Kansas City, Board of Public Utilities 540 MINNESOTA AVENUE • KANSAS CITY, KANSAS 66101 • (913) 573-9000

December 6, 2011

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

Subject: ***Responses to recommendations contained in:*** **Coal Combustion Waste Impoundment Round 7 – Dam Assessment Report (Site #009), Nearman Creek Power Station, Coal Ash Pond Dike, Kansas City Board of Public Utilities, Kansas City, Kansas, Dewberry & Davis, LLC, April 2011**

Dear Mr. Hoffman:

Please accept this letter and the enclosed documents as responses from the Kansas City Board of Public Utilities (BPU) to the recommendations contained in the above referenced document. A copy of the recommendations has been enclosed as a reference. We have complied with each of the four recommendations.

1.2.1 Stability Analysis Report
Enclosed please find the following Report: "Geotechnical Exploration and Stability Analysis of the Nearman Creek Power Station Bottom Ash Pond Dike." AECOM Technical Services, Inc., November 2011. The lengthy stability anlysis report favorably concludes that the dike should withstand static and seismic forces.

1.2.2 Field Observations
The plug inside the 30" outlet pipe at the Bottom Ash Pond has been resealed and the drainage area will be inspected routinely to ensure tightness as part of the on-going surveillance program.

1.2.3 O&M
The dike slopes on the Bottom Ash Pond continue to be mowed twice per year as part of BPU's landscape contract. The condition of the vegetation will also be routinely inspected as part of the on-going surveillance program.

1.2.4 Surveillance
Enclosed is a copy of the Ash Pond Surveillance Program. The dike will be inspected at least quarterly for a variety of vegetation, erosion, and other issues.

Request for Status Upgrade to "Satisfactory"
BPU again reiterates that the safety of this community has never been threatened. The impoundment was well designed by a licensed Professional Engineer and has been maintained and operated safely for more than 30 years. **Therefore, having complied with recommendations in the inspection report, BPU requests the "Poor" rating for the Nearman Bottom Ash Pond be upgraded to "Satisfactory" as soon as possible.**

Thanks for your assistance. If you have any questions, please contact me by phone at (913) 573-9856 or email at *pcassidy@bpu.com.*

Sincerely,

Patrick J. Cassidy
Director, Environmental Services

PJC/pjc

C: D. Dorsey, J. Frick, P. Knefel, H. Nguyen, I. Setzler, D. Quach, F. Lutz (LD&B)

Enclosures: 1. Excerpts of recommendation from Dewberry Inspection Report
2. AECOM Stability Analysis Report
3. Ash Pond Surveillance Program

FINAL

Coal Combustion Waste Impoundment
Round 7 - Dam Assessment Report

Nearman Creek Power Station

Coal Ash Pond Dike
Kansas City Board of Public Utilities
Kansas City, Kansas

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

Dewberry & Davis, LLC
Fairfax, Virginia

Under Contract Number: EP-09W001727
April 2011

FINAL

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

Although observations made during the site visit do not indicate signs of overstress, significant settlement, shear failure, or other signs of instability, the structural stability cannot be evaluated without reviewing the results of engineering analyses of the slope stability factors of safety under various load conditions. It is recommended that if the original design analyses cannot be located, a new geotechnical engineering evaluation be conducted. The new geotechnical engineering evaluation should be based on current standards, including seismic loading conditions.

1.2.2 Recommendations Regarding the Field Observations

The leakage through the outlet should be investigated and the 30" pipe should either be removed or an alternate closure mechanism installed on the outlet pipe.

1.2.3 Recommendations Regarding the Maintenance and Methods of Operation

Although the maintenance program appears to be adequate, it is recommended that a vegetation control program be instituted. Regular mowing or spraying would improve periodic inspections as well as improve the ability to identify animal borrows or other potential problems.

1.2.4 Recommendations Regarding the Surveillance and Monitoring Program

It is recommended that a written surveillance program of the dike system be developed. Such a program will ensure regular inspections and possibly prevent deterioration of dike conditions.

AECOM Environment

Prepared for:
Lutz, Daily, & Brain, LLC
Overland Park, Kansas

Prepared by:
AECOM Technical Services, Inc.
Green Bay, WI
60198190
November 2011

Geotechnical Exploration and Stability Analysis of the Nearman Creek Power Station Bottom Ash Pond Dike

Kansas City Board of Public Utilities
Nearman Creek Power Station
Kansas City, Kansas

AECOM Environment

Prepared for:
Lutz, Daily, & Brain, LLC
Overland Park, Kansas

Prepared by:
AECOM Technical Services, Inc.
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November 2011

Geotechnical Exploration and Stability Analysis of the Nearman Creek Power Station Bottom Ash Pond Dike

Prepared By: John M. Trast, P.E.

Directed By: Kenneth J. Bergschultz, P.E.

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Executive Summary

The United States Environmental Protection Agency (US EPA) has embarked on an initiative to investigate the potential for catastrophic failure of surface impoundments and management units used for the storage and disposal of sluiced coal combustion products. The US EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of management units; note the extent of deterioration, status of maintenance, and need for repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification. The US EPA retained Dewberry & Davis, LLC (Dewberry) as their engineering contractor to perform the assessment of the Kansas City Board of Public Utilities (KC BPU) Nearman Creek Power Station Bottom Ash Pond.

The KC BPU Nearman Creek Power Station bottom ash pond was constructed in conjunction with Unit 1 of the power station. The pond was constructed by building perimeter dikes on the existing fluvial soils and lining the inside of the dikes with compacted low permeability soils. Construction of the pond was completed May 30, 1980, and permitted by the Kansas Department of Health & Environment (KDHE) on February 11, 1982. Dewberry reviewed documentation submitted to US EPA by KC BPU regarding the design, construction, operation and maintenance of the pond and performed an assessment into the status of the bottom ash pond dikes at the power station. The field inspection and assessment was completed by Dewberry on September 21, 2010. Their assessment report classifies the ash pond as SMALL in accordance with the United States Army Corp of Engineers, Guidelines for Safety Inspection Dams ER 1110-2106 and LOW HAZARD in accordance with Federal Emergency Management Agency Guidelines for Dam Safety dated April 2004. However, Dewberry and the US EPA concluded that although there were no observed structural defects on the embankments; there have never been any spills, unpermitted releases, or other performance problems with the embankments; daily observations of the embankments are performed; and maintenance of the embankments is performed to prevent and control erosion; the structural soundness of the management unit dikes was rated as POOR because of the lack of documentation of engineering analysis verifying design slope stability. In order to upgrade the rating from POOR to SATISFACTORY, KC BPU was requested to provide technical documentation regarding the structural stability of the ash pond dikes. No other recognized existing or potential management unit safety deficiencies were identified.

Lutz, Daily & Brain, LLC (LD&B) was retained by KC BPU to implement the work tasks required by the US EPA report. AECOM Technical Services, Inc. (AECOM) was retained by LD&B, to prepare the geotechnical stability analysis portion of these tasks. LD&B is the engineer of record for the KC BPU Nearman Creek Power Station and this report will become a part of their permanent record for the site. In order to obtain pertinent geotechnical information and to perform the stability analysis, LD&B contracted a local drilling subcontractor, Alpha Omega Geotech, Inc. (Alpha Omega) of Kansas City, Kansas, to implement a subsurface exploration program under the direction of AECOM. Field samples collected as part of the exploration program were provided to AECOM for laboratory analysis and testing. In addition, Alpha Omega assisted AECOM personnel in performing down-hole seismic testing to assess liquefaction potential.

Based on the results of the subsurface exploration and field and laboratory testing programs, stability analyses were performed and are presented in this report addressing end-of-construction, steady-state, earthquake, and rapid drawdown loading conditions. The result of the geotechnical stability analysis shows that the bottom ash pond dikes have adequate factor of safety under the steady state, rapid draw down, and seismic conditions modeled. In addition, the in-situ seismic testing and SPT N-Value correlation data show that the bottom ash pond dikes have adequate factor of safety against liquefaction.

Based on the information available in the permanent operating record, the geotechnical exploration, and field and laboratory testing completed in May 2011, it is our opinion that no further exploration or investigation is necessary at this time.

1.0 Introduction

The KC BPU Nearman Creek Power Station is located at 4240 North 55th Street in Kansas City, Kansas. Figure 1 - Site Location Diagram shows the location of the power plant. The facility has one 261 MW (nameplate capacity) wall-fired dry bottom boiler base load unit that burns low-sulfur Powder River Basin Coal. A second generating unit is an 86 MW (nameplate capacity), natural gas/fuel oil-fired simple cycle combustion turbine that provides peaking power. Unit 1 was commissioned in 1981. Fly ash generated by coal combustion is collected in electro-static precipitators and is dry handled for beneficial reuse or disposal. Bottom ash is collected from the bottom of the boiler and sluiced to a 6.6-acre bottom ash pond for storage and subsequent beneficial use or disposal. The bottom ash pond has an approximate storage capacity of 124 acre-feet. The pond is immediately north of the power station and shares a portion of the power stations ring dike and is adjacent to the Missouri River. The bottom ash pond is designed to accumulate and store bottom ash and allow for the recirculation of clean water from the clear water section of the pond. The pond was constructed by building a perimeter dike on the existing alluvial soils. Construction of the pond was completed May 30, 1980, and the unit was permitted by the KDHE on February 11, 1982.

Initiated by pending changes in the federal regulatory requirements related to ash storage ponds, an assessment was performed by the US EPA into the status of the ash pond at the KC BPU Nearman Creek Power Station. The US EPA assessment report requires various steps be taken to assure public safety and future integrity of the ash pond. Among the findings of the assessment report was that geotechnical stability analysis of the perimeter dikes was not available for the bottom ash pond. In order to maintain an adequate rating of the facility, a geotechnical stability analysis addressing short- and long-term stability of the pond has been prepared and is presented in this report.

LD&B was retained by KC BPU to implement the work tasks required by the US EPA report. AECOM was retained by LD&B, to prepare the geotechnical stability analysis portion of these tasks. LD&B is the engineer of record for the KC BPU Nearman Creek Power Station and this report will become a part of their permanent record for the site. In order to obtain pertinent geotechnical information and to perform the stability analysis, LD&B contracted a local drilling subcontractor, Alpha Omega Geotech, Inc. (Alpha Omega) of Kansas City, Kansas, to implement a subsurface exploration program under the direction of AECOM. Field samples collected as part of the exploration program were provided to AECOM for laboratory analysis and testing. In addition, Alpha Omega assisted AECOM personnel in performing down-hole seismic testing to assess liquefaction potential.

Based on the results of the subsurface exploration and field and laboratory testing programs, stability analyses were performed and are presented in this report addressing end-of-construction, steady-state, earthquake, and rapid drawdown loading conditions. This report contains the findings of the subsurface exploration, field and laboratory testing, and the stability analysis performed by AECOM.

2.0 Scope of Work

AECOM's authorized scope of work included the following to assess the ash pond:

- Review of existing documentation regarding the design and construction of the ash pond including historic soil boring information and operating records for the pond.

- Geotechnical exploration using conventional soil boring methods to collect representative samples of subsurface materials for visual classification and field and laboratory testing. The borings were completed using a combination of solid-stem augers and wash bore rotary drilling techniques using drilling fluid. Continuous soil samples were obtained using a split-barrel sampler or thin-wall Shelby tubes in general accordance with ASTM D 1586 Standard Practice for Standard Penetration Test and Split-Barrel Sampling of Soils or ASTM D 1587 Standard Practice for Thin-Walled Tube Sampling of Soils, respectively. An AECOM representative was on-site during the course of the drilling operations, laid out the boring locations, oversaw drilling operations, and preparation of field boring logs.

- Seismic testing to determine the shear wave velocity profile at two locations on site. One location was on top of the existing perimeter dike and one location was located at the perimeter toe of the dike. The shear wave velocity profile was determined using a single hole, downhole seismic technique in general accordance with ASTM D 7400 Standard Test Methods for Downhole Seismic Testing.

- Laboratory testing to determine the moisture content, unit dry density, index properties, and strength of selected samples of the material recovered from the soil borings.

- Engineering analysis of the retaining dikes including geotechnical stability analyses.

This report presents the results of the above scope of work and includes:

1. A summary of the results of the records review conducted for the bottom ash pond, presented in Section 3.

2. Results of the seismic testing including an explanation of the methodology and interpretation of the results in the context of field observations from the geotechnical exploration activities. The seismic testing is discussed in Section 4 of this report.

3. Results of the geotechnical exploration and field testing are discussed in Section 5 and the boring logs are presented in Appendix A.

4. The laboratory testing procedures and test results are discussed in Sections 6 and 7 and the laboratory test results are presented in Appendix B.

5. Methodology and results of the geotechnical stability analysis are discussed in Section 8.

3.0 Documentation Review and Exploration Program Development

AECOM reviewed the available geotechnical information from historic boring and laboratory test data near and around the bottom ash pond. LD&B provided logs for soil borings D2-74, 10-75, 52-75, 55-75, 56-75, 57-75, D-1, D-2, D-3, and D-4. Soil borings D2-74, 10-75, 52-75, 55-75, 56-75, and 57-75 are immediately adjacent to the bottom ash pond and were completed using hollow stem augers. Borings D-1, D-2, D-3, and D-4, are soil borings to bedrock around the power station and were completed using wash bore techniques. All of the borings were completed prior to construction of the bottom ash pond and the power station. The borings immediately adjacent to the pond dikes were performed using hollow-stem augers and the saturated granular soils below the water table were likely disturbed during sampling and drilling, leading to lower Standard Penetration Test (SPT) values. The borings completed using wash bore drilling (Boring D-1 to D-4) should have accurate Standard Penetration Test (SPT) N-values, although are not sufficient for conducting the stability analysis because of their proximity and location in comparison to the ash pond dikes. The foundation soils below and adjacent to the perimeter dikes were also expected to have consolidated and settled, gaining strength since completion of the dike. For these reasons, the SPT values are considered not representative of the strengths of the foundation soils in their present condition. Therefore, a geotechnical exploration program was developed to determine updated soil properties for geotechnical evaluation and stability analysis.

In developing the scope of work for the exploration program, AECOM reviewed field and laboratory test data collected as part of the construction quality assurance (CQA) and documentation program implemented during the construction of the bottom ash pond dikes in 1979 and 1980. In general, structural fill was placed, compacted, and tested in a controlled manner consistent with standard engineering practices for the construction of retainer dikes. The interior slopes and floor of the pond was lined with low-permeability soil that was placed, compacted, and tested in a manner consistent with standard engineering practices for the construction of compacted clay liners. CQA testing during construction included material property testing of the soils used in construction. Testing included compaction testing, moisture-density relationship testing using standard Proctor compaction effort, grain-size distribution, dry density, water content, Atterberg limits, and hydraulic conductivity.

Based on our review of the CQA data, AECOM proposed a geotechnical exploration program consisting of 5 soil borings extending to a depth of 55 feet. Figure 2 - Soil Boring location Diagram shows the location of the soil borings. The borings were to be advanced using a combination of solid-stem augers and wash bore rotary drilling using drilling fluid. Soil samples were obtained at 2.5-foot intervals to a depth of 30 feet and at 5-foot intervals thereafter to boring termination depth. SPT sampling was performed using a calibrated hammer. Three borings were completed from the top of the retainer dikes and two borings were located adjacent to the dikes along pre-selected cross-sections that were chosen based on geometry to be analyzed as part of the stability analysis. The cross-sections were chosen based on design and as-built geometry of the bottom ash pond. Down-hole seismic testing was completed at two locations, at the top of the dike in boring B-1 and at the toe of the dike in boring B-2. Laboratory testing consisted of water content, dry unit weight, calibrated pentrometer, grain-size distribution, and direct shear testing. If cohesive soils had been encountered, undisturbed soil samples would have been collected for triaxial shear and consolidation testing.

4.0 Seismic Testing

In order to assess liquefaction potential of the subsurface soils, shear wave downhole seismic (DHS) testing was performed in general accordance with ASTM D 4700 Standard Test Method for Downhole Seismic Testing. Velocity data were collected at 2 feet below ground surface and at 5-foot vertical intervals thereafter to the termination depth of the borings using a surface energy source. Shear wave testing was completed to depths of 49.7 and 49.8 feet below ground surface in borings B-1 and B-2, respectively. In order to collect shear wave velocity data, AECOM performed hammer strikes on a weighted steel beam oriented transverse to the borehole. This surface source provided a reversible input signal, which aids in discriminating between compression-wave energy and shear wave arrivals. For data collection and recording purposes, a triaxial downhole geophone was placed in the boreholes. Seismic signals were amplified and filtered using a Geometrics ES-3000 engineering seismograph controlled by a notebook computer via ethernet interface. Shear wave field records were digitally recorded and saved to computer disk for the interpretation phase of the project.

Quality control measures were employed in the field to ensure a clear, reversible shear-wave arrival. Initial interpretations were recorded in the field and subsequent higher precision arrival time picks were made during later analysis using software purpose-made for this task. Surface-to-receiver travel times were recorded and interval velocities were calculated for each test depth. Seismic raypath lengths were calculated to account for the horizontal offset of the steel beam used to generate the seismic energy. Reduction of the field data yielded calculated shear wave interval velocities for each borehole, which are presented in Tables 4.1 and 4.2 for borings B-1 and B-2, respectively.

4.1 Boring B-1 Seismic Testing

Boring B-1 is located on top of the bottom ash pond dike and was drilled to a depth of approximately 55 feet. Boring logs are provided in Appendix A. In general, the boring log indicates that the silty-clay berm material extends to a depth of about 20 feet, then native loose to medium dense silt or silty sand from about 20 to 25 feet, and then cleaner fine to medium sands from about 25 to 55 feet. The relatively density of these cleaner sands were in the medium dense to dense range.

The shear wave interval velocities ranged from 485 to 962 feet per second (fps). The highest measured velocity was observed on the top of the dike material where highly compacted surface material exists. Lower velocities (485 fps) were observed at the elevation of the base of the dike where native silts and sandy-silts were encountered. The shear wave velocities increased between depths of 30 to 40 feet where medium sands were encountered. The shear wave velocities below this depth were consistent with the native materials encountered above 30 feet. The calculated shear wave velocities are within a range that is consistent with the recorded SPT N-values.

Table 4.1 - Calculated Shear Wave Interval Velocities for Boring B-1

Geophone Depth (ft)	Offset (ft)	Raypath Distance (ft)	Traveltime (seconds)	Interval Velocity (ft/s)	Depth Interval
2	5	5.39	0.0056	962	0 to 2
5	5	7.07	0.0078	766	2 to 5
10	5	11.18	0.0131	775	5 to 10
15	5	15.81	0.0204	634	10 to 15
20	5	20.62	0.0303	485	15 to 20
25	5	25.50	0.038	634	20 to 25
30	5	30.41	0.0465	579	25 to 30
35	5	35.36	0.0526	810	30 to 35
40	5	40.31	0.0581	901	35 to 40
45	5	45.28	0.0658	645	40 to 45
49.8	5	50.05	0.0727	692	45 to 49.8

4.2 Boring B-2 Seismic Testing

Boring B-2 was located on the floodplain at the base of the dike and was also drilled to a depth of 55 feet. Boring logs are provided in Appendix A. In general, fluvial sands were encountered with some silty topsoil in the top few feet. The boring log indicates that native loose to medium dense silt or silty sand to about 6 feet below the ground surface, and then loose to medium dense cleaner fine to medium sands from about 6 to 55 feet.

Low shear wave velocities were observed in the top 5 feet and at a depth of approximately 25 feet where low SPT N-values (blow counts) were observed. The observed shear wave velocity in the sands varied from 438 to 885 fps. The calculated shear wave velocities are within a range that is consistent with the recorded SPT N-values.

Table 4.2 - Calculated Shear Wave Interval Velocities for Boring B-2

Geophone Depth (ft)	Offset (ft)	Raypath Distance (ft)	Traveltime (seconds)	Interval Velocity (ft/s)	Depth Interval
2	6.9	7.18	0.0196	367	0 to 2
5	6.9	8.52	0.0228	418	2 to 5
10	6.9	12.15	0.0269	885	5 to 10
15	6.9	16.51	0.0319	872	10 to 15
20	6.9	21.16	0.0381	749	15 to 20
25	6.9	25.93	0.049	438	20 to 25
30	6.9	30.78	0.0569	614	25 to 30
35	6.9	35.67	0.0626	858	30 to 35
40	6.9	40.59	0.0689	780	35 to 40
45	6.9	45.53	0.0751	796	40 to 45
49.7	6.9	50.18	0.0814	738	45 to 49.7

4.3 Seismic Test Results

Downhole seismic testing and analysis at two locations has yielded the following information:

- The shear-wave velocity of the perimeter dike soils was estimated to be in the range of 634 to 962 fps in boring B-1.
- The shear-wave velocity of the native silty soils at the base of the dike and ground surface, in boring B-1 and B-2, respectively, varied from 367 to 485 fps.
- The calculated shear wave velocity of the native fine to medium sands encountered below the base of the dike and below the surface soils varied from 438 to 901 fps.

Detailed subsurface information collected at these two boring locations is presented on the soil boring logs included in Appendix A.

5.0 Geotechnical Exploration

Alpha Omega Geotech, Inc., of Kansas City, Kansas, implemented the subsurface exploration program under the direction of AECOM. Field work was performed from April 27 through May 3, 2011. The AECOM field staff observed the exploration work, assisted with collection of soil samples for geotechnical testing, and completed field boring logs.

Soil borings were advanced using continuous solid-stem flight augers. Representative samples were obtained at near continuous intervals to a depth of 30 feet and at 5-foot intervals thereafter to the boring termination depths. The samples were obtained in general accordance with ASTM D 1586 - Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils. Following collection, soil specimens were classified in the field and the collected samples were containerized and returned to the AECOM soils laboratory for further classification and laboratory testing.

In total, five soil borings were performed across the project site for collection of representative soil specimens for field observation, classification, and laboratory analyses. Each of the borings was advanced to a nominal depth of 55 feet. Of these five locations, three of the borings were located at the crest of the ash pond containment dikes (boring B-1, B-3, and B-4). The remaining two borings (Borings B-2 and B-5) were located at the toe of the containment dikes. Please refer to the Soil Boring Location Diagram in Appendix A for the specific location of the borings.

The drill crew checked for the presence of obvious groundwater inflows or standing water in the boreholes while drilling and sampling. These observations and measurements are noted on the lower left-hand corner of the boring logs. The drill crew backfilled and abandoned the boreholes in accordance with the KDHE Amended Regulations, Article 30: Water Well Contractor’s License, Water Well Construction and Abandonment.

6.0 Laboratory Analytical Procedures

Multiple laboratory tests were performed on soil specimens collected during the geotechnical exploration, the laboratory test parameters and methods are listed below. Testing was conducted by AECOM geotechnical laboratory technicians in accordance with accepted engineering standards and practice. Our geotechnical laboratories are certified by multiple state and federal agencies to complete geotechnical testing in accordance with ASTM, United States Army Corp of Engineers, and State Departments of Transportation approved methods and standards.

6.1 Test Parameters and Methods

- Particle size analyses were performed in general accordance with ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils
- Moisture content measurements were performed in general accordance with ASTM D 2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- Direct Shear tests were performed in general accordance with ASTM D 3080 - Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions
- Unconfined compressive strengths of relatively undisturbed portions of cohesive soils were estimated using a calibrated penetrometer.
- An explanation of typical laboratory procedures is presented in Appendix B of this report.

7.0 Subsurface Conditions

7.1 Dike Fill Soils

All three of the dike borings encountered brownish gray silty clay soils extending from the top of the dike at an approximate elevation of 762.5 feet to depths of 20 to 23 feet. The dry unit weight of the dike material ranged from 90 to 115 pounds per cubic foot (pcf), with a corresponding range in moisture content of 15 to 22 percent. The consistency of the dike fill ranged from stiff to hard. The SPT N-Value of the fill ranged from 7 to 17 blows per foot.

7.2 Natural Deposits

The native materials below the dike fills ranged in texture from silts and clayey silts to cleaner sands and silty sands. The materials extended to the termination depth of the borings. The relative density of the granular deposits was typically in the loose to medium dense range and tended to have decreasing fines content with depth. Based on the direct shear testing, the silty sand and sand exhibited an angle of internal friction of 35 to 36 degrees.

7.3 Ground Water Conditions

Ground water level observations were made during and upon completion of drilling operations. At the time of drilling operations, the groundwater elevation at the site was approximately 728 feet. The groundwater level should be expected to vary annually and seasonally based on variations in surface water runoff, precipitation, and the water level of the Missouri River adjacent to the dikes. Groundwater levels around the pond could also be influenced by the water level within the pond.

8.0 Analysis and Recommendations

8.1 Geotechnical Stability Analysis

Based on the geometry of the bottom ash pond, AECOM selected two cross-sections for analysis. The pond dikes were evaluated using two sets of time-dependent soil strength parameters. Both effective stress analysis and total stress analysis were conducted to evaluate the pond dikes. Effective stress analysis parameters were used to model drained, long-term, steady-state loading conditions where excess pore water pressures have had time to dissipate. Total stress analysis parameters were used to model undrained, short-term loading conditions such as end of construction, rapid drawdown, and seismic events, where excess pore water pressures could develop in fine-grained soils and not have not had time to dissipate. Table 8.1 summarizes the effective and total stress soil strength parameters.

Table 8.1 - Soil Parameters Used For the Geotechnical Stability Analysis

Soil Type	Unit Weight	Effective Stress		Total Stress	
	pcf	c' (psf)	ϕ'	c (psf)	ϕ
Upper Dike Fill	110	0	24	2000	0
Lower Dike Fill	110	0	26	3000	0
Upper Silty Sand and Silt	100	0	30	500	0
Lower Natural Sand	120	0	35.5	0	35.5

The bottom ash pond was not designed to have operating levels above the perimeter dike. So, the bottom ash stored within the pond was assigned no strength parameters as a conservative approach to the analysis. The ash was modeled as water so that it applied weight and pressure but did not contribute any stabilizing resistance.

Three loading conditions were analyzed for each of the two cross-sections selected for analysis at the site. The cross-sections were generated at the boring locations so that an accurate soil model could be prepared. The loading conditions modeled are referred to as the steady state condition, the rapid draw down condition, and the seismic condition. The steady state conditions model the pond under their normal operating condition. The groundwater levels modeled are based on the design pond levels and the groundwater levels that were observed during our field exploration program. These cross-sections were analyzed for the effective stress and total stress conditions. The total stress conditions would be representative of the expected undrained soil strengths immediately after filling of the pond is completed. The effective stress condition is a representation of the drained, long-term strengths that can be expected over time. This would be the normal steady-state operating condition of the pond. The rapid draw down case is representative of the conditions that would occur immediately after a significant flood event. The groundwater levels may remain high for a period after the flood waters have dropped. It is important to evaluate the total stress and the effective stress strengths for this case as the water pressures, especially within the finer grained soils used in construction of the dikes, can be difficult to predict due to the rapid nature of the loading and drainage that occurs. The Seismic case also needs evaluation in a similar fashion, because it can be difficult to predict pore water conditions due to the rapid nature of the loading and drainage that occurs. The seismic condition analyzes what effect an earthquake would have on the stability of the pond. AECOM chose a maximum probable earthquake for the Nearman Creek Power Station site based on the 2008 United States Geological Survey National Seismic Hazard Maps, Peterson et.al (2008). The maximum probable earthquake has a peak ground acceleration of 0.04 g with a 2% Probability of Exceedance in 50 years. This event is typically the most severe event considered in normal engineering practice.

The computer model Slope W was used to analyze the stability of the dikes under the various loading conditions. The Morenstern-Price method of slices was used to analyze the stability of the slopes. Both circular and block-type failures were analyzed. The factor of safety is computed by summing the driving forces or moments and dividing by the sum of the resisting forces or moments. The desired factors of safety are based on the loading condition and normal engineering practice, for the steady state loading condition a safety factor of 1.5 or greater would generally be considered acceptable, for the rapid draw down condition a factor of safety of 1.2 or greater would generally be considered acceptable, and for the seismic event a safety factor of 1.2 or greater is generally considered acceptable. However, after any significant seismic or flooding event, a comprehensive inspection should be performed to evaluate the dikes and any necessary repairs implemented.

Table 8.2 summarizes the analyses that were completed and the resulting computed factors of safety. The computer outputs for each case analyzed are included in Appendix C.

