Report of Geotechnical Exploration and Slope Stability Evaluation

Ash Pond
Cumberland Fossil Plant
Stewart County, Tennessee

Stantec Consulting Services Inc.
One Team. Infinite Solutions
11687 Lebanon Road
Cincinnati, Ohio 45241-20026
Tel: (513) 842-4200 • Fax: (513) 842-8250
www.stantec.com

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

March, 2010

Stantec Consulting Services Inc.
1409 North Forbes Road
Lexington KY 40511-2050
Tel: (859) 422-3000
Fax: (859) 422-3100

Stantec

March 29, 2010
File: 175539016R01

Mr. Barry S. Snider, PE
Tennessee Valley Authority
1101 Market Street
LP2N
Chattanooga, Tennessee 37402

Re: Report of Geotechnical Exploration and Slope Stability Evaluation
Ash Pond
Cumberland Fossil Plant
Stewart County, Tennessee

Dear Mr. Snider:

Stantec Consulting Services Inc. (Stantec) has completed a geotechnical exploration of the Ash Pond at the Coal Combustion Product Disposal Complex at the Cumberland Fossil Plant. Our final report includes discussions of general site conditions, scope of work performed, subsurface conditions, and results of laboratory testing and our engineering analyses.

The report also includes a review of historical documentation provided by TVA, and our conclusions and recommendations relative to future use of the facility. These services were performed under Engineering Service Request ESR/TAO 894 in accordance with the terms and provisions established in our System-Wide Services Agreement dated December 22, 2008.

Stantec appreciates the opportunity to provide engineering services for this project. If you have any questions, or if we may be of further assistance, please contact our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Daniel B. Rogers

Daniel B. Rogers, PE
Project Engineer

Stan A. Harris

Stan A. Harris, PE
Principal

Report of Geotechnical Exploration and Slope Stability Evaluation

Ash Pond
Cumberland Fossil Plant
Stewart County, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

March, 2010

Report of Geotechnical Exploration

Ash Pond
Cumberland Fossil Plant
Stewart County, Tennessee

Table of Contents

Section **Page No.**

Table of Contents
(Continued)

Section **Page No.**

List of Tables

Table **Page No.**

Table of Contents
(Continued)

List of Figures

Table of Contents
(Continued)
List of Appendices

Appendix

Executive Summary

Stantec Consulting Services Inc. (Stantec) has completed a Geotechnical Exploration and Slope Stability Evaluation of the Ash Pond Complex at the Cumberland Fossil Plant. This study was performed to evaluate slope stability and seepage for existing conditions at the Ash Pond.

Background Information

The Ash Pond Complex is approximately 50 acres in area. It consists of the Retention Pond and the Stilling Basin, contiguous structures located on the north end of the larger coal combustion product (CCP) waste disposal complex. The Ash Pond receives effluent from the Bottom Ash Pond and also receives runoff from the perimeter ditch system which surrounds the Gypsum Disposal Area Complex. With a total length of approximately 4,200 feet, the dike system that surrounds the Ash Pond has a maximum height of about 36 feet above Wells Creek. The dike system was constructed with approximately 3H:1V slopes, but isolated areas are slightly steeper (2.8:1V).

Water in the Retention Pond generally flows to the northwest and exits to the Stilling Basin through a 100-foot wide opening in the dike separating the two structures. A floating boom spans the opening and aids in removal of floating solids. Decanted water discharges from the Stilling Basin through four 36-inch pipe spillways. Each spillway has a 48-inch concrete riser with a 120-inch diameter corrugated steel pipe skimmer. The spillways drain into a concrete discharge channel that leads to the main plant discharge channel and Lake Barkley.

TVA has classified the Ash Pond Complex as a “high hazard” facility due to the potential for damage to the downstream state highway and bridge should a failure of the impoundment occur. Currently, Stantec and TVA are in the early stages of performing a detailed study to more accurately determine the downstream impacts resulting from a failure. Stantec is also in the process of studying modifications and/or replacements of the existing Ash Pond spillways. One of the outcomes of these efforts may be lowering the pool elevation by several feet.

According to historical documents provided by TVA, a seep was noted in 1974 through the dike along the western side of the Retention Pond. A repair was performed consisting of placing a 40-foot wide clay seal on the interior of the dike. The area is monitored annually and no further seepage has been noted. There are no other reported cases of seepage or slope instability.

Scope of Geotechnical Exploration

This study began with a review of TVA-provided historical information along with site inspections. A geotechnical exploration program was then developed and executed. The exploration consisted of drilling 30 soil test/sample borings at 16 locations. Piezometers were installed at 7 locations and slope inclinometer casings at three locations. Drilling locations were positioned along eight cross sections around the Retention Pond and the Stilling Basin. Laboratory testing performed included moisture content, classification, permeability and shear strength testing to establish key index properties and strength parameters.

Results of Exploration and Engineering Analyses

Eleven primary soil horizons were identified from the field and laboratory program. These primary horizons generally fall into one of three categories: 1) natural foundation soils which included alluvial clay and alluvial sands and gravels, 2) dikes constructed with natural clays and varying amounts of gravel, and 3) coal combustion byproducts including fly ash and bottom ash.

Following the drilling and laboratory testing program, seepage and slope stability analyses were performed to quantify factors of safety for current conditions. The dikes were assessed under static, long-term steady state conditions since the dikes have been in their current configuration for a long time. Analyses were performed on eight sections.

Phreatic surfaces predicted by the seepage analyses were generally in good agreement with levels measured in piezometers installed as part of this study. At three locations, Sections P, Q and R, the calculated factor of safety against piping was found to be less than the recommended acceptable minimum value of 4. Results of the slope stability analyses indicates factors of safety against long-term slope stability failure are greater than the target value of 1.5. If the pond water level or top of dike elevations are lowered in the future, the factors of safety would tend to increase.

Two alternatives have been proposed to increase the factor of safety against piping at Sections P, Q and R. The first is to construct a toe berm along the banks of Wells Creek. This method would likely require obtaining 401/404 permits. A second alternative would be installing a sheet pile cutoff wall along the interior side of the dike system. It is recommended that a final decision on the mitigation option to follow not be made until Stantec's breaching spillway studies are completed. Changes resulting from those studies, such as the operating pond level, would have an impact on the design of remedial measures.

Report of Geotechnical Exploration

Ash Pond
Cumberland Fossil Plant
Stewart County, Tennessee

1. Introduction

1.1. General

Tennessee Valley Authority (TVA) retained Stantec Consulting Services Inc. (Stantec) to perform facility assessments at eleven (11) active and one closed electricity-generating fossil plants. Specifically, Stantec was requested to assess the coal combustion product (CCP) disposal facilities at these generating plants. In general, the facilities consisted of ash ponds, scrubber sludge (gypsum) ponds, wet ash dredge cells, dry ash stacks and gypsum stacks. A number of facilities were abandoned (having completed their design life), while a majority of them were actively receiving combustion products at the time of this project.

1.2. Facilities Assessment Project

Stantec's scope of work for the facilities assessment project is divided into four main phases, with Phase 1 divided into two sub-phases, 1A and 1B. Brief descriptions of Stantec's scope of work for each phase are presented in the following paragraphs.

- Phase 1A – Review most recent TVA inspection reports, observe critical disposal features while accompanied by TVA personnel, develop a list of primary concerns and recommend immediate action or engineering assessment as considered necessary.

- Phase 1B – Review available historical documentation, re-visit sites for more detailed observations and measurements, complete dam safety checklists adapted from standard dam safety protocols, recommend immediate action as judged necessary and recommend sites/features that should undergo further evaluation.

- Phase 2 – Evaluate TVA facilities based on current dam safety criteria adopted by the state in which the plant is located, conduct geotechnical explorations and engineering analyses at sites recommended in Phase 1B, and complete conceptual and final repair designs and budget level cost estimates.

- Phase 3 – Design repairs for sites recommended in Phase 2 and prepare construction plans and specifications as well as permit/planning documents.

- Phase 4 – Provide dam safety training for TVA staff and update operation manuals.

At the time of this report, Phase 1 of the assessment is complete. Phase 2 is being implemented at several facilities located within the different plants. The Phase 1 report recommended that Phase 2 evaluations include geotechnical explorations and hydraulic/hydrologic assessments. This document reports the results of a geotechnical exploration of the dikes surrounding the Retention and Stilling Ponds within the Cumberland Fossil Plant. The exploration was performed to evaluate dike slope stability and seepage for the existing conditions.

2. Cumberland Fossil Plant

2.1. Location

The Cumberland Fossil Plant (CUF) is located in western Tennessee west-southwest of Clarksville, Tennessee on the south shore of Lake Barkley, as shown in Figure 1. The plant is adjacent to the town of Cumberland City, Tennessee. The plant can be accessed by state Highway 233, which connects to TVA-owned roads.

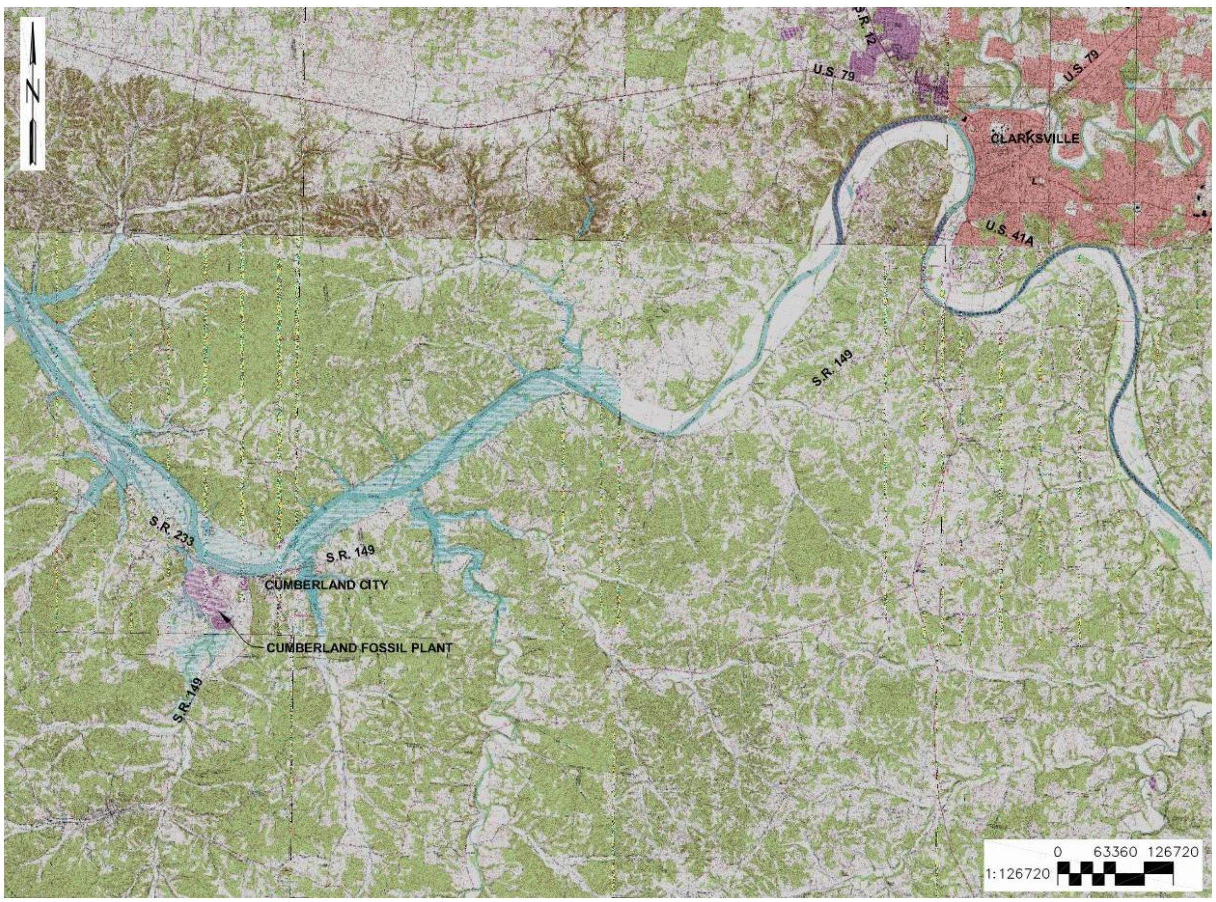


Figure 1. Portions of 7 ½-minute U.S.G.S. topographic maps (Cumberland City and Clarksville quadrangles) showing the vicinity of the Cumberland Fossil Plant near Cumberland City and Clarksville, Tennessee.

2.2. Power Generation

Cumberland Fossil Plant (CUF) has two coal-fired generating units and produces more power than any other plant in the TVA system. The plant was constructed between 1968 and 1973. The winter net dependable generating capacity is about 2,530 megawatts. The plant consumes approximately 20,000 tons of coal a day and produces roughly 750,000 tons of combustion products in the forms of fly ash and bottom ash each year.

Sulfur dioxide scrubbers for both coal-fired generating units were installed in 1994. The process generates a synthetic gypsum byproduct. Approximately 1,000,000 tons of gypsum is produced each year, depending upon the actual amount of coal burned. The gypsum is marketed as a building material.

3. Ash Pond

3.1. General

The ash pond complex is comprised of the retention pond and the stilling basin. These structures are contiguous structures on the north end of the larger coal combustion product (CCP) waste disposal complex (Shown in Figures 2 and 3). Each structure was formed by construction of divider dikes in order to create areas for a two-staged, gravity, water clarification process. The ash pond processes the effluent from the bottom ash pond and the drainage and runoff from the entire waste disposal complex. With a total length of approximately 4,200 feet, the dike system that surrounds the ash pond has a maximum height of 36 feet above the pool of Wells Creek. The dike system was constructed with slopes of approximately 3H:1V, but isolated areas are slightly steeper (2.8H:1V).

Water flows to the ash pond from the bottom ash pond which receives slurry directly from the generating plant. The water decanted from the bottom ash pond is conveyed to the 37.4-acre retention pond by a 72-inch diameter pipe spillway. Water from the disposal area perimeter ditch (see Stantec's 2009 Report for perimeter ditch details) is also conveyed to the retention pond via 36-inch diameter pipes at two locations through the dike between the pond and the dry fly ash stack. One 36-inch pipe is on the west end of the divider dike and a pair of 36-inch pipes are near the east end of the dike.

Water in the retention pond flows generally to the northwest and exits to the stilling basin through a 100-foot wide opening in the dike separating the two structures. A floating boom spans the opening and aids in settlement of very fine solids.

Decanted water discharges from the stilling basin through four 36-inch pipe spillways. Each spillway has a 48-inch concrete riser with 120-inch diameter corrugated steel pipe skimmer. The spillways empty clean water into a concrete discharge channel that leads to the main plant discharge channel and Lake Barkley.

3.2. Dry Fly Ash Stack and Gypsum Disposal Complex

Stantec submitted a Draft Report of Geotechnical Exploration for the Cumberland Dry Fly Ash Stack and Gypsum Disposal Complex on December 16, 2009. This report references historical data and laboratory test results presented in that report.

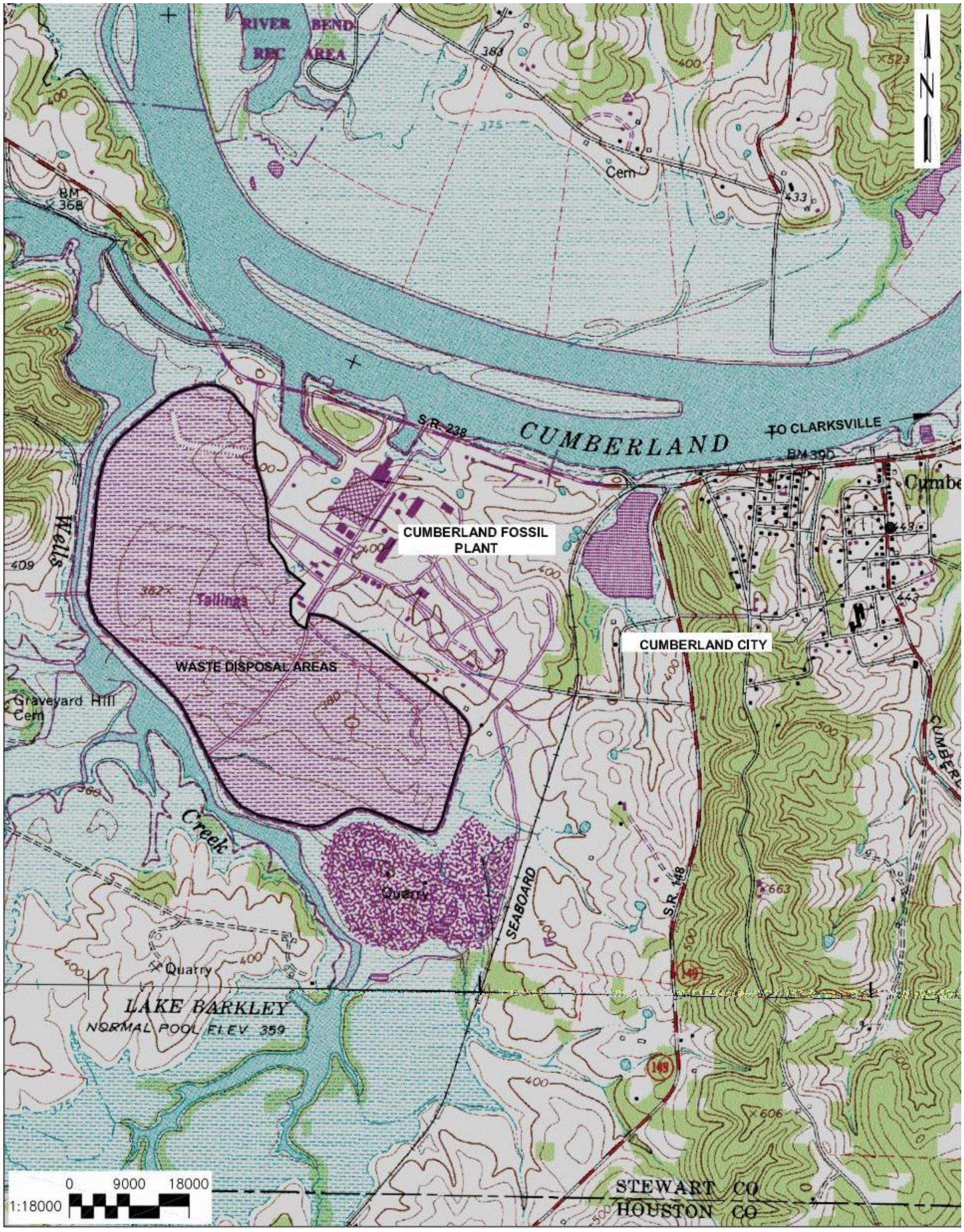


Figure 2. Portion of 7 ½-minute U.S.G.S. topographic map (Cumberland City quadrangle) showing Cumberland Fossil Plant.

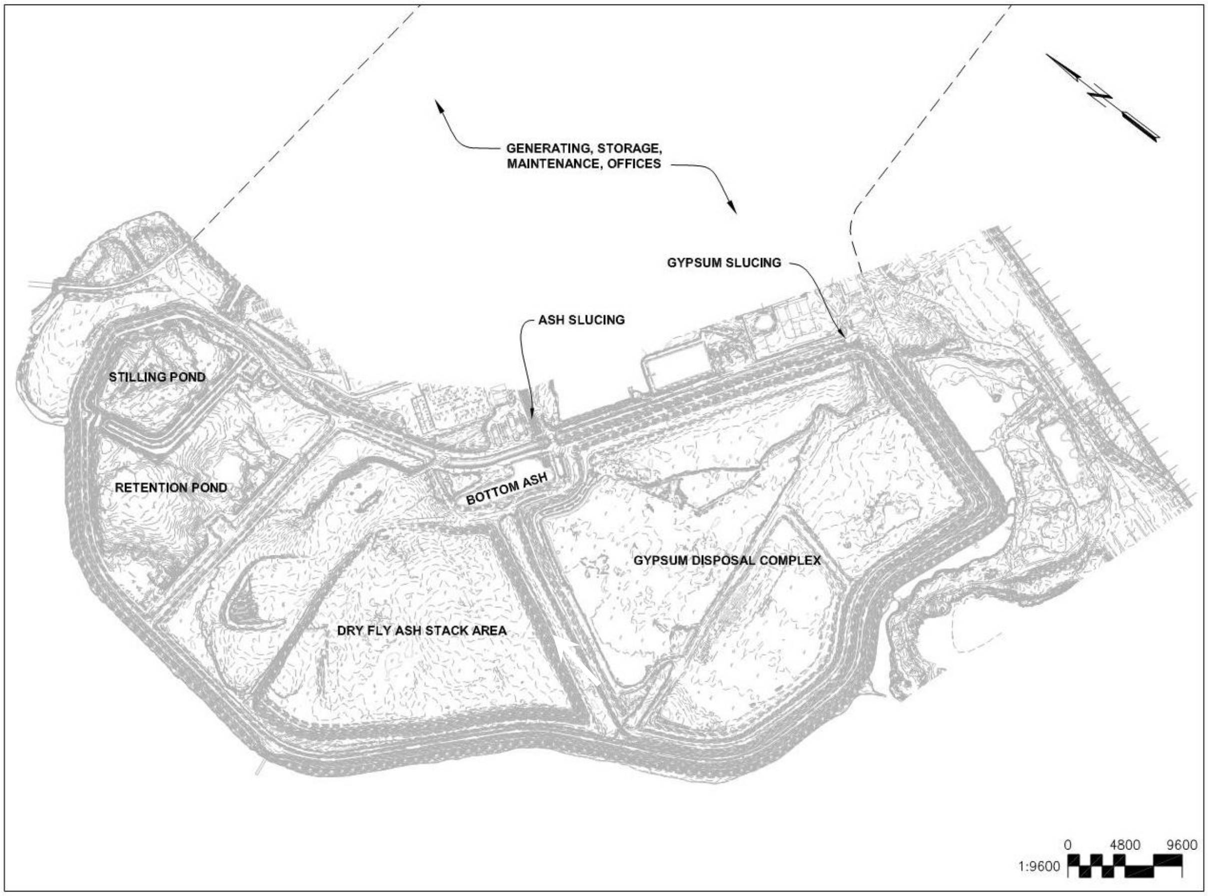


Figure 3. General layout of the Cumberland Fossil Plant showing the components of the coal combustion by-product disposal complex

4. Scope of Work

The scope of the geotechnical exploration was divided into the following tasks.

a. Review of Available Information

b. Review of General Site Geology

c. Subsurface Exploration

d. Field Instrumentation and Monitoring

e. Surveying

f. Laboratory Testing

g. Engineering Analyses

h. Conceptual Design of Repairs

The work performed as part of these tasks is described in the following sections.

5. Review of Available Information

5.1. General

As part of the facilities assessment (Phase 1) project, Stantec reviewed documents provided by TVA pertaining to the waste disposal area. The Phase 1 Coal Combustion Product Facility Summary is included in Appendix A.

5.2. Reviewed Documents

Below is a summary of the documents reviewed for the geotechnical exploration.

Table 1. List of Documents Reviewed for Geotechnical Exploration

Reference No.	Document Name	Type of Document	Dated	Agency	TVA Reference No.
1	Ash Dike Raising, Borrow Areas B & D	Memo	June 16, 1981	TVA	CDB 81 0619 005
2	Ash Pond Pressure Grouting Records	Grouting Records	3/1991 – 8/1991	TVA	N/A
3	Ash Pond Dikes - Chronological Events	Memo	January 17, 1992	TVA	N/A
4	Operations Manual	Manual	September, 2003	TVA	IDL811020082
5	Wastewater Flow Schematic – NPDES Permit No. TN0005789	Schematic	May, 2005	TVA	N/A
6	2009 Annual Inspection of Waste Disposal Areas	Report	February 11, 2009	TVA	N/A
7	Reports of Annual Waste Area Inspections	Reports	1972 - 2008	TVA	Various

Selected historical documents were presented in the Draft Report of Geotechnical Exploration for the Dry Fly Ash Stack and the Gypsum Disposal Complex. They are not included with this report. A short summary of each item in Table 1 appears below.

Item No. 1 Ash Dike Raising, Borrow Areas B & D – This memo from the chief of the Construction Services Branch reports borrow area soil boring and laboratory soil testing results for soil used in raising the original perimeter dike of the ash disposal area.

Item No. 2 Ash Pond Pressure Grouting Records – Daily records of the pressure grouting of over 5,000 feet of the foundation of the ash pond dike in 1991.

Item No. 3 Ash Pond Dikes – Chronological Events – A brief history is given by K.W. Burnett, manager, Civil Section One, Fossil Engineering, of the ash pond dikes from construction in 1969 to the October, 1991 pressure grouting of the dike foundation in a memo to Gary Nuyt.

Item No. 4 Operations Manual, Dry Ash and Gypsum Stacking Facility – The manual contains sections on site information, description of the solid waste, general site preparation, daily operations, surface water management and geologic buffer system. It also contains sections on the gas control system, groundwater monitoring, environmental protection, closure and post closure and quality assurance/quality control. Appendices contain specifications, calculations, studies, regulations, policies, and miscellaneous information.

Item No. 5 Wastewater Flow Schematic for NPDES Permit No. TN0-005789 – This one-page schematic flow diagram shows amounts and sources of drainage and process water flows in millions of gallons per day. The schematic shows intake of 2096.877 MGD gallons with 2097.062 MGD flowing out to the Cumberland River.

Item No. 6 2009 Annual Inspection of Waste Disposal Areas – Prepared by Stantec, the report contains the results of an annual inspection of the waste disposal areas at Cumberland Fossil Plant. The pages contain descriptions, observations and recommendations for the Coal Yard Drainage Basin, Chemical Treatment Pond, Active Ash Pond, Dry Ash Stack, Wet Gypsum Stacking Area and the slough beside Highway 233, including associated ditches, dikes, roads and effluent points.

Item No. 7 Reports of Annual Waste Area Inspections, 1972-2008 – These annual reports were prepared by various persons within TVA. The reports contain the results of an annual inspection of the waste disposal areas (as they existed at the time of the inspection) at Cumberland Fossil (or Steam) Plant. Also included are the 2007 (performed 2006) Annual Ash Pond Dike Stability Report and Quarterly Red Water Seep Inspections as well as the 2008 (performed 2007) Quarterly Red Water Seep Inspections. A copy of the Dredge Report for the Coal Yard Runoff Pond is also included in the binder.

First noted in 1974, there was a seep that was present through the dike in the area that is now the ash pond. According to the 1974 annual report, in February of the same year the seep appeared at the location of the “northernmost dike crossing of the abandoned Wells Creek channel.” A repair was affected immediately by placing a 40-foot wide clay seal on the interior of the dike. The area was monitored specifically for a period of 4 years and is now monitored during the course of the annual inspections. No additional incidence of seepage in this area has been recorded.

5.3. Design Drawings

A set of reduced-sized drawings approved as part of TDEC permit No. IDL 811020082 was obtained from TVA. The drawings for the FGD Retrofit Project for Units 1 and 2 were originally produced by United Engineers and Constructors. They were issued for permit on August 20, 1993 and updated December 21, 1993, according to the title block. Other markings on the first sheet of the drawings indicate a modification to the permit dated July 11,1994.

The set contains Drawing Nos. 10W302-1 through 10W302-27 and shows 8 stages of construction progressing towards the waste disposal area configuration present today. The drawings also show the construction of the Retention Pond out of Area 2 with no modification of the Stilling Pond, which has remained unchanged.

Copies of a few of the original construction drawings of the waste disposal area were found with miscellaneous memorandums and with a few of the annual reports. Sheets 10N212 through -214, 10N218, 10N224 and 10N225 were used to show particular aspects of the facilities. No drawings marked "As-Built" or similar were found.

6. Site Geology

6.1. General

The Physiographic Regions of Tennessee Map (Tennessee Department of Environment and Conservation (TDEC)) indicates that the project site is located in the Western Highland Rim of Middle Tennessee. Underlying bedrock of the region is chiefly Mississippian limestone, chert, shale, and sandstone with exposures of Devonian, Silurian, Ordovician, and Cambrian limestone, chert, and shale. In the northern part of the Western Highland Rim, caves and other karst features may be present. The ground surface elevation in the vicinity of the project ranges from approximately 360 feet to 650 feet above mean sea level.

The Generalized Geologic Map of Tennessee (Tennessee Department of Environment and Conservation, 2009) indicates that the areas surrounding the project site are underlain by rock of Mississippian age. In the immediate vicinity of the project site, rock of Ordovician age predominates.

6.2. Soils

The soil survey (Web Soil Survey of Stewart County, Tennessee, United States Department of Agriculture (USDA), 2009) indicates that the soils surrounding the Cumberland Fossil Plant are Silt-Loams or Silty Clay-Loams of the Nolen, Sengtown, Bodine, Egam, Maury, Lindside, Melvinville, Byler and Wolftever Associations. These soils are described as moderately deep to deep, moderately well to well drained, moderately sloped soils that formed from the weathering of interbedded sedimentary rock. These soils generally range from silt loam to clay loam in texture. Typical USCS soil classifications of these soil types are CL, CL-ML, SM, GC and GM.

6.3. Bedrock Geology

The Cumberland Fossil Plant is underlain by bedrock primarily of Ordovician age, with smaller amounts of Silurian and Devonian aged rock. The plant is situated in an ancient meteorite impact crater just north of the impact zone. This event has produced a large variation in the contour of the bedrock below the facility as well as several mapped faults (Shown in Figure 4).

According to the Geologic Map of the Cumberland City Quadrangle (USGS 1968, revised 1986), the complex site is predominantly underlain by bedrock belonging to the Mannie Shale, Fernvale Limestone, Hermitage, Carters, Lebanon, Ridley, Pierce and Murfreesboro Limestone Formations, in general order of descending lithology. Each of these formations is of Ordovician age and is comprised of limestones which may be described as thin to thick bedded, greenish-gray to gray, coarse to crystalline grained, argillaceous and hard. The Hermitage Formation also contains thin bedded to laminated gray sandy shale and the Mannie Shale Formation contains shale and limestone interbedded.

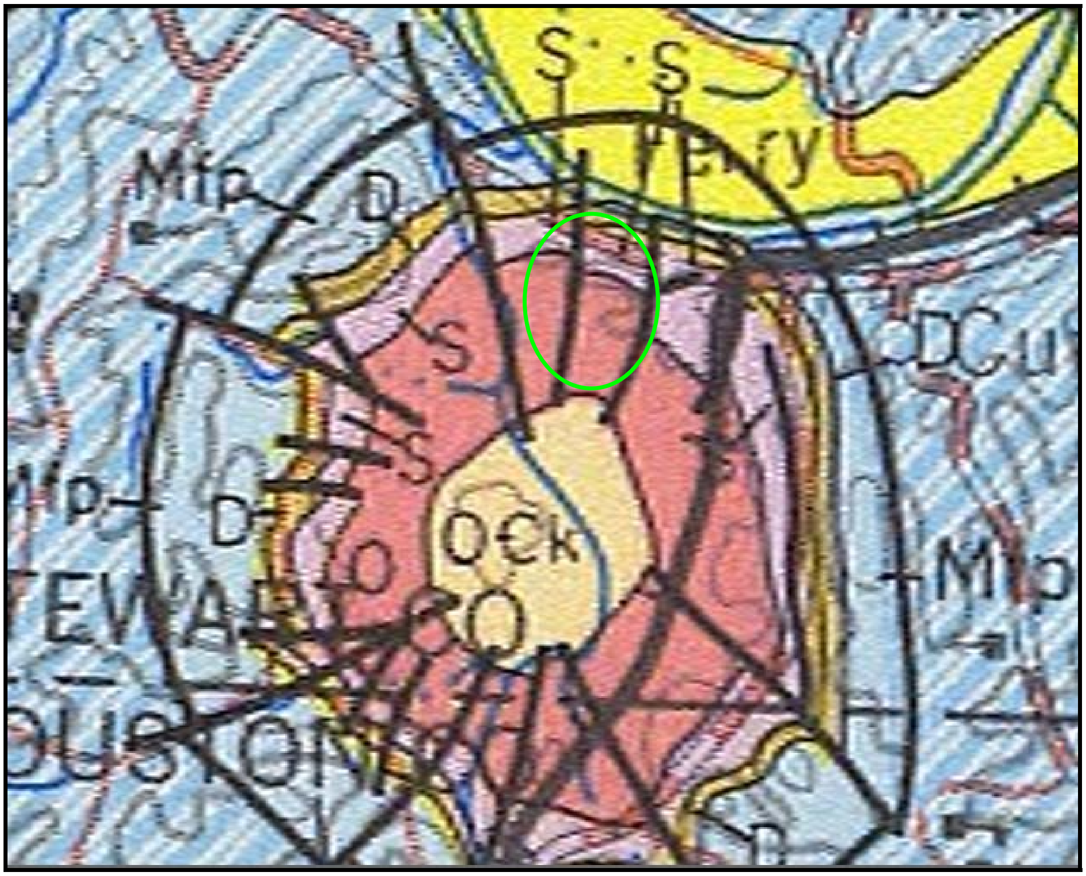


Figure 4. Portion of Geologic Map With Approximate Location of Cumberland Fossil Plant Indicated (USGS Geologic Map of the Cumberland City Quadrangle (1966, revised 1986).

6.4. Hydrology and Hydrogeology

Surface water migrates along natural drainage swales and diversions along local hillsides. The Cumberland River and Wells Creek, which bound the project area, together with their respective tributaries collect the surface water and drain the groundwater from this area. These rivers flow generally northward and are part of the Lake Barkley watershed.

Groundwater migrates through both primary and secondary porosity at the site. Groundwater seeps into the alluvium, residual soils and/or unconsolidated material within the project area. Some of that water migrates along the top of bedrock, saturating the interface between the top of bedrock and unconsolidated material, until the groundwater seeps into the bedrock or finds a fracture or joint to follow. Below top of bedrock, the water migrates through the fractures, joints, bedding planes and other voids in the bedrock. The groundwater eventually intercepts the existing groundwater in the area and/or eventually flows to the surface at a lower elevation.

7. Subsurface Exploration

7.1. General

Stantec performed the fieldwork for the geotechnical exploration from July 21 through August 14, 2009. The exploration consisted of test borings, sampling, rock coring, instrumentation and backfilling. The work was performed around and on the Retention Pond and Stilling Basin dikes. Stantec drilled 30 soil test borings mainly on top and along the downstream toe of the pond dikes. The locations were chosen by Stantec to be along pre-determined cross-section alignments. The boring locations were surveyed by TVA after drilling. The locations are shown on the boring layout in Appendix B.

The borings were drilled using both 3¼- and 4¼-inch inside diameter hollow-stemmed augers powered by a truck-mounted drill rig or an ATV-mounted drill rig.

In the soil test borings, continuous standard penetration tests (SPT's) were performed in accordance with ASTM D1586 until original (foundation) soils were encountered, after which SPTs were continued at 2.5-foot intervals. The results of SPT testing are presented on the boring logs included in Appendix C.

After soil borings with SPT samples were drilled and an understanding of the subsurface profile at a particular location was obtained, offset borings were advanced, if required. The offset borings were used to obtain undisturbed, thin-walled (Shelby) tube samples in particular materials at specific depths. Thin-walled (Shelby) tube samples were obtained in accordance with ASTM D 1587. Sample depths and percent of recovery are presented on the boring logs.

In addition to the samples described above, disturbed bag samples of soils, typically consisting of auger cuttings obtained from the borehole during the drilling process, were also taken for laboratory testing.

A Stantec geotechnical engineer or geologist directed the drill crews, logged the subsurface materials encountered during the exploration and collected soil samples. During field logging particular attention was given to the material's color, texture, moisture content and consistency or relative density.

Rock coring was performed in selected borings using NQ2-size (2-inch diameter) wire-line coring equipment. Core runs began at top of weathered rock and were either 5 or 10 feet in length. Upon retrieval, the core was extracted and sequentially placed in a core storage box and labeled.

The onsite representative then logged the core noting its physical appearance, integrity and bedding characteristics. The amount of core recovered from the operation was also noted and expressed in the log as a percentage recovered. The Rock Quality Designation (RQD) value, a simple, quantitative indication of rock competency, was determined for each coring run by adding the length of all naturally occurring pieces in a run greater than 4 inches and dividing by the length of the total run. The resultant is expressed as a percentage.

Upon completion of drilling, the boreholes without instrumentation were backfilled using a mixture of Portland cement and bentonite clay. Boreholes with piezometers received a quartz sand filter pack around the piezometer, a bentonite seal above the sand then backfill with the cement and bentonite mixture. Boreholes with slope inclinometers were backfilled with high-solids cement-bentonite grout placed by tremie pipe to displace cuttings and drilling fluid. Soil auger cuttings were disposed of by plant personnel.

Following the field exploration, the SPT samples, Shelby tubes and bag samples were transported to Stantec's (or approved vendor's) laboratory for testing. The remnant samples will be available for review up to thirty (30) days following testing and the submittal of the final version of this report, at which time the samples will be discarded unless prior arrangements have been made with Stantec.

7.2. Summary of Borings

A boring layout drawing is presented on a drawing included in Appendix B. Typed boring logs are presented in Appendix C. A summary of boring information is presented in Table 2, where all measurements are expressed in feet.

Table 2. Summary of Borings

Boring No.[(1)]	Top of Hole (Elevation)	Northing[(2)]	Easting[(2)]	Bottom of Hole (Feet)	Bottom of Hole (Elevation)
STN-47	380.0	732324.14	1509428.51	40.5	339.5
STN-48	395.0	732333.24	1509489.49	55	340
STN-48 A	395.0	732333.24	1509489.49	15	380
STN-49	379.2	732928.84	1509696.68	64.1	315.1
STN-50	394.5	732872.44	1509725.55	38	356.5
STN-50 A	394.5	732869.56	1509722.77	91	303.5
STN-50 B	394.5	732875.32	1509728.33	39	355.5
STN-51	378.8	733191.78	1510006.75	66.5	312.3
STN-52	394.9	733149.40	1510045.62	84	310.9
STN-52 A	394.9	733149.4	1510045.62	10	384.9
STN-53	376.0	733453.67	1510310.59	27	349
STN-53 A	376.0	733456.66	1510307.93	96	280
STN-53 B	376.0	733450.68	1510313.25	43	333
STN-54	395.0	733419.93	1510374.67	100.3	294.7
STN-54 A	395.0	733417.3	1510371.66	52.5	342.5
STN-55	379.5	733614.54	1510849.80	75	304.5
STN-56	395.0	733560.12	1510902.86	76.2	318.8
STN-56 A	395.0	733560.12	1510902.86	10	385
STN-57	381.5	733365.74	1511360.12	56.5	325
STN-57 A	381.5	733368.89	1511362.59	21	360.5
STN-57 B	381.5	733365.74	1511360.12	66.5	315
STN-58	395.0	733305.89	1511314.36	62.9	332.1
STN-58 A	394.8	733308.7	1511311.51	47	347.8
STN-59	383.0	732780.76	1511517.22	35	348
STN-59 A	383.0	732780.76	1511517.22	38	345
STN-59 B	383.0	732780.76	1511517.22	46.3	336.7
STN-60	395.1	732791.74	1511426.11	43.6	351.5
STN-61	387.2	732271.84	1511477.99	22.5	364.7
STN-62	394.8	732274.04	1511365.06	32	362.8
STN-62 A	394.8	732274.04	1511365.06	10	384.8

7.3. Subsurface Soil Conditions

Eleven primary soil horizons have been identified using soil boring results and available historical documents from TVA archives. Below are brief descriptions of the horizons. Two-letter classification codes (CL, SM, SP, etc.) in the descriptions refer to the Unified Soil Classification System (USCS).

Coal Combustion Products:

- Fly Ash – Classifies as silt (ML) or silt with sand/silty sand. Light gray to black or gray brown, silt to clay-sized grains, dry to wet, soft to very stiff. Lenses of bottom ash or lean clay may be present.

  - Fly Ash (Sluiced) or Fly Ash/Bottom Ash (Sluiced) – Saturated fly ash, bottom ash, or a laminated zone of both that is wet to saturated, hydraulically placed, very soft to medium stiff. Fly ash alone classifies as silt (ML). The fly ash/bottom ash (sluiced) was visually classified as silty sand with gravel (SP), silty sand (SM), and sandy lean clay (CL). For purposes of slope stability analyses, a distinction was not drawn between sluiced fly ash and a combination material of sluiced fly ash and bottom ash. Definite zones were unclear. Sluiced fly ash properties were conservatively assumed for both materials. This material was not encountered during the field exploration of this project. The presence of this material was inferred due to the purpose of the pond.

- Bottom Ash – Segregated and placed bottom ash. Classifies as a silty sand with gravel (SP) or silty sand (SM). Dark gray to black, coarse grained, damp to wet, very loose to very dense with occasional interbedded layers of fly ash and clay. Medium sand to gravel-sized grains with some fines. This material may be present on the site as a construction material, however it was not encountered in any of Stantec's borings during this exploration.

Natural Soils Used In Dike Construction:

- Dike 1 – The original perimeter dike. A lean clay (CL), red brown to gray brown, moist to wet, very soft to very stiff. Occasional gray mottling, with areas of sand or gravel, chert fragments, few organics and manganese concretions. Approximate top of dike elevation is 380 feet. In a limited area, the material was classified as a fat clay (CH).

  Stantec identified this zone in most borings surrounding the Retention and Stilling Ponds just above natural ground.

- Dike 2 – The raised dike uphill of the original perimeter dike. It has a crushed stone covered crest between 0.5 and 1.0 feet deep. Dike 2 was identified by Stantec along the outside perimeter of the Retention and Stilling Ponds. It is not found in the divider dike between the Dry Fly Ash Stack and Retention Pond. The approximate top of dike elevation is 395 feet. The raised dike has two distinct soil horizons:

  - Dike 2 (Lean Clay) – Lean clay (CL) to lean clay with gravel, some cobbles, light brown to brown, some gray mottling, moist to wet, soft to very stiff.

- Dike 2 (Fat Clay) – Fat clay (CH) to fat clay with gravel, dark brown to reddish brown, damp to wet, firm to very stiff. This layer is typically near the top of Dike 2 or may compose the complete Dike 2 zone.

Natural Foundation Soils:

- Alluvial (Clay) – Lean clay (CL), silty grading to sandy, manganese concretions, reddish brown to light gray, some gray mottling, soft to very stiff, moist to wet, with rock fragments. Few organics and wood fragments, but typically has a faint organic odor near the suspected natural ground interface.

- Alluvial (Granular) – Varying between silty sand with gravel (SM), yellowish brown to light gray, moist to wet, very loose to compact, medium to coarse grained, poorly sorted with increasing gravel size and gravel with clay to silt and sand (GP-GC or GM), gray, wet, angular, loose to very dense. Some wood fragments with a slight organic odor near the suspected natural ground interface.

Bedrock:

- Interbedded Limestone and Shale – Limestone is light gray, hard, and thick bedded. Shale is light gray, calcareous, moderately hard and laminated. Core recovery ranged from 94 to 100 percent. RQD ranged from 56 to 100 percent. When core was obtained, limestone comprised approximately 50 to 90 percent of the recovery.

7.4. Subsurface Water

Subsurface water was encountered in most of the borings advanced during this exploration. A water level reading was taken after the boring had been drilled but before the installation of instrumentation. Typically, subsurface water was not found in borings advanced purposely to a shallow depth to obtain undisturbed samples. The depths to water noted immediately after drilling are shown on the boring logs presented in Appendix C. Additional water level readings were and are being obtained from piezometers installed in some of the borings, as discussed in the following section of this report.

8. Field Instrumentation and Monitoring

8.1. General

Stantec's exploration included the installation and monitoring of geotechnical instrumentation. Piezometers and slope inclinometer casings were installed in some of the boreholes to provide data relative to existing conditions and to provide a baseline for future monitoring efforts. Initial or baseline readings preceded a regular and ongoing instrumentation monitoring program.

8.2. Instrumentation

Two types of instruments were installed as part of the geotechnical exploration. These include standpipe piezometers (PZ) and slope inclinometer (SI) casings.

Standpipe piezometers, installed in a borehole, consist of a screened interval of pipe (generally 10-ft) joined to a 1-inch diameter riser pipe. The screened interval was placed in a sand pack and a bentonite seal was placed above the sand to isolate the target pore water pressure reading zone. The annular space between the riser pipe and the borehole was backfilled to the surface with bentonite grout to prevent vertical migration of water. The riser pipe was terminated above ground and protected with either a lockable metal cover or a flush-mounted 6" diameter manhole.

Slope inclinometer casings consist of 2.75-inch outside diameter PVC casing with interior vertical grooves also installed in a borehole. The annular space between the casing and borehole was backfilled to the surface with cement-bentonite grout. The casing was terminated above ground and protected with either a lockable metal cover or a flush-mounted 6" diameter manhole. Lockable covers used in typical installation are shown in Figure 5. Table 3 provides a summary of the instruments installed. Appendix D presents the PZ and SI instrumentation logs.

Figure 5. Typical Instrumentation (Slope Inclinometers, Piezometers) Installation

Table 3. Summary of Instrumentation

Boring No.	Instrument	Surface Elevation	Tip Elevation
STN-49	PZ	379.18	322.2
STN-50A	SI	394.47	309.5
STN-50B	PZ	394.47	355.5
STN-53A	PZ	376.01	311.0
STN-53B	PZ	376.01	333.0
STN-54	SI	394.95	295.0
STN-54A	PZ	394.95	344.0
STN-57A	PZ	381.52	361.5
STN-58	SI	394.79	333.3
STN-58A	PZ	394.79	349.3

8.3. Monitoring of Dike Slope Conditions

Stantec is monitoring the instruments installed during the exploration. Water level readings (from PZs) and slope movement data (from SIs) are obtained on a monthly basis and the results to date are included in Appendix E. PZ readings are taken using a water level indicator and SI readings are obtained using a portable traversing inclinometer designed for this purpose. The first SI survey established the initial profile of the casing and subsequent surveys measure changes in the profile of the casing if movement of the slope has occurred.

Instrumentation readings are currently obtained on a monthly schedule. Future reading schedules may be modified in response to detection of any significant variation in readings. Depending on factors such as the magnitude, location and circumstances of the reading variation, the schedule may be adjusted to read the instruments more often, say, weekly or daily.

Generally, water levels across the site have fallen nearly one foot since the initial readings and varied by just a few tenths of a foot between monthly readings. The piezometers on the west side of the Retention Pond (PZ-49 and PZ-50) show water levels approximately 10 to 12 feet below the ground surface. The water levels of the remaining instruments around the ponds show water levels varying between 13 to 20 feet below the ground surface.

Slope Inclinometers have been installed around the perimeter of the site and are being monitored for slope movement. No significant lateral movements have been detected to date.

9. Surveying

9.1. General

Topographic mapping of the disposal facility was developed from aerial photography provided by TVA. Contour mapping of the bottom of the stilling and retention ponds was developed from a hydrographic field survey, also provided by TVA.

9.2. Aerial Survey

Topographic mapping and aerial photogrammetry were created by Tuck Mapping Solutions Inc., Big Stone Gap, Virginia. The project site was flown April 17, 2009. The base mapping was completed May 19, 2009. Horizontal datum is NAD27 and vertical datum is NGVD29. The coordinate system is Tennessee State Plane and the contour interval of the mapping is one foot. The limits of the topographic mapping as well as control points referenced to the State Plane Coordinates system were established by TVA. The results of aerial survey can be seen on the boring layout presented in Appendix B.

9.3. Topographic Survey

Topographic surveying was performed by TVA to locate the soil borings. Field cross sections were also taken to provide a check on the aerial mapping.

9.4. Hydrographic Survey

TVA performed a hydrographic survey of the retention and stilling ponds in September of 2008. The results (contour lines) of the hydrographic survey of the ponds are shown on the boring layout Appendix B.

10. Laboratory Testing

10.1. General

Soil and rock samples from the field exploration were returned to a Stantec (or certified vendor's) materials laboratory for inventory and testing. The laboratory tests were performed in accordance with ASTM standard testing procedures. Detailed results of laboratory testing are presented in Appendix F.

10.2. Laboratory Tests Performed

Each soil sample was visually classified and tested for natural moisture content. Engineering classification tests were performed on samples reflecting the main soil horizons. The represented horizons are: "raised" dike, "original" dike and foundation soils. A summary of laboratory tests and the corresponding testing standard are presented in Table 4. Not all tests were performed on all samples.

