Electric Energy, Inc.

January 20, 2011

Mr. Stephen Hoffman
US Environmental Protection Agency (5304P)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Plan for Addressing Recommendations in the Site Assessment Report
Electric Energy, Inc., Joppa Power Station.

Dear Mr. Hoffman:

Electric Energy, Inc. (EEI) is responding to your January 7, 2011 letter requesting a follow up to the recommendations made in the September 24, 2010 Dam Safety Assessment Report of the Joppa Power Station CCW Impoundment.

We have reviewed the recommendations and intend to address each one to insure continued stability of the CCR impoundment. The following is our response to each of the recommendations listed in your letter and in the Final Report.

6.1 Urgent Action Items. None of the recommendations were considered to be urgent.

EEI Response – EEI will continue its dam inspection and maintenance program and perform any repairs that are necessary to insure a safe facility. The success of this program is reflected in the fact that no urgent action items were found during the Dam Safety Assessment.

6.2 Long Term Improvement

1. *Outboard slopes – remove deleterious vegetation and continue regular maintenance of the slopes; repair any areas of sloughs, slides and erosion.*

EEI Response – EEI will continue our program of removing vegetation that EEI determines to be deleterious. EEI will also continue our program of maintaining the slopes by evaluating sloughs, slides, and erosion on a case by case basis and repairing those that are determined to affect the structural integrity of the impoundment.

2. *Outboard Toe – investigate the extent of seepage, monitor on a regular basis, and develop alternatives for treating the deteriorated sections of the embankment*

EEI Response – EEI will continue to monitor areas of suspected seepage. EEI has cleared vegetation from the outboard toe of the impoundment and has installed a road along the toe which allows access for inspections and to make embankment repairs.

3. *Inboard slopes – keep vegetation under control to allow for visual inspection of the exposed portion of the slope above the water line.*

EEI Response - EEI will keep vegetation under control to allow for visual inspection of the exposed portion of the slope above the water line.

4. *Additional Studies – perform geotechnical investigation, cross-sectional topographic survey, and slope stability analysis of critical sections. Install piezometer to check phreatic levels within the embankment. Analyze for normal pool with steady state seepage, maximum surcharge pool, and seismic loading conditions and, depending on the results of the analysis, consider alternatives for stabilizing the embankments and control the seepage.*

EEI Response – EEI performed a geotechnical investigation in 2010. The investigation included a topographic survey and slope stability analysis of the critical section. A piezometer was installed to check phreatic levels within the embankment. The geotechnical investigation report is attached.

6.3 Monitoring and Future Inspection

Consideration should be given to inspections by licensed dam safety engineers on a regular basis to document the continued proper maintenance and operation of the Ash Pond. This is especially critical for the portion of the Southern Pond embankment where seepage was observed.

EEI Response – EEI will continue our program of having the Ash Pond embankment inspected annually by qualified dam safety engineers.

Please contact Mr. Bruce Parker, Senior Engineer, at (618) 543-3458 if there are any questions regarding this response. Also future correspondence regarding the Joppa Station should be addressed to me at the address on the bottom of this letter.

Sincerely,

William H. Sheppard
President

WHS:BP
Enclosure

cc: M. Menne, Ameren

GLOBAL STABILITY EVALUATION
EAST ASH POND
EEI JOPPA POWER GENERATING FACILITY
JOPPA, ILLINOIS

Prepared for:

ELECTRIC ENERGY, INC.
Joppa, Illinois

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Geotechnology Project No. J017150.02

November 10, 2010

Projects\Deliverables\J017150.02 Slope Stability RF.doc

GEOTECHNOLOGY INC
FROM THE GROUND UP

November 10, 2010

J017150.02

Mr. John Morvich, C.P.M.
Electric Energy, Inc.
2100 Portland Road
Joppa, Illinois 62953

GLOBAL STABILITY EVALUATION
EAST ASH POND
EEI JOPPA POWER GENERATING FACILITY
JOPPA, ILLINOIS

Dear Mr. Morvich:

Presented in this report are the results of an embankment stability evaluation conducted for the referenced project. This exploration was conducted in general accordance with our May 21, 2010 revised proposal. This report includes our project understanding, observed site conditions, conclusions and/or recommendations, and support data as given in the Table of Contents.

It has been our pleasure to provide these services to you, and we would welcome the opportunity to provide other services during the course of the project. Please contact us if you need further information or clarification about this document.

Very truly yours,

GEOTECHNOLOGY, INC.

STATE OF ILLINOIS
SENTHIL B. KUMAR
No. 062-054233
REGISTERED PROFESSIONAL ENGINEER

Senthil Kumar, P.E.
Senior Engineer
Geotechnical Group

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SK/DMS/JAB:sk/jsj/jrh

Copies submitted: (3) hard copies
(1) pdf format on CD

J017150.02

GLOBAL STABILITY EVALUATION
EAST ASH POND
EEI JOPPA POWER GENERATING FACILITY
JOPPA, ILLINOIS

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GLOBAL STABILITY EVALUATION
EAST ASH POND
EEI JOPPA POWER GENERATING FACILITY
JOPPA, ILLINOIS

SECTION I - PROJECT DATA

AUTHORIZATION

The services documented in this report were provided in accordance with the terms, conditions and scope of services described in the agreement between Electric Energy, Inc. (EEI) and Geotechnology dated May 28, 2010, and Geotechnology's May 21, 2010 revised proposal numbered P017237.01A. The project was authorized by the signed acceptance of the agreement by Mr. W.H. Sheppard, President of EEI.

PURPOSE AND SCOPE OF SERVICES

The purpose of our services was to perform a stability analysis of the ash pond embankment. Briefly, services consisted of site reconnaissance, drilling five borings, installing two piezometers, laboratory testing, engineering analyses and preparation of this report. Important information prepared by The Association of Engineering Firms Practicing in the Geosciences (ASFE) for studies of the type is included in Appendix A for your review.

PROJECT AND SITE DESCRIPTION

We understand that the coal-ash waste materials from the power generating process at the EEI Joppa Power Plant are stored in the east ash pond located northeast of the plant. The site location and general topography of the area as per U.S.G.S. map of the vicinity are shown on Plate 1. The ash pond is in the floodplain of the Ohio River and was constructed circa 1973. Based on data provided by EEI, the ash pond is contained by an approximately 6,825-foot long embankment. Based on 1973 construction drawings the embankment height on the east site of the ash pond varies from 30 to 40 feet including a 15-foot deep ditch along the berm toe. At the section surveyed for the slope stability analysis the embankment height is 25 feet, slope varies from 1V:2.2H (Vertical:Horizontal) to 1V:1.3H and the approximately 20-foot wide crest is at El 379[1]. The ditch shown on the 1973 construction drawings appears to be backfilled to existing ground surface El 355. The ash pond is generally dry, except to the southeast where water is ponding. Along the east slope of the ash pond embankment, riprap is present on the downstream slope face. The remainder is covered with heavy foliage. EEI-owned rail tracks are present near the outside toe of the outermost embankment. A drainage swale is present between the tracks and the embankment.

[1] All elevations herein refer to the mean sea level (msl) datum in feet.

SECTION II - FIELD EXPLORATION AND LABORATORY TESTING

FIELD EXPLORATION

The field exploration consisted of drilling six borings, designated as Borings B-1 through -5 and -2A, at approximately the locations shown on Plate 2. Boring B-2A was drilled adjacent to Boring B-2 to obtain a Shelby tube sample. The borings were located in the field by Geotechnology by measuring distances from existing site features. Subsequently, the boring locations were surveyed by Milano & Grunloh Engineers LLC, and the location coordinates and elevations were provided to Geotechnology. The spot elevations surveyed along the crest of the embankment is included in Appendix E.

The borings were drilled to predetermined depths of 40 to 60 feet using a CME 550 rotary drill rig equipped with hollow stem augers. Standard Penetration Tests (SPT's) were performed using an automatic hammer. Split-spoon samples and relatively undisturbed Shelby tube samples were obtained at the depths indicated on the boring logs presented in Appendix B. An explanation of the terms and symbols used on the borings is provided in Appendix B.

A representative from Geotechnology provided technical direction during field exploration, observed drilling and sampling, assisted in obtaining samples and prepared descriptive logs of the material encountered. The boring logs represent conditions observed at the time of exploration, and have been edited to incorporate results of the laboratory tests as appropriate.

Unless noted on the logs, the lines designating the changes between various strata represent approximate boundaries. The transition between materials may be gradual or may occur between recovered samples. The stratification given on the logs, or described herein, is for use by Geotechnology in its analyses and should not be used as the basis of design or construction cost estimates without realizing that there can be variation from that shown or described.

The logs and related information depict subsurface conditions only at the specific locations and times where sampling was conducted. The passage of time may result in changes in conditions, interpreted to exist, at or between the locations where sampling was conducted.

LABORATORY TESTING

Laboratory testing was performed to estimate pertinent engineering and index properties of the soil. Moisture contents were determined for cohesive soil samples, and Atterberg limits tests were accomplished on selected samples. Consolidated-undrained triaxial and unconfined compression tests were performed on representative samples. Laboratory test results are presented in Appendices B and C.

SECTION III - SUBSURFACE CONDITIONS

STRATIGRAPHY

The overburden in borings drilled along the embankment consists of fill underlain by alluvial material transported and deposited by the Ohio River. The fill is approximately 22 feet thick and is generally comprised of silty clay. A representative sample in the fill had a unit dry density of 112 pounds per cubic foot (pcf). Moisture content percentages ranged from the mid teens to the lower twenties. SPT N-values in the embankment fill varied from 2 to 16 blows per foot (bpf).

Beneath the embankment fill and at the surface in Borings B-4 and -5, an alluvial deposit of silty clay is present. The silty clay extends to the 40- to 60-foot depths of exploration. The consistency of the silty clay generally varies from soft to very stiff; representative samples had unit dry densities in the range of 96 to 104 pcf. Auger refusal material was not encountered in the borings.

