	713.70	4.5%	3.4%	1.0%
SP-20	8104.44	4200.76	726.00	7.83		718.17			
SP-20	8104.44	4200.76	726.00	7.83	110	718.17	4.5%	3.9%	1.0%
SP-21	8104.44	4310.91	730.96	8.46		722.50			

Table 13. MC6F – F2 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Pipe Flowline Slope		
Point	North	East	Flowline Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-14	8441.35	3991.88	709.74	5.38	140	704.36	3.0%	2.2%	1.0%
SP-15	8441.35	4131.87	713.94	6.54		707.40			
SP-15	8441.35	4131.87	713.94	6.54	149	707.40	3.0%	3.1%	1.0%
SP-16	8441.35	4280.39	718.40	6.43		711.97			

CALCULATION SHEET

Client: Wayne Disposal, Inc.
Project: WDI Final Cover Grading Modification
Calculation: Settlement Analysis

Project No.: 1208070015.005
Calculated By: RR Date: 5/16/2022
Checked By: KF Date: 5/17/2022
Approved By: XZ Date: 5/17/2022

Table 14. MC6F – F3 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Floor/Pipe Slope		
Point	North	East	Pipe Invert Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-7	8529.72	4583.16	709.66	3.70	50	705.97	4.1%	2.4%	1.0%
SP-7b	8480.14	4583.16	711.70	4.54		707.15			
SP-7b	8480.14	4583.16	711.70	4.54	122	707.15	4.1%	4.9%	1.0%
SP-8	8357.69	4583.16	716.72	3.52		713.19			
SP-8	8357.69	4583.16	716.72	3.52	122	713.19	4.1%	2.2%	1.0%
SP-8b	8235.24	4583.16	721.74	5.84		715.90			
SP-8b	8235.24	4583.16	721.74	5.84	42	715.90	4.1%	4.3%	1.0%
SP-9	8193.03	4583.16	723.47	5.73		717.73			
SP-9	8193.03	4583.16	723.47	5.73	42	717.73	10.2%	5.0%	1.0%
SP-9b	8150.83	4583.16	727.78	7.92		719.86			
SP-9b	8150.83	4583.16	727.78	7.92	17	719.86	5.0%	3.8%	1.0%
SP-10	8134.31	4583.16	728.61	8.11		720.50			
SP-10	8134.31	4583.16	728.61	8.11	98	720.50	5.0%	3.9%	1.0%
SP-10b	8035.92	4583.16	733.53	9.22		724.31			
SP-10b	8035.92	4583.16	733.53	9.22	60	724.31	5.0%	4.4%	1.0%
SP-11	7975.92	4583.16	736.53	9.56		726.97			

Table 15. MC6F – F4 Pipe Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Floor/Pipe Slope		
Point	North	East	Pipe Invert Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-1	8515.67	4957.47	700.50	3.49	35	697.01	5.0%	2.1%	1.0%
SP-1b	8481.11	4957.47	702.23	4.49		697.73			
SP-1b	8481.11	4957.47	702.23	4.49	121	697.73	5.0%	3.7%	1.0%
SP-2	8360.25	4957.47	708.27	6.06		702.21			
SP-2	8360.25	4957.47	708.27	6.06	121	702.21	5.0%	3.9%	1.0%
SP-2b	8239.39	4957.47	714.31	7.39		706.92			
SP-2b	8239.39	4957.47	714.31	7.39	49	706.92	5.0%	6.8%	1.0%
SP-3	8190.21	4957.47	716.77	6.51		710.27			
SP-3	8190.21	4957.47	716.77	6.51	49	710.27	5.0%	5.0%	1.0%
SP-3b	8141.04	4957.47	719.23	6.52		712.71			
SP-3b	8141.04	4957.47	719.23	6.52	105	712.71	5.0%	1.4%	1.0%
SP-4	8035.92	4957.47	724.49	10.34		714.15			
SP-4	8035.92	4957.47	724.49	10.34	60	714.15	5.0%	6.0%	1.0%
SP-4b	7975.92	4957.47	727.49	9.76		717.73			

CALCULATION SHEET

Client: Wayne Disposal, Inc.
Project: WDI Final Cover Grading Modification
Calculation: Settlement Analysis

Project No.: 1208070015.005
Calculated By: RR Date: 5/16/2022
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Approved By: XZ Date: 5/17/2022

Table 16. MC6F – F1 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Floor/Pipe Slope		
Point	North	East	Pipe Invert Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-19b	8154.60	4063.30	735.96	6.62	27	729.34	5.9%	8.0%	2.0%
SP-19d	8181.85	4063.30	737.57	6.06		731.51			
SP-19d	8181.85	4063.30	737.57	6.06	34	731.51	5.9%	5.7%	2.0%
SP-19a	8215.56	4063.30	739.57	6.14		733.42			
SP-19a	8215.56	4063.30	739.57	6.14	41	733.42	5.9%	6.5%	2.0%
SP-19c	8256.70	4063.30	742.00	5.91		736.09			

Table 17. MC6F – F2 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Floor/Pipe Slope		
Point	North	East	Pipe Invert Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-15	8441.35	4131.87	715.04	7.29	35	707.75	2.6%	3.9%	2.0%
SP-15c	8476.72	4131.87	715.98	6.85		709.12			
SP-15c	8476.72	4131.87	715.98	6.85	49	709.12	2.6%	5.3%	2.0%
SP-15b	8525.36	4131.87	717.26	5.59		711.67			
SP-15b	8525.36	4131.87	717.26	5.59	49	711.67	2.6%	3.3%	2.0%
SP-15a	8574.00	4131.87	718.55	5.27		713.28			
SP-15a	8574.00	4131.87	718.55	5.27	53	713.28	2.6%	5.1%	2.0%
SP-15d	8626.95	4131.87	719.95	3.94		716.01			

Table 18. MC6F – F3 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Floor/Pipe Slope		
Point	North	East	Pipe Invert Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-10b	8035.92	4583.16	734.63	9.39	155	725.24	3.3%	3.9%	2.0%
SP-12	8035.92	4738.22	739.78	8.56		731.22			
SP-10b	8035.92	4583.16	734.63	9.39	158	725.24	3.3%	2.7%	2.0%
SP-13	8035.92	4425.42	739.86	10.33		729.53			

Table 19. MC6F – F4 Cross Slope Flowline Settlement Calculation Summary

			Elevation			Liner Grade	Floor/Pipe Slope		
Point	North	East	Pipe Invert Elevation	Settlement	Length	Post-Settlement	Pre-Settlement	Post-Settlement	Min. Slope
	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	[%]
SP-4	8035.92	4957.47	725.59	10.34	183	715.24	3.3%	5.2%	2.0%
SP-5	8035.92	4774.37	731.66	6.97		724.68			
SP-4	8035.92	4957.47	725.59	10.34	185	715.24	3.3%	3.9%	2.0%
SP-6	8035.92	5142.88	731.74	9.22		722.51			

CONCLUSIONS

The post-settlement slope of the leachate collection pipe should be at least 1% and each cell floor cross slope should be at least 2% per Rule 299.9620 (4) (EGLE 2020). This calculation estimated the settlement at points along the leachate collection pipe and cross slopes within cells affected by the proposed revised final grades. The settlement of each of these points was used to calculate the post-settlement slopes of the liner system in these cells. This settlement analysis determined that all leachate collection pipes and cross slopes within MC VI-E, MC-VI-F, and MC-VI-G sub cells G1, G2, and G3 meet the required minimum post-settlement slopes.

REFERENCES

Coduto, D.P. (1999) *Geotechnical Engineering: Principles and Practices*, Prentice-Hall Inc., New Jersey

EGLE (2020) *Part 111 Administrative Rules,* Department of Environment, Great Lakes, and Energy *Hazardous Waste Management*, Materials Management Division.

NTH Consultants, Ltd. (2011a) *Volume III – WDI Operating License Application Master Cells VI F & G.*

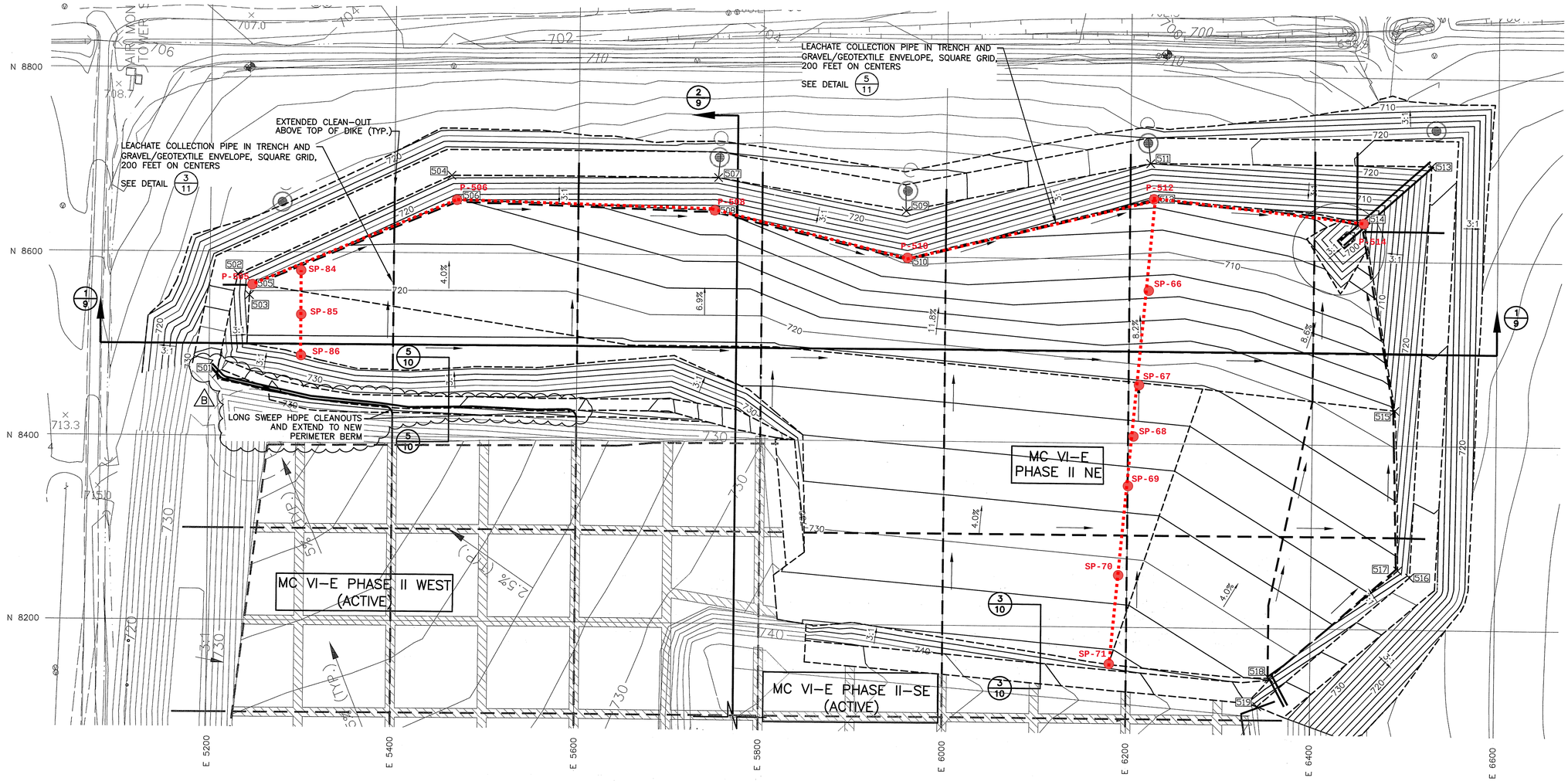
NTH Consultants, Ltd. (2011b) Engineering Drawings. *Wayne Disposal, Inc. Site No. 2 Master Cell VI-F&G.*

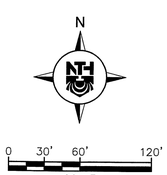
NTH Consultants, Ltd. (2008) Master Cell VI-E Design Modification Plans. *Wayne Disposal, Inc. Site No. 2.*

Attachment A-2.2.1

Settlement Analysis Points

Final Cover Grading Modification





LEGEND:

- 730 — PROPOSED TOP OF DIKE/ PRIMARY CLAY LINER CONTOURS
- 730 — EXISTING CONTOUR
- PROPOSED GRADE BREAK
- 520 — PROPOSED PRIMARY CLAY LINER POINT NUMBER ID
- PROPOSED LEACHATE COLLECTION SUMP LOCATION SEE DETAIL 1/11
- EXISTING LEACHATE COLLECTION SUMP LOCATION
- PROPOSED LEACHATE COLLECTION PIPE AND FLOW DIRECTION
- EXISTING LEACHATE COLLECTION PIPE AND FLOW DIRECTION
- EXISTING 2 EXTRA LAYERS OF GEONET, 7.5' WIDE, BENEATH GEOCOMPOSITE IN SQUARE GRID 100 FEET ON CENTERS
- ±8% — FLOOR SLOPE
- EXISTING LEACHATE SUMP
- EXISTING LEACHATE SUMP VALVE PIT
- EXISTING CLEANOUT
- PROPOSED CLEANOUT

PRIMARY CLAY LINER COORDINATES

POINT NO.	NORTHING	EASTING	ELEVATION	
501	8466.47	5208.11	732.36	
502	8575.56	5230.55	725.00	
503	8552.98	5243.24	720.23	
504	8684.58	5461.79	725.00	
505	8565.19	5246.41	719.62	B
506	8657.89	5468.01	716.07	
507	8684.58	5752.00	724.00	
508	8649.05	5748.66	712.17	A B
509	8650.52	5956.38	726.00	
510	8599.09	5958.86	709.36	
511	8704.86	6221.78	718.00	
512	8666.18	6226.32	705.21	
513	8704.86	6527.36	723.50	
514	8641.95	6454.04	701.00	
515	8437.99	6489.67	718.29	
516	8257.01	6507.34	729.00	
517	8264.46	6494.44	724.51	
518	8146.02	6355.69	731.45	
519	8115.19	6342.71	737.66	

DRAFT

NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services

Northville, MI	248.553.6300
Detroit, MI	313.237.3900
Lansing, MI	517.484.6900
Grand Rapids, MI	616.957.3690
Exton, PA	610.524.2300
Lehigh Valley, PA	484.893.1440
Cleveland, OH	216.334.4040
Indianapolis, IN	317.735.7649

SUBMITTAL

REV	DESCRIPTION	DATE	BY
A	PER MDEQ COMMENTS	1/23/09	JHL
B	MODIFY FLOOR/TIE IN	8/1/11	DRL

PROJECT NAME:
MASTER CELL VI-E DESIGN MODIFICATION

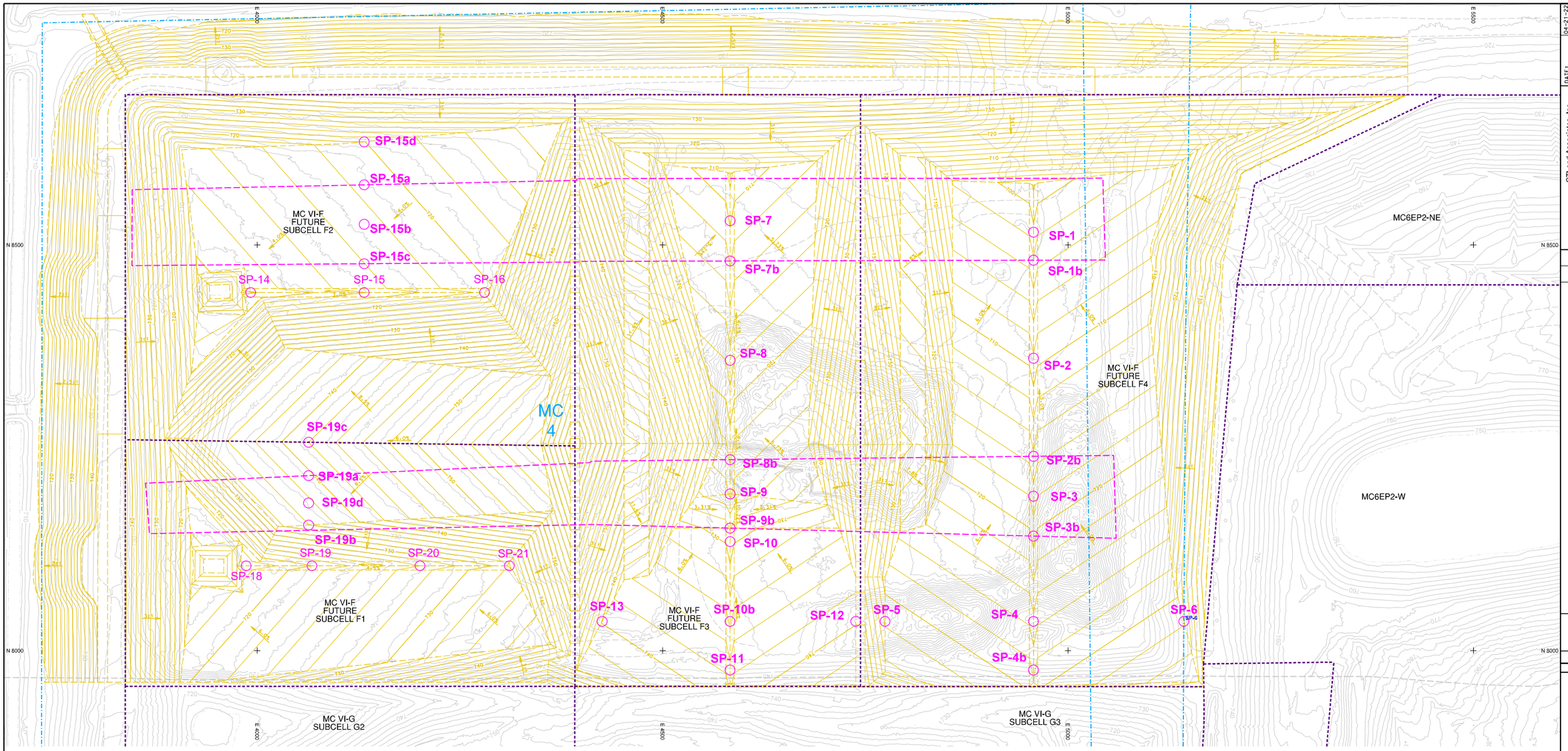
PROJECT LOCATION:
WDI SITE NO. 2
VAN BUREN TWP., WAYNE COUNTY, MICHGAN

NTH PROJECT NO.: 13-070804-05	CAD FILE NAME: SHEET 5
DESIGNED BY: JHL	INCEP DATE: 1/21/08
DRAWN BY: DRL	DRAWING SCALE: AS SHOWN
CHECKED BY: ISS	SUBMITTED DATE: 8/1/2011

SHEET TITLE:
TOP OF PRIMARY LINER ELEVATION PLAN

SHEET REFERENCE NUMBER:
5

J:\GEM\2010145\production sets\civil\permit modifications\5 top of primary liner elevation plan.dwg Plotted: 8/1/2011 10:54 AM by kostrowski



LEGEND

- PHASE BOUNDARY
- OLD CELL BOUNDARY
- N 6500 + GRID COORDINATES
- 710 EXISTING TOPO CONTOURS (2 FT INTERVAL)
- 710 EXISTING TOP OF WASTE CONTOURS (2 FT INTERVAL)
- 710 PROPOSED TOP OF PRIMARY LINER CONTOUR (2 FT INTERVAL)
- 710 PROPOSED EXPANSION FINAL GRADE CONTOURS (2 FT INTERVAL)
- SETTLEMENT PLATE
- APPROXIMATE INTERCELL DIKES IN MC4

N

0 25' 50' 100'
SCALE

REV. 09

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.ctiandassociates.com

DATE: 04-21-22
DESIGNED BY: RR
DRAWN BY: PAA
CHECKED BY:
APPROVED BY:

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REV	DATE	REVISION DESCRIPTION	DN	APP
0	04-21-22	ISSUED FOR REVIEW	PAA	RR

WAYNE DISPOSAL, INC. SITE NO. 2
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

F1-F4 SETTLEMENT POINT PLAN

PROJECT NUMBER
1198070047
SCALE
1" = 50'
DRAWING NO

DATE PLOTTED: FRIDAY
DATE PLOTTED: 04/29/22
PLOTTED BY: RR

DRAWING SIZE: 30" x 42"

EXISTING MC VI-G SUBCELL G1-EAST PHASE 2

EXISTING MC VI-G SUBCELL G1-EAST PHASE 1

EXISTING MC VI-G SUBCELL G3

EXISTING MC VI-G SUBCELL G1

EXISTING MC VI-G SUBCELL G2

SP-04
700.700

SP-18
684.000

SP-03
710.000

SP-21
689.690

SP-17
682.000

SP-19
686.000

SP-05
723.200

SP-02
718.570

SP-06
724.000

SP-16
679.000

SP-01
726.990

SP-07
726.820

SP-15
675.000

SP-20
678.000

SP-08
722.000

SP-09
718.000

SP-14
670.000

SP-13
668.000

SP-10
712.000

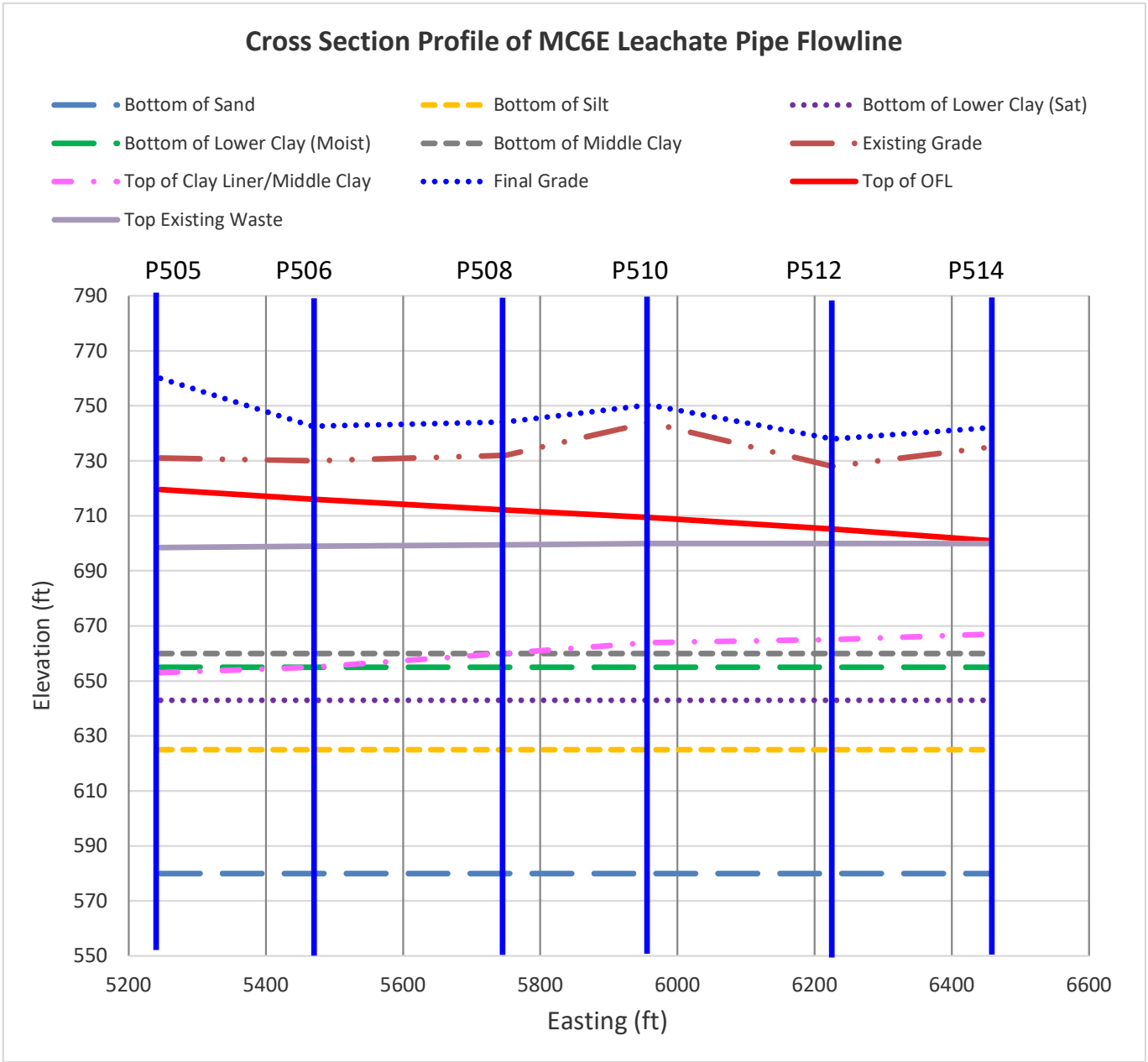
SP-12
717.800

SP-11
709.220

Attachment A-2.2.2

Cross-section Profiles and Settlement Calculation Spreadsheets

Final Cover Grading Modification


Cross Section Profile of MC6E Leachate Pipe Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
P505
P506
P508
P510
P512
P514
790
770
750
730
710
690
670
650
630
610
590
570
550
Elevation (ft)
5200
5400
5600
5800
6000
6200
6400
6600
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
P505	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8565.19	5246.41	719.62	760.00	731.00	660.00	655.00	643.00	625.00	580.00	653.00	698.50

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	36.38	103.0	0	3747.1									
	3	OFL	18.38	135.0	1	-2481.3									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	7.06	135.0	0	953.1	0.102	0.017	0.005	2957.9	2957.9	5708.7	NC	0.206	0.009
	3	OFL	7.06	135.0	0	953.1	0.102	0.017	0.005	3911.0	3911.0	6661.8	NC	0.167	0.009
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	4646.3	4646.3	7397.1	NC	0.092	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	5163.8	5163.8	7914.7	NC	0.084	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	5681.4	5681.4	8432.2	NC	0.078	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	6199.0	6199.0	8949.8	NC	0.073	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	6716.5	6716.5	9467.4	NC	0.068	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	7234.1	7234.1	9984.9	NC	0.064	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	7751.7	7751.7	10502.5	NC	0.060	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	8269.2	8269.2	11020.1	NC	0.057	0.035
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	8528.0	4610.0	11278.8	NC	-	-
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	8528.0	4610.0	11278.8	NC	-	-
	7	Lower Clay (Moist)	0.00	128.0	0	-	0.171	0.029	0.009	8528.0	4610.0	11278.8	NC	-	-
	8	Lower Clay (Sat)	5.00	65.6	0	328.0	0.171	0.029	0.009	8692.0	4774.0	11442.8	NC	0.102	0.011
	8	Lower Clay (Sat)	5.00	65.6	0	328.0	0.171	0.029	0.009	9020.0	5102.0	11770.8	NC	0.099	0.011
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9465.7	5547.7	12216.5	NC	0.150	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10029.1	6111.1	12779.9	NC	0.142	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10547.5	6629.5	13298.3	NC	0.091	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11020.9	7102.9	13771.7	NC	0.087	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11494.3	7576.3	14245.1	NC	0.084	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11967.7	8049.7	14718.5	NC	0.081	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12441.1	8523.1	15191.9	NC	0.078	-
														1.860	0.320
													Total Settlement [ft]	**2.18**	

Variables & Constants	
Point Name	P505
Settlement Layer [ft]	132.6
ERROR	0.0
# of Layers	19
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
P506	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8657.89	5468.01	716.07	742.65	730.00	660.00	655.00	643.00	625.00	580.00	655.00	699.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	22.58	103.0	0	2325.7									
	3	OFL	20.93	135.0	1	-2825.5									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	5.04	135.0	0	679.7	0.102	0.017	0.005	3165.4	3165.4	4150.6	NC	0.060	0.006
	3	OFL	5.04	135.0	0	679.7	0.102	0.017	0.005	3845.1	3845.1	4830.3	NC	0.051	0.006
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	4435.3	4435.3	5420.4	NC	0.038	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	4935.8	4935.8	5920.9	NC	0.035	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	5436.3	5436.3	6421.4	NC	0.032	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	5936.8	5936.8	6921.9	NC	0.029	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	6437.3	6437.3	7422.4	NC	0.027	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	6937.8	6937.8	7922.9	NC	0.025	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	7438.3	7438.3	8423.4	NC	0.024	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	7938.8	7938.8	8923.9	NC	0.022	0.034
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	8189.0	4610.0	9174.2	NC	-	-
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	8189.0	4610.0	9174.2	NC	-	-
	7	Lower Clay (Moist)	0.00	128.0	0	-	0.171	0.029	0.009	8189.0	4610.0	9174.2	NC	-	-
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8385.8	4806.8	9371.0	NC	0.049	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8779.4	5200.4	9764.6	NC	0.047	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9257.9	5678.9	10243.1	NC	0.059	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9821.3	6242.3	10806.5	NC	0.056	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10339.7	6760.7	11324.9	NC	0.036	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10813.1	7234.1	11798.3	NC	0.034	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11286.5	7707.5	12271.7	NC	0.033	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11759.9	8180.9	12745.1	NC	0.031	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12233.3	8654.3	13218.5	NC	0.030	-
														0.721	0.310
												Total Settlement [ft]		1.03	

Variables & Constants	
Point Name	P506
Settlement Layer [ft]	129.1
ERROR	0.0
# of Layers	19
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
P508	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8649.05	5748.66	712.17	744.14	732.00	660.00	655.00	643.00	625.00	580.00	660.00	699.50

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	27.97	103.0	0	2880.9									
	3	OFL	26.83	135.0	1	-3622.1									
	4	Existing Waste	0.00	91.0	0	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	2.83	135.0	0	382.7	0.102	0.017	0.005	3813.4	3813.4	4557.3	NC	0.022	0.004
	3	OFL	2.83	135.0	0	382.7	0.102	0.017	0.005	4196.1	4196.1	4940.0	NC	0.020	0.004
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	4612.2	4612.2	5356.0	NC	0.026	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	5061.5	5061.5	5805.3	NC	0.024	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	5510.8	5510.8	6254.6	NC	0.022	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	5960.1	5960.1	6704.0	NC	0.020	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	6409.4	6409.4	7153.3	NC	0.019	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	6858.7	6858.7	7602.6	NC	0.018	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	7308.0	7308.0	8051.9	NC	0.017	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	7757.3	7757.3	8501.2	NC	0.016	0.030
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	7982.0	4610.0	8725.9	NC	-	-
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	7982.0	4610.0	8725.9	NC	-	-
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	8302.0	4930.0	9045.9	NC	0.032	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8818.8	5446.8	9562.7	NC	0.036	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9212.4	5840.4	9956.3	NC	0.035	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9690.9	6318.9	10434.8	NC	0.043	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10254.3	6882.3	10998.2	NC	0.041	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10772.7	7400.7	11516.6	NC	0.026	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11246.1	7874.1	11990.0	NC	0.025	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11719.5	8347.5	12463.4	NC	0.024	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12192.9	8820.9	12936.8	NC	0.023	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12666.3	9294.3	13410.2	NC	0.022	-
														0.510	0.288
													Total Settlement [ft]	**0.80**	

Variables & Constants	
Point Name	P508
Settlement Layer [ft]	125.2
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
P510	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8599.09	5958.86	709.36	750.38	744.00	660.00	655.00	643.00	625.00	580.00	664.00	700.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	37.02	103.0	0	3813.1									
	3	OFL	41.64	135.0	1	-5621.4									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	1.18	135.0	0	159.3	0.102	0.017	0.005	5701.1	5701.1	5377.7	OC-1	-0.001	0.002
	3	OFL	1.18	135.0	0	159.3	0.102	0.017	0.005	5860.4	5860.4	5537.0	OC-1	-0.000	0.002
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	6144.8	6144.8	5821.4	OC-1	-0.001	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	6554.3	6554.3	6230.9	OC-1	-0.001	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	6963.8	6963.8	6640.4	OC-1	-0.001	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	7373.3	7373.3	7049.9	OC-1	-0.001	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	7782.8	7782.8	7459.4	OC-1	-0.001	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	8192.3	8192.3	7868.9	OC-1	-0.001	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	8601.8	8601.8	8278.4	OC-1	-0.001	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	9011.3	9011.3	8687.9	OC-1	-0.001	0.028
	6	Middle Clay	2.00	136.0	0	272.0	0.102	0.017	0.005	9352.0	9352.0	9028.7	OC-1	-0.001	0.003
	6	Middle Clay	2.00	136.0	0	272.0	0.102	0.017	0.005	9624.0	9624.0	9300.7	OC-1	-0.001	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	10080.0	10080.0	9756.7	OC-1	-0.002	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	10596.8	10596.8	10273.5	OC-1	-0.002	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	10990.4	10990.4	10667.1	OC-1	-0.002	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	11468.9	11468.9	11145.6	OC-1	-	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	12032.3	12032.3	11709.0	OC-1	-	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12550.7	12550.7	12227.4	OC-1	-	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13024.1	13024.1	12700.8	OC-1	-	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13497.5	13497.5	13174.2	OC-1	-	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13970.9	13970.9	13647.6	OC-1	-	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	14444.3	14444.3	14121.0	OC-1	-	-
														-0.018	0.268
												Total Settlement [ft]		0.25	

Variables & Constants	
Point Name	P510
Settlement Layer [ft]	122.4
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
P512	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8666.18	6226.32	705.21	737.98	728.00	660.00	655.00	643.00	625.00	580.00	665.00	700.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	28.77	103.0	0	2963.3									
	3	OFL	28.00	135.0	1	-3780.0									
	4	Existing Waste	1.79	91.0	1	-162.9									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3942.9	3942.9	4448.3	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3942.9	3942.9	4448.3	NC	-	-
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	4131.8	4131.8	4637.2	NC	0.017	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	4509.5	4509.5	5015.0	NC	0.015	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	4887.3	4887.3	5392.7	NC	0.014	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	5265.1	5265.1	5770.5	NC	0.013	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	5642.8	5642.8	6148.2	NC	0.012	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	6020.6	6020.6	6526.0	NC	0.012	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	6398.4	6398.4	6903.8	NC	0.011	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	6776.1	6776.1	7281.5	NC	0.010	0.025
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	7135.0	4780.0	7640.4	NC	0.008	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	7475.0	5120.0	7980.4	NC	0.007	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7965.0	5610.0	8470.4	NC	0.023	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8481.8	6126.8	8987.2	NC	0.026	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8875.4	6520.4	9380.8	NC	0.025	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9353.9	6998.9	9859.3	NC	0.031	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9917.3	7562.3	10422.7	NC	0.029	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10435.7	8080.7	10941.1	NC	0.018	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10909.1	8554.1	11414.5	NC	0.018	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11382.5	9027.5	11887.9	NC	0.017	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11855.9	9500.9	12361.3	NC	0.016	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12329.3	9974.3	12834.7	NC	0.016	-
														0.338	0.249
												Total Settlement [ft]		0.59	

Variables & Constants	
Point Name	P512
Settlement Layer [ft]	118.2
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

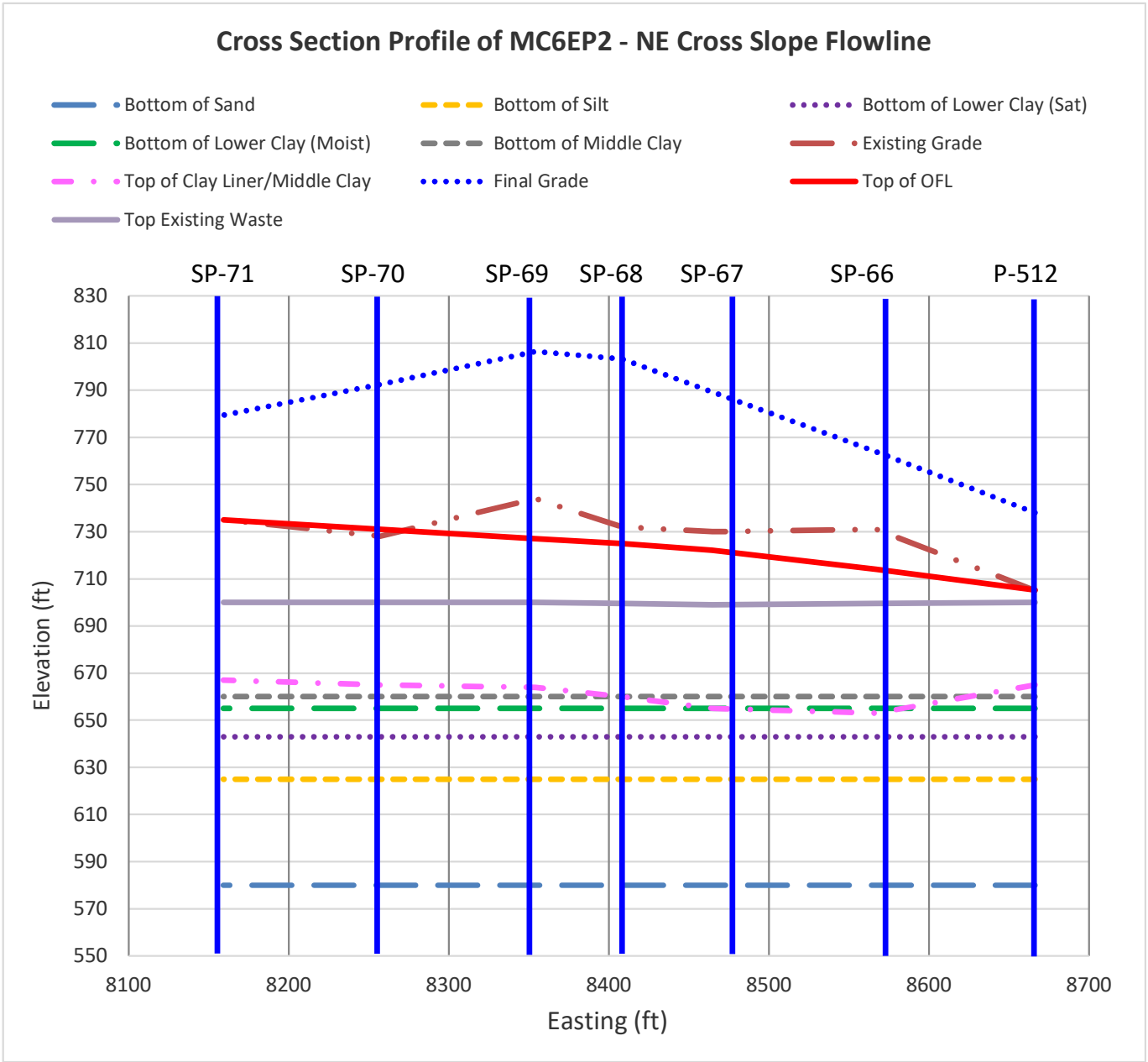
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
P514	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8641.95	6454.04	701.00	742.00	735.00	660.00	655.00	643.00	625.00	580.00	667.00	700.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	37.00	103.0	0	3811.0									
	3	OFL	35.00	135.0	1	-4725.0									
	4	Existing Waste	6.00	91.0	1	-546.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	5271.0	5271.0	5296.0	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	5271.0	5271.0	5296.0	NC	-	-
	4	Existing Waste	3.38	91.0	0	307.1	0.080	0.013	0.024	5424.6	5424.6	5449.6	NC	0.001	0.021
	4	Existing Waste	3.38	91.0	0	307.1	0.080	0.013	0.024	5731.7	5731.7	5756.7	NC	0.001	0.021
	4	Existing Waste	3.38	91.0	0	307.1	0.080	0.013	0.024	6038.8	6038.8	6063.8	NC	0.000	0.021
	4	Existing Waste	3.38	91.0	0	307.1	0.080	0.013	0.024	6345.9	6345.9	6370.9	NC	0.000	0.021
	4	Existing Waste	3.38	91.0	0	307.1	0.080	0.013	0.024	6653.1	6653.1	6678.1	NC	0.000	0.021
	4	Existing Waste	3.38	91.0	0	307.1	0.080	0.013	0.024	6960.2	6960.2	6985.2	NC	0.000	0.021
	4	Existing Waste	3.38	91.0	0	307.1	0.080	0.013	0.024	7267.3	7267.3	7292.3	NC	0.000	0.021
	4	Existing Waste	3.38	91.0	0	307.1	0.080	0.013	0.024	7574.4	7574.4	7599.4	NC	0.000	0.021
	6	Middle Clay	3.50	136.0	0	476.0	0.102	0.017	0.005	7966.0	7966.0	7991.0	NC	0.000	0.004
	6	Middle Clay	3.50	136.0	0	476.0	0.102	0.017	0.005	8442.0	8442.0	8467.0	NC	0.000	0.004
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	9000.0	9000.0	9025.0	NC	0.001	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9516.8	9516.8	9541.8	NC	0.001	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9910.4	9910.4	9935.4	NC	0.001	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10388.9	10388.9	10413.9	NC	0.001	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10952.3	10952.3	10977.3	NC	0.001	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11470.7	11470.7	11495.7	NC	0.001	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11944.1	11944.1	11969.1	NC	0.001	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12417.5	12417.5	12442.5	NC	0.001	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12890.9	12890.9	12915.9	NC	0.001	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13364.3	13364.3	13389.3	NC	0.001	-
														0.015	0.213
											Total Settlement [ft]			0.23	

Variables & Constants	
Point Name	P514
Settlement Layer [ft]	114.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6EP2 - NE Cross Slope Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-71
SP-70
SP-69
SP-68
SP-67
SP-66
P-512
830
810
790
770
750
730
710
690
670
650
630
610
590
570
550
Elevation (ft)
8100
8200
8300
8400
8500
8600
8700
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
P-512	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8666.18	6226.32	705.21	737.98	705.00	660.00	655.00	643.00	625.00	580.00	665.00	700.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	28.77	103.0	0	2963.3									
	3	OFL	5.00	135.0	1	-675.0									
	4	Existing Waste	1.79	91.0	1	-162.9									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	837.9	837.9	4448.3	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	837.9	837.9	4448.3	NC	-	-
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	1026.8	1026.8	4637.2	NC	0.217	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	1404.5	1404.5	5015.0	NC	0.184	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	1782.3	1782.3	5392.7	NC	0.160	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	2160.1	2160.1	5770.5	NC	0.142	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	2537.8	2537.8	6148.2	NC	0.128	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	2915.6	2915.6	6526.0	NC	0.116	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	3293.4	3293.4	6903.8	NC	0.107	0.025
	4	Existing Waste	4.15	91.0	0	377.8	0.080	0.013	0.024	3671.1	3671.1	7281.5	NC	0.099	0.025
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	3860.0	4610.0	7470.4	OC-2	-	-
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	3860.0	4610.0	7470.4	OC-2	-	-
	7	Lower Clay (Moist)	0.00	128.0	0	-	0.171	0.029	0.009	3860.0	4610.0	7470.4	OC-2	-	-
	8	Lower Clay (Sat)	11.00	65.6	0	721.6	0.171	0.029	0.009	4220.8	4970.8	7831.2	OC-2	0.394	0.025
	8	Lower Clay (Sat)	11.00	65.6	0	721.6	0.171	0.029	0.009	4942.4	5692.4	8552.8	OC-2	0.352	0.025
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	5584.9	6334.9	9195.3	OC-2	0.218	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6148.3	6898.3	9758.7	OC-2	0.203	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	6666.7	7416.7	10277.1	OC-2	0.127	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7140.1	7890.1	10750.5	OC-2	0.121	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7613.5	8363.5	11223.9	OC-2	0.115	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8086.9	8836.9	11697.3	OC-2	0.110	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8560.3	9310.3	12170.7	OC-2	0.105	-
														2.897	0.254
													Total Settlement [ft]	**3.15**	

Variables & Constants	
Point Name	P-512
Settlement Layer [ft]	118.2
ERROR	0.0
# of Layers	17
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-66	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8566.99	6221.70	714.00	763.83	731.00	660.00	655.00	643.00	625.00	580.00	653.00	699.50

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	45.83	103.0	0	4720.5									
	3	OFL	24.00	135.0	1	-3240.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	3.75	135.0	0	506.3	0.102	0.017	0.005	3493.1	3493.1	6458.6	NC	0.102	0.005
	3	OFL	3.75	135.0	0	506.3	0.102	0.017	0.005	3999.4	3999.4	6964.9	NC	0.092	0.005
	4	Existing Waste	5.81	91.0	0	528.9	0.080	0.013	0.024	4517.0	4517.0	7482.5	NC	0.102	0.036
	4	Existing Waste	5.81	91.0	0	528.9	0.080	0.013	0.024	5045.9	5045.9	8011.4	NC	0.093	0.036
	4	Existing Waste	5.81	91.0	0	528.9	0.080	0.013	0.024	5574.8	5574.8	8540.3	NC	0.086	0.036
	4	Existing Waste	5.81	91.0	0	528.9	0.080	0.013	0.024	6103.8	6103.8	9069.3	NC	0.080	0.036
	4	Existing Waste	5.81	91.0	0	528.9	0.080	0.013	0.024	6632.7	6632.7	9598.2	NC	0.075	0.036
	4	Existing Waste	5.81	91.0	0	528.9	0.080	0.013	0.024	7161.7	7161.7	10127.1	NC	0.070	0.036
	4	Existing Waste	5.81	91.0	0	528.9	0.080	0.013	0.024	7690.6	7690.6	10656.1	NC	0.066	0.036
	4	Existing Waste	5.81	91.0	0	528.9	0.080	0.013	0.024	8219.5	8219.5	11185.0	NC	0.062	0.036
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	8484.0	4610.0	11449.5	NC	-	-
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	8484.0	4610.0	11449.5	NC	-	-
	7	Lower Clay (Moist)	0.00	128.0	0	-	0.171	0.029	0.009	8484.0	4610.0	11449.5	NC	-	-
	8	Lower Clay (Sat)	5.00	65.6	0	328.0	0.171	0.029	0.009	8648.0	4774.0	11613.5	NC	0.109	0.011
	8	Lower Clay (Sat)	5.00	65.6	0	328.0	0.171	0.029	0.009	8976.0	5102.0	11941.5	NC	0.106	0.011
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9421.7	5547.7	12387.2	NC	0.160	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9985.1	6111.1	12950.6	NC	0.152	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10503.5	6629.5	13469.0	NC	0.097	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10976.9	7102.9	13942.4	NC	0.093	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11450.3	7576.3	14415.8	NC	0.090	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11923.7	8049.7	14889.2	NC	0.087	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12397.1	8523.1	15362.6	NC	0.084	-
														1.808	0.317
													Total Settlement [ft]	2.13	

Variables & Constants	
Point Name	SP-66
Settlement Layer [ft]	127.0
ERROR	0.0
# of Layers	19
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-67	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8464.52	6211.68	722.00	789.22	730.00	660.00	655.00	643.00	625.00	580.00	655.00	699.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	63.22	103.0	0	6511.7									
	3	OFL	15.00	135.0	1	-2025.0									
	4	Existing Waste	0.00	91.0	0	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	8.00	135.0	0	1080.0	0.102	0.017	0.005	2565.0	2565.0	8536.7	NC	0.426	0.010
	3	OFL	8.00	135.0	0	1080.0	0.102	0.017	0.005	3645.0	3645.0	9616.7	NC	0.344	0.010
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	4435.3	4435.3	10406.9	NC	0.163	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	4935.8	4935.8	10907.4	NC	0.152	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	5436.3	5436.3	11407.9	NC	0.142	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	5936.8	5936.8	11908.4	NC	0.133	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	6437.3	6437.3	12408.9	NC	0.125	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	6937.8	6937.8	12909.4	NC	0.119	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	7438.3	7438.3	13409.9	NC	0.113	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	7938.8	7938.8	13910.4	NC	0.107	0.034
	6	Middle Clay	-2.50	136.0	0	-340.0	0.102	0.017	0.005	8019.0	4440.0	13990.7	NC	-0.062	-0.003
	6	Middle Clay	-2.50	136.0	0	-340.0	0.102	0.017	0.005	7679.0	4100.0	13650.7	NC	-0.064	-0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7829.0	4250.0	13800.7	NC	0.210	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8345.8	4766.8	14317.5	NC	0.240	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8739.4	5160.4	14711.1	NC	0.232	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9217.9	5638.9	15189.6	NC	0.293	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9781.3	6202.3	15753.0	NC	0.279	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10299.7	6720.7	16271.4	NC	0.179	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10773.1	7194.1	16744.8	NC	0.172	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11246.5	7667.5	17218.2	NC	0.166	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11719.9	8140.9	17691.6	NC	0.161	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12193.3	8614.3	18165.0	NC	0.156	-
														3.787	0.323
													Total Settlement [ft]	**4.11**	

Variables & Constants	
Point Name	SP-67
Settlement Layer [ft]	135.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-68	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8408.01	6206.15	725.00	803.24	732.00	660.00	655.00	643.00	625.00	580.00	660.00	699.50

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	74.24	103.0	0	7646.7									
	3	OFL	14.00	135.0	1	-1890.0									
	4	Existing Waste	0.00	91.0	0	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	9.25	135.0	0	1248.8	0.102	0.017	0.005	2514.4	2514.4	9756.1	NC	0.556	0.012
	3	OFL	9.25	135.0	0	1248.8	0.102	0.017	0.005	3763.1	3763.1	11004.8	NC	0.440	0.012
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	4612.2	4612.2	11853.9	NC	0.162	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	5061.5	5061.5	12303.2	NC	0.152	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	5510.8	5510.8	12752.5	NC	0.144	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	5960.1	5960.1	13201.8	NC	0.136	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	6409.4	6409.4	13651.1	NC	0.130	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	6858.7	6858.7	14100.4	NC	0.124	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	7308.0	7308.0	14549.8	NC	0.118	0.030
	4	Existing Waste	4.94	91.0	0	449.3	0.080	0.013	0.024	7757.3	7757.3	14999.1	NC	0.113	0.030
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	7982.0	4610.0	15223.7	NC	-	-
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	7982.0	4610.0	15223.7	NC	-	-
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	8302.0	4930.0	15543.7	NC	0.233	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8818.8	5446.8	16060.5	NC	0.267	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9212.4	5840.4	16454.1	NC	0.258	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9690.9	6318.9	16932.6	NC	0.327	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10254.3	6882.3	17496.0	NC	0.313	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10772.7	7400.7	18014.4	NC	0.201	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11246.1	7874.1	18487.8	NC	0.194	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11719.5	8347.5	18961.2	NC	0.188	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12192.9	8820.9	19434.6	NC	0.182	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12666.3	9294.3	19908.0	NC	0.177	-
														4.416	0.305
											Total Settlement [ft]			**4.72**	

Variables & Constants	
Point Name	SP-68
Settlement Layer [ft]	138.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-69	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8354.03	6200.87	727.00	806.37	744.00	660.00	655.00	643.00	625.00	580.00	664.00	700.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	75.37	103.0	0	7763.1									
	3	OFL	24.00	135.0	1	-3240.0									
	4	Existing Waste	0.00	91.0	0	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	10.00	135.0	0	1350.0	0.102	0.017	0.005	3915.0	3915.0	9923.1	NC	0.412	0.013
	3	OFL	10.00	135.0	0	1350.0	0.102	0.017	0.005	5265.0	5265.0	11273.1	NC	0.337	0.013
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	6144.8	6144.8	12152.9	NC	0.107	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	6554.3	6554.3	12562.4	NC	0.102	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	6963.8	6963.8	12971.9	NC	0.097	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	7373.3	7373.3	13381.4	NC	0.093	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	7782.8	7782.8	13790.9	NC	0.089	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	8192.3	8192.3	14200.4	NC	0.086	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	8601.8	8601.8	14609.9	NC	0.083	0.028
	4	Existing Waste	4.50	91.0	0	409.5	0.080	0.013	0.024	9011.3	9011.3	15019.4	NC	0.080	0.028
	6	Middle Clay	2.00	136.0	0	272.0	0.102	0.017	0.005	9352.0	4746.0	15360.1	NC	0.044	0.003
	6	Middle Clay	2.00	136.0	0	272.0	0.102	0.017	0.005	9624.0	5018.0	15632.1	NC	0.043	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	10080.0	5474.0	16088.1	NC	0.174	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	10596.8	5990.8	16604.9	NC	0.200	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	10990.4	6384.4	16998.5	NC	0.194	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	11468.9	6862.9	17477.0	NC	0.247	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	12032.3	7426.3	18040.4	NC	0.237	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12550.7	7944.7	18558.8	NC	0.153	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13024.1	8418.1	19032.2	NC	0.148	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13497.5	8891.5	19505.6	NC	0.144	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13970.9	9364.9	19979.0	NC	0.140	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	14444.3	9838.3	20452.4	NC	0.136	-
														3.346	0.290
													Total Settlement [ft]	**3.64**	

Variables & Constants	
Point Name	SP-69
Settlement Layer [ft]	140.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-70	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8257.04	6191.39	731.00	792.47	728.00	660.00	655.00	643.00	625.00	580.00	665.00	700.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	57.47	103.0	0	5919.4									
	3	OFL	4.00	135.0	1	-540.0									
	4	Existing Waste	0.00	91.0	0	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	12.00	135.0	0	1620.0	0.102	0.017	0.005	1350.0	1350.0	8214.4	NC	0.960	0.015
	3	OFL	12.00	135.0	0	1620.0	0.102	0.017	0.005	2970.0	2970.0	9834.4	NC	0.636	0.015
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	3979.1	3979.1	10843.5	NC	0.152	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	4377.2	4377.2	11241.6	NC	0.143	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	4775.3	4775.3	11639.7	NC	0.135	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	5173.4	5173.4	12037.8	NC	0.128	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	5571.6	5571.6	12436.0	NC	0.122	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	5969.7	5969.7	12834.1	NC	0.116	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	6367.8	6367.8	13232.2	NC	0.111	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	6765.9	6765.9	13630.3	NC	0.106	0.027
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	7135.0	4780.0	13999.4	NC	0.075	0.003
	6	Middle Clay	2.50	136.0	0	340.0	0.102	0.017	0.005	7475.0	5120.0	14339.4	NC	0.072	0.003
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7965.0	5610.0	14829.4	NC	0.231	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8481.8	6126.8	15346.2	NC	0.264	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8875.4	6520.4	15739.8	NC	0.255	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9353.9	6998.9	16218.3	NC	0.323	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9917.3	7562.3	16781.7	NC	0.308	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10435.7	8080.7	17300.1	NC	0.198	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10909.1	8554.1	17773.5	NC	0.191	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11382.5	9027.5	18246.9	NC	0.184	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11855.9	9500.9	18720.3	NC	0.179	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12329.3	9974.3	19193.7	NC	0.173	-
														5.064	0.291
													Total Settlement [ft]	**5.35**	

Variables & Constants	
Point Name	SP-70
Settlement Layer [ft]	144.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

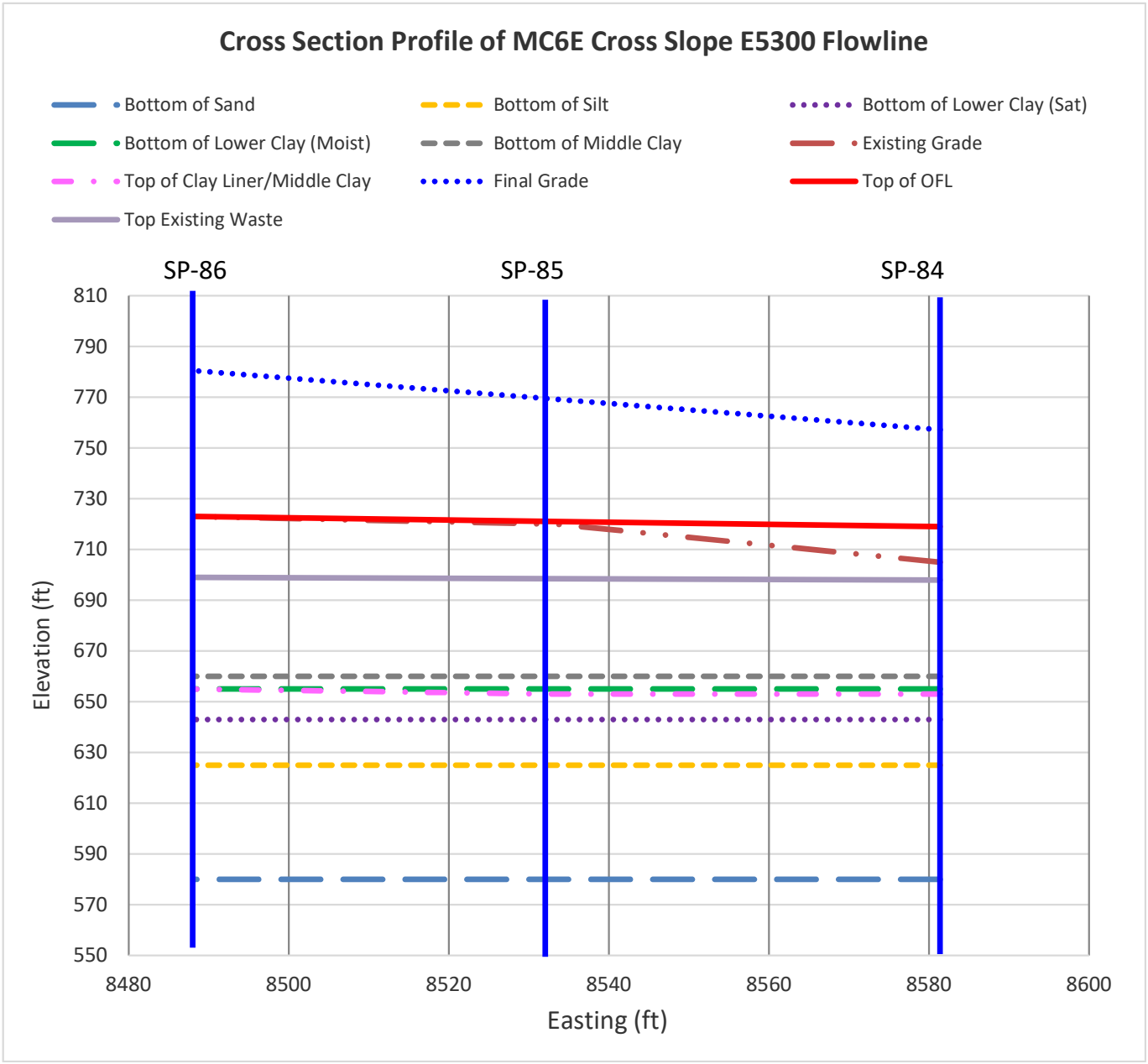
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-71	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8159.20	6181.82	735.00	779.45	735.00	660.00	655.00	643.00	625.00	580.00	667.00	700.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	40.45	103.0	0	4166.4									
	3	OFL	7.00	135.0	1	-945.0									
	4	Existing Waste	0.00	91.0	0	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	14.00	135.0	0	1890.0	0.102	0.017	0.005	1890.0	1890.0	6596.4	NC	0.775	0.018
	3	OFL	14.00	135.0	0	1890.0	0.102	0.017	0.005	3780.0	3780.0	8486.4	NC	0.502	0.018
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	4912.7	4912.7	9619.0	NC	0.096	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	5288.1	5288.1	9994.4	NC	0.091	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	5663.4	5663.4	10369.8	NC	0.087	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	6038.8	6038.8	10745.2	NC	0.083	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	6414.2	6414.2	11120.5	NC	0.079	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	6789.6	6789.6	11495.9	NC	0.075	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	7164.9	7164.9	11871.3	NC	0.072	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	7540.3	7540.3	12246.7	NC	0.070	0.025
	6	Middle Clay	3.50	136.0	0	476.0	0.102	0.017	0.005	7966.0	4848.0	12672.4	NC	0.072	0.004
	6	Middle Clay	3.50	136.0	0	476.0	0.102	0.017	0.005	8442.0	5324.0	13148.4	NC	0.069	0.004
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	9000.0	5882.0	13706.4	NC	0.156	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9516.8	6398.8	14223.2	NC	0.179	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9910.4	6792.4	14616.8	NC	0.173	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10388.9	7270.9	15095.3	NC	0.219	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10952.3	7834.3	15658.7	NC	0.210	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11470.7	8352.7	16177.1	NC	0.134	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11944.1	8826.1	16650.5	NC	0.130	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12417.5	9299.5	17123.9	NC	0.126	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12890.9	9772.9	17597.3	NC	0.122	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13364.3	10246.3	18070.7	NC	0.118	-
														3.637	0.286
													Total Settlement [ft]	**3.92**	

Variables & Constants	
Point Name	SP-71
Settlement Layer [ft]	148.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6E Cross Slope E5300 Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-86
SP-85
SP-84
810
790
770
750
730
710
690
670
650
630
610
590
570
550
Elevation (ft)
8480
8500
8520
8540
8560
8580
8600
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-84	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8581.38	5296.64	719.00	757.19	705.00	660.00	655.00	643.00	625.00	580.00	653.00	698.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	34.19	103.0	0	3521.6									
	3	OFL	14.00	135.0	0	1890.0									
	4	Existing Waste	0.00	91.0	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	3.50	135.0	0	472.5	0.102	0.017	0.005	236.3	236.3	6187.8	NC	0.506	0.004
	3	OFL	3.50	135.0	0	472.5	0.102	0.017	0.005	708.8	708.8	6660.3	NC	0.347	0.004
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	1200.9	1200.9	7152.5	NC	0.349	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	1712.8	1712.8	7664.4	NC	0.293	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	2224.7	2224.7	8176.3	NC	0.254	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	2736.6	2736.6	8688.1	NC	0.226	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	3248.4	3248.4	9200.0	NC	0.203	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	3760.3	3760.3	9711.9	NC	0.185	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	4272.2	4272.2	10223.8	NC	0.171	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	4784.1	4784.1	10735.6	NC	0.158	0.034
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	5040.0	4610.0	10991.6	NC	-	-
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	5040.0	4610.0	10991.6	NC	-	-
	7	Lower Clay (Moist)	0.00	128.0	0	-	0.171	0.029	0.009	5040.0	4610.0	10991.6	NC	-	-
	8	Lower Clay (Sat)	5.00	65.6	0	328.0	0.171	0.029	0.009	5204.0	4774.0	11155.6	NC	0.283	0.011
	8	Lower Clay (Sat)	5.00	65.6	0	328.0	0.171	0.029	0.009	5532.0	5102.0	11483.6	NC	0.271	0.011
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	5977.7	5547.7	11929.3	NC	0.405	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6541.1	6111.1	12492.7	NC	0.379	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7059.5	6629.5	13011.1	NC	0.239	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7532.9	7102.9	13484.5	NC	0.228	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8006.3	7576.3	13957.9	NC	0.217	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8479.7	8049.7	14431.3	NC	0.208	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8953.1	8523.1	14904.7	NC	0.199	-
														5.122	0.308
													Total Settlement [ft]	**5.43**	

Variables & Constants	
Point Name	SP-84
Settlement Layer [ft]	125.0
ERROR	0.0
# of Layers	19
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-85	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8533.44	5296.64	721.00	769.16	720.00	660.00	655.00	643.00	625.00	580.00	653.00	698.50

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	44.16	103.0	0	4548.5									
	3	OFL	6.00	135.0	1	-810.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	7.75	135.0	0	1046.3	0.102	0.017	0.005	1333.1	1333.1	6556.6	NC	0.547	0.010
	3	OFL	7.75	135.0	0	1046.3	0.102	0.017	0.005	2379.4	2379.4	7602.9	NC	0.399	0.010
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	3161.3	3161.3	8384.8	NC	0.193	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	3678.8	3678.8	8902.3	NC	0.175	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	4196.4	4196.4	9419.9	NC	0.160	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	4714.0	4714.0	9937.4	NC	0.147	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	5231.5	5231.5	10455.0	NC	0.137	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	5749.1	5749.1	10972.6	NC	0.128	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	6266.7	6266.7	11490.1	NC	0.120	0.035
	4	Existing Waste	5.69	91.0	0	517.6	0.080	0.013	0.024	6784.2	6784.2	12007.7	NC	0.113	0.035
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	7043.0	4610.0	12266.5	NC	-	-
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	7043.0	4610.0	12266.5	NC	-	-
	7	Lower Clay (Moist)	0.00	128.0	0	-	0.171	0.029	0.009	7043.0	4610.0	12266.5	NC	-	-
	8	Lower Clay (Sat)	5.00	65.6	0	328.0	0.171	0.029	0.009	7207.0	4774.0	12430.5	NC	0.202	0.011
	8	Lower Clay (Sat)	5.00	65.6	0	328.0	0.171	0.029	0.009	7535.0	5102.0	12758.5	NC	0.196	0.011
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7980.7	5547.7	13204.2	NC	0.295	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8544.1	6111.1	13767.6	NC	0.280	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9062.5	6629.5	14286.0	NC	0.178	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9535.9	7102.9	14759.4	NC	0.171	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10009.3	7576.3	15232.8	NC	0.164	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10482.7	8049.7	15706.2	NC	0.158	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10956.1	8523.1	16179.6	NC	0.152	-
														3.913	0.322
													Total Settlement [ft]	**4.23**	

Variables & Constants	
Point Name	SP-85
Settlement Layer [ft]	134.0
ERROR	0.0
# of Layers	19
t / t_p [ratio]	1.8

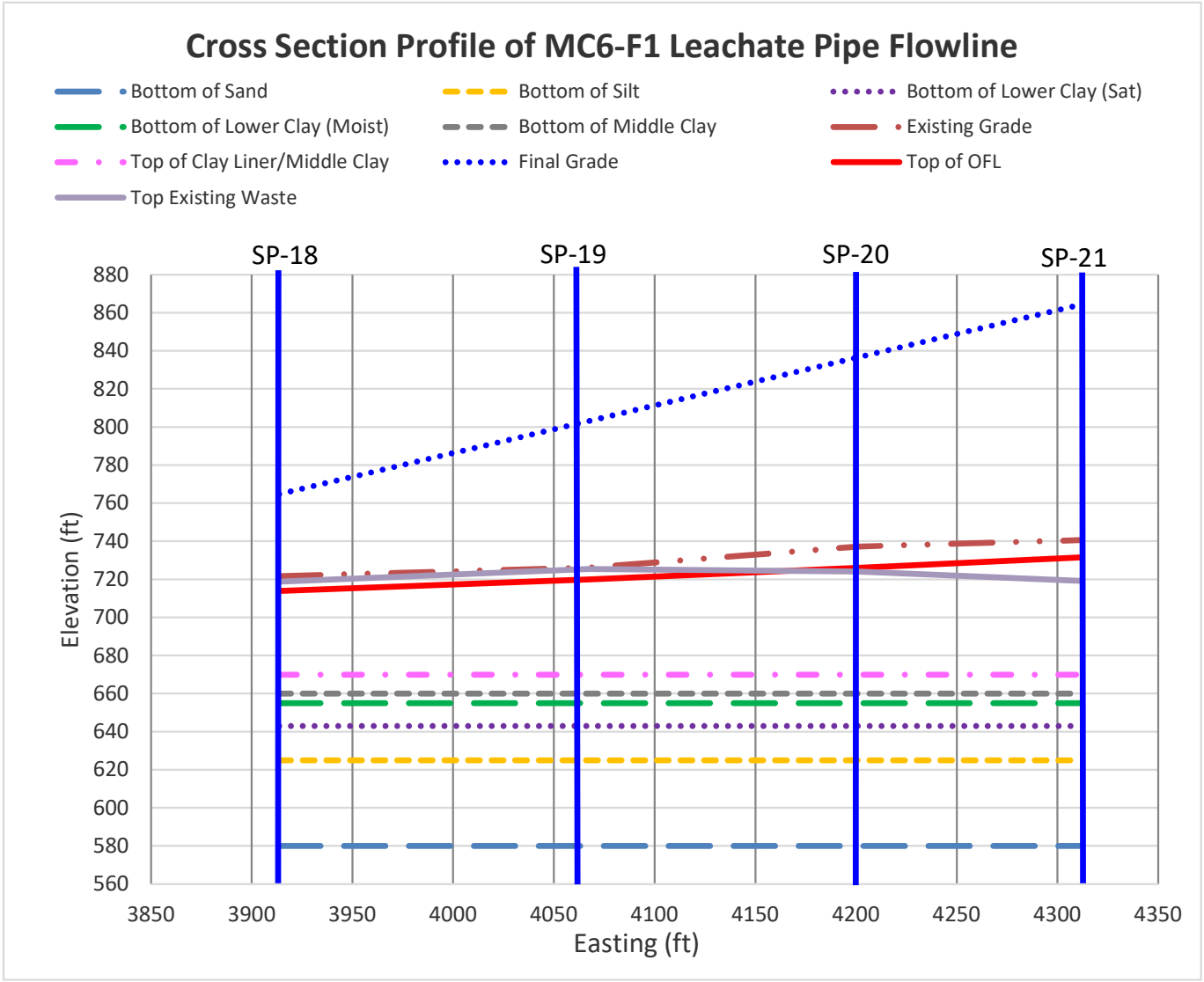
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-86	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8488.08	5296.64	723.00	780.49	723.00	660.00	655.00	643.00	625.00	580.00	655.00	699.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	53.49	103.0	0	5509.5									
	3	OFL	7.00	135.0	1	-945.0									
	4	Existing Waste	0.00	91.0	0	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	8.50	135.0	0	1147.5	0.102	0.017	0.005	1518.8	1518.8	7568.2	NC	0.605	0.011
	3	OFL	8.50	135.0	0	1147.5	0.102	0.017	0.005	2666.3	2666.3	8715.7	NC	0.446	0.011
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	3490.3	3490.3	9539.7	NC	0.192	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	3990.8	3990.8	10040.2	NC	0.176	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	4491.3	4491.3	10540.7	NC	0.163	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	4991.8	4991.8	11041.2	NC	0.152	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	5492.3	5492.3	11541.7	NC	0.142	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	5992.8	5992.8	12042.2	NC	0.133	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	6493.3	6493.3	12542.7	NC	0.126	0.034
	4	Existing Waste	5.50	91.0	0	500.5	0.080	0.013	0.024	6993.8	6993.8	13043.2	NC	0.119	0.034
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	7244.0	4610.0	13293.5	NC	-	-
	6	Middle Clay	0.00	136.0	0	-	0.102	0.017	0.005	7244.0	4610.0	13293.5	NC	-	-
	7	Lower Clay (Moist)	0.00	128.0	0	-	0.171	0.029	0.009	7244.0	4610.0	13293.5	NC	-	-
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7440.8	4806.8	13490.3	NC	0.265	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7834.4	5200.4	13883.9	NC	0.255	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8312.9	5678.9	14362.4	NC	0.321	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8876.3	6242.3	14925.8	NC	0.305	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9394.7	6760.7	15444.2	NC	0.194	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9868.1	7234.1	15917.6	NC	0.187	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10341.5	7707.5	16391.0	NC	0.180	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10814.9	8180.9	16864.4	NC	0.174	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11288.3	8654.3	17337.8	NC	0.168	-
														4.302	0.319
													Total Settlement [ft]	**4.62**	

Variables & Constants	
Point Name	SP-86
Settlement Layer [ft]	136.0
ERROR	0.0
# of Layers	19
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-F1 Leachate Pipe Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-18
SP-19
SP-20
SP-21
Elevation (ft)
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
3850
3900
3950
4000
4050
4100
4150
4200
4250
4300
4350
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-18	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8104.44	3986.36	716.35	782.96	716.06	660.00	655.00	643.00	625.00	580.00	670.00	716.06

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	62.61	103.0	0	6448.8									
	3	OFL	0.00	135.0	1	-									
	4	Existing Waste	6.71	91.0	1	-610.4									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	610.4	610.4	7933.8	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	610.4	610.4	7933.8	NC	-	-
	4	Existing Waste	4.92	91.0	0	447.6	0.080	0.013	0.024	834.2	834.2	8157.6	NC	0.390	0.030
	4	Existing Waste	4.92	91.0	0	447.6	0.080	0.013	0.024	1281.8	1281.8	8605.3	NC	0.325	0.030
	4	Existing Waste	4.92	91.0	0	447.6	0.080	0.013	0.024	1729.4	1729.4	9052.9	NC	0.283	0.030
	4	Existing Waste	4.92	91.0	0	447.6	0.080	0.013	0.024	2177.1	2177.1	9500.5	NC	0.252	0.030
	4	Existing Waste	4.92	91.0	0	447.6	0.080	0.013	0.024	2624.7	2624.7	9948.1	NC	0.228	0.030
	4	Existing Waste	4.92	91.0	0	447.6	0.080	0.013	0.024	3072.3	3072.3	10395.8	NC	0.208	0.030
	4	Existing Waste	4.92	91.0	0	447.6	0.080	0.013	0.024	3519.9	3519.9	10843.4	NC	0.192	0.030
	4	Existing Waste	4.92	91.0	0	447.6	0.080	0.013	0.024	3967.6	3967.6	11291.0	NC	0.179	0.030
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4531.4	4950.0	11854.8	OC-2	0.197	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5211.4	5630.0	12534.8	OC-2	0.180	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5871.4	6290.0	13194.8	OC-2	0.279	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6388.2	6806.8	13711.6	OC-2	0.317	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6781.8	7200.4	14105.2	OC-2	0.304	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7260.3	7678.9	14583.7	OC-2	0.376	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7823.7	8242.3	15147.1	OC-2	0.357	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8342.1	8760.7	15665.5	OC-2	0.227	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8815.5	9234.1	16138.9	OC-2	0.218	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9288.9	9707.5	16612.3	OC-2	0.210	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9762.3	10180.9	17085.7	OC-2	0.202	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10235.7	10654.3	17559.1	OC-2	0.195	-
														5.120	0.293
												Total Settlement [ft]		5.41	

Variables & Constants	
Point Name	SP-18
Settlement Layer [ft]	129.4
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-19	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8104.44	4067.43	720.00	803.23	716.08	660.00	655.00	643.00	625.00	580.00	670.00	716.08

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	79.23	103.0	0	8160.4									
	3	OFL	0.00	135.0	1	-									
	4	Existing Waste	3.08	91.0	1	-280.1									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	280.1	280.1	8700.4	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	280.1	280.1	8700.4	NC	-	-
	4	Existing Waste	5.38	91.0	0	489.1	0.080	0.013	0.024	524.7	524.7	8945.0	NC	0.530	0.033
	4	Existing Waste	5.38	91.0	0	489.1	0.080	0.013	0.024	1013.8	1013.8	9434.1	NC	0.417	0.033
	4	Existing Waste	5.38	91.0	0	489.1	0.080	0.013	0.024	1502.9	1502.9	9923.2	NC	0.352	0.033
	4	Existing Waste	5.38	91.0	0	489.1	0.080	0.013	0.024	1992.0	1992.0	10412.4	NC	0.309	0.033
	4	Existing Waste	5.38	91.0	0	489.1	0.080	0.013	0.024	2481.2	2481.2	10901.5	NC	0.276	0.033
	4	Existing Waste	5.38	91.0	0	489.1	0.080	0.013	0.024	2970.3	2970.3	11390.6	NC	0.251	0.033
	4	Existing Waste	5.38	91.0	0	489.1	0.080	0.013	0.024	3459.4	3459.4	11879.7	NC	0.230	0.033
	4	Existing Waste	5.38	91.0	0	489.1	0.080	0.013	0.024	3948.6	3948.6	12368.9	NC	0.213	0.033
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4533.1	4950.0	12953.4	OC-2	0.216	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5213.1	5630.0	13633.4	OC-2	0.199	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5873.1	6290.0	14293.4	OC-2	0.309	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6389.9	6806.8	14810.2	OC-2	0.351	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6783.5	7200.4	15203.8	OC-2	0.337	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7262.0	7678.9	15682.3	OC-2	0.419	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7825.4	8242.3	16245.7	OC-2	0.398	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8343.8	8760.7	16764.1	OC-2	0.254	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8817.2	9234.1	17237.5	OC-2	0.244	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9290.6	9707.5	17710.9	OC-2	0.235	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9764.0	10180.9	18184.3	OC-2	0.227	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10237.4	10654.3	18657.7	OC-2	0.219	-
														5.986	0.315
													Total Settlement [ft]	**6.30**	

Variables & Constants	
Point Name	SP-19
Settlement Layer [ft]	133.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-20	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8104.44	4200.76	726.00	836.56	721.70	660.00	655.00	643.00	625.00	580.00	670.00	721.70

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	106.56	103.0	0	10975.3									
	3	OFL	0.00	135.0	FALSE	-									
	4	Existing Waste	2.70	91.0	1	-245.6									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	245.6	245.6	11515.3	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	245.6	245.6	11515.3	NC	-	-
	4	Existing Waste	6.13	91.0	0	557.4	0.080	0.013	0.024	524.3	524.3	11794.0	NC	0.663	0.038
	4	Existing Waste	6.13	91.0	0	557.4	0.080	0.013	0.024	1081.6	1081.6	12351.4	NC	0.518	0.038
	4	Existing Waste	6.13	91.0	0	557.4	0.080	0.013	0.024	1639.0	1639.0	12908.8	NC	0.439	0.038
	4	Existing Waste	6.13	91.0	0	557.4	0.080	0.013	0.024	2196.4	2196.4	13466.2	NC	0.386	0.038
	4	Existing Waste	6.13	91.0	0	557.4	0.080	0.013	0.024	2753.8	2753.8	14023.5	NC	0.346	0.038
	4	Existing Waste	6.13	91.0	0	557.4	0.080	0.013	0.024	3311.1	3311.1	14580.9	NC	0.315	0.038
	4	Existing Waste	6.13	91.0	0	557.4	0.080	0.013	0.024	3868.5	3868.5	15138.3	NC	0.290	0.038
	4	Existing Waste	6.13	91.0	0	557.4	0.080	0.013	0.024	4425.9	4425.9	15695.7	NC	0.269	0.038
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5044.6	4950.0	16314.3	NC	0.260	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5724.6	5630.0	16994.3	NC	0.241	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6384.6	6290.0	17654.3	NC	0.378	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6901.4	6806.8	18171.1	NC	0.431	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7295.0	7200.4	18564.7	NC	0.416	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7773.5	7678.9	19043.2	NC	0.525	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8336.9	8242.3	19606.6	NC	0.501	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8855.3	8760.7	20125.0	NC	0.321	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9328.7	9234.1	20598.4	NC	0.310	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9802.1	9707.5	21071.8	NC	0.299	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10275.5	10180.9	21545.2	NC	0.289	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10748.9	10654.3	22018.6	NC	0.280	-
														7.480	0.352
													Total Settlement [ft]	**7.83**	

Variables & Constants	
Point Name	SP-20
Settlement Layer [ft]	139.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

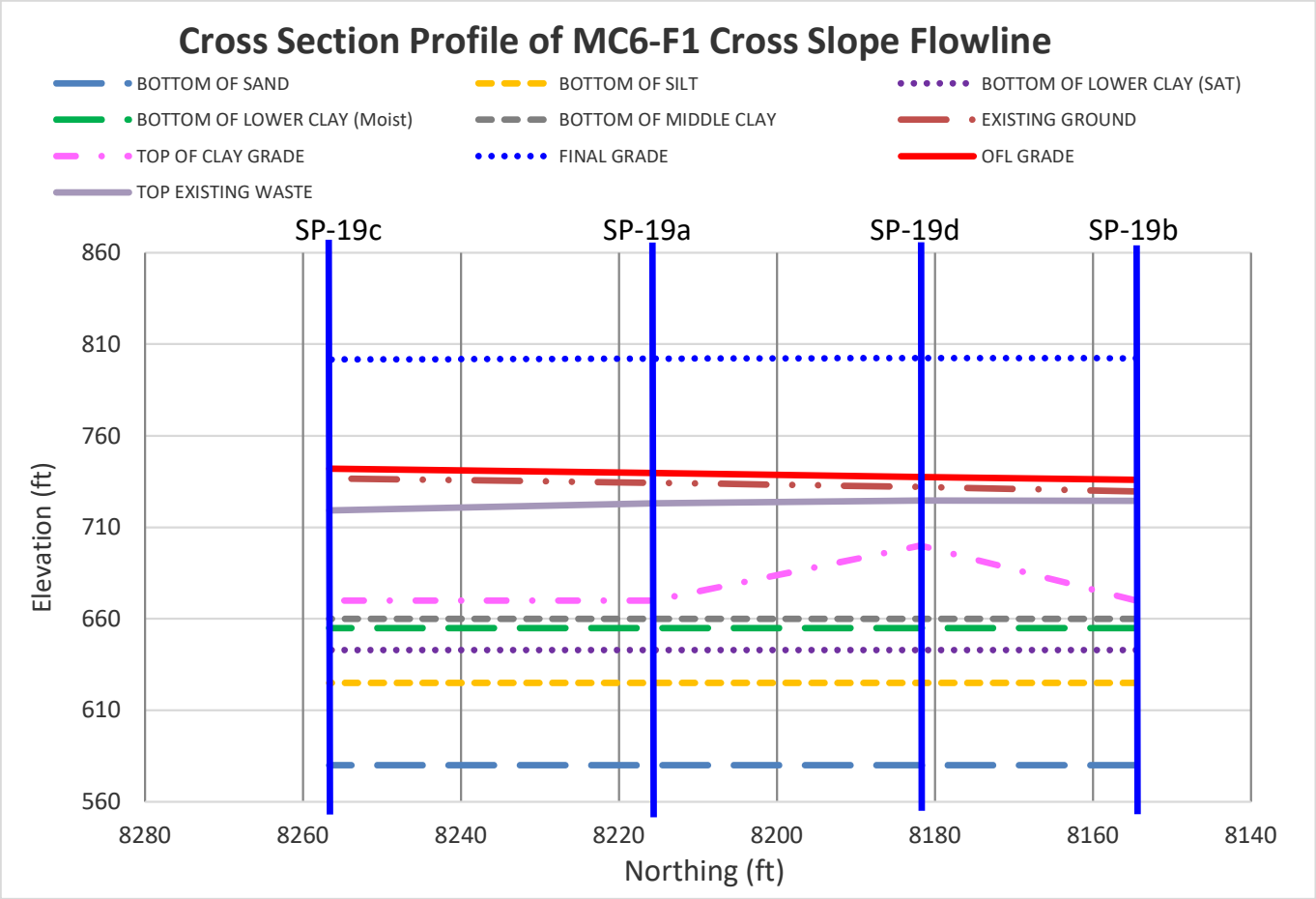
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-21	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8104.44	4310.91	730.96	864.09	728.55	660.00	655.00	643.00	625.00	580.00	670.00	728.55

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	129.14	103.0	0	13300.9									
	3	OFL	0.00	135.0	FALSE	-									
	4	Existing Waste	4.59	91.0	1	-417.6									
		<none>		-	0	-									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	417.6	417.6	13840.9	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	417.6	417.6	13840.9	NC	-	-
	4	Existing Waste	6.74	91.0	0	613.8	0.080	0.013	0.024	724.5	724.5	14147.8	NC	0.696	0.041
	4	Existing Waste	6.74	91.0	0	613.8	0.080	0.013	0.024	1338.2	1338.2	14761.6	NC	0.563	0.041
	4	Existing Waste	6.74	91.0	0	613.8	0.080	0.013	0.024	1952.0	1952.0	15375.3	NC	0.484	0.041
	4	Existing Waste	6.74	91.0	0	613.8	0.080	0.013	0.024	2565.7	2565.7	15989.1	NC	0.429	0.041
	4	Existing Waste	6.74	91.0	0	613.8	0.080	0.013	0.024	3179.5	3179.5	16602.9	NC	0.387	0.041
	4	Existing Waste	6.74	91.0	0	613.8	0.080	0.013	0.024	3793.3	3793.3	17216.6	NC	0.354	0.041
	4	Existing Waste	6.74	91.0	0	613.8	0.080	0.013	0.024	4407.0	4407.0	17830.4	NC	0.328	0.041
	4	Existing Waste	6.74	91.0	0	613.8	0.080	0.013	0.024	5020.8	5020.8	18444.1	NC	0.305	0.041
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5667.7	4950.0	19091.0	NC	0.269	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6347.7	5630.0	19771.0	NC	0.252	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7007.7	6290.0	20431.0	NC	0.397	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7524.5	6806.8	20947.8	NC	0.456	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7918.1	7200.4	21341.4	NC	0.442	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8396.6	7678.9	21819.9	NC	0.560	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8960.0	8242.3	22383.3	NC	0.537	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9478.4	8760.7	22901.7	NC	0.345	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9951.8	9234.1	23375.1	NC	0.334	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10425.2	9707.5	23848.5	NC	0.323	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10898.6	10180.9	24321.9	NC	0.314	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11372.0	10654.3	24795.3	NC	0.305	-
														8.079	0.382
													Total Settlement [ft]	**8.46**	

Variables & Constants	
Point Name	SP-21
Settlement Layer [ft]	144.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-F1 Cross Slope Flowline
BOTTOM OF SAND
BOTTOM OF SILT
BOTTOM OF LOWER CLAY (SAT)
BOTTOM OF LOWER CLAY (Moist)
BOTTOM OF MIDDLE CLAY
EXISTING GROUND
TOP OF CLAY GRADE
FINAL GRADE
OFL GRADE
TOP EXISTING WASTE
SP-19c
SP-19a
SP-19d
SP-19b
860
810
760
710
660
610
560
Elevation (ft)
8280
8260
8240
8220
8200
8180
8160
8140
Northing (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-19a	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8215.56	4063.30	739.57	802.24	734.24	660.00	655.00	643.00	625.00	580.00	670.00	723.18

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	58.7	103.0	0	6043.3	-	-	-	-	-	-		-	-
	3	OFL	1.7	135.0	1	-225.9	-	-	-	-	-	-		-	-
	4	Existing Waste	-	91.0	1	0.0	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	4.7	135.0	0	633.6	0.102	0.017	0.005	542.7	542.7	7845.0	NC	0.555	0.006
	3	OFL	4.7	135.0	0	633.6	0.102	0.017	0.005	1176.2	1176.2	8478.6	NC	0.411	0.006
	4	Existing Waste	6.6	91.0	0	604.9	0.080	0.013	0.024	1795.5	1795.5	9097.8	NC	0.375	0.041
	4	Existing Waste	6.6	91.0	0	604.9	0.080	0.013	0.024	2400.4	2400.4	9702.8	NC	0.323	0.041
	4	Existing Waste	6.6	91.0	0	604.9	0.080	0.013	0.024	3005.3	3005.3	10307.7	NC	0.285	0.041
	4	Existing Waste	6.6	91.0	0	604.9	0.080	0.013	0.024	3610.2	3610.2	10912.6	NC	0.255	0.041
	4	Existing Waste	6.6	91.0	0	604.9	0.080	0.013	0.024	4215.2	4215.2	11517.5	NC	0.232	0.041
	4	Existing Waste	6.6	91.0	0	604.9	0.080	0.013	0.024	4820.1	4820.1	12122.5	NC	0.213	0.041
	4	Existing Waste	6.6	91.0	0	604.9	0.080	0.013	0.024	5425.0	5425.0	12727.4	NC	0.197	0.041
	4	Existing Waste	6.6	91.0	0	604.9	0.080	0.013	0.024	6029.9	6029.9	13332.3	NC	0.183	0.041
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6672.4	6672.4	13974.8	NC	0.164	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7352.4	7352.4	14654.8	NC	0.153	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	8012.4	8012.4	15314.8	NC	0.241	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8529.2	8529.2	15831.6	NC	0.276	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8922.8	8922.8	16225.2	NC	0.266	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9401.3	9401.3	16703.7	NC	0.337	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9964.7	9964.7	17267.1	NC	0.322	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10483.1	10483.1	17785.5	NC	0.207	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10956.5	10956.5	18258.9	NC	0.200	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11429.9	11429.9	18732.3	NC	0.193	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11903.3	11903.3	19205.7	NC	0.187	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12376.7	12376.7	19679.1	NC	0.181	-
														5.755	0.390
											Total Settlement [ft]			6.14	

Variables & Constants	
Point Name	SP-19a
Settlement Layer [ft]	152.6
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-19b	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8154.60	4063.30	735.96	802.36	729.64	660.00	655.00	643.00	625.00	580.00	670.00	724.59

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	62.4	103.0	0	6427.4	-	-	-	-	-	-		-	-
	3	OFL	0.7	135.0	1	-91.9	-	-	-	-	-	-		-	-
	4	Existing Waste	-	91.0	1	0.0	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	2.2	135.0	0	295.0	0.102	0.017	0.005	239.4	239.4	8059.9	NC	0.340	0.003
	3	OFL	2.2	135.0	0	295.0	0.102	0.017	0.005	534.4	534.4	8354.8	NC	0.266	0.003
	4	Existing Waste	6.8	91.0	0	621.0	0.080	0.013	0.024	992.3	992.3	8812.8	NC	0.518	0.042
	4	Existing Waste	6.8	91.0	0	621.0	0.080	0.013	0.024	1613.3	1613.3	9433.7	NC	0.419	0.042
	4	Existing Waste	6.8	91.0	0	621.0	0.080	0.013	0.024	2234.2	2234.2	10054.7	NC	0.357	0.042
	4	Existing Waste	6.8	91.0	0	621.0	0.080	0.013	0.024	2855.2	2855.2	10675.7	NC	0.313	0.042
	4	Existing Waste	6.8	91.0	0	621.0	0.080	0.013	0.024	3476.2	3476.2	11296.6	NC	0.279	0.042
	4	Existing Waste	6.8	91.0	0	621.0	0.080	0.013	0.024	4097.1	4097.1	11917.6	NC	0.253	0.042
	4	Existing Waste	6.8	91.0	0	621.0	0.080	0.013	0.024	4718.1	4718.1	12538.5	NC	0.232	0.042
	4	Existing Waste	6.8	91.0	0	621.0	0.080	0.013	0.024	5339.0	5339.0	13159.5	NC	0.214	0.042
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5989.5	5989.5	13810.0	NC	0.185	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6669.5	6669.5	14490.0	NC	0.172	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	7329.5	7329.5	15150.0	NC	0.270	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7846.3	7846.3	15666.8	NC	0.308	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8239.9	8239.9	16060.4	NC	0.297	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8718.4	8718.4	16538.9	NC	0.375	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9281.8	9281.8	17102.3	NC	0.358	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9800.2	9800.2	17620.7	NC	0.229	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10273.6	10273.6	18094.1	NC	0.221	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10747.0	10747.0	18567.5	NC	0.214	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11220.4	11220.4	19040.9	NC	0.207	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11693.8	11693.8	19514.3	NC	0.200	-
														6.227	0.392
											Total Settlement [ft]			**6.62**	

Variables & Constants	
Point Name	SP-19b
Settlement Layer [ft]	149.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

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- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-19c	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8256.70	4063.30	742.00	801.66	736.69	660.00	655.00	643.00	625.00	580.00	670.00	719.14

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	55.7	103.0	0	5733.3	-	-	-	-	-	-		-	-
	3	OFL	1.7	135.0	1	-228.6	-	-	-	-	-	-		-	-
	4	Existing Waste	-	91.0	1	0.0	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	7.9	135.0	0	1070.6	0.102	0.017	0.005	763.9	763.9	7753.6	NC	0.814	0.010
	3	OFL	7.9	135.0	0	1070.6	0.102	0.017	0.005	1834.5	1834.5	8824.2	NC	0.552	0.010
	4	Existing Waste	6.1	91.0	0	559.0	0.080	0.013	0.024	2649.3	2649.3	9638.9	NC	0.276	0.038
	4	Existing Waste	6.1	91.0	0	559.0	0.080	0.013	0.024	3208.2	3208.2	10197.9	NC	0.247	0.038
	4	Existing Waste	6.1	91.0	0	559.0	0.080	0.013	0.024	3767.2	3767.2	10756.9	NC	0.224	0.038
	4	Existing Waste	6.1	91.0	0	559.0	0.080	0.013	0.024	4326.2	4326.2	11315.8	NC	0.205	0.038
	4	Existing Waste	6.1	91.0	0	559.0	0.080	0.013	0.024	4885.1	4885.1	11874.8	NC	0.190	0.038
	4	Existing Waste	6.1	91.0	0	559.0	0.080	0.013	0.024	5444.1	5444.1	12433.8	NC	0.176	0.038
	4	Existing Waste	6.1	91.0	0	559.0	0.080	0.013	0.024	6003.1	6003.1	12992.7	NC	0.165	0.038
	4	Existing Waste	6.1	91.0	0	559.0	0.080	0.013	0.024	6562.0	6562.0	13551.7	NC	0.155	0.038
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7181.5	7181.5	14171.2	NC	0.151	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7861.5	7861.5	14851.2	NC	0.141	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	8521.5	8521.5	15511.2	NC	0.222	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9038.3	9038.3	16028.0	NC	0.255	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9431.9	9431.9	16421.6	NC	0.247	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9910.4	9910.4	16900.1	NC	0.313	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10473.8	10473.8	17463.5	NC	0.300	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10992.2	10992.2	17981.9	NC	0.192	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11465.6	11465.6	18455.3	NC	0.186	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11939.0	11939.0	18928.7	NC	0.180	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12412.4	12412.4	19402.1	NC	0.175	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12885.8	12885.8	19875.5	NC	0.169	-
														5.534	0.373
											Total Settlement [ft]			**5.91**	

Variables & Constants	
Point Name	SP-19c
Settlement Layer [ft]	155.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

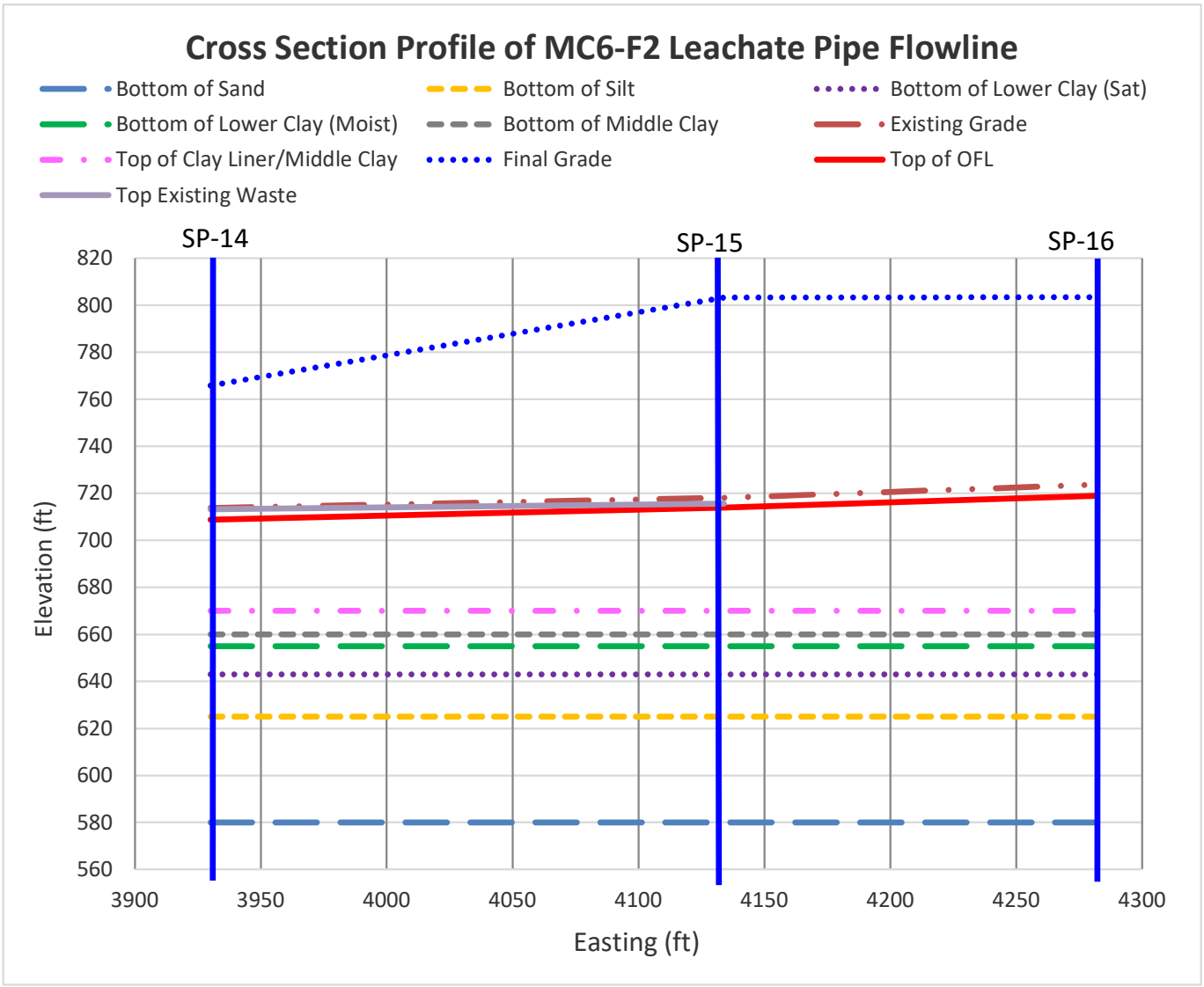
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-19d	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8181.85	4063.30	737.57	802.45	732.11	660.00	655.00	643.00	625.00	580.00	700.00	724.70

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	60.9	103.0	0	6270.7	-	-	-	-	-	-		-	-
	3	OFL	1.5	135.0	1	-207.7	-	-	-	-	-	-		-	-
	4	Existing Waste	-	91.0	1	0.0	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	2.9	135.0	0	396.6	0.102	0.017	0.005	406.0	406.0	7953.9	NC	0.387	0.004
	3	OFL	2.9	135.0	0	396.6	0.102	0.017	0.005	802.6	802.6	8350.5	NC	0.305	0.004
	4	Existing Waste	3.1	91.0	0	280.9	0.080	0.013	0.024	1141.3	1141.3	8689.3	NC	0.218	0.019
	4	Existing Waste	3.1	91.0	0	280.9	0.080	0.013	0.024	1422.3	1422.3	8970.2	NC	0.198	0.019
	4	Existing Waste	3.1	91.0	0	280.9	0.080	0.013	0.024	1703.2	1703.2	9251.1	NC	0.182	0.019
	4	Existing Waste	3.1	91.0	0	280.9	0.080	0.013	0.024	1984.1	1984.1	9532.0	NC	0.168	0.019
	4	Existing Waste	3.1	91.0	0	280.9	0.080	0.013	0.024	2265.0	2265.0	9812.9	NC	0.157	0.019
	4	Existing Waste	3.1	91.0	0	280.9	0.080	0.013	0.024	2546.0	2546.0	10093.9	NC	0.148	0.019
	4	Existing Waste	3.1	91.0	0	280.9	0.080	0.013	0.024	2826.9	2826.9	10374.8	NC	0.139	0.019
	4	Existing Waste	3.1	91.0	0	280.9	0.080	0.013	0.024	3107.8	3107.8	10655.7	NC	0.132	0.019
	6	Middle Clay	20.0	136.0	0	2720.0	0.102	0.017	0.005	4608.3	4608.3	12156.2	NC	0.859	0.026
	6	Middle Clay	20.0	136.0	0	2720.0	0.102	0.017	0.005	7328.3	7328.3	14876.2	NC	0.627	0.026
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	9008.3	9008.3	16556.2	NC	0.226	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9525.1	9525.1	17073.0	NC	0.260	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9918.7	9918.7	17466.6	NC	0.252	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10397.2	10397.2	17945.1	NC	0.320	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10960.6	10960.6	18508.5	NC	0.307	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11479.0	11479.0	19026.9	NC	0.198	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11952.4	11952.4	19500.3	NC	0.191	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12425.8	12425.8	19973.7	NC	0.186	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12899.2	12899.2	20447.1	NC	0.180	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13372.6	13372.6	20920.5	NC	0.175	-
														5.815	0.249
											Total Settlement [ft]			**6.06**	

Variables & Constants	
Point Name	SP-19d
Settlement Layer [ft]	150.6
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-F2 Leachate Pipe Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top Existing Waste
SP-14
SP-15
SP-16
820
800
780
760
740
720
700
680
660
640
620
600
580
560
Elevation (ft)
3900
3950
4000
4050
4100
4150
4200
4250
4300
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-14	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8441.35	3991.88	709.74	781.25	706.84	660.00	655.00	643.00	625.00	580.00	670.00	706.84

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	67.51	103.0	0	6953.7									
	3	OFL	0.00	135.0	1	-									
	4	Existing Waste	4.10	91.0	1	-373.4									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	373.4	373.4	8438.7	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	373.4	373.4	8438.7	NC	-	-
	4	Existing Waste	4.09	91.0	0	372.4	0.080	0.013	0.024	559.6	559.6	8624.9	NC	0.389	0.025
	4	Existing Waste	4.09	91.0	0	372.4	0.080	0.013	0.024	932.1	932.1	8997.3	NC	0.322	0.025
	4	Existing Waste	4.09	91.0	0	372.4	0.080	0.013	0.024	1304.5	1304.5	9369.7	NC	0.280	0.025
	4	Existing Waste	4.09	91.0	0	372.4	0.080	0.013	0.024	1676.9	1676.9	9742.1	NC	0.250	0.025
	4	Existing Waste	4.09	91.0	0	372.4	0.080	0.013	0.024	2049.3	2049.3	10114.5	NC	0.227	0.025
	4	Existing Waste	4.09	91.0	0	372.4	0.080	0.013	0.024	2421.7	2421.7	10487.0	NC	0.208	0.025
	4	Existing Waste	4.09	91.0	0	372.4	0.080	0.013	0.024	2794.1	2794.1	10859.4	NC	0.193	0.025
	4	Existing Waste	4.09	91.0	0	372.4	0.080	0.013	0.024	3166.6	3166.6	11231.8	NC	0.180	0.025
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3692.8	4950.0	11758.0	OC-2	0.202	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4372.8	5630.0	12438.0	OC-2	0.185	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5032.8	6290.0	13098.0	OC-2	0.286	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5549.6	6806.8	13614.8	OC-2	0.324	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5943.2	7200.4	14008.4	OC-2	0.311	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6421.7	7678.9	14486.9	OC-2	0.372	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6985.1	8242.3	15050.3	OC-2	0.353	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7503.5	8760.7	15568.7	OC-2	0.225	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7976.9	9234.1	16042.1	OC-2	0.216	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8450.3	9707.5	16515.5	OC-2	0.208	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8923.7	10180.9	16988.9	OC-2	0.200	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9397.1	10654.3	17462.3	OC-2	0.193	-
														5.125	0.252
													Total Settlement [ft]	**5.38**	

Variables & Constants	
Point Name	SP-14
Settlement Layer [ft]	122.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-15	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8441.35	4131.87	713.94	803.30	709.96	660.00	655.00	643.00	625.00	580.00	670.00	709.96

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	85.36	103.0	0	8792.3									
	3	OFL	0.00	135.0	1	-									
	4	Existing Waste	3.02	91.0	1	-274.6									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	274.6	274.6	10277.3	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	274.6	274.6	10277.3	NC	-	-
	4	Existing Waste	4.62	91.0	0	420.2	0.080	0.013	0.024	484.7	484.7	10487.4	NC	0.493	0.028
	4	Existing Waste	4.62	91.0	0	420.2	0.080	0.013	0.024	904.9	904.9	10907.6	NC	0.399	0.028
	4	Existing Waste	4.62	91.0	0	420.2	0.080	0.013	0.024	1325.1	1325.1	11327.7	NC	0.344	0.028
	4	Existing Waste	4.62	91.0	0	420.2	0.080	0.013	0.024	1745.3	1745.3	11747.9	NC	0.306	0.028
	4	Existing Waste	4.62	91.0	0	420.2	0.080	0.013	0.024	2165.4	2165.4	12168.1	NC	0.277	0.028
	4	Existing Waste	4.62	91.0	0	420.2	0.080	0.013	0.024	2585.6	2585.6	12588.3	NC	0.254	0.028
	4	Existing Waste	4.62	91.0	0	420.2	0.080	0.013	0.024	3005.8	3005.8	13008.5	NC	0.235	0.028
	4	Existing Waste	4.62	91.0	0	420.2	0.080	0.013	0.024	3426.0	3426.0	13428.7	NC	0.219	0.028
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3976.1	4950.0	13978.8	OC-2	0.238	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4656.1	5630.0	14658.8	OC-2	0.219	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5316.1	6290.0	15318.8	OC-2	0.341	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5832.9	6806.8	15835.6	OC-2	0.388	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6226.5	7200.4	16229.2	OC-2	0.373	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6705.0	7678.9	16707.7	OC-2	0.456	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7268.4	8242.3	17271.1	OC-2	0.434	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7786.8	8760.7	17789.5	OC-2	0.277	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8260.2	9234.1	18262.9	OC-2	0.267	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8733.6	9707.5	18736.3	OC-2	0.257	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9207.0	10180.9	19209.7	OC-2	0.248	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9680.4	10654.3	19683.1	OC-2	0.240	-
														6.264	0.278
													Total Settlement [ft]	**6.54**	

Variables & Constants	
Point Name	SP-15
Settlement Layer [ft]	126.9
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

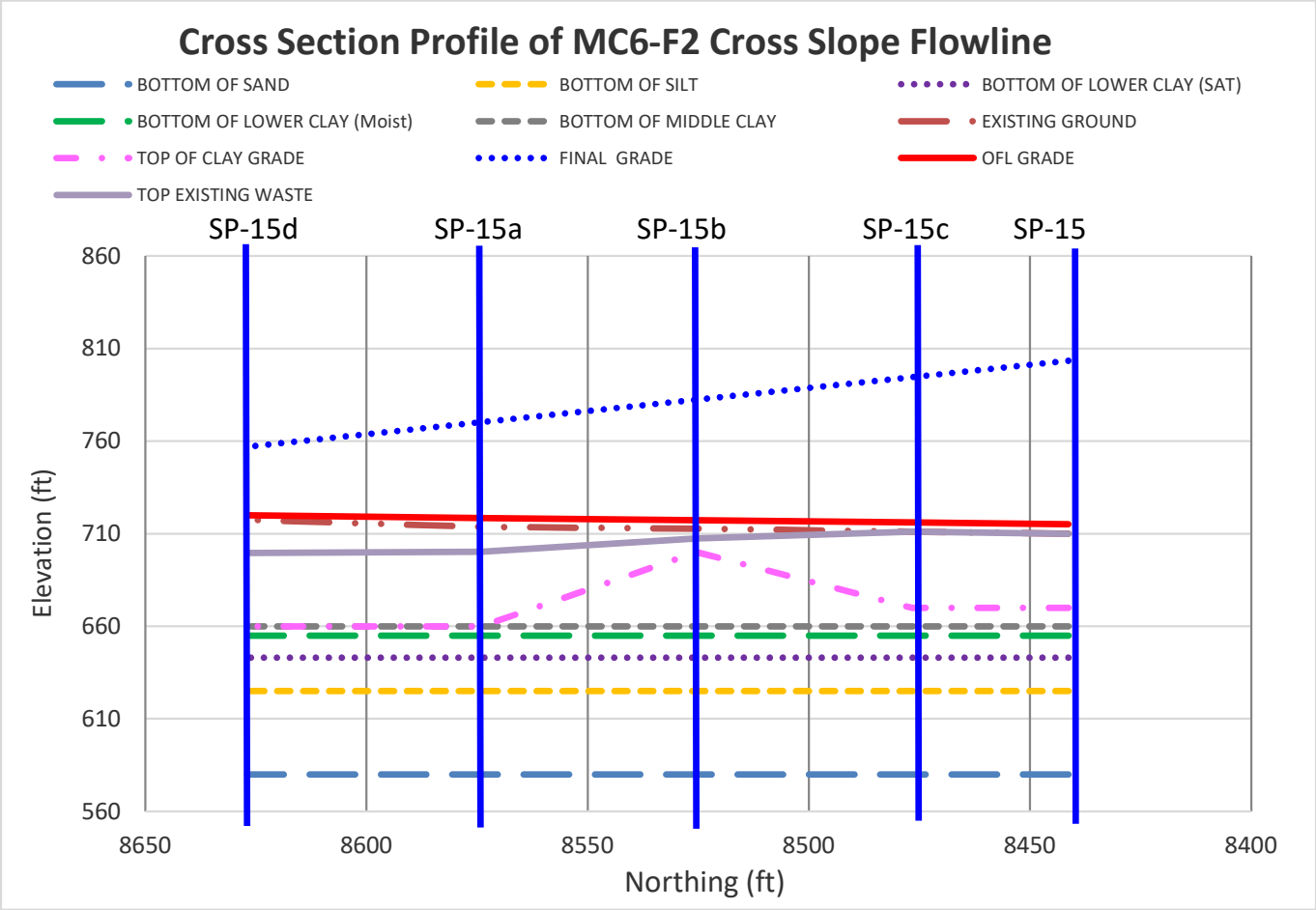
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-16	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8441.35	4280.39	718.40	803.53	715.93	660.00	655.00	643.00	625.00	580.00	670.00	712.67

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	81.13	103.0	0	8356.4									
	3	OFL	3.26	135.0	1	-440.5									
	4	Existing Waste	1.27	91.0	1	-115.6									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	556.1	556.1	9841.4	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	556.1	556.1	9841.4	NC	-	-
	4	Existing Waste	5.17	91.0	0	470.9	0.080	0.013	0.024	791.5	791.5	10076.8	NC	0.457	0.032
	4	Existing Waste	5.17	91.0	0	470.9	0.080	0.013	0.024	1262.4	1262.4	10547.7	NC	0.382	0.032
	4	Existing Waste	5.17	91.0	0	470.9	0.080	0.013	0.024	1733.3	1733.3	11018.6	NC	0.333	0.032
	4	Existing Waste	5.17	91.0	0	470.9	0.080	0.013	0.024	2204.2	2204.2	11489.5	NC	0.297	0.032
	4	Existing Waste	5.17	91.0	0	470.9	0.080	0.013	0.024	2675.1	2675.1	11960.3	NC	0.269	0.032
	4	Existing Waste	5.17	91.0	0	470.9	0.080	0.013	0.024	3145.9	3145.9	12431.2	NC	0.247	0.032
	4	Existing Waste	5.17	91.0	0	470.9	0.080	0.013	0.024	3616.8	3616.8	12902.1	NC	0.229	0.032
	4	Existing Waste	5.17	91.0	0	470.9	0.080	0.013	0.024	4087.7	4087.7	13373.0	NC	0.213	0.032
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4663.1	4950.0	13948.4	OC-2	0.232	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5343.1	5630.0	14628.4	OC-2	0.213	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6003.1	6290.0	15288.4	OC-2	0.333	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6519.9	6806.8	15805.2	OC-2	0.379	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6913.5	7200.4	16198.8	OC-2	0.364	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7392.0	7678.9	16677.3	OC-2	0.455	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7955.4	8242.3	17240.7	OC-2	0.433	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8473.8	8760.7	17759.1	OC-2	0.276	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8947.2	9234.1	18232.5	OC-2	0.266	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9420.6	9707.5	18705.9	OC-2	0.256	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9894.0	10180.9	19179.3	OC-2	0.248	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10367.4	10654.3	19652.7	OC-2	0.239	-
														6.120	0.305
												Total Settlement [ft]		6.43	

Variables & Constants	
Point Name	SP-16
Settlement Layer [ft]	131.4
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-F2 Cross Slope Flowline
BOTTOM OF SAND
BOTTOM OF SILT
BOTTOM OF LOWER CLAY (SAT)
BOTTOM OF LOWER CLAY (Moist)
BOTTOM OF MIDDLE CLAY
EXISTING GROUND
TOP OF CLAY GRADE
FINAL GRADE
OFL GRADE
TOP EXISTING WASTE
SP-15d
SP-15a
SP-15b
SP-15c
SP-15
860
810
760
710
660
610
560
Elevation (ft)
8650
8600
8550
8500
8450
8400
Northing (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-15	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8441.35	4131.87	715.04	803.30	709.96	660.00	655.00	643.00	625.00	580.00	670.00	709.96

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	84.3	103.0	0	8679.0	-	-	-	-	-	-		-	-
	3	OFL	-	135.0	1	0.0	-	-	-	-	-	-		-	-
	4	Existing Waste	1.9	91.0	1	-174.5	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	-	135.0	0	0.0	0.102	0.017	0.005	174.5	174.5	10164.0	NC	-	-
	3	OFL	-	135.0	0	-	0.102	0.017	0.005	174.5	174.5	10164.0	NC	-	-
	4	Existing Waste	4.8	91.0	0	432.7	0.080	0.013	0.024	390.9	390.9	10380.3	NC	0.542	0.029
	4	Existing Waste	4.8	91.0	0	432.7	0.080	0.013	0.024	823.6	823.6	10813.0	NC	0.425	0.029
	4	Existing Waste	4.8	91.0	0	432.7	0.080	0.013	0.024	1256.3	1256.3	11245.7	NC	0.362	0.029
	4	Existing Waste	4.8	91.0	0	432.7	0.080	0.013	0.024	1689.0	1689.0	11678.4	NC	0.319	0.029
	4	Existing Waste	4.8	91.0	0	432.7	0.080	0.013	0.024	2121.6	2121.6	12111.1	NC	0.288	0.029
	4	Existing Waste	4.8	91.0	0	432.7	0.080	0.013	0.024	2554.3	2554.3	12543.8	NC	0.263	0.029
	4	Existing Waste	4.8	91.0	0	432.7	0.080	0.013	0.024	2987.0	2987.0	12976.5	NC	0.243	0.029
	4	Existing Waste	4.8	91.0	0	432.7	0.080	0.013	0.024	3419.7	3419.7	13409.2	NC	0.226	0.029
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	3976.1	3976.1	13965.6	NC	0.278	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	4656.1	4656.1	14645.6	NC	0.254	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	5316.1	5316.1	15305.6	NC	0.393	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	5832.9	5832.9	15822.4	NC	0.445	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	6226.5	6226.5	16216.0	NC	0.427	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	6705.0	6705.0	16694.5	NC	0.535	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	7268.4	7268.4	17257.9	NC	0.507	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	7786.8	7786.8	17776.3	NC	0.323	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8260.2	8260.2	18249.7	NC	0.310	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8733.6	8733.6	18723.1	NC	0.298	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9207.0	9207.0	19196.5	NC	0.287	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9680.4	9680.4	19669.9	NC	0.277	-
														7.000	0.285
											Total Settlement [ft]			7.29	

Variables & Constants	
Point Name	SP-15
Settlement Layer [ft]	128.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

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- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-15d	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8626.95	4131.87	719.95	756.90	717.45	660.00	655.00	643.00	625.00	580.00	660.00	699.50

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	33.0	103.0	0	3394.1	-	-	-	-	-	-		-	-
	3	OFL	4.5	135.0	1	-607.4	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	6.7	135.0	0	907.7	0.102	0.017	0.005	1061.3	1061.3	5333.0	NC	0.481	0.009
	3	OFL	6.7	135.0	0	907.7	0.102	0.017	0.005	1969.0	1969.0	6240.7	NC	0.344	0.009
	4	Existing Waste	4.9	91.0	0	449.3	0.080	0.013	0.024	2647.6	2647.6	6919.3	NC	0.165	0.030
	4	Existing Waste	4.9	91.0	0	449.3	0.080	0.013	0.024	3096.9	3096.9	7368.6	NC	0.149	0.030
	4	Existing Waste	4.9	91.0	0	449.3	0.080	0.013	0.024	3546.3	3546.3	7818.0	NC	0.136	0.030
	4	Existing Waste	4.9	91.0	0	449.3	0.080	0.013	0.024	3995.6	3995.6	8267.3	NC	0.125	0.030
	4	Existing Waste	4.9	91.0	0	449.3	0.080	0.013	0.024	4444.9	4444.9	8716.7	NC	0.116	0.030
	4	Existing Waste	4.9	91.0	0	449.3	0.080	0.013	0.024	4894.3	4894.3	9166.0	NC	0.108	0.030
	4	Existing Waste	4.9	91.0	0	449.3	0.080	0.013	0.024	5343.6	5343.6	9615.3	NC	0.101	0.030
	4	Existing Waste	4.9	91.0	0	449.3	0.080	0.013	0.024	5793.0	5793.0	10064.7	NC	0.095	0.030
	6	Middle Clay	-	136.0	0	-	0.102	0.017	0.005	6017.7	6017.7	10289.4	NC	-	-
	6	Middle Clay	-	136.0	0	-	0.102	0.017	0.005	6017.7	6017.7	10289.4	NC	-	-
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	6337.7	6337.7	10609.4	NC	0.191	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	6854.5	6854.5	11126.2	NC	0.216	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7248.1	7248.1	11519.8	NC	0.206	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	7726.6	7726.6	11998.3	NC	0.258	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8290.0	8290.0	12561.7	NC	0.244	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8808.4	8808.4	13080.1	NC	0.155	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9281.8	9281.8	13553.5	NC	0.148	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9755.2	9755.2	14026.9	NC	0.142	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10228.6	10228.6	14500.3	NC	0.136	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10702.0	10702.0	14973.7	NC	0.131	-
														3.645	0.298
											Total Settlement [ft]			3.94	

Variables & Constants	
Point Name	SP-15d
Settlement Layer [ft]	133.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-15a	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8574.00	4131.87	718.55	770.14	713.73	660.00	655.00	643.00	625.00	580.00	660.00	700.30

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	47.6	103.0	0	4901.9	-	-	-	-	-	-		-	-
	3	OFL	2.2	135.0	1	-295.0	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	5.6	135.0	0	759.6	0.102	0.017	0.005	674.8	674.8	6766.7	NC	0.575	0.007
	3	OFL	5.6	135.0	0	759.6	0.102	0.017	0.005	1434.4	1434.4	7526.3	NC	0.413	0.007
	4	Existing Waste	5.0	91.0	0	458.4	0.080	0.013	0.024	2043.4	2043.4	8135.3	NC	0.242	0.031
	4	Existing Waste	5.0	91.0	0	458.4	0.080	0.013	0.024	2501.7	2501.7	8593.6	NC	0.216	0.031
	4	Existing Waste	5.0	91.0	0	458.4	0.080	0.013	0.024	2960.1	2960.1	9052.0	NC	0.196	0.031
	4	Existing Waste	5.0	91.0	0	458.4	0.080	0.013	0.024	3418.5	3418.5	9510.4	NC	0.179	0.031
	4	Existing Waste	5.0	91.0	0	458.4	0.080	0.013	0.024	3876.8	3876.8	9968.7	NC	0.165	0.031
	4	Existing Waste	5.0	91.0	0	458.4	0.080	0.013	0.024	4335.2	4335.2	10427.1	NC	0.154	0.031
	4	Existing Waste	5.0	91.0	0	458.4	0.080	0.013	0.024	4793.6	4793.6	10885.5	NC	0.144	0.031
	4	Existing Waste	5.0	91.0	0	458.4	0.080	0.013	0.024	5252.0	5252.0	11343.9	NC	0.135	0.031
	6	Middle Clay	-	136.0	0	-	0.102	0.017	0.005	5481.1	5481.1	11573.0	NC	-	-
	6	Middle Clay	-	136.0	0	-	0.102	0.017	0.005	5481.1	5481.1	11573.0	NC	-	-
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	5801.1	5801.1	11893.0	NC	0.267	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	6317.9	6317.9	12409.8	NC	0.301	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	6711.5	6711.5	12803.4	NC	0.288	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	7190.0	7190.0	13281.9	NC	0.360	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	7753.4	7753.4	13845.3	NC	0.340	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8271.8	8271.8	14363.7	NC	0.216	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8745.2	8745.2	14837.1	NC	0.207	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9218.6	9218.6	15310.5	NC	0.198	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9692.0	9692.0	15783.9	NC	0.191	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10165.4	10165.4	16257.3	NC	0.184	-
														4.967	0.300
											Total Settlement [ft]			**5.27**	

Variables & Constants	
Point Name	SP-15a
Settlement Layer [ft]	131.5
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-15b	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8525.36	4131.87	717.26	782.30	712.63	660.00	655.00	643.00	625.00	580.00	700.00	707.54

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	61.0	103.0	0	6286.9	-	-	-	-	-	-		-	-
	3	OFL	2.4	135.0	1	-319.6	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	1.4	135.0	0	183.8	0.102	0.017	0.005	411.5	411.5	7863.8	NC	0.178	0.002
	3	OFL	1.4	135.0	0	183.8	0.102	0.017	0.005	595.2	595.2	8047.5	NC	0.157	0.002
	4	Existing Waste	0.9	91.0	0	85.8	0.080	0.013	0.024	730.0	730.0	8182.3	NC	0.079	0.006
	4	Existing Waste	0.9	91.0	0	85.8	0.080	0.013	0.024	815.8	815.8	8268.1	NC	0.076	0.006
	4	Existing Waste	0.9	91.0	0	85.8	0.080	0.013	0.024	901.5	901.5	8353.8	NC	0.073	0.006
	4	Existing Waste	0.9	91.0	0	85.8	0.080	0.013	0.024	987.3	987.3	8439.6	NC	0.070	0.006
	4	Existing Waste	0.9	91.0	0	85.8	0.080	0.013	0.024	1073.1	1073.1	8525.4	NC	0.068	0.006
	4	Existing Waste	0.9	91.0	0	85.8	0.080	0.013	0.024	1158.8	1158.8	8611.1	NC	0.066	0.006
	4	Existing Waste	0.9	91.0	0	85.8	0.080	0.013	0.024	1244.6	1244.6	8696.9	NC	0.064	0.006
	4	Existing Waste	0.9	91.0	0	85.8	0.080	0.013	0.024	1330.4	1330.4	8782.7	NC	0.062	0.006
	6	Middle Clay	20.0	136.0	0	2720.0	0.102	0.017	0.005	2733.3	2733.3	10185.6	NC	1.165	0.026
	6	Middle Clay	20.0	136.0	0	2720.0	0.102	0.017	0.005	5453.3	5453.3	12905.6	NC	0.763	0.026
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	7133.3	7133.3	14585.6	NC	0.266	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7650.1	7650.1	15102.4	NC	0.303	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8043.7	8043.7	15496.0	NC	0.292	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8522.2	8522.2	15974.5	NC	0.368	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9085.6	9085.6	16537.9	NC	0.351	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9604.0	9604.0	17056.3	NC	0.224	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10077.4	10077.4	17529.7	NC	0.216	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10550.8	10550.8	18003.1	NC	0.209	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11024.2	11024.2	18476.5	NC	0.202	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11497.6	11497.6	18949.9	NC	0.195	-
														5.448	0.140
											Total Settlement [ft]			**5.59**	

Variables & Constants	
Point Name	SP-15b
Settlement Layer [ft]	130.3
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

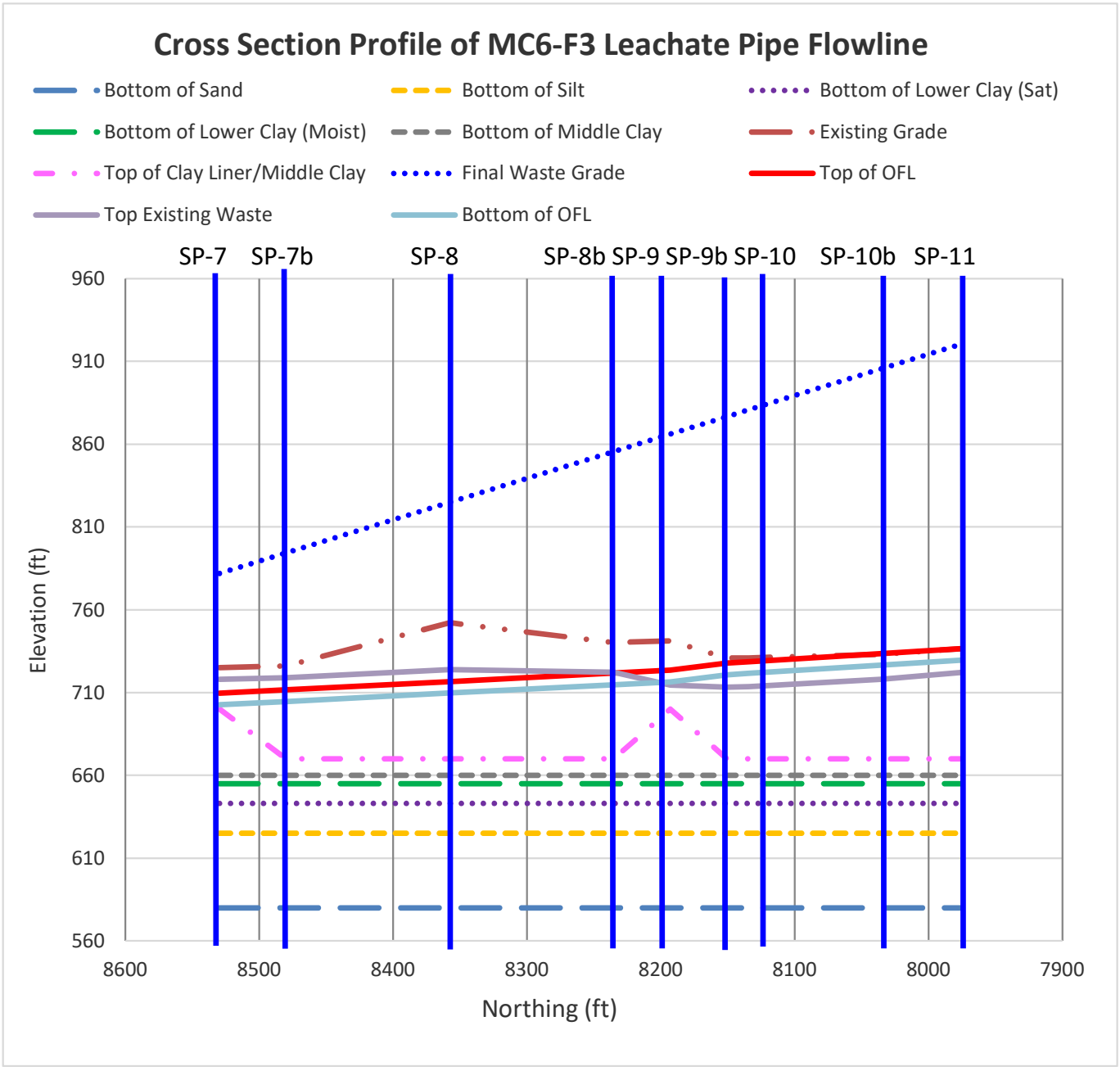
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-15c	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8476.72	4131.87	715.98	794.46	711.06	660.00	655.00	643.00	625.00	580.00	670.00	711.06

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	74.5	103.0	0	7671.9	-	-	-	-	-	-		-	-
	4	Existing Waste	2.1	91.0	1	-190.1	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	-	135.0	0	0.0	0.102	0.017	0.005	190.1	190.1	9156.9	NC	-	-
	3	OFL	-	135.0	0	-	0.102	0.017	0.005	190.1	190.1	9156.9	NC	-	-
	4	Existing Waste	4.9	91.0	0	443.3	0.080	0.013	0.024	411.8	411.8	9378.6	NC	0.529	0.030
	4	Existing Waste	4.9	91.0	0	443.3	0.080	0.013	0.024	855.1	855.1	9821.9	NC	0.413	0.030
	4	Existing Waste	4.9	91.0	0	443.3	0.080	0.013	0.024	1298.4	1298.4	10265.3	NC	0.350	0.030
	4	Existing Waste	4.9	91.0	0	443.3	0.080	0.013	0.024	1741.8	1741.8	10708.6	NC	0.307	0.030
	4	Existing Waste	4.9	91.0	0	443.3	0.080	0.013	0.024	2185.1	2185.1	11151.9	NC	0.276	0.030
	4	Existing Waste	4.9	91.0	0	443.3	0.080	0.013	0.024	2628.5	2628.5	11595.3	NC	0.251	0.030
	4	Existing Waste	4.9	91.0	0	443.3	0.080	0.013	0.024	3071.8	3071.8	12038.6	NC	0.231	0.030
	4	Existing Waste	4.9	91.0	0	443.3	0.080	0.013	0.024	3515.2	3515.2	12482.0	NC	0.214	0.030
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	4076.8	4076.8	13043.6	NC	0.258	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	4756.8	4756.8	13723.6	NC	0.235	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	5416.8	5416.8	14383.6	NC	0.363	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	5933.6	5933.6	14900.4	NC	0.410	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	6327.2	6327.2	15294.0	NC	0.393	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	6805.7	6805.7	15772.5	NC	0.493	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	7369.1	7369.1	16335.9	NC	0.467	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	7887.5	7887.5	16854.3	NC	0.297	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8360.9	8360.9	17327.7	NC	0.285	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8834.3	8834.3	17801.1	NC	0.274	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9307.7	9307.7	18274.5	NC	0.264	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9781.1	9781.1	18747.9	NC	0.254	-
														6.564	0.291
											Total Settlement [ft]			**6.85**	

Variables & Constants	
Point Name	SP-15c
Settlement Layer [ft]	129.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-F3 Leachate Pipe Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Waste Grade
Top of OFL
Top Existing Waste
Bottom of OFL
SP-7
SP-7b
SP-8
SP-8b
SP-9
SP-9b
SP-10
SP-10b
SP-11
960
910
860
810
760
710
660
610
560
Elevation (ft)
8600
8500
8400
8300
8200
8100
8000
7900
Northing (ft)

SETTLEMENT POINT	Coordinates		Elevations									
SP-7	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8529.72	4583.16	709.66	781.96	725.04	660.00	655.00	643.00	625.00	580.00	700.00	718.02

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	68.3	103.0	0	7034.7	-	-	-	-	-	-		-	-
	3	OFL	7.0	135.0	1	-947.2	-	-	-	-	-	-		-	-
	4	Existing Waste	15.4	91.0	1	-1397.8	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	-	135.0	0	0.0	0.102	0.017	0.005	2345.0	2345.0	8519.7	NC	-	-
	3	OFL	-	135.0	0	-	0.102	0.017	0.005	2345.0	2345.0	8519.7	NC	-	-
	4	Existing Waste	0.3	91.0	0	30.3	0.080	0.013	0.024	2360.1	2360.1	8534.8	NC	0.015	0.002
	4	Existing Waste	0.3	91.0	0	30.3	0.080	0.013	0.024	2390.4	2390.4	8565.1	NC	0.015	0.002
	4	Existing Waste	0.3	91.0	0	30.3	0.080	0.013	0.024	2420.7	2420.7	8595.4	NC	0.015	0.002
	4	Existing Waste	0.3	91.0	0	30.3	0.080	0.013	0.024	2451.0	2451.0	8625.7	NC	0.015	0.002
	4	Existing Waste	0.3	91.0	0	30.3	0.080	0.013	0.024	2481.3	2481.3	8655.9	NC	0.014	0.002
	4	Existing Waste	0.3	91.0	0	30.3	0.080	0.013	0.024	2511.6	2511.6	8686.2	NC	0.014	0.002
	4	Existing Waste	0.3	91.0	0	30.3	0.080	0.013	0.024	2541.9	2541.9	8716.5	NC	0.014	0.002
	4	Existing Waste	0.3	91.0	0	30.3	0.080	0.013	0.024	2572.1	2572.1	8746.8	NC	0.014	0.002
	6	Middle Clay	20.0	136.0	0	2720.0	0.102	0.017	0.005	3947.3	3947.3	10122.0	NC	0.834	0.026
	6	Middle Clay	20.0	136.0	0	2720.0	0.102	0.017	0.005	6667.3	6667.3	12842.0	NC	0.581	0.026
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	8347.3	8347.3	14522.0	NC	0.206	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8864.1	8864.1	15038.8	NC	0.236	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9257.7	9257.7	15432.4	NC	0.228	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9736.2	9736.2	15910.9	NC	0.288	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10299.6	10299.6	16474.3	NC	0.275	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10818.0	10818.0	16992.7	NC	0.177	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11291.4	11291.4	17466.1	NC	0.171	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11764.8	11764.8	17939.5	NC	0.165	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12238.2	12238.2	18412.9	NC	0.160	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12711.6	12711.6	18886.3	NC	0.155	-
														3.590	0.106
												Total Settlement [ft]		3.70	

Variables & Constants	
Point Name	SP-7
Settlement Layer [ft]	122.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-7b	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8480.14	4583.16	711.70	794.35	726.02	660.00	655.00	643.00	625.00	580.00	670.00	718.97

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	78.7	103.0	0	8101.9	-	-	-	-	-	-		-	-
	3	OFL	7.1	135.0	1	-952.2	-	-	-	-	-	-		-	-
	4	Existing Waste	14.3	91.0	1	-1299.0	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	-	135.0	0	0.0	0.102	0.017	0.005	2251.2	2251.2	9586.9	NC	-	-
	3	OFL	-	135.0	0	-	0.102	0.017	0.005	2251.2	2251.2	9586.9	NC	-	-
	4	Existing Waste	4.3	91.0	0	394.7	0.080	0.013	0.024	2448.6	2448.6	9784.2	NC	0.209	0.027
	4	Existing Waste	4.3	91.0	0	394.7	0.080	0.013	0.024	2843.2	2843.2	10178.9	NC	0.192	0.027
	4	Existing Waste	4.3	91.0	0	394.7	0.080	0.013	0.024	3237.9	3237.9	10573.5	NC	0.178	0.027
	4	Existing Waste	4.3	91.0	0	394.7	0.080	0.013	0.024	3632.5	3632.5	10968.2	NC	0.167	0.027
	4	Existing Waste	4.3	91.0	0	394.7	0.080	0.013	0.024	4027.2	4027.2	11362.9	NC	0.156	0.027
	4	Existing Waste	4.3	91.0	0	394.7	0.080	0.013	0.024	4421.9	4421.9	11757.5	NC	0.147	0.027
	4	Existing Waste	4.3	91.0	0	394.7	0.080	0.013	0.024	4816.5	4816.5	12152.2	NC	0.139	0.027
	4	Existing Waste	4.3	91.0	0	394.7	0.080	0.013	0.024	5211.2	5211.2	12546.8	NC	0.132	0.027
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5748.5	5748.5	13084.2	NC	0.182	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6428.5	6428.5	13764.2	NC	0.169	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	7088.5	7088.5	14424.2	NC	0.264	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7605.3	7605.3	14941.0	NC	0.301	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7998.9	7998.9	15334.6	NC	0.290	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8477.4	8477.4	15813.1	NC	0.366	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9040.8	9040.8	16376.5	NC	0.348	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9559.2	9559.2	16894.9	NC	0.223	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10032.6	10032.6	17368.3	NC	0.215	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10506.0	10506.0	17841.7	NC	0.207	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10979.4	10979.4	18315.1	NC	0.200	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11452.8	11452.8	18788.5	NC	0.193	-
														4.278	0.264
												Total Settlement [ft]		4.54	

Variables & Constants	
Point Name	SP-7b
Settlement Layer [ft]	124.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-8	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8357.69	4583.16	716.72	824.97	752.20	660.00	655.00	643.00	625.00	580.00	670.00	723.92

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	104.3	103.0	0	10737.8	-	-	-	-	-	-		-	-
	3	OFL	28.3	135.0	1	-3817.2	-	-	-	-	-	-		-	-
	4	Existing Waste	14.2	91.0	1	-1292.7	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	-	135.0	0	0.0	0.102	0.017	0.005	5109.9	5109.9	12222.8	NC	-	-
	3	OFL	-	135.0	0	-	0.102	0.017	0.005	5109.9	5109.9	12222.8	NC	-	-
	4	Existing Waste	5.0	91.0	0	451.8	0.080	0.013	0.024	5335.8	5335.8	12448.7	NC	0.146	0.030
	4	Existing Waste	5.0	91.0	0	451.8	0.080	0.013	0.024	5787.6	5787.6	12900.4	NC	0.138	0.030
	4	Existing Waste	5.0	91.0	0	451.8	0.080	0.013	0.024	6239.4	6239.4	13352.2	NC	0.131	0.030
	4	Existing Waste	5.0	91.0	0	451.8	0.080	0.013	0.024	6691.1	6691.1	13804.0	NC	0.125	0.030
	4	Existing Waste	5.0	91.0	0	451.8	0.080	0.013	0.024	7142.9	7142.9	14255.7	NC	0.119	0.030
	4	Existing Waste	5.0	91.0	0	451.8	0.080	0.013	0.024	7594.7	7594.7	14707.5	NC	0.114	0.030
	4	Existing Waste	5.0	91.0	0	451.8	0.080	0.013	0.024	8046.4	8046.4	15159.3	NC	0.109	0.030
	4	Existing Waste	5.0	91.0	0	451.8	0.080	0.013	0.024	8498.2	8498.2	15611.1	NC	0.105	0.030
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	9064.1	9064.1	16176.9	NC	0.128	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	9744.1	9744.1	16856.9	NC	0.121	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	10404.1	10404.1	17516.9	NC	0.193	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	10920.9	10920.9	18033.7	NC	0.223	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	11314.5	11314.5	18427.3	NC	0.217	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	11793.0	11793.0	18905.8	NC	0.277	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	12356.4	12356.4	19469.2	NC	0.267	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12874.8	12874.8	19987.6	NC	0.172	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13348.2	13348.2	20461.0	NC	0.167	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13821.6	13821.6	20934.4	NC	0.162	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	14295.0	14295.0	21407.8	NC	0.158	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	14768.4	14768.4	21881.2	NC	0.154	-
														3.228	0.295
											Total Settlement [ft]			**3.52**	

Variables & Constants	
Point Name	SP-8
Settlement Layer [ft]	129.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-8b	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8235.24	4583.16	721.74	855.58	740.25	660.00	655.00	643.00	625.00	580.00	670.00	722.35

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	129.8	103.0	0	13373.7	-	-	-	-	-	-		-	-
	3	OFL	17.9	135.0	1	-2417.1	-	-	-	-	-	-		-	-
	4	Existing Waste	7.6	91.0	1	-692.4	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	-	135.0	0	0.0	0.102	0.017	0.005	3109.6	3109.6	14858.7	NC	-	-
	3	OFL	-	135.0	0	-	0.102	0.017	0.005	3109.6	3109.6	14858.7	NC	-	-
	4	Existing Waste	5.6	91.0	0	508.9	0.080	0.013	0.024	3364.0	3364.0	15113.1	NC	0.292	0.034
	4	Existing Waste	5.6	91.0	0	508.9	0.080	0.013	0.024	3872.9	3872.9	15622.0	NC	0.271	0.034
	4	Existing Waste	5.6	91.0	0	508.9	0.080	0.013	0.024	4381.8	4381.8	16130.9	NC	0.253	0.034
	4	Existing Waste	5.6	91.0	0	508.9	0.080	0.013	0.024	4890.6	4890.6	16639.7	NC	0.238	0.034
	4	Existing Waste	5.6	91.0	0	508.9	0.080	0.013	0.024	5399.5	5399.5	17148.6	NC	0.225	0.034
	4	Existing Waste	5.6	91.0	0	508.9	0.080	0.013	0.024	5908.4	5908.4	17657.5	NC	0.213	0.034
	4	Existing Waste	5.6	91.0	0	508.9	0.080	0.013	0.024	6417.3	6417.3	18166.4	NC	0.202	0.034
	4	Existing Waste	5.6	91.0	0	508.9	0.080	0.013	0.024	6926.1	6926.1	18675.3	NC	0.193	0.034
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7520.6	7520.6	19269.7	NC	0.208	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	8200.6	8200.6	19949.7	NC	0.197	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	8860.6	8860.6	20609.7	NC	0.313	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9377.4	9377.4	21126.5	NC	0.362	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9771.0	9771.0	21520.1	NC	0.352	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10249.5	10249.5	21998.6	NC	0.448	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10812.9	10812.9	22562.0	NC	0.431	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11331.3	11331.3	23080.4	NC	0.278	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11804.7	11804.7	23553.8	NC	0.270	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12278.1	12278.1	24027.2	NC	0.262	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12751.5	12751.5	24500.6	NC	0.255	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13224.9	13224.9	24974.0	NC	0.248	-
														5.512	0.326
											Total Settlement [ft]			**5.84**	

Variables & Constants	
Point Name	SP-8b
Settlement Layer [ft]	134.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-9	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8193.03	4583.16	723.47	866.13	741.21	660.00	655.00	643.00	625.00	580.00	700.00	714.49

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	138.7	103.0	0	14282.1	-	-	-	-	-	-		-	-
	3	OFL	24.7	135.0	1	-3340.9	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	1.0	135.0	0	133.2	0.102	0.017	0.005	3407.5	3407.5	15833.7	NC	0.067	0.001
	3	OFL	1.0	135.0	0	133.2	0.102	0.017	0.005	3540.7	3540.7	15966.9	NC	0.066	0.001
	4	Existing Waste	1.8	91.0	0	164.9	0.080	0.013	0.024	3689.8	3689.8	16116.0	NC	0.093	0.011
	4	Existing Waste	1.8	91.0	0	164.9	0.080	0.013	0.024	3854.6	3854.6	16280.8	NC	0.091	0.011
	4	Existing Waste	1.8	91.0	0	164.9	0.080	0.013	0.024	4019.5	4019.5	16445.7	NC	0.089	0.011
	4	Existing Waste	1.8	91.0	0	164.9	0.080	0.013	0.024	4184.4	4184.4	16610.6	NC	0.087	0.011
	4	Existing Waste	1.8	91.0	0	164.9	0.080	0.013	0.024	4349.2	4349.2	16775.4	NC	0.085	0.011
	4	Existing Waste	1.8	91.0	0	164.9	0.080	0.013	0.024	4514.1	4514.1	16940.3	NC	0.083	0.011
	4	Existing Waste	1.8	91.0	0	164.9	0.080	0.013	0.024	4679.0	4679.0	17105.2	NC	0.082	0.011
	4	Existing Waste	1.8	91.0	0	164.9	0.080	0.013	0.024	4843.8	4843.8	17270.0	NC	0.080	0.011
	6	Middle Clay	20.0	136.0	0	2720.0	0.102	0.017	0.005	6286.3	6286.3	18712.5	NC	0.966	0.026
	6	Middle Clay	20.0	136.0	0	2720.0	0.102	0.017	0.005	9006.3	9006.3	21432.5	NC	0.768	0.026
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	10686.3	10686.3	23112.5	NC	0.286	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	11203.1	11203.1	23629.3	NC	0.333	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	11596.7	11596.7	24022.9	NC	0.325	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	12075.2	12075.2	24501.4	NC	0.415	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	12638.6	12638.6	25064.8	NC	0.401	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13157.0	13157.0	25583.2	NC	0.260	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13630.4	13630.4	26056.6	NC	0.253	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	14103.8	14103.8	26530.0	NC	0.247	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	14577.2	14577.2	27003.4	NC	0.241	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	15050.6	15050.6	27476.8	NC	0.235	-
														5.552	0.181
												Total Settlement [ft]		5.73	

Variables & Constants	
Point Name	SP-9
Settlement Layer [ft]	136.5
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-9b	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8150.83	4583.16	727.78	876.68	730.80	660.00	655.00	643.00	625.00	580.00	670.00	713.30

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	144.9	103.0	0	14924.7	-	-	-	-	-	-		-	-
	3	OFL	10.0	135.0	1	-1353.1	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	3.7	135.0	0	504.8	0.102	0.017	0.005	1605.5	1605.5	16662.1	NC	0.388	0.005
	3	OFL	3.7	135.0	0	504.8	0.102	0.017	0.005	2110.4	2110.4	17167.0	NC	0.347	0.005
	4	Existing Waste	5.4	91.0	0	492.5	0.080	0.013	0.024	2609.0	2609.0	17665.7	NC	0.360	0.033
	4	Existing Waste	5.4	91.0	0	492.5	0.080	0.013	0.024	3101.6	3101.6	18158.2	NC	0.332	0.033
	4	Existing Waste	5.4	91.0	0	492.5	0.080	0.013	0.024	3594.1	3594.1	18650.8	NC	0.310	0.033
	4	Existing Waste	5.4	91.0	0	492.5	0.080	0.013	0.024	4086.7	4086.7	19143.3	NC	0.290	0.033
	4	Existing Waste	5.4	91.0	0	492.5	0.080	0.013	0.024	4579.2	4579.2	19635.8	NC	0.274	0.033
	4	Existing Waste	5.4	91.0	0	492.5	0.080	0.013	0.024	5071.8	5071.8	20128.4	NC	0.259	0.033
	4	Existing Waste	5.4	91.0	0	492.5	0.080	0.013	0.024	5564.3	5564.3	20620.9	NC	0.246	0.033
	4	Existing Waste	5.4	91.0	0	492.5	0.080	0.013	0.024	6056.8	6056.8	21113.5	NC	0.235	0.033
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6643.1	6643.1	21699.7	NC	0.262	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7323.1	7323.1	22379.7	NC	0.247	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	7983.1	7983.1	23039.7	NC	0.394	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8499.9	8499.9	23556.5	NC	0.454	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8893.5	8893.5	23950.1	NC	0.441	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9372.0	9372.0	24428.6	NC	0.562	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9935.4	9935.4	24992.0	NC	0.541	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10453.8	10453.8	25510.4	NC	0.349	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10927.2	10927.2	25983.8	NC	0.339	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11400.6	11400.6	26457.2	NC	0.329	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11874.0	11874.0	26930.6	NC	0.320	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12347.4	12347.4	27404.0	NC	0.312	-
														7.590	0.327
													Total Settlement [ft]	7.92	

Variables & Constants	
Point Name	SP-9b
Settlement Layer [ft]	140.8
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-10	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8134.31	4583.16	728.61	880.81	731.03	660.00	655.00	643.00	625.00	580.00	670.00	713.56

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	148.2	103.0	0	15264.5	-	-	-	-	-	-		-	-
	3	OFL	9.4	135.0	1	-1271.2	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	4.0	135.0	0	543.0	0.102	0.017	0.005	1542.8	1542.8	17021.0	NC	0.428	0.005
	3	OFL	4.0	135.0	0	543.0	0.102	0.017	0.005	2085.8	2085.8	17564.0	NC	0.380	0.005
	4	Existing Waste	5.4	91.0	0	495.5	0.080	0.013	0.024	2605.1	2605.1	18083.3	NC	0.367	0.033
	4	Existing Waste	5.4	91.0	0	495.5	0.080	0.013	0.024	3100.7	3100.7	18578.9	NC	0.339	0.033
	4	Existing Waste	5.4	91.0	0	495.5	0.080	0.013	0.024	3596.2	3596.2	19074.4	NC	0.316	0.033
	4	Existing Waste	5.4	91.0	0	495.5	0.080	0.013	0.024	4091.8	4091.8	19570.0	NC	0.296	0.033
	4	Existing Waste	5.4	91.0	0	495.5	0.080	0.013	0.024	4587.3	4587.3	20065.5	NC	0.279	0.033
	4	Existing Waste	5.4	91.0	0	495.5	0.080	0.013	0.024	5082.9	5082.9	20561.1	NC	0.264	0.033
	4	Existing Waste	5.4	91.0	0	495.5	0.080	0.013	0.024	5578.4	5578.4	21056.6	NC	0.251	0.033
	4	Existing Waste	5.4	91.0	0	495.5	0.080	0.013	0.024	6074.0	6074.0	21552.2	NC	0.240	0.033
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6661.7	6661.7	22139.9	NC	0.266	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7341.7	7341.7	22819.9	NC	0.251	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	8001.7	8001.7	23479.9	NC	0.400	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8518.5	8518.5	23996.7	NC	0.461	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8912.1	8912.1	24390.3	NC	0.449	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9390.6	9390.6	24868.8	NC	0.571	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9954.0	9954.0	25432.2	NC	0.550	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10472.4	10472.4	25950.6	NC	0.355	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10945.8	10945.8	26424.0	NC	0.344	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11419.2	11419.2	26897.4	NC	0.335	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11892.6	11892.6	27370.8	NC	0.326	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12366.0	12366.0	27844.2	NC	0.317	-
														7.784	0.329
											Total Settlement [ft]			**8.11**	

Variables & Constants	
Point Name	SP-10
Settlement Layer [ft]	141.6
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-10b	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8035.92	4583.16	733.53	905.39	733.05	660.00	655.00	643.00	625.00	580.00	670.00	717.99

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	167.9	103.0	0	17289.9	-	-	-	-	-	-		-	-
	3	OFL	6.5	135.0	1	-880.7	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	4.3	135.0	0	576.7	0.102	0.017	0.005	1169.1	1169.1	19063.3	NC	0.528	0.005
	3	OFL	4.3	135.0	0	576.7	0.102	0.017	0.005	1745.8	1745.8	19639.9	NC	0.458	0.005
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	2307.0	2307.0	20201.2	NC	0.452	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	2852.9	2852.9	20747.1	NC	0.413	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	3398.7	3398.7	21292.9	NC	0.382	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	3944.6	3944.6	21838.8	NC	0.357	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	4490.4	4490.4	22384.6	NC	0.335	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	5036.3	5036.3	22930.5	NC	0.316	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	5582.1	5582.1	23476.3	NC	0.299	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	6128.0	6128.0	24022.2	NC	0.285	0.037
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6740.9	6740.9	24635.1	NC	0.287	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7420.9	7420.9	25315.1	NC	0.272	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	8080.9	8080.9	25975.1	NC	0.434	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8597.7	8597.7	26491.9	NC	0.501	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8991.3	8991.3	26885.5	NC	0.488	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9469.8	9469.8	27364.0	NC	0.622	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10033.2	10033.2	27927.4	NC	0.600	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10551.6	10551.6	28445.8	NC	0.388	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11025.0	11025.0	28919.2	NC	0.377	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11498.4	11498.4	29392.6	NC	0.367	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11971.8	11971.8	29866.0	NC	0.357	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12445.2	12445.2	30339.4	NC	0.348	-
														8.867	0.357
											Total Settlement [ft]			9.22	

Variables & Constants	
Point Name	SP-10b
Settlement Layer [ft]	146.5
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-11	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7975.92	4583.16	736.53	920.38	736.50	660.00	655.00	643.00	625.00	580.00	670.00	722.12

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	179.8	103.0	0	18524.3	-	-	-	-	-	-		-	-
	3	OFL	7.0	135.0	1	-940.4	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	3.7	135.0	0	499.9	0.102	0.017	0.005	1190.3	1190.3	20259.2	NC	0.465	0.005
	3	OFL	3.7	135.0	0	499.9	0.102	0.017	0.005	1690.1	1690.1	20759.1	NC	0.411	0.005
	4	Existing Waste	6.5	91.0	0	592.9	0.080	0.013	0.024	2236.5	2236.5	21305.5	NC	0.510	0.040
	4	Existing Waste	6.5	91.0	0	592.9	0.080	0.013	0.024	2829.5	2829.5	21898.4	NC	0.463	0.040
	4	Existing Waste	6.5	91.0	0	592.9	0.080	0.013	0.024	3422.4	3422.4	22491.3	NC	0.426	0.040
	4	Existing Waste	6.5	91.0	0	592.9	0.080	0.013	0.024	4015.3	4015.3	23084.2	NC	0.396	0.040
	4	Existing Waste	6.5	91.0	0	592.9	0.080	0.013	0.024	4608.2	4608.2	23677.1	NC	0.371	0.040
	4	Existing Waste	6.5	91.0	0	592.9	0.080	0.013	0.024	5201.1	5201.1	24270.1	NC	0.349	0.040
	4	Existing Waste	6.5	91.0	0	592.9	0.080	0.013	0.024	5794.1	5794.1	24863.0	NC	0.330	0.040
	4	Existing Waste	6.5	91.0	0	592.9	0.080	0.013	0.024	6387.0	6387.0	25455.9	NC	0.313	0.040
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7023.4	7023.4	26092.4	NC	0.291	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7703.4	7703.4	26772.4	NC	0.276	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	8363.4	8363.4	27432.4	NC	0.441	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8880.2	8880.2	27949.2	NC	0.511	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9273.8	9273.8	28342.8	NC	0.498	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9752.3	9752.3	28821.3	NC	0.635	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10315.7	10315.7	29384.7	NC	0.614	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10834.1	10834.1	29903.1	NC	0.397	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11307.5	11307.5	30376.5	NC	0.386	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11780.9	11780.9	30849.9	NC	0.376	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12254.3	12254.3	31323.3	NC	0.367	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12727.7	12727.7	31796.7	NC	0.358	-
														9.183	0.381
											Total Settlement [ft]			**9.56**	

Variables & Constants	
Point Name	SP-11
Settlement Layer [ft]	149.5
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

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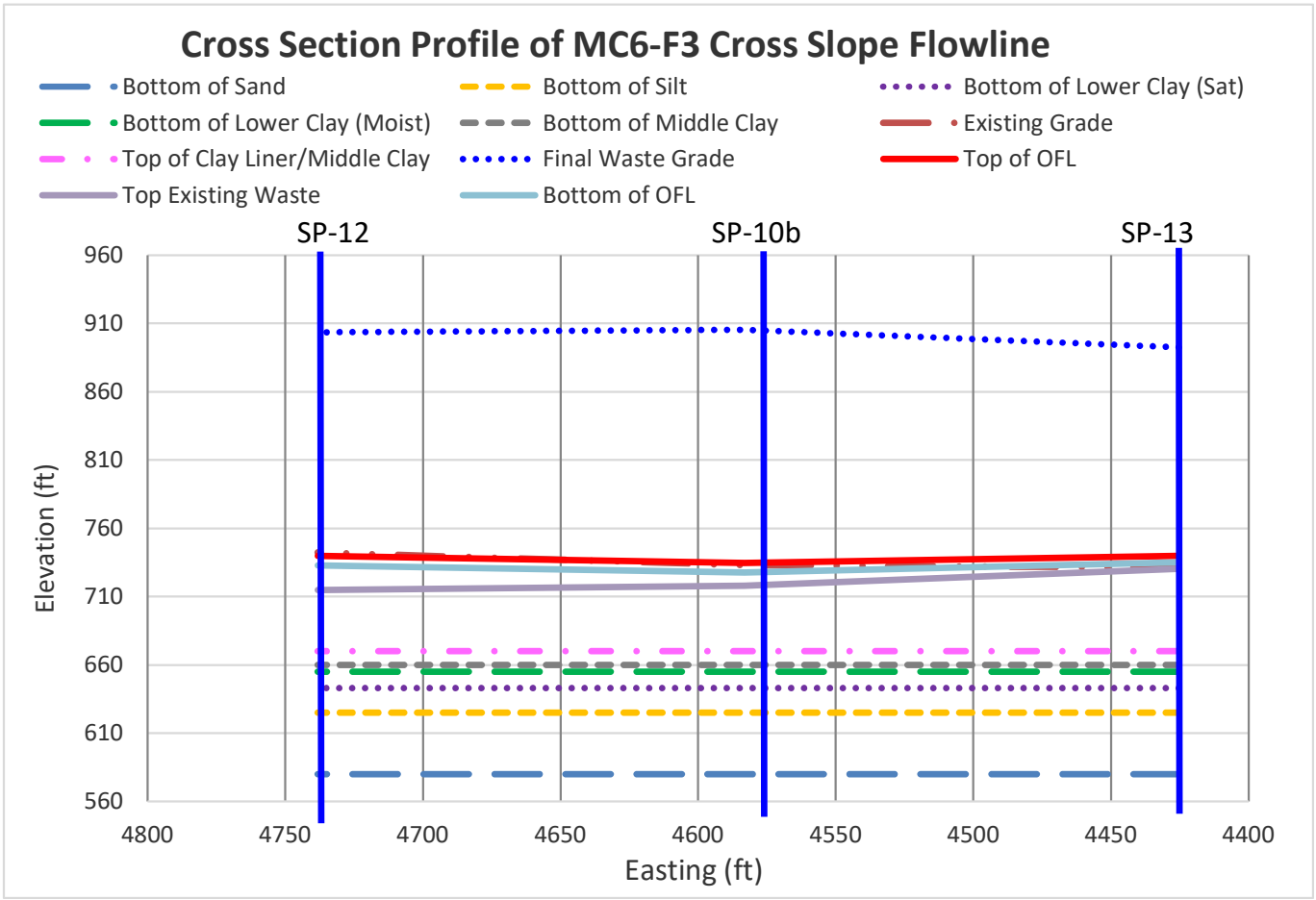
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-F3 Cross Slope Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Waste Grade
Top of OFL
Top Existing Waste
Bottom of OFL
SP-12
SP-10b
SP-13
960
910
860
810
760
710
660
610
560
Elevation (ft)
4800
4750
4700
4650
4600
4550
4500
4450
4400
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
SP-10b	North	East	OFL	Final Grades	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8035.92	4583.16	734.63	905.39	733.05	660.00	655.00	643.00	625.00	580.00	670.00	717.99

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	166.8	103.0	0	17176.6	-	-	-	-	-	-		-	-
	3	OFL	5.4	135.0	1	-732.2	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	4.8	135.0	0	650.9	0.102	0.017	0.005	1057.7	1057.7	18987.1	NC	0.617	0.006
	3	OFL	4.8	135.0	0	650.9	0.102	0.017	0.005	1708.6	1708.6	19638.0	NC	0.522	0.006
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	2307.0	2307.0	20236.4	NC	0.453	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	2852.9	2852.9	20782.3	NC	0.414	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	3398.7	3398.7	21328.1	NC	0.383	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	3944.6	3944.6	21874.0	NC	0.357	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	4490.4	4490.4	22419.8	NC	0.335	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	5036.3	5036.3	22965.7	NC	0.316	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	5582.1	5582.1	23511.5	NC	0.300	0.037
	4	Existing Waste	6.0	91.0	0	545.9	0.080	0.013	0.024	6128.0	6128.0	24057.4	NC	0.285	0.037
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6740.9	6740.9	24670.3	NC	0.287	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7420.9	7420.9	25350.3	NC	0.272	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	8080.9	8080.9	26010.3	NC	0.434	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8597.7	8597.7	26527.1	NC	0.502	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8991.3	8991.3	26920.7	NC	0.489	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9469.8	9469.8	27399.2	NC	0.623	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10033.2	10033.2	27962.6	NC	0.601	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10551.6	10551.6	28481.0	NC	0.388	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11025.0	11025.0	28954.4	NC	0.377	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11498.4	11498.4	29427.8	NC	0.367	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11971.8	11971.8	29901.2	NC	0.358	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12445.2	12445.2	30374.6	NC	0.349	-
														9.028	0.358
											Total Settlement [ft]			9.39	

Variables & Constants	
Point Name	SP-10b
Settlement Layer [ft]	147.6
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grades	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-12	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8035.92	4738.22	739.78	903.60	742.32	660.00	655.00	643.00	625.00	580.00	670.00	714.91

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	159.8	103.0	0	16461.0	-	-	-	-	-	-		-	-
	3	OFL	9.5	135.0	1	-1288.0	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	8.9	135.0	0	1206.4	0.102	0.017	0.005	1891.2	1891.2	18549.2	NC	0.904	0.011
	3	OFL	8.9	135.0	0	1206.4	0.102	0.017	0.005	3097.6	3097.6	19755.6	NC	0.733	0.011
	4	Existing Waste	5.6	91.0	0	510.9	0.080	0.013	0.024	3956.2	3956.2	20614.3	NC	0.322	0.034
	4	Existing Waste	5.6	91.0	0	510.9	0.080	0.013	0.024	4467.1	4467.1	21125.1	NC	0.303	0.034
	4	Existing Waste	5.6	91.0	0	510.9	0.080	0.013	0.024	4977.9	4977.9	21636.0	NC	0.287	0.034
	4	Existing Waste	5.6	91.0	0	510.9	0.080	0.013	0.024	5488.8	5488.8	22146.8	NC	0.272	0.034
	4	Existing Waste	5.6	91.0	0	510.9	0.080	0.013	0.024	5999.7	5999.7	22657.7	NC	0.259	0.034
	4	Existing Waste	5.6	91.0	0	510.9	0.080	0.013	0.024	6510.5	6510.5	23168.6	NC	0.248	0.034
	4	Existing Waste	5.6	91.0	0	510.9	0.080	0.013	0.024	7021.4	7021.4	23679.4	NC	0.237	0.034
	4	Existing Waste	5.6	91.0	0	510.9	0.080	0.013	0.024	7532.2	7532.2	24190.3	NC	0.228	0.034
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	8127.7	8127.7	24785.7	NC	0.247	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	8807.7	8807.7	25465.7	NC	0.235	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	9467.7	9467.7	26125.7	NC	0.377	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9984.5	9984.5	26642.5	NC	0.437	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	10378.1	10378.1	27036.1	NC	0.427	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10856.6	10856.6	27514.6	NC	0.545	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	11420.0	11420.0	28078.0	NC	0.527	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11938.4	11938.4	28596.4	NC	0.341	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12411.8	12411.8	29069.8	NC	0.333	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12885.2	12885.2	29543.2	NC	0.324	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13358.6	13358.6	30016.6	NC	0.316	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13832.0	13832.0	30490.0	NC	0.309	-
														8.212	0.350
											Total Settlement [ft]			**8.56**	

Variables & Constants	
Point Name	SP-12
Settlement Layer [ft]	152.8
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

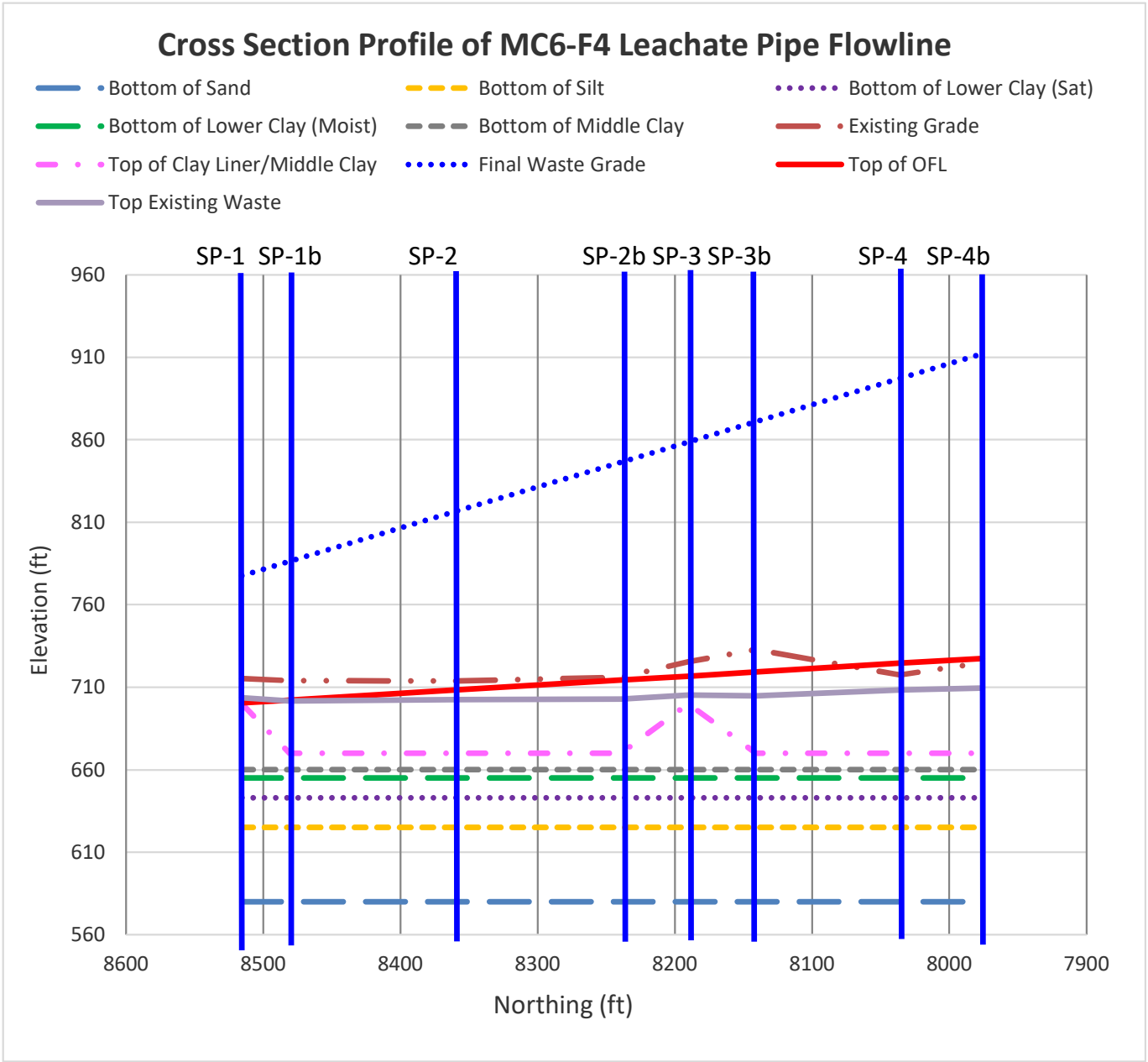
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grades	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-13	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8035.92	4425.42	739.86	892.49	731.21	660.00	655.00	643.00	625.00	580.00	670.00	730.27

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	148.6	103.0	0	15308.6	-	-	-	-	-	-		-	-
	3	OFL	8.7	135.0	0	1168.7	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	0.5	135.0	0	63.3	0.102	0.017	0.005	31.6	31.6	17048.9	NC	0.131	0.001
	3	OFL	0.5	135.0	0	63.3	0.102	0.017	0.005	94.9	94.9	17112.2	NC	0.108	0.001
	4	Existing Waste	7.5	91.0	0	685.5	0.080	0.013	0.024	469.4	469.4	17486.6	NC	0.947	0.046
	4	Existing Waste	7.5	91.0	0	685.5	0.080	0.013	0.024	1154.9	1154.9	18172.2	NC	0.721	0.046
	4	Existing Waste	7.5	91.0	0	685.5	0.080	0.013	0.024	1840.5	1840.5	18857.7	NC	0.609	0.046
	4	Existing Waste	7.5	91.0	0	685.5	0.080	0.013	0.024	2526.0	2526.0	19543.3	NC	0.536	0.046
	4	Existing Waste	7.5	91.0	0	685.5	0.080	0.013	0.024	3211.5	3211.5	20228.8	NC	0.482	0.046
	4	Existing Waste	7.5	91.0	0	685.5	0.080	0.013	0.024	3897.1	3897.1	20914.4	NC	0.440	0.046
	4	Existing Waste	7.5	91.0	0	685.5	0.080	0.013	0.024	4582.6	4582.6	21599.9	NC	0.406	0.046
	4	Existing Waste	7.5	91.0	0	685.5	0.080	0.013	0.024	5268.2	5268.2	22285.5	NC	0.377	0.046
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5951.0	5951.0	22968.2	NC	0.299	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6631.0	6631.0	23648.2	NC	0.282	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	7291.0	7291.0	24308.2	NC	0.447	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7807.8	7807.8	24825.0	NC	0.515	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8201.4	8201.4	25218.6	NC	0.501	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8679.9	8679.9	25697.1	NC	0.636	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9243.3	9243.3	26260.5	NC	0.612	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9761.7	9761.7	26778.9	NC	0.394	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10235.1	10235.1	27252.3	NC	0.383	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10708.5	10708.5	27725.7	NC	0.372	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11181.9	11181.9	28199.1	NC	0.362	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11655.3	11655.3	28672.5	NC	0.352	-
														9.911	0.422
												Total Settlement [ft]		10.33	

Variables & Constants	
Point Name	SP-13
Settlement Layer [ft]	151.2
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-F4 Leachate Pipe Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Waste Grade
Top of OFL
Top Existing Waste
SP-1
SP-1b
SP-2
SP-2b
SP-3
SP-3b
SP-4
SP-4b
960
910
860
810
760
710
660
610
560
Elevation (ft)
8600
8500
8400
8300
8200
8100
8000
7900
Northing (ft)

SETTLEMENT POINT	Coordinates		Elevations									
SP-1	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8515.67	4957.47	700.50	777.57	715.28	660.00	655.00	643.00	625.00	580.00	700.00	703.57

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	73.1	103.0	0	7526.5	-	-	-	-	-	-		-	-
	3	OFL	11.7	135.0	1	-1581.0	-	-	-	-	-	-		-	-
	4	Existing Waste	3.6	91.0	1	-324.7	-	-	-	-	-	-		-	-
	6	Middle Clay	6.5	136.0	1	-884.2	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	-	135.0	0	0.0	0.102	0.017	0.005	2790.0	2790.0	9011.5	NC	-	-
	3	OFL	-	135.0	0	-	0.102	0.017	0.005	2790.0	2790.0	9011.5	NC	-	-
	4	Existing Waste	-	91.0	0	-	0.080	0.013	0.024	2790.0	2790.0	9011.5	NC	-	-
	4	Existing Waste	-	91.0	0	-	0.080	0.013	0.024	2790.0	2790.0	9011.5	NC	-	-
	4	Existing Waste	-	91.0	0	-	0.080	0.013	0.024	2790.0	2790.0	9011.5	NC	-	-
	4	Existing Waste	-	91.0	0	-	0.080	0.013	0.024	2790.0	2790.0	9011.5	NC	-	-
	4	Existing Waste	-	91.0	0	-	0.080	0.013	0.024	2790.0	2790.0	9011.5	NC	-	-
	4	Existing Waste	-	91.0	0	-	0.080	0.013	0.024	2790.0	2790.0	9011.5	NC	-	-
	4	Existing Waste	-	91.0	0	-	0.080	0.013	0.024	2790.0	2790.0	9011.5	NC	-	-
	4	Existing Waste	-	91.0	0	-	0.080	0.013	0.024	2790.0	2790.0	9011.5	NC	-	-
	6	Middle Clay	16.7	136.0	0	2277.9	0.102	0.017	0.005	3928.9	3928.9	10150.5	NC	0.704	0.021
	6	Middle Clay	16.7	136.0	0	2277.9	0.102	0.017	0.005	6206.8	6206.8	12428.4	NC	0.515	0.021
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	7665.8	7665.8	13887.3	NC	0.221	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8182.6	8182.6	14404.1	NC	0.252	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8576.2	8576.2	14797.7	NC	0.243	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9054.7	9054.7	15276.2	NC	0.307	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9618.1	9618.1	15839.6	NC	0.292	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10136.5	10136.5	16358.0	NC	0.187	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10609.9	10609.9	16831.4	NC	0.180	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11083.3	11083.3	17304.8	NC	0.174	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11556.7	11556.7	17778.2	NC	0.168	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12030.1	12030.1	18251.6	NC	0.163	-
														3.407	0.082
											Total Settlement [ft]			**3.49**	

Variables & Constants	
Point Name	SP-1
Settlement Layer [ft]	113.5
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-1b	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8481.11	4957.47	702.23	786.30	713.96	660.00	655.00	643.00	625.00	580.00	670.00	701.70

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	80.1	103.0	0	8247.4	-	-	-	-	-	-		-	-
	3	OFL	12.3	135.0	1	-1655.3	-	-	-	-	-	-		-	-
	4	Existing Waste	6.5	91.0	1	-588.7	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	-	135.0	0	0.0	0.102	0.017	0.005	2244.0	2244.0	9732.4	NC	-	-
	3	OFL	-	135.0	0	-	0.102	0.017	0.005	2244.0	2244.0	9732.4	NC	-	-
	4	Existing Waste	3.2	91.0	0	287.0	0.080	0.013	0.024	2387.4	2387.4	9875.9	NC	0.156	0.019
	4	Existing Waste	3.2	91.0	0	287.0	0.080	0.013	0.024	2674.4	2674.4	10162.8	NC	0.146	0.019
	4	Existing Waste	3.2	91.0	0	287.0	0.080	0.013	0.024	2961.3	2961.3	10449.8	NC	0.138	0.019
	4	Existing Waste	3.2	91.0	0	287.0	0.080	0.013	0.024	3248.3	3248.3	10736.8	NC	0.131	0.019
	4	Existing Waste	3.2	91.0	0	287.0	0.080	0.013	0.024	3535.2	3535.2	11023.7	NC	0.125	0.019
	4	Existing Waste	3.2	91.0	0	287.0	0.080	0.013	0.024	3822.2	3822.2	11310.7	NC	0.119	0.019
	4	Existing Waste	3.2	91.0	0	287.0	0.080	0.013	0.024	4109.2	4109.2	11597.6	NC	0.114	0.019
	4	Existing Waste	3.2	91.0	0	287.0	0.080	0.013	0.024	4396.1	4396.1	11884.6	NC	0.109	0.019
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	4879.6	4879.6	12368.1	NC	0.206	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5559.6	5559.6	13048.1	NC	0.189	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	6219.6	6219.6	13708.1	NC	0.293	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	6736.4	6736.4	14224.9	NC	0.333	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7130.0	7130.0	14618.5	NC	0.320	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	7608.5	7608.5	15097.0	NC	0.402	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8171.9	8171.9	15660.4	NC	0.381	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8690.3	8690.3	16178.8	NC	0.243	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9163.7	9163.7	16652.2	NC	0.233	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9637.1	9637.1	17125.6	NC	0.225	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10110.5	10110.5	17599.0	NC	0.217	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10583.9	10583.9	18072.4	NC	0.209	-
														4.288	0.206
											Total Settlement [ft]			**4.49**	

Variables & Constants	
Point Name	SP-1b
Settlement Layer [ft]	115.2
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-2	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8360.25	4957.47	708.27	816.46	713.79	660.00	655.00	643.00	625.00	580.00	670.00	702.48

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	104.2	103.0	0	10731.3	-	-	-	-	-	-		-	-
	3	OFL	11.3	135.0	1	-1526.9	-	-	-	-	-	-		-	-
	4	Existing Waste	1.2	91.0	1	-109.8	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	-	135.0	0	0.0	0.102	0.017	0.005	1636.7	1636.7	12216.3	NC	-	-
	3	OFL	-	135.0	0	-	0.102	0.017	0.005	1636.7	1636.7	12216.3	NC	-	-
	4	Existing Waste	3.9	91.0	0	355.7	0.080	0.013	0.024	1814.5	1814.5	12394.2	NC	0.261	0.024
	4	Existing Waste	3.9	91.0	0	355.7	0.080	0.013	0.024	2170.2	2170.2	12749.9	NC	0.240	0.024
	4	Existing Waste	3.9	91.0	0	355.7	0.080	0.013	0.024	2525.9	2525.9	13105.6	NC	0.224	0.024
	4	Existing Waste	3.9	91.0	0	355.7	0.080	0.013	0.024	2881.6	2881.6	13461.3	NC	0.209	0.024
	4	Existing Waste	3.9	91.0	0	355.7	0.080	0.013	0.024	3237.3	3237.3	13817.0	NC	0.197	0.024
	4	Existing Waste	3.9	91.0	0	355.7	0.080	0.013	0.024	3593.0	3593.0	14172.7	NC	0.186	0.024
	4	Existing Waste	3.9	91.0	0	355.7	0.080	0.013	0.024	3948.7	3948.7	14528.4	NC	0.177	0.024
	4	Existing Waste	3.9	91.0	0	355.7	0.080	0.013	0.024	4304.4	4304.4	14884.0	NC	0.168	0.024
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	4822.2	4822.2	15401.9	NC	0.257	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5502.2	5502.2	16081.9	NC	0.238	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	6162.2	6162.2	16741.9	NC	0.371	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	6679.0	6679.0	17258.7	NC	0.423	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7072.6	7072.6	17652.3	NC	0.408	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	7551.1	7551.1	18130.8	NC	0.514	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8114.5	8114.5	18694.2	NC	0.489	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8632.9	8632.9	19212.6	NC	0.313	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9106.3	9106.3	19686.0	NC	0.301	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9579.7	9579.7	20159.4	NC	0.291	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10053.1	10053.1	20632.8	NC	0.281	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10526.5	10526.5	21106.2	NC	0.272	-
														5.820	0.243
											Total Settlement [ft]			**6.06**	

Variables & Constants	
Point Name	SP-2
Settlement Layer [ft]	121.3
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-2b	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8239.39	4957.47	714.31	846.44	715.96	660.00	655.00	643.00	625.00	580.00	670.00	702.95

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	128.1	103.0	0	13197.2	-	-	-	-	-	-		-	-
	3	OFL	8.6	135.0	1	-1167.6	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	2.2	135.0	0	294.7	0.102	0.017	0.005	1314.9	1314.9	14829.5	NC	0.234	0.003
	3	OFL	2.2	135.0	0	294.7	0.102	0.017	0.005	1609.7	1609.7	15124.3	NC	0.217	0.003
	4	Existing Waste	4.1	91.0	0	374.8	0.080	0.013	0.024	1944.4	1944.4	15459.0	NC	0.297	0.025
	4	Existing Waste	4.1	91.0	0	374.8	0.080	0.013	0.024	2319.2	2319.2	15833.8	NC	0.275	0.025
	4	Existing Waste	4.1	91.0	0	374.8	0.080	0.013	0.024	2694.0	2694.0	16208.6	NC	0.257	0.025
	4	Existing Waste	4.1	91.0	0	374.8	0.080	0.013	0.024	3068.7	3068.7	16583.3	NC	0.241	0.025
	4	Existing Waste	4.1	91.0	0	374.8	0.080	0.013	0.024	3443.5	3443.5	16958.1	NC	0.228	0.025
	4	Existing Waste	4.1	91.0	0	374.8	0.080	0.013	0.024	3818.3	3818.3	17332.8	NC	0.216	0.025
	4	Existing Waste	4.1	91.0	0	374.8	0.080	0.013	0.024	4193.0	4193.0	17707.6	NC	0.206	0.025
	4	Existing Waste	4.1	91.0	0	374.8	0.080	0.013	0.024	4567.8	4567.8	18082.4	NC	0.197	0.025
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5095.2	5095.2	18609.8	NC	0.287	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5775.2	5775.2	19289.8	NC	0.267	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	6435.2	6435.2	19949.8	NC	0.420	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	6952.0	6952.0	20466.6	NC	0.481	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7345.6	7345.6	20860.2	NC	0.465	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	7824.1	7824.1	21338.7	NC	0.588	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8387.5	8387.5	21902.1	NC	0.563	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8905.9	8905.9	22420.5	NC	0.361	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9379.3	9379.3	22893.9	NC	0.349	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9852.7	9852.7	23367.3	NC	0.338	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10326.1	10326.1	23840.7	NC	0.327	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10799.5	10799.5	24314.1	NC	0.317	-
														7.131	0.259
											Total Settlement [ft]			**7.39**	

Variables & Constants	
Point Name	SP-2b
Settlement Layer [ft]	127.3
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-3	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8190.21	4957.47	716.77	858.66	725.49	660.00	655.00	643.00	625.00	580.00	700.00	705.26

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	137.9	103.0	0	14202.8	-	-	-	-	-	-		-	-
	3	OFL	15.7	135.0	1	-2122.1	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	2.3	135.0	0	304.6	0.102	0.017	0.005	2274.4	2274.4	15840.1	NC	0.194	0.003
	3	OFL	2.3	135.0	0	304.6	0.102	0.017	0.005	2579.0	2579.0	16144.7	NC	0.183	0.003
	4	Existing Waste	0.7	91.0	0	59.8	0.080	0.013	0.024	2761.2	2761.2	16326.9	NC	0.041	0.004
	4	Existing Waste	0.7	91.0	0	59.8	0.080	0.013	0.024	2821.0	2821.0	16386.7	NC	0.040	0.004
	4	Existing Waste	0.7	91.0	0	59.8	0.080	0.013	0.024	2880.8	2880.8	16446.5	NC	0.040	0.004
	4	Existing Waste	0.7	91.0	0	59.8	0.080	0.013	0.024	2940.6	2940.6	16506.4	NC	0.039	0.004
	4	Existing Waste	0.7	91.0	0	59.8	0.080	0.013	0.024	3000.5	3000.5	16566.2	NC	0.039	0.004
	4	Existing Waste	0.7	91.0	0	59.8	0.080	0.013	0.024	3060.3	3060.3	16626.0	NC	0.039	0.004
	4	Existing Waste	0.7	91.0	0	59.8	0.080	0.013	0.024	3120.1	3120.1	16685.8	NC	0.038	0.004
	4	Existing Waste	0.7	91.0	0	59.8	0.080	0.013	0.024	3179.9	3179.9	16745.7	NC	0.038	0.004
	6	Middle Clay	20.0	136.0	0	2720.0	0.102	0.017	0.005	4569.8	4569.8	18135.6	NC	1.221	0.026
	6	Middle Clay	20.0	136.0	0	2720.0	0.102	0.017	0.005	7289.8	7289.8	20855.6	NC	0.931	0.026
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	8969.8	8969.8	22535.6	NC	0.342	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9486.6	9486.6	23052.4	NC	0.396	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9880.2	9880.2	23446.0	NC	0.385	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10358.7	10358.7	23924.5	NC	0.491	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10922.1	10922.1	24487.9	NC	0.473	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11440.5	11440.5	25006.3	NC	0.306	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11913.9	11913.9	25479.7	NC	0.297	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12387.3	12387.3	25953.1	NC	0.289	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12860.7	12860.7	26426.5	NC	0.281	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13334.1	13334.1	26899.9	NC	0.274	-
														6.378	0.128
													Total Settlement [ft]	**6.51**	

Variables & Constants	
Point Name	SP-3
Settlement Layer [ft]	129.8
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-3b	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8141.04	4957.47	719.23	870.94	732.81	660.00	655.00	643.00	625.00	580.00	670.00	704.77

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	147.7	103.0	0	15213.7	-	-	-	-	-	-		-	-
	3	OFL	20.6	135.0	1	-2778.7	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	3.7	135.0	0	503.5	0.102	0.017	0.005	3030.4	3030.4	16950.4	NC	0.284	0.005
	3	OFL	3.7	135.0	0	503.5	0.102	0.017	0.005	3533.9	3533.9	17453.9	NC	0.264	0.005
	4	Existing Waste	4.3	91.0	0	395.5	0.080	0.013	0.024	3983.4	3983.4	17903.4	NC	0.227	0.027
	4	Existing Waste	4.3	91.0	0	395.5	0.080	0.013	0.024	4379.0	4379.0	18298.9	NC	0.216	0.027
	4	Existing Waste	4.3	91.0	0	395.5	0.080	0.013	0.024	4774.5	4774.5	18694.5	NC	0.206	0.027
	4	Existing Waste	4.3	91.0	0	395.5	0.080	0.013	0.024	5170.0	5170.0	19090.0	NC	0.197	0.027
	4	Existing Waste	4.3	91.0	0	395.5	0.080	0.013	0.024	5565.5	5565.5	19485.5	NC	0.189	0.027
	4	Existing Waste	4.3	91.0	0	395.5	0.080	0.013	0.024	5961.0	5961.0	19881.0	NC	0.182	0.027
	4	Existing Waste	4.3	91.0	0	395.5	0.080	0.013	0.024	6356.6	6356.6	20276.5	NC	0.175	0.027
	4	Existing Waste	4.3	91.0	0	395.5	0.080	0.013	0.024	6752.1	6752.1	20672.1	NC	0.169	0.027
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7289.8	7289.8	21209.8	NC	0.237	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	7969.8	7969.8	21889.8	NC	0.224	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	8629.8	8629.8	22549.8	NC	0.357	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9146.6	9146.6	23066.6	NC	0.412	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	9540.2	9540.2	23460.2	NC	0.401	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10018.7	10018.7	23938.7	NC	0.511	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	10582.1	10582.1	24502.1	NC	0.492	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11100.5	11100.5	25020.5	NC	0.318	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11573.9	11573.9	25493.9	NC	0.309	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12047.3	12047.3	25967.3	NC	0.300	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12520.7	12520.7	26440.7	NC	0.292	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12994.1	12994.1	26914.1	NC	0.285	-
														6.246	0.274
											Total Settlement [ft]			**6.52**	

Variables & Constants	
Point Name	SP-3b
Settlement Layer [ft]	132.2
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-4	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8035.92	4957.47	724.49	897.17	717.38	660.00	655.00	643.00	625.00	580.00	670.00	708.31

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	168.7	103.0	0	17374.3	-	-	-	-	-	-		-	-
	3	OFL	7.1	135.0	0	959.8	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	4.5	135.0	0	612.2	0.102	0.017	0.005	306.1	306.1	19180.2	NC	0.831	0.006
	3	OFL	4.5	135.0	0	612.2	0.102	0.017	0.005	918.3	918.3	19792.4	NC	0.617	0.006
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	1442.3	1442.3	20316.4	NC	0.440	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	1878.0	1878.0	20752.1	NC	0.400	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	2313.8	2313.8	21187.9	NC	0.368	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	2749.5	2749.5	21623.6	NC	0.343	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	3185.3	3185.3	22059.4	NC	0.322	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	3621.0	3621.0	22495.1	NC	0.304	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	4056.7	4056.7	22930.8	NC	0.288	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	4492.5	4492.5	23366.6	NC	0.274	0.029
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5050.4	5050.4	23924.5	NC	0.345	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5730.4	5730.4	24604.5	NC	0.323	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	6390.4	6390.4	25264.5	NC	0.510	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	6907.2	6907.2	25781.3	NC	0.587	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7300.8	7300.8	26174.9	NC	0.569	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	7779.3	7779.3	26653.4	NC	0.722	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8342.7	8342.7	27216.8	NC	0.693	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8861.1	8861.1	27735.2	NC	0.446	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9334.5	9334.5	28208.6	NC	0.432	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9807.9	9807.9	28682.0	NC	0.419	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10281.3	10281.3	29155.4	NC	0.407	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10754.7	10754.7	29628.8	NC	0.396	-
														10.038	0.298
											Total Settlement [ft]			**10.34**	

Variables & Constants	
Point Name	SP-4
Settlement Layer [ft]	137.4
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

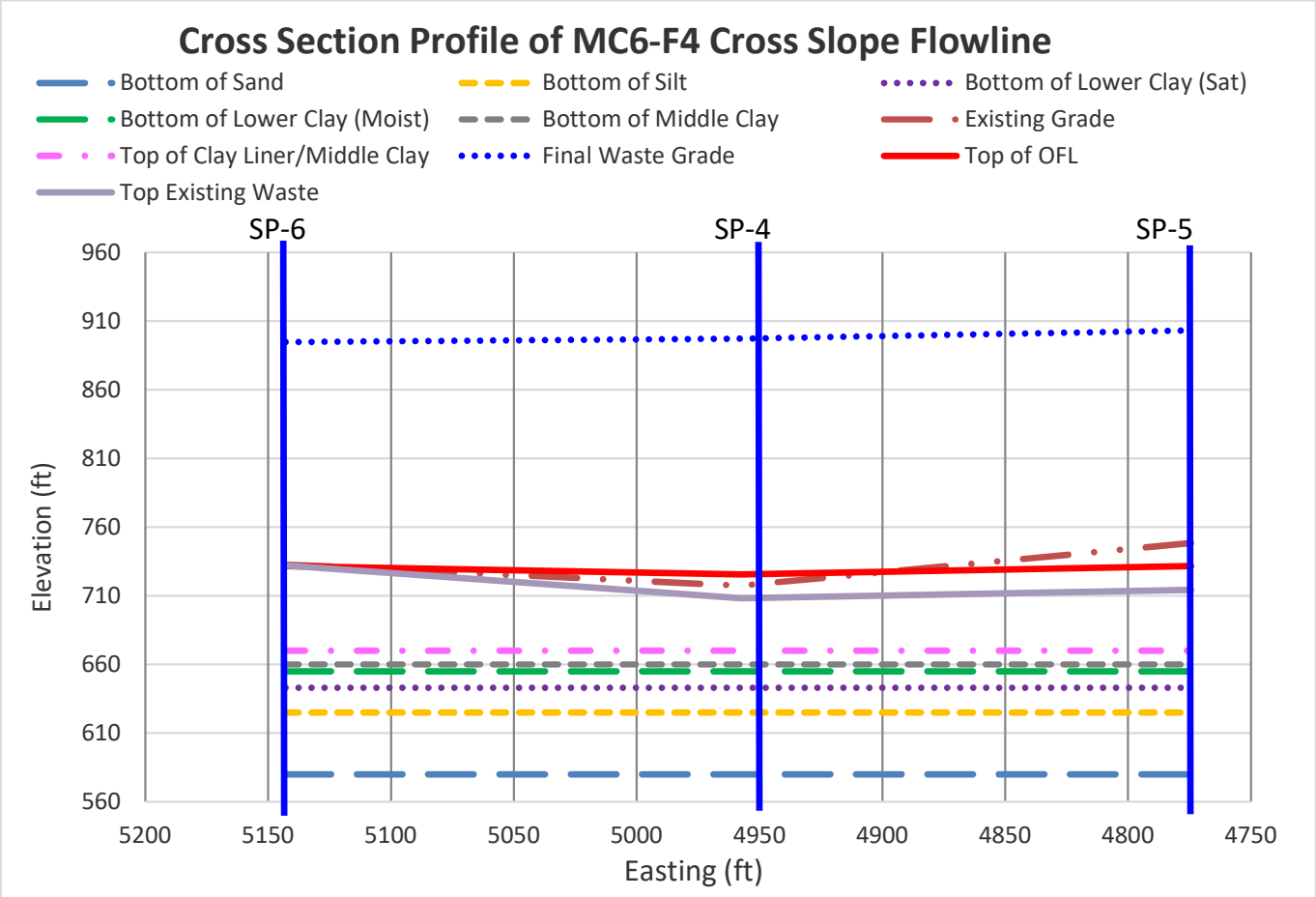
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-4b	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7975.92	4957.47	727.49	912.14	724.87	660.00	655.00	643.00	625.00	580.00	670.00	709.53

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	180.7	103.0	0	18607.7	-	-	-	-	-	-		-	-
	3	OFL	4.4	135.0	1	-592.3	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	5.5	135.0	0	739.3	0.102	0.017	0.005	962.0	962.0	20462.3	NC	0.742	0.007
	3	OFL	5.5	135.0	0	739.3	0.102	0.017	0.005	1701.3	1701.3	21201.7	NC	0.612	0.007
	4	Existing Waste	4.9	91.0	0	449.7	0.080	0.013	0.024	2295.8	2295.8	21796.2	NC	0.386	0.030
	4	Existing Waste	4.9	91.0	0	449.7	0.080	0.013	0.024	2745.5	2745.5	22245.9	NC	0.359	0.030
	4	Existing Waste	4.9	91.0	0	449.7	0.080	0.013	0.024	3195.2	3195.2	22695.6	NC	0.337	0.030
	4	Existing Waste	4.9	91.0	0	449.7	0.080	0.013	0.024	3644.9	3644.9	23145.2	NC	0.317	0.030
	4	Existing Waste	4.9	91.0	0	449.7	0.080	0.013	0.024	4094.6	4094.6	23594.9	NC	0.301	0.030
	4	Existing Waste	4.9	91.0	0	449.7	0.080	0.013	0.024	4544.3	4544.3	24044.6	NC	0.286	0.030
	4	Existing Waste	4.9	91.0	0	449.7	0.080	0.013	0.024	4994.0	4994.0	24494.3	NC	0.273	0.030
	4	Existing Waste	4.9	91.0	0	449.7	0.080	0.013	0.024	5443.7	5443.7	24944.0	NC	0.261	0.030
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6008.5	6008.5	25508.8	NC	0.320	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6688.5	6688.5	26188.8	NC	0.302	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	7348.5	7348.5	26848.8	NC	0.481	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7865.3	7865.3	27365.6	NC	0.556	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8258.9	8258.9	27759.2	NC	0.540	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8737.4	8737.4	28237.7	NC	0.688	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9300.8	9300.8	28801.1	NC	0.663	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9819.2	9819.2	29319.5	NC	0.428	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10292.6	10292.6	29792.9	NC	0.415	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10766.0	10766.0	30266.3	NC	0.404	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11239.4	11239.4	30739.7	NC	0.393	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11712.8	11712.8	31213.1	NC	0.383	-
														9.448	0.308
												Total Settlement [ft]		**9.76**	

Variables & Constants	
Point Name	SP-4b
Settlement Layer [ft]	140.5
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-F4 Cross Slope Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Waste Grade
Top of OFL
Top Existing Waste
SP-6
SP-4
SP-5
960
910
860
810
760
710
660
610
560
Elevation (ft)
5200
5150
5100
5050
5000
4950
4900
4850
4800
4750
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-4	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8035.92	4957.47	725.59	897.17	717.38	660.00	655.00	643.00	625.00	580.00	670.00	708.31

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	167.6	103.0	0	17261.0	-	-	-	-	-	-		-	-
	3	OFL	8.2	135.0	0	1108.3	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	4.5	135.0	0	612.2	0.102	0.017	0.005	306.1	306.1	19215.4	NC	0.832	0.006
	3	OFL	4.5	135.0	0	612.2	0.102	0.017	0.005	918.3	918.3	19827.6	NC	0.617	0.006
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	1442.3	1442.3	20351.6	NC	0.440	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	1878.0	1878.0	20787.3	NC	0.400	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	2313.8	2313.8	21223.1	NC	0.369	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	2749.5	2749.5	21658.8	NC	0.343	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	3185.3	3185.3	22094.6	NC	0.322	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	3621.0	3621.0	22530.3	NC	0.304	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	4056.7	4056.7	22966.0	NC	0.288	0.029
	4	Existing Waste	4.8	91.0	0	435.7	0.080	0.013	0.024	4492.5	4492.5	23401.8	NC	0.275	0.029
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5050.4	5050.4	23959.7	NC	0.345	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	5730.4	5730.4	24639.7	NC	0.323	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	6390.4	6390.4	25299.7	NC	0.511	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	6907.2	6907.2	25816.5	NC	0.587	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7300.8	7300.8	26210.1	NC	0.570	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	7779.3	7779.3	26688.6	NC	0.723	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8342.7	8342.7	27252.0	NC	0.694	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	8861.1	8861.1	27770.4	NC	0.446	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9334.5	9334.5	28243.8	NC	0.433	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9807.9	9807.9	28717.2	NC	0.420	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10281.3	10281.3	29190.6	NC	0.408	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10754.7	10754.7	29664.0	NC	0.397	-
														10.047	0.298
											Total Settlement [ft]			**10.34**	

Variables & Constants	
Point Name	SP-4
Settlement Layer [ft]	137.4
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-5	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8035.92	4774.37	731.66	903.18	748.37	660.00	655.00	643.00	625.00	580.00	670.00	714.26

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	167.5	103.0	0	17254.7	-	-	-	-	-	-		-	-
	3	OFL	23.7	135.0	1	-3201.0	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	5.2	135.0	0	701.7	0.102	0.017	0.005	3551.9	3551.9	19090.6	NC	0.387	0.007
	3	OFL	5.2	135.0	0	701.7	0.102	0.017	0.005	4253.6	4253.6	19792.3	NC	0.354	0.007
	4	Existing Waste	5.5	91.0	0	503.5	0.080	0.013	0.024	4856.2	4856.2	20394.9	NC	0.276	0.034
	4	Existing Waste	5.5	91.0	0	503.5	0.080	0.013	0.024	5359.7	5359.7	20898.4	NC	0.262	0.034
	4	Existing Waste	5.5	91.0	0	503.5	0.080	0.013	0.024	5863.2	5863.2	21401.9	NC	0.249	0.034
	4	Existing Waste	5.5	91.0	0	503.5	0.080	0.013	0.024	6366.7	6366.7	21905.4	NC	0.238	0.034
	4	Existing Waste	5.5	91.0	0	503.5	0.080	0.013	0.024	6870.2	6870.2	22408.9	NC	0.227	0.034
	4	Existing Waste	5.5	91.0	0	503.5	0.080	0.013	0.024	7373.7	7373.7	22912.4	NC	0.218	0.034
	4	Existing Waste	5.5	91.0	0	503.5	0.080	0.013	0.024	7877.2	7877.2	23415.9	NC	0.209	0.034
	4	Existing Waste	5.5	91.0	0	503.5	0.080	0.013	0.024	8380.7	8380.7	23919.4	NC	0.202	0.034
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	8972.4	8972.4	24511.1	NC	0.223	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	9652.4	9652.4	25191.1	NC	0.212	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	10312.4	10312.4	25851.1	NC	0.341	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	10829.2	10829.2	26367.9	NC	0.397	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	11222.8	11222.8	26761.5	NC	0.387	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	11701.3	11701.3	27240.0	NC	0.495	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	12264.7	12264.7	27803.4	NC	0.480	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	12783.1	12783.1	28321.8	NC	0.311	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13256.5	13256.5	28795.2	NC	0.303	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	13729.9	13729.9	29268.6	NC	0.296	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	14203.3	14203.3	29742.0	NC	0.289	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	14676.7	14676.7	30215.4	NC	0.282	-
														6.638	0.336
											Total Settlement [ft]			**6.97**	

Variables & Constants	
Point Name	SP-5
Settlement Layer [ft]	144.7
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

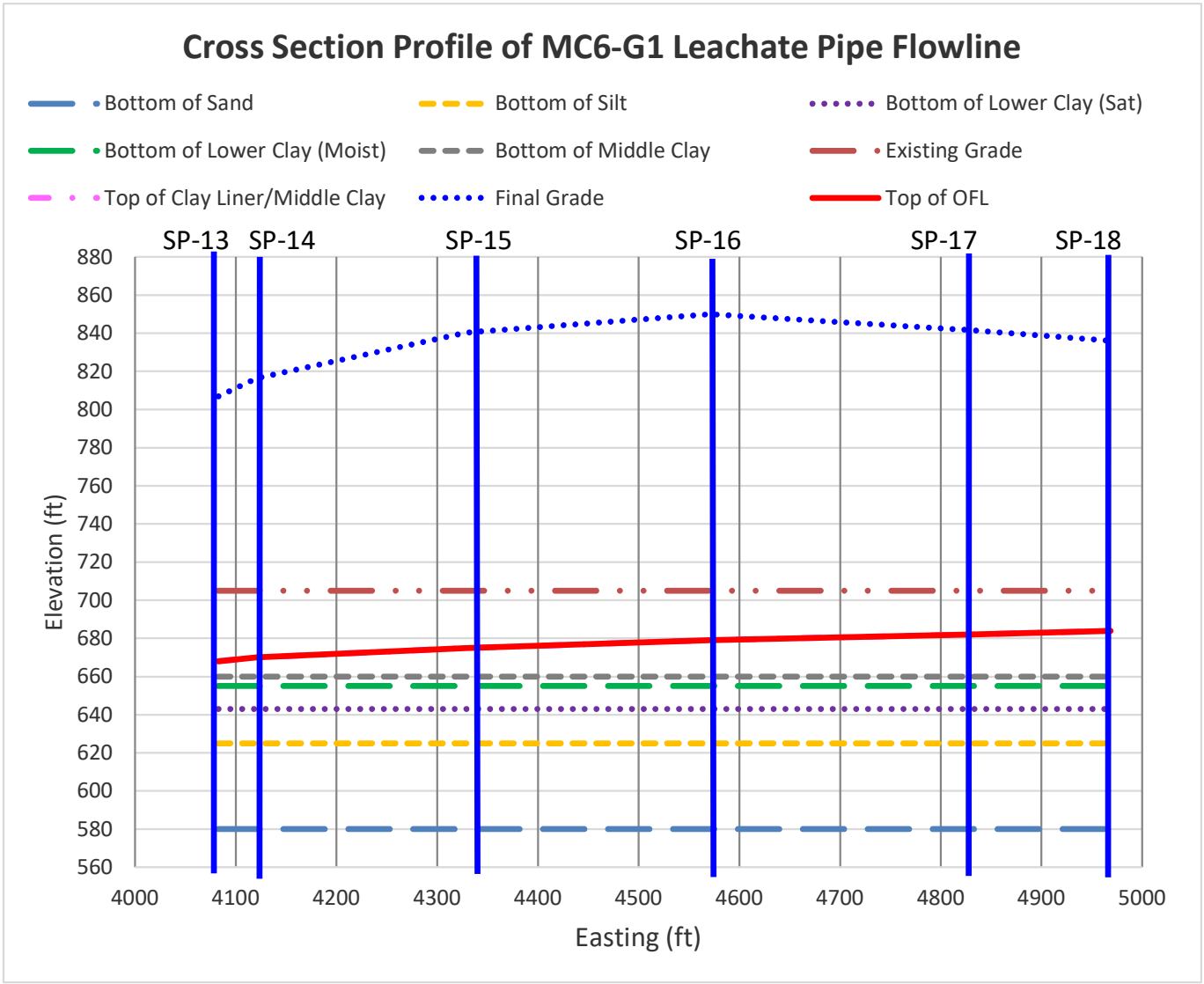
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
SP-6	North	East	OFL	Final Grade	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8035.92	5142.88	731.74	894.72	732.72	660.00	655.00	643.00	625.00	580.00	670.00	732.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]		S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	159.0	103.0	0	16375.7	-	-	-	-	-	-		-	-
	3	OFL	0.7	135.0	1	-96.9	-	-	-	-	-	-		-	-
	4	Existing Waste	7.3	91.0	1	-661.1	-	-	-	-	-	-		-	-
	3	OFL	7.00	135.0	0	945.0	-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
		#N/A		#N/A	0		-	-	-	-	-	-		-	-
Consolidation	3	OFL	-	135.0	0	0.0	0.102	0.017	0.005	758.0	758.0	17860.7	NC	-	-
	3	OFL	-	135.0	0	-	0.102	0.017	0.005	758.0	758.0	17860.7	NC	-	-
	4	Existing Waste	6.8	91.0	0	622.6	0.080	0.013	0.024	1069.3	1069.3	18172.0	NC	0.673	0.042
	4	Existing Waste	6.8	91.0	0	622.6	0.080	0.013	0.024	1691.9	1691.9	18794.6	NC	0.572	0.042
	4	Existing Waste	6.8	91.0	0	622.6	0.080	0.013	0.024	2314.5	2314.5	19417.2	NC	0.506	0.042
	4	Existing Waste	6.8	91.0	0	622.6	0.080	0.013	0.024	2937.1	2937.1	20039.8	NC	0.456	0.042
	4	Existing Waste	6.8	91.0	0	622.6	0.080	0.013	0.024	3559.8	3559.8	20662.4	NC	0.418	0.042
	4	Existing Waste	6.8	91.0	0	622.6	0.080	0.013	0.024	4182.4	4182.4	21285.0	NC	0.387	0.042
	4	Existing Waste	6.8	91.0	0	622.6	0.080	0.013	0.024	4805.0	4805.0	21907.6	NC	0.361	0.042
	4	Existing Waste	6.8	91.0	0	622.6	0.080	0.013	0.024	5427.6	5427.6	22530.3	NC	0.338	0.042
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6078.9	6078.9	23181.6	NC	0.296	0.006
	6	Middle Clay	5.0	136.0	0	680.0	0.102	0.017	0.005	6758.9	6758.9	23861.6	NC	0.279	0.006
	7	Lower Clay (Moist)	5.0	128.0	0	640.0	0.171	0.029	0.009	7418.9	7418.9	24521.6	NC	0.444	0.011
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	7935.7	7935.7	25038.4	NC	0.512	0.014
	8	Lower Clay (Sat)	6.0	65.6	0	393.6	0.171	0.029	0.009	8329.3	8329.3	25432.0	NC	0.497	0.014
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	8807.8	8807.8	25910.5	NC	0.633	-
	9	Silt	9.0	62.6	0	563.4	0.150	-	-	9371.2	9371.2	26473.9	NC	0.609	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	9889.6	9889.6	26992.3	NC	0.392	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10363.0	10363.0	27465.7	NC	0.381	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	10836.4	10836.4	27939.1	NC	0.370	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11309.8	11309.8	28412.5	NC	0.360	-
	10	Sand	9.0	52.6	0	473.4	0.100	-	-	11783.2	11783.2	28885.9	NC	0.350	-
														8.836	0.387
												Total Settlement [ft]		9.22	

Variables & Constants	
Point Name	SP-6
Settlement Layer [ft]	144.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G1 Leachate Pipe Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
SP-13
SP-14
SP-15
SP-16
SP-17
SP-18
Elevation (ft)
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
4000
4100
4200
4300
4400
4500
4600
4700
4800
4900
5000
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-13	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7339.00	4082.84	668.00	806.93	705.00	660.00	655.00	643.00	625.00	580.00	668.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	134.93	103.0	0	13897.8									
	3	OFL	44.00	135.0	1	-5940.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	5940.0	5940.0	15382.8	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	5940.0	5940.0	15382.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5940.0	5940.0	15382.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5940.0	5940.0	15382.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5940.0	5940.0	15382.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5940.0	5940.0	15382.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5940.0	5940.0	15382.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5940.0	5940.0	15382.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5940.0	5940.0	15382.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5940.0	5940.0	15382.8	NC	-	-
	6	Middle Clay	0.50	136.0	0	68.0	0.102	0.017	0.005	5974.0	5974.0	15416.8	NC	0.021	0.001
	6	Middle Clay	0.50	136.0	0	68.0	0.102	0.017	0.005	6042.0	6042.0	15484.8	NC	0.021	0.001
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6396.0	6396.0	15838.8	NC	0.337	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6912.8	6912.8	16355.6	NC	0.384	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7306.4	7306.4	16749.2	NC	0.370	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7784.9	7784.9	17227.7	NC	0.466	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8348.3	8348.3	17791.1	NC	0.444	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8866.7	8866.7	18309.5	NC	0.283	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9340.1	9340.1	18782.9	NC	0.273	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9813.5	9813.5	19256.3	NC	0.263	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10286.9	10286.9	19729.7	NC	0.255	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10760.3	10760.3	20203.1	NC	0.246	-
														3.362	0.040
													Total Settlement [ft]	**3.40**	

Variables & Constants	
Point Name	SP-13
Settlement Layer [ft]	81.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-14	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7339.00	4120.94	670.00	816.46	705.00	660.00	655.00	643.00	625.00	580.00	670.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	142.46	103.0	0	14673.4									
	3	OFL	42.00	135.0	1	-5670.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	5670.0	5670.0	16158.4	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	5670.0	5670.0	16158.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5670.0	5670.0	16158.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5670.0	5670.0	16158.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5670.0	5670.0	16158.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5670.0	5670.0	16158.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5670.0	5670.0	16158.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5670.0	5670.0	16158.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5670.0	5670.0	16158.4	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	5670.0	5670.0	16158.4	NC	-	-
	6	Middle Clay	1.50	136.0	0	204.0	0.102	0.017	0.005	5772.0	5772.0	16260.4	NC	0.069	0.002
	6	Middle Clay	1.50	136.0	0	204.0	0.102	0.017	0.005	5976.0	5976.0	16464.4	NC	0.067	0.002
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6398.0	6398.0	16886.4	NC	0.360	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6914.8	6914.8	17403.2	NC	0.411	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7308.4	7308.4	17796.8	NC	0.397	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7786.9	7786.9	18275.3	NC	0.500	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8350.3	8350.3	18838.7	NC	0.477	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8868.7	8868.7	19357.1	NC	0.305	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9342.1	9342.1	19830.5	NC	0.294	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9815.5	9815.5	20303.9	NC	0.284	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10288.9	10288.9	20777.3	NC	0.275	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10762.3	10762.3	21250.7	NC	0.266	-
														3.706	0.043
													Total Settlement [ft]	**3.75**	

Variables & Constants	
Point Name	SP-14
Settlement Layer [ft]	83.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-15	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7339.00	4329.23	675.00	840.32	705.00	660.00	655.00	643.00	625.00	580.00	675.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	161.32	103.0	0	16616.0									
	3	OFL	37.00	135.0	1	-4995.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4995.0	4995.0	18101.0	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	6	Middle Clay	4.00	136.0	0	544.0	0.102	0.017	0.005	5267.0	5267.0	18373.0	NC	0.221	0.005
	6	Middle Clay	4.00	136.0	0	544.0	0.102	0.017	0.005	5811.0	5811.0	18917.0	NC	0.209	0.005
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6403.0	6403.0	19509.0	NC	0.414	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6919.8	6919.8	20025.8	NC	0.473	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7313.4	7313.4	20419.4	NC	0.458	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7791.9	7791.9	20897.9	NC	0.578	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8355.3	8355.3	21461.3	NC	0.553	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8873.7	8873.7	21979.7	NC	0.355	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9347.1	9347.1	22453.1	NC	0.343	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9820.5	9820.5	22926.5	NC	0.331	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10293.9	10293.9	23399.9	NC	0.321	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10767.3	10767.3	23873.3	NC	0.311	-
														4.567	0.049
													Total Settlement [ft]	**4.62**	

Variables & Constants	
Point Name	SP-15
Settlement Layer [ft]	88.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-16	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7339.00	4571.07	679.00	849.99	705.00	660.00	655.00	643.00	625.00	580.00	679.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	166.99	103.0	0	17200.0									
	3	OFL	33.00	135.0	1	-4455.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4455.0	4455.0	18685.0	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4455.0	4455.0	18685.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4455.0	4455.0	18685.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4455.0	4455.0	18685.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4455.0	4455.0	18685.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4455.0	4455.0	18685.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4455.0	4455.0	18685.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4455.0	4455.0	18685.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4455.0	4455.0	18685.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4455.0	4455.0	18685.0	NC	-	-
	6	Middle Clay	6.00	136.0	0	816.0	0.102	0.017	0.005	4863.0	4863.0	19093.0	NC	0.364	0.008
	6	Middle Clay	6.00	136.0	0	816.0	0.102	0.017	0.005	5679.0	5679.0	19909.0	NC	0.333	0.008
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6407.0	6407.0	20637.0	NC	0.434	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6923.8	6923.8	21153.8	NC	0.498	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7317.4	7317.4	21547.4	NC	0.481	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7795.9	7795.9	22025.9	NC	0.609	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8359.3	8359.3	22589.3	NC	0.583	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8877.7	8877.7	23107.7	NC	0.374	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9351.1	9351.1	23581.1	NC	0.362	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9824.5	9824.5	24054.5	NC	0.350	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10297.9	10297.9	24527.9	NC	0.339	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10771.3	10771.3	25001.3	NC	0.329	-
														5.056	0.054
											Total Settlement [ft]			**5.11**	

Variables & Constants	
Point Name	SP-16
Settlement Layer [ft]	92.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-17	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7338.93	4827.73	682.00	841.74	705.00	660.00	655.00	643.00	625.00	580.00	682.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	155.74	103.0	0	16041.2									
	3	OFL	30.00	135.0	1	-4050.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4050.0	4050.0	17526.2	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	4560.0	4560.0	18036.2	NC	0.457	0.010
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	5580.0	5580.0	19056.2	NC	0.408	0.010
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6410.0	6410.0	19886.2	NC	0.420	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6926.8	6926.8	20403.0	NC	0.481	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7320.4	7320.4	20796.6	NC	0.465	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7798.9	7798.9	21275.1	NC	0.588	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8362.3	8362.3	21838.5	NC	0.563	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8880.7	8880.7	22356.9	NC	0.361	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9354.1	9354.1	22830.3	NC	0.349	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9827.5	9827.5	23303.7	NC	0.337	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10300.9	10300.9	23777.1	NC	0.327	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10774.3	10774.3	24250.5	NC	0.317	-
														5.074	0.058
													Total Settlement [ft]	**5.13**	

Variables & Constants	
Point Name	SP-17
Settlement Layer [ft]	95.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

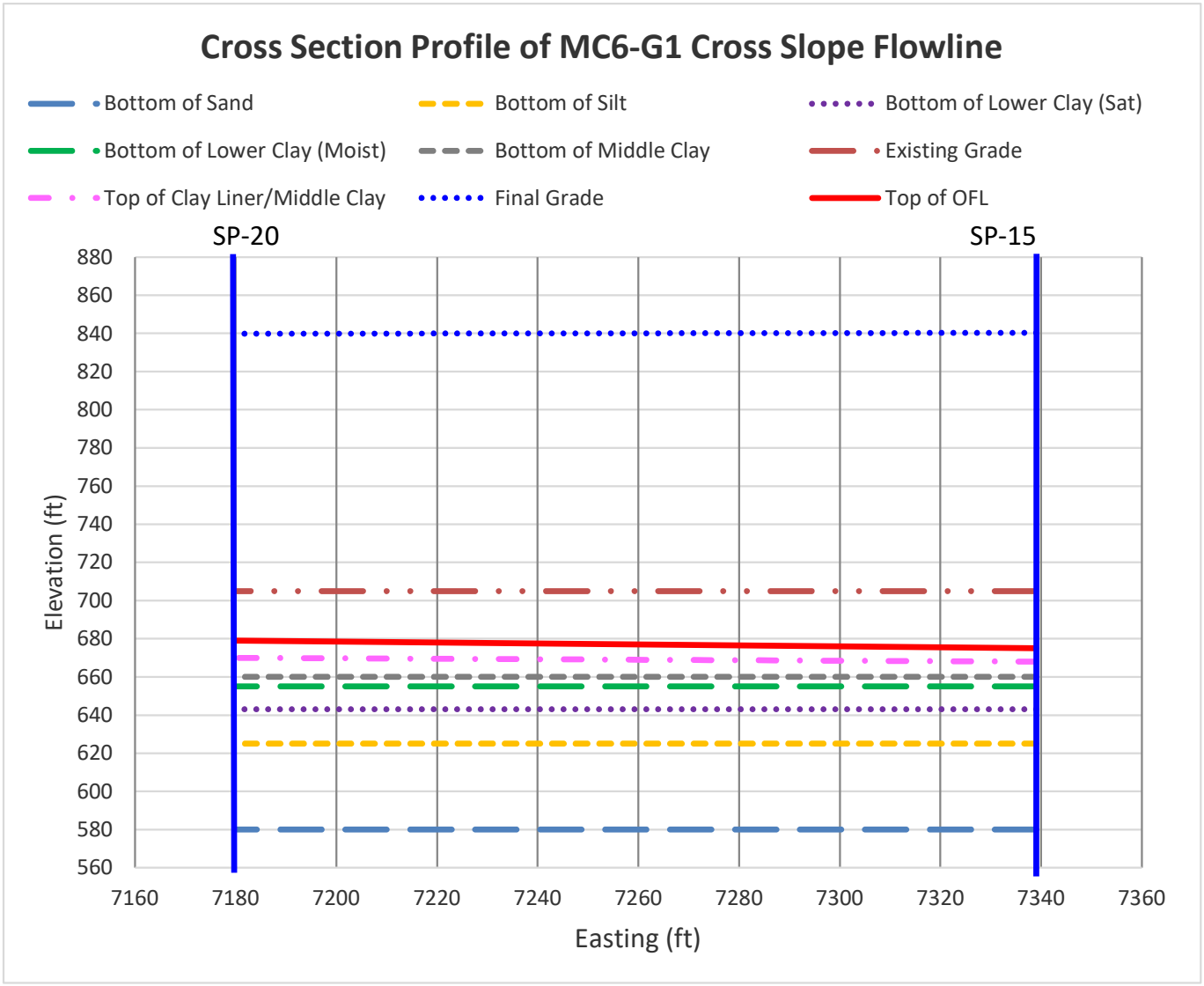
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

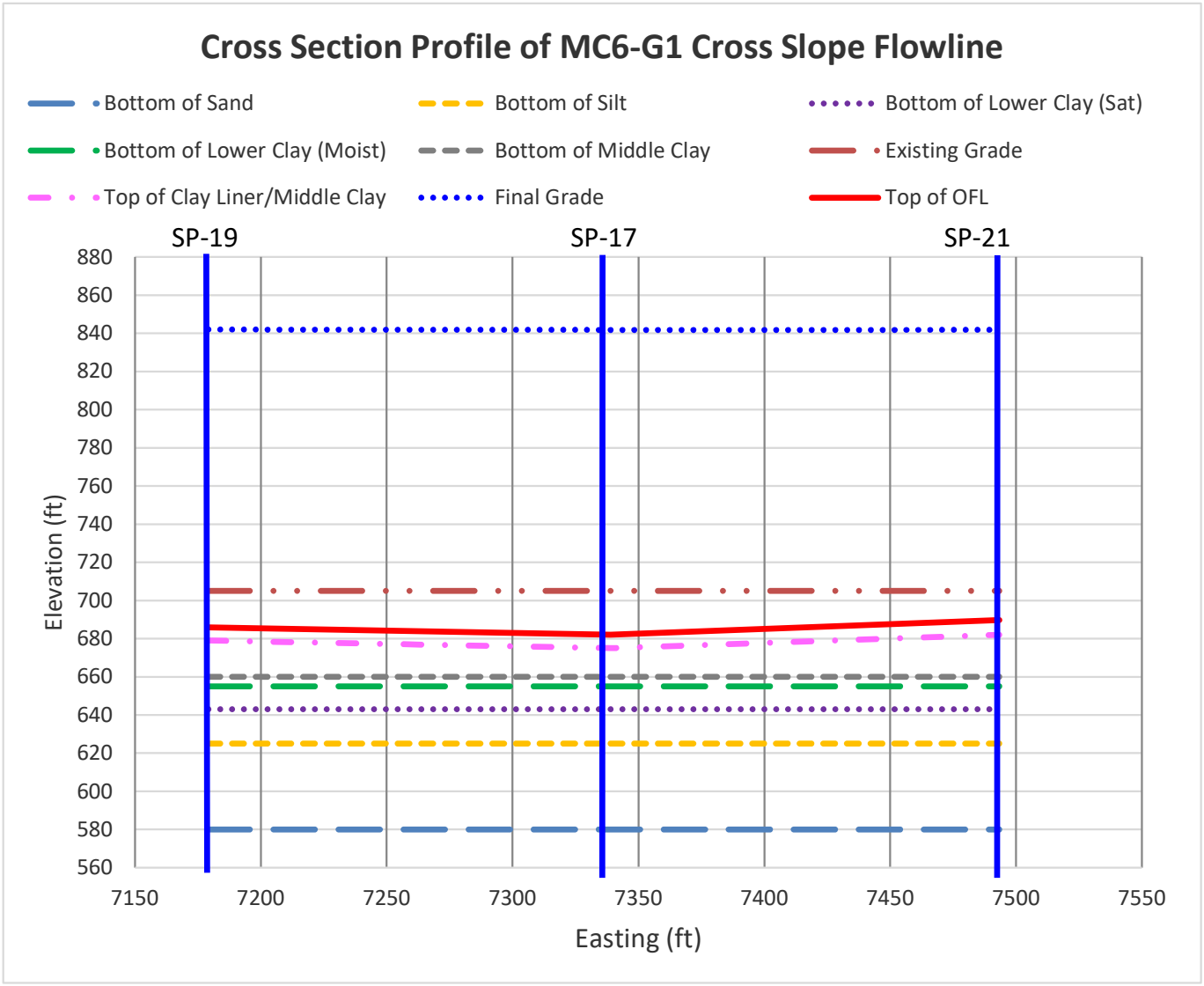
SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-18	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7338.96	4968.72	684.00	836.10	705.00	660.00	655.00	643.00	625.00	580.00	684.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	148.10	103.0	0	15254.3									
	3	OFL	28.00	135.0	1	-3780.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3780.0	3780.0	16739.3	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3780.0	3780.0	16739.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3780.0	3780.0	16739.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3780.0	3780.0	16739.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3780.0	3780.0	16739.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3780.0	3780.0	16739.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3780.0	3780.0	16739.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3780.0	3780.0	16739.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3780.0	3780.0	16739.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3780.0	3780.0	16739.3	NC	-	-
	6	Middle Clay	8.50	136.0	0	1156.0	0.102	0.017	0.005	4358.0	4358.0	17317.3	NC	0.520	0.011
	6	Middle Clay	8.50	136.0	0	1156.0	0.102	0.017	0.005	5514.0	5514.0	18473.3	NC	0.455	0.011
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6412.0	6412.0	19371.3	NC	0.411	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6928.8	6928.8	19888.1	NC	0.470	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7322.4	7322.4	20281.7	NC	0.454	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7800.9	7800.9	20760.2	NC	0.574	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8364.3	8364.3	21323.6	NC	0.549	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8882.7	8882.7	21842.0	NC	0.352	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9356.1	9356.1	22315.4	NC	0.340	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9829.5	9829.5	22788.8	NC	0.329	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10302.9	10302.9	23262.2	NC	0.318	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10776.3	10776.3	23735.6	NC	0.309	-
														5.079	0.061
													Total Settlement [ft]	**5.14**	

Variables & Constants	
Point Name	SP-18
Settlement Layer [ft]	97.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G1 Cross Slope Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
SP-20
SP-15
Elevation (ft)
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
7160
7180
7200
7220
7240
7260
7280
7300
7320
7340
7360
Easting (ft)


Cross Section Profile of MC6-G1 Cross Slope Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
SP-19
SP-17
SP-21
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
Elevation (ft)
7150
7200
7250
7300
7350
7400
7450
7500
7550
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-15	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7339.00	4329.23	675.00	840.32	705.00	660.00	655.00	643.00	625.00	580.00	668.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	161.32	103.0	0	16616.0									
	3	OFL	37.00	135.0	1	-4995.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4995.0	4995.0	18101.0	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4995.0	4995.0	18101.0	NC	-	-
	6	Middle Clay	4.00	136.0	0	544.0	0.102	0.017	0.005	5267.0	5267.0	18373.0	NC	0.221	0.005
	6	Middle Clay	4.00	136.0	0	544.0	0.102	0.017	0.005	5811.0	5811.0	18917.0	NC	0.209	0.005
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6403.0	6403.0	19509.0	NC	0.414	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6919.8	6919.8	20025.8	NC	0.473	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7313.4	7313.4	20419.4	NC	0.458	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7791.9	7791.9	20897.9	NC	0.578	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8355.3	8355.3	21461.3	NC	0.553	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8873.7	8873.7	21979.7	NC	0.355	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9347.1	9347.1	22453.1	NC	0.343	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9820.5	9820.5	22926.5	NC	0.331	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10293.9	10293.9	23399.9	NC	0.321	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10767.3	10767.3	23873.3	NC	0.311	-
														4.567	0.049
													Total Settlement [ft]	**4.62**	

Variables & Constants	
Point Name	SP-15
Settlement Layer [ft]	88.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-17	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7338.93	4827.73	682.00	841.74	705.00	660.00	655.00	643.00	625.00	580.00	675.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	155.74	103.0	0	16041.2									
	3	OFL	30.00	135.0	1	-4050.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4050.0	4050.0	17526.2	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4050.0	4050.0	17526.2	NC	-	-
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	4560.0	4560.0	18036.2	NC	0.457	0.010
	6	Middle Clay	7.50	136.0	0	1020.0	0.102	0.017	0.005	5580.0	5580.0	19056.2	NC	0.408	0.010
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6410.0	6410.0	19886.2	NC	0.420	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6926.8	6926.8	20403.0	NC	0.481	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7320.4	7320.4	20796.6	NC	0.465	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7798.9	7798.9	21275.1	NC	0.588	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8362.3	8362.3	21838.5	NC	0.563	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8880.7	8880.7	22356.9	NC	0.361	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9354.1	9354.1	22830.3	NC	0.349	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9827.5	9827.5	23303.7	NC	0.337	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10300.9	10300.9	23777.1	NC	0.327	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10774.3	10774.3	24250.5	NC	0.317	-
														5.074	0.058
													Total Settlement [ft]	**5.13**	

Variables & Constants	
Point Name	SP-17
Settlement Layer [ft]	95.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-19	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7179.21	4823.35	686.00	841.92	705.00	660.00	655.00	643.00	625.00	580.00	679.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	151.92	103.0	0	15647.8									
	3	OFL	26.00	135.0	1	-3510.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3510.0	3510.0	17132.8	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3510.0	3510.0	17132.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3510.0	3510.0	17132.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3510.0	3510.0	17132.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3510.0	3510.0	17132.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3510.0	3510.0	17132.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3510.0	3510.0	17132.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3510.0	3510.0	17132.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3510.0	3510.0	17132.8	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3510.0	3510.0	17132.8	NC	-	-
	6	Middle Clay	9.50	136.0	0	1292.0	0.102	0.017	0.005	4156.0	4156.0	17778.8	NC	0.612	0.012
	6	Middle Clay	9.50	136.0	0	1292.0	0.102	0.017	0.005	5448.0	5448.0	19070.8	NC	0.527	0.012
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6414.0	6414.0	20036.8	NC	0.423	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6930.8	6930.8	20553.6	NC	0.484	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7324.4	7324.4	20947.2	NC	0.468	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7802.9	7802.9	21425.7	NC	0.592	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8366.3	8366.3	21989.1	NC	0.567	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8884.7	8884.7	22507.5	NC	0.363	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9358.1	9358.1	22980.9	NC	0.351	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9831.5	9831.5	23454.3	NC	0.340	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10304.9	10304.9	23927.7	NC	0.329	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10778.3	10778.3	24401.1	NC	0.319	-
														5.376	0.063
													Total Settlement [ft]	**5.44**	

Variables & Constants	
Point Name	SP-19
Settlement Layer [ft]	99.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-20	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7180.19	4317.03	678.98	839.83	705.00	660.00	655.00	643.00	625.00	580.00	670.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	156.85	103.0	0	16155.3									
	3	OFL	33.02	135.0	1	-4457.4									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4457.4	4457.4	17640.3	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	4457.4	4457.4	17640.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4457.4	4457.4	17640.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4457.4	4457.4	17640.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4457.4	4457.4	17640.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4457.4	4457.4	17640.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4457.4	4457.4	17640.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4457.4	4457.4	17640.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4457.4	4457.4	17640.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	4457.4	4457.4	17640.3	NC	-	-
	6	Middle Clay	5.99	136.0	0	814.8	0.102	0.017	0.005	4864.8	4864.8	18047.7	NC	0.348	0.008
	6	Middle Clay	5.99	136.0	0	814.8	0.102	0.017	0.005	5679.6	5679.6	18862.5	NC	0.319	0.008
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6407.0	6407.0	19589.9	NC	0.415	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6923.8	6923.8	20106.7	NC	0.475	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7317.4	7317.4	20500.3	NC	0.459	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7795.9	7795.9	20978.8	NC	0.580	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8359.3	8359.3	21542.2	NC	0.555	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8877.7	8877.7	22060.6	NC	0.356	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9351.1	9351.1	22534.0	NC	0.344	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9824.5	9824.5	23007.4	NC	0.333	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10297.9	10297.9	23480.8	NC	0.322	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10771.3	10771.3	23954.2	NC	0.312	-
														4.818	0.054
													Total Settlement [ft]	**4.87**	

Variables & Constants	
Point Name	SP-20
Settlement Layer [ft]	92.0
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

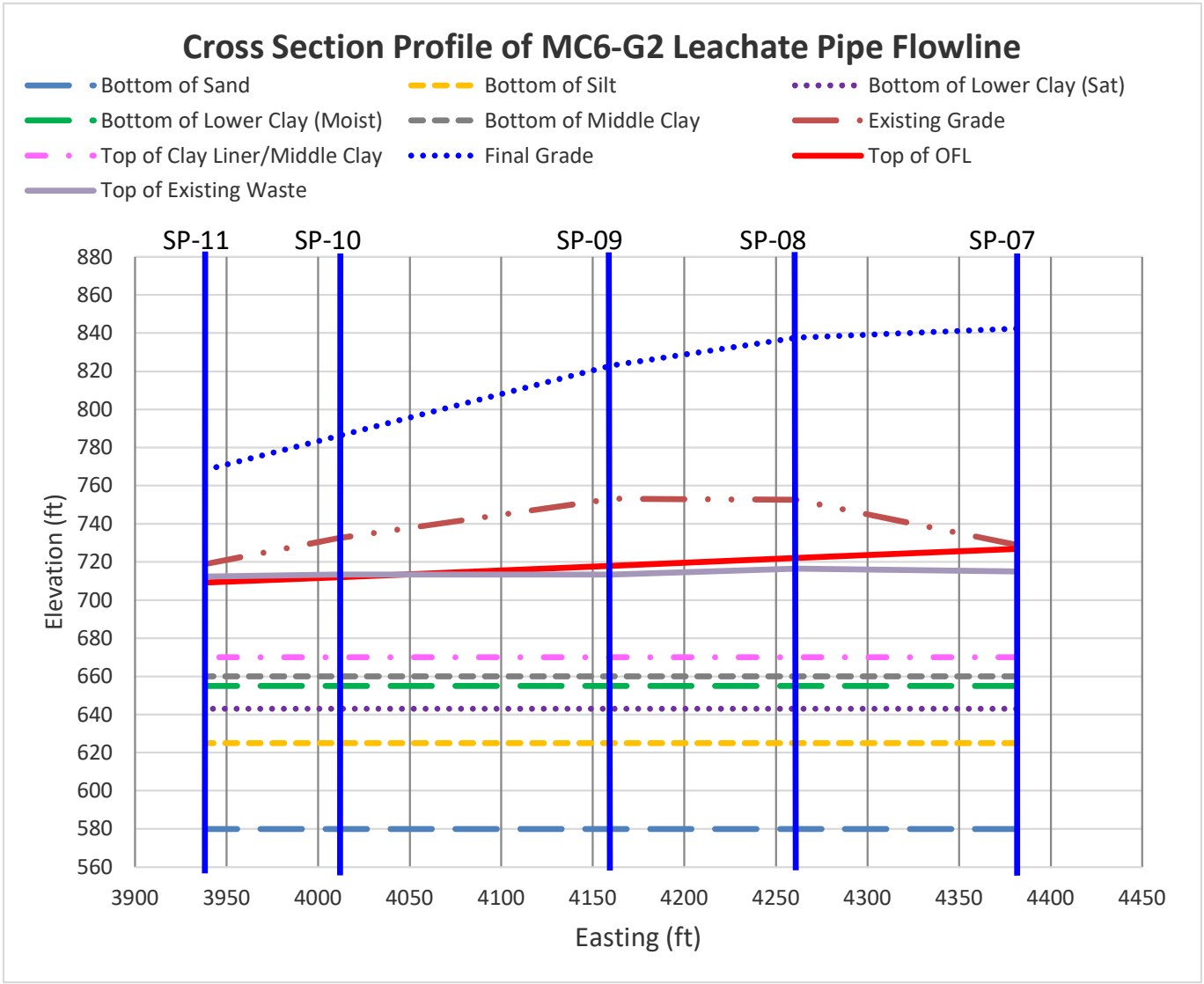
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-21	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7493.33	4826.63	689.69	841.78	705.00	660.00	655.00	643.00	625.00	580.00	682.00	0.00

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	148.09	103.0	0	15253.3									
	3	OFL	22.31	135.0	1	-3011.8									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3011.8	3011.8	16738.3	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3011.8	3011.8	16738.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3011.8	3011.8	16738.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3011.8	3011.8	16738.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3011.8	3011.8	16738.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3011.8	3011.8	16738.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3011.8	3011.8	16738.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3011.8	3011.8	16738.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3011.8	3011.8	16738.3	NC	-	-
	4	Existing Waste	0.00	91.0	0	-	0.080	0.013	0.024	3011.8	3011.8	16738.3	NC	-	-
	6	Middle Clay	11.35	136.0	0	1542.9	0.102	0.017	0.005	3783.3	3783.3	17509.7	NC	0.770	0.014
	6	Middle Clay	11.35	136.0	0	1542.9	0.102	0.017	0.005	5326.2	5326.2	19052.7	NC	0.641	0.014
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6417.7	6417.7	20144.1	NC	0.425	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6934.5	6934.5	20660.9	NC	0.486	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7328.1	7328.1	21054.5	NC	0.470	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7806.6	7806.6	21533.0	NC	0.595	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8370.0	8370.0	22096.4	NC	0.569	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8888.4	8888.4	22614.8	NC	0.365	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9361.8	9361.8	23088.2	NC	0.353	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9835.2	9835.2	23561.6	NC	0.341	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10308.6	10308.6	24035.0	NC	0.331	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10782.0	10782.0	24508.4	NC	0.321	-
														5.667	0.068
													Total Settlement [ft]	**5.74**	

Variables & Constants	
Point Name	SP-21
Settlement Layer [ft]	102.7
ERROR	0.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G2 Leachate Pipe Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top of Existing Waste
SP-11
SP-10
SP-09
SP-08
SP-07
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
Elevation (ft)
3900
3950
4000
4050
4100
4150
4200
4250
4300
4350
4400
4450
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-07	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7843.09	4381.18	726.82	842.39	729.06	660.00	655.00	643.00	625.00	580.00	670.00	714.96

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	111.57	103.0	0	11491.7									
	3	OFL	9.24	135.0	1	-1247.4									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	2.43	135.0	0	328.1	0.102	0.017	0.005	1411.4	1411.4	13140.7	NC	0.240	0.003
	3	OFL	2.43	135.0	0	328.1	0.102	0.017	0.005	1739.5	1739.5	13468.8	NC	0.220	0.003
	4	Existing Waste	5.62	91.0	0	511.4	0.080	0.013	0.024	2159.2	2159.2	13888.5	NC	0.363	0.034
	4	Existing Waste	5.62	91.0	0	511.4	0.080	0.013	0.024	2670.6	2670.6	14399.9	NC	0.329	0.034
	4	Existing Waste	5.62	91.0	0	511.4	0.080	0.013	0.024	3182.0	3182.0	14911.4	NC	0.302	0.034
	4	Existing Waste	5.62	91.0	0	511.4	0.080	0.013	0.024	3693.5	3693.5	15422.8	NC	0.279	0.034
	4	Existing Waste	5.62	91.0	0	511.4	0.080	0.013	0.024	4204.9	4204.9	15934.2	NC	0.260	0.034
	4	Existing Waste	5.62	91.0	0	511.4	0.080	0.013	0.024	4716.3	4716.3	16445.6	NC	0.244	0.034
	4	Existing Waste	5.62	91.0	0	511.4	0.080	0.013	0.024	5227.7	5227.7	16957.0	NC	0.230	0.034
	4	Existing Waste	5.62	91.0	0	511.4	0.080	0.013	0.024	5739.1	5739.1	17468.5	NC	0.217	0.034
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6334.9	6334.9	18064.2	NC	0.232	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	7014.9	7014.9	18744.2	NC	0.218	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7674.9	7674.9	19404.2	NC	0.344	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8191.7	8191.7	19921.0	NC	0.396	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8585.3	8585.3	20314.6	NC	0.384	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9063.8	9063.8	20793.1	NC	0.487	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9627.2	9627.2	21356.5	NC	0.467	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10145.6	10145.6	21874.9	NC	0.300	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10619.0	10619.0	22348.3	NC	0.291	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11092.4	11092.4	22821.7	NC	0.282	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11565.8	11565.8	23295.1	NC	0.274	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12039.2	12039.2	23768.5	NC	0.266	-
														6.625	0.333
											Total Settlement [ft]			6.96	

Variables & Constants	
Point Name	SP-07
Settlement Layer [ft]	139.8
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-08	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7842.87	4261.26	722.00	837.60	752.63	660.00	655.00	643.00	625.00	580.00	670.00	716.45

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	111.60	103.0	0	11494.8									
	3	OFL	36.18	135.0	1	-4884.3									
	4	Existing Waste	1.45	91.0	1	-132.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	5016.3	5016.3	12979.8	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	5016.3	5016.3	12979.8	NC	-	-
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	5272.2	5272.2	13235.7	NC	0.180	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	5784.1	5784.1	13747.6	NC	0.169	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	6295.9	6295.9	14259.5	NC	0.160	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	6807.8	6807.8	14771.4	NC	0.151	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	7319.7	7319.7	15283.2	NC	0.144	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	7831.6	7831.6	15795.1	NC	0.137	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	8343.4	8343.4	16307.0	NC	0.131	0.034
	4	Existing Waste	5.63	91.0	0	511.9	0.080	0.013	0.024	8855.3	8855.3	16818.9	NC	0.125	0.034
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	9451.3	9451.3	17414.8	NC	0.135	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	10131.3	10131.3	18094.8	NC	0.128	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	10791.3	10791.3	18754.8	NC	0.205	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	11308.1	11308.1	19271.6	NC	0.238	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	11701.7	11701.7	19665.2	NC	0.231	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	12180.2	12180.2	20143.7	NC	0.295	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	12743.6	12743.6	20707.1	NC	0.285	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13262.0	13262.0	21225.5	NC	0.184	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13735.4	13735.4	21698.9	NC	0.179	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	14208.8	14208.8	22172.3	NC	0.174	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	14682.2	14682.2	22645.7	NC	0.169	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	15155.6	15155.6	23119.1	NC	0.165	-
														3.586	0.328
													Total Settlement [ft]	**3.91**	

Variables & Constants	
Point Name	SP-08
Settlement Layer [ft]	135.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-09	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7842.87	4160.67	718.00	823.02	753.15	660.00	655.00	643.00	625.00	580.00	670.00	713.41

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	101.02	103.0	0	10405.1									
	3	OFL	39.74	135.0	1	-5364.9									
	4	Existing Waste	2.41	91.0	1	-219.3									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	5584.2	5584.2	11890.1	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	5584.2	5584.2	11890.1	NC	-	-
	4	Existing Waste	5.13	91.0	0	466.4	0.080	0.013	0.024	5817.4	5817.4	12123.2	NC	0.131	0.031
	4	Existing Waste	5.13	91.0	0	466.4	0.080	0.013	0.024	6283.8	6283.8	12589.6	NC	0.124	0.031
	4	Existing Waste	5.13	91.0	0	466.4	0.080	0.013	0.024	6750.1	6750.1	13056.0	NC	0.117	0.031
	4	Existing Waste	5.13	91.0	0	466.4	0.080	0.013	0.024	7216.5	7216.5	13522.4	NC	0.112	0.031
	4	Existing Waste	5.13	91.0	0	466.4	0.080	0.013	0.024	7682.9	7682.9	13988.7	NC	0.107	0.031
	4	Existing Waste	5.13	91.0	0	466.4	0.080	0.013	0.024	8149.3	8149.3	14455.1	NC	0.102	0.031
	4	Existing Waste	5.13	91.0	0	466.4	0.080	0.013	0.024	8615.6	8615.6	14921.5	NC	0.098	0.031
	4	Existing Waste	5.13	91.0	0	466.4	0.080	0.013	0.024	9082.0	9082.0	15387.9	NC	0.094	0.031
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	9655.2	9655.2	15961.1	NC	0.111	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	10335.2	10335.2	16641.1	NC	0.105	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	10995.2	10995.2	17301.1	NC	0.168	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	11512.0	11512.0	17817.9	NC	0.195	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	11905.6	11905.6	18211.5	NC	0.189	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	12384.1	12384.1	18690.0	NC	0.241	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	12947.5	12947.5	19253.4	NC	0.233	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13465.9	13465.9	19771.8	NC	0.150	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	13939.3	13939.3	20245.2	NC	0.146	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	14412.7	14412.7	20718.6	NC	0.142	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	14886.1	14886.1	21192.0	NC	0.138	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	15359.5	15359.5	21665.4	NC	0.134	-
														2.838	0.303
													Total Settlement [ft]	**3.14**	

Variables & Constants	
Point Name	SP-09
Settlement Layer [ft]	131.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-10	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7842.87	4009.79	712.00	785.83	732.26	660.00	655.00	643.00	625.00	580.00	670.00	713.45

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	69.83	103.0	0	7192.5									
	3	OFL	18.81	135.0	1	-2539.3									
	4	Existing Waste	8.45	91.0	1	-769.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3308.3	3308.3	8677.5	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3308.3	3308.3	8677.5	NC	-	-
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	3507.4	3507.4	8876.6	NC	0.141	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	3905.5	3905.5	9274.7	NC	0.131	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	4303.6	4303.6	9672.8	NC	0.123	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	4701.7	4701.7	10070.9	NC	0.116	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	5099.9	5099.9	10469.1	NC	0.109	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	5498.0	5498.0	10867.2	NC	0.104	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	5896.1	5896.1	11265.3	NC	0.098	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	6294.2	6294.2	11663.4	NC	0.094	0.027
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6833.3	6833.3	12202.5	NC	0.128	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	7513.3	7513.3	12882.5	NC	0.119	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	8173.3	8173.3	13542.5	NC	0.188	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8690.1	8690.1	14059.3	NC	0.214	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9083.7	9083.7	14452.9	NC	0.207	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9562.2	9562.2	14931.4	NC	0.261	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10125.6	10125.6	15494.8	NC	0.249	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10644.0	10644.0	16013.2	NC	0.160	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11117.4	11117.4	16486.6	NC	0.154	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11590.8	11590.8	16960.0	NC	0.149	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12064.2	12064.2	17433.4	NC	0.144	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12537.6	12537.6	17906.8	NC	0.139	-
														3.030	0.266
													Total Settlement [ft]	**3.30**	

Variables & Constants	
Point Name	SP-10
Settlement Layer [ft]	125.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

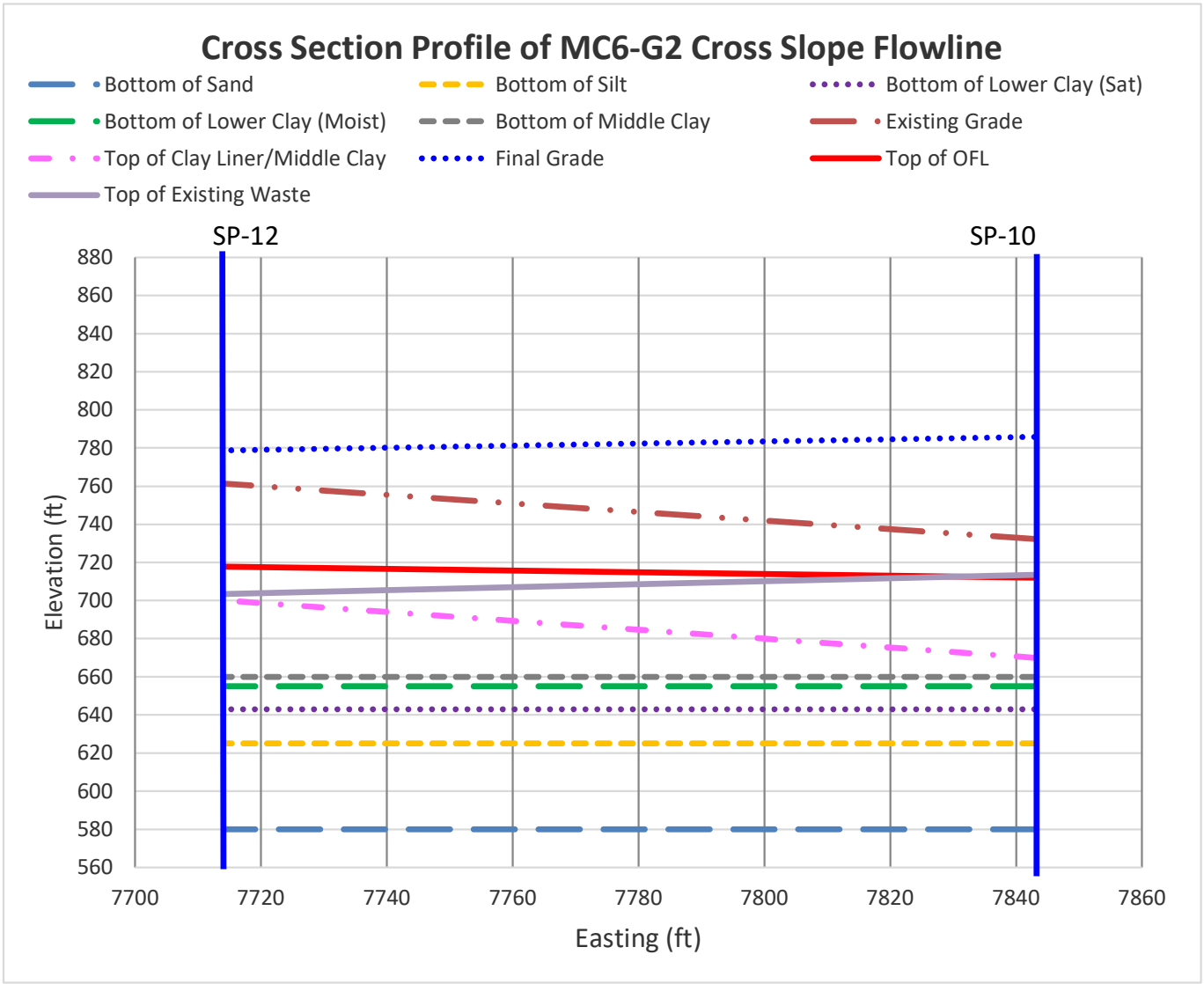
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-11	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7842.87	3939.91	709.22	768.61	719.14	660.00	655.00	643.00	625.00	580.00	670.00	712.34

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	55.39	103.0	0	5705.2									
	3	OFL	6.80	135.0	1	-918.0									
	4	Existing Waste	10.12	91.0	1	-920.9									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1838.9	1838.9	7190.2	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1838.9	1838.9	7190.2	NC	-	-
	4	Existing Waste	4.03	91.0	0	366.5	0.080	0.013	0.024	2022.2	2022.2	7373.4	NC	0.181	0.025
	4	Existing Waste	4.03	91.0	0	366.5	0.080	0.013	0.024	2388.7	2388.7	7739.9	NC	0.165	0.025
	4	Existing Waste	4.03	91.0	0	366.5	0.080	0.013	0.024	2755.2	2755.2	8106.4	NC	0.151	0.025
	4	Existing Waste	4.03	91.0	0	366.5	0.080	0.013	0.024	3121.7	3121.7	8472.9	NC	0.140	0.025
	4	Existing Waste	4.03	91.0	0	366.5	0.080	0.013	0.024	3488.2	3488.2	8839.4	NC	0.130	0.025
	4	Existing Waste	4.03	91.0	0	366.5	0.080	0.013	0.024	3854.7	3854.7	9205.9	NC	0.122	0.025
	4	Existing Waste	4.03	91.0	0	366.5	0.080	0.013	0.024	4221.2	4221.2	9572.4	NC	0.115	0.025
	4	Existing Waste	4.03	91.0	0	366.5	0.080	0.013	0.024	4587.7	4587.7	9938.9	NC	0.108	0.025
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5110.9	5110.9	10462.2	NC	0.159	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5790.9	5790.9	11142.2	NC	0.145	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6450.9	6450.9	11802.2	NC	0.224	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6967.7	6967.7	12319.0	NC	0.254	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7361.3	7361.3	12712.6	NC	0.243	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7839.8	7839.8	13191.1	NC	0.305	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8403.2	8403.2	13754.5	NC	0.289	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8921.6	8921.6	14272.9	NC	0.184	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9395.0	9395.0	14746.3	NC	0.176	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9868.4	9868.4	15219.7	NC	0.169	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10341.8	10341.8	15693.1	NC	0.163	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10815.2	10815.2	16166.5	NC	0.157	-
														3.580	0.249
													Total Settlement [ft]	**3.83**	

Variables & Constants	
Point Name	SP-11
Settlement Layer [ft]	122.2
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G2 Cross Slope Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top of Existing Waste
SP-12
SP-10
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
Elevation (ft)
7700
7720
7740
7760
7780
7800
7820
7840
7860
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-10	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7842.87	4009.79	712.00	785.83	732.26	660.00	655.00	643.00	625.00	580.00	670.00	713.45

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	69.83	103.0	0	7192.5									
	3	OFL	18.81	135.0	1	-2539.3									
	4	Existing Waste	8.45	91.0	1	-769.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3308.3	3308.3	8677.5	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	3308.3	3308.3	8677.5	NC	-	-
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	3507.4	3507.4	8876.6	NC	0.141	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	3905.5	3905.5	9274.7	NC	0.131	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	4303.6	4303.6	9672.8	NC	0.123	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	4701.7	4701.7	10070.9	NC	0.116	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	5099.9	5099.9	10469.1	NC	0.109	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	5498.0	5498.0	10867.2	NC	0.104	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	5896.1	5896.1	11265.3	NC	0.098	0.027
	4	Existing Waste	4.38	91.0	0	398.1	0.080	0.013	0.024	6294.2	6294.2	11663.4	NC	0.094	0.027
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6833.3	6833.3	12202.5	NC	0.128	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	7513.3	7513.3	12882.5	NC	0.119	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	8173.3	8173.3	13542.5	NC	0.188	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8690.1	8690.1	14059.3	NC	0.214	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	9083.7	9083.7	14452.9	NC	0.207	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9562.2	9562.2	14931.4	NC	0.261	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	10125.6	10125.6	15494.8	NC	0.249	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10644.0	10644.0	16013.2	NC	0.160	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11117.4	11117.4	16486.6	NC	0.154	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11590.8	11590.8	16960.0	NC	0.149	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12064.2	12064.2	17433.4	NC	0.144	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12537.6	12537.6	17906.8	NC	0.139	-
														3.030	0.266
													Total Settlement [ft]	**3.30**	

Variables & Constants	
Point Name	SP-10
Settlement Layer [ft]	125.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

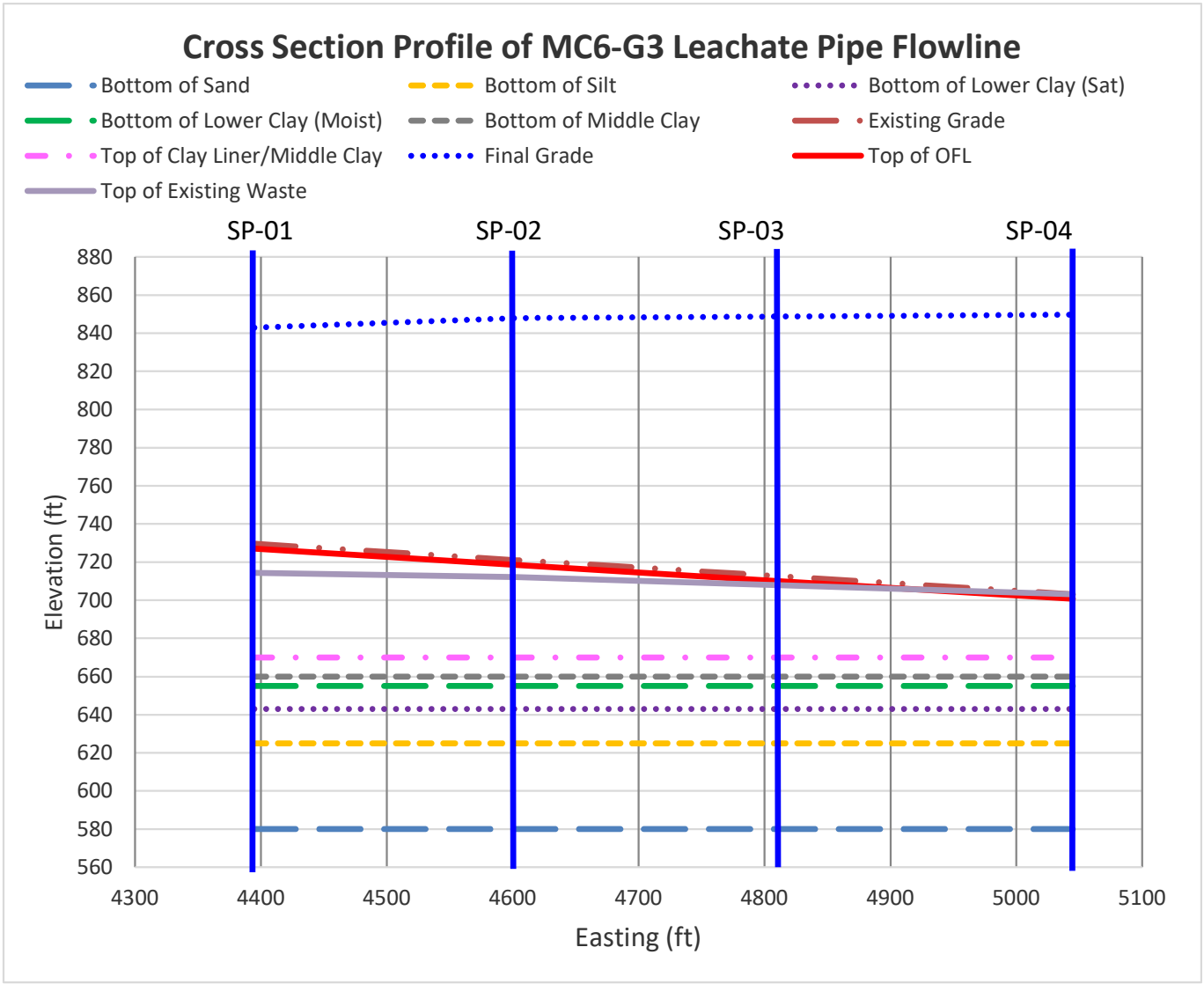
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-12	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7714.37	4002.92	717.80	778.73	761.23	660.00	655.00	643.00	625.00	580.00	700.00	703.41

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	56.93	103.0	0	5863.8									
	3	OFL	50.43	135.0	1	-6808.1									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	3.69	135.0	0	498.8	0.102	0.017	0.005	7057.5	7057.5	7598.2	NC	0.012	0.005
	3	OFL	3.69	135.0	0	498.8	0.102	0.017	0.005	7556.3	7556.3	8097.0	NC	0.011	0.005
	4	Existing Waste	0.43	91.0	0	38.8	0.080	0.013	0.024	7825.1	7825.1	8365.8	NC	0.001	0.003
	4	Existing Waste	0.43	91.0	0	38.8	0.080	0.013	0.024	7863.9	7863.9	8404.6	NC	0.001	0.003
	4	Existing Waste	0.43	91.0	0	38.8	0.080	0.013	0.024	7902.7	7902.7	8443.4	NC	0.001	0.003
	4	Existing Waste	0.43	91.0	0	38.8	0.080	0.013	0.024	7941.5	7941.5	8482.2	NC	0.001	0.003
	4	Existing Waste	0.43	91.0	0	38.8	0.080	0.013	0.024	7980.2	7980.2	8521.0	NC	0.001	0.003
	4	Existing Waste	0.43	91.0	0	38.8	0.080	0.013	0.024	8019.0	8019.0	8559.8	NC	0.001	0.003
	4	Existing Waste	0.43	91.0	0	38.8	0.080	0.013	0.024	8057.8	8057.8	8598.6	NC	0.001	0.003
	4	Existing Waste	0.43	91.0	0	38.8	0.080	0.013	0.024	8096.6	8096.6	8637.4	NC	0.001	0.003
	6	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	9476.0	9476.0	10016.8	NC	0.049	0.026
	6	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	12196.0	12196.0	12736.8	NC	0.038	0.026
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	13876.0	13876.0	14416.8	NC	0.014	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	14392.8	14392.8	14933.6	NC	0.016	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	14786.4	14786.4	15327.2	NC	0.016	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	15264.9	15264.9	15805.7	NC	0.020	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	15828.3	15828.3	16369.1	NC	0.020	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	16346.7	16346.7	16887.5	NC	0.013	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	16820.1	16820.1	17360.9	NC	0.012	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	17293.5	17293.5	17834.3	NC	0.012	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	17766.9	17766.9	18307.7	NC	0.012	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	18240.3	18240.3	18781.1	NC	0.011	-
														0.266	0.120
													Total Settlement [ft]	0.39	

Variables & Constants	
Point Name	SP-12
Settlement Layer [ft]	130.8
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G3 Leachate Pipe Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top of Existing Waste
SP-01
SP-02
SP-03
SP-04
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
Elevation (ft)
4300
4400
4500
4600
4700
4800
4900
5000
5100
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-01	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7842.77	4394.77	726.99	842.94	729.59	660.00	655.00	643.00	625.00	580.00	670.00	714.35

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	111.95	103.0	0	11530.9									
	3	OFL	9.60	135.0	1	-1296.0									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	2.82	135.0	0	380.7	0.102	0.017	0.005	1486.4	1486.4	13206.2	NC	0.273	0.004
	3	OFL	2.82	135.0	0	380.7	0.102	0.017	0.005	1867.1	1867.1	13586.9	NC	0.248	0.004
	4	Existing Waste	5.54	91.0	0	504.5	0.080	0.013	0.024	2309.6	2309.6	14029.5	NC	0.347	0.034
	4	Existing Waste	5.54	91.0	0	504.5	0.080	0.013	0.024	2814.1	2814.1	14534.0	NC	0.316	0.034
	4	Existing Waste	5.54	91.0	0	504.5	0.080	0.013	0.024	3318.6	3318.6	15038.5	NC	0.291	0.034
	4	Existing Waste	5.54	91.0	0	504.5	0.080	0.013	0.024	3823.1	3823.1	15542.9	NC	0.270	0.034
	4	Existing Waste	5.54	91.0	0	504.5	0.080	0.013	0.024	4327.6	4327.6	16047.4	NC	0.252	0.034
	4	Existing Waste	5.54	91.0	0	504.5	0.080	0.013	0.024	4832.0	4832.0	16551.9	NC	0.237	0.034
	4	Existing Waste	5.54	91.0	0	504.5	0.080	0.013	0.024	5336.5	5336.5	17056.4	NC	0.224	0.034
	4	Existing Waste	5.54	91.0	0	504.5	0.080	0.013	0.024	5841.0	5841.0	17560.9	NC	0.212	0.034
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6433.3	6433.3	18153.1	NC	0.230	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	7113.3	7113.3	18833.1	NC	0.216	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7773.3	7773.3	19493.1	NC	0.341	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8290.1	8290.1	20009.9	NC	0.393	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8683.7	8683.7	20403.5	NC	0.381	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9162.2	9162.2	20882.0	NC	0.483	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9725.6	9725.6	21445.4	NC	0.464	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10244.0	10244.0	21963.8	NC	0.298	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10717.4	10717.4	22437.2	NC	0.289	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11190.8	11190.8	22910.6	NC	0.280	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11664.2	11664.2	23384.0	NC	0.272	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	12137.6	12137.6	23857.4	NC	0.264	-
														6.581	0.331
													Total Settlement [ft]	**6.91**	

Variables & Constants	
Point Name	SP-01
Settlement Layer [ft]	140.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-02	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7822.70	4603.12	718.57	847.89	721.01	660.00	655.00	643.00	625.00	580.00	670.00	712.11

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	125.32	103.0	0	12908.0									
	3	OFL	8.90	135.0	1	-1201.5									
	4	Existing Waste	0.54	91.0	1	-49.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1250.6	1250.6	14393.0	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1250.6	1250.6	14393.0	NC	-	-
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	1487.1	1487.1	14629.4	NC	0.413	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	1959.9	1959.9	15102.2	NC	0.369	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	2432.8	2432.8	15575.1	NC	0.335	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	2905.6	2905.6	16048.0	NC	0.309	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	3378.5	3378.5	16520.8	NC	0.287	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	3851.4	3851.4	16993.7	NC	0.268	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	4324.2	4324.2	17466.5	NC	0.252	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	4797.1	4797.1	17939.4	NC	0.238	0.032
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5373.5	5373.5	18515.8	NC	0.274	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6053.5	6053.5	19195.8	NC	0.256	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6713.5	6713.5	19855.8	NC	0.403	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7230.3	7230.3	20372.6	NC	0.462	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7623.9	7623.9	20766.2	NC	0.446	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8102.4	8102.4	21244.7	NC	0.565	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8665.8	8665.8	21808.1	NC	0.541	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9184.2	9184.2	22326.5	NC	0.347	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9657.6	9657.6	22799.9	NC	0.336	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10131.0	10131.0	23273.3	NC	0.325	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10604.4	10604.4	23746.7	NC	0.315	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11077.8	11077.8	24220.1	NC	0.306	-
														7.045	0.307
													Total Settlement [ft]	**7.35**	

Variables & Constants	
Point Name	SP-02
Settlement Layer [ft]	131.6
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-03	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7800.62	4813.09	710.00	848.78	712.66	660.00	655.00	643.00	625.00	580.00	670.00	707.78

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	134.78	103.0	0	13882.3									
	3	OFL	4.88	135.0	1	-658.8									
	4	Existing Waste	4.78	91.0	1	-435.0									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1093.8	1093.8	15367.3	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1093.8	1093.8	15367.3	NC	-	-
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	1281.5	1281.5	15555.0	NC	0.358	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	1656.8	1656.8	15930.4	NC	0.324	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	2032.2	2032.2	16305.8	NC	0.298	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	2407.6	2407.6	16681.2	NC	0.277	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	2783.0	2783.0	17056.5	NC	0.260	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	3158.3	3158.3	17431.9	NC	0.245	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	3533.7	3533.7	17807.3	NC	0.232	0.025
	4	Existing Waste	4.13	91.0	0	375.4	0.080	0.013	0.024	3909.1	3909.1	18182.7	NC	0.220	0.025
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4436.8	4436.8	18710.3	NC	0.319	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5116.8	5116.8	19390.3	NC	0.295	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	5776.8	5776.8	20050.3	NC	0.462	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6293.6	6293.6	20567.1	NC	0.528	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	6687.2	6687.2	20960.7	NC	0.509	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7165.7	7165.7	21439.2	NC	0.643	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	7729.1	7729.1	22002.6	NC	0.613	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8247.5	8247.5	22521.0	NC	0.393	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8720.9	8720.9	22994.4	NC	0.379	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9194.3	9194.3	23467.8	NC	0.366	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9667.7	9667.7	23941.2	NC	0.354	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10141.1	10141.1	24414.6	NC	0.343	-
														7.419	0.254
													Total Settlement [ft]	7.67	

Variables & Constants	
Point Name	SP-03
Settlement Layer [ft]	123.0
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

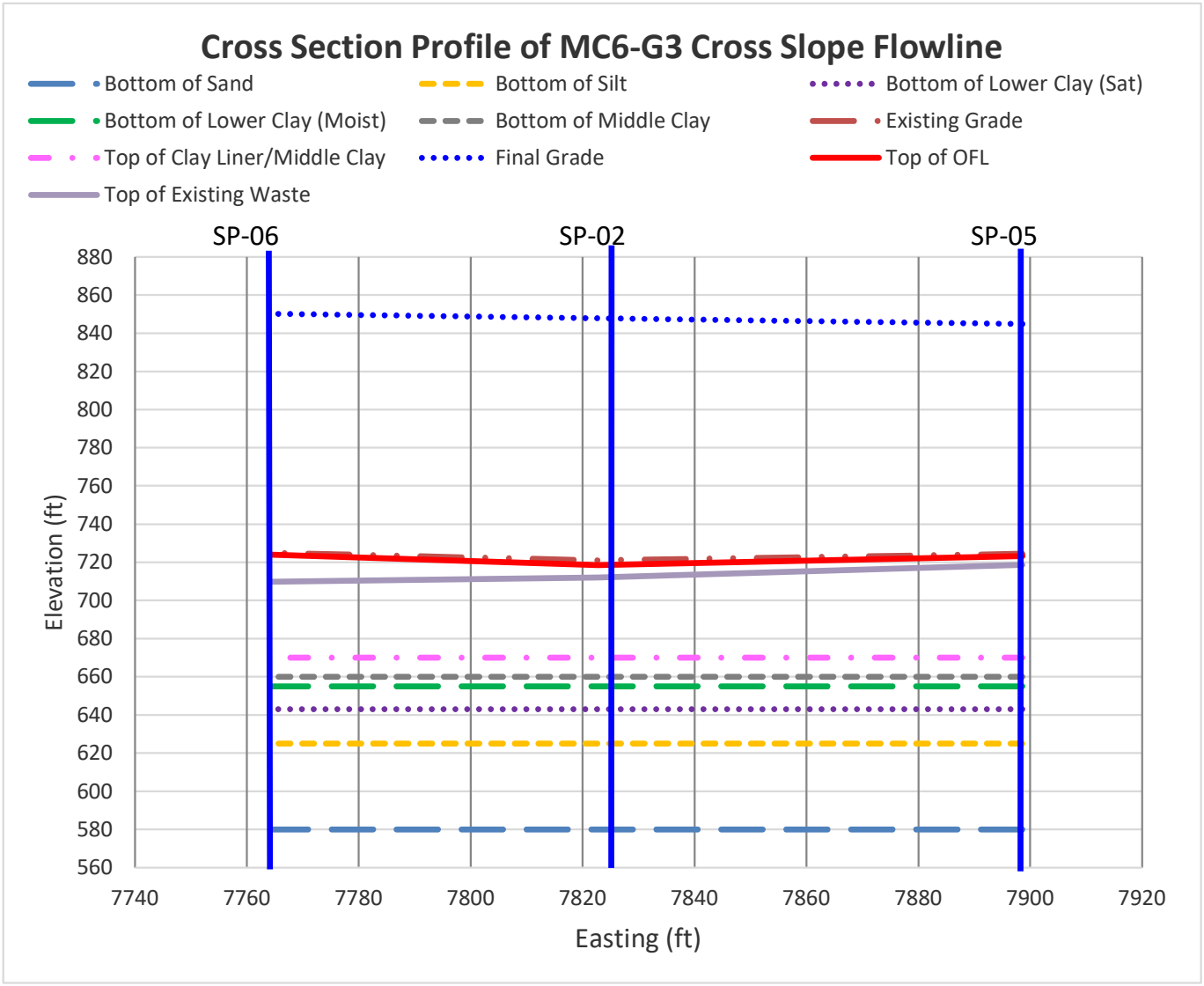
- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-04	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7776.87	5044.82	700.70	849.73	703.09	660.00	655.00	643.00	625.00	580.00	670.00	703.09

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	145.03	103.0	0	14938.1									
	3	OFL	0.00	135.0	1	-									
	4	Existing Waste	9.39	91.0	1	-854.5									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	854.5	854.5	16423.1	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	854.5	854.5	16423.1	NC	-	-
	4	Existing Waste	2.96	91.0	0	269.6	0.080	0.013	0.024	989.3	989.3	16557.9	NC	0.290	0.018
	4	Existing Waste	2.96	91.0	0	269.6	0.080	0.013	0.024	1258.9	1258.9	16827.5	NC	0.267	0.018
	4	Existing Waste	2.96	91.0	0	269.6	0.080	0.013	0.024	1528.5	1528.5	17097.1	NC	0.249	0.018
	4	Existing Waste	2.96	91.0	0	269.6	0.080	0.013	0.024	1798.0	1798.0	17366.6	NC	0.233	0.018
	4	Existing Waste	2.96	91.0	0	269.6	0.080	0.013	0.024	2067.6	2067.6	17636.2	NC	0.221	0.018
	4	Existing Waste	2.96	91.0	0	269.6	0.080	0.013	0.024	2337.2	2337.2	17905.8	NC	0.210	0.018
	4	Existing Waste	2.96	91.0	0	269.6	0.080	0.013	0.024	2606.8	2606.8	18175.4	NC	0.200	0.018
	4	Existing Waste	2.96	91.0	0	269.6	0.080	0.013	0.024	2876.4	2876.4	18445.0	NC	0.191	0.018
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	3351.2	3351.2	18919.8	NC	0.383	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	4031.2	4031.2	19599.8	NC	0.350	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	4691.2	4691.2	20259.8	NC	0.543	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5208.0	5208.0	20776.6	NC	0.617	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	5601.6	5601.6	21170.2	NC	0.592	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6080.1	6080.1	21648.7	NC	0.745	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	6643.5	6643.5	22212.1	NC	0.708	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7161.9	7161.9	22730.5	NC	0.451	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	7635.3	7635.3	23203.9	NC	0.434	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8108.7	8108.7	23677.3	NC	0.419	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	8582.1	8582.1	24150.7	NC	0.404	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9055.5	9055.5	24624.1	NC	0.391	-
														7.898	0.197
													Total Settlement [ft]	**8.10**	

Variables & Constants	
Point Name	SP-04
Settlement Layer [ft]	113.7
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.