Table 4. Laboratory Tests

Test	Standard
Natural Moisture Content	ASTM D 2216
Particle Size Analysis	ASTM D 422
Dry Density	ASTM D 2166
Shear Strength	ASTM D 4767
Permeability	ASTM D 5084
Atterberg Limits	ASTM D 4318
Specific Gravity	ASTM D 422
Particle Size Analysis	ASTM D 854
Standard Proctor	ASTM D 698

10.3. Natural Moisture Content

Natural moisture content tests were performed on all SPT, bag and Shelby tube samples. The results of moisture content determinations are presented in Appendix F.

10.4. Particle Size Analyses, Atterberg Limits and Specific Gravity, Classification

Particle size analyses and Atterberg limits tests were performed on 7 samples of Dike 2, 7 of Dike 1, 6 samples of Alluvial Granular and 4 samples of Alluvial Clay.

Many of the test samples were composite SPT samples. Composite SPT samples consist of materials from different depths but of the same material, as determined through visual classification.

The particle size analyses were performed in accordance with ASTM D-422, “Particle Size Analysis of Soils,” using sieve analysis for the soil fraction greater than 0.074mm (No. 200 sieve size) and hydrometer analysis for the fraction smaller than 0.074mm. The individual grain size distribution curves generated from these tests are presented in Appendix F.

Atterberg limits tests were conducted in accordance with ASTM D 4318 Method A. The liquid limit, plastic limit and plasticity index are reported in Appendix F. The samples were also tested for specific gravity in accordance with ASTM D 854. The results of particle size analyses and Atterberg limits tests were used to classify the soil samples.

The samples were classified in accordance with the Unified Soil Classification Soil System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) method. The results of the classification testing are contained in Appendix F. Table 5 summarizes the classification testing results.

Table 5. Summary of Classification Testing Results

Material Type		w_0 (%)	G_s	LL	PL	PI	Gravel (3"- 4.75 mm) (> No. 4)	Sand (4.75-2 mm) (No. 4-No. 200)	Silt (0.075-0.005 mm) (<No. 200)	Clay (<0.005 mm)	USCS
Dike 1	*max*	43.5	2.70	72	27	47	23	29	46	65	CH
	min	18.8	2.65	34	17	13	1	9	13	28	CL
	average	26.8	2.67	49	21	28	9	18	33	40	CL-CH
Dike 2	*max*	29.3	2.76	68	23	45	44	32	37	57	CH
	min	20.9	2.68	46	16	29	0	18	11	21	CL
	average	22.9	2.71	55	19	36	11	26	23	40	CH-CL
Alluvial Clay	*max*	29.7	2.71	68	23	45	13	20	65	62	CH
	min	22.8	2.62	30	16	10	0	7	26	27	CL
	average	26.3	2.67	48	19	29	4	11	41	44	CL
Alluvial Granular	*max*	37.4	2.73	68	36	34	59	49	27	28	GP
	min	21.5	2.65	41	23	13	18	18	7	5	SM
	average	28.9	2.68	53	28	25	35	31	15	18	GP-GM

10.5. Unit Weight and Moisture-Density (Proctor) Testing

Once the Shelby tube samples were extruded, suitable portions representative of selected soil horizons were trimmed for testing. The natural moisture content and both the unit weight wet and unit weight dry was determined for each sample. The test results are presented in

Appendix F. Table 6 summarizes the unit weight test results. Also shown in Table 6 are the results of moisture-density (Standard Proctor) tests performed on samples of dike and borrow area materials. Three samples of dike material and one borrow area sample were tested in accordance with ASTM D 698, Method 'A'.

Table 6. Summary of Unit Weight Test Results

Boring Location	Sample Depth Interval (feet)	Material	Unit Weight Dry (pcf)	Moisture Content (%)	Maximum Dry Density (pcf)	Percent Maximum Dry Density (%)	Optimum Moisture Content (%)	Moisture Content Variation (%)
STN-50B	15.6-16.3	Dike 2 (Lean)	91.9	25	105.6	87	18.9	+6.1
STN-50B	16.3-16.9	Dike 2 (Lean)	95.4	31	105.6	90	18.9	+12.1
STN-53A	43.0-43.8	Alluvial (Clay)	93.5	26	--	--	--	--
STN-53A	43.8-44.4	Alluvial (Clay)	98.7	26	--	--	--	--
STN-53A	44.4-45.0	Alluvial (Clay)	98.9	24	--	--	--	--
STN-54A	6.6-7.2	Dike 2 (Fat)	90.7	27	103.1	88	20.2	+6.8
STN-54A	7.3-8.0	Dike 2 (Fat)	105.3	21	103.1	102	20.2	+0.8
STN-54A	8.4-8.9	Dike 2 (Fat)	101.5	22	103.1	98	20.2	+1.8
STN-54A	30.0-30.6	Dike 2 (Lean)	97.8	26	102.1	96	21.9	+4.1
STN-54A	30.6-31.8	Dike 2 (Lean)	110	20	102.1	108	21.9	-1.9
STN-54A	45.2-45.8	Alluvial (Clay)	99.2	25	--	--	--	--
STN-54A	45.8-46.4	Alluvial (Clay)	102.6	24	--	--	--	--
STN-54A	46.3-47.0	Alluvial (Clay)	101.7	24	--	--	--	--
STN-57A	5.3-5.8	Dike 1 (Lean)	92.9	29	--	--	--	--
STN-58A	25.4-26.0	Dike 1 (Lean)	92.13	28	--	--	--	--
STN-58A	25.4-26.0	Dike 1 (Lean)	98.88	26	--	--	--	--
STN-58A	26.0-26.5	Dike 1 (Lean)	93	27	--	--	--	--
STN-58A	26.5-27	Dike 1 (Lean)	98.2	28	--	--	--	--
STN-58A	35.3-35.8	Alluvial (Clay)	71.4	60	--	--	--	--
STN-58A	35.8-36.4	Alluvial (Clay)	80.1	40	--	--	--	--
STN-58A	36.4-37.0	Alluvial (Clay)	87.5	30	--	--	--	--
STN-58A	46.5-47.0	Alluvial (Clay)	59.6	69	--	--	--	--

-- Proctor test not conducted on this material

The in-situ unit weights were compared to the unit weights of the Shelby tube samples that were obtained in the same vicinity from where the proctor samples were taken. In Dike 2, the unit weights of the samples ranged from as low as 87 percent to as high as 108 percent of maximum standard proctor. It should be noted that the proctor unit weights are lower than expected due to using test method A to conduct the proctor tests. Test method A excludes the gravel fraction for the compacted specimen. According to the US Army Corps of Engineers, soil placed for dams and levees should be compacted to at least 95 percent standard proctor (EM 1110-2-1911, Chapter 5).

10.6. Shear Strength Testing

Consolidated undrained triaxial compression tests were performed on the trimmed samples. All shear strength tests were conducted in accordance with ASTM D 4767. The test results are presented in Appendix F. Table 7 summarizes the consolidated undrained triaxial compression test results.

Table 7. Summary of Consolidated Undrained Triaxial Testing

Boring	Depth (ft)	Material Type	γ_{w0} (pcf)	w_0 (%)	c' (psf)	ϕ' (deg)
STN-54A	30.6-31.2	Dike 2 (Lean Clay)	132.3	20.3	220.3	32.1
STN-54A	31.2-31.8		130.6	19.4		
STN-58A	26.0-26.5	Dike 1 (Lean Clay)	117.8	27.9	220.3	22.3
STN-58A	26.5-27.0		124.3	25.7		
STN-54A	45.2-45.8	Alluvial Clay	124.9	24.9	220.3	33.3
STN-54A	45.8-46.4		125.8	23.2		
Dike 2 (Lean Clay) Bulk (STN-48A)			121.2	21.0	220.3	29.5
			120.9	20.9		
			121.0	20.6		
Dike 2 (Lean Clay) Bulk (STN-52A)			119.7	23.6	97.2	29.8
			119.1	23.4		
			119.3	23.4		
Dike 2 (Fat Clay) Bulk (STN-58)			120.3	23.5	254.9	29.4
			121.9	23.4		
			122.0	23.6		

10.7. Permeability Testing

Falling Head Permeability (FHP) tests were performed on additional trimmed samples. All permeability tests were conducted in accordance with ASTM D 5084. The test results are presented in Appendix F. Table 8 summarizes the permeability test results.

Table 8. Summary of Permeability Testing

Boring	Depth (ft)	Material Type	Permeability (cm/sec)
STN-48A	5-15 (Bulk)	Dike 2 – Lean Clay	2.8e-8
STN-52A	5-10 (Bulk)	Dike 2 – Lean Clay	3.5e-8
STN-54A	30.0-30.6	Dike 2 – Lean Clay	6.5e-8
STN-58	10-20 (Bulk)	Dike 2 – Fat Clay	2.7e-8
STN-48A	26.0-26.5	Dike 1 – Lean Clay	6.3e-8
STN-53A	43.8-43.2	Alluvial Clay	7.4e-8

11. Engineering Analyses

11.1. General

Engineering analyses of the dikes surrounding the Retention and Stilling Ponds consists of examining slope stability and seepage of ground water through in-situ materials. The analyses were performed using available historic information, results of the geotechnical field exploration and the results of the laboratory testing. Multiple cross-sections were analyzed for slope stability and also for seepage.

Cross-section locations and extents to use for analyses were chosen according to several factors. The cross-sections were selected because they are representative of the facilities as a whole, are along the most critical slopes and are at regular intervals along the dike alignment. The cross-sections are named using letters 'P' through 'W'. Figure 6 shows the cross-section locations and orientations for the project area.

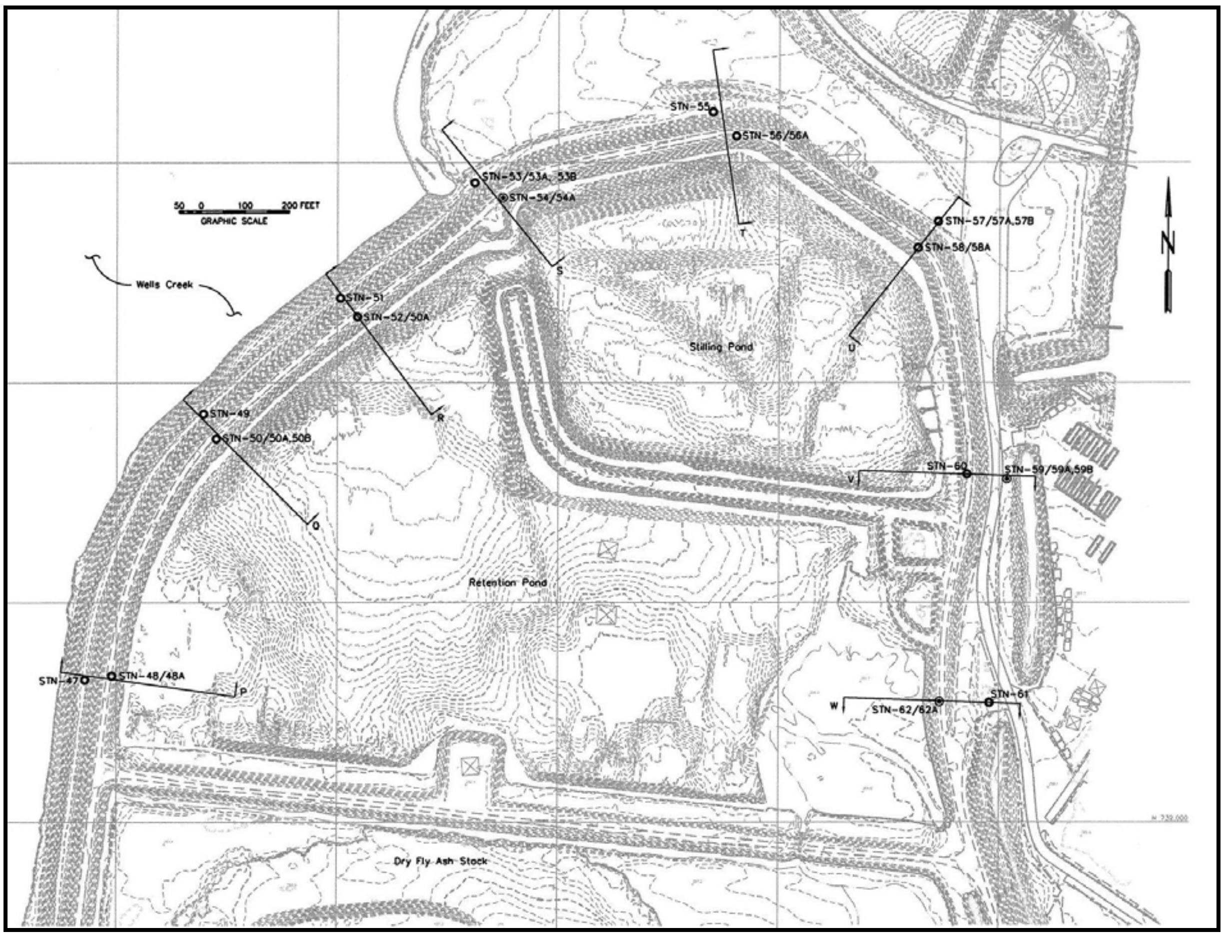


Figure 6. Plan View of the Retention and Stilling Ponds with the Locations of the Stability Cross-Sections Indicated.

11.2. Seepage Analysis

11.2.1. Background

The objective of this seepage analysis was to estimate the magnitude of seepage gradients (for the evaluation of potential piping) and pore water pressures within the soils (for the evaluation of slope stability). Seepage was examined in terms of total head (and pore water pressure) distribution within a given cross section of the dike assuming steady-state seepage conditions were achieved.

The numerical seepage models were developed using SEEP/W 2007 (Version 7.14), a finite element code tailored for modeling groundwater seepage in soil and rock. SEEP/W is distributed by GEO-SLOPE International, Ltd, of Calgary, Alberta, Canada (www.geo-slope.com). SEEP/W uses soil properties, geometry, and boundary conditions provided by the user to compute the total hydraulic head at nodal points within the modeled cross-sections. Among other features, SEEP/W includes a graphical user interface, semi-automated mesh generation routines, iterative algorithms for solving unconfined flow problems, specialized boundary conditions (seepage faces, etc.), capabilities for steady-state or transient analyses, and features for visualizing model predictions. The code also includes material models that allow tracking both saturated and unsaturated flow, including the transition in seepage characteristics for soils that become saturated or unsaturated during the problem simulation.

11.2.2. Boundary Conditions

Boundary conditions for the SEEP/W analysis were assumed as follows. Steady-state seepage was assumed for the analysis, with the static pool levels placed at approximate El. 384.23 feet for the Retention and Stilling Ponds. For the left side of Sections P through U, the pool level for Wells Creek/Cumberland River was set at El. 359.5 feet. For Sections V and W the outer boundary condition was assumed to be the invert of a surface ditch that leads to the outlet channel. This elevation was determined to be approximately El. 375 feet. Along the vertical, interior edge of the model, the hydraulic head at each node was constant with depth and equal to the pool elevations of the ash ponds (El. 384.23 feet). A total head equal to the pool levels was also applied to all submerged nodes along the ground surface of the interior side. Other nodes along the ground surface were treated as potential seepage exits. At various steps in the computer analysis, if the software determines that water flows from the mesh at these nodes along the ground surface, SEEP/W assigned a head equal to the elevation of the node. This routine effectively models the seepage exit to the ground surface. The horizontal boundary at the base of the model (located within the bedrock) was modeled as a seepage barrier, with no vertical flow across the boundary nodes. Steady state seepage was assumed for the analysis.

11.2.3. Seepage Properties

For each modeled cross-section, a representative subsurface profile was compiled based on boring logs, known project history and available historical mapping. Material properties were estimated based on available laboratory data, correlations with classification data, and on typical values for similar materials. In some cases, the laboratory data used referenced previous work that Stantec had completed around the coal combustion products disposal facility. Material properties used in the seepage analysis are summarized in Table 9.

Table 9. Material Properties for SEEP/W Analysis

Soil Horizon	Saturated k_v (cm/s)	Ratio k_h / k_v	Specific Gravity G_s	Void Ratio e	Volumetric Water Content		Basis
					Residual	Saturated	
Clay Dike 1 - Lean Clay	6.50E-07	10	2.67	0.704	0.06	0.413	Available Laboratory Data and Correlation w/ Typical Values
Clay Dike 1 - Fat Clay	2.70E-08	10	2.67	0.709	0.09	0.415	Available Laboratory Data and Correlation w/ Typical Values
Clay Dike 2 - Lean Clay	4.27E-08	10	2.71	0.540	0.08	0.351	Available Laboratory Data and Correlation w/ Typical Values
Clay Dike 2 - Fat Clay	2.70E-08	10	2.71	0.540	0.09	0.351	Available Laboratory Data and Correlation w/ Typical Values
Fly Ash - Sluiced	8.41E-05	50	2.50	0.550	0.015	0.3548	Available Laboratory Data and Correlation w/ Typical Values
Alluvial – Clay	7.41E-08	20	2.67	0.667	0.07	0.401	Available Laboratory Data and Correlation w/ Typical Values
Alluvial – Granular	1.00E-04	20	2.68	0.370	0.02	0.27	Correlation w/ Typical Values
Bedrock	3.05E-11	10	N/A	N/A	0	0.05	Correlation w/ Typical Values

Note: SEEP/W requires input parameters k_h and ratio of k_v/k_h

For this table, the variables referenced are:

- K_v is the vertical hydraulic conductivity,
- K_h is the horizontal hydraulic conductivity,
- G_s is the specific gravity of solids,
- e is the void ratio,

Horizontal Hydraulic Conductivity (K_h): The K_h values for the in-situ materials (with the exception of bedrock) were estimated based on permeability test results on Shelby tube samples. Cone Penetrometer Test (CPT) dissipation results from the Dry Fly Ash Stack/Gypsum Disposal Complex report were also used for fly ash. These estimates were compared to typical values from similar TVA projects, similar facility types, and technical literature. A tabular summary of the hydraulic conductivity information is included in Appendix G, Material Property Calculation.

The K_v values for gravel and rip rap were assumed based on typical values. A very low K_v value was assigned to bedrock assuming some fractures would be present in the shale and limestone, allowing minimal flow.

Vertical Hydraulic Conductivity (K_v): The ratio of K_v to K_h was estimated based on permeability test results on Shelby tube samples and CPT dissipation results (fly ash only). These estimates were compared to typical values from similar TVA projects, similar facility types, and technical literature. This ratio was used to calculation the K_v.

Specific Gravity of Solids (G_s): Specific gravity is a dimensionless unit defined as the ratio of density of the material to the density of water.

Saturated Volumetric Water Content: These values were estimated based on general material type using the article, “Estimation of Soil Water Properties” (Rawls et al. 1982).

Residual Water Content: These values of all materials were estimated based on general material type using the article, “Estimation of Soil Water Properties” (Rawls et al. 1982).

Significant engineering judgment is needed to select appropriate hydraulic properties for earth/soil materials. Unlike other key properties, hydraulic conductivity can vary over several orders of magnitude for a range of soils, often with substantial anisotropy for seepage in horizontal versus vertical directions. Laboratory test samples often do not represent important variations within a larger soil deposit. For this analysis, an iterative process of parametric variation was used to arrive at final estimates of the seepage properties. Results from trial simulations were compared to field data (measured piezometric levels) and the material parameters were then varied until the solutions reasonably matched the field data. The final set of parameters are presented in Table 9.

The ratio of horizontal hydraulic conductivity (kh) to vertical hydraulic conductivity (kv) was estimated based on placement, depositional characteristics, and origin of the materials. An isotropic material would have kh/kv = 1, while deposits of horizontally layered soils will have much higher values. For this analysis, higher ranges of ratios were used for sluiced ash and native materials, whereas a lower range of ratios was assumed for compacted dike materials.

The governing equations in SEEP/W are formulated to consider seepage through unsaturated soils. In the simulations for this study, this formulation is used to locate the phreatic surface for unconfined seepage through the dike cross-sections. To represent the change in hydraulic conductivity due to de-saturation of each soil, SEEP/W implements a model based on two curves, a hydraulic conductivity function and a volumetric water content function. Three parameters are needed to define this behavior: the saturated hydraulic conductivity, saturated water content, and residual water content (water content of air dried soil). Of these, only the residual water contents were not previously estimated for each material. Values were estimated based on typical values for similar soils. The simulation results show very low sensitivity to the selection of these values.

11.2.4. Comparison to Field Observations

After the initial seepage parameters were estimated, results from the SEEP/W model were compared to pore water pressures actually measured in the 7 piezometers installed within the CUF Retention and Stilling pond perimeter dikes. Nodes were placed in the model at the same location as the actual piezometer tips so that the total head predicted at the node could be compared to the corresponding piezometer reading. The material properties in each modeled cross-section were then varied until a reasonable match was obtained between the seepage predictions and field data. Specifically, the saturated hydraulic conductivity and the kh/kv ratios were adjusted (while still maintaining the parameters within expected ranges) to give model predictions as consistent as possible with field measurements and observations.

The comparison between the field piezometer measurements and final SEEP/W predictions show the predicted groundwater table ranging from about 1.5 feet below to 3 feet above the readings obtained in the piezometers. Most differences are between about 1-foot below to 2 feet above the actual readings. In one section (Section U) the SEEP/W results predict water levels to be as much as 10 feet higher that actual piezometer readings. These differences are judged to be acceptable given the limited information available and unknown conditions between the modeled cross-sections and borings. For Section U, it is unknown if the actual stratigraphy differs from how it is currently modeled. In sections P, Q and R, the models indicate some amount of seepage emanating from the toe of Dike 1. This is consistent with historic reports in the area of Section Q, although no seepage has been reported in recent years. In summary, the seepage models appear to give a reasonable prediction of the phreatic surface location when compared to field observations and piezometer measurements.

11.2.5. Critical Exit Gradients

Seepage forces, resulting from hydrodynamic drag on the soil particles, can destabilize earthen structures. Excessive hydraulic gradients near the ground surface can lead to the initiation of soil erosion and piping, which has caused numerous dam failures in the past. Hydraulic gradients (computed where seepage exits at the ground surface) can be evaluated to understand the potential severity of this problem.

Where upward seepage through a uniform soil exits the ground surface, the factor of safety with respect to soil piping (FSpiping) is as defined below.

$$FS_{piping} = \frac{i_{crit}}{i} \qquad \textbf{Eqn. 11.1}$$

Where "i" is the vertical gradient in the soil at the exit point. The critical gradient (icrit) is related to the submerged unit weight of the soil, and can be computed as:

$$i_{crit} = \frac{\gamma_{sub}}{\gamma_w} = \frac{G_s - 1}{1 + e} \qquad \textbf{Eqn. 11.2}$$

where γsub is the submerged unit weight of the soil, γw is the unit weight of water, Gs is the specific gravity of the soil particles, and e is the void ratio. For nearly all soils, the critical gradient is between about 0.6 and 1.4, with a typical value near 1.

When FSpiping = 1, the effective stress is zero and the near-surface soils are subject to piping or heaving, but only for vertical seepage that actually exits to the ground surface. If the phreatic surface is buried, then the FSpiping will be greater than 1 even when i=icrit.

11.2.6. Results of Seepage Analysis

Plots from the SEEP/W analyses of the eight cross-sections through the CUF pond dikes are presented in Appendix H. The plots show the finite element mesh, material zones, and boundary conditions used in each analysis. The results are depicted in contour plots of seepage gradients and include a phreatic line as well.

On each modeled cross-section, examination of the output (predicted phreatic surface and vertical gradients) can be used to search for areas where the potential for excessive vertical gradients might exist that could possibly initiate the erosion or piping of material. In general, areas of potential concern are where water seeps laterally out onto a sloping ground surface, or where vertical, upward seepage occurs at the ground surface. The potential for piping was evaluated using the factor of safety equation as defined in Section 11.2.5. First, contour plots of vertical gradient were examined to determine the general location of the maximum vertical exit gradient. On the modeled cross-sections, the maximum upward gradient occurs near or beyond the exterior toe of the dikes. For the factor of safety calculations, vertical gradients from these locations were then used along with the critical gradients determined from the soil properties.

The calculated factors of safety against piping are summarized in Table 10. They range from 1.3 to 49, with two values being even greater (Sections T and W) because a critical exit point was not predicted by the model. Stantec recommends a target factor of safety against piping of 4, based on information contained in United States Army Corps of Engineers (USACE) manual EM 1110-2-1901. Hence, on five of the eight cross sections modeled, the recommended target factor of safety for piping at the critical seepage exit points is met or exceeded.

Table 10. Summary of Computed Exit Gradients and Minimum Factors of Safety Against Piping

Cross Section*	Vertical Gradient (i_y) at Critical Exit Point	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}
P	0.75	Toe of Dike 1	Alluvial Clay	1.00	1.3
Q	0.42	Toe of Dike 1	Alluvial Clay	1.00	2.4
R	0.38	Toe of Dike 1	Alluvial Clay	1.00	2.6
S	0.02	Toe of Dike 2	Dike 1 – Lean Clay	0.98	49.0
T	Critical Exit Location Not Identified	N/A	Dike 1 – Lean Clay	0.98	>4.0
U	0.06	Toe of Dike 2	Dike 1 – Lean Clay	0.98	16.3
V	0.18	Ditch in Dike 1	Dike 1 – Fat Clay	0.97	5.4
W	Critical Exit Location Not Identified	N/A	Dike 1 – Fat Clay	0.97	>4.0

*Refer to Appendix B for locations of cross-sections.

11.2.7. Remedial Improvements

A review of the seepage analysis results indicate less than acceptable factors of safety against piping for Sections P, Q and R. These areas represent the western dike of the Retention Pond. Factors of safey against piping can be improved by the addition of a toe berm or by construction of a barrier wall Alternatives are proposed to increase the resistance to piping to meet USACE design criteria. The conceptual improvements are shown in Appendix B.

To raise the minimum factor of safety to 4.0 or greater, two options were considered and modeled. Option 1 is a seepage berm that extends approximately 40 feet from the toe of Dike 1. Conceptually, the seepage berm would include the installation of a graded filter consisting of sand, bedding stone (TDOT No. 2 stone) and rip-rap (Class A). The seepage berm would be embedded approximately 5 feet into the creek bed and maintain a minimum thickness of 5 feet up the slope to approximately EL. 370 feet. The exit gradient would be significantly reduced, thereby increasing the factor of safety against piping well above the desired minimum of 4.

Option 2 consists of installing a sheet pile cutoff wall through the upstream side of the dikes. As modeled, the sheet piling would be installed to approximate depths of 45 to 55 feet. The sheet piling should be of an interlocking design such as to minimize the flow of water through the joints and of sufficient material thickness to withstand driving through expected subsurface materials. Installed properly, the sheet pile wall would serve to increase the length of the drainage path and thereby reduce the exit gradient.

Seepage analyses were performed on Section P for these repair scenarios and the results are presented in Table 11.

Table 11. Summary of Seepage Analyses – Mitigation Option

Cross Section*	Repair Mitigation Option	Vertical Gradient (i_y) at Critical Exit Point	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}
P	Seepage Berm	0.11	Toe of Dike 1	Alluvial Clay	1.00	9.1
P	Cutoff Wall	Critical Exit Location Not Identified	N/A	Alluvial Clay	1.00	>4.0

*Refer to Appendix B for locations of cross-sections.

11.3. Slope Stability Analysis

11.3.1. SLOPE/W Model

The stability of the Ash Pond dike slopes was analyzed using limit equilibrium methods. Analyses were performed for static, long-term conditions with steady-state seepage conditions. The slopes were analyzed using SLOPE/W software, which is available from GEO-SLOPE International, Ltd., of Calgary, Alberta, Canada (www.geo-slope.com). SLOPE/W is a special-purpose computer program designed to analyze the stability of earth slopes using two-dimensional, limit equilibrium methods. With SLOPE/W, the distribution of pore water pressures within the earth mass can be determined using a defined piezometric line or it can be mapped directly from a SEEP/W solution.

In this study, steady-state pore pressures were obtained from the SEEP/W seepage analysis program. As previously stated, the phreatic line determined by SEEP/W was initially established by using the borehole water levels observed at the time of drilling, piezometer readings, the normal pool level of Wells Creek and visual observations of free water in surface ditches. The unit weight and shear strength properties used in the stability analyses are summarized in Tables 7 and 8.

11.3.2. Limit Equilibrium Methods in SLOPE/W

The limit equilibrium method for analyzing slope stability evaluates the static equilibrium of a soil mass above a potential failure surface. For conventional, two-dimensional methods of analysis, the slide mass above an assumed failure surface is split into vertical slices and stresses are evaluated along the sides and base of each slice. The factor of safety against a slope failure (FS_{slope}) is defined as:

$$FS_{slope} = \frac{\text{shear strength of soil}}{\text{shear stress required for equilibrium}} \qquad \textbf{Eqn. 3}$$

where the strengths and stresses are computed along a defined failure surface, on the base of the vertical slices. The shearing resistance at locations along the potential slip surface are computed, with appropriate Mohr-Coulomb strength parameters, as a function of the total or effective normal stress.

Spencer's solution procedure (Spencer 1967; USACE 2003; Duncan and Wright 2005), which satisfies all of the conditions of equilibrium for each slice, was used in this study. Spencer's procedure computes FS_{slope} for an assumed failure surface. A search must be made to find the critical slip surface corresponding to the lowest FS_{slope}. Both curved and noncircular potential failure surfaces can be evaluated.

11.3.3. Slope Stability of the Dikes Surrounding the Retention and Stilling Ponds

The outslope of each dike cross-section was analyzed for slope stability using SLOPE/W 2007. SLOPE/W incorporates various search routines to locate the critical slip surface. For the analyses presented here, the "Entrance and Exit" method was employed. Once the potential failure surface with the lowest factor of safety was identified, the optimization routine was run.

Optimization allows the failure surface geometry to be modified based on the properties of the material through which the surface penetrates. The minimum and maximum range for the entrance and exit points of the failure surface was parametrically varied over a wide range to determine the likely solution region for the critical surface. In subsequent runs, the search was refined by narrowing the range and spacing for the candidate points. In addition, the entrance and exit ranges were also specified so that each "structure" was investigated individually. This allows for a comparison of the factors of safety of each portion of the slope within the cross-section.

Where the surface slope is composed of cohesionless (c' = 0) materials, an infinite slope failure (shallow sliding parallel to the surface) will be critical. While solutions were initially obtained for this case, these shallow sloughs were deemed to be minor and would be able to be repaired before any additional instabilities occurred. Suction pressures in unsaturated surface soils will often create enough apparent cohesion to prevent this type of failure. If shallow sliding does occur, the resulting deformations are unlikely to threaten the integrity of the dike. Neglecting the repair of the "minor slides" can lead to larger, more serious failures. To force the search routine to evaluate deeper failure mechanisms, a minimum failure depth of at least 10 feet was specified for each section.

11.3.4. Slope Stability Parameters

Table 12 summarizes the parameters selected for each of the soil horizons used in the analyses. Specifics of how the parameters were selected are provided in Appendix G (Material Property Calculation).

Table 12. Slope Stability Shear Strength Parameters

Material Type	Unit Weight, g' (pcf)	Effective Stress	
		Cohesion, c' (psf)	Friction Angle, φ' (deg)
Clay Dike 1 – Lean Clay	123	200	22
Clay Dike 1 – Fat Clay	119	200	22
Clay Dike 2 - Lean Clay	123	200	32
Clay Dike 2 - Fat Clay	119	200	29
Fly Ash – Sluiced	100	0	22
Alluvial – Clay	124	200	33
Alluvial – Granular	130	0	32
Bedrock	Impenetrable		

11.3.5. Results of Slope Stability Analysis

Using the strength parameters (c' and ϕ') listed in Table 10, the existing dike configuration was analyzed at each of the eight cross sections. Geo-Slope's Slope/W computer program was used for the analyses with pore pressures calculated from the imported seepage analysis. Long term (effective stress), steady state seepage conditions were analyzed using Spencer's method. For the Spencer's method analyses, curved failure surfaces with optimization were analyzed. Minor details of the geometry, such as various small gravel surface zones and bottom ash cover, were not represented in the stability model.

The stability analyses focused on the potential for failure of both the interior and exterior dike slopes. SLOPE/W failure surfaces from these analyses are presented on the drawings in Appendix B. The results are summarized in Table 13.

Table 13. Summary of Computed Factors of Safety for Slope Stability

Section*	Minimum Exterior	Minimum Interior
P	1.7	3.0
Q	1.9	3.0
R	2.0	2.9
S	2.5	3.2
T	2.9	2.9
U	2.6	2.1
V	2.8	2.9
W	7.2	2.7

*Refer to Figure 6 for plan view of site with section locations

The Tennessee Department of Environment and Conservation (TDEC) "Rules and Regulations Applied to the Safe Dams Act of 1973" provides guidance and standards with regards to existing dams. The standards do not specifically address target factors of safety for slope stability, but instead merely indicate that the dam shall be "stable". Based on discussions with TVA and to be in accordance with current prevailing practice, a minimum factor of safety of 1.5 was adopted for long term slope stability conditions using the guidelines presented in USACE Manual EM 1110-2-1902 "Slope Stability".

The results of the slope stability analyses demonstrate that the factors of safety against long term steady state seepage slope instability range from 1.7 to 7.2 with most results falling between 2 and 3. Hence the resulting factors of safety are greater than the target of 1.5 for each cross section. For each cross section, the minimum factor of safety was generally associated with the minimum 10-foot deep slip surface. In each case, deeper failure surfaces resulted in higher factors of safety. The slip surfaces are shown on the cross sections that are included in Appendix B. Appendix I includes the program output from SLOPE/W.

There was no indication in the slope stability analyses that a translational (noncircular) failure surface would give a factor of safety lower than obtained for optimized curved surfaces. Overall, the geometry of the dike cross sections and the foundation stratigraphy do not appear to be susceptible to sliding along a planar surface. The results in Table 12 and Appendix B represent factors of safety computed from the optimized, curved slip surface routine.

12. Conclusions and Recommendations

12.1. The conclusions and recommendations that follow are based upon Stantec's understanding of the facility as outlined in this report, and in TVA's plans for future operations. This understanding of the facility developed from reviews of historical information provided by TVA, discussions with TVA personnel throughout the course of this work and results of the geotechnical exploration and stability analysis.

12.2. Stantec performed a preliminary hazard assessment of the Cumberland Ash Pond in the summer of 2009, based primarily on USGS topographic mapping. The Ash Pond is currently considered to be a high hazard facility, due to the potential for downstream damage to the existing State highway and bridge should the impoundment fail. Stantec and TVA are currently undertaking a detailed study to more accurately determine the downstream impacts resulting from a failure. Stantec is also in the process of studying modifications and/or replacement of the existing Ash Pond spillways. One of the outcomes of these efforts may be lowering the pool elevation by several feet. Currently, there are no plans in place to permanently close the facility.

12.3. The results of the seepage analyses were reviewed to identify conditions where seepage and possible piping may occur. Seepage outbreaks along the slopes can create the potential for the initiation of soil piping if excessive vertical gradients exist. The seepage analyses showed that maximum vertical exit gradients typically occur near or beyond the exterior toe of the dikes. At three locations, Sections P, Q and R, the calculated factor of safety against piping was found to be less than the recommended acceptable minimum value of 4.

12.4. Review of historic documents, including Annual Inspections performed by TVA personnel, indicate a history of seepage along the banks of Wells Creek, near Sections P and Q. Remediation efforts in 1974 included the placement of a clay blanket on the interior of the Ash Pond dikes in that vicinity. Seepage reportedly ceased within months and has not been reported since that time.

12.5. Two alternatives have been proposed to increase the factor of safety against piping at Sections P, Q and R. The first is to construct a toe berm along the banks of Wells Creek. This method would likely cost less than the second alternative, however significant permitting challenges exist. To construct the toe berm below the ordinary water level of Wells Creek would require both a 404 and 401 permit. For this reason, it is recommended that a driven sheet pile wall be considered. No environmental permitting would be required. It is recommended that design of the sheet pile wall not be performed until the current studies on the pond spillways and hazard status are complete. If the pool level is to be lowered significantly, it will have an impact on the sheet pile wall design. Also, construction of the sheet pile wall should be coordinated with other construction projects that may take place such as modification of the spillways or lowering of the dikes.

12.6. Results of the slope stability analyses indicate factors of safety against long-term slope stability failure are greater than the target value of 1.5. If the pond water level or top of dike elevations are lowered in the future, the factors of safety would tend to increase.

12.7. The inspection program at CUF should include regular inspections of the bank of Wells Creek in the vicinity of Sections P, Q and R. Any noted seeps should be located on a map and observed at regular intervals. An accurate approximation of flow should be recorded along with photographs of the seep area. The seep area should be kept clear of vegetation in order to facilitate visual observation. Any rapid changes in the seep should be reported to the appropriate personnel.

13. Closure and Limitations of Study

13.1. The scope of this evaluation was limited to consider only the potential risks of dike failure under long-term, steady-state seepage loading conditions. This assessment did not consider potential failure modes related to spillway capacity and overtopping or seepage along penetrations through the embankments (including the buried spillway pipes).

13.2. The recommendations presented herein are based on information gathered (from various sources) using that degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. Subsurface profiles are generally based on straight-line interpolation between borings and no warranties can be made regarding the continuity of subsurface conditions between the borings.

13.3. The boring logs and related information presented in this report depict approximate subsurface conditions only at the specific boring locations noted and at the time of drilling. Conditions at other locations may differ from those occurring at the boring locations. Also, the passage of time may result in a change in the subsurface conditions at the boring locations.

Appendix A

Phase 1 Coal Combustion Product Facility Summaries, 2009

TVA Disposal Facility Assessment
Phase 1 Coal Combustion Product Disposal Facility Summary
Cumberland Fossil Plant (CUF)
Ash Pond (AP-1)

1. General Facility Information

Facility Status:	Active	NID Identification:	TN16109
Surface Area (inside dikes)	50 acres (estimated)	Maximum Height (toe to top of dike):	35 feet (estimated)
Free Water Volume:	1,296,069 CY (9/2008)	Maximum Water Storage:	2,165,158 CY (9/2008)
Estimated CCB Storage:	1,305,346 CY	Dike Length:	5,600 feet (estimated)
Plant Discharge to Facility:	Not provided by TVA	Current Pool Elevation:	384 feet (estimated)

2. Site Visit Information

Stantec Assessment Team:	Stephen Bickel, PE, Nathan Bader, PE, Stan Harris, PE and Matthew Hoy, EIT
TVA Staff Present:	Stuart Harris and Carrie McCarty
Field Assessment Dates:	January 14, 2009 and February 3 - 4, 2009
Weather/Site Conditions:	Mid-30 degrees F, sunny, moist ground both days.

3. History/Description of Usage

History and Operation:

This disposal area was constructed in 1969. As part of this construction, Wells Creek was relocated in order to construct what was initially known as Disposal Area 1. As a result, portions of the current Active Ash Pond and Dry Stack were constructed over the original location of Wells Creek. Area 1 was located within the perimeter dikes that now include the current ash and gypsum disposal areas. In 1977, the divider dike for the stilling pool to the north (interior divider dike) was constructed. In 1979, the dikes around the Ash Pond were raised to elevation 395 feet with clay. In 1986, approximately 300 feet of the west portion of the divider dike between the Ash Pond and the Dry Ash Stack was constructed. In 1995-96, the current divider dike between the Ash Pond and Dry Stack was constructed (exterior divider dike) to

	form the current configuration. Approximately 135,000 dry tons of bottom ash is wet sluiced to the Ash Pond annually. Dewatered bottom ash is reclaimed and stacked in the Dry Stack area. Outlet for the Ash Pond is through four 48-inch RCP riser pipe/weirs that discharge through four 36-inch RCP sections into an adjacent discharge channel.
Past Failures/Releases:	No failures or releases reported.

4. Owner's Operations, Maintenance and Inspection Information

Emergency Action Plan:	No EAP has been prepared for this facility.
Operations Manual:	"Operations Manual: Dry Ash and Gypsum Stacking Facility", prepared by Tennessee Valley Authority, October 10, 2003.
TVA Maintenance:	Exterior slopes are mowed every two years.
TVA Inspections:	TVA Engineering performs annual dike inspections and prepares reports. Plant personnel recently started making daily observations, with documented inspections made weekly.
Problems Previously Identified During Past TVA Inspections:	Sloughed areas on interior divider dike, tree growth on dikes, animal burrows.

5. Documents Reviewed

See attached Document Log for complete list of documents provided by TVA for review. In particular, the following provided pertinent information for the assessment of this facility:

TVA Design Drawings:	10N212, 213, 214, 218, 224, 225, 10W287-1, 287-2, 6314-W-C110200 through 222
TVA As-Built Drawings:	None available.
TVA Construction Testing Records:	None available.
TVA Annual Inspection Reports:	TVA Annual Inspection Reports 1972-1984, 1986-1990, 1994-1995, 1997-2004, 2006-2008.

Geotechnical Data: "Cumberland Steam Plant - Ash Dike Raising - Borrow Area B Expansion and Proposed Borrow Area D", Memorandum from Frank Van Meter to G.L. Buchanan, June 16, 1981.

"Cumberland Fossil Plant - Ash Disposal Area No. 1A", Power Engineering & Construction Calculations, K.W. Burnett, December 19, 1990.

"Ash Pond Dike - Recommended Engineering Properties for Slope Stability Analyses", Tennessee Valley Authority, December 12, 1986.

"Recommendations for Stability Improvement, Ash Pond Dike System, Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering, March 13, 1992.

"Report of Site Investigation - Cumberland Fossil Plant Soils Investigation for Ash Pond Dike and Borrow Areas", Hall, Blake, and Associates, Inc., October 3, 1986.

6. Stantec Field Observations

See attached Concerns/Photo Log, Photos, and Site Plan Drawing.

6.1. Interior Slopes

Vegetation: Phragmites and brush, dense coverage.

Trees: Sparse small trees were noted in various areas on the majority of dikes.

Wave Wash Protection: The interior divider dike separating the Stilling Pond from the Ash Pond has riprap protection. None observed on other interior slopes.

Erosion: Erosion observed along divider dike to Dry Ash Stack around 36 inch HDPE pipe. The pipe is located at the west end of the divider dike; rill/gullies noted in various areas along this divider dike.

Instabilities: None observed.

Animal Burrows: None observed.

Freeboard:	**Measured:**	10.9 feet at Section 2
	Design:	Not available on drawings provided.
Encroachments:	None observed.	
Slope:	**Measured:**	1.8H:1V along divider dike at Section 1, 2.5H:1V along inner perimeter dike slope (Estimated), 2.2H:1V along Dry Stack divider dike at Section 3.
	Design:	2H:1V on interior divider dike (from Drawing 10N224), 2.5H:1V on perimeter dike (from Drawing 10N213).

6.2. Crest

Crest Cover and Slope:	Gravel-covered road on perimeter dike, crest appears relatively flat. Bottom ash and gravel-covered road on interior stilling pond divider dike, crest appears relatively flat. Bottom ash-covered road on divider dike between Dry Ash Stack and Ash Pond, crest appears relatively flat.	
Erosion:	Minor erosion rill/gullies on divider dike to Dry Ash Stack.	
Alignment:	Alignment appeared to agree with design drawings.	
Settlement/Cracking:	None observed.	
Bare Spots/Rutting:	None observed.	
Width:	**Measured:**	19 feet on divider dike at Section 1; 20 feet on perimeter dike at Section 2; 31 feet on Dry Stack divider dike at Section 3.
	Design:	16 feet on interior divider dike and perimeter dike (from Drawings 10N224 and 10N213). No information available for Dry Stack divider dike.

6.3. Exterior Slopes

Vegetation:	Maintained grass, adequate coverage.
Trees:	None observed.
Erosion:	None observed.

Instabilities:	None observed.
Uniform Appearance:	Good.
Seepage:	Standing water was observed along north portion of perimeter dike.
Benches:	None observed.
Foundations, Drains, Relief Wells, Instrumentation:	No provisions for drainage/seepage control, or instrumentation were observed.
Animal Burrows:	One burrow on exterior dike was observed.
Slope:	**Measured:** 2.7H:1V at Section 2. **Design:** 3H:1V (from Drawing 10N213).
Height:	**Measured:** 15 feet at Section 2 **Design:** 35 feet at outlet area (from Drawing 10N214).

6.4. Spillway Weirs/Riser Inlets

Number:	Four, located at the east end of the stilling pond.
Size, Type and Material:	48-inch RCP push-together riser sections with standard TVA steel skimmers.
Height of Riser Inlets:	23 feet (est. from Drawing 10N214)
Access:	All spillways accessible via steel catwalks.
Joints:	Unable to observe below inlet any joint leakage or sealant.
Mis-Alignment:	None reported or observed.
Closed/Abandoned Conduits:	None reported or observed.

6.5. Outlet Pipes

Number:	Four
Size, Type and Material:	36-inch RCP
Headwall:	None observed.

Joint Separations: Unknown, unable to observe.

Mis-Alignment: Unknown, unable to observe.

Closed/Abandoned Conduits: None reported or observed.

7. Notable Observations and Concerns

- The absence of an Emergency Action Plan, Operation and Maintenance Plan, as-built drawings and construction testing records is a concern.
- One animal burrow was noted along the perimeter dike.
- Standing water attributed to poor drainage was noted along the toe of the north perimeter dike.
- RCP push-together riser spillways are a concern.
- Some minor erosion was noted along the outslope of the perimeter roadway just east of the sluicing channel.
- A few small trees were noted along the stilling pond divider dike.
- Erosion was noted along the new 36-inch HDPE drain pipe along the west end of the Ash Pond-Dry Stack divider dike. Several other areas of minor erosion along this divider dike were also noted.
- Some erosion was noted along the north outslope of the bottom ash area.
- The steel angles within the standard skimmers were observed to be corroded and in poor condition. Walkways that are supported by the skimmers are putting eccentric loading on the structure.

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- It is recommended that the perimeter dikes for the Ash Pond undergo further engineering study to evaluate slope stability and seepage. It is also recommended that a hydraulic and hydrologic analysis be performed to check freeboard and pond outlet adequacy relative to process flow and stormwater.
- Based on the findings of Phase 2 and designs from Phase 3, if performed, Stantec recommends that the existing O&M Manual be reviewed and updated. These updates may include sections on routine monitoring and facility maintenance.
- It is recommended that a program be established to develop as-built drawings and

construction records for future maintenance and construction activities.

8.2. Maintenance Recommendations

- Remove trees from noted locations.
- Repair animal burrows where noted.
- Cut and maintain heavy/tall phragmite growth on slopes of ponds to allow better observation. Establish mowing program of ponds and disposal areas.
- Regrade and repair erosion areas where noted.
- The RCP riser spillway outlet system may ultimately be modified or replaced, pending Stantec-TVA assessment of replacement system. Monitor the spillway systems until that time.
- Monitor standing water along toe of perimeter dike. Regrade adjacent drainage ditch if conditions worsen.
- Continue annual inspection program and execute recommendations.
- Evaluate the structural condition of the skimmers and the way walkways are supported, and modify or replace as necessary.

Drawing Mark AP-1-1 Crest and inside slopes of the perimeter dikes around the Ash Pond.

Drawing Mark AP-1-2 Animal burrow along north perimeter dike of Ash Pond.

Drawing Mark AP-1-3 Standing water along toe of north perimeter Ash Pond dike.

Drawing Mark AP-1-4 Spillways at northeast side of Stilling Pond.

Drawing Mark AP-1-5   Spillway discharge and channel.

Drawing Mark AP-1-6   Trees on stilling pond divider dike.

Drawing Mark AP-1-7 Erosion around 36" HDPE drain pipe along the west end of the divider dike.

Drawing Mark AP-1-8 Erosion along north outslope of Bottom Ash Area.

Drawing Mark AP-1-9 Erosion along divider dike between Dry Ash Stack and Ash Pond.

Concerns/Photo Log		
Drawing Mark	**Comments**	**Photo/GPS ID**
AP-1-1	Crest and inside slopes of the perimeter dikes around the Ash Pond.	Photo 26B
AP-1-2	Animal burrow along north perimeter dike of Ash Pond.	Photo 21B
AP-1-3	Standing water along toe of north perimeter Ash Pond dike.	Photo 23B
AP-1-4	Spillways at northeast side of Stilling Pond.	Photo 25B
AP-1-5	Spillway discharge and channel.	Photo 24B
AP-1-6	Trees on stilling pond divider dike.	Photo 48B
AP-1-7	Erosion around 36" HDPE drain pipe along the west end of the divider dike.	Photo 38B
AP-1-8	Erosion along north outslope of Bottom Ash Area.	Photo 14B
AP-1-9	Erosion along divider dike between Dry Ash Stack and Ash Pond.	Photo 41B

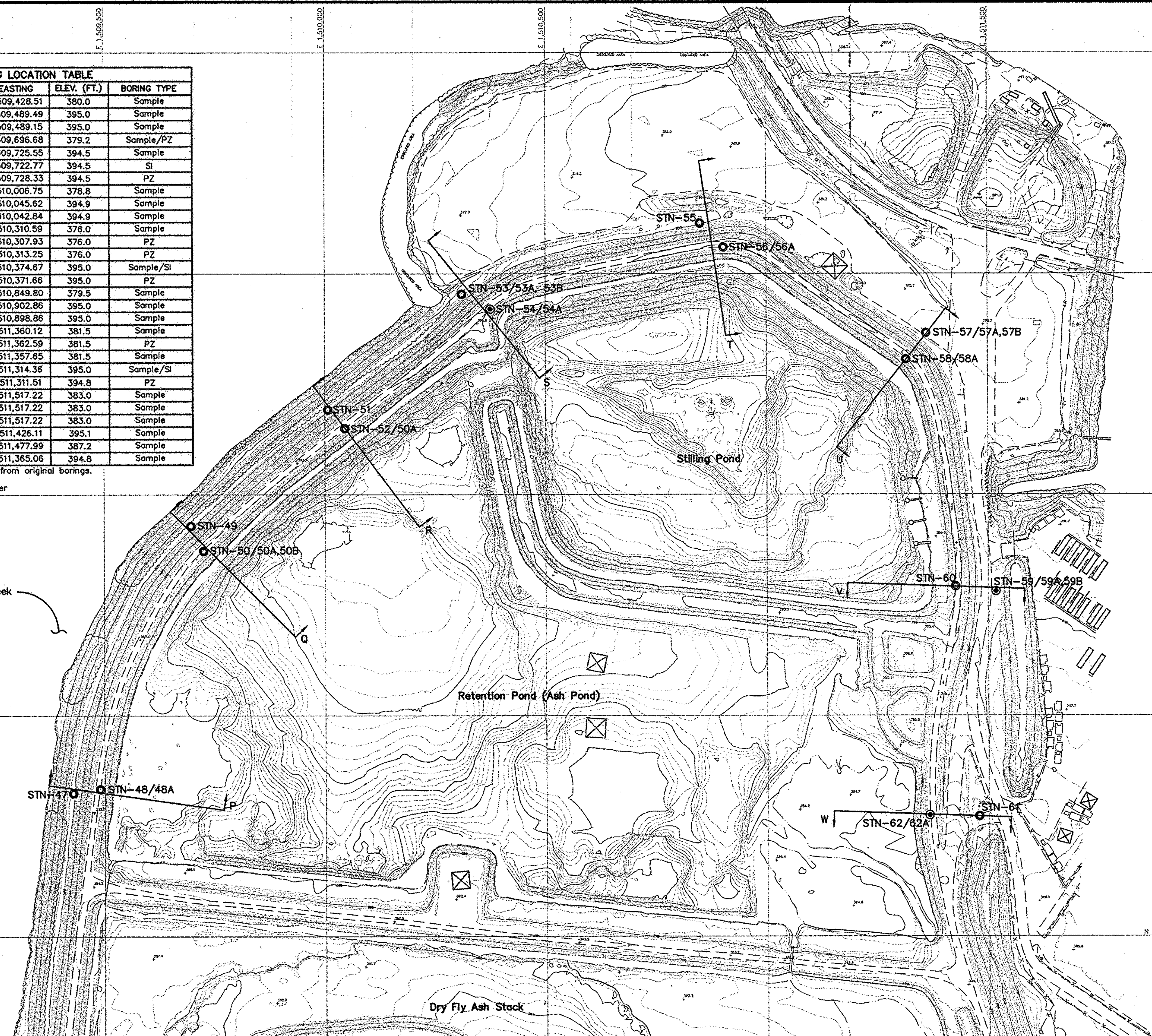
Appendix B

Boring Layout and Cross Sections

NOT TO SCALE

BORING LOCATION TABLE				
BORING	NORTHING	EASTING	ELEV. (FT.)	BORING TYPE
STN-47	732,324.14	1,509,428.51	380.0	Sample
STN-48	732,333.24	1,509,489.49	395.0	Sample
*STN-48A	732,329.25	1,509,489.15	395.0	Sample
STN-49	732,928.84	1,509,696.68	379.2	Sample/PZ
STN-50	732,872.44	1,509,725.55	394.5	Sample
*STN-50A	732,869.56	1,509,722.77	394.5	SI
*STN-50B	732,875.32	1,509,728.33	394.5	PZ
STN-51	733,191.78	1,510,006.75	378.8	Sample
STN-52	733,149.40	1,510,045.62	394.9	Sample
*STN-52A	733,146.52	1,510,042.84	394.9	Sample
STN-53	733,453.67	1,510,310.59	376.0	Sample
*STN-53A	733,456.66	1,510,307.93	376.0	PZ
*STN-53B	733,450.68	1,510,313.25	376.0	PZ
STN-54	733,419.93	1,510,374.67	395.0	Sample/SI
*STN-54A	733,417.30	1,510,371.66	395.0	PZ
STN-55	733,614.54	1,510,849.80	379.5	Sample
STN-56	733,560.12	1,510,902.86	395.0	Sample
*STN-56A	733,560.12	1,510,898.86	395.0	Sample
STN-57	733,365.74	1,511,360.12	381.5	Sample
*STN-57A	733,368.89	1,511,362.59	381.5	PZ
*STN-57B	733,362.59	1,511,357.65	381.5	Sample
STN-58	733,305.89	1,511,314.36	395.0	Sample/SI
*STN-58A	733,308.70	1,511,311.51	394.8	PZ
STN-59	732,780.76	1,511,517.22	383.0	Sample
*STN-59A	732,784.76	1,511,517.22	383.0	Sample
STN-60	732,776.76	1,511,517.22	383.0	Sample
STN-61	732,791.74	1,511,426.11	395.1	Sample
STN-62	732,271.84	1,511,477.99	387.2	Sample
*STN-62A	732,274.04	1,511,365.06	394.8	Sample

*Estimated based on offsets from original borings.
"PZ" denotes Piezometer
"SI" denotes Slope Inclinometer



BORING LAYOUT
SCALE: 1"=100'

GRAPHIC SCALE: 1" = 100'
CONTOUR INTERVAL = 1'

LEGEND

- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests
- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests and Rock Core

NOTE:

The topographic mapping provided is based on horizontal datum NAD27 and vertical datum NGV29 using State Plane Tennessee coordinate system. The site photography was performed on 4/17/2009.

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R -	-	-	-	-	-	-	-	-	-	-	-
R 0	03/29/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	-	-	-

RECORD DRAWING

SCALE: 1"=100' EXCEPT AS NOTED

YARD
RETENTION AND STILLING PONDS

GEOTECHNICAL EXPLORATION
BORING LAYOUT

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

STAN A. HARRIS
REGISTERED ENGINEER
AGRICULTURE COMMERCE
No. 00113308
STATE OF TENNESSEE
3/25/11

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
Tel. 513.842.8200
Fax 513.842.8250
www.stantec.com

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

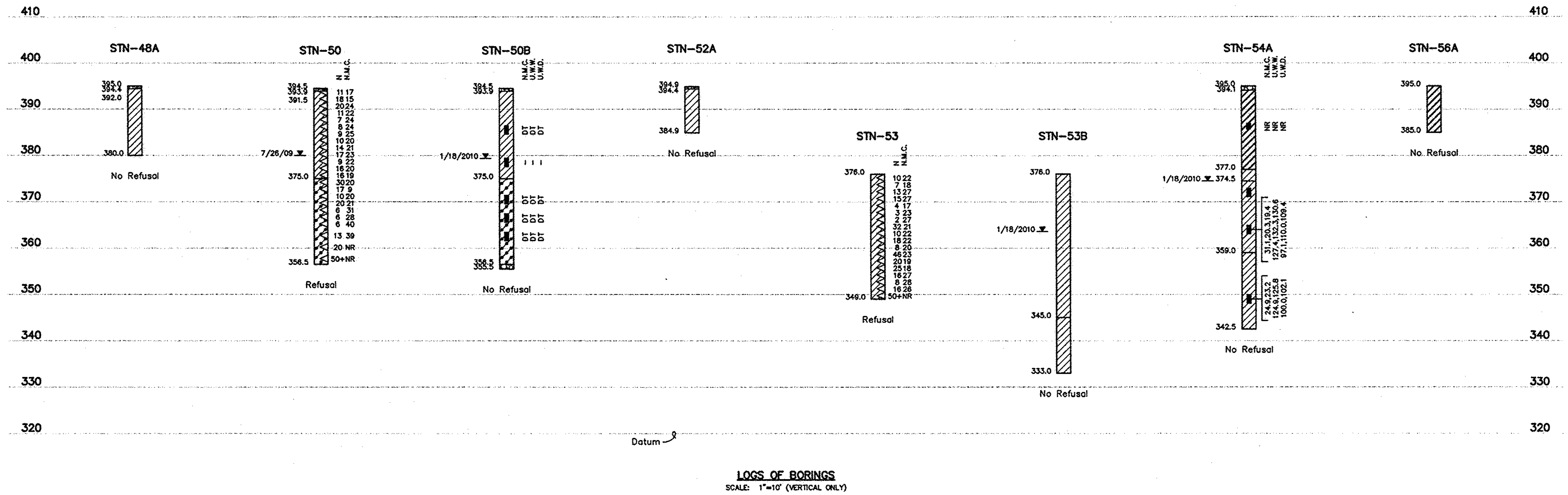
AUTOCAD R 2000 | DATE 03/29/10 | 46 | C | 10W544-01 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

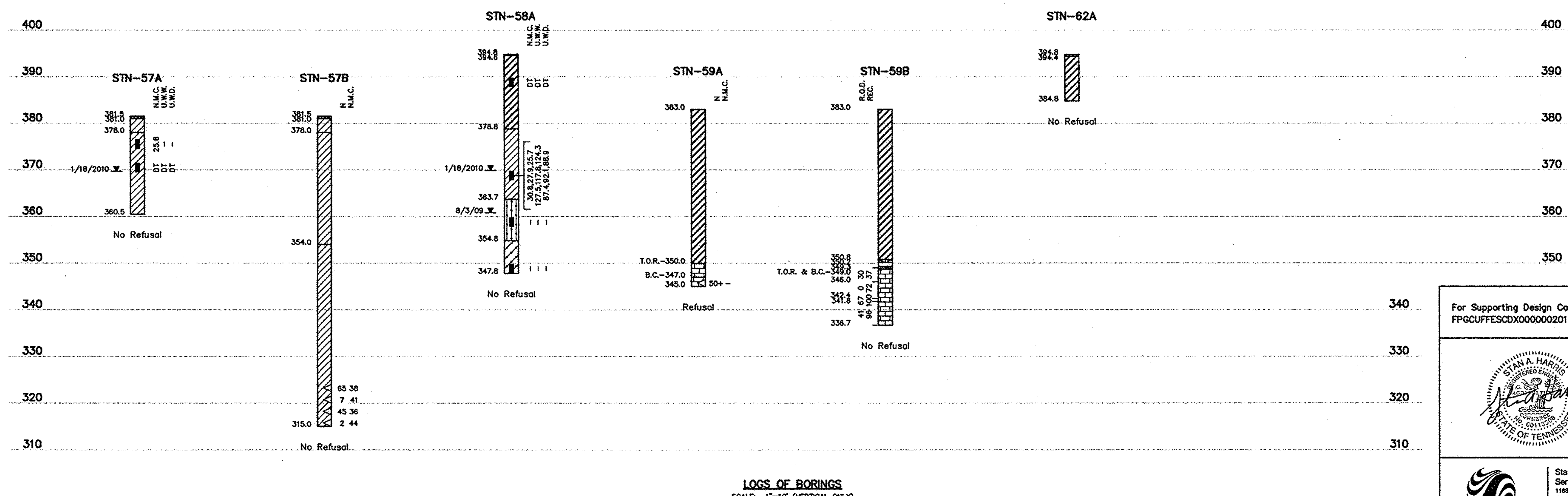
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

NOT TO SCALE



LOGS OF BORINGS
SCALE: 1"=10' (VERTICAL ONLY)



LOGS OF BORINGS
SCALE: 1"=10' (VERTICAL ONLY)

LEGEND

- Fly Ash, gray to dark gray, damp to wet, soft.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, little to some sand, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, dark gray-brown to gray-brown, some gravel, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, dark gray to olive-brown, damp to wet, loose to medium dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
DT	Damaged Tube, No Specimen
NR	Little to No Recovery
03/31/09	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R–	–	–	–	–	–	–	–	–	–	–
R 0	03/29/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–
RECORD DRAWING										

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
RETENTION AND STILLING PONDS

GEOTECHNICAL EXPLORATION
LOGS OF BORINGS
NOT ON CROSS SECTIONS

STAN A. HARRIS
REGISTERED ENGINEER
No. 00113508
STATE OF TENNESSEE
3/25/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

Stantec
Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
Tel. 513.842.8200
Fax 513.842.8250
www.stantec.com

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/29/10 | 46 | C | 10W544–02 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

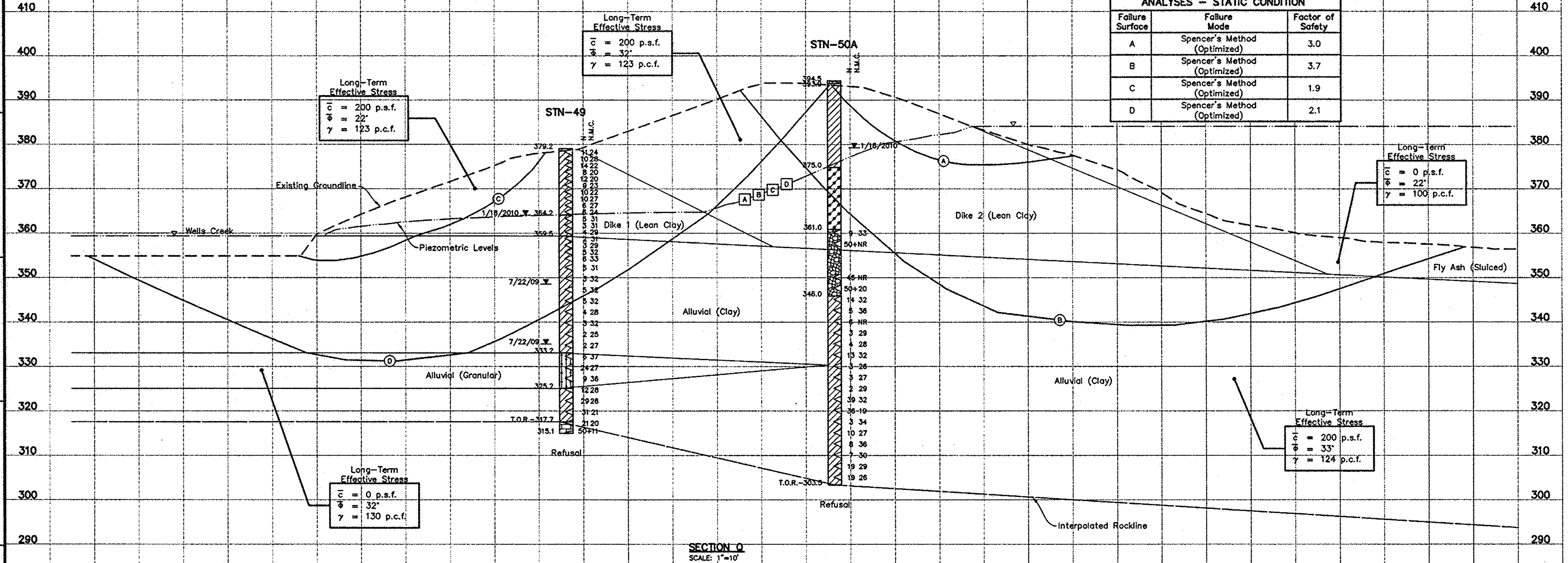
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

NOT TO SCALE

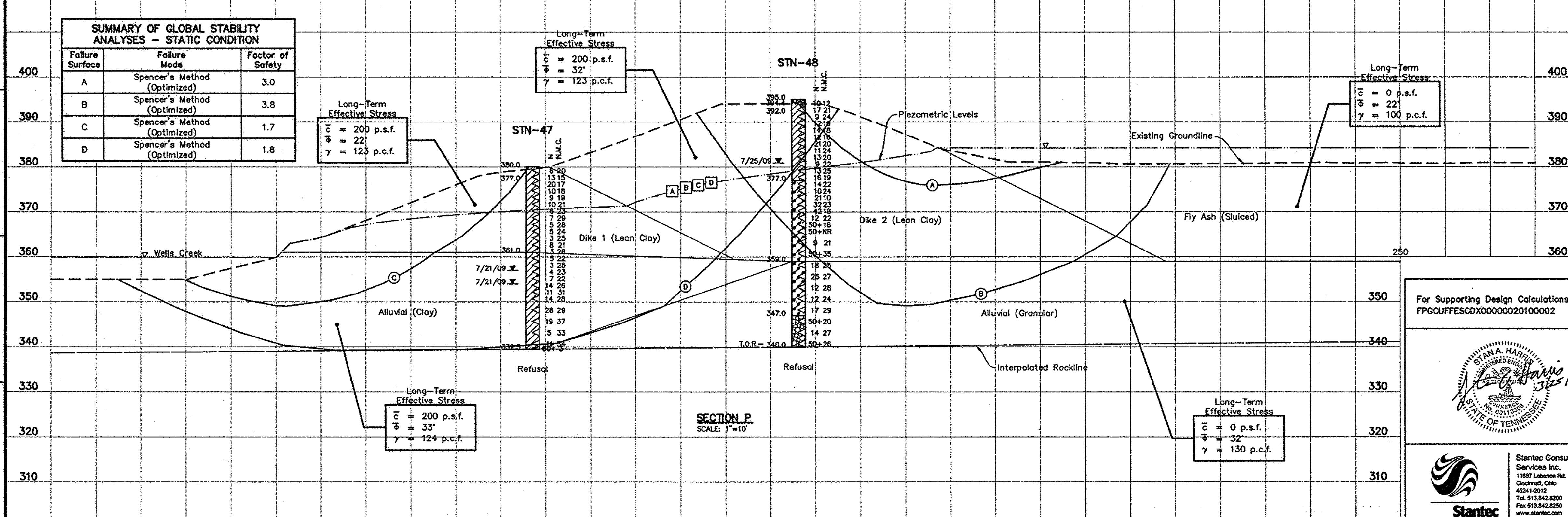
SUMMARY OF GLOBAL STABILITY ANALYSES – STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	3.0
B	Spencer's Method (Optimized)	3.7
C	Spencer's Method (Optimized)	1.9
D	Spencer's Method (Optimized)	2.1



SUMMARY OF GLOBAL STABILITY ANALYSES – STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	3.0
B	Spencer's Method (Optimized)	3.8
C	Spencer's Method (Optimized)	1.7
D	Spencer's Method (Optimized)	1.8



LEGEND

- Fly Ash, gray to dark gray, damp to wet, soft.
- Lean Clay, light brown, red–brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, little to some sand, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, dark gray–brown to gray–brown, some gravel, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, dark gray to olive–brown, damp to wet, loose to medium dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
DT	Damaged Tube, No Specimen
NR	Little to No Recovery
03/31/09 ▼	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock–like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide–tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CO
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	03/29/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
RETENTION AND STILLING PONDS

GEOTECHNICAL EXPLORATION RETENTION POND STABILITY SECTION P & Q – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE
3/25/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

Stantec
Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
Tel. 513.842.8200
Fax 513.842.8250
www.stantec.com

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

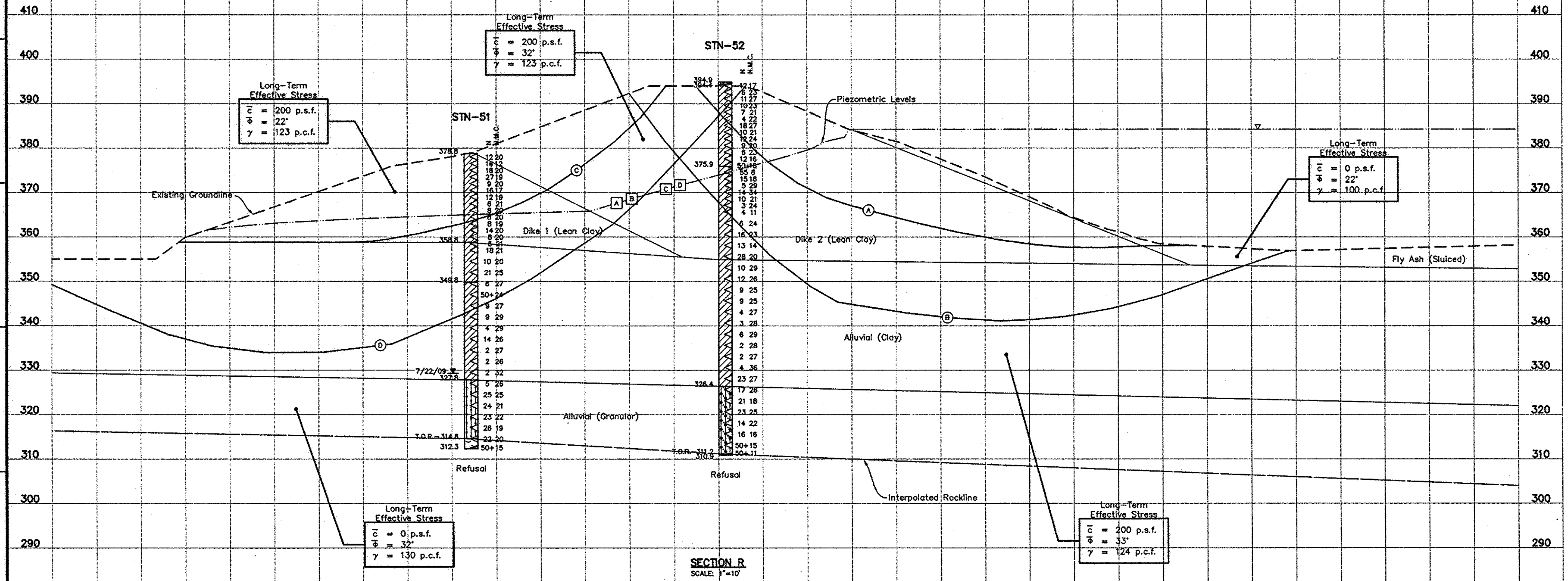
AUTOCAD R 2000 | DATE 03/29/10 | 46 | C | 10W544–03 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

NOT TO SCALE



SECTION R
SCALE: 1"=10'

LEGEND

- Fly Ash, gray to dark gray, damp to wet, soft.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, little to some sand, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, dark gray-brown to gray-brown, some gravel, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, dark gray to olive-brown, damp to wet, loose to medium dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
DT	Damaged Tube, No Specimen
NR	Little to No Recovery
03/31/09 ▼	Water Level and Date Recorded
T.O.R.-	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.-	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered

SUMMARY OF GLOBAL STABILITY ANALYSES – STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	3.0
B	Spencer's Method (Optimized)	3.5
C	Spencer's Method (Optimized)	2.1
D	Spencer's Method (Optimized)	2.3

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	03/29/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–

RECORD DRAWING

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
RETENTION AND STILLING PONDS

GEOTECHNICAL EXPLORATION
RETENTION POND STABILITY
SECTION R – EX. CONDITIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

STAN A. HARRIS REGISTERED ENGINEER No. 00113308 STATE OF TENNESSEE 3/25/10

Stantec
Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
Tel. 513.842.8200
Fax 513.842.8250
www.stantec.com

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/29/10 | 46 | C | 10W544-04 | R 0

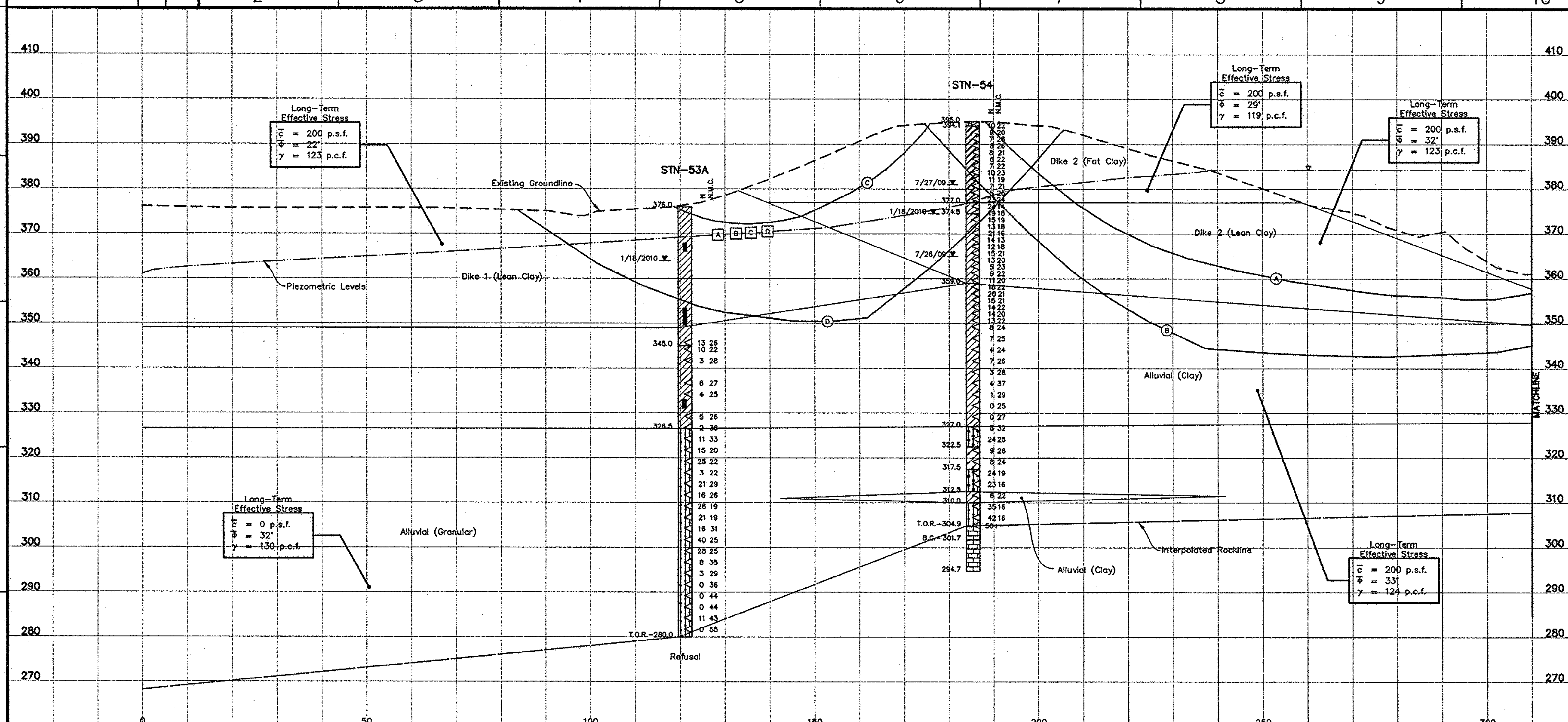
STANTEC | 0
TASK COMPLETED BY: | REV NO.

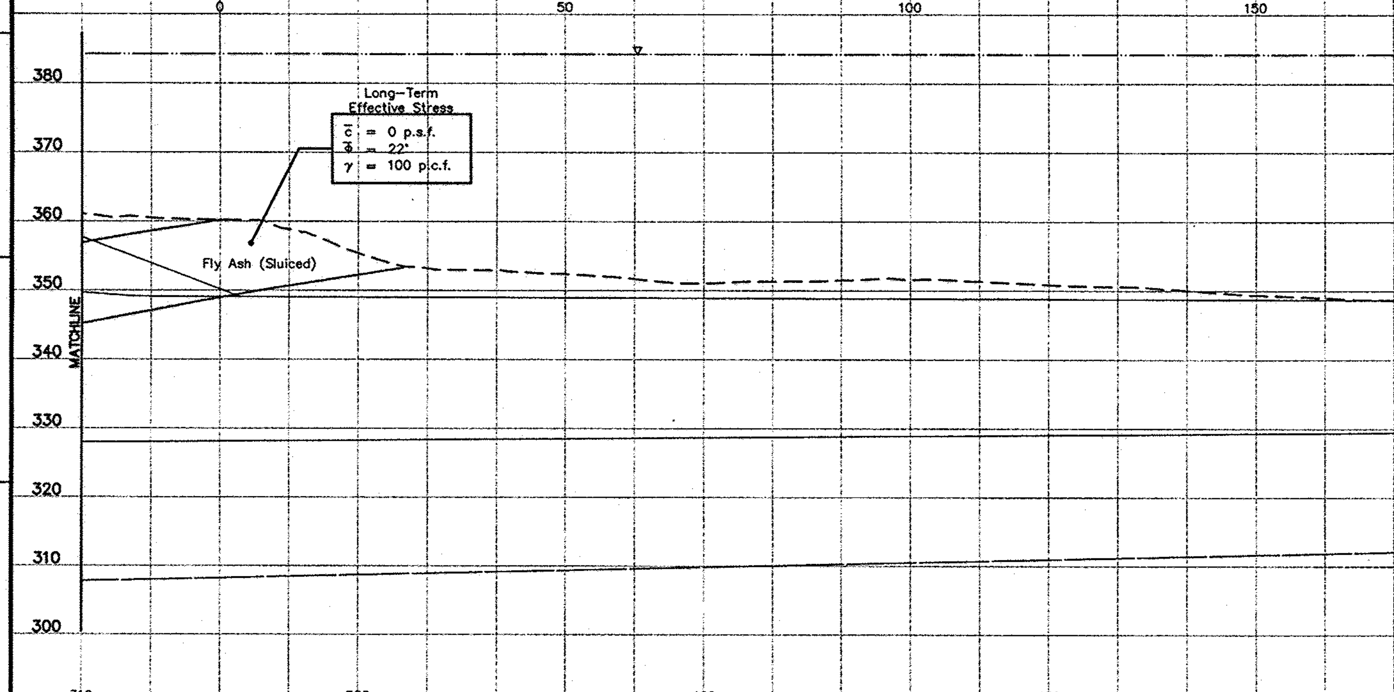
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

46 C 10W544-04

NOT TO SCALE





SUMMARY OF GLOBAL STABILITY ANALYSES – STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	3.2
B	Spencer's Method (Optimized)	3.6
C	Spencer's Method (Optimized)	2.5
D	Spencer's Method (Optimized)	3.4

LEGEND

- Fly Ash, gray to dark gray, damp to wet, soft.
- Lean Clay, light brown, red–brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, little to some sand, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, dark gray–brown to gray–brown, some gravel, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, dark gray to olive–brown, damp to wet, loose to medium dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
DT	Damaged Tube, No Specimen
NR	Little to No Recovery
03/31/09 ▼	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock–like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide–tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	03/29/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–
RECORD DRAWING										

SCALE: AS SHOWN EXCEPT AS NOTED

STAN A. HARRIS, REGISTERED ENGINEER, No. 00113308, STATE OF TENNESSEE 3/25/10

YARD
RETENTION AND STILLING PONDS

GEOTECHNICAL EXPLORATION
STILLING POND STABILITY
SECTION S – EX. CONDITIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
Tel. 513.842.8200
Fax 513.842.8250
www.stantec.com

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

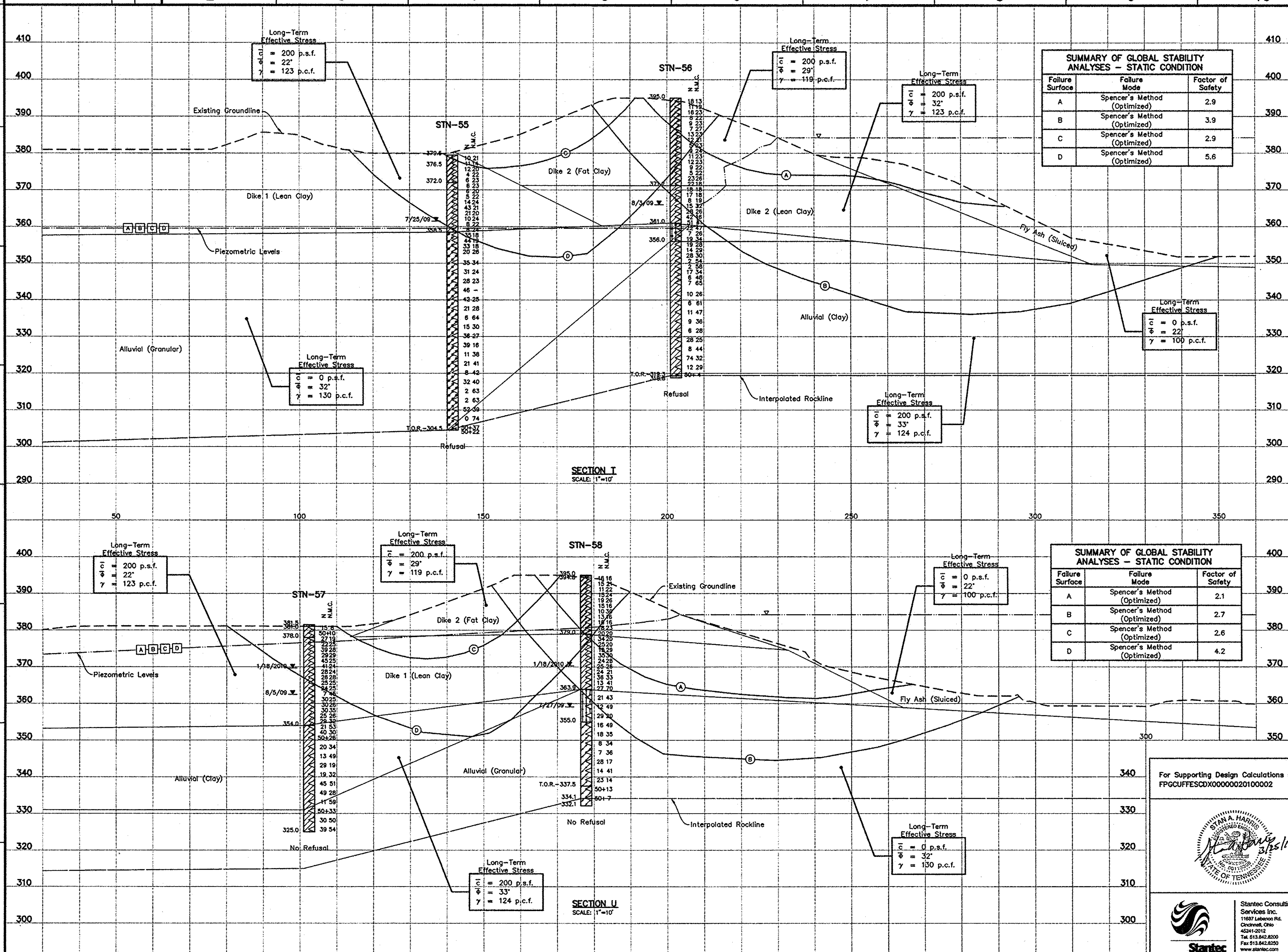
AUTOCAD R 2000 | DATE 03/29/10 | 46 | C | 10W544–05 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

NOT TO SCALE



SUMMARY OF GLOBAL STABILITY ANALYSES – STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	2.9
B	Spencer's Method (Optimized)	3.9
C	Spencer's Method (Optimized)	2.9
D	Spencer's Method (Optimized)	5.6

SUMMARY OF GLOBAL STABILITY ANALYSES – STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	2.1
B	Spencer's Method (Optimized)	2.7
C	Spencer's Method (Optimized)	2.6
D	Spencer's Method (Optimized)	4.2

LEGEND

- Fly Ash, gray to dark gray, damp to wet, soft.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, little to some sand, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, dark gray-brown to gray-brown, some gravel, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, dark gray to olive-brown, damp to wet, loose to medium dense.
- Shale, gray to dark gray, soft, highly to completely weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C. — Natural Moisture Content (%)
DT — Damaged Tube, No Specimen
NR — Little to No Recovery
03/31/09 — Water Level and Date Recorded
T.O.R. — Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C. — Begin Rock Core
R.Q.D. — Rock Quality Designation (%)
REC. — Recovery (%)
Refusal — Auger Refusal using a carbide-tipped tooth auger bit
No Refusal — No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100002

R 0 03/29/10 DBR CW DBR SAH SAH SAH TJ
RECORD DRAWING

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
RETENTION AND STILLING PONDS
GEOTECHNICAL EXPLORATION
STILLING POND STABILITY
SECTION T & U – EX. CONDITIONS

DESIGNED BY: D. ROGERS | DRAWN BY: C. WITHERS | CHECKED BY: D. ROGERS | SUPERVISED BY: S. HARRIS | REVIEWED BY: S. HARRIS | APPROVED BY: S. HARRIS | ISSUED BY: T. JOHNSON

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
Tel. 513.842.8200
Fax 513.842.8250
www.stantec.com

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

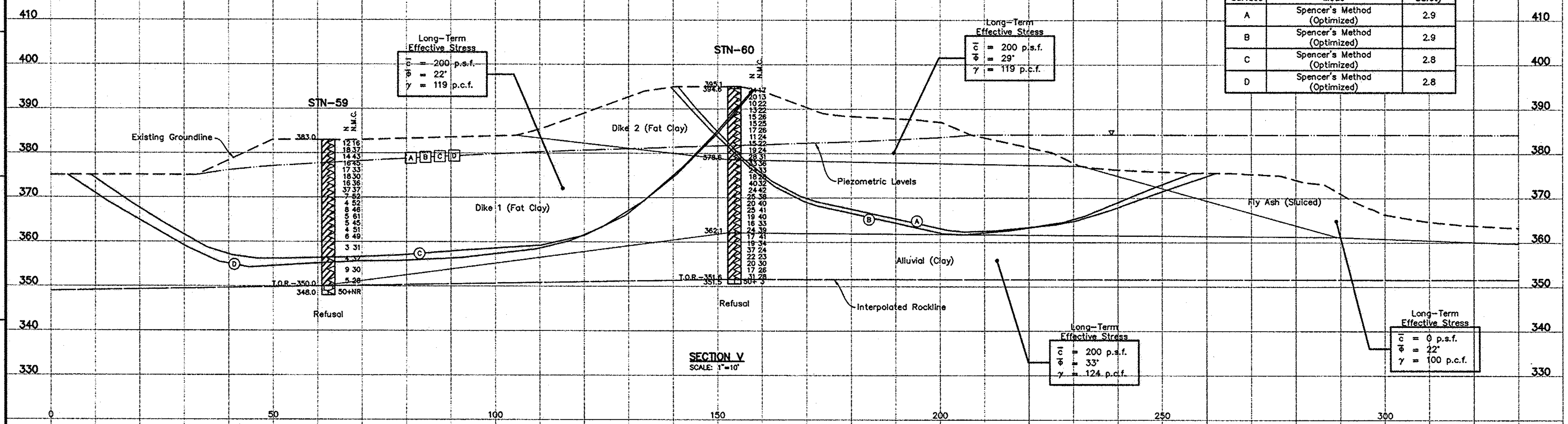
AUTOCAD R 2000 | 03/29/10 | 46 | C | 10W544-06 | R 0

STANTEC 0
TASK COMPLETED BY: REV NO.

PLOT FACTOR:XX
W_TVA
C.A.D. DRAWING
DO NOT ALTER MANUALLY

NOT TO SCALE

SUMMARY OF GLOBAL STABILITY ANALYSES – STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	2.9
B	Spencer's Method (Optimized)	2.9
C	Spencer's Method (Optimized)	2.8
D	Spencer's Method (Optimized)	2.8

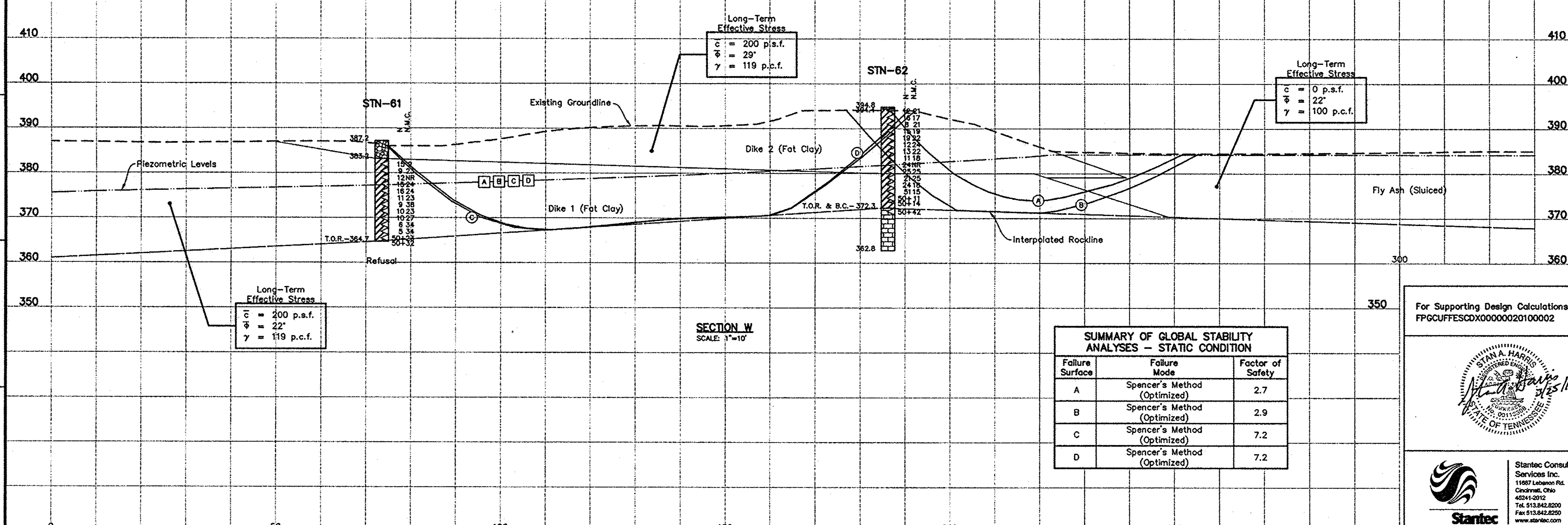


SECTION V
SCALE: 1"=10'

LEGEND

- Fly Ash, gray to dark gray, damp to wet, soft.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, little to some sand, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, dark gray-brown to gray-brown, some gravel, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, dark gray to olive-brown, damp to wet, loose to medium dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
DT	Damaged Tube, No Specimen
NR	Little to No Recovery
03/31/09 ▼	Water Level and Date Recorded
T.O.R.–	Top of Rock (indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered



SECTION W
SCALE: 1"=10'

SUMMARY OF GLOBAL STABILITY ANALYSES – STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	2.7
B	Spencer's Method (Optimized)	2.9
C	Spencer's Method (Optimized)	7.2
D	Spencer's Method (Optimized)	7.2

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R –	–	–	–	–	–	–	–	–	–	–
R 0	03/29/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–

RECORD DRAWING

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
RETENTION AND STILLING PONDS

GEOTECHNICAL EXPLORATION
STILLING POND STABILITY
SECTION V & W – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER No. 00112308 STATE OF TENNESSEE 3/25/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
Tel. 513.842.8200
Fax 513.842.8250
www.stantec.com

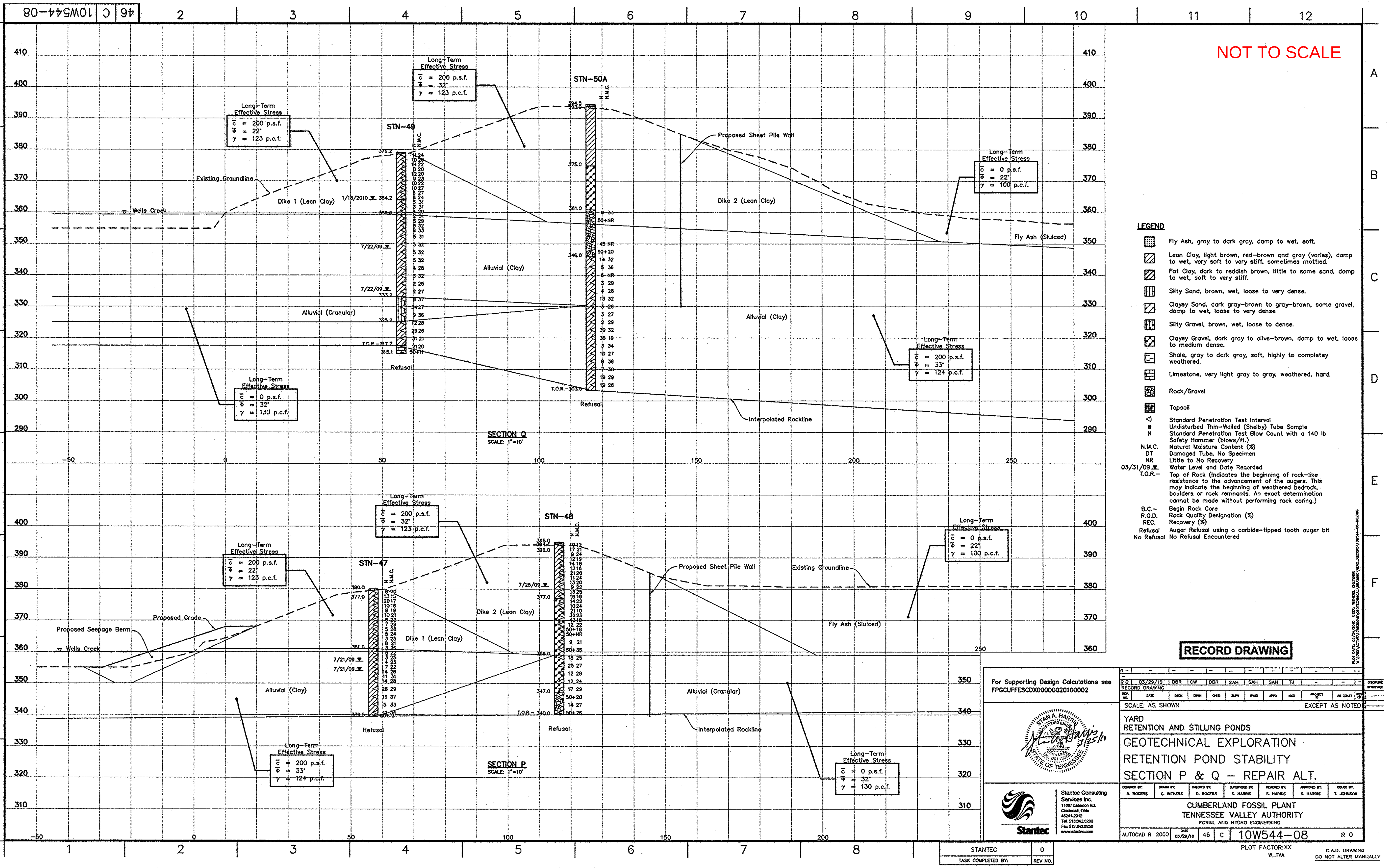
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/29/10 | 46 | C | 10W544–07 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



NOT TO SCALE
STN-50A
STN-49
STN-48
STN-47
Long-Term Effective Stress
Existing Groundline
Wells Creek
Dike 1 (Lean Clay)
Dike 2 (Lean Clay)
Alluvial (Clay)
Alluvial (Granular)
Fly Ash (Sluiced)
Proposed Sheet Pile Wall
Interpolated Rockline
Refusal
Proposed Grade
Proposed Seepage Berm
SECTION Q
SCALE: 1"=10'
SECTION P
SCALE: 1"=10'
LEGEND
Fly Ash, gray to dark gray, damp to wet, soft.
Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
Fat Clay, dark to reddish brown, little to some sand, damp to wet, soft to very stiff.
Silty Sand, brown, wet, loose to very dense.
Clayey Sand, dark gray-brown to gray-brown, some gravel, damp to wet, loose to very dense
Silty Gravel, brown, wet, loose to dense.
Clayey Gravel, dark gray to olive-brown, damp to wet, loose to medium dense.
Shale, gray to dark gray, soft, highly to completey weathered.
Limestone, very light gray to gray, weathered, hard.
Rock/Gravel
Topsoil
Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
DT Damaged Tube, No Specimen
NR Little to No Recovery
03/31/09 Water Level and Date Recorded
T.O.R.– Top of Rock (indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.– Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal Auger Refusal using a carbide-tipped tooth auger bit
No Refusal No Refusal Encountered
RECORD DRAWING
For Supporting Design Calculations see FPGCUFFESCDX00000020100002
SCALE: AS SHOWN EXCEPT AS NOTED
YARD
RETENTION AND STILLING PONDS
GEOTECHNICAL EXPLORATION
RETENTION POND STABILITY
SECTION P & Q – REPAIR ALT.
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING
Stantec Consulting Services Inc.
AUTOCAD R 2000
03/29/10
46 C 10W544-08 R 0
PLOT FACTOR:XX
C.A.D. DRAWING DO NOT ALTER MANUALLY

Appendix C

Boring Logs

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-47** Total Depth 40.5 ft
County	Stewart, TN	Surface Elevation	380.0 ft
Project Type	HSA 4.25	Date Started	7/21/09 Completed 7/21/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	26.0 ft Date/Time 7/21/09
Logged By	Anthony Aloti	Depth to Water	23.0 ft Date/Time 7/21/09

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
380.0	0.0	Top of Hole							
		Lean Clay, with a trace gravel, gray to brown & red, moist, fill (CL)		SPT-1	0.0 - 1.5	1.5	3-3-3	20	
				SPT-2	1.5 - 3.0	1.5	6-6-7	15	
				SPT-3	3.0 - 4.5	1.3	8-9-11	17	
				SPT-4	4.5 - 6.0	0.3	4-5-5	18	
				SPT-5	6.0 - 7.5	1.3	1-3-6	19	
				SPT-6	7.5 - 9.0	1.3	4-5-5	21	
				SPT-7	9.0 - 10.5	1.5	2-3-3	23	
				SPT-8	10.5 - 12.0	1.3	2-3-4	29	
				SPT-9	12.0 - 13.5	1.3	2-2-3	28	
				SPT-10	13.5 - 15.0	1.3	1-1-4	24	
				SPT-11	15.0 - 16.5	1.2	1-1-2	25	
				SPT-12	16.5 - 18.0	1.3	1-3-5	21	
361.0	19.0			SPT-13	18.0 - 19.5	1.3	2-1-2	26	Organic clay (19' - 22')
		Lean Clay, with a trace gravel, gray & brown, moist to wet (CL)		SPT-14	19.5 - 21.0	1.2	1-1-4	22	
				SPT-15	21.0 - 22.5	1.3	2-2-1	25	
				SPT-16	22.5 - 24.0	0.9	1-2-2	23	
				SPT-17	24.0 - 25.5	1.3	3-2-5	22	
				SPT-18	25.5 - 27.0	1.5	7-7-7	26	
				SPT-19	27.0 - 28.5	1.5	2-4-7	31	
				SPT-20	28.5 - 30.0	0.3	4-6-8	28	
				SPT-21	31.0 - 32.5	1.3	6-17-11	29	
				SPT-22	33.5 - 35.0	1.5	9-11-8	37	

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-47**
		Total Depth	40.5 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		Lean Clay, with a trace gravel, gray & brown, moist to wet (CL) *(Continued)*		SPT-23	36.0 - 37.5	1.5	2-3-2	33	Cobbles
				SPT-24	38.5 - 40.0	0.7	1-6-5	34	
339.5	40.5			SPT-25	40.4 - 40.5	0.1	50+/0.1	3	
		Auger Refusal / Bottom of Hole Top of Rock = 40.5 Elevation (339.5)							

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-48** Total Depth 55.0 ft
County	Stewart, TN	Surface Elevation	395.0 ft
Project Type	HSA 4.25	Date Started	7/25/09 Completed 7/25/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	14.1 ft Date/Time 7/25/09
Logged By	D. Chapman	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
395.0	0.0	Top of Hole							
394.4	0.6	Crushed stone (road bed)		SPT-1	0.0 - 1.5	1.0	13-5-5	12	
		Sandy Lean Clay, red brown, trace sand to fine gravel, moist, stiff to very stiff (CL/CH)		SPT-2	1.5 - 3.0	1.0	12-8-9	21	
				SPT-3	3.0 - 4.5	0.7	6-5-4	24	
				SPT-4	4.5 - 6.0	0.8	4-5-7	19	
				SPT-5	6.0 - 7.5	0.7	2-6-8	18	Organic matter at top of spoon Pushed a rock with spoon
				SPT-6	7.5 - 9.0	0.1	5-6-6	16	
				SPT-7	9.0 - 10.5	1.1	6-7-12	20	
				SPT-8	10.5 - 12.0	1.5	3-5-6	24	
				SPT-9	12.0 - 13.5	1.3	3-6-7	20	Spoon contains organic matter
				SPT-10	13.5 - 15.0	1.2	4-4-5	22	
				SPT-11	15.0 - 16.5	1.5	3-4-9	25	Mottles
377.0	18.0			SPT-12	16.5 - 18.0	0.7	5-8-8	19	No organic matter, some fine gravel
		Clayey Gravel With Sand, some silt, red brown to olive yellow, wet, loose to dense (GC)		SPT-13	18.0 - 19.5	0.1	3-6-8	22	Grinding through cobbles.
				SPT-14	19.5 - 21.0	0.6	1-5-5	24	Alternately rough and smooth drilling below 18'
				SPT-15	21.0 - 22.5	0.4	12-13-8	10	
				SPT-16	22.5 - 24.0	0.5	6-17-15	23	
				SPT-17	24.0 - 25.5	0.7	21-28-14	18	
				SPT-18	25.5 - 27.0	0.3	4-5-7	22	Grinding on cobbles
				SPT-19	27.0 - 27.9	0.4	7-50+/0.4	18	
				SPT-20	28.5 - 28.8	0.0	50+/0.3	--	
				SPT-21	31.0 - 32.5	0.3	3-6-3	21	
				SPT-22	33.5 - 33.7	0.3	50+/0.2	35	
359.0	36.0								

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-48**
		Total Depth	55.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Sand With Gravel, some silt and clay to silty clay, red brown to olive gray, moiist to wet, medium dense (GC) *(Continued)*		SPT-23	36.0 - 37.5	1.0	5-8-10	25	
				SPT-24	38.5 - 40.0	1.5	1-12-13	27	Mottles
				SPT-25	41.0 - 42.5	1.5	5-6-6	28	
				SPT-26	43.5 - 45.0	1.5	4-5-7	24	
347.0	48.0			SPT-27	46.0 - 47.5	1.5	5-8-9	29	
		Cobbles with sand and gravel		SPT-28	48.5 - 49.9	0.4	8-11-50+/0.4	20	Grinding on cobbles
				SPT-29	51.0 - 52.5	1.0	5-7-7	27	2" diameter spoon/140# autohammer
340.0	55.0			SPT-30	53.5 - 54.8	1.4	8-11-50+/0.3	26	Crushed rock in tip of spoon
		Auger Refusal / Bottom of Hole Top of Rock = 54.8 Elevation (340.2)							Backfill Full depth with Cement -Bentonite Grout

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-48 A** Total Depth 15.0 ft
County	Stewart, TN	Surface Elevation	395.0 ft
Project Type	HSA 4.25	Date Started	8/7/09 Completed 8/7/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	Dry Date/Time 8/7/09
Logged By	Z. Massey	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.0	0.0	Top of Hole							
394.4	0.6	Crushed stone (road bed)							
		Sandy Lean Clay, red brown, trace sand to fine gravel, moist, stiff to very stiff (CL/CH)		BAG-1	5.0 - 15.0			--	
380.0	15.0								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-49** Total Depth 64.1 ft
County	Stewart, TN	Surface Elevation	379.2 ft
Project Type	HSA 4.25	Date Started	7/21/09 Completed 7/22/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	44.0 ft Date/Time 7/22/09
Logged By	Anthony Aloti	Depth to Water	30.5 ft Date/Time 7/22/09

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
379.2	0.0	Top of Hole						
		Lean Clay, red brown to brown, trace sand and gravel, moist, stiff to medium stiff (CL)	SPT-1	0.0 - 1.5	0.9	5-5-6	24	
			SPT-2	1.5 - 3.0	0.9	4-5-5	28	PZ installed, Screen 47-57
			SPT-3	3.0 - 4.5	1.0	5-7-7	22	
			SPT-4	4.5 - 6.0	0.7	5-4-4	20	
			SPT-5	6.0 - 7.5	0.3	3-6-6	20	
			SPT-6	7.5 - 9.0	1.4	3-4-5	23	
			SPT-7	9.0 - 10.5	1.3	3-5-5	22	
			SPT-8	10.5 - 12.0	1.2	3-5-5	27	gravel block shoe
			SPT-9	12.0 - 13.5	1.0	2-3-3	27	
364.2	15.0		SPT-10	13.5 - 15.0	1.2	2-3-3	24	
		Lean Clay, gray, trace sand, moist, medium stiff to soft (CL)	SPT-11	15.0 - 16.5	1.5	2-2-3	31	
			SPT-12	16.5 - 18.0	1.5	1-1-2	31	
359.5	19.7		SPT-13	18.0 - 19.5	0.9	1-2-2	29	
		Lean Clay, gray with brown mottles, trace sand and gravel, moist, soft, with cobble zones (CL)	SPT-14	19.5 - 21.0	1.1	2-1-1	31	Organic rich zone 20.0-21.2
			SPT-15	21.0 - 22.5	0.9	1-1-2	29	
			SPT-16	22.5 - 24.0	0.9	1-2-3	32	cobble zone 23.2-25.0
			SPT-17	24.0 - 25.5	0.7	2-2-4	33	
			SPT-18	26.0 - 27.5	1.5	2-2-3	31	
			SPT-19	28.5 - 30.0	1.5	1-2-1	32	
			SPT-20	31.0 - 32.5	1.5	2-2-3	32	
			SPT-21	33.5 - 35.0	1.5	2-2-3	32	

SUBSURFACE LOG

Stantec

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-49** Total Depth 64.1 ft

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Lean Clay, gray with brown mottles, trace sand and gravel, moist, soft, with cobble zones (CL) *(Continued)*		SPT-22	36.0 - 37.5	1.5	2-2-2	28	
				SPT-23	38.5 - 40.0	1.5	2-1-2	32	
				SPT-24	41.0 - 42.5	1.5	1-1-1	25	
333.2	46.0			SPT-25	43.5 - 45.0	0.9	0-1-1	27	water encountered, rise to 30.5
		Silty Sand, grayish brown, wet, loose to medium dense, medium to fine grained (SM)		SPT-26	46.0 - 47.5	1.3	2-2-4	37	
				SPT-27	48.5 - 50.0	0.9	7-11-13	27	
325.2	54.0			SPT-28	51.0 - 52.5	0.7	5-4-5	36	
		Lean Clay, gray, wet, little sand and gravel, very stiff, some weathered rock fragments (CL)		SPT-29	53.5 - 55.0	1.5	5-7-5	28	
				SPT-30	56.0 - 57.5	1.5	5-8-21	26	
317.7	61.5			SPT-31	58.5 - 60.0	1.3	8-11-19	21	some weathered rock fragments
		Weathered limestone		SPT-32	61.0 - 62.5	1.0	12-13-8	20	
315.1	64.1			SPT-33	63.5 - 64.1	0.3	42-50+/0.1	11	

Auger Refusal / Bottom of Hole

Top of Rock = 61.5 Elevation (317.7)

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-50** Total Depth 38.0 ft
County	Stewart, TN	Surface Elevation	394.5 ft
Project Type	HSA 4.25	Date Started	7/26/09 Completed 7/26/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	14.5 ft Date/Time 7/26/09
Logged By	D. Chapman	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.5	0.0	Top of Hole							
393.9	0.6	Crushed stone (road bed)		SPT-1	0.0 - 1.5	1.0	3-5-6	17	
		Sandy Lean Clay, trace small gravel, red brown, moist, medium stiff to very stiff (CL)		SPT-2	1.5 - 3.0	0.8	8-7-11	15	
				SPT-3	3.0 - 4.5	1.5	8-5-15	24	
				SPT-4	4.5 - 6.0	1.3	5-7-4	22	
				SPT-5	6.0 - 7.5	1.0	2-3-4	24	
				SPT-6	7.5 - 9.0	0.5	3-3-5	24	
				SPT-7	9.0 - 10.5	1.5	2-5-4	25	
				SPT-8	10.5 - 12.0	1.6	5-4-6	20	
				SPT-9	12.0 - 13.5	1.0	5-6-8	21	
				SPT-10	13.5 - 15.0	0.9	2-8-9	23	
				SPT-11	15.0 - 16.5	0.8	2-3-6	22	
				SPT-12	16.5 - 18.0	0.3	5-6-10	20	Rock in tip of spoon
375.0	19.5			SPT-13	18.0 - 19.5	0.7	3-7-9	19	Rocks in top of spoon
		Clayey Gravel With Sand, very dark gray to olive brown, wet, loose to medium dense (GC)		SPT-14	19.5 - 21.0	0.0	4-9-21	20	Very dark gray
				SPT-15	21.0 - 22.5	0.7	12-9-8	9	
				SPT-16	22.5 - 24.0	0.3	3-5-5	20	
				SPT-17	24.0 - 25.5	0.5	6-12-8	21	
				SPT-18	25.5 - 27.0	0.7	3-3-3	31	Silty clay layer 26.5 - 28.5
				SPT-19	27.0 - 28.5	0.8	2-3-3	28	Olive brown
				SPT-20	28.5 - 30.0	0.3	2-2-4	40	
				SPT-21	31.0 - 32.5	0.9	1-1-12	39	Silty clay layer 31 - 33.5
				SPT-22	33.5 - 35.0	0.0	5-8-12	--	Began grinding on cobbles

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-50** Total Depth 38.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
356.5	38.0			SPT-23	36.0 - 37.3	0.0	2-3-50+/0.3	--	
		Auger Refusal / Bottom of Hole							Auger refusal and bottom of boring. No piezometer installed. Grouted to ground surface.

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-50 A** Total Depth 91.0 ft
County	Stewart, TN	Surface Elevation	394.5 ft
Project Type	HSA 4.25	Date Started	7/27/09 Completed 7/27/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	Dry Date/Time 7/27/09
Logged By	D. Chapman	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.5	0.0	Top of Hole							
		Augered (Refer to STN-50)							Augered 0 - 33.5. For soil description, see log for B-50.
361.0	33.5								
		Cobbles and boulders interbedded with silty clay		SPT-1	33.5 - 35.0	0.7	3-3-3	33	
				SPT-2	36.0 - 36.0	0.0	50+/0	--	Drilling through

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	B-50 A
		Total Depth	91.0 ft

Lithology Elevation	Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Cobbles and boulders interbedded with silty clay *(Continued)*						cobbles Auger refusal at 37'. Drilled with 4 1/8" rotary bit 0 - 42'. Drilled with 4 1/4 inside diameter augers 42 - 43.5.
			SPT-3	43.5 - 45.0	0.2	15-21-24	--	3" outside diameter spoon. Rock in tip.
			SPT-4	46.0 - 47.3	0.4	14-34-50+/0.3	20	Sand and gravel layer with some silt and clay 46 - 48.5
346.0	48.5	Lean Clay, red brown to very dark gray, moist to wet, soft to very stiff (CL)	SPT-5	48.5 - 50.0	0.9	3-7-7	32	Strong brown
			SPT-6	51.0 - 52.5	1.1	6-2-3	36	Dark reddish brown
			SPT-7	54.0 - 55.5	0.0	2-3-3	--	
			SPT-8	56.0 - 57.5	0.5	2-2-1	29	Olive
			SPT-9	58.5 - 60.0	1.5	1-2-2	28	Dark olive
			SPT-10	61.0 - 62.5	1.3	3-5-8	32	Layer of sand with little fine gravel 62 - 63
			SPT-11	63.5 - 65.0	1.5	1-1-2	26	
			SPT-12	66.0 - 67.5	1.1	1-1-2	27	Very dark gray
			SPT-13	68.5 - 70.0	1.3	1-1-1	29	
			SPT-14	71.0 - 72.5	1.2	16-21-18	32	Layer of sand with little fine gravel 72 - 73
			SPT-15	73.5 - 75.0	0.8	9-16-20	19	
			SPT-16	76.0 - 77.5	0.8	2-1-3	34	

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-50 A** Total Depth 91.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay, red brown to very dark gray, moist to wet, soft to very stiff (CL) *(Continued)*		SPT-17	78.5 - 80.0	1.3	2-4-6	27	
				SPT-18	81.0 - 82.5	1.4	1-3-5	36	
				SPT-19	83.5 - 85.0	1.5	1-1-6	30	
				SPT-20	86.0 - 87.5	1.2	6-7-12	29	
				SPT-21	88.5 - 90.0	1.0	3-4-15	26	Sample contains some fine sand
303.5	91.0								
		Auger Refusal / Bottom of Hole Top of Rock = 91.0 Elevation (303.5)							Bottom of boring at auger refusal. Installed a Slope Inclinometer to 85'.

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-50 B**	Total Depth	39.0 ft
County	Stewart, TN	Surface Elevation	394.5 ft		
Project Type	HSA 4.25	Date Started	7/28/09	Completed	7/28/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	Dry	Date/Time	7/28/09
Logged By	D. Chapman	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.5	0.0	Top of Hole							
393.9	0.6	Crushed stone (road bed)							
		Sandy Lean Clay, trace small gravel, red brown, moist, medium stiff to very stiff (CL)							
				ST-1	8.0 - 10.0	0.0		--	Tube Crushed
				ST-2	15.0 - 17.0	1.5		--	
375.0	19.5								
		Clayey Gravel With Sand, very dark gray to olive brown, wet, loose to medium dense (GC)							
				ST-3	23.0 - 25.0	0.0		--	Tube Crushed
				ST-4	27.0 - 29.0	0.0		--	Tube Crushed
				ST-5	31.0 - 33.0	0.0		--	Tube Crushed

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-50 B**	Total Depth	39.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
356.5	38.0								
355.5	39.0	Cobbles (Augered)							
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-51**	Total Depth	66.5 ft
County	Stewart, TN	Surface Elevation	378.8 ft		
Project Type	HSA 4.25	Date Started	7/22/09	Completed	7/22/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	49.5 ft	Date/Time	7/22/09
Logged By	Anthony Aloti	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
378.8	0.0	Top of Hole							
		Lean Clay, red brown to brown, trace sand and gravel, moist, stiff to medium stiff (CL)		SPT-1	0.0 - 1.5	1.3	4-5-7	20	
				SPT-2	1.5 - 3.0	1.3	7-8-8	12	
				SPT-3	3.0 - 4.5	0.9	6-7-11	20	
				SPT-4	4.5 - 6.0	1.3	8-16-11	19	
				SPT-5	6.0 - 7.5	1.5	4-4-5	20	
				SPT-6	7.5 - 9.0	1.4	4-5-11	17	
				SPT-7	9.0 - 10.5	1.5	2-5-7	19	
				SPT-8	10.5 - 12.0	1.5	2-2-4	21	
				SPT-9	12.0 - 13.5	1.5	2-3-5	20	
				SPT-10	13.5 - 15.0	1.3	4-3-5	20	
				SPT-11	15.0 - 16.5	1.3	2-3-5	19	
				SPT-12	16.5 - 18.0	1.5	3-6-8	20	
				SPT-13	18.0 - 19.5	1.3	3-4-4	20	
358.8	20.0								
		Lean Clay, brown with few gray mottles, trace sand and gravel, moist, medium stiff to very stiff (CL)		SPT-14	19.5 - 21.0	1.4	3-3-3	21	
				SPT-15	21.0 - 22.5	0.5	4-7-11	21	
				SPT-16	23.5 - 25.0	1.3	1-5-5	20	
				SPT-17	26.0 - 27.5	1.1	8-10-11	25	
349.8	29.0								
		Lean Clay, red brown to gray, some gravel, moist, stiff to medium stiff, some cobble zones (CL)		SPT-18	28.5 - 30.0	1.3	1-3-3	27	
				SPT-19	31.0 - 31.3	0.2	50+/0.3	24	
				SPT-20	33.5 - 35.0	1.5	14-5-4	27	

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-51**
		Total Depth	66.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay, red brown to gray, some gravel, moist, stiff to medium stiff, some cobble zones (CL) *(Continued)*		SPT-21	36.0 - 37.5	1.5	12-5-4	29	
				SPT-22	38.5 - 40.0	1.5	2-2-2	29	
				SPT-23	41.0 - 42.5	1.3	7-4-10	26	
				SPT-24	43.5 - 45.0	1.3	3-1-1	27	
				SPT-25	46.0 - 47.5	1.3	2-1-1	26	
				SPT-26	48.5 - 50.0	1.3	5-1-1	32	
327.8	51.0	Silty Sand, brown to grayish brown, wet, loose to medium dense, medium to fine grained, grading gravelly (SM)		SPT-27	51.0 - 52.5	0.4	4-3-2	26	
				SPT-28	53.5 - 55.0	1.1	3-12-13	25	
				SPT-29	56.0 - 57.5	1.5	12-11-13	21	
				SPT-30	58.5 - 60.0	1.3	8-10-13	22	
				SPT-31	61.0 - 62.5	0.9	6-16-20	19	
314.6	64.2	Shale, completely to highly weathered 64.2-66.0		SPT-32	63.5 - 65.0	1.4	15-12-10	20	
312.3	66.5			SPT-33	66.0 - 66.4	0.3	50+/0.4	15	

Auger Refusal /
Bottom of Hole

Top of Rock = 64.2
Elevation (314.6)

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-52**	Total Depth	84.0 ft
County	Stewart, TN	Surface Elevation	394.9 ft		
Project Type	HSA 4.25	Date Started	7/28/09	Completed	7/29/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	Dry	Date/Time	7/29/09
Logged By	D. Chapman	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.9	0.0	Top of Hole							
394.4	0.5	Crushed stone		SPT-1	0.0 - 1.5	1.5	7-8-4	17	
		Sandy Lean Clay, little gravel, red-brown to brown, moist medium stiff to very stiff (CL)		SPT-2	1.5 - 3.0	0.5	5-3-3	23	
				SPT-3	3.0 - 4.5	0.9	3-5-6	27	
				SPT-4	4.5 - 6.0	1.3	3-7-3	23	
				SPT-5	6.0 - 7.5	1.0	1-3-4	21	
				SPT-6	7.5 - 9.0	0.9	2-2-2	22	
				SPT-7	9.0 - 10.5	1.0	7-9-9	27	
				SPT-8	10.5 - 12.0	1.1	3-6-4	21	
				SPT-9	12.0 - 13.5	0.9	3-2-10	24	
				SPT-10	13.5 - 15.0	0.8	2-4-5	20	
				SPT-11	15.0 - 16.5	1.0	2-2-4	23	
				SPT-12	16.5 - 18.0	0.9	2-5-7	16	
375.9	19.0			SPT-13	18.0 - 18.9	0.7	7-50+/0.4	18	
		Lean Clay, Silty clay, some to no sand and gravel, wet, soft to very stiff, brown to gray (CL)		SPT-14	19.5 - 21.0	0.8	9-24-31	8	Stone blocked spoon
				SPT-15	21.0 - 22.5	0.5	5-9-6	18	
				SPT-16	22.5 - 24.0	0.0	4-3-2	29	
				SPT-17	24.0 - 25.5	0.0	2-4-10	34	
				SPT-18	25.5 - 27.0	1.2	4-5-5	21	
				SPT-19	27.0 - 28.5	0.4	1-1-2	24	
				SPT-20	28.5 - 30.0	0.2	2-1-3	11	
				SPT-21	31.0 - 32.5	0.8	2-4-2	24	
				SPT-22	33.5 - 35.0	0.7	9-7-9	23	

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-52**
		Total Depth	84.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay, Silty clay, some to no sand and gravel, wet, soft to very stiff, brown to gray (CL) *(Continued)*		SPT-23	36.0 - 37.5	0.1	1-3-10	14	
				SPT-24	38.5 - 40.0	0.4	7-16-12	20	
				SPT-25	41.0 - 42.5	1.0	5-4-6	29	
				SPT-26	43.5 - 45.0	0.9	3-5-7	26	
				SPT-27	46.0 - 47.5	1.2	2-3-6	25	no sand and gravel
				SPT-28	48.5 - 50.0	1.5	3-4-5	25	
				SPT-29	51.0 - 52.5	1.3	1-2-2	27	
				SPT-30	53.5 - 55.0	1.5	1-1-2	28	
				SPT-31	56.0 - 57.5	1.3	3-3-3	29	
				SPT-32	58.5 - 60.0	1.4	2-1-1	28	
				SPT-33	61.0 - 62.5	1.3	1-1-1	27	
				SPT-34	63.5 - 65.0	0.4	1-2-2	36	
				SPT-35	66.0 - 67.5	1.0	10-12-11	27	
326.4	68.5								
		Gravel With Silt And Sand, poorly graded, some gravel and silt, wet, medium dense to dense (GP-GM)		SPT-36	68.5 - 70.0	0.6	7-8-9	26	
				SPT-37	71.0 - 72.5	0.7	6-9-12	18	
				SPT-38	73.5 - 75.0	0.5	5-10-13	25	
				SPT-39	76.0 - 77.5	0.4	8-8-6	22	

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-52**	Total Depth	84.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth	Description	Rock Core RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Gravel With Silt And Sand, poorly graded, some gravel and silt, wet, medium dense to dense (GP-GM) *(Continued)*	SPT-40	78.5 - 80.0	0.8	7-8-8	16	
			SPT-41	81.0 - 81.8	0.7	5-50+/0.3	15	
311.2	83.7		SPT-42	83.5 - 83.7	0.2	50+/0.2	11	
310.9	84.0	Limestone and shale fragments						
		Auger Refusal / Bottom of Hole Top of Rock = 83.7 Elevation (311.2)						

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-52 A**
		Total Depth	10.0 ft
County	Stewart, TN	Surface Elevation	394.9 ft
Project Type	HSA 4.25	Date Started	8/7/09
		Completed	8/7/09
Supervisor	D. Rogers	Depth to Water	Dry
Driller	J. Felts	Date/Time	8/7/09
Logged By	Z. Massey	Depth to Water	N/A
		Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.9	0.0	Top of Hole						
394.4	0.5	Crushed stone						
		Sandy Lean Clay, little gravel, red-brown to brown, moist medium stiff to very stiff (CL)	BAG-1	5.0 - 10.0			--	
384.9	10.0							
		No Refusal / Bottom of Hole						

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-53** Total Depth 27.0 ft
County	Stewart, TN	Surface Elevation	376.0 ft
Project Type	HSA 4.25	Date Started	7/23/09 Completed 7/23/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	Dry Date/Time 7/23/09
Logged By	D. Chapman	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
376.0	0.0	Top of Hole							
		Lean Clay, with trace sand to fine gravel, red brown to mottled liight greenish gray and olive brown, moist, soft to very stiff (CL)		SPT-1	0.0 - 1.5	0.7	2-5-5	22	
				SPT-2	1.5 - 3.0	0.8	4-3-4	18	
				SPT-3	3.0 - 4.5	0.7	4-5-8	27	
				SPT-4	4.5 - 6.0	1.3	3-8-7	27	
				SPT-5	6.0 - 7.5	0.7	2-2-2	17	
				SPT-6	7.5 - 9.0	0.7	1-1-2	23	
				SPT-7	9.0 - 10.5	0.3	1-1-1	27	
				SPT-8	10.5 - 12.0	0.2	1-2-30	21	
				SPT-9	12.0 - 13.5	0.5	4-5-5	22	
				SPT-10	13.5 - 15.0	0.7	5-8-10	22	
				SPT-11	15.0 - 16.5	1.3	4-3-5	20	
				SPT-12	16.5 - 18.0	0.2	11-21-25	23	
				SPT-13	18.0 - 19.5	1.3	7-11-9	19	
				SPT-14	19.5 - 21.0	1.1	7-12-13	18	
				SPT-15	21.0 - 22.5	1.5	7-8-8	27	
				SPT-16	22.5 - 24.0	0.5	4-3-5	28	
				SPT-17	24.0 - 25.5	0.5	7-8-8	26	
				SPT-18	26.0 - 26.0	0.0	50+/0	--	
349.0	27.0								
		Auger Refusal / Bottom of Hole							Bottom of boring at 27' at auger refusal on a boulder. No piezometer was installed. The boring was grouted to ground surface. Moved 6' west and drilled B-53A.

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-53 A** Total Depth 96.0 ft
County	Stewart, TN	Surface Elevation	376.0 ft
Project Type	HSA 4.25	Date Started	7/23/09 Completed 7/24/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	12.0 ft Date/Time 7/24/09
Logged By	D. Chapman	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
376.0	0.0	Top of Hole							
		Lean Clay, trace sand to fine gravel, red brown to mottled light greenish gray and olive brown, moist, soft to very stiff (CL)							See log B-53 for descriptions of SPT samples from 0 - 27' below ground surface
				ST-1	8.0 - 10.0	1.5		--	Shelby tube 8'-10'
				ST-2	22.5 - 24.5	0.0		--	Shelby tube attempted 22.5' - 24.5'. No recovery.
				ST-3	24.5 - 26.5	0.0		--	Shelby tube attempted 24.5' - 26.5'. No recovery.
				SPT-1	29.5 - 31.0	1.5	5-8-7	26	
345.0	31.0	Lean Clay, dark olive to dark gray, moist, soft to stiff (CL)		SPT-2	31.0 - 32.5	1.5	3-8-2	22	
				SPT-3	33.5 - 35.0	1.5	2-1-2	28	

Project Number 175539016 | Location Cumberland Fossil

Project Name Ash Ponds | Boring No. **B-53 A** | Total Depth 96.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Lean Clay, dark olive to dark gray, moist, soft to stiff (CL) *(Continued)*	SPT-4	38.5 - 40.0	1.5	1-2-4	27	
			SPT-5	41.0 - 42.5	1.5	1-2-2	25	
			ST-4	43.0 - 45.0	1.5		--	Shelby tube 43' - 45'
			SPT-6	46.0 - 47.5	0.2	1-2-3	26	
326.5	49.5		SPT-7	48.5 - 50.0	1.5	1-1-1	36	Dark olive
		Silty Sand, Silty sand, some fine gravel, dark olive to olive yellow, wet, very loose to dense (SM)	SPT-8	51.0 - 52.5	1.5	4-8-3	33	
			SPT-9	53.5 - 55.0	1.5	6-7-8	20	
			SPT-10	56.0 - 57.5	1.5	5-11-14	22	
			SPT-11	58.5 - 60.0	0.8	7-2-1	22	Silty clay layer 58' - 60'
			SPT-12	61.0 - 62.5	0.6	5-10-11	29	
			SPT-13	63.5 - 65.0	0.5	3-7-9	26	
			SPT-14	66.0 - 67.5	1.5	9-12-14	19	
			SPT-15	68.5 - 70.0	1.0	8-10-11	19	
			SPT-16	71.0 - 72.5	1.3	5-5-11	31	
			SPT-17	73.5 - 75.0	1.4	8-23-17	25	Dark olive
			SPT-18	76.0 - 77.5	1.3	10-12-16	25	

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-53 A** Total Depth 96.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Silty Sand, Silty sand, some fine gravel, dark olive to olive yellow, wet, very loose to dense (SM) *(Continued)*		SPT-19	78.5 - 80.0	0.7	1-1-7	35	
				SPT-20	81.0 - 82.5	0.7	1-1-2	29	
				SPT-21	83.5 - 85.0	1.0	0-0-0	36	
				SPT-23	88.5 - 80.0	1.5		44	
				SPT-22	86.0 - 87.5	1.5	0-0-0	44	
				SPT-24	91.0 - 92.5	1.5	0-8-3	43	Cobble & boulder layer 92' - 96'
				SPT-25	93.5 - 95.0	1.5	0-0-0	55	
280.0	96.0								
		Auger Refusal / Bottom of Hole Top of Rock = 96.0 Elevation (280.0)							Bottom of boring at 96' at auger refusal on apparent limestone bedrock. Installed a piezometer screened from 55' - 65' below ground surface

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-53 B** — Total Depth 43.0 ft
County	Stewart, TN	Surface Elevation	376.0 ft
Project Type	HSA 4.25	Date Started	7/24/09 — Completed 7/24/09
Supervisor	D. Rogers — Driller Jerry Huntoon	Depth to Water	Dry — Date/Time 7/24/09
Logged By	D. Chapman	Depth to Water	N/A — Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
376.0	0.0	Top of Hole						
		Lean Clay, trace sand to fine gravel, red brown to mottled light greenish gray and olive brown, moist, soft to very stiff (CL)						
345.0	31.0							
		Lean Clay, dark olive to dark gray, moist, soft to stiff (CL)						

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-53 B**	Total Depth	43.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Lean Clay, dark olive to dark gray, moist, soft to stiff (CL) *(Continued)*							
333.0	43.0								
		No Refusal / Bottom of Hole							Bottom of boring at 43'. No refusal. Installed a piezometer screened from 33' - 43' below ground surface.

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-54** Total Depth 100.3 ft
County	Stewart, TN	Surface Elevation	395.0 ft
Project Type	HSA 4.25	Date Started	7/26/09 Completed 7/27/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	30.0 ft Date/Time 7/26/09
Logged By	James Felts	Depth to Water	14.0 ft Date/Time 7/27/09

Lithology Elevation	Depth	Description	Overburden Rock Core	Sample # RQD	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois.Cont. % Run Depth	Remarks
395.0	0.0	Top of Hole							
394.1	0.9	Crushed stone		SPT-1	0.0 - 1.5	1.0	2-5-5	22	
		Fat Clay, dark red-brown, with sand and chert gravel, damp to moist, stiff (CH)		SPT-2	1.5 - 3.0	0.8	2-4-5	20	
				SPT-3	3.0 - 4.5	1.2	2-3-4	28	
				SPT-4	4.5 - 6.0	1.2	2-4-4	26	
				SPT-5	6.0 - 7.5	0.9	2-2-6	21	
				SPT-6	7.5 - 9.0	1.2	2-3-3	22	
				SPT-7	9.0 - 10.5	0.5	3-3-4	22	
				SPT-8	10.5 - 12.0	0.9	4-5-5	23	
				SPT-9	12.0 - 13.5	1.2	2-5-6	19	
				SPT-10	13.5 - 15.0	1.0	4-3-4	21	
				SPT-11	15.0 - 16.5	0.9	2-2-3	25	
377.0	18.0			SPT-12	16.5 - 18.0	1.4	9-10-13	24	
		Lean Clay, Silty clay, brown with gray lenses, very stiff, damp, trace flyash 18-18.3 (CL)		SPT-13	18.0 - 19.5	1.2	3-10-14	14	Wood Fragments 19.5-21.0
374.5	20.5			SPT-14	19.5 - 21.0	1.2	5-9-10	18	
		Lean Clay, Silty clay, brown-gray mottled, trace gravel, moist to wet, stiff to very stiff (CL)		SPT-15	21.0 - 22.5	1.3	4-6-9	19	
				SPT-16	22.5 - 24.0	1.2	1-5-8	18	
				SPT-17	24.0 - 25.5	1.3	4-9-12	16	
				SPT-18	25.5 - 27.0	0.1	5-6-8	13	
				SPT-19	27.0 - 28.5	1.3	3-5-7	18	
				SPT-20	28.5 - 30.0	1.3	3-6-9	21	Organics @ 29.0
				SPT-21	30.0 - 31.5	0.9	2-5-8	20	
				SPT-22	31.5 - 33.0	1.5	2-2-3	23	
				SPT-23	33.0 - 34.5	1.4	0-2-4	22	Organics @ 33.0-34.5
359.0	36.0			SPT-24	34.5 - 36.0	1.0	0-4-7	20	

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-54** Total Depth 100.3 ft

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Lean Clay, dark gray, damp to wet, very stiff to very soft, zones of sand and gravel (CL) *(Continued)*		SPT-25	36.0 - 37.5	1.2	2-5-11	22	
				SPT-26	37.5 - 39.0	1.2	3-7-13	21	
				SPT-27	39.0 - 40.5	1.5	3-6-9	21	
				SPT-28	40.5 - 42.0	0.9	3-6-8	22	
				SPT-29	42.0 - 43.5	1.0	3-6-8	20	
				SPT-30	43.5 - 45.0	1.2	4-6-7	22	
				SPT-31	45.0 - 46.5	1.3	2-4-4	24	
				SPT-32	47.5 - 49.0	1.2	1-3-4	25	
				SPT-33	50.0 - 51.5	1.0	0-1-3	24	
				SPT-34	52.5 - 54.0	1.4	0-3-4	26	
				SPT-35	55.0 - 56.5	1.5	0-1-2	28	
				SPT-36	57.5 - 59.0	1.5	0-1-3	37	
				SPT-37	60.0 - 61.5	1.2	0-0-1	29	
				SPT-38	62.5 - 64.0	1.5	0-0-0	25	
				SPT-39	65.0 - 66.5	1.5	0-0-0	27	
327.0	68.0								
		Silty Gravel, with cobbles, gray, wet, medium dense (GM)		SPT-40	67.5 - 69.0	0.6	1-3-5	32	
				SPT-41	70.0 - 71.5	0.6	2-10-14	25	
322.5	72.5								
		Clayey Sand, with gravel, brown-gray, wet, dense (SC)		SPT-42	72.5 - 74.0	0.5	5-3-6	28	
				SPT-43	75.0 - 76.5	0.9	1-6-2	24	
317.5	77.5								

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-54** Total Depth 100.3 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
312.5	82.5	Silty Gravel, with cobbles, gray, wet, medium dense (GM) *(Continued)*		SPT-44	77.5 - 79.0	0.8	10-14-10	19	
				SPT-45	80.0 - 81.5	0.7	7-9-14	16	
310.0	85.0	Lean Clay, gray, wet, medium stiff, trace sand (CL)		SPT-46	82.5 - 84.0	0.9	12-3-3	22	
304.9	90.1	Silty Sand With Gravel, coarse, wet, gray, dense (SM)		SPT-47	85.0 - 86.5	1.1	18-20-15	16	
				SPT-48	87.5 - 89.0	0.7	15-20-22	16	
				SPT-49	90.0 - 90.1	0.0	50+/0.1	--	
301.7	93.3	(rollered hard)							Began Core
294.7	100.3	Limestone(80%) with zone highly weathered shale(20%) Limestone is hard, gray, fractured, water stained Shale is highly weathered, fissile, brown, eroded		21	7.0	4.6	66	100.3	

Bottom of Hole

Top of Rock = 90.1
Elevation (304.9)

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-54 A** — Total Depth 52.5 ft
County	Stewart, TN	Surface Elevation	395.0 ft
Project Type	HSA 4.25	Date Started	7/28/09 — Completed 7/29/09
Supervisor	D. Rogers — Driller J. Felts	Depth to Water	Dry — Date/Time 7/29/09
Logged By	James Felts	Depth to Water	N/A — Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.0	0.0	Top of Hole							
394.1	0.9	Crushed stone							
		Fat Clay, dark red-brown, with sand and chert gravel, damp to moist, stiff (CH)		ST-2	8.0 - 9.4	0.5		--	
377.0	18.0								
		Lean Clay, Silty clay, brown with gray lenses, very stiff, damp, trace flyash 18-18.3 (CL)							
374.5	20.5								
		Lean Clay, Silty clay, brown-gray mottled, trace gravel, moist to wet, stiff to very stiff (CL)		ST-3	22.0 - 24.0	1.4		--	
				ST-4	30.0 - 32.0	1.8		--	
359.0	36.0								

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-54 A**
		Total Depth	52.5 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		Lean Clay, dark gray, damp to wet, very stiff to very soft, zones of sand and gravel (CL) *(Continued)*		ST-5	45.0 - 47.0	2.0		--	
342.5	52.5	No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-55** Total Depth 75.0 ft
County	Stewart, TN	Surface Elevation	379.5 ft
Project Type	HSA 4.25	Date Started	7/24/09 Completed 7/25/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	18.0 ft Date/Time 7/25/09
Logged By	D. Chapman	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
379.5	0.0	Top of Hole						
		Fat Clay, trace sand and fine gravel, red brown, moist, soft to stiff (CH)(FILL)	SPT-1	0.0 - 1.5	0.7	5-4-6	21	
			SPT-2	1.5 - 3.0	0.8	4-5-6	14	
			SPT-3	3.0 - 4.5	1.2	5-6-6	20	Trace brick
			SPT-4	4.5 - 6.0	1.2	2-1-3	22	
372.0	7.5		SPT-5	6.0 - 7.5	1.5	2-2-4	23	
		Lean Clay With Sand, red brown, moist, medium stiff to very stiff (CL)	SPT-6	7.5 - 9.0	1.5	1-2-4	23	Trace roots and organics
			SPT-7	9.0 - 10.5	1.5	2-3-3	20	
			SPT-8	10.5 - 12.0	1.5	2-3-2	22	
			SPT-9	12.0 - 13.5	1.5	4-6-8	24	
			SPT-10	13.5 - 15.0	1.3	2-24-19	21	
			SPT-11	15.0 - 16.5	0.7	6-16-5	20	Drilled through cobbles from 15' - 16'
			SPT-12	16.5 - 18.0	1.3	2-4-6	24	
			SPT-13	18.0 - 19.5	1.5	3-3-5	22	
358.5	21.0		SPT-14	19.5 - 21.0	1.3	2-3-5	24	Olive brown
		Clayey Gravel With Sand, little to some silt, olive brown to olive yellow, very loose to dense (GC)	SPT-15	21.0 - 22.5	1.0	4-12-23	18	
			SPT-16	22.5 - 24.0	1.2	16-23-21	19	
			SPT-17	24.0 - 25.5	1.3	4-8-25	18	
			SPT-18	25.5 - 27.0	1.5	3-9-11	26	
			SPT-19	28.5 - 30.0	1.3	8-13-22	34	
			SPT-20	31.0 - 32.5	0.3	4-19-12	24	Olive yellow
			SPT-21	33.5 - 35.0	1.3	29-21-7	23	

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-55**	Total Depth	75.0 ft

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Clayey Gravel With Sand, little to some silt, olive brown to olive yellow, very loose to dense (GC) *(Continued)*	SPT-22	36.0 - 37.5	0.8	11-15-31	--	
			SPT-23	38.5 - 40.0	0.5	6-26-16	25	
			SPT-24	41.0 - 42.5	1.3	8-10-11	28	
			SPT-25	43.5 - 45.0	1.5	2-3-3	64	Silt-rich zone 43.5' - 47.5'
			SPT-26	46.0 - 47.5	1.3	7-5-10	30	
			SPT-27	48.5 - 50.0	1.3	13-26-10	27	
			SPT-28	51.0 - 52.5	1.2	5-12-27	16	
			SPT-29	53.5 - 55.0	1.5	11-7-4	38	
			SPT-30	56.0 - 57.5	1.3	8-17-4	41	
			SPT-31	58.5 - 60.0	0.8	1-3-5	42	
			SPT-32	61.0 - 62.5	0.8	8-25-7	40	
			SPT-33	63.5 - 65.0	0.8	8-1-1	63	
			SPT-34	66.0 - 67.5	1.5	1-1-1	63	
			SPT-35	68.5 - 70.0	1.0	8-46-6	39	Bottom of boring. Auger refusal on apparent limestone bedrock. Grouted 75' - ground surface.
			SPT-36	71.0 - 72.5	1.0	0-0-0	74	
304.5	75.0		SPT-37	73.5 - 75.0	0.4	8-8-50+/0.5	37	
		Auger Refusal / Bottom of Hole	SPT-38	75.0 - 75.1	0.1	50+/0.	22	

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-55** Total Depth 75.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Top of Rock = 75.0 Elevation (304.5)							

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Stantec

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-56** Total Depth 76.2 ft
County	Stewart, TN	Surface Elevation	395.0 ft
Project Type	HSA 4.25	Date Started	8/3/09 Completed 8/4/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	29.0 ft Date/Time 8/3/09
Logged By	Z. Massey	Depth to Water	N/A Date/Time N/A

Lithology		Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
Elevation	Depth								
395.0	0.0	Top of Hole							
		Fat Clay, red brown to brown, damp to moist, medium stiff to very stiff, with chert and other rock fragments (CH)		SPT-1	0.0 - 1.5	0.7	11-10-8	13	
				SPT-2	1.5 - 3.0	0.9	4-5-6	19	
				SPT-3	3.0 - 4.5	1.5	6-7-9	23	
				SPT-4	4.5 - 6.0	1.5	6-3-5	22	
				SPT-5	6.0 - 7.5	1.0	2-3-6	23	
				SPT-6	7.5 - 9.0	1.3	2-3-4	27	
				SPT-7	9.0 - 10.5	1.3	4-7-6	23	
				SPT-8	10.5 - 12.0	1.5	4-6-6	21	
				SPT-9	12.0 - 13.5	0.7	3-2-3	23	
				SPT-10	13.5 - 15.0	0.8	13-4-5	24	
				SPT-11	15.0 - 16.5	1.1	4-5-6	23	
				SPT-12	16.5 - 18.0	1.0	4-5-7	23	
				SPT-13	18.0 - 19.5	0.1	2-3-6	22	
				SPT-14	19.5 - 21.0	0.3	2-3-2	22	
				SPT-15	21.0 - 22.5	0.5	5-9-14	26	
371.2	23.8			SPT-16	22.5 - 24.0	1.5	5-8-14	18	
		Lean Clay, gray to brown, moist to wet, medium stiff to very stiff, mottled, with rock fragments, occasional organics (CL)		SPT-17	24.0 - 25.5	0.8	4-8-10	18	
				SPT-18	25.5 - 27.0	1.4	4-8-9	18	
				SPT-19	27.0 - 28.5	0.9	6-4-4	19	
				SPT-20	28.5 - 30.0	1.0	3-6-9	32	
				SPT-21	30.0 - 31.5	1.2	3-9-19	26	
				SPT-22	31.5 - 33.0	1.2	7-27-15	16	
361.0	34.0			SPT-23	33.0 - 34.5	1.3	14-6-45	41	
		Silty Gravel With Sand, tan to brown, wet, medium stiff to very stiff (GM)		SPT-24	34.5 - 36.0	1.2	6-2-20	47	

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-56**	Total Depth	76.2 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
				SPT-25	36.0 - 37.5	0.4	3-3-4	26	
356.0	39.0			SPT-26	37.5 - 39.0	1.4	3-10-9	34	
		Lean Clay, red brown to brown, moist to wet, very soft to very stiff, with chert and other rock fragments (CL)		SPT-27	39.0 - 40.5	0.8	13-9-10	28	
				SPT-28	40.5 - 42.0	0.8	3-3-11	29	
				SPT-29	42.0 - 43.5	1.3	4-15-13	30	
				SPT-30	43.5 - 45.0	0.5	1-1-1	54	
				SPT-31	45.0 - 46.5	0.5	1-1-1	58	
				SPT-32	46.5 - 48.0	0.5	1-1-16	34	
				SPT-33	48.0 - 49.5	0.8	20-3-3	48	
				SPT-34	49.5 - 51.0	1.0	1-4-3	65	
				SPT-35	52.5 - 54.0	1.4	1-1-9	26	
				SPT-36	55.0 - 56.5	1.3	2-3-3	61	
				SPT-37	57.5 - 59.0	1.0	1-1-10	47	
				SPT-38	60.0 - 61.5	1.3	1-1-8	36	
				SPT-39	62.5 - 64.0	1.1	8-2-4	28	
				SPT-40	65.0 - 66.5	1.2	10-18-10	25	
				SPT-41	67.5 - 69.0	1.5	2-4-4	44	
				SPT-42	70.0 - 71.5	1.3	10-44-30	32	
				SPT-43	72.5 - 74.0	1.0	15-11-1	29	
319.6	75.4			SPT-44	75.0 - 75.7	0.4	2-50+/0.2	4	
318.8	76.2	Augered Hard							
		Auger Refusal /							

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-56**	Total Depth	76.2 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Bottom of Hole Top of Rock = 75.4 Elevation (319.6)							

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-56 A**
		Total Depth	10.0 ft
County	Stewart, TN	Surface Elevation	395.0 ft
Project Type	HSA 4.25	Date Started	8/4/09
		Completed	8/4/09
Supervisor	D. Rogers	Depth to Water	Dry
Driller	J. Felts	Date/Time	8/4/09
Logged By	Z. Massey	Depth to Water	N/A
		Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
395.0	0.0	Top of Hole							
		Fat Clay, red brown to brown, damp to moist, medium stiff to very stiff, with chert and other rock fragments (CH)		BAG-1	6.0 - 10.0			--	
385.0	10.0								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-57** Total Depth 56.5 ft
County	Stewart, TN	Surface Elevation	381.5 ft
Project Type	HSA 3.25	Date Started	8/5/09 Completed 8/5/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	19.0 ft Date/Time 8/5/09
Logged By	Z. Massey	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
381.5	0.0	Top of Hole							
381.0	0.5	Crushed stone		SPT-1	0.0 - 1.5	1.0	16-9-6	8	
		Lean Clay, with gravel,damp to moist, gray to brown, very stiff (CL) (FILL)		SPT-2	1.5 - 2.3	0.8	19-50+/0.3	10	
378.0	3.5			SPT-3	3.0 - 4.5	1.2	5-10-17	19	
		Sandy Lean Clay, gray to brown, moist, very stiff (CL)		SPT-4	4.5 - 6.0	1.5	8-9-13	25	
				SPT-5	6.0 - 7.5	1.2	12-18-21	28	
				SPT-6	7.5 - 9.0	1.5	6-11-18	29	
				SPT-7	9.0 - 10.5	1.2	16-21-24	25	
				SPT-8	10.5 - 12.0	1.2	16-21-20	24	
				SPT-9	12.0 - 13.5	1.3	11-13-15	24	
				SPT-10	13.5 - 15.0	1.5	7-11-15	28	
				SPT-11	15.0 - 16.5	1.5	10-10-15	25	
				SPT-12	16.5 - 18.0	1.3	9-12-12	25	
				SPT-13	18.0 - 19.5	1.1	2-3-4	45	
				SPT-14	19.5 - 21.0	1.5	6-12-18	25	
				SPT-15	21.0 - 22.5	1.5	14-15-15	26	
				SPT-16	22.5 - 24.0	1.5	11-14-16	35	
				SPT-17	24.0 - 25.5	1.5	6-12-13	26	
				SPT-18	25.5 - 27.0	1.5	9-11-18	32	
354.0	27.5			SPT-19	27.0 - 28.5	1.5	9-13-8	53	
		Lean Clay, with sand, red brown to gray, moist, stiff to very stiff, with rock fragments (CL)		SPT-20	28.5 - 30.0	1.5	8-17-23	30	
				SPT-21	30.0 - 30.7	0.7	12-50+/0.2	26	
				SPT-22	32.5 - 34.0	1.5	9-8-12	34	
				SPT-23	35.0 - 36.5	1.5	8-4-9	49	

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-57**	Total Depth	56.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Lean Clay, with sand, red brown to gray, moist, stiff to very stiff, with rock fragments (CL) *(Continued)*	SPT-24	37.5 - 39.0	1.2	11-19-10	19	
			SPT-25	40.0 - 41.5	1.1	5-3-16	32	
			SPT-26	42.5 - 44.0	1.4	6-25-20	51	
			SPT-27	45.0 - 46.5	1.5	15-16-33	28	
			SPT-28	47.5 - 49.0	1.5	10-5-6	59	
			SPT-29	50.0 - 50.9	0.9	20-50+/0.4	33	Boulders below 50 feet.
			SPT-30	52.5 - 54.0	0.9	5-14-16	50	
325.0	56.5		SPT-31	55.0 - 56.5	1.5	3-16-23	54	
		No Refusal / Bottom of Hole						Augers broke at 57 feet. Offset 3ft for B-57B

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-57 A** — Total Depth 21.0 ft
County	Stewart, TN	Surface Elevation	381.5 ft
Project Type	HSA 3.25	Date Started	8/6/09 — Completed 8/6/09
Supervisor	D. Rogers — Driller Mark Martin	Depth to Water	Dry — Date/Time 8/6/09
Logged By	Z. Massey	Depth to Water	N/A — Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
381.5	0.0	Top of Hole						
381.0	0.5	Crushed stone						
378.0	3.5	Lean Clay, with gravel,damp to moist, gray to brown, very stiff (CL)						
		Sandy Lean Clay, gray to brown, moist, very stiff (CL)	ST-1	5.0 - 7.0	2.0		--	PZ Installed Screen 10'-20'
			ST-2	10.0 - 12.0	2.0		--	
360.5	21.0	No Refusal / Bottom of Hole						

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-57 B** Total Depth 66.5 ft
County	Stewart, TN	Surface Elevation	381.5 ft
Project Type	HSA 3.25	Date Started	8/6/09 Completed 8/6/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	Dry Date/Time 8/6/09
Logged By	Z. Massey	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
381.5	0.0	Top of Hole							
381.0	0.5	Crushed stone							
378.0	3.5	Lean Clay, with gravel,damp to moist, gray to brown, very stiff (CL) (FILL)							
		Sandy Lean Clay, gray to brown, moist, very stiff (CL)							
354.0	27.5								
		Lean Clay, with sand, red brown to gray, moist, stiff to very stiff, with rock fragments (CL)							

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-57 B**
		Total Depth	66.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay, with sand, red brown to gray, moist, stiff to very stiff, with rock fragments (CL) *(Continued)*							
				SPT-32	57.5 - 59.0	1.4	43-38-27	38	
				SPT-33	60.0 - 61.5	1.5	4-3-4	41	
				SPT-34	62.5 - 64.0	0.9	20-29-16	36	
315.0	66.5			SPT-35	65.0 - 66.5	0.2	1-1-1	44	Broke augers again. Pull augers and grout
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-58** Total Depth 62.9 ft
County	Stewart, TN	Surface Elevation	395.0 ft
Project Type	HSA 4.25	Date Started	7/26/09 Completed 7/27/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	35.9 ft Date/Time 7/27/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.0	0.0	Top of Hole							
394.8	0.2	Crushed Stone		SPT-1	0.0 - 1.5	0.4	6-7-9	16	
		Sandy Fat Clay, red brown, damp to moist, very stiff, with coarse sand, little gravel (CH)		SPT-2	1.5 - 3.0	0.8	6-7-8	21	SI installed to 61.5
				SPT-3	3.0 - 4.5	0.4	3-6-5	22	
				SPT-4	4.5 - 6.0	1.5	3-5-10	24	
				SPT-5	6.0 - 7.5	0.6	8-10-9	26	gravel block spoon
				SPT-6	7.5 - 9.0	0.3	5-6-9	16	
				SPT-7	9.0 - 10.5	0.8	3-4-6	30	
				SPT-8	10.5 - 12.0	0.4	4-6-7	16	
				SPT-9	12.0 - 13.5	0.3	7-8-8	16	
				SPT-10	13.5 - 15.0	1.5	5-7-11	23	
				BAG-1	10.0 - 20.0			--	
379.0	16.0			SPT-11	15.0 - 16.5	1.5	5-10-10	20	
		Lean Clay, brown gray, damp to moist, very stiff, with coarse sand, trace gravel, mottled (CL)		SPT-12	16.5 - 18.0	1.5	12-15-19	20	
				SPT-13	18.0 - 19.5	1.5	7-14-11	20	
				SPT-14	19.5 - 21.0	1.5	3-6-9	29	
				SPT-15	21.0 - 22.5	1.5	10-15-20	30	
				SPT-16	22.5 - 24.0	1.5	7-9-15	28	
				SPT-17	24.0 - 25.5	1.5	7-10-15	26	
				SPT-18	25.5 - 27.0	1.5	5-12-12	21	
				SPT-19	27.0 - 28.5	1.5	12-19-17	33	
				SPT-20	28.5 - 30.0	1.5	5-5-8	41	brown sandy lens 28-29
363.9	31.1			SPT-21	30.0 - 31.5	1.5	5-6-21	70	
		Silty Sand With Gravel, brown, wet, medium dense, (SM)		SPT-22	32.5 - 34.0	13.0	3-11-10	43	
				SPT-23	35.0 - 36.5	1.2	3-4-8	49	

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-58**	Total Depth	62.9 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
355.0	40.0	Silty Sand With Gravel, brown, wet, medium dense, (SM) *(Continued)*		SPT-24	37.5 - 39.0	1.3	35-13-16	20	occasional black mottling
		Clayey Sand With Gravel, dark gray brown to gray brown, wet, medium dense, mottled (SC)		SPT-25	40.0 - 41.5	1.5	7-5-11	49	gravelly zone 41-41.4
				SPT-26	42.5 - 44.0	1.5	6-8-10	35	
				SPT-27	45.0 - 46.5	1.5	5-4-4	34	
				SPT-28	47.5 - 49.0	1.2	5-4-3	36	lighter by 48
				SPT-29	50.0 - 51.5	0.8	22-23-5	17	51-51.2 weathered rock
				SPT-30	52.5 - 54.0	1.0	0-6-8	41	
				SPT-31	55.0 - 56.5	0.6	6-11-12	14	
				SPT-32	57.5 - 58.1	0.5	36-50+	13	
334.1	60.9			SPT-33	60.0 - 60.2	0.2	50+	7	
332.1	62.9	No Core							

Auger Refusal /
Bottom of Hole

Top of Rock = 57.5
Elevation (337.5)

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-58 A** — Total Depth 47.0 ft
County	Stewart, TN	Surface Elevation	394.8 ft
Project Type	HSA 3.25	Date Started	8/3/09 — Completed 8/4/09
Supervisor	D. Rogers — Driller Mark Martin	Depth to Water	34.0 ft — Date/Time 8/3/09
Logged By	Z. Massey	Depth to Water	N/A — Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.8	0.0	Top of Hole							
394.6	0.2	Crushed Stone							
		Sandy Fat Clay, red brown, damp to moist, very stiff, with coarse sand, little gravel (CH)							PZ installed Screen 35.5'-45.5'
				ST-1	5.0 - 7.0	1.0		--	
378.8	16.0			ST-2	15.0 - 17.0	1.0		--	
		Lean Clay, brown gray, damp to moist, very stiff, with coarse sand, trace gravel, mottled (CL)							
				ST-3	25.0 - 27.0	1.7		--	
363.7	31.1	Silty Sand With Gravel, brown, wet, medium dense, (SM)							
				ST-4	35.0 - 37.0	1.7		--	

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-58 A** Total Depth 47.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
354.8	40.0	Silty Sand With Gravel, brown, wet, medium dense, (SM) *(Continued)*							
347.8	47.0	Clayey Sand With Gravel, dark gray brown to gray brown, wet, medium dense, mottled (SC)		ST-5	45.0 - 47.0	1.2		--	
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-59** Total Depth 35.0 ft
County	Stewart, TN	Surface Elevation	383.0 ft
Project Type	HSA 4.25	Date Started	7/25/09 Completed 7/25/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	Dry Date/Time 7/25/09
Logged By	D. Chapman	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
383.0	0.0	Top of Hole							
		Fat Clay, trace to little sand and fine gravel, red brown, moist, soft to very stiff (CH)		SPT-1	0.0 - 1.5	1.3	5-5-7	16	
				SPT-2	1.5 - 3.0	1.0	5-10-8	37	
				SPT-3	3.0 - 4.5	1.3	6-6-8	43	
				SPT-4	4.5 - 6.0	1.2	5-7-9	45	
				SPT-5	6.0 - 7.5	1.3	15-8-9	33	
				SPT-6	7.5 - 9.0	1.5	15-9-9	30	
				SPT-7	9.0 - 10.5	1.3	5-8-8	36	
				SPT-8	10.5 - 12.0	0.8	8-15-22	37	
				SPT-9	12.0 - 13.5	1.5	7-4-3	52	
				SPT-10	13.5 - 15.0	1.3	1-1-3	52	
				SPT-11	15.0 - 16.5	1.3	1-3-5	46	
				SPT-12	16.5 - 18.0	1.5	2-2-3	61	
				SPT-13	18.0 - 19.5	0.5	3-2-3	45	
				SPT-14	19.5 - 21.0	1.3	1-2-2	51	
				SPT-15	21.0 - 22.5	1.1	3-2-4	49	
				SPT-16	23.5 - 25.0	1.4	1-1-2	31	
				SPT-17	26.0 - 27.5	1.3	3-2-2	32	
				SPT-18	28.5 - 30.0	0.7	3-3-6	30	
				SPT-19	31.0 - 32.5	1.3	2-3-2	28	Drilled in bedrock from 33' - 35'
350.0	33.0	Augered (rock)							
348.0	35.0			SPT-20	33.5 - 35.0	0.0	50+/0.0	--	
		Auger Refusal / Bottom of Hole							Bottom of boring. Auger refusal in limestone

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-59**
		Total Depth	35.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Top of Rock = 33.0 Elevation (350.0)							bedrock.

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-59 A** — Total Depth 38.0 ft
County	Stewart, TN	Surface Elevation	383.0 ft
Project Type	HSA 4.25	Date Started	7/24/09 — Completed 7/25/09
Supervisor	D. Rogers — Driller Jerry Huntoon	Depth to Water	Dry — Date/Time 7/25/09
Logged By	D. Chapman	Depth to Water	N/A — Date/Time N/A

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
383.0	0.0	Top of Hole							
		Fat Clay, trace to little sand and fine gravel, red brown, moist, soft to very stiff (CH)							Drilled 0 - 35' with 4 1/4" inside diameter hollow stem augers. Drilled from 0 - 36' with a 4 1/8" diameter roller cone. Cored 36' - 38' with a 3" OD barrel. Broke trough into soil or weathered shale seam. Recovered 0.5' of limestone.
350.0	33.0								
		Augered (Rock)							
347.0	36.0								Began Core

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-59 A**
		Total Depth	38.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
345.0	38.0	Limestone, light gray, hard, with clay seams *(Continued)*		25	2.0	0.5	25	38.0	
				SPT-1	38.0 - 38.0	0.0	50+/0"	--	Spoon refusal/bottom of boring. No piezometer installed.
		Bottom of Hole Top of Rock = 33.0 Elevation (350.0)							

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-59 B**	Total Depth	46.3 ft
County	Stewart, TN	Surface Elevation	383.0 ft		
Project Type	HSA 4.25	Date Started	8/5/09	Completed	8/5/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	Dry	Date/Time	8/5/09
Logged By	M. Wethington	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
383.0	0.0	Top of Hole							
		Fat Clay, trace to little sand and fine gravel, red brown, moist, soft to very stiff (CH)							
350.8	32.2								
350.2	32.8	Cobbles							
349.3	33.7	Soil, soft (Augered)							
349.0	34.0	Rock (Augered)							Began Core

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-59 B**	Total Depth	46.3 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Limestone, gray, hard, fractured and water stained, few clay seams *(Continued)*		30	3.0	1.1	37	37.0	
				0	3.6	2.6	72	40.6	
				67	0.6	0.6	100	41.2	
336.7	46.3			41	5.1	4.9	96	46.3	

Bottom of Hole

Top of Rock = 33.7
Elevation (349.3)

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-60** Total Depth 43.6 ft
County	Stewart, TN	Surface Elevation	395.1 ft
Project Type	HSA 3.25	Date Started	7/26/09 Completed 7/26/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	Dry Date/Time 7/26/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.1	0.0	Top of Hole							
394.6	0.5	Crushed Stone		SPT-1	0.0 - 1.5	0.4	13-10-14	17	
		Sandy Fat Clay, red brown, damp to moist, very stiff, some gravel, some sand (CH)		SPT-2	1.5 - 3.0		10-10-10	13	
				SPT-3	3.0 - 4.5	0.6	5-5-5	22	
				SPT-4	4.5 - 6.0	1.1	7-5-8	22	
				SPT-5	6.0 - 7.5	1.4	4-6-9	26	
				SPT-6	7.5 - 9.0	1.3	5-4-11	25	
				SPT-7	9.0 - 10.5	1.5	8-9-8	26	
				SPT-8	10.5 - 12.0	1.0	3-4-7	24	
				SPT-9	12.0 - 13.5	1.2	2-5-10	22	
				SPT-10	13.5 - 15.0	1.2	4-8-11	24	
378.6	16.5			SPT-11	15.0 - 16.5	1.1	3-3-25	31	
		Fat Clay, red brown with gray, damp to moist, very stiff, trace gravel, trace sand, mottled (CH)		SPT-12	16.5 - 18.0	1.5	16-16-17	36	
				SPT-13	18.0 - 19.5	1.5	6-11-13	33	
				SPT-14	19.5 - 21.0	1.5	6-7-11	28	
				SPT-15	21.0 - 22.5	1.5	6-15-25	32	
				SPT-16	22.5 - 24.0	1.5	8-11-13	42	
				SPT-17	24.0 - 25.5	1.5	8-12-13	38	few sandy lenses
				SPT-18	25.5 - 27.0	1.4	5-8-12	40	
				SPT-19	27.0 - 28.5	1.5	7-11-14	41	
				SPT-20	28.5 - 30.0	1.5	8-9-10	40	
				SPT-21	30.0 - 31.5	1.5	4-7-9	33	
362.1	33.0			SPT-22	31.5 - 33.0	1.5	8-14-10	39	
		Fat Clay, brown with gray, damp to moist, very stiff, trace gravel, little sand, mottled (CH)		SPT-23	33.0 - 34.5	1.5	5-8-9	41	
				SPT-24	34.5 - 36.0	0.6	4-8-11	34	more sand and gravel 33-35

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Project Number	175539016	Location	Cumberland Fossil		
Project Name	Ash Ponds	Boring No.	**B-60**	Total Depth	43.6 ft

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fat Clay, brown with gray, damp to moist, very stiff, trace gravel, little sand, mottled (CH) *(Continued)*		SPT-25	36.0 - 37.5	1.5	13-18-19	24	
				SPT-26	37.5 - 39.0	1.5	7-10-12	23	
				SPT-27	39.0 - 40.5	1.5	5-8-12	30	
				SPT-28	40.5 - 42.0	1.5	5-7-10	26	
351.6	43.5			SPT-29	42.0 - 43.5	1.5	14-14-17	28	43-43.1 wet sand lens
351.5	43.6	Limestone, light gray		SPT-30	43.5 - 43.6	0.1	50+	3	

Auger Refusal /
Bottom of Hole

Top of Rock = 43.5
Elevation (351.6)

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-61** Total Depth 22.5 ft
County	Stewart, TN	Surface Elevation	387.2 ft
Project Type	HSA 4.25	Date Started	7/26/09 Completed 7/26/09
Supervisor	D. Rogers Driller Jerry Huntoon	Depth to Water	Dry Date/Time 7/26/09
Logged By	D. Chapman	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
387.2	0.0	Top of Hole						
383.2	4.0	Crushed stone (road bed)						
		Fat Clay, red brown, moist, medium stiff to very stiff (CH	SPT-1	4.5 - 6.0	0.3	37-7-8	2	
			SPT-2	6.0 - 7.5	0.7	4-4-5	23	Little sand to fine gravel
			SPT-3	7.5 - 9.0	0.0	4-6-6	--	
			SPT-4	9.0 - 10.5	1.5	3-6-9	24	Trace sand to fine gravel
			SPT-5	10.5 - 12.0	0.3	3-5-11	24	
			SPT-6	12.0 - 13.5	1.1	2-3-8	23	
			SPT-7	13.5 - 15.0	0.8	1-3-6	38	
			SPT-8	15.0 - 16.5	1.0	2-4-6	23	
			SPT-9	16.5 - 18.0	1.3	2-2-8	27	
			SPT-10	18.0 - 19.5	1.5	1-3-3	34	
			SPT-11	19.5 - 21.0	1.3	1-2-3	34	
364.7	22.5		SPT-12	21.0 - 22.5	1.2	2-3-50+/0.2	23	
		Auger Refusal / Bottom of Hole Top of Rock = 22.5 Elevation (364.7)	SPT-13	22.5 - 22.5	0.0	50+/0	32	Crushed limestone in spoon tip Bottom of boring. Auger refusal on apparent limestone bedrock. No piezometer installed.

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-62** Total Depth 32.0 ft
County	Stewart, TN	Surface Elevation	394.8 ft
Project Type	HSA 3.25	Date Started	7/25/09 Completed 7/25/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	Dry Date/Time 7/25/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.8	0.0	Top of Hole							
394.4	0.4	Crushed Stone		SPT-1	0.0 - 1.5	0.9	7-5-7	21	
		Fat Clay, red brown, damp to moist, very stiff, some coarse sand, some gravel (CH)		SPT-2	1.5 - 3.0	1.1	7-7-9	17	
				SPT-3	3.0 - 4.5	0.9	3-3-5	21	
				SPT-4	4.5 - 6.0	1.5	3-4-11	19	
				SPT-5	6.0 - 7.5	1.5	12-10-9	22	sand lens 7.2-7.3
				SPT-6	7.5 - 9.0	0.1	5-5-7	24	
				SPT-7	9.0 - 10.5	1.5	2-5-8	22	
				SPT-8	10.5 - 12.0	0.8	3-6-5	18	
				SPT-9	12.0 - 13.5	0.0	4-9-15	--	stone block spoon
				SPT-10	13.5 - 15.0	0.3	7-9-16	25	
				SPT-11	15.0 - 16.5	0.9	4-9-13	25	
				SPT-12	16.5 - 18.0	0.6	12-14-10	18	gravelly 16-18
				SPT-13	18.0 - 19.5	1.0	4-11-40	15	
				SPT-14	19.5 - 19.9	0.3	50+	11	boulder 19-22
				SPT-15	21.0 - 21.4	0.3	50+	14	
371.3	23.5			SPT-16	22.5 - 23.8	1.5	33-35-50+	42	Began Core
		Limestone, gray, hard, close fracture spacing, zones water stainec			2.4	0.0	0	26.0	
362.8	32.0				6.0	6.0	100	32.0	

Bottom of Hole

Top of Rock = 23.5
Elevation (371.3)

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Stantec

SUBSURFACE LOG

Project Number	175539016	Location	Cumberland Fossil
Project Name	Ash Ponds	Boring No.	**B-62 A** — Total Depth: 10.0 ft
County	Stewart, TN	Surface Elevation	394.8 ft
Project Type	HSA 4.25	Date Started	8/7/09 — Completed: 8/7/09
Supervisor	D. Rogers — Driller: J. Felts	Depth to Water	Dry — Date/Time: 8/7/09
Logged By	Z. Massey	Depth to Water	N/A — Date/Time: N/A

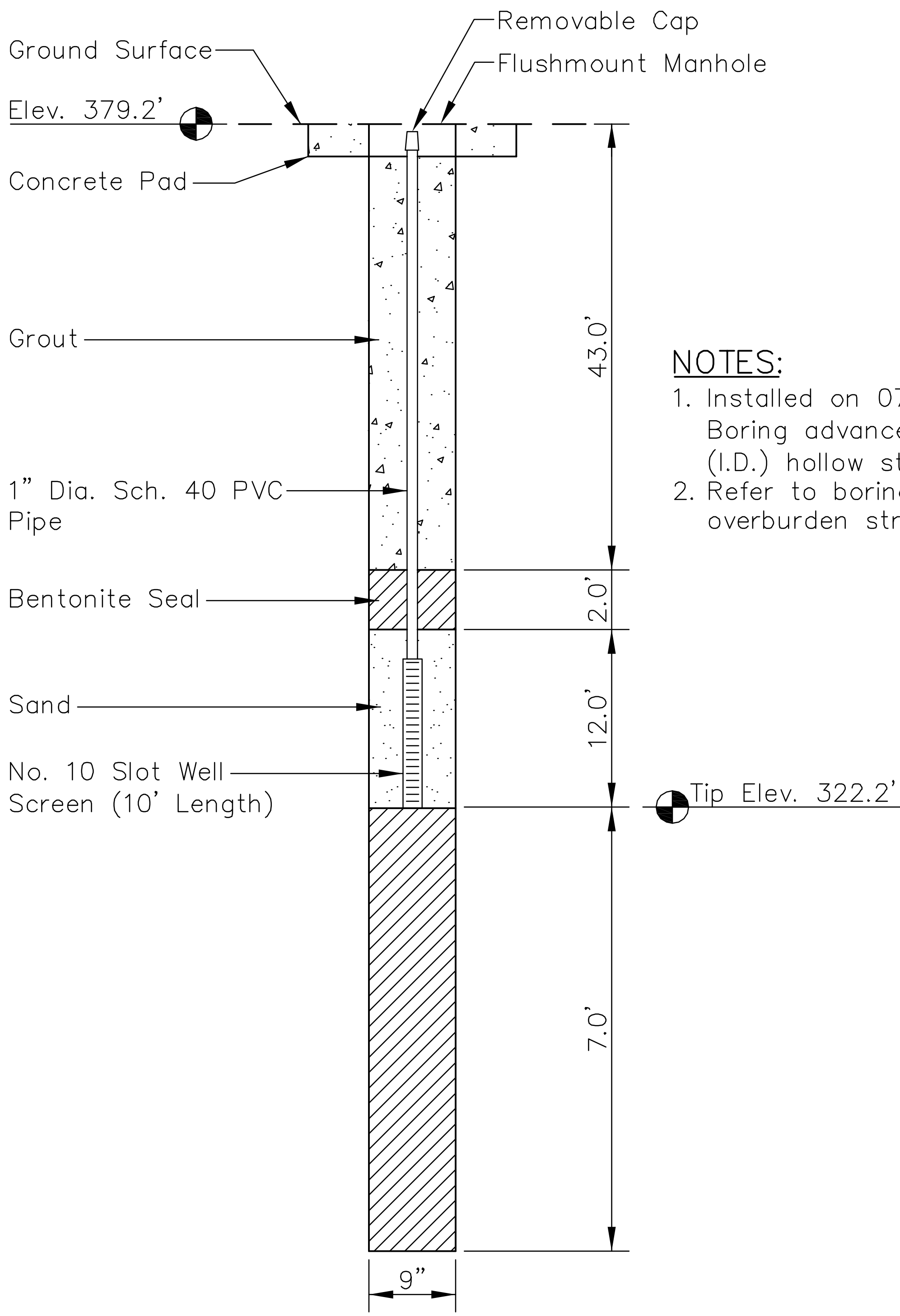
Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
394.8	0.0	Top of Hole							
394.4	0.4	Crushed Stone							
384.8	10.0	Fat Clay, red brown, damp to moist, very stiff, some coarse sand, some gravel (CH)		BAG-1	5.0 - 10.0			--	

No Refusal /
Bottom of Hole

STANTEC/FMSM_LEGACY 175539016-CUF.GPJ FMSM-GRAPHIC LOG.GDT 1/27/10

Appendix D

Instrumentation Logs



NOTES:

1. Installed on 07/22/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 01/12/2010 USER: JENNINGS, MATTHEW
V:\1755\ACTIVE\175539016\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39016B-CUF-3XX-PZ49.DWG

LOCATION:

Northing: 732,928.84
Easting: 1,509,696.68
Ground Elevation: 379.2'

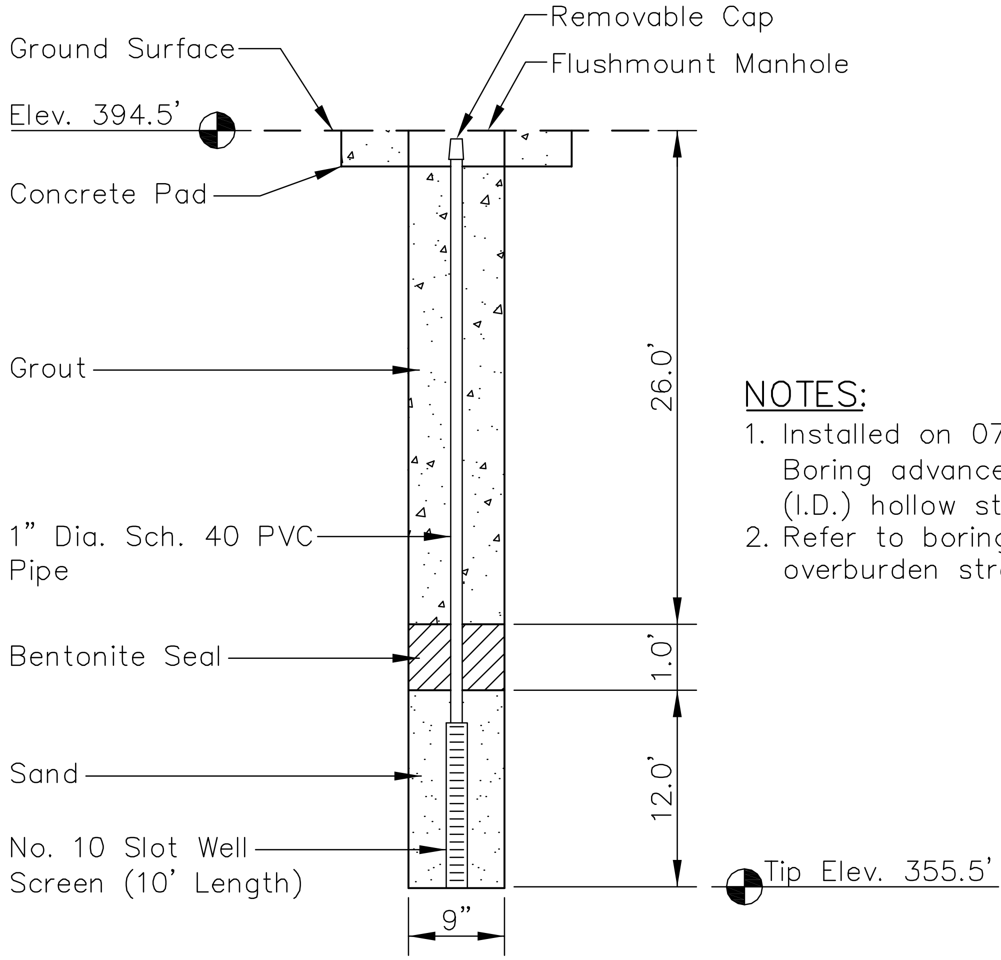
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

PIEZOMETER STN-49
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	MJ	DATE	JAN., 2010	REVISED		SHEET
CHECKED BY	DBR	PROJ. NO.	175539016	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 07/28/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 01/12/2010 USER: JENNINGS, MATTHEW
V: \1755\ACTIVE\175539016\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39016B-CUF-3XX-PZ50B.DWG

LOCATION:

Northing: 732,875.32
Easting: 1,509,728.33
Ground Elevation: 394.5'

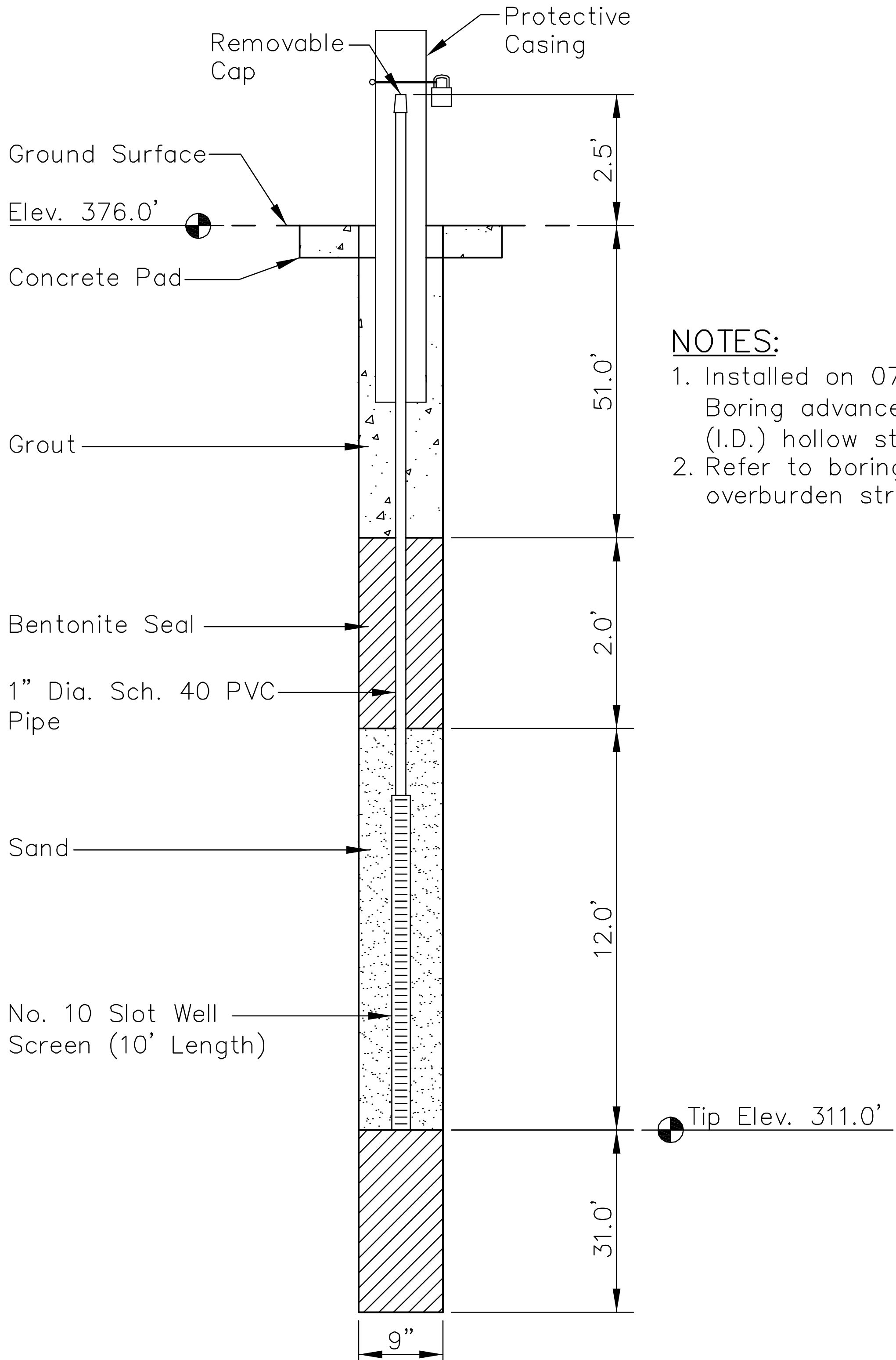
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

PIEZOMETER STN-50B
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

				REVISED		SHEET
DRAWN BY	MJ	DATE	JAN., 2010			
CHECKED BY	DBR	PROJ. NO.	175539016	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 07/24/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 01/12/2010 USER: JENNINGS, MATTHEW
V:\1755\ACTIVE\175539016\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39016B-CUF-3XX-PZ53A.DWG

LOCATION:

Northing: 733,456.66
Easting: 1,510,307.93
Ground Elevation: 376.0'

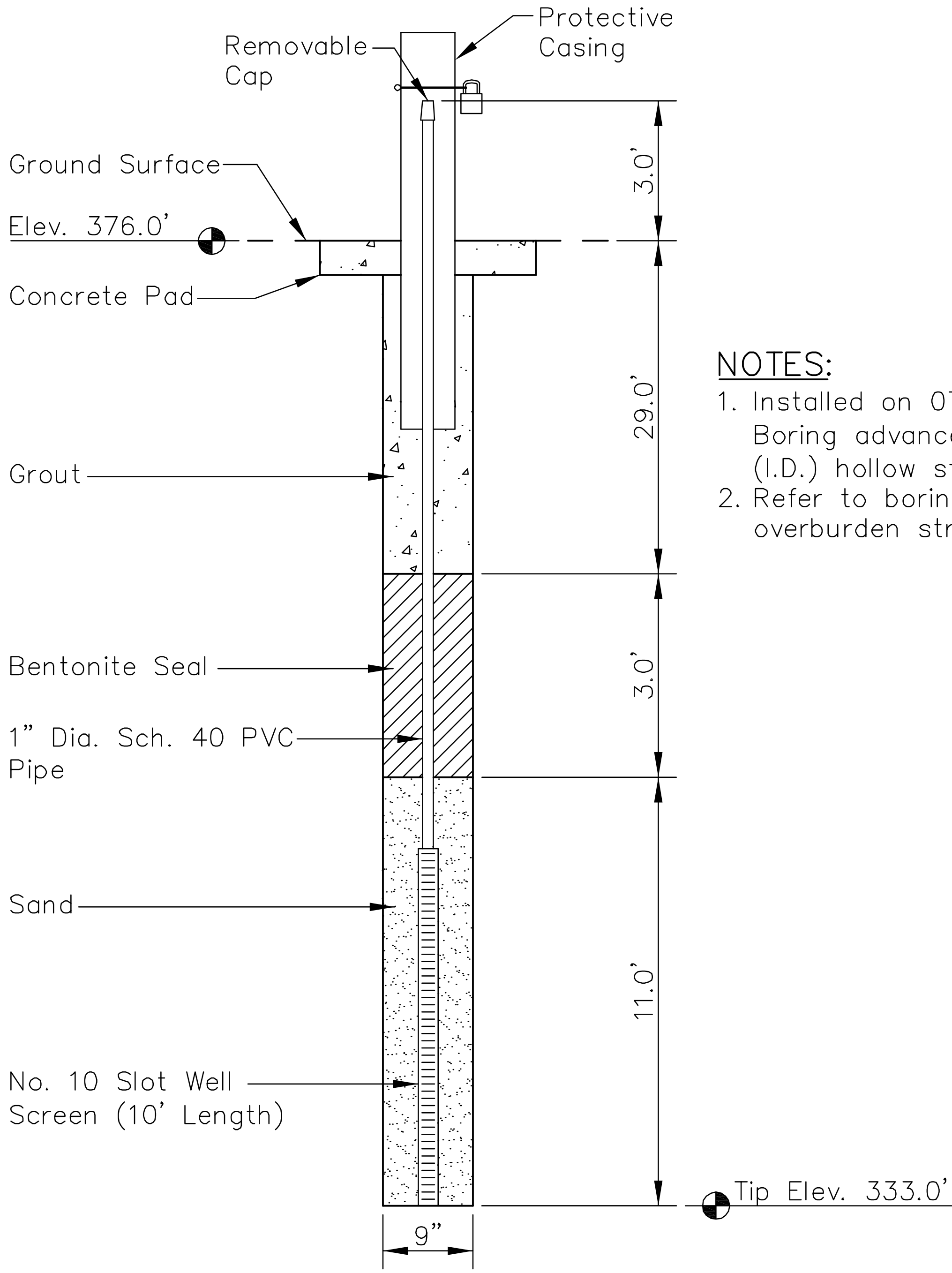
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

PIEZOMETER STN-53A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	CW	DATE	JAN., 2010	REVISED		SHEET
CHECKED BY	DBR	PROJ. NO.	175539016	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 07/24/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 01/12/2010 USER: JENNINGS, MATTHEW
V:\1755\ACTIVE\175539016\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39016B-CUF-3XX-PZ53B.DWG

LOCATION:

Northing: 733,450.68
Easting: 1,510,313.25
Ground Elevation: 376.0'

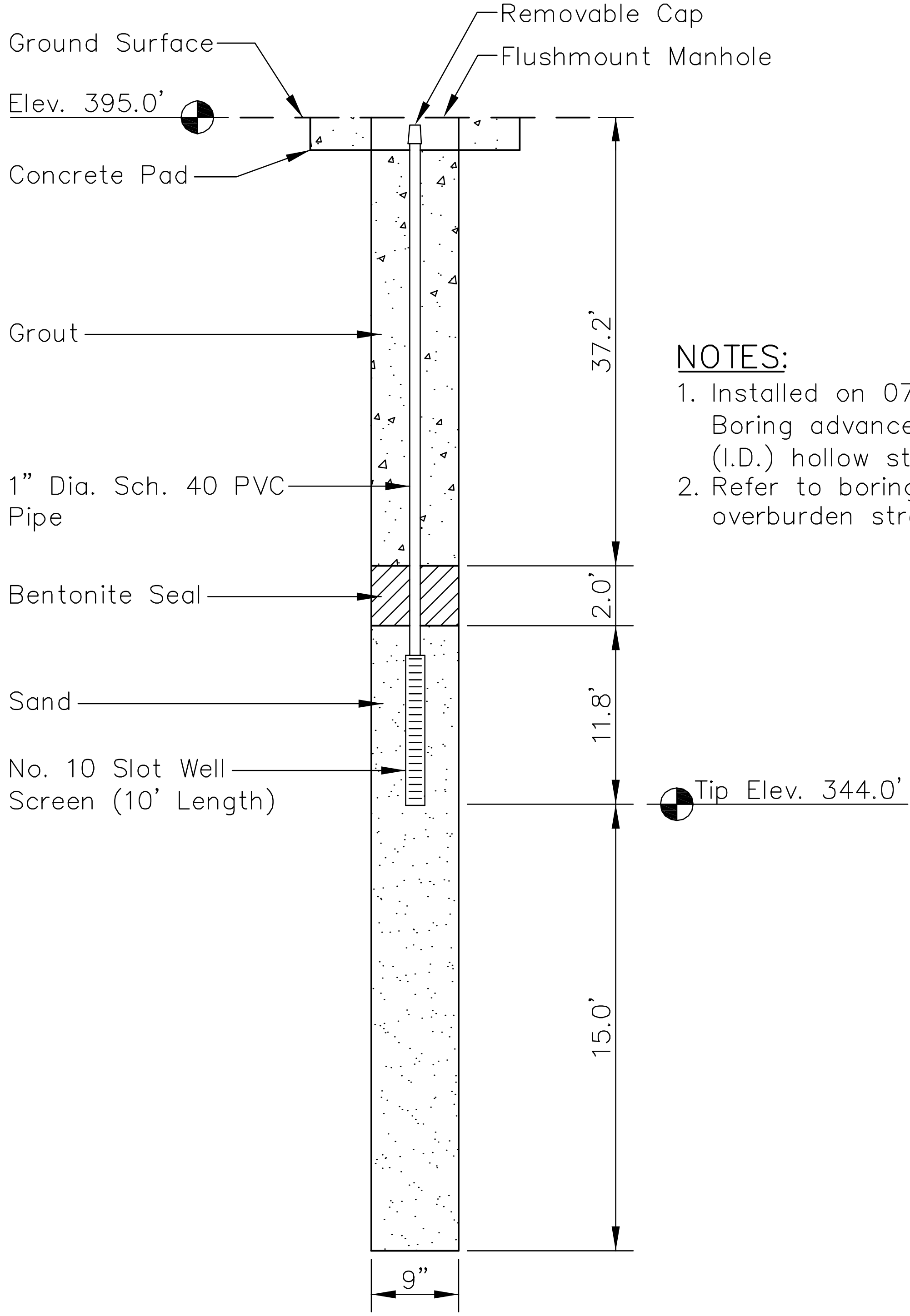
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

PIEZOMETER STN-53B
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	MJ	DATE	JAN., 2010	REVISED		SHEET
CHECKED BY	DBR	PROJ. NO.	175539016	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 07/29/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 01/12/2010 USER: JENNINGS, MATTHEW
V: \1755\ACTIVE\175539016\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39016B-CUF-3XX-PZ54A.DWG

LOCATION:

Northing: 733,417.30
Easting: 1,510,371.66
Ground Elevation: 395.0'

Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

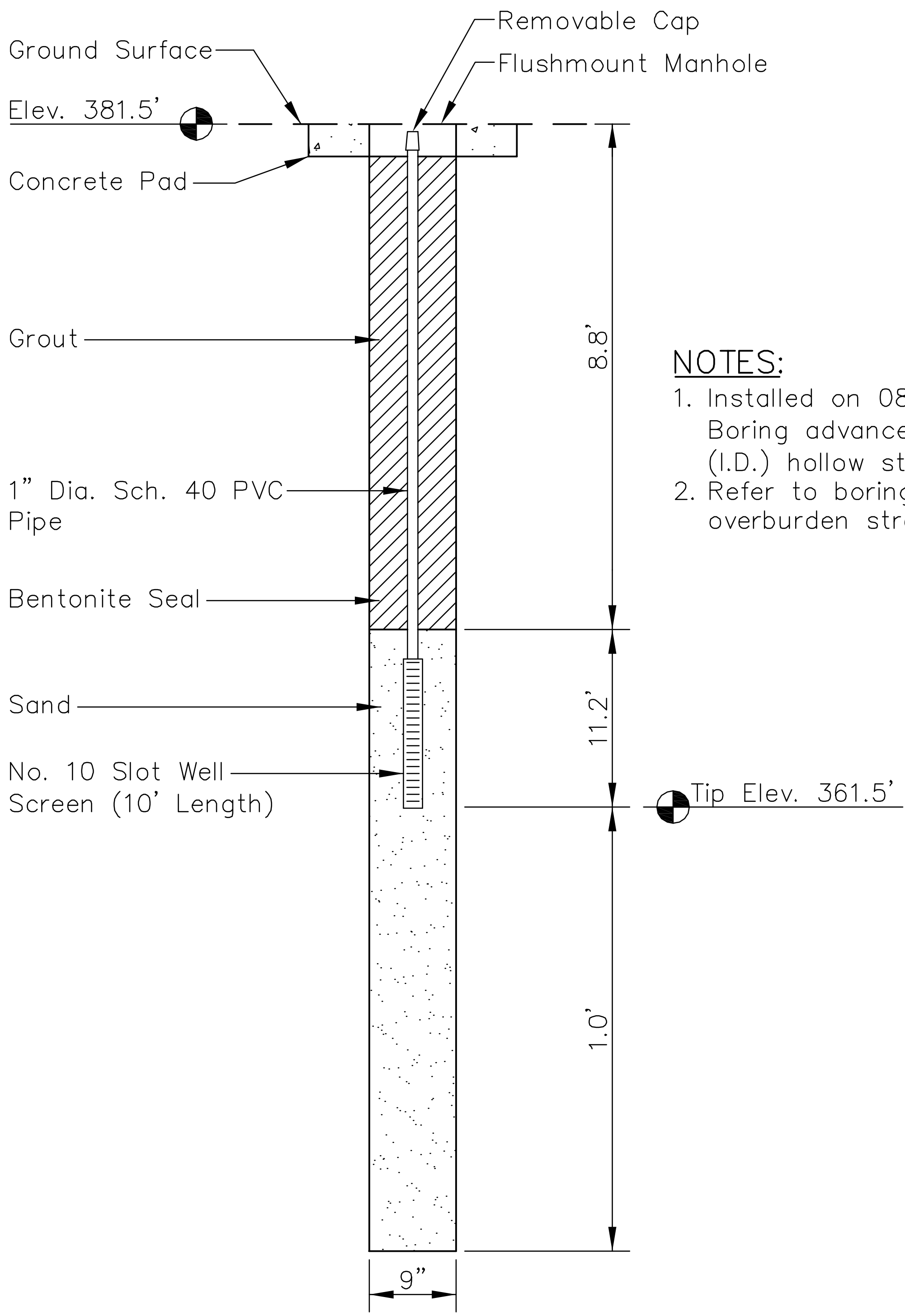
PIEZOMETER STN-54A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200

www.stantec.com

DRAWN BY	MJ	DATE	JAN., 2010	REVISED		SHEET
CHECKED BY	DBR	PROJ. NO.	175539016	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 08/06/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 01/12/2010 USER: JENNINGS, MATTHEW
V:\1755\ACTIVE\175539016\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39016B-CUF-3XX-PZ57A.DWG

LOCATION:

Northing: 733,368.89
Easting: 1,511,362.59
Ground Elevation: 381.5'

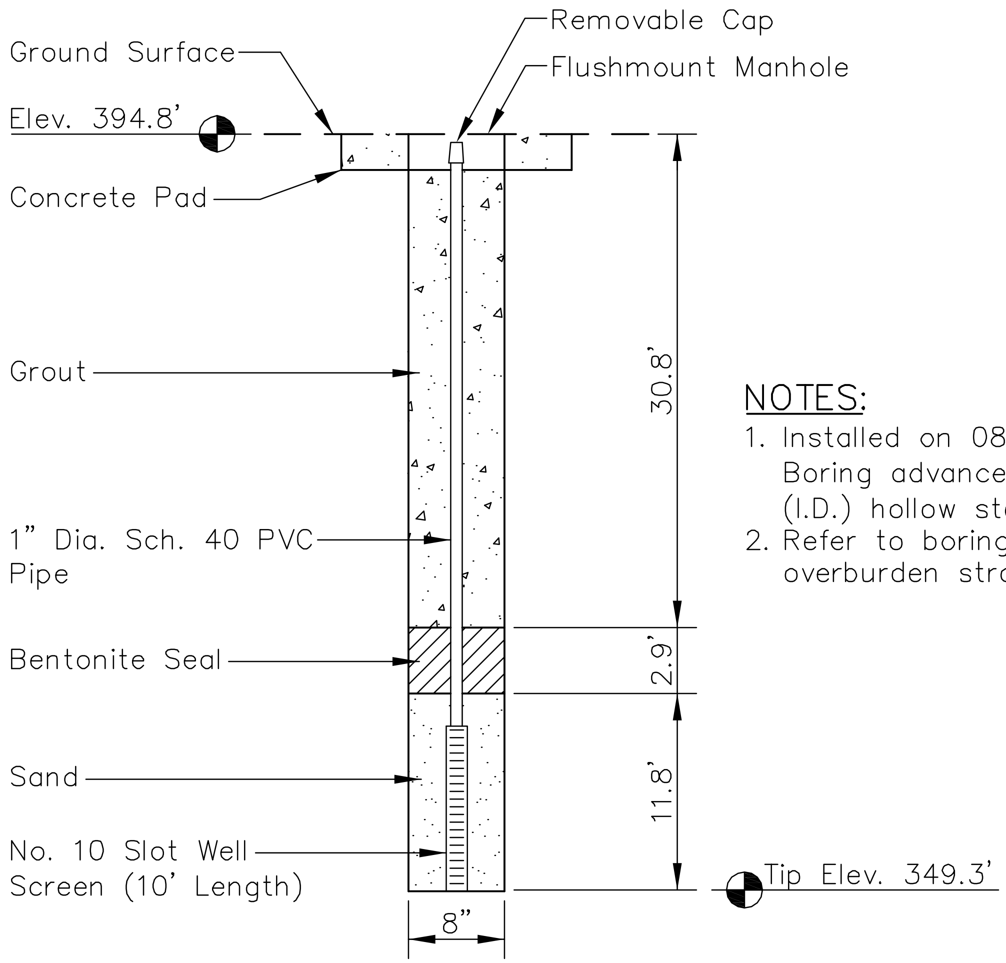
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

PIEZOMETER STN-57A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	MJ	DATE	JAN., 2010	REVISED		SHEET
CHECKED BY	DBR	PROJ. NO.	175539016	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 08/04/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

Northing: 733,308.70
Easting: 1,511,311.51
Ground Elevation: 394.8'

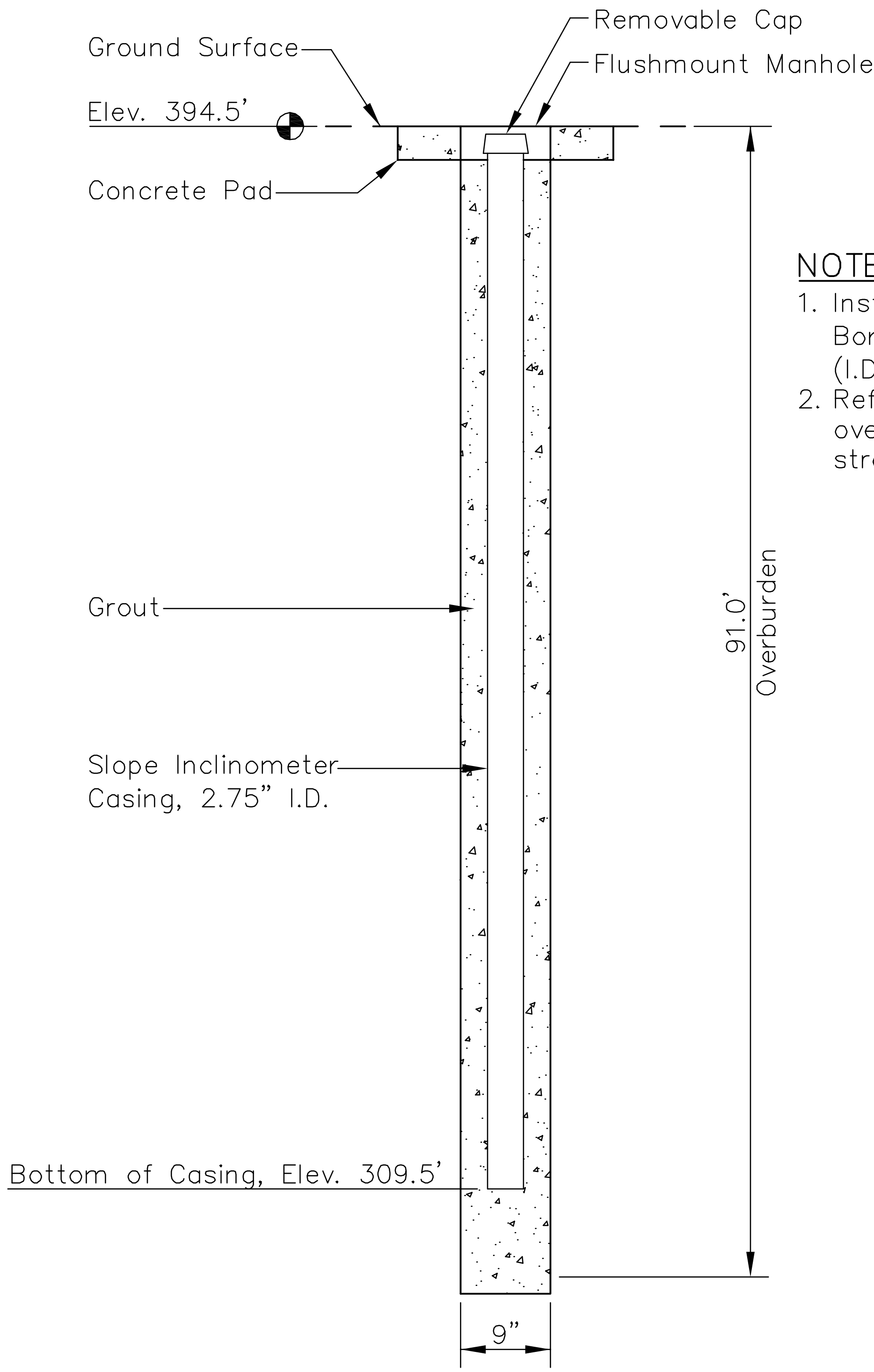
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

PIEZOMETER STN-58A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	MJ	DATE	JAN., 2010	REVISED		SHEET
CHECKED BY	DBR	PROJ. NO.	175539016	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:
1. Installed on 07/27/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 01/12/2010 USER: JENNINGS, MATTHEW
V:\1755\ACTIVE\175539016\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39016B-CUF-3XX-SI50A.DWG

LOCATION:
Northing: 732,869.56
Easting: 1,509,722.77
Ground Elevation: 394.5'

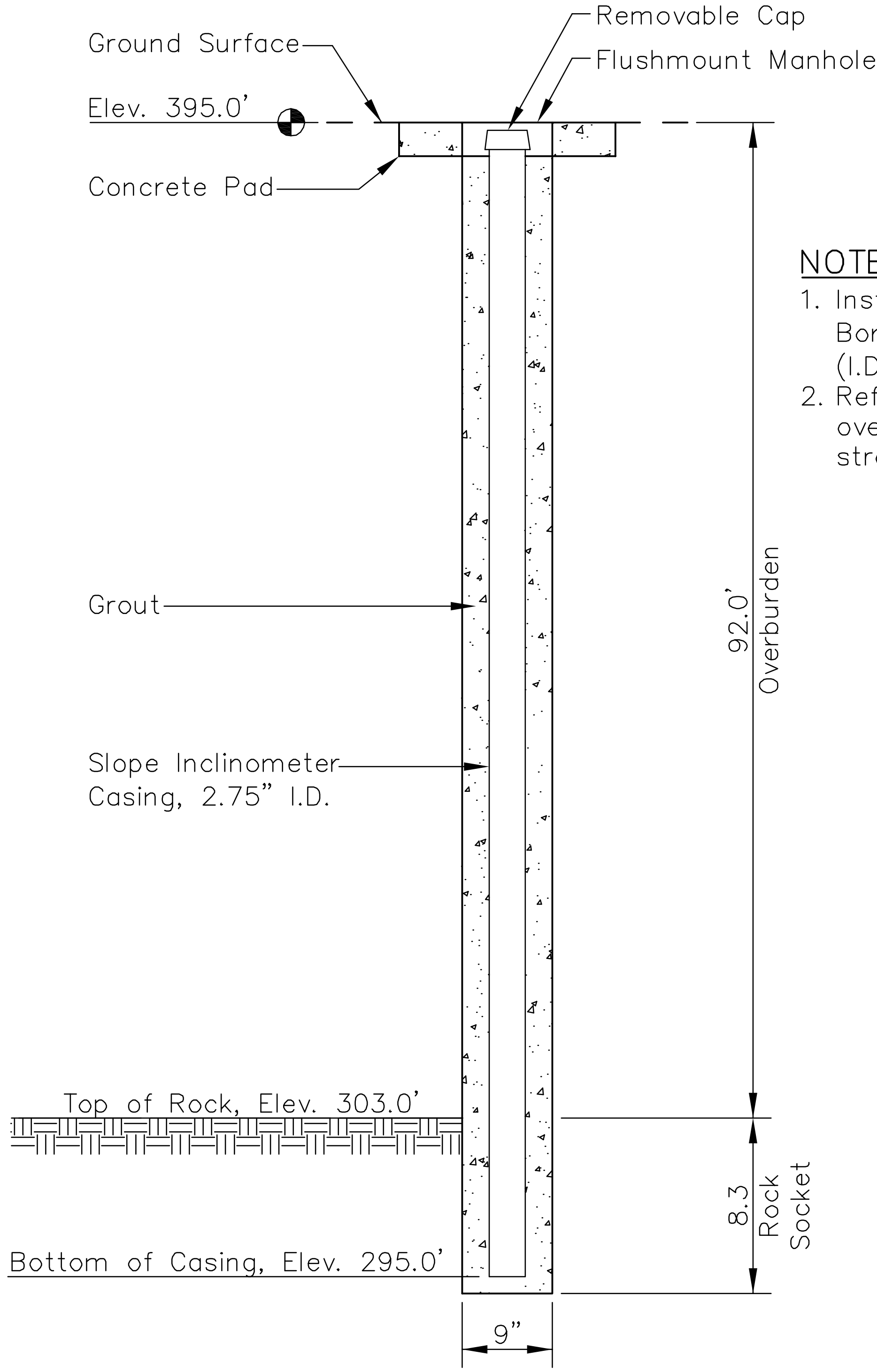
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

SLOPE INCLINOMETER STN-50A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	MJ	DATE	JAN., 2010	REVISED		SHEET
CHECKED BY	DBR	PROJ. NO.	175539016	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 07/28/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 01/12/2010 USER: JENNINGS, MATTHEW
V:\1755\ACTIVE\175539016\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39016B-CUF-3XX-SI54.DWG

LOCATION:

Northing: 733,419.93
Easting: 1,510,374.67
Ground Elevation: 395.0'

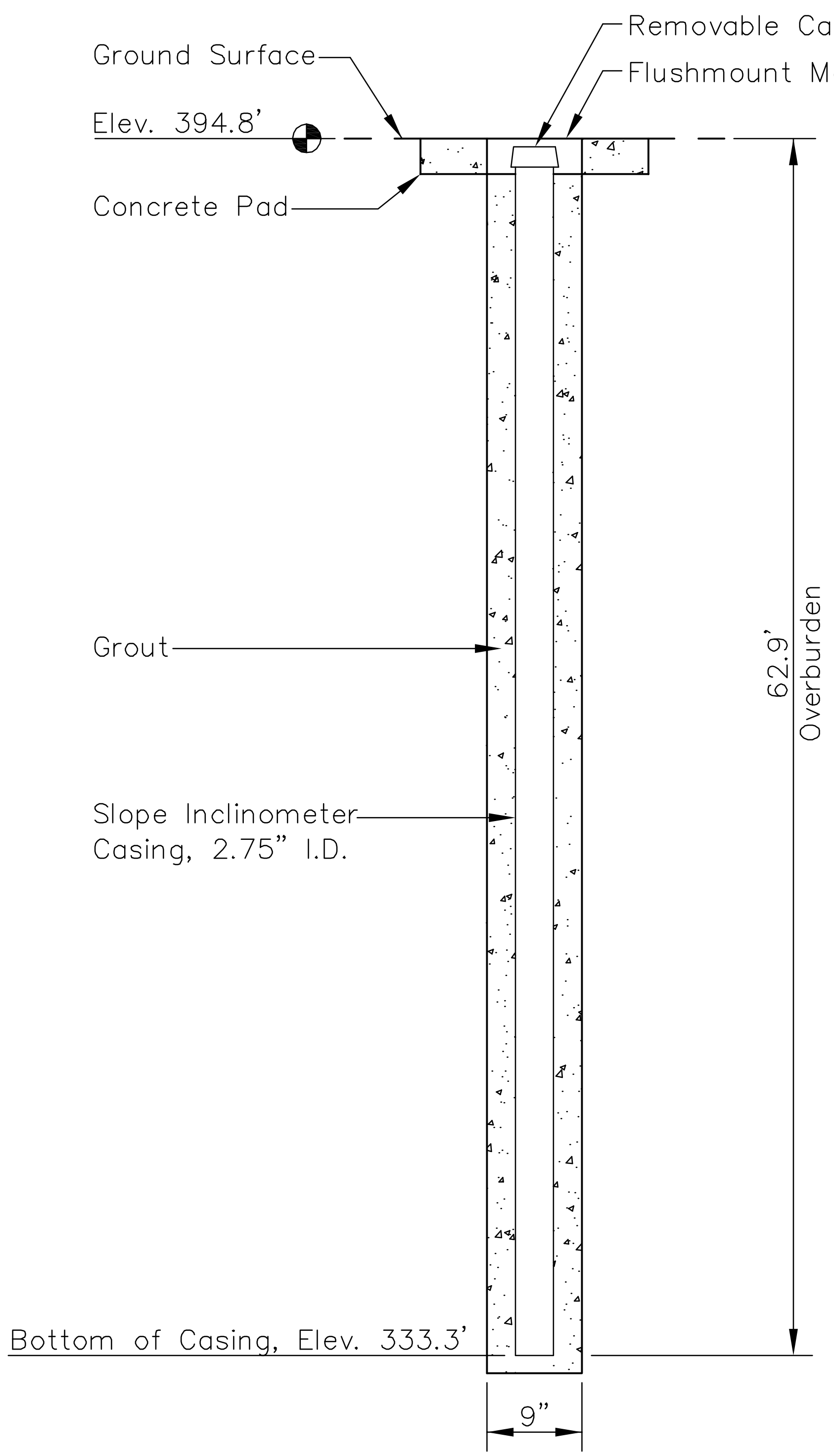
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

SLOPE INCLINOMETER STN-54
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	MJ	**DATE**	JAN., 2010	**REVISED**		**SHEET**
CHECKED BY	DBR	**PROJ. NO.**	175539016	1.	3.	**1 OF 1**
CHECKED BY	SAH	**SCALE**	NTS	2.	4.	



NOTES:

1. Installed on 07/28/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 01/12/2010 USER: JENNINGS, MATTHEW
V:\1755\ACTIVE\175539016\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39016B-CUF-3XX-SI58.DWG

LOCATION:

Northing: 733,305.89
Easting: 1,511,314.36
Ground Elevation: 394.8'

Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

SLOPE INCLINOMETER STN-58
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

				REVISED		SHEET
DRAWN BY	MJ	DATE	JAN., 2010			
CHECKED BY	DBR	PROJ. NO.	175539016	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	

Appendix E

Instrumentation Monitoring Results

PIEZOMETER
CUF: Main Ashpond
815 Cumberland City Rd
Cumberland City,TN
175539016

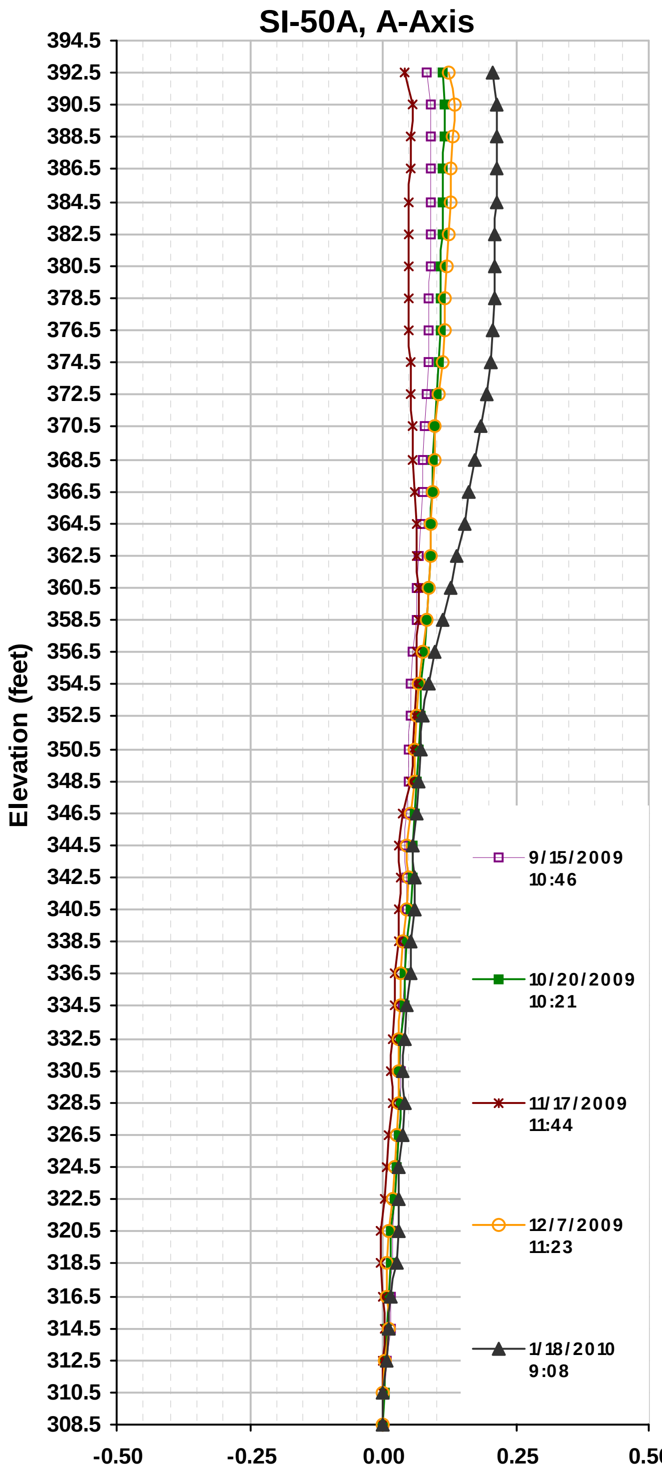
	8/19/2009				9/15/2009				10/20/2009			
Location	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)
49	379.2	0.0	11.9	367.3	379.2	0.0	13.1	366.1	379.2	0.0	11.8	367.4
50B	394.5	0.0	14.3	380.2	394.5	0.0	17.7	376.9	394.5	0.0	14.4	380.1
53A	376.0	2.5	13.2	365.3	376.0	2.5	14.1	364.4	376.0	2.5	13.5	365.0
53B	376.0	3.0	14.0	365.0	376.0	3.0	14.8	364.2	376.0	3.0	15.0	364.0
54A	395.0	0.0	21.3	373.7	395.0	0.0	22.0	373.0	395.0	0.0	22.5	372.5
57A	381.5	0.0	12.0	369.5	381.5	0.0	11.0	370.5	381.5	0.0	10.4	371.1
58A	394.8	0.0	24.1	370.7	394.8	0.0	23.9	370.9	394.8	0.0	23.4	371.4

* Change from previous reading

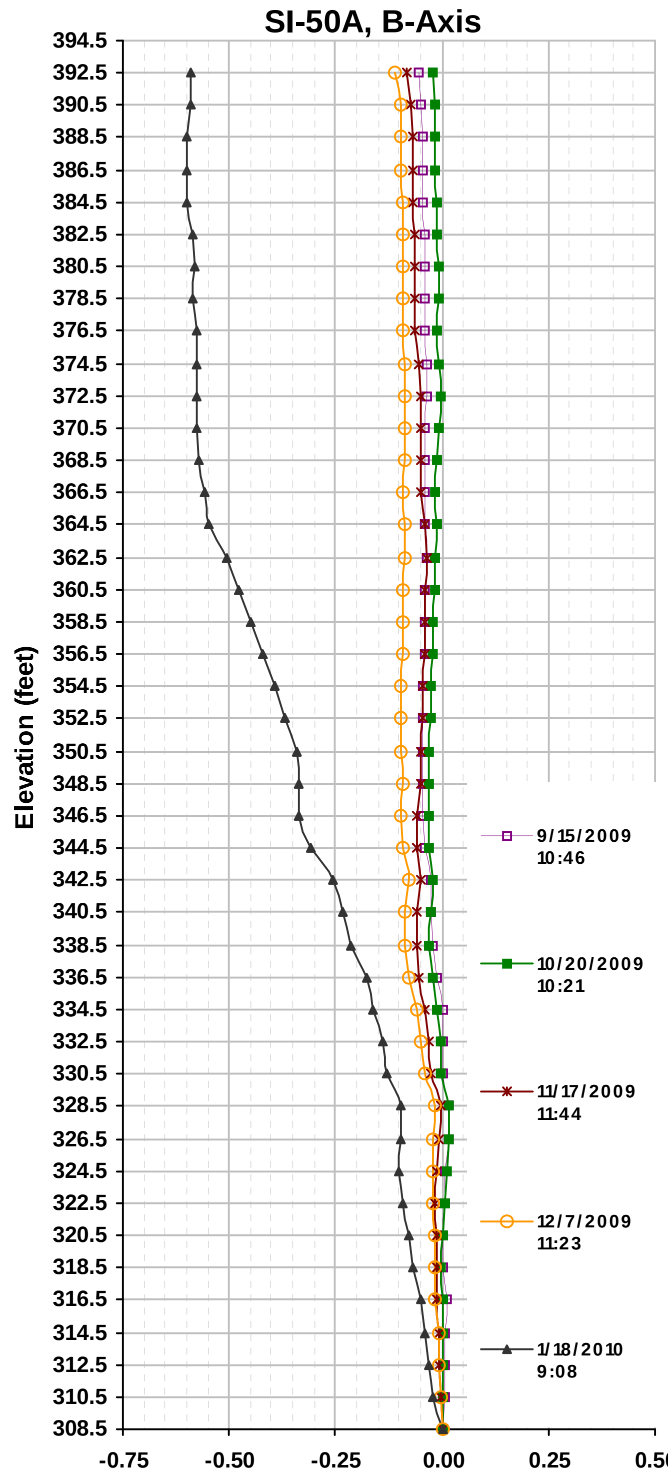
PIEZOMETER
CUF: Main Ashpond
815 Cumberland City Rd
Cumberland City,TN
175539016

	11/17/2009				12/7/2009				1/18/2010			
Location	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)	Surface Elevation (ft)	Stickup (ft)	Depth Measurement(ft)	Water Elevation (ft)
49	379.2	0.0	12.4	366.8	379.2	0.0	12.9	366.3	379.2	0.0	13.1	366.1
50B	394.5	0.0	14.5	380.0	394.5	0.0	15.0	379.5	394.5	0.0	15.1	379.4
53A	376.0	2.5	14.3	364.2	376.0	2.5	14.9	363.6	376.0	2.5	15.0	363.5
53B	376.0	3.0	13.9	365.1	376.0	3.0	15.3	363.7	376.0	3.0	15.4	363.6
54A	395.0	0.0	21.9	373.1	395.0	0.0	22.4	372.6	395.0	0.0	21.1	373.9
57A	381.5	0.0	10.7	370.8	381.5	0.0	11.5	370.0	381.5	0.0	11.8	369.7
58A	394.8	0.0	24.1	370.7	394.8	0.0	24.6	370.2	394.8	0.0	24.9	369.9

* Change from previous reading

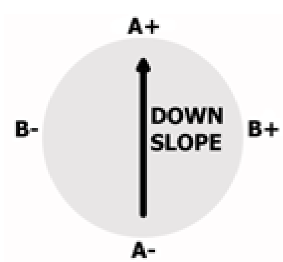


Cumulative Displacement (in) from 8/19/2009



Cumulative Displacement (in) from 8/19/2009

Stantec



Cumberland Fossil Plant

Cumberland City, TN
175539016
1/18/2010

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 9/15/2009 10:46:55 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:44 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-109	115	-0.1344	-117	119	-0.1416	-0.0072	0.0840
4	-55	60	-0.0690	-57	59	-0.0696	-0.0006	0.0912
6	9	-5	0.0084	8	-6	0.0084	0.0000	0.0918
8	142	-134	0.1656	142	-137	0.1674	0.0018	0.0918
10	298	-297	0.3570	298	-299	0.3582	0.0012	0.0900
12	511	-506	0.6102	509	-508	0.6102	0.0000	0.0888
14	704	-699	0.8418	703	-702	0.8430	0.0012	0.0888
16	867	-864	1.0386	865	-865	1.0380	-0.0006	0.0876
18	1154	-1152	1.3836	1153	-1154	1.3842	0.0006	0.0882
20	1551	-1551	1.8612	1553	-1556	1.8654	0.0042	0.0876
22	1962	-1962	2.3544	1966	-1966	2.3592	0.0048	0.0834
24	2332	-2330	2.7972	2334	-2334	2.8008	0.0036	0.0786
26	2694	-2693	3.2322	2695	-2694	3.2334	0.0012	0.0750
28	3029	-3023	3.6312	3028	-3026	3.6324	0.0012	0.0738
30	3291	-3290	3.9486	3293	-3294	3.9522	0.0036	0.0726
32	3512	-3514	4.2156	3515	-3517	4.2192	0.0036	0.0690
34	3692	-3691	4.4298	3694	-3694	4.4328	0.0030	0.0654
36	3857	-3855	4.6272	3861	-3859	4.6320	0.0048	0.0624
38	3973	-3972	4.7670	3976	-3975	4.7706	0.0036	0.0576
40	4004	-4004	4.8048	4006	-4007	4.8078	0.0030	0.0540
42	3954	-3952	4.7436	3955	-3953	4.7448	0.0012	0.0510
44	3805	-3800	4.5630	3805	-3802	4.5642	0.0012	0.0498
46	3504	-3505	4.2054	3507	-3506	4.2078	0.0024	0.0486
48	3279	-3274	3.9318	3281	-3277	3.9348	0.0030	0.0462
50	3239	-3243	3.8892	3239	-3239	3.8868	-0.0024	0.0432
52	3245	-3247	3.8952	3247	-3247	3.8964	0.0012	0.0456
54	3286	-3283	3.9414	3287	-3286	3.9438	0.0024	0.0444
56	3282	-3288	3.9420	3285	-3289	3.9444	0.0024	0.0420
58	3300	-3301	3.9606	3299	-3303	3.9612	0.0006	0.0396
60	3314	-3317	3.9786	3317	-3323	3.9840	0.0054	0.0390
62	3287	-3290	3.9462	3288	-3291	3.9474	0.0012	0.0336
64	3191	-3198	3.8334	3192	-3197	3.8334	0.0000	0.0324
66	3089	-3095	3.7104	3093	-3094	3.7122	0.0018	0.0324
68	3055	-3051	3.6636	3058	-3055	3.6678	0.0042	0.0306
70	3020	-3026	3.6276	3022	-3029	3.6306	0.0030	0.0264
72	2934	-2941	3.5250	2937	-2943	3.5280	0.0030	0.0234
74	2849	-2858	3.4242	2850	-2860	3.4260	0.0018	0.0204
76	3027	-3033	3.6360	3031	-3034	3.6390	0.0030	0.0186
78	3081	-3082	3.6978	3083	-3084	3.7002	0.0024	0.0156

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 9/15/2009 10:46:55 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:44 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	3177	-3173	3.8100	3182	-3176	3.8148	0.0048	0.0132
82	3235	-3242	3.8862	3238	-3245	3.8898	0.0036	0.0084
84	3274	-3275	3.9294	3278	-3279	3.9342	0.0048	0.0048
86	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 10/20/2009 10:21:38 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:44 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-109	115	-0.1344	-110	122	-0.1392	-0.0048	0.1134
4	-55	60	-0.0690	-51	62	-0.0678	0.0012	0.1182
6	9	-5	0.0084	14	-4	0.0108	0.0024	0.1170
8	142	-134	0.1656	147	-133	0.1680	0.0024	0.1146
10	298	-297	0.3570	303	-293	0.3576	0.0006	0.1122
12	511	-506	0.6102	515	-504	0.6114	0.0012	0.1116
14	704	-699	0.8418	710	-697	0.8442	0.0024	0.1104
16	867	-864	1.0386	873	-859	1.0392	0.0006	0.1080
18	1154	-1152	1.3836	1161	-1147	1.3848	0.0012	0.1074
20	1551	-1551	1.8612	1558	-1550	1.8648	0.0036	0.1062
22	1962	-1962	2.3544	1971	-1959	2.3580	0.0036	0.1026
24	2332	-2330	2.7972	2339	-2330	2.8014	0.0042	0.0990
26	2694	-2693	3.2322	2699	-2690	3.2334	0.0012	0.0948
28	3029	-3023	3.6312	3034	-3021	3.6330	0.0018	0.0936
30	3291	-3290	3.9486	3296	-3288	3.9504	0.0018	0.0918
32	3512	-3514	4.2156	3521	-3512	4.2198	0.0042	0.0900
34	3692	-3691	4.4298	3698	-3691	4.4334	0.0036	0.0858
36	3857	-3855	4.6272	3866	-3854	4.6320	0.0048	0.0822
38	3973	-3972	4.7670	3982	-3970	4.7712	0.0042	0.0774
40	4004	-4004	4.8048	4011	-4003	4.8084	0.0036	0.0732
42	3954	-3952	4.7436	3962	-3950	4.7472	0.0036	0.0696
44	3805	-3800	4.5630	3811	-3797	4.5648	0.0018	0.0660
46	3504	-3505	4.2054	3510	-3505	4.2090	0.0036	0.0642
48	3279	-3274	3.9318	3289	-3274	3.9378	0.0060	0.0606
50	3239	-3243	3.8892	3245	-3235	3.8880	-0.0012	0.0546
52	3245	-3247	3.8952	3255	-3243	3.8988	0.0036	0.0558
54	3286	-3283	3.9414	3297	-3283	3.9480	0.0066	0.0522
56	3282	-3288	3.9420	3291	-3284	3.9450	0.0030	0.0456
58	3300	-3301	3.9606	3309	-3296	3.9630	0.0024	0.0426
60	3314	-3317	3.9786	3323	-3319	3.9852	0.0066	0.0402
62	3287	-3290	3.9462	3297	-3283	3.9480	0.0018	0.0336
64	3191	-3198	3.8334	3199	-3188	3.8322	-0.0012	0.0318
66	3089	-3095	3.7104	3099	-3093	3.7152	0.0048	0.0330
68	3055	-3051	3.6636	3063	-3047	3.6660	0.0024	0.0282
70	3020	-3026	3.6276	3027	-3025	3.6312	0.0036	0.0258
72	2934	-2941	3.5250	2943	-2941	3.5304	0.0054	0.0222
74	2849	-2858	3.4242	2855	-2857	3.4272	0.0030	0.0168
76	3027	-3033	3.6360	3037	-3029	3.6396	0.0036	0.0138
78	3081	-3082	3.6978	3089	-3076	3.6990	0.0012	0.0102

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 10/20/2009 10:21:38 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:45 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	3177	-3173	3.8100	3186	-3170	3.8136	0.0036	0.0090
82	3235	-3242	3.8862	3243	-3239	3.8892	0.0030	0.0054
84	3274	-3275	3.9294	3282	-3271	3.9318	0.0024	0.0024
86	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 11/17/2009 11:44:50 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:45 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-109	115	-0.1344	-118	125	-0.1458	-0.0114	0.0432
4	-55	60	-0.0690	-54	60	-0.0684	0.0006	0.0546
6	9	-5	0.0084	10	-6	0.0096	0.0012	0.0540
8	142	-134	0.1656	145	-135	0.1680	0.0024	0.0528
10	298	-297	0.3570	300	-297	0.3582	0.0012	0.0504
12	511	-506	0.6102	511	-506	0.6102	0.0000	0.0492
14	704	-699	0.8418	706	-699	0.8430	0.0012	0.0492
16	867	-864	1.0386	867	-862	1.0374	-0.0012	0.0480
18	1154	-1152	1.3836	1154	-1145	1.3794	-0.0042	0.0492
20	1551	-1551	1.8612	1553	-1549	1.8612	0.0000	0.0534
22	1962	-1962	2.3544	1964	-1958	2.3532	-0.0012	0.0534
24	2332	-2330	2.7972	2333	-2327	2.7960	-0.0012	0.0546
26	2694	-2693	3.2322	2693	-2687	3.2280	-0.0042	0.0558
28	3029	-3023	3.6312	3027	-3019	3.6276	-0.0036	0.0600
30	3291	-3290	3.9486	3291	-3287	3.9468	-0.0018	0.0636
32	3512	-3514	4.2156	3514	-3510	4.2144	-0.0012	0.0654
34	3692	-3691	4.4298	3693	-3690	4.4298	0.0000	0.0666
36	3857	-3855	4.6272	3859	-3855	4.6284	0.0012	0.0666
38	3973	-3972	4.7670	3976	-3972	4.7688	0.0018	0.0654
40	4004	-4004	4.8048	4010	-4006	4.8096	0.0048	0.0636
42	3954	-3952	4.7436	3959	-3951	4.7460	0.0024	0.0588
44	3805	-3800	4.5630	3810	-3803	4.5678	0.0048	0.0564
46	3504	-3505	4.2054	3515	-3518	4.2198	0.0144	0.0516
48	3279	-3274	3.9318	3286	-3278	3.9384	0.0066	0.0372
50	3239	-3243	3.8892	3242	-3237	3.8874	-0.0018	0.0306
52	3245	-3247	3.8952	3250	-3244	3.8964	0.0012	0.0324
54	3286	-3283	3.9414	3291	-3283	3.9444	0.0030	0.0312
56	3282	-3288	3.9420	3292	-3287	3.9474	0.0054	0.0282
58	3300	-3301	3.9606	3303	-3297	3.9600	-0.0006	0.0228
60	3314	-3317	3.9786	3319	-3317	3.9816	0.0030	0.0234
62	3287	-3290	3.9462	3294	-3289	3.9498	0.0036	0.0204
64	3191	-3198	3.8334	3198	-3190	3.8328	-0.0006	0.0168
66	3089	-3095	3.7104	3099	-3098	3.7182	0.0078	0.0174
68	3055	-3051	3.6636	3058	-3049	3.6642	0.0006	0.0096
70	3020	-3026	3.6276	3026	-3028	3.6324	0.0048	0.0090
72	2934	-2941	3.5250	2942	-2945	3.5322	0.0072	0.0042
74	2849	-2858	3.4242	2850	-2858	3.4248	0.0006	-0.0030
76	3027	-3033	3.6360	3028	-3029	3.6342	-0.0018	-0.0036
78	3081	-3082	3.6978	3081	-3074	3.6930	-0.0048	-0.0018

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 11/17/2009 11:44:50 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:45 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	3177	-3173	3.8100	3181	-3173	3.8124	0.0024	0.0030
82	3235	-3242	3.8862	3238	-3239	3.8862	0.0000	0.0006
84	3274	-3275	3.9294	3277	-3273	3.9300	0.0006	0.0006
86	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 12/7/2009 11:23:30 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:45 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-109	115	-0.1344	-118	124	-0.1452	-0.0108	0.1230
4	-55	60	-0.0690	-53	58	-0.0666	0.0024	0.1338
6	9	-5	0.0084	11	-6	0.0102	0.0018	0.1314
8	142	-134	0.1656	146	-136	0.1692	0.0036	0.1296
10	298	-297	0.3570	301	-299	0.3600	0.0030	0.1260
12	511	-506	0.6102	515	-507	0.6132	0.0030	0.1230
14	704	-699	0.8418	709	-701	0.8460	0.0042	0.1200
16	867	-864	1.0386	870	-862	1.0392	0.0006	0.1158
18	1154	-1152	1.3836	1157	-1151	1.3848	0.0012	0.1152
20	1551	-1551	1.8612	1560	-1556	1.8696	0.0084	0.1140
22	1962	-1962	2.3544	1970	-1965	2.3610	0.0066	0.1056
24	2332	-2330	2.7972	2337	-2330	2.8002	0.0030	0.0990
26	2694	-2693	3.2322	2700	-2692	3.2352	0.0030	0.0960
28	3029	-3023	3.6312	3034	-3021	3.6330	0.0018	0.0930
30	3291	-3290	3.9486	3295	-3290	3.9510	0.0024	0.0912
32	3512	-3514	4.2156	3520	-3513	4.2198	0.0042	0.0888
34	3692	-3691	4.4298	3698	-3691	4.4334	0.0036	0.0846
36	3857	-3855	4.6272	3865	-3857	4.6332	0.0060	0.0810
38	3973	-3972	4.7670	3982	-3973	4.7730	0.0060	0.0750
40	4004	-4004	4.8048	4010	-4006	4.8096	0.0048	0.0690
42	3954	-3952	4.7436	3959	-3952	4.7466	0.0030	0.0642
44	3805	-3800	4.5630	3810	-3799	4.5654	0.0024	0.0612
46	3504	-3505	4.2054	3510	-3510	4.2120	0.0066	0.0588
48	3279	-3274	3.9318	3287	-3277	3.9384	0.0066	0.0522
50	3239	-3243	3.8892	3243	-3236	3.8874	-0.0018	0.0456
52	3245	-3247	3.8952	3253	-3243	3.8976	0.0024	0.0474
54	3286	-3283	3.9414	3296	-3283	3.9474	0.0060	0.0450
56	3282	-3288	3.9420	3290	-3287	3.9462	0.0042	0.0390
58	3300	-3301	3.9606	3304	-3298	3.9612	0.0006	0.0348
60	3314	-3317	3.9786	3321	-3317	3.9828	0.0042	0.0342
62	3287	-3290	3.9462	3294	-3284	3.9468	0.0006	0.0300
64	3191	-3198	3.8334	3197	-3189	3.8316	-0.0018	0.0294
66	3089	-3095	3.7104	3097	-3097	3.7164	0.0060	0.0312
68	3055	-3051	3.6636	3060	-3049	3.6654	0.0018	0.0252
70	3020	-3026	3.6276	3026	-3028	3.6324	0.0048	0.0234
72	2934	-2941	3.5250	2942	-2945	3.5322	0.0072	0.0186
74	2849	-2858	3.4242	2853	-2858	3.4266	0.0024	0.0114
76	3027	-3033	3.6360	3033	-3027	3.6360	0.0000	0.0090
78	3081	-3082	3.6978	3087	-3075	3.6972	-0.0006	0.0090

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 12/7/2009 11:23:30 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:45 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	3177	-3173	3.8100	3185	-3173	3.8148	0.0048	0.0096
82	3235	-3242	3.8862	3242	-3241	3.8898	0.0036	0.0048
84	3274	-3275	3.9294	3277	-3274	3.9306	0.0012	0.0012
86	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 1/18/2010 9:08:14 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:45 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-109	115	-0.1344	-119	121	-0.1440	-0.0096	0.2064
4	-55	60	-0.0690	-56	59	-0.0690	0.0000	0.2160
6	9	-5	0.0084	10	-7	0.0102	0.0018	0.2160
8	142	-134	0.1656	141	-137	0.1668	0.0012	0.2142
10	298	-297	0.3570	300	-298	0.3588	0.0018	0.2130
12	511	-506	0.6102	511	-506	0.6102	0.0000	0.2112
14	704	-699	0.8418	705	-701	0.8436	0.0018	0.2112
16	867	-864	1.0386	870	-865	1.0410	0.0024	0.2094
18	1154	-1152	1.3836	1159	-1153	1.3872	0.0036	0.2070
20	1551	-1551	1.8612	1560	-1558	1.8708	0.0096	0.2034
22	1962	-1962	2.3544	1973	-1969	2.3652	0.0108	0.1938
24	2332	-2330	2.7972	2341	-2337	2.8068	0.0096	0.1830
26	2694	-2693	3.2322	2705	-2700	3.2430	0.0108	0.1734
28	3029	-3023	3.6312	3036	-3030	3.6396	0.0084	0.1626
30	3291	-3290	3.9486	3305	-3301	3.9636	0.0150	0.1542
32	3512	-3514	4.2156	3526	-3522	4.2288	0.0132	0.1392
34	3692	-3691	4.4298	3706	-3699	4.4430	0.0132	0.1260
36	3857	-3855	4.6272	3871	-3865	4.6416	0.0144	0.1128
38	3973	-3972	4.7670	3987	-3980	4.7802	0.0132	0.0984
40	4004	-4004	4.8048	4014	-4011	4.8150	0.0102	0.0852
42	3954	-3952	4.7436	3958	-3956	4.7484	0.0048	0.0750
44	3805	-3800	4.5630	3806	-3806	4.5672	0.0042	0.0702
46	3504	-3505	4.2054	3508	-3505	4.2078	0.0024	0.0660
48	3279	-3274	3.9318	3282	-3281	3.9378	0.0060	0.0636
50	3239	-3243	3.8892	3240	-3238	3.8868	-0.0024	0.0576
52	3245	-3247	3.8952	3247	-3246	3.8958	0.0006	0.0600
54	3286	-3283	3.9414	3291	-3292	3.9498	0.0084	0.0594
56	3282	-3288	3.9420	3285	-3285	3.9420	0.0000	0.0510
58	3300	-3301	3.9606	3306	-3305	3.9666	0.0060	0.0510
60	3314	-3317	3.9786	3318	-3320	3.9828	0.0042	0.0450
62	3287	-3290	3.9462	3291	-3293	3.9504	0.0042	0.0408
64	3191	-3198	3.8334	3191	-3190	3.8286	-0.0048	0.0366
66	3089	-3095	3.7104	3097	-3095	3.7152	0.0048	0.0414
68	3055	-3051	3.6636	3059	-3057	3.6696	0.0060	0.0366
70	3020	-3026	3.6276	3022	-3023	3.6270	-0.0006	0.0306
72	2934	-2941	3.5250	2940	-2938	3.5268	0.0018	0.0312
74	2849	-2858	3.4242	2857	-2855	3.4272	0.0030	0.0294
76	3027	-3033	3.6360	3037	-3039	3.6456	0.0096	0.0264
78	3081	-3082	3.6978	3086	-3084	3.7020	0.0042	0.0168

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 1/18/2010 9:08:14 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:45 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	3177	-3173	3.8100	3182	-3178	3.8160	0.0060	0.0126
82	3235	-3242	3.8862	3246	-3240	3.8916	0.0054	0.0066
84	3274	-3275	3.9294	3276	-3275	3.9306	0.0012	0.0012
86	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 9/15/2009 10:46:55 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:53 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	3	49	-0.0276	-2	57	-0.0354	-0.0078	-0.0564
4	9	50	-0.0246	9	54	-0.0270	-0.0024	-0.0486
6	41	14	0.0162	42	15	0.0162	0.0000	-0.0462
8	23	30	-0.0042	23	33	-0.0060	-0.0018	-0.0462
10	-18	61	-0.0474	-18	65	-0.0498	-0.0024	-0.0444
12	-55	107	-0.0972	-53	111	-0.0984	-0.0012	-0.0420
14	-109	163	-0.1632	-108	167	-0.1650	-0.0018	-0.0408
16	-102	146	-0.1488	-101	146	-0.1482	0.0006	-0.0390
18	-115	161	-0.1656	-115	166	-0.1686	-0.0030	-0.0396
20	-38	70	-0.0648	-35	72	-0.0642	0.0006	-0.0366
22	118	-78	0.1176	121	-77	0.1188	0.0012	-0.0372
24	238	-205	0.2658	241	-204	0.2670	0.0012	-0.0384
26	341	-303	0.3864	344	-301	0.3870	0.0006	-0.0396
28	413	-368	0.4686	412	-366	0.4668	-0.0018	-0.0402
30	429	-384	0.4878	430	-382	0.4872	-0.0006	-0.0384
32	411	-342	0.4518	416	-341	0.4542	0.0024	-0.0378
34	335	-262	0.3582	342	-258	0.3600	0.0018	-0.0402
36	255	-223	0.2868	257	-218	0.2850	-0.0018	-0.0420
38	143	-75	0.1308	149	-78	0.1362	0.0054	-0.0402
40	6	40	-0.0204	10	47	-0.0222	-0.0018	-0.0456
42	-122	190	-0.1872	-122	190	-0.1872	0.0000	-0.0438
44	-301	368	-0.4014	-305	359	-0.3984	0.0030	-0.0438
46	-511	527	-0.6228	-511	529	-0.6240	-0.0012	-0.0468
48	-658	722	-0.8280	-662	730	-0.8352	-0.0072	-0.0456
50	-793	841	-0.9804	-797	854	-0.9906	-0.0102	-0.0384
52	-909	968	-1.1262	-905	974	-1.1274	-0.0012	-0.0282
54	-1005	1075	-1.2480	-1006	1083	-1.2534	-0.0054	-0.0270
56	-1088	1107	-1.3170	-1087	1125	-1.3272	-0.0102	-0.0216
58	-1131	1180	-1.3866	-1140	1195	-1.4010	-0.0144	-0.0114
60	-1175	1225	-1.4400	-1175	1226	-1.4406	-0.0006	0.0030
62	-1208	1273	-1.4886	-1209	1273	-1.4892	-0.0006	0.0036
64	-1238	1265	-1.5018	-1241	1281	-1.5132	-0.0114	0.0042
66	-1271	1298	-1.5414	-1272	1300	-1.5432	-0.0018	0.0156
68	-1290	1363	-1.5918	-1290	1346	-1.5816	0.0102	0.0174
70	-1298	1344	-1.5852	-1296	1342	-1.5828	0.0024	0.0072
72	-1221	1253	-1.4844	-1221	1252	-1.4838	0.0006	0.0048
74	-1090	1122	-1.3272	-1089	1123	-1.3272	0.0000	0.0042
76	-1062	1093	-1.2930	-1065	1099	-1.2984	-0.0054	0.0042
78	-1165	1220	-1.4310	-1164	1218	-1.4292	0.0018	0.0096

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 9/15/2009 10:46:55 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:53 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-1138	1189	-1.3962	-1137	1189	-1.3956	0.0006	0.0078
82	-1095	1139	-1.3404	-1095	1136	-1.3386	0.0018	0.0072
84	-1039	1087	-1.2756	-1027	1090	-1.2702	0.0054	0.0054
86	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 10/20/2009 10:21:38 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:53 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	3	49	-0.0276	-4	54	-0.0348	-0.0072	-0.0234
4	9	50	-0.0246	8	51	-0.0258	-0.0012	-0.0162
6	41	14	0.0162	41	14	0.0162	0.0000	-0.0150
8	23	30	-0.0042	21	31	-0.0060	-0.0018	-0.0150
10	-18	61	-0.0474	-20	62	-0.0492	-0.0018	-0.0132
12	-55	107	-0.0972	-55	110	-0.0990	-0.0018	-0.0114
14	-109	163	-0.1632	-108	164	-0.1632	0.0000	-0.0096
16	-102	146	-0.1488	-102	144	-0.1476	0.0012	-0.0096
18	-115	161	-0.1656	-117	167	-0.1704	-0.0048	-0.0108
20	-38	70	-0.0648	-37	73	-0.0660	-0.0012	-0.0060
22	118	-78	0.1176	122	-78	0.1200	0.0024	-0.0048
24	238	-205	0.2658	241	-207	0.2688	0.0030	-0.0072
26	341	-303	0.3864	349	-305	0.3924	0.0060	-0.0102
28	413	-368	0.4686	410	-367	0.4662	-0.0024	-0.0162
30	429	-384	0.4878	430	-385	0.4890	0.0012	-0.0138
32	411	-342	0.4518	415	-341	0.4536	0.0018	-0.0150
34	335	-262	0.3582	341	-264	0.3630	0.0048	-0.0168
36	255	-223	0.2868	259	-217	0.2856	-0.0012	-0.0216
38	143	-75	0.1308	151	-78	0.1374	0.0066	-0.0204
40	6	40	-0.0204	11	43	-0.0192	0.0012	-0.0270
42	-122	190	-0.1872	-122	186	-0.1848	0.0024	-0.0282
44	-301	368	-0.4014	-305	367	-0.4032	-0.0018	-0.0306
46	-511	527	-0.6228	-511	523	-0.6204	0.0024	-0.0288
48	-658	722	-0.8280	-655	726	-0.8286	-0.0006	-0.0312
50	-793	841	-0.9804	-795	854	-0.9894	-0.0090	-0.0306
52	-909	968	-1.1262	-898	969	-1.1202	0.0060	-0.0216
54	-1005	1075	-1.2480	-1001	1077	-1.2468	0.0012	-0.0276
56	-1088	1107	-1.3170	-1085	1122	-1.3242	-0.0072	-0.0288
58	-1131	1180	-1.3866	-1131	1198	-1.3974	-0.0108	-0.0216
60	-1175	1225	-1.4400	-1177	1235	-1.4472	-0.0072	-0.0108
62	-1208	1273	-1.4886	-1206	1277	-1.4898	-0.0012	-0.0036
64	-1238	1265	-1.5018	-1239	1298	-1.5222	-0.0204	-0.0024
66	-1271	1298	-1.5414	-1270	1292	-1.5372	0.0042	0.0180
68	-1290	1363	-1.5918	-1286	1359	-1.5870	0.0048	0.0138
70	-1298	1344	-1.5852	-1297	1338	-1.5810	0.0042	0.0090
72	-1221	1253	-1.4844	-1222	1249	-1.4826	0.0018	0.0048
74	-1090	1122	-1.3272	-1090	1116	-1.3236	0.0036	0.0030
76	-1062	1093	-1.2930	-1063	1095	-1.2948	-0.0018	-0.0006
78	-1165	1220	-1.4310	-1166	1223	-1.4334	-0.0024	0.0012

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 10/20/2009 10:21:38 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:53 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-1138	1189	-1.3962	-1136	1187	-1.3938	0.0024	0.0036
82	-1095	1139	-1.3404	-1098	1139	-1.3422	-0.0018	0.0012
84	-1039	1087	-1.2756	-1029	1092	-1.2726	0.0030	0.0030
86	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 11/17/2009 11:44:50 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:53 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	3	49	-0.0276	-2	62	-0.0384	-0.0108	-0.0840
4	9	50	-0.0246	10	57	-0.0282	-0.0036	-0.0732
6	41	14	0.0162	43	19	0.0144	-0.0018	-0.0696
8	23	30	-0.0042	26	33	-0.0042	0.0000	-0.0678
10	-18	61	-0.0474	-16	67	-0.0498	-0.0024	-0.0678
12	-55	107	-0.0972	-51	114	-0.0990	-0.0018	-0.0654
14	-109	163	-0.1632	-103	169	-0.1632	0.0000	-0.0636
16	-102	146	-0.1488	-98	150	-0.1488	0.0000	-0.0636
18	-115	161	-0.1656	-118	174	-0.1752	-0.0096	-0.0636
20	-38	70	-0.0648	-37	79	-0.0696	-0.0048	-0.0540
22	118	-78	0.1176	123	-73	0.1176	0.0000	-0.0492
24	238	-205	0.2658	241	-200	0.2646	-0.0012	-0.0492
26	341	-303	0.3864	347	-299	0.3876	0.0012	-0.0480
28	413	-368	0.4686	407	-356	0.4578	-0.0108	-0.0492
30	429	-384	0.4878	434	-378	0.4872	-0.0006	-0.0384
32	411	-342	0.4518	417	-338	0.4530	0.0012	-0.0378
34	335	-262	0.3582	342	-258	0.3600	0.0018	-0.0390
36	255	-223	0.2868	261	-214	0.2850	-0.0018	-0.0408
38	143	-75	0.1308	155	-73	0.1368	0.0060	-0.0390
40	6	40	-0.0204	18	48	-0.0180	0.0024	-0.0450
42	-122	190	-0.1872	-120	188	-0.1848	0.0024	-0.0474
44	-301	368	-0.4014	-299	371	-0.4020	-0.0006	-0.0498
46	-511	527	-0.6228	-499	522	-0.6126	0.0102	-0.0492
48	-658	722	-0.8280	-651	727	-0.8268	0.0012	-0.0594
50	-793	841	-0.9804	-790	862	-0.9912	-0.0108	-0.0606
52	-909	968	-1.1262	-892	973	-1.1190	0.0072	-0.0498
54	-1005	1075	-1.2480	-995	1078	-1.2438	0.0042	-0.0570
56	-1088	1107	-1.3170	-1082	1128	-1.3260	-0.0090	-0.0612
58	-1131	1180	-1.3866	-1127	1205	-1.3992	-0.0126	-0.0522
60	-1175	1225	-1.4400	-1175	1241	-1.4496	-0.0096	-0.0396
62	-1208	1273	-1.4886	-1203	1283	-1.4916	-0.0030	-0.0300
64	-1238	1265	-1.5018	-1236	1306	-1.5252	-0.0234	-0.0270
66	-1271	1298	-1.5414	-1265	1295	-1.5360	0.0054	-0.0036
68	-1290	1363	-1.5918	-1286	1362	-1.5888	0.0030	-0.0090
70	-1298	1344	-1.5852	-1293	1343	-1.5816	0.0036	-0.0120
72	-1221	1253	-1.4844	-1221	1255	-1.4856	-0.0012	-0.0156
74	-1090	1122	-1.3272	-1090	1123	-1.3278	-0.0006	-0.0144
76	-1062	1093	-1.2930	-1055	1099	-1.2924	0.0006	-0.0138
78	-1165	1220	-1.4310	-1161	1235	-1.4376	-0.0066	-0.0144

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 11/17/2009 11:44:50 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:53 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-1138	1189	-1.3962	-1134	1194	-1.3968	-0.0006	-0.0078
82	-1095	1139	-1.3404	-1095	1149	-1.3464	-0.0060	-0.0072
84	-1039	1087	-1.2756	-1031	1097	-1.2768	-0.0012	-0.0012
86	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 12/7/2009 11:23:30 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:53 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	3	49	-0.0276	-3	62	-0.0390	-0.0114	-0.1092
4	9	50	-0.0246	11	56	-0.0270	-0.0024	-0.0978
6	41	14	0.0162	44	18	0.0156	-0.0006	-0.0954
8	23	30	-0.0042	25	33	-0.0048	-0.0006	-0.0948
10	-18	61	-0.0474	-17	64	-0.0486	-0.0012	-0.0942
12	-55	107	-0.0972	-51	114	-0.0990	-0.0018	-0.0930
14	-109	163	-0.1632	-105	167	-0.1632	0.0000	-0.0912
16	-102	146	-0.1488	-97	147	-0.1464	0.0024	-0.0912
18	-115	161	-0.1656	-115	173	-0.1728	-0.0072	-0.0936
20	-38	70	-0.0648	-34	76	-0.0660	-0.0012	-0.0864
22	118	-78	0.1176	123	-77	0.1200	0.0024	-0.0852
24	238	-205	0.2658	242	-203	0.2670	0.0012	-0.0876
26	341	-303	0.3864	352	-300	0.3912	0.0048	-0.0888
28	413	-368	0.4686	412	-362	0.4644	-0.0042	-0.0936
30	429	-384	0.4878	432	-381	0.4878	0.0000	-0.0894
32	411	-342	0.4518	416	-339	0.4530	0.0012	-0.0894
34	335	-262	0.3582	341	-259	0.3600	0.0018	-0.0906
36	255	-223	0.2868	262	-213	0.2850	-0.0018	-0.0924
38	143	-75	0.1308	152	-73	0.1350	0.0042	-0.0906
40	6	40	-0.0204	15	49	-0.0204	0.0000	-0.0948
42	-122	190	-0.1872	-121	191	-0.1872	0.0000	-0.0948
44	-301	368	-0.4014	-299	374	-0.4038	-0.0024	-0.0948
46	-511	527	-0.6228	-507	525	-0.6192	0.0036	-0.0924
48	-658	722	-0.8280	-654	730	-0.8304	-0.0024	-0.0960
50	-793	841	-0.9804	-795	865	-0.9960	-0.0156	-0.0936
52	-909	968	-1.1262	-890	975	-1.1190	0.0072	-0.0780
54	-1005	1075	-1.2480	-995	1083	-1.2468	0.0012	-0.0852
56	-1088	1107	-1.3170	-1083	1129	-1.3272	-0.0102	-0.0864
58	-1131	1180	-1.3866	-1133	1205	-1.4028	-0.0162	-0.0762
60	-1175	1225	-1.4400	-1176	1243	-1.4514	-0.0114	-0.0600
62	-1208	1273	-1.4886	-1208	1285	-1.4958	-0.0072	-0.0486
64	-1238	1265	-1.5018	-1238	1305	-1.5258	-0.0240	-0.0414
66	-1271	1298	-1.5414	-1269	1296	-1.5390	0.0024	-0.0174
68	-1290	1363	-1.5918	-1289	1362	-1.5906	0.0012	-0.0198
70	-1298	1344	-1.5852	-1297	1343	-1.5840	0.0012	-0.0210
72	-1221	1253	-1.4844	-1221	1259	-1.4880	-0.0036	-0.0222
74	-1090	1122	-1.3272	-1089	1122	-1.3266	0.0006	-0.0186
76	-1062	1093	-1.2930	-1061	1100	-1.2966	-0.0036	-0.0192
78	-1165	1220	-1.4310	-1162	1235	-1.4382	-0.0072	-0.0156

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 12/7/2009 11:23:30 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:53 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-1138	1189	-1.3962	-1137	1193	-1.3980	-0.0018	-0.0084
82	-1095	1139	-1.3404	-1096	1146	-1.3452	-0.0048	-0.0066
84	-1039	1087	-1.2756	-1034	1095	-1.2774	-0.0018	-0.0018
86	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

CURRENT SURVEY 1/18/2010 9:08:14 AM

INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:53 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	3	49	-0.0276	-41	11	-0.0312	-0.0036	-0.5916
4	9	50	-0.0246	-25	-2	-0.0138	0.0108	-0.5880
6	41	14	0.0162	-5	-33	0.0168	0.0006	-0.5988
8	23	30	-0.0042	-19	-9	-0.0060	-0.0018	-0.5994
10	-18	61	-0.0474	-54	42	-0.0576	-0.0102	-0.5976
12	-55	107	-0.0972	-99	77	-0.1056	-0.0084	-0.5874
14	-109	163	-0.1632	-145	115	-0.1560	0.0072	-0.5790
16	-102	146	-0.1488	-147	118	-0.1590	-0.0102	-0.5862
18	-115	161	-0.1656	-148	124	-0.1632	0.0024	-0.5760
20	-38	70	-0.0648	-55	55	-0.0660	-0.0012	-0.5784
22	118	-78	0.1176	92	-100	0.1152	-0.0024	-0.5772
24	238	-205	0.2658	210	-224	0.2604	-0.0054	-0.5748
26	341	-303	0.3864	306	-321	0.3762	-0.0102	-0.5694
28	413	-368	0.4686	362	-400	0.4572	-0.0114	-0.5592
30	429	-384	0.4878	366	-374	0.4440	-0.0438	-0.5478
32	411	-342	0.4518	350	-358	0.4248	-0.0270	-0.5040
34	335	-262	0.3582	264	-287	0.3306	-0.0276	-0.4770
36	255	-223	0.2868	201	-227	0.2568	-0.0300	-0.4494
38	143	-75	0.1308	77	-99	0.1056	-0.0252	-0.4194
40	6	40	-0.0204	-50	28	-0.0468	-0.0264	-0.3942
42	-122	190	-0.1872	-185	171	-0.2136	-0.0264	-0.3678
44	-301	368	-0.4014	-355	326	-0.4086	-0.0072	-0.3414
46	-511	527	-0.6228	-517	516	-0.6198	0.0030	-0.3342
48	-658	722	-0.8280	-720	712	-0.8592	-0.0312	-0.3372
50	-793	841	-0.9804	-861	857	-1.0308	-0.0504	-0.3060
52	-909	968	-1.1262	-958	955	-1.1478	-0.0216	-0.2556
54	-1005	1075	-1.2480	-1072	1041	-1.2678	-0.0198	-0.2340
56	-1088	1107	-1.3170	-1140	1114	-1.3524	-0.0354	-0.2142
58	-1131	1180	-1.3866	-1194	1147	-1.4046	-0.0180	-0.1788
60	-1175	1225	-1.4400	-1240	1199	-1.4634	-0.0234	-0.1608
62	-1208	1273	-1.4886	-1267	1225	-1.4952	-0.0066	-0.1374
64	-1238	1265	-1.5018	-1299	1260	-1.5354	-0.0336	-0.1308
66	-1271	1298	-1.5414	-1286	1284	-1.5420	-0.0006	-0.0972
68	-1290	1363	-1.5918	-1340	1307	-1.5882	0.0036	-0.0966
70	-1298	1344	-1.5852	-1340	1315	-1.5930	-0.0078	-0.1002
72	-1221	1253	-1.4844	-1257	1242	-1.4994	-0.0150	-0.0924
74	-1090	1122	-1.3272	-1122	1105	-1.3362	-0.0090	-0.0774
76	-1062	1093	-1.2930	-1094	1094	-1.3128	-0.0198	-0.0684
78	-1165	1220	-1.4310	-1219	1183	-1.4412	-0.0102	-0.0486

SITE CUFTVA

INSTALLATION SI-50A

DESCRIPTION

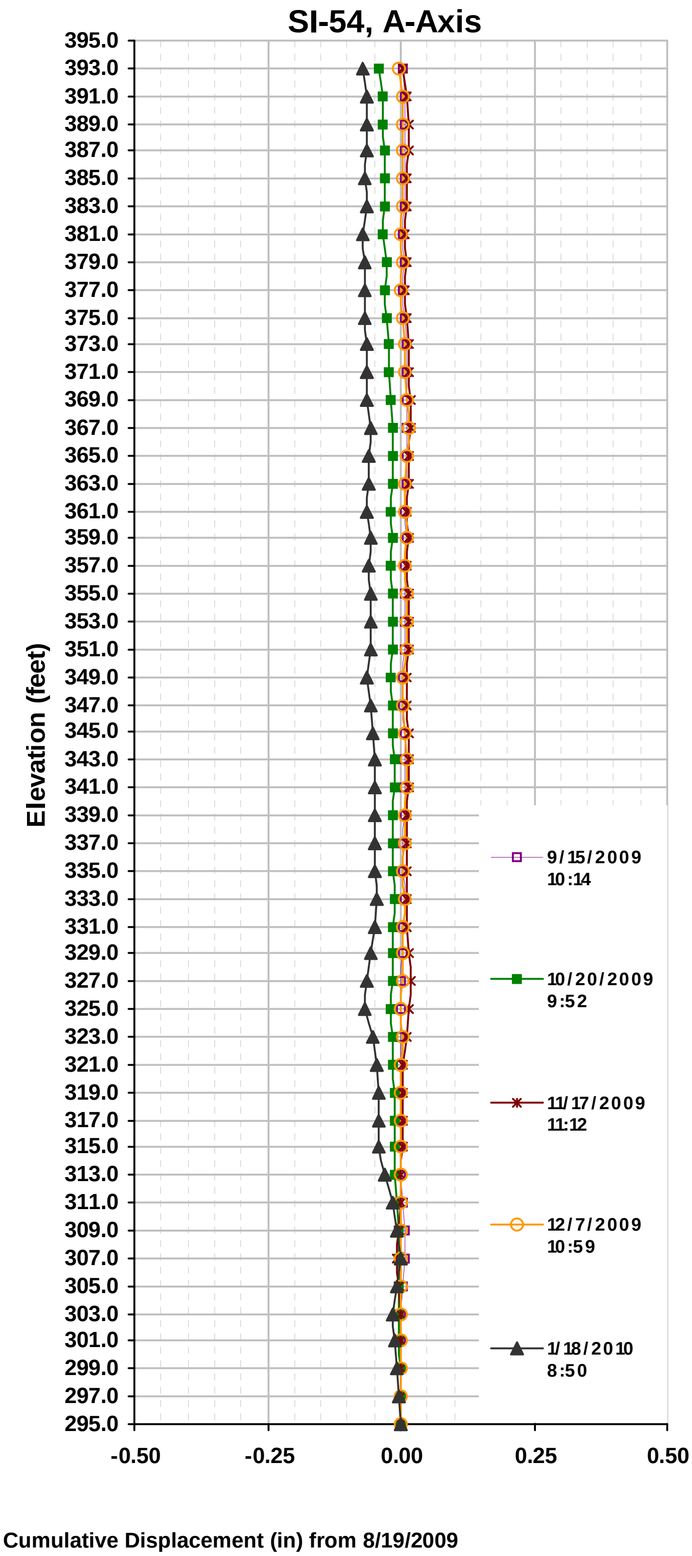
CURRENT SURVEY 1/18/2010 9:08:14 AM

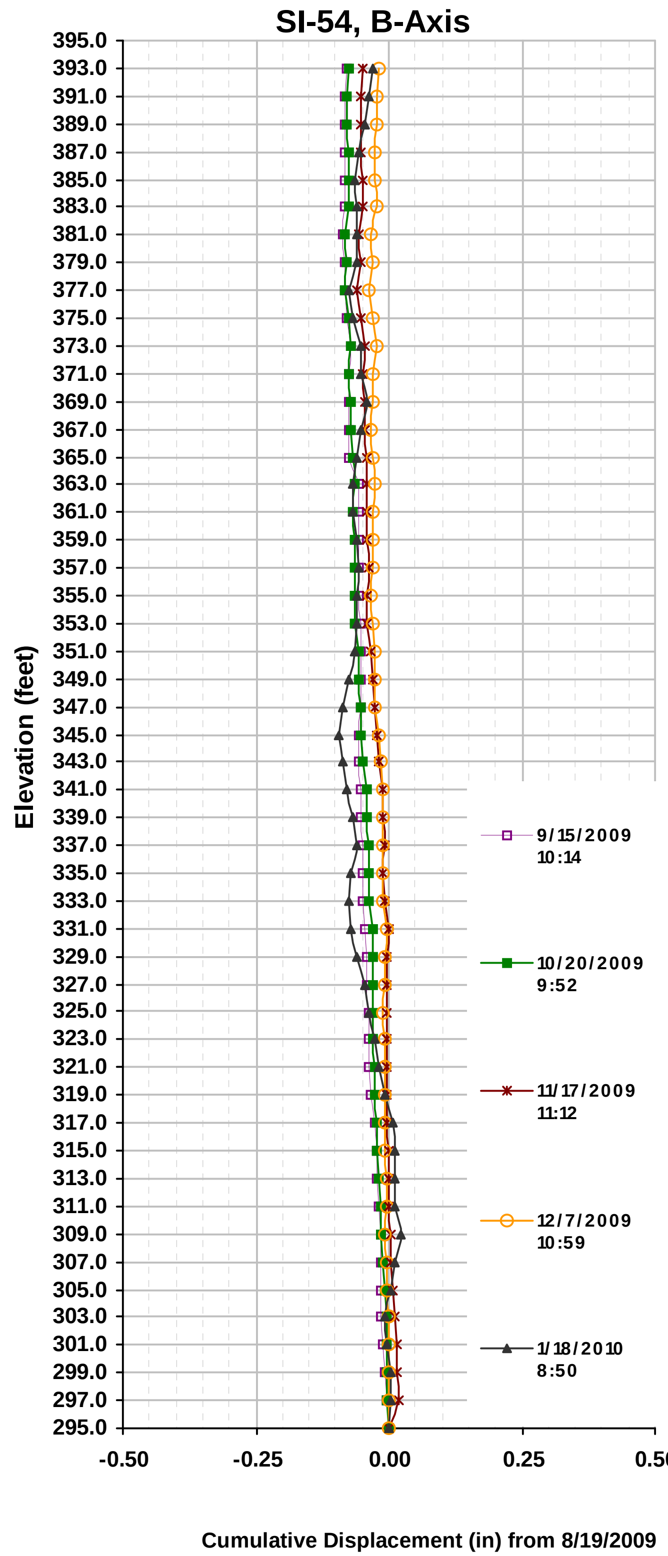
INITIAL SURVEY 8/19/2009 11:00:39 AM

DATE PRINTED 1/18/2010 2:14:53 PM

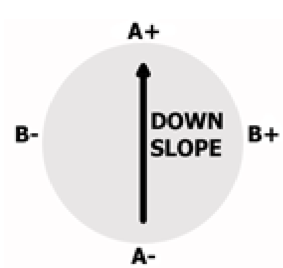
Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-1138	1189	-1.3962	-1186	1155	-1.4046	-0.0084	-0.0384
82	-1095	1139	-1.3404	-1133	1113	-1.3476	-0.0072	-0.0300
84	-1039	1087	-1.2756	-1082	1082	-1.2984	-0.0228	-0.0228
86	0	0	0.0000	0	0	0.0000	0.0000	0.0000





Stantec



Cumberland Fossil Plant

Cumberland City, TN

175539016

1/18/2010

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 9/15/2009 10:14:38 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:20:43 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	74	-64	0.0828	69	-62	0.0786	-0.0042	0.0048
4	56	-47	0.0618	54	-49	0.0618	0.0000	0.0090
6	2	8	-0.0036	1	5	-0.0024	0.0012	0.0090
8	-46	54	-0.0600	-47	51	-0.0588	0.0012	0.0078
10	-82	94	-0.1056	-85	92	-0.1062	-0.0006	0.0066
12	-81	91	-0.1032	-81	85	-0.0996	0.0036	0.0072
14	-91	100	-0.1146	-95	100	-0.1170	-0.0024	0.0036
16	-69	77	-0.0876	-70	74	-0.0864	0.0012	0.0060
18	-3	12	-0.0090	-6	11	-0.0102	-0.0012	0.0048
20	21	-12	0.0198	14	-10	0.0144	-0.0054	0.0060
22	37	-28	0.0390	36	-31	0.0402	0.0012	0.0114
24	10	0	0.0060	9	-2	0.0066	0.0006	0.0102
26	-29	38	-0.0402	-33	38	-0.0426	-0.0024	0.0096
28	-209	217	-0.2556	-210	214	-0.2544	0.0012	0.0120
30	-273	284	-0.3342	-275	281	-0.3336	0.0006	0.0108
32	-214	221	-0.2610	-212	218	-0.2580	0.0030	0.0102
34	-174	183	-0.2142	-178	184	-0.2172	-0.0030	0.0072
36	-242	253	-0.2970	-243	249	-0.2952	0.0018	0.0102
38	-262	269	-0.3186	-263	268	-0.3186	0.0000	0.0084
40	-224	237	-0.2766	-226	234	-0.2760	0.0006	0.0084
42	-209	216	-0.2550	-211	215	-0.2556	-0.0006	0.0078
44	-157	166	-0.1938	-155	161	-0.1896	0.0042	0.0084
46	-216	224	-0.2640	-219	223	-0.2652	-0.0012	0.0042
48	-243	252	-0.2970	-247	251	-0.2988	-0.0018	0.0054
50	-293	303	-0.3576	-295	302	-0.3582	-0.0006	0.0072
52	-305	313	-0.3708	-307	311	-0.3708	0.0000	0.0078
54	-339	350	-0.4134	-341	346	-0.4122	0.0012	0.0078
56	-393	402	-0.4770	-394	399	-0.4758	0.0012	0.0066
58	-410	418	-0.4968	-411	415	-0.4956	0.0012	0.0054
60	-481	491	-0.5832	-485	490	-0.5850	-0.0018	0.0042
62	-413	420	-0.4998	-413	417	-0.4980	0.0018	0.0060
64	-224	233	-0.2742	-223	231	-0.2724	0.0018	0.0042
66	-13	21	-0.0204	-13	18	-0.0186	0.0018	0.0024
68	133	-123	0.1536	133	-127	0.1560	0.0024	0.0006
70	-34	46	-0.0480	-39	46	-0.0510	-0.0030	-0.0018
72	-326	333	-0.3954	-328	331	-0.3954	0.0000	0.0012
74	-453	464	-0.5502	-455	462	-0.5502	0.0000	0.0012
76	-467	479	-0.5676	-468	477	-0.5670	0.0006	0.0012
78	-414	426	-0.5040	-415	422	-0.5022	0.0018	0.0006

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 9/15/2009 10:14:38 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:20:43 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-475	488	-0.5778	-477	488	-0.5790	-0.0012	-0.0012
82	-674	685	-0.8154	-679	685	-0.8184	-0.0030	0.0000
84	-905	915	-1.0920	-909	916	-1.0950	-0.0030	0.0030
86	-1082	1094	-1.3056	-1086	1094	-1.3080	-0.0024	0.0060
88	-1042	1045	-1.2522	-1040	1040	-1.2480	0.0042	0.0084
90	-871	882	-1.0518	-871	877	-1.0488	0.0030	0.0042
92	-773	779	-0.9312	-774	777	-0.9306	0.0006	0.0012
94	-746	759	-0.9030	-748	758	-0.9036	-0.0006	0.0006
96	-769	781	-0.9300	-772	779	-0.9306	-0.0006	0.0012
98	-844	849	-1.0158	-842	848	-1.0140	0.0018	0.0018
100	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 10/20/2009 9:52:54 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:20:43 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	74	-64	0.0828	65	-60	0.0750	-0.0078	-0.0426
4	56	-47	0.0618	52	-47	0.0594	-0.0024	-0.0348
6	2	8	-0.0036	-1	6	-0.0042	-0.0006	-0.0324
8	-46	54	-0.0600	-47	53	-0.0600	0.0000	-0.0318
10	-82	94	-0.1056	-86	94	-0.1080	-0.0024	-0.0318
12	-81	91	-0.1032	-81	85	-0.0996	0.0036	-0.0294
14	-91	100	-0.1146	-97	103	-0.1200	-0.0054	-0.0330
16	-69	77	-0.0876	-69	73	-0.0852	0.0024	-0.0276
18	-3	12	-0.0090	-7	13	-0.0120	-0.0030	-0.0300
20	21	-12	0.0198	15	-10	0.0150	-0.0048	-0.0270
22	37	-28	0.0390	34	-30	0.0384	-0.0006	-0.0222
24	10	0	0.0060	5	2	0.0018	-0.0042	-0.0216
26	-29	38	-0.0402	-33	39	-0.0432	-0.0030	-0.0174
28	-209	217	-0.2556	-209	214	-0.2538	0.0018	-0.0144
30	-273	284	-0.3342	-275	281	-0.3336	0.0006	-0.0162
32	-214	221	-0.2610	-212	218	-0.2580	0.0030	-0.0168
34	-174	183	-0.2142	-179	185	-0.2184	-0.0042	-0.0198
36	-242	253	-0.2970	-243	249	-0.2952	0.0018	-0.0156
38	-262	269	-0.3186	-265	269	-0.3204	-0.0018	-0.0174
40	-224	237	-0.2766	-227	235	-0.2772	-0.0006	-0.0156
42	-209	216	-0.2550	-212	214	-0.2556	-0.0006	-0.0150
44	-157	166	-0.1938	-155	159	-0.1884	0.0054	-0.0144
46	-216	224	-0.2640	-221	224	-0.2670	-0.0030	-0.0198
48	-243	252	-0.2970	-248	253	-0.3006	-0.0036	-0.0168
50	-293	303	-0.3576	-296	303	-0.3594	-0.0018	-0.0132
52	-305	313	-0.3708	-308	310	-0.3708	0.0000	-0.0114
54	-339	350	-0.4134	-340	346	-0.4116	0.0018	-0.0114
56	-393	402	-0.4770	-395	400	-0.4770	0.0000	-0.0132
58	-410	418	-0.4968	-410	415	-0.4950	0.0018	-0.0132
60	-481	491	-0.5832	-485	491	-0.5856	-0.0024	-0.0150
62	-413	420	-0.4998	-414	416	-0.4980	0.0018	-0.0126
64	-224	233	-0.2742	-225	231	-0.2736	0.0006	-0.0144
66	-13	21	-0.0204	-14	19	-0.0198	0.0006	-0.0150
68	133	-123	0.1536	132	-127	0.1554	0.0018	-0.0156
70	-34	46	-0.0480	-39	47	-0.0516	-0.0036	-0.0174
72	-326	333	-0.3954	-327	333	-0.3960	-0.0006	-0.0138
74	-453	464	-0.5502	-456	463	-0.5514	-0.0012	-0.0132
76	-467	479	-0.5676	-470	477	-0.5682	-0.0006	-0.0120
78	-414	426	-0.5040	-417	424	-0.5046	-0.0006	-0.0114

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 10/20/2009 9:52:54 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:20:43 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-475	488	-0.5778	-477	487	-0.5784	-0.0006	-0.0108
82	-674	685	-0.8154	-681	684	-0.8190	-0.0036	-0.0102
84	-905	915	-1.0920	-909	915	-1.0944	-0.0024	-0.0066
86	-1082	1094	-1.3056	-1086	1093	-1.3074	-0.0018	-0.0042
88	-1042	1045	-1.2522	-1042	1043	-1.2510	0.0012	-0.0024
90	-871	882	-1.0518	-873	879	-1.0512	0.0006	-0.0036
92	-773	779	-0.9312	-776	778	-0.9324	-0.0012	-0.0042
94	-746	759	-0.9030	-750	759	-0.9054	-0.0024	-0.0030
96	-769	781	-0.9300	-773	778	-0.9306	-0.0006	-0.0006
98	-844	849	-1.0158	-843	850	-1.0158	0.0000	0.0000
100	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 11/17/2009 11:12:58 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:20:43 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	74	-64	0.0828	66	-58	0.0744	-0.0084	0.0030
4	56	-47	0.0618	54	-46	0.0600	-0.0018	0.0114
6	2	8	-0.0036	1	7	-0.0036	0.0000	0.0132
8	-46	54	-0.0600	-45	52	-0.0582	0.0018	0.0132
10	-82	94	-0.1056	-83	94	-0.1062	-0.0006	0.0114
12	-81	91	-0.1032	-77	85	-0.0972	0.0060	0.0120
14	-91	100	-0.1146	-95	103	-0.1188	-0.0042	0.0060
16	-69	77	-0.0876	-69	75	-0.0864	0.0012	0.0102
18	-3	12	-0.0090	-6	12	-0.0108	-0.0018	0.0090
20	21	-12	0.0198	16	-7	0.0138	-0.0060	0.0108
22	37	-28	0.0390	36	-30	0.0396	0.0006	0.0168
24	10	0	0.0060	7	2	0.0030	-0.0030	0.0162
26	-29	38	-0.0402	-30	39	-0.0414	-0.0012	0.0192
28	-209	217	-0.2556	-205	212	-0.2502	0.0054	0.0204
30	-273	284	-0.3342	-273	282	-0.3330	0.0012	0.0150
32	-214	221	-0.2610	-213	219	-0.2592	0.0018	0.0138
34	-174	183	-0.2142	-177	187	-0.2184	-0.0042	0.0120
36	-242	253	-0.2970	-240	249	-0.2934	0.0036	0.0162
38	-262	269	-0.3186	-265	271	-0.3216	-0.0030	0.0126
40	-224	237	-0.2766	-226	237	-0.2778	-0.0012	0.0156
42	-209	216	-0.2550	-210	215	-0.2550	0.0000	0.0168
44	-157	166	-0.1938	-153	162	-0.1890	0.0048	0.0168
46	-216	224	-0.2640	-216	223	-0.2634	0.0006	0.0120
48	-243	252	-0.2970	-247	255	-0.3012	-0.0042	0.0114
50	-293	303	-0.3576	-293	301	-0.3564	0.0012	0.0156
52	-305	313	-0.3708	-308	313	-0.3726	-0.0018	0.0144
54	-339	350	-0.4134	-337	346	-0.4098	0.0036	0.0162
56	-393	402	-0.4770	-392	401	-0.4758	0.0012	0.0126
58	-410	418	-0.4968	-410	417	-0.4962	0.0006	0.0114
60	-481	491	-0.5832	-482	490	-0.5832	0.0000	0.0108
62	-413	420	-0.4998	-416	420	-0.5016	-0.0018	0.0108
64	-224	233	-0.2742	-226	234	-0.2760	-0.0018	0.0126
66	-13	21	-0.0204	-16	23	-0.0234	-0.0030	0.0144
68	133	-123	0.1536	133	-125	0.1548	0.0012	0.0174
70	-34	46	-0.0480	-31	38	-0.0414	0.0066	0.0162
72	-326	333	-0.3954	-322	328	-0.3900	0.0054	0.0096
74	-453	464	-0.5502	-452	463	-0.5490	0.0012	0.0042
76	-467	479	-0.5676	-469	479	-0.5688	-0.0012	0.0030
78	-414	426	-0.5040	-416	426	-0.5052	-0.0012	0.0042

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 11/17/2009 11:12:58 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:20:44 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-475	488	-0.5778	-471	484	-0.5730	0.0048	0.0054
82	-674	685	-0.8154	-673	682	-0.8130	0.0024	0.0006
84	-905	915	-1.0920	-903	913	-1.0896	0.0024	-0.0018
86	-1082	1094	-1.3056	-1082	1090	-1.3032	0.0024	-0.0042
88	-1042	1045	-1.2522	-1043	1048	-1.2546	-0.0024	-0.0066
90	-871	882	-1.0518	-874	883	-1.0542	-0.0024	-0.0042
92	-773	779	-0.9312	-775	780	-0.9330	-0.0018	-0.0018
94	-746	759	-0.9030	-747	759	-0.9036	-0.0006	0.0000
96	-769	781	-0.9300	-770	778	-0.9288	0.0012	0.0006
98	-844	849	-1.0158	-842	852	-1.0164	-0.0006	-0.0006
100	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 12/7/2009 10:59:23 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:20:44 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	74	-64	0.0828	70	-57	0.0762	-0.0066	-0.0030
4	56	-47	0.0618	57	-44	0.0606	-0.0012	0.0036
6	2	8	-0.0036	3	10	-0.0042	-0.0006	0.0048
8	-46	54	-0.0600	-42	54	-0.0576	0.0024	0.0054
10	-82	94	-0.1056	-81	97	-0.1068	-0.0012	0.0030
12	-81	91	-0.1032	-75	88	-0.0978	0.0054	0.0042
14	-91	100	-0.1146	-93	106	-0.1194	-0.0048	-0.0012
16	-69	77	-0.0876	-65	77	-0.0852	0.0024	0.0036
18	-3	12	-0.0090	-2	15	-0.0102	-0.0012	0.0012
20	21	-12	0.0198	18	-5	0.0138	-0.0060	0.0024
22	37	-28	0.0390	38	-27	0.0390	0.0000	0.0084
24	10	0	0.0060	10	5	0.0030	-0.0030	0.0084
26	-29	38	-0.0402	-27	43	-0.0420	-0.0018	0.0114
28	-209	217	-0.2556	-204	217	-0.2526	0.0030	0.0132
30	-273	284	-0.3342	-270	285	-0.3330	0.0012	0.0102
32	-214	221	-0.2610	-209	221	-0.2580	0.0030	0.0090
34	-174	183	-0.2142	-175	190	-0.2190	-0.0048	0.0060
36	-242	253	-0.2970	-237	252	-0.2934	0.0036	0.0108
38	-262	269	-0.3186	-262	274	-0.3216	-0.0030	0.0072
40	-224	237	-0.2766	-222	239	-0.2766	0.0000	0.0102
42	-209	216	-0.2550	-206	218	-0.2544	0.0006	0.0102
44	-157	166	-0.1938	-150	163	-0.1878	0.0060	0.0096
46	-216	224	-0.2640	-215	228	-0.2658	-0.0018	0.0036
48	-243	252	-0.2970	-243	256	-0.2994	-0.0024	0.0054
50	-293	303	-0.3576	-293	308	-0.3606	-0.0030	0.0078
52	-305	313	-0.3708	-304	315	-0.3714	-0.0006	0.0108
54	-339	350	-0.4134	-335	349	-0.4104	0.0030	0.0114
56	-393	402	-0.4770	-390	404	-0.4764	0.0006	0.0084
58	-410	418	-0.4968	-406	418	-0.4944	0.0024	0.0078
60	-481	491	-0.5832	-479	494	-0.5838	-0.0006	0.0054
62	-413	420	-0.4998	-411	420	-0.4986	0.0012	0.0060
64	-224	233	-0.2742	-221	234	-0.2730	0.0012	0.0048
66	-13	21	-0.0204	-11	25	-0.0216	-0.0012	0.0036
68	133	-123	0.1536	137	-124	0.1566	0.0030	0.0048
70	-34	46	-0.0480	-34	48	-0.0492	-0.0012	0.0018
72	-326	333	-0.3954	-321	333	-0.3924	0.0030	0.0030
74	-453	464	-0.5502	-451	466	-0.5502	0.0000	0.0000
76	-467	479	-0.5676	-465	481	-0.5676	0.0000	0.0000
78	-414	426	-0.5040	-412	428	-0.5040	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 12/7/2009 10:59:23 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:20:44 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-475	488	-0.5778	-472	490	-0.5772	0.0006	0.0000
82	-674	685	-0.8154	-674	686	-0.8160	-0.0006	-0.0006
84	-905	915	-1.0920	-903	918	-1.0926	-0.0006	0.0000
86	-1082	1094	-1.3056	-1080	1094	-1.3044	0.0012	0.0006
88	-1042	1045	-1.2522	-1038	1047	-1.2510	0.0012	-0.0006
90	-871	882	-1.0518	-869	884	-1.0518	0.0000	-0.0018
92	-773	779	-0.9312	-771	783	-0.9324	-0.0012	-0.0018
94	-746	759	-0.9030	-745	762	-0.9042	-0.0012	-0.0006
96	-769	781	-0.9300	-767	782	-0.9294	0.0006	0.0006
98	-844	849	-1.0158	-838	855	-1.0158	0.0000	0.0000
100	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 1/18/2010 8:50:35 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:20:44 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	74	-64	0.0828	66	-63	0.0774	-0.0054	-0.0696
4	56	-47	0.0618	51	-51	0.0612	-0.0006	-0.0642
6	2	8	-0.0036	-1	4	-0.0030	0.0006	-0.0636
8	-46	54	-0.0600	-49	48	-0.0582	0.0018	-0.0642
10	-82	94	-0.1056	-88	89	-0.1062	-0.0006	-0.0660
12	-81	91	-0.1032	-79	81	-0.0960	0.0072	-0.0654
14	-91	100	-0.1146	-99	100	-0.1194	-0.0048	-0.0726
16	-69	77	-0.0876	-72	72	-0.0864	0.0012	-0.0678
18	-3	12	-0.0090	-7	8	-0.0090	0.0000	-0.0690
20	21	-12	0.0198	14	-12	0.0156	-0.0042	-0.0690
22	37	-28	0.0390	34	-32	0.0396	0.0006	-0.0648
24	10	0	0.0060	4	-3	0.0042	-0.0018	-0.0654
26	-29	38	-0.0402	-37	39	-0.0456	-0.0054	-0.0636
28	-209	217	-0.2556	-212	213	-0.2550	0.0006	-0.0582
30	-273	284	-0.3342	-277	278	-0.3330	0.0012	-0.0588
32	-214	221	-0.2610	-213	214	-0.2562	0.0048	-0.0600
34	-174	183	-0.2142	-184	184	-0.2208	-0.0066	-0.0648
36	-242	253	-0.2970	-246	247	-0.2958	0.0012	-0.0582
38	-262	269	-0.3186	-267	268	-0.3210	-0.0024	-0.0594
40	-224	237	-0.2766	-230	231	-0.2766	0.0000	-0.0570
42	-209	216	-0.2550	-214	213	-0.2562	-0.0012	-0.0570
44	-157	166	-0.1938	-156	156	-0.1872	0.0066	-0.0558
46	-216	224	-0.2640	-225	225	-0.2700	-0.0060	-0.0624
48	-243	252	-0.2970	-249	250	-0.2994	-0.0024	-0.0564
50	-293	303	-0.3576	-303	304	-0.3642	-0.0066	-0.0540
52	-305	313	-0.3708	-308	310	-0.3708	0.0000	-0.0474
54	-339	350	-0.4134	-344	345	-0.4134	0.0000	-0.0474
56	-393	402	-0.4770	-397	398	-0.4770	0.0000	-0.0474
58	-410	418	-0.4968	-412	413	-0.4950	0.0018	-0.0474
60	-481	491	-0.5832	-490	491	-0.5886	-0.0054	-0.0492
62	-413	420	-0.4998	-409	413	-0.4932	0.0066	-0.0438
64	-224	233	-0.2742	-222	223	-0.2670	0.0072	-0.0504
66	-13	21	-0.0204	-10	12	-0.0132	0.0072	-0.0576
68	133	-123	0.1536	132	-131	0.1578	0.0042	-0.0648
70	-34	46	-0.0480	-53	52	-0.0630	-0.0150	-0.0690
72	-326	333	-0.3954	-336	336	-0.4032	-0.0078	-0.0540
74	-453	464	-0.5502	-461	462	-0.5538	-0.0036	-0.0462
76	-467	479	-0.5676	-472	475	-0.5682	-0.0006	-0.0426
78	-414	426	-0.5040	-421	421	-0.5052	-0.0012	-0.0420

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 1/18/2010 8:50:35 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:20:44 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-475	488	-0.5778	-490	489	-0.5874	-0.0096	-0.0408
82	-674	685	-0.8154	-693	696	-0.8334	-0.0180	-0.0312
84	-905	915	-1.0920	-916	915	-1.0986	-0.0066	-0.0132
86	-1082	1094	-1.3056	-1093	1093	-1.3116	-0.0060	-0.0066
88	-1042	1045	-1.2522	-1036	1039	-1.2450	0.0072	-0.0006
90	-871	882	-1.0518	-870	874	-1.0464	0.0054	-0.0078
92	-773	779	-0.9312	-776	779	-0.9330	-0.0018	-0.0132
94	-746	759	-0.9030	-754	759	-0.9078	-0.0048	-0.0114
96	-769	781	-0.9300	-777	779	-0.9336	-0.0036	-0.0066
98	-844	849	-1.0158	-849	849	-1.0188	-0.0030	-0.0030
100	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 9/15/2009 10:14:38 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:21:35 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	108	-53	0.0966	111	-54	0.0990	0.0024	-0.0786
4	128	-64	0.1152	127	-65	0.1152	0.0000	-0.0810
6	163	-102	0.1590	165	-102	0.1602	0.0012	-0.0810
8	247	-189	0.2616	248	-188	0.2616	0.0000	-0.0822
10	314	-261	0.3450	314	-260	0.3444	-0.0006	-0.0822
12	338	-283	0.3726	344	-283	0.3762	0.0036	-0.0816
14	262	-198	0.2760	261	-195	0.2736	-0.0024	-0.0852
16	239	-178	0.2502	241	-175	0.2496	-0.0006	-0.0828
18	283	-226	0.3054	281	-221	0.3012	-0.0042	-0.0822
20	255	-212	0.2802	253	-203	0.2736	-0.0066	-0.0780
22	157	-120	0.1662	163	-123	0.1716	0.0054	-0.0714
24	34	26	0.0048	33	30	0.0018	-0.0030	-0.0768
26	-44	102	-0.0876	-42	103	-0.0870	0.0006	-0.0738
28	-26	80	-0.0636	-26	80	-0.0636	0.0000	-0.0744
30	15	39	-0.0144	-14	39	-0.0318	-0.0174	-0.0744
32	9	31	-0.0132	11	32	-0.0126	0.0006	-0.0570
34	-123	186	-0.1854	-124	188	-0.1872	-0.0018	-0.0576
36	-179	243	-0.2532	-178	246	-0.2544	-0.0012	-0.0558
38	-199	261	-0.2760	-196	259	-0.2730	0.0030	-0.0546
40	-265	317	-0.3492	-267	321	-0.3528	-0.0036	-0.0576
42	-265	323	-0.3528	-266	327	-0.3558	-0.0030	-0.0540
44	-233	296	-0.3174	-231	297	-0.3168	0.0006	-0.0510
46	-167	225	-0.2352	-165	223	-0.2328	0.0024	-0.0516
48	-57	103	-0.0960	-53	103	-0.0936	0.0024	-0.0540
50	41	10	0.0186	42	13	0.0174	-0.0012	-0.0564
52	62	-5	0.0402	62	-1	0.0378	-0.0024	-0.0552
54	43	23	0.0120	43	25	0.0108	-0.0012	-0.0528
56	-29	89	-0.0708	-29	94	-0.0738	-0.0030	-0.0516
58	-71	131	-0.1212	-68	134	-0.1212	0.0000	-0.0486
60	-20	69	-0.0534	-18	70	-0.0528	0.0006	-0.0486
62	46	11	0.0210	46	17	0.0174	-0.0036	-0.0492
64	30	31	-0.0006	29	34	-0.0030	-0.0024	-0.0456
66	-68	129	-0.1182	-67	134	-0.1206	-0.0024	-0.0432
68	-119	180	-0.1794	-118	184	-0.1812	-0.0018	-0.0408
70	-205	253	-0.2748	-204	258	-0.2772	-0.0024	-0.0390
72	-278	331	-0.3654	-275	335	-0.3660	-0.0006	-0.0366
74	-344	399	-0.4458	-346	402	-0.4488	-0.0030	-0.0360
76	-455	504	-0.5754	-458	510	-0.5808	-0.0054	-0.0330
78	-564	616	-0.7080	-565	621	-0.7116	-0.0036	-0.0276

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 9/15/2009 10:14:38 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:21:35 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-665	709	-0.8244	-665	714	-0.8274	-0.0030	-0.0240
82	-691	740	-0.8586	-691	746	-0.8622	-0.0036	-0.0210
84	-698	763	-0.8766	-697	767	-0.8784	-0.0018	-0.0174
86	-746	805	-0.9306	-743	809	-0.9312	-0.0006	-0.0156
88	-678	734	-0.8472	-675	736	-0.8466	0.0006	-0.0150
90	-615	661	-0.7656	-614	665	-0.7674	-0.0018	-0.0156
92	-534	588	-0.6732	-533	593	-0.6756	-0.0024	-0.0138
94	-576	628	-0.7224	-575	634	-0.7254	-0.0030	-0.0114
96	-646	703	-0.8094	-647	708	-0.8130	-0.0036	-0.0084
98	-708	746	-0.8724	-711	751	-0.8772	-0.0048	-0.0048
100	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 10/20/2009 9:52:54 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:21:35 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	108	-53	0.0966	109	-57	0.0996	0.0030	-0.0756
4	128	-64	0.1152	127	-64	0.1146	-0.0006	-0.0786
6	163	-102	0.1590	162	-101	0.1578	-0.0012	-0.0780
8	247	-189	0.2616	245	-189	0.2604	-0.0012	-0.0768
10	314	-261	0.3450	314	-261	0.3450	0.0000	-0.0756
12	338	-283	0.3726	345	-287	0.3792	0.0066	-0.0756
14	262	-198	0.2760	258	-194	0.2712	-0.0048	-0.0822
16	239	-178	0.2502	245	-182	0.2562	0.0060	-0.0774
18	283	-226	0.3054	274	-219	0.2958	-0.0096	-0.0834
20	255	-212	0.2802	253	-207	0.2760	-0.0042	-0.0738
22	157	-120	0.1662	164	-123	0.1722	0.0060	-0.0696
24	34	26	0.0048	27	28	-0.0006	-0.0054	-0.0756
26	-44	102	-0.0876	-43	103	-0.0876	0.0000	-0.0702
28	-26	80	-0.0636	-30	81	-0.0666	-0.0030	-0.0702
30	15	39	-0.0144	11	39	-0.0168	-0.0024	-0.0672
32	9	31	-0.0132	11	29	-0.0108	0.0024	-0.0648
34	-123	186	-0.1854	-126	187	-0.1878	-0.0024	-0.0672
36	-179	243	-0.2532	-181	245	-0.2556	-0.0024	-0.0648
38	-199	261	-0.2760	-197	258	-0.2730	0.0030	-0.0624
40	-265	317	-0.3492	-266	319	-0.3510	-0.0018	-0.0654
42	-265	323	-0.3528	-270	329	-0.3594	-0.0066	-0.0636
44	-233	296	-0.3174	-233	297	-0.3180	-0.0006	-0.0570
46	-167	225	-0.2352	-171	225	-0.2376	-0.0024	-0.0564
48	-57	103	-0.0960	-61	104	-0.0990	-0.0030	-0.0540
50	41	10	0.0186	38	13	0.0150	-0.0036	-0.0510
52	62	-5	0.0402	58	-2	0.0360	-0.0042	-0.0474
54	43	23	0.0120	42	23	0.0114	-0.0006	-0.0432
56	-29	89	-0.0708	-33	92	-0.0750	-0.0042	-0.0426
58	-71	131	-0.1212	-72	131	-0.1218	-0.0006	-0.0384
60	-20	69	-0.0534	-23	68	-0.0546	-0.0012	-0.0378
62	46	11	0.0210	41	16	0.0150	-0.0060	-0.0366
64	30	31	-0.0006	31	31	0.0000	0.0006	-0.0306
66	-68	129	-0.1182	-69	130	-0.1194	-0.0012	-0.0312
68	-119	180	-0.1794	-119	180	-0.1794	0.0000	-0.0300
70	-205	253	-0.2748	-205	255	-0.2760	-0.0012	-0.0300
72	-278	331	-0.3654	-279	333	-0.3672	-0.0018	-0.0288
74	-344	399	-0.4458	-343	401	-0.4464	-0.0006	-0.0270
76	-455	504	-0.5754	-457	506	-0.5778	-0.0024	-0.0264
78	-564	616	-0.7080	-566	617	-0.7098	-0.0018	-0.0240

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 10/20/2009 9:52:54 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:21:35 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-665	709	-0.8244	-667	711	-0.8268	-0.0024	-0.0222
82	-691	740	-0.8586	-697	742	-0.8634	-0.0048	-0.0198
84	-698	763	-0.8766	-701	763	-0.8784	-0.0018	-0.0150
86	-746	805	-0.9306	-749	807	-0.9336	-0.0030	-0.0132
88	-678	734	-0.8472	-681	735	-0.8496	-0.0024	-0.0102
90	-615	661	-0.7656	-617	663	-0.7680	-0.0024	-0.0078
92	-534	588	-0.6732	-535	588	-0.6738	-0.0006	-0.0054
94	-576	628	-0.7224	-576	627	-0.7218	0.0006	-0.0048
96	-646	703	-0.8094	-648	706	-0.8124	-0.0030	-0.0054
98	-708	746	-0.8724	-712	746	-0.8748	-0.0024	-0.0024
100	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 11/17/2009 11:12:58 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:21:35 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	108	-53	0.0966	112	-53	0.0990	0.0024	-0.0492
4	128	-64	0.1152	131	-61	0.1152	0.0000	-0.0516
6	163	-102	0.1590	165	-100	0.1590	0.0000	-0.0516
8	247	-189	0.2616	249	-185	0.2604	-0.0012	-0.0516
10	314	-261	0.3450	317	-257	0.3444	-0.0006	-0.0504
12	338	-283	0.3726	350	-285	0.3810	0.0084	-0.0498
14	262	-198	0.2760	259	-190	0.2694	-0.0066	-0.0582
16	239	-178	0.2502	249	-181	0.2580	0.0078	-0.0516
18	283	-226	0.3054	281	-217	0.2988	-0.0066	-0.0594
20	255	-212	0.2802	253	-201	0.2724	-0.0078	-0.0528
22	157	-120	0.1662	162	-119	0.1686	0.0024	-0.0450
24	34	26	0.0048	34	31	0.0018	-0.0030	-0.0474
26	-44	102	-0.0876	-39	106	-0.0870	0.0006	-0.0444
28	-26	80	-0.0636	-26	85	-0.0666	-0.0030	-0.0450
30	15	39	-0.0144	17	45	-0.0168	-0.0024	-0.0420
32	9	31	-0.0132	13	33	-0.0120	0.0012	-0.0396
34	-123	186	-0.1854	-121	189	-0.1860	-0.0006	-0.0408
36	-179	243	-0.2532	-177	247	-0.2544	-0.0012	-0.0402
38	-199	261	-0.2760	-193	261	-0.2724	0.0036	-0.0390
40	-265	317	-0.3492	-260	322	-0.3492	0.0000	-0.0426
42	-265	323	-0.3528	-269	335	-0.3624	-0.0096	-0.0426
44	-233	296	-0.3174	-233	299	-0.3192	-0.0018	-0.0330
46	-167	225	-0.2352	-169	230	-0.2394	-0.0042	-0.0312
48	-57	103	-0.0960	-56	112	-0.1008	-0.0048	-0.0270
50	41	10	0.0186	41	18	0.0138	-0.0048	-0.0222
52	62	-5	0.0402	62	4	0.0348	-0.0054	-0.0174
54	43	23	0.0120	46	27	0.0114	-0.0006	-0.0120
56	-29	89	-0.0708	-26	96	-0.0732	-0.0024	-0.0114
58	-71	131	-0.1212	-66	133	-0.1194	0.0018	-0.0090
60	-20	69	-0.0534	-17	75	-0.0552	-0.0018	-0.0108
62	46	11	0.0210	43	22	0.0126	-0.0084	-0.0090
64	30	31	-0.0006	35	33	0.0012	0.0018	-0.0006
66	-68	129	-0.1182	-63	134	-0.1182	0.0000	-0.0024
68	-119	180	-0.1794	-114	183	-0.1782	0.0012	-0.0024
70	-205	253	-0.2748	-200	257	-0.2742	0.0006	-0.0036
72	-278	331	-0.3654	-276	335	-0.3666	-0.0012	-0.0042
74	-344	399	-0.4458	-339	403	-0.4452	0.0006	-0.0030
76	-455	504	-0.5754	-451	509	-0.5760	-0.0006	-0.0036
78	-564	616	-0.7080	-561	621	-0.7092	-0.0012	-0.0030

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 11/17/2009 11:12:58 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:21:35 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-665	709	-0.8244	-662	714	-0.8256	-0.0012	-0.0018
82	-691	740	-0.8586	-689	746	-0.8610	-0.0024	-0.0006
84	-698	763	-0.8766	-695	768	-0.8778	-0.0012	0.0018
86	-746	805	-0.9306	-743	810	-0.9318	-0.0012	0.0030
88	-678	734	-0.8472	-676	741	-0.8502	-0.0030	0.0042
90	-615	661	-0.7656	-614	669	-0.7698	-0.0042	0.0072
92	-534	588	-0.6732	-532	596	-0.6768	-0.0036	0.0114
94	-576	628	-0.7224	-572	632	-0.7224	0.0000	0.0150
96	-646	703	-0.8094	-646	710	-0.8136	-0.0042	0.0150
98	-708	746	-0.8724	-704	718	-0.8532	0.0192	0.0192
100	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 12/7/2009 10:59:23 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:21:35 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	108	-53	0.0966	115	-55	0.1020	0.0054	-0.0186
4	128	-64	0.1152	130	-62	0.1152	0.0000	-0.0240
6	163	-102	0.1590	166	-100	0.1596	0.0006	-0.0240
8	247	-189	0.2616	250	-186	0.2616	0.0000	-0.0246
10	314	-261	0.3450	316	-258	0.3444	-0.0006	-0.0246
12	338	-283	0.3726	347	-290	0.3822	0.0096	-0.0240
14	262	-198	0.2760	259	-194	0.2718	-0.0042	-0.0336
16	239	-178	0.2502	250	-182	0.2592	0.0090	-0.0294
18	283	-226	0.3054	278	-216	0.2964	-0.0090	-0.0384
20	255	-212	0.2802	255	-203	0.2748	-0.0054	-0.0294
22	157	-120	0.1662	166	-123	0.1734	0.0072	-0.0240
24	34	26	0.0048	34	27	0.0042	-0.0006	-0.0312
26	-44	102	-0.0876	-39	103	-0.0852	0.0024	-0.0306
28	-26	80	-0.0636	-26	83	-0.0654	-0.0018	-0.0330
30	15	39	-0.0144	11	43	-0.0192	-0.0048	-0.0312
32	9	31	-0.0132	16	32	-0.0096	0.0036	-0.0264
34	-123	186	-0.1854	-123	186	-0.1854	0.0000	-0.0300
36	-179	243	-0.2532	-178	245	-0.2538	-0.0006	-0.0300
38	-199	261	-0.2760	-194	259	-0.2718	0.0042	-0.0294
40	-265	317	-0.3492	-264	321	-0.3510	-0.0018	-0.0336
42	-265	323	-0.3528	-267	332	-0.3594	-0.0066	-0.0318
44	-233	296	-0.3174	-230	298	-0.3168	0.0006	-0.0252
46	-167	225	-0.2352	-165	228	-0.2358	-0.0006	-0.0258
48	-57	103	-0.0960	-61	107	-0.1008	-0.0048	-0.0252
50	41	10	0.0186	39	16	0.0138	-0.0048	-0.0204
52	62	-5	0.0402	62	1	0.0366	-0.0036	-0.0156
54	43	23	0.0120	46	25	0.0126	0.0006	-0.0120
56	-29	89	-0.0708	-29	91	-0.0720	-0.0012	-0.0126
58	-71	131	-0.1212	-68	132	-0.1200	0.0012	-0.0114
60	-20	69	-0.0534	-20	72	-0.0552	-0.0018	-0.0126
62	46	11	0.0210	42	20	0.0132	-0.0078	-0.0108
64	30	31	-0.0006	36	30	0.0036	0.0042	-0.0030
66	-68	129	-0.1182	-65	129	-0.1164	0.0018	-0.0072
68	-119	180	-0.1794	-115	182	-0.1782	0.0012	-0.0090
70	-205	253	-0.2748	-203	257	-0.2760	-0.0012	-0.0102
72	-278	331	-0.3654	-276	335	-0.3666	-0.0012	-0.0090
74	-344	399	-0.4458	-341	402	-0.4458	0.0000	-0.0078
76	-455	504	-0.5754	-452	510	-0.5772	-0.0018	-0.0078
78	-564	616	-0.7080	-562	618	-0.7080	0.0000	-0.0060

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 12/7/2009 10:59:23 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:21:35 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-665	709	-0.8244	-663	713	-0.8256	-0.0012	-0.0060
82	-691	740	-0.8586	-686	744	-0.8580	0.0006	-0.0048
84	-698	763	-0.8766	-696	763	-0.8754	0.0012	-0.0054
86	-746	805	-0.9306	-745	810	-0.9330	-0.0024	-0.0066
88	-678	734	-0.8472	-676	738	-0.8484	-0.0012	-0.0042
90	-615	661	-0.7656	-614	667	-0.7686	-0.0030	-0.0030
92	-534	588	-0.6732	-530	593	-0.6738	-0.0006	0.0000
94	-576	628	-0.7224	-571	633	-0.7224	0.0000	0.0006
96	-646	703	-0.8094	-643	707	-0.8100	-0.0006	0.0006
98	-708	746	-0.8724	-710	742	-0.8712	0.0012	0.0012
100	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

CURRENT SURVEY 1/18/2010 8:50:35 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

DATE PRINTED 1/18/2010 2:21:35 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	108	-53	0.0966	73	-99	0.1032	0.0066	-0.0306
4	128	-64	0.1152	88	-118	0.1236	0.0084	-0.0372
6	163	-102	0.1590	133	-152	0.1710	0.0120	-0.0456
8	247	-189	0.2616	211	-234	0.2670	0.0054	-0.0576
10	314	-261	0.3450	272	-300	0.3432	-0.0018	-0.0630
12	338	-283	0.3726	301	-321	0.3732	0.0006	-0.0612
14	262	-198	0.2760	211	-246	0.2742	-0.0018	-0.0618
16	239	-178	0.2502	206	-234	0.2640	0.0138	-0.0600
18	283	-226	0.3054	235	-263	0.2988	-0.0066	-0.0738
20	255	-212	0.2802	215	-227	0.2652	-0.0150	-0.0672
22	157	-120	0.1662	135	-143	0.1668	0.0006	-0.0522
24	34	26	0.0048	-14	-6	-0.0048	-0.0096	-0.0528
26	-44	102	-0.0876	-78	52	-0.0780	0.0096	-0.0432
28	-26	80	-0.0636	-54	38	-0.0552	0.0084	-0.0528
30	15	39	-0.0144	-22	-7	-0.0090	0.0054	-0.0612
32	9	31	-0.0132	-17	2	-0.0114	0.0018	-0.0666
34	-123	186	-0.1854	-174	150	-0.1944	-0.0090	-0.0684
36	-179	243	-0.2532	-232	193	-0.2550	-0.0018	-0.0594
38	-199	261	-0.2760	-242	216	-0.2748	0.0012	-0.0576
40	-265	317	-0.3492	-304	277	-0.3486	0.0006	-0.0588
42	-265	323	-0.3528	-300	282	-0.3492	0.0036	-0.0594
44	-233	296	-0.3174	-264	243	-0.3042	0.0132	-0.0630
46	-167	225	-0.2352	-194	179	-0.2238	0.0114	-0.0762
48	-57	103	-0.0960	-83	68	-0.0906	0.0054	-0.0876
50	41	10	0.0186	-5	-28	0.0138	-0.0048	-0.0930
52	62	-5	0.0402	11	-39	0.0300	-0.0102	-0.0882
54	43	23	0.0120	-13	-13	0.0000	-0.0120	-0.0780
56	-29	89	-0.0708	-82	48	-0.0780	-0.0072	-0.0660
58	-71	131	-0.1212	-104	77	-0.1086	0.0126	-0.0588
60	-20	69	-0.0534	-49	31	-0.0480	0.0054	-0.0714
62	46	11	0.0210	-3	-26	0.0138	-0.0072	-0.0768
64	30	31	-0.0006	-20	-1	-0.0114	-0.0108	-0.0696
66	-68	129	-0.1182	-121	99	-0.1320	-0.0138	-0.0588
68	-119	180	-0.1794	-169	143	-0.1872	-0.0078	-0.0450
70	-205	253	-0.2748	-244	233	-0.2862	-0.0114	-0.0372
72	-278	331	-0.3654	-322	300	-0.3732	-0.0078	-0.0258
74	-344	399	-0.4458	-392	370	-0.4572	-0.0114	-0.0180
76	-455	504	-0.5754	-500	483	-0.5898	-0.0144	-0.0066
78	-564	616	-0.7080	-606	582	-0.7128	-0.0048	0.0078

SITE CUFTVA

INSTALLATION SI-54

DESCRIPTION

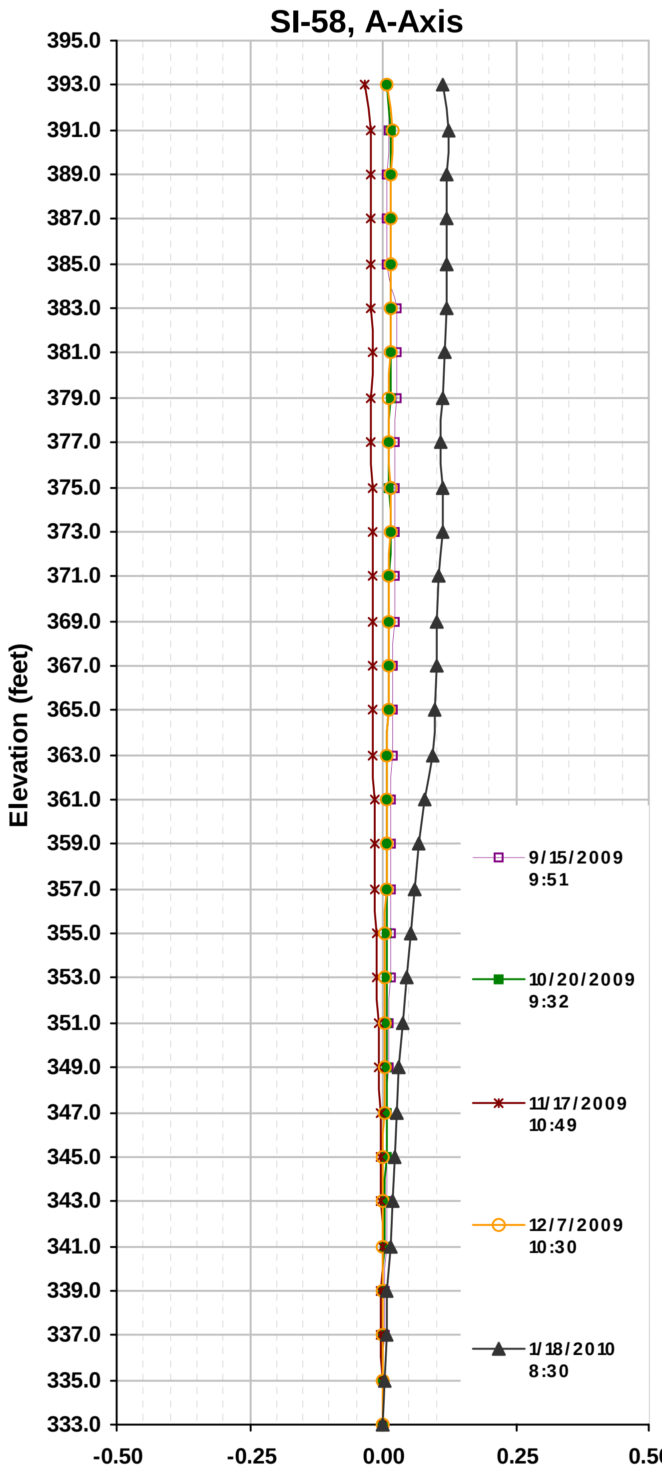
CURRENT SURVEY 1/18/2010 8:50:35 AM

INITIAL SURVEY 8/19/2009 10:24:47 AM

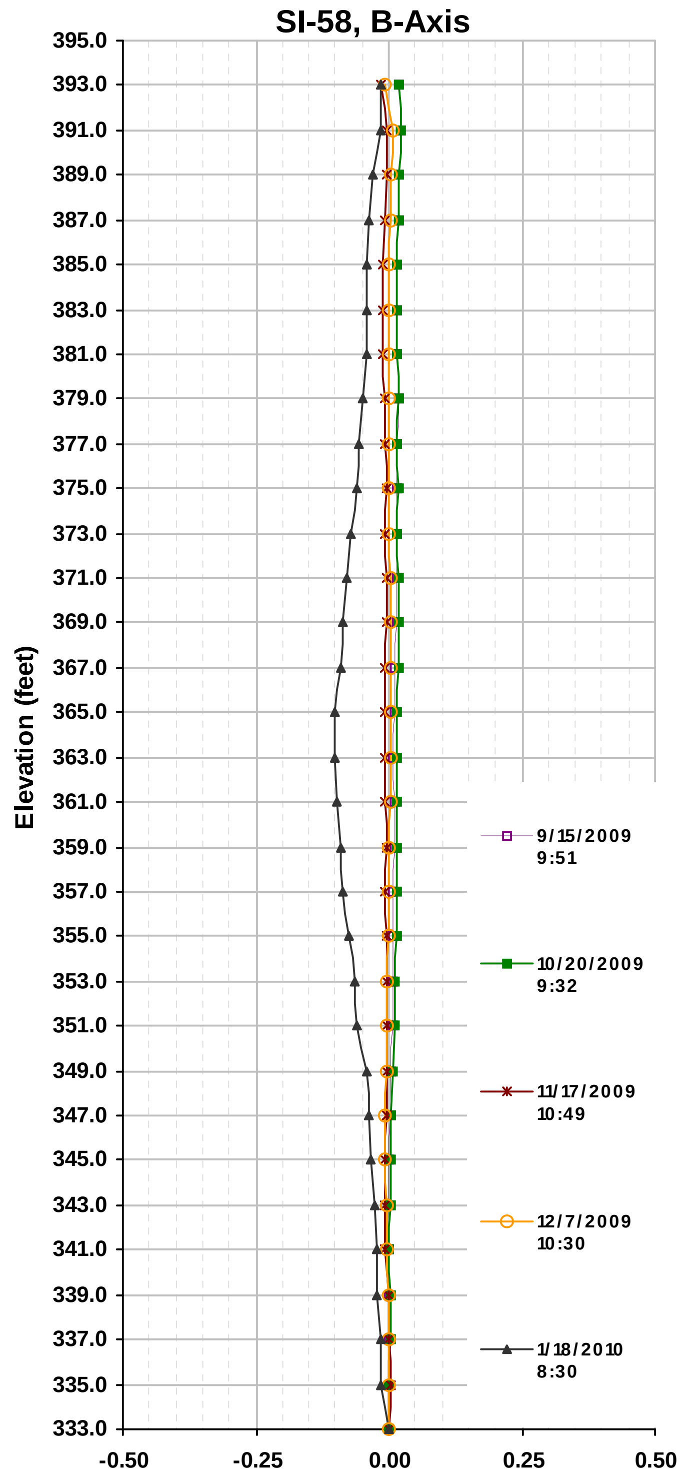
DATE PRINTED 1/18/2010 2:21:35 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-665	709	-0.8244	-700	671	-0.8226	0.0018	0.0126
82	-691	740	-0.8586	-733	700	-0.8598	-0.0012	0.0108
84	-698	763	-0.8766	-757	723	-0.8880	-0.0114	0.0120
86	-746	805	-0.9306	-776	755	-0.9186	0.0120	0.0234
88	-678	734	-0.8472	-712	687	-0.8394	0.0078	0.0114
90	-615	661	-0.7656	-639	620	-0.7554	0.0102	0.0036
92	-534	588	-0.6732	-579	546	-0.6750	-0.0018	-0.0066
94	-576	628	-0.7224	-622	597	-0.7314	-0.0090	-0.0048
96	-646	703	-0.8094	-688	663	-0.8106	-0.0012	0.0042
98	-708	746	-0.8724	-719	726	-0.8670	0.0054	0.0054
100	0	0	0.0000	0	0	0.0000	0.0000	0.0000

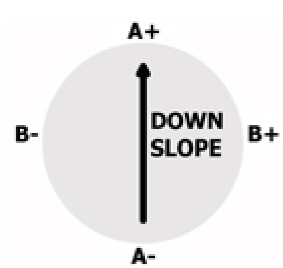


Cumulative Displacement (in) from 8/19/2009



Cumulative Displacement (in) from 8/19/2009

Stantec



Cumberland Fossil Plant

Cumberland City, TN
175539016
1/18/2010

SITE CUFTVA

INSTALLATION SI-58

DESCRIPTION

CURRENT SURVEY 9/15/2009 9:51:58 AM

INITIAL SURVEY 8/19/2009 9:45:12 AM

DATE PRINTED 1/18/2010 2:22:15 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-547	550	-0.6582	-551	553	-0.6624	-0.0042	0.0060
4	-613	618	-0.7386	-613	614	-0.7362	0.0024	0.0102
6	-536	542	-0.6468	-538	541	-0.6474	-0.0006	0.0078
8	-260	267	-0.3162	-256	268	-0.3144	0.0018	0.0084
10	109	-104	0.1278	107	-73	0.1080	-0.0198	0.0066
12	253	-248	0.3006	251	-249	0.3000	-0.0006	0.0264
14	181	-175	0.2136	181	-179	0.2160	0.0024	0.0270
16	153	-146	0.1794	153	-150	0.1818	0.0024	0.0246
18	109	-100	0.1254	107	-102	0.1254	0.0000	0.0222
20	93	-89	0.1092	92	-90	0.1092	0.0000	0.0222
22	118	-109	0.1362	118	-111	0.1374	0.0012	0.0222
24	99	-91	0.1140	97	-93	0.1140	0.0000	0.0210
26	63	-56	0.0714	62	-59	0.0726	0.0012	0.0210
28	-66	78	-0.0864	-67	75	-0.0852	0.0012	0.0198
30	-164	170	-0.2004	-165	167	-0.1992	0.0012	0.0186
32	-11	11	-0.0132	-11	10	-0.0126	0.0006	0.0174
34	200	-202	0.2412	200	-203	0.2418	0.0006	0.0168
36	401	-403	0.4824	400	-405	0.4830	0.0006	0.0162
38	514	-511	0.6150	514	-513	0.6162	0.0012	0.0156
40	593	-593	0.7116	593	-594	0.7122	0.0006	0.0144
42	741	-736	0.8862	742	-737	0.8874	0.0012	0.0138
44	860	-859	1.0314	861	-861	1.0332	0.0018	0.0126
46	913	-910	1.0938	913	-913	1.0956	0.0018	0.0108
48	983	-978	1.1766	984	-978	1.1772	0.0006	0.0090
50	987	-984	1.1826	987	-986	1.1838	0.0012	0.0084
52	966	-962	1.1568	966	-963	1.1574	0.0006	0.0072
54	1062	-1058	1.2720	1063	-1062	1.2750	0.0030	0.0066
56	1025	-1022	1.2282	1025	-1024	1.2294	0.0012	0.0036
58	1054	-1049	1.2618	1054	-1051	1.2630	0.0012	0.0024
60	1085	-1082	1.3002	1085	-1084	1.3014	0.0012	0.0012
62	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-58

DESCRIPTION

CURRENT SURVEY 10/20/2009 9:32:05 AM

INITIAL SURVEY 8/19/2009 9:45:12 AM

DATE PRINTED 1/18/2010 2:22:15 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-547	550	-0.6582	-550	560	-0.6660	-0.0078	0.0084
4	-613	618	-0.7386	-609	618	-0.7362	0.0024	0.0162
6	-536	542	-0.6468	-534	545	-0.6474	-0.0006	0.0138
8	-260	267	-0.3162	-258	272	-0.3180	-0.0018	0.0144
10	109	-104	0.1278	113	-99	0.1272	-0.0006	0.0162
12	253	-248	0.3006	256	-245	0.3006	0.0000	0.0168
14	181	-175	0.2136	186	-175	0.2166	0.0030	0.0168
16	153	-146	0.1794	157	-146	0.1818	0.0024	0.0138
18	109	-100	0.1254	111	-96	0.1242	-0.0012	0.0114
20	93	-89	0.1092	96	-85	0.1086	-0.0006	0.0126
22	118	-109	0.1362	123	-107	0.1380	0.0018	0.0132
24	99	-91	0.1140	102	-87	0.1134	-0.0006	0.0114
26	63	-56	0.0714	67	-54	0.0726	0.0012	0.0120
28	-66	78	-0.0864	-63	79	-0.0852	0.0012	0.0108
30	-164	170	-0.2004	-159	173	-0.1992	0.0012	0.0096
32	-11	11	-0.0132	-6	16	-0.0132	0.0000	0.0084
34	200	-202	0.2412	206	-199	0.2430	0.0018	0.0084
36	401	-403	0.4824	404	-399	0.4818	-0.0006	0.0066
38	514	-511	0.6150	518	-508	0.6156	0.0006	0.0072
40	593	-593	0.7116	596	-590	0.7116	0.0000	0.0066
42	741	-736	0.8862	743	-731	0.8844	-0.0018	0.0066
44	860	-859	1.0314	864	-855	1.0314	0.0000	0.0084
46	913	-910	1.0938	918	-908	1.0956	0.0018	0.0084
48	983	-978	1.1766	987	-975	1.1772	0.0006	0.0066
50	987	-984	1.1826	991	-982	1.1838	0.0012	0.0060
52	966	-962	1.1568	970	-959	1.1574	0.0006	0.0048
54	1062	-1058	1.2720	1067	-1057	1.2744	0.0024	0.0042
56	1025	-1022	1.2282	1029	-1019	1.2288	0.0006	0.0018
58	1054	-1049	1.2618	1058	-1047	1.2630	0.0012	0.0012
60	1085	-1082	1.3002	1088	-1079	1.3002	0.0000	0.0000
62	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-58

DESCRIPTION

CURRENT SURVEY 11/17/2009 10:49:52 AM

INITIAL SURVEY 8/19/2009 9:45:12 AM

DATE PRINTED 1/18/2010 2:22:15 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-547	550	-0.6582	-555	558	-0.6678	-0.0096	-0.0330
4	-613	618	-0.7386	-613	617	-0.7380	0.0006	-0.0234
6	-536	542	-0.6468	-537	542	-0.6474	-0.0006	-0.0240
8	-260	267	-0.3162	-262	266	-0.3168	-0.0006	-0.0234
10	109	-104	0.1278	108	-103	0.1266	-0.0012	-0.0228
12	253	-248	0.3006	251	-247	0.2988	-0.0018	-0.0216
14	181	-175	0.2136	182	-177	0.2154	0.0018	-0.0198
16	153	-146	0.1794	153	-147	0.1800	0.0006	-0.0216
18	109	-100	0.1254	107	-98	0.1230	-0.0024	-0.0222
20	93	-89	0.1092	92	-87	0.1074	-0.0018	-0.0198
22	118	-109	0.1362	120	-110	0.1380	0.0018	-0.0180
24	99	-91	0.1140	98	-89	0.1122	-0.0018	-0.0198
26	63	-56	0.0714	64	-56	0.0720	0.0006	-0.0180
28	-66	78	-0.0864	-67	78	-0.0870	-0.0006	-0.0186
30	-164	170	-0.2004	-163	170	-0.1998	0.0006	-0.0180
32	-11	11	-0.0132	-11	14	-0.0150	-0.0018	-0.0186
34	200	-202	0.2412	199	-200	0.2394	-0.0018	-0.0168
36	401	-403	0.4824	399	-402	0.4806	-0.0018	-0.0150
38	514	-511	0.6150	513	-510	0.6138	-0.0012	-0.0132
40	593	-593	0.7116	591	-591	0.7092	-0.0024	-0.0120
42	741	-736	0.8862	740	-733	0.8838	-0.0024	-0.0096
44	860	-859	1.0314	859	-858	1.0302	-0.0012	-0.0072
46	913	-910	1.0938	913	-909	1.0932	-0.0006	-0.0060
48	983	-978	1.1766	982	-976	1.1748	-0.0018	-0.0054
50	987	-984	1.1826	987	-983	1.1820	-0.0006	-0.0036
52	966	-962	1.1568	966	-960	1.1556	-0.0012	-0.0030
54	1062	-1058	1.2720	1063	-1059	1.2732	0.0012	-0.0018
56	1025	-1022	1.2282	1025	-1021	1.2276	-0.0006	-0.0030
58	1054	-1049	1.2618	1053	-1049	1.2612	-0.0006	-0.0024
60	1085	-1082	1.3002	1084	-1080	1.2984	-0.0018	-0.0018
62	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-58

DESCRIPTION

CURRENT SURVEY 12/7/2009 10:30:39 AM

INITIAL SURVEY 8/19/2009 9:45:12 AM

DATE PRINTED 1/18/2010 2:22:15 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-547	550	-0.6582	-554	558	-0.6672	-0.0090	0.0090
4	-613	618	-0.7386	-611	615	-0.7356	0.0030	0.0180
6	-536	542	-0.6468	-535	541	-0.6456	0.0012	0.0150
8	-260	267	-0.3162	-261	265	-0.3156	0.0006	0.0138
10	109	-104	0.1278	109	-102	0.1266	-0.0012	0.0132
12	253	-248	0.3006	254	-246	0.3000	-0.0006	0.0144
14	181	-175	0.2136	183	-177	0.2160	0.0024	0.0150
16	153	-146	0.1794	154	-147	0.1806	0.0012	0.0126
18	109	-100	0.1254	108	-97	0.1230	-0.0024	0.0114
20	93	-89	0.1092	94	-87	0.1086	-0.0006	0.0138
22	118	-109	0.1362	122	-109	0.1386	0.0024	0.0144
24	99	-91	0.1140	100	-89	0.1134	-0.0006	0.0120
26	63	-56	0.0714	65	-56	0.0726	0.0012	0.0126
28	-66	78	-0.0864	-66	77	-0.0858	0.0006	0.0114
30	-164	170	-0.2004	-162	169	-0.1986	0.0018	0.0108
32	-11	11	-0.0132	-9	11	-0.0120	0.0012	0.0090
34	200	-202	0.2412	203	-201	0.2424	0.0012	0.0078
36	401	-403	0.4824	402	-403	0.4830	0.0006	0.0066
38	514	-511	0.6150	516	-511	0.6162	0.0012	0.0060
40	593	-593	0.7116	593	-593	0.7116	0.0000	0.0048
42	741	-736	0.8862	743	-736	0.8874	0.0012	0.0048
44	860	-859	1.0314	861	-858	1.0314	0.0000	0.0036
46	913	-910	1.0938	915	-910	1.0950	0.0012	0.0036
48	983	-978	1.1766	985	-977	1.1772	0.0006	0.0024
50	987	-984	1.1826	989	-982	1.1826	0.0000	0.0018
52	966	-962	1.1568	968	-961	1.1574	0.0006	0.0018
54	1062	-1058	1.2720	1065	-1059	1.2744	0.0024	0.0012
56	1025	-1022	1.2282	1026	-1021	1.2282	0.0000	-0.0012
58	1054	-1049	1.2618	1054	-1049	1.2618	0.0000	-0.0012
60	1085	-1082	1.3002	1086	-1079	1.2990	-0.0012	-0.0012
62	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-58

DESCRIPTION

CURRENT SURVEY 1/18/2010 8:30:01 AM

INITIAL SURVEY 8/19/2009 9:45:12 AM

DATE PRINTED 1/18/2010 2:22:15 PM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-547	550	-0.6582	-555	558	-0.6678	-0.0096	0.1128
4	-613	618	-0.7386	-612	617	-0.7374	0.0012	0.1224
6	-536	542	-0.6468	-537	540	-0.6462	0.0006	0.1212
8	-260	267	-0.3162	-262	266	-0.3168	-0.0006	0.1206
10	109	-104	0.1278	109	-106	0.1290	0.0012	0.1212
12	253	-248	0.3006	256	-252	0.3048	0.0042	0.1200
14	181	-175	0.2136	185	-178	0.2178	0.0042	0.1158
16	153	-146	0.1794	152	-149	0.1806	0.0012	0.1116
18	109	-100	0.1254	104	-102	0.1236	-0.0018	0.1104
20	93	-89	0.1092	94	-88	0.1092	0.0000	0.1122
22	118	-109	0.1362	123	-115	0.1428	0.0066	0.1122
24	99	-91	0.1140	99	-96	0.1170	0.0030	0.1056
26	63	-56	0.0714	63	-60	0.0738	0.0024	0.1026
28	-66	78	-0.0864	-70	72	-0.0852	0.0012	0.1002
30	-164	170	-0.2004	-161	162	-0.1938	0.0066	0.0990
32	-11	11	-0.0132	0	2	0.0000	0.0132	0.0924
34	200	-202	0.2412	214	-208	0.2532	0.0120	0.0792
36	401	-403	0.4824	410	-408	0.4908	0.0084	0.0672
38	514	-511	0.6150	519	-514	0.6198	0.0048	0.0588
40	593	-593	0.7116	602	-597	0.7194	0.0078	0.0540
42	741	-736	0.8862	750	-743	0.8958	0.0096	0.0462
44	860	-859	1.0314	868	-864	1.0392	0.0078	0.0366
46	913	-910	1.0938	917	-913	1.0980	0.0042	0.0288
48	983	-978	1.1766	985	-981	1.1796	0.0030	0.0246
50	987	-984	1.1826	990	-985	1.1850	0.0024	0.0216
52	966	-962	1.1568	970	-966	1.1616	0.0048	0.0192
54	1062	-1058	1.2720	1068	-1061	1.2774	0.0054	0.0144
56	1025	-1022	1.2282	1028	-1023	1.2306	0.0024	0.0090
58	1054	-1049	1.2618	1057	-1051	1.2648	0.0030	0.0066
60	1085	-1082	1.3002	1089	-1084	1.3038	0.0036	0.0036
62	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-58

DESCRIPTION

CURRENT SURVEY 9/15/2009 9:51:58 AM

INITIAL SURVEY 8/19/2009 9:45:12 AM

DATE PRINTED 1/18/2010 2:22:33 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	216	-172	0.2328	212	-173	0.2310	-0.0018	0.0198
4	229	-181	0.2460	231	-181	0.2472	0.0012	0.0216
6	245	-203	0.2688	248	-203	0.2706	0.0018	0.0204
8	355	-322	0.4062	360	-323	0.4098	0.0036	0.0186
10	530	-481	0.6066	532	-478	0.6060	-0.0006	0.0150
12	586	-543	0.6774	588	-542	0.6780	0.0006	0.0156
14	567	-525	0.6552	569	-519	0.6528	-0.0024	0.0150
16	611	-567	0.7068	613	-566	0.7074	0.0006	0.0174
18	674	-629	0.7818	677	-627	0.7824	0.0006	0.0168
20	729	-681	0.8460	732	-681	0.8478	0.0018	0.0162
22	785	-737	0.9132	787	-734	0.9126	-0.0006	0.0144
24	890	-843	1.0398	892	-842	1.0404	0.0006	0.0150
26	987	-945	1.1592	993	-944	1.1622	0.0030	0.0144
28	1082	-1036	1.2708	1085	-1036	1.2726	0.0018	0.0114
30	1179	-1130	1.3854	1183	-1129	1.3872	0.0018	0.0096
32	1148	-1110	1.3548	1147	-1107	1.3524	-0.0024	0.0078
34	1022	-970	1.1952	1024	-969	1.1958	0.0006	0.0102
36	942	-894	1.1016	945	-893	1.1028	0.0012	0.0096
38	839	-793	0.9792	841	-791	0.9792	0.0000	0.0084
40	706	-655	0.8166	709	-656	0.8190	0.0024	0.0084
42	602	-563	0.6990	603	-562	0.6990	0.0000	0.0060
44	538	-483	0.6126	539	-483	0.6132	0.0006	0.0060
46	400	-365	0.4590	403	-366	0.4614	0.0024	0.0054
48	185	-153	0.2028	186	-154	0.2040	0.0012	0.0030
50	25	-4	0.0174	27	-2	0.0174	0.0000	0.0018
52	213	-164	0.2262	216	-166	0.2292	0.0030	0.0018
54	218	-177	0.2370	217	-173	0.2340	-0.0030	-0.0012
56	253	-202	0.2730	254	-201	0.2730	0.0000	0.0018
58	203	-153	0.2136	205	-152	0.2142	0.0006	0.0018
60	171	-125	0.1776	174	-124	0.1788	0.0012	0.0012
62	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-58

DESCRIPTION

CURRENT SURVEY 10/20/2009 9:32:05 AM

INITIAL SURVEY 8/19/2009 9:45:12 AM

DATE PRINTED 1/18/2010 2:22:33 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	216	-172	0.2328	211	-170	0.2286	-0.0042	0.0174
4	229	-181	0.2460	230	-183	0.2478	0.0018	0.0216
6	245	-203	0.2688	247	-203	0.2700	0.0012	0.0198
8	355	-322	0.4062	357	-325	0.4092	0.0030	0.0186
10	530	-481	0.6066	530	-479	0.6054	-0.0012	0.0156
12	586	-543	0.6774	587	-545	0.6792	0.0018	0.0168
14	567	-525	0.6552	568	-520	0.6528	-0.0024	0.0150
16	611	-567	0.7068	612	-567	0.7074	0.0006	0.0174
18	674	-629	0.7818	673	-628	0.7806	-0.0012	0.0168
20	729	-681	0.8460	731	-682	0.8478	0.0018	0.0180
22	785	-737	0.9132	784	-735	0.9114	-0.0018	0.0162
24	890	-843	1.0398	889	-842	1.0386	-0.0012	0.0180
26	987	-945	1.1592	989	-946	1.1610	0.0018	0.0192
28	1082	-1036	1.2708	1083	-1037	1.2720	0.0012	0.0174
30	1179	-1130	1.3854	1181	-1131	1.3872	0.0018	0.0162
32	1148	-1110	1.3548	1147	-1110	1.3542	-0.0006	0.0144
34	1022	-970	1.1952	1021	-971	1.1952	0.0000	0.0150
36	942	-894	1.1016	943	-894	1.1022	0.0006	0.0150
38	839	-793	0.9792	839	-794	0.9798	0.0006	0.0144
40	706	-655	0.8166	708	-656	0.8184	0.0018	0.0138
42	602	-563	0.6990	603	-566	0.7014	0.0024	0.0120
44	538	-483	0.6126	538	-485	0.6138	0.0012	0.0096
46	400	-365	0.4590	403	-367	0.4620	0.0030	0.0084
48	185	-153	0.2028	186	-154	0.2040	0.0012	0.0054
50	25	-4	0.0174	25	-5	0.0180	0.0006	0.0042
52	213	-164	0.2262	213	-169	0.2292	0.0030	0.0036
54	218	-177	0.2370	215	-175	0.2340	-0.0030	0.0006
56	253	-202	0.2730	254	-203	0.2742	0.0012	0.0036
58	203	-153	0.2136	202	-155	0.2142	0.0006	0.0024
60	171	-125	0.1776	172	-127	0.1794	0.0018	0.0018
62	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-58

DESCRIPTION

CURRENT SURVEY 11/17/2009 10:49:52 AM

INITIAL SURVEY 8/19/2009 9:45:12 AM

DATE PRINTED 1/18/2010 2:22:33 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	216	-172	0.2328	211	-162	0.2238	-0.0090	-0.0144
4	229	-181	0.2460	233	-176	0.2454	-0.0006	-0.0054
6	245	-203	0.2688	251	-203	0.2724	0.0036	-0.0048
8	355	-322	0.4062	361	-323	0.4104	0.0042	-0.0084
10	530	-481	0.6066	533	-476	0.6054	-0.0012	-0.0126
12	586	-543	0.6774	588	-538	0.6756	-0.0018	-0.0114
14	567	-525	0.6552	570	-517	0.6522	-0.0030	-0.0096
16	611	-567	0.7068	616	-564	0.7080	0.0012	-0.0066
18	674	-629	0.7818	674	-625	0.7794	-0.0024	-0.0078
20	729	-681	0.8460	735	-678	0.8478	0.0018	-0.0054
22	785	-737	0.9132	787	-730	0.9102	-0.0030	-0.0072
24	890	-843	1.0398	893	-839	1.0392	-0.0006	-0.0042
26	987	-945	1.1592	993	-943	1.1616	0.0024	-0.0036
28	1082	-1036	1.2708	1086	-1034	1.2720	0.0012	-0.0060
30	1179	-1130	1.3854	1183	-1128	1.3866	0.0012	-0.0072
32	1148	-1110	1.3548	1148	-1106	1.3524	-0.0024	-0.0084
34	1022	-970	1.1952	1025	-966	1.1946	-0.0006	-0.0060
36	942	-894	1.1016	947	-890	1.1022	0.0006	-0.0054
38	839	-793	0.9792	841	-788	0.9774	-0.0018	-0.0060
40	706	-655	0.8166	710	-651	0.8166	0.0000	-0.0042
42	602	-563	0.6990	606	-561	0.7002	0.0012	-0.0042
44	538	-483	0.6126	539	-480	0.6114	-0.0012	-0.0054
46	400	-365	0.4590	405	-362	0.4602	0.0012	-0.0042
48	185	-153	0.2028	190	-153	0.2058	0.0030	-0.0054
50	25	-4	0.0174	27	1	0.0156	-0.0018	-0.0084
52	213	-164	0.2262	214	-162	0.2256	-0.0006	-0.0066
54	218	-177	0.2370	219	-169	0.2328	-0.0042	-0.0060
56	253	-202	0.2730	257	-195	0.2712	-0.0018	-0.0018
58	203	-153	0.2136	206	-146	0.2112	-0.0024	0.0000
60	171	-125	0.1776	174	-126	0.1800	0.0024	0.0024
62	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-58

DESCRIPTION

CURRENT SURVEY 12/7/2009 10:30:39 AM

INITIAL SURVEY 8/19/2009 9:45:12 AM

DATE PRINTED 1/18/2010 2:22:33 PM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	216	-172	0.2328	205	-163	0.2208	-0.0120	-0.0060
4	229	-181	0.2460	232	-179	0.2466	0.0006	0.0060
6	245	-203	0.2688	250	-202	0.2712	0.0024	0.0054
8	355	-322	0.4062	359	-321	0.4080	0.0018	0.0030
10	530	-481	0.6066	533	-477	0.6060	-0.0006	0.0012
12	586	-543	0.6774	589	-542	0.6786	0.0012	0.0018
14	567	-525	0.6552	572	-518	0.6540	-0.0012	0.0006
16	611	-567	0.7068	614	-568	0.7092	0.0024	0.0018
18	674	-629	0.7818	673	-626	0.7794	-0.0024	-0.0006
20	729	-681	0.8460	731	-680	0.8466	0.0006	0.0018
22	785	-737	0.9132	786	-733	0.9114	-0.0018	0.0012
24	890	-843	1.0398	890	-840	1.0380	-0.0018	0.0030
26	987	-945	1.1592	991	-944	1.1610	0.0018	0.0048
28	1082	-1036	1.2708	1083	-1034	1.2702	-0.0006	0.0030
30	1179	-1130	1.3854	1182	-1129	1.3866	0.0012	0.0036
32	1148	-1110	1.3548	1151	-1106	1.3542	-0.0006	0.0024
34	1022	-970	1.1952	1026	-968	1.1964	0.0012	0.0030
36	942	-894	1.1016	946	-892	1.1028	0.0012	0.0018
38	839	-793	0.9792	843	-791	0.9804	0.0012	0.0006
40	706	-655	0.8166	711	-655	0.8196	0.0030	-0.0006
42	602	-563	0.6990	605	-561	0.6996	0.0006	-0.0036
44	538	-483	0.6126	541	-481	0.6132	0.0006	-0.0042
46	400	-365	0.4590	405	-363	0.4608	0.0018	-0.0048
48	185	-153	0.2028	188	-151	0.2034	0.0006	-0.0066
50	25	-4	0.0174	25	-1	0.0156	-0.0018	-0.0072
52	213	-164	0.2262	209	-165	0.2244	-0.0018	-0.0054
54	218	-177	0.2370	218	-171	0.2334	-0.0036	-0.0036
56	253	-202	0.2730	256	-198	0.2724	-0.0006	0.0000
58	203	-153	0.2136	204	-150	0.2124	-0.0012	0.0006
60	171	-125	0.1776	175	-124	0.1794	0.0018	0.0018
62	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-58

DESCRIPTION

CURRENT SURVEY 1/18/2010 8:30:01 AM

INITIAL SURVEY 8/19/2009 9:45:12 AM

DATE PRINTED 1/18/2010 2:22:33 PM

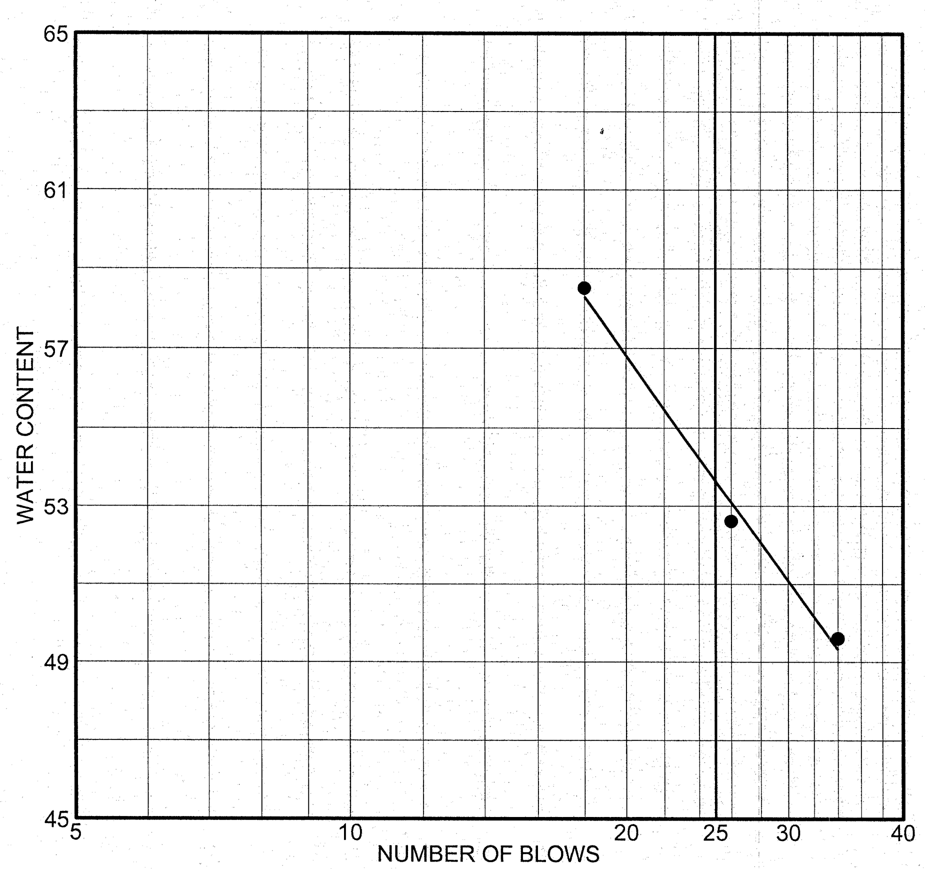
Data Reduction for B Axis:

