# CALCULATION SUMMARY SHEET



PROJECT NUMBER: S142019

PROJECT NAME: USEN – Trench 13 Design, Slope Stability Calculations (Amended)

DATE: October 2015

CALCULATION NUMBER: C.02A Revision:

**CALCULATION TITLE: Trench 13 Excavation Sidewall Stability (Amended)**

**DESCRIPTION OF CALCULATION:**

Calculation to document the stability of the Trench 13 excavation configuration for static and pseudo-static loading conditions considering 2015 laboratory testing and field determination of surface soil thicness.

**REFERENCES USED:** Number of Reference Pages Attached:

1. Previous Calculation: Trench 13 slope stability calculation
2. Modeling Program: WinStabl Version 3.00
3. Soil properties determined by lab testing for Trench 13 design (copies included)
4. Test pit records from Trench 13 geotechnical investigation (in Subsurface Exploration Report)

**REVIEW COMMENTS:**

.

CALCULATION MADE BY: SLWampler (SRE DATE: 6 SEP 2015

CALCULATION CHECKED BY: PAZlatev (SRES) DATE: 13 SEP 2015

CALCULATION REVISED BY: DATE:

CALCULATION REVIEWED BY: PAZlatev (SRES) DATE: 13 SEP 2015

**AMENDED EXCAVATION SLOPE STABILITY CALCULATION – UTILIZING 2015 SOIL PROPERTIES**

Slope stability analyses were done utilizing soil properties representing the replacement of the low-cohesive strength (also called "cohesionless") surface soil layer with compacted native soil materials. Prior to conducting the 2015 geotechnical investigation, the surface soil was considered to be up to 16 feet thick and the 'leveling berm' (to be constructed of the same compacted soil) was considered at up to 10 feet thick, for a maximum combined thickness of 26 feet. The properties of the replaced (compacted) surface soil layer (including leveling berm) were determined by Trench 12 soil testing. These properties were:

Density = 110 PCF
Cohesive strength, C=370 PSF
Angle of internal friction, phi = 35 degrees

C and phi were the average of two Trench 12 test values (reference in prior calculation)

For Trench 13 design, a geotechnical investigation was conducted to determine deep stratigraphy (i.e., materials present from ground surface to as much as 20 feet below Trench 13 total depth) and to determine thickness and physical properties of the natural low-cohesion surface soil layer. One objective of this investigation was to provide site-specific physical properties for the surface soil layer resulting from replacement of low-cohesion native soil and construction of the leveling berm.

Soil samples tested from 2015 Trench 13 geotechnical investigation test pits were identified as "unconsolidated" (from the low-cohesion surface soil) and "consolidated" (from the native soil layer immediately beneath the low-cohesion layer). Eight samples were tested, one from each soil type from each of four test pits. Test specimens were compacted at a dry density and moisture content intended to represent the condition of the replaced and compacted surface soil. The target Maximum Dry Density (MDD) and Optimum Moisture Content (OMC), as determined by ASTM D1557, were 95% (min.) and OMC ± 2%. [1]

Considering all of the test values to be representative of the mixed materials that will be used for the replaced and compacted surface soil layer, the average properties are:

Density = 125 PCF
Cohesive strength, C = 300 PSF
Angle of internal friction, phi = 35 degrees

The Trench 12 values are similar and could be considered together with the more recent Trench 13 test results resulting in a slightly lower density and slightly higher cohesion. However, the following slope stability analyses were done using the average of only the Trench 13 values.

The method used for this slope stability calculation is the Modified Bishop method of circular failure plane search done using the program WinStabl (reference in prior Trench 13 calculation). The program was formulated to determine SF (safety factor) against slope failure for failure planes

[1] Note – the dry densities of soil samples tested to determine cohesive strength were lower that 95% MDD. These values represent the densities before testing and higher 'as-tested' densities would have resulted from normal loads imposed to conduct direct shear testing. The as-tested densities more directly represent the 'as compacted' soil properties in the excavation sidewall.

fully within the replaced/compacted surface soil (i.e., shallow failure) and failure planes involving the full vertical thickness of excavated soil (i.e., deeper failure).

Physical Model: The physical model used for the slope stability analyses is the same as used for other Trench 13 slope stability calculations. That is, excavation slopes of 0.5 H : 1.0 V (Horizontal : Vertical) and maximum depth of 75 feet. This condition approximates the excavation dimensions at each of the Trench 13 LCRS sumps. Within this excavation profile, the uppermost soil layer is the combination of the removed/replaced low-cohesion soil layer and the leveling berm. This material is represented in the physical model as a total of 20 ft of replaced (compacted) surface soil. This layer replaces 10 ft of natural surface soil and adds 10 ft of 'leveling berm'.

The properties of replaced (compacted) surface soil are the average of those determined for the 2015 geotechnical investigation. As noted above.

Results of this calculation

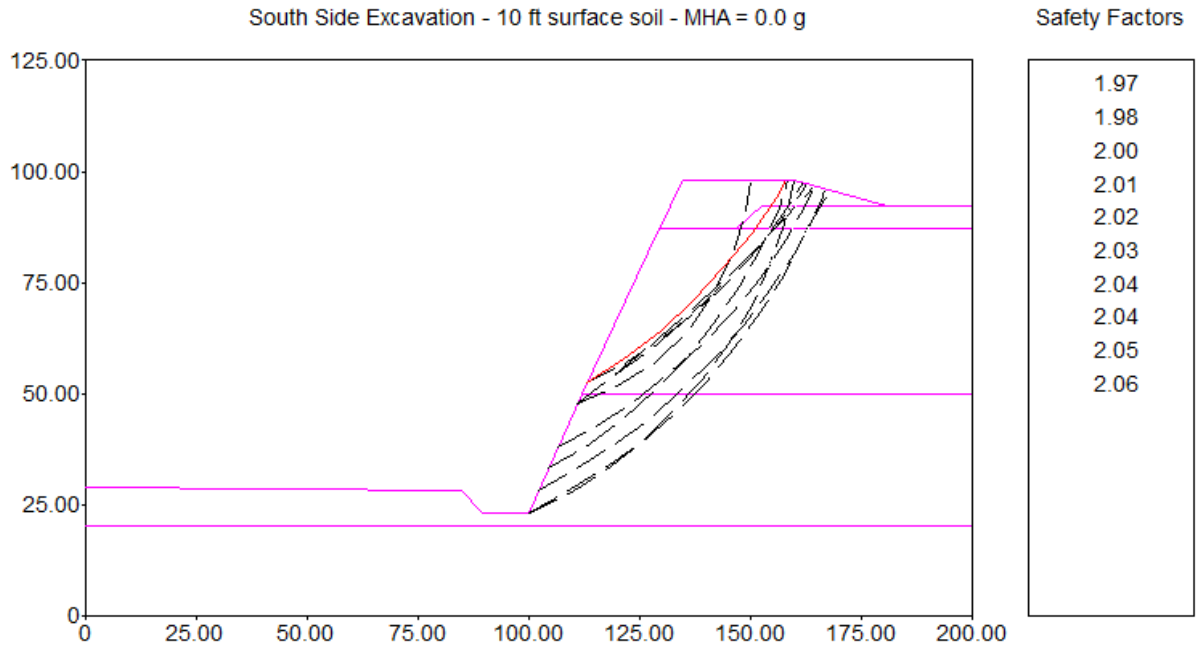
| Model | MHA | Min. Safety Factor |
|---|---|---|
| RUN 1 – Deeper failure | MHA = 0.0 g | 1.97 |
| RUN 2 – Shallow failure | MHA = 0.0 g | 2.22 |
| RUN 3 – Deeper failure | MHA = 0.42 g | 1.21 |
| RUN 4 – Shallow failure | MHA = 0.42 g | 1.30 |

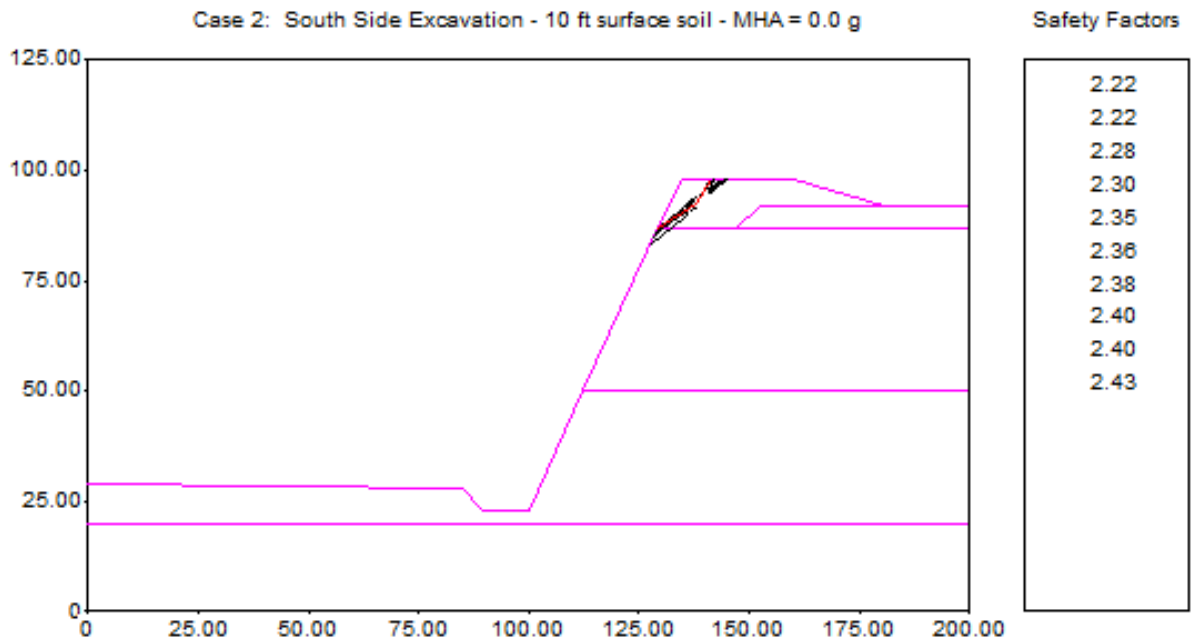
MHA -= maximum horizontal acceleration in % g

Findings

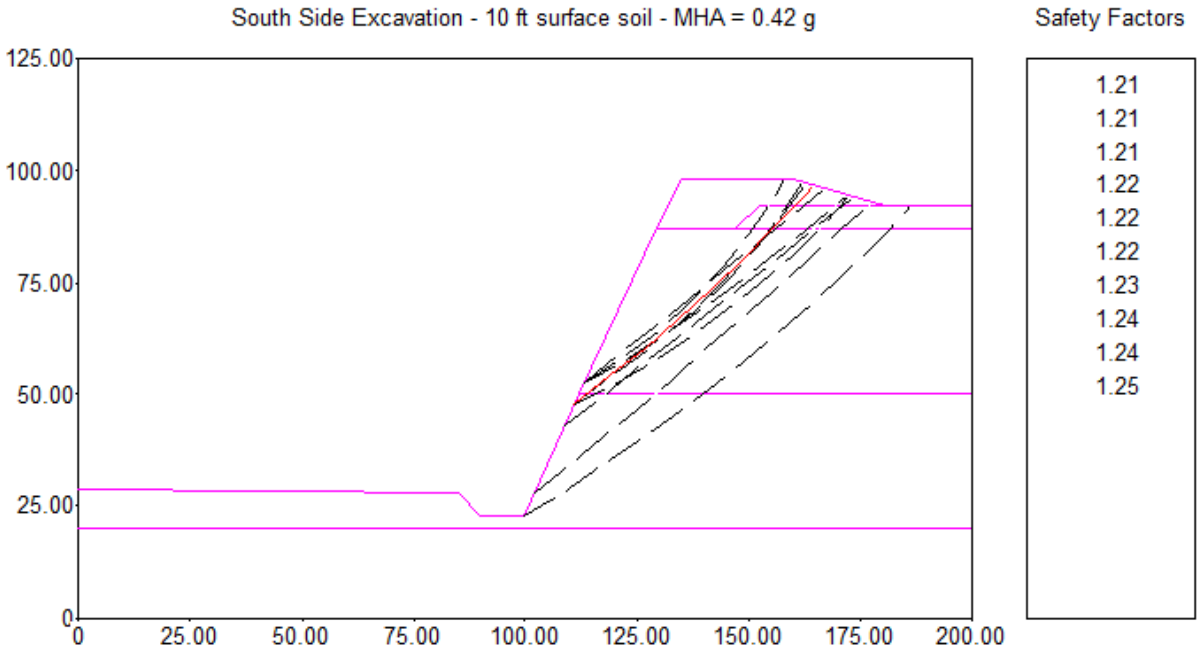
Using the properties of the compacted soil formed by the use of the mix of low-cohesion surface soil and underlying 'consolidated' soil in the Trench 13 excavation sidewalls, acceptable factors of safety against slope failure are achieved for shallow and deep slope failures under static and earthquake (i.e., pseudo-static) failure scenarios. The explanation of static and pseudo-static failure scenarios and the explanation of acceptable safety factors is provided in another Trench 13 calculation.

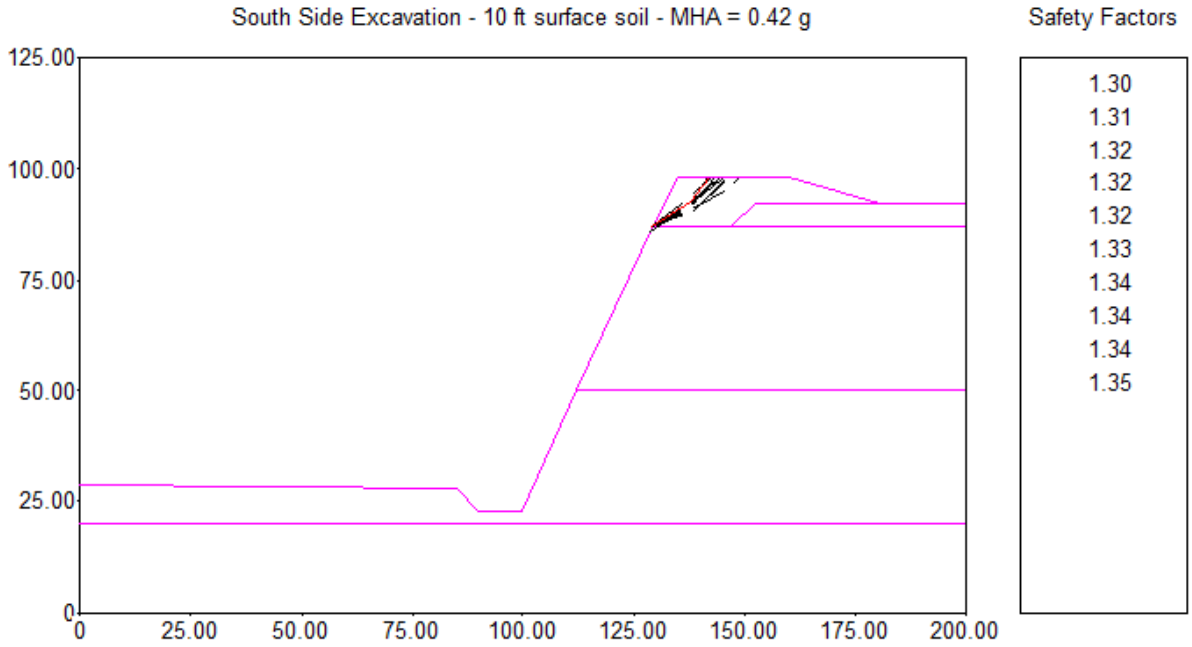
RUNS 1 and 2 – Deep failure, MHA = 0.0 g and Shallow failure, MHA = 0.0 g



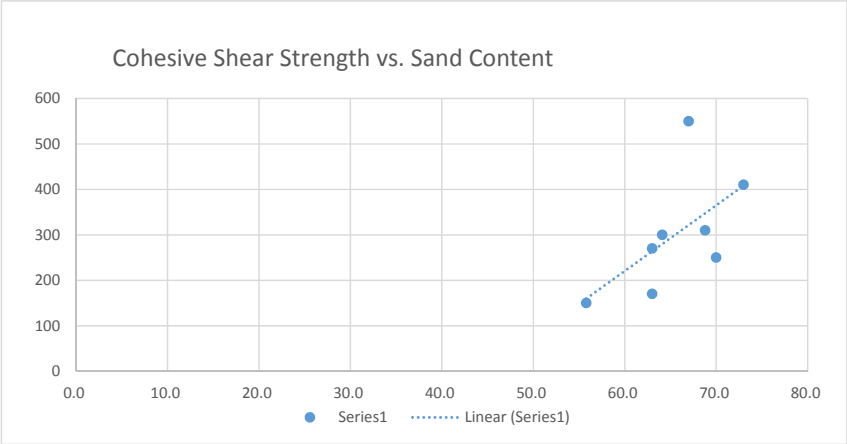



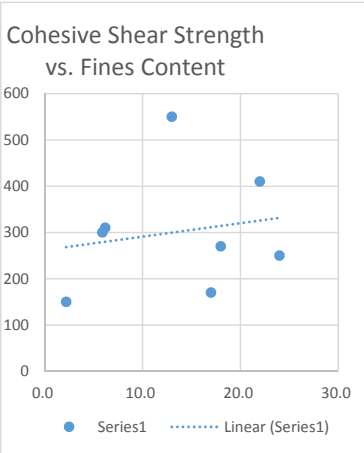
RUNS 3 and 4 – Deep failure, MHA = 0.42 g and Shallow failure, MHA = 0.42 g

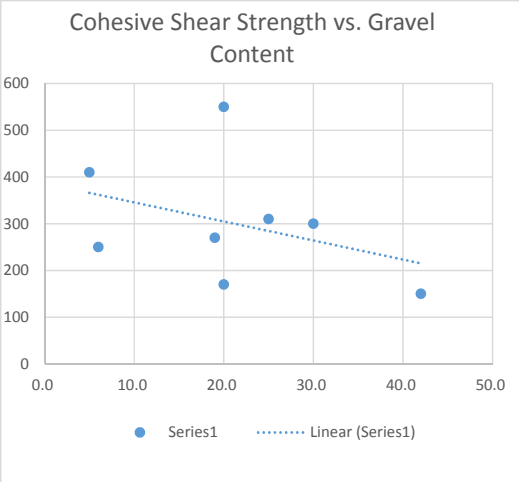


| Sample | | Cohesion | Phi, degrees | MDD, PCF | Dry Density (average, as tested) | Opt Moisture, % | %MDD as tested | Moisture Content (average, as tested) | Gravel, % | Sand, % | Fines,% |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Consol | 4 | 150 | 40.6 | 124.5 | 113.0 | 6.0 | 90.8% | 6.1 | 42.0 | 55.8 | 2.2 |
| Unconsol | 3 | 170 | 32.2 | 123.9 | 111.6 | 7.8 | 90.0% | 7.9 | 20.0 | 63.0 | 17.0 |
| Unconsol | 1 | 250 | 30.6 | 117.6 | 105.9 | 10.5 | 90.1% | 10.7 | 6.0 | 70.0 | 24.0 |
| Unconsol | 4 | 270 | 30.1 | 127.0 | 114.7 | 7.7 | 90.3% | 7.5 | 19.0 | 63.0 | 18.0 |
| Consol | 3 | 300 | 41.2 | 131.7 | 119.5 | 6.9 | 90.7% | 6.9 | 30.0 | 64.1 | 5.9 |
| Consol | 2 | 310 | 37.6 | 125.8 | 116.4 | 8.2 | 92.5% | 7.5 | 25.0 | 68.8 | 6.2 |
| Consol | 1 | 410 | 32.8 | 130.0 | 117.4 | 6.5 | 90.3% | 6.3 | 5.0 | 73.0 | 22.0 |
| Unconsol | 2 | 550 | 34.0 | 120.7 | 109.3 | 10.6 | 90.6% | 10.4 | 20.0 | 67.0 | 13.0 |
| | | | | | | | | | | | |
| All soil | | 301.3 | 34.9 | 125.2 | 113.5 | 8.0 | 90.7% | -- | 20.9 | 65.6 | 13.5 |
| Unconsol | | 310.0 | 31.7 | 122.3 | 110.4 | 9.2 | 90.3% | -- | 16.3 | 65.8 | 18.0 |
| Consol | | 292.5 | 38.1 | 128.0 | 116.6 | 6.9 | 91.1% | -- | 25.5 | 65.4 | 9.1 |



Excavation, MHA = 0.0 g, deeper failure plane
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION South Side Excavation - 10 ft surface so
il - MHA = 0.0 g

BOUNDARY COORDINATES

10 Top Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 127.00 | 82.00 | 3 |
| 6 | 127.00 | 82.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 130.00 | 87.00 | 147.00 | 87.00 | 3 |
| 12 | 147.00 | 87.00 | 153.00 | 92.00 | 2 |
| 13 | 153.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 147.00 | 87.00 | 200.00 | 87.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Excavation, MHA = 0.0 g, deeper failure plane

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 125.0 | 125.0 | 300.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Horizontal Earthquake Loading Coefficient
Of0.000 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

25 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 120.00 ft.