GROUNDWATER

Groundwater was observed while drilling Borings B-1 and -3 at depths of 45 and 35 feet, respectively. Groundwater levels shown on the boring logs may not have stabilized before backfilling, which is typical in less permeable cohesive soil. Consequently, the indicated/lack of observed groundwater levels may not represent present or future levels. Groundwater levels may vary significantly over time due to the effects of seasonal variation in precipitation, recharge, the stage of Ohio River or other factors not evident at the time of exploration.

Open-standpipe piezometers were installed in Borings B-1 and -4 to permit subsequent measurement of the groundwater levels. The piezometers consist of 2-inch diameter PVC pipe, with a 10-foot length of screen placed within the boring. The piezometers were backfilled with sand within the screened interval, sealed above the screen with bentonite pellets, and the remainder backfilled with cement-bentonite grout. A protective steel well casing was placed at the ground surface or over the riser pipe. Details of the piezometer installation at each of the borings are presented on the Piezometer Installation Reports in Appendix D. Groundwater was observed in Piezometers B-1 and -4 at depths of 21 and 38 feet, respectively, 3 months after completion of drilling. After 4½ months groundwater was at depths of 18 and 41 feet, respectively.

SECTION IV –GLOBAL STABILITY EVALUATION

As part of the embankment evaluation, slope stability analyses were performed. Current topographic plans were not provided. However, the project surveyor provided the latitude, longitude and the surface elevation of the boring locations. This information was used to develop the slope profile. Results of the analysis are discussed in subsequent sections.

SLOPE STABILITY ANALYSIS

Slope stability analysis consists of comparing the driving forces within a cross-section of slope to the resisting forces and determining the factor of safety. Gravity forces tend to move the slope downwards (driving force), while resisting forces derived from the soil shear strength tend to keep the slope in place. When the driving force acting on the slope is greater than the resisting force, sliding can occur. The factor of safety of the slope is the ratio of the restraining force divided by the driving force. Generally, when the factor of safety is 1 or less, the slope is considered to be unstable. The accepted standard in local practice and consistent with IDNR dam safety requirement is to have a factor of safety of 1.5 for long term static stability of a slope, and 1.0 for pseudo-static conditions (seismic loading).

Slope stability analyses were performed for the east embankment of the east ash pond. The location of a typical cross-section of the embankment is represented by Section A-A, and is shown on Plate 2. Soil properties used in the stability analysis were selected based on laboratory test results and Geotechnology's experience with similar materials. The soil properties used in the models are summarized in the following table:

SOIL PROPERTIES			
Soil Type	**Density (pcf)**	**Cohesion (psf)**	**Friction Angle (°)**
Embankment Fill	125	50	31
Alluvial soil (CL)	120	50	33

Geotechnology performed stability analysis for deep seated, global failure of the embankment. Representative cross-sections of the embankments are shown on the attached Plates 3 through 6. Since the embankments have been in place for over 30 years, long-term stability of the embankments was analyzed (i.e. effective stress conditions). Based on the piezometer data groundwater was assumed to be between El 325 and 375 for the analysis of the ash pond embankment as shown on Plate 3. Also, a parametric analysis of the piezometer level was performed by partially saturating the slope to determine the phereatic surface for a corresponding factor of safety of 1.5. A pseudo-static seismic analysis was performed on a typical embankment section using horizontal accelerations of 0.65g and 0.22g, respectively, which corresponds to seismic events with a mean return time of 2,500 and 500 years (Plates 5 and 6), respectively. Details of determining of the horizontal accelerations are given in a subsequent section. The

Morgenstern-Price procedure was used to compute factors of safety. The computer program SLOPE/W was used to perform the computations. The calculated factors of safety are given in the following table.

SLOPE STABILITY ANALYSIS RESULTS			
Analysis Condition	**Calculated Factor of Safety**	**Target Factor of Safety**	**Reference Plate No.**
Existing Conditions, Steady State Seepage	1.7	1.5	3
Partially Saturated Slope, Steady State Seepage	1.5	1.5	4
Slope with Seismic Forces Mean Return Time 2,500 Years	0.5	1.0	5
Slope with Seismic Forces Mean Return Time 500 Years	1.0	1.0	6

We recommend a minimum factor of safety of 1.5 for long-term stability. Based on the analyses, the embankment has a factor of safety greater than the IDNR recommended factor of safety of 1.5. During an extreme event, such as an earthquake, a factor of safety of 1.0 or more is recommended. However, for a horizontal acceleration of 0.65g (mean return time 2,500 years) the resulting factor of safety was less than 1. But a factor of safety of 1.0 was calculated for a horizontal acceleration of 0.22g (mean return time 500 years).

SEISMICITY

The site is located in a region of the country that has a significant seismic risk due to the presence of the New Madrid Seismic Zone (NMSZ) in southeastern Missouri and the Wabash Valley Seismic Zone (WVSZ) in southeastern Illinois and southwestern Indiana. The NMSZ is the site of three of the largest magnitude earthquake events (estimated surface-wave magnitudes greater than or equal to 8.0) to strike North America in recorded history (December 1811 through February 1812). Researchers predict that the WVSZ is capable of producing large earthquakes similar in magnitude to the 1811-1812 NMSZ earthquakes.

Per the Illinois Department of Natural Resources for a dam construction permit, the seismic hazard analysis should use bedrock peak ground accelerations with a 2% probability of exceedence (PE) in 50 years (mean return time of 2,500 years). The National Seismic Hazards Mapping Project (NSHMP) interactive deaggregations models (2002 edition) were used to obtain the probabilistic bedrock accelerations at the site. The NSHMP models consider ground motion from many sources surrounding the site location with the assumption that the site condition is rock with an average shear wave velocity of 2,500 ft/s. Bedrock spectral response acceleration at short periods (S_s), and at 1-second periods (S_1) of 2.4 g and 0.7 g, respectively, were obtained from the NSHMP models.

A detailed site-specific seismic hazard analysis was beyond our scope of services. The guidelines established by the International Building Code, 2006 edition (IBC 2006) were used to propagate the bedrock acceleration to the ground surface. Based on the boring data and Section 1613.5.6 of the IBC 2006, we calculated that the underlying soil profile within the upper 100 feet could be defined as Site Class D (stiff soil profile). Using Site Class D and guidelines in Section 1802 of IBC 2006, we were able to calculate an approximate surficial horizontal peak ground acceleration of 0.65g, which was used in the slope stability analysis. Using similar methods for a 10% probability of exceedence (PE) in 50 years (mean return time of 500 years) the spectral response acceleration at short periods (S_S) and the corresponding approximate surficial horizontal peak ground acceleration were determined as 0.6g and 0.22g, respectively.

SECTION V - LIMITATIONS OF REPORT

This report has been prepared on behalf of and for the exclusive use of the client for specific application to the named project as described herein. If this report is provided to prospective contractors, the client should make it clear that the information is provided for factual data only and not as a warranty of subsurface conditions included in this report. Unanticipated soil or rock conditions may require the expenditure of additional funds to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

Geotechnology has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. No other representation, expressed or implied, is included or intended.

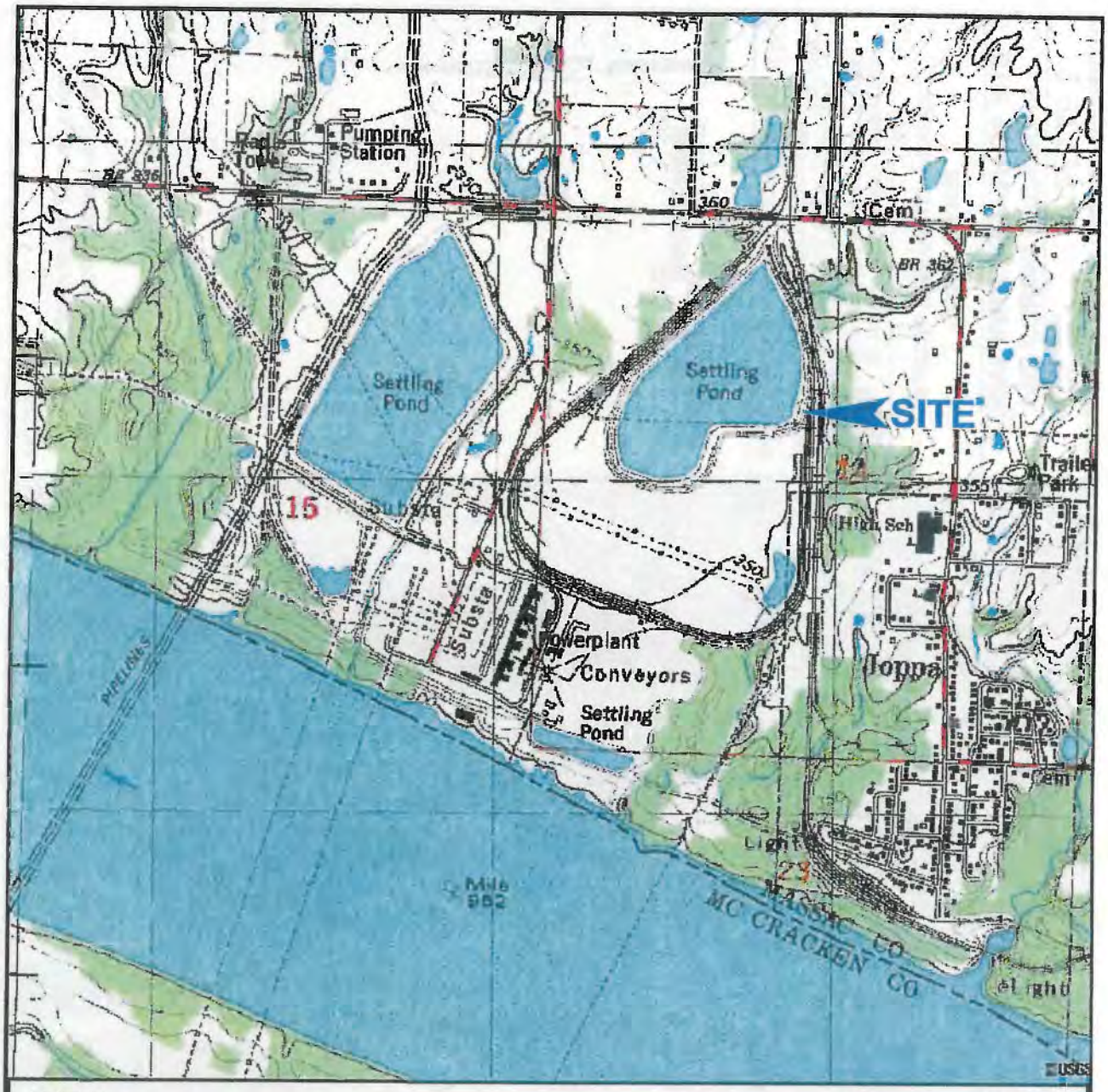
Unless specifically stated in our proposal or this report, the scope of our services for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic material in the soil, surface water, groundwater or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client. Our scope did not include any services to investigate or detect the presence of mold or any other biological contaminants (such as spores, fungus, bacteria, viruses, and the by-products of such organisms) on and around the site, or any services designed or intended to prevent or lower the risk of the occurrence of an infestation of mold or other biological contaminants.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the subsurface exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Discrete sampling cannot be relied on to