Cross Section Profile of MC6-G3 Cross Slope Flowline
Bottom of Sand
Bottom of Silt
Bottom of Lower Clay (Sat)
Bottom of Lower Clay (Moist)
Bottom of Middle Clay
Existing Grade
Top of Clay Liner/Middle Clay
Final Grade
Top of OFL
Top of Existing Waste
SP-06
SP-02
SP-05
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
Elevation (ft)
7740
7760
7780
7800
7820
7840
7860
7880
7900
7920
Easting (ft)

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-02	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7822.70	4603.12	718.57	847.89	721.01	660.00	655.00	643.00	625.00	580.00	670.00	712.11

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	125.32	103.0	0	12908.0									
	3	OFL	8.90	135.0	1	-1201.5									
	4	Existing Waste	0.54	91.0	1	-49.1									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1250.6	1250.6	14393.0	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1250.6	1250.6	14393.0	NC	-	-
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	1487.1	1487.1	14629.4	NC	0.413	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	1959.9	1959.9	15102.2	NC	0.369	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	2432.8	2432.8	15575.1	NC	0.335	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	2905.6	2905.6	16048.0	NC	0.309	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	3378.5	3378.5	16520.8	NC	0.287	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	3851.4	3851.4	16993.7	NC	0.268	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	4324.2	4324.2	17466.5	NC	0.252	0.032
	4	Existing Waste	5.20	91.0	0	472.9	0.080	0.013	0.024	4797.1	4797.1	17939.4	NC	0.238	0.032
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5373.5	5373.5	18515.8	NC	0.274	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6053.5	6053.5	19195.8	NC	0.256	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6713.5	6713.5	19855.8	NC	0.403	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7230.3	7230.3	20372.6	NC	0.462	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7623.9	7623.9	20766.2	NC	0.446	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8102.4	8102.4	21244.7	NC	0.565	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8665.8	8665.8	21808.1	NC	0.541	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9184.2	9184.2	22326.5	NC	0.347	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9657.6	9657.6	22799.9	NC	0.336	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10131.0	10131.0	23273.3	NC	0.325	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10604.4	10604.4	23746.7	NC	0.315	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11077.8	11077.8	24220.1	NC	0.306	-
														7.045	0.307
													Total Settlement [ft]	**7.35**	

Variables & Constants	
Point Name	SP-02
Settlement Layer [ft]	131.6
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-05	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7898.60	4609.46	723.20	844.86	724.47	660.00	655.00	643.00	625.00	580.00	670.00	718.71

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	117.66	103.0	0	12119.0									
	3	OFL	5.76	135.0	1	-777.6									
	4	Existing Waste	2.51	91.0	1	-228.4									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1006.0	1006.0	13604.0	NC	-	-
	3	OFL	0.00	135.0	0	-	0.102	0.017	0.005	1006.0	1006.0	13604.0	NC	-	-
	4	Existing Waste	5.78	91.0	0	525.5	0.080	0.013	0.024	1268.8	1268.8	13866.7	NC	0.480	0.035
	4	Existing Waste	5.78	91.0	0	525.5	0.080	0.013	0.024	1794.3	1794.3	14392.3	NC	0.418	0.035
	4	Existing Waste	5.78	91.0	0	525.5	0.080	0.013	0.024	2319.8	2319.8	14917.8	NC	0.373	0.035
	4	Existing Waste	5.78	91.0	0	525.5	0.080	0.013	0.024	2845.3	2845.3	15443.3	NC	0.339	0.035
	4	Existing Waste	5.78	91.0	0	525.5	0.080	0.013	0.024	3370.9	3370.9	15968.8	NC	0.312	0.035
	4	Existing Waste	5.78	91.0	0	525.5	0.080	0.013	0.024	3896.4	3896.4	16494.4	NC	0.290	0.035
	4	Existing Waste	5.78	91.0	0	525.5	0.080	0.013	0.024	4421.9	4421.9	17019.9	NC	0.270	0.035
	4	Existing Waste	5.78	91.0	0	525.5	0.080	0.013	0.024	4947.4	4947.4	17545.4	NC	0.254	0.035
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5550.2	5550.2	18148.2	NC	0.262	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6230.2	6230.2	18828.2	NC	0.245	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	6890.2	6890.2	19488.2	NC	0.386	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7407.0	7407.0	20005.0	NC	0.443	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7800.6	7800.6	20398.6	NC	0.428	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8279.1	8279.1	20877.1	NC	0.542	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8842.5	8842.5	21440.5	NC	0.519	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9360.9	9360.9	21958.9	NC	0.333	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9834.3	9834.3	22432.3	NC	0.322	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10307.7	10307.7	22905.7	NC	0.312	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10781.1	10781.1	23379.1	NC	0.303	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11254.5	11254.5	23852.5	NC	0.294	-
														7.126	0.335
													Total Settlement [ft]	7.46	

Variables & Constants	
Point Name	SP-05
Settlement Layer [ft]	136.2
ERROR	0.0
# of Layers	20
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations									
	North	East	OFL	Final	Existing	BOTTOM MC	BOTTOM LC (DRY)	BOTTOM LC (SAT)	BOTTOM SILT	BOTTOM SAND	TOP CLAY	TOP EXISTING WASTE
SP-06	[ft]	[ft]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	7764.39	4602.88	724.00	850.23	724.93	660.00	655.00	643.00	625.00	580.00	670.00	709.76

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	σ_0' [psf]	σ_c' [psf]	σ_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Cover	4.00	135.0	0	540.0									
	2	New Waste	122.23	103.0	0	12589.7									
	3	OFL	7.93	135.0	1	-1070.5									
	4	Existing Waste	0.00	91.0	1	-									
	3	OFL	7.00	135.0	0	945.0									
		<none>		-	0	-									
		<none>		-	0	-									
Consolidation	3	OFL	3.62	135.0	0	488.7	0.102	0.017	0.005	1314.9	1314.9	14319.0	NC	0.383	0.005
	3	OFL	3.62	135.0	0	488.7	0.102	0.017	0.005	1803.6	1803.6	14807.7	NC	0.338	0.005
	4	Existing Waste	4.97	91.0	0	452.3	0.080	0.013	0.024	2274.1	2274.1	15278.2	NC	0.329	0.030
	4	Existing Waste	4.97	91.0	0	452.3	0.080	0.013	0.024	2726.4	2726.4	15730.5	NC	0.303	0.030
	4	Existing Waste	4.97	91.0	0	452.3	0.080	0.013	0.024	3178.6	3178.6	16182.8	NC	0.281	0.030
	4	Existing Waste	4.97	91.0	0	452.3	0.080	0.013	0.024	3630.9	3630.9	16635.0	NC	0.263	0.030
	4	Existing Waste	4.97	91.0	0	452.3	0.080	0.013	0.024	4083.2	4083.2	17087.3	NC	0.247	0.030
	4	Existing Waste	4.97	91.0	0	452.3	0.080	0.013	0.024	4535.4	4535.4	17539.6	NC	0.234	0.030
	4	Existing Waste	4.97	91.0	0	452.3	0.080	0.013	0.024	4987.7	4987.7	17991.8	NC	0.222	0.030
	4	Existing Waste	4.97	91.0	0	452.3	0.080	0.013	0.024	5440.0	5440.0	18444.1	NC	0.211	0.030
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6006.1	6006.1	19010.3	NC	0.255	0.006
	6	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6686.1	6686.1	19690.3	NC	0.239	0.006
	7	Lower Clay (Moist)	5.00	128.0	0	640.0	0.171	0.029	0.009	7346.1	7346.1	20350.3	NC	0.378	0.011
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	7862.9	7862.9	20867.1	NC	0.435	0.014
	8	Lower Clay (Sat)	6.00	65.6	0	393.6	0.171	0.029	0.009	8256.5	8256.5	21260.7	NC	0.421	0.014
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	8735.0	8735.0	21739.2	NC	0.535	-
	9	Silt	9.00	62.6	0	563.4	0.150	-	-	9298.4	9298.4	22302.6	NC	0.513	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	9816.8	9816.8	22821.0	NC	0.330	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10290.2	10290.2	23294.4	NC	0.319	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	10763.6	10763.6	23767.8	NC	0.310	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11237.0	11237.0	24241.2	NC	0.301	-
	10	Sand	9.00	52.6	0	473.4	0.100	-	-	11710.4	11710.4	24714.6	NC	0.292	-
														7.137	0.305
													Total Settlement [ft]	**7.44**	

Variables & Constants	
Point Name	SP-06
Settlement Layer [ft]	137.0
ERROR	0.0
# of Layers	22
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

6. Attachment A-2.3 Waste Compression Index Estimation

Attachment A-2.3

Estimation of In-Place Waste Compression Index

CALCULATION SHEET

Client: Wayne Disposal, Inc.	Project No.:	1208070015.005			
Project: WDI Settlement Evaluation	Calculated By:	KF	Date:	5/4/2022	
Calculation: Estimation of In-place Waste Compression Index	Checked By:	XZ	Date:	5/9/2022	
	Approved By:		Date:		

ESTIMATION OF IN-PLACE WASTE COMPRESSION INDEX

OBJECTIVE

The purpose of this calculation is to estimate a modified compression index (C'_c) and a modified secondary compression index (C'_α) suitable for calculating the settlement of the existing in-place waste at WDI under the effect of increasing overburden pressures.

METHODOLOGY AND RESULTS

Existing solid waste layers in-place in Master Cells (MC) I, IV, and V at WDI are expected to compress when subjected to additional overburden pressure resulting from cell construction and landfill operations. Credible estimates of settlement resulting from this compression are needed to evaluate potential settlement effects of overlying cells and to mitigate those effects through engineering design. Compression due to changes in overburden pressure is termed primary compression. Modified compression index C'_c is defined with respect to primary compression settlement (S_c *[ft]*) as

$$S_c = C'_c h_0 \left(log \frac{\sigma_i}{\sigma_0} \right) \quad (1)$$

Where:

C'_c = modified compression index
h_0 = initial compressible layer thickness [ft]
σ_0 = initial overburden pressure acting on the compressible layer [psf]
σ_i = final overburden pressure acting on the compressible layer [psf]

The modified compression index for existing waste at WDI was estimated using three methods:

- McDougall (2011, see Attachment A-2.3.1) reports values of C'_c between 0.08 and 0.26 for old waste, including one example where C'_c = 0.08 for a landfill with waste 15-20 years old. The age of the waste in MC I, IV, and V are above 40 years (Att. A). Therefore, C'_c = 0.08 is accepted as representative for WDI.
- NTH (2008, see Attachment A-2.3.2) monitored settlement profiler conduits embedded beneath MC VI-E and above MC V to measure changes in elevation from the time the MC VI-E floor was constructed above MC V. Table 1 presents the results of relevant data collected from the "North-South" profiler. These data were selected for analysis due to their completeness, the relative length of the profiler conduit compared to others at the site, and the relatively high MC-VI waste fill above the profilers. These attributes make these data more relevant to the objective of this calculation than other profiler data collected. Using the available data about the in-place waste thickness and the thickness of new waste overburden, NTH (2008) calculated values of C'_c from these data. NTH (2008) assumed values of unit weight and layer thickness for various components of the system as

shown in Table 2. NTH (2008) Calculated values of C'_c between 0.04 to 0.17 from these data (Table 1). The median of these calculated C'_c values is 0.07.

Table 1. Estimates of Modified Compression Index from North-South Profiler, March 2007 Monitoring Event Reported by NTH (2008).

Estimation of Modified Compression Index North-South Profiler March 2007 Monitoring Event					
Station	**Baseline Measured Pipe Elevation (ft)**	**Measured Settlement (ft)**	**MC V Waste Thick (ft)**	**MC VI-E Waste Thick (ft)**	**Estimated Mod. Compression Index**
120	736.85	0.51	36.8	13.7	0.07
140	736.51	0.44	36.5	18.1	0.05
160	735.89	0.45	35.9	25.2	0.04
180	736.49	0.63	36	29.5	0.05
200	735.13	0.69	34.1	30.9	0.05
220	734.53	0.49	33	27.7	0.04
240	734.23	0.64	32.2	23.1	0.06
260	733.59	0.55	31.6	21.2	0.06
280	733.08	0.48	31.1	21.3	0.05
300	732.83	0.77	30.3	21.5	0.08
320	732.48	0.62	29.5	21.8	0.07
340	731.61	0.52	29.6	23.2	0.05
360	731.39	0.7	30.4	24	0.07
380	730.9	0.74	30.4	24.2	0.07
400	730.32	0.7	30.3	24.1	0.07
420	729.76	0.66	29.8	21.6	0.07
440	729.33	1.02	29.3	18.8	0.13
460	728.77	0.92	35.8	17.9	0.1
480	729.14	0.8	36.1	17.6	0.09
500	728.29	1.34	35.3	15.1	0.17
520	727.1	1.26	34.1	15.2	0.16
540	726.44	1.09	33.4	14.8	0.15
560	726.08	1.18	33.1	13.5	0.17
580	725.6	1.09	32.6	12.7	0.17
600	724.9	1.08	31.9	12.5	0.17

Table 2. Layer Unit Weights and Thicknesses Assumed by NTH (2008).

Layer	Thickness (ft)	Unit Weight (pcf)
MC VI-E Waste	Varies	111
MC VI-E Liner System	10	135
MC V Gas Venting Layer	1	120
MC V Waste	Varies	60

- NTH (2011a, Attachment A-2.3.3) conducted a full-scale settlement test within the MC IV footprint using a soil stockpile with buried settlement plates.
    a. The settlement plates were positioned such that surveys at the top of the settlement plates reported the elevation at the bottom of the stockpile. By surveying the settlement plates before and after fill placement, NTH (2011a) were able to estimate settlement of the subgrade under the increased overburden from the soil stockpile
    b. Calculations provided by NTH (2011a) assumed an in-place value of C'_c = 0.236 for MC IV waste and compared the resulting estimated settlement to measured values.
    c. CTI conducted an additional evaluation of these settlement data. CTI's calculations differ from NTH (2011a) in two respects: 1) CTI estimated consolidation and the corresponding compression of the underlying clay subgrade and 2) CTI used the 2:1 method to estimate the influence of the stockpile loading on increases in vertical stress within the underlying compressible waste and soil layers. A summary of this evaluation is presented in Table 3. Detailed intermediate calculation steps and equations are provided in Attachment A-2.3.4.
    d. Applying the 2:1 method (Holtz et al., 2011) where the stress at depth q_z is calculated as $q_z = q_0 BL / [(B + z)(L + z)]$ where q_0 is the overburden stress at the ground surface, B is the loaded area width, L is the loaded area length, and z is the depth from ground surface to the layer considered.
        i. CTI subdivided the waste into three layers and the underlying clay into six layers. The purpose of the six clay layers was to calculate different degrees of consolidation relative to the bottom of clay so that a conservative estimate (i.e., reasonably high estimate) of compression at the time the settlement plates were surveyed could be made.
        ii. For the three waste layers, the effective stress at the midpoint of each layer was computed for the following time steps: 1) just prior to stockpile placement (30 years after initial waste placement) and 2) 57 days after stockpile placement, corresponding to the available survey data.
        iii. The incremental change in effective vertical stress for each waste layer due to stockpile placement was then input to Eq. 1 with an assumed trial value of C'_c to estimate the compression of that layer. This value of C'_c was revised until the sum

of the clay and waste layer compression due to the stockpile equaled the measured value.

iv. For the six clay layers, the effective stress at the midpoint of each layer was computed for the following time steps: 1) just prior to stockpile placement (30 years after initial waste placement) and 2) 57 days after stockpile placement, corresponding to the available survey data. The effective stress calculation for each point considers both the excess pore pressure and degree of consolidation from initial waste placement and the excess pore pressure and degree of consolidation from the stockpile placement at the time of the survey measurement. To estimate the remaining excess pore pressure for these two load increments, a degree of consolidation *U* was computed for each point assuming double drainage of the clay (i.e., excess pore pressure can dissipate to both the MC IV waste and the underlying aquifer). Degree of consolidation for each point was computed numerically using Eq. 2, 3, and 4:

$$U = \frac{u_0 - u_z}{u_0} \tag{2}$$

Where:

u_0 = Excess pore pressure prior to consolidation [psf]
u_z = Excess pore pressure following consolidation [psf], calculated using Eq. 3

$$u_z = \sum_{m=0}^{m=25} \left[\frac{2u_0}{M} sin\left(\frac{Mz}{H_{dr}}\right)\right] e^{-M^2 T_v} \tag{3}$$

Where:

m = Integer used to numerically evaluate series
z = Depth to point where consolidation is being calculated [ft] relative to drainage face
M = $(\pi/2)(2m + 1)$
H_{dr} = Drainage length [ft]
T_v = Time factor, calculated using Eq. 4

$$T_v = \frac{c_v t}{H_{dr}^2} \tag{4}$$

Where:

c_v = Coefficient of vertical consolidation [ft^2/day]
t = Elapsed time since excess pore pressure (from load) was applied [days]
σ_i = final overburden pressure acting on the compressible layer [psf]

v. Because the incremental increase in effective stress due to overburden pressure for a given time increment is equal to the total stress minus the remaining excess pore

pressure, the contribution of overburden pressure is equal to the product of the increase in total stress from that increment and the *U* for the same increment.

vi. The compression of each of the six clay layers was computed as shown in Attachment A-2.3.4 using Eq. 1, where the initial effective stress and final effective stress correspond to the values computed prior to and 57 days after stockpile placement, respectively.

vii. Following the calculation of waste and clay layer compression for each layer, the total estimated settlement was computed as the sum of these values and compared to the measured total settlement. The trial value of waste C'c was then adjusted and settlement recomputed until the estimated value matched the measured value.

viii. A summary of the above calculations appears in Table 3. Table 3 reports the total settlement calculated for the clay layers as well as the compression estimated for each waste layer and the corresponding overburden pressure. Finally, Table 3 reports the estimated value of C'_c that yields the measured total settlement. CTI's estimates of C'_c from the settlement plate data are between 0.01 and 0.10. The median value is 0.08.

Table 3. CTI Interpretation of Settlement Plate Data from NTH (2011a)

Settlement Plate	1	2	3	4	5	6	7	8	9	10
Total Settlement (ft)	0.13	0.71	0.73	0.63	0.79	0.78	0.78	0.78	0.79	0.30
Clay Settlement (ft)	0.06	0.06	0.05	0.04	0.05	0.05	0.05	0.06	0.06	0.06
Waste Settlement Upper Layer (ft)	0.03	0.28	0.31	0.27	0.35	0.30	0.36	0.31	0.31	0.10
Surcharge Load (psf)	1488	1488	1471	1454	1506	1488	1471	1471	1488	1488
Waste Settlement Middle Layer (ft)	0.02	0.20	0.20	0.17	0.21	0.22	0.21	0.21	0.22	0.07
Surcharge Load (psf)	1287	1273	1222	1209	1315	1260	1247	1247	1260	1260
Waste Settlement Lower Layer (ft)	0.02	0.17	0.17	0.14	0.17	0.21	0.17	0.20	0.20	0.07
Surcharge Load (psf)	1128	1117	1045	1026	1173	1095	1075	1075	1085	1095
Waste C'c	0.01	0.09	0.09	0.08	0.09	0.10	0.09	0.08	0.08	0.03

Table 4. Layer Unit Weights and Thicknesses Assumed by CTI.

Layer	Thickness (ft)	Unit Weight (pcf)
Stockpile	Varies	111
Existing Cover Soil	Varies [A]	120
MC IV Waste	Varies [B]	77
Clay Subgrade	Varies (Bottom Elevation = 641) [B]	128.1 – 135.7

Notes:
[A] existing cover soil estimated as the difference between the top of waste elevation obtained from prior intercell dike investigations and the surface topo elevation at the time of the test
[B] bottom of waste elevation estimated from prior intercell dike investigations; bottom of clay elevation obtained from hydrogeological investigation cross sections.

Existing solid waste layers in-place in Master Cells (MC) I, IV, and V at WDI are expected to compress over time independently of overburden stress increments, termed secondary compression. Modified secondary compression index C'_α is defined with respect to secondary compression settlement (S_α *[ft]*) as

CALCULATION SHEET

Project No.: 1208070015.005

Client: Wayne Disposal, Inc. | Calculated By: KF | Date: 5/4/2022

Project: WDI Settlement Evaluation | Checked By: XZ | Date: 5/9/2022

Calculation: Estimation of In-place Waste Compression Index | Approved By: | Date:

$$S_\alpha = C'_\alpha h_0 \left(log \frac{t_2}{t_1} \right) \quad (5)$$

Where:

h_0 = initial compressible layer thickness [ft]

t_2 = Time at end of time increment for which secondary compression is being estimated [days]

t_1 = Time at beginning of time increment for which secondary compression is being estimated [days]

The modified secondary compression index for existing waste at WDI was estimated using two methods:

- McDougall (2011, see Attachment A-2.3.1) reports values of C'_α between 0.001 and 0.24 for old waste. The range of values illustrates the uncertainty in this parameter and the difficulty of calculating it relative of other factors affecting measurement of landfill settlement.
- NTH (2011b, see Attachment A-2.3.5) applied a value of C'_α = 0.024 in its calculations based on and examination of site investigation data. Based on the values reported by McDougall (2011), this value is accepted as a conservative estimate for settlement calculation purposes.

CONCLUSIONS

- Full-scale measurements of settlement above existing waste in-place are preferred to laboratory measurements due to the inherent heterogeneity of waste. However, obtaining reliable values of C'_c from these measurements requires methods to extract estimates of waste compression from settlement cause by other factors, such as compression of the underlying soil.
- Based on data from three sources – a published article, a settlement profiler survey of MC V waste, and a stockpile settlement study of MC IV waste – CTI estimates that C'_c = 0.08 is a representative value to use when calculating settlement of existing waste at WDI. These three sources of data show good agreement with each other and represent measurements of settlement that are relevant to the problem of compression due to additional overburden pressure considered for analysis and design of cell floors at WDI.
- Based on available data, a value of C'_α = 0.024 is proposed for use to estimate secondary compression settlement of existing waste.

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Attachment A-2.3.1

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Chapter 3

Settlement: the short and the long of it.

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3.1 INTRODUCTION

Total settlement in municipal solid waste (MSW) landfills can be considerable, from 25% to 50% of original fill thickness (Bjarngard and Edgers, 1990). Some occurs very quickly, i.e. during the filling phase (or short term), but there remains a significant amount of long-term settlement. Deformations of this magnitude and duration impact on the design, operation, closure and future use of landfills. Long-term settlement defines the pre-closure fill level and hence chargeable void space. If the eventual settlement is excessive or unforeseen, the integrity of the capping layer and any infrastructure for the collection of gas or recirculation of leachate may be compromised. Even if the capping layer remains intact it is necessary to avoid depressions on the upper surface where rainwater could pond. Finally, since settlement can continue for many years, it will pose a constraint on future development, including vertical expansion of the site. So, for engineers charged with the design of a landfill facility or site restoration, an understanding of, and ability to analyse, landfill settlement is required.

It is well known that landfill settlement is the product of a combination of processes, including load and biodegradation-related phenomena. Whilst existing geotechnical settlement models can handle load effects, they are limited in their ability to deal with biodegradation. There already exist a number of good reviews of the form and capability of these models, see for example, El-Fadel and Khoury (2000); Elagroudy et al. (2008). In this chapter conventional methods of geotechnical settlement analysis are reviewed as the background to recent work to develop a more fundamental approach to landfill settlement analysis. In addition to the review papers, there are a number of research papers that have contributed to the preparation of this chapter but which have not been expressly cited; these papers are collected in the bibliography.

It should also be noted that this chapter reports on a state of knowledge during and immediately following the International Symposium on Waste Mechanics, which was held in New Orleans following GeoCongress 2008. Papers published in 2009 and 2010 have not been included in this review.

3.2 GENERAL FEATURES

In general, landfill settlement is a combination of short-term load-related displacement and long-term displacement under constant load. The magnitude of short term settlement can be large but is adequately explained by conventional geotechnical techniques. The magnitude and nature of long-term landfill settlement were first elucidated nearly 50 years ago. Merz and Stone (1962) reported that test cells in which biodegradation had been enhanced showed settlement three times greater than that occurring in a control cell. Sowers (1973) concluded that the rate of long-term or secondary settlement is related to the organic content. He gave mathematical interpretations of load and long-term settlement. Yen and Scanlon (1975), from data extending over a 9 year period, observed a logarithmic relationship between rate of settlement and time. The influence of these early studies has been long-lasting, especially Sowers' model, probably due to its simplicity.

Some 15 years later the existence of two distinct phases of secondary settlement was recognised, first by Bjarngard and Edgers (1990) who investigated a large field data set, and later by König, et al. (1996), see Figs. 1 and 2. Explanations were given in terms of settlement mechanisms of the kind first put forward by Sowers. In the first phase settlement occurs at a relatively slow rate and is dominated by mechanical processes whereas in the second phase there is a higher rate of settlement attributed to decomposition.

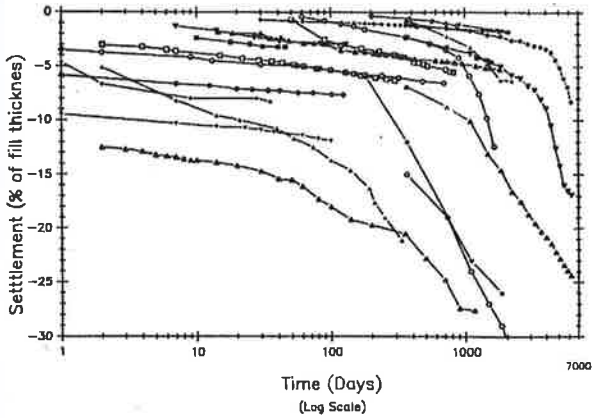

FIG 1. Landfill settlement vs. log time from field case histories (Bjarngard and Edgers (1990)

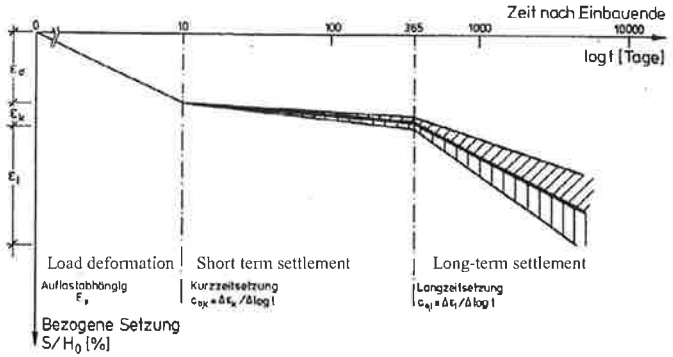

FIG. 2 Idealisation of settlement over time (from König et al, 1996)

3.2.1 Mechanisms of settlement & temporal classification

Settlement in landfilled waste is commonly described in terms of the five mechanisms identified by Sowers (1973):

- Mechanical: distortion, bending and crushing
- Ravelling: erosion, sifting of fines
- Physico-chemical: corrosion, oxidation and combustion
- Bio-chemical decay: fermentation & decay, aerobic and anaerobic
- Interactions, between the four other mechanisms.

Yen and Scanlon (1975) also identified five mechanisms of long-term settlement, which correspond closely to Sowers:

- Movement of fines into large voids
- Strength loss due to chemical & biological reactions
- Material loss due to biodegradation and methane production
- Creep processes
- Consolidation processes.

It is evident from these lists that there are mechanisms contributing to settlement in waste refuse that do not occur in engineering or inert soils. In fact only creep and consolidation would be recognised as conventional settlement mechanisms and the existence of consolidation in MSW has been questioned since (i) waste is less than fully saturated, especially at the time of placement, and (ii) even if saturated, has a permeability that is too high to allow any persistent build up of excess pore water pressure (Bjarngard and Edgers, 1990; Wall and Zeiss, 1995).

The likely incidence of settlement mechanisms during the life of a landfill site is shown in Fig. 3. Settlement following load, which may be due to self-weight or

surcharge, e.g. capping, is generally regarded as complete within about a month of application. Mechanical creep is usually regarded as occurring at a gradually decreasing rate, *ceteris paribus*, throughout the life of the site although between one and 30 days creep effects are probably masked by load-related effects. According to Bjarngard and Edgers (1990) and König et al. (1996), biodegradation-related effects rise to prominence after about one year. Physico-chemical/corrosion effects and ravelling are probably the least well understood mechanisms. The former is shown as a rising then falling rate trend but of smaller magnitude than biodegradation; in the absence of better information, the latter is assumed to be constant throughout.

Not surprisingly, the variability of the waste stream, over time and between locations, means that the influence, if not the existence, of individual mechanisms will differ from site to site. A universal interpretation of landfill settlement behaviour has therefore proved elusive; however, there is some consensus on its temporal classification.

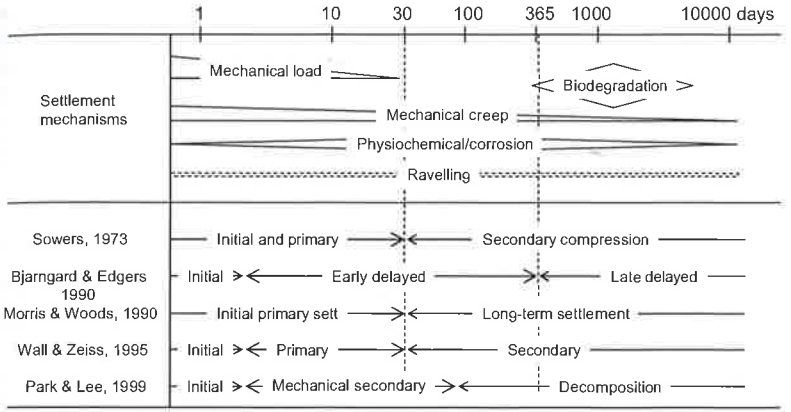

FIG. 3 Occurrence of settlement mechanisms and temporal classifications adopted by selected publications.

The bottom part of Fig. 3 shows the temporal classification of settlement as proposed by several researchers. There is consensus about the sequence of mechanisms. Load-related effects, commonly referred to as *Initial* and *Primary* settlement are thought to occur over the first month by Sowers (1973), Morris and Woods (1990) and Wall and Zeiss (1995). After one month, mechanical creep, physico-chemical/corrosion and biodegradation related effects dominate in what is collectively referred to as either the *Secondary* or *Long-term* phase. This phase can continue for 30 or more years. Bjarngard and Edgers (1990) and Park and Lee (1997), use different terminologies and time frames but their interpretations are consistent with others and the general sequence of settlement mechanisms.

Hence a combination of *primary* and *secondary* settlement conveniently classifies the mechanisms contributing to landfill settlement. Primary settlement occurs very quickly by comparison to the life of the landfill and can be adequately described by load-induced settlement models. Secondary settlement, driven by biodegradation effects, creep and physicochemical corrosion is a long-term phenomenon, which has for some time relied on time-dependent methods.

Before taking a closer look at existing and the newly developing more fundamental landfill settlement models, it is instructive to recognize the range of influencing factors that the input parameters of landfill settlement models strive to represent.

3.2.2 Influencing factors

Figure 4 shows a range of factors influencing landfill settlement feeding into a simplified suite of primary and secondary settlement mechanisms. Influencing factors can be viewed as (i) factors defining the condition of the waste within a landfill cell, i.e. internal to the landfill (the boxed factors), and (ii) factors or site operations and controls or initial conditions which influence the internal conditions. Some of the factors influencing biodegradation, namely moisture, leachate and gas composition, are not readily or explicitly incorporated into conventional settlement models. Moreover, during the period under investigation, the influence of these factors can change and in a way that is neither gradual nor predictable. Indeed, Landva et al. (1984) concluded that decomposition effects are too complex to predict.

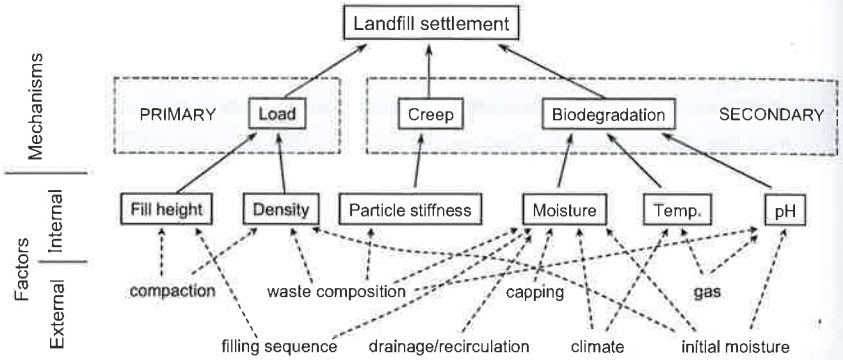

FIG. 4 Mechanisms and factors influencing landfill settlement.

Factors controlling the chemical and (micro)biological processes were considered in the very earliest investigations into landfill settlement. Watering and aerobic conditions were observed to be responsible for settlement some three times greater than that occurring in a dry anaerobic cell (Merz and Stone, 1962). Sowers (1973) noted that keeping a site dry may halt decomposition. He also recognised the complex role of moisture noting that flooding with no opportunity for water circulation may also halt decomposition because of (microbial) product inhibition. El-Fadel (1999) reported on factors such as moisture, sludge and buffer addition and their impact on biodegradation in a series of test cells at the Mountain View Controlled Landfill Project. Significant increases in the amount and rate of settlement were observed when biodegradation is enhanced (as indicated in the data presented in Fig. 5) and was shown by Benson et al. (2007). A fundamental understanding of the factors controlling waste decomposition elucidated by environmental engineers and others with expertise in microbiology is now well established, e.g. Farquhar and Rovers (1973); Leckie et al. (1979); Barlaz et al. (1989).

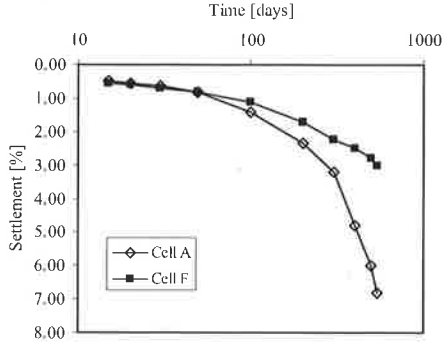

FIG 5. Effect of leachate recirculation on settlement magnitude [Cell A]; adapted from El Fadel (1999) [Cell F = control]

3.3 PRIMARY (LOAD-RELATED) COMPRESSION MODELS

Primary or load-related compression analysis and prediction has a long history in geotechnical analysis. The landfill settlement analysis described here is one dimensional, in the vertical direction, and occurs in response to changes in vertical stress. The relationship between stress and strain is assumed, for the purposes of monotonic loading, to be adequately described by a compression index, compression ratio, or one-dimensional (constrained) modulus.

3.3.1 Compression index

The compression index is the slope of the void ratio-log vertical stress relationship, i.e.

$$de = C_C \log\left(\frac{\sigma_{V0} + d\sigma_V}{\sigma_{V0}}\right) \quad (1)$$

where

e = void ratio
C_C = compression index [dimensionless]
σ_{V0} = the initial vertical stress
$d\sigma_V$ = change in vertical stress

Sowers (1973) and Morris and Woods (1990) proposed the use of a compression index, concluding that its value was related to initial void ratio. Sowers indicates that C_C is $0.15e_0$ for fills low in organic and $0.55e_0$ for fills high in organic content. Use of the compression index is hindered by the difficulty of determining the void ratio in waste.

3.3.2 Compression ratio

The compression ratio, also referred to as the modified compression index, is the slope of the vertical strain-log vertical stress. It avoids the need to determine the void ratio.

$$d\varepsilon = \frac{dH}{H_0} = C_R \log\left(\frac{\sigma_{V0} + d\sigma_V}{\sigma_{V0}}\right) \qquad (2)$$

where

$d\varepsilon$ = vertical strain increment
dH = change in height
H_0 = initial height
C_R = compression ratio [dimensionless]

Oweis and Khera (1998) summarise C_R and C_C values for a range of waste types; for example C_R values range between 0.08 (for 15 to 20 year old waste) to 0.41 (waste with high organic content).

Kavazanjian et al. (1999) also reported compression ratio values for a number of waste samples tested in a large laboratory (460 mm diameter by 460 mm high) oedometer. Their results (Fig. 6) indicate virgin compression ratios of between 0.121 and 0.247; they also reveal irreversibility in the load-strain behaviour.

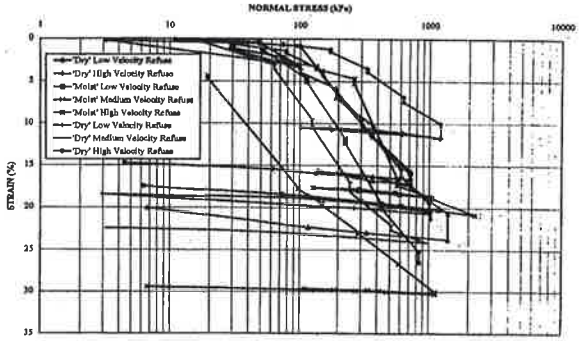

FIG. 6 Large scale laboratory compression data from Kavazanjian et al. (1999)

3.3.3 One-dimensional (Constrained) modulus

The one-dimensional (or constrained) modulus is defined as:

$$d\varepsilon = \frac{dH}{H_0} = \frac{d\sigma_V}{D} \qquad (3)$$

where

D = one-dimensional modulus [kN/m^2]

The magnitude of the constrained modulus is dependent on the applied stress level, whereas the compression index and compression ratio values are constant with the logarithm of stress. Watts & Charles (1990, 1999) measured constrained modulus values for a range of waste types and sites finding values ranging between 550 and 6000 kN/m^2. Beaven and Powrie (1995) and Jessberger and Kockel (1995) also used the constrained modulus.

3.3.4 Compressibility: primary compression ratios and one dimensional moduli

Compression ratios can be converted to an equivalent constrained modulus by combining Eqs. 2 & 3,

$$C_R \log\left(\frac{\sigma_V + d\sigma_V}{\sigma_V}\right) = \frac{d\sigma_V}{D}$$

From which we can deduce that for a unit increment of vertical stress $d\sigma_V$ at stress level σ_V,

$$D = \frac{1}{C_R \log\left(1 + \frac{1}{\sigma_V}\right)} \qquad (4)$$

Figure 7 shows a selection of measured compression ratio values (converted to constrained modulus values using Eq. 4) is presented together with directly measured constrained modulus values. Some of the outlying values, such as the high modulus values reported by Watts and Charles (1999), are known to be obtained from 40 year old refuse having a high bulk unit weight, i.e. 18 kN/m^3, with noted ash and rubble content. Notwithstanding the outliers, directly measured constrained modulus values, both in the laboratory and in the field, lie within the range of compression ratios reported by Oweis and Khera (1998), i.e. from 0.08 to 0.41. There is no clear influence of age on compressibility; the compressibility of the aged waste tested by Beaven (1999) reveals a compressibility closer to the high organic content waste in conditions

favourable to decomposition reported by Oweis and Khera, rather than the 15-20 year old waste (also reported by Oweis and Khera).

It should be borne in mind however, that the physical condition of aged waste in the laboratory is usually different to that in the field. The decomposition process will produce a waste structure that is destroyed by sampling and subsequent placement in a laboratory cell. Compaction will probably produce a denser matrix with lower porosity in the laboratory compared to the in situ condition.

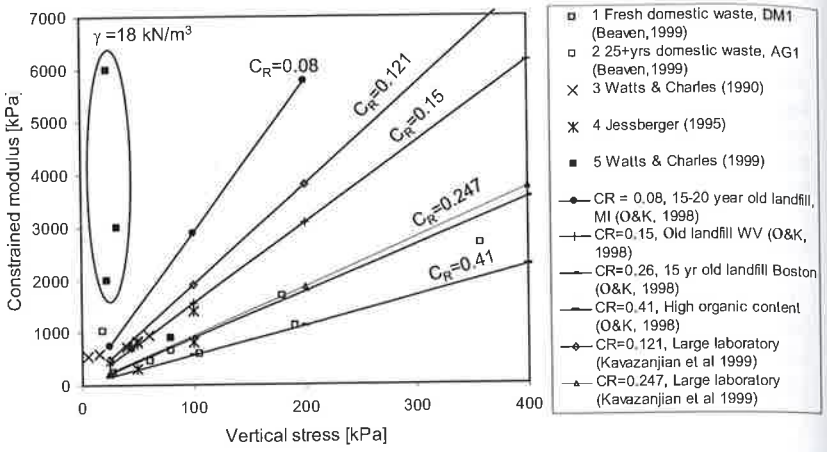

Fig. 7 Measured waste compressibility shown as constrained modulus values. Data points measured as constrained modulus; connected data calculated as constrained modulus from compression ratio values as denoted.

3.4 TIME-DEPENDENT SETTLEMENT MODELS

The complexity of the factors controlling the full range of secondary settlement mechanisms and the difficulty of their measurement, especially in the field, encouraged considerable interest in time-dependent methods. Simple in form, these models relate surface settlement to time and may be expeditious if the landfill milieu evolves in a gradual and predictable way. Several functions have been used:

3.4.1 Logarithmic (or 'soil mechanics')

Originally proposed by Sowers (1973), this form of settlement model is familiar as the soil mechanics secondary compression model,

$$de = C_\alpha \log\left(\frac{t_2}{t_1}\right) \tag{5}$$

where

C_α = secondary compression index [dimensionless]
t_1 = initial time of interest
t_2 = later time of interest

Morris and Woods (1990) and Wall and Zeiss (1995) avoid determination of void ratio by using a secondary compression ratio,

$$d\varepsilon = \frac{dH}{H_0} = C'_\alpha \log\left(\frac{t_2}{t_1}\right) \tag{6}$$

where C'_α is the modified secondary compression index or secondary compression ratio, i.e.

$$C'_\alpha = \frac{C_\alpha}{1+e_0} \tag{7}$$

3.4.2 Exponential (or Rheological)

Originally proposed by Gibson and Lo (1971) for long-term settlement of peat, the rheological model was first applied to waste refuse by Edil et al. (1990). It is a combination of a Hookean spring representing primary stiffness and a Kelvin element representing long-term settlement. This model can also account for primary settlement, although for the purposes of this review, only the time-dependent component is considered.

$$s(t) = H \cdot \Delta\sigma\left\{a + b\left(1 - \exp^{\left(-\frac{\lambda}{b}t\right)}\right)\right\} \tag{7}$$

where

s = settlement
$\Delta\sigma$ = vertical stress increment
a = primary stiffness parameter
b = secondary stiffness parameter
λ = compression rate parameter
H= initial height of refuse

3.4.3 Power creep

Also presented by Edil et al (1990), the power creep model is given by,

$$s(t) = H \cdot \Delta\sigma.m\left(\frac{t}{t_r}\right)^n \tag{8}$$

where

m = model parameter (compressibility)
n = model parameter (rate of compression)
t_r = reference time (taken to be I day)
H= initial height of refuse

3.4.4 Hyperbolic

The hyperbolic model was first applied to MSW by Ling et al.(1998). It utilises the ultimate settlement magnitude and initial rate of settlement as key parameters in its formulation.

$$s(t) = \frac{t}{1/\rho_0 + t/s_{ult}} \tag{9}$$

where

ρ_0 = initial rate of settlement
s_{ult} = ultimate settlement

3.4.5 Form and limitations of simple time-dependent functions

The performance of the time-dependent settlement functions depends on their ability to match data and the inherent shape of the function. Figure 8a shows the shape of the four functions over a two year period. Model parameters have been contrived to force the functions to follow similar paths. It would appear that any of the functions might be tuned to a field data set over the short period in question. Indeed, efforts to match these functions to field data have lead to the following observations:

- The combination of mechanical secondary compression, physico-chemical action and biochemical decay follows a linear settlement-log time relationship when there has been no drastic change in the [landfill] environment – Sowers (1973)
- Back calculation of parameters from field data shows better fit for the power creep model than the rheological model – Edil et al (1990)
- Hyperbolic model performed better than either power creep or logarithmic model, with correlation coefficients greater than 0.97, when fitted to three field scale data sets – Ling et al (1998)

Consider now the long-term predictive capability of the simple models, i.e. of the functions themselves. Figure 8b indicates final settlement magnitudes to a logarithmic time scale. The rheological and hyperbolic models become asymptotic to a final settlement value and would seem to offer some realistic long-term settlement prediction. In contrast, logarithmic and power models predict ongoing settlement. In the case of the power law model, deceleration in the rate of settlement is slow and settlement has fallen off the scale in less than 3 years. Clearly, the choice of model has a dramatic influence on the prediction of ultimate settlement.

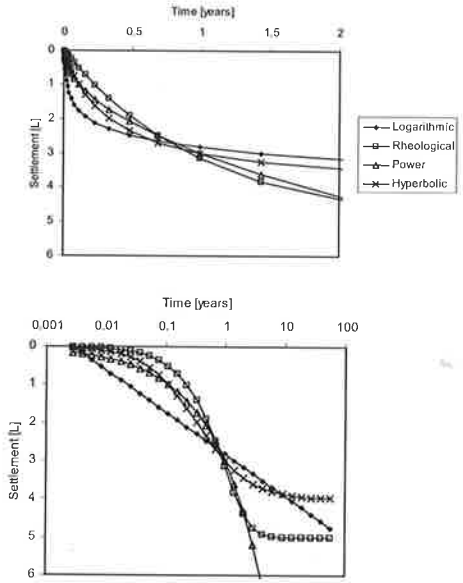

FIG. 8 Form of time-dependent functions over (a) two year period (a) and (b) much longer period (< 100 years)

Work to improve the long term fit of the time-dependent model functions has turned to two-stage secondary settlement models.

3.4.6 Two-stage secondary settlement models

Bjarngard and Edgers (1990) and König et al (1996) highlighted the existence of two identifiable stages of secondary settlement. The first is attributable to mechanical phenomena whereas the second is due to the onset of biodegradation and associated mass loss. Work by Hossain et al. (2003) on the settlement of degraded waste samples also points to a two-stage secondary process. However, care must be exercised in the interpretation of laboratory tests where degraded samples are remoulded into an oedometer as (already noted) the in situ fabric is inevitably lost. The simulation of

secondary settlement including an accelerated phase of settlement improves the capability of time-dependent approaches. A number of models that expressly account for a second accelerated stage have been developed.

Edgers, Noble and Williams (1992)

Edgers et al. (1992) state that mass loss leads to a weakened matrix, increased compressibility and changed permeability. They also highlight the relevance of gas generation to secondary settlement. Indeed the kinetics of microbial growth is described as background to their two stage model but caution that the settlement mechanism is not at all clear. They idealised secondary settlement as a combination of (i) mechanical creep in the first stage described by a logarithmic model and (ii) bio-settlements in the second stage. In the first stage vertical strain is given by,

$$\varepsilon = \varepsilon_1 + \frac{A\exp^{(\alpha D)} t_1}{1-m}\left(\left(\frac{t}{t_1}\right)^{1-m} - 1\right) \quad \text{for m} \neq 1 \qquad (10a)$$

$$\varepsilon = \varepsilon_1 + A\exp^{(\alpha D)} t_1 \ln\left(\frac{t}{t_1}\right) \quad \text{for m} = 1 \qquad (10b)$$

where

ε = strain
D = stress level
ε_1 and t_1 are known reference values
A, α and m are rate process parameters.

The combination of Eq. 10 allows for non-linear ε-log t relationships, i.e. m $\neq$ 1.

In the second stage,

$$\varepsilon_{bio} = B\left(\exp^{\beta(t-t_k)} - 1\right) \qquad (11)$$

where

B = scale factor corresponding to decomposition settlement
β = parameter reflecting microbial activity
t_k = time at which bio-settlements begin.

Excellent agreement for the model is claimed with four field cases for which B, β, and t_k could be back calculated.

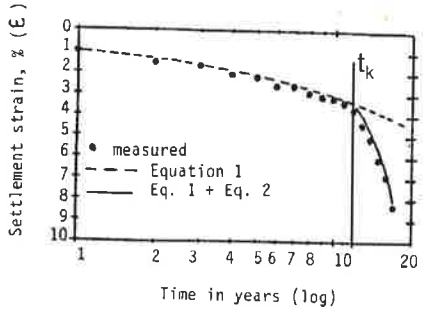

FIG. 9 Comparison of settlements including effects of decomposition using two stage secondary settlement model; modified from Edgers et al., 1992. Eqs. 1 & 2 in the figure refer to Eqs. 10a & 11 above.

Park and Lee (1997, 2002)

Park and Lee highlight the importance of biodegradation and the difficulty that soil mechanics has in accounting for biodegradation effects. They proposed a mechanical secondary compression stage using a combination of logarithmic and first order kinetic models. The logarithmic model is applied to the first stage,

$$\Delta\varepsilon(t)_{mec} = C_\alpha \log\left(\frac{t+\Delta t}{t}\right) \qquad (12)$$

where C_α is the compression ratio (strictly C'_α according to the notation of Eqs. 5 & 6), followed by secondary compression due to decomposition depicted by first order kinetics,

$$\Delta\varepsilon(t)_{dec} = \varepsilon_{tot-dec}\left(1 - \exp^{(-kt_{bio})}\right) \qquad (13)$$

where

$\varepsilon_{tot\text{-}dec}$ = total settlement due to decomposition
t_{bio} = time since decomposition settlement commenced.

Park and Lee are well aware of the microbial circumstances of the landfill environment, noting that the decomposition process is first methanogen-limited then, once methanogenesis is established, becomes hydrolysis-limited. Microbiological evolution and the associated decomposition can then be considered to reflect the progress of secondary settlement. They also highlight the importance of moisture availability in decomposition process.

El-Fadel, Shazbak, Saliby and Leckie (1999)

El-Fadel et al (1999) postulated an increase in void ratio and weakened structure due to biodegradation. They correlated settlement in six large field cells with three models, the power, Gibson & Lo (exponential) and 1-D consolidation (logarithmic) models, where the 1-D consolidation model is implemented as a two stage model.

The field cells, actually the Mountain View Controlled Landfill Project (Halvadakis et al. 1988), were configured to investigate a number of the factors controlling biodegradation, e.g. leachate recirculation and combinations of sludge, buffer and water addition. Secondary settlement in the logarithmic model was broken down into two separate stages defined by secondary compression ratios $C_{\alpha 1}$ and $C_{\alpha 2}$, where the ratio of $C_{\alpha 2}/C_{\alpha 1} \approx 10$ (strictly C'_{α} according to the notation of Eqs. 5 & 6). The distinction between the two stages is fixed by the time at which the slope of the stress-strain curve changes. Figure 10 shows the modelling and field results for cell B, which had sludge and buffer addition. Over the period and for all cells, it was noted that the two-stage 1-D consolidation model out-performed both the exponential (Gibson & Lo) and power models although the exponential model performed acceptably in all cases.

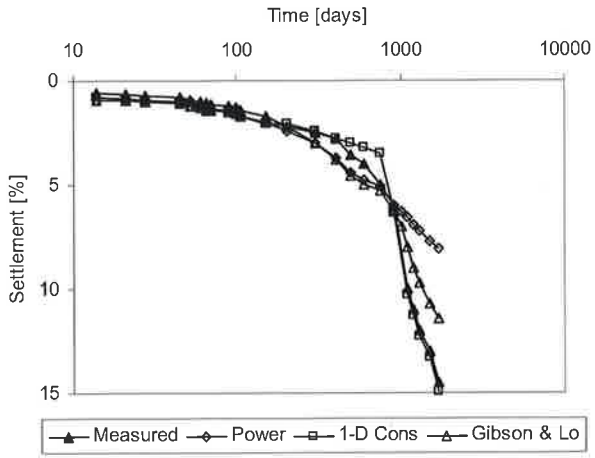

FIG. 10 Comparison of models with measured settlement data for cell B, Mountain View Controlled Landfill Project, after El Fadel et al. (1999)

Marques, Filz and Vilar (2003)

Marques et al. proposed a variant on Park and Lee's two stage model. They have first a mechanical creep stage (ε_C) followed by a biological decomposition (ε_B) stage. Mechanical creep is based on the exponential model,

$$\varepsilon = b\Delta\sigma\left(1-\exp^{-ct'}\right) \tag{14}$$

where

b = creep coefficient
$\Delta\sigma$ = stress increment
c = compression rate parameter
t' = time since application of the stress increment.

Biological decomposition is also given by an exponential model,

$$\varepsilon = E_{DG}\left(1-\exp^{-dt''}\right) \tag{15}$$

where

E_{DG} = total strain due to decomposition
d = decomposition rate parameter
t'' = time since placement of the waste in the landfill

In the models described so far, model parameters defined cell-averaged or site-wide conditions. Marques et al. point out that the implementation of their two stage model is on a layer basis, i.e. they model the filling phase. This is a matter which is addressed in more detail later in this chapter. Using model parameters obtained by regression analysis, surface settlements predicted by the model were found to be in good agreement with field data.

Hossain and Gabr (2005)

The model presented by Hossain and Gabr extends the two stage logarithmic model adopted by El Fadel et al. to three stages. An initial early stage of decomposition is proposed, when the landfill environment is predominantly acidogenic (or pre-methanogenic). Settlement is dominated by creep. In the next stage, biological decomposition is added. In the third stage, biological effects are exhausted but there remains some creep settlement.

Eq. 6 is used,

$$d\varepsilon = \frac{dH}{H_0} = C_R \log\left(\frac{t_2}{t_1}\right) \tag{6}$$

where three secondary compression ratios, corresponding to the early creep, biodegradation and final creep stages are $C_{\alpha i}$, C_{β} and $C_{\alpha f}$ respectively, are input into Eq. 6. There are four times, t_1 to t_4, corresponding to the start and end of the settlement stages as denoted in Fig. 11.

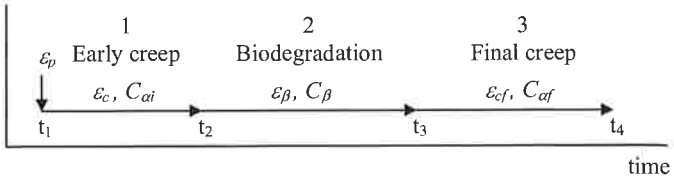

FIG. 11 Time dependent secondary settlement model extending to three stages as proposed by Hossain & Gabr (2005)

Small-scale laboratory compression tests provided values of $C_{\alpha i}$ and C_β ; the final creep stage was not considered so the comparison is of a two stage model only. A number of field projects, including the Mountain View Controlled Landfill Project (Halvadakis, 1988) and Yolo County landfill, were simulated. The test data was well matched by the model holding stage 1 and stage 2 compressibility ratios constant and manipulating only t_2 values, as can be seen in Fig. 12.

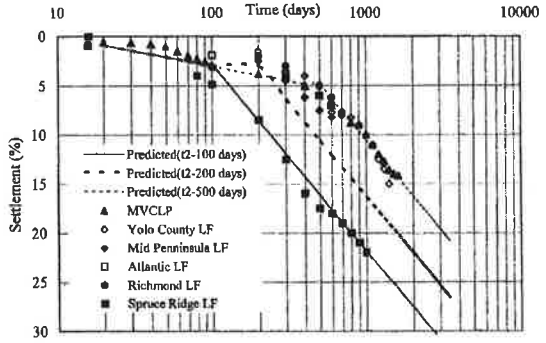

FIG. 12 Comparison of predicted and observed field settlement for bioreactor landfills, from Hossain and Gabr (2005)

3.4.7 Summary of two stage secondary settlement model and parameter values

The two stage models are a sequential combination of secondary settlement functions, as summarised in Table 1. Parameter value ranges, where provided, are also given.

3.4.8 Performance and limitations of time-dependent models

Time-dependent models appear to capture well the main landfill settlement features over sometimes considerable periods of time. However, in all cases model parameters have been tuned to fit model output to the data. The models have not yet been proven successful in the *a priori* prediction of either the magnitude or the timing of final settlement. Indeed, this may be an unrealistic expectation. It has been shown that different settlement models follow similar paths over short time frames but later diverge to quite different ultimate settlement magnitudes. Even if the choice of model

is easy, the meaning of the model parameters and their determination is not. Biodegradation contributes significantly to total settlement and is a function of a complex set of conditions that extend beyond the normal geotechnical remit. Mapping both the biodegradation process and its manifestation as settlement onto a simple time-dependent function results in a highly empirical treatment of the phenomenon. The parameters in such a model lose physical meaning and can only be determined in an observational manner.

Nevertheless, some consistency has been found in secondary compression ratio values. Oweis and Khera (1998) reported secondary compression ratio values ranging between 0.001 for old landfills with high soil contents to 0.02 – 0.24 for old (15-20 yr) waste. Parameter values range over more than an order of magnitude. However, it is difficult to associate these data with particular wastes. Normal soil descriptions do not account for the state of decomposition and simple age descriptors may not give an adequate description. For example, a 1 or 2 year old waste at a site where decomposition has been allowed or even encouraged may be more degraded that 15 year old waste lying in a 'dry tomb' site. If biodegradation effects are to be accounted for in a predictive manner, a more fundamental treatment is required.

Table 1: Summary of functions used in two stage secondary settlement models and reported parameter values

	First stage	Second stage
Edgers, Noble and Williams (1992)	logarithmic	Exponential β = 0.1622 to 1.267 yr^{-1}
Park and Lee (1997, 2002)	logarithmic Fresh, field: C_α =0.02 Fresh, lab: C_α = 0.037 15 yrs, lab: C_α = 0.01 15~30 yrs, lab: C_α = 0.008	Exponential Fresh, field: $\varepsilon_{tot\text{-}dec}$ = *10-25%;* k = 0.245 – 0.548 yr^{-1} 8 yrs, field: $\varepsilon_{tot\text{-}dec}$ = *<1-7%;* k = 0.584 – 2.19 yr^{-1} 20 yrs, field: $\varepsilon_{tot\text{-}dec}$ = *1-3%;* k = 0.365 – 17.56 yr^{-1}
El-Fadel, Shazbak, Saliby and Leckie (1999)	logarithmic Field $C_{\alpha 1}$ = 0.015 – 0.035	logarithmic Field $C_{\alpha 2}$ = 0.132 – 0.25
Marques, Filz and Vilar (2003)	exponential 5 yrs, field b = 4×10^{-4} m^2/kN c = 1×10^{-3} day^{-1}	exponential 5 yrs, field E_{DG} = 0.15 – 0.21 d = 0.8×10^{-3} –2.5×10^{-3} day^{-1}
Hossain and Gabr[1] (2005)	logarithmic Field $C_{\alpha i}$ = 0.03 t_2 = 100 – 500 days	logarithmic Field C_β = 0.19

[1] third stage not active

3.4.9 Time-dependent settlement with depth

Even if the issue of waste description can be avoided, say by conducting compression tests on a particular waste from the site under investigation, the state of decomposition may still affect settlement prediction. Working cells may be filled over a period of time extending two years. The measured surface settlement will therefore be a function of decomposition processes that may be considerably more advanced at the base of a site than in the upper layers.

With few exceptions, the time-dependent settlement models described so far have been applied to and/or obtained from a sample of waste or the full depth of a landfill cell. In other words, compression parameters have been cell- or depth-averaged. Compression ratios of this kind must be deployed judiciously. Alternatively, the settlement model may be deployed on a lift basis. Models presented by Morris and Woods (1990), Bleiker et al. (1995) and Marques et al. (2003) in the preceding section, offer such a capability. Both of these models apply the exponential model to individual layers of waste, summing the layer settlement predictions to obtain surface settlement.

Another model that exploits the time-dependent nature of the filling process is the Incremental Settlement Prediction Model (Olivier et al. 2003). In this model, the logarithmic function is applied to discrete layers of waste, the times of placement of which are used to determined the settlement of each lift. From a number of field scale validation exercises, Olivier et al found the compression ratio to vary relatively little around an average value of (C'_α =) 0.11 when deployed in this way. Findings such as these indicate the benefit of implementing the settlement model on a spatial basis.

3.5 MORE FUNDAMENTAL SETTLEMENT MODELS

This section introduces a number of more fundamental landfill behaviour models that have emerged in recent years. The significance of biodegradation-related settlement has already been noted and the review of fundamental models begins with a review of the factors controlling biodegradation.

3.5.1 Biodegradation factors

The principal factors influencing the rate and extent of biodegradation in landfilled waste were outlined in Fig.4. It is not a definitive list but it does introduce a useful distinction between internal and external factors.

Internal factors

In Fig. 4, factors such as moisture content, temperature and pH are classified as internal. Internal factors define fundamental physical, chemical and (micro)biological phenomena that drive a predictable evolution of the landfill milieu. They give rise to process-based model parameters and may be derived from small scale or laboratory

tests. Their influence can be regarded as universal from site to site and region to region. Factors that may be regarded as internal, including those identified in Fig. 4 are:

- moisture content: it is generally acknowledged that moisture is the main factor controlling biodegradation (Rees 1980; Reinhart and Townsend 1997); certainly it is the most easily controlled via external operations such as leachate recirculation.
- temperature: that microbiological activity is temperature-dependent can be clearly shown in the laboratory but the impact of temperature on decomposition in the field is less clearly defined. Test cells in the UK (Landfill 2000) showed very high rates of gas production achieved at temperatures below 15°C. At another UK test site, Brogborough, there was no correlation between gas production and temperature (Knox 1999).
- waste composition: the amount of degradable matter and its degradability. There have been a number of investigations of waste composition. See Grisolia et al. (1993) for one of the earlier three part classifications into inert, highly deformable and readily biodegradable fractions.
- leachate quality (pH): acid accumulation can inhibit microbial activity and thereby stall the decomposition process (van Meerten et al. 1995).
- gas and liquid conductivity: the ease with which required reactants and inhibiting products to the digestion process can diffuse through the waste (Bleiker et al. 1995)
- microbiology: the anaerobic digestion process requires a consortium of hydrolytic, acetogenic and methanogenic bacteria to become established; the growth rate of methanogens is relatively slow so accelerated methanogenesis takes time to become established (Barlaz et al. 1989).

External factors

Referring again to Fig. 4, factors that can be regarded as external include:

- site geometry: defines the lateral extent and depth of waste, and hence constrains stress- or depth-related properties such as density, porosity, gas and hydraulic conductivities.
- filling sequence: the state of a layer of waste is defined by its placement, i.e.
  - its position in relation to site geometry and hence overburden stress/in situ density
  - timing which defines the commencement of decomposition, climatic influence (rainfall/evaporation) and internal moisture redistribution
- climate: influences boundary moisture transfers
- operational controls: includes waste compaction and placement procedures, daily cover soils, time of capping, leachate management (recirculation and/or sludge addition).

External factors are effectively initial conditions or features of a particular site that define the biodegradation process both initially (geometry, filling sequence, compaction) and during the life of the site (climate, leachate management). They convey the spatial aspects of the problem and influence the biodegradation model accordingly. Waste type and external factors such as climate and operational practices may be similar at sites that are geographically close, but they are unlikely to be the same from region to region. Geometry and filling sequence are most likely to differ from site to site irrespective of their geographical proximity. External factors are largely site-specific; they influence the decomposition process through their impact on the internal factors referred to in the previous section.

So, biodegradation factors can be associated with the fundamental biodegradation processes or they define the circumstances in which those processes occur. Such a classification is instructive as it emphasises both the formulation of the fundamental model and its implementation at field scale.

3.5.2 Biodegradation consequences - mass loss and settlement

If a biodegradation model is to be used to control long-term settlement then some means of interpreting the volumetric consequences of mass loss is required. Conventional soil mechanics volume descriptors, such as the void ratio, are not unique indicators of overall volume in waste because of the changing solid phase volume. For example, the degradation of solid mass may be accompanied by an equivalent (to the solid volume lost) increase in void volume. There is then no change in overall volume although the void ratio has increased and the waste has become more skeletal. Settlement of this form can be seen in Fig. 13, which shows layer strain calculated from field measurements at depth in an Australian landfill (McDougall et al, 2004), where episodes of settlement showing zero settlement strain giving way to renewed movement can be seen.

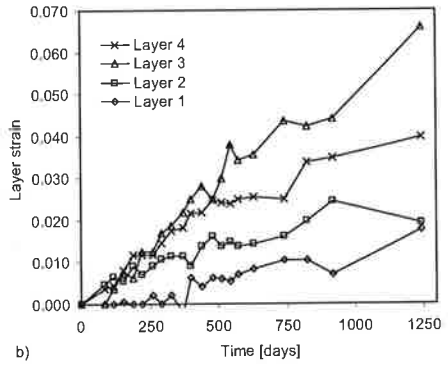

FIG. 13 Displacement of settlement monitoring stations at Lyndhurst Sanitary Landfill, stations in Control A shown as layer strain (adapted from Yuen, 1999).

Alternatively, decomposition may be accompanied by contemporaneous rearrangement of solids and overall settlement. In this case the associated change in void ratio is a function of changes in both void and solid phase volumes; void ratios may remain unchanged despite overall settlement. In fact, a constant void ratio condition is implicitly assumed by some of the fundamental landfill settlement models.

A general description of the relationship between decomposition of solid degradable matter, i.e. a change in solid phase volume V_S, and the induced change in void volume V_V, was presented by McDougall & Pyrah (2004), i.e.

$$dV_V = \Lambda \, dV_S \tag{16}$$

where Λ is the decomposition (or degradation)-induced void change parameter. Table 2 summarises changes in volumetric state variables and likely mechanical consequences associated with key values of Λ.

Coupling biodegradation with volume changes in this way offers three important benefits. Firstly, biodegradation settlement is not treated as a highly empirical time-dependent process. Time is communicated through solid organic matter depletion, which is controlled by the biodegradation model. There is a maximum rate of depletion but within that rate, under the influence of moisture deficit/addition or acid accumulation or changing crystallinity, for example, decomposition may slow down, accelerate, or stop completely. Secondly, there is no constraint on the form of biodegradation model selected; it can be as simple or as complex as necessary. Thirdly, this approach allows for a more fundamental treatment of changes in material properties such as stiffness, e.g. hardening with load and creep or (more likely) softening with decomposition.

Table 2: Decomposition induced void change parameter - reference values and associated phase composition changes where $dV_s < 0$.

Λ	Void ratio	Overall volume	Phase composition and its expected strength
-1	Maximum increase	No change	Much looser & possibly weaker
0	Increase	Reduction	Looser & possibly weaker
e (= void ratio)	No change	Large reduction	No change
>e	Decrease	Maximum reduction	More compact & possibly stronger

3.5.3 Model architecture – general ingredients

The classification of biodegradation factors presented in this chapter and the coupling of biodegradation with volumetric changes points to three main ingredients of a more fundamental approach to landfill settlement:

1. a model of the biodegradation process driven by parameters representing mainly internal factors
2. a means of implementation that communicates external factors as both initial and ongoing boundary conditions to the biodegradation model and,
3. an interpretation of the volumetric consequences of mass loss.

The models reviewed here are HBM (McDougall, 2007), LDAT (White et. al.2004), Moduelo (Lobo et al. 2008) and a model that has been developed at the University of Bahia, Brazil by Machado et al. (2008). Not all of these models have settlement analysis as their prime objective. The models also focus, to varying degrees, on hydrology or leachate quality and the strength of waste, so there is no common suite of factors upon which the models are founded. However, it is reasonable to say that they all recognise the importance of long-term volume change in the interpretation of landfill behaviour at field scale.

3.5.4 HBM, Edinburgh Napier University

The HBM model is a combination of three models each describing the hydraulic, biodegradation and mechanical behaviour of landfilled waste. The emphasis of this model is on settlement at field scale.

The hydraulic model is an unsaturated flow model. The biodegradation model is a two stage anaerobic digestion model and the mechanical model a visco-elasto-plastic deformation model. The three models are coupled as shown in Fig. 14, thereby enabling the integration and internal definition of system behaviour and variables that would otherwise be assumed constant or considered discretely. There is, for example, moisture control of biodegradation of solid degradable matter. The biodegradation model accounts for the enzymatic hydrolysis of solid cellulolytic matter. It is not a function of time but of the amount of moisture, volatile fatty acid (VFA) inhibition and the change in bioavailability. The hydrolysis function has the form:

$$r_g = \theta_E\, b\left[1-\left[\frac{S_O - S}{S_O}\right]^n\right]\exp\left(-k_{VFA}(c)\right) \qquad (17)$$

where

r_g = rate of VFA accumulation [$g_{VFA}/(m^3_{aqueous}.day)$]
θ_E = effective moisture content
b = maximum hydrolysis rate [$g_{VFA}/(m^3_{aqueous}.day)$]
S = solid degradable fraction [kg/m^3]
n = bioavailability transformation parameter
k_{VFA} = product inhibition coefficient [$m^3_{aqueous}/g_{VFA}$]

c = VFA concentration [$g_{VFA}/m^3_{aqueous}$]

Equation 17 allows any of the controlling factors to affect the rate of hydrolysis/VFA accumulation, for example it may be stalled due to lack of moisture, excessive VFA accumulation (low pH) or reducing bioavailability. Equally, restoration of say a moisture deficit will accelerate the hydrolysis.

Moreover, biodegradation adjusts solid and void phase volumes, in other words the porosity, through the decomposition induced void change parameter Λ referred to above. This parameter can be evaluated from large scale laboratory tests, e.g. those by Olivier and Gourc (2007). Figure 15 shows the Olivier and Gourc test data together with HBM simulation output at selected Λ values.

The HBM model is implemented using the finite element method and can therefore simulate the filling phase by timed disclosure of individual elements. In this way, porosity and density changes due to load application and biodegradation can be handled; the saturated hydraulic conductivity can then be internally defined and automatically adjusted for overburden stress or biodegradation. The similitude of the hydraulic model is thereby considerably enhanced.

The HBM model does not account for gas migration and considers only a very simple leachate chemistry – a lumped volatile fatty acid concentration and a methanogenic biomass concentration.

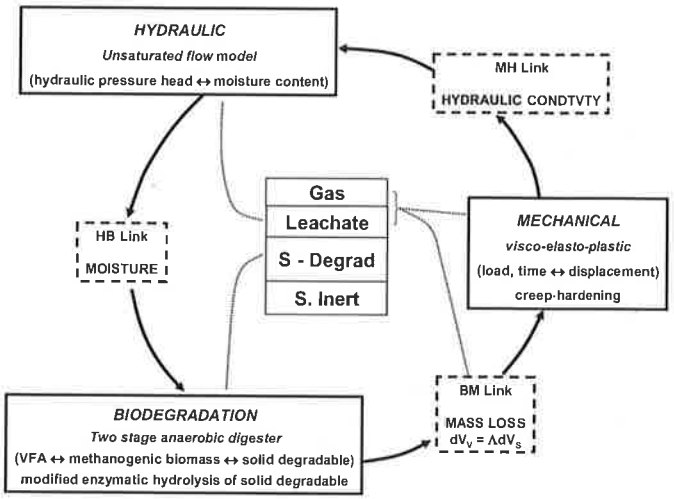

FIG. 14. Schematic diagram showing the constitutive formulation of the HBM model.

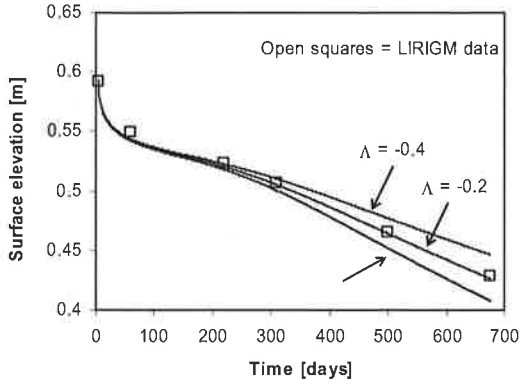

FIG. 15 Predicted (HBM) and measured secondary settlement behaviour during the experiment (LIRIGM, Olivier & Gourc, 2007) for selected values of decomposition-induced void change parameter, Λ.

3.5.5 LDAT, University of Southampton

LDAT has been developed at the University of Southampton (White et al. 2004), initially to interpret the long-term biodegradation of solid waste. It was designed to accommodate, in a spatially distributed context, a range of biochemical degradation pathways comprising the enzymatic hydrolysis, subsequent acetogenesis and methanogenesis. Biodegradation is treated as a three stage anaerobic digestion process, see Fig. 16. The degradation steps are handled using Monod kinetics, hence the depletion of the organic substrate by enzymatic hydrolysis is given by,

$$\frac{\partial C_S}{\partial t} = \left[\frac{\mu C_M}{K + C_M} C_S \right] \tag{18}$$

where

C_S = concentration of substrate [g/m^3]
C_M = concentration of hydrolytic enzymes [g/m^3]
μ = specific growth rate [g/m^3/day]
K = half saturation constant [g/m^3]

Physical properties such as density (and hydraulic conductivity) are determined from empirical relationships relating these properties to effective stress, i.e. to depth. In the case of dry density, a relationship of the form,

$$\rho'_S = A(\sigma - u)^a \tag{19}$$

where

ρ'_S = dry density
A, a = empirical coefficients
σ = total stress
u = pore water pressure

In this way a variation of density with depth is driven by empirical data and is not restricted to constant void ratio changes. With a similar expression controlling the hydraulic conductivity, LDAT offers an interpretation of degradation processes that allows for the kind of property variation with depth that will occur at field scale. A strength of the LDAT model is that the empirical relationships around which the model is built are obtained from the large-scale experimental facility at Pitsea.

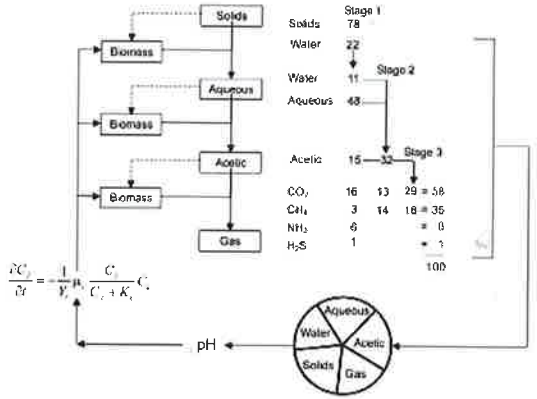

FIG. 16 Diagrammatic representation of the biodegradation process, from White et al (2004)

3.5.6 Moduelo, University of Cantabria

Moduelo is a landfill simulation tool that has been developed over a number of years at the University of Cantabria. It has available to it hydrological, biodegradation and settlement models. The biodegradation model uses a combination of first order kinetic functions to depict the conversion of readily and slowly hydrolysable solid matter into intermediate compounds and acetic acid, from which methane and carbon dioxide are produced. Lobo et al. (2008) indicate that biodegradation settlement is treated as a function of solid mass according to the 'Meruelo model'. In this case, the settlement to mass loss factor is taken to be 0.264 (no units given).

3.5.7 University of Bahia, Brazil

Machado et al. (2008) present an extension to the model they reported in 2002 (Machado et al. 2002). The earlier presentation deals with load and creep related

compression and shear behaviour, idealising waste as a combination of paste-like and fibrous fractions. The fibrous fraction is made up of plastic or plastic-like components and allows for strain hardening under deviatoric stress. The paste-like fraction contains all other materials including a degradable part.

In the 2008 extension, degradation is handled by a first order decay function based on the USEPA gas generation model,

$$\frac{\Delta m_s}{m_{so}} = \frac{L_o(1+w)\{1-\exp^{-kt}\}}{C_m} \tag{20}$$

where

m_s = mass of solids [subscript o refers to initial conditions]
L_o = methane generation potential [m^3 CH_4/Mg of refuse]
k = methane generation rate constant [1/yr]
w = MSW water content on dry weight basis
C_m = MSW organic matter methane yield [m^3 CH_4/Mg of dry refuse]

Biodegradation volume changes are handled by α, a decomposition-induced volume change parameter like the Λ parameter. Importantly, they indicate that values of α are not constant but a function of the biodegradation stage and probably other variables such as stress and waste composition. In the absence of more information, Machado et al (2008) propose that α is linearly related to the progress of decomposition, i.e.

$$\alpha(t) = \frac{-\alpha^* \Delta m_s}{m_{so}} \tag{21}$$

where

$\alpha(t)$ = mass loss generated volume change parameter
α^* = maximum value of α

From Eq. 21, the Authors compute volumetric strains over time using,

$$d\varepsilon_v = -\left(\frac{\gamma_{so}}{\gamma_{sp}}\right)\left(\frac{1}{1+e_o}\right)(1-\alpha(t))\frac{\partial m_s}{\partial t}\frac{1}{m_{so}}dt \tag{22}$$

where

γ_s = specific weight of MSW
γ_{sp} = specific weight of paste

The dependence of Λ on the degradation process, actually dissolution, has been reported in another paper in this volume (McDougall 2010, this volume). The data are obtained from tests on sand-salt mixtures, so quite different to waste, but they do show a common trend in the evolution of the parameter Λ over a range of stress states.

Comparison of this data with the form implied by Eq. 21 suggests that this is a topic that warrants further investigation.

3.5.8 Summary of more fundamental model features

Table 3 is provided not as a complete and definitive statement of model capabilities but as a synopsis of the different emphases and varying degrees of complexity embodied by the more fundamental settlement models.

Table 3 Summary of general features and modelling capabilities included in the four fundamental settlement models.

	HBM	Moduelo	LDAT	Brazil
	McDougall (2007)	Lobo et al (2008)	White et al (2004)	Machado et al (2002, 2008)
Settlement	Yes load, creep & biodegradation	Yes, biodegradation	Yes load, biodegradation	Yes, load, creep & biodegradation
Biodegradation	2 stage: hydrolysis, methanogenesis	3 stage: hydrolysis, acetogenesis, gasification	3 stage: lytic, acidogenesis, methanogenesis	based on USEPA gas model
Control	1) modified hydrolysis; 2) Monod	All first order kinetics	All Monod	First order kinetic
Pathways	1: bioavailability transformation	2: readily & slowly hydrolysable	3: fast, medium & slow	
Moisture control	Yes	Yes	Yes	Yes
Leachate species	VFA, MB	Intermediates, HAc, NH_3, H_2S	VFA, HAc,	N/A
pH inhibition	Yes			
Gas species	LFG	CH_4, CO_2	CH_4, CO_2	CH4
Biodegradation-related volume change	Λ	e fixed	density function	α (= Λ)
Implementation	Finite Element	Finite element	Finite difference, constant volume	

3.6 LANDFILL MODELLING CHALLENGE

Despite their state of development, indeed as a means of encouraging more coherent development, the landfill models described above were all invited to enter the landfill modelling challenge. Prediction of long-term settlement was one of the three main objectives of the challenge. The challenge was devised by the Waste Management Research group at the University of Southampton. It is comprehensively reported in two special issues of Waste and Resource Management (2008), see in particular Beaven et al. (2008) and Beaven (2008).

The Challenge

The landfill modelling challenge was a blind prediction exercise. Two consolidating anaerobic reactors were run for a period of 919 days during which time leachate quality, gas production and settlement were monitored. Each reactor is 480 mm diameter by 900 mm high, filled with 27 kg of fresh shredded MSW, and subjected to a vertical load (50 kPa & 150 kPa). Leachate quality data for the first 77 days was made available. The modellers were then asked to predict leachate quality, gas production and settlement for the remaining period of the test.

Lesson learned from the Challenge

Figure 17 shows the settlement predictions for CAR1 made by each of the four models together with the measured data. Whilst two of the models match the measured settlement behaviour reasonably well, perhaps the most significant observation to be made from Fig. 17 is the ability of the models to delineate an acceleration in settlement strain. The measured data show a relatively distinct acceleration at about 70 days. The HBM and Brazilian models show a general acceleration rather than a pronounced change of strain rates in the two phases; LDAT produces the greatest contrast between strain rates.

Importantly, the settlement behaviour modelled in Fig. 17 has been produced without resorting to *a priori* input of a transition time. No gas production data was released to the modellers. However, modellers were given the initial VFA data from which an acceleration in settlement could be deduced. Figure 18 shows these data. Very low VFA concentrations at 60 days indicate the consumption of excess VFA and the onset of accelerated methanogenesis together with increased settlement rate.

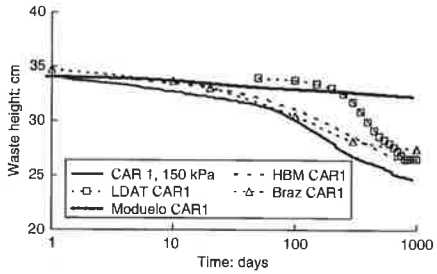

FIG. 17 Predicted waste settlements in CAR 1; from Beaven (2008)

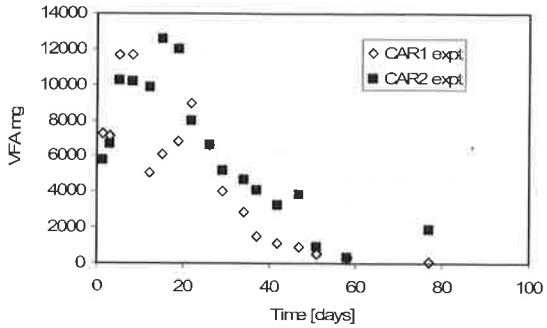

FIG. 18. Total VFA concentrations calculated from individual VFA concentrations measured in CARs 1 & 2 in the Landfill Modelling Challenge (Beaven et al. 2008)

Whilst the predicted settlement behaviour may be encouraging, if it is being modelled as a fundamental consequence of biodegradation-related mass loss, then it should be possible to match model and measured gas production curves. These are shown in Fig. 19, from which it is apparent that model predictions of gas production are mostly significantly lower than the actual gas production.

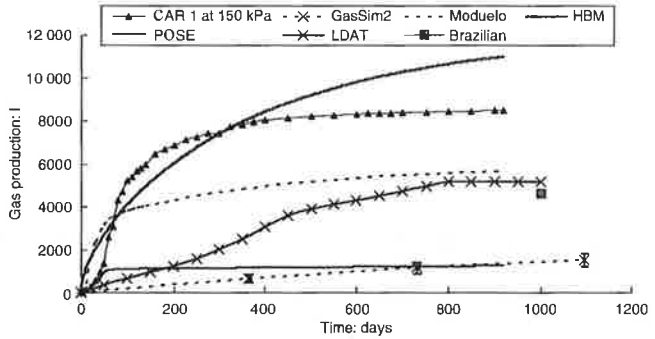

FIG. 19. Measured and predicted total [LFG] gas production for CAR1, from Beaven (2008)

The fit appears disappointing but is not necessarily indicative of a fundamental flaw in the biodegradation models. Rather, it emphasises the need to quantify the gas yield of the waste in question, i.e. the degradable content. Stoichiometric equations indicate precisely how much cellulolytic matter is required to produce a given quantity of landfill gas but the amount of gas produced by a given amount of organic matter depends on its degradability or bioavailability. Some organic matter is readily

degradable, some shielded by lignin; when shielded, degradation proceeds slowly, if at all. So, whilst gas production curves reflect the current rate and progress of biodegradation, knowledge of a parameter like the methane yield coefficients in Eq. 20 is necessary to define the process end point, i.e. the gas volume evolved and mass degraded as a proportion of the total 'organic' content present. Consider Fig. 20, which shows relationships between degradation, gas production and settlement. The stoichiometric relationship between gas production and mass loss is shown as a linear function with the total amount of cellulolytic matter denoted by M_O. M_C is the mass loss associated with current gas production, G_C. M_F is the amount of this waste that will eventually be degraded. The ratio of M_F to M_O is directly related to the yield coefficient C_m in Eq. 20. With this information, and a knowledge of the way in which a volume change parameter such as Λ evolves, it is possible to estimate ultimate long-term settlement magnitudes, S_F. It is through the forensic analysis of challenges of this kind that the role of biodegradation, its evolution in field-scale landfill cells and impact on settlement will be revealed.

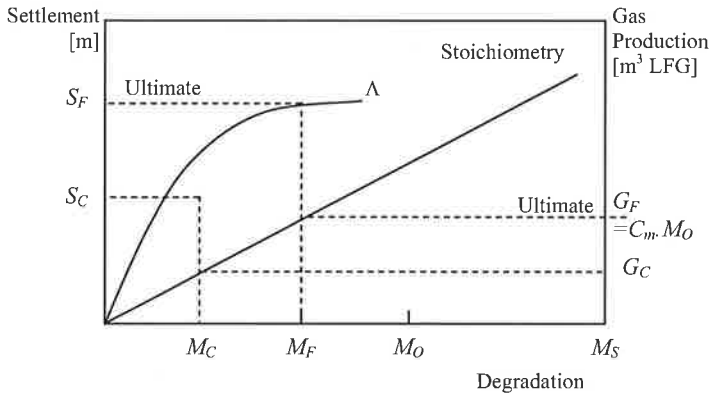

FIG. 20 Progress of settlement as a function of degradation, controlled by void volume change parameter Λ and gas production, via stoichiometric equation, showing limiting condition, i.e. ultimate settlement, defined by yield coefficient.

3.7 SUMMARY & CONCLUDING REMARKS

The analysis of landfill settlement is at a crossroads. Techniques for the analysis of short-term load-related primary compression and long-term settlement have been the subject of much research. For many years, one-dimensional compression and time-dependent analyses have been the main analytical tools. They have been shown to match well field observations over short periods of time and can be extended by the use of two settlement stages. However, the highly empirical nature of the analysis means that long-term settlement predictions will depend on the controlling conditions remaining constant for the life of the cell.

Recently there has been interest in more fundamental models. These models allow for the integration of mechanical, biodegradation and physico-chemical related phenomena. The latter phenomena are not part of the normal soil mechanics analytical toolkit. A number of models have emerged, four have been considered in this chapter, each with its own strength and emphasis. They do, however, all recognise the volumetric consequences of mass loss. Fundamental equations that link stress-related phenomena to microbial processes (and vice versa) are not known. Yet, we have seen here that mass loss is directly related to solid volume loss, which through a decomposition-induced volume change parameter, can be incorporated into settlement calculations. It therefore remains to understand and quantify the relationship between mass loss and the induced change in void volume. It is likely that this will be a function of (i) the stress state, (ii) particle stiffness, size distribution and shape, (iii) particle skeleton stiffness, and (iv) the rate and progress of degradation.

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Attachment A-2.3.2a

NTH Consultants, Ltd. (2008) *Settlement Monitoring Report: Master Cell VI-E – Phase I*.

Introduction

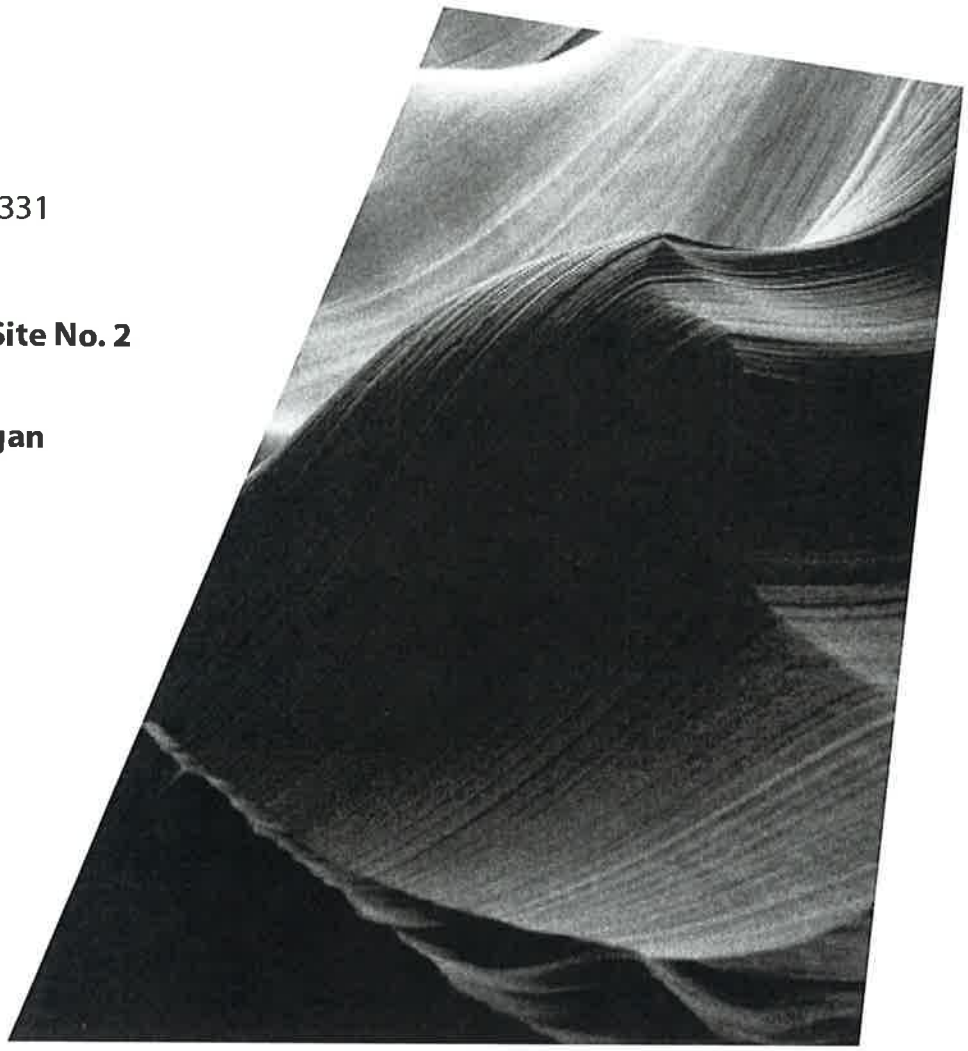
Master Cell VI-E

Settlement Monitoring Event
September 2008

Project No. 62-080256-04
November 2008

NTH Consultants, Ltd.
38955 Hills Tech Drive
Farmington Hills, MI 48331

Prepared For:
Wayne Disposal Inc., Site No. 2
Van Buren Township,
Wayne County, Michigan



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1.0 BACKGROUND

Wayne Disposal, Inc., Site No. 2 (WDI) is located in Van Buren Township, Wayne County, near Belleville, Michigan. Master Cells (MC) V, VI and VII comprise the hazardous waste landfills at the site. MC VI is a fully licensed, operating landfill unit. MC V and MC VII were previously filled and have been closed, in accordance with approved Closure Plans, for more than 10 years.

The previously approved design modification incorporates raising the top of waste of MC VI (sub-cells A-North, A-South, B, C and D) and extending MC VI over the existing final cover of MC V. The portion of MC VI to be constructed over MC V, designated as sub-cell VI-E, will be constructed in several phases. Phase 1 construction was complete in 2004 and waste placement began on September 24, 2004 and on the eastern half of the cell began in September 2005. Phase 2 (SE) construction was completed in 2006. Waste placement in this area commenced in October 2007. The construction of Phase 2 West was completed in early 2008 and waste placement began in late September 2008.

This report documents the September 2008 monitoring of VI-E Phase 1 and Phase 2 settlement and horizontal tensile strain behavior in accordance with the "MC VI-E Settlement Monitoring Plan" (Third Revision, August 12, 2002) and "Revisions to the Settlement Monitoring Plan", dated May 24, 2006. Locations for the settlement and strain monitoring instruments are displayed on Plates 1 and 2, in Appendix A. The data collected from the various instruments has been compared to the Level I Criteria for differential settlement and horizontal tensile strain in Table 1 of the aforementioned monitoring plan. In addition, a quality assurance evaluation was completed for the data collected during this monitoring event.

Since the last monitoring event in March 2008, waste has been placed within the Phase 1 and Phase 2 SE area over the instrumentation and profilers. The top of the waste is approximately at Elevation 770 feet on the western side of Phase 1 and Elevation 798 on the eastern side of Phase 1. The top of the waste in the Phase 2 SE area is approximately at Elevation 790 feet extending northerly from the Phase 1 area.

2.0 HORIZONTAL TENSILE STRAIN

Strain in the primary geomembrane liner is measured by 49 strain meters (Geokon Model 4430) installed at seven locations, or "clusters", in the primary clay, beneath the primary geomembrane in the Phase 1 area (Appendix A, Plate 1). Each cluster is laid in a 44-foot long trench and consists of a string of six strain meters placed end to end, in series, with one foot of space between them.

A seventh strain meter is located parallel to the fourth meter in each series. We refer to the pairing of the fourth and seventh meters as "companion" meters. The purpose of the companion meters is to verify data consistency/reliability (see Section 2.2). The companion meter pairs are:

- Cluster 1: SM-4 and SM-5
- Cluster 2: SM-11 and SM-12
- Cluster 3: SM-18 and SM-19
- Cluster 4: SM-25 and SM-26
- Cluster 5: SM-31 and SM-33 (Original companion meters were SM-32 and SM-33. See the report for November 2004 monitoring event for a detailed discussion on the change.)
- Cluster 6: SM-39 and SM-40
- Cluster 7: SM-45 and SM-46 (Original companion meters were SM-46 and SM-47. See the report for the November 2004 monitoring event for a detailed discussion on the change.)

2.1 DATA REDUCTION

Average baseline readings and all subsequent readings collected to date for the strain meters are presented on attached Figures 1 through 7 and summarized in Table 1. The readings and associated data reduction spreadsheet, as well as a sample calculation, are presented in Appendix B.

During this monitoring period, five of the 49 strain meters provided no readings (SM-10, SM-13, SM-30, SM-34, SM-47). These five strain meters were among the eight "non reading" strain meters identified during Geokon's testing. Geokon's test results for the "non reading" strain meters were presented in the March 2005 report.

2.2 DATA QUALITY ASSURANCE EVALUATION

The data quality assurance evaluation was performed as described in the MC VI-E Settlement Monitoring Plan. The purpose of this evaluation is to ensure that the collected data is statistically consistent – that is to say that the difference between companion strain meters (within a single cluster) is statistically equal from one monitoring event to the next. The difference between the paired strain meters for each cluster was evaluated using control charts. The control charts were established using the mean and 3-standard deviations (3s) of the differences between companion meters measured during the baseline monitoring period. Table 2 presents the parameters used to establish the control charts for all the clusters. A sample

Strain Meter	Cluster	Average Baseline 8/04	11/15/04	/28/07	09/27/07	04/02/08	09/24/08
1	1	Compression	Compression	Cpression	Compression	Compression	Compression
2	1	Compression	Compression	Cpression	Compression	Compression	Compression
3	1	Compression	Compression	Cpression	Compression	Compression	Compression
4	1	Compression	Compression	Cpression	Compression	Compression	Compression
5	1	Compression	Compression	Cpression	Compression	Compression	Compression
6	1	Compression	Compression	C0.10	0.12	0.18	0.44
7	1	0.16	0.13	0.24	0.27	0.37	0.69
8	2	0.04	Compression	Cpression	Compression	Compression	Compression
9	2	0.12	0.08	0.08	0.10	0.03	0.06
10	2	Compression	NR	NR	NR	NR	NR
11	2	0.11	0.10	0.14	0.17	0.12	0.21
12	2	0.15	0.18	0.26	0.28	0.21	0.23
13	2	Compression	NR	NR	NR	NR	NR
14	2	Compression	Compression	C0.01	0.05	Compression	0.02
15	3	1.11	1.13	1.18	1.21	1.15	1.19
16	3	Compression	Compression	Cpression	Compression	Compression	Compression
17	3	Compression	Compression	Cpression	Compression	Compression	Compression
18	3	Compression	Compression	Cpression	Compression	Compression	Compression
19	3	Compression	Compression	Cpression	Compression	Compression	Compression
20	3	Compression	Compression	Cpression	Compression	Compression	Compression
21	3	0.05	0.05	0.03	0.05	0.00	0.03
22	4	Compression	Compression	Cpression	Compression	Compression	Compression
23	4	0.12	0.17	0.34	ORC	0.38	0.41
24	4	0.13	0.21	0.41	0.43	0.41	0.44
25	4	0.20	0.32	0.52	0.54	0.53	0.55
26	4	0.16	0.24	0.42	0.44	0.43	0.44
27	4	Compression	0.06	0.37	0.38	0.37	0.38
28	4	0.11	0.16	0.29	0.30	0.28	0.30
29	5	Compression	Compression	Cpression	Compression	Compression	Compression
30	5	Compression	NR	NR	NR	NR	NR
31	5	Compression	Compression	Cpression	Compression	Compression	Compression
32	5	Compression	ORC	ORC	Compression	Compression	Compression
33	5	Compression	Compression	Cpression	Compression	Compression	Compression
34	5	Compression	NR	NR	NR	NR	NR
35	5	Compression	Compression	Cpression	Compression	Compression	Compression
36	6	0.29	0.15	0.09	0.05	0.06	0.05
37	6	Compression	Compression	Cpression	Compression	Compression	Compression
38	6	0.14	0.13	0.19	0.16	0.14	0.13
39	6	0.12	0.15	0.21	0.19	0.17	0.14
40	6	0.13	0.00	C0.00	Compression	Compression	Compression
41	6	Compression	Compression	Cpression	Compression	Compression	Compression
42	6	0.11	0.09	0.30	0.28	0.29	0.29
43	7	Compression	Compression	Cpression	Compression	Compression	Compression
44	7	0.01	Compression	Cpression	Compression	Compression	Compression
45	7	0.10	0.14	0.07	0.09	0.07	0.08
46	7	Compression	Compression	Cpression	Compression	Compression	Compression
47	7	0.15	NR	NR	NR	NR	NR
48	7	0.07	NR	ORC	NR	Compression	Compression
49	7	0.13	0.14	0.08	0.08	0.05	0.05

Notes:

1. Unit: %
2. NR = No Reading
3. ORC = Over Range in Compression = Reading is greater than 1.6%
4. Level I criteria: 8.4%

calculation of these parameters is included in Appendix B. The control chart for each of the clusters is presented in Figures 8 through 14. The upper and lower limits of the control charts were established as the larger of mean ± 3s or mean ± 3 x manufacturer error where manufacturer error is ± 0.03 inches of strain or ± 0.05 percent (0.03/61x100 where 0.03 is the instrument error in inches and 61 is the instrument length in inches). In other words, the error in the differences between companion strain meter measurements cannot be less than the meter measurement error stated by the manufacturer.

Using data from the most recent monitoring event, differences between companion strain meters were plotted on the control charts (Figures 8 through 14). All strain differences are between the upper and lower limits of the control charts.

TABLE 2
STRAIN METER
CONTROL CHART PARAMETERS

Cluster	Companion Strain Meters	Mean[1]	Standard Deviation (s)[1]	3s	3 x Accuracy
1	SM-4 / SM-5	0.4291	0.0545	0.1635[2]	0.15
2	SM-11 / SM-12	-0.0392	0.0385	0.1155	0.15[2]
3	SM-18 / SM-19	0.5634	0.0113	0.0339	0.15[2]
4	SM-25 / SM-26	0.0329	0.0944	0.2832[2]	0.15
5	SM-31 / SM-33	-0.6193	0.3090	0.9270[2]	0.15
6	SM-39 / SM-40	-0.0068	0.0774	0.2322[2]	0.15
7	SM-45 / SM-46	0.2050	0.2108	0.6324[2]	0.15

[1] Developed using data collected during baseline monitoring.

[2] Used in calculating upper and lower limits of control chart.

2.3 DATA COMPARISON TO CRITERIA

The percent strain measured from each of the strain meters, which was summarized in Table 1, was compared to the Level I Criteria of the MC VI-E Settlement Monitoring Plan. The Level I Criteria for tensile strain is one-third of the ultimate biaxial tensile strain of the primary geomembrane. Testing of the geomembrane

used in the construction of the VI-E liner indicates that the mean ultimate biaxial tensile strain is 25.1 percent (Appendix C). Therefore, the Level I Criteria for tensile strain is 8.4 percent. As shown on Table 1, the maximum tensile strain measured during the March 2008 monitoring event was 1.19 percent, which is below the Level I Criteria.

Review of the strain meter data shows increases in the strain meter clusters except for SM-3 in cluster 1 and the strain meters in cluster 6 from the previous monitoring event. SM-3 in cluster 1 and the strain meters in cluster 6 show decreases in strain for the two previous monitoring events.

3.0 DIFFERENTIAL SETTLEMENT

3.1 SETTLEMENT PROFILER

There are three settlement profilers in VI-E Phase 1 designated as north-south, northern east-west and southern east-west profilers and two settlement profilers in VI-E Phase 2 designated as Phase 2 north-south and Phase 2 east-west profilers. The settlement profiler alignments are shown on Plate 2 in Appendix A. The Phase 2 north-south profiler is a continuation of the Phase 1 north-south profiler. The settlement profilers are HDPE pipelines that span the floor of the cell buried within the leachate collection system sand layer. A sensor (Geokon Model 4651) was pulled through each pipeline to measure elevations at set points or "stations" from which slopes and settlement were determined. The stations were located as follows:

- Every 200 feet as the sensor was pulled away from the reference station
- Every 20 feet as the sensor was pulled toward the reference station

During the installation of the Phase 2 north-south profiler, the first 80 feet of the Phase 1 north-south profiler was cut out to install the Phase 2 north-south profiler. The Phase 1/Phase 2 connection for the north-south profiler occurs at station 80 on the Phase 1 north-south profiler and station 690 on the Phase 2 north-south profiler.

During this monitoring event, we were able to pull the profiler sensor through all four profiler pipes and complete the elevation survey.

3.1.1 Data Reduction

Elevation profiles are presented on Figures 15 through 19. These figures present the baseline readings, a mid-

term settlement reading, the current monitoring event elevation profile, and the 5-year settlement projection limits (for the north-south, northern east-west and southern east-west profiler) as calculated in section 4.0 of this report. The readings and associated data reduction spreadsheet, as well as a sample calculation, are presented in Appendix B.

3.1.2 Data Quality Assurance Evaluation

The data quality assurance evaluation is described in the MC VI-E Settlement Monitoring Plan. The procedure of measuring elevations every 200 feet going away from the reference station and every 20 feet approaching the reference station creates duplicate elevation measurements at the following stations:

- Phase 1 north-south profiler: 200, 400 feet
- Phase 2 north-south profiler: 0, 200, 400, 600 feet
- Northern east-west profiler: 0, 200, 400, 600, 800, 1,000 and 1,200 feet
- Southern east-west profiler: 0, 200, 400, 600, 800, 1,000 and 1,200 feet
- Phase 2 east-west profiler: 0, 200, 400, 600 feet

Differences between duplicate elevation measurements during the baseline monitoring period were used to develop control charts. Differences between duplicate elevation measurements during post-baseline monitoring events will always be compared to the control charts to verify data quality.

During the four-day baseline monitoring period for each profiler pipe, we calculated a daily mean and standard deviation of the differences between duplicate measurements (i.e. for each profiler pipe there were four means and four standard deviations). Then we calculated the mean and three standard deviations of the daily means (Centerline and Upper/Lower Limits respectively in Figures 20, 22, 24, 26 and 28); and the mean and three standard deviations of the daily standard deviations (Centerline and Upper/Lower Limits respectively in Figures 21, 23, 25, 27 and 29). These means and standard deviations were used to prepare control charts (Figures 20-29). Control chart parameters are presented in Table 3 and a sample calculation is included in Appendix B. Elevation differences between the Phase 1 settlement gauges (Section 3.2) and the northern east-west profiler were included in the data used to create the control charts for the northern east-west profiler. The elevation differences between the Phase 2 western settlement gauge and the Phase 2 east-west profiler were included in the data used to create the control charts for the Phase 2 east-west profiler.

TABLE 3
PROFILER SURVEY
CONTROL CHART PARAMETERS

Northern East-West Profiler			Southern East-West Profiler			Phase 1 North-South Profiler			Phase 2 East-West Profiler			Phase 2 North-South Profiler		
Date	Avg. (ft)	St. Dev. (ft)	Date	Avg. (ft)	St. Dev. (ft)	Date	Avg. (ft)	St. Dev. (ft)	Date	Avg. (ft)	St. Dev. (ft)	Date	Avg. (ft)	St. Dev. (ft)
9/15/04	0.09	0.1453	8/25/04	0.03	0.0771	9/15/04	-0.10	0.0867	6/12/08	-0.11	0.2369	6/12/08	0.07	0.0392
9/16/04	0.02	0.1538	8/26/04	-0.02	0.0416	9/16/04	-0.17	0.1672	7/9/08	-0.01	0.2418	7/9/08	-0.01	0.0216
9/17/04	-0.01	0.1460	8/27/04	0.00	0.0338	9/17/04	0.02	0.0352	7/11/08	-0.16	0.2648	7/11/08	-0.01	0.0728
9/18/04	-0.09	0.1200	8/28/04	0.06	0.0738	9/18/04	-0.13	0.1160	7/15/08	-0.13	0.3128	7/15/08	0.31	0.0667
Avg.	0.0002	0.1413	Avg.	0.02	0.0566	Avg.	-0.10	0.1013	Avg.	-0.1035	0.2641	Avg.	0.09	0.0500
St. Dev. (σ)	0.0743	0.0743	St. Dev. (σ)	0.0359	0.0221	St. Dev. (σ)	0.0853	0.0552	St. Dev. (σ)	0.0639	0.0347	St. Dev. (σ)	0.1537	0.0239
3σ	0.2228	0.0441	3σ	0.1077	0.0662	3σ	0.2559	0.1656	3σ	0.1917	0.1041	3σ	0.4611	0.0718

The purpose of the control charts is to provide an ongoing statistical comparison of the differences in duplicate elevation measurements to the corresponding differences measured during the baseline period. For each post-baseline monitoring event the differences in duplicate elevation measurements will be calculated and from those differences a mean and standard deviation will be calculated and plotted. Means will be plotted on Figures 20, 22, 24, 26 and 28; standard deviations on Figures 21, 23, 25, 27 and 29. For the differences in duplicate measurements to be acceptable – i.e. to be statistically consistent – the plotted points must fall inside of the Upper and Lower Limits shown in Figures 20 through 29. Review of the control charts, updated with the most recent data, indicates that duplicate elevation measurements are statistically consistent.

3.1.3 Data Comparison to Criteria

The MC VI-E Settlement Monitoring Plan Level I Criteria limits the amount by which the slope of the VI-E floor can rise or fall, relative to the original (baseline) slope, to a maximum of plus or minus three percent without slope reversal (i.e. uphill slopes must remain uphill; downhill slopes must remain downhill). For each post-baseline monitoring event, the slope of each 20-foot increment will be measured and compared to the corresponding average baseline slope (Tables 4 through 8). Provided the difference between current and average baseline slope is, in all cases, no more than plus or minus three percent, and no slopes have changed direction, Level I Criteria will be satisfied. For example, for a baseline slope of 4 percent, the current slope must be between 1 percent and 7 percent to satisfy Level I Criteria. For a baseline slope of 1 percent, the current slope must remain greater than zero (cannot subtract 3 percent from 1 percent without creating a slope reversal) and less than or equal to 4 percent. However, as stated in the "Revisions to the Settlement Monitoring Plan", dated May 24, 2006, the slope criteria in the settlement monitoring plan should not be applied to the surveyed slopes between stations located on side slopes, pipe crossings, and where profile pipes are oriented parallel to the floor slopes

Review of Tables 4 through 8 indicates that the measured pipe slopes along all the profilers does not exceed the Level 1 criteria between stations not located in pipe crossings and pipe access sections.

Based on the data from the stations not located in the pipe crossings and pipe access sections, the Phase 1 north-south pipe has minimal settlement since the last monitoring event in March 2007 and as much as 1.6 feet since the background period.

Table 4
Slope Comparison
Phase 1 North-South Pro

Station Interval (ft)	Station Interval Location	Average Baseline Slope 8/04	11/15/2004		1/20/2005		2/1/2005		3/24/2005		5/24/2005		5/27/2005		7/19/2005		Sl
			Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	
0-20	side slope	-	-		-		-		-		-		-		-		
20-40	side slope	4.55	4.73	-0.18	4.95	-0.39	5.06	-0.50	5.29	-0.73	2.90	1.65	5.58	-1.03	4.15	0.40	5
40-60	side slope	27.99	27.68	0.31	26.55	1.45	25.85	2.15	28.30	-0.31	25.68	2.32	25.66	2.33	29.79	-1.80	2
60-80	side slope	-22.41	-22.84	0.43	-22.94	0.53	-23.52	1.11	-23.48	1.08	-20.43	-1.98	-20.86	-1.55	-23.97	1.56	-2
80-100	side slope	-8.02	-7.70	-0.32	-7.60	-0.42	-6.62	-1.40	-8.16	0.15	-8.96	0.94	-8.27	0.25	-7.64	-0.37	-
100-120	cell floor	-2.30	-2.56	0.26	-2.49	0.19	-3.08	0.78	-2.31	0.01	-2.63	0.33	-2.59	0.29	-2.74	0.44	-
120-140	cell floor	-1.70	-1.33	-0.37	-1.64	-0.07	-1.37	-0.34	-1.57	-0.14	-0.74	-0.97	-0.42	-1.28	-0.26	-1.44	-
140-160	cell floor	-3.11	-3.39	0.28	-3.31	0.20	-3.60	0.49	-3.21	0.10	-4.45	1.34	-4.79	1.68	-3.70	0.58	-
160-180	pipe crossing	3.02	3.03	-0.01	2.60	0.42	2.07	0.95	3.07	-0.05	3.51	-0.49	2.70	0.32	2.96	0.06	2
180-200	pipe crossing	-6.81	-7.07	0.26	-6.74	-0.07	-6.54	-0.28	-7.28	0.47	-7.28	0.47	-6.77	-0.04	-7.08	0.27	-
200-220	pipe crossing	-3.02	-2.92	-0.10	-2.57	-0.45	-2.78	-0.24	-2.54	-0.49	-2.21	-0.82	-3.09	0.06	-3.09	0.07	-
220-240	cell floor	-1.46	-1.69	0.23	-2.19	0.73	-2.04	0.58	-2.14	0.68	-1.45	-0.01	-1.68	0.21	-1.43	-0.03	-
240-260	cell floor	-3.22	-3.22	0.00	-3.16	-0.06	-3.42	0.20	-3.61	0.39	-2.09	-1.13	-2.15	-1.07	-2.87	-0.35	-
260-280	cell floor	-2.55	-1.93	-0.62	-2.06	-0.49	-2.15	-0.40	-1.76	-0.79	-5.16	2.61	-0.83	-1.72	-1.43	-1.12	-
280-300	cell floor	-1.25	-1.74	0.49	-1.65	0.40	-1.37	0.12	-1.38	0.13	2.39	-3.65	-2.08	0.82	-0.60	-0.65	-
300-320	cell floor	-1.75	-2.03	0.28	-2.34	0.59	-2.80	1.04	-2.28	0.52	-2.48	0.72	-1.67	-0.09	-2.50	0.75	-
320-340	cell floor	-4.36	-4.35	-0.01	-4.03	-0.33	-3.48	-0.88	-4.15	-0.21	-6.49	2.13	-5.23	0.87	-4.71	0.36	-
340-360	cell floor	-1.07	-1.34	0.27	-1.44	0.36	-2.47	1.39	-1.49	0.41	-1.85	0.77	-0.79	-0.28	-1.72	0.65	-
360-380	cell floor	-2.49	-2.17	-0.32	-2.47	-0.02	-2.08	-0.40	-3.48	0.99	-2.26	-0.22	-2.74	0.26	-2.32	-0.17	-
380-400	cell floor	-2.91	-2.69	-0.22	-2.96	0.05	-3.25	0.34	-2.75	-0.15	-3.26	0.36	-4.55	1.64	-3.60	0.70	-
400-420	cell floor	-2.79	-2.57	-0.22	-2.58	-0.21	-1.58	-1.21	-1.92	-0.88	-3.05	0.26	-2.42	-0.38	-2.41	-0.38	-
420-440	cell floor	-2.13	-2.56	0.43	-2.62	0.49	-2.42	0.29	-1.81	-0.32	-3.02	0.89	-3.29	1.16	-3.46	1.33	-
440-460	pipe crossing	-2.84	-2.60	-0.24	-0.49	-2.34	-3.53	0.69	-4.19	1.35	-3.28	0.45	-1.44	-1.39	-3.75	0.91	
460-480	pipe crossing	1.87	2.64	-0.77	0.58	1.30	3.07	-1.20	1.36	0.51	2.76	-0.89	1.00	0.87	3.67	-1.79	
480-500	pipe crossing	-4.27	-4.97	0.70	-6.38	2.11	-5.63	1.36			-4.55	0.29	-6.17	1.91	-6.25	1.99	
500-520	cell floor	-5.95	-5.38	-0.57	-4.69	-1.27	-6.28	0.33			-5.75	-0.21	-4.76	-1.19	-5.61	-0.34	
520-540	cell floor	-3.29	-3.76	0.47	-4.08	0.79	-2.97	-0.32			-3.66	0.37	-4.62	1.33	-5.52	2.23	
540-560	cell floor	-1.79	-1.98	0.19	0.96	-2.75	-1.08	-0.71			-3.19	1.40	-2.50	0.71	-1.34	-0.45	
560-580	cell floor	-2.40	-2.13	-0.27	-4.24	1.84	-3.59	1.19			-1.61	-0.79	-1.60	-0.80	-2.99	0.59	
580-600	cell floor	-3.53	-3.23	-0.30	-3.80	0.27	-2.58	-0.94			-3.66	0.13	-3.46	-0.07	-3.17	-0.36	

Notes:

1. Elevation at station 0 is taken at the reference station prior to 9/23/2008 readings. Subsequent readings from 9/23/2008 use the reference station from Phase 2 North-South Profiler since the Phase 1 and Phase 2 profilers were joined.
2. Level 1 Criteria: slope difference must be less than ± 3% and not reverse direction
3. Unit: %
4. Shaded numbers indicate an anomalous result.
5. Pipe crossing and sideslope intervals are not compared to Level 1 Criteria
6. N/A: The Phase 1 profiler pipe was cut at station 80 to install the Phase 2 profiler pipe. These stations are no longer available for readings.

Table 5 Slope Comparison Phase 2 North-South Profiler				
Station Interval (ft)	Station Interval Location	Average Baseline Slope 7/08	9/23/2008	
			Slope	Slope Difference
0-20	side slope	-	-	
20-40	side slope	-33.48	-34.52	1.03
40-60	side slope	-25.83	-27.31	1.48
60-80	side slope	-16.74	-17.89	1.14
80-100	cell floor	0.40	0.37	0.03
100-120	cell floor	1.72	1.81	-0.08
120-140	pipe crossing	0.95	1.05	-0.09
140-160	pipe crossing	2.54	2.71	-0.17
160-180	pipe crossing	2.65	2.47	0.18
180-200	cell floor	0.60	0.68	-0.08
200-220	pipe crossing	1.82	1.82	0.01
220-240	pipe crossing	2.94	3.10	-0.15
240-260	pipe crossing	2.05	2.27	-0.22
260-280	cell floor	2.11	1.60	0.50
280-300	cell floor	1.54	1.48	0.06
300-320	cell floor	1.00	1.46	-0.46
320-340	pipe crossing	1.29	1.33	-0.05
340-360	pipe crossing	2.41	2.17	0.24
360-380	pipe crossing	2.99	2.98	0.00
380-400	cell floor	-0.44	-0.53	0.09
400-420	cell floor	0.36	1.39	-1.03
420-440	cell floor	2.01	1.76	0.24
440-460	cell floor	0.32	0.31	0.01
460-480	cell floor	1.60	2.10	-0.50
480-500	cell floor	1.95	2.00	-0.05
500-520	cell floor	2.28	2.19	0.08
520-540	pipe crossing	1.95	2.12	-0.17
540-560	pipe crossing	3.72	3.55	0.17
560-580	pipe crossing	0.71	0.88	-0.18
580-600	cell floor	6.70	6.53	0.17
600-620	cell floor	6.66	6.71	-0.05
620-640	cell floor	2.80	2.84	-0.04
640-660	P2/P1 Tie-In (Sideslope)	7.88	5.87	2.01
660-680	P2/P1 Tie-In (Sideslope)	-4.47	-3.84	-0.63

Notes:

1. Elevation at station 0 is taken at the reference station
2. Level 1 Criteria: slope difference must be less than ± 3% and not reverse direction
3. Unit: %
4. Shaded numbers indicate an anomalous result.
5. Pipe crossing and sideslope intervals are not compared to Level 1 Criteria

Table 6
Slope Comparison
Northern East-West Profiler

In	Station Interval Location	Average Baseline Slope 8/04	11/15/2004		1/18/2005		3/23/2005		5/24/2005		5/25/2005		7/18/2005		9/20/2005		9/21/2005	
			Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference
0-20	sideslope	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20-40	sideslope	-31.04	-29.85	-1.18	-28.40	-2.64	-29.09	-1.95	-27.40	-3.64	-29.61	-1.43	-29.40	-1.64	-29.21	-1.83	-28.24	-2.80
40-60	sideslope	-2.40	-3.09	0.69	-2.36	-0.03	-2.47	0.08	-3.07	0.67	-1.38	-1.02	-1.62	-0.77	-2.30	-0.09	-3.20	0.81
60-80	sideslope	4.57	4.82	-0.25	4.86	-0.29	4.71	-0.15	3.29	1.28	4.21	0.35	4.84	-0.27	4.80	-0.24	4.73	-0.16
80-100	cell floor	4.95	5.02	-0.07	4.84	0.11	5.09	-0.14	4.91	0.04	6.12	-1.17	4.91	0.04	4.35	0.59	5.01	-0.06
100-120	cell floor	5.09	5.07	0.03	5.32	-0.22	5.06	0.03	5.46	-0.37	3.67	1.42	4.70	0.39	5.10	-0.01	4.82	0.28
120-140	cell floor	4.69	4.67	0.01	4.73	-0.05	4.88	-0.20	5.61	-0.92	5.60	-0.91	4.67	0.01	5.45	-0.76	4.82	-0.14
140-160	cell floor	4.99	5.10	-0.11	4.69	0.30	4.82	0.17	3.96	1.03	4.19	0.80	4.42	0.57	4.15	0.83	5.37	-0.39
160-180	cell floor	5.00	4.91	0.08	5.01	-0.01	4.73	0.27	4.07	0.92	5.35	-0.35	5.61	-0.61	4.51	0.49	4.37	0.63
180-200	cell floor	3.13	3.21	-0.08	2.89	0.24	3.45	-0.32	6.00	-2.87	4.26	-1.13	3.47	-0.33	1.80	1.33	3.56	-0.43
200-220	cell floor	3.40	3.30	0.10	3.81	-0.41	3.66	-0.26	3.03	0.37	3.35	0.05	2.94	0.46	5.38	-1.99	3.12	0.28
220-240	pipe crossing	5.77	5.97	-0.20	5.84	-0.07	5.91	-0.14	6.13	-0.36	6.09	-0.32	5.74	0.03	7.11	-1.34	7.12	-1.35
240-260	pipe crossing	0.75	0.52	0.23	0.99	-0.24	0.23	0.52	-0.59	1.34	0.05	0.70	0.13	0.62	-1.66	2.41	-1.09	1.84
260-280	pipe crossing	1.80	1.81	-0.01	1.56	0.24	1.60	0.20	0.48	1.32	0.05	1.75	1.92	-0.12	1.92	-0.13	2.23	-0.43
280-300	cell floor	1.86	1.91	-0.05	1.45	0.42	2.01	-0.15	2.52	-0.66	1.84	0.03	1.94	-0.08	1.70	0.16	1.74	0.12
300-320	cell floor	2.51	2.40	0.11	2.22	0.30	2.73	-0.22	2.37	0.14	2.55	-0.04	2.89	-0.37	3.53	-1.02	2.39	0.13
320-340	cell floor	2.01	2.09	-0.08	2.03	-0.03	1.92	0.08	1.85	0.15	2.17	-0.17	0.93	1.08	1.76	0.25	1.77	0.24
340-360	cell floor	0.98	1.05	-0.07	1.00	-0.02	0.98	0.00	0.81	0.17	0.71	0.27	1.64	-0.66	1.29	-0.30	1.36	-0.38
360-380	cell floor	1.18	1.22	-0.05	1.63	-0.46	1.28	-0.10	1.52	-0.35	0.98	0.20	1.00	0.18	1.69	-0.51	0.91	0.27
380-400	cell floor	1.00	0.85	0.15	0.84	0.16	0.94	0.06	0.53	0.47	1.13	-0.13	0.93	0.07	0.56	0.44	0.87	0.13
400-420	cell floor	1.48	1.42	0.06	1.51	-0.03	1.52	-0.03	2.29	-0.81	1.44	0.04	2.11	-0.63	0.80	0.68	1.32	0.17
420-440	pipe crossing	3.12	3.87	-0.75	3.45	-0.33	3.78	-0.66	3.71	-0.58	4.79	-1.67	4.11	-0.99	5.47	-2.35	5.39	-2.27
440-460	pipe crossing	1.37	0.73	0.63	1.21	0.16	0.43	0.93	1.87	-0.51	0.46	0.91	0.24	1.13	-0.84	2.20	-1.14	2.50
460-480	pipe crossing	-0.58	-0.39	-0.18	-0.71	0.14	-0.33	-0.24	0.44	-1.02	-0.40	-0.18	-0.14	-0.44	0.42	-1.00	0.33	-0.90
480-500	pipe crossing	1.42	1.34	0.08	1.91	-0.49	1.79	-0.37	-0.70	2.12	1.85	-0.43	1.31	0.10	1.44	-0.02	1.54	-0.12
500-520	cell floor	1.63	1.59	0.05	1.32	0.31	1.84	-0.21	2.77	-1.13	2.00	-0.37	1.98	-0.34	2.05	-0.41	2.08	-0.45
520-540	cell floor	0.75	0.84	-0.08	0.86	-0.11	0.57	0.19	0.28	0.47	0.35	0.41	0.74	0.02	0.54	0.21	0.62	0.13
540-560	cell floor	1.03	1.41	-0.38	1.17	-0.13	1.24	-0.20	0.95	0.09	1.20	-0.17	0.94	0.09	1.42	-0.39	1.44	-0.41
560-580	cell floor	1.41	0.90	0.51	1.40	0.02	1.11	0.31	1.50	-0.09	1.18	0.24	1.15	0.26	1.28	0.13	1.01	0.40
580-600	cell floor	0.99	1.03	-0.04	0.84	0.15	1.14	-0.15	1.16	-0.17	1.42	-0.43	1.44	-0.45	1.03	-0.04	1.11	-0.12
600-620	pipe crossing	0.84	0.73	0.12	0.78	0.06	0.57	0.27	0.34	0.50	0.23	0.62	0.07	0.78	0.13	0.71	0.13	0.71
620-640	pipe crossing	0.29	0.45	-0.17	0.81	-0.53	0.54	-0.26	0.79	-0.50	0.94	-0.65	0.53	-0.25	2.73	-2.44	2.46	-2.18
640-660	pipe crossing	1.36	1.29	0.07	0.84	0.51	0.88	0.48	0.23	1.12	0.09	1.26	0.11	1.24	-2.95	4.31	-2.57	3.92
660-680	pipe crossing	-5.70	-5.47	-0.23	-5.53	-0.17	-5.52	-0.18	-5.10	-0.60	-5.30	-0.40	-5.00	-0.70	-4.27	-1.43	-4.85	-0.85
680-700	pipe crossing	-1.81	-2.10	0.29	-2.26	0.44	-2.07	0.26	-1.87	0.06	-1.52	-0.29	-1.57	-0.24	-1.29	-0.52	-0.46	-1.35
700-720	cell floor	-0.91	-0.84	-0.07	-0.42	-0.49	-1.20	0.29	-0.76	-0.15	-0.92	0.01	-0.67	-0.24	-1.38	0.48	-1.35	0.44
720-740	cell floor	-0.65	-0.73	0.08	-0.80	0.15	-0.20	-0.45	-0.64	-0.01	-0.74	0.09	-0.80	0.14	0.20	-0.86	-0.71	0.06
740-760	cell floor	-0.73	-0.77	0.04	-0.68	-0.05	-0.77	0.04	-0.77	0.04	-0.56	-0.17	-0.48	-0.25	-1.40	0.67	-0.51	-0.22
760-780	cell floor	-1.34	-1.33	-0.01	-1.39	0.05	-1.23	-0.11	-1.36	0.02	-1.66	0.32	-1.68	0.34	-0.89	-0.45	-1.51	0.16
780-800	cell floor	-1.47	-1.46	-0.01	-1.46	-0.01	-1.38	-0.09	-1.51	0.03	-1.17	-0.30	-1.21	-0.26	-1.36	-0.11	-1.16	-0.31
800-820	cell floor	-1.65	-1.51	-0.15	-1.42	-0.23	-1.71	0.05	-1.45	-0.20	-1.76	0.11	-1.63	-0.02	-1.88	0.22	-2.00	0.35
820-840	pipe crossing	1.67	1.60	0.08	1.49	0.18	2.14	-0.47	2.09	-0.42	2.22	-0.54	2.47	-0.79	3.25	-1.58	3.90	-2.22
840-860	pipe crossing	-1.45	-1.24	-0.20	-0.81	-0.63	-1.79	0.35	-1.51	0.06	-1.73	0.29	-2.06	0.61	-3.07	1.62	-4.05	2.60
860-880	pipe crossing	-3.12	-3.66	0.55	-3.91	0.80	-3.55	0.44	-3.46	0.34	-3.30	0.19	-3.56	0.45	-3.09	-0.02	-3.22	0.10
880-900	cell floor	-1.63	-1.43	-0.19	-2.50	0.87	-0.93	-0.69	-1.59	-0.04	-1.23	-0.40	-1.44	-0.19	-1.69	0.06	-1.75	0.12
[illegible]	cell floor	-1.78	-1.60	-0.18	-0.85	-0.93	-2.02	0.24	-1.88	0.10	-1.87	0.09	-2.00	0.22	-1.11	-0.68	-1.32	-0.46
	cell floor	-1.78	-2.13	0.35	-2.39	0.62	-2.22	0.45	-2.19	0.42	-2.74	0.96	-1.54	-0.24	-2.93	1.15	-0.92	-0.86
	cell floor	-2.38	-2.57	0.19	-2.61	0.23	-2.67	0.29	-2.68	0.30	-2.35	-0.03	-2.24	-0.13	-2.42	0.05	-2.89	0.51
960-980	cell floor	-2.01	-1.97	-0.03	-1.83	-0.18	-2.11	0.10	-1.79	-0.22	-2.30	0.29	-2.09	0.09	-0.92	-1.09	-2.37	0.36
980-1000	cell floor	-2.79	-2.66	-0.13	-2.57	-0.22	-2.55	-0.24	-2.80	0.02	-2.64	-0.15	-3.06	0.27	-4.20	1.41	-2.98	0.19
1000-1020	cell floor	-2.96	-2.77	-0.19	-2.66	-0.29	-3.38	0.42	-2.97	0.01	-2.93	-0.02	-3.07	0.11	-3.06	0.10	-2.94	-0.02
1020-1040	pipe crossing	-1.22	-1.32	0.10	-1.43	0.20	-0.96	-0.26	-1.00	-0.23	-0.54	-0.69	-0.22	-1.00	0.63	-1.85	0.44	-1.67
1040-1060	pipe crossing	-2.51	-2.47	-0.04	-2.54	0.03	-2.68	0.16	-3.04	0.52	-3.56	1.05	-4.05	1.54	-5.87	3.36	-5.09	2.58
1060-1080	cell floor	-7.57	-7.55	-0.02	-7.80	0.24	-7.14	-0.42	-7.27	-0.30	-7.07	-0.50	-6.63	-0.94	-6.21	-1.36	-7.42	-0.14
1080-1100	cell floor	-3.74	-4.01	0.27	-3.73	-0.01	-3.39	-0.35	-3.92	0.18	-4.10	0.36	-4.38	0.64	-4.32	0.58	-4.42	0.68
1100-1120	cell floor	-4.32	-4.15	-0.18	-4.22	-0.10	-4.50	0.17	-4.17	-0.16	-4.04	-0.29	-4.27	-0.06	-4.34	0.02	-3.84	-0.49
1120-1140	cell floor	-3.17	-3.28	0.11	-3.26	0.09	-3.53	0.37	-2.99	-0.17	-3.34	0.17	-2.49	-0.68	-2.41	-0.76	-3.11	-0.06
1140-1160	cell floor	-3.66	-3.53	-0.13	-3.58	-0.08	-3.51	-0.15	-3.87	0.20	-3.73	0.07	-3.77	0.11	-4.12	0.46	-3.45	-0.22
1160-1180	cell floor	-4.03	-4.17	0.14	-4.39	0.36	-4.31	0.28	-4.30	0.27	-4.57	0.54	-3.96	-0.07	-3.93	-0.11	-4.14	0.11
1180-1200	sideslope	-1.31	-1.40	0.09	-1.33	0.02	-1.04	-0.27	-0.71	-0.60	-0.50	-0.81	-0.67	-0.64	1.10	-2.41	0.81	-2.12
1200-1220	sideslope	14.15	14.98	-0.83	13.81	0.33	16.59	-2.44	16.68	-2.54	16.31	-2.17	16.11	-1.96	21.00	-6.86	18.90	-4.76
1220-1240	sideslope	28.04	26.59	1.45	28.22	-0.18	26.04	2.00	25.17	2.86	27.17	0.86	26.20	1.84	20.05	7.99	19.36	8.68

Notes:

1. Elevation at station 0 is taken at the reference station
2. Level 1 Criteria: slope difference must be less than ± 3% and not reverse direction
3. Unit: %
4. Shaded numbers indicate an anomalous result.
5. Pipe crossing and sideslope intervals are not compared to Level 1 Criteria

Station Interval	Station Interval Location	Average Baseline Slope 8/04	11/16/2004		5/26/2005		5/31/2005		3/27/2007		6/27/2007		9/27/2007		3/31/2008		9/24/2008	
			Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference	Slope	Slope Difference
0-20	sideslope	-	-		-		-		-		-		-		-		-	
20-40	sideslope	-28.32	-30.35	2.03	-30.17	1.84	-30.48	9.10	0.78	-30.57	2.24	-30.03	1.70	-35.91	7.59	-28.79	0.47
40-60	sideslope	-15.57	-13.57	-2.00	-16.51	0.93	-15.23	5.25	-0.32	-15.09	-0.48	-15.10	-0.48	-14.42	-1.16	-15.71	0.14
60-80	sideslope	-3.50	-3.20	-0.30	-4.22	0.72	-4.04	.86	0.36	-3.51	0.01	-3.94	0.44	-5.02	1.52	-3.90	0.40
80-100	pipe access	1.44	1.46	-0.01	0.35	1.09	0.32	.24	1.68	-0.45	1.89	-0.16	1.60	1.08	0.37	-0.32	1.76
100-120	pipe access	1.93	1.73	0.20	0.68	1.26	0.88	.99	0.94	0.70	1.24	0.94	1.00	4.52	-2.58	1.16	0.77
120-140	pipe access	1.78	1.99	-0.22	2.01	-0.24	2.44	.58	-0.81	2.41	-0.63	2.34	-0.56	4.15	-2.37	2.30	-0.52
140-160	pipe access	2.19	1.41	0.78	2.05	0.14	1.90	.41	0.78	1.54	0.65	1.31	0.89	0.07	2.12	1.44	0.76
160-180	pipe access	1.05	0.83	0.22	2.14	-1.09	2.26	.93	-1.88	2.84	-1.79	2.71	-1.66	1.69	-0.64	2.60	-1.55
180-200	pipe access	0.86	0.58	0.27	2.25	-1.39	1.50	.09	-0.24	1.06	-0.20	1.27	-0.41	2.73	-1.88	1.44	-0.59
200-220	pipe access	-0.06	-0.60	0.54	-0.14	0.08	-0.12	.88	-0.94	1.14	-1.20	0.97	-1.03	1.02	-1.08	1.15	-1.21
220-240	pipe access	-0.87	-0.94	0.06	-0.82	-0.06	-0.52	.32	-0.56	-0.37	-0.51	-0.31	-0.57	-0.38	-0.49	-0.69	-0.19
240-260	pipe access	-0.87	-0.35	-0.52	-0.11	-0.76	-0.23	.00	-0.87	0.02	-0.89	0.11	-0.98	-0.59	-0.28	0.28	-1.15
260-280	pipe crossing	-0.15	-0.18	0.03	0.87	-1.01	0.18	.53	-0.67	0.35	-0.49	0.35	-0.49	0.06	-0.20	0.39	-0.54
280-300	pipe crossing	3.85	4.23	-0.37	4.35	-0.49	5.26	.26	-0.40	4.20	-0.35	4.28	-0.43	4.48	-0.62	4.44	-0.59
300-320	pipe crossing	-0.71	-1.63	0.92	-1.11	0.40	-1.92	.50	1.79	-2.55	1.84	-2.41	1.70	-1.92	1.21	-2.54	1.84
320-340	pipe crossing	-1.42	-1.09	-0.33	-0.34	-1.08	-0.58	.01	-1.41	0.12	-1.54	-0.05	-1.37	-1.68	0.26	-0.02	-1.40
340-360	cell floor	1.74	2.63	-0.90	2.12	-0.39	2.66	.40	-0.66	2.53	-0.80	2.66	-0.93	3.27	-1.54	2.61	-0.87
360-380	cell floor	3.03	3.46	-0.43	2.44	0.59	3.01	.87	0.16	2.86	0.17	2.87	0.16	4.21	-1.18	2.72	0.31
380-400	cell floor	2.67	2.88	-0.21	1.22	1.45	1.23	.07	-0.40	2.73	-0.06	2.80	-0.13	0.81	1.86	2.78	-0.11
400-420	cell floor	2.94	3.07	-0.13	3.09	-0.15	2.92	.48	0.46	2.70	0.24	2.70	0.24	3.23	-0.29	2.52	0.42
420-440	cell floor	2.96	3.18	-0.22	2.97	-0.01	3.62	.07	-0.11	2.89	0.07	2.85	0.11	2.01	0.95	2.93	0.03
440-460	cell floor	3.05	3.18	-0.13	3.51	-0.46	2.92	.70	0.35	2.90	0.15	2.95	0.10	4.22	-1.17	2.94	0.11
460-480	cell floor	2.85	2.97	-0.12	4.67	-1.82	3.59	.55	-0.71	3.45	-0.60	2.89	-0.04	0.69	2.16	2.91	-0.06
480-500	pipe crossing	6.07	6.59	-0.53	6.29	-0.23	7.97	.64	-1.57	7.71	-1.64	8.18	-2.12	9.11	-3.05	8.17	-2.11
500-520	pipe crossing	3.73	3.17	0.56	2.77	0.95	2.13	.16	3.57	-0.09	3.82	-0.37	4.09	-0.53	4.26	-0.51	4.23
520-540	pipe crossing	-1.52	-1.15	-0.37	-1.10	-0.42	-1.02	.21	-1.73	0.30	-1.82	0.37	-1.89	-0.27	-1.25	0.41	-1.93
540-560	cell floor	2.82	2.80	0.02	2.74	0.08	3.14	.28	-0.46	3.41	-0.59	3.31	-0.49	4.01	-1.20	3.44	-0.62
560-580	cell floor	2.62	2.62	0.01	2.90	-0.28	2.37	.28	-0.65	2.74	-0.12	2.73	-0.11	2.99	-0.36	2.79	-0.17
580-600	cell floor	2.70	2.52	0.17	2.66	0.04	2.60	.84	0.86	1.46	1.24	1.73	0.96	1.08	1.62	1.37	1.33
600-620	cell floor	2.01	2.05	-0.04	2.04	-0.03	2.02	.65	-0.65	2.77	-0.77	2.34	-0.34	2.73	-0.72	2.40	-0.39
620-640	cell floor	2.15	1.99	0.16	2.18	-0.03	2.13	.46	-0.32	2.38	-0.23	2.35	-0.21	1.83	0.31	2.09	0.05
640-660	cell floor	3.95	3.98	-0.03	4.21	-0.25	4.34	.38	-0.42	4.08	-0.12	4.10	-0.14	5.13	-1.17	3.85	0.10
660-680	pipe crossing	2.75	2.81	-0.06	2.82	-0.08	2.70	.41	1.34	1.35	1.39	1.12	1.63	1.05	1.70	1.25	1.49
680-700	pipe crossing	1.03	1.04	-0.02	1.24	-0.21	0.81	.88	0.14	0.70	0.33	0.86	0.17	0.07	0.95	0.48	0.55
700-720	pipe crossing	-3.53	-3.71	0.18	-4.44	0.91	-4.00	.12	4.60	-7.92	4.39	-8.05	4.52	-7.84	4.31	-8.61	5.09
720-740	cell floor	-5.84	-5.85	0.01	-5.31	-0.53	-5.89	.55	-0.29	-5.06	-0.78	-5.42	-0.42	-5.47	-0.37	-5.44	-0.40
740-760	cell floor	-3.34	-3.32	-0.01	-3.69	0.36	-2.79	.05	0.71	-3.07	-0.27	-3.99	0.65	-6.15	2.81	-4.35	1.01
760-780	cell floor	-2.53	-2.66	0.12	-2.63	0.09	-3.06	.94	0.40	-3.86	1.33	-3.11	0.58	-1.87	-0.67	-3.40	0.87
780-800	cell floor	-2.93	-2.96	0.02	-2.53	-0.41	-2.94	.76	-1.17	-1.90	-1.03	-1.31	-1.63	-0.51	-2.42	-1.59	-1.35
800-820	cell floor	-2.26	-1.96	-0.30	-2.69	0.43	-2.05	.66	1.40	-2.82	0.56	-3.95	1.69	-4.25	1.99	-4.25	1.99
820-840	cell floor	-3.39	-3.30	-0.09	-3.10	-0.28	-2.59	.20	-0.19	-3.54	0.16	-3.18	-0.21	-5.19	1.81	-3.65	0.26
840-860	cell floor	-2.51	-2.77	0.26	-2.48	-0.04	-3.52	.87	0.36	-2.57	0.06	-2.77	0.26	-1.51	-1.00	-2.64	0.13
[illegible]	cell floor	-2.23	-2.45	0.22	-2.63	0.41	-2.73	.03	0.80	-3.37	1.15	-3.02	0.79	-1.63	-0.59	-2.71	0.48
[illegible]	pipe crossing	-1.08	-1.02	-0.06	-0.99	-0.09	-1.00	.21	-4.29	3.37	-4.45	3.02	-4.10	3.84	-4.92	3.22	-4.30
900-920	pipe crossing	0.32	0.33	-0.02	0.28	0.04	0.19	.88	7.19	-7.16	7.47	-6.34	6.65	-8.24	8.55	-6.20	6.52
920-940	pipe crossing	-6.93	-6.64	-0.29	-6.81	-0.12	-5.47	.88	-4.05	-2.90	-4.03	-2.92	-4.01	-2.96	-3.97	-2.28	-4.65
940-960	pipe crossing	-2.06	-1.86	-0.20	-1.45	-0.61	-2.51	.71	-1.35	-1.58	-0.48	-1.05	-1.00	1.52	-3.58	-1.07	-0.99
960-980	pipe access	0.17	0.29	-0.12	0.30	-0.13	0.19	28	-1.11	1.50	-1.33	1.43	-1.26	0.61	-0.44	1.61	-1.44
980-1000	pipe access	0.60	0.65	-0.05	0.82	-0.22	0.98	.72	1.32	0.28	0.32	-0.63	1.23	-1.48	2.08	-0.20	0.80
1000-1020	pipe access	0.37	0.11	0.26	0.17	0.20	0.02	.76	1.13	-1.79	2.16	-0.63	1.00	0.99	-0.61	-0.72	1.09
1020-1040	pipe access	0.03	0.09	-0.05	-0.65	0.68	0.18	.54	1.58	-0.57	0.60	-1.14	1.17	-2.13	2.17	-0.80	0.84
1040-1060	pipe access	-0.69	-0.44	-0.25	-0.56	-0.12	-1.14	.54	0.86	-1.54	0.86	-1.34	0.65	0.71	-1.40	-1.87	1.18
1060-1080	pipe access	-0.79	-0.64	-0.15	-0.65	-0.14	-0.60	.22	-0.56	0.03	-0.82	-0.16	-0.63	-0.43	-0.35	0.33	-1.12
1080-1100	pipe access	0.47	0.24	0.23	0.46	0.01	0.36	.20	-0.73	1.02	-0.55	1.11	-0.64	-1.83	2.30	1.29	-0.82
1100-1120	pipe crossing	1.13	1.39	-0.26	1.54	-0.41	2.20	.44	-3.31	4.51	-3.38	4.95	-3.82	8.51	-7.38	4.76	-3.62
1120-1140	pipe crossing	6.82	6.34	0.49	5.83	1.00	5.61	.62	7.44	-0.22	7.05	-1.07	7.89	-1.14	7.97	-1.00	7.82
1140-1160	pipe crossing	-5.58	-5.79	0.20	-6.48	0.90	-6.99	.38	-1.20	-5.18	-0.40	-4.02	-1.56	-4.41	-1.18	-3.67	-1.91
1160-1180	pipe crossing	-2.22	-2.01	-0.21	-1.31	-0.91	-0.74	.43	-1.79	0.04	-2.26	-0.47	-1.75	-0.57	-1.65	-0.44	-1.78
1180-1200	pipe crossing	-1.10	-1.33	0.24	-1.04	-0.06	-1.27	.15	-2.25	0.94	-2.04	1.56	-2.65	-0.32	-0.78	1.32	-2.41
1200-1220	pipe crossing	2.57	2.72	-0.16	3.17	-0.60	2.85	91	0.66	2.03	0.54	1.62	0.95	1.66	0.91	1.67	0.90
1220-1240	pipe crossing	-0.98	-1.49	0.51	-1.98	1.01	-1.40	.10	2.12	-3.14	2.17	-3.11	2.13	-2.21	1.24	-2.79	1.82
1240-1260	pipe crossing	-4.76	-4.83	0.07	-4.51	-0.25	-5.04	.96	-3.80	-0.21	-4.55	-0.80	-3.96	-0.75	-4.01	-0.80	-3.96
1260-1280	pipe crossing	-1.79	-1.85	0.06	-1.78	-0.01	-1.37	.12	-1.91	-0.42	-1.38	0.03	-1.82	1.78	-3.57	0.09	-1.88
1280-1300	pipe crossing	-2.06	-1.83	-0.24	-1.78	-0.28	-1.91	54	-2.60	0.44	-2.50	1.16	-3.22	-0.17	-1.89	1.55	-3.61
1300-1320	sideslope	0.08	-0.06	0.14	0.83	-0.76	0.36	68	-9.60	10.44	-10.37	10.21	-10.14	8.92	-8.85	10.84	-10.77
1320-1340	sideslope	12.16	12.27	-0.11	13.54	-1.38	13.75	.18	-14.03	25.69	-13.53	25.54	-13.38	26.73	-14.58	26.28	-14.12
1340-1360	sideslope	28.37	28.54	-0.18	26.78	1.59	29.42	.43	8.94	18.66	9.71	18.71	9.66	20.73	7.64	18.75	9.62

Notes:

1. Elevation at station 0 is taken at the reference station
2. Level 1 Criteria: slope difference must be less than ± 3% and not reverse direction
3. Unit: %
4. Shaded numbers indicate an anomalous result.
5. Pipe crossing and sideslope intervals are not compared to Level 1 Criteria

Table 8
Slope Comparison
Phase 2 East-West Profiler

Station Interval (ft)	Station Interval Location	Average Baseline Slope 7/08	9/23/2008	
			Slope	Slope Difference
0-20	side slope	-	-	
20-40	side slope	-33.58	-34.32	0.74
40-60	side slope	-30.25	-29.76	-0.49
60-80	side slope	-8.09	-8.18	0.09
80-100	cell floor	0.23	0.06	0.17
100-120	cell floor	1.15	1.12	0.03
120-140	cell floor	0.73	1.13	-0.40
140-160	cell floor	1.49	1.85	-0.36
160-180	cell floor	0.83	0.22	0.61
180-200	pipe crossing	2.17	2.53	-0.36
200-220	pipe crossing	6.20	5.80	0.40
220-240	pipe crossing	-2.41	-2.23	-0.19
240-260	cell floor	2.33	2.54	-0.21
260-280	cell floor	2.47	2.70	-0.23
280-300	cell floor	2.52	2.53	-0.01
300-320	cell floor	2.58	2.89	-0.31
320-340	cell floor	1.87	1.82	0.05
340-360	cell floor	2.05	1.85	0.20
360-380	pipe crossing	3.03	2.76	0.28
380-400	pipe crossing	2.30	2.20	0.10
400-420	pipe crossing	8.04	8.87	-0.82
420-440	cell floor	-3.58	-3.80	0.22
440-460	pipe crossing	3.22	2.83	0.39
460-480	pipe crossing	3.54	3.54	0.00
480-500	pipe crossing	3.76	3.49	0.27
500-520	cell floor	1.66	2.06	-0.40
520-540	cell floor	1.46	1.44	0.02
540-560	cell floor	0.92	0.91	0.01
560-580	cell floor	2.09	2.59	-0.50
580-600	cell floor	2.81	3.00	-0.19
600-620	pipe crossing	7.75	9.64	-1.90
620-633	side slope	27.18	24.48	2.70

Notes:

1. Elevation at station 0 is taken at the reference station
2. Level 1 Criteria: slope difference must be less than ± 3% and not reverse direction
3. Unit: %
4. Shaded numbers indicate an anomalous result.
5. Pipe crossing and sideslope intervals are not compared to Level 1 Criteria

Based on the data from the stations not located in the pipe crossings and pipe access sections, the northern east-west profiler pipe has settled as much as 1.6 feet on the east side of the cell and as much as 0.9 feet on the west side of the cell since the previous monitoring event. The northern east-west profiler has settled as much as 2.8 feet on the east side of the cell and 0.9 feet on the west side of the cell since the background monitoring period. The settlement on the east side can be attributed to the active filling in the Phase 2 SE area which extends laterally over the Phase 1 area and the northern east-west profiler.

Based on the data from the stations not located in the pipe crossings and pipe access sections, the southern east-west profiler pipe has settled as much as 0.6 feet since the previous monitoring event and as much as 3.5 feet since the background monitoring period.

Based on the data from the stations not located in the pipe crossings and pipe access sections, the Phase 2 profiler pipes have minimal settlement, since no waste had been placed in the Phase 2 West area at the time of monitoring.

3.2 SETTLEMENT GAUGES

There are three settlement gauges (Geokon Model 4650): two in the Phase 1 area (one on the east side of VI-E and one on the west side, adjacent to the northern east-west profiler) and one in the Phase 2 area (adjacent to the Phase 2 east-west profiler) and are shown on Plate 2. The purpose of the gauges is to provide duplicate liner elevation measurements for comparison to measurements obtained from the adjacent profilers. The Phase 1 area west and east settlement gauges measure elevations at approximately the same locations as stations 171 feet and 1067 feet, respectively, of the northern east-west profiler. The Phase 2 western settlement gauge measures elevation at approximately the same location as station 476 on the Phase 2 east-west profiler.

3.2.1 Data Reduction

Figures 17, 19, 30, and 31 present the elevations of the settlement sensors. Readings, data reduction and a sample calculation are presented in Appendix B. The Phase 1 west settlement sensor has minimal settlement since the previous monitoring period while the east sensor has settled 0.5 feet. The Phase 1 west

and east sensors have settled 0.5 and 2.2 feet, respectively, since the background monitoring period. The settlement experienced in the east sensor can be attributed to the active filling in the southeast corner of Phase 2 SE area which extends laterally over the Phase 1 area and the settlement gauge. The Phase 2 western settlement gauge has minimal settlement since no waste had been placed in Phase 2 West at the time of monitoring.

3.2.2 Data Quality Assurance Evaluation

We compared the elevations of the two settlement gauges to the corresponding elevations of the northern east-west profiler pipe for the Phase 1 area and the Phase 2 western settlement gauge with the Phase 2 east-west profiler pipe. The differences in elevations were used in the data quality assurance evaluation, as explained in Section 3.1.2

4.0 FIVE-YEAR PROJECTIONS OF SETTLEMENT

The MC VI-E Settlement Monitoring Plan requires that a five-year settlement projection be performed once every year. Based on the plan, a range of five-year projections should be estimated, based on the observed settlement at each location, (assumed to be the mean for that location) and on confidence limits about that mean. Baseline data was used to estimate a 95% confidence interval associated with the profiler measurements. For each location of the profiler pipes, the upper and lower limits of the elevation measurements were estimated as the measured elevation plus/minus the 95% confidence interval for each event. The sample calculations for estimating the 95% confidence interval, determining the modified compression index, and the five-year projections of settlement, are included in Appendix B.

For each monitoring event at each station, the value of the modified compression index was estimated based on the measured elevation. Then for each station, we determined the mean value of the modified compression index using the modified compression index that was estimated for each of the available monitoring events. The mean value of modified compression index at each station was then used to complete the future settlement projection for each station. The above approach was then repeated using the upper and lower limits of the elevation measurements to estimate the upper and lower bounds of the future settlement projections.

The eastern half of the northern east-west profiler pipe, southern east-west profiler pipe and the Phase 1 north-south profiler pipe located under more than five feet of waste were used for this evaluation. The Phase 1 north-south and southern east-west profiler pipes were evaluated based on available data from 2005 to 2008. The eastern half of the northern east-west profiler pipe was evaluated based on data from the March 2008 and September 2008 monitoring events. The western half of the northern east-west, the Phase 2 east-west, and the Phase 2 north-south profilers were not used in this analysis because there is less than five feet of waste above the pipes. The equations and spreadsheets used to determine the five-year settlement projections are included in Appendix B. The results of the settlement projection are summarized on Tables 9, 10, and 11.

The predicted five-year settlement for each location was compared to the Level I criteria presented on Table 1 of the monitoring plan. The Level I criteria is defined as five-year settlement profiler slope, as compared to baseline, that has a total reversed slope height of greater than one foot. Review of Table 9 through Table 11 indicate no predicted pipe slopes with a reversed slope height greater than one foot for the Phase 1 north-south profiler, the southern east-west profiler, and the eastern half of the northern east-west profiler for the stations not located on the pipe crossings and pipe access sections.

Table 9
Five-Year Projection of Settlement
Phase 1 North-South Profiler
Average

P1 Station	Baseline Measure Pipe Elevation ft	Baseline Slope %	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Slope Height ft	Comments
120	736.85	-2.30	1.42	734.92			cell floor
140	736.51	-1.70	1.05	735.02	0.50	0.10	cell floor
160	735.89	-3.11	0.63	734.81	-1.09		cell floor
180	736.49	3.02	0.62	735.24	2.17		pipe crossing
200	735.13	-6.81	0.67	733.77	-7.36		pipe crossing
220	734.53	-3.02	0.70	733.34	-2.13		pipe crossing
240	734.23	-1.46	0.99	732.60	-3.70		cell floor
260	733.59	-3.22	0.57	732.47	-0.65		cell floor
280	733.06	-2.55	0.43	732.17	-1.51		cell floor
300	732.83	-1.25	0.68	731.40	-3.85		cell floor
320	732.48	-1.75	0.47	731.39	-0.06		cell floor
340	731.61	-4.36	0.79	730.30	-5.44		cell floor
360	731.39	-1.07	1.03	729.66	-3.19		cell floor
380	730.90	-2.49	1.18	728.99	-3.40		cell floor
400	730.32	-2.91	1.43	728.19	-3.97		cell floor
420	729.76	-2.79	1.37	727.73	-2.29		cell floor
440	729.33	-2.13	2.08	726.24	-7.49		cell floor
460	728.77	-2.84	2.15	725.69	-2.75		pipe crossing
480	729.14	1.87	2.23	726.11	2.09		pipe crossing
500	728.29	-4.27	3.20	723.75	-11.90		pipe crossing
520	727.10	-5.95	3.23	722.61	-5.89		cell floor
540	726.44	-3.29	3.26	722.09	-2.60		cell floor
560	726.08	-1.79	3.51	721.39	-3.49		cell floor
580	725.80	-2.40	3.47	721.04	-1.78		cell floor
600	724.90	-3.53	3.36	720.48	-2.89		cell floor

= Slope Reversal

Table 9
Five-Year Projection of Settlement
Phase 1 North-South Profiler
95% Confidence- Upper Limit

P1 Station	Baseline Measure Pipe Elevation ft	Baseline Slope %	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Slope Height ft	Comments
120	736.85	-2.30	1.25	735.10			cell floor
140	736.51	-1.70	0.91	735.16	0.34	0.07	cell floor
160	735.89	-3.11	0.57	734.87	-1.49		cell floor
180	736.49	3.02	0.81	735.24	1.89		pipe crossing
200	735.13	-6.81	0.72	733.72	-7.66		pipe crossing
220	734.53	-3.02	0.83	733.41	-1.53		pipe crossing
240	734.23	-1.46	0.91	732.68	-3.65		cell floor
260	733.59	-3.22	0.43	732.61	-0.34		cell floor
280	733.06	-2.55	0.30	732.30	-1.57		cell floor
300	732.83	-1.25	0.55	731.51	-3.95		cell floor
320	732.48	-1.75	0.31	731.55	0.20	0.04	cell floor
340	731.61	-4.38	0.64	730.45	-5.51		cell floor
360	731.39	-1.07	0.82	729.87	-2.88		cell floor
380	730.90	-2.49	1.00	729.17	-3.55		cell floor
400	730.32	-2.91	1.28	728.34	-4.14		cell floor
420	729.76	-2.79	1.14	727.96	-1.89		cell floor
440	729.33	-2.13	1.82	726.50	-7.32		cell floor
460	728.77	-2.84	2.07	725.77	-3.63		pipe crossing
480	729.14	1.87	2.13	726.21	2.19		pipe crossing
500	728.29	-4.27	3.40	723.55	-13.43		pipe crossing
520	727.10	-5.95	3.14	722.70	-4.23		cell floor
540	726.44	-3.29	2.93	722.42	-1.44		cell floor
560	726.08	-1.79	3.25	721.65	-3.81		cell floor
580	725.60	-2.40	3.11	721.40	-1.28		cell floor
600	724.90	-3.53	2.93	720.89	-2.56		cell floor

= Slope Reversal

Table 9
Five-Year Projection of Settlement
Phase 1 North-South Profiler
95% Confidence-Lower Limit

P1 Station	Baseline Measure Pipe Elevation ft	Baseline Slope %	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Slope Height ft	Comments
120	736.85	-2.30	1.81	734.53			cell floor
140	736.51	-1.70	1.28	734.79	1.33	0.27	cell floor
160	735.89	-3.11	0.80	734.64	-0.79		cell floor
180	736.49	3.02	0.83	735.02	1.93		pipe crossing
200	735.13	-6.81	0.91	733.53	-7.48		pipe crossing
220	734.53	-3.02	0.90	733.14	-1.97		pipe crossing
240	734.23	-1.46	1.11	732.49	-3.26		cell floor
260	733.59	-3.22	0.68	732.36	-0.63		cell floor
280	733.06	-2.55	0.50	732.10	-1.28		cell floor
300	732.83	-1.25	0.73	731.33	-3.90		cell floor
320	732.48	-1.75	0.58	731.28	-0.21		cell floor
340	731.61	-4.36	0.89	730.20	-5.42		cell floor
360	731.39	-1.07	1.24	729.48	-3.72		cell floor
380	730.90	-2.49	1.36	728.81	-3.28		cell floor
400	730.32	-2.91	1.59	728.03	-3.87		cell floor
420	729.76	-2.79	1.58	727.52	-2.54		cell floor
440	729.33	-2.13	2.34	725.98	-7.77		cell floor
460	728.77	-2.84	2.84	725.20	-3.88		pipe crossing
480	729.14	1.87	2.58	725.78	2.89		pipe crossing
500	728.29	-4.27	4.13	722.82	-14.98		pipe crossing
520	727.10	-5.95	3.42	722.42	-1.97		cell floor
540	726.44	-3.29	3.55	721.79	-3.14		cell floor
560	726.08	-1.79	3.73	721.17	-3.11		cell floor
580	725.60	-2.40	3.79	720.72	-2.24		cell floor
600	724.90	-3.53	3.74	720.08	-3.23		cell floor

= Slope Reversal

Table 10
Five-Year Projection of Settlement
Southern East-West Profiler
Average

Station	Baseline Measure Pipe Elevation ft	Baseline Slope %	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Slope Height ft	Comments
40	724.91	-28.32	3.53	719.60			Sideslope
60	721.83	-15.57	0.93	719.10	-2.53		Sideslope
80	721.14	-3.50	0.63	718.62	-2.40		Sideslope
100	721.42	1.44	0.55	718.63	0.07		Pipe Access
120	721.81	1.93	0.49	718.92	1.46		Pipe Access
140	722.17	1.78	0.38	719.49	2.85		Pipe Access
160	722.60	2.19	0.38	719.79	1.47		Pipe Access
180	722.81	1.05	0.29	720.39	3.02		Pipe Access
200	722.99	0.86	0.36	720.61	1.10		Pipe Access
220	722.97	-0.06	0.58	720.62	0.04	0.01	Pipe Access
240	722.80	-0.87	0.83	720.24	-1.92		Pipe Access
260	722.62	-0.87	1.08	720.05	-0.95		Pipe Access
280	722.60	-0.15	1.44	719.76	-1.45		Pipe Crossing
300	723.37	3.85	2.04	720.05	1.46		Pipe Crossing
320	723.22	-0.71	2.47	719.11	-4.68		Pipe Crossing
340	722.94	-1.42	2.73	718.84	-1.35		Pipe Crossing
360	723.29	1.74	2.56	719.53	3.46		Cell Floor
380	723.89	3.03	2.32	720.32	3.91		Cell Floor
400	724.43	2.67	2.51	720.68	1.84		Cell Floor
420	725.02	2.94	2.59	721.11	2.12		Cell Floor
440	725.61	2.96	2.60	721.69	2.89		Cell Floor
460	726.22	3.05	2.40	722.47	3.93		Cell Floor
480	726.79	2.85	2.10	723.35	4.39		Cell Floor
500	728.00	6.07	0.83	726.26	14.69		Pipe Crossing
520	728.74	3.73	2.35	724.63	-8.17		Pipe Crossing
540	728.44	-1.52	1.19	725.88	6.26	-0.38	Pipe Crossing
560	729.00	2.82	0.88	726.87	4.99		Cell Floor
580	729.53	2.62	0.75	727.56	3.41		Cell Floor
600	730.06	2.70	0.95	727.63	0.39		Cell Floor
620	730.47	2.01	0.92	728.14	2.54		Cell Floor
640	730.90	2.15	0.19	729.29	5.77		Cell Floor
660	731.69	3.95	0.06	730.19	4.51		Cell Floor
680	732.23	2.75	0.34	730.16	-0.15	-0.03	Pipe Crossing
700	732.44	1.03	0.42	730.17	0.05		Pipe Crossing
720	731.73	-3.53	1.15	727.73	-12.30		Pipe Crossing
740	730.57	-5.84	1.01	726.78	-4.75		Cell Floor
760	729.90	-3.34	0.94	725.99	-3.96		Cell Floor
780	729.39	-2.53	1.00	725.25	-3.72		Cell Floor
800	728.81	-2.93	0.69	725.24	-0.02		Cell Floor
820	728.36	-2.26	0.67	724.41	-4.18		Cell Floor
840	727.68	-3.39	0.65	723.71	-3.52		Cell Floor
860	727.18	-2.51	0.62	723.21	-2.50		Cell Floor
880	726.73	-2.23	0.62	722.66	-2.74		Cell Floor
900	726.52	-1.08	0.26	723.67	5.05		Pipe Crossing
920	726.58	0.32	0.86	721.83	-9.22	-0.83	Pipe Crossing
940	725.20	-6.93	0.43	721.81	-0.12		Pipe Crossing
960	724.78	-2.06	0.31	721.71	-0.50		Pipe Crossing
980	724.82	0.17	0.28	722.06	1.77		Pipe Access
1000	724.94	0.60	0.32	721.98	-0.40		Pipe Access
1020	725.01	0.37	0.39	721.77	-1.07		Pipe Access
1040	725.02	0.03	0.49	721.51	-1.28	-0.55	Pipe Access
1060	724.88	-0.69	0.59	721.04	-2.38		Pipe Access
1080	724.73	-0.79	0.63	721.06	0.12	0.02	Pipe Access
1100	724.82	0.47	0.63	721.32	1.28		Pipe Access
1120	725.05	1.13	0.31	722.59	6.38		Pipe Crossing
1140	726.41	6.82	0.78	721.92	-3.37	-0.67	Pipe Crossing
1160	725.29	-5.58	0.58	721.38	-2.67		Pipe Crossing
1180	724.85	-2.22	0.43	721.45	0.33		Pipe Crossing
1200	724.63	-1.10	0.35	721.79	1.71	0.41	Pipe Crossing
1220	725.14	2.57	0.42	722.05	1.31		Pipe Crossing
1240	724.95	-0.98	0.65	721.27	-3.94		Pipe Crossing
1260	724.00	-4.76	0.49	721.26	0.00		Pipe Crossing
1280	723.64	-1.79	0.53	721.24	-0.12		Pipe Crossing
1300	723.23	-2.06	0.39	721.69	2.24	0.45	Pipe Crossing

= slope reversal

Table 10 cont.
Five-Year Projection of Settlement
Southern East-West Profiler
95% Confidence-Upper Limit

Station	Baseline Measure Pipe Elevation ft	Baseline Slope %	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Slope Height ft	Comments
40	724.91	-28.32	2.86	720.27			Sideslope
60	721.83	-15.57	0.89	719.14	-5.68		Sideslope
80	721.14	-3.50	0.59	718.66	-2.40		Sideslope
100	721.42	1.44	0.53	718.66	-0.01	0.00	Pipe Access
120	721.81	1.93	0.48	718.94	1.41		Pipe Access
140	722.17	1.78	0.33	719.55	3.05		Pipe Access
160	722.60	2.19	0.37	719.80	1.24		Pipe Access
180	722.81	1.05	0.28	720.40	3.04		Pipe Access
200	722.99	0.86	0.35	720.63	1.11		Pipe Access
220	722.97	-0.06	0.56	720.64	0.08	0.02	Pipe Access
240	722.80	-0.87	0.78	720.29	-1.76		Pipe Access
260	722.62	-0.87	1.01	720.11	-0.92		Pipe Access
280	722.60	-0.15	1.35	719.85	-1.28		Pipe Crossing
300	723.37	3.85	1.86	720.22	1.86		Pipe Crossing
320	723.22	-0.71	2.33	719.25	-4.90		Pipe Crossing
340	722.94	-1.42	2.60	718.98	-1.35		Pipe Crossing
360	723.29	1.74	2.37	719.73	3.78		Cell Floor
380	723.89	3.03	2.07	720.57	4.22		Cell Floor
400	724.43	2.67	2.34	720.86	1.43		Cell Floor
420	725.02	2.94	2.39	721.31	2.27		Cell Floor
440	725.61	2.96	2.34	721.94	3.15		Cell Floor
460	726.22	3.05	2.25	722.63	3.42		Cell Floor
480	726.79	2.85	1.94	723.51	4.43		Cell Floor
500	728.00	6.07	0.62	726.46	14.91		Pipe Crossing
520	728.74	3.73	2.22	724.76	-8.54		Pipe Crossing
540	728.44	-1.52	1.07	725.99	6.19	-0.47	Pipe Crossing
560	729.00	2.82	0.82	726.93	4.68		Cell Floor
580	729.53	2.62	0.67	727.64	3.58		Cell Floor
600	730.06	2.70	0.74	727.85	1.00		Cell Floor
620	730.47	2.01	0.76	728.30	2.30		Cell Floor
640	730.90	2.15	0.07	729.41	5.55		Cell Floor
660	731.69	3.95	-0.01	730.26	4.24		Cell Floor
680	732.23	2.75	0.29	730.21	-0.24		Pipe Crossing
700	732.44	1.03	0.39	730.21	-0.01	-0.05	Pipe Crossing
720	731.73	-3.53	1.10	727.78	-12.22		Pipe Crossing
740	730.57	-5.84	0.97	726.83	-4.78		Cell Floor
760	729.90	-3.34	0.89	726.04	-3.95		Cell Floor
780	729.39	-2.53	0.97	725.28	-3.79		Cell Floor
800	728.81	-2.93	0.65	725.28	0.00	0.00	Cell Floor
820	728.36	-2.26	0.62	724.47	-4.08		Cell Floor
840	727.68	-3.39	0.62	723.73	-3.68		Cell Floor
860	727.18	-2.51	0.59	723.23	-2.49		Cell Floor
880	726.73	-2.23	0.56	722.72	-2.58		Cell Floor
900	726.52	-1.08	0.20	723.72	5.03		Pipe Crossing
920	726.58	0.32	0.83	721.86	-9.35	-0.86	Pipe Crossing
940	725.20	-6.93	0.39	721.84	-0.11		Pipe Crossing
960	724.78	-2.06	0.30	721.72	-0.58		Pipe Crossing
980	724.82	0.17	0.25	722.09	1.84		Pipe Access
1000	724.94	0.60	0.30	722.00	-0.47		Pipe Access
1020	725.01	0.37	0.36	721.80	-0.99		Pipe Access
1040	725.02	0.03	0.46	721.54	-1.30	-0.55	Pipe Access
1060	724.88	-0.69	0.57	721.05	-2.43		Pipe Access
1080	724.73	-0.79	0.61	721.08	0.14	0.03	Pipe Access
1100	724.82	0.47	0.59	721.36	1.38		Pipe Access
1120	725.05	1.13	0.29	722.61	6.26		Pipe Crossing
1140	726.41	6.82	0.74	721.95	-3.28	-0.66	Pipe Crossing
1160	725.29	-5.58	0.56	721.41	-2.73		Pipe Crossing
1180	724.85	-2.22	0.40	721.48	0.34		Pipe Crossing
1200	724.63	-1.10	0.32	721.82	1.72	0.41	Pipe Crossing
1220	725.14	2.57	0.40	722.07	1.27		Pipe Crossing
1240	724.95	-0.98	0.61	721.30	-3.86		Pipe Crossing
1260	724.00	-4.76	0.45	721.31	0.03	0.01	Pipe Crossing
1280	723.64	-1.79	0.48	721.30	-0.06		Pipe Crossing
1300	723.23	-2.06	0.29	721.80	2.51	0.50	Pipe Crossing

= slope reversal

Table 10 cont.
Five-Year Projection of Settlement
Southern East-West Profiler
95% Confidence-Lower Limit

Station	Baseline Measure Pipe Elevation ft	Baseline Slope %	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Slope Height ft	Comments
40	724.91	-28.32	3.59	719.54			Sideslope
60	721.83	-15.57	0.97	719.06	-2.40		Sideslope
80	721.14	-3.50	0.67	718.58	-2.41		Sideslope
100	721.42	1.44	0.58	718.61	0.14		Pipe Access
120	721.81	1.93	0.51	718.91	1.51		Pipe Access
140	722.17	1.78	0.44	719.44	2.65		Pipe Access
160	722.60	2.19	0.38	719.78	1.71		Pipe Access
180	722.81	1.05	0.30	720.38	3.00		Pipe Access
200	722.99	0.86	0.38	720.60	1.08		Pipe Access
220	722.97	-0.06	0.61	720.60	0.00	0.00	Pipe Access
240	722.80	-0.87	0.88	720.18	-2.07		Pipe Access
260	722.62	-0.87	1.14	719.99	-0.99		Pipe Access
280	722.60	-0.15	1.54	719.66	-1.62		Pipe Crossing
300	723.37	3.85	2.21	719.87	1.05		Pipe Crossing
320	723.22	-0.71	2.60	718.98	-4.46		Pipe Crossing
340	722.94	-1.42	2.86	718.71	-1.34		Pipe Crossing
360	723.29	1.74	2.76	719.34	3.14		Cell Floor
380	723.89	3.03	2.58	720.06	3.60		Cell Floor
400	724.43	2.67	2.69	720.51	2.24		Cell Floor
420	725.02	2.94	2.80	720.90	1.98		Cell Floor
440	725.61	2.96	2.85	721.43	2.63		Cell Floor
460	726.22	3.05	2.56	722.32	4.44		Cell Floor
480	726.79	2.85	2.27	723.19	4.35		Cell Floor
500	728.00	6.07	1.03	726.05	14.47		Pipe Crossing
520	728.74	3.73	2.49	724.49	-7.81		Pipe Crossing
540	728.44	-1.52	1.30	725.76	6.33	-0.29	Pipe Crossing
560	729.00	2.82	0.93	726.82	5.31		Cell Floor
580	729.53	2.62	0.84	727.47	3.25		Cell Floor
600	730.06	2.70	1.16	727.42	-0.23	-0.05	Cell Floor
620	730.47	2.01	1.09	727.98	2.78		Cell Floor
640	730.90	2.15	0.31	729.17	5.98		Cell Floor
660	731.69	3.95	0.12	730.13	4.78		Cell Floor
680	732.23	2.75	0.39	730.12	-0.05	-0.01	Pipe Crossing
700	732.44	1.03	0.46	730.14	0.11		Pipe Crossing
720	731.73	-3.53	1.20	727.68	-12.38		Pipe Crossing
740	730.57	-5.84	1.06	726.74	-4.72		Cell Floor
760	729.90	-3.34	0.98	725.94	-3.97		Cell Floor
780	729.39	-2.53	1.03	725.22	-3.65		Cell Floor
800	728.81	-2.93	0.72	725.21	-0.04		Cell Floor
820	728.36	-2.26	0.73	724.35	-4.29		Cell Floor
840	727.68	-3.39	0.67	723.68	-3.36		Cell Floor
860	727.18	-2.51	0.65	723.18	-2.52		Cell Floor
880	726.73	-2.23	0.68	722.60	-2.90		Cell Floor
900	726.52	-1.08	0.32	723.61	5.07		Pipe Crossing
920	726.58	0.32	0.89	721.80	-9.08	-0.80	Pipe Crossing
940	725.20	-6.93	0.46	721.77	-0.13		Pipe Crossing
960	724.78	-2.06	0.33	721.69	-0.42		Pipe Crossing
980	724.82	0.17	0.31	722.03	1.69		Pipe Access
1000	724.94	0.60	0.34	721.96	-0.33		Pipe Access
1020	725.01	0.37	0.43	721.73	-1.16		Pipe Access
1040	725.02	0.03	0.52	721.48	-1.25	-0.55	Pipe Access
1060	724.88	-0.69	0.61	721.02	-2.32		Pipe Access
1080	724.73	-0.79	0.65	721.04	0.10	0.02	Pipe Access
1100	724.82	0.47	0.68	721.27	1.17		Pipe Access
1120	725.05	1.13	0.33	722.57	6.50		Pipe Crossing
1140	726.41	6.82	0.82	721.88	-3.46	-0.69	Pipe Crossing
1160	725.29	-5.58	0.61	721.35	-2.61		Pipe Crossing
1180	724.85	-2.22	0.46	721.42	0.32		Pipe Crossing
1200	724.63	-1.10	0.38	721.76	1.71	0.41	Pipe Crossing
1220	725.14	2.57	0.44	722.03	1.35		Pipe Crossing
1240	724.95	-0.98	0.69	721.23	-4.02		Pipe Crossing
1260	724.00	-4.76	0.53	721.22	-0.03		Pipe Crossing
1280	723.64	-1.79	0.59	721.18	-0.18		Pipe Crossing
1300	723.23	-2.06	0.50	721.58	1.98	0.39	Pipe Crossing

= slope reversal

Table 11
Five-Year Projection of Settlement
Northern East-West Profiler
Average

Station	Baseline Measured Pipe Elev	Baseline Slope	Final Settlement	Final Pipe Elevation	Final Slope	Slope Height	Comments
	ft	%	ft	ft	%	ft	
680	736.52	-5.70	1.33	734.07	-		pipe crossing
700	736.16	-1.81	1.00	733.75	-1.62		pipe crossing
720	735.98	-0.91	0.68	733.85	0.50		cell floor
740	735.85	-0.65	0.45	733.99	0.71	0.14	cell floor
760	735.70	-0.73	0.43	733.79	-1.01		cell floor
780	735.43	-1.34	0.48	733.30	-2.44		cell floor
800	735.14	-1.47	0.44	733.03	-1.36		cell floor
820	734.81	-1.65	0.30	732.78	-1.27		pipe crossing
840	735.14	1.67	0.11	733.66	4.43		pipe crossing
860	734.85	-1.45	0.20	732.06	-8.05		pipe crossing
880	734.23	-3.12	0.16	731.58	-2.41		pipe crossing
900	733.90	-1.63	0.13	731.33	-1.24		cell floor
920	733.55	-1.78	0.13	730.82	-2.53		cell floor
940	733.19	-1.78	0.12	730.28	-2.70		cell floor
960	732.72	-2.38	0.12	729.82	-2.28		cell floor
980	732.32	-2.01	0.17	729.45	-1.88		cell floor
1000	731.76	-2.79	0.23	728.81	-3.22		cell floor
1020	731.17	-2.96	0.25	728.25	-2.80		pipe crossing
1040	730.92	-1.22	0.21	728.73	2.42	0.48	pipe crossing
1060	730.42	-2.51	0.46	726.82	-9.60		pipe crossing
1080	728.91	-7.57	0.32	726.03	-3.95		cell floor
1100	728.16	-3.74	0.24	725.66	-1.83		cell floor
1120	727.30	-4.32	0.24	725.12	-2.70		cell floor
1140	726.67	-3.17	0.26	724.76	-1.83		cell floor
1160	725.93	-3.66	0.35	724.04	-3.61		cell floor
1180	725.13	-4.03	0.25	723.79	-1.25		sideslope

= slope reversal

Five-Year Projection of Settlement
Northern East-West Profiler
95% Confidence Upper Limit

Station	Baseline Measured Pipe Elev	Baseline Slope	Final Settlement	Final Pipe Elevation	Final Slope	Slope Height	Comments
	ft	%	ft	ft	%	ft	
680	736.52	-5.70	1.78	733.61	-		pipe crossing
700	736.16	-1.81	1.21	733.54	-0.35		pipe crossing
720	735.98	-0.91	0.73	733.80	1.29		cell floor
740	735.85	-0.65	0.42	734.03	1.13	0.23	cell floor
760	735.70	-0.73	0.39	733.83	-0.98		cell floor
780	735.43	-1.34	0.43	733.35	-2.41		cell floor
800	735.14	-1.47	0.43	733.04	-1.54		cell floor
820	734.81	-1.65	0.30	732.78	-1.31		pipe crossing
840	735.14	1.67	0.10	733.68	4.47		pipe crossing
860	734.85	-1.45	0.20	732.06	-8.09		pipe crossing
880	734.23	-3.12	0.15	731.59	-2.37		pipe crossing
900	733.90	-1.63	0.12	731.34	-1.26		cell floor
920	733.55	-1.78	0.12	730.83	-2.55		cell floor
940	733.19	-1.78	0.11	730.29	-2.68		cell floor
960	732.72	-2.38	0.11	729.84	-2.29		cell floor
980	732.32	-2.01	0.15	729.47	-1.83		cell floor
1000	731.76	-2.79	0.20	728.83	-3.20		cell floor
1020	731.17	-2.96	0.23	728.27	-2.79		pipe crossing
1040	730.92	-1.22	0.18	728.76	2.42	0.48	pipe crossing
1060	730.42	-2.51	0.41	726.86	-9.51		pipe crossing
1080	728.91	-7.57	0.28	726.08	-3.93		cell floor
1100	728.16	-3.74	0.19	725.71	-1.81		cell floor
1120	727.30	-4.32	0.18	725.18	-2.65		cell floor
1140	726.67	-3.17	0.18	724.84	-1.73		cell floor
1160	725.93	-3.66	0.20	724.19	-3.24		cell floor
1180	725.13	-4.03	0.16	723.88	-1.55		sideslope

= slope reversal

Five-Year Projection of Settlement Northern East-West Profiler 95% Confidence Lower Limit							
Station	Baseline Measured Pipe Elev	Baseline Slope	Final Settlement	Final Pipe Elevation	Final Slope	Slope Height	Comments
	ft	%	ft	ft	%	ft	
680	736.52	-5.70	2.58	732.82	-		pipe crossing
700	736.16	-1.81	1.66	733.09	1.34		pipe crossing
720	735.98	-0.91	0.92	733.61	2.61		cell floor
740	735.85	-0.65	0.53	733.92	1.52	0.30	cell floor
760	735.70	-0.73	0.49	733.73	-0.92		cell floor
780	735.43	-1.34	0.53	733.26	-2.39		cell floor
800	735.14	-1.47	0.52	732.95	-1.52		cell floor
820	734.81	-1.65	0.35	732.73	-1.09		pipe crossing
840	735.14	1.67	0.13	733.64	4.57		pipe crossing
860	734.85	-1.45	0.21	732.05	-7.99		pipe crossing
880	734.23	-3.12	0.18	731.56	-2.44		pipe crossing
900	733.90	-1.63	0.14	731.32	-1.22		cell floor
920	733.55	-1.78	0.13	730.82	-2.51		cell floor
940	733.19	-1.78	0.13	730.28	-2.70		cell floor
960	732.72	-2.38	0.12	729.82	-2.27		cell floor
980	732.32	-2.01	0.18	729.44	-1.90		cell floor
1000	731.76	-2.79	0.23	728.80	-3.20		cell floor
1020	731.17	-2.96	0.25	728.25	-2.78		pipe crossing
1040	730.92	-1.22	0.20	728.73	2.42	0.48	pipe crossing
1060	730.42	-2.51	0.44	726.84	-9.52		pipe crossing
1080	728.91	-7.57	0.30	726.05	-3.94		cell floor
1100	728.16	-3.74	0.22	725.69	-1.80		cell floor
1120	727.30	-4.32	0.21	725.15	-2.69		cell floor
1140	726.67	-3.17	0.22	724.80	-1.78		cell floor
1160	725.93	-3.66	0.26	724.13	-3.36		cell floor
1180	725.13	-4.03	0.35	723.69	-2.16		sideslope
	= slope reversal						

5.0 CONCLUSION

Data was collected from the functioning strain meters, settlement profiler pipes and settlement gauges on September 23 and 24, 2008.

Review of the profiler data for the stations not located on the pipe crossings and pipe access sections indicates that as much as 3.5 feet of settlement has occurred since waste placement began in September 2004

A comparison of the data to the control charts is within the acceptable limits for each instrument. In addition, Level I Criteria for all horizontal strains and differential settlements between stations not located on the pipe crossings and pipe access sections were not exceeded.

The 5-year settlement predictions were performed for this monitoring event based on data collected from 2005 to 2008, in accordance with the monitoring plan. The eastern half of the northern east-west profiler, southern east-west profiler pipe and the Phase 1 north-south profiler pipe under more than five feet of waste were used for this evaluation. The western half of the northern east-west profiler as well as the Phase 2 north-south profiler and the Phase 2 east-west profiler, were not used in the evaluation because of the limited waste over the profiler pipes. Review of the results indicates the Level I criteria were not exceeded at any station not located on the pipe crossings or pipe access sections.

The next monitoring event will take place in March 2009.

Figure 1
Cluster 1
Strain Meter Measurements

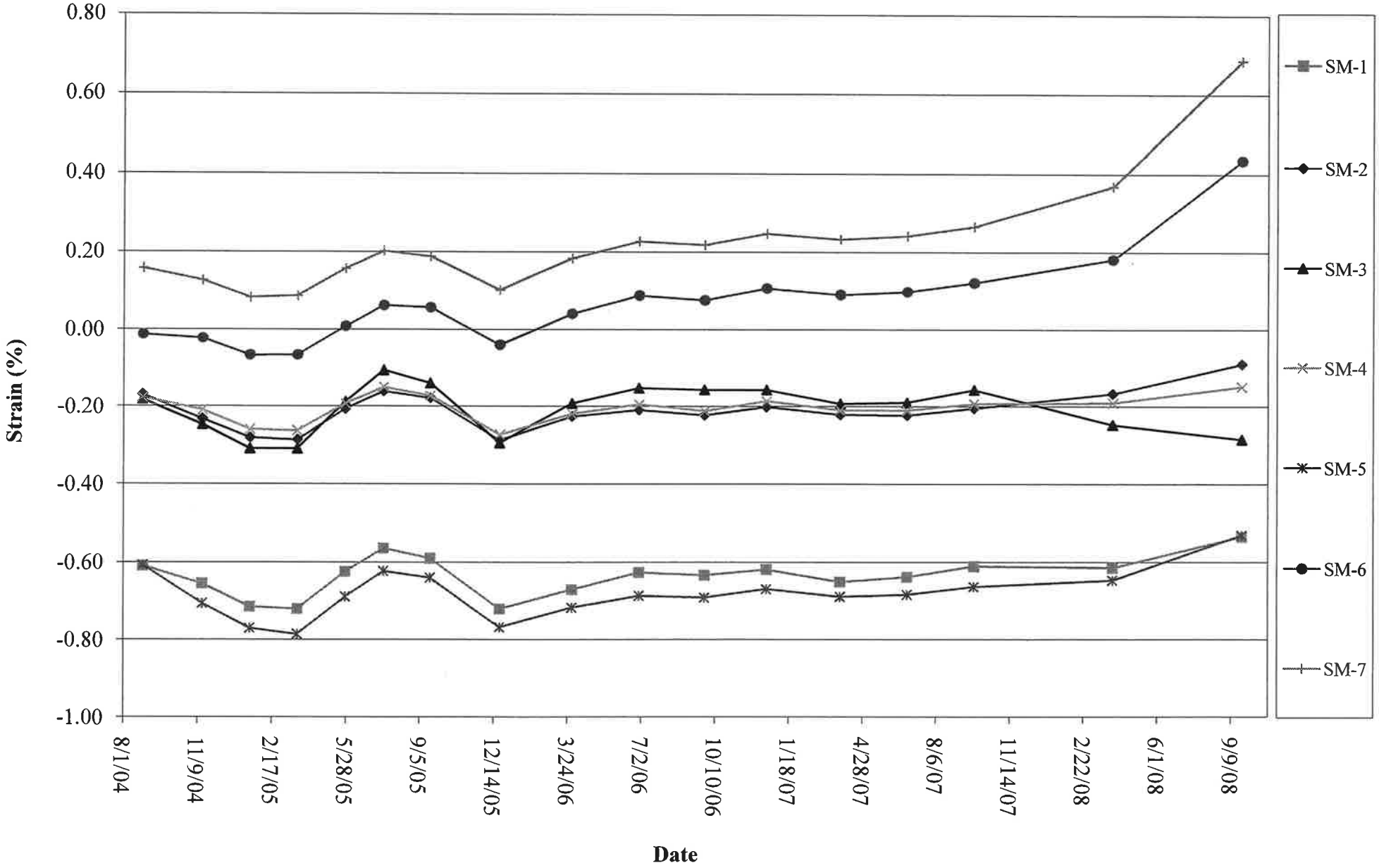


Figure 2
Cluster 2
Strain Meter Measurements

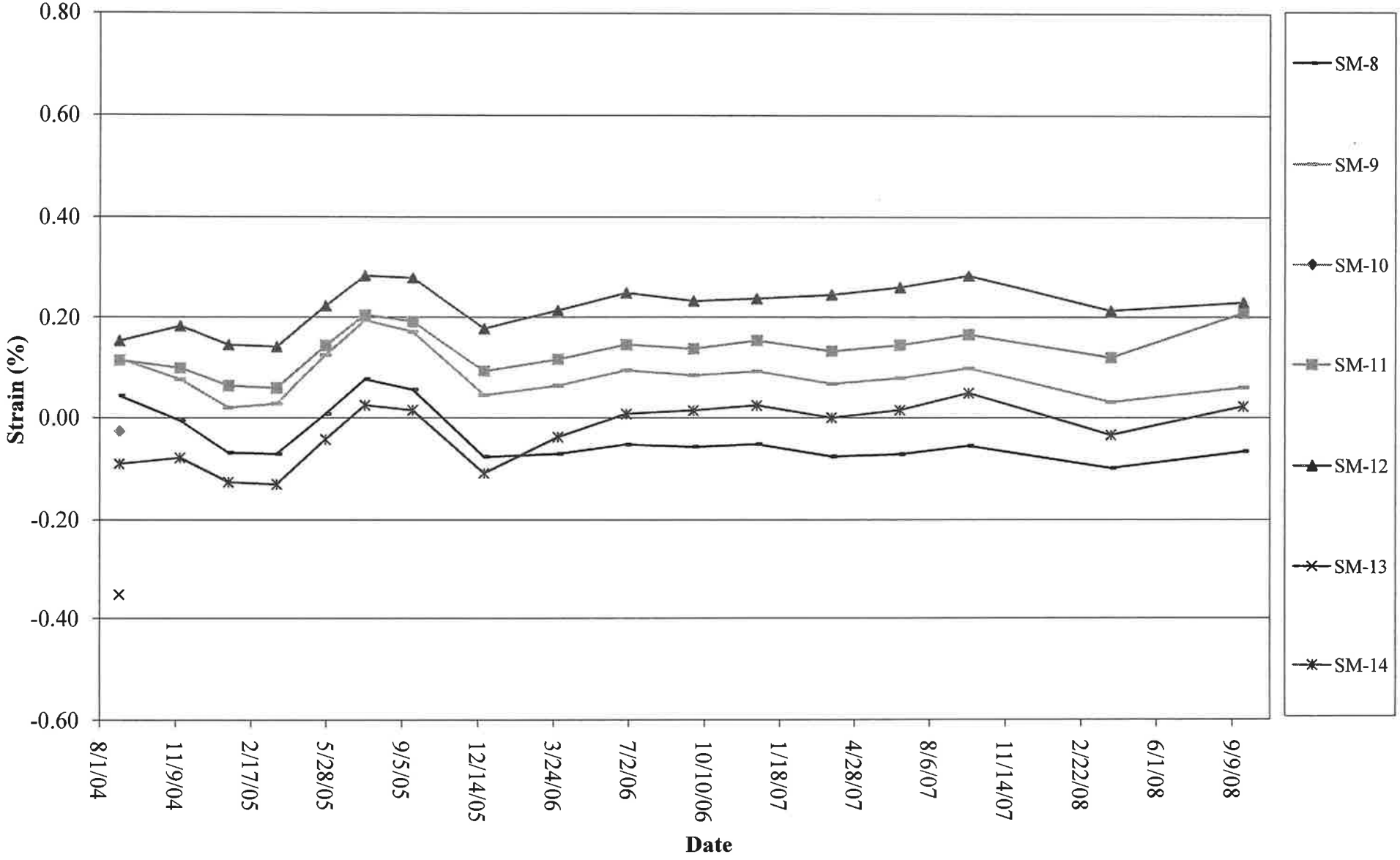


Figure 3
Cluster 3
Strain Meter Measurements

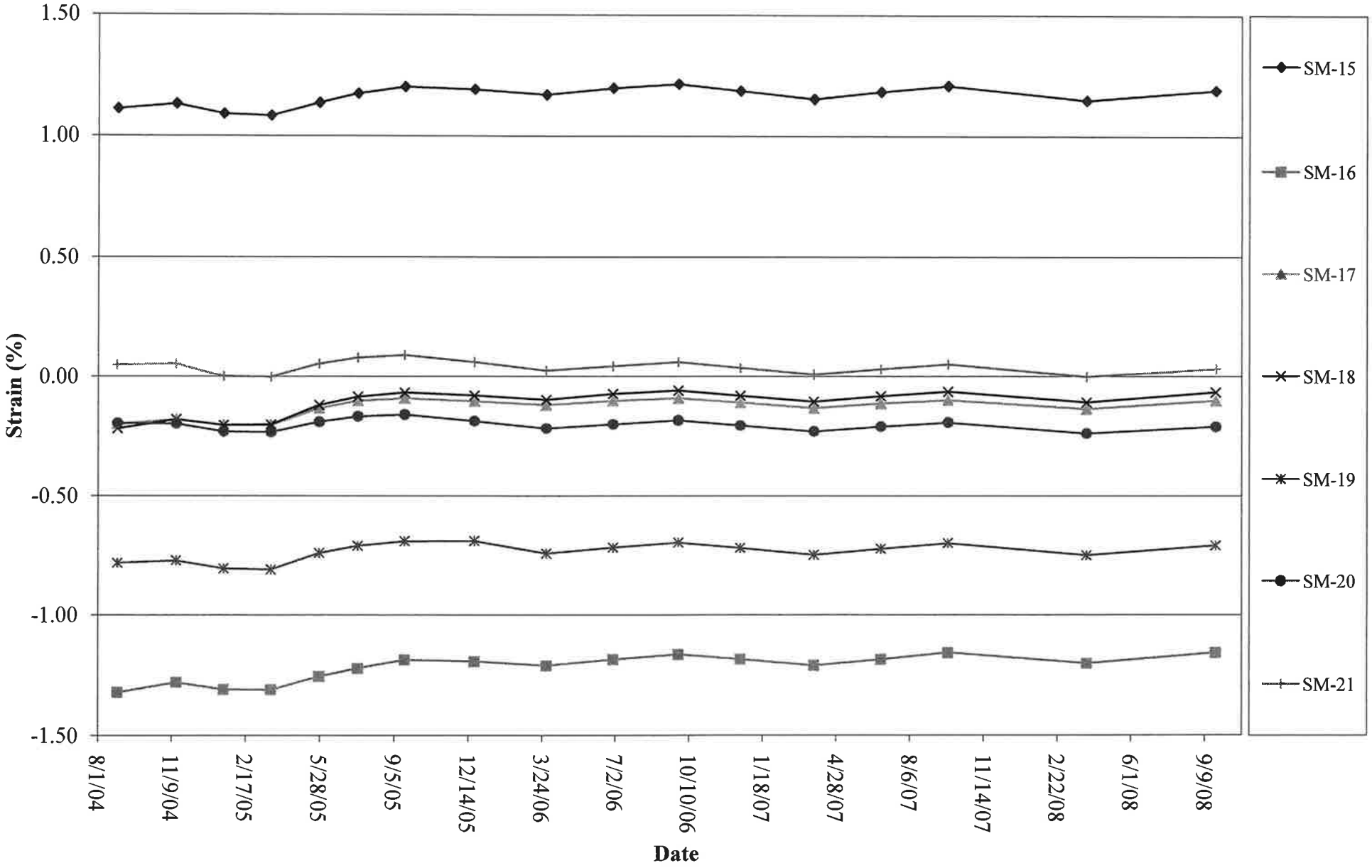


Figure 4
Cluster 4
Strain Meter Measurements

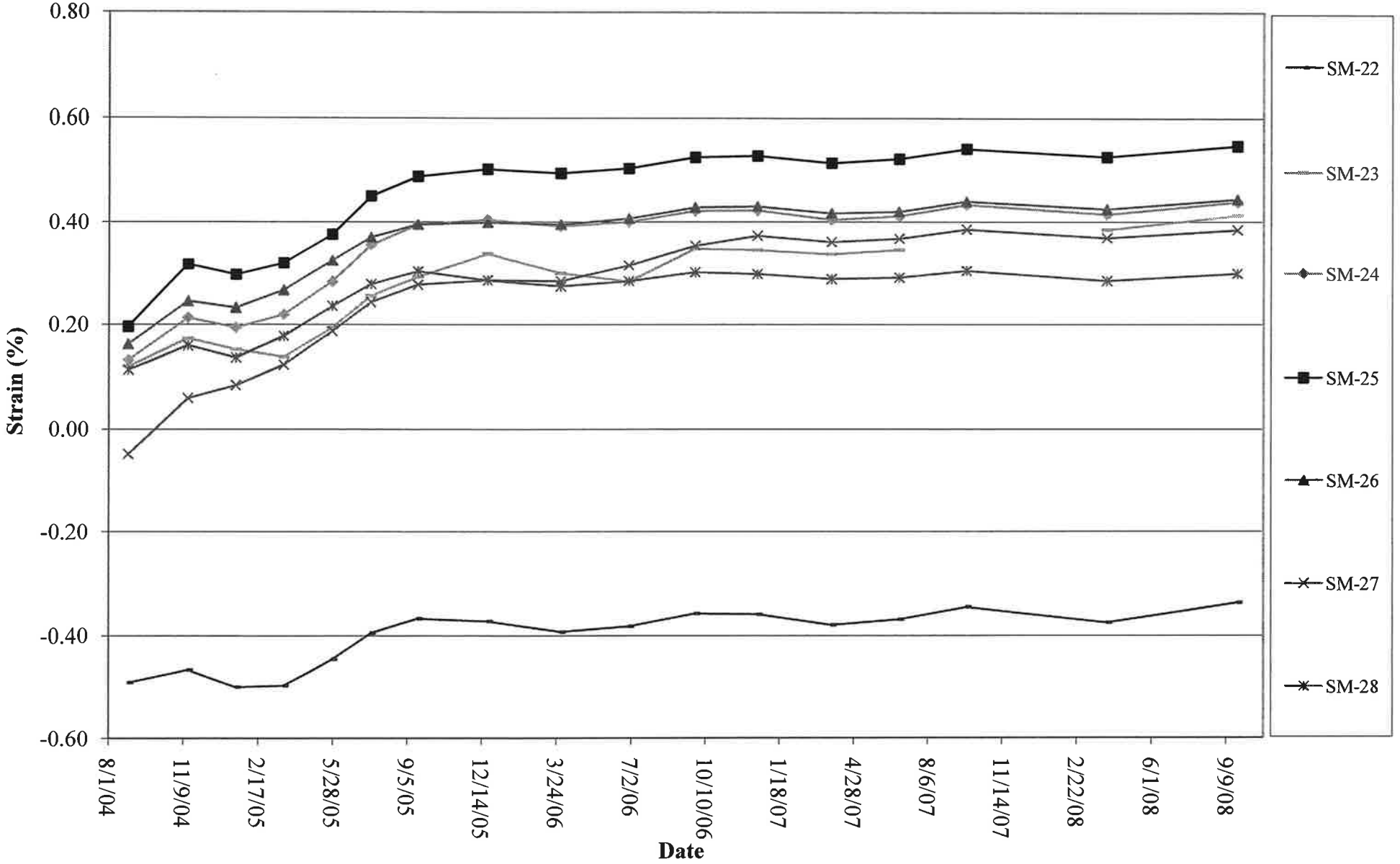


Figure 5
Cluster 5
Strain Meter Measurements

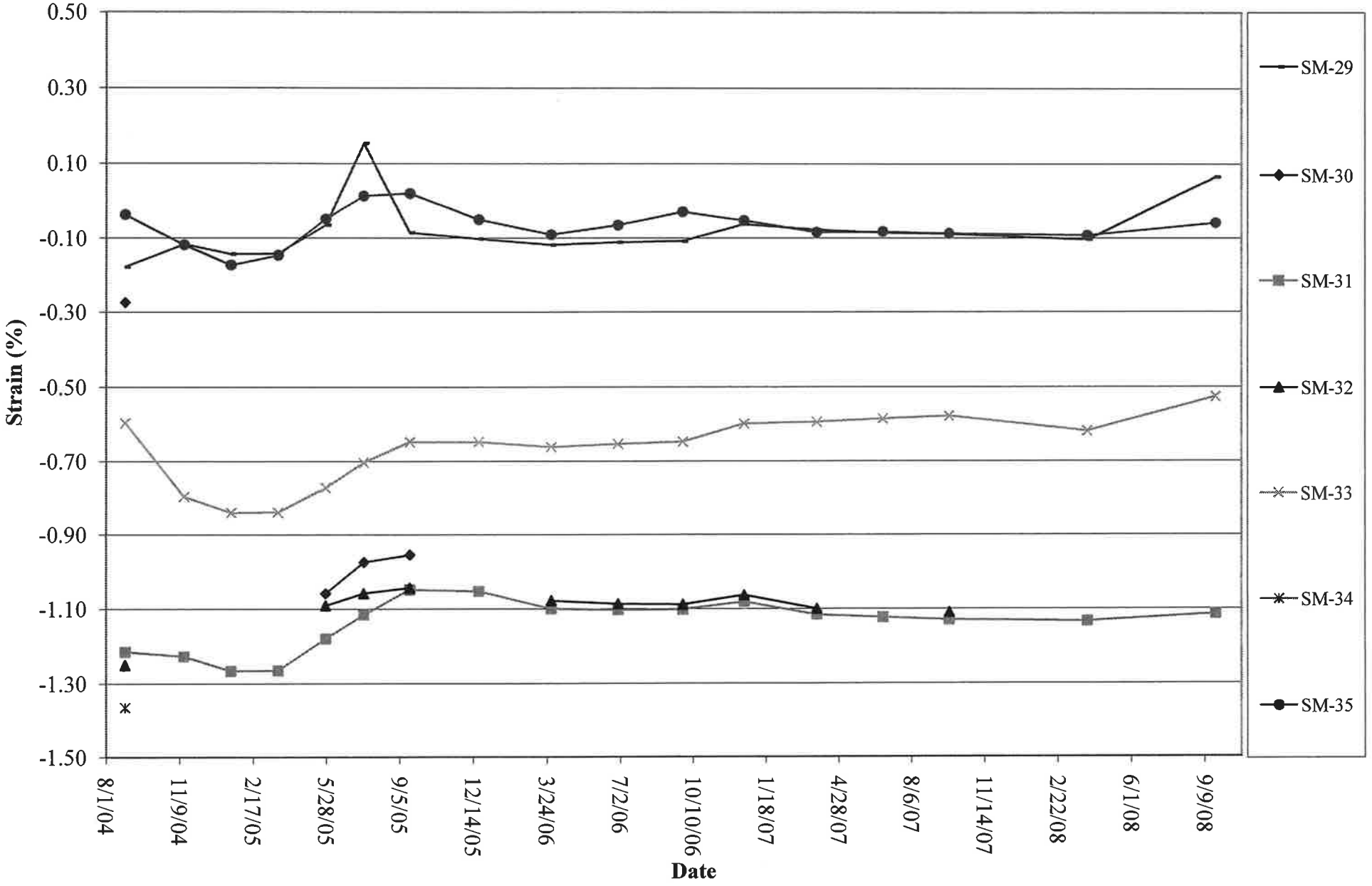


Figure 6
Cluster 6
Strain Meter Measurements

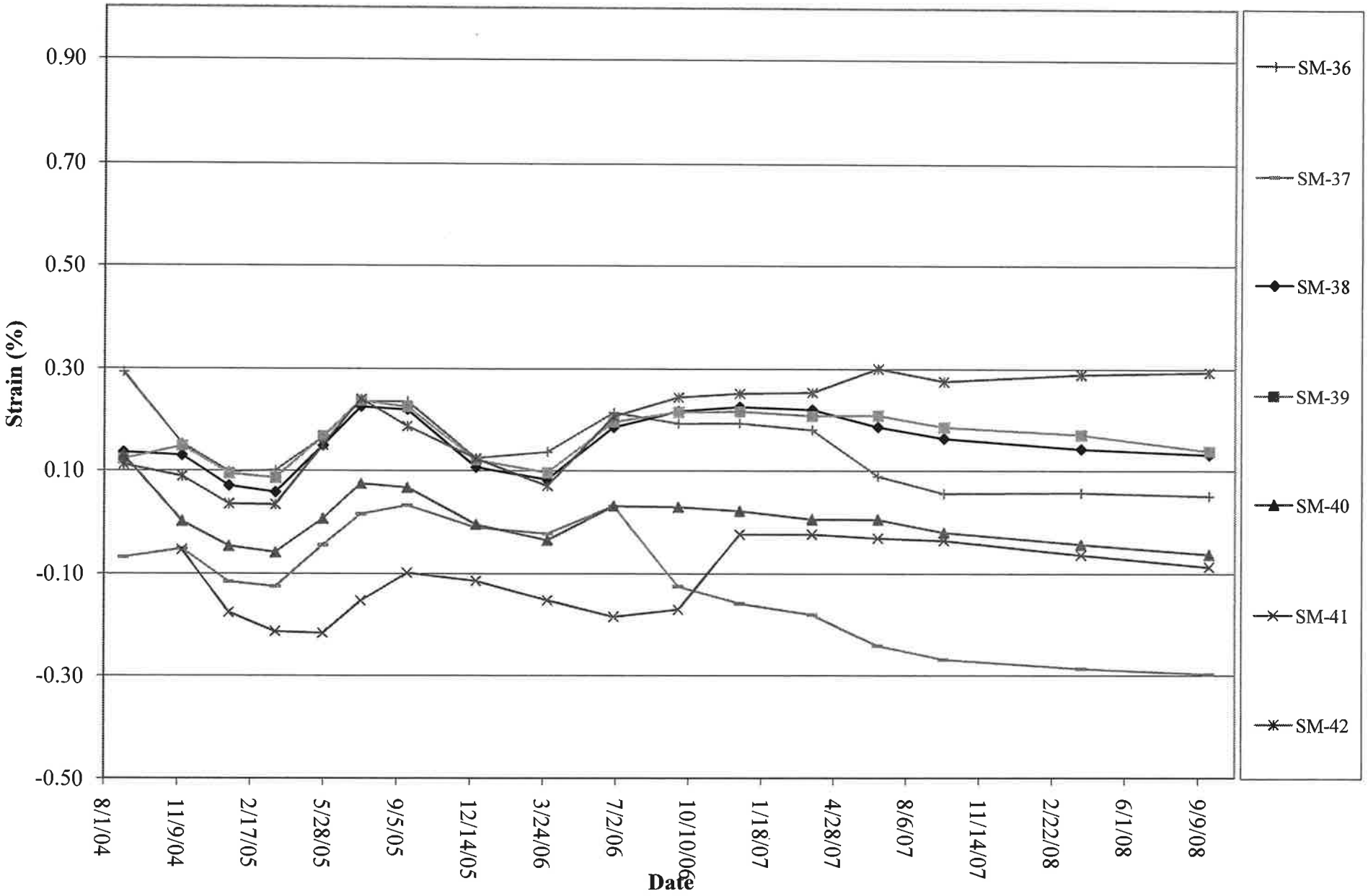


Figure 7
Cluster 7
Strain Meter Measurements

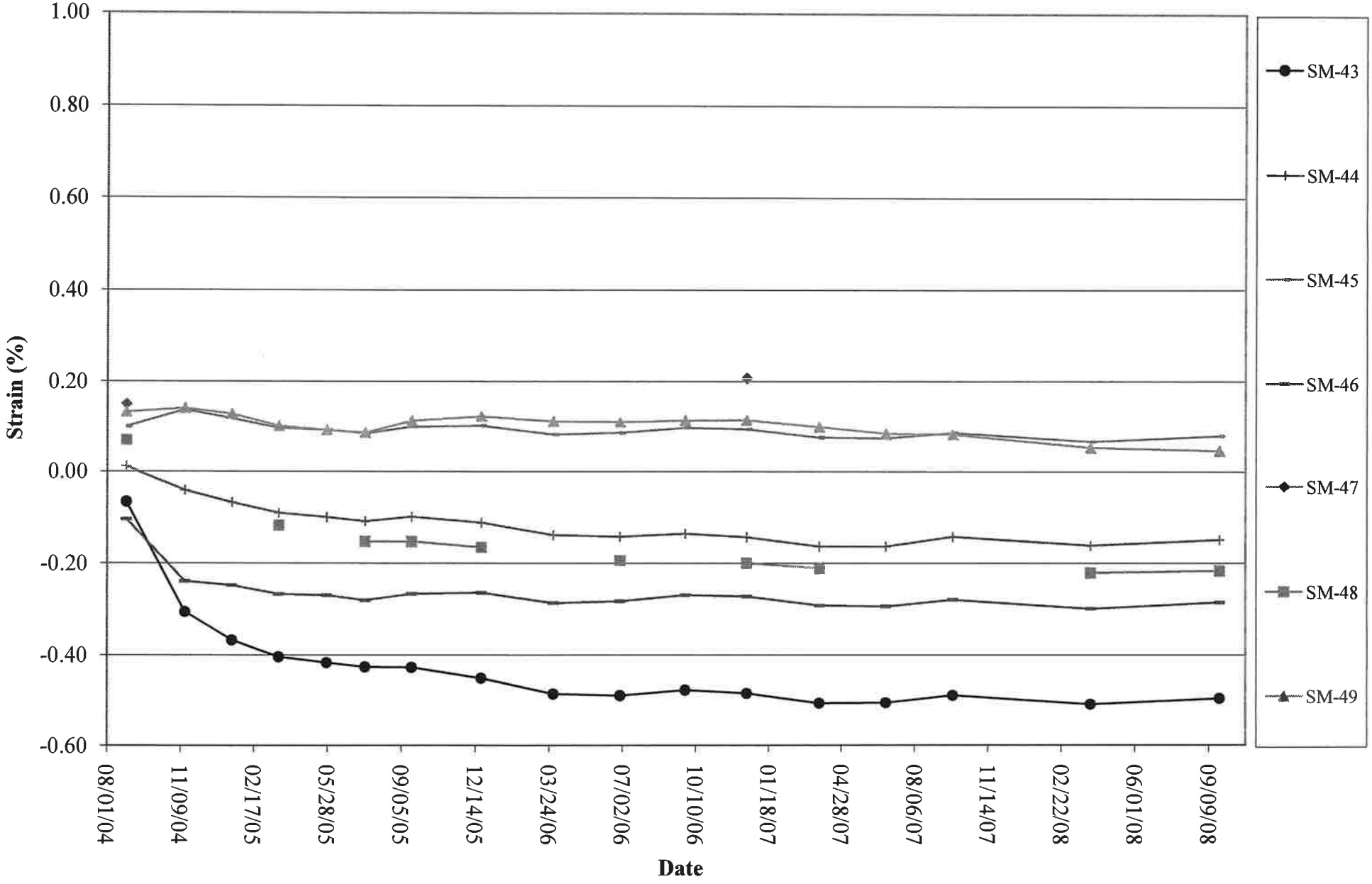


Figure 8
Cluster 1 - Control Chart
Strain Meter Data Quality Verification
SM-4/SM-5 Differential

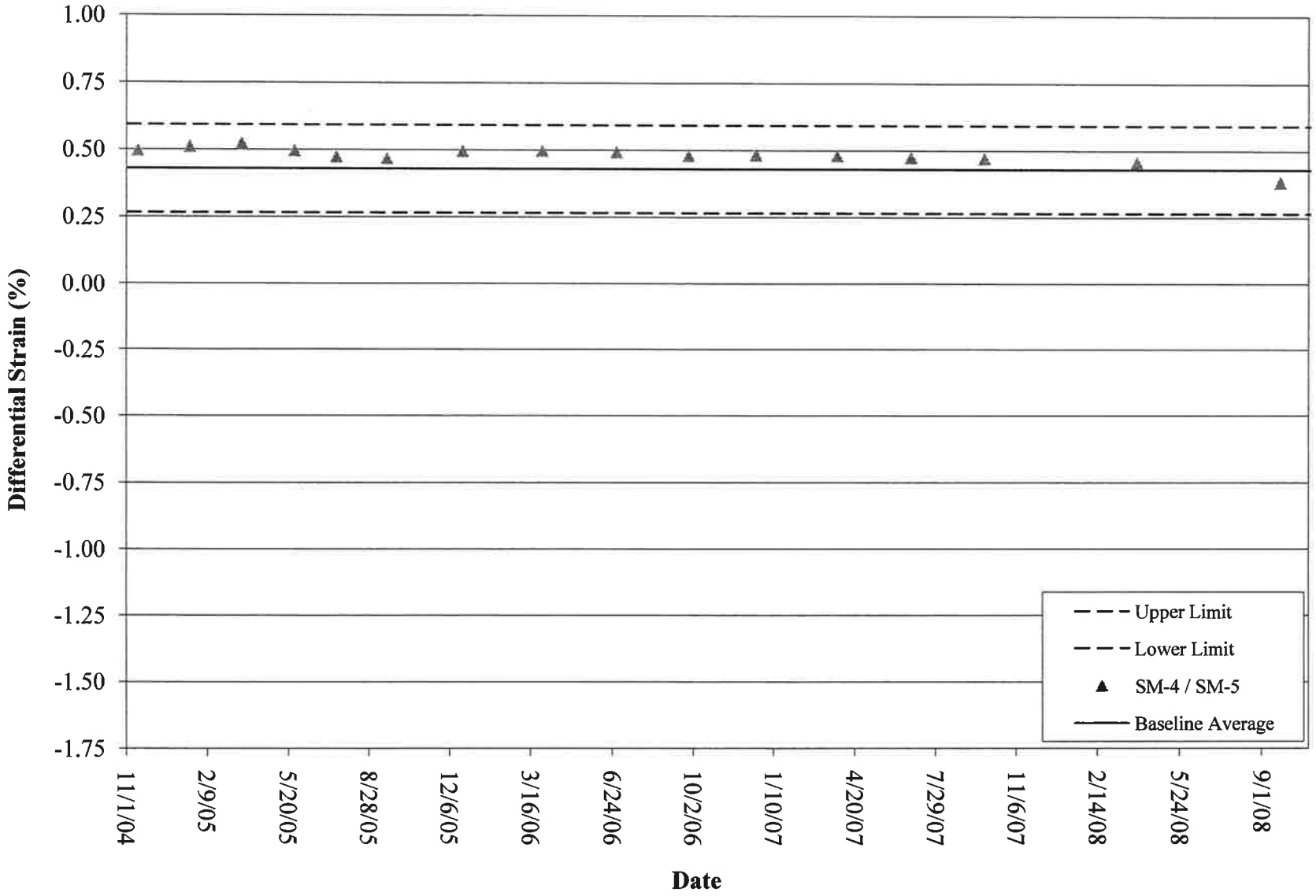


Figure 9
Cluster 2 - Control Chart
Strain Meter Data Quality Verification
SM-11/SM-12 Differential

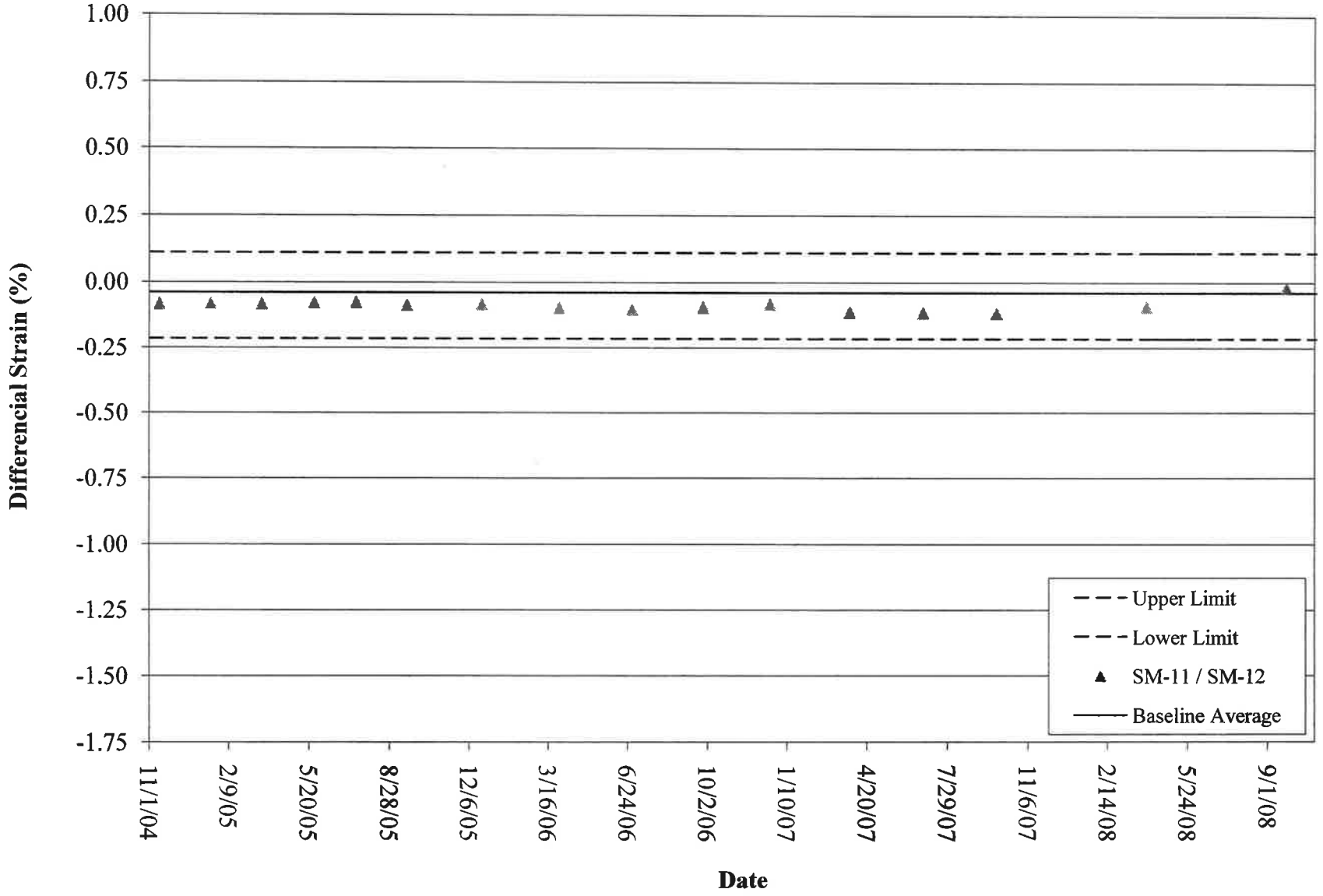


Figure 10
Cluster 3 - Control Chart
Strain Meter Data Quality Verification
SM-18/SM-19 Differential

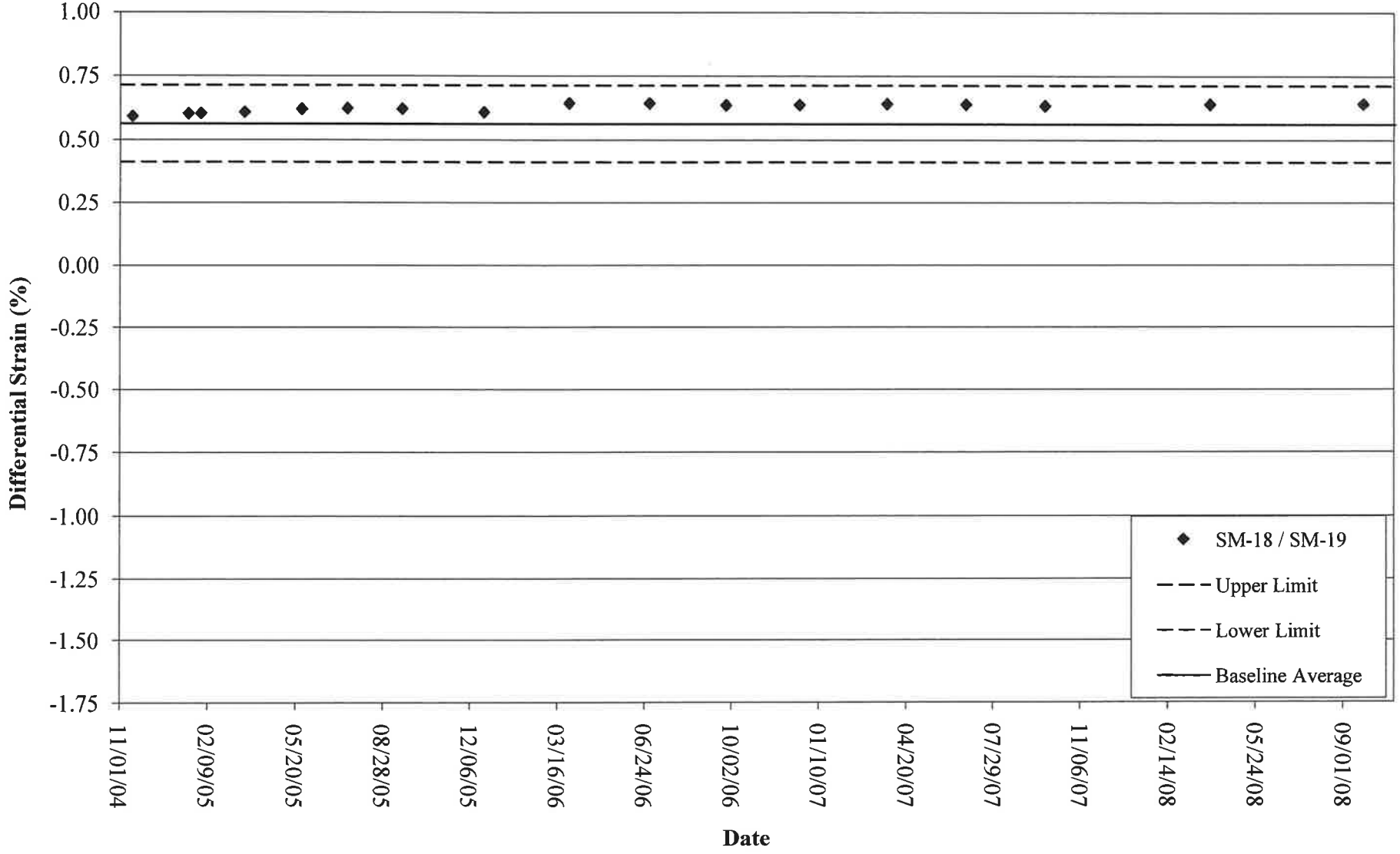


Figure 11
Cluster 3 - Control Chart
Strain Meter Data Quality Verification
SM-25/SM-26 Differential

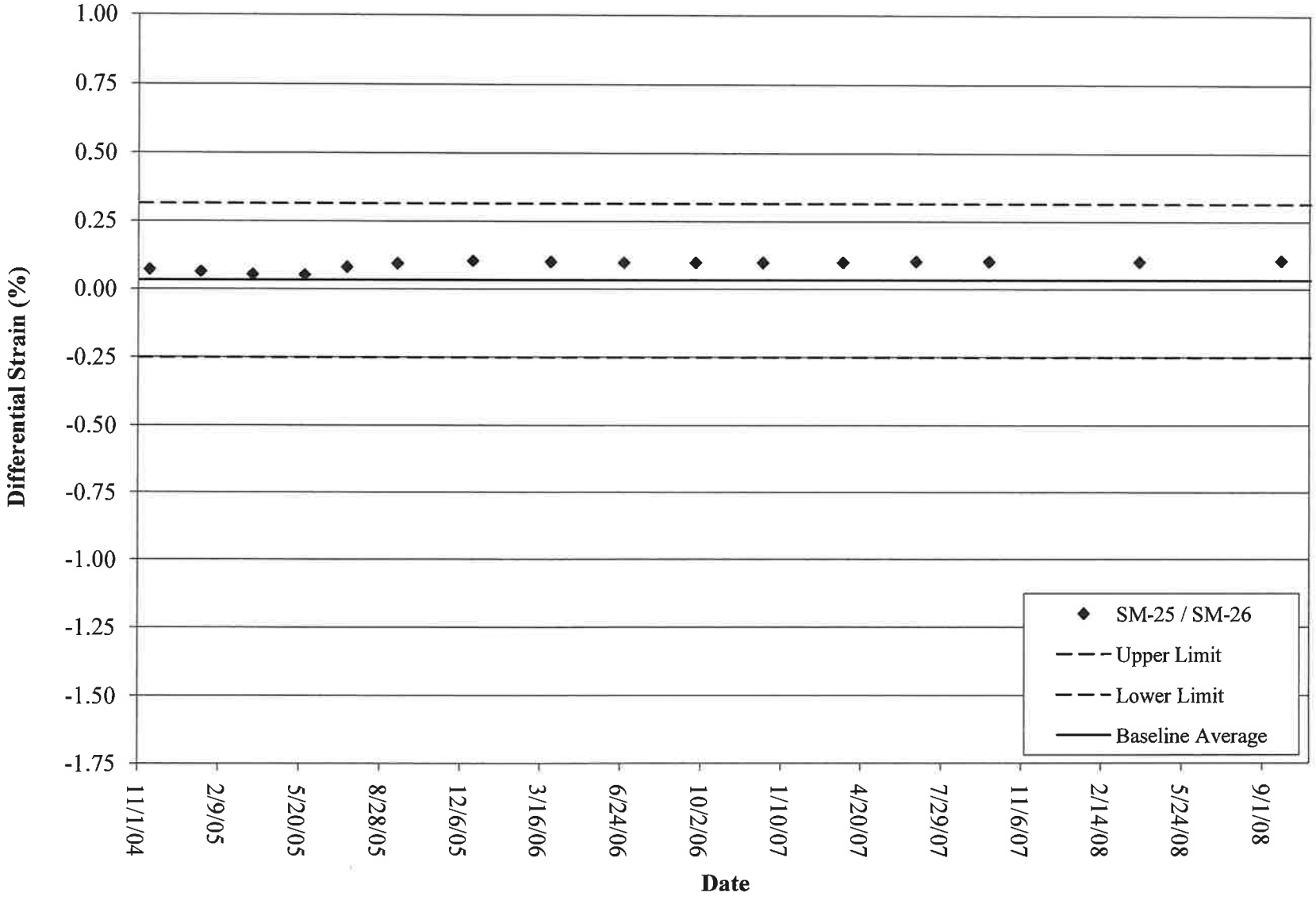


Figure 12
Cluster 5 - Control Chart
Strain Meter Data Quality Verification
SM-31/SM-33 Differential

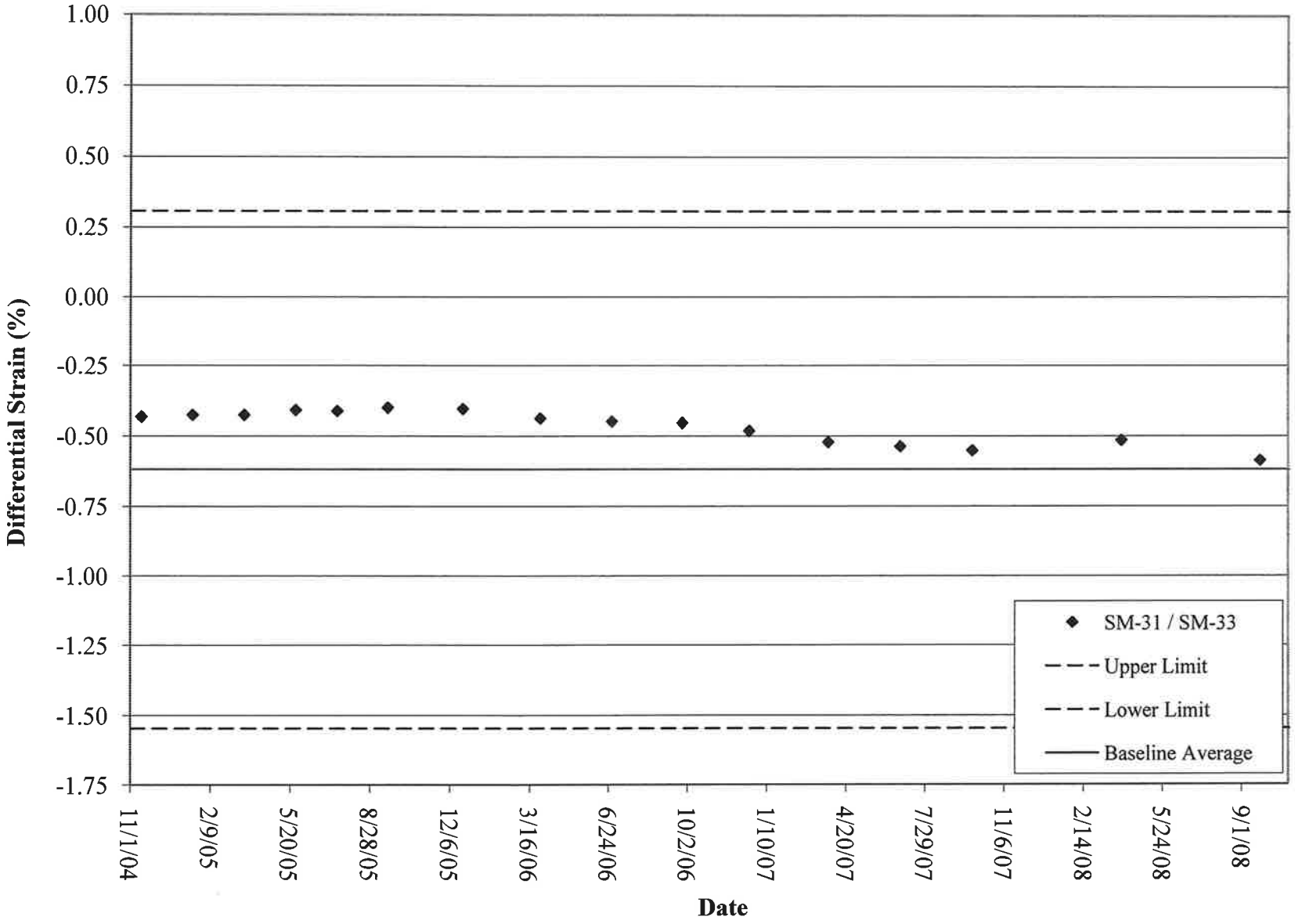


Figure 13
Cluster 6 - Control Chart
Strain Meter Data Quality Verification
SM-39/SM-40

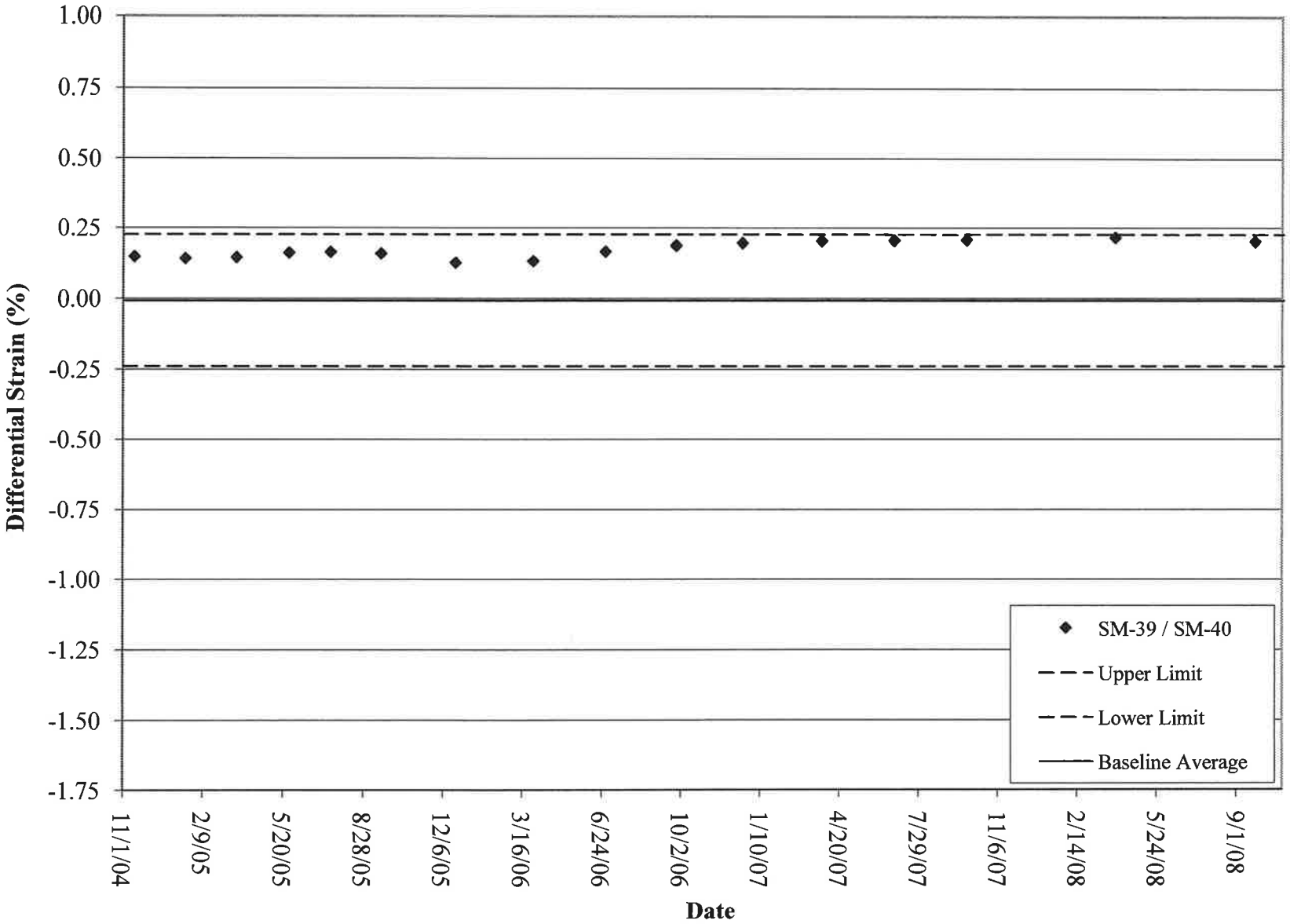


Figure 14
Cluster 7 - Control Chart
Strain Meter Data Quality Verification
SM-45/SM-46 Differential

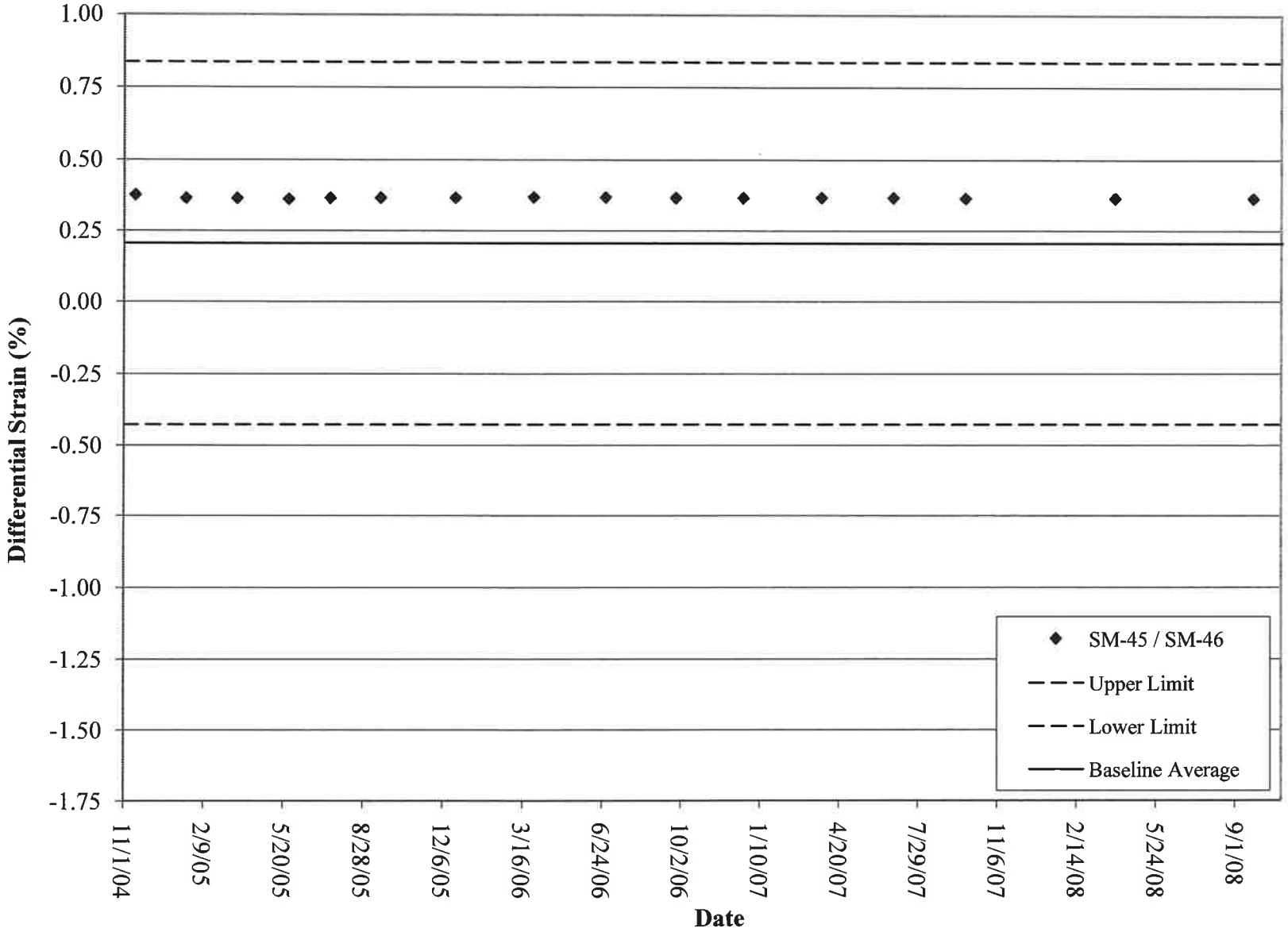


Figure 15
Phase 1 North-South Profiler

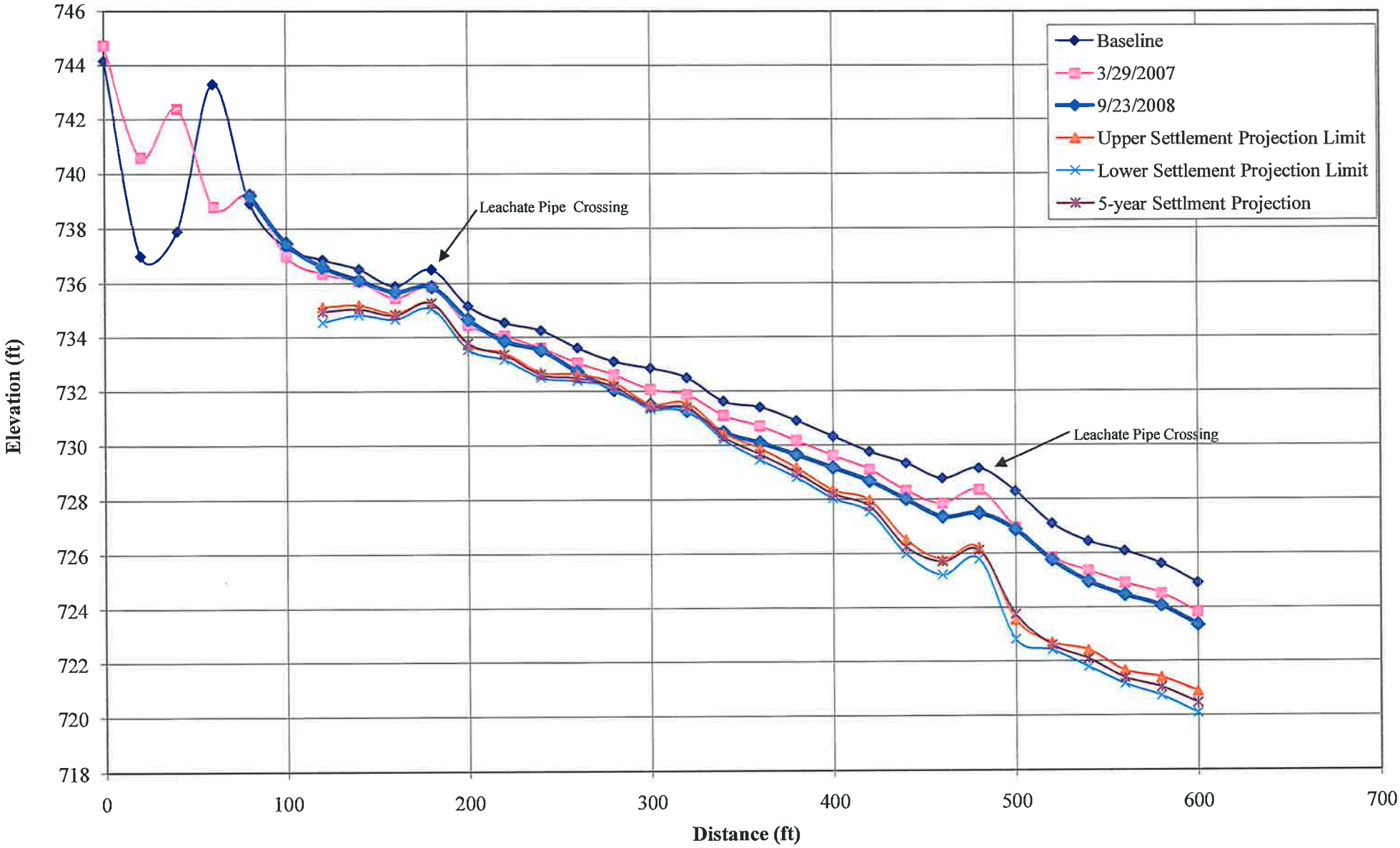


Figure 16
Phase 2 North - South Profiler

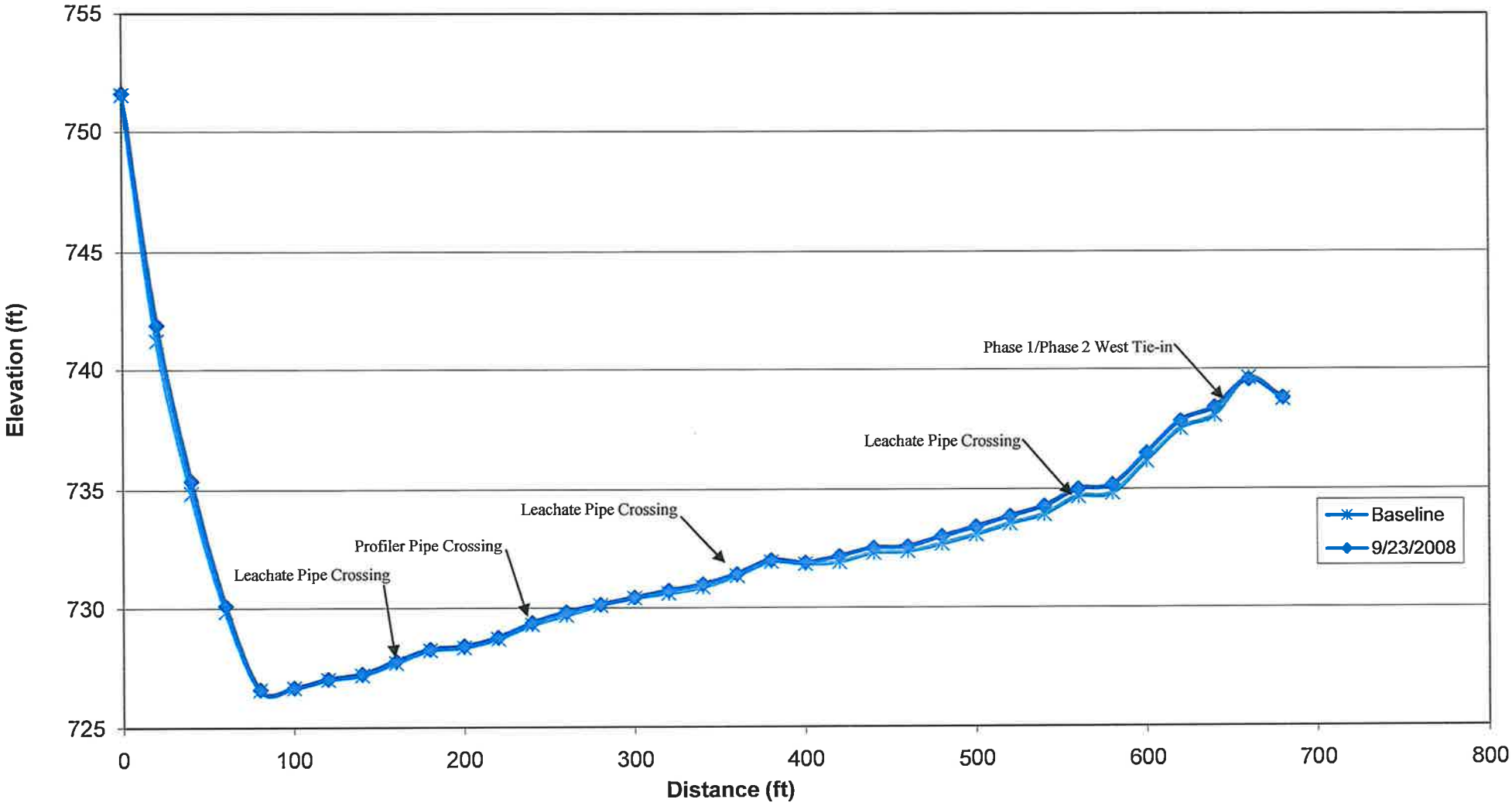


Figure 17
Northern East-West Profiler

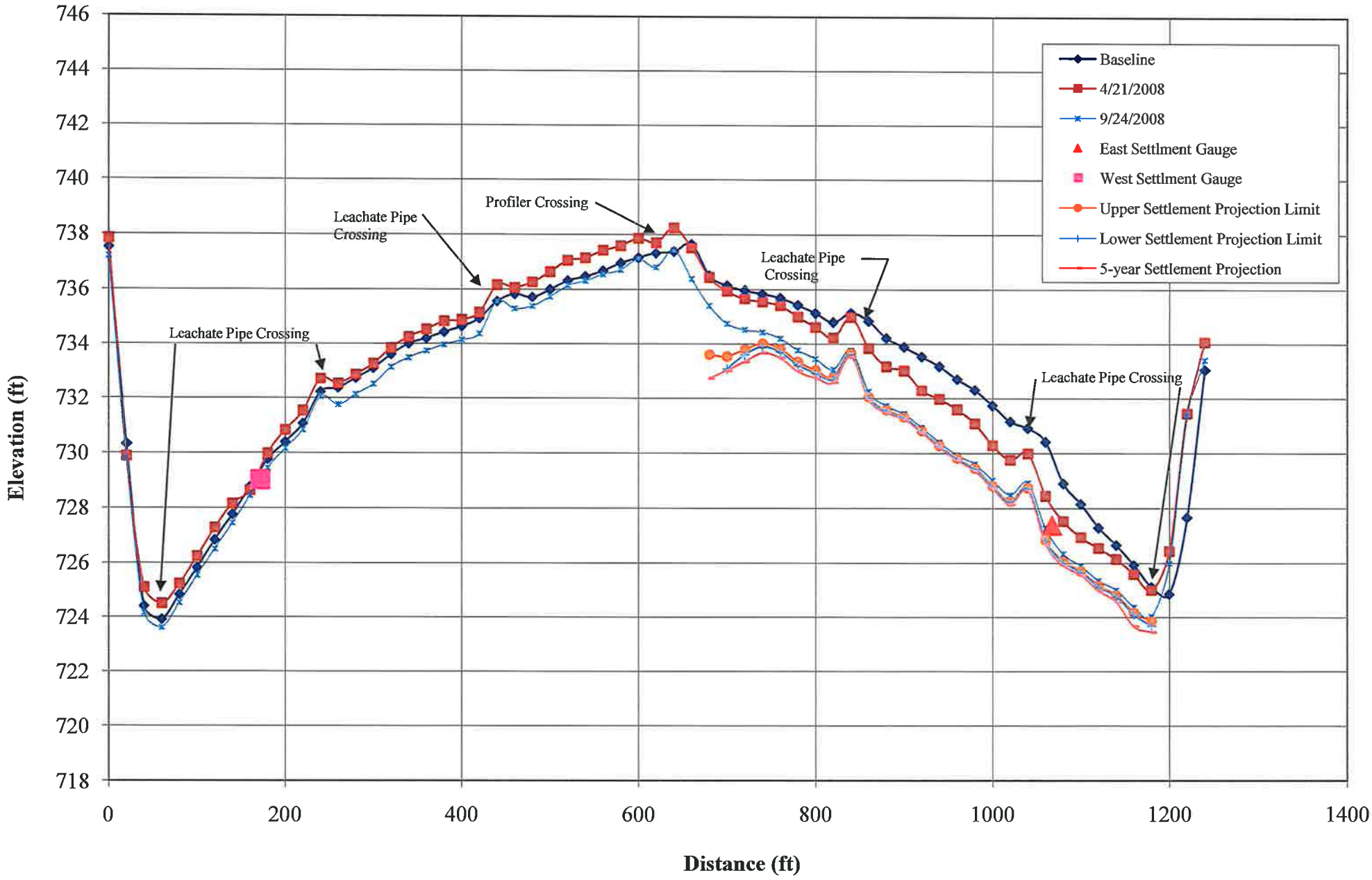


Figure 18
Southern East-West Profiler

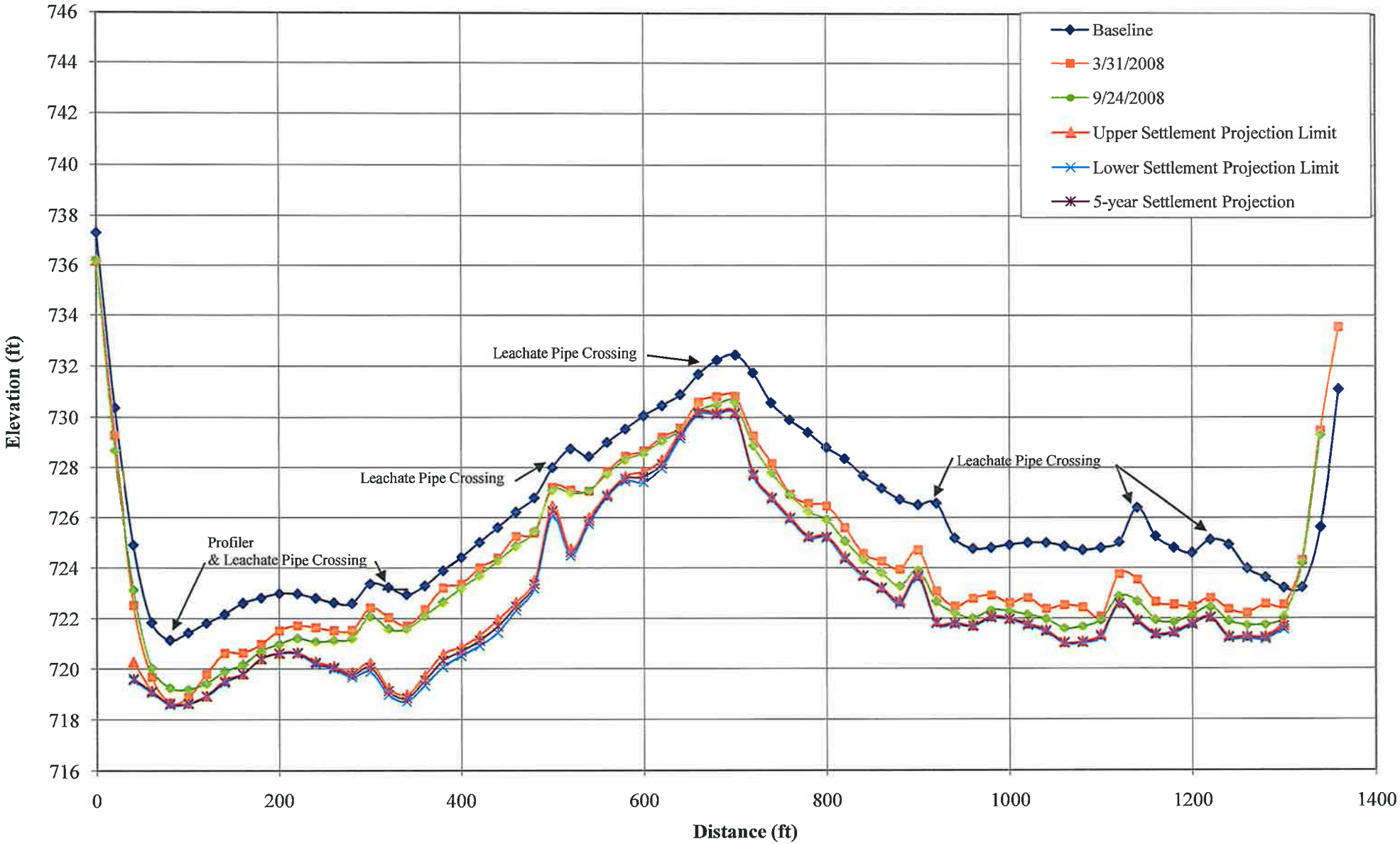


Figure 19
Phase 2 East-West Profiler

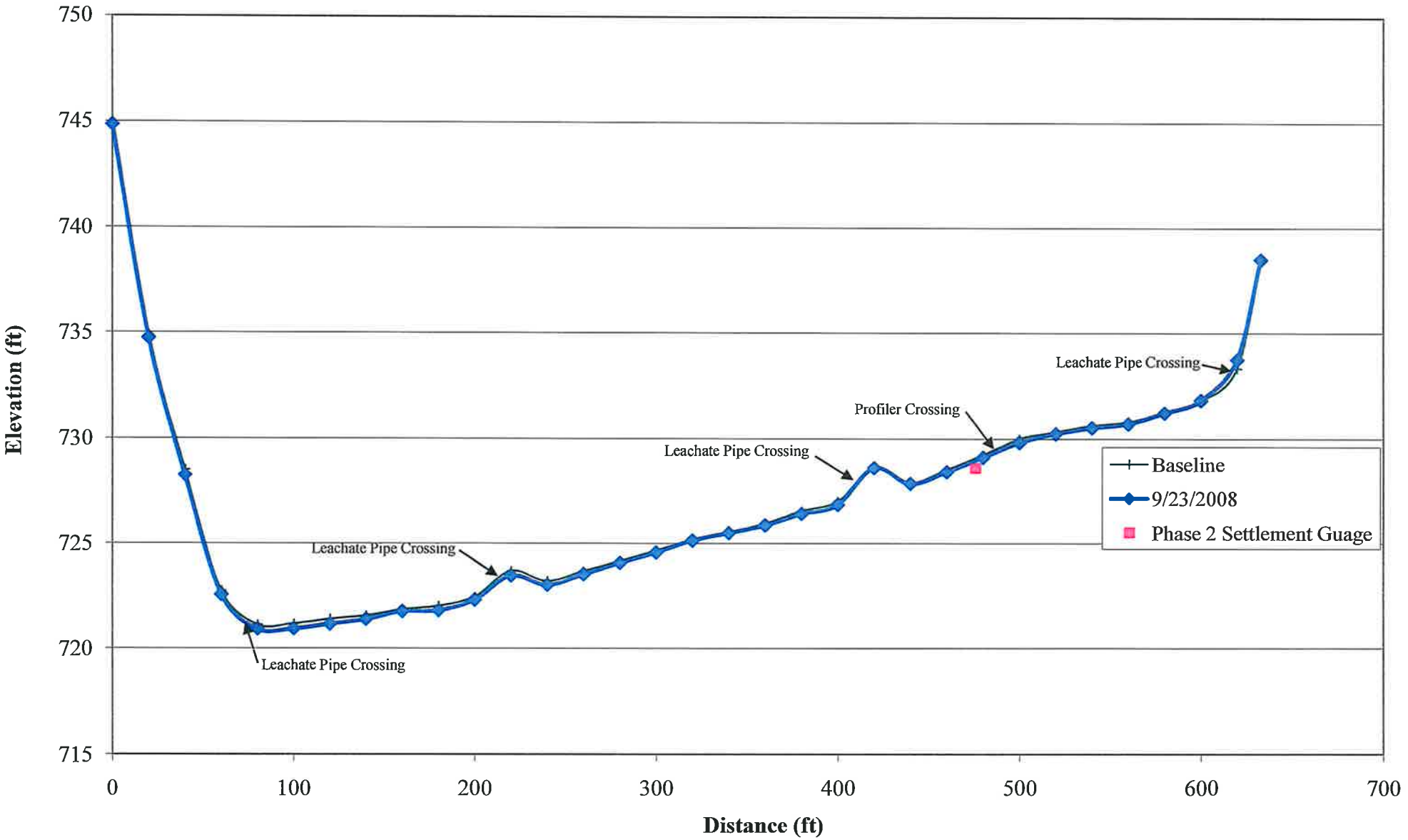


Figure 20
Phase 1 North-South Profiler
Control Chart - Mean

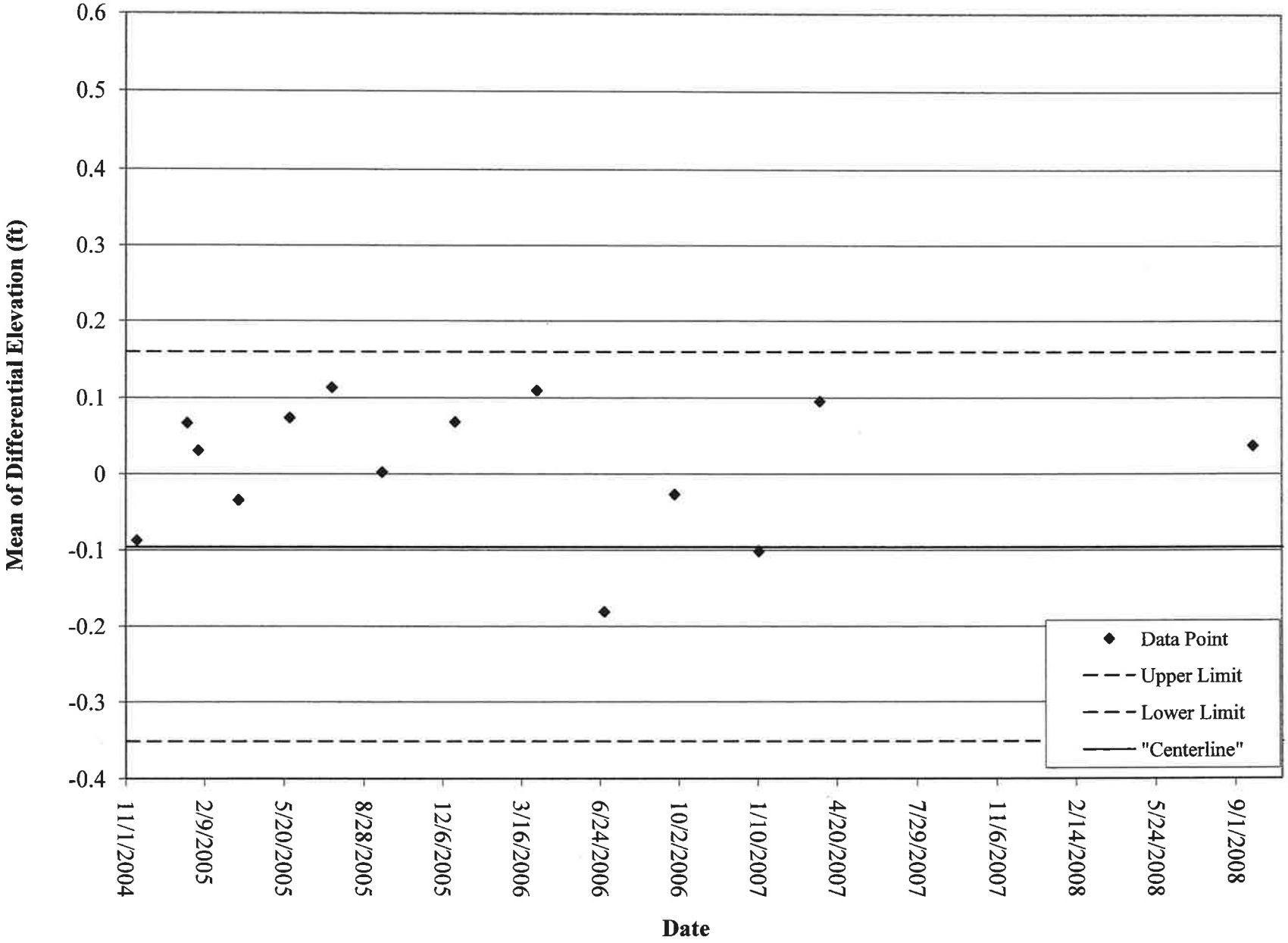


Figure 21
Phase 1 North-South Profiler
Control Chart - Standard Deviation

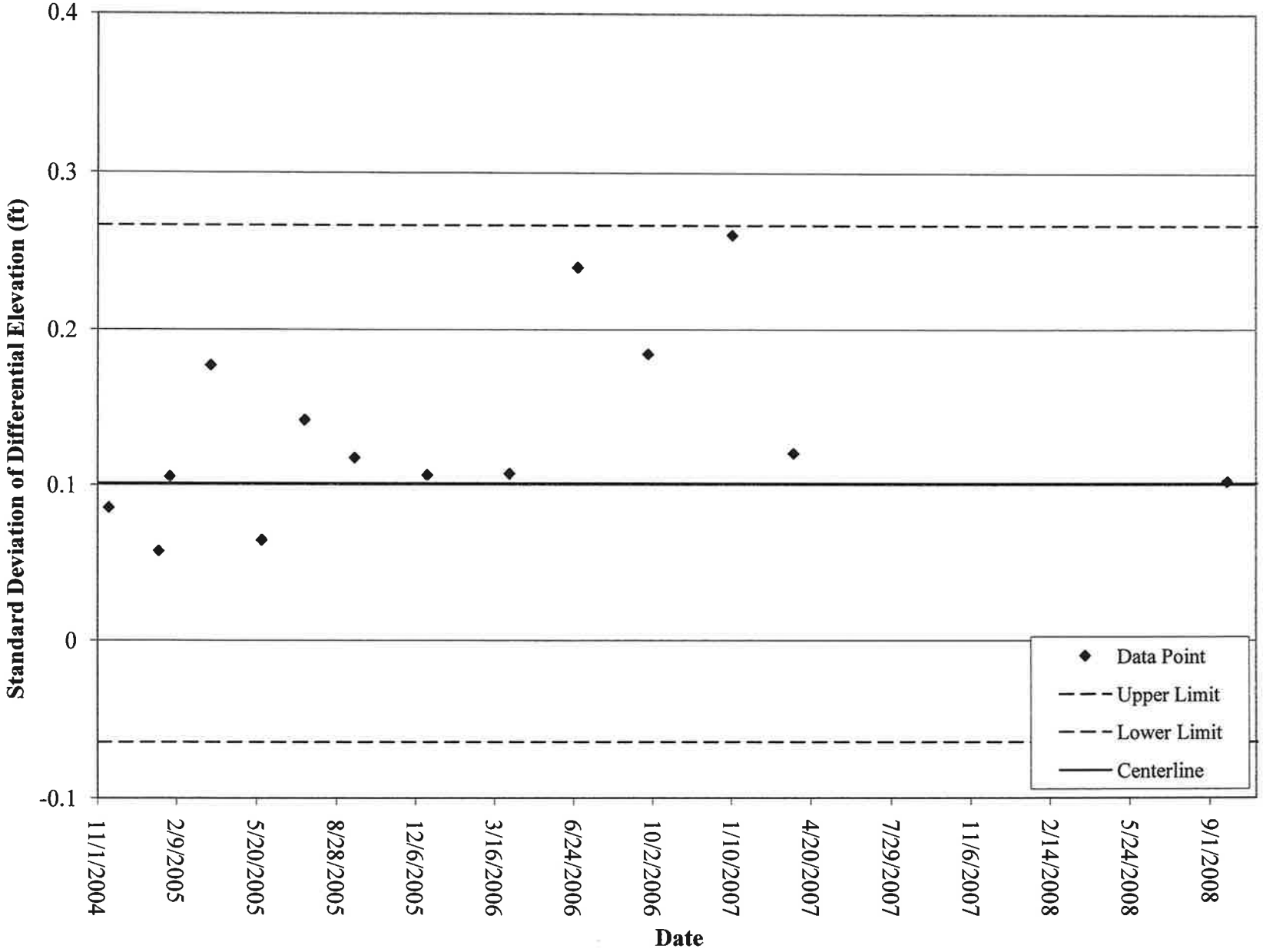


Figure 22
Phase 2 North-South Profiler
Control Chart - Mean

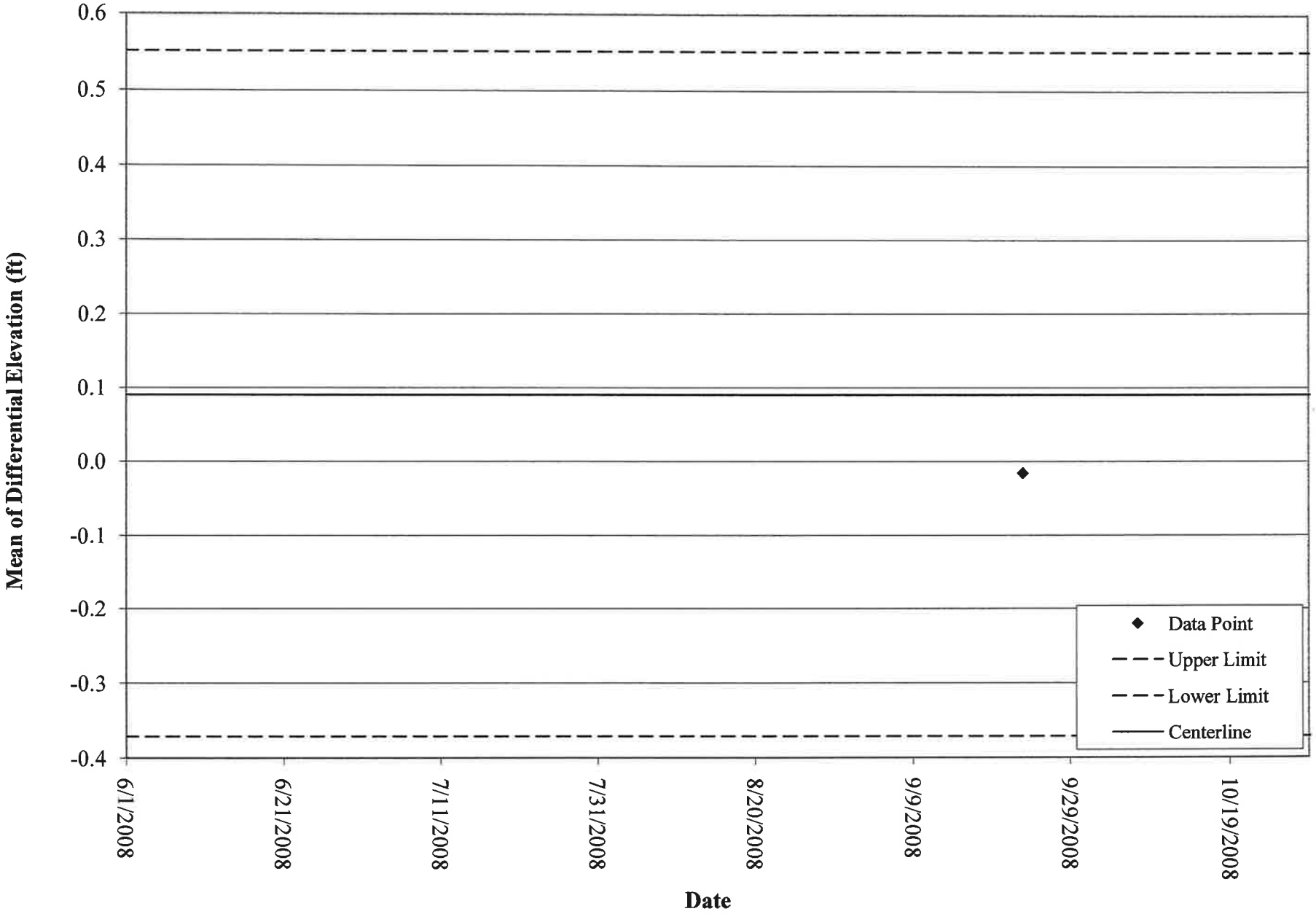


Figure 23
Phase 2 North-South Profiler
Control Chart - Standard Deviation

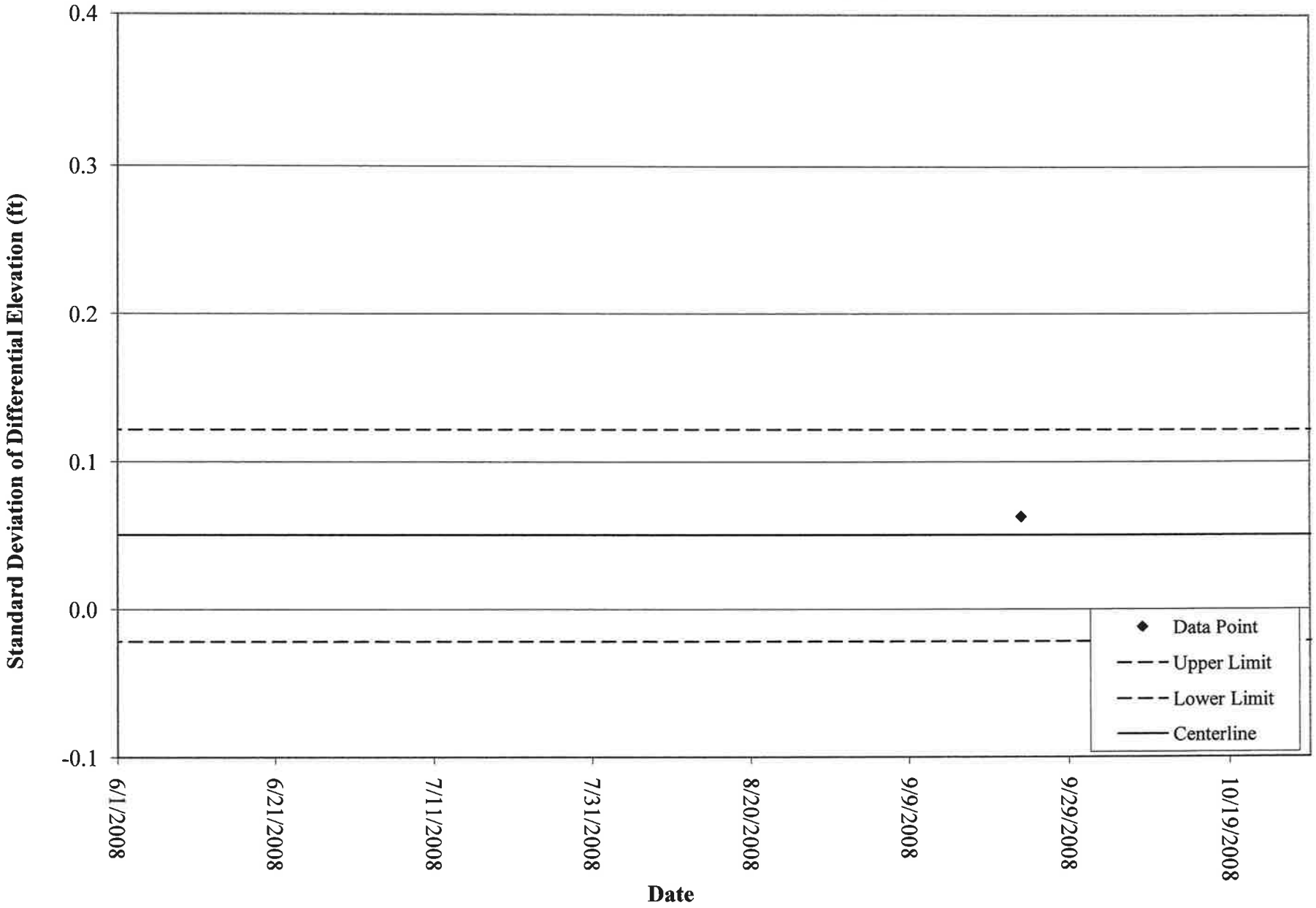


Figure 24
Northern East-West Profiler
Control Chart - Mean

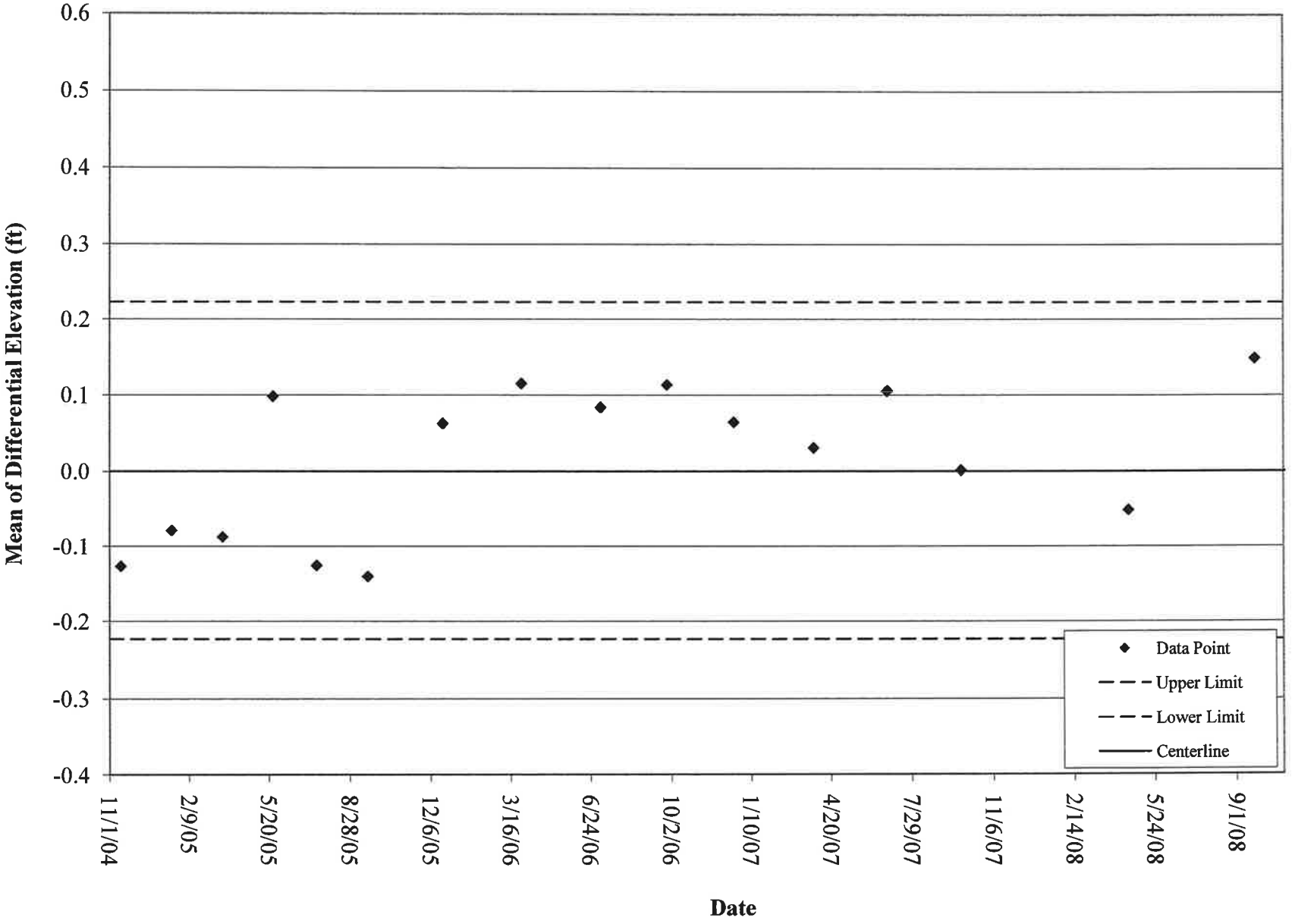


Figure 25
Northern East-West Profiler
Control Chart - Standard Deviation

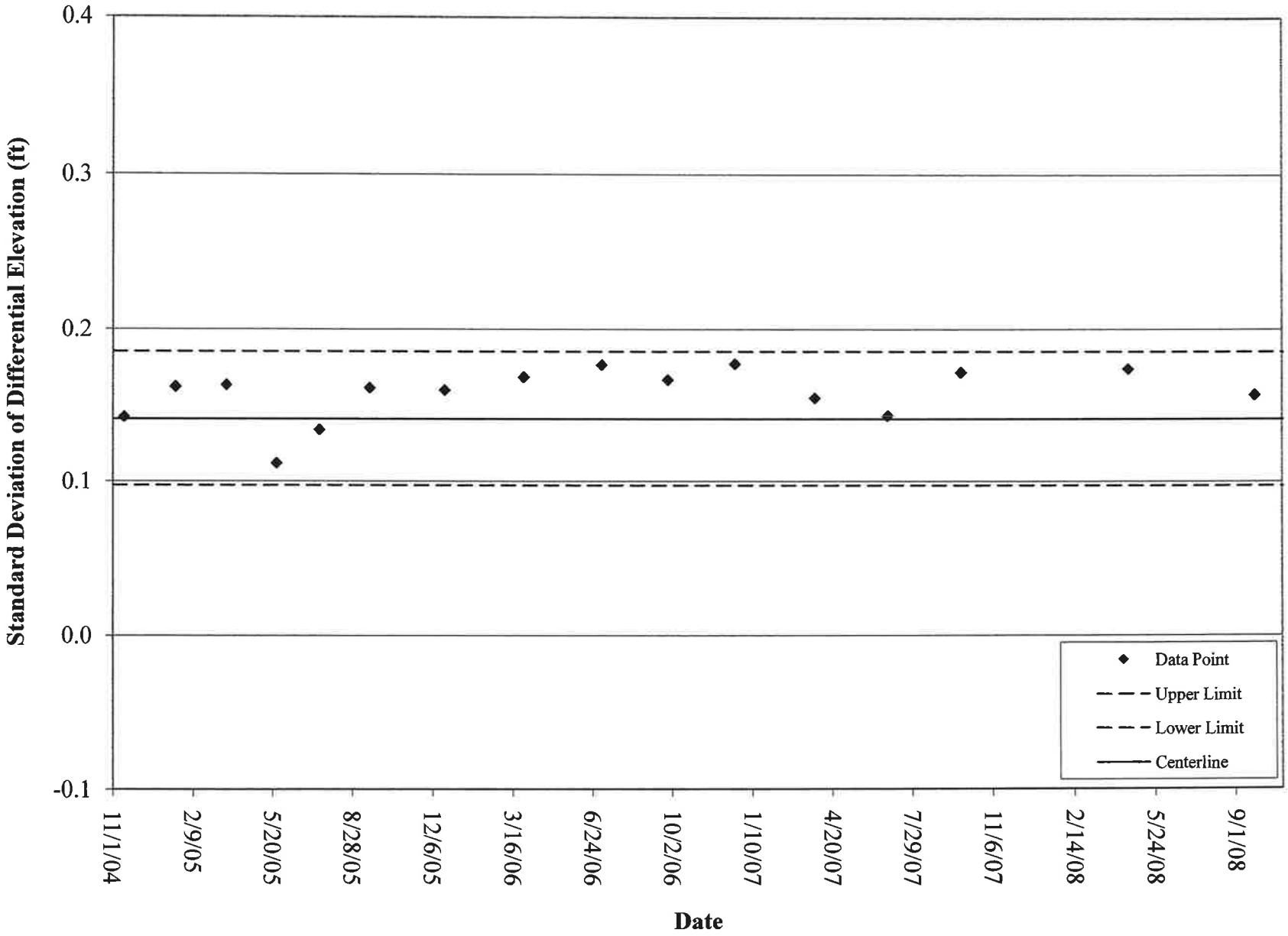


Figure 26
Southern East-West Profiler
Control Chart - Mean

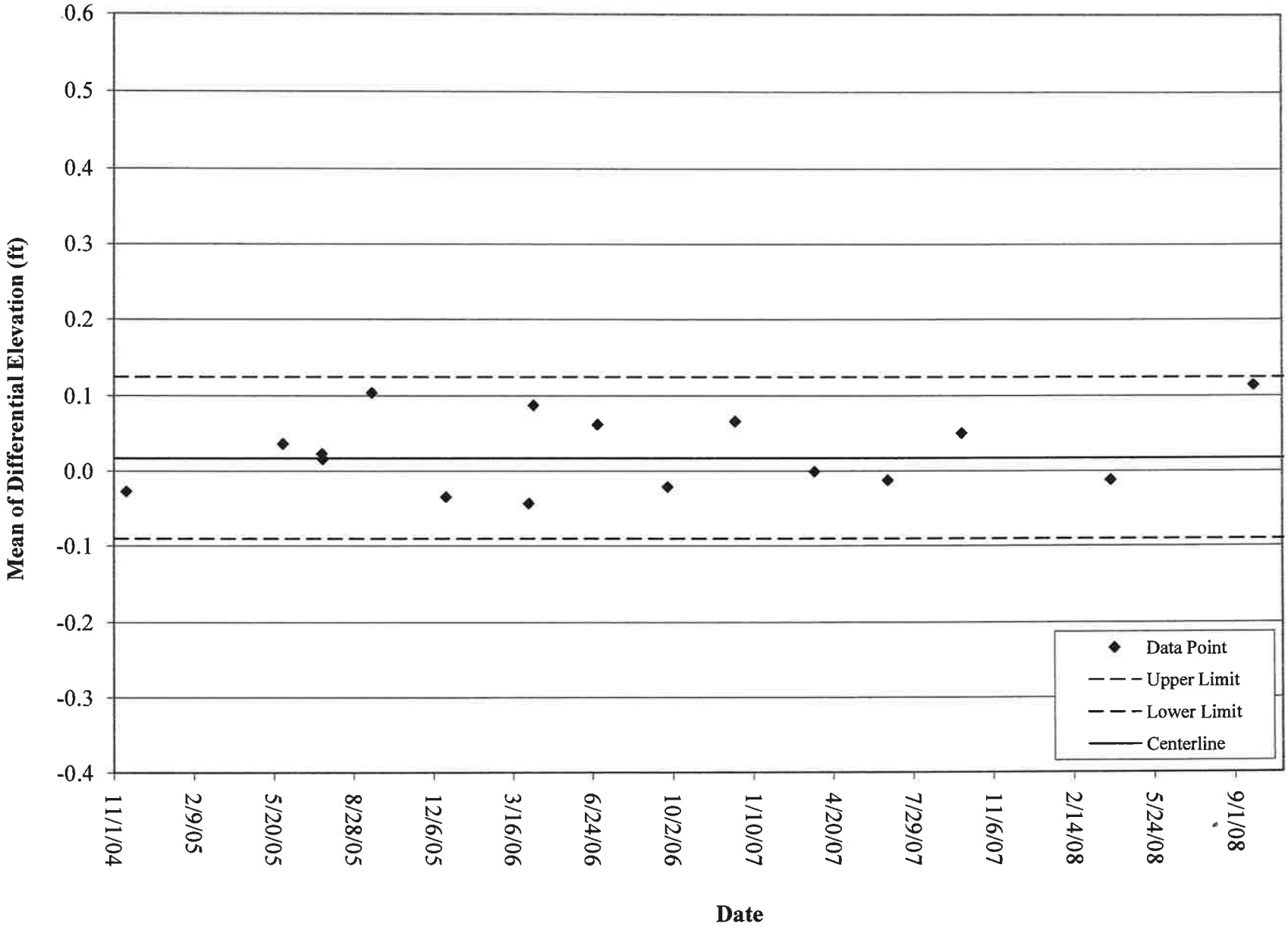


Figure 27
Southern East-West Profiler
Control Chart - Standard Deviation

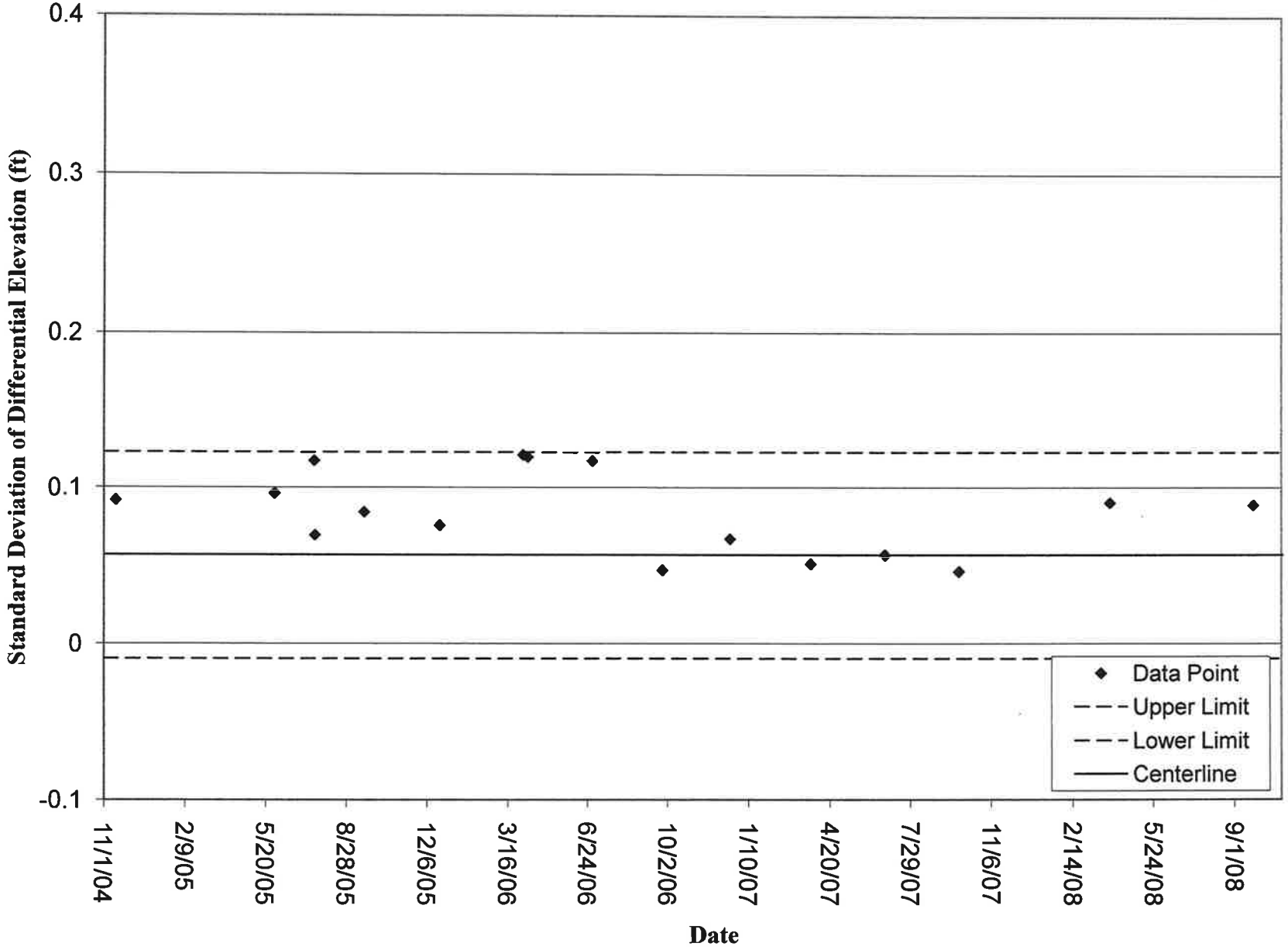


Figure 28
Phase 2 East-West Profiler
Control Chart - Mean

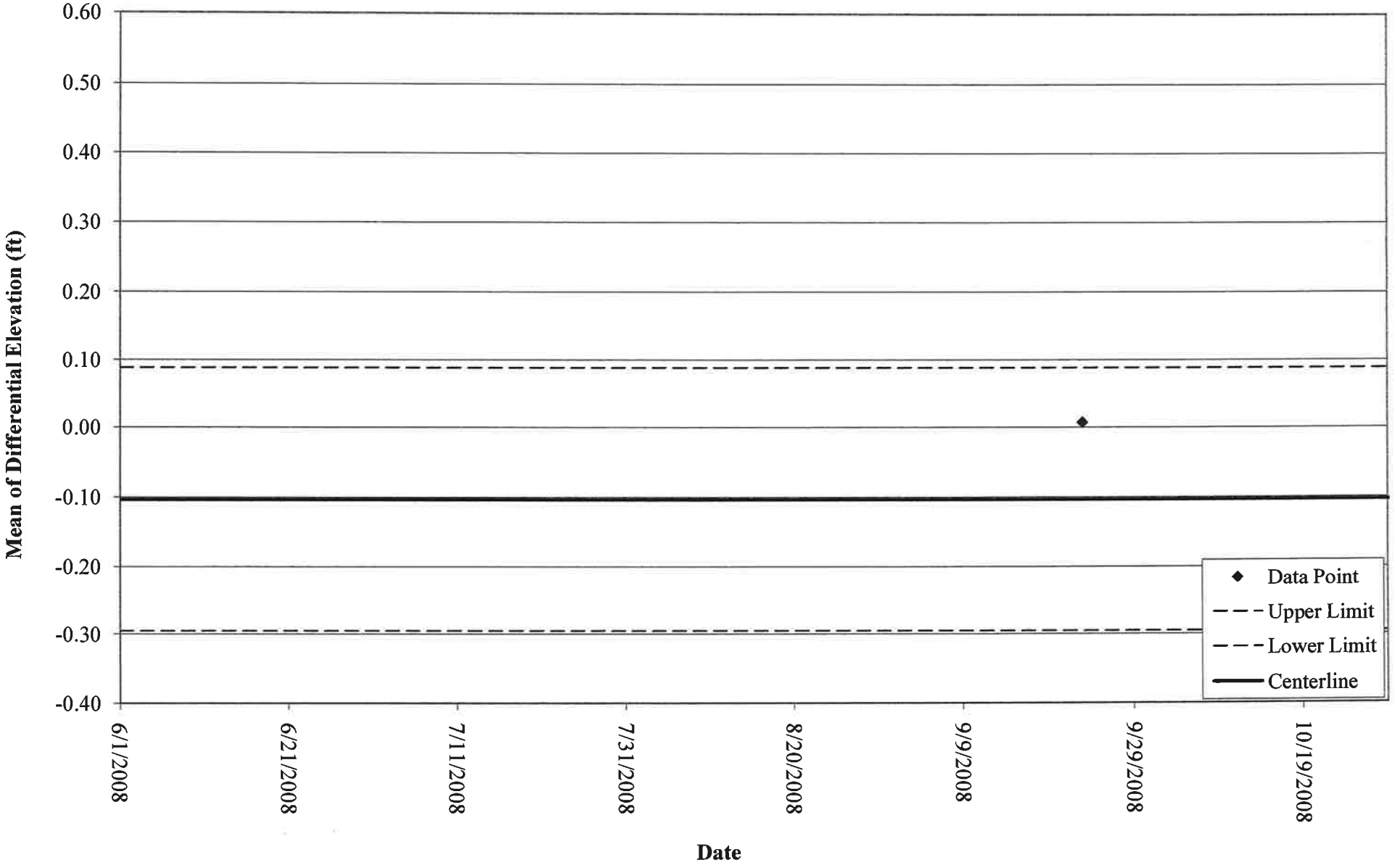


Figure 29
Phase 2 East-West Profiler
Control Chart - Standard Deviation

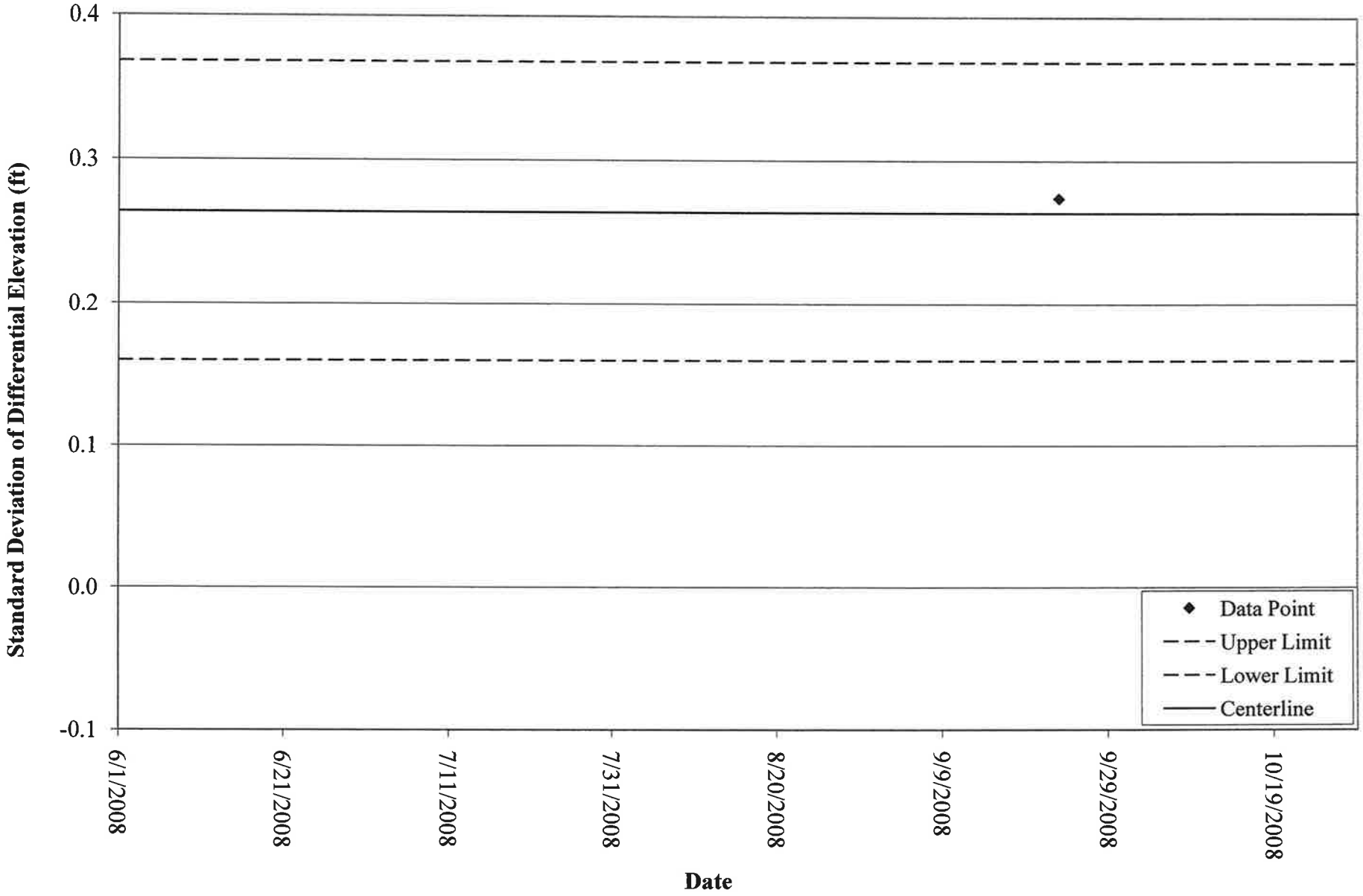


Figure 30
Phase 1 Settlement Gauge Measurements

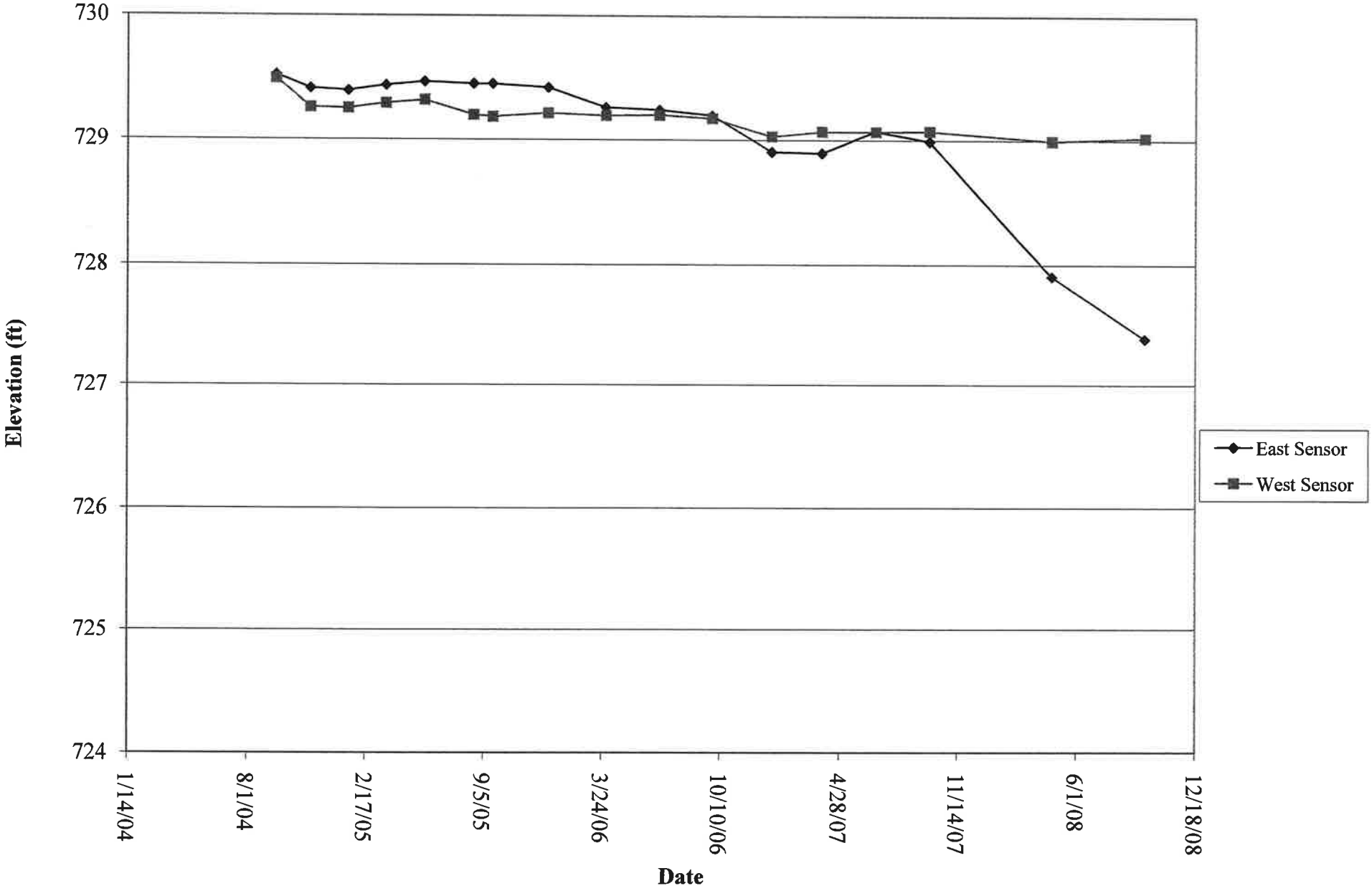
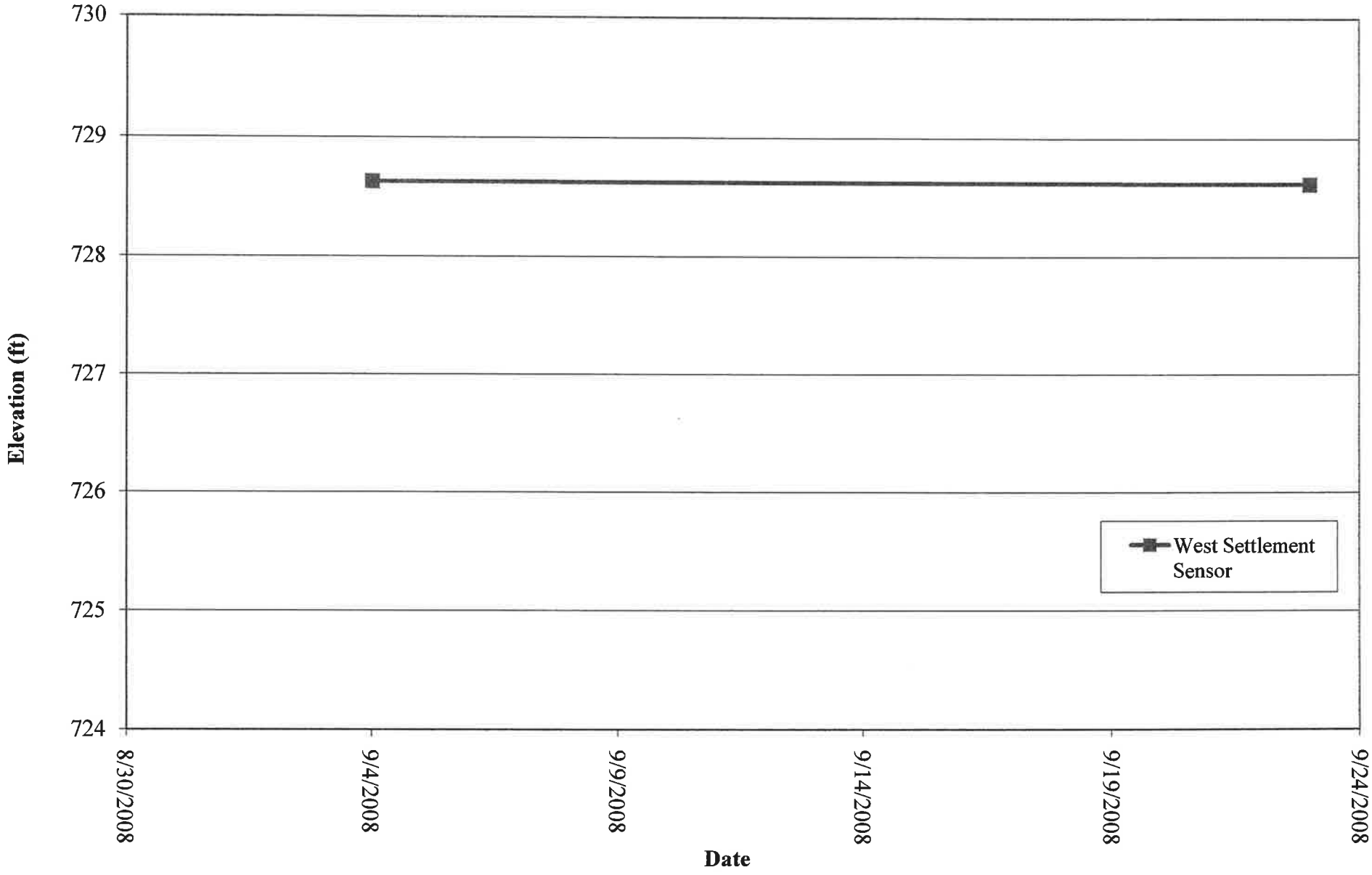


Figure 31
Phase 2 Settlement Gauge Measurements



Attachment A-2.3.2b

NTH Consultants, Ltd. (2008) *Settlement Monitoring Report: Master Cell VI-E – Phase I*.

Appendix B Part II

= 4812 psf

Stress at mid-height of MC V waste at future waste height

σ'_f = 4812 + (111 pcf * (748.5-740.8-3 ft) +(130 pcf * 3 ft) = 5725 psf

Settlement at Point 100 can be estimated as

ΔH_{i-f} = 0.17 * 43.42 Log (5725/4812) = 0.55 feet

7. Estimate of Post Settlement Slope

For Stations 100 and 120,

Estimated Settlement is 0.55 feet and 0.49 feet for Stations 100 and 120, respectively
Current Pipe Elevation for Station 100 is 719.18
Current Pipe Elevation for Station 120 is 719.42
Post-Settlement Elevation for Station 100 = 719.18 – 0.55 = 718.63
Post-Settlement Elevation for Station 120 = 719.42 – 0.49 = 718.92
Baseline floor slope from Stations 100 to 120 is approximately 1.93%
Distance between Stations 100 to 120 is approximately 20 feet
Post settlement slope for Stations 100 to 120 is
(718.63 – 718.92) / 20 * 100= 1.45%

There is no slope reversal between Station 100 and 120

8. Steps 6 and 7 are repeated using the upper and lower limits of the estimated values of $C_{c\varepsilon}$.

9. If there is a slope reversal, as shown between Station 200 and 220 on Table 10, the total reversed slope height is calculated.

Final projected pipe elevation for Station 200 = 720.61
Final projected pipe elevation for Station 220 = 720.62
Total reversed slope height = 720.62– 720.61= 0.01 feet

Estimation of Modified Compression Index
North-South Profiler
January 2005 Monitoring Event

Station	MC V T Liner Elev	2/1/05 MC VI-E Waste Elev	Baseline Measured Pipe Elev	Baseline Slope	2/1/05 Measured Pipe Elev	Measured settlement	MC V Waste Thick.	MC VI-E Waste Thick.	Stress @ Midpoint of MC V Wast Initial	Final	Estimated Modif. Compres Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
400	690	738.5	730.32	-2.91	729.55	0.77	30.3	7.2	2380	3177	0.20
420	690	738.5	729.76	-2.79	729.23	0.53	29.8	7.7	2363	3222	0.13
440	690	734.5	729.33	-2.13	728.75	0.59	29.3	4.2	2350	2813	0.26
460	683	737.0	728.77	-2.84	728.04	0.72	35.8	7.2	2543	3346	0.17
480	683	737.0	729.14	1.87	728.66	0.48	36.1	6.9	2554	3316	0.12
500	683	737.0	728.29	-4.27	727.53	0.76	35.3	7.7	2529	3385	0.17
520	683	736.0	727.10	-5.95	726.28	0.82	34.1	7.9	2493	3370	0.18
540	683	736.0	726.44	-3.29	725.68	0.76	33.4	8.6	2473	3423	0.16
560	683	735.5	726.08	-1.79	725.47	0.61	33.1	8.4	2462	3397	0.13
580	683	735.5	725.60	-2.40	724.75	0.85	32.6	8.9	2448	3436	0.18
600	683	736.0	724.90	-3.53	724.24	0.66	31.9	10.1	2427	3548	0.13

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - January 2005 Monitoring Event											
		2/1/05	Baseline		2/1/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
400	690	738.5	730.32	-2.91	729.63	0.69	30.3	7.2	2380	3177	0.18
420	690	738.5	729.76	-2.79	729.34	0.42	29.8	7.7	2363	3222	0.10
440	690	734.5	729.33	-2.13	728.86	0.48	29.3	4.2	2350	2813	0.21
460	683	737.0	728.77	-2.84	728.15	0.61	35.8	7.2	2543	3346	0.14
480	683	737.0	729.14	1.87	728.73	0.41	36.1	6.9	2554	3316	0.10
500	683	737.0	728.29	-4.27	727.66	0.63	35.3	7.7	2529	3385	0.14
520	683	736.0	727.10	-5.95	726.33	0.77	34.1	7.9	2493	3370	0.17
540	683	736.0	726.44	-3.29	725.80	0.64	33.4	8.6	2473	3423	0.14
560	683	735.5	726.08	-1.79	725.55	0.53	33.1	8.4	2462	3397	0.11
580	683	735.5	725.60	-2.40	724.87	0.73	32.6	8.9	2448	3436	0.15
600	683	736.0	724.90	-3.53	724.38	0.52	31.9	10.1	2427	3548	0.10

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Lower Limit - January 2005 Monitoring Event											
		2/1/05	Baseline		2/1/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initia	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
400	690	738.5	730.32	-2.91	729.47	0.85	30.3	7.2	2380	3177	0.22
420	690	738.5	729.76	-2.79	729.12	0.64	29.8	7.7	2363	3222	0.16
440	690	734.5	729.33	-2.13	728.64	0.70	29.3	4.2	2350	2813	0.30
460	683	737.0	728.77	-2.84	727.93	0.84	35.8	7.2	2543	3346	0.20
480	683	737.0	729.14	1.87	728.58	0.56	36.1	6.9	2554	3316	0.14
500	683	737.0	728.29	-4.27	727.40	0.88	35.3	7.7	2529	3385	0.20
520	683	736.0	727.10	-5.95	726.23	0.87	34.1	7.9	2493	3370	0.20
540	683	736.0	726.44	-3.29	725.57	0.87	33.4	8.6	2473	3423	0.18
560	683	735.5	726.08	-1.79	725.38	0.70	33.1	8.4	2462	3397	0.15
580	683	735.5	725.60	-2.40	724.63	0.97	32.6	8.9	2448	3436	0.20
600	683	736.0	724.90	-3.53	724.10	0.80	31.9	10.1	2427	3548	0.15

Estimation of Modified Compression Index											
North-South Profiler											
March 2005 Monitoring Event											
		4/1/05	Baseline		3/24/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	730.95	0.44	31.4	5.6	2412	3034	0.14
380	690	740.0	730.90	-2.49	730.26	0.64	30.9	8.1	2397	3296	0.15
400	690	740.5	730.32	-2.91	729.71	0.61	30.3	9.2	2380	3399	0.13
420	690	741.5	729.76	-2.79	729.32	0.43	29.8	10.7	2363	3555	0.08
440	690	742.0	729.33	-2.13	728.96	0.37	29.3	11.7	2350	3645	0.07
460	683	741.5	728.77	-2.84	728.13	0.64	35.8	11.7	2543	3846	0.10
480	683	741.5	729.14	1.87	728.40	0.74	36.1	11.4	2554	3815	0.12

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - March 2005 Monitoring Event											
		4/1/05	Baseline		3/24/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	731.06	0.33	31.4	5.6	2412	3034	0.11
380	690	740.0	730.90	-2.49	730.36	0.53	30.9	8.1	2397	3296	0.13
400	690	740.5	730.32	-2.91	729.79	0.53	30.3	9.2	2380	3399	0.11
420	690	741.5	729.76	-2.79	729.43	0.32	29.8	10.7	2363	3555	0.06
440	690	742.0	729.33	-2.13	729.07	0.26	29.3	11.7	2350	3645	0.05
460	683	741.5	728.77	-2.84	728.24	0.53	35.8	11.7	2543	3846	0.08
480	683	741.5	729.14	1.87	728.47	0.67	36.1	11.4	2554	3815	0.11

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Lower Limit - March 2005 Monitoring Event											
		4/1/05	Baseline		3/24/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	730.84	0.56	31.4	5.6	2412	3034	0.18
380	690	740.0	730.90	-2.49	730.15	0.75	30.9	8.1	2397	3296	0.17
400	690	740.5	730.32	-2.91	729.63	0.69	30.3	9.2	2380	3399	0.15
420	690	741.5	729.76	-2.79	729.21	0.54	29.8	10.7	2363	3555	0.10
440	690	742.0	729.33	-2.13	728.85	0.48	29.3	11.7	2350	3645	0.09
460	683	741.5	728.77	-2.84	728.01	0.75	35.8	11.7	2543	3846	0.12
480	683	741.5	729.14	1.87	728.32	0.82	36.1	11.4	2554	3815	0.13

Estimation of Modified Compression Index											
North-South Profiler											
May 2005 Monitoring Event											
		5/1/05	Baseline		5/27/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	730.86	0.54	31.4	5.6	2412	3034	0.17
380	690	740.0	730.90	-2.49	730.31	0.59	30.9	8.1	2397	3296	0.14
400	690	740.5	730.32	-2.91	729.40	0.92	30.3	9.2	2380	3399	0.19
420	690	741.5	729.76	-2.79	728.92	0.84	29.8	10.7	2363	3555	0.16
440	690	742.0	729.33	-2.13	728.26	1.07	29.3	11.7	2350	3645	0.19
460	683	741.5	728.77	-2.84	727.97	0.79	35.8	11.7	2543	3846	0.12
480	683	742.0	729.14	1.87	728.17	0.97	36.1	11.9	2554	3871	0.15
500	683	741.0	728.29	-4.27	726.94	1.35	35.3	11.7	2529	3829	0.21
520	683	740.0	727.10	-5.95	725.99	1.11	34.1	11.9	2493	3814	0.18
540	683	740.0	726.44	-3.29	725.06	1.38	33.4	12.6	2473	3867	0.21
560	683	739.0	726.08	-1.79	724.57	1.52	33.1	11.9	2462	3785	0.25
580	683	738.0	725.60	-2.40	724.25	1.36	32.6	11.4	2448	3713	0.23
600	683	736.0	724.90	-3.53	723.55	1.34	31.9	10.1	2427	3548	0.26

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - May 2005 Monitoring Event											
		5/1/05	Baseline		5/27/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	730.97	0.42	31.4	5.6	2412	3034	0.14
380	690	740.0	730.90	-2.49	730.42	0.48	30.9	8.1	2397	3296	0.11
400	690	740.5	730.32	-2.91	729.48	0.83	30.3	9.2	2380	3399	0.18
420	690	741.5	729.76	-2.79	729.03	0.73	29.8	10.7	2363	3555	0.14
440	690	742.0	729.33	-2.13	728.37	0.96	29.3	11.7	2350	3645	0.17
460	683	741.5	728.77	-2.84	728.09	0.68	35.8	11.7	2543	3846	0.11
480	683	742.0	729.14	1.87	728.25	0.89	36.1	11.9	2554	3871	0.14
500	683	741.0	728.29	-4.27	727.07	1.22	35.3	11.7	2529	3829	0.19
520	683	740.0	727.10	-5.95	726.04	1.06	34.1	11.9	2493	3814	0.17
540	683	740.0	726.44	-3.29	725.18	1.26	33.4	12.6	2473	3867	0.19
560	683	739.0	726.08	-1.79	724.65	1.43	33.1	11.9	2462	3785	0.23
580	683	738.0	725.60	-2.40	724.36	1.24	32.6	11.4	2448	3713	0.21
600	683	736.0	724.90	-3.53	723.69	1.20	31.9	10.1	2427	3548	0.23

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Lower Limit - May 2005 Monitoring Event											
		5/1/05	Baseline		5/27/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	730.75	0.65	31.4	5.6	2412	3034	0.21
380	690	740.0	730.90	-2.49	730.21	0.69	30.9	8.1	2397	3296	0.16
400	690	740.5	730.32	-2.91	729.32	1.00	30.3	9.2	2380	3399	0.21
420	690	741.5	729.76	-2.79	728.81	0.95	29.8	10.7	2363	3555	0.18
440	690	742.0	729.33	-2.13	728.15	1.18	29.3	11.7	2350	3645	0.21
460	683	741.5	728.77	-2.84	727.86	0.91	35.8	11.7	2543	3846	0.14
480	683	742.0	729.14	1.87	728.10	1.04	36.1	11.9	2554	3871	0.16
500	683	741.0	728.29	-4.27	726.81	1.47	35.3	11.7	2529	3829	0.23
520	683	740.0	727.10	-5.95	725.94	1.16	34.1	11.9	2493	3814	0.18
540	683	740.0	726.44	-3.29	724.95	1.49	33.4	12.6	2473	3867	0.23
560	683	739.0	726.08	-1.79	724.48	1.60	33.1	11.9	2462	3785	0.26
580	683	738.0	725.60	-2.40	724.13	1.47	32.6	11.4	2448	3713	0.25
600	683	736.0	724.90	-3.53	723.41	1.48	31.9	10.1	2427	3548	0.28

Estimation of Modified Compression Index											
North-South Profiler											
July 2005 Monitoring Event											
		7/28/05	Baseline		7/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	731.03	0.37	31.4	5.6	2412	3034	0.12
380	690	740.0	730.90	-2.49	730.56	0.33	30.9	8.1	2397	3296	0.08
400	690	740.5	730.32	-2.91	729.84	0.47	30.3	9.2	2380	3399	0.10
420	690	741.5	729.76	-2.79	729.36	0.40	29.8	10.7	2363	3555	0.08
440	690	742.0	729.33	-2.13	728.67	0.66	29.3	11.7	2350	3645	0.12
460	683	741.5	728.77	-2.84	727.92	0.84	35.8	11.7	2543	3846	0.13
480	683	742.0	729.14	1.87	728.65	0.49	36.1	11.9	2554	3871	0.07
500	683	741.0	728.29	-4.27	727.41	0.88	35.3	11.7	2529	3829	0.14
520	683	740.5	727.10	-5.95	726.28	0.81	34.1	12.4	2493	3870	0.13
540	683	740.0	726.44	-3.29	725.18	1.26	33.4	12.6	2473	3867	0.19
560	683	739.0	726.08	-1.79	724.91	1.17	33.1	11.9	2462	3785	0.19
580	683	738.0	725.60	-2.40	724.32	1.29	32.6	11.4	2448	3713	0.22
600	683	736.0	724.90	-3.53	723.68	1.22	31.9	10.1	2427	3548	0.23

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - July 2005 Monitoring Event											
		7/28/05	Baseline		7/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	731.14	0.25	31.4	5.6	2412	3034	0.08
380	690	740.0	730.90	-2.49	730.67	0.23	30.9	8.1	2397	3296	0.05
400	690	740.5	730.32	-2.91	729.93	0.39	30.3	9.2	2380	3399	0.08
420	690	741.5	729.76	-2.79	729.47	0.29	29.8	10.7	2363	3555	0.05
440	690	742.0	729.33	-2.13	728.78	0.55	29.3	11.7	2350	3645	0.10
460	683	741.5	728.77	-2.84	728.03	0.73	35.8	11.7	2543	3846	0.11
480	683	742.0	729.14	1.87	728.73	0.41	36.1	11.9	2554	3871	0.06
500	683	741.0	728.29	-4.27	727.53	0.75	35.3	11.7	2529	3829	0.12
520	683	740.5	727.10	-5.95	726.33	0.76	34.1	12.4	2493	3870	0.12
540	683	740.0	726.44	-3.29	725.29	1.15	33.4	12.6	2473	3867	0.18
560	683	739.0	726.08	-1.79	725.00	1.08	33.1	11.9	2462	3785	0.18
580	683	738.0	725.60	-2.40	724.43	1.17	32.6	11.4	2448	3713	0.20
600	683	736.0	724.90	-3.53	723.82	1.08	31.9	10.1	2427	3548	0.20

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Lower Limit - July 2005 Monitoring Event											
		7/28/05	Baseline		7/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
340											
360	690	738.0	731.39	-1.07	730.91	0.48	31.4	5.6	2412	3034	0.15
380	690	740.0	730.90	-2.49	730.46	0.44	30.9	8.1	2397	3296	0.10
400	690	740.5	730.32	-2.91	729.76	0.55	30.3	9.2	2380	3399	0.12
420	690	741.5	729.76	-2.79	729.25	0.51	29.8	10.7	2363	3555	0.10
440	690	742.0	729.33	-2.13	728.56	0.77	29.3	11.7	2350	3645	0.14
460	683	741.5	728.77	-2.84	727.81	0.96	35.8	11.7	2543	3846	0.15
480	683	742.0	729.14	1.87	728.58	0.56	36.1	11.9	2554	3871	0.09
500	683	741.0	728.29	-4.27	727.28	1.01	35.3	11.7	2529	3829	0.16
520	683	740.5	727.10	-5.95	726.23	0.87	34.1	12.4	2493	3870	0.13
540	683	740.0	726.44	-3.29	725.07	1.37	33.4	12.6	2473	3867	0.21
560	683	739.0	726.08	-1.79	724.83	1.25	33.1	11.9	2462	3785	0.20
580	683	738.0	725.60	-2.40	724.20	1.40	32.6	11.4	2448	3713	0.24
600	683	736.0	724.90	-3.53	723.54	1.36	31.9	10.1	2427	3548	0.26

Estimation of Modified Compression Index											
North-South Profiler											
September 2005 Monitoring Event											
		8/30/05	Baseline		9/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	731.08	0.32	31.4	5.6	2412	3034	0.10
380	690	740.0	730.90	-2.49	730.55	0.35	30.9	8.1	2397	3296	0.08
400	690	741.0	730.32	-2.91	729.89	0.43	30.3	9.7	2380	3454	0.09
420	690	741.5	729.76	-2.79	729.44	0.32	29.8	10.7	2363	3555	0.06
440	690	741.5	729.33	-2.13	728.68	0.65	29.3	11.2	2350	3590	0.12
460	683	741.5	728.77	-2.84	728.10	0.67	35.8	11.7	2543	3846	0.10
480	683	742.0	729.14	1.87	728.38	0.76	36.1	11.9	2554	3871	0.12
500	683	741.0	728.29	-4.27	727.10	1.18	35.3	11.7	2529	3829	0.19
520	683	740.5	727.10	-5.95	726.09	1.01	34.1	12.4	2493	3870	0.15
540	683	740.0	726.44	-3.29	725.41	1.03	33.4	12.6	2473	3867	0.16
560	683	739.0	726.08	-1.79	724.97	1.12	33.1	11.9	2462	3785	0.18
580	683	738.0	725.60	-2.40	724.46	1.14	32.6	11.4	2448	3713	0.19
600	683	736.0	724.90	-3.53	723.84	1.06	31.9	10.1	2427	3548	0.20

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - September 2005 Monitoring Event											
		8/30/05	Baseline		9/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	731.19	0.21	31.4	5.6	2412	3034	0.07
380	690	740.0	730.90	-2.49	730.66	0.24	30.9	8.1	2397	3296	0.06
400	690	740.5	730.32	-2.91	729.97	0.34	30.3	9.2	2380	3399	0.07
420	690	741.5	729.76	-2.79	729.55	0.21	29.8	10.7	2363	3555	0.04
440	690	742.0	729.33	-2.13	728.79	0.54	29.3	11.7	2350	3645	0.10
460	683	741.5	728.77	-2.84	728.21	0.55	35.8	11.7	2543	3846	0.09
480	683	742.0	729.14	1.87	728.46	0.68	36.1	11.9	2554	3871	0.10
500	683	741.0	728.29	-4.27	727.23	1.06	35.3	11.7	2529	3829	0.17
520	683	740.5	727.10	-5.95	726.14	0.96	34.1	12.4	2493	3870	0.15
540	683	740.0	726.44	-3.29	725.53	0.91	33.4	12.6	2473	3867	0.14
560	683	739.0	726.08	-1.79	725.05	1.03	33.1	11.9	2462	3785	0.17
580	683	738.0	725.60	-2.40	724.57	1.03	32.6	11.4	2448	3713	0.17
600	683	736.0	724.90	-3.53	723.98	0.92	31.9	10.1	2427	3548	0.18

Estimation of Modified Compression Index

North-South Profiler

95% Confidence Lower Limit - September 2005 Monitoring Event

		8/30/05	Baseline		9/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
360	690	738.0	731.39	-1.07	730.96	0.43	31.4	5.6	2412	3034	0.14
380	690	740.0	730.90	-2.49	730.45	0.45	30.9	8.1	2397	3296	0.11
400	690	740.5	730.32	-2.91	729.81	0.51	30.3	9.2	2380	3399	0.11
420	690	741.5	729.76	-2.79	729.33	0.43	29.8	10.7	2363	3555	0.08
440	690	742.0	729.33	-2.13	728.57	0.76	29.3	11.7	2350	3645	0.14
460	683	741.5	728.77	-2.84	727.98	0.78	35.8	11.7	2543	3846	0.12
480	683	742.0	729.14	1.87	728.30	0.84	36.1	11.9	2554	3871	0.13
500	683	741.0	728.29	-4.27	726.98	1.31	35.3	11.7	2529	3829	0.21
520	683	740.5	727.10	-5.95	726.04	1.06	34.1	12.4	2493	3870	0.16
540	683	740.0	726.44	-3.29	725.30	1.14	33.4	12.6	2473	3867	0.18
560	683	739.0	726.08	-1.79	724.88	1.20	33.1	11.9	2462	3785	0.19
580	683	738.0	725.60	-2.40	724.34	1.26	32.6	11.4	2448	3713	0.21
600	683	736.0	724.90	-3.53	723.70	1.20	31.9	10.1	2427	3548	0.23

Estimation of Modified Compression Index											
North-South Profiler											
December 2005 Monitoring Event											
		1/3/06	Baseline		12/21/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	749.4	736.85	-2.30	736.35	0.50	36.8	11.6	2575	3862	0.08
140	690	752.4	736.51	-1.70	736.09	0.41	36.5	14.9	2565	4217	0.05
160	690	753.4	735.89	-3.11	735.36	0.53	35.9	16.5	2547	4378	0.06
180	691	754.0	736.49	3.02	736.27	0.22	36.0	16.5	2550	4382	0.03
200	691	754.0	735.13	-6.81	734.40	0.73	34.1	17.9	2494	4477	0.08
220	692	753.8	734.53	-3.02	734.07	0.46	33.0	18.2	2461	4485	0.05
240	692	753.3	734.23	-1.46	733.66	0.57	32.2	18.1	2437	4445	0.07
260	692	752.9	733.59	-3.22	733.41	0.18	31.6	18.3	2418	4448	0.02
280	692	751.4	733.08	-2.55	733.13	-0.05	31.1	17.3	2402	4328	-0.01
300	693	746.2	732.83	-1.25	732.51	0.32	30.3	12.3	2380	3748	0.05
320	693	743.0	732.48	-1.75	732.46	0.02	29.5	9.6	2354	3416	0.00
340	692	741.7	731.61	-4.36	731.10	0.51	29.6	9.1	2358	3372	0.11
360	691	742.2	731.39	-1.07	730.87	0.53	30.4	9.8	2382	3469	0.11
380	691	742.5	730.90	-2.49	730.22	0.68	30.4	10.6	2382	3559	0.13
400	690	742.8	730.32	-2.91	729.76	0.55	30.3	11.5	2380	3651	0.10
420	690	742.4	729.76	-2.79	729.21	0.55	29.8	11.7	2363	3659	0.10
440	690	742.3	729.33	-2.13	728.76	0.57	29.3	11.9	2350	3676	0.10
460	683	742.2	728.77	-2.84	727.83	0.94	35.8	12.4	2543	3924	0.14
480	683	742.1	729.14	1.87	728.51	0.63	36.1	12.0	2554	3883	0.10
500	683	741.7	728.29	-4.27	727.14	1.15	35.3	12.4	2529	3909	0.17
520	683	740.7	727.10	-5.95	725.96	1.14	34.1	12.6	2493	3886	0.17
540	683	740.1	726.44	-3.29	725.44	1.00	33.4	12.6	2473	3873	0.15
560	683	738.6	726.08	-1.79	725.34	0.74	33.1	11.5	2462	3743	0.12
580	683	736.8	725.60	-2.40	725.03	0.57	32.6	10.2	2448	3581	0.11
600	683	735.7	724.90	-3.53	724.59	0.30	31.9	9.8	2427	3509	0.06

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - December 2005 Monitoring Event											
		1/3/06	Baseline		12/21/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	749.4	736.85	-2.30	736.48	0.37	36.8	11.6	2575	3862	0.06
140	690	752.4	736.51	-1.70	736.22	0.29	36.5	14.9	2565	4217	0.04
160	690	753.4	735.89	-3.11	735.47	0.41	35.9	16.5	2547	4378	0.05
180	691	754.0	736.49	3.02	736.39	0.10	36.0	16.5	2550	4382	0.01
200	691	754.0	735.13	-6.81	734.50	0.63	34.1	17.9	2494	4477	0.07
220	692	753.8	734.53	-3.02	734.19	0.34	33.0	18.2	2461	4485	0.04
240	692	753.3	734.23	-1.46	733.74	0.49	32.2	18.1	2437	4445	0.06
260	692	752.9	733.59	-3.22	733.53	0.06	31.6	18.3	2418	4448	0.01
280	692	751.4	733.08	-2.55	733.23	-0.15	31.1	17.3	2402	4328	-0.02
300	693	746.2	732.83	-1.25	732.61	0.22	30.3	12.3	2380	3748	0.04
320	693	743.0	732.48	-1.75	732.59	-0.11	29.5	9.6	2354	3416	-0.02
340	692	741.7	731.61	-4.36	731.21	0.40	29.6	9.1	2358	3372	0.09
360	691	742.2	731.39	-1.07	730.98	0.42	30.4	9.8	2382	3469	0.08
380	691	742.5	730.90	-2.49	730.32	0.57	30.4	10.6	2382	3559	0.11
400	690	742.8	730.32	-2.91	729.85	0.47	30.3	11.5	2380	3651	0.08
420	690	742.4	729.76	-2.79	729.32	0.44	29.8	11.7	2363	3659	0.08
440	690	742.3	729.33	-2.13	728.87	0.46	29.3	11.9	2350	3676	0.08
460	683	742.2	728.77	-2.84	727.94	0.82	35.8	12.4	2543	3924	0.12
480	683	742.1	729.14	1.87	728.59	0.55	36.1	12.0	2554	3883	0.08
500	683	741.7	728.29	-4.27	727.27	1.02	35.3	12.4	2529	3909	0.15
520	683	740.7	727.10	-5.95	726.01	1.09	34.1	12.6	2493	3886	0.17
540	683	740.1	726.44	-3.29	725.56	0.88	33.4	12.6	2473	3873	0.14
560	683	738.6	726.08	-1.79	725.42	0.66	33.1	11.5	2462	3743	0.11
580	683	736.8	725.60	-2.40	725.15	0.45	32.6	10.2	2443	3581	0.08
600	683	735.7	724.90	-3.53	724.73	0.16	31.9	9.8	2427	3509	0.03

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Lower Limit - December 2005 Monitoring Event											
		1/3/06	Baseline		12/21/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	749.4	736.85	-2.30	736.22	0.63	36.8	11.6	2575	3862	0.10
140	690	752.4	736.51	-1.70	735.97	0.54	36.5	14.9	2565	4217	0.07
160	690	753.4	735.89	-3.11	735.25	0.64	35.9	16.5	2547	4378	0.08
180	691	754.0	736.49	3.02	736.16	0.33	36.0	16.5	2550	4382	0.04
200	691	754.0	735.13	-6.81	734.31	0.83	34.1	17.9	2494	4477	0.10
220	692	753.8	734.53	-3.02	733.94	0.58	33.0	18.2	2461	4485	0.07
240	692	753.3	734.23	-1.46	733.58	0.65	32.2	18.1	2437	4445	0.08
260	692	752.9	733.59	-3.22	733.29	0.30	31.6	18.3	2418	4448	0.04
280	692	751.4	733.08	-2.55	733.02	0.06	31.1	17.3	2402	4328	0.01
300	693	746.2	732.83	-1.25	732.41	0.42	30.3	12.3	2380	3748	0.07
320	693	743.0	732.48	-1.75	732.33	0.15	29.5	9.6	2354	3416	0.03
340	692	741.7	731.61	-4.36	730.99	0.62	29.6	9.1	2358	3372	0.13
360	691	742.2	731.39	-1.07	730.75	0.64	30.4	9.8	2382	3469	0.13
380	691	742.5	730.90	-2.49	730.11	0.78	30.4	10.6	2382	3559	0.15
400	690	742.8	730.32	-2.91	729.68	0.63	30.3	11.5	2380	3651	0.11
420	690	742.4	729.76	-2.79	729.10	0.66	29.8	11.7	2363	3659	0.12
440	690	742.3	729.33	-2.13	728.65	0.68	29.3	11.9	2350	3676	0.12
460	683	742.2	728.77	-2.84	727.71	1.05	35.8	12.4	2543	3924	0.16
480	683	742.1	729.14	1.87	728.44	0.70	36.1	12.0	2554	3883	0.11
500	683	741.7	728.29	-4.27	727.01	1.27	35.3	12.4	2529	3909	0.19
520	683	740.7	727.10	-5.95	725.91	1.19	34.1	12.6	2493	3886	0.18
540	683	740.1	726.44	-3.29	725.33	1.11	33.4	12.6	2473	3873	0.17
560	683	738.6	726.08	-1.79	725.25	0.83	33.1	11.5	2462	3743	0.14
580	683	736.8	725.60	-2.40	724.92	0.69	32.6	10.2	2448	3581	0.13
600	683	735.7	724.90	-3.53	724.45	0.44	31.9	9.8	2427	3509	0.09

Estimation of Modified Compression Index											
North-South Profiler											
March 2006 Monitoring Event											
		3/30/06	Baseline		4/4/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	749.2	736.85	-2.30	735.61	1.24	36.8	11.3	2575	3831	0.20
140	690	753.5	736.51	-1.70	735.09	1.42	36.5	16.0	2565	4339	0.17
160	690	761.5	735.89	-3.11	734.66	1.23	35.9	24.6	2547	5273	0.11
180	691	766.7	736.49	3.02	734.84	1.65	36.0	29.2	2550	5793	0.13
200	691	767.9	735.13	-6.81	733.72	1.41	34.1	31.8	2494	6021	0.11
220	692	763.0	734.53	-3.02	733.31	1.21	33.0	27.4	2461	5507	0.11
240	692	756.2	734.23	-1.46	732.89	1.34	32.2	20.9	2437	4759	0.14
260	692	755.4	733.59	-3.22	732.73	0.86	31.6	20.8	2418	4730	0.09
280	692	751.4	733.08	-2.55	732.14	0.95	31.1	17.3	2402	4321	0.12
300	693	746.1	732.83	-1.25	731.93	0.90	30.3	12.3	2380	3743	0.15
320	693	743.0	732.48	-1.75	731.77	0.71	29.5	9.6	2354	3416	0.15
340	692	741.7	731.61	-4.36	730.38	1.23	29.6	9.1	2358	3372	0.27
360	691	742.2	731.39	-1.07	730.23	1.16	30.4	9.8	2382	3471	0.23
380	691	742.4	730.90	-2.49	729.54	1.36	30.4	10.5	2382	3551	0.26
400	690	745.3	730.32	-2.91	729.00	1.32	30.3	14.0	2380	3931	0.20
420	690	745.7	729.76	-2.79	728.59	1.17	29.8	15.0	2363	4024	0.17
440	690	745.3	729.33	-2.13	727.82	1.51	29.3	15.0	2350	4010	0.22
460	683	744.6	728.77	-2.84	727.35	1.41	35.8	14.8	2543	4184	0.18
480	683	743.7	729.14	1.87	728.11	1.03	36.1	13.6	2554	4060	0.14
500	683	742.3	728.29	-4.27	726.46	1.82	35.3	13.0	2529	3970	0.26
520	683	741.2	727.10	-5.95	725.34	1.75	34.1	13.1	2493	3942	0.26
540	683	740.1	726.44	-3.29	724.77	1.67	33.4	12.6	2473	3873	0.26
560	683	738.6	726.08	-1.79	724.32	1.76	33.1	11.5	2462	3743	0.29
580	683	736.8	725.60	-2.40	724.30	1.30	32.6	10.2	2448	3581	0.24
600	683	735.7	724.90	-3.53	723.24	1.66	31.9	9.8	2427	3509	0.32

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - March 2006 Monitoring Event											
		3/30/06	Baseline		4/4/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	749.2	736.85	-2.30	735.74	1.11	36.8	11.3	2575	3831	0.17
140	690	753.5	736.51	-1.70	735.22	1.29	36.5	16.0	2565	4339	0.15
160	690	761.5	735.89	-3.11	734.77	1.12	35.9	24.6	2547	5273	0.10
180	691	766.7	736.49	3.02	734.96	1.53	36.0	29.2	2550	5793	0.12
200	691	767.9	735.13	-6.81	733.82	1.31	34.1	31.8	2494	6021	0.10
220	692	763.0	734.53	-3.02	733.44	1.09	33.0	27.4	2461	5507	0.09
240	692	756.2	734.23	-1.46	732.97	1.26	32.2	20.9	2437	4759	0.13
260	692	755.4	733.59	-3.22	732.85	0.74	31.6	20.8	2418	4730	0.08
280	692	751.4	733.08	-2.55	732.24	0.84	31.1	17.3	2402	4321	0.11
300	693	746.1	732.83	-1.25	732.03	0.81	30.3	12.3	2380	3743	0.14
320	693	743.0	732.48	-1.75	731.90	0.58	29.5	9.6	2354	3416	0.12
340	692	741.7	731.61	-4.36	730.49	1.12	29.6	9.1	2358	3372	0.24
360	691	742.2	731.39	-1.07	730.35	1.05	30.4	9.8	2382	3471	0.21
380	691	742.4	730.90	-2.49	729.65	1.25	30.4	10.5	2382	3551	0.24
400	690	745.3	730.32	-2.91	729.08	1.23	30.3	14.0	2380	3931	0.19
420	690	745.7	729.76	-2.79	728.70	1.06	29.8	15.0	2363	4024	0.15
440	690	745.3	729.33	-2.13	727.93	1.40	29.3	15.0	2350	4010	0.21
460	683	744.6	728.77	-2.84	727.47	1.30	35.8	14.8	2543	4184	0.17
480	683	743.7	729.14	1.87	728.18	0.96	36.1	13.6	2554	4060	0.13
500	683	742.3	728.29	-4.27	726.59	1.70	35.3	13.0	2529	3970	0.25
520	683	741.2	727.10	-5.95	725.40	1.70	34.1	13.1	2493	3942	0.25
540	683	740.1	726.44	-3.29	724.89	1.55	33.4	12.6	2473	3873	0.24
560	683	738.6	726.08	-1.79	724.40	1.68	33.1	11.5	2462	3743	0.28
580	683	736.8	725.60	-2.40	724.42	1.19	32.6	10.2	2448	3581	0.22
600	683	735.7	724.90	-3.53	723.38	1.52	31.9	9.8	2427	3509	0.30

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Lower Limit - March 2006 Monitoring Event											
		3/30/06	Baseline		4/4/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	749.2	736.85	-2.30	735.48	1.37	36.8	11.3	2575	3831	0.22
140	690	753.5	736.51	-1.70	734.96	1.55	36.5	16.0	2565	4339	0.19
160	690	761.5	735.89	-3.11	734.54	1.34	35.9	24.6	2547	5273	0.12
180	691	766.7	736.49	3.02	734.73	1.76	36.0	29.2	2550	5793	0.14
200	691	767.9	735.13	-6.81	733.62	1.51	34.1	31.8	2494	6021	0.12
220	692	763.0	734.53	-3.02	733.19	1.34	33.0	27.4	2461	5507	0.12
240	692	756.2	734.23	-1.46	732.81	1.42	32.2	20.9	2437	4759	0.15
260	692	755.4	733.59	-3.22	732.61	0.98	31.6	20.8	2418	4730	0.11
280	692	751.4	733.08	-2.55	732.03	1.05	31.1	17.3	2402	4321	0.13
300	693	746.1	732.83	-1.25	731.83	1.00	30.3	12.3	2380	3743	0.17
320	693	743.0	732.48	-1.75	731.64	0.84	29.5	9.6	2354	3416	0.18
340	692	741.7	731.61	-4.36	730.26	1.35	29.6	9.1	2358	3372	0.29
360	691	742.2	731.39	-1.07	730.12	1.27	30.4	9.8	2382	3471	0.26
380	691	742.4	730.90	-2.49	729.44	1.46	30.4	10.5	2382	3551	0.28
400	690	745.3	730.32	-2.91	728.92	1.40	30.3	14.0	2380	3931	0.21
420	690	745.7	729.76	-2.79	728.48	1.28	29.8	15.0	2363	4024	0.19
440	690	745.3	729.33	-2.13	727.71	1.62	29.3	15.0	2350	4010	0.24
460	683	744.6	728.77	-2.84	727.24	1.52	35.8	14.8	2543	4184	0.20
480	683	743.7	729.14	1.87	728.03	1.11	36.1	13.6	2554	4060	0.15
500	683	742.3	728.29	-4.27	726.34	1.95	35.3	13.0	2529	3970	0.28
520	683	741.2	727.10	-5.95	725.29	1.80	34.1	13.1	2493	3942	0.27
540	683	740.1	726.44	-3.29	724.66	1.78	33.4	12.6	2473	3873	0.27
560	683	738.6	726.08	-1.79	724.23	1.85	33.1	11.5	2462	3743	0.31
580	683	736.8	725.60	-2.40	724.18	1.42	32.6	10.2	2448	3581	0.26
600	683	735.7	724.90	-3.53	723.10	1.80	31.9	9.8	2427	3509	0.35

Estimation of Modified Compression Index											
North-South Profiler											
June 2006 Monitoring Event											
		5/29/06	Baseline		6/29/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	750.1	736.85	-2.30	735.54	1.31	36.8	12.3	2575	3939	0.19
140	690	756.3	736.51	-1.70	735.17	1.34	36.5	18.8	2565	4649	0.14
160	690	762.7	735.89	-3.11	735.14	0.74	35.9	25.8	2547	5407	0.06
180	691	766.6	736.49	3.02	735.33	1.16	36.0	29.1	2550	5775	0.09
200	691	767.2	735.13	-6.81	733.89	1.24	34.1	31.1	2494	5947	0.10
220	692	763.0	734.53	-3.02	733.55	0.97	33.0	27.4	2461	5505	0.08
240	692	755.9	734.23	-1.46	733.30	0.93	32.2	20.6	2437	4725	0.10
260	692	755.7	733.59	-3.22	733.08	0.51	31.6	21.1	2418	4758	0.06
280	692	756.0	733.08	-2.55	733.02	0.06	31.1	21.9	2402	4830	0.01
300	693	756.0	732.83	-1.25	732.58	0.25	30.3	22.2	2380	4844	0.03
320	693	755.7	732.48	-1.75	732.48	0.00	29.5	22.2	2354	4822	0.00
340	692	756.0	731.61	-4.36	731.02	0.59	29.6	23.4	2358	4955	0.06
360	691	756.0	731.39	-1.07	730.62	0.77	30.4	23.6	2382	5002	0.08
380	691	755.8	730.90	-2.49	729.57	1.33	30.4	23.9	2382	5033	0.13
400	690	751.3	730.32	-2.91	728.46	1.85	30.3	20.0	2380	4601	0.21
420	690	746.5	729.76	-2.79	728.15	1.61	29.8	15.8	2363	4111	0.23
440	690	745.2	729.33	-2.13	727.78	1.55	29.3	14.9	2350	4000	0.23
460	683	744.1	728.77	-2.84	727.58	1.18	35.8	14.3	2543	4129	0.16
480	683	742.3	729.14	1.87	727.59	1.55	36.1	12.1	2554	3901	0.23
500	683	741.3	728.29	-4.27	726.17	2.12	35.3	12.0	2529	3858	0.33
520	683	740.8	727.10	-5.95	725.55	1.55	34.1	12.7	2493	3901	0.23
540	683	740.1	726.44	-3.29	724.43	2.02	33.4	12.6	2473	3875	0.31
560	683	739.0	726.08	-1.79	723.89	2.19	33.1	11.9	2462	3780	0.36
580	683	737.7	725.60	-2.40	723.51	2.09	32.6	11.0	2448	3674	0.36
600	683	736.8	724.90	-3.53	722.98	1.92	31.9	10.9	2427	3632	0.34

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - June 2006 Monitoring Event											
		6/29/06	Baseline		6/29/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	750.1	736.85	-2.30	735.67	1.18	36.8	12.3	2575	3939	0.17
140	690	756.3	736.51	-1.70	735.30	1.21	36.5	18.8	2565	4649	0.13
160	690	762.7	735.89	-3.11	735.25	0.63	35.9	25.8	2547	5407	0.05
180	691	766.6	736.49	3.02	735.45	1.04	36.0	29.1	2550	5775	0.08
200	691	767.2	735.13	-6.81	733.99	1.14	34.1	31.1	2494	5947	0.09
220	692	763.0	734.53	-3.02	733.68	0.85	33.0	27.4	2461	5505	0.07
240	692	755.9	734.23	-1.46	733.39	0.85	32.2	20.6	2437	4725	0.09
260	692	755.7	733.59	-3.22	733.20	0.39	31.6	21.1	2418	4758	0.04
280	692	756.0	733.08	-2.55	733.12	-0.04	31.1	21.9	2402	4830	0.00
300	693	756.0	732.83	-1.25	732.67	0.16	30.3	22.2	2380	4844	0.02
320	693	755.7	732.48	-1.75	732.60	-0.12	29.5	22.2	2354	4822	-0.01
340	692	756.0	731.61	-4.36	731.13	0.48	29.6	23.4	2358	4955	0.05
360	691	756.0	731.39	-1.07	730.73	0.66	30.4	23.6	2382	5002	0.07
380	691	755.8	730.90	-2.49	729.67	1.22	30.4	23.9	2382	5033	0.12
400	690	751.3	730.32	-2.91	728.55	1.77	30.3	20.0	2380	4601	0.20
420	690	746.5	729.76	-2.79	728.26	1.50	29.8	15.8	2363	4111	0.21
440	690	745.2	729.33	-2.13	727.89	1.44	29.3	14.9	2350	4000	0.21
460	683	744.1	728.77	-2.84	727.70	1.07	35.8	14.3	2543	4129	0.14
480	683	742.3	729.14	1.87	727.67	1.47	36.1	12.1	2554	3901	0.22
500	683	741.3	728.29	-4.27	726.30	1.99	35.3	12.0	2529	3858	0.31
520	683	740.8	727.10	-5.95	725.60	1.50	34.1	12.7	2493	3901	0.23
540	683	740.1	726.44	-3.29	724.54	1.90	33.4	12.6	2473	3875	0.29
560	683	739.0	726.08	-1.79	723.97	2.11	33.1	11.9	2462	3780	0.34
580	683	737.7	725.60	-2.40	723.63	1.98	32.6	11.0	2448	3674	0.34
600	683	736.8	724.90	-3.53	723.12	1.78	31.9	10.9	2427	3632	0.32

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Lower Limit - June 2006 Monitoring Event											
		3/29/06	Baseline		6/29/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	750.1	736.85	-2.30	735.41	1.44	36.8	12.3	2575	3939	0.21
140	690	756.3	736.51	-1.70	735.04	1.46	36.5	18.8	2565	4649	0.16
160	690	762.7	735.89	-3.11	735.03	0.86	35.9	25.8	2547	5407	0.07
180	691	766.6	736.49	3.02	735.21	1.27	36.0	29.1	2550	5775	0.10
200	691	767.2	735.13	-6.81	733.79	1.34	34.1	31.1	2494	5947	0.10
220	692	763.0	734.53	-3.02	733.43	1.09	33.0	27.4	2461	5505	0.09
240	692	755.9	734.23	-1.46	733.22	1.01	32.2	20.6	2437	4725	0.11
260	692	755.7	733.59	-3.22	732.95	0.64	31.6	21.1	2418	4758	0.07
280	692	756.0	733.08	-2.55	732.92	0.17	31.1	21.9	2402	4830	0.02
300	693	756.0	732.83	-1.25	732.48	0.35	30.3	22.2	2380	4844	0.04
320	693	755.7	732.48	-1.75	732.35	0.13	29.5	22.2	2354	4822	0.01
340	692	756.0	731.61	-4.36	730.90	0.71	29.6	23.4	2358	4955	0.07
360	691	756.0	731.39	-1.07	730.51	0.89	30.4	23.6	2382	5002	0.09
380	691	755.8	730.90	-2.49	729.46	1.44	30.4	23.9	2382	5033	0.15
400	690	751.3	730.32	-2.91	728.38	1.93	30.3	20.0	2380	4601	0.22
420	690	746.5	729.76	-2.79	728.04	1.72	29.8	15.8	2363	4111	0.24
440	690	745.2	729.33	-2.13	727.67	1.66	29.3	14.9	2350	4000	0.25
460	683	744.1	728.77	-2.84	727.47	1.30	35.8	14.3	2543	4129	0.17
480	683	742.3	729.14	1.87	727.52	1.62	36.1	12.1	2554	3901	0.24
500	683	741.3	728.29	-4.27	726.04	2.24	35.3	12.0	2529	3858	0.35
520	683	740.8	727.10	-5.95	725.50	1.60	34.1	12.7	2493	3901	0.24
540	683	740.1	726.44	-3.29	724.31	2.13	33.4	12.6	2473	3875	0.33
560	683	739.0	726.08	-1.79	723.80	2.28	33.1	11.9	2462	3780	0.37
580	683	737.7	725.60	-2.40	723.39	2.21	32.6	11.0	2448	3674	0.38
600	683	736.8	724.90	-3.53	722.84	2.06	31.9	10.9	2427	3632	0.37

Estimation of Modified Compression Index											
North-South Profiler											
September 2006 Monitoring Event											
		9/29/06	Baseline		9/26/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	750.2	736.85	-2.30	736.28	0.57	36.8	12.3	2575	3942	0.08
140	690	755.3	736.51	-1.70	736.01	0.50	36.5	17.8	2565	4539	0.06
160	690	762.1	735.89	-3.11	735.32	0.57	35.9	25.2	2547	5346	0.05
180	691	766.4	736.49	3.02	735.85	0.00	36.0	28.9	2550	5758	0.00
200	691	767.2	735.13	-6.81	734.38	0.00	34.1	31.1	2494	5942	0.00
220	692	763.0	734.53	-3.02	734.02	0.00	33.0	27.4	2461	5506	0.00
240	692	756.7	734.23	-1.46	733.16	1.07	32.2	21.4	2437	4815	0.11
260	692	755.8	733.59	-3.22	732.78	0.81	31.6	21.2	2418	4773	0.09
280	692	755.7	733.08	-2.55	732.58	0.50	31.1	21.6	2402	4797	0.05
300	693	756.0	732.83	-1.25	731.82	1.01	30.3	22.2	2380	4841	0.11
320	693	756.0	732.48	-1.75	731.73	0.75	29.5	22.5	2354	4854	0.08
340	692	756.9	731.61	-4.36	730.64	0.97	29.6	24.3	2358	5052	0.10
360	691	756.5	731.39	-1.07	730.34	1.05	30.4	24.1	2382	5054	0.11
380	691	755.8	730.90	-2.49	729.78	1.12	30.4	23.9	2382	5035	0.11
400	690	753.6	730.32	-2.91	729.50	0.82	30.3	22.2	2380	4849	0.09
420	690	751.1	729.76	-2.79	728.79	0.97	29.8	20.3	2363	4621	0.11
440	690	748.5	729.33	-2.13	728.09	1.25	29.3	18.2	2350	4370	0.16
460	683	746.4	728.77	-2.84	727.40	0.00	35.8	16.6	2543	4384	0.00
480	683	744.6	729.14	1.87	727.96	0.00	36.1	14.5	2554	4163	0.00
500	683	742.2	728.29	-4.27	726.21	0.00	35.3	12.9	2529	3965	0.00
520	683	741.7	727.10	-5.95	725.40	1.70	34.1	13.6	2493	4004	0.24
540	683	740.0	726.44	-3.29	725.20	1.24	33.4	12.5	2473	3866	0.19
560	683	739.0	726.08	-1.79	724.40	1.68	33.1	11.9	2462	3780	0.27
580	683	737.7	725.60	-2.40	724.30	1.30	32.6	11.0	2448	3674	0.23
600	683	736.8	724.90	-3.53	723.28	1.62	31.9	10.9	2427	3632	0.29

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - September 2006 Monitoring Event											
		9/29/06	Baseline		9/26/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	750.2	736.85	-2.30	736.41	0.44	36.8	12.3	2575	3942	0.07
140	690	755.3	736.51	-1.70	736.13	0.38	36.5	17.8	2565	4539	0.04
160	690	762.1	735.89	-3.11	735.43	0.46	35.9	25.2	2547	5346	0.04
180	691	766.4	736.49	3.02	735.97	0.52	36.0	28.9	2550	5758	0.04
200	691	767.2	735.13	-6.81	734.48	0.65	34.1	31.1	2494	5942	0.05
220	692	763.0	734.53	-3.02	734.15	0.38	33.0	27.4	2461	5506	0.03
240	692	756.7	734.23	-1.46	733.25	0.99	32.2	21.4	2437	4815	0.10
260	692	755.8	733.59	-3.22	732.90	0.69	31.6	21.2	2418	4773	0.07
280	692	755.7	733.08	-2.55	732.69	0.40	31.1	21.6	2402	4797	0.04
300	693	756.0	732.83	-1.25	731.92	0.92	30.3	22.2	2380	4841	0.10
320	693	756.0	732.48	-1.75	731.85	0.63	29.5	22.5	2354	4854	0.07
340	692	756.9	731.61	-4.36	730.75	0.85	29.6	24.3	2358	5052	0.09
360	691	756.5	731.39	-1.07	730.45	0.94	30.4	24.1	2382	5054	0.09
380	691	755.8	730.90	-2.49	729.88	1.01	30.4	23.9	2382	5035	0.10
400	690	753.6	730.32	-2.91	729.58	0.74	30.3	22.2	2380	4849	0.08
420	690	751.1	729.76	-2.79	728.90	0.86	29.8	20.3	2363	4621	0.10
440	690	748.5	729.33	-2.13	728.20	1.14	29.3	18.2	2350	4370	0.14
460	683	746.4	728.77	-2.84	727.51	1.26	35.8	16.6	2543	4384	0.15
480	683	744.6	729.14	1.87	728.04	1.10	36.1	14.5	2554	4163	0.14
500	683	742.2	728.29	-4.27	726.33	1.95	35.3	12.9	2529	3965	0.28
520	683	741.7	727.10	-5.95	725.45	1.65	34.1	13.6	2493	4004	0.24
540	683	740.0	726.44	-3.29	725.31	1.13	33.4	12.5	2473	3866	0.17
560	683	739.0	726.08	-1.79	724.49	1.60	33.1	11.9	2462	3780	0.26
580	683	737.7	725.60	-2.40	724.41	1.19	32.6	11.0	2448	3674	0.21
600	683	736.8	724.90	-3.53	723.42	1.48	31.9	10.9	2427	3632	0.27

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Lower Limit - September 2006 Monitoring Event											
		9/29/06	Baseline		9/26/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	750.2	736.85	-2.30	736.15	0.70	36.8	12.3	2575	3942	0.10
140	690	755.3	736.51	-1.70	735.88	0.63	36.5	17.8	2565	4539	0.07
160	690	762.1	735.89	-3.11	735.20	0.68	35.9	25.2	2547	5346	0.06
180	691	766.4	736.49	3.02	735.73	0.76	36.0	28.9	2550	5758	0.06
200	691	767.2	735.13	-6.81	734.28	0.85	34.1	31.1	2494	5942	0.07
220	692	763.0	734.53	-3.02	733.90	0.63	33.0	27.4	2461	5506	0.05
240	692	756.7	734.23	-1.46	733.08	1.15	32.2	21.4	2437	4815	0.12
260	692	755.8	733.59	-3.22	732.66	0.93	31.6	21.2	2418	4773	0.10
280	692	755.7	733.08	-2.55	732.48	0.60	31.1	21.6	2402	4797	0.06
300	693	756.0	732.83	-1.25	731.72	1.11	30.3	22.2	2380	4841	0.12
320	693	756.0	732.48	-1.75	731.60	0.88	29.5	22.5	2354	4854	0.10
340	692	756.9	731.61	-4.36	730.53	1.08	29.6	24.3	2358	5052	0.11
360	691	756.5	731.39	-1.07	730.23	1.17	30.4	24.1	2382	5054	0.12
380	691	755.8	730.90	-2.49	729.67	1.23	30.4	23.9	2382	5035	0.12
400	690	753.6	730.32	-2.91	729.42	0.90	30.3	22.2	2380	4849	0.10
420	690	751.1	729.76	-2.79	728.68	1.08	29.8	20.3	2363	4621	0.12
440	690	748.5	729.33	-2.13	727.98	1.36	29.3	18.2	2350	4370	0.17
460	683	746.4	728.77	-2.84	727.28	1.48	35.8	16.6	2543	4384	0.18
480	683	744.6	729.14	1.87	727.88	1.26	36.1	14.5	2554	4163	0.16
500	683	742.2	728.29	-4.27	726.08	2.21	35.3	12.9	2529	3965	0.32
520	683	741.7	727.10	-5.95	725.34	1.75	34.1	13.6	2493	4004	0.25
540	683	740.0	726.44	-3.29	725.08	1.36	33.4	12.5	2473	3866	0.21
560	683	739.0	726.08	-1.79	724.32	1.77	33.1	11.9	2462	3780	0.29
580	683	737.7	725.60	-2.40	724.18	1.42	32.6	11.0	2448	3674	0.25
600	683	736.8	724.90	-3.53	723.14	1.76	31.9	10.9	2427	3632	0.32

Estimation of Modified Compression Index											
North-South Profiler											
December 2006 Monitoring Event											
		1/2/07	Baseline		1/11/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	751.5	736.85	-2.30	736.75	0.10	36.8	13.7	2575	4095	0.01
140	690	755.6	736.51	-1.70	735.81	0.70	36.5	18.1	2565	4575	0.08
160	690	762.1	735.89	-3.11	735.17	0.71	35.9	25.2	2547	5343	0.06
180	691	767.0	736.49	3.02	735.88	0.61	36.0	29.5	2550	5827	0.05
200	691	766.9	735.13	-6.81	734.46	0.67	34.1	30.8	2494	5914	0.05
220	692	762.6	734.53	-3.02	733.76	0.77	33.0	27.1	2461	5465	0.07
240	692	757.5	734.23	-1.46	733.55	0.68	32.2	22.3	2437	4907	0.07
260	692	755.8	733.59	-3.22	733.31	0.28	31.6	21.2	2418	4770	0.03
280	692	755.3	733.08	-2.55	732.51	0.57	31.1	21.2	2402	4757	0.06
300	693	755.4	732.83	-1.25	732.11	0.72	30.3	21.5	2380	4770	0.08
320	693	755.3	732.48	-1.75	732.06	0.42	29.5	21.8	2354	4776	0.05
340	692	755.8	731.61	-4.36	731.57	0.04	29.6	23.2	2358	4929	0.00
360	691	756.4	731.39	-1.07	731.15	0.24	30.4	24.0	2382	5046	0.02
380	691	756.1	730.90	-2.49	730.58	0.32	30.4	24.2	2382	5070	0.03
400	690	755.4	730.32	-2.91	729.79	0.53	30.3	24.1	2380	5053	0.05
420	690	752.3	729.76	-2.79	729.23	0.53	29.8	21.6	2363	4758	0.06
440	690	749.2	729.33	-2.13	728.18	1.15	29.3	18.8	2350	4441	0.14
460	683	747.0	728.77	-2.84	727.64	1.13	35.8	17.2	2543	4451	0.13
480	683	744.8	729.14	1.87	728.36	0.78	36.1	14.6	2554	4177	0.10
500	683	742.9	728.29	-4.27	727.65	0.63	35.3	13.6	2529	4036	0.09
520	683	740.5	727.10	-5.95	726.08	1.02	34.1	12.4	2493	3870	0.16
540	683	739.7	726.44	-3.29	725.63	0.81	33.4	12.3	2473	3835	0.13
560	683	739.0	726.08	-1.79	725.38	0.70	33.1	11.9	2462	3780	0.11
580	683	738.3	725.60	-2.40	724.44	1.16	32.6	11.7	2448	3743	0.19
600	683	737.6	724.90	-3.53	724.00	0.90	31.9	11.7	2427	3728	0.15

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - December 2006 Monitoring Event											
		1/2/07	Baseline		1/11/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	751.5	736.85	-2.30	736.88	-0.03	36.8	13.7	2575	4095	0.00
140	690	755.6	736.51	-1.70	735.94	0.57	36.5	18.1	2565	4575	0.06
160	690	762.1	735.89	-3.11	735.28	0.60	35.9	25.2	2547	5343	0.05
180	691	767.0	736.49	3.02	736.00	0.49	36.0	29.5	2550	5827	0.04
200	691	766.9	735.13	-6.81	734.56	0.57	34.1	30.8	2494	5914	0.04
220	692	762.6	734.53	-3.02	733.88	0.65	33.0	27.1	2461	5465	0.06
240	692	757.5	734.23	-1.46	733.63	0.60	32.2	22.3	2437	4907	0.06
260	692	755.8	733.59	-3.22	733.43	0.16	31.6	21.2	2418	4770	0.02
280	692	755.3	733.08	-2.55	732.62	0.46	31.1	21.2	2402	4757	0.05
300	693	755.4	732.83	-1.25	732.21	0.62	30.3	21.5	2380	4770	0.07
320	693	755.3	732.48	-1.75	732.19	0.29	29.5	21.8	2354	4776	0.03
340	692	755.8	731.61	-4.36	731.68	-0.07	29.6	23.2	2358	4929	-0.01
360	691	756.4	731.39	-1.07	731.27	0.13	30.4	24.0	2382	5046	0.01
380	691	756.1	730.90	-2.49	730.68	0.22	30.4	24.2	2382	5070	0.02
400	690	755.4	730.32	-2.91	729.87	0.44	30.3	24.1	2380	5053	0.04
420	690	752.3	729.76	-2.79	729.34	0.42	29.8	21.6	2363	4758	0.05
440	690	749.2	729.33	-2.13	728.29	1.04	29.3	18.8	2350	4441	0.13
460	683	747.0	728.77	-2.84	727.75	1.01	35.8	17.2	2543	4451	0.12
480	683	744.8	729.14	1.87	728.44	0.70	36.1	14.6	2564	4177	0.09
500	683	742.9	728.29	-4.27	727.78	0.51	35.3	13.6	2529	4036	0.07
520	683	740.5	727.10	-5.95	726.13	0.97	34.1	12.4	2493	3870	0.15
540	683	739.7	726.44	-3.29	725.74	0.70	33.4	12.3	2473	3835	0.11
560	683	739.0	726.08	-1.79	725.46	0.62	33.1	11.9	2462	3780	0.10
580	683	738.3	725.60	-2.40	724.56	1.04	32.6	11.7	2448	3743	0.17
600	683	737.6	724.90	-3.53	724.14	0.76	31.9	11.7	2427	3728	0.13

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Lower Limit - December 2006 Monitoring Event											
		1/2/07	Baseline		1/11/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	751.5	736.85	-2.30	736.62	0.23	36.8	13.7	2575	4095	0.03
140	690	755.6	736.51	-1.70	735.68	0.82	36.5	18.1	2565	4575	0.09
160	690	762.1	735.89	-3.11	735.06	0.83	35.9	25.2	2547	5343	0.07
180	691	767.0	736.49	3.02	735.77	0.72	36.0	29.5	2550	5827	0.06
200	691	766.9	735.13	-6.81	734.37	0.77	34.1	30.8	2494	5914	0.06
220	692	762.6	734.53	-3.02	733.63	0.89	33.0	27.1	2461	5465	0.08
240	692	757.5	734.23	-1.46	733.47	0.76	32.2	22.3	2437	4907	0.08
260	692	755.8	733.59	-3.22	733.19	0.40	31.6	21.2	2418	4770	0.04
280	692	755.3	733.08	-2.55	732.41	0.67	31.1	21.2	2402	4757	0.07
300	693	755.4	732.83	-1.25	732.01	0.82	30.3	21.5	2380	4770	0.09
320	693	755.3	732.48	-1.75	731.93	0.55	29.5	21.8	2354	4776	0.06
340	692	755.8	731.61	-4.36	731.45	0.16	29.6	23.2	2358	4929	0.02
360	691	756.4	731.39	-1.07	731.04	0.35	30.4	24.0	2382	5046	0.04
380	691	756.1	730.90	-2.49	730.47	0.43	30.4	24.2	2382	5070	0.04
400	690	755.4	730.32	-2.91	729.71	0.61	30.3	24.1	2380	5053	0.06
420	690	752.3	729.76	-2.79	729.12	0.64	29.8	21.6	2363	4758	0.07
440	690	749.2	729.33	-2.13	728.07	1.26	29.3	18.8	2350	4441	0.16
460	683	747.0	728.77	-2.84	727.53	1.24	35.8	17.2	2543	4451	0.14
480	683	744.8	729.14	1.87	728.29	0.85	36.1	14.6	2554	4177	0.11
500	683	742.9	728.29	-4.27	727.53	0.76	35.3	13.6	2529	4036	0.11
520	683	740.5	727.10	-5.95	726.03	1.07	34.1	12.4	2493	3870	0.16
540	683	739.7	726.44	-3.29	725.51	0.93	33.4	12.3	2473	3835	0.15
560	683	739.0	726.08	-1.79	725.29	0.79	33.1	11.9	2462	3780	0.13
580	683	738.3	725.60	-2.40	724.33	1.28	32.6	11.7	2448	3743	0.21
600	683	737.6	724.90	-3.53	723.86	1.04	31.9	11.7	2427	3728	0.17

Estimation of Modified Compression Index											
North-South Profiler											
March 2007 Monitoring Event											
		4/2/07	Baseline		3/29/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	751.5	736.85	-2.30	736.34	0.51	36.8	13.7	2575	4095	0.07
140	690	755.6	736.51	-1.70	736.07	0.44	36.5	18.1	2565	4575	0.05
160	690	762.1	735.89	-3.11	735.43	0.45	35.9	25.2	2547	5343	0.04
180	691	767.0	736.49	3.02	735.86	0.63	36.0	29.5	2550	5827	0.05
200	691	767.1	735.13	-6.81	734.44	0.69	34.1	30.9	2494	5927	0.05
220	692	763.3	734.53	-3.02	734.04	0.49	33.0	27.7	2461	5541	0.04
240	692	758.3	734.23	-1.46	733.59	0.64	32.2	23.1	2437	4998	0.06
260	692	755.8	733.59	-3.22	733.04	0.55	31.6	21.2	2418	4769	0.06
280	692	755.4	733.08	-2.55	732.60	0.48	31.1	21.3	2402	4771	0.05
300	693	755.4	732.83	-1.25	732.06	0.77	30.3	21.5	2380	4769	0.08
320	693	755.3	732.48	-1.75	731.86	0.62	29.5	21.8	2354	4777	0.07
340	692	755.8	731.61	-4.36	731.09	0.52	29.6	23.2	2358	4929	0.05
360	691	756.4	731.39	-1.07	730.70	0.70	30.4	24.0	2382	5046	0.07
380	691	756.1	730.90	-2.49	730.16	0.74	30.4	24.2	2382	5070	0.07
400	690	755.4	730.32	-2.91	729.62	0.70	30.3	24.1	2380	5053	0.07
420	690	752.3	729.76	-2.79	729.10	0.66	29.8	21.6	2363	4758	0.07
440	690	749.2	729.33	-2.13	728.32	1.02	29.3	18.8	2350	4441	0.13
460	683	747.6	728.77	-2.84	727.84	0.92	35.8	17.9	2543	4526	0.10
480	683	747.7	729.14	1.87	728.34	0.80	36.1	17.6	2554	4505	0.09
500	683	744.4	728.29	-4.27	726.95	1.34	35.3	15.1	2529	4203	0.17
520	683	743.3	727.10	-5.95	725.84	1.26	34.1	15.2	2493	4180	0.16
540	683	742.2	726.44	-3.29	725.35	1.09	33.4	14.3	2473	4114	0.15
560	683	740.5	726.08	-1.79	724.90	1.18	33.1	13.5	2462	3956	0.17
580	683	739.3	725.60	-2.40	724.51	1.09	32.6	12.7	2448	3860	0.17
600	683	738.4	724.90	-3.53	723.82	1.08	31.9	12.5	2427	3817	0.17

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Upper Limit - March 2007 Monitoring Event											
		4/2/07	Baseline		3/29/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	751.5	736.85	-2.30	736.47	0.38	36.8	13.7	2575	4095	0.05
140	690	755.6	736.51	-1.70	736.20	0.31	36.5	18.1	2565	4575	0.03
160	690	762.1	735.89	-3.11	735.55	0.34	35.9	25.2	2547	5343	0.03
180	691	767.0	736.49	3.02	735.97	0.52	36.0	29.5	2550	5827	0.04
200	691	767.1	735.13	-6.81	734.54	0.59	34.1	30.9	2494	5927	0.05
220	692	763.3	734.53	-3.02	734.16	0.36	33.0	27.7	2461	5541	0.03
240	692	758.3	734.23	-1.46	733.68	0.56	32.2	23.1	2437	4998	0.06
260	692	755.8	733.59	-3.22	733.16	0.43	31.6	21.2	2418	4769	0.05
280	692	755.4	733.08	-2.55	732.71	0.37	31.1	21.3	2402	4771	0.04
300	693	755.4	732.83	-1.25	732.15	0.68	30.3	21.5	2380	4769	0.07
320	693	755.3	732.48	-1.75	731.99	0.49	29.5	21.8	2354	4777	0.05
340	692	755.8	731.61	-4.36	731.20	0.41	29.6	23.2	2358	4929	0.04
360	691	756.4	731.39	-1.07	730.81	0.58	30.4	24.0	2382	5046	0.06
380	691	756.1	730.90	-2.49	730.27	0.63	30.4	24.2	2382	5070	0.06
400	690	755.4	730.32	-2.91	729.70	0.61	30.3	24.1	2380	5053	0.06
420	690	752.3	729.76	-2.79	729.21	0.55	29.8	21.6	2363	4758	0.06
440	690	749.2	729.33	-2.13	728.43	0.91	29.3	18.8	2350	4441	0.11
460	683	747.6	728.77	-2.84	727.95	0.81	35.8	17.9	2543	4526	0.09
480	683	747.7	729.14	1.87	728.42	0.72	36.1	17.6	2554	4505	0.08
500	683	744.4	728.29	-4.27	727.08	1.21	35.3	15.1	2529	4203	0.16
520	683	743.3	727.10	-5.95	725.89	1.20	34.1	15.2	2493	4180	0.16
540	683	742.2	726.44	-3.29	725.46	0.98	33.4	14.8	2473	4114	0.13
560	683	740.5	726.08	-1.79	724.99	1.10	33.1	13.5	2462	3956	0.16
580	683	739.3	725.60	-2.40	724.63	0.98	32.6	12.7	2448	3860	0.15
600	683	738.4	724.90	-3.53	723.96	0.94	31.9	12.5	2427	3817	0.15

Estimation of Modified Compression Index											
North-South Profiler											
95% Confidence Lower Limit - March 2007 Monitoring Event											
		4/2/07	Baseline		3/29/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC V-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	751.5	736.85	-2.30	736.21	0.63	36.8	13.7	2575	4095	0.09
140	690	755.6	736.51	-1.70	735.94	0.56	36.5	18.1	2565	4575	0.06
160	690	762.1	735.89	-3.11	735.32	0.57	35.9	25.2	2547	5343	0.05
180	691	767.0	736.49	3.02	735.74	0.75	36.0	29.5	2550	5827	0.06
200	691	767.1	735.13	-6.81	734.34	0.79	34.1	30.9	2494	5927	0.06
220	692	763.3	734.53	-3.02	733.92	0.61	33.0	27.7	2461	5541	0.05
240	692	758.3	734.23	-1.46	733.51	0.72	32.2	23.1	2437	4998	0.07
260	692	755.8	733.59	-3.22	732.92	0.67	31.6	21.2	2413	4769	0.07
280	692	755.4	733.08	-2.55	732.50	0.58	31.1	21.3	2402	4771	0.06
300	693	755.4	732.83	-1.25	731.96	0.87	30.3	21.5	2380	4769	0.10
320	693	755.3	732.48	-1.75	731.73	0.75	29.5	21.8	2354	4777	0.08
340	692	755.8	731.61	-4.36	730.98	0.63	29.6	23.2	2353	4929	0.07
360	691	756.4	731.39	-1.07	730.59	0.81	30.4	24.0	2382	5046	0.08
380	691	756.1	730.90	-2.49	730.06	0.84	30.4	24.2	2382	5070	0.08
400	690	755.4	730.32	-2.91	729.54	0.78	30.3	24.1	2380	5053	0.08
420	690	752.3	729.76	-2.79	728.99	0.77	29.8	21.6	2363	4758	0.08
440	690	749.2	729.33	-2.13	728.21	1.13	29.3	18.8	2350	4441	0.14
460	683	747.6	728.77	-2.84	727.73	1.04	35.8	17.9	2543	4526	0.12
480	683	747.7	729.14	1.87	728.26	0.88	36.1	17.6	2554	4505	0.10
500	683	744.4	728.29	-4.27	726.82	1.47	35.3	15.1	2529	4203	0.19
520	683	743.3	727.10	-5.95	725.79	1.31	34.1	15.2	2493	4180	0.17
540	683	742.2	726.44	-3.29	725.23	1.21	33.4	14.8	2473	4114	0.16
560	683	740.5	726.08	-1.79	724.82	1.27	33.1	13.5	2462	3956	0.19
580	683	739.3	725.60	-2.40	724.39	1.21	32.6	12.7	2448	3860	0.19
600	683	738.4	724.90	-3.53	723.68	1.22	31.9	12.5	2427	3817	0.19

Estimation of Modified Compression Index											
Phase 1 North-South Profiler											
September 2008 Monitoring Event											
		9/4/08	Baseline		9/23/08				Stress @ Midpoint of		Estimated
P1	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	754.1	736.85	-2.30	736.34	0.25	36.8	16.2	2575	4376	0.03
140	690	760.8	736.51	-1.70	736.07	0.40	36.5	23.3	2565	5152	0.04
160	690	766.6	735.89	-3.11	735.43	0.23	35.9	29.7	2547	5841	0.02
180	691	767.4	736.49	3.02	735.86	0.64	36.0	29.9	2550	5866	0.05
200	691	766.9	735.13	-6.81	734.44	0.49	34.1	30.7	2494	5907	0.04
220	692	762.7	734.53	-3.02	734.04	0.69	33.0	27.2	2461	5481	0.06
240	692	765.0	734.23	-1.46	733.59	0.73	32.2	29.7	2437	5736	0.06
260	692	770.8	733.59	-3.22	733.04	0.88	31.6	36.3	2418	6442	0.07
280	692	775.8	733.08	-2.55	732.60	1.04	31.1	41.7	2402	7030	0.07
300	693	778.7	732.83	-1.25	732.06	1.36	30.3	44.9	2380	7361	0.09
320	693	778.0	732.48	-1.75	731.86	1.22	29.5	44.5	2354	7295	0.08
340	692	774.9	731.61	-4.36	731.09	1.14	29.6	42.3	2358	7055	0.08
360	691	771.1	731.39	-1.07	730.70	1.31	30.4	38.7	2382	6680	0.10
380	691	766.4	730.90	-2.49	730.16	1.25	30.4	34.5	2382	6209	0.10
400	690	761.5	730.32	-2.91	729.62	1.15	30.3	30.2	2380	5733	0.10
420	690	756.6	729.76	-2.79	729.10	1.08	29.8	25.8	2363	5229	0.11
440	690	751.9	729.33	-2.13	728.32	1.34	29.3	21.6	2350	4742	0.15
460	683	747.4	728.77	-2.84	727.84	1.41	35.8	17.6	2543	4496	0.16
480	683	744.9	729.14	1.87	728.34	1.66	36.1	14.8	2554	4192	0.21
500	683	743.6	728.29	-4.27	726.95	1.41	35.3	14.3	2529	4116	0.19
520	683	743.7	727.10	-5.95	725.84	1.35	34.1	15.6	2493	4224	0.17
540	683	742.5	726.44	-3.29	725.35	1.49	33.4	15.1	2473	4146	0.20
560	683	741.1	726.08	-1.79	724.90	1.62	33.1	14.0	2462	4019	0.23
580	683	739.9	725.60	-2.40	724.51	1.54	32.6	13.2	2448	3919	0.23
600	683	739.0	724.90	-3.53	723.82	1.55	31.9	13.1	2427	3878	0.24

Estimation of Modified Compression Index											
Phase 1 North-South Profiler											
95% Confidence Upper Limit - March 2008 Monitoring Event											
		9/4/08	Baseline		9/23/08				Stress @ Midpoint of		Estimated
P1	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	754.1	736.85	-2.30	736.47	0.38	36.8	16.2	2575	4376	0.04
140	690	760.8	736.51	-1.70	736.20	0.31	36.5	23.3	2565	5152	0.03
160	690	766.6	735.89	-3.11	735.54	0.34	35.9	29.7	2547	5841	0.03
180	691	767.4	736.49	3.02	735.97	0.52	36.0	29.9	2550	5866	0.04
200	691	766.9	735.13	-6.81	734.54	0.59	34.1	30.7	2494	5907	0.05
220	692	762.7	734.53	-3.02	734.16	0.36	33.0	27.2	2461	5481	0.03
240	692	765.0	734.23	-1.46	733.67	0.56	32.2	29.7	2437	5736	0.05
260	692	770.8	733.59	-3.22	733.16	0.43	31.6	36.3	2413	6442	0.03
280	692	775.8	733.08	-2.55	732.71	0.38	31.1	41.7	2402	7030	0.03
300	693	778.7	732.83	-1.25	732.15	0.68	30.3	44.9	2380	7361	0.05
320	693	778.0	732.48	-1.75	731.99	0.49	29.5	44.5	2354	7295	0.03
340	692	774.9	731.61	-4.36	731.20	0.41	29.6	42.3	2353	7055	0.03
360	691	771.1	731.39	-1.07	730.81	0.59	30.4	38.7	2382	6680	0.04
380	691	766.4	730.90	-2.49	730.27	0.63	30.4	34.5	2382	6209	0.05
400	690	761.5	730.32	-2.91	729.70	0.62	30.3	30.2	2380	5733	0.05
420	690	756.6	729.76	-2.79	729.21	0.55	29.8	25.8	2363	5229	0.05
440	690	751.9	729.33	-2.13	728.42	0.91	29.3	21.6	2350	4742	0.10
460	683	747.4	728.77	-2.84	727.95	0.81	35.8	17.6	2543	4496	0.09
480	683	744.9	729.14	1.87	728.41	0.73	36.1	14.8	2554	4192	0.09
500	683	743.6	728.29	-4.27	727.07	1.21	35.3	14.3	2529	4116	0.16
520	683	743.7	727.10	-5.95	725.90	1.20	34.1	15.6	2493	4224	0.15
540	683	742.5	726.44	-3.29	725.48	0.97	33.4	15.1	2473	4146	0.13
560	683	741.1	726.08	-1.79	725.00	1.09	33.1	14.0	2462	4019	0.15
580	683	739.9	725.60	-2.40	724.64	0.96	32.6	13.2	2448	3919	0.14
600	683	739.0	724.90	-3.53	723.98	0.92	31.9	13.1	2427	3878	0.14

Estimation of Modified Compression Index											
Phase 1 North-South Profiler											
95% Confidence Lower Limit - March 2008 Monitoring Event											
		9/4/08	Baseline		9/23/08				Stress @ Midpoint of		Estimated
P1	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Waste		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
120	690	754.1	736.85	-2.30	736.22	0.63	36.8	16.2	2575	4376	0.07
140	690	760.8	736.51	-1.70	735.95	0.56	36.5	23.3	2565	5152	0.05
160	690	766.6	735.89	-3.11	735.32	0.56	35.9	29.7	2547	5841	0.04
180	691	767.4	736.49	3.02	735.74	0.75	36.0	29.9	2550	5866	0.06
200	691	766.9	735.13	-6.81	734.34	0.79	34.1	30.7	2494	5907	0.06
220	692	762.7	734.53	-3.02	733.92	0.61	33.0	27.2	2461	5481	0.05
240	692	765.0	734.23	-1.46	733.51	0.72	32.2	29.7	2437	5736	0.06
260	692	770.8	733.59	-3.22	732.92	0.67	31.6	36.3	2418	6442	0.05
280	692	775.8	733.08	-2.55	732.50	0.58	31.1	41.7	2402	7030	0.04
300	693	778.7	732.83	-1.25	731.96	0.87	30.3	44.9	2380	7361	0.06
320	693	778.0	732.48	-1.75	731.74	0.74	29.5	44.5	2354	7295	0.05
340	692	774.9	731.61	-4.36	730.98	0.63	29.6	42.3	2358	7055	0.04
360	691	771.1	731.39	-1.07	730.59	0.81	30.4	38.7	2382	6680	0.06
380	691	766.4	730.90	-2.49	730.06	0.84	30.4	34.5	2382	6209	0.07
400	690	761.5	730.32	-2.91	729.54	0.78	30.3	30.2	2380	5733	0.07
420	690	756.6	729.76	-2.79	728.99	0.77	29.8	25.8	2363	5229	0.07
440	690	751.9	729.33	-2.13	728.21	1.12	29.3	21.6	2350	4742	0.13
460	683	747.4	728.77	-2.84	727.73	1.04	35.8	17.6	2543	4496	0.12
480	683	744.9	729.14	1.87	728.26	0.88	36.1	14.8	2554	4192	0.11
500	683	743.6	728.29	-4.27	726.82	1.46	35.3	14.3	2529	4116	0.20
520	683	743.7	727.10	-5.95	725.79	1.31	34.1	15.6	2493	4224	0.17
540	683	742.5	726.44	-3.29	725.22	1.22	33.4	15.1	2473	4146	0.16
560	683	741.1	726.08	-1.79	724.81	1.28	33.1	14.0	2462	4019	0.18
580	683	739.9	725.60	-2.40	724.38	1.22	32.6	13.2	2448	3919	0.18
600	683	739.0	724.90	-3.53	723.66	1.24	31.9	13.1	2427	3878	0.19

Five-Year Projection of Settlement
Phase 1 North-South Profiler
Average

P1 Station	Baseline Measured Pipe Elev ft	Baseline Slope %	9/23/08 Measured Pipe Elev ft	Measured settlement ft	Stress @ Midpoint of MC V Waste Initial psf	Average Modif. Compres Index	Final Waste Elevation ft	Final Waste Thickness ft	Final stress psf	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Check	Slope Difference	Comments
120	736.85	-2.30	736.34	0.25	4376	0.09	815.00	77.15	11196	1.42	734.92				cell floor
140	736.51	-1.70	736.07	0.40	5152	0.08	817.00	79.49	11446	1.05	735.02	0.50	slope reversal	0.10	cell floor
160	735.89	-3.11	735.43	0.23	5841	0.06	819.50	82.61	11774	0.63	734.81	-1.09			cell floor
180	736.49	3.02	735.86	0.64	5866	0.06	821.50	84.01	11932	0.62	735.24	2.17			pipe crossing
200	735.13	-6.81	734.44	0.49	5907	0.06	824.00	87.87	12304	0.67	733.77	-7.38			pipe crossing
220	734.53	-3.02	734.04	0.69	5481	0.06	826.00	90.47	12560	0.70	733.34	-2.13			pipe crossing
240	734.23	-1.46	733.59	0.73	5736	0.09	828.00	92.77	12791	0.99	732.60	-3.70			cell floor
260	733.59	-3.22	733.04	0.88	6442	0.06	829.50	94.91	13010	0.57	732.47	-0.65			cell floor
280	733.08	-2.55	732.60	1.04	7030	0.05	830.50	96.42	13162	0.43	732.17	-1.51			cell floor
300	732.83	-1.25	732.06	1.36	7361	0.08	831.00	97.17	13223	0.66	731.40	-3.85			cell floor
320	732.48	-1.75	731.86	1.22	7295	0.06	831.00	97.52	13236	0.47	731.39	-0.06			cell floor
340	731.61	-4.36	731.09	1.14	7055	0.10	830.50	97.89	13281	0.79	730.30	-5.44			cell floor
360	731.39	-1.07	730.70	1.31	6680	0.11	830.50	98.11	13329	1.03	729.66	-3.19			cell floor
380	730.90	-2.49	730.16	1.25	6209	0.12	830.00	98.10	13328	1.18	728.99	-3.40			cell floor
400	730.32	-2.91	729.62	1.15	5733	0.13	830.00	98.68	13390	1.43	728.19	-3.97			cell floor
420	729.76	-2.79	729.10	1.08	5229	0.11	829.50	98.74	13380	1.37	727.73	-2.29			cell floor
440	729.33	-2.13	728.32	1.34	4742	0.16	829.50	99.17	13415	2.08	726.24	-7.49			cell floor
460	728.77	-2.84	727.84	1.41	4496	0.12	829.00	99.23	13615	2.15	725.69	-2.75			pipe crossing
480	729.14	1.87	728.34	1.66	4192	0.12	829.00	98.86	13585	2.23	726.11	2.09			pipe crossing
500	728.29	-4.27	726.95	1.41	4116	0.17	829.00	99.71	13654	3.20	723.75	-11.90			pipe crossing
520	727.10	-5.95	725.84	1.35	4224	0.19	828.50	100.40	13695	3.23	722.61	-5.69			cell floor
540	726.44	-3.29	725.35	1.49	4146	0.19	825.00	97.56	13359	3.26	722.09	-2.60			cell floor
560	726.08	-1.79	724.90	1.62	4019	0.21	820.00	92.92	12833	3.51	721.39	-3.49			cell floor
580	725.60	-2.40	724.51	1.54	3919	0.21	815.00	88.40	12317	3.47	721.04	-1.76			cell floor
600	724.90	-3.53	723.82	1.55	3878	0.22	810.00	84.10	11819	3.36	720.46	-2.89			cell floor

Five-Year Projection of Settlement
Phase 1 North-South Profiler
95% Confidence Upper Limit - Average

P1 Station	Baseline Measured Pipe Elev	Baseline Slope	9/23/08 Measured Pipe Elev	Measured settlement	Stress @ Midpoint of MC V Waste Initial	Average Modif. Compres Index	Final Waste Elevation	Final Waste Thickness	Final stress	Final Settlement	Final Pipe Elevation	Final Slope	Check	Slope Difference	Comments
	ft	%	ft	ft	psf		ft	ft	psf	ft	ft	%			
120	736.85	-2.30	736.34	0.25	4376	0.08	815.00	77.15	11529	1.25	735.10				cell floor
140	736.51	-1.70	736.07	0.40	5152	0.07	817.00	79.49	11779	0.91	735.16	0.34	slope reversal	0.07	cell floor
160	735.89	-3.11	735.43	0.23	5841	0.05	819.50	82.61	12107	0.57	734.87	-1.49			cell floor
180	736.49	3.02	735.86	0.64	5866	0.05	821.50	84.01	12265	0.61	735.24	1.89			pipe crossing
200	735.13	-6.81	734.44	0.49	5907	0.06	824.00	87.87	12637	0.72	733.72	-7.66			pipe crossing
220	734.53	-3.02	734.04	0.69	5481	0.05	826.00	90.47	12893	0.63	733.41	-1.53			pipe crossing
240	734.23	-1.46	733.59	0.73	5736	0.08	828.00	92.77	13124	0.91	732.68	-3.65			cell floor
260	733.59	-3.22	733.04	0.88	6442	0.04	829.50	94.91	13343	0.43	732.61	-0.34			cell floor
280	733.08	-2.55	732.60	1.04	7030	0.03	830.50	96.42	13495	0.30	732.30	-1.57			cell floor
300	732.83	-1.25	732.06	1.36	7361	0.07	831.00	97.17	13556	0.55	731.51	-3.95			cell floor
320	732.48	-1.75	731.86	1.22	7295	0.04	831.00	97.52	13569	0.31	731.55	0.20	slope reversal	0.04	cell floor
340	731.61	-4.36	731.09	1.14	7055	0.08	830.50	97.89	13614	0.64	730.45	-5.51			cell floor
360	731.39	-1.07	730.70	1.31	6680	0.09	830.50	98.11	13662	0.82	729.87	-2.88			cell floor
380	730.90	-2.49	730.16	1.25	6209	0.10	830.00	98.10	13661	1.00	729.17	-3.55			cell floor
400	730.32	-2.91	729.62	1.15	5733	0.11	830.00	98.68	13723	1.28	728.34	-4.14			cell floor
420	729.76	-2.79	729.10	1.08	5229	0.09	829.50	98.74	13713	1.14	727.96	-1.89			cell floor
440	729.33	-2.13	728.32	1.34	4742	0.13	829.50	99.17	13748	1.82	726.50	-7.32			cell floor
460	728.77	-2.84	727.84	1.41	4496	0.12	829.00	99.23	13948	2.07	725.77	-3.63			pipe crossing
480	729.14	1.87	728.34	1.66	4192	0.11	829.00	98.86	13918	2.13	726.21	2.19			pipe crossing
500	728.29	-4.27	726.95	1.41	4116	0.18	829.00	99.71	13987	3.40	723.55	-13.43			pipe crossing
520	727.10	-5.95	725.84	1.35	4224	0.18	828.50	100.40	14028	3.14	722.70	-4.23			cell floor
540	726.44	-3.29	725.35	1.49	4146	0.17	825.00	97.56	13692	2.93	722.42	-1.44			cell floor
560	726.08	-1.79	724.90	1.62	4019	0.19	820.00	92.92	13166	3.25	721.65	-3.81			cell floor
580	725.60	-2.40	724.51	1.54	3919	0.19	815.00	88.40	12650	3.11	721.40	-1.26			cell floor
600	724.90	-3.53	723.82	1.55	3878	0.19	810.00	84.10	12152	2.93	720.89	-2.56			cell floor

Five-Year Projection of Settlement
Phase 1 North-South Profiler
95% Confidence Lower Limit - Average

P1 Station	Baseline Measured Pipe Elev	Baseline Slope	9/23/08 Measured Pipe Elev	Measured settlement	Stress @ Midpoint of MC V Waste Initial	Average Modif. Compres Index	Final Waste Elevation	Final Waste Thickness	Final stress	Final Settlement	Final Pipe Elevation	Final Slope	Check	Slope Difference	Comments
	ft	%	ft	ft	psf		ft	ft	psf	ft	ft	%			
120	736.85	-2.30	736.34	0.25	4376	0.12	815.00	77.15	11529	1.81	734.53				cell floor
140	736.51	-1.70	736.07	0.40	5152	0.10	817.00	79.49	11779	1.28	734.79	1.33	slope reversal	0.27	cell floor
160	735.89	-3.11	735.43	0.23	5841	0.07	819.50	82.61	12107	0.80	734.64	-0.79			cell floor
180	736.49	3.02	735.86	0.64	5866	0.07	821.50	84.01	12265	0.83	735.02	1.93			pipe crossing
200	735.13	-6.81	734.44	0.49	5907	0.08	824.00	87.87	12637	0.91	733.53	-7.48			pipe crossing
220	734.53	-3.02	734.04	0.69	5481	0.07	826.00	90.47	12893	0.90	733.14	-1.97			pipe crossing
240	734.23	-1.46	733.59	0.73	5736	0.10	828.00	92.77	13124	1.11	732.49	-3.26			cell floor
260	733.59	-3.22	733.04	0.88	6442	0.07	829.50	94.91	13343	0.68	732.36	-0.63			cell floor
280	733.08	-2.55	732.60	1.04	7030	0.06	830.50	96.42	13495	0.50	732.10	-1.28			cell floor
300	732.83	-1.25	732.06	1.36	7361	0.09	831.00	97.17	13556	0.73	731.33	-3.90			cell floor
320	732.48	-1.75	731.86	1.22	7295	0.07	831.00	97.52	13569	0.58	731.28	-0.21			cell floor
340	731.61	-4.36	731.09	1.14	7055	0.11	830.50	97.89	13614	0.89	730.20	-5.42			cell floor
360	731.39	-1.07	730.70	1.31	6680	0.13	830.50	98.11	13662	1.24	729.46	-3.72			cell floor
380	730.90	-2.49	730.16	1.25	6209	0.13	830.00	98.10	13661	1.36	728.81	-3.26			cell floor
400	730.32	-2.91	729.62	1.15	5733	0.14	830.00	98.68	13723	1.59	728.03	-3.87			cell floor
420	729.76	-2.79	729.10	1.08	5229	0.13	829.50	98.74	13713	1.58	727.52	-2.54			cell floor
440	729.33	-2.13	728.32	1.34	4742	0.17	829.50	99.17	13748	2.34	725.98	-7.77			cell floor
460	728.77	-2.84	727.84	1.41	4496	0.15	829.00	99.23	13948	2.64	725.20	-3.88			pipe crossing
480	729.14	1.87	728.34	1.66	4192	0.14	829.00	98.86	13918	2.56	725.78	2.89			pipe crossing
500	728.29	-4.27	726.95	1.41	4116	0.22	829.00	99.71	13987	4.13	722.82	-14.98			pipe crossing
520	727.10	-5.95	725.84	1.35	4224	0.19	828.50	100.40	14028	3.42	722.42	-1.97			cell floor
540	726.44	-3.29	725.35	1.49	4146	0.20	825.00	97.56	13692	3.55	721.79	-3.14			cell floor
560	726.08	-1.79	724.90	1.62	4019	0.22	820.00	92.92	13166	3.73	721.17	-3.11			cell floor
580	725.60	-2.40	724.51	1.54	3919	0.23	815.00	88.40	12650	3.79	720.72	-2.24			cell floor
600	724.90	-3.53	723.82	1.55	3878	0.24	810.00	84.10	12152	3.74	720.08	-3.23			cell floor

Estimation of Modified Compression Index
Southern East-West Profiler
May 2005 Monitoring Event

		5/2/05	Baseline		5/31/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.53	-					
40			724.91	-28.32	723.70	1.21					
60	668	729.0	721.83	-15.57	720.69	1.15	43.8	6.2	2785	3469	0.27
80	668	736.0	721.14	-3.50	719.88	1.25	43.1	13.9	2764	4303	0.15
100	668	741.0	721.42	1.44	719.95	1.48	43.4	18.6	2773	4835	0.14
120	668	746.5	721.81	1.93	720.12	1.69	43.8	23.7	2784	5414	0.13
140	668	746.0	722.17	1.78	720.61	1.56	44.2	22.8	2795	5330	0.13
160	668	745.0	722.60	2.19	720.99	1.62	44.6	21.4	2808	5183	0.14
180	668	744.5	722.81	1.05	721.44	1.37	44.8	20.7	2814	5111	0.12
200	668	743.0	722.99	0.86	721.74	1.25	45.0	19.0	2820	4930	0.11
220	668	741.5	722.97	-0.06	721.72	1.26	45.0	17.5	2819	4765	0.12
240	683	741.0	722.80	-0.87	721.61	1.19	29.8	17.2	2364	4273	0.15
260	683	739.5	722.62	-0.87	721.57	1.06	29.6	15.9	2359	4121	0.15
280	683	738.5	722.60	-0.15	721.60	0.99	29.6	14.9	2358	4012	0.15
300	683	737.0	723.37	3.85	722.65	0.71	30.4	12.6	2381	3783	0.12
320	683	735.0	723.22	-0.71	722.27	0.96	30.2	10.8	2377	3573	0.18
340	683	733.5	722.94	-1.42	722.15	0.79	29.9	9.6	2368	3429	0.16
360	683	734.0	723.29	1.74	722.68	0.60	30.3	9.7	2379	3457	0.12
380	683	735.0	723.89	3.03	723.29	0.61	30.9	10.1	2397	3519	0.12
400	683	733.0	724.43	2.67	723.53	0.89	31.4	7.6	2413	3253	0.22
420	683	733.0	725.02	2.94	724.12	0.90	32.0	7.0	2430	3206	0.23
440	683	734.0	725.61	2.96	724.84	0.77	32.6	7.4	2448	3269	0.19
460	683	735.0	726.22	3.05	725.42	0.79	33.2	7.8	2466	3330	0.18
480	683	736.0	726.79	2.85	726.14	0.64	33.8	8.2	2484	3395	0.14
500	683	736.5	728.00	6.07	727.73	0.27	35.0	7.5	2520	3353	0.06
520	683	736.5	728.74	3.73	728.16	0.58	35.7	6.8	2542	3292	0.15
540	683	737.0	728.44	-1.52	727.95	0.48	35.4	7.6	2533	3373	0.11
560	690	737.5	729.00	2.82	728.58	0.42	29.0	7.5	2340	3172	0.11
580	690	737.0	729.53	2.62	729.05	0.47	29.5	6.5	2356	3074	0.14
600	690	736.0	730.06	2.70	729.58	0.49	30.1	4.9	2372	2920	0.18

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - May 2005 Monitoring Event											
		5/2/05	Baseline		5/31/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.67						
40			724.91	-28.32	723.88	1.03					
60	668	729.0	721.83	-15.57	720.75	1.09	43.8	6.2	2785	3469	0.26
80	668	736.0	721.14	-3.50	719.98	1.16	43.1	13.9	2764	4303	0.14
100	668	741.0	721.42	1.44	720.03	1.39	43.4	18.6	2773	4835	0.13
120	668	746.5	721.81	1.93	720.18	1.63	43.8	23.7	2784	5414	0.13
140	668	746.0	722.17	1.78	720.87	1.29	44.2	22.8	2795	5330	0.10
160	668	745.0	722.60	2.19	721.03	1.58	44.6	21.4	2808	5183	0.13
180	668	744.5	722.81	1.05	721.51	1.30	44.8	20.7	2814	5111	0.11
200	668	743.0	722.99	0.86	721.81	1.18	45.0	19.0	2820	4930	0.11
220	668	741.5	722.97	-0.06	721.77	1.20	45.0	17.5	2819	4765	0.12
240	683	741.0	722.80	-0.87	721.70	1.10	29.8	17.2	2364	4273	0.14
260	683	739.5	722.62	-0.87	721.63	0.99	29.6	15.9	2359	4121	0.14
280	683	738.5	722.60	-0.15	721.67	0.92	29.6	14.9	2358	4012	0.14
300	683	737.0	723.37	3.85	722.74	0.63	30.4	12.6	2381	3783	0.10
320	683	735.0	723.22	-0.71	722.33	0.90	30.2	10.8	2377	3573	0.17
340	683	733.5	722.94	-1.42	722.20	0.74	29.9	9.6	2368	3429	0.15
360	683	734.0	723.29	1.74	722.75	0.54	30.3	9.7	2379	3457	0.11
380	683	735.0	723.89	3.03	723.38	0.51	30.9	10.1	2397	3519	0.10
400	683	733.0	724.43	2.67	723.59	0.84	31.4	7.6	2413	3253	0.20
420	683	733.0	725.02	2.94	724.19	0.83	32.0	7.0	2430	3206	0.22
440	683	734.0	725.61	2.96	724.93	0.68	32.6	7.4	2448	3269	0.17
460	683	735.0	726.22	3.05	725.48	0.74	33.2	7.8	2466	3330	0.17
480	683	736.0	726.79	2.85	726.20	0.58	33.8	8.2	2484	3395	0.13
500	683	736.5	728.00	6.07	727.81	0.19	35.0	7.5	2520	3353	0.04
520	683	736.5	728.74	3.73	728.21	0.53	35.7	6.8	2542	3292	0.13
540	683	737.0	728.44	-1.52	728.01	0.43	35.4	7.6	2533	3373	0.10
560	690	737.5	729.00	2.82	728.61	0.39	29.0	7.5	2340	3172	0.10
580	690	737.0	729.53	2.62	729.11	0.42	29.5	6.5	2356	3074	0.12
600	690	736.0	730.06	2.70	729.70	0.36	30.1	4.9	2372	2920	0.13

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit - May 2005 Monitoring Event											
		5/2/05	Baseline		5/31/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.39						
40			724.91	-28.32	723.52	1.39					
60	668	729.0	721.83	-15.57	720.63	1.21	43.8	6.2	2785	3469	0.29
80	668	736.0	721.14	-3.50	719.78	1.35	43.1	13.9	2764	4303	0.16
100	668	741.0	721.42	1.44	719.86	1.56	43.4	18.6	2773	4835	0.15
120	668	746.5	721.81	1.93	720.06	1.75	43.8	23.7	2784	5414	0.14
140	668	746.0	722.17	1.78	720.35	1.82	44.2	22.8	2795	5330	0.15
160	668	745.0	722.60	2.19	720.95	1.66	44.6	21.4	2808	5183	0.14
180	668	744.5	722.81	1.05	721.37	1.44	44.8	20.7	2814	5111	0.12
200	668	743.0	722.99	0.86	721.67	1.31	45.0	19.0	2820	4930	0.12
220	668	741.5	722.97	-0.06	721.66	1.31	45.0	17.5	2819	4765	0.13
240	683	741.0	722.80	-0.87	721.53	1.27	29.8	17.2	2364	4273	0.17
260	683	739.5	722.62	-0.87	721.50	1.13	29.6	15.9	2359	4121	0.16
280	683	738.5	722.60	-0.15	721.53	1.06	29.6	14.9	2358	4012	0.16
300	683	737.0	723.37	3.85	722.57	0.80	30.4	12.6	2381	3783	0.13
320	683	735.0	723.22	-0.71	722.21	1.01	30.2	10.8	2377	3573	0.19
340	683	733.5	722.94	-1.42	722.10	0.84	29.9	9.6	2368	3429	0.17
360	683	734.0	723.29	1.74	722.62	0.67	30.3	9.7	2379	3457	0.14
380	683	735.0	723.89	3.03	723.19	0.70	30.9	10.1	2397	3519	0.14
400	683	733.0	724.43	2.67	723.47	0.95	31.4	7.6	2413	3253	0.23
420	683	733.0	725.02	2.94	724.05	0.97	32.0	7.0	2430	3206	0.25
440	683	734.0	725.61	2.96	724.75	0.85	32.6	7.4	2448	3269	0.21
460	683	735.0	726.22	3.05	725.37	0.85	33.2	7.8	2466	3330	0.20
480	683	736.0	726.79	2.85	726.08	0.70	33.8	8.2	2484	3395	0.15
500	683	736.5	728.00	6.07	727.65	0.34	35.0	7.5	2520	3353	0.08
520	683	736.5	728.74	3.73	728.10	0.64	35.7	6.8	2542	3292	0.16
540	683	737.0	728.44	-1.52	727.90	0.54	35.4	7.6	2533	3373	0.12
560	690	737.5	729.00	2.82	728.55	0.45	29.0	7.5	2340	3172	0.12
580	690	737.0	729.53	2.62	729.00	0.52	29.5	6.5	2356	3074	0.15
600	690	736.0	730.06	2.70	729.45	0.62	30.1	4.9	2372	2920	0.23

Estimation of Modified Compression Index											
Southern East-West Profiler											
July 2005 Monitoring Event											
		7/28/05	Baseline		7/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.56	-					
40			724.91	-28.32	723.69	1.22					
60	668	734.0	721.83	-15.57	720.51	1.32	43.8	11.2	2785	4024	0.19
80	668	740.0	721.14	-3.50	719.61	1.53	43.1	17.9	2764	4747	0.15
100	668	745.0	721.42	1.44	719.57	1.85	43.4	22.6	2773	5279	0.15
120	668	750.0	721.81	1.93	719.80	2.01	43.8	27.2	2784	5802	0.14
140	668	755.0	722.17	1.78	720.26	1.91	44.2	31.8	2795	6329	0.12
160	668	760.5	722.60	2.19	720.54	2.07	44.6	36.9	2808	6904	0.12
180	668	761.5	722.81	1.05	720.99	1.82	44.8	37.7	2814	6998	0.10
200	668	756.5	722.99	0.86	721.22	1.76	45.0	32.5	2820	6429	0.11
220	668	752.0	722.97	-0.06	721.43	1.55	45.0	28.0	2819	5930	0.11
240	683	748.5	722.80	-0.87	721.43	1.37	29.8	24.7	2364	5106	0.14
260	683	744.5	722.62	-0.87	721.40	1.22	29.6	20.9	2359	4676	0.14
280	683	741.0	722.60	-0.15	721.38	1.22	29.6	17.4	2358	4290	0.16
300	683	738.0	723.37	3.85	722.30	1.06	30.4	13.6	2381	3894	0.16
320	683	736.0	723.22	-0.71	722.02	1.21	30.2	11.8	2377	3684	0.21
340	683	733.5	722.94	-1.42	721.93	1.01	29.9	9.6	2368	3429	0.21
360	683	734.0	723.29	1.74	722.44	0.85	30.3	9.7	2379	3457	0.17
380	683	735.0	723.89	3.03	723.12	0.77	30.9	10.1	2397	3519	0.15
400	683	733.0	724.43	2.67	723.46	0.97	31.4	7.6	2413	3253	0.24
420	683	733.0	725.02	2.94	724.12	0.89	32.0	7.0	2430	3206	0.23
440	683	734.0	725.61	2.96	724.74	0.86	32.6	7.4	2448	3269	0.21
460	683	735.0	726.22	3.05	725.34	0.88	33.2	7.8	2466	3330	0.20
480	683	736.0	726.79	2.85	725.96	0.82	33.8	8.2	2484	3395	0.18
500	683	736.5	728.00	6.07	727.63	0.37	35.0	7.5	2520	3353	0.08
520	683	736.5	728.74	3.73	727.84	0.90	35.7	6.8	2542	3292	0.22
540	683	737.0	728.44	-1.52	727.80	0.63	35.4	7.6	2533	3373	0.14
560	690	737.5	729.00	2.82	728.26	0.74	29.0	7.5	2340	3172	0.19
580	690	737.0	729.53	2.62	728.99	0.54	29.5	6.5	2356	3074	0.16
600	690	736.0	730.06	2.70	729.42	0.64	30.1	4.9	2372	2920	0.24

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - July 2005 Monitoring Event											
		7/28/05	Baseline		7/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.70						
40			724.91	-28.32	723.88	1.04					
60	668	734.0	721.83	-15.57	720.57	1.26	43.8	11.2	2785	4024	0.18
80	668	740.0	721.14	-3.50	719.70	1.43	43.1	17.9	2764	4747	0.14
100	668	745.0	721.42	1.44	719.66	1.76	43.4	22.6	2773	5279	0.15
120	668	750.0	721.81	1.93	719.86	1.95	43.8	27.2	2784	5802	0.14
140	668	755.0	722.17	1.78	720.52	1.65	44.2	31.8	2795	6329	0.11
160	668	760.5	722.60	2.19	720.58	2.03	44.6	36.9	2808	6904	0.12
180	668	761.5	722.81	1.05	721.06	1.75	44.8	37.7	2814	6998	0.10
200	668	756.5	722.99	0.86	721.29	1.70	45.0	32.5	2820	6429	0.11
220	668	752.0	722.97	-0.06	721.48	1.49	45.0	28.0	2819	5930	0.10
240	683	748.5	722.80	-0.87	721.51	1.29	29.8	24.7	2364	5106	0.13
260	683	744.5	722.62	-0.87	721.47	1.15	29.6	20.9	2359	4676	0.13
280	683	741.0	722.60	-0.15	721.45	1.14	29.6	17.4	2358	4290	0.15
300	683	738.0	723.37	3.85	722.39	0.98	30.4	13.6	2381	3894	0.15
320	683	736.0	723.22	-0.71	722.07	1.15	30.2	11.8	2377	3684	0.20
340	683	733.5	722.94	-1.42	721.98	0.96	29.9	9.6	2368	3429	0.20
360	683	734.0	723.29	1.74	722.50	0.78	30.3	9.7	2379	3457	0.16
380	683	735.0	723.89	3.03	723.21	0.68	30.9	10.1	2397	3519	0.13
400	683	733.0	724.43	2.67	723.52	0.91	31.4	7.6	2413	3253	0.22
420	683	733.0	725.02	2.94	724.19	0.82	32.0	7.0	2430	3206	0.21
440	683	734.0	725.61	2.96	724.83	0.78	32.6	7.4	2448	3269	0.19
460	683	735.0	726.22	3.05	725.39	0.82	33.2	7.8	2466	3330	0.19
480	683	736.0	726.79	2.85	726.02	0.76	33.8	8.2	2484	3395	0.17
500	683	736.5	728.00	6.07	727.71	0.29	35.0	7.5	2520	3353	0.07
520	683	736.5	728.74	3.73	727.90	0.84	35.7	6.8	2542	3292	0.21
540	683	737.0	728.44	-1.52	727.86	0.58	35.4	7.6	2533	3373	0.13
560	690	737.5	729.00	2.82	728.30	0.71	29.0	7.5	2340	3172	0.18
580	690	737.0	729.53	2.62	729.04	0.49	29.5	6.5	2356	3074	0.14
600	690	736.0	730.06	2.70	729.55	0.52	30.1	4.9	2372	2920	0.19

Estimation of Modified Compression Index

Southern East-West Profiler

95% Confidence Lower Limit - July 2005 Monitoring Event

		7/28/05	Baseline		7/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.42						
40			724.91	-28.32	723.51	1.40					
60	668	734.0	721.83	-15.57	720.45	1.38	43.8	11.2	2785	4024	0.20
80	668	740.0	721.14	-3.50	719.51	1.63	43.1	17.9	2764	4747	0.16
100	668	745.0	721.42	1.44	719.49	1.94	43.4	22.6	2773	5279	0.16
120	668	750.0	721.81	1.93	719.73	2.08	43.8	27.2	2784	5802	0.15
140	668	755.0	722.17	1.78	720.00	2.17	44.2	31.8	2795	6329	0.14
160	668	760.5	722.60	2.19	720.50	2.11	44.6	36.9	2808	6904	0.12
180	668	761.5	722.81	1.05	720.92	1.89	44.8	37.7	2814	6998	0.11
200	668	756.5	722.99	0.86	721.15	1.83	45.0	32.5	2820	6429	0.11
220	668	752.0	722.97	-0.06	721.37	1.60	45.0	28.0	2819	5930	0.11
240	683	748.5	722.80	-0.87	721.34	1.46	29.8	24.7	2364	5106	0.15
260	683	744.5	722.62	-0.87	721.34	1.29	29.6	20.9	2359	4676	0.15
280	683	741.0	722.60	-0.15	721.31	1.29	29.6	17.4	2358	4290	0.17
300	683	738.0	723.37	3.85	722.22	1.15	30.4	13.6	2381	3894	0.18
320	683	736.0	723.22	-0.71	721.96	1.27	30.2	11.8	2377	3684	0.22
340	683	733.5	722.94	-1.42	721.88	1.06	29.9	9.6	2368	3429	0.22
360	683	734.0	723.29	1.74	722.37	0.91	30.3	9.7	2379	3457	0.19
380	683	735.0	723.89	3.03	723.03	0.87	30.9	10.1	2397	3519	0.17
400	683	733.0	724.43	2.67	723.40	1.03	31.4	7.6	2413	3253	0.25
420	683	733.0	725.02	2.94	724.06	0.96	32.0	7.0	2430	3206	0.25
440	683	734.0	725.61	2.96	724.66	0.95	32.6	7.4	2448	3269	0.23
460	683	735.0	726.22	3.05	725.29	0.93	33.2	7.8	2466	3330	0.21
480	683	736.0	726.79	2.85	725.90	0.88	33.8	8.2	2484	3395	0.19
500	683	736.5	728.00	6.07	727.55	0.45	35.0	7.5	2520	3353	0.10
520	683	736.5	728.74	3.73	727.79	0.95	35.7	6.8	2542	3292	0.24
540	683	737.0	728.44	-1.52	727.75	0.69	35.4	7.6	2533	3373	0.16
560	690	737.5	729.00	2.82	728.23	0.77	29.0	7.5	2340	3172	0.20
580	690	737.0	729.53	2.62	728.93	0.59	29.5	6.5	2356	3074	0.17
600	690	736.0	730.06	2.70	729.30	0.77	30.1	4.9	2372	2920	0.28

Estimation of Modified Compression Index											
Southern East-West Profiler											
September 2005 Monitoring Event											
		8/30/05	Baseline		9/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.25	-					
40			724.91	-28.32	723.44	1.48					
60	668	734.0	721.83	-15.57	720.41	1.43	43.8	11.2	2785	4024	0.20
80	668	740.0	721.14	-3.50	719.62	1.52	43.1	17.9	2764	4747	0.15
100	668	745.0	721.42	1.44	719.57	1.85	43.4	22.6	2773	5279	0.15
120	668	750.0	721.81	1.93	719.80	2.01	43.8	27.2	2784	5802	0.14
140	668	755.0	722.17	1.78	720.29	1.88	44.2	31.8	2795	6329	0.12
160	668	761.0	722.60	2.19	720.57	2.03	44.6	37.4	2808	6959	0.12
180	668	761.5	722.81	1.05	721.08	1.74	44.8	37.7	2814	6998	0.10
200	668	756.5	722.99	0.86	721.33	1.65	45.0	32.5	2820	6429	0.10
220	668	752.5	722.97	-0.06	721.51	1.47	45.0	28.5	2819	5986	0.10
240	683	748.5	722.80	-0.87	721.49	1.31	29.8	24.7	2364	5106	0.13
260	683	744.5	722.62	-0.87	721.45	1.17	29.6	20.9	2359	4676	0.13
280	683	741.0	722.60	-0.15	721.43	1.17	29.6	17.4	2358	4290	0.15
300	683	738.0	723.37	3.85	722.42	0.94	30.4	13.6	2381	3894	0.15
320	683	736.0	723.22	-0.71	722.11	1.11	30.2	11.8	2377	3684	0.19
340	683	733.5	722.94	-1.42	722.06	0.88	29.9	9.6	2368	3429	0.18
360	683	734.0	723.29	1.74	722.48	0.81	30.3	9.7	2379	3457	0.16
380	683	735.0	723.89	3.03	723.04	0.86	30.9	10.1	2397	3519	0.17
400	683	733.0	724.43	2.67	723.67	0.76	31.4	7.6	2413	3253	0.19
420	683	733.0	725.02	2.94	724.31	0.70	32.0	7.0	2430	3206	0.18
440	683	734.0	725.61	2.96	724.97	0.64	32.6	7.4	2448	3269	0.16
460	683	735.0	726.22	3.05	725.61	0.61	33.2	7.8	2466	3330	0.14
480	683	736.0	726.79	2.85	726.25	0.54	33.8	8.2	2484	3395	0.12
500	683	736.5	728.00	6.07	727.80	0.20	35.0	7.5	2520	3353	0.05
520	683	736.5	728.74	3.73	727.99	0.75	35.7	6.8	2542	3292	0.19
540	683	737.0	728.44	-1.52	727.99	0.45	35.4	7.6	2533	3373	0.10
560	690	737.5	729.00	2.82	728.60	0.40	29.0	7.5	2340	3172	0.11
580	690	737.0	729.53	2.62	729.18	0.35	29.5	6.5	2356	3074	0.10
600	690	736.0	730.06	2.70	729.63	0.43	30.1	4.9	2372	2920	0.16

Estimation of Modified Compression Index

Southern East-West Profiler

95% Confidence Upper Limit - September 2005 Monitoring Event

		8/30/05	Baseline		9/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.39	-					
40			724.91	-28.32	723.62	1.29					
60	668	734.0	721.83	-15.57	720.47	1.37	43.8	11.2	2785	4024	0.20
80	668	740.0	721.14	-3.50	719.72	1.42	43.1	17.9	2764	4747	0.14
100	668	745.0	721.42	1.44	719.66	1.76	43.4	22.6	2773	5279	0.15
120	668	750.0	721.81	1.93	719.87	1.94	43.8	27.2	2784	5802	0.14
140	668	755.0	722.17	1.78	720.55	1.61	44.2	31.8	2795	6329	0.10
160	668	761.0	722.60	2.19	720.61	1.99	44.6	37.4	2808	6959	0.11
180	668	761.5	722.81	1.05	721.15	1.67	44.8	37.7	2814	6998	0.09
200	668	756.5	722.99	0.86	721.40	1.58	45.0	32.5	2820	6429	0.10
220	668	752.5	722.97	-0.06	721.56	1.41	45.0	28.5	2819	5986	0.10
240	683	748.5	722.80	-0.87	721.57	1.23	29.8	24.7	2364	5106	0.12
260	683	744.5	722.62	-0.87	721.52	1.11	29.6	20.9	2359	4676	0.13
280	683	741.0	722.60	-0.15	721.50	1.10	29.6	17.4	2358	4290	0.14
300	683	738.0	723.37	3.85	722.51	0.86	30.4	13.6	2381	3894	0.13
320	683	736.0	723.22	-0.71	722.17	1.05	30.2	11.8	2377	3684	0.18
340	683	733.5	722.94	-1.42	722.12	0.82	29.9	9.6	2368	3429	0.17
360	683	734.0	723.29	1.74	722.54	0.75	30.3	9.7	2379	3457	0.15
380	683	735.0	723.89	3.03	723.13	0.76	30.9	10.1	2397	3519	0.15
400	683	733.0	724.43	2.67	723.73	0.70	31.4	7.6	2413	3253	0.17
420	683	733.0	725.02	2.94	724.38	0.64	32.0	7.0	2430	3206	0.17
440	683	734.0	725.61	2.96	725.05	0.55	32.6	7.4	2448	3269	0.14
460	683	735.0	726.22	3.05	725.66	0.55	33.2	7.8	2466	3330	0.13
480	683	736.0	726.79	2.85	726.31	0.48	33.8	8.2	2484	3395	0.10
500	683	736.5	728.00	6.07	727.88	0.12	35.0	7.5	2520	3353	0.03
520	683	736.5	728.74	3.73	728.05	0.70	35.7	6.8	2542	3292	0.17
540	683	737.0	728.44	-1.52	728.05	0.39	35.4	7.6	2533	3373	0.09
560	690	737.5	729.00	2.82	728.63	0.37	29.0	7.5	2340	3172	0.10
580	690	737.0	729.53	2.62	729.23	0.29	29.5	6.5	2356	3074	0.09
600	690	736.0	730.06	2.70	729.76	0.31	30.1	4.9	2372	2920	0.11

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit - September 2005 Monitoring Event											
		8/30/05	Baseline		9/20/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.11	-					
40			724.91	-28.32	723.25	1.66					
60	668	734.0	721.83	-15.57	720.35	1.49	43.8	11.2	2785	4024	0.21
80	668	740.0	721.14	-3.50	719.52	1.62	43.1	17.9	2764	4747	0.16
100	668	745.0	721.42	1.44	719.49	1.94	43.4	22.6	2773	5279	0.16
120	668	750.0	721.81	1.93	719.74	2.07	43.8	27.2	2784	5802	0.15
140	668	755.0	722.17	1.78	720.03	2.14	44.2	31.8	2795	6329	0.14
160	668	761.0	722.60	2.19	720.53	2.07	44.6	37.4	2808	6959	0.12
180	668	761.5	722.81	1.05	721.01	1.81	44.8	37.7	2814	6998	0.10
200	668	756.5	722.99	0.86	721.27	1.72	45.0	32.5	2820	6429	0.11
220	668	752.5	722.97	-0.06	721.45	1.52	45.0	28.5	2819	5986	0.10
240	683	748.5	722.80	-0.87	721.40	1.40	29.8	24.7	2364	5106	0.14
260	683	744.5	722.62	-0.87	721.39	1.24	29.6	20.9	2359	4676	0.14
280	683	741.0	722.60	-0.15	721.36	1.24	29.6	17.4	2358	4290	0.16
300	683	738.0	723.37	3.85	722.34	1.03	30.4	13.6	2381	3894	0.16
320	683	736.0	723.22	-0.71	722.06	1.17	30.2	11.8	2377	3684	0.20
340	683	733.5	722.94	-1.42	722.01	0.93	29.9	9.6	2368	3429	0.19
360	683	734.0	723.29	1.74	722.41	0.88	30.3	9.7	2379	3457	0.18
380	683	735.0	723.89	3.03	722.94	0.95	30.9	10.1	2397	3519	0.18
400	683	733.0	724.43	2.67	723.61	0.82	31.4	7.6	2413	3253	0.20
420	683	733.0	725.02	2.94	724.24	0.77	32.0	7.0	2430	3206	0.20
440	683	734.0	725.61	2.96	724.88	0.73	32.6	7.4	2448	3269	0.18
460	683	735.0	726.22	3.05	725.56	0.66	33.2	7.8	2466	3330	0.15
480	683	736.0	726.79	2.85	726.19	0.60	33.8	8.2	2484	3395	0.13
500	683	736.5	728.00	6.07	727.72	0.28	35.0	7.5	2520	3353	0.06
520	683	736.5	728.74	3.73	727.94	0.80	35.7	6.8	2542	3292	0.20
540	683	737.0	728.44	-1.52	727.93	0.51	35.4	7.6	2533	3373	0.11
560	690	737.5	729.00	2.82	728.57	0.43	29.0	7.5	2340	3172	0.11
580	690	737.0	729.53	2.62	729.13	0.40	29.5	6.5	2356	3074	0.12
600	690	736.0	730.06	2.70	729.51	0.56	30.1	4.9	2372	2920	0.21

Estimation of Modified Compression Index
Southern East-West Profiler
December 2005 Monitoring Event

		1/3/06	Baseline		12/22/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.08	-					
40			724.91	-28.32	723.41	1.51					
60	668	735.5	721.83	-15.57	720.42	1.41	43.8	12.7	2785	4191	0.18
80	668	742.3	721.14	-3.50	719.40	1.74	43.1	20.2	2764	5005	0.16
100	668	748.4	721.42	1.44	719.66	1.76	43.4	25.9	2773	5653	0.13
120	668	750.2	721.81	1.93	719.70	2.11	43.8	27.4	2784	5823	0.15
140	668	755.5	722.17	1.78	720.08	2.09	44.2	32.4	2795	6388	0.13
160	668	758.0	722.60	2.19	720.47	2.14	44.6	34.4	2808	6626	0.13
180	668	758.0	722.81	1.05	721.15	1.67	44.8	34.2	2814	6609	0.10
200	668	757.7	722.99	0.86	721.23	1.76	45.0	33.7	2820	6556	0.11
220	668	753.5	722.97	-0.06	721.53	1.44	45.0	29.5	2819	6098	0.10
240	683	748.6	722.80	-0.87	721.38	1.42	29.8	24.8	2364	5117	0.14
260	683	744.5	722.62	-0.87	721.35	1.28	29.6	20.8	2359	4673	0.15
280	683	740.2	722.60	-0.15	721.67	0.93	29.6	16.6	2358	4197	0.13
300	683	735.7	723.37	3.86	722.43	0.94	30.4	11.4	2381	3043	0.17
320	683	735.1	723.22	-0.71	722.44	0.78	30.2	10.9	2377	3587	0.15
340	683	734.0	722.94	-1.42	722.12	0.82	29.9	10.1	2368	3485	0.16
360	683	734.0	723.29	1.74	722.81	0.48	30.3	9.7	2379	3457	0.10
380	683	734.2	723.89	3.03	723.03	0.86	30.9	9.3	2397	3425	0.18
400	683	734.4	724.43	2.67	723.64	0.78	31.4	8.9	2413	3405	0.17
420	683	735.6	725.02	2.94	724.60	0.42	32.0	9.5	2430	3490	0.08
440	683	736.7	725.61	2.96	725.26	0.34	32.6	10.1	2448	3571	0.06
460	683	737.5	726.22	3.05	725.97	0.25	33.2	10.3	2466	3609	0.05
480	683	738.2	726.79	2.85	726.56	0.23	33.8	10.4	2484	3637	0.04
500	683	738.8	728.00	6.07	728.21	-0.21	35.0	9.8	2520	3607	-0.04
520	683	739.0	728.74	3.73	728.30	0.45	35.7	9.2	2542	3565	0.09
540	683	739.2	728.44	-1.52	728.12	0.31	35.4	9.8	2533	3618	0.06
560	690	739.3	729.00	2.82	728.73	0.27	29.0	9.3	2340	3372	0.06
580	690	739.1	729.53	2.62	729.33	0.19	29.5	8.6	2356	3305	0.04
600	691	738.9	730.06	2.70	729.79	0.27	29.1	7.8	2342	3207	0.07
620	692	738.3	730.47	2.01	730.33	0.14	28.5	6.8	2324	3078	0.04
640	693	737.7	730.90	2.15	731.20	-0.31	27.9	5.8	2307	2950	-0.10
660	693	738.6	731.69	3.95	732.00	-0.31	28.7	5.9	2331	2987	-0.10
680	692	739.3	732.23	2.75	732.25	-0.02	30.2	6.1	2377	3054	-0.01
700	691	739.5	732.44	1.03	732.36	0.08	31.4	6.0	2413	3083	0.02
720	690	738.5	731.73	-3.53	730.74	1.00	31.7	5.8	2422	3063	0.31
740	689	738.1	730.57	-5.84	729.78	0.79	31.6	6.5	2417	3138	0.22
760	689	737.5	729.90	-3.34	729.31	0.59	30.9	6.6	2397	3125	0.17
780	689	737.3	729.39	-2.53	728.75	0.64	30.4	6.9	2382	3146	0.18
800	689	737.1	728.81	-2.93	728.34	0.47	29.8	7.2	2364	3168	0.12
820	689	736.7	728.36	-2.26	727.81	0.55	29.4	7.4	2351	3170	0.14
840	689	736.4	727.68	-3.39	727.13	0.55	28.7	7.7	2330	3186	0.14
860	690	735.9	727.18	-2.51	726.65	0.53	27.7	7.8	2300	3162	0.14
880	690	735.1	726.73	-2.23	726.15	0.58	27.2	7.4	2287	3106	0.16
900	690	734.5	726.52	-1.08	726.77	-0.25	26.5	7.0	2265	3041	-0.07
920	690	734.8	726.58	0.32	724.95	1.63	26.6	7.2	2267	3069	0.47
940	688	736.0	725.20	-6.93	724.29	0.91	27.2	9.8	2286	3374	0.20
960	686	737.3	724.78	-2.06	724.40	0.38	29.3	11.5	2349	3627	0.07
980	683	737.8	724.82	0.17	724.43	0.39	31.8	12.0	2425	3754	0.06
1000	681	740.7	724.94	0.60	724.44	0.50	33.9	14.8	2488	4131	0.07
1020	681	744.2	725.01	0.37	724.47	0.54	34.0	18.2	2490	4509	0.06
1040	680	743.7	725.02	0.03	724.55	0.47	35.0	17.7	2521	4483	0.05
1060	679	740.4	724.88	-0.69	724.13	0.76	35.9	14.6	2546	4162	0.10
1080	679	739.6	724.73	-0.79	723.95	0.78	35.7	13.9	2542	4086	0.11
1100	679	740.0	724.82	0.47	724.08	0.74	36.3	14.2	2560	4134	0.10
1120	679	740.0	725.05	1.13	725.47	-0.43	36.5	14.0	2566	4115	-0.06
1140	678	740.0	726.41	6.82	724.86	1.55	38.4	12.6	2622	4020	0.22
1160	678	740.0	725.29	-5.58	724.20	1.10	37.3	13.7	2589	4110	0.15
1180	678	737.5	724.85	-2.22	724.21	0.64	36.8	11.6	2575	3865	0.10
1200	678	735.0	724.63	-1.10	724.45	0.18	36.6	9.3	2569	3605	0.03
1220	678	732.2	725.14	2.57	724.81	0.33	37.1	6.0	2584	3252	0.09
1240	678	731.6	724.95	-0.98	724.04	0.91	36.9	5.6	2578	3202	0.26
1260	678	730.6	724.00	-4.76	723.70	0.30	36.5	5.6	2565	3188	0.09
1280	678	729.2	723.64	-1.79	723.24	0.39	36.1	4.6	2554	3059	0.14
1300	677	726.9	723.23	-2.06	723.17	0.05	36.2	2.7	2557	2856	0.03

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - December 2005 Monitoring Event											
		1/3/06	Baseline		12/22/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.22						
40			724.91	-28.32	723.59	1.32					
60	668	735.5	721.83	-15.57	720.48	1.35	43.8	12.7	2785	4191	0.17
80	668	742.3	721.14	-3.50	719.49	1.64	43.1	20.2	2764	5005	0.15
100	668	748.4	721.42	1.44	719.75	1.67	43.4	25.9	2773	5653	0.12
120	668	750.2	721.81	1.93	719.76	2.05	43.8	27.4	2784	5823	0.15
140	668	755.5	722.17	1.78	720.34	1.83	44.2	32.4	2795	6388	0.12
160	668	758.0	722.60	2.19	720.51	2.10	44.6	34.4	2808	6826	0.13
180	668	758.0	722.81	1.05	721.22	1.60	44.8	34.2	2814	6609	0.10
200	668	757.7	722.99	0.86	721.30	1.69	45.0	33.7	2820	6556	0.10
220	668	753.5	722.97	-0.06	721.59	1.38	45.0	29.5	2819	6098	0.09
240	683	748.6	722.80	-0.87	721.47	1.33	29.8	24.8	2364	5117	0.13
260	683	744.5	722.62	-0.87	721.41	1.21	29.6	20.8	2359	4673	0.14
280	683	740.2	722.60	-0.15	721.74	0.86	29.6	16.6	2358	4197	0.12
300	683	735.7	723.37	3.85	722.51	0.85	30.4	11.4	2381	3643	0.15
320	683	735.1	723.22	-0.71	722.50	0.73	30.2	10.9	2377	3587	0.13
340	683	734.0	722.94	-1.42	722.17	0.77	29.9	10.1	2368	3485	0.15
360	683	734.0	723.29	1.74	722.87	0.41	30.3	9.7	2379	3457	0.08
380	683	734.2	723.89	3.03	723.13	0.77	30.9	9.3	2397	3425	0.16
400	683	734.4	724.43	2.67	723.70	0.72	31.4	8.9	2413	3405	0.15
420	683	735.6	725.02	2.94	724.66	0.35	32.0	9.5	2430	3490	0.07
440	683	736.7	725.61	2.96	725.35	0.26	32.6	10.1	2448	3571	0.05
460	683	737.5	726.22	3.05	726.02	0.20	33.2	10.3	2466	3609	0.04
480	683	738.2	726.79	2.85	726.62	0.17	33.8	10.4	2484	3637	0.03
500	683	738.8	728.00	6.07	728.29	-0.29	35.0	9.8	2520	3607	-0.05
520	683	739.0	728.74	3.73	728.35	0.39	35.7	9.2	2542	3565	0.07
540	683	739.2	728.44	-1.52	728.18	0.26	35.4	9.8	2533	3618	0.05
560	690	739.3	729.00	2.82	728.76	0.24	29.0	9.3	2340	3372	0.05
580	690	739.1	729.53	2.62	729.38	0.14	29.5	8.6	2356	3305	0.03
600	691	738.9	730.06	2.70	729.92	0.15	29.1	7.8	2342	3207	0.04
620	692	738.3	730.47	2.01	730.41	0.06	28.5	6.8	2324	3078	0.02
640	693	737.7	730.90	2.15	731.32	-0.42	27.9	5.8	2307	2950	-0.14
660	693	738.6	731.69	3.95	732.07	-0.38	28.7	5.9	2331	2987	-0.12
680	692	739.3	732.23	2.75	732.30	-0.07	30.2	6.1	2377	3054	-0.02
700	691	739.5	732.44	1.03	732.40	0.04	31.4	6.0	2413	3083	0.01
720	690	738.5	731.73	-3.53	730.80	0.94	31.7	5.8	2422	3063	0.29
740	689	738.1	730.57	-5.84	729.84	0.73	31.6	6.5	2417	3138	0.20
760	689	737.5	729.90	-3.34	729.37	0.53	30.9	6.6	2397	3125	0.15
780	689	737.3	729.39	-2.53	728.79	0.60	30.4	6.9	2382	3146	0.16
800	689	737.1	728.81	-2.93	728.40	0.41	29.8	7.2	2364	3168	0.11
820	689	736.7	728.36	-2.26	727.91	0.45	29.4	7.4	2351	3170	0.12
840	689	736.4	727.68	-3.39	727.18	0.50	28.7	7.7	2330	3186	0.13
860	690	735.9	727.18	-2.51	726.70	0.47	27.7	7.8	2300	3162	0.12
880	690	735.1	726.73	-2.23	726.27	0.46	27.2	7.4	2287	3106	0.13
900	690	734.5	726.52	-1.08	726.88	-0.36	26.5	7.0	2265	3041	-0.11
920	690	734.8	726.58	0.32	725.02	1.55	26.6	7.2	2267	3069	0.45
940	688	736.0	725.20	-6.93	724.39	0.81	27.2	9.8	2286	3374	0.18
960	686	737.3	724.78	-2.06	724.46	0.32	29.3	11.5	2349	3627	0.06
980	683	737.8	724.82	0.17	724.55	0.27	31.8	12.0	2425	3754	0.05
1000	681	740.7	724.94	0.60	724.51	0.43	33.9	14.8	2488	4131	0.06
1020	681	744.2	725.01	0.37	724.61	0.40	34.0	18.2	2490	4509	0.05
1040	680	743.7	725.02	0.03	724.66	0.36	35.0	17.7	2521	4483	0.04
1060	679	740.4	724.88	-0.69	724.19	0.69	35.9	14.6	2546	4162	0.09
1080	679	739.6	724.73	-0.79	724.02	0.71	36.7	13.9	2542	4000	0.10
1100	679	740.0	724.82	0.47	724.21	0.61	36.3	14.2	2560	4134	0.08
1120	679	740.0	725.05	1.13	725.54	-0.49	36.5	14.0	2566	4115	-0.07
1140	678	740.0	726.41	6.82	724.99	1.42	38.4	12.6	2622	4020	0.20
1160	678	740.0	725.29	-5.58	724.31	0.98	37.3	13.7	2589	4110	0.13
1180	678	737.5	724.85	-2.22	724.34	0.51	36.8	11.6	2575	3865	0.08
1200	678	735.0	724.63	-1.10	724.58	0.05	36.6	9.3	2569	3605	0.01
1220	678	732.2	725.14	2.57	724.89	0.25	37.1	6.0	2584	3252	0.07
1240	678	731.6	724.95	-0.98	724.16	0.79	36.9	5.6	2578	3202	0.23
1260	678	730.6	724.00	-4.76	723.82	0.18	36.5	5.6	2565	3188	0.05
1280	678	729.2	723.64	-1.79	723.36	0.28	36.1	4.6	2554	3059	0.10
1300	677	726.9	723.23	-2.06	723.32	-0.09	36.2	2.7	2557	2856	-0.05

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit - December 2005 Monitoring Event											
		1/3/06	Baseline		12/22/05				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		728.94						
40			724.91	-28.32	723.22	1.69					
60	668	735.5	721.83	-15.57	720.36	1.48	43.8	12.7	2785	4191	0.19
80	668	742.3	721.14	-3.50	719.30	1.84	43.1	20.2	2764	5005	0.17
100	668	748.4	721.42	1.44	719.58	1.85	43.4	25.9	2773	5653	0.14
120	668	750.2	721.81	1.93	719.64	2.18	43.8	27.4	2784	5823	0.15
140	668	755.5	722.17	1.78	719.81	2.35	44.2	32.4	2795	6386	0.15
160	668	758.0	722.60	2.19	720.43	2.18	44.6	34.4	2808	6626	0.13
180	668	758.0	722.81	1.05	721.08	1.74	44.8	34.2	2814	6609	0.10
200	668	757.7	722.99	0.86	721.16	1.82	45.0	33.7	2820	6556	0.11
220	668	753.5	722.97	-0.06	721.48	1.50	45.0	29.5	2819	6098	0.10
240	683	748.6	722.80	-0.87	721.30	1.50	29.8	24.8	2364	5117	0.15
260	683	744.6	722.62	0.87	721.28	1.34	29.6	20.8	2359	4673	0.15
280	683	740.2	722.60	-0.15	721.60	1.00	29.6	16.6	2358	4197	0.13
300	683	735.7	723.37	3.85	722.34	1.02	30.4	11.4	2381	3643	0.18
320	683	735.1	723.22	-0.71	722.38	0.84	30.2	10.9	2377	3587	0.16
340	683	734.0	722.94	-1.42	722.07	0.87	29.9	10.1	2368	3485	0.17
360	683	734.0	723.29	1.74	722.75	0.54	30.3	9.7	2379	3457	0.11
380	683	734.2	723.89	3.03	722.94	0.95	30.9	9.3	2397	3425	0.20
400	683	734.4	724.43	2.67	723.58	0.84	31.4	8.9	2413	3405	0.18
420	683	735.6	725.02	2.94	724.53	0.49	32.0	9.5	2430	3490	0.10
440	683	736.7	725.61	2.96	725.18	0.43	32.6	10.1	2448	3571	0.08
460	683	737.5	726.22	3.05	725.91	0.30	33.2	10.3	2466	3609	0.06
480	683	738.2	726.79	2.85	726.50	0.29	33.8	10.4	2484	3637	0.05
500	683	738.8	728.00	6.07	728.13	-0.13	35.0	9.8	2520	3607	-0.02
520	683	739.0	728.74	3.73	728.24	0.50	35.7	9.2	2542	3565	0.10
540	683	739.2	728.44	-1.52	728.07	0.37	35.4	9.8	2533	3618	0.07
560	690	739.3	729.00	2.82	728.70	0.31	29.0	9.3	2340	3372	0.07
580	690	739.1	729.53	2.62	729.28	0.25	29.5	8.6	2356	3305	0.06
600	691	738.9	730.06	2.70	729.67	0.40	29.1	7.8	2342	3207	0.10
620	692	738.3	730.47	2.01	730.25	0.21	28.5	6.8	2324	3078	0.08
640	693	737.7	730.90	2.15	731.09	-0.19	27.9	5.8	2307	2950	-0.06
660	693	738.6	731.69	3.95	731.93	-0.24	28.7	5.9	2331	2987	-0.08
680	692	739.3	732.23	2.75	732.20	0.04	30.2	6.1	2377	3054	0.01
700	691	739.5	732.44	1.03	732.32	0.12	31.4	6.0	2413	3083	0.04
720	690	738.5	731.73	-3.53	730.68	1.06	31.7	5.8	2422	3063	0.33
740	689	738.1	730.57	-5.84	729.73	0.84	31.6	6.5	2417	3138	0.24
760	689	737.5	729.90	-3.34	729.25	0.65	30.9	6.6	2397	3125	0.18
780	689	737.3	729.39	-2.53	728.71	0.69	30.4	6.9	2382	3146	0.19
800	689	737.1	728.81	-2.93	728.28	0.53	29.8	7.2	2364	3168	0.14
820	689	736.7	728.36	-2.26	727.70	0.66	29.4	7.4	2351	3170	0.17
840	689	736.4	727.68	-3.39	727.08	0.60	28.7	7.7	2330	3186	0.15
860	690	735.9	727.18	-2.51	726.59	0.59	27.7	7.8	2300	3162	0.15
880	690	735.1	726.73	-2.23	726.03	0.70	27.2	7.4	2287	3106	0.19
900	690	734.5	726.52	-1.08	726.66	-0.14	26.5	7.0	2265	3041	-0.04
920	690	734.8	726.58	0.32	724.88	1.70	26.6	7.2	2267	3089	0.49
940	688	736.0	725.20	-6.93	724.19	1.00	27.2	9.8	2286	3374	0.22
960	686	737.3	724.78	-2.06	724.35	0.44	29.3	11.5	2349	3627	0.08
980	683	737.8	724.82	0.17	724.32	0.50	31.8	12.0	2425	3754	0.08
1000	681	740.7	724.94	0.60	724.37	0.57	33.9	14.8	2488	4131	0.08
1020	681	744.2	725.01	0.37	724.34	0.68	34.0	18.2	2490	4509	0.08
1040	680	743.7	725.02	0.03	724.43	0.59	35.0	17.7	2521	4483	0.07
1060	679	740.4	724.88	-0.69	724.07	0.82	35.9	14.6	2546	4162	0.11
1080	679	739.6	724.73	-0.79	723.88	0.84	35.7	13.9	2542	4086	0.11
1100	679	740.0	724.82	0.47	723.95	0.87	36.3	14.2	2560	4134	0.12
1120	679	740.0	725.05	1.13	725.41	-0.36	36.5	14.0	2586	4115	-0.05
1140	678	740.0	726.41	6.82	724.73	1.68	38.4	12.6	2622	4020	0.24
1160	678	740.0	725.29	-5.58	724.09	1.21	37.3	13.7	2589	4110	0.16
1180	678	737.5	724.85	-2.22	724.07	0.78	36.8	11.6	2575	3865	0.12
1200	678	735.0	724.63	-1.10	724.32	0.31	36.6	9.3	2569	3605	0.06
1220	678	732.2	725.14	2.57	724.73	0.41	37.1	6.0	2584	3252	0.11
1240	678	731.6	724.95	-0.98	723.92	1.03	36.9	5.6	2578	3202	0.30
1260	678	730.6	724.00	-4.76	723.58	0.42	36.5	5.6	2565	3188	0.12
1280	678	729.2	723.64	-1.79	723.13	0.51	38.1	4.6	2554	3059	0.18
1300	677	726.9	723.23	-2.06	723.03	0.20	36.2	2.7	2557	2856	0.11

Estimation of Modified Compression Index											
Southern East-West Profiler											
March 2006 Monitoring Event											
		3/30/08	Baseline		4/10/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.36	-					
40	668	729.7	724.91	-28.32	723.62	1.30	46.9	3.8	2877	3298	0.47
60	668	735.5	721.83	-15.57	720.70	1.14	43.8	12.7	2785	4191	0.15
80	668	742.3	721.14	-3.50	719.87	1.27	43.1	20.2	2764	5005	0.11
100	668	749.3	721.42	1.44	719.31	2.11	43.4	26.9	2773	5755	0.15
120	668	750.2	721.81	1.93	719.60	2.21	43.8	27.4	2784	5823	0.16
140	668	755.5	722.17	1.78	720.53	1.64	44.2	32.4	2795	6388	0.10
160	668	760.1	722.60	2.19	720.76	1.84	44.6	36.5	2808	6859	0.11
180	668	761.4	722.81	1.05	721.24	1.58	44.8	37.6	2814	6983	0.09
200	668	757.7	722.99	0.86	721.56	1.43	45.0	33.7	2820	6556	0.09
220	668	753.5	722.97	-0.06	721.89	1.09	45.0	29.5	2819	6098	0.07
240	683	748.6	722.80	-0.87	721.77	1.03	29.8	24.8	2364	5117	0.10
260	683	744.5	722.62	-0.87	721.64	0.98	29.6	20.8	2359	4673	0.11
280	683	740.2	722.60	-0.15	721.48	1.11	29.6	16.6	2358	4197	0.15
300	683	735.7	723.37	3.85	722.39	0.97	30.4	11.4	2381	3643	0.17
320	683	735.1	723.22	-0.71	722.39	0.83	30.2	10.9	2377	3587	0.15
340	683	734.0	722.94	-1.42	721.65	1.29	29.9	10.1	2368	3485	0.26
360	683	734.0	723.29	1.74	722.17	1.12	30.3	9.7	2379	3457	0.23
380	683	734.2	723.89	3.03	723.04	0.86	30.9	9.3	2397	3425	0.18
400	683	734.4	724.43	2.67	723.83	0.60	31.4	8.9	2413	3405	0.13
420	683	736.9	725.02	2.94	724.38	0.64	32.0	10.8	2430	3634	0.11
440	683	738.9	725.61	2.96	724.68	0.93	32.6	12.2	2448	3807	0.15
460	683	740.5	726.22	3.05	725.42	0.80	33.2	13.3	2466	3940	0.12
480	683	740.7	726.79	2.85	726.43	0.35	33.8	12.9	2484	3917	0.05
500	683	741.5	728.00	6.07	728.14	-0.14	35.0	12.5	2520	3910	-0.02
520	683	741.5	728.74	3.73	728.01	0.73	35.7	11.8	2542	3850	0.11
540	683	741.6	728.44	-1.52	728.62	-0.18	35.4	12.2	2533	3885	-0.03
560	690	742.1	729.00	2.82	729.19	-0.19	29.0	12.1	2340	3681	-0.03
580	690	741.9	729.53	2.62	729.68	-0.15	29.5	11.4	2356	3618	-0.03
600	691	739.0	730.06	2.70	730.04	0.02	29.1	7.9	2342	3217	0.01
620	692	738.3	730.47	2.01	730.74	-0.28	28.5	6.8	2324	3078	-0.08
640	693	737.7	730.90	2.15	731.17	-0.28	27.9	5.8	2307	2950	-0.09
660	693	738.6	731.69	3.95	732.24	-0.55	28.7	5.9	2331	2987	-0.18
680	692	739.3	732.23	2.75	732.48	-0.25	30.2	6.1	2377	3054	-0.08
700	691	739.5	732.44	1.03	732.46	-0.02	31.4	6.0	2413	3081	-0.01
720	690	738.5	731.73	-3.53	730.91	0.83	31.7	5.8	2422	3063	0.25
740	689	738.1	730.57	-5.84	729.65	0.92	31.6	6.5	2417	3138	0.26
760	689	737.5	729.90	-3.34	729.48	0.42	30.9	6.6	2397	3125	0.12
780	689	737.3	729.39	-2.53	728.89	0.50	30.4	6.9	2382	3146	0.14
800	689	737.1	728.81	-2.93	728.29	0.52	29.8	7.2	2364	3168	0.14
820	889	736.7	728.36	-2.26	727.56	0.80	29.4	7.4	2351	3170	0.21
840	689	736.4	727.68	-3.39	727.19	0.49	28.7	7.7	2330	3186	0.13
860	690	735.9	727.18	-2.51	726.65	0.53	27.7	7.8	2300	3162	0.14
880	690	735.1	726.73	-2.23	726.32	0.42	27.2	7.4	2287	3106	0.11
900	690	734.7	726.52	-1.08	726.19	0.33	26.5	7.2	2265	3060	0.09
920	690	737.7	726.58	0.32	725.46	1.12	26.6	10.1	2267	3389	0.24
940	688	739.2	725.20	-6.93	724.68	0.52	27.2	13.0	2286	3730	0.09
960	686	740.2	724.78	-2.06	724.36	0.42	29.3	14.4	2349	3944	0.06
980	683	742.1	724.82	0.17	724.46	0.35	31.8	16.3	2425	4228	0.05
1000	681	744.6	724.94	0.60	724.42	0.52	33.9	18.7	2488	4561	0.06
1020	681	747.2	725.01	0.37	724.19	0.83	34.0	21.2	2490	4845	0.08
1040	680	749.9	725.02	0.03	723.90	1.12	35.0	23.8	2521	5167	0.10
1060	679	752.6	724.88	-0.69	723.76	1.12	35.9	26.8	2546	5517	0.09
1080	679	754.3	724.73	-0.79	723.38	1.34	35.7	28.6	2542	5712	0.11
1100	679	754.3	724.82	0.47	723.44	1.38	36.3	28.5	2580	5718	0.11
1120	679	754.0	725.05	1.13	724.45	0.60	36.5	28.0	2566	5671	0.05
1140	678	753.7	726.41	6.82	724.24	2.17	38.4	26.3	2622	5536	0.17
1160	678	753.4	725.29	-5.58	723.43	1.87	37.3	27.1	2589	5602	0.15
1180	678	753.1	724.85	-2.22	723.08	1.77	36.8	27.3	2575	5604	0.14
1200	678	752.8	724.63	-1.10	723.52	1.11	36.6	27.1	2569	5580	0.09
1220	678	752.2	725.14	2.57	723.90	1.24	37.1	26.1	2584	5480	0.10
1240	678	749.4	724.95	-0.98	723.25	1.70	36.9	23.4	2578	5176	0.15
1260	678	744.6	724.00	-4.76	722.93	1.07	36.5	19.6	2565	4740	0.11
1280	678	739.2	723.64	-1.79	722.78	0.86	36.1	14.6	2554	4175	0.11
1300	677	733.3	723.23	-2.06	723.17	0.06	36.2	9.1	2557	3567	0.01

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - March 2006 Monitoring Event											
		3/30/06	Baseline		4/10/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.50						
40	668	729.7	724.91	-28.32	723.80	1.11	46.9	3.8	2877	3298	0.40
60	668	735.5	721.83	-15.57	720.76	1.08	43.8	12.7	2785	4191	0.14
80	668	742.3	721.14	-3.50	719.97	1.17	43.1	20.2	2764	5005	0.11
100	668	749.3	721.42	1.44	719.40	2.03	43.4	26.9	2773	5755	0.15
120	668	750.2	721.81	1.93	719.66	2.15	43.8	27.4	2784	5823	0.15
140	668	755.5	722.17	1.78	720.79	1.38	44.2	32.4	2795	6388	0.09
160	668	760.1	722.60	2.19	720.80	1.80	44.6	36.5	2808	6859	0.10
180	668	761.4	722.81	1.05	721.31	1.51	44.8	37.6	2814	6983	0.09
200	668	757.7	722.99	0.86	721.62	1.38	45.0	33.7	2820	6556	0.08
220	668	753.5	722.97	-0.06	721.94	1.03	45.0	29.5	2819	6098	0.07
240	683	748.6	722.80	-0.87	721.85	0.94	29.8	24.8	2364	5117	0.09
260	683	744.5	722.62	-0.87	721.71	0.92	29.6	20.8	2359	4673	0.10
280	683	740.2	722.60	-0.15	721.55	1.04	29.6	16.6	2358	4197	0.14
300	003	735.7	723.07	3.05	722.48	0.80	30.4	11.4	2381	3643	0.16
320	683	735.1	723.22	-0.71	722.45	0.77	30.2	10.9	2377	3587	0.14
340	683	734.0	722.94	-1.42	721.70	1.24	29.9	10.1	2368	3485	0.25
360	683	734.0	723.29	1.74	722.24	1.05	30.3	9.7	2379	3457	0.21
380	683	734.2	723.89	3.03	723.13	0.76	30.9	9.3	2397	3425	0.16
400	683	734.4	724.43	2.67	723.89	0.54	31.4	8.9	2413	3405	0.11
420	683	736.9	725.02	2.94	724.44	0.57	32.0	10.8	2430	3834	0.10
440	683	738.9	725.61	2.96	724.77	0.84	32.6	12.2	2448	3807	0.13
460	683	740.5	726.22	3.05	725.47	0.75	33.2	13.3	2466	3940	0.11
480	683	740.7	726.79	2.85	726.49	0.29	33.8	12.9	2484	3917	0.04
500	683	741.5	728.00	6.07	728.22	-0.22	35.0	12.5	2520	3910	-0.03
520	683	741.5	728.74	3.73	728.07	0.68	35.7	11.8	2542	3850	0.11
540	683	741.6	728.44	-1.52	728.67	-0.24	35.4	12.2	2533	3885	-0.04
560	690	742.1	729.00	2.82	729.23	-0.22	29.0	12.1	2340	3681	-0.04
580	690	741.9	729.53	2.62	729.73	-0.21	29.5	11.4	2356	3618	-0.04
600	691	739.0	730.06	2.70	730.17	-0.10	29.1	7.9	2342	3217	-0.03
620	692	738.3	730.47	2.01	730.82	-0.35	28.5	6.8	2324	3078	-0.10
640	693	737.7	730.90	2.15	731.29	-0.40	27.9	5.8	2307	2950	-0.13
660	693	738.6	731.69	3.95	732.31	-0.62	28.7	5.9	2331	2987	-0.20
680	692	739.3	732.23	2.75	732.54	-0.30	30.2	6.1	2377	3054	-0.09
700	691	739.5	732.44	1.03	732.50	-0.06	31.4	6.0	2413	3081	-0.02
720	690	738.5	731.73	-3.53	730.97	0.77	31.7	5.8	2422	3063	0.24
740	689	738.1	730.57	-5.84	729.70	0.87	31.6	6.5	2417	3138	0.24
760	689	737.5	729.90	-3.34	729.53	0.37	30.9	6.6	2397	3125	0.10
780	689	737.3	729.39	-2.53	728.94	0.46	30.4	6.9	2382	3146	0.13
800	689	737.1	728.81	-2.93	728.35	0.46	29.8	7.2	2364	3168	0.12
820	689	736.7	728.36	-2.26	727.67	0.69	29.4	7.4	2351	3170	0.18
840	689	736.4	727.68	-3.39	727.24	0.44	28.7	7.7	2330	3186	0.11
860	690	735.9	727.18	-2.51	726.70	0.47	27.7	7.8	2300	3162	0.12
880	690	735.1	726.73	-2.23	726.43	0.30	27.2	7.4	2287	3106	0.08
900	690	734.7	726.52	-1.08	726.30	0.21	26.5	7.2	2265	3060	0.06
920	690	737.7	726.58	0.32	725.53	1.05	26.6	10.1	2267	3389	0.23
940	688	739.2	725.20	-6.93	724.77	0.42	27.2	13.0	2286	3730	0.07
960	686	740.2	724.78	-2.06	724.42	0.36	29.3	14.4	2349	3944	0.06
980	683	742.1	724.82	0.17	724.58	0.24	31.8	16.3	2425	4228	0.03
1000	681	744.6	724.94	0.60	724.49	0.45	33.9	18.7	2488	4561	0.05
1020	681	747.2	725.01	0.37	724.32	0.69	34.0	21.2	2490	4845	0.07
1040	680	749.9	725.02	0.03	724.01	1.01	35.0	23.8	2521	5167	0.09
1060	679	752.6	724.88	-0.69	723.82	1.06	35.9	26.8	2546	5517	0.09
1080	679	754.3	724.73	-0.79	723.45	1.28	35.7	28.6	2542	5712	0.10
1100	679	754.3	724.82	0.47	723.57	1.25	36.3	28.5	2560	5718	0.10
1120	679	754.0	725.05	1.13	724.52	0.53	36.5	28.0	2566	5671	0.04
1140	678	753.7	726.41	6.82	724.37	2.03	38.4	26.3	2622	5536	0.16
1160	678	753.4	725.29	-5.58	723.54	1.76	37.3	27.1	2589	5602	0.14
1180	678	753.1	724.85	-2.22	723.21	1.64	36.8	27.3	2575	5604	0.13
1200	678	752.8	724.63	-1.10	723.65	0.98	36.6	27.1	2569	5580	0.08
1220	678	752.2	725.14	2.57	723.99	1.16	37.1	26.1	2584	5480	0.10
1240	678	749.4	724.95	-0.98	723.37	1.58	36.9	23.4	2578	5176	0.14
1260	678	744.6	724.00	-4.76	723.05	0.95	36.5	19.6	2565	4740	0.10
1280	678	739.2	723.64	-1.79	722.89	0.75	36.1	14.6	2554	4175	0.10
1300	677	733.3	723.23	-2.06	723.31	-0.08	36.2	9.1	2557	3567	-0.02

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit -March 2006 Monitoring Event											
		3/30/06	Baseline		4/10/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.22						
40	668	729.7	724.91	-28.32	723.43	1.48	46.9	3.8	2877	3298	0.53
60	668	735.5	721.83	-15.57	720.64	1.20	43.8	12.7	2785	4191	0.15
80	668	742.3	721.14	-3.50	719.77	1.37	43.1	20.2	2764	5005	0.12
100	668	749.3	721.42	1.44	719.22	2.20	43.4	26.9	2773	5755	0.16
120	668	750.2	721.81	1.93	719.54	2.27	43.8	27.4	2784	5823	0.16
140	668	755.5	722.17	1.78	720.27	1.90	44.2	32.4	2795	6388	0.12
160	668	760.1	722.60	2.19	720.72	1.88	44.6	36.5	2808	6859	0.11
180	668	761.4	722.81	1.05	721.17	1.65	44.8	37.6	2814	6983	0.09
200	668	757.7	722.99	0.86	721.49	1.50	45.0	33.7	2820	6556	0.09
220	668	753.5	722.97	-0.06	721.83	1.14	45.0	29.5	2819	6098	0.08
240	683	748.6	722.80	-0.87	721.68	1.12	29.8	24.8	2364	5117	0.11
260	683	744.5	722.62	-0.87	721.58	1.05	29.6	20.8	2359	4673	0.12
280	683	740.2	722.60	-0.15	721.41	1.19	29.6	16.6	2358	4197	0.16
300	683	735.7	723.37	3.85	722.31	1.06	30.4	11.4	2381	3643	0.19
320	683	735.1	723.22	-0.71	722.34	0.89	30.2	10.9	2377	3587	0.16
340	683	734.0	722.94	-1.42	721.60	1.34	29.9	10.1	2368	3485	0.27
360	683	734.0	723.29	1.74	722.11	1.18	30.3	9.7	2379	3457	0.24
380	683	734.2	723.89	3.03	722.94	0.95	30.9	9.3	2397	3425	0.20
400	683	734.4	724.43	2.67	723.77	0.66	31.4	8.9	2413	3405	0.14
420	683	736.9	725.02	2.94	724.31	0.71	32.0	10.8	2430	3634	0.13
440	683	738.9	725.61	2.96	724.59	1.01	32.6	12.2	2448	3807	0.16
460	683	740.5	726.22	3.05	725.36	0.85	33.2	13.3	2466	3940	0.13
480	683	740.7	726.79	2.85	726.37	0.41	33.8	12.9	2484	3917	0.06
500	683	741.5	728.00	6.07	728.06	-0.06	35.0	12.5	2520	3910	-0.01
520	683	741.5	728.74	3.73	727.96	0.78	35.7	11.8	2542	3850	0.12
540	683	741.6	728.44	-1.52	728.56	-0.12	35.4	12.2	2533	3885	-0.02
560	690	742.1	729.00	2.82	729.16	-0.16	29.0	12.1	2340	3681	-0.03
580	690	741.9	729.53	2.62	729.63	-0.10	29.5	11.4	2356	3618	-0.02
600	691	739.0	730.06	2.70	729.91	0.15	29.1	7.9	2342	3217	0.04
620	692	738.3	730.47	2.01	730.67	-0.20	28.5	6.8	2324	3078	-0.06
640	693	737.7	730.90	2.15	731.06	-0.16	27.9	5.8	2307	2950	-0.05
660	693	738.6	731.69	3.95	732.17	-0.48	28.7	5.9	2331	2987	-0.16
680	692	739.3	732.23	2.75	732.43	-0.20	30.2	6.1	2377	3054	-0.08
700	691	739.5	732.44	1.03	732.42	0.02	31.4	6.0	2413	3081	0.00
720	690	738.5	731.73	-3.53	730.85	0.88	31.7	5.8	2422	3063	0.27
740	689	738.1	730.57	-5.84	729.59	0.98	31.6	6.5	2417	3138	0.27
760	689	737.5	729.90	-3.34	729.42	0.48	30.9	6.6	2397	3125	0.14
780	689	737.3	729.39	-2.53	728.85	0.54	30.4	6.9	2382	3146	0.15
800	689	737.1	728.81	-2.93	728.23	0.58	29.8	7.2	2364	3168	0.15
820	689	736.7	728.36	-2.26	727.45	0.90	29.4	7.4	2351	3170	0.24
840	689	736.4	727.68	-3.39	727.14	0.53	28.7	7.7	2330	3186	0.14
860	690	735.9	727.18	-2.51	726.59	0.58	27.7	7.8	2300	3162	0.15
880	690	735.1	726.73	-2.23	726.20	0.53	27.2	7.4	2287	3106	0.15
900	690	734.7	726.52	-1.08	726.08	0.44	26.5	7.2	2265	3060	0.13
920	690	737.7	726.58	0.32	725.39	1.19	26.6	10.1	2267	3389	0.26
940	688	739.2	725.20	-6.93	724.58	0.61	27.2	13.0	2286	3730	0.11
960	686	740.2	724.78	-2.06	724.30	0.48	29.3	14.4	2349	3944	0.07
980	683	742.1	724.82	0.17	724.35	0.47	31.8	16.3	2425	4228	0.06
1000	681	744.6	724.94	0.60	724.35	0.59	33.9	18.7	2488	4561	0.07
1020	681	747.2	725.01	0.37	724.05	0.96	34.0	21.2	2490	4845	0.10
1040	680	749.9	725.02	0.03	723.79	1.23	35.0	23.8	2521	5167	0.11
1060	679	752.6	724.88	-0.69	723.70	1.18	35.9	26.8	2546	5517	0.10
1080	679	754.3	724.73	-0.79	723.31	1.41	35.7	28.6	2542	5712	0.11
1100	679	754.3	724.82	0.47	723.31	1.51	36.3	28.5	2560	5718	0.12
1120	679	754.0	725.05	1.13	724.38	0.66	36.5	28.0	2566	5671	0.05
1140	678	753.7	728.41	6.82	724.11	2.30	38.4	26.3	2622	5536	0.18
1160	678	753.4	725.29	-5.58	723.32	1.98	37.3	27.1	2589	5602	0.16
1180	678	753.1	724.85	-2.22	722.94	1.91	36.8	27.3	2575	5604	0.15
1200	678	752.8	724.63	-1.10	723.39	1.24	36.6	27.1	2569	5580	0.10
1220	678	752.2	725.14	2.57	723.82	1.32	37.1	26.1	2584	5480	0.11
1240	678	749.4	724.95	-0.98	723.13	1.82	36.9	23.4	2578	5176	0.16
1260	678	744.6	724.00	-4.76	722.81	1.19	36.5	19.6	2565	4740	0.12
1280	678	739.2	723.64	-1.79	722.66	0.98	36.1	14.6	2554	4175	0.13
1300	677	733.3	723.23	-2.06	723.02	0.20	36.2	9.1	2557	3567	0.04

Estimation of Modified Compression Index
Southern East-West Profiler
June 2006 Monitoring Event

		6/29/06	Baseline		6/30/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.17	-					
40	668	729.7	724.91	-28.32	723.18	1.73	46.9	3.8	2877	3298	0.62
60	668	735.5	721.83	-15.57	720.65	1.19	43.8	12.7	2785	4191	0.15
80	668	742.3	721.14	-3.50	720.11	1.03	43.1	20.2	2764	5005	0.09
100	668	749.3	721.42	1.44	719.45	1.97	43.4	26.9	2773	5755	0.14
120	668	750.2	721.81	1.93	719.56	2.25	43.8	27.4	2784	5823	0.16
140	668	755.5	722.17	1.78	720.26	1.91	44.2	32.4	2795	6388	0.12
160	668	760.1	722.60	2.19	720.58	2.03	44.6	36.5	2808	6859	0.12
180	668	761.4	722.81	1.05	720.88	1.93	44.8	37.6	2814	6983	0.11
200	668	757.7	722.99	0.86	721.23	1.75	45.0	33.7	2820	6556	0.11
220	668	753.5	722.97	-0.06	721.04	1.93	45.0	29.5	2819	6098	0.13
240	683	748.6	722.80	-0.87	721.32	1.48	29.8	24.8	2364	5117	0.15
260	683	744.5	722.62	-0.87	721.48	1.15	29.6	20.8	2359	4673	0.13
280	683	740.2	722.60	-0.15	721.45	1.14	29.6	16.6	2358	4197	0.15
300	683	736.7	723.37	3.85	722.00	1.38	30.4	11.4	2301	3640	0.24
320	683	735.1	723.22	-0.71	722.79	0.44	30.2	10.9	2377	3587	0.08
340	683	734.0	722.94	-1.42	721.32	1.62	29.9	10.1	2368	3485	0.32
360	683	734.7	723.29	1.74	722.15	1.14	30.3	10.5	2379	3539	0.22
380	683	735.3	723.89	3.03	722.75	1.14	30.9	10.4	2397	3556	0.21
400	683	737.0	724.43	2.67	723.25	1.17	31.4	11.6	2413	3701	0.20
420	683	738.7	725.02	2.94	723.70	1.32	32.0	12.7	2430	3837	0.21
440	683	739.8	725.61	2.96	724.15	1.45	32.6	13.2	2448	3913	0.22
460	683	740.9	726.22	3.05	725.08	1.13	33.2	13.7	2468	3984	0.16
480	683	741.0	726.79	2.85	725.78	1.01	33.8	13.2	2484	3951	0.15
500	683	741.5	728.00	6.07	727.64	0.36	35.0	12.5	2520	3908	0.05
520	683	742.5	728.74	3.73	727.60	1.14	35.7	12.7	2542	3954	0.17
540	683	744.4	728.44	-1.52	727.96	0.48	35.4	14.9	2533	4192	0.06
560	690	745.7	729.00	2.82	728.90	0.10	29.0	15.7	2340	4083	0.01
580	690	750.4	729.53	2.62	729.09	0.43	29.5	19.9	2356	4566	0.05
600	691	755.5	730.06	2.70	729.21	0.85	29.1	24.4	2342	5051	0.09
620	692	756.0	730.47	2.01	729.79	0.68	28.5	24.5	2324	5047	0.07
640	693	756.0	730.90	2.15	730.67	0.22	27.9	24.1	2307	4982	0.02
660	693	756.0	731.69	3.95	731.63	0.06	28.7	23.3	2331	4918	0.01
680	692	756.0	732.23	2.75	731.72	0.51	30.2	22.8	2377	4904	0.05
700	691	756.3	732.44	1.03	731.92	0.52	31.4	22.8	2413	4947	0.05
720	690	754.4	731.73	-3.53	730.51	1.22	31.7	21.7	2422	4827	0.13
740	689	748.6	730.57	-5.84	729.32	1.25	31.6	17.0	2417	4303	0.16
760	689	745.9	729.90	-3.34	728.88	1.02	30.9	15.0	2397	4063	0.14
780	689	744.3	729.39	-2.53	728.12	1.28	30.4	13.9	2382	3928	0.19
800	689	742.7	728.81	-2.93	727.55	1.25	29.8	12.9	2364	3791	0.21
820	689	741.3	728.36	-2.26	727.40	0.96	29.4	12.0	2351	3680	0.17
840	689	740.1	727.68	-3.39	726.75	0.93	28.7	11.4	2330	3599	0.17
860	690	738.8	727.18	-2.51	726.17	1.01	27.7	10.6	2300	3479	0.20
880	690	738.3	726.73	-2.23	725.73	1.00	27.2	10.6	2287	3464	0.20
900	690	737.9	726.52	-1.08	726.26	0.26	26.5	10.4	2265	3423	0.05
920	690	738.5	726.58	0.32	724.75	1.83	26.6	11.0	2267	3484	0.37
940	688	738.9	725.20	-6.93	724.14	1.05	27.2	12.7	2286	3699	0.18
960	688	740.2	724.78	-2.08	723.81	0.97	29.3	14.4	2349	3946	0.15
980	683	742.2	724.82	0.17	723.82	1.00	31.8	16.4	2425	4245	0.13
1000	681	744.8	724.94	0.60	723.59	1.35	33.9	18.9	2488	4585	0.15
1020	681	747.6	725.01	0.37	723.38	1.64	34.0	21.6	2490	4883	0.16
1040	680	750.6	725.02	0.03	723.17	1.85	35.0	24.5	2521	5243	0.17
1060	679	753.5	724.88	-0.69	722.83	2.05	35.9	27.6	2546	5613	0.17
1080	679	756.6	724.73	-0.79	722.68	2.05	35.7	30.9	2542	5968	0.15
1100	679	760.2	724.82	0.47	722.73	2.09	36.3	34.4	2560	6380	0.14
1120	679	763.0	725.05	1.13	723.66	1.38	36.5	36.9	2566	6667	0.09
1140	678	763.3	726.41	6.82	723.23	3.18	38.4	35.9	2622	6602	0.21
1160	678	760.7	725.29	-5.58	722.48	2.82	37.3	34.4	2589	6405	0.19
1180	678	757.7	724.85	-2.22	722.33	2.52	36.8	31.8	2575	6106	0.18
1200	678	753.9	724.63	-1.10	722.55	2.08	36.6	28.3	2569	5710	0.16
1220	678	752.6	725.14	2.57	722.82	2.32	37.1	26.5	2584	5521	0.19
1240	678	749.4	724.95	-0.98	722.24	2.71	36.9	23.4	2578	5176	0.24
1260	678	744.6	724.00	-4.76	722.07	1.93	36.5	19.6	2565	4740	0.20
1280	678	739.2	723.64	-1.79	721.96	1.68	36.1	14.6	2554	4175	0.22
1300	677	733.3	723.23	-2.06	722.13	1.10	36.2	9.1	2557	3567	0.21

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - June 2006 Monitoring Event											
		6/29/06	Baseline		6/30/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.30	-					
40	668	729.7	724.91	-28.32	723.36	1.55	46.9	3.8	2877	3298	0.56
60	668	735.5	721.83	-15.57	720.71	1.13	43.8	12.7	2785	4191	0.15
80	668	742.3	721.14	-3.50	720.21	0.93	43.1	20.2	2764	5005	0.08
100	668	749.3	721.42	1.44	719.54	1.88	43.4	26.9	2773	5755	0.14
120	668	750.2	721.81	1.93	719.63	2.19	43.8	27.4	2784	5823	0.16
140	668	755.5	722.17	1.78	720.52	1.65	44.2	32.4	2795	6388	0.10
160	668	760.1	722.60	2.19	720.62	1.99	44.6	36.5	2808	6859	0.11
180	668	761.4	722.81	1.05	720.95	1.86	44.8	37.6	2814	6983	0.11
200	668	757.7	722.99	0.86	721.30	1.69	45.0	33.7	2820	6556	0.10
220	668	753.5	722.97	-0.06	721.10	1.88	45.0	29.5	2819	6098	0.12
240	683	748.6	722.80	-0.87	721.40	1.40	29.8	24.8	2364	5117	0.14
260	683	744.5	722.62	-0.87	721.54	1.08	29.6	20.8	2359	4673	0.12
280	683	740.2	722.60	-0.15	721.52	1.07	29.6	16.6	2358	4197	0.14
300	683	735.7	723.37	3.85	722.09	1.28	30.4	11.4	2381	3643	0.23
320	683	735.1	723.22	-0.71	722.85	0.38	30.2	10.9	2377	3587	0.07
340	683	734.0	722.94	-1.42	721.37	1.57	29.9	10.1	2368	3485	0.31
360	683	734.7	723.29	1.74	722.21	1.08	30.3	10.5	2379	3539	0.21
380	683	735.3	723.89	3.03	722.85	1.04	30.9	10.4	2397	3556	0.20
400	683	737.0	724.43	2.67	723.31	1.12	31.4	11.6	2413	3701	0.19
420	683	738.7	725.02	2.94	723.77	1.25	32.0	12.7	2430	3837	0.20
440	683	739.8	725.61	2.96	724.24	1.37	32.6	13.2	2448	3913	0.21
460	683	740.9	728.22	3.05	725.14	1.08	33.2	13.7	2468	3984	0.16
480	683	741.0	726.79	2.85	725.84	0.95	33.8	13.2	2484	3951	0.14
500	683	741.5	728.00	6.07	727.72	0.28	35.0	12.5	2520	3908	0.04
520	683	742.5	728.74	3.73	727.65	1.09	35.7	12.7	2542	3954	0.16
540	683	744.4	728.44	-1.52	728.02	0.42	35.4	14.9	2533	4192	0.05
560	690	745.7	729.00	2.82	728.93	0.07	29.0	15.7	2340	4083	0.01
580	690	750.4	729.53	2.62	729.15	0.38	29.5	19.9	2356	4566	0.04
600	691	755.5	730.06	2.70	729.34	0.72	29.1	24.4	2342	5051	0.07
620	692	756.0	730.47	2.01	729.87	0.60	28.5	24.5	2324	5047	0.06
640	693	758.0	730.90	2.15	730.79	0.10	27.9	24.1	2307	4982	0.01
660	693	756.0	731.69	3.95	731.70	-0.01	28.7	23.3	2331	4918	0.00
680	692	756.0	732.23	2.75	731.77	0.46	30.2	22.8	2377	4904	0.05
700	691	756.3	732.44	1.03	731.96	0.48	31.4	22.8	2413	4947	0.05
720	690	754.4	731.73	-3.53	730.57	1.16	31.7	21.7	2422	4827	0.12
740	689	748.6	730.57	-5.84	729.38	1.19	31.6	17.0	2417	4303	0.15
760	689	745.9	729.90	-3.34	728.93	0.97	30.9	15.0	2397	4063	0.14
780	689	744.3	729.39	-2.53	728.16	1.23	30.4	13.9	2382	3928	0.19
800	689	742.7	728.81	-2.93	727.61	1.19	29.8	12.9	2364	3791	0.20
820	689	741.3	728.36	-2.26	727.51	0.85	29.4	12.0	2351	3680	0.15
840	689	740.1	727.68	-3.39	726.80	0.88	28.7	11.4	2330	3599	0.16
860	890	738.8	727.18	-2.51	726.22	0.95	27.7	10.6	2300	3479	0.19
880	690	738.3	726.73	-2.23	725.85	0.88	27.2	10.6	2287	3464	0.18
900	690	737.9	726.52	-1.08	726.37	0.15	26.5	10.4	2265	3423	0.03
920	690	738.5	726.58	0.32	724.82	1.76	26.6	11.0	2267	3484	0.36
940	688	738.9	725.20	-6.93	724.24	0.96	27.2	12.7	2286	3699	0.17
960	686	740.2	724.78	-2.06	723.87	0.92	29.3	14.4	2349	3946	0.14
980	683	742.2	724.82	0.17	723.93	0.89	31.8	16.4	2425	4245	0.11
1000	681	744.8	724.94	0.60	723.66	1.28	33.9	18.9	2488	4585	0.14
1020	681	747.6	725.01	0.37	723.52	1.50	34.0	21.6	2490	4883	0.15
1040	680	750.6	725.02	0.03	723.28	1.74	35.0	24.5	2521	5243	0.16
1060	679	753.5	724.88	-0.69	722.90	1.99	35.9	27.6	2546	5613	0.16
1080	679	756.6	724.73	-0.79	722.75	1.98	35.7	30.9	2542	5968	0.15
1100	679	760.2	724.82	0.47	722.86	1.96	36.3	34.4	2560	6380	0.14
1120	679	763.0	725.05	1.13	723.73	1.32	36.5	36.9	2566	6667	0.09
1140	678	763.3	726.41	6.82	723.36	3.05	38.4	35.9	2622	6602	0.20
1160	678	760.7	725.29	-5.58	722.59	2.71	37.3	34.4	2589	6405	0.18
1180	678	757.7	724.85	-2.22	722.46	2.39	36.8	31.8	2575	6106	0.17
1200	678	753.9	724.63	-1.10	722.68	1.95	36.6	28.3	2569	5710	0.15
1220	678	752.6	725.14	2.57	722.90	2.24	37.1	26.5	2584	5521	0.18
1240	678	749.4	724.95	-0.98	722.36	2.59	36.9	23.4	2578	5176	0.23
1260	678	744.6	724.00	-4.76	722.19	1.80	36.5	19.6	2565	4740	0.19
1280	678	739.2	723.64	-1.79	722.07	1.56	36.1	14.6	2554	4175	0.20
1300	677	733.3	723.23	-2.06	722.28	0.95	36.2	9.1	2557	3567	0.18

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit - June 2006 Monitoring Event											
		6/29/06	Baseline		6/30/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.03	-					
40	668	729.7	724.91	-28.32	723.00	1.91	46.9	3.8	2877	3298	0.69
60	668	735.5	721.83	-15.57	720.58	1.25	43.8	12.7	2785	4191	0.16
80	668	742.3	721.14	-3.50	720.01	1.12	43.1	20.2	2764	5005	0.10
100	668	749.3	721.42	1.44	719.37	2.06	43.4	26.9	2773	5755	0.15
120	668	750.2	721.81	1.93	719.50	2.31	43.8	27.4	2784	5823	0.16
140	668	755.5	722.17	1.78	719.99	2.17	44.2	32.4	2795	6388	0.14
160	668	760.1	722.60	2.19	720.54	2.07	44.6	36.5	2808	6859	0.12
180	668	761.4	722.81	1.05	720.81	2.00	44.8	37.6	2814	6983	0.11
200	668	757.7	722.99	0.86	721.16	1.82	45.0	33.7	2820	6556	0.11
220	668	753.5	722.97	-0.06	720.98	1.99	45.0	29.5	2819	6098	0.13
240	683	748.6	722.80	-0.87	721.23	1.57	29.8	24.8	2364	5117	0.16
260	683	744.5	722.62	-0.87	721.41	1.21	29.6	20.8	2350	4673	0.14
280	683	740.2	722.60	-0.15	721.38	1.21	29.6	16.6	2358	4197	0.16
300	683	738.7	723.37	3.85	721.92	1.45	30.4	11.4	2381	3643	0.26
320	683	735.1	723.22	-0.71	722.73	0.49	30.2	10.9	2377	3587	0.09
340	683	734.0	722.94	-1.42	721.27	1.68	29.9	10.1	2368	3485	0.33
360	683	734.7	723.29	1.74	722.08	1.21	30.3	10.5	2379	3539	0.23
380	683	735.3	723.89	3.03	722.66	1.23	30.9	10.4	2397	3556	0.23
400	683	737.0	724.43	2.67	723.19	1.23	31.4	11.6	2413	3701	0.21
420	683	738.7	725.02	2.94	723.63	1.39	32.0	12.7	2430	3837	0.22
440	683	739.8	725.61	2.96	724.07	1.54	32.6	13.2	2448	3913	0.23
460	683	740.9	726.22	3.05	725.03	1.19	33.2	13.7	2466	3984	0.17
480	683	741.0	726.79	2.85	725.72	1.07	33.8	13.2	2484	3951	0.16
500	683	741.5	728.00	6.07	727.56	0.44	35.0	12.5	2520	3908	0.07
520	683	742.5	728.74	3.73	727.55	1.20	35.7	12.7	2542	3954	0.17
540	683	744.4	728.44	-1.52	727.91	0.53	35.4	14.9	2533	4192	0.07
560	690	745.7	729.00	2.82	728.87	0.13	29.0	15.7	2340	4083	0.02
580	690	750.4	729.53	2.62	729.04	0.49	29.5	19.9	2356	4566	0.06
600	691	755.5	730.06	2.70	729.09	0.98	29.1	24.4	2342	5051	0.10
620	692	756.0	730.47	2.01	729.71	0.75	28.5	24.5	2324	5047	0.08
640	693	756.0	730.90	2.15	730.56	0.34	27.9	24.1	2307	4982	0.04
660	693	756.0	731.69	3.95	731.56	0.13	28.7	23.3	2331	4918	0.01
680	692	756.0	732.23	2.75	731.67	0.57	30.2	22.8	2377	4904	0.08
700	691	756.3	732.44	1.03	731.88	0.56	31.4	22.8	2413	4947	0.06
720	690	754.4	731.73	-3.53	730.45	1.28	31.7	21.7	2422	4827	0.14
740	689	748.6	730.57	-5.84	729.26	1.31	31.6	17.0	2417	4303	0.17
760	689	745.9	729.90	-3.34	728.82	1.08	30.9	15.0	2397	4063	0.15
780	689	744.3	729.39	-2.53	728.08	1.32	30.4	13.9	2382	3928	0.20
800	689	742.7	728.81	-2.93	727.50	1.31	29.8	12.9	2364	3791	0.21
820	689	741.3	728.36	-2.26	727.29	1.06	29.4	12.0	2351	3680	0.19
840	689	740.1	727.68	-3.39	726.70	0.98	28.7	11.4	2330	3599	0.18
860	690	738.8	727.18	-2.51	726.11	1.06	27.7	10.6	2300	3479	0.21
880	690	738.3	726.73	-2.23	725.61	1.12	27.2	10.6	2287	3464	0.23
900	690	737.9	726.52	-1.08	726.14	0.37	26.5	10.4	2265	3423	0.08
920	690	738.5	726.58	0.32	724.68	1.90	26.6	11.0	2267	3484	0.38
940	688	738.9	725.20	-6.93	724.05	1.15	27.2	12.7	2286	3699	0.20
960	686	740.2	724.78	-2.06	723.75	1.03	29.3	14.4	2349	3946	0.16
980	683	742.2	724.82	0.17	723.70	1.12	31.8	16.4	2425	4245	0.14
1000	681	744.8	724.94	0.60	723.52	1.42	33.9	18.9	2488	4585	0.16
1020	681	747.6	725.01	0.37	723.24	1.77	34.0	21.6	2490	4883	0.18
1040	680	750.6	725.02	0.03	723.06	1.96	35.0	24.5	2521	5243	0.18
1060	679	753.5	724.88	-0.69	722.77	2.11	35.9	27.6	2546	5613	0.17
1080	679	756.6	724.73	-0.79	722.61	2.11	35.7	30.9	2542	5968	0.16
1100	679	760.2	724.82	0.47	722.60	2.22	36.3	34.4	2560	6380	0.15
1120	679	763.0	725.05	1.13	723.60	1.45	36.5	36.9	2566	6667	0.10
1140	678	763.3	726.41	6.82	723.10	3.31	38.4	35.9	2622	6602	0.22
1160	678	760.7	725.29	-5.58	722.36	2.93	37.3	34.4	2589	6405	0.20
1180	678	757.7	724.85	-2.22	722.19	2.66	36.8	31.8	2575	6106	0.19
1200	678	753.9	724.63	-1.10	722.42	2.21	36.6	28.3	2569	5710	0.17
1220	678	752.6	725.14	2.57	722.74	2.41	37.1	26.5	2584	5521	0.20
1240	678	749.4	724.95	-0.98	722.11	2.83	36.9	23.4	2578	5176	0.25
1260	678	744.6	724.00	-4.76	721.95	2.05	36.5	19.6	2565	4740	0.21
1280	678	739.2	723.64	-1.79	721.85	1.79	36.1	14.6	2554	4175	0.23
1300	677	733.3	723.23	-2.06	721.99	1.24	36.2	9.1	2557	3567	0.24

Estimation of Modified Compression Index
Southern East-West Profiler
September 2006 Monitoring Event

Station	MC V T Liner Elev	9/29/06 MC VI-E Waste Elev	Baseline Measured Pipe Elev	Baseline Slope	9/26/06 Measured Pipe Elev	Measured settlement	MC V Waste Thick.	MC VI-E Waste Thick.	Stress @ Midpoint of MC V Wast Initial	Stress @ Midpoint of MC V Wast Final	Estimated Modif. Compres Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.09	-					
40	668	733.1	724.91	-28.32	723.54	1.37	46.9	7.2	2877	3672	0.28
60	668	735.8	721.83	-15.57	720.27	1.57	43.8	13.0	2785	4229	0.20
80	668	739.4	721.14	-3.50	719.63	1.50	43.1	17.2	2764	4677	0.15
100	668	743.1	721.42	1.44	719.67	1.75	43.4	20.7	2773	5071	0.15
120	668	747.2	721.81	1.93	719.98	1.83	43.8	24.4	2784	5489	0.14
140	668	751.4	722.17	1.78	720.31	1.85	44.2	28.2	2795	5930	0.13
160	668	755.6	722.60	2.19	720.58	2.03	44.6	32.0	2808	6361	0.13
180	668	759.6	722.81	1.05	721.16	1.65	44.8	35.8	2814	6790	0.10
200	668	757.6	722.99	0.86	721.42	1.57	45.0	33.7	2820	6555	0.10
220	668	753.5	722.97	-0.06	721.72	1.26	45.0	29.5	2819	6098	0.08
240	683	748.6	722.80	-0.87	721.55	1.25	29.8	24.8	2364	5117	0.13
260	683	744.5	722.62	-0.87	721.54	1.09	29.6	20.8	2359	4673	0.12
280	683	740.2	722.60	-0.15	721.67	0.92	29.6	16.6	2358	4197	0.12
300	683	735.7	723.37	3.85	722.54	0.83	30.4	11.4	2381	3643	0.15
320	683	735.1	723.22	-0.71	722.08	1.14	30.2	10.9	2377	3587	0.21
340	683	734.0	722.94	-1.42	722.01	0.93	29.9	10.1	2368	3485	0.19
360	683	734.7	723.29	1.74	722.59	0.70	30.3	10.5	2379	3539	0.13
380	683	735.7	723.89	3.03	723.14	0.75	30.9	10.8	2397	3600	0.14
400	683	737.0	724.43	2.67	723.82	0.61	31.4	11.5	2413	3694	0.10
420	683	740.8	725.02	2.94	724.31	0.71	32.0	14.8	2430	4074	0.10
440	683	744.0	725.61	2.96	724.89	0.71	32.6	17.4	2448	4380	0.09
460	683	746.0	726.22	3.05	725.40	0.82	33.2	18.8	2466	4549	0.09
480	683	747.9	726.79	2.85	725.98	0.80	33.8	20.1	2484	4720	0.09
500	683	749.3	728.00	6.07	727.77	0.22	35.0	20.3	2520	4775	0.02
520	683	750.5	728.74	3.73	727.70	1.05	35.7	20.8	2542	4846	0.10
540	683	751.1	728.44	-1.52	727.82	0.62	35.4	21.7	2533	4937	0.06
560	690	753.9	729.00	2.82	728.47	0.53	29.0	23.9	2340	4995	0.06
580	690	755.8	729.53	2.62	729.10	0.43	29.5	25.3	2356	5166	0.04
600	691	756.2	730.06	2.70	729.46	0.61	29.1	25.1	2342	5133	0.06
620	692	756.6	730.47	2.01	729.99	0.48	28.5	25.1	2324	5109	0.05
640	693	757.1	730.90	2.15	730.47	0.43	27.9	25.2	2307	5099	0.04
660	693	756.8	731.69	3.95	731.42	0.27	28.7	24.1	2331	5004	0.03
680	692	756.1	732.23	2.75	731.72	0.52	30.2	22.8	2377	4911	0.05
700	691	754.4	732.44	1.03	731.98	0.46	31.4	20.9	2413	4734	0.05
720	690	752.3	731.73	-3.53	730.42	1.32	31.7	19.6	2422	4593	0.15
740	689	750.1	730.57	-5.84	729.48	1.08	31.6	18.6	2417	4478	0.13
760	689	747.5	729.90	-3.34	728.86	1.04	30.9	16.6	2397	4235	0.14
780	689	744.2	729.39	-2.53	728.27	1.13	30.4	13.8	2382	3912	0.17
800	689	742.7	728.81	-2.93	728.01	0.80	29.8	12.9	2364	3791	0.13
820	689	741.4	728.36	-2.26	727.39	0.97	29.4	12.0	2351	3685	0.17
840	689	740.9	727.68	-3.39	726.79	0.89	28.7	12.2	2330	3684	0.16
860	690	739.9	727.18	-2.51	726.25	0.92	27.7	11.7	2300	3599	0.17
880	690	738.1	726.73	-2.23	725.72	1.01	27.2	10.4	2287	3437	0.21
900	690	737.3	726.52	-1.08	726.32	0.19	26.5	9.8	2265	3350	0.04
920	690	738.1	726.58	0.32	724.83	1.75	26.6	10.6	2267	3440	0.36
940	688	739.3	725.20	-6.93	724.26	0.94	27.2	13.1	2286	3743	0.16
960	686	740.2	724.78	-2.06	724.02	0.77	29.3	14.4	2349	3946	0.12
980	883	742.2	724.82	0.17	724.11	0.70	31.8	16.4	2425	4245	0.09
1000	681	744.8	724.94	0.60	723.95	0.99	33.9	18.9	2488	4585	0.11
1020	681	747.6	725.01	0.37	723.73	1.29	34.0	21.6	2490	4883	0.13
1040	680	750.6	725.02	0.03	723.39	1.63	35.0	24.5	2521	5243	0.15
1060	679	753.5	724.88	-0.69	723.00	1.88	35.9	27.6	2546	5613	0.15
1080	679	756.6	724.73	-0.79	722.87	1.86	35.7	30.9	2542	5968	0.14
1100	679	760.2	724.82	0.47	722.99	1.83	36.3	34.4	2560	6380	0.13
1120	679	763.0	725.05	1.13	723.90	1.15	36.5	36.9	2566	6667	0.08
1140	678	763.3	726.41	6.82	723.60	2.81	38.4	35.9	2622	6602	0.18
1160	678	760.7	725.29	-5.58	722.74	2.55	37.3	34.4	2589	6405	0.17
1180	678	757.7	724.85	-2.22	722.64	2.21	36.8	31.8	2575	6106	0.16
1200	678	753.9	724.63	-1.10	722.93	1.70	36.6	28.3	2569	5709	0.13
1220	678	752.5	725.14	2.57	723.22	1.92	37.1	26.3	2584	5505	0.16
1240	678	748.9	724.95	-0.98	722.60	2.35	36.9	23.0	2578	5127	0.21
1260	678	743.9	724.00	-4.76	722.41	1.59	36.5	18.9	2565	4661	0.17
1280	678	739.1	723.64	-1.79	722.42	1.22	36.1	14.5	2554	4160	0.16
1300	677	733.4	723.23	-2.06	722.61	0.62	36.2	9.2	2557	3576	0.12

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - September 2006 Monitoring Event											
		9/29/06	Baseline		9/26/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.23	-					
40	668	733.1	724.91	-28.32	723.72	1.19	46.9	7.2	2877	3672	0.24
60	668	735.8	721.83	-15.57	720.33	1.51	43.8	13.0	2785	4229	0.19
80	668	739.4	721.14	-3.50	719.73	1.40	43.1	17.2	2764	4677	0.14
100	668	743.1	721.42	1.44	719.76	1.66	43.4	20.7	2773	5071	0.15
120	668	747.2	721.81	1.93	720.04	1.77	43.8	24.4	2784	5489	0.14
140	668	751.4	722.17	1.78	720.57	1.59	44.2	28.2	2795	5930	0.11
160	668	755.6	722.60	2.19	720.62	1.99	44.6	32.0	2808	6361	0.13
180	668	759.6	722.81	1.05	721.23	1.58	44.8	35.8	2814	6790	0.09
200	668	757.6	722.99	0.86	721.48	1.50	45.0	33.7	2820	6555	0.09
220	668	753.5	722.97	-0.06	721.77	1.20	45.0	29.5	2819	6098	0.08
240	683	748.6	722.80	-0.87	721.63	1.17	29.8	24.8	2364	5117	0.12
260	683	744.5	722.62	-0.87	721.60	1.02	29.6	20.8	2359	4673	0.12
280	683	740.2	722.60	-0.15	721.74	0.85	29.6	16.6	2358	4197	0.12
300	003	735.7	723.37	3.05	722.62	0.74	30.4	11.4	2381	3643	0.13
320	683	735.1	723.22	-0.71	722.14	1.09	30.2	10.9	2377	3587	0.20
340	683	734.0	722.94	-1.42	722.06	0.88	29.9	10.1	2368	3485	0.18
360	683	734.7	723.29	1.74	722.65	0.63	30.3	10.5	2379	3539	0.12
380	683	735.7	723.89	3.03	723.23	0.66	30.9	10.8	2397	3600	0.12
400	683	737.0	724.43	2.67	723.88	0.55	31.4	11.5	2413	3694	0.09
420	683	740.8	725.02	2.94	724.38	0.64	32.0	14.8	2430	4074	0.09
440	683	744.0	725.61	2.96	724.98	0.63	32.6	17.4	2448	4360	0.08
460	683	746.0	726.22	3.05	725.45	0.76	33.2	18.8	2466	4549	0.09
480	683	747.9	726.79	2.85	726.04	0.75	33.8	20.1	2484	4720	0.08
500	683	749.3	728.00	6.07	727.85	0.15	35.0	20.3	2520	4775	0.01
520	683	750.5	728.74	3.73	727.75	0.99	35.7	20.8	2542	4846	0.10
540	683	751.1	728.44	-1.52	727.88	0.56	35.4	21.7	2533	4937	0.05
560	690	753.9	729.00	2.82	728.50	0.50	29.0	23.9	2340	4995	0.05
580	690	755.8	729.53	2.62	729.15	0.37	29.5	25.3	2356	5166	0.04
600	691	756.2	730.06	2.70	729.58	0.48	29.1	25.1	2342	5133	0.05
620	692	756.6	730.47	2.01	730.07	0.40	28.5	25.1	2324	5109	0.04
640	693	757.1	730.90	2.15	730.58	0.31	27.9	25.2	2307	5099	0.03
660	693	756.8	731.69	3.95	731.49	0.20	28.7	24.1	2331	5004	0.02
680	692	756.1	732.23	2.75	731.77	0.46	30.2	22.8	2377	4911	0.05
700	691	754.4	732.44	1.03	732.02	0.42	31.4	20.9	2413	4734	0.05
720	690	752.3	731.73	-3.53	730.48	1.26	31.7	19.6	2422	4593	0.14
740	689	750.1	730.57	-5.84	729.54	1.03	31.6	18.6	2417	4478	0.12
760	689	747.5	729.90	-3.34	728.92	0.98	30.9	16.6	2397	4235	0.13
780	689	744.2	729.39	-2.53	728.31	1.09	30.4	13.8	2382	3912	0.17
800	689	742.7	728.81	-2.93	728.07	0.74	29.8	12.9	2364	3791	0.12
820	689	741.4	728.36	-2.26	727.49	0.86	29.4	12.0	2351	3685	0.15
840	689	740.9	727.68	-3.39	726.84	0.84	28.7	12.2	2330	3684	0.15
860	690	739.9	727.18	-2.51	726.31	0.87	27.7	11.7	2300	3599	0.16
880	690	738.1	726.73	-2.23	725.84	0.89	27.2	10.4	2287	3437	0.19
900	690	737.3	726.52	-1.08	726.43	0.08	26.5	9.8	2285	3350	0.02
920	690	736.1	726.58	0.32	724.90	1.68	26.6	10.6	2267	3440	0.35
940	688	739.3	725.20	-6.93	724.36	0.84	27.2	13.1	2286	3743	0.14
960	686	740.2	724.78	-2.06	724.07	0.71	29.3	14.4	2349	3946	0.11
980	683	742.2	724.82	0.17	724.23	0.59	31.8	16.4	2425	4245	0.08
1000	681	744.8	724.94	0.60	724.02	0.92	33.9	18.9	2488	4585	0.10
1020	681	747.6	725.01	0.37	723.86	1.15	34.0	21.6	2490	4883	0.12
1040	680	750.6	725.02	0.03	723.50	1.52	35.0	24.5	2521	5243	0.14
1060	679	753.5	724.88	-0.69	723.06	1.82	35.9	27.6	2546	5613	0.15
1080	679	756.6	724.73	-0.79	722.94	1.79	35.7	30.9	2542	5968	0.14
1100	679	760.2	724.82	0.47	723.12	1.70	36.3	34.4	2560	6360	0.12
1120	679	763.0	725.05	1.13	723.96	1.08	36.5	36.9	2566	6667	0.07
1140	678	763.3	726.41	6.82	723.73	2.68	38.4	35.9	2622	6602	0.17
1160	678	760.7	725.29	-5.58	722.85	2.44	37.3	34.4	2589	6405	0.17
1180	678	757.7	724.85	-2.22	722.77	2.08	36.8	31.8	2575	6106	0.15
1200	678	753.9	724.63	-1.10	723.06	1.57	36.6	28.3	2569	5709	0.12
1220	678	752.5	725.14	2.57	723.31	1.84	37.1	26.3	2584	5505	0.15
1240	678	748.9	724.95	-0.98	722.72	2.23	36.9	23.0	2578	5127	0.20
1260	678	743.9	724.00	-4.76	722.53	1.47	36.5	18.9	2565	4661	0.15
1280	678	739.1	723.64	-1.79	722.53	1.11	36.1	14.5	2554	4160	0.14
1300	677	733.4	723.23	-2.06	722.76	0.47	36.2	9.2	2557	3576	0.09

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit - September 2006 Monitoring Event											
		9/29/06	Baseline		9/26/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		728.95	-					
40	668	733.1	724.91	-28.32	723.36	1.55	46.9	7.2	2877	3672	0.31
60	668	735.8	721.83	-15.57	720.21	1.63	43.8	13.0	2785	4229	0.20
80	668	739.4	721.14	-3.50	719.54	1.60	43.1	17.2	2764	4677	0.16
100	668	743.1	721.42	1.44	719.59	1.84	43.4	20.7	2773	5071	0.16
120	668	747.2	721.81	1.93	719.92	1.89	43.8	24.4	2784	5489	0.15
140	668	751.4	722.17	1.78	720.05	2.12	44.2	28.2	2795	5930	0.15
160	668	755.6	722.60	2.19	720.54	2.07	44.6	32.0	2808	6361	0.13
180	668	759.6	722.81	1.05	721.09	1.72	44.8	35.8	2814	6790	0.10
200	668	757.6	722.99	0.86	721.35	1.64	45.0	33.7	2820	6555	0.10
220	668	753.5	722.97	-0.06	721.66	1.31	45.0	29.5	2819	6098	0.09
240	683	748.6	722.80	-0.87	721.46	1.34	29.8	24.8	2364	5117	0.13
260	683	744.5	722.62	-0.87	721.47	1.15	29.6	20.8	2359	4673	0.13
280	683	740.2	722.60	-0.15	721.60	1.00	29.6	16.6	2358	4197	0.13
300	683	735.7	723.37	3.85	722.46	0.91	30.4	11.4	2381	3643	0.16
320	683	735.1	723.22	-0.71	722.02	1.20	30.2	10.9	2377	3587	0.22
340	683	734.0	722.94	-1.42	721.95	0.99	29.9	10.1	2368	3485	0.20
360	683	734.7	723.29	1.74	722.52	0.76	30.3	10.5	2379	3539	0.15
380	683	735.7	723.89	3.03	723.05	0.84	30.9	10.8	2397	3600	0.15
400	683	737.0	724.43	2.67	723.76	0.67	31.4	11.5	2413	3694	0.11
420	683	740.8	725.02	2.94	724.24	0.77	32.0	14.8	2430	4074	0.11
440	683	744.0	725.61	2.96	724.81	0.80	32.6	17.4	2448	4380	0.10
460	683	746.0	726.22	3.05	725.34	0.87	33.2	18.8	2466	4549	0.10
480	683	747.9	726.79	2.85	725.92	0.86	33.8	20.1	2484	4720	0.09
500	683	749.3	728.00	6.07	727.70	0.30	35.0	20.3	2520	4775	0.03
520	683	750.5	728.74	3.73	727.64	1.10	35.7	20.8	2542	4846	0.11
540	683	751.1	728.44	-1.52	727.76	0.68	35.4	21.7	2533	4937	0.07
560	690	753.9	729.00	2.82	728.44	0.56	29.0	23.9	2340	4995	0.06
580	690	755.8	729.53	2.62	729.04	0.48	29.5	25.3	2356	5166	0.05
600	691	756.2	730.06	2.70	729.33	0.73	29.1	25.1	2342	5133	0.07
620	692	756.6	730.47	2.01	729.91	0.55	28.5	25.1	2324	5109	0.06
640	693	757.1	730.90	2.15	730.35	0.55	27.9	25.2	2307	5099	0.06
660	693	756.8	731.69	3.95	731.35	0.34	28.7	24.1	2331	5004	0.04
680	692	756.1	732.23	2.75	731.67	0.57	30.2	22.8	2377	4911	0.06
700	691	754.4	732.44	1.03	731.94	0.50	31.4	20.9	2413	4734	0.05
720	690	752.3	731.73	-3.53	730.36	1.38	31.7	19.6	2422	4593	0.16
740	689	750.1	730.57	-5.84	729.43	1.14	31.6	18.6	2417	4478	0.13
760	689	747.5	729.90	-3.34	728.80	1.10	30.9	16.6	2397	4235	0.14
780	689	744.2	729.39	-2.53	728.23	1.17	30.4	13.8	2382	3912	0.18
800	689	742.7	728.81	-2.93	727.95	0.86	29.8	12.9	2364	3791	0.14
820	689	741.4	728.36	-2.26	727.28	1.08	29.4	12.0	2351	3685	0.19
840	689	740.9	727.68	-3.39	726.74	0.94	28.7	12.2	2330	3684	0.16
860	690	739.9	727.18	-2.51	726.20	0.98	27.7	11.7	2300	3599	0.18
880	690	738.1	726.73	-2.23	725.60	1.13	27.2	10.4	2287	3437	0.23
900	690	737.3	726.52	-1.08	726.21	0.31	26.5	9.8	2265	3350	0.07
920	690	738.1	726.58	0.32	724.76	1.82	26.6	10.6	2267	3440	0.38
940	688	739.3	725.20	-6.93	724.16	1.03	27.2	13.1	2286	3743	0.18
960	688	740.2	724.78	-2.06	723.96	0.83	29.3	14.4	2349	3946	0.13
980	683	742.2	724.82	0.17	724.00	0.82	31.8	16.4	2425	4245	0.11
1000	681	744.8	724.94	0.60	723.88	1.06	33.9	18.9	2488	4585	0.12
1020	681	747.6	725.01	0.37	723.59	1.42	34.0	21.6	2490	4883	0.14
1040	680	750.6	725.02	0.03	723.28	1.74	35.0	24.5	2521	5243	0.16
1060	679	753.5	724.88	-0.69	722.94	1.94	35.9	27.6	2546	5613	0.16
1080	679	756.6	724.73	-0.79	722.80	1.92	35.7	30.9	2542	5968	0.15
1100	679	760.2	724.82	0.47	722.86	1.96	36.3	34.4	2560	6380	0.14
1120	679	763.0	725.05	1.13	723.83	1.22	36.5	36.9	2566	6667	0.08
1140	678	763.3	726.41	6.82	723.47	2.94	38.4	35.9	2622	6602	0.19
1160	678	760.7	725.29	-5.58	722.63	2.66	37.3	34.4	2589	6405	0.18
1180	678	757.7	724.85	-2.22	722.50	2.35	36.8	31.8	2575	6106	0.17
1200	678	753.9	724.63	-1.10	722.80	1.83	38.6	28.3	2569	5709	0.14
1220	678	752.5	725.14	2.57	723.14	2.00	37.1	26.3	2584	5505	0.16
1240	678	748.9	724.95	-0.98	722.48	2.47	36.9	23.0	2578	5127	0.22
1260	678	743.9	724.00	-4.76	722.29	1.71	36.5	18.9	2565	4661	0.18
1280	678	739.1	723.64	-1.79	722.30	1.34	36.1	14.5	2554	4160	0.17
1300	677	733.4	723.23	-2.06	722.47	0.78	36.2	9.2	2557	3576	0.14

Estimation of Modified Compression Index
Southern East-West Profiler
December 2006 Monitoring Event

Station	MC V T Liner Elev	1/2/07 MC VI-E Waste Elev	Baseline Measured Pipe Elev	Baseline Slope	12/19/06 Measured Pipe Elev	Measured settlement	MC V Waste Thick.	MC VI-E Waste Thick.	Stress @ Midpoint of MC V Wast		Estimated Modif. Compres Index
									Initial	Final	
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		728.93	-					
40	668	728.6	724.91	-28.32	723.67	1.24	46.9	2.7	2877	3177	0.61
60	668	732.8	721.83	-15.57	720.36	1.48	43.8	10.0	2785	3893	0.23
80	668	736.6	721.14	-3.50	719.81	1.32	43.1	14.5	2764	4371	0.15
100	668	740.8	721.42	1.44	719.57	1.86	43.4	18.4	2773	4812	0.18
120	668	744.7	721.81	1.93	719.89	1.92	43.8	21.9	2784	5217	0.16
140	668	748.6	722.17	1.78	720.52	1.65	44.2	25.4	2795	5618	0.12
160	668	752.4	722.60	2.19	720.56	2.05	44.6	28.8	2808	6004	0.14
180	668	756.2	722.81	1.05	721.16	1.65	44.8	32.4	2814	6414	0.10
200	668	757.4	722.99	0.86	721.62	1.37	45.0	33.4	2820	6531	0.08
220	668	753.6	722.97	-0.06	721.91	1.06	45.0	29.6	2819	6104	0.07
240	683	749.3	722.80	-0.87	721.46	1.34	29.8	25.5	2364	5197	0.13
260	683	744.8	722.62	-0.87	721.48	1.14	29.6	21.1	2359	4705	0.13
280	683	740.2	722.60	-0.15	721.63	0.97	29.6	16.7	2358	4206	0.13
300	683	736.9	723.37	3.05	722.02	0.74	30.4	12.5	2381	3771	0.12
320	683	736.5	723.22	-0.71	722.39	0.84	30.2	12.3	2377	3742	0.14
340	683	736.3	722.94	-1.42	722.08	0.86	29.9	12.4	2368	3745	0.14
360	683	734.8	723.29	1.74	722.61	0.68	30.3	10.5	2379	3542	0.13
380	683	735.8	723.89	3.03	723.32	0.57	30.9	10.9	2397	3602	0.10
400	683	736.5	724.43	2.67	723.91	0.52	31.4	11.1	2413	3647	0.09
420	683	739.1	725.02	2.94	724.27	0.75	32.0	13.1	2430	3883	0.11
440	683	742.5	725.61	2.96	724.88	0.72	32.6	15.9	2448	4217	0.09
460	683	745.9	726.22	3.05	725.62	0.60	33.2	18.7	2466	4538	0.07
480	683	748.2	726.79	2.85	726.05	0.74	33.8	20.4	2484	4752	0.08
500	683	749.6	728.00	6.07	727.71	0.29	35.0	20.6	2520	4806	0.03
520	683	750.7	728.74	3.73	727.86	0.88	35.7	21.0	2542	4872	0.09
540	683	753.1	728.44	-1.52	728.16	0.28	35.4	23.6	2533	5156	0.03
560	690	754.9	729.00	2.82	728.62	0.38	29.0	24.9	2340	5103	0.04
580	690	756.5	729.53	2.62	729.22	0.31	29.5	26.0	2356	5239	0.03
600	691	756.5	730.06	2.70	729.63	0.44	29.1	25.4	2342	5165	0.04
620	692	756.7	730.47	2.01	730.44	0.02	28.5	25.3	2324	5130	0.00
640	693	756.5	730.90	2.15	730.91	-0.01	27.9	24.7	2307	5043	0.00
660	693	756.2	731.69	3.95	731.81	-0.12	28.7	23.5	2331	4936	-0.01
680	692	756.4	732.23	2.75	732.03	0.21	30.2	23.2	2377	4949	0.02
700	691	757.5	732.44	1.03	731.99	0.45	31.4	24.1	2413	5088	0.04
720	690	762.3	731.73	-3.53	730.34	1.39	31.7	29.6	2422	5706	0.12
740	689	768.1	730.57	-5.84	729.65	0.92	31.6	36.6	2417	6477	0.07
760	689	770.4	729.90	-3.34	728.45	1.45	30.9	39.5	2397	6778	0.10
780	689	770.3	729.39	-2.53	728.14	1.25	30.4	39.9	2382	6813	0.09
800	689	770.1	728.81	-2.93	727.65	1.16	29.8	40.3	2364	6833	0.08
820	689	767.5	728.36	-2.26	727.00	1.36	29.4	38.2	2351	6590	0.10
840	689	764.9	727.68	-3.39	726.35	1.33	28.7	36.2	2330	6349	0.11
860	690	761.1	727.18	-2.51	726.09	1.09	27.7	32.9	2300	5953	0.10
880	690	755.7	726.73	-2.23	725.36	1.38	27.2	28.0	2287	5397	0.14
900	690	752.1	726.52	-1.08	725.97	0.55	26.5	24.6	2265	4997	0.06
920	690	747.1	726.58	0.32	724.72	1.86	26.6	19.6	2267	4437	0.24
940	688	746.0	725.20	-6.93	724.30	0.90	27.2	19.9	2286	4489	0.11
960	686	755.7	724.78	-2.06	723.97	0.82	29.3	29.9	2349	5664	0.07
980	683	758.8	724.82	0.17	724.02	0.80	31.8	33.0	2425	6085	0.06
1000	681	760.8	724.94	0.60	723.98	0.96	33.9	34.8	2488	6354	0.07
1020	681	762.0	725.01	0.37	723.53	1.48	34.0	36.0	2490	6489	0.10
1040	680	763.3	726.02	0.03	723.19	1.83	35.0	37.2	2521	6655	0.12
1060	679	764.1	724.88	-0.69	722.85	2.03	35.9	38.2	2546	6786	0.13
1080	679	764.5	724.73	-0.79	722.91	1.82	35.7	38.8	2542	6843	0.12
1100	679	764.1	724.82	0.47	722.97	1.85	36.3	38.3	2560	6810	0.12
1120	679	762.4	725.05	1.13	723.85	1.20	36.5	36.3	2566	6598	0.08
1140	678	756.9	726.41	6.82	723.60	2.80	38.4	29.5	2622	5897	0.21
1160	678	753.6	725.29	-5.58	722.76	2.53	37.3	27.3	2589	5620	0.20
1180	678	753.2	724.85	-2.22	723.06	1.79	36.8	27.3	2575	5611	0.14
1200	678	752.7	724.63	-1.10	722.97	1.66	36.6	27.1	2569	5574	0.13
1220	678	752.2	725.14	2.57	723.72	1.43	37.1	26.1	2584	5478	0.12
1240	678	749.3	724.95	-0.98	722.80	2.14	36.9	23.4	2578	5175	0.19
1260	678	744.1	724.00	-4.76	722.57	1.43	36.5	19.1	2565	4682	0.15
1280	678	739.0	723.64	-1.79	722.79	0.84	36.1	14.4	2554	4152	0.11
1300	677	734.2	723.23	-2.06	722.96	0.27	36.2	9.9	2557	3659	0.05

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - December 2006 Monitoring Event											
		1/2/07	Baseline		12/19/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.07	-					
40	668	728.6	724.91	-28.32	723.86	1.06	46.9	2.7	2877	3177	0.52
60	668	732.8	721.83	-15.57	720.42	1.42	43.8	10.0	2785	3893	0.22
80	668	736.6	721.14	-3.50	719.91	1.23	43.1	14.5	2764	4371	0.14
100	668	740.8	721.42	1.44	719.65	1.77	43.4	18.4	2773	4812	0.17
120	668	744.7	721.81	1.93	719.95	1.86	43.8	21.9	2784	5217	0.16
140	668	748.6	722.17	1.78	720.78	1.38	44.2	25.4	2795	5618	0.10
160	668	752.4	722.60	2.19	720.60	2.01	44.6	28.8	2808	6004	0.14
180	668	756.2	722.81	1.05	721.23	1.58	44.8	32.4	2814	6414	0.10
200	668	757.4	722.99	0.86	721.68	1.30	45.0	33.4	2820	6531	0.08
220	668	753.6	722.97	-0.06	721.97	1.01	45.0	29.6	2819	6104	0.07
240	683	749.3	722.80	-0.87	721.54	1.26	29.8	25.5	2364	5197	0.12
260	683	744.8	722.62	-0.87	721.55	1.08	29.6	21.1	2359	4705	0.12
280	683	740.2	722.60	-0.15	721.70	0.90	29.6	16.7	2358	4206	0.12
300	683	736.9	723.37	3.85	722.71	0.66	30.4	12.5	2381	3771	0.11
320	683	736.5	723.22	-0.71	722.45	0.78	30.2	12.3	2377	3742	0.13
340	683	736.3	722.94	-1.42	722.13	0.81	29.9	12.4	2368	3745	0.14
360	683	734.8	723.29	1.74	722.67	0.61	30.3	10.5	2379	3542	0.12
380	683	735.8	723.89	3.03	723.42	0.48	30.9	10.9	2397	3602	0.09
400	683	736.5	724.43	2.67	723.96	0.46	31.4	11.1	2413	3647	0.08
420	683	739.1	725.02	2.94	724.33	0.68	32.0	13.1	2430	3883	0.10
440	683	742.5	725.61	2.96	724.97	0.64	32.6	15.9	2448	4217	0.08
460	683	745.9	726.22	3.05	725.67	0.55	33.2	18.7	2466	4538	0.06
480	683	748.2	726.79	2.85	726.11	0.68	33.8	20.4	2484	4752	0.07
500	683	749.6	728.00	6.07	727.79	0.21	35.0	20.6	2520	4806	0.02
520	683	750.7	728.74	3.73	727.91	0.83	35.7	21.0	2542	4872	0.08
540	683	753.1	728.44	-1.52	728.21	0.22	35.4	23.6	2533	5156	0.02
560	690	754.9	729.00	2.82	728.65	0.35	29.0	24.9	2340	5103	0.04
580	690	756.5	729.53	2.62	729.27	0.26	29.5	26.0	2356	5239	0.02
600	691	756.5	730.06	2.70	729.76	0.31	29.1	25.4	2342	5165	0.03
620	692	756.7	730.47	2.01	730.52	-0.05	28.5	25.3	2324	5130	-0.01
640	693	756.5	730.90	2.15	731.02	-0.13	27.9	24.7	2307	5043	-0.01
660	693	756.2	731.69	3.95	731.88	-0.19	28.7	23.5	2331	4936	-0.02
680	692	756.4	732.23	2.75	732.08	0.15	30.2	23.2	2377	4949	0.02
700	691	757.5	732.44	1.03	732.03	0.41	31.4	24.1	2413	5088	0.04
720	690	762.3	731.73	-3.53	730.40	1.33	31.7	29.6	2422	5706	0.11
740	689	768.1	730.57	-5.84	729.71	0.86	31.6	36.6	2417	6477	0.06
760	689	770.4	729.90	-3.34	728.51	1.39	30.9	39.5	2397	6778	0.10
780	689	770.3	729.39	-2.53	728.18	1.21	30.4	39.9	2382	6813	0.09
800	689	770.1	728.81	-2.93	727.71	1.10	29.8	40.3	2364	6833	0.08
820	689	767.5	728.36	-2.26	727.10	1.25	29.4	38.2	2351	6590	0.10
840	689	764.9	727.68	-3.39	726.39	1.29	28.7	36.2	2330	6349	0.10
860	690	761.1	727.18	-2.51	726.15	1.03	27.7	32.9	2300	5953	0.09
880	690	755.7	726.73	-2.23	725.47	1.26	27.2	28.0	2287	5397	0.12
900	690	752.1	726.52	-1.08	726.08	0.44	26.5	24.6	2265	4997	0.05
920	690	747.1	726.58	0.32	724.79	1.79	26.6	19.6	2267	4437	0.23
940	688	746.0	725.20	-6.93	724.39	0.80	27.2	19.9	2286	4489	0.10
960	686	755.7	724.78	-2.06	724.03	0.76	29.3	29.9	2349	5664	0.07
980	683	758.8	724.82	0.17	724.13	0.69	31.8	33.0	2425	6085	0.05
1000	681	760.8	724.94	0.60	724.05	0.89	33.9	34.8	2488	6354	0.06
1020	681	762.0	725.01	0.37	723.67	1.35	34.0	36.0	2490	6489	0.10
1040	680	763.3	725.02	0.03	723.30	1.72	35.0	37.2	2521	6655	0.12
1060	679	764.1	724.88	-0.69	722.92	1.97	35.9	38.2	2546	6786	0.13
1080	670	764.6	724.73	0.70	722.07	1.75	35.7	30.0	2542	6043	0.11
1100	679	764.1	724.82	0.47	723.10	1.72	36.3	38.3	2560	6810	0.11
1120	679	762.4	725.05	1.13	723.92	1.13	36.5	36.3	2566	6598	0.08
1140	678	756.9	726.41	6.82	723.73	2.67	38.4	29.5	2622	5897	0.20
1160	678	753.6	725.29	-5.58	722.87	2.42	37.3	27.3	2589	5620	0.19
1180	678	753.2	724.85	-2.22	723.19	1.66	36.8	27.3	2575	5611	0.13
1200	678	752.7	724.63	-1.10	723.10	1.53	36.6	27.1	2569	5574	0.12
1220	678	752.2	725.14	2.57	723.80	1.35	37.1	26.1	2584	5478	0.11
1240	678	749.3	724.95	-0.98	722.92	2.02	36.9	23.4	2578	5175	0.18
1260	678	744.1	724.00	-4.76	722.69	1.31	36.5	19.1	2565	4682	0.14
1280	678	739.0	723.64	-1.79	722.91	0.73	36.1	14.4	2554	4152	0.10
1300	677	734.2	723.23	-2.06	723.10	0.13	36.2	9.9	2557	3659	0.02

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit - December 2006 Monitoring Event											
		1/2/07	Baseline		12/19/06				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initiel	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		728.80	-					
40	668	728.6	724.91	-28.32	723.49	1.42	46.9	2.7	2877	3177	0.71
60	668	732.8	721.83	-15.57	720.30	1.54	43.8	10.0	2785	3893	0.24
80	668	736.6	721.14	-3.50	719.71	1.42	43.1	14.5	2764	4371	0.17
100	668	740.8	721.42	1.44	719.48	1.94	43.4	18.4	2773	4812	0.19
120	668	744.7	721.81	1.93	719.83	1.98	43.8	21.9	2784	5217	0.17
140	668	748.6	722.17	1.78	720.26	1.91	44.2	25.4	2795	5618	0.14
160	668	752.4	722.60	2.19	720.52	2.09	44.6	28.8	2808	6004	0.14
180	668	756.2	722.81	1.05	721.09	1.72	44.8	32.4	2814	6414	0.11
200	668	757.4	722.99	0.86	721.55	1.44	45.0	33.4	2820	6531	0.09
220	668	753.6	722.97	-0.06	721.86	1.12	45.0	29.6	2819	6104	0.07
240	683	749.3	722.80	-0.87	721.37	1.43	29.8	25.5	2364	5197	0.14
260	683	744.8	722.62	-0.87	721.42	1.21	29.6	21.1	2359	4705	0.14
280	683	740.2	722.80	-0.15	721.56	1.04	29.6	16.7	2358	4206	0.14
300	683	736.9	723.37	3.85	722.54	0.83	30.4	12.6	2381	3771	0.14
320	683	736.5	723.22	-0.71	722.33	0.89	30.2	12.3	2377	3742	0.15
340	683	736.3	722.94	-1.42	722.03	0.91	29.9	12.4	2368	3745	0.15
360	683	734.8	723.29	1.74	722.54	0.74	30.3	10.5	2379	3542	0.14
380	683	735.8	723.89	3.03	723.23	0.66	30.9	10.9	2397	3602	0.12
400	683	736.5	724.43	2.67	723.85	0.58	31.4	11.1	2413	3647	0.10
420	683	739.1	725.02	2.94	724.20	0.82	32.0	13.1	2430	3883	0.13
440	683	742.5	725.61	2.96	724.80	0.81	32.6	15.9	2448	4217	0.11
460	683	745.9	726.22	3.05	725.56	0.65	33.2	18.7	2466	4538	0.07
480	683	748.2	726.79	2.85	725.99	0.80	33.8	20.4	2484	4752	0.08
500	683	749.6	728.00	6.07	727.63	0.37	35.0	20.6	2520	4806	0.04
520	683	750.7	728.74	3.73	727.81	0.94	35.7	21.0	2542	4872	0.09
540	683	753.1	728.44	-1.52	728.10	0.34	35.4	23.6	2533	5156	0.03
560	690	754.9	729.00	2.82	728.59	0.41	29.0	24.9	2340	5103	0.04
580	690	756.5	729.53	2.62	729.16	0.36	29.5	26.0	2356	5239	0.04
600	691	756.5	730.06	2.70	729.50	0.56	29.1	25.4	2342	5165	0.06
620	692	756.7	730.47	2.01	730.37	0.10	28.5	25.3	2324	5130	0.01
640	693	756.5	730.90	2.15	730.79	0.11	27.9	24.7	2307	5043	0.01
660	693	756.2	731.69	3.95	731.74	-0.05	28.7	23.5	2331	4936	-0.01
680	692	756.4	732.23	2.75	731.98	0.26	30.2	23.2	2377	4949	0.03
700	691	757.5	732.44	1.03	731.95	0.49	31.4	24.1	2413	5088	0.05
720	690	762.3	731.73	-3.53	730.28	1.45	31.7	29.6	2422	5706	0.12
740	689	768.1	730.57	-5.84	729.60	0.97	31.6	36.6	2417	6477	0.07
760	689	770.4	729.90	-3.34	728.40	1.50	30.9	39.5	2397	6778	0.11
780	689	770.3	729.39	-2.53	728.10	1.29	30.4	39.9	2382	6813	0.09
800	689	770.1	728.81	-2.93	727.59	1.22	29.8	40.3	2364	6833	0.09
820	689	767.5	728.36	-2.26	726.89	1.46	29.4	38.2	2351	6590	0.11
840	689	764.9	727.68	-3.39	726.30	1.38	28.7	36.2	2330	6349	0.11
860	690	761.1	727.18	-2.51	726.04	1.14	27.7	32.9	2300	5953	0.10
880	690	755.7	726.73	-2.23	725.24	1.49	27.2	28.0	2287	5397	0.15
900	690	752.1	728.52	-1.08	725.86	0.66	26.5	24.6	2265	4997	0.07
920	690	747.1	726.58	0.32	724.65	1.93	26.6	19.6	2267	4437	0.25
940	688	746.0	725.20	-6.93	724.20	1.00	27.2	19.9	2286	4489	0.13
960	686	755.7	724.78	-2.06	723.91	0.87	29.3	29.9	2349	5664	0.08
980	683	758.8	724.82	0.17	723.90	0.92	31.8	33.0	2425	6085	0.07
1000	681	760.8	724.94	0.60	723.91	1.03	33.9	34.8	2488	6354	0.07
1020	681	762.0	725.01	0.37	723.39	1.62	34.0	36.0	2490	6489	0.11
1040	680	763.3	725.02	0.03	723.08	1.94	35.0	37.2	2521	6655	0.13
1060	679	764.1	724.88	-0.69	722.79	2.09	35.9	38.2	2546	6786	0.14
1080	679	764.5	724.73	-0.79	722.84	1.89	35.7	38.8	2542	6843	0.12
1100	679	764.1	724.82	0.47	722.84	1.98	36.3	38.3	2560	6810	0.13
1120	679	762.4	725.05	1.13	723.78	1.26	36.5	36.3	2566	6598	0.08
1140	678	756.9	726.41	6.82	723.47	2.94	38.4	29.5	2622	5897	0.22
1160	678	753.6	725.29	-5.58	722.65	2.64	37.3	27.3	2589	5620	0.21
1180	678	753.2	724.85	-2.22	722.92	1.93	36.8	27.3	2575	5611	0.15
1200	678	752.7	724.63	-1.10	722.84	1.79	36.6	27.1	2569	5574	0.15
1220	678	752.2	725.14	2.57	723.63	1.51	37.1	26.1	2584	5478	0.12
1240	678	749.3	724.95	-0.98	722.68	2.27	36.9	23.4	2578	5175	0.20
1260	678	744.1	724.00	-4.76	722.45	1.55	36.5	19.1	2565	4682	0.16
1280	678	739.0	723.64	-1.79	722.68	0.96	36.1	14.4	2554	4152	0.13
1300	677	734.2	723.23	-2.08	722.81	0.42	36.2	9.9	2557	3659	0.07

Estimation of Modified Compression Index											
Southern East-West Profiler											
March 2007 Monitoring Event											
		4/2/07	Baseline		3/27/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.06	-					
40	668	728.6	724.91	-28.32	723.47	1.45	46.9	2.7	2877	3177	0.72
60	668	732.8	721.83	-15.57	720.45	1.38	43.8	10.0	2785	3893	0.22
80	668	736.6	721.14	-3.50	719.68	1.46	43.1	14.5	2764	4371	0.17
100	668	740.8	721.42	1.44	719.63	1.79	43.4	18.4	2773	4812	0.17
120	668	744.7	721.81	1.93	719.83	1.98	43.8	21.9	2784	5217	0.17
140	668	748.6	722.17	1.78	720.35	1.82	44.2	25.4	2795	5618	0.14
160	668	752.4	722.60	2.19	720.63	1.98	44.6	28.8	2808	8004	0.13
180	668	756.2	722.81	1.05	721.21	1.60	44.8	32.4	2814	6414	0.10
200	668	757.4	722.99	0.86	721.43	1.55	45.0	33.4	2820	6531	0.09
220	668	753.6	722.97	-0.06	721.61	1.36	45.0	29.6	2819	6104	0.09
240	683	749.3	722.80	-0.87	721.55	1.25	29.8	25.5	2364	5197	0.12
260	683	744.8	722.62	-0.87	721.55	1.08	29.6	21.1	2359	4705	0.12
280	683	740.2	722.60	-0.15	721.65	0.94	29.6	16.7	2358	4206	0.13
300	683	736.9	723.37	3.85	722.50	0.88	30.4	12.5	2381	3771	0.14
320	683	736.5	723.22	-0.71	722.00	1.22	30.2	12.3	2377	3742	0.21
340	683	736.3	722.94	-1.42	722.00	0.94	29.9	12.4	2368	3745	0.16
360	683	735.5	723.29	1.74	722.48	0.81	30.3	11.2	2379	3621	0.15
380	683	737.2	723.89	3.03	723.05	0.84	30.9	12.3	2397	3759	0.14
400	683	737.8	724.43	2.67	723.67	0.76	31.4	12.4	2413	3790	0.12
420	683	739.1	725.02	2.94	724.16	0.85	32.0	13.1	2430	3882	0.13
440	683	740.9	725.61	2.96	724.78	0.83	32.6	14.3	2448	4038	0.12
460	683	745.3	726.22	3.05	725.32	0.90	33.2	18.1	2466	4471	0.10
480	683	748.3	726.79	2.85	726.03	0.76	33.8	20.5	2484	4755	0.08
500	683	750.5	728.00	6.07	727.55	0.45	35.0	21.5	2520	4909	0.04
520	683	750.9	728.74	3.73	727.58	1.16	35.7	21.2	2542	4893	0.11
540	683	752.8	728.44	-1.52	727.62	0.81	35.4	23.4	2533	5129	0.07
560	690	754.9	729.00	2.82	728.28	0.72	29.0	24.9	2340	5103	0.07
580	690	756.5	729.53	2.62	728.93	0.59	29.5	26.0	2356	5239	0.06
600	691	756.5	730.06	2.70	729.30	0.76	29.1	25.4	2342	5165	0.08
620	692	756.7	730.47	2.01	729.83	0.63	28.5	25.3	2324	5130	0.06
640	693	756.5	730.90	2.15	730.32	0.57	27.9	24.7	2307	5043	0.06
660	693	756.2	731.69	3.95	731.20	0.49	28.7	23.5	2331	4936	0.05
680	692	756.5	732.23	2.75	731.48	0.75	30.2	23.2	2377	4954	0.08
700	691	757.5	732.44	1.03	731.66	0.78	31.4	24.1	2413	5086	0.08
720	690	763.8	731.73	-3.53	730.04	1.70	31.7	31.1	2422	5873	0.14
740	689	770.4	730.57	-5.84	728.93	1.64	31.6	38.8	2417	6727	0.12
760	689	771.1	729.90	-3.34	728.12	1.78	30.9	40.2	2397	6863	0.13
780	689	770.9	729.39	-2.53	727.53	1.86	30.4	40.5	2382	6880	0.13
800	689	771.8	728.81	-2.93	727.18	1.63	29.8	42.0	2364	7021	0.12
820	689	769.7	728.36	-2.26	726.45	1.91	29.4	40.4	2351	6830	0.14
840	689	766.0	727.68	-3.39	725.81	1.87	28.7	37.3	2330	6476	0.15
860	690	769.3	727.18	-2.51	725.23	1.94	27.7	41.1	2300	6861	0.15
880	690	771.4	726.73	-2.23	724.63	2.10	27.2	43.7	2287	7139	0.16
900	690	774.2	726.52	-1.08	725.27	1.25	26.5	46.7	2265	7447	0.09
920	690	775.1	726.58	0.32	723.90	2.68	26.6	47.5	2267	7539	0.19
940	688	776.0	725.20	-6.93	723.32	1.87	27.2	49.8	2286	7814	0.13
960	686	775.8	724.78	-2.06	723.18	1.60	29.3	50.0	2349	7898	0.10
980	683	770.6	724.82	0.17	723.44	1.38	31.8	44.8	2425	7398	0.09
1000	681	765.9	724.94	0.60	723.29	1.65	33.9	39.9	2488	6922	0.11
1020	681	765.5	725.01	0.37	723.14	1.87	34.0	39.4	2490	6868	0.12
1040	680	765.1	725.02	0.03	722.83	2.19	35.0	39.1	2521	6855	0.14
1060	679	765.9	724.88	-0.69	722.52	2.36	35.9	40.0	2546	6991	0.15
1080	679	765.3	724.73	0.70	722.48	2.26	36.7	30.6	2642	6038	0.14
1100	679	764.6	724.82	0.47	722.72	2.10	36.3	38.8	2560	6867	0.13
1120	679	763.2	725.05	1.13	723.61	1.44	36.5	37.1	2566	6689	0.09
1140	678	757.5	726.41	6.82	723.48	2.93	38.4	30.1	2622	5961	0.21
1160	678	753.6	725.29	-5.58	722.61	2.69	37.3	27.3	2589	5621	0.21
1180	678	753.2	724.85	-2.22	722.52	2.33	36.8	27.4	2575	5611	0.19
1200	678	752.7	724.63	-1.10	722.75	1.88	36.6	27.1	2569	5575	0.15
1220	678	752.2	725.14	2.57	723.13	2.01	37.1	26.1	2584	5479	0.17
1240	678	749.3	724.95	-0.98	722.51	2.44	36.9	23.4	2578	5175	0.22
1260	678	744.1	724.00	-4.76	722.32	1.68	36.5	19.1	2565	4682	0.18
1280	678	739.0	723.64	-1.79	722.34	1.30	36.1	14.4	2554	4152	0.17
1300	677	734.2	723.23	-2.06	722.45	0.78	36.2	9.9	2557	3659	0.14

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - March 2007 Monitoring Event											
		4/2/07	Baseline		3/27/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.19	-					
40	668	728.6	724.91	-28.32	723.65	1.26	46.9	2.7	2877	3177	0.63
60	668	732.8	721.83	-15.57	720.51	1.32	43.8	10.0	2785	3893	0.21
80	668	736.6	721.14	-3.50	719.78	1.36	43.1	14.5	2764	4371	0.16
100	668	740.8	721.42	1.44	719.72	1.71	43.4	18.4	2773	4812	0.16
120	668	744.7	721.81	1.93	719.89	1.92	43.8	21.9	2784	5217	0.16
140	668	748.6	722.17	1.78	720.61	1.56	44.2	25.4	2795	5618	0.12
160	668	752.4	722.60	2.19	720.67	1.94	44.6	28.8	2808	6004	0.13
180	668	756.2	722.81	1.05	721.28	1.53	44.8	32.4	2814	6414	0.10
200	668	757.4	722.99	0.86	721.50	1.49	45.0	33.4	2820	6531	0.09
220	668	753.6	722.97	-0.06	721.67	1.31	45.0	29.6	2819	6104	0.09
240	683	749.3	722.80	-0.87	721.63	1.17	29.8	25.5	2364	5197	0.11
260	683	744.8	722.62	-0.87	721.61	1.01	29.6	21.1	2359	4705	0.11
280	683	740.2	722.60	-0.15	721.72	0.87	29.6	16.7	2358	4206	0.12
300	683	736.9	723.37	3.85	722.59	0.78	30.4	12.5	2381	3771	0.13
320	683	736.5	723.22	-0.71	722.06	1.17	30.2	12.3	2377	3742	0.20
340	683	736.3	722.94	-1.42	722.05	0.89	29.9	12.4	2368	3745	0.15
360	683	735.5	723.29	1.74	722.54	0.74	30.3	11.2	2379	3621	0.13
380	683	737.2	723.89	3.03	723.15	0.75	30.9	12.3	2397	3759	0.12
400	683	737.8	724.43	2.67	723.73	0.70	31.4	12.4	2413	3790	0.11
420	683	739.1	725.02	2.94	724.23	0.78	32.0	13.1	2430	3882	0.12
440	683	740.9	725.61	2.96	724.86	0.74	32.6	14.3	2448	4038	0.10
460	683	745.3	726.22	3.05	725.37	0.85	33.2	18.1	2466	4471	0.10
480	683	748.3	726.79	2.85	726.09	0.70	33.8	20.5	2484	4755	0.07
500	683	750.5	728.00	6.07	727.63	0.37	35.0	21.5	2520	4909	0.04
520	683	750.9	728.74	3.73	727.64	1.11	35.7	21.2	2542	4893	0.11
540	683	752.8	728.44	-1.52	727.68	0.76	35.4	23.4	2533	5129	0.07
560	690	754.9	729.00	2.82	728.31	0.69	29.0	24.9	2340	5103	0.07
580	690	756.5	729.53	2.62	728.99	0.54	29.5	26.0	2356	5239	0.05
600	691	756.5	730.06	2.70	729.43	0.64	29.1	25.4	2342	5165	0.06
620	692	756.7	730.47	2.01	729.91	0.56	28.5	25.3	2324	5130	0.06
640	693	758.5	730.90	2.15	730.44	0.45	27.9	24.7	2307	5043	0.05
660	693	756.2	731.69	3.95	731.27	0.42	28.7	23.5	2331	4936	0.04
680	692	756.5	732.23	2.75	731.53	0.70	30.2	23.2	2377	4954	0.07
700	691	757.5	732.44	1.03	731.70	0.74	31.4	24.1	2413	5086	0.07
720	690	763.8	731.73	-3.53	730.10	1.64	31.7	31.1	2422	5873	0.13
740	689	770.4	730.57	-5.84	728.98	1.58	31.6	38.8	2417	6727	0.11
760	689	771.1	729.90	-3.34	728.18	1.73	30.9	40.2	2397	6863	0.12
780	689	770.9	729.39	-2.53	727.57	1.82	30.4	40.5	2382	6880	0.13
800	689	771.8	728.81	-2.93	727.24	1.57	29.8	42.0	2364	7021	0.11
820	689	769.7	728.36	-2.26	726.55	1.80	29.4	40.4	2351	6830	0.13
840	689	766.0	727.68	-3.39	725.85	1.82	28.7	37.3	2330	6476	0.14
860	690	769.3	727.18	-2.51	725.29	1.89	27.7	41.1	2300	6861	0.14
880	690	771.4	726.73	-2.23	724.75	1.99	27.2	43.7	2287	7139	0.15
900	690	774.2	726.52	-1.08	725.38	1.13	26.5	46.7	2265	7447	0.08
920	690	775.1	726.58	0.32	723.97	2.61	26.6	47.5	2267	7539	0.19
940	688	776.0	725.20	-6.93	723.42	1.78	27.2	49.8	2286	7814	0.12
960	686	775.8	724.78	-2.06	723.24	1.55	29.3	50.0	2349	7898	0.10
980	683	770.6	724.82	0.17	723.55	1.27	31.8	44.8	2425	7398	0.08
1000	681	765.9	724.94	0.60	723.36	1.57	33.9	39.9	2488	6922	0.10
1020	681	765.5	725.01	0.37	723.28	1.74	34.0	39.4	2490	6868	0.12
1040	680	765.1	725.02	0.03	722.94	2.08	35.0	39.1	2521	6855	0.14
1060	679	765.9	724.88	-0.69	722.59	2.30	35.9	40.0	2546	6991	0.15
1080	679	765.3	724.73	-0.79	722.55	2.18	35.7	39.6	2542	6938	0.14
1100	679	764.6	724.82	0.47	722.85	1.97	36.3	38.8	2560	6867	0.13
1120	679	763.2	725.05	1.13	723.67	1.37	36.5	37.1	2568	6689	0.09
1140	678	757.5	726.41	6.82	723.61	2.79	38.4	30.1	2622	5961	0.20
1160	678	753.6	725.29	-5.58	722.72	2.58	37.3	27.3	2589	5621	0.21
1180	678	753.2	724.85	-2.22	722.65	2.19	36.8	27.4	2575	5611	0.18
1200	678	752.7	724.63	-1.10	722.88	1.75	36.6	27.1	2569	5575	0.14
1220	678	752.2	725.14	2.57	723.21	1.93	37.1	26.1	2584	5479	0.16
1240	678	749.3	724.95	-0.98	722.63	2.31	36.9	23.4	2578	5175	0.21
1260	678	744.1	724.00	-4.76	722.44	1.56	36.5	19.1	2565	4682	0.16
1280	678	739.0	723.64	-1.79	722.46	1.18	36.1	14.4	2554	4152	0.15
1300	677	734.2	723.23	-2.06	722.60	0.63	36.2	9.9	2557	3659	0.11

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit - March 2007 Monitoring Event											
		4/2/07	Baseline		3/27/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		728.92	-					
40	668	728.6	724.91	-28.32	723.28	1.63	46.9	2.7	2877	3177	0.81
60	668	732.8	721.83	-15.57	720.39	1.44	43.8	10.0	2785	3893	0.23
80	668	736.6	721.14	-3.50	719.58	1.55	43.1	14.5	2764	4371	0.18
100	668	740.8	721.42	1.44	719.54	1.88	43.4	18.4	2773	4812	0.18
120	668	744.7	721.81	1.93	719.77	2.04	43.8	21.9	2784	5217	0.17
140	668	748.6	722.17	1.78	720.08	2.08	44.2	25.4	2795	5618	0.16
160	668	752.4	722.60	2.19	720.59	2.02	44.6	28.8	2808	6004	0.14
180	668	756.2	722.81	1.05	721.14	1.67	44.8	32.4	2814	6414	0.10
200	668	757.4	722.99	0.86	721.37	1.62	45.0	33.4	2820	6531	0.10
220	668	753.6	722.97	-0.06	721.55	1.42	45.0	29.6	2819	6104	0.09
240	683	749.3	722.80	-0.87	721.46	1.34	29.8	25.5	2364	5197	0.13
260	683	744.8	722.62	-0.87	721.48	1.14	29.6	21.1	2359	4705	0.13
280	683	740.2	722.60	-0.15	721.58	1.02	29.6	16.7	2358	4206	0.14
300	683	736.9	723.37	3.85	722.42	0.95	30.4	12.5	2381	3771	0.16
320	683	736.5	723.22	-0.71	721.94	1.28	30.2	12.3	2377	3742	0.21
340	683	736.3	722.94	-1.42	721.95	0.99	29.9	12.4	2368	3745	0.17
360	683	735.5	723.29	1.74	722.41	0.87	30.3	11.2	2379	3621	0.16
380	683	737.2	723.89	3.03	722.96	0.93	30.9	12.3	2397	3759	0.15
400	683	737.8	724.43	2.67	723.61	0.82	31.4	12.4	2413	3790	0.13
420	683	739.1	725.02	2.94	724.09	0.92	32.0	13.1	2430	3882	0.14
440	683	740.9	725.61	2.96	724.69	0.92	32.6	14.3	2448	4038	0.13
460	683	745.3	726.22	3.05	725.26	0.95	33.2	18.1	2468	4471	0.11
480	683	748.3	726.79	2.85	725.97	0.82	33.8	20.5	2484	4755	0.09
500	683	750.5	728.00	6.07	727.47	0.53	35.0	21.5	2520	4909	0.05
520	683	750.9	728.74	3.73	727.53	1.21	35.7	21.2	2542	4893	0.12
540	683	752.8	728.44	-1.52	727.57	0.87	35.4	23.4	2533	5129	0.08
560	690	754.9	729.00	2.82	728.25	0.75	29.0	24.9	2340	5103	0.08
580	690	756.5	729.53	2.62	728.88	0.65	29.5	26.0	2356	5239	0.06
600	691	756.5	730.06	2.70	729.18	0.89	29.1	25.4	2342	5165	0.09
620	692	756.7	730.47	2.01	729.75	0.71	28.5	25.3	2324	5130	0.07
640	693	756.5	730.90	2.15	730.21	0.69	27.9	24.7	2307	5043	0.07
660	693	756.2	731.69	3.95	731.13	0.56	28.7	23.5	2331	4936	0.06
680	692	756.5	732.23	2.75	731.43	0.81	30.2	23.2	2377	4954	0.08
700	691	757.5	732.44	1.03	731.62	0.82	31.4	24.1	2413	5086	0.08
720	690	763.8	731.73	-3.53	729.98	1.76	31.7	31.1	2422	5873	0.14
740	689	770.4	730.57	-5.84	728.87	1.70	31.6	38.8	2417	6727	0.12
760	689	771.1	729.90	-3.34	728.06	1.84	30.9	40.2	2397	6863	0.13
780	689	770.9	729.39	-2.53	727.49	1.90	30.4	40.5	2382	6880	0.14
800	689	771.8	728.81	-2.93	727.12	1.69	29.8	42.0	2364	7021	0.12
820	689	769.7	728.36	-2.26	726.34	2.01	29.4	40.4	2351	6830	0.15
840	689	766.0	727.68	-3.39	725.76	1.92	28.7	37.3	2330	6476	0.15
860	690	769.3	727.18	-2.51	725.18	2.00	27.7	41.1	2300	6861	0.15
880	690	771.4	726.73	-2.23	724.51	2.22	27.2	43.7	2287	7139	0.17
900	690	774.2	726.52	-1.08	725.16	1.36	26.5	46.7	2265	7447	0.10
920	690	775.1	726.58	0.32	723.83	2.75	26.6	47.5	2267	7539	0.20
940	688	776.0	725.20	-6.93	723.23	1.97	27.2	49.8	2286	7814	0.14
960	686	775.8	724.78	-2.06	723.12	1.66	29.3	50.0	2349	7898	0.11
980	683	770.6	724.82	0.17	723.32	1.50	31.8	44.8	2425	7398	0.10
1000	681	765.9	724.94	0.60	723.22	1.72	33.9	39.9	2488	6922	0.11
1020	681	765.5	725.01	0.37	723.00	2.01	34.0	39.4	2490	6868	0.13
1040	680	765.1	725.02	0.03	722.72	2.30	35.0	39.1	2521	6855	0.15
1060	679	765.9	724.88	-0.69	722.46	2.42	35.9	40.0	2546	6991	0.15
1080	679	765.3	724.73	-0.79	722.41	2.31	35.7	39.6	2542	6938	0.15
1100	679	764.6	724.82	0.47	722.59	2.23	36.3	38.8	2560	6867	0.14
1120	679	763.2	725.05	1.13	723.54	1.51	36.5	37.1	2566	6689	0.10
1140	678	757.5	726.41	6.82	723.35	3.06	38.4	30.1	2622	5961	0.22
1160	678	753.6	725.29	-5.58	722.50	2.80	37.3	27.3	2589	5621	0.22
1180	678	753.2	724.85	-2.22	722.39	2.46	36.8	27.4	2575	5611	0.20
1200	678	752.7	724.63	-1.10	722.62	2.01	36.6	27.1	2569	5575	0.16
1220	678	752.2	725.14	2.57	723.05	2.09	37.1	26.1	2584	5479	0.17
1240	678	749.3	724.95	-0.98	722.39	2.56	36.9	23.4	2578	5175	0.23
1260	678	744.1	724.00	-4.76	722.20	1.80	36.5	19.1	2565	4682	0.19
1280	678	739.0	723.64	-1.79	722.23	1.41	36.1	14.4	2554	4152	0.18
1300	677	734.2	723.23	-2.06	722.31	0.92	36.2	9.9	2557	3659	0.16

Estimation of Modified Compression Index
Southern East-West Profiler
June 2007 Monitoring Event

		7/2/07	Baseline		6/27/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.22	-					
40	668	728.6	724.91	-28.32	723.37	1.54	46.9	2.7	2877	3177	0.76
60	668	732.8	721.83	-15.57	720.39	1.45	43.8	10.0	2785	3893	0.23
80	668	736.6	721.14	-3.50	719.69	1.45	43.1	14.5	2764	4371	0.17
100	668	740.8	721.42	1.44	719.60	1.83	43.4	18.4	2773	4812	0.18
120	668	744.7	721.81	1.93	719.74	2.07	43.8	21.9	2784	5217	0.17
140	668	748.6	722.17	1.78	720.22	1.95	44.2	25.4	2795	5618	0.15
160	668	752.4	722.60	2.19	720.53	2.08	44.6	28.8	2808	6004	0.14
180	668	756.2	722.81	1.05	721.09	1.72	44.8	32.4	2814	6414	0.11
200	668	757.4	722.99	0.86	721.31	1.68	45.0	33.4	2820	6531	0.10
220	668	753.6	722.97	-0.06	721.53	1.44	45.0	29.6	2819	6104	0.10
240	683	749.3	722.80	-0.87	721.46	1.34	29.8	25.5	2364	5197	0.13
260	683	744.8	722.62	-0.87	721.47	1.16	29.6	21.1	2359	4705	0.13
280	683	740.2	722.60	-0.15	721.53	1.06	29.6	16.7	2358	4206	0.14
300	683	730.9	723.37	3.85	722.37	0.99	30.4	12.5	2361	3771	0.16
320	683	736.5	723.22	-0.71	721.86	1.36	30.2	12.3	2377	3742	0.23
340	683	736.3	722.94	-1.42	721.89	1.05	29.9	12.4	2368	3746	0.18
360	683	735.5	723.29	1.74	722.39	0.89	30.3	11.2	2379	3621	0.16
380	683	737.2	723.89	3.03	722.97	0.93	30.9	12.3	2397	3762	0.15
400	683	738.1	724.43	2.67	723.51	0.92	31.4	12.7	2413	3817	0.15
420	683	739.0	725.02	2.94	724.05	0.96	32.0	13.0	2430	3874	0.15
440	683	739.2	725.61	2.96	724.63	0.98	32.6	12.6	2448	3850	0.15
460	683	740.7	726.22	3.05	725.21	1.01	33.2	13.4	2466	3958	0.15
480	683	742.0	726.79	2.85	725.90	0.89	33.8	14.2	2484	4059	0.12
500	683	745.2	728.00	6.07	727.43	0.56	35.0	16.2	2520	4321	0.07
520	683	749.3	728.74	3.73	727.42	1.33	35.7	19.5	2542	4708	0.14
540	683	753.7	728.44	-1.52	727.48	0.96	35.4	24.2	2533	5224	0.09
560	690	758.3	729.00	2.82	728.16	0.84	29.0	28.3	2340	5478	0.08
580	690	762.5	729.53	2.62	728.71	0.82	29.5	32.0	2356	5904	0.07
600	691	767.8	730.06	2.70	729.00	1.07	29.1	36.7	2342	6417	0.08
620	692	772.8	730.47	2.01	729.55	0.91	28.5	41.4	2324	6917	0.07
640	693	776.7	730.90	2.15	730.03	0.87	27.9	44.8	2307	7280	0.06
660	693	780.2	731.69	3.95	730.84	0.84	28.7	47.5	2331	7606	0.06
680	692	782.2	732.23	2.75	731.11	1.12	30.2	48.9	2377	7809	0.07
700	691	782.4	732.44	1.03	731.25	1.19	31.4	48.9	2413	7845	0.07
720	690	781.2	731.73	-3.53	729.67	2.06	31.7	48.5	2422	7802	0.13
740	689	779.7	730.57	-5.84	728.66	1.91	31.6	48.1	2417	7757	0.12
760	689	776.4	729.90	-3.34	728.05	1.85	30.9	45.5	2397	7446	0.12
780	689	775.3	729.39	-2.53	727.28	2.12	30.4	44.9	2382	7363	0.14
800	689	774.5	728.81	-2.93	726.90	1.91	29.8	44.7	2364	7327	0.13
820	689	773.0	728.36	-2.26	726.33	2.02	29.4	43.6	2351	7192	0.14
840	689	771.2	727.68	-3.39	725.62	2.05	28.7	42.6	2330	7054	0.15
860	690	770.7	727.18	-2.51	725.11	2.07	27.7	42.6	2300	7024	0.15
880	690	771.6	726.73	-2.23	724.44	2.30	27.2	43.9	2287	7155	0.17
900	690	774.3	726.52	-1.08	725.11	1.41	26.5	46.8	2265	7461	0.10
920	690	775.5	726.58	0.32	723.68	2.90	26.6	47.9	2267	7585	0.21
940	688	776.0	725.20	-6.93	723.10	2.09	27.2	49.8	2286	7814	0.14
960	686	776.0	724.78	-2.06	722.79	2.00	29.3	50.2	2349	7922	0.13
980	683	774.0	724.82	0.17	723.09	1.73	31.8	48.2	2425	7777	0.11
1000	681	765.9	724.94	0.60	723.14	1.79	33.9	40.0	2488	6929	0.12
1020	681	765.5	725.01	0.37	722.79	2.23	34.0	39.4	2490	6869	0.15
1040	680	765.1	725.02	0.03	722.67	2.35	35.0	39.0	2521	6854	0.15
1060	679	765.9	724.88	-0.69	722.36	2.52	35.9	40.1	2546	6992	0.16
1080	679	765.3	724.73	-0.79	722.37	2.36	35.7	39.6	2542	6938	0.15
1100	679	764.6	724.82	0.47	722.57	2.25	36.3	38.8	2560	6867	0.14
1120	679	763.2	725.05	1.13	723.47	1.57	36.5	37.1	2566	6689	0.10
1140	678	757.5	726.41	6.82	723.43	2.98	38.4	30.1	2622	5961	0.22
1160	678	753.6	725.29	-5.58	722.39	2.90	37.3	27.3	2589	5621	0.23
1180	678	753.2	724.85	-2.22	722.40	2.45	36.8	27.4	2575	5611	0.20
1200	678	752.7	724.63	-1.10	722.59	2.04	38.6	27.1	2569	5575	0.17
1220	678	752.2	725.14	2.57	723.00	2.15	37.1	26.1	2584	5479	0.18
1240	678	749.3	724.95	-0.98	722.37	2.58	36.9	23.4	2578	5175	0.23
1260	678	744.1	724.00	-4.76	722.33	1.67	36.5	19.1	2565	4682	0.18
1280	678	739.0	723.64	-1.79	722.24	1.40	36.1	14.4	2554	4152	0.18
1300	677	734.2	723.23	-2.06	722.33	0.90	36.2	9.9	2557	3659	0.16

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - June 2007 Monitoring Event											
		7/2/07	Baseline		6/27/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.38		729.36	-					
40	668	728.6	724.91	-28.32	723.56	1.36	46.9	2.7	2877	3177	0.67
60	668	732.8	721.83	-15.57	720.45	1.39	43.8	10.0	2785	3893	0.22
80	668	736.6	721.14	-3.50	719.78	1.35	43.1	14.5	2764	4371	0.16
100	668	740.8	721.42	1.44	719.68	1.74	43.4	18.4	2773	4812	0.17
120	668	744.7	721.81	1.93	719.80	2.01	43.8	21.9	2784	5217	0.17
140	668	748.6	722.17	1.78	720.48	1.69	44.2	25.4	2795	5618	0.13
160	668	752.4	722.60	2.19	720.57	2.04	44.6	28.8	2808	6004	0.14
180	668	756.2	722.81	1.05	721.16	1.65	44.8	32.4	2814	6414	0.10
200	668	757.4	722.99	0.86	721.37	1.61	45.0	33.4	2820	6531	0.10
220	668	753.6	722.97	-0.06	721.59	1.38	45.0	29.6	2819	6104	0.09
240	683	749.3	722.80	-0.87	721.55	1.25	29.8	25.5	2364	5197	0.12
260	683	744.8	722.62	-0.87	721.53	1.09	29.6	21.1	2359	4705	0.12
280	683	740.2	722.60	-0.15	721.61	0.99	29.6	16.7	2358	4206	0.13
300	683	736.9	723.37	3.85	722.46	0.91	30.4	12.5	2381	3771	0.15
320	683	736.5	723.22	-0.71	721.92	1.30	30.2	12.3	2377	3742	0.22
340	683	736.3	722.94	-1.42	721.94	1.00	29.9	12.4	2368	3745	0.17
360	683	735.5	723.29	1.74	722.46	0.83	30.3	11.2	2379	3621	0.15
380	683	737.2	723.89	3.03	723.06	0.83	30.9	12.3	2397	3762	0.14
400	683	738.1	724.43	2.67	723.57	0.86	31.4	12.7	2413	3817	0.14
420	683	739.0	725.02	2.94	724.12	0.90	32.0	13.0	2430	3874	0.14
440	683	739.2	725.61	2.96	724.72	0.89	32.6	12.6	2448	3850	0.14
460	683	740.7	726.22	3.05	725.26	0.95	33.2	13.4	2466	3958	0.14
480	683	742.0	726.79	2.85	725.96	0.83	33.8	14.2	2484	4059	0.12
500	683	745.2	728.00	6.07	727.51	0.49	35.0	16.2	2520	4321	0.06
520	683	749.3	728.74	3.73	727.47	1.27	35.7	19.5	2542	4708	0.13
540	683	753.7	728.44	-1.52	727.53	0.90	35.4	24.2	2533	5224	0.08
560	690	758.3	729.00	2.82	728.19	0.81	29.0	28.3	2340	5478	0.08
580	690	762.5	729.53	2.62	728.76	0.77	29.5	32.0	2356	5904	0.07
600	691	767.8	730.06	2.70	729.12	0.94	29.1	36.7	2342	6417	0.07
620	692	772.8	730.47	2.01	729.63	0.84	28.5	41.4	2324	6917	0.06
640	693	776.7	730.90	2.15	730.14	0.75	27.9	44.8	2307	7280	0.05
660	693	780.2	731.69	3.95	730.91	0.77	28.7	47.5	2331	7606	0.05
680	692	782.2	732.23	2.75	731.16	1.07	30.2	48.9	2377	7809	0.07
700	691	782.4	732.44	1.03	731.29	1.15	31.4	48.9	2413	7845	0.07
720	690	781.2	731.73	-3.53	729.73	2.00	31.7	48.5	2422	7802	0.12
740	689	779.7	730.57	-5.84	728.72	1.85	31.6	48.1	2417	7757	0.12
760	689	776.4	729.90	-3.34	728.10	1.80	30.9	45.5	2397	7446	0.12
780	689	775.3	729.39	-2.53	727.32	2.08	30.4	44.9	2382	7363	0.14
800	689	774.5	728.81	-2.93	726.96	1.85	29.8	44.7	2364	7327	0.13
820	689	773.0	728.36	-2.26	726.44	1.92	29.4	43.6	2351	7192	0.13
840	689	771.2	727.68	-3.39	725.67	2.01	28.7	42.6	2330	7054	0.15
860	690	770.7	727.18	-2.51	725.17	2.01	27.7	42.6	2300	7024	0.15
880	690	771.6	726.73	-2.23	724.55	2.18	27.2	43.9	2287	7155	0.16
900	690	774.3	726.52	-1.08	725.22	1.29	26.5	46.8	2265	7461	0.09
920	690	775.5	726.58	0.32	723.75	2.83	26.6	47.9	2267	7585	0.20
940	688	776.0	725.20	-6.93	723.20	2.00	27.2	49.8	2286	7814	0.14
960	686	776.0	724.78	-2.06	722.84	1.94	29.3	50.2	2349	7922	0.13
980	683	774.0	724.82	0.17	723.20	1.62	31.8	48.2	2425	7777	0.10
1000	681	765.9	724.94	0.60	723.22	1.72	33.9	40.0	2488	6929	0.11
1020	681	765.5	725.01	0.37	722.92	2.09	34.0	39.4	2490	6869	0.14
1040	680	765.1	725.02	0.03	722.78	2.24	35.0	39.0	2521	6854	0.15
1060	679	765.9	724.88	-0.69	722.43	2.46	35.9	40.1	2546	6992	0.16
1080	679	765.3	724.73	-0.79	722.44	2.29	35.7	39.6	2542	6938	0.15
1100	679	764.6	724.82	0.47	722.70	2.12	36.3	38.8	2560	6867	0.14
1120	679	763.2	725.05	1.13	723.54	1.50	36.5	37.1	2566	6689	0.10
1140	678	757.5	726.41	6.82	723.56	2.85	38.4	30.1	2622	5961	0.21
1160	678	753.6	725.29	-5.58	722.51	2.79	37.3	27.3	2589	5621	0.22
1180	678	753.2	724.85	-2.22	722.54	2.31	36.8	27.4	2575	5611	0.19
1200	678	752.7	724.63	-1.10	722.72	1.91	36.6	27.1	2569	5575	0.15
1220	678	752.2	725.14	2.57	723.08	2.07	37.1	26.1	2584	5479	0.17
1240	678	749.3	724.95	-0.98	722.49	2.46	36.9	23.4	2578	5175	0.22
1260	678	744.1	724.00	-4.76	722.45	1.55	36.5	19.1	2565	4682	0.16
1280	678	739.0	723.64	-1.79	722.36	1.28	36.1	14.4	2554	4152	0.17
1300	677	734.2	723.23	-2.06	722.47	0.75	36.2	9.9	2557	3659	0.13

Estimation of Modified Compression Index
Southern East-West Profiler
95% Confidence Lower Limit - June 2007 Monitoring Event

		7/2/07	Baseline		6/27/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.08	-					
40	668	728.6	724.91	-28.32	723.19	1.72	46.9	2.7	2877	3177	0.85
60	668	732.8	721.83	-15.57	720.33	1.51	43.8	10.0	2785	3893	0.24
80	668	736.6	721.14	-3.50	719.59	1.55	43.1	14.5	2764	4371	0.18
100	668	740.8	721.42	1.44	719.51	1.91	43.4	18.4	2773	4812	0.18
120	668	744.7	721.81	1.93	719.67	2.14	43.8	21.9	2784	5217	0.18
140	668	748.6	722.17	1.78	719.90	2.21	44.2	25.4	2795	5618	0.17
160	668	752.4	722.60	2.19	720.49	2.12	44.6	28.8	2808	6004	0.14
180	668	756.2	722.81	1.05	721.02	1.79	44.8	32.4	2814	6414	0.11
200	668	757.4	722.99	0.86	721.24	1.75	45.0	33.4	2820	6531	0.11
220	668	753.6	722.97	-0.06	721.48	1.50	45.0	29.6	2819	6104	0.10
240	683	749.3	722.80	-0.87	721.38	1.42	29.8	25.5	2364	5197	0.14
260	683	744.8	722.62	-0.87	721.40	1.23	29.6	21.1	2359	4705	0.14
280	683	740.2	722.60	-0.15	721.46	1.13	29.6	16.7	2358	4206	0.15
300	683	736.9	723.37	3.85	722.29	1.08	30.4	12.5	2381	3771	0.18
320	683	736.5	723.22	-0.71	721.81	1.42	30.2	12.3	2377	3742	0.24
340	683	736.3	722.94	-1.42	721.84	1.10	29.9	12.4	2368	3745	0.19
360	683	735.5	723.29	1.74	722.33	0.96	30.3	11.2	2379	3621	0.17
380	683	737.2	723.89	3.03	722.87	1.02	30.9	12.3	2397	3762	0.17
400	683	738.1	724.43	2.67	723.45	0.98	31.4	12.7	2413	3817	0.16
420	683	739.0	725.02	2.94	723.98	1.03	32.0	13.0	2430	3874	0.16
440	683	739.2	725.61	2.96	724.54	1.06	32.6	12.6	2448	3850	0.17
460	683	740.7	726.22	3.05	725.15	1.06	33.2	13.4	2466	3958	0.16
480	683	742.0	726.79	2.85	725.84	0.95	33.8	14.2	2484	4059	0.13
500	683	745.2	728.00	6.07	727.36	0.64	35.0	16.2	2520	4321	0.08
520	683	749.3	728.74	3.73	727.36	1.38	35.7	19.5	2542	4708	0.14
540	683	753.7	728.44	-1.52	727.42	1.02	35.4	24.2	2533	5224	0.09
560	690	758.3	729.00	2.82	728.13	0.88	29.0	28.3	2340	5478	0.08
580	690	762.5	729.53	2.62	728.65	0.87	29.5	32.0	2356	5904	0.07
600	691	767.8	730.06	2.70	728.87	1.19	29.1	36.7	2342	6417	0.09
620	692	772.8	730.47	2.01	729.47	0.99	28.5	41.4	2324	6917	0.07
640	693	776.7	730.90	2.15	729.91	0.99	27.9	44.8	2307	7280	0.07
660	693	780.2	731.69	3.95	730.77	0.91	28.7	47.5	2331	7606	0.06
680	692	782.2	732.23	2.75	731.06	1.17	30.2	48.9	2377	7809	0.08
700	691	782.4	732.44	1.03	731.21	1.23	31.4	48.9	2413	7845	0.08
720	690	781.2	731.73	-3.53	729.61	2.12	31.7	48.5	2422	7802	0.13
740	689	779.7	730.57	-5.84	728.61	1.96	31.6	48.1	2417	7757	0.12
760	689	776.4	729.90	-3.34	727.99	1.91	30.9	45.5	2397	7446	0.13
780	689	775.3	729.39	-2.53	727.24	2.16	30.4	44.9	2382	7363	0.14
800	689	774.5	728.81	-2.93	726.84	1.97	29.8	44.7	2364	7327	0.13
820	689	773.0	728.36	-2.26	726.23	2.13	29.4	43.6	2351	7192	0.15
840	689	771.2	727.68	-3.39	725.58	2.10	28.7	42.8	2330	7054	0.15
860	690	770.7	727.18	-2.51	725.06	2.12	27.7	42.6	2300	7024	0.16
880	690	771.6	726.73	-2.23	724.32	2.41	27.2	43.9	2287	7155	0.18
900	690	774.3	726.52	-1.08	725.00	1.52	26.5	46.8	2265	7461	0.11
920	690	775.5	726.58	0.32	723.61	2.97	26.6	47.9	2267	7585	0.21
940	688	776.0	725.20	-6.93	723.01	2.19	27.2	49.8	2286	7814	0.15
960	686	776.0	724.78	-2.06	722.73	2.06	29.3	50.2	2349	7922	0.13
980	683	774.0	724.82	0.17	722.97	1.85	31.8	48.2	2425	7777	0.11
1000	681	765.9	724.94	0.60	723.07	1.87	33.9	40.0	2488	6929	0.12
1020	681	765.5	725.01	0.37	722.65	2.36	34.0	39.4	2490	6869	0.16
1040	680	765.1	725.02	0.03	722.56	2.46	35.0	39.0	2521	6854	0.16
1060	679	765.9	724.88	-0.69	722.30	2.58	35.9	40.1	2546	6992	0.16
1080	679	765.3	724.73	-0.79	722.30	2.42	35.7	39.6	2542	6938	0.16
1100	679	764.6	724.82	0.47	722.44	2.38	36.3	38.8	2560	6867	0.15
1120	679	763.2	725.05	1.13	723.41	1.64	36.5	37.1	2566	6689	0.11
1140	678	757.5	726.41	6.82	723.30	3.11	38.4	30.1	2622	5961	0.23
1160	678	753.6	725.29	-5.58	722.28	3.01	37.3	27.3	2589	5621	0.24
1180	678	753.2	724.85	-2.22	722.27	2.58	36.8	27.4	2575	5611	0.21
1200	678	752.7	724.63	-1.10	722.46	2.17	36.6	27.1	2569	5575	0.18
1220	678	752.2	725.14	2.57	722.91	2.23	37.1	26.1	2584	5479	0.18
1240	678	749.3	724.95	-0.98	722.25	2.70	36.9	23.4	2578	5175	0.24
1260	678	744.1	724.00	-4.76	722.20	1.79	36.5	19.1	2565	4682	0.19
1280	678	739.0	723.64	-1.79	722.13	1.51	36.1	14.4	2554	4152	0.20
1300	677	734.2	723.23	-2.06	722.19	1.04	36.2	9.9	2557	3659	0.18

Estimation of Modified Compression Index											
Southern East-West Profiler											
September 2007 Monitoring Event											
		10/2/07	Baseline		9/27/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Meesured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Weste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Weste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.15	-					
40	668	728.6	724.91	-28.32	723.40	1.51	46.9	2.7	2877	3177	0.75
60	668	732.8	721.83	-15.57	720.42	1.42	43.8	10.0	2785	3893	0.22
80	668	736.6	721.14	-3.50	719.63	1.51	43.1	14.5	2764	4371	0.18
100	668	740.8	721.42	1.44	719.60	1.83	43.4	18.4	2773	4812	0.18
120	668	744.7	721.81	1.93	719.78	2.03	43.8	21.9	2784	5217	0.17
140	668	748.6	722.17	1.78	720.25	1.91	44.2	25.4	2795	5618	0.14
160	668	752.4	722.60	2.19	720.51	2.09	44.8	28.8	2808	6004	0.14
180	668	756.2	722.81	1.05	721.05	1.76	44.8	32.4	2814	6414	0.11
200	668	757.4	722.99	0.86	721.31	1.68	45.0	33.4	2820	6531	0.10
220	668	753.6	722.97	-0.06	721.50	1.47	45.0	29.6	2819	6104	0.10
240	683	749.3	722.80	-0.87	721.44	1.38	29.8	25.5	2364	5197	0.13
260	883	744.8	722.62	-0.87	721.46	1.16	29.6	21.1	2359	4705	0.13
280	683	740.2	722.60	-0.15	721.53	1.06	29.6	16.7	2358	4206	0.14
300	683	736.9	723.37	3.85	722.39	0.98	30.4	12.5	2381	3771	0.16
320	683	736.5	723.22	-0.71	721.91	1.32	30.2	12.3	2377	3742	0.22
340	683	736.3	722.94	-1.42	721.90	1.04	29.9	12.4	2368	3745	0.18
360	683	735.5	723.29	1.74	722.43	0.86	30.3	11.2	2379	3621	0.16
380	683	737.2	723.89	3.03	723.00	0.89	30.9	12.3	2397	3762	0.15
400	683	738.1	724.43	2.67	723.56	0.86	31.4	12.7	2413	3817	0.14
420	883	739.0	725.02	2.94	724.10	0.91	32.0	13.0	2430	3874	0.14
440	683	739.2	725.61	2.96	724.67	0.93	32.6	12.6	2448	3850	0.15
460	683	740.7	726.22	3.05	725.26	0.95	33.2	13.4	2466	3958	0.14
480	683	742.0	726.79	2.85	725.84	0.95	33.8	14.2	2484	4059	0.13
500	683	745.2	728.00	6.07	727.47	0.53	35.0	16.2	2520	4321	0.06
520	683	749.3	728.74	3.73	727.40	1.34	35.7	19.5	2542	4708	0.14
540	683	753.7	728.44	-1.52	727.47	0.97	35.4	24.2	2533	5224	0.09
560	690	758.3	729.00	2.82	728.13	0.87	29.0	28.3	2340	5478	0.08
580	690	762.5	729.53	2.62	728.68	0.85	29.5	32.0	2356	5904	0.07
600	691	767.8	730.06	2.70	729.03	1.04	29.1	36.7	2342	6417	0.08
620	692	772.8	730.47	2.01	729.50	0.97	28.5	41.4	2324	6917	0.07
640	693	776.7	730.90	2.15	729.97	0.93	27.9	44.8	2307	7280	0.07
660	693	780.2	731.69	3.95	730.78	0.90	28.7	47.5	2331	7606	0.06
680	692	782.1	732.23	2.75	731.01	1.23	30.2	48.9	2377	7806	0.08
700	691	782.8	732.44	1.03	731.18	1.26	31.4	49.3	2413	7890	0.08
720	690	782.2	731.73	-3.53	729.58	2.16	31.7	49.5	2422	7911	0.13
740	689	783.0	730.57	-5.84	728.49	2.07	31.6	51.5	2417	8130	0.12
760	689	783.6	729.90	-3.34	727.70	2.20	30.9	52.7	2397	8248	0.13
780	689	786.2	729.39	-2.53	727.07	2.32	30.4	55.8	2382	8571	0.14
800	689	788.9	728.81	-2.93	726.81	2.00	29.8	59.1	2364	8928	0.12
820	689	791.4	728.36	-2.26	726.02	2.33	29.4	62.0	2351	9238	0.13
840	689	793.5	727.68	-3.39	725.39	2.29	28.7	64.8	2330	9522	0.13
860	690	794.3	727.18	-2.51	724.83	2.34	27.7	66.1	2300	9637	0.14
880	690	792.8	726.73	-2.23	724.23	2.50	27.2	65.1	2287	9513	0.15
900	690	791.5	726.52	-1.08	724.83	1.68	26.5	64.0	2265	9368	0.10
920	690	790.2	726.58	0.32	723.57	3.01	26.6	62.6	2267	9219	0.19
940	688	787.2	725.20	-6.93	722.99	2.21	27.2	61.0	2286	9053	0.14
960	686	781.5	724.78	-2.06	722.77	2.01	29.3	55.8	2349	8537	0.12
980	683	777.2	724.82	0.17	723.06	1.76	31.8	51.4	2425	8127	0.11
1000	681	775.7	724.94	0.60	722.93	2.00	33.9	49.8	2488	8016	0.12
1020	681	775.2	725.01	0.37	722.81	2.21	34.0	49.2	2490	7955	0.13
1040	680	774.9	725.02	0.03	722.58	2.44	35.0	48.9	2521	7949	0.14
1060	679	774.6	724.88	-0.69	722.31	2.57	35.9	48.7	2546	7952	0.14
1080	679	774.2	724.73	-0.79	722.28	2.45	35.7	48.5	2542	7925	0.14
1100	679	771.9	724.82	0.47	722.50	2.32	36.3	46.1	2560	7676	0.13
1120	679	762.9	725.05	1.13	723.49	1.55	36.5	36.9	2566	6660	0.10
1140	678	757.7	726.41	6.82	723.28	3.13	38.4	30.3	2622	5990	0.23
1160	678	756.6	725.29	-5.58	722.47	2.82	37.3	30.3	2589	5957	0.21
1180	678	756.1	724.85	-2.22	722.38	2.47	36.8	30.3	2575	5934	0.18
1200	678	754.9	724.63	-1.10	722.69	1.94	36.6	29.3	2569	5817	0.15
1220	678	754.2	725.14	2.57	723.01	2.13	37.1	28.1	2584	5702	0.17
1240	678	753.1	724.95	-0.98	722.39	2.56	36.9	27.2	2578	5597	0.21
1260	678	747.0	724.00	-4.76	722.23	1.76	36.5	22.0	2565	5009	0.17
1280	678	739.9	723.64	-1.79	722.24	1.40	36.1	15.2	2554	4245	0.18
1300	677	734.2	723.23	-2.06	722.47	0.76	36.2	9.9	2557	3658	0.13

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - September 2007 Monitoring Event											
		10/2/07	Baseline		9/27/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.29	-					
40	668	728.6	724.91	-28.32	723.58	1.33	46.9	2.7	2877	3177	0.66
60	668	732.8	721.83	-15.57	720.48	1.36	43.8	10.0	2785	3893	0.21
80	668	736.6	721.14	-3.50	719.73	1.41	43.1	14.5	2764	4371	0.16
100	668	740.8	721.42	1.44	719.68	1.74	43.4	18.4	2773	4812	0.17
120	668	744.7	721.81	1.93	719.85	1.96	43.8	21.9	2784	5217	0.16
140	668	748.6	722.17	1.78	720.51	1.65	44.2	25.4	2795	5618	0.12
160	668	752.4	722.60	2.19	720.55	2.05	44.6	28.8	2808	6004	0.14
180	668	756.2	722.61	1.65	721.12	1.69	44.6	32.4	2814	6414	0.11
200	668	757.4	722.99	0.86	721.37	1.61	45.0	33.4	2820	6531	0.10
220	668	753.6	722.97	-0.06	721.56	1.42	45.0	29.6	2819	6104	0.09
240	683	749.3	722.80	-0.87	721.52	1.27	29.8	25.5	2364	5197	0.12
260	683	744.8	722.62	-0.87	721.53	1.10	29.6	21.1	2359	4705	0.12
280	683	740.2	722.60	-0.15	721.60	0.99	29.6	16.7	2358	4206	0.13
300	683	736.9	723.37	3.85	722.47	0.89	30.4	12.5	2381	3771	0.15
320	683	736.5	723.22	-0.71	721.96	1.26	30.2	12.3	2377	3742	0.21
340	683	736.3	722.94	-1.42	721.95	0.99	29.9	12.4	2368	3745	0.17
360	683	735.5	723.29	1.74	722.49	0.79	30.3	11.2	2379	3621	0.14
380	683	737.2	723.89	3.03	723.10	0.80	30.9	12.3	2397	3762	0.13
400	683	738.1	724.43	2.67	723.62	0.80	31.4	12.7	2413	3817	0.13
420	683	739.0	725.02	2.94	724.17	0.84	32.0	13.0	2430	3874	0.13
440	683	739.2	725.61	2.96	724.78	0.85	32.6	12.6	2448	3850	0.13
460	683	740.7	726.22	3.05	725.32	0.90	33.2	13.4	2466	3958	0.13
480	683	742.0	726.79	2.85	725.90	0.89	33.8	14.2	2484	4059	0.12
500	683	745.2	728.00	6.07	727.55	0.45	35.0	16.2	2520	4321	0.05
520	683	749.3	728.74	3.73	727.45	1.29	35.7	19.5	2542	4708	0.13
540	683	753.7	728.44	-1.52	727.53	0.91	35.4	24.2	2533	5224	0.08
560	890	758.3	729.00	2.02	720.17	0.84	29.0	28.3	2340	5478	0.08
580	690	762.5	729.53	2.62	728.73	0.79	29.5	32.0	2356	5904	0.07
600	691	767.8	730.06	2.70	729.15	0.91	29.1	36.7	2342	6417	0.07
620	692	772.8	730.47	2.01	729.57	0.89	28.5	41.4	2324	6917	0.07
640	693	776.7	730.90	2.15	730.08	0.81	27.9	44.8	2307	7280	0.06
660	693	780.2	731.69	3.95	730.85	0.83	28.7	47.5	2331	7606	0.06
680	692	782.1	732.23	2.75	731.06	1.17	30.2	48.9	2377	7806	0.08
700	691	782.8	732.44	1.03	731.22	1.22	31.4	49.3	2413	7890	0.08
720	690	782.2	731.73	-3.53	729.64	2.10	31.7	49.5	2422	7911	0.13
740	689	783.0	730.57	-5.84	728.55	2.02	31.6	51.5	2417	8130	0.12
760	689	783.6	729.90	-3.34	727.75	2.15	30.9	52.7	2397	8248	0.13
780	689	786.2	729.39	-2.53	727.11	2.28	30.4	55.8	2382	8571	0.13
800	689	788.9	728.81	-2.93	726.87	1.94	29.8	59.1	2364	8928	0.11
820	689	791.4	728.36	-2.26	726.13	2.23	29.4	62.0	2351	9238	0.13
840	689	793.5	727.88	-3.39	725.43	2.25	28.7	64.8	2330	9522	0.13
860	690	794.3	727.18	-2.51	724.89	2.29	27.7	66.1	2300	9637	0.13
880	690	792.8	726.73	-2.23	724.35	2.38	27.2	65.1	2287	9513	0.14
900	690	791.5	726.52	-1.08	724.95	1.57	26.5	64.0	2265	9368	0.10
920	690	790.2	726.58	0.32	723.64	2.94	26.6	62.6	2267	9219	0.18
940	688	787.2	725.20	-6.93	723.08	2.11	27.2	61.0	2286	9053	0.13
960	686	781.5	724.78	-2.06	722.83	1.95	29.3	55.8	2349	8537	0.12
980	683	777.2	724.82	0.17	723.18	1.64	31.8	51.4	2425	8127	0.10
1000	681	775.7	724.94	0.60	723.00	1.93	33.9	49.8	2488	8016	0.11
1020	681	775.2	725.01	0.37	722.94	2.07	34.0	49.2	2490	7955	0.12
1040	680	774.9	725.02	0.03	722.69	2.33	35.0	48.9	2521	7949	0.13
1060	679	774.6	724.88	-0.89	722.37	2.51	35.9	48.7	2546	7952	0.14
1080	679	774.2	724.73	-0.79	722.35	2.38	35.7	48.5	2542	7925	0.13
1100	679	771.9	724.82	0.47	722.63	2.19	36.3	46.1	2560	7676	0.13
1120	679	762.9	725.05	1.13	723.56	1.49	36.5	36.9	2566	6660	0.10
1140	678	757.7	726.41	6.82	723.41	3.00	38.4	30.3	2622	5990	0.22
1160	678	756.6	725.29	-5.58	722.58	2.71	37.3	30.3	2589	5957	0.20
1180	678	756.1	724.85	-2.22	722.51	2.34	36.8	30.3	2575	5934	0.17
1200	678	754.9	724.63	-1.10	722.82	1.81	36.6	29.3	2569	5817	0.14
1220	678	754.2	725.14	2.57	723.10	2.05	37.1	28.1	2584	5702	0.16
1240	678	753.1	724.95	-0.98	722.51	2.43	36.9	27.2	2578	5597	0.20
1260	678	747.0	724.00	-4.76	722.35	1.64	36.5	22.0	2565	5009	0.15
1280	678	739.9	723.64	-1.79	722.35	1.29	36.1	15.2	2554	4245	0.16
1300	677	734.2	723.23	-2.06	722.62	0.61	36.2	9.9	2557	3658	0.11

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit - September 2007 Monitoring Event											
		10/2/07	Baseline		9/27/07				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.02	-					
40	668	728.6	724.91	-28.32	723.22	1.69	46.9	2.7	2877	3177	0.84
60	668	732.8	721.83	-15.57	720.36	1.48	43.8	10.0	2785	3893	0.23
80	668	736.6	721.14	-3.50	719.53	1.60	43.1	14.5	2764	4371	0.19
100	668	740.6	721.42	1.44	719.51	1.91	43.4	18.4	2773	4812	0.18
120	668	744.7	721.81	1.93	719.72	2.09	43.8	21.9	2784	5217	0.17
140	668	748.6	722.17	1.78	719.99	2.18	44.2	25.4	2795	5618	0.16
160	668	752.4	722.60	2.19	720.47	2.13	44.6	28.8	2808	6004	0.14
180	668	756.2	722.81	1.05	720.98	1.83	44.8	32.4	2814	6414	0.11
200	668	757.4	722.99	0.86	721.24	1.75	45.0	33.4	2820	6531	0.11
220	668	753.6	722.97	-0.06	721.44	1.53	45.0	29.6	2819	6104	0.10
240	683	749.3	722.80	-0.87	721.35	1.45	29.8	25.5	2364	5197	0.14
260	683	744.8	722.62	-0.87	721.40	1.23	29.6	21.1	2359	4705	0.14
280	683	740.2	722.60	-0.15	721.46	1.13	29.6	16.7	2358	4206	0.15
300	683	736.9	723.37	3.85	722.30	1.06	30.4	12.5	2381	3771	0.18
320	683	736.5	723.22	-0.71	721.85	1.38	30.2	12.3	2377	3742	0.23
340	683	736.3	722.94	-1.42	721.84	1.10	29.9	12.4	2368	3745	0.18
360	683	735.5	723.29	1.74	722.36	0.92	30.3	11.2	2379	3621	0.17
380	683	737.2	723.89	3.03	722.91	0.98	30.9	12.3	2397	3762	0.16
400	683	738.1	724.43	2.67	723.50	0.92	31.4	12.7	2413	3817	0.15
420	683	739.0	725.02	2.94	724.04	0.98	32.0	13.0	2430	3874	0.15
440	683	739.2	725.61	2.96	724.59	1.02	32.6	12.6	2448	3850	0.16
460	683	740.7	726.22	3.05	725.21	1.01	33.2	13.4	2466	3958	0.15
480	683	742.0	726.79	2.85	725.78	1.01	33.8	14.2	2484	4059	0.14
500	683	745.2	728.00	6.07	727.39	0.60	35.0	16.2	2520	4321	0.07
520	683	749.3	728.74	3.73	727.34	1.40	35.7	19.5	2542	4708	0.15
540	683	753.7	728.44	-1.52	727.41	1.02	35.4	24.2	2533	5224	0.09
560	690	758.3	729.00	2.82	728.10	0.90	29.0	28.3	2340	5478	0.08
580	690	762.5	729.53	2.62	728.63	0.90	29.5	32.0	2356	5904	0.08
600	691	767.8	730.06	2.70	728.90	1.16	29.1	36.7	2342	6417	0.09
620	692	772.8	730.47	2.01	729.42	1.05	28.5	41.4	2324	6917	0.08
640	693	776.7	730.90	2.15	729.85	1.05	27.9	44.8	2307	7280	0.08
660	693	780.2	731.69	3.95	730.72	0.97	28.7	47.5	2331	7606	0.07
680	692	782.1	732.23	2.75	730.96	1.28	30.2	48.9	2377	7806	0.08
700	691	782.8	732.44	1.03	731.14	1.30	31.4	49.3	2413	7890	0.08
720	690	782.2	731.73	-3.53	729.52	2.22	31.7	49.5	2422	7911	0.14
740	689	783.0	730.57	-5.84	728.44	2.13	31.6	51.5	2417	8130	0.13
760	689	783.6	729.90	-3.34	727.64	2.26	30.9	52.7	2397	8248	0.14
780	689	786.2	729.39	-2.53	727.03	2.36	30.4	55.8	2382	8571	0.14
800	689	788.9	728.81	-2.93	726.75	2.05	29.8	59.1	2364	8928	0.12
820	689	791.4	728.36	-2.26	725.92	2.44	29.4	62.0	2351	9238	0.14
840	689	793.5	727.68	-3.39	725.34	2.34	28.7	64.8	2330	9522	0.13
860	690	794.3	727.18	-2.51	724.78	2.40	27.7	66.1	2300	9637	0.14
880	690	792.8	726.73	-2.23	724.11	2.62	27.2	65.1	2287	9513	0.16
900	690	791.5	726.52	-1.08	724.72	1.79	26.5	64.0	2265	9368	0.11
920	690	790.2	726.58	0.32	723.50	3.08	28.6	62.6	2267	9219	0.19
940	688	787.2	725.20	-6.93	722.89	2.31	27.2	61.0	2286	9053	0.14
960	686	781.5	724.78	-2.06	722.72	2.07	29.3	55.8	2349	8537	0.13
980	683	777.2	724.82	0.17	722.95	1.87	31.8	51.4	2425	8127	0.11
1000	681	775.7	724.94	0.60	722.86	2.08	33.9	49.8	2488	8016	0.12
1020	681	775.2	725.01	0.37	722.67	2.34	34.0	49.2	2490	7955	0.14
1040	680	774.9	725.02	0.03	722.47	2.55	35.0	48.9	2521	7949	0.15
1060	679	774.0	724.00	-0.09	722.25	2.83	35.9	48.7	2548	7952	0.15
1080	679	774.2	724.73	-0.79	722.21	2.51	35.7	48.5	2542	7925	0.14
1100	679	771.9	724.82	0.47	722.37	2.45	36.3	46.1	2560	7676	0.14
1120	679	762.9	725.05	1.13	723.43	1.62	36.5	36.9	2586	6660	0.11
1140	678	757.7	726.41	6.82	723.15	3.26	38.4	30.3	2622	5990	0.24
1160	678	756.6	725.29	-5.58	722.36	2.93	37.3	30.3	2589	5957	0.22
1180	678	756.1	724.85	-2.22	722.25	2.60	36.8	30.3	2575	5934	0.19
1200	678	754.9	724.63	-1.10	722.56	2.07	36.6	29.3	2569	5817	0.16
1220	678	754.2	725.14	2.57	722.93	2.21	37.1	28.1	2584	5702	0.17
1240	678	753.1	724.95	-0.98	722.27	2.68	36.9	27.2	2578	5597	0.22
1260	678	747.0	724.00	-4.76	722.11	1.89	36.5	22.0	2565	5009	0.18
1280	678	739.9	723.64	-1.79	722.13	1.51	36.1	15.2	2554	4245	0.19
1300	677	734.2	723.23	-2.06	722.33	0.90	36.2	9.9	2557	3658	0.16

Estimation of Modified Compression Index
Southern East-West Profiler
March 2008 Monitoring Event

		4/3/08	Baseline		3/31/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.28						
40	668	728.7	724.91	-28.32	722.52	2.39	46.9	2.7	2877	3182	1.16
60	668	732.8	721.83	-15.57	719.67	2.17	43.8	10.0	2785	3893	0.34
80	668	736.6	721.14	-3.50	718.67	2.47	43.1	14.5	2764	4371	0.29
100	668	740.8	721.42	1.44	718.88	2.54	43.4	18.4	2773	4812	0.24
120	668	744.7	721.81	1.93	719.78	2.03	43.8	21.9	2784	5217	0.17
140	668	748.6	722.17	1.78	720.61	1.55	44.2	25.4	2795	5618	0.12
160	668	752.4	722.60	2.19	720.63	1.98	44.6	28.8	2808	6004	0.13
180	668	756.2	722.61	1.65	720.97	1.65	44.8	32.4	2814	6414	0.12
200	668	757.2	722.99	0.86	721.51	1.47	45.0	33.3	2820	6511	0.09
220	668	753.3	722.97	-0.06	721.72	1.26	45.0	29.4	2819	6077	0.08
240	683	748.8	722.80	-0.87	721.64	1.16	29.8	25.0	2364	5139	0.12
260	683	744.5	722.62	-0.87	721.52	1.10	29.6	20.8	2359	4670	0.13
280	683	740.2	722.60	-0.15	721.53	1.06	29.6	16.6	2358	4203	0.14
300	683	736.5	723.37	3.85	722.43	0.94	30.4	12.1	2381	3729	0.16
320	683	736.2	723.22	-0.71	722.04	1.18	30.2	11.9	2377	3703	0.20
340	683	735.9	722.94	-1.42	721.71	1.23	29.9	11.9	2368	3692	0.21
360	683	733.9	723.29	1.74	722.36	0.93	30.3	9.6	2379	3448	0.19
380	683	737.5	723.89	3.03	723.20	0.69	30.9	12.6	2397	3797	0.11
400	683	738.6	724.43	2.67	723.36	1.06	31.4	13.2	2413	3875	0.16
420	683	739.0	725.02	2.94	724.01	1.01	32.0	13.0	2430	3868	0.16
440	683	739.7	725.61	2.96	724.41	1.19	32.6	13.1	2448	3901	0.18
460	683	740.6	726.22	3.05	725.26	0.96	33.2	13.4	2466	3954	0.14
480	683	742.6	726.79	2.85	725.39	1.39	33.8	14.8	2484	4127	0.19
500	683	745.7	728.00	6.07	727.21	0.79	35.0	16.7	2520	4375	0.09
520	683	749.5	728.74	3.73	727.10	1.64	35.7	19.7	2542	4733	0.17
540	683	753.5	728.44	-1.52	727.05	1.39	35.4	24.0	2533	5200	0.13
560	690	758.1	729.00	2.82	727.85	1.15	29.0	28.1	2340	5466	0.11
580	690	762.7	729.53	2.62	728.45	1.08	29.5	32.1	2356	5922	0.09
600	691	767.2	730.06	2.70	728.66	1.40	29.1	36.1	2342	6354	0.11
620	692	772.0	730.47	2.01	729.21	1.26	28.5	40.6	2324	6827	0.09
640	693	776.5	730.90	2.15	729.58	1.32	27.9	44.6	2307	7254	0.10
660	693	779.6	731.69	3.95	730.60	1.09	28.7	46.9	2331	7542	0.07
680	692	781.7	732.23	2.75	730.81	1.43	30.2	48.5	2377	7760	0.09
700	691	783.4	732.44	1.03	730.82	1.62	31.4	49.9	2413	7957	0.10
720	690	784.3	731.73	-3.53	729.26	2.47	31.7	51.5	2422	8140	0.15
740	689	784.2	730.57	-5.84	728.17	2.40	31.6	52.6	2417	8256	0.14
760	689	783.8	729.90	-3.34	726.94	2.96	30.9	52.9	2397	8266	0.18
780	689	783.7	729.39	-2.53	726.57	2.83	30.4	53.3	2382	8294	0.17
800	689	791.0	728.81	-2.93	726.47	2.34	29.8	61.2	2364	9155	0.13
820	689	795.1	728.36	-2.26	725.62	2.74	29.4	65.7	2351	9646	0.15
840	689	795.2	727.68	-3.39	724.58	3.10	28.7	66.6	2330	9719	0.17
860	690	796.0	727.18	-2.51	724.28	2.90	27.7	67.8	2300	9830	0.17
880	690	796.2	726.73	-2.23	723.95	2.78	27.2	68.5	2287	9891	0.16
900	690	796.4	726.52	-1.08	724.72	1.80	26.5	68.9	2265	9908	0.11
920	690	796.5	726.58	0.32	723.08	3.50	26.6	68.9	2267	9917	0.21
940	688	796.0	725.20	-6.93	722.49	2.71	27.2	69.8	2286	10034	0.16
960	686	794.6	724.78	-2.06	722.79	1.99	29.3	68.8	2349	9991	0.11
980	683	792.2	724.82	0.17	722.91	1.91	31.8	66.4	2425	9790	0.10
1000	681	788.4	724.94	0.60	722.62	2.32	33.9	62.4	2488	9417	0.12
1020	681	784.1	725.01	0.37	722.81	2.20	34.0	58.1	2490	8938	0.12
1040	680	778.6	725.02	0.03	722.39	2.63	35.0	52.6	2521	8358	0.14
1060	679	772.4	724.88	-0.69	722.53	2.35	35.9	46.5	2546	7711	0.14
1080	679	767.8	724.73	-0.79	722.44	2.28	35.7	42.0	2542	7207	0.14
1100	679	766.0	724.82	0.47	722.08	2.74	36.3	40.2	2560	7018	0.17
1120	679	764.8	725.05	1.13	723.77	1.27	36.5	38.7	2566	6864	0.08
1140	678	764.0	726.41	6.82	723.54	2.88	38.4	36.6	2622	6684	0.18
1160	678	763.1	725.29	-5.58	722.66	2.63	37.3	36.8	2589	6673	0.17
1180	678	762.3	724.85	-2.22	722.55	2.30	36.8	36.4	2575	6617	0.15
1200	678	758.7	724.63	-1.10	722.49	2.14	36.6	33.0	2569	6237	0.15
1220	678	754.4	725.14	2.57	722.82	2.33	37.1	28.2	2584	5717	0.18
1240	678	750.0	724.95	-0.98	722.37	2.57	36.9	24.0	2578	5246	0.23
1260	678	744.6	724.00	-4.76	722.22	1.77	36.5	19.6	2565	4737	0.18
1280	678	739.5	723.64	-1.79	722.58	1.06	36.1	14.8	2554	4202	0.14
1300	677	734.7	723.23	-2.06	722.55	0.68	36.2	10.5	2557	3717	0.12

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Upper Limit - March 2008 Monitoring Event											
		4/3/08	Baseline		3/31/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.42	-					
40	668	728.7	724.91	-28.32	722.71	2.21	46.9	2.7	2877	3182	1.08
60	668	732.8	721.83	-15.57	719.73	2.11	43.8	10.0	2785	3893	0.33
80	668	736.6	721.14	-3.50	718.76	2.37	43.1	14.5	2764	4371	0.28
100	668	740.8	721.42	1.44	718.97	2.45	43.4	18.4	2773	4812	0.24
120	668	744.7	721.81	1.93	719.85	1.96	43.8	21.9	2784	5217	0.16
140	668	748.6	722.17	1.78	720.88	1.29	44.2	25.4	2795	5618	0.10
160	668	752.4	722.60	2.19	720.67	1.94	44.6	28.8	2808	6004	0.13
180	668	756.2	722.81	1.05	721.04	1.78	44.8	32.4	2814	6414	0.11
200	668	757.2	722.99	0.86	721.58	1.41	45.0	33.3	2820	6511	0.09
220	668	753.3	722.97	-0.06	721.77	1.20	45.0	29.4	2819	6077	0.08
240	683	748.8	722.80	-0.87	721.72	1.07	29.8	25.0	2364	5139	0.11
260	683	744.5	722.62	-0.87	721.59	1.04	29.6	20.8	2359	4670	0.12
280	683	740.2	722.60	-0.15	721.60	0.99	29.6	16.6	2358	4203	0.13
300	683	736.5	723.37	3.85	722.51	0.86	30.4	12.1	2381	3729	0.14
320	683	736.2	723.22	-0.71	722.10	1.12	30.2	11.9	2377	3703	0.19
340	683	735.9	722.94	-1.42	721.76	1.18	29.9	11.9	2388	3692	0.20
360	683	733.9	723.29	1.74	722.42	0.86	30.3	9.6	2379	3448	0.18
380	683	737.5	723.89	3.03	723.29	0.60	30.9	12.6	2397	3797	0.10
400	683	738.6	724.43	2.67	723.42	1.00	31.4	13.2	2413	3875	0.16
420	683	739.0	725.02	2.94	724.08	0.94	32.0	13.0	2430	3868	0.15
440	683	739.7	725.61	2.96	724.50	1.11	32.6	13.1	2448	3901	0.17
460	683	740.6	726.22	3.05	725.31	0.91	33.2	13.4	2466	3954	0.13
480	683	742.6	726.79	2.85	725.45	1.33	33.8	14.8	2484	4127	0.18
500	683	745.7	728.00	6.07	727.29	0.71	35.0	16.7	2520	4375	0.08
520	683	749.5	728.74	3.73	727.16	1.58	35.7	19.7	2542	4733	0.16
540	683	753.5	728.44	-1.52	727.11	1.33	35.4	24.0	2533	5200	0.12
560	690	758.1	729.00	2.82	727.88	1.12	29.0	28.1	2340	5456	0.10
580	690	762.7	729.53	2.62	728.50	1.02	29.5	32.1	2358	5922	0.09
600	691	767.2	730.06	2.70	728.79	1.28	29.1	36.1	2342	6354	0.10
620	692	772.0	730.47	2.01	729.29	1.18	28.5	40.6	2324	6827	0.09
640	693	776.5	730.90	2.15	729.69	1.20	27.9	44.6	2307	7254	0.09
660	693	779.6	731.69	3.95	730.67	1.02	28.7	46.9	2331	7542	0.07
680	692	781.7	732.23	2.75	730.86	1.37	30.2	48.5	2377	7760	0.09
700	691	783.4	732.44	1.03	730.86	1.58	31.4	49.9	2413	7957	0.10
720	690	784.3	731.73	-3.53	729.32	2.41	31.7	51.5	2422	8140	0.14
740	689	784.2	730.57	-5.84	728.23	2.34	31.6	52.6	2417	8256	0.14
760	689	783.8	729.90	-3.34	727.00	2.90	30.9	52.9	2397	8266	0.17
780	689	783.7	729.39	-2.53	726.61	2.79	30.4	53.3	2382	8294	0.17
800	689	791.0	728.81	-2.93	726.53	2.28	29.8	61.2	2364	9155	0.13
820	689	795.1	728.36	-2.26	725.72	2.63	29.4	65.7	2351	9646	0.15
840	689	795.2	727.68	-3.39	724.63	3.05	28.7	66.6	2330	9719	0.17
860	690	796.0	727.18	-2.51	724.33	2.84	27.7	67.8	2300	9830	0.16
880	690	796.2	726.73	-2.23	724.07	2.66	27.2	68.5	2287	9891	0.15
900	690	796.4	726.52	-1.08	724.83	1.69	26.5	68.9	2265	9908	0.10
920	690	796.5	728.58	0.32	723.15	3.43	26.6	68.9	2267	9917	0.20
940	688	796.0	725.20	-6.93	722.58	2.61	27.2	69.8	2286	10034	0.15
960	686	794.6	724.78	-2.06	722.85	1.94	29.3	68.8	2349	9991	0.11
980	683	792.2	724.82	0.17	723.03	1.79	31.8	66.4	2425	9790	0.09
1000	681	788.4	724.94	0.60	722.69	2.25	33.9	62.4	2488	9417	0.11
1020	681	784.1	725.01	0.37	722.95	2.06	34.0	58.1	2490	8938	0.11
1040	680	778.6	725.02	0.03	722.50	2.52	35.0	52.6	2521	8358	0.14
1060	679	772.4	724.88	-0.69	722.59	2.29	35.9	46.5	2546	7711	0.13
1080	679	767.8	724.73	-0.79	722.51	2.22	35.7	42.0	2542	7207	0.14
1100	679	766.0	724.82	0.47	722.21	2.61	36.3	40.2	2560	7018	0.16
1120	679	764.8	725.05	1.13	723.84	1.21	36.5	38.7	2586	6864	0.08
1140	678	764.0	726.41	6.82	723.68	2.73	38.4	36.6	2622	6684	0.18
1160	678	763.1	725.29	-5.58	722.77	2.52	37.3	36.8	2589	6673	0.16
1180	678	762.3	724.85	-2.22	722.68	2.17	36.8	36.4	2575	6617	0.14
1200	678	758.7	724.63	-1.10	722.62	2.01	36.6	33.0	2569	6237	0.14
1220	678	754.4	725.14	2.57	722.90	2.24	37.1	28.2	2584	5717	0.18
1240	678	750.0	724.95	-0.98	722.50	2.45	36.9	24.0	2578	5246	0.22
1260	678	744.6	724.00	-4.76	722.35	1.65	36.5	19.6	2565	4737	0.17
1280	678	739.5	723.64	-1.79	722.69	0.95	36.1	14.8	2554	4202	0.12
1300	677	734.7	723.23	-2.06	722.69	0.54	36.2	10.5	2557	3717	0.09

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit - March 2008 Monitoring Event											
		4/3/08	Baseline		3/31/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		729.14	-					
40	668	728.7	724.91	-28.32	722.34	2.57	46.9	2.7	2877	3182	1.25
60	688	732.8	721.83	-15.57	719.61	2.23	43.8	10.0	2785	3893	0.35
80	668	736.6	721.14	-3.50	718.57	2.57	43.1	14.5	2764	4371	0.30
100	668	740.8	721.42	1.44	718.80	2.63	43.4	18.4	2773	4812	0.25
120	668	744.7	721.81	1.93	719.72	2.09	43.8	21.9	2784	5217	0.17
140	668	748.6	722.17	1.78	720.35	1.81	44.2	25.4	2795	5618	0.14
160	668	752.4	722.60	2.19	720.59	2.02	44.6	28.8	2808	6004	0.14
180	668	756.2	722.81	1.05	720.90	1.92	44.8	32.4	2814	6414	0.12
200	668	757.2	722.99	0.86	721.44	1.54	45.0	33.3	2820	6511	0.09
220	868	753.3	722.97	-0.06	721.66	1.31	45.0	29.4	2819	6077	0.09
240	683	748.8	722.80	-0.87	721.55	1.25	29.8	25.0	2364	5139	0.12
260	683	744.5	722.62	-0.87	721.45	1.17	29.6	20.8	2359	4670	0.13
280	683	740.2	722.80	-0.15	721.46	1.14	29.6	16.6	2358	4203	0.16
300	683	736.5	723.37	3.85	722.34	1.02	30.4	12.1	2381	3729	0.17
320	683	736.2	723.22	-0.71	721.99	1.24	30.2	11.9	2377	3703	0.21
340	683	735.9	722.94	-1.42	721.65	1.29	29.9	11.9	2368	3692	0.22
360	683	733.9	723.29	1.74	722.30	0.99	30.3	9.6	2379	3448	0.20
380	683	737.5	723.89	3.03	723.11	0.78	30.9	12.6	2397	3797	0.13
400	683	738.6	724.43	2.67	723.30	1.12	31.4	13.2	2413	3875	0.17
420	683	739.0	725.02	2.94	723.94	1.07	32.0	13.0	2430	3868	0.17
440	683	739.7	725.61	2.96	724.33	1.28	32.6	13.1	2448	3901	0.19
460	683	740.6	726.22	3.05	725.20	1.01	33.2	13.4	2466	3954	0.15
480	683	742.6	726.79	2.85	725.33	1.45	33.8	14.8	2484	4127	0.19
500	683	745.7	728.00	6.07	727.13	0.87	35.0	16.7	2520	4375	0.10
520	683	749.5	728.74	3.73	727.05	1.69	35.7	19.7	2542	4733	0.18
540	683	753.5	728.44	-1.52	726.99	1.45	35.4	24.0	2533	5200	0.13
560	690	758.1	729.00	2.82	727.82	1.18	29.0	28.1	2340	5456	0.11
580	690	762.7	729.53	2.62	728.39	1.13	29.5	32.1	2356	5922	0.10
600	691	767.2	730.06	2.70	728.54	1.53	29.1	36.1	2342	6354	0.12
620	692	772.0	730.47	2.01	729.13	1.33	28.5	40.6	2324	6827	0.10
640	693	776.5	730.90	2.15	729.46	1.44	27.9	44.6	2307	7254	0.10
660	693	779.6	731.69	3.95	730.53	1.15	28.7	46.9	2331	7542	0.08
680	692	781.7	732.23	2.75	730.76	1.48	30.2	48.5	2377	7760	0.10
700	691	783.4	732.44	1.03	730.78	1.66	31.4	49.9	2413	7957	0.10
720	690	784.3	731.73	-3.53	729.20	2.53	31.7	51.5	2422	8140	0.15
740	689	784.2	730.57	-5.84	728.11	2.45	31.6	52.6	2417	8256	0.15
760	689	783.8	729.90	-3.34	726.89	3.02	30.9	52.9	2397	8266	0.18
780	689	783.7	729.39	-2.53	726.53	2.87	30.4	53.3	2382	8294	0.17
800	689	791.0	728.81	-2.93	726.41	2.40	29.8	61.2	2364	9155	0.14
820	689	795.1	728.36	-2.26	725.51	2.84	29.4	65.7	2351	9646	0.16
840	889	795.2	727.68	-3.39	724.53	3.15	28.7	66.6	2330	9719	0.18
860	690	796.0	727.18	-2.51	724.22	2.95	27.7	67.8	2300	9830	0.17
880	690	796.2	726.73	-2.23	723.83	2.90	27.2	68.5	2287	9891	0.17
900	690	796.4	726.52	-1.08	724.61	1.91	26.5	68.9	2265	9908	0.11
920	690	796.5	726.58	0.32	723.01	3.57	26.6	68.9	2267	9917	0.21
940	688	796.0	725.20	-6.93	722.39	2.81	27.2	69.8	2286	10034	0.16
960	686	794.6	724.78	-2.06	722.73	2.05	29.3	68.8	2349	9991	0.11
980	683	792.2	724.82	0.17	722.80	2.02	31.8	66.4	2425	9790	0.10
1000	681	788.4	724.94	0.60	722.55	2.39	33.9	62.4	2488	9417	0.12
1020	681	784.1	725.01	0.37	722.68	2.34	34.0	58.1	2490	8938	0.12
1040	680	778.6	725.02	0.03	722.28	2.74	35.0	52.6	2521	8358	0.15
1060	679	772.4	724.88	-0.69	722.47	2.41	35.9	46.5	2546	7711	0.14
1080	679	767.8	724.73	-0.79	722.38	2.35	35.7	42.0	2542	7207	0.15
1100	679	766.0	724.82	0.47	721.95	2.87	36.3	40.2	2560	7018	0.18
1120	679	764.8	725.05	1.13	723.71	1.34	36.5	38.7	2566	6864	0.09
1140	678	764.0	726.41	6.82	723.41	2.99	38.4	36.6	2622	6684	0.19
1160	678	763.1	725.29	-5.58	722.55	2.74	37.3	36.8	2589	6673	0.18
1180	678	762.3	724.85	-2.22	722.42	2.43	36.8	36.4	2575	6617	0.16
1200	678	758.7	724.63	-1.10	722.35	2.28	36.6	33.0	2569	6237	0.16
1220	678	754.4	725.14	2.57	722.74	2.41	37.1	28.2	2584	5717	0.19
1240	678	750.0	724.95	-0.98	722.25	2.69	36.9	24.0	2578	5246	0.24
1260	678	744.6	724.00	-4.76	722.10	1.89	36.5	19.6	2565	4737	0.19
1280	678	739.5	723.64	-1.79	722.47	1.17	36.1	14.8	2554	4202	0.15
1300	677	734.7	723.23	-2.06	722.40	0.83	36.2	10.5	2557	3717	0.14

Estimation of Modified Compression Index											
Southern East-West Profiler											
September 2008 Monitoring Event											
		9/4/08	Baseline		9/24/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		728.67						
40	668	728.7	724.91	-28.32	723.13	1.78	46.9	2.7	2877	3182	0.87
60	668	732.8	721.83	-15.57	720.03	1.81	43.8	10.0	2785	3894	0.28
80	668	736.6	721.14	-3.50	719.25	1.89	43.1	14.5	2764	4371	0.22
100	668	740.8	721.42	1.44	719.18	2.24	43.4	18.4	2773	4812	0.22
120	668	744.7	721.81	1.93	719.42	2.39	43.8	21.9	2784	5217	0.20
140	668	748.6	722.17	1.78	719.88	2.29	44.2	25.4	2795	5619	0.17
160	668	752.4	722.60	2.19	720.16	2.44	44.6	28.8	2808	6005	0.17
180	668	756.2	722.81	1.05	720.68	2.13	44.8	32.4	2814	6414	0.13
200	668	757.2	722.99	0.86	720.97	2.01	45.0	33.3	2820	6511	0.12
220	668	753.3	722.97	-0.06	721.20	1.77	45.0	29.4	2819	6078	0.12
240	683	748.8	722.80	-0.87	721.07	1.73	29.8	25.0	2364	5139	0.17
260	683	744.5	722.62	-0.87	721.12	1.50	29.6	20.8	2359	4671	0.17
280	683	740.2	722.60	-0.15	721.20	1.40	29.6	16.6	2358	4203	0.19
300	683	736.5	723.37	3.85	722.09	1.28	30.4	12.1	2381	3730	0.22
320	683	736.2	723.22	-0.71	721.58	1.65	30.2	11.9	2377	3703	0.28
340	683	735.9	722.94	-1.42	721.57	1.37	29.9	11.9	2368	3692	0.24
360	683	733.9	723.29	1.74	722.10	1.19	30.3	9.6	2379	3448	0.24
380	683	737.5	723.89	3.03	722.64	1.25	30.9	12.6	2397	3797	0.20
400	683	738.6	724.43	2.67	723.20	1.23	31.4	13.2	2413	3875	0.19
420	683	739.0	725.02	2.94	723.70	1.32	32.0	13.0	2430	3868	0.20
440	683	739.7	725.61	2.96	724.28	1.32	32.6	13.1	2448	3901	0.20
460	683	740.6	726.22	3.05	724.87	1.34	33.2	13.4	2466	3954	0.20
480	683	742.6	726.79	2.85	725.45	1.33	33.8	14.8	2484	4127	0.18
500	683	745.7	728.00	6.07	727.08	0.91	35.0	16.7	2520	4374	0.11
520	683	749.5	728.74	3.73	726.98	1.76	35.7	19.7	2542	4733	0.18
540	683	753.5	728.44	-1.52	727.06	1.37	35.4	24.0	2533	5200	0.12
560	690	758.1	729.00	2.82	727.75	1.25	29.0	28.1	2340	5455	0.12
580	690	762.6	729.53	2.62	728.31	1.22	29.5	32.1	2356	5922	0.10
600	691	767.2	730.06	2.70	728.58	1.48	29.1	36.1	2342	6353	0.12
620	692	772.0	730.47	2.01	729.06	1.40	28.5	40.6	2324	6827	0.11
640	693	776.5	730.90	2.15	729.48	1.41	27.9	44.6	2307	7254	0.10
660	693	779.6	731.69	3.95	730.25	1.43	28.7	46.9	2331	7541	0.10
680	692	781.7	732.23	2.75	730.50	1.73	30.2	48.5	2377	7760	0.11
700	691	783.4	732.44	1.03	730.60	1.84	31.4	49.9	2413	7957	0.11
720	690	784.2	731.73	-3.53	728.88	2.85	31.7	51.5	2422	8139	0.17
740	689	784.2	730.57	-5.84	727.80	2.77	31.6	52.6	2417	8256	0.16
760	689	783.8	729.90	-3.34	726.93	2.97	30.9	52.9	2397	8266	0.18
780	689	783.7	729.39	-2.53	726.25	3.15	30.4	53.3	2382	8295	0.19
800	689	791.0	728.81	-2.93	725.93	2.88	29.8	61.2	2384	9156	0.16
820	689	795.1	728.36	-2.26	725.08	3.28	29.4	65.7	2351	9645	0.18
840	689	794.4	727.68	-3.39	724.35	3.33	28.7	65.7	2330	9626	0.19
860	690	795.6	727.18	-2.51	723.82	3.35	27.7	67.5	2300	9788	0.19
880	690	796.6	726.73	-2.23	723.28	3.45	27.2	68.8	2287	9928	0.20
900	690	797.1	726.52	-1.08	723.93	2.59	26.5	69.6	2265	9994	0.15
920	690	797.4	726.58	0.32	722.69	3.89	26.6	69.8	2267	10020	0.23
940	688	796.4	725.20	-6.93	722.23	2.96	27.2	70.2	2286	10081	0.17
960	686	793.9	724.78	-2.06	722.02	2.77	29.3	68.1	2349	9905	0.15
980	683	790.7	724.82	0.17	722.34	2.48	31.8	64.8	2425	9623	0.13
1000	681	788.1	724.94	0.60	722.30	2.64	33.9	62.2	2488	9387	0.13
1020	681	783.9	725.01	0.37	722.16	2.86	34.0	57.9	2490	8917	0.15
1040	680	779.1	725.02	0.03	722.00	3.02	35.0	53.1	2521	8413	0.16
1060	679	773.9	724.88	-0.69	721.62	3.26	35.9	48.1	2546	7881	0.19
1080	679	769.0	724.73	-0.79	721.69	3.04	35.7	43.3	2542	7346	0.18
1100	679	765.9	724.82	0.47	721.95	2.87	36.3	40.1	2560	7014	0.18
1120	679	764.9	725.05	1.13	722.90	2.15	36.5	38.8	2566	6875	0.14
1140	678	763.7	726.41	6.82	722.70	3.71	38.4	36.3	2622	6655	0.24
1160	678	762.6	725.29	-5.58	721.96	3.33	37.3	36.3	2589	6623	0.22
1180	678	760.4	724.85	-2.22	721.88	2.97	36.8	34.5	2575	6408	0.20
1200	678	757.0	724.63	-1.10	722.14	2.49	36.6	31.3	2569	6048	0.18
1220	678	753.3	725.14	2.57	722.47	2.67	37.1	27.2	2584	5602	0.21
1240	678	749.2	724.95	-0.98	721.92	3.03	36.9	23.2	2578	5157	0.27
1260	678	745.0	724.00	-4.76	721.76	2.24	36.5	20.0	2565	4790	0.23
1280	678	740.9	723.64	-1.79	721.77	1.87	36.1	16.3	2554	4358	0.22
1300	677	738.7	723.23	-2.06	722.08	1.14	36.2	12.5	2557	3940	0.17

Estimation of Modified Compression Index
Southern East-West Profiler
95% Confidence Upper Limit - September 2008 Monitoring Event

		9/4/08	Baseline		9/24/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Meesured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Finel	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		728.80	-					
40	668	728.7	724.91	-28.32	723.32	1.60	46.9	2.7	2877	3182	0.78
60	668	732.8	721.83	-15.57	720.09	1.75	43.8	10.0	2785	3894	0.27
80	668	736.6	721.14	-3.50	719.35	1.79	43.1	14.5	2764	4371	0.21
100	668	740.8	721.42	1.44	719.27	2.15	43.4	18.4	2773	4812	0.21
120	668	744.7	721.81	1.93	719.48	2.33	43.8	21.9	2784	5217	0.20
140	668	748.6	722.17	1.78	720.14	2.03	44.2	25.4	2795	5619	0.15
160	668	752.4	722.60	2.19	720.20	2.40	44.6	28.8	2808	6005	0.16
180	668	756.2	722.81	1.05	720.75	2.06	44.8	32.4	2814	6414	0.13
200	668	757.2	722.99	0.86	721.04	1.95	45.0	33.3	2820	6511	0.12
220	668	753.3	722.97	-0.06	721.26	1.71	45.0	29.4	2819	6078	0.11
240	683	748.8	722.80	-0.87	721.15	1.65	29.8	25.0	2364	5139	0.16
260	683	744.5	722.62	-0.87	721.19	1.44	29.6	20.8	2359	4671	0.16
280	683	740.2	722.60	-0.15	721.27	1.33	29.6	16.6	2358	4203	0.18
300	683	736.5	723.37	3.85	722.17	1.20	30.4	12.1	2381	3730	0.20
320	683	736.2	723.22	-0.71	721.64	1.59	30.2	11.9	2377	3703	0.27
340	683	735.9	722.94	-1.42	721.63	1.31	29.9	11.9	2368	3692	0.23
360	683	733.9	723.29	1.74	722.16	1.13	30.3	9.6	2379	3448	0.23
380	683	737.5	723.89	3.03	722.73	1.16	30.9	12.6	2397	3797	0.19
400	683	738.6	724.43	2.67	723.28	1.17	31.4	13.2	2413	3875	0.18
420	683	739.0	725.02	2.94	723.77	1.25	32.0	13.0	2430	3868	0.19
440	683	739.7	725.61	2.96	724.37	1.24	32.6	13.1	2448	3901	0.19
460	683	740.6	726.22	3.05	724.93	1.29	33.2	13.4	2466	3954	0.19
480	683	742.6	726.79	2.85	725.51	1.27	33.8	14.8	2484	4127	0.17
500	683	745.7	728.00	8.07	727.16	0.84	35.0	16.7	2520	4374	0.10
520	683	749.5	728.74	3.73	727.03	1.71	35.7	19.7	2542	4733	0.18
540	683	753.5	728.44	-1.52	727.12	1.32	35.4	24.0	2533	5200	0.12
560	690	758.1	729.00	2.82	727.78	1.22	29.0	28.1	2340	5455	0.11
580	690	762.6	729.53	2.62	728.36	1.16	29.5	32.1	2356	5922	0.10
600	691	767.2	730.06	2.70	728.71	1.36	29.1	36.1	2342	6353	0.11
620	692	772.0	730.47	2.01	729.14	1.33	28.5	40.6	2324	8827	0.10
640	693	776.5	730.90	2.15	729.60	1.30	27.9	44.6	2307	7254	0.09
660	693	779.6	731.69	3.95	730.32	1.36	28.7	46.9	2331	7541	0.09
680	692	781.7	732.23	2.75	730.55	1.68	30.2	48.5	2377	7760	0.11
700	691	783.4	732.44	1.03	730.64	1.80	31.4	49.9	2413	7957	0.11
720	690	784.2	731.73	-3.53	728.94	2.79	31.7	51.5	2422	8139	0.17
740	689	784.2	730.57	-5.84	727.85	2.72	31.6	52.6	2417	8256	0.16
760	689	783.8	729.90	-3.34	726.98	2.92	30.9	52.9	2397	8266	0.18
780	689	783.7	729.39	-2.53	726.29	3.11	30.4	53.3	2382	8295	0.19
800	689	791.0	728.81	-2.93	725.99	2.82	29.8	81.2	2364	9156	0.16
820	689	795.1	728.36	-2.26	725.19	3.17	29.4	65.7	2351	9645	0.18
840	689	794.4	727.68	-3.39	724.40	3.28	28.7	65.7	2330	9626	0.19
860	690	795.6	727.18	-2.51	723.88	3.30	27.7	67.5	2300	9788	0.19
880	690	796.6	726.73	-2.23	723.40	3.33	27.2	68.8	2287	9928	0.19
900	690	797.1	726.52	-1.08	724.04	2.48	26.5	69.6	2265	9994	0.15
920	690	797.4	726.58	0.32	722.76	3.82	26.6	69.8	2267	10020	0.22
940	688	796.4	725.20	-6.93	722.33	2.87	27.2	70.2	2286	10081	0.16
960	686	793.9	724.78	-2.06	722.08	2.71	29.3	68.1	2349	9905	0.15
980	683	790.7	724.82	0.17	722.46	2.36	31.8	64.8	2425	9623	0.12
1000	681	788.1	724.94	0.60	722.37	2.57	33.9	62.2	2488	9387	0.13
1020	681	783.9	725.01	0.37	722.29	2.72	34.0	57.9	2490	8917	0.14
1040	680	779.1	725.02	0.03	722.11	2.91	35.0	53.1	2521	8413	0.16
1060	679	773.9	724.88	-0.60	721.68	3.20	35.9	48.1	2548	7881	0.18
1080	679	769.0	724.73	-0.79	721.76	2.97	35.7	43.3	2542	7346	0.18
1100	679	765.9	724.82	0.47	722.08	2.74	36.3	40.1	2560	7014	0.17
1120	679	764.9	725.05	1.13	722.96	2.08	36.5	38.8	2566	6875	0.13
1140	678	763.7	726.41	6.82	722.83	3.58	38.4	36.3	2622	6655	0.23
1160	678	762.6	725.29	-5.58	722.07	3.22	37.3	36.3	2589	6623	0.21
1180	678	760.4	724.85	-2.22	722.01	2.84	36.8	34.5	2575	6408	0.19
1200	678	757.0	724.63	-1.10	722.27	2.36	36.6	31.3	2569	6048	0.17
1220	678	753.3	725.14	2.57	722.56	2.59	37.1	27.2	2584	5602	0.21
1240	678	749.2	724.95	-0.98	722.04	2.91	36.9	23.2	2578	5157	0.26
1260	678	745.0	724.00	-4.76	721.88	2.12	36.5	20.0	2565	4790	0.21
1280	678	740.9	723.64	-1.79	721.89	1.75	36.1	16.3	2554	4358	0.21
1300	677	736.7	723.23	-2.06	722.23	1.00	36.2	12.5	2557	3940	0.15

Estimation of Modified Compression Index											
Southern East-West Profiler											
95% Confidence Lower Limit - September 2008 Monitoring Event											
		9/4/08	Baseline		9/24/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
20			730.36		728.53	-					
40	668	728.7	724.91	-28.32	722.95	1.96	46.9	2.7	2877	3182	0.96
60	668	732.8	721.83	-15.57	719.97	1.87	43.8	10.0	2785	3894	0.29
80	668	738.6	721.14	-3.50	719.15	1.98	43.1	14.5	2764	4371	0.23
100	668	740.8	721.42	1.44	719.10	2.33	43.4	18.4	2773	4812	0.22
120	668	744.7	721.81	1.93	719.35	2.46	43.8	21.9	2784	5217	0.21
140	668	748.6	722.17	1.78	719.61	2.55	44.2	25.4	2795	5619	0.19
160	668	752.4	722.60	2.19	720.12	2.48	44.6	28.8	2808	6005	0.17
180	668	756.2	722.81	1.05	720.61	2.20	44.8	32.4	2814	6414	0.14
200	668	757.2	722.99	0.86	720.91	2.08	45.0	33.3	2820	6511	0.13
220	668	753.3	722.97	-0.06	721.15	1.83	45.0	29.4	2819	6078	0.12
240	683	748.8	722.80	-0.87	720.98	1.82	29.8	25.0	2364	5139	0.18
260	683	744.5	722.62	-0.87	721.06	1.57	29.6	20.8	2359	4671	0.18
280	683	740.2	722.60	-0.15	721.13	1.47	29.6	16.6	2358	4203	0.20
300	683	736.5	723.37	3.85	722.00	1.36	30.4	12.1	2381	3730	0.23
320	683	736.2	723.22	-0.71	721.52	1.70	30.2	11.9	2377	3703	0.29
340	683	735.9	722.94	-1.42	721.52	1.42	29.9	11.9	2368	3692	0.25
360	683	733.9	723.29	1.74	722.03	1.26	30.3	9.6	2379	3448	0.26
380	683	737.5	723.89	3.03	722.55	1.35	30.9	12.6	2397	3797	0.22
400	683	738.6	724.43	2.67	723.14	1.29	31.4	13.2	2413	3875	0.20
420	683	739.0	725.02	2.94	723.63	1.38	32.0	13.0	2430	3868	0.21
440	683	739.7	725.61	2.96	724.20	1.41	32.6	13.1	2448	3901	0.21
460	683	740.6	726.22	3.05	724.82	1.40	33.2	13.4	2466	3954	0.21
480	683	742.6	726.79	2.85	725.39	1.39	33.8	14.8	2484	4127	0.19
500	683	745.7	728.00	6.07	727.00	0.99	35.0	16.7	2520	4374	0.12
520	683	749.5	728.74	3.73	726.93	1.81	35.7	19.7	2542	4733	0.19
540	683	753.5	728.44	-1.52	727.01	1.43	35.4	24.0	2533	5200	0.13
560	690	758.1	729.00	2.82	727.72	1.28	29.0	28.1	2340	5455	0.12
580	690	762.6	729.53	2.62	728.26	1.27	29.5	32.1	2356	5922	0.11
600	691	767.2	730.06	2.70	728.46	1.61	29.1	36.1	2342	6353	0.13
620	692	772.0	730.47	2.01	728.99	1.48	28.5	40.6	2324	6827	0.11
640	693	776.5	730.90	2.15	729.36	1.53	27.9	44.6	2307	7254	0.11
660	693	779.6	731.69	3.95	730.18	1.50	28.7	46.9	2331	7541	0.10
680	692	781.7	732.23	2.75	730.45	1.78	30.2	48.5	2377	7760	0.11
700	691	783.4	732.44	1.03	730.56	1.88	31.4	49.9	2413	7957	0.12
720	690	784.2	731.73	-3.53	728.82	2.91	31.7	51.5	2422	8139	0.17
740	689	784.2	730.57	-5.84	727.74	2.83	31.6	52.6	2417	8256	0.17
760	689	783.8	729.90	-3.34	726.87	3.03	30.9	52.9	2397	8268	0.18
780	689	783.7	729.39	-2.53	726.21	3.19	30.4	53.3	2382	8295	0.19
800	689	791.0	728.81	-2.93	725.87	2.94	29.8	61.2	2364	9156	0.17
820	689	795.1	728.36	-2.26	724.98	3.38	29.4	65.7	2351	9645	0.19
840	689	794.4	727.68	-3.39	724.30	3.38	28.7	65.7	2330	9626	0.19
860	690	795.6	727.18	-2.51	723.77	3.41	27.7	67.5	2300	9788	0.20
880	690	796.6	726.73	-2.23	723.16	3.57	27.2	68.8	2287	9928	0.21
900	690	797.1	726.52	-1.08	723.81	2.70	28.5	89.6	2265	9994	0.16
920	690	797.4	726.58	0.32	722.62	3.96	26.6	89.8	2267	10020	0.23
940	688	796.4	725.20	-6.93	722.14	3.06	27.2	70.2	2286	10081	0.17
960	686	793.9	724.78	-2.08	721.96	2.82	29.3	68.1	2349	9905	0.15
980	683	790.7	724.82	0.17	722.23	2.59	31.8	64.8	2425	9623	0.14
1000	681	788.1	724.94	0.60	722.23	2.71	33.9	62.2	2488	9387	0.14
1020	681	783.9	725.01	0.37	722.02	2.99	34.0	57.9	2490	8917	0.16
1040	680	779.1	725.02	0.03	721.89	3.13	35.0	53.1	2521	8413	0.17
1060	679	773.9	724.88	-0.69	721.56	3.32	35.9	48.1	2546	7881	0.19
1080	679	769.0	724.73	-0.79	721.62	3.10	35.7	43.3	2542	7346	0.19
1100	679	765.9	724.82	0.47	721.82	3.00	36.3	40.1	2560	7014	0.19
1120	679	764.9	725.05	1.13	722.83	2.22	36.5	38.8	2566	6875	0.14
1140	678	763.7	726.41	6.82	722.57	3.84	38.4	36.3	2622	6655	0.25
1160	678	762.6	725.29	-5.58	721.85	3.44	37.3	36.3	2589	6623	0.23
1180	678	760.4	724.85	-2.22	721.74	3.11	36.8	34.5	2575	6408	0.21
1200	678	757.0	724.63	-1.10	722.01	2.62	36.6	31.3	2569	6048	0.19
1220	678	753.3	725.14	2.57	722.39	2.75	37.1	27.2	2584	5602	0.22
1240	678	749.2	724.95	-0.98	721.79	3.15	36.9	23.2	2578	5157	0.28
1260	678	745.0	724.00	-4.76	721.63	2.36	36.5	20.0	2565	4790	0.24
1280	678	740.9	723.64	-1.79	721.66	1.98	36.1	16.3	2554	4358	0.24
1300	677	736.7	723.23	-2.06	721.94	1.29	36.2	12.5	2557	3940	0.19

Five-Year Projection of Settlement

Southern East-West Profiler

Average

Station	Baseline Measured Pipe Elev ft	Baseline Slope %	9/24/08 Measured Pipe Elev ft	Measured settlement ft	Stress @ Midpoint of MC V Wast Initial psf	Final psf	Average Modif. Compres Index	Final Waste Elevation ft	Final Wasle Thickness ft	Final stress psf	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Check	Slope Difference	Comments
20	730.36		728.67													
40	724.91	-28.32	723.13	1.78	2877	2877	0.69	735.50	9.59	3694	3.53	719.60				Sideslope
60	721.83	-15.57	720.03	1.81	3894	5002	0.22	741.00	18.17	4858	0.93	719.10	-2.53			Sideslope
80	721.14	-3.50	719.25	1.89	4371	5977	0.16	745.00	22.86	5359	0.63	718.62	-2.40			Sideslope
100	721.42	1.44	719.18	2.24	4812	6851	0.17	748.50	26.08	5724	0.55	718.63	0.07			Pipe Access
120	721.81	1.93	719.42	2.39	5217	7650	0.16	752.50	29.69	6137	0.49	718.92	1.46			Pipe Access
140	722.17	1.78	719.88	2.29	5619	8442	0.13	756.50	33.33	6552	0.38	719.49	2.85			Pipe Access
160	722.60	2.19	720.16	2.44	6005	9201	0.13	760.50	36.90	6961	0.38	719.79	1.47			Pipe Access
180	722.81	1.05	720.68	2.13	6414	10014	0.11	764.50	40.69	7388	0.29	720.39	3.02			Pipe Access
200	722.99	0.86	720.97	2.01	6511	10202	0.10	768.50	44.51	7818	0.36	720.61	1.10			Pipe Access
220	722.97	-0.06	721.20	1.77	6078	9336	0.10	772.50	48.53	8263	0.58	720.62	0.04	slope reversal	0.01	Pipe Access
240	722.80	-0.87	721.07	1.73	5139	7914	0.13	776.50	52.70	8271	0.83	720.24	-1.92			Pipe Access
260	722.62	-0.87	721.12	1.50	4671	6983	0.13	780.50	56.88	8729	1.08	720.05	-0.95			Pipe Access
280	722.60	-0.15	721.20	1.40	4203	6049	0.14	784.00	60.40	9120	1.44	719.76	-1.45			Pipe Crossing
300	723.37	3.85	722.09	1.28	3730	5078	0.16	789.00	64.63	9612	2.04	720.05	1.46			Pipe Crossing
320	723.22	-0.71	721.58	1.65	3703	5029	0.19	792.50	68.28	10012	2.47	719.11	-4.68			Pipe Crossing
340	722.94	-1.42	721.57	1.37	3692	5015	0.20	797.50	73.56	10590	2.73	718.84	-1.35			Pipe Crossing
360	723.29	1.74	722.10	1.19	3448	4518	0.17	802.50	78.21	11117	2.56	719.53	3.46			Cell Floor
380	723.89	3.03	722.64	1.25	3797	5197	0.15	808.00	83.11	11679	2.32	720.32	3.91			Cell Floor
400	724.43	2.67	723.20	1.23	3875	5337	0.16	812.50	87.07	12135	2.51	720.68	1.84			Cell Floor
420	725.02	2.94	723.70	1.32	3868	5306	0.16	817.50	91.48	12642	2.59	721.11	2.12			Cell Floor
440	725.61	2.96	724.28	1.32	3901	5353	0.15	822.50	95.89	13149	2.60	721.69	2.89			Cell Floor
460	726.22	3.05	724.87	1.34	3954	5441	0.13	827.50	100.28	13655	2.40	722.47	3.93			Cell Floor
480	726.79	2.85	725.45	1.33	4127	5770	0.12	829.50	101.71	13831	2.10	723.35	4.39			Cell Floor
500	728.00	6.07	727.08	0.91	4374	6229	0.05	829.50	100.50	13733	0.83	726.26	14.69			Pipe Crossing
520	728.74	3.73	726.98	1.76	4733	6923	0.14	829.50	99.76	13672	2.35	724.63	-8.17	slope reversal		Pipe Crossing
540	728.44	-1.52	727.06	1.37	5200	7866	0.08	830.00	100.56	13753	1.19	725.88	6.26	slope reversal	-0.38	Pipe Crossing
560	729.00	2.82	727.75	1.25	5455	8571	0.08	830.00	100.00	13497	0.88	726.87	4.99			Cell Floor
	729.53	2.62	728.31	1.22	5922	9487	0.07	830.00	99.47	13454	0.75	727.56	3.41			Cell Floor
	730.06	2.70	728.58	1.48	6353	10365	0.10	830.00	98.94	13381	0.95	727.63	0.39			Cell Floor
620	730.47	2.01	729.06	1.40	6827	11329	0.11	830.50	99.03	13374	0.92	728.14	2.54			Cell Floor
640	730.90	2.15	729.48	1.41	7254	12200	0.03	831.00	99.10	13364	0.19	729.29	5.77			Cell Floor
660	731.69	3.95	730.25	1.43	7541	12752	0.01	831.00	98.31	13300	0.06	730.19	4.51			Cell Floor
680	732.23	2.75	730.50	1.73	7760	13143	0.05	831.00	97.77	13286	0.34	730.16	-0.15	slope reversal	-0.03	Pipe Crossing
700	732.44	1.03	730.60	1.84	7957	13501	0.06	831.00	97.56	13299	0.42	730.17	0.05			Pipe Crossing
720	731.73	-3.53	728.88	2.85	8139	13857	0.17	831.00	98.27	13386	1.15	727.73	-12.30			Pipe Crossing
740	730.57	-5.84	727.80	2.77	8256	14094	0.15	831.00	99.43	13511	1.01	726.78	-4.75			Cell Floor
760	729.90	-3.34	726.93	2.97	8266	14134	0.14	831.00	100.10	13565	0.94	725.99	-3.96			Cell Floor
780	729.39	-2.53	726.25	3.15	8295	14207	0.15	830.50	100.11	13551	1.00	725.25	-3.72			Cell Floor
800	728.81	-2.93	725.93	2.88	9156	15947	0.13	830.50	100.69	13598	0.69	725.24	-0.02			Cell Floor
820	728.36	-2.26	725.08	3.28	9645	16940	0.15	830.00	100.64	13579	0.67	724.41	-4.18			Cell Floor
840	727.68	-3.39	724.35	3.33	9626	16921	0.15	830.00	101.32	13634	0.65	723.71	-3.52			Cell Floor
860	727.18	-2.51	723.82	3.35	9788	17277	0.15	830.00	101.82	13660	0.62	723.21	-2.50			Cell Floor
880	726.73	-2.23	723.28	3.45	9928	17569	0.17	829.50	101.77	13640	0.62	722.66	-2.74			Cell Floor
900	726.52	-1.08	723.93	2.59	9994	17723	0.07	829.00	101.48	13587	0.26	723.67	5.05	slope reversal		Pipe Crossing
920	726.58	0.32	722.69	3.89	10020	17773	0.27	825.50	97.92	13194	0.86	721.83	-9.22	slope reversal	-0.83	Pipe Crossing
940	725.20	-6.93	722.23	2.96	10081	17875	0.15	821.00	94.80	12866	0.43	721.81	-0.12			Pipe Crossing
960	724.78	-2.06	722.02	2.77	9905	17461	0.11	816.00	90.22	12419	0.31	721.71	-0.50			Pipe Crossing
980	724.82	0.17	722.34	2.48	9623	16821	0.09	811.50	85.68	11992	0.28	722.06	1.77			Pipe Access
1000	724.94	0.60	722.30	2.64	9387	16286	0.11	807.00	81.06	11543	0.32	721.98	-0.40	slope reversal		Pipe Access
1020	725.01	0.37	722.16	2.86	8917	15344	0.12	803.00	76.99	11093	0.39	721.77	-1.07	slope reversal		Pipe Access
1040	725.02	0.03	722.00	3.02	8413	14306	0.13	799.00	72.98	10678	0.49	721.51	-1.28	slope reversal	-0.55	Pipe Access
1060	724.88	-0.69	721.62	3.26	7881	13216	0.14	795.00	69.12	10275	0.59	721.04	-2.38			Pipe Access
1080	724.73	-0.79	721.69	3.04	7346	12149	0.14	791.00	65.27	9844	0.63	721.06	0.12	slope reversal	0.02	Pipe Access
1100	724.82	0.47	721.95	2.87	7014	11468	0.14	787.00	61.18	9408	0.63	721.32	1.28			Pipe Access
1120	725.05	1.13	722.90	2.15	6875	11184	0.08	782.50	56.45	8890	0.31	722.59	6.38			Pipe Crossing
1140	726.41	6.82	722.70	3.71	6655	10687	0.21	778.50	51.09	8350	0.78	721.92	-3.37	slope reversal	-0.67	Pipe Crossing
1160	725.29	-5.58	721.96	3.33	6623	10657	0.19	774.50	48.21	7997	0.58	721.38	-2.67			Pipe Crossing
1180	724.85	-2.22	721.88	2.97	6408	10240	0.17	770.00	44.15	7533	0.43	721.45	0.33	slope reversal		Pipe Crossing
1200	724.63	-1.10	722.14	2.49	6048	9526	0.14	766.00	40.37	7107	0.35	721.79	1.71	slope reversal	0.41	Pipe Crossing
1220	725.14	2.57	722.47	2.67	5602	8619	0.16	762.00	35.86	6621	0.42	722.05	1.31			Pipe Crossing
1240	724.95	-0.98	721.92	3.03	5157	7735	0.22	758.00	32.05	6193	0.65	721.27	-3.94			Pipe Crossing
1260	724.00	-4.76	721.76	2.24	4790	7016	0.16	753.50	28.50	5786	0.49	721.26	0.00			Pipe Crossing
1280	723.64	-1.79	721.77	1.87	4358	6162	0.16	749.50	24.86	5371	0.53	721.24	-0.12			Pipe Crossing
1300	723.23	-2.06	722.08	1.14	3940	5323	0.11	745.00	20.77	4920	0.39	721.69	2.24	slope reversal	0.45	Pipe Crossing

Five-Year Projection of Settlement
Southern East-West Profiler
95% Confidence Upper Limit - Average

Station	Baseline Measured Pipe Elev ft	Baseline Slope %	9/24/08 Measured Pipe Elev ft	Measured settlement ft	Stress @ Midpoint of MC V Wast Initial psf	Stress @ Midpoint of MC V Wast Final psf	Average Modif. Compres Index	Final Waste Elevation ft	Final Waste Thickness ft	Final stress psf	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Check	Slope Difference	Comments
20	730.36		728.67													
40	724.91	-28.32	723.13	1.78	3182	3487	0.61	735.50	9.59	3999	2.88	720.27				Sideslope
60	721.83	-15.57	720.03	1.81	3894	5002	0.21	741.00	18.17	4858	0.89	719.14	-5.68			Sideslope
80	721.14	-3.50	719.25	1.89	4371	5977	0.15	745.00	22.86	5359	0.59	718.66	-2.40			Sideslope
100	721.42	1.44	719.18	2.24	4812	6851	0.16	748.50	26.08	5724	0.53	718.66	-0.01	slope reversal	0.00	Pipe Access
120	721.81	1.93	719.42	2.39	5217	7650	0.15	752.50	29.69	6137	0.48	718.94	1.41			Pipe Access
140	722.17	1.78	719.88	2.29	5619	8442	0.11	756.50	33.33	6552	0.33	719.55	3.05			Pipe Access
160	722.60	2.19	720.16	2.44	6005	9201	0.13	760.50	36.90	6961	0.37	719.80	1.24			Pipe Access
180	722.81	1.05	720.68	2.13	6414	10014	0.10	764.50	40.69	7388	0.28	720.40	3.04			Pipe Access
200	722.99	0.86	720.97	2.01	6511	10202	0.10	768.50	44.51	7818	0.35	720.63	1.11			Pipe Access
220	722.97	-0.06	721.20	1.77	6078	9336	0.09	772.50	48.53	8263	0.56	720.64	0.08	slope reversal	0.02	Pipe Access
240	722.80	-0.87	721.07	1.73	5139	7914	0.13	776.50	52.70	8271	0.78	720.29	-1.76			Pipe Access
260	722.62	-0.87	721.12	1.50	4671	6083	0.13	780.50	56.88	8729	1.01	720.11	-0.92			Pipe Access
280	722.60	-0.15	721.20	1.40	4203	6049	0.14	784.00	60.40	9120	1.35	719.85	-1.28			Pipe Crossing
300	723.37	3.85	722.09	1.28	3730	5078	0.15	789.00	64.63	9612	1.86	720.22	1.86			Pipe Crossing
320	723.22	-0.71	721.58	1.65	3703	5029	0.18	792.50	68.28	10012	2.33	719.25	-4.90			Pipe Crossing
340	722.94	-1.42	721.57	1.37	3692	5015	0.19	797.50	73.56	10590	2.60	718.98	-1.35			Pipe Crossing
360	723.29	1.74	722.10	1.19	3448	4518	0.15	802.50	78.21	11117	2.37	719.73	3.78			Cell Floor
380	723.89	3.03	722.64	1.25	3797	5197	0.14	808.00	83.11	11679	2.07	720.57	4.22			Cell Floor
400	724.43	2.67	723.20	1.23	3875	5337	0.15	812.50	87.07	12135	2.34	720.86	1.43			Cell Floor
420	725.02	2.94	723.70	1.32	3868	5306	0.14	817.50	91.48	12642	2.39	721.31	2.27			Cell Floor
440	725.61	2.96	724.28	1.32	3901	5353	0.14	822.50	95.89	13149	2.34	721.94	3.15			Cell Floor
460	726.22	3.05	724.87	1.34	3954	5441	0.13	827.50	100.28	13655	2.25	722.63	3.42			Cell Floor
480	726.79	2.85	725.45	1.33	4127	5770	0.11	829.50	101.71	13831	1.94	723.51	4.43			Cell Floor
500	728.00	6.07	727.08	0.91	4374	6229	0.04	829.50	100.50	13733	0.62	726.46	14.91			Pipe Crossing
520	728.74	3.73	726.98	1.76	4733	6923	0.13	829.50	99.76	13672	2.22	724.76	-8.54	slope reversal		Pipe Crossing
540	728.44	-1.52	727.06	1.37	5200	7866	0.07	830.00	100.56	13753	1.07	725.99	6.19	slope reversal	-0.47	Pipe Crossing
560	729.00	2.82	727.75	1.25	5455	8571	0.07	830.00	100.00	13497	0.82	726.93	4.68			Cell Floor
580	729.53	2.62	728.31	1.22	5922	9487	0.06	830.00	99.47	13454	0.67	727.64	3.58			Cell F
600	730.06	2.70	728.58	1.48	6353	10365	0.08	830.00	98.94	13381	0.74	727.85	1.00			Cell Fl
620	730.47	2.01	729.06	1.40	6827	11329	0.09	830.50	99.03	13374	0.76	728.30	2.30			Cell Floor
640	730.90	2.15	729.48	1.41	7254	12200	0.01	831.00	99.10	13364	0.07	729.41	5.55			Cell Floor
660	731.69	3.95	730.25	1.43	7541	12752	0.00	831.00	98.31	13300	-0.01	730.26	4.24			Cell Floor
680	732.23	2.75	730.50	1.73	7760	13143	0.04	831.00	97.77	13286	0.29	730.21	-0.24	slope reversal		Pipe Crossing
700	732.44	1.03	730.60	1.84	7957	13501	0.06	831.00	97.56	13299	0.39	730.21	-0.01	slope reversal	-0.05	Pipe Crossing
720	731.73	-3.53	728.88	2.85	8139	13857	0.16	831.00	98.27	13386	1.10	727.78	-12.22			Pipe Crossing
740	730.57	-5.84	727.80	2.77	8256	14094	0.14	831.00	99.43	13511	0.97	726.83	-4.78			Cell Floor
760	729.90	-3.34	726.93	2.97	8266	14134	0.13	831.00	100.10	13565	0.89	726.04	-3.95			Cell Floor
780	729.39	-2.53	726.25	3.15	8295	14207	0.15	830.50	100.11	13551	0.97	725.28	-3.79			Cell Floor
800	728.81	-2.93	725.93	2.88	9156	15947	0.13	830.50	100.69	13598	0.65	725.28	0.00	slope reversal	0.00	Cell Floor
820	728.36	-2.26	725.08	3.28	9645	16940	0.14	830.00	100.64	13579	0.62	724.47	-4.08			Cell Floor
840	727.68	-3.39	724.35	3.33	9626	16921	0.14	830.00	101.32	13634	0.62	723.73	-3.68			Cell Floor
860	727.18	-2.51	723.82	3.35	9788	17277	0.15	830.00	101.82	13660	0.59	723.23	-2.49			Cell Floor
880	726.73	-2.23	723.28	3.45	9928	17569	0.15	829.50	101.77	13640	0.56	722.72	-2.58			Cell Floor
900	726.52	-1.08	723.93	2.59	9994	17723	0.06	829.00	101.48	13587	0.20	723.72	5.03	slope reversal		Pipe Crossing
920	726.58	0.32	722.69	3.89	10020	17773	0.26	825.50	97.92	13194	0.83	721.86	-9.35	slope reversal	-0.86	Pipe Crossing
940	725.20	-6.93	722.23	2.96	10081	17875	0.14	821.00	94.80	12866	0.39	721.84	-0.11			Pipe Crossing
960	724.78	-2.06	722.02	2.77	9905	17461	0.10	816.00	90.22	12419	0.30	721.72	-0.58			Pipe Crossing
980	724.82	0.17	722.34	2.48	9623	16821	0.08	811.50	85.68	11992	0.25	722.09	1.84			Pipe Access
1000	724.94	0.60	722.30	2.64	9387	16286	0.10	807.00	81.06	11543	0.30	722.00	-0.47	slope reversal		Pipe Access
1020	725.01	0.37	722.16	2.86	8917	15344	0.11	803.00	76.99	11093	0.36	721.80	-0.99	slope reversal		Pipe Access
1040	725.02	0.03	722.00	3.02	8413	14306	0.13	799.00	72.98	10678	0.46	721.54	-1.30	slope reversal	-0.55	Pipe Access
1060	724.88	-0.69	721.62	3.26	7881	13216	0.14	795.00	69.12	10275	0.57	721.05	-2.43			Pipe Access
1080	724.73	-0.79	721.69	3.04	7346	12149	0.13	791.00	65.27	9844	0.61	721.08	0.14	slope reversal	0.03	Pipe Access
1100	724.82	0.47	721.95	2.87	7014	11468	0.13	787.00	61.18	9408	0.59	721.36	1.38			Pipe Access
1120	725.05	1.13	722.90	2.15	6875	11184	0.07	782.50	56.45	8890	0.29	722.61	6.26			Pipe Crossing
1140	726.41	6.82	722.70	3.71	6655	10687	0.20	778.50	51.09	8350	0.74	721.95	-3.28	slope reversal	-0.66	Pipe Crossing
1160	725.29	-5.58	721.96	3.33	6623	10657	0.18	774.50	48.21	7997	0.56	721.41	-2.73			Pipe Crossing
1180	724.85	-2.22	721.88	2.97	6408	10240	0.15	770.00	44.15	7533	0.40	721.48	0.34	slope reversal		Pipe Crossing
1200	724.63	-1.10	722.14	2.49	6046	9526	0.12	766.00	40.37	7107	0.32	721.82	1.72	slope reversal	0.41	Pipe Crossing
1220	725.14	2.57	722.47	2.67	5802	8619	0.15	762.00	35.86	6621	0.40	722.07	1.27			Pipe Crossing
1240	724.95	-0.98	721.92	3.03	5157	7735	0.21	758.00	32.05	6193	0.61	721.30	-3.88			Pipe Crossing
1260	724.00	-4.76	721.76	2.24	4790	7016	0.15	753.50	28.50	5786	0.45	721.31	0.03	slope reversal	0.01	Pipe Crossing
1280	723.64	-1.79	721.77	1.87	4358	6162	0.15	749.50	24.86	5371	0.48	721.30	-0.06			Pipe Crossing
1300	723.23	-2.06	722.08	1.14	3940	5323	0.08	745.00	20.77	4920	0.29	721.80	2.51	slope reversal	0.50	Pipe Crossing

Five-Year Projection of Settlement
Southern East-West Profiler
95% Confidence Lower Limit - Average

Station	Baseline Measured Pipe Elev ft	Baseline Slope %	9/24/08 Measured Pipe Elev ft	Measured settlement ft	Stress @ Midpoint of MC V Wast Initial psf	Stress @ Midpoint of MC V Wast Final psf	Average Modif. Compres Index	Final Waste Elevation ft	Final Waste Thickness ft	Final stress psf	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Check	Slope Difference	Comments
20	730.36		728.67													
40	724.91	-28.32	723.13	1.78	3182	3487	0.77	735.50	9.59	3999	3.59	719.54				Sideslope
60	721.83	-15.57	720.03	1.81	3894	5002	0.23	741.00	18.17	4858	0.97	719.06	-2.40			Sideslope
80	721.14	-3.50	719.25	1.89	4371	5977	0.18	745.00	22.86	5359	0.67	718.58	-2.41			Sideslope
100	721.42	1.44	719.18	2.24	4812	6851	0.18	748.50	26.08	5724	0.58	718.61	0.14			Pipe Access
120	721.81	1.93	719.42	2.39	5217	7650	0.18	752.50	29.69	6137	0.51	718.91	1.51			Pipe Access
140	722.17	1.78	719.88	2.29	5619	8442	0.15	756.50	33.33	6552	0.44	719.44	2.65			Pipe Access
160	722.60	2.19	720.16	2.44	6005	9201	0.13	760.50	38.90	6961	0.38	719.78	1.71			Pipe Access
180	722.81	1.05	720.68	2.13	6414	10014	0.11	764.50	40.69	7388	0.30	720.38	3.00			Pipe Access
200	722.99	0.86	720.97	2.01	6511	10202	0.11	768.50	44.51	7818	0.38	720.60	1.08			Pipe Access
220	722.97	-0.06	721.20	1.77	6078	9336	0.10	772.50	48.53	8263	0.61	720.60	0.00	slope reversal	0.00	Pipe Access
240	722.80	-0.87	721.07	1.73	5139	7914	0.14	776.50	52.70	8271	0.88	720.18	-2.07			Pipe Access
260	722.62	-0.87	721.12	1.50	4671	6983	0.14	780.50	56.88	8729	1.14	719.99	-0.99			Pipe Access
280	722.60	-0.15	721.20	1.40	4203	6049	0.15	784.00	60.40	9120	1.54	719.66	-1.62			Pipe Crossing
300	723.37	3.85	722.09	1.28	3730	5078	0.18	789.00	64.63	9612	2.21	719.87	1.05			Pipe Crossing
320	723.22	-0.71	721.58	1.65	3703	5029	0.20	792.50	68.28	10012	2.60	718.98	-4.46			Pipe Crossing
340	722.94	-1.42	721.57	1.37	3692	5015	0.21	797.50	73.56	10590	2.86	718.71	-1.34			Pipe Crossing
360	723.29	1.74	722.10	1.19	3448	4518	0.18	802.50	78.21	11117	2.76	719.34	3.14			Cell Floor
380	723.89	3.03	722.64	1.25	3797	5197	0.17	808.00	83.11	11679	2.58	720.06	3.60			Cell Floor
400	724.43	2.67	723.20	1.23	3875	5337	0.17	812.50	87.07	12135	2.69	720.51	2.24			Cell Floor
420	725.02	2.94	723.70	1.32	3868	5306	0.17	817.50	91.48	12642	2.80	720.90	1.98			Cell Floor
440	725.61	2.96	724.28	1.32	3901	5353	0.17	822.50	95.89	13149	2.85	721.43	2.63			Cell Floor
460	726.22	3.05	724.87	1.34	3954	5441	0.14	827.50	100.28	13655	2.56	722.32	4.44			Cell Floor
480	726.79	2.85	725.45	1.33	4127	5770	0.13	829.50	101.71	13831	2.27	723.19	4.35			Cell Floor
500	728.00	6.07	727.08	0.91	4374	6229	0.06	829.50	100.50	13733	1.03	726.05	14.47			Pipe Crossing
520	728.74	3.73	726.98	1.76	4733	6923	0.15	829.50	99.76	13672	2.49	724.49	-7.81	slope reversal		Pipe Crossing
	728.44	-1.52	727.06	1.37	5200	7866	0.09	830.00	100.56	13753	1.30	725.76	6.33	slope reversal	-0.29	Pipe Crossing
	729.00	2.82	727.75	1.25	5455	8571	0.08	830.00	100.00	13497	0.93	726.82	5.31			Cell Floor
560	729.53	2.62	728.31	1.22	5922	9487	0.08	830.00	99.47	13454	0.84	727.47	3.25			Cell Floor
600	730.06	2.70	728.58	1.48	6353	10365	0.12	830.00	98.94	13381	1.16	727.42	-0.23	slope reversal	-0.05	Cell Floor
620	730.47	2.01	729.06	1.40	6827	11329	0.13	830.50	99.03	13374	1.09	727.98	2.78			Cell Floor
640	730.90	2.15	729.48	1.41	7254	12200	0.04	831.00	99.10	13364	0.31	729.17	5.98			Cell Floor
660	731.69	3.95	730.25	1.43	7541	12752	0.02	831.00	98.31	13300	0.12	730.13	4.78			Cell Floor
680	732.23	2.75	730.50	1.73	7760	13143	0.05	831.00	97.77	13286	0.39	730.12	-0.05	slope reversal	-0.01	Pipe Crossing
700	732.44	1.03	730.60	1.84	7957	13501	0.07	831.00	97.56	13299	0.46	730.14	0.11			Pipe Crossing
720	731.73	-3.53	728.88	2.85	8139	13857	0.18	831.00	98.27	13386	1.20	727.68	-12.38			Pipe Crossing
740	730.57	-5.84	727.80	2.77	8256	14094	0.16	831.00	99.43	13511	1.06	726.74	-4.72			Cell Floor
760	729.90	-3.34	726.93	2.97	8266	14134	0.15	831.00	100.10	13565	0.98	725.94	-3.97			Cell Floor
780	729.39	-2.53	726.25	3.15	8295	14207	0.16	830.50	100.11	13551	1.03	725.22	-3.65			Cell Floor
800	728.81	-2.93	725.93	2.88	9156	15947	0.14	830.50	100.69	13598	0.72	725.21	-0.04			Cell Floor
820	728.36	-2.26	725.08	3.28	9645	16940	0.17	830.00	100.64	13579	0.73	724.35	-4.29			Cell Floor
840	727.68	-3.39	724.35	3.33	9626	16921	0.16	830.00	101.32	13634	0.67	723.68	-3.36			Cell Floor
860	727.18	-2.51	723.82	3.35	9788	17277	0.16	830.00	101.82	13660	0.65	723.18	-2.52			Cell Floor
880	726.73	-2.23	723.28	3.45	9928	17569	0.18	829.50	101.77	13640	0.68	722.60	-2.90			Cell Floor
900	726.52	-1.08	723.93	2.59	9994	17723	0.09	829.00	101.48	13587	0.32	723.61	5.07	slope reversal		Pipe Crossing
920	726.58	0.32	722.69	3.89	10020	17773	0.28	825.50	97.92	13194	0.89	721.80	-9.08	slope reversal	-0.80	Pipe Crossing
940	725.20	-6.93	722.23	2.96	10081	17875	0.16	821.00	94.80	12866	0.46	721.77	-0.13			Pipe Crossing
960	724.78	-2.06	722.02	2.77	9905	17461	0.11	816.00	90.22	12419	0.33	721.69	-0.42			Pipe Crossing
980	724.82	0.17	722.34	2.48	9623	16821	0.10	811.50	85.68	11992	0.31	722.03	1.69			Pipe Access
1000	724.94	0.60	722.30	2.64	9387	16286	0.11	807.00	81.06	11543	0.34	721.96	-0.33	slope reversal		Pipe Access
1020	725.01	0.37	722.16	2.86	8917	15344	0.13	803.00	76.99	11093	0.43	721.73	-1.16	slope reversal		Pipe Access
1040	725.02	0.03	722.00	3.02	8413	14306	0.14	799.00	72.98	10678	0.52	721.48	-1.25	slope reversal	-0.55	Pipe Access
1060	724.88	-0.69	721.62	3.26	7881	13216	0.15	795.00	69.12	10275	0.61	721.02	-2.32			Pipe Access
1080	724.73	-0.79	721.69	3.04	7346	12149	0.14	791.00	65.27	9844	0.65	721.04	0.10	slope reversal	0.02	Pipe Access
1100	724.82	0.47	721.95	2.87	7014	11468	0.15	787.00	61.18	9408	0.68	721.27	1.17			Pipe Access
1120	725.05	1.13	722.90	2.15	6875	11184	0.08	782.50	56.45	8890	0.33	722.57	6.50			Pipe Crossing
1140	728.41	6.82	722.70	3.71	6655	10687	0.22	778.50	51.09	8350	0.82	721.88	-3.46	slope reversal	-0.69	Pipe Crossing
1160	725.29	-5.58	721.96	3.33	6623	10657	0.20	774.50	48.21	7997	0.61	721.35	-2.61			Pipe Crossing
1180	724.85	-2.22	721.88	2.97	6408	10240	0.18	770.00	44.15	7533	0.46	721.42	0.32	slope reversal		Pipe Crossing
1200	724.63	-1.10	722.14	2.49	6048	9526	0.15	766.00	40.37	7107	0.38	721.76	1.71	slope reversal	0.41	Pipe Crossing
1220	725.14	2.57	722.47	2.67	5602	8619	0.16	762.00	35.86	6621	0.44	722.03	1.35			Pipe Crossing
1240	724.95	-0.98	721.92	3.03	5157	7735	0.23	758.00	32.05	6193	0.69	721.23	-4.02			Pipe Crossing
1260	724.00	-4.78	721.76	2.24	4790	7016	0.18	753.50	28.50	5786	0.53	721.22	-0.03			Pipe Crossing
1280	723.64	-1.79	721.77	1.87	4358	6182	0.18	749.50	24.86	5371	0.59	721.18	-0.18			Pipe Crossing
	723.23	-2.06	722.08	1.14	3940	5323	0.14	745.00	20.77	4920	0.50	721.58	1.98	slope reversal	0.39	Pipe Crossing

Settlement estimate Sept08 FINAL © C H A V O All

Estimation of Modified Compression Index											
Northern East-West Profiler											
March 2008 Monitoring Event											
		4/3/08	Baseline		1/21/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
680	686	747.5	736.52	-5.70	736.45	1.12	40.9	12.8	2696	4118	0.15
700	685	750.3	736.16	-1.81	735.95	1.40	41.1	25.7	2702	5552	0.11
720	685	762.8	735.98	-0.91	735.66	1.44	41.4	27.1	2712	5716	0.11
740	684	764.0	735.85	-0.65	735.55	1.40	41.8	30.8	2725	6139	0.09
760	683	767.6	735.70	-0.73	735.41	1.48	42.2	33.6	2737	6467	0.09
780	683	770.3	735.43	-1.34	735.00	1.65	42.5	32.1	2745	6314	0.11
800	682	768.6	735.14	-1.47	734.62	1.67	42.8	31.7	2753	6273	0.11
820	682	767.8	734.81	-1.65	734.24	1.73	43.0	32.7	2759	6389	0.11
840	681	768.5	735.14	1.67	734.98	1.36	43.9	32.9	2786	6438	0.09
860	681	769.0	734.85	-1.45	733.85	2.59	44.1	33.9	2793	6559	0.16
880	680	769.8	734.23	-3.12	733.18	2.49	44.0	34.7	2791	6648	0.15
900	680	770.0	733.90	-1.63	733.02	2.45	44.2	34.3	2797	6599	0.15
920	679	769.2	733.55	-1.78	732.30	2.60	44.4	33.9	2802	6560	0.16
940	679	768.4	733.19	-1.78	731.98	2.79	44.3	31.2	2799	6257	0.18
960	679	765.3	732.72	-2.38	731.61	2.77	44.1	30.4	2793	6164	0.18
980	678	764.1	732.32	-2.01	731.10	2.69	44.0	30.4	2789	6163	0.18
1000	678	763.7	731.76	-2.79	730.30	2.73	43.7	30.2	2780	6132	0.18
1020	678	763.0	731.17	-2.96	729.77	2.67	43.4	30.1	2771	6114	0.18
1040	678	762.3	730.92	-1.22	730.00	1.99	43.4	30.2	2772	6124	0.13
1060	677	762.1	730.42	-2.51	728.46	3.15	43.2	28.2	2765	5897	0.22
1080	677	759.6	728.91	-7.57	727.53	2.56	41.9	23.3	2728	5311	0.21
1100	677	753.2	728.16	-3.74	726.95	2.26	41.4	17.9	2713	4695	0.23
1120	676	747.0	727.30	-4.32	726.56	1.94	40.9	13.4	2696	4188	0.25
1140	676	741.7	726.67	-3.17	726.15	1.65	40.5	9.3	2685	3715	0.29
1160	676	736.9	725.93	-3.66	725.61	1.55	40.0	5.1	2671	3236	0.46
1180	676	732.0	725.13	-4.03	725.01	1.09	39.5	5.9	2655	3309	0.29

Estimation of Modified Compression Index											
Northern East-West Profiler											
95% Confidence Upper Limit - March 2008 Monitoring Event											
		4/3/08	Baseline		4/21/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif, Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick,	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
680	686	747.5	736.52	-5.70	736.57	-0.05	40.9	10.0	2696	3804	-0.01
700	685	750.3	736.16	-1.81	736.07	0.09	41.1	13.2	2702	4164	0.01
720	685	762.8	735.98	-0.91	735.76	0.21	41.4	25.9	2712	5584	0.02
740	684	764.0	735.85	-0.65	735.64	0.20	41.8	27.2	2725	5742	0.01
760	683	767.6	735.70	-0.73	735.50	0.19	42.2	30.9	2737	6168	0.01
780	683	770.3	735.43	-1.34	735.10	0.33	42.5	33.9	2745	6505	0.02
800	682	768.6	735.14	-1.47	734.73	0.41	42.8	32.4	2753	6354	0.03
820	682	767.8	734.81	-1.65	734.32	0.48	43.0	32.0	2759	6316	0.03
840	681	768.5	735.14	1.67	735.07	0.07	43.9	32.4	2786	6378	0.00
860	681	769.0	734.85	-1.45	733.90	0.96	44.1	33.2	2793	6477	0.06
880	680	769.8	734.23	-3.12	733.31	0.92	44.0	34.6	2791	6626	0.06
900	680	770.0	733.90	-1.63	733.13	0.77	44.2	35.1	2797	6691	0.05
920	679	769.2	733.55	-1.78	732.37	1.18	44.4	34.6	2802	6643	0.07
940	679	768.4	733.19	-1.78	732.09	1.10	44.3	34.2	2799	6597	0.07
960	679	765.3	732.72	-2.38	731.70	1.02	44.1	31.6	2793	6304	0.07
980	678	764.1	732.32	-2.01	731.23	1.09	44.0	30.8	2789	6205	0.07
1000	678	763.7	731.76	-2.79	730.41	1.35	43.7	31.0	2780	6216	0.09
1020	678	763.0	731.17	-2.96	729.87	1.30	43.4	30.8	2771	6188	0.09
1040	678	762.3	730.92	-1.22	730.09	0.84	43.4	30.4	2772	6142	0.06
1060	677	762.1	730.42	-2.51	728.53	1.89	43.2	30.7	2765	6173	0.13
1080	677	759.6	728.91	-7.57	727.62	1.29	41.9	29.7	2728	6027	0.09
1100	677	753.2	728.16	-3.74	727.05	1.12	41.4	24.0	2713	5380	0.09
1120	676	747.0	727.30	-4.32	726.66	0.64	40.9	18.7	2696	4773	0.06
1140	676	741.7	726.67	-3.17	726.25	0.42	40.5	14.1	2685	4248	0.05
1160	676	736.9	725.93	-3.66	725.72	0.22	40.0	10.0	2671	3782	0.04
1180	676	732.0	725.13	-4.03	725.18	-0.05	39.5	5.9	2655	3309	-0.01

Estimation of Modified Compression Index											
Northern East-West Profiler											
95% Confidence Lower Limit - March 2008 Monitoring Event											
		4/3/08	Baseline		4/21/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
680	686	747.5	736.52	-5.70	736.33	0.19	40.9	10.0	2696	3804	0.03
700	685	750.3	736.16	-1.81	735.83	0.33	41.1	13.2	2702	4164	0.04
720	685	762.8	735.98	-0.91	735.56	0.42	41.4	25.9	2712	5584	0.03
740	684	764.0	735.85	-0.65	735.45	0.39	41.8	27.2	2725	5742	0.03
760	683	767.6	735.70	-0.73	735.31	0.39	42.2	30.9	2737	6168	0.03
780	883	770.3	735.43	-1.34	734.90	0.54	42.5	33.9	2745	6505	0.03
800	682	768.6	735.14	-1.47	734.52	0.62	42.8	32.4	2753	6354	0.04
820	682	767.8	734.81	-1.65	734.15	0.65	43.0	32.0	2759	6316	0.04
840	681	768.5	735.14	1.67	734.90	0.25	43.9	32.4	2786	6378	0.02
860	681	769.0	734.85	-1.45	733.80	1.05	44.1	33.2	2793	6477	0.07
880	680	769.8	734.23	-3.12	733.04	1.18	44.0	34.6	2791	6626	0.07
900	680	770.0	733.90	-1.63	732.91	0.99	44.2	35.1	2797	6691	0.06
920	679	769.2	733.55	-1.78	732.23	1.32	44.4	34.6	2802	6643	0.08
940	679	768.4	733.19	-1.78	731.87	1.32	44.3	34.2	2799	6597	0.08
960	679	765.3	732.72	-2.38	731.52	1.20	44.1	31.6	2793	6304	0.08
980	678	764.1	732.32	-2.01	730.96	1.35	44.0	30.8	2789	6205	0.09
1000	678	763.7	731.76	-2.79	730.18	1.58	43.7	31.0	2780	6216	0.10
1020	678	763.0	731.17	-2.96	729.68	1.49	43.4	30.8	2771	6188	0.10
1040	678	762.3	730.92	-1.22	729.92	1.01	43.4	30.4	2772	6142	0.07
1060	677	762.1	730.42	-2.51	728.39	2.03	43.2	30.7	2765	6173	0.13
1080	677	759.6	728.91	-7.57	727.44	1.47	41.9	29.7	2728	6027	0.10
1100	677	753.2	728.16	-3.74	726.85	1.31	41.4	24.0	2713	5380	0.11
1120	676	747.0	727.30	-4.32	726.45	0.85	40.9	18.7	2696	4773	0.08
1140	676	741.7	726.67	-3.17	726.05	0.61	40.5	14.1	2685	4248	0.08
1160	676	736.9	725.93	-3.66	725.49	0.44	40.0	10.0	2671	3782	0.07
1180	676	732.0	725.13	-4.03	724.83	0.30	39.5	5.9	2655	3309	0.08

Estimation of Modified Compression Index Northern East-West Profiler September 2008 Monitoring Event											
		9/4/08	Baseline		9/24/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
680	686	745.7	736.52	-5.70	735.40	1.12	40.9	15.2	2696	4385	0.13
700	685	752.7	736.16	-1.81	734.75	1.40	41.1	24.2	2702	5393	0.11
720	685	761.4	735.98	-0.91	734.54	1.44	41.4	33.9	2712	6471	0.09
740	684	770.8	735.85	-0.65	734.45	1.40	41.8	35.8	2725	6695	0.09
760	683	772.6	735.70	-0.73	734.22	1.48	42.2	36.6	2737	6796	0.09
780	683	773.3	735.43	-1.34	733.78	1.65	42.5	37.5	2745	6907	0.10
800	682	773.9	735.14	-1.47	733.47	1.67	42.8	44.9	2753	7741	0.09
820	682	781.1	734.81	-1.65	733.08	1.73	43.0	52.6	2759	8597	0.08
840	681	788.4	735.14	1.67	733.78	1.36	43.9	55.2	2786	8908	0.06
860	681	791.3	734.85	-1.45	732.26	2.59	44.1	56.2	2793	9026	0.12
880	680	792.0	734.23	-3.12	731.74	2.49	44.0	56.9	2791	9103	0.11
900	680	792.1	733.90	-1.63	731.46	2.45	44.2	57.0	2797	9129	0.11
920	679	791.9	733.55	-1.78	730.95	2.60	44.4	56.6	2802	9084	0.11
940	679	791.1	733.19	-1.78	730.41	2.79	44.3	56.0	2799	9010	0.12
960	679	790.1	732.72	-2.38	729.94	2.77	44.1	52.3	2793	8603	0.13
980	678	786.1	732.32	-2.01	729.62	2.69	44.0	47.1	2789	8014	0.13
1000	678	780.4	731.76	-2.79	729.03	2.73	43.7	42.4	2780	7489	0.14
1020	678	775.2	731.17	-2.96	728.50	2.67	43.4	38.0	2771	6991	0.15
1040	678	770.2	730.92	-1.22	728.94	1.99	43.4	32.5	2772	6383	0.13
1060	677	764.5	730.42	-2.51	727.27	3.15	43.2	29.6	2765	6051	0.21
1080	677	761.0	728.91	-7.57	726.35	2.56	41.9	28.2	2728	5857	0.18
1100	677	758.1	728.16	-3.74	725.91	2.26	41.4	23.9	2713	5361	0.18
1120	676	753.0	727.30	-4.32	725.36	1.94	40.9	19.7	2696	4879	0.18
1140	676	748.0	726.67	-3.17	725.02	1.65	40.5	15.4	2685	4392	0.19
1160	676	743.0	725.93	-3.66	724.38	1.55	40.0	10.3	2671	3817	0.25
1180	676	737.3	725.13	-4.03	724.04	1.09	39.5	11.1	2655	3891	0.17

Estimation of Modified Compression Index
Northern East-West Profiler
March 2008 Monitoring Event

Station	MC V T Liner Elev	4/3/08 MC VI-E Waste Elev	Baseline Measured Pipe Elev	Baseline Slope	4/21/08 Measured Pipe Elev	Measured settlement	MC V Waste Thick.	MC VI-E Waste Thick.	Stress @ Midpoint of MC V Wast		Estimated Modif. Compres Index
									Initial	Final	
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
680	686	747.5	736.52	-5.70	736.45	0.07	40.9	12.8	2696	4118	0.01
700	685	750.3	736.16	-1.81	735.95	0.21	41.1	25.7	2702	5552	0.02
720	685	762.8	735.98	-0.91	735.66	0.31	41.4	27.1	2712	5716	0.02
740	684	764.0	735.85	-0.65	735.55	0.30	41.8	30.8	2725	6139	0.02
760	683	767.6	735.70	-0.73	735.41	0.29	42.2	33.6	2737	6467	0.02
780	683	770.3	735.43	-1.34	735.00	0.43	42.5	32.1	2745	6314	0.03
800	682	768.6	735.14	-1.47	734.62	0.51	42.8	31.7	2753	6273	0.03
820	682	767.8	734.81	-1.65	734.24	0.57	43.0	32.7	2759	6389	0.04
840	681	768.5	735.14	1.67	734.98	0.16	43.9	32.9	2786	6438	0.01
860	681	769.0	734.85	-1.45	733.85	1.00	44.1	33.9	2793	6559	0.06
880	680	769.8	734.23	-3.12	733.18	1.05	44.0	34.7	2791	6648	0.06
900	680	770.0	733.90	-1.63	733.02	0.88	44.2	34.3	2797	6599	0.05
920	679	769.2	733.55	-1.78	732.30	1.25	44.4	33.9	2802	6560	0.08
940	679	768.4	733.19	-1.78	731.98	1.21	44.3	31.2	2799	6257	0.08
960	679	765.3	732.72	-2.38	731.61	1.11	44.1	30.4	2793	6164	0.07
980	678	764.1	732.32	-2.01	731.10	1.22	44.0	30.4	2789	6163	0.08
1000	678	763.7	731.76	-2.79	730.30	1.46	43.7	30.2	2780	6132	0.10
1020	678	763.0	731.17	-2.96	729.77	1.40	43.4	30.1	2771	6114	0.09
1040	678	762.3	730.92	-1.22	730.00	0.92	43.4	30.2	2772	6124	0.06
1060	677	762.1	730.42	-2.51	728.46	1.96	43.2	28.2	2765	5897	0.14
1080	677	759.6	728.91	-7.57	727.53	1.38	41.9	23.3	2728	5311	0.11
1100	677	753.2	728.16	-3.74	726.95	1.21	41.4	17.9	2713	4695	0.12
1120	676	747.0	727.30	-4.32	726.56	0.74	40.9	13.4	2696	4188	0.10
1140	676	741.7	726.67	-3.17	726.15	0.52	40.5	9.3	2685	3715	0.09
1160	676	736.9	725.93	-3.66	725.61	0.33	40.0	5.1	2671	3236	0.10
1180	676	732.0	725.13	-4.03	725.01	0.12	39.5	5.9	2655	3309	0.03

Estimation of Modified Compression Index											
Northern East-West Profiler											
95% Confidence Lower Limit - September 2008 Monitoring Event											
		9/4/08	Baseline		9/24/08				Stress @ Midpoint of		Estimated
	MC V	MC VI-E	Measured	Baseline	Measured	Measured	MC V	MC VI-E	MC V Wast		Modif. Compres
Station	T Liner Elev	Waste Elev	Pipe Elev	Slope	Pipe Elev	settlement	Waste Thick.	Waste Thick.	Initial	Final	Index
	ft	ft	ft	%	ft	ft	ft	ft	psf	psf	
680	686	745.7	736.52	-5.70	735.28	1.24	40.9	8.2	2696	3604	0.24
700	685	752.7	736.16	-1.81	734.63	1.52	41.1	15.6	2702	4431	0.17
720	685	761.4	735.98	-0.91	734.43	1.54	41.4	24.4	2712	5424	0.12
740	684	770.8	735.85	-0.65	734.35	1.49	41.8	34.0	2725	6497	0.09
760	683	772.6	735.70	-0.73	734.12	1.58	42.2	35.9	2737	6723	0.10
780	683	773.3	735.43	-1.34	733.68	1.75	42.5	36.8	2745	6834	0.10
800	682	773.9	735.14	-1.47	733.37	1.77	42.8	37.8	2753	6947	0.10
820	682	781.1	734.81	-1.65	732.99	1.81	43.0	45.3	2759	7784	0.09
840	681	788.4	735.14	1.67	733.69	1.45	43.9	52.3	2786	8586	0.07
860	681	791.3	734.85	-1.45	732.21	2.64	44.1	55.4	2793	8948	0.12
880	680	792.0	734.23	-3.12	731.60	2.62	44.0	56.8	2791	9093	0.12
900	680	792.1	733.90	-1.63	731.35	2.56	44.2	57.2	2797	9145	0.11
920	679	791.9	733.55	-1.78	730.88	2.67	44.4	57.4	2802	9173	0.12
940	679	791.1	733.19	-1.78	730.30	2.90	44.3	57.0	2799	9121	0.13
960	679	790.1	732.72	-2.38	729.85	2.86	44.1	56.4	2793	9056	0.13
980	678	786.1	732.32	-2.01	729.49	2.83	44.0	52.7	2789	8644	0.13
1000	678	780.4	731.76	-2.79	728.92	2.84	43.7	47.6	2780	8068	0.14
1020	678	775.2	731.17	-2.96	728.41	2.76	43.4	43.0	2771	7545	0.15
1040	678	770.2	730.92	-1.22	728.85	2.07	43.4	38.3	2772	7019	0.12
1060	677	764.5	730.42	-2.51	727.20	3.22	43.2	33.0	2765	6432	0.20
1080	677	761.0	728.91	-7.57	726.26	2.65	41.9	31.1	2728	6181	0.18
1100	677	758.1	728.16	-3.74	725.81	2.35	41.4	28.9	2713	5926	0.17
1120	676	753.0	727.30	-4.32	725.26	2.04	40.9	24.7	2696	5439	0.16
1140	676	748.0	726.67	-3.17	724.92	1.74	40.5	20.3	2685	4939	0.16
1160	676	743.0	725.93	-3.66	724.27	1.66	40.0	16.1	2671	4460	0.19
1180	676	737.3	725.13	-4.03	723.87	1.26	39.5	11.1	2655	3891	0.19

Five-Year Projection of Settlement
Northern East-West Profiler
Average

Station	Baseline Slope %	9/24/08 Measured Pipe Elev ft	Measured settlement ft	MC V Waste Thick. ft	Stress @ Midpoint of MC V Wast Initial psf	Final psf	Average Modif. Compres Index	Final Waste Elevation ft	Final Waste Thickness ft	Final stress psf	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Check	Slope Difference	Comments
680	-5.70	735.40	1.12	40.9	3604	4512	0.07	807.79	69.63	10553	1.33	734.07	-	-		pipe crossing
700	-1.81	734.75	1.40	41.1	4431	6159	0.07	807.15	69.30	10528	1.00	733.75	-1.62			pipe crossing
720	-0.91	734.54	1.44	41.4	5424	8135	0.06	806.45	68.78	10481	0.68	733.85	0.50	s ope reversal		cell floor
740	-0.65	734.45	1.40	41.8	6497	10270	0.05	805.76	68.22	10431	0.45	733.99	0.71	s ope reversal	0.14	cell floor
760	-0.73	734.22	1.48	42.2	6723	10709	0.05	805.06	67.61	10382	0.43	733.79	-1.01			cell floor
780	-1.34	733.78	1.65	42.5	6834	10923	0.06	804.31	67.07	10336	0.48	733.30	-2.44			cell floor
800	-1.47	733.47	1.67	42.8	6947	11142	0.06	803.50	66.55	10287	0.44	733.03	-1.36			cell floor
820	-1.65	733.08	1.73	43.0	7784	12810	0.06	802.69	66.08	10240	0.30	732.78	-1.27			pipe crossing
840	1.67	733.78	1.36	43.9	8586	14386	0.04	801.88	64.79	10140	0.11	733.66	4.43			pipe crossing
860	-1.45	732.26	2.59	44.1	8948	15103	0.09	800.93	64.08	10074	0.20	732.06	-8.05			pipe crossing
880	-3.12	731.74	2.49	44.0	9093	15395	0.09	799.93	63.44	10030	0.16	731.58	-2.41			pipe crossing
900	-1.63	731.46	2.45	44.2	9145	15493	0.08	798.67	62.47	9932	0.13	731.33	-1.24			cell floor
920	-1.78	730.95	2.60	44.4	9173	15544	0.10	797.38	61.54	9833	0.13	730.82	-2.53			cell floor
940	-1.78	730.41	2.79	44.3	9121	15442	0.10	796.09	60.64	9727	0.12	730.28	-2.70			cell floor
960	-2.38	729.94	2.77	44.1	9056	15320	0.10	794.83	58.71	9634	0.12	729.82	-2.28			cell floor
980	-2.01	729.62	2.69	44.0	8644	14499	0.11	792.42	54.15	9407	0.17	729.45	-1.88			cell floor
1000	-2.79	729.03	2.73	43.7	8068	13355	0.12	787.46	49.74	8910	0.23	728.81	-3.22			cell floor
1020	-2.96	728.50	2.67	43.4	7545	12319	0.12	782.50	45.36	8415	0.25	728.25	-2.80			pipe crossing
1040	-1.22	728.94	1.99	43.4	7019	11265	0.09	777.52	40.61	7890	0.21	728.73	2.42	slope reversal	0.48	pipe crossing
1060	-2.51	727.27	3.15	43.2	6432	10099	0.18	772.53	36.10	7385	0.46	726.82	-9.60			pipe crossing
1080	-7.57	726.35	2.56	41.9	6181	9635	0.15	767.52	32.58	6959	0.32	726.03	-3.95			cell floor
1100	-3.74	725.91	2.26	41.4	5926	9138	0.15	762.49	28.30	6470	0.24	725.66	-1.83			cell floor
1120	-4.32	725.36	1.94	40.9	5439	8182	0.14	757.47	24.14	5990	0.24	725.12	-2.70			cell floor
1140	-3.17	725.02	1.65	40.5	4939	7193	0.14	752.44	19.75	5492	0.26	724.76	-1.83			cell floor
1160	-3.66	724.38	1.55	40.0	4460	6248	0.17	747.42	15.46	5002	0.35	724.04	-3.61			cell floor
1180	-4.03	724.04	1.09	39.5	3891	5126	0.10	742.39	-726.13	4517	0.25	723.79	-1.25			sideslope

Note: Total Reversed Slope Height at Sta. 740 is calculated from 740 to 720 due to the fact the slope reversal goes into a pipe crossing and the elevation cannont be accurately determined.

Five-Year Projection of Settlement
Northern East-West Profiler
95% Confidence Upper Limit - Average

		9/24/08			Stress @ Midpoint of		Average									
	Baseline	Measured	Measured	MC V	MC V Wast		Modif. Compres	Final Waste	Final		Final	Final Pipe	Final		Slope	
Station	Slope	Pipe Elev	se:tlement	Waste Thick.	Initial	Final	Index	Elevation	Waste Thickness	Final stress	Settlement	Elevation	Slope	Check	Difference	Comments
	%	ft	ft	ft	psf	psf		ft	ft	psf	ft	ft	%			
680	-5.70	735.40	1.12	40.9	3604	4512	0.09	807.79	70.27	10553	1.78	733.61	-	-		pipe crossing
700	-1.81	734.75	1.40	41.1	4431	6159	0.08	807.15	69.99	10528	1.21	733.54	-0.35			pipe crossing
720	-0.91	734.54	1.44	41.4	5424	8135	0.06	806.45	69.48	10481	0.73	733.80	1.29	slope reversal		cell floor
740	-0.65	734.45	1.40	41.8	6497	10270	0.05	805.76	68.91	10431	0.42	734.03	1.13	slope reversal	0.23	cell floor
760	-0.73	734.22	1.48	42.2	6723	10709	0.05	805.06	68.36	10382	0.39	733.83	-0.98			cell floor
780	-1.34	733.78	1.65	42.5	6834	10923	0.06	804.31	67.87	10336	0.43	733.35	-2.41			cell floor
800	-1.47	733.47	1.67	42.8	6947	11142	0.06	803.50	67.36	10287	0.43	733.04	-1.54			cell floor
820	-1.65	733.08	1.73	43.0	7784	12810	0.06	802.69	66.89	10240	0.30	732.78	-1.31			pipe crossing
840	1.67	733.78	1.36	43.9	8586	14386	0.03	801.88	65.74	10140	0.10	733.68	4.47			pipe crossing
860	-1.45	732.26	2.59	44.1	8948	15103	0.09	800.93	65.08	10074	0.20	732.06	-8.09			pipe crossing
880	-3.12	731.74	2.49	44.0	9093	15395	0.08	799.93	64.70	10030	0.15	731.59	-2.37			pipe crossing
900	-1.63	731.46	2.45	44.2	9145	15493	0.07	798.67	63.76	9932	0.12	731.34	-1.26			cell floor
920	-1.78	730.95	2.60	44.4	9173	15544	0.09	797.38	62.83	9833	0.12	730.83	-2.55			cell floor
940	-1.78	730.41	2.79	44.3	9121	15442	0.09	796.09	61.90	9727	0.11	730.29	-2.68			cell floor
960	-2.38	729.94	2.77	44.1	9056	15320	0.09	794.83	61.11	9634	0.11	729.84	-2.29			cell floor
980	-2.01	729.62	2.69	44.0	8644	14499	0.09	792.42	59.11	9407	0.15	729.47	-1.83			cell floor
1000	-2.79	729.03	2.73	43.7	8068	13355	0.11	787.46	54.70	8910	0.20	728.83	-3.20			cell floor
1020	-2.96	728.50	2.67	43.4	7545	12319	0.11	782.50	50.33	8415	0.23	728.27	-2.79			pipe crossing
1040	-1.22	728.94	1.99	43.4	7019	11265	0.08	777.52	45.60	7890	0.18	728.76	2.42	slope reversal	0.48	pipe crossing
1060	-2.51	727.27	3.15	43.2	6432	10099	0.16	772.53	41.11	7385	0.41	726.86	-9.51			pipe crossing
1080	-7.57	726.35	2.56	41.9	6181	9635	0.13	767.52	37.61	6959	0.28	726.08	-3.93			cell floor
1100	-3.74	725.91	2.26	41.4	5926	9138	0.12	762.49	33.33	6470	0.19	725.71	-1.81			cell floor
1120	-4.32	725.36	1.94	40.9	5439	8182	0.11	757.47	29.17	5990	0.18	725.18	-2.65			cell floor
1140	-3.17	725.02	1.65	40.5	4939	7193	0.10	752.44	24.78	5492	0.18	724.84	-1.73			cell floor
1160	-3.66	724.38	1.55	40.0	4460	6248	0.10	747.42	20.48	5002	0.20	724.19	-3.24			cell floor
1180	-4.03	724.04	1.09	39.5	3891	5126	0.06	742.39	16.26	4517	0.16	723.88	-1.55			sideslope
Note:	Total Reversed Slope Height at Sta. 740 is calculated from 740 to 720 due to the fact the slope reversal goes into a pipe crossing and the elevation cannont be accurately determined.															

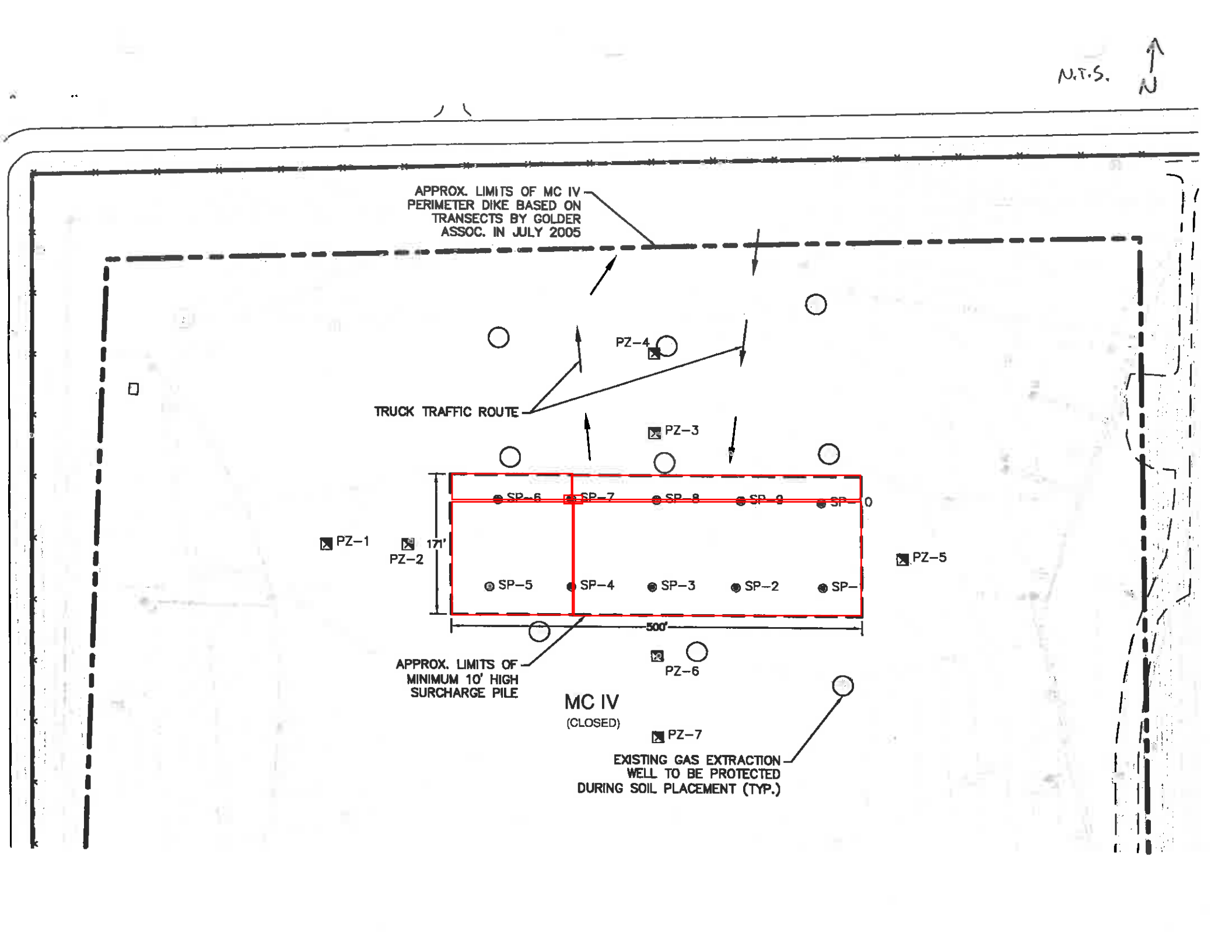
Five-Year Projection of Settlement
Northern East-West Profiler
95% Confidence Lower Limit - Average

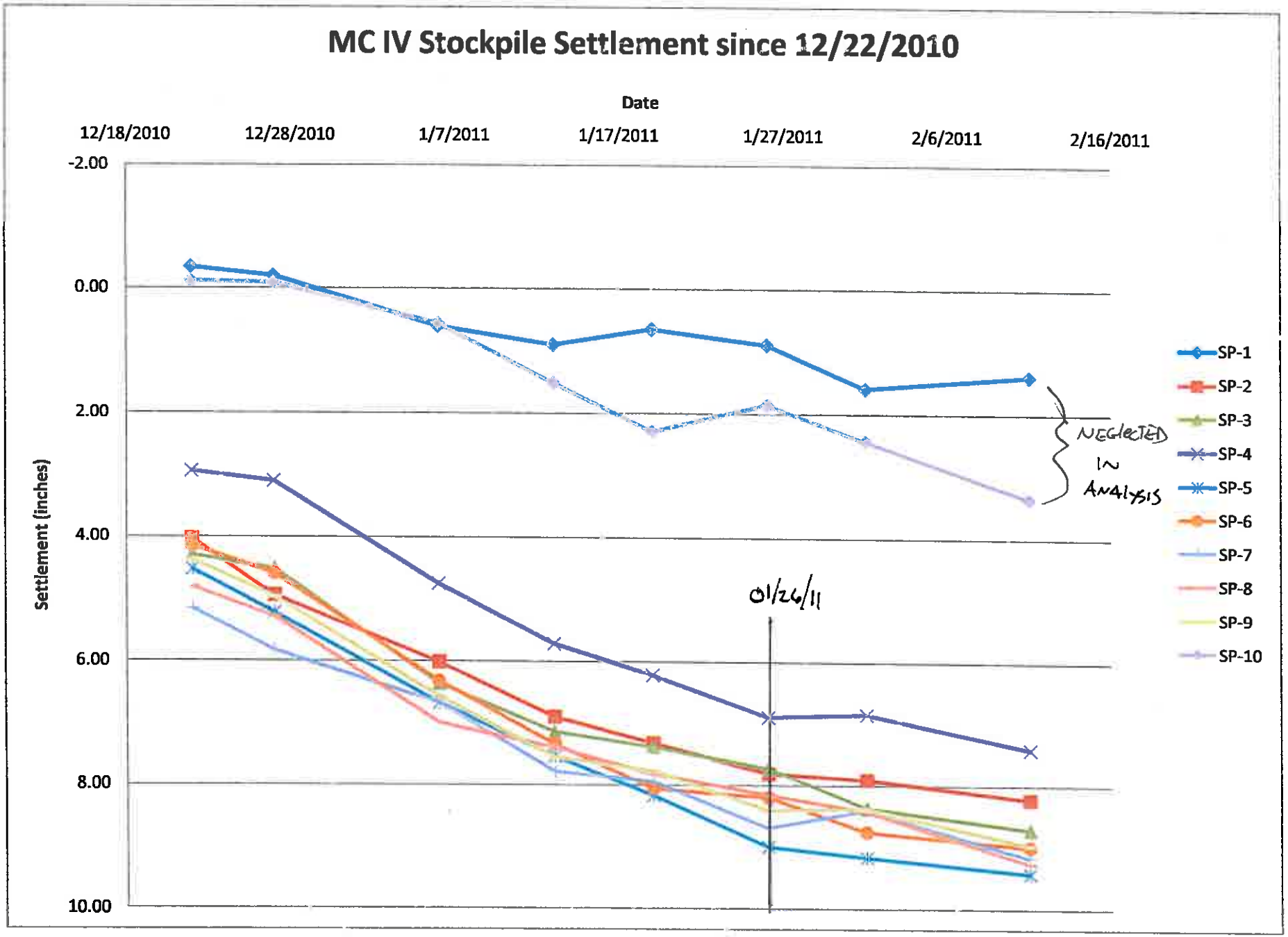
Station	Baseline Slope %	9/24/08 Measured Pipe Elev ft	Measured settlement ft	MC V Waste Thick. ft	Stress @ Midpoint of MC V Wast Initial psf	Stress @ Midpoint of MC V Wast Final psf	Average Modif. Compres Index	Final Waste Elevation ft	Final Waste Thickness ft	Final stress psf	Final Settlement ft	Final Pipe Elevation ft	Final Slope %	Check	Slope Difference	Comments
680	-5.70	735.40	1.12	40.9	3604	4512	0.14	807.79	70.27	10553	2.58	732.82	-	-		pipe crossing
700	-1.81	734.75	1.40	41.1	4431	6159	0.11	807.15	69.99	10528	1.66	733.09	1.34	slope reversal		pipe crossing
720	-0.91	734.54	1.44	41.4	5424	8135	0.08	806.45	69.48	10481	0.92	733.61	2.61	slope reversal		cell floor
740	-0.65	734.45	1.40	41.8	6497	10270	0.06	805.76	68.91	10431	0.53	733.92	1.52	slope reversal	0.30	cell floor
760	-0.73	734.22	1.48	42.2	6723	10709	0.06	805.08	68.36	10382	0.49	733.73	-0.92			cell floor
780	-1.34	733.78	1.65	42.5	6834	10923	0.07	804.31	67.87	10336	0.53	733.26	-2.39			cell floor
800	-1.47	733.47	1.67	42.8	6947	11142	0.07	803.50	67.36	10287	0.52	732.95	-1.52			cell floor
820	-1.65	733.08	1.73	43.0	7784	12810	0.07	802.69	66.89	10240	0.35	732.73	-1.09			pipe crossing
840	1.67	733.78	1.36	43.9	8586	14386	0.04	801.88	65.74	10140	0.13	733.64	4.57			pipe crossing
860	-1.45	732.26	2.59	44.1	8948	15103	0.09	800.93	65.08	10074	0.21	732.05	-7.99			pipe crossing
880	-3.12	731.74	2.49	44.0	9093	15395	0.09	799.93	64.70	10030	0.18	731.56	-2.44			pipe crossing
900	-1.63	731.46	2.45	44.2	9145	15493	0.09	798.67	63.76	9932	0.14	731.32	-1.22			cell floor
920	-1.78	730.95	2.60	44.4	9173	15544	0.10	797.38	62.83	9833	0.13	730.82	-2.51			cell floor
940	-1.78	730.41	2.79	44.3	9121	15442	0.10	796.09	61.90	9727	0.13	730.28	-2.70			cell floor
960	-2.38	729.94	2.77	44.1	9056	15320	0.10	794.83	61.11	9634	0.12	729.82	-2.27			cell floor
980	-2.01	729.62	2.69	44.0	8644	14499	0.11	792.42	59.11	9407	0.18	729.44	-1.90			cell floor
1000	-2.79	729.03	2.73	43.7	8068	13355	0.12	787.46	54.70	8910	0.23	728.80	-3.20			cell floor
1020	-2.96	728.50	2.67	43.4	7545	12319	0.12	782.50	50.33	8415	0.25	728.25	-2.78			pipe crossing
1040	-1.22	728.94	1.99	43.4	7019	11265	0.09	777.52	45.60	7890	0.20	728.73	2.42	slope reversal	0.48	pipe crossing
1060	-2.51	727.27	3.15	43.2	6432	10099	0.17	772.53	41.11	7385	0.44	726.84	-9.52			pipe crossing
1080	-7.57	726.35	2.56	41.9	6181	9635	0.14	767.52	37.61	6959	0.30	726.05	-3.94			cell floor
1100	-3.74	725.91	2.26	41.4	5926	9138	0.14	762.49	33.33	6470	0.22	725.69	-1.80			cell floor
1120	-4.32	725.36	1.94	40.9	5439	8182	0.12	757.47	29.17	5990	0.21	725.15	-2.69			cell floor
1140	-3.17	725.02	1.65	40.5	4939	7193	0.12	752.44	24.78	5492	0.22	724.80	-1.78			cell floor
1160	-3.66	724.38	1.55	40.0	4460	6248	0.13	747.42	20.48	5002	0.26	724.13	-3.36			cell floor
1180	-4.03	724.04	1.09	39.5	3891	5126	0.14	742.39	16.26	4517	0.35	723.69	-2.16			sideslope

Note: Total Reversed Slope Height at Sta. 740 is calculated from 740 to 720 due to the fact the slope reversal goes into a pipe crossing and the elevation cannont be accurately determined.

Attachment A-2.3.3

NTH Consultants, Ltd. (2011a) *Volume III: Basis of Design Report – WDI Operating License Application Master Cells VI F & G*. Stockpile Test.


N.T.S.
N
APPROX. LIMITS OF MC IV PERIMETER DIKE BASED ON TRANSECTS BY GOLDER ASSOC. IN JULY 2005
PZ-4
TRUCK TRAFFIC ROUTE
PZ-3
SP-6
SP-7
SP-8
SP-9
SP-0
PZ-1
PZ-2
171'
PZ-5
SP-5
SP-4
SP-3
SP-2
SP-
500'
APPROX. LIMITS OF MINIMUM 10' HIGH SURCHARGE PILE
PZ-6
MC IV
(CLOSED)
PZ-7
EXISTING GAS EXTRACTION WELL TO BE PROTECTED DURING SOIL PLACEMENT (TYP.)


MC IV Stockpile Settlement since 12/22/2010
Date
12/18/2010
12/28/2010
1/7/2011
1/17/2011
1/27/2011
2/6/2011
2/16/2011
Settlement (inches)
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
SP-1
SP-2
SP-3
SP-4
SP-5
SP-6
SP-7
SP-8
SP-9
SP-10
NEGLECTED IN ANALYSIS
01/26/11

EQ8 - MC 4 SETTLEMENT PLATES

				12/16/2010				12/22/2010				12/27/2010				1/8/2011				1/13/2011				1/18/2011				1/28/2011				2/1/2011				2/11/2011			
ID	NORTHING	EASTING	ORIGINAL GROUND SURFACE	T/PIPE ELEV.	INC. SETT.	PILE ELEV.	Sett. to Date (inches)	T/PIPE ELEV.	INC. SETT.	PILE ELEV.	Sett. to Date (inches)	T/PIPE ELEV.	INC. SETT.	PILE ELEV.	Sett. to Date (inches)	T/PIPE ELEV.	INC. SETT.	PILE ELEV.	Sett. to Date (inches)	T/PIPE ELEV.	INC. SETT.	PILE ELEV.	Sett. to Date (inches)	T/PIPE ELEV.	INC. SETT.	PILE ELEV.	Sett. to Date (inches)	T/PIPE ELEV.	INC. SETT.	PILE ELEV.	Sett. to Date (inches)	T/PIPE ELEV.	INC. SETT.	PILE ELEV.	Sett. to Date (inches)	T/PIPE ELEV.	INC. SETT.	PILE ELEV.	Sett. to Date (inches)
SP-1	8335.93	4631.56	727.81	737.83	-	-	0	737.53	-0.03	-	-0.34	737.85	0.01	-	-0.20	737.56	0.07	736.78	0.61	737.56	0.02	-	0.90	737.58	-0.02	-	0.85	737.58	0.02	-	0.89	737.50	0.08	-	1.59	737.52	-0.02	-	1.39
SP-2	8335.86	4526.54	728.97	740.08	-	-	0	744.78	0.34	-	4.03	744.70	0.08	-	4.94	744.61	0.09	742.44	6.01	744.54	0.07	-	6.90	744.51	0.03	-	7.31	744.48	0.04	-	7.61	744.40	0.01	-	7.80	744.43	0.03	-	8.22
SP-3	8335.72	4423.85	733.52	743.67	-	-	0	748.39	0.38	-	4.29	748.33	0.02	-	4.51	748.17	0.15	748.56	5.36	748.11	0.08	-	7.14	748.08	0.02	-	7.36	748.08	0.03	-	7.73	748.01	0.05	-	8.36	747.98	0.03	-	8.70
SP-4	8335.51	4325.28	732.53	743.08	-	-	0	747.88	0.25	-	2.84	747.87	0.01	-	3.10	747.73	0.14	745.29	4.75	747.65	0.08	-	5.71	747.61	0.04	-	6.21	747.55	0.06	-	6.73	747.58	0.00	-	6.94	747.51	0.05	-	7.40
SP-5	8335.17	4225.68	729.29	739.20	-	-	0	743.88	0.38	-	4.52	743.80	0.08	-	5.22	743.63	0.12	740.42	9.67	743.61	0.07	-	7.54	743.56	0.05	-	8.18	743.49	0.07	-	8.98	743.47	0.01	-	9.16	743.45	0.02	-	9.41
SP-6	8441.21	4226.59	725.15	736.24	-	-	0	742.99	0.25	-	4.14	742.99	0.04	-	4.98	742.74	0.14	740.17	8.32	742.66	0.08	-	7.34	742.60	0.06	-	8.05	742.59	0.01	-	8.19	742.54	0.05	-	8.75	742.52	0.02	-	8.99
SP-7	8442.16	4326.11	730.16	740.31	-	-	0	744.92	0.43	-	5.15	744.85	0.06	-	5.69	744.79	0.07	742.89	6.67	744.70	0.09	-	7.78	744.63	0.01	-	7.94	744.62	0.08	-	8.68	744.65	-0.02	-	8.49	744.59	0.06	-	9.18
SP-8	8441.88	4429.67	731.20	741.42	-	-	0	746.08	0.40	-	4.81	746.02	0.04	-	5.26	745.87	0.14	743.80	8.01	745.84	0.03	-	7.39	745.69	0.04	-	7.92	745.76	0.03	-	9.19	745.73	0.02	-	9.42	745.66	0.07	-	9.29
SP-9	8441.22	4532.30	728.72	738.98	-	-	0	743.87	0.36	-	4.37	743.82	0.05	-	4.98	743.46	0.13	738.62	8.57	743.40	0.05	-	7.55	743.36	0.02	-	7.77	743.33	0.05	-	8.41	743.33	0.00	-	8.37	743.26	0.05	-	8.66
SP-10	8439.80	4630.45	724.64	734.74	-	-	0	734.75	-0.01	-	-0.11	734.74	0.00	-	-0.09	734.69	0.05	730.43	0.58	734.61	0.08	-	1.51	734.55	0.07	-	2.29	734.58	-0.04	-	1.80	734.53	0.05	-	2.43	734.48	0.05	-	3.35

updated with length of additional rod
from top of rod to center of coupling was 60-7/16 inches = 5.036 feet

NTH Consultants, Ltd.
Infrastructure Engineering
and Environmental Services

Job WD1 F/S [illegible]	Project No. 13-0609R1-03	Sheet No. 1	
Subject ANALYSIS OF PARAMETERS	By DRJ	Date 1/19/11	
[illegible] MC IV SURCHARGE	Checked By KRO	Date 2/23/11	

"Due to short loading time of MC IV stockpile [...] of lower clay, assume consolidation has not occurred."

ASSUME FOLLOWING:

$S_T = S_{CON} + S_{USAT\ WASTE} + S_{WASTE} + S_{CLAY} + S_{SILT} + S_{SAND}$

S_{CON}: FIXED

S_{CLAY}: DUE TO SHORT LOADING TIME OF MC IV STOCKPILE & [illegible] STRENGTH OF LOWER CLAY, ASSUME CONSOLIDATION HAS NOT OCCURRED

possibly sand

S_{SILT} & S_{SAND}: ASSUME [illegible] OF THESE INPUT PARAMETERS HAVE LITTLE TO NO EFFECT ON SETTLEMENT WITHIN [illegible]. ASSUME A FIXED VALUE. BASED ON SETTLEMENT ESTIMATE & DEPTH OF [illegible] SETTLEMENT OF THESE LAYERS IS NEGLIGIBLE.

$S_{USAT\ V}$: DUE TO RELATIVE THICKNESS OF THIS LAYER, STRENGTH OF CLAY MIX AT TOMESITE & UNSATURATED NATURE OF CLAY COVER, ASSUME SETTLEMENT IS NEGLIGIBLE.

Settlement of Cover

SINCE SP-[illegible] & SP-[illegible] ARE OUTSIDE OF THE FOOT PRINT OF THE [illegible], NEGLECT FOR THIS ANALYSIS.

→ AVERAGE TOTAL SETTLEMENT ESTIMATED FOR SP-2 TO SP-9

$S_T = 0.72$ ft

$\therefore S_T = S_{USAT\ WASTE} + S_{CLAY} + 0.02$

$0.72 - 0.02 = S_{USAT\ WASTE}$

$= 0.70$ ft

→ TOTAL MEASURED SETTLEMENT (AVG) FOR SP-2 TO SP-9

$S_T = 0.69$ ft

USING $C_{CE} = 0.236$
$C_{RE} = 0.024$ for MC IV GRANULAR WASTE

SP-7
N8442 E4326

COVERED BY FACTOR

Existing stress = ((730 - 721)/2) × 0.130
MID PT. σ_i
= 0.62 KSF

Depth to middle of layer = 5 ft
FROM [illegible]

$\Delta\sigma_z$ = 1.21 kips/ft² (From stress calculator)

Future stress = $\sigma_i + \Delta\sigma_z$ = 0.62 ksf + 1.21 kips/ft² = 1.83 ksf
MID PT. σ_f

Elastic compression = (730 - 721) × (1.21 / 100) = 0.010 ft

Primary Consolidation 0 ↖
Secondary Consolidation 0 ← NO CONSOLIDATION OCCURS IN THIS LAYER SINCE THE CLAY IS UNSATURATED.

TOTAL COMPRESSION OF LAYER = 0.010 ft

UNSATURATED

Existing stress = 0.62 + ((730-721)/2 × 0.30) + (721-695)/2 × 0.130 = 2.21 kips/ft²
MID PT. σ_i

Depth to middle of layer = (730-721) + (721-695)/2 = 21 ft

$\Delta\sigma_z$ = 0.33 kips/ft² (From stress calculator)

Future stress = 2.21 + 0.33 = 2.54 kips/ft²
MID PT. σ_f

Primary compression = 23 × (0.28 log (2.54/2.21)) = 0.32 ft

Secondary compression = 23 × (0.024 log (3/1)) = 0.16 ft

Total compression of layer = 0.49 ft

NTH Consultants, Ltd.
Infrastructure Engineering
and Environmental Services

Job WOI F/G Development	Project No. 13-[illegible]	Sheet No.	3
Subject MC IV Surcharge	By DLL	Date	1/19/11
Pile Settlement Estimate	Checked By KRO	Date	2/23/11

SAT. WASTE

Existing stress @ mid pt. of σ_z = $2.2 \text{ kg/ft} + [(721-698)/2 \times 0.086] + [(698-675)/2 \times (0.086-0.0624)] = 3.46$

Depth to mid pt of σ_z = $(730-721) + (721-698) + (698-675)/2 = 44.5$

$\Delta\sigma_z = 0.10 \text{ kg/ft}^2$ (from stress calculation)

Final stress @ mid pt. of σ_z = $3.46 + 0.1 = 3.56 \text{ kg/ft}^2$

Primary compression = $23 \times (0.236 \log(3.56/3.46)) = 0.07$ ft

Secondary compression = $23 \times (0.014 \log(2/1)) = 0.17$ ft

Total compression WASTE = 0.23 ft

NEGLECT SETTLEMENT IN LOWER C'A, LAYERS SINCE STRENGTH of clay results in very little SETTLEMENT occurring over the short TIME FRAME of MCIV SURCHARGE RELATIVE to the compressible WASTE LAYERS.

SETTLEMENT IN SILT IS NEGLIGIBLE & FIXED @ 0.01 ft, SETTLEMENT IN SAND IS Negligible & FIXED @ 0.0 ft.

TOTAL ESTIMATED SETTLEMENT = ST = 0.01 (SCOV, FIXED) + 0.49 + 0.23 (SILT, SAMSTE) + 0.01 (SAND, FIXED) + 0

$S_T = 0.74$ ft

TOTAL MEASURED SETTLEMENT OF SETTLEMENT PLATE 1 as of 1/19/11 : ST = 0.76 ft

Table 1
Summary of Settlement Points

Point	Northing	Easting	Existing Ground Surface Elevation (ft)	Estimated Final Ground Surface Elevation (ft)	Measured Final Ground Surface as of 01/19/11 (ft)	Total Estimated Settlement (ft)	Total Measured Settlement (ft)	Difference (ft)
SP-1	8336	4632	727.6	727.0	727.5	0.6	0.1	0.5
SP-2	8336	4526	730.0	729.4	729.3	0.6	0.7	-0.1
SP-3	8336	4424	733.5	732.8	732.9	0.7	0.6	0.1
SP-4	8336	4325	733.0	732.2	732.4	0.8	0.6	0.2
SP-5	8335	4226	729.2	728.4	728.4	0.8	0.8	0.0
SP-6	8441	4237	728.2	727.5	727.5	0.7	0.7	0.0
SP-7	8442	4326	730.2	729.4	729.4	0.7	0.8	0.0
SP-8	8442	4430	731.2	730.5	730.5	0.7	0.7	0.0
SP-9	8441	4532	728.7	728.0	728.0	0.8	0.7	0.0
SP-10	8440	4630	724.6	723.7	724.5	0.9	0.1	0.8

Not included in analysis. Outside of full stockpile surcharge height.

S:\Waste\Engineering\Site #2\6F & G development\Calculation packages\[Settlment Analysis MC IV Surcharge Pile (Modified Indices & Stress Distribution).xls]Summary Table

Table of Settlement Estimates - Sheet 1 of 1

Point		SP-1	SP-2	SP-3	SP-4	SP-5	SP-6	SP-7	SP-8	SP-9	SP-10
Northing	ft	N8336	N8336	N8336	N8336	N8335	N8441	N8442	N8442	N8441	N8440
Easting	ft	E4632	E4526	E4424	E4325	E4226	E4237	E4326	E4430	E4532	E4630
Bottom of clay elevation	ft	644	650	656	658	660	661	659	653	642	638
MC IV liner elevation	ft	674	674	674	671	687	675	675	675	675	675
Current MC IV cover elevation	ft	728	730	734	733	729	728	730	731	729	725
Top of MC IV waste	ft	714	715	723	723	722	718	721	720	719	718
Existing leachate elevation	ft	704	703	703	702	700	696	698	699	700	701
Thickness of existing unsaturated waste	ft	10	12	20	21	22	22	23	21	19	17
Thickness of existing saturated waste	ft	30	29	29	31	13	21	23	24	25	26
MC IV Surcharge elevation	ft	736	742	747	745	740	740	743	744	740	730
Thickness of Surcharge	ft	8	12	13	12	11	12	13	12	11	6
Cover on MC IV											
Depth to Midpoint of Layer	ft	7	7	5	5	4	5	5	6	5	3
Existing stress at midpoint	ksf	0.86	0.95	0.71	0.63	0.47	0.69	0.62	0.73	0.63	0.44
Future stress at midpoint	ksf	1.85	1.94	1.92	1.84	1.81	1.90	1.83	1.83	1.84	1.90
Elastic compression	ft	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Primary consolidation	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Secondary compression	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total compression in layer	ft	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Existing Unsaturated MC IV Waste											
Depth to Midpoint of Layer	ft	18	21	21	20	18	21	21	22	19	15
Existing stress at midpoint	ksf	2.17	2.44	2.27	2.17	1.88	2.31	2.21	2.36	2.08	1.60
Future stress at midpoint	ksf	2.57	2.77	2.60	2.52	2.28	2.64	2.54	2.67	2.46	2.10
Elastic compression	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Primary consolidation	ft	0.18	0.16	0.27	0.33	0.44	0.29	0.32	0.27	0.33	0.47
Secondary compression	ft	0.08	0.09	0.14	0.15	0.16	0.16	0.16	0.15	0.14	0.12
Total compression in layer	ft	0.26	0.25	0.41	0.48	0.59	0.45	0.49	0.42	0.46	0.59
Existing Saturated MC IV Waste											
Depth to Midpoint of Layer	ft	39	41	45	46	35	43	44	44	41	37
Existing stress at midpoint	ksf	2.97	3.31	3.45	3.46	2.97	3.48	3.46	3.55	3.19	2.64
Future stress at midpoint	ksf	3.10	3.43	3.55	3.56	3.12	3.59	3.56	3.65	3.31	2.78
Elastic compression	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Primary consolidation	ft	0.13	0.11	0.08	0.09	0.06	0.07	0.07	0.07	0.09	0.14
Secondary compression	ft	0.22	0.21	0.21	0.22	0.09	0.15	0.17	0.17	0.18	0.19
Total compression in layer	ft	0.35	0.32	0.29	0.31	0.15	0.22	0.23	0.24	0.28	0.33
Upper Clay Layer*		**	**	**	**		**	**	**	**	**
Depth to Midpoint of Layer	ft	-	-	-	-	45	-	-	-	-	-
Existing stress at midpoint	ksf	-	-	-	-	3.37	-	-	-	-	-
Future stress at midpoint	ksf	-	-	-	-	3.47	-	-	-	-	-
Elastic compression	ft	-	-	-	-	0.00	-	-	-	-	-
Primary consolidation	ft	-	-	-	-	0.01	-	-	-	-	-
Secondary compression	ft	-	-	-	-	0.01	-	-	-	-	-
Total compression in layer	ft	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
Middle Clay Layer*											
Depth to Midpoint of Layer	ft	69	68	66	64	59	58	63	67	70	68
Existing stress at midpoint	ksf	4.42	4.53	4.47	4.29	4.38	4.26	4.32	4.62	4.68	4.30
Future stress at midpoint	ksf	4.47	4.58	4.52	4.34	4.44	4.32	4.37	4.67	4.72	4.35
Elastic compression	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Primary consolidation	ft	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Secondary compression	ft	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.04	0.06	0.06
Total compression in layer	ft	0.07	0.06	0.05	0.04	0.04	0.04	0.04	0.05	0.07	0.09
Silt Layer											
Depth to Midpoint of Layer	ft	93	92	93	91	87	85	88	92	95	93
Existing stress at midpoint	ksf	6.12	6.19	6.11	5.79	6.48	5.90	5.97	6.31	6.43	6.07
Future stress at midpoint	ksf	6.15	6.22	6.14	5.82	6.51	5.93	6.00	6.34	6.45	6.10
Elastic compression	ft	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
Primary consolidation	ft	-	-	-	-	-	-	-	-	-	-
Secondary compression	ft	-	-	-	-	-	-	-	-	-	-
Total compression in layer	ft	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
Sand Layer											
Depth to Midpoint of Layer	ft	125	127	131	130	127	126	128	129	126	122
Existing stress at midpoint	ksf	7.90	8.16	8.25	8.02	8.75	8.20	8.22	8.38	8.16	7.66
Future stress at midpoint	ksf	7.91	8.17	8.26	8.03	8.76	8.21	8.23	8.39	8.17	7.67
Elastic compression	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Primary consolidation	ft	-	-	-	-	-	-	-	-	-	-
Secondary compression	ft	-	-	-	-	-	-	-	-	-	-
Total compression in layer	ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Settlement - MC IV Cover	ft	0.6	0.6	0.7	0.8	0.8	0.7	0.7	0.7	0.8	0.9

* Assume Clay Settlment has not occurred. Removed from Final Settlment Amount

** No upper clay in this area. Assume Middle Clay extends to MC IV Liner.

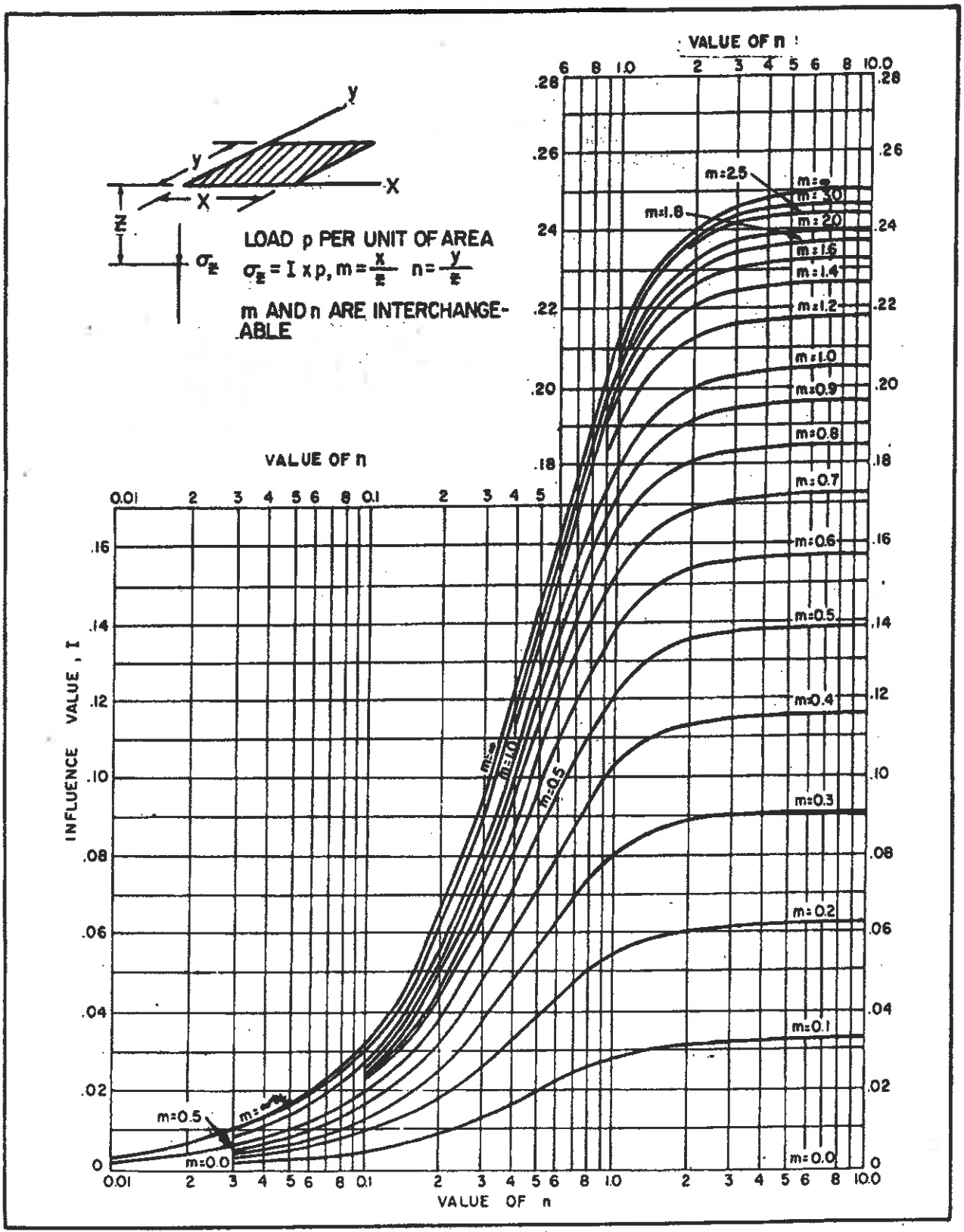


FIGURE 4
Influence Value for Vertical Stress Beneath a Corner of a Uniformly Loaded Rectangular Area (Boussinesq Case)

NTH Consultant, Ltd.
Stress Distribution Calculation
Project Name: WDI MC VI F/G Development
NTH Project No.: 13-060921-03
Calculated By: David R. Lutz
Checked By:

Ground Contact Pressure(psi): 11.25

	x	y
Contact Dimension (ft x ft):	428	99
Soil Unit Weight (pcf):		135
Stockpile Height (ft)		12

m=x/z, x=17.8 ft?

n=y/z, y=4.2 ft?

4 x I x 11.25 psi suggests Pe is at center of stockpile

Depth (ft)	I	Pe (psi)	Pe (ksf)	m	n
3	0.226	10.15	1.46	5.94	1.38
5	0.187	8.43	1.21	3.57	0.83
7	0.153	6.89	0.99	2.55	0.59
15	0.077	3.46	0.50	1.19	0.28
18	0.062	2.79	0.40	0.99	0.23
19	0.058	2.61	0.38	0.94	0.22
20	0.054	2.44	0.35	0.89	0.21
21	0.051	2.29	0.33	0.85	0.20
22	0.048	2.15	0.31	0.81	0.19
35	0.024	1.06	0.15	0.51	0.12
37	0.021	0.97	0.14	0.48	0.11
39	0.020	0.88	0.13	0.46	0.11
41	0.018	0.81	0.12	0.43	0.10
43	0.017	0.75	0.11	0.41	0.10
44	0.016	0.72	0.10	0.41	0.09
45	0.015	0.69	0.10	0.40	0.09
46	0.015	0.66	0.10	0.39	0.09
58	0.010	0.43	0.06	0.31	0.07
59	0.009	0.42	0.06	0.30	0.07
63	0.008	0.37	0.05	0.28	0.07
64	0.008	0.36	0.05	0.28	0.06
66	0.008	0.34	0.05	0.27	0.06
67	0.007	0.33	0.05	0.27	0.06
68	0.007	0.32	0.05	0.26	0.06
69	0.007	0.31	0.05	0.26	0.06
70	0.007	0.31	0.04	0.25	0.06
85	0.005	0.21	0.03	0.21	0.05
87	0.004	0.20	0.03	0.20	0.05
88	0.004	0.20	0.03	0.20	0.05
91	0.004	0.18	0.03	0.20	0.05
92	0.004	0.18	0.03	0.19	0.04
93	0.004	0.18	0.03	0.19	0.04
95	0.004	0.17	0.02	0.19	0.04
122	0.002	0.10	0.02	0.15	0.03
125	0.002	0.10	0.01	0.14	0.03
126	0.002	0.10	0.01	0.14	0.03
127	0.002	0.10	0.01	0.14	0.03
128	0.002	0.09	0.01	0.14	0.03
130	0.002	0.09	0.01	0.14	0.03
131	0.002	0.09	0.01	0.14	0.03

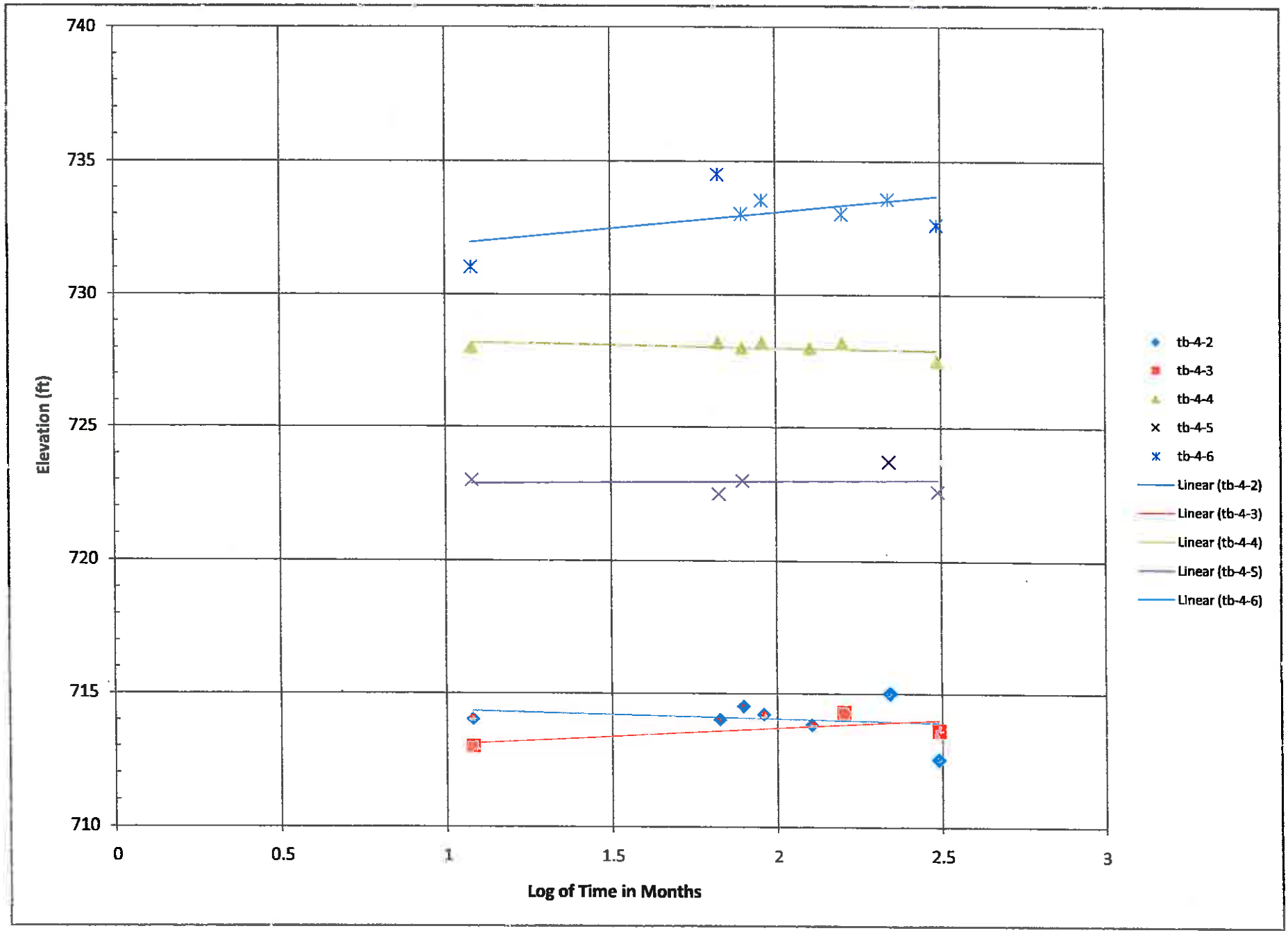
Determination of $C_\alpha E$

TB	N	E	Liner Elevation	Waste Thickness (ft)	May-08	Jan-01	Dec-95	Apr-93	Apr-92	Apr-90	Apr-89	Apr-88	Sep-83	Slope	Modified Index
tb-4-2	8709.01	4218.68	675.5	31	712.5	715.0	714.3	713.8		714.2	714.5	714	714	0.31457	0.01015
tb-4-3	8561.04	4941.60	682.6	26	713.6		714.3						713	-0.63108	
tb-4-4	8555.73	4522.19	691.5	31	727.5		728.2	728		728.2	728	728.2	728	0.20920	0.00675
tb-4-5	8543.41	4004.36	687.6	17	722.6	723.7					723	722.5	723	-0.10563	
tb-4-6	8397.15	4450.68	673.6	54	732.6	733.5	733			733.5	733	734.5	731	-1.21047	
tb-4-7	8380.50	3803.97	674.5	34	714.5	716.4							715.9	0.44679	0.01314
tb-4-8	8333.74	4851.49	661.4	51	720.4	720.8	721						721	0.28290	0.00555
tb-4-10	8248.81	4156.86	692.6	31	730.6	732.5	732	731.8		732	732.5	732.2	733	1.17604	0.03794
tb-4-11	8123.84	4744.32	660.2	44	728.2	729.4	729						729	0.19913	0.00453
tb-4-12	8114.52	4262.79	737.6	46	737.6	738.0	738.1	737.8		738.2	738.5	738.2	737	-0.47971	
tb-4-13	8086.91	3804.42	672.2	40	718.2	719.9				718.5	721	719	720	0.83351	0.02084
tb-4-14	7869.58	4911.80	673.2	40	718.2	719.7	719						719.5	0.51187	0.01280
tb-4-15	7942.88	4623.23	692.9	32	729.9	730.9	730.1	731.8				734	733	2.38543	0.07454
tb-4-17	7949.07	4184.93	691.2	36.5	735.2	736.2	735.8	735.8		735	735.5	735.5	737	0.87702	0.02403
tb-4-18	7798.94	3979.03	674.6	36.5	716.6	718.1	718	718		718	715.8	716	720	1.52085	0.04167
tb-4-19	7995.23	4374.15	678	51	735	736.5	735.8	737		741		739.5	736	0.82997	0.01627
tb-4-20	8190.02	4440.79	693	32	735	736.9	735.9	736.5		739.9		738.5	737	1.30671	0.04083
tb-4-21	8458.90	4358.61	675	46	730	731.5	730.5	730.5		730.5	731	731.8	729.5	-0.58516	
tb-1-2	6832.47	4917.83	674.4	31	709.4	710.9		710	709.8	710.5	710.5	710	711	0.72726	0.02346
tb-1-3	6847.69	3970.06	667.8	42	715.8	717.0		716.5	717	715	717	717	719	1.96608	0.04681
tb-1-5	6654.26	4115.69	687.8	24	722.8	724.8		723.8	724.2	723.5	725	725	725	1.14365	0.04765
tb-1-6	6455.09	4885.98	689	19	716	717.1		716.5	716		713.9	714	715	-1.45075	
tb-1-8	6458.92	3891.50	698.9	17	726.9	728.9		727	728	727.5	729	729	730	1.89261	0.11133
tb-1-9	6334.58	4449.41	680.9	32	723.9	726.6		726.2				726.5	727	1.46579	0.04581
tb-1-10	6797.10	4250.48	683	25.5	721	723.5		721.8	722.1	721	723	723	724.2	1.71538	0.06727
tb-1-11	6592.96	4458.17	666	46	723	724.9		724.5	724.5	724.5	725	725	725.8	1.52318	0.03311
tb-1-12	6368.94	4247.03	683	38	726	728.9		729.8		729	729.8		729.5	1.61540	0.04251

Indicates Invalid Slope.

$$\text{Modified Index} = \frac{C_\alpha}{1+e_o} = \frac{\Delta}{H \log t_2/t_1} = \frac{\text{Slope of Line}}{H} \quad (H = \text{Waste Thickness})$$

S:\Waste\Engineering\Site #2\6F & G development\[Modified Compression Index.xls]Modified Data


740
735
730
725
720
715
710
Elevation (ft)
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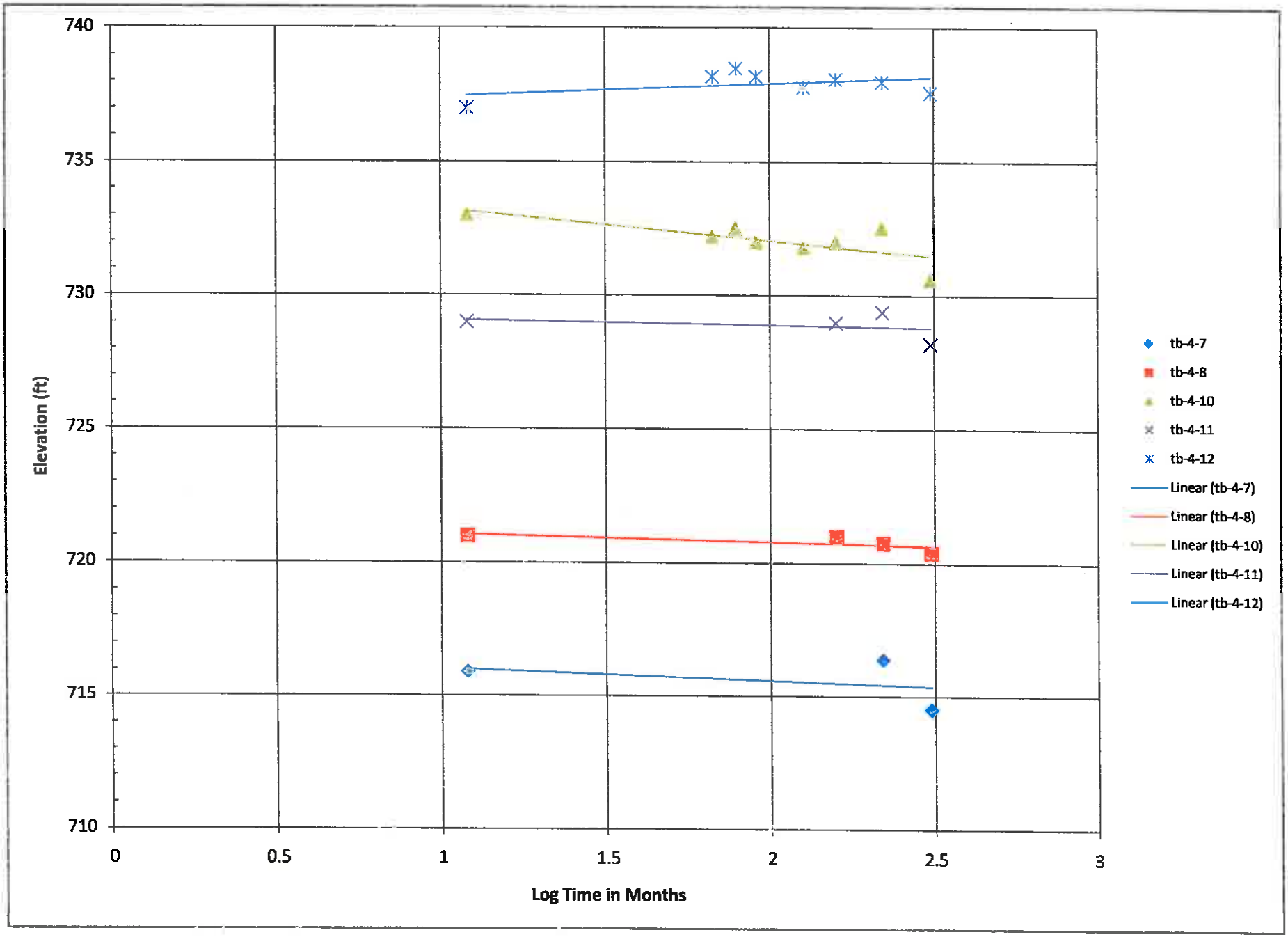
0.5
1
1.5
2
2.5
3
Log of Time in Months
tb-4-2
tb-4-3
tb-4-4
tb-4-5
tb-4-6
Linear (tb-4-2)
Linear (tb-4-3)
Linear (tb-4-4)
Linear (tb-4-5)
Linear (tb-4-6)


740
735
730
725
720
715
710
Elevation (ft)
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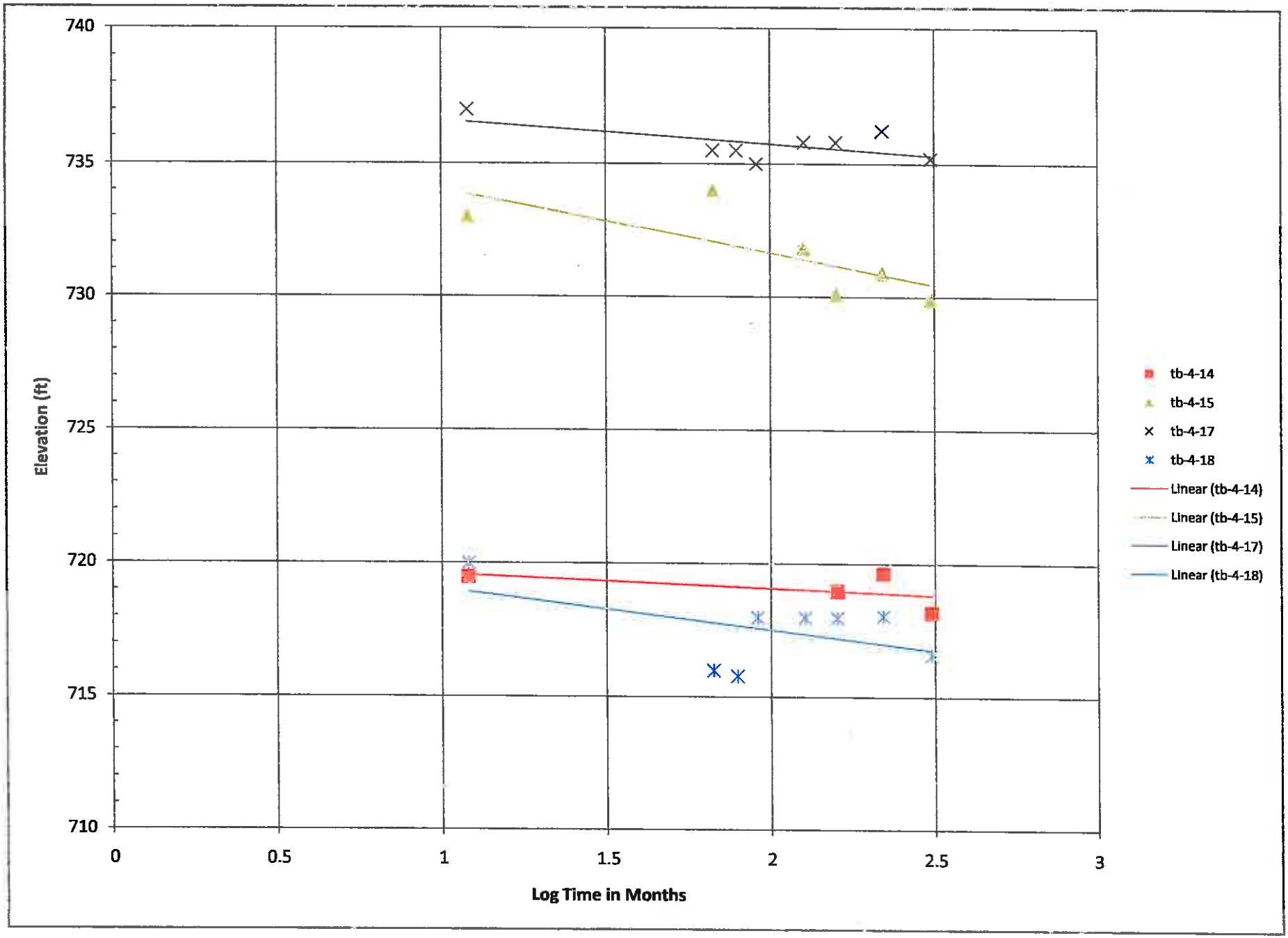
0.5
1
1.5
2
2.5
3
Log Time in Months
tb-4-7
tb-4-8
tb-4-10
tb-4-11
tb-4-12
Linear (tb-4-7)
Linear (tb-4-8)
Linear (tb-4-10)
Linear (tb-4-11)
Linear (tb-4-12)


740
735
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725
720
715
710
Elevation (ft)
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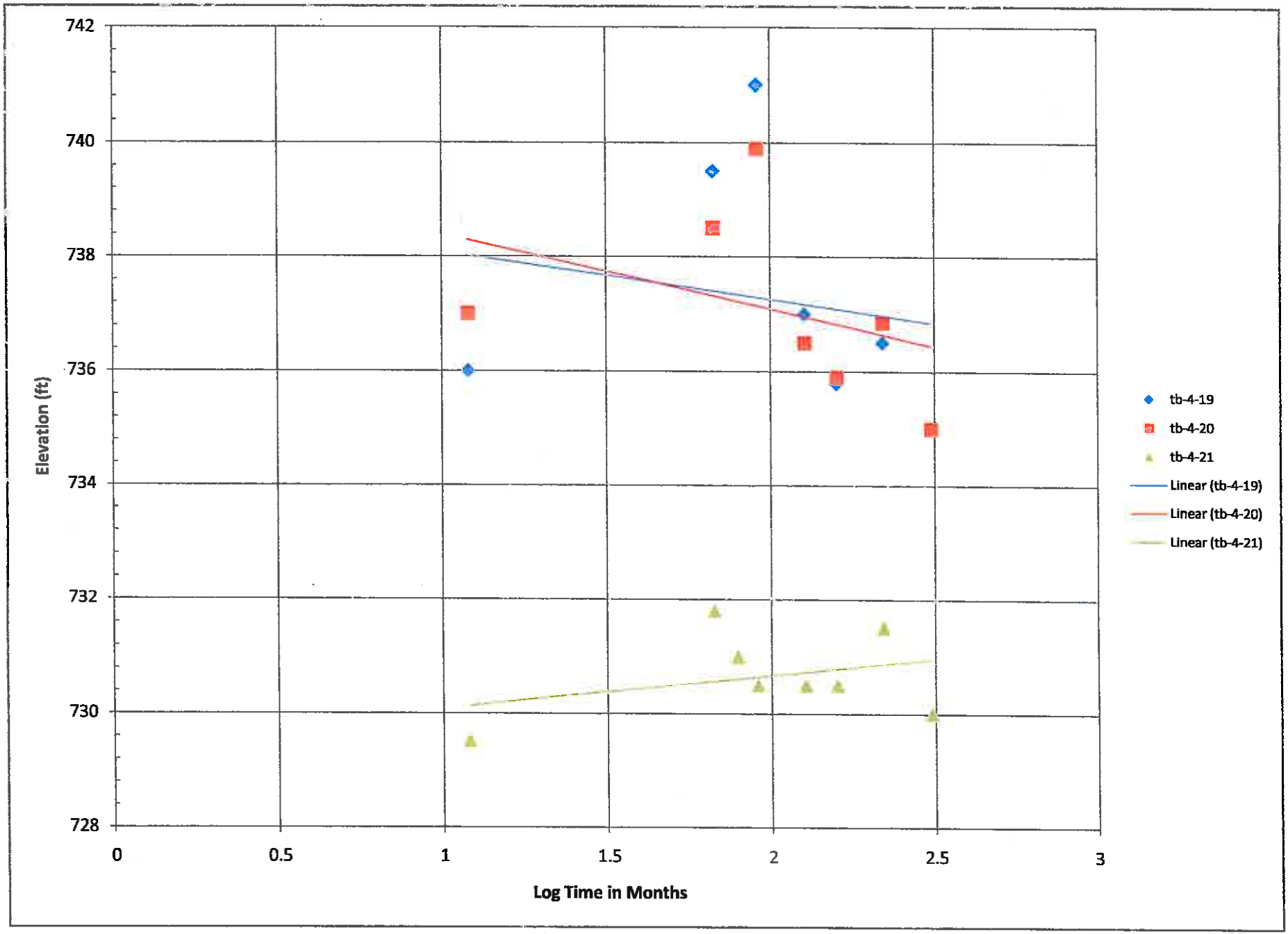
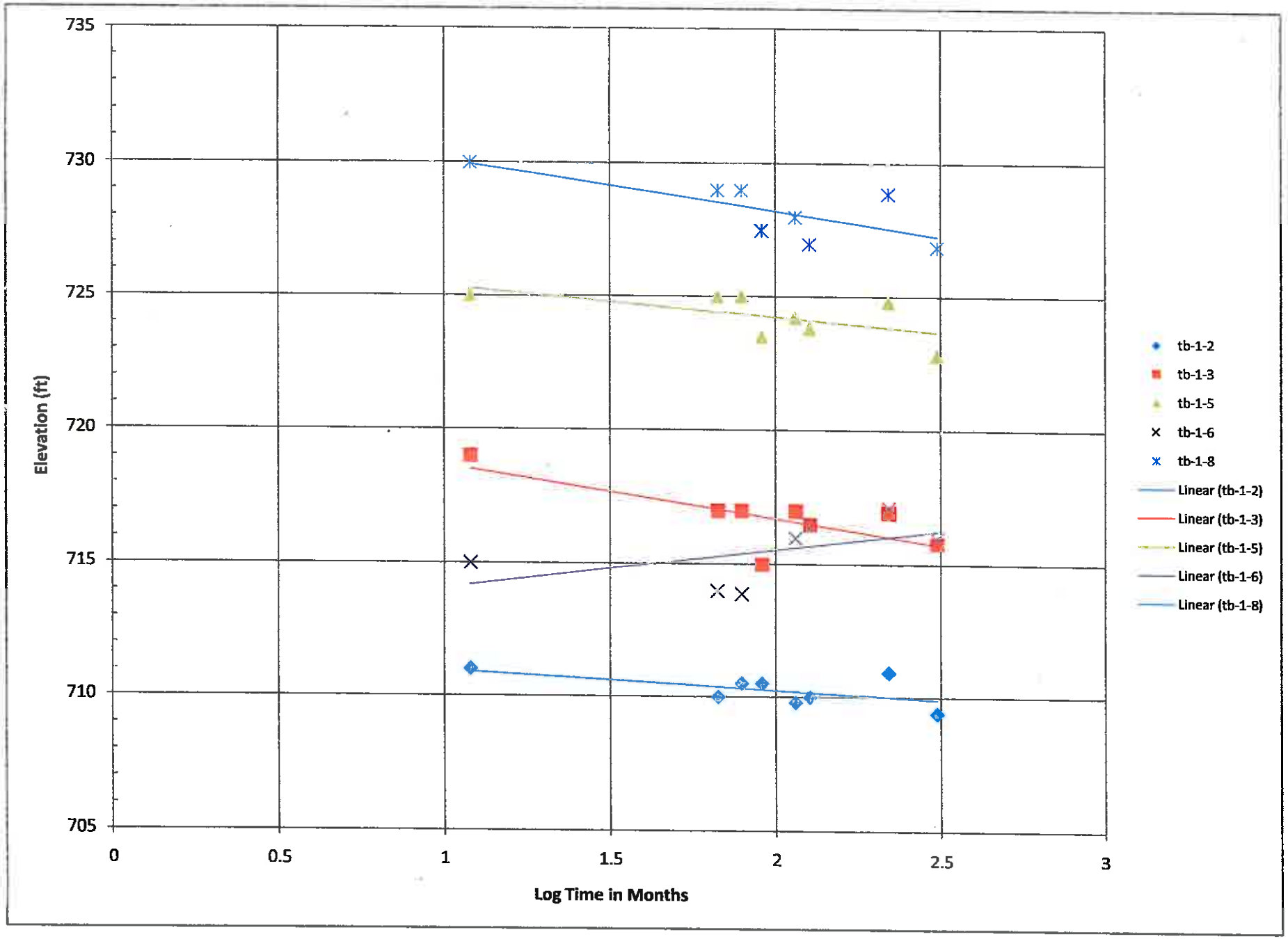
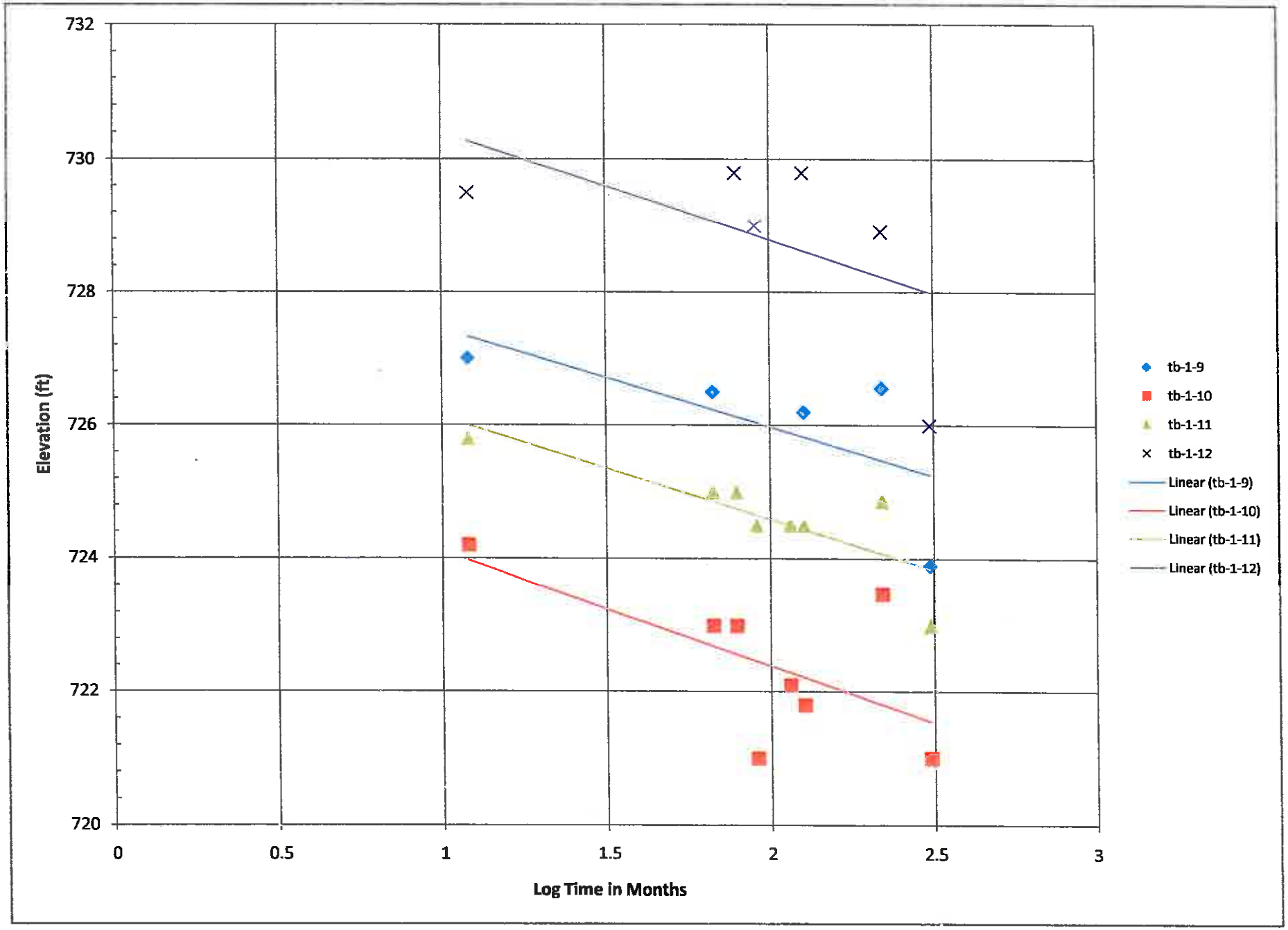
1
1.5
2
2.5
3
Log Time in Months
tb-4-14
tb-4-15
tb-4-17
tb-4-18
Linear (tb-4-14)
Linear (tb-4-15)
Linear (tb-4-17)
Linear (tb-4-18)


742
740
738
736
734
732
730
728
Elevation (ft)
0
0.5
1
1.5
2
2.5
3
Log Time in Months
tb-4-19
tb-4-20
tb-4-21
Linear (tb-4-19)
Linear (tb-4-20)
Linear (tb-4-21)


735
730
725
720
715
710
705
Elevation (ft)
0
0.5
1
1.5
2
2.5
3
Log Time in Months
tb-1-2
tb-1-3
tb-1-5
tb-1-6
tb-1-8
Linear (tb-1-2)
Linear (tb-1-3)
Linear (tb-1-5)
Linear (tb-1-6)
Linear (tb-1-8)


732
730
728
726
724
722
720
Elevation (ft)
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0.5
1
1.5
2
2.5
3
Log Time in Months
tb-1-9
tb-1-10
tb-1-11
tb-1-12
Linear (tb-1-9)
Linear (tb-1-10)
Linear (tb-1-11)
Linear (tb-1-12)

Attachment A-2.3.4

CTI Back-Calculation of C'_c from NTH (2011a) Stockpile Test Results

midpoint depth	Clay Layer	Top Elevation	Bottom Elevation	Midpoint Elevation	Taken from CTI Data Review	Thickness	AVG MC	e_0	$\gamma_{soil, mois}$	$\sigma_{excavatio}$	$u_{excavation}$	p_c	c_v	C_r, (assumed same as C_c)	C_c
ft bgs						ft	%		pcf	psf	psf	psf	ft.^{2}/day		
0.00	1	687	687	687	655	0	18	0.47	129.8	0	0	1660	0.08	0.1499	0.1499
7.00	2	680	680	680	655	0	18	0.47	129.8	0	0	1660	0.08	0.1499	0.1499
14.00	3	676	669	673	655	7	18	0.47	135.7	475	0	1660	0.08	0.1499	0.1499
21.00	4	669	662	666	655	7	18	0.47	135.7	1425	0	1660	0.08	0.1499	0.1499
28.00	5	662	655	659	655	7	22	0.47	128.1	2348	0	1660	0.08	0.1499	0.1499
35.00	6	655	648	652	655	7	22	0.76	128.1	3245	218	2724	0.08	0.3010	0.3010
42.00	7	648	641	645	655	7	22	0.76	128.1	4142	655	2724	0.08	0.3010	0.3010

Point Name	Unit	SP-1 (2)	SP-2	SP-3	SP-4 (2)	SP-6
Existing Topo Elevation, from 2/11/2011	ft.	736	742	747	745	740
Soil stockpile thickness (H_{pile})	ft.	8	12	13	12	12
Cover thickness (H_{cover})	ft.	14	15	11	10	10
Top of Waste Elevation	ft.	714	715	723	723	718
Elevation of Bottom of Waste	ft.	674	674	674	671	675
Waste thickness (H_w)	ft.	40	41	49	52	43
Bottom of Clay	ft.	644	650	656	658	661
Clay thickness (H_{clay})	ft.	30	24	18	13	14
Waste unit weight (γ_{msw})	pcf			77		
Water unit weight (γ_w)	pcf			62.4		
Cover soil unit weight (γ_{soil})	pcf			120		
Soil stockpile unit weight (γ_{soil})	pcf			120		
Elevation of Top of Leachate Level		704	703	703	702	696
Time Elapsed since waste placement	years			30		
Time Elapsed since stockpile placement	days			57		
Maximum settlement (S_n)	ft.	0.12	0.68	0.73	0.62	0.75
WASTE						
Waste Element thickness ($H_n = H_w$ / 3)	ft.	13.33	13.67	16.33	17.33	14.33
Initial depth to element midpoint (z = 1/6 H_w; 1/2 H_w; 5/6 H_w)	ft.	6.67 20.00 33.33	6.83 20.50 34.17	8.17 24.50 40.83	8.67 26.00 43.33	7.17 21.50 35.83
Pore Pressure prior to leachate, u0	psf	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00
Final Pore Pressure, uf	psf	0.00 624.00 1456.00	0.00 530.40 1383.20	0.00 280.80 1300.00	0.00 312.00 1393.60	0.00 0.00 863.20
Final eff. stress at midpoint ($\sigma_0' = z * \gamma_{msw} + H_{cover} * \gamma_{soil}$)-uf	psf	2193.33 2596.00 2790.67	2206.17 2728.10 2927.63	2308.83 3285.70 3524.17	2347.33 3370.00 3623.07	2231.83 3335.50 3575.97
Change in stress from stockpile (from 2V:1H Pressure Distribution)	psf	1488.67 1287.56 1128.03	1488.67 1273.99 1117.12	1471.38 1222.01 1045.43	1454.42 1209.56 1026.32	1488.67 1260.65 1095.83
Final stress ($\sigma_i' = \sigma'_0 + \Delta\sigma$)	psf	3682.00 3883.56 3918.69	3694.84 4002.09 4044.75	3780.21 4507.71 4569.59	3801.75 4579.56 4649.39	3720.50 4824.17 5064.64
TOP 3 CLAY LAYERS						
Clay Element thickness ($H_{n,clay}$ = H_{clay} / 6)	ft.	5.00	4.00	3.00	2.17	2.33
Initial depth to element midpoint (z = 1/12 H_{clay}; 3/12 H_{clay}; 5/12 H_{clay})	ft.	2.50 7.50 12.50	2.00 6.00 10.00	1.50 4.50 7.50	1.08 3.25 5.42	1.17 3.50 5.83
Elevation		671.50 666.50 661.50	672.00 668.00 664.00	672.50 669.50 666.50	669.92 667.75 665.58	673.83 671.50 669.17
midpoint depth within clay	ft bgs	15.00 20.00 25.00	14.50 18.50 22.50	14.00 17.00 20.00	16.58 18.75 20.92	12.67 15.00 17.33
upper layer midpoint depth	ft bgs	14.00 14.00 21.00	14.00 14.00 21.00	14.00 14.00 14.00	14.00 14.00 14.00	7.00 14.00 14.00
lower layer midpoint depth	ft bgs	21.00 21.00 28.00	21.00 21.00 28.00	21.00 21.00 21.00	21.00 21.00 21.00	14.00 21.00 21.00
upper preconsolidation stress (total)	psf	474.95 474.95 1424.85	474.95 474.95 1424.85	474.95 474.95 474.95	474.95 474.95 474.95	0.00 474.95 474.95
lower preconsolidation stress (total)	psf	1424.85 1424.85 2348.15	1424.85 1424.85 2348.15	1424.85 1424.85 1424.85	1424.85 1424.85 1424.85	474.95 1424.85 1424.85
preconsolidation stress (total)	psf	610.65 1289.15 1952.45	542.80 1085.60 1622.70	474.95 882.05 1289.15	825.51 1119.53 1413.54	384.48 610.65 927.28
Total Stress at Midpoint	psf	610.65 1289.15 1952.45	542.80 1085.60 1622.70	474.95 882.05 1289.15	825.51 1119.53 1413.54	384.48 610.65 927.28
Initial Pore Pressure, u0	psf	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00
Drainage Height of Clay, H_{dr}, based on free draining in aquifer and waste	ft.	15.00	12.00	9.00	6.50	7.00
Tv from waste (30 years)		3.89 3.89 3.89	6.08 6.08 6.08	10.81 10.81 10.81	20.73 20.73 20.73	17.88 17.88 17.88
U (percent consolidation of clay), avg from waste		1.00 1.00 1.00	1.00 1.00 1.00	1.00 1.00 1.00	1.00 1.00 1.00	1.00 1.00 1.00
Tv from stockpile		0.02 0.02 0.02	0.03 0.03 0.03	0.06 0.06 0.06	0.11 0.11 0.11	0.09 0.09 0.09
U (percent consolidation of clay), avg from stockpile		0.41 0.01 0.00	0.51 0.05 0.00	0.62 0.14 0.01	0.72 0.28 0.08	0.70 0.25 0.06
Final eff. stress at midpoint due to waste ($\sigma_0' = z * \gamma_{clay}+(U_{clay, from waste})*(H_w*\gamma_{msw} + H_{cover} *\gamma_{soil})$), consolidation from 1981-2011 - u0	psf	5370.54 6048.86 6712.06	5499.80 6042.60 6579.70	5567.95 5975.05 6382.15	6029.51 6323.53 6617.54	5375.48 5601.65 5918.28
Final Pore Pressure, uf	psf	1773.20 1575.60 1378.00	1684.80 1435.20 1185.60	1653.60 1341.60 1029.60	1757.60 1404.00 1050.40	1170.00 889.20 608.40
Change in stress from stockpile (from 2V:1H Pressure Distribution) * U_stockpile	psf	607.00 16.71 0.01	755.93 59.77 1.01	911.36 166.41 14.10	1046.99 342.39 87.11	1040.98 311.32 65.99
Final stress (σ_f '= $\sigma_0 + \Delta\sigma$) from stockpile - uf	psf	4204.35 4489.98 5334.06	4570.93 4667.17 5395.11	4825.71 4799.86 5366.65	5318.89 5261.91 5654.25	5246.47 5023.77 5375.88
Element Settlement $S_{n,clay}$ = [$H_{n,clay}$ * $C_{r,clay}$*log (σ_f / σ_0)]/(1+$e_{0, clay}$)}	ft.	0.03 0.00 0.00	0.03 0.00 0.00	0.03 0.00 0.00	0.02 0.01 0.00	0.02 0.01 0.00
BOTTOM 3 CLAY LAYERS						
Initial depth to element midpoint (z = 7/12 H_{clay}; 9/12 H_{clay}; 11/12 H_{clay})	ft.	17.50 22.50 27.50	14.00 18.00 22.00	10.50 13.50 16.50	7.58 9.75 11.92	8.17 10.50 12.83
Elevation		656.50 651.50 646.50	660.00 656.00 652.00	663.50 660.50 657.50	663.42 661.25 659.08	666.83 664.50 662.17
midpoint depth within clay	ft bgs	30.00 35.00 40.00	26.50 30.50 34.50	23.00 26.00 29.00	23.08 25.25 27.42	19.67 22.00 24.33
upper layer midpoint depth	ft bgs	28.00 35.00 35.00	21.00 28.00 28.00	21.00 21.00 28.00	21.00 21.00 21.00	14.00 21.00 21.00
lower layer midpoint depth	ft bgs	35.00 42.00 42.00	28.00 35.00 35.00	28.00 28.00 35.00	28.00 28.00 28.00	21.00 28.00 28.00
upper preconsolidation stress (total)	psf	2348.15 3244.85 3244.85	1424.85 2348.15 2348.15	1424.85 1424.85 2348.15	1424.85 1424.85 1424.85	474.95 1424.85 1424.85
lower preconsolidation stress (total)	psf	3244.85 4141.55 4141.55	2348.15 3244.85 3244.85	2348.15 2348.15 3244.85	2348.15 2348.15 2348.15	1424.85 2348.15 2348.15
preconsolidation stress (total)	psf	2604.35 3244.85 3885.35	2150.30 2668.40 3180.80	1688.65 2084.35 2476.25	1699.64 1985.43 2271.21	1243.92 1556.75 1864.52
Total Stress at Midpoint	psf	2604.35 3244.85 3885.35	2150.30 2668.40 3180.80	1688.65 2084.35 2476.25	1699.64 1985.43 2271.21	1243.92 1556.75 1864.52
Initial Pore Pressure, u0	psf	0.00 218.40 530.40	0.00 0.00 187.20	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00
Tv from waste (30 years)		3.89 3.89 3.89	6.08 6.08 6.08	10.81 10.81 10.81	20.73 20.73 20.73	17.88 17.88 17.88
U (percent consolidation of clay), avg from waste		1.00 1.00 1.00	1.00 1.00 1.00	1.00 1.00 1.00	1.00 1.00 1.00	1.00 1.00 1.00
Tv from stockpile		0.02 0.02 0.02	0.03 0.03 0.03	0.06 0.06 0.06	0.11 0.06 0.06	0.09 0.09 0.09
U (percent consolidation of clay), avg from stockpile		0.00 0.01 0.41	0.00 0.05 0.51	0.01 0.14 0.62	0.08 0.14 0.62	0.06 0.25 0.70
Final stress at midpoint due to waste ($\sigma_0' = z * \gamma_{clay}+(U_{clay, from waste})*(H_w*\gamma_{msw} + H_{cover} *\gamma_{soil})$), consolidation from 1990-2020 - u0	psf	7363.96 7786.16 8114.84	7107.30 7625.40 7950.60	6781.65 7177.35 7569.25	6903.64 7189.43 7475.21	5754.92 6067.75 6375.52
Final Pore Pressure, uf	psf	1180.40 982.80 785.20	936.00 686.40 436.80	717.60 405.60 93.60	696.80 343.20 0.00	327.60 46.80 0.00
Change in stress from stockpile (from 2V:1H Pressure Distribution) * U_stockpile	psf	0.01 16.70 459.76	1.34 59.74 567.09	19.84 166.36 647.40	123.42 164.66 635.57	89.63 311.25 766.17
Final stress (σ_f = $\sigma_0 + \Delta\sigma$) from stockpile - uf	psf	6183.56 6820.06 7789.41	6172.64 6998.74 8080.89	6083.89 6938.11 8123.05	6330.26 7010.89 8110.78	5516.95 6332.20 7141.69
Element Settlement $S_{n,clay}$ = $H_{n,clay}$ * $C_{c,clay}$*log (σ_f / σ_0)]/(1+$e_{0, clay}$)	ft.	0.00 0.00 0.02	0.00 0.00 0.02	0.00 0.00 0.01	0.00 0.00 0.01	0.00 0.01 0.01
CLAY						
Max total settlement of clay ($S_{t,clay}$)	ft.	0.06	0.06	0.05	0.04	0.05
WASTE						
Element settlement S_n =Cc'*Hn * log (sf / s0)	ft.	0.03 0.02 0.02	0.28 0.20 0.17	0.31 0.20 0.17	0.27 0.17 0.14	0.30 0.22 0.21
C_c' (trial and error)		0.010	0.090	0.090	0.075	0.095

midpoint depth	Clay Layer	Top Elevation	Bottom Elevation	Midpoint Elevation	Taken from CTI Data Review	Thickness	AVG MC	e_0	$\gamma_{soil, mois}$	$\sigma_{excavatio}$	$u_{excavation}$	p_c	c_v	C_r, (assumed same as C_c)	C_c
ft bgs						ft	%		pcf	psf	psf	psf	ft.^{2}/day		
3.50	1	690	683	687	655	7	18	0.47	129.8	454	0	1660	0.08	0.1499	0.1499
10.50	2	683	676	680	655	7	18	0.47	129.8	1363	0	1660	0.08	0.1499	0.1499
17.50	3	676	669	673	655	7	18	0.47	135.7	2292	0	1660	0.08	0.1499	0.1499
24.50	4	669	662	666	655	7	18	0.47	135.7	3242	0	1660	0.08	0.1499	0.1499
31.50	5	662	655	659	655	7	22	0.47	128.1	4165	0	1660	0.08	0.1499	0.1499
38.50	6	655	648	652	655	7	22	0.76	128.1	5062	218	2724	0.08	0.3010	0.3010
45.50	7	648	641	645	655	7	22	0.76	128.1	5959	655	2724	0.08	0.3010	0.3010

Point Name	Unit	SP-5 (2)		
Existing Topo Elevation, from 2/11/2011	ft.	740		
Soil stockpile thickness (H_{pile})	ft.	11		
Cover thickness (H_{cover})	ft.	7		
Top of Waste Elevation	ft.	722		
Elevation of Bottom of Waste	ft.	687		
Waste thickness (H_w)	ft.	35		
Bottom of Clay	ft.	660		
Clay thickness (H_{clay})	ft.	27		
Waste unit weight (γ_{msw})	pcf		77	
Water unit weight (γ_w)	pcf		62.4	
Cover soil unit weight (γ_{soil})	pcf		120	
Soil stockpile unit weight (γ_{soil})	pcf		120	
Elevation of Top of Leachate Level		700		
Time Elapsed since waste placement	years		30	
Time Elapsed since stockpile placement	days		57	
Maximum settlement (S_n)	ft.	0.78		
WASTE				
Waste Element thickness ($H_n = H_w$ / 3)	ft.	11.67		
Initial depth to element midpoint (z = 1/6 H_w; 1/2 H_w; 5/6 H_w)	ft.	5.83	17.50	29.17
Pore Pressure prior to leachate, u0	psf	0.00	0.00	0.00
Final Pore Pressure, uf	psf	0.00	0.00	447.20
Final eff. stress at midpoint (σ_0' = z * γ_{msw} + H_{cover} * γ_{soil})-uf	psf	1289.17	2187.50	2638.63
Change in stress from stockpile (from 2V:1H Pressure Distribution)	psf	1506.31	1315.45	1173.46
Final stress ($\sigma_f' = \sigma'_0 + \Delta\sigma$)	psf	2795.48	3502.95	3812.09
TOP 3 CLAY LAYERS				
Clay Element thickness ($H_{n,clay}$ = H_{clay} / 6)	ft.	4.50		
Initial depth to element midpoint (z = 1/12 H_{clay}; 3/12 H_{clay}; 5/12 H_{clay})	ft.	2.25	6.75	11.25
Elevation		684.75	680.25	675.75
midpoint depth within clay	ft bgs	5.25	9.75	14.25
upper layer midpoint depth	ft bgs	3.50	3.50	10.50
lower layer midpoint depth	ft bgs	10.50	10.50	17.50
upper preconsolidation stress (total)	psf	454.30	454.30	1362.90
lower preconsolidation stress (total)	psf	1362.90	1362.90	2292.15
preconsolidation stress (total)	psf	681.45	1265.55	1860.71
Total Stress at Midpoint	psf	681.45	1265.55	1860.71
Initial Pore Pressure, u0	psf	0.00	0.00	0.00
Drainage Height of Clay, H_{dr}, based on free draining in aquifer and waste	ft.	13.50		
Tv from waste (30 years)		4.81	4.81	4.81
U (percent consolidation of clay), avg from waste		1.00	1.00	1.00
Tv from stockpile		0.03	0.03	0.03
U (percent consolidation of clay), avg from stockpile		0.03	0.03	0.46
Final eff. stress at midpoint due to waste (σ_0' = z * γ_{clay}+($U_{clay,\ from\ waste}$)*(H_w*γ_{msw} + H_{cover} *γ_{soil})), consolidation from 1981-2011 - u0	psf	4216.44	4800.53	5395.68
Final Pore Pressure, uf	psf	717.60	530.40	343.20
Change in stress from stockpile (from 2V:1H Pressure Distribution) * U_stockpile	psf	687.22	33.38	0.19
Final stress (σ_f '= σ_0 + $\Delta\sigma$) from stockpile - uf	psf	4186.06	4303.51	5052.68
Element Settlement $S_{n,clay}$ = [$H_{n,clay}$ * $C_{r,clay}$*log (σ_f / σ_0)]/(1+$e_{0,\ clay}$)}	ft.	0.04	0.00	0.00
BOTTOM 3 CLAY LAYERS				
Initial depth to element midpoint (z = 7/12 H_{clay}; 9/12 H_{clay}; 11/12 H_{clay})	ft.	15.75	20.25	24.75
Elevation		671.25	666.75	662.25
midpoint depth within clay	ft bgs	18.75	23.25	27.75
upper layer midpoint depth	ft bgs	17.50	17.50	24.50
lower layer midpoint depth	ft bgs	24.50	24.50	31.50
upper preconsolidation stress (total)	psf	2292.15	2292.15	3242.05
lower preconsolidation stress (total)	psf	3242.05	3242.05	4165.35
preconsolidation stress (total)	psf	2461.78	3072.43	3670.73
Total Stress at Midpoint	psf	2461.78	3072.43	3670.73
Initial Pore Pressure, u0	psf	0.00	0.00	0.00
Tv from waste (30 years)		4.81	4.81	4.81
U (percent consolidation of clay), avg from waste		1.00	1.00	1.00
Tv from stockpile		0.03	0.03	0.03
U (percent consolidation of clay), avg from stockpile		0.00	0.03	0.46
Final stress at midpoint due to waste (σ_0' = z * γ_{clay}+($U_{clay,\ from\ waste}$)*(H_w*γ_{msw} + H_{cover} *γ_{soil})), consolidation from 1990-2020 - u0	psf	5996.74	6607.40	7205.72
Final Pore Pressure, uf	psf	156.00	0.00	0.00
Change in stress from stockpile (from 2V:1H Pressure Distribution) * U_stockpile	psf	0.25	33.36	535.18
Final stress (σ_f = σ_0 + $\Delta\sigma$) from stockpile - uf	psf	5840.99	6640.76	7740.89
Element Settlement $S_{n,clay}$ = $H_{n,clay}$ * $C_{c,clay}$*log (σ_f / σ_0)]/(1+$e_{0,\ clay}$)	ft.	0.00	0.00	0.01
CLAY				
Max total settlement of clay ($S_{t,clay}$)	ft.	0.05		
WASTE				
Element settlement S_n =Cc'*Hn * log (sf / s0)	ft.	0.35	0.21	0.17
C_c' (trial and error)		0.090		

midpoint depth	Clay Layer	Top Elevation	Bottom Elevation	Midpoint Elevation	Taken from CTI Data Review	Thickness	AVG MC	e_0	$\gamma_{soil, mois}$	$\sigma_{excavatic}$	$u_{excavation}$	p_c	c_v	C_r, (assumed same as C_c)	C_c
ft bgs						ft	%		pcf	psf	psf	psf	ft.^{2}/day		
0.00	1	687	687	687	655	0	18	0.47	129.8	0	0	1660	0.08	0.1499	0.1499
7.00	2	680	680	680	655	0	18	0.47	129.8	0	0	1660	0.08	0.1499	0.1499
14.00	3	676	669	673	655	7	18	0.47	135.7	475	0	1660	0.08	0.1499	0.1499
21.00	4	669	662	666	655	7	18	0.47	135.7	1425	0	1660	0.08	0.1499	0.1499
28.00	5	662	655	659	655	7	22	0.47	128.1	2348	0	1660	0.08	0.1499	0.1499
35.00	6	655	648	652	655	7	22	0.76	128.1	3245	218	2724	0.08	0.3010	0.3010
42.00	7	648	641	645	655	7	22	0.76	128.1	4142	655	2724	0.08	0.3010	0.3010

Point Name	Unit	SP-7			SP-9 (2)			SP-10			SP-10		
Existing Topo Elevation, from 2/11/2011	ft.	743			744			740			730		
Soil stockpile thickness (H_{pile})	ft.	13			12			11			6		
Cover thickness (H_{cover})	ft.	9			12			10			6		
Top of Waste Elevation	ft.	721			720			719			718		
Elevation of Bottom of Waste	ft.	675			675			675			675		
Waste thickness (H_w)	ft.	46			45			44			43		
Bottom of Clay	ft.	659			653			642			638		
Clay thickness (H_{clay})	ft.	16			22			33			37		
Waste unit weight (γ_{msw})	pcf	77											
Water unit weight (γ_w)	pcf	62.4											
Cover soil unit weight (γ_{soil})	pcf	120											
Soil stockpile unit weight (γ_{soil})	pcf	120											
Elevation of Top of Leachate Level		698			699			700					
Time Elapsed since waste placement	years	30											
Time Elapsed since stockpile placement	days	57											
Maximum settlement (S_n)	ft.	0.76			0.77			0.75			0.28		
WASTE													
Waste Element thickness ($H_n = H_w$ / 3)	ft.	15.33			15.00			14.67			14.67		
Initial depth to element midpoint (z = 1/6 H_w; 1/2 H_w; 5/6 H_w)	ft.	7.67	23.00	38.33	7.50	22.50	37.50	7.33	22.00	36.67	7.17	21.50	35.83
Pore Pressure prior to leachate, u0	psf	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Final Pore Pressure, uf	psf	0.00	0.00	956.80	0.00	93.60	1029.60	0.00	187.20	1102.40	0.00	156.00	1050.40
Final eff. stress at midpoint ($\sigma_0' = z * \gamma_{msw} + H_{cover} * \gamma_{soil}$)-uf	psf	1670.33	2851.00	3074.87	1657.50	2718.90	2937.90	1644.67	2586.80	2800.93	1631.83	2579.50	2788.77
Change in stress from stockpile (from 2V:1H Pressure Distribution)	psf	1471.38	1247.55	1075.20	1471.38	1247.55	1075.20	1488.67	1260.65	1085.43	1488.67	1260.65	1095.83
Final stress ($\sigma_f' = \sigma'_0 + \Delta\sigma$)	psf	3141.71	4098.55	4150.06	3128.88	4190.28	4409.28	3133.34	4075.47	4289.60	3120.50	4068.17	4277.44
TOP 3 CLAY LAYERS													
Clay Element thickness ($H_{n,clay}$ = H_{clay} / 6)	ft.	2.67			3.67			5.50			6.17		
Initial depth to element midpoint (z = 1/12 H_{clay}; 3/12 H_{clay}; 5/12 H_{clay})	ft.	1.33	4.00	6.67	1.83	5.50	9.17	2.75	8.25	13.75	3.08	9.25	15.42
Elevation		673.67	671.00	668.33	673.17	669.50	665.83	672.25	666.75	661.25	671.92	665.75	659.58
midpoint depth within clay	ft bgs	12.83	15.50	18.17	13.33	17.00	20.67	14.25	19.75	25.25	14.58	20.75	26.92
upper layer midpoint depth	ft bgs	7.00	14.00	14.00	7.00	14.00	14.00	14.00	14.00	21.00	14.00	14.00	21.00
lower layer midpoint depth	ft bgs	14.00	21.00	21.00	14.00	21.00	21.00	21.00	21.00	28.00	21.00	21.00	28.00
upper preconsolidation stress (total)	psf	0.00	474.95	474.95	0.00	474.95	474.95	474.95	474.95	1424.85	474.95	474.95	1424.85
lower preconsolidation stress (total)	psf	474.95	1424.85	1424.85	474.95	1424.85	1424.85	1424.85	1424.85	2348.15	1424.85	1424.85	2348.15
preconsolidation stress (total)	psf	395.79	678.50	1040.37	429.72	882.05	1379.62	508.88	1255.23	1985.43	554.11	1390.93	2205.26
Total Stress at Midpoint	psf	395.79	678.50	1040.37	429.72	882.05	1379.62	508.88	1255.23	1985.43	554.11	1390.93	2205.26
Initial Pore Pressure, u0	psf	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drainage Height of Clay, H_{dr}, based on free draining in aquifer and waste	ft.	8.00			11.00			16.50			18.50		
Tv from waste (30 years)		13.69	13.69	13.69	7.24	7.24	7.24	3.22	3.22	3.22	3.22	3.22	3.22
U (percent consolidation of clay), avg from waste		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Tv from stockpile		0.07	0.07	0.07	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02
U (percent consolidation of clay), avg from stockpile		0.66	0.19	0.03	0.54	0.07	0.00	0.36	0.01	0.00	0.31	0.00	0.00
Final eff. stress at midpoint due to waste ($\sigma_0' = z * \gamma_{clay}+(U_{clay, from waste})*(H_w*\gamma_{msw} + H_{cover} *\gamma_{soil})$), consolidation from 1981-2011 - u0	psf	5017.79	5300.50	5662.37	5334.72	5787.05	6284.62	5096.34	5841.75	6571.41	5141.51	5977.32	6791.19
Final Pore Pressure, uf	psf	1294.80	1014.00	733.20	1383.20	1154.40	925.60	1497.60	1372.80	1248.00	1490.04	1350.11	1210.18
Change in stress from stockpile (from 2V:1H Pressure Distribution) * U_stockpile	psf	969.39	231.26	31.44	800.11	85.51	0.00	539.61	7.90	0.00	457.37	2.73	0.00
Final stress ($\sigma_f' = \sigma_0 + \Delta\sigma$) from stockpile - uf	psf	4692.38	4517.76	4960.61	4751.63	4718.16	5359.02	4138.35	4476.85	5323.41	4108.84	4629.93	5581.00
Element Settlement $S_{n,clay}$ = [$H_{n,clay}$ * $C_{r,clay}$*log (σ_f / σ_0)]/(1+$e_{0, clay}$)}	ft.	0.03	0.01	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00
BOTTOM 3 CLAY LAYERS													
Initial depth to element midpoint (z = 7/12 H_{clay}; 9/12 H_{clay}; 11/12 H_{clay})	ft.	9.33	12.00	14.67	12.83	16.50	20.17	19.25	24.75	30.25	21.58	27.75	33.92
Elevation		665.67	663.00	660.33	662.17	658.50	654.83	655.75	650.25	644.75	653.42	647.25	641.08
midpoint depth within clay	ft bgs	20.83	23.50	26.17	24.33	28.00	31.67	30.75	36.25	41.75	33.08	39.25	45.42
upper layer midpoint depth	ft bgs	14.00	21.00	21.00	21.00	28.00	28.00	28.00	35.00	35.00	28.00	35.00	42.00
lower layer midpoint depth	ft bgs	21.00	28.00	28.00	28.00	35.00	35.00	35.00	42.00	42.00	35.00	42.00	
upper preconsolidation stress (total)	psf	474.95	1424.85	1424.85	1424.85	2348.15	2348.15	2348.15	3244.85	3244.85	2348.15	3244.85	
lower preconsolidation stress (total)	psf	1424.85	2348.15	2348.15	2348.15	3244.85	3244.85	3244.85	4141.55	4141.55	3244.85	4141.55	
preconsolidation stress (total)	psf	1402.23	1754.60	2106.33	1864.52	2348.15	2817.85	2700.43	3404.98	4109.53	2999.33	3789.28	
Total Stress at Midpoint	psf	1402.23	1754.60	2106.33	1864.52	2348.15	2817.85	2700.43	3404.98	4109.53	2999.33	3789.28	3791.13
Initial Pore Pressure, u0	psf	0.00	0.00	0.00	0.00	0.00	10.40	0.00	296.40	639.60	98.80	483.60	868.40
Tv from waste (30 years)		13.69	13.69	13.69	7.24	7.24	7.24	3.22	3.22	3.22	3.22	3.22	3.22
U (percent consolidation of clay), avg from waste		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Tv from stockpile		0.07	0.07	0.07	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02
U (percent consolidation of clay), avg from stockpile		0.03	0.19	0.66	0.00	0.07	0.54	0.00	0.01	0.36	0.00	0.01	0.36
Final stress at midpoint due to waste ($\sigma_0' = z * \gamma_{clay}+(U_{clay, from waste})*(H_w*\gamma_{msw} + H_{cover} *\gamma_{soil})$), consolidation from 1990-2020 - u0	psf	6024.23	6376.60	6728.33	6769.52	7253.15	7712.45	7286.41	7695.10	8057.39	7486.68	7892.68	7510.91
Final Pore Pressure, uf	psf	452.40	171.60	0.00	696.80	468.00	239.20	1123.20	998.40	873.60	1070.25	930.33	790.40
Change in stress from stockpile (from 2V:1H Pressure Distribution) * U_stockpile	psf	43.01	231.20	708.25	0.00	85.47	584.52	0.00	7.89	393.26	-0.04	7.89	397.03
Final stress ($\sigma_f = \sigma_0 + \Delta\sigma$) from stockpile - uf	psf	5614.85	6436.20	7436.59	6072.72	6870.62	8057.77	6163.21	6704.60	7577.05	6416.39	6970.24	7117.54
Element Settlement $S_{n,clay}$ = $H_{n,clay}$ * $C_{c,clay}$*log (σ_f / σ_0)]/(1+$e_{0, clay}$)	ft.	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02
CLAY													
Max total settlement of clay ($S_{t,clay}$)	ft.	0.05			0.06			0.06			0.06		
WASTE													
Element settlement S_n =Cc'*Hn * log (sf / s0)	ft.	0.36	0.21	0.17	0.31	0.21	0.20	0.31	0.22	0.20	0.10	0.07	0.07
C_c' (trial and error)		0.085			0.075			0.075			0.025		

Attachment A-2.3.5

NTH Consultants, Ltd. (2011b) *Volume III: Basis of Design Report – WDI Operating License Application Master Cells VI F & G*. Section 2.2 – Settlement Analysis.

2.2 SETTLEMENT ANALYSIS (Rule 299.9505(d)(i))

Settlement of the landfill floor may adversely affect the overlying liner and leachate collection system. Excessive differential settlement, occurring over very short distances, may reduce the functionality of the leachate collection system. Rule 299.905(d)(i) requires settlement analysis on soils underlying the liner system to estimate total and differential settlement, including immediate settlement, primary consolidation, and secondary consolidation based on maximum loading.

We performed settlement analysis to estimate the expected total and differential settlements within the floor of MC VI-F & G due to the placement of waste. Our analysis included estimating the anticipated change in the major leachate collection pipe bedding slopes due to such settlement. The settlement of the cell floor due to compressions of MC VI-F & G liner system, MC I/IV waste (where applicable), underlying native clay layers, and native silt/sand layer was estimated.

2.2.1 Background Data & Assumptions

Based on the engineering plans, the cell floor slopes from 2.5 percent to 33 percent and the leachate collection pipes slope at a minimum of 1 percent in the MC VI-F & G. The final cover elevations at MC VI-F & G range from 709 to 851 feet and the cover slopes ranging from 4 to 25 percent.

To complete our analysis, we needed soil compressibility characteristics for the underlying silts/sands and clayey soils, as well as the MC I/IV waste. These properties include compression index, secondary compression index, and soil elastic modulus. The compressibility characteristics of the soils and waste were developed based on the subsurface soil investigations completed in the area and a test surcharge loading over MC IV. The development of these properties and subsurface profiles are provided in a calculation package, entitled Subsurface Soil/Waste Profiles and Corresponding Physical Properties and included in Appendix A. The clay layer that occurs in the wooded lot area was divided into three sub-layers designated as upper, middle and lower, based on its compressibility characteristics. These properties are summarized in the following table:

TABLE 1 SUMMARY OF COMPRESSIBILITY CHARACTERISTICS			
LAYER	$C_{c\varepsilon}$	$C_{\alpha\varepsilon}$	**E** (ksf)
MC I/IV Final Cover Clay	0.07	0.01	1050
MC I Granular/Clayey Waste	0.236	0.024	N/A
MC IV Clayey Waste	0.147	0.024	N/A
MC IV Granular Waste	0.236	0.024	N/A
Upper Sand	N/A	N/A	280
Upper Clay	0.102	0.005	1000
Middle Clay			2250
Lower Clay	0.171	0.009	1000
Silt	N/A	N/A	114
Sand	N/A	N/A	350

N/A - Not Applicable

Additionally, in order to account for the difference in compressibility of the inter-cell clay dikes and the waste, an evaluation of the MC IV inter-cell dike locations was conducted. This evaluation included a review of existing historical records, the hydrogeologic investigation of MC IV, and an electromagnetic geophysical survey of the cell in order to approximate the location of the inter-cell dike structures. These dike locations were incorporated into the settlement calculations to evaluate the impact that settlement will have on floor drainage slopes and the strain in the liner over the dikes. The complete evaluation of the inter-cell dike locations is included with the settlement calculation in Appendix B.

An intra-cell dike investigation was not completed for MC I at this time. As mentioned previously, construction of Master Cell 6G (Phases 3 to 6), overlaying the existing MC I is not anticipated to be completed for approximately 20 years. A minimum of 5 years prior to construction of Master Cell 6G (Phases 3 to 6), an inter-cell dike investigation will be completed to confirm the design

assumptions used. If necessary, the design will be revised and submitted to the MDEQ for approval at that time.

2.2.2 Method of Analysis

We estimated the settlements at 137 locations across the MC VI-F & G floor. These points are located either on slope breaks, on an approximately 200-foot grid, or on the locations of major leachate collection pipes. For the clay soils and clayey waste, we used the consolidation theory to estimate the settlement. For the sandy soils and granular waste, we used elastic method to estimate settlement.

2.2.3 Results of Settlement Analysis

The settlement analysis is detailed in Appendix B. The results of our analysis indicate that the total settlements of the MC VI-F & G cell floor ranges from 2.5 feet to 17 feet under maximum waste loading. Such settlements are expected to occur over more than 30 years. The post settlement cell floor slopes are greater than 2.24 percent and the floor at the major leachate pipe locations slopes a minimum of 1 percent, satisfying Rule 299.9620(4).

2.3 BEARING CAPACITY CALCULATION (Rule 299.9505(d)(ii))

Rule 299.9505(d)(ii) requires strength analysis which determines the bearing capacity and stability of the underlying soils. We completed bearing capacity calculation for the underlying soils and waste to evaluate their capacities to support the waste in MC VI-F & G using a conventional bearing capacity model. In general, a conventional bearing capacity failure of a landfill is unlikely. Our bearing capacity calculations support this conclusion, indicating that there is a very large factor of safety against this mode of failure. Our bearing capacity calculations are presented in Appendix C.

2.4 SLOPE STABILITY ANALYSIS (Rule 299.9505(d)(iii))

Rule 299.9505(d)(iii) requires slope stability analysis, including all of the following information: (A) side slope stability under excavation; (B) liner system stability under construction; (C) waste mass stability during filling; (D) final cover stability; and (E) long-term post closure stability. We completed slope stability analyses on ten profiles to evaluate side slope stability under excavation,

7. Engineering Plan Sheets Rev. J

WAYNE DISPOSAL, INC. SITE NO. 2
MASTER CELL VI-F&G

VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

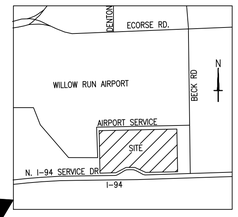
CTI PROJECT NO.1218070017

FEBRUARY 2011
REVISED: SEPTEMBER 2011
REVISED: MAY 2018
REVISED: MAY 2021
REVISED: JULY 2021
REVISED: AUGUST 2021
REVISED: NOVEMBER 2021
REVISED: MAY 2022

OWNER:
Wayne Disposal, Inc.
49350 N. I-94 Service Drive
Belleville, Michigan 48111

ENGINEER:
CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377

MICHIGAN
APPROX. SCALE: 1"=50 MILES



LOCATION MAP- WAYNE COUNTY
NO SCALE

SHEET INDEX

01	TITLE SHEET
02	GENERAL SITE PLAN
03	CONSTRUCTION PHASING
04	TOP OF SUBGRADE GRADING PLAN
05	TOP OF SECONDARY LINER GRADING PLAN
06	TOP OF PRIMARY LINER GRADING PLAN
07	LEACHATE MANAGEMENT PLAN
08	FINAL COVER GRADING PLAN (1 OF 2)
09	FINAL COVER GRADING PLAN (2 OF 2)
10	STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)
10 A	ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)
11	STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)
11 A	ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)
12	CROSS SECTION (1 OF 3)
13	CROSS SECTION (2 OF 3)
14	CROSS SECTION (3 OF 3)
15	LINER SYSTEM DETAILS (1 OF 2)
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19 A	ENGINEERED TURF FINAL COVER DETAILS
20	STORMWATER MANAGEMENT SYSTEM DETAILS
20 A	ENGINEERED TURF STORMWATER MANAGEMENT SYSTEM DETAILS
21	CONCEPTUAL GAS VENTING SYSTEM

REV.	DATE	REVISION DESCRIPTION	DRN	APP
J	05/18/22	SUBCELLS C4-C6 REVISIONS	LEH	XZ
I	10/08/21	SUBCELLS C4-C7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H1	5/10/22	REVISED LINER GRADES IN F3	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	5/28/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
E	5/29/18	ADDENDUM 1	PAA	XZ
D	5/08/18	REV. BASED ON MDEQ'S COMMENTS	PAA	XZ
C	5/02/18	SUBCELLS C2 AND C3 REVISIONS	PAA	XZ
B	9/23/11	PER MDEQ COMMENTS		DRL
A	6/10/11	PHASING DESIGNATIONS		DRL

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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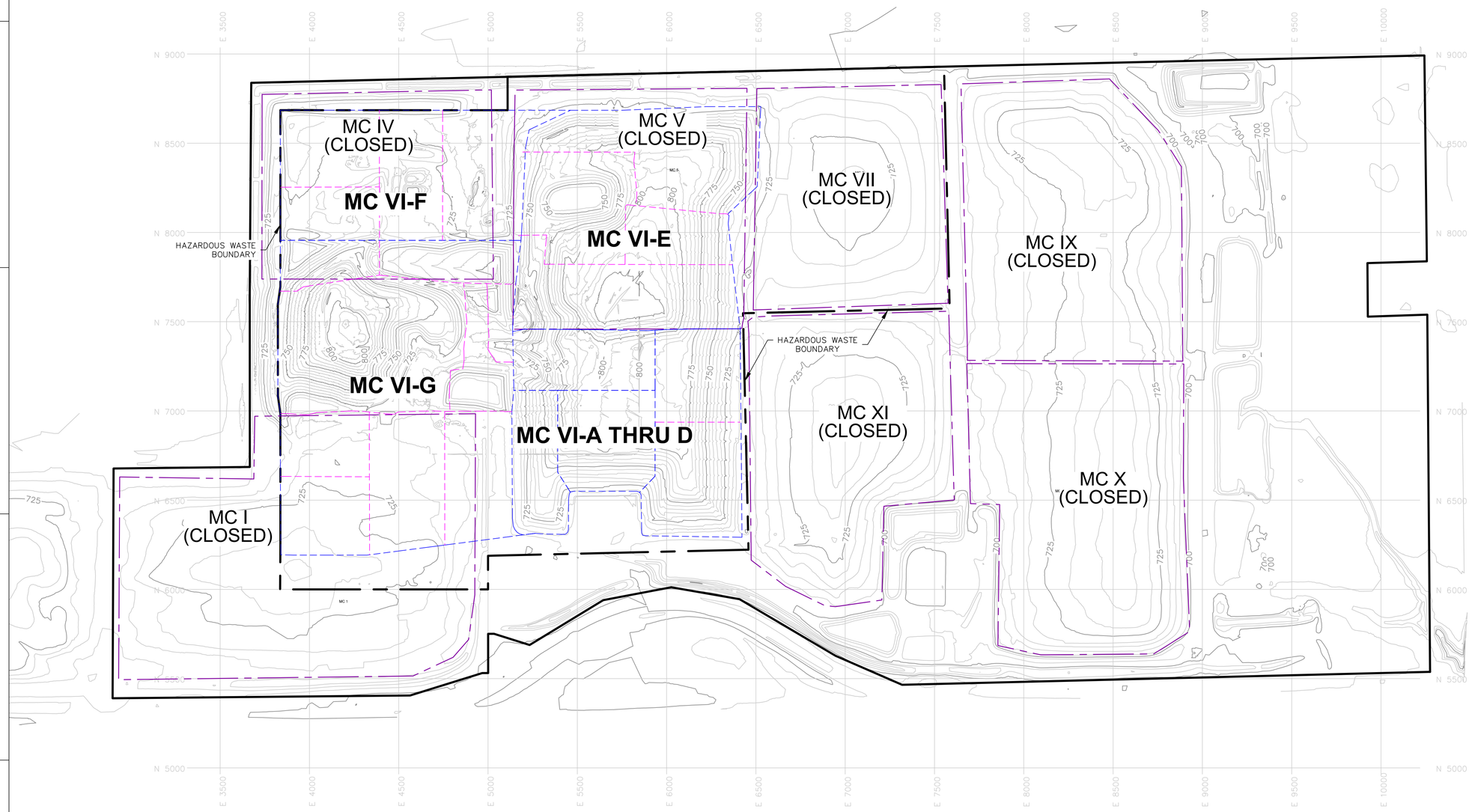
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

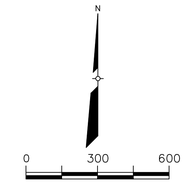
TITLE SHEET

PROJECT NUMBER
1218070017

SCALE
NONE

DRAWING NO
01





LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- PREVIOUSLY PERMITTED HAZARDOUS WASTE BOUNDARY
- PROPERTY BOUNDARY
- SUBCELL BOUNDARY
- CELL BOUNDARY
- CELL BOUNDARY (CLOSED)

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.

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DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN	APP
F	05/17/21	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ

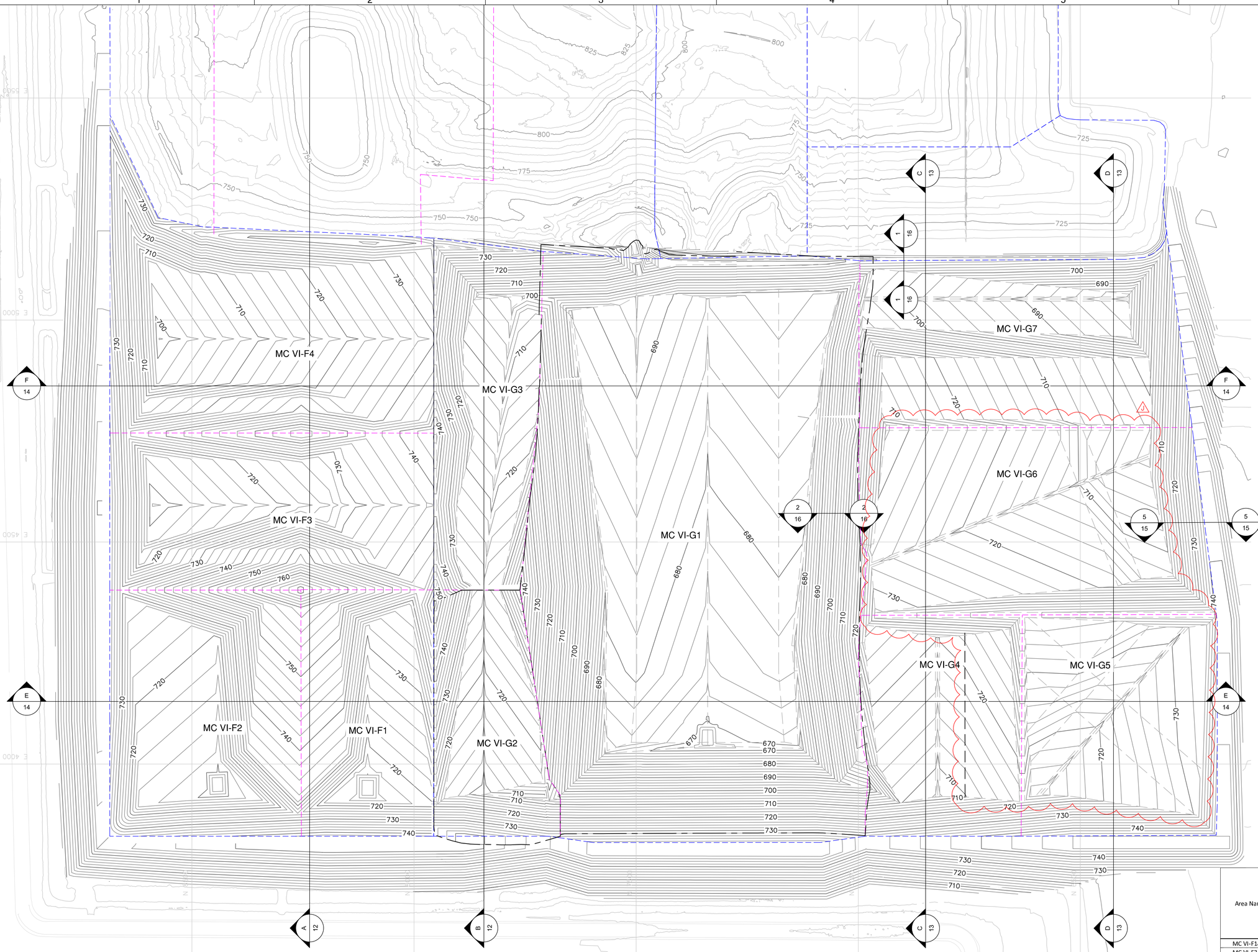
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

GENERAL SITE PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 300'

DRAWING NO
02



NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES DEPICTED IN MC VI G4–G7 REPRESENT REDESIGN TOP OF PRIMARY LINER. GRADES DEPICTED IN MC VI G3 AND MC VI F1–F4 REPRESENT PERMITTED TOP OF PRIMARY LINER. GRADES DEPICTED IN MC VI G1 AND G2 REPRESENT AS-BUILT TOP OF PRIMARY LINER.

Area Name	Footprint Area (AC)	2018 Permit Incremental Volume (CY)	2021 Proposed Revised Incremental Volume (CY)	2021 Volume Adjustment (CY)**
MC VI-F1&F2	9.3	810,822	779,386	-31,436
MC VI-F3&F4	12.9	1,865,000	1,854,314	-10,686
MC VI-G1	19.9	2,354,444	2,354,444	0
MC VI-G2&G3	7.2	796,778	785,806	-10,972
MC VI-G4	5.3	694,662	674,689	-19,973
MC VI-G5	5.5	490,000	561,933	71,933
MC VI-G6	7.4	3,598,173	3,648,588	50,415
MC VI-G7	5.5	1,120,000	1,129,083	9,083
Final Grade Changes	-	-	3,871,240	3,871,240
ClosureTurf	-	-	687,764	687,764
Total	73	11,729,879	16,347,247	4,617,368

REV	DATE	DESCRIPTION	BY	APP
J	05/18/22	SUBCELLS G4–G6 REVISIONS	LEH	XZ
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H1	5/10/22	REVISED LINER GRADES IN F3	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG	XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PJA	XZ
	DATE	REVISION DESCRIPTION	DRN	APP

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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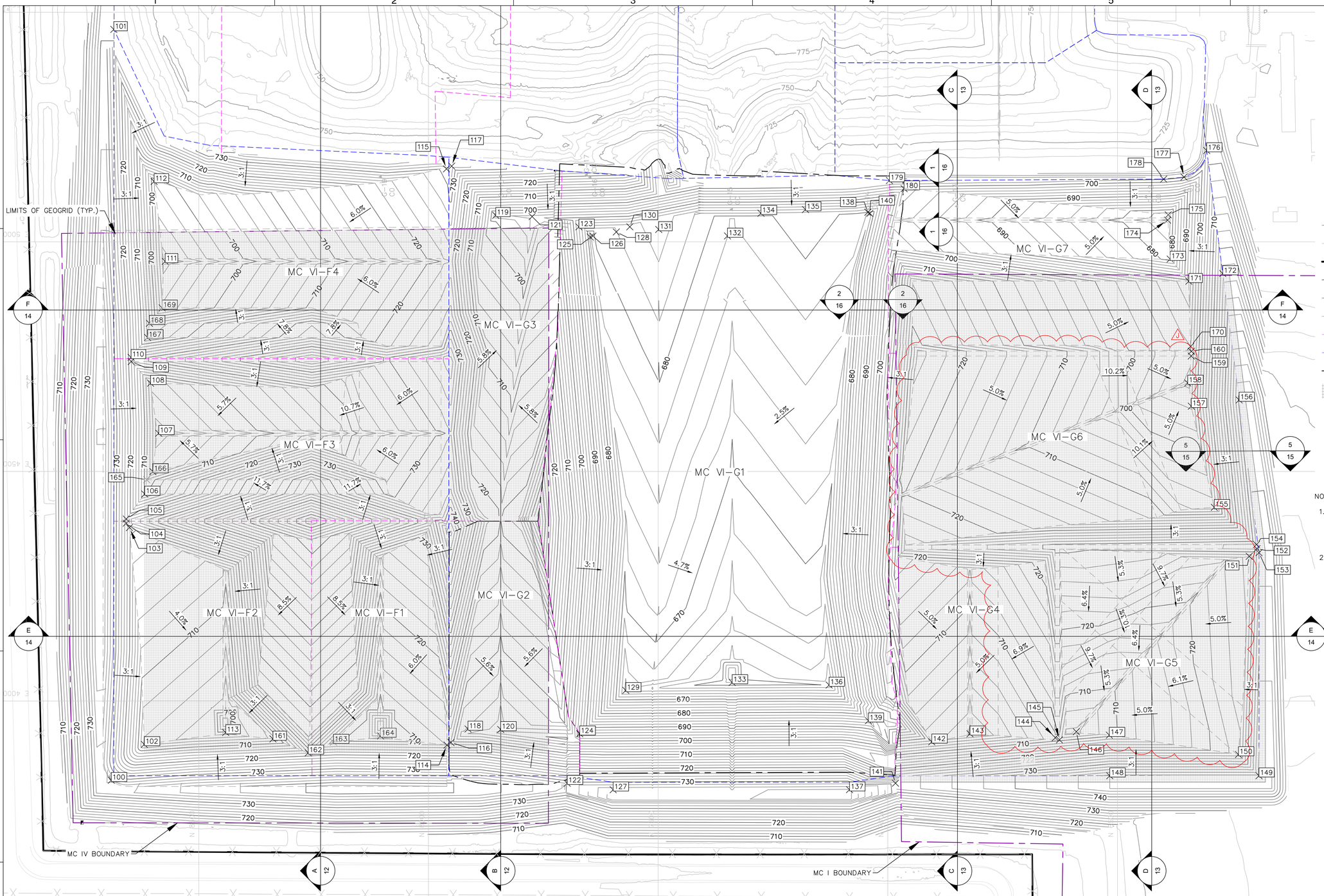
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CONSTRUCTION PHASING

PROJECT NUMBER 1218070017
SCALE 1" = 100'
DRAWING NO 03



NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES DEPICTED IN MC VI G4–G7 REPRESENT REDESIGN TOP OF SUBGRADE. GRADES DEPICTED IN MC VI G3 AND MC VI F1–F4 REPRESENT PERMITTED TOP OF SUBGRADE. GRADES DEPICTED IN MC VI G1–G2 REPRESENT AS–BUILT TOP OF SUBGRADE.

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
100	8690.50	3827.42	734.59
101	8685.01	5462.64	720.71
102	8618.55	3905.51	705.52
103	8651.01	4377.72	720.55
104	8658.02	4387.32	722.90
105	8657.98	4396.41	722.90
106	8617.74	4450.87	709.61
107	8587.22	4583.16	699.69
108	8605.02	4692.10	704.63
109	8647.15	4739.42	718.12
110	8647.41	4748.52	718.10

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
111	8573.16	4957.47	690.00
112	8597.34	5131.53	698.08
113	8441.35	3931.51	700.30
114	7959.71	3904.14	712.08
115	7960.81	5158.83	731.11
116	7951.05	3909.68	712.00
117	7949.45	5164.97	732.77
118	7913.92	3939.16	705.45
119	7853.52	5057.82	696.85
120	7842.73	3938.19	702.00
121	7774.33	5054.99	702.31

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
122	7697.89	3821.03	730.74
123	7672.54	5032.68	686.26
124	7670.81	3928.84	694.50
125	7647.66	5010.45	678.68
126	7641.99	5012.71	680.19
127	7597.89	3806.80	735.60
128	7591.06	5021.51	682.01
129	7570.41	4023.20	663.24
130	7561.67	5032.75	683.13
131	7498.71	5027.05	685.09
132	7349.00	5012.85	678.14

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
133	7338.74	4040.41	658.10
134	7276.06	5062.38	679.69
135	7179.18	5070.45	681.75
136	7127.70	4034.87	660.23
137	7083.24	3807.01	736.24
138	7043.49	5064.48	678.89
139	7042.16	3957.20	684.60
140	7039.03	5062.00	677.47
141	6983.25	3821.03	729.35
142	6904.32	3911.10	702.78
143	6821.02	3928.71	699.29

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
144	6635.43	3920.12	709.62
145	6626.33	3915.27	709.38
146	6589.57	3933.24	704.54
147	6517.71	3925.72	709.11
148	6516.74	3837.32	738.70
149	6191.88	3837.32	738.70
150	6236.64	3883.43	723.04
151	6213.12	4315.18	726.74
152	6196.33	4331.76	732.33
153	6191.88	4323.06	733.99
154	6197.28	4340.86	732.32

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
155	6289.21	4421.83	704.87
156	6235.08	4655.62	730.74
157	6339.21	4642.09	695.71
158	6347.00	4692.65	692.54
159	6339.40	4751.42	694.40
160	6339.09	4761.72	694.38
161	8338.55	3917.48	706.54
162	8261.82	3887.03	717.74
163	8206.84	3910.54	710.69
164	8104.44	3923.96	705.92
165	8613.32	4481.85	708.19

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
166	8600.04	4499.82	703.81
167	8611.51	4791.69	705.67
168	8607.53	4822.70	704.00
169	8579.88	4856.23	694.33
170	6340.69	4772.28	694.00
171	6344.57	4914.23	690.81
172	6270.86	4931.07	715.66
173	6385.28	4962.52	677.18
174	6390.87	5047.34	674.35
175	6389.40	5058.83	674.71
176	6305.65	5198.88	701.00

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
177	6355.11	5141.16	700.60
178	6399.40	5136.66	700.50
179	6996.47	5133.58	702.89
180	6964.50	5115.83	696.87

REVISIONS						
REV	DATE	DESCRIPTION	DRN	APP		
J	05/18/22	SUBCELLS G4–G6 REVISIONS	LEH	XZ		
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ		
H1	5/10/22	REVISED LINER GRADES IN F3	LEH	XZ		
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ		
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH	XZ		
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG	XZ		
B	9/23/11	PER MDEQ COMMENTS	DRL			
REV	DATE	REVISION DESCRIPTION	DRN	APP		

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

CTI and Associates, Inc.
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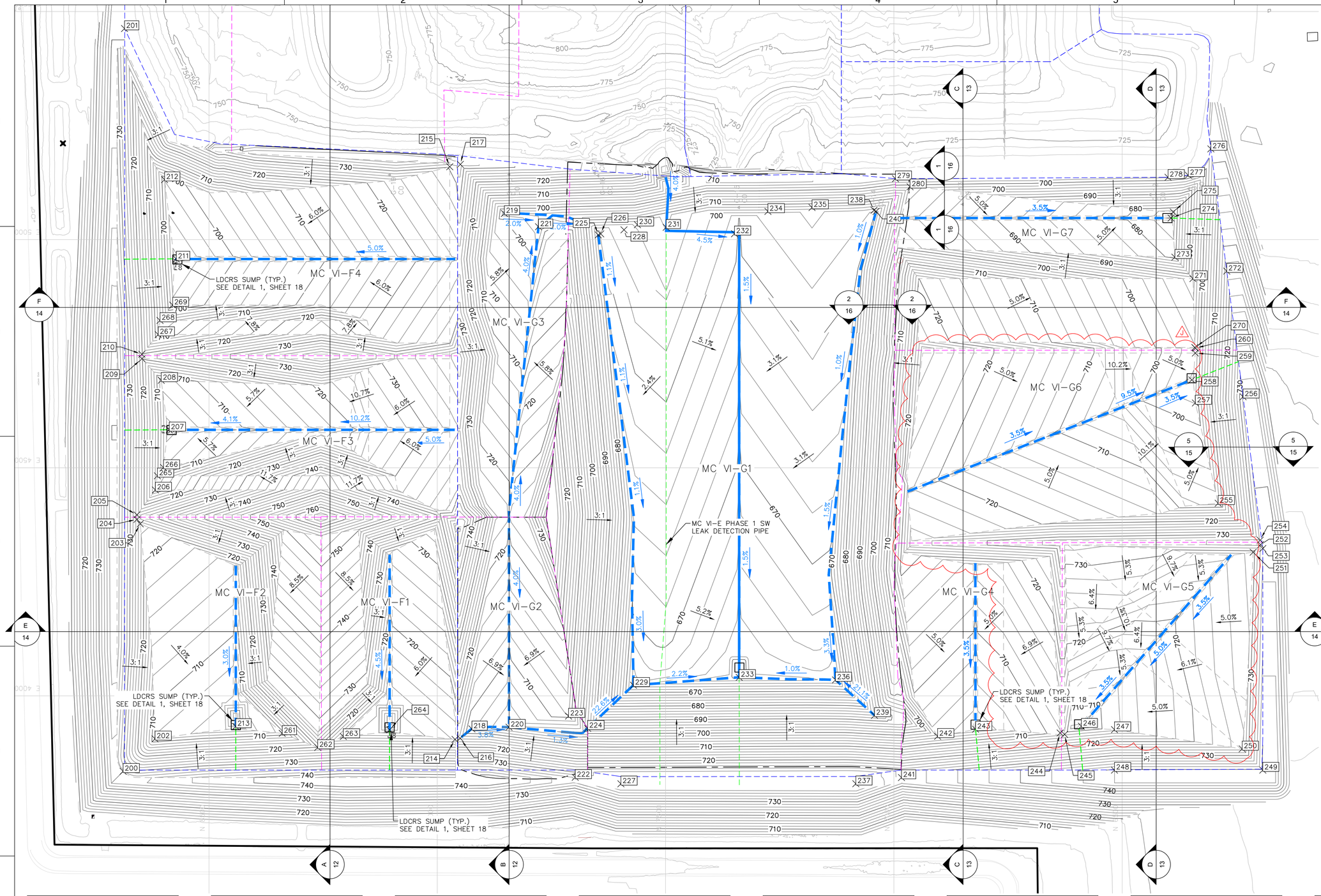
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF SUBGRADE GRADING PLAN (BOTTOM OF STRUCTURAL FILL)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
04



NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES, PIPING, AND GEOCOMPOSITE DEPICTED IN MC VI-G SUBCELLS G1-G2 REPRESENT AS-BUILT TOP OF SECONDARY LINER.

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
200	8688.12	3834.75	734.54
201	8685.01	5462.64	722.82
202	8618.20	3905.87	707.73
203	8650.61	4377.11	722.72
204	8657.79	4386.96	725.14
205	8657.75	4396.77	725.14
206	8617.41	4451.36	711.82
207	8587.09	4583.16	701.96
208	8604.65	4691.67	706.83
209	8646.85	4739.06	720.34
210	8647.14	4748.88	720.32

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
211	8571.60	4957.47	692.34
212	8597.34	5131.53	698.08
213	8441.35	3933.09	702.62
214	7961.13	3904.60	714.25
215	7972.65	5159.77	730.25
216	7949.91	3907.03	713.51
217	7949.45	5164.97	732.77
218	7924.24	3927.69	706.53
219	7853.05	5057.35	696.67
220	7842.87	3931.37	703.56
221	7778.32	5028.27	695.84

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
222	7697.85	3821.52	733.74
223	7712.50	3955.68	716.00
224	7670.78	3929.03	697.65
225	7647.54	5010.47	681.80
226	7641.99	5012.71	683.24
227	7597.85	3807.29	738.60
228	7591.06	5021.51	685.01
229	7570.29	4023.33	666.36
230	7561.67	5032.75	686.20
231	7498.71	5027.05	688.09
232	7349.00	5012.85	681.14

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
233	7338.74	4040.54	661.22
234	7275.80	5061.92	682.69
235	7179.18	5070.45	684.75
236	7127.83	4034.99	663.35
237	7083.28	3807.50	739.24
238	7043.49	5064.48	681.99
239	7042.34	3957.36	687.71
240	7039.01	5061.89	680.59
241	6983.25	3821.03	729.35
242	6904.12	3911.47	704.92
243	6821.02	3927.03	701.43

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
244	6635.79	3918.76	727.26
245	6625.98	3915.61	711.60
246	6589.27	3933.58	706.76
247	6516.74	3926.02	711.36
248	6516.74	3837.32	740.80
249	6191.88	3837.32	740.80
250	6237.05	3883.85	728.94
251	6213.04	4314.83	728.94
252	6196.66	4331.41	734.53
253	6191.88	4323.06	736.09
254	6197.69	4341.22	734.52

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
255	6289.64	4422.21	707.06
256	6235.08	4655.62	732.84
257	6339.55	4642.05	697.92
258	6347.33	4692.52	694.75
259	6339.72	4751.42	696.61
260	6339.39	4762.08	696.60
261	8339.62	3917.89	708.70
262	8261.82	3887.03	720.06
263	8205.80	3910.98	712.87
264	8104.44	3925.52	708.25
265	8612.99	4482.34	710.40

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
266	8599.66	4500.45	706.00
267	8611.29	4791.97	707.91
268	8607.34	4822.95	706.25
269	8579.58	4856.63	696.54
270	6340.78	4763.72	696.12
271	6344.93	4914.63	693.00
272	6270.86	4931.07	717.76
273	6384.46	4961.54	679.80
274	6392.85	5047.34	675.52
275	6387.94	5060.54	677.00
276	6305.65	5198.88	703.10

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
277	6355.11	5141.16	702.70
278	6399.40	5136.66	702.60
279	6996.47	5133.58	704.99
280	6964.50	5115.83	698.97

REVISIONS				
REV	DATE	DESCRIPTION		
C	5/03/18	SUBCELLS G2 AND G1 REVISIONS	LEH	XZ
D	11/20/20	SUBCELLS F1-F4 REVISIONS	LEH	XZ
E	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	8/25/21	RESPONSE TO EGLE COMMENTS	WRG	XZ
G	5/10/22	REVISED LINER GRADES IN F3	LEH	XZ
H	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H1	8/9/22	SUBCELLS G4-G6 REVISIONS	LEH	XZ
I	05/18/22		LEH	XZ
J			PJAA	XZ
			DRN	APP

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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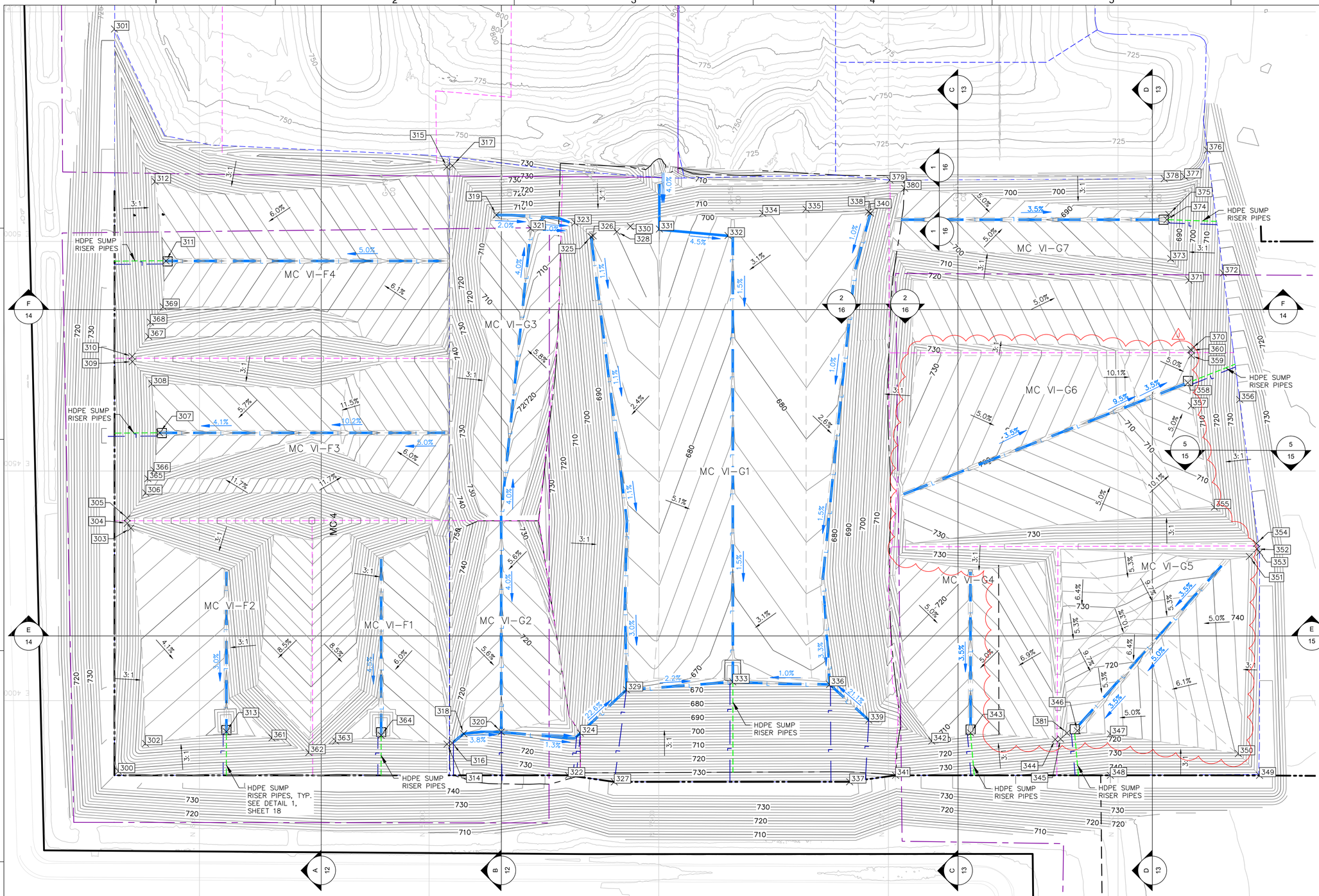
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF SECONDARY LINER GRADING PLAN

PROJECT NUMBER 1218070017
SCALE 1" = 100'
DRAWING NO 05



NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES, PIPING, AND GEOCOMPOSITE DEPICTED IN MC VI-G SUBCELLS G1-G2 REPRESENT AS-BUILT TOP OF PRIMARY LINER.

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
300	8676.40	3846.28	734.54
301	8685.01	5462.64	728.25
302	8617.38	3906.71	712.94
303	8649.60	4375.66	727.86
304	8657.24	4386.11	730.42
305	8657.19	4397.62	730.43
306	8616.71	4452.40	717.06
307	8586.84	4583.16	738.81
308	8603.70	4689.90	712.00
309	8646.14	4738.22	725.58
310	8646.48	4749.72	725.56

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
311	8572.76	4957.47	697.64
312	8596.51	5130.39	703.29
313	8441.35	3932.29	707.95
314	7960.91	3905.27	719.50
315	7961.26	5161.96	736.10
316	7949.75	3907.70	718.61
317	7949.45	5164.97	738.31
318	7924.50	3928.02	711.75
319	7853.52	5057.82	702.31
320	7842.87	3931.97	708.82
321	7778.32	5028.27	701.20

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
322	7696.73	3837.32	733.74
323	7682.58	5040.91	697.50
324	7670.57	3929.29	702.88
325	7647.35	5010.49	687.00
326	7642.85	5012.25	688.18
327	7596.74	3823.09	738.60
328	7591.06	5021.51	690.24
329	7570.10	4023.55	671.56
330	7561.67	5032.75	691.59
331	7498.71	5027.05	693.52
332	7349.00	5012.85	686.42

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
333	7338.74	4040.74	666.42
334	7273.49	5061.28	687.73
335	7179.18	5070.45	689.94
336	7128.04	4035.19	668.55
337	7084.38	3823.30	739.24
338	7043.49	5064.48	687.10
339	7042.63	3957.62	692.90
340	7038.96	5061.69	685.79
341	6984.38	3837.32	732.38
342	6905.54	3911.96	710.13
343	6821.04	3929.78	706.74

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
344	6636.63	3915.52	716.79
345	6625.13	3916.54	716.85
346	6588.59	3934.36	711.99
347	6516.55	3927.33	716.00
348	6516.74	3837.32	746.00
349	6191.88	3837.32	746.00
350	6237.97	3884.80	730.38
351	6214.06	4313.84	734.09
352	6197.42	4330.56	735.81
353	6191.88	4323.06	741.29
354	6198.61	4342.06	739.71

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
355	6290.21	4421.30	712.32
356	6235.08	4655.62	738.04
357	6340.31	4641.95	703.14
358	6348.07	4692.23	699.98
359	6340.43	4751.42	701.83
360	6340.08	4762.92	701.83
361	8342.16	3918.88	713.80
362	8261.82	3887.00	725.54
363	8203.29	3912.03	718.03
364	8104.44	3924.55	713.57
365	8612.28	4483.38	715.64

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
366	8598.82	4501.60	711.19
367	8610.47	4793.01	713.10
368	8606.52	4823.99	711.44
369	8578.86	4857.57	701.75
370	6341.52	4764.63	701.33
371	6345.63	4915.50	698.23
372	6270.86	4931.07	722.96
373	6385.28	4962.52	684.48
374	6393.59	5047.34	680.74
375	6389.40	5058.83	682.01
376	6305.65	5198.88	708.30

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
377	6355.11	5141.16	707.90
378	6399.40	5136.66	707.80
379	6996.47	5133.58	710.19
380	6964.50	5115.83	704.17
381	6611.15	3929.60	712.90

REVISIONS			
REV	DATE	REVISION DESCRIPTION	
J	05/16/22	SUBCELLS G4-G6 REVISIONS	
I	10/06/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	
H1	5/10/22	REVISED LINER GRADES IN F3	
H	8/25/21	RESPONSE TO EGLE COMMENTS	
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR COMMENTS	
F	05/28/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	
E	5/29/18	ADDENDUM	

	DATE:	05/16/22
	DESIGNED BY:	LEH
	DRAWN BY:	WRG
	CHECKED BY:	CAB
	APPROVED BY:	XZ

LEH	XZ	
WRG	XZ	
LEH	XZ	
LEH	XZ	
WRG	XZ	
PAA	XZ	
DRN	APP	

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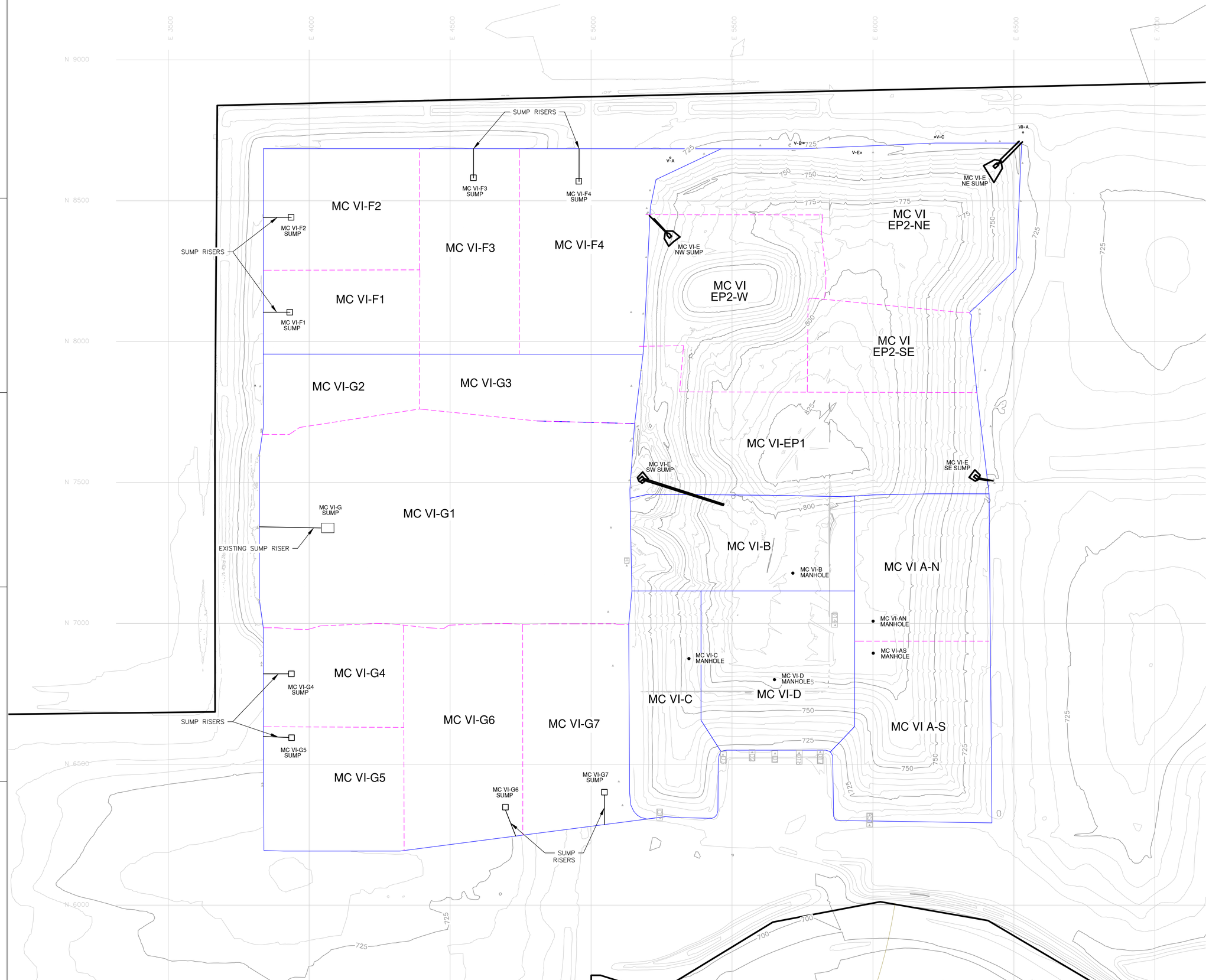
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF PRIMARY LINER GRADING PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
06



N

0 150 300

SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- SUBCELL BOUNDARIES
- CELL BOUNDARIES
- PROPERTY BOUNDARY

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN	APP
A	6/10/11	PHASING DESIGNATIONS	WRG	XZ
F	11/20/20	SUBCELLS F1–F4 REVISIONS	LEH	XZ
C	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR COMMENTS	WRG	XZ
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEACHATE MANAGEMENT PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 150'

DRAWING NO
07

AIRPORT SERVICE RD.

MC VI-F1

MC VI-F2

MC VI-F3

MC VI- F4

MC VI-G2

MC VI-G3

MC VI-EP1

MC VI EP2-NE

MC VI EP2-SE

MC VI EP2-W

MC VI-F1 SUMP

MC VI-F2 SUMP

MC VI-F3 SUMP

MC VI-F4 SUMP

MC VI-E NE SUMP

MC VI-E NW SUMP

FINAL COVER PENETRATION DETAIL SEE DETAIL 5, SHEET 19

EXTEND CLEANOUT NORTH ALONG TOP OF CELL DIKE AND DAYLIGHT AT NORTH PERIMETER DIKE

PROTECT ALL MC V MANHOLES WITH 3' RETAINING WALL/CONCRETE MH SECTION (TYP.)

SHEET 08

SHEET 09

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAKLINES
- SUBCELL BOUNDARY
- CELL BOUNDARY
- G-6 CO — LEACHATE COLLECTION SYSTEM CLEANOUTS
- V-A — EXISTING MANHOLES
- SUMP LOCATION AND COVER PENETRATION

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. CLEANOUTS IN MC VI-AN, AS, B, C, AND D ARE TO BE ABANDONED EXCEPT B1, C1, D1 THROUGH D3, D14, D17, D18, AND AS1.
3. BEFORE PLACING WASTE AROUND MC VI-C SUMP RISER, A MONITORING PROGRAM SHOULD BE IMPLEMENTED TO MONITOR ITS FUNCTIONALITY.
4. PRIOR TO PLACING WASTE AROUND CLEANOUTS E-22 THROUGH E-26, THE CLEANOUTS SHOULD BE EVALUATED TO DETERMINE IF THE LEACHATE COLLECTION LINE CAN BE CLEANED BY A SINGLE ACCESS POINT. IF NOT, THE CLEANOUT SHOULD BE EXTENDED.

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DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REV	DATE	REVISION DESCRIPTION	DRN	APP
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	06/17/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
08

SHEET 08
SHEET 09

MC VI-G1 EP2
MC VI-G1
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-C
MC VI-D
MC VI-B
MC VI A-N
MC VI A-S

MC VI-G SUMP
MC VI-G4 SUMP
MC VI-G5 SUMP
MC VI-G6 SUMP
MC VI-G7 SUMP
MC VI-E SW SUMP
MC VI-E SE SUMP
MC VI-C MANHOLE (SEE NOTE 3)
MC VI-B MANHOLE
MC VI-AN MANHOLE
MC VI-AS MANHOLE
MC VI-B LEAK DETECTION RISER
MC VI-AN LEAK DETECTION RISER
MC VI-C LEAK DETECTION RISER
MC VI-D MANHOLE
MC VI-AS LEAK DETECTION RISER
MC VI-D LEAK DETECTION RISER

FINAL COVER PENETRATION DETAIL SEE DETAIL 5, SHEET 19
EXTEND CLEANOUT NORTH ALONG TOP OF CELL DIKE AND DAYLIGHT AT NORTH PERIMETER DIKE
PIPING DETAIL SEE DETAIL 5, SHEET 19

N 6600
N 6800

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAKLINES
- SUBCELL BOUNDARY
- CELL BOUNDARY
- GEOCOMPOSITE (TRANSMISSIVITY 5.0 X 10^{-4} M^2/S)
- G-6 CO — LEACHATE COLLECTION SYSTEM CLEANOUTS
- EXISTING LEAK DETECTION OR SUMP RISERS
- SUMP LOCATION AND COVER PENETRATION

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. CLEANOUTS IN MC VI-AN, AS, B, C, AND D ARE TO BE ABANDONED EXCEPT B1, C1, D1 THROUGH D3, D14, D17, D18, AND AS1.
3. BEFORE PLACING WASTE AROUND MC VI-C SUMP RISER, A MONITORING PROGRAM SHOULD BE IMPLEMENTED TO MONITOR ITS FUNCTIONALITY.
4. PRIOR TO PLACING WASTE AROUND CLEANOUTS E-22 THROUGH E-26, THE CLEANOUTS SHOULD BE EVALUATED TO DETERMINE IF THE LEACHATE COLLECTION LINE CAN BE CLEANED BY A SINGLE ACCESS POINT. IF NOT, THE CLEANOUT SHOULD BE EXTENDED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	05/28/21	SUBCELLS G2 AND G3 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
C	5/02/18	PHASING DESIGNATIONS	PAA	XZ
A	6/10/11	REVISION DESCRIPTION	DRL	

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (2 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
09

AIRPORT SERVICE RD.

MC VI-F1
MC VI-F2
MC VI-F3
MC VI-F4
MC VI-G2
MC VI-G3
MC VI-EP1
MC VI EP2-W
MC VI EP2-NE
MC VI EP2-SE

DB-2, DB-12, DB-14, DB-15, DB-16, DB-17, DB-18, DB-19, DB-20, DB-21, DB-22, DB-23, DB-24, DB-25, DB-26, DB-27, DB-28, DB-29, DB-30, DB-31, DB-32, DB-33, DB-41

DIVERSION BERM DETAIL (TYP.) SEE DETAIL 3, SHEET 20

DOWNSLOPE CHANNEL DS-2 SEE DETAIL 1, SHEET 20

DOWNSLOPE CHANNEL DS-3 SEE DETAIL 1, SHEET 20

DOWNSLOPE CHANNEL DS-6 SEE DETAIL 1, SHEET 20

SHEET 10
SHEET 11

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (3/20)
- DOWNSLOPE CHANNELS (1/20)

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

REVISIONS	REV	DATE	REVISION DESCRIPTION	DRN	APP
	I	10/08/21	SUBCELLS C4-C7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
	H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
	G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR COMMENTS	LEH	XZ
	F	01/20/21	SUBCELLS F1-F4 REVISIONS	WRG	XZ

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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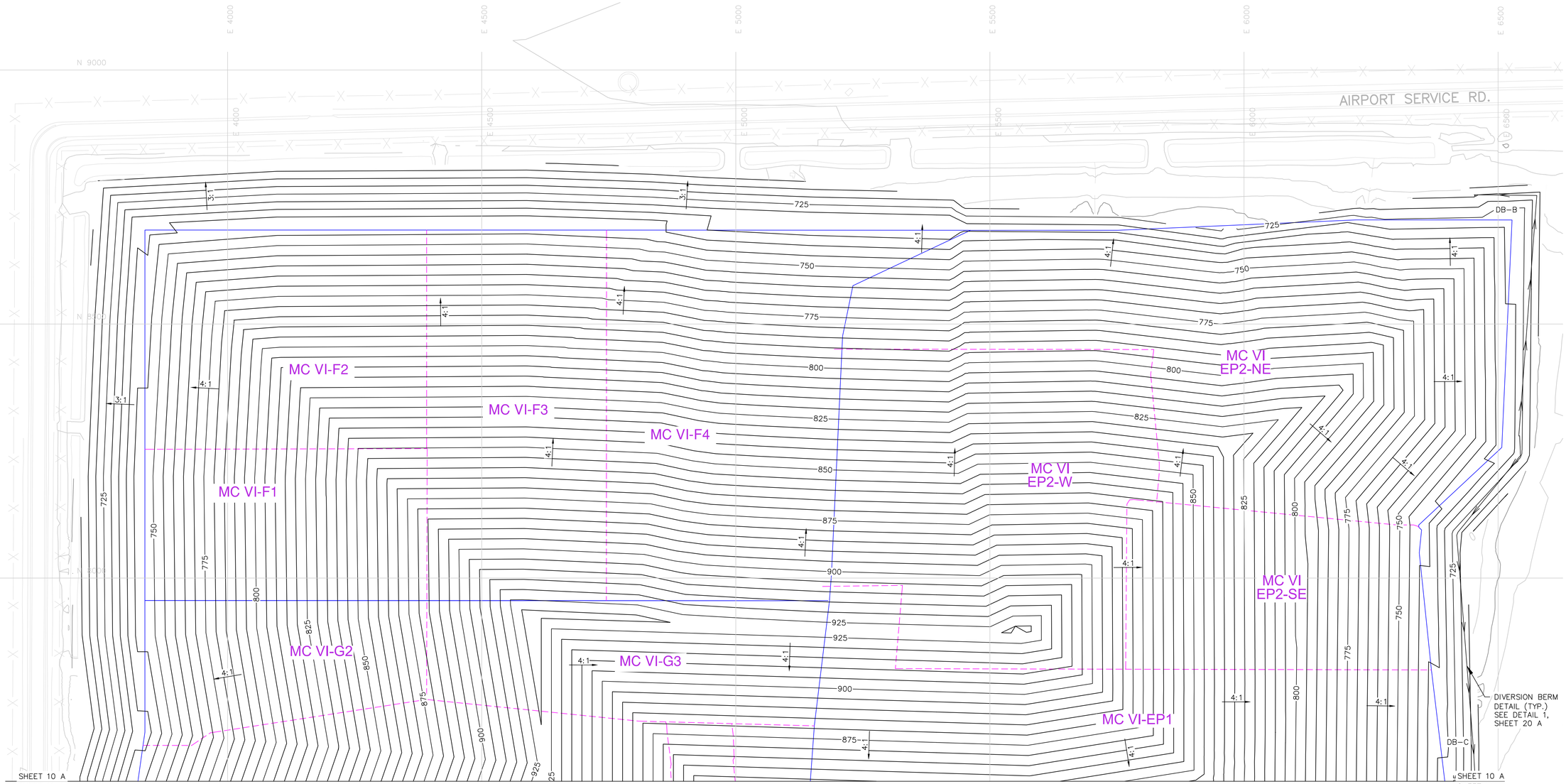
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
10



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (1 / 20 A)

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	
1	10/08/21	SUBCELLS C4-C7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG XZ
			DRN APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
10 A

SHEET 10
SHEET 11

MC VI-G1
MC VI-G1 EP2
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-B
MC VI A-N
MC VI-C
MC VI-D
MC VI A-S

DOWNSLOPE CHANNEL DS-5
SEE DETAIL 1 SHEET 20

DOWNSLOPE CHANNEL DS-1
SEE DETAIL 1, SHEET 20

DOWNSLOPE CHANNEL DS-4
SEE DETAIL 1, SHEET 20

DIVERSION BERM
DETAIL (TYP.). SEE
DETAILS 3, SHEET 20

CATCH BASIN S4A

DB-1 DB-2 DB-3 DB-4 DB-5 DB-6 DB-7 DB-8 DB-9 DB-10 DB-11 DB-12 DB-34 DB-35 DB-36 DB-37 DB-38 DB-39 DB-40 DB-42 DB-43 DB-44 DB-45

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (3/20)
- DOWNSLOPE CHANNELS (1/20)

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

REV	DATE	REVISION DESCRIPTION
F	01/20/21	SUBCELLS T1-4 REVISIONS
G	7/14/21	REVISED LINER GRADES IN T1-T4 AND OTHER MINOR COMMENTS
H	8/25/21	RESPONSE TO EGLE COMMENTS
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES

	DATE:	10/08/21
	DESIGNED BY:	LEH
	DRAWN BY:	WRG
	CHECKED BY:	CAB
	APPROVED BY:	XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
11

SHEET 10 A
SHEET 11 A

SHEET 10 A
SHEET 11 A

MC VI-G1
MC VI-G1 EP2
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-B
MC VI A-N
MC VI-C
MC VI-D
MC VI A-S

DB-A-1
DB-A-2
DB-D-1
DB-D-2
DB-E
DB-F
DB-G
DB-H

DIVERSION BERM DETAIL (TYP.)
SEE DETAILS 1, SHEET 20 A

CATCH BASIN S4A

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (1 / 20 A)

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION	WRG	XZ
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	DRN	APP

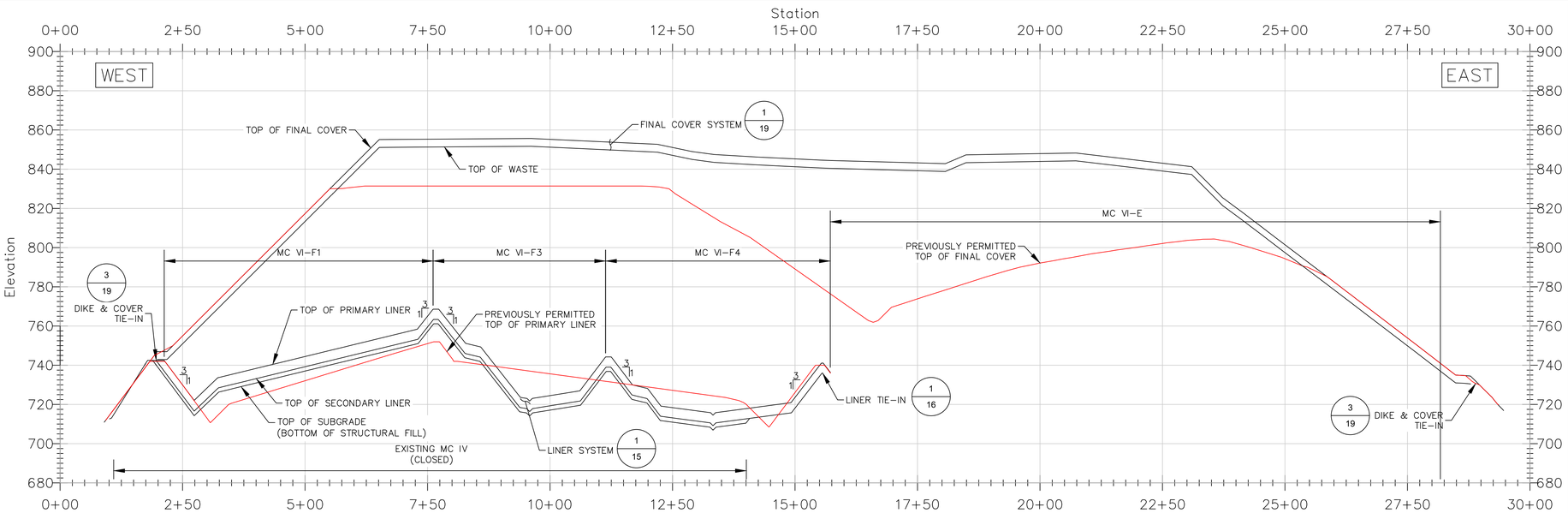
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)

PROJECT NUMBER
1218070017

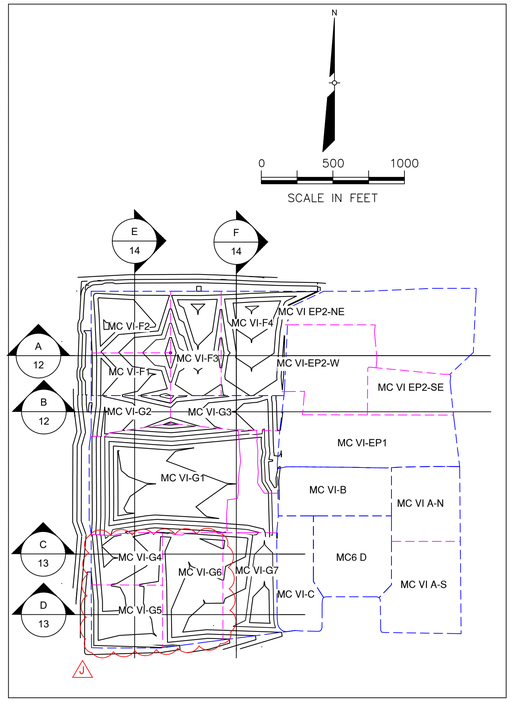
SCALE
1" = 100'

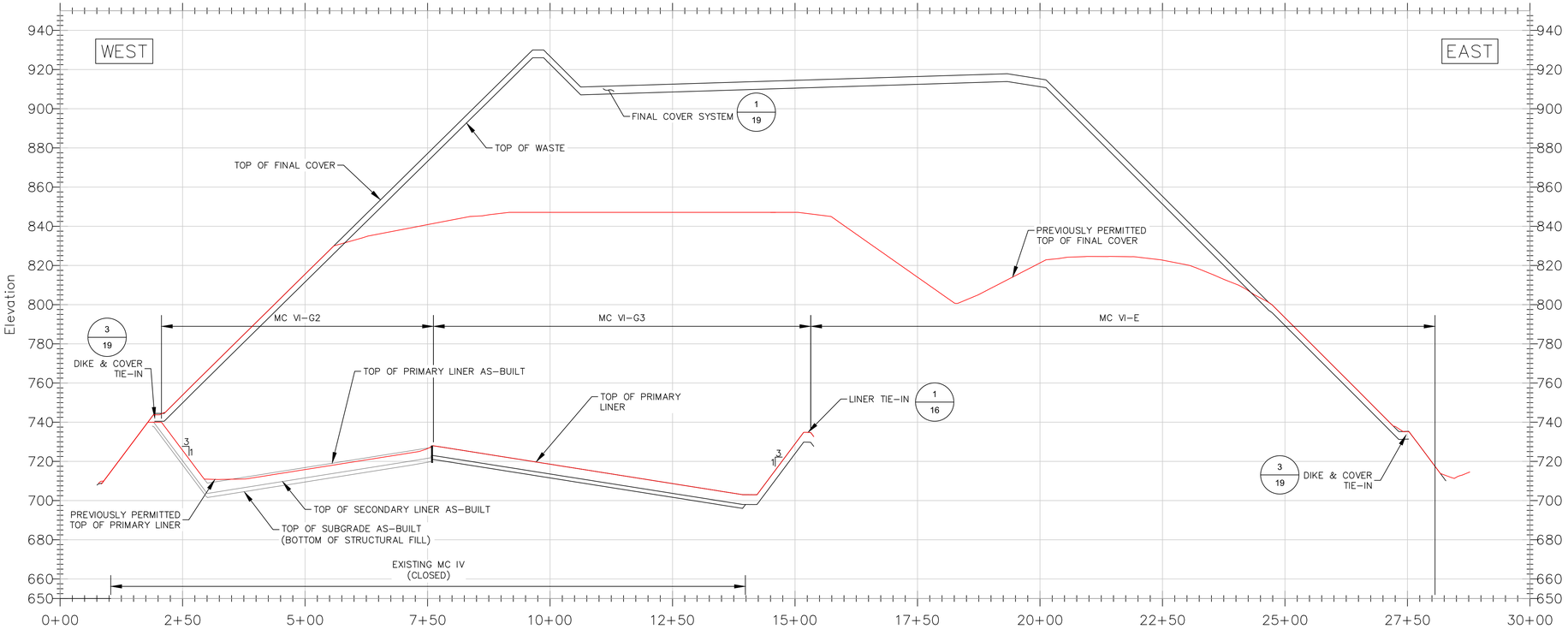
DRAWING NO
11 A



A 12 SECTION THROUGH MC VI–F AND MC VI–E

SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)





B 12 SECTION THROUGH MC VI–G2, G3, AND MC VI–E

SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)

REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN
J	05/18/22	SUBCELLS G4–G6 REVISIONS	LEH
I	10/08/21	SUBCELLS G4–G7 REVISIONS, FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
H1	5/10/22	REVISED LINER GRADES IN F3	LEH
G	07/14/21	REVISED LINER GRADES IN F1–F2 AND OTHER MINOR CORRECTIONS	XZ
F	05/17/21	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG
E	5/02/16	SUBCELLS G2 AND G3 REVISIONS	XZ
B	9/23/11	PER MDEQ COMMENTS	DRL
	DATE:		APP
	DESIGNED BY:		LEH
	DRAWN BY:		WRG
	CHECKED BY:		CAB
	APPROVED BY:		XZ

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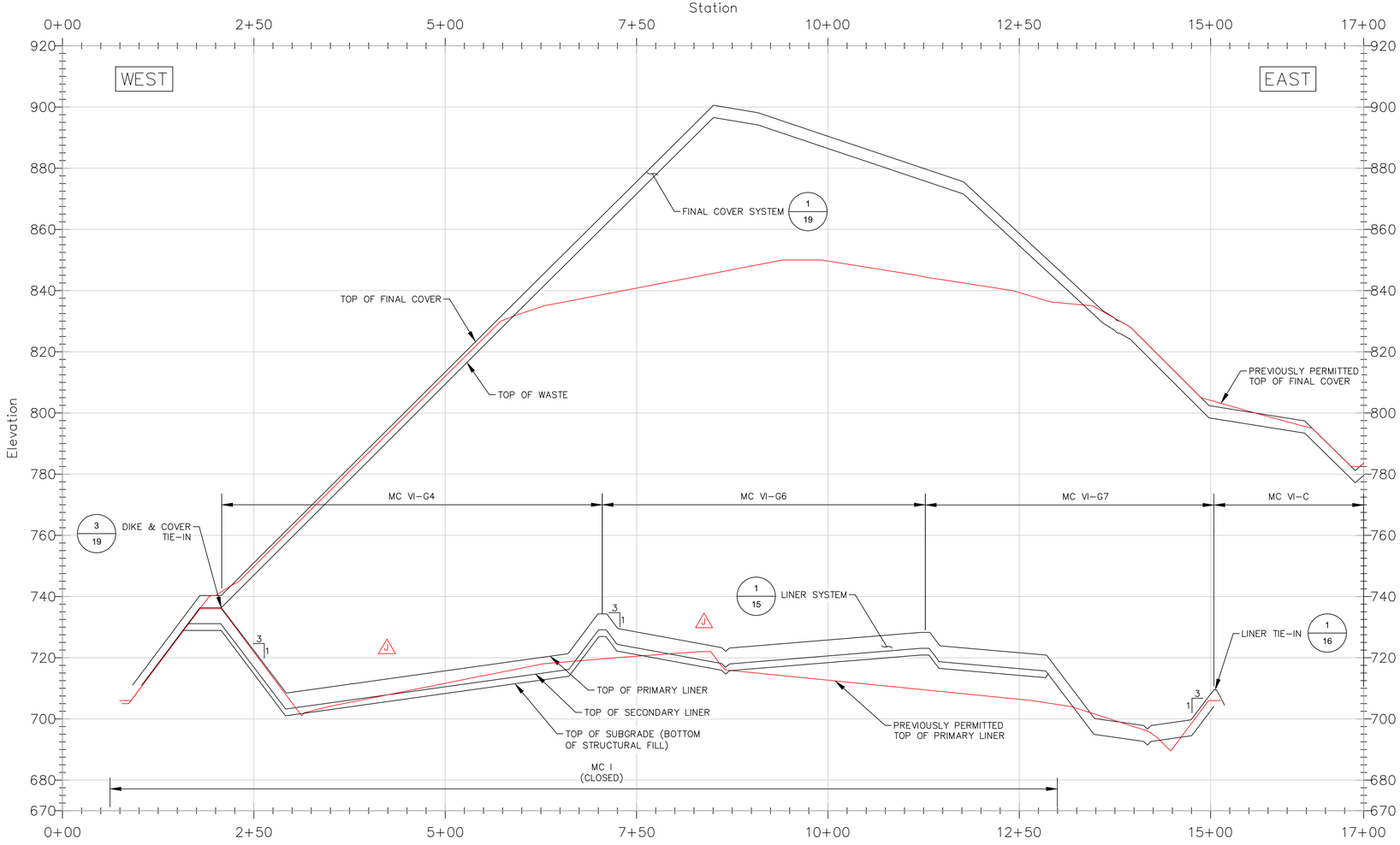
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (1 OF 3)

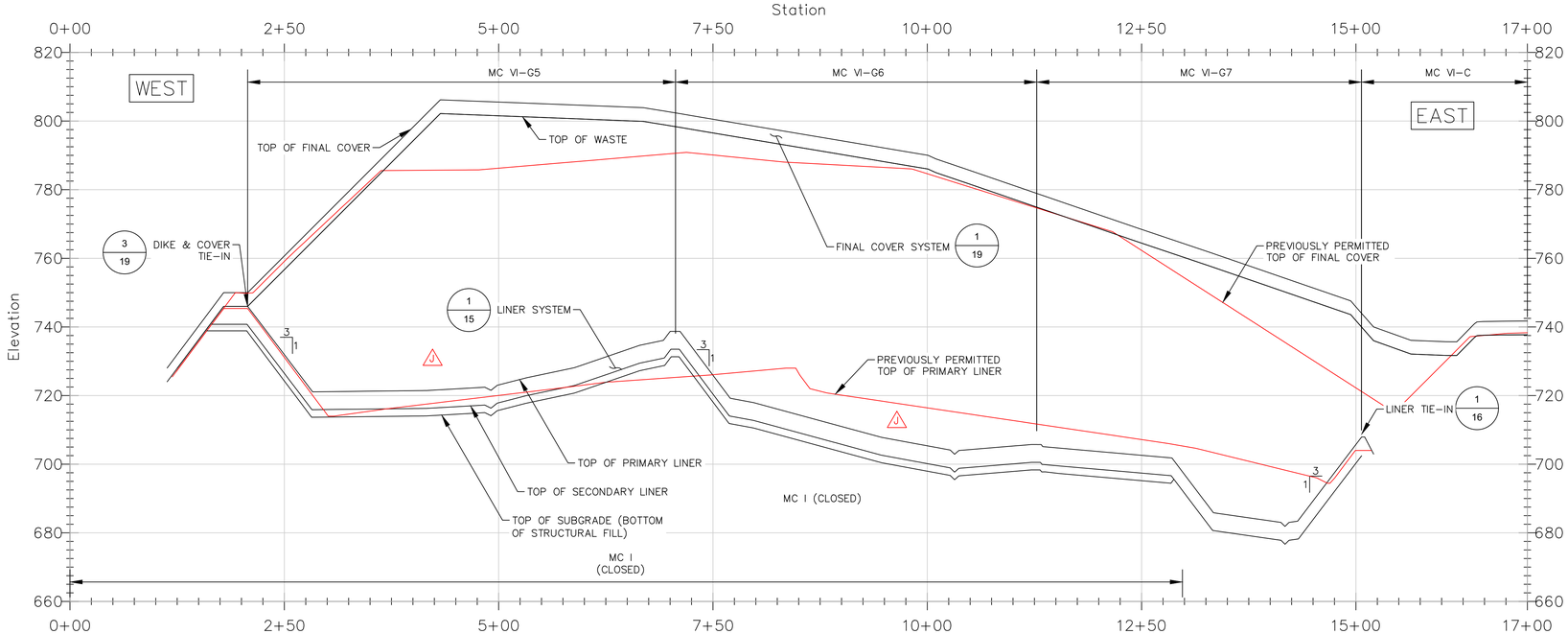
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

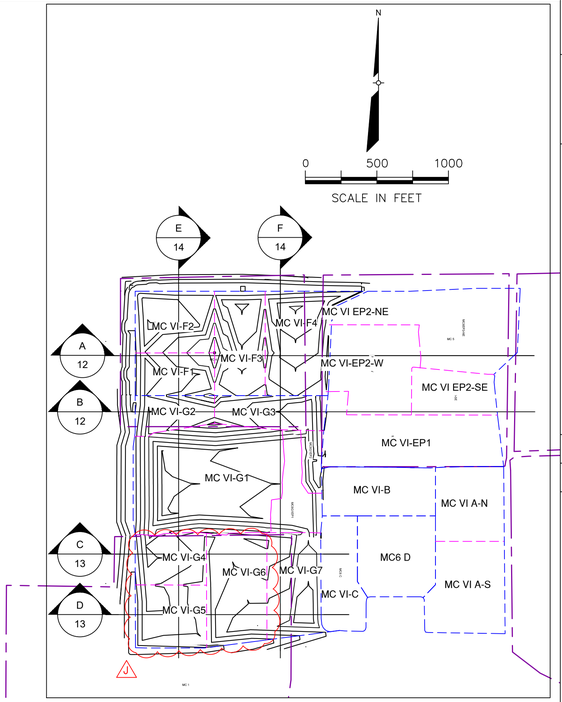
DRAWING NO
12



C/13 SECTION THROUGH MC VI–G4, G6, G7
SCALE: 1"=80' (HORIZONTAL), 1"=10' (VERTICAL)



D/13 SECTION THROUGH MC VI–G5, G6, G7
SCALE: 1"=80' (HORIZONTAL), 1"=10' (VERTICAL)



DATE:	05/18/22
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	
J	05/18/22	SUBCELLS G4–G6 REVISIONS	LEH XZ
I	10/08/21	SUBCELLS G4–G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG XZ
H1	5/10/22	REVISED LINER GRADES IN F3	LEH XZ
G	07/14/21	REVISED LINER GRADES IN F1–F2 AND OTHER MINOR CORRECTIONS	LEH XZ
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA XZ
REV	DATE	REVISION DESCRIPTION	DRN APP

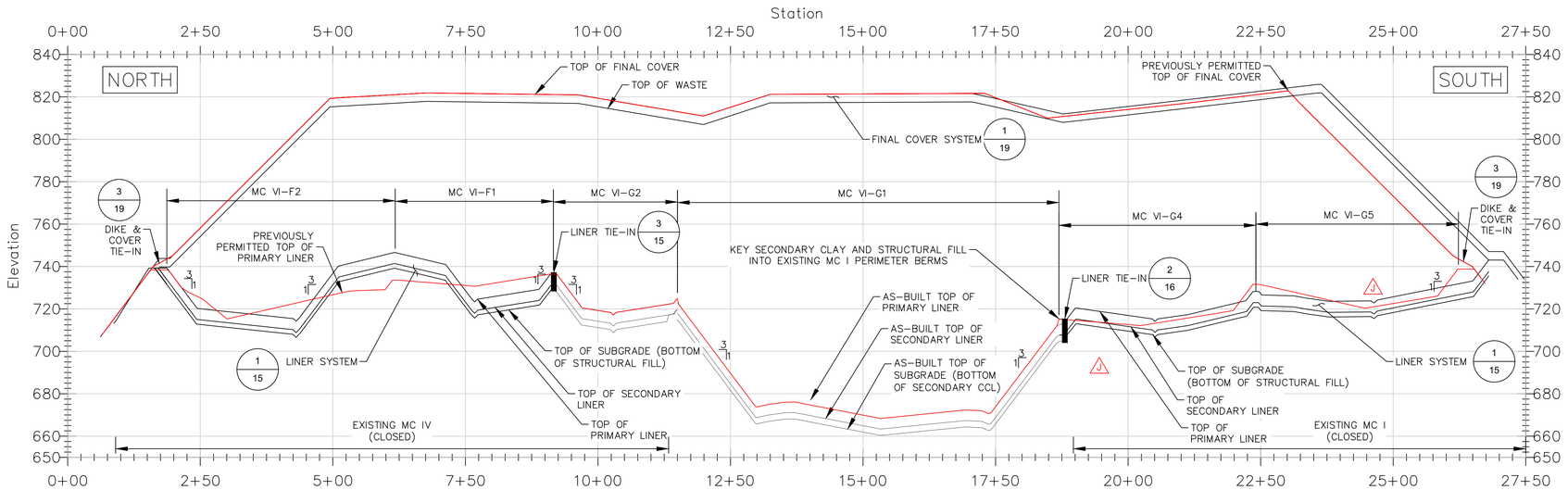
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (2 OF 3)

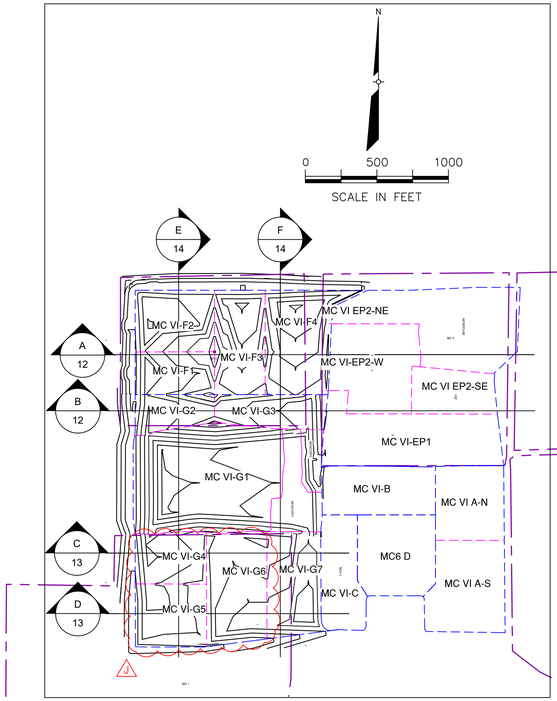
PROJECT NUMBER
1218070017

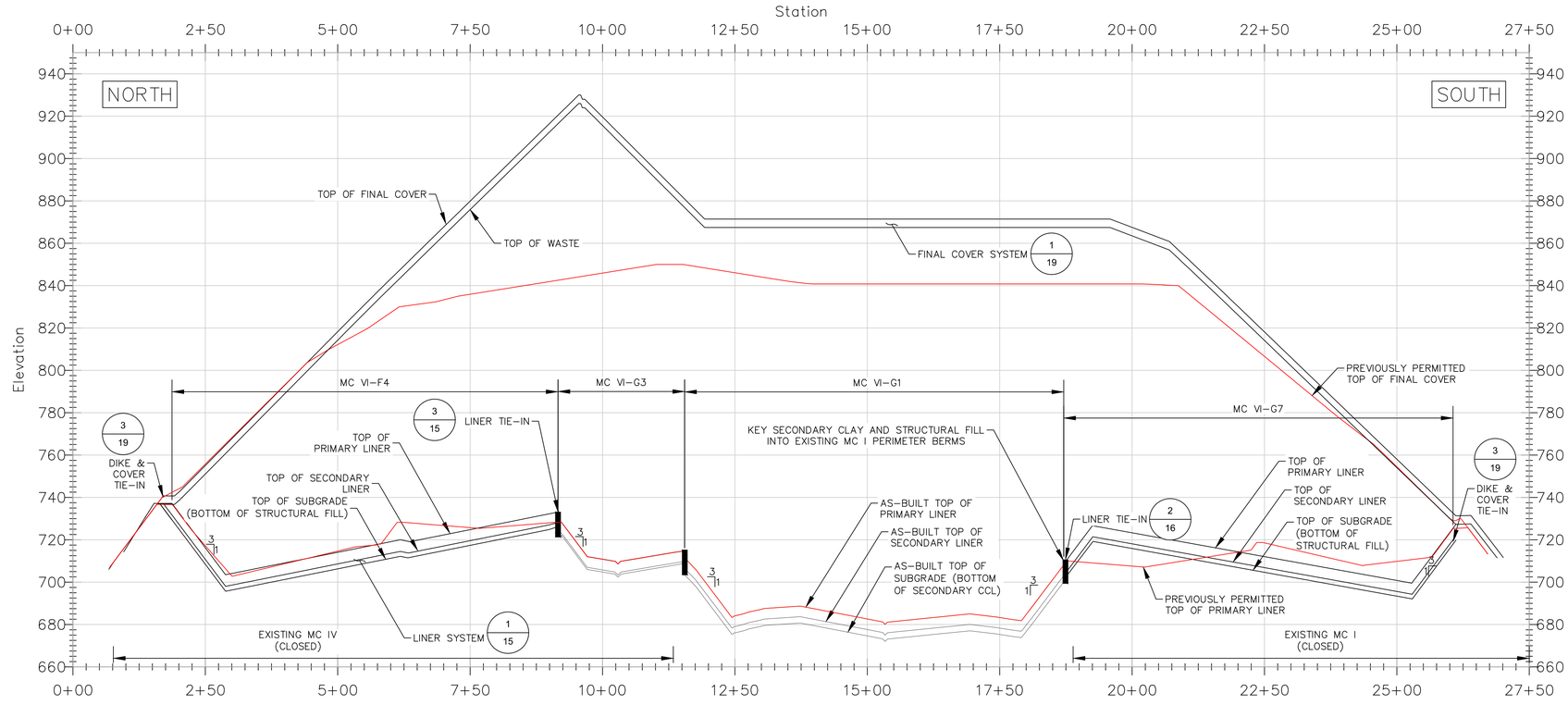
SCALE
AS SHOWN

DRAWING NO
13



E
14
SECTION THROUGH PROPOSED MC VI–F AND MC VI–G
SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)





F
14
SECTION THROUGH PROPOSED MC VI–F AND MC VI–G
SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)

DATE:	05/18/22
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REVISIONS	REV	DATE	REVISION DESCRIPTION	BY	APP
	J	05/18/22	SUBCELLS G4–G6 REVISIONS	LEH	XZ
	I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
	H1	5/10/22	REVISED LINER GRADES IN F3	LEH	XZ
	G	07/14/21	SUBCELLS F1–F4 REVISIONS	LEH	XZ
	F	11/20/20	SUBCELLS F1-F2 AND OTHER MINOR CORRECTIONS	WRG	XZ
	C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ

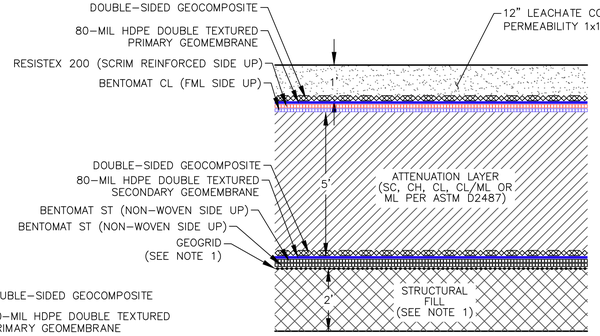
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (3 OF 3)

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

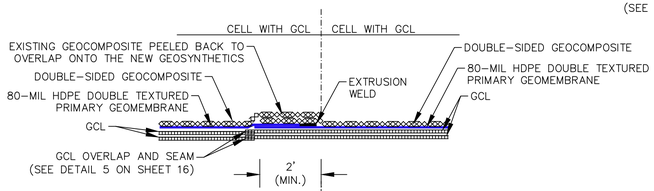
DRAWING NO
14



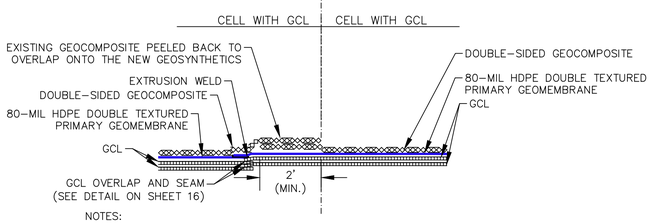
1/15 FLOOR LINER SYSTEM USING GCL
NOT TO SCALE

NOTE:

1. STRUCTURAL FILL AND GEOGRID NOT REQUIRED OUTSIDE OF MC I AND MC VI. SEE LIMITS ON SHEET 04
2. SEE DETAIL 5 SHEET 16 FOR GCL OVERLAP



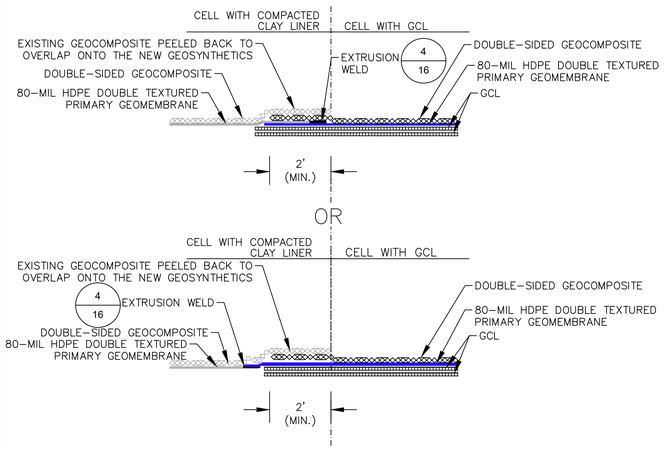
OR



NOTES:

A. NEW AND EXISTING GEOCOMPOSITE LAYERS SHALL BE CONNECTED AS FOLLOWS:
   – GEONET CORES SHALL BE JOINED BY PLASTIC FASTENERS.
   – TOP GEOTEXTILE SHALL BE SEWN TOGETHER OR COVERED WITH EXTRA NON-WOVEN GEOTEXTILE (MINIMUM 24" WIDE) HEAT BONDED TO THE EXISTING GEOTEXTILE.
B. AT GCL SEAMS, DRY BENTONITE POWDER SHALL BE APPLIED PER MANUFACTURER'S INSTALLATION GUIDELINES.
C. SEAMS SHOULD BE CONSTRUCTED SUCH THAT THEY ARE SHINGLED IN THE DIRECTION OF THE GRADE TO PREVENT FLOW FROM ENTERING THE OVERLAP ZONE.

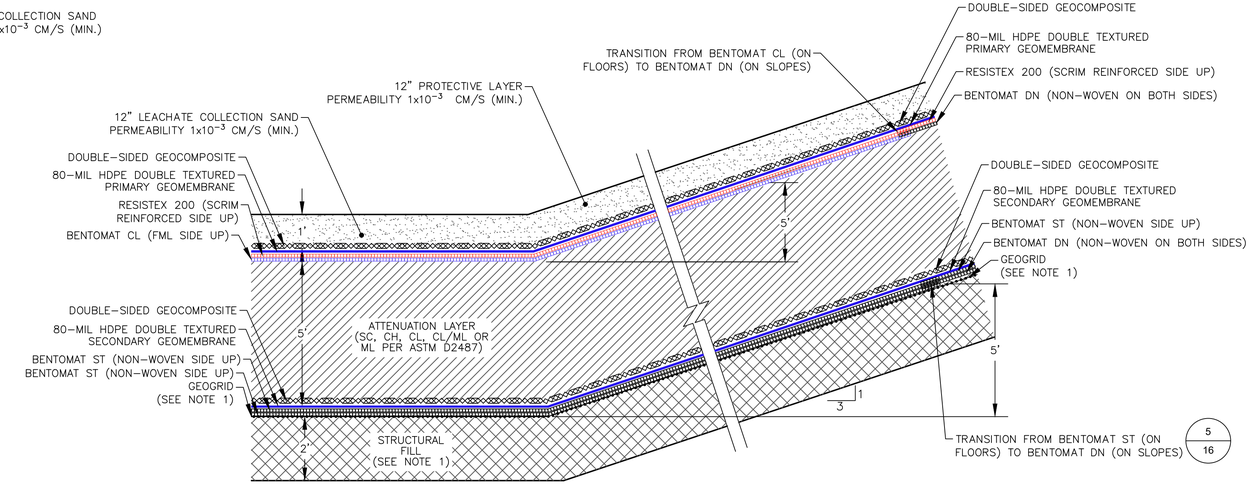
3/15 LINER TIE-IN DETAIL I
NOT TO SCALE



NOTES:

A. NEW AND EXISTING GEOCOMPOSITE LAYERS SHALL BE CONNECTED AS FOLLOWS:
   – GEONET CORES SHALL BE JOINED BY PLASTIC FASTENERS.
   – TOP GEOTEXTILE SHALL BE SEWN TOGETHER OR COVERED WITH EXTRA NON-WOVEN GEOTEXTILE (MINIMUM 24" WIDE) HEAT BONDED TO THE EXISTING GEOTEXTILE.
B. SEAMS SHOULD BE CONSTRUCTED SUCH THAT THEY ARE SHINGLED IN THE DIRECTION OF THE GRADE TO PREVENT FLOW FROM ENTERING THE OVERLAP ZONE.

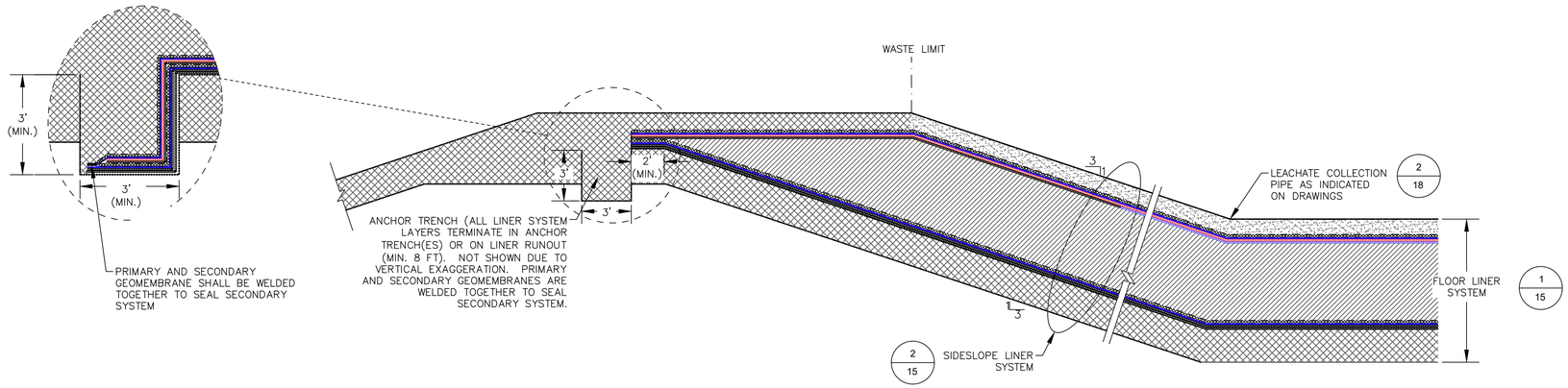
4/15 LINER TIE-IN DETAIL II
NOT TO SCALE



2/15 SIDESLOPE LINER SYSTEM USING GCL
NOT TO SCALE

NOTE:

1. STRUCTURAL FILL AND GEOGRID NOT REQUIRED OUTSIDE OF MC I AND MC IV. SEE LIMITS ON SHEET 04
2. SEE DETAIL 5 SHEET 16 FOR GCL OVERLAP REQUIREMENT.



5/15 G CELLS PERIMETER DIKE
NOT TO SCALE

REVISIONS			
REV	DATE	REVISION DESCRIPTION	
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	XZ
F	11/20/20	SUBCELLS F1-F4 REVISIONS	LEH
B	9/23/11	PER MDEQ COMMENTS	WRG
A	6/10/11	PHASING DESIGNATIONS	XZ
			DRL
			DRN
			APP

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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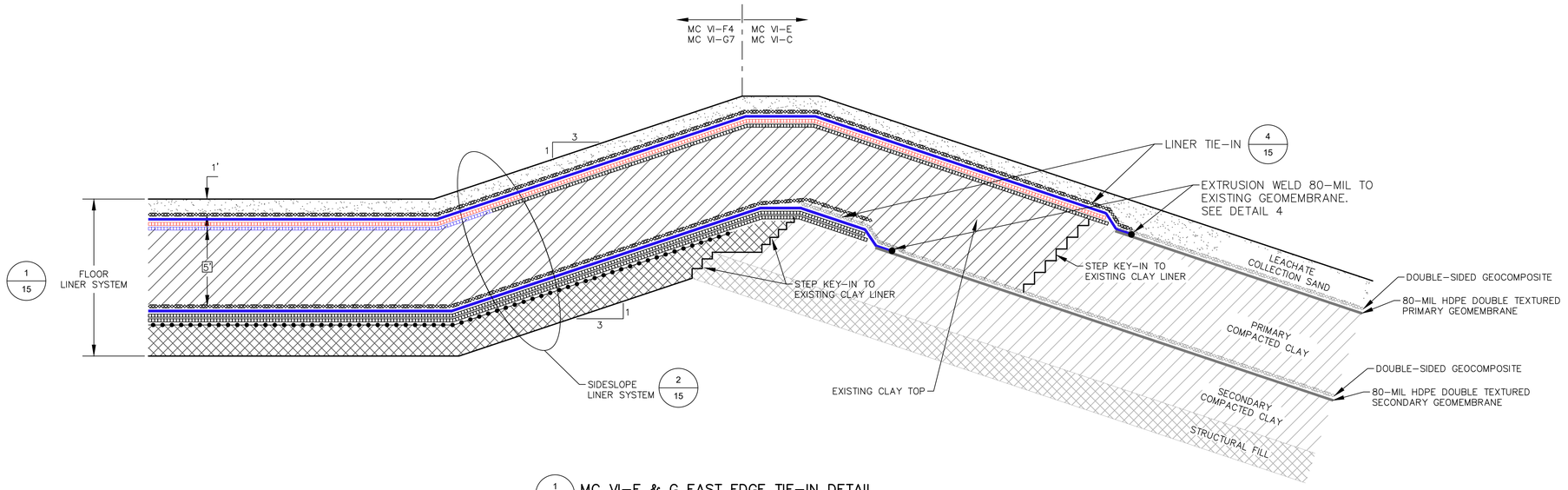
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (1 OF 2)

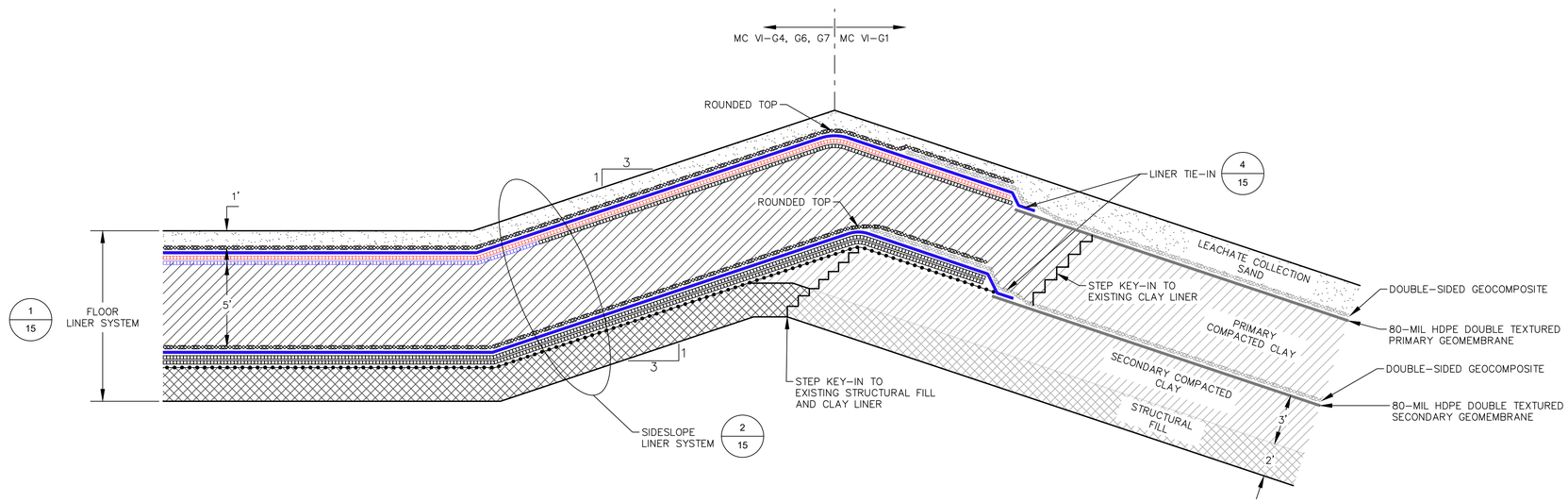
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

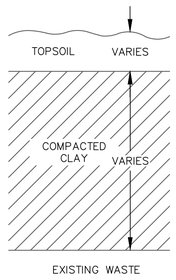
DRAWING NO
15



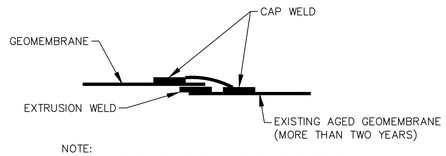
1/16 MC VI-F & G EAST EDGE TIE-IN DETAIL
NOT TO SCALE



2/16 MC VI-G1 TO MC VI-G4, G6, AND G7 TIE-IN DETAIL
NOT TO SCALE

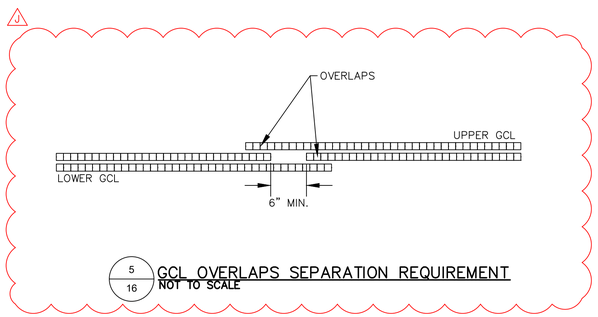


3/16 MC I & MC IV COVER DETAIL
NOT TO SCALE



NOTE:
DETAIL APPLIES AT LOCATIONS WHERE GEOMEMBRANE
TIES INTO EXISTING GEOMEMBRANE

4/16 GEOMEMBRANE WELDING DETAIL
NOT TO SCALE



5/16 GCL OVERLAPS SEPARATION REQUIREMENT
NOT TO SCALE

REVISIONS			
REV	DATE	REVISION DESCRIPTION	
J	5/18/22	SUBCELLS G4-G6 REVISIONS	LEH
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH
F	11/20/20	SUBCELLS F1-F4 REVISIONS	WRG
E	5/29/18	ADDENDUM #1	PAA
D	5/08/18	REVISION BASED ON MDEQ'S COMMENTS	PAA
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA
			DRN

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
LINER SYSTEM DETAILS (2 OF 2)
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (2 OF 2)

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

DRAWING NO
16

Geosynthetic Materials

Material	Location	Description	Product	Additional Requirements
80-mil Geomembrane	Primary and secondary liners	80-mil HDPE, textured both sides	GSE HD textured, or equivalent	The CQA Consultant shall manage the direct shear testing of the geomembrane samples, as needed, per the direction of the Design Engineer and in accordance with the design requirements of the project.
40-mil Geomembrane	Final cover	40-mil HDPE, textured both sides	GSE HD textured, or equivalent	
Geosynthetic Clay Liner	Final cover and secondary liner	Sodium bentonite encapsulated between two geotextiles that are needle-punched or stitch-bonded together	CETCO Bentomat ST, or equivalent	The CQA Consultant shall manage the direct shear testing of the GCL samples, as needed, per the direction of the Design Engineer and in accordance with the design requirements of the project.
Geosynthetic Clay Liner	Primary and secondary liners	Sodium bentonite encapsulated between two geotextiles that are needle-punched together	CETCO Bentomat DN, or equivalent	
Geosynthetic Clay Liner	Primary liner	Sodium bentonite encapsulated between two geotextiles that are needle-punched and laminated to a geofilm	CETCO Bentomat CL, or equivalent	
Geosynthetic Clay Liner	Primary Liner	Polymer-modified bentonite	CETCO Resistex 200 FLW9, or equivalent	
Geocomposite	LCS	HDPE, bonded top and bottom to geotextile meeting requirements of geotextile; geocomposite transmissivity* (minimum): MC VI-F1, F3, and F4: 3.2E-04 m2/sec MC VI- F2: 4.1E-04 m2/sec MC VI-G4, G5, and G6: 4.2E-04 m2/sec MC VI-G7: 7.4E-04 m2/sec	GSE FABRINET, or equivalent	Geonet and geotextile shall meet the requirements of the project plans and drawings.
Geocomposite	LDCRS	200-mil HDPE, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET, or equivalent	
Cover Geocomposite	Final cover	Refer to Stormwater Calculation (A.6.8) for minimum geocomposite transmisssivity, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET, or equivalent	
Geonet	LCS and LDCRS sumps, and LDCRS collectors	200-mil HDPE	GSE HYPERNET, or equivalent	Transmissivity requirements per the direction of the Design Engineer and in accordance with the design requirements of the project.
Geotextile	All geocomposites, gravel/geotextile envelopes for LCS, and final cover perimeter drain	Nominal 8 oz/yd^2, needle-punched, non-woven polypropylene	Amoco 4508, Synthetic Industries Geotex 801, or equivalent	AASHTO M288-96 requirements for Separation Geotextile (Class 2)
Geogrid	Above structural fill	Biaxial Polymeric Grid	Huesker Fortrac 80-80, or equivalent	None

LCS denotes leachate collection system
LDCRS denotes leak detection, collection, and removal system.
*Geocomposite Transmissivity Test Requirements:
Per ASTM 4716 with a gradient of 0.1, confining pressure of 10,000 psf, boundary conditions of geomembrane/sand;transmissivity test should be run until the sample reaches equilibrium (becomes asymptotic) or 100 hours, whichever comes first.

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REV	DATE	DRN	APP
1	10/08/21	WRG	XZ
F	11/10/20	WRG	XZ
E	5/29/18	PAA	XZ
D	5/09/18	PAA	XZ

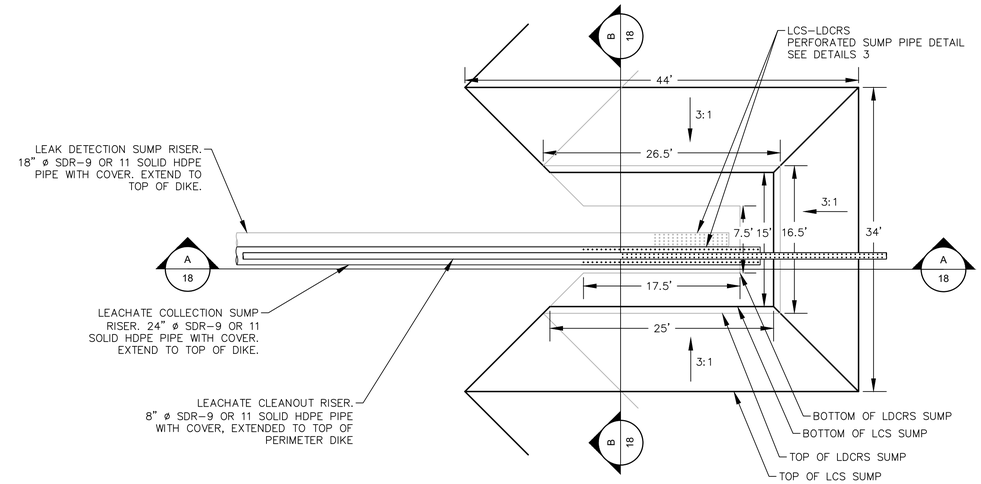
DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

1 10/08/21 SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES
F 11/10/20 SUBCELLS F1-F4 REVISIONS
E 5/29/18 ADDENDUM 1
D 5/09/18 REVISION BASED ON MDEQ'S COMMENTS
REV DATE REVISION DESCRIPTION

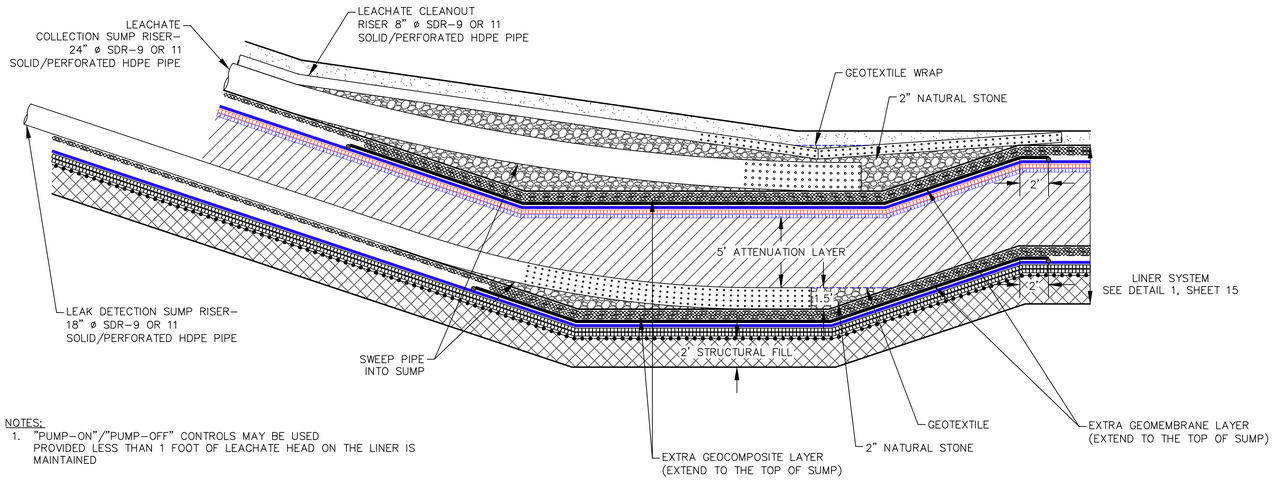
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

GEOSYNTHETIC MATERIALS REQUIREMENTS

PROJECT NUMBER 12180700017
SCALE AS SHOWN
DRAWING NO 17

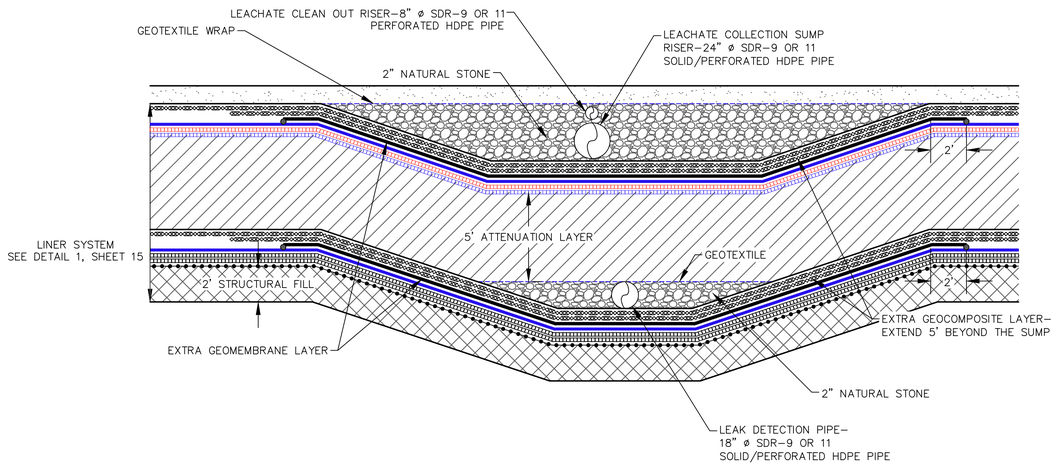


1/18 LCS-LDCRS SUMP (TYP.)
NOT TO SCALE



NOTES:
1. "PUMP-ON"/"PUMP-OFF" CONTROLS MAY BE USED PROVIDED LESS THAN 1 FOOT OF LEACHATE HEAD ON THE LINER IS MAINTAINED

A 18 SUMP CROSS-SECTION A
NOT TO SCALE

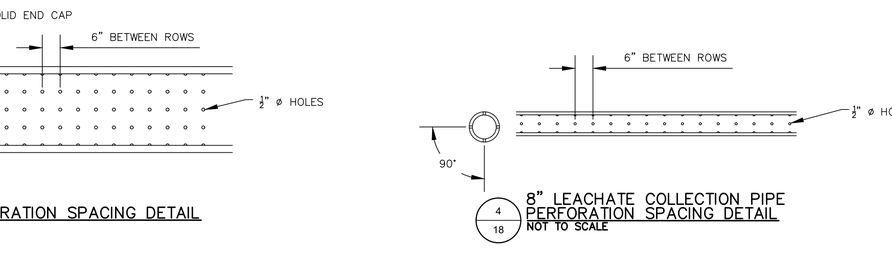


B 18 SUMP CROSS-SECTION B
NOT TO SCALE

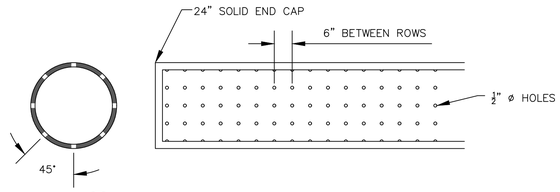
△J

Parameter	Symbol	Value	Unit	Notes and Equations
Sump Length (Top)	L_T	44	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Width (Top)	W_T	34	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Top Area	A_T	1,496	ft^2	L X W
Sump Length (Bottom)	L_B	25	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Width (Bottom)	W_B	15	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Bottom Area	A_B	375	ft2	L X W
Depth of Sump	h_0	3.2	ft	Based on Slope 3:1 and Sump Dimensions
Porosity of Aggregates	n	0.3		assumption
Pump On from Bottom	h_1	36	inch	
Pump Off from Bottom	h_2	12	inch	
Pump On Area	A_1	1,419	ft^2	L=43 ft; W=33 ft
Pump Off Area	A_2	651	ft^2	L=31 ft; W=21 ft
Leachate Generation Rate	Q_{in}	47,693	GPD	Source: Attachment A-4_Leachate Collection System Flow Capacity Analysis
		33.1	GPM	
Leachate Pumping Rate	Q_{out}	37.0	GPM	typical pumping rate; minimum pumping rate is 34 gpm.
Effective Sump Storage Volume	Veff	4,535	gal.	$V_{eff} = \frac{1}{3} n \frac{h_1 - h_2}{12} \left(A_1 + A_2 + \sqrt{A_1 A_2}\right) \times 7.481$
Pump Off Time	Toff	2.3	hr	$T_{off} = \frac{V_{eff}}{Q_{in}} \times 24$
Pump On Time	Ton	19.5	hr	$T_{on} = \frac{V_{eff}}{Q_{out} \times 60 - \frac{Q_{in}}{24}}$
Pump Cycle Time	T_{cycle}	21.8	hr	$T_{cycle} = T_{on} + T_{off}$
Pump Cycle	N	1.1		$N = \frac{24}{T_{cycle}}$

NOTES
1. Dimension of the sump used in this calculation is an example. The actual dimension of the sump can be varied.
2. The effective sump storage volume presented in this calculation is a minimum required volume.
3. The leachate pumping rate presented in this calculation is for illustration purpose. Other size of pump with different flow rate can be used as long as the leachate level above the primary liner can be maintained below 12-inch.



2/18 CELL FLOOR LEACHATE COLLECTION PIPE AND LEAK DETECTION GEONET (TYP.)
NOT TO SCALE



3/18 SUMP PERFORATION SPACING DETAIL
NOT TO SCALE

4/18 8" LEACHATE COLLECTION PIPE PERFORATION SPACING DETAIL
NOT TO SCALE

REV	DATE	REVISION DESCRIPTION	DRN	APP
J	05/18/22	SUBCELLS C4-C6 REVISIONS	LEH	XZ
I	10/08/21	SUBCELLS C4-C7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN T1-T4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	11/20/20	SUBCELLS T1-T4 REVISIONS	WRG	XZ
B	9/23/11	PER MDEQ COMMENTS	DRL	

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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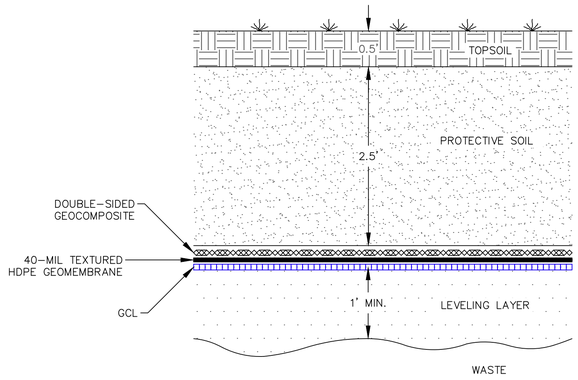
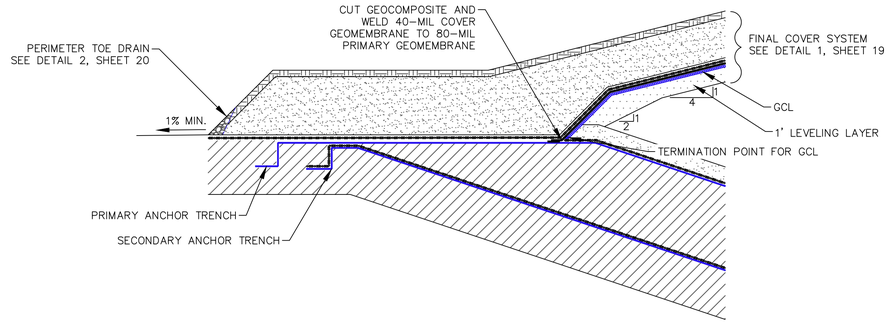
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEACHATE COLLECTION SYSTEM DETAILS

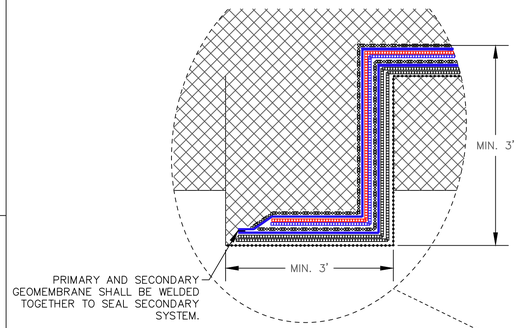
PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 18



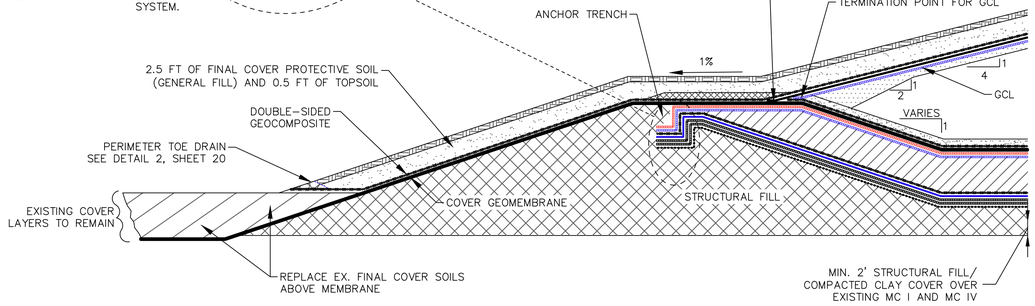
1/19 FINAL COVER SYSTEM
1"=2'



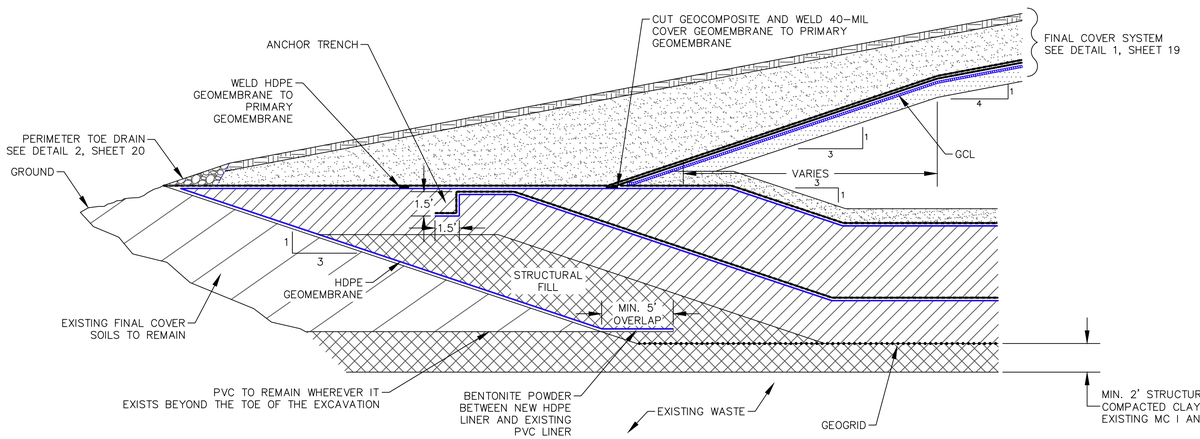
2/19 FINAL COVER TIE-IN DETAIL
MC VI-AN, AS, C & D
NOT TO SCALE



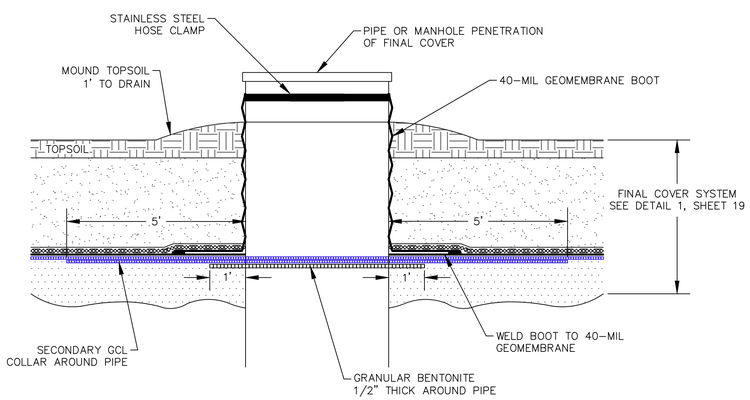
NOTE:
THE GEOMEMBRANE DOES NOT EXTEND TO THE OUTSIDE FACE OF THE PERIMETER DIKE WHERE IT IS LOCATED OUTSIDE OF THE MC I/MC IV FOOTPRINT.



3/19 DIKE AND COVER TIE-IN DETAIL (TYP.)
MC VI-F, MC VI-G, & EAST SIDE OF MC VI-E
NOT TO SCALE



4/19 DIKE AND COVER TIE-IN DETAIL
NORTH SIDE OF MC VI-E
NOT TO SCALE



5/19 FINAL COVER PENETRATION DETAIL (TYP.)
NOT TO SCALE

REVISIONS	REV	DATE	DESCRIPTION	DRN	APP
1	F	11/20/20	SUBCELLS T1-4 REVISIONS	WRG	XZ
H	G	7/14/21	REVISED LINER GRADES IN T1-4	LEH	XZ
I	H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
	I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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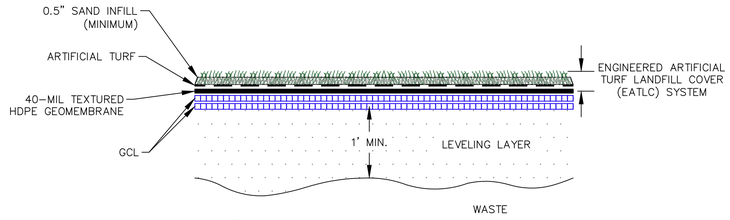
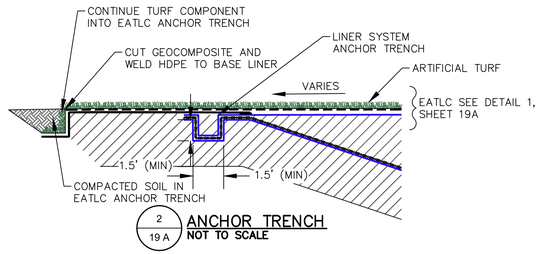
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER DETAILS

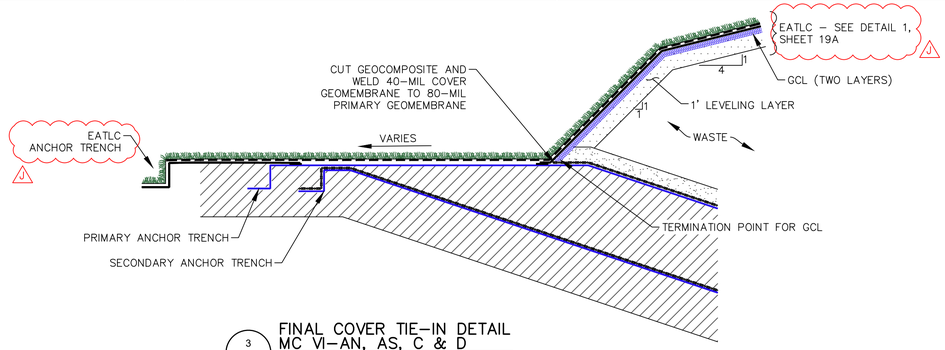
PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 19



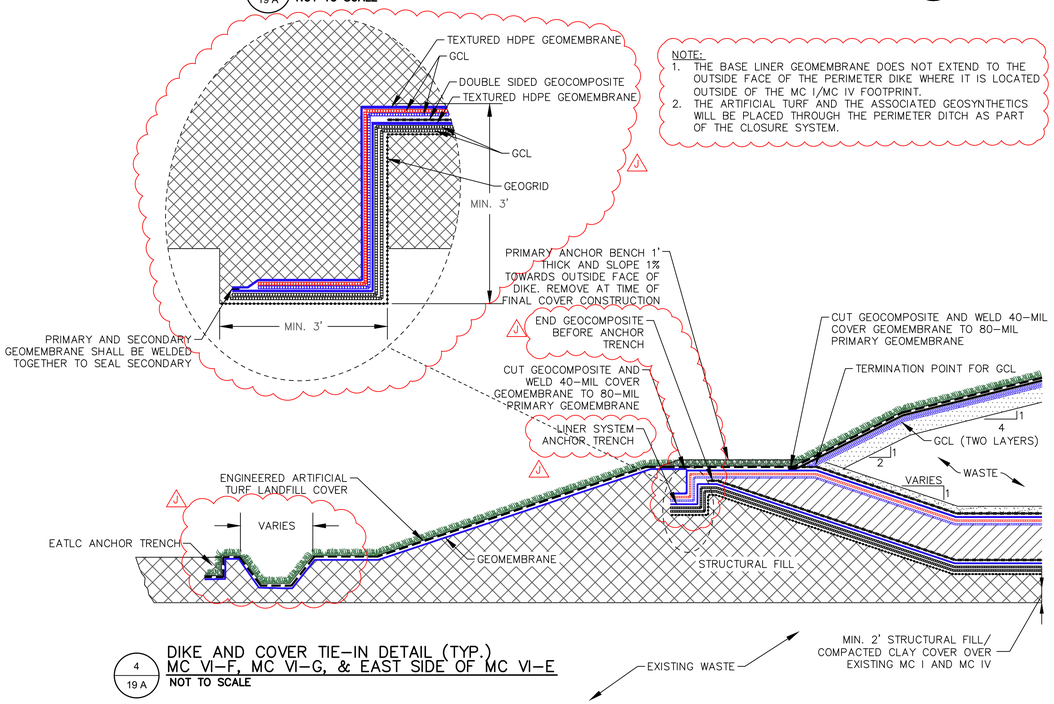
1 / 19 A **FINAL COVER SYSTEM**
NOT TO SCALE



2 / 19 A **ANCHOR TRENCH**
NOT TO SCALE

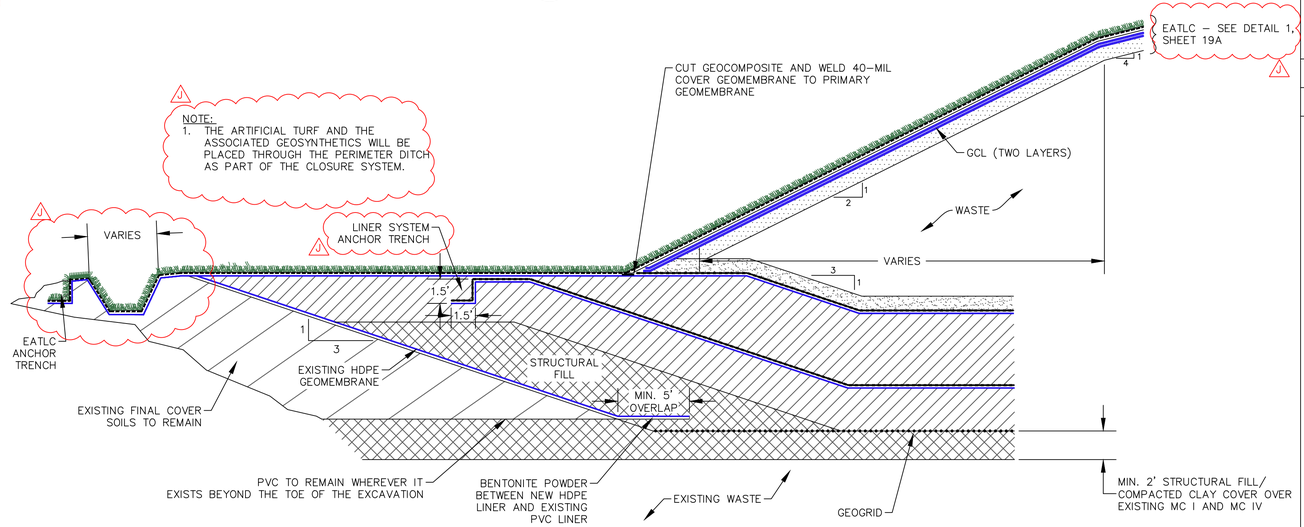


3 / 19 A **FINAL COVER TIE-IN DETAIL MC VI-AN, AS, C & D**
NOT TO SCALE

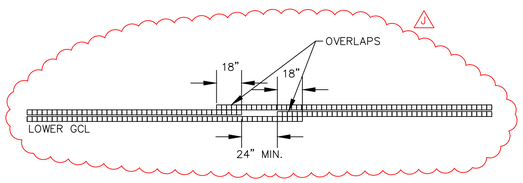


NOTE:
1. THE BASE LINER GEOMEMBRANE DOES NOT EXTEND TO THE OUTSIDE FACE OF THE PERIMETER DIKE WHERE IT IS LOCATED OUTSIDE OF THE MC I/MC IV FOOTPRINT.
2. THE ARTIFICIAL TURF AND THE ASSOCIATED GEOSYNTHETICS WILL BE PLACED THROUGH THE PERIMETER DITCH AS PART OF THE CLOSURE SYSTEM.

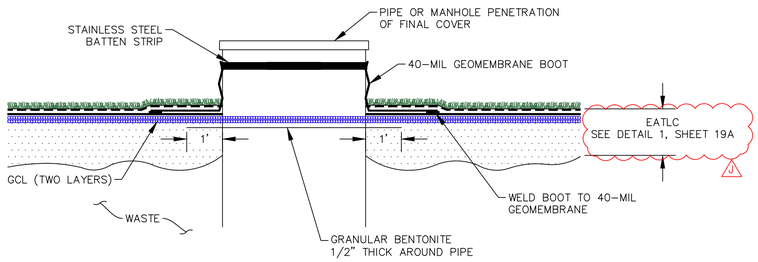
4 / 19 A **DIKE AND COVER TIE-IN DETAIL (TYP.) MC VI-F, MC VI-G, & EAST SIDE OF MC VI-E**
NOT TO SCALE



5 / 19 A **DIKE AND COVER TIE-IN DETAIL NORTH SIDE OF MC VI-E**
NOT TO SCALE



6 / 19 A **GEOSYNTHETIC CLAY LINER OVERLAP DETAIL**
NOT TO SCALE



7 / 19 A **FINAL COVER PENETRATION DETAIL (TYP.)**
NOT TO SCALE

NOTE:
1. ALL GEOSYNTHETIC CLAY LINER (GCL) SHALL BE COVERED WITH GEOMEMBRANE WITHIN 24 HOURS AFTER PLACEMENT OF GCL AND OVERLAPPED A MINIMUM OF 18-INCHES DURING INSTALLATION.
2. ALL OVERLAPPED SEAMS ARE TO BE HEAT-TACKED USING A QUICK PASS OF A FLAME TORCH FOLLOWED BY QUICK APPLICATION OF APPROPRIATE PRESSURE AS PROVIDED BY A ROLLER, FOOT PRESSURE, OR OTHER MEANS.
3. THE CONTRACTOR SHALL INSTALL THE TWO LAYERS OF THE GCL STAGGERED BY A MINIMUM OF 24-INCHES BETWEEN UPPER AND LOWER GCL SEAMS.
4. REINFORCED GCL MUST BE USED ON ALL SLOPES AS PART OF THE CLOSURE SYSTEM.
5. CONSTRUCTION OF THE FINAL COVER SYSTEM SHALL BE SUPPORTED BY A VENEER STABILITY ANALYSIS. EACH GEOSYNTHETIC/GEOSYNTHETIC AND GEOSYNTHETIC/SOIL INTERFACE INCLUDED IN EATLC SYSTEM SHALL BE CONSIDERED FOR PREQUALIFICATION TESTING PRIOR TO INSTALLATION OF THE COVER SYSTEM. THE CRITICAL INTERFACE SHALL BE DETERMINED BY A COMPARISON OF INTERFACE STRENGTH TEST RESULTS OF REPRESENTATIVE SAMPLES OF MATERIALS USED FOR CONSTRUCTION FOR EACH INTERFACE. THE CRITICAL INTERFACE IS THE LOWEST SHEAR STRENGTH TEST RESULT THAT CORRESPONDS TO THE NORMAL STRESS EXHIBITED BY THE EATLC COVER SYSTEM WHICH IS EXPECTED TO BE BETWEEN 5 AND 6 PSF.

AT MINIMUM, THE FOLLOWING INTERFACES SHALL HAVE INTERFACE TEST RESULTS FOR COMPARISON.
- BASE GEOTEXTILE OF THE EATLC AND GEOMEMBRANE
- GEOMEMBRANE AND TOP LAYER OF GCL.
- TOP LAYER OF GCL AND BOTTOM LAYER OF GCL.
- BOTTOM LAYER OF GCL AND LEVELING SOIL LAYER.
- INTERNAL SHEAR STRENGTH OF THE GCL UNDER HYDRATED CONDITIONS.

7. INTERFACE FRICTION TESTS PERFORMED TO QUALIFY ACCEPTABLE MATERIALS FOR PLACEMENT OF EATLC COVER MATERIALS SHALL CONSIDER LARGE-DISPLACEMENT STRENGTH TEST RESULTS ON THE FINAL COVER SIDE-SLOPES STEEPER THAN 10% AND PEAK STRENGTH TEST RESULTS FOR ALL OTHER SLOPES. THE MINIMUM DESIGN FACTOR OF SAFETY FOR STATIC STABILITY SHALL BE 1.3 FOR FINAL COVER SIDE-SLOPES STEEPER THAN 10% THAT CONSIDER LARGE-DISPLACEMENT STRENGTH TESTING RESULTS. THE MINIMUM DESIGN FACTOR OF SAFETY FOR STATIC STABILITY SHALL BE 1.5 FOR ALL OTHER FINAL COVER SLOPES THAT CONSIDER PEAK STRENGTH.
8. NO EQUIPMENT TRAFFIC SHALL BE ALLOWED TO TRAVERSE AREAS OF EATLC WITHOUT PRIOR APPROVAL BY THE ENGINEER.

VENEER STABILITY INTERFACE STRENGTH REQUIREMENTS		
	FINAL COVER SLOPES > 10%	FINAL COVER SLOPES ≤ 10%
REQUIRED INTERFACE STRENGTH TEST DATA	LARGE-DISPLACEMENT STRENGTH	PEAK STRENGTH
MIN. EQUIV. ACCEPTABLE INTERFACE STRENGTH*	18 DEGREES	20.5 DEGREES
MIN. ACCEPTABLE FS FOR VENEER STABILITY	1.3	1.5

*COMBINATIONS OF TESTED INTERFACE FRICTION ANGLE AND SHEAR STRENGTH INTERCEPT MEASURED AT THE NORMAL STRESS (5-6 PSF)EXHIBITED BY THE EATLC COVER SYSTEM THAT SATISFIES THE FACTOR OF SAFETY CRITERIA ARE ACCEPTABLE

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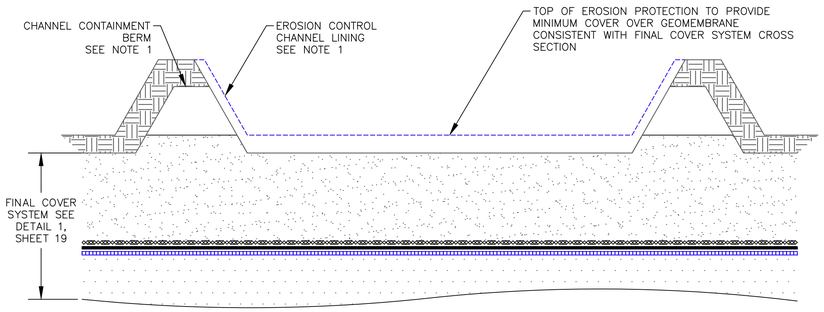
DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: C4B
APPROVED BY: XZ

REVISIONS				
REV	DATE	REVISION DESCRIPTION		
J	05/18/22	RESPONSE TO EGLE COMMENTS DATED 3/29/2022	LEH	XZ
I	10/08/21	SUBCELLS G4-C7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
			DRN	APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF FINAL COVER DETAILS

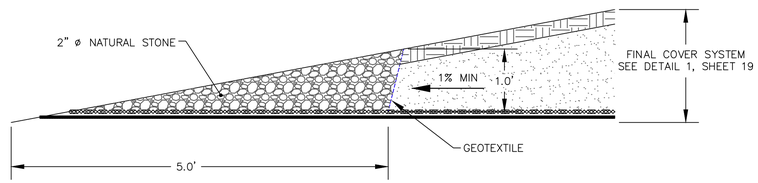
PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 19 A



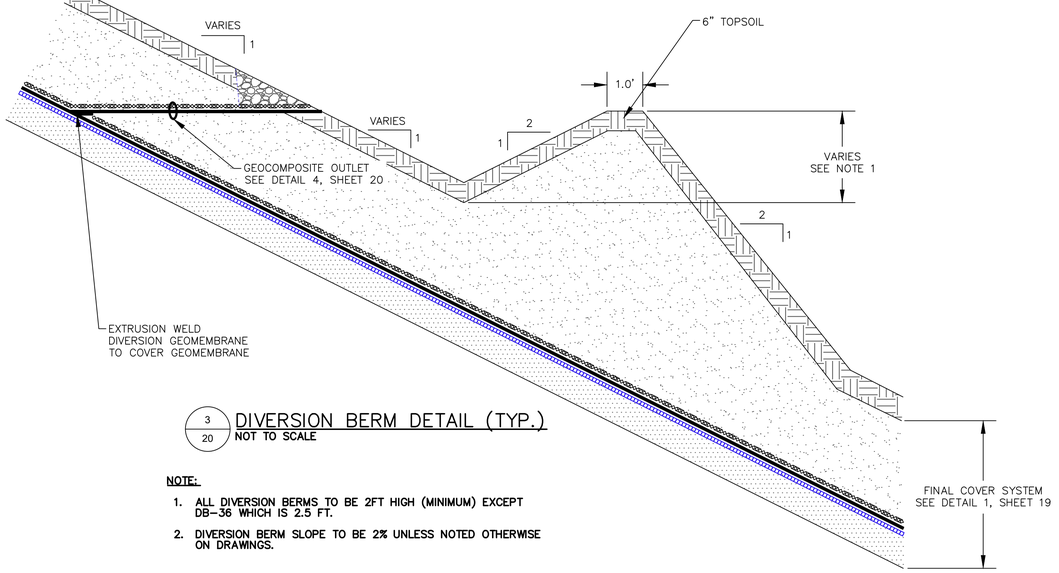
1/20 TYPICAL DOWNSLOPE CHANNEL DETAIL
NOT TO SCALE

NOTE:

1. DIMENSIONS AND CONFIGURATION OF DOWNSLOPE CHANNEL CONTAINMENT BERMS AND CHANNEL WILL BE DETERMINED BY THE EROSION CONTROL CHANNEL LINING CHOSEN. CHANNEL AND OUTLET ENERGY DISSIPATER DESIGN TO BE COMPLETED PRIOR TO CONSTRUCTION.



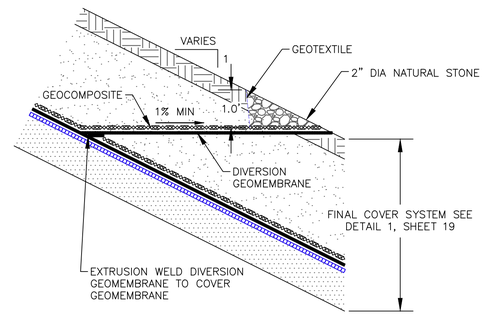
2/20 PERIMETER TOE DRAIN
NOT TO SCALE



3/20 DIVERSION BERM DETAIL (TYP.)
NOT TO SCALE

NOTE:

1. ALL DIVERSION BERMS TO BE 2FT HIGH (MINIMUM) EXCEPT DB-36 WHICH IS 2.5 FT.
2. DIVERSION BERM SLOPE TO BE 2% UNLESS NOTED OTHERWISE ON DRAWINGS.



4/20 GEOCOMPOSITE OUTLET DETAIL (TYP.)
NOT TO SCALE

NOTE:

1. ALTERNATE GEOCOMPOSITE OUTLETS SUCH AS PIPE MAY BE USED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REVISIONS			
REV.	DATE	REVISION DESCRIPTION	
F	11/20/20	SUBCELLS F1-F4 REVISIONS	DRN
I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
			WRG
			DRN
			XZ
			XZ
			APP

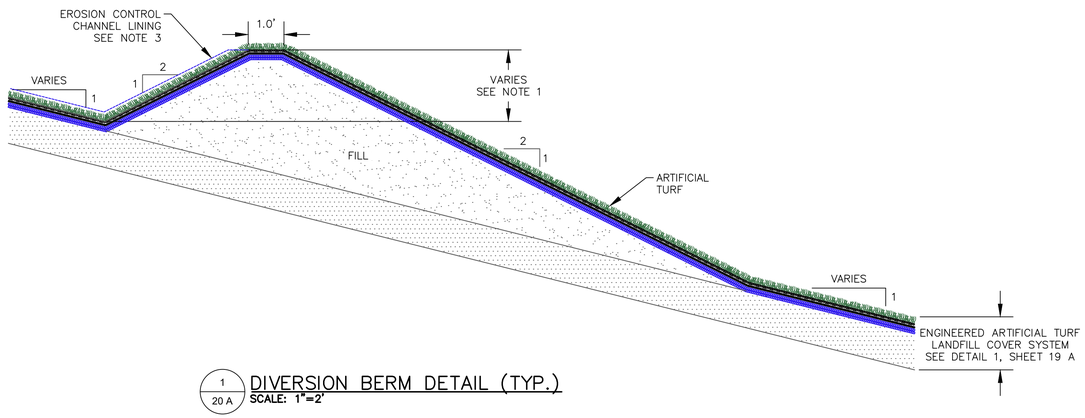
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORMWATER MANAGEMENT SYSTEM DETAILS

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

DRAWING NO
20



1 / 20 A DIVERSION BERM DETAIL (TYP.)
SCALE: 1"=2'

NOTE:

1. ALL DIVERSION BERMS TO BE 2FT HIGH (MINIMUM).
2. DIVERSION BERM SLOPE TO BE 2% UNLESS NOTED OTHERWISE ON DRAWINGS.
3. DIMENSIONS AND CONFIGURATION OF DIVERSION BERMS WILL BE DETERMINED BY THE EROSION CONTROL CHANNEL LINING CHOSEN. CHANNEL AND OUTLET ENERGY DISSIPATER DESIGN TO BE COMPLETED PRIOR TO CONSTRUCTION.

REVISIONS				
REV	DATE	REVISION DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORMWATER MANAGEMENT SYSTEM DETAILS

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

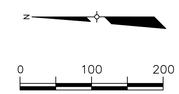
DRAWING NO
20 A

GAS VENTING LINE (TYP) — 1/21

MC VI-F4 | MC VI-F3 | MC VI-F2 | MC VI-F1 | MC VI-G3 | MC VI-G2 | MC VI-G1 | MC VI-G7 | MC VI-G6 | MC VI-G5 | MC VI-G4

450' (MAX)

5000 E | 4500 E | 4000 E

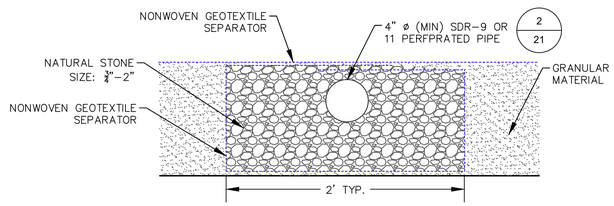


LEGEND

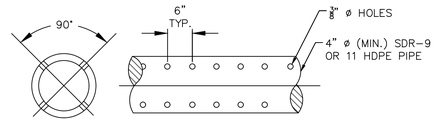
- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — MASTER CELL VI–F & G MAJOR CONTOURS
- MASTER CELL VI–F & G MINOR CONTOURS
- GAS VENTING LINE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.



1/21 VENTING LINE DETAIL FOR SUBCELLS F1–4 AND G4–7 OVER EXISTING MC I AND MC IV
NOT TO SCALE



2/21 VENTING PIPE DETAIL
NOT TO SCALE

REVISIONS				
REV	DATE	DESCRIPTION		
J	05/18/22	SUBCELLS G4–G6 REVISIONS	LEH	XZ
I	10/08/21	SUBCELLS G4–G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG	XZ
H1	5/10/22	REVISED LINER GRADES IN F3	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	11/10/20	SUBCELLS F1–F4 REVISIONS	WRG	XZ
E	5/29/18	ADDENDUM	PAA	XZ
REV	DATE	REVISION DESCRIPTION	DRN	APP

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
CONCEPTUAL GAS VENTING SYSTEM
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CONCEPTUAL GAS VENTING SYSTEM

PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 21

2021 Permit Application
Attachment B6 Engineering Plan

Responses to EGLE Comments and Revisions of Calculations and Engineering Plan

Part 2 Engineered Artificial Turf Landfill Cover

Submitted May 25, 2022
by CTI and Associates, Inc.

TABLE OF CONTENT

1a. EGLE comments dated Mar. 22, 2022
1b. Responses to EGLE comments dated Mar. 22, 2022
2. EATLC Equivalency Demonstration Rev.01
  2a. Narratives
  2b. Attachment A Drawings: Sheet 19A Rev.02
  2c. Attachment C Veneer Stability Analysis Rev.01
  2d. Attachment D Wind Uplift Evaluation Rev.01
  2e. Attachment E CloureTurf Integrity Study Rev.01
  2f. Attachment I HELP Analysis Rev.01

Technical Comments on WDI 2021 Permit Application
Attachment B Engineered Artificial Turf Cover Alternate

March 22, 2022

1. Per the Part 111 Rules requirement for the equivalent demonstration of the alternative final cover design, CTI should demonstrate if the proposed engineered artificial turf cover system is equivalent to the standard Part 111 cover system shown in Figure 1 and not a conventional solid waste cover system or a so-called permitted cover system. For example, the title of Table 1 – Comparison of Engineered Artificial Turf Landfill Cover to Convention Cover in 3.0 Equivalency Demonstration should be changed to Table 1 – Comparison of Engineered Artificial Turf Landfill Cover to Part 111 Rules Hazardous Landfill Cover, and the cover system used to conduct HELP model evaluation in Attachment I: Hydrologic Evaluation of Landfill Performance (HELP) Model also should be a standard Part 111 cover system vs. a proposed engineered turf cover system, and so on.

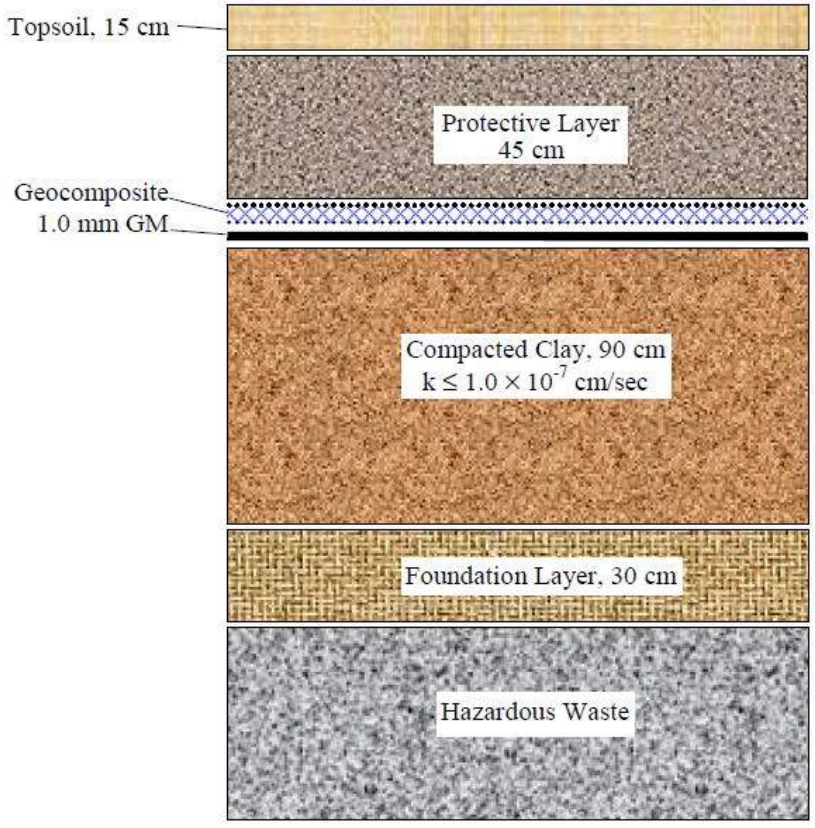

Figure 1 – Part 111 Final Cover System

2. CTI should indicate that the reinforced GCL must be used on the slope when the cover slop is

greater than 10%.

3. GCL should be minimized expose time and be covered by geomembrane, engineered turf, and sand infill to minimize bentonite drying in the GCL during installation period if the final cover system is constructed in high temperature season. The normal moisture content of the bentonite in GCL is 35%. The shrinkage for the different types of GCLs can be up to from 7 to 22% (Thiel et al., 2006). Koerner and Koerner (2005a, 2005b) considered three possible mechanisms for GCL panel shrinkage: (1) Cyclic wetting and drying; (2) Longitudinal steep slope tensioning of the GCL; and (3) GCL contraction on relatively flat slopes caused by "gathering" under textured geomembranes. Of these three possibilities they believed that Mechanism 2 (slope tensioning) is the major factor that contributes to the problem in the field. Three actual projects in which GCL panels had either lost a portion of their original overlap or had completely separated are shown in Figure 2. The overlap distance is typically 6 to 12 inches (150 to 300 mm). The warm temperatures can reduce the moisture content of the bentonite and cause reduction or even complete loss of overlap distance. This is obviously unacceptable. If reduction in overlap distance from elevated temperatures is anticipated, the overlap should be increased (USEPA, 1993; Daniel and Koerner, 2007). In addition, unlike conventional Part 111 cover system, the proposed engineered artificial turf cover system does not have 2-ft protective soil and topsoil load applying on the GCLs and the normal load over the GCL is very small. It makes more potential movement and deformation of the GCLs due to construction equipment movement during construction, or temperature deformation and other effects during operation and long-term closure periods. The languages regarding minimize expose time for GCL during installation period and increasing the GCL overlap distance on the sideslope area should be added in the construction specifications.

Figure 2 – Photographs of Actual GCL Panel Separation Problems at Different Projects in USA (Thiel and Richardson, 2005; Thiel and Rowe, 2010)

4. CTI should provide the detail information to explain what type of geomembrane will be used in the proposed engineered artificial turf cover system, a special 50-mil LLDPE Agru Super Gripnet® geomembrane developed by Agru America, Inc. for a standard ClosureTurf cover system shown in Figure 3 or a general 40-mil textured HDPE geomembrane. If a special 50-mil LLDPE Agru Super Gripnet® geomembrane is selected, a drainage layer will be located between the geotextile base of the engineered synthetic turf and the Agru Super Gripnet® geomembrane (see Figure 4 and Figure 5). Then, Detail 1/19A Final Cover System in Drawing No. 19A must be revised to show this drainage layer in the cover cross section.

Figure 3 – 50-mil LLDPE Agru Super Gripnet® geomembrane and engineered synthetic turf

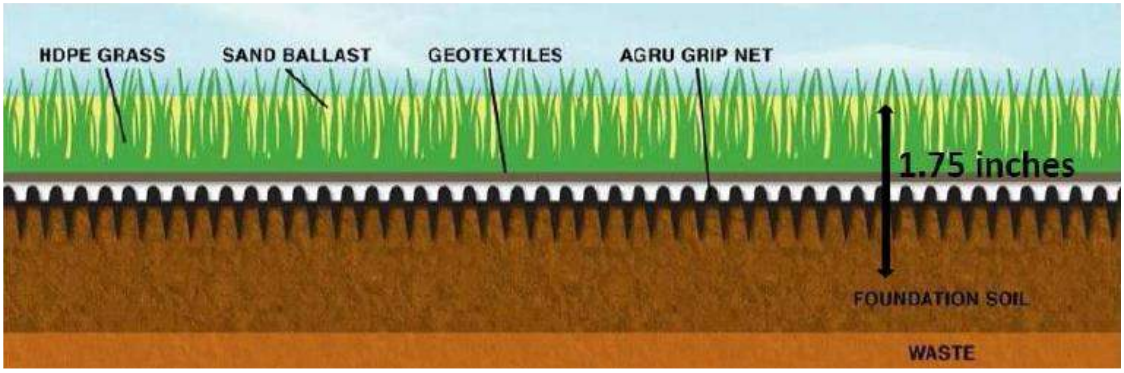

Figure 4 – Cross section of ClosureTurf cover system (Eichelberger, 2016)

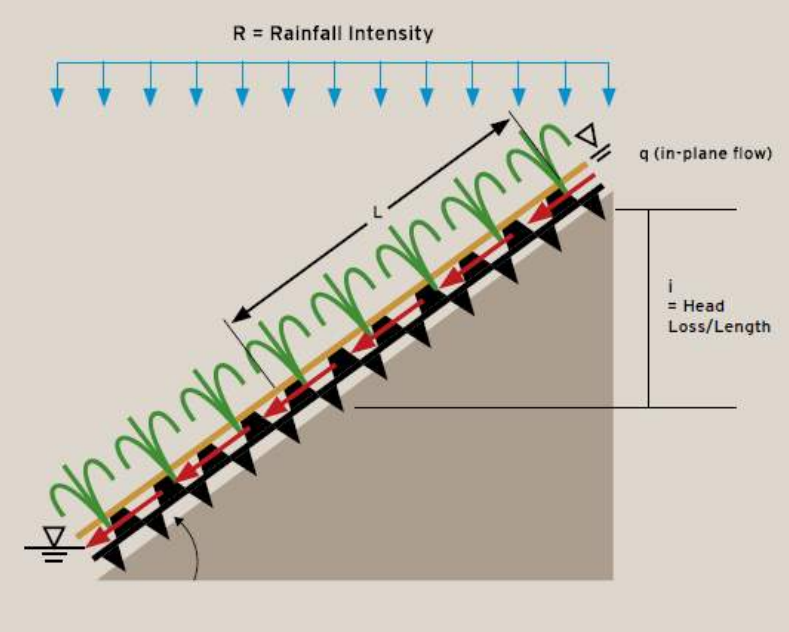

Figure 5 – Drainage performance of ClosureTurf (Agru and WatershedGeo, 2014)

5. There is no any drainage trench located at the toe of the proposed engineered artificial turf cover system (see both Detail 3/19A Dike and Cover Tie-in Detail (Typ.) MC VI-F, MC VI-G, & East Side of MC VI-E and Detail 4/19A Dike and Cover Tie-in Detail North Side of MC VI-E. CTI should explain why the toe drainage is not needed for the proposed engineered artificial turf cover system. The traditional and artificial turf cover systems have different materials, structures, and thickness. They may cause the different amounts of the surface run-on and run-off, lateral drainage, soil moisture storage, infiltration, and evaporation and evapotranspiration. Because the proposed cover system uses the artificial turf that will not have the transpiration function and only have the evaporation function. In addition, this type of cover system does not have 2-ft soil protective layer and topsoil and also does not have soil moisture storage function. Thus, if the engineered turf cover system is used to replace the traditional cover system, the amount of the surface run-off may be increased.

6. Two layers of GCL will be used in the engineered artificial turf cover system to replace 3-ft compacted clay layer. CTI should add a notice in construction specifications to stagger the overlapping positions of upper and lower layers of GCLs and avoid the side edge and end overlaps of the GCLs at the same locations for both layers of GCL.

7. The geomembrane used in the proposed cover system shown in Figure 1 Cross Section (Typical ClosureTurf Cover) of Attachment C Veneer Stability Analysis (Page 52) is 40-mil LLDPE. However, the geomembrane used in the proposed cover system shown in Figure 2 Engineered Artificial Turf Landfill Cover System in 2.0 Configuration of the Final Cover

System is 40-mil Textured HDPE Geomembrane. CTI must clarify this discrepancy.

8. The interface shear strengths for the current proposed engineered turf cover system is not only the interface friction angle between engineered components above geomembrane, δ_A (i.e., the interface friction angle between the engineered turf and geomembrane) and the interface friction angle between engineered components below geomembrane, δ_A (i.e., the interface friction angle between the geomembrane and soil). Based on the designed engineered turf cover system, the interface shear strengths that must be considered include the interface between the base geotextile of the engineered turf and geomembrane, the interface between the geomembrane and the top layer of GCL, the interface between two layers of GCLs, and the interface between the bottom layer of GCL and leveling soil layer. In addition, the internal shear strength of two layers of GCL should also be considered in possible hydrated condition. All these considerations were not mentioned Attachment C: Veneer Stability Analysis. CTI must add some design and construction specifications to explain how to determine the critical interface or internal shear strength for the proposed final cover system to meet the required shear strength based on the calculations.

9. Landfill usually settles a considerable amount during the filling operation and even after closure. The settlement of the waste fill causes the large deformation of the landfill cover system, which tends to induce shear stresses in the final cover system. These shear stresses induce large shear displacements along specific interfaces in the cover systems that may lead to the mobilization of reduced or residual interface strength (Mitchell et al., 1990; Seed et al., 1990). In addition, thermal expansion and contraction of the final cover systems during construction may also contribute to the accumulation of shear displacements and the mobilization of residual interface strength (Stark and Poeppel, 1994). Filz et al. (2001) conducted finite-element analyses using a displacement softening interface to investigate the effects of progressive failure on the slope stability of the geosynthetic lined and covered landfills. It was found that the interface (or internal) shear strength of the liner and cover systems on the sideslope are almost always in post-peak condition (i.e., in large-deformation or residual condition) even if the waste height is not high. It can be seen that the waste depth can be up to 210 feet from Drawing No. 12 of Attachment C of B6_Permit Engineering Drawings and the slope height of the final cover can be up to 190 feet from Drawing Nos. 12 and 14 of Attachment C of B6_Permit Engineering Drawings. The vertical riser pipes installed in MC VI-A-to-D have been damaged due to the waste settlement caused by about only 80-ft waste depth as shown in Figure 6. This shows that the settlement that occurs in the hazardous waste landfill is also quite large. Therefore, residual interface or internal shear strengths should be assessed and considered for the final cover system for a normal design condition to make a long-term landfill stable and safe even after being subjected to large waste settlements (Byrne, 1994; Gilbert et al., 1996; Esterhuizen et al., 2001; Filz et al., 2001).

Figure 6 – Vertical riser pipe collapse due to large settlement of the hazardous waste in WDI MC VI-A-to-D

10. A testing report entitled “Aerodynamic Evaluations of Closure Turf Ground Cover” included in Attachment D Wind Uplift Evaluation indicated that the geomembrane used to conduct test to evaluate the aerodynamic properties by GTRI is the 50-mil LLDPE Agru Super Gripnet® geomembrane and not a general 40-mil textured HDPE geomembrane indicated in the CTI proposed report. Therefore, the aerodynamic properties investigated by using the 50-mil LLDPE Agru Super Gripnet® geomembrane cannot be used to represent the aerodynamic properties for a general 40-mil textured HDPE geomembrane. CTI can have three options: (1) change to use the same tested 50-mil LLDPE Agru Super Gripnet® geomembrane, (2) use the selected 40-mil textured HDPE geomembrane to rerun the aerodynamic test, or (3) use theoretical certification and practical experiences to demonstrate the aerodynamic properties of the selected geomembrane is equivalent to or better than the tested 50-mil LLDPE Agru Super Gripnet® geomembrane.

11. Similar to above Comment 10, a 50-mil LLDPE Agru Super Gripnet® geomembrane and not a proposed 40-mil textured HDPE geomembrane was used to conduct the ClosureTurf Integrity Study by SGI Testing Services, which was reported in Attachment E: ClosureTurf Integrity Study. The study was based on a condition that the 50-mil LLDPE Agru Super Gripnet® geomembrane was directly placed on the foundation soil and not on the GCL, see Figure 7 (i.e., Figure 1 in Attachment E) and Figure 8 (i.e., Figure 2 in 1.0 Purpose). Thus, there are at least two conditions for the proposed engineered turf cover (i.e., geomembrane and the material beneath the geomembrane are different with the demonstration study including in Attachment E. CTI must provide detailed description to explain whether or not the study results presented in Attachment E based on the cross section shown in Figure 7 is also suitable for the cross section shown in Figure 8. If so, why?

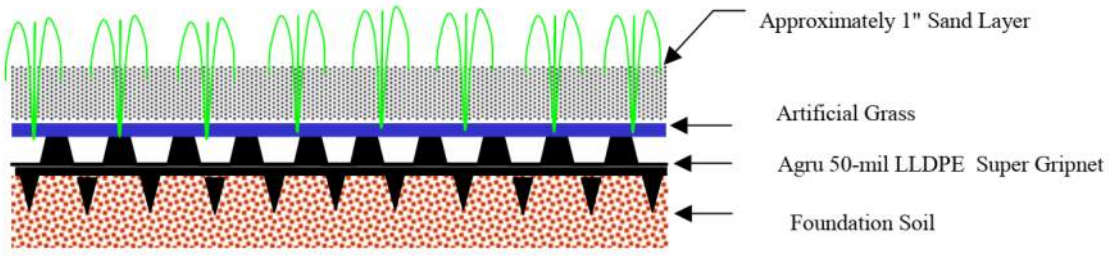

Figure 7 – Cross-section of the Closure Turf system used in integrity study (i.e., Figure 1 in Attachment E)

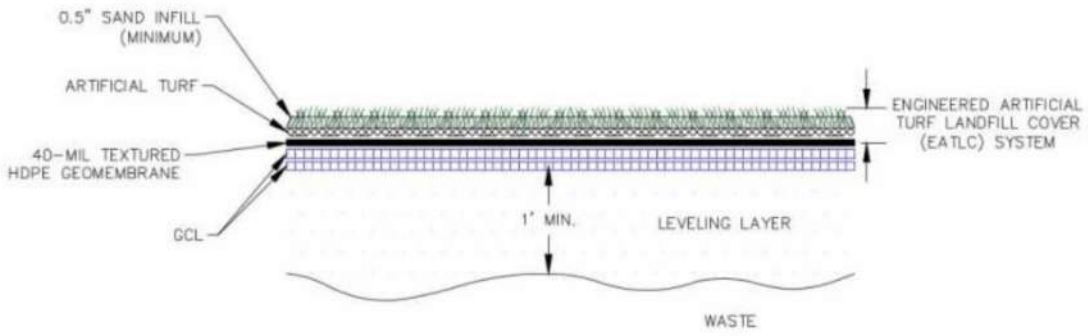

Figure 8 – Cross-section of the proposed engineered artificial turf landfill system (i.e., Figure 2 in 1.0 Purpose)

12. It can be seen from Figure 9 (i.e., Detail 3/19A in Drawing No. 19A of Attachment A: Drawings) that there are total eight (8) layers of geosynthetic materials will buried in a anchor trench. They are a layer of geogrid, 4 layers of GCL, 2 layers of 80-mil HDPE geomembrane, and a layer of double-side geocomposite. Although the anchor trench has expanded to 3-ft wide and 3-ft deep, it is impossible to bend 8 layers of geosynthetic materials to two 90-degree angles as shown in Figure 9, especially for the geocomposite with relatively large thickness and not easily curved. It is suggested that the end of the geocomposite can be stopped at the top edge of the anchor trench and not extended into the anchor trench. This will much improve the anchoring function of the barrier materials buried in the anchor trench.

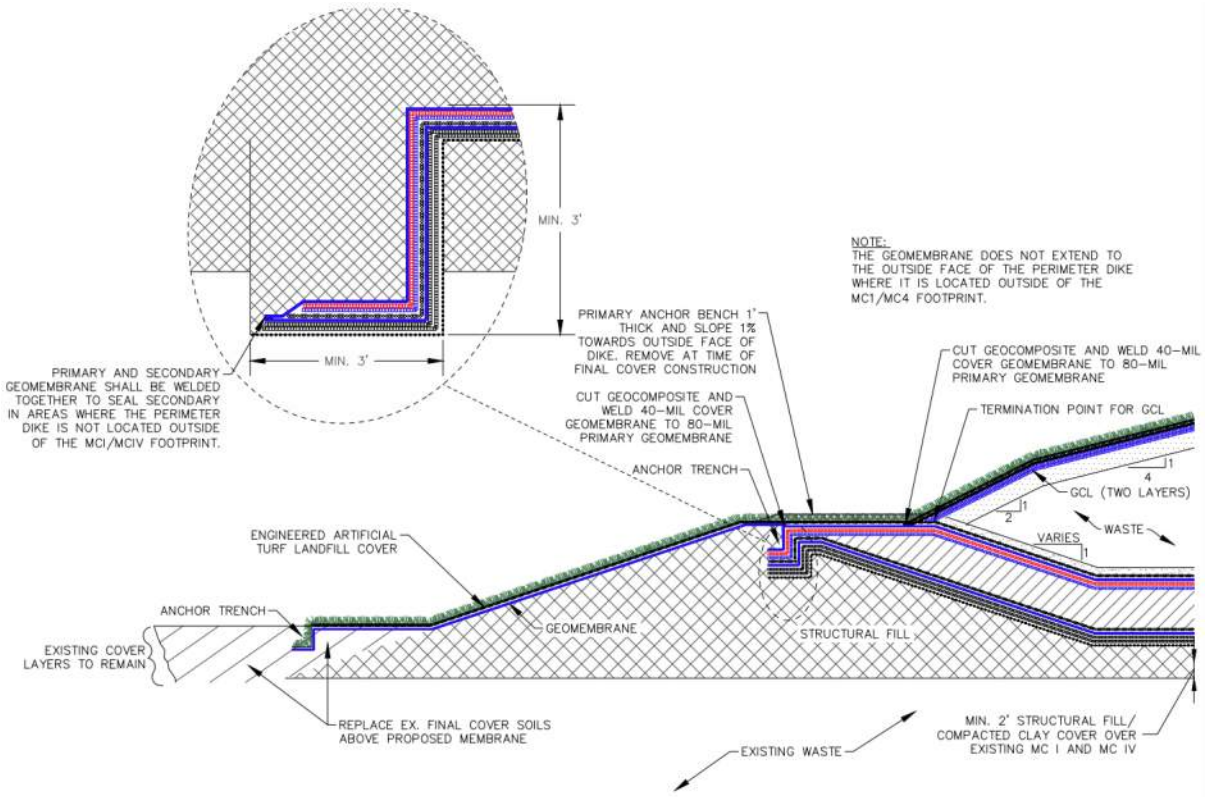

Figure 9 – Anchor trench detail (i.e., Detail 3/19A in Drawing No. 19A)

13. Drawing Nos. 10 and 11 in the Permit Engineering Drawings show the storm water management and sedimentation plan, which include the diversion berms parallel to the contour lines and the downslope channels perpendicular to the contour lines. Drawing Nos. 10A and 11A in the Permit Engineering Drawings and Attachment A: Drawings of Attachment B: Engineered Artificial Turf Landfill Final Cover Alternate show the storm water management and sedimentation plan by using the alternative engineered artificial turf cover system. No any downslope channel was shown on this alternative cover system. The diversion berms were only arranged near the south toe area and a part of the east toe area. Do the size of the diversion berms used on the alternative cover system are the same as the diversion berm used on the traditional cover system because the details of the cross section sizes of the diversion berms are not shown on Drawing Nos. 10A and 11A?

14. Only the diversion berms are shown on Drawing Nos. 10A and 11A for the alternative engineered turf cover system. The peripheral drainage system at the boundaries of the new vertical expanded cells MC VI-G4, MC VI-G5, MC VI-G6, and MC VI-G7 are not shown on these stormwater management drawings.

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RESPONSE TO EGLE TECHNICAL COMMENTS ON WDI 2021 PERMIT APPLICATION

Attachment B Engineered Artificial Turf Cover Alternate

Commented by EGLE on March 22, 2022

Responded by CTI on April 18, 2022

Please note the figures referenced by EGLE and the list of references at the end of the original document are appreciated but have been eliminated from this response for clarity. EGLE comments are reproduced in italics below for convenience. CTI responses follow in blue color.

1. *Per the Part 111 Rules requirement for the equivalent demonstration of the alternative final cover design, CTI should demonstrate if the proposed engineered artificial turf cover system is equivalent to the standard Part 111 cover system shown in Figure 1 and not a conventional solid waste cover system or a so-called permitted cover system. For example, the title of Table 1 – Comparison of Engineered Artificial Turf Landfill Cover to Convention Cover in 3.0 Equivalency Demonstration should be changed to Table 1 – Comparison of Engineered Artificial Turf Landfill Cover to Part 111 Rules Hazardous Landfill Cover, and the cover system used to conduct HELP model evaluation in Attachment I: Hydrologic Evaluation of Landfill Performance (HELP) Model also should be a standard Part 111 cover system vs. a proposed engineered turf cover system, and so on.*

Response: Table 1 in Section 3.0 is a qualitative analysis of the Engineered Artificial Turf Landfill Cover to the cover system called out in Part 111 of the Rule. The title of Table 1 has been modified to be: *"Equivalency of EATLC to Part 111 Rules Hazardous Landfill Cover"*

The HELP model for the conventional final cover (Attachment B1 of Attachment I) have been modified to the same requirements in Part 111.

The results from this revised model did not significantly change (Table 1 and 2 in Attachment I).

2. *CTI should indicate that the reinforced GCL must be used on the slope when the cover slop is greater than 10%.*

Response: Reinforced GCL is planned for use at WDI as part of the cap system on all landfill slopes. The following language has been added to the Engineered Turf Final Cover Detail Drawings: *"Reinforced GCL must be used on all slopes as part of the closure system*."

3. *GCL should be minimized expose time and be covered by geomembrane, engineered turf, and sand infill to minimize bentonite drying in the GCL during installation period if the final cover system is constructed in high temperature season. The normal moisture content of the bentonite in GCL is 35%. The shrinkage for the different types of GCLs can be up to from 7 to 22% (Thiel et al., 2006). Koerner and Koerner (2005a, 2005b) considered three possible mechanisms for GCL panel shrinkage: (1) Cyclic wetting and drying; (2) Longitudinal steep slope tensioning of the GCL; and (3) GCL contraction*

on relatively flat slopes caused by "gathering" under textured geomembranes. Of these three possibilities they believed that Mechanism 2 (slope tensioning) is the major factor that contributes to the problem in the field. Three actual projects in which GCL panels had either lost a portion of their original overlap or had completely separated are shown in Figure 2. The overlap distance is typically 6 to 12 inches (150 to 300 mm). The warm temperatures can reduce the moisture content of the bentonite and cause reduction or even complete loss of overlap distance. This is obviously unacceptable. If reduction in overlap distance from elevated temperatures is anticipated, the overlap should be increased (USEPA, 1993; Daniel and Koerner, 2007). In addition, unlike conventional Part 111 cover system, the proposed engineered artificial turf cover system does not have 2-ft protective soil and topsoil load applying on the GCLs and the normal load over the GCL is very small. It makes more potential movement and deformation of the GCLs due to construction equipment movement during construction, or temperature deformation and other effects during operation and long-term closure periods. The languages regarding minimize expose time for GCL during installation period and increasing the GCL overlap distance on the sideslope area should be added in the construction specifications.

Response: We agree that due to the lower confined normal pressure, the GCL could be subjected to the shrinkage issues under the artificial turf. However, comparing to the bare geomembrane cover over the GCL, the GCL in the EATLC is also protected by geomembrane, artificial turf, and sand infill. The confined normal pressure is significantly higher than the bare geomembrane. The artificial turf will also reduce UV radiation exposure for the geomembrane. With the sand infill layer, the temperature variation of the EATLC will be significantly lower than GCL under bare geomembrane. At this point, there is no study conducted on the potential GCL shrinkage in the EATLC to our knowledge. To take a conservative approach, we will propose the overlap distance based on information from the studies on GCL under bare geomembrane. We will revisit this issue when more information is available.

The GCL overlap between adjacent panels has been increased to 18-inches, which is the higher end of the range recommended in Thiel and Rowe (2010), to compensate for separation. In addition to the increased overlap distance, the installation procedure will include the use of heat tacking all seams, which was also recommended as a strategy to control shrinkage (Thiel and Rowe 2010). The following language has been added to the Engineered Turf Final Cover Detail Drawings:

"All geosynthetic clay liner (GCL) shall be covered with geomembrane within 24 hours after placement of GCL and overlapped a minimum of 18-inches during installation

All overlapped seams are to be heat-tacked using a quick pass of a flame torch followed by quick application of appropriate pressure as provided by a roller, foot pressure, or other means."

4. *CTI should provide the detail information to explain what type of geomembrane will be used in the proposed engineered artificial turf cover system, a special 50-mil LLDPE Agru Super Gripnet® geomembrane developed by Agru America, Inc. for a standard ClosureTurf cover system shown in Figure 3 or a general 40-mil textured HDPE geomembrane. If a special 50-mil LLDPE Agru Super Gripnet® geomembrane is selected, a drainage layer will be located between the geotextile base of the engineered synthetic turf and the Agru Super Gripnet® geomembrane (see Figure 4 and Figure 5). Then, Detail 1/19A Final Cover System in Drawing No. 19A must be revised to show this drainage layer in the cover cross section.*

Response: A special 50-mil LLDPE Agru Super Gripnet membrane is not expected to be needed for the slopes at WDI. Instead, as noted in the submittal, the version that includes a 40-mil textured HDPE membrane is expected to be used. Based on the veneer stability analysis (Attachment C), it will be adequate for maintaining the integrity of the overlying materials and will adhere to the underlying substrate.

5. *There is no any drainage trench located at the toe of the proposed engineered artificial turf cover system (see both Detail 3/19A Dike and Cover Tie-in Detail (Typ.) MC VI-F, MC VI-G, & East Side of MC VI-E and Detail 4/19A Dike and Cover Tie-in Detail North Side of MC VI-E. CTI should explain why the toe drainage is not needed for the proposed engineered artificial turf cover system. The traditional and artificial turf cover systems have different materials, structures, and thickness. They may cause the different amounts of the surface run-on and run-off, lateral drainage, soil moisture storage, infiltration, and evaporation and evapotranspiration. Because the proposed cover system uses the artificial turf that will not have the transpiration function and only have the evaporation function. In addition, this type of cover system does not have 2-ft soil protective layer and topsoil and also does not have soil moisture storage function. Thus, if the engineered turf cover system is used to replace the traditional cover system, the amount of the surface run-off may be increased.*

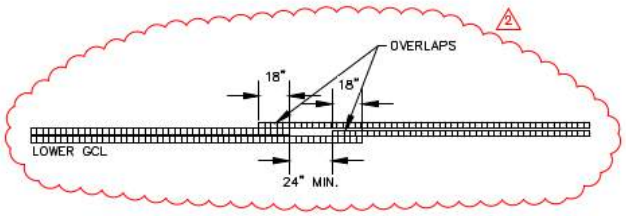
Response: The amount of runoff from EATLC is expected to be greater than traditional cover for the reasons noted. An evaluation of the surface runoff was conducted utilizing HydroCAD and recommended input parameters from the Closure Turf manufacturer. This evaluation was included in Attachment K. The weighted curve number for the EATLC is 95 which is significantly higher than the value used for the conventional cover which is 84.

Because the runoff remains on the surface, there is no need for a subsurface drainage collection system or toe drainage. Details 3, 4, and 5 were focused specifically on the different layers of the EATLC cap and their interaction/tie-ins with each other and the liner system. However, the closure turf will be terminated beyond a perimeter ditch. These perimeter ditches will capture the stormwater runoff which is managed above the liner/turf. Details 4 and 5 in Sheet 19A have been modified with a typical perimeter ditch for clarity.

6. *Two layers of GCL will be used in the engineered artificial turf cover system to replace 3-ft compacted clay layer. CTI should add a notice in construction specifications to stagger the overlapping positions of upper and lower layers of GCLs and avoid the side edge and end overlaps of the GCLs at the same locations for both layers of GCL*

Response: The following language has been added to the Engineered Turf Final Cover Detail Drawings: *"The Contractor shall install the two layers of the GCL staggered by a minimum 24-inches between upper and lower GCL seams."*

The following detail has also been added on Sheet 19A.



6 / 19 A GEOSYNTHETIC CLAY LINER OVERLAP DETAIL
NOT TO SCALE

7. *The geomembrane used in the proposed cover system shown in Figure 1 Cross Section (Typical ClosureTurf Cover) of Attachment C Veneer Stability Analysis (Page 52) is 40-mil LLDPE. However, the geomembrane used in the proposed cover system shown in Figure 2 Engineered Artificial Turf Landfill Cover System in 2.0 Configuration of the Final Cover System is 40-mil Textured HDPE Geomembrane. CTI must clarify this discrepancy.*

Response: The veneer stability analysis has been revised to be consistent with Figure 2 in Section 2.0 (using 40-mil HDPE geomembrane). This change does not alter the results or conclusions of the veneer stability analysis.

8. *The interface shear strengths for the current proposed engineered turf cover system is not only the interface friction angle between engineered components above geomembrane, δ_A (i.e., the interface friction angle between the engineered turf and geomembrane) and the interface friction angle between engineered components below geomembrane, δ_A (i.e., the interface friction angle between the geomembrane and soil). Based on the designed engineered turf cover system, the interface shear strengths that must be considered include the interface between the (1)base geotextile of the engineered turf and geomembrane, the (2)interface between the geomembrane and the top layer of GCL, the(3) interface between two layers of GCLs, and the (4)interface between the bottom layer of GCL and leveling soil layer. In addition, (5)the internal shear strength of two layers of GCL should also be considered in possible hydrated condition. All these considerations were not mentioned Attachment C: Veneer Stability Analysis. CTI must add some design and construction specifications to explain how to determine the critical interface or internal shear strength for the proposed final cover*

system to meet the required shear strength based on the calculations.

Response: The following language has been added to the Engineered Turf Final Cover Detail Drawings:

Construction of the final cover system shall be supported by a veneer stability analysis. Each geosynthetic/geosynthetic and geosynthetic/soil interface included in the EATLC system shall be considered for prequalification testing prior to installation of the cover system. The critical interface shall be determined by a comparison of interface strength test results of representative samples of materials used for construction for each interface. The critical interface is the lowest shear strength test result that corresponds to the normal stress exhibited by the EATLC cover system which is expected to be between 5 and 6 psf.

At minimum, the following interfaces shall have interface test results for comparison.

- *Base geotextile of the EATLC and Geomembrane*
- *Geomembrane and Top layer of GCL*
- *Top layer of GCL and Bottom layer of GCL*
- *Bottom layer of GCL and Leveling soil layer*
- *Internal shear strength of the GCL under hydrated conditions*

	Veneer Stability Interface Strength Requirements	
	Final Cover Slopes > 10%	Final Cover Slopes ⩽ 10%
Required Interface Strength Test Data	Large-Displacement Strength	Peak Strength
Min. Equiv. Acceptable Interface Strength*	18 Degrees	20.5 Degrees
Min. Acceptable FS for Veneer Stability	1.3	1.5

*Combinations of tested interface friction angle and shear strength intercept measured at the normal stress (5 to 6 psf) exhibited by the EATLC cover system that satisfies the factor of safety criteria are acceptable.

9. *Landfill usually settles a considerable amount during the filling operation and even after closure. The settlement of the waste fill causes the large deformation of the landfill cover system, which tends to induce shear stresses in the final cover system. These shear stresses induce large shear displacements along specific interfaces in the cover systems that may lead to the mobilization of reduced or residual interface strength (Mitchell et al., 1990; Seed et al., 1990). In addition, thermal expansion and contraction of the final cover systems during construction may also contribute to the accumulation of shear displacements and the mobilization of residual interface strength (Stark and Poeppel, 1994). Filz et al. (2001) conducted finite-element analyses using a displacement softening interface to investigate the effects of progressive failure on the slope stability of the geosynthetic lined and covered landfills. It was found that the interface (or internal) shear strength of the liner and cover systems on the sideslope are almost always in post-peak condition (i.e., in large-deformation or residual condition) even if the waste height is not high. It can be seen that the waste depth can be up to 210 feet from Drawing No. 12 of Attachment C of B6_Permit Engineering Drawings and the slope height of the final cover can be up to 190 feet from Drawing Nos. 12 and 14 of Attachment C of*

B6_Permit Engineering Drawings. The vertical riser pipes installed in MC VI-A-to-D have been damaged due to the waste settlement caused by about only 80-ft waste depth as shown in Figure 6. This shows that the settlement that occurs in the hazardous waste landfill is also quite large. Therefore, residual interface or internal shear strengths should be assessed and considered for the final cover system for a normal design condition to make a long-term landfill stable and safe even after being subjected to large waste settlements (Byrne, 1994; Gilbert et al., 1996; Esterhuizen et al., 2001; Filz et al., 2001).

Response: The following language has been added to the Engineered Turf Final Cover Detail Drawings:

Interface friction tests performed to qualify acceptable materials for placement of EATLC cover materials shall consider large-displacement strength test results on the final cover side-slopes steeper than 10% and peak strength test results for all other slopes. The minimum design factor of safety for static stability shall be 1.3 for final cover side-slopes steeper than 10% that consider large-displacement strength testing results. The minimum design factor of safety for static stability shall be 1.5 for all other final cover slopes that consider peak strength.

10. *A testing report entitled "Aerodynamic Evaluations of Closure Turf Ground Cover" included in Attachment D Wind Uplift Evaluation indicated that the geomembrane used to conduct test to evaluate the aerodynamic properties by GTRI is the 50-mil LLDPE Agru Super Gripnet® geomembrane and not a general 40-mil textured HDPE geomembrane indicated in the CTI proposed report. Therefore, the aerodynamic properties investigated by using the 50-mil LLDPE Agru Super Gripnet® geomembrane cannot be used to represent the aerodynamic properties for a general 40-mil textured HDPE geomembrane. CTI can have three options: (1) change to use the same tested 50-mil LLDPE Agru Super Gripnet® geomembrane, (2) use the selected 40-mil textured HDPE geomembrane to rerun the aerodynamic test, or (3) use theoretical certification and practical experiences to demonstrate the aerodynamic properties of the selected geomembrane is equivalent to or better than the tested 50-mil LLDPE Agru Super Gripnet® geomembrane.*

Response: Super Gripnet is not necessary for this application. Rerunning this test specifically for the 40 mil textured HDPE geomembrane is also not practical given the current access to the testing apparatus used to generate the test results provided. It should be noted that the fundamental aspect being measured in the aerodynamic testing is the ability of the turf to adhere to the underlying geomembrane without any mechanical connection between the two besides frictional resistance. By inspection, the Super Gripnet represents a conservative scenario in relation to the textured HDPE geomembrane. For the textured HDPE geomembrane, there is no appreciable gap between the geomembrane and the overlying geotextile backing allowing for more intimate contact and a greater degree of resistance to movement.

A recent paper (Zhu, M., at el. 2022) offers an additional method of analysis for evaluating the resistance of EATLC to uplift pressure. Using the results from the wind tunnel

experiment, a mean wind uplift pressure was calculated for the site based on ClosureTurf above a textured geomembrane (Attachment D2 - Amendment #1 Calculations). The calculated maximum uplift pressure was 3.60 psf and the weight of the ClosureTurf cover is 5.4 psf per unit area. The factor of safety for wind uplift is 1.5 under worst case wind conditions per ASCE 7-16.

11. *Similar to above Comment 10, a 50-mil LLDPE Agru Super Gripnet® geomembrane and not a proposed 40-mil textured HDPE geomembrane was used to conduct the ClosureTurf Integrity Study by SGI Testing Services, which was reported in Attachment E: ClosureTurf Integrity Study. The study was based on a condition that the 50-mil LLDPE Agru Super Gripnet® geomembrane was directly placed on the foundation soil and not on the GCL, see Figure 7 (i.e., Figure 1 in Attachment E) and Figure 8 (i.e., Figure 2 in 1.0 Purpose). Thus, there are at least two conditions for the proposed engineered turf cover (i.e., geomembrane and the material beneath the geomembrane are different with the demonstration study including in Attachment E. CTI must provide detailed description to explain whether or not the study results presented in Attachment E based on the cross section shown in Figure 7 is also suitable for the cross section shown in Figure 8. If so, why?*

Response: Review of the calculations provided in the demonstration performed by SGI show that the only fundamental difference in the demonstration and the proposed plan for WDI is how the material will perform on a slope, because the friction angle anticipated using 40-mil textured HDPE geomembrane is slightly lower than what would be anticipated using Super Gripnet. That is the only input parameter that varies from the assumptions in the SGI analysis and no other characteristic differences between the two geomembranes are germane to the analysis.

The submittal has been revised to include an amendment (Attachment E – Amendment #1) using the minimum friction angle derived from the veneer stability analysis. It shows a factor of safety lower than the result included in the SGI analysis, but still acceptable for traffic on the slope.

12. *It can be seen from Figure 9 (i.e., Detail 3/19A in Drawing No. 19A of Attachment A: Drawings) that there are total eight (8) layers of geosynthetic materials will buried in a anchor trench. They are a layer of geogrid, 4 layers of GCL, 2 layers of 80-mil HDPE geomembrane, and a layer of double-side geocomposite. Although the anchor trench has expanded to 3-ft wide and 3-ft deep, it is impossible to bend 8 layers of geosynthetic materials to two 90-degree angles as shown in Figure 9, especially for the geocomposite with relatively large thickness and not easily curved. It is suggested that the end of the geocomposite can be stopped at the top edge of the anchor trench and not extended into the anchor trench. This will much improve the anchoring function of the barrier materials buried in the anchor trench.*

Response: The details on Drawing 19A have been modified to show the termination of the geocomposite prior to the bend in the anchor trench.

13. *Drawing Nos. 10 and 11 in the Permit Engineering Drawings show the storm water management and sedimentation plan, which include the diversion berms parallel to the contour lines and the downslope channels perpendicular to the contour lines. Drawing Nos. 10A and 11A in the Permit Engineering Drawings and Attachment A: Drawings of Attachment B: Engineered Artificial Turf Landfill Final Cover Alternate show the storm water management and sedimentation plan by using the alternative engineered artificial turf cover system. No any downslope channel was shown on this alternative cover system. The diversion berms were only arranged near the south toe area and a part of the east toe area. Do the size of the diversion berms used on the alternative cover system are the same as the diversion berm used on the traditional cover system because the details of the cross section sizes of the diversion berms are not shown on Drawing Nos. 10A and 11A?*

Response: The diversion berms used for the engineered artificial turf cover (EATLC) system are larger than the diversion berms designed for the traditional final cover.

The diversion berms for the traditional cover system are shown on Drawings 10 and 11, and are discussed in detail in Appendix A-6.2 of the original submittal. Except DB-36, the traditional cover diversion berms are 2 ft high. DB-36 is 2.5 ft high.

The diversion berms for the EATLC are shown on Drawings 10A and 11A, and are discussed in detail in Appendix K-2 of the original submittal. The diversion berm heights for the EATLC are generally 2.5 or 3.0 ft high. Due to the small drainage area, the 2 ft high DB-G berm is the only EATLC berm less than 2.5 ft high.

14. *Only the diversion berms are shown on Drawing Nos. 10A and 11A for the alternative engineered turf cover system. The peripheral drainage system at the boundaries of the new vertical expanded cells MC VI-G4, MC VI-G5, MC VI-G6, and MC VI-G7 are not shown on these stormwater management drawings.*

Response: Engineering Drawings 10A and 11A are intended to show the surface water management features directly associated with the final cover. The peripheral drainage system features are shown in Figures 1 and 2 provided in Attachment K-1.5 of the original submittal. Calculations that discuss the evaluation of the North Sedimentation Basin, South Sedimentation Basin and related surface water control structures/features are provided in Attachment K-1.6. The North and South Sedimentation Basins and related surface water management features have sufficient capacity to manage surface water run-off flows under final conditions.

REFERANCES

Thiel, R., & Rowe, R. K. (2010). Technical Developments related to the Problem of GCL Panel Shrinkage when placed below an Exposed Geomembrane. 3rd International Symposium on Geosynthetic Clay Liners.

Zhu, M., Sarkar, P., Hou, F., & Zheng, J. (2022), Wind Tunnel Study and Uplift Analysis of Geosynthetic Covers. Geo-Congress

Attachment B

EATLF Alternate

Revision 1 – 4/15/22

US Ecology
Wayne Disposal, Inc.
Belleville, Michigan

Engineered Artificial Turf Landfill Cover Equivalency Demonstration

Rev.0 - November 2021

Rev.1 – April 2022

Prepared for:

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Amendment #1 Maximum Mean Wind Uplift Pressure Calculation

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1.0 PURPOSE

CTI and Associates, Inc. has prepared this report to demonstrate the equivalency of Engineered Artificial Turf Landfill Cover (EATLC) system to Part 111 cover system. Final cover requirements specified by Code of Federal Regulations (CFR) §264.310 require the final cover to in part:

- Provide long-term minimization of migration of liquids through the closed landfill
- Promote drainage of the cover
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

In addition to prescriptive requirements for the final cover over a hazardous waste landfill, Michigan Administrative Code R 299.9619(6)(a) also states the owner or operator can: Substitute an equivalent design which shall include a flexible membrane liner component with a minimum thickness of 1 mm (40 mil), depending on the type of material selected, and demonstrates to the director that it provides equivalent environmental protection.

The following sections will demonstrate that EATLC provides similar or better performance to the current final cover system. This demonstration compares the following key characteristics:

- Minimizing Maintenance
- Minimizing Infiltration
- Minimizing Erosion Potential
- Promotion of Surface Water Runoff
- Resisting Damage from Settlement
- Promoting Slope Stability

2.0 CONFIGURATION OF THE FINAL COVER SYSTEM

2.1 RULE REQUIRED COVER SYSTEM

The current rule required cover system for a hazardous waste landfill consists of the following components (from bottom to top):

- Compacted Clay – 90cm/36-in (min)
- Flexible Membrane Liner - 40-mil
- Additional Material - 60cm/24-in maximum depth of frost protection

2.2 ENGINEERED ARTIFICIAL TURF LANDFILL COVER SYSTEM

The Engineered Artificial Turf Landfill Cover system will consist of the following components (from bottom to top):

- Leveling Layer - 1-ft (min)
- Geosynthetic Clay Liner (Two layers)
- HDPE Geomembrane - 40-mil textured
- Engineered Artificial Turf
- Sand Infill - 0.5-inch

Figure 2 below depicts the details of the final cover system based on the proposed EATLC design. Additional details of the EATLC system as part of the final cover system are included in **Attachment A**. Photos of the top and underside of the EATLC are presented in **Figure 3 and 4**, respectively.

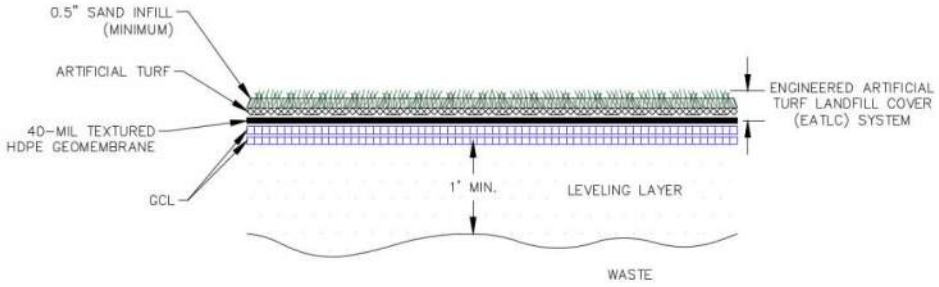


Figure 1 – Engineered Artificial Turf Landfill Cover System

Figure 2 - View of engineered artificial turf with sand infill and textured geomembrane

Figure 3 - Underside view of engineered artificial turf and textured geomembrane

3.0 EQUIVALENCY DEMONSTRATION

3.1 SUMMARY

This demonstration generally applies to alternative covers consisting of engineered artificial turf. However, all the specific data cited is reflective of ClosureTurf, a commercially available product manufactured by WatershedGeo designed specifically for landfill cover systems. It is to date perhaps the best known and best studied system. Other similar systems exist and as they are developed and come to market are likely to behave similarly and have similar properties. WDI will evaluate other similar systems at the time of the final cover installation based on specifications and the data provided by manufacturers. The selected products shall provide equivalent functions and performance as demonstrated in this report.

This demonstration shows that based on all the key and relevant criteria evaluated, engineered artificial turf landfill cover systems have been demonstrated to perform at least as well as traditional cover systems. **Table 1** below shows a summary of these specific criteria. The remainder of the document provides detail to support the conclusions in **Table 1**. Drawings and details depicting EATLC used in the final cover system at WDI are contained in **Attachment A**.

Table 1 – Comparison of Engineered Artificial Turf Landfill Cover to Part 111 Rules Hazardous Landfill Cover

Category		Criterion for Evaluation	Equivalency of **EATLC** to Part 111 Rules Hazardous Landfill Cover			
				EATLC		Conventional Cover
Incl. 40 mil min Geomembrane [per R 299.9619(6)(a)]			✓	40 mil		40 mil (typ)
Minimize	Maint-enance	Turf resilience	✓	Permanent, no mowing, no reseeding		Continual mowing and upkeep
		Slope stability	✓	Critical interface is FML/GCL/GCL/Soil		Critical interface is FML/GCL/Soil
		Static factor of safety (sat. cond)	✓	1.9-2.4 (typ) – slope 4:1		1.3 – 1.5 (typ) - max. slope 4:1
	Erosion	Annual estimated erosion amount	✓	<0.5 tons per acre per year		Up to 2 tons per acre per year

		Resistance to shear forces	✓	Limiting flow velocity is >11 ft/s		Limiting flow velocity 5 ft/s (without turf reinforcement mats)
	Infiltra-tion	Storm water leakage into landfill	✓	0.000 in/day (per HELP Model)		0.000 in/day (per HELP model)
		Reduce ponding potential	✓	Min. slopes ≥ 4% (easy to observe ponding)		Min. slopes ≥ 4%
Promote Runoff		Subsurface drainage capacity	✓	No need (all drainage managed on surface)		Limited by geocomposite capacity
		Runoff curve number	✓	92-95 (typ)		<90 (typ)
		Cover retains water	✓	Infiltration layer eliminated		Infiltration layer holds water
Resist Damage from Settlement		Rutting and deformation of cover	✓	Low potential, subgrade stays dry		Higher potential, subgrade retains water
		Time to complete repairs	✓	Hours		Days to repair/ weeks for new media

3.2 MAINTENANCE

The vegetative/infiltration layer in traditional cover systems typically requires a number of significant maintenance activities through closure and post-closure of the landfill. These can include:

- Mowing/excess vegetation removal
- Establishment/reestablishment of vegetation
- Erosion protection/repair
- Desiccation repair
- Addressing burrowing animals/burrow repair
- Settlement/Ponding
- Silt/sedimentation removal from drainage channels

By contrast, one of the biggest advantages of engineered artificial turf landfill cover systems is it greatly reduces the maintenance efforts making for a more protective barrier because it is more likely to remain intact throughout the closure/post-closure period.

EATLC has the following maintenance related properties:

- It does not require mowing
- Panels can be replaced more easily and within a matter of hours
- Resistance to erosion
- Resistance to damage from animals
- Settlement is more easily spotted and repaired
- Negligible sedimentation runoff

The technical aspects of these items are detailed more fully below.

3.2.1 Design Life

The engineered turf blades of engineered turf are specifically designed to resist the damaging effects of prolonged ultraviolet exposure. The design lifetime of the complete cover system is represented by the half-life of when half of the tensile strength of the synthetic turf fibers is reached from UV degradation. For ClosureTurf, Watershed Geo has conducted UV performance testing over the past several years at a testing facility in New River, Arizona and at some of the original closure turf installation locations (Pensacola, Florida and Jena, Louisiana). Independent performance assessments indicate that the half-life

(50% retained tensile strength) of the UV exposed HDPE grass blades is in excess of 100 years. See Figure 7 of the report included as part of **Attachment B**. The extrapolated service life is expected to be on the order of 200 years or greater, based upon the minimum required tensile strength.

The other components of the EATLC system also have design lives well over 100 years. Both the geomembrane and the geotextile backing component of engineered turf are shielded from UV exposure by the turf fibers and the infill sand and resist degradation. This results in extending the design life in comparison to exposed materials, so those protected components are expected to have a design life of several hundred years.

3.2.2 Veneer Stability

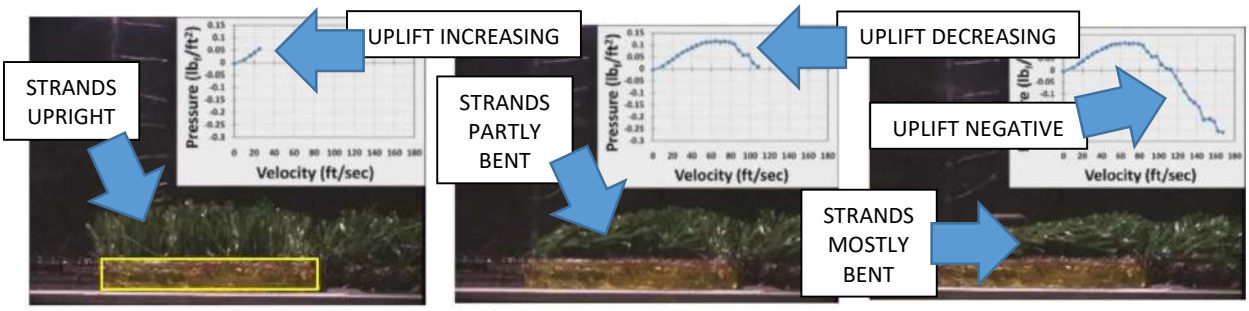
Sliding of the soil cover on top of the geomembrane in a traditional cover system is a potential design concern. This is especially true after major storm events if the drainage system between the soil and geomembrane is not properly designed. For EATLC, the thick soil component is removed, eliminating the potential for seepage forces to build up providing for greater stability. For the proposed design at WDI, the critical interfaces are the same for both systems, that is FML/GCL, GCL/GCL, and GCL/Soil. By eliminating the soil veneer, greater stability and steeper slopes with the same factor of safety are achievable.

Veneer stability analyses were performed to compare each cover system by determining the required interface friction angle for the critical interface(s) and demonstrate the stability of the final cover soils over the cap/cover system geosynthetics. The longest and steepest slope was chosen to be analyzed for minimum interface shear strength requirements, and the following two conditions were checked: Static Unsaturated and Static Saturated. The results of this analysis are given in **Attachment C**. The analyses indicate that the factors of safety are well above the minimum required values for both conditions.

3.2.3 Wind Uplift

A related concern for EATLC is wind uplift. The geotextile/turf layer is designed to be installed on top of the geomembrane and remain in place without anchoring it to the geomembrane below. It relies on interface friction and overlying sand ballast to remain immobile.

The Georgia Tech Research Institute conducted 2D, full scale wind tunnel tests to evaluate ClosureTurf under several wind speeds to evaluate aerodynamic properties and potential for uplift. The experiment measured the aerodynamic forces acting on the permeable upper turf layer and evaluated the wind speed in relation to the sand ballast. The purpose of the ballast is twofold: 1) Prevent liftoff and 2) Prevent tangential motion along the interface between the turf material and the geomembrane underlayment resulting from aerodynamic lift and drag acting on the turf layer. The testing performed determined the sand ballast requirements needed to counteract the uplift pressure. Illustration of the test and the results are depicted in **Figure 5** below. Interestingly, maximum uplift occurs at around 50 mph before the uplift begins to drop and become negative. This is due to the grass blades bending over, breaking the suction force resulting in a downward force due to drag. The maximum uplift corresponds to approximately 0.12 psf. This is much less than the downward force created by 0.5 in of sand which is approximately 4.5 psf.



V_{inf} = 25 ft/sec = 17 mph V_{inf} = 110 ft/sec = 75 mph V_{inf} = 170 ft/sec = 115 mph

Figure 4 – Wind tunnel testing results

The wind tunnel testing compared uplift pressure at both the interior and along the edge of the samples. Maximum uplift pressure was observed along the edge. At 66 mph, which represents the historical peak wind gust for Detroit based on the available wind data from the National Climatic Data Center, the minimum sand ballast required was 0.2 in. Additional details are contained in **Attachment D.**

Likewise, another wind tunnel study completed to evaluate geosynthetic covers which included Closure Turf. This study evaluated the maximum mean wind uplift pressure utilizing wind speeds from ASCE 7-16 and compared them to the weight of the Closure Turf engineered turf cover with a sand infill thickness of 0.5 inches. The study and subsequent calculation are located in Attachment D/Attachment D - Amendment#1.

3.2.4 Rutting

For conventional soil covers, the soil infiltration layer holds water during the wetter portions of the year. When this occurs in areas that require routine access or areas along access road alignments can experience rutting from vehicles and possibly even foot traffic.

Engineered artificial turf was evaluated by another 3rd party consultant (SGI) for subgrade integrity where ground pressure from heavy equipment was evaluated in relation to maintaining the integrity of the engineered artificial turf landfill cover components. Results showed that when the subgrade is protected by EATLC, including the sand infill, the subgrade can handle equipment with tire pressures up to 60 psi on 3H:1V slopes and up to 90 psi on relatively flat slopes with no appreciable damage to the engineered turf of the subgrade. This evaluation is contained in **Attachment E**.

3.2.5 Ponding/Settlement Repairs

For a conventional cover system, settlement may lead to ponding on the surface and local saturation of infiltration layer. Because of the resulting soft subgrade, repairs may be delayed due to difficulties getting the necessary heavy equipment to the area and/or risking additional damage to the cover system from rutting and erosion from the equipment. As shown in **Figure 6**, excessive settlement can also affect the performance of the underlying geosynthetics which may or may not be apparent at the surface. Vegetated cover soils can obscure the ability to inspect for geosynthetic defects or anomalies resulting from excessive settlement. The presence of the vegetated soil layer also hinders the ability to implement repairs, in the event that the corrective measures are necessary since it must be fully over excavated to make repairs which can require significant effort and delay repairs even more. Finally, once the repairs

are made, it may take several weeks to reestablish vegetation before the repair is fully implemented. Total time for repairs is likely measured in weeks perhaps to more than a month.

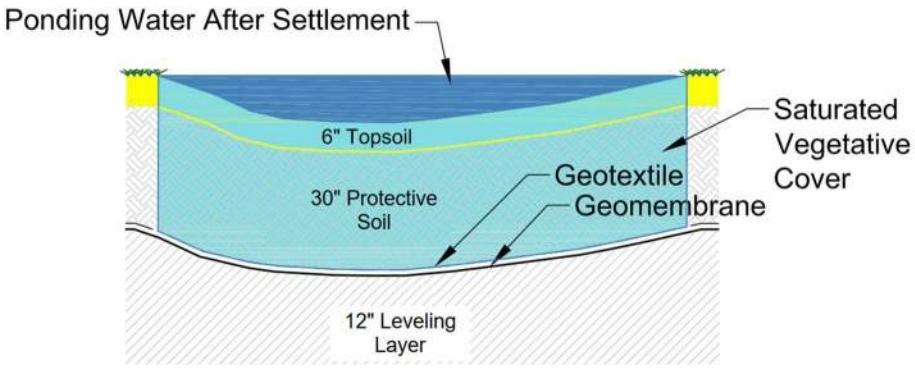


Figure 5 – Repairs to conventional cover

In contrast, repair of settlement in areas where engineered artificial turf landfill cover is utilized can be addressed much more quickly as depicted in **Figure 7**. Because there is no soil component, the potential for soft subgrade is minimized and the geosynthetic components can be readily accessed and inspected. Any ponded water can be pumped and removed, the geosynthetics removed to reveal the settlement area, the depressed area filled with soil to bring it back up to grade, and the area quickly seamed and repaired. There is no need to reseed the area. Total time for repair can likely be measured in hours.

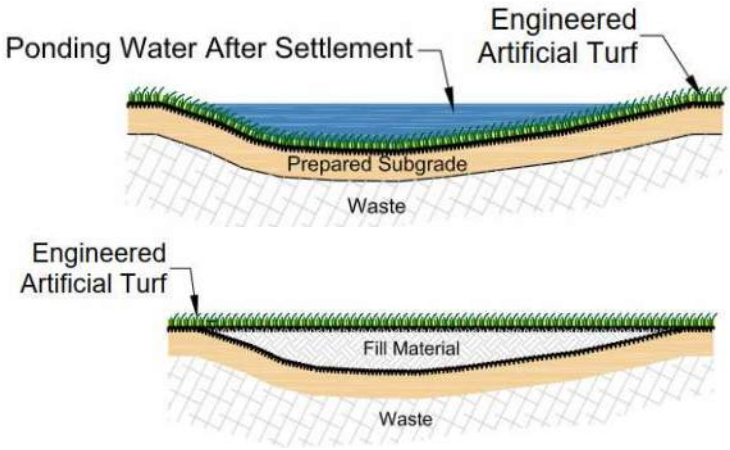


Figure 6 – Repairs to Engineered Artificial Turf Landfill Cover

3.3 EROSION

For a conventional cover system, the ability to resist erosion is primarily related to the establishment (and retention) of adequate vegetation. It can be difficult to establish and maintain adequate vegetation across the full extent of a landfill. Extended periods of drought can quickly transition to high intensity downpours.

The vegetative/infiltration soil layer is the primary component of the conventional cover system which is subject to erosion. On-site soils that are likely to be used for this layer consist primarily of a combination of silt, clay, and sand particles in various proportions. Erosional stability of these individual particles is influenced by soil adhesion, vegetative cover, and internal friction. Erosion of the vegetative soil layer cannot be entirely arrested since some of the stability parameters vary over time and various climatic conditions. Silt loams, loams, fine sands and sandy loams are the most detachable soil particles (Morgan, 2005) which make up a large percentage of vegetative soil.

Based on the current design, the estimated annual rate of soil erosion (discharge) from the conventional vegetative cover system is predicted to range up to 1.3 tons per acre, per year (USE 2021). Also, significant, additional erosion could occur during a single, extreme storm event potentially resulting in damage to the engineered soil components requiring costly repairs. Additionally, perimeter channels within a conventional cover can become laden with sediments which can be detrimental to vegetation in that zone and can lead to water quality concerns, erosion rills, and an increasingly complex maintenance program to maintain adequate vegetation.

Engineered artificial turf landfill cover is designed to essentially eliminate this potential by eliminating the vegetative/infiltration soil layer. The EATLC system does have a 0.5-in thick specified infill sand layer that is spread within the engineered artificial turf layer which is used for ballast and for UV protection of the underlying geotextile backing of the engineered artificial turf components. However, in comparison to traditional cover, the sand infill is much less erodible. It consists of a coarse-grained sand meeting specific standards tested for resistance to erosion. Stability of the sand aggregates is influenced by internal friction and turf strand reinforcement which are static properties and allow for the potential for soil erosion to be minimized by design.

Watershed Geo has completed extensive hydraulic testing to evaluate the sand infill's performance under various surface water conditions. The summary of this testing program is included in **Attachment F** and the sand infill specifications developed from this testing is included in **Attachment G**. Sand infill that conforms to these specifications is expected to experience minimal sand movement under the design surface water conditions.

3.4 Infiltration Equivalency

By design, the vegetated soil layer is intended to act as a large sponge which soaks up precipitation during storm events and provides a moisture reservoir for the vegetation. However, one of the undesirable consequences of the sponge action is that each time the soil layer becomes saturated (during prolonged storm events), the soil layer will slowly release or seep a steady flow of water across the underlying cover membrane for several days after the storm event. Subsequently, the opportunity for water leakage through any cover membrane defects is extended. Therefore, the presence of the vegetated soil layer inadvertently prolongs an undesirable window of opportunity where leakage might occur.

Alternative engineered artificial turf landfill cover systems perform similar to or better than the prescribed traditional cover systems in terms of infiltration (Carlson, et al., 2019). The primary reasons for this are 1) The geomembrane material is itself designed to be essentially impermeable and 2) Because they don't have a soil component that could potentially hold water, synthetic turf cover systems like ClosureTurf have a much smaller hydraulic head over the geomembrane layer driving infiltration in comparison to traditional cover systems. The full technical paper cited is provided in **Attachment H**.

The final cover systems described in Section 2.0 were each modeled in the USEPA's Hydrologic Evaluation of Landfill Performance (HELP) Model. The results showed that EATLC compared to the current permitted traditional cover system produced similar rates and sheds much more water than a traditional cover system. The analysis shows that both cover systems allow for negligible flow through the geosynthetic composite cover. The EATLC system meets the criteria from a hydrologic standpoint of being at least as protective as the permitted cover system. Complete results for the entire simulation period are included in **Attachment I**.

3.5 Surface Water Considerations

The use of an engineered artificial turf landfill cover system allows the landfill to manage a larger volume of surface water with similar or smaller annual infiltration compared to a traditional cover system. For a traditional cover system, benches and berms are designed to intercept long flow paths of runoff and prevent rill erosion. With engineered artificial turf, the cover system isn't subjected to this same rill erosion even for long flow lengths. This allows for the removal of mid-slope features and the EATLC is then able to utilize surface flow as the primary means of conveyance. Without these intercept features and with the higher run-off coefficients, the cover system will discharge faster and minimize the time that surface water is flowing on the geomembrane liner. The complete technical paper that compares the hydrologic performance of engineered artificial turf to a traditional cover system is included in **Attachment J**.

A surface water analysis was performed for the use of EATLC. The currently permitted design was updated to account for the properties of EATLC. For example, the design run-off curve number for EATLC is 95, compared to 84 for the traditional cover system. Compared to the traditional final cover system the downslope channels and almost all of the diversion berms in the landfill expansion area were removed. The only berms that remain are along select locations of the perimeter of the landfill to route runoff to ditches and storm sewer inlets. Plans showing the location of the remaining berms are included in **Attachment A**. The runoff velocity and flow depths in some downstream ditches also increased. To handle this, the ditches receiving sheet flow from EATLC areas will be lined with engineered artificial turf. The height of the containment berms on the outside edge of the perimeter channels are being increased or channel lining modified, as necessary, to accommodate the higher runoff volumes. Also, some culverts increased in size to transmit the increased flows. The complete surface water analysis is included in **Attachment K**. The EATLC stormwater management system is shown on Figures 1 and 2 in Attachment K-1.5.

The run-off water quality characteristics, including turbidity (total suspended solids), for a traditional cover system tend to degrade during high intensity precipitation events, because of increased flow rates and increased erosional shear forces on the vegetative soils. The turbidity water quality related to an EATLC system remains clear throughout a wide spectrum of high intensity storm events since the manufactured sand infill lacks fine silt or clay particles and has been engineered to specifically resist the range of expected erosional forces.

Concerns regarding other potential water quality considerations (nitrates, BOD, fertilizers, etc.) are also eliminated with an EATLC system.

3.6 Additional Considerations

In addition to the technical considerations, there are other considerations for the use of engineered artificial turf landfill cover.

3.6.1 Aesthetics

Figure 7 – Engineered artificial turf options

The engineered artificial turf component is available in a variety of colors to better blend in with adjacent topography and vegetation. It can be installed with a random pattern to look more natural as shown in **Figure 8.**

3.6.2 Carbon Footprint

Based on a 2012 study, the CO_2 footprint of engineered artificial turf systems are only 20% of the traditional multilayered cover systems (Koerner, 2012). This is largely due to greatly reducing truck and equipment traffic and the ability to install engineered artificial turf approximately 50% faster than conventional cover. This process is depicted in **Figure 9**. This also increases safety for both onsite personnel and offsite motorists sharing the road with haul trucks.

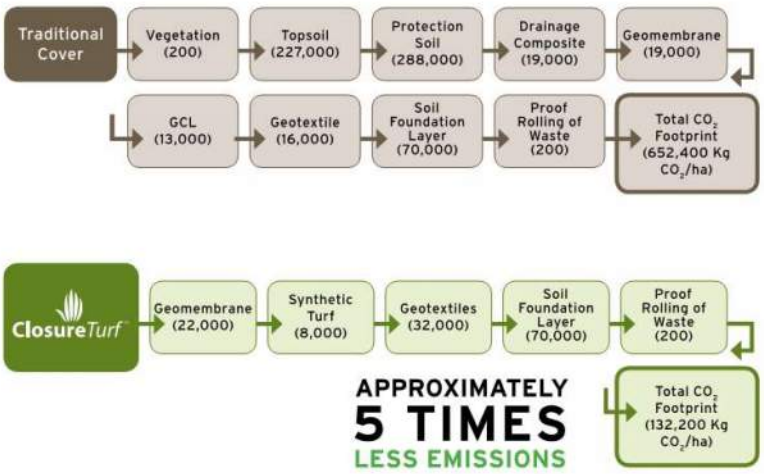


Figure 8 – CO_2 footprint traditional vs. ClosureTurf

3.6.3 Renewable Energy

Engineered artificial turf landfill cover systems can also be leveraged to be better locations for renewable energy projects. As depicted in Figure 9 which shows obvious challenges with mowing around solar panels, lowered maintenance costs are perhaps the most noticeable advantage where mowing can be eliminated, erosion potential is very low, and repairs are more easily performed where needed. In some cases, maintenance requirements like mowing can make projects cost prohibitive.

Figure 9 – Example of renewable energy project where maintenance could be reduced using EATLC

4.0 REFERENCES

Carlson, C. P., Zhu, M. & Ebrahimi, A., 2019. *Hydrologic Performance of Synthetic Turf Cover Systems and Their Equivalency to Prescriptive Cover Systems.* Houston, Industrial Fabrics Association International, p. 8.

Koerner, R. M., 2012. Traditional vs. Exposed Geomembrane Landfill Covers. *Geosynthetics*, 1 October, pp. 34-41.

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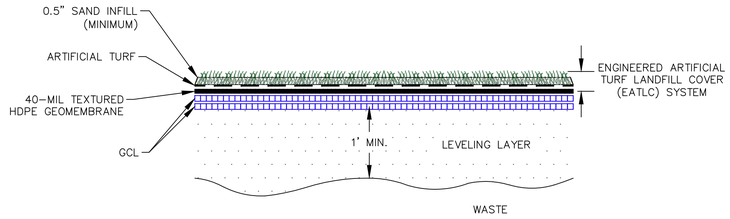
USE, 2021. 2021 WDI Permit Modification, Calculation A-6.9

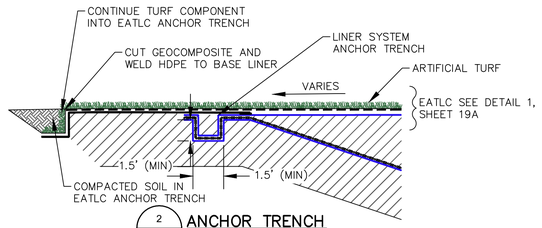
Attachment A

Drawings

Sheet 19A_Rev2 – 4/15/22



1 / 19 A **FINAL COVER SYSTEM**
NOT TO SCALE



2 / 19 A **ANCHOR TRENCH**
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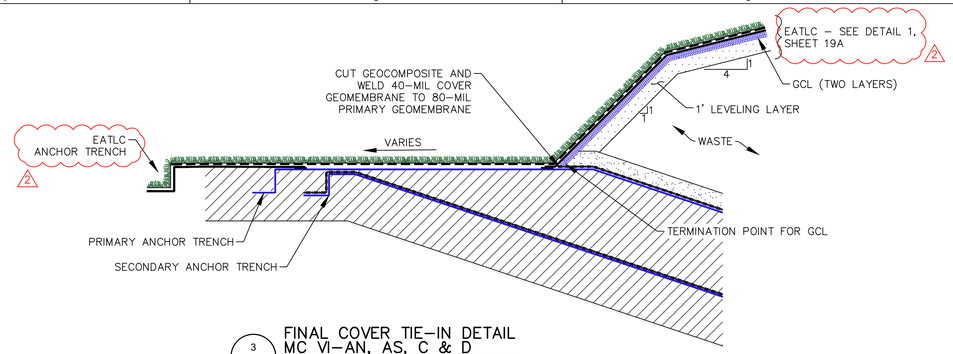
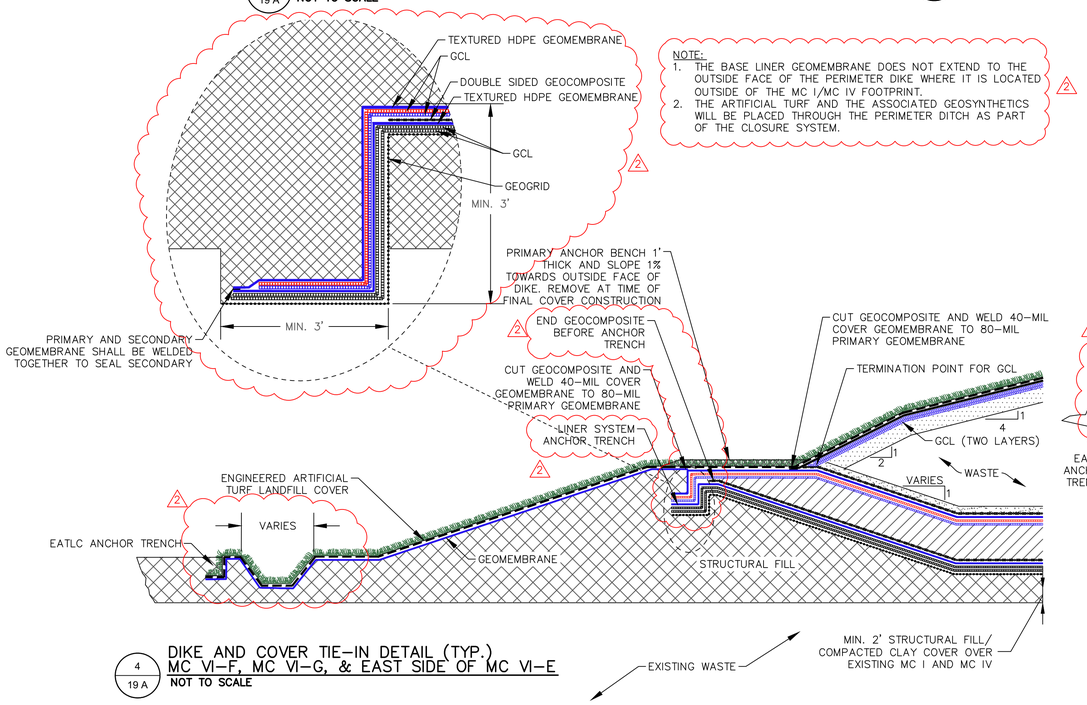
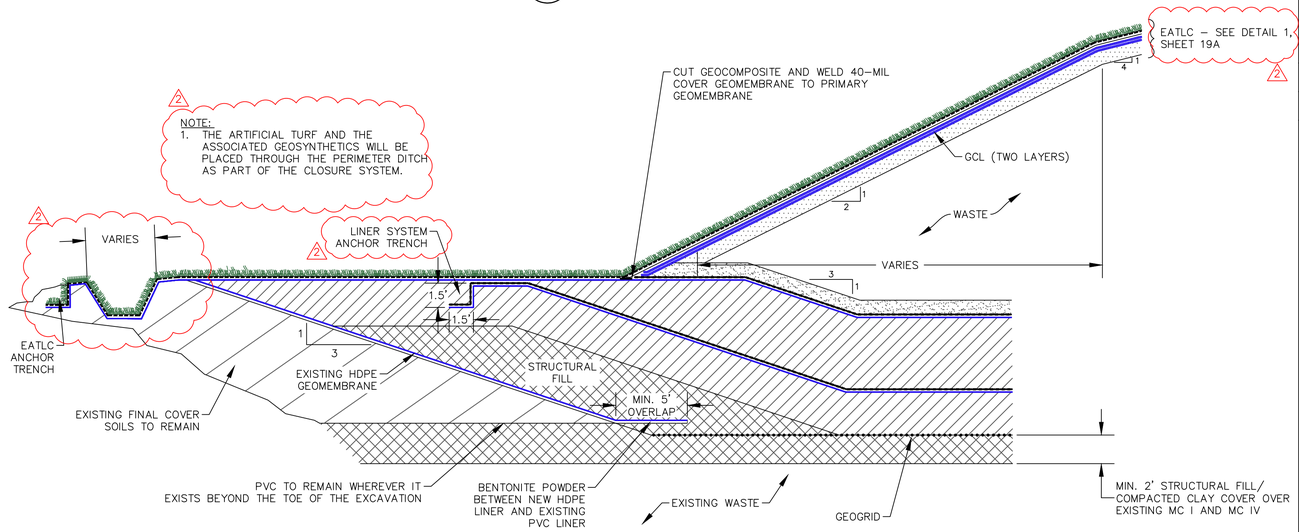


3 / 19 A **FINAL COVER TIE-IN DETAIL MC VI-AN, AS, C & D**
NOT TO SCALE

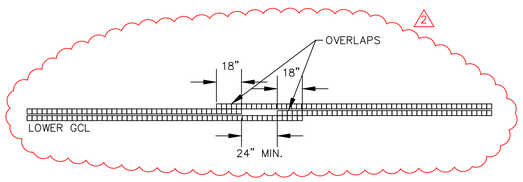


NOTE:
1. THE BASE LINER GEOMEMBRANE DOES NOT EXTEND TO THE OUTSIDE FACE OF THE PERIMETER DIKE WHERE IT IS LOCATED OUTSIDE OF THE MC I/MC IV FOOTPRINT.
2. THE ARTIFICIAL TURF AND THE ASSOCIATED GEOSYNTHETICS WILL BE PLACED THROUGH THE PERIMETER DITCH AS PART OF THE CLOSURE SYSTEM.

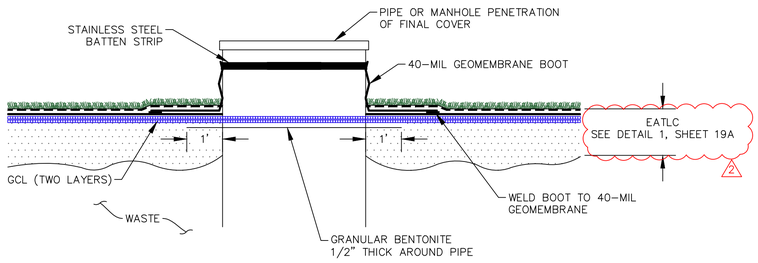
4 / 19 A **DIKE AND COVER TIE-IN DETAIL (TYP.) MC VI-F, MC VI-G, & EAST SIDE OF MC VI-E**
NOT TO SCALE



5 / 19 A **DIKE AND COVER TIE-IN DETAIL NORTH SIDE OF MC VI-E**
NOT TO SCALE



6 / 19 A **GEOSYNTHETIC CLAY LINER OVERLAP DETAIL**
NOT TO SCALE



7 / 19 A **FINAL COVER PENETRATION DETAIL (TYP.)**
NOT TO SCALE

NOTE:
1. ALL GEOSYNTHETIC CLAY LINER (GCL) SHALL BE COVERED WITH GEOMEMBRANE WITHIN 24 HOURS AFTER PLACEMENT OF GCL AND OVERLAPPED A MINIMUM OF 18-INCHES DURING INSTALLATION.
2. ALL OVERLAPPED SEAMS ARE TO BE HEAT-TACKED USING A QUICK PASS OF A FLAME TORCH FOLLOWED BY QUICK APPLICATION OF APPROPRIATE PRESSURE AS PROVIDED BY A ROLLER, FOOT PRESSURE, OR OTHER MEANS.
3. THE CONTRACTOR SHALL INSTALL THE TWO LAYERS OF THE GCL STAGGERED BY A MINIMUM OF 24-INCHES BETWEEN UPPER AND LOWER GCL SEAMS.
4. REINFORCED GCL MUST BE USED ON ALL SLOPES AS PART OF THE CLOSURE SYSTEM.
5. CONSTRUCTION OF THE FINAL COVER SYSTEM SHALL BE SUPPORTED BY A VENEER STABILITY ANALYSIS. EACH GEOSYNTHETIC/GEOSYNTHETIC AND GEOSYNTHETIC/SOIL INTERFACE INCLUDED IN EATLC SYSTEM SHALL BE CONSIDERED FOR PREQUALIFICATION TESTING PRIOR TO INSTALLATION OF THE COVER SYSTEM. THE CRITICAL INTERFACE SHALL BE DETERMINED BY A COMPARISON OF INTERFACE STRENGTH TEST RESULTS OF REPRESENTATIVE SAMPLES OF MATERIALS USED FOR CONSTRUCTION FOR EACH INTERFACE. THE CRITICAL INTERFACE IS THE LOWEST SHEAR STRENGTH TEST RESULT THAT CORRESPONDS TO THE NORMAL STRESS EXHIBITED BY THE EATLC COVER SYSTEM WHICH IS EXPECTED TO BE BETWEEN 5 AND 6 PSF.

AT MINIMUM, THE FOLLOWING INTERFACES SHALL HAVE INTERFACE TEST RESULTS FOR COMPARISON.
- BASE GEOTEXTILE OF THE EATLC AND GEOMEMBRANE
- GEOMEMBRANE AND TOP LAYER OF GCL.
- TOP LAYER OF GCL AND BOTTOM LAYER OF GCL.
- BOTTOM LAYER OF GCL AND LEVELING SOIL LAYER.
- INTERNAL SHEAR STRENGTH OF THE GCL UNDER HYDRATED CONDITIONS.

7. INTERFACE FRICTION TESTS PERFORMED TO QUALIFY ACCEPTABLE MATERIALS FOR PLACEMENT OF EATLC COVER MATERIALS SHALL CONSIDER LARGE-DISPLACEMENT STRENGTH TEST RESULTS ON THE FINAL COVER SIDE-SLOPES STEEPER THAN 10% AND PEAK STRENGTH TEST RESULTS FOR ALL OTHER SLOPES. THE MINIMUM DESIGN FACTOR OF SAFETY FOR STATIC STABILITY SHALL BE 1.3 FOR FINAL COVER SIDE-SLOPES STEEPER THAN 10% THAT CONSIDER LARGE-DISPLACEMENT STRENGTH TESTING RESULTS. THE MINIMUM DESIGN FACTOR OF SAFETY FOR STATIC STABILITY SHALL BE 1.5 FOR ALL OTHER FINAL COVER SLOPES THAT CONSIDER PEAK STRENGTH.
8. NO EQUIPMENT TRAFFIC SHALL BE ALLOWED TO TRAVERSE AREAS OF EATLC WITHOUT PRIOR APPROVAL BY THE ENGINEER.

VENEER STABILITY INTERFACE STRENGTH REQUIREMENTS		
	FINAL COVER SLOPES > 10%	FINAL COVER SLOPES ≤ 10%
REQUIRED INTERFACE STRENGTH TEST DATA	LARGE-DISPLACEMENT STRENGTH	PEAK STRENGTH
MIN. EQUIV. ACCEPTABLE INTERFACE STRENGTH*	18 DEGREES	20.5 DEGREES
MIN. ACCEPTABLE FS FOR VENEER STABILITY	1.3	1.5

*COMBINATIONS OF TESTED INTERFACE FRICTION ANGLE AND SHEAR STRENGTH INTERCEPT MEASURED AT THE NORMAL STRESS (5-6 PSF)EXHIBITED BY THE EATLC COVER SYSTEM THAT SATISFIES THE FACTOR OF SAFETY CRITERIA ARE ACCEPTABLE

DATE: 04/15/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: C4B
APPROVED BY: XZ

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REVISIONS				
REV	DATE	REVISION DESCRIPTION		
2	04/12/22	NOTE ADDITIONS, GEOSYNTHETIC MODIFICATIONS	WRG	XZ
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
			DRN	APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF FINAL COVER DETAILS

PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 19 A

Attachment C

Veneer Stability Analysis

Revision 1 – 4/15/22

Project Name:	WDI Final Cover Alternative Evaluation	Client:	U.S. Ecology
Project Number:	1208070066	Project Manager:	Xianda Zhao, Ph.D., P.E.
Project Location:	Belleville, Michigan	QA Manager:	Te-Yang Soong, Ph.D., P.E.

Calculation Sheet Information

Calculation Medium: ☒ Electronic
☐ Hard-copy Number of pages (excluding cover sheet):

Title of Calculation:	Veneer Stability Analysis
Calculation Originator:	Andrew McAvinew, P.E.
Calculation Contributors:	
Calculation Checker:	James Moseley, P.E.

Calculation Objective

1. Determine the minimum drained and undrained strength parameters (friction angle and cohesion/adhesion), necessary to obtain the appropriate factors of safety for cover system stability, specifically for the proposed engineered turf system.

Assumptions/Open Items

1. No geosynthetic reinforcements
2. No tension allowed in geosynthetics (T=0)
3. No interface adhesion
4. Geotextile/turf thickness is 0.5 mm
5. GCL is two (2) 0.25 mm layers
6. ClosureTurf and sand infill are fully interlocked and do not represent a critical interface
7. Critical interface(s) are between the GM/GCL/GCL/Subgrade soil

Design Criteria/Design Basis (with Reference to Source of Data)

1. The required minimum factors of safety for static unsaturated and static saturated are 1.5 and 1.1, respectively.

Results/Conclusions

1. The minimum strength parameters were developed using the minimum factors of safety. These minimum specifications calculated are within the range of reasonable characteristics for the materials involved.

Tabular Summary of Analyses

Component	Controlling Analysis	Minimum Strength Parameters*				
		ϕ (deg)	c (psf)	δ_A (deg)	δ_B (deg)	a (psf)
Sand Infill	Static Unsaturated, Minimum FS = 1.5	25	0	-	-	-
All geosynthetic and soil interfaces above FML	Static Unsaturated, Minimum FS = 1.5	-	-	20.5	-	0
All geosynthetic and soil interfaces below FML	Static Unsaturated, Minimum FS = 1.5	-	-	-	20.5	0

*Minimum specifications assume no cohesion/adhesion. Laboratory testing of the components over the range of normal stresses to be encountered in the field may result in a Mohr-Coloumb failure envelope suggesting a nonzero value for cohesion/adhesion. In such cases, the friction angle may be lower than that specified and still be acceptable as long as the actual shear strength for the materials is greater than the envelop devloped with the minimum specification noted above.

References/Source Documents

1. WDI MC6 – Rev 1 drawing set.

Revision Records

Checker comments provided on: ☐ Hard-copy ☒ Electronic File

No.	Revision Identifier (Number or Letter)	Version Type		Originator Initials	Date	Checker Initials	Date
		Draft	Final				
1	Rev. 0	☐	☒	APM	07/07/21	JLM	10/05/21
2		☐	☐				
3		☐	☐				

Approval
☐ The Detail Check has been completed. Any significant issues not resolved between the Checker and Originator have been resolved by the Approver.

Originator Signature	Date
Checker Signature	Date
Approved Signature	Date

cti 34705 W 12 Mile Rd, Ste 230 Farmington Hills, MI 48331 Tel. (248) 486-5100	US Ecology, Wayne Disposal Veneer Stability Calculation 2021 Permit Modification	JOB	1208070066	
		SHEET NO	1 OF	3
		CALCULATED BY	APM DATE	07/07/21
		CHECKED BY	JLM DATE	10/05/21
		SCALE	NA	

Objective:

Determine the minimum drained and undrained strength parameters (friction angle and cohesion/adhesion), necessary to obtain the appropriate factors of safety for cover system stability, specifically for the proposed engineered turf system.

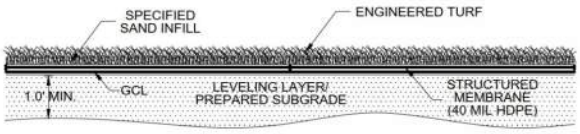


Figure 1. Cross Section (Typical ClosureTurf Cover)

Method:

Use methods outlined in journal paper *Influence Of Water Flow On The Stability Of Geosynthetic-Soil Layered Systems On Slopes* by Giroud et. al. for calculations of static stability. Seismic conditions are not evaluated because the facility is not located in a historically seismic active area.

Figure 1 depicts Wayne Disposal proposed cover system design using engineered turf
Figure 2 shows variables assumed in Giroud's method

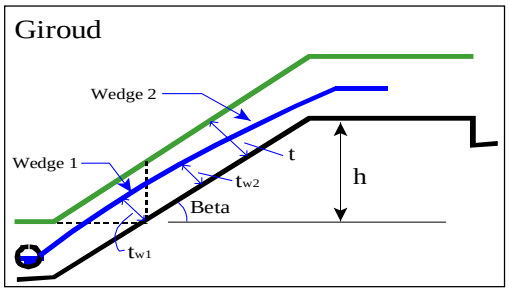


Figure 2. Variable Definitions

Calculations: Condition 1 - Static Unsaturated

Assume: the following conditions:

- No geosynthetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- Geotextile/turf thickness is 0.5 mm
- GCL is two (2) 0.25 mm layers
- ClosureTurf and sand infill are fully interlocked and do not represent a critical interface.

Given: Soil conditions, liner system design, and slope geometry

Slope Geometry

Slope Angle (b)		4 :1 =	14.04	degrees
Slope Height (h)	205	ft		

Engineered Turf Material Properties

	Turf/GTX	Sand Infill	Wt. Avg.	
Thickness (t)	0.002	0.042	0.043	ft (GTX is 0.5 mm (assumed)/sand infill is 0.5 in typ.)
Dry Unit Weight (γ_d)	135.5	105.0	106.2	pcf (turf based on vendor info, sand is conservatively assumed)
field cond. (w_F)	N/A	15.0	15.0	% (field moisture of sand conservatively assumed)
Unit Weight - field cond. (γ_T)	135.5	120.8	121.3	pcf
Specific Gravity (G_S)	N/A	2.65	2.65	(sand conservatively assumed)
Saturated Moisture (w_{SAT})	N/A	21.7	21.7	%
Saturated Unit Weight (γ_{SAT})	135.5	127.8	128.1	pcf
Buoyant Unit Weight (γ_B)	73.1	65.4	65.7	pcf
Total Normal Stress (σ)	0.22	5.03	5.25	pcf (total normal stress of ClosureTurf)
Shear Strength - both (ϕ) , (c)	25	deg,	0	psf (internal friction angle for sand, conservatively assumed)

Determine: The factor of safety (FS_A) against sliding of the engineered components along interfaces between materials above FML

where:
$$FS_A = \frac{\gamma_t (t - t_w) + \gamma_b t_w}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{\tan\delta_A}{\tan\beta} + \frac{a_A / \sin\beta}{\gamma_t (t - t_w) + \gamma_{sat} t_w} + \frac{\gamma_t (t - t^*_w) + \gamma_b t^*_w}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{t}{h} \frac{\sin\phi}{2\sin\beta \cos\beta \cos(\beta + \phi)}$$
$$+ \frac{c\, t/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{\cos\phi}{\sin\beta \cos(\beta + \phi)} + \frac{T/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w}$$

δ_A = interface friction angle between engineered components above FML
a_A = adhesion between engineered components above FML
T = geosynthetic tension above the slip surface
t_w = thickness of flow in Wedge 2 (see Figure 2)
t^*_w = thickness of flow in Wedge 1 (see Figure 2)
(All other variables previously defined)

Determine: The factor of safety (FS_B) against sliding of the engineered components along interfaces between materials below FML

where:
$$FS_B = \frac{\tan\delta_B}{\tan\beta} + \frac{a_B / \sin\beta}{\gamma_t (t - t_w) + \gamma_{sat} t_w} + \frac{\gamma_t (t - t^*_w) + \gamma_b t^*_w}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{t}{h} \frac{\sin\phi}{2\sin\beta \cos\beta \cos(\beta + \phi)}$$
$$+ \frac{ct/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{\cos\phi}{\sin\beta \cos(\beta + \phi)} + \frac{T/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w}$$

δ_B = interface friction angle between engineered components above FML
a_B = adhesion between engineered components above FML
(All other variables previously defined)

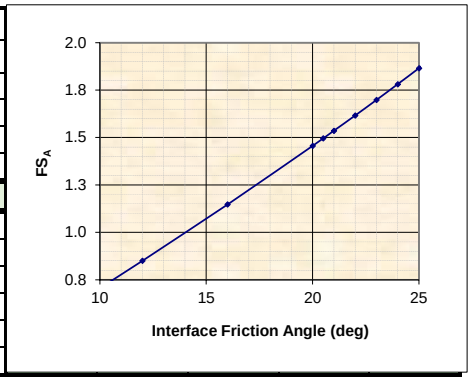
Calculations: Cover Condition 1 - Static Unsaturated (continued)

The first term quantifies the contribution of the interface friction angle to stability. The second term quantifies the contribution of the interface adhesion to stability. The third and fourth terms quantify the contribution of the toe buttressing effect, which results from the shear strength of the soil located at the toe of the slope above the slip surface. Both terms depend on the soil internal friction angle, whereas only the fourth term depends on the soil cohesion. The fifth term quantifies the contribution to the factor of safety of any tension in the geosynthetics located above the slip surface (which may include one or more geosynthetics specifically used as reinforcement).

Required angle of friction (δ) to obtain a FS_A and FS_B equal to 1.5 under unsaturated conditions is tabulated as follows:

Factor of Safety Above FML (FS_A)

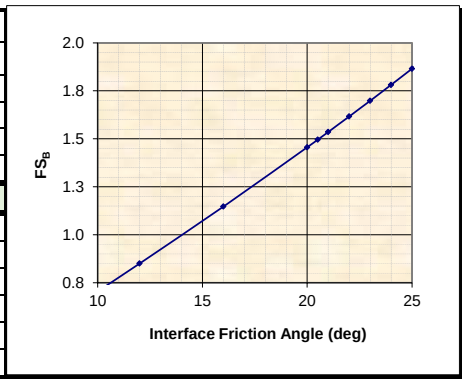
Interface Strength Param.		Water on slope		
δ_A (deg)	a_A (psf)	t_w (ft)	t^*_w (ft)	FS_A
10	0	0	0	0.71
12	0	0	0	0.85
16	0	0	0	1.15
20	0	0	0	1.46
20.5	0	0	0	1.50
21	0	0	0	1.54
22	0	0	0	1.62
23	0	0	0	1.70
24	0	0	0	1.78
25	0	0	0	1.87
26	0	0	0	1.95



► δ_A @ FS=1.5 20.5 deg ==> use 20.5 deg for spec. (check against other conditions)

Factor of Safety Below FML (FS_B)

Interface Strength Param.		Water on slope		
δ_B (deg)	a_B (psf)	t_w (ft)	t^*_w (ft)	FS_B
10	0	0	0	0.71
12	0	0	0	0.85
16	0	0	0	1.15
20	0	0	0	1.46
20.5	0	0	0	1.50
21	0	0	0	1.54
22	0	0	0	1.62
23	0	0	0	1.70
24	0	0	0	1.78
25	0	0	0	1.87
26	0	0	0	1.95



► δ_B @ FS=1.5 20.5 deg ==> use 20.5 deg for spec. (check against other conditions)

Calculations: Cover Condition 2 - Static Saturated

Determine: The static factor of safety for $FS_{A\&B}$ assuming varying depth of surface water on top of the engineered turf modeling surface water depths from sheet and/or shalllow concentrated flow on top of the cover system. ClosureTurf does not have a subsurface drainage layer; therefore, evaluation of seepage induced pressure in the cover system is not applicable. The manufacturer of ClosureTurf has demonstrated that erosion of the sand infill is very unlikely under the anticipated flow conditions (See Attachment A) and flow will generally occur on top of the sand infill where relative permeability is much higher. Because of the shallow depth of sand infill, flow characteristics, and resistance to erosion, seepage forces within the sand can be neglected. Under these conditions, the first two terms in the stability equation reduce to:

$$FS_{A\&B} = \frac{a}{(\gamma_t - \gamma_w)z}\frac{2}{\sin(2\beta)} + [cot\beta]tan\delta + \ldots.$$

The factor of safety should meet or exceed 1.1 under saturated conditions. Because seepage forces are neglected, there is no need to distiguish between the interfaces above or below the impermeable membrane. Assume minimum shear strength parameters δ and a are equal to values from analysis for Cover Condition 1. It should be noted that this analysis also assumes no apparent adhesion is present in the interface. This assumption is extremely conservative because each of the critical interfaces (GM/GCL/GCL/soil) all involve cohesive materials which likley will be present under wet conditoins. Any appreciable measureable apparent adhesion will make the materials inherently stable

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		SHEET NO	3	OF	3
		CALCULATED BY	APM	DATE	07/07/21
		CHECKED BY	JLM	DATE	10/05/21
		SCALE	NA		

Assume: The following conditions:

- No geosynthetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- Geotextile/turf thickness is 0.5 mm
- GCL is two (2) 0.25 mm layers
- ClosureTurf and sand infill are fully interlocked and do not represent a critical interface.
- Critical interface(s) are between the GM/GCL/GCL/subgrade soil
- Seepage forces are negligible and are not considered

Given: Soil conditions, liner system design, and slope geometry

Slope Geometry

Slope Angle (b)	4 :1 =	14.04	degrees
Slope Height (h)	205 ft		

ClosureTurf Material Properties

	Turf/GTX	Sand Infill	Wtd. Avg.	
Thickness (t)	0.002	0.042	0.043	ft (GTX is 0.5 mm (assumed)/sand infill is 0.5 in typ.)
Dry Unit Weight (γ_d)	135.5	105.0	106.2	pcf (turf based on vendor info, sand is conservatively assumed)
Moisture - field cond. (w_F)	N/A	15.00	15.0	% (field moisture of sand conservatively assumed)
Unit Weight - field cond. (γ_T)	135.5	120.8	121.3	
Specific Gravity (G_S)	N/A	2.65	2.65	(sand conservatively assumed)
Saturated Moisture (w_{SAT})	N/A	21.7	21.7	%
Saturated Unit Weight (γ_{SAT})	135.5	127.8	128.1	pcf
Buoyant Unit Weight (γ_B)	73.1	65.4	65.7	pcf
Shear Strength - both (ϕ) , (c)	25 deg,		0	psf (internal friction angle for sand, conservatively assumed)

Factor of Safety Above FML ($FS_{A\&B}$)

Interface Strength Param.		Water on slope		
δ_A (deg)	a_A (psf)	t_w (ft)	t^*_w (ft)	FS_B
20.5	0	0.00	0.00	1.50
20.5	0	0.20	0.20	1.50
20.5	0	0.20	0.20	1.50
20.5	0	0.30	0.30	1.50
20.5	0	0.40	0.40	1.50
20.5	0	0.50	0.50	1.49
20.5	0	0.60	0.60	1.49
20.5	0	0.70	0.70	1.49
20.5	0	0.80	0.80	1.49
20.5	0	0.90	0.90	1.49
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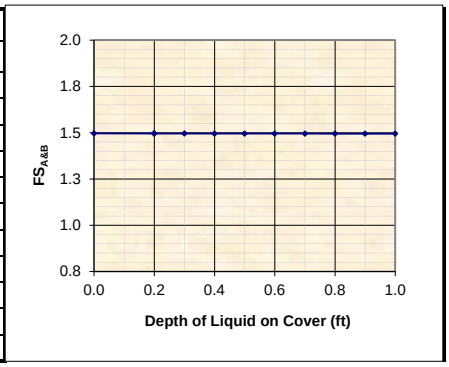

► $FS_{A\&B}$ reqd≥ 1.1 ==> minimum $FS_{A\&B}$ equals 1.49 with saturated sand infill ==> OK

Results: Tabular Summary of Analyses

Component	Controlling Analysis	Minimum Interface Shear Strength Parameters (Peak)*				
		ϕ (deg)	c (psf)	δ_A (deg)	δ_B (deg)	a (psf)
Sand Infill	Static Unsaturated, Minimum FS = 1.5	25	0	-	-	-
All geosynthetic and soil interfaces above FML	Static Unsaturated, Minimum FS = 1.5	-	-	20.5	-	0
All geosynthetic and soil interfaces below FML	Static Unsaturated, Minimum FS = 1.5	-	-	-	20.5	0

*Minimum specifications assume no cohesion/adhesion. Laboratory testing of the components over the range of normal stresses to be encountered in the field may result in a Mohr-Coloumb failure envelope suggesting a nonzero value for cohesion/adhesion. In such cases, the friction angle may be lower than that specified and still be acceptable as long as the actual shear strength for the materials is greater than the envelop developed with the minimum specification noted above.

Conclusions:

The proposed engineered turf cover system for WDI was evaluated for shallow translational/veneer failures along the geosynthetic components parallel to the slope. Worst case cross sections were utilized as noted in the analyses. Minimum factors of safety are based on typical industry standard values which were used to develop minimum strength parameters for each of the components. The minimum specifications noted above are within the range of reasonable characteristics for the materials involved. Therefore, the minimum specifications calculated are acceptable.

Attachment D

Wind Uplift Evaluation

Revision 1 – 4/15/22

July 8, 2010

Mr. Michael R. Ayres, P.E.
Closure Turf, LCC
3005 Breckinridge Blvd.
Duluth, GA 30096

Subject: **Aerodynamic Evaluations of Closure Turf Ground Cover Materials**

References: **1: Contract # AGR DTD 5/14/10**

Dear Mr. Ayres and Closure Turf LCC affiliates:

The Georgia Tech Research Institute is pleased to submit the attached Report, covering the period from May 14 to July 8, 2010, in fulfillment of Reference. This document details the tasks and analysis made on contracted work performed by the GTRI Aerospace, Transportation and Advanced Systems Laboratory and its team members on Phase I of the Project entitled "Aerodynamic Evaluations of Closure Turf Ground Cover Materials".

We look forward to continuation of this work for/with Closure Turf, LCC upon the adoption of Phase II activities related to aerodynamic investigation of Closure Turf Material or other desired evaluations.

Sincerely,

Graham M. Blaylock
Principal Investigator

Aerodynamic Evaluations of Closure Turf Ground Cover

Phase I REPORT
May 14 – July 8, 2010

Project Expires: August 14, 2010

Contract No. AGR DTD 5/14/10
Proposal No. ATASL-AATD-10-1119

GTRI Project No. D-6244

Prepared for:
Mr. Michael R. Ayres, P.E.
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Introduction

GTRI has been contracted by Closure Turf, LCC to **experimentally evaluate the aerodynamic properties and ballast requirements** of a novel synthetic ground-cover system under a range of wind speed conditions (V_{inf}). The Closure Turf Material was tested full-scale in **GTRI's subsonic Model Test Facility (MTF) wind tunnel** wherein the normal force loading (lb_f/ft^2) and the shear stress (lb_f/ft^2) were determined for a suitable section of the material. The turf material was tested in two configurations, one representing the perimeter of the turf installation (Fig 5) and the 2nd at a representative interior section (Fig 6). Both installations were evaluated on a **flat level surface**. The installation is shown in Figures 1a-d below.

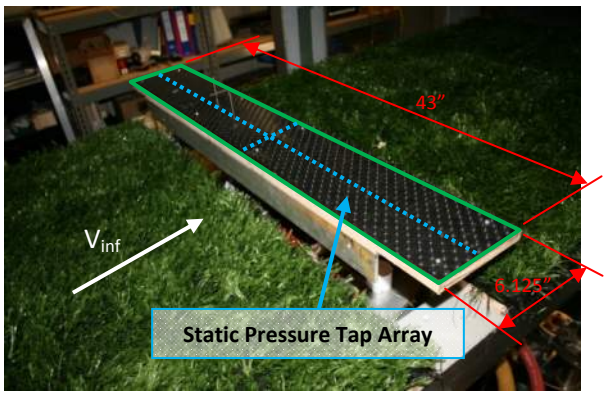

Figure 1a – Model Before Final Turf Layer

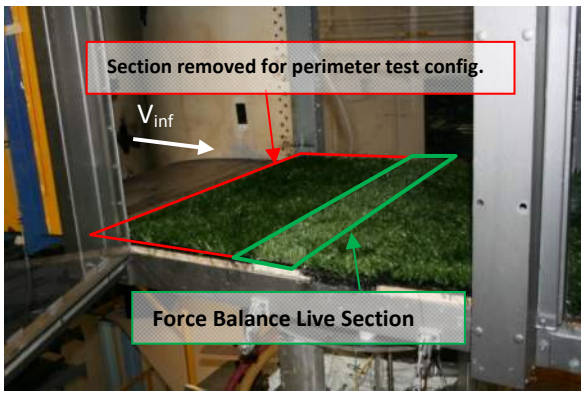

Figure 1b – Turf Installed & Model Lowered

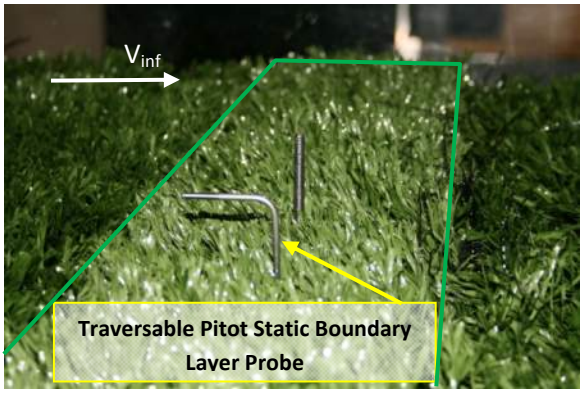

Figure 1c - Pitot Static Boundary Layer Probe

Figure 1d – Full Installation Looking Downstream

Program Description

Closure Turf system - The Closure Turf ground cover system consists of two independent layers. The first layer is a **geomembrane** to cap the upper soil layer. This is then covered with a **geotextile** turf layer (Fig 2a and 2b)

Geomembrane Layer -The impermeable geomembrane is made from Agru 50-mil LLDPE Super Gripnet® material and is used to cap the terrain being covered. It has an array of spikes to interface to the soil below and an array of studs to interface with the turf covering above. Throughout the testing and subsequent analysis of the Closure Turf system, **it was assumed that the geomembrane will be sufficiently installed to prevent movement of that layer.**

Geotextile Turf Layer – This component is designed to be installed on top of the geomembrane. The turf is intended to remain in place without an anchoring system linking it to the geomembrane below. It relies on the interface friction and sand ballast added on top of the turf to ensure that it remains immobile under all environmental conditions. It is constructed of two permeable sheets of woven HDPE mesh material which are linked together with synthetic blades of grass that are looped through the two HDPE substrates (Fig 2a).

Figure 2a – Closure Turf Synthetic Ground Cover System

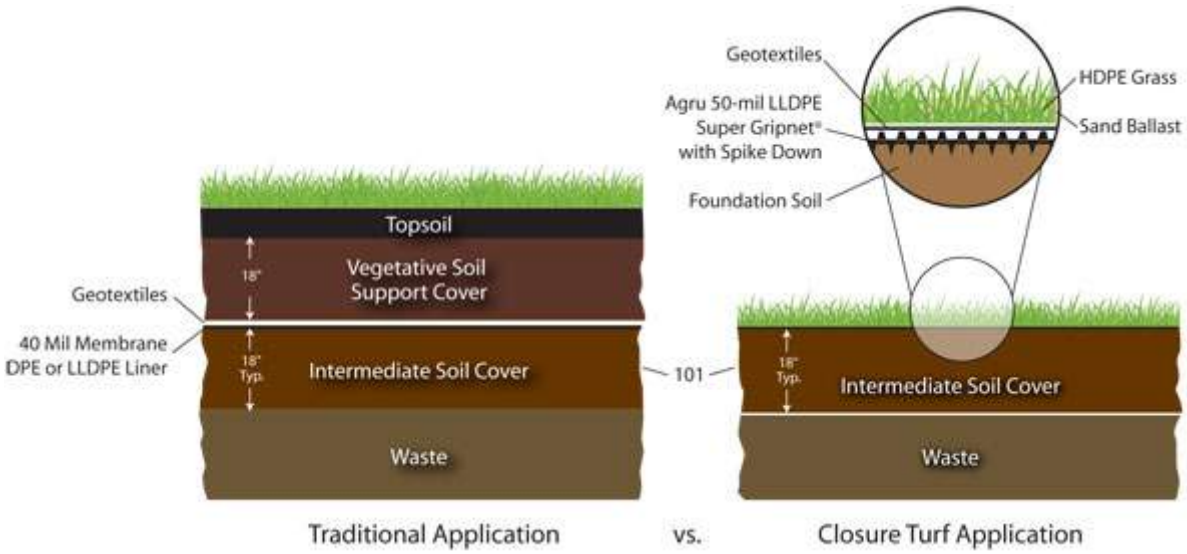

Figure 2b – Installation of Closure Turf

Purpose – The scope of this program was to conduct a full-scale wind tunnel test and experimentally isolate and measure the aerodynamic forces acting on a section of the permeable upper geotextile turf layer alone as installed above the impermeable geomembrane. The wind tunnel install configuration would simulate a wide range of wind speeds flowing over a **flat and level terrain installation** of the Closure Turf ground cover system (Fig 1a-d). The sand ballast requirements needed to counteract the resulting aerodynamic forces could then be determined. The purpose of the ballast is twofold. It serves to prevent both lift-off and tangential motion of the turf material along the geomembrane underlayment **resulting from aerodynamic lift and drag acting on the turf layer**.

Methodology

Model Design – The model represented a full-scale 2D section of the Closure Turf material with a 6.125" chord (stream-wise dimension) with a width of 43" that spanned the tunnel wall to wall. This area constituted the live balance section upon which the total sum of all aerodynamic forces could be measured by a 6 component force balance located under the test section. The model consisted of 4 layers listed below from the lower to uppermost turf layer

1) ¾" Furniture grade plywood support base – This incorporated several pressure taps on the underside in order to measure the ambient pressure (P_{amb}) to determine the vertical force (F_{amb}) due to pressure acting upward on the lower surface of the model.
2) Foam Filler Layer – This represented the soil layer surrounding the lower geomembrane spikes.
3) Impermeable Goemembrane Layer – This was fixed rigidly to the base. An array of static pressure taps was installed on the upper side of this layer, shown schematically in Fig. 1a. These

pressures were integrated numerically to determine the force (F_{geo}) due to pressure acting down on the membrane.

4) Geotextile Turf Layer – The turf was first mounted to a thin wire support frame to maintain the geometry and to provide a safety measure to prevent material from dislodging in the tunnel. The frame was then mounted rigidly on top of the lower construction flush with the top of the geomembrane upper surface studs.

Pitot Static Boundary Layer Probe – In general, pressure variation through the height of the boundary layer is due to viscous forces which cause deficits in the total pressure as the bounding flat and level surface is approached. The static pressure remains constant. However, the unique characteristics of the flexible and permeable turf layer warranted investigating the boundary layer formation on the Closure Turf system. To accomplish this, a traverse system was built into the model to actuate a Pitot static probe vertically through the boundary layer (Fig 1c). This allows the measurement of the total and static pressure as a function of the probe height, defined as h = 0" at the upper surface of the turf HDPE woven mesh. From these measurements the flow velocity distribution was determined. This characterizes the shape of the boundary layer which is by its nature a transition from the no slip condition at the surface ($V = 0$) to free stream conditions ($V = V_{inf}$). The characteristics of this boundary layer profile such as the BL thickness, the height required for the flow to reach free stream velocity, provide valuable insight into the observed results.

Force Balance – An under floor 6 component force balance was utilized to measure the aerodynamic lift (L) and the total drag (D) of the model. These forces were transmitted to the balance through a vertical strut which mounted to the underside of the model base. It should be noted that these forces represent the total sum of all pressure distributions acting on the model resolved vertically and tangentially. As such the isolated vertical force acting on just the turf layer (L_{turf}) is found by Equation 1.

$$L_{turf} = L - L_{amb} + L_{geo} \quad \text{(Eq 1)}$$

Under the confines of this program, it was not feasible to separate the drag acting on just the turf from skin friction and pressure drag acting on the geomembrane. That being the case, the total drag as measured from the force balance was taken as the drag acting on the turf. This results in a conservative overestimation of the actual turf drag force present.

Installation Conditions – Two installation conditions were examined separately. To more accurately simulate the actual installation conditions, both geomembrane and turf layers were installed upstream and downstream of the balance live model (Fig 1b and 1d). This represents an **interior** condition and in this case the model was located approximately 18" inboard of the **perimeter**. It was also suspected that the perimeter, if unaccounted for, could lead to a worse case situation. To determine the nature of this the upstream turf was removed leaving just the geomembrane as a stand in for a typical surface soil roughness that could be expected at the edge of a real world installation. This left the model mounted turf exposed at the leading edge.

Results and Discussion

These results represent the required thickness of sand for the Closure Turf system as installed on **flat and level terrain**. The density of the sand was provided by Closure Turf. If a different material density is to be used as ballast, the results can be recalculated via Equation 2.

In all cases, **the driving parameter for the depth of the sand is tangential slip due to the aerodynamic formation of shear stress**. The sand ballast requirements have been illustrated in Figures 5 and 6 for several assumed representative interface coefficients of static friction (μ_s). The **minimum** required sand ballast height is found by Equation 2.

$$h_{sand}(in) = \frac{1}{\rho_{sand}}\left(\frac{\tau}{\mu_s} + P\right)\frac{12in}{ft} \quad \text{(Eq 2)}$$

Where:

$$\rho_{sand} = Weight\ Density\ of\ Ballast(sand) = 110\ \frac{lb_f}{ft^3}$$

$$\tau = \frac{D}{Area} = Shear\ Stress, \frac{lb_f}{ft^2}$$

$$P = \frac{L_{turf}}{Area} = Normal\ Force\ Loading, \frac{lb_f(+tve\ up)}{ft^2}$$

The measured data for determining the sand depth are shown in Table I and Table II and plotted in Figures 5 and 6 for the perimeter and interior configurations respectively. The last column of each table gives the resulting sand height requirement, based on Equation 2, for μ_s = 0.93. This value was determined independently from the efforts of this program by Closure Turf affiliates and supplied for use in this analysis.

Perimeter Condition (PC) – The ballast requirement resulting from this configuration are substantially greater than the interior condition. For the given μ_s =0.93 a **minimum** sand height of 0.4" or 3.6 lb_f/ft^2 is needed to provide the ballast based on the resulting shear at 175 ft/s. The lifting pressure will be satisfied by this loading as shown in Figure 4. It should be noted that the required ballast height due to uplift goes from positive to negative at around 115 ft/s. There are several factors contributing to these results.

PC Boundary Layer (BL) – The profile for the perimeter condition is shown in Figure 4 (Red Curve). One characteristic to note is that the boundary layer thickness reaches 99% of free stream velocity at a height of approximately 2". This subjects the turf to up to 89% of the total free stream based on a max vertical blade height of 1.25". This has several resulting effects which can be followed in Figures 3a to 3f. The cascade of effects proceeds as follows.

The blades are subject to higher velocities and thus higher increasing drag as the wind speed increases. The higher drag increases the bending of the blades back onto the mesh substrate. The effect of this has 2 **counteracting effects on the net lift**. At lower velocities (Fig3a-b) the blades are bent slightly with the

flow being deflected and accelerated of over the perimeter as shown by the tufts. This flow acceleration increases the **local** velocity and lowers the local static pressure **below** that of free stream static which creates the pressure differential building up in 3a and b Additionally, in this installation, the perimeter exposes the gap between the turf and the geomembrane which allows for some uplift pressure recovery beneath the turf. However, as the free stream velocity increases, the drag is increased further by virtue of greater velocity exposure in the relatively thin boundary layer, the bending angle of the turf also increases (Fig 3b-c). This bending produces an increasing down force reaction which starts to counteract the suction created by the local flow acceleration. Simultaneously, the slightly reduced turf profile geometry (caused by the increased bending) shown in Figure 3c-d begins to reduce the relative local flow acceleration and thus also reduces the suction. This continues until the net vertical force becomes zero at about 110 ft/s (Fig 3d) and continues to decrease through Figure 3f.

Interior Condition (IC) – This condition owes its behavior to the formation of a drastically different boundary layer than the perimeter as shown by the blue profile in Figure 4. Compared to the Perimeter profile it is 25% thicker with no measurable velocity until the height is greater than 50% of the turf length (0.75”). The blades thusly experience a maximum velocity of 45% of free stream. This reduces the drag acting on the turf layer. Furthermore, the static pressure remains constant as a function of height through the BL which effectively prevents the formation of a pressure differential on the flat and level permeable turf membrane.

The cause for the deficient boundary layer is created by longer flow paths over a given surface and all boundaries grow in thickness and increase in turbulence with increasing distance. In the case of Closure Turf, the interaction of the flow with the flexible blades causes this growth to occur quite rapidly. The distance producing the profile in Fig 4 was 18” however, the effect of the growing boundary layer can be seen even in the perimeter condition development in Figures 3a –f. The Model section (highlighted in yellow) is 6.125” wide. It is clearly seen that little to no defection occurs in the turf at a distance just over 6 inches behind the perimeter edge. Thus the boundary layer at further distances than 18” and greater from the perimeter can be expected to have minimal interaction with the turf. Figure 6 shows these results by producing measurements requiring minimal ballast.

Final Comments and Executive Summary

GTRI was contracted by Closure Turf to determine the effective required ballast in terms of sand thickness needed to counteract the aerodynamic forces versus wind velocity acting on a permeable geotextile synthetic turf ground covering material that is to be overlaid onto an impermeable geomembrane underlayment. *It was found that in both perimeter and interior loading conditions, the shear acting on the material serves as the more demanding factor for determining the ballast.*

- **The resulting measurements represent the forces acting on the permeable Turf Layer *only*. The impermeable geomembrane layer was to be assumed immobile as a founding assumption of this program**

- **If it is determined that the static interface friction coefficient (μ_s) between the soil and the lower side of the membrane is lower than that occurring between the turf and the membrane upper surface studs, the lower μ_s should be used in Equation 2 to recalculate the sand depth required by shear. The same shear data given in Tables I & II will apply because, as discussed within the methodology section, the measured shear could not be feasibly separated between the two layers independently and thus represents their combined effect.**
- **The sand ballast depths represented in Figures 5 & 6 and Tables I & II are the Minimum depths required, the proper factor of safety has been left to be determined by Closure Turf, LCC and the authorized building permit issuing agencies.**
- **The perimeter of the turf installation is much more demanding than interior sections.**
- **All measurements were made on a rigidly constrained system. It was not within the scope of this investigation to determine what dynamic effects might occur, including gusts or erosion of sand ballast or any possible unstable perturbations.**
- **All configurations consisted of flat and level terrain installation.**
- **All calculations and measurements assume that the blade length is increased to account for any added ballast material. This is to ensure that the installation matches the conditions as tested.**

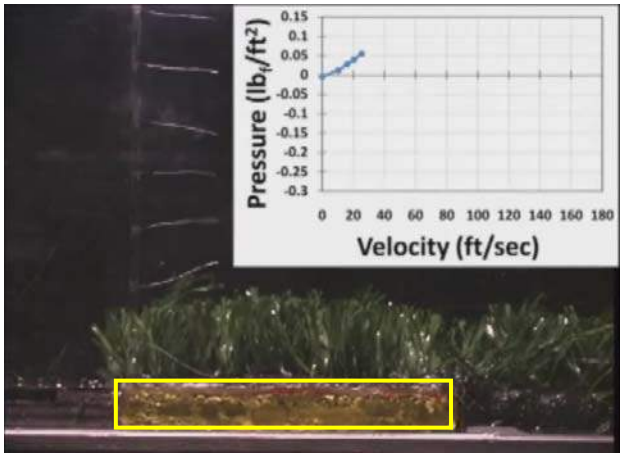

Figure 3a: Vinf = 25 ft/sec

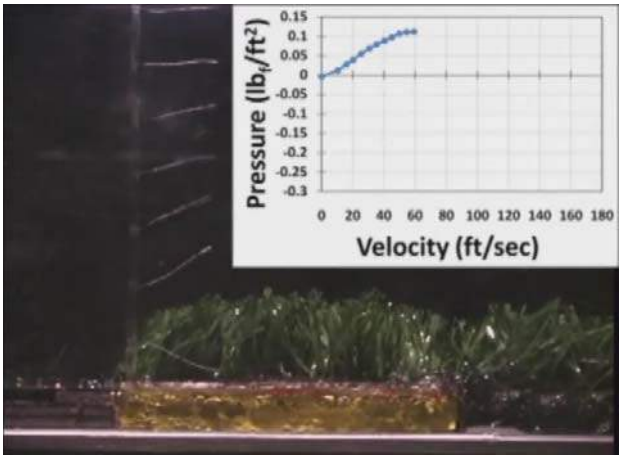

Figure 3b: Vinf = 60 ft/sec

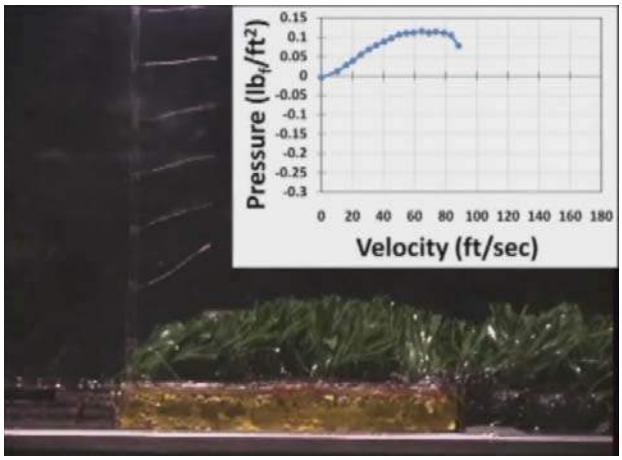

Figure 3c: Vinf = 90 ft/sec

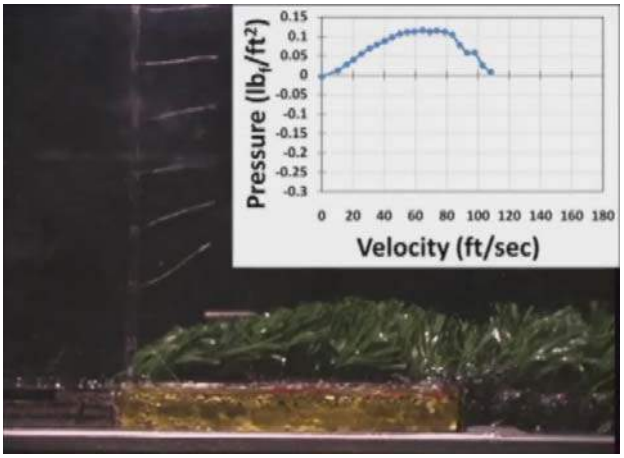

Figure 3d: Vinf = 110 ft/sec

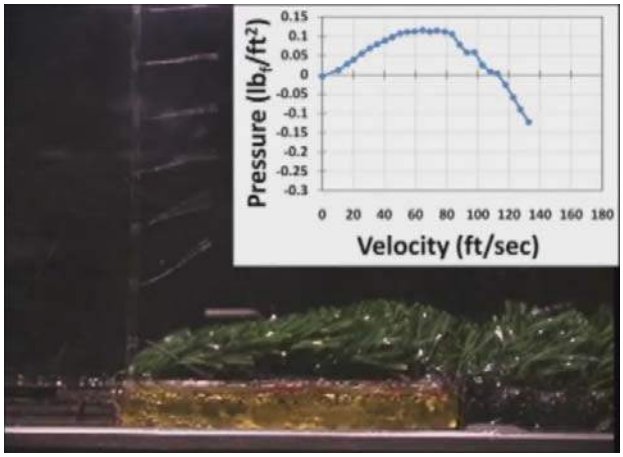

Figure 3e: Vinf = 135 ft/sec

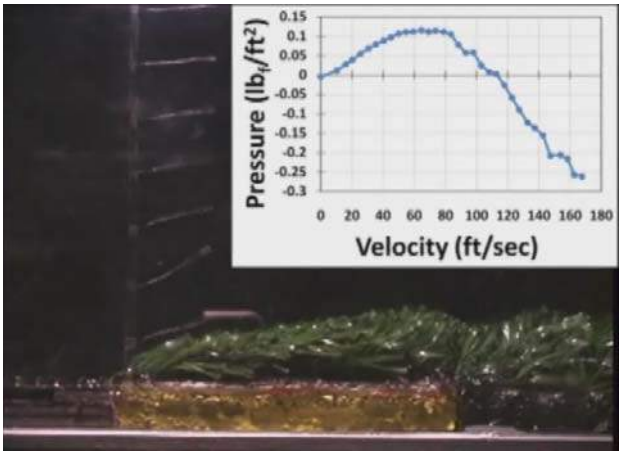

Figure 3f: Vinf = 170 ft/sec

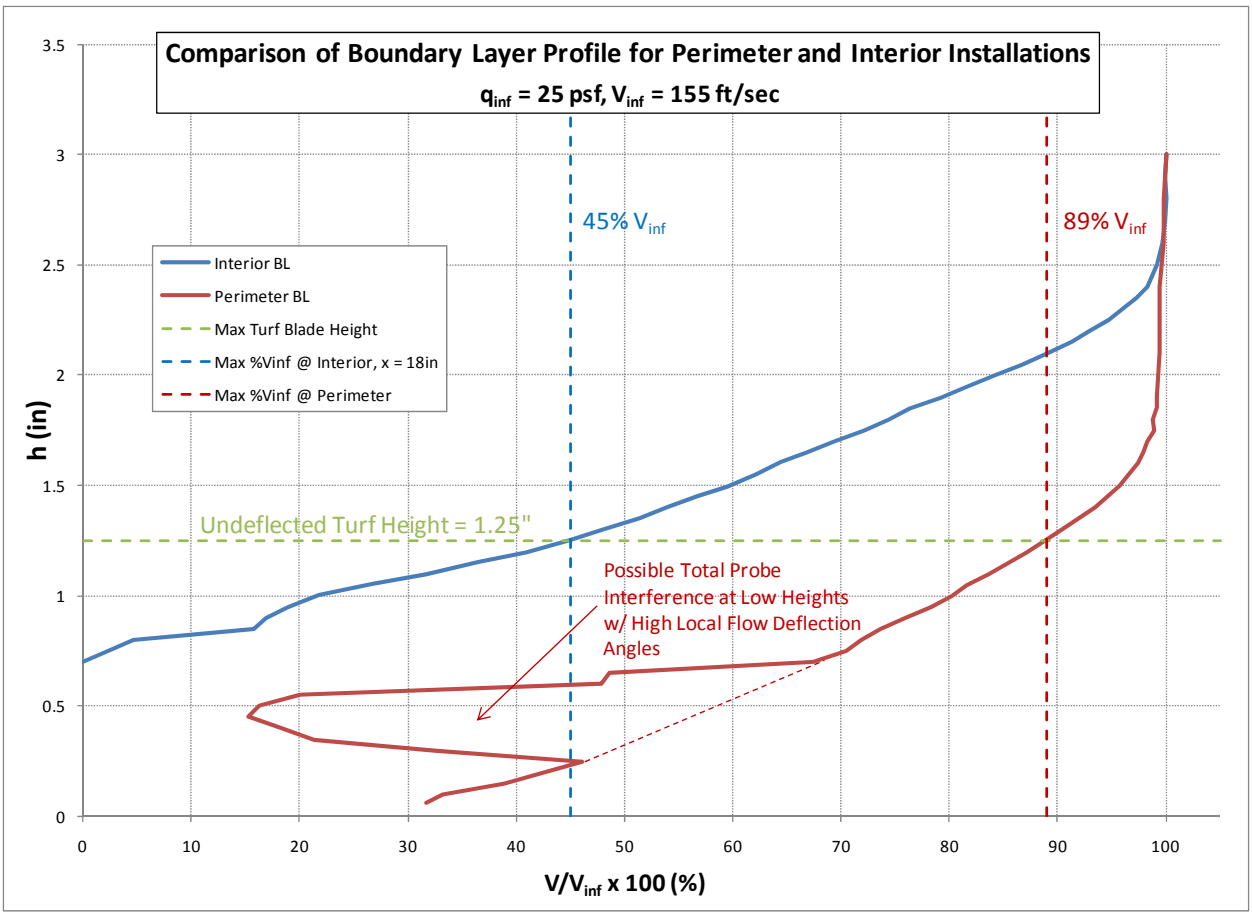

Figure 4 – Non-Dimensional Boundary Layer Profiles for Perimeter and Interior Installations

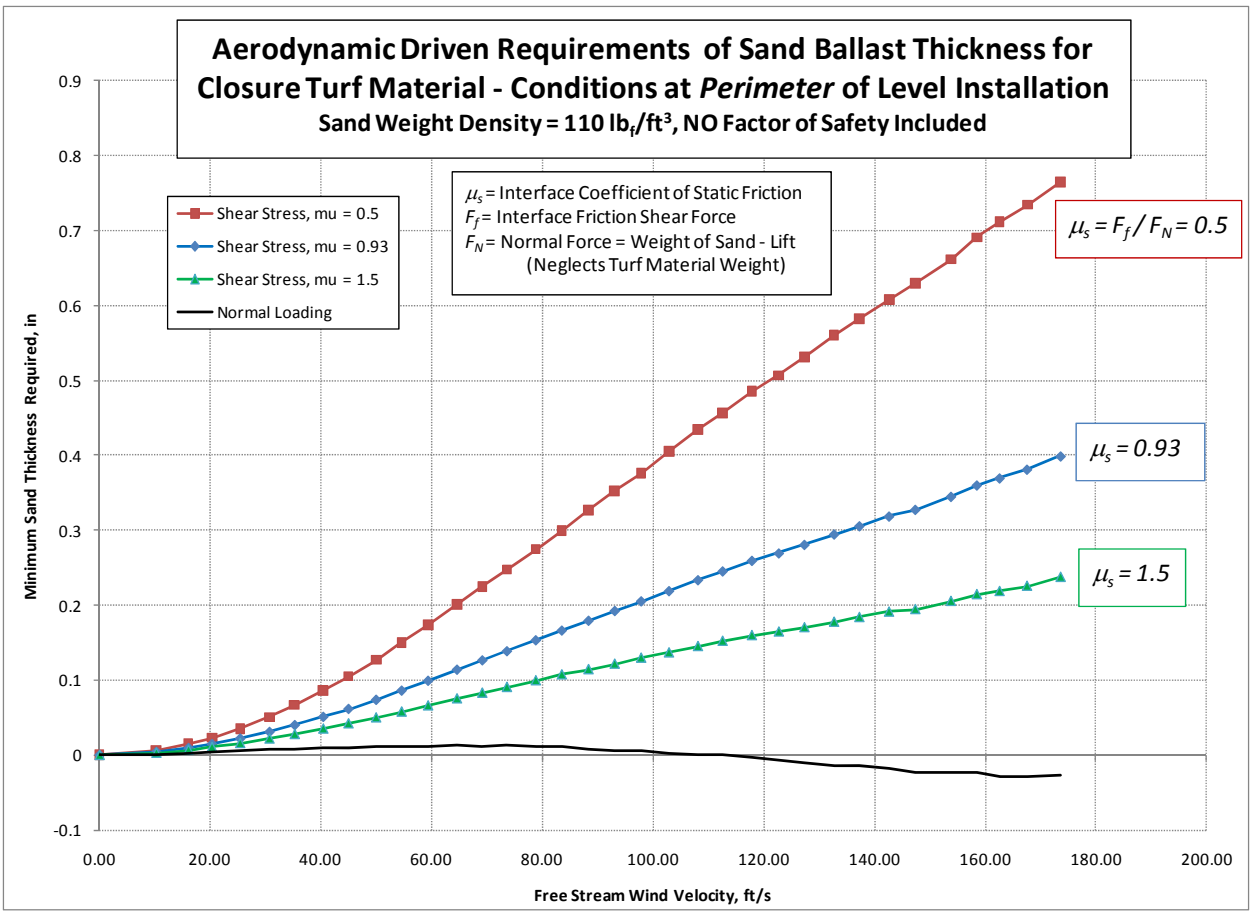

Figure 5 – Sand Ballast Minimum Requirement at the *Perimeter* of Turf Installation

Table I - Perimeter Installation				
Wind Speed (*ft/s*)	Wind Speed (*mi/hr*)	Turf Normal Force Loading (lb_f/ft^2)	Turf Shear Stress (lb_f/ft^2)	Sand Height Due to Shear (*in*)
0.00	0.00	0	0	0
10.26	6.99	0.011689	0.023784	0.0040651
16.06	10.95	0.027798	0.053106	0.009262
20.31	13.84	0.039396	0.086922	0.0144939
25.40	17.32	0.054936	0.136103	0.0219582
30.70	20.93	0.06927	0.198423	0.0308322
35.26	24.04	0.078777	0.266915	0.0399035
40.42	27.56	0.088429	0.351918	0.0509275
44.97	30.66	0.096783	0.434606	0.0615383
49.97	34.07	0.10646	0.529776	0.0737576
54.57	37.21	0.110561	0.630469	0.0860165
59.36	40.47	0.111817	0.741903	0.099225
64.58	44.03	0.115373	0.865046	0.1140578
69.15	47.15	0.111526	0.975305	0.1265718
73.60	50.18	0.114496	1.076528	0.1387694
78.82	53.74	0.111457	1.204017	0.1533926
83.52	56.94	0.104976	1.320714	0.1663744
88.34	60.23	0.077354	1.458158	0.1794835
93.08	63.46	0.057303	1.588598	0.192597
97.86	66.72	0.058201	1.697814	0.2055063
102.89	70.15	0.024978	1.844449	0.2190825
108.12	73.72	0.007601	1.985703	0.2337562
112.58	76.76	0.002646	2.090641	0.2455251
117.87	80.37	-0.026041	2.237684	0.2596441
122.74	83.69	-0.058742	2.352732	0.2695721
127.36	86.84	-0.089852	2.479185	0.2810115
132.72	90.49	-0.122289	2.627843	0.2949108
137.29	93.61	-0.135769	2.734267	0.305924
142.65	97.26	-0.155489	2.863465	0.3189279
147.40	100.50	-0.208034	2.98848	0.3278602
153.84	104.89	-0.206002	3.134988	0.3452676
158.51	108.08	-0.21588	3.274285	0.3605298
162.63	110.88	-0.256805	3.392572	0.3699406
167.59	114.26	-0.261535	3.496667	0.3816351
173.66	118.41	-0.23928	3.626641	0.3993092

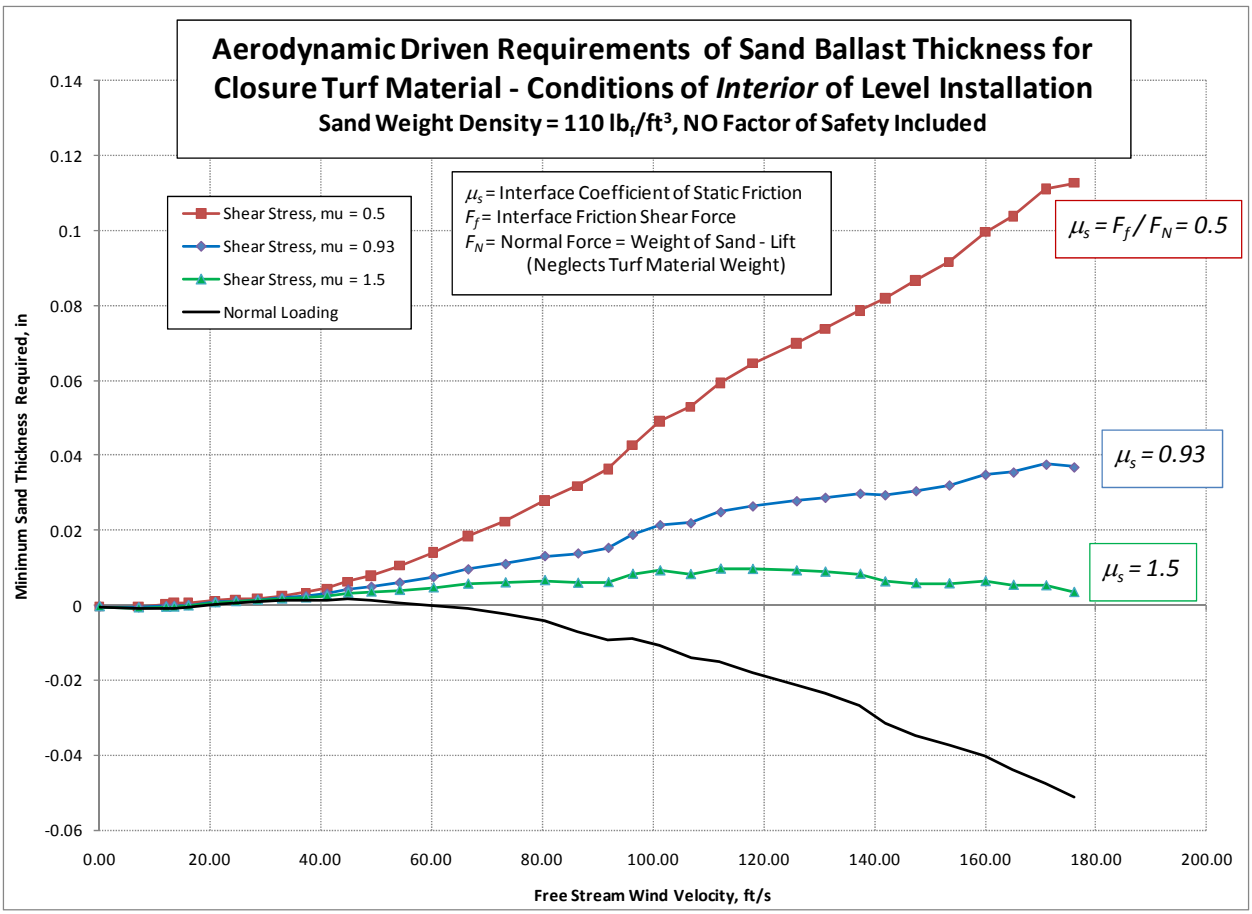

Figure 6 – Minimum Sand Ballast Requirement in the *Interior* of Turf Installation

Table I - Interior Installation				
Wind Speed (ft/s)	Wind Speed (mi/hr)	Turf Normal Force Loading (lb_f/ft^2)	Turf Sheer Stress (lb_f/ft^2)	Sand Height Due to Shear (*in*)
0.00	0.00	-0.00419	0.000471	0
7.07	4.82	-0.00858	0.002819	-0.000605326
12.02	8.20	-0.00858	0.005658	-0.000272305
13.47	9.18	-0.009201	0.006927	-0.000191194
16.05	10.94	-0.005314	0.005174	2.72117E-05
20.91	14.26	0.003753	0.0034	0.000808245
24.64	16.80	0.006062	0.004099	0.00114213
28.56	19.47	0.009925	0.003388	0.001480147
32.94	22.46	0.011669	0.005393	0.001905592
37.27	25.41	0.011221	0.009767	0.002369798
41.09	28.01	0.013608	0.013502	0.003068321
44.90	30.61	0.015886	0.02088	0.004182285
49.08	33.47	0.011842	0.03072	0.004895374
54.21	36.96	0.006407	0.045273	0.006009561
60.31	41.12	-0.000648	0.064883	0.007540218
66.57	45.39	-0.006394	0.087581	0.009575904
73.32	49.99	-0.019878	0.112271	0.01100111
80.43	54.84	-0.037311	0.146631	0.013129826
86.42	58.92	-0.06477	0.178237	0.013841748
91.90	62.66	-0.083261	0.208285	0.01534924
96.30	65.66	-0.081403	0.236369	0.018846242
101.24	69.02	-0.097454	0.273298	0.021427071
106.76	72.79	-0.129489	0.30751	0.021945482
112.17	76.48	-0.138401	0.341067	0.024909568
117.97	80.43	-0.163997	0.378085	0.026459565
125.89	85.83	-0.193612	0.417441	0.027845377
131.07	89.36	-0.215792	0.445855	0.028758761
137.38	93.67	-0.245542	0.482763	0.029842691
141.88	96.73	-0.289393	0.520185	0.029448623
147.46	100.54	-0.317409	0.555461	0.030530279
153.47	104.64	-0.340708	0.59023	0.032067045
159.99	109.08	-0.369093	0.641021	0.034928388
165.05	112.53	-0.4029	0.677722	0.035545455
170.96	116.56	-0.437374	0.727691	0.037646121
176.00	120.00	-0.469865	0.751682	0.036915842

Wind Tunnel Study and Uplift Analysis of Geosynthetic Covers

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ABSTRACT

Geosynthetic covers, including the exposed geomembrane cover and engineered turf cover, have been used as alternatives to conventional soil-geosynthetic covers for closure of landfills and other waste containment facilities. Because the geomembrane component in geosynthetic covers is not overburdened with a soil layer, uplift of geomembrane due to wind loads is of a concern in the design and construction of such covers. A wind tunnel study was performed to evaluate performance of an exposed geomembrane cover and the ClosureTurf engineered turf cover under wind loads on small-scale test models that were built to simulate a landfill cross section. The wind tunnel test results are presented in the form of dimensionless wind pressure coefficients. The wind-induced uplift pressure is found to be affected by the surface roughness of the cover and the slope ratio. The measured maximum uplift pressure coefficient values for the ClosureTurf engineered turf cover are approximately 30% of those for a smooth exposed geomembrane cover, demonstrating significant improvement of wind uplift resistance of the engineered turf cover. An example calculation of the maximum wind uplift pressure on the engineered turf cover is presented.

INTRODUCTION

Landfill covers have been used to protect human and the environment from exposure to the waste. A typical landfill cover prescribed by the federal and state solid waste management regulations in the USA consists of, from bottom to top, a geomembrane barrier layer, a geocomposite drainage layer, and protective and vegetative soil layers. Geosynthetic covers, including the exposed geomembrane cover and engineered turf cover (e.g., ClosureTurf), have been used as alternatives to conventional soil-geosynthetic covers for temporary and final closure of landfills and other waste containment facilities (SWANA 2017).

The exposed geomembrane cover consists of only a geomembrane barrier layer. It eliminates the issues of veneer-type slope instability and soil erosion associated with the prescriptive soil covers. However, since the geomembrane is directly exposed to the environment, it is vulnerable to ultraviolet (UV) damage that limits the design life of the exposed geomembrane cover (Gleason et al. 2001). The engineered turf cover utilizes an engineered synthetic turf layer infilled with sand to cover the underlying geomembrane and protect it from UV degradation (Zhu et al. 2019). Since its first installation in 2009, the engineered turf cover has been

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increasingly used to close municipal solid waste (MSW) landfills, industrial waste landfill and coal combustion residuals (CCR) impoundments and landfills (Abreu R.C. and Franklin J. 2014, Saindon 2019, O'Malley et al. 2019).

Field observations have shown that the exposed geomembrane can be uplifted by wind. Giroud et al. (1995) summarized the study by Dedrick (1973), where wind tunnel tests were conducted on a reduced-scale test model that simulated an empty reservoir. Based on the published wind tunnel test results, Giroud developed the suction factors for the design of exposed geomembrane cover against wind uplift. A method was also presented to calculate the maximum allowable wind velocity for an exposed geomembrane cover when it is not uplifted and the tension and strain of the geomembrane when it is uplifted. The method was later revised by Zornberg and Giroud (1997) to incorporate the influence of slope inclination and a more accurate expression of the tension-strain relationship of geomembrane.

Recently a wind tunnel study was performed by the authors to evaluate performance of the ClosureTurf engineered turf cover under wind loads. Small-scale test models were built to simulate a landfill cross section with a top deck and two side slopes. The models were first covered with the geomembrane to simulate the exposed geomembrane cover. The engineered synthetic turf layer was added later to simulate the engineered turf cover. This paper summarizes the wind tunnel test program and presents the test results for both the exposed geomembrane and ClosureTurf engineered turf covers.

WIND TUNNEL TEST SETUPS

The wind tunnel study was carried out between 2018 and 2020 in the Aerodynamic and Atmospheric Boundary Layer (AABL) Wind and Gust Tunnel located in the Department of Aerospace Engineering at Iowa State University, Ames, Iowa. The purpose of the study was to investigate wind performance of the ClosureTurf engineered turf cover and establish wind pressure distribution profiles through model testing. These profiles can be used to evaluate wind loads, especially wind uplift pressures acting on the ClosureTurf engineered turf cover.

Four test models were constructed with different sizes to simulate a typical landfill cross section that had a side-slope of 3 Horizontal to 1 Vertical (3H:1V) on one side, a flat top deck, and a side-slope of 4H:1V on the other side. The heights of the models varied from 0.15 m (0.5 ft) to 0.46 m (1.5 ft) and the widths varied from 0.46 m (1.5 ft) to 0.76 m (2.5 ft). Each model had two different slopes allowing rotation in the wind tunnel to test two different windward conditions. A velocity probe was used to record point-wise measurements of the upstream wind velocity. Pressure taps were used to measure wind pressures at fifteen locations along the model surface. The pressure taps were connected by flexible vinyl tubes to a pressure scanner module, where data were recorded. The geometry of one of the test models is shown in Figure 1 along with a photo showing the model inside the wind tunnel. Figure 2 illustrates the distribution of measurement points.

The study included tests of both the exposed geomembrane and engineered turf covers. Two types of exposed geomembranes were tested, including a 40-mil (1-mm) thick high-density polyethylene (HDPE) smooth geomembrane and a 50-mil (1.3-mm) thick HDPE structured geomembrane with rough "studded" surface. The engineered turf cover was tested with the engineered synthetic turf layer placed on the 50-mil HDPE structured geomembrane with rough "studded" surface. The geomembrane and engineered turf covers were fixed to the model base in order to measure the wind pressures. No sand infill was applied into the engineered turf during the tests.

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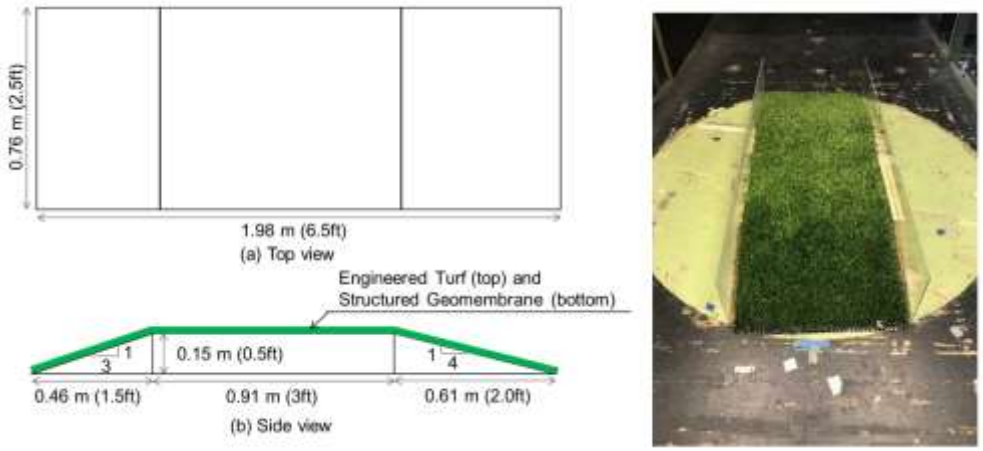

Figure 1. A wind tunnel test model (left - model geometry; right - photo of model inside wind tunnel).

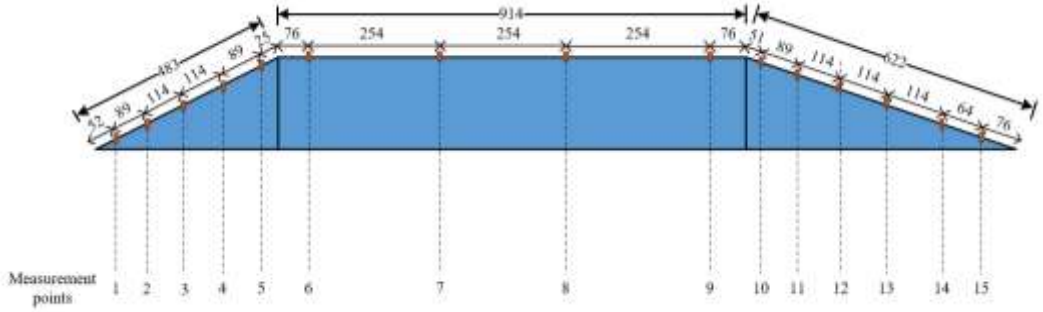

Figure 2. Distribution of wind pressure measurement points (dimension units are in mm).

WIND PRESSURE COEFFICIENT

The wind pressure coefficient is denoted as C_p and defined as follows (Giroud et al. 1995, Zheng et al. 2020):

$$C_p = \frac{\Delta P}{0.5\rho U(H)^2} \quad (1)$$

where, ΔP, psf or N/m^2, is the difference between the pressure on the surface of the model and the static pressure of the upstream flow inside the wind tunnel, which is a function of the wind speed in the tests; ρ is the air density (ρ = 1.225 kg/m^3 or 0.00237 slug/ft^3 at 15ºC and sea level); and U(H) is the upstream mean wind speed at a height equal to the height of the top of the model, ft/s or m/s, with H being the height of the model, ft or m. A positive value of C_p corresponds to the wind load acting toward the surface (i.e., downward pressure) and a negative value of C_p corresponds to the wind load acting away from the surface (i.e., uplift pressure).

The mean wind speed profile upstream of the model was determined by measuring mean wind speeds at several elevations from the wind tunnel floor. The Power-Law (Peterson and Hennessey 1978) is used for modeling the mean wind speed profile upstream of the test models:

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$$\frac{U(z)}{U_{ref}} = \left(\frac{Z}{Z_{ref}}\right)^{\alpha} \quad (2)$$

where, Z is the height above ground; Z_{ref} is the reference height taken as z = H (i.e., at the top of slope model); U_{ref} is the mean wind speed at the reference height taken as U(H); U(z) is the mean wind speed at elevation z; and α is the Power-Law exponent that depends on the terrain over which the wind develops. The value of α was determined as 0.14. Figure 3 shows an example of the measured wind speed profile and the power-law curve fit using α equal to 0.14.

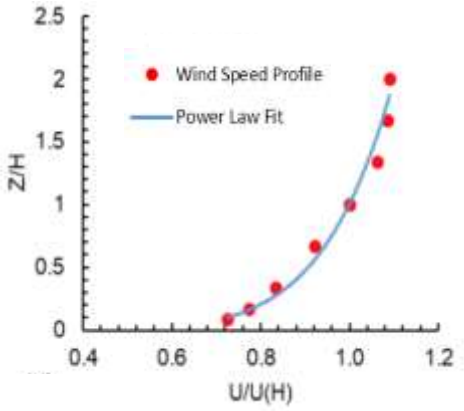

Figure 3. Measured wind speed profile and power-law curve fit (α = 0.14).

A number of test cases were conducted based on combinations of test model, cover type, and wind direction. For each test case, the model was tested for 2 to 3 wind speeds ranging from approximately 5.3 to 22.3 meters per sec (m/s) or 12 to 50 miles per hour (mph). At each wind speed 2 to 3 data runs were taken, resulting in a total of 4 to 9 data sets for each test case. The measured surface pressures were normalized by wind speeds and reported as the dimensionless pressure coefficients according to Eq. 1. The pressure coefficients were found to be consistent and did not show significant variations with respect to the magnitude of wind speed or model sizes. The average C_p values were calculated from the 4 to 9 data sets and reported as the final C_p values for each test case.

WIND TUNNEL TEST RESULTS

Exposed Geomembrane Cover. The measured wind pressure coefficient profiles are plotted in Figure 4 for the smooth and rough geomembranes with wind blowing toward the 3H:1V slope and Figure 5 for the smooth geomembrane with wind blowing toward the 4H:1V slope. In the remainder text of this paper, C_p values are reported as absolute values and the context of the value (i.e., downward or uplift pressure) is made clear. The test results indicate that:

- The windward side slope (i.e., the slope facing toward the wind) was initially under downward pressure. The rest of the model was under uplift pressure.
- The maximum uplift pressures occurred near the slope crests with peaks on both the windward and leeward (i.e., the slope facing away from the wind) side slopes.
- For the smooth geomembrane:

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- When the 3H:1V was on the windward side, the measured maximum uplift C_p values were 1.24 near the crest of the 3H:1V slope and 1.15 near the crest of the 4H:1V slope;
- When the 4H:1V slope was on the windward side, the measured maximum uplift C_p values were 1.13 near the crest of the 4H:1V slope and 1.34 near the crest of the 3H:1V slope; and
- The measured maximum uplift C_p value for 3H:1V slope is approximately 10% greater than that for 4H:1V slope.

- For the rough "studded" geomembrane:
  - For the case of the 3H:1V slope on the windward side, the three models with different sizes yielded reasonably consistent results, indicating that the measured C_p values can be considered independent on the model scale. The average measured maximum uplift C_p values were 0.60 near the crest of the 3H:1V slope and 0.40 near the crest of the 4H:1V slope; and
  - The measured uplift C_p values were significantly lower than those for the smooth geomembrane, indicating that wind uplift pressure decreased as the surface roughness of the cover increased.

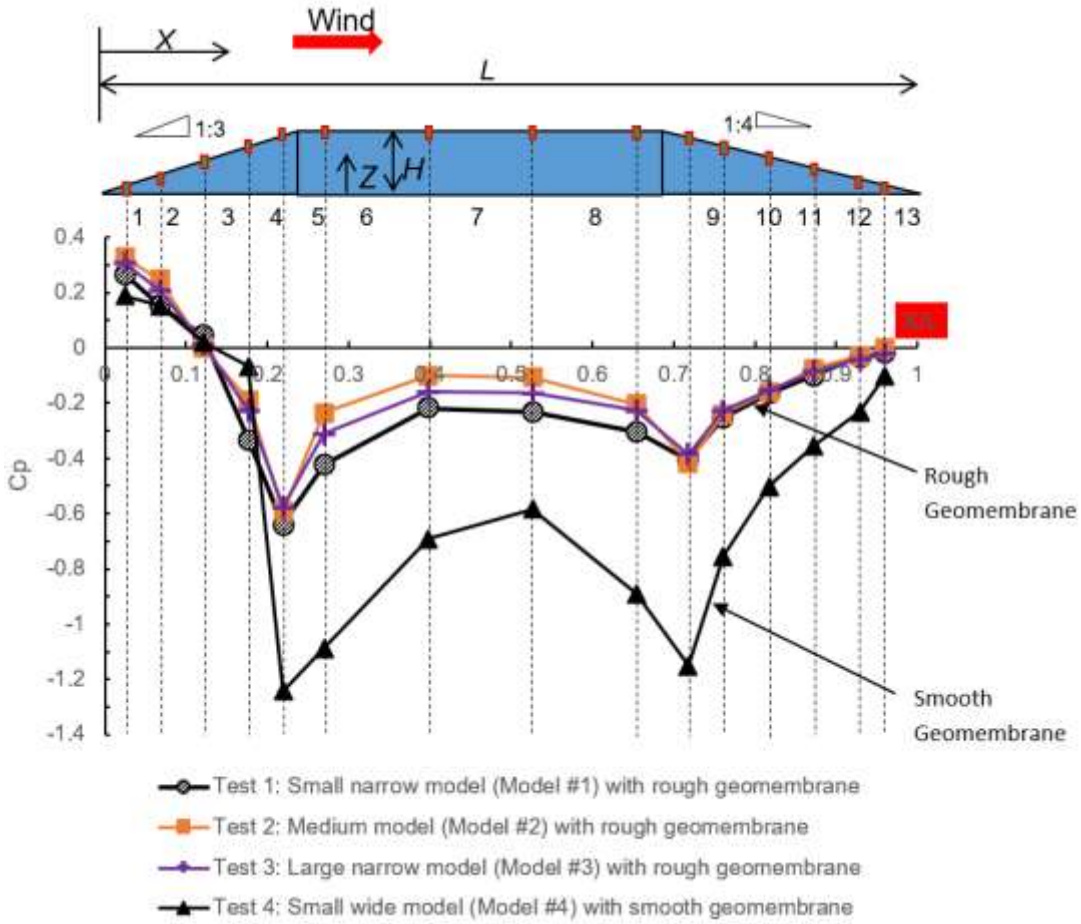

Figure 4. Measured C_p profiles of exposed smooth and rough geomembrane covers. (wind toward 3H:1V slope)

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Giroud et al. (1995) proposed a solution of wind-generated uplift coefficient for geomembrane, which was denoted as the suction factor for design of any slope based on the critical leeward slope. In this solution, the suction factors were recommended to be 1.0 in the top deck of a slope, 0.85 in the top third of a slope, 0.70 in the middle third of a slope and 0.55 in the lower third of a slope. The average suction factor on a slope was 0.70. This solution was later modified (Perera et al. 2011), where the suction factors were decreased by 23% based on field performance of exposed geomembrane covers (e.g., the maximum suction factor was decreased from 1.0 to 0.77 in the top deck of a slope). It should be noted that neither of these solutions accounted for variation in surface roughness of geomembrane nor the slope ratio. With respect to the maximum uplift pressure coefficient, both the original and modified solutions by Giroud and Perera are within the range of coefficients measured in this study. The values of the original solution are closer to these measured for the smooth geomembrane and the values of the modified solution are closer to these measured for the rough, "studded" geomembrane.

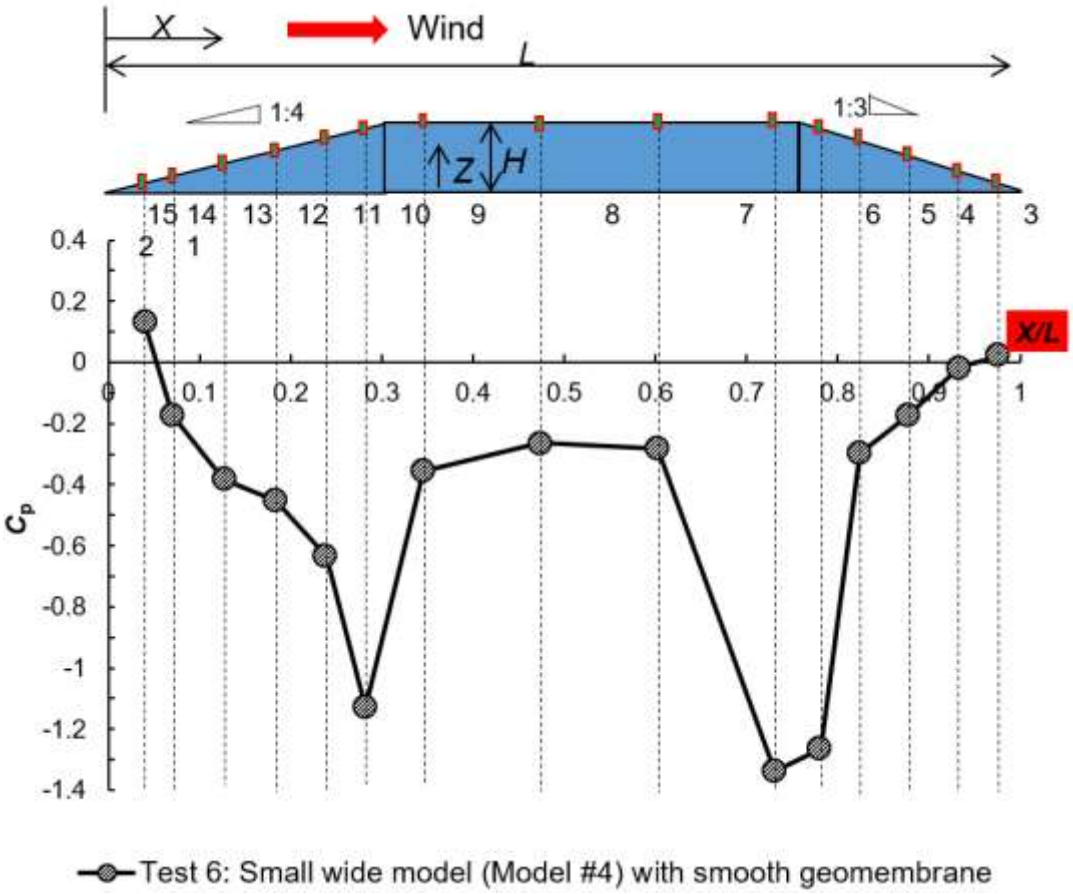

Figure 5. Measured C_p profiles of exposed smooth geomembrane cover. (wind toward 4H:1V slope)

ClosureTurf Engineered Turf Cover. The measured wind pressure coefficient profiles are plotted in Figure 6 for the ClosureTurf engineered turf cover with wind blowing toward the 3H:1V slope and Figure 7 with wind blowing toward the 4H:1V slope. The test results indicate that:

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- Approximately half of the windward side slope was under downward pressure and the rest of the model was under uplift pressure.
- The maximum uplift pressures occurred on the top near the crest of the windward side slope. The second peak near the crest of the leeward side slope was much smaller than that near the crest of the windward side slope.
- For the case of the 3H:1V slope on the windward side, the four models with different sizes yielded reasonably consistent results, indicating that the measured C_p values can be considered independent on the model scale. The average measured maximum uplift C_p value was 0.38 near the crest of the 3H:1V slope and 0.25 near the crest of the 4H:1V slope. These values are approximately 65% of those for the rough, "studded" exposed geomembrane cover and 25% of those for the smooth exposed geomembrane cover.
- When the 4H:1V slope was on the windward side, the measured maximum uplift C_p values were 0.29 near the crest of the 4H:1V slope and 0.18 near the crest of the 3H:1V slope, which are lower than those for the 3H:1V slope.

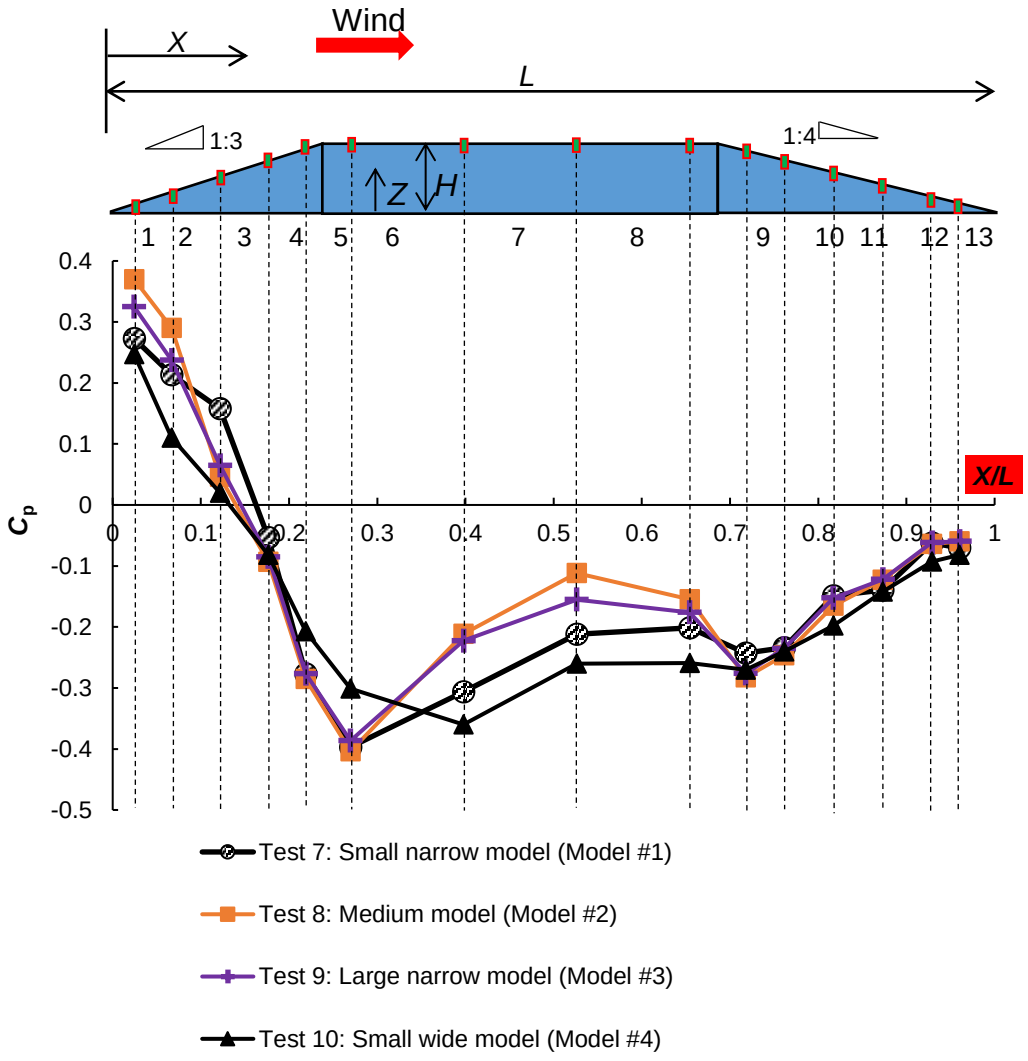

Figure 6. Measured C_p profiles of engineered turf cover. (wind toward 3H:1V slope)

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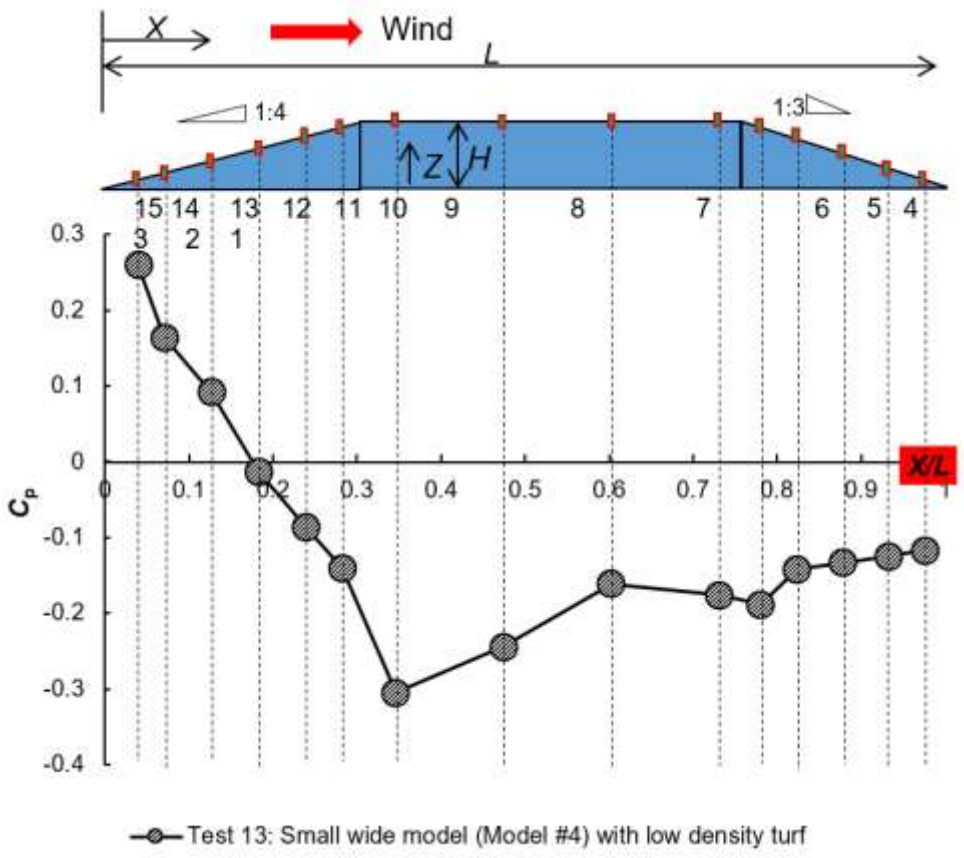

Figure 7. Measured C_p profiles of engineered turf cover. (wind toward 4H:1V slope)

Summary. The measured maximum wind uplift pressure coefficients are summarized in Table 1 below.

Table 1. Measured maximum wind uplift pressure coefficients. (compared with Giroud's solutions)

Cover Type	3H:1V Slope (This study)	4H:1V Slope (This study)	Giroud's Solution	Modified Giroud's Solution
Smooth Exposed Geomembrane Cover	1.24	1.13	1.0	0.77
Rough, "Studded" Exposed Geomembrane Cover	0.60	N/A		
ClosureTurf Engineered Turf Cover	0.38	0.29	N/A	N/A

EXAMPLE WIND UPLIFT CALCULATIONS OF ENGINEERED TURF COVER

A hypothetical landfill located in Ames, Iowa will be closed with the ClosureTurf engineered turf cover, which consists of (from bottom to top) a structured geomembrane, an engineered synthetic turf, and a 0.5-in (12.7-mm) thick sand infill. The landfill is 50 ft (15.24 m) high with a 3H:1V side slope. The design wind speed was assumed to be 83 mph (121.73 ft/s) or 133.58

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km/h (37.10 m/s) for Ames, Iowa based on ASCE 7-16 (https://hazards.atcouncil.org/#/). This corresponds to the 3-second gust speed at 32.8 ft (or 10 m) elevation in open terrain, U_3(32.8ft) or U_3(10m), with a mean recurrence interval (MRI) of 25 years.

Li et al. (2020) presented a detailed study on using the 3-second gust speed divided by a conversion factor to account for the uplift resistance provided by the temporary suction developed below the geomembrane as it is being uplifted. The conversion factor ranges from 1.23 to 1.75 based on varying tropical cyclone conditions and averaging periods (1 minute to 1 hour) (Harper et al. 2008). An example calculation was presented in Li's paper that used the 60-minute (i.e., hourly) average wind speed in the design of the anchor system for an exposed geomembrane cover. To obtain the 60-minute average wind speed, the 3-second gust speed was reduced by a conversion factor of 1.75 that corresponded to an in-land, roughly open terrain.

For the example calculation presented in this paper, the mean hourly wind speed at 32.8-ft (or 10-m) elevation, U(32.8ft) or U(10m), is conservatively calculated from the 3-second gust speed, U_3(32.8ft), using a factor of 1.5 for an open terrain (Vickery and Skerlj 2005):

$$U(32.8ft) = U_3(32.8ft) / 1.5 = 121.73 \text{ ft/s} / 1.5 = 81.15 \text{ ft/s (English Units)}$$

$$U(10m) = U_3(10m) / 1.5 = 37.10 \text{ m/s} / 1.5 = 24.73 \text{ m/s (SI Units)}$$

Using U(32.8 ft) or U(10m) as the reference, the mean hourly wind speed at top of the landfill, U(H) with H = 50 ft (15.24 m), is calculated using Eq. 2:

$$\frac{U(H)}{U(32.8\text{ ft})} = \left(\frac{H}{32.8\text{ ft}}\right)^{0.14};\ \frac{U(H)}{81.15\text{ ft/s}} = \left(\frac{50\text{ ft}}{32.8\text{ ft}}\right)^{0.14};\ U(H) = 86.08\text{ ft/s (English Units)}$$

$$\frac{U(H)}{U(10\text{ m})} = \left(\frac{H}{10\text{ m}}\right)^{0.14};\ \frac{U(H)}{24.73\text{ m/s}} = \left(\frac{15.24\text{ m}}{10\text{ m}}\right)^{0.14};\ U(H) = 26.23\text{ m/s (SI Units)}$$

The maximum mean wind uplift pressure is calculated according to Eq. 1 using the maximum uplift C_p value of 0.38 for a 3H:1V slope:

$$P_{max} = C_p \times 0.5\rho U(H)^2 = 0.38 \times 0.5 \times 0.00237 \times 86.08^2 = 3.34 \text{ psf (English Units)}$$

$$P_{max} = C_p \times 0.5\rho U(H)^2 = 0.38 \times 0.5 \times 1.225 \times 26.23^2 = 160.14 \text{ N/m}^2 \text{ (SI Units)}$$

The weight of the ClosureTurf engineered turf cover per unit area is about 5.4 psf (258.6 N/m^2) with a 0.5-in (12.7-mm) thickness of sand infill. The factor of safety (FS) for wind uplift is calculated to be 1.6 (i.e., 5.4 psf/3.34 psf or 258.6 N/m^2/160.14 N/m^2) for the assumed landfill cross section. Therefore, the engineered turf cover is considered to have adequate wind resistance under the design wind loads. If a higher design wind speed is used and the maximum uplift pressure exceeds the weight per unit area of engineered turf cover, further calculations may be required to evaluate whether the tension induced by the wind loads is acceptable; or thicker sand infill, anchor trenches or other means can be used to further secure/ballast the cover. Note that these additional measures would only be needed in those portions of the cover where the predicted FS is deemed not adequate.

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CONCLUSION

The wind tunnel study is presented that was carried out to evaluate wind uplift of the exposed geomembrane and ClosureTurf engineered turf landfill covers. The wind tunnel tests were performed on scaled slope models with different slope ratios, surface roughness, and wind speeds. The test results showed that:

- The wind-induced uplift pressure is mainly affected by the surface roughness of the cover. The measured maximum uplift pressure coefficient decreases as the roughness increases from smooth geomembrane to rough "studded" geomembrane to rougher engineered turf. The measured maximum uplift pressure coefficient values for the engineered turf cover are approximately 60% of those for the rough, "studded" exposed geomembrane cover and 30% of those for the smooth exposed geomembrane cover, which demonstrates the effect of the engineered synthetic turf layer on protecting the underlying geomembrane from wind uplift.
- The wind pressure is also affected by the slope ratio. Compared with a 4H:1V slope, the measured maximum uplift pressure coefficient values of a 3H:1V slope increase by approximately 10% and 30%, respectively, for the smooth exposed geomembrane and engineered turf covers; and
- The distributions of the measured wind pressure coefficients have been found to be reasonably consistent with respect to varying wind speeds and model sizes, which confirms that the dimensionless coefficients measured on small-scale models tested under wind speeds in the wind tunnel facility can be scaled up and used for full-scale landfill cross section subject to higher design wind speeds.

The wind pressure coefficient profiles presented in this paper can be used to evaluate whether the geosynthetic landfill covers, i.e., the exposed geomembrane and engineered turf covers, have sufficient resistance against wind uplift under the selected design wind speed.

ACKNOWLEDGEMENT

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ATTACHMENT D2
AMENDMENT #1

ASCE 7-15 (http://hazards.atcouncil.org/#/

25-year	80	mph	=	117.36 ft/s

33 ft 3-second gust speed height - need to check from ASCE 7-16

	Uplift Resistance			
U(1.5)	1.5	78.24	ft/s	Mean Hourly Windspeed

$$\frac{U(H)}{U(3s\ Gust\ Speed\ Height)} = \frac{H}{(3s\ Gust\ Speed\ Height)}\ ^{\wedge}0.14$$

H = 225 Height of Landfill

U(H) = Wind Speed at height of Landfill

U(H) = 102.36 ft/s @U(1.5)

C_p = 0.29 -Wind Pressure Coefficient - 4:1 slope (windward), 3:1 slope (leeward)

ρ= 0.00237 slug/ft3 air density @ 15C

P_{max} = mean wind uplift pressure

P_{max} = 3.60 psf @U(1.5)

Closure Turf cover per unit area = 5.4 psf

Factor of Safety

FS= 1.50 @U(1.5)

Attachment E

ClosureTurf Integrity Study

Revision 1 – 4/15/22

ATTACHMENT E
AMENDMENT #1

INTERFACE DIRECT SHEAR TEST RESULTS

ATTACHMENT E
AMENDMENT #1

40mil Textured LLDPE to Turf
Peak Friction Angle of 23 Degrees

(1)

$$\sigma_n = \frac{W \cos\alpha}{4A} \qquad (1)$$

α = 14 degrees
σ_n =
W = 8000 lbs
A= 78.53982 in^2

where:

α = the slope angle;

σ_n = contact normal stress between the tire and sand;

W = total gravity force of equipment; and

A = contact area between a tire and sand layer.

(2) $\sigma_n = \frac{8000\cos\alpha}{4*78.54} = 25.5\cos\alpha$

Assuming: (i) the tire-soil contact area is approximately equivalent to a 10 inch diameter circular area and (ii) the total weight of a RTCE is 8000 lbs, then the contact normal stress in the unit of psi is:

$$\sigma_n = \frac{8000\cos\alpha}{4(3.14)(5^2)} = 25.5\cos\alpha \qquad (2)$$

Flat	α =	0	σ_n =	25.5
4:1 Slope	α =	14	σ_n =	24.74254
3:1 Slope	α =	18.4	σ_n =	24.19634
2:1 Slope	α =	26.6	σ_n =	22.80093

(3)

$$FS = \frac{A\sigma_n \tan\delta}{0.25(W)\sin\alpha} \qquad (3)$$

α = 14 degrees 0.244346 radians
σ_n = 24.74254
δ = 23 degrees 0.401426 radians -Lab Results from Agru
W = 8000
A= 78.53982

FS = 1.7

where:

α = the slope angle;

σ_n = contact normal stress between the tire and sand;

δ = the peak friction angle of the Closure Turf system;

W = total gravity force of equipment; and

A = contact area between a tire and sand layer.

(4)

α = 14 degrees 0.244346 radians
δ = 23 degrees From Agru testing 0.401426 radians

Substituting Equation (1) into (3), Equation (3) is reduced to:

FS= 1.7

$$FS = \frac{\tan\delta}{\tan\alpha} \qquad (4)$$

40mil Textured LLDPE to Turf
Peak Friction Angle of 20.5 Degrees

(1)

$$\sigma_n = \frac{W \cos\alpha}{4A} \qquad (1)$$

α = 14 degrees
σ_n =
W = 8000 lbs
A= 78.53982 in^2

where:

α = the slope angle;

σ_n = contact normal stress between the tire and sand;

W = total gravity force of equipment; and

A = contact area between a tire and sand layer.

(2) $\sigma_n = \frac{8000\cos\alpha}{4*78.54} = 25.5\cos\alpha$

Assuming: (i) the tire-soil contact area is approximately equivalent to a 10 inch diameter circular area and (ii) the total weight of a RTCE is 8000 lbs, then the contact normal stress in the unit of psi is:

$$\sigma_n = \frac{8000\cos\alpha}{4(3.14)(5^2)} = 25.5\cos\alpha \qquad (2)$$

Flat	α =	0	σ_n =	25.5
4:1 Slope	α =	14	σ_n =	24.74254
3:1 Slope	α =	18.4	σ_n =	24.19634
2:1 Slope	α =	26.6	σ_n =	22.80093

(3)

$$FS = \frac{A\sigma_n \tan\delta}{0.25(W)\sin\alpha} \qquad (3)$$

α = 14 degrees 0.244346 radians
σ_n = 24.74254
δ = 20.5 degrees 0.357792 radians -Lab Results from Agru
W = 8000
A= 78.53982

FS = 1.5

where:

α = the slope angle;

σ_n = contact normal stress between the tire and sand;

δ = the peak friction angle of the Closure Turf system;

W = total gravity force of equipment; and

A = contact area between a tire and sand layer.

(4)

α = 14 degrees 0.244346 radians
δ = 20.5 degrees From Agru testing 0.357792 radians

Substituting Equation (1) into (3), Equation (3) is reduced to:

FS= 1.5

$$FS = \frac{\tan\delta}{\tan\alpha} \qquad (4)$$

40mil Textured LLDPE to Turf
Peak Friction Angle of 19 Degrees

(1)

$$\sigma_n = \frac{W \cos\alpha}{4A} \quad (1)$$

α = 14 degrees
σ_n =
W = 8000 lbs
A= 78.53982 in^2

where:

α = the slope angle;

σ_n = contact normal stress between the tire and sand;

W = total gravity force of equipment; and

A = contact area between a tire and sand layer.

(2) $\sigma_n = \frac{8000\cos\alpha}{4*78.54} = 25.5\cos\alpha$

Assuming: (i) the tire-soil contact area is approximately equivalent to a 10 inch diameter circular area and (ii) the total weight of a RTCE is 8000 lbs, then the contact normal stress in the unit of psi is:

$$\sigma_n = \frac{8000\cos\alpha}{4(3.14)(5^2)} = 25.5\cos\alpha \quad (2)$$

Flat	α =	0	σ_n =	25.5
4:1 Slope	α =	14	σ_n =	24.74254
3:1 Slope	α =	18.4	σ_n =	24.19634
2:1 Slope	α =	26.6	σ_n =	22.80093

(3)

$$FS = \frac{A\sigma_n \tan\delta}{0.25(W)\sin\alpha} \quad (3)$$

α = 14 degrees 0.244346 radians
σ_n = 24.74254
δ = 19 degrees 0.331613 radians -Lab Results from Agru
W = 8000
A= 78.53982

FS = 1.4

where:

α = the slope angle;

σ_n = contact normal stress between the tire and sand;

δ = the peak friction angle of the Closure Turf system;

W = total gravity force of equipment; and

A = contact area between a tire and sand layer.

(4)

α = 14 degrees 0.244346 radians
δ = 19 degrees From Agru testing 0.331613 radians

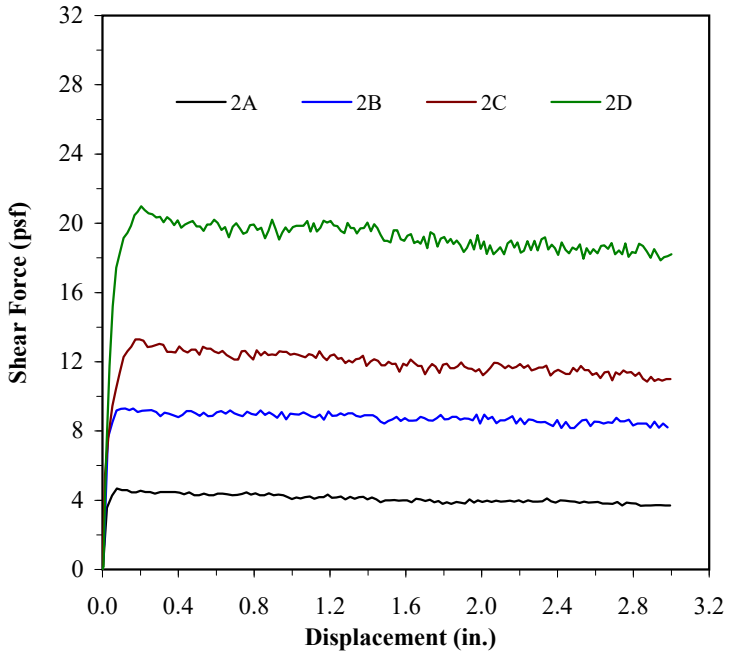
Substituting Equation (1) into (3), Equation (3) is reduced to:

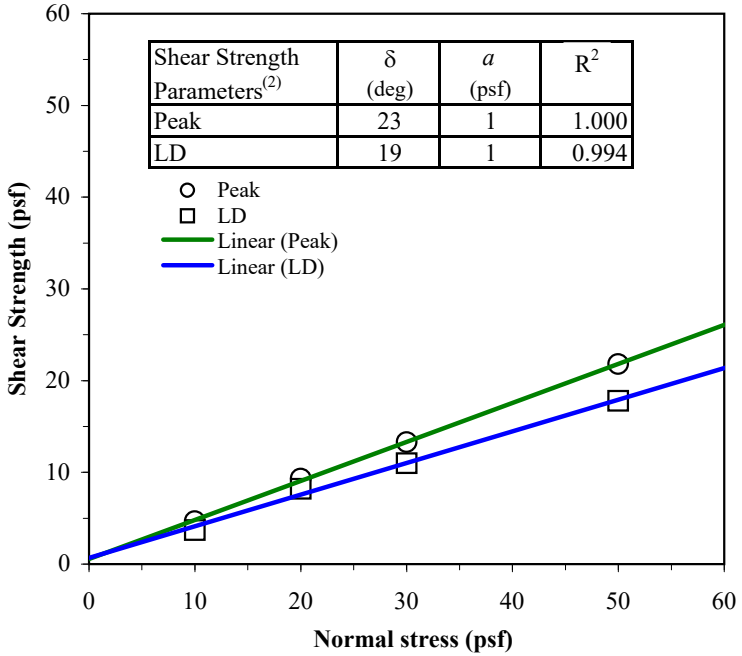
FS= 1.4

$$FS = \frac{\tan\delta}{\tan\alpha} \quad (4)$$

WATERSHED GEOSYNTHETICS LLC
INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Concrete sand
CT32 Synthetic Turf with base geotextile side down against
Agru 40-mil Microspike LLDPE geomembrane with dull side up
Lower Shear Box: Concrete sand





Shear Strength Parameters[2]	δ (deg)	*a* (psf)	R^2
Peak	23	1	1.000
LD	19	1	0.994

Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	Soaking		Consolidation		Lower Soil			Upper Soil			Soil Shear Strength		Shear Strengths		Failure Mode
				Stress (psf)	Time (hour)	Stress (psf)	Time (hour)	γ_d (pcf)	ω_i (%)	ω_f (%)	γ_d (pcf)	ω_i (%)	ω_f (%)	ϕ (deg)	c (psf)	τ_P (psf)	τ_{LD} (psf)	
2A	12 x 12	10	0.04	10	24	-	-	-	-	-	-	-	-	-	-	4.7	3.7	(1)
2B	12 x 12	20	0.04	20	24	-	-	-	-	-	-	-	-	-	-	9.3	8.2	(1)
2C	12 x 12	30	0.04	30	24	-	-	-	-	-	-	-	-	-	-	13.3	11.0	(1)
2D	12 x 12	50	0.04	50	24	-	-	-	-	-	-	-	-	-	-	21.8	17.8	(1)

NOTES:
(1) Sliding (i.e., shear failure) occurred at the interface between the geotextile side of heavy closure turf and the dull side of agru 40-mil microspike LLDPE geomembrane.
(2) The reported total-stress parameters of friction angle and adhesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

DATE OF TEST: 5/6/2019

SGI TESTING SERVICES, LLC

FIGURE NO.	1
PROJECT NO.	SGI19014
DOCUMENT NO.	
FILE NO.	

Attachment I

Hydrologic **Evaluation of Landfill**

Performance (HELP) Model Analysis

Revision 1 – 4/15/22

HELP Model Comparison
Engineered Turf / Traditional Cover

Rev. 0 - November 2021

Rev. 1 - April 2022

Prepared by:

CTI and Associates, Inc.
34705 West 12 Mile Rd, Suite 230
Farmington Hills, MI 48331
Phone: (248) 560-0725

CALCULATION SHEET

Project No.:

Client: US Ecology – Wayne Disposal | Calculated By: BME | Date: 4/7/22

Project: Engineered Turf Equivalency Demonstration Report | Checked By: JLM | Date: 4/8/22

Calculation HELP Model – Cover Comparison | Approved By: | Date:

Table of Contents

1.0 Objective 1
2.0 Final Cover Comparison Methodology 1
2.1. HELP Model Parameters 1
2.2. Model Assumptions 2
2.3. Standard Soil Cover System Material Textures 3
2.4. Engineered Turf Cover System Material Textures 3
3.0 Results 3
4.0 Conclusions 4

Attachments

Attachment A: Final Cover Comparison Calculations
Attachment B1: Rule Required Cover System HELP Model Output
Attachment B2: Engineered Turf Cover System HELP Model Output
Attachment C: Climate Data Information

CALCULATION SHEET

Project No.:					
Client:	US Ecology – Wayne Disposal	Calculated By:	BME	Date:	4/7/22
Project:	Engineered Turf Equivalency Demonstration Report	Checked By:	JLM	Date:	4/8/22
Calculation	HELP Model – Cover Comparison	Approved By:		Date:	

1.0 OBJECTIVE

CTI and Associates has prepared this report to demonstrate the hydrologic equivalency of engineered turf to the traditional cover system requirements specified by 40 Code of Federal Regulations (CFR) §264.310 which in part requires the final cover to in part

- Provide long-term minimization of migration of liquids through the closed landfill
- Promote drainage of the cover
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

In addition to prescriptive requirements for the final cover over a hazardous waste landfill, Michigan Administrative Code R 299.9619(6)(a) also states the owner or operator can: Substitute an equivalent design which shall include a flexible membrane liner component with a minimum thickness of 1 mm (40 mil), depending on the type of material selected, and demonstrates to the director that it provides equivalent environmental protection.

ClosureTurf, which is an engineered turf designed to be used for landfill cover systems, already includes the 40 mil minimum geomembrane. It is the most developed and tested of the commercially available engineered turf products and is the subject of this comparison. Other aspects of environmental protection can be demonstrated through various performance demonstrations. To demonstrate the hydrologic performance of ClosureTurf, the Hydrologic Evaluation of Landfill Performance (HELP) Model, was used to compare the amount of percolation through the cover system expected for each system.

2.0 FINAL COVER COMPARISON METHODOLOGY

The HELP Model was developed by USEPA specifically to compare the hydrologic performance of different cover designs while considering a variety of environmental, soil, and design variables (Schroeder et al., 1994). Version 4.0.1 was used for this evaluation. The results of the HELP Model provide a detailed look at daily, monthly, and annual contact water amounts expected to be generated for a given cover design. Therefore, the efficacy of each cover evaluated can be directly compared by the amount of contact water generated. A detailed engineering manual discussing the basis for the model is available online at the following location: https://www.epa.gov/land-research/hydrologic-evaluation-landfill-performance-help-model. Updated information on version 4.0 from USEPA used in this analysis can be found here: https://www.epa.gov/land-research/hydrologic-evaluation-landfill-performance-help-model.

2.1. HELP MODEL PARAMETERS

The HELP Model requires four different types of climate data to execute including: evapotranspiration, precipitation, temperature, and solar radiation. Each data group is based on a specific location and can

either be synthetically generated using the HELP Model or manually entered. For this analysis, the most important parameter is precipitation because it directly correlates to the amount of contact water generated. For all four groups, the program was used to generate 100 years of synthetic data based on the default database associated with the closest weather station to the site, Detroit Metro Airport, which is approximately 12 miles east of the site. The synthetic precipitation data was back checked with the National Oceanic and Atmospheric Administration's (NOAA) Summary of Monthly Normals for precipitation to determine if the actual climate values were consistent with the model data. It was determined that they were in good agreement for purposes of this analysis. This comparison is included in the calculations in Attachment A.

The remaining model parameters included site geometry and material characteristics. A standard of one acre was used for each analysis. Representative slope lengths and grades were also used as depicted in the summary Tables 1 and 2. With the exception of the cover system materials modeled, all other inputs into the model were held constant to facilitate a fair comparison. For purposes of the comparison, each final cover system was input into the model and the amount of contact water measured after 100 years was compared. The model presents peak daily results and average annual results over the 100-year simulation period. Input parameters are included in the output files contained in Attachments B1 and B2. Climate data are included in Attachment C.

2.2. MODEL ASSUMPTIONS

The following assumptions were made in performing the HELP Model Analysis. For reference, the HELP Model User's Guide For Version 4 can be found online at: https://www.epa.gov/land-research/help-40-user-manual.

- The geosynthetics materials are assumed to be constructed with good quality workmanship and in accordance with the project CQA Plan. An industry standard defect area of 0.0001 m^2 was assumed in the analysis with a placement quality of "good". This represents one pinhole-type defect and four pinhole installation defects per acre. Both designs include a 40 mil geomembrane underlain by a GCL. Geomembrane hydraulic conductivity was modeled as $4.0x10^{-13}$ cm/sec while GCL hydraulic conductivity was modeled as $3.0x10^{-9}$ cm/sec

- The initial water contents of all layers were manually set equal to the default HELP specified field capacity of the material, which represents the water content of the material after a prolonged period of gravity drainage. However, it should be noted that for the purpose of calculating hydraulic flow through the landfill system, the HELP Model conservatively assumes that all barrier layers (final cover barrier layer) are saturated.

- The HELP Model was utilized to synthetically generate temperature, precipitation, evapotranspiration, and solar radiation data based on Detroit Metro, Michigan. The evaporative zone depth was conservatively reduced from the default value based on the given cover system.

CALCULATION SHEET | Project No.:

Client: US Ecology – Wayne Disposal | Calculated By: BME | Date: 4/7/22

Project: Engineered Turf Equivalency Demonstration Report | Checked By: JLM | Date: 4/8/22

Calculation: HELP Model – Cover Comparison | Approved By: | Date:

- The HELP Model results are independent of the landfill area. A one acre area was considered for the analysis. Therefore, cover system leakage results are presented as cubic feet per acre per time period (annual or daily). Results were converted to gallons per acre per time period using the conversion factor listed below:

$$\frac{ft^3}{time\ period} \times \frac{7.48\ gallons}{ft^3} \times \frac{time\ period}{\#\ of\ days}$$

2.3. Standard Soil Cover System Material Textures

Cover materials for the OAC prescribed Standard Soil Cover System used in the HELP Model were modeled as follows:

- The Infiltration Layer was modeled consistent with past analyses as follows:
  - Porosity: 0.471
  - Wilting Point: 0.21
  - Saturated Hydraulic Conductivity: 5.0×10^{-4} cm/sec.
- The geocomposite drainage Layer was modeled as HELP default texture 20 with effective saturated hydraulic conductivity of 10 cm/s.

2.4. Engineered Turf Cover System Material Textures

The engineered turf was modeled as recommended by the manufacturer of ClosureTurf and based on the published characteristics of the materials.

- The sand infill material was modeled as follows:
  - Porosity: 0.437
  - Wilting Point: 0.024
  - Saturated Hydraulic Conductivity: 2.5×10^{-2} cm/sec
- The lateral drainage characteristics were modeled with an effective Saturated Hydraulic Conductivity of 31.6 cm/s.

3.0 Results

The HELP model output files for the required and proposed cover systems are provided in Appendix B. The key results of the HELP Model comparison depicting the hydraulic performance of each cover system are included in Table 1 and Table 2 below. Note that these results are presented for comparative purposes and may not represent accurate estimates of actual leakage through the constructed cover system.

CALCULATION SHEET

Project No.:

Client: US Ecology – Wayne Disposal | Calculated By: BME | Date: 4/7/22

Project: Engineered Turf Equivalency Demonstration Report | Checked By: JLM | Date: 4/8/22

Calculation: HELP Model – Cover Comparison | Approved By: | Date:

Table 1: Rainfall/Runoff/Infiltration of standard cover system versus Engineered Turf Cover System

Final Cover Systems	Slope	Slope Length (ft)	Average Annual Precipitation (in)	Average Annual Runoff (in)	Average Annual Perc. Through Membrane (in)
Rule Required Cover System	4%	625	31.7	3.037	4E-6
Engineered Turf	4%	625	31.7	8.0	1E-6
Rule Required Cover System	25%	200	31.7	2.225	4E-6
Engineered Turf	25%	820	31.7	7.9	1E-6

Table 2: Hydraulic Performance of the Rule Required Cover System versus Engineered Turf Cover System

Final Cover Systems	Slope	Slope Length (ft)	Average Daily Leakage Rate (Gal/Acre/Day)	Peak Daily Leakage Rate (Gal/Acre/Day)	Average Annual Leakage Rate (Gal/Acre/Year)
Rule Required Cover System	4%	625	3.3E-4	3.1E-5	0.12
Engineered Turf	4%	625	8.1E-5	4.4E-4	0.03
Rule Required Cover System	25%	200	3.0E-4	2.0E-5	0.11
Engineered Turf	25%	820	8.6E-5	2.3E-4	0.03

4.0 CONCLUSIONS

The results in Table 1 and Table 2 provide a side-by-side comparison of the 40 CFR §264.310 rule required design standard versus engineered turf which shows that the proposed alternate cover system will result in similar rates and sheds much more water than a traditional cover system. Although percolation rates are mathematically different, this likely is due to limitations in the model for handling such small values relative to the overall resolution of the model. In any case, it shows that both cover systems allow for negligible flow through the geosynthetic composite cover. From a hydrologic standpoint, the proposed alternate material meets the criteria for being at least as protective to the environment as the rule required cover system.

Attachment A
Final Cover Comparison Calculations

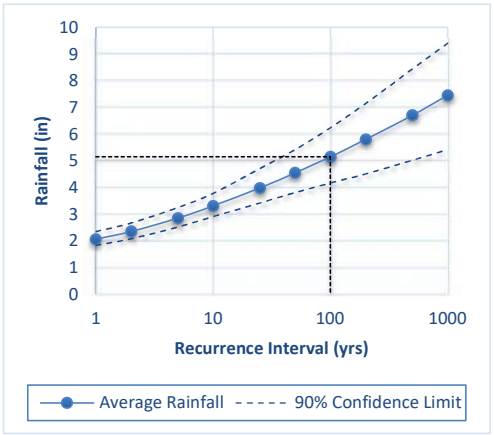
28001 Cabot Dr. Novi, MI 48377 **Tel. (248) 486-5100**	**USE/WDI** Final Cover Comparison 2021 WDI Permit Mod	JOB **1208070066** SHT NO **1** OF **3** CALC BY **JLM** DATE **10/03/21** CHK BY **XZ** DATE

Review climate data for the site and determine total normal precip, monthly extreme values, and 100 yr/24 hr storm based on local NOAA Data

National Environmental Satellite, Data, and Information Service: Climate Normals 1981-2010
Station Data: DETROIT MET. AIRPORT, MI US USW00094847 Lat 42.2313° N Long -83.3308° W

Normal Precipitation

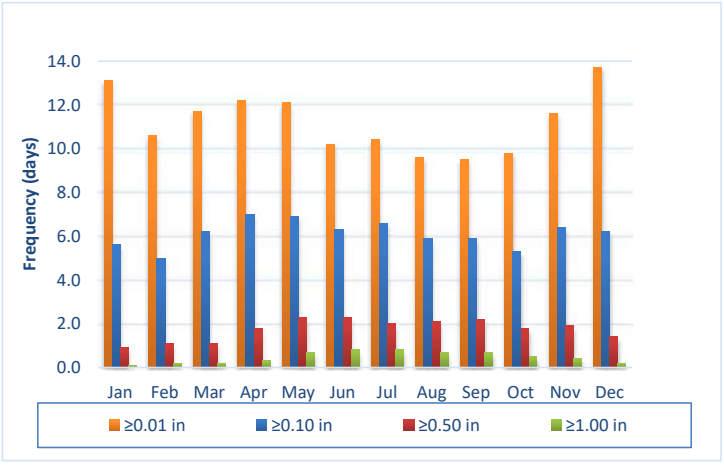
Month	Rainfall (in)	Snowfall (in)	Extreme Daily Rainfall.* (in)	Year	24-hr Storm Duration Rainfall Recurrence Interval (yr)	Precip. (in)
Jan	1.96	12.5	2.06	11/2020		0
Feb	2.02	10.2	2.41	09/1876	1	2.06
Mar	2.28	6.9	1.97	30/2017	2	2.35
Apr	2.90	1.7	3.58	20/2000	5	2.85
May	3.38	0.0	2.56	26/1968	10	3.31
Jun	3.52	0.0	3.07	06/1903	25	3.98
Jul	3.37	0.0	4.74	31/1925	50	4.55
Aug	3.00	0.0	4.57	11/2014	100	5.15
Sep	3.27	0.0	3.71	11/2000	200	5.8
Oct	2.52	0.1	3.29	Mar-54	500	6.71
Nov	2.79	1.5	2.59	22/1909	1000	7.45
Dec	2.46	9.6	2.17	21/1967		
Year	33.47	42.50				



*Extreme data from 1874 through 2021

Frequency Distribution for Daily Precipitation (1981-2010)

Mth/Rain	≥0.01 in	≥0.10 in	≥0.50 in	≥1.00 in
Jan	13.1	5.6	0.9	0.1
Feb	10.6	5.0	1.1	0.2
Mar	11.7	6.2	1.1	0.2
Apr	12.2	7.0	1.8	0.3
May	12.1	6.9	2.3	0.7
Jun	10.2	6.3	2.3	0.8
Jul	10.4	6.6	2.0	0.8
Aug	9.6	5.9	2.1	0.7
Sep	9.5	5.9	2.2	0.7
Oct	9.8	5.3	1.8	0.5
Nov	11.6	6.4	1.9	0.4
Dec	13.7	6.2	1.4	0.2
Year	134.5	73.3	20.9	5.6



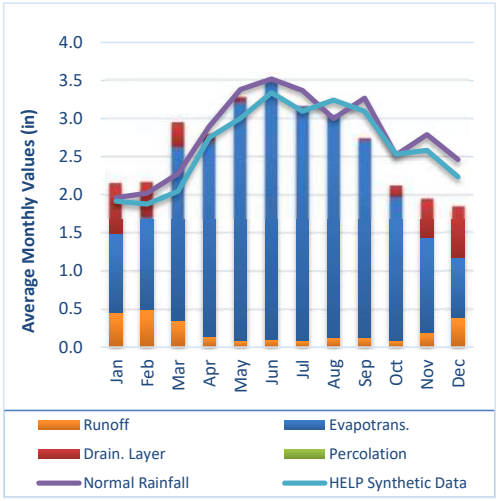
28001 Cabot Dr. Novi, MI 48377 **Tel. (248) 486-5100**	**USE/WDI** Final Cover Comparison 2021 WDI Permit Mod	JOB **1208070066** SHT NO **2** OF **3** CALC BY **JLM** DATE **10/03/21** CHK BY **XZ** DATE

Compare climate data and HELP model results. Determine average daily precipitation, stormwater runoff, and leachate generation due to percolation through the infiltration layer based on HELP model data.

HELP Model Average Monthly Precipitation & Leachate Data

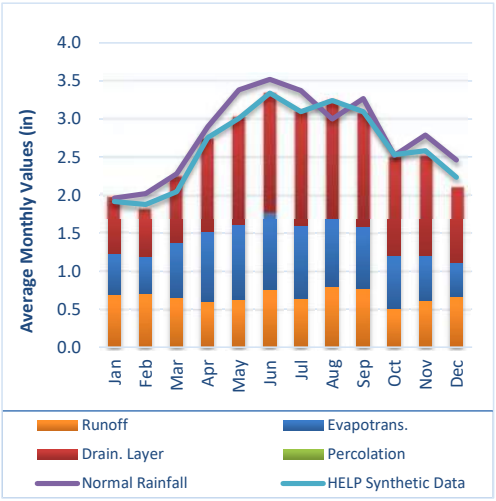
HELP Model - 100 yrs of Synthetic Weather Data - (Permitted Cover System, 1 Acre, 625 ft/4% slope, SCS Curve No. 90.0)

Average Month	Rainfall in	Runoff in	Evapotrans. in	Evap. Zone in	Drain. Layer in	Percolation in
Jan	1.91	0.457	1.038	0.344	0.660	0.000
Feb	1.88	0.488	1.217	0.332	0.464	0.000
Mar	2.05	0.350	2.274	0.305	0.327	0.000
Apr	2.76	0.137	2.564	0.283	0.092	0.000
May	3.01	0.083	3.125	0.275	0.067	0.000
Jun	3.34	0.101	3.386	0.268	0.013	0.000
Jul	3.10	0.084	3.059	0.258	0.016	0.000
Aug	3.24	0.124	2.912	0.267	0.007	0.000
Sep	3.10	0.128	2.582	0.280	0.030	0.000
Oct	2.53	0.084	1.890	0.293	0.149	0.000
Nov	2.58	0.196	1.245	0.322	0.514	0.000
Dec	2.24	0.387	0.790	0.340	0.678	0.000
Year	31.73	2.62	26.08		3.02	0.000
Peak Daily	2.40	2.20			0.342	0.000



HELP Model - 100 yrs of Synthetic Weather Data - (CT Cover System, 1 Acre, 625 ft/4% slope, SCS Curve No. 96.7)

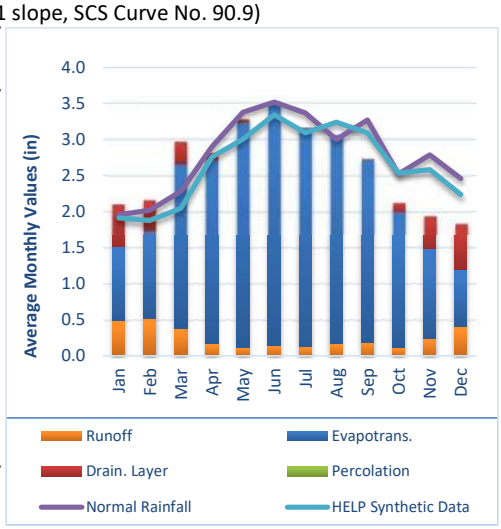
Average Month	Rainfall in	Runoff in	Evapotrans. in	Evap. Zone in	Drain. Layer in	Percolation in
Jan	1.91	0.698	0.536	0.130	0.750	0.000
Feb	1.88	0.707	0.481	0.100	0.637	0.000
Mar	2.05	0.655	0.726	0.088	0.871	0.000
Apr	2.76	0.597	0.923	0.080	1.223	0.000
May	3.01	0.624	0.986	0.076	1.419	0.000
Jun	3.34	0.762	1.008	0.079	1.569	0.000
Jul	3.10	0.640	0.964	0.076	1.496	0.000
Aug	3.24	0.800	0.894	0.075	1.550	0.000
Sep	3.10	0.777	0.811	0.072	1.487	0.000
Oct	2.53	0.505	0.697	0.073	1.299	0.000
Nov	2.58	0.612	0.586	0.081	1.320	0.000
Dec	2.24	0.664	0.449	0.111	0.998	0.000
Year	31.73	8.04	9.06		14.62	0.000
Peak Daily	2.4	2.44			0.591	0.000



28001 Cabot Dr. Novi, MI 48377 **Tel. (248) 486-5100**	**USE/WDI** Final Cover Comparison 2021 WDI Permit Mod	JOB **1208070066** SHT NO **3** OF **3** CALC BY **JLM** DATE **10/03/21** CHK BY **XZ** DATE

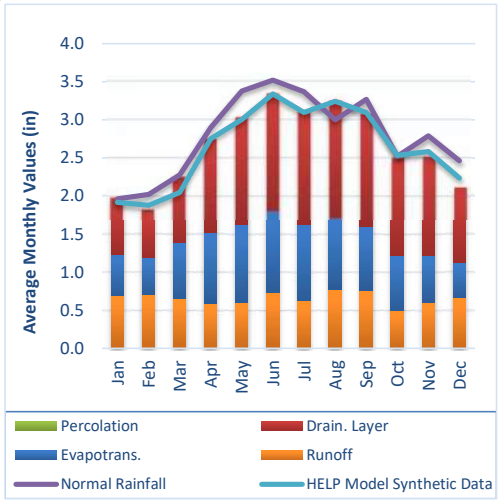
HELP Model - 100 yrs of Synthetic Weather Data - (Permit Cover System, 1 Acre, 200 ft/4:1 slope, SCS Curve No. 90.9)

Average Month	Rainfall in	Runoff in	Evapotrans. in	Evap. Zone in	Drain. Layer in	Percolation in
Jan	1.91	0.486	1.037	0.350	0.585	0.000
Feb	1.88	0.519	1.217	0.339	0.430	0.000
Mar	2.05	0.383	2.272	0.311	0.316	0.000
Apr	2.76	0.169	2.552	0.288	0.090	0.000
May	3.01	0.122	3.105	0.279	0.052	0.000
Jun	3.34	0.149	3.357	0.272	0.009	0.000
Jul	3.10	0.123	3.030	0.262	0.010	0.000
Aug	3.24	0.177	2.881	0.269	0.001	0.000
Sep	3.10	0.186	2.535	0.283	0.013	0.000
Oct	2.53	0.119	1.880	0.296	0.126	0.000
Nov	2.58	0.242	1.241	0.325	0.461	0.000
Dec	2.24	0.415	0.790	0.344	0.635	0.000
Year	31.73	3.09	25.90		2.73	0.000
Peak Daily	2.40	2.21			0.250	0.000



HELP Model - 100 yrs of Synthetic Weather Data - (CT Cover System, 1 Acre, 820 ft/4:1 slope, SCS Curve No. 96.8)

Average Month	Rainfall in	Runoff in	Evapotrans. in	Evap. Zone in	Drain. Layer in	Percolation in
Jan	1.91	0.693	0.542	0.344	0.749	0.000
Feb	1.88	0.705	0.486	0.332	0.632	0.000
Mar	2.05	0.653	0.736	0.305	0.867	0.000
Apr	2.76	0.586	0.939	0.283	1.222	0.000
May	3.01	0.602	1.020	0.275	1.407	0.000
Jun	3.34	0.733	1.068	0.268	1.537	0.000
Jul	3.10	0.622	1.001	0.258	1.477	0.000
Aug	3.24	0.768	0.945	0.267	1.531	0.000
Sep	3.10	0.754	0.848	0.280	1.473	0.000
Oct	2.53	0.496	0.721	0.293	1.283	0.000
Nov	2.58	0.603	0.609	0.322	1.300	0.000
Dec	2.24	0.663	0.461	0.340	0.990	0.000
Year	31.73	7.88	9.38		14.47	0.000
Peak Daily	2.40	2.44			0.642	0.000



Conclusions:

Overall, the HELP synthetic data correlates well with the available monthly climate normals data from NOAA. It underpredicts rainfall by a little over an inch. As the primary objective of the HELP model is to demonstrate the Engineered Turf cover system has an equivalent or better hydrologic performance compared to the permitted soil cover system, this HELP model is sufficient for comparison purposes.

The final cover comparison shows that the Engineered Turf barrier used in the alternate cover system prevents infiltration as effectively as the permitted cover which is to say the both effectively prevent infiltration when installed properly. The biggest difference as illustrated by the results is the soil component of the traditional cover holds a large portion of the surface water while the engineered turf sheds that water.

R 299.9619(6)(a) states the owner or operator can substitute an equivalent design which shall include a flexible membrane liner component with a minimum thickness of 1 mm (40 mil), depending on the type of material selected, and demonstrates to the director that it provides equivalent environmental protection. ClosureTurf includes the geomembrane, it also offers equivalent environmental protection as it relates surface water infiltration and percolation through the cover system.

Attachment B1
Rule Required Cover System HELP Model Output

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: MC Cell VI-F&G Rule Req. Cover Simulated On: 4/7/2022 21:57

Layer 1
Type 1 - Vertical Percolation Layer (Cover Soil)
WDI Veg/Infiltration Layer
Material Texture Number 43

Thickness	=	36	inches
Porosity	=	0.471	vol/vol
Field Capacity	=	0.342	vol/vol
Wilting Point	=	0.21	vol/vol
Initial Soil Water Content	=	0.3411	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-04	cm/sec

Layer 2
Type 2 - Lateral Drainage Layer
Drainage Net (0.5 cm)
Material Texture Number 20

Thickness	=	0.2	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.0113	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	25	%
Drainage Length	=	200	ft

Layer 3
Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	4	Holes/Acre
FML Placement Quality	=	3	Good

Layer 4
Type 3 - Barrier Soil Liner

CL - Clay Loam (Moderate)
Material Texture Number 25

Thickness	=	36	inches
Porosity	=	0.437	vol/vol
Field Capacity	=	0.373	vol/vol
Wilting Point	=	0.266	vol/vol
Initial Soil Water Content	=	0.437	vol/vol
Effective Sat. Hyd. Conductivity	=	3.60E-06	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	90.9	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	16	inches
Initial Water in Evaporative Zone	=	5.219	inches
Upper Limit of Evaporative Storage	=	7.536	inches
Lower Limit of Evaporative Storage	=	3.36	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	28.015	inches
Total Initial Water	=	28.015	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	42.18	Degrees
Maximum Leaf Area Index	=	3.5	
Start of Growing Season (Julian Date)	=	90	days
End of Growing Season (Julian Date)	=	216	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	72	%
Average 3rd Quarter Relative Humidity	=	80	%
Average 4th Quarter Relative Humidity	=	77	%

Note: Evapotranspiration data was obtained for Belleville, Michigan

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.913949	1.878746	2.045516	2.755274	3.005731	3.34107
3.096216	3.243099	3.096181	2.533399	2.583786	2.235743

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.7	30.4	42.7	54.8	68.5	78.1
81.5	79	68.8	56.2	44	31.5

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Average Annual Totals Summary

Title: MC Cell VI-F&G Rule Req. Cover
Simulated on: 4/7/2022 22:02

	Average Annual Totals for Years 1 - 100*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	31.73	[3.35]	115,175.2	100.00
Runoff	3.037	[1.286]	11,025.3	9.57
Evapotranspiration	25.683	[2.72]	93,229.4	80.95
Subprofile1				
Lateral drainage collected from Layer 2	3.0027	[1.3809]	10,899.9	9.46
Percolation/leakage through Layer 4	0.000004	[0.000002]	0.0145	0.00
Average Head on Top of Layer 3	0.0001	[0.0001]	---	---
Water storage				
Change in water storage	0.0057	[0.8045]	20.6	0.02

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: MC Cell VI-F&G Rule Req. Cover
Simulated on: 4/7/2022 22:02

	Peak Values for Years 1 - 100*		
	(inches)		(cubic feet)
Precipitation	2.40		8,721.4
Runoff	2.224		8,073.1
Subprofile1			
Drainage collected from Layer 2	0.2831		1,027.7
Percolation/leakage through Layer 4	0.000000		0.0010
Average head on Layer 3	0.0042		---
Maximum head on Layer 3	0.0085		---
Location of maximum head in Layer 2	0.00	(feet from drain)	
Other Parameters			
Snow water	4.1439		15,042.2
Maximum vegetation soil water	0.4307	(vol/vol)	
Minimum vegetation soil water	0.2100	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: MC Cell VI-F&G Rule Req. Cover
Simulated on: 4/7/2022 22:02
Simulation period: 100 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	12.8492	0.3569
2	0.0022	0.0109
3	0.0000	0.0000
4	15.7320	0.4370
Snow water	0.0000	---

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: Rule Cover System_MinSlope **Simulated On:** 4/8/2022 15:06

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
WDI Veg/Infiltration Layer
Material Texture Number 43

Thickness	=	36	inches
Porosity	=	0.471	vol/vol
Field Capacity	=	0.342	vol/vol
Wilting Point	=	0.21	vol/vol
Initial Soil Water Content	=	0.3428	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-04	cm/sec

Layer 2

Type 2 - Lateral Drainage Layer
Drainage Net (0.5 cm)
Material Texture Number 20

Thickness	=	0.2	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.0104	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	25	%
Drainage Length	=	200	ft

Layer 3

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	4	Holes/Acre
FML Placement Quality	=	3	Good

Layer 4

Type 3 - Barrier Soil Liner

CL - Clay Loam (Moderate)
Material Texture Number 25

Thickness	=	36	inches
Porosity	=	0.437	vol/vol
Field Capacity	=	0.373	vol/vol
Wilting Point	=	0.266	vol/vol
Initial Soil Water Content	=	0.437	vol/vol
Effective Sat. Hyd. Conductivity	=	3.60E-06	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	86.5	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	16	inches
Initial Water in Evaporative Zone	=	5.219	inches
Upper Limit of Evaporative Storage	=	7.536	inches
Lower Limit of Evaporative Storage	=	3.36	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	28.075	inches
Total Initial Water	=	28.075	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	42.18	Degrees
Maximum Leaf Area Index	=	3.5	
Start of Growing Season (Julian Date)	=	90	days
End of Growing Season (Julian Date)	=	216	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	72	%
Average 3rd Quarter Relative Humidity	=	80	%
Average 4th Quarter Relative Humidity	=	77	%

Note: Evapotranspiration data was obtained for Belleville, Michigan

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.913949	1.878746	2.045516	2.755274	3.005731	3.34107
3.096216	3.243099	3.096181	2.533399	2.583786	2.235743

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.7	30.4	42.7	54.8	68.5	78.1
81.5	79	68.8	56.2	44	31.5

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Average Annual Totals Summary

Title: Rule Cover System_MinSlope
Simulated on: 4/8/2022 15:11

	Average Annual Totals for Years 1 - 100*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	31.73	[3.35]	115,175.2	100.00
Runoff	2.225	[1.235]	8,075.2	7.01
Evapotranspiration	26.078	[2.81]	94,664.5	82.19
Subprofile1				
Lateral drainage collected from Layer 2	3.4207	[1.5505]	12,417.0	10.78
Percolation/leakage through Layer 4	0.000004	[0.000002]	0.0162	0.00
Average Head on Top of Layer 3	0.0001	[0.0001]	---	---
Water storage				
Change in water storage	0.0051	[0.8178]	18.4	0.02

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: Rule Cover System_MinSlope
Simulated on: 4/8/2022 15:11

	Peak Values for Years 1 - 100*		
	(inches)		(cubic feet)
Precipitation	2.40		8,721.4
Runoff	2.224		8,073.0
Subprofile1			
Drainage collected from Layer 2	0.4261		1,546.9
Percolation/leakage through Layer 4	0.000000		0.0015
Average head on Layer 3	0.0064		---
Maximum head on Layer 3	0.0128		---
Location of maximum head in Layer 2	0.00	(feet from drain)	
Other Parameters			
Snow water	4.1439		15,042.2
Maximum vegetation soil water	0.4414	(vol/vol)	
Minimum vegetation soil water	0.2100	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: Rule Cover System_MinSlope
Simulated on: 4/8/2022 15:11
Simulation period: 100 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	12.8487	0.3569
2	0.0022	0.0109
3	0.0000	0.0000
4	15.7320	0.4370
Snow water	0.0000	---

Attachment B2
Engineered Turf Cover System HELP Model Output

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: MC Cell VI-F&G Engineered Turf **Simulated On:** 10/7/2021 16:03

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
Engineered Turf
Material Texture Number 44

Thickness	=	0.5	inches
Porosity	=	0.437	vol/vol
Field Capacity	=	0.062	vol/vol
Wilting Point	=	0.024	vol/vol
Initial Soil Water Content	=	0.024	vol/vol
Effective Sat. Hyd. Conductivity	=	2.50E-02	cm/sec

Layer 2

Type 2 - Lateral Drainage Layer
Studded Drainage Layer
Material Texture Number 123

Thickness	=	0.13	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	3.16E+01	cm/sec
Slope	=	25	%
Drainage Length	=	820	ft

Layer 3

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 4

Type 3 - Barrier Soil Liner

Bentonite (High)
Material Texture Number 17

Thickness	=	0.5	inches
Porosity	=	0.75	vol/vol
Field Capacity	=	0.747	vol/vol
Wilting Point	=	0.4	vol/vol
Initial Soil Water Content	=	0.75	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-09	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	96.8	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	0.5	inches
Initial Water in Evaporative Zone	=	0.012	inches
Upper Limit of Evaporative Storage	=	0.218	inches
Lower Limit of Evaporative Storage	=	0.012	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	0.388	inches
Total Initial Water	=	0.388	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	42.18	Degrees
Maximum Leaf Area Index	=	1	
Start of Growing Season (Julian Date)	=	90	days
End of Growing Season (Julian Date)	=	216	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	72	%
Average 3rd Quarter Relative Humidity	=	80	%
Average 4th Quarter Relative Humidity	=	77	%

Note: Evapotranspiration data was obtained for Belleville, Michigan

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.913949	1.878746	2.045516	2.755274	3.005731	3.34107
3.096216	3.243099	3.096181	2.533399	2.583786	2.235743

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.7	30.4	42.7	54.8	68.5	78.1
81.5	79	68.8	56.2	44	31.5

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Average Annual Totals Summary

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:09

	Average Annual Totals for Years 1 - 100*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	31.73	[3.35]	115,175.2	100.00
Runoff	7.879	[1.761]	28,601.5	24.83
Evapotranspiration	9.378	[1.156]	34,041.5	29.56
Subprofile1				
Lateral drainage collected from Layer 2	14.4711	[1.3463]	52,530.2	45.61
Percolation/leakage through Layer 4	0.000001	[0]	0.0042	0.00
Average Head on Top of Layer 3	0.0008	[0.0001]	---	---
Water storage				
Change in water storage	0.0006	[0.5254]	2.1126	0.00

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:10

	Peak Values for Years 1 - 100*		
	(inches)		(cubic feet)
Precipitation	2.40		8,721.4
Runoff	2.440		8,855.5
Subprofile1			
Drainage collected from Layer 2	0.6423		2,331.7
Percolation/leakage through Layer 4	0.000000		0.0000
Average head on Layer 3	0.0125		---
Maximum head on Layer 3	0.0250		---
Location of maximum head in Layer 2	0.00	(feet from drain)	
Other Parameters			
Snow water	4.1439		15,042.2
Maximum vegetation soil water	0.4370	(vol/vol)	
Minimum vegetation soil water	0.0240	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:10
Simulation period: 100 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	0.0702	0.1404
2	0.0013	0.0100
3	0.0000	0.0000
4	0.3749	0.7499
Snow water	0.0000	---

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: MC Cell VI-F&G Engineered Turf **Simulated On:** 10/7/2021 16:47

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
Engineered Turf
Material Texture Number 44

Thickness	=	0.5	inches
Porosity	=	0.437	vol/vol
Field Capacity	=	0.062	vol/vol
Wilting Point	=	0.024	vol/vol
Initial Soil Water Content	=	0.024	vol/vol
Effective Sat. Hyd. Conductivity	=	2.50E-02	cm/sec

Layer 2

Type 2 - Lateral Drainage Layer
Studded Drainage Layer
Material Texture Number 123

Thickness	=	0.13	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	3.16E+01	cm/sec
Slope	=	4	%
Drainage Length	=	625	ft

Layer 3

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 4

Type 3 - Barrier Soil Liner

Bentonite (High)
Material Texture Number 17

Thickness	=	0.5	inches
Porosity	=	0.75	vol/vol
Field Capacity	=	0.747	vol/vol
Wilting Point	=	0.4	vol/vol
Initial Soil Water Content	=	0.75	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-09	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	96.7	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	0.5	inches
Initial Water in Evaporative Zone	=	0.012	inches
Upper Limit of Evaporative Storage	=	0.218	inches
Lower Limit of Evaporative Storage	=	0.012	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	0.388	inches
Total Initial Water	=	0.388	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	42.18	Degrees
Maximum Leaf Area Index	=	1	
Start of Growing Season (Julian Date)	=	90	days
End of Growing Season (Julian Date)	=	216	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	72	%
Average 3rd Quarter Relative Humidity	=	80	%
Average 4th Quarter Relative Humidity	=	77	%

Note: Evapotranspiration data was obtained for Belleville, Michigan

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.913949	1.878746	2.045516	2.755274	3.005731	3.34107
3.096216	3.243099	3.096181	2.533399	2.583786	2.235743

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.7	30.4	42.7	54.8	68.5	78.1
81.5	79	68.8	56.2	44	31.5

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 42.18/-83.49

Average Annual Totals Summary

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:52

	Average Annual Totals for Years 1 - 100*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	31.73	[3.35]	115,175.2	100.00
Runoff	8.042	[1.78]	29,191.4	25.35
Evapotranspiration	9.064	[1.106]	32,901.7	28.57
Subprofile1				
Lateral drainage collected from Layer 2	14.6223	[1.3618]	53,078.9	46.09
Percolation/leakage through Layer 4	0.000001	[0]	0.0040	0.00
Average Head on Top of Layer 3	0.0036	[0.0003]	---	---
Water storage				
Change in water storage	0.0009	[0.5232]	3.2043	0.00

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:53

	Peak Values for Years 1 - 100*		
	(inches)		(cubic feet)
Precipitation	2.40		8,721.4
Runoff	2.440		8,855.5
Subprofile1			
Drainage collected from Layer 2	0.5917		2,147.8
Percolation/leakage through Layer 4	0.000000		0.0001
Average head on Layer 3	0.0517		---
Maximum head on Layer 3	0.1032		---
Location of maximum head in Layer 2	0.50	(feet from drain)	
Other Parameters			
Snow water	4.1439		15,042.2
Maximum vegetation soil water	0.4370	(vol/vol)	
Minimum vegetation soil water	0.0240	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: MC Cell VI-F&G Engineered Turf
Simulated on: 10/7/2021 16:53
Simulation period: 100 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	0.1003	0.2005
2	0.0013	0.0100
3	0.0000	0.0000
4	0.3750	0.7500
Snow water	0.0000	---

Attachment C
Climate Data Information

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Summary of Monthly Normals
1981-2010

Generated on 10/03/2021

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 631 ft. Lat: 42.2313° N Lon: -83.3308° W
Station: **DETROIT METROPOLITAN AIRPORT, MI US USW00094847**

Temperature (°F)

	Mean						Cooling Degree Days Base (above)						Heating Degree Days Base (above)				Mean Number of Days					
Month	Daily Max	Daily Min	Mean	Long Term Max Std Dev	Long Term Min Std Dev	Long Term Avg Std Dev	55	57	60	65	70	72	55	57	60	65	Max >= 100	Max >= 90	Max >= 50	Max <= 32	Min <= 32	Min <= 0
01	32.0	19.1	25.6	4.7	5.7	5.1	-7777	-7777	0	0	0	0	913	975	1068	1223	0.0	0.0	1.6	15.7	26.7	2.0
02	35.2	21.0	28.1	4.1	4.3	4.1	-7777	-7777	-7777	-7777	0	0	753	809	893	1033	0.0	0.0	2.0	10.6	24.3	0.8
03	45.8	28.6	37.2	3.8	3.0	3.3	6	4	2	-7777	-7777	0	558	618	709	862	0.0	0.0	10.3	3.5	20.3	-7777
04	59.1	39.4	49.2	3.1	2.4	2.6	47	34	20	6	1	-7777	220	266	342	479	0.0	0.0	23.8	0.1	5.6	0.0
05	69.9	49.4	59.7	3.8	3.4	3.5	186	145	97	42	13	7	42	63	108	208	0.0	0.4	30.7	0.0	0.2	0.0
06	79.3	59.5	69.4	2.7	2.4	2.4	434	376	291	167	75	50	2	4	9	35	-7777	2.4	30.0	0.0	0.0	0.0
07	83.4	63.9	73.6	2.7	2.3	2.3	578	516	423	271	137	95	0	-7777	-7777	2	-7777	4.5	31.0	0.0	0.0	0.0
08	81.4	62.6	72.0	2.7	2.6	2.6	527	465	373	225	103	68	-7777	-7777	1	8	0.0	2.5	31.0	0.0	0.0	0.0
09	74.0	54.7	64.4	2.8	1.9	2.2	294	244	175	84	29	16	14	23	44	104	0.0	0.5	30.0	0.0	0.0	0.0
10	61.6	43.3	52.4	3.0	2.8	2.8	69	49	27	8	2	1	148	190	261	397	0.0	0.0	27.3	0.0	1.9	0.0
11	48.8	34.3	41.5	3.7	2.9	3.1	8	4	1	-7777	0	0	412	468	555	704	0.0	0.0	13.2	0.9	12.5	0.0
12	36.1	24.1	30.1	5.1	5.2	5.0	1	-7777	-7777	0	0	0	773	834	927	1082	0.0	0.0	2.6	10.5	23.9	0.7
Summary	58.9	41.7	50.3	3.5	3.2	3.2	2150	1837	1409	803	360	237	3835	4250	4917	6137	0.0	10.3	233.5	41.3	115.4	3.5

-7777: a non-zero value that would round to zero

Empty or blank cells indicate data is missing or insufficient occurrences to compute value

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Summary of Monthly Normals
1981-2010

Generated on 10/03/2021

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 631 ft. Lat: 42.2313° N Lon: -83.3308° W
Station: **DETROIT METROPOLITAN AIRPORT, MI US USW00094847**

Precipitation (in.)								
	Totals	Mean Number of Days				Precipitation Probabilities Probability that precipitation will be equal to or less than the indicated amount		
	Means	Daily Precipitation				Monthly Precipitation vs. Probability Levels		
Month	Mean	>= 0.01	>= 0.10	>= 0.50	>= 1.00	0.25	0.50	0.75
01	1.96	13.1	5.6	0.9	0.1	1.28	1.80	2.80
02	2.02	10.6	5.0	1.1	0.2	0.89	1.83	3.02
03	2.28	11.7	6.2	1.1	0.2	1.46	2.15	3.18
04	2.90	12.2	7.0	1.8	0.3	2.11	2.72	3.85
05	3.38	12.1	6.9	2.3	0.7	2.20	3.00	4.61
06	3.52	10.2	6.3	2.3	0.8	2.35	3.37	4.91
07	3.37	10.4	6.6	2.0	0.8	2.43	3.22	4.38
08	3.00	9.6	5.9	2.1	0.7	1.60	3.07	4.19
09	3.27	9.5	5.9	2.2	0.7	1.74	2.86	4.28
10	2.52	9.8	5.3	1.8	0.5	1.56	2.15	3.54
11	2.79	11.6	6.4	1.9	0.4	1.78	2.68	3.31
12	2.46	13.7	6.2	1.4	0.2	1.61	2.39	2.91
Summary	33.47	134.5	73.3	20.9	5.6	21.01	31.24	44.98

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Summary of Monthly Normals
1981-2010

Generated on 10/03/2021

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 631 ft. Lat: 42.2313° N Lon: -83.3308° W
Station: **DETROIT METROPOLITAN AIRPORT, MI US USW00094847**

Snow (in.)													
	Totals	Mean Number of Days									Snow Probabilities Probability that snow will be equal to or less than the indicated amount		
	Means	Snowfall >= Thresholds					Snow Depth >= Thresholds				Monthly Snow vs. Probability Levels Values derived from the incomplete gamma distribution.		
Month	Snowfall Mean	0.01	1.0	3.0	5.00	10.00	1	3	5	10	.25	.50	.75
01	12.5	10.4	3.7	1.1	0.4	0.2	17.4	11.0	5.9	1.3	7.0	9.9	17.9
02	10.2	8.3	3.2	1.2	0.4	0.0	12.7	7.5	3.7	0.9	4.9	9.0	14.6
03	6.9	5.4	2.1	0.7	0.3	0.0	5.6	3.1	1.6	0.0	3.4	5.8	9.7
04	1.7	1.6	0.4	0.2	0.1	0.0	0.5	0.3	0.1	0.0	0.0	0.6	2.0
05	-7777	-7777	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.1	0.2	-7777	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	1.5	2.3	0.5	-7777	0.0	0.0	1.0	0.2	0.0	0.0	0.1	0.9	2.2
12	9.6	8.5	3.2	0.9	0.4	0.0	8.7	5.4	3.4	0.3	4.9	7.8	13.2
Summary	42.5	36.7	13.1	4.1	1.6	0.2	45.9	27.5	14.7	2.5	20.3	34.0	59.6

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U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Summary of Monthly Normals
1981-2010

Generated on 10/03/2021

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 631 ft. Lat: 42.2313° N Lon: -83.3308° W
Station: **DETROIT METROPOLITAN AIRPORT, MI US USW00094847**

Growing Degree Units (Monthly)

Base	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
40	10	12	84	298	609	882	1043	992	731	390	132	21
45	3	3	41	185	456	732	888	837	581	254	66	9
50	1	1	17	100	310	582	733	682	433	144	26	3
55	-7777	-7777	6	47	186	434	578	527	294	69	8	1
60	0	-7777	2	20	97	291	423	373	175	27	1	-7777
Growing Degree Units for Corn (Monthly)												
50/86	3	6	48	163	352	576	713	671	449	202	57	8

Growing Degree Units (Accumulated Monthly)

Base	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
40	10	22	106	404	1013	1895	2938	3930	4661	5051	5183	5204
45	3	6	47	232	688	1420	2308	3145	3726	3980	4046	4055
50	1	2	19	119	429	1011	1744	2426	2859	3003	3029	3032
55	0	0	6	53	239	673	1251	1778	2072	2141	2149	2150
60	0	0	2	22	119	410	833	1206	1381	1408	1409	1409
Growing Degree Units for Corn (Monthly Accumulated)												
50/86	3	9	57	220	572	1148	1861	2532	2981	3183	3240	3248

Note: For corn, temperatures below 50 are set to 50, and temperatures above 86 are set to 86.

-7777: a non-zero value that would round to zero.

Empty or blank cells indicate data is missing or insufficient occurrences to compute value.

NOAA Atlas 14, Volume 8, Version 2 DETROIT METRO AP
Station ID: 20-2103
Location name: Detroit, Michigan, USA*
Latitude: 42.2314°, Longitude: -83.3308°
Elevation:
Elevation (station metadata): 631 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.312 (0.271-0.367)	0.369 (0.319-0.434)	0.463 (0.400-0.545)	0.543 (0.466-0.642)	0.656 (0.544-0.794)	0.745 (0.604-0.909)	0.835 (0.654-1.04)	0.929 (0.698-1.18)	1.06 (0.763-1.36)	1.15 (0.812-1.50)
10-min	0.457 (0.396-0.537)	0.540 (0.468-0.635)	0.678 (0.585-0.799)	0.795 (0.682-0.939)	0.960 (0.797-1.16)	1.09 (0.884-1.33)	1.22 (0.958-1.52)	1.36 (1.02-1.72)	1.55 (1.12-1.99)	1.69 (1.19-2.20)
15-min	0.557 (0.483-0.655)	0.658 (0.570-0.774)	0.827 (0.714-0.974)	0.970 (0.832-1.15)	1.17 (0.972-1.42)	1.33 (1.08-1.62)	1.49 (1.17-1.85)	1.66 (1.25-2.10)	1.88 (1.36-2.43)	2.06 (1.45-2.68)
30-min	0.764 (0.662-0.898)	0.902 (0.781-1.06)	1.13 (0.979-1.34)	1.33 (1.14-1.57)	1.61 (1.34-1.95)	1.83 (1.48-2.24)	2.05 (1.61-2.55)	2.29 (1.72-2.90)	2.60 (1.88-3.36)	2.85 (2.01-3.71)
60-min	0.974 (0.844-1.14)	1.15 (0.996-1.35)	1.45 (1.25-1.71)	1.70 (1.46-2.01)	2.07 (1.72-2.51)	2.36 (1.92-2.89)	2.66 (2.09-3.31)	2.97 (2.24-3.77)	3.40 (2.46-4.39)	3.73 (2.63-4.87)
2-hr	1.18 (1.03-1.38)	1.40 (1.22-1.63)	1.76 (1.53-2.06)	2.08 (1.79-2.44)	2.53 (2.11-3.05)	2.89 (2.36-3.51)	3.26 (2.58-4.04)	3.66 (2.77-4.61)	4.20 (3.06-5.39)	4.62 (3.28-5.98)
3-hr	1.31 (1.15-1.53)	1.55 (1.35-1.80)	1.95 (1.69-2.27)	2.29 (1.98-2.68)	2.80 (2.35-3.37)	3.20 (2.63-3.89)	3.63 (2.88-4.48)	4.08 (3.10-5.12)	4.70 (3.44-6.01)	5.19 (3.69-6.69)
6-hr	1.55 (1.36-1.79)	1.80 (1.58-2.08)	2.24 (1.96-2.60)	2.64 (2.29-3.06)	3.21 (2.72-3.85)	3.69 (3.05-4.45)	4.19 (3.35-5.14)	4.73 (3.63-5.91)	5.48 (4.04-6.97)	6.07 (4.36-7.78)
12-hr	1.80 (1.59-2.07)	2.06 (1.82-2.37)	2.53 (2.22-2.90)	2.94 (2.57-3.39)	3.57 (3.05-4.26)	4.09 (3.41-4.92)	4.65 (3.75-5.68)	5.26 (4.06-6.53)	6.11 (4.54-7.74)	6.80 (4.91-8.65)
24-hr	2.06 (1.83-2.35)	2.35 (2.08-2.67)	2.85 (2.52-3.25)	3.31 (2.91-3.78)	3.98 (3.42-4.71)	4.55 (3.81-5.42)	5.15 (4.17-6.24)	5.80 (4.51-7.15)	6.71 (5.02-8.44)	7.45 (5.42-9.41)
2-day	2.35 (2.10-2.66)	2.69 (2.40-3.04)	3.27 (2.90-3.70)	3.78 (3.34-4.29)	4.52 (3.89-5.29)	5.12 (4.30-6.04)	5.75 (4.68-6.90)	6.42 (5.02-7.85)	7.35 (5.54-9.16)	8.09 (5.93-10.2)
3-day	2.58 (2.31-2.90)	2.93 (2.62-3.30)	3.54 (3.15-3.99)	4.06 (3.60-4.60)	4.82 (4.16-5.61)	5.44 (4.58-6.38)	6.08 (4.96-7.25)	6.75 (5.30-8.21)	7.69 (5.81-9.53)	8.42 (6.20-10.5)
4-day	2.78 (2.49-3.12)	3.14 (2.82-3.53)	3.76 (3.36-4.23)	4.30 (3.82-4.85)	5.07 (4.38-5.88)	5.70 (4.81-6.66)	6.34 (5.19-7.55)	7.03 (5.53-8.52)	7.97 (6.04-9.85)	8.71 (6.43-10.9)
7-day	3.29 (2.97-3.67)	3.69 (3.32-4.12)	4.36 (3.91-4.88)	4.94 (4.41-5.54)	5.77 (5.00-6.64)	6.43 (5.45-7.46)	7.11 (5.84-8.40)	7.82 (6.18-9.41)	8.79 (6.70-10.8)	9.55 (7.09-11.8)
10-day	3.75 (3.39-4.17)	4.18 (3.77-4.65)	4.90 (4.41-5.46)	5.51 (4.93-6.16)	6.39 (5.55-7.31)	7.08 (6.02-8.18)	7.79 (6.42-9.15)	8.52 (6.76-10.2)	9.52 (7.28-11.6)	10.3 (7.68-12.7)
20-day	5.10 (4.63-5.62)	5.61 (5.09-6.19)	6.46 (5.84-7.14)	7.16 (6.44-7.95)	8.15 (7.11-9.23)	8.91 (7.62-10.2)	9.69 (8.02-11.3)	10.5 (8.35-12.4)	11.5 (8.87-14.0)	12.3 (9.26-15.1)
30-day	6.27 (5.71-6.89)	6.87 (6.25-7.56)	7.86 (7.13-8.65)	8.66 (7.82-9.57)	9.75 (8.53-11.0)	10.6 (9.07-12.0)	11.4 (9.47-13.2)	12.2 (9.78-14.4)	13.3 (10.3-16.0)	14.1 (10.6-17.2)
45-day	7.79 (7.12-8.53)	8.56 (7.81-9.37)	9.76 (8.88-10.7)	10.7 (9.70-11.8)	12.0 (10.5-13.4)	12.9 (11.1-14.6)	13.8 (11.5-15.8)	14.6 (11.7-17.2)	15.7 (12.1-18.8)	16.5 (12.5-20.0)
60-day	9.13 (8.36-9.96)	10.1 (9.20-11.0)	11.5 (10.5-12.6)	12.6 (11.4-13.8)	14.0 (12.3-15.6)	15.0 (12.9-16.9)	16.0 (13.3-18.2)	16.8 (13.5-19.6)	17.9 (13.8-21.3)	18.6 (14.1-22.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

EPA TECHNICAL REVIEW OF 2021 PERMIT APPLICATION
OCTOBER 2, 2023

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 5

77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

Sylwia Scott
Environmental Manager
US Ecology
49350 North I-94 Service Drive
Belleville, Michigan 48111-1854

Re: Technical Review of Landfill Design for Renewal of the Federal TSCA PCB Chemical Waste Landfill Approval, Wayne Disposal, Inc.; MID 048 090 633

Dear Ms. Scott:

On November 5, 2021, the U.S. Environmental Protection Agency received a renewal application for the Toxic Substances Control Act (TSCA) polychlorinated biphenyl (PCB) chemical waste landfill approval and hazardous waste landfill permit, which included some design modifications. On May 25, 2022, the EPA received WDI's responses to comments based on three submittals of Michigan Department of Environment, Great Lakes, and Energy's (EGLE) technical review comments on the landfill design for the permit renewals. The May 2022 submittal included further updates to the landfill design drawings and technical specifications. EPA's contractor, TRC, performed a further technical review of the landfill design based on these documents.

TRC's technical review is attached to this letter. Please review the attached document and provide responses to the comments and questions contained within the document (bolded text).

If you have questions, please contact Lisa Graczyk, of my staff, at (312) 353-3219 or graczyk.lisa@epa.gov.

Sincerely,

MOLLY FINN Digitally signed by MOLLY FINN Date: 2023.10.02 08:25:47 -05'00'

Molly Finn
Supervisor
Waste Management Permitting Section

Attachment: Technical Review of 2021 Permit Application 2022 Response to EGLE Comments and Revisions of Calculations and Engineering Plans at Wayne Disposal Inc.

Recycled/Recyclable • Printed with Vegetable Oil Based Inks on 100% Recycled Paper (100% Post Consumer)

cc: Robert L. Thompson, EPA ORC
Christine Matlock, MI EGLE
Kelly McInnis, US Ecology

999 Fourier Dr., Ste. 101
Madison, WI 53717

T 608.826.3600
TRCcompanies.com

March 27, 2023

Lisa Graczyk
Waste Management Permitting Section
U.S. EPA Region 5
77 W. Jackson Blvd. (LL-17J)
Chicago, Illinois 60604

Subject: Technical Review of 2021 Permit Application 2022 Response to EGLE Comments and Revisions of Calculations and Engineering Plans at Wayne Disposal Inc., Belleville, Michigan
TRC Project No. 502380.0000.0000

Dear Ms. Graczyk:

This letter presents the results of TRC's technical review of the proposed landfill liner design modifications for Wayne Disposal Inc. (WDI) Master Cell VI, Subcells F1-F4 and G4-G7. A Google Earth site location map is included in **Attachment 1**.

On April 19, 2022, the United States Environmental Protection Agency (EPA) approved the proposed geosynthetic clay liner (GCL) design for Master Cell VI (MCVI) Subcells F1 through F4 and G4 through G7. This review investigated the technical equivalency of the design modifications presented in the November 2021 PCB landfill renewal application submitted to the EPA and the Michigan Department of Environment, Great Lakes, and Energy (EGLE). This submittal was performed in response to EGLE comments to the proposed modifications submitted in November 2021. The EGLE comment responses to the modifications were submitted by WDI in May 2022.

Conclusions of this review are based on information presented in WDI's 684-page Response and Revisions Package and meetings with EGLE and the EPA, along with general conformance to EGLE regulations and the TSCA PCB regulations. This review began by identifying the modifications that were made by WDI for MCVI Subcells F1-F4 and G4-G7. Based on our understanding, the three notable adjustments of the proposed system include:

- Adjusting the MCVI G1-G7 (MCVI-G) base liner to improve the leachate management operations and provide additional leak detection capabilities. The proposed upgrades include the addition of dedicated leachate collection and leak detection sumps for each cell in MCVI-G.
- Enhancing the final cover design with the use of a geosynthetic engineered artificial turf final cover.
- Improving the geometry of the final grade in order to improve the stormwater management system.

As a result of these modifications, changes in the waste design capacity for the facility were also proposed. These proposed changes resulted in revisions of the geotechnical calculations and engineering plan. TRC reviewed the changes, and a summary of TRC's findings is presented below.

- **Slope Stability** – CTI analyzed global stability failures through underlying soils, the proposed waste thickness, and along the proposed liner system. The stability models examined cross sections of the proposed landfill design where the most critical conditions were determined based on-site geometry, including liner slopes and waste grades.

CTI provided responses to comments submitted by EGLE in February 2022. The comments regarding the slope stability analyses resulted in few changes to the overall calculation including the revision of attachment IDs, revision of soil properties so that they remained consistent with other structural calculations, and discussion on the use of total and effective stress cases for soil properties when performing stability analyses.

TRC reviewed the final design drawings and agreed that these cross sections are representative of critical conditions. The models determined factors of safety against slope stability failure greater than the minimum allowable requirements, 1.5 for final conditions and 1.3 for interim conditions. Additionally, the soil and waste strength parameters assumed by CTI are considered suitable based on the information provided, referenced literatures, and TRC's experience on similar projects.

- **Settlement Analysis** – CTI estimated the anticipated settlement for MC-VI E, F, and G cells. The settlement models examine the anticipated stability caused by the additional loading from the proposed waste and final cover onto the existing landfill, intercell clay dikes, and native soils.

  CTI provided responses to comments submitted by EGLE in February 2022. EGLE noted in their submitted comments that intercell clay dikes exist along the proposed footprint of the MC-VI G cells, which could create differential settlement along base grades of the landfill, negatively impacting the leachate collection system. The comments regarding the settlement analyses resulted in revisions of the MC-VI G cells base liner grades to improve the leachate management of the cells.

  TRC reviewed the settlement analyses revised by CTI. Based on the methods and results of the anticipated settlement, post-settlement slopes and leachate collection line slopes are expected to satisfy Rule 299.9620 (4) such that leachate collection pipes experience at least 1% slope and cross slopes remain at least 2% along the base liner (EGLE 2020).

  According to CTI, expected settlement in areas along the base liner grades are anticipated to be as high as 10 feet. Settlement at this scale places additional tension along the geosynthetic component of the liner. The increase tension may cause the geomembrane component to tear at welded seams, creating leaks over time in the liner system. Additionally, GCLs subjected to large settlement can develop voids along the overlapping panels.

  TRC has provided comments to EGLE and the EPA pertaining to this issue during review of the MC-VI F settlement calculation in September 2022, see **Attachment 2**. These concerns are also attributed to the settlement calculations performed for MC-VI E and G contained in this revision package. At the time of review, TRC recommended that CTI re-evaluate the conditions of the proposed landfill or provide additional analysis to evaluate that the geosynthetic components of the liner system are able to withstand the anticipated settlement and continue to provide an effective liner for the landfill.

  After conversations between EGLE, CTI, and EPA, CTI provided additional analysis that evaluated the expected strain of the proposed geosynthetic components of the liner on October 19, 2022. Based on TRC's review of this additional information, the anticipated strain along the geosynthetics, namely the GCL and geomembrane, satisfies the generally accepted tolerances of the materials. TRC ultimately recommended that an increase in the GCL overlap from 12 inches to 24 inches was warranted to protect against shifting in the liner system, which CTI agreed to.

The geosynthetics strain should be evaluated in the remaining subcells to confirm that impacts on the liner system are within accepted tolerances. In addition, the GCL should continue to be overlapped by at least 24 inches in future subcells to provide additional protection.

- **Engineered Artificial Turf Cover Alternate (EATLC)** – CTI provided responses for the comments submitted by EGLE on March 22, 2022, pertaining to the proposed Engineered Artificial Turf Cover Alternate (EATLC).

  TRC reviewed CTI's responses and subsequent revisions. The revisions included both minor text alterations and calculation/drawing revisions.

  TRC reviewed the Veneer Stability Analysis and Interface Analysis provided by CTI. The calculation determined the minimum strength parameters necessary for the interface between the designed geosynthetic cover system. Based on the results, TRC determined the calculations to be suitable. TRC understands that direct shear testing is to be performed for the geosynthetic layers prior to construction to confirm that strength parameters satisfy the minimum requirements based on the results of the calculation. This is a typical route for geosynthetic construction and testing plan described by CTI in comment No. 8 of the B6 Response Part II appears to be satisfactory. **It is recommended that the interface stability calculations and the direct shear testing results should be included as part of the construction documentation report for each construction event to confirm conformance.**

  Wind Uplift Evaluations performed by CTI and subsequent EGLE comments and CTI responses were also reviewed. EGLE indicated that the use of a 50-mil HDPE Super Gripnet® geomembrane and not the proposed 40-mil textured HDPE geomembrane was an inconsistency in the wind uplift evaluation. However, CTI's response justified that a 40-mil textured HDPE would have more surface area in contact with the overlying geotextile, thus providing more friction between the two geosynthetics and a less conservative result. TRC agrees with the justification. Additionally, CTI provided an additional method of analysis comparing the expected pressures from wind uplift with the pressure of the cover system (Attachment D2- Amendment #1 Calculations). This method is also agreeable with TRC.

  TRC reviewed the revisions made to the drawings by CTI in response to EGLE's comments. TRC believes the responses to EGLE's comments regarding the cover system alternative and the drawing revisions appear to be agreeable. However, TRC believes that the lack of diversion berms or benching along the EATLC could create excessive infill displacement during large scale rain events. Sand infill displacement could leave exposed geotextile backing which would be subject to UV degradation and/or impact damage. Alternatives to sand infill could be a Hydrobinder infill or adhesion application along the slopes that would limit erosion on the turf. ClosureTurf manufacturers are able to provide assistance and recommendations for closure system design. TRC is unsure as to whether or not CTI reached out to a manufacturer to review their design. **Due to the nature of the site, it is recommended (if not already completed) that the proposed design for the EATLC along with the proposed stormwater management associated with this scenario be reviewed by the manufacture of the closure turf to confirm that the proposed materials are adequate for the application.**

- **Leachate Collection System** – CTI provided responses for the comments submitted by EGLE relating to the leachate collection system that was modified as summarized above. CTI noted in EGLE's Comment 17 in Part 1 of the response package that deflection and pipe strength were not considered in the existing landfill due to the construction of the existing landfill not having a lateral leachate collection system. TRC finds this justification agreeable and waste increases in this area should not impact the existing landfill in a negative way. **However, if there are locations where increases in waste heights occurred over an existing or proposed leachate collection pipe, an evaluation of the pipe strength in those locations are recommended.**

  Based on CTI's calculation, it is demonstrated that the sump will not overflow given the anticipated leachate generation rate, sump size, and pumping rate, but the duration at which the pump can be off prior to the sump filling up may bring about logistics issues in the future if the pumps need to be turned off for an extended period of time.

- **Surface Water Management System Design** – CTI provided design drawings and stormwater calculations for the final cover stormwater management plan as part of the permit application for both a traditional final cover design as well as an alternative final cover design involving EATLC. Overall, TRC found the CTI's responses to EGLE's comment generally agreeable.

  Following TRC's review of the overall design, there are several comments for CTI's consideration.

  The traditional final cover diversion berm design presented by CTI includes substantial diversion berm lengths (excess of 1,000 feet in some areas). Standard practice is to minimize the length of these berms, with more frequent downslope channels to minimize erosion along the berm or the possibility of overtopping. Though the soil loss equation does not indicate excess erosion, substantial flows are expected along these diversion berms which may cause issues along the corners of the site. Based on previous experience, it is generally unwise to have berms be routed around corners of the landfill as the potential for erosion is greater in these areas. Diversion berms should break at corners of the final cover corners and be routed in separate directions. The addition of downslope channels/flumes would assist in this. In addition, it should be confirmed that these diversion berms are able to provide positive slope along the entire length of the berm even with the settlement of the final cover system, especially along those berms that are shallow in slope. **Has CTI looked at the erosion potential around the corners of the landfill and sloping of the berms following settlement of the final cover?**

  – Based on the provided configuration, it appears that the downslope channels are currently laid out to have two diversion berm outlets meeting at one location along the slope of the channel. It is understood that the channel design has not been completed; however, the layouts of the discharges for the diversion berms and the potential erosion at those locations should be taken into account for the final channel design. **Information on how the channel design will minimize erosion should be provided.**

– The alternative final cover stormwater management design involves a low number of diversion berms with some designed with shallow slopes. How will the settlement of the final cover affect slopes of the diversion berms? Will they be able to maintain positive drainage as there is minimal freeboard for the larger storm events. **Has CTI considered the possibility of the berms being overtopped due primarily to the velocity at which the surface water will flow down the slope?**

Sincerely,

TRC

Michael J. Amstadt, P.E.
Principal Project Manager

Attachments: 1. Wayne Disposal Inc. Site Map
2. Technical Review of the 2022 MCVI F3 Liner Grade

cc: BreAnne Kahnk – TRC
Greg Beronja – SC&A

Attachment 1

Wayne Disposal Inc. Site Map

Wayne Disposal Inc.
F1-F4
G4-G7
Google Earth
© 2021 Google
Belleville Lake
N
3000 ft

Attachment 2

Technical Review of the 2022 MCVI F3 Liner Grade

Technical Review of the 2022 Master Cell VI Subcell F3 Liner Grade Minor Modification by TRC (Dated 9/12/2022)

Responses by WDI and CTI

General Response to Comments Received from TRC

In general, CTI chose a very conservative approach to estimate total settlements (i.e., calculating high values) as noted by the reviewers. Even under a very conservative set of input parameters, the effects of settlement on MCVI-F3 were tolerable. Therefore, the analyses do not need to be refined any further. The following detailed responses explain in greater detail the engineering considerations behind the choices noted by TRC.

1) Primary and Secondary Consolidation Time, t_1 and t_2

Comment:

CTI's time required to complete primary consolidation (t1) and secondary (t2) is 40 years and 70 years, respectively (see Attachment 1). CTI notes that these values are assumed. TRC recommends CTI provide further clarification as to why those numbers were chosen. Based on TRC's experience with similar projects, primary consolidation time is not typically assumed and is back calculated based on average degree of consolidation, and coefficient of vertical consolidation.

Response:

Selection of time values t_1 and t_2 for the purpose of estimating secondary settlement effectively establishes the window over which accumulating volumetric strain in the subgrade due to creep will impact the overlying construction. Because the MCVI-F3 design floor elevations and slopes are established at the time of construction, any settlement that occurs after that point in time is relevant to post-settlement estimates of floor elevation and slope. The existing waste beneath MCVI-F3 is the most significant source of secondary settlement (i.e., time-dependent creep of the subgrade). Published studies (see for example Marques et al. 2003) into the settlement behavior of MSW show that there are three main modes of volumetric change in MSW causing settlement: 1) mechanical compression under changing load, 2) biological decomposition, and 3) time-dependent creep. Large-scale studies of appropriate settlement calculation parameters to estimate these three contributions to MSW settlement index time-dependent calculations to the time of waste placement. The waste in MCIV located below MCVI-F3 was placed in the 1980s, hence biological decomposition and time-dependent creep started at that time. At the time of proposed waste placement in MCVI-F3, the MSW in MCIV will be approximately 40 years old. Therefore, consistent with the selection of secondary settlement parameters, t_1 was set at 40 years. The significance of this selection is that, at the time of MCVI-F3 construction, secondary settlement of MCIV waste has been occurring for 40 years. Time t_2 was set at 70 years since secondary settlement is largely exhausted by this point in time.

Regarding the choice of language to express the physical significance of t_1, it is customary to refer to this parameter as "end of primary consolidation" in geotechnical engineering because in fine-grained soils,

secondary compression curves are fit to consolidation test time histories following practicable maximum dissipation of excess pore pressure. However, at MCIV and elsewhere, MSW in a landfill is partially saturated and does not accumulate excess pore pressure as is common in saturated consolidation tests on soils. Moreover, secondary settlement predictions in MSW are indexed to the time of waste placement, as discussed above.

TRC's Comment (9/28/2022):

Since MCIV was constructed and filled in the 1980s, it can be assumed that a portion of the primary settlement of the placed existing waste has occurred over the last 40 plus years and that the existing landfill is now primarily experiencing secondary settlement. It is unclear why 40 years was chosen for the primary consolidation time (t_1) of the new landfill construction if the waste and soils being constructed on have already underwent some form of consolidation prior to construction of MCVI. It is unclear if this previous consolidation that generally occurs while waste settles during operation and post-closure is also accounted for in the settlement calculations? If it is, the doubling down on previous settlement is not justified. If not, TRC recommends further justification on why this very conservative approach is used.

CTI's response:

Because the secondary compression equation calculates the change in settlement between t_1 and t_2, and construction of MCVI-F takes place 40+ years after construction of MCIV, CTI selected 40 years for t_1 to exclude secondary compression that takes place prior to MCVI-F construction. That way, the effects of settlement on the newly construction MCVIF grades are quantified. This calculation is performed once, so the effects of secondary compression are not double-counted.

2) Preconsolidation Pressures of Clay Layers

Comment:

CTI stated the preconsolidation pressure of the middle and lower clay layer were taken to be equal to the initial overburden pressure acting on them prior to development, refer to Attachment 2. Based on TRC's experience, Preconsolidation pressures are not typically equal to what is established as overburden pressure. If preconsolidation pressures were assumed, the state of consolidation (normally consolidated, over consolidated, etc.) can be affected, which, in turn, affects overall settlement. CTI also explains that subsurface information was based on historical MC-IV drawings as well as geoprobe investigations. TRC requests CTI confirm in-situ soil sampling was performed along the clay layers and that laboratory testing (either for the most recent investigation or historical) such as one-dimensional consolidation tests or the like was conducted to adequately assign soil properties to the soils.

Response:

The depositional environment of the WDI site is coarse-grained lacustrine deposits near the outflow of a historic glacial outwash channel (see GeoWebFace, EGLE 2022). Accordingly, the glacio-lacustrine deposits at the site will be normally consolidated to lightly overconsolidated at the time the natural ground surface was initially disturbed. Initial development of the site to construct MCIV excavated several feet of in-situ soil to create the MCIV floor. MCIV subsequently received waste and then soil fill. The settlement

calculations reconstruct this time history to estimate the preconsolidation pressure of subgrade waste and fill at the time of MCVI-F3 construction. The assumption of normally consolidated soils at the time of initial development is consistent with the depositional environment. The preconsolidation pressure in many places was estimated to increase based on post-development activities.

One-dimensional consolidation tests were performed on samples retrieved from several of the clay layers encountered in borings around the perimeter of WDI. Both compression and consolidation parameters were obtained from these tests. As is expected for glacio-lacustrine deposits, the estimated preconsolidation pressures from these tests indicated normally to lightly overconsolidated soils. Accordingly, CTI chose to conservatively model the stress history of the soils beneath MCIV assuming that they were normally consolidated prior to excavation of MCIV.

TRC's comment (9/28/2022):

Can it be assumed, whether conservative or not, that the preconsolidation pressures of the clay layers today mirror the pressures of the clay prior to the existing MCIV landfill being constructed and filled? TRC would assume pressures would transition to over consolidated, even if slightly, after the landfill was filled in the 1980s and loading commenced. Whether it can be justified that modeling the way CTI has chosen to do is conservative, it is possible that it has created an unrealistic representation of anticipated settlement. Please provide Consolidation results.

CTI's Response:

CTI concurs that the preconsolidation pressures pre-development within MCIV should be the minimum preconsolidation pressures. Based on the depositional environment and available consolidation test data, the clays on site are normally consolidated to lightly overconsolidated. CTI conservatively assumed the soils to be normally consolidated pre-development. As noted by TRC, this assumption will result in estimates of settlement that are greater than expected. This approach is conservative for purposes of designing the MCVI-F floor slopes and evaluating liner system strain. CTI has provided a summary of the consolidation test data (Attachment 1) and its interpretation.

3) Non-cohesive Layer Settlement Calculation Methods

Comment:

Settlement calculations for sandy or non-cohesive soils are typically performed using the theory of elasticity (elastic settlement). It is unclear whether elastic settlement calculation methods were used for the underlying silt and sandy soils below the native clays given the consolidation case and compression parameters. If non-cohesive soil settlements are calculated through consolidation methods, this may contribute to high settlement values, refer to Attachment 3.

Response:

Elastic settlement calculations of the form [settlement = pressure / elastic modulus] and its variants are understood to be important design checks for building foundations and other designs where a combination of volumetric and distortion strain will contribute to settlement. Consider, for example, the work of Foye et al. (2008) that examined immediate elastic strain from distortion in clay. Significant work

in the geotechnical literature to understand the implications of modulus selection, stress propagation, and confining stresses near point of application includes Schmertmann (1978) and predecessor papers. This work included a quantitative assessment of the depth of influence for shallow foundations, indicating that strains contributing to settlement become negligible between 2 to 4 times the width (B) of the loaded area, depending on the planimetric geometry of the foundation. In contrast, the same work shows that strains in the shallow region beneath a foundation, in the 0.1B to 0.2B region directly beneath the loaded area are dominated by elevated confining stresses from the applied load and correspondingly limited distortion. In the case of MCVI-F, the loaded area of the landfill is >1,200 feet wide and the depth to the relatively less compressible hardpan is about 130 feet, for a depth-to-width ratio of 0.1B or less. Accordingly, distortion strains are negligible while volumetric strains will dominate the subgrade behavior. For this reason, settlement calculations of the form [settlement = pressure / elastic modulus], which rely on semi-empirical formulations suited to regions of soil up to 4B below shallow foundations, are considered ill-suited to the site-specific conditions. CTI opted for a conservative approach of estimating volumetric settlement of the silt and sand subgrade using traditional non-linear compression equations. Coduto (1998) offers some guidance for the application of this approach to granular soils. CTI has conservatively applied compression indices about 10 times greater than is typical for sands and silts. As the reviewers noted, even with this conservative approach, an acceptable result is still obtained. Therefore, a more refined analysis is not necessary.

TRC's comment (9/28/2022):

TRC has not further comment. Though the practice is conservative, TRC finds the justification agreeable.

4) Calculated Settlement Results

Comment:

CTI's settlement results for MCVI-F ranged from 3.16 feet to 8.68 feet. TRC agrees that estimated differential settlement will not impact the leachate collection system or cross slopes in a way that does not meet the criteria of Rule 299.9620 (4) (EGLE 2020). However, the calculated settlements are very high, based on TRC's experience, refer to Attachment 4. Large scale settlement, as predicted by CTI, can create issues along the geosynthetic liner. Geomembrane under increased tension due to settlement can tear at the welded seams. Additionally, geosynthetic clay liners (GCL) subjected to large settlement can create voids where overlapping was performed during construction because GCL panels are not welded or sewn together. This can create issues for leachate management with the possibility of leaks along the liner system. The subject matter mentioned above can have an effect on total settlement calculations. TRC recommends re-evaluation of the assumed or calculated consolidation and soil parameters. Otherwise, TRC recommends CTI provide analysis that suggests the liner system will not be affected with the estimated settlement.

Response:

CTI agrees that the estimated values of total settlement are high as noted. These conservative estimates of total settlement are the consequence of the conservative settlement analysis parameters noted in the previous responses. To address the question about liner system integrity, CTI offers the following

additional calculation of elongation of the proposed liner system in MCVI-F3 under the effects of the conservatively estimated settlement values.

Uniaxial strain in the proposed MCVI-F3 liner system was calculated using the following equation:

$$\varepsilon(\%) = \frac{dl}{l_0}$$

Where:

dl = change in length [ft] (l_1-l_0)
l_0 = initial length [ft]
l_1 = Post-settlement length [ft]

				Elevation			Liner Grade				
Flow Line	**Point**	**North**	**East**	**Pipe Invert Elevation**	**Settlement**	**Length**	**Post-Settlement**	**l_0**	**l_1**	**dl**	**e**
		[ft]	**[ft]**	**[ft]**	**[ft]**	**[ft]**	**[ft]**	**ft**	**ft**	**ft**	**%**
Subcell F3 leachate pipe flow line	SP-7	8529.72	4583.16	709.66	3.75	50	705.91	49.62	49.60	-0.02	-0.05%
	SP-7b	8480.14	4583.16	711.70	4.46		707.24				
	SP-7b	8480.14	4583.16	711.70	4.46	122	707.24	122.55	122.60	0.05	0.04%
	SP-8	8357.69	4583.16	716.72	3.36		713.35				
	SP-8	8357.69	4583.16	716.72	3.36	122	713.35	122.55	122.50	-0.05	-0.04%
	SP-8b	8235.24	4583.16	721.74	4.84		716.89				
	SP-8b	8235.24	4583.16	721.74	4.84	42	716.89	42.24	42.25	0.01	0.03%
	SP-9	8193.03	4583.16	723.47	4.56		718.90				
	SP-9	8193.03	4583.16	723.47	4.56	42	718.90	42.42	42.28	-0.14	-0.34%
	SP-9b	8150.83	4583.16	727.78	6.33		721.45				
	SP-9b	8150.83	4583.16	727.78	6.33	17	721.45	16.54	16.53	0.00	-0.02%
	SP-10	8134.31	4583.16	728.61	6.42		722.19				
	SP-10	8134.31	4583.16	728.61	6.42	98	722.19	98.52	98.50	-0.02	-0.02%
	SP-10b	8035.92	4583.16	733.53	6.89		726.65				
	SP-10b	8035.92	4583.16	733.53	6.89	60	726.65	60.07	60.08	0.00	0.00%
	SP-11	7975.92	4583.16	736.53	6.84		729.69				

The calculated strains in the table above are all 0.3% or less. Maximum arch strains in polyethylene geomembranes can be about 1 to 2%, respectively to prevent rupture (Peggs, Schmucker, and Carey 2005). The maximum change in length was estimated to be less than 0.14 feet, which is significantly less

than the required overlap in GCL panels (6 inches or 0.5 feet). Therefore, even under this conservative set of estimates, differential settlement is expected to have acceptable effects on the liner system.

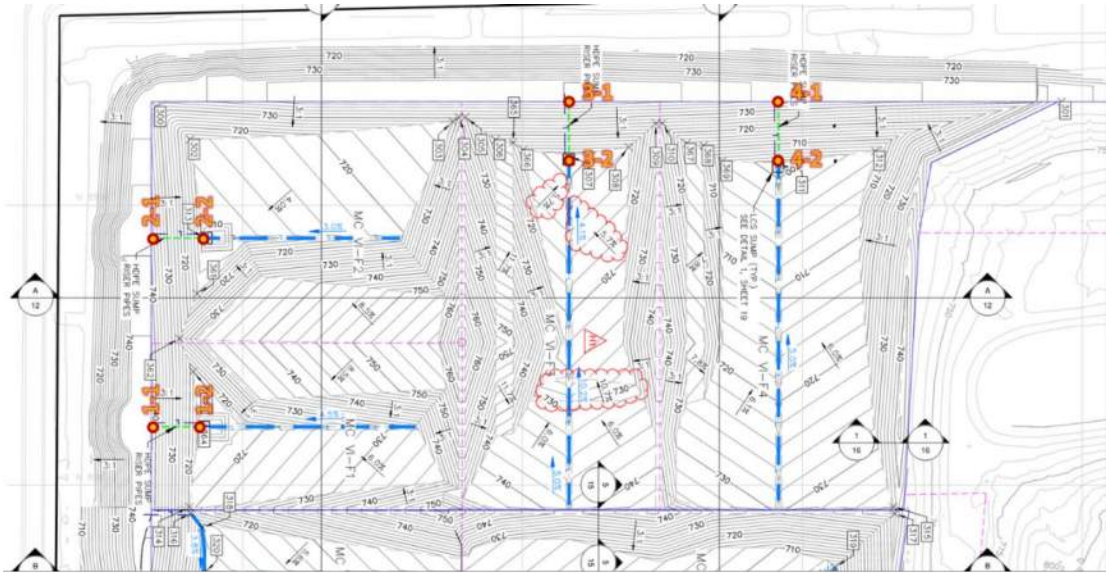
TRC's comment (9/28/2022):

TRC recommends CTI provide further justification on whether the greatest amount of strain will truly occur along the leachate collection line. The greatest strain often occurs in areas were the greatest settlement deferential is produced over a relatively small linear distance. These areas are typically at the toe of the cell's sideslope because the edge of the landfill anchor trench (which can be assumed to have little to no settlement) to the low point of the liner grades (at the toe or sump that sits against the cell's sideslope) produces the greatest settlement difference. In addition, this also may occur in the areas of the intercell dikes where the increased slopes may cause some additional differential settlement due to the additional compressible layers. TRC recommends CTI evaluate the expected strain for the proposed cells at these locations to confirm that stability and integrity of the geomembrane and the overlap of the GCL are maintained.

CTI's Response:

CTI concurs that the greatest liner system strains may occur along the perimeter sideslopes where the change in overburden pressure with distance is the greatest. CTI has revised the settlement calculation sheet with these additional analyses.

CTI evaluated differential settlement between additional points along the longest, steepest exterior slopes in each subcell as follows. Exterior sideslopes were selected because the overburden pressure from future waste placement decreases to zero at the crest of slope. However, added pressure from perimeter berm construction and final cover construction contributes to total settlement in these locations.



TOP OF PRIMARY LINER SYSTEM CONTOURS WITH PERIMETER SETTLEMENT POINTS

Total settlement was estimated at each of the 8 points. The resulting estimates are tabulated below. Elongation and strain in the proposed MCVI-F liner system were calculated using the following equation:

$$\varepsilon(\%) = \frac{dl}{l_0}$$

Where:

dl = change in length [ft] (l_1-l_0)

l_0 = initial length [ft]

l_1 = Post-settlement length [ft]

			Elevation		Horiz. Dist.	Liner Grade	Floor/Pipe Slope		elongation calculations			
Flow Line	Point	Station	liner elevation	Settlement		Post-Settlement	Pre-Settlement	Post-Settlement	l_0	l_1	dl	ε
		[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	ft	ft	ft	%
sideslope	1-1	0.00	742.74	1.24	88	741.49	33.33%	36.26%	92.23	93.08	0.84	0.91%
	1-2	87.50	713.57	3.81		709.76						
	2-1	0.00	739.55	1.17	95	738.38	33.33%	35.92%	99.93	100.73	0.80	0.80%
	2-2	94.80	707.95	3.62		704.33						
	3-1	0.00	740.05	1.32	98	738.74	33.33%	35.24%	103.51	104.12	0.61	0.59%
	3-2	98.20	707.32	3.19		704.13						
	4-1	0.00	735.01	1.16	112	733.85	33.33%	35.78%	118.16	119.06	0.89	0.76%
	4-2	112.10	697.64	3.90		693.74						

The calculated strains in the table above are all 0.9% or less. Previous, highly conservative criteria for maximum arch strains in polyethylene geomembranes recommended limiting such strains to 1 to 2% to prevent rupture (Peggs, Schmucker, and Carey 2005). This limit was referenced by CTi in its previous response. Peggs, Schmucker, and Carey (2005) go on to say that these criteria are excessively conservative, particularly considering the actual resin formulations used for geomembranes. Accordingly, the authors concluded that maximum arch strains of 4 to 6% are more appropriate for textured geomembranes, albeit also conservative given the tolerable elongation values observed for geomembranes. Therefore, these estimated strain values are acceptable. The maximum change in length was estimated to be less than 0.9 feet, which is less than the required overlap in GCL panels (12 inches or 1 foot) in the end-to-end direction. Note that this comparison assumes that all elongation will be realized

as a decrease in overlap in the GCL rather than a combination of GCL elongation and reduced overlap. Therefore, even under this conservative set of estimates, differential settlement is expected to have acceptable effects on the liner system. Furthermore, as discussed by TRC, additional conservatism in the total settlement estimates, caused by subgrade stress history assumptions and selection of compressibility parameters means that these estimates are more pessimistic than anticipated actual values.

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Technical Review of the 2022 Master Cell VI Subcell F3 Liner Grade Minor Modification by EGLE (Email Dated 9/13/2022)

Responses by WDI and CTI

Comments from EGLE:

The Michigan Department of Environment, Great Lakes, and Energy, Materials Management Division, has reviewed the August 17, 2022, MC VI-F3 Minor Modification Request. EGLE is providing draft comments below to help expedite the review process. A formal comments letter will be forthcoming.

1) Liner System Integrity

Comment:

Revise the request to state what design criteria and assumptions were used to ensure that the liner systems retain their integrity post settlement.

Response:

Please see the response to comment 4 from TRC. CTI concluded that the strain imposed on the MCVI-F liner system is well within the acceptable range for the component geosynthetics.

2) Attachment A-1 Design Criteria and Assumptions

Comment:

Bullet Point 6: Verify that the data gathered from the located in Table 1B is anticipated to be consistent with future waste.

Response:

The unit weights computed in Table 1B are a weighted average of all of the waste types received over the last several years and represents the most credible mix of materials and unit weights anticipated for the site. Year-to-year variations in average unit weight are evident in the historical record and are expected to continue. Accordingly, CTI has selected a conservative (high) value of unit weight for use in engineering evaluations so that the resulting designs are not reliant upon an optimistic assessment of unit weight in any one year. Global stability of the site will be determined by average unit weight since potential global movement of the waste mass would mobilize materials placed over several years.

3) Attachment A-1 Conclusion

Comment:

Bullet Point 4: Provide a demonstration that the 20 feet is within an acceptable range.

Response:

Referring to the critical results presented in Table 5 for the MCVI-F3 flowline, the most severe differential settlement occurs between settlement points SP9 and SP-9b with the following intermediate calculations:

- Distance between points = 42 ft
- SP-9b total settlement = 6.60 ft
- SP-9 total settlement = 4.65 ft
- SP9b to SP-9 differential settlement = 6.60 ft – 4.65 ft = 1.95 ft
- Change in slope = 1.95 ft / 42 ft = 4.64%

If the actual toe of the intercell dike is 20 feet closer to the crest, the following calculations result:

- Distance between points = 22 ft (moved 20 feet closer together)
- SP-9b total settlement = 6.60 ft (taken as the same for the purposes of this demonstration)
- SP-9 total settlement = 4.65 ft (taken as the same for the purposes of this demonstration)
- SP9b to SP-9 differential settlement = 6.60 ft – 4.65 ft = 1.95 ft
- Change in slope = 1.95 ft / 22 ft = 8.86%

The design slope in this area is 10.2%, allowing for as much as 9.2% change in slope post-settlement (i.e., a 10.2% slope can be reduced by 9.2% and still meet the rule-required 1.0% post-settlement slope). The above calculation shows that even if the dike is 20-feet narrower than currently understood, the resulting change in slope is less than 9.2% (8.9% < 9.2%).Therefore, a 20-foot deviation in the toe of intercell dike is within acceptable limits.

4) Attachment B Drawings – shot tables

Comment:

Verify that the elevations on the drawings are acceptable. There are mistakes, such as on Drawing 4, Points 166 and 108 appear to be incorrect.

Response:

CTI checked all the subgrade, TSL, and TPL points for F3 and F4. CTI corrected the following point elevations.

- Subgrade points 108, 117, 118, and 166
- TSL point 266

Revised pdfs for sheets 4 and 5 are attached.

Attachment 1

Consolidation Test Summary

Soil borings performed between December 23, 2020 and January 7, 2021 at the perimeter of Master Cells I, IV, V, VI, and VII (MC I, IV, V, VI, and VII) at Wayne Disposal, Inc. (WDI, Site) in Belleville, Michigan retrieved a number of Shelby tube samples for lab testing. Attachment 1 is a map of the boring locations. Table 1 summarizes compression parameters (void ratio e, compression index C_c, recompression index C_r, preconsolidation pressure p_c) reported by the testing laboratory from consolidation tests performed on these samples. Table 1 reports calculated values of modified compression index $C_c' = C_c / (1 + e_0)$ and modified recompression index $C_r' = C_r / (1 + e_0)$. Also shown in Table 1 is an estimated value in in-situ vertical effective stress (σ_0') and a calculated value of overconsolidation ratio (OCR) = p_c / σ_0'. Most samples appear normally consolidated to lightly overconsolidated. The test reports provided by the testing laboratory are provided as Attachment 2.

Table 1. Summary of Compression Parameters from Consolidation Testing

sample	PB-20-1 ST-1&ST-2	PB-20-4 ST-1	PB-20-7 ST-2	PB-20-8A ST-1	PB-20-9B ST-2	PB-20-10 ST-1	Median
Depth (ft bgs)	72	61	71	61	51	24	
e_0	0.369	0.436	0.487	0.985	0.469	0.572	0.478
C_c	0.06	0.14	0.07	0.06	0.18	0.13	0.1
C_r	0.02	0.03	0.02	0.02	0.06	0.05	0.025
p_c (psf)	6005	6598	6016	7528	9308	4315	6307
C_c'	0.044	0.097	0.047	0.030	0.123	0.032	0.045
C_r'	0.015	0.021	0.013	0.010	0.041	0.032	0.018
σ_0' (psf)	6,947	5,719	6,060	5,071	4,203	2,306	
OCR	0.9	1.2	1.0	1.5	2.2	1.9	1.4

Attachment 1

Boring Location Map

N 9.000
N 8.000
N 7.000
E 4.000
E 5.000
E 6.000

PB-20-04
PB-20-05A
PB-20-07
PB-20-08A
PB-20-09B
PB-20-03A
PB-20-02
PB-20-01/01A
PB-20-10
PB-20-11A

MC VI-F2
MC 4
MC VI-F3
MC VI-F4
MC VI-F1
MC VI-G2
MC VI-G3
MC VI-G4
MC VI-G6
MC VI-G5
MC VI-G7
MC VI-G1-EP2
MC VI-G1-EP1
MC6G1
MC6EP2-NE
MC 5
MC6EP2-W
MC6EP2-SE
MC6EP1-SW
MC6 B
MC6 A-N
MC6 D
MC6 C
MC6 A-S

N

LEGEND

- 710 — EXISTING TOPOGRAPHY
- CLOSED CELL BOUNDARY
- MASTER CELL VI
- PROPERTY LINE
- BORING LOCATION

NOTES:

1. AERIAL TOPOGRAPHY MAP BY DRONEVIEW TECHNOLOGIES. DATE OF PHOTOGRAPHY: NOVEMBER 24, 2021. UPDATED WITH FLYOVER FROM SEPTEMBER 24, 2022.

SCALE 0' 50' 100' 200'

RECORD UTILITY POINTS

POINT#	NORTHING	EASTING	ELEVATION
PB-20-01/01A	6976.80	3723.24	711.30
PB-20-02	7833.37	3684.01	712.02
PB-20-03A	8296.21	3680.51	711.99
PB-20-04	8725.71	3694.89	711.45
PB-20-05A	8840.72	4416.27	711.03
PB-20-07	8851.28	5328.71	712.21
PB-20-08A	8845.88	5823.87	711.84
PB-20-09B	8888.29	6487.11	703.59
PB-20-10	6482.76	5010.01	703.69
PB-20-11A	6622.99	6460.26	706.80

CTI and Associates, Inc.
34705 W. 12 Mile Road, Ste. 230
Farmington Hills, Michigan 48331
Phone: 248.553.8505 Fax: 248.553.5050
www.ctiompanies.com

DATE: 10/08/22
DESIGNED BY: KF
DRAWN BY: BDA
CHECKED BY: MB
APPROVED BY:

This drawing was prepared by CTI & Associates, Inc. (CTI). It is the property of CTI and is not to be used for any purpose other than that specifically stated in the agreement between CTI and the client for whom it was prepared. Reuse of this drawing without the written consent of CTI is prohibited and any unauthorized use will be at the user's sole risk and without liability to CTI. Unauthorized use of this drawing constitutes an agreement to defend and indemnify CTI from any and all claims, liability, and expenses resulting from such use.

DRN APP

REV DATE REVISION DESCRIPTION

WAYNE DISPOSAL SITE NO. 2
WAYNE, MICHIGAN

ECP-445
RECORD BORING LOCATIONS
PERIMETER BORING INVESTIGATION

PROJECT NUMBER 1228070064
SCALE 1" = 100'
DRAWING NO **1**

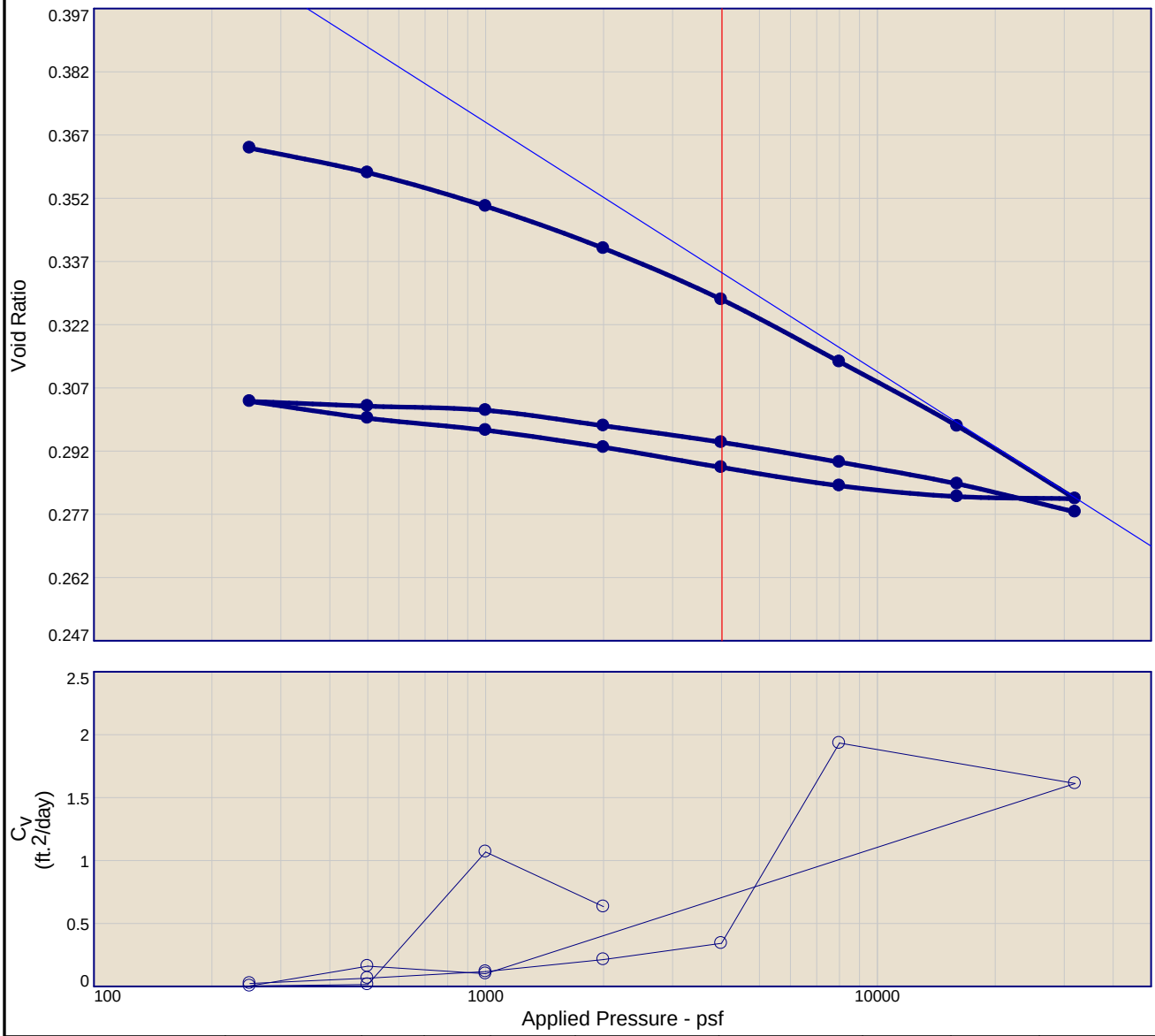
DWG PLOTTED: 14:01 PM
DATE PLOTTED: 10/11/2022
FILENAME: S:\Drawings\projects\Commercial\GS Energy\WDS\ECP\2020\ECP-445 Report\ECP-445 RECORD PERIMETER BORING INVESTIGATION SHEET 1.dgn

DRAWING SIZE: 30" x 42"

Attachment 2

Laboratory Consolidation Test Reports

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
107.7 %	14.2 %	127.7	18	5	2.8	6000	6005	0.06	0.02	0.369

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 2121- **Client:** CTI & Associates, Inc.

Project: CTI - WDI Lower Clay Investigation

Source: PB-20-1A **Depth:** 70.0'-74.0' **Sample No.:** ST-1 & ST-2

Remarks:

DLZ

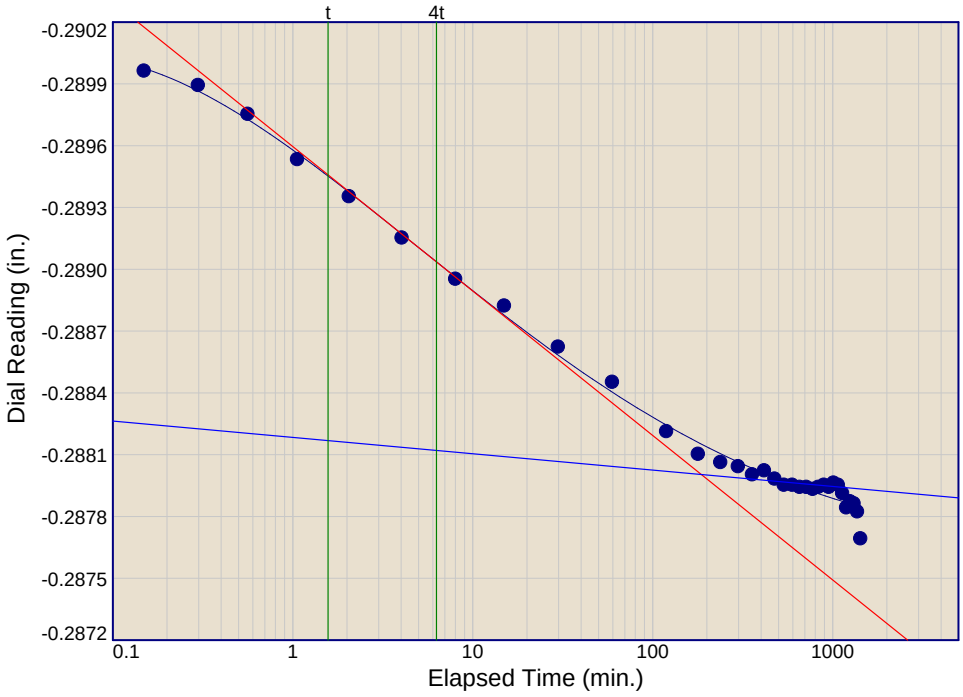
Figure

Tested By: BW **Checked By:** SR

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

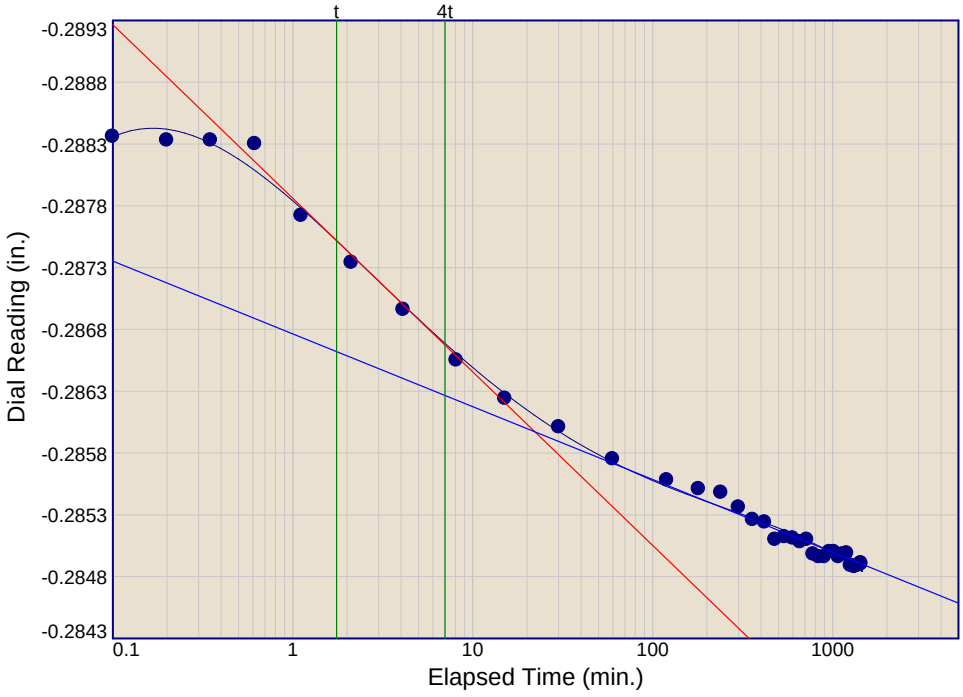
Source of Sample: PB-20-1A Depth: 70.0'-74.0' Sample Number: ST-1 & ST-2



Load No.= 1
Load= 250 psf
D_0 = -0.2899
D_{50} = -0.2889
D_{100} = -0.2880
T_{50} = 8.75 min.

C_v @ T_{50}
0.024 ft.^{2}/day

C_α = 0.000



Load No.= 2
Load= 500 psf
D_0 = -0.2883
D_{50} = -0.2872
D_{100} = -0.2860
T_{50} = 3.16 min.

C_v @ T_{50}
0.066 ft.^{2}/day

C_α = 0.001

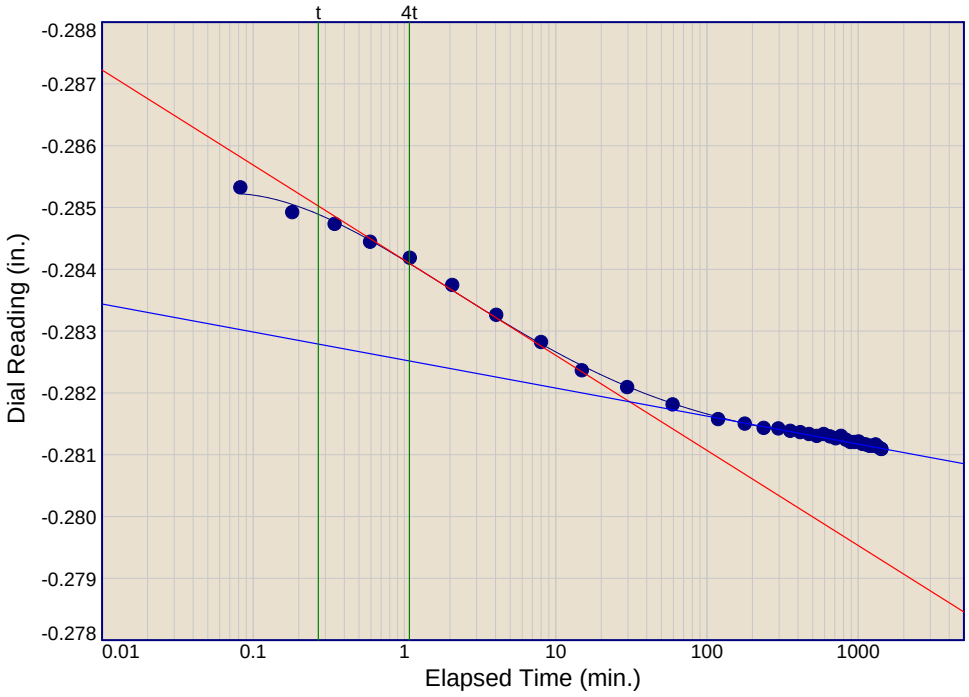
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

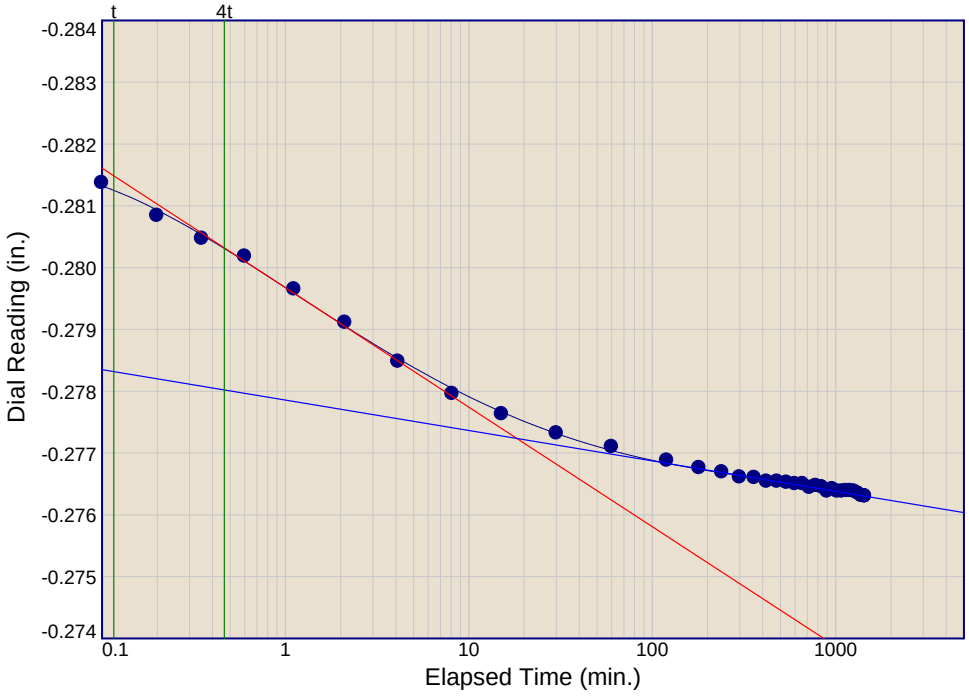
Source of Sample: PB-20-1A Depth: 70.0'-74.0' Sample Number: ST-1 & ST-2



Load No.= 3
Load= 1000 psf
D_0 = -0.2857
D_{50} = -0.2838
D_{100} = -0.2819
T_{50} = 1.76 min.

C_v @ T_{50}
0.118 ft.^{2}/day

C_α = 0.001



Load No.= 4
Load= 2000 psf
D_0 = -0.2822
D_{50} = -0.2797
D_{100} = -0.2772
T_{50} = 0.96 min.

C_v @ T_{50}
0.214 ft.^{2}/day

C_α = 0.001

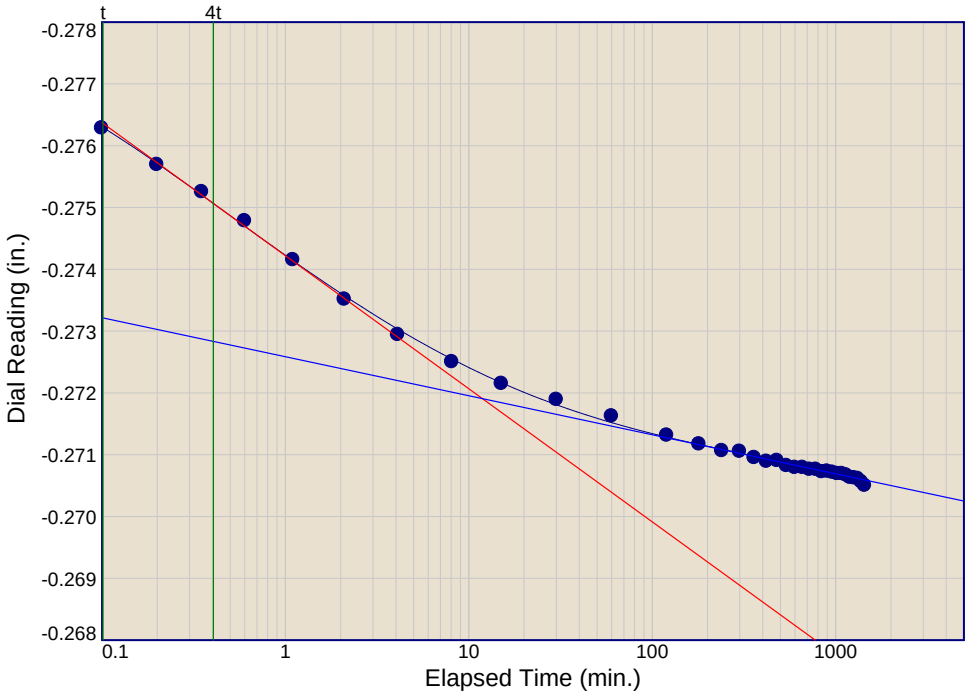
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

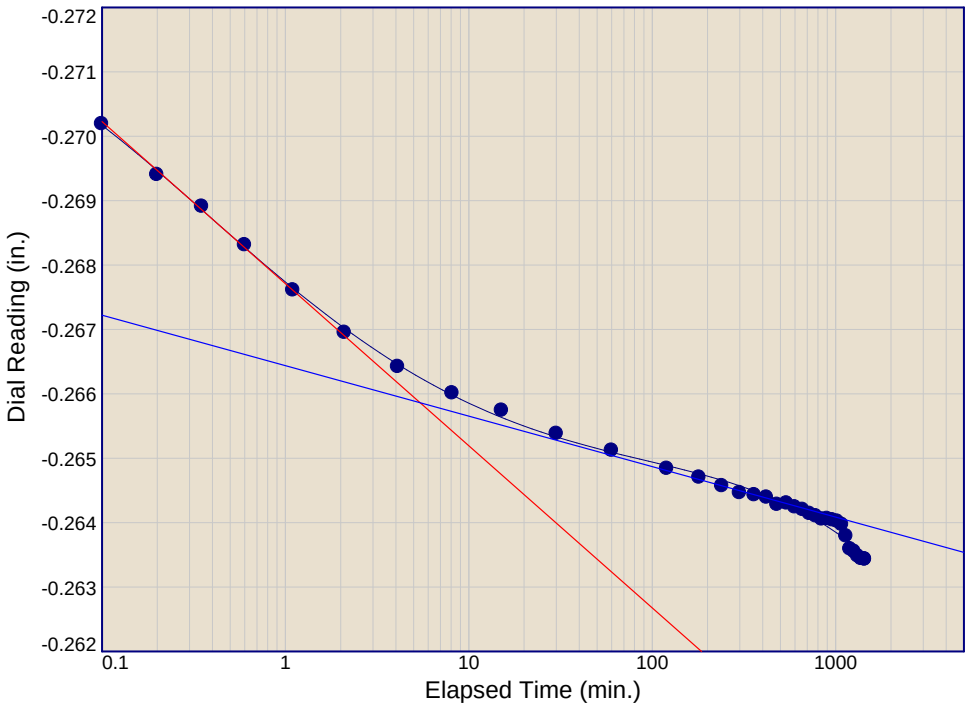
Source of Sample: PB-20-1A Depth: 70.0'-74.0' Sample Number: ST-1 & ST-2



Load No.= 5
Load= 4000 psf
D_0 = -0.2775
D_{50} = -0.2747
D_{100} = -0.2719
T_{50} = 0.59 min.

C_v @ T_{50}
0.343 ft.^{2}/day

C_α = 0.001



Load No.= 6
Load= 8000 psf
D_0 = -0.2744
D_{50} = -0.2701
D_{100} = -0.2659
T_{50} = 0.10 min.

C_v @ T_{50}
1.933 ft.^{2}/day

C_α = 0.002

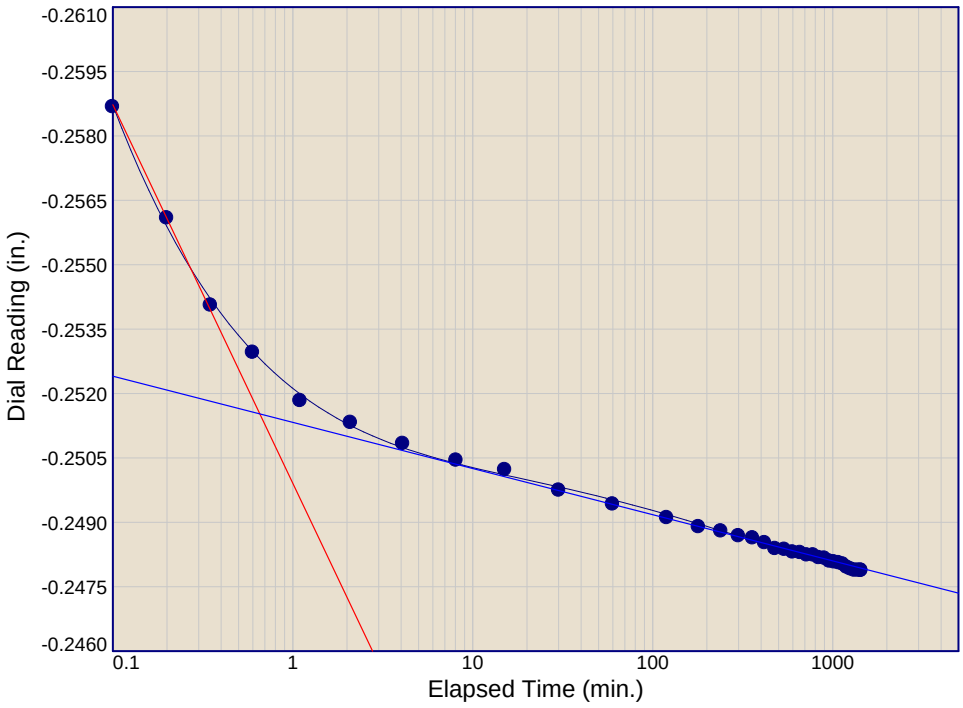
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

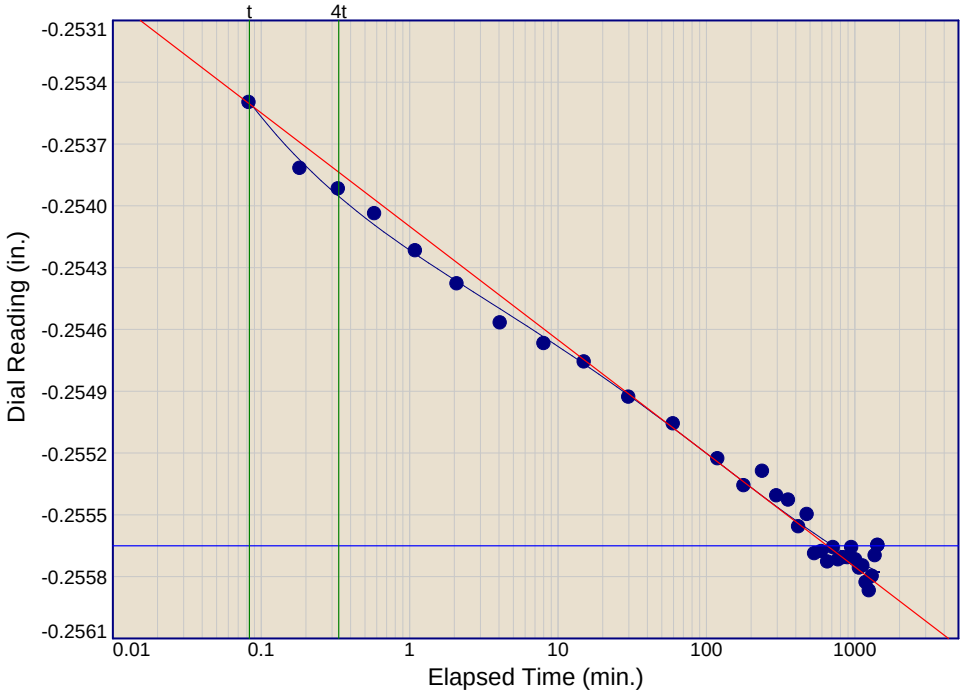
Source of Sample: PB-20-1A Depth: 70.0'-74.0' Sample Number: ST-1 & ST-2



Load No.= 8
Load= 32000 psf
D_0 = -0.2644
D_{50} = -0.2580
D_{100} = -0.2515
T_{50} = 0.12 min.

C_v @ T_{50}
1.613 ft.^{2}/day

C_α = 0.002



Load No.= 13
Load= 1000 psf
D_0 = -0.2530
D_{50} = -0.2543
D_{100} = -0.2556
T_{50} = 1.86 min.

C_v @ T_{50}
0.101 ft.^{2}/day

C_α = 0.000

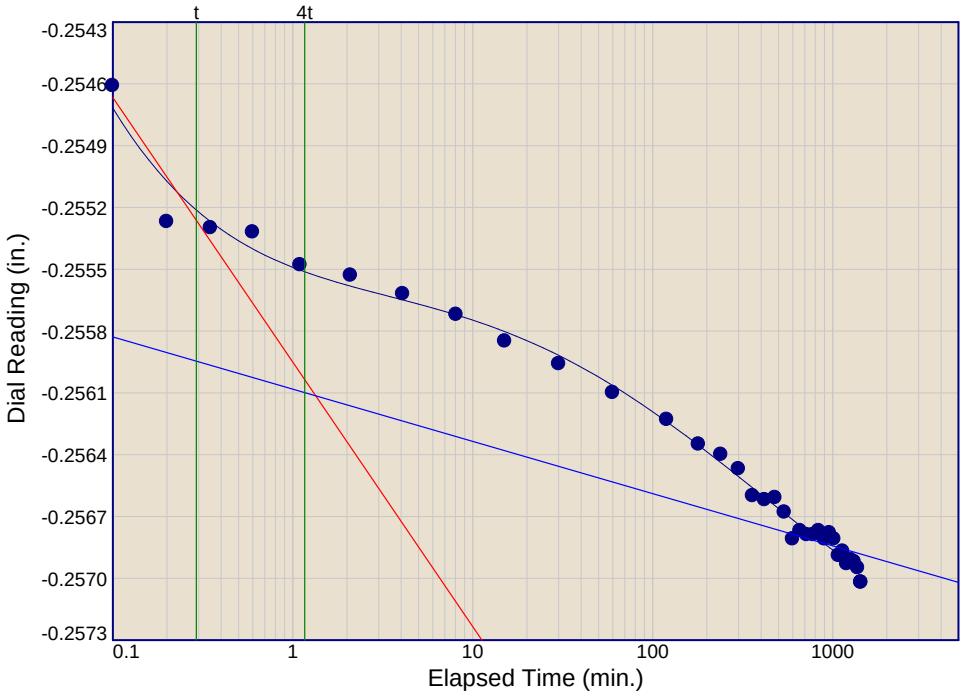
Figure

DLZ, INC.

Dial Reading vs. Time

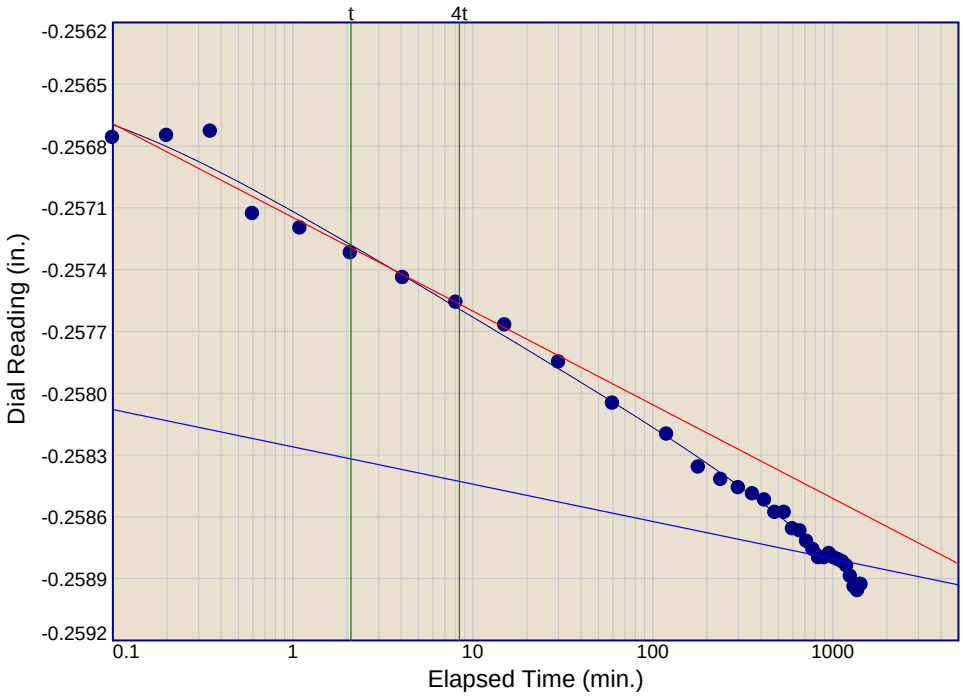
Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-1A Depth: 70.0'-74.0' Sample Number: ST-1 & ST-2



Load No.= 14
Load= 500 psf
D_0 = -0.2549
D_{50} = -0.2555
D_{100} = -0.2561
T_{50} = 1.18 min.

C_v @ T_{50}
0.161 ft.^{2}/day



Load No.= 15
Load= 250 psf
D_0 = -0.2570
D_{50} = -0.2580
D_{100} = -0.2590
T_{50} = 46.50 min.

C_v @ T_{50}
0.004 ft.^{2}/day

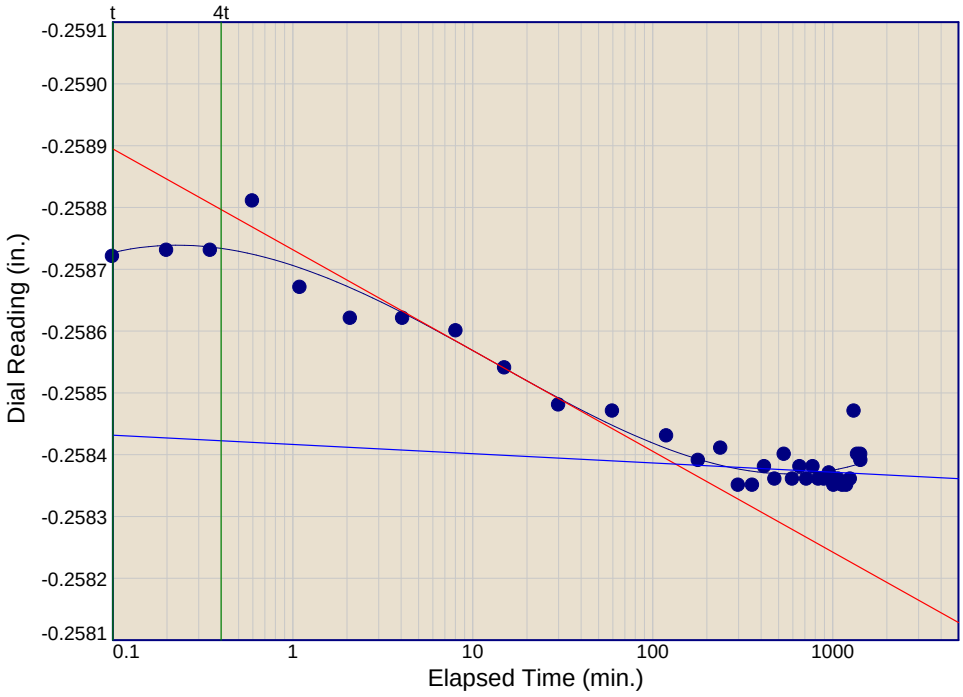
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

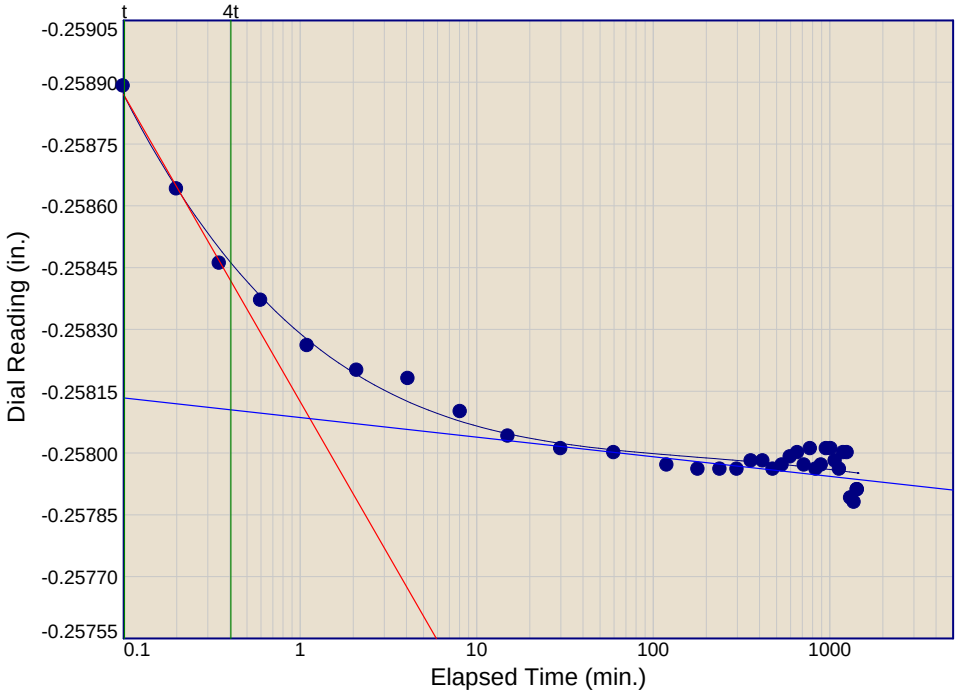
Source of Sample: PB-20-1A Depth: 70.0'-74.0' Sample Number: ST-1 & ST-2



Load No.= 16
Load= 500 psf
D_0 = -0.2587
D_{50} = -0.2586
D_{100} = -0.2584
T_{50} = 12.56 min.

C_v @ T_{50}
0.015 $ft.^2/day$

C_α = 0.000



Load No.= 17
Load= 1000 psf
D_0 = -0.2593
D_{50} = -0.2587
D_{100} = -0.2581
T_{50} = 0.18 min.

C_v @ T_{50}
1.069 $ft.^2/day$

C_α = 0.000

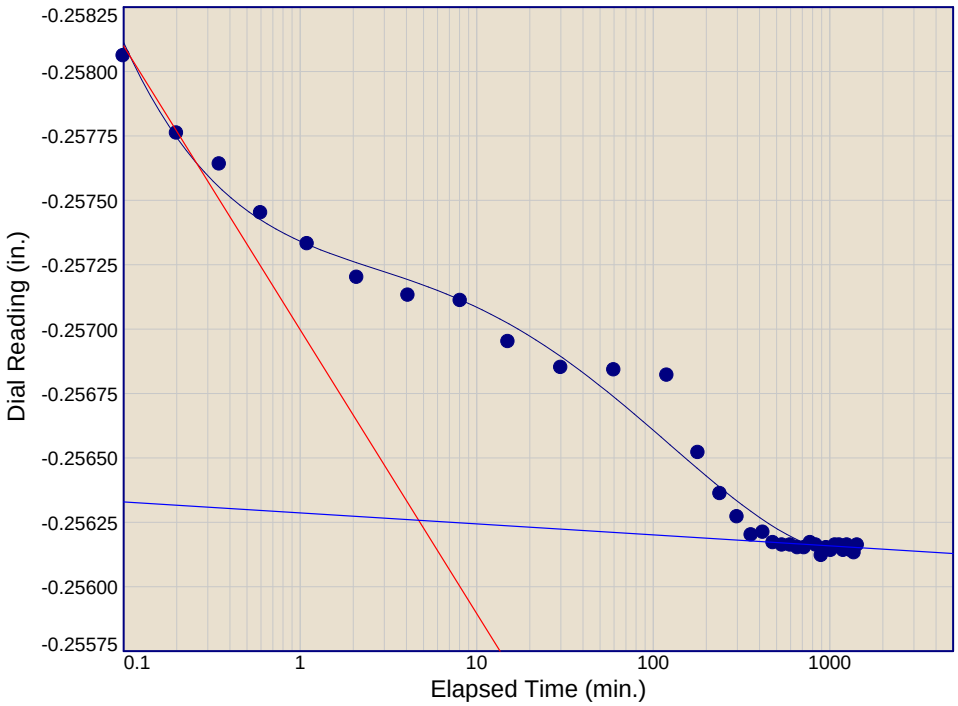
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-1A Depth: 70.0'-74.0' Sample Number: ST-1 & ST-2



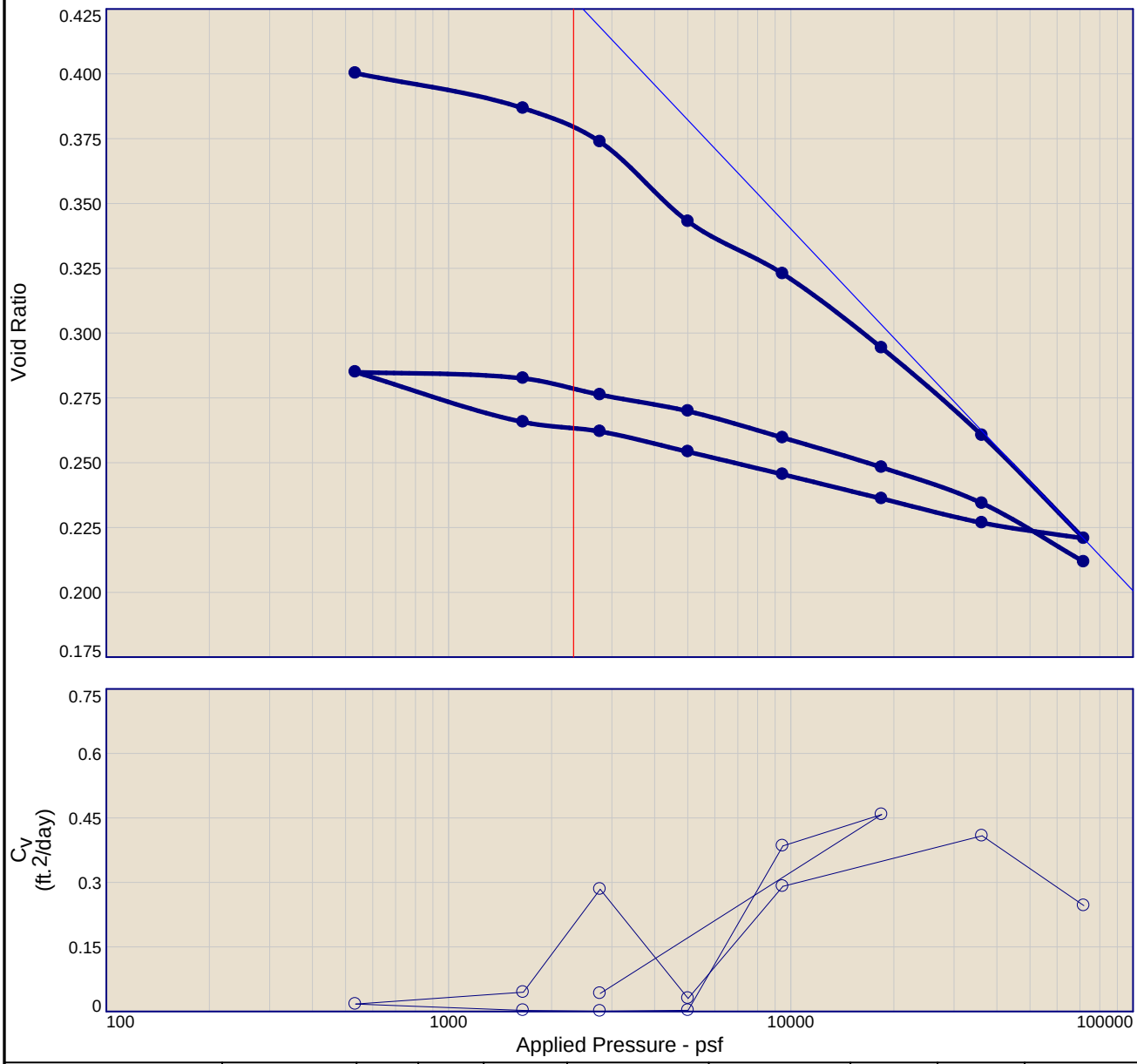
Load No.= 18
Load= 2000 psf
D_0 = -0.2589
D_{50} = -0.2576
D_{100} = -0.2563
T_{50} = 0.30 min.

C_v @ T_{50}
0.634 ft.^{2}/day

C_α = 0.000

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
95.6 %	15.1 %	122.0	18	6	2.77	5000	6598	0.14	0.03	0.436

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 2121- **Client:** CTI & Associates, Inc.

Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-4 **Depth:** 60.0'-62.0' **Sample Number:** ST-1

Remarks:

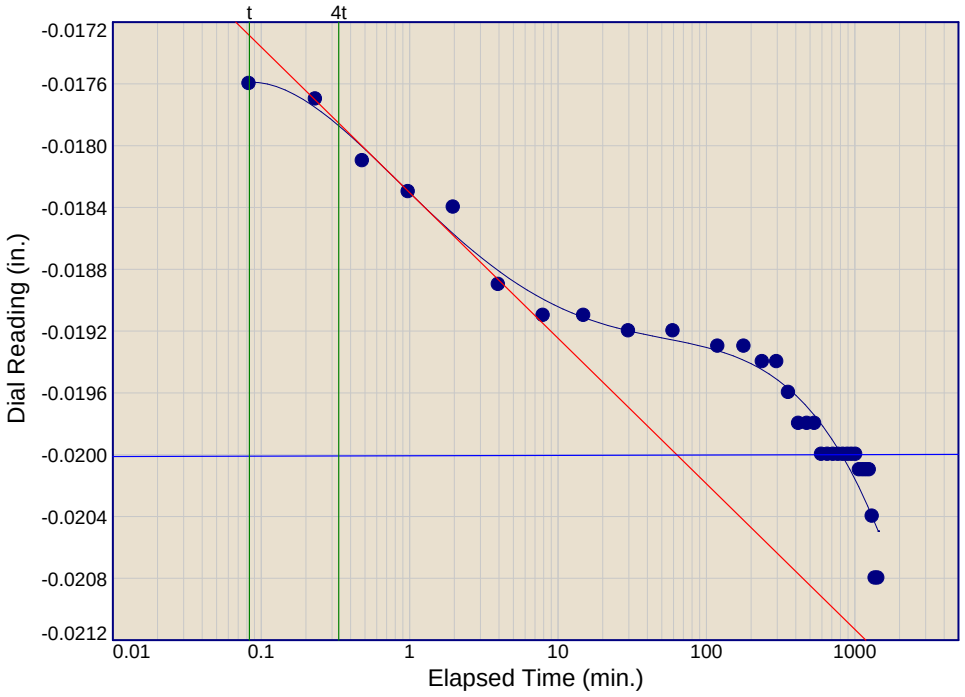
DLZ

Figure

Dial Reading vs. Time

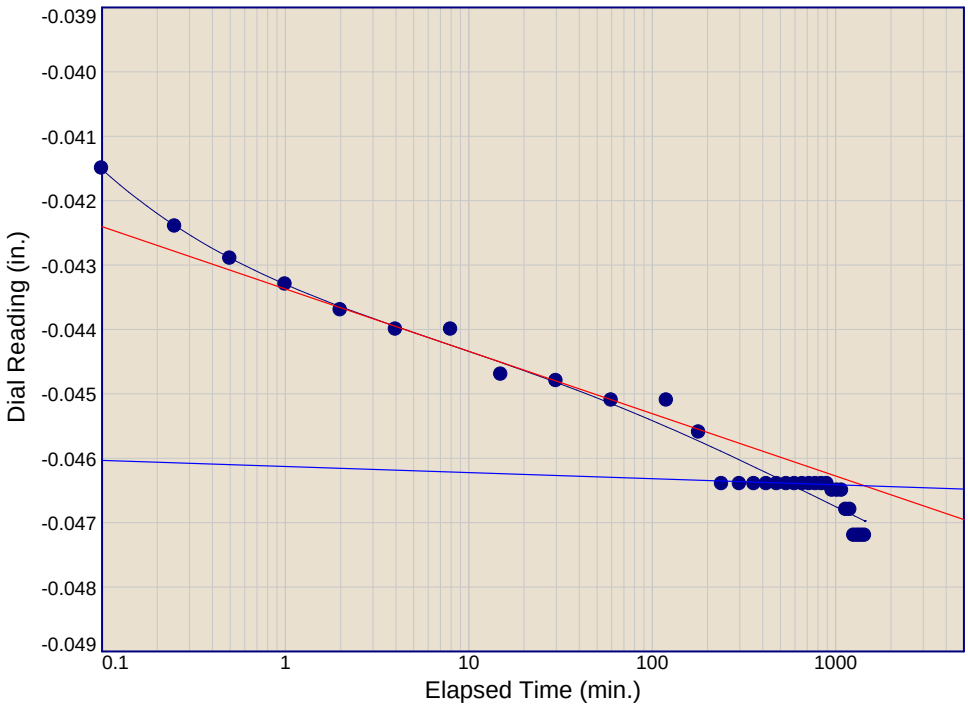
Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-4 Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 3
Load= 2774 psf
D_0 = -0.0173
D_{50} = -0.0187
D_{100} = -0.0200
T_{50} = 2.48 min.

C_v @ T_{50}
0.042 ft.^{2}/day



Load No.= 6
Load= 18432 psf
D_0 = -0.0380
D_{50} = -0.0422
D_{100} = -0.0464
T_{50} = 0.20 min.

C_v @ T_{50}
0.458 ft.^{2}/day

C_α = 0.000

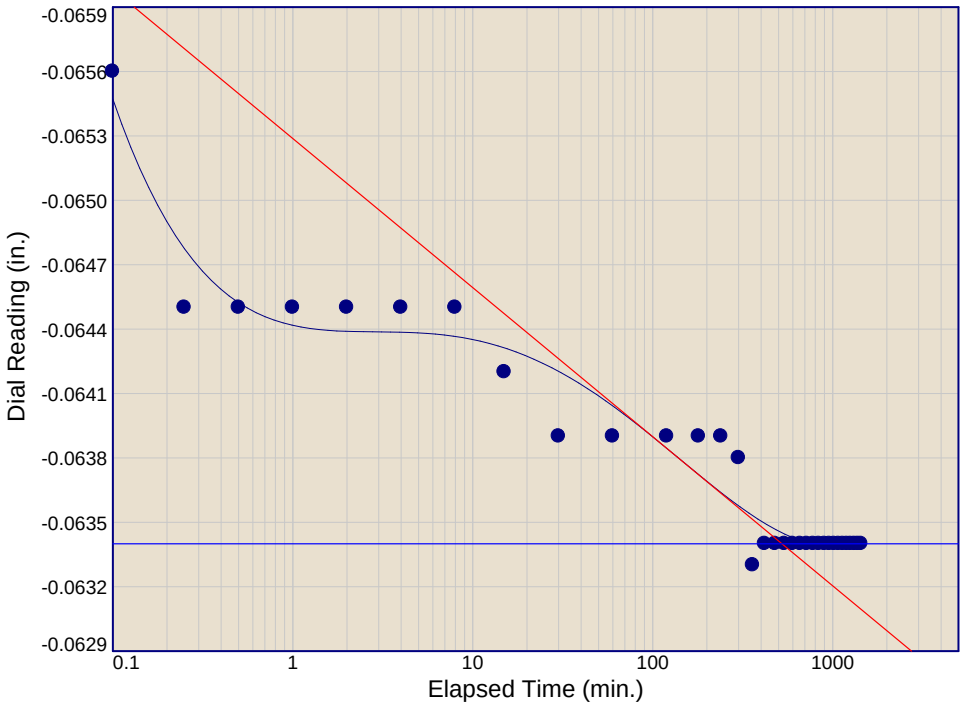
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

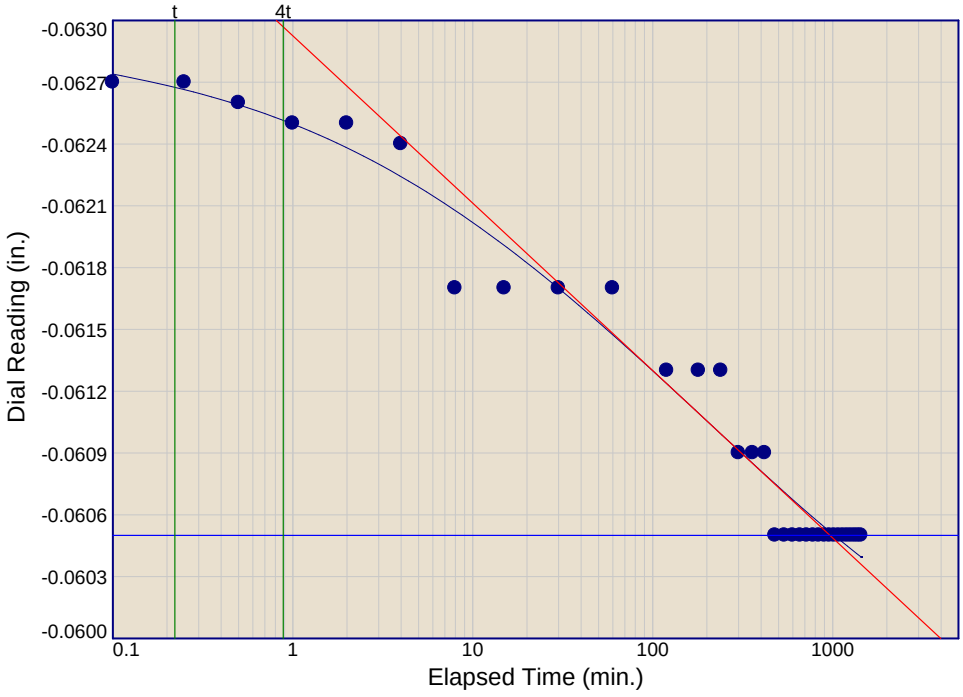
Source of Sample: PB-20-4 Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 11
Load= 9481 psf
D_0 = -0.0663
D_{50} = -0.0648
D_{100} = -0.0634
T_{50} = 0.22 min.

C_v @ T_{50}
0.385 ft.^{2}/day

C_α = 0.000



Load No.= 12
Load= 5012 psf
D_0 = -0.0628
D_{50} = -0.0617
D_{100} = -0.0605
T_{50} = 33.16 min.

C_v @ T_{50}
0.003 ft.^{2}/day

C_α = 0.000

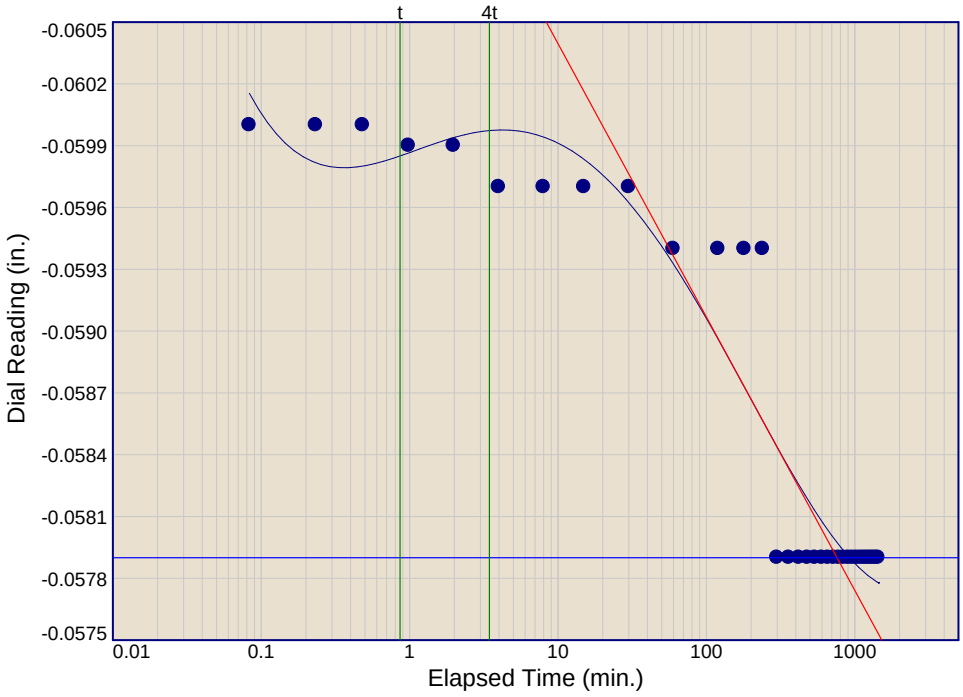
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

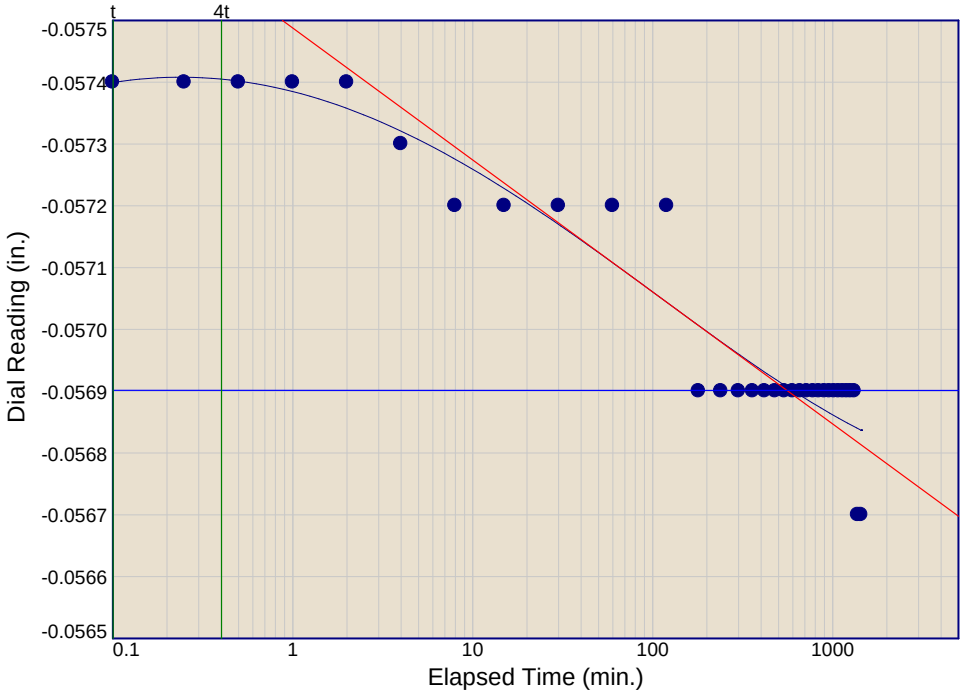
Source of Sample: PB-20-4 Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 13
Load= 2774 psf
D_0 = -0.0597
D_{50} = -0.0588
D_{100} = -0.0579
T_{50} = 155.55 min.

C_v @ T_{50}
0.001 ft.^{2}/day

C_α = 0.000



Load No.= 14
Load= 1654 psf
D_0 = -0.0574
D_{50} = -0.0571
D_{100} = -0.0569
T_{50} = 38.53 min.

C_v @ T_{50}
0.002 ft.^{2}/day

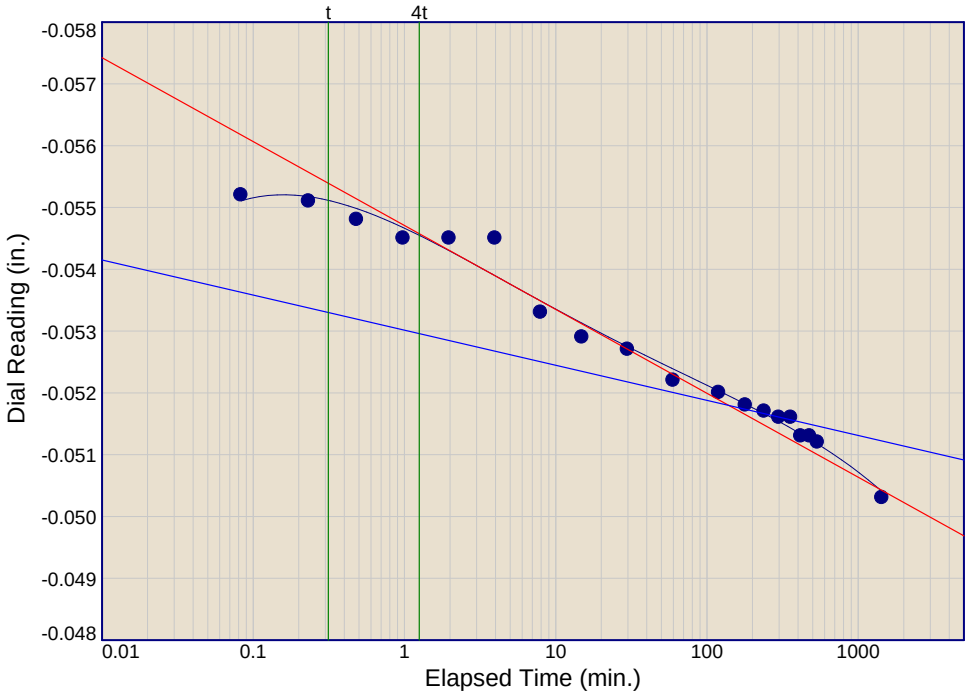
Figure

DLZ, INC.

Dial Reading vs. Time

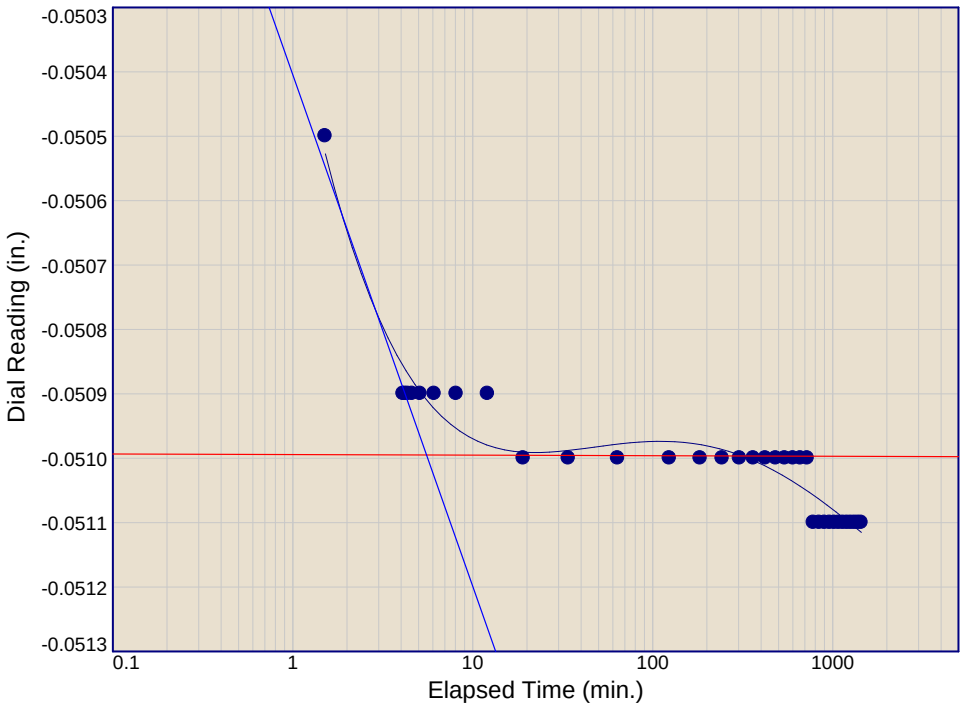
Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-4 Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 15
Load= 535 psf
D_0 = -0.0557
D_{50} = -0.0537
D_{100} = -0.0518
T_{50} = 5.16 min.

C_v @ T_{50}
0.017 ft.^{2}/day



Load No.= 16
Load= 1654 psf
D_0 = -0.0503
D_{50} = -0.0506
D_{100} = -0.0510
T_{50} = 2.00 min.

C_v @ T_{50}
0.045 ft.^{2}/day

C_α = 0.002

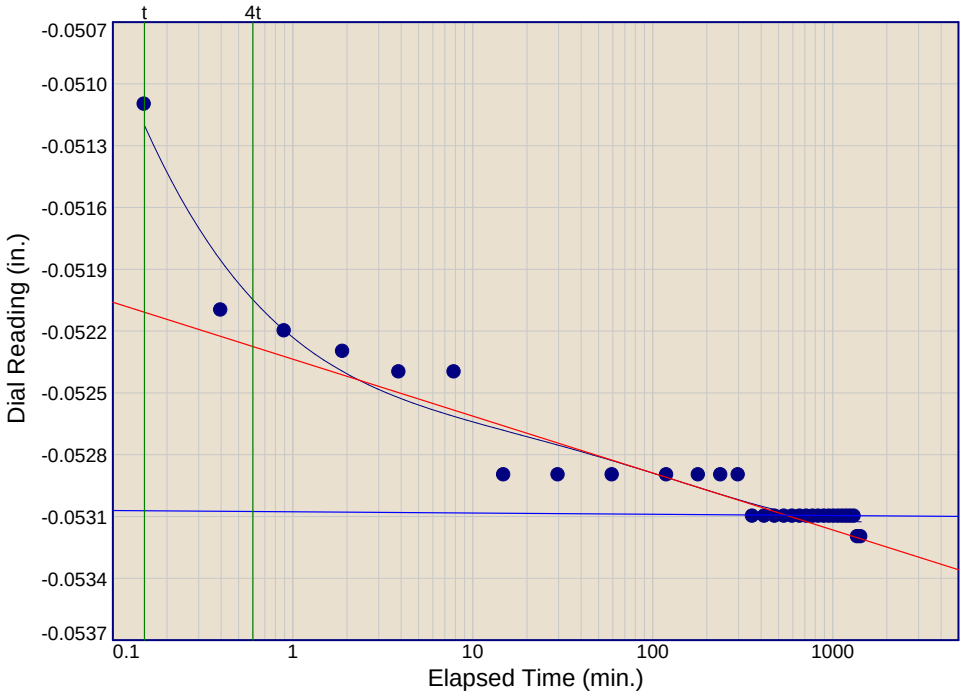
DLZ, INC.

Figure

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

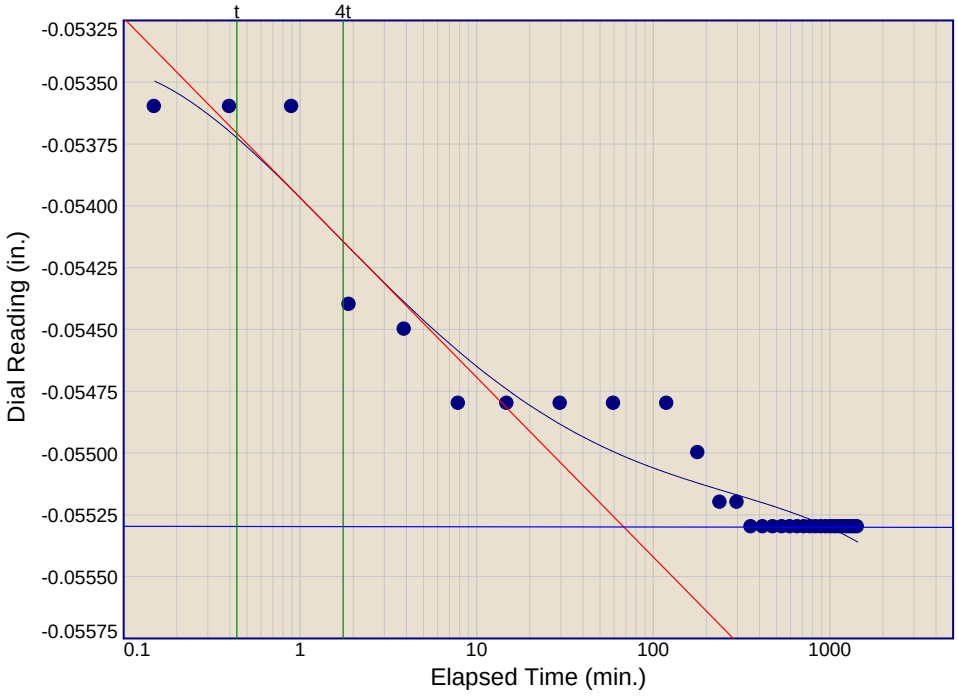
Source of Sample: PB-20-4 Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 17
Load= 2774 psf
D_0 = -0.0504
D_{50} = -0.0517
D_{100} = -0.0531
T_{50} = 0.31 min.

C_v @ T_{50}
0.284 ft.^{2}/day

C_α = 0.000



Load No.= 18
Load= 5012 psf
D_0 = -0.0533
D_{50} = -0.0543
D_{100} = -0.0553
T_{50} = 2.91 min.

C_v @ T_{50}
0.030 ft.^{2}/day

C_α = 0.000

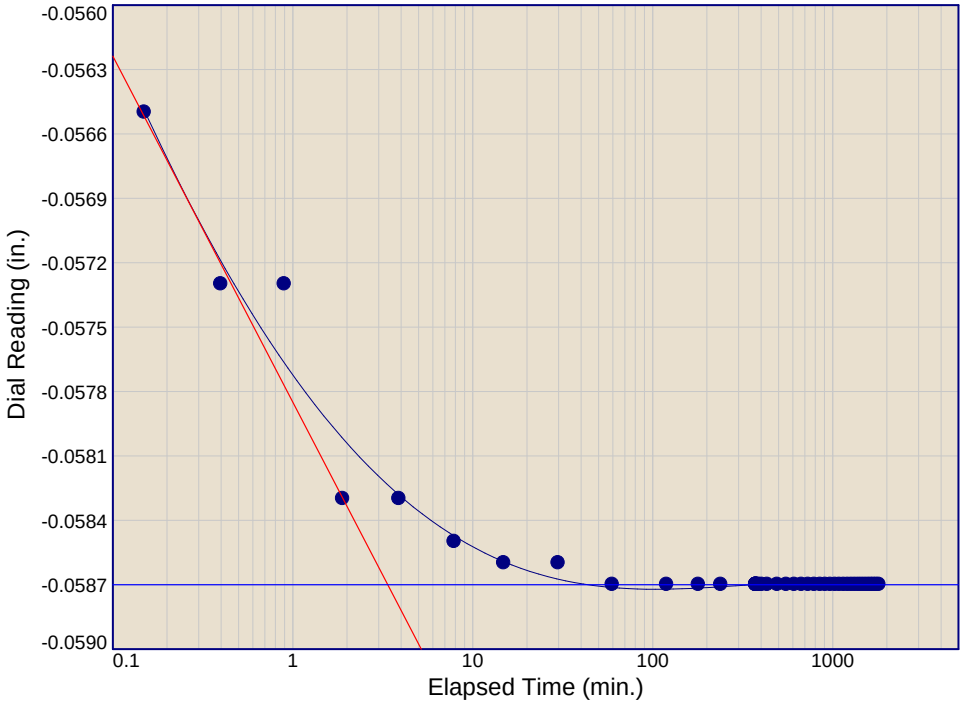
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

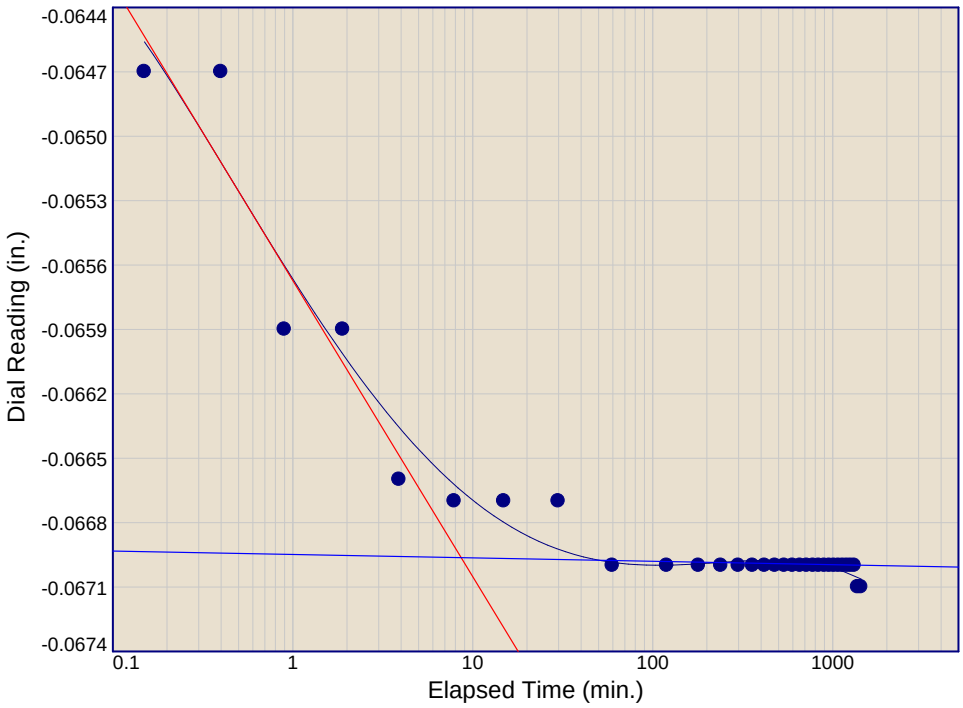
Source of Sample: PB-20-4 Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 19
Load= 9481 psf
D_0 = -0.0553
D_{50} = -0.0570
D_{100} = -0.0587
T_{50} = 0.30 min.

C_v @ T_{50}
0.291 ft.^{2}/day

C_α = 0.000



Load No.= 21
Load= 36233 psf
D_0 = -0.0625
D_{50} = -0.0647
D_{100} = -0.0670
T_{50} = 0.20 min.

C_v @ T_{50}
0.408 ft.^{2}/day

C_α = 0.000

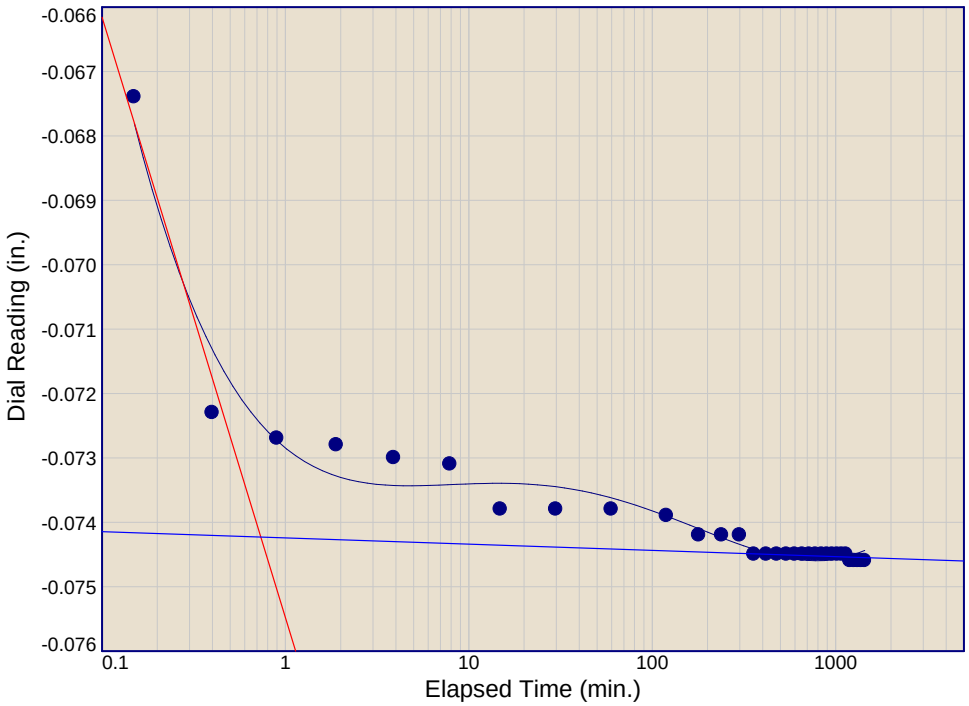
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-4 Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 22
Load= 71839 psf
D_0 = -0.0674
D_{50} = -0.0708
D_{100} = -0.0742
T_{50} = 0.33 min.

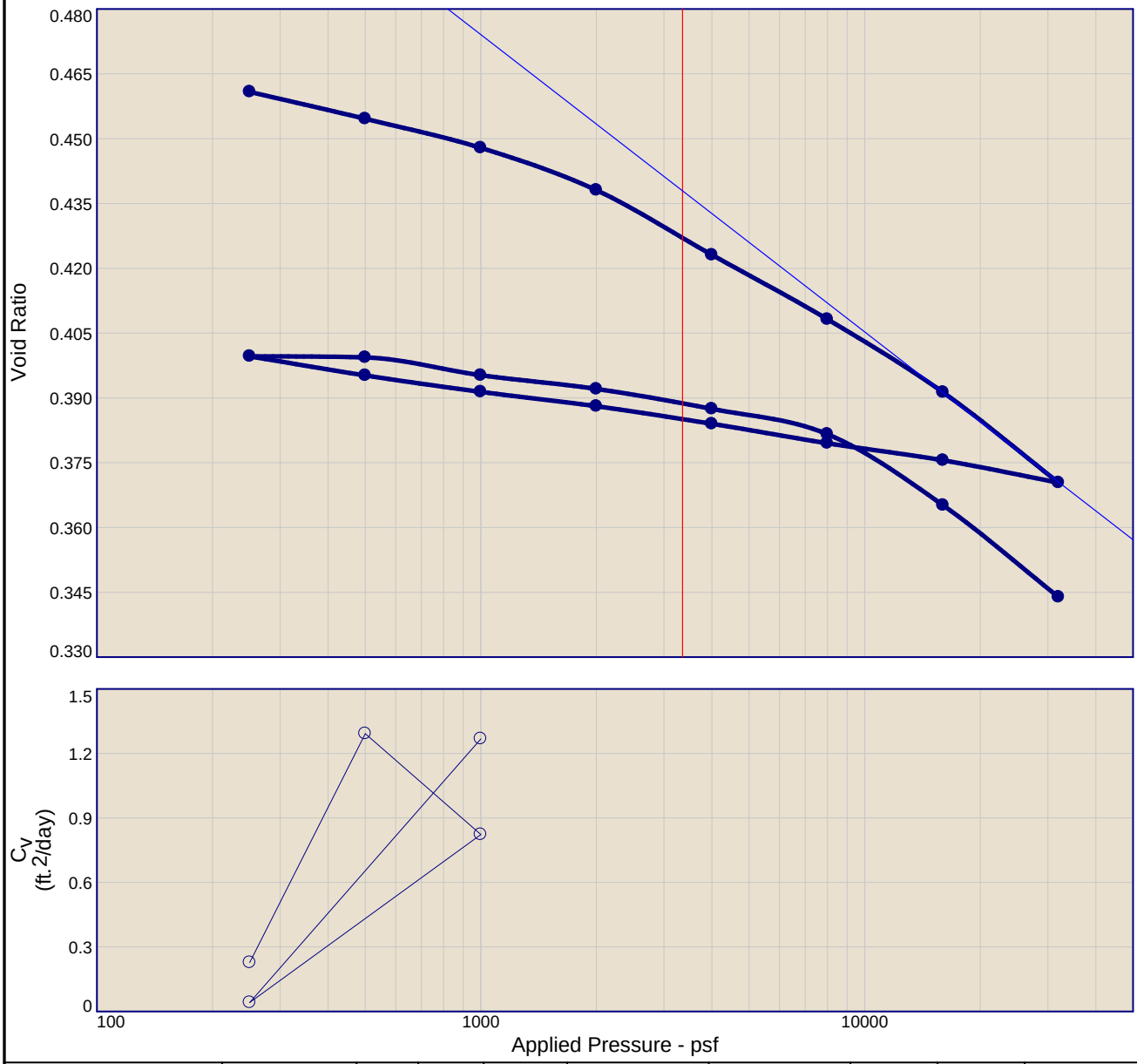
C_v @ T_{50}
0.246 ft.^{2}/day

C_α = 0.000

Figure

DLZ, INC.

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
115.5 %	20.1 %	117.6	22	8	2.8	6000	6016	0.07	0.02	0.487

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 2121- **Client:** CTI & Associates, Inc.

Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-7 **Depth:** 70.0'-72.0' **Sample Number:** ST-2

Remarks:

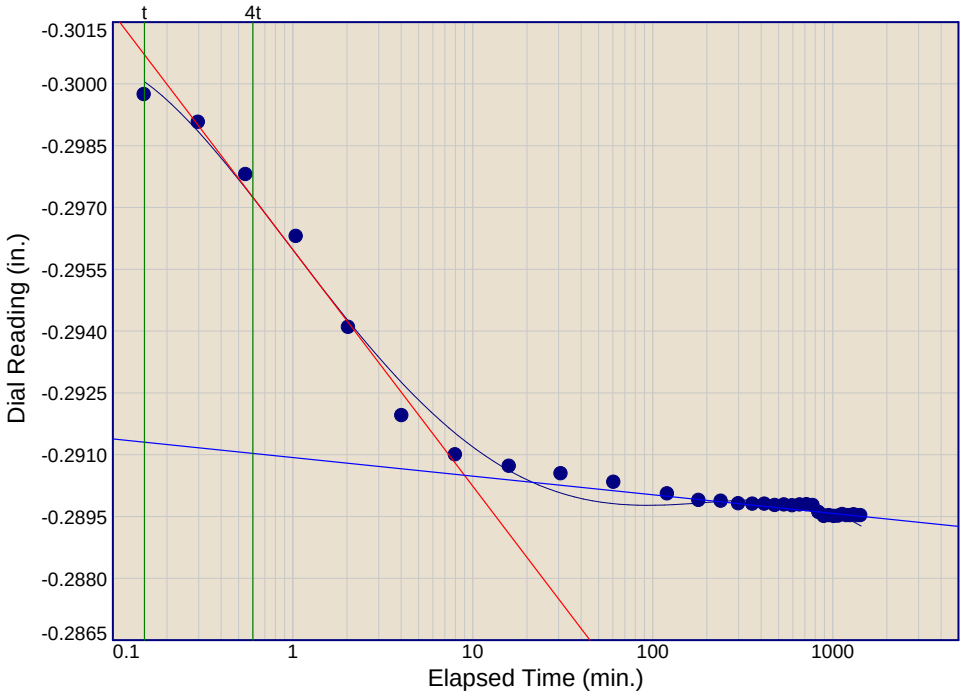
DLZ

Figure

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

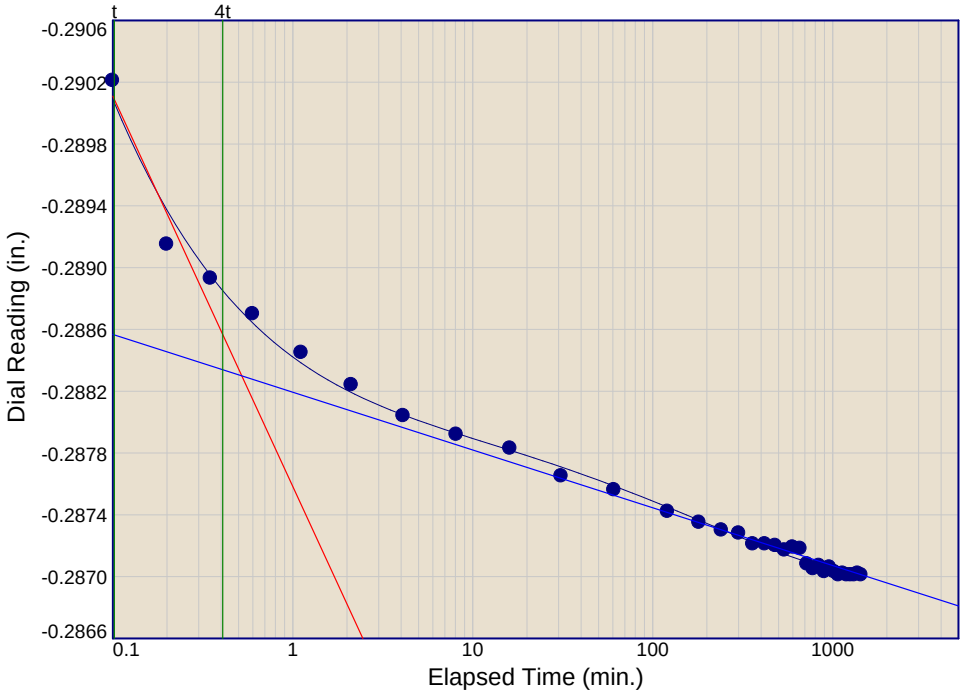
Source of Sample: PB-20-7 Depth: 70.0'-72.0' Sample Number: ST-2



Load No.= 1
Load= 250 psf
D_0 = -0.3029
D_{50} = -0.2967
D_{100} = -0.2905
T_{50} = 0.75 min.

C_v @ T_{50}
0.227 ft.^{2}/day

C_α = 0.001



Load No.= 2
Load= 500 psf
D_0 = -0.2913
D_{50} = -0.2898
D_{100} = -0.2883
T_{50} = 0.13 min.

C_v @ T_{50}
1.292 ft.^{2}/day

C_α = 0.001

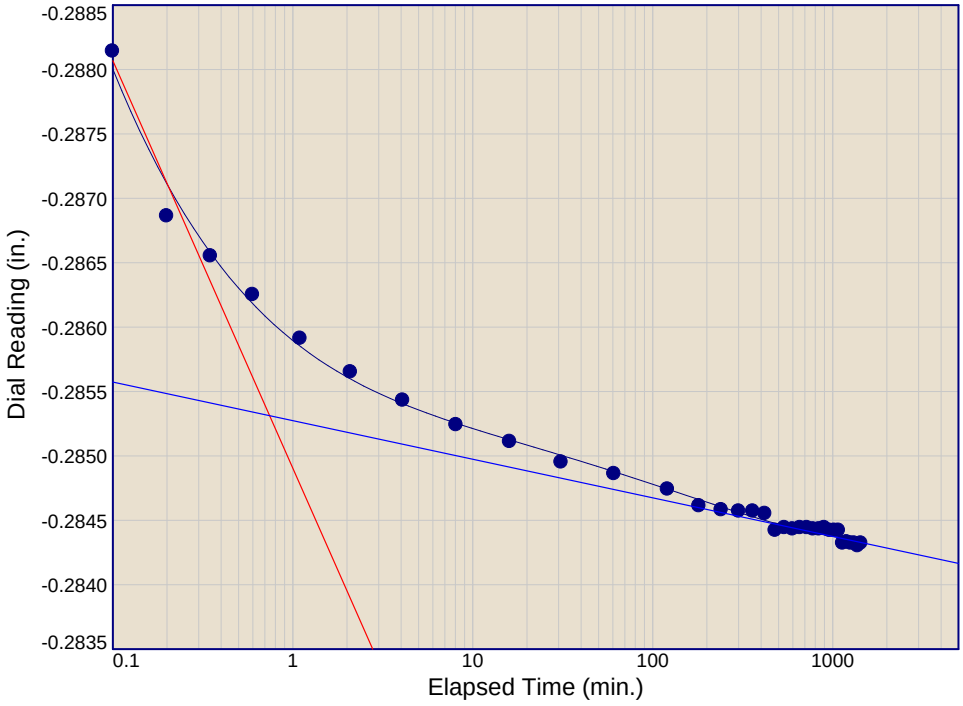
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

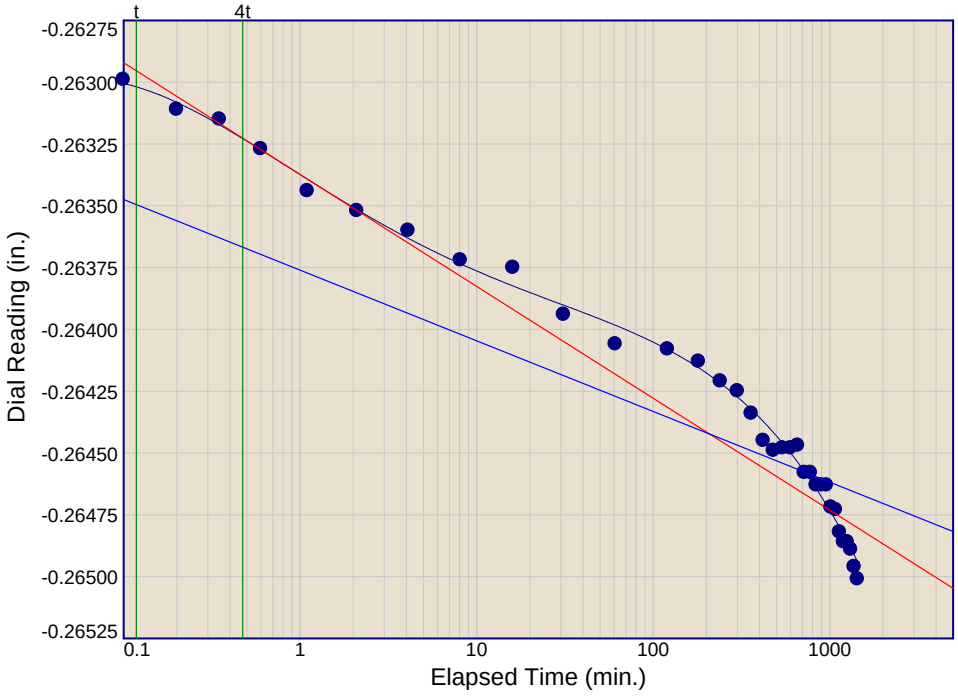
Source of Sample: PB-20-7 Depth: 70.0'-72.0' Sample Number: ST-2



Load No.= 3
Load= 1000 psf
D_0 = -0.2889
D_{50} = -0.2871
D_{100} = -0.2853
T_{50} = 0.20 min.

C_v @ T_{50}
0.823 ft.^{2}/day

C_α = 0.001



Load No.= 15
Load= 250 psf
D_0 = -0.2628
D_{50} = -0.2636
D_{100} = -0.2644
T_{50} = 3.73 min.

C_v @ T_{50}
0.041 ft.^{2}/day

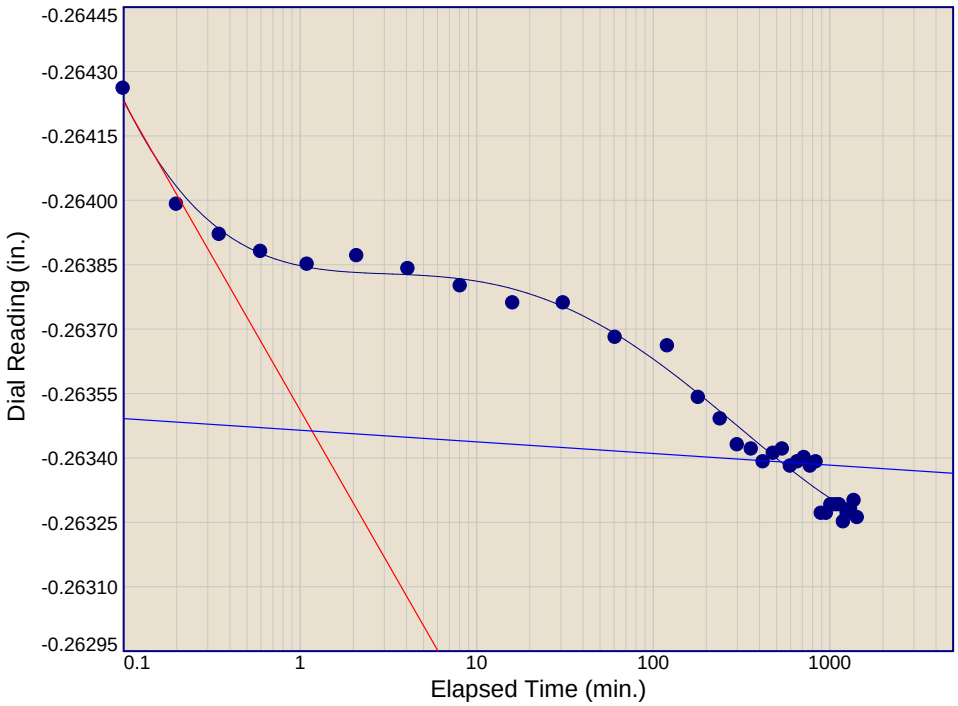
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-7 Depth: 70.0'-72.0' Sample Number: ST-2



Load No.= 17
Load= 1000 psf
D_0 = -0.2649
D_{50} = -0.2642
D_{100} = -0.2635
T_{50} = 0.12 min.

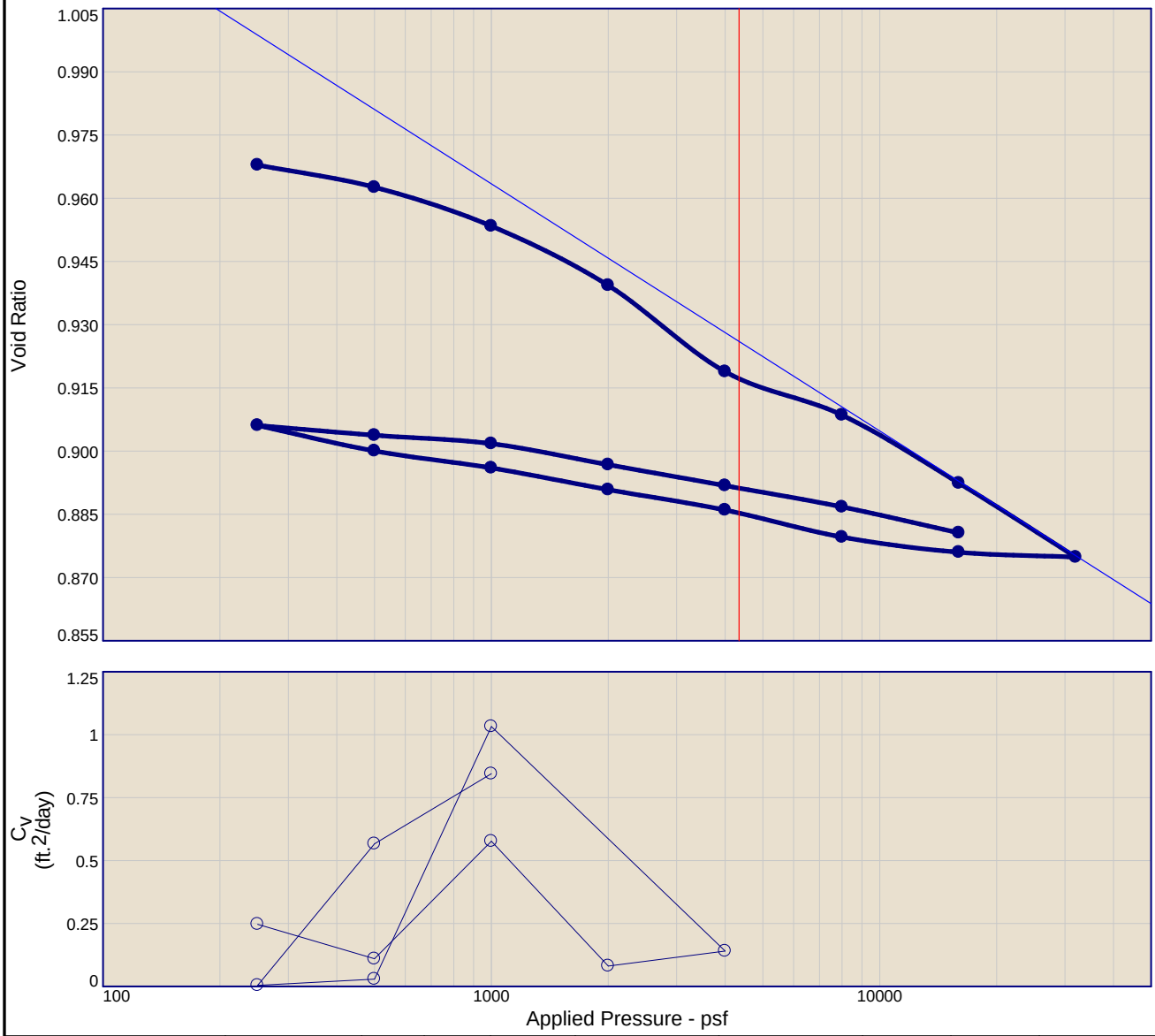
C_v @ T_{50}
1.268 ft.^{2}/day

C_α = 0.000

Figure

DLZ, INC.

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
47.1 %	17.2 %	84.9	20	5	2.7	3700	7528	0.06	0.02	0.985

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 2121- **Client:** CTI & Associates, Inc.

Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-8A **Depth:** 60.0'-62.0' **Sample Number:** ST-1

DLZ

Remarks:

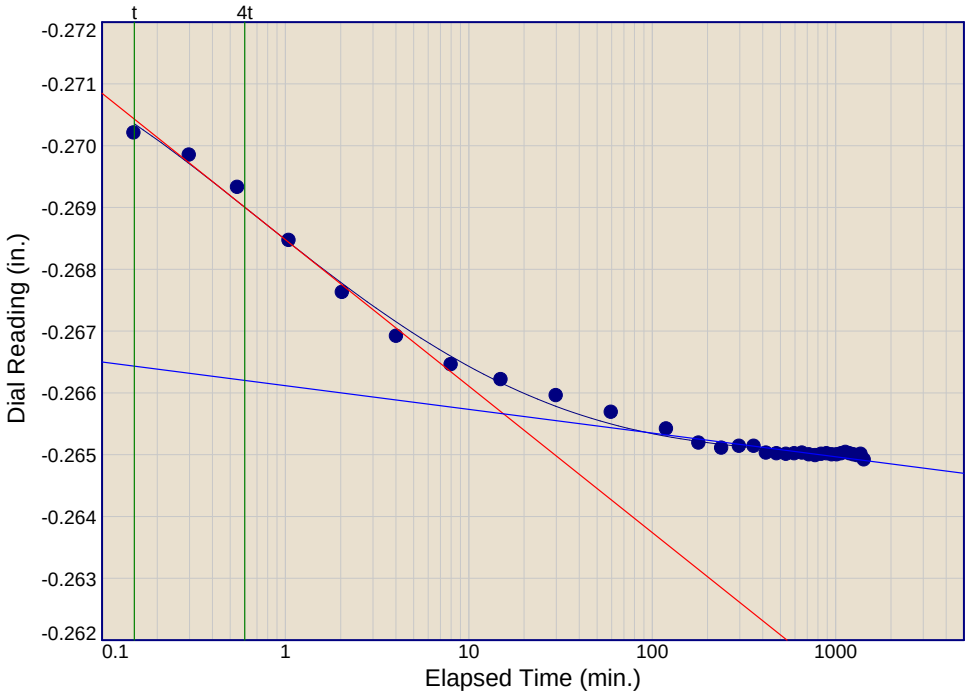
Figure

Tested By: Austin Davis **Checked By:** Steve Robinson

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

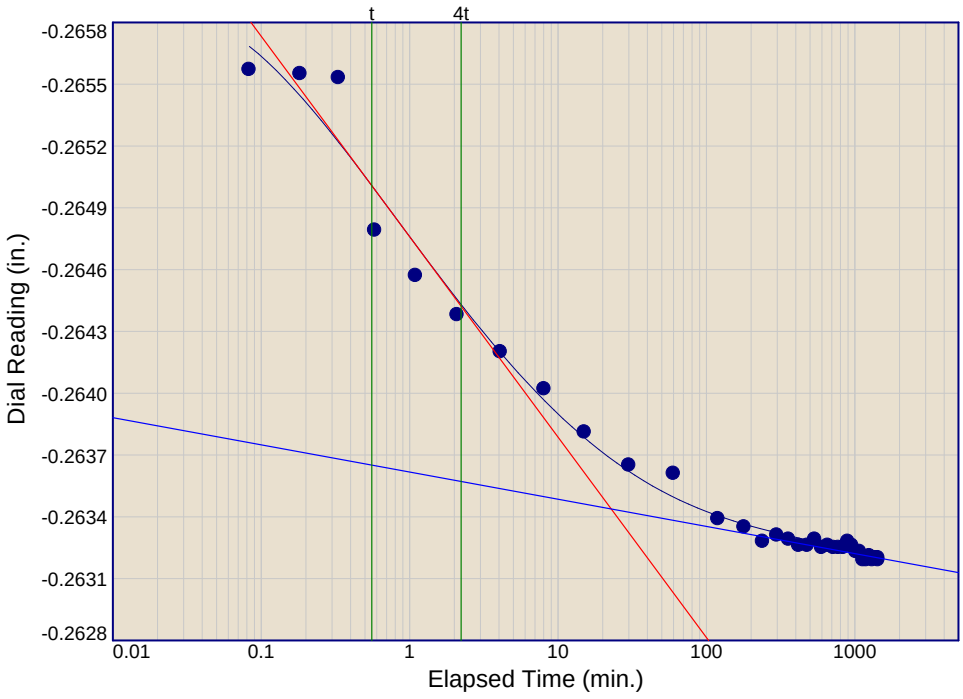
Source of Sample: PB-20-8A Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 1
Load= 250 psf
D_0 = -0.2717
D_{50} = -0.2687
D_{100} = -0.2657
T_{50} = 0.82 min.

C_v @ T_{50}
0.247 ft.^{2}/day

C_α = 0.001



Load No.= 2
Load= 500 psf
D_0 = -0.2656
D_{50} = -0.2645
D_{100} = -0.2634
T_{50} = 1.82 min.

C_v @ T_{50}
0.110 ft.^{2}/day

C_α = 0.000

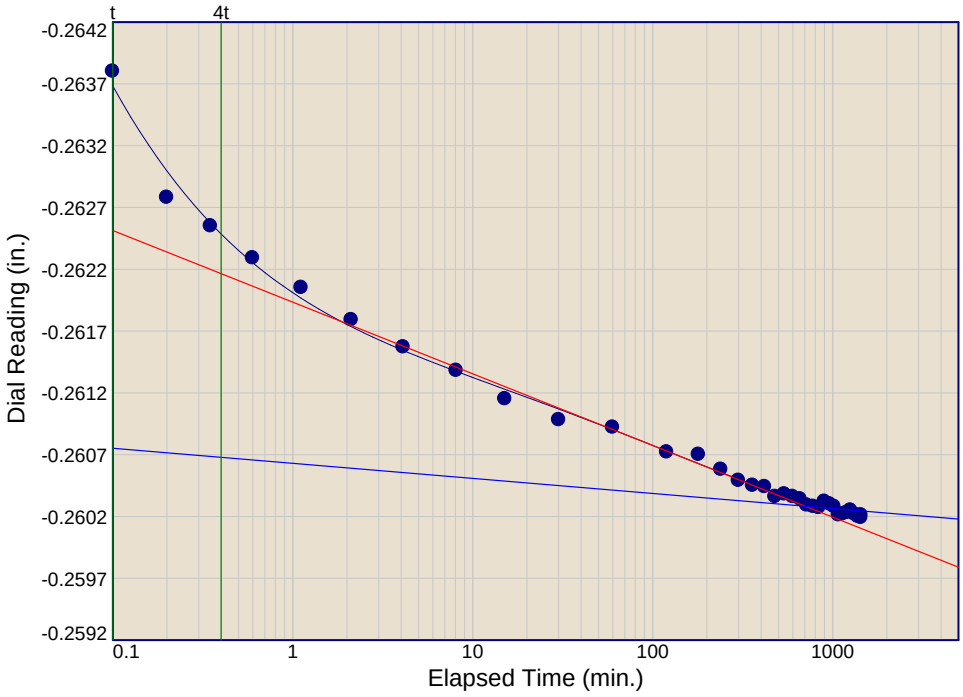
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

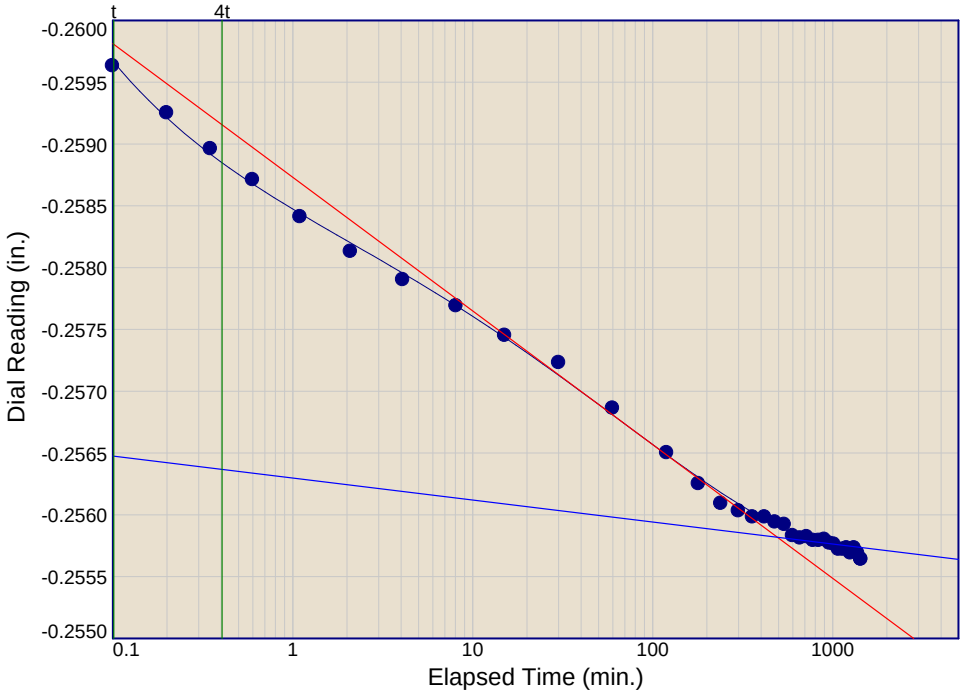
Source of Sample: PB-20-8A Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 3
Load= 1000 psf
D_0 = -0.2649
D_{50} = -0.2626
D_{100} = -0.2603
T_{50} = 0.35 min.

C_v @ T_{50}
0.577 ft.^{2}/day

C_α = 0.000



Load No.= 4
Load= 2000 psf
D_0 = -0.2605
D_{50} = -0.2581
D_{100} = -0.2558
T_{50} = 2.42 min.

C_v @ T_{50}
0.081 ft.^{2}/day

C_α = 0.001

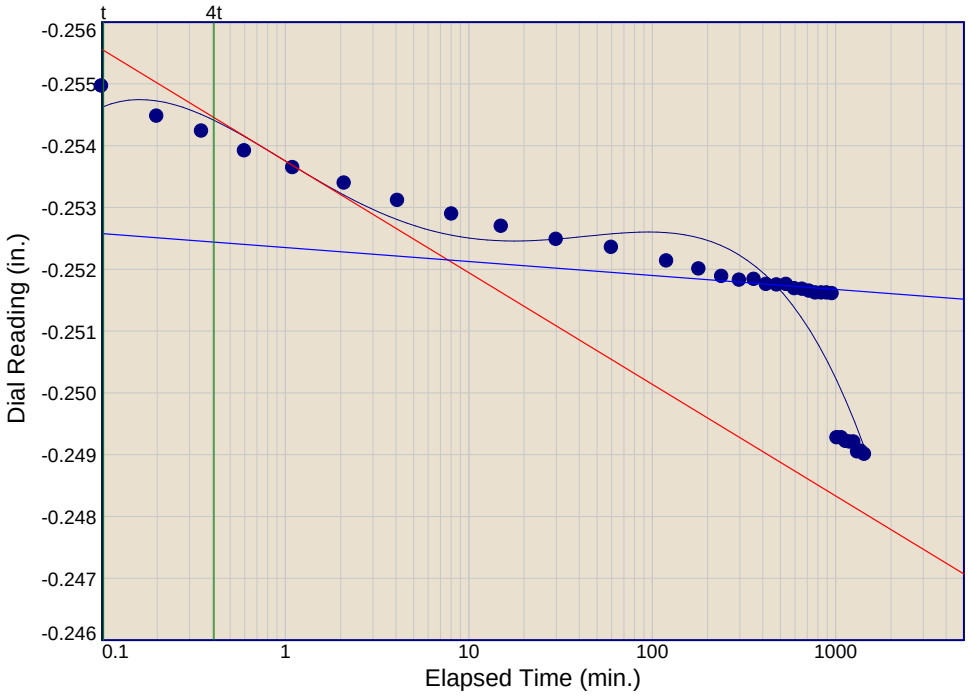
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

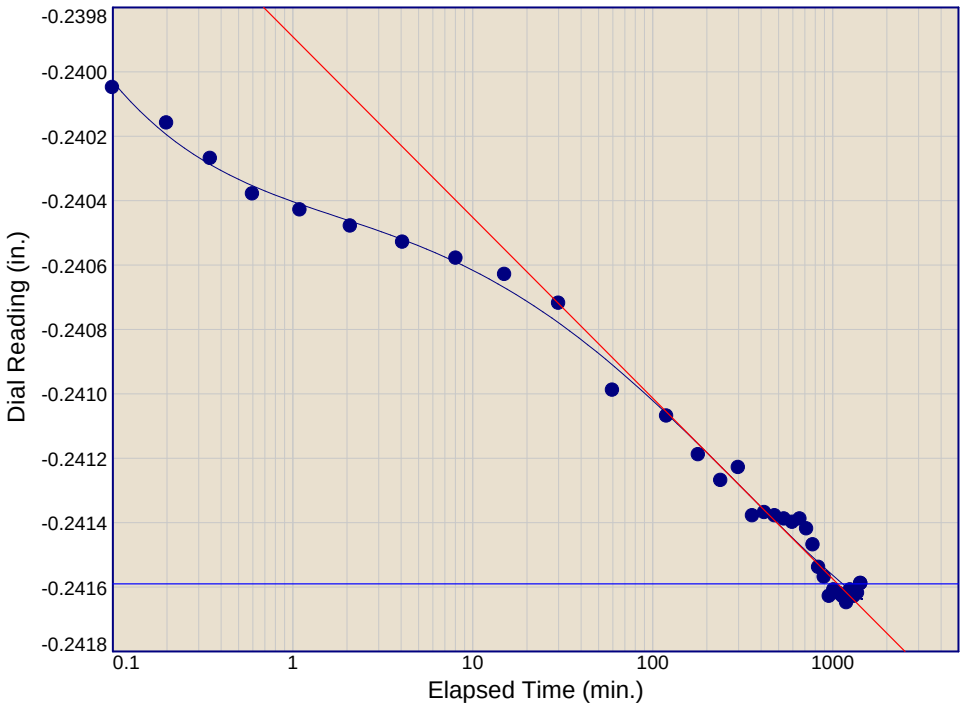
Source of Sample: PB-20-8A Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 5
Load= 4000 psf
D_0 = -0.2549
D_{50} = -0.2535
D_{100} = -0.2522
T_{50} = 1.38 min.

C_v @ T_{50}
0.141 ft.^{2}/day

C_α = 0.001



Load No.= 13
Load= 1000 psf
D_0 = -0.2388
D_{50} = -0.2402
D_{100} = -0.2416
T_{50} = 0.18 min.

C_v @ T_{50}
1.032 ft.^{2}/day

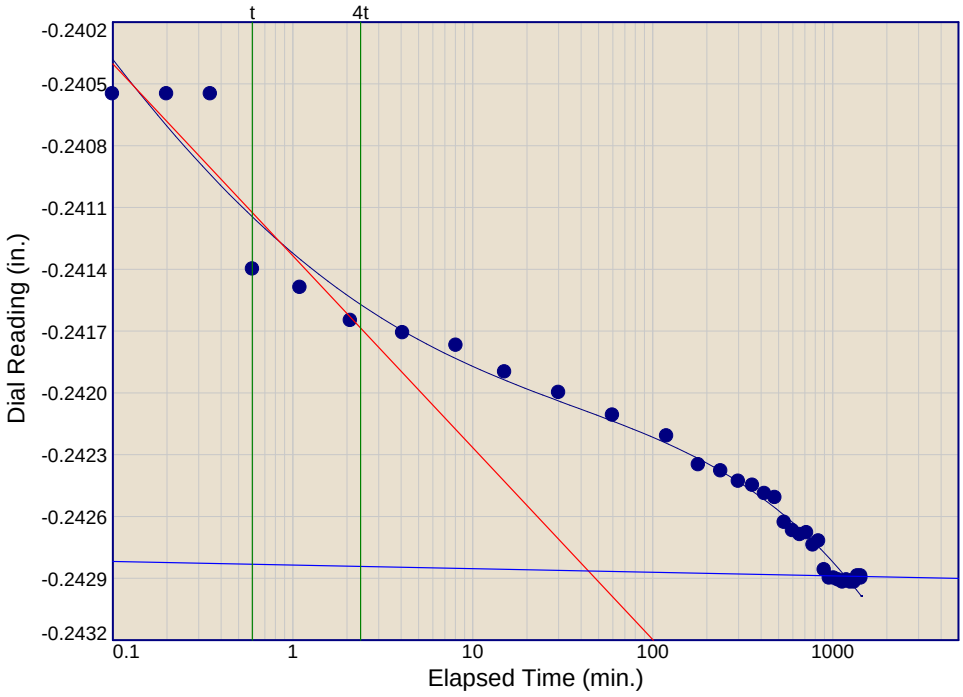
C_α = 0.000

Figure

Dial Reading vs. Time

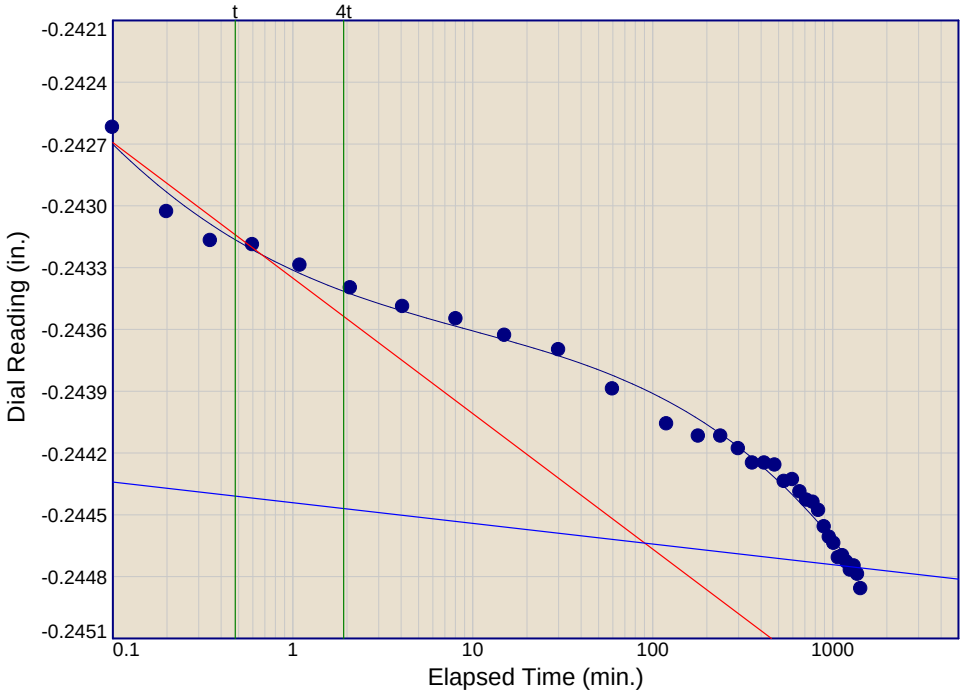
Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-8A Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 14
Load= 500 psf
D_0 = -0.2407
D_{50} = -0.2418
D_{100} = -0.2429
T_{50} = 6.43 min.

C_v @ T_{50}
0.029 $ft.^2/day$



Load No.= 15
Load= 250 psf
D_0 = -0.2429
D_{50} = -0.2438
D_{100} = -0.2446
T_{50} = 43.38 min.

C_v @ T_{50}
0.004 $ft.^2/day$

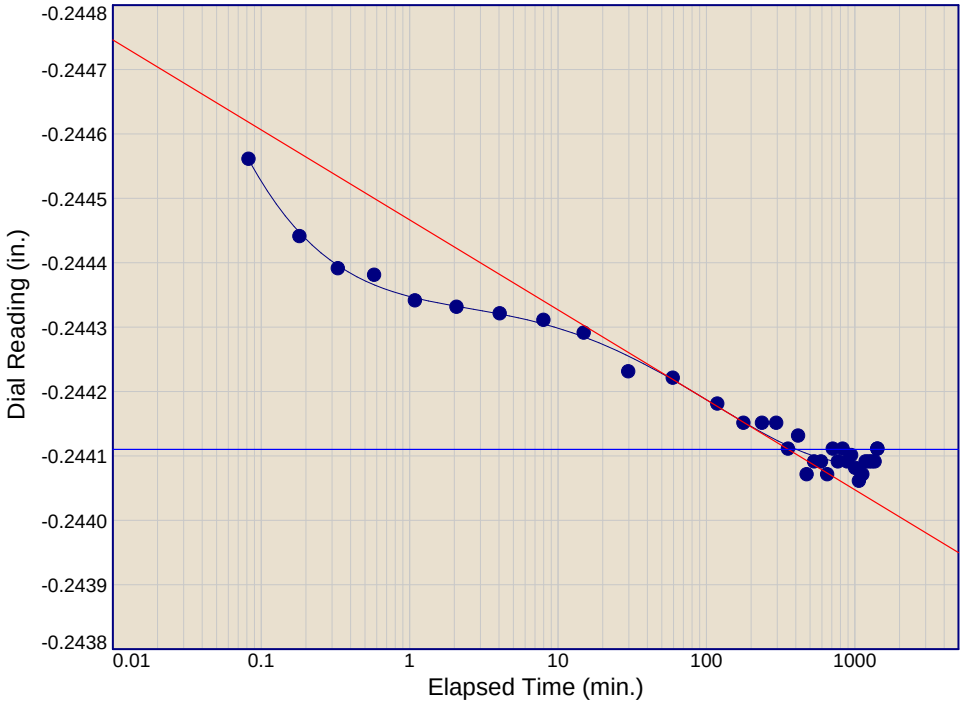
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

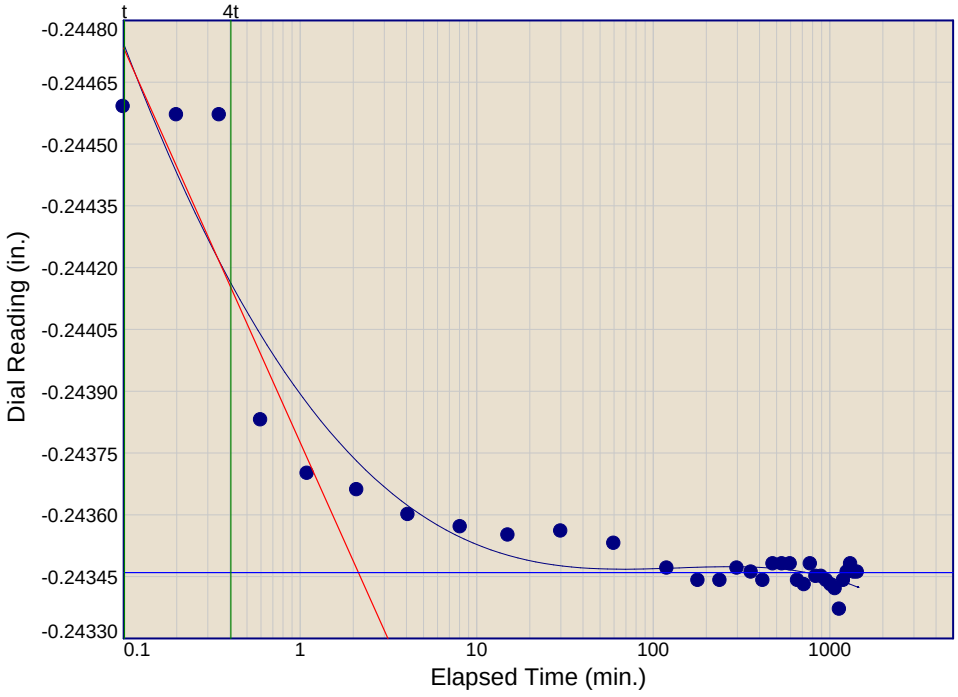
Source of Sample: PB-20-8A Depth: 60.0'-62.0' Sample Number: ST-1



Load No.= 16
Load= 500 psf
D_0 = -0.2447
D_{50} = -0.2444
D_{100} = -0.2441
T_{50} = 0.33 min.

C_v @ T_{50}
0.567 ft.^{2}/day

C_α = 0.000



Load No.= 17
Load= 1000 psf
D_0 = -0.2453
D_{50} = -0.2444
D_{100} = -0.2435
T_{50} = 0.22 min.

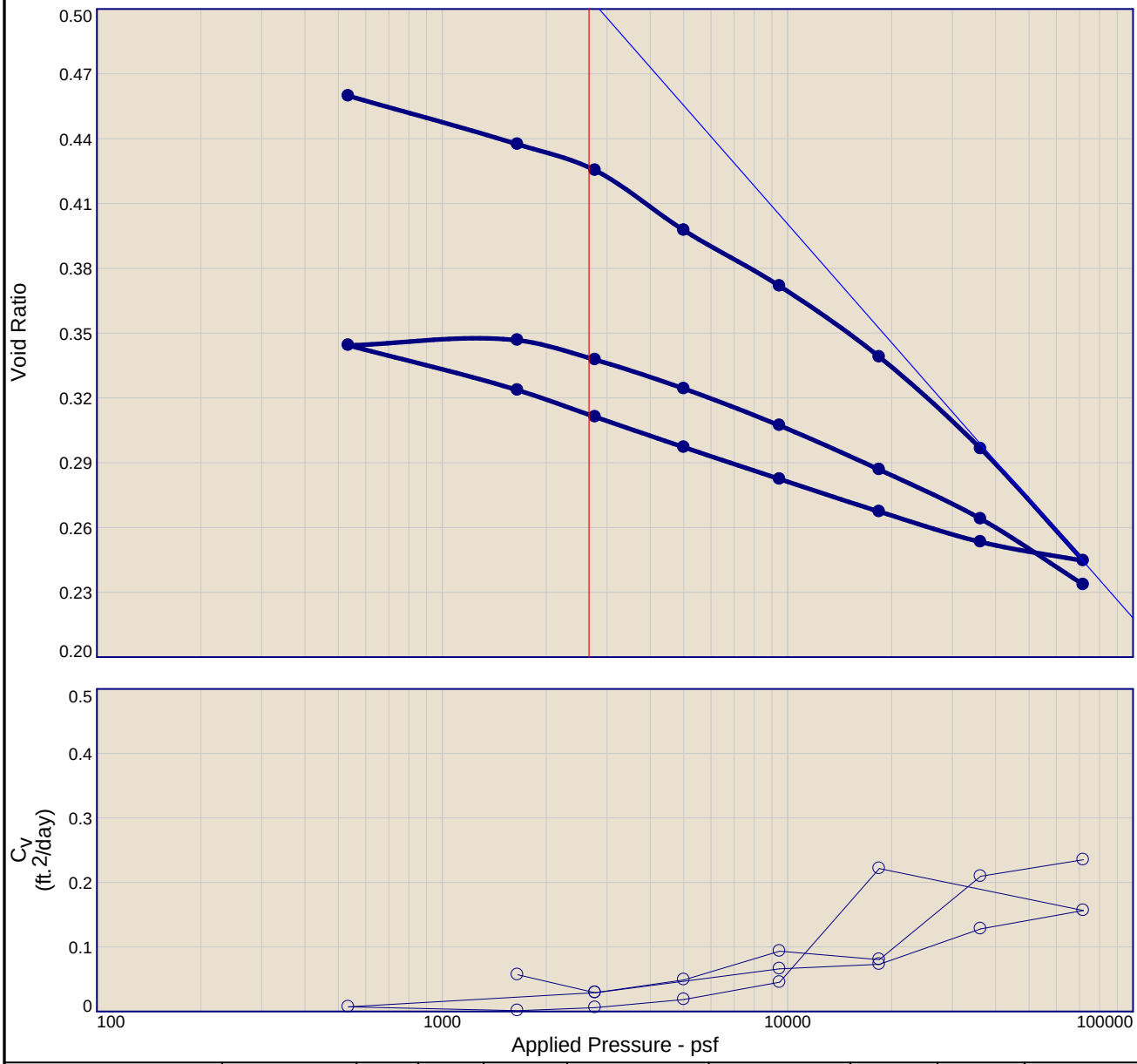
C_v @ T_{50}
0.845 ft.^{2}/day

C_α = 0.000

Figure

DLZ, INC.

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
100.0 %	17.1 %	116.9	32	15	2.75	4300	9308	0.18	0.06	0.469

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 2121- **Client:** CTI & Associates, Inc.

Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-9B **Depth:** 50.0'-52.5' **Sample Number:** ST-2

Remarks:

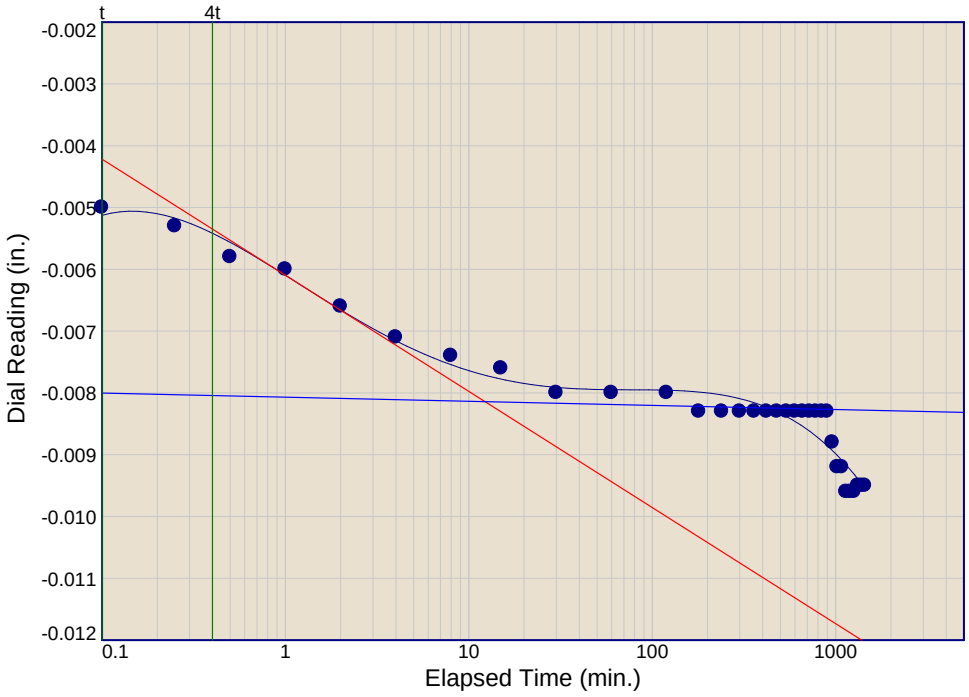
DLZ

Figure

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

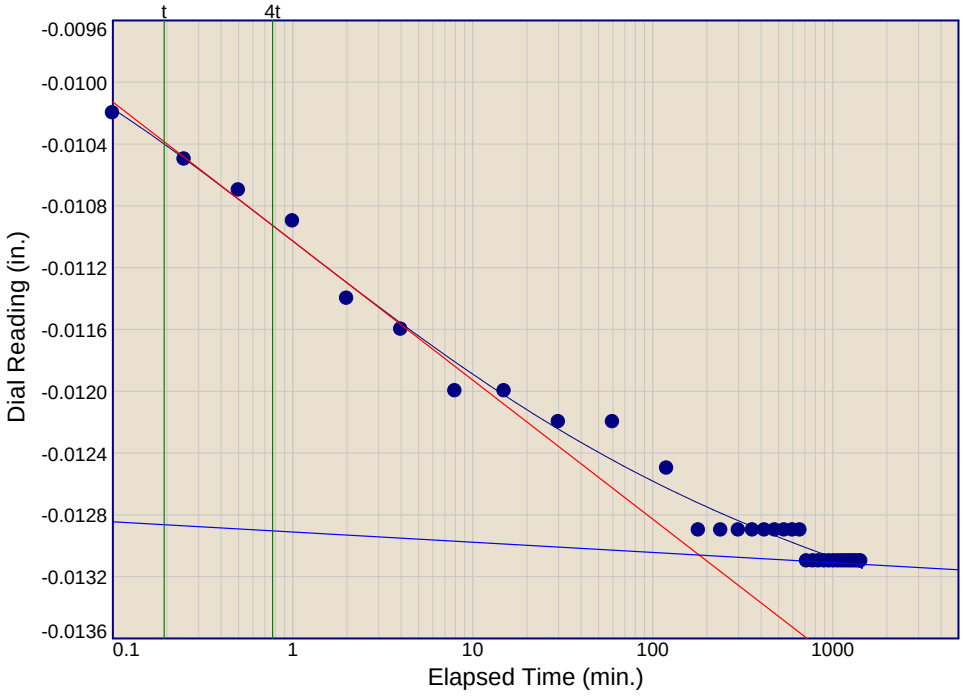
Source of Sample: PB-20-9B Depth: 50.0'-52.5' Sample Number: ST-2



Load No.= 2
Load= 1654 psf
D_0 = -0.0048
D_{50} = -0.0065
D_{100} = -0.0081
T_{50} = 1.62 min.

C_v @ T_{50}
0.057 ft.^{2}/day

C_α = 0.000



Load No.= 3
Load= 2774 psf
D_0 = -0.0099
D_{50} = -0.0115
D_{100} = -0.0131
T_{50} = 3.11 min.

C_v @ T_{50}
0.029 ft.^{2}/day

C_α = 0.000

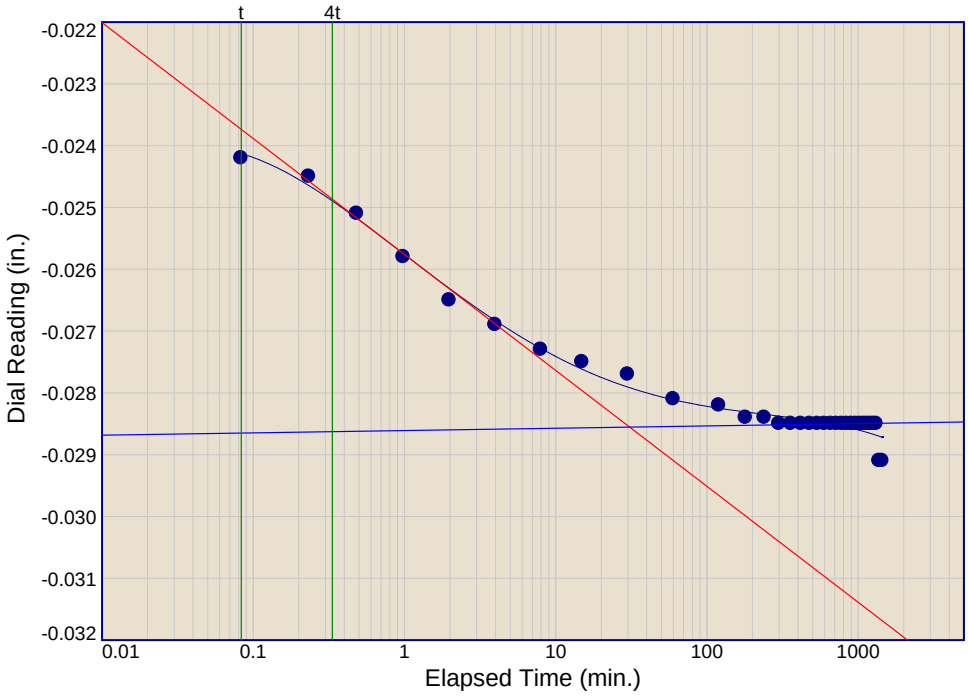
Figure

DLZ, INC.

Dial Reading vs. Time

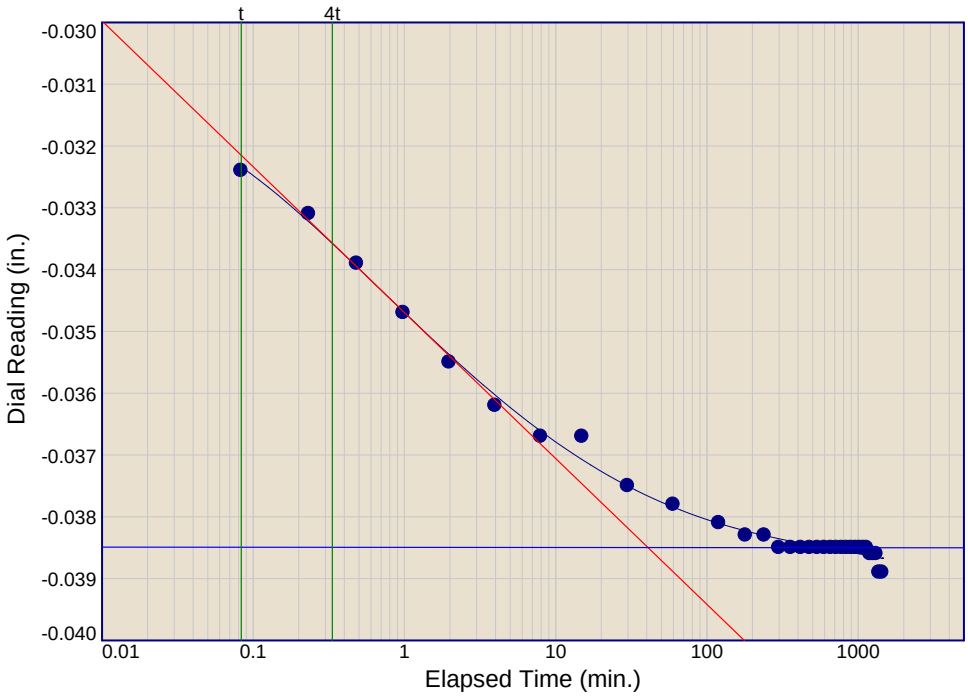
Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-9B Depth: 50.0'-52.5' Sample Number: ST-2



Load No.= 5
Load= 9481 psf
D_0 = -0.0234
D_{50} = -0.0260
D_{100} = -0.0286
T_{50} = 1.28 min.

C_v @ T_{50}
0.066 ft.^{2}/day



Load No.= 6
Load= 18432 psf
D_0 = -0.0311
D_{50} = -0.0348
D_{100} = -0.0385
T_{50} = 1.11 min.

C_v @ T_{50}
0.073 ft.^{2}/day

C_α = 0.000

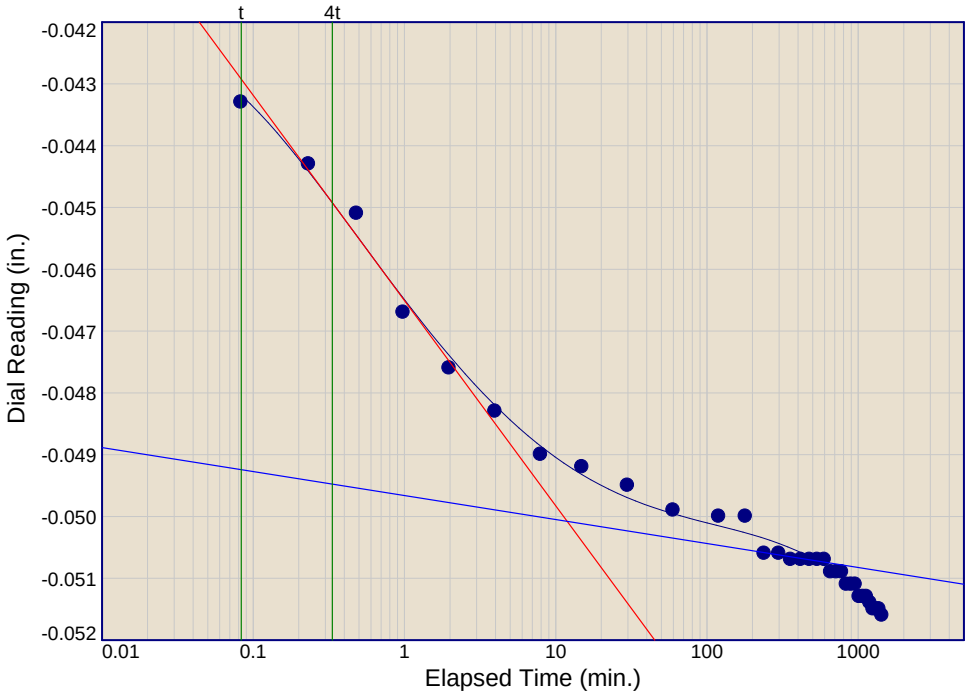
DLZ, INC.

Figure

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

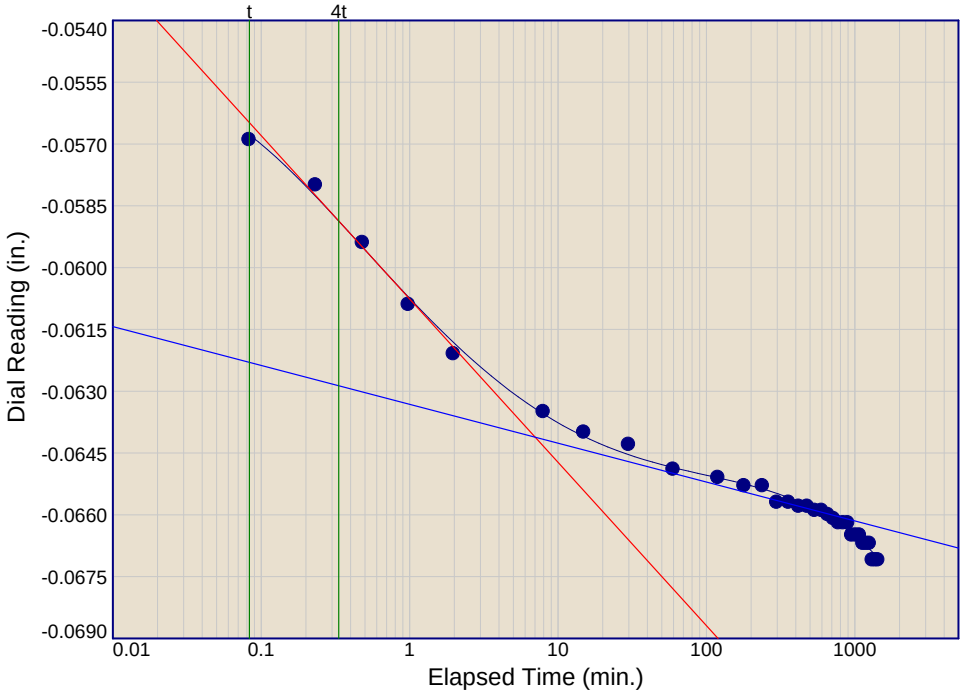
Source of Sample: PB-20-9B Depth: 50.0'-52.5' Sample Number: ST-2



Load No.= 7
Load= 36233 psf
D_0 = -0.0414
D_{50} = -0.0458
D_{100} = -0.0501
T_{50} = 0.60 min.

C_v @ T_{50}
0.128 ft.^{2}/day

C_α = 0.001



Load No.= 8
Load= 71839 psf
D_0 = -0.0547
D_{50} = -0.0594
D_{100} = -0.0641
T_{50} = 0.45 min.

C_v @ T_{50}
0.157 ft.^{2}/day

C_α = 0.003

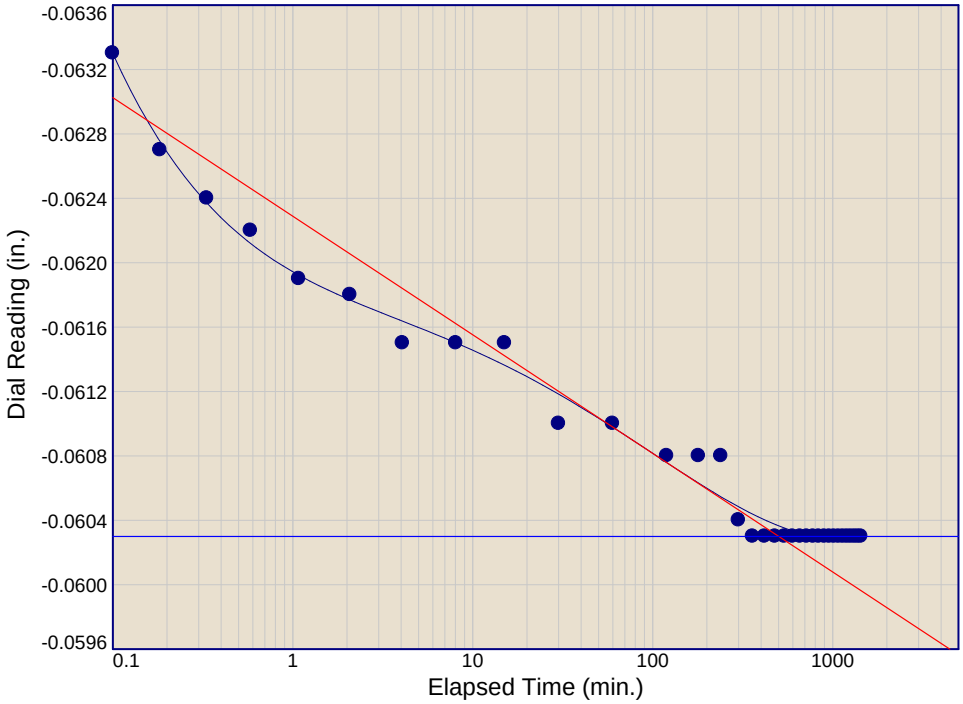
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

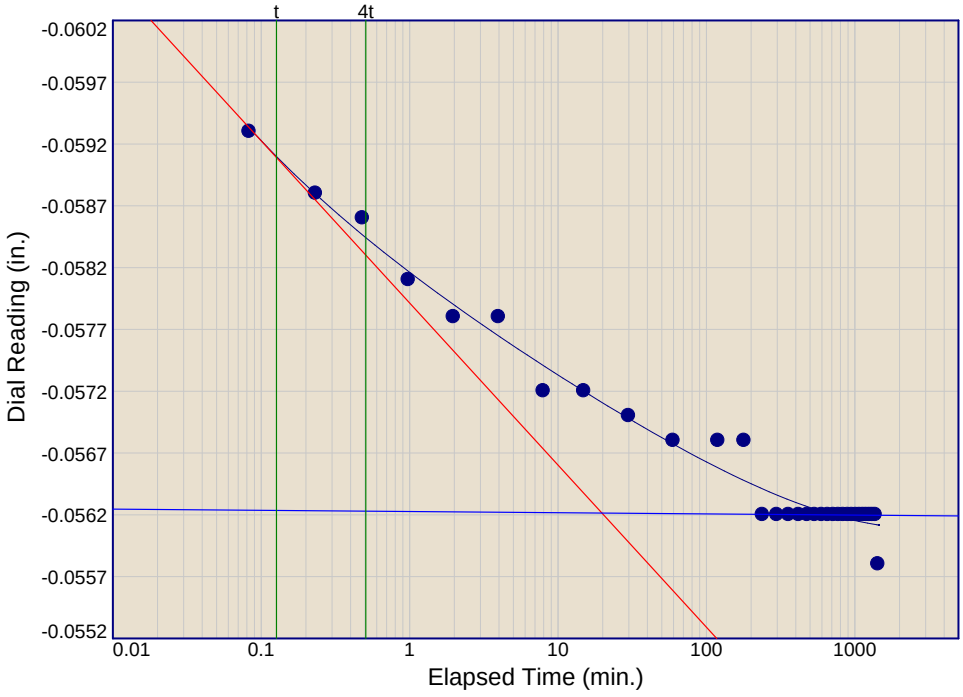
Source of Sample: PB-20-9B Depth: 50.0'-52.5' Sample Number: ST-2



Load No.= 10
Load= 18432 psf
D_0 = -0.0645
D_{50} = -0.0624
D_{100} = -0.0603
T_{50} = 0.32 min.

C_v @ T_{50}
0.221 ft.^{2}/day

C_α = 0.000



Load No.= 11
Load= 9481 psf
D_0 = -0.0598
D_{50} = -0.0580
D_{100} = -0.0562
T_{50} = 1.58 min.

C_v @ T_{50}
0.045 ft.^{2}/day

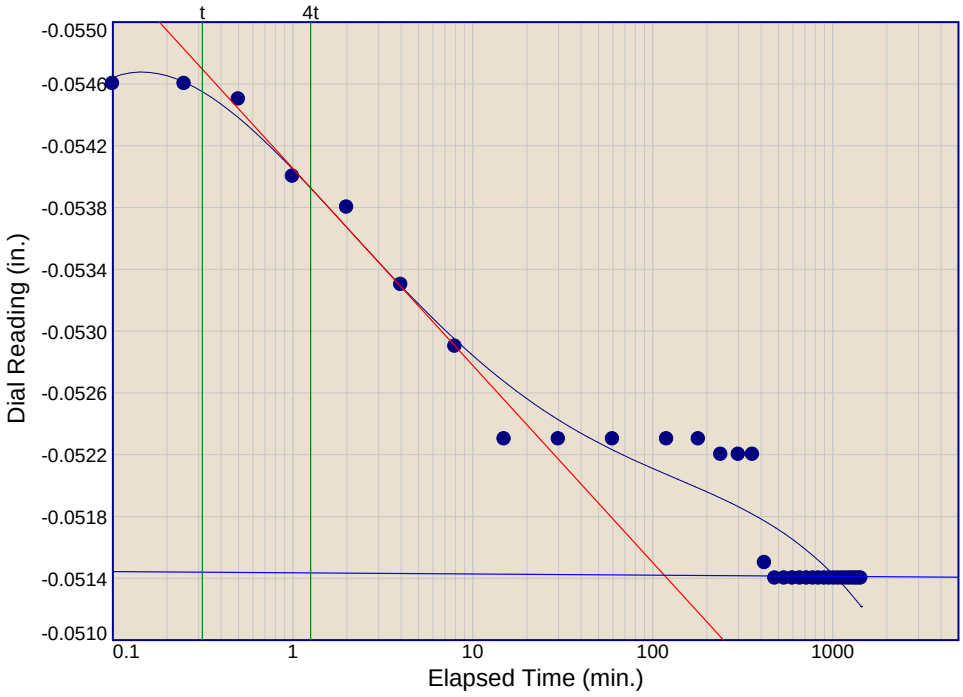
Figure

DLZ, INC.

Dial Reading vs. Time

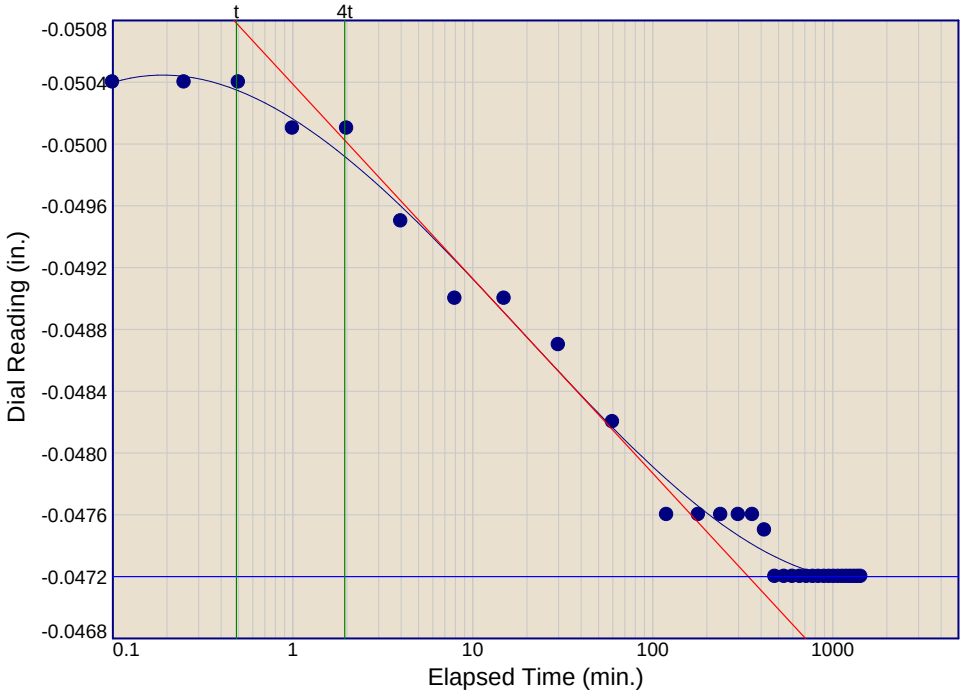
Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-9B Depth: 50.0'-52.5' Sample Number: ST-2



Load No.= 12
Load= 5012 psf
D_0 = -0.0552
D_{50} = -0.0533
D_{100} = -0.0514
T_{50} = 3.96 min.

C_v @ T_{50}
0.018 ft.^{2}/day



Load No.= 13
Load= 2774 psf
D_0 = -0.0508
D_{50} = -0.0490
D_{100} = -0.0472
T_{50} = 12.86 min.

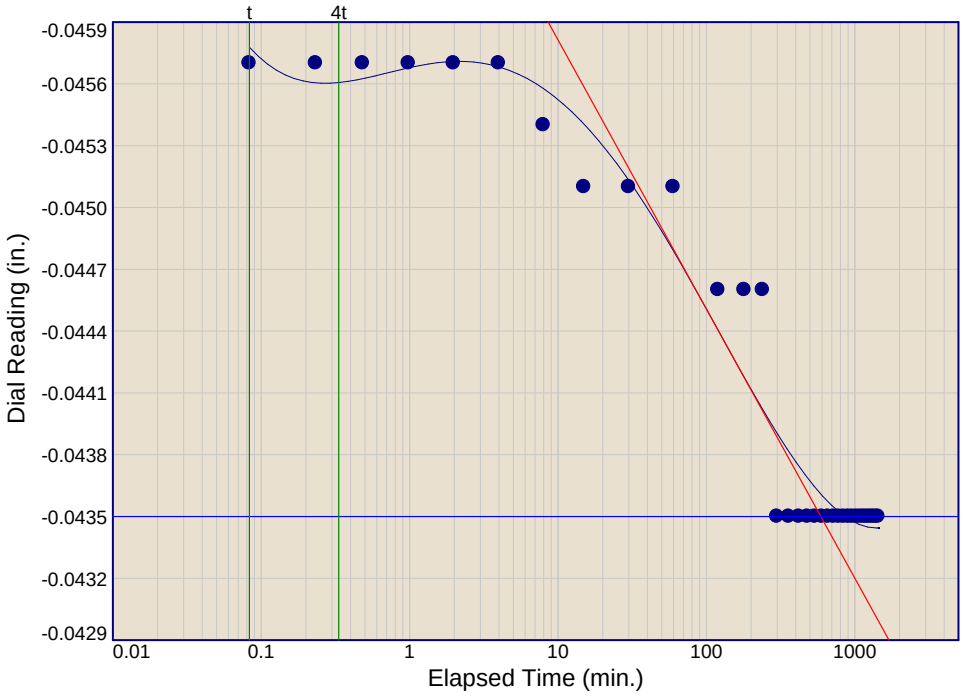
C_v @ T_{50}
0.006 ft.^{2}/day

C_α = 0.000

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

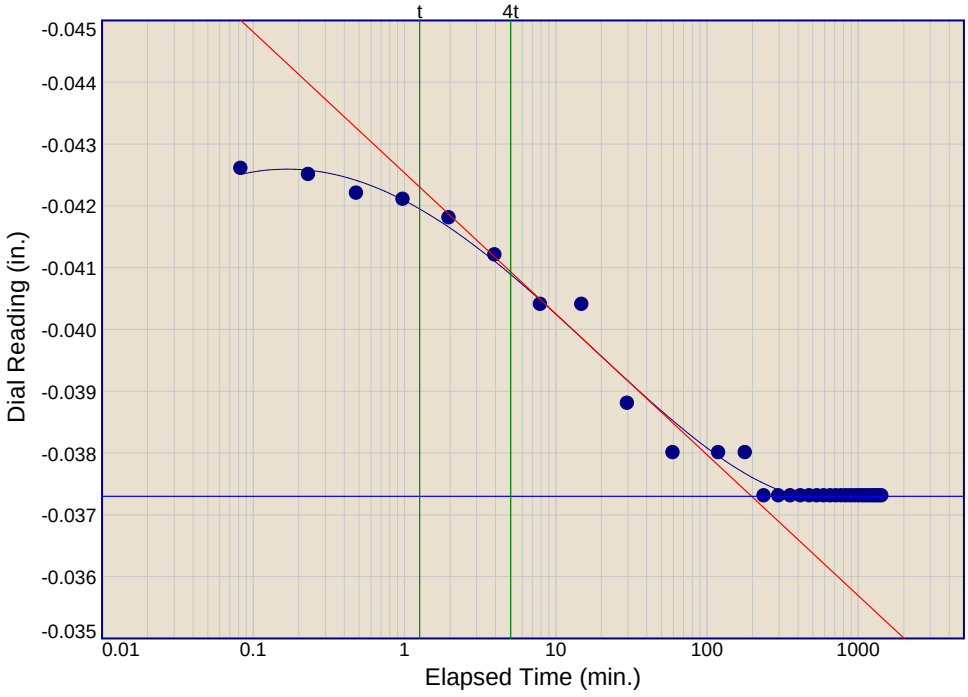
Source of Sample: PB-20-9B Depth: 50.0'-52.5' Sample Number: ST-2



Load No.= 14
Load= 1654 psf
D_0 = -0.0459
D_{50} = -0.0447
D_{100} = -0.0435
T_{50} = 67.62 min.

C_v @ T_{50}
0.001 ft.^{2}/day

C_α = 0.000



Load No.= 15
Load= 535 psf
D_0 = -0.0430
D_{50} = -0.0402
D_{100} = -0.0373
T_{50} = 11.02 min.

C_v @ T_{50}
0.007 ft.^{2}/day

C_α = 0.000

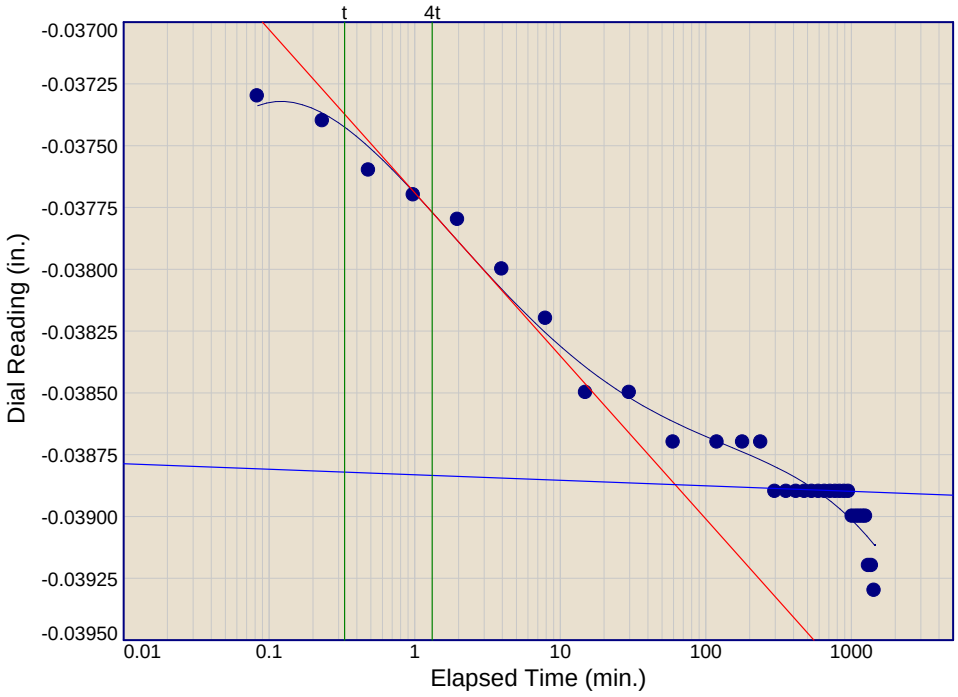
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

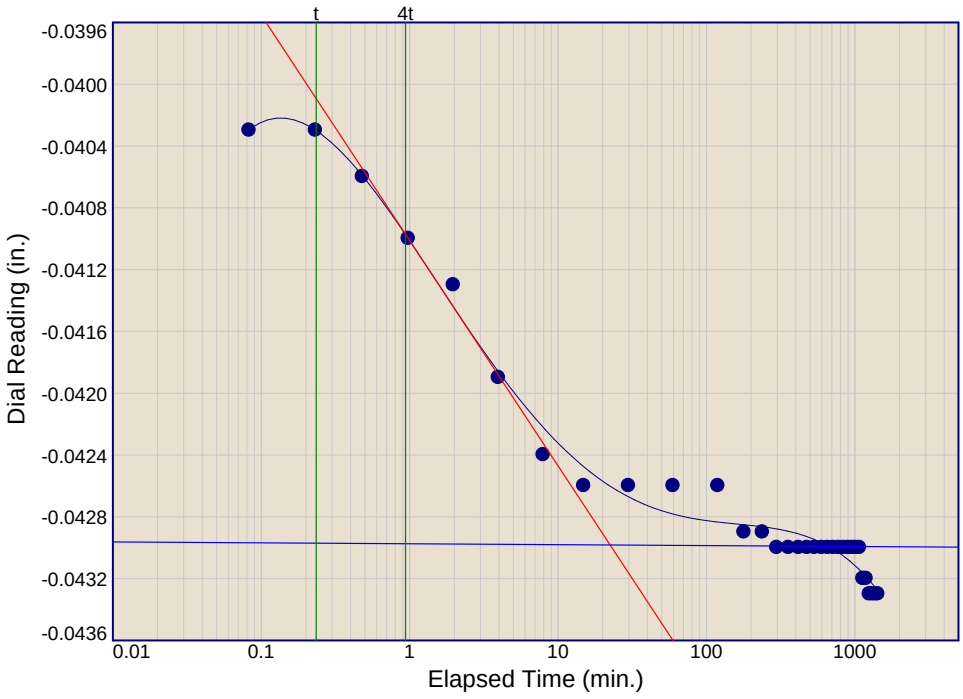
Source of Sample: PB-20-9B Depth: 50.0'-52.5' Sample Number: ST-2



Load No.= 17
Load= 2774 psf
D_0 = -0.0371
D_{50} = -0.0380
D_{100} = -0.0389
T_{50} = 2.71 min.

C_v @ T_{50}
0.029 ft.^{2}/day

C_α = 0.000



Load No.= 18
Load= 5012 psf
D_0 = -0.0396
D_{50} = -0.0413
D_{100} = -0.0430
T_{50} = 1.59 min.

C_v @ T_{50}
0.049 ft.^{2}/day

C_α = 0.000

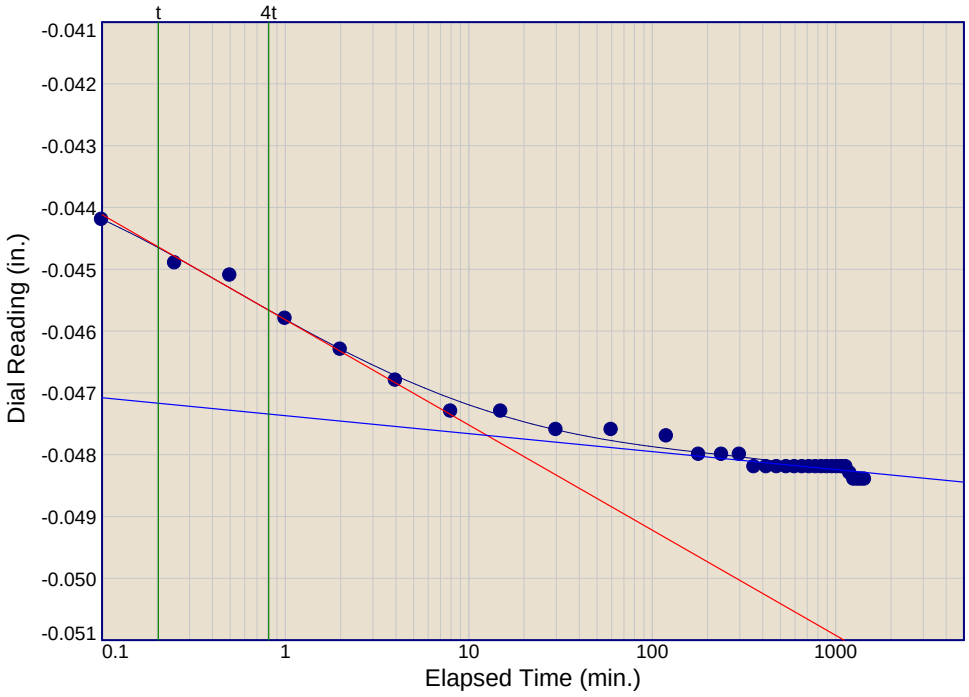
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

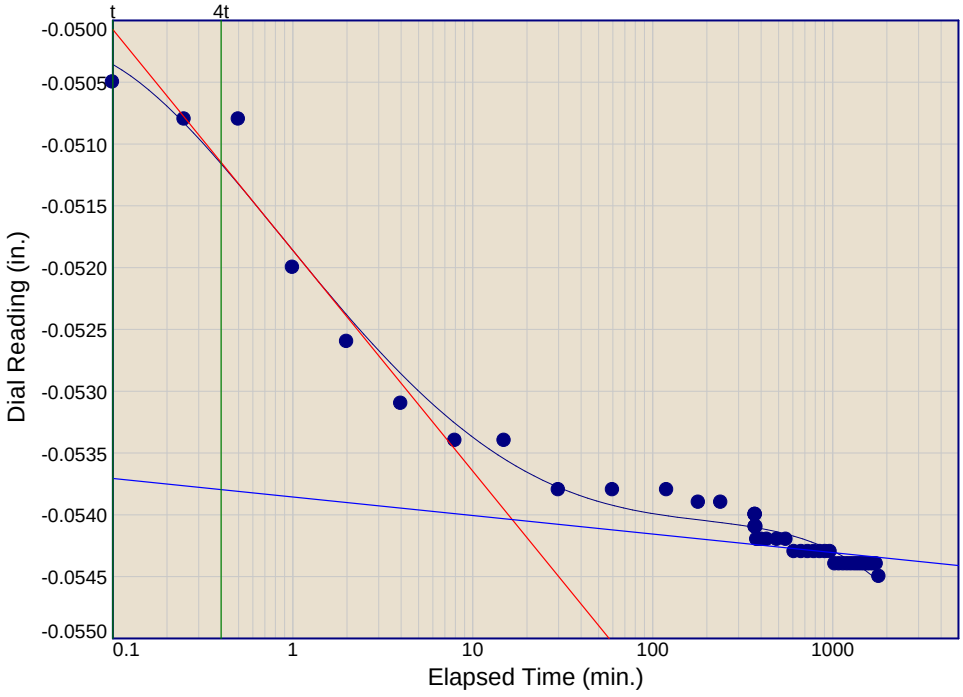
Source of Sample: PB-20-9B Depth: 50.0'-52.5' Sample Number: ST-2



Load No.= 19
Load= 9481 psf
D_0 = -0.0436
D_{50} = -0.0457
D_{100} = -0.0477
T_{50} = 0.81 min.

C_v @ T_{50}
0.093 $ft.^2/day$

C_α = 0.001



Load No.= 20
Load= 18432 psf
D_0 = -0.0496
D_{50} = -0.0518
D_{100} = -0.0540
T_{50} = 0.92 min.

C_v @ T_{50}
0.080 $ft.^2/day$

C_α = 0.001

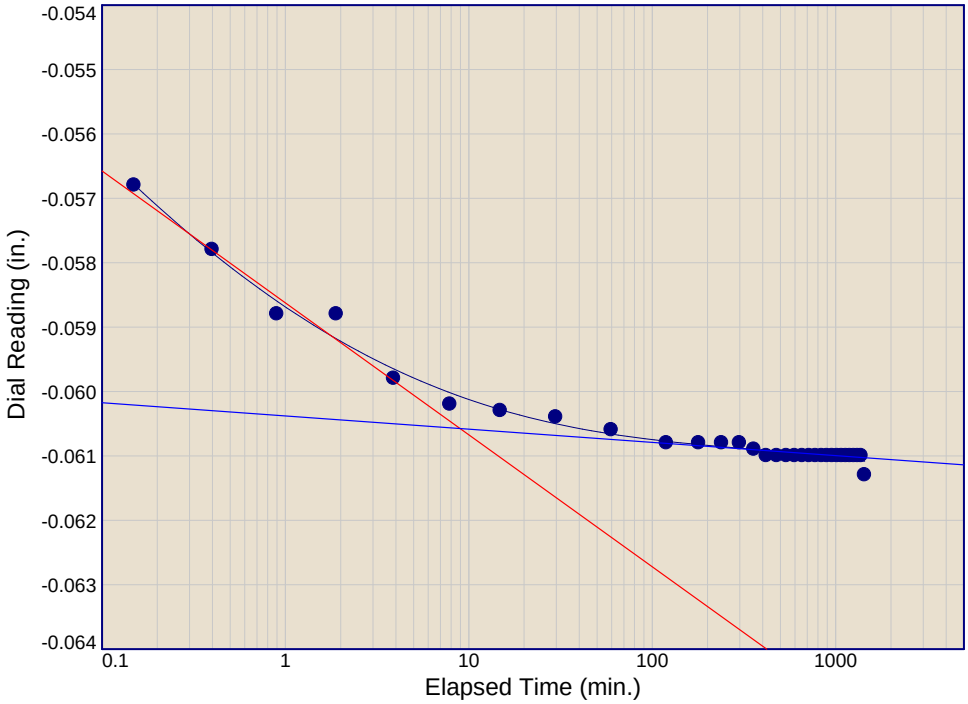
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

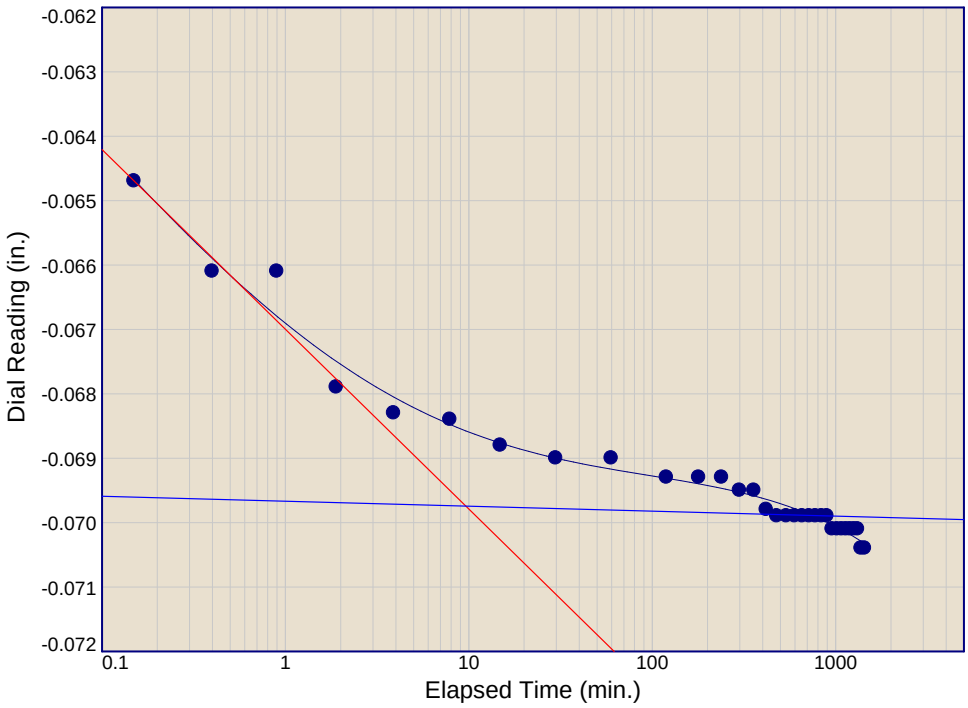
Source of Sample: PB-20-9B Depth: 50.0'-52.5' Sample Number: ST-2



Load No.= 21
Load= 36233 psf
D_0 = -0.0548
D_{50} = -0.0577
D_{100} = -0.0606
T_{50} = 0.34 min.

C_v @ T_{50}
0.210 ft.^{2}/day

C_α = 0.001



Load No.= 22
Load= 71839 psf
D_0 = -0.0613
D_{50} = -0.0655
D_{100} = -0.0697
T_{50} = 0.29 min.

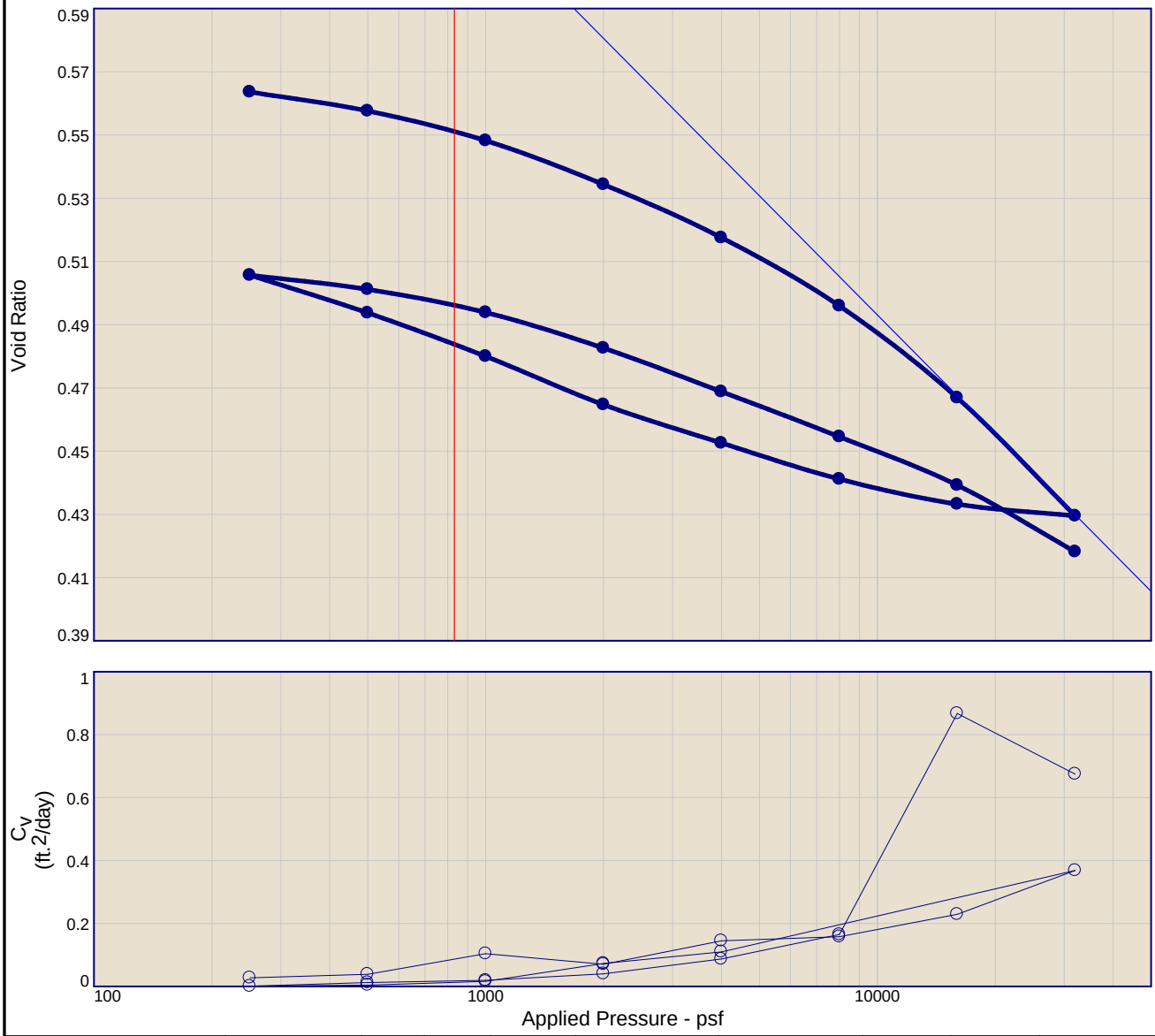
C_v @ T_{50}
0.235 ft.^{2}/day

C_α = 0.000

Figure

DLZ, INC.

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
106.4 %	21.8 %	110.6	22	6	2.785	2100	4315	0.13	0.05	0.572

MATERIAL DESCRIPTION	USCS	AASHTO

Project No. 2121- **Client:** CTI & Associates, Inc.

Project: CTI - WDI Lower Clay Investigation

Source: PB-20-10 **Depth:** 20-22 & 23.5-25.5 **Sample No.:** ST-1 & ST-2

DLZ

Remarks:

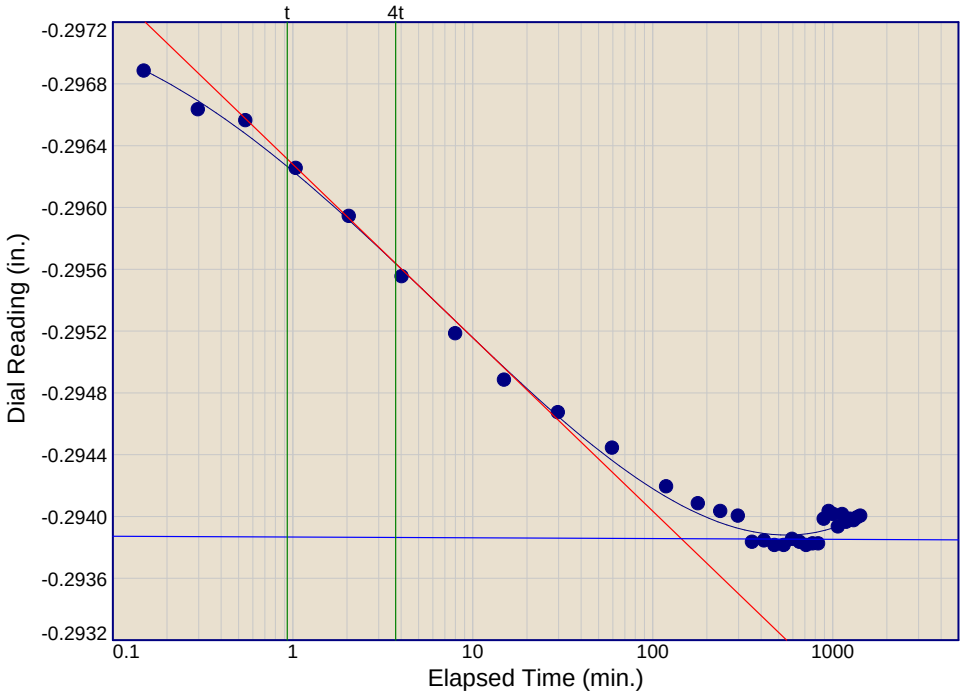
Figure

Tested By: Brian Witt **Checked By:** Steve Robinson

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

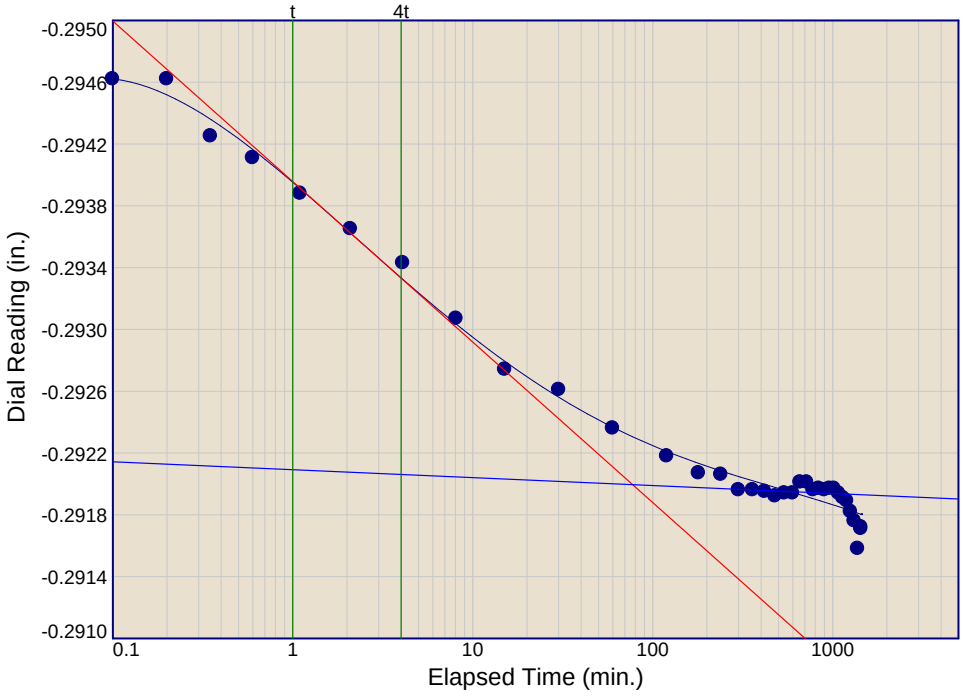
Source of Sample: PB-20-10 Depth: 20-22 & 23.5-25.5 Sample Number: ST-1 & ST-2



Load No.= 1
Load= 250 psf
D_0 = -0.2969
D_{50} = -0.2954
D_{100} = -0.2939
T_{50} = 6.40 min.

C_v @ T_{50}
0.027 ft.^{2}/day

C_α = 0.000



Load No.= 2
Load= 500 psf
D_0 = -0.2946
D_{50} = -0.2933
D_{100} = -0.2920
T_{50} = 4.49 min.

C_v @ T_{50}
0.039 ft.^{2}/day

C_α = 0.000

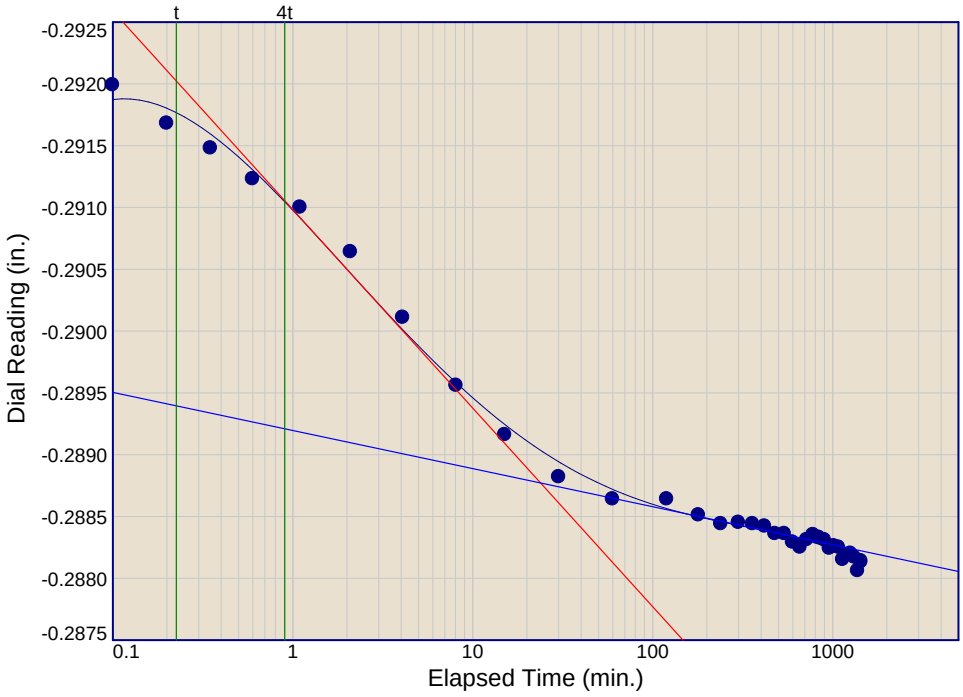
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

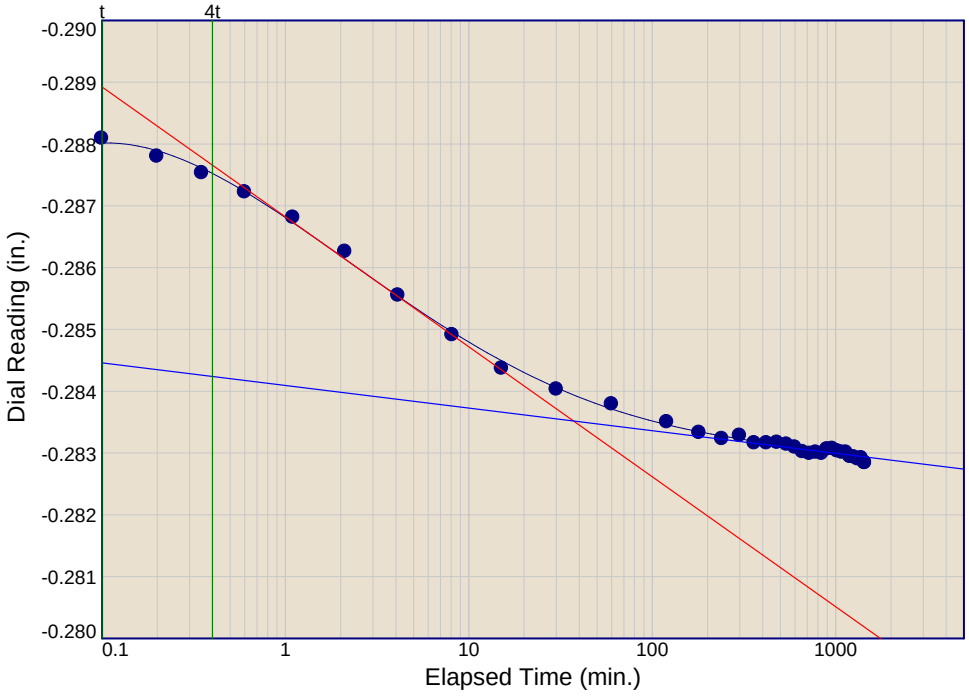
Source of Sample: PB-20-10 Depth: 20-22 & 23.5-25.5 Sample Number: ST-1 & ST-2



Load No.= 3
Load= 1000 psf
D_0 = -0.2925
D_{50} = -0.2906
D_{100} = -0.2888
T_{50} = 1.66 min.

C_v @ T_{50}
0.104 $ft.^2/day$

C_α = 0.001



Load No.= 4
Load= 2000 psf
D_0 = -0.2885
D_{50} = -0.2860
D_{100} = -0.2835
T_{50} = 2.42 min.

C_v @ T_{50}
0.070 $ft.^2/day$

C_α = 0.001

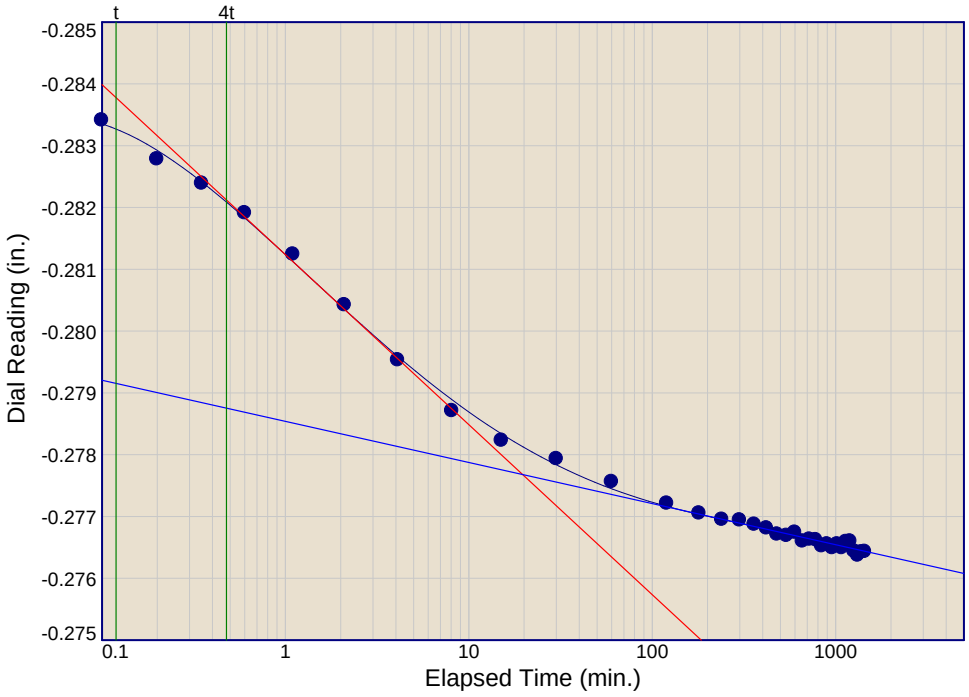
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

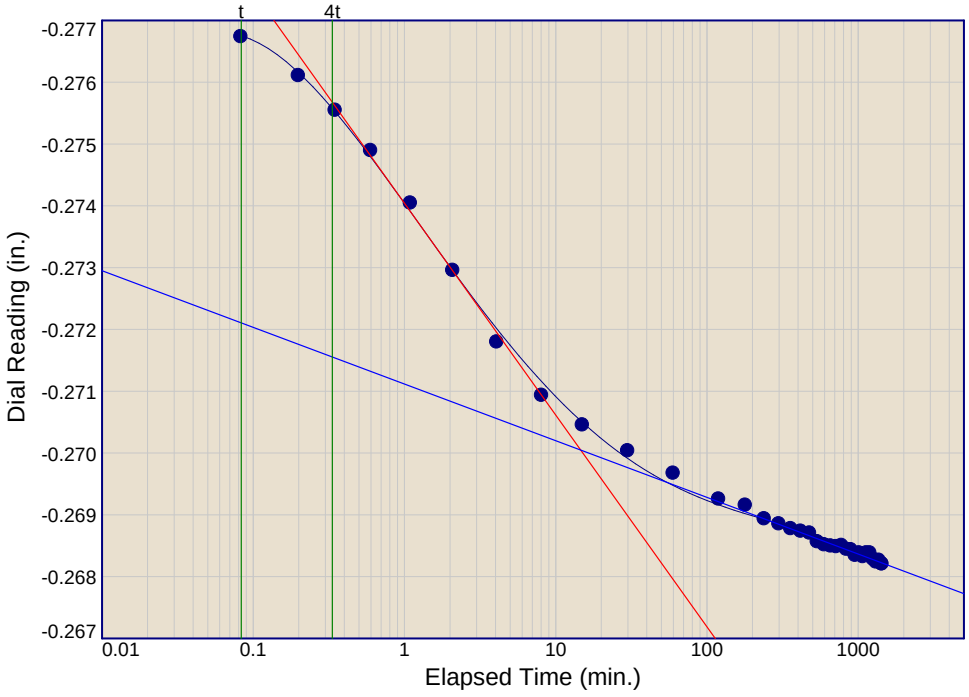
Source of Sample: PB-20-10 Depth: 20-22 & 23.5-25.5 Sample Number: ST-1 & ST-2



Load No.= 5
Load= 4000 psf
D_0 = -0.2845
D_{50} = -0.2811
D_{100} = -0.2777
T_{50} = 1.15 min.

C_v @ T_{50}
0.145 ft.^{2}/day

C_α = 0.002



Load No.= 6
Load= 8000 psf
D_0 = -0.2779
D_{50} = -0.2740
D_{100} = -0.2700
T_{50} = 1.04 min.

C_v @ T_{50}
0.158 ft.^{2}/day

C_α = 0.002

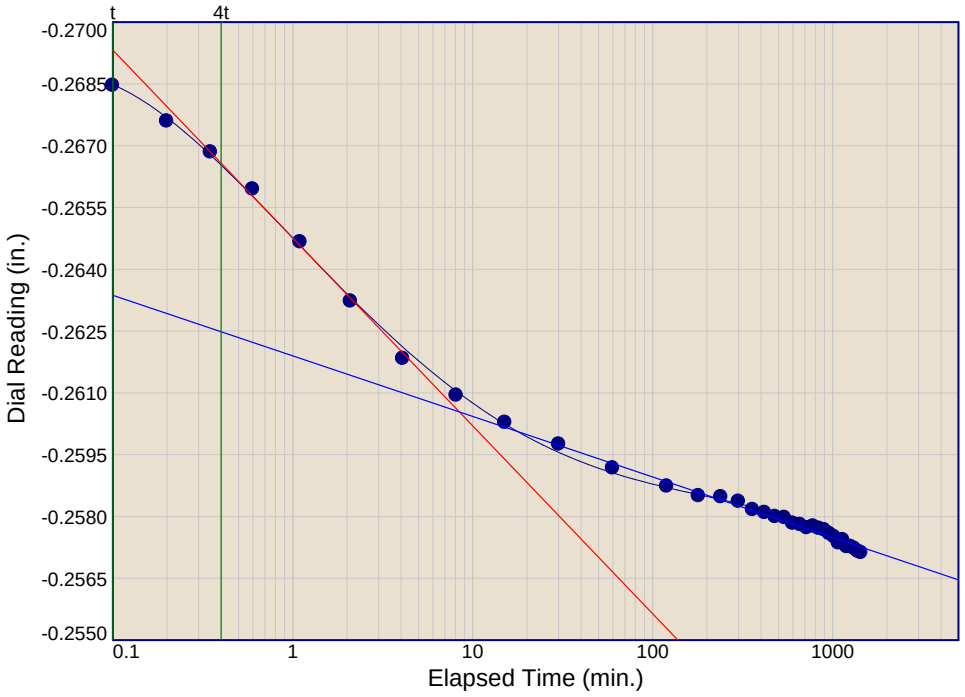
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

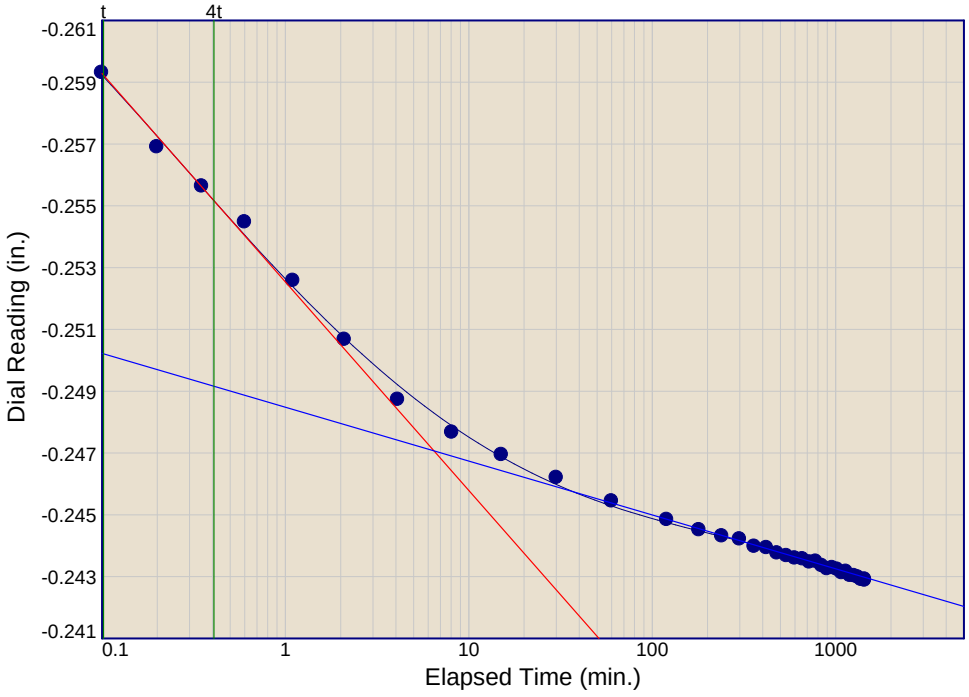
Source of Sample: PB-20-10 Depth: 20-22 & 23.5-25.5 Sample Number: ST-1 & ST-2



Load No.= 7
Load= 16000 psf
D_0 = -0.2704
D_{50} = -0.2655
D_{100} = -0.2605
T_{50} = 0.69 min.

C_v @ T_{50}
0.229 ft.^{2}/day

C_α = 0.004



Load No.= 8
Load= 32000 psf
D_0 = -0.2632
D_{50} = -0.2551
D_{100} = -0.2471
T_{50} = 0.41 min.

C_v @ T_{50}
0.369 ft.^{2}/day

C_α = 0.005

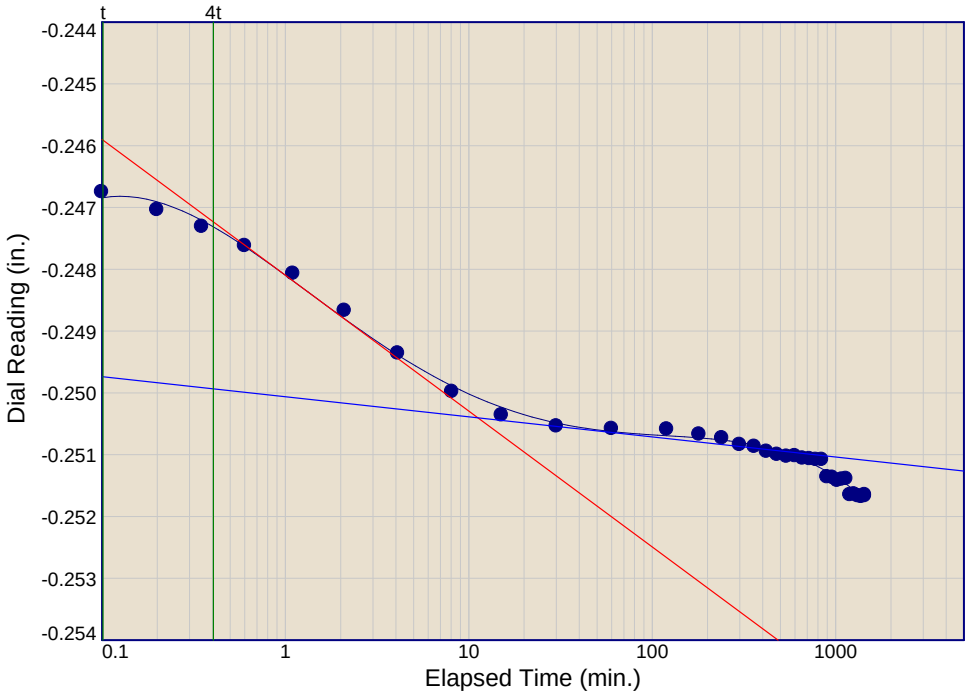
Figure

DLZ, INC.

Dial Reading vs. Time

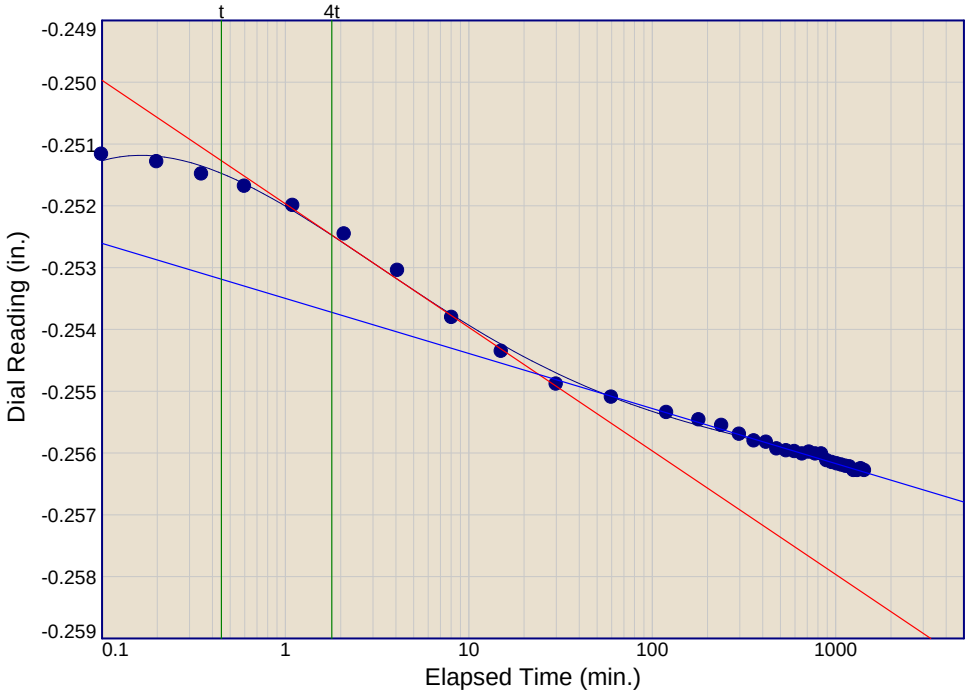
Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-10 Depth: 20-22 & 23.5-25.5 Sample Number: ST-1 & ST-2



Load No.= 11
Load= 4000 psf
D_0 = -0.2464
D_{50} = -0.2484
D_{100} = -0.2504
T_{50} = 1.36 min.

C_v @ T_{50}
0.110 ft.^{2}/day



Load No.= 12
Load= 2000 psf
D_0 = -0.2505
D_{50} = -0.2526
D_{100} = -0.2547
T_{50} = 2.07 min.

C_v @ T_{50}
0.073 ft.^{2}/day

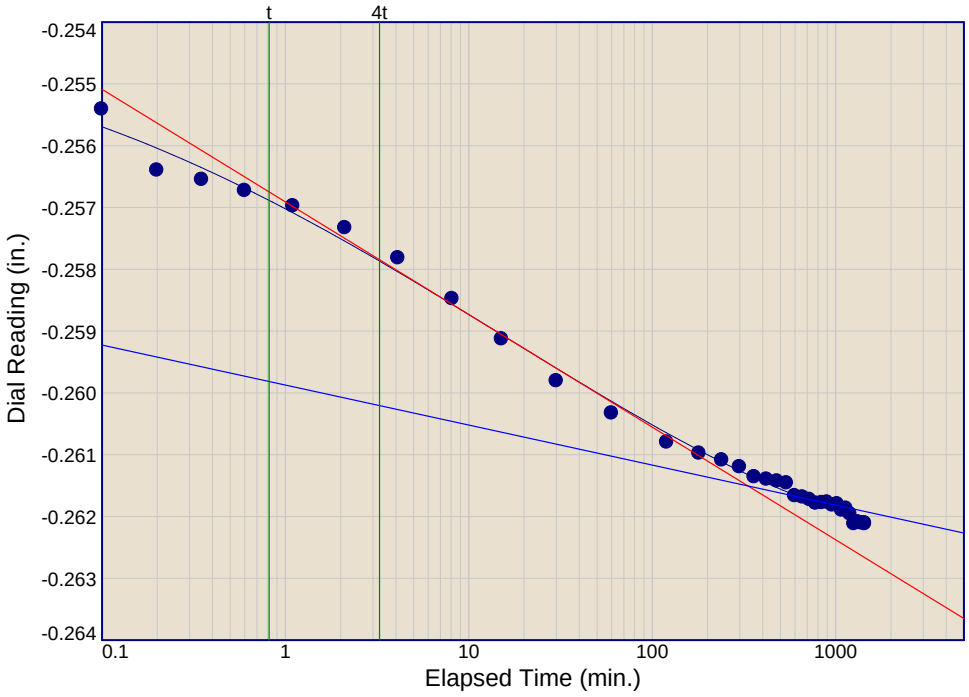
Figure

DLZ, INC.

Dial Reading vs. Time

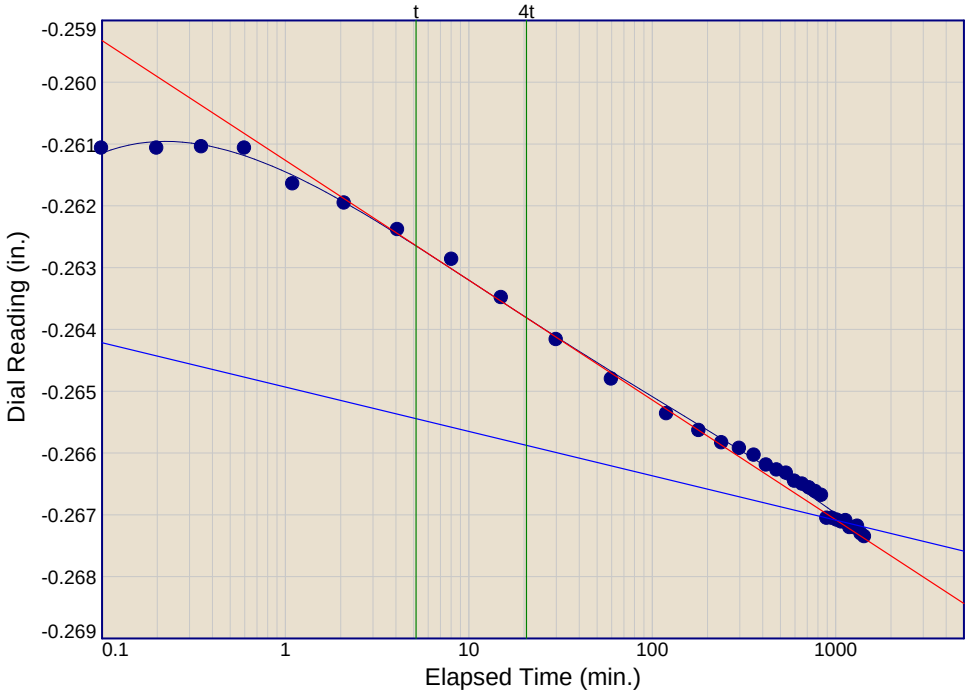
Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

Source of Sample: PB-20-10 Depth: 20-22 & 23.5-25.5 Sample Number: ST-1 & ST-2



Load No.= 13
Load= 1000 psf
D_0 = -0.2559
D_{50} = -0.2587
D_{100} = -0.2615
T_{50} = 9.64 min.

C_v @ T_{50}
0.016 ft.^{2}/day



Load No.= 14
Load= 500 psf
D_0 = -0.2615
D_{50} = -0.2643
D_{100} = -0.2671
T_{50} = 36.88 min.

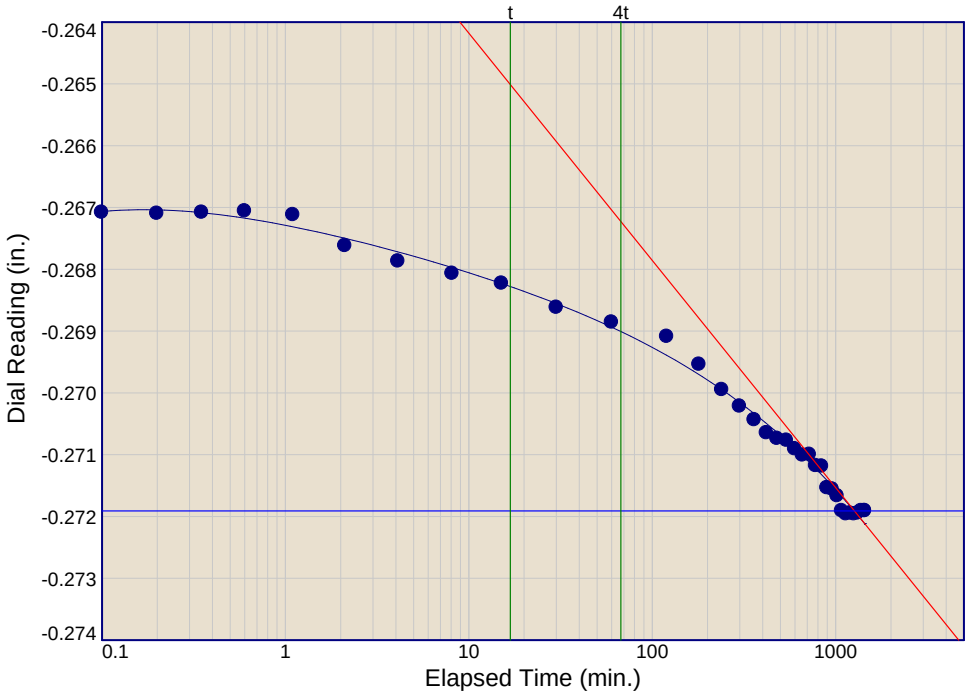
C_v @ T_{50}
0.004 ft.^{2}/day

Figure

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

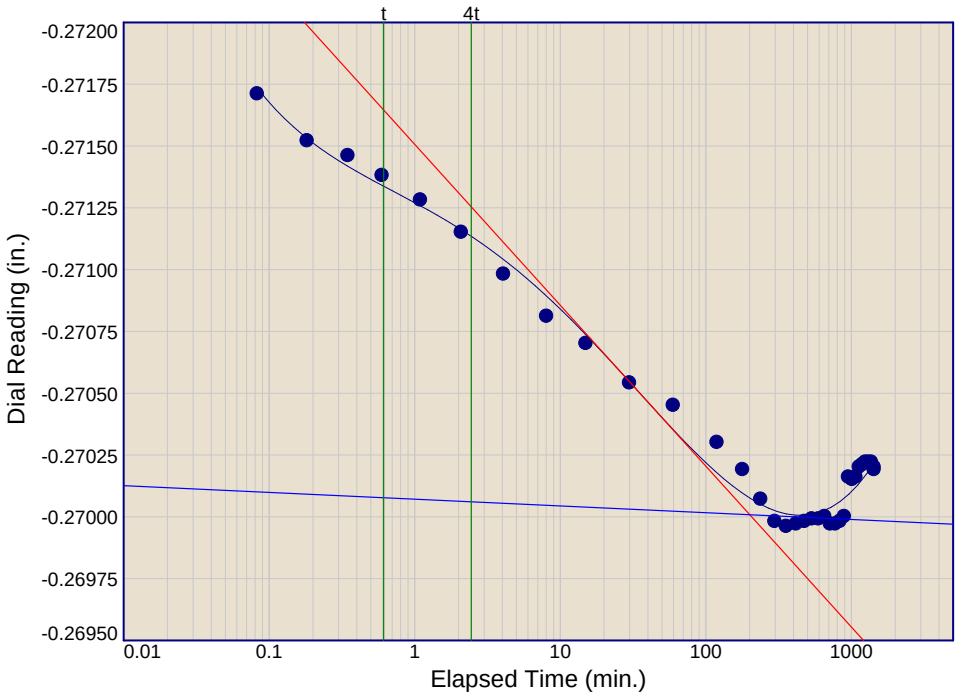
Source of Sample: PB-20-10 Depth: 20-22 & 23.5-25.5 Sample Number: ST-1 & ST-2



Load No.= 15
Load= 250 psf
D_0 = -0.2676
D_{50} = -0.2697
D_{100} = -0.2719
T_{50} = 186.19 min.

C_v @ T_{50}
0.001 $ft.^2/day$

C_α = 0.000



Load No.= 16
Load= 500 psf
D_0 = -0.2715
D_{50} = -0.2708
D_{100} = -0.2700
T_{50} = 12.99 min.

C_v @ T_{50}
0.012 $ft.^2/day$

C_α = 0.000

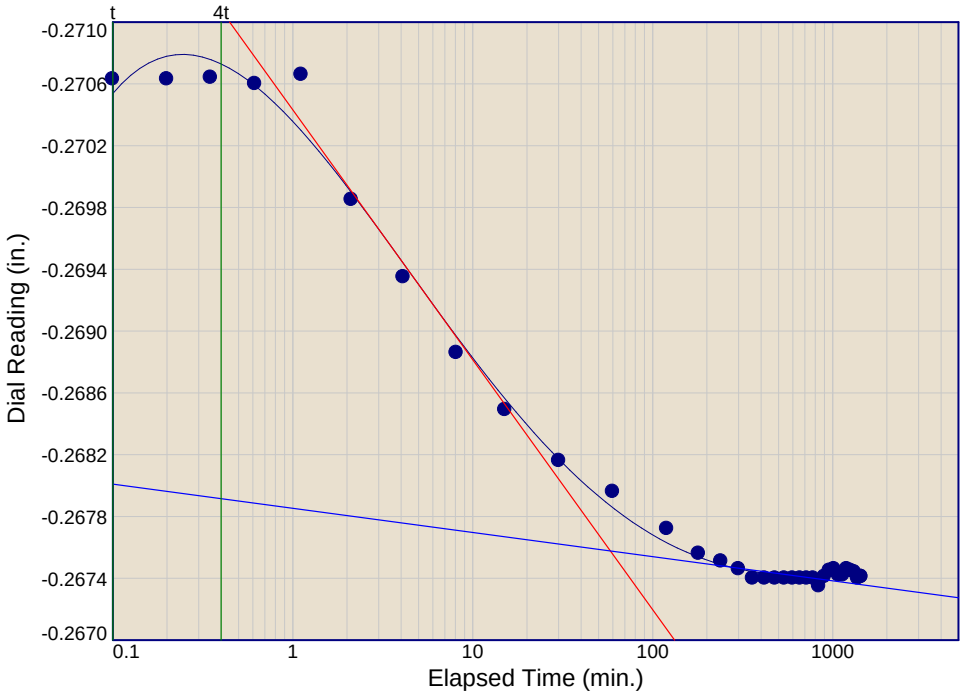
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

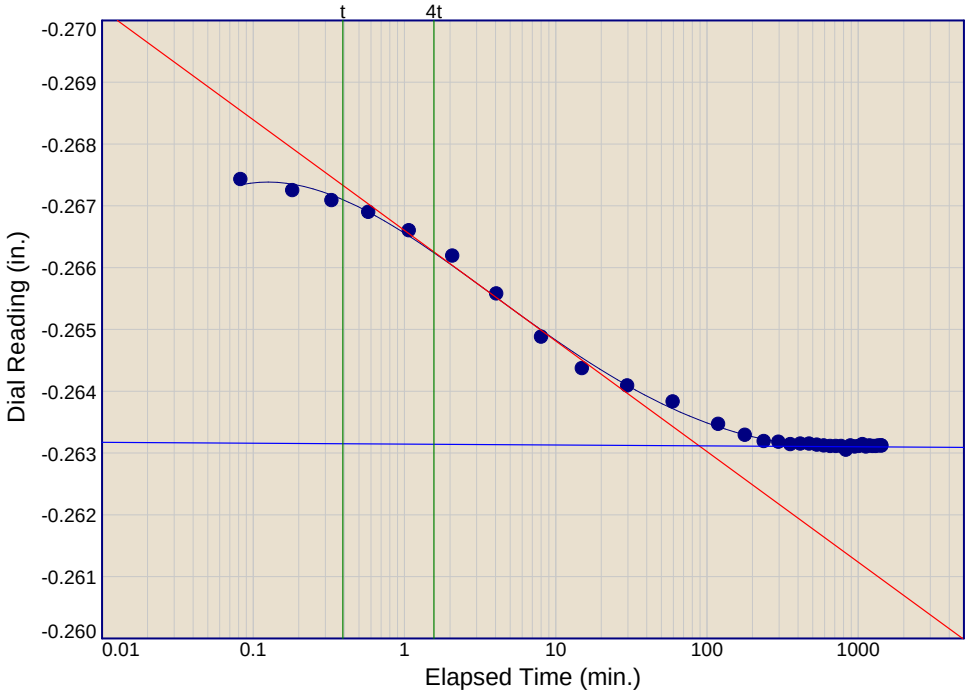
Source of Sample: PB-20-10 Depth: 20-22 & 23.5-25.5 Sample Number: ST-1 & ST-2



Load No.= 17
Load= 1000 psf
D_0 = -0.2703
D_{50} = -0.2690
D_{100} = -0.2676
T_{50} = 8.16 min.

C_v @ T_{50}
0.020 ft.^{2}/day

C_α = 0.000



Load No.= 18
Load= 2000 psf
D_0 = -0.2680
D_{50} = -0.2655
D_{100} = -0.2631
T_{50} = 3.94 min.

C_v @ T_{50}
0.040 ft.^{2}/day

C_α = 0.000

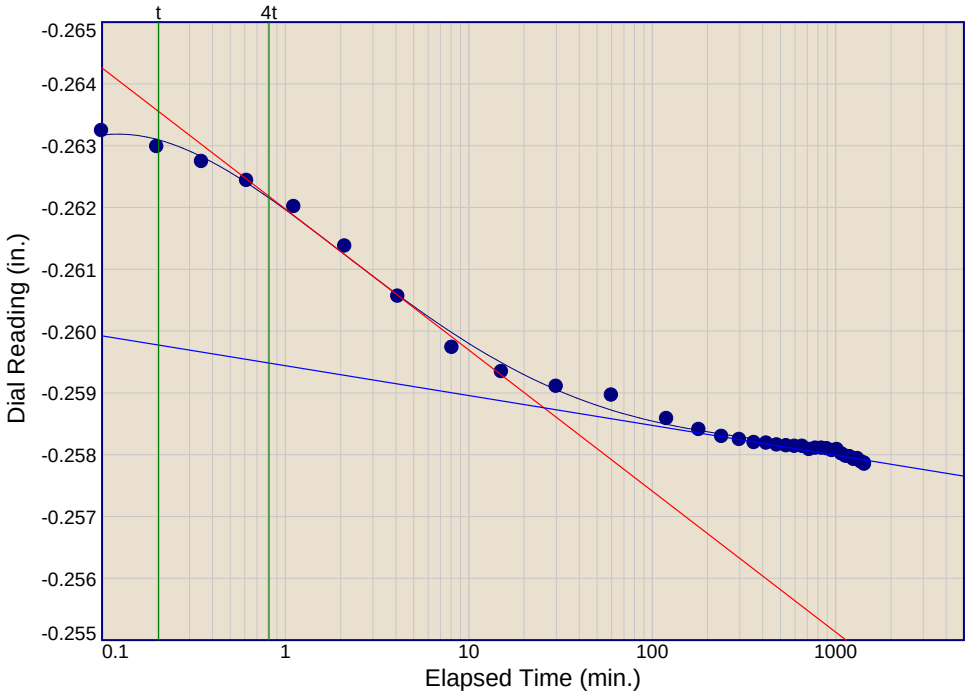
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

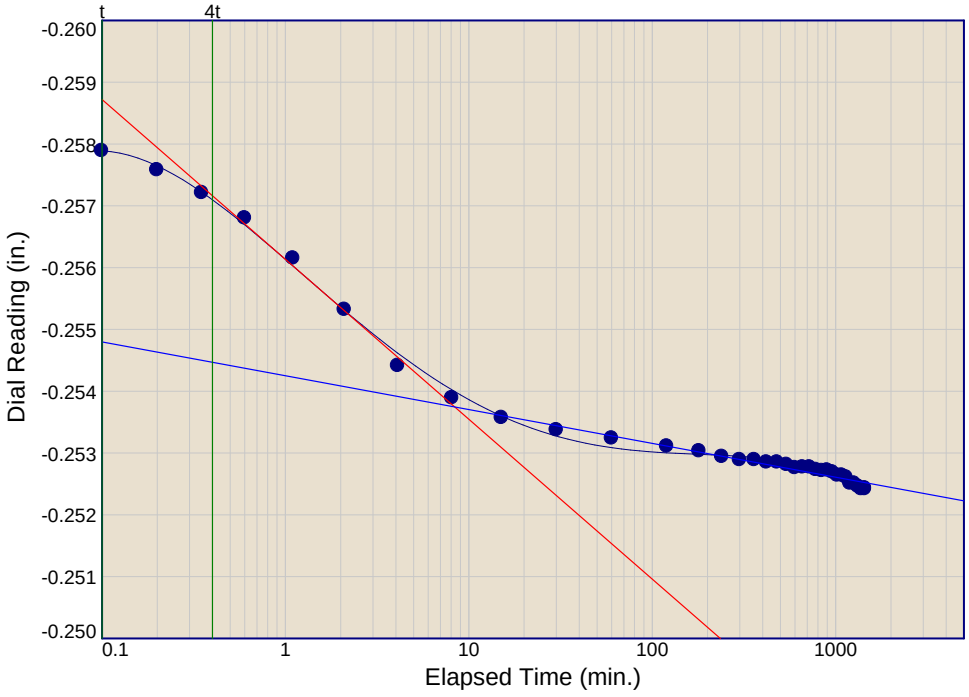
Source of Sample: PB-20-10 Depth: 20-22 & 23.5-25.5 Sample Number: ST-1 & ST-2



Load No.= 19
Load= 4000 psf
D_0 = -0.2640
D_{50} = -0.2614
D_{100} = -0.2588
T_{50} = 1.79 min.

C_v @ T_{50}
0.087 ft.^{2}/day

C_α = 0.001



Load No.= 20
Load= 8000 psf
D_0 = -0.2587
D_{50} = -0.2562
D_{100} = -0.2537
T_{50} = 0.93 min.

C_v @ T_{50}
0.165 ft.^{2}/day

C_α = 0.001

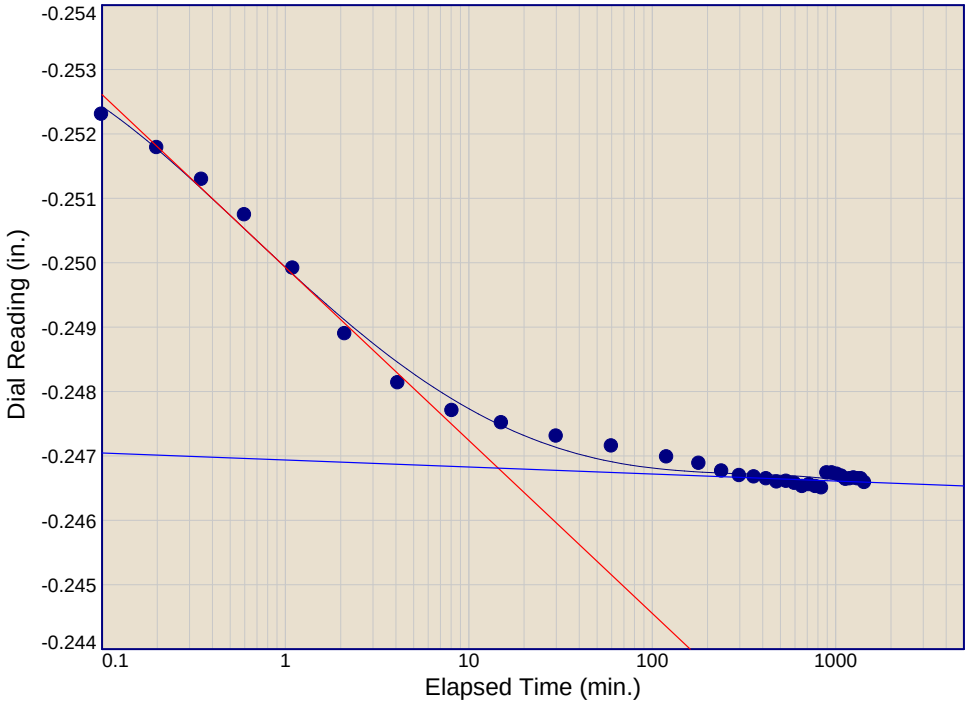
Figure

DLZ, INC.

Dial Reading vs. Time

Project No.: 2121-4618.00
Project: CTI - WDI Lower Clay Investigation

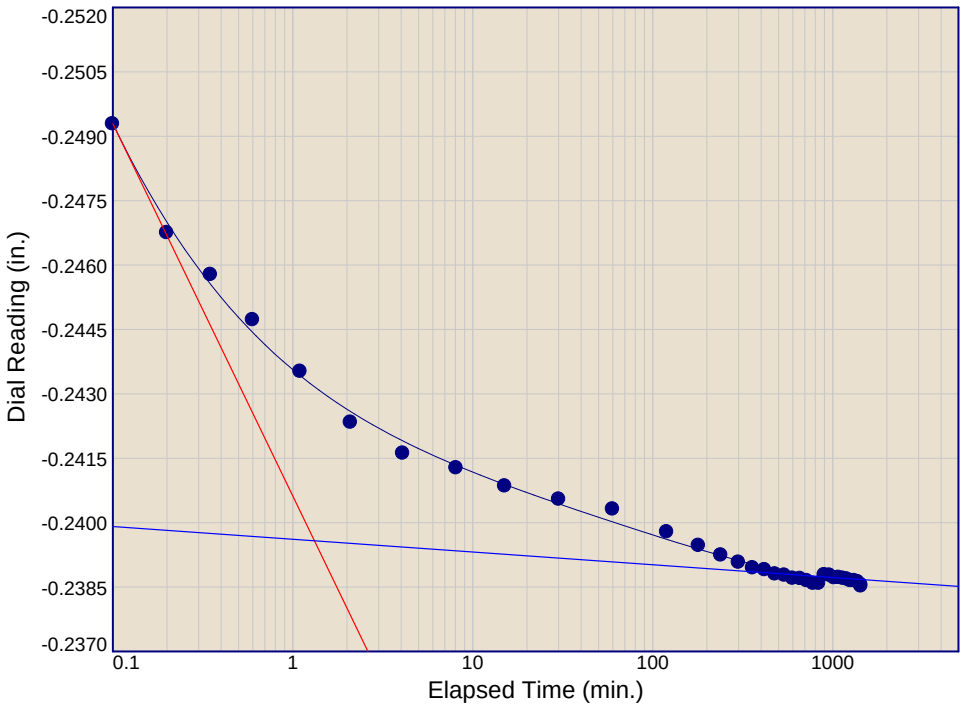
Source of Sample: PB-20-10 Depth: 20-22 & 23.5-25.5 Sample Number: ST-1 & ST-2



Load No.= 21
Load= 16000 psf
D_0 = -0.2570
D_{50} = -0.2519
D_{100} = -0.2468
T_{50} = 0.17 min.

C_v @ T_{50}
0.867 ft.^{2}/day

C_α = 0.000



Load No.= 22
Load= 32000 psf
D_0 = -0.2539
D_{50} = -0.2467
D_{100} = -0.2396
T_{50} = 0.22 min.

C_v @ T_{50}
0.675 ft.^{2}/day

C_α = 0.001

Figure

DLZ, INC.

Technical Review of the 2022 Master Cell VI Subcell F3 Liner Grade Minor Modification by TRC (Dated 9/12/2022)

Responses by WDI and CTI

TRC's Comment (Email dated 10/5/2022, Attachment 2):

Overall I find the analysis of the side slope strain agreeable. The strains expected on the geomembrane are all a little less than 1% which should be fine. The greatest change in slope length was about 0.9 ft. Given the overlap specifications along the side slope of 12 inches (1 ft), this gives about 0.1 ft or 1.2 inches of possible overlap after settlement (assuming the settlement occurs as calculated). This is a small margin of error, in our opinion. **TRC's recommendation would be to increase the overlap to a minimum of 24 inches for GCL overlapping alongside slopes moving forward.**

CTI's response:

In previous discussions TRC stated that the settlement estimate prepared by CTI is very conservative (overestimated potential settlement). Despite such a conservative approach, CTI demonstrated that estimated post-settlement strain values are acceptable. Even though the cumulative elongation of the subgrade can reach 0.9 ft, the geosynthetic will be slowly "stretched" less than 1% because the geosynthetic including the GCL is under high normal stress. In another words, the geosynthetic including the GCL is pinched in-place between the layers of the liner system and will gradually move with the subgrade as settlement progresses. Accordingly, the calculated elongation will not result in separation of the GCL at the panel overlaps because the effects of elongation are distributed over the length of the GCL.

However, since WDI is in need of a timely approval, we agree that the GCL end overlap on the perimeter sideslope (3 horizontal vs. 1 vertical at north sideslopes of MCVI-F3 and F4) will be increased to 24 inches.

TRC's Comment (Email dated 10/5/2022):

We have no further recommendation of analysis with this settlement calculation. However, once CTI puts together a formal submittal for EPA and MEGLE's records, it is recommended that they add the settlement analysis (spreadsheets) of the points in the table below to the submittal for record.

CTI's Response:

The calculation sheets are included in Attachment 1.

ATTACHMENT 1

Settlement Calculation At Perimeter Berm in MCVI-F1 to F4

SETTLEMENT POINT	Coordinates		Elevations										
	North	East		Proposed BOW	Current TOW	Existing Ground	Current BOW	Proposed TOW	BOT MID CLAY	MOIST CLAY	BOT SAT CLAY	BOT SILT	BOT SAND
1-1	[ft]	[ft]		[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8104.4	3837.1		742.7	716.0	716.0	700.0	742.7	660.0	653.5	639.6	625.0	580.0

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Final Cover Soi;	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	0.00	103.0	0	0.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	8.00	135.0	0	1080.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	5.00	135.0	1	-675.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
Consolidation	3	Existing Cover Soil	9.37	135.0	0	1264.7	0.102	0.017	0.005	1307.4	1307.4	2252.4	NC	0.226	0.012
	3	Existing Cover Soil	9.37	135.0	0	1264.7	0.102	0.017	0.005	2572.1	2572.1	3517.1	NC	0.130	0.012
	4	Exisitng waste	8.00	91.0	0	728.0	0.147	0.025	-	3568.5	3568.5	4513.5	NC	0.120	-
	4	Exisitng waste	8.00	91.0	0	728.0	0.147	0.025	-	4296.5	4296.5	5241.5	NC	0.102	-
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	6020.5	6020.5	6965.5	NC	0.129	0.026
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	8740.5	8740.5	9685.5	NC	0.091	0.026
	6	Lower Clay (moist)	6.50	128.0	0	832.0	0.171	0.029	0.009	10516.5	10516.5	11461.5	NC	0.042	0.015
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	11160.4	11160.4	12105.4	NC	0.042	0.016
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	11616.3	11616.3	12561.3	NC	0.040	0.016
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	12072.8	12072.8	13017.8	NC	0.036	-
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	12529.8	12529.8	13474.8	NC	0.035	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	12995.0	12995.0	13940.0	NC	0.027	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	13468.4	13468.4	14413.4	NC	0.027	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	13941.8	13941.8	14886.8	NC	0.026	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	14415.2	14415.2	15360.2	NC	0.025	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	14888.6	14888.6	15833.6	NC	0.024	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
														1.120	0.122
														Total Settlement [ft]	**1.24**

Variables & Constants	
Point Name	1-1
Settlement Layer [ft]	154.7
ERROR	870.7
# of Layers	16
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations										
	North	East		Proposed BOW	Current TOW	Existing Ground	Current BOW	Proposed TOW	BOT MID CLAY	MOIST CLAY	BOT SAT CLAY	BOT SILT	BOT SAND
1-2	[ft]	[ft]		[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8104.4	3924.6		713.6	716.0	716.0	700.0	764.6	660.0	653.5	639.6	625.0	580.0

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Final Cover Soi;	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	51.04	103.0	0	5257.3	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	8.00	135.0	0	1080.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	5.00	135.0	1	-675.0	-	-	-	-	-	-		-	-
	4	Exisitng waste	10.43	91.0	1	-949.1	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
Consolidation	3	Existing Cover Soil	0.00	135.0	0	0.0	0.102	0.017	0.005	1624.1	1624.1	6877.3	NC	-	-
	3	Existing Cover Soil	0.00	135.0	0	-	0.102	0.017	0.005	1624.1	1624.1	6877.3	NC	-	-
	4	Exisitng waste	2.79	91.0	0	253.4	0.147	0.025	-	1750.8	1750.8	7004.0	NC	0.246	-
	4	Exisitng waste	2.79	91.0	0	253.4	0.147	0.025	-	2004.3	2004.3	7257.4	NC	0.229	-
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	3491.0	3491.0	8744.2	NC	0.813	0.026
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	6211.0	6211.0	11464.2	NC	0.543	0.026
	6	Lower Clay (moist)	6.50	128.0	0	832.0	0.171	0.029	0.009	7987.0	7987.0	13240.2	NC	0.244	0.015
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	8631.0	8631.0	13884.1	NC	0.245	0.016
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	9086.9	9086.9	14340.0	NC	0.235	0.016
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	9543.3	9543.3	14796.5	NC	0.209	-
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	10000.3	10000.3	15253.5	NC	0.201	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	10465.5	10465.5	15718.7	NC	0.159	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	10938.9	10938.9	16192.1	NC	0.153	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11412.3	11412.3	16665.5	NC	0.148	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11885.7	11885.7	17138.9	NC	0.143	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	12359.1	12359.1	17612.3	NC	0.138	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
														3.708	0.098
														3.81	

Total Settlement [ft]

Variables & Constants	
Point Name	1-2
Settlement Layer [ft]	125.6
ERROR	841.6
# of Layers	14
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations										
2-1	North	East		Proposed BOW	Current TOW	Existing Ground	Current BOW	Proposed TOW	BOT MID CLAY	MOIST CLAY	BOT SAT CLAY	BOT SILT	BOT SAND
	[ft]	[ft]		[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8441.4	3837.5		739.6	707.0	707.0	700.0	739.6	660.0	653.5	639.6	625.0	580.0

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Final Cover Soi;	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	0.00	103.0	0	0.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	8.00	135.0	0	1080.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	5.00	135.0	1	-675.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
Consolidation	3	Existing Cover Soil	12.28	135.0	0	1657.1	0.102	0.017	0.005	1503.6	1503.6	2448.6	NC	0.265	0.016
	3	Existing Cover Soil	12.28	135.0	0	1657.1	0.102	0.017	0.005	3160.7	3160.7	4105.7	NC	0.142	0.016
	4	Exisitng waste	3.50	91.0	0	318.5	0.147	0.025	-	4148.5	4148.5	5093.5	NC	0.046	-
	4	Exisitng waste	3.50	91.0	0	318.5	0.147	0.025	-	4467.0	4467.0	5412.0	NC	0.043	-
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	5986.3	5986.3	6931.3	NC	0.130	0.026
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	8706.3	8706.3	9651.3	NC	0.091	0.026
	6	Lower Clay (moist)	6.50	128.0	0	832.0	0.171	0.029	0.009	10482.3	10482.3	11427.3	NC	0.042	0.015
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	11126.2	11126.2	12071.2	NC	0.042	0.016
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	11582.1	11582.1	12527.1	NC	0.040	0.016
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	12038.6	12038.6	12983.6	NC	0.036	-
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	12495.6	12495.6	13440.6	NC	0.035	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	12960.8	12960.8	13905.8	NC	0.028	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	13434.2	13434.2	14379.2	NC	0.027	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	13907.6	13907.6	14852.6	NC	0.026	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	14381.0	14381.0	15326.0	NC	0.025	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	14854.4	14854.4	15799.4	NC	0.024	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
														1.041	0.129

SETTLEMENT POINT	Coordinates		Elevations										
2-2	North	East		Proposed BOW	Current TOW	Existing Ground	Current BOW	Proposed TOW	BOT MID CLAY	MOIST CLAY	BOT SAT CLAY	BOT SILT	BOT SAND
	[ft]	[ft]		[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8441.4	3932.3		708.0	707.0	707.0	670.0	763.3	660.0	653.5	639.6	625.0	580.0

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Final Cover Soi;	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	55.30	103.0	0	5695.9	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	8.00	135.0	0	1080.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	15.00	135.0	1	-2025.0	-	-	-	-	-	-		-	-
	4	Exisitng waste	7.05	91.0	1	-641.5	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
Consolidation	3	Existing Cover Soil	0.00	135.0	0	0.0	0.102	0.017	0.005	2666.6	2666.6	7315.9	NC	-	-
	3	Existing Cover Soil	0.00	135.0	0	-	0.102	0.017	0.005	2666.6	2666.6	7315.9	NC	-	-
	4	Exisitng waste	14.98	91.0	0	1362.7	0.147	0.025	-	3347.9	3347.9	7997.3	NC	0.832	-
	4	Exisitng waste	14.98	91.0	0	1362.7	0.147	0.025	-	4710.6	4710.6	9360.0	NC	0.656	-
	5	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	5732.0	5732.0	10381.4	NC	0.132	0.006
	5	Middle Clay	5.00	136.0	0	680.0	0.102	0.017	0.005	6412.0	6412.0	11061.4	NC	0.121	0.006
	6	Lower Clay (moist)	6.50	128.0	0	832.0	0.171	0.029	0.009	7168.0	7168.0	11817.4	NC	0.241	0.015
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	7812.0	7812.0	12461.3	NC	0.241	0.016
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	8267.9	8267.9	12917.2	NC	0.230	0.016
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	8724.3	8724.3	13373.7	NC	0.203	-
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	9181.3	9181.3	13830.7	NC	0.195	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	9646.5	9646.5	14295.9	NC	0.154	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	10119.9	10119.9	14769.3	NC	0.148	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	10593.3	10593.3	15242.7	NC	0.142	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11066.7	11066.7	15716.1	NC	0.137	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11540.1	11540.1	16189.5	NC	0.132	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
														3.565	0.060
													Total Settlement [ft]	3.62	

Variables & Constants	
Point Name	2-2
Settlement Layer [ft]	120.0
ERROR	827.0
# of Layers	14
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations										
3-1	North	East		Proposed BOW	Current TOW	Existing Ground	Current BOW	Proposed TOW	BOT MID CLAY	MOIST CLAY	BOT SAT CLAY	BOT SILT	BOT SAND
	[ft]	[ft]		[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8488.6	4583.2		740.1	718.0	725.0	700.0	740.1	660.0	653.5	639.6	625.0	580.0

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Final Cover Soi;	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	0.00	103.0	0	0.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	8.00	135.0	0	1080.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	5.00	135.0	1	-675.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
Consolidation	3	Existing Cover Soil	3.53	135.0	0	476.1	0.102	0.017	0.005	913.1	913.1	1858.1	NC	0.111	0.005
	3	Existing Cover Soil	3.53	135.0	0	476.1	0.102	0.017	0.005	1389.2	1389.2	2334.2	NC	0.081	0.005
	4	Exisitng waste	9.00	91.0	0	819.0	0.147	0.025	-	2036.7	2036.7	2981.7	NC	0.219	-
	4	Exisitng waste	9.00	91.0	0	819.0	0.147	0.025	-	2855.7	2855.7	3800.7	NC	0.164	-
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	4625.2	4625.2	5570.2	NC	0.165	0.026
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	7345.2	7345.2	8290.2	NC	0.107	0.026
	6	Lower Clay (moist)	6.50	128.0	0	832.0	0.171	0.029	0.009	9121.2	9121.2	10066.2	NC	0.048	0.015
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	9765.2	9765.2	10710.2	NC	0.048	0.016
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	10221.1	10221.1	11166.1	NC	0.046	0.016
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	10677.5	10677.5	11622.5	NC	0.040	-
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	11134.5	11134.5	12079.5	NC	0.039	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11599.7	11599.7	12544.7	NC	0.031	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	12073.1	12073.1	13018.1	NC	0.029	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	12546.5	12546.5	13491.5	NC	0.028	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	13019.9	13019.9	13964.9	NC	0.027	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	13493.3	13493.3	14438.3	NC	0.026	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
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	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
														1.210	0.107
														1.32	

Total Settlement [ft]

Variables & Constants	
Point Name	3-1
Settlement Layer [ft]	145.1
ERROR	863.1
# of Layers	16
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations										
	North	East		Proposed BOW	Current TOW	Existing Ground	Current BOW	Proposed TOW	BOT MID CLAY	MOIST CLAY	BOT SAT CLAY	BOT SILT	BOT SAND
3-2	[ft]	[ft]		[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8586.8	4583.2		707.3	718.0	725.0	700.0	764.6	660.0	653.5	639.6	625.0	580.0

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Final Cover Soi;	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	57.28	103.0	0	5900.2	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	8.00	135.0	0	1080.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	5.00	135.0	1	-675.0	-	-	-	-	-	-		-	-
	4	Exisitng waste	18.68	91.0	1	-1699.9	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
Consolidation	3	Existing Cover Soil	0.00	135.0	0	0.0	0.102	0.017	0.005	2374.9	2374.9	7520.2	NC	-	-
	3	Existing Cover Soil	0.00	135.0	0	-	0.102	0.017	0.005	2374.9	2374.9	7520.2	NC	-	-
	4	Exisitng waste	0.00	91.0	0	-	0.147	0.025	-	2374.9	2374.9	7520.2	NC	-	-
	4	Exisitng waste	0.00	91.0	0	-	0.147	0.025	-	2374.9	2374.9	7520.2	NC	-	-
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	3734.9	3734.9	8880.2	NC	0.767	0.026
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	6454.9	6454.9	11600.2	NC	0.519	0.026
	6	Lower Clay (moist)	6.50	128.0	0	832.0	0.171	0.029	0.009	8230.9	8230.9	13376.2	NC	0.234	0.015
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	8874.8	8874.8	14020.1	NC	0.236	0.016
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	9330.8	9330.8	14476.1	NC	0.227	0.016
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	9787.2	9787.2	14932.5	NC	0.201	-
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	10244.2	10244.2	15389.5	NC	0.194	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	10709.4	10709.4	15854.7	NC	0.153	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11182.8	11182.8	16328.1	NC	0.148	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11656.2	11656.2	16801.5	NC	0.143	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	12129.6	12129.6	17274.9	NC	0.138	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	12603.0	12603.0	17748.3	NC	0.134	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
														3.094	0.098

Total Settlement [ft] **3.19**

Variables & Constants	
Point Name	3-2
Settlement Layer [ft]	120.0
ERROR	838.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations										
4-1	North	East		Proposed BOW	Current TOW	Existing Ground	Current BOW	Proposed TOW	BOT MID CLAY	MOIST CLAY	BOT SAT CLAY	BOT SILT	BOT SAND
	[ft]	[ft]		[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8460.7	4957.5		735.0	704.0	715.0	700.0	735.0	660.0	653.5	639.6	625.0	580.0

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Final Cover Soi;	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	0.00	103.0	0	0.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	8.00	135.0	0	1080.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	5.00	135.0	1	-675.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
Consolidation	3	Existing Cover Soil	6.00	135.0	0	810.5	0.102	0.017	0.005	1080.2	1080.2	2025.2	NC	0.167	0.008
	3	Existing Cover Soil	6.00	135.0	0	810.5	0.102	0.017	0.005	1890.7	1890.7	2835.7	NC	0.108	0.008
	4	Exisitng waste	2.00	91.0	0	182.0	0.147	0.025	-	2386.9	2386.9	3331.9	NC	0.043	-
	4	Exisitng waste	2.00	91.0	0	182.0	0.147	0.025	-	2568.9	2568.9	3513.9	NC	0.040	-
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	4019.9	4019.9	4964.9	NC	0.187	0.026
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	6739.9	6739.9	7684.9	NC	0.116	0.026
	6	Lower Clay (moist)	6.50	128.0	0	832.0	0.171	0.029	0.009	8515.9	8515.9	9460.9	NC	0.051	0.015
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	9159.9	9159.9	10104.9	NC	0.051	0.016
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	9615.8	9615.8	10560.8	NC	0.048	0.016
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	10072.2	10072.2	11017.2	NC	0.043	-
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	10529.2	10529.2	11474.2	NC	0.041	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	10994.4	10994.4	11939.4	NC	0.032	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11467.8	11467.8	12412.8	NC	0.031	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11941.2	11941.2	12886.2	NC	0.030	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	12414.6	12414.6	13359.6	NC	0.029	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	12888.0	12888.0	13833.0	NC	0.028	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
														1.043	0.113
													Total Settlement [ft]	1.16	

Variables & Constants	
Point Name	4-1
Settlement Layer [ft]	136.0
ERROR	840.0
# of Layers	16
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

SETTLEMENT POINT	Coordinates		Elevations										
	North	East		Proposed BOW	Current TOW	Existing Ground	Current BOW	Proposed TOW	BOT MID CLAY	MOIST CLAY	BOT SAT CLAY	BOT SILT	BOT SAND
4-2	[ft]	[ft]		[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]	[ft MSL]
	8572.8	4957.5		697.6	704.0	715.0	700.0	763.0	660.0	653.5	639.6	625.0	580.0

	Layer Type	Layer	Layer Height	Eff. Unit Weight	Cut Layer	Inc. Layer Stress	Compression Parameters			Initial Stress	Consolidation Stress (midpoint of layer)	Final Stress	Consolidation Case	Primary Settlement	Secondary Settlement
			H [ft]	γ' [pcf]	1 = yes 0 = no	σ_i [psf]	$\frac{C_c}{1+e_0}$	$\frac{C_r}{1+e_0}$	$\frac{C_\alpha}{1+e_0}$	p_0' [psf]	p_c' [psf]	p_f' [psf]	-	S_c [ft]	S_s [ft]
Overburden	1	Final Cover Soi;	4.00	135.0	0	540.0	-	-	-	-	-	-		-	-
	2	New Waste	65.39	103.0	0	6735.3	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	8.00	135.0	0	1080.0	-	-	-	-	-	-		-	-
	3	Existing Cover Soil	5.00	135.0	1	-675.0	-	-	-	-	-	-		-	-
	4	Exisitng waste	14.36	91.0	1	-1306.8	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
		<none>	0.00	0.0	0	0.0	-	-	-	-	-	-		-	-
Consolidation	3	Existing Cover Soil	0.00	135.0	0	0.0	0.102	0.017	0.005	1981.8	1981.8	8355.3	NC	-	-
	3	Existing Cover Soil	0.00	135.0	0	-	0.102	0.017	0.005	1981.8	1981.8	8355.3	NC	-	-
	4	Exisitng waste	0.00	91.0	0	-	0.147	0.025	-	1981.8	1981.8	8355.3	NC	-	-
	4	Exisitng waste	0.00	91.0	0	-	0.147	0.025	-	1981.8	1981.8	8355.3	NC	-	-
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	3341.8	3341.8	9715.3	NC	0.946	0.026
	5	Middle Clay	20.00	136.0	0	2720.0	0.102	0.017	0.005	6061.8	6061.8	12435.3	NC	0.637	0.026
	6	Lower Clay (moist)	6.50	128.0	0	832.0	0.171	0.029	0.009	7837.8	7837.8	14211.3	NC	0.287	0.015
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	8481.7	8481.7	14855.3	NC	0.289	0.016
	7	Lower Clay (saturated)	6.95	65.6	0	455.9	0.171	0.029	0.009	8937.6	8937.6	15311.2	NC	0.278	0.016
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	9394.1	9394.1	15767.7	NC	0.246	-
	8	Silt	7.30	62.6	0	457.0	0.150	-	-	9851.1	9851.1	16224.7	NC	0.237	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	10316.3	10316.3	16689.8	NC	0.188	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	10789.7	10789.7	17163.2	NC	0.181	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11263.1	11263.1	17636.6	NC	0.175	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	11736.5	11736.5	18110.0	NC	0.170	-
	9	Sand	9.00	52.6	0	473.4	0.100	-	-	12209.9	12209.9	18583.4	NC	0.164	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
	-	<none>		-	0	-	-	-	-	-		-	-	-	-
														3.799	0.098
														3.90	

Total Settlement [ft]

Variables & Constants	
Point Name	4-2
Settlement Layer [ft]	120.0
ERROR	824.0
# of Layers	12
t / t_p [ratio]	1.8

- Use the master "Material Properties" sheet to input the correct "Layer Type" into column C. This will auto-populate the density and compression parameters. Coordinates and elevations are referenced from the "Points" sheet for comparison to the total consolidation layer.
- Split layers greater than 10 feet thick.
- Existing layers that are to be removed are to be marked with a "1" in the "Cut Layer" column.

ATTACHMENT 2

Emails Dated Oct. 6, 2022

Xianda Zhao

From: Graczyk, Lisa <graczyk.lisa@epa.gov>
Sent: Thursday, October 6, 2022 10:24 AM
To: Sylwia Scott
Cc: Christine Matlock; Xianda Zhao; ConfortiR@michigan.gov; Kevin Foye; Kahnk, BreAnne; Amstadt, Michael; Bauman, Zach; Mooney, Susan; Phil Tannian; Michael Takacs
Subject: FW: [EXTERNAL] FW: 2022 Master Cell VI Subcell F3 Liner Grade Modification Response to Comments

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Sylwia,

Please see TRC's review of the settlement calculations for the side slopes and their recommendation.

In summary, the settlement calculations for the side slopes are acceptable. However, both EPA and MEGLE agree that there should be additional overlap of the GCL based on the small margin of error.

Please let us know if you would like to discuss this.

Thank you.

Lisa

Lisa Graczyk
U.S. EPA Region 5
tel: 312/353-3219; FAX: 312/886-6869

From: Bauman, Zach <ZBauman@trccompanies.com>
Sent: Wednesday, October 5, 2022 10:01 AM
To: Graczyk, Lisa <graczyk.lisa@epa.gov>
Cc: Christine Matlock <matlockC2@michigan.gov>; Amstadt, Michael <MAmstadt@trccompanies.com>; Kahnk, BreAnne <bkahnk@trccompanies.com>
Subject: RE: [EXTERNAL] FW: 2022 Master Cell VI Subcell F3 Liner Grade Modification Response to Comments

Lisa,

We have reviewed the calcs performed by CTI for the sideslope strain calcs. I quickly created a check to confirm the math.

Overall I find the analysis of the side slope strain agreeable. The strains expected on the geomembrane are all a little less than 1% which should be fine. The greatest change in slope length was about 0.9 ft. Given the overlap specifications along the side slope of 12 inches (1 ft), this gives about 0.1 ft or 1.2 inches of possible overlap after settlement (assuming the settlement occurs as calculated). This is a small margin of error, in our opinion. **TRC's recommendation would be to increase the overlap to a minimum of 24 inches for GCL overlapping alongside slopes moving forward.**

We have no further recommendation of analysis with this settlement calculation. However, once CTI puts together a formal submittal for EPA and MEGLE's records, it is recommended that they add the settlement analysis (spreadsheets) of the points in the table below to the submittal for record.

Zachary Bauman, PE
Project Engineer, Geo-Environmental and Civil Engineering Group

TRC

708 Heartland Trail, Suite 3000, Madison, WI 53717
C: 608.416.0821
LinkedIn | Twitter | Blog | www.TRCcompanies.com

Please note that our domain name and email addresses have changed.

From: Graczyk, Lisa <graczyk.lisa@epa.gov>
Sent: Monday, October 3, 2022 1:57 PM
To: Amstadt, Michael <MAmstadt@trccompanies.com>; Kahnk, BreAnne <bkahnk@trccompanies.com>; Bauman, Zach <ZBauman@trccompanies.com>
Cc: Christine Matlock <matlockC2@michigan.gov>
Subject: [EXTERNAL] FW: 2022 Master Cell VI Subcell F3 Liner Grade Modification Response to Comments

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ALWAYS hover over the link to preview the actual URL/site and confirm its legitimacy.

Hi Mike, Breanne, and Zach,

Let me know when you think you can complete a review the data below. And please spot check the calculations as you did before.

Also, let's set up a meeting to discuss this after your review.

Thanks.

Lisa

Lisa Graczyk
U.S. EPA Region 5
tel: 312/353-3219; FAX: 312/886-6869

From: Kevin Foye <kfoye@cticompanies.com>
Sent: Monday, October 3, 2022 1:11 PM
To: Graczyk, Lisa <graczyk.lisa@epa.gov>; Christine Matlock <matlockC2@michigan.gov>; Sylwia Scott <sylwia.scott@usecology.com>
Cc: Amstadt, Michael <MAmstadt@trccompanies.com>; Xianda Zhao <xzhao@cticompanies.com>; Bauman, Zach <ZBauman@trccompanies.com>; Kahnk, BreAnne <bkahnk@trccompanies.com>; ConfortiR@michigan.gov; Phil Tannian <phil.tannian@usecology.com>; Michael Takacs <Michael.Takacs@usecology.com>; Mooney, Susan <mooney.susan@epa.gov>
Subject: RE: 2022 Master Cell VI Subcell F3 Liner Grade Modification Response to Comments

All,

I am writing to follow up my email below and offer the following additional clarifications:

- When preparing these additional calculations, the same soil and waste properties (unit weight, compression index, pre-development stress history) were applied as in the previous analyses.
- Because the perimeter berm points are new analysis points, CTI introduced the geometric information (existing bottom of waste, existing top of waste, proposed bottom of waste, proposed top of waste, etc.) for these points to complete the analysis.

Kevin

Protecting, Enhancing, and Restoring our Environment

Kevin Foye, Ph.D., P.E.*
Sr. Engineer
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Demand Safety, Deliver Quality

*registered in MI, IN, OH, KY, TX, NM, VA, NV, ID, SC, NY, MO, WA

From: Kevin Foye
Sent: Friday, September 30, 2022 5:53 PM
To: Graczyk, Lisa <graczyk.lisa@epa.gov>; Christine Matlock <matlockC2@michigan.gov>; Sylwia Scott <Sylwia.Scott@usecology.com>
Cc: Amstadt, Michael <MAmstadt@trccompanies.com>; Xianda Zhao <xzhao@cticompanies.com>; Bauman, Zach <ZBauman@trccompanies.com>; Kahnk, BreAnne <bkahnk@trccompanies.com>; Conforti, Rich (EGLE) <CONFORTIR@michigan.gov>; Phil Tannian <phil.tannian@usecology.com>; Michael Takacs <Michael.Takacs@usecology.com>; Mooney, Susan <mooney.susan@epa.gov>
Subject: RE: 2022 Master Cell VI Subcell F3 Liner Grade Modification Response to Comments

All,

Based on our conversation with yesterday, CTI has performed some additional calculations in response to the outstanding comment (comment #4)

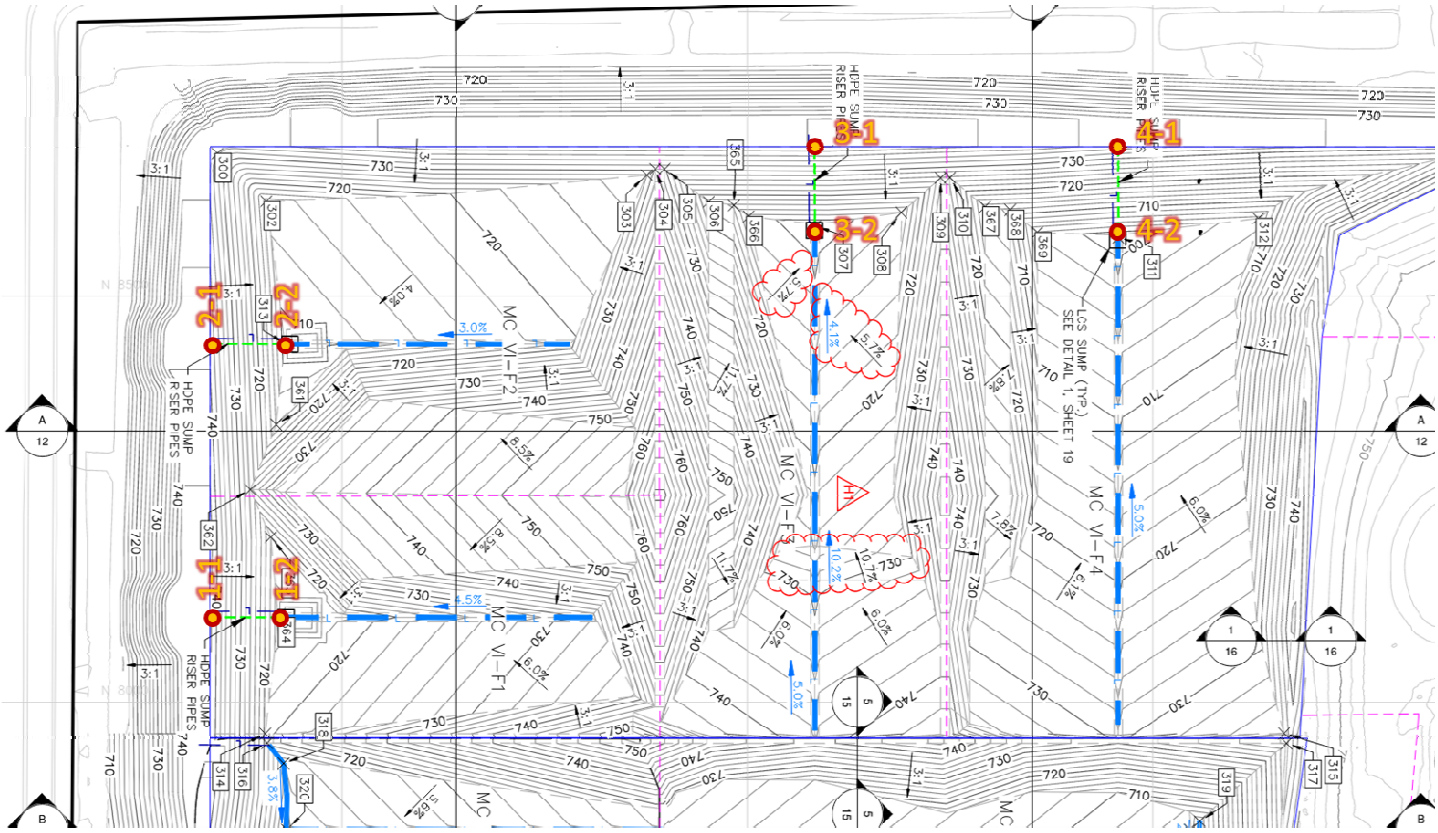
Comment:

TRC recommends CTI provide further justification on whether the greatest amount of strain will truly occur along the leachate collection line. The greatest strain often occurs in areas were the greatest settlement deferential is produced over a relatively small linear distance. These areas are typically at the toe of the cell's sideslope because the edge of the landfill anchor trench (which can be assumed to have little to no settlement) to the low point of the liner grades (at the toe or sump that sits against the cell's sideslope) produces the greatest settlement difference. In addition, this also may occur in the areas of the intercell dikes where the increased slopes may cause some additional differential settlement due to the additional compressible layers. TRC recommends CTI evaluate the expected strain for the proposed cells at these locations to confirm that stability and integrity of the geomembrane and the overlap of

the GCL are maintained.

Response:

As noted by TRC, the maximum strain may occur elsewhere, particularly where there are steep slopes resulting in significant differences in overburden pressure and compressible subgrade thickness. Therefore, CTI evaluated differential settlement between additional points along the longest, steepest exterior slopes in each subcell as follows. Exterior sideslopes were selected because the overburden pressure from future waste placement decreases to zero at the crest of slope. However, added pressure from perimeter berm construction and final cover construction contributes to value of total settlement in these locations.



TOP OF PRIMARY LINER SYSTEM CONTOURS WITH PERIMETER SETTLEMENT POINTS

Total settlement was estimated at each of the 8 points. The resulting estimates are tabulated below. Elongation and strain in the proposed MCVI-F liner system were calculated using the following equation:

$$\varepsilon(\%) = \frac{dl}{l_0}$$

Where:

dl = change in length [ft] (l_1-l_0)
l_0 = initial length [ft]
l_1 = Post-settlement length [ft]

			Elevation		Horiz. Dist.	Liner Grade	Floor/Pip
Flow Line	Point	Station	liner elevation	Settlement		Post-Settlement	Pre-Settlement
sideslope		[ft]	[ft]	[ft]	[ft]	[ft]	[%]

	1-1	0.00	742.74	1.24	88	741.49	33.33%
	1-2	87.50	713.57	3.81		709.76	
	2-1	0.00	739.55	1.17	95	738.38	33.33%
	2-2	94.80	707.95	3.62		704.33	
	3-1	0.00	740.05	1.32	98	738.74	33.33%
	3-2	98.20	707.32	3.19		704.13	
	4-1	0.00	735.01	1.16	112	733.85	33.33%
	4-2	112.10	697.64	3.90		693.74	

The calculated strains in the table above are all 1.1% or less. Previous, highly conservative criteria for maximum arch strains in polyethylene geomembranes recommended limiting such strains to 1 to 2% to prevent rupture (Peggs, Schmucker, and Carey 2005). This limit was referenced by CTi in its previous response. Peggs, Schmucker, and Carey (2005) go on to say that these criteria are excessively conservative, particularly considering the actual resin formulations used for geomembranes. Accordingly, the authors concluded that maximum arch strains of 4 to 6% are more appropriate for textured geomembranes, albeit also conservative given the tolerable elongation values observed for geomembranes. Therefore, these estimated strain values are acceptable. The maximum change in length was estimated to be less than 0.9 feet, which is less than the required overlap in GCL panels (12 inches or 1 foot) in the end-to-end direction. Note that this comparison assumes that all elongation will be realized as a decrease in overlap in the GCL rather than a combination of GCL elongation and reduced overlap. Therefore, even under this conservative set of estimates, differential settlement is expected to have acceptable effects on the liner system. Furthermore, as discussed by TRC, additional conservatism in the total settlement estimates, caused by subgrade stress history assumptions and selection of compressibility parameters means that these estimates are more pessimistic than anticipated actual values.

Regards,

Kevin

Protecting, Enhancing, and Restoring our Environment

Kevin Foye, Ph.D., P.E.*
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From: Graczyk, Lisa <graczyk.lisa@epa.gov>
Sent: Wednesday, September 28, 2022 9:44 AM
To: Sylwia Scott <sylwia.scott@usecology.com>; Christine Matlock <matlockC2@michigan.gov>
Cc: Amstadt, Michael <MAmstadt@trccompanies.com>; Xianda Zhao <xzhao@cticompanies.com>; Bauman, Zach <ZBauman@trccompanies.com>; Kahnk, BreAnne <bkahnk@trccompanies.com>; ConfortiR@michigan.gov; Phil Tannian

<phil.tannian@usecology.com>; Michael Takacs <Michael.Takacs@usecology.com>; Mooney, Susan <mooney.susan@epa.gov>
Subject: RE: 2022 Master Cell VI Subcell F3 Liner Grade Modification Response to Comments

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Sylwia,

We have further questions/comments based on the response to comments that USE emailed on September 15th. Please review the attached document from EPA's contractor, TRC, and provide written responses.

It may be helpful if we set up a conference call to discuss the attached comments between EPA, MEGLE, USE, CTI, and TRC. Let me know what you think and please provide times that work. Note that I am fairly open Thursday, Friday, and Monday. I currently only have an early morning meeting on Friday (9-930 CT) and Monday (930-1030 CT).

Thank you.

Lisa

Lisa Graczyk
U.S. EPA Region 5
tel: 312/353-3219; FAX: 312/886-6869

From: Sylwia Scott <Sylwia.Scott@usecology.com>
Sent: Thursday, September 15, 2022 7:25 AM
To: Graczyk, Lisa <graczyk.lisa@epa.gov>; Christine Matlock <matlockC2@michigan.gov>
Cc: Amstadt, Michael <MAmstadt@trccompanies.com>; Xianda Zhao <xzhao@cticompanies.com>; Bauman, Zach <ZBauman@trccompanies.com>; Kahnk, BreAnne <bkahnk@trccompanies.com>; ConfortiR@michigan.gov; Phil Tannian <phil.tannian@usecology.com>; Michael Takacs <Michael.Takacs@usecology.com>
Subject: 2022 Master Cell VI Subcell F3 Liner Grade Modification Response to Comments

Attached please find responses to both EPA and EGLE comments regarding Wayne Disposal Inc.'s Master Cell VI Subcell F3 Liner Grade modification. Please let me know if you have any additional questions.

Sylwia Scott
Area Environmental Manager
49350 North I-94 Service Drive
Belleville, MI 48111
e Sylwia.Scott@Usecology.com
o 734-699-6294
Emergency Response: 800.899.4672

US ecology
A Republic Services Company

RESPONSE TO EPA TECHNICAL REVIEW

March 1, 2024

Mr. William Carr
General Manager
Republic Services
49350 North Interstate 94 Service Drive
Belleville, MI 48111

Subject: **Response to EPA Technical Review dated Oct. 2, 2023**
Wayne Disposal, Inc. MID 048 090 633

Dear Mr. Carr

CTI and Associates, Inc. (CTI) was retained by Republic Services, Inc. to submit this response to EPA's October 2, 2023 letter containing the technical review of proposed landfill liner design modifications for Wayne Disposal Inc. (WDI) Master Cell VI, Subcells F1-F4 and G4-G7. This review was performed by EPA's contractor, TRC. WDI is located in Belleville, Michigan and is owned by Republic Services, Inc.

CTI's response to TRC's comments is presented as **Attachment 1**, accompanied by two additional calculation sheets. These calculations address TRC's concerns regarding the potential overtopping of stormwater ditches and the diversion berms.

Attachment 2 contains engineering plans for following changes. All modifications have been indicated using red bubbles, each accompanied by the revision identifier "K":

1. Relocation of the existing leachate collection sump (MC6ENW) within the future disposal area, Master Cell VI-F4 (MC VI-F4), to avoid penetration of the primary liner system by the leak detection sump riser. Additionally, a sampling pipe with the necessary sump riser will be installed to segregate the liquid collected in subcell MC6 E Phase 2 West leak detection system from MC VI-F4.
2. Adjustment of the liner grades around the existing leachate extraction manhole (MC5A Manhole) in MCVI-F4 to prevent liner system penetration.
3. Minor adjustments to the final grades to ease the construction and installation of the final cover. Note that the adjustment will not have any adverse impact on the stormwater management system and no significant adjustment will be required for the stormwater management system.

Attachment 3 includes geotechnical calculations for the extension of the existing manhole in MC5A, demonstrating the feasibility of the proposed extension.

Attachment 4 presents the revised cover letter for the "2021 Permit Application Attachment B6 Engineering Plans," incorporating the following revisions:

1. Update of Figure 1 "Proposed Master Cell VI-F and G Layout"
2. Updated of Figure 2 "Proposed Final Grades"

3. Revision of "Summary of Design Capacity" due to the changes in the primary liner grades and the final grades
4. Updated drawing list

Please contact the undersigned if you have any questions regarding this response.

Sincerely,
CTI and Associates, Inc.

Xianda Zhao, Ph.D., P.E.
Senior Engineer

Attachment 1 CTI's Response to TRC Technical Comments
Attachment 2 Engineering Plans
Attachment 3 MC5A Manhole Extension Calculations
Attachment 4 Cover letter for "2021 Permit Application Attachment B6 Engineering Plans"

Cc:
Kelly McInnis, Republic Services, WDI
Sylwia Scott, Republic Services, WDI

Attachment 1

CTI's Response to TRC Technical Comments

Comments on CTI's Responses for EPA's Technical Comments

Dated Oct. 2, 2023

Responded by CTI on March 1, 2024

Settlement Analysis

The geosynthetics strain should be evaluated in the remaining subcells to confirm that impacts on the liner system are within accepted tolerances. In addition, the GCL should continue to be overlapped by at least 24 inches in future subcells to provide additional protection.

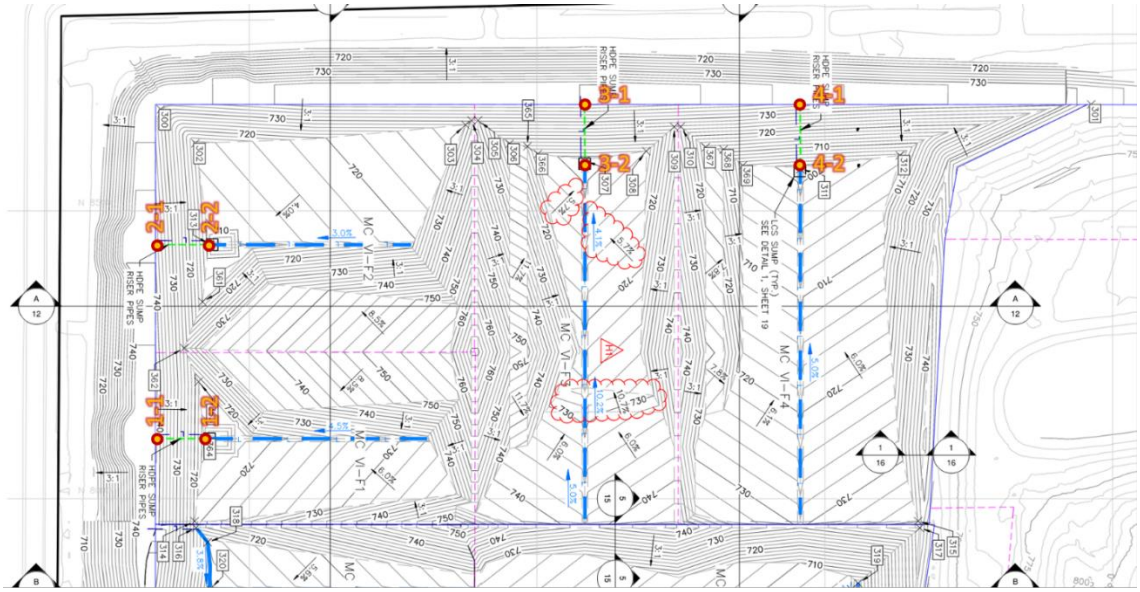
Response:

The liner strain calculation has been performed for the remaining subcell flowlines as requested. The attached liner strain calculation tables report the calculated values (Attachment 1). All calculated strain values are less than the allowable limits (<1 to 2%). Previous, highly conservative criteria for maximum arch strains in polyethylene geomembranes recommended limiting such strains to 1 to 2% to prevent rupture (Peggs, Schmucker, and Carey 2005). This limit was referenced by CTI in its previous responses. Peggs, Schmucker, and Carey (2005) go on to say that these criteria are excessively conservative, particularly considering the actual resin formulations used for geomembranes. Accordingly, the authors concluded that maximum arch strains of 4 to 6% are more appropriate for textured geomembranes, albeit also conservative given the tolerable elongation values observed for geomembranes. Therefore, these estimated strain values are acceptable.

As we stated in the previous responses (MCVI-F3 Minor Modification), even though the cumulative elongation of the subgrade can reach 0.9 ft, the geosynthetic will be slowly "stretched" less than 1% because the geosynthetic including the GCL is under high normal stress. In another words, the geosynthetic including the GCL is pinched in-place between the layers of the liner system and will gradually move with the subgrade as settlement progresses. Accordingly, the calculated elongation will not result in separation of the GCL at the panel overlaps because the effects of elongation are distributed over the length of the GCL.

Similarly to the discussion for the MCVI-F3 Minor Modification, CTI anticipates that greater values of strain will be estimated for cell perimeter sideslopes than for cell floors. Perimeter sideslopes are where the change in overburden pressure with distance is the greatest. CTI Selected several pairs of settlement analysis point along the MC-F and MC-G exterior

sideslopes for this purpose. Exterior sideslopes were selected because the overburden pressure from future waste placement decreases to zero at the crest of slope. However, added pressure from perimeter berm construction and final cover construction contributes to total settlement in these locations. Accordingly, CTI has estimated post-settlement liner strain values for the MCVI-G subcells in addition to the values presented previously for MCVI-F subcells. Both the liner strain results calculated previously for the MCVI-F subcells and the MCVI-G subcells are reported in the table below. All calculated strain values are less than the allowable limits (<1 to 2%).



TOP OF PRIMARY LINER SYSTEM CONTOURS WITH PERIMETER SETTLEMENT POINTS

MCVI-F Perimeter Sideslope Liner Strain Calculation Results (calculated strain highlighted in green)

		Elevation		Horiz. Dist.	Liner Grade	Floor/Pipe Slope		elongation calculations			
Point	Station	liner elevation	Settlement		Post-Settlement	Pre-Settlement	Post-Settlement	l_0	l_1	dl	ε
	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	ft	ft	ft	%
1-1	0	742.74	1.24	88	741.49	33.33%	36.26%	92.23	93.08	0.84	0.91%
1-2	87.5	713.57	3.81		709.76						
2-1	0	739.55	1.17	95	738.38	33.33%	35.92%	99.93	100.73	0.8	0.80%
2-2	94.8	707.95	3.62		704.33						
3-1	0	740.05	1.32	98	738.74	33.33%	35.24%	103.51	104.12	0.61	0.59%
3-2	98.2	707.32	3.19		704.13						
4-1	0	735.01	1.16	112	733.85	33.33%	35.78%	118.16	119.06	0.89	0.76%
4-2	112.1	697.64	3.9		693.74						

TOP OF PRIMARY LINER SYSTEM CONTOURS WITH PERIMETER SETTLEMENT POINTS

MCVI-G Perimeter Sideslope Liner Strain Calculation Results (calculated strain highlighted in green)

		Elevation		Horiz. Dist.	Liner Grade	Floor/Pipe Slope		elongation calculations			
Point	Station	liner elevation	Settlement		Post-Settlement	Pre-Settlement	Post-Settlement	l_0	l_1	dl	e
	[ft]	[ft]	[ft]	[ft]	[ft]	[%]	[%]	ft	ft	ft	%
1-1	0	735	2.05	215	732.95	33.02%	33.80%	226.42	226.95	0.53	0.23%
1-2	215	664	3.72		660.28						
2-1	0	740	2.58	94	737.42	34.04%	35.52%	99.3	99.75	0.46	0.46%
2-2	94	708	3.97		704.03						
4-1	0	738	0.6	90	737.4	33.33%	36.61%	94.87	95.84	0.97	1.03%
4-2	90	708	3.55		704.45						
5-1	0	744	0.37	92	743.63	32.61%	33.45%	96.77	97.01	0.24	0.25%
5-2	92	714	1.15		712.85						
6-1	0	735	0.2	102	734.8	32.35%	34.32%	107.21	107.84	0.63	0.59%
6-2	102	702	2.2		699.8						
7-1	0	717	1.65	108	715.35	32.41%	33.56%	113.53	113.92	0.39	0.34%
7-2	108	682	2.9		679.1						

Engineered Artificial Turf Cover Alternate (EATLC)

It is recommended that the interface stability calculations and the direct shear testing results should be included as part of the construction documentation report for each construction event to confirm conformance.

Response:

Drawings depicting the EATLC have been revised to include the following note: "The interface stability calculations and the direct shear testing results are to be included as part of the construction documentation report for each construction event to confirm conformance with site CQA Plan."

Due to the nature of the site, it is recommended (if not already completed) that the proposed design for the EATLC along with the proposed stormwater management associated with this scenario be reviewed by the manufacture of the closure turf to confirm that the proposed materials are adequate for the application.

Response:

Drawing (Sheet 19A) depicting the EATLC have been revised to include the following note: "The EATLC material shall be designed and installed in accordance with the manufacturer's recommendations including: size and spacing of the diversion berms, locations and lengths of downslope channels, and location and type of erosion control measures including energy dissipaters and any necessary ballast."

Leachate Collection System

However, if there are locations where increases in waste heights occurred over an existing or proposed leachate collection pipe, an evaluation of the pipe strength in those locations are recommended.

Response:

Calculations have been prepared for locations where increases in waste heights occurred over an existing or proposed leachate collection pipe. These calculations, along with a narrative discussion, are located in Attachment A-2 "Pipe Strength and Deflection Calculations" which were included with the original submittal.

Surface Water Management System Design

Has CTI looked at the erosion potential around the corners of the landfill and sloping of the berms following settlement of the final cover?.

Response:

Locations along the diversion berms such as corners will be evaluated for the need of additional erosion control at the time of final detailed design, prior to construction of the final cover.

Information on how the channel design will minimize erosion should be provided.

Response:

Additional potential erosion in the downslopes at the diversion berm discharge locations will be taken into account during final detailed design prior to construction of the final cover.

Additional erosion protection such as geosynthetic liner, riprap, concrete block liner, etc. will be utilized as determined during final detailed design of the downslopes.

Has CTI considered the possibility of the berms being overtopped due primarily to the velocity at which the surface water will flow down the slope?

Response:

New calculation on the overtopping potential are prepared (A-6.10 and K-7). As demonstrated in the attached calculations, the overtopping of the proposed perimeter stormwater berm or ditch will not occur.

A-6.10

Surface Water Berm Overtopping Analysis for Conventional Final Cover

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Berm Overtopping Analysis

Project No.: 23L058
Calculated By: TCR Date: 01/25/2024
Checked By: RB Date: 01/25/2024
Approved By: XZ Date: 01/25/2024

Surface Water Berm Overtopping Analysis

Objective

Evaluate the surface water diversion berms and Northwest Ditch (NWD) for overtopping due to the increased water depth resulting from the velocity of surface water run-off from the landfill sideslopes.

Design Criteria, Assumptions, and Methodology

1. Surface water diversion berms and the NWD collect surface water run-off from the landfill sideslopes. Diversion berm and NWD locations are shown on the Figure provided in Attachment A-6.10.1. For the purposes of this calculation, the NWD and the channel formed by diversion berms will be referred to as the "receiving channel".
2. The surface run-off from the landfill sideslopes will cause a temporary increase in water depth when entering the receiving channel either by creating a hydraulic jump or flowing through the channel and up the containing berm. This increase in depth is calculated by two methods, energy balance formulas and hydraulic jump formulas. The larger of the two is conservatively used in the evaluation summary.
3. Energy balance formulas are used to calculate the maximum height the water will flow up the containment berm based on conservation of energy.
4. The hydraulic jump formulas are based on the Fruede number and are obtained from Figure 7.16 of "Stormwater Modeling and Design", Haestad Methods and S.R. Durrans 2003.
5. Conservatively use the 1.52 inch, 100-yr, 15-min storm event in the analysis. The NOAA Atlas 14 rainfall data is provided in Attachment A-6.1.1.
6. Estimate the peak run-off using two methods, one assumes the average peak run-off and the other uses Manning's Equation and a trapezoidal channel to represent a localized sideslope flow area for design purposes. Conservatively use the larger of the two calculated run-off values.
7. Calculate the average run-off for the storm event assuming 100% run-off (CN=100). As discussed in Attachment A-6.1, a curve number of 84 for "Fair Pasture" represents the proposed final cover conditions, therefore, assuming 100% run-off is conservative.
8. Calculate the localized run-off using Manning's equation and assuming a trapezoidal channel.
9. A Manning's number of 0.15 is used to represent the grass sheet flow areas of the final cover.
10. The slope horizontal length is the slope length draining to the berm or ditch. Conservatively use the largest length for each location, 190 ft for surface water diversion berms and 210 ft for the NWD. The maximum slope of the landfill sideslope draining to the receiving channel is 25% for the surface water diversion berms and 33% for the NWD.
11. Conservatively use shallow concentrated flow and short grass pasture to represent the sheet flow on the slope. Estimate the flow velocity using Figure 15-2, Velocity versus slope for shallow concentrated flow, and the equations from Table 15-2 from the 2008 National Engineering Handbook Part 630 Hydrology (NEH 630).
12. The base flow of water flowing in the receiving channel will provide energy dissipation for run-off entering from the sideslope. This energy dissipation will reduce the calculated water

depth increase. The calculation also uses a 2.0 safety factor. Due to these two factors and the conservative calculation assumptions, additional freeboard is not warranted. The receiving channel will be considered sufficient and the flow will be contained within the receiving channel if the design flow depth plus the increased water depth is less than the receiving channel containment depth.

Calculation

A spreadsheet is used to perform the Manning's Equation, the energy balance equations, and hydraulic jump calculations used to calculate the increased water depth in the surface water diversion berms and NWD. The spreadsheet output is summarized in Table A-6.10.1 and discussed below. Spreadsheet inputs, outputs, and formulas are provided in Attachment A-6.10.2.

Table A-6.10.1: Diversion Berm and NWD Overtopping Summary

Location	Design Flow Depth (A)	Increased Water Depth Due to Sideslope Run-off (B)	Total Depth (A +B)	Containment Depth/Height	Is containment provided? (see Note 1)
Diversion Berm, 2.5' Depth	1.77 ft. (See Note 2)	0.39 ft.	2.16 ft.	2.5 ft. (See Note 2)	Yes
Diversion Berm, 2' Depth	1.30 ft. (See Note 2)	0.39 ft.	1.69 ft.	2.0 ft. (See Note 2)	Yes
NWD	Elev. 710.2 (See Note 3)	0.51 ft.	Elev. 710.71	Elev. 712.0 (See Note 3)	Yes

Notes:
1. In addition to conservative inputs, these calculations include 2.0 Factor of Safety, and do not account for the energy dissipation effects of water flowing in the receiving channel. Therefore, the total depth is conservatively overestimated and is provided for comparison purposes.
2. From Attachment A-6.2, Surface Water Diversion Berm Analysis, two diversion berm depths can be used to represent all the diversion berms receiving run-off from the proposed final cover. For each berm depth the maximum flow depth is used.
3. The NWD flow depth and containment berm depth are discussed in Attachment A-6.4, Surface Water Ditch Analysis.

Conclusion

The proposed diversions berms and NWD will collect surface water run-off and function as designed without overtopping due to surface water run-off from the landfill sideslopes.

ATTACHMENT A-6.10.1

DIVERSION BERM AND NWD LOCATION FIGURE

A-6.10

Maximum 33% slope draining to NWD

Maximum 25% slope draining to 1% berm

Approximate Northwest Ditch (NWD)

AIRPORT SERVICE RD.

MASTER CELL IV

MASTER CELL VI

MASTER CELL VII

MASTER CELL IX

MASTER CELL XI

MASTER CELL X

NWD/MC VII CULVERT 2–12" HDPE 2–18" HDPE

N–MC VII CULVERT, 54" RCP 36" RCP

N–MC IX DITCH

CONTAINMENT BERM

NE–MC IX DITCH

N–MC VII DITCH

MCVII/IX CULVERT 3–24" CMP

TOPO/CONTAINMENT BERM

NSB NORTH INLET CULVERT 54" RCP/HDPE 3–30" CMP

NSB SOUTH INLET CULVERT 3–30" HDPE

NSB–NORTH

LOWER TO ELEV. 693

E–MC IX DITCH

E–MC IX CULVERT 36" HDPE

NSB–SOUTH

MC VII/XI CULVERT 24" RCP

MC VII/IX DITCH

MC VII/XI DITCH

MC X/XI CULVERT 30" HDPE (MIN)

MC X/XI DITCH

SSB EAST INLET CULVERT 30" RCP

SSB–NORTH

SSB–SOUTH

W–MC X DITCH

W–MC X DV (DIVERSION BERM)

E–MC X DV (DIVERSION BERM)

E–MC X DITCH

S–MC X DITCH

LINED POND SEE NOTE 5.

DOWNSLOPE CHANNEL DS–1

DOWNSLOPE CHANNEL DS–2

DOWNSLOPE CHANNEL DS–3

DOWNSLOPE CHANNEL DS–4

DOWNSLOPE CHANNEL DS–5

DOWNSLOPE CHANNEL DS–6

TYPICAL DIVERSION BERM SLOPE –2%

TYPICAL DIVERSION BERM SLOPE– 2%

N–MC VI DITCH

S–MC VI DITCH

MC VI/11 DITCH

EXISTING 30–INCH CMP CULVERT, OVERFLOW REMAINS IN CHANNEL

S–MC XI DV (DIVERSION BERM)

E–MCI CULVERT

E–MC I DITCH

PROPOSED JUNCTION MANHOLE

PROPOSED STORM SEWER

TDU

REST AREA

N. I–94 SERVICE DRIVE

WEST BOUND I–94

DB–1 DB–2 DB–3 DB–4 DB–5 DB–6 DB–7 DB–8 DB–9 DB–10 DB–11 DB–12 DB–14 DB–15 DB–16 DB–17 DB–18 DB–19 DB–20 DB–21 DB–22 DB–23 DB–24 DB–25 DB–26 DB–27 DB–28 DB–29 DB–30 DB–31 DB–32 DB–33 DB–34 DB–35 DB–36 DB–37 DB–38 DB–39 DB–40 DB–41 DB–42 DB–43 DB–44 DB–45 DB–46

210'

190'

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN DECEMBER, 2020 BY WDI.
2. THE DESIGN SURFACE SHOWN REPRESENTS THE MCVI FINAL GRADES – 2021 REDESIGN BY CTI.
3. CONVEYANCE SYSTEMS ARE DESIGNED TO COLLECT AND CONTROL THE RUNOFF FROM AT LEAST A 25–YR, 24–HR STORM AND MANAGE A 100–YR, 24–HR STORM.
4. SURFACE WATER MANAGEMENT SYSTEM DESIGN INFORMATION PROVIDED IN APPENDIX A. ALTERNATE CONFIGURATIONS AND MATERIALS THAT MEET DESIGN CRITERIA MAY BE UTILIZED..
5. THIS EXPANSION REDUCES THE DRAINAGE AREA TO THE LINED POND. THEREFORE THE DESIGN OF THE LINED POND, LINED POND SEWER, AND ASSOCIATED DRAINAGE AREA WILL CONTINUE TO FUNCTION AS ORIGINALLY DESIGNED AND IS NOT PART OF THE SSB DRAINAGE AREA.

N

0 200 400

SCALE IN FEET

LEGEND

- 500 EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- DIVERSION BERM
- WATERSHED BOUNDARY
- DITCH FLOW PATH
- DIVERSION BERM
- DOWNSLOPE CHANNEL
- SOUTH SEDIMENTATION BASIN STORM SEWER
- LINED POND STORM SEWER
- CULVERT
- CATCH BASIN, CURB STYLE
- CATCH BASIN INLET
- STORM MANHOLE COVER
- LINED POND WATERSHED (NOT MODELED)
- CONTAINMENT BERM
- PROPOSED STORM SEWER
- PROPOSED CATCH BASIN/MANHOLE

DATE: 01/29/24
DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	APP
			DRN

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI - REV I
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

DIVERSION BERM AND NWD LOCATIONS

PROJECT NUMBER 1218070017
SCALE 1" = 200'
DRAWING NO A-6.10.1
FIGURE 1

ATTACHMENT A-6.10.2

WATER DEPTH INCREASE SPREADSHEET RESULTS

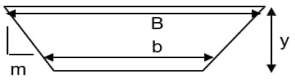
2021 WDI Permit Modification App.

Location: NWD

Slope Horizontal Length	210	ft	Rain (NOAA Atlas 14, 100-yr, 15 min)	1.52	in
Slope	33%		Width	10.01	ft
Sheet Flow (NEH 630)	3.996	ft/s	Q (average, assuming CN=100)	0.296	cfs
Short grass pasture					
Base Flow in Ditch	0	inch,	0 ft;	Not includeded here, discussed in calculation.	

Localized Concentrated Flow on Sideslope

$$Q = \frac{1.49}{n} A R_h^{2/3} S^{1/2}$$



S	33.00%	b (ft)	10
n	0.15	y (ft)	0.0427
		m1 (H)	0.1
		m2 (H)	0.1
		Required Q (ft3/s)	0.296
B	10.01	**Q (ft3/s)**	**0.296**
P	10.09	Q (gpm)	133
A	0.43	Q (gpd)	191172
Rh	0.042322312		
		V (ft/s)	**0.693**

0.000

Water Level Rise in Ditch (Energy Balance)

$$y_1 + \frac{V_1^2}{2g} = y_2 + \frac{V_2^2}{2g}$$

Assuming $V_2 = 0$

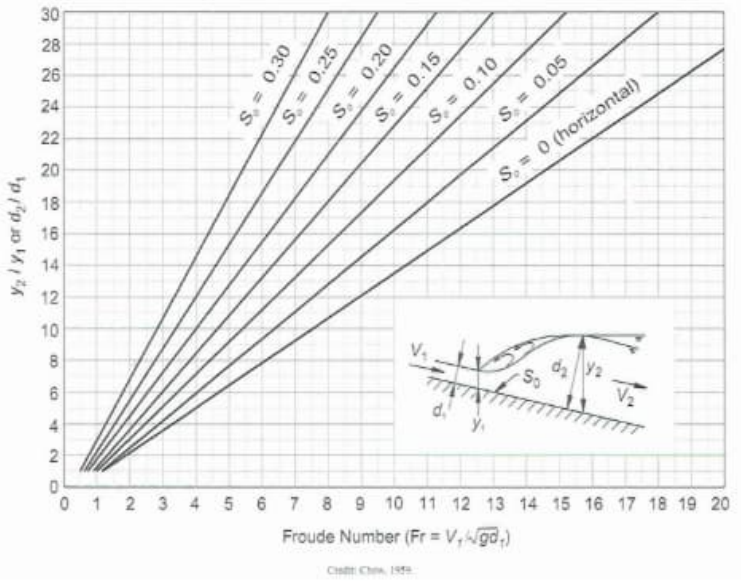
$$y_2 = \frac{V_1^2}{2g} + y_1$$

V	y1	y2
(ft/s)	(ft)	(ft)
0.693	0.043	**0.0501**
3.996	0.007	**0.2554**

Hydraulic Jump on Slope (Energy Balance)

V	y1	Fr	y2/y1	y2
(ft/s)	(ft)			(ft)
0.693	0.0427	0.59	no jump	**0.0427**
3.996	0.0074	8.19	13.01	**0.0962**

Figure 7.16
Ratio of downstream to upstream depths for a hydraulic jump in a rectangular channel as a function of the channel slope and upstream Froude number



From Figure 7.16	
Down Slope	5%
Fr	y2/y1
2	2.31
16	26.5
a	**1.728**
b	**-1.146**

Required Ditch Depth	
FS	**2**
H (ft)	**0.51**

Source: Haestad Methods and S.R. Durrans 2003, "Stormwater Conveyance Modeling and Design", Haestad Methods, CT Page 262 Figure 7.16

2021 WDI Permit Modification App.

Location: Diversion Berm

Slope Horizontal Length	190	ft	Rain (NOAA Atlas 14, 100-yr, 15 min)	1.52	in
Slope	25%		Width	10.01	ft
Sheet Flow (NEH 630)	3.479	ft/s	Q (average, assuming CN=100)	0.268	cfs
Short grass pasture					
Base Flow in Ditch	0	inch,	0 ft;	Not includeded here, discussed in calculation.	

Localized Concentrated Flow on Sideslope

$$Q = \frac{1.49}{n} A R_h^{2/3} S^{1/2}$$

S	25.00%	b (ft)	10
n	0.15	y (ft)	0.0437
		m1 (H)	0.1
		m2 (H)	0.1
		Required Q (ft3/s)	0.268
B	10.01	**Q (ft3/s)**	**0.268**
P	10.09	Q (gpm)	120
A	0.44	Q (gpd)	172969
Rh	0.043312686		
		V (ft/s)	**0.613**

0.000

Water Level Rise in Ditch (Energy Balance)

$$y_1 + \frac{V_1^2}{2g} = y_2 + \frac{V_2^2}{2g}$$

Assuming $V_2 = 0$

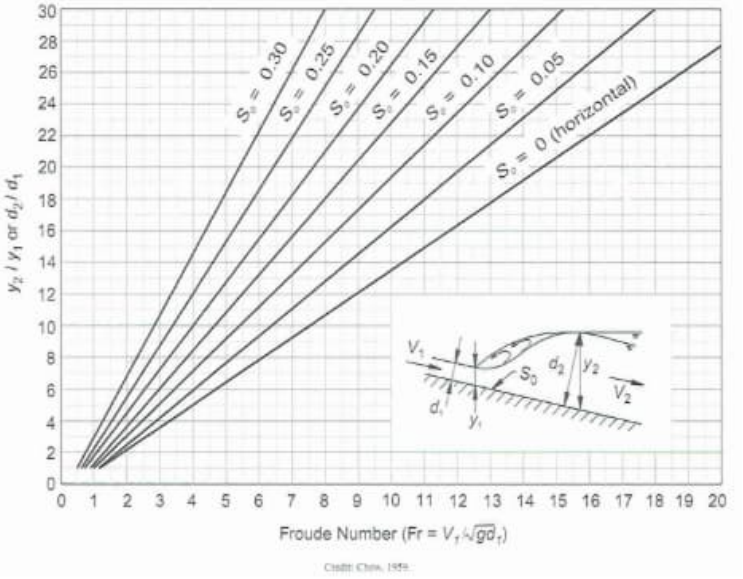
$$y_2 = \frac{V_1^2}{2g} + y_1$$

V	y1	y2
(ft/s)	(ft)	(ft)
0.613	0.044	**0.0495**
3.479	0.008	**0.1956**

Hydraulic Jump on Slope (Energy Balance)

V	y1	Fr	y2/y1	y2
(ft/s)	(ft)			(ft)
0.613	0.0437	0.52	no jump	**0.0437**
3.479	0.0077	6.99	10.93	**0.0841**

Figure 7.16
Ratio of downstream to upstream depths for a hydraulic jump in a rectangular channel as a function of the channel slope and upstream Froude number



From Figure 7.16	
Down Slope	5%
Fr	y2/y1
2	2.31
16	26.5
a	**1.728**
b	**-1.146**

Required Ditch Depth	
FS	**2**
H (ft)	**0.39**

Source: Haestad Methods and S.R. Durrans 2003, "Stormwater Conveyance Modeling and Design", Haestad Methods, CT Page 262 Figure 7.16

K-7

Surface Water Berm Overtopping Analysis for Engineered Turf Final Cover

CALCULATION SHEET
Client: US Ecology - Wayne Disposal
Project: 2021 WDI Permit Modification Application
Calculation: Surface Water Berm Overtopping Analysis

Project No.: 23L058
Calculated By: TCR Date: 01/25/2024
Checked By: RB Date: 01/25/2024
Approved By: XZ Date: 01/25/2024

Surface Water Berm Overtopping Analysis -Engineered Turf

Objective

Evaluate the surface water diversion berms and Northwest Ditch (NWD) for overtopping due to the increased water depth resulting from the velocity of surface water run-off from the landfill sideslopes.

Design Criteria, Assumptions, and Methodology

1. Surface water diversion berms and the NWD collect surface water run-off from the landfill sideslopes. Diversion berm and NWD locations are shown on the Figure provided in Attachment K-7.1. For the purposes of this calculation, the NWD and the channel formed by diversion berms will be referred to as the "receiving channel".
2. The surface run-off from the landfill sideslopes will cause a temporary increase in water depth when entering the receiving channel either by creating a hydraulic jump or flowing through the channel and up the containing berm. This increase in depth is calculated by two methods, energy balance formulas and hydraulic jump formulas. The larger of the two is conservatively used in the evaluation summary.
3. Energy balance formulas are used to calculate the maximum height the water will flow up the containment berm based on conservation of energy.
4. The hydraulic jump formulas are based on the Fruede number and are obtained from Figure 7.16 of "Stormwater Modeling and Design", Haestad Methods and S.R. Durrans 2003.
5. Conservatively use the 1.52 inch, 100-yr, 15-min storm event in the analysis. The NOAA Atlas 14 rainfall data is provided in Attachment K-1.1.
6. Estimate the peak run-off using two methods, one assumes the average peak run-off and the other uses Manning's Equation and a trapezoidal channel to represent a localized sideslope flow area for design purposes. Conservatively use the larger of the two calculated run-off values.
7. Calculate the average run-off for the storm event assuming 100% run-off (CN=100). As discussed in Attachment K-1.1, a curve number of 95 represents the proposed engineered artificial turf final cover, therefore, assuming 100% run-off is conservative.
8. Calculate the localized run-off using Manning's equation and assuming a trapezoidal channel.
9. The slope horizontal length is the slope length draining to the berm or ditch. Conservatively use the largest length for each location, 690 ft for surface water diversion berms and 920 ft for the NWD. The maximum slope of the landfill sideslope draining to the receiving channel is 25% for the surface water diversion berms and 33% for the NWD.
10. A Manning's number of 0.12 is used to represent the engineered turf sheet flow areas of the final cover based on Closure Turf manufacturer recommendations.
11. The engineered turf component of an artificial engineered turf final cover gives the natural look and feel of grass. The manufacturer recommended Manning's number for Closure Turf is similar to typical short grass sheet flow values. Engineered artificial turf is assumed to perform similar to short grass when estimating surface water flow on the landfill surface.
12. Conservatively use shallow concentrated flow and short grass pasture to represent the sheet flow on the slope. Estimate the flow velocity using Figure 15-2, Velocity versus slope for

shallow concentrated flow, and the equations from Table 15-2 from the 2008 National Engineering Handbook Part 630 Hydrology (NEH 630).

13. The base flow of water flowing in the receiving channel will provide energy dissipation for run-off entering from the sideslope. This energy dissipation will reduce the calculated water depth increase. The calculation also uses a 2.0 safety factor. Due to these two factors and the conservative calculation assumptions, additional freeboard is not warranted. The receiving channel will be considered sufficient, and the flow will be contained within the receiving channel if the design flow depth plus the increased water depth is less than the receiving channel containment depth.

Calculation

A spreadsheet is used to perform the Manning's Equation, the energy balance equations, and hydraulic jump calculations used to calculate the increased water depth in the surface water diversion berms and NWD. The spreadsheet output is summarized in Table K-7.1 and discussed below. Spreadsheet inputs, outputs, and formulas are provided in Attachment K-7.2.

Table K-7.1: Diversion Berm and NWD Overtopping Summary

Location	Design Flow Depth (A)	Increased Water Depth Due to Sideslope Run-off (B)	Total Depth (A +B)	Containment Depth/Height	Is containment provided? (see Note 1)
Diversion Berm, 3.0' Depth	2.37 ft. (See Note 2)	0.43 ft	2.80 ft	3.0 ft. (See Note 2)	Yes
Diversion Berm, 2.5' Depth	1.58 ft. (See Note 2)	0.43 ft	2.01 ft	2.5 ft. (See Note 2)	Yes
Diversion Berm, 2' Depth	0.69 ft. (See Note 2)	0.43 ft	1.12 ft.	2.0 ft. (See Note 2)	Yes
NWD	Elev. 710.2 (See Note 3)	0.56 ft	Elev. 710.76	Elev. 712.0 (See Note 3)	Yes

Notes:
1. In addition to conservative inputs, these calculations include 2.0 Factor of Safety, and do not account for the energy dissipation effects of water flowing in the receiving channel. Therefore, the total depth is conservatively overestimated and is provided for comparison purposes.
2. From Attachment K-2, Surface Water Diversion Berm Analysis -Engineered Turf, three diversion berm depths can be used to represent all the diversion berms receiving run-off from the proposed final cover. For each berm depth the maximum flow depth is used.
3. The NWD flow depth and containment berm depth are discussed in Attachment K-3, Surface Water Ditch Analysis -Engineered Turf.
4. The diversion berm depths are identified on the Figure provided in Attachment K-7.1.

Conclusion

The proposed diversions berms and NWD will collect surface water run-off and function as designed without overtopping due to surface water run-off from the landfill sideslopes with artificial engineered turf final cover.

ATTACHMENT K-7.1

DIVERSION BERM AND NWD
LOCATION FIGURE – ENGINEERED TURF

K-7

Approximate Northwest Ditch (NWD)

Maximum 33% slope draining to NWD

Maximum 25% slope draining to 1% berm

920'

690'

AIRPORT SERVICE RD.

NWD/MC VII CULVERT
3–30" HDPE
1–18" HDPE

N–MC VII CULVERT,
54" RCP
36" RCP

N–MC IX DITCH

CONTAINMENT BERM

NE–MC IX DITCH

N–MC VII DITCH

MCVII/IX CULVERT
3–24" CMP

TOPO/CONTAINMENT BERM

MASTER CELL IV

MASTER CELL VI

MASTER CELL VII

MASTER CELL IX

MASTER CELL XI

MASTER CELL X

DB–B

Berm Depth: 3 ft

DB–C

Berm Depth: 3 ft

TYPICAL DIVERSION BERM SLOPE– 2%

MC VII/XI CULVERT
24" RCP

MC VII/IX DITCH

MC VII/XI DITCH

MC X/XI CULVERT
30" HDPE (MIN)

MC X/XI DITCH

NSB NORTH INLET CULVERT
54" RCP/HDPE
3–30" CMP

CONTAINMENT BERM

NSB–NORTH

LOWER TO ELEV. 693

E–MC IX DITCH

E–MC IX CULVERT
36" HDPE

NSB–SOUTH

EXISTING 30–INCH CMP CULVERT, OVERFLOW REMAINS IN CHANNEL

MC VI/XI DITCH

S–MC XI DV (DIVERSION BERM)

SSB EAST INLET CULVERT 30" RCP

Berm Depth: 2.5 ft

DB–D–2

DB–D–1

DB–E

DB–F

DB–G

DB–H

Berm Depth: 2 ft

Berm Depth: 3 ft

DB–A–2

DB–A–1

TYPICAL DIVERSION BERM SLOPE –2%

RIPRAP FLOW DIFFUSER

E–MCI CULVERT
24" CPP

E–MC I DITCH

Berm Depth: 2.5 ft

JUNCTION MANHOLE

PROPOSED STORM SEWER

I–94 SERVICE DRIVE

CONTAINMENT BERM

REST AREA

DB–46

SSB–NORTH

SSB–SOUTH

W–MC X DITCH

W–MC X DV (DIVERSION BERM)

CONTAINMENT BERM

E–MC X DV (DIVERSION BERM)

E–MC X DITCH

S–MC X DITCH

LINED POND SEE NOTE 5.

N. I–94 SERVICE DRIVE

WEST BOUND I–94

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN DECEMBER, 2020 BY WDI.
2. THE DESIGN SURFACE SHOWN REPRESENTS THE MCVI FINAL GRADES – 2021 REDESIGN BY CTI.
3. CONVEYANCE SYSTEMS ARE DESIGNED TO COLLECT AND CONTROL THE RUNOFF FROM AT LEAST A 25–YR, 24–HR STORM AND MANAGE A 100–YR, 24–HR STORM.
4. SURFACE WATER MANAGEMENT SYSTEM DESIGN INFORMATION FOR ENGINEERED TURF FINAL COVER PROVIDED IN APPENDIX K. ALTERNATE CONFIGURATIONS AND MATERIALS THAT MEET DESIGN CRITERIA MAY BE UTILIZED.
5. THIS EXPANSION REDUCES THE DRAINAGE AREA TO THE LINED POND. THEREFORE THE DESIGN OF THE LINED POND, LINED POND SEWER, AND ASSOCIATED DRAINAGE AREA WILL CONTINUE TO FUNCTION AS ORIGINALLY DESIGNED AND IS NOT PART OF THE SSB DRAINAGE AREA.

N

0 200 400

SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- DIVERSION BERM
- WATERSHED BOUNDARY
- DITCH FLOW PATH
- DIVERSION BERM
- RIPRAP FLOW DIFFUSER
- SOUTH SEDIMENTATION BASIN STORM SEWER
- LINED POND STORM SEWER
- CULVERT
- CATCH BASIN, CURB STYLE
- CATCH BASIN INLET
- STORM MANHOLE COVER
- LINED POND WATERSHED (NOT MODELED)
- CONTAINMENT BERM
- PROPOSED STORM SEWER
- PROPOSED CATCH BASIN/MANHOLE

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DESIGNED BY:	
DRAWN BY:	
CHECKED BY:	
APPROVED BY:	

REVISIONS				
REV	DATE	REVISION DESCRIPTION	DRN	APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

DIVERSION BERM AND NWD LOCATIONS - ENGINEERED TURF

PROJECT NUMBER
1218070017

SCALE
AS NOTED

DRAWING NO
K-7.1
FIGURE 1

ATTACHMENT K-7.2

WATER DEPTH INCREASE SPREADSHEET RESULTS

2021 WDI Permit Modification App.

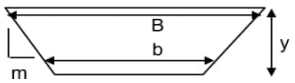
Location: NWD -Eng. Turf

Slope Horizontal Length	920	ft	Rain (NOAA Atlas 14, 100-yr, 15 min)	1.52	in
Slope	33%		Width	10.02	ft
Sheet Flow (NEH 630)	3.996	ft/s	Q (average, assuming CN=100)	1.297	cfs
Short grass pasture					
Base Flow in Ditch	0	inch,	0 ft;	Not includeded here, discussed in calculation.	

Localized Concentrated Flow on Sideslope

$$Q = \frac{1.49}{n} A R_h^{2/3} S^{1/2}$$

S	33.00%	b (ft)	10
n	0.12	y (ft)	0.0909
		m1 (H)	0.1
		m2 (H)	0.1



		Required Q (ft3/s)	1.297	
B	10.02	**Q (ft3/s)**	**1.297**	*0.000*
P	10.18	Q (gpm)	582	
A	0.91	Q (gpd)	838319	
Rh	0.089355429			
		V (ft/s)	**1.426**	

Water Level Rise in Ditch (Energy Balance)

$$y_1 + \frac{V_1^2}{2g} = y_2 + \frac{V_2^2}{2g}$$

Assuming $V_2 = 0$

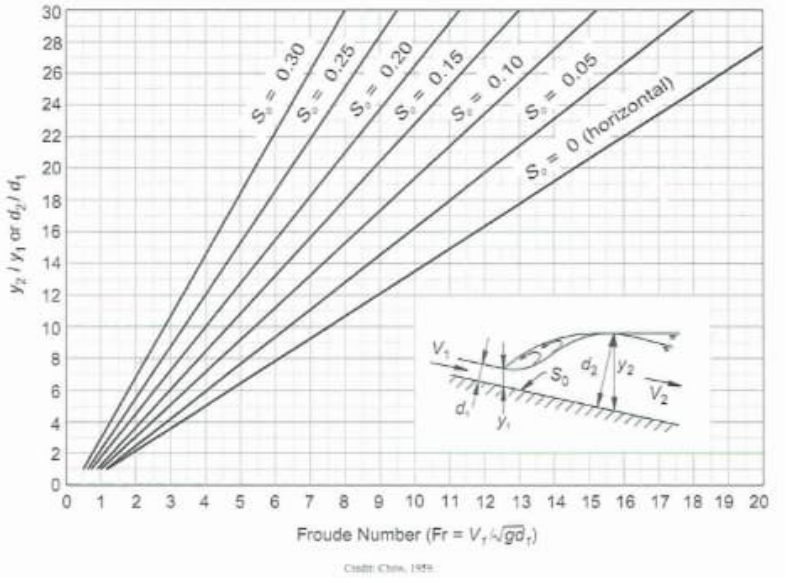
$$y_2 = \frac{V_1^2}{2g} + y_1$$

V	y1	y2
(ft/s)	(ft)	(ft)
1.426	0.091	**0.1225**
3.996	0.032	**0.2804**

Hydraulic Jump on Slope (Energy Balance)

V	y1	Fr	y2/y1	y2
(ft/s)	(ft)			(ft)
1.426	0.0909	0.83	no jump	**0.0909**
3.996	0.0324	3.91	5.62	**0.1819**

Figure 7.16
Ratio of downstream to upstream depths for a hydraulic jump in a rectangular channel as a function of the channel slope and upstream Froude number



Source: Haestad Methods and S.R. Durrans 2003, "Stormwater Conveyance Modeling and Design", Haestad Methods, CT Page 262 Figure 7.16

From Figure 7.16	
Down Slope	5%
Fr	y2/y1
2	2.31
16	26.5
a	**1.728**
b	**-1.146**

Required Ditch Depth	
FS	**2**
H (ft)	**0.56**

2021 WDI Permit Modification App.

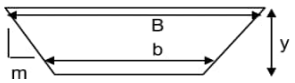
Location: Diversion Berm -Eng. Turf

Slope Horizontal Length	690	ft	Rain (NOAA Atlas 14, 100-yr, 15 min)	1.52	in
Slope	25%		Width	10.02	ft
Sheet Flow (NEH 630)	3.479	ft/s	Q (average, assuming CN=100)	0.973	cfs
Short grass pasture					
Base Flow in Ditch	0	inch,	0 ft;	Not includeded here, discussed in calculation.	

Localized Concentrated Flow on Sideslope

$$Q = \frac{1.49}{n} A R_h^{2/3} S^{1/2}$$

S	25.00%	b (ft)	10
n	0.12	y (ft)	0.0831
		m1 (H)	0.1
		m2 (H)	0.1



		Required Q (ft3/s)	0.973	
B	10.02	**Q (ft3/s)**	**0.973**	*0.000*
P	10.17	Q (gpm)	437	
A	0.83	Q (gpd)	628641	
Rh	0.081788387			
		V (ft/s)	**1.170**	

Water Level Rise in Ditch (Energy Balance)

$$y_1 + \frac{V_1^2}{2g} = y_2 + \frac{V_2^2}{2g}$$

Assuming $V_2 = 0$

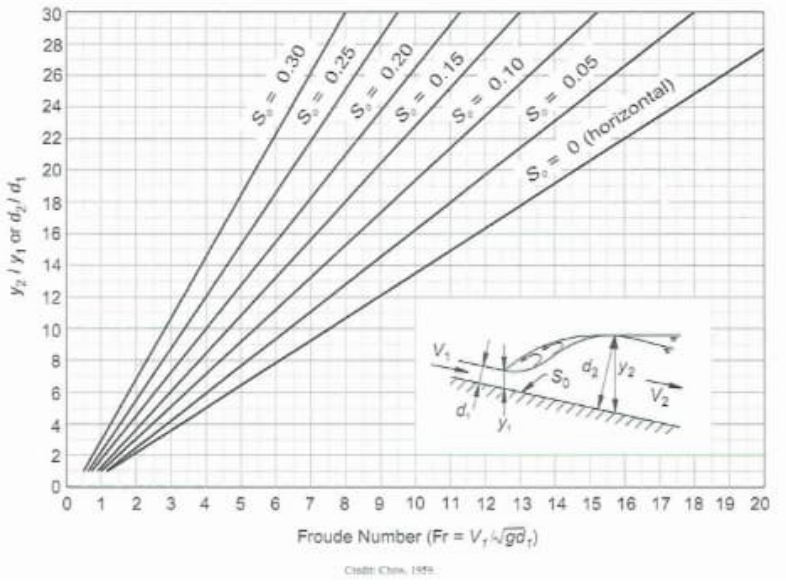
$$y_2 = \frac{V_1^2}{2g} + y_1$$

V	y1	y2
(ft/s)	(ft)	(ft)
1.170	0.083	**0.1043**
3.479	0.028	**0.2158**

Hydraulic Jump on Slope (Energy Balance)

V	y1	Fr	y2/y1	y2
(ft/s)	(ft)			(ft)
1.170	0.0831	0.72	no jump	**0.0831**
3.479	0.0279	3.67	5.19	**0.1450**

Figure 7.16
Ratio of downstream to upstream depths for a hydraulic jump in a rectangular channel as a function of the channel slope and upstream Froude number



Source: Haestad Methods and S.R. Durrans 2003, "Stormwater Conveyance Modeling and Design", Haestad Methods, CT Page 262 Figure 7.16

From Figure 7.16	
Down Slope	5%
Fr	y2/y1
2	2.31
16	26.5
a	**1.728**
b	**-1.146**

Required Ditch Depth	
FS	**2**
H (ft)	**0.43**

Attachment 2

Engineering Plans

WAYNE DISPOSAL, INC. SITE NO. 2
MASTER CELL VI-F&G

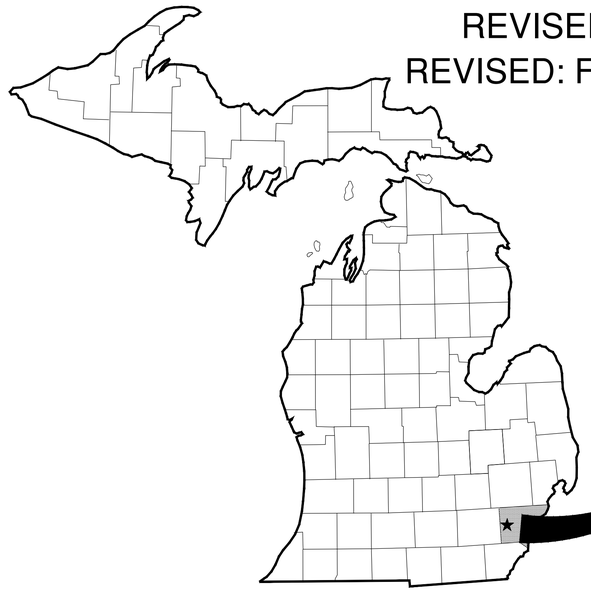
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CTI PROJECT NO.1218070017

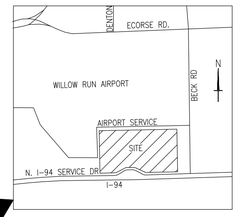
FEBRUARY 2011
REVISED: SEPTEMBER 2011
REVISED: MAY 2018
REVISED: MAY 2021
REVISED: JULY 2021
REVISED: AUGUST 2021
REVISED: NOVEMBER 2021
REVISED: MAY 2022
REVISED: FEBRUARY 2024

OWNER:
Wayne Disposal, Inc.
49350 N. I-94 Service Drive
Belleville, Michigan 48111

ENGINEER:
CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, Michigan 48377



MICHIGAN
APPROX. SCALE: 1"=50 MILES



LOCATION MAP- WAYNE COUNTY
NO SCALE

SHEET INDEX

01	TITLE SHEET
02	GENERAL SITE PLAN
03	CONSTRUCTION PHASING
04	TOP OF SUBGRADE GRADING PLAN
05	TOP OF SECONDARY LINER GRADING PLAN
06	TOP OF PRIMARY LINER GRADING PLAN
07	LEACHATE MANAGEMENT PLAN
08	FINAL COVER GRADING PLAN (1 OF 2)
09	FINAL COVER GRADING PLAN (2 OF 2)
10	STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)
10 A	ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)
11	STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)
11 A	ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)
12	CROSS SECTION (1 OF 3)
13	CROSS SECTION (2 OF 3)
14	CROSS SECTION (3 OF 3)
15	LINER SYSTEM DETAILS (1 OF 2)
16	LINER SYSTEM DETAILS (2 OF 2)
17	GEOSYNTHETIC MATERIALS REQUIREMENTS
18	LEACHATE COLLECTION SYSTEM DETAILS
18A	LEAK DETECTION AND LEACHATE SYSTEM FOR MC VI F4 EAST
18B	CONNECTION DETAILS FOR MC VI-E PHASE 2 WEST LEAK DETECTION SUMP
19	FINAL COVER DETAILS
19 A	ENGINEERED TURF FINAL COVER DETAILS
20	STORMWATER MANAGEMENT SYSTEM DETAILS
20 A	ENGINEERED TURF STORMWATER MANAGEMENT SYSTEM DETAILS
21	CONCEPTUAL GAS VENTING SYSTEM

CTI and Associates, Inc.
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Novi, Michigan 48377
248.465.5100 fax 248.486.5050
www.ctiengineers.com

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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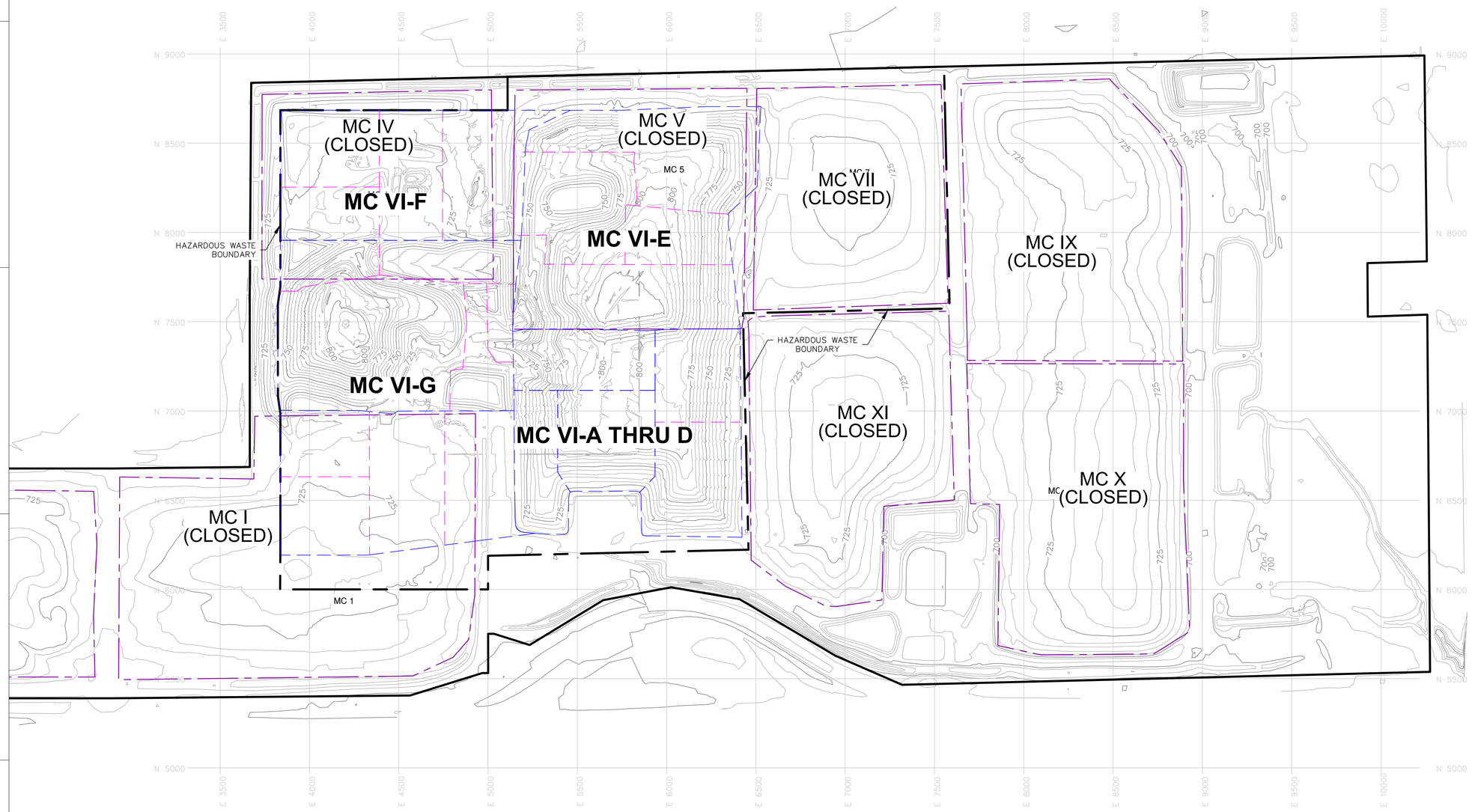
REV	DATE	REVISION DESCRIPTION	DRN	APP
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN	XZ
J	05/18/22	SUBCELLS G4-G6 REVISIONS	LEH	XZ
I	10/08/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG	XZ
H1	5/10/22	REVISED LINER GRADES IN F3	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	5/28/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
E	5/29/18	ADDENDUM 1	PAA	XZ
D	5/08/18	REV. BASED ON MDEQ'S COMMENTS	PAA	XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ
B	9/23/11	PERMIT MDEQ COMMENTS		DRL
A	6/10/11	PHASING DESIGNATIONS		DRL

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TITLE SHEET

PROJECT NUMBER 1218070017
SCALE NONE
DRAWING NO 01



0 300 600

SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- PREVIOUSLY PERMITTED HAZARDOUS WASTE BOUNDARY
- PROPERTY BOUNDARY
- SUBCELL BOUNDARY
- CELL BOUNDARY
- CELL BOUNDARY (CLOSED)

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.

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DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN	APP
F	05/17/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ

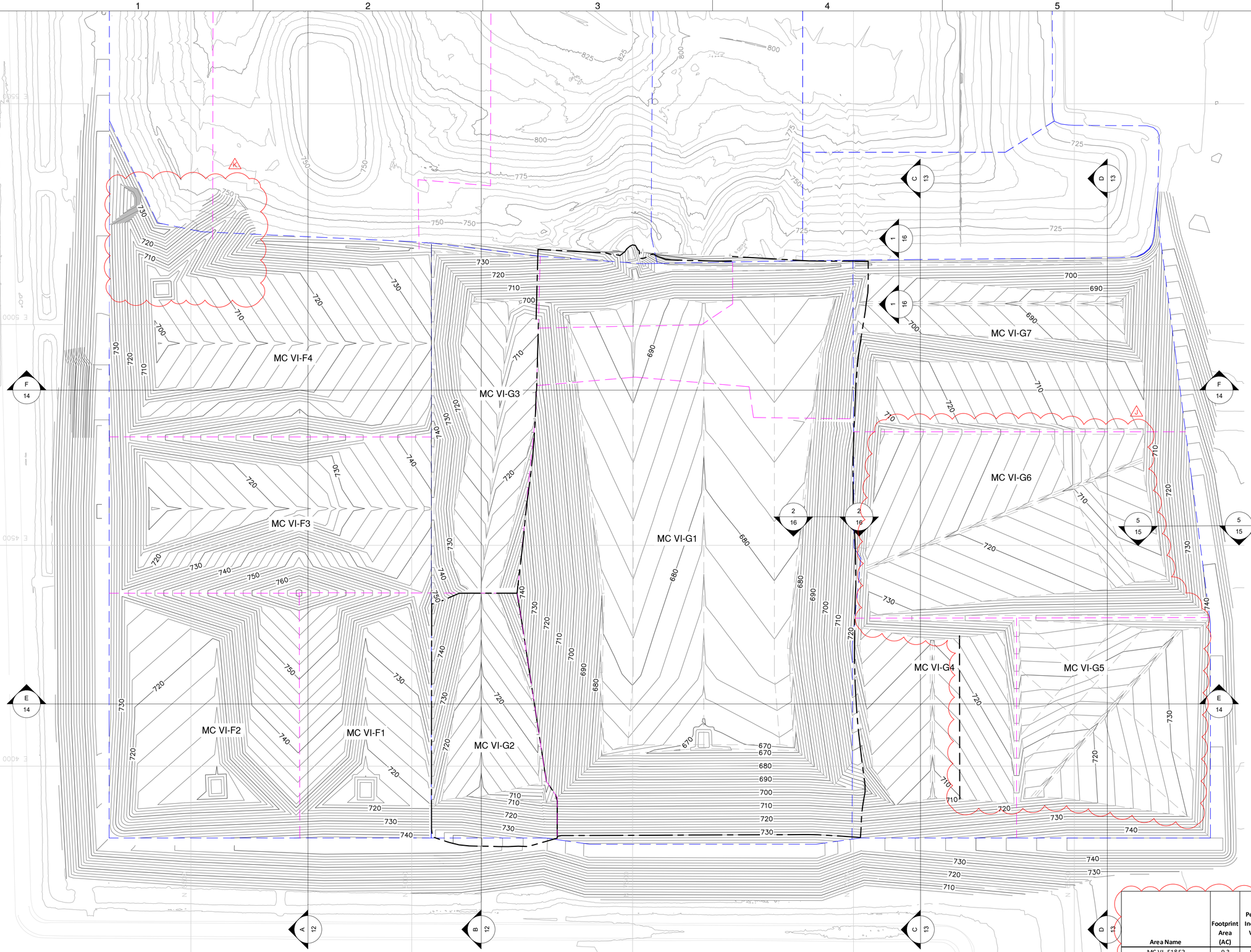
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

GENERAL SITE PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 300'

DRAWING NO
02



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- PROPERTY BOUNDARY
- 500 — MASTER CELL VI-F & G MAJOR CONTOURS
- MASTER CELL VI-F & G MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- AS-BUILT BOUNDARY

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES DEPICTED IN MC VI G4–G7 REPRESENT REDESIGN TOP OF PRIMARY LINER. GRADES DEPICTED IN MC VI G3 AND MC VI F1–F4 REPRESENT PERMITTED TOP OF PRIMARY LINER. GRADES DEPICTED IN MC VI G1 AND G2 REPRESENT AS–BUILT TOP OF PRIMARY LINER.

Area Name	Footprint Area (AC)	2018 Permitted Incremetal Volume (CY)	2021 Proposed Incremetal Volume Rev. I (CY)	2022 Proposed Incremetal Volume Rev. J (CY)	2024 Proposed Incremetal Volume Rev. K (CY)	Volume Adjustment from 2018 Permit Rev. K (CY)
MC VI- F1&F2	9.3	810,822	779,386	779,386	779,386	-31,436
MC VI- F3&F4	12.9	1,865,000	1,854,314	1,854,314	1,860,480	-4,520
MC VI - G1	19.9	2,354,444	2,354,444	2,354,444	2,354,444	0
MC VI- G2&G3	7.2	796,778	785,806	785,806	785,806	-10,972
MC VI- G4	5.3	694,662	678,662	674,689	674,689	-19,973
MC VI- G5	5.5	490,000	364,000	561,933	561,933	71,933
MC VI- G6	7.4	3,598,173	3,650,173	3,648,588	3,648,588	50,415
MC VI- G7	5.5	1,120,000	1,213,000	1,129,083	1,129,083	9,083
Final Grade Changes	-		3,871,240	3,871,240	4,412,664	4,412,664
Engineered Artificial Turf Cover	-		-	687,764	687,764	687,764
Total	**73**	**11,729,879**	**16,238,789**	**16,347,247**	**16,894,837**	**5,164,958**

REVISIONS	DATE	DRN	APP
K	02/23/24	AN	XZ
J	05/18/22	LEH	XZ
I	10/08/21	WRG	XZ
H1	5/10/22	LEH	XZ
H	8/25/21	LEH	XZ
G	7/14/21	WRG	XZ
F	11/20/20	PJA	XZ
C	5/02/18	DRN	APP

REV	DATE	REVISION DESCRIPTION
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS
J	05/18/22	SUBCELLS G4–G6 REVISIONS
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES
H1	5/10/22	REVISED LINER GRADES IN F3
H	8/25/21	RESPONSE TO EGLE COMMENTS
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS
F	11/20/20	SUBCELLS F1–F4 REVISIONS
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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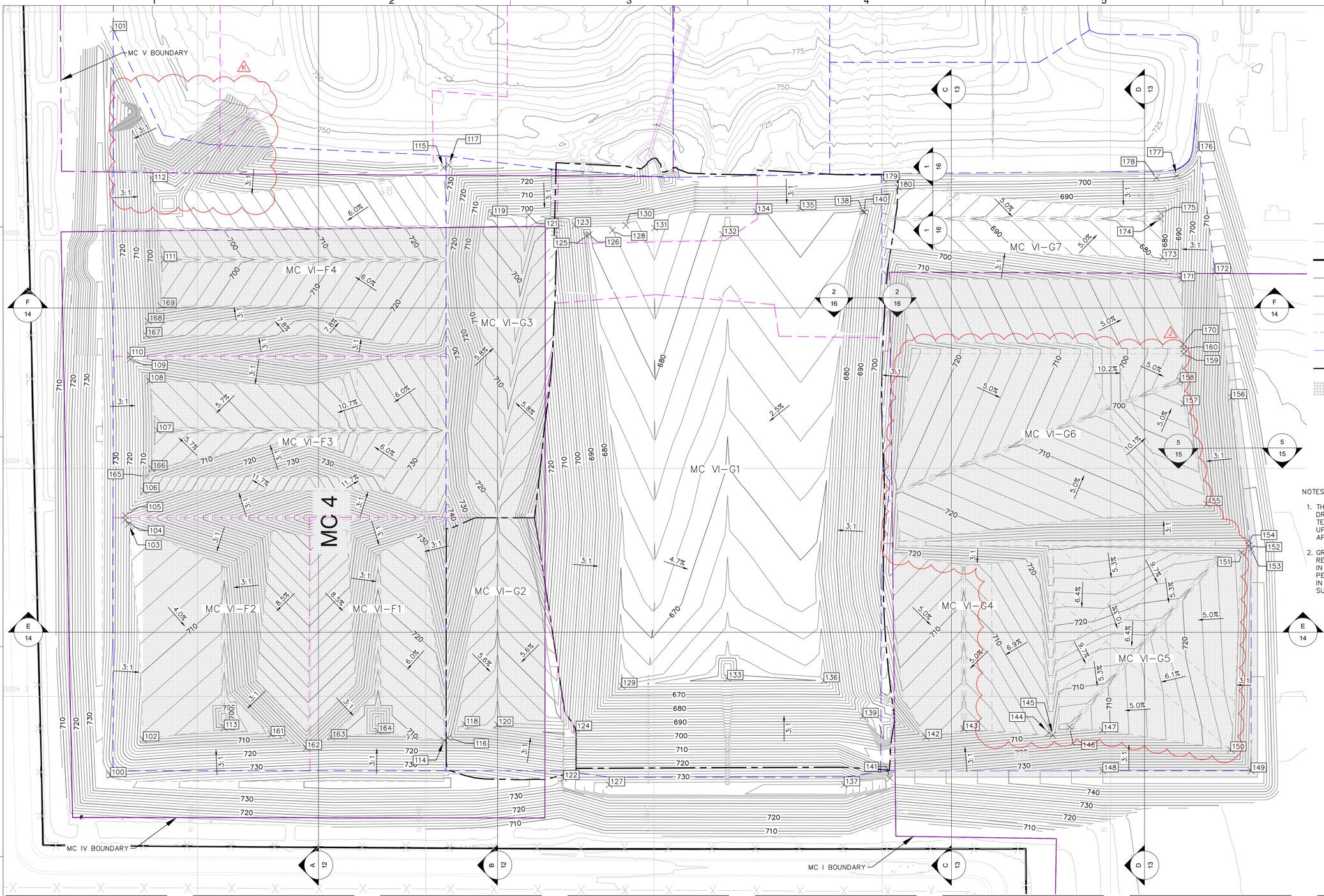
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CONSTRUCTION PHASING

PROJECT NUMBER 1218070017
SCALE 1" = 100'
DRAWING NO 03



LEGEND

- EXISTING MAJOR CONTOURS
- EXISTING MAJOR CONTOURS
- PROPERTY BOUNDARY
- MASTER CELL VI–F & G MAJOR CONTOURS
- MASTER CELL VI–F & G MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- AS–BUILT BOUNDARY
- AREA TO BE COVERED BY GEOGRID
- DIKE COORDINATE POINT NO.
- SLOPE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES DEPICTED IN MC VI G4–G7 REPRESENT REDESIGN TOP OF SUBGRADE. GRADES DEPICTED IN MC VI G3 AND MC VI F1–F4 REPRESENT PERMITTED TOP OF SUBGRADE. GRADES DEPICTED IN MC VI G1–G2 REPRESENT AS–BUILT TOP OF SUBGRADE.

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
100	8690.50	3827.42	734.59
101	8685.01	5462.64	720.71
102	8618.55	3905.51	705.52
103	8651.01	4377.72	720.55
104	8658.02	4387.32	722.90
105	8657.98	4396.41	722.90
106	8617.74	4450.87	709.61
107	8587.22	4583.16	699.69
108	8605.02	4692.10	704.63
109	8647.15	4739.42	718.12
110	8647.41	4748.52	718.10

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
111	8573.16	4957.47	690.00
112	8597.34	5131.53	698.08
113	8441.35	3931.51	700.30
114	7959.71	3904.14	712.08
115	7960.81	5158.83	731.11
116	7951.05	3909.68	712.00
117	7949.45	5164.97	732.77
118	7913.92	3939.16	705.45
119	7853.52	5057.82	696.85
120	7842.73	3938.19	702.00
121	7774.33	5054.99	702.31

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
122	7697.89	3821.03	730.74
123	7672.54	5032.68	686.26
124	7670.81	3928.84	694.50
125	7647.66	5010.45	678.68
126	7641.99	5012.71	680.19
127	7597.89	3806.80	735.60
128	7591.06	5021.51	682.01
129	7570.41	4023.20	663.24
130	7561.67	5032.75	683.13
131	7498.71	5027.05	685.09
132	7349.00	5012.85	678.14

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
133	7338.74	4040.41	658.10
134	7276.06	5062.38	679.69
135	7179.18	5070.45	681.75
136	7127.70	4034.87	660.23
137	7083.24	3807.01	736.24
138	7043.49	5064.48	678.89
139	7042.16	3957.20	684.60
140	7039.03	5062.00	677.47
141	6983.25	3821.03	729.35
142	6904.32	3911.10	702.78
143	6821.02	3928.71	699.29

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
144	6635.43	3920.12	709.62
145	6626.33	3915.27	709.38
146	6589.57	3933.24	704.54
147	6517.71	3925.72	709.11
148	6516.74	3837.32	738.70
149	6191.88	3837.32	738.70
150	6236.64	3883.43	723.04
151	6213.12	4315.18	726.74
152	6196.33	4331.76	732.33
153	6191.88	4323.06	733.99
154	6197.28	4340.86	732.32

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
155	6289.21	4421.83	704.87
156	6235.08	4655.62	730.74
157	6339.21	4642.09	695.71
158	6347.00	4692.65	692.54
159	6339.40	4751.42	694.40
160	6339.09	4761.72	694.38
161	8338.55	3917.48	706.54
162	8261.82	3887.03	717.74
163	8206.84	3910.54	710.69
164	8104.44	3923.96	705.92
165	8613.32	4481.85	708.19

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
166	8600.04	4499.82	703.81
167	8611.51	4791.69	705.67
168	8607.53	4822.70	704.00
169	8579.88	4856.23	694.33
170	6340.69	4772.28	694.00
171	6344.57	4914.23	690.81
172	6270.86	4931.07	715.66
173	6385.28	4962.52	677.18
174	6390.87	5047.34	674.35
175	6389.40	5058.83	674.71
176	6305.65	5198.88	701.00

SUBGRADE COORDINATES			
Point #	Northing	Easting	Elevation (ft)
177	6355.11	5141.16	700.60
178	6399.40	5136.66	700.50
179	6996.47	5133.58	702.89
180	6964.50	5115.83	696.87

REVISIONS					
REV	DATE	APPROVED BY:	CHECKED BY:	DRAWN BY:	DESIGNED BY:
K	02/23/24	XZ	CAB	WRG	LEH
J	05/18/22	XZ	CAB	WRG	LEH
I	10/08/21	XZ	CAB	WRG	LEH
H1	5/10/22	XZ	CAB	WRG	LEH
H	8/25/21	XZ	CAB	WRG	LEH
G	7/14/21	XZ	CAB	WRG	LEH
F	11/20/20	XZ	CAB	WRG	LEH
B	9/23/11	DRL	CAB	DRN	AN
REV	DATE	APP			

REVISION DESCRIPTION
PER MDEQ COMMENTS
SUBCELLS F1–F4 REVISIONS
RESPONSE TO EGLE COMMENTS
REVISED LINER GRADES IN F3
SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES
SUBCELLS G4–G6 REVISIONS
SUBCELL F4 AND FINAL COVER REVISIONS

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www.ctiengineers.com

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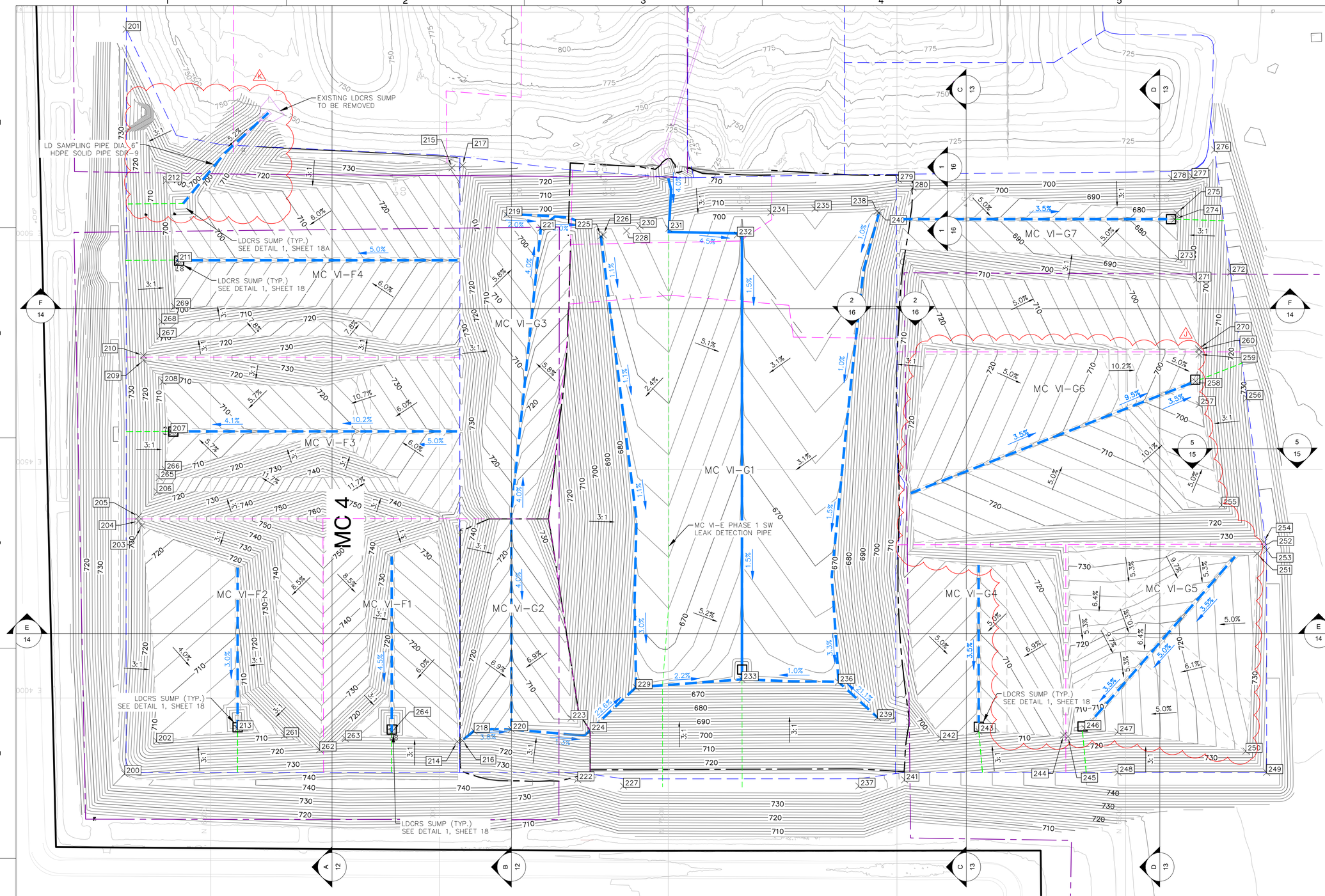
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF SUBGRADE GRADING PLAN (BOTTOM OF STRUCTURAL FILL)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
04



LEGEND

- EXISTING MAJOR CONTOURS
- EXISTING MAJOR CONTOURS
- PROPERTY BOUNDARY
- MASTER CELL VI–F & G MAJOR CONTOURS
- MASTER CELL VI–F & G MINOR CONTOURS
- GRADE BREAK
- AS–BUILT BOUNDARY
- COORDINATE POINT NO.
- SLOPE
- 2 EXTRA LAYERS OF GEONET 7.5' WIDE BENEATH GEOCOMPOSITE WITH FLOW DIRECTION
- 5 EXTRA LAYERS OF GEONET, 11.5' WIDE, BENEATH GEOCOMPOSITE WITH FLOW DIRECTION
- SUBCELL BOUNDARY
- CELL BOUNDARY
- SOLID SUMP RISER PIPE
- LEAK DETECTION SUMP

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES, PIPING, AND GEOCOMPOSITE DEPICTED IN MC VI–G SUBCELLS G1–G2 REPRESENT AS–BUILT TOP OF SECONDARY LINER.

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
200	8688.12	3834.75	734.54
201	8685.01	5462.64	722.82
202	8618.20	3905.87	707.73
203	8650.61	4377.11	722.72
204	8657.79	4386.96	725.14
205	8657.75	4396.77	725.14
206	8617.41	4451.36	711.82
207	8587.09	4583.16	701.96
208	8604.65	4691.67	706.83
209	8646.85	4739.06	720.34
210	8647.14	4748.88	720.32

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
211	8571.60	4957.47	692.34
212	8597.34	5131.53	698.08
213	8441.35	3933.09	702.62
214	7961.13	3904.60	714.25
215	7972.65	5159.77	730.25
216	7949.91	3907.03	713.51
217	7949.45	5164.97	732.77
218	7924.24	3927.69	706.53
219	7853.05	5057.35	696.67
220	7842.87	3931.37	703.56
221	7778.32	5028.27	695.84

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
222	7697.85	3821.52	733.74
223	7712.50	3955.68	716.00
224	7670.78	3929.03	697.65
225	7647.54	5010.47	681.80
226	7641.99	5012.71	683.24
227	7597.85	3807.29	738.60
228	7591.06	5021.51	685.01
229	7570.29	4023.33	666.36
230	7561.67	5032.75	686.20
231	7498.71	5027.05	688.09
232	7349.00	5012.85	681.14

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
233	7338.74	4040.54	661.22
234	7275.80	5061.92	682.69
235	7179.18	5070.45	684.75
236	7127.83	4034.99	663.35
237	7083.28	3807.50	739.24
238	7043.49	5064.48	681.99
239	7042.34	3957.36	687.71
240	7039.01	5061.89	680.59
241	6983.25	3821.03	729.35
242	6904.12	3911.47	704.92
243	6821.02	3927.03	701.43

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
244	6635.79	3918.76	727.26
245	6625.98	3915.61	711.60
246	6589.27	3933.58	706.76
247	6516.74	3926.02	711.36
248	6516.74	3837.32	740.80
249	6191.88	3837.32	740.80
250	6237.05	3883.85	728.94
251	6213.04	4314.83	728.94
252	6196.66	4331.41	734.53
253	6191.88	4323.06	736.09
254	6197.69	4341.22	734.52

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
255	6289.64	4422.21	707.06
256	6235.08	4655.62	732.84
257	6339.55	4642.05	697.92
258	6347.33	4692.52	694.75
259	6339.72	4751.42	696.61
260	6339.39	4762.08	696.60
261	8339.62	3917.89	708.70
262	8261.82	3887.03	720.06
263	8205.80	3910.98	712.87
264	8104.44	3925.52	708.25
265	8612.99	4482.34	710.40

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
266	8599.66	4500.45	706.00
267	8611.29	4791.97	707.91
268	8607.34	4822.95	706.25
269	8579.58	4856.63	696.54
270	6340.78	4763.72	696.12
271	6344.93	4914.63	693.00
272	6270.86	4931.07	717.76
273	6384.46	4961.54	679.80
274	6392.85	5047.34	675.52
275	6387.94	5060.54	677.00
276	6305.65	5198.88	703.10

SECONDARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
277	6355.11	5141.16	702.70
278	6399.40	5136.66	702.60
279	6996.47	5133.58	704.99
280	6964.50	5115.83	698.97

REVISIONS			
REV	DATE		
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN
J	05/18/22	SUBCELLS G4–G6 REVISIONS	LEH
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
H1	5/10/22	REVISED LINER GRADES IN F3	LEH
H	8/25/21	RESPONSE TO EGLE COMMENTS	XZ
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS	LEH
F	11/20/20	SUBCELLS F1–F4 REVISIONS	XZ
C	5/03/18	SUBCELLS G2 AND G3 REVISIONS	WRG
REV	DATE	REVISION DESCRIPTION	PJA
			XZ
			DRN
			APP

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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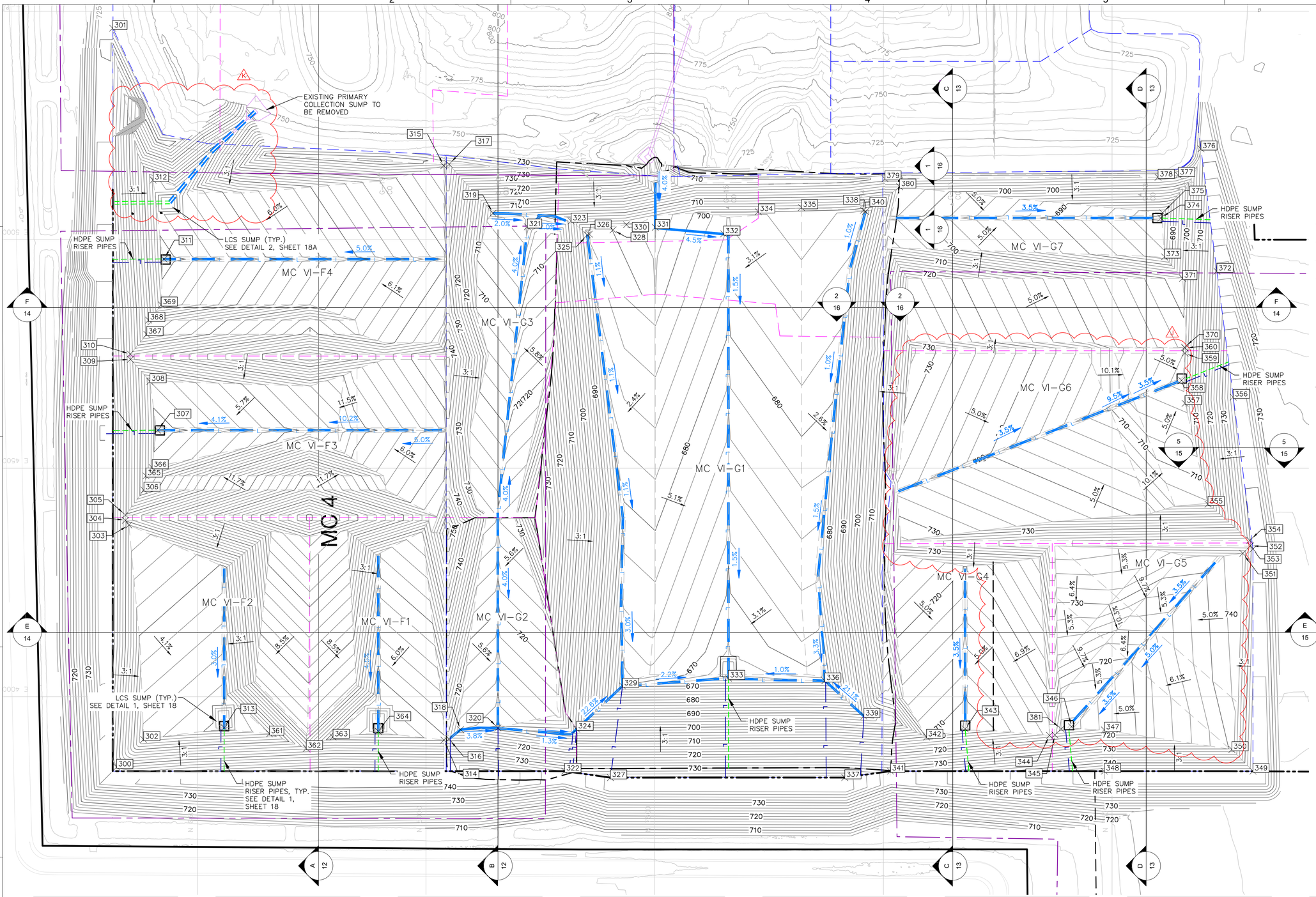
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF SECONDARY LINER GRADING PLAN

PROJECT NUMBER 1218070017
SCALE 1" = 100'
DRAWING NO 05



LEGEND

- EXISTING MAJOR CONTOURS
- EXISTING MAJOR CONTOURS
- MASTER CELL VI–F & G MAJOR CONTOURS
- MASTER CELL VI–F & G MINOR CONTOURS
- GRADE BREAK
- PROPOSED POINT NO.
- SLOPE
- SUBCELL BOUNDARY
- CELL BOUNDARY
- AS–BUILT BOUNDARY
- LEACHATE COLLECTION PIPE AND FLOW DIRECTION
- LEACHATE CLEANOUT PIPE
- PRIMARY COLLECTION SUMP
- SOLID SUMP RISER PIPE

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. GRADES, PIPING, AND GEOCOMPOSITE DEPICTED IN MC VI–G SUBCELLS G1–G2 REPRESENT AS–BUILT TOP OF PRIMARY LINER.

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
300	8676.40	3846.28	734.54
301	8685.01	5462.64	728.25
302	8617.38	3906.71	712.94
303	8649.60	4375.66	727.86
304	8657.24	4386.11	730.42
305	8657.19	4397.62	730.43
306	8616.71	4452.40	717.06
307	8586.84	4583.16	738.81
308	8603.70	4689.90	712.00
309	8646.14	4738.22	725.58
310	8646.48	4749.72	725.56

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
311	8572.76	4957.47	697.64
312	8596.51	5130.39	703.29
313	8441.35	3932.29	707.95
314	7960.91	3905.27	719.50
315	7961.26	5161.96	736.10
316	7949.75	3907.70	718.61
317	7949.45	5164.97	738.31
318	7924.50	3928.02	711.75
319	7853.52	5057.82	702.31
320	7842.87	3931.97	708.82
321	7778.32	5028.27	701.20

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
322	7696.73	3837.32	733.74
323	7682.58	5040.91	697.50
324	7670.57	3929.29	702.88
325	7647.35	5010.49	687.00
326	7642.85	5012.25	688.18
327	7596.74	3823.09	738.60
328	7591.06	5021.51	690.24
329	7570.10	4023.55	671.56
330	7561.67	5032.75	691.59
331	7498.71	5027.05	693.52
332	7349.00	5012.85	686.42

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
333	7338.74	4040.74	666.42
334	7273.49	5061.28	687.73
335	7179.18	5070.45	689.94
336	7128.04	4035.19	668.55
337	7084.38	3823.30	739.24
338	7043.49	5064.48	687.10
339	7042.63	3957.62	692.90
340	7038.96	5061.69	685.79
341	6984.38	3837.32	732.38
342	6905.54	3911.96	710.13
343	6821.04	3929.78	706.74

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
344	6636.63	3915.52	716.79
345	6625.13	3916.54	716.85
346	6588.59	3934.36	711.99
347	6516.55	3927.33	716.00
348	6516.74	3837.32	746.00
349	6191.88	3837.32	746.00
350	6237.97	3884.80	730.38
351	6214.06	4313.84	734.09
352	6197.42	4330.56	735.81
353	6191.88	4323.06	741.29
354	6198.61	4342.06	739.71

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
355	6290.21	4421.30	712.32
356	6235.08	4655.62	738.04
357	6340.31	4641.95	703.14
358	6348.07	4692.23	699.98
359	6340.43	4751.42	701.83
360	6340.08	4762.92	701.83
361	8342.16	3918.88	713.80
362	8261.82	3887.00	725.54
363	8203.29	3912.03	718.03
364	8104.44	3924.55	713.57
365	8612.28	4483.38	715.64

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
366	8598.82	4501.60	711.19
367	8610.47	4793.01	713.10
368	8606.52	4823.99	711.44
369	8578.86	4857.57	701.75
370	6341.52	4764.63	701.33
371	6345.63	4915.50	698.23
372	6270.86	4931.07	722.96
373	6385.28	4962.52	684.48
374	6393.59	5047.34	680.74
375	6389.40	5058.83	682.01
376	6305.65	5198.88	708.30

PRIMARY COORDINATE POINTS			
Point #	Northing	Easting	Elevation
377	6355.11	5141.16	707.90
378	6399.40	5136.66	707.80
379	6996.47	5133.58	710.19
380	6964.50	5115.83	704.17
381	6611.15	3929.60	712.90

REVISIONS						
REV	DATE	DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DESCRIPTION
K	02/23/24	LEH	WRG	CAB	XZ	SUBCELL F4 AND FINAL COVER REVISIONS
J	05/18/22	LEH	WRG	CAB	XZ	SUBCELLS G4–G6 REVISIONS
I	10/08/21	LEH	WRG	CAB	XZ	SUBCELLS G4–G7 REVISIONS, FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES
H1	5/10/22	LEH	WRG	CAB	XZ	REVISED LINER GRADES IN F3
H	8/25/21	LEH	WRG	CAB	XZ	RESPONSE TO EGLE COMMENTS
G	7/14/21	LEH	WRG	CAB	XZ	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR COMMENTS
F	05/28/21	LEH	WRG	CAB	XZ	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS
E	5/29/18	PAA	WRG	CAB	XZ	ADDENDUM
REV	DATE	DRN	CHK	APP	AN	REVISION DESCRIPTION

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

TOP OF PRIMARY LINER GRADING PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
06

MC VI-F2
MC VI-F3
MC VI-F4
MC VI-F1
MC VI-G2
MC VI-G3
MC VI-G1
MC VI-G4
MC VI-G6
MC VI-G7
MC VI-G5
MC VI EP2-NE
MC VI EP2-W
MC VI EP2-SE
MC VI-EP1
MC VI-B
MC VI A-N
MC VI A-S
MC VI-C
MC VI-D

SUMP RISERS
MC VI-F3 SUMP
MC VI-F4 WEST SUMP
MC VI-F4 EAST SUMP (REPLACES NC VI-E NW SUMP)
MC VI-E NW SUMP (TO BE REMOVED)
MC VI-E NE SUMP
MC VI-F2 SUMP
MC VI-F1 SUMP
MC VI-E SW SUMP
MC VI-E SE SUMP
MC VI-G SUMP
EXISTING SUMP RISER
MC VI-B MANHOLE
MC VI-AN MANHOLE
MC VI-AS MANHOLE
MC VI-C MANHOLE
MC VI-D MANHOLE
MC VI-G4 SUMP
MC VI-G5 SUMP
MC VI-G6 SUMP
MC VI-G7 SUMP

N
0 150 300
SCALE IN FEET

LEGEND
- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- SUBCELL BOUNDARIES
- CELL BOUNDARIES
- PROPERTY BOUNDARY

NOTES:
1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.

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DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REVISIONS	REV	DATE	REVISION DESCRIPTION	DRN	APP
	A	6/10/11	PHASING DESIGNATIONS	DRL	XZ
	F	11/20/20	SUBCELLS F1-F4 REVISIONS	WRG	XZ
	G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR COMMENTS	LEH	XZ
	I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
	K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEACHATE MANAGEMENT PLAN

PROJECT NUMBER
1218070017

SCALE
1" = 150'

DRAWING NO
07

AIRPORT SERVICE RD.

MC VI-F1
MC VI-F2
MC VI-F3
MC VI- F4
MC VI-G2
MC VI-G3
MC VI-EP1
MC VI EP2-W
MC VI EP2-SE
MC VI EP2-NE

MC VI-F1 SUMP
MC VI-F2 SUMP
MC VI-F3 SUMP
MC VI-F4 SUMP
MC VI-E NE SUMP

FINAL COVER PENETRATION DETAIL SEE DETAIL 5, SHEET 19

EXTEND CLEANOUT NORTH ALONG TOP OF CELL DIKE AND DAYLIGHT AT NORTH PERIMETER DIKE OR THROUGH WASTE (TYP.)

PROTECT ALL MC V MANHOLES WITH 3' RETAINING WALL/CONCRETE MH SECTION (TYP.)

SHEET 08
SHEET 09

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAKLINES
- SUBCELL BOUNDARY
- CELL BOUNDARY
- G-6 CO — LEACHATE COLLECTION SYSTEM CLEANOUTS
- V-A — EXISTING MANHOLES
- SUMP LOCATION AND COVER PENETRATION

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. CLEANOUTS IN MC VI-AN, AS, B, C, AND D ARE TO BE ABANDONED EXCEPT B1, C1, D1 THROUGH D3, D14, D17, D18, AND AS1.
3. BEFORE PLACING WASTE AROUND MC VI-C SUMP RISER, A MONITORING PROGRAM SHOULD BE IMPLEMENTED TO MONITOR ITS FUNCTIONALITY.
4. PRIOR TO PLACING WASTE AROUND CLEANOUTS E-22 THROUGH E-26, THE CLEANOUTS SHOULD BE EVALUATED TO DETERMINE IF THE LEACHATE COLLECTION LINE CAN BE CLEANED BY A SINGLE ACCESS POINT. IF NOT, THE CLEANOUT SHOULD BE EXTENDED.

REVISIONS			
REV	DATE	REVISION DESCRIPTION	
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN
I	10/08/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	XZ
F	05/17/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	LEH
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	WRG
REV	DATE	REVISION DESCRIPTION	DRN

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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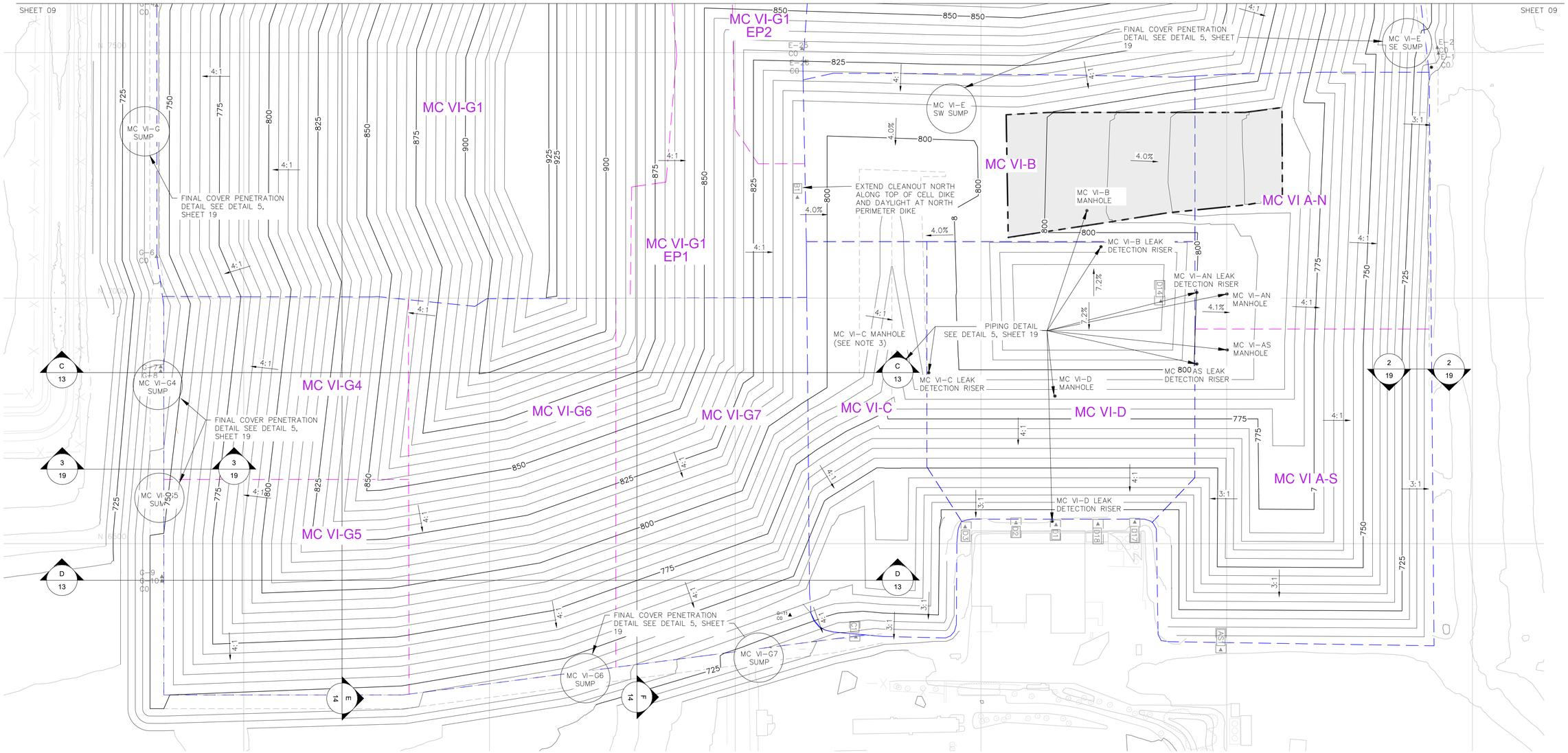
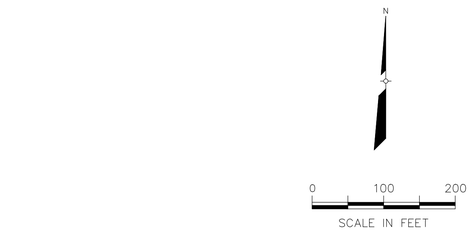
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (1 OF 2)

PROJECT NUMBER 1218070017
SCALE 1" = 100'
DRAWING NO 08





LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAKLINES
- SUBCELL BOUNDARY
- CELL BOUNDARY
- GEOCOMPOSITE (TRANSMISSIVITY 5.0 X 10^{-4} M^2/S)
- G-6 CO — LEACHATE COLLECTION SYSTEM CLEANOUTS
- EXISTING LEAK DETECTION OR SUMP RISERS
- SUMP LOCATION AND COVER PENETRATION

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. CLEANOUTS IN MC VI-AN, AS, B, C, AND D ARE TO BE ABANDONED EXCEPT B1, C1, D1 THROUGH D3, D14, D17, D18, AND AS1.
3. BEFORE PLACING WASTE AROUND MC VI-C SUMP RISER, A MONITORING PROGRAM SHOULD BE IMPLEMENTED TO MONITOR ITS FUNCTIONALITY.
4. PRIOR TO PLACING WASTE AROUND CLEANOUTS E-22 THROUGH E-26, THE CLEANOUTS SHOULD BE EVALUATED TO DETERMINE IF THE LEACHATE COLLECTION LINE CAN BE CLEANED BY A SINGLE ACCESS POINT. IF NOT, THE CLEANOUT SHOULD BE EXTENDED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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28001 Cabot Drive, Ste. 250
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REVISIONS			
REV	DATE	REVISION DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	05/28/21	F1-F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	WRG	XZ
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ
B	6/10/11	PHASING DESIGNATIONS	DRL	XZ
A	6/10/11	REVISION DESCRIPTION	DRN	APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER GRADING PLAN (2 OF 2)

PROJECT NUMBER 1218070017
SCALE 1" = 100'
DRAWING NO 09

AIRPORT SERVICE RD.

MC VI-F1
MC VI-F2
MC VI-F3
MC VI-F4
MC VI-G2
MC VI-G3
MC VI-EP1
MC VI EP2-W
MC VI EP2-NE
MC VI EP2-SE

DB-2 DB-12 DB-14 DB-15 DB-16 DB-17 DB-18 DB-19 DB-20 DB-21 DB-22 DB-23 DB-24 DB-25 DB-26 DB-27 DB-28 DB-29 DB-30 DB-31 DB-32 DB-33 DB-41

DIVERSION BERM DETAIL (TYP.) SEE DETAIL 3, SHEET 20

DOWNSLOPE CHANNEL DS-2 SEE DETAIL 1, SHEET 20

DOWNSLOPE CHANNEL DS-3 SEE DETAIL 1, SHEET 20

DOWNSLOPE CHANNEL DS-6 SEE DETAIL 1, SHEET 20

SHEET 10
SHEET 11

N 9000
N 8500
N 8000
E 4000
E 4500
E 5000
E 5500
E 6000
E 6500

725 750 775 800 825 850 875 900 925

3:1 4:1

0 100 200
SCALE IN FEET

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (3/20)
- DOWNSLOPE CHANNELS (1/20)

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

REVISIONS			
REV	DATE	REVISION DESCRIPTION	BY
F	01/20/21	SUBCELLS F1-F4 REVISIONS	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR COMMENTS	LEH
H	8/25/21	RESPONSE TO EGLE COMMENTS	XZ
I	10/08/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN
			XZ
			XZ
			XZ
			XZ
			DRN

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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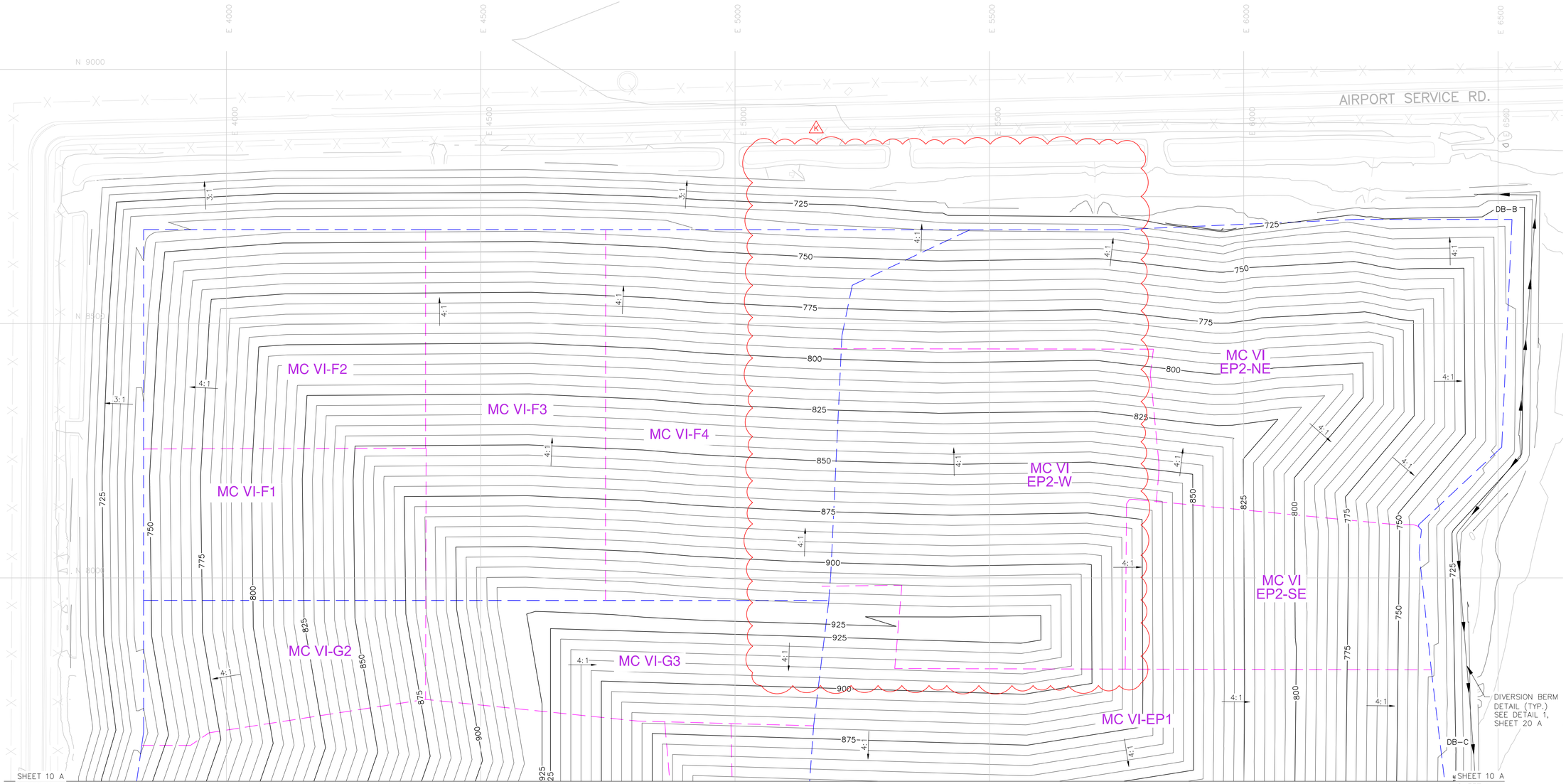
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
10



LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (1 / 20 A)

N

0 100 200

SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REVISIONS				
REV	DATE	REVISION DESCRIPTION	DRN	APP
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN	XZ
I	10/08/21	SUBCELLS G4-G7 REVISIONS	WRG	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (1 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
10 A

SHEET 10
SHEET 11

MC VI-G1
MC VI-G1 EP2
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-B
MC VI A-N
MC VI-C
MC VI-D
MC VI A-S

DOWNSLOPE CHANNEL DS-5
SEE DETAIL 1 SHEET 20

DOWNSLOPE CHANNEL DS-1
SEE DETAIL 1, SHEET 20

DOWNSLOPE CHANNEL DS-4
SEE DETAIL 1, SHEET 20

DIVERSION BERM
DETAIL (TYP.). SEE
DETAILS 3, SHEET 20

CATCH BASIN S4A

DB-1 DB-2 DB-3 DB-4 DB-5 DB-6 DB-7 DB-8 DB-9 DB-10 DB-11 DB-12 DB-34 DB-35 DB-36 DB-37 DB-38 DB-39 DB-40 DB-42 DB-43 DB-44 DB-45

N 6400
N 6600

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (3/20)
- DOWNSLOPE CHANNELS (1/20)

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
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REVISIONS				
REV	DATE	REVISION DESCRIPTION	BY	APP
F	01/20/21	SUBCELLS F1-F4 REVISIONS	WRG	XZ
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR COMMENTS	LEH	XZ
H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
I	10/08/21	SUBCELLS G4-G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG	XZ

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)

PROJECT NUMBER
1218070017

SCALE
1" = 100'

DRAWING NO
11

SHEET 10 A
SHEET 11 A

MC VI-G1
MC VI-G1 EP2
MC VI-G1 EP1
MC VI-G4
MC VI-G5
MC VI-G6
MC VI-G7
MC VI-B
MC VI A-N
MC VI-C
MC VI-D
MC VI A-S

DB-39
DB-A-1
DB-A-2
DB-D-1
DB-D-2
DB-E
DB-F
DB-G
DB-H

DIVERSION BERM DETAIL (TYP.)
SEE DETAILS 1, SHEET 20 A

CATCH BASIN S4A

LEGEND

- 500 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- 500 — TOP OF FINAL COVER MAJOR CONTOURS
- TOP OF FINAL COVER MINOR CONTOURS
- GRADE BREAK
- SUBCELL BOUNDARY
- CELL BOUNDARY
- DIVERSION BERM (1 / 20 A)

N

0 100 200
SCALE IN FEET

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.
2. DIVERSION BERMS ARE SLOPED AT 2% UNLESS OTHERWISE NOTED.

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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REV	DATE	REVISION DESCRIPTION
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES

WRG XZ
DRN APP

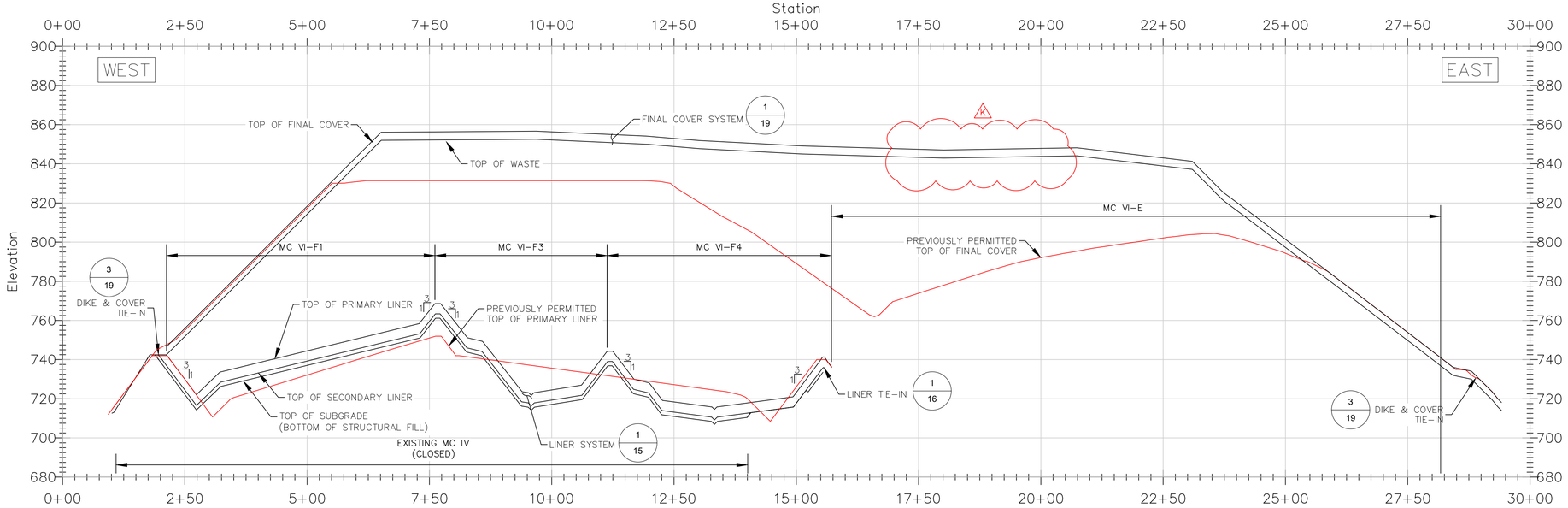
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORM WATER MANAGEMENT AND SEDIMENTATION PLAN (2 OF 2)

PROJECT NUMBER
1218070017

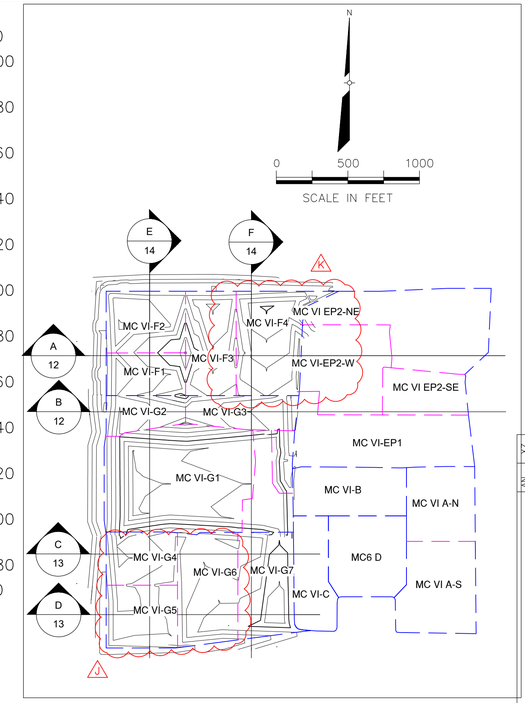
SCALE
1" = 100'

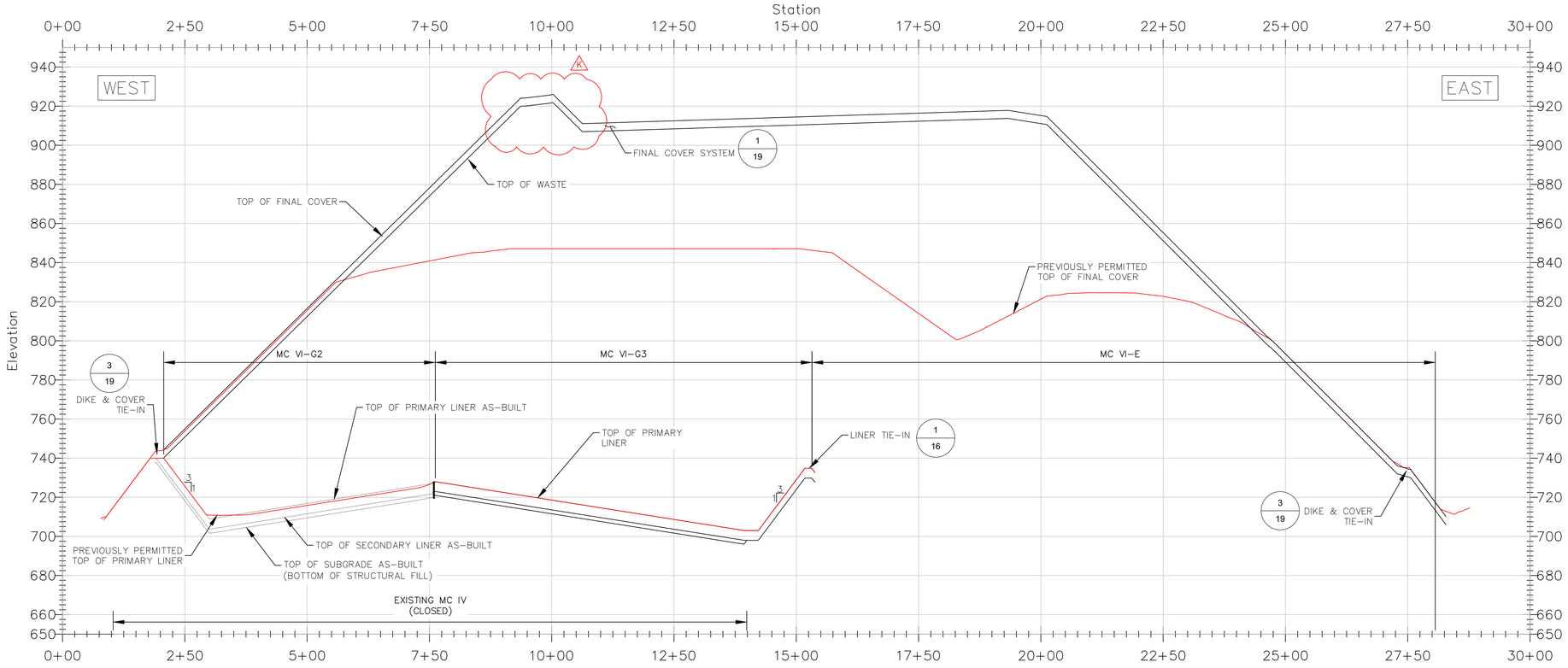
DRAWING NO
11 A



A/12 SECTION THROUGH MC VI–F AND MC VI–E

SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)





B/12 SECTION THROUGH MC VI–G2, G3, AND MC VI–E

SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)

REVISIONS						
REV	DATE	REVISION DESCRIPTION	DRL			
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	XZ			
J	05/18/22	SUBCELLS G4–G6 REVISIONS	XZ			
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	XZ			
H1	5/10/22	REVISED LINER GRADES IN F3	XZ			
G	07/14/21	REVISED LINER GRADES IN F1–F2 AND OTHER MINOR CORRECTIONS	XZ			
F	05/17/21	F1–F4 REVISIONS AND RESPONSE TO EGLE COMMENTS	XZ			
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS	XZ			
B	9/23/11	PER WDEQ COMMENTS				

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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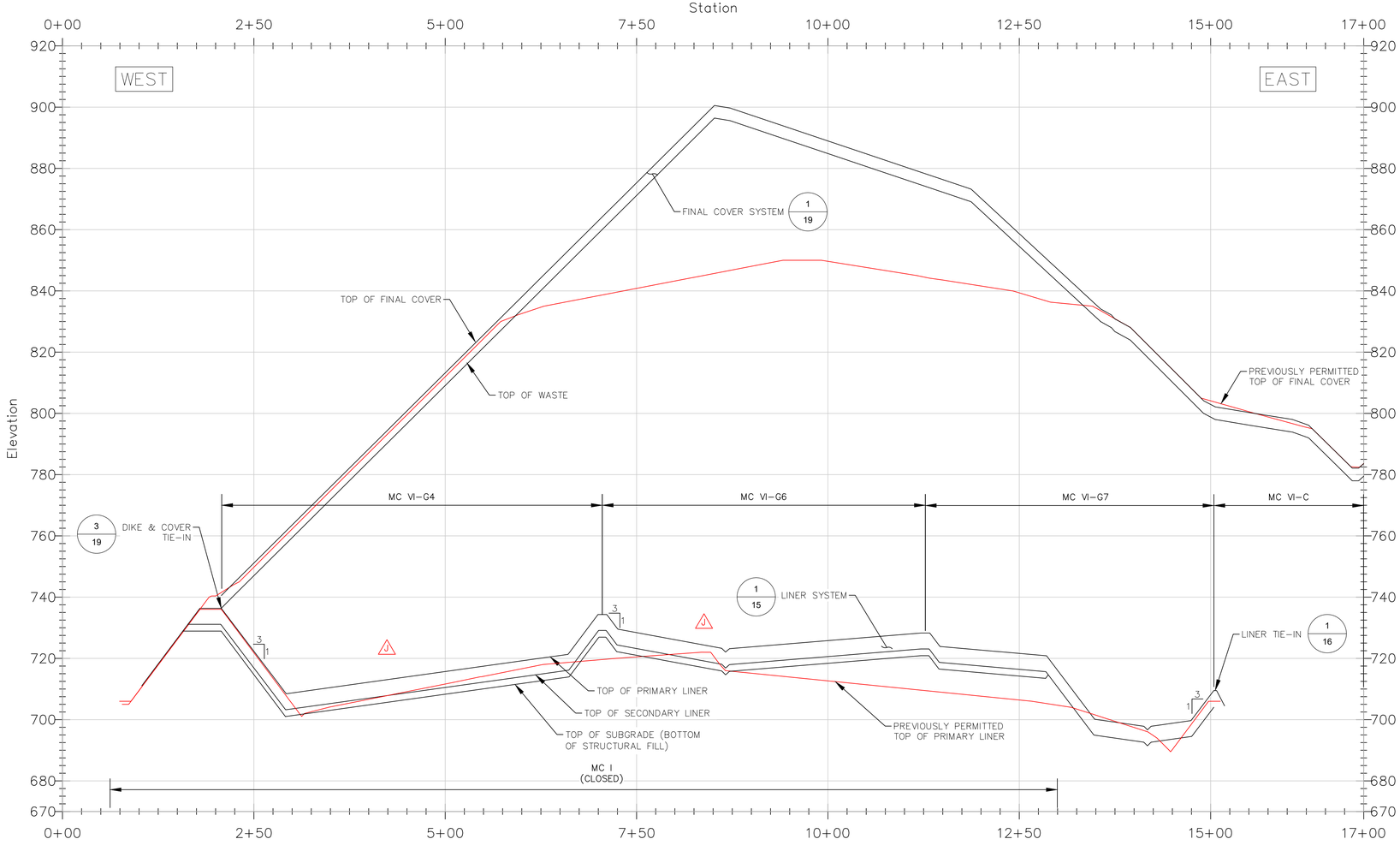
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (1 OF 3)

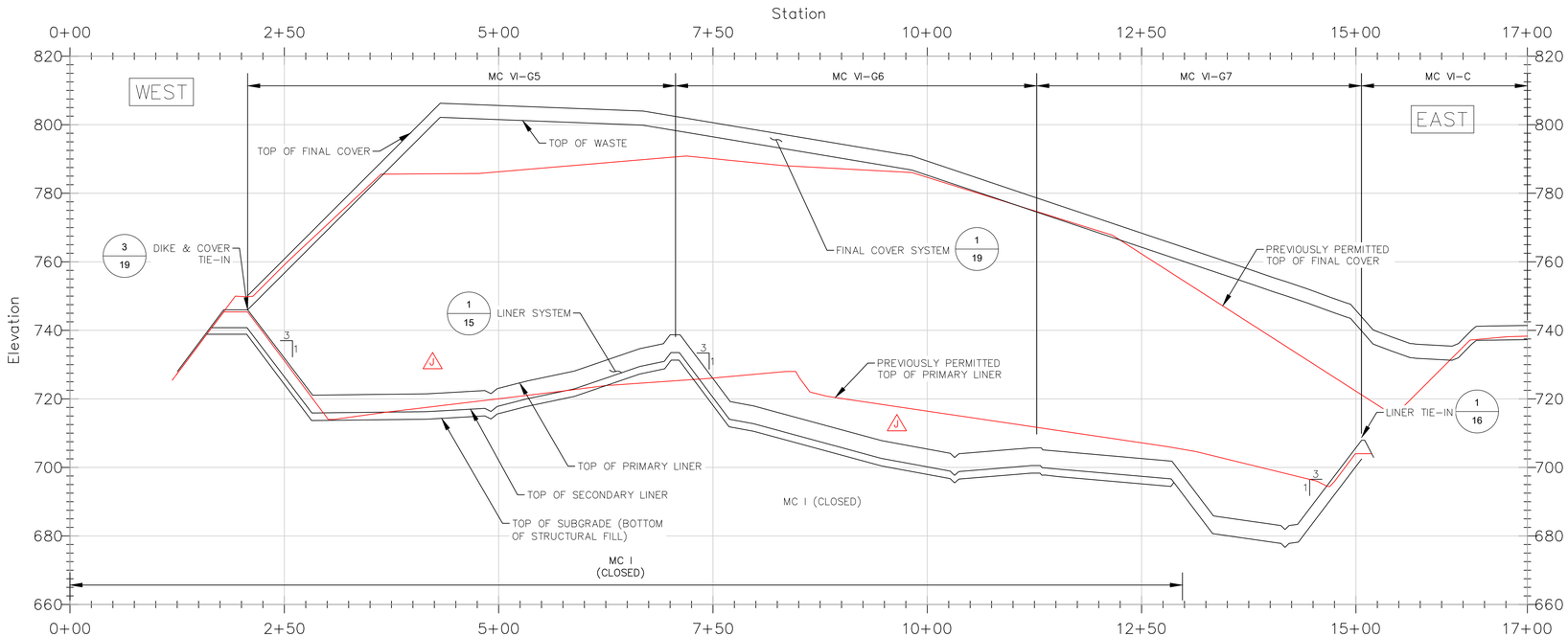
PROJECT NUMBER 1218070017

SCALE AS SHOWN

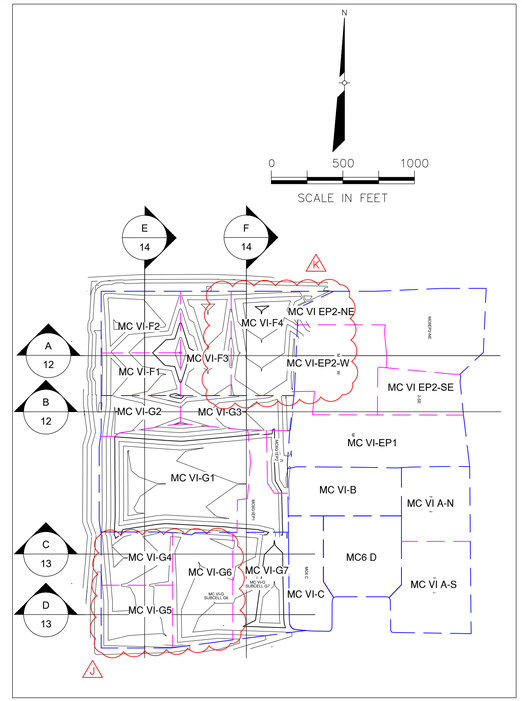
DRAWING NO 12



C/13 SECTION THROUGH MC VI–G4, G6, G7
SCALE: 1"=80' (HORIZONTAL), 1"=10' (VERTICAL)



D/13 SECTION THROUGH MC VI–G5, G6, G7
SCALE: 1"=80' (HORIZONTAL), 1"=10' (VERTICAL)



	DATE:	DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
J	05/18/22	LEH	WRG	CAB	XZ

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REV	DATE	REVISION DESCRIPTION	DRN	APP
J	05/18/22	SUBCELLS G4–G6 REVISIONS	LEH	XZ
I	10/08/21	SUBCELLS G4–G7 REVISIONS, FINAL GRADE MODIFICATIONS, MISCELLANEOUS CHANGES	WRG	XZ
H1	5/10/22	REVISED LINER GRADES IN F3	LEH	XZ
G	07/14/21	REVISED LINER GRADES IN F1–F2 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG	XZ
E	5/02/18	SUBCELLS G2 AND G3 REVISIONS	PAA	XZ

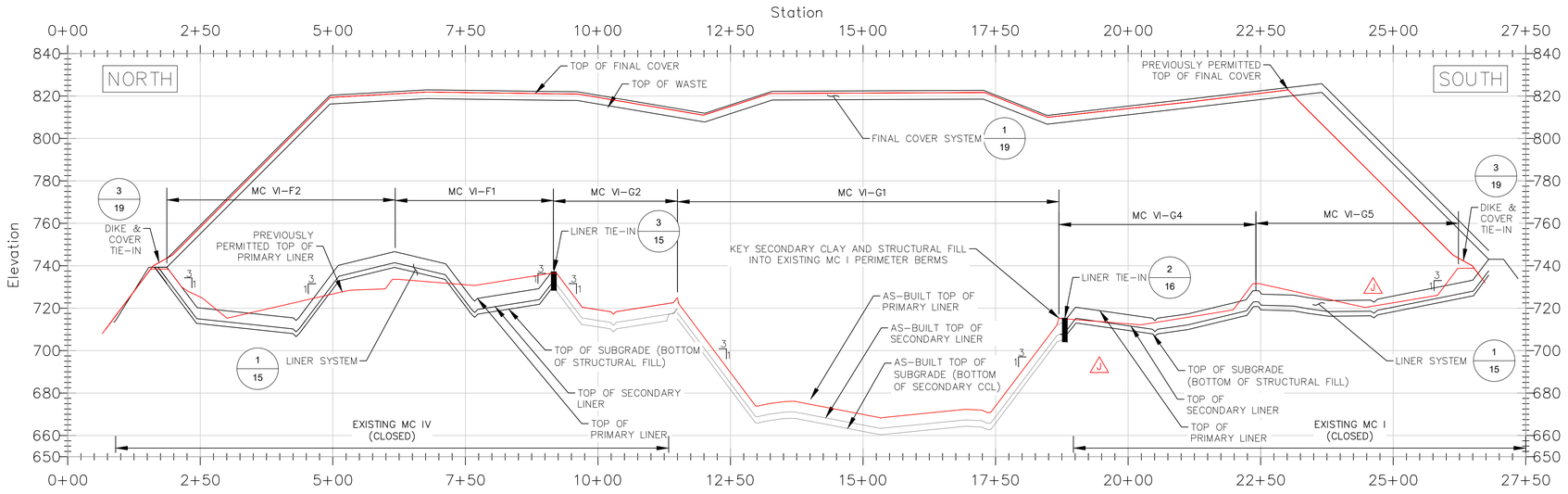
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (2 OF 3)

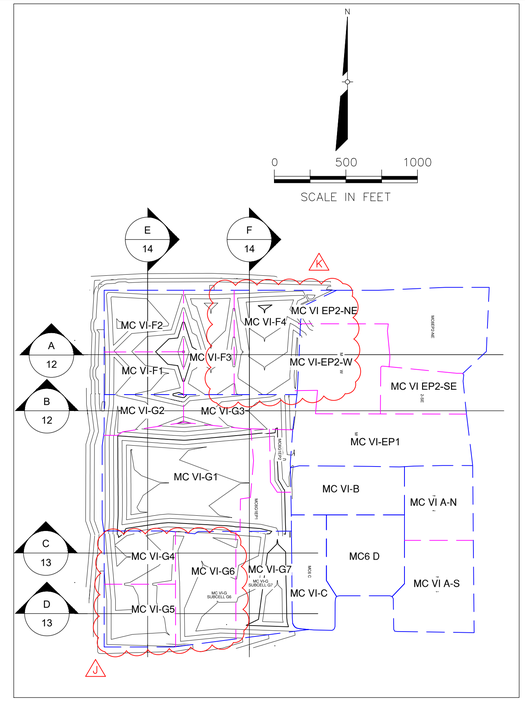
PROJECT NUMBER
1218070017

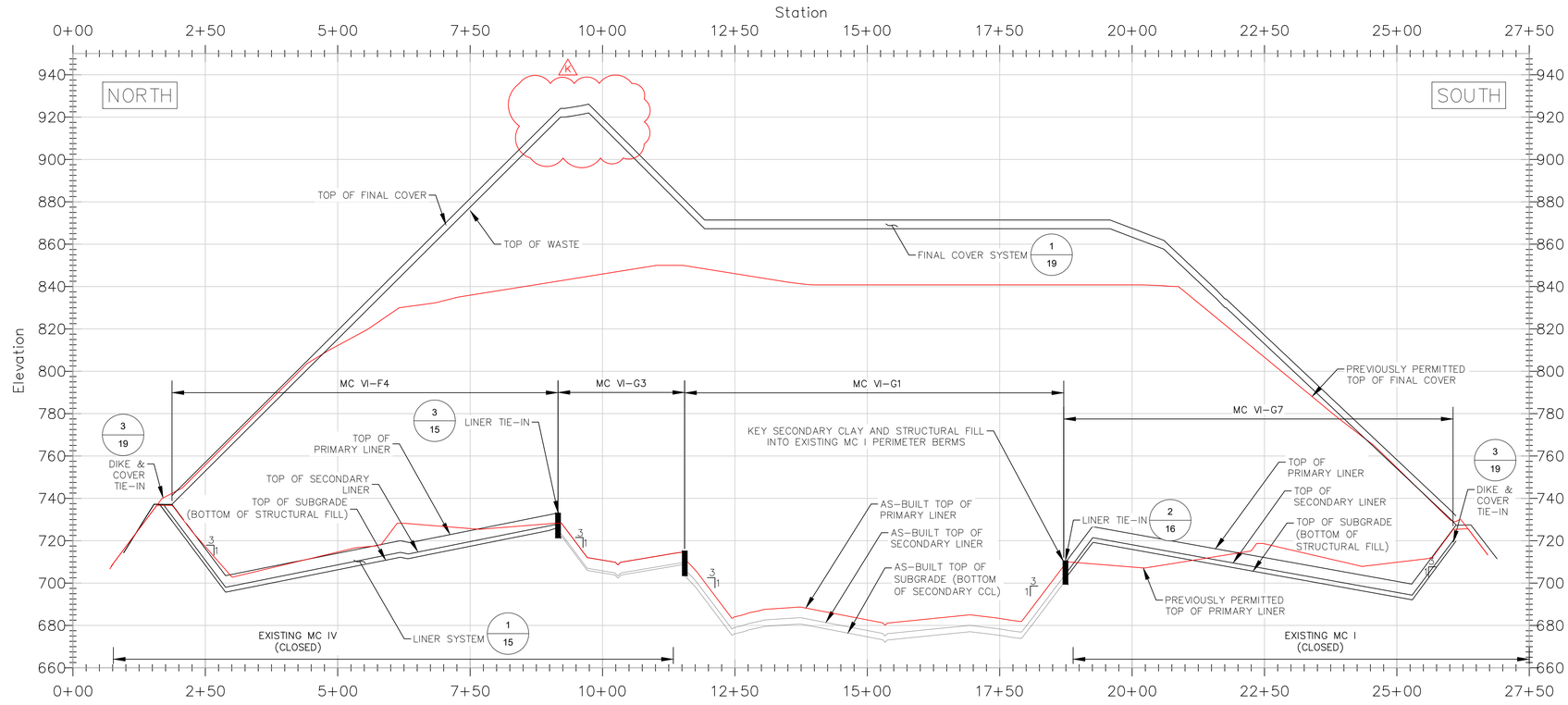
SCALE
AS SHOWN

DRAWING NO
13



E
14
SECTION THROUGH PROPOSED MC VI–F AND MC VI–G
SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)





F
14
SECTION THROUGH PROPOSED MC VI–F AND MC VI–G
SCALE: 1"=125' (HORIZONTAL), 1"=10' (VERTICAL)

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REV	DATE	REVISION DESCRIPTION	DRN	APP
K	02/23/24	SUBCELL F4 AND FINAL COVER REVISIONS	AN	XZ
J	05/18/22	SUBCELLS G4–G6 REVISIONS	LEH	XZ
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
H1	5/10/22	REVISED LINER GRADES IN F3	LEH	XZ
G	07/14/21	REVISED LINER GRADES IN F1–F2 AND OTHER MINOR CORRECTIONS	LEH	XZ
F	11/20/20	SUBCELLS F1–F4 REVISIONS	WRG	XZ
C	5/20/18	SUBCELLS G2 AND G3 REVISIONS	P.AA	XZ

DATE:	05/18/22
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

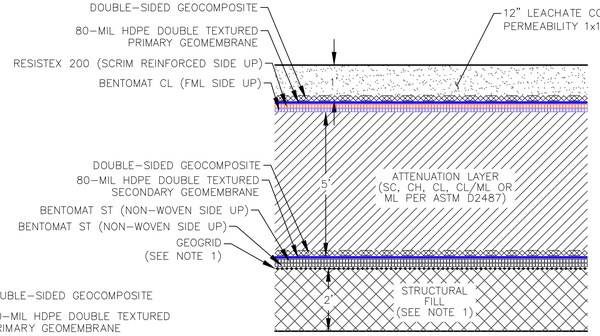
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CROSS SECTION (3 OF 3)

PROJECT NUMBER
1218070017

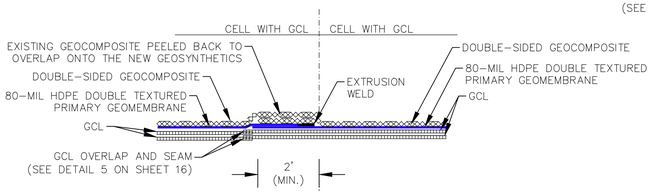
SCALE
AS SHOWN

DRAWING NO
14



1/15 **FLOOR LINER SYSTEM USING GCL**
NOT TO SCALE

NOTE:
1. STRUCTURAL FILL AND GEOGRID NOT REQUIRED OUTSIDE OF MC I, MC IV AND MC V. SEE LIMITS ON SHEET 04
2. SEE DETAIL 5 SHEET 16 FOR GCL OVERLAP



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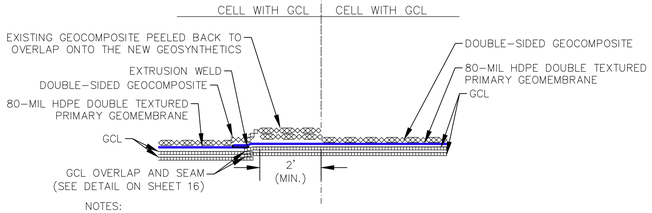


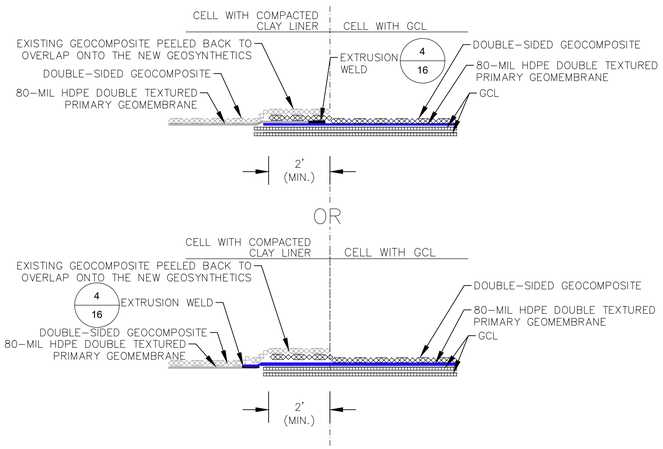
NOTES:

A. NEW AND EXISTING GEOCOMPOSITE LAYERS SHALL BE CONNECTED AS FOLLOWS:
   – GEONET CORES SHALL BE JOINED BY PLASTIC FASTENERS.
   – TOP GEOTEXTILE SHALL BE SEWN TOGETHER OR COVERED WITH EXTRA NON-WOVEN GEOTEXTILE (MINIMUM 24" WIDE) HEAT BONDED TO THE EXISTING GEOTEXTILE.

B. AT GCL SEAMS, DRY BENTONITE POWDER SHALL BE APPLIED PER MANUFACTURER'S INSTALLATION GUIDELINES.

C. SEAMS SHOULD BE CONSTRUCTED SUCH THAT THEY ARE SHINGLED IN THE DIRECTION OF THE GRADE TO PREVENT FLOW FROM ENTERING THE OVERLAP ZONE.

3/15 **LINER TIE-IN DETAIL I**
NOT TO SCALE

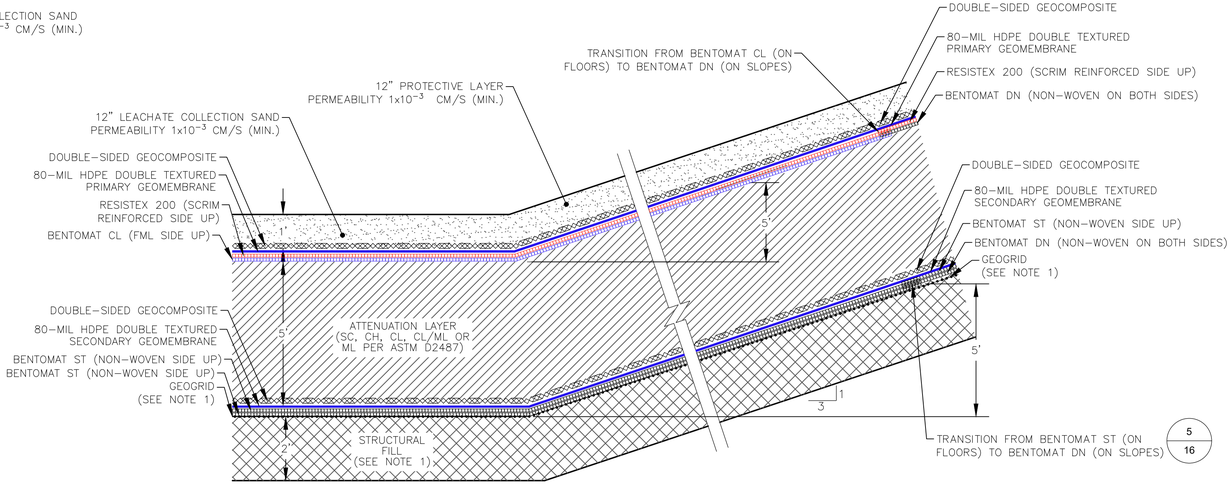


NOTES:

A. NEW AND EXISTING GEOCOMPOSITE LAYERS SHALL BE CONNECTED AS FOLLOWS:
   – GEONET CORES SHALL BE JOINED BY PLASTIC FASTENERS.
   – TOP GEOTEXTILE SHALL BE SEWN TOGETHER OR COVERED WITH EXTRA NON-WOVEN GEOTEXTILE (MINIMUM 24" WIDE) HEAT BONDED TO THE EXISTING GEOTEXTILE.

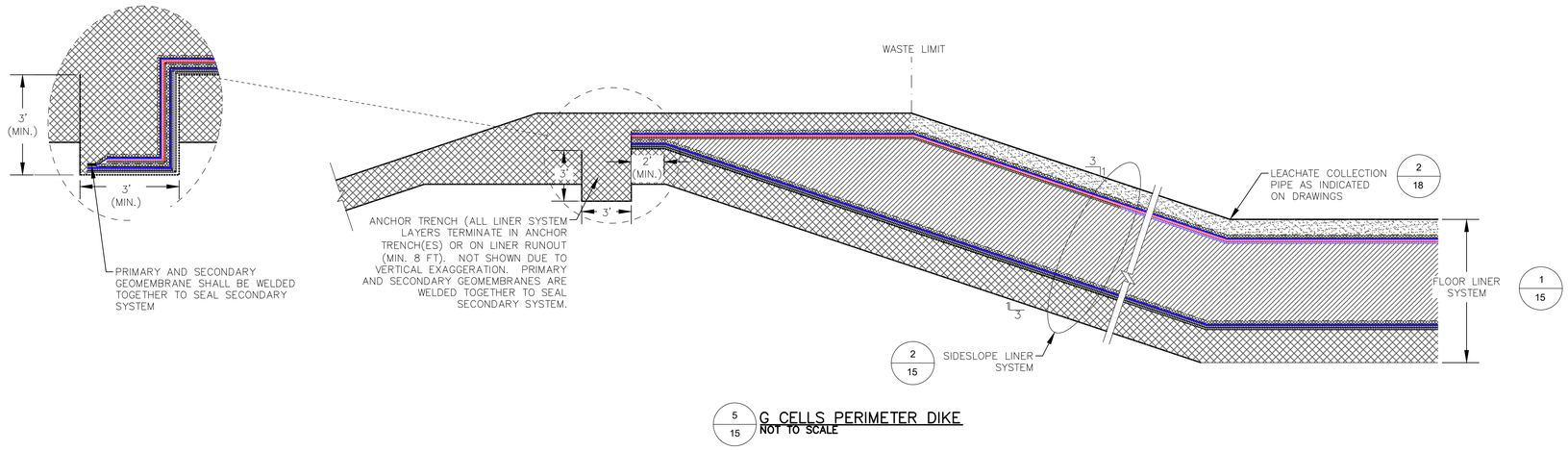
B. SEAMS SHOULD BE CONSTRUCTED SUCH THAT THEY ARE SHINGLED IN THE DIRECTION OF THE GRADE TO PREVENT FLOW FROM ENTERING THE OVERLAP ZONE.

4/15 **LINER TIE-IN DETAIL II**
NOT TO SCALE



2/15 **SIDESLOPE LINER SYSTEM USING GCL**
NOT TO SCALE

NOTE:
1. STRUCTURAL FILL AND GEOGRID NOT REQUIRED OUTSIDE OF MC I, MC IV AND MC V. SEE LIMITS ON SHEET 04
2. SEE DETAIL 5 SHEET 16 FOR GCL OVERLAP REQUIREMENT.



5/15 **G CELLS PERIMETER DIKE**
NOT TO SCALE

DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

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K	2/13/24	REVISED NOTE TO INCLUDE MC I, MC IV, AND MC V
I	10/08/21	SUBCELLS G4–G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES
G	7/14/21	REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS
F	11/20/20	SUBCELLS F1–F4 REVISIONS
B	9/23/11	PER MDEQ COMMENTS
A	6/10/11	PHASING DESIGNATIONS
REV.	DATE	REVISION DESCRIPTION

JWC	XZ	DRL	
WRG	XZ	DRL	
LEH	XZ	DRL	
WRG	XZ	DRL	DRN

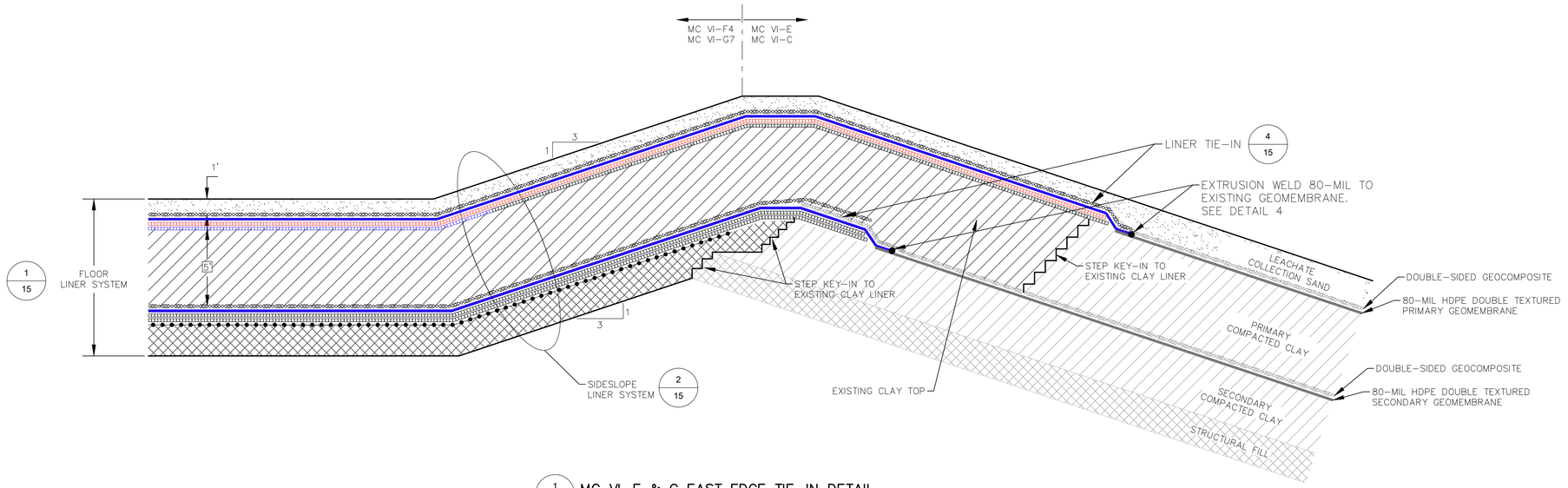
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (1 OF 2)

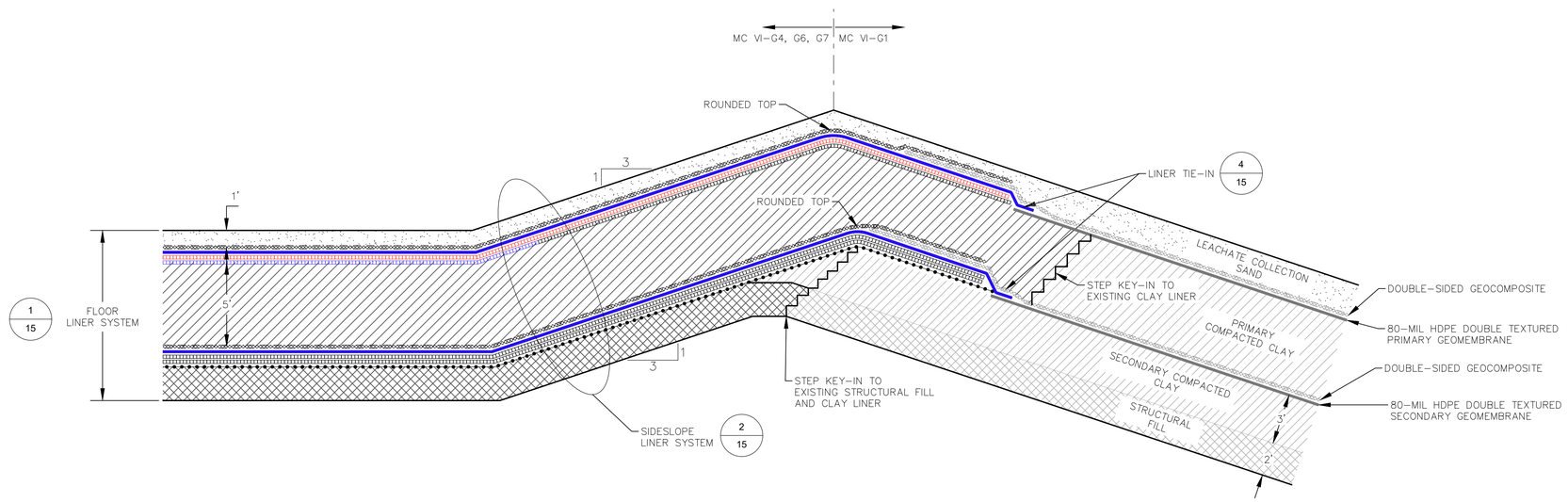
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

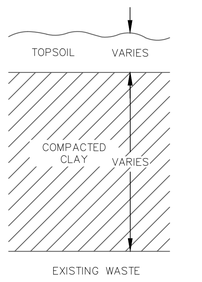
DRAWING NO
15



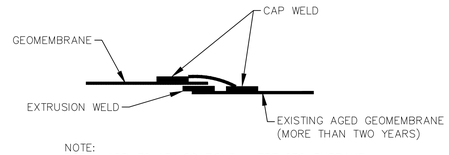
1/16 MC VI-F & G EAST EDGE TIE-IN DETAIL
NOT TO SCALE



2/16 MC VI-G1 TO MC VI-G4, G6, AND G7 TIE-IN DETAIL
NOT TO SCALE

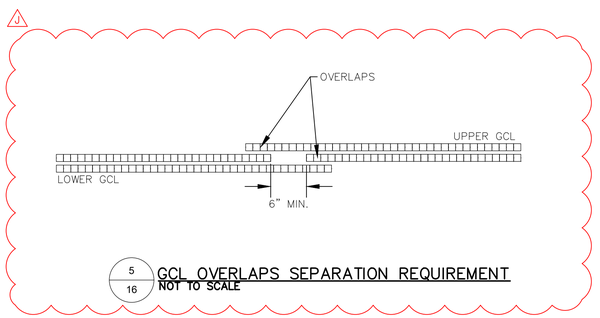


3/16 MC I & MC IV COVER DETAIL
NOT TO SCALE



NOTE:
DETAIL APPLIES AT LOCATIONS WHERE GEOMEMBRANE
TIES INTO EXISTING GEOMEMBRANE

4/16 GEOMEMBRANE WELDING DETAIL
NOT TO SCALE



5/16 GCL OVERLAPS SEPARATION REQUIREMENT
NOT TO SCALE

REV	DATE	DESCRIPTION
J	5/18/22	SUBCELLS G4-G6 REVISIONS
I	10/06/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES
G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS
F	11/20/20	SUBCELLS F1-F4 REVISIONS
E	5/29/18	ADDENDUM I
D	5/08/18	REVISION BASED ON MDEQ'S COMMENTS
C	5/02/18	SUBCELLS G2 AND G3 REVISIONS

	DATE:	05/18/22
	DESIGNED BY:	LEH
	DRAWN BY:	WRG
	CHECKED BY:	CAB
	APPROVED BY:	XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
LINER SYSTEM DETAILS (2 OF 2)
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LINER SYSTEM DETAILS (2 OF 2)

PROJECT NUMBER
1218070017

SCALE
AS SHOWN

DRAWING NO
16

Geosynthetic Materials

Material	Location	Description	Product	Additional Requirements
80-mil Geomembrane	Primary and secondary liners	80-mil HDPE, textured both sides	GSE HD textured, or equivalent	The CQA Consultant shall manage the direct shear testing of the geomembrane samples, as needed, per the direction of the Design Engineer and in accordance with the design requirements of the project.
40-mil Geomembrane	Final cover	40-mil HDPE, textured both sides	GSE HD textured, or equivalent	
Geosynthetic Clay Liner	Final cover and secondary liner	Sodium bentonite encapsulated between two geotextiles that are needle-punched or stitch-bonded together	CETCO Bentomat ST, or equivalent	The CQA Consultant shall manage the direct shear testing of the GCL samples, as needed, per the direction of the Design Engineer and in accordance with the design requirements of the project.
Geosynthetic Clay Liner	Primary and secondary liners	Sodium bentonite encapsulated between two geotextiles that are needle-punched together	CETCO Bentomat DN, or equivalent	
Geosynthetic Clay Liner	Primary liner	Sodium bentonite encapsulated between two geotextiles that are needle-punched and laminated to a geofilm	CETCO Bentomat CL, or equivalent	
Geosynthetic Clay Liner	Primary Liner	Polymer-modified bentonite	CETCO Resistex 200 FLW9, or equivalent	
Geocomposite	LCS	HDPE, bonded top and bottom to geotextile meeting requirements of geotextile; geocomposite transmissivity* (minimum): MC VI-F1, F3, and F4: 3.2E-04 m2/sec MC VI- F2: 4.1E-04 m2/sec MC VI-G4, G5, and G6: 4.2E-04 m2/sec MC VI-G7: 7.4E-04 m2/sec	GSE FABRINET, or equivalent	Geonet and geotextile shall meet the requirements of the project plans and drawings.
Geocomposite	LDCRS	200-mil HDPE, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET, or equivalent	
Cover Geocomposite	Final cover	Refer to Stormwater Calculation (A.6.8) for minimum geocomposite transmisssivity, bonded top and bottom to geotextile meeting requirements below	GSE FABRINET, or equivalent	
Geonet	LCS and LDCRS sumps, and LDCRS collectors	200-mil HDPE	GSE HYPERNET, or equivalent	Transmissivity requirements per the direction of the Design Engineer and in accordance with the design requirements of the project.
Geotextile	All geocomposites, gravel/geotextile envelopes for LCS, and final cover perimeter drain	Nominal 8 oz/yd^2, needle-punched, non-woven polypropylene	Amoco 4508, Synthetic Industries Geotex 801, or equivalent	AASHTO M288-96 requirements for Separation Geotextile (Class 2)
Geogrid	Above structural fill	Biaxial Polymeric Grid	Huesker Fortrac 80-80, or equivalent	None

LCS denotes leachate collection system
LDCRS denotes leak detection, collection, and removal system.
*Geocomposite Transmissivity Test Requirements:
Per ASTM 4716 with a gradient of 0.1, confining pressure of 10,000 psf, boundary conditions of geomembrane/sand;transmissivity test should be run until the sample reaches equilibrium (becomes asymptotic) or 100 hours, whichever comes first.

CTI and Associates, Inc.
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DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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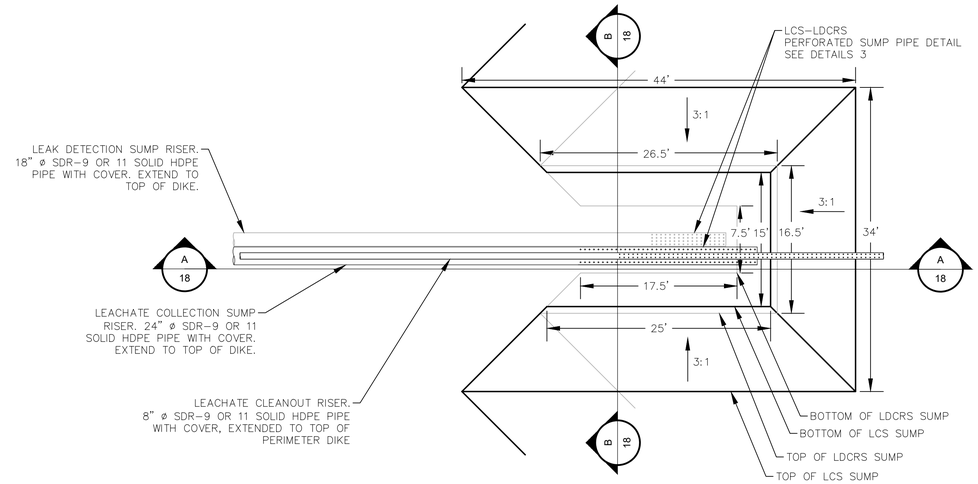
REV	DATE	REVISIONS	BY	APP
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
E	11/10/20	SUBCELLS F1-F4 REVISIONS	WRG	XZ
D	5/29/18	ADDENDUM 1	PAA	XZ
C	5/09/18	REVISION BASED ON MDEQ'S COMMENTS	PAA	XZ
B	5/08/18	REVISION DESCRIPTION	DRN	APP

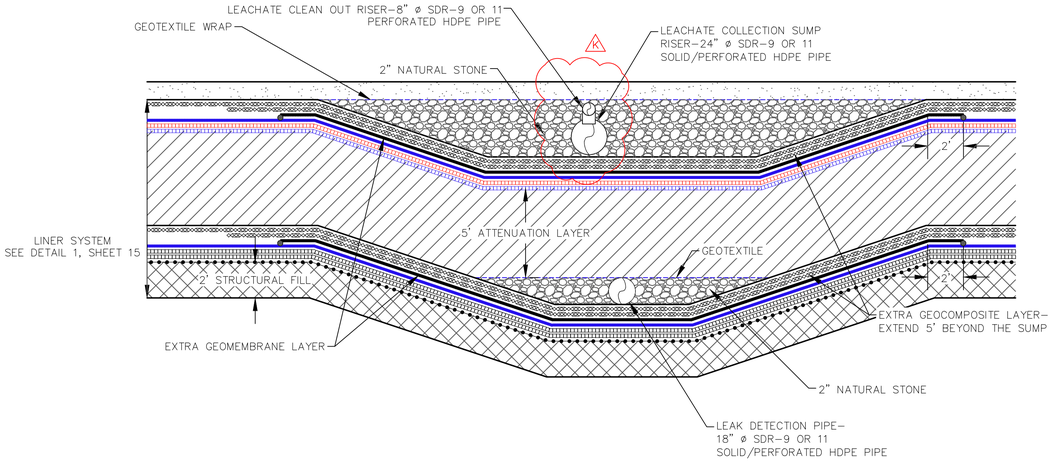
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

GEOSYNTHETIC MATERIALS REQUIREMENTS

PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 17



1/18 LCS-LDCRS SUMP (TYP.)
NOT TO SCALE

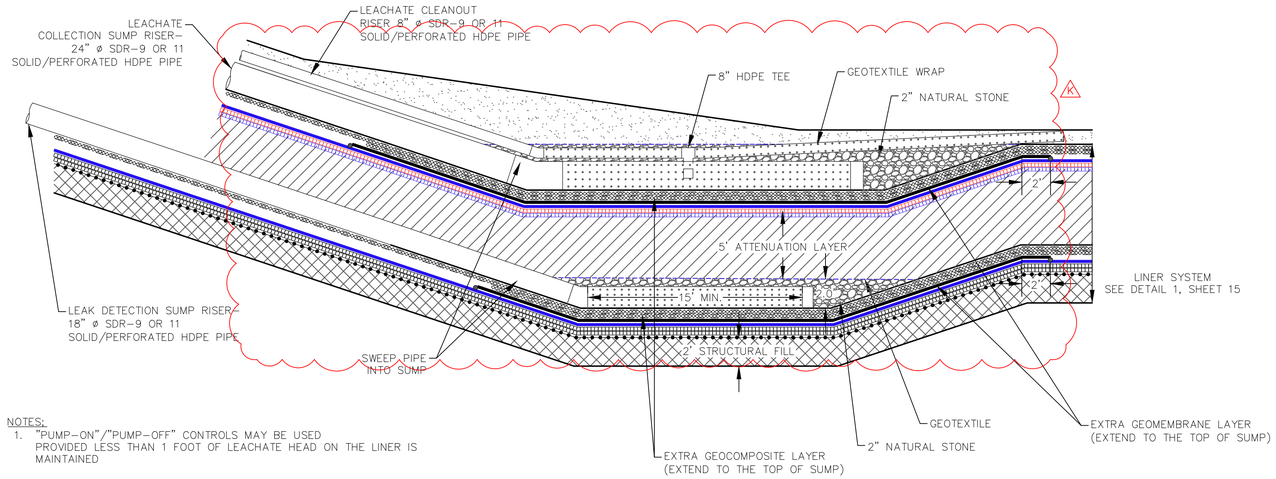


B 18 SUMP CROSS-SECTION B
NOT TO SCALE

J

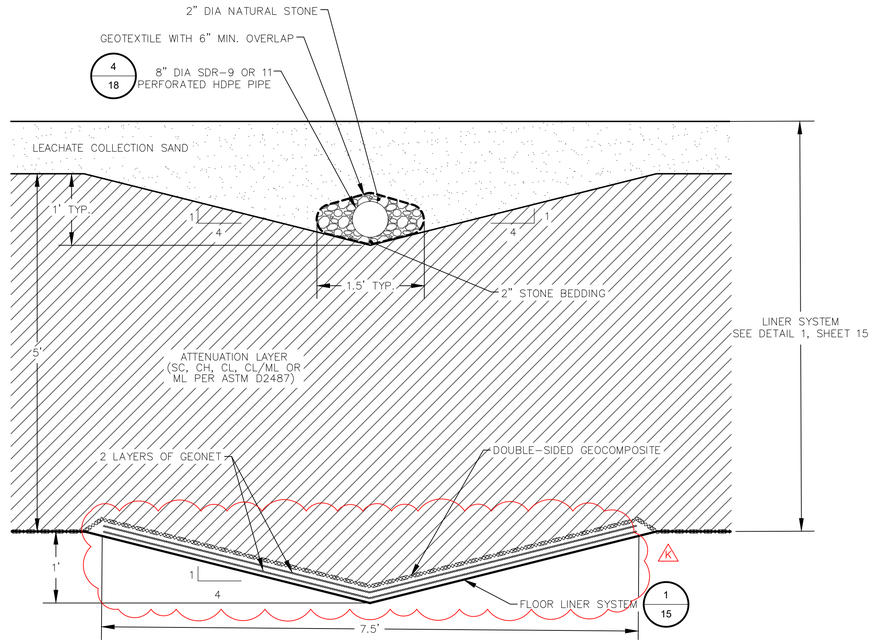
Parameter	Symbol	Value	Unit	Notes and Equations
Sump Length (Top)	L_T	44	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Width (Top)	W_T	34	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Top Area	A_T	1,496	ft^2	L X W
Sump Length (Bottom)	L_B	25	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Width (Bottom)	W_B	15	ft	Source: Drawing SH18 Leachate Collection System Details
Sump Bottom Area	A_B	375	ft2	L X W
Depth of Sump	h_0	3.2	ft	Based on Slope 3:1 and Sump Dimensions
Porosity of Aggregates	n	0.3		assumption
Pump On from Bottom	h_1	36	inch	
Pump Off from Bottom	h_2	12	inch	
Pump On Area	A_1	1,419	ft^2	L=43 ft; W=33 ft
Pump Off Area	A_2	651	ft^2	L=31 ft; W=21 ft
Leachate Generation Rate	Q_{in}	47,693	GPD	Source: Attachment A-4_Leachate Collection System Flow Capacity Analysis
		33.1	GPM	
Leachate Pumping Rate	Q_{out}	37.0	GPM	typical pumping rate; minimum pumping rate is 34 gpm.
Effective Sump Storage Volume	V_{eff}	4,535	gal.	$V_{eff} = \frac{1}{3} n \frac{h_1 - h_2}{12} (A_1 + A_2 + \sqrt{A_1 A_2}) \times 7.481$
Pump Off Time	T_{off}	2.3	hr	$T_{off} = \frac{V_{eff}}{Q_{in}} \times 24$
Pump On Time	T_{on}	19.5	hr	$T_{on} = \frac{V_{eff}}{Q_{out} \times 60 - \frac{Q_{in}}{24}}$
Pump Cycle Time	T_{cycle}	21.8	hr	$T_{cycle} = T_{on} + T_{off}$
Pump Cycle	N	1.1		$N = \frac{24}{T_{cycle}}$

NOTES
1. Dimension of the sump used in this calculation is an example. The actual dimension of the sump can be varied.
2. The effective sump storage volume presented in this calculation is a minimum required volume.
3. The leachate pumping rate presented in this calculation is for illustration purpose. Other size of pump with different flow rate can be used as long as the leachate level above the primary liner can be maintained below 12-inch.

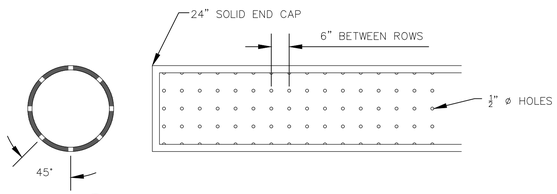


NOTES:
1. "PUMP-ON"/"PUMP-OFF" CONTROLS MAY BE USED PROVIDED LESS THAN 1 FOOT OF LEACHATE HEAD ON THE LINER IS MAINTAINED

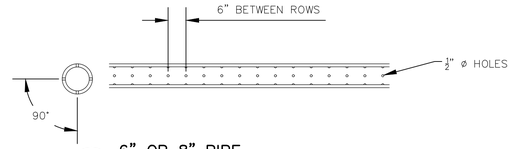
A 18 SUMP CROSS-SECTION A
NOT TO SCALE



2/18 CELL FLOOR LEACHATE COLLECTION PIPE AND LEAK DETECTION GEONET (TYP.)
NOT TO SCALE



3/18 SUMP PERFORATION SPACING DETAIL
NOT TO SCALE



4/18 6" OR 8" PIPE PERFORATION SPACING DETAIL
NOT TO SCALE

REV	DATE	REVISION DESCRIPTION
K	02/13/24	CHANGED LINETYPE FOR LAYERS
J	05/18/22	SUBCELLS C4-C6 REVISIONS
I	10/08/21	SUBCELLS C4-C7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES
H	8/25/21	RESPONSE TO EGLE COMMENTS
G	7/14/21	REVISED LINER GRADES IN T-F4 AND OTHER MINOR CORRECTIONS
F	11/20/20	SUBCELLS T-I4 REVISIONS
E	9/23/11	PER MDEQ COMMENTS

	DATE:	INIC
	05/18/22	
DESIGNED BY:	LEH	LEH
DRAWN BY:	WRG	LEH
CHECKED BY:	CAB	XZ
APPROVED BY:	XZ	LEH
		XZ
		WRG
		XZ
		DRL
		DRN
		APP

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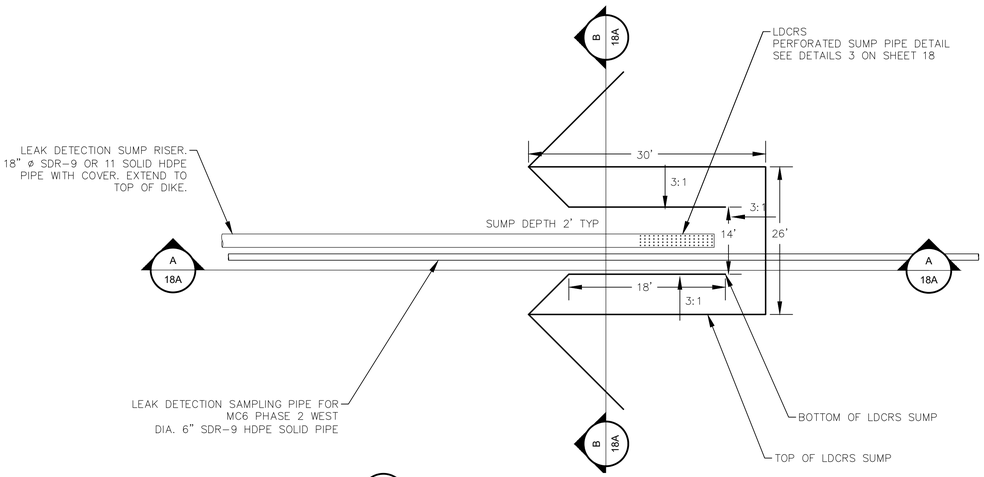
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEACHATE COLLECTION SYSTEM DETAILS

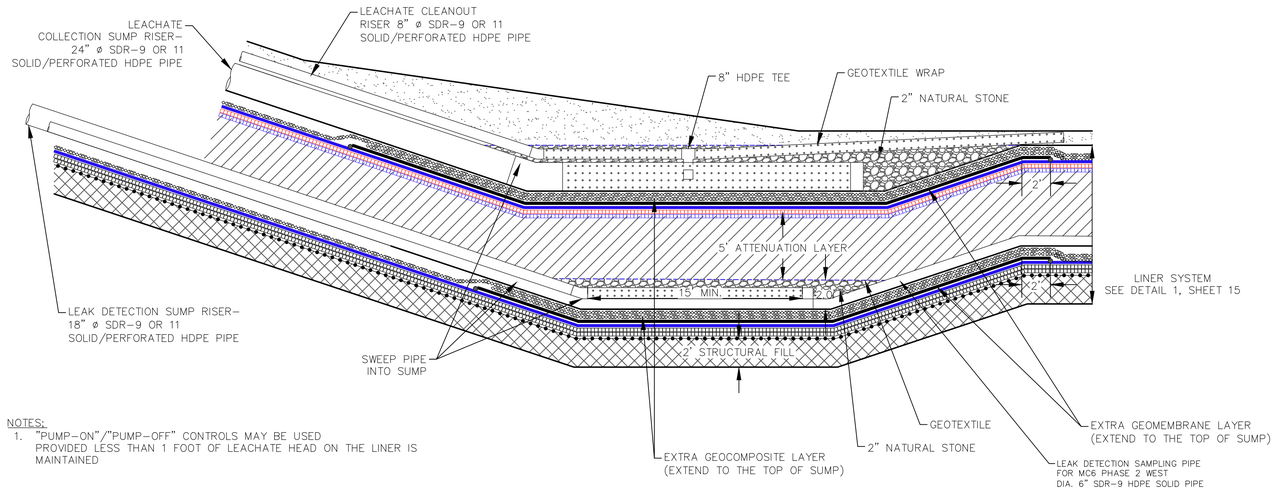
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

DRAWING NO
18

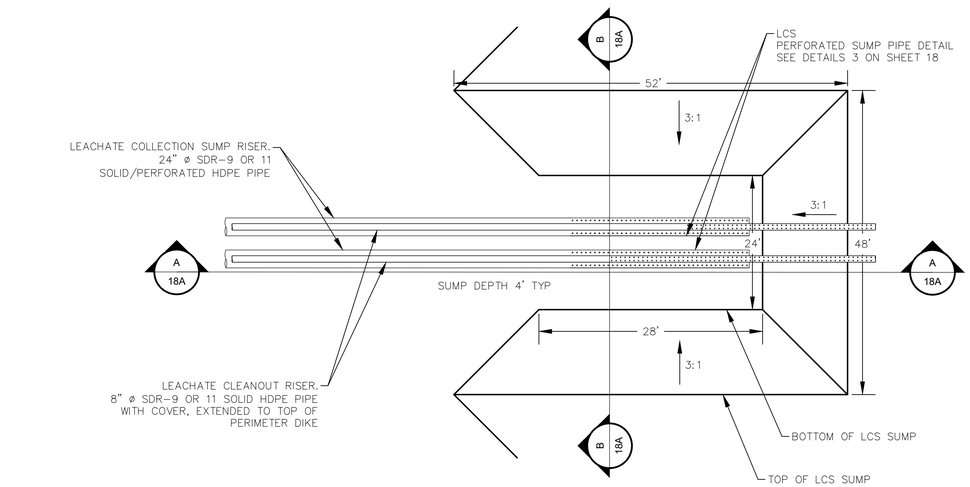


1 / 18A MC6F4 EAST LDCRS SUMP (TYP.)
NOT TO SCALE

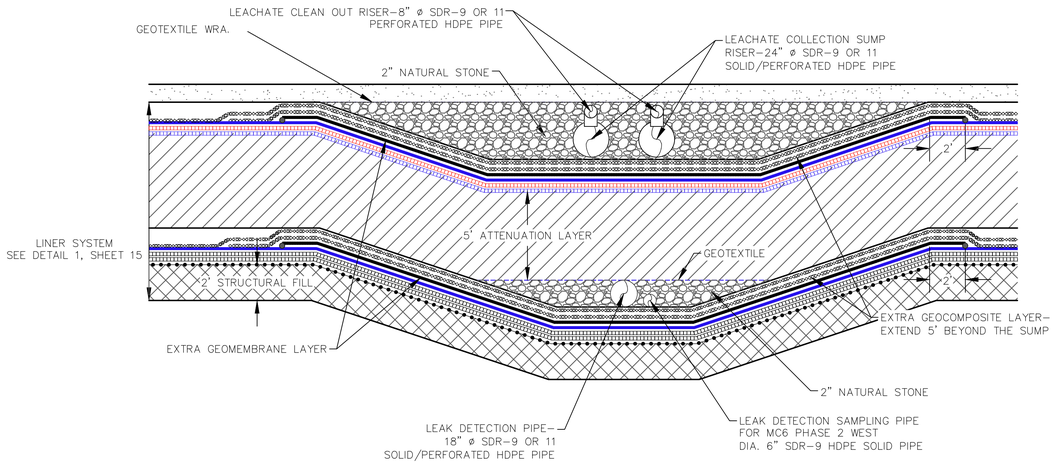


NOTES:
1. "PUMP-ON"/"PUMP-OFF" CONTROLS MAY BE USED PROVIDED LESS THAN 1 FOOT OF LEACHATE HEAD ON THE LINER IS MAINTAINED

A / 18A MC6F4 EAST SUMPS CROSS-SECTION A
NOT TO SCALE



2 / 18A MC6F4 EAST LCS SUMP (TYP.)
NOT TO SCALE



B / 18A MC6F4 EAST SUMPS CROSS-SECTION B
NOT TO SCALE

3 / 18A CELL FLOOR LEACHATE COLLECTION PIPE AND LEAK DETECTION GEONET FROM MC6E PHASE 2 WEST TO MC6F4 EAST (TYP.)
NOT TO SCALE

DATE:	05/18/22
DESIGNED BY:	XZ
DRAWN BY:	JC
CHECKED BY:	BA
APPROVED BY:	XZ

CTI and Associates, Inc.
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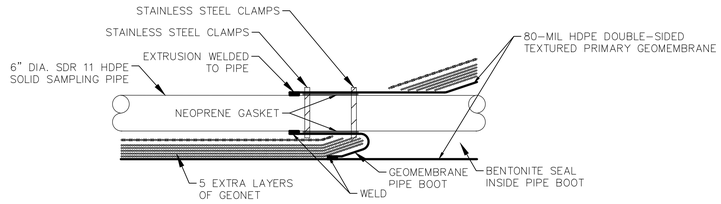
REVISIONS	REV	DATE	REVISION DESCRIPTION
	K	02/13/24	NEW SHEET
DRN	JC		
APP	XZ		

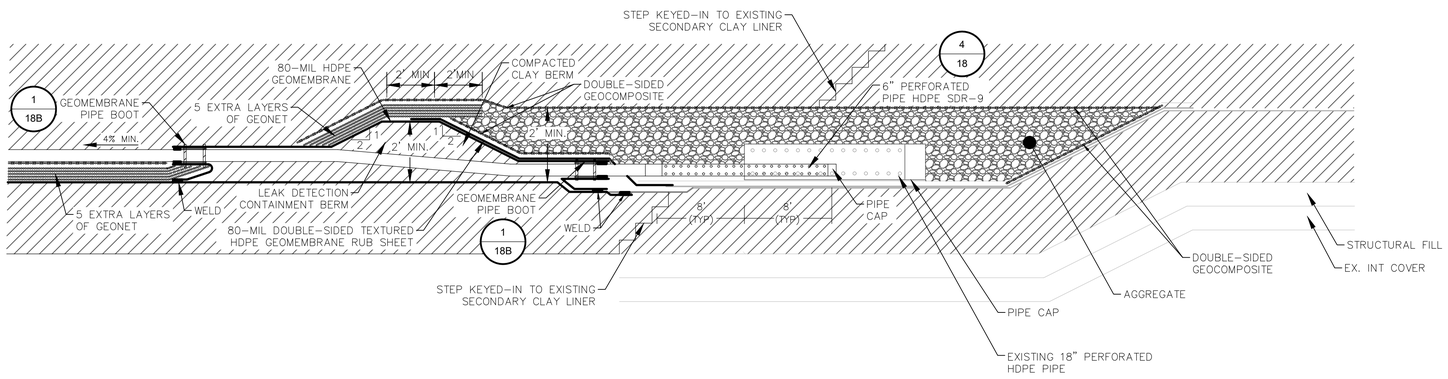
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

LEAK DETECTION AND LEACHATE SYSTEM FOR MC VI F4 EAST

PROJECT NUMBER
1218070017
SCALE
AS SHOWN
DRAWING NO
18A



1/18B **TYPICAL GEOMEMBRANE BOOT DETAIL**
NOT TO SCALE



2/18B **MODIFICATION OF EXISTING LEAK DETECTION SUMP IN SUBCELL MC VI-E PHASE 2 WEST**
NOT TO SCALE

DATE:	05/18/22
DESIGNED BY:	XZ
DRAWN BY:	JC
CHECKED BY:	BA
APPROVED BY:	XZ

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REVISIONS			
REV	DATE	REVISION DESCRIPTION	
K	02/13/24	NEW SHEET	
			JC DRN
			XZ APP

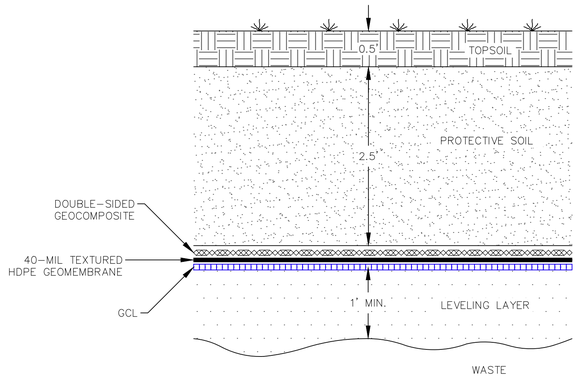
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CONNECTION DETAILS FOR MC VI-E PHASE 2 WEST LEAK DETECTION SUMP

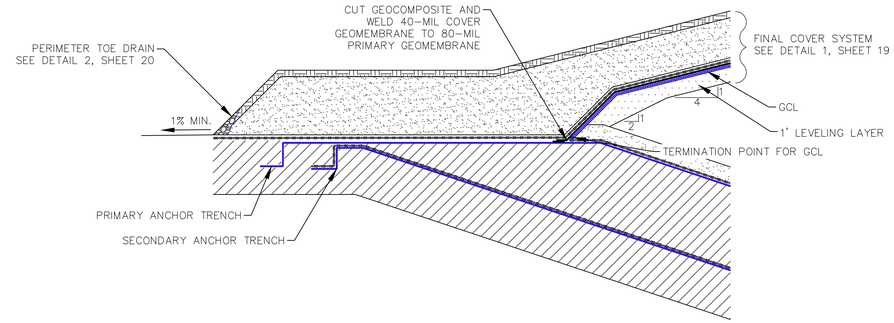
PROJECT NUMBER
1218070017

SCALE
AS SHOWN

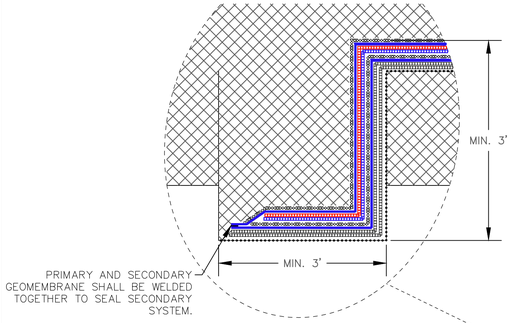
DRAWING NO
18B



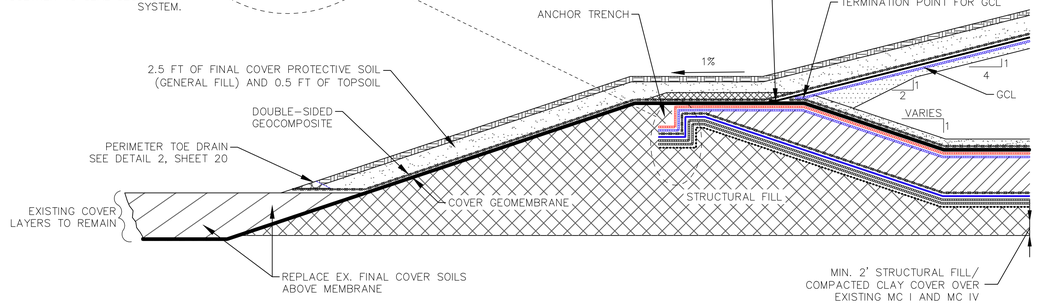
1/19 FINAL COVER SYSTEM
1"=2'



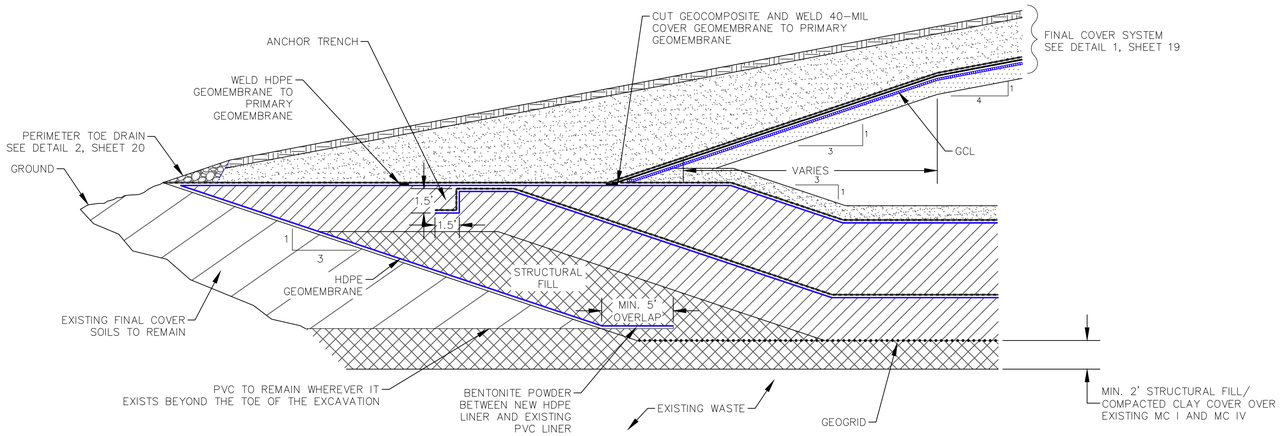
2/19 FINAL COVER TIE-IN DETAIL
MC VI-AN, AS, C & D
NOT TO SCALE



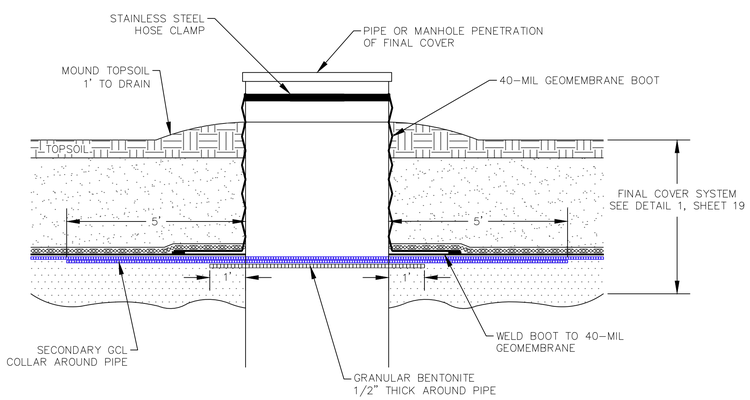
NOTE:
THE GEOMEMBRANE DOES NOT EXTEND TO THE OUTSIDE FACE OF THE PERIMETER DIKE WHERE IT IS LOCATED OUTSIDE OF THE MC I/MC IV FOOTPRINT.



3/19 DIKE AND COVER TIE-IN DETAIL (TYP.)
MC VI-F, MC VI-G, & EAST SIDE OF MC VI-E
NOT TO SCALE



4/19 DIKE AND COVER TIE-IN DETAIL
NORTH SIDE OF MC VI-E
NOT TO SCALE



5/19 FINAL COVER PENETRATION DETAIL (TYP.)
NOT TO SCALE

REVISIONS	REV	DATE	DESCRIPTION	BY	APP
	F	1/20/20	SUBCELLS F1-F4 REVISIONS	WRG	DRN
	G	7/14/21	REVISED LINER GRADES IN F1-F4 AND OTHER MINOR CORRECTIONS	LEH	XZ
	H	8/25/21	RESPONSE TO EGLE COMMENTS	LEH	XZ
	I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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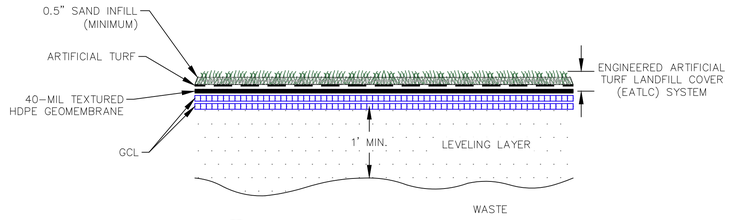
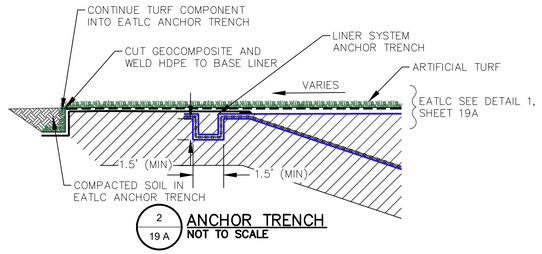
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

FINAL COVER DETAILS

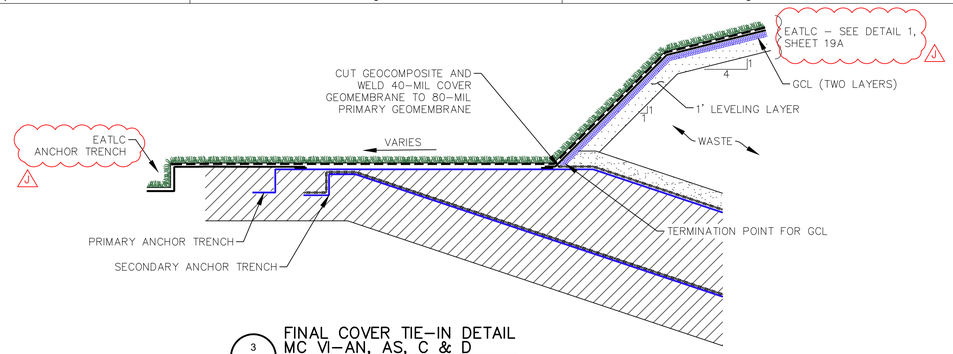
PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 19



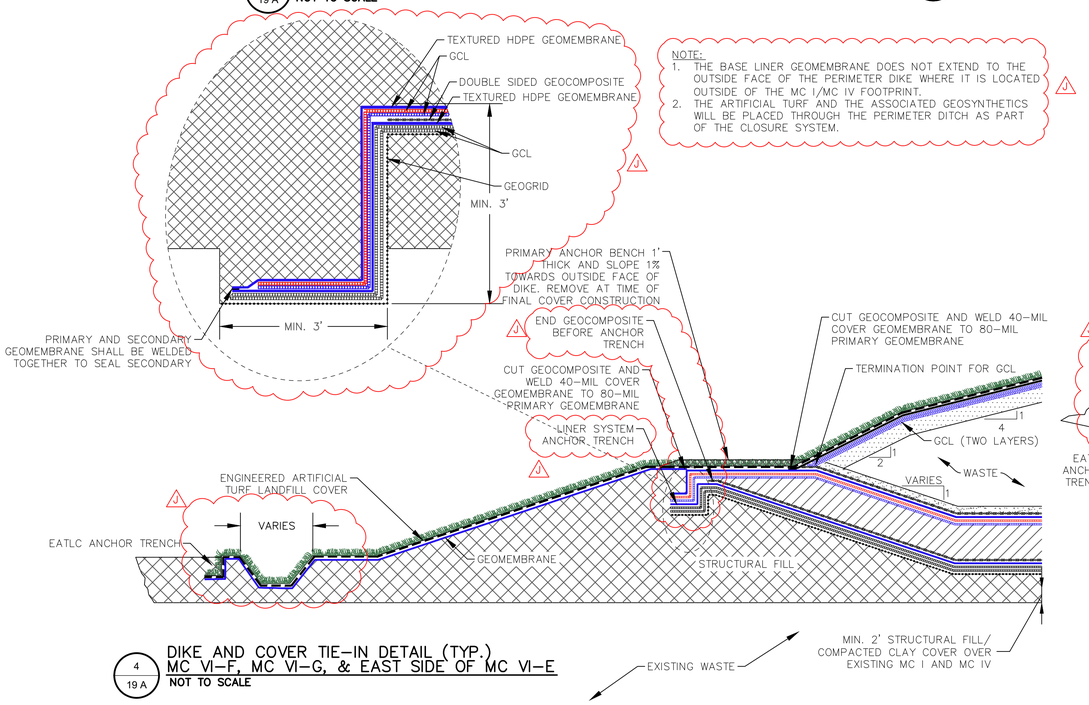
1 / 19 A **FINAL COVER SYSTEM**
NOT TO SCALE



2 / 19 A **ANCHOR TRENCH**
NOT TO SCALE

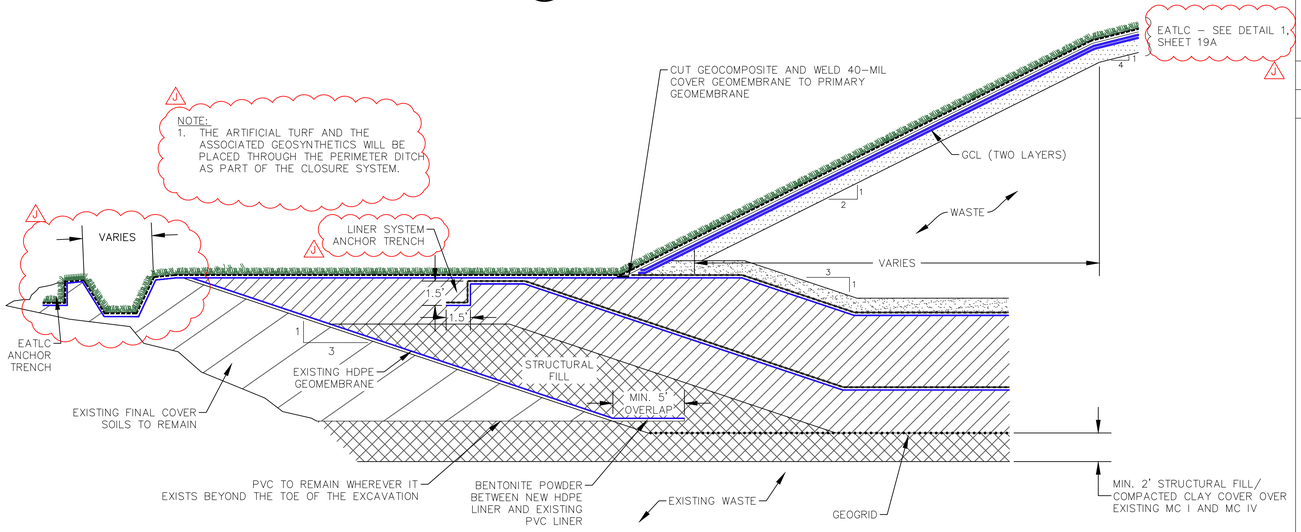


3 / 19 A **FINAL COVER TIE-IN DETAIL MC VI-AN, AS, C & D**
NOT TO SCALE

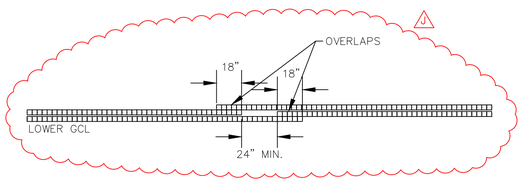


NOTE:
1. THE BASE LINER GEOMEMBRANE DOES NOT EXTEND TO THE OUTSIDE FACE OF THE PERIMETER DIKE WHERE IT IS LOCATED OUTSIDE OF THE MC I/MC IV FOOTPRINT.
2. THE ARTIFICIAL TURF AND THE ASSOCIATED GEOSYNTHETICS WILL BE PLACED THROUGH THE PERIMETER DITCH AS PART OF THE CLOSURE SYSTEM.

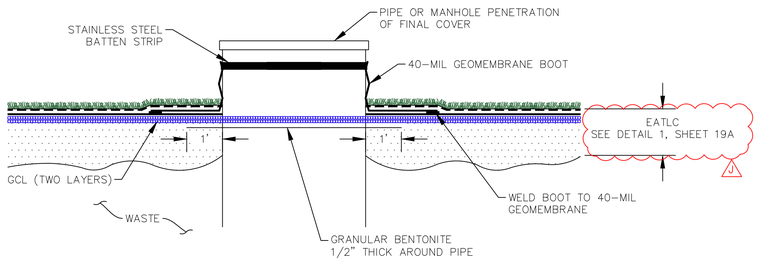
4 / 19 A **DIKE AND COVER TIE-IN DETAIL (TYP.) MC VI-F, MC VI-G, & EAST SIDE OF MC VI-E**
NOT TO SCALE



5 / 19 A **DIKE AND COVER TIE-IN DETAIL NORTH SIDE OF MC VI-E**
NOT TO SCALE



6 / 19 A **GEOSYNTHETIC CLAY LINER OVERLAP DETAIL**
NOT TO SCALE



7 / 19 A **FINAL COVER PENETRATION DETAIL (TYP.)**
NOT TO SCALE

NOTE:
1. ALL GEOSYNTHETIC CLAY LINER (GCL) SHALL BE COVERED WITH GEOMEMBRANE WITHIN 24 HOURS AFTER PLACEMENT OF GCL AND OVERLAPPED A MINIMUM OF 18-INCHES DURING INSTALLATION.
2. ALL OVERLAPPED SEAMS ARE TO BE HEAT-TACKED USING A QUICK PASS OF A FLAME TORCH FOLLOWED BY QUICK APPLICATION OF APPROPRIATE PRESSURE AS PROVIDED BY A ROLLER, FOOT PRESSURE, OR OTHER MEANS.
3. THE CONTRACTOR SHALL INSTALL THE TWO LAYERS OF THE GCL STAGGERED BY A MINIMUM OF 24-INCHES BETWEEN UPPER AND LOWER GCL SEAMS.
4. REINFORCED GCL MUST BE USED ON ALL SLOPES AS PART OF THE CLOSURE SYSTEM.
5. CONSTRUCTION OF THE FINAL COVER SYSTEM SHALL BE SUPPORTED BY A VENEER STABILITY ANALYSIS. EACH GEOSYNTHETIC/GEOSYNTHETIC AND GEOSYNTHETIC/SOIL INTERFACE INCLUDED IN EATLC SYSTEM SHALL BE CONSIDERED FOR PREQUALIFICATION TESTING PRIOR TO INSTALLATION OF THE COVER SYSTEM. THE CRITICAL INTERFACE SHALL BE DETERMINED BY A COMPARISON OF INTERFACE STRENGTH TEST RESULTS OF REPRESENTATIVE SAMPLES OF MATERIALS USED FOR CONSTRUCTION FOR EACH INTERFACE. THE CRITICAL INTERFACE IS THE LOWEST SHEAR STRENGTH TEST RESULT THAT CORRESPONDS TO THE NORMAL STRESS EXHIBITED BY THE EATLC COVER SYSTEM WHICH IS EXPECTED TO BE BETWEEN 5 AND 6 PSF.

AT MINIMUM, THE FOLLOWING INTERFACES SHALL HAVE INTERFACE TEST RESULTS FOR COMPARISON.
- BASE GEOTEXTILE OF THE EATLC AND GEOMEMBRANE
- GEOMEMBRANE AND TOP LAYER OF GCL.
- TOP LAYER OF GCL AND BOTTOM LAYER OF GCL.
- BOTTOM LAYER OF GCL AND LEVELING SOIL LAYER.
- INTERNAL SHEAR STRENGTH OF THE GCL UNDER HYDRATED CONDITIONS.

7. INTERFACE FRICTION TESTS PERFORMED TO QUALIFY ACCEPTABLE MATERIALS FOR PLACEMENT OF EATLC COVER MATERIALS SHALL CONSIDER LARGE-DISPLACEMENT STRENGTH TEST RESULTS ON THE FINAL COVER SIDE-SLOPES STEEPER THAN 10% AND PEAK STRENGTH TEST RESULTS FOR ALL OTHER SLOPES. THE MINIMUM DESIGN FACTOR OF SAFETY FOR STATIC STABILITY SHALL BE 1.3 FOR FINAL COVER SIDE-SLOPES STEEPER THAN 10% THAT CONSIDER LARGE-DISPLACEMENT STRENGTH TESTING RESULTS. THE MINIMUM DESIGN FACTOR OF SAFETY FOR STATIC STABILITY SHALL BE 1.5 FOR ALL OTHER FINAL COVER SLOPES THAT CONSIDER PEAK STRENGTH.
8. NO EQUIPMENT TRAFFIC SHALL BE ALLOWED TO TRAVERSE AREAS OF EATLC WITHOUT PRIOR APPROVAL BY THE ENGINEER.

VENEER STABILITY INTERFACE STRENGTH REQUIREMENTS		
	FINAL COVER SLOPES > 10%	FINAL COVER SLOPES ≤ 10%
REQUIRED INTERFACE STRENGTH TEST DATA	LARGE-DISPLACEMENT STRENGTH	PEAK STRENGTH
MIN. EQUIV. ACCEPTABLE INTERFACE STRENGTH*	18 DEGREES	20.5 DEGREES
MIN. ACCEPTABLE FS FOR VENEER STABILITY	1.3	1.5

*COMBINATIONS OF TESTED INTERFACE FRICTION ANGLE AND SHEAR STRENGTH INTERCEPT MEASURED AT THE NORMAL STRESS (5-6 PSF)EXHIBITED BY THE EATLC COVER SYSTEM THAT SATISFIES THE FACTOR OF SAFETY CRITERIA ARE ACCEPTABLE

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: C4B
APPROVED BY: XZ

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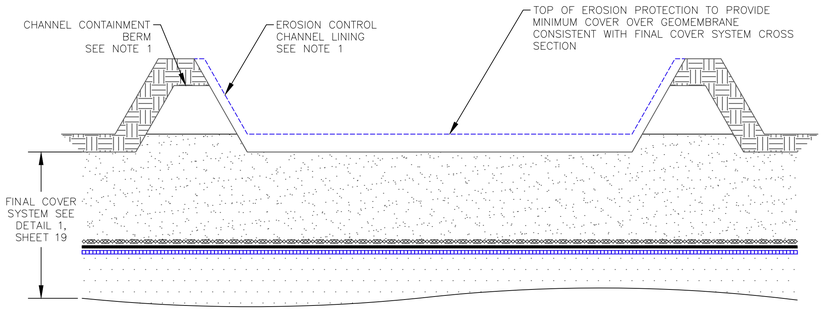
REVISIONS				
REV	DATE			
J	05/18/22	RESPONSE TO EGLE COMMENTS DATED 3/29/2022	LEH	XZ
I	10/08/21	SUBCELLS, G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
		REVISION DESCRIPTION	DRN	APP

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF FINAL COVER DETAILS

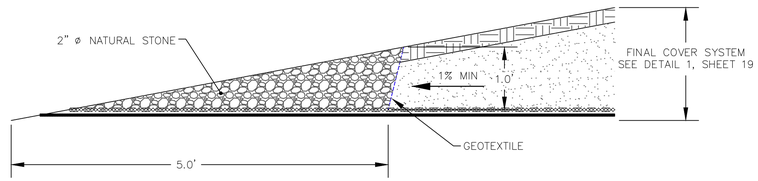
PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 19 A



1/20 TYPICAL DOWNSLOPE CHANNEL DETAIL
NOT TO SCALE

NOTE:

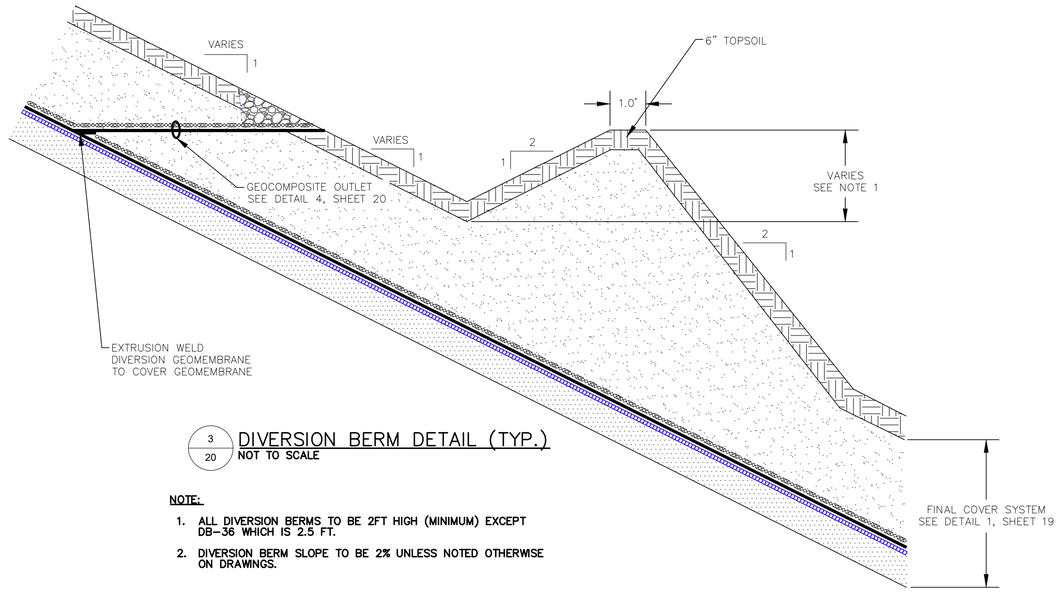
1. DIMENSIONS AND CONFIGURATION OF DOWNSLOPE CHANNEL CONTAINMENT BERMS AND CHANNEL WILL BE DETERMINED BY THE EROSION CONTROL CHANNEL LINING CHOSEN. CHANNEL AND OUTLET ENERGY DISSIPATER DESIGN TO BE COMPLETED PRIOR TO CONSTRUCTION.



2/20 PERIMETER TOE DRAIN
NOT TO SCALE

Erosion Control Channel Lining	Maximum Allowable Design		Comments
	Velocity	Slope	
Grass	5 fps	Varies	Maximum allowable design slope varies based on peak flows within channel.
Riprap	Varies	25%	Maximum allowable design velocity varies with slope to maintain stable riprap.
TRM (Turf Reinforcement Mat)	15 fps	25%	Final design limits to be determined based on actual TRM chosen.
Articulated Concrete Block Mat (e.g. Flexamat)	30 fps	33.30%	Final design limits to be determined based on actual product chosen.
Other	Varies	Varies	Additional erosion control materials may be utilized based on availability, effectiveness, and cost.

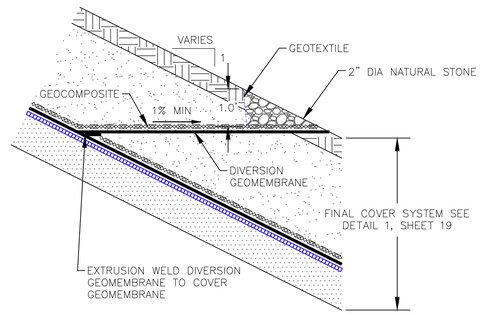
K



3/20 DIVERSION BERM DETAIL (TYP.)
NOT TO SCALE

NOTE:

1. ALL DIVERSION BERMS TO BE 2FT HIGH (MINIMUM) EXCEPT DB-36 WHICH IS 2.5 FT.
2. DIVERSION BERM SLOPE TO BE 2% UNLESS NOTED OTHERWISE ON DRAWINGS.



4/20 GEOCOMPOSITE OUTLET DETAIL (TYP.)
NOT TO SCALE

NOTE:

1. ALTERNATE GEOCOMPOSITE OUTLETS SUCH AS PIPE MAY BE USED.

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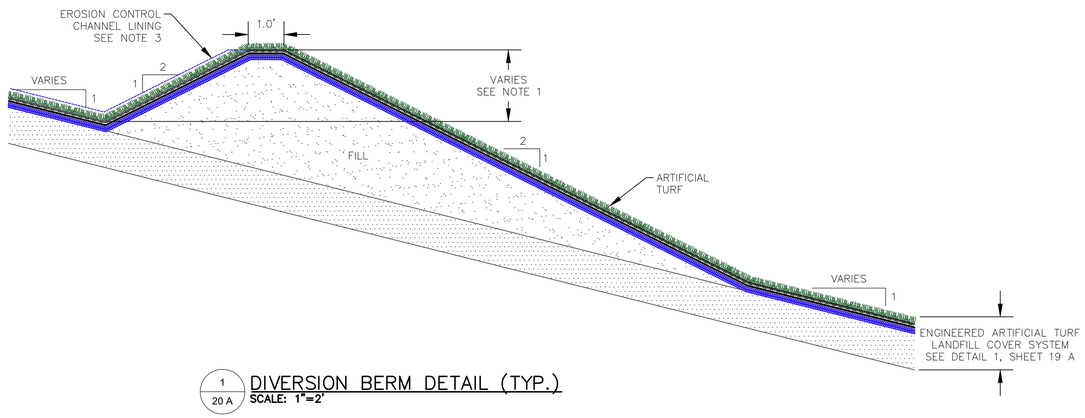
DATE:	10/08/21
DESIGNED BY:	LEH
DRAWN BY:	WRG
CHECKED BY:	CAB
APPROVED BY:	XZ

REVISIONS	REV	DATE	REVISION DESCRIPTION	DRN	APP
	F	11/20/20	SUBCELLS F1-F4 REVISIONS	WRG	XZ
	I	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ
	K	02/08/24	ADDED EROSION CONTROL TABLE	JWC	XZ

WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

STORMWATER MANAGEMENT SYSTEM DETAILS

PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 20



1/20 A DIVERSION BERM DETAIL (TYP.)
SCALE: 1"=2'

NOTE:

1. ALL DIVERSION BERMS TO BE 2FT HIGH (MINIMUM).
2. DIVERSION BERM SLOPE TO BE 2% UNLESS NOTED OTHERWISE ON DRAWINGS.
3. DIMENSIONS AND CONFIGURATION OF DIVERSION BERMS WILL BE DETERMINED BY THE EROSION CONTROL CHANNEL LINING CHOSEN. CHANNEL AND OUTLET ENERGY DISSIPATER DESIGN TO BE COMPLETED PRIOR TO CONSTRUCTION.

DATE: 10/08/21
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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REVISIONS

REV	DATE	DESCRIPTION	DRN	APP
1	10/08/21	SUBCELLS G4-G7 REVISIONS; FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES	WRG	XZ

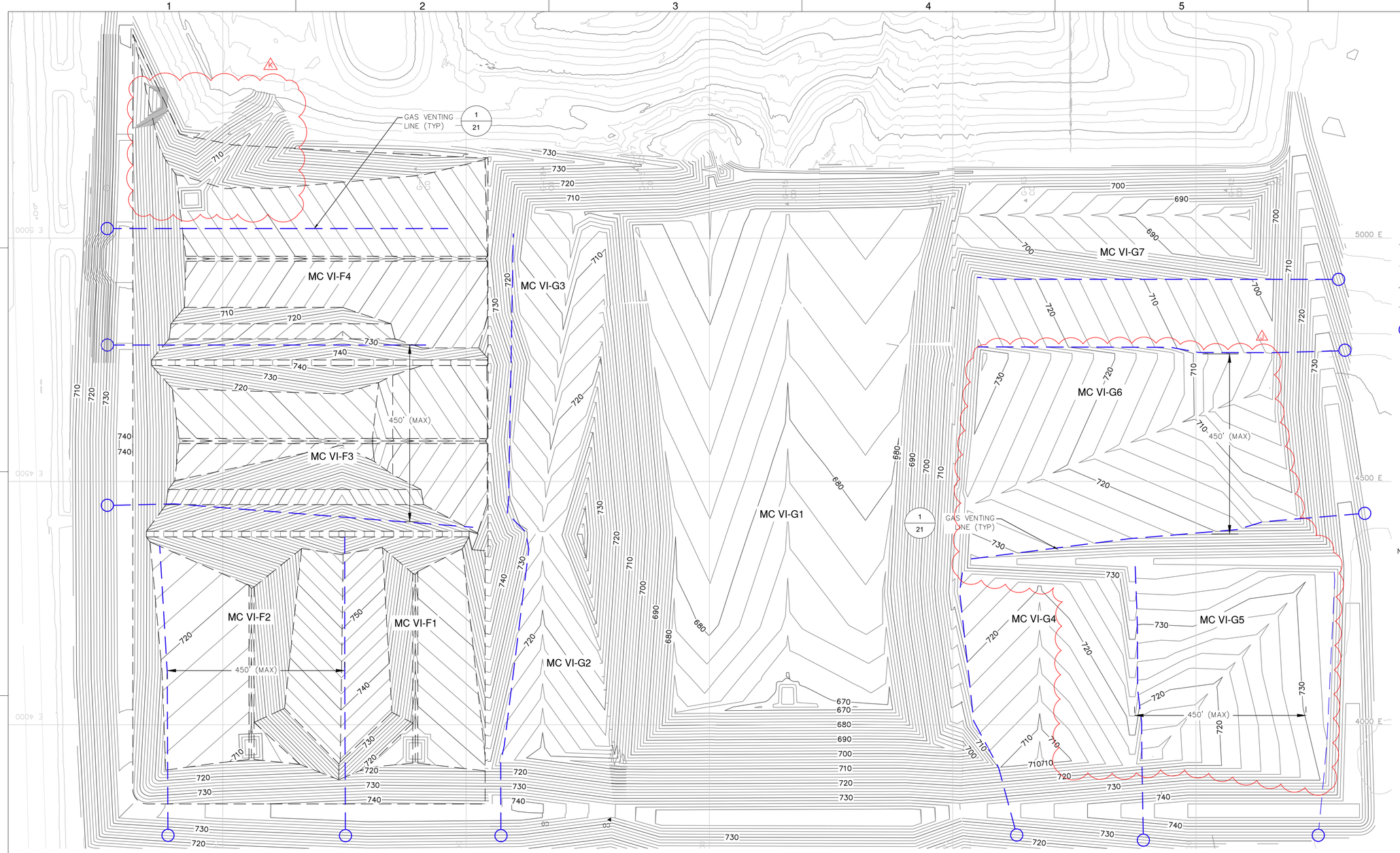
WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

ENGINEERED TURF STORMWATER MANAGEMENT SYSTEM DETAILS

PROJECT NUMBER
1218070017

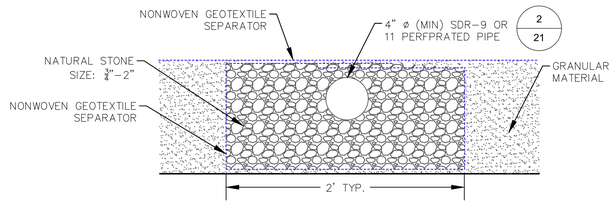
SCALE
AS SHOWN

DRAWING NO
20 A

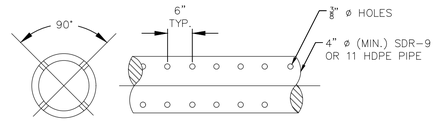


NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL DRONE SURVEY PROVIDED BY DRONEVIEW TECHNOLOGIES, DATED DECEMBER 10, 2020. UPDATED WITH DRONE AERIAL SURVEY DATED APRIL 2, 2021.



1/21 VENTING LINE DETAIL FOR SUBCELLS F1–4 AND G4–7 OVER EXISTING MC I AND MC IV
NOT TO SCALE



2/21 VENTING PIPE DETAIL
NOT TO SCALE

REVISIONS			
REV	DATE	DRN	APP
A	5/29/18	PAA	XZ
ADDENDUM			
B	7/14/21	WRG	XZ
REVISED LINER GRADES IN F1–F4 AND OTHER MINOR CORRECTIONS			
C	11/20/20	LEH	XZ
SUBCELLS F1–F4 REVISIONS			
D	8/25/21	LEH	XZ
RESPONSE TO EGLE COMMENTS			
E	5/10/22	LEH	XZ
REVISED LINER GRADES IN F3			
F	10/08/21	WRG	XZ
SUBCELLS G4–G7 REVISIONS, FINAL GRADE MODIFICATIONS; MISCELLANEOUS CHANGES			
G	05/18/22	LEH	XZ
SUBCELLS G4–G6 REVISIONS			
H	02/23/24	AN	XZ
SUBCELL F4 AND FINAL COVER REVISIONS			

DATE: 05/18/22
DESIGNED BY: LEH
DRAWN BY: WRG
CHECKED BY: CAB
APPROVED BY: XZ

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WAYNE DISPOSAL, INC. SITE NO. 2 - MASTER CELL VI-F&G
CONCEPTUAL GAS VENTING SYSTEM
VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN

CONCEPTUAL GAS VENTING SYSTEM

PROJECT NUMBER 1218070017
SCALE AS SHOWN
DRAWING NO 21

Attachment 3

MC5A Manhole Extension Calculations

CALCULATION SHEET
Client: Republic Services – Wayne Disposal Inc.
Project: WDI License Renew
Calculation: MC5A MH Extension Evaluations

Project No.: 22L070
Calculated By: DQ Date: 02/23/2023
Checked By: KF Date: 02/23/2023
Approved By: XZ Date: 02/23/2023

MC5A Manhole Extension Evaluations
Wayne Disposal, Inc.

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CALCULATION SHEET

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1. Objectives

- Evaluate the current condition of the existing MC5A manhole;
- Predict future conditions after installing an extended manhole section in the final cover condition for two design options;
- Check the manhole sections for tolerable axial stress and manhole base settlement under these different conditions;
- Provide engineering recommendations for designing an extended MC5A manhole section.

2. Parameter Determinations

The American Society for Testing and Materials (ASTM) standard ASTM-F1759[6] recommends an interface friction coefficient of 0.4 ($\mu = \tan\delta_{h\text{-}w} = 0.4$) between the HDPE manhole riser and the waste, corresponding to a $\delta_{h\text{-}w}$ value of 21.8 degrees. For the HDPE manhole section and on-site waste interface, a 21.8-degree friction angle is adopted (i.e., $\delta_{h\text{-}w} = 21.8°$).

In accordance with Reference [5], the interface friction angles between the formed concrete and different soil types are as follows:

- 17 to 19 degrees for silty clay and medium-stiff/stiff clay,
- 17 to 22 degrees for clean sand and silty sand-gravel mixture, and
- 22 to 26 degrees for clean gravel and gravel-sand mixtures.

Based on past experiences, it was observed that the interface friction angle between the waste and the adjacent material closely resembled the interface friction angle between unsaturated cohesive soil, such as silty clay, and adjacent material[7]. Since the existing manhole is constructed with prefabricated concrete pipes, which typically have relatively smooth sidewalls, a conservative estimate of a 22.5-degree interface friction angle is employed between the concrete manhole and the on-site waste.

The key parameters utilized in the design calculations are summarized in Table 1. It is important to note that since there were no specific testing values available from either on-site or laboratory investigations for these parameters, conservative values were chosen based on a comprehensive review of relevant references.

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Table 1 – Parameters used in calculations

Parameter	Value	Reference
Unit weight of existing waste	γ_{ew} = 91 lb/ft^3	Ref. [1]
Unit weight of new waste	γ_{nw} = 103 lb/ft^3	Ref. [4]
Unit weight of final cover	γ_{cover} = 135 lb/ft^3	Ref. [4]
Unit weight of clay liner and clay cap	γ_{clay} = 135 lb/ft^3	Ref. [16]
Unit weight of structural fill	γ_{fill} = 135 lb/ft^3	Ref. [16]
Unit weight of concrete manhole	γ_{conc} = 150 lb/ft^3	Ref. [2]
Unit weight of HDPE manhole	γ_{HDPE} = 61 lb/ft^3	Ref. [3]
Internal friction angle of the waste	ϕ_w = 34°	Ref. [4]
Interface friction angle between concrete manhole and waste or clay	$\delta_{c\text{-}w}$ = 22.5° $\tan\delta_{c\text{-}w}$ = 0.414	Ref. [5]
Interface friction angle between the HDPE and the waste or clay	$\delta_{h\text{-}w}$ = 21.8° $\tan\delta_{h\text{-}w}$ = 0.4	Ref. [6]
Compressive strength of concrete	σ_{conc} = 2,500 psi	Ref. [8]
Long-term allowable compressive stress of HDPE	$(\sigma_{HDPE})_{allow}$ = 1,000 psi	Ref. [6]
Long-term stress relaxation modulus of HDPE	E_{HDPE} = 28,250 psi	Ref. [6]
Long-term Poisson's ratio of HDPE	ν_{HDPE} = 0.48	Ref. [6]
Long-term allowable compressive stress of HDPE	$(\sigma_{HDPE})_{allow}$ = 1,000 psi	Ref. [6]
Young's modulus of the soil	E_S = 7,000 psi (medium clay & hazardous waste)	Ref. [6]

3. Evaluation Methods and Engineering Calculations

3.1 Evaluation Method for Vertical Subsurface Risers

The performance limits of vertical subsurface risers include ring deflection, ring and axial stress (or strain), and ring and axial buckling. Radially-directed load acting on a vertical riser causes ring deformation and ring bending stresses. The radial load varies along the length of the riser (see Figure 1). In addition to radial stresses, considerable axial stress may exist in the vertical riser wall as a result of "downdrag". Downdrag occurs as the backfill soil and waste surrounding the riser consolidates and settles. Axial load is induced through the frictional resistance of the manhole to the backfill settlement (see Figure 2). The riser must also be checked for axial compressive stress and axial buckling due to downdrag force[6][9].

3.1.1 Horizontal Earth Pressure (Radial Pressure)

Horizontal earth pressure exists in all soil deposits. Figure 1 illustrates the horizontal pressure acting on a manhole riser. The active earth pressure modified for uneven soil compaction around the circumference of the riser can be used. Use of the active pressure is based on measurements taken by Gartung et al. (1989)[10] and on the ability of the material placed around the manhole to accept tangential stresses and thus relieve some of the lateral pressure. It may actually understate the load on the manhole, however this appears to be offset by the stress relaxation that occurs in the HDPE manhole as shown by Hossain (1990)[11]. Stress relaxation permits mobilization of horizontal arching, thus the active earth pressure can be assumed for design purposes.

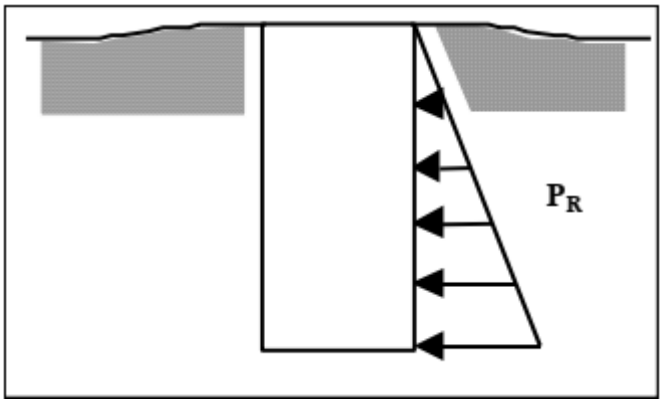

Figure 1 – Horizontal pressure on vertical subsurface riser[6]

The radially-directed earth pressure:

$$P_R = C_A \cdot K_A \cdot \gamma \cdot H \quad (1.1a)$$

For layered soils and wastes,

$$P_R = C_A \cdot K_A \cdot (\Sigma \gamma_i \cdot H_i) \quad (1.1b)$$

Where:
P_R = radial earth pressure, lb/ft^2;
γ = unit weight of the waste backfilled around riser, lb/ft^3;
H = height of waste fill around riser, ft;
γ_i = unit weight of the i^{th} layer of waste or soil around riser, lb/ft^3,
H_i = height of the i^{th} layer of waste or soil around riser, ft;
C_A = parameter, C_A = 1.21 recommended by ASTM-F1759;
K_A = active earth pressure coefficient,

$$K_A = \tan^2 (45 - \phi_i/2) \quad (1.2)$$

Where:
ϕ_i = Internal friction angle of the waste backfilled around riser, ϕ_{waste} = 34°.

3.1.2 Downdrag Force

The settlement of backfill material surrounding a manhole riser develops a shear stress between the manhole and the fill, which acts as "downdrag" along the outside of the manhole. Downdrag creates a longitudinal (axial) compressive force in the riser wall. It is illustrated in Figure 2. The settling process begins with the first lift of fill placed around the manhole and continues until all the fill is placed and consolidated. As fill is placed around a manhole, the axial force coupled into the manhole by downdrag shear will increase until it equals the frictional force between the soil and manhole. When this limit is reached, slippage of the fill immediately adjacent to the manhole occurs. This limits the axial force to the value of the frictional force.

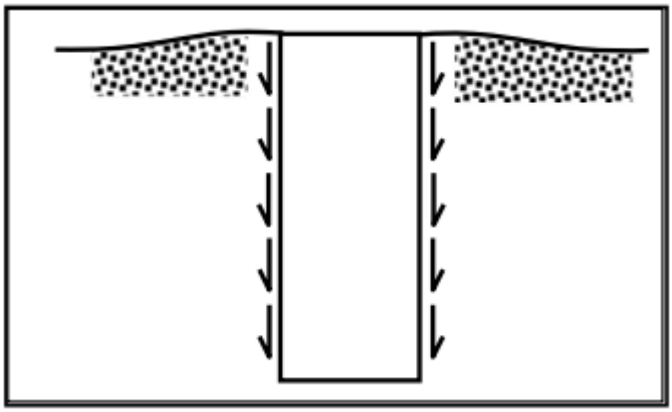

Figure 2 – Downdrag shear stress on vertical subsurface riser[6]

The average downdrag shear stress on manhole:

$$T_A = \mu \cdot (P_{R1} + P_{R2})/2 \quad (1.3)$$

Where:
T_A = average downdrag shear stress on manhole, lb/ft^2,

P_{R1} = radial pressure at top of riser, lb/ft^2,
P_{R2} = radial pressure at base of riser, lb/ft^2,
μ = interface friction coefficient between HDPE manhole riser and waste, $\mu = \tan\delta_{h\text{-}w} = 0.4$ (i.e., $\tan\delta_{h\text{-}w} = 21.8°$) recommended by ASTM-F1759.

Swan et al.[12] and Martin et al.[13] suggest a coefficient of friction between a granular or granular-cohesive soil and HDPE of 0.4, i.e., $\mu = \tan\delta_{h\text{-}w} = 0.4$ (i.e., $\tan\delta_{h\text{-}w} = 21.8°$).

The downdrag force acting on the manhole that causes a compressive stress in the manhole riser wall:

$$P_D = T_A \cdot \pi \cdot D_o \cdot H \qquad (1.4)$$

Where:
P_D = downdrag force acting on manhole, lb,
D_o = outside diameter of HDPE manhole riser, ft,
T_A = average downdrag shear stress on manhole, lb/ft^2,
H = height of waste fill around manhole, ft.

3.2 Existing Manhole in Current Condition

Calculation of downdrag force mobilized along the existing manhole from the current waste surface to the bottom of the existing manhole (Figure 3)

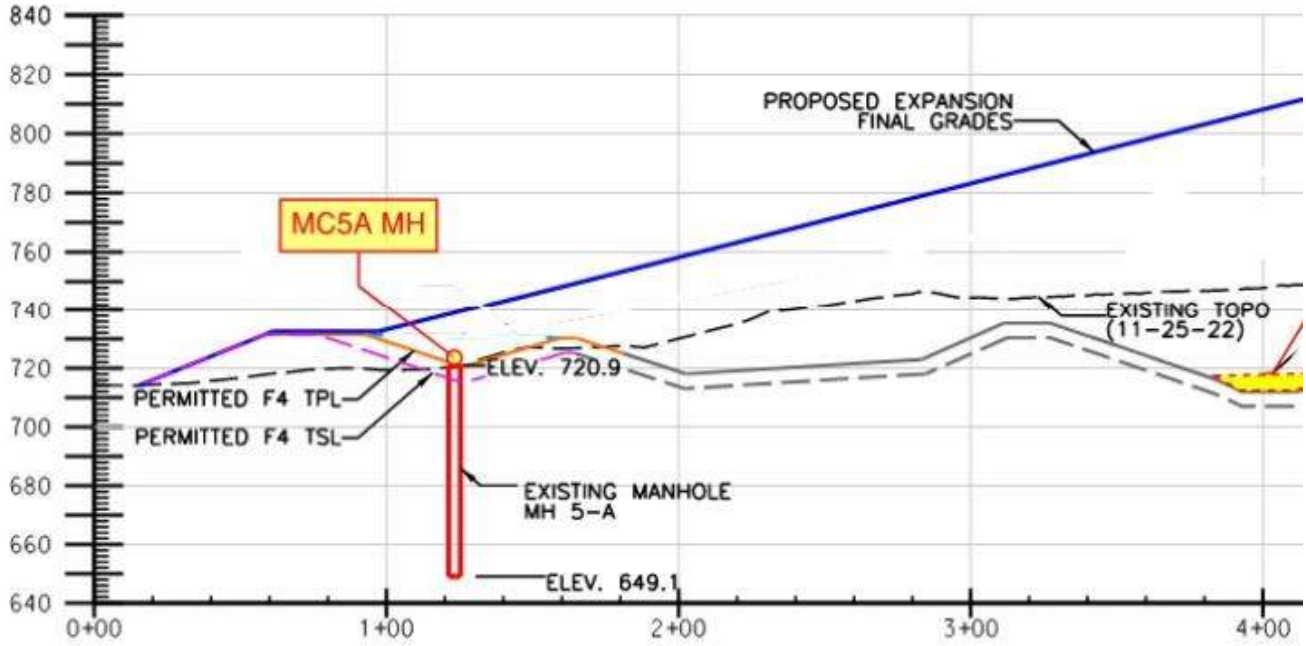

Figure 3 – Cross-section of existing MC5A manhole in current condition

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The forces acting on existing MC5A manhole in the current condition are shown in Figure 4. The dimensions and elevations of MC5A manhole in the current condition are listed in Table 2.

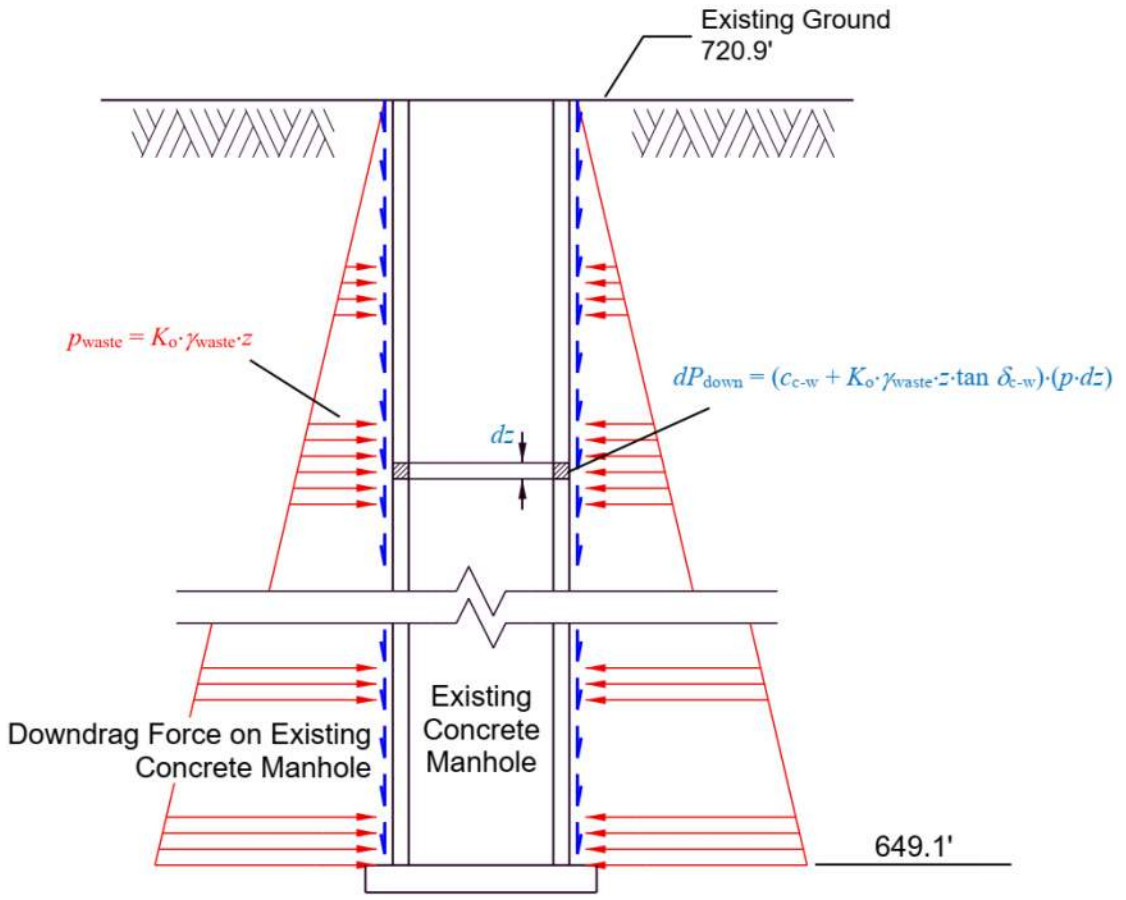

Figure 4 – Forces on existing MC5A manhole in current condition

Table 2 – Dimensions of MC5A manhole in current condition

Elevation of top of existing clay cap (ft)	720.9
Elevation of top of existing waste (ft)	712.9
Elevation of bottom of existing manhole (ft)	649.1
Thickness of existing clay cap (ft)	8.0
Depth of existing waste (ft)	63.8
Total depth of existing manhole (H_1) (ft)	71.8
Outer diameter of concrete manhole (D_o) (inch)	72
Inner diameter of concrete manhole (D_{in}) (inch)	63
Wall thickness of concrete manhole (t_{conc}) (inch)	4.5

The calculation results of MC5A manhole in the current condition are listed in Table 3. It can be seen from Table 3 that the calculation results can meet the requirement.

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Table 3 – Calculation results of MC5A manhole in current condition

Interface friction angle between concrete manhole and waste, $\delta_{c\text{-}w}$	22.5°
Interface shear strength between concrete manhole and waste, $\tan\delta_{c\text{-}w}$	0.414
Downdrag force on existing manhole (lb)	690,243
Compressive stress of drowndrag force (psi)	723
Weight of existing concrete manhole (lb)	71,371
Compressive stress of manhole weight (psi)	75
Total Compressive Force at bottom of manhole (lb)	761,613
Total Compressive Stress at bottom of manhole, σ_{total} (lb/ft^2)	114,929
Total Compressive Stress at bottom of manhole, σ_{total} (psi)	**798**
$\sigma_{total} < (\sigma_{conc})_{allow}$ = 2,500 psi	OK

3.3 Adding an Extended Manhole Section to Reach Proposed Final Cover Elevation

Figure 5 illustrates the positioning relative to the MC5A manhole and two cells of existing MC6EP2-NE and future MC VI-F4. The drawing shows that the MC5A manhole lies outside both cells of MC6EP2-NE and MC VI-F4. Despite its external placement, the MC5A manhole will receive the same final cover as the cells of MC6EP2-NE and MC VI-F4. Structural fill will be placed around the MC5A manhole, extending from the current clay cap covering existing waste up to the bottom elevation of the final cover.

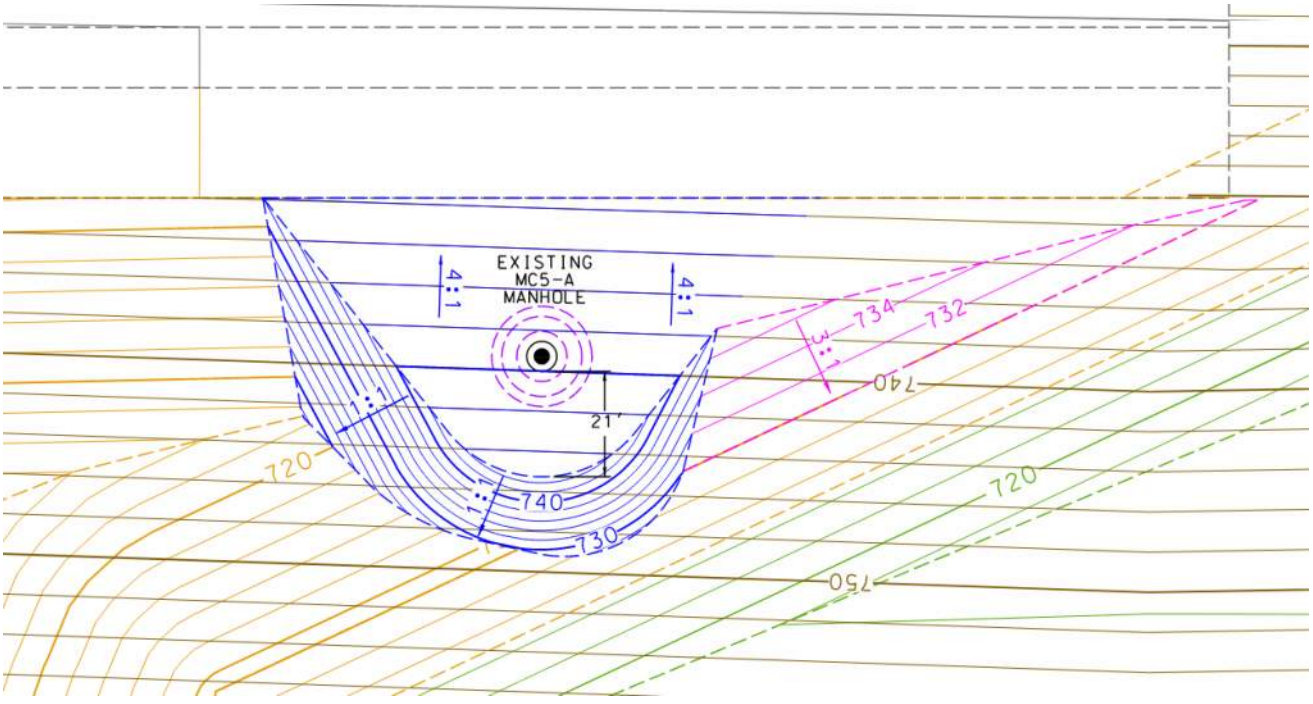

Figure 5 – Position of MC5A manhole relative to existing MC6EP2-NE and future MC VI-F4

An extended manhole section must be added on the top of the existing concrete manhole to reach the proposed final cover elevation (Figure 6). Figure 7 is the composition of the final cover system. There

are two options for this proposed extension. Option one is to install a same size concrete section on the top of the existing manhole. Option two is to install an HDPE section over the existing concrete manhole. The design calculations for these two options are described as follows.

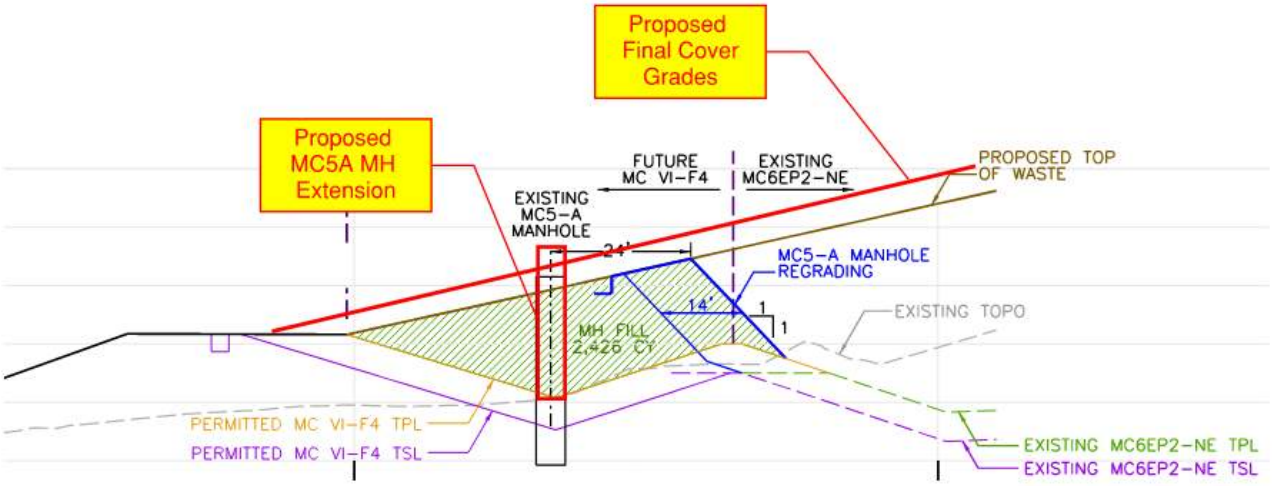

Figure 6 – Cross-section of extended MC5A manhole in closure condition

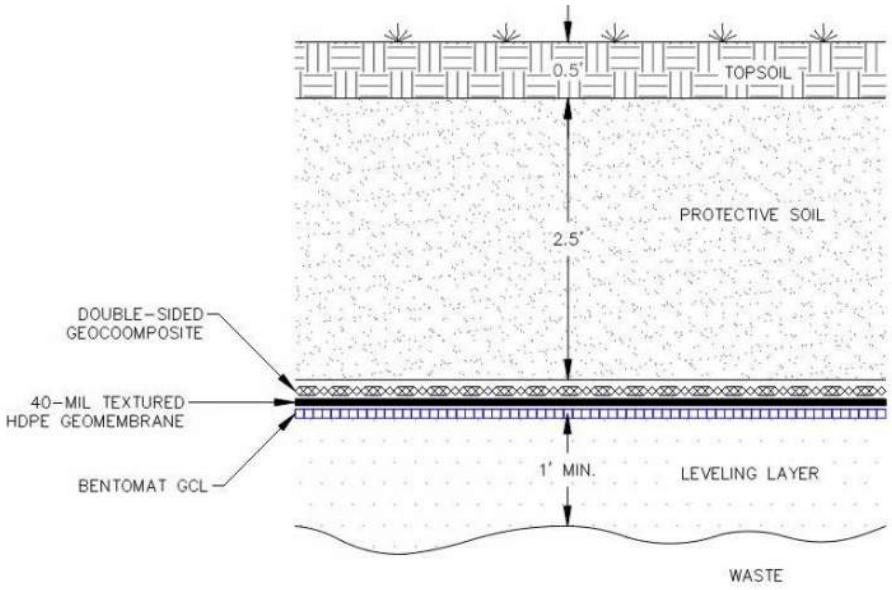

Figure 7 – Composition of final cover system

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3.3.1 Option 1: Installing an Extended Concrete Section

A same size concrete manhole section with outer diameter of 6-ft and wall thickness of 4.5-inch will be installed on the top of the existing concrete manhole.

Calculation of downdrag force mobilized along the extended manhole section from the surface of the final cover to the bottom of the existing manhole (Figure 8)

The forces acting on the existing concrete manhole and the extended concrete section are shown in Figure 8. The dimensions, elevations, and depths of the existing manhole and the proposed extended concrete section are listed in Table 4.

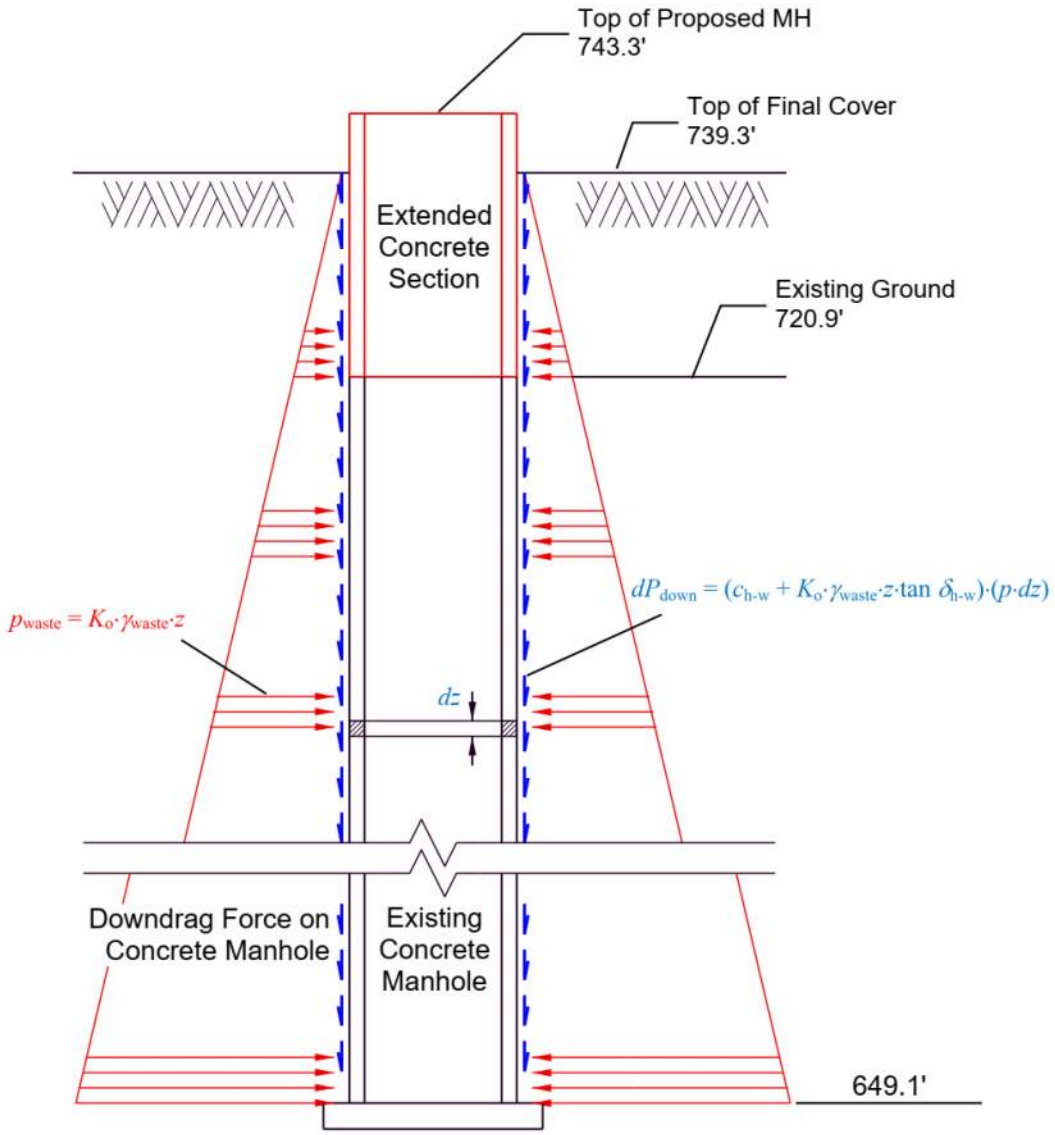

Figure 8 – Forces on existing concrete manhole and extended concrete section

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Table 4 – Dimensions of existing manhole with extended concrete section

Elevation of rim of extended concrete section (ft)	743.3
Elevation of top of final cover (ft)	739.3
Elevation of top of structural fill (ft)	735.3
Elevation of top of existing clay cap (ft)	720.9
Elevation of top of existing waste (ft)	712.9
Elevation of bottom of existing manhole (ft)	649.1
Thickness of final cover (ft)	4.0
Depth of structural fill (ft)	14.4
Depth of extended concrete section (H_2) (ft)	18.4
Thickness of existing clay cap (ft)	8.0
Depth of existing waste (ft)	63.8
Total depth of existing manhole (H_1) (ft)	71.8
Total depth of manhole in waste after extension ($H_1 + H_2$) (ft)	90.2
Length of extended concrete section (H_{2T}) (ft)	22.4
Total length of manhole (ft)	94.2
Dimensions of Extended Concrete Section	
Outer diameter of extended concrete section $(D_{HDPE})_{out}$ (inch)	72
Inner diameter of extended concrete section $(D_{HDPE})_{in}$ (inch)	63
Wall thickness of extended concrete section (t_{HDPE}) (inch)	4.5
Dimensions of Existing Concrete Manhole	
Outer diameter of existing concrete manhole $(D_{conc})_{out}$ (inch)	72
Inner diameter of existing concrete manhole $(D_{conc})_{in}$ (inch)	63
Wall thickness of existing concrete manhole (t_{conc}) (inch)	4.5

The calculation results of the existing manhole with the concrete extended section are listed in Table 5. It can be seen from Table 5 that the calculation results can meet the requirement.

Table 5 – Calculation results of existing manhole with extended concrete section

Interface friction angle between concrete and waste, $\delta_{c\text{-}w}$	22.5°
Interface shear strength between concrete and waste, $\tan\delta_{c\text{-}w}$	0.414
Downdrag force on manhole with extended section (lb)	1,254,180
Compressive stress of downdrag force (psi)	1,314
Weight of existing concrete manhole with extended section (lb)	93,637
Compressive stress of manhole weight (psi)	98
Total Compressive Force at bottom of manhole (lb)	1,347,817
Total Compressive Stress at bottom of manhole, σ_{total} (lb/ft^2)	203,388
Total Compressive Stress at bottom of manhole, σ_{total} (psi)	**1,412**
$\sigma_{total} < (\sigma_{conc})_{allow}$ = 2,500 psi	OK

3.3.2 Option 2: Installing an Extended HDPE Manhole Section

A HDPE pipe with outer diameter of 2,250 mm (88.58 inches) and SDR of 26 (see Appendix A, B:17, Page 34) will be selected as an extended manhole section to install over the existing concrete manhole (Figures 9 and 10).

Calculation of downdrag force mobilized along the extended HDPE manhole section and the existing concrete manhole (Figures 9 and 10)

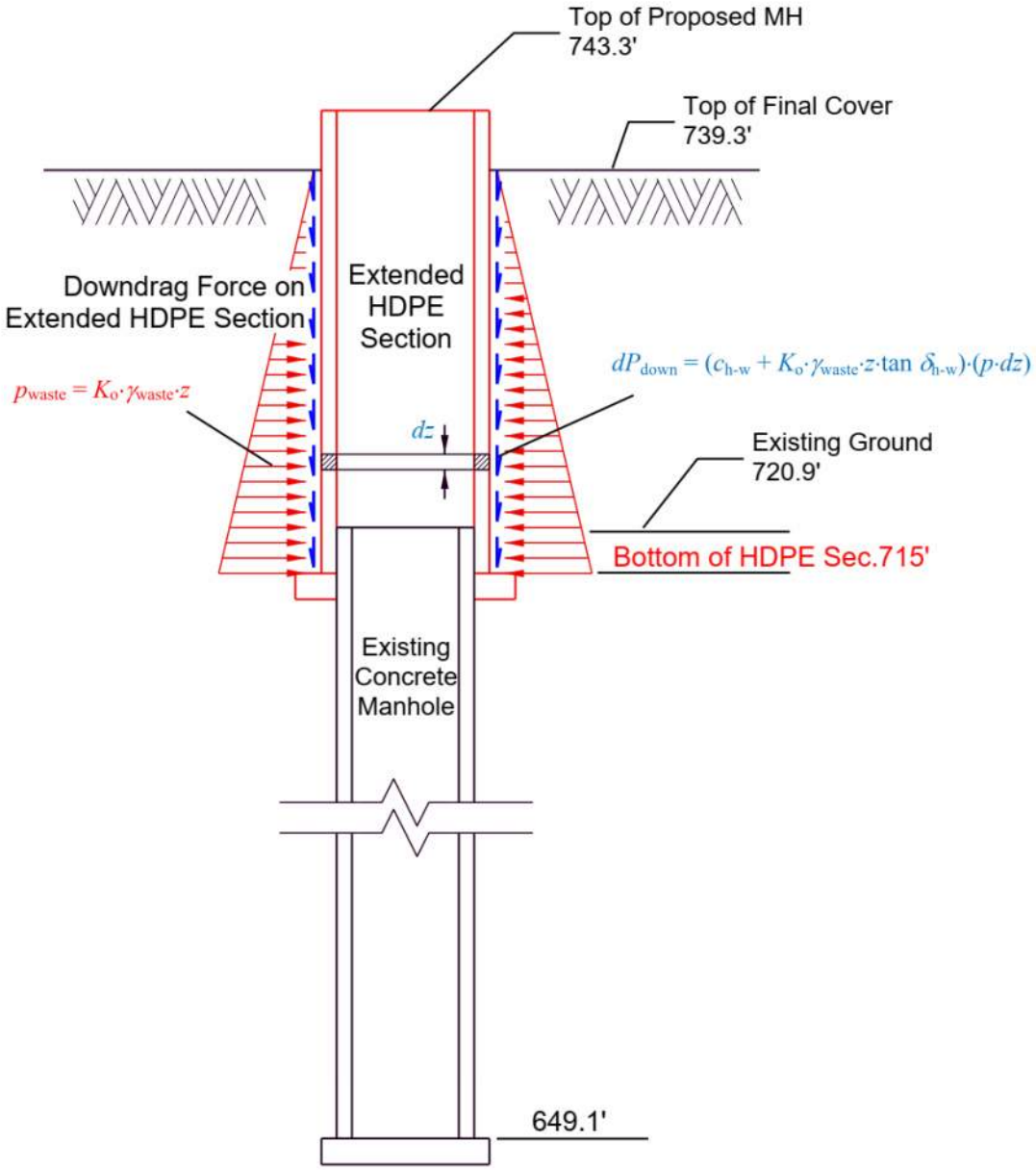

Figure 9 – Forces on extended HDPE section

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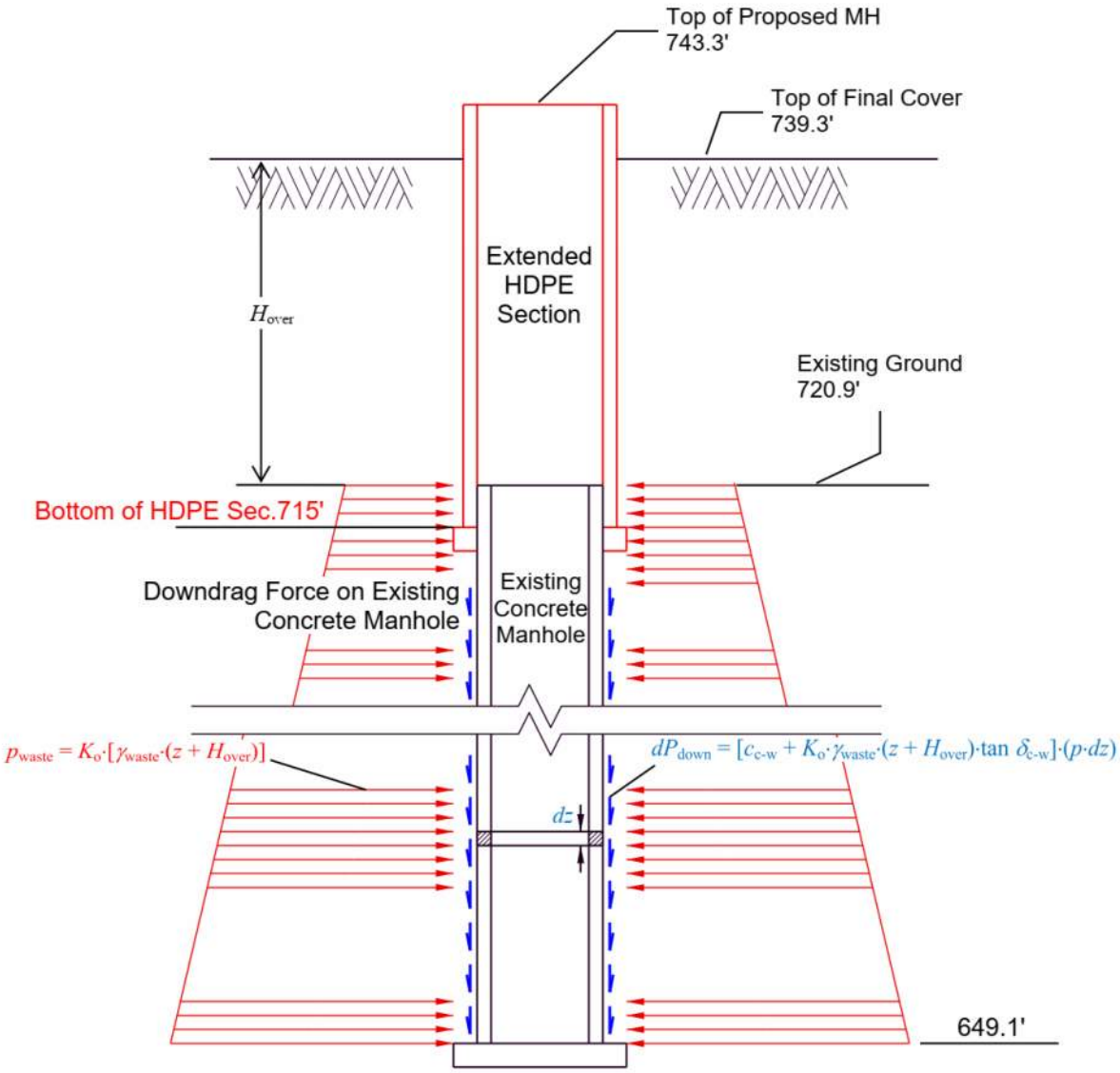

Figure 10 – Forces on existing concrete manhole after installing an extended HDPE section

The dimensions, elevations, and depths of the existing manhole and the proposed HDPE extended section are listed in Table 6.

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Table 6 – Dimensions of existing manhole with HDPE extended section

Elevation of rim of extended HDPE section (ft)	743.3
Elevation of top of final cover (ft)	739.3
Elevation of top of structural fill (ft)	735.3
Elevation of top of existing clay cap (ft)	720.9
Bottom elevation of extended HDPE section (ft)	715.0
Elevation of top of existing waste (ft)	712.9
Elevation of bottom of existing manhole (ft)	649.1
Thickness of final cover (ft)	4.0
Depth of structural fill (ft)	14.4
Depth of extended HDPE section in existing waste (ft)	5.9
Depth of extended HDPE section (H_2) (ft)	24.3
Thickness of existing clay cap (ft)	8.0
Depth of existing waste (ft)	63.8
Depth of extended HDPE section (H_2) (ft)	24.3
Depth of existing manhole (H_1) (ft)	71.8
Total length of extended HDPE section (H_{2T}) (ft)	28.3
Length of concrete manhole (ft)	71.8
Dimensions of Extended HDPE Manhole Section	
Outer diameter of extended HDPE section $(D_{HDPE})_{out}$ (inch)	88.580 (2,250 mm)
Inner diameter of extended HDPE section $(D_{HDPE})_{in}$ (inch)	81.766
Wall thickness of extended HDPE section (t_{HDPE}) (inch) ($SDR = D_o/t$)	3.407 (SDR = 26)
Dimensions of Existing Concrete Manhole	
Outer diameter of existing concrete manhole $(D_{conc})_{out}$ (inch)	72
Inner diameter of existing concrete manhole $(D_{conc})_{in}$ (inch)	63
Wall thickness of existing concrete manhole (t_{conc}) (inch)	4.5

The calculation results of the existing manhole with the HDPE extended section are listed in Table 7. It can be seen from Table 7 that the calculation results can meet the requirement.

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Table 7 – Calculation results of existing manhole with extended HDPE section

Interface friction angle between concrete manhole and waste for H_1, $\delta_{c\text{-}w}$	22.5°
Interface shear strength between concrete manhole and waste for H_1, $\tan\delta_{c\text{-}w}$	0.414
Interface friction angle between HDPE and waste for H_2, $\delta_{h\text{-}w}$	21.8°
Interface shear strength between HDPE and waste for H_2, $\tan\delta_{h\text{-}w}$	0.4
Downdrag force on HDPE extension (lb)	126,469
Compressive stress of HDPE extension (psi)	139
Weight of HDPE extended manhole (lb)	10,929
Compressive stress of manhole weight (psi)	12
Total compressive force at bottom of extended HDPE section (lb)	137,398
Compressive stress of HDPE manhole weight (lb/ft^2)	21,703
Total compressive stress at bottom of extended HDPE manhole, σ_{h2} (psi)	**151**
$\sigma_{h2} < (\sigma_{HDPE})_{allow}$ = 1,000 psi	OK
Downdrag force on existing concrete manhole (lb)	1,121,184
Compressive stress of downdrag force on existing concrete manhole (psi)	1,175
Weight of existing concrete manhole (lb)	71,371
Compressive stress of existing concrete manhole weight (psi)	75
Total compressive force of at bottom of concrete manhole, (lb)	1,192,555
Total compressive stress of at bottom of concrete manhole, σ_{total} (lb/ft^2)	179,959
Total compressive stress of at bottom of concrete manhole, σ_{total} (psi)	**1,250**
$\sigma_{total} < (\sigma_{conc})_{allow}$ = 2,500 psi	OK

3.4 Evaluation of Ring and Axial Buckling for HDPE Extended Section

Because the selected HDPE pipe has large outer diameter (OD = 88.58 inches) and relative small thickness (t_{HDPE} = 3.407 inches) (see Appendix A, B:17, Page 34) and the long-term stress relaxation modulus of HDPE is much lower than that of the concrete, both possible ring and axial buckling for HDPE extended section must be checked. The performance limits of vertical subsurface risers include ring deflection, ring and axial stress (or strain), and ring and axial buckling.

3.4.1 Ring Compressive Thrust, Bending, and Buckling

Radially-directed load acting on a vertical riser causes ring deformation and ring bending stresses and may cause ring buckling damage[6][9].

3.4.1.1 Ring Compressive Thrust

The ring compressive thrust[6][9]:

$$N_T = (P_R/144)\cdot R_M \quad (4.1)$$

where
N_T = ring compressive thrust, lb/in,
P_R = radial waste pressure, lb/ft^2, see Equation (1.1),
R_M = mean radius of manhole riser, in.

$$R_M = (D_{in} + t)/2 \quad (4.2)$$

or

$$R_M = (D_o - t)/2 \quad (4.3)$$

where
D_{in} = inside diameter of manhole riser, in,
D_o = outer diameter of manhole riser, in,
t = minimum wall thickness of manhole riser, in.

The ring compressive strain due to ring compressive thrust[9]:

$$\varepsilon_T = N_T/(E\cdot t) \quad (4.4)$$

where
ε_T = ring compressive strain, in/in,
N_T = ring compressive thrust, lb/in,
E = modulus of elasticity of HDPE, psi, E_{HDPE} = 28,250 psi[6],
t = minimum wall thickness of manhole riser, in.

The ring compressive strain should be limited to 3.5%.

3.4.1.2 Ring Bending

The radial pressure applied to a riser varies around the circumference due to variability in the fill material. This eccentricity introduces bending strain in the riser wall. Per ASTM-F1759[6], it can be assumed that the ring bending deflections will be low and generally on the order of one or two percent of the manhole diameter. The eccentricity factor, *e*, can be calculated from[6]:

$$e = C_o \cdot R_M = 0.5 \cdot C_o \cdot D_M \quad (4.5)$$

where
e = eccentricity, in,
C_o = 0.02 ovality correction factor for 2% deflection recommended by ASTM-F1759[6],
R_M = mean riser radius, in,
D_M = mean riser diameter, in.

The ring bending moment in the riser wall due to the ring thrust acting over the eccentricity can be found[6]:

$$M_E = 0.5 \cdot e \cdot N_T \quad (4.6)$$

where
M_E = ring bending moment, in-lb/in,
e = eccentricity, in,
N_T = ring compressive thrust, lb/in.

The ring bending strain[9]:

$$\varepsilon_B = \frac{6 \cdot M_E}{E \cdot t^2} \quad (4.7)$$

where
ε_B = bending strain, in/in
M_E = bending moment, (in-lb)/in
E = modulus of elasticity of HDPE, psi, E_{HDPE} = 28,250 psi[6],
t = minimum wall thickness of manhole riser, in.

3.4.1.3 Combined Ring Compression and Ring Bending Strain

The total ring strain occurring in the manhole riser wall is given by[6]:

$$\varepsilon_C = \varepsilon_T + \varepsilon_B \quad (4.8)$$

where
ε_B = combined ring strain, in/in,
ε_T = ring compressive strain, in/in,
ε_B = bending strain, in/in.

The ring bending strain and the ring compressive strain can be added together to obtain the maximum (combined) ring strain. Per ASTM-F1759[6], the combined ring bending and ring compressive strain should be limited to 5%.

3.4.1.4 Ring Bucking

If the ring compressive thrust exceeds a critical buckling value, the riser may lose the ability to handle flexural deformation and buckle. For the manhole riser above the groundwater level, the critical ring compressive thrust at buckling[9]:

$$N_{CR} = 0.3 \cdot R_H \cdot t \cdot E^{1/3} \cdot E_S^{2/3} \quad (4.9)$$

where
N_{CR} = critical ring compressive thrust (no groundwater), lb/in,
R_H = geometry factor,
t = minimum riser wall thickness, in,
E = modulus of elasticity of HDPE, psi, E_{HDPE} = 28,250 psi[6],
E_S = Young's Modulus of the soil, psi. E_S = 7,000 psi (medium clay & hazardous waste)[6].

The value of R_H depends on the Relative Stiffness, RS[9]:

$$RS = \frac{0.22 \cdot E \cdot t^3}{E_S \cdot R_M^3} \quad (4.10)$$

where
R_M = the mean radius of the manhole riser, in.

Where the relative stiffness, *RS*, is less than 0.005, R_H equals 1.0, which is usually the case for HDPE manholes in granular or compacted granular-cohesive embedment.

Per ASTM-F1759[6], the ring compressive thrust, N_T, given by Equation (4.1) should not exceed one-half of the critical ring compressive thrust, N_{CR}, as calculated using Equation (4.9) (i.e., $N_T \leq 0.5N_{CR}$). A higher safety factor may be used if desired by the Engineer.

The manhole top and bottom enhance the ring buckling resistance of the manhole riser. They act to stiffen the manhole against ring deformation. However, the increase in resistance is normally not considered in design as the enhancement diminishes with distance from the top or bottom.

3.4.2 Axial (Longitudinal) Compressive Strain and Buckling

Axial (longitudinal) compressive strain in the manhole wall may be caused by any of the following: (1) the downdrag load, (2) the weight of the manhole and appurtenances attached to the wall, and (3) the weight of equipment or machines on top of the manhole. Axial (longitudinal) strain is highest at or near the bottom of the manhole. Thus, the riser must also be checked for axial compressive stress and axial buckling due to downdrag force[6].

For design, the maximum axial strain from Equation (4.11) must be less than the allowable strain for the manhole material (generally 3.5%) and less than the critical longitudinal axial buckling strain from Equation (4.12)[6][9].

$$\varepsilon_A = \frac{P_{down} + P_L + P_W}{E \cdot \pi \cdot D_M \cdot t} \qquad (4.11)$$

where
ε_A = longitudinal (axial) compressive strain, in/in, $\varepsilon_A < 3.5\%$,
P_{down} = downdrag force from Equation (1.1), lb,
P_L = live load including equipment, lb,
P_W = dead load including riser weight, lb,
E = modulus of elasticity of HDPE, psi, E_{HDPE} = 28,250 psi[6],
D_M = riser mean diameter, in,
t = minimum riser wall thickness, in.

For solid wall riser pipes, the minimum riser wall thickness is simply the wall thickness of the riser. For closed profile or hollow core riser pipes, the minimum riser wall thickness is not the "overall wall thickness" or "equivalent solid wall thickness", but the sum of the inner and outer skin thickness, which may be found by subtracting the height of the hollow core or profile from the "overall wall thickness".

Local wall buckling of the structure may occur if the axial (longitudinal) compressive strain exceeds the critical axial compressive strain. Equation (4.12) gives the critical axial (longitudinal) compressive strain for an unsupported (non-buried) riser[9]:

$$\varepsilon_{CR} = \frac{2 \cdot t}{D_M \cdot [3(1 - \nu)]^{1/2}} \qquad (4.12)$$

where
ε_{CR} = critical longitudinal (axial) compressive strain (buckling strain), in/in, $\varepsilon_{CR} \geq \varepsilon_A$,
D_M = riser mean diameter, in,
ν = Poisson's ratio for HDPE, long-term Poisson's ratio of HDPE: ν_{HDPE} = 0.48 (ASTM F1759)[6],
t = minimum wall thickness, in.

ASTM F1759 allows Equation (4.12) to be applied without the use of a safety factor where granular soil or compacted granular-cohesive soil surrounds the manhole. Embedment soil increases the riser's resistance to local wall buckling, which normally enhances the safety factor. Thus for design, ε_A must be less than or equal to ε_{CR} and as stated above ε_A must also be less than 3.5%[6].

3.5 Ring and Axial Compressive Stresses

3.5.1 Ring Compressive Stress

$$\sigma_R = P_R \cdot D_o/(2 \cdot t)/144 \quad (4.13)$$

where
σ_R = ring compressive stress, psi,
P_R = lateral earth pressure at bottom of manhole, lb,
D_o = outer diameter of manhole, ft,
t = wall thickness of manhole, ft.

The value of 144 in above equation is used to convert lb/ft^2 to psi.

3.5.2 Axial Compressive Stresses

$$\sigma_A = (P_{down} + W_{manhole})/A_{CSA}/144 \quad (4.14)$$

where
σ_A = axial compressive stress, psi,
P_{down} = downdrag force along manhole, lb,
$W_{manhole}$ = weight of manhole, lb,
A_{CSA} = cross section area of manhole, ft^2.
The value of 144 in above equation is used to convert lb/ft^2 to psi.

The buckling calculation results for the HDPE extended section in the closure condition are listed in Table 8. It can be seen from Table 8 that the calculation results can meet the requirement.

Table 8 – Buckling calculations of HDPE extended section in closure condition

	Interface friction angle between HDPE and waste for extended section, $\delta_{h\text{-}w}$	21.8°
	Interface shear strength between HDPE and waste for extended section, $\tan\delta_{h\text{-}w}$	0.4
	Elevation of rim of extended HDPE manhole (ft)	743.3
	Elevation of top of final cover (ft)	739.3
	Elevation of bottom of extended HDPE manhole (ft)	715.0
	Buried depth of extended HDPE manhole (H_2) (ft)	24.3
	Total length of extended manhole (H_{2T}) (ft)	28.3
1	**Ring Compressive Strain**	
	Ring compressive strain, ε_T (%)	**0.34**
	$\varepsilon_T \leq 3.5\%$	OK
2	**Ring Bending Strain**	
	Ring bending strain, ε_B (%)	0.26
3	**Combined Ring Strain**	
	Combined ring strain, $\varepsilon_T + \varepsilon_B$ (%)	**0.60**
	$\varepsilon_T + \varepsilon_B \leq 5.0\%$	OK
4	**Ring Bucking**	
	Critical ring compressive thrust, N_{CR} (lb/in)	11,391
	$0.5 \cdot N_{CR}$ (lb/in)	5,696
	Ring compressive thrust, N_T (lb/in)	**332**
	$N_T \leq 0.5N_{CR}$	OK
5	**Ring Compressive Stress**	
	Ring compressive stress, σ_R (psi)	**101**
	$\sigma_R < (\sigma_{HDPE})_{allow}$ = 1,000 psi	OK
6	**Axial Compressive Strain,**	
	Axial compressive strain, ε_A (%) (for E_{HDPE} = 28,250 psi)	**0.53**
	$\varepsilon_A < 3.5\%$	OK
7	**Axial bucking**	
	Critical axial compressive strain, ε_{CR} (%)	**6.41**
	$\varepsilon_A < \varepsilon_{CR}$ (for E_{HDPE} = 28,250 psi)	OK
8	**Axial Compressive Stress**	
	Axial compressive stress, σ_A (psi)	**151**
	$\sigma_A < (\sigma_{HDPE})_{allow}$ = 1,000 psi	OK

4. Localized Settlement Analysis of Manhole Base

The evaluation of the landfill liner under the manhole includes calculations of the localized settlement of the manhole base in both the current and final cover conditions.

The settlement of the bottom clay layer can be divided into two parts. The first part is the cell floor settlement caused by the weight of the waste filled in the cell. This part of the settlement is uniform

settlement. The value of this part of the settlement will not affect the liner integrity. The second part is the localized settlement (or depression) of the manhole base caused by the extra loading due to the downdrag force of the manhole. The extra load can be calculated as follows:

Extra Load = Downdrag Force – Waste Load

This localized settlement (or depression) of the manhole base will directly affect the liner integrity, which must be paid attention.

Vertical Stress below Center of a Uniformly Loaded Circular Area[14]:

$$\Delta q = q\{1 - \frac{1}{[(R_o/z)^2 + 1]^{3/2}}\}$$

Where

Δq = increment of vertical stress at depth z, lb/ft^2;
q = extra uniform load on circular area, lb/ft^2;
R_o = radius of circular area, i.e., the radius of the manhole base, ft;
z = depth, ft.

For overconsolidated soil, the primary consolidation settlement is given by[14]

If $\sigma_i + \Delta q_i \le p_{ci}$,

$$\Delta H_{ci} = C_r' \cdot H_i \cdot \log\frac{\sigma_i + \Delta q_i}{\sigma_i}$$

If $\sigma_i + \Delta q_i > p_{ci}$,

$$\Delta H_c = C_r' \cdot H_i \cdot \log\frac{p_{ci}}{\sigma_i} + C_c' \cdot H_i \cdot \log\frac{\sigma_i + \Delta q_i}{p_{ci}}$$

where

ΔH_c = primary consolidation settlement of clay layer, ft;
H_i = initial thickness of clay layer of the ith layer, ft;
C_r' = modified recompression index;
C_c' = modified primary compression index.
σ_i = initial vertical effective stress of the ith layer, lb/ft^2;
p_{ci} = preconsolidation pressure of the ith layer, lb/ft^2, $p_{ci} = p_{co} + \sigma_i$;
Δq_i = increment of vertical effective stress of the ith layer, lb/ft^2.

The parameters and data used to conduct settlement calculations in various conditions are listed in Table 12.

CALCULATION SHEET
Client: Republic Services – Wayne Disposal Inc.
Project: WDI License Renew
Calculation: MC5A MH Extension Evaluations

Project No.: 22L070
Calculated By: DQ Date: 02/23/2023
Checked By: KF Date: 02/23/2023
Approved By: XZ Date: 02/23/2023

Table 12 – Soil parameters and pressure data used in settlement calculations

Unit weight of clay[16]	135 lb/ft^3
Unit weight of excavated soil[1]	125 lb/ft^3
Unit weight of existing waste[1]	91 lb/ft^3
Unit weight of new waste[4]	103 lb/ft^3
Unit weight of structural fill[16]	135 lb/ft^3
Unit weight of final cover[4]	135 lb/ft^3
Unit weight of existing clay cap[16]	135 lb/ft^3
Outer diameter of base of exiting concrete manhole, R_{base}	7 ft
Area of base of exiting concrete manhole, A_{base}	38.5 ft^2
Elevation of top of final cover	739.3 ft
Elevation of previous ground surface	720.9 ft
Thickness of final cover	4 ft
Depth of structural fill	14.4 ft
Thickness of existing clay cap	8.0 ft
Depth of existing waste	63.8 ft
Elevation of bottom of manhole	649.1 ft
Depth from manhole bottom to previous ground surface	71.8 ft
Preconsolidation pressure, p_{co} (125 × 71.8 = 8,975)	8,975 lb/ft^2
Thickness of settlement calculation layer	6 ft
Modified primary compression index, C_c' [1]	0.102
Modified Recompression index, C_r' [1]	0.017
Modified secondary compression index, C_α'	*
*Assume $\Delta H_{\alpha i}/\Delta H_{ci}$ = 5%. So, $\Delta H_i = \Delta H_{ci} + \Delta H_{\alpha i} = 1.05\Delta H_{ci}$	
Current Condition	
Total compressive force of manhole base on clay liner, P_{total}	761,613 lb
Total compressive pressure of manhole base on Liner, q_t (P_{total}/A_{base})	19,790 lb/ft^2
Waste pressure on base floor in current condition, p_w	6,886 lb/ft^2
Extra compressive pressure of manhole base on Liner, Δq ($q_t - p_w$)	12,904 lb/ft^2
Final Cover Condition	
Option 1: Installing an Extended Concrete Manhole Section	
Total compressive force of manhole base on clay liner, P_{total}	1,347,817 lb
Total compressive pressure of manhole base on clay liner, q_t (P_{total}/A_{base})	35,022 lb/ft^2
Waste pressure on base floor in current condition, p_w	9,370 lb/ft^2
Extra compressive pressure of manhole base on clay liner, Δq ($q_t - p_w$)	25,652 lb/ft^2
Option 2: Installing an Extended HDPE Manhole Section	
Total compressive force of manhole base on clay liner, P_{total}	1,192,555 lb
Total compressive pressure of manhole base on clay liner, q_t (P_{total}/A_{base})	30,988 lb/ft^2
Waste pressure on base floor in current condition, p_w	9,370 lb/ft^2
Extra compressive pressure of manhole base on clay liner, Δq ($q_t - p_w$)	21,618 lb/ft^2

4.1 Current Condition

The calculation results of the localized settlement of the manhole base in the current condition are listed in Table 13.

Table 13 – Settlement calculation results in current condition

Layer	Depth (ft)	z	R_o/z	p_{ci} (ft_2)	σ_i (lb/ft^2)	Δq_i (lb/ft^2)	$\Delta q_i/\sigma_i$	$\Delta q_i+\sigma_i$ (lb/ft^2)	ΔH_{ci} (ft)	ΔH_i (ft)	ΣH_i (ft)	ΣH_i (in)
1	0 ~ 5	2.5	1.400	8313	338	10370	30.727	10708	0.174	0.183	0.183	2.20
2	5 ~ 10	7.5	0.467	8988	1013	3302	3.261	4314	0.054	0.056	0.239	2.87
3	10~ 15	12.5	0.280	9663	1688	1381	0.819	3069	0.022	0.023	0.262	3.15
4	15 ~ 20	17.5	0.200	10338	2363	737	0.312	3100	0.010	0.011	0.273	3.28
5	20 ~ 25	22.5	0.156	11013	3038	455	0.150	3492	0.005	0.005	0.278	3.34
6	25 ~ 30	27.5	0.127	11688	3713	307	0.083	4020	0.003	0.003	0.281	3.38
7	30 ~ 35	32.5	0.108	12363	4388	221	0.050	4609	0.002	0.002	0.283	3.40
8	35 ~ 40	37.5	0.093	13038	5063	167	0.033	5229	0.001	0.001	0.285	3.42
9	40 ~ 45	42.5	0.082	13713	5738	130	0.023	5868	0.001	0.001	0.285	3.43
10	45 ~ 50	47.5	0.074	14388	6413	104	0.016	6517	0.001	0.001	0.286	3.43
11	50 ~ 55	52.5	0.067	15063	7088	86	0.012	7173	0.000	0.000	0.287	3.44
12	55 ~ 60	57.5	0.061	15738	7763	71	0.009	7834	0.000	0.000	**0.287**	**3.44**

The localized settlement of the manhole base in the current condition is

$$\Delta H = 3.44 \text{ inch}$$

4.2 Final Cover Condition

Option 1: Installing an Extended Concrete Manhole Section

The calculation results of the localized settlement of the manhole base for Option 1 in the final cover condition are listed in Table 14.

Table 14 – Settlement calculation results for Option 1 in final cover condition

Layer	Depth (ft)	z	R_o/z	p_{ci} (ft_2)	σ_i (lb/ft^2)	Δq_i (lb/ft^2)	$\Delta q_i/\sigma_i$	$\Delta q_i+\sigma_i$ (lb/ft^2)	ΔH_{ci} (ft)	ΔH_i (ft)	ΣH_i (ft)	ΣH_i (in)
1	0 ~ 5	2.5	1.400	9313	338	20615	61.082	20953	0.302	0.317	0.317	3.81
2	5 ~ 10	7.5	0.467	9988	1013	6564	6.483	7576	0.074	0.078	0.395	4.74
3	10~ 15	12.5	0.280	10663	1688	2746	1.627	4433	0.036	0.037	0.433	5.19
4	15 ~ 20	17.5	0.200	11338	2363	1466	0.620	3828	0.018	0.019	0.451	5.42
5	20 ~ 25	22.5	0.156	12013	3038	904	0.298	3941	0.010	0.010	0.461	5.54
6	25 ~ 30	27.5	0.127	12688	3713	611	0.165	4323	0.006	0.006	0.467	5.61
7	30 ~ 35	32.5	0.108	13363	4388	440	0.100	4827	0.004	0.004	0.471	5.65
8	35 ~ 40	37.5	0.093	14038	5063	332	0.065	5394	0.002	0.002	0.474	5.68
9	40 ~ 45	42.5	0.082	14713	5738	259	0.045	5996	0.002	0.002	0.475	5.70
10	45 ~ 50	47.5	0.074	15388	6413	208	0.032	6620	0.001	0.001	0.476	5.72
11	50 ~ 55	52.5	0.067	16063	7088	170	0.024	7258	0.001	0.001	0.477	5.73
12	55 ~ 60	57.5	0.061	16738	7763	142	0.018	7904	0.001	0.001	0.478	5.74
13	60 ~ 65	62.5	0.056	17413	8438	120	0.014	8558	0.001	0.001	**0.479**	**5.74**

The localized settlement of the manhole base for Option 1 in the final cover condition is

$$\Delta H = 5.74 \text{ inch}$$

Option 2: Installing an Extended HDPE Manhole Section

The calculation results of the localized settlement of the manhole base for Option 2 in the final cover condition are listed in Table 15.

Table 15 – Settlement calculation results for Option 2 in final cover condition

Layer	Depth (ft)	z	R_o/z	p_{ci} (ft_2)	σ_i (lb/ft^2)	Δq_i (lb/ft^2)	$\Delta q_i/\sigma_i$	$\Delta q_i+\sigma_i$ (lb/ft^2)	ΔH_{ci} (ft)	ΔH_i (ft)	ΣH_i (ft)	ΣH_i (in)
1	0 ~ 5	2.5	1.400	8313	338	17373	51.476	17711	0.286	0.300	0.300	3.60
2	5 ~ 10	7.5	0.467	8988	1013	5531	5.463	6544	0.069	0.072	0.372	4.47
3	10~ 15	12.5	0.280	9663	1688	2314	1.371	4002	0.032	0.033	0.406	4.87
4	15 ~ 20	17.5	0.200	10338	2363	1235	0.523	3598	0.016	0.016	0.422	5.07
5	20 ~ 25	22.5	0.156	11013	3038	762	0.251	3799	0.008	0.009	0.431	5.17
6	25 ~ 30	27.5	0.127	11688	3713	515	0.139	4227	0.005	0.005	0.436	5.23
7	30 ~ 35	32.5	0.108	12363	4388	371	0.084	4758	0.003	0.003	0.439	5.27
8	35 ~ 40	37.5	0.093	13038	5063	279	0.055	5342	0.002	0.002	0.441	5.29
9	40 ~ 45	42.5	0.082	13713	5738	218	0.038	5956	0.001	0.001	0.443	5.31
10	45 ~ 50	47.5	0.074	14388	6413	175	0.027	6587	0.001	0.001	0.444	5.32
11	50 ~ 55	52.5	0.067	15063	7088	143	0.020	7231	0.001	0.001	0.444	5.33
12	55 ~ 60	57.5	0.061	15738	7763	120	0.015	7882	0.001	0.001	0.445	5.34
13	60 ~ 65	62.5	0.056	16413	8438	101	0.012	8539	0.000	0.000	**0.445**	**5.35**

The localized settlement of the manhole base for Option 2 in the final cover condition can be calculated as follows:

$$\Delta H = 5.35 \text{ inch}$$

5. Engineering Analysis

5.1 Existing Concrete Manhole in Current Condition

From Table 3, it can be seen that the compressive stress at the bottom of the existing concrete manhole in the current condition is 798 psi for the interface friction angle between the concrete manhole wall and the waste of 22.5°. This is much less than the allowable stress of the concrete of 2,500 psi.

A review of the inspection videos conducted on January 27, 2023 revealed no visible damage in the current condition. The measured pH value from the on-site leachate was 8.5. Some research observed the compressive strength of concrete cubes can slightly increase with increasing pH of the environment[15].

The localized settlement under the manhole base due to the extra compressive pressure of 12,904 lb/ft^2 in the current condition is 3.44 inches.

5.2 Extended Manhole in Final Cover Condition

5.2.1 Option 1: Installing an Extended Concrete Manhole Section

If a same size concrete manhole section with outer diameter of 6-ft and wall thickness of 4.5-inch will be installed on the top of the existing concrete manhole, it can be seen from Table 5 that the compressive stress at the bottom of the existing concrete manhole is 1,412 psi for the interface friction angle between the concrete manhole wall and the waste of 22.5°. It is also lower than the allowable stress of the concrete of 2,500 psi.

The localized settlement under the manhole base due to the extra compressive pressure of 25,652 lb/ft^2 for Option 1 in the final cover condition is 5.74 inches.

5.2.2 Option 2: Installing an Extended HDPE Manhole Section

If a HDPE pipe with outer diameter of 2,250 mm (88.58 inches) and SDR of 26 (see Appendix A, B:17, Page 34) will be selected as an extended manhole section to install over the existing concrete manhole (Figures 6 and 7), it can be seen from Table 7 that the compressive stress at the bottom of the extended HDPE section is 151 psi for the interface friction angle between the HDPE manhole wall and the waste of 21.8° and this is much less than the allowable stress of the HDPE of 1,000 psi. The compressive stress at the bottom of the existing concrete manhole is 1,250 psi for the interface friction angle between the concrete manhole wall and the waste of 22.5° and it is also much lower than the allowable stress of the concrete of 2,500 psi.

From the calculation results shown in Table 8, it can also seen that both ring and axial buckling for HDPE extended section and all other calculated strains and stresses can meet the design requirements. This indicates that the choice of Option 2 is also feasible.

The localized settlement under the manhole base due to the extra compressive pressure of 21,618 lb/ft^2 for Option 2 in the final cover condition is 5.35 inches.

All calculated results for various conditions are summarized in Table 16.

Table 16 – Summery of calculation results

	Current	Final Cover	
		Option 1	Option 2
Compressive Pressure			
Total compressive force at bottom of HDPE section			137,398 lb
Total compressive stress of extended HDPE section			151 psi
$(\sigma_{HDPE})_{allow}$ = 1,000 psi			OK
Total compressive force at bottom of concrete manhole	761,613 lb	1,347,817 lb	1,192,555 lb
Total compressive stress of existing concrete manhole	798 psi	1,412 psi	1,250 psi
$(\sigma_{conc})_{allow}$ = 2,500 psi	OK	OK	OK
Localized Settlement			
Extra compressive pressure	12,904 lb/ft^2	25,652 lb/ft^2	21,618 lb/ft^2
Localized settlement of manhole base	3.44 in.	5.74 in.	5.35 in.

5.3 Localized Settlement of Manhole Base

Due to the small base of the manhole and the uniform loading, the settlement induced by the downdrag force resembles a localized settlement at a small area, as depicted in Figure 11. This localized settlement primarily compresses the clay layer beneath the manhole base and does not lead to the cracking of the clay layer.

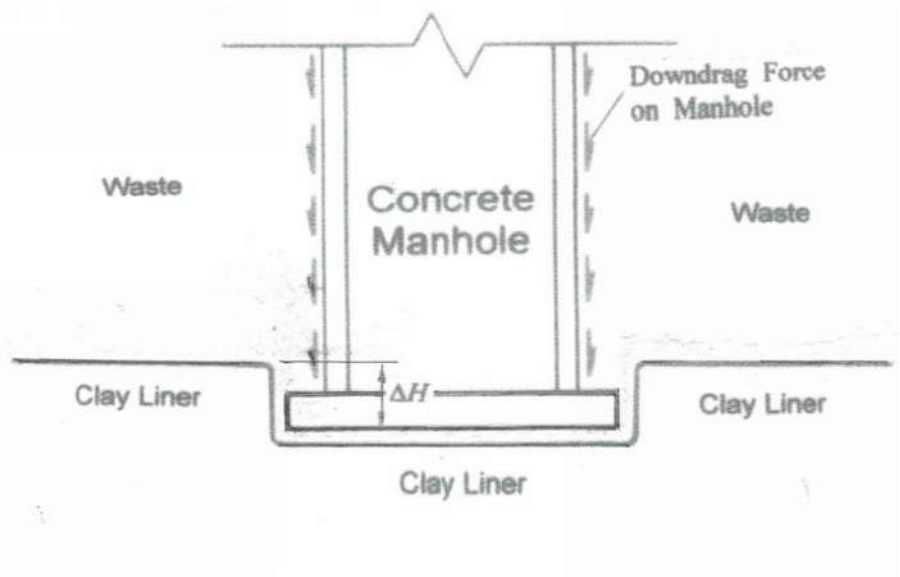

Figure 11 – Localized settlement on bottom clay due to manhole downdrag force

Directly beneath the bottom of the manhole at MC5A, there is a natural clay layer extending several tens of feet deep. This layer's thickness will decrease by 3.44 inches, 5.74 inches, and 5.35 inches due to localized settlement under the manhole base in the current condition, Option 1, and Option 2 under the final cover condition, respectively. Notably, a natural clay layer that is at least 20 feet deep and has a hydraulic conductivity of lower than 1.0×10^{-7} cm/sec is located beneath the cell bottom. The actual depth of this on-site clay layer significantly exceeds 20 feet. The localized settlement might also diminish the hydraulic conductivity of the clay layer in the vicinity of the manhole's bottom. Overall, despite the localized compressive deformation, the clay layer's ability to act as a hydraulic barrier is expected to be consistent with that of the undisturbed original clay layer.

In addition, the settlement of the waste surrounding the manhole will create a downdrag force downward against the sidewall of the manhole. However, the frictional force between the sidewall of the manhole and the waste can also prevent the sink of the manhole. This is different from the overall settlement of the entire landfill and the entire building. This manhole is buried within the waste. Therefore, the current calculated settlement of the manhole base is actually on the conservative side.

Furthermore, Michigan's clay is a glacial soil, which belongs to over-consolidated soil, exhibiting a high over-consolidated ratio (OCR). The pre-consolidation pressure was greatly underestimated in the current calculations. This contributes to another conservative nature of the calculation results.

6. Recommendations

Based on the information presented in Figure 5, it is evident that the proposed new waste filling area in MCVI-F will not encompass the current MC5A manhole. As a result, the extended MC5A manhole section will not traverse through the 5-ft double composite liner system of MCVI-F.

Option 1 entails the use of a concrete extended manhole section. An advantage of Option 1 is that the construction of a concrete extension is convenient.

Option 2 involves the utilization of an HDPE extended manhole section. An advantage of Option 2 is that the interface friction angle between the HDPE and adjacent materials is lower than that between concrete and adjacent materials. Consequently, this reduces the downdrag force along the extended section. Additionally, a sleeve joint will be designed to connect the extended HDPE section to the existing concrete manhole, as depicted in Figures 9 and 10. This design effectively prevents the transfer of downdrag forces to the existing concrete manhole. Selecting Option 2 also contributes to a reduction in the compressive pressure at the bottom of the manhole, which can reduce the localized settlement of the manhole base.

If Option 2 is selected, it is recommended to use a SDR-26 HDPE pipe with an outer diameter of 88.58 inches as the new extension for the MC5A manhole. This HDPE pipe, as detailed in Appendix A, B:17, Page 34, has a wall thickness of 3.407 inches. It is worth noting that the inner diameter of this HDPE pipe measures 81.36 inches, which is larger than the existing concrete manhole's outer diameter, which stands at 72 inches. The choice of this particular size results in an approximate 4.68-inch gap between the extended HDPE section and the existing concrete manhole. To fill this gap effectively, bentonite particles can be used.

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CALCULATION SHEET

Client: Republic Services – Wayne Disposal Inc.
Project: WDI License Renew
Calculation: MC5A MH Extension Evaluations

Project No.: 22L070
Calculated By: DQ Date: 02/23/2023
Checked By: KF Date: 02/23/2023
Approved By: XZ Date: 02/23/2023

Appendix A
4710 HDPE Pipe Sizes

CALCULATION SHEET

Client: Republic Services – Wayne Disposal Inc.
Project: WDI License Renew
Calculation: MC5A MH Extension Evaluations

Project No.: 22L070
Calculated By: DQ Date: 02/23/2023
Checked By: KF Date: 02/23/2023
Approved By: XZ Date: 02/23/2023

For reference only. Actual dimensions may vary.
Solo para referencia. Las dimensiones reales pueden variar.

IPS ASTM STANDARDS ISCO

4710 HDPE PIPE SIZES IPS AND LARGE DIAMETER METRIC

4710 Tamaños HDPE tuberías IPS y Diámetro Grande Métrico

DR		26			32.5		
PE4710 Pressure Rating / Resistencia a la Presión		80 psi			63 psi		
Nom. OD / DE Nominal (in)	Actual OD / DE Actual (in)	Min Wall / Espesor Mínimo de Pared (in)	Avg ID / DI Promedio (in)	Weight / Peso (lb/ft)	Min Wall / Espesor Mínimo de Pared (in)	Avg ID / DI Promedio (in)	Weight / Peso (lb/ft)
¾"	1.05	---	---	---	---	---	---
1"	1.315	---	---	---	---	---	---
1¼"	1.66	---	---	---	---	---	---
1½"	1.9	---	---	---	---	---	---
2"	2.375	---	---	---	---	---	---
3"	3.5	---	---	---	---	---	---
4"	4.5	0.173	4.133	1.035	0.138	4.206	0.835
5"	5.375	0.207	4.937	1.47	0.165	5.024	1.19
5"	5.563	0.214	5.109	1.582	0.171	5.2	1.28
6"	6.625	0.255	6.085	2.25	0.204	6.193	1.811
7"	7.125	0.274	6.544	2.582	0.219	6.66	2.083
8"	8.625	0.332	7.922	3.8	0.265	8.062	3.07
10"	10.75	0.413	9.873	5.91	0.331	10.049	4.77
12"	12.75	0.49	11.71	8.312	0.392	11.918	6.71
14"	14	0.538	12.858	10.022	0.431	13.087	8.09
16"	16	0.615	14.695	13.09	0.492	14.956	10.561
18"	18	0.692	16.532	16.57	0.554	16.826	13.37
20"	20	0.769	18.369	20.453	0.615	18.695	16.501
22"	22	0.846	20.206	24.75	0.677	20.565	19.97
24"	24	0.923	22.043	29.452	0.738	22.434	23.762
26"	26	1	23.88	34.57	0.8	24.304	27.94
28"	28	1.077	25.717	40.187	0.862	26.174	32.421
30"	30	1.154	27.554	46.135	0.923	28.043	37.196
32"	32	1.231	29.391	52.494	0.985	29.913	42.34
34"	34	1.308	31.228	59.264	1.046	31.782	47.773
36"	36	1.385	33.065	66.444	1.108	33.652	53.581
42"	42	1.615	38.575	90.393	1.292	39.26	72.893
48"	48	1.846	44.086	118.082	1.477	44.869	95.233
54"	54	2.077	49.597	149.464	1.662	50.478	120.556
1600mm/63"	62.99	2.423	57.854	203.63	1.938	58.881	164.28
1800mm	70.87	2.726	65.088	Call	2.147*	66.314*	Call
2000mm	78.74	3.028	72.32	Call	2.386*	73.682*	Call
2250mm	88.58	3.407	81.36	Call	2.684*	82.892*	Call
2500mm	98.43	3.786	90.4	Call	2.983*	92.102*	Call

Sizes between 2500mm - 3500mm available. Contact ISCO for more information.

1. Pressures are based on using water at 23°C (73°F).
2. Average inside diameter calculated using actual OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.
3. Other piping sizes or DR's may be available upon request.
4. Standard Lengths:
   - 40' for 2"-24"
   - 50' for 26" and larger
   - Coils available for ¾ - 4" (6" by special order)

* DR33

1. Las presiones están basadas en el uso de agua a 23°C (73°F).
2. El diámetro interno promedio calculado el diámetro externo real y la pared mínima más 6% para uso la estimación de flujos de fluidos. El diámetro interno real variará.
3. Otros tamaños o DR de tubería pueden estar disponibles bajo pedido.
4. Longitudes estándar
   - 40 pies para 2 -24 pulgadas
   - 50 pies para 26 pulgadas o mayores
   - Bobinas disponibles para ¾ a 6 pulgadas (8 pulgadas para pedidos especiales)

ASTM MATERIALS Materiales ASTM

1-800-345-4726 ISCO PRODUCT CATALOG North American | Q3 2018 www.isco-pipe.com B: 17

Attachment 4

Cover Letter

2021 Permit Application
Attachment B6 Engineering Plans
Revised March 1, 2024

2021 Permit Application

Attachment B6 Engineering Plans

Revised March 1, 2024

Introduction

This report provides the technical basis for landfill design improvements to Master Cell VI (MC-VI) requested in Wayne Disposal Inc.'s (WDI) 2021 Part 111, Hazardous Waste Operating License renewal application. The improvements being requested include:

- Adjusting the MC VI-G1 through G7 (here in referred to as MC VI-G) base liner to improve the leachate management operations and provide additional leak detection capabilities. The proposed upgrades include the addition of dedicated leachate collection and leak detection sumps for each cell in MC VI-G.
- Enhancing the final cover design with the use of a geosynthetic engineered artificial turf final cover system.
- Improving the geometry of the final grade in order to improve the storm water management system

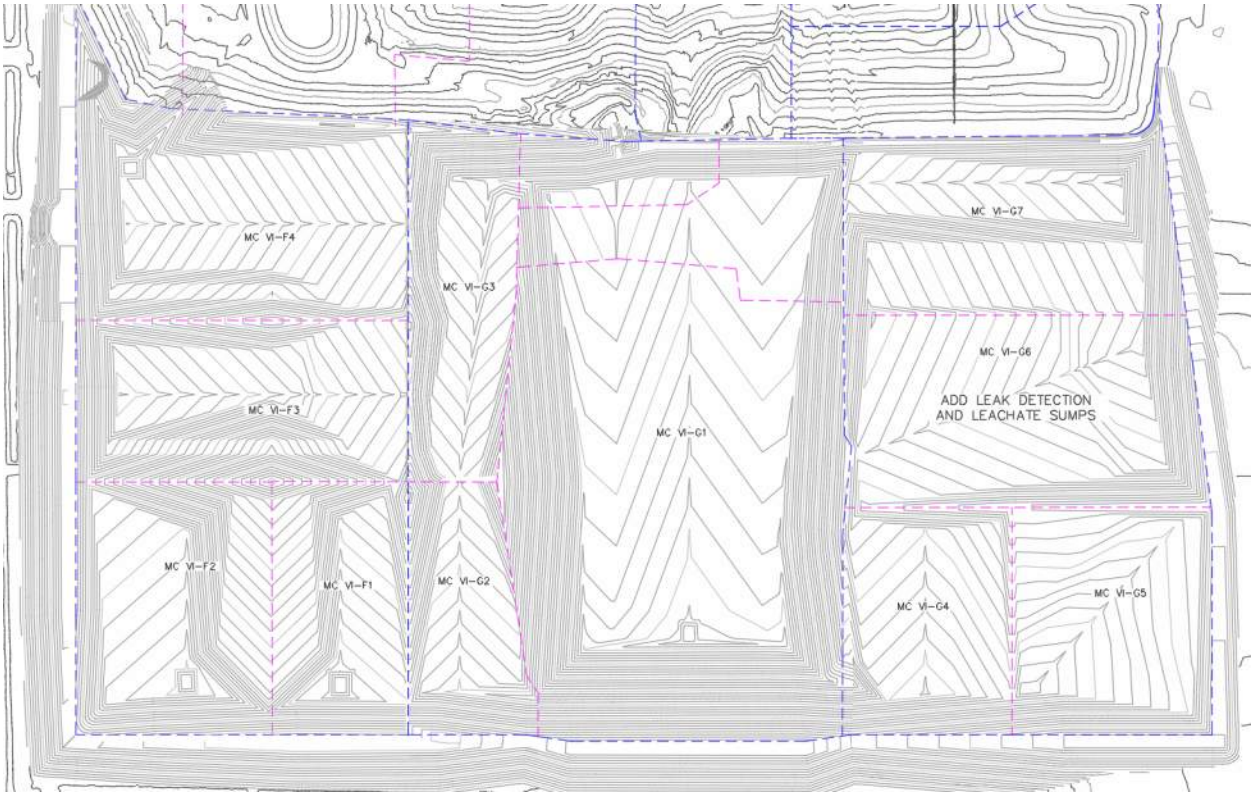
The design improvements at WDI alter the theoretical hazardous waste design capacity of the facility. As a result, WDI also requested to update the permit capacity to reflect the adjusted theoretical hazardous waste design capacity. Calculations, included in Attachments A and B of this section, provide the basis for design of the alternative final cover system. A complete set of permit engineering drawings is included in Attachment C of this section for ease of review and reference.

CTI and Associates, Inc. (CTI) is providing a summary of the methodology used to evaluate the upgrades and recommendations along with supporting documentation, which includes calculations and the revised permit engineering drawings.

Master Cell VI-G4 through G7 Upgrade

The proposed upgrades to MC VI-G include a liner grade change to facilitate the addition of dedicated leachate collection and leak detection sumps for each cell including MC VI-G4 through G7. To incorporate these sumps into the design, cell layouts have been modified to allow for optimal flow of the leachate collection and leak detection systems. Figure 1 displays the proposed area of the MC VI-G base liner grades and layout.

Figure 1. Proposed Master Cell VI-F and G Layout



Final Cover Grade

Prior to the 2012 WDI landfill capacity expansion, the Willow Run Airport Runway 14/32 restricted the height of the vertical boundary of the landfill. The runway was removed in 2014, allowing WDI to reevaluate the geometry of the final grade. This proposed change allows the geometry of the final grade to have a more consistent slope, which will allow for a more controlled and direct storm water management system.

Figure 2. Proposed Final Grades

Alternative Final Cover – Engineered Artificial Turf Landfill Cover System

As part of this submittal, WDI is proposing an alternate to the final cover system design. The alternative final cover is an engineered three component system comprised of a structured geomembrane, an engineered turf, and a specialized sand infill. The foundation of the system is an impermeable, highly transmissive structured geomembrane. The engineered turf component gives the system the appearance of grass while eliminating the maintenance challenges associated with a vegetation-based system (e.g., mowing, erosion). The specialized sand infill component is placed between the blades of the engineered turf and allows the system to be trafficked while also providing enhances UV protection. The engineered

alternative final cover system is fast and easy to install for an aesthetically pleasing, cost-effective landfill closure solution. During post closure, the proposed alternative cover system is highly erosion resistant, very low maintenance and easy to repair on the rare occasions it is needed. Details and calculations in support of this proposed alternate are included in Attachment B of this section.

Summary of Design Capacity

WDI's currently permitted design capacity is approximately 22,453,720 million cubic yards of hazardous waste. The original hazardous waste capacity was 11,000,000 cubic yards. However, the Willow Run Airport Runway 14/32 that existed at the time of the original permit restricted the height of the vertical boundary, which limited the hazardous waste capacity to 10,723,720 cubic yards. In 2012, the MC VI-F/G expansion increased the capacity by 11,730,000 cubic yards.

As part of this submittal, the final grade elevations of MC IV-G2 and MC VI-G3 are being adjusted to their original configuration which was revised in 2018 to ensure a net zero capacity change with a geocomposite clay liner design. Additionally, the area previously restricted by Willow Run Airport Runway 14/32 has been adjusted to improve the storm water management system and increase the maximum elevation to 930 feet above mean sea level. This adjustment will result in an increased capacity of 4,412,664 cubic yards. The floor grades (in MC VI F and G) have been adjusted to include leachate collection and leak detection sumps. Adjusting the floor grades results in an decrease in capacity of 64,530 cubic yards.

The use of an alternative final cover system design provides approximately 687,764 cubic yards of capacity.

The total net gain in the hazardous waste capacity incorporating the sum of these adjustments is 5,164,958 cubic yards.

Design Calculations

In order to add leachate collection and leak detection sumps, the base liner grades in MC VI-G were revised and cell layouts were updated. The grades of the final cover have been adjusted to allow for more controlled and direct storm water management. Design calculations to support the liner grade and final cover grade changes are included in Attachment A of this section. Calculations contained in Attachment A of this section include:

- Geotechnical Slope Stability Analysis (Attachment A-1)
- Geotechnical Settlement Calculations (Attachment A-2)
- Pipe Strength and Deflection Calculations (Attachment A-3)
- Leachate Collection System Flow Capacity Analysis (Attachment A-4)
- Head-on-Liner Calculations (Attachment A-5)
- Surface Water Calculations (Attachment A-6)

The design calculations related to the engineered artificial turf landfill cover system are included in Attachment B of this section.

Permit Drawings

The proposed upgrades to the MC VI-G base liner and WDI final grades will result in revisions to the permit engineering drawing sheets listed in Table 1. A complete set of permit engineering drawings is included in Attachment C of this section for ease of review and reference.

List of Attachments to This Section

Attachment A: Design Calculations

- Attachment A-1: Slope Stability Analysis
- Attachment A-2: Settlement Calculations
- Attachment A-3: Pipe Strength and Deflection Calculations
- Attachment A-4: Leachate Collection System Flow Capacity Analysis
- Attachment A-5: Head-on-Liner Calculations and Minimum Geocomposite Transmissivity
- Attachment A-6: Surface Water Calculations

Attachment B: Engineered Artificial Turf Landfill Final Cover Alternate

Attachment C: Permit Engineering Drawings (under separate cover)

Table 1. List of Revised Permit Engineering Drawings

Sheet	Title
01	Title Sheet
02	General Site Plan
03	Construction Phasing
04	Top of Subgrade Grading Plan
05	Top of Secondary Liner Grading Plan
06	Top of Primary Liner Grading Plan
07	Leachate Management Plan
08	Final Cover Grading Plan (1 of 2)
09	Final Cover Grading Plan (2 of 2)
10	Stormwater Management and Sedimentation Plan (1 of 2)
10A	Engineered Turf Stormwater Management Plan (1 of 2)
11	Stormwater Management and Sedimentation Plan (2 of 2)
11A	Stormwater Management and Sedimentation Plan (2 of 2)
12	Cross Sections (1 of 3)
13	Cross Sections (2 of 3)
14	Cross Sections (3 of 3)
15	Liner System Details (1 of 2)
16	Liner System Details (2 of 2)
17	Leachate Collection System Details (1 of 2)
18	Leachate Collection System Details (2 of 2)
18A	Leak Detection and Leachate System for MC VI F4 East
18B	Connection Details for MC VI-E Phase 2 West Leak Detection Sump
19	Final Cover Details
19A	Engineered Turf Final Cover Details
20	Stormwater Management System Details
20A	Engineered Turf Stormwater Management System Details
21	Conceptual Gas Venting System

Notes

1. All modifications have been indicated using red bubbles, each accompanied by the revision identifier “K”
2. Sheets 18A and 18B are new sheets in the revision K.

RESPONSE TO TECHNICAL REVIEW
BY CTI ON NOVEMBER 6, 2024

Comments on CTI's Responses for EPA (TRC)'s Technical Comments

Dated Nov. 1, 2024

Responded by CTI on Nov. 6, 2024

TRC Initial Comment: Has CTI considered the possibility of the berms being overtopped due primarily to the velocity at which the surface water will flow down the slope?

CTI Response: New calculation on the overtopping potential are prepared (A-6.10 and K-7). As demonstrated in the attached calculations, the overtopping of the proposed perimeter stormwater berm or ditch will not occur.

TRC Updated Response: Please provide further explanation for choosing to model the calculation from a 100-year, 15 minute storm rather than a 25-year, 24 hour or 100-year, 24-hour storm that was used when CTI was performing original stormwater analyses for the site.

Response:

In the original design of the stormwater management system, the water conveyance system features are designed based on 25-yr, 24-hr storm event as required by 40CFR 264.301(h) and MI Part 111 R299.9505 (f) (iii). The stormwater storage (sediment basins and temporary overfill storm sewer manholes) are designed based on 100-yr, 24-hr storm event as required by MI Part 111 R299.9604(b).

As we described in the calculation A-6.10 and K-7, the more critical condition for the potential water jumping will be when the ditch is empty. To provide additional protection, a short duration (15 min) and high intensity (100-yr) event is used for the overtopping calculation.

The comparison of the design flowrates is presented in Table 1. The flowrate used in the calculation is higher than the peak flowrate calculated using a 25-yr, 24-hr storm event.

Table 1. Design Flow Comparison for Overtopping Calculation

	NWD	Diversion Berm	NWD	Diversion Berm
	(33% Slope)	(25% Slope)	(33% Slope)	(25% Slope)
Scenario	Conventional Cover, CN=100		Engineered Turf Cover, CN=100	
Calculation A-6.10; K-7 Rational Calc Design Average Flow 100-yr, 15 min storm event (see Note 1)	0.296 cfs	0.268 cfs	1.297 cfs	0.973 cfs
	Conventional Cover, CN=84		Engineered Turf Cover, CN=95	
HydroCAD Model Peak Flow 25-yr, 24-hr storm event (see Note 2)	0.19 cfs	0.18 cfs	1.15 cfs	0.84 cfs
Notes:				
1. Design flow used in berm overtopping calculation.				
2. Water conveyance system features are designed based on 25-yr, 24-hr storm event 40CFR 264.301(h); MI Part 111 R299.9505 (f) (iii)				