Each Surface Terminates Between X = 130.00 ft.
and X = 195.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 8 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.33 | 52.85 |
| 2 | 121.76 | 58.24 |

Excavation, MHA = 0.0 g, deeper failure plane

| | | |
|---|---|---|
| 3 | 129.72 | 64.28 |
| 4 | 137.18 | 70.94 |
| 5 | 144.09 | 78.17 |
| 6 | 150.40 | 85.93 |
| 7 | 156.08 | 94.16 |
| 8 | 158.30 | 98.00 |

Circle Center At X = 49.8 ; Y = 161.4 and Radius, 125.8

*** 1.973 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 119.37 | 53.64 |
| 3 | 127.33 | 59.70 |
| 4 | 134.95 | 66.17 |
| 5 | 142.23 | 73.02 |
| 6 | 149.14 | 80.25 |
| 7 | 155.67 | 87.83 |
| 8 | 161.79 | 95.74 |
| 9 | 162.80 | 97.20 |

Circle Center At X = 7.4 ; Y = 208.9 and Radius, 191.4

*** 1.982 ***

Failure Surface Specified By 8 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.33 | 52.85 |
| 2 | 122.21 | 57.45 |
| 3 | 130.62 | 62.86 |
| 4 | 138.50 | 69.01 |
| 5 | 145.78 | 75.87 |
| 6 | 152.40 | 83.37 |
| 7 | 158.30 | 91.44 |
| 8 | 161.90 | 97.46 |

Circle Center At X = 67.8 ; Y = 151.3 and Radius, 108.5

*** 1.996 ***

Failure Surface Specified By 12 Coordinate Points

| Point | X-Surf | Y-Surf |
|---|---|---|

Excavation, MHA = 0.0 g, deeper failure plane

| No. | (ft) | (ft) |
|---|---|---|
| 1 | 100.00 | 23.00 |
| 2 | 108.84 | 27.67 |
| 3 | 117.31 | 32.99 |
| 4 | 125.35 | 38.93 |
| 5 | 132.92 | 45.47 |
| 6 | 139.98 | 52.56 |
| 7 | 146.48 | 60.15 |
| 8 | 152.39 | 68.22 |
| 9 | 157.67 | 76.71 |
| 10 | 162.30 | 85.57 |
| 11 | 166.25 | 94.76 |
| 12 | 166.71 | 96.08 |

Circle Center At X = 42.6 ; Y = 142.5 and Radius, 132.5

*** 2.010 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 119.12 | 53.99 |
| 3 | 126.93 | 60.23 |
| 4 | 134.55 | 66.72 |
| 5 | 141.95 | 73.44 |
| 6 | 149.14 | 80.39 |
| 7 | 156.10 | 87.57 |
| 8 | 162.83 | 94.96 |
| 9 | 164.36 | 96.75 |

Circle Center At X = -74.1 ; Y = 303.9 and Radius, 315.9

*** 2.016 ***

Failure Surface Specified By 8 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 120.29 | 51.96 |
| 3 | 128.64 | 57.47 |
| 4 | 135.90 | 64.34 |
| 5 | 141.85 | 72.38 |
| 6 | 146.30 | 81.34 |
| 7 | 149.12 | 90.93 |
| 8 | 149.91 | 98.00 |

Circle Center At X = 93.2 ; Y = 102.2 and Radius, 57.1

Excavation, MHA = 0.0 g, deeper failure plane

*** 2.032 ***

Failure Surface Specified By 11 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 102.22 | 28.00 |
| 2 | 110.92 | 32.94 |
| 3 | 119.27 | 38.45 |
| 4 | 127.23 | 44.49 |
| 5 | 134.77 | 51.06 |
| 6 | 141.86 | 58.11 |
| 7 | 148.47 | 65.62 |
| 8 | 154.56 | 73.55 |
| 9 | 160.11 | 81.87 |
| 10 | 165.09 | 90.54 |
| 11 | 167.67 | 95.81 |

Circle Center At X = 32.4 ; Y = 161.0 and Radius, 150.2

*** 2.042 ***

Failure Surface Specified By 11 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 100.00 | 23.00 |
| 2 | 108.95 | 27.45 |
| 3 | 117.44 | 32.75 |
| 4 | 125.36 | 38.85 |
| 5 | 132.67 | 45.68 |
| 6 | 139.27 | 53.18 |
| 7 | 145.13 | 61.29 |
| 8 | 150.17 | 69.93 |
| 9 | 154.35 | 79.01 |
| 10 | 157.63 | 88.46 |
| 11 | 159.94 | 98.00 |

Circle Center At X = 58.5 ; Y = 117.6 and Radius, 103.3

*** 2.042 ***

Failure Surface Specified By 10 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 106.67 | 38.00 |
| 2 | 115.44 | 42.80 |
| 3 | 123.81 | 48.27 |

Excavation, MHA = 0.0 g, deeper failure plane

| | | |
|---|---|---|
| 4 | 131.73 | 54.38 |
| 5 | 139.14 | 61.09 |
| 6 | 146.01 | 68.36 |
| 7 | 152.28 | 76.15 |
| 8 | 157.93 | 84.40 |
| 9 | 162.92 | 93.07 |
| 10 | 164.63 | 96.68 |

Circle Center At X = 49.8 ; Y = 152.4 and Radius, 127.7

*** 2.049 ***

Failure Surface Specified By 10 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 104.44 | 33.00 |
| 2 | 112.97 | 38.24 |
| 3 | 121.01 | 44.17 |
| 4 | 128.53 | 50.76 |
| 5 | 135.47 | 57.97 |
| 6 | 141.77 | 65.73 |
| 7 | 147.40 | 74.00 |
| 8 | 152.30 | 82.71 |
| 9 | 156.46 | 91.81 |
| 10 | 158.68 | 98.00 |

Circle Center At X = 46.8 ; Y = 136.4 and Radius, 118.4

*** 2.057 ***

```
           Y            A     X     I     S            F     T

           0.00     25.00     50.00     75.00    100.00    125.00

X      0.00 +-------*-+-*-------+---------+---------+---------+
            -
            -
            -
            -
            -
      25.00 +
            -
            -
            -
            -
            -
A     50.00 +
            -
            -
            -
            -
```

Excavation, MHA = 0.0 g, deeper failure plane

```
            -
X     75.00 +
            -
            -          *
            -
            -        *
            -
I    100.00 +        *
            -          7.0
            -       ...4. .9 .
            -         ...7.0. .2*1
            -           .4...9... .. .
            -       .......7..0..251. ..
S    125.00 +           ....4..9....5.... .  *
            -        .........7.0..6231..... . *
            -         ........4.7.9...25 .. .... * *
            -         ...........8.09.6.1...... ....
            -          ... ......4.7. 0..2..........
            -            ...........48.9..31.6.*. ..
     150.00 +          ...............7.8...2.1.6..6
            -              ............4.79.83.2 *1.
            -            ...................4.798.3.*
            -               .................. 4..922
            -              ......................7.49
            -                  ....................
F    175.00 +                 ......................
            -                     ................*
            -                      ................
            -                         .............
            -                            ..........
            -                                  ....
T    200.00 +       *           *              * *
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REV - Excavation, MHA = 0.0 g, shallow failure plane
** PCSTABL6 **

by
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University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION  Case 2:  South Side Excavation - 10 ft s
urface soil - MHA = 0.0 g

BOUNDARY COORDINATES

10 Top  Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 127.00 | 82.00 | 3 |
| 6 | 127.00 | 82.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 130.00 | 87.00 | 147.00 | 87.00 | 3 |
| 12 | 147.00 | 87.00 | 153.00 | 92.00 | 2 |
| 13 | 153.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 147.00 | 87.00 | 200.00 | 87.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

REV - Excavation, MHA = 0.0 g, shallow failure plane

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 125.0 | 125.0 | 300.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

25 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 125.00 ft.
and X = 130.00 ft.

Each Surface Terminates Between X = 142.00 ft.
and X = 150.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 137.81 | 92.37 |
| 3 | 142.10 | 98.00 |

Circle Center At X = 120.1 ; Y = 110.3 and Radius, 25.2

*** 2.219 ***

Failure Surface Specified By 3 Coordinate Points

REV - Excavation, MHA = 0.0 g, shallow failure plane

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 137.75 | 92.45 |
| 3 | 142.55 | 98.00 |

Circle Center At X = 115.7 ; Y = 116.4 and Radius, 32.5

*** 2.225 ***

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 137.36 | 93.00 |
| 3 | 142.86 | 98.00 |

Circle Center At X = 67.7 ; Y = 175.1 and Radius, 107.7

*** 2.284 ***

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 138.25 | 91.64 |
| 3 | 143.17 | 98.00 |

Circle Center At X = 123.8 ; Y = 108.0 and Radius, 21.8

*** 2.301 ***

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 128.89 | 85.78 |
| 2 | 136.98 | 91.65 |
| 3 | 144.56 | 98.00 |

Circle Center At X = 49.5 ; Y = 203.8 and Radius, 142.3

REV - Excavation, MHA = 0.0 g, shallow failure plane
*** 2.350 ***

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 128.89 | 85.78 |
| 2 | 137.01 | 91.61 |
| 3 | 144.66 | 98.00 |

Circle Center At X = 52.7 ; Y = 200.4 and Radius, 137.6

*** 2.355 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 128.89 | 85.78 |
| 2 | 136.84 | 91.85 |
| 3 | 144.78 | 97.92 |
| 4 | 144.88 | 98.00 |

Circle Center At X = ****** ; Y = 6045.1 and Radius, 7493.0

*** 2.385 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 128.89 | 85.78 |
| 2 | 137.03 | 91.58 |
| 3 | 144.99 | 97.64 |
| 4 | 145.43 | 98.00 |

Circle Center At X = -51.8 ; Y = 347.8 and Radius, 318.3

*** 2.403 ***

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|

REV - Excavation, MHA = 0.0 g, shallow failure plane

| | | |
|---|---|---|
| 1 | 128.33 | 84.67 |
| 2 | 135.51 | 91.63 |
| 3 | 142.08 | 98.00 |

Circle Center At X = ****** ; Y = 6811.5 and Radius, 9363.2

*** 2.405 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 127.78 | 83.56 |
| 2 | 135.59 | 89.81 |
| 3 | 142.07 | 97.41 |
| 4 | 142.41 | 98.00 |

Circle Center At X = 98.8 ; Y = 127.7 and Radius, 52.8

*** 2.427 ***

```
           Y            A     X     I     S            F     T

           0.00     25.00     50.00     75.00    100.00    125.00

X       0.00 +-------*-+-*-------+---------+---------+---------+
             -
             -
             -
             -
             -
       25.00 +
             -
             -
             -
             -
             -
A      50.00 +
             -
             -
             -
             -
             -
X      75.00 +
             -
             -          *
             -
             -        *
             -
I     100.00 +        *
             -
             -
```

```
      REV - Excavation, MHA = 0.0 g, shallow failure plane
            -                     *
            -
            -
S    125.00 +                                ..*
            -                                 05*
            -                               ......* *
            -                                ....01.
            -                                 ......1
            -                                  .*...5
     150.00 +                                    ....
            -                                     *
            -                                       *
            -
            -
            -
F    175.00 +
            -                                     *
            -
            -
            -
            -
T    200.00 +       *            *               * *
```

Excavation, MHA = 0.42 g, deeper failure plane
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION South Side Excavation - 10 ft surface so
il - MHA = 0.42 g

BOUNDARY COORDINATES

10 Top Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 127.00 | 82.00 | 3 |
| 6 | 127.00 | 82.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 130.00 | 87.00 | 147.00 | 87.00 | 3 |
| 12 | 147.00 | 87.00 | 153.00 | 92.00 | 2 |
| 13 | 153.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 147.00 | 87.00 | 200.00 | 87.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Excavation, MHA = 0.42 g, deeper failure plane

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 125.0 | 125.0 | 300.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Horizontal Earthquake Loading Coefficient
Of0.420 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

25 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 120.00 ft.

Each Surface Terminates Between X = 130.00 ft.
and X = 195.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 119.12 | 53.99 |

Excavation, MHA = 0.42 g, deeper failure plane

| | | |
|---|---|---|
| 3 | 126.93 | 60.23 |
| 4 | 134.55 | 66.72 |
| 5 | 141.95 | 73.44 |
| 6 | 149.14 | 80.39 |
| 7 | 156.10 | 87.57 |
| 8 | 162.83 | 94.96 |
| 9 | 164.36 | 96.75 |

Circle Center At X = -74.1 ; Y = 303.9 and Radius, 315.9

*** 1.205 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 119.37 | 53.64 |
| 3 | 127.33 | 59.70 |
| 4 | 134.95 | 66.17 |
| 5 | 142.23 | 73.02 |
| 6 | 149.14 | 80.25 |
| 7 | 155.67 | 87.83 |
| 8 | 161.79 | 95.74 |
| 9 | 162.80 | 97.20 |

Circle Center At X = 7.4 ; Y = 208.9 and Radius, 191.4

*** 1.209 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 111.11 | 48.00 |
| 2 | 119.99 | 52.60 |
| 3 | 128.63 | 57.63 |
| 4 | 137.01 | 63.09 |
| 5 | 145.12 | 68.95 |
| 6 | 152.92 | 75.20 |
| 7 | 160.40 | 81.83 |
| 8 | 167.55 | 88.83 |
| 9 | 172.68 | 94.38 |

Circle Center At X = 22.6 ; Y = 229.8 and Radius, 202.3

*** 1.214 ***

Failure Surface Specified By 8 Coordinate Points

Excavation, MHA = 0.42 g, deeper failure plane

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.33 | 52.85 |
| 2 | 121.15 | 59.08 |
| 3 | 128.96 | 65.33 |
| 4 | 136.75 | 71.60 |
| 5 | 144.53 | 77.88 |
| 6 | 152.30 | 84.18 |
| 7 | 160.05 | 90.50 |
| 8 | 166.83 | 96.05 |

Circle Center At X = ****** ; Y = 3860.7 and Radius, 4866.6

*** 1.218 ***

Failure Surface Specified By 8 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.33 | 52.85 |
| 2 | 122.21 | 57.45 |
| 3 | 130.62 | 62.86 |
| 4 | 138.50 | 69.01 |
| 5 | 145.78 | 75.87 |
| 6 | 152.40 | 83.37 |
| 7 | 158.30 | 91.44 |
| 8 | 161.90 | 97.46 |

Circle Center At X = 67.8 ; Y = 151.3 and Radius, 108.5

*** 1.220 ***

Failure Surface Specified By 9 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.33 | 52.85 |
| 2 | 122.01 | 57.82 |
| 3 | 130.53 | 63.05 |
| 4 | 138.89 | 68.53 |
| 5 | 147.09 | 74.27 |
| 6 | 155.10 | 80.25 |
| 7 | 162.93 | 86.47 |
| 8 | 170.56 | 92.93 |
| 9 | 172.30 | 94.49 |

Circle Center At X = -46.4 ; Y = 341.8 and Radius, 330.2

*** 1.221 ***

Excavation, MHA = 0.42 g, deeper failure plane

Failure Surface Specified By 8 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 113.33 | 52.85 |
| 2 | 121.76 | 58.24 |
| 3 | 129.72 | 64.28 |
| 4 | 137.18 | 70.94 |
| 5 | 144.09 | 78.17 |
| 6 | 150.40 | 85.93 |
| 7 | 156.08 | 94.16 |
| 8 | 158.30 | 98.00 |

Circle Center At X = 49.8 ; Y = 161.4 and Radius, 125.8

*** 1.230 ***

Failure Surface Specified By 10 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 108.89 | 43.00 |
| 2 | 116.81 | 49.11 |
| 3 | 124.71 | 55.24 |
| 4 | 132.60 | 61.39 |
| 5 | 140.47 | 67.55 |
| 6 | 148.33 | 73.74 |
| 7 | 156.17 | 79.94 |
| 8 | 164.00 | 86.16 |
| 9 | 171.82 | 92.40 |
| 10 | 173.86 | 94.04 |

Circle Center At X = ****** ; Y = 3390.8 and Radius, 4224.9

*** 1.236 ***

Failure Surface Specified By 13 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 100.00 | 23.00 |
| 2 | 108.48 | 28.30 |
| 3 | 116.84 | 33.78 |
| 4 | 125.08 | 39.46 |
| 5 | 133.19 | 45.31 |
| 6 | 141.16 | 51.34 |
| 7 | 149.00 | 57.55 |
| 8 | 156.70 | 63.94 |
| 9 | 164.25 | 70.49 |

Excavation, MHA = 0.42 g, deeper failure plane

| | | |
|---|---|---|
| 10 | 171.66 | 77.21 |
| 11 | 178.91 | 84.09 |
| 12 | 186.01 | 91.14 |
| 13 | 186.84 | 92.00 |

Circle Center At X = -133.1 ; Y = 405.6 and Radius, 448.0

*** 1.241 ***

Failure Surface Specified By 11 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 102.22 | 28.00 |
| 2 | 109.97 | 34.33 |
| 3 | 117.68 | 40.70 |
| 4 | 125.35 | 47.11 |
| 5 | 133.00 | 53.55 |
| 6 | 140.61 | 60.04 |
| 7 | 148.18 | 66.57 |
| 8 | 155.72 | 73.14 |
| 9 | 163.23 | 79.74 |
| 10 | 170.71 | 86.39 |
| 11 | 177.93 | 92.88 |

Circle Center At X = ****** ; Y = 1523.9 and Radius, 1928.0

*** 1.250 ***

```
           Y            A     X     I     S            F     T

           0.00     25.00     50.00     75.00    100.00    125.00

X      0.00 +-------*-+-*-------+---------+---------+---------+
            -
            -
            -
            -
            -
      25.00 +
            -
            -
            -
            -
            -
A     50.00 +
            -
            -
            -
            -
            -
X     75.00 +
```

Excavation, MHA = 0.42 g, deeper failure plane

```
            -
            -          *
            -
            -        *
            -
I    100.00 +        *
            -          0..
            -       ...9. 0. 8
            -         ....... .1*4
            -           ..9.0...8 .. .
            -       .............2154 ..
S    125.00 +           ....9..0..8.1.... .  *
            -        ..............3254..... . *
            -         ........9..0...821 .. .... * *
            -         ...............3.654..... ....
            -          ... ......9..0 .8.1..........
            -            ...............3.54...*. ..
     150.00 +          ............9...0.8..1.7.....
            -             ..............03.6541 *7.
            -            .............9......3..45.*
            -               ............9...0 86..11
            -              ......................3.4.
            -                  ............9...0.63
F    175.00 +                 ......................8
            -                     .............9..*
            -                      ................
            -                         ...........99
            -                            ..........
            -                                   ....
T    200.00 +       *           *              * *
```

Excavation, MHA = 0.42 g, shallow failure plane
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION South Side Excavation - 10 ft surface so
il - MHA = 0.42 g

BOUNDARY COORDINATES

10 Top Boundaries
16 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 0.00 | 29.00 | 85.00 | 28.00 | 4 |
| 2 | 85.00 | 28.00 | 90.00 | 23.00 | 4 |
| 3 | 90.00 | 23.00 | 100.00 | 23.00 | 4 |
| 4 | 100.00 | 23.00 | 112.00 | 50.00 | 4 |
| 5 | 112.00 | 50.00 | 127.00 | 82.00 | 3 |
| 6 | 127.00 | 82.00 | 132.00 | 92.00 | 1 |
| 7 | 132.00 | 92.00 | 135.00 | 98.00 | 1 |
| 8 | 135.00 | 98.00 | 160.00 | 98.00 | 1 |
| 9 | 160.00 | 98.00 | 181.00 | 92.00 | 1 |
| 10 | 181.00 | 92.00 | 200.00 | 92.00 | 2 |
| 11 | 130.00 | 87.00 | 147.00 | 87.00 | 3 |
| 12 | 147.00 | 87.00 | 153.00 | 92.00 | 2 |
| 13 | 153.00 | 92.00 | 181.00 | 92.00 | 2 |
| 14 | 147.00 | 87.00 | 200.00 | 87.00 | 3 |
| 15 | 112.00 | 50.00 | 200.00 | 50.00 | 4 |
| 16 | 0.00 | 20.00 | 200.00 | 20.00 | 5 |

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Excavation, MHA = 0.42 g, shallow failure plane

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 125.0 | 125.0 | 300.0 | 35.0 | 0.00 | 0.0 | 0 |
| 2 | 120.0 | 120.0 | 0.0 | 35.0 | 0.00 | 0.0 | 0 |
| 3 | 120.0 | 120.0 | 1440.0 | 35.0 | 0.00 | 0.0 | 0 |
| 4 | 120.0 | 120.0 | 2880.0 | 35.0 | 0.00 | 0.0 | 0 |
| 5 | 120.0 | 120.0 | 4320.0 | 35.0 | 0.00 | 0.0 | 0 |

A Horizontal Earthquake Loading Coefficient
Of0.420 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

25 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 125.00 ft.
and X = 130.00 ft.

Each Surface Terminates Between X = 142.00 ft.
and X = 150.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 15.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 137.75 | 92.45 |

Excavation, MHA = 0.42 g, shallow failure plane

| | | |
|---|---|---|
| 3 | 142.55 | 98.00 |

Circle Center At X = 115.7 ; Y = 116.4 and Radius, 32.5

*** 1.297 ***

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 137.81 | 92.37 |
| 3 | 142.10 | 98.00 |

Circle Center At X = 120.1 ; Y = 110.3 and Radius, 25.2

*** 1.306 ***

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 138.25 | 91.64 |
| 3 | 143.17 | 98.00 |

Circle Center At X = 123.8 ; Y = 108.0 and Radius, 21.8

*** 1.323 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 138.58 | 90.96 |
| 3 | 147.05 | 96.28 |
| 4 | 149.09 | 98.00 |

Circle Center At X = 105.1 ; Y = 153.8 and Radius, 71.2

*** 1.324 ***

Failure Surface Specified By 3 Coordinate Points

Excavation, MHA = 0.42 g, shallow failure plane

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 137.36 | 93.00 |
| 3 | 142.86 | 98.00 |

Circle Center At X = 67.7 ; Y = 175.1 and Radius, 107.7

*** 1.324 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 138.69 | 90.70 |
| 3 | 146.10 | 97.42 |
| 4 | 146.41 | 98.00 |

Circle Center At X = 123.1 ; Y = 115.3 and Radius, 29.1

*** 1.334 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 129.44 | 86.89 |
| 2 | 138.69 | 90.71 |
| 3 | 145.89 | 97.65 |
| 4 | 146.05 | 98.00 |

Circle Center At X = 124.0 ; Y = 113.2 and Radius, 26.8

*** 1.341 ***

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 128.89 | 85.78 |
| 2 | 136.98 | 91.65 |
| 3 | 144.56 | 98.00 |

Circle Center At X = 49.5 ; Y = 203.8 and Radius, 142.3

Excavation, MHA = 0.42 g, shallow failure plane

*** 1.344 ***

Failure Surface Specified By 3 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 128.89 | 85.78 |
| 2 | 137.01 | 91.61 |
| 3 | 144.66 | 98.00 |

Circle Center At X = 52.7 ; Y = 200.4 and Radius, 137.6

*** 1.344 ***

Failure Surface Specified By 4 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 128.89 | 85.78 |
| 2 | 137.03 | 91.58 |
| 3 | 144.99 | 97.64 |
| 4 | 145.43 | 98.00 |

Circle Center At X = -51.8 ; Y = 347.8 and Radius, 318.3

*** 1.347 ***

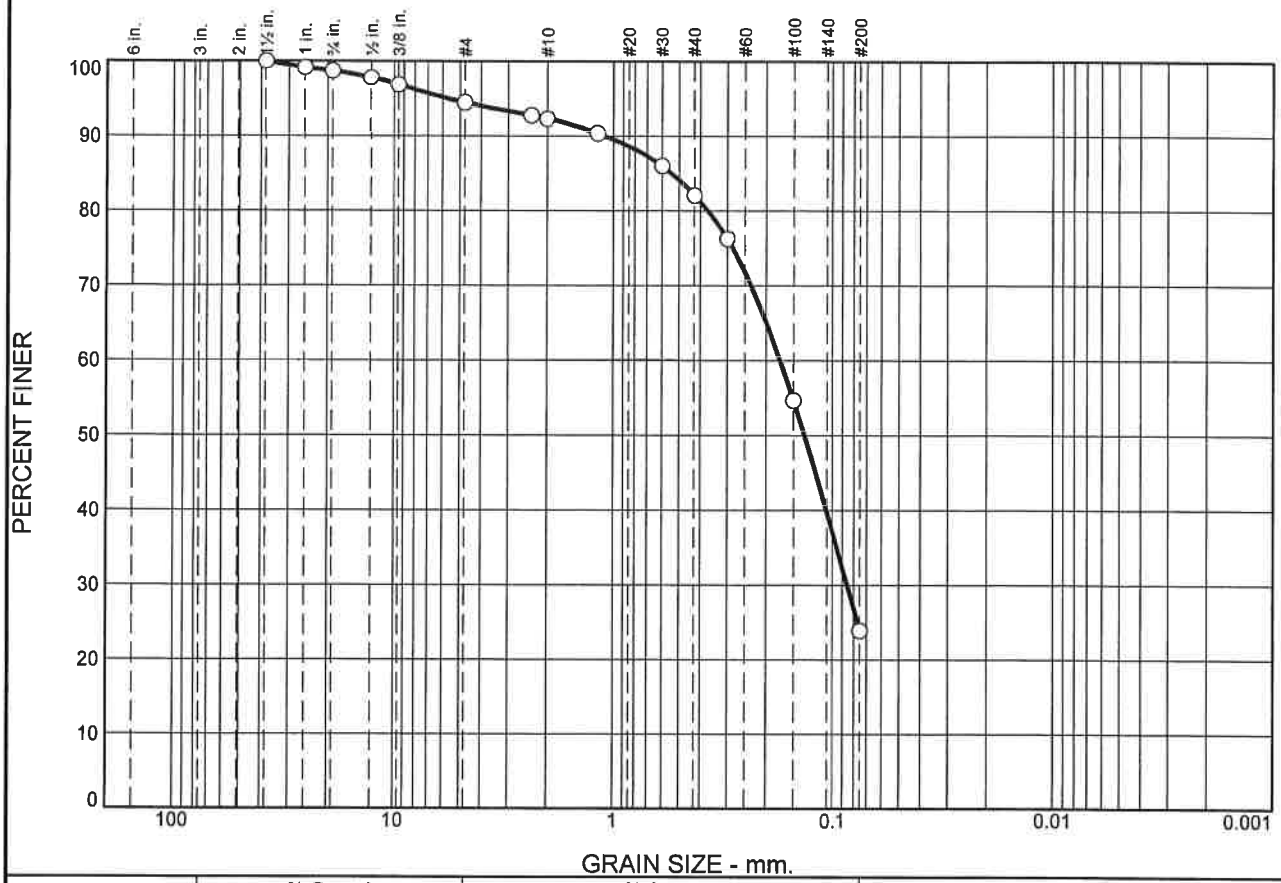
```
           Y            A     X     I     S            F     T

           0.00     25.00     50.00     75.00    100.00    125.00
X      0.00 +-------*-+-*-------+---------+---------+---------+
            -
            -
            -
            -
            -
      25.00 +
            -
            -
            -
            -
            -
A     50.00 +
            -
            -
            -
```

Excavation, MHA = 0.42 g, shallow failure plane