accurately reflect natural variations in stratigraphy that may exist between sample locations and/or intervals. Unless specifically noted, the scope of our services did not include an assessment of the effects of flooding and natural erosion of adjacent creeks or rivers on the project site.

The recommendations included in this report have been based in part on assumptions about natural variations in site stratigraphy that may only be completely evaluated during earthwork and foundation construction. Accordingly, Geotechnology should be retained to perform construction observation and complete its geotechnical engineering service using observational methods. Geotechnology cannot assume liability for the adequacy of its recommendations when they are used in the field without Geotechnology being retained to observe construction.

The conclusions or recommendations presented in this report should not be used if the nature, design, or location of the facilities is changed or if there is a substantial lapse in time between the submittal of this report and the start of work at the site. If changes are contemplated, Geotechnology must review them to assess their impact on findings, conclusions, and/or design recommendations given in this report. Geotechnology will not be responsible for any claims, damages, or liability associated with any other party's interpretations of the subsurface data or reuse of the subsurface data or engineering analyses in this report without our express written authorization.



NOTES

Plan adapted from a 7.5 minute U.S.G.S. map for Joppa, Illinois Quadrangle, last revised in 1982.

0 2,000 4,000

SCALE IN FEET

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Drawn By: SLC	Ck'd By: SL	App'vd By: RBP
Date: 07-06-10	Date: 9/20/10	Date: 9/20/10

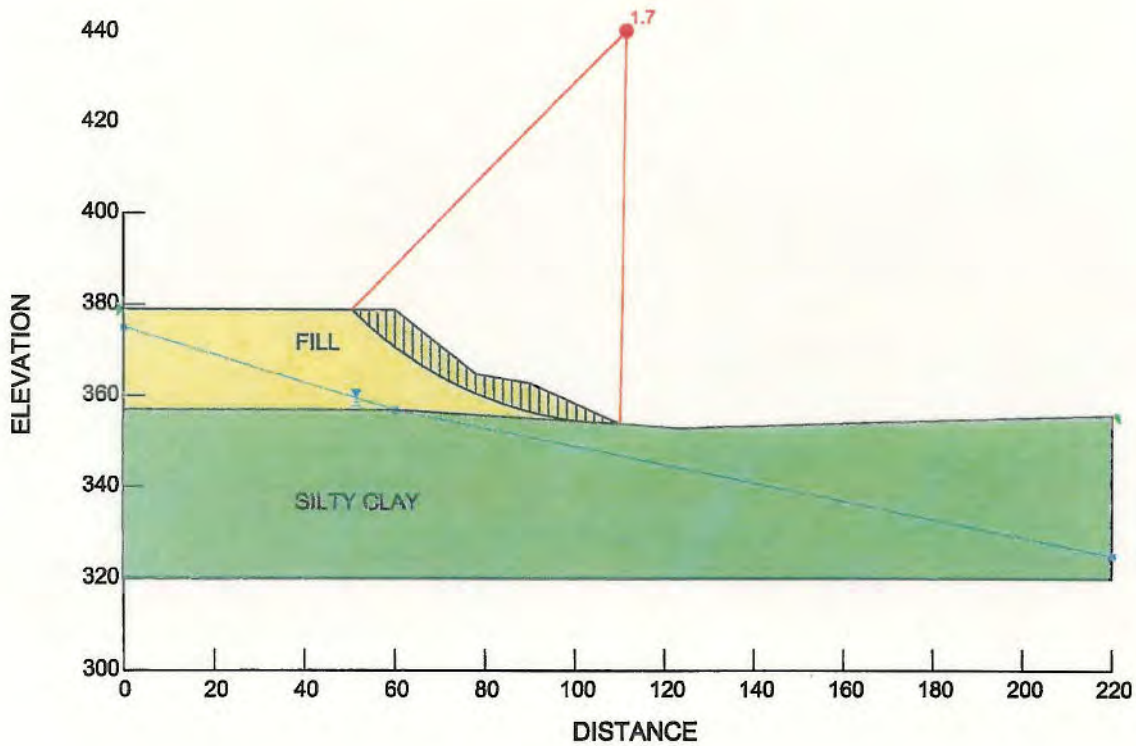
GEOTECHNOLOGY INC.
ENGINEERING AND ENVIRONMENTAL SERVICES
ST. LOUIS • COLLINSVILLE • KANSAS CITY

Electric Energy Inc. Facility
Joppa, Illinois

SITE LOCATION AND TOPOGRAPHY

Project Number J017150.02

PLATE 1



NOTE

1. See Plate 2 for location of cross section.

Drawn By: SLC	Ck'd By: SR	App'vd By: SR
Date: 09-17-10	Date: 10/22/10	Date: 11/09/10

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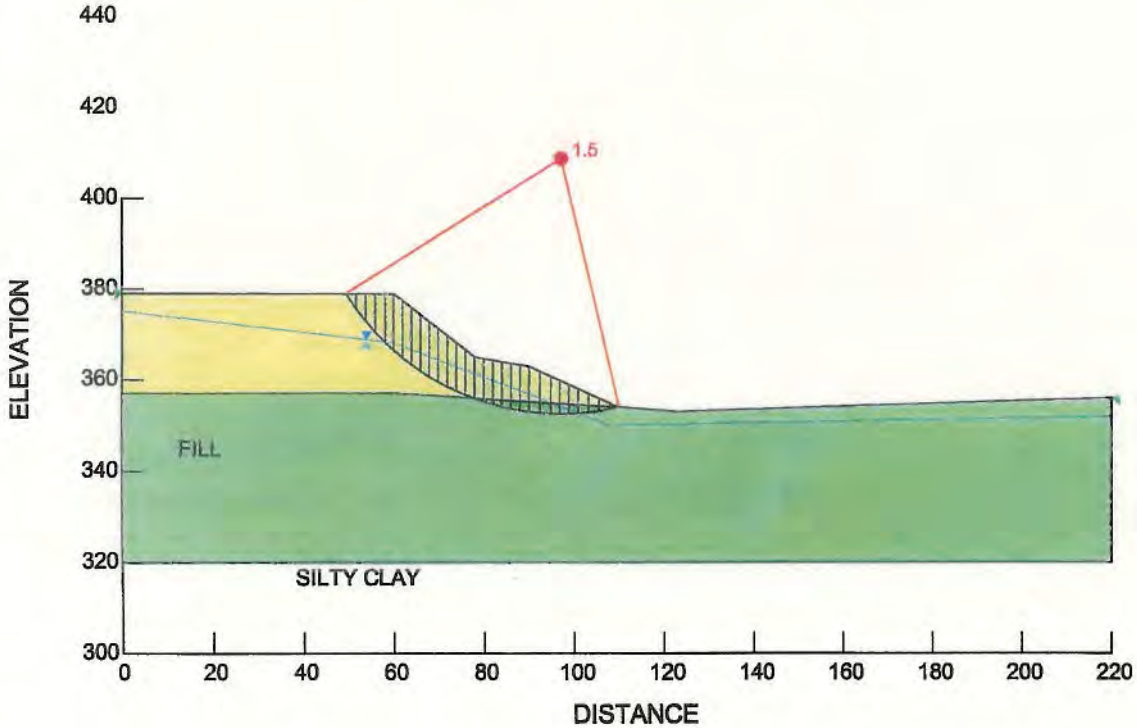
Electric Energy Inc. Facility
Joppa, Illinois

SLOPE STABILITY CROSS SECTION A-A'
STEADY STATE SEEPAGE A - A'

Project Number
J017150.02

PLATE 3



NOTE

1. See Plate 2 for location of cross section.

2. Analysis is a parametric study of piezometric surface for a corresponding FOS=1.5. The piezometric surface shown does not represent observed conditions but represents an upper limit below which the FOS is equal to or greater than the target FOS 1.5.