Table 8.2 - Summary of Geotechnical Stability Analysis Runs

Run	Section	Effective Stress	Total Stress	Groundwater Condition			Slip Surface	Factor of Safety
				Condition	Interior Elevation	Exterior Elevation		
A1-1	A-A'	X		Steady State (static)	760	728	Block	1.5
A1-2	A-A'	X		Steady State (static)	760	728	Circular	1.7
A1-3	A-A'		X	Steady State (static)	760	728	Block	5.8
A1-4	A-A'		X	Steady State (static)	760	728	Circular	5.7
A2-1	A-A'		X	Rapid Drawdown	762.5	Ground Surface	Block	1.8
A2-2	A-A'		X	Rapid Drawdown	762.5	Ground Surface	Circular	3.6
A3-1	A-A'	X		Steady State (seismic)	760	728	Block	1.4
A3-2	A-A'	X		Steady State (seismic)	760	728	Circular	1.5
A3-3	A-A'		X	Steady State (seismic)	760	728	Block	5.1
A3-4	A-A'		X	Steady State (seismic)	760	728	Circular	5.0
B1-1	B-B'	X		Steady State (static)	760	728	Block	1.5
B1-2	B-B'	X		Steady State (static)	760	728	Circular	1.6
B1-3	B-B'		X	Steady State (static)	760	728	Block	4.0
B1-4	B-B'		X	Steady State (static)	760	728	Circular	4.5

B2-1	B-B'		X	Rapid Drawdown	762.5	Ground Surface	Block	1.6
B2-2	B-B'		X	Rapid Drawdown	762.5	Ground Surface	Circular	3.1
B3-1	B-B'	X		Steady State (seismic)	760	728	Block	1.2
B3-2	B-B'	X		Steady State (seismic)	760	728	Circular	1.4
B3-3	B-B'		X	Steady State (seismic)	760	728	Block	3.5
B3-4	B-B'		X	Steady State (seismic)	760	728	Circular	3.8

8.2 Liquefaction Assessment

In addition to applying the seismic loading condition in the stability analysis, it is necessary to evaluate the liquefaction potential for the soils underlying the ash pond. Liquefaction occurs in loose granular soils subjected to cyclic loading conditions such as an earthquake. It is a result of cyclic shearing of the soils which causes an increase in pore water pressure and a decrease in effective stress. If the duration and magnitude of the shaking is sufficient to raise the pore water pressure equal to the vertical stress in the soil (effective stress decreases to zero), the soil effectively loses all strength, liquefies, and acts like a heavy-fluid or quick sand.

The liquefaction analysis was performed based on the SPT N-Value correlations published by Idriss and Boulanger (2008) in the Earthquake Engineering Research Institute Monograph. In addition, the liquefaction potential of the foundation soils were analyzed based on the shear wave velocity profile using the procedures recommended in Youd, et.al. (2001). Both analyses indicate the safety factor against liquefaction is greater than 2.0 in most cases with a minimum factor of safety of 1.5 in a few isolated locations. The factor of safety against liquefaction was calculated as the ration of the cyclic stress ratio (CSR) using the simplified procedures proposed by Idriss and Boulanger compares by the cyclic resistance ratio (CRR) calculated using the criteria presented in the above references. The liquefaction calculations are included in Appendix D.

8.3 Recommendations

The Nearman Creek Power Station bottom ash pond dikes were constructed in conjunction with Unit 1 of the power station. The pond was constructed by building perimeter dikes on the existing alluvial soils and lining the inside of the dikes with compacted low-permeability clay soils. Construction of the pond was completed May 30, 1980, and permitted by the KDHE on February 11, 1982. The US EPA performed an assessment of the status of the ash pond at the KC BPU Nearman Creek Power Station and requested that a geotechnical stability analysis of bottom ash pond dikes be performed to address short- and long-term stability of the pond.

After reviewing construction documentation and subsurface investigation data from the permanent operating record of the site, AECOM recommended an exploration program, along with field and laboratory testing to determine pertinent soil properties for geotechnical stability analysis and liquefaction assessment. The result of the geotechnical stability analysis shows that the bottom ash pond has adequate factor of safety under the steady state, rapid draw down, and seismic conditions modeled. In addition, the in-situ seismic testing and SPT N-Value correlation data show that the bottom ash pond has adequate factor of safety against liquefaction. Based on the information available in the permanent operating record, the geotechnical exploration, and field and laboratory testing completed in May 2011, no further exploration or investigation is necessary at this time.

9.0 General Qualifications

This report has been prepared in general accordance with normally accepted geotechnical engineering practices to aid in the evaluation of this site for our Client. We have prepared this report for the purpose intended by our Client, and reliance on its contents by anyone other than our Client is done at the sole risk of the user. No other warranty, either expressed or implied, is made. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects relevant to the geotechnical characteristics. In the event that any changes in the design or location of the facilities as outlined in this report are planned, we should be informed so that the changes can be reviewed and the conclusions of this report modified, as necessary, in writing by the geotechnical engineer.

The analysis and recommendations submitted in this report are based on the data obtained from the soil borings performed at the locations indicated on the location diagram and from the information discussed in this report. This report does not reflect any variations which may occur between the borings. In the performance of subsurface explorations, specific information is obtained at specific locations at specific times. However, it is a well-known fact that variations in soil and rock conditions exist on most sites between boring locations and that seasonal and annual fluctuations in groundwater levels will likely occur.

10.0 References

ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils

ASTM D 1586 Standard Practice for Standard Penetration Test and Split-Barrel Sampling of Soils

ASTM D 1587 Standard Practice for Thin-Walled Tube Sampling of Soils,

ASTM D 2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 3080 - Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions

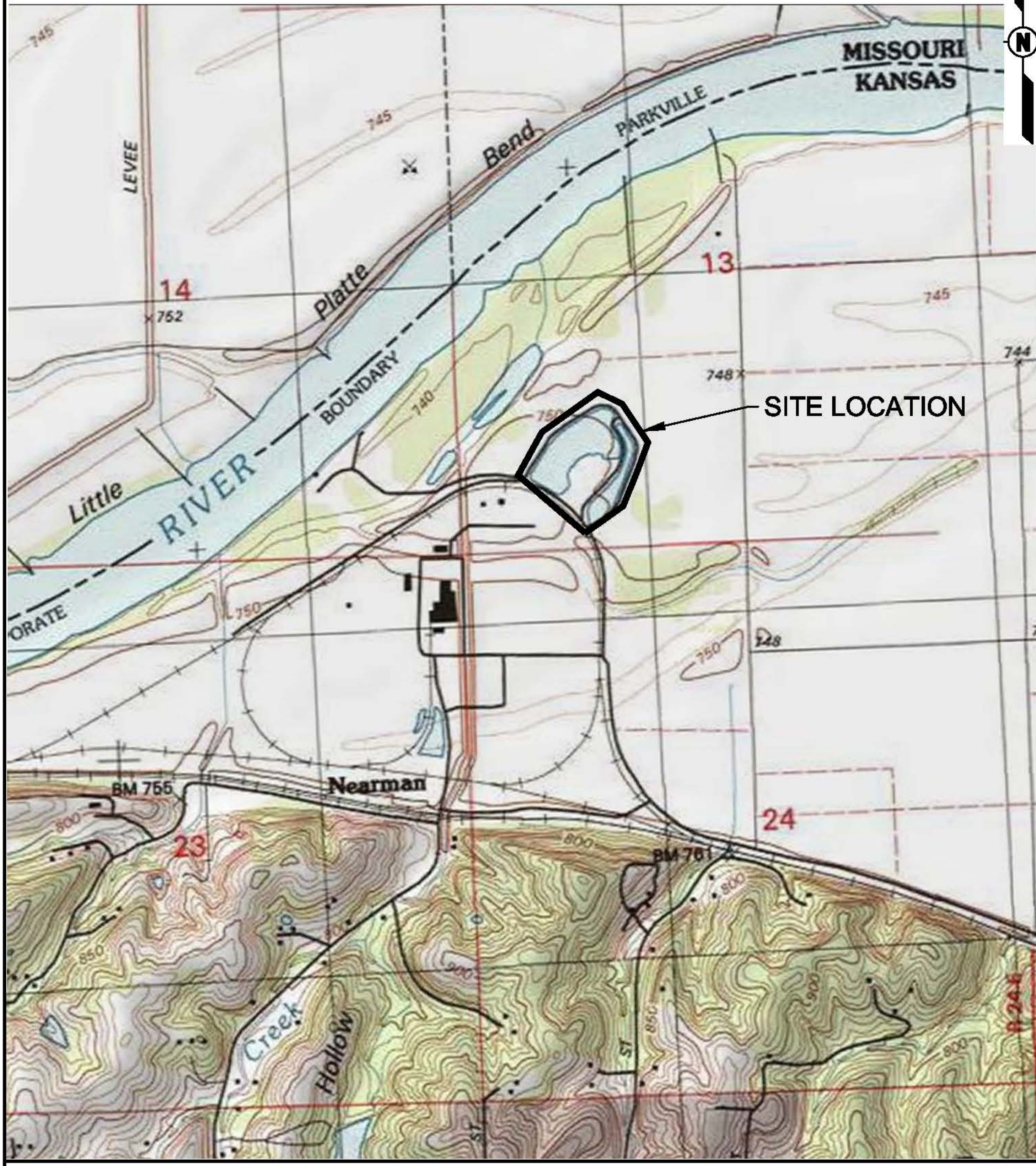
ASTM D 7400 Standard Test Methods for Downhole Seismic Testing

Idriss, I.M. and R.W. Boulanger. (2008). “Soil liquefaction during earthquake”. Earthquake Engineering Research Institute, EERI Publication MNO-12.

Petersen, M.D., A.D. Frankel, S.C. Harmsen, C.S. Mueller, K.M. Haller, R.L. Wheeler, R.L. Wesson, Y. Zeng, O.S. Boyd, D.M. Perkins, N. Luco, E.H. Field, C.J. Wills, and K.S. Rukstales. (2008). Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008–1128, 61 p.

Youd T.L., I.M. Idriss, R.D. Andrus, I. Arango, G. Castro, J.T. Christian, R. Dobry, W.D.L. Finn, L.F. Harder Jr., M.E. Hynes, K. Ishihara, J.P. Koester, S.S.C. Liao, W.F. Marcuson III, G.R. Martin, J.K. Mitchell, Y. Moriwaki, M.S. Power, P.K. Robertson, R.B. Seed, and K.H. Stokoe II. (2001). “Liquefaction resistance of soils summary report from the 1996 NCEER and 1998 NCEER/NSF workshops on evaluation of liquefaction resistance of soils.” *Journal of Geotechnical and Geoenvironmental Engineering,* ASCE, 127(10), 817-833.

MAP SOURCE: MODIFIED FROM PARKVILLE, KANSAS.
U.S.G.S. QUADRANGLES.



SITE LOCATION DIAGRAM

BOTTOM ASH PONDS
KANSAS CITY BOARD OF PUBLIC UTILITES
KANSAS CITY, KANSAS

AECOM

1035 Kepler Drive
Green Bay, WI 54311
920.468.1978
www.aecom.com

Drawn :	DTB	8/3/2011
Checked:	JMT	8/3/2011
Approved:	JMT	8/3/2011
PROJECT NUMBER	60198190	
FIGURE NUMBER	1	

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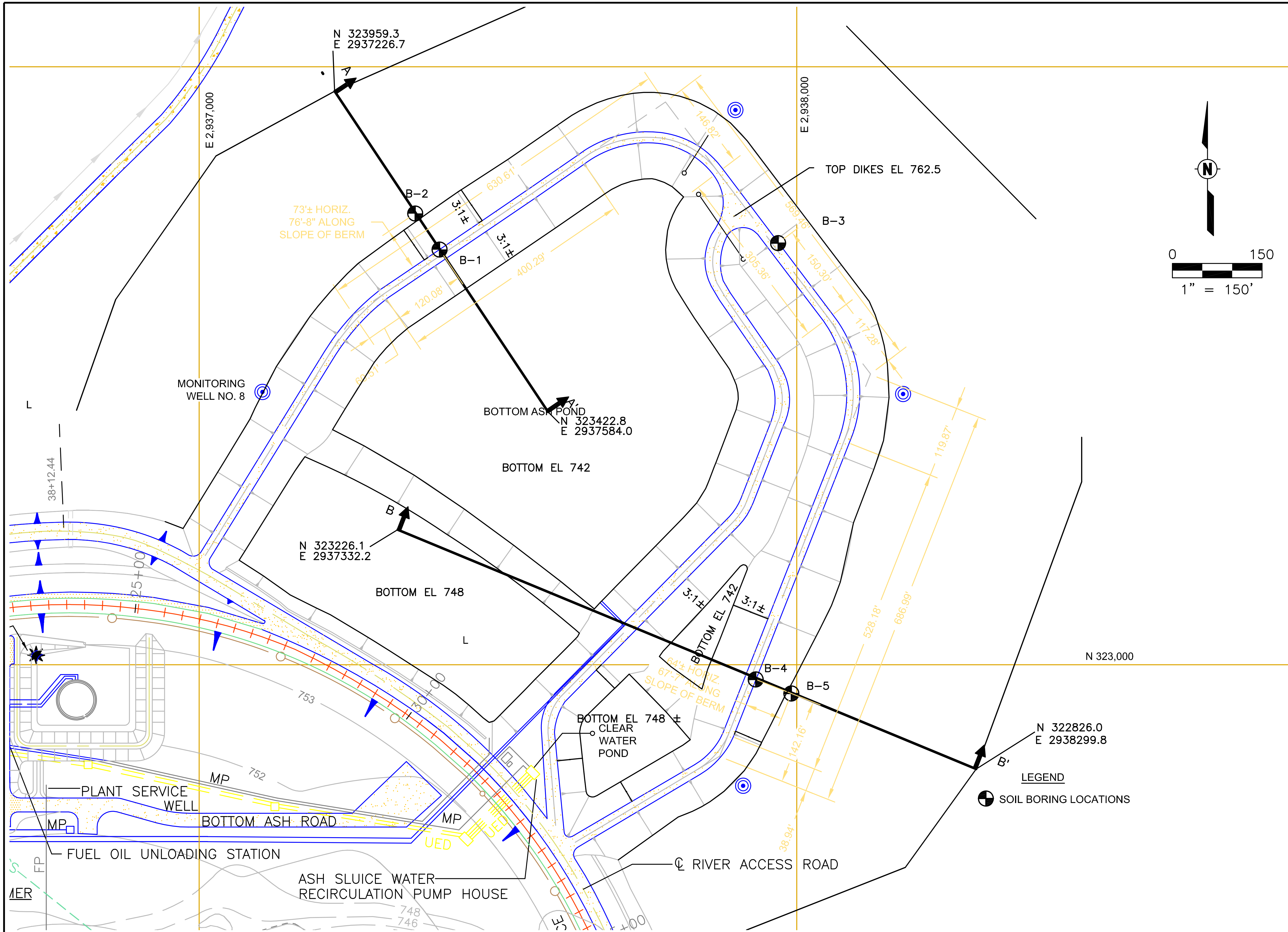

AECOM

1035 Kepler Drive
Green Bay, Wisconsin 54311
920.468.1978
www.aecom.com

BORING LOCATION MAP

BOTTOM ASH PONDS
KANSAS CITY BOARD OF PUBLIC UTILITIES
KANSAS CITY, KANSAS

Drawn :	DTB	6/30/2011
Checked:	JMT	6/30/2011
Approved:	JMT	6/30/2011

PROJECT NUMBER 60198190

FIGURE NUMBER 2

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Appendix A

Geotechnical Exploration

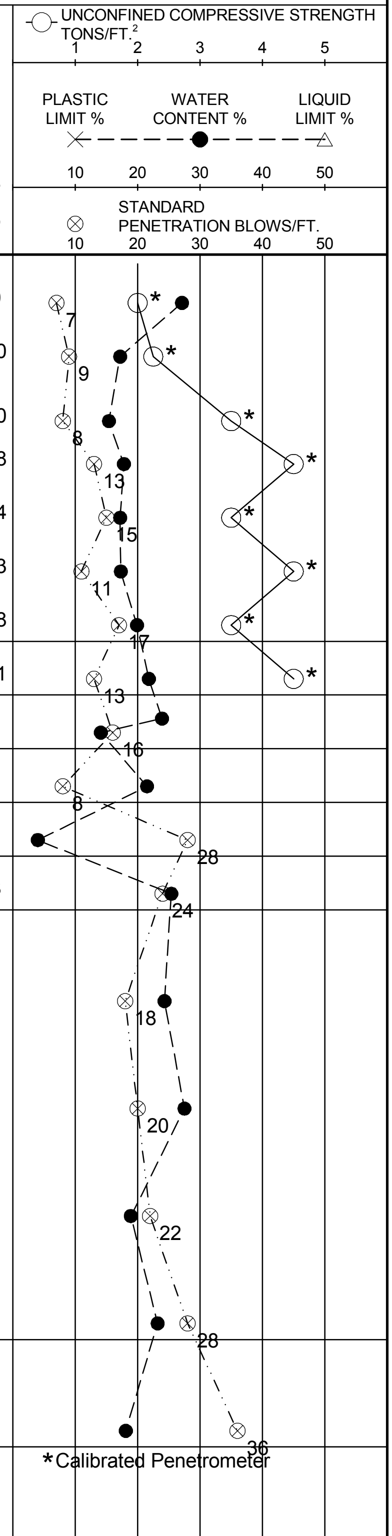
Boring Logs

AECOM	CLIENT: **Kansas City Board of Public Utilities**	LOG OF BORING NUMBER **B-1**
	PROJECT NAME: **Nearman Creek Power Station**	ARCHITECT/ENGINEER: **Lutz, Daily & Brain, LLC**

SITE LOCATION
Bottom Ash Pond

SURFACE ELEVATION: +762.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS. / Ft.^{3}
	1	SS	Fill: Grayish brown to dark grayish brown silty clay (CL), with a trace to little fine sand and a trace of fine gravel, thin silt seams below 10.5 feet - moist - very stiff to hard	90.0
5.0	2	SS		109.0
	3	SS		112.0
10.0	4	SS		109.8
	5	SS		111.4
15.0	6	SS		115.3
	7	SS	18.0	108.8
20.0	8	SS	Fill: Dark gray brown silty clay (CL) with a trace of silt seams, some silty fine sand - moist - hard (20.5)	105.1
	9	0 SS	Light brown silty fine sand (SM) and light grayish brown silt (ML) - moist - medium dense (23.0)	
25.0	10	SS	Brown silt (ML) with brown fine sand - moist - loose (25.5)	
	11	SS	Brown fine sand (SP-SM) trace silt - moist - medium dense (28.0)	
30.0	12	SS	Grayish brown silt (ML) with fine to medium sand (SP) - moist - medium dense (30.5)	97.8
			Brown fine to coarse sand (SP-SM to SP) trace silt (becoming grayish brown below 40 ft.) - saturated - medium dense	
35.0	13	SS		
40.0	14	SS		
45.0	15	SS		
50.0	16	SS	50.5	
			Brown fine to coarse sand (SP) with gray silty clay - moist - dense	
55.0	17	SS	55.5	
55.5			End of Boring. Boring advanced to 55.5 feet with solid-stem auger Boring backfilled with 3/8" chipped bentonite	



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL 34.0 ft WD	BORING STARTED 4/28/11	AECOM OFFICE **1035 Kepler Drive Green Bay, Wisconsin 54311**	
WL	BORING COMPLETED 4/28/11	ENTERED BY CAH	SHEET NO. 1 OF 1
WL	RIG/FOREMAN /Alpha Geotech/ALS	APP'D BY JXT	AECOM JOB NO. 60198190

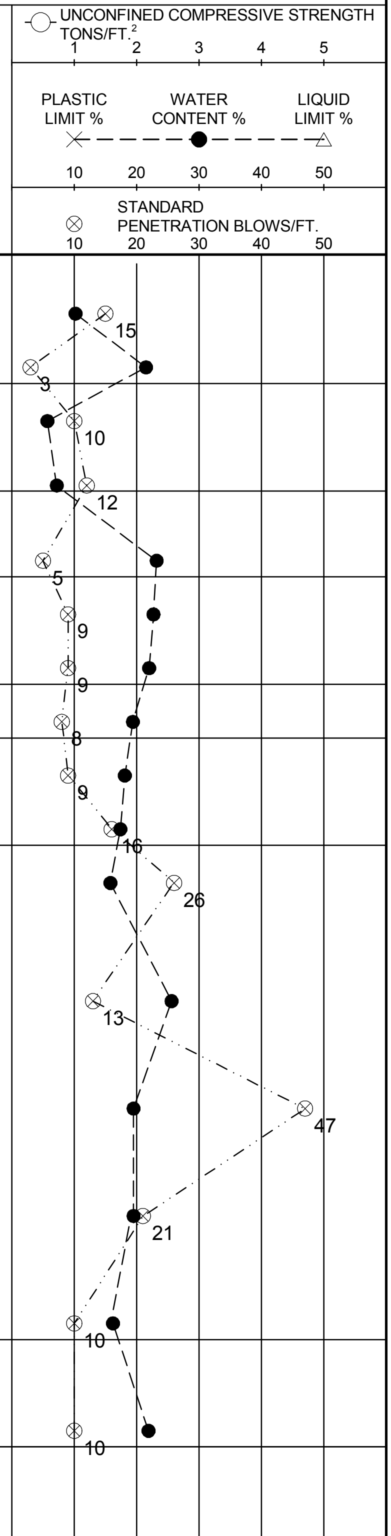
STS060701 60198190.GPJ STS.GDT 7/7/11

AECOM

CLIENT	**Kansas City Board of Public Utilities**
LOG OF BORING NUMBER	**B-2**
PROJECT NAME	**Nearman Creek Power Station**
ARCHITECT/ENGINEER	**Lutz, Daily & Brain, LLC**
SITE LOCATION	**Bottom Ash Pond**

SURFACE ELEVATION: +743.8

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
	1	SS	Grayish brown silty fine sand (SM) with grayish brown silt (ML) - moist - medium dense to very loose	15
5.0	2	SS		3
6.0				
	3	SS	Brown fine sand (SP) - moist - medium dense	10
10.0	4	SS		12
11.0				
			Brown silty fine sand (SM) - moist - loose	
15.0	6	SS		5
	7	SS	Brown fine to coarse sand (SP), trace silt - moist - loose	9
20.0	8	SS		9
	9	SS	Grayish brown fine to medium sand (SP-SM), trace silt - wet - loose	8
22.5				
25.0	10	SS	Brown fine to medium sand (SP), trace silt - moist - loose to medium dense	9
	11	SS		16
27.5				
30.0	12	SS	Gray brown fine to coarse sand (SP to SP-SM), trace silt - moist - dense to medium dense	26
35.0	13	SS		13
40.0	14	SS		47
45.0	15	SS		21
50.0	16	SS		10
50.5				
55.0	17	SS	Grayish brown fine to coarse sand (SP), trace silt - moist - medium dense	10
55.5				
55.5			End of Boring Boring advanced to 55.5 feet with solid-stem auger Boring backfilled with 3/8" chipped bentonite	



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL 16.0 ft WD	BORING STARTED 5/2/11	AECOM OFFICE	1035 Kepler Drive, Green Bay, Wisconsin 54311
WL	BORING COMPLETED 5/2/11	ENTERED BY CAH	SHEET NO. 1 OF 1
WL	RIG/FOREMAN /Alpha Geotech/ALS	APP'D BY JXT	AECOM JOB NO. 60198190

STS060701 60198190.GPJ STS.GDT 7/7/11

AECOM	CLIENT: **Kansas City Board of Public Utilities**	LOG OF BORING NUMBER **B-3**
	PROJECT NAME: **Nearman Creek Power Station**	ARCHITECT/ENGINEER: **Lutz, Daily & Brain, LLC**

SITE LOCATION: **Bottom Ash Pond**

SURFACE ELEVATION: +762.5

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} (1, 2, 3, 4, 5) — PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % (10, 20, 30, 40, 50) — STANDARD PENETRATION BLOWS/FT. (10, 20, 30, 40, 50)

DESCRIPTION OF MATERIAL

Depth (ft)	Description of Material
0.0 – 15.5	Fill: Dark grayish brown silty clay (CL), with trace sand and silt seams - moist - hard to very stiff
15.5 – 23.0	Fill: Dark grayish brown silty clay to clayey silt (CL-ML), trace silt seams - moist - medium dense
23.0 – 25.5	Brown silt (ML) with silty very fine sand (SM) - moist - medium dense
25.5 – 35.5	Brown fine sand (SP) - wet - medium dense
35.5 – 40.5	Brown fine to coarse sand (SP) - moist - dense
40.5 – 45.5	Grayish brown fine sand (SP-SM), trace silt - moist - dense
45.5 – 55.5	Brown to grayish brown fine to coarse sand (SP) - wet - medium dense to dense (SP)
55.5	End of Boring Boring advanced to 55.5 feet with solid-stem auger Boring backfilled with 3/8" chipped bentonite

Sample No.	Sample Type	Unit Dry Wt. (lbs./ft.^{3})	Standard Penetration Blows/Ft.
1	SS	97.9	15
2	SS	93.5	11
3	SS	97.1	11
4	SS	101.4	12
5	SS	95.8	12
6	SS	105.1	14
7	SS	102.8	23
8	SS	91.9	18
9	SS	96.6	18
10	SS	111.0	11
11	SS		17
12	SS		20
13	SS		16
14	SS		39
15	SS		30
16	SS		17
17	SS		35

*Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

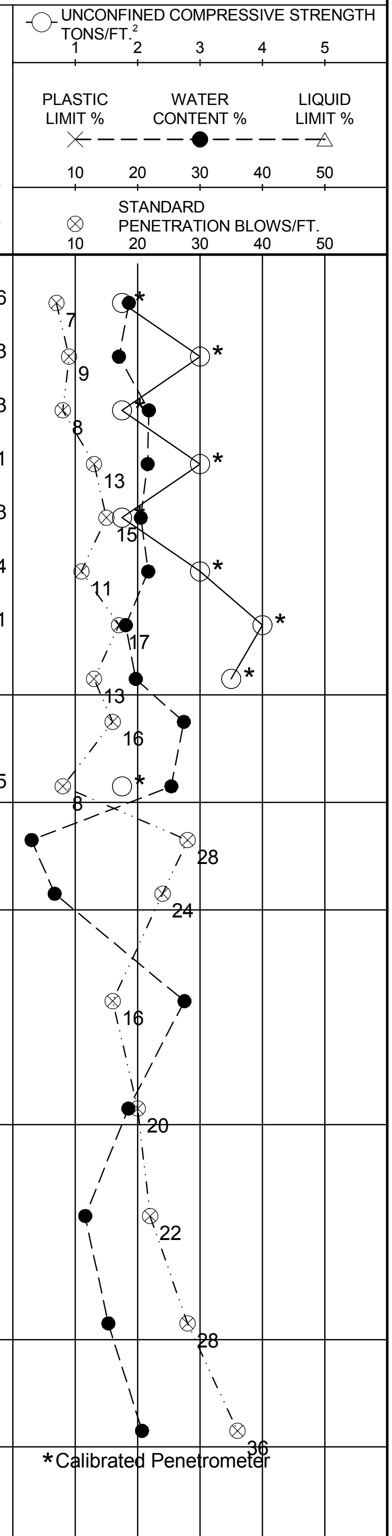
WL 34.0 ft WD	BORING STARTED 4/28/11	AECOM OFFICE	1035 Kepler Drive Green Bay, Wisconsin 54311
WL	BORING COMPLETED 4/28/11	ENTERED BY CAH	SHEET NO. 1 OF 1
WL	RIG/FOREMAN /Alpha Geotech/ALS	APP'D BY JXT	AECOM JOB NO. 60198190

AECOM	CLIENT **Kansas City Board of Public Utilities**	LOG OF BORING NUMBER **B-4**
	PROJECT NAME **Nearman Creek Power Station**	ARCHITECT/ENGINEER **Lutz, Daily & Brain, LLC**

SITE LOCATION
Bottom Ash Pond

SURFACE ELEVATION: +762.5

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS. / Ft.^{3}
		1	SS	Fill: Dark grayish brown to grayish brown silty clay (CL to CL-ML), trace to some sand, trace silt seams - moist - stiff to hard	109.6
5.0		2	SS		108.3
		3	SS		113.3
10.0		4	SS		103.1
		5	SS		103.3
15.0		6	SS		101.4
		7	SS		106.1
20.0		8	SS	20.5	
		9	SS	Grayish brown to brown silt (ML) with some fine sand, trace clay - moist - medium dense to loose	
25.0		10	SS	25.5	114.5
		11	SS	Brown fine sand (SP) - moist - medium dense	
30.0		12	SS	30.5	
				Brown fine to medium sand (SP) - wet - medium dense	
35.0		13	SS		
40.0		14	SS	40.5	
				Brown fine to coarse sand (SP), trace gravel - moist - medium dense	
45.0		15	SS		
50.0		16	SS	50.5	
				Grayish brown fine to medium sand (SP) - moist - dense	
55.0		17	SS	55.5	
55.5				End of Boring Boring advanced to 55.5 feet with solid-stem auger Boring backfilled with 3/8" chipped bentonite	