```
            -
            -
X     75.00 +
            -
            -          *
            -
            -        *
            -
I    100.00 +        *
            -
            -
            -                   *
            -
            -
S    125.00 +                              ..*
            -                                .8*
            -                              ......* *
            -                               ....41.
            -                                ......1
            -                                 .*...4
     150.00 +                                   ...4
            -                                    *
            -                                      *
            -
            -
            -
F    175.00 +
            -                                    *
            -
            -
            -
            -
T    200.00 +       *            *               * *
```

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0 | 1 | 5 | 2 | 10 | 58 | 24 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.5 | 100 | | |
| 1 | 99 | | |
| .75 | 99 | | |
| .5 | 98 | | |
| .375 | 97 | | |
| #4 | 94 | | |
| #8 | 93 | | |
| #10 | 92 | | |
| #16 | 90 | | |
| #30 | 86 | | |
| #40 | 82 | | |
| #50 | 76 | | |
| #100 | 55 | | |
| #200 | 24 | | |

* (no specification provided)

**Soil Description**

Silty sand

**Atterberg Limits**

PL= NP LL= NV PI= NP

**Coefficients**

$D_{90}$= 1.1050 $D_{85}$= 0.5423 $D_{60}$= 0.1729
$D_{50}$= 0.1340 $D_{30}$= 0.0855 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SM AASHTO= A-2-4(0)

**Remarks**

SAMPLED BY: CLIENT
ASTM D6913

**Location:** UNCONSOLIDATED PIT 1
**Sample Number:** 15-265-2

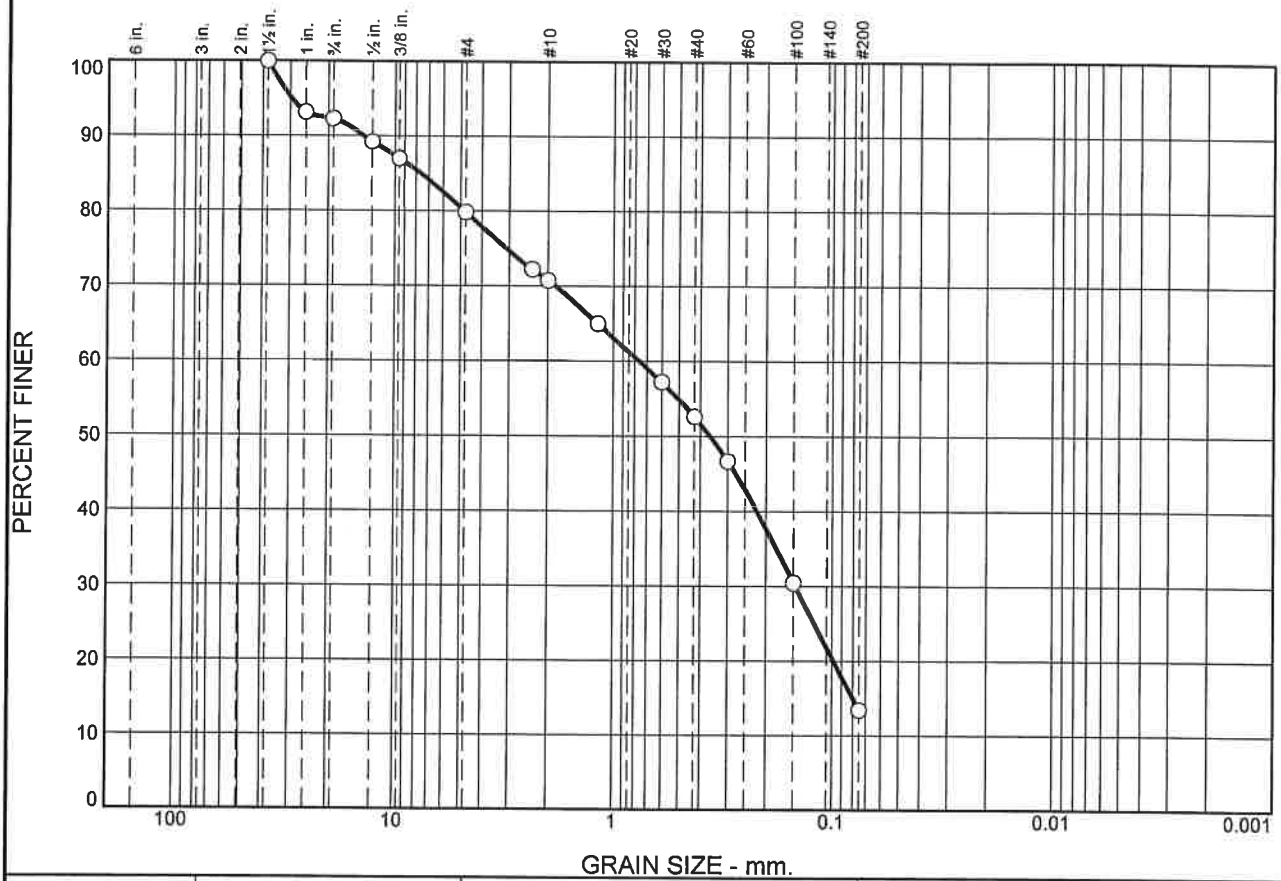
**Date:** 9/25/15

GES GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Project:** USE TRENCH 13 GEOTECH
**Project No:** 2015 MISC **Figure**

**Tested By:** T. FULLER

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0 | 8 | 12 | 9 | 18 | 40 | 13 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.5 | 100 | | |
| 1 | 93 | | |
| .75 | 92 | | |
| .5 | 89 | | |
| .375 | 87 | | |
| #4 | 80 | | |
| #8 | 72 | | |
| #10 | 71 | | |
| #16 | 65 | | |
| #30 | 57 | | |
| #40 | 53 | | |
| #50 | 47 | | |
| #100 | 30 | | |
| #200 | 13 | | |

* (no specification provided)

**Soil Description**

Silty sand with gravel

**Atterberg Limits**

PL= NP LL= NV PI= NP

**Coefficients**

$D_{90}$= 13.9402 $D_{85}$= 7.6182 $D_{60}$= 0.7597
$D_{50}$= 0.3609 $D_{30}$= 0.1472 $D_{15}$= 0.0799
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SM AASHTO= A-2-4(0)

**Remarks**

SAMPLED BY: CLIENT
ASTM D6913

**Location:** UNCONSOLIDATED PIT 2
**Sample Number:** 15-265-4

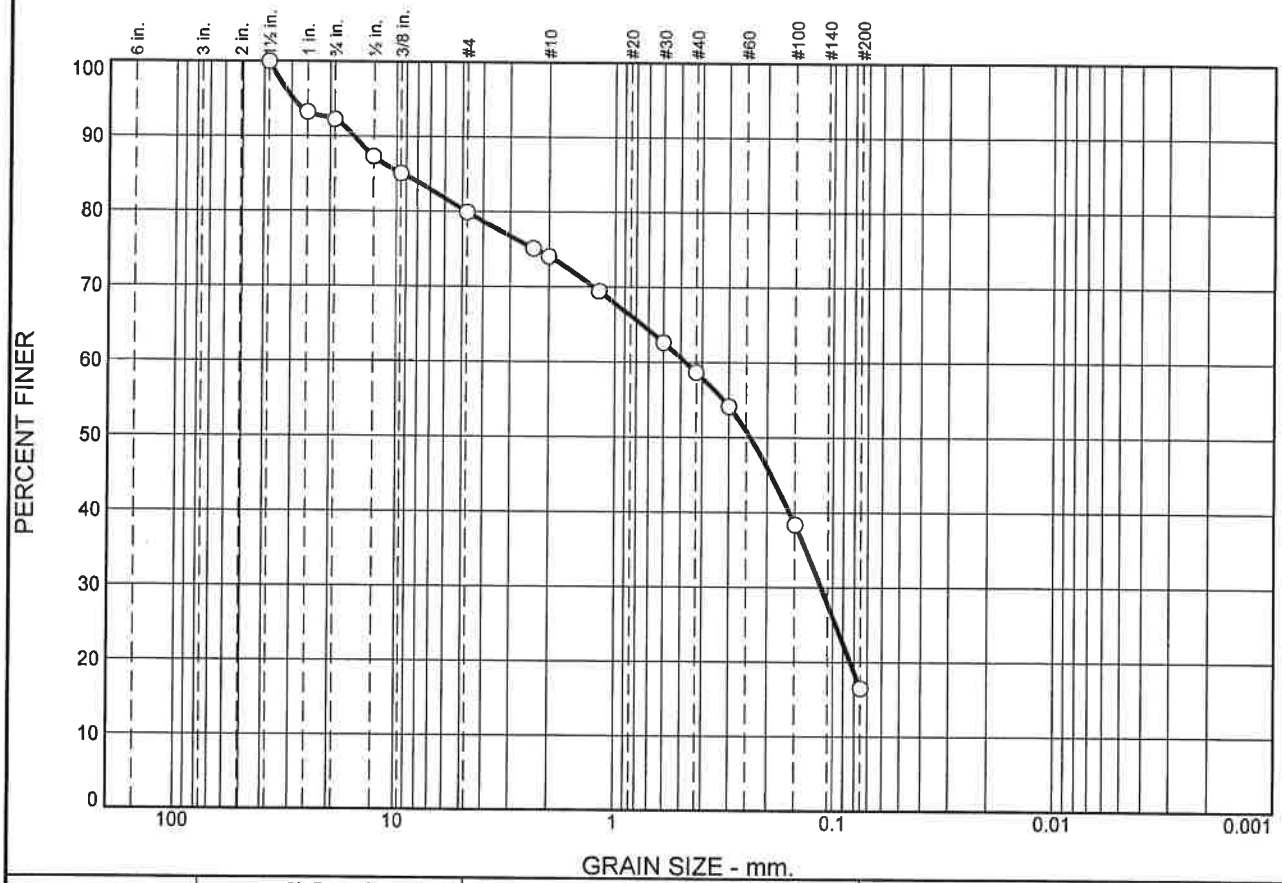
**Date:** 9/25/15

GES GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Project:** USE TRENCH 13 GEOTECH
**Project No:** 2015 MISC **Figure**

**Tested By:** J.J./T.F.

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0 | 8 | 12 | 6 | 15 | 42 | 17 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.5 | 100 | | |
| 1 | 93 | | |
| .75 | 92 | | |
| .5 | 87 | | |
| .375 | 85 | | |
| #4 | 80 | | |
| #8 | 75 | | |
| #10 | 74 | | |
| #16 | 69 | | |
| #30 | 63 | | |
| #40 | 59 | | |
| #50 | 54 | | |
| #100 | 38 | | |
| #200 | 17 | | |

* (no specification provided)

**Soil Description**

Silty sand with gravel

**Atterberg Limits**

PL= NP LL= NV PI= NP

**Coefficients**

$D_{90}$= 15.5825 $D_{85}$= 9.4044 $D_{60}$= 0.4768
$D_{50}$= 0.2395 $D_{30}$= 0.1135 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SM AASHTO= A-2-4(0)

**Remarks**

SAMPLED BY: CLIENT
ASTM D6913

**Location:** UNCONSOLIDATED PIT 3
**Sample Number:** 15-265-6

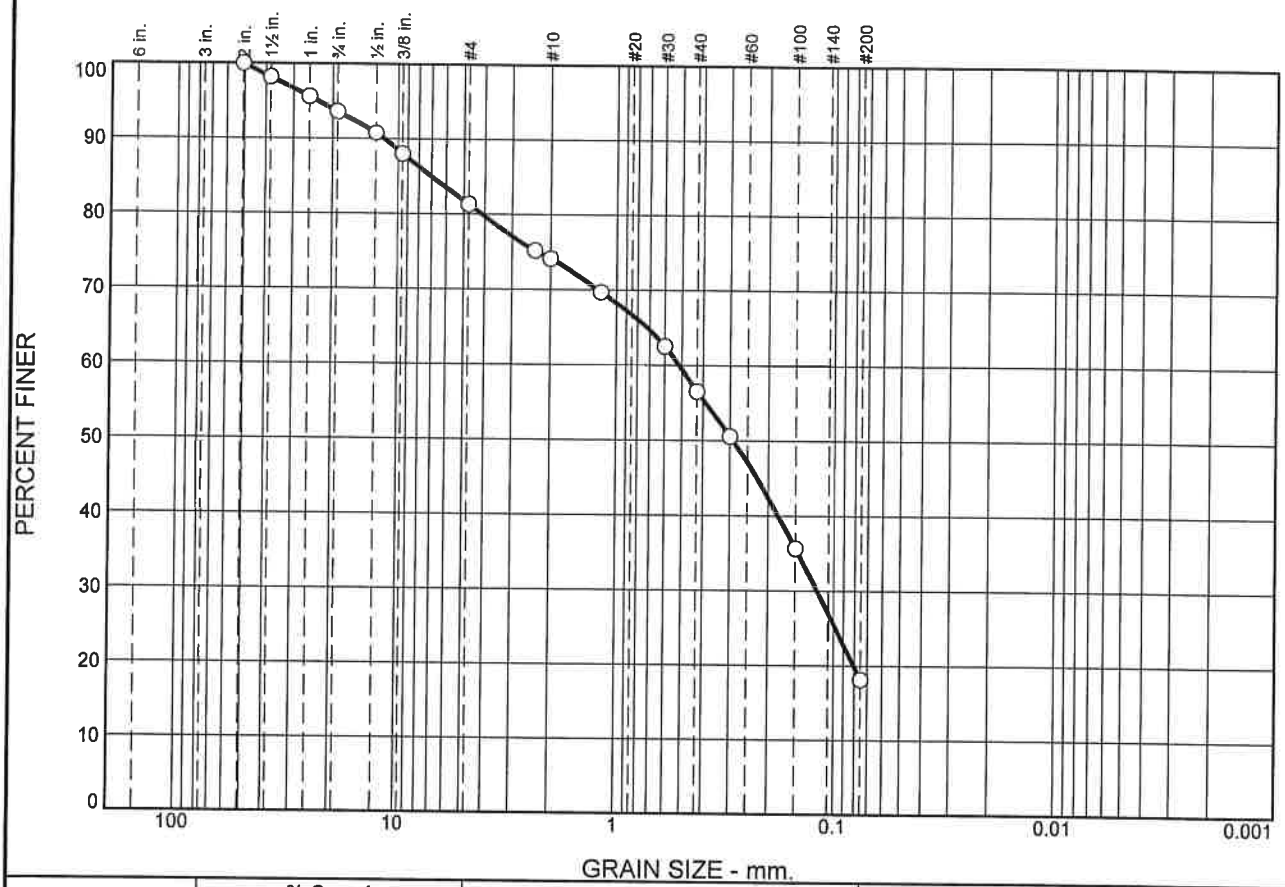
**Date:** 9/25/15

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
GES

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Project:** USE TRENCH 13 GEOTECH
**Project No:** 2015 MISC **Figure**

**Tested By:** J.J./T.F.

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0 | 6 | 13 | 7 | 17 | 39 | 18 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2 | 100 | | |
| 1.5 | 98 | | |
| 1 | 96 | | |
| .75 | 94 | | |
| .5 | 91 | | |
| .375 | 88 | | |
| #4 | 81 | | |
| #8 | 75 | | |
| #10 | 74 | | |
| #16 | 70 | | |
| #30 | 63 | | |
| #40 | 57 | | |
| #50 | 51 | | |
| #100 | 36 | | |
| #200 | 18 | | |

* (no specification provided)

**Soil Description**

Silty sand with gravel

**Atterberg Limits**

PL= NP LL= NV PI= NP

**Coefficients**

$D_{90}$= 11.5970 $D_{85}$= 7.0198 $D_{60}$= 0.5152
$D_{50}$= 0.2905 $D_{30}$= 0.1193 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SM AASHTO= A-2-4(0)

**Remarks**

SAMPLED BY: CLIENT
ASTM D6913

**Location:** UNCONSOLIDATED PIT 4
**Sample Number:** 15-265-8

**Date:** 9/25/15

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
GES

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Project:** USE TRENCH 13 GEOTECH
**Project No:** 2015 MISC
**Figure**

**Tested By:** J.J./T.F.

# COMPACTION TEST REPORT

**Curve No.: 15-265-2**

**Project No.:** 2015 MISC

**Date:** 09/16/15

**Project:** USE TRENCH 13 GEOTECH

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES

**Location:** UNCONSOLIDATED PIT 1

**Sample Number:** 15-265-2

**Remarks:**

**MATERIAL DESCRIPTION**

**Description:**

**Classifications -** **USCS:** N/A **AASHTO:** N/A

**Nat. Moist. =** N/A %

**Sp.G. =** 2.65

**Liquid Limit =** N/A

**Plasticity Index =** N/A

**% < No.200 =** N/A %

| ROCK CORRECTED TEST RESULTS |
|---|
| Maximum dry density = 117.6 pcf |
| Optimum moisture = 10.5 % |

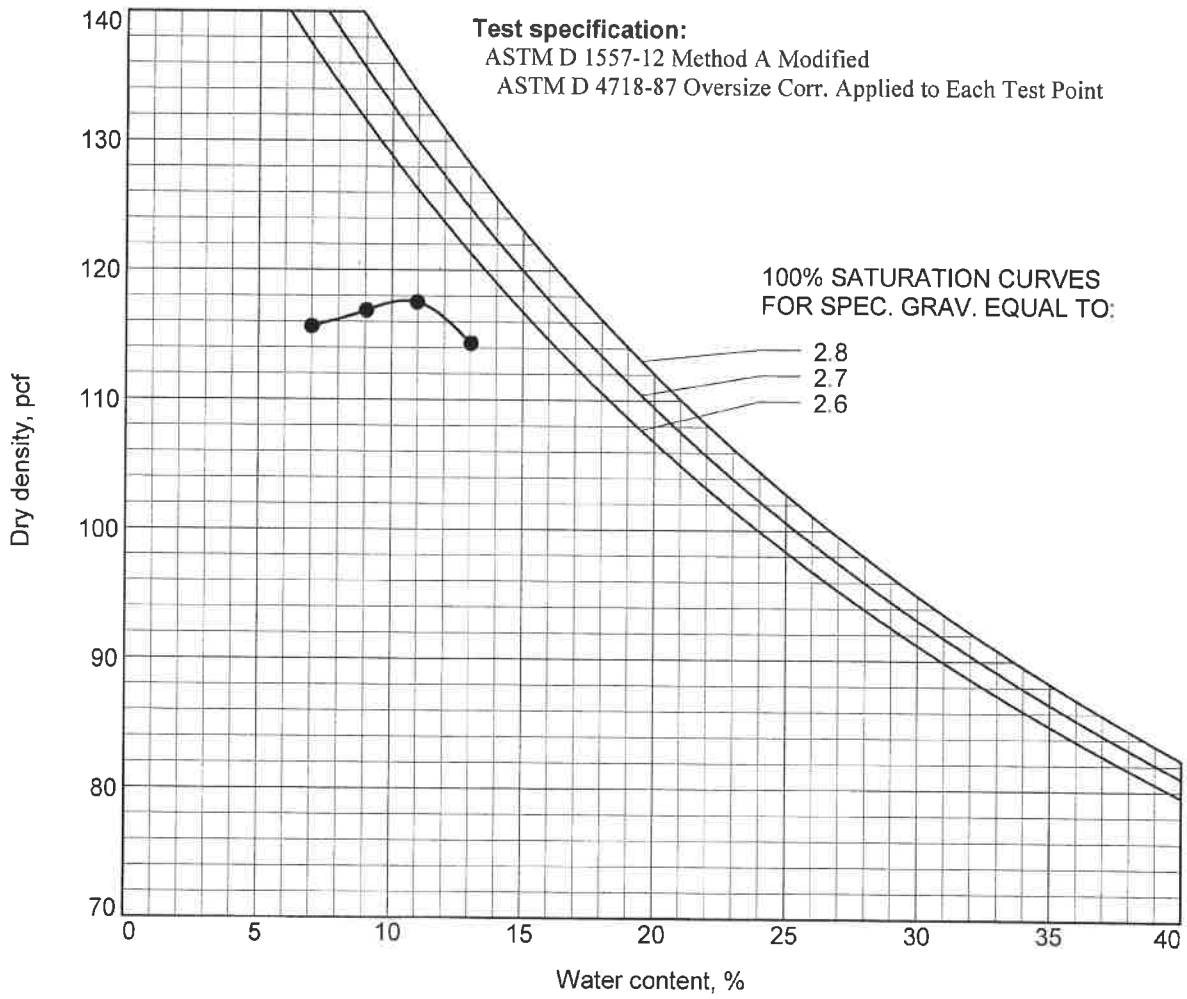



**Figure** 15-265-2

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Tested By:** J. JOHNSON

# COMPACTION TEST REPORT

**Curve No.: 15-265-4**

**Project No.:** 2015 MISC **Date:** 09/18/15
**Project:** USE TRENCH 13 GEOTECH
**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Location:** UNCONSOLIDATED PIT 2
**Sample Number:** 15-265-4
**Remarks:**

**MATERIAL DESCRIPTION**

**Description:**

**Classifications -** **USCS:** N/A **AASHTO:** N/A
**Nat. Moist. =** N/A % **Sp.G. =** 2.65
**Liquid Limit =** N/A **Plasticity Index =** N/A
**% < No.200 =** N/A %

| ROCK CORRECTED TEST RESULTS |
|---|
| Maximum dry density = 120.7 pcf |
| Optimum moisture = 10.6 % |

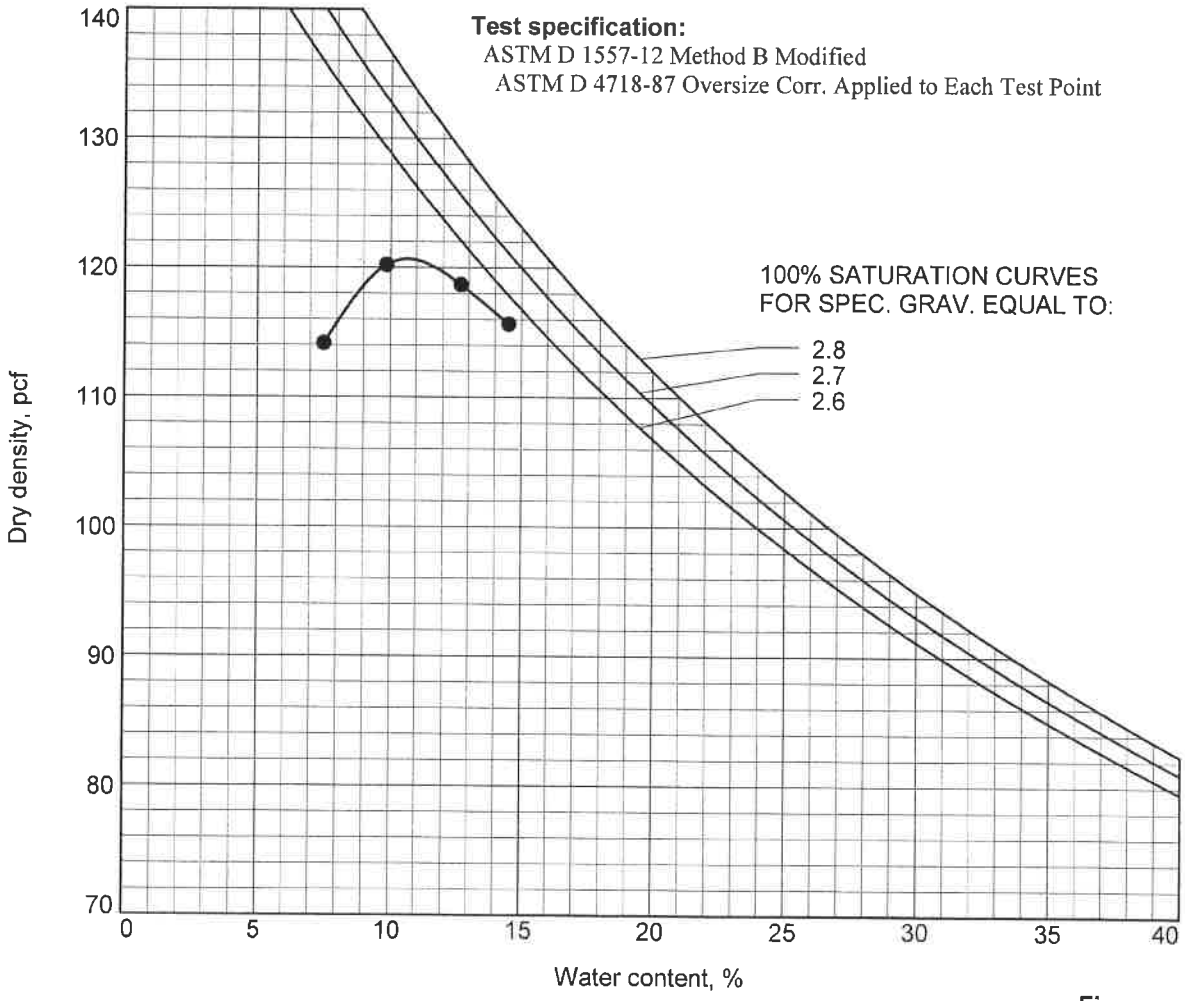



**Figure** 15-265-4

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Tested By:** J. JOHNSON

# COMPACTION TEST REPORT

**Curve No.: 15-265-6**

**Project No.:** 2015 MISC

**Date:** 09/18/15

**Project:** USE TRENCH 13 GEOTECH

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES

**Location:** UNCONSOLIDATED PIT 3

**Sample Number:** 15-265-6

**Remarks:**

**MATERIAL DESCRIPTION**

**Description:**

**Classifications -** **USCS:** N/A **AASHTO:** N/A

**Nat. Moist. =** N/A %

**Sp.G. =** 2.65

**Liquid Limit =** N/A

**Plasticity Index =** N/A

**% < No.200 =** N/A %

| ROCK CORRECTED TEST RESULTS |
|---|
| Maximum dry density = 123.9 pcf |
| Optimum moisture = 7.8 % |

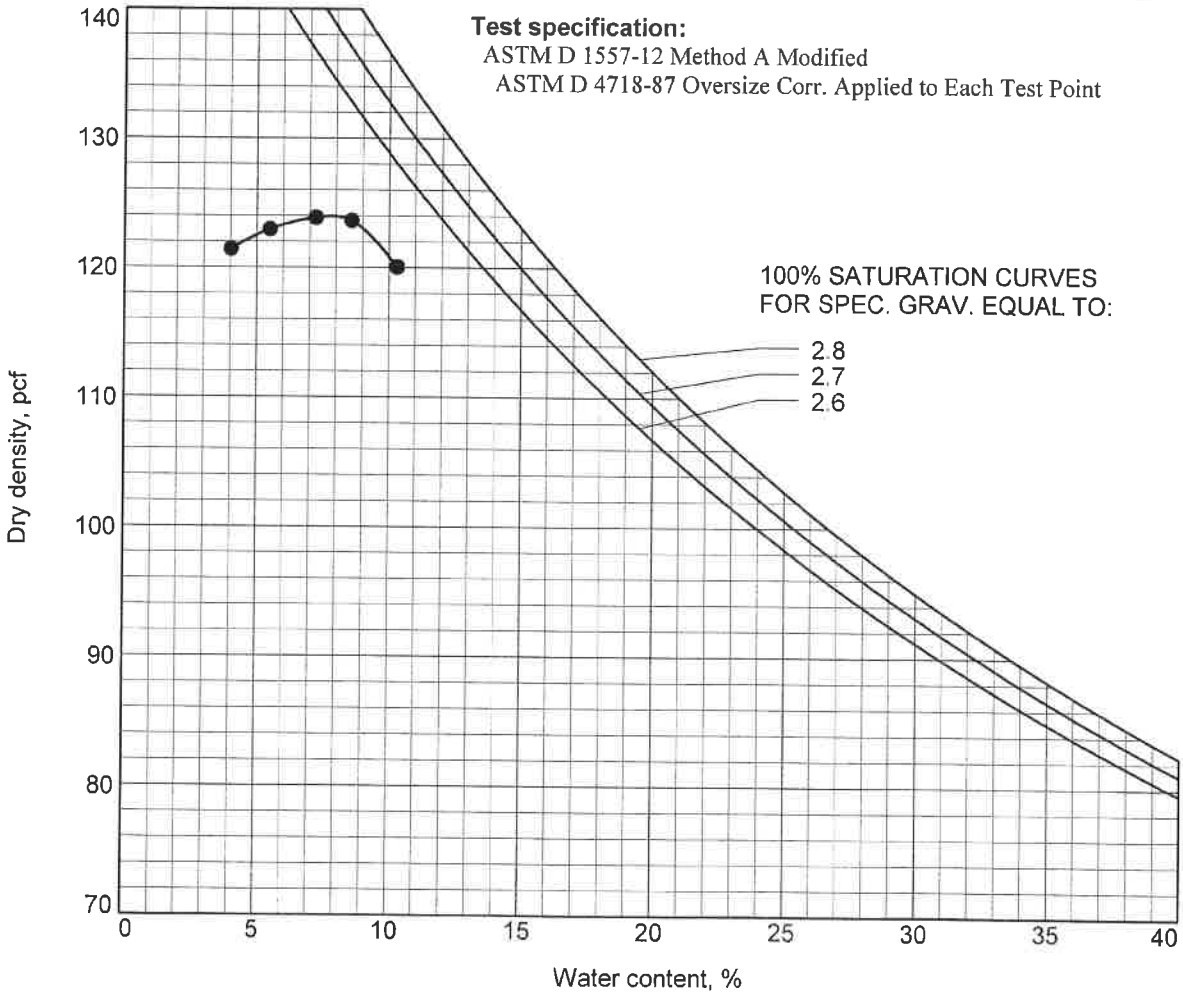



**Figure** 15-265-6

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Tested By:** J. JOHNSON

# COMPACTION TEST REPORT

**Curve No.: 15-265-8**

**Project No.:** 2015 MISC

**Date:** 9/18/15

**Project:** USE TRENCH 13 GEOTECH

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES

**Location:** UNCONSOLIDATED PIT 4

**Sample Number:** 15-265-8

**Remarks:** SAMPLED BY: CLIENT

**MATERIAL DESCRIPTION**

**Description:**

**Classifications -** **USCS:** **AASHTO:**

**Nat. Moist. =**

**Sp.G. =** 2.65

**Liquid Limit =**

**Plasticity Index =**

**% < No.200 =** N/A %

| ROCK CORRECTED TEST RESULTS |
|---|
| Maximum dry density = 127.0 pcf |
| Optimum moisture = 7.7 % |

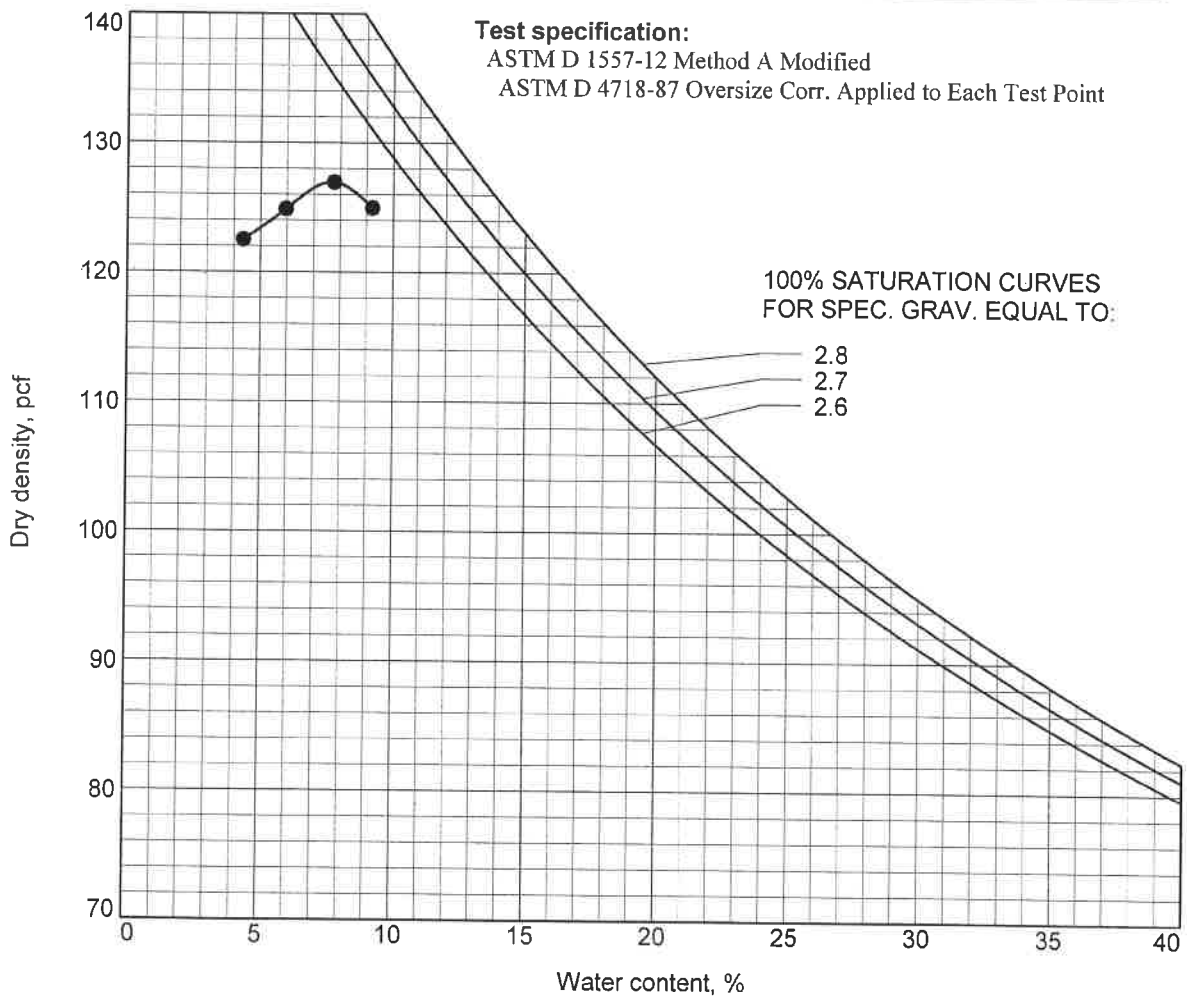
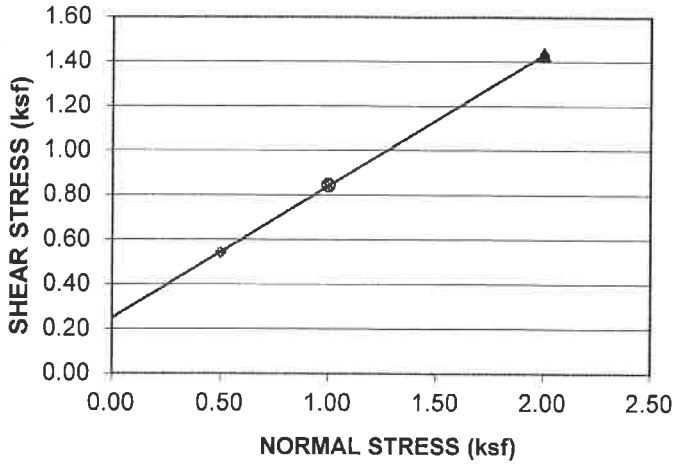



**Figure** 15-265-8

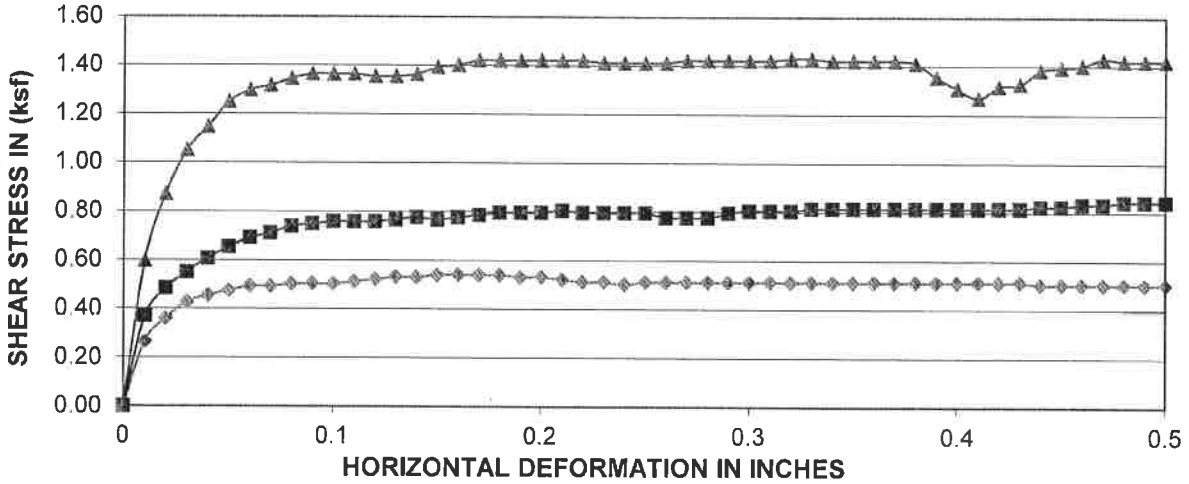
**GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.**

**Tested By:** J. JOHNSON

# DIRECT SHEAR TEST




| | |
|---|---|
| STRENGTH INTERCEPT: | 0.25 KSF |
| FRICTION ANGLE (PHI) | 30.6 DEG. |




| SYMBOL | MOISTURE CONTENT % | DRY DENSITY (pcf) | NORMAL STRESS (ksf) | PEAK SHEAR (ksf) | RESIDUAL SHEAR (ksf) |
|---|---|---|---|---|---|
| 1.0 ksf | 10.7 | 105.7 | 0.50 | 0.54 | 0.50 |
| 2.0 ksf | 10.7 | 105.9 | 1.00 | 0.84 | 0.84 |
| 4.0 ksf | 10.7 | 106.0 | 2.00 | 1.43 | 1.42 |

SAMPLED BY: CLIENT TESTED BY: A.S LAB NO: 15-265-2

SOIL DESCRIPTION: SAND DATE OF TEST: 9/16/2015

LOCATION OF SAMPLE: UNCONSOLITATED PIT 1

REMARKS:

GES
GEOTECHNICAL & ENVIRONMENTAL SERVICES INC
(702) 365 1001
7150 PLACID STREET
LAS VEGAS, NV 89119

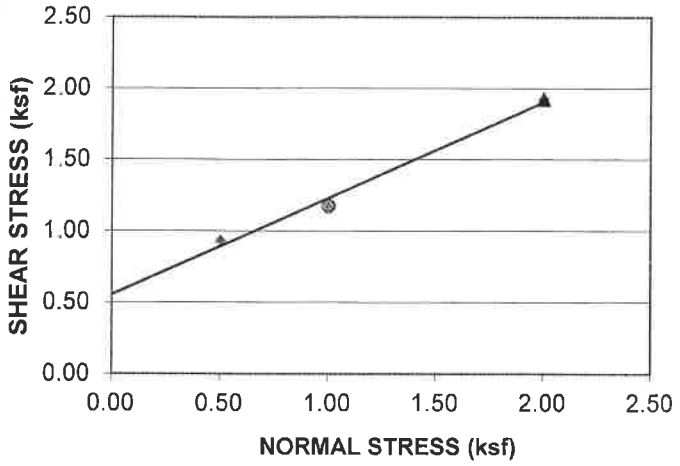
PROJECT NAME: USE TRENCH 13 GEOTECH

CLIENT NAME: SWIFT RIVER ENVIRONMENTAL SERVICES

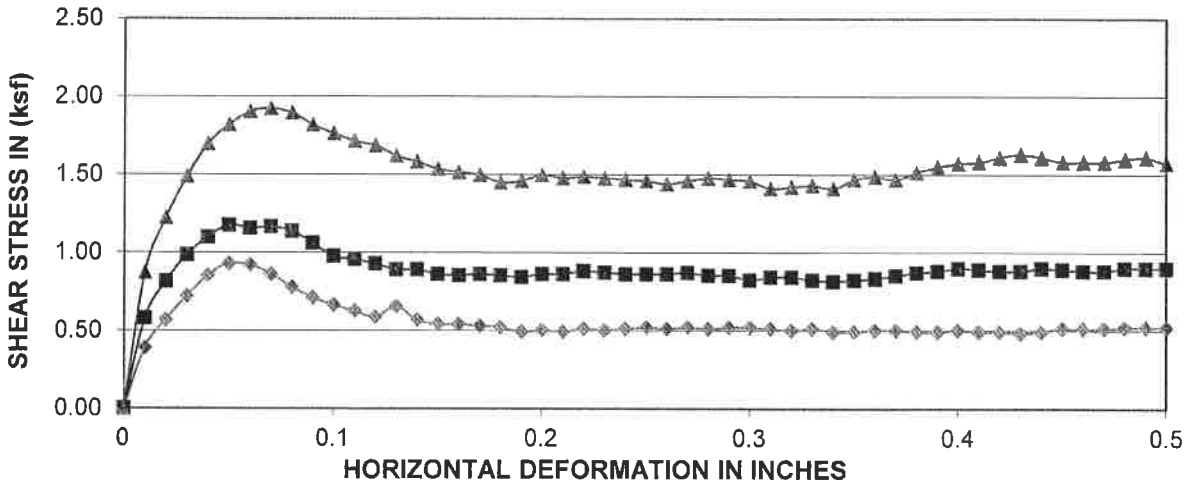
PROJECT NO. 2015MISC

Figure 15-265

# DIRECT SHEAR TEST




| | |
|---|---|
| STRENGTH INTERCEPT: | 0.55 KSF |
| FRICTION ANGLE (PHI) | 34.0 DEG. |




| SYMBOL | MOISTURE CONTENT % | DRY DENSITY (pcf) | NORMAL STRESS (ksf) | PEAK SHEAR (ksf) | RESIDUAL SHEAR (ksf) |
|---|---|---|---|---|---|
| —◆— 1.0 ksf | 10.4 | 109.6 | 0.50 | 0.93 | 0.52 |
| —■— 2.0 ksf | 10.4 | 109.6 | 1.00 | 1.17 | 0.90 |
| —▲— 4.0 ksf | 10.4 | 108.8 | 2.00 | 1.92 | 1.57 |

SAMPLED BY: CLIENT TESTED BY: A.S LAB NO: 15-265-4

SOIL DESCRIPTION: SAND DATE OF TEST: 9/18/2015

LOCATION OF SAMPLE: UNCONSOLIDATED PIT 2

REMARKS:

GES
GEOTECHNICAL & ENVIRONMENTAL SERVICES INC
(702) 365 1001
7150 PLACID STREET
LAS VEGAS, NV 89119

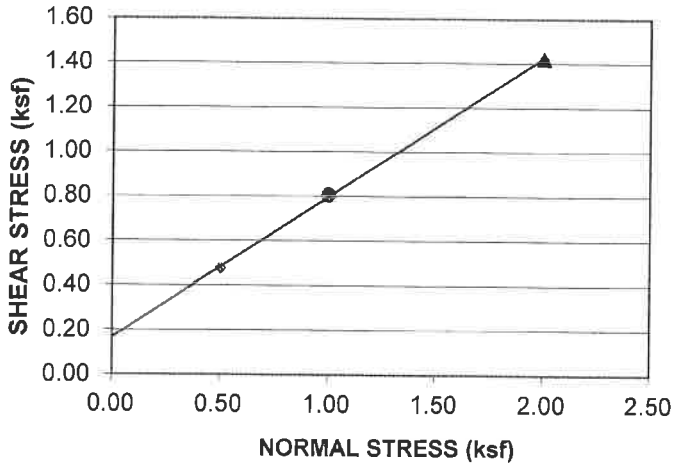
PROJECT NAME: USE TRENCH 13 GEOTECH

CLIENT NAME: SWIFT RIVER ENVIRONMENTAL SERVICES

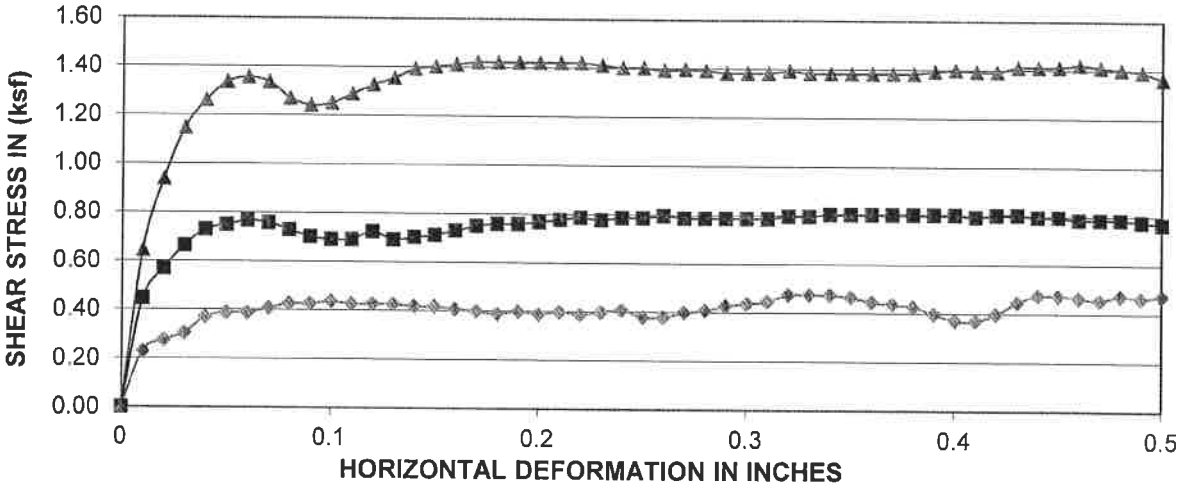
PROJECT NO. 2015MISC

Figure 15-265

# DIRECT SHEAR TEST




| | |
|---|---|
| STRENGTH INTERCEPT: | 0.17 KSF |
| FRICTION ANGLE (PHI) | 32.2 DEG. |




| SYMBOL | MOISTURE CONTENT % | DRY DENSITY (pcf) | NORMAL STRESS (ksf) | PEAK SHEAR (ksf) | RESIDUAL SHEAR (ksf) |
|---|---|---|---|---|---|
| —◆— 1.0 ksf | 7.9 | 111.3 | 0.50 | 0.47 | 0.47 |
| —■— 2.0 ksf | 7.9 | 111.7 | 1.00 | 0.80 | 0.77 |
| —▲— 4.0 ksf | 7.9 | 111.7 | 2.00 | 1.42 | 1.36 |

SAMPLED BY: CLIENT TESTED BY: A.S LAB NO: 15-265-6

SOIL DESCRIPTION: SAND DATE OF TEST: 9/21/2015

LOCATION OF SAMPLE: UNCONSOLIDATED PIT 3

REMARKS:

GES
GEOTECHNICAL & ENVIRONMENTAL SERVICES INC
(702) 365 1001
7150 PLACID STREET
LAS VEGAS, NV 89119

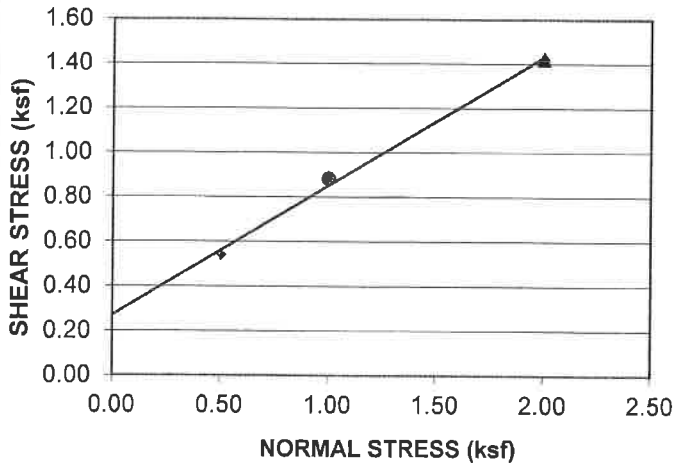
PROJECT NAME: USE TRENCH 13 GEOTECH

CLIENT NAME: SWIFT RIVER ENVIRONMENTAL SERVICES

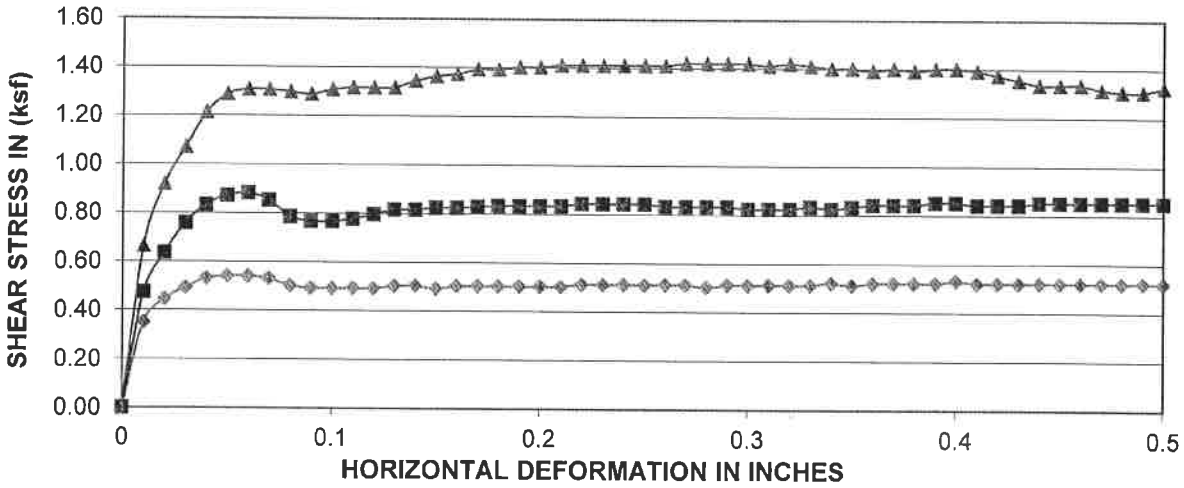
PROJECT NO. 2015 MISC

Figure 15-265

# DIRECT SHEAR TEST




| | |
|---|---|
| STRENGTH INTERCEPT: | 0.27 KSF |
| FRICTION ANGLE (PHI) | 30.1 DEG. |




| SYMBOL | MOISTURE CONTENT % | DRY DENSITY (pcf) | NORMAL STRESS (ksf) | PEAK SHEAR (ksf) | RESIDUAL SHEAR (ksf) |
|---|---|---|---|---|---|
| 1.0 ksf | 7.5 | 114.5 | 0.50 | 0.54 | 0.52 |
| 2.0 ksf | 7.5 | 115.0 | 1.00 | 0.88 | 0.85 |
| 4.0 ksf | 7.5 | 114.6 | 2.00 | 1.42 | 1.33 |

SAMPLED BY: CLIENT TESTED BY: A.S LAB NO: 15-265-8

SOIL DESCRIPTION: SAND DATE OF TEST: 9/22/2015

LOCATION OF SAMPLE: UNCONSOLIDATED PIT 4

REMARKS:

GES
GEOTECHNICAL & ENVIRONMENTAL SERVICES INC
(702) 365 1001
7150 PLACID STREET
LAS VEGAS, NV 89119

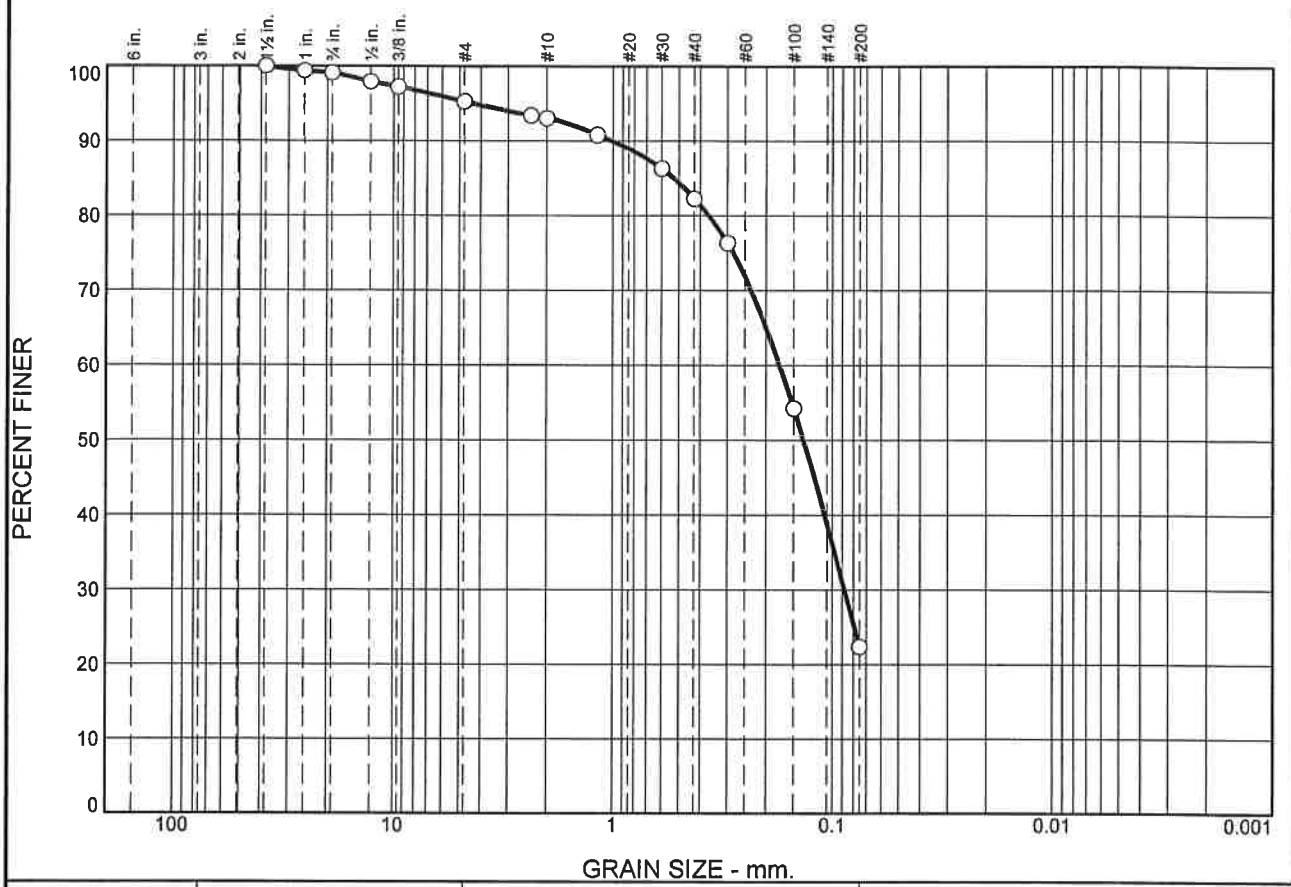
PROJECT NAME: USE TRENCH 13 GEOTECH

CLIENT NAME: SWIFT RIVER ENVIRONMENTAL SERVICES

PROJECT NO. 2015 MISC

Figure 15-265

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0 | 1 | 4 | 2 | 11 | 60 | 22 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.5 | 100 | | |
| 1 | 99 | | |
| .75 | 99 | | |
| .5 | 98 | | |
| .375 | 97 | | |
| #4 | 95 | | |
| #8 | 93 | | |
| #10 | 93 | | |
| #16 | 91 | | |
| #30 | 86 | | |
| #40 | 82 | | |
| #50 | 76 | | |
| #100 | 54 | | |
| #200 | 22 | | |

* (no specification provided)

**Soil Description**

Silty sand

**Atterberg Limits**

PL= NP LL= NV PI= NP

**Coefficients**

$D_{90}$= 1.0121 $D_{85}$= 0.5302 $D_{60}$= 0.1739
$D_{50}$= 0.1357 $D_{30}$= 0.0878 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SM AASHTO= A-2-4(0)

**Remarks**

ASTM D6913

**Location:** CONSOLIDATED PIT 1
**Sample Number:** 15-265-1

**Date:** 09/25/15

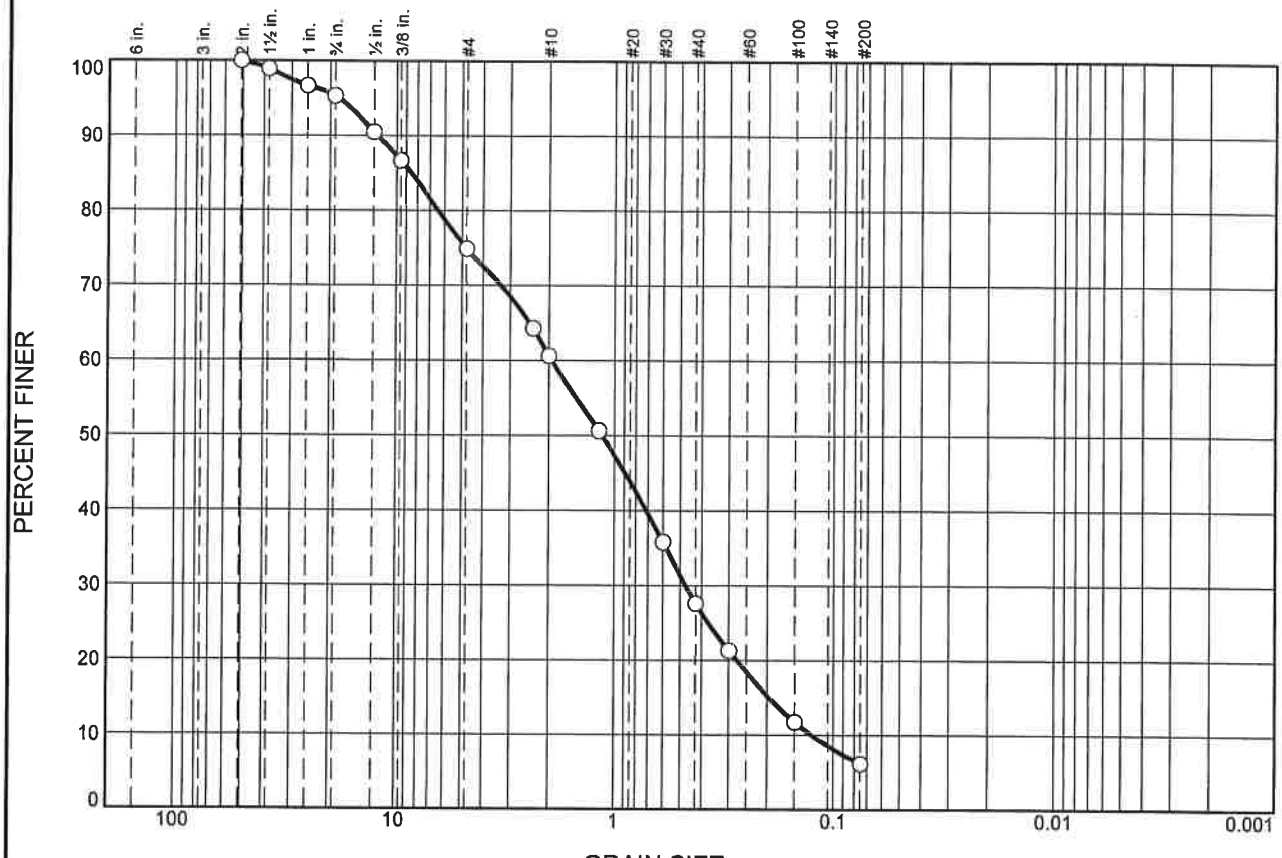
GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
GES

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Project:** USE TRENCH 13 GEOTECH

**Project No:** 2015 MISC **Figure**

**Tested By:** T. FULLER

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0 | 5 | 20 | 14 | 33 | 22 | 6 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2 | 100 | | |
| 1.5 | 99 | | |
| 1 | 97 | | |
| .75 | 95 | | |
| .5 | 90 | | |
| .375 | 87 | | |
| #4 | 75 | | |
| #8 | 64 | | |
| #10 | 61 | | |
| #16 | 51 | | |
| #30 | 36 | | |
| #40 | 28 | | |
| #50 | 21 | | |
| #100 | 12 | | |
| #200 | 6.2 | | |

* (no specification provided)

**Soil Description**

Poorly graded sand with silt and gravel

**Atterberg Limits**

PL= NP LL= NV PI= NP

**Coefficients**

$D_{90}$= 12.2372 $D_{85}$= 8.5797 $D_{60}$= 1.9434
$D_{50}$= 1.1421 $D_{30}$= 0.4726 $D_{15}$= 0.1966
$D_{10}$= 0.1260 $C_u$= 15.42 $C_c$= 0.91

**Classification**

USCS= SP-SM AASHTO= A-1-b

**Remarks**

SAMPLED BY: CLIENT
ASTM D6913

**Location:** CONSOLIDADED PIT 2
**Sample Number:** 15-265-3

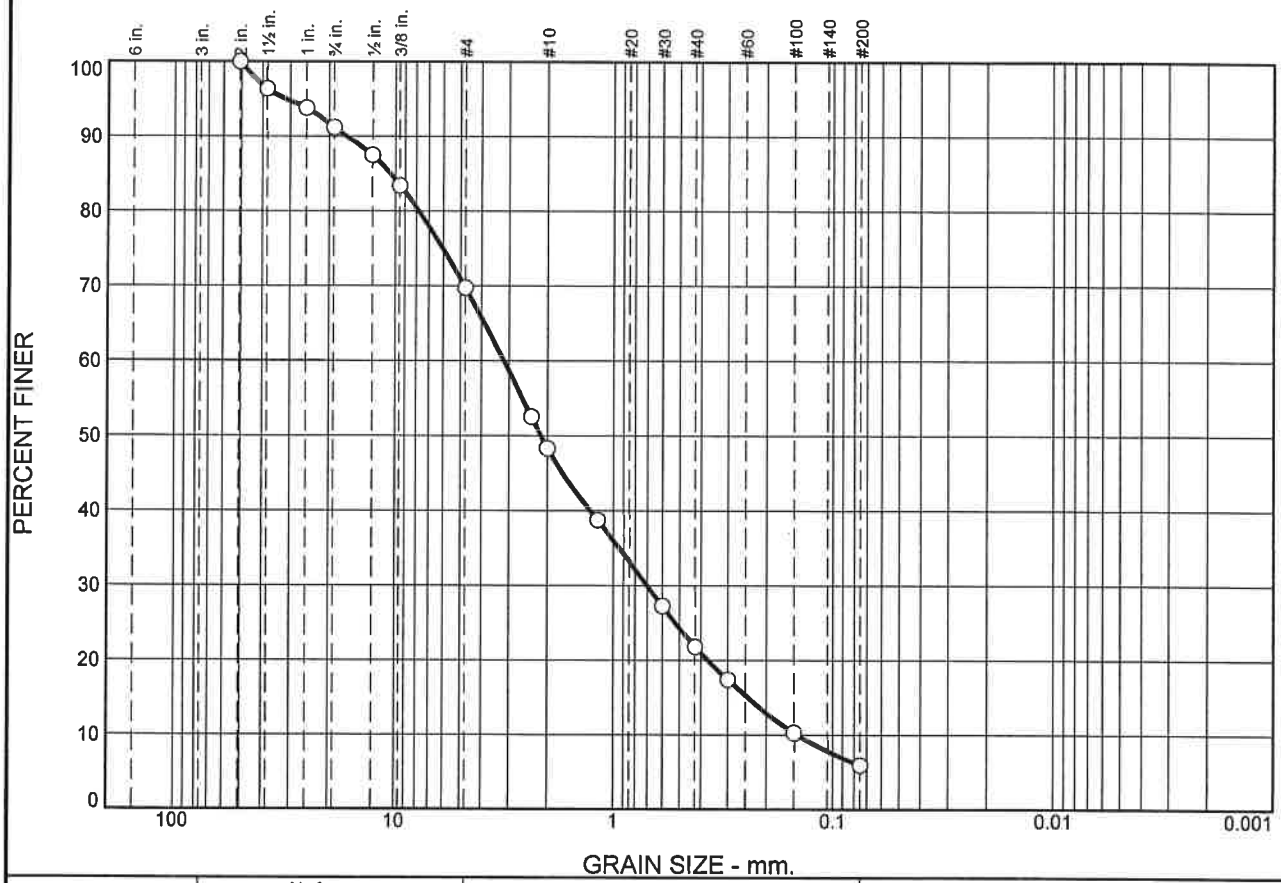
**Date:** 9/25/15

GES GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Project:** USE TRENCH 13 GEOTECH
**Project No:** 2015 MISC **Figure**

**Tested By:** T. FULLER

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0 | 9 | 21 | 22 | 26 | 16 | 6 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2 | 100 | | |
| 1.5 | 96 | | |
| 1 | 94 | | |
| .75 | 91 | | |
| .5 | 87 | | |
| .375 | 83 | | |
| #4 | 70 | | |
| #8 | 52 | | |
| #10 | 48 | | |
| #16 | 39 | | |
| #30 | 27 | | |
| #40 | 22 | | |
| #50 | 17 | | |
| #100 | 10 | | |
| #200 | 5.9 | | |

* (no specification provided)

**Soil Description**

Well-graded sand with silt and gravel

**Atterberg Limits**

PL= NP LL= NV PI= NP

**Coefficients**

$D_{90}$= 16.6904 $D_{85}$= 10.5793 $D_{60}$= 3.1662
$D_{50}$= 2.1415 $D_{30}$= 0.7048 $D_{15}$= 0.2433
$D_{10}$= 0.1452 $C_u$= 21.80 $C_c$= 1.08

**Classification**

USCS= SW-SM AASHTO= A-1-a

**Remarks**

SAMPLED BY: CLIENT
ASTM D6913

**Location:** CONSOLIDATED PIT 3
**Sample Number:** 15-265-5

**Date:** 9/25/15

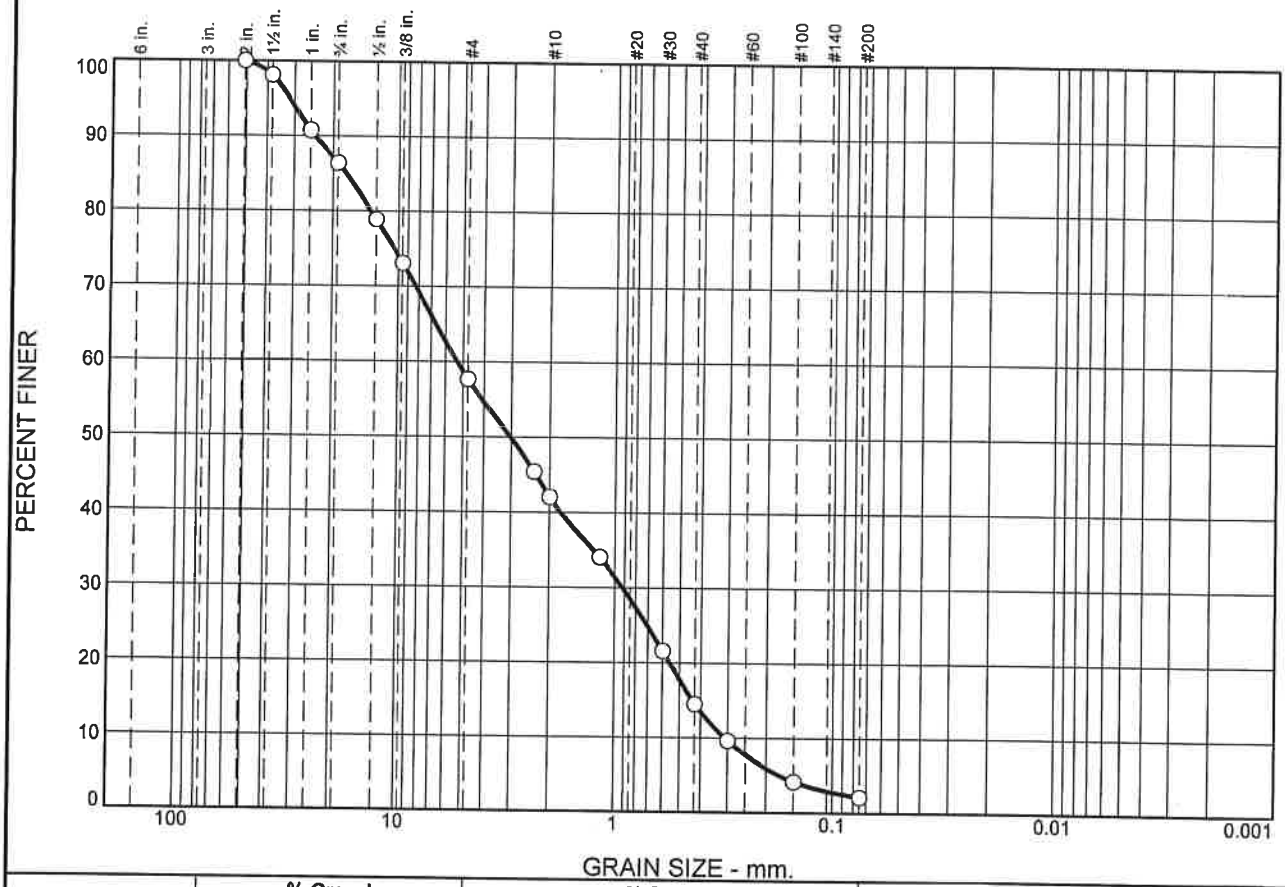
GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
GES

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Project:** USE TRENCH 13 GEOTECH

**Project No:** 2015 MISC **Figure**

**Tested By:** J.J./T.F.

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0 | 14 | 28 | 16 | 27 | 13 | 2 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2 | 100 | | |
| 1.5 | 98 | | |
| 1 | 91 | | |
| .75 | 86 | | |
| .5 | 79 | | |
| .375 | 73 | | |
| #4 | 58 | | |
| #8 | 45 | | |
| #10 | 42 | | |
| #16 | 34 | | |
| #30 | 22 | | |
| #40 | 15 | | |
| #50 | 10 | | |
| #100 | 4 | | |
| #200 | 2.2 | | |

* (no specification provided)

**Soil Description**

Poorly graded sand with gravel

**Atterberg Limits**

PL= NP LL= NV PI= NP

**Coefficients**

$D_{90}$= 24.3198 $D_{85}$= 17.5252 $D_{60}$= 5.3235
$D_{50}$= 3.0349 $D_{30}$= 0.9208 $D_{15}$= 0.4359
$D_{10}$= 0.3099 $C_u$= 17.18 $C_c$= 0.51

**Classification**

USCS= SP AASHTO= A-1-a

**Remarks**

SAMPLED BY: CLIENT
ASTM D6913

**Location:** CONSOLIDATED PIT 4
**Sample Number:** 15-265-7

**Date:** 9/25/15

GES GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Project:** USE TRENCH 13 GEOTECH

**Project No:** 2015 MISC **Figure**

**Tested By:** J.J./T.F.

# COMPACTION TEST REPORT

**Curve No.: 15-265-1**

**Project No.:** 2015 MISC **Date:** 09/16/15
**Project:** USE TRENCH 13 GEOTECH
**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Location:** CONSOLIDATED PIT 1
**Sample Number:** 15-265-1
**Remarks:**

**MATERIAL DESCRIPTION**

**Description:**

**Classifications -** **USCS:** N/A **AASHTO:** N/A
**Nat. Moist. =** N/A %
**Liquid Limit =** N/A
**Sp.G. =** 2.65
**Plasticity Index =** N/A
**% < No.200 =** N/A %

| ROCK CORRECTED TEST RESULTS |
|---|
| Maximum dry density = 130.0 pcf |
| Optimum moisture = 6.5 % |

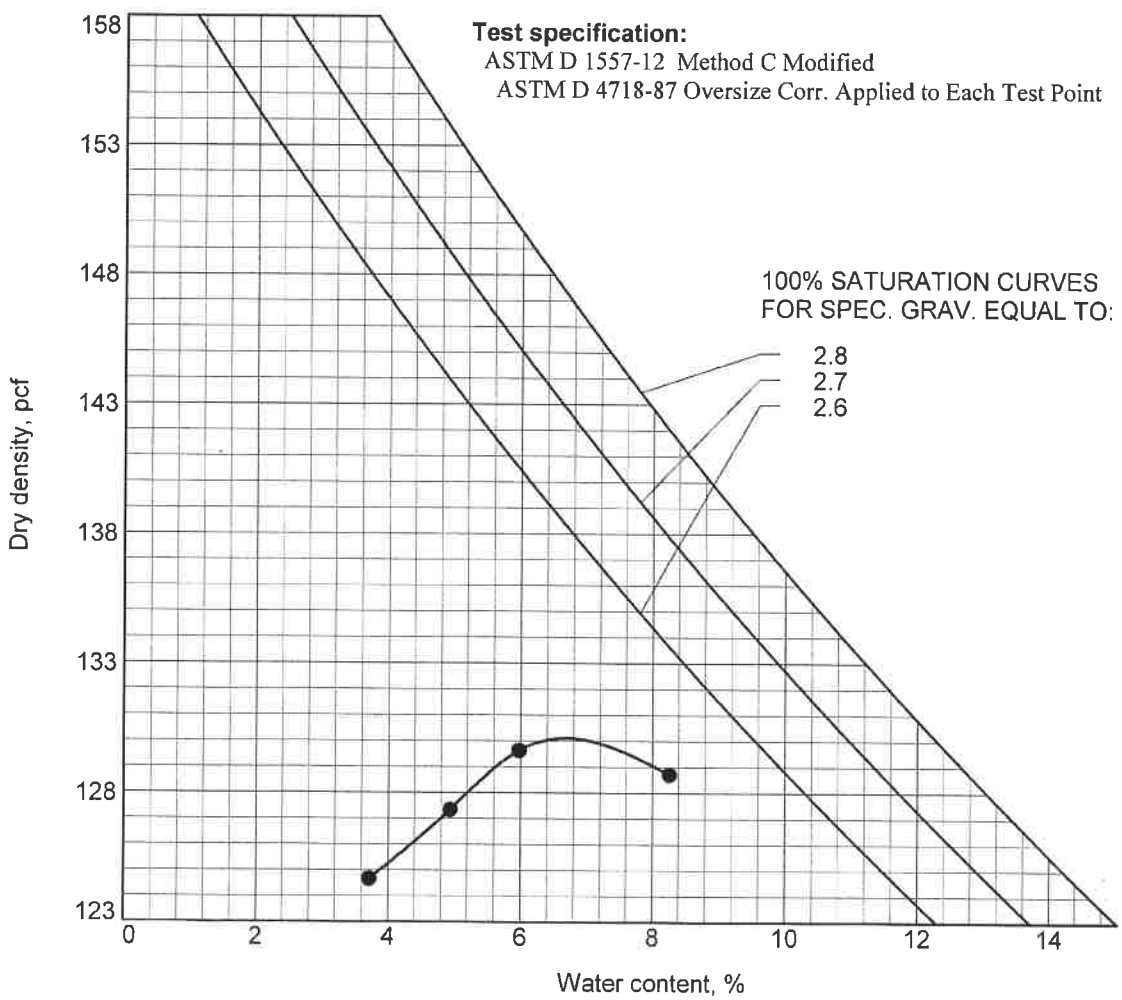



**Figure** 15-265-1

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Tested By:** T. FULLER

# COMPACTION TEST REPORT

**Curve No.: 15-265-3**

**Project No.:** 2015 MISC **Date:** 09/18/15
**Project:** USE TRENCH 13 GEOTECH
**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Location:** CONSOLIDADED PIT 2
**Sample Number:** 15-265-3
**Remarks:**

**MATERIAL DESCRIPTION**

**Description:**

**Classifications -** **USCS:** N/A **AASHTO:** N/A
**Nat. Moist. =** N/A % **Sp.G. =** 2.65
**Liquid Limit =** N/A **Plasticity Index =** N/A
**% < No.200 =** N/A %

| ROCK CORRECTED TEST RESULTS |
|---|
| Maximum dry density = 125.8 pcf |
| Optimum moisture = 8.2 % |

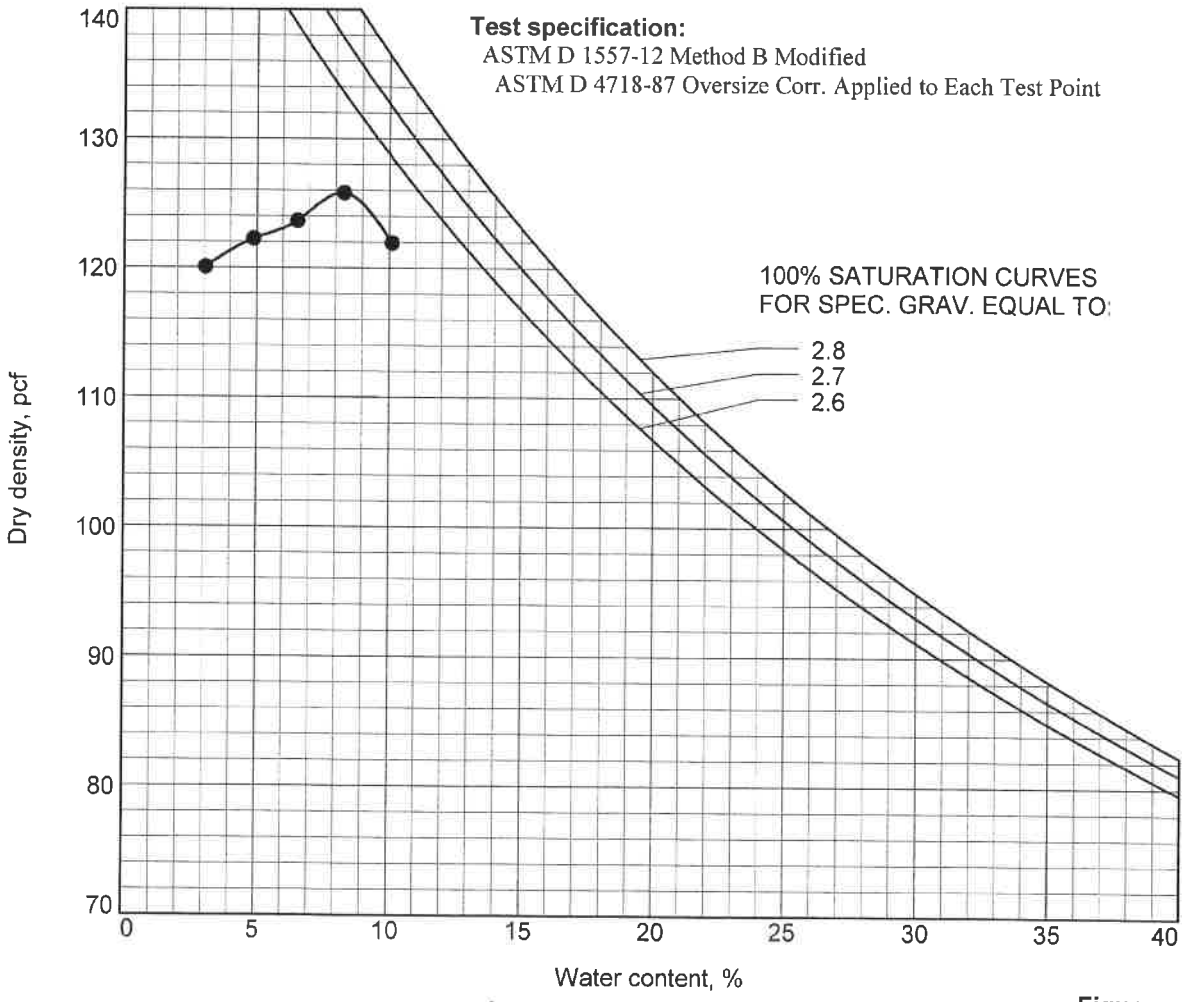



**Figure** 15-265-3

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Tested By:** J. JOHNSON

# COMPACTION TEST REPORT

**Curve No.: 15-265-5**

**Project No.:** 2015 MISC

**Date:** 09/18/15

**Project:** USE TRENCH 13 GEOTECH

**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES

**Location:** CONSOLIDATED PIT 3

**Sample Number:** 15-265-5

**Remarks:**

**MATERIAL DESCRIPTION**

**Description:**

**Classifications -** **USCS:** N/A **AASHTO:** N/A

**Nat. Moist. =** N/A %

**Sp.G. =** 2.65

**Liquid Limit =** N/A

**Plasticity Index =** N/A

**% < No.200 =** N/A %

| ROCK CORRECTED TEST RESULTS |
|---|
| Maximum dry density = 131.7 pcf |
| Optimum moisture = 6.9 % |

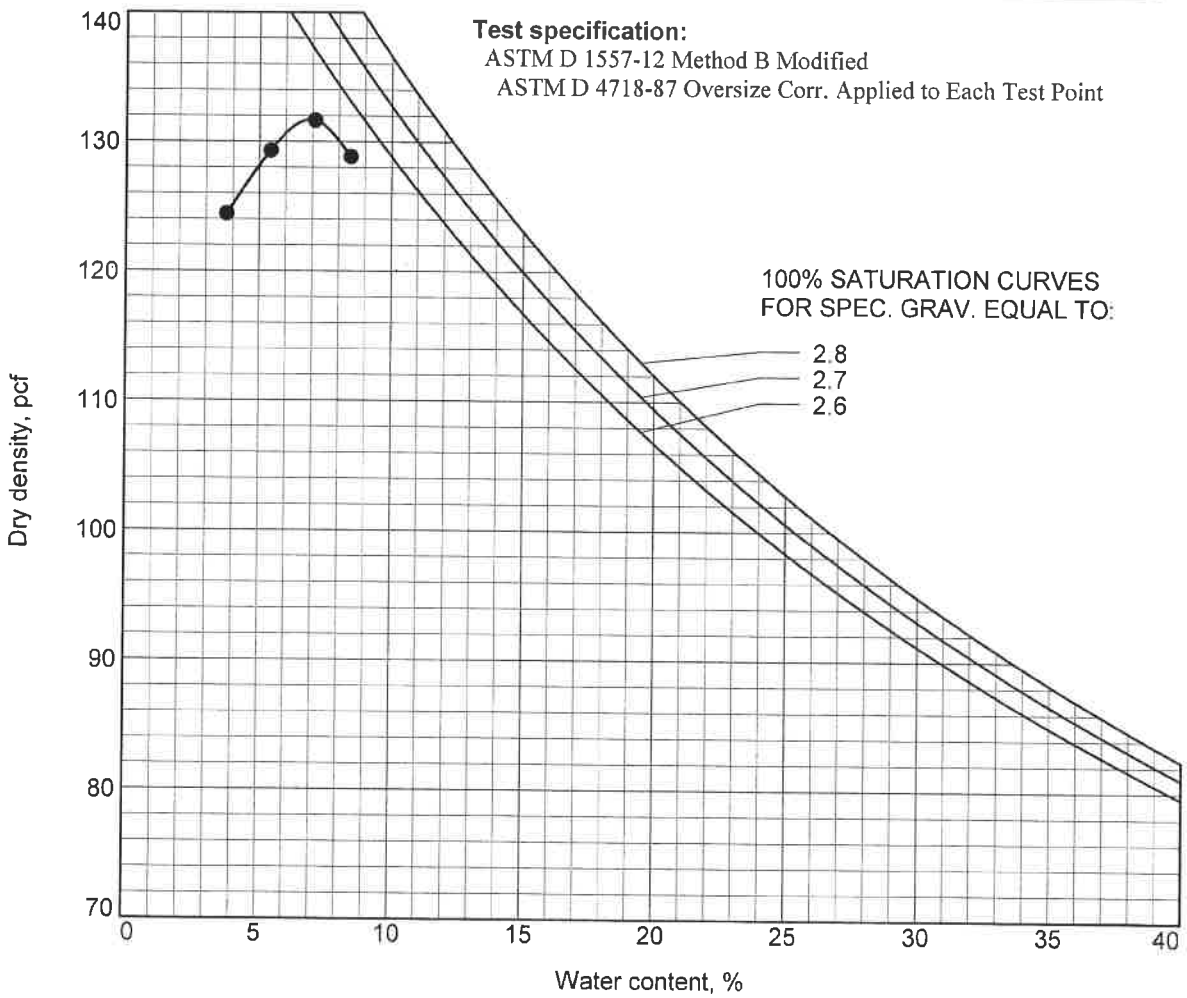



**Figure** 15-265-5

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Tested By:** T. FULLER

# COMPACTION TEST REPORT

**Curve No.: 15-265-7**

**Project No.:** 2015 MISC **Date:** 09/18/15
**Project:** USE TRENCH 13 GEOTECH
**Client:** SWIFT RIVER ENVIRONMENTAL SERVICES
**Location:** CONSOLIDATED PIT 4
**Sample Number:** 15-265-7
**Remarks:**

**MATERIAL DESCRIPTION**

**Description:**

**Classifications -** **USCS:** N/A **AASHTO:** N/A
**Nat. Moist. =** N/A % **Sp.G. =** 2.65
**Liquid Limit =** N/A **Plasticity Index =** N/A
**% < No.200 =** N/A %

| ROCK CORRECTED TEST RESULTS |
|---|
| Maximum dry density = 124.5 pcf |
| Optimum moisture = 6.0 % |

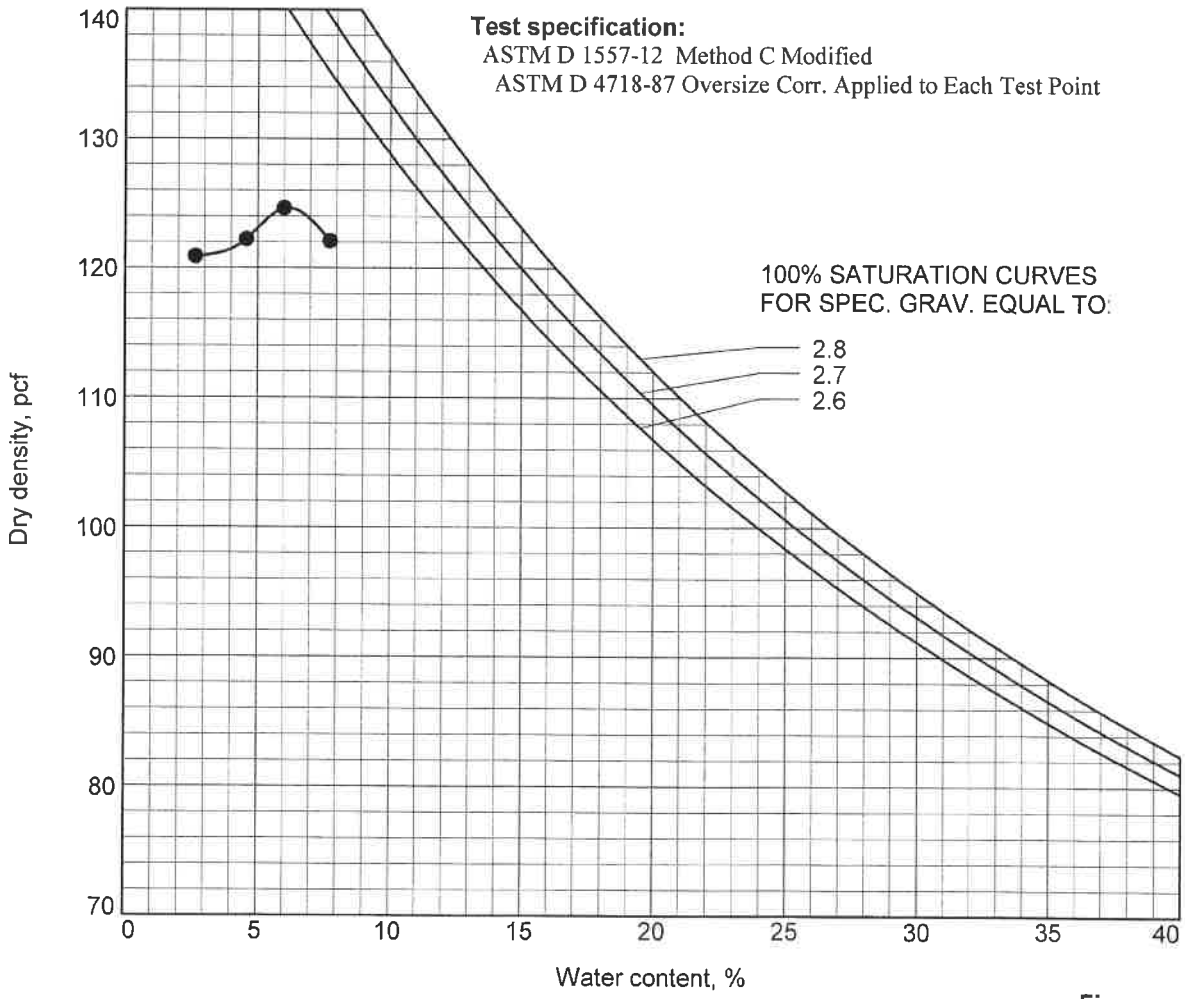
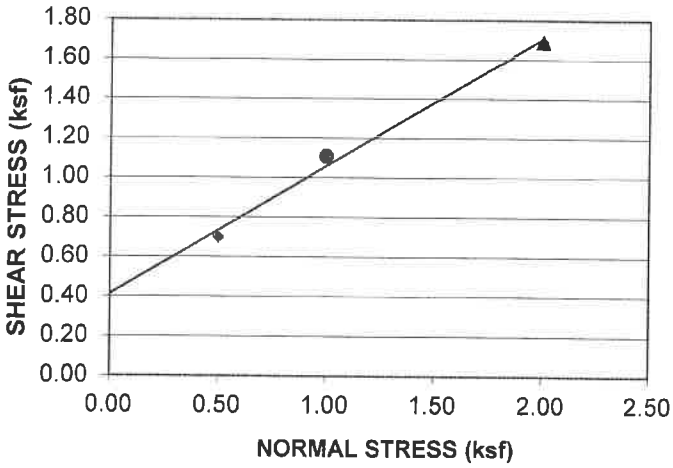



**Figure** 15-265-7

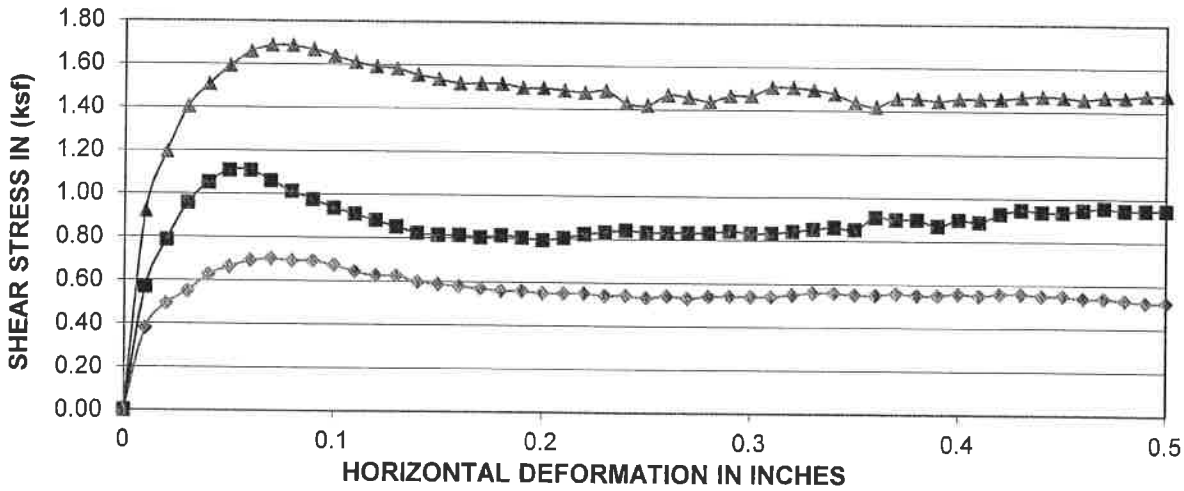
GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

**Tested By:** T. FULLER

# DIRECT SHEAR TEST




| | |
|---|---|
| STRENGTH INTERCEPT: | 0.41 KSF |
| FRICTION ANGLE (PHI) | 32.8 DEG. |




| SYMBOL | MOISTURE CONTENT % | DRY DENSITY (pcf) | NORMAL STRESS (ksf) | PEAK SHEAR (ksf) | RESIDUAL SHEAR (ksf) |
|---|---|---|---|---|---|
| —◆— 1.0 ksf | 6.3 | 117.4 | 0.50 | 0.70 | 0.52 |
| —■— 2.0 ksf | 6.3 | 117.7 | 1.00 | 1.11 | 0.95 |
| —▲— 4.0 ksf | 6.3 | 117.9 | 2.00 | 1.69 | 1.48 |

SAMPLED BY: CLIENT TESTED BY: A.S LAB NO: 15-265-1

SOIL DESCRIPTION: SAND DATE OF TEST: 9/17/2015

LOCATION OF SAMPLE: CONSOLIDATED PIT 1

REMARKS:

GES
GEOTECHNICAL & ENVIRONMENTAL SERVICES INC
(702) 365 1001
7150 PLACID STREET
LAS VEGAS, NV 89119

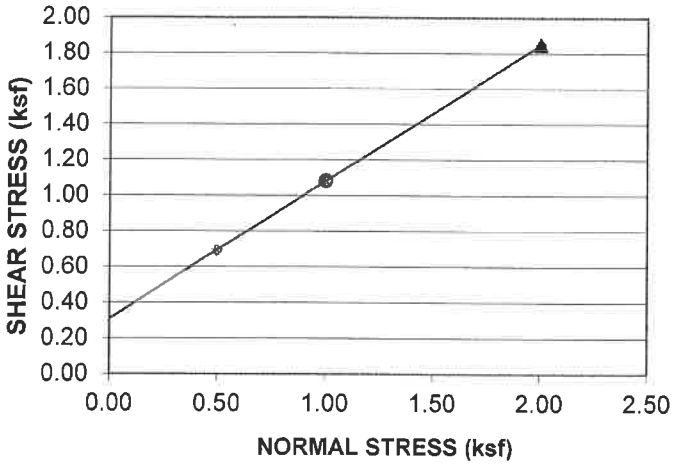
PROJECT NAME: USE TRENCH 13 GEOTECH

CLIENT NAME: SWIFT RIVER ENVIRONMENTAL SERVICES

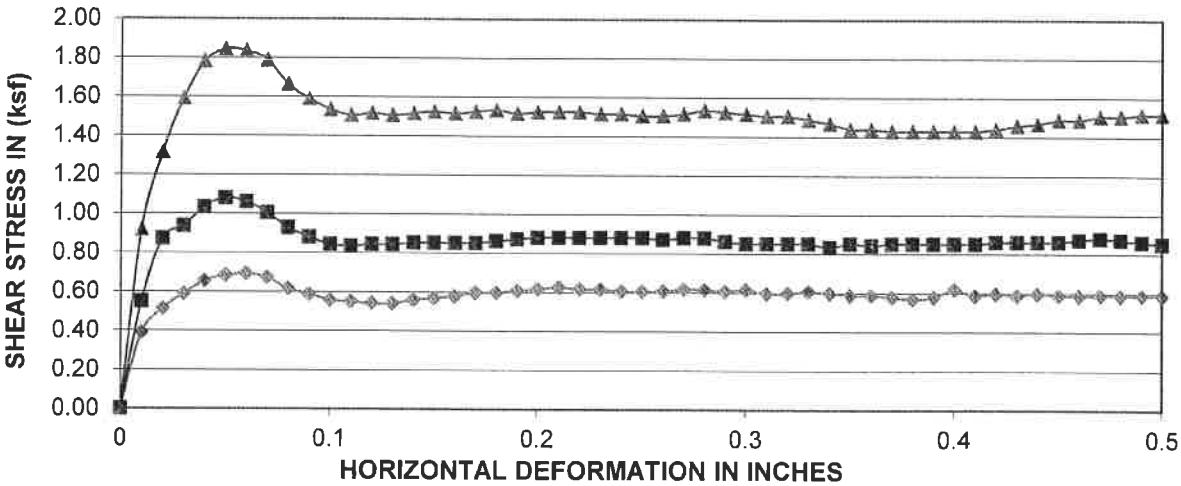
PROJECT NO. 2015MISC

Figure 15-265

# DIRECT SHEAR TEST




| | |
|---|---|
| STRENGTH INTERCEPT: | 0.31 KSF |
| FRICTION ANGLE (PHI) | 37.6 DEG. |




| SYMBOL | MOISTURE CONTENT % | DRY DENSITY (pcf) | NORMAL STRESS (ksf) | PEAK SHEAR (ksf) | RESIDUAL SHEAR (ksf) |
|---|---|---|---|---|---|
| 1.0 ksf | 7.5 | 116.2 | 0.50 | 0.69 | 0.59 |
| 2.0 ksf | 7.5 | 116.6 | 1.00 | 1.08 | 0.85 |
| 4.0 ksf | 7.5 | 116.3 | 2.00 | 1.85 | 1.52 |

SAMPLED BY: CLIENT TESTED BY: A.S LAB NO: 15-265-3

SOIL DESCRIPTION: SAND DATE OF TEST: 9/21/2015

LOCATION OF SAMPLE: CONSOLIDATED 2

REMARKS:

GES
GEOTECHNICAL & ENVIRONMENTAL SERVICES INC
(702) 365 1001
7150 PLACID STREET
LAS VEGAS, NV 89119

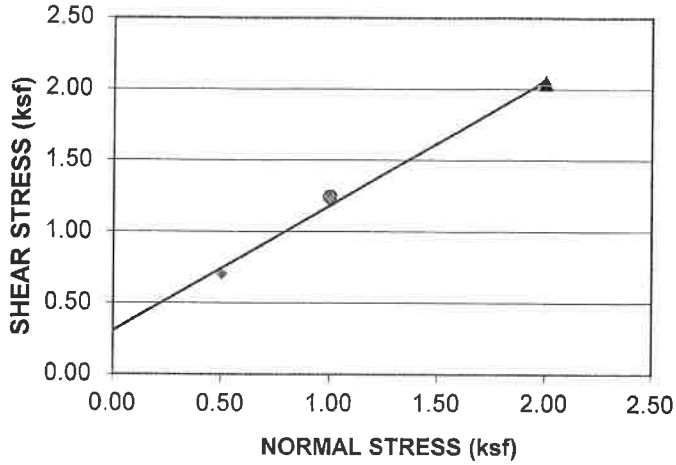
PROJECT NAME: USE TRENCH 13 GEOTECH

CLIENT NAME: SWIFT RIVER ENVIRONMENTAL SERVICES

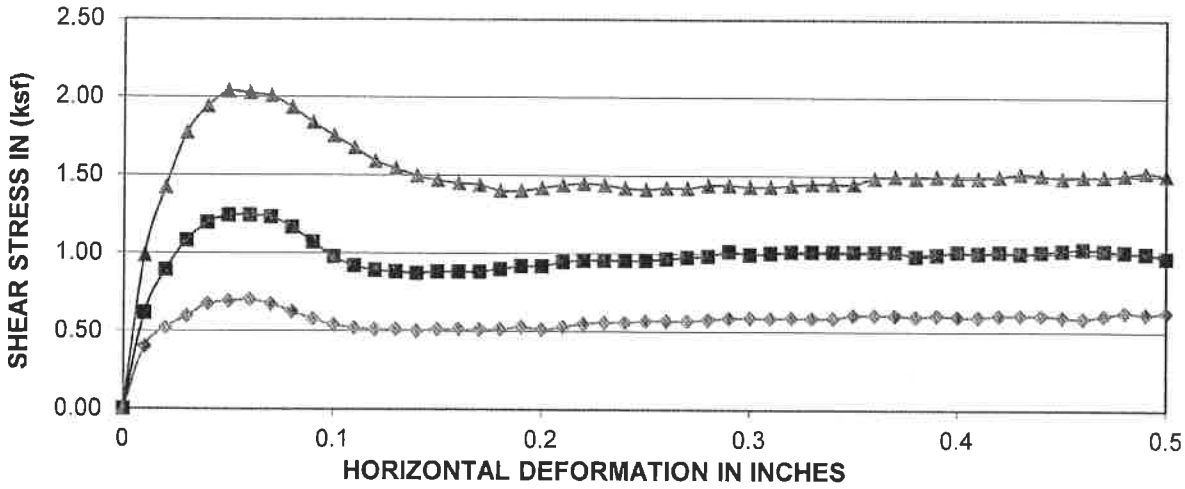
PROJECT NO. 2015 MISC

Figure 15-265

# DIRECT SHEAR TEST




| | |
|---|---|
| STRENGTH INTERCEPT: | 0.30 KSF |
| FRICTION ANGLE (PHI) | 41.2 DEG. |




| SYMBOL | MOISTURE CONTENT % | DRY DENSITY (pcf) | NORMAL STRESS (ksf) | PEAK SHEAR (ksf) | RESIDUAL SHEAR (ksf) |
|---|---|---|---|---|---|
| —◆— 1.0 ksf | 6.9 | 118.8 | 0.50 | 0.70 | 0.63 |
| —■— 2.0 ksf | 6.9 | 119.6 | 1.00 | 1.24 | 0.98 |
| —▲— 4.0 ksf | 6.9 | 120.1 | 2.00 | 2.04 | 1.51 |

SAMPLED BY: CLIENT TESTED BY: A.S LAB NO: 15-265-5

SOIL DESCRIPTION: SAND DATE OF TEST: 9/21/2015

LOCATION OF SAMPLE: CONSOLIDATED PIT 3

REMARKS:

GES
GEOTECHNICAL & ENVIRONMENTAL SERVICES INC
(702) 365 1001
7150 PLACID STREET
LAS VEGAS, NV 89119

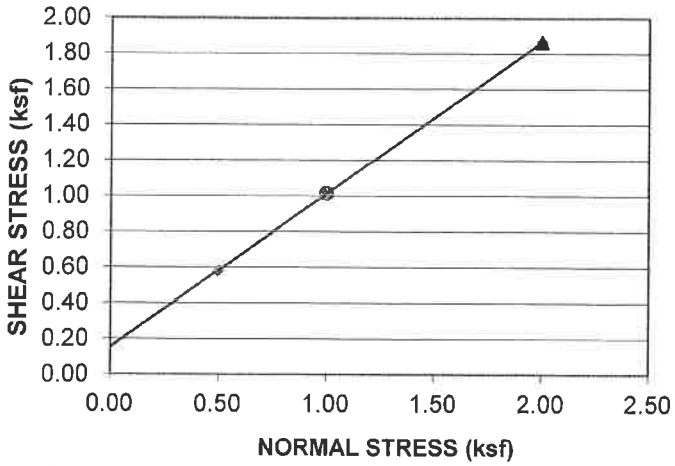
PROJECT NAME: USE TRENCH 13 GEOTECH

CLIENT NAME: SWIFT RIVER ENVIRONMENTAL SERVICES

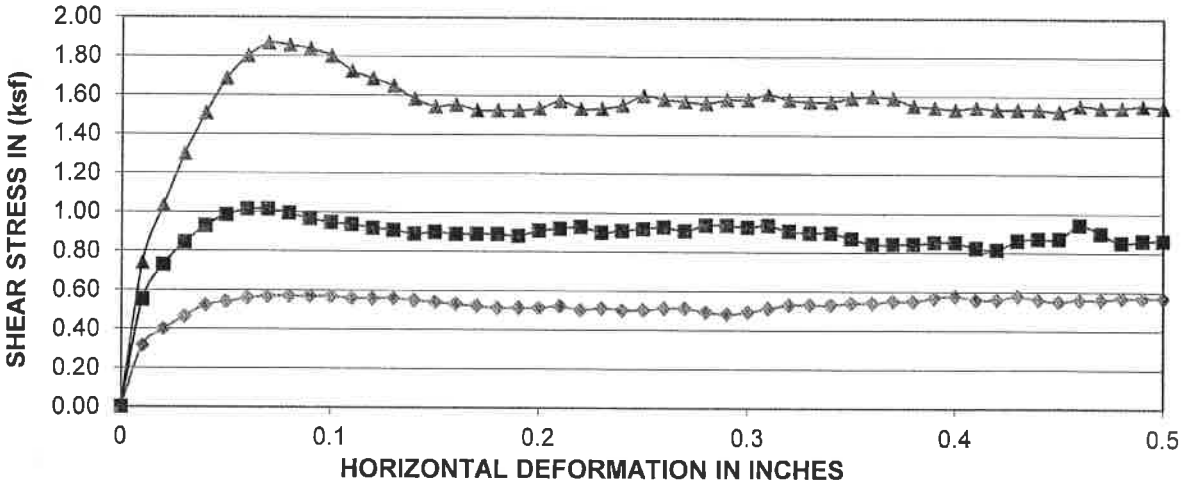
PROJECT NO. 2015 MISC

Figure 15-265

# DIRECT SHEAR TEST




| | |
|---|---|
| STRENGTH INTERCEPT: | 0.15 KSF |
| FRICTION ANGLE (PHI) | 40.6 DEG. |




| SYMBOL | MOISTURE CONTENT % | DRY DENSITY (pcf) | NORMAL STRESS (ksf) | PEAK SHEAR (ksf) | RESIDUAL SHEAR (ksf) |
|---|---|---|---|---|---|
| —◆— 1.0 ksf | 6.1 | 113.0 | 0.50 | 0.58 | 0.57 |
| —■— 2.0 ksf | 6.1 | 112.6 | 1.00 | 1.01 | 0.86 |
| —▲— 4.0 ksf | 6.1 | 113.6 | 2.00 | 1.87 | 1.54 |

SAMPLED BY: CLIENT TESTED BY: A.S LAB NO: 15-265-7

SOIL DESCRIPTION: SAND DATE OF TEST: 9/22/2015

LOCATION OF SAMPLE: CONSOLIDATED PIT 4

REMARKS:


GES

GEOTECHNICAL & ENVIRONMENTAL SERVICES INC
(702) 365 1001
7150 PLACID STREET
LAS VEGAS, NV 89119


PROJECT NAME: USE TRENCH 13 GEOTECK

CLIENT NAME: SWIFT RIVER ENVIRONMENTAL SERVICES

PROJECT NO. 2015 MISC

Figure 15-265