Drawn By: SLC	Ck'd By:	App'vd By:
Date: 09-17-10	Date: 10/28/10	Date: 11/9/10

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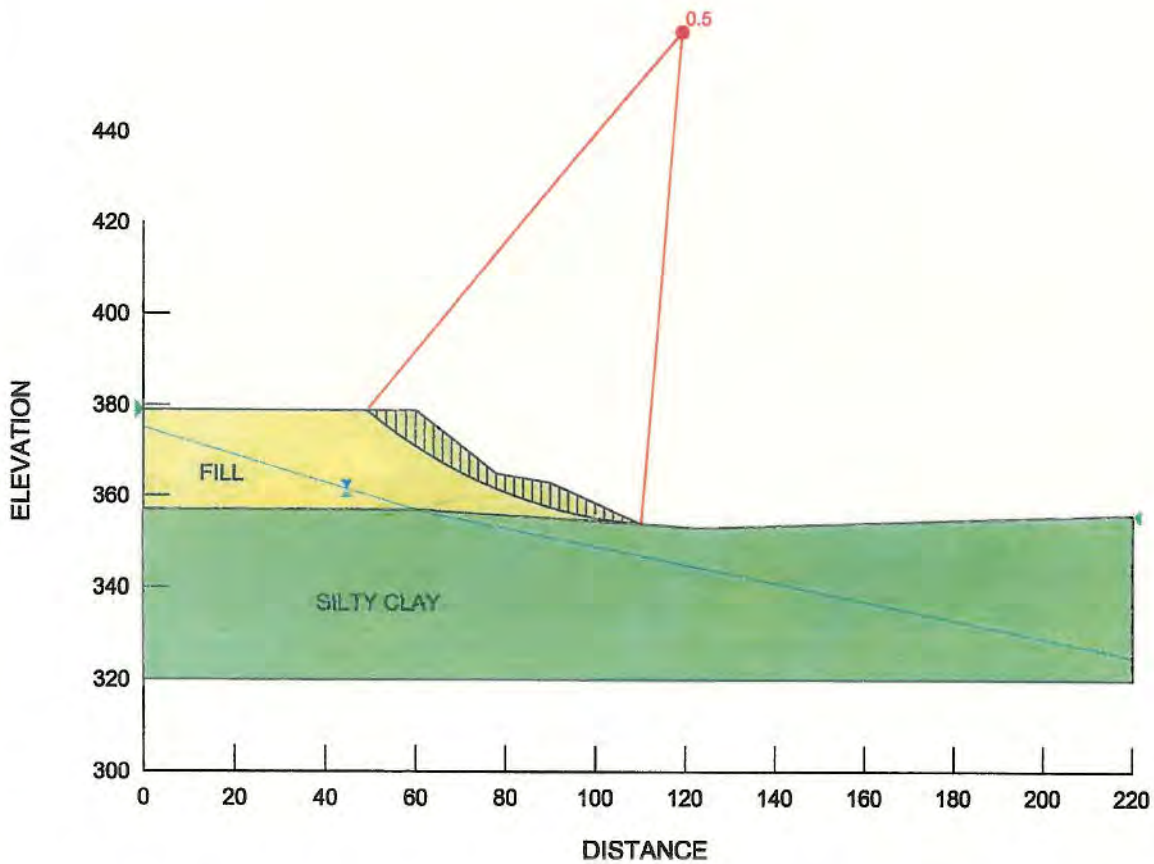
Joppa, Illinois

SLOPE STABILITY CROSS SECTION A-A'
STEADY STATE SEEPAGE
SLOPE PARTIALLY SATURATED

Project Number J017150.02	PLATE 4



NOTE

1. See Plate 2 for location of cross section.

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Date: 09-17-10	Date: 10/28/10	Date: 11/9/10

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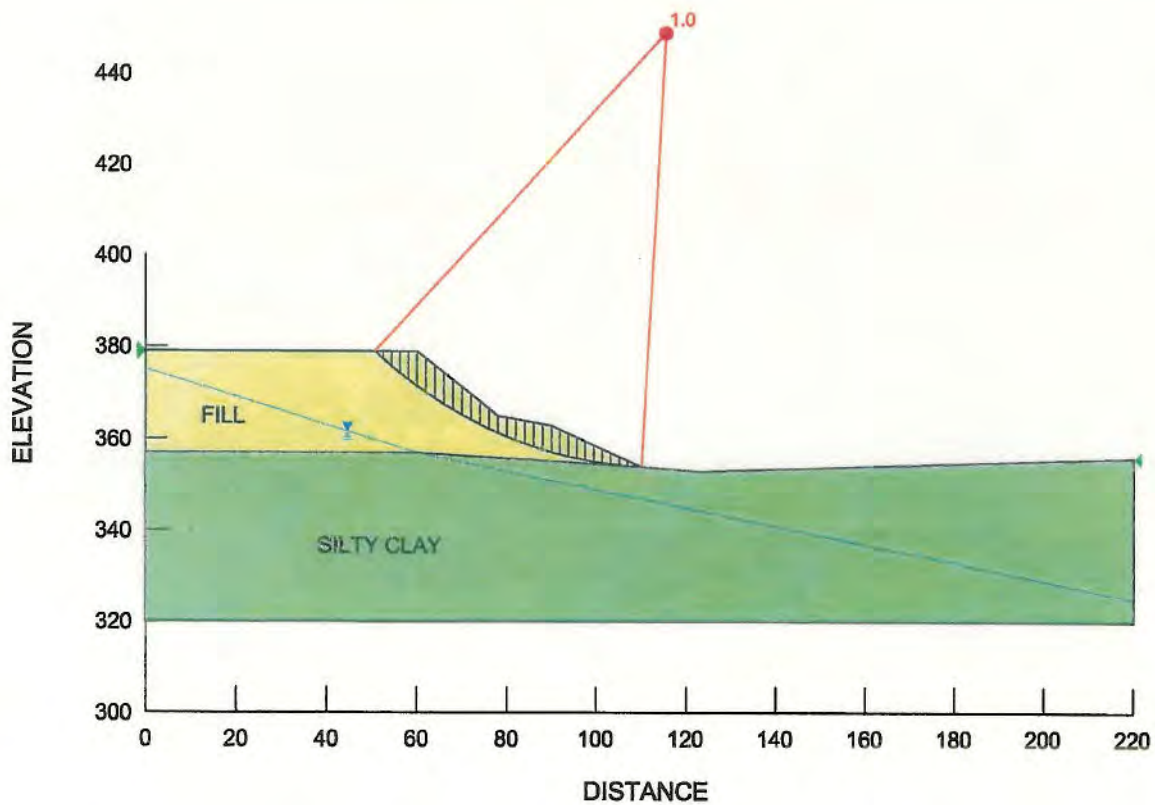
Joppa, Illinois

SLOPE STABILITY CROSS SECTION A-A'
SEISMIC ANALYSIS
(MEAN RETURN TIME 2,500 YEARS)

Project Number J017150.02	PLATE 5

NOTE

1. See Plate 2 for location of cross section.



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Date: 09-17-10	Date: 10/20/10	Date: 11/9/10

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ENGINEERING AND ENVIRONMENTAL SERVICES
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Electric Energy Inc. Facility
Joppa, Illinois

SLOPE STABILITY CROSS SECTION A-A'
SEISMIC ANALYSIS
(MEAN RETURN TIME 500 YEARS)

Project Number J017150.02	PLATE 6

APPENDIX A

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/THE BEST PEOPLE ON EARTH exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

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IIGER030815.0MRP

APPENDIX B

DETAILED LOGS OF BORINGS
BORING LOG: TERMS AND SYMBOLS

Surface Elevation: 379.3 | Completion Date: 6/15/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL: brown and gray, silty clay		
		2-4-5	SS1
5		2-4-9	SS2
		3-4-5	SS3
10		2-4-6	SS4
15		2-4-7	SS5
20		1-3-5	SS6
	Soft to stiff, brown and gray, silty CLAY - (CL)		
25		0-1-1	SS7
		96	ST8
30		96	ST9
35		1-4-5	SS10
40		3-5-6	SS11
		6-5-6	SS12

GRAPHIC LOG

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02G - EEI JOPPA.GPJ GTINC 063B3D1.GPJ 9/7/10

GROUNDWATER DATA

ENCOUNTERED AT 45 FEET ▽

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER BGF LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: Sec	App'vd. by: RBP
Date: 6/29/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: B-1

Project No. J017150.02

Surface Elevation: 379.3 | Completion Date: 6/15/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	SHEAR STRENGTH, tsf (Δ - UU/2, O - QU/2, □ - SV; 0.5, 1.0, 1.5, 2.0, 2.5) / STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT) / WATER CONTENT, % (PL 10, 20, 30, 40, 50 LL)
	Soft to stiff, brown and gray, silty CLAY - (CL) *(continued)*				
50	with sand		3-3-5	SS13	
55	trace sand		3-6-7	SS14	
60	Boring terminated at 60 feet.		4-6-7	SS15	
65					
70					
75					
80					
85					

GROUNDWATER DATA

ENCOUNTERED AT 45 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER BGF LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: SLC	App'vd. by: RJP
Date: 6/29/10	Date: 8/26/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash pond Evaluation
EEI Facility
Joppa, Illinois

CONTINUATION OF
LOG OF BORING: B-1

Project No. J017150.02

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002.WL J017150.02G - EEI JOPPA.GPJ GTINC 063830.GPJ 9/7/10

Surface Elevation: 379.1 | Completion Date: 6/16/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL: brown and gray, silty clay			
			1-1-2	SS1
			1-1-1	SS2
5				
			1-1-2	SS3
			1-2-1	SS4
10				
			3-5-7	SS5
15				
			3-5-10	SS6
20				
	Stiff to very stiff, brown and gray, silty CLAY - CL			
			2-2-5	SS7
25				
			2-4-5	SS8
30				
			2-3-5	SS9
35				
			3-3-6	SS10
40				
			1-2-2	SS11

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - TV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ● LL

10 20 30 40 50

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER BGF LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: SJC	App'vd. by: KOP
Date: 6/29/10	Date: [illegible]	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: B-2

Project No. J017150.02

LOG OF BORING 2002 WL J017150.02G - EEI JOPPA.GPJ GTINC.0638301.GPJ 9/17/10

Surface Elevation: 379.1 | Completion Date: 6/16/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Stiff to very stiff, brown and gray, silty CLAY - CL *(continued)*			
			104	ST12
			104	ST13
50				
			5-7-10	SS14
55				
			4-6-6	SS15
60	Boring terminated at 60 feet.			
65				
70				
75				
80				
85				