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	BORING STARTED **4/27/11**	AECOM OFFICE	**1035 Kepler Drive Green Bay, Wisconsin 54311**
WL	BORING COMPLETED **4/27/11**	ENTERED BY **CAH**	SHEET NO. **1** OF **1**
WL	RIG/FOREMAN **/Alpha Geotech/ALS**	APP'D BY **JXT**	AECOM JOB NO. **60198190**

STS060701 60198190.GPJ STS.GDT 7/7/11

AECOM	CLIENT: **Kansas City Board of Public Utilities**	LOG OF BORING NUMBER **B-5**
	PROJECT NAME: **Nearman Creek Power Station**	ARCHITECT/ENGINEER: **Lutz, Daily & Brain, LLC**

SITE LOCATION
Bottom Ash Pond

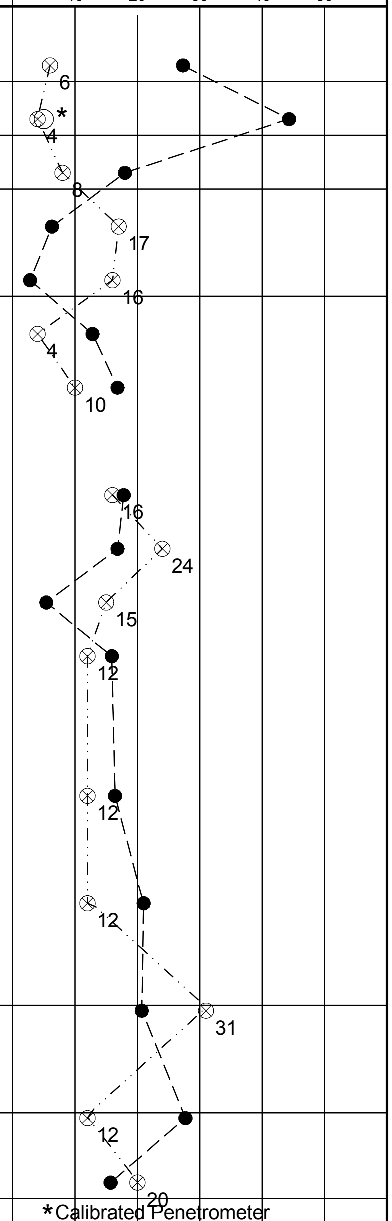
UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION: +743.0

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS. / Ft.^{3}
		1	SS			Possible Fill: Dark brown silt (ML) with some fine sand - moist - loose (to 3.5)	
5.0		2	SS			Possible Fill: Dark brown silty clay (CL), trace sand and silt seams - moist - soft (to 6.0)	
		3	SS			Brown silty fine sand (SM) - moist - loose (to 8.5)	
10.0		4	SS			Brown fine sand (SP to SP-SM), trace silt and medium sand - moist - medium dense	
		5	SS			(to 13.5)	
15.0		6	SS			Brown fine to coarse sand (SP), trace silt and gravel, becoming grayish brown below 31 feet - moist - loose to medium dense	
		7	SS				
20.0		8	SS				
		9	SS				
25.0		10	SS				
		11	SS				
30.0		12	SS				
35.0		13	SS				
40.0		14	SS				
45.0		15	SS			(to 46.5) Dark gray to black fine to coarse sand (SP-SM), trace silt and clay - moist - dense to medium dense	
50.0		16	SS			(to 51.5) Grayish brown fine to coarse sand (SP), trace gravel - moist - medium dense	
55.0		17	SS			(to 55.5)	
55.5						End of Boring Boring advanced to 55.5 feet with solid-stem auger Boring backfilled with 3/8" chipped bentonite	



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	BORING STARTED 5/3/11	AECOM OFFICE	**1035 Kepler Drive Green Bay, Wisconsin 54311**
WL	BORING COMPLETED 5/3/11	ENTERED BY **CAH**	SHEET NO. **1** OF **1**
WL	RIG/FOREMAN **/Alpha Geotech/ALS**	APP'D BY **JXT**	AECOM JOB NO. **60198190**

STS060701 60198190.GPJ STS.GDT 7/7/11

AECOM

AECOM General Notes

Drilling and Sampling Symbols:

SS : Split Spoon - 1-3/8" I.D. 2" O.D. (Unless otherwise noted)	HS : Hollow Stem Auger
ST : Shelby Tube-2" O.D. (Unless otherwise noted)	WS : Wash Sample
PA : Power Auger	FT : Fish Tail
DB : Diamond Bit-NX, BX, AX	RB : Rock Bit
AS : Auger Sample	BS : Bulk Sample
JS : Jar Sample	PM : Pressuremeter Test
VS : Vane Shear	GS : Giddings Sampler
OS : Osterberg Sampler	

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

Water Level Measurement Symbols:

WL : Water Level	WCI : Wet Cave In
WS : While Sampling	DCI : Dry Cave In
WD : While Drilling	BCR : Before Casing Removal
AB : After Boring	ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the boring at the time indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations must be sought.

Gradation Description and Terminology:

Coarse grained or granular soils have more than 50% of their dry weight retained on a #200 sieve; they are described as boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as clay or clayey silt if they are cohesive and silt if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

Major Component of Sample	Size Range	Description of Other Components Present in Sample	Percent Dry Weight
Boulders	Over 8 in. (200 mm)	Trace	1-9
Cobbles	8 inches to 3 inches (200 mm to 75 mm)	Little	10-19
Gravel	3 inches to #4 sieve (75 mm to 4.76 mm)	Some	20-34
Sand	#4 to #200 sieve (4.76 mm to 0.074 mm)	And	35-50
Silt	Passing #200 sieve (0.074 mm to 0.005 mm)		
Clay	Smaller than 0.005 mm		

Consistency of Cohesive Soils: / Relative Density of Granular Soils:

Unconfined Compressive Strength, Qu, tsf	Consistency	N-Blows per foot	Relative Density
<0.25	Very Soft	0 - 3	Very Loose
0.25 - 0.49	Soft	4 - 9	Loose
0.50 - 0.99	Medium (firm)	10 - 29	Medium Dense
1.00 - 1.99	Stiff	30 - 49	Dense
2.00 - 3.99	Very Stiff	50 - 80	Very Dense
4.00 - 8.00	Hard	>80	Extremely Dense
>8.00	Very Hard		

AECOM Field and Laboratory Procedures

Field Sampling Procedures

Auger Sampling (AS)

In this procedure, soil samples are collected from cuttings off of the auger flights as they are removed from the ground. Such samples provide a general indication of subsurface conditions; however, they do not provide undisturbed samples, nor do they provide samples from discrete depths.

Split-Barrel Sampling (SS) - (ASTM Standard D-1586-99)

In the split-barrel sampling procedure, a 2-inch O.D. split barrel sampler is driven into the soil a distance of 18 inches by means of a 140-pound hammer falling 30 inches. The value of the Standard Penetration Resistance is obtained by counting the number of blows of the hammer over the final 12 inches of driving. This value provides a qualitative indication of the in-place relative density of cohesionless soils. The indication is qualitative only, however, since many factors can significantly affect the Standard Penetration Resistance Value, and direct correlation of results obtained by drill crews using different rigs, drilling procedures, and hammer-rod-spoon assemblies should not be made. A portion of the recovered sample is placed in a sample jar and returned to the laboratory for further analysis and testing.

Shelby Tube Sampling Procedure (ST) - ASTM Standard D-1587-94

In the Shelby tube sampling procedure, a thin-walled steel seamless tube with a sharp cutting edge is pushed hydraulically into the soil and a relatively undisturbed sample is obtained. This procedure is generally employed in cohesive soils. The tubes are identified, sealed and carefully handled in the field to avoid excessive disturbance and are returned to the laboratory for extrusion and further analysis and testing.

Giddings Sampler (GS)

This type of sampling device consists of 5-foot sections of thin-wall tubing which are capable of retrieving continuous columns of soil in 5-foot maximum increments. Because of a continuous slot in the sampling tubes, the sampler allows field determination of stratification boundaries and containerization of soil samples from any sampling depth within the 5-foot interval.

AECOM

AECOM Field and Laboratory Procedures

Subsurface Exploration Procedures

Hand-Auger Drilling (HA)

In this procedure, a sampling device is driven into the soil by repeated blows of a sledge hammer or a drop hammer. When the sampler is driven to the desired sample depth, the soil sample is retrieved. The hole is then advanced by manually turning the hand auger until the next sampling depth increment is reached. The hand auger drilling between sampling intervals also helps to clean and enlarge the borehole in preparation for obtaining the next sample.

Power Auger Drilling (PA)

In this type of drilling procedure, continuous flight augers are used to advance the boreholes. They are turned and hydraulically advanced by a truck, trailer or track-mounted unit as site accessibility dictates. In auger drilling, casing and drilling mud are not required to maintain open boreholes.

Hollow Stem Auger Drilling (HS)

In this drilling procedure, continuous flight augers having open stems are used to advance the boreholes. The open stem allows the sampling tool to be used without removing the augers from the borehole. Hollow stem augers thus provide support to the sides of the borehole during the sampling operations.

Rotary Drilling (RB)

In employing rotary drilling methods, various cutting bits are used to advance the boreholes. In this process, surface casing and/or drilling fluids are used to maintain open boreholes.

Diamond Core Drilling (DB)

Diamond core drilling is used to sample cemented formations. In this procedure, a double tube (or triple tube) core barrel with a diamond bit cuts an annular space around a cylindrical prism of the material sampled. The sample is retrieved by a catcher just above the bit. Samples recovered by this procedure are placed in sturdy containers in sequential order.

AECOM Laboratory Procedures

Water Content (Wc)

The water content of a soil is the ratio of the weight of water in a given soil mass to the weight of the dry soil. Water content is generally expressed as a percentage.

Hand Penetrometer (Qp)

In the hand penetrometer test, the unconfined compressive strength of a soil is determined, to a maximum value of 4.5 tons per square foot (tsf) or 7.0 tsf depending on the testing device utilized, by measuring the resistance of the soil sample to penetration by a small, spring-calibrated cylinder. The hand penetrometer test has been carefully correlated with unconfined compressive strength tests, and thereby provides a useful and a relatively simple testing procedure in which soil strength can be quickly and easily estimated.

Unconfined Compression Tests (Qu)

In the unconfined compression strength test, an undisturbed prism of soil is loaded axially until failure or until 20% strain has been reached, whichever occurs first.

Dry Density (γd)

The dry density is a measure of the amount of solids in a unit volume of soil. Use of this value is often made when measuring the degree of compaction of a soil.

Classification of Samples

In conjunction with the sample testing program, all soil samples are examined in our laboratory and visually classified on the basis of their texture and plasticity in accordance with the AECOM Soil Classification System which is described on a separate sheet. The soil descriptions on the boring logs are derived from this system as well as the component gradation terminology, consistency of cohesive soils and relative density of granular soils as described on a separate sheet entitled "AECOM General Notes". The estimated group symbols included in parentheses following the soil descriptions on the boring logs are in general conformance with the Unified Soil Classification System (USCS) which serves as the basis of the AECOM Soil Classification System.

AECOM Standard Boring Log Procedures

In the process of obtaining and testing samples and preparing this report, standard procedures are followed regarding field logs, laboratory data sheets and samples.

Field logs are prepared during performance of the drilling and sampling operations and are intended to essentially portray field occurrences, sampling locations and procedures.

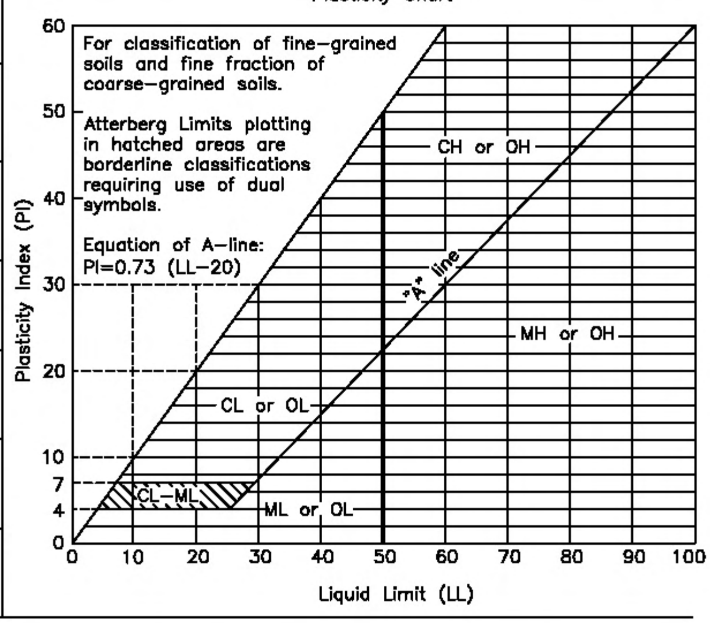
Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory by experienced geotechnical engineers, and as such, differences between the field logs and the final logs may exist. The engineer preparing the report reviews the field logs, laboratory test data and classifications, and using judgment and experience in interpreting this data, may make further changes. It is common practice in the geotechnical engineering profession not to include field logs and laboratory data sheets in engineering reports, because they do not represent the engineer's final opinions as to appropriate descriptions for conditions encountered in the exploration and testing work. Results of laboratory tests are generally shown on the boring logs or are described in the text of the report, as appropriate.

Samples taken in the field, some of which are later subjected to laboratory tests, are retained in our laboratory for sixty days and are then discarded unless special disposition is requested by our client. Samples retained over a long period of time, even in sealed jars, are subject to moisture loss which changes the apparent strength of cohesive soil, generally increasing the strength from what was originally encountered in the field. Since they are then no longer representative of the moisture conditions initially encountered, observers of these samples should recognize this factor.

AECOM Soil Classification System [1]

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is ***larger*** than No. 200 sieve size)	Gravel (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravel (Little or no fines)	GW	Well-graded, gravel, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent . . . . . . GW, GP, SW, SP; More than 12 percent . . . . . GM, GC, SM, SC; 5 to 12 percent . . . . . Borderline cases ***requiring*** dual symbols [3]	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3	
			GP	Poorly graded gravel, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravel with fines (Appreciable amount of fines)	GM	Silty gravel, gravel-sand-silt mixtures		Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols
			GC	Clayey gravel, gravel-sand-clay mixtures		Atterberg limits above "A" line or PI greater than 7	
	Sand (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sand (Little or no fines)	SW	Well-graded sand, gravelly sand, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3	
			SP	Poorly graded sand, gravelly sand, little or no fines		Not meeting all gradation requirements for SW	
		Sand with fines (Appreciable amount of fines)	SM	Silty sand, sand-silt mixtures		Atterberg limits below "A" line or PI less than 4	Limits plotting in hatched zone with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols
			SC	Clayey sand, sand-clay mixtures		Atterberg limits above "A" line or PI greater than 7	
Fine-grained soils (More than half of material is ***smaller*** than No. 200 sieve size)	Silt and clay (Liquid limit less than 50)		ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity			
			CL	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay			
			OL	Organic silt and organic silty clay of low plasticity			
	Silt and clay (Liquid limit greater than 50)		MH	Inorganic silt, micaceous or diatomaceous fine sandy or silty soils, elastic silt			
			CH	Inorganic clay of high plasticity, fat clay			
			OH	Organic clay of medium to high plasticity, organic silt			
	Highly organic soils		PT	Peat and other highly organic soil			

Plasticity Chart [2]



1. See AECOM General Notes for component gradation terminology, consistency of cohesive soils and relative density of granular soils.
2. Reference: Unified Soil Classification Systems
3. Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

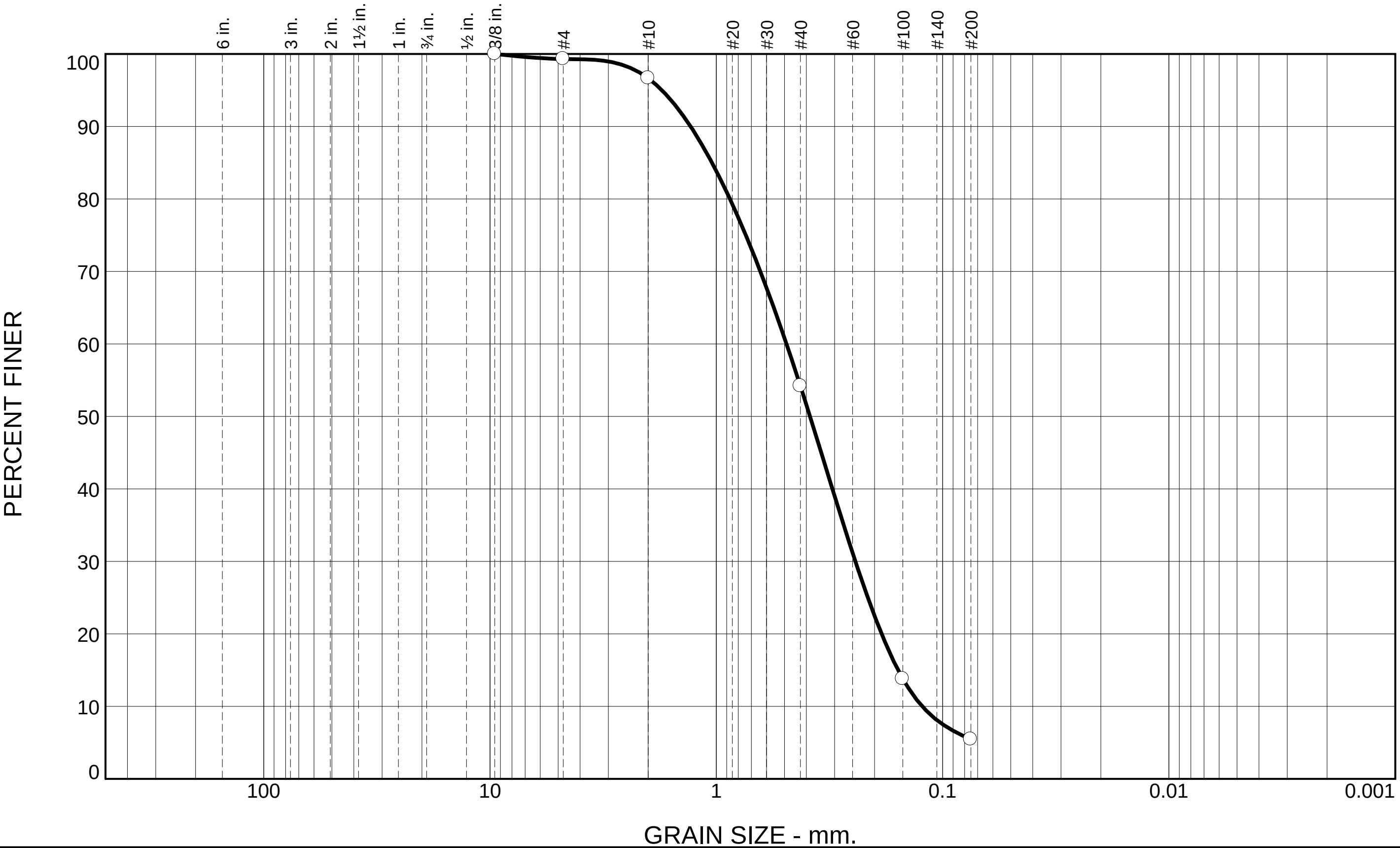
Appendix B

Geotechnical Laboratory Testing

Particle Size Distribution Reports

Direct Shear Test Reports

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.7	2.6	42.5	48.8	5.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.3		
#10	96.7		
#40	54.2		
#100	13.8		
#200	5.4		

* (no specification provided)

Material Description

BROWN FINE TO MEDIUM SAND, TRACE SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.2987 D_{85}= 1.0453 D_{60}= 0.4898
D_{50}= 0.3855 D_{30}= 0.2429 D_{15}= 0.1574
D_{10}= 0.1232 C_u= 3.98 C_c= 0.98

Classification

USCS= AASHTO=

Remarks

Sample Number: B-2 S-10 **Depth:** 23.5'-25.0'

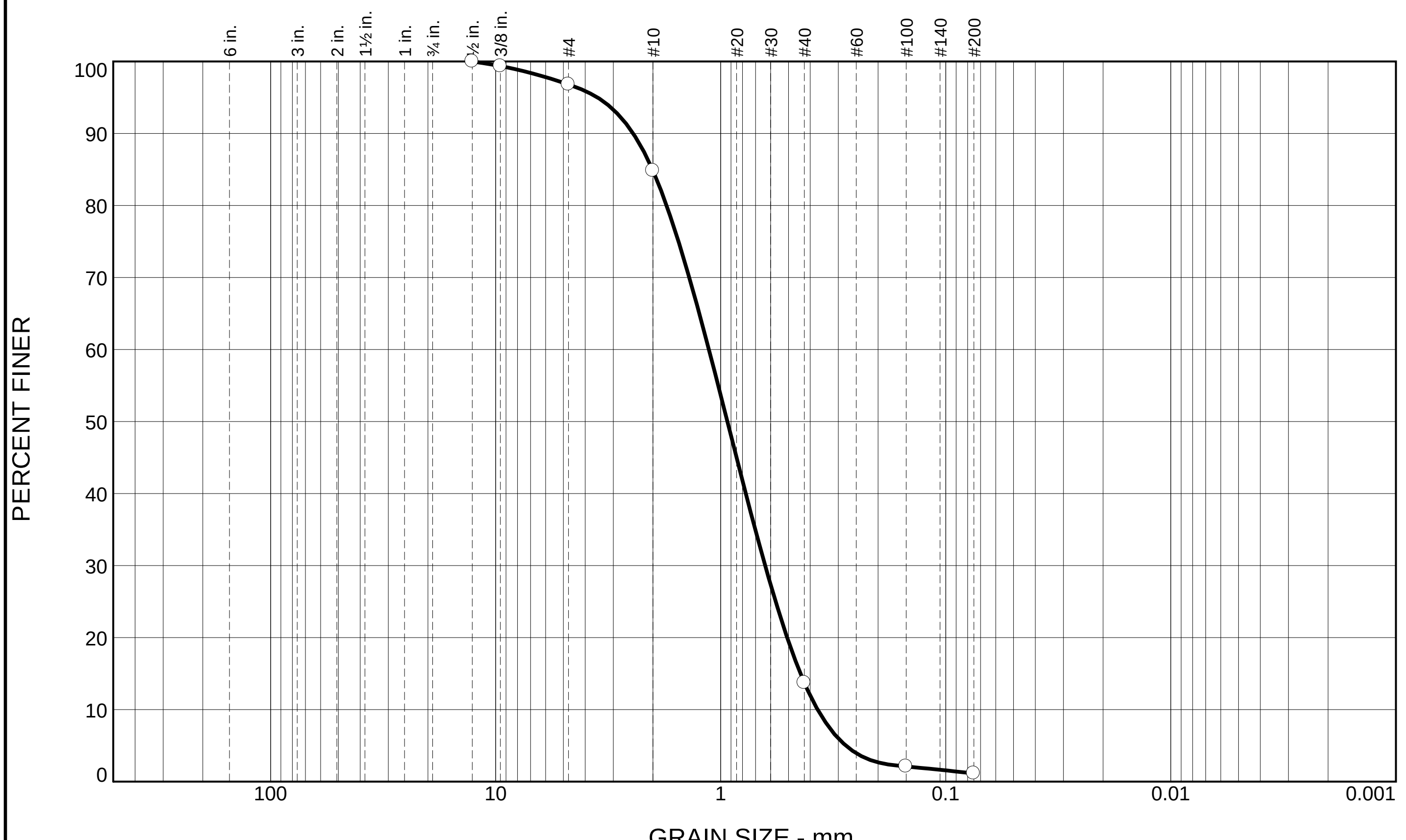
Date: 06/21/11

AECOM

Client: LUTZ, DAILY, AND BRAIN, LLC
Project: NEARMAN CREEK ASH POND

Project No: 60198190 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.2	12.0	71.1	12.6	1.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	99.4		
#4	96.8		
#10	84.8		
#40	13.7		
#100	2.1		
#200	1.1		

* (no specification provided)

Material Description

BROWN FINE TO COARSE SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.4484 D_{85}= 2.0103 D_{60}= 1.1286
D_{50}= 0.9340 D_{30}= 0.6345 D_{15}= 0.4425
D_{10}= 0.3712 C_u= 3.04 C_c= 0.96

Classification

USCS= SP AASHTO=

Remarks

Sample Number: B-2 S-16 **Depth:** 49.0'-50.5'

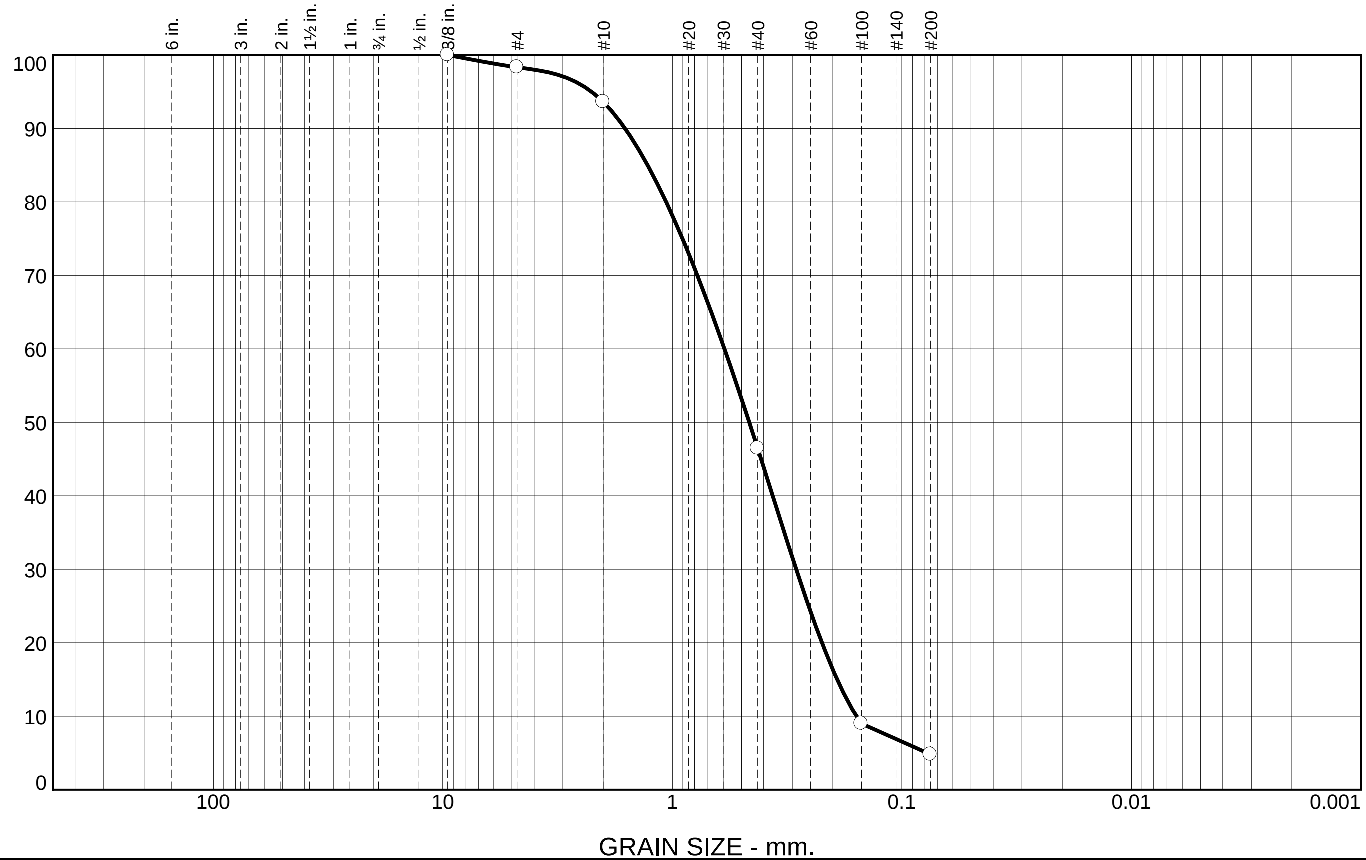
Date: 06/21/11

AECOM

Client: LUTZ, DAILY, AND BRAIN, LLC
Project: NEARMAN CREEK ASH POND

Project No: 60198190 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.7	4.7	47.1	41.7	4.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.3		
#10	93.6		
#40	46.5		
#100	9.0		
#200	4.8		

* (no specification provided)

Material Description

DARK BROWN FINE TO MEDIUM SAND, TRACE SILT, TRACE COARSE SAND, TRACE ORGANICS

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.6059 D_{85}= 1.2816 D_{60}= 0.5928
D_{50}= 0.4623 D_{30}= 0.2886 D_{15}= 0.1914
D_{10}= 0.1578 C_u= 3.76 C_c= 0.89

Classification

USCS= SP AASHTO=

Remarks

Sample Number: B-5 S-16 **Depth:** 50.0'-51.5'

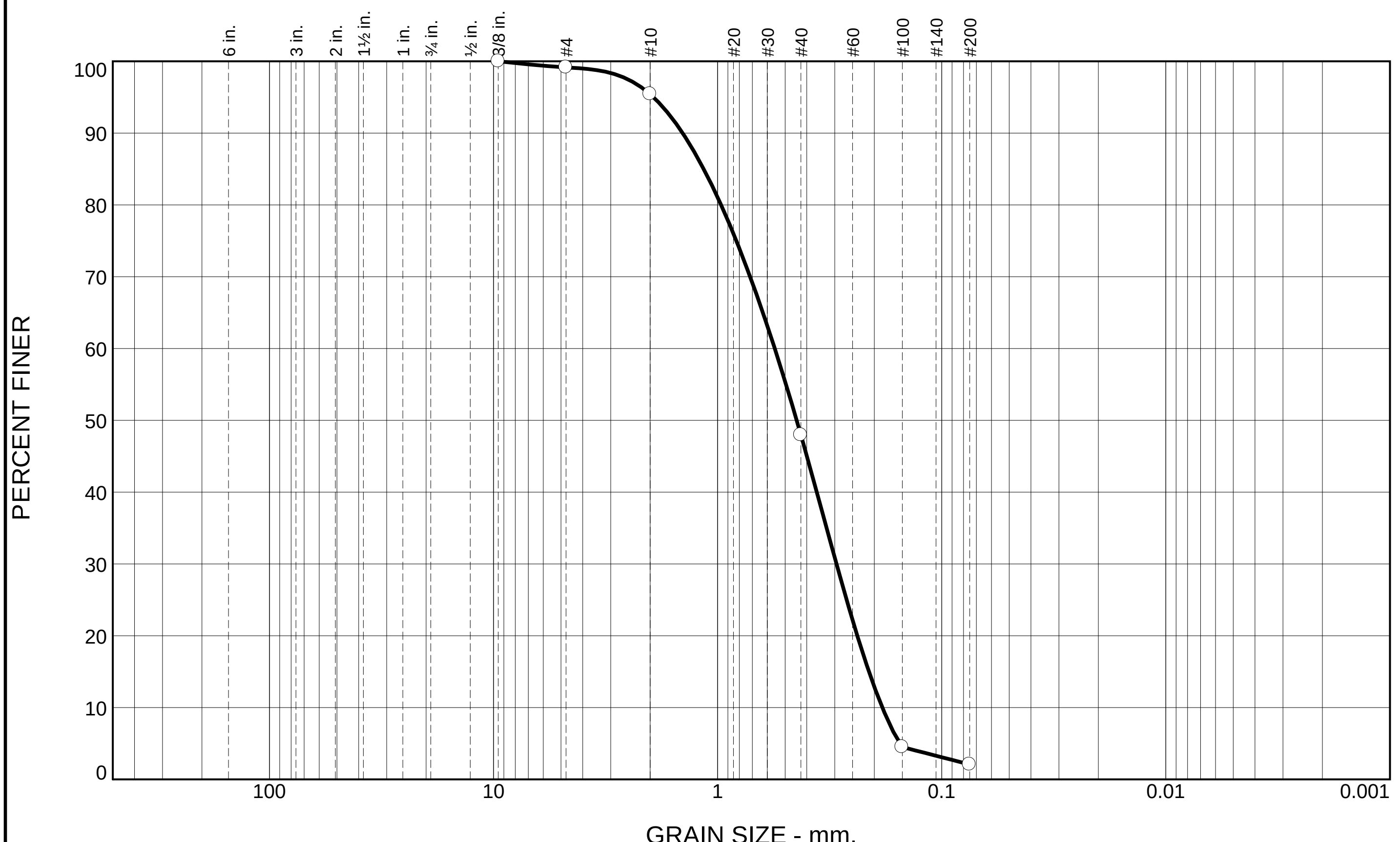
Date: 06/21/11

AECOM

Client: LUTZ, DAILY, AND BRAIN, LLC
Project: NEARMAN CREEK ASH POND

Project No: 60198190 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.9	3.7	47.5	45.8	2.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.1		
#10	95.4		
#40	47.9		
#100	4.5		
#200	2.1		

* (no specification provided)

Material Description

BROWN FINE TO MEDIUM SAND, TRACE SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.4320 D_{85}= 1.1544 D_{60}= 0.5560
D_{50}= 0.4440 D_{30}= 0.2949 D_{15}= 0.2112
D_{10}= 0.1842 C_u= 3.02 C_c= 0.85

Classification

USCS= SP AASHTO=

Remarks

Sample Number: B-5 S-7 **Depth:** 17.0'-18.5'

Date: 06/21/11

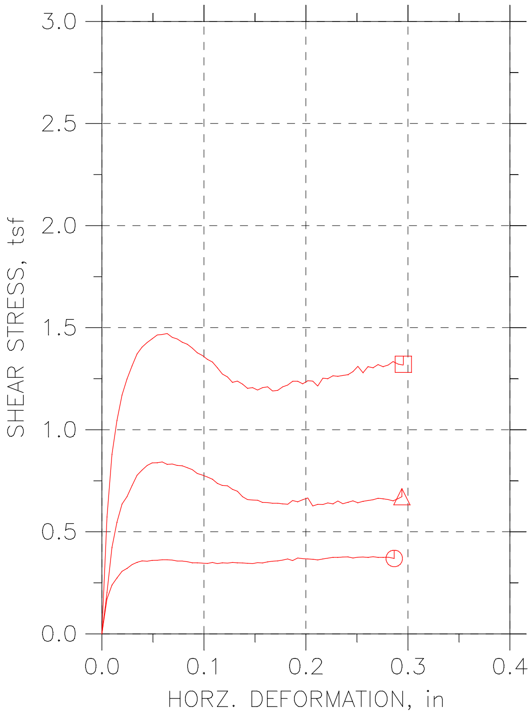
AECOM

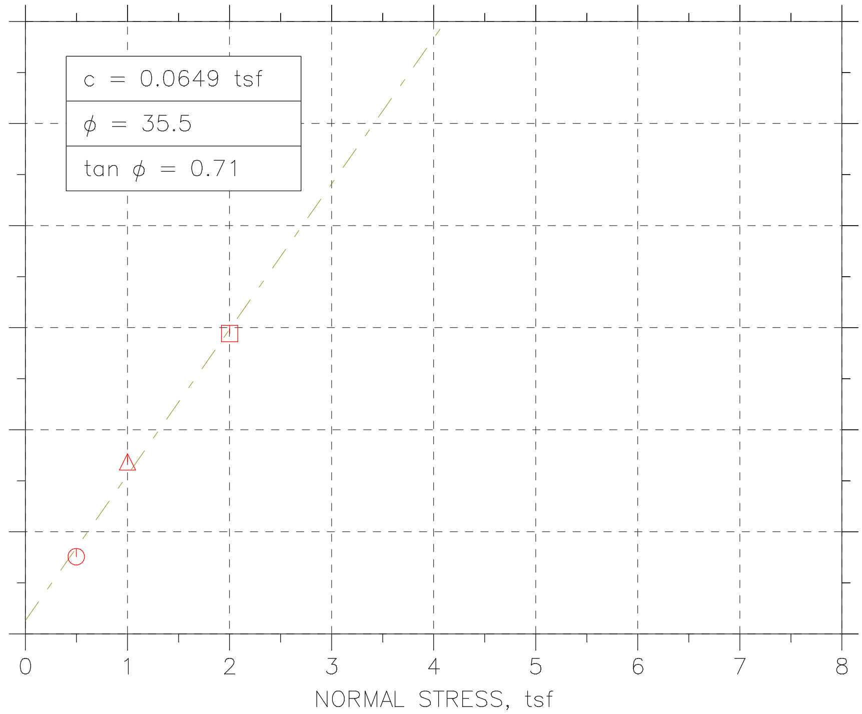
Client: LUTZ, DAILY, AND BRAIN, LLC
Project: NEARMAN CREEK ASH POND

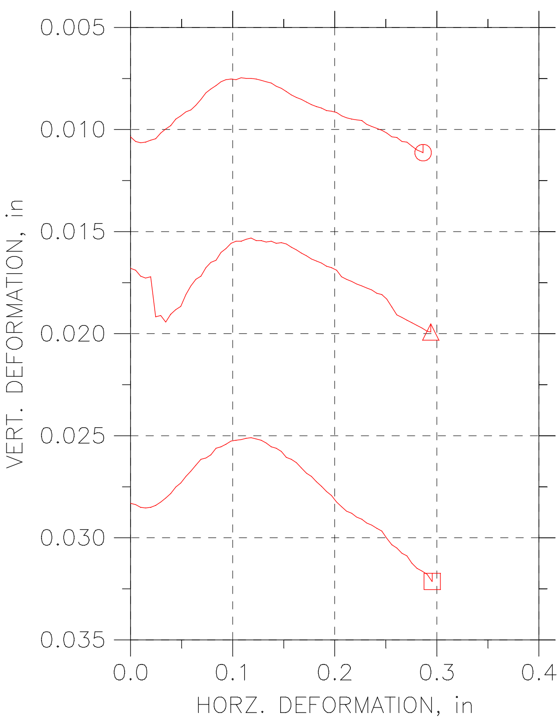
Project No: 60198190 **Figure**

DIRECT SHEAR TEST REPORT

AECOM







Symbol		○	△	□	
Test No.		.5 TSF	1 TSF	2 TSF	
Sample No.		S13,14,15	S13,14,15	S13,14,15	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.4972	2.4965	2.4965	
	Area, in^2	4.8979	4.8948	4.8948	
	Height, in	1.1748	1.1736	1.1736	
	Water Content, %	16.40	17.42	15.84	
	Dry Density, pcf	104.58	103.86	105.32	
	Saturation, %	74.70	77.85	73.53	
	Void Ratio	0.58187	0.59291	0.5708	
Consol. Height, in		1.1723	1.1627	1.1499	
Consol. Void Ratio		0.57849	0.57811	0.53902	
Final	Water Content, %	18.40	18.92	18.04	
	Dry Density, pcf	105.58	105.65	108.28	
	Saturation, %	86.02	88.60	90.59	
	Void Ratio	0.56688	0.56588	0.52778	
Normal Stress, tsf		0.49775	1.0009	2.001	
Max. Shear Stress, tsf		0.37802	0.84181	1.471	
Ult. Shear Stress, tsf		0.36934	0.67202	1.3204	
Time to Failure, min		63.884	15.853	16.745	

Project: NEARMAN ASH POND STABIL.	Disp. Rate, in/min	0.004	0.004	0.004	
Location: KANSAS CITY, KS	Estimated Specific Gravity	2.65	2.65	2.65	
Project No.: 60198190	Liquid Limit	NP	NP	NP	
Boring No.: B-5	Plastic Limit	NP	NP	NP	
Sample Type: REMOLDED	Plasticity Index	NP	NP	NP	
Description: F-M SAND TRACE SILT - GRAYISH BROWN (SP)					
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO APPROX. 100.0-105.0 PCF.					

Thu, 16-JUN-2011 09:17:24

DIRECT SHEAR TEST DATA

Project: NEARMAN ASH POND STABIL.
Boring No.: B-5
Sample No.: S13,14,15
Test No.: .5 TSF

Location: KANSAS CITY, KS
Tested By: BCM
Test Date: 6/14/11
Sample Type: REMOLDED

Project No.: 60198190
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: F-M SAND TRACE SILT - GRAYISH BROWN (SP)
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO APPROX. 100.0-105.0 PCF.

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	0.4978	0.01036	0	0
2	2.02	0.4985	0.01059	0.1713	0.004942
3	3.22	0.4993	0.01065	0.2391	0.009883
4	4.27	0.5001	0.01062	0.2738	0.01478
5	5.63	0.5009	0.01052	0.3062	0.01972
6	6.53	0.5001	0.01046	0.3204	0.02461
7	7.80	0.5001	0.01017	0.3394	0.02955
8	9.00	0.5009	0.009974	0.3504	0.03449
9	10.11	0.5009	0.009813	0.3575	0.03939
10	11.19	0.5009	0.009492	0.3559	0.04438
11	12.32	0.5001	0.009331	0.3599	0.04922
12	13.62	0.5017	0.009138	0.3607	0.05417
13	14.62	0.5009	0.009041	0.363	0.05906
14	15.75	0.5001	0.008816	0.363	0.064
15	16.90	0.5001	0.008526	0.3614	0.06894
16	18.12	0.5009	0.008205	0.3567	0.07384
17	19.28	0.5009	0.008012	0.3567	0.07878
18	20.46	0.5009	0.007851	0.3536	0.08367
19	21.66	0.4993	0.007658	0.348	0.08861
20	22.77	0.5001	0.007561	0.348	0.09351
21	24.00	0.5001	0.007529	0.3465	0.09845
22	25.24	0.5001	0.007561	0.3449	0.1034
23	26.49	0.5009	0.007465	0.3496	0.1083
24	27.42	0.5001	0.007497	0.3441	0.1132
25	28.54	0.5001	0.007497	0.348	0.1181
26	29.69	0.4993	0.007529	0.3465	0.1231
27	30.97	0.5017	0.007593	0.3496	0.128
28	32.11	0.4985	0.007658	0.348	0.1329
29	33.27	0.4985	0.007722	0.3472	0.1378
30	34.41	0.4993	0.007883	0.3457	0.1427
31	35.66	0.497	0.007979	0.3441	0.1477
32	36.64	0.4985	0.00814	0.3488	0.1526
33	37.89	0.4985	0.008301	0.3472	0.1575
34	39.19	0.4985	0.00843	0.3528	0.1624
35	40.24	0.4978	0.008526	0.3559	0.1673
36	41.48	0.4993	0.008655	0.3575	0.1723
37	42.63	0.4985	0.008784	0.3614	0.1772
38	43.78	0.4993	0.00888	0.367	0.1821
39	44.95	0.4978	0.008945	0.3591	0.187
40	46.17	0.4993	0.009073	0.3717	0.192
41	47.36	0.4985	0.009105	0.3686	0.1969
42	48.50	0.4985	0.00917	0.367	0.2018
43	49.65	0.4985	0.009331	0.3654	0.2068
44	50.75	0.4985	0.009427	0.3622	0.2116
45	51.89	0.4985	0.009492	0.367	0.2166
46	53.04	0.4985	0.009524	0.3709	0.2215
47	54.18	0.4993	0.009556	0.3749	0.2264
48	55.47	0.4993	0.009749	0.3749	0.2313
49	56.66	0.4993	0.009846	0.3764	0.2362
50	57.72	0.4985	0.009942	0.3772	0.2412
51	58.96	0.4978	0.01004	0.3717	0.2461
52	60.03	0.4985	0.01017	0.3757	0.251
53	61.45	0.4985	0.01036	0.3764	0.256
54	62.47	0.4985	0.01039	0.3749	0.2608
55	63.88	0.4978	0.01059	0.378	0.2658
56	64.80	0.4985	0.01062	0.3749	0.2707
57	66.04	0.4978	0.01081	0.3749	0.2756
58	67.13	0.4985	0.011	0.3757	0.2805
59	68.26	0.4985	0.0111	0.3709	0.2855
60	68.43	0.4985	0.01113	0.3693	0.2866

DIRECT SHEAR TEST DATA

Project: NEARMAN ASH POND STABIL.
Boring No.: B-5
Sample No.: S13,14,15
Test No.: 1 TSF

Location: KANSAS CITY, KS
Tested By: BCM
Test Date: 6/14/11
Sample Type: REMOLDED

Project No.: 60198190
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: F-M SAND TRACE SILT - GRAYISH BROWN (SP)
Remarks: TEST PERFORMED AS PER ASTM D 3080

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	0.9985	0.0168	0	0
2	2.52	0.9985	0.01689	0.2029	0.004942
3	3.84	0.9977	0.01718	0.4233	0.009883
4	4.96	0.9993	0.01728	0.5465	0.01478
5	6.17	1	0.01721	0.6357	0.01972
6	7.50	1	0.01918	0.672	0.02461
7	8.53	1.001	0.01911	0.7265	0.02955
8	9.93	1	0.01943	0.7771	0.03449
9	11.12	1.002	0.01905	0.8023	0.03939
10	12.36	1.006	0.01882	0.8252	0.04433
11	13.38	1.002	0.01866	0.8371	0.04922
12	14.65	1.001	0.01808	0.8379	0.05417
13	15.85	1.001	0.01766	0.8418	0.05906
14	16.94	1.001	0.01734	0.8308	0.064
15	18.20	1.001	0.01718	0.8323	0.06894
16	19.51	1	0.01676	0.8252	0.07384
17	20.67	1.002	0.01651	0.8236	0.07878
18	21.75	1.001	0.01641	0.8142	0.08367
19	23.12	1.001	0.01602	0.8047	0.08861
20	24.18	1	0.01583	0.7857	0.09351
21	25.40	1.001	0.01557	0.7778	0.09845
22	26.69	1.001	0.01548	0.7684	0.1034
23	27.86	1	0.01548	0.7573	0.1083
24	29.07	1	0.01538	0.7368	0.1132
25	30.24	0.9993	0.01532	0.7265	0.1181
26	31.28	1	0.01544	0.7249	0.1231
27	32.64	1	0.01544	0.7083	0.128
28	33.79	1.002	0.01551	0.6989	0.1329
29	35.04	0.9985	0.01548	0.672	0.1378
30	36.13	0.9977	0.01557	0.6578	0.1427
31	37.30	0.9993	0.01554	0.6554	0.1477
32	38.56	0.9993	0.0156	0.6547	0.1526
33	39.82	0.9993	0.01577	0.6436	0.1575
34	41.00	0.9977	0.01589	0.6428	0.1624
35	42.17	0.9985	0.01606	0.6396	0.1673
36	43.40	0.9993	0.01618	0.6396	0.1723
37	44.55	0.9985	0.01634	0.6365	0.1772
38	45.71	0.9977	0.01644	0.6349	0.1822
39	46.88	0.9993	0.01654	0.6531	0.187
40	48.03	0.9985	0.0167	0.6468	0.192
41	49.35	0.9977	0.01676	0.657	0.1969
42	50.53	0.9985	0.01689	0.6657	0.2018
43	51.78	0.9985	0.01721	0.6262	0.2067
44	52.99	0.9977	0.01734	0.6341	0.2116
45	54.05	0.9977	0.01744	0.6333	0.2166
46	55.31	0.9985	0.01757	0.6412	0.2215
47	56.68	0.9985	0.01766	0.6365	0.2264
48	57.82	0.9985	0.01776	0.6507	0.2313
49	58.80	0.9969	0.01786	0.6373	0.2362
50	60.01	0.9977	0.01802	0.6444	0.2412
51	61.03	0.9993	0.01808	0.6515	0.2461
52	62.23	0.9985	0.01831	0.642	0.251
53	63.58	0.9985	0.01869	0.6491	0.256
54	64.77	0.9985	0.01908	0.6531	0.2608
55	65.89	0.9993	0.01921	0.657	0.2658
56	67.18	0.9985	0.01934	0.6641	0.2707
57	68.35	0.9993	0.01947	0.6618	0.2756
58	69.54	0.9985	0.01959	0.6578	0.2805
59	70.74	0.9977	0.01972	0.6515	0.2855
60	71.93	0.9985	0.01988	0.6625	0.2904
61	72.82	0.9977	0.01992	0.672	0.2941

DIRECT SHEAR TEST DATA

Project: NEARMAN ASH POND STABIL.
Boring No.: B-5
Sample No.: S13,14,15
Test No.: 2 TSF

Location: KANSAS CITY, KS
Tested By: BCM
Test Date: 6/14/11
Sample Type: REMOLDED

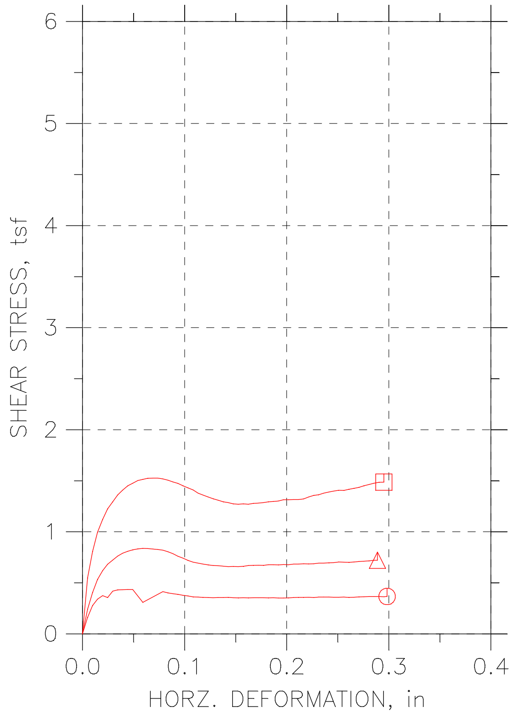
Project No.: 60198190
Checked By: WPQ
Depth: ----
Elevation: ----

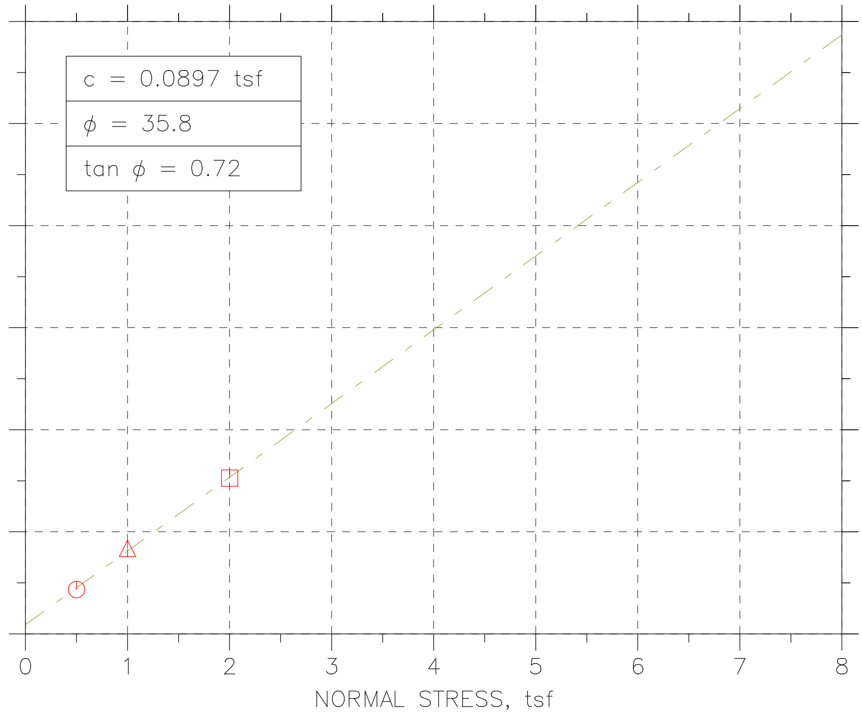
Soil Description: F-M SAND TRACE SILT - GRAYISH BROWN (SP)
Remarks: TEST PERFORMED AS PER ASTM D 3080

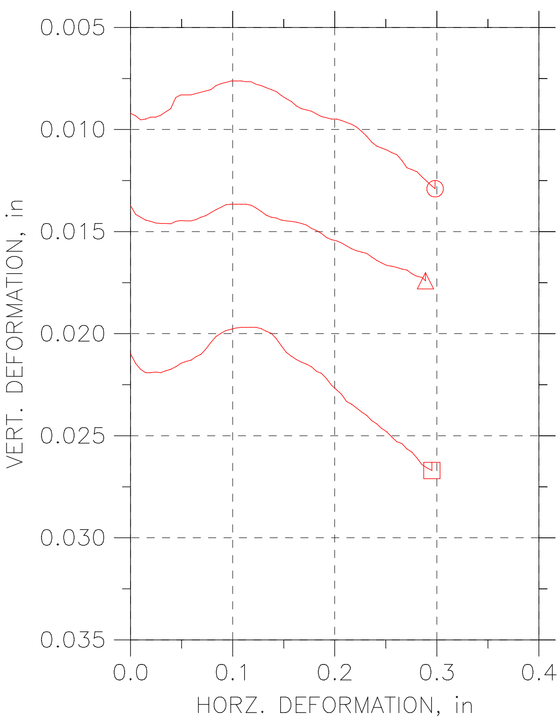
	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.999	0.02831	0	0
2	2.11	1.998	0.02838	0.5733	0.004942
3	3.44	1.999	0.02851	0.879	0.009883
4	4.68	1.999	0.02854	1.045	0.01478
5	6.00	2	0.02851	1.17	0.01972
6	7.11	2	0.02841	1.249	0.02461
7	8.40	2	0.02825	1.314	0.02955
8	9.64	2.002	0.02806	1.372	0.03449
9	10.79	2.001	0.02783	1.405	0.03939
10	11.93	2.001	0.02751	1.427	0.04433
11	13.09	2.001	0.02732	1.446	0.04922
12	14.38	2	0.02699	1.464	0.05417
13	15.53	2.001	0.02674	1.467	0.05906
14	16.74	2.001	0.02645	1.471	0.064
15	17.94	2	0.02616	1.452	0.06894
16	19.10	2	0.02609	1.444	0.07384
17	20.31	2	0.02593	1.428	0.07878
18	21.61	2.001	0.02561	1.419	0.08372
19	22.85	2	0.02555	1.4	0.08861
20	23.88	2	0.02542	1.377	0.09351
21	24.97	2	0.02526	1.364	0.09845
22	26.14	2	0.02523	1.345	0.1034
23	27.47	1.999	0.02519	1.332	0.1084
24	28.57	1.994	0.02513	1.303	0.1132
25	29.87	1.999	0.0251	1.273	0.1181
26	31.04	1.999	0.02516	1.259	0.1231
27	32.15	1.998	0.02523	1.232	0.128
28	33.39	1.999	0.02535	1.238	0.1329
29	34.58	1.999	0.02555	1.223	0.1378
30	35.81	1.997	0.02561	1.203	0.1427
31	36.94	1.999	0.02577	1.206	0.1477
32	38.22	1.999	0.02606	1.194	0.1526
33	39.34	1.999	0.02616	1.206	0.1575
34	40.42	1.999	0.02632	1.21	0.1624
35	41.80	1.999	0.02658	1.19	0.1673
36	42.84	1.999	0.02683	1.193	0.1723
37	44.10	1.998	0.02699	1.21	0.1772
38	45.33	1.998	0.02725	1.218	0.1821
39	46.41	1.999	0.02748	1.238	0.1871
40	47.58	1.999	0.02773	1.238	0.192
41	48.88	1.995	0.02793	1.225	0.1969
42	50.18	1.997	0.02825	1.24	0.2018
43	51.41	1.999	0.02847	1.238	0.2067
44	52.56	1.999	0.0287	1.214	0.2116
45	53.60	1.998	0.0288	1.253	0.2166
46	54.88	1.997	0.02899	1.25	0.2215
47	56.09	1.998	0.02909	1.264	0.2264
48	57.35	1.998	0.02928	1.261	0.2313
49	58.40	1.999	0.02938	1.266	0.2362
50	59.68	1.997	0.02954	1.27	0.2412
51	60.85	1.999	0.02967	1.285	0.2461
52	62.12	1.999	0.03002	1.311	0.251
53	63.19	1.998	0.03034	1.279	0.256
54	64.36	1.997	0.0305	1.308	0.2608
55	65.65	1.999	0.03076	1.303	0.2658
56	66.70	1.999	0.03089	1.319	0.2707
57	68.16	1.997	0.03124	1.309	0.2756
58	69.30	1.999	0.0315	1.317	0.2805
59	70.32	1.999	0.03163	1.334	0.2855
60	71.67	1.998	0.03179	1.321	0.2904
61	72.75	1.996	0.03214	1.317	0.2953
62	72.78	1.997	0.03214	1.32	0.2954

DIRECT SHEAR TEST REPORT

AECOM







	Symbol	○	△	□	
	Test No.	.5 TSF	1 TSF	2 TSF	
	Sample No.	S-4,5,6	S-4,5,6	S-4,5,6	
	Shape	Circular	Circular	Circular	
Initial	Dimension, in	2.4969	2.498	2.4961	
Initial	Area, in^2	4.8964	4.901	4.8933	
Initial	Height, in	1.1748	1.1744	1.1752	
Initial	Water Content, %	15.94	15.56	16.23	
Initial	Dry Density, pcf	106.75	107.02	106.4	
Initial	Saturation, %	76.85	75.53	77.50	
Initial	Void Ratio	0.54979	0.54581	0.55488	
	Consol. Height, in	1.1713	1.1658	1.158	
	Consol. Void Ratio	0.54512	0.5345	0.53206	
Final	Water Content, %	19.24	18.25	18.13	
Final	Dry Density, pcf	107.93	108.63	108.87	
Final	Saturation, %	95.72	92.51	92.46	
Final	Void Ratio	0.53277	0.52289	0.51955	
	Normal Stress, tsf	0.50108	0.99963	2.0016	
	Max. Shear Stress, tsf	0.43419	0.83759	1.5266	
	Ult. Shear Stress, tsf	0.3663	0.72165	1.4872	
	Time to Failure, min	14.441	17.59	19.965	

Project: NEARMAN ASH POND STABIL.	Disp. Rate, in/min	0.004	0.004	0.004	
Location: KANSAS CITY, KS	Estimated Specific Gravity	2.65	2.65	2.65	
Project No.: 60198190	Liquid Limit	NP	NP	NP	
Boring No.: B-5	Plastic Limit	NP	NP	NP	
Sample Type: REMOLDED	Plasticity Index	NP	NP	NP	
Description: F-M SAND TRACE SILT - BROWN (SP)					
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO APPROX. 100.0-105.0 PCF					

Thu, 16-JUN-2011 13:17:17

DIRECT SHEAR TEST DATA

Project: NEARMAN ASH POND STABIL.
Boring No.: B-5
Sample No.: S-4,5,6
Test No.: .5 TSF

Location: KANSAS CITY, KS
Tested By: BCM
Test Date: 6/14/11
Sample Type: REMOLDED

Project No.: 60198190
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: F-M SAND TRACE SILT - BROWN (SP)
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO APPROX. 100.0-105.0 PCF

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	0.4963	0.009202	0	0
2	3.52	0.4979	0.009331	0.161	0.004942
3	4.87	0.4987	0.009524	0.2771	0.009883
4	6.15	0.5003	0.009492	0.3402	0.01478
5	7.32	0.5003	0.009395	0.375	0.01972
6	8.46	0.4979	0.009395	0.356	0.02466
7	9.67	0.5011	0.009299	0.4184	0.02955
8	10.96	0.5019	0.009138	0.4302	0.03449
9	11.94	0.5011	0.008977	0.4318	0.03939
10	13.19	0.5003	0.00843	0.4342	0.04433
11	14.44	0.5011	0.008301	0.4342	0.04922
12	16.63	0.4123	0.008301	0.3079	0.05906
13	21.46	0.5011	0.008044	0.4145	0.07878
14	22.82	0.5003	0.007851	0.4018	0.08367
15	23.99	0.5003	0.007754	0.3939	0.08861
16	25.05	0.5003	0.00769	0.3868	0.09351
17	26.42	0.4995	0.007625	0.3774	0.09845
18	27.52	0.4995	0.007625	0.371	0.1034
19	28.69	0.4987	0.007625	0.3616	0.1083
20	29.99	0.4987	0.007658	0.3608	0.1132
21	31.14	0.4987	0.007658	0.3576	0.1181
22	32.32	0.4987	0.007786	0.356	0.1231
23	33.44	0.4987	0.007851	0.3545	0.128
24	34.64	0.4995	0.007947	0.356	0.1329
25	35.85	0.4979	0.008044	0.3552	0.1378
26	37.00	0.4987	0.00814	0.3576	0.1427
27	38.21	0.4987	0.008333	0.3545	0.1477
28	39.48	0.4987	0.008494	0.3529	0.1526
29	40.56	0.4995	0.008623	0.3537	0.1575
30	41.90	0.4987	0.008848	0.3521	0.1625
31	43.03	0.4987	0.008977	0.3537	0.1673
32	44.18	0.4987	0.009041	0.3537	0.1723
33	45.32	0.4979	0.009105	0.3537	0.1772
34	46.71	0.4987	0.009234	0.3521	0.1821
35	47.67	0.4987	0.009363	0.3537	0.187
36	48.87	0.4987	0.009427	0.3505	0.192
37	50.13	0.4987	0.009492	0.3505	0.1969
38	51.35	0.4987	0.009492	0.3529	0.2018
39	52.62	0.4987	0.009556	0.3552	0.2067
40	53.81	0.4987	0.009652	0.3568	0.2116
41	54.86	0.4987	0.009749	0.3568	0.2166
42	56.03	0.4987	0.009878	0.3592	0.2215
43	57.26	0.4979	0.0101	0.3552	0.2264
44	58.64	0.4987	0.01033	0.3608	0.2313
45	59.81	0.4987	0.01062	0.3608	0.2362
46	61.08	0.4987	0.01081	0.36	0.2412
47	62.07	0.4987	0.01091	0.3584	0.2461
48	63.29	0.4987	0.011	0.3584	0.251
49	64.37	0.4987	0.01113	0.3608	0.256
50	65.50	0.4979	0.01123	0.3576	0.2608
51	66.89	0.4987	0.01152	0.3584	0.2658
52	68.06	0.4987	0.01187	0.3616	0.2707
53	69.33	0.4987	0.01197	0.3631	0.2756
54	70.57	0.4987	0.01207	0.3655	0.2805
55	71.54	0.4987	0.01232	0.3655	0.2855
56	72.85	0.4987	0.01255	0.3647	0.2904
57	73.96	0.4987	0.01277	0.3639	0.2953
58	74.66	0.4987	0.0129	0.3663	0.2984

DIRECT SHEAR TEST DATA

Project: NEARMAN ASH POND STABIL.
Boring No.: B-5
Sample No.: S-4,5,6
Test No.: 1 TSF

Location: KANSAS CITY, KS
Tested By: BCM
Test Date: 6/14/11
Sample Type: REMOLDED

Project No.: 60198190
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: F-M SAND TRACE SILT - BROWN (SP)
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO APPROX. 100.0-105.0 PCF

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	0.9973	0.01373	0	0
2	4.26	0.9965	0.01415	0.2406	0.004942
3	5.38	0.9941	0.0143	0.4046	0.009883
4	6.69	0.9957	0.01444	0.5332	0.01478
5	7.97	0.998	0.0145	0.6199	0.01972
6	9.18	0.998	0.01458	0.6822	0.02461
7	10.21	0.998	0.0146	0.7224	0.02955
8	11.54	0.9965	0.0146	0.7619	0.03449
9	12.74	0.9988	0.01462	0.7895	0.03939
10	13.86	0.9988	0.0145	0.8092	0.04433
11	15.07	0.9988	0.01446	0.8234	0.04922
12	16.44	0.9988	0.01448	0.8329	0.05417
13	17.59	0.9996	0.01448	0.8376	0.05906
14	18.63	0.9988	0.01442	0.8352	0.064
15	20.01	0.9988	0.0143	0.8313	0.06894
16	21.06	0.9988	0.01421	0.8265	0.07384
17	22.29	0.9996	0.01407	0.8195	0.07878
18	23.56	0.9996	0.01393	0.8037	0.08367
19	24.74	0.9988	0.01381	0.7855	0.08861
20	25.96	0.9988	0.01368	0.7611	0.09351
21	27.08	0.998	0.01366	0.7414	0.09845
22	28.21	0.9973	0.01366	0.7193	0.1034
23	29.44	0.9965	0.01366	0.7019	0.1083
24	30.58	0.9973	0.01366	0.6925	0.1132
25	31.82	0.9965	0.0137	0.6838	0.1181
26	33.05	0.9973	0.01385	0.6751	0.1231
27	34.19	0.9973	0.01401	0.6688	0.128
28	35.49	0.998	0.01419	0.6672	0.1329
29	36.65	0.9973	0.0143	0.6633	0.1378
30	37.75	0.9965	0.01434	0.6586	0.1427
31	38.93	0.9965	0.01444	0.6601	0.1477
32	40.28	0.9973	0.01448	0.6586	0.1526
33	41.27	0.9965	0.0145	0.6609	0.1575
34	42.63	0.9973	0.01454	0.6696	0.1625
35	43.76	0.9965	0.0146	0.6704	0.1673
36	44.95	0.9965	0.01468	0.6728	0.1723
37	46.19	0.9965	0.01485	0.6712	0.1772
38	47.43	0.9973	0.01495	0.6767	0.1821
39	48.46	0.9973	0.01509	0.6775	0.187
40	49.63	0.9973	0.01529	0.6759	0.192
41	50.87	0.9973	0.0154	0.6783	0.1969
42	52.18	0.9973	0.01546	0.6775	0.2018
43	53.48	0.9973	0.01556	0.6838	0.2067
44	54.66	0.998	0.0157	0.6838	0.2116
45	55.65	0.9965	0.01584	0.687	0.2166
46	56.88	0.9973	0.01594	0.6846	0.2215
47	57.95	0.9973	0.01601	0.687	0.2264
48	59.08	0.998	0.01607	0.6925	0.2313
49	60.47	0.9965	0.01625	0.6933	0.2363
50	61.72	0.9965	0.01641	0.6956	0.2412
51	62.88	0.9965	0.01654	0.6972	0.2461
52	64.15	0.9965	0.01666	0.7035	0.251
53	65.18	0.9973	0.0167	0.7019	0.256
54	66.47	0.9965	0.01676	0.7011	0.2608
55	67.67	0.9973	0.01684	0.7035	0.2658
56	68.89	0.9965	0.01688	0.709	0.2707
57	70.00	0.9965	0.01706	0.7114	0.2756
58	71.15	0.9973	0.01719	0.7146	0.2805
59	72.34	0.9973	0.01725	0.7209	0.2855
60	73.37	0.9965	0.01741	0.7217	0.289

DIRECT SHEAR TEST DATA

Project: NEARMAN ASH POND STABIL.
Boring No.: B-5
Sample No.: S-4,5,6
Test No.: 2 TSF

Location: KANSAS CITY, KS
Tested By: BCM
Test Date: 6/14/11
Sample Type: REMOLDED

Project No.: 60198190
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: F-M SAND TRACE SILT - BROWN (SP)
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO APPROX. 100.0-105.0 PCF

	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.996	0.02098	0	0
2	3.00	1.989	0.02146	0.5487	0.004942
3	4.15	1.998	0.02175	0.8066	0.009883
4	5.45	1.999	0.02191	0.9957	0.01478
5	6.61	2.001	0.02191	1.122	0.01972
6	7.92	2	0.02188	1.225	0.02461
7	9.10	2.001	0.02191	1.294	0.02955
8	10.40	2.001	0.02181	1.362	0.03449
9	11.57	2.002	0.02175	1.408	0.03939
10	12.84	2.001	0.02162	1.451	0.04433
11	14.09	2.001	0.02146	1.476	0.04922
12	15.46	2.002	0.02136	1.502	0.05417
13	16.39	2.002	0.0213	1.513	0.05906
14	17.53	2.002	0.02114	1.524	0.064
15	18.68	2.001	0.02101	1.525	0.06894
16	19.97	2.002	0.02075	1.527	0.07384
17	21.10	2.001	0.02043	1.517	0.07878
18	22.31	2.001	0.02014	1.505	0.08367
19	23.53	2.002	0.01998	1.489	0.08861
20	24.72	2.001	0.01985	1.474	0.09351
21	25.97	2.001	0.01979	1.451	0.09845
22	27.20	2.001	0.01972	1.43	0.1034
23	28.24	2	0.01969	1.409	0.1083
24	29.49	1.999	0.01969	1.378	0.1132
25	30.62	1.999	0.01969	1.36	0.1181
26	31.86	1.999	0.01969	1.34	0.1231
27	32.94	1.999	0.01976	1.324	0.128
28	34.17	1.998	0.01988	1.309	0.1329
29	35.47	1.999	0.01998	1.293	0.1378
30	36.64	1.999	0.02024	1.285	0.1427
31	37.91	1.998	0.02059	1.273	0.1477
32	38.97	1.999	0.02091	1.271	0.1526
33	40.11	1.998	0.02111	1.274	0.1575
34	41.37	1.998	0.02127	1.271	0.1624
35	42.56	1.998	0.0214	1.277	0.1673
36	43.79	1.998	0.02149	1.281	0.1723
37	44.87	1.999	0.02162	1.287	0.1772
38	46.18	1.999	0.02185	1.294	0.1822
39	47.41	1.999	0.02194	1.297	0.187
40	48.60	1.998	0.0222	1.301	0.192
41	49.78	1.998	0.02252	1.314	0.1969
42	50.92	1.998	0.02275	1.314	0.2018
43	52.07	1.998	0.02297	1.315	0.2067
44	53.27	1.998	0.02333	1.316	0.2116
45	54.44	1.999	0.02346	1.322	0.2166
46	55.73	1.998	0.02365	1.341	0.2215
47	56.91	1.999	0.02384	1.356	0.2264
48	58.13	1.999	0.024	1.363	0.2313
49	59.34	1.999	0.02426	1.379	0.2362
50	60.57	1.999	0.02442	1.389	0.2412
51	61.78	1.998	0.02465	1.398	0.2461
52	62.80	1.998	0.02481	1.407	0.251
53	64.24	1.999	0.02506	1.406	0.256
54	65.31	1.998	0.02529	1.416	0.2608
55	66.39	1.998	0.02539	1.426	0.2658
56	67.64	1.998	0.02564	1.436	0.2707
57	68.89	1.998	0.0258	1.451	0.2756
58	70.02	1.998	0.02609	1.463	0.2805
59	71.41	1.998	0.02642	1.475	0.2855
60	72.61	1.998	0.02658	1.486	0.2904
61	73.63	1.999	0.02671	1.487	0.2952

Appendix C

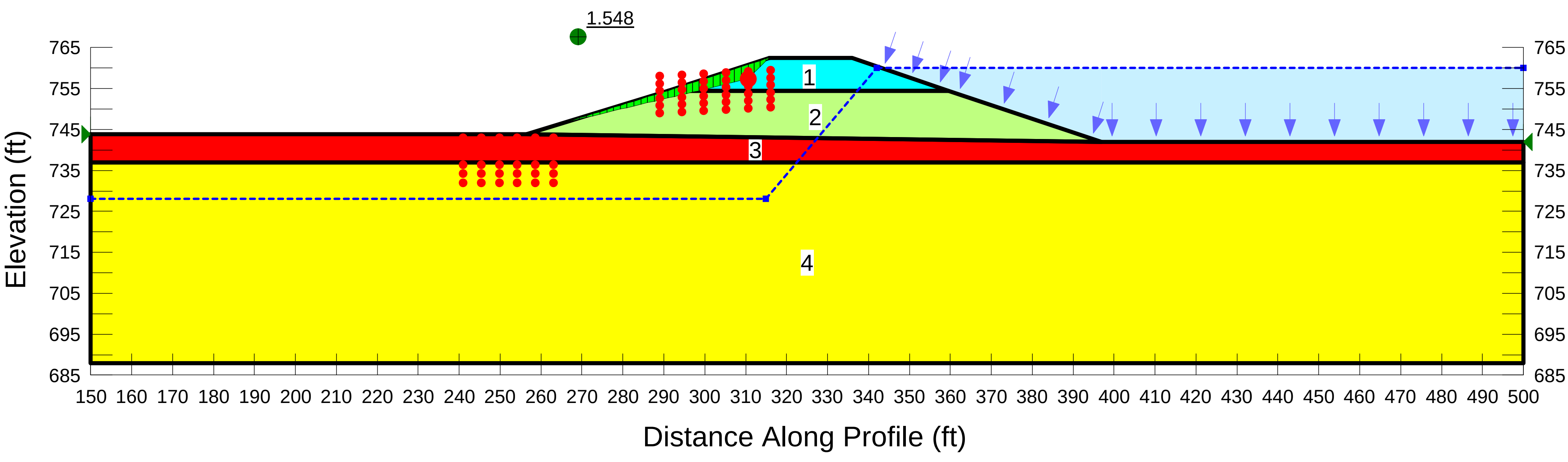
Global Stability Analysis

Kansas City Board of Public Utilities
Nearman Creek Power Station
Slope Stability Analysis
AECOM Project No. 60198190
(SLOPE-W Analyses - AMH - 6-16-11)

Run #	Section	Effective Stress	Total Stress	Groundwater Condition			Slip Surface	Factor of Safety
				Condition	Interior Elevation	Exterior Elevation		
A1-1	A-A'	X		Steady State (static)	760	728	Block	1.5
A1-2	A-A'	X		Steady State (static)	760	728	Circular	1.7
A1-3	A-A'		X	Steady State (static)	760	728	Block	5.8
A1-4	A-A'		X	Steady State (static)	760	728	Circular	5.7
A2-1	A-A'		X	Rapid Drawdown	762.5	Ground Surface	Block	1.8
A2-2	A-A'		X	Rapid Drawdown	762.5	Ground Surface	Circular	3.6
A3-1	A-A'	X		Steady State (seismic)	760	728	Block	1.4
A3-2	A-A'	X		Steady State (seismic)	760	728	Circular	1.5
A3-3	A-A'		X	Steady State (sesimic)	760	728	Block	5.1
A3-4	A-A'		X	Steady State (seismic)	760	728	Circular	5
B1-1	B-B'	X		Steady State (static)	760	728	Block	1.5
B1-2	B-B'	X		Steady State (static)	760	728	Circular	1.6
B1-3	B-B'		X	Steady State (static)	760	728	Block	4.0
B1-4	B-B'		X	Steady State (static)	760	728	Circular	4.5
B2-1	B-B'		X	Rapid Drawdown	762.5	Ground Surface	Block	1.6
B2-2	B-B'		X	Rapid Drawdown	762.5	Ground Surface	Circular	3.1
B3-1	B-B'	X		Steady State (seismic)	760	728	Block	1.2
B3-2	B-B'	X		Steady State (seismic)	760	728	Circular	1.4
B3-3	B-B'		X	Steady State (sesimic)	760	728	Block	3.5
B3-4	B-B'		X	Steady State (seismic)	760	728	Circular	3.8

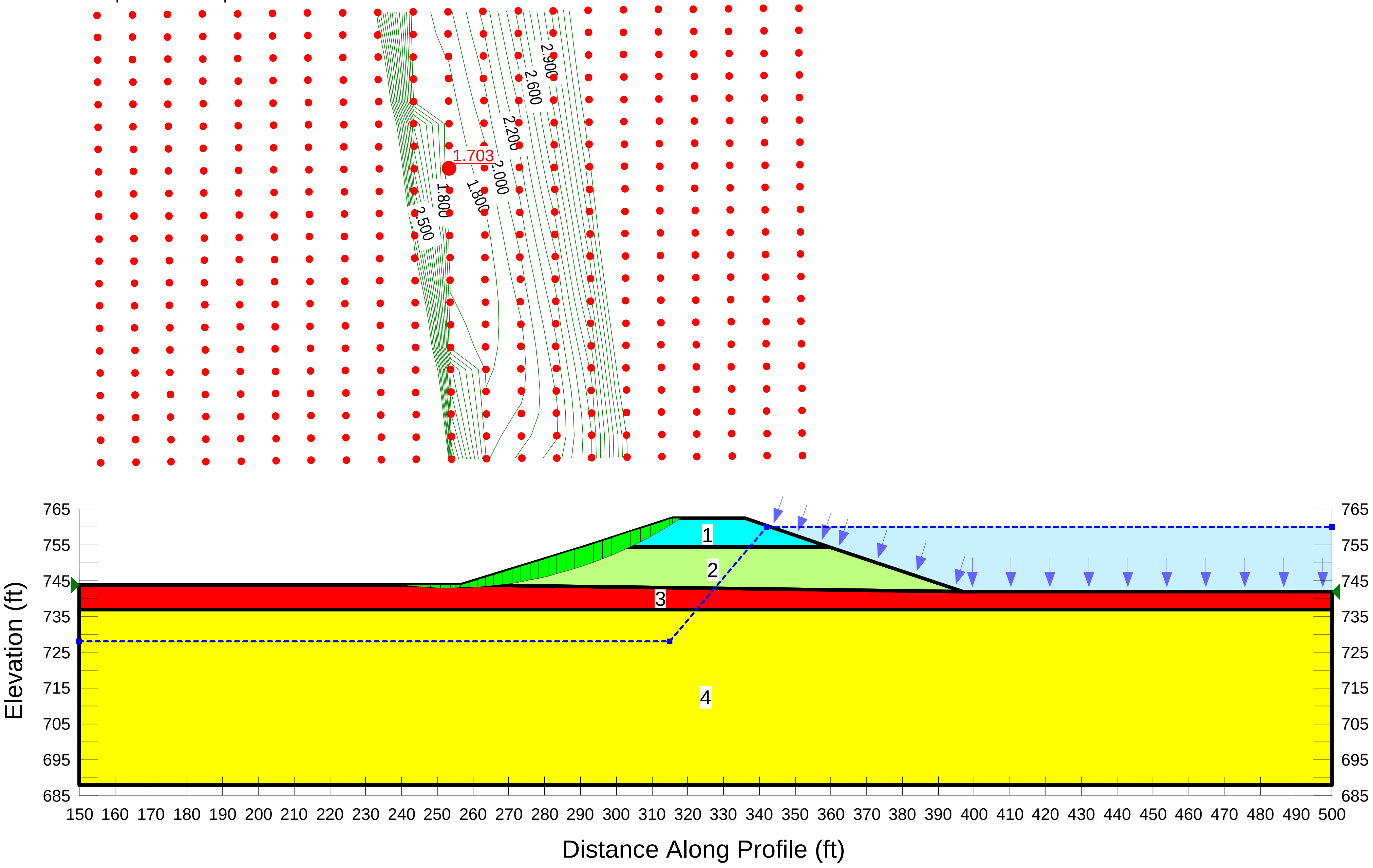
Name: A1-1
Description: Steady State- Block - Drained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analyses at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 41 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Right to Left
Slip Surface Option: Block
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill   Model: Mohr-Coulomb   Unit Weight: 110 pcf   Cohesion: 0 psf   Phi: 24 °
Name: 2 - Lower Levee Fill   Model: Mohr-Coulomb   Unit Weight: 110 pcf   Cohesion: 0 psf   Phi: 26 °
Name: 3 - Silt   Model: Mohr-Coulomb   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 30 °
Name: 4 - Sand   Model: Mohr-Coulomb   Unit Weight: 120 pcf   Cohesion: 0 psf   Phi: 35.8 °



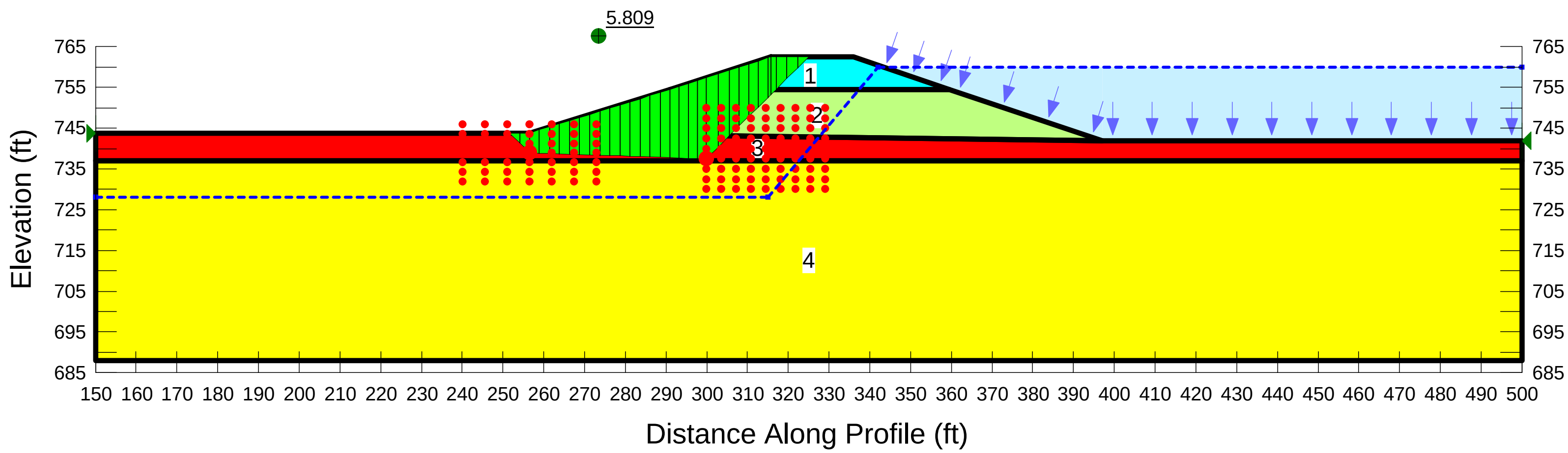
Name: A1-2
Description: Steady State- Circular - Drained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analyses at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 41 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Right to Left
Slip Surface Option: Grid and Radius
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 24 °
Name: 2 - Lower Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 26 °
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.8 °



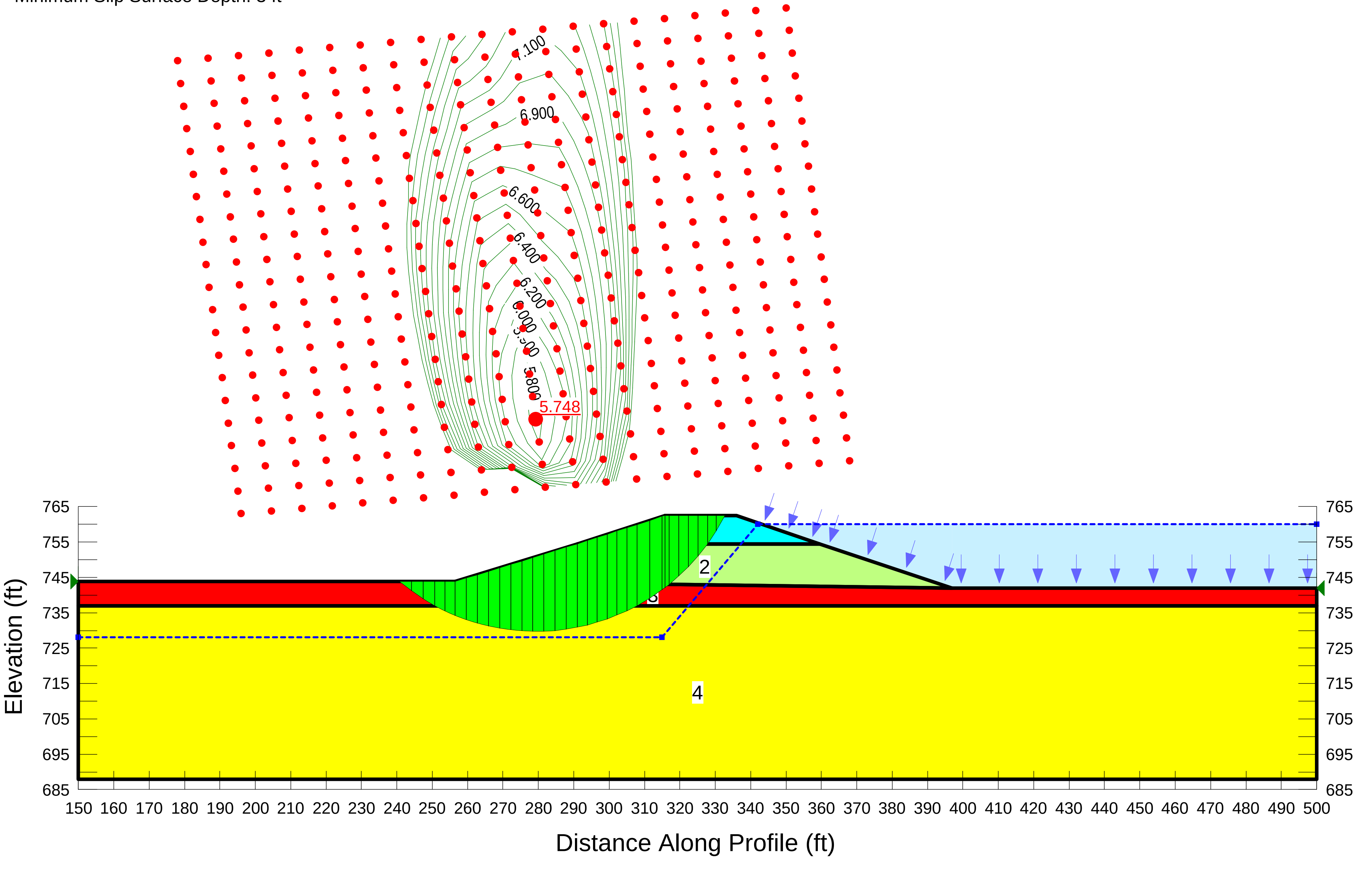
Name: A1-3
Description: Steady State- Block - Undrained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analyses at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 39 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Right to Left
Slip Surface Option: Block
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 4000 psf
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.8 °



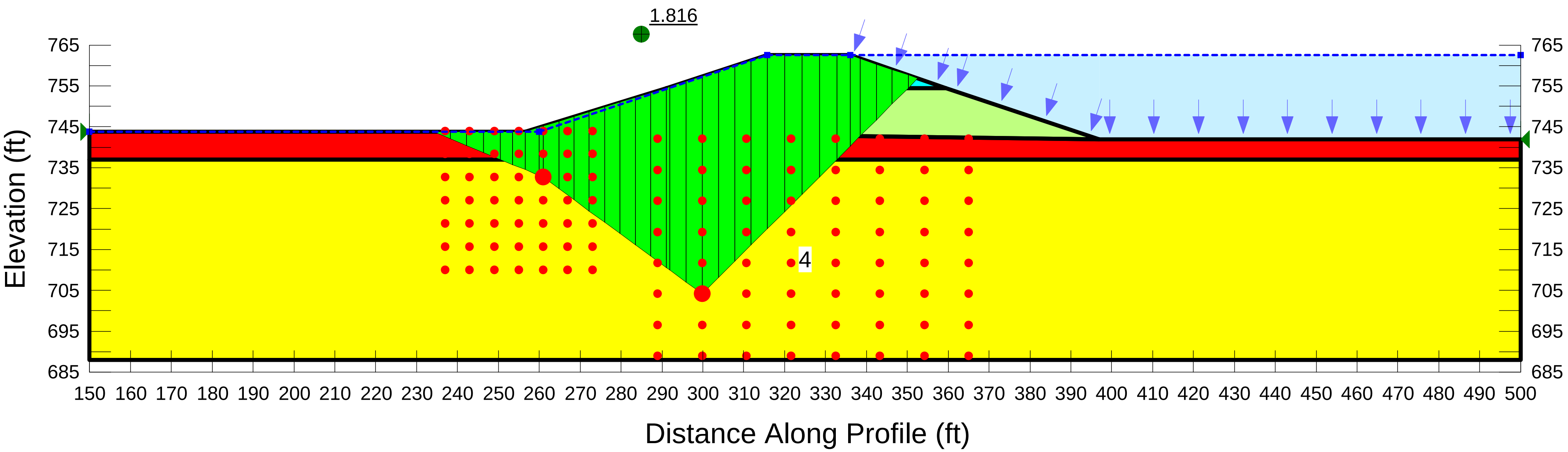
Name: A1-4
Description: Steady State- Circular - Undrained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analyses at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 39 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Right to Left
Slip Surface Option: Grid and Radius
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 4000 psf
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.8 °



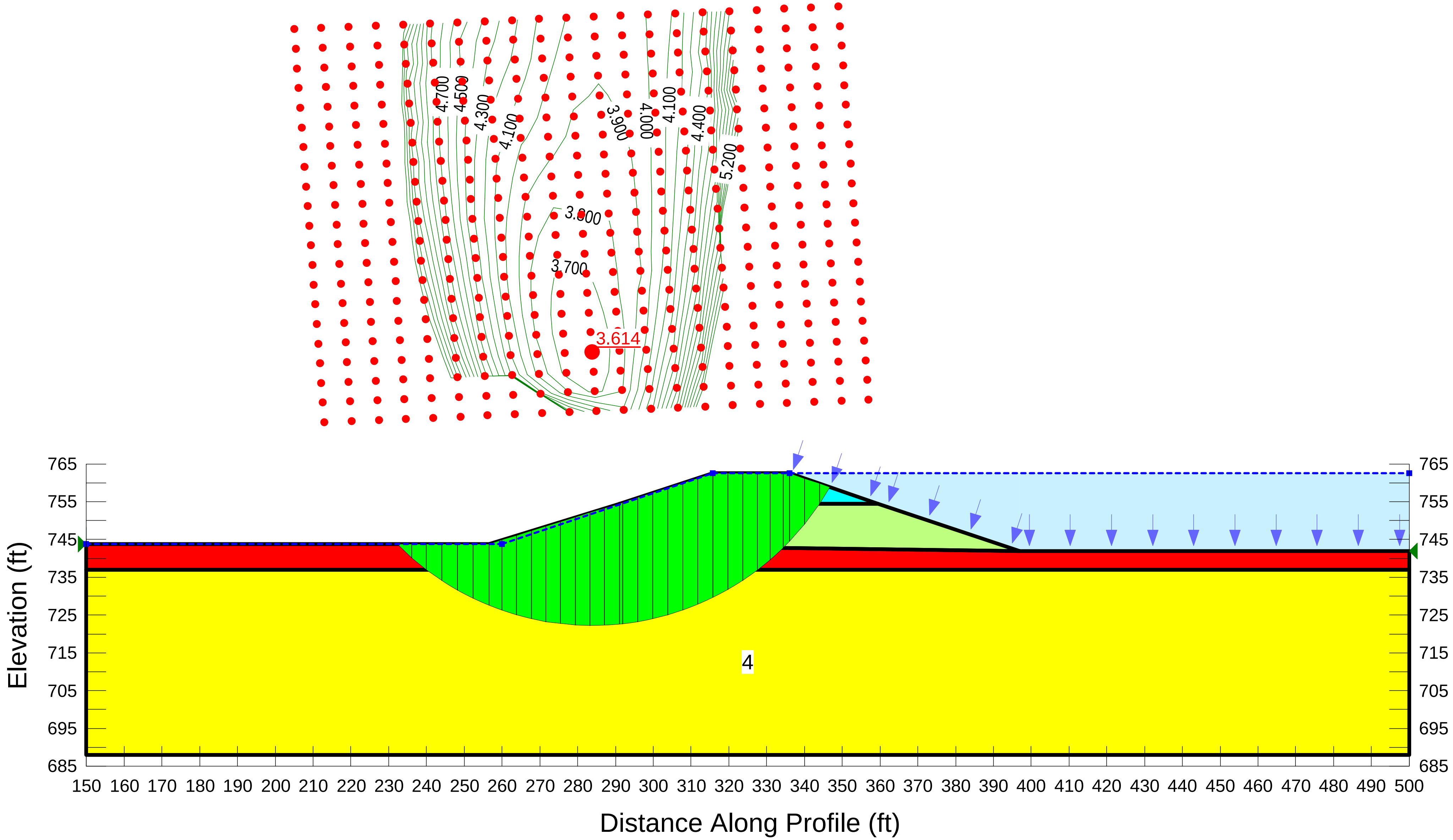
Name: A2-1
Description: Rapid Drawdown- Block
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analyses at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 37 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Right to Left
Slip Surface Option: Block
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 4000 psf
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.8 °



Name: A2-2
Description: Rapid Drawdown- Block
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analyses at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 37 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Right to Left
Slip Surface Option: Grid and Radius
Minimum Slip Surface Depth: 3 ft

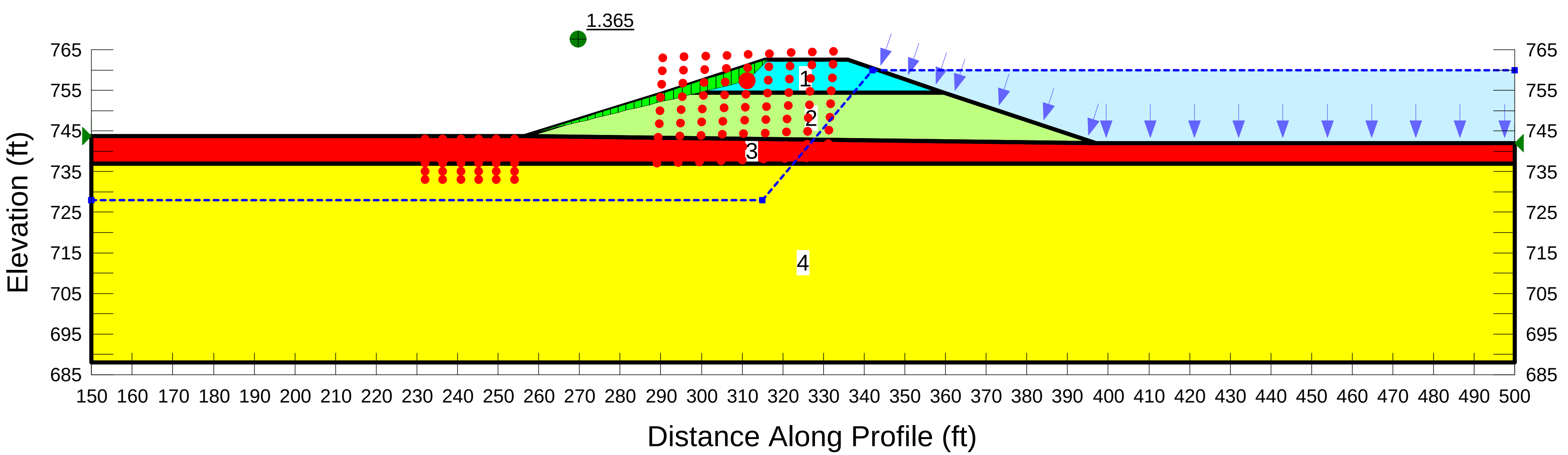
Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 4000 psf
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.8 °



Name: A3-1
Description: Seismic- Block - Drained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analysies at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 43 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Right to Left
Slip Surface Option: Block
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 24 °
Name: 2 - Lower Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 26 °
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.8 °

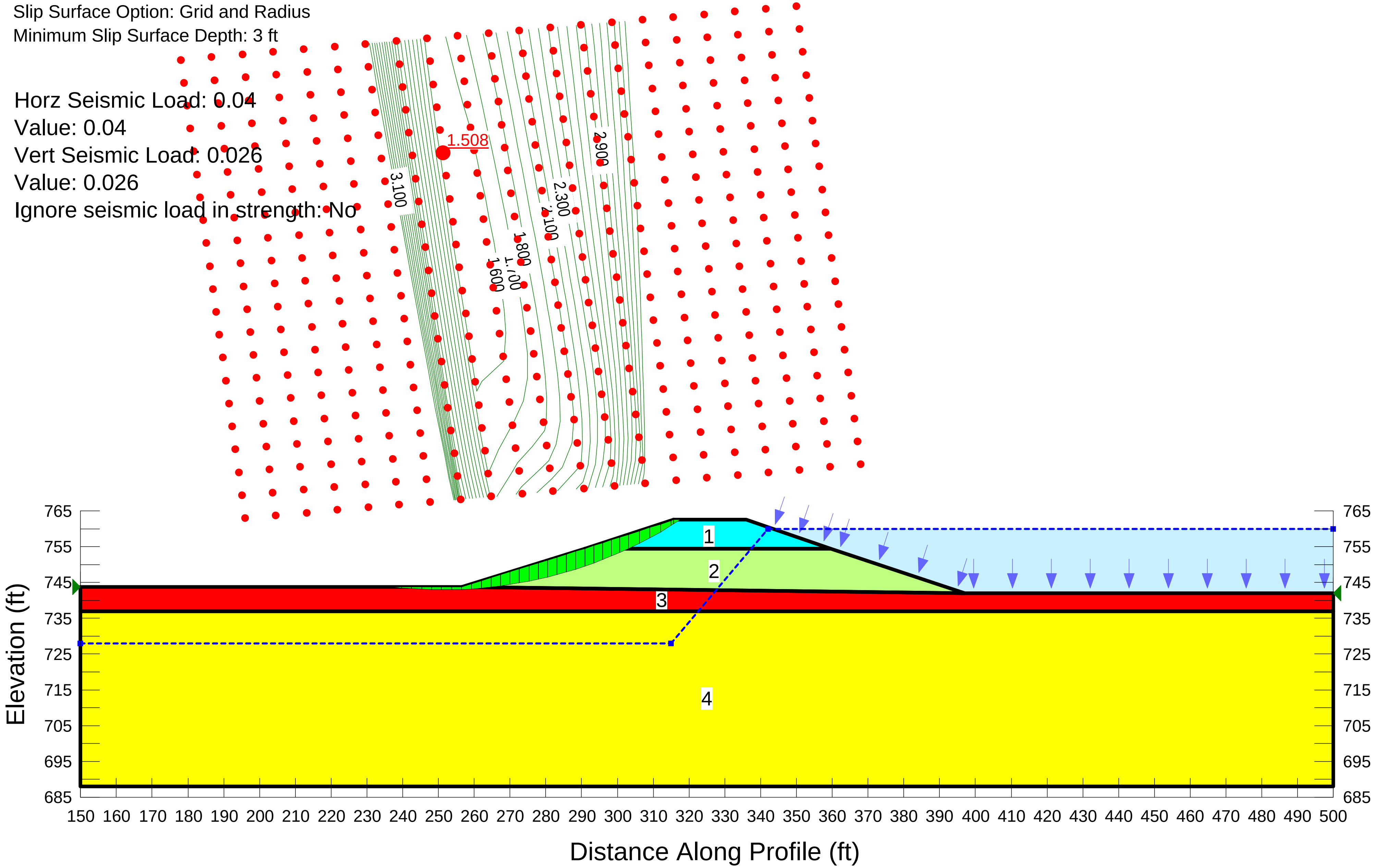
Horz Seismic Load: 0.04
Value: 0.04
Vert Seismic Load: 0.026
Value: 0.026
Ignore seismic load in strength: No



Name: A3-2
Description: Seismic- Circular - Drained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analysies at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 43 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Right to Left
Slip Surface Option: Grid and Radius
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill   Model: Mohr-Coulomb   Unit Weight: 110 pcf   Cohesion: 0 psf   Phi: 24 °
Name: 2 - Lower Levee Fill   Model: Mohr-Coulomb   Unit Weight: 110 pcf   Cohesion: 0 psf   Phi: 26 °
Name: 3 - Silt   Model: Mohr-Coulomb   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 30 °
Name: 4 - Sand   Model: Mohr-Coulomb   Unit Weight: 120 pcf   Cohesion: 0 psf   Phi: 35.8 °

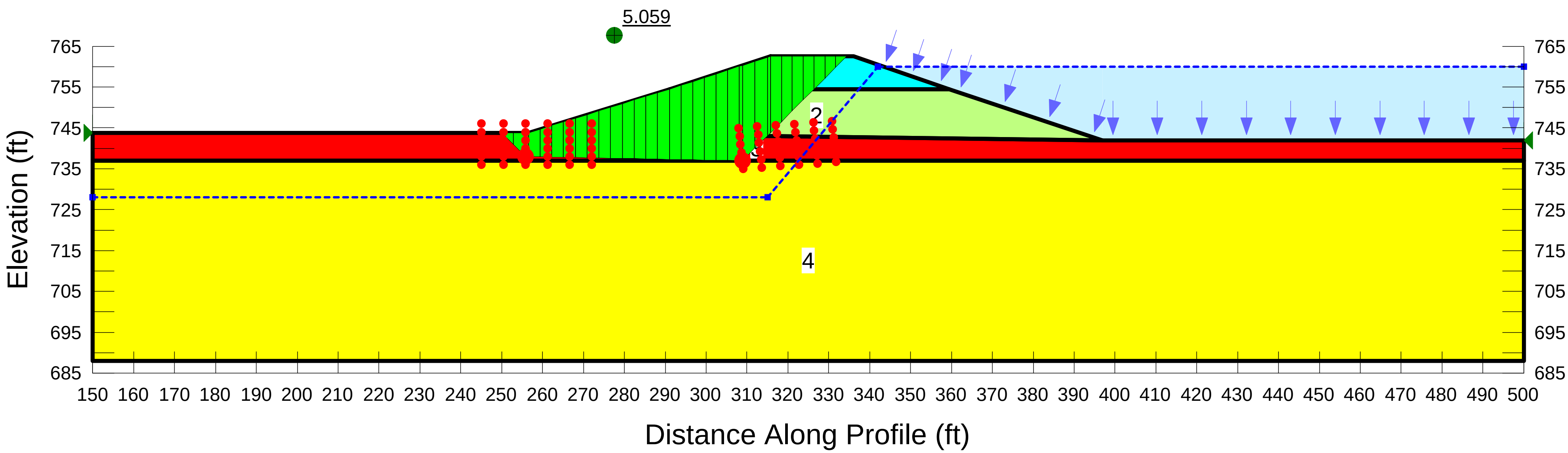
Horz Seismic Load: 0.04
Value: 0.04
Vert Seismic Load: 0.026
Value: 0.026
Ignore seismic load in strength: No



Name: A3-3
Description: Seismic- Block -Undrained ah=0.04g av=2/3ah
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analysies at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 41 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Right to Left
Slip Surface Option: Block
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 4000 psf
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.8 °

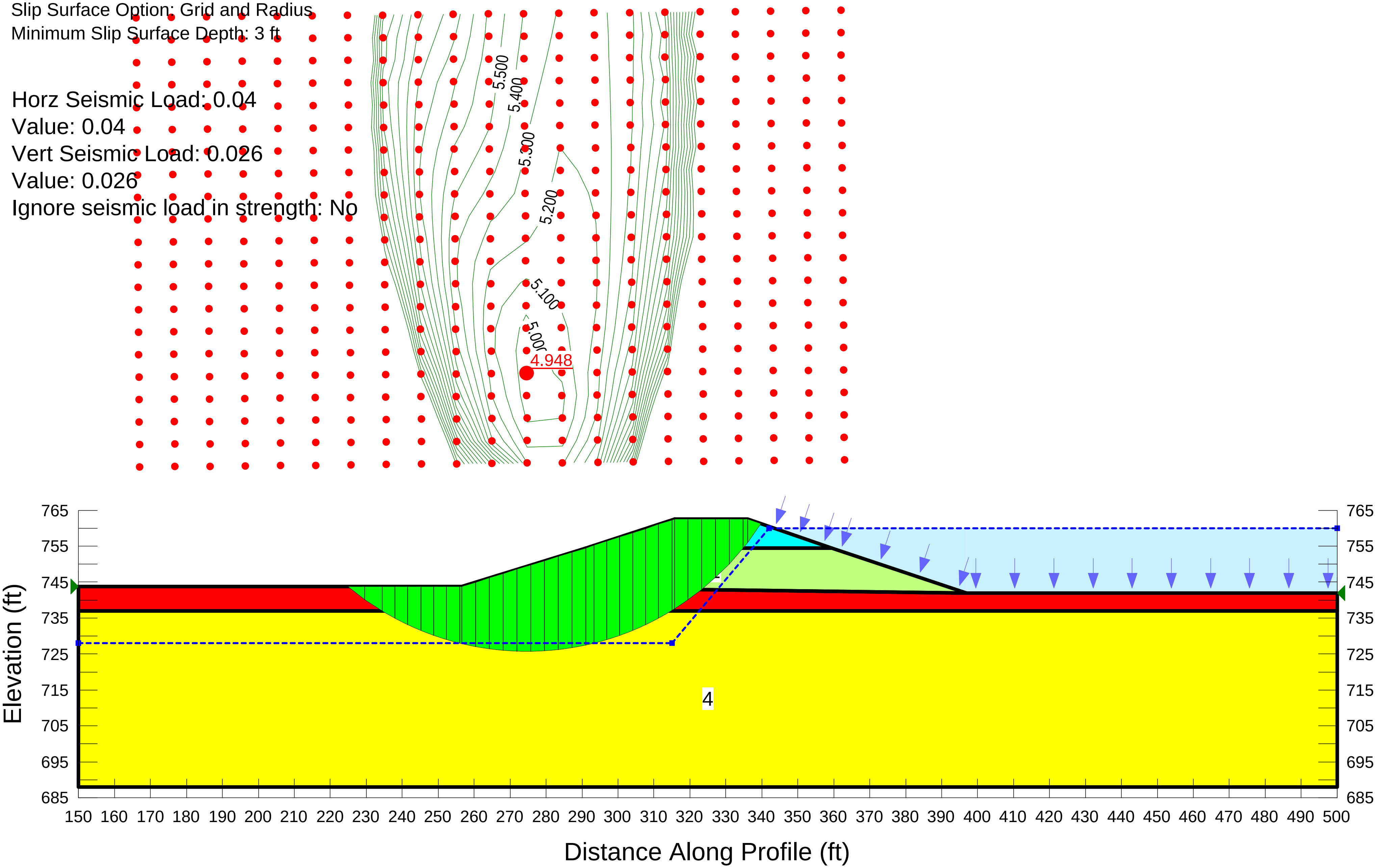
Horz Seismic Load: 0.04
Value: 0.04
Vert Seismic Load: 0.026
Value: 0.026
Ignore seismic load in strength: No



Name: A3-4
Description: Seismic- Circular - Undrained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analysies at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 42 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Right to Left
Slip Surface Option: Grid and Radius
Minimum Slip Surface Depth: 3 ft

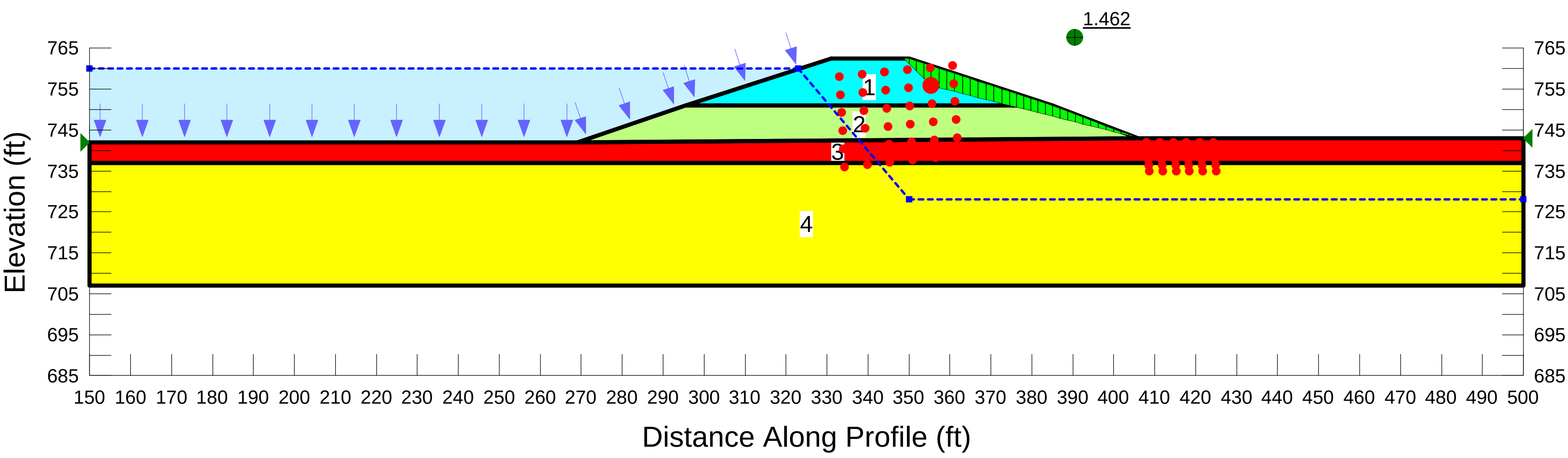
Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 4000 psf
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.8 °

Horz Seismic Load: 0.04
Value: 0.04
Vert Seismic Load: 0.026
Value: 0.026
Ignore seismic load in strength: No



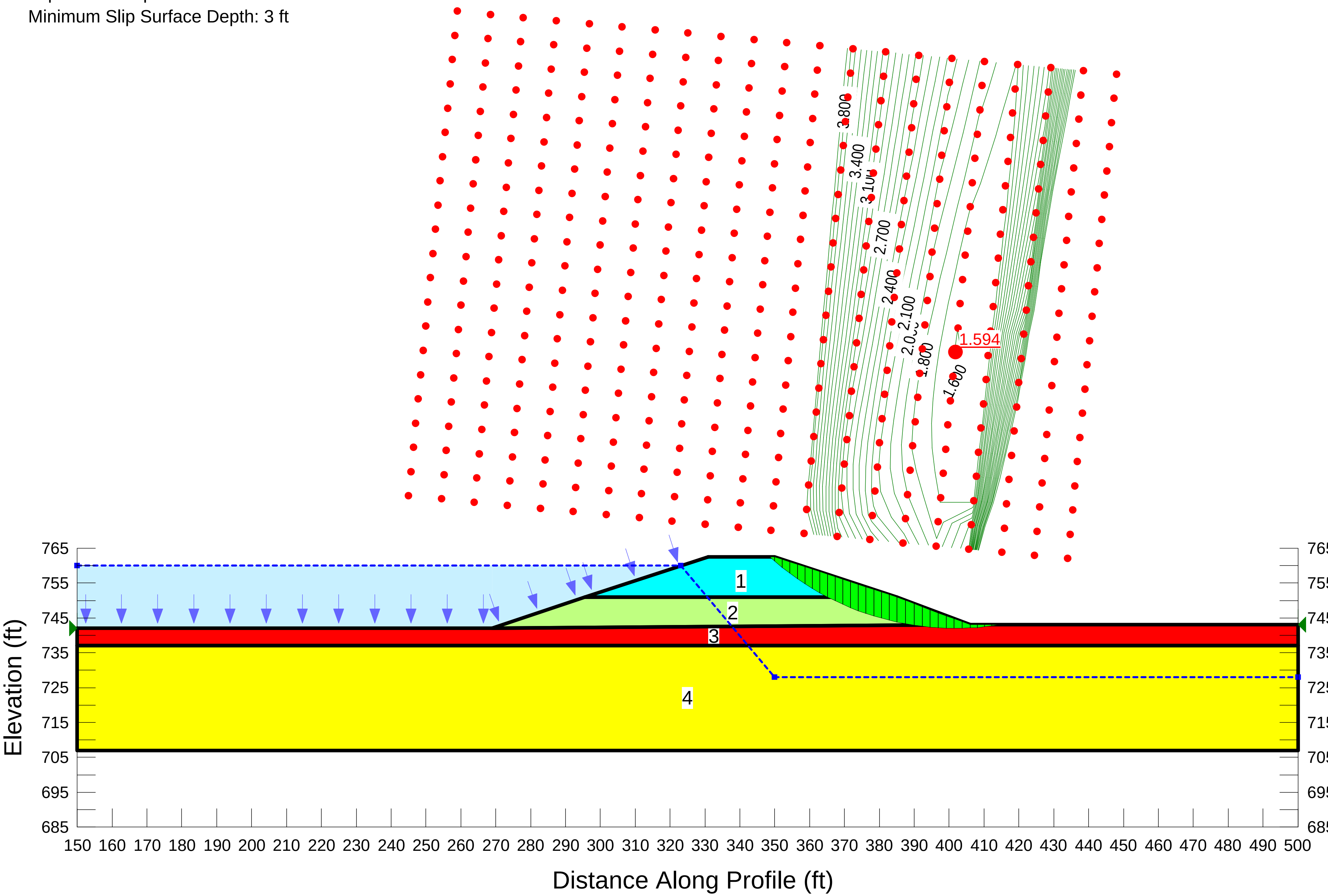
Name: B1-1
Description: Steady State- Block - Drained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analysies at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 36 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Left to Right
Slip Surface Option: Block
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 24 °
Name: 2 - Lower Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 26 °
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.5 °



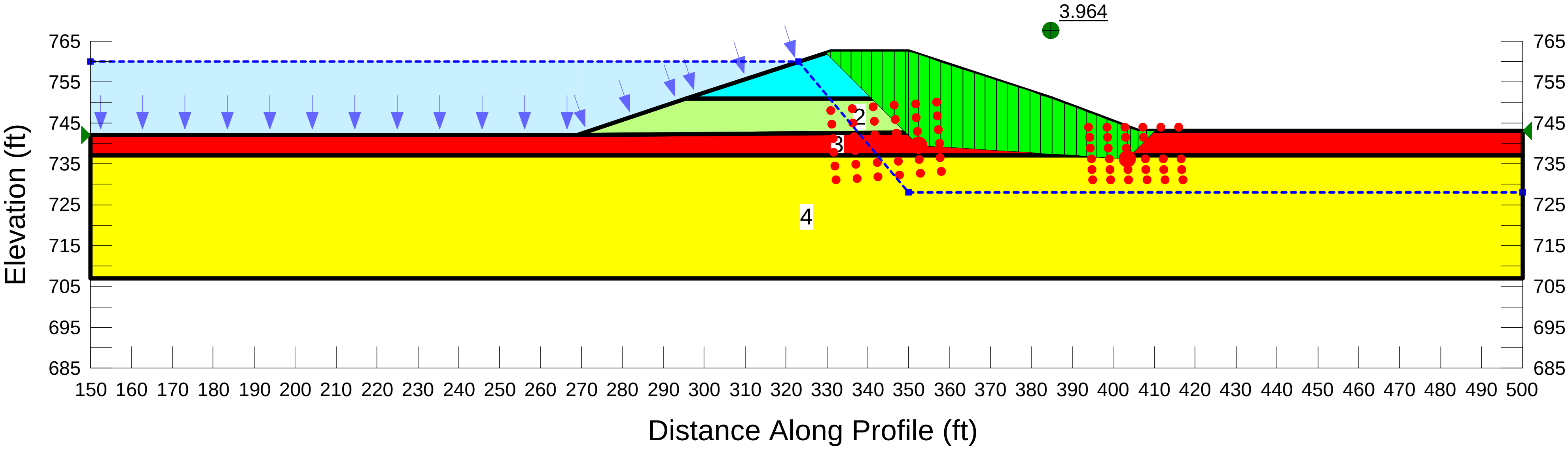
Name: B1-2
Description: Steady State- Circular - Drained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analysies at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 33 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Left to Right
Slip Surface Option: Grid and Radius
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 24 °
Name: 2 - Lower Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 26 °
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.5 °



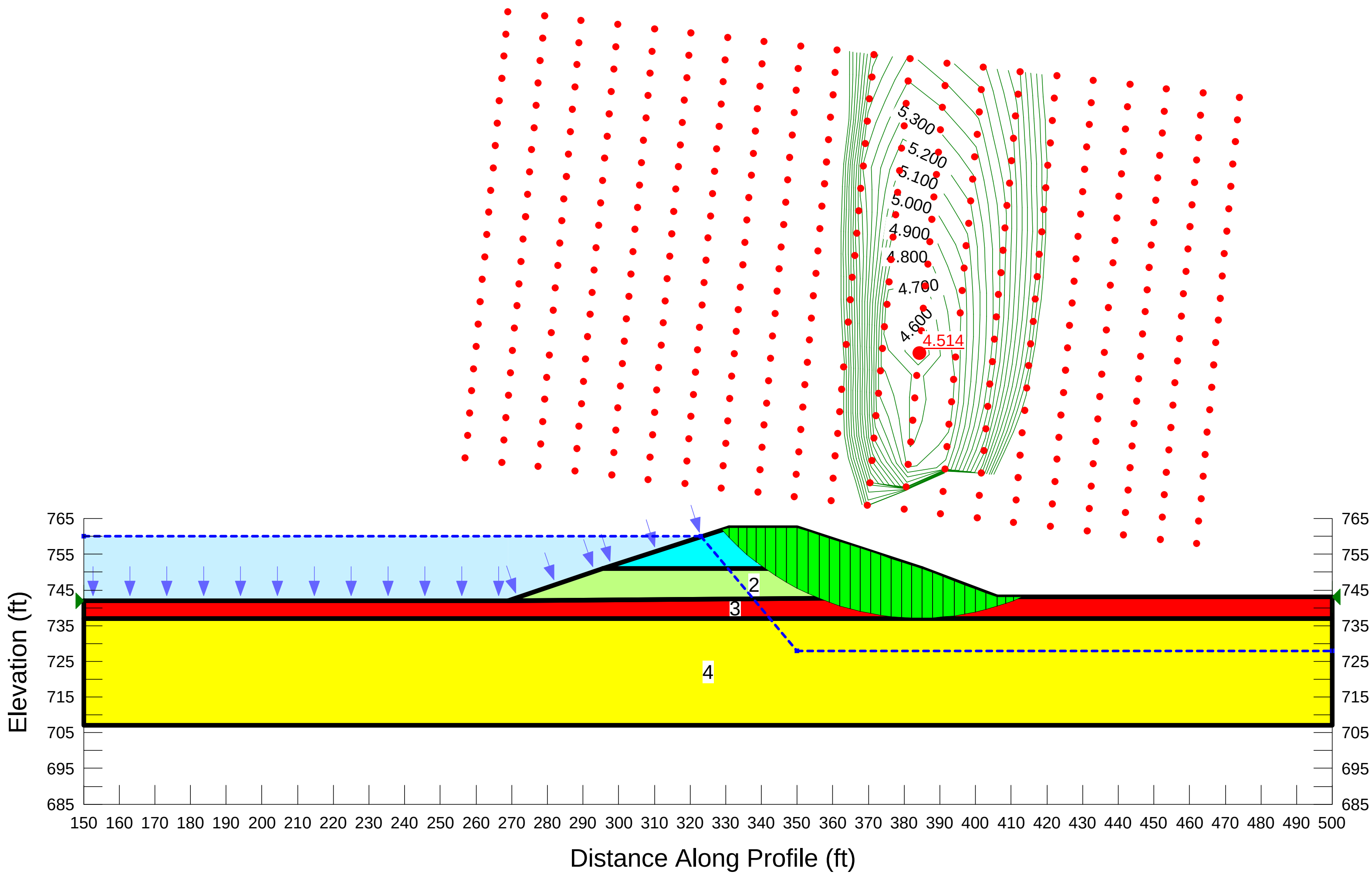
Name: B1-3
Description: Steady State- Block - Undrained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analysies at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 32 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Left to Right
Slip Surface Option: Block
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 3000 psf
Name: 3 - Silt Model: Undrained (Phi=0) Unit Weight: 100 pcf Cohesion: 500 psf
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.5 °



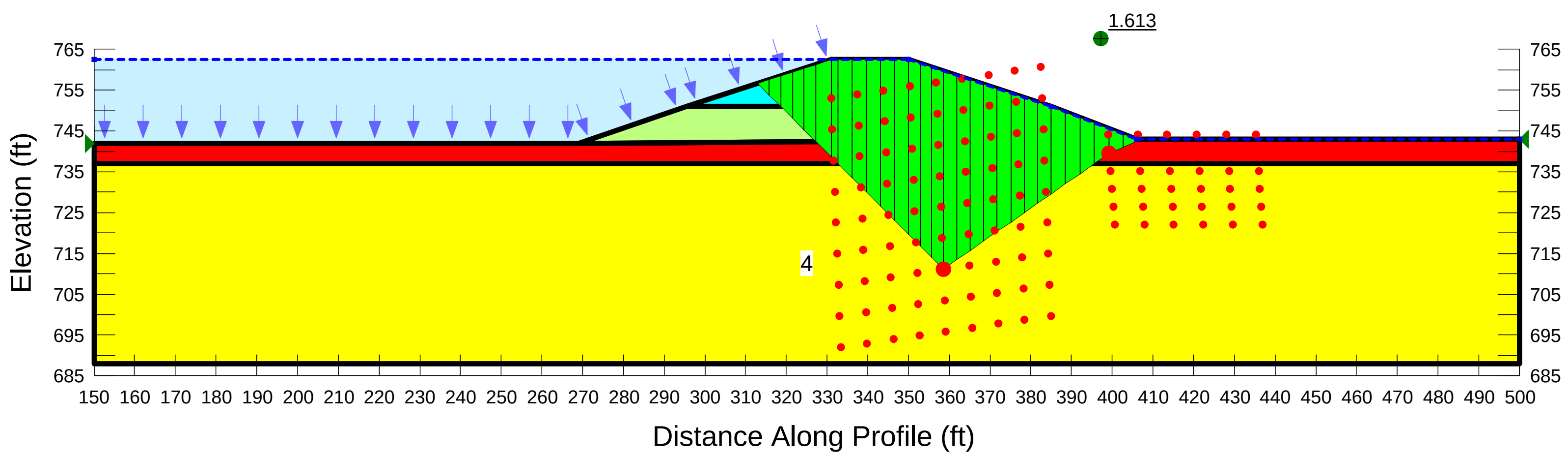
Name: B1-4
Description: Steady State- Circular - Undrained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analyses at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 31 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Left to Right
Slip Surface Option: Grid and Radius
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 3000 psf
Name: 3 - Silt Model: Undrained (Phi=0) Unit Weight: 100 pcf Cohesion: 500 psf
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.5 °

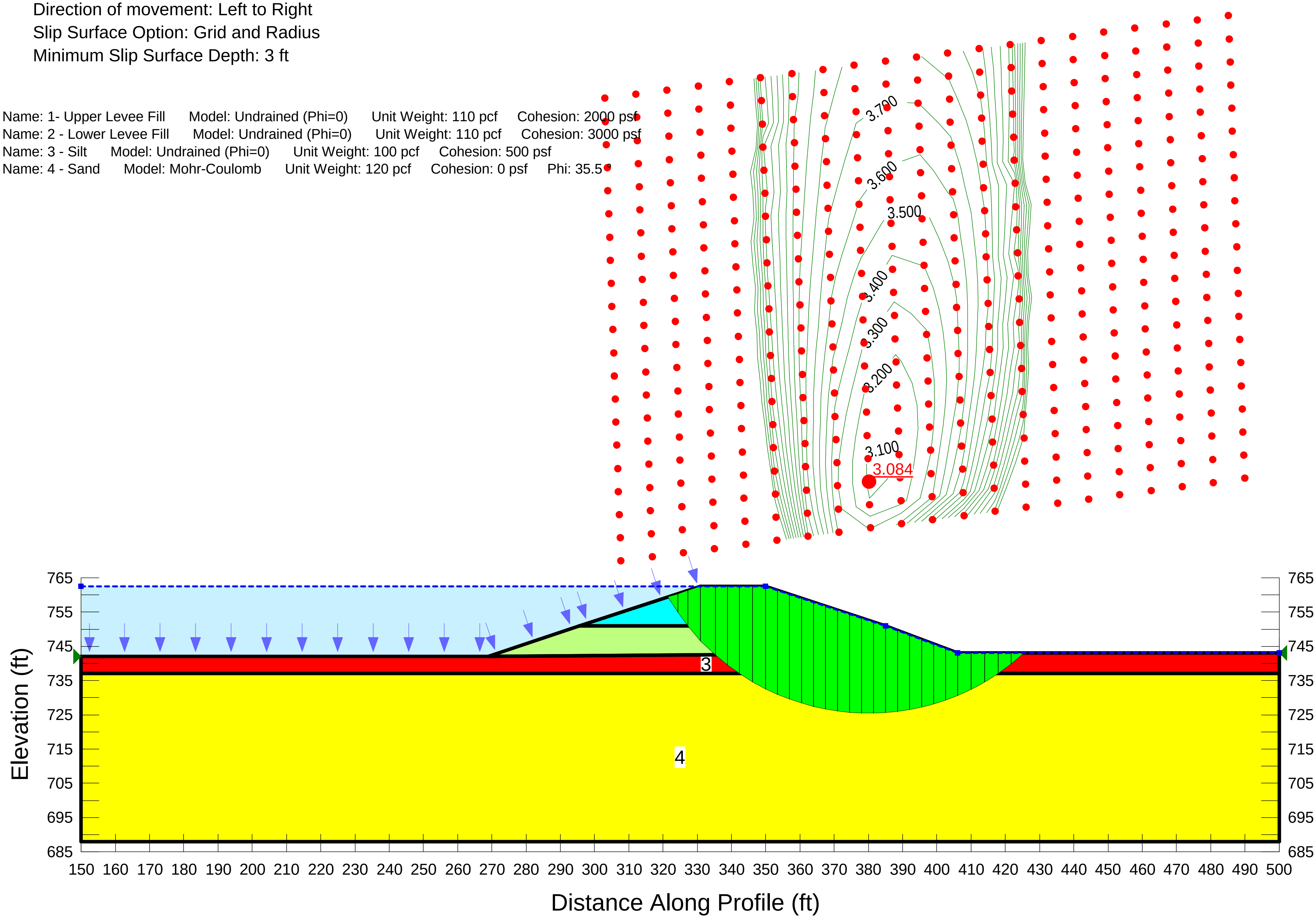


Name: B2-1
Description: Rapid Drawdown - Block
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analysies at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 40 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Left to Right
Slip Surface Option: Block
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 3000 psf
Name: 3 - Silt Model: Undrained (Phi=0) Unit Weight: 100 pcf Cohesion: 500 psf
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.5 °



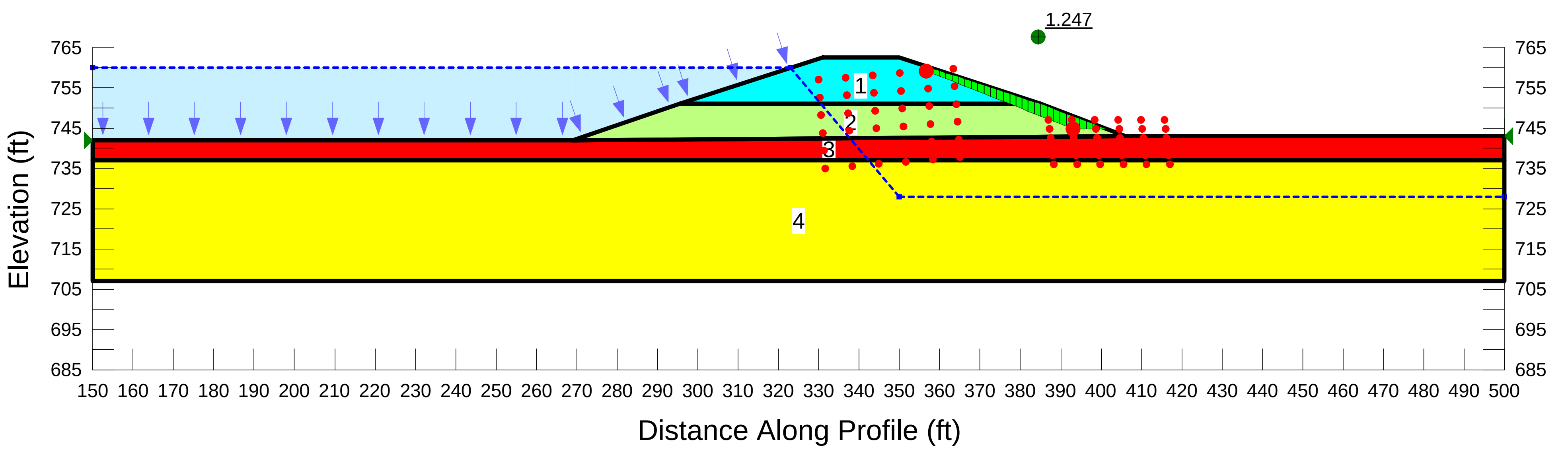
Name: B2-2
Description: Rapid Drawdown - Circular
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analyses at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 41 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Left to Right
Slip Surface Option: Grid and Radius
Minimum Slip Surface Depth: 3 ft



Name: B3-1
Description: Seismic - Block - Drained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analyses at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 39 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Left to Right
Slip Surface Option: Block
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 24 °
Name: 2 - Lower Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 26 °
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.5 °

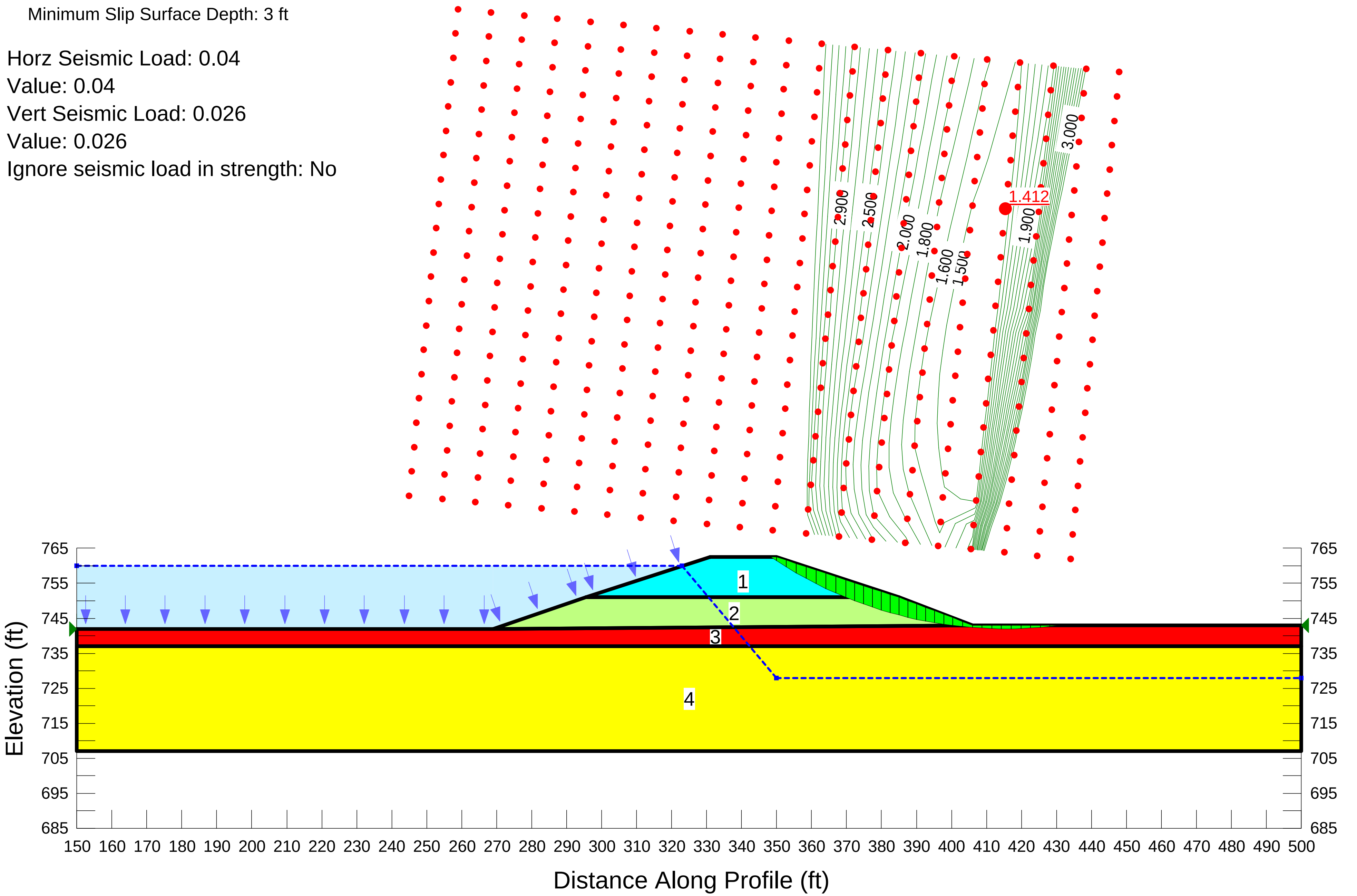
Horz Seismic Load: 0.04
Value: 0.04
Vert Seismic Load: 0.026
Value: 0.026
Ignore seismic load in strength: No



Name: B3-2
Description: Seismic - Circular - Drained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analyses at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 39 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Left to Right
Slip Surface Option: Grid and Radius
Minimum Slip Surface Depth: 3 ft

Horz Seismic Load: 0.04
Value: 0.04
Vert Seismic Load: 0.026
Value: 0.026
Ignore seismic load in strength: No

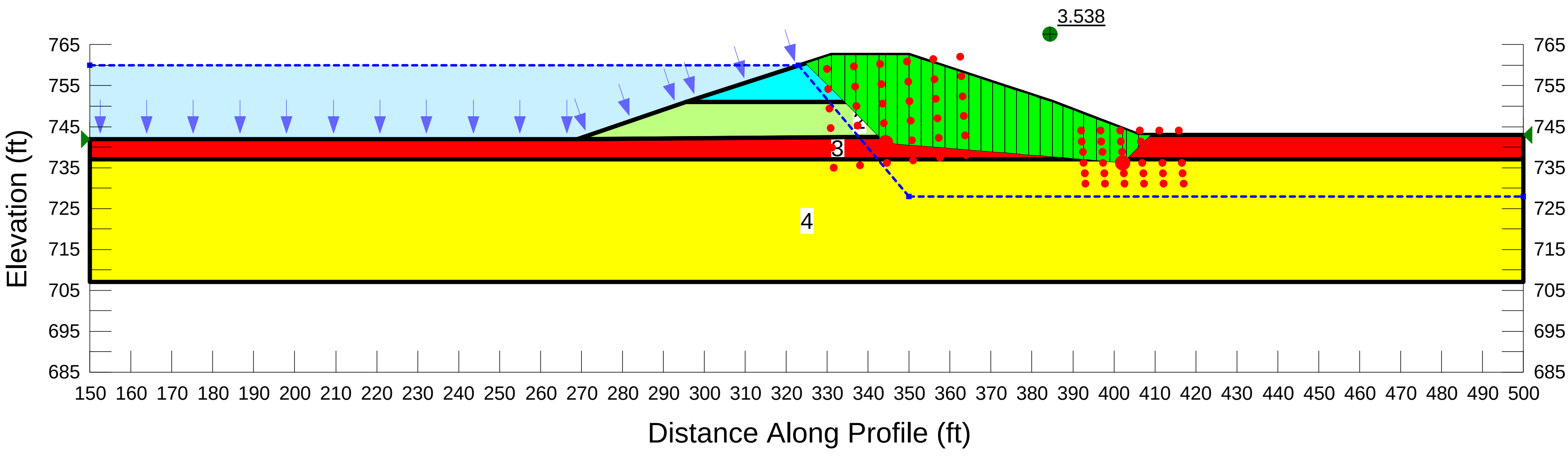
Name: 1- Upper Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 24 °
Name: 2 - Lower Levee Fill Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 26 °
Name: 3 - Silt Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 30 °
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.5 °



Name: B3-3
Description: Seismic - Block - Undrained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analysies at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 40 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Left to Right
Slip Surface Option: Block
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 3000 psf
Name: 3 - Silt Model: Undrained (Phi=0) Unit Weight: 100 pcf Cohesion: 500 psf
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.5 °

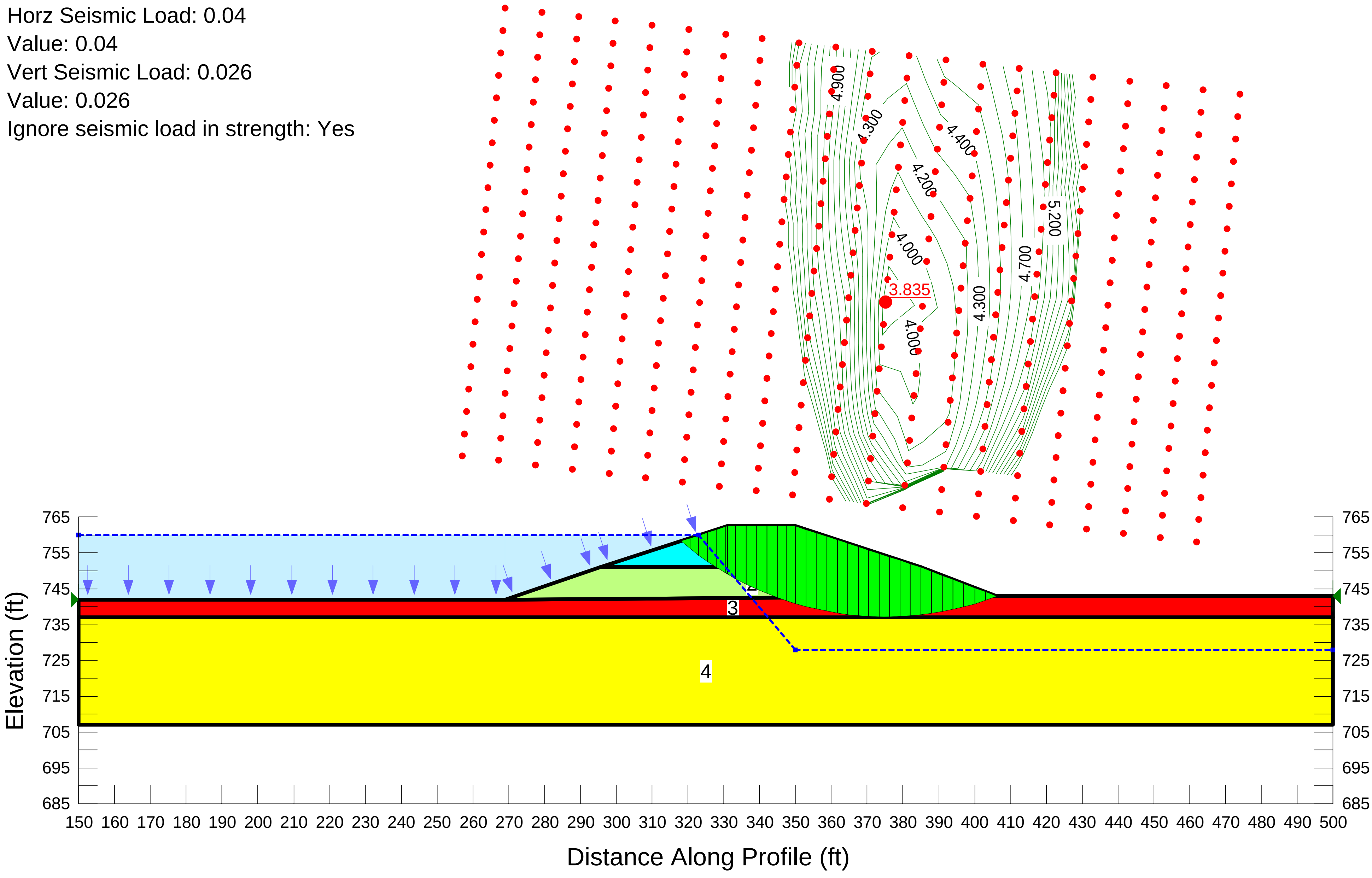
Horz Seismic Load: 0.04
Value: 0.04
Vert Seismic Load: 0.026
Value: 0.026
Ignore seismic load in strength: Yes



Name: B3-4
Description: Seismic- Circular - Undrained
Title: 60198190 Nearman Creek Power Station Stability
Comments: Stability Analysies at sections A-A'
Created By: Humphrey, Aaron
Revision Number: 41 Date: 6/16/2011
Method: Morgenstern-Price
Direction of movement: Left to Right
Slip Surface Option: Grid and Radius
Minimum Slip Surface Depth: 3 ft

Name: 1- Upper Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 2000 psf
Name: 2 - Lower Levee Fill Model: Undrained (Phi=0) Unit Weight: 110 pcf Cohesion: 3000 psf
Name: 3 - Silt Model: Undrained (Phi=0) Unit Weight: 100 pcf Cohesion: 500 psf
Name: 4 - Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35.5 °

Horz Seismic Load: 0.04
Value: 0.04
Vert Seismic Load: 0.026
Value: 0.026
Ignore seismic load in strength: Yes



Appendix D

Liquefaction Assessment Calculations

Kansas City Board of Public Utilities
Nearman Creek Power Station
Bottom Ash Pond Liquifaction Assessment

Boring B-1

Input Parameters

Peak Ground Acceleration =	0.04964
Earthquake Magnitude M =	7.7
Water table depth (ft) =	34
Average g above water table (pcf)	115
Average g below water table (pcf)	120
Borehole diameter (in)	4
Requires correction for sample liners	no

Rod lengths assumed to equal depth plus 2 feet for above ground extension

SPT Sample Number	Depth (ft)	Measured N	Soil type (USCS)	Flag "clay", "unsaturated", "unreliable"	Fines content (%)	Energy Ratio	CE	CB	CR	CS	N60	σvc (psf)	σ'vc (psf)	CN	(N1)60	DN for fines content	(N1)60-cs	Stress reduction coefficient, rd	CSR	MSF for sand	Kσ for sand	CRR for M=7.5 &s'vc = 1atm	CRR	Factor of Safety
1	3.0	7	CL	CLAY	0	60	1	1	0.75	1	5.25	345	345	1.611597	N.A.	N.A.	N.A.	1.000456	0.032281	0.948543	1.100000	N.A	N.A	N.A
2	5.5	9	CL	CLAY	2	60	1	1	0.75	1	6.75	632.5	632.5	1.374020	N.A.	N.A.	N.A.	0.995214	0.032112	0.948543	1.100000	N.A	N.A	N.A
3	8.0	8	CL	CLAY	2	60	1	1	0.75	1	6	920	920	1.245021	N.A.	N.A.	N.A.	0.989462	0.031926	0.948543	1.100000	N.A	N.A	N.A
4	10.5	13	CL	CLAY	1	60	1	1	0.8	1	10.4	1207.5	1207.5	1.159052	N.A.	N.A.	N.A.	0.983219	0.031725	0.948543	1.100000	N.A	N.A	N.A
5	13.0	15	CL	CLAY	1	60	1	1	0.85	1	12.75	1495	1495	1.095715	N.A.	N.A.	N.A.	0.976508	0.031508	0.948543	1.100000	N.A	N.A	N.A
6	15.5	11	CL	CLAY	1	60	1	1	0.85	1	9.35	1782.5	1782.5	1.046161	N.A.	N.A.	N.A.	0.969355	0.031277	0.948543	1.050609	N.A	N.A	N.A
7	18.0	17	CL	CLAY	1	60	1	1	0.85	1	14.45	2070	2070	1.005800	N.A.	N.A.	N.A.	0.961784	0.031033	0.948543	1.006485	N.A	N.A	N.A
8	20.5	13	CL	CLAY	1	60	1	1	0.95	1	12.35	2357.5	2357.5	0.971964	N.A.	N.A.	N.A.	0.953822	0.030776	0.948543	0.968110	N.A	N.A	N.A
9	23.0	16	SM		1	60	1	1	0.95	1	15.2	2645	2645	0.894257	13.592710	0.000000	13.592710	0.945496	0.030507	0.948543	0.976508	0.144657	0.133990	2
10	25.5	8	ML		1	60	1	1	0.95	1	7.6	2932.5	2932.5	0.824392	6.265380	0.000000	6.265380	0.936836	0.030228	0.948543	0.973930	0.093651	0.086516	2
11	28.0	28	SP		1	60	1	1	0.95	1	26.6	3220	3220	0.837827	22.286203	0.000000	22.286203	0.927871	0.029939	0.948543	0.938814	0.237501	0.211495	2
12	30.5	24	ML		1	60	1	1	0.95	1	22.8	3507.5	3507.5	0.793652	18.095259	0.000000	18.095259	0.918630	0.029641	0.948543	0.937241	0.184665	0.164170	2
13	35.5	18	SP-SM		1	60	1	1	1	1	18	4090	3996.4	0.724585	13.042532	0.000000	13.042532	0.899444	0.029701	0.948543	0.934385	0.140359	0.124400	2
14	40.5	20	SP-SM		1	60	1	1	1	1	20	4690	4284.4	0.704940	14.098799	0.000000	14.098799	0.879524	0.031065	0.948543	0.924350	0.148696	0.130375	2
15	45.5	22	SP-SM		1	60	1	1	1	1	22	5290	4572.4	0.688083	15.137836	0.000000	15.137836	0.859119	0.032071	0.948543	0.914184	0.157283	0.136386	2
16	50.5	28	SP		1	60	1	1	1	1	28	5890	4860.4	0.689852	19.315868	0.000000	19.315868	0.838473	0.032785	0.948543	0.891900	0.197815	0.167353	2
17	55.5	36	SP		1	60	1	1	1	1	36	6490	5148.4	0.702009	25.272332	0.000000	25.272332	0.817828	0.033264	0.948543	0.853775	0.296602	0.240201	2

Kansas City Board of Public Utilities
Nearman Creek Power Station
Bottom Ash Pond Liquifaction Assessment

Boring B-2

Input Parameters

Peak Ground Acceleration =	0.04964
Earthquake Magnitude M =	7.7
Water table depth (ft) =	16
Average g above water table (pcf)	115
Average g below water table (pcf)	120
Borehole diameter (in)	4
Requires correction for sample liners	no

Rod lengths assumed to equal depth plus 2 feet for above ground extension

SPT Sample Number	Depth (ft)	Measured N	Soil type (USCS)	Flag "clay", "unsaturated", "unreliable"	Fines content (%)	Energy Ratio	CE	CB	CR	CS	N60	σvc (psf)	σ'vc (psf)	CN	(N1)60	DN for fines content	(N1)60-cs	Stress reduction coefficient, rd	CSR	MSF for sand	Kσ for sand	CRR for M=7.5 &s'vc = 1atm	CRR	Factor of Safety
1	3.5	15	SP-SM		0	60	1	1	0.75	1	11.25	402.5	402.5	1.700000	19.125000	0.000000	19.125000	0.999449	0.032248	0.948543	1.100000	0.195665	0.204156	2
2	6	3	SM		2	60	1	1	0.75	1	2.25	690	690	1.700000	3.825000	0.000000	3.825000	0.994104	0.032076	0.948543	1.080544	0.079536	0.081520	2
3	8.5	10	SP		2	60	1	1	0.8	1	8	977.5	977.5	1.492597	11.940779	0.000000	11.940779	0.988251	0.031887	0.948543	1.076552	0.132015	0.134808	2
4	11	12	SP		1	60	1	1	0.8	1	9.6	1265	1265	1.301691	12.496237	0.000000	12.496237	0.981913	0.031682	0.948543	1.052040	0.136180	0.135895	2
6	15	5	SM		1	60	1	1	0.85	1	4.25	1725	1725	1.133972	4.819381	0.000000	4.819381	0.970820	0.031324	0.948543	1.015359	0.085098	0.081958	2
7	17.7	9	SP		1	60	1	1	0.85	1	7.65	2044	1937.92	1.051038	8.040442	0.000000	8.040442	0.962713	0.032763	0.948543	1.007534	0.104854	0.100208	2
8	20	9	SP		1	60	1	1	0.95	1	8.55	2320	2070.4	1.012232	8.654584	0.000000	8.654584	0.955444	0.034545	0.948543	1.001911	0.108900	0.103494	2
9	22.5	8	SP-SM		1	60	1	1	0.95	1	7.6	2620	2214.4	0.974201	7.403931	0.000000	7.403931	0.947189	0.036160	0.948543	0.996200	0.100751	0.095203	2
10	25	9	SP		1	60	1	1	0.95	1	8.55	2920	2358.4	0.940437	8.040738	0.000000	8.040738	0.938594	0.037496	0.948543	0.990706	0.104856	0.098536	2
11	27.5	16	SP		1	60	1	1	0.95	1	15.2	3220	2502.4	0.920053	13.984804	0.000000	13.984804	0.929687	0.038599	0.948543	0.982088	0.147779	0.137664	2
12	30	26	SP-SM		1	60	1	1	0.95	1	24.7	3520	2646.4	0.910372	22.486195	0.000000	22.486195	0.920499	0.039505	0.948543	0.967146	0.240713	0.220825	2
13	35.5	13	SP-SM		1	60	1	1	1	1	13	4180	2963.2	0.836331	10.872297	0.000000	10.872297	0.899444	0.040939	0.948543	0.967904	0.124223	0.114049	2
14	40.5	47	SP		1	60	1	1	1	1	47	4780	3251.2	0.883198	41.510310	0.000000	41.510310	0.879524	0.041723	0.948543	0.873266	2.000000	1.656660	2
15	45.5	21	SP		1	60	1	1	1	1	21	5380	3539.2	0.784314	16.470587	0.000000	16.470587	0.859119	0.042138	0.948543	0.939847	0.168991	0.150653	2
16	50.5	10	SP		1	60	1	1	1	1	10	5980	3827.2	0.709364	7.093640	0.000000	7.093640	0.838473	0.042272	0.948543	0.951058	0.098785	0.089116	2
17	55.5	10	SP		1	60	1	1	1	1	10	6580	4115.2	0.678100	6.781003	0.000000	6.781003	0.817828	0.042193	0.948543	0.945744	0.096828	0.086862	2

Kansas City Board of Public Utilities
Nearman Creek Power Station
Bottom Ash Pond Liquifaction Assessment

Boring B-3

Input Parameters

Peak Ground Acceleration =	0.04964
Earthquake Magnitude M =	7.7
Water table depth (ft) =	34
Average g above water table (pcf)	115
Average g below water table (pcf)	120
Borehole diameter (in)	4
Requires correction for sample liners	no

Rod lengths assumed to equal depth plus 2 feet for above ground extension

SPT Sample Number	Depth (ft)	Measured N	Soil type (USCS)	Flag "clay", "unsaturated", "unreliable"	Fines content (%)	Energy Ratio	CE	CB	CR	CS	N60	σvc (psf)
1	3	15	CL		0	60	1	1	0.75	1	11.25	345
2	5.5	11	CL		2	60	1	1	0.75	1	8.25	632.5
3	8	11	CL		2	60	1	1	0.75	1	8.25	920
4	10.5	12	CL		1	60	1	1	0.8	1	9.6	1207.5
5	13	12	CL		1	60	1	1	0.85	1	10.2	1495
6	15.5	14	CL		1	60	1	1	0.85	1	11.9	1782.5
7	18	23	CL-ML		1	60	1	1	0.85	1	19.55	2070
8	20.5	16	CL-ML		1	60	1	1	0.95	1	15.2	2357.5
9	23	16	CL-ML		1	60	1	1	0.95	1	15.2	2645
10	25.5	11	ML		1	60	1	1	0.95	1	10.45	2932.5
11	28	17	SM		1	60	1	1	0.95	1	16.15	3220
12	30.5	20	SP		1	60	1	1	0.95	1	19	3507.5
13	35.5	16	SP		1	60	1	1	1	1	16	4090
14	40.5	39	SP		1	60	1	1	1	1	39	4690
15	45.5	30	SP-SM		1	60	1	1	1	1	30	5290
16	50.5	17	SP		1	60	1	1	1	1	17	5890
17	55.5	35	SP		1	60	1	1	1	1	35	6490

SPT Sample Number	σ'vc (psf)	CN	(N1)60	DN for fines content	(N1)60-cs	Stress reduction coefficient, rd	CSR	MSF for sand	Kσ for sand	CRR for M=7.5 &s'vc = 1atm	CRR	Factor of Safety
1	345	1.700000	19.125000	0.000000	19.125000	1.000456	0.032281	0.948543	1.100000	0.195665	0.204156	2
2	632.5	1.700000	14.025000	0.000000	14.025000	0.995214	0.032112	0.948543	1.100000	0.148102	0.154529	2
3	920	1.530644	12.627812	0.000000	12.627812	0.989462	0.031926	0.948543	1.084659	0.137179	0.141136	2
4	1207.5	1.330841	12.776070	0.000000	12.776070	0.983219	0.031725	0.948543	1.057328	0.138310	0.138714	2
5	1495	1.196220	12.201442	0.000000	12.201442	0.976508	0.031508	0.948543	1.034765	0.133959	0.131484	2
6	1782.5	1.090902	12.981740	0.000000	12.981740	0.969355	0.031277	0.948543	1.017659	0.139889	0.135034	2
7	2070	1.009779	19.741181	0.000000	19.741181	0.961784	0.031033	0.948543	1.002903	0.202748	0.192874	2
8	2357.5	0.948171	14.412203	0.000000	14.412203	0.953822	0.030776	0.948543	0.988277	0.151243	0.141779	2
9	2645	0.894257	13.592710	0.000000	13.592710	0.945496	0.030507	0.948543	0.976508	0.144657	0.133990	2
10	2932.5	0.833713	8.712296	0.000000	8.712296	0.936836	0.030228	0.948543	0.971307	0.109285	0.100687	2
11	3220	0.808436	13.056238	0.000000	13.056238	0.927871	0.029939	0.948543	0.956653	0.140465	0.127461	2
12	3507.5	0.781404	14.846669	0.000000	14.846669	0.918630	0.029641	0.948543	0.944308	0.154834	0.138687	2
13	3996.4	0.716660	11.466554	0.000000	11.466554	0.899444	0.029701	0.948543	0.938056	0.128522	0.114357	2
14	4284.4	0.774706	30.213541	0.000000	30.213541	0.879524	0.031065	0.948543	0.855542	0.498592	0.404616	2
15	4572.4	0.719537	21.586112	0.000000	21.586112	0.859119	0.032071	0.948543	0.890746	0.226885	0.191698	2
16	4860.4	0.643573	10.940743	0.000000	10.940743	0.838473	0.032785	0.948543	0.920539	0.124714	0.108897	2
17	5148.4	0.697965	24.428765	0.000000	24.428765	0.817828	0.033264	0.948543	0.858785	0.277102	0.225726	2

Kansas City Board of Public Utilities
Nearman Creek Power Station
Bottom Ash Pond Liquifaction Assessment

Boring B-4

Input Parameters

Peak Ground Acceleration =	0.04964
Earthquake Magnitude M =	7.7
Water table depth (ft) =	34
Average g above water table (pcf)	115
Average g below water table (pcf)	120
Borehole diameter (in)	4
Requires correction for sample liners	no

Rod lengths assumed to equal depth plus 2 feet for above ground extension

SPT Sample Number	Depth (ft)	Measured N	Soil type (USCS)	Flag "clay", "unsaturated", "unreliable"	Fines content (%)	Energy Ratio	CE	CB	CR	CS	N60	σvc (psf)	σ'vc (psf)	CN	(N1)60	DN for fines content	(N1)60-cs	Stress reduction coefficient, rd	CSR	MSF for sand	Kσ for sand	CRR for M=7.5 &s'vc = 1atm	CRR	Factor of Safety
1	3	7	CL		0	60	1	1	0.75	1	5.25	345	345	1.700000	8.925000	0.000000	8.925000	1.000456	0.032281	0.948543	1.100000	0.110709	0.115514	2
2	5.5	9	CL		2	60	1	1	0.75	1	6.75	632.5	632.5	1.700000	11.475000	0.000000	11.475000	0.995214	0.032112	0.948543	1.100000	0.128584	0.134164	2
3	8	8	CL		2	60	1	1	0.75	1	6	920	920	1.578020	9.468121	0.000000	9.468121	0.989462	0.031926	0.948543	1.075352	0.114392	0.116682	2
4	10.5	13	CL		1	60	1	1	0.8	1	10.4	1207.5	1207.5	1.323115	13.760394	0.000000	13.760394	0.983219	0.031725	0.948543	1.059420	0.145986	0.146702	2
5	13	15	CL-ML		1	60	1	1	0.85	1	12.75	1495	1495	1.183776	15.093146	0.000000	15.093146	0.976508	0.031508	0.948543	1.038629	0.156904	0.154580	2
6	15.5	11	CL-ML		1	60	1	1	0.85	1	9.35	1782.5	1782.5	1.096678	10.253935	0.000000	10.253935	0.969355	0.031277	0.948543	1.015978	0.119838	0.115488	2
7	18	17	CL-ML		1	60	1	1	0.85	1	14.45	2070	2070	1.010839	14.606617	0.000000	14.606617	0.961784	0.031033	0.948543	1.002401	0.152841	0.145324	2
8	20.5	13	CL-ML		1	60	1	1	0.95	1	12.35	2357.5	2357.5	0.945187	11.673063	0.000000	11.673063	0.953822	0.030776	0.948543	0.989392	0.130036	0.122036	2
9	23	16	ML		1	60	1	1	0.95	1	15.2	2645	2645	0.894257	13.592710	0.000000	13.592710	0.945496	0.030507	0.948543	0.976508	0.144657	0.133990	2
10	25.5	8	ML		1	60	1	1	0.95	1	7.6	2932.5	2932.5	0.824392	6.265380	0.000000	6.265380	0.936836	0.030228	0.948543	0.973930	0.093651	0.086516	2
11	28	28	SP		1	60	1	1	0.95	1	26.6	3220	3220	0.837827	22.286203	0.000000	22.286203	0.927871	0.029939	0.948543	0.938814	0.237501	0.211495	2
12	30.5	24	SP		1	60	1	1	0.95	1	22.8	3507.5	3507.5	0.793652	18.095259	0.000000	18.095259	0.918630	0.029641	0.948543	0.937241	0.184665	0.164170	2
13	35.5	16	SP		1	60	1	1	1	1	16	4090	3996.4	0.716660	11.466554	0.000000	11.466554	0.899444	0.029701	0.948543	0.938056	0.128522	0.114357	2
14	40.5	20	SP		1	60	1	1	1	1	20	4690	4284.4	0.704940	14.098799	0.000000	14.098799	0.879524	0.031065	0.948543	0.924350	0.148696	0.130375	2
15	45.5	22	SP		1	60	1	1	1	1	22	5290	4572.4	0.688083	15.137836	0.000000	15.137836	0.859119	0.032071	0.948543	0.914184	0.157283	0.136386	2
16	50.5	28	SP		1	60	1	1	1	1	28	5890	4860.4	0.689852	19.315868	0.000000	19.315868	0.838473	0.032785	0.948543	0.891900	0.197815	0.167353	2
17	55.5	36	SP		1	60	1	1	1	1	36	6490	5148.4	0.702009	25.272332	0.000000	25.272332	0.817828	0.033264	0.948543	0.853775	0.296602	0.240201	2

Kansas City Board of Public Utilities
Nearman Creek Power Station
Bottom Ash Pond Liquifaction Assessment

Boring B-5

Input Parameters

Peak Ground Acceleration =	0.04964
Earthquake Magnitude M =	7.7
Water table depth (ft) =	15
Average g above water table (pcf)	115
Average g below water table (pcf)	120
Borehole diameter (in)	4
Requires correction for sample liners	no

Rod lengths assumed to equal depth plus 2 feet for above ground extension

SPT Sample Number	Depth (ft)	Measured N	Soil type (USCS)	Flag "clay", "unsaturated", "unreliable"	Fines content (%)	Energy Ratio	CE	CB	CR	CS	N60	σvc (psf)	σ'vc (psf)
1	3.5	6	CL		0	60	1	1	0.75	1	4.5	402.5	402.5
2	6	4	CL		0	60	1	1	0.75	1	3	690	690
3	8.5	8	CL		0	60	1	1	0.8	1	6.4	977.5	977.5
4	11	14	CL		0	60	1	1	0.8	1	11.2	1265	1265
5	13.5	16	CL-ML		0	60	1	1	0.85	1	13.6	1552.5	1552.5
6	16	4	CL-ML		0	60	1	1	0.85	1	3.4	1845	1782.6
7	18.5	10	CL-ML		0	60	1	1	0.95	1	9.5	2145	1926.6
8	21	4	CL-ML		0	60	1	1	0.95	1	3.8	2445	2070.6
9	23.5	16	ML		0	60	1	1	0.95	1	15.2	2745	2214.6
10	26	24	ML		0	60	1	1	0.95	1	22.8	3045	2358.6
11	28.5	15	SP		0	60	1	1	0.95	1	14.25	3345	2502.6
12	31	12	SP		0	60	1	1	0.95	1	11.4	3645	2646.6
13	37.5	12	SP		0	60	1	1	1	1	12	4425	3021
14	42.5	12	SP		0	60	1	1	1	1	12	5025	3309
15	47.5	31	SP		0	60	1	1	1	1	31	5625	3597
16	52.5	12	SP		0	60	1	1	1	1	12	6225	3885
17	55.5	20	SP		0	60	1	1	1	1	20	6585	4057.8

SPT Sample Number	CN	(N1)60	DN for fines content	(N1)60-cs	Stress reduction coefficient, rd	CSR	MSF for sand	Kσ for sand	CRR for M=7.5 &s'vc = 1atm	CRR	Factor of Safety
1	1.700000	7.650000	0.000000	7.650000	0.999449	0.032248	0.948543	1.100000	0.102326	0.106767	2
2	1.700000	5.100000	0.000000	5.100000	0.994104	0.032076	0.948543	1.085273	0.086715	0.089267	2
3	1.522464	9.743772	0.000000	9.743772	0.988251	0.031887	0.948543	1.070592	0.116287	0.118089	2
4	1.288214	14.427997	0.000000	14.427997	0.981913	0.031682	0.948543	1.055834	0.151372	0.151600	2
5	1.159883	15.774412	0.000000	15.774412	0.975112	0.031463	0.948543	1.035300	0.162766	0.159841	2
6	1.114920	3.790730	0.000000	3.790730	0.967873	0.032323	0.948543	1.012304	0.079349	0.076192	2
7	1.052059	9.994559	0.000000	9.994559	0.960222	0.034495	0.948543	1.008652	0.118025	0.112921	2
8	1.013830	3.852552	0.000000	3.852552	0.952185	0.036278	0.948543	1.001561	0.079686	0.075704	2
9	0.978025	14.865974	0.000000	14.865974	0.943790	0.037746	0.948543	0.994978	0.154995	0.146281	2
10	0.954850	21.770573	0.000000	21.770573	0.935067	0.038951	0.948543	0.984499	0.229592	0.214402	2
11	0.918575	13.089695	0.000000	13.089695	0.926044	0.039938	0.948543	0.982655	0.140724	0.131167	2
12	0.886211	10.102809	0.000000	10.102809	0.916752	0.040739	0.948543	0.979273	0.118780	0.110333	2
13	0.824363	9.892358	0.000000	9.892358	0.891550	0.042136	0.948543	0.967273	0.117315	0.107637	2
14	0.782454	9.389454	0.000000	9.389454	0.871407	0.042698	0.948543	0.959669	0.113855	0.103640	2
15	0.809044	25.080367	0.000000	25.080367	0.850876	0.042933	0.948543	0.913440	0.291926	0.252935	2
16	0.711786	8.541433	0.000000	8.541433	0.830202	0.042922	0.948543	0.946923	0.108148	0.097139	2
17	0.726224	14.524477	0.000000	14.524477	0.817828	0.042822	0.948543	0.929086	0.152164	0.134099	2

Kansas City Board of Public Utilities
Nearman Creek Power Station
Bottom Ash Pond Liquifaction Assessment

SWV B-1

Input Parameters

Peak Ground Acceleration =	0.04964
Earthquake Magnitude M =	7.7
Water table depth (ft) =	34
Average g above water table (pcf)	115
Average g below water table (pcf)	120
Vs1* (m/s)	215

Depth	Measured Vs	Measured V	σvc (psf)	σ'vc (psf)	Vs1	rd	CSR	CRR	MSF	FS
ft	ft/s	m/s								
0.1	961.63	293.1799	11.5	11.5	1064.675	1.005868	0.032455	1	0.948543	2
2	961.63	293.1799	230	230	503.4539	1.002404	0.032344	1	0.948543	2
2	766.31	233.6311	230	230	401.1956	1.002404	0.032344	1	0.948543	2
5	766.31	233.6311	575	575	319.0591	0.996304	0.032147	1	0.948543	2
5	775.33	236.3811	575	575	322.8147	0.996304	0.032147	1	0.948543	2
10	775.33	236.3811	1150	1150	271.4537	0.984505	0.031766	1	0.948543	2
10	634.39	193.4116	1150	1150	222.1087	0.984505	0.031766	1	0.948543	2
15	634.39	193.4116	1725	1725	200.6978	0.97082	0.031324	0.271367	0.948543	2
15	485.26	147.9451	1725	1725	153.5186	0.97082	0.031324	0.084368	0.948543	2
20	485.26	147.9451	2300	2300	142.8651	0.955444	0.030828	0.070696	0.948543	2
20	633.71	193.2043	2300	2300	186.5702	0.955444	0.030828	0.162043	0.948543	2
25	633.71	193.2043	2875	2875	176.4472	0.938594	0.030285	0.128098	0.948543	2
25	578.67	176.4238	2875	2875	161.1221	0.938594	0.030285	0.096059	0.948543	2
30	578.67	176.4238	3450	3450	153.943	0.920499	0.029701	0.084972	0.948543	2
30	810.09	246.9787	3450	3450	215.5074	0.920499	0.029701	1	0.948543	2
35	810.09	246.9787	4030	3967.6	208.1062	0.9014	0.029542	0.488415	0.948543	2
35	901.08	274.7195	4030	3967.6	231.4808	0.9014	0.029542	1	0.948543	2
40	901.08	274.7195	4630	4255.6	227.4609	0.881542	0.030946	1	0.948543	2
40	644.89	196.6128	4630	4255.6	162.7905	0.881542	0.030946	0.098909	0.948543	2
45	644.89	196.6128	5230	4543.6	160.1472	0.861174	0.031984	0.094446	0.948543	2
45	691.8	210.9146	5230	4543.6	171.7965	0.861174	0.031984	0.116717	0.948543	2
49.8	691.8	210.9146	5806	4820.08	169.2781	0.841369	0.032701	0.111258	0.948543	2

Kansas City Board of Public Utilities
Nearman Creek Power Station
Bottom Ash Pond Liquifaction Assessment

SWV B-2

Input Parameters

Peak Ground Acceleration =	0.04964
Earthquake Magnitude M =	7.7
Water table depth (ft) =	15
Average g above water table (pcf)	115
Average g below water table (pcf)	120
Vs1* (m/s)	215

Depth	Measured Vs	/leasured V	σvc (psf)	σ'vc (psf)	Vs1	rd	CSR	CRR	FS
ft	ft/s	m/s							
0.1	366.53	111.747	11.5	11.5	405.8062	1.005868	0.032455	1	2
2	366.53	111.747	230	230	191.8939	1.002404	0.032344	0.189168	2
2	417.86	127.3963	230	230	218.7673	1.002404	0.032344	1	2
5	417.86	127.3963	575	575	173.9793	0.996304	0.032147	0.121826	2
5	884.96	269.8049	575	575	368.46	0.996304	0.032147	1	2
10	884.96	269.8049	1150	1150	309.8367	0.984505	0.031766	1	2
10	872.28	269.8049	1150	1150	309.8367	0.984505	0.031766	1	2
15	872.28	265.939	1725	1725	275.9576	0.97082	0.031324	1	2
15	749.34	265.939	1725	1725	275.9576	0.97082	0.031324	1	2
20	749.34	228.4573	2325	2013	228.0876	0.955444	0.035607	1	2
20	438.34	228.4573	2325	2013	228.0876	0.955444	0.035607	1	2
25	438.34	133.6402	2925	2301	129.0374	0.938594	0.038497	0.05618	1.45933
25	613.74	133.6402	2925	2301	129.0374	0.938594	0.038497	0.05618	1.45933
30	613.74	187.1159	3525	2589	175.4224	0.920499	0.040439	0.125424	2
30	857.96	187.1159	3525	2589	175.4224	0.920499	0.040439	0.125424	2
35	857.96	261.5732	4125	2877	238.8448	0.9014	0.041701	1	2
35	780.49	261.5732	4125	2877	238.8448	0.9014	0.041701	1	2
40	780.49	237.9543	4725	3165	212.1571	0.881542	0.042464	1.07091	2
40	795.99	237.9543	4725	3165	212.1571	0.881542	0.042464	1.07091	2
45	795.99	242.6799	5325	3453	211.7104	0.861174	0.042851	0.936742	2
45	738.22	242.6799	5325	3453	211.7104	0.861174	0.042851	0.936742	2
49.8	738.22	225.0671	5901	3729.48	192.6005	0.841369	0.042955	0.193588	2

Kansas City
Board of Public Utilities

Ash Pond Surveillance Program

Nearman Creek Power Station
Kansas City Board of Public Utilities (BPU)
Kansas Landfill Permit No.: 413

Purpose:

This Surveillance Program for the ash pond at the Nearman Creek Power Station (Nearman) has been adopted to ensure the integrity of the dike structure at the Bottom Ash Pond through regular inspections and to prevent possible deterioration of embankments.

This Surveillance Program was prepared in compliance with the recommendations of the April 2011 report prepared for the United States Environmental Agency titled "Coal Combustion Waste Impoundment, Round 7 – Dam Assessment Report, Nearman Creek Power Station, Coal Ash Pond Dike, Kansas City Board of Public Utilities, Kansas City, Kansas."

Monthly Inspections:

The entire length of the levee embankment surrounding the Nearman Bottom Ash Pond will be inspected at least quarterly. The inspection will be conducted by the Environmental Services Department of BPU.

Scope

- The form titled, "ASH POND INSPECTION AND SURVEILLANCE FORM" (Reference Attachment A) will be used as a guide for inspection of both sides and the top of the levee.
- This form may be modified and enhanced in the future as required to include other variables that are found to be appropriately included.
- All questions will be answered with a check mark indicating "yes" or "no."
- All items are worded so that a "no" answer is indicative of needed corrective action.
- All items answered with a "no" will be brought to the attention of the appropriate BPU staff.
- The completed inspection and surveillance forms will be filed for future reference and tracking of ash pond operations and maintenance.

Maintenance

The Environmental Services Department will convey any deficiencies noted on the Inspection and Surveillance Form to the BPU Division responsible for the noted area of maintenance. Where appropriate, the Environmental Services Department will suggest corrective actions.

ASH POND INSPECTION AND SURVEILLANCE FORM

Nearman Creek Power Station
Kansas City Board of Public Utilities
Kansas Landfill Permit No.: 413

Check the appropriate box below. Provide comment when appropriate.

Inspection Checklist	Yes	No		Yes	No
1. Water level at normal level? (At discharge weir El. & approx. 5 feet below top of berm.)			9. Embankment free of signs of burrowing animals?		
2. Crest of embankment free of shrinkage cracks?			10. Sloped surfaces uniform and free of bulging or sloughing?		
3. Crest of embankment uniformity level and free of signs of settlement?			11. Sloped embankments free of signs or seepage?		
4. Crushed rock surfacing on crest of embankment in good condition?			12. Flat area at least 15 feet wide next to toe of embankment is free of trees or shrubs?		
5. Vegetation height less than 12"? (preferably between 4 to 12 inches)			13. Riprap on north slope is in good condition?		
6. All exposed sloped embankment covered with vegetation?			14. Is buried pipe on east side dry? (Outfall 005)		
7. All exposed sloped embankment free of trees or shrubs?			15. Is area free of waste and trash?		
8. Sloped embankment areas free of any signs of erosion?			16. Ash loading and hauling operations in proper order?		

Any of these items answered as "no" are to be reported for further evaluation. Use map on back of this sheet to show location and extent of any deficiencies. Also use space below and back of sheet to make explanatory comments.

Issue No.	Comments

ESD PERSONNEL PRINTED NAME	ESD TITLE
ESD PERSONNEL SIGNATURE	DATE

Inspection copies to Nearman Creek: Supervisor of Plant Operations; Plant Engineer