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - TV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER BGF LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by:	App'vd. by:
Date: 6/29/10	Date: 10/20/10	Date: 9/20/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ash pond Evaluation
EEI Facility
Joppa, Illinois

CONTINUATION OF LOG OF BORING: B-2

Project No. J017150.02

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02G - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/17/10

Surface Elevation: 379.1 | Completion Date: 6/15/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL: brown and gray, silty clay trace gravel			
			3-8-8	SS1
			2-3-6	SS2
5			112	ST3
	Boring terminated at 7 feet.			
10				
15				
20				
25				
30				
35				
40				

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - TV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02G - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/17/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER BGF LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: Sa	App'vd. by: RBP
Date: 6/29/10	Date: 9/22/10	Date: 9/29/10

GEOTECHNOLOGY INC

FROM THE GROUND UP

Ash pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: B-2A

Project No. J017150.02

Surface Elevation: 378.7 | Completion Date: 6/15/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL: brown and gray, silty clay	5-5-6	SS1
5		3-4-5	SS2
		4-6-7	SS3
10		2-3-4	SS4
15		3-4-7	SS5
20		4-6-8	SS6
	Medium stiff to very stiff, brown, silty CLAY - CL		
25		4-6-8	SS7
30		2-2-4	SS8
35	∇	4-4-7	SS9
40		3-4-6	SS10
		4-5-8	SS11

GRAPHIC LOG

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.02G - EEI JOPPA.GPJ GTINC 0538331.GPJ 9/7/10

GROUNDWATER DATA

ENCOUNTERED AT 35 FEET ∇

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER BGF LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: SEC	App'vd by: RSP
Date: 6/29/10	Date: 9/20/10	Date: 9/21/10

GEOTECHNOLOGY INC

FROM THE GROUND UP

Ash pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: B-3

Project No. J017150.02

Surface Elevation: 378.7 | Completion Date: 6/15/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to very stiff, brown, silty CLAY - CL *(continued)*			
50			3-4-5	SS12
55			5-7-11	SS13
60			7-11-11	SS14
	Boring terminated at 60 feet.			
65				
70				
75				
80				
85				

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 ▯ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ● LL

10 20 30 40 50

GROUNDWATER DATA

ENCOUNTERED AT 35 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER BGF LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: SLC	App'vd. by: KBY
Date: 6/29/10	Date: 6/30/10	Date: 9/21/10

GEOTECHNOLOGY INC

FROM THE GROUND UP

Ash pond Evaluation
EEI Facility
Joppa, Illinois

CONTINUATION OF
LOG OF BORING: B-3

Project No. J017150.02

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2502 WL J017150 02G - EEI JOPPA.GPJ GTINC 0638301.GPJ 9/7/10

Surface Elevation: 352.6 | Completion Date: 6/17/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Soft to very stiff, brown and gray, silty CLAY - CL			
			5-2-2	SS1
			0-2-3	SS2
5				
				ST3
				ST4
10				
			0-1-3	SS5
15				
			3-4-4	SS6
20				
			5-8-11	SS7
25				
			8-9-12	SS8
30				
			3-4-8	SS9
35				
			3-4-9	SS10
40	Boring terminated at 40 feet.			

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL | 10 20 30 40 50 | LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY

LOG OF BORING 2002 WL J017150.02G - EEI JOPPA.GPJ GTINC 063831.GPJ 9/7/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM __ FEET

PH DRILLER BGF LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: JL	App'vd. by RBP
Date: 6/29/10	Date: 9/20/10	Date: 9/20/10

GEOTECHNOLOGY INC

FROM THE GROUND UP

Ash pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: B-4

Project No. J017150.02

Surface Elevation: 356.1 | Completion Date: 6/17/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to very stiff, brown and gray, silty CLAY - CL			
			1-3-3	SS1
			2-5-6	SS2
5			1-2-3	SS3
			2-5-8	SS4
10				
			3-6-10	SS5
15				
			4-7-11	SS6
20				
			5-5-9	SS7
25				
			6-8-10	SS8
30				
			6-6-6	SS9
35				
			5-5-6	SS10
40	Boring terminated at 40 feet.			

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 Π - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY

LOG OF BORING 2002 WL J017150.02G - EEI JOPPA.GPJ GTINC 063831.GPJ 9/7/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER BGF LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: [illegible]	App'vd. by: KBR
Date: 6/29/10	Date: 9/20/10	Date: 9/28/10

GEOTECHNOLOGY INC

FROM THE GROUND UP

Ash pond Evaluation
EEI Facility
Joppa, Illinois

LOG OF BORING: B-5

Project No. J017150.02

BORING LOG: TERMS AND SYMBOLS

GENERAL NOTES

1. *Information on each boring log is a compilation of subsurface conditions based on soil or rock classifications obtained from the field as well as from laboratory testing of samples. The strata lines on the logs may be approximate or the transition between the strata may be gradual rather than distinct. Water level measurements refer only to those ob - served at the times and places indicated, and may vary with time, geologic condition or construction activity.*
2. *Relative composition and Unified Soil Classification designations are based on visual estimates and are approximate only. If laboratory tests were performed to classify the soil, the unified designation is show in parenthesis.*
3. *Value given in Unit Dry Weight/SPT Column is either a unit dry weight in pounds per cubic foot, if adjacent to a ST sample designation, or blows per 6-inch increment if adjacent to a SS sample designation.*

ABBREVIATIONS

UU/2	*Shear Strength from Unconsolidated – Undrained Triaxial Test (ASTM D2850)*
QU/2	*Shear Strength from Unconfined Compression Test (ASTM D2166)*
SV	*Shear Strength from Field Vane (ASTM D2573)*
PL	*Plastic Limit (ASTM D4318)*
LL	*Liquid Limit (ASTM D4318)*

LEGEND

CS	Continuous Sampler
GB	Grab Sample Taken From Auger Cuttings Or Wash Water Return
NX 100/42	NX Rock Core with Percent Recovery/R.Q.D. Given In Adjacent Column
PST	Three Inch Diameter Piston Tube Sample
SS	Split Spoon Sample (Standard Penetration Test)
ST	Three Inch Diameter Shelby Tube Sample
*	Sample Not Recovered
SV	Field Vane Test

SPLIT – BARREL SAMPLER DRIVING RECORD

Blow Per Foot (N-Value)	*Description*
25	*25 blows drove sampler 12 inches after initial 6 inches of seating.*
75/10"	*75 blows drove sampler 10 inches after initial 6 inches of seating.*
50/S3"	*50 blows drove sampler 3 inches during initial 6 inch seating interval.*

NOTES: 1. *To avoid damage to sampling tools, driving is limited to 50 blows during any six inch interval.*
2. *N-Value (Blow Count) is the standard penetration resistance based on the total number of blows, using a 140-lb hammer with 30-inch free fall, required to drive a split spoon the last two of three, 6-inch drive increments. (Example: 4/7/9, N = 7 + 9 = 16). Values are shown as a summation on grid plot and may be shown as 4/7/9 in Unit Dry Weight – SPT column.*

RELATIVE COMPOSITION

Trace.....0-10 %
With/Some.....11-35 %
Soil modifier such..... > 35 %
As silty, clayey, sandy, etc.

DENSITY OF GRANULAR SOILS

Descriptive Term:	***N—Value***
Very Loose	*0 - 4*
Loose	*5 - 10*
Medium Dense	*11 - 30*
Dense	*31 - 50*
Very Dense	*> 50*

STRENGTH OF COHESIVE SOILS

Consistency	**Undrained Shear Strength Tons Per Sq. Ft.**	**Field Test**	**Approximate N-Value Range**
Very Soft	*less than 0.12*	*Thumb will penetrate soil more than 1"*	*0 - 1*
Soft	*13 to 0.25*	*Thumb will penetrate soil about 1"*	*2 - 4*
Medium Stiff	*0.26 to 0.50*	*Thumb will penetrate soil about ¼"*	*5 – 8*
Stiff	*0.51 to 1.00*	*Thumb hardly indents soil*	*9 – 15*
Very Stiff	*1.01 to 2.00*	*Thumb will not indent soil, but readily indented with thumbnail*	*16 – 30*
Hard	*greater than 2.00*	*Thumbnail will not indent soil*	*> 30*

SOIL GRAIN SIZE

U.S. STANDARD SIEVE

12"	3"	¾"	4	10	40	200		
BOULDERS	COBBLES	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		

300 76.2 19.1 4.76 2.00 0.42 0.074 0.002

SOIL GRAIN SIZE IN MILLIMETERS

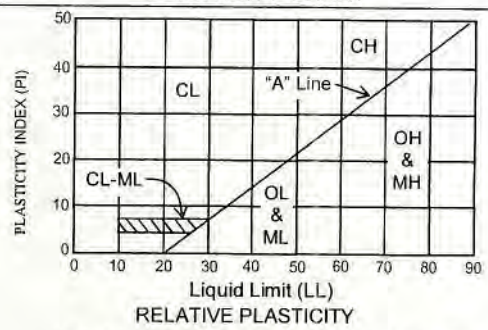
SOIL STRUCTURE

Calcareous *– Having appreciable quantities of carbonate.*
Fissured *– Containing shrinkage or relief cracks, often filled with sand or silt; usually more or less vertical.*
Slickensided *– Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along those planes.*
Layer *– Inclusion greater than 3 inches thick.*
Seam *– Inclusion 1/8 inch to 3 inches thick extending through the sample*
Parting *– Inclusion less than 1/8 inch thick.*
Pocket *– Inclusion of material of different texture that is smaller than the diameter of the sample.*
Interlayered *– Soil samples composed of alternating layers of different soil types.*
Intermixed *– Soil samples composed of pockets of different soil types and a layered or laminated structure is not evident.*
Laminated *– Soil sample composed of alternating partings or seams of different soil type.*

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOL	DESCRIPTION
Coarse-Grained Soils (More than 50% Larger than No 200 Sieve Size)	Gravel and Gravelly Soils	Clean Gravels Little or no Fines	GW	Well-Graded Gravel, Gravel-Sand Mixture
			GP	Poorly –Graded Gravel, Gravel-Sand Mixture
		Gravels with Appreciable Fines	GM	Silty Gravel, Gravel-Sand-Silt Mixture
			GC	Clayey-Gravel, Gravel-Sand-Clay Mixture
	Sand and Sandy Soils	Clean Sands Little or no Fines	SW	Well-Graded Sand, Gravelly Sand
			SP	Poorly Graded Sand, Gravelly Sand
		Sands with Appreciable Fines	SM	Silty Sand, Sand-Silt Mixture
			SC	Clayey Sand, Sand-Clay Mixture
Fine-Grained Soils (More than 50% Smaller than No 200 Sieve Size)	Silts and Clays	Liquid Limit Less Than 50	ML	Silt, Clayey Silt, Silty or Clayey Very Fine Sand, Slight Plasticity
			CL	Clay, Sandy Clay, Silty Clay, Low to Medium Plasticity
			OL	Organic Silts, or Silty Clays of Low Plasticity
	Silts and Clays	Liquid Limit More Than 50	MH	Silt, Fine Sandy or Silt Soil with High Plasticity
			CH	Clay, High Plasticity
			OH	Organic Clay of Medium to High Plasticity
	Highly Organic Soils		PT	Peat, Humus, Swamp Soil

PLASTICITY CHART



RELATIVE PLASTICITY

Nonplastic	Cannot Roll Into Ball
Trace Plasticity	Barely Roll Into Ball
Medium Plastic	Can be Rolled Into Ball
Highly Plastic	No Rupture by Kneading

VISUAL DESCRIPTION CRITERIA*

TABLE 1: CRITERIA FOR DESCRIBING ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular	Particles are similar to angular description but have rounded edges
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges
Rounded	Particles have smoothly curved sides and no edges

TABLE 2: CRITERIA FOR DESCRIBING PARTICLE SHAPE

Description	Criteria
Flat	Particles with width/thickness X3
Elongated	Particles with length/width X3
Flat and Elongated	Particles meet criteria for both flat and elongated

TABLE 3: CRITERIA FOR DESCRIBING MOISTURE CONDITION

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, but no visible water
Wet	Visible free water, usually soil is below the water table

TABLE 4: CRITERIA FOR DESCRIBING REACTION WITH HCL

Description	Criteria
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming rapidly

TABLE 6: CRITERIA FOR DESCRIBING CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

*NOTES: 1. Tables adapted from ASTM D2488 "Description and identification of Soils" (Visual-Manual Procedure)
2. Tables 5, 7 and 11 incorporated into other information on this plate.

TABLE 8: CRITERIA FOR DESCRIBING DRY STRENGTH

Description	Criteria
None	The dry specimen crumbles into powder with mere pressure of handling
Low	The dry specimen crumbles into powder with some finger pressure
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure
High	The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface.
Very High	The dry specimen cannot be broken between the thumb and a hard surface

TABLE 9: CRITERIA FOR DESCRIBING DILATANCY

Description	Criteria
None	No visible change in the specimen
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

TABLE 10: CRITERIA FOR DESCRIBING TOUGHNESS

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness

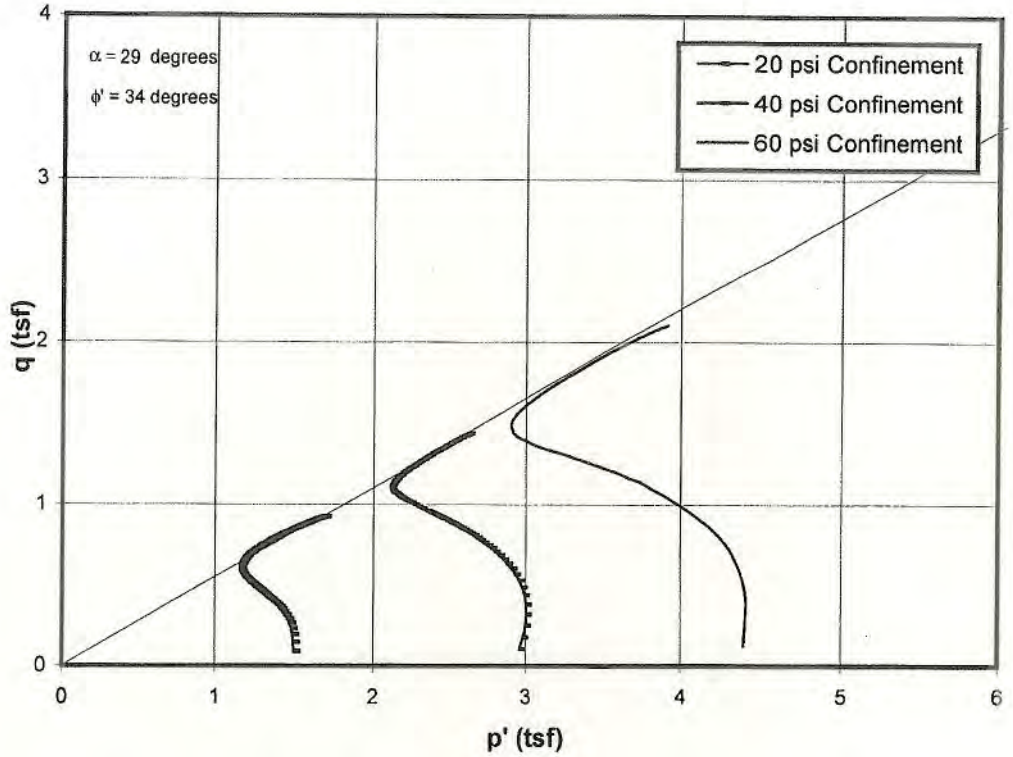
TABLE 12: IDENTIFICATION OF INORGANIC FINE-GRAINED SOILS FROM MANUAL TESTS

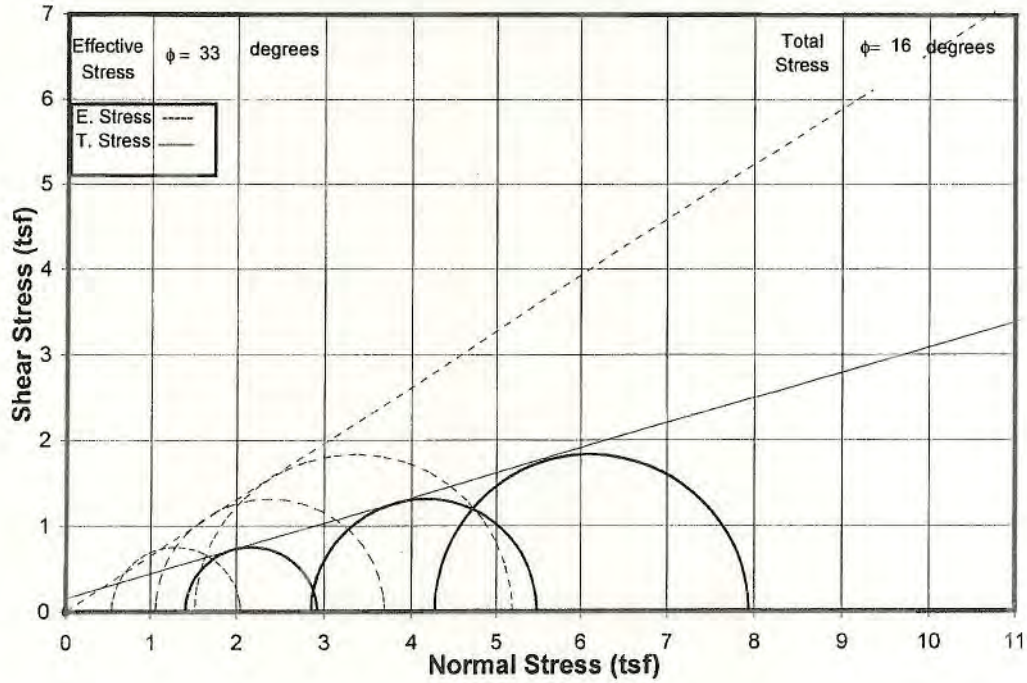
Soil Symbol	Dry Strength	Dilatancy	Toughness
ML	None to low	Slow to rapid	Low or thread cannot be formed
CL	Medium to high	None to slow	Medium
MH	Low to medium	None to slow	Low to medium
CH	High to very high	none	High

APPENDIX C

LABORATORY TEST DATA

GEOTECHNOLOGY INC
FROM THE GROUND UP





CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

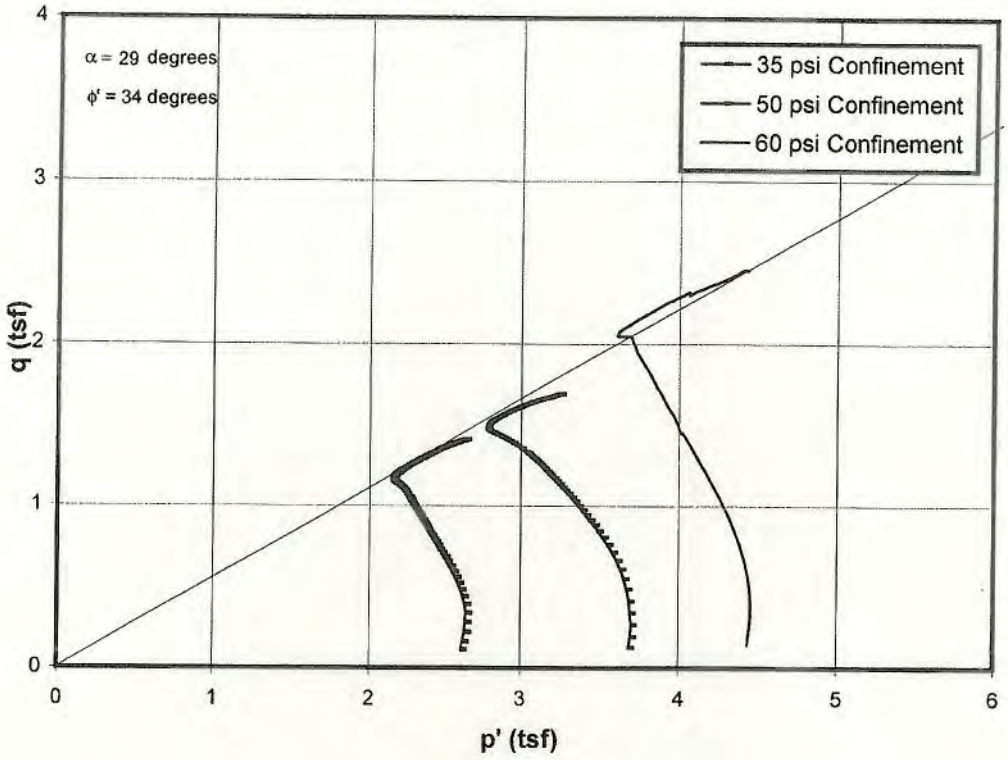
ASTM D 4767

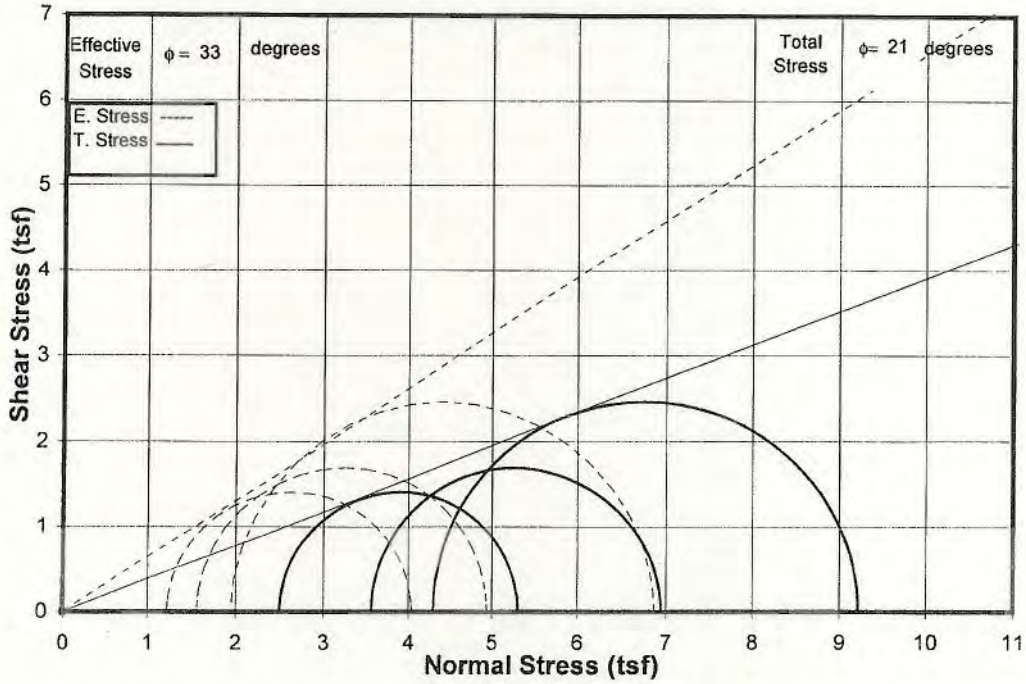
Project No.: J017150.02

Boring: B-1

Sample: ST-9, ST-8, ST-8 - Depth: 27, 25, 25

GEOTECHNOLOGY INC
FROM THE GROUND UP





CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 4767

Project No.: J017150.02

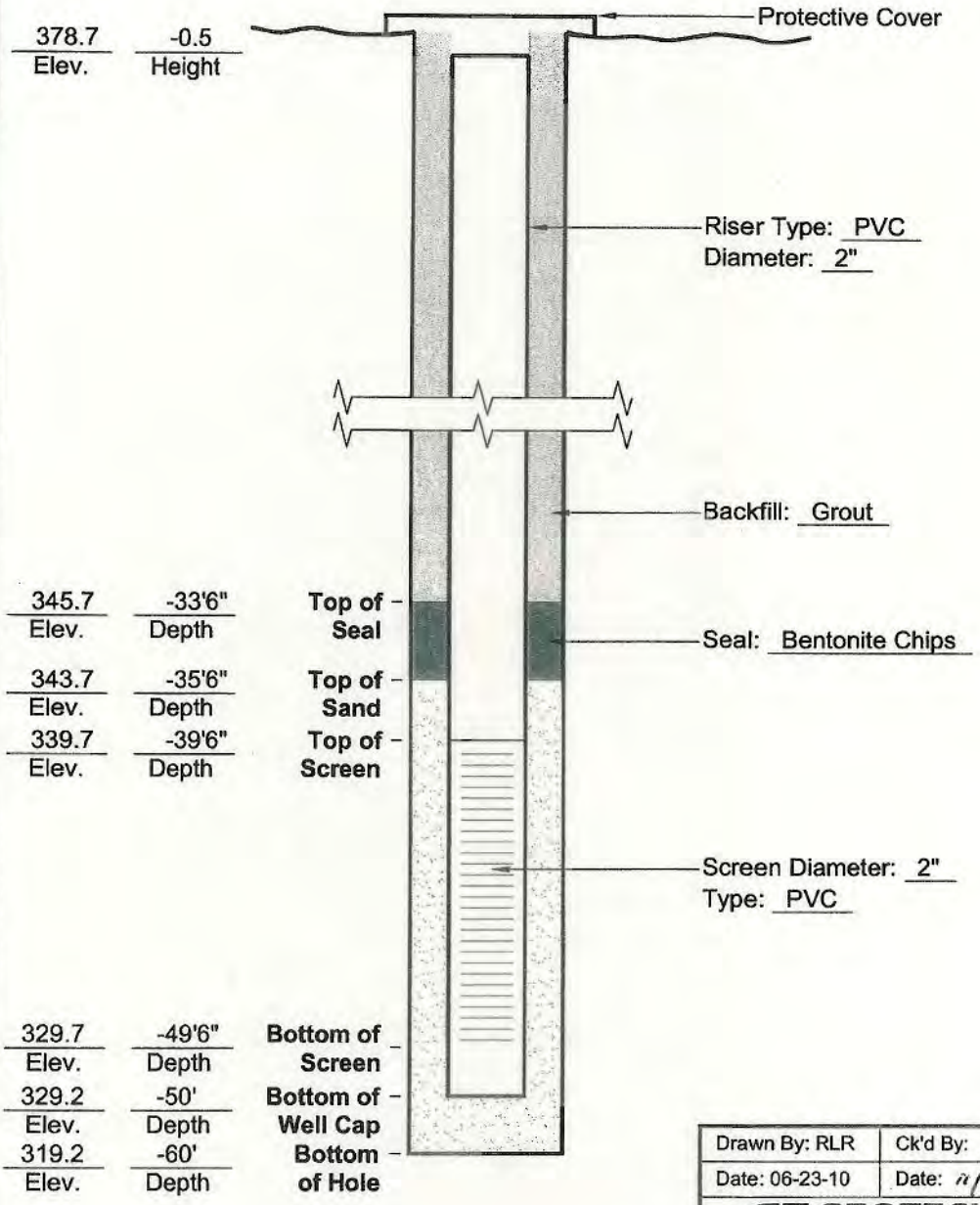
Boring: B-2

Sample: ST-13, ST-12, ST-12 - Depth: 48, 46, 46

APPENDIX D

PIEZOMETER INSTALLATION DETAILS

Date Installed: 06-15-10



Drawn By: RLR	Ck'd By: SR	App'vd By: SR
Date: 06-23-10	Date: 11/9/10	Date: 11/9/10

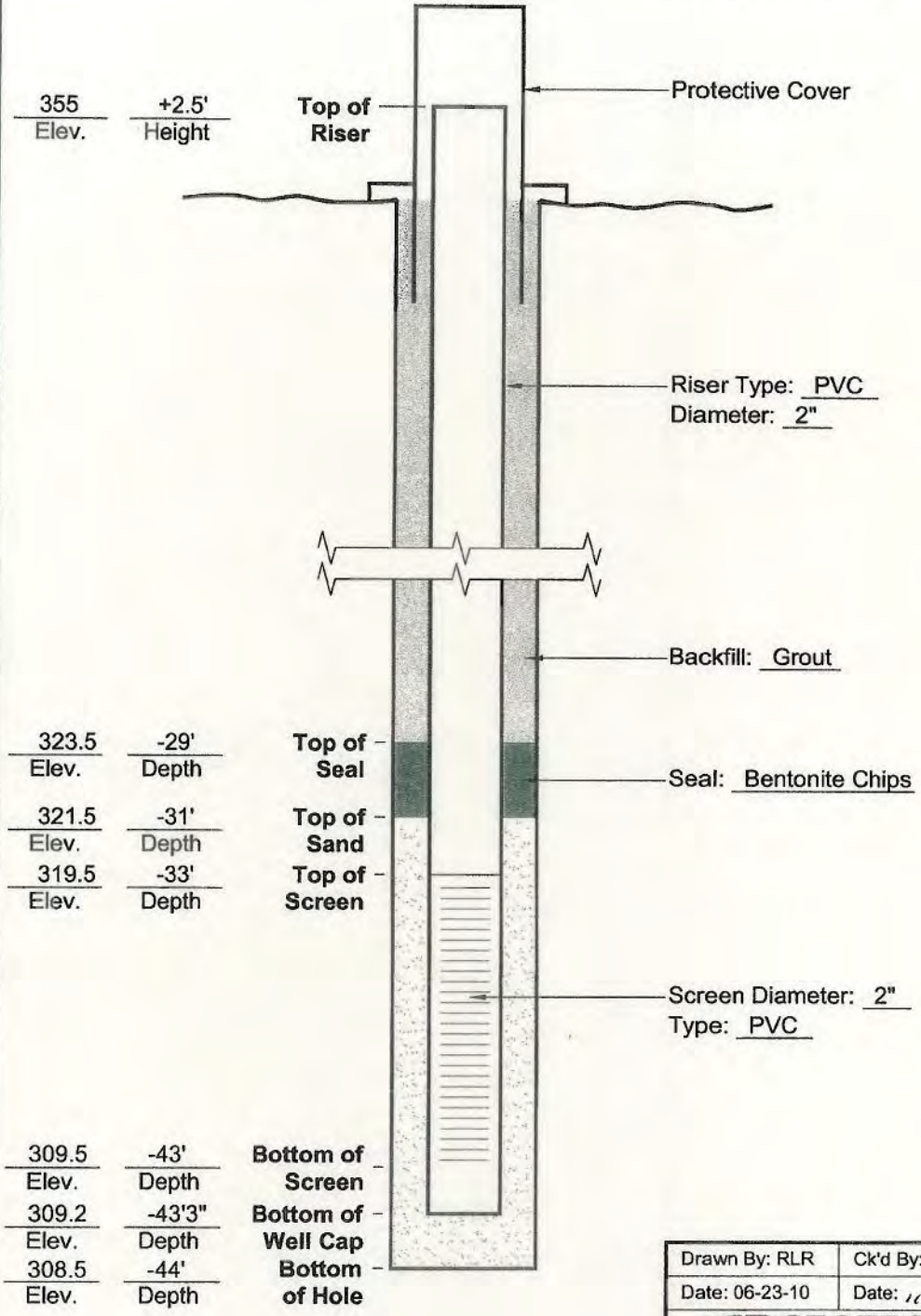
GEOTECHNOLOGY INC.
ENGINEERING AND ENVIRONMENTAL SERVICES
ST. LOUIS • COLLINSVILLE • KANSAS CITY

Electric Energy Inc. Facility
Joppa, Illinois

PIEZOMETER CONSTRUCTION DIAGRAM

Project Number J017150.02	B-1

Date Installed: 06-17-10



Drawn By: RLR	Ck'd By: SK	App'vd By: SK
Date: 06-23-10	Date: 11/9/10	Date: 11/9/10

GEOTECHNOLOGY INC.
ENGINEERING AND ENVIRONMENTAL SERVICES
ST. LOUIS • COLLINSVILLE • KANSAS CITY

Electric Energy Inc. Facility
Joppa, Illinois

PIEZOMETER CONSTRUCTION DIAGRAM

Project Number J017150.02	B-4

APPENDIX E

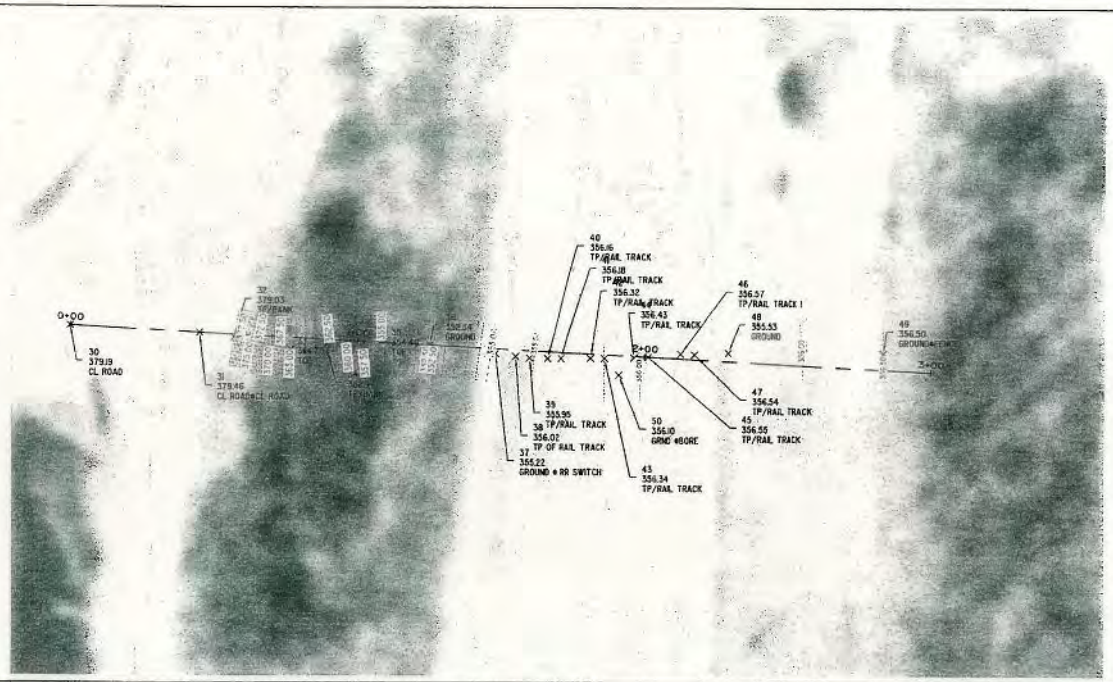
SURVEY DATA

MILANO & GRUNLOH ENGINEERS, LLC
84 WEST WASHINGTON
P.O. BOX 897
EFFINGHAM, ILLINOIS 62401
Phone: (217) 347-7262
(800) 677-2714
Fax #: (217) 342-3433
Web Address: www.mgengineers.com
Design Firm #: 184-003108

File name: S:\DWG\10\10165BG7\dwg\Elevations.dwg
Plot date: 10/27/10 at 14:45
F.B. 628

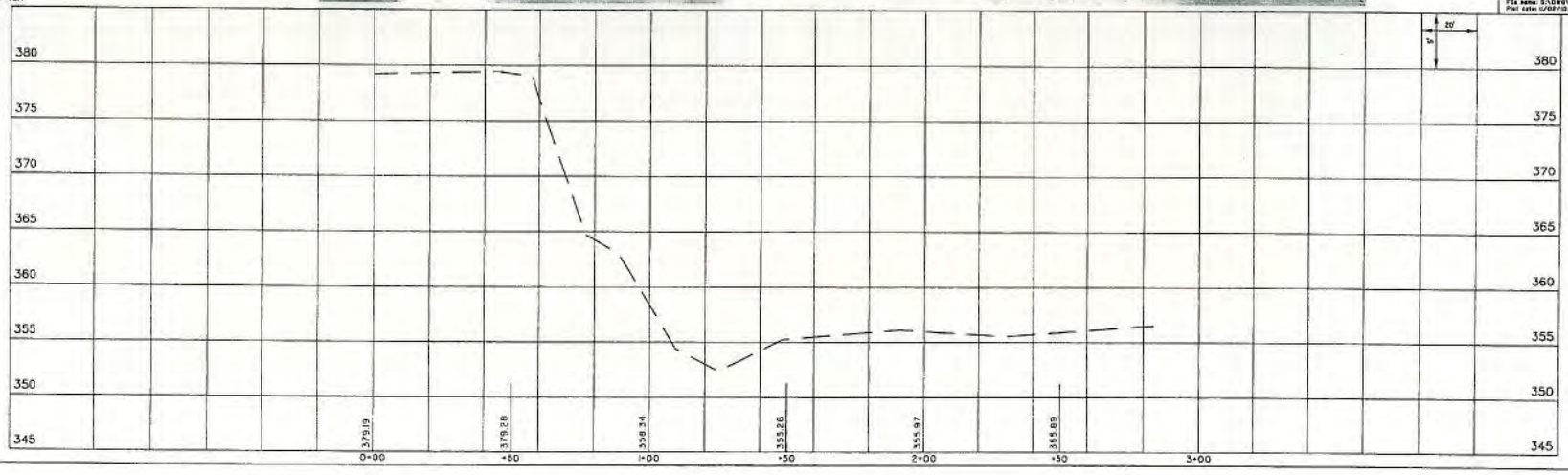
AMEREN-CIPS
JOPPA FACILITY

Point	Station	Offset	Elevation	Description
30	0+00.00	0.000'	379.194'	CL ROAD
31	0+44.90	0.000'	379.457'	CL ROAD@CL ROAD
32	0+57.15	0.965'	379.026'	TP/BANK
33	0+76.99	4.146'	364.702'	TOE
34	0+89.18	1.686'	362.974'	TP/BANK
35	1+09.30	-0.691'	354.404'	TOE
36	1+24.89	-0.138'	352.345'	GROUND
37	1+47.93	1.693'	355.221'	GROUND @ RR SWITCH
38	1+55.26	2.214'	356.020'	TP OF RAIL TRACK
39	1+60.17	2.517'	355.946'	TP/RAIL TRACK
40	1+66.52	2.365'	356.158'	TP/RAIL TRACK
41	1+71.39	2.054'	356.184'	TP/RAIL TRACK
42	1+81.39	1.455'	356.317'	TP/RAIL TRACK
43	1+86.31	1.240'	356.338'	TP/RAIL TRACK
44	1+96.36	0.529'	356.432'	TP/RAIL TRACK
45	2+01.30	0.003'	356.549'	TP/RAIL TRACK
46	2+12.60	-1.665'	356.566'	TP/RAIL TRACK 1
47	2+17.53	-1.729'	356.541'	TP/RAIL TRACK
48	2+29.46	-2.930'	355.533'	GROUND
49	2+83.31	-5.706'	356.501'	GROUND @ FENCE
50	1+91.53	6.726'	356.102'	GRND @BORE



N

SCALES:
1" =20' HOR
1" =5' VER



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OTTAWA, ILLINOIS 61350
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Web Address: www.mgengineers.com
Design Firm #: 184-003368

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Plot date: 11/02/10 at 14:00 F.A. 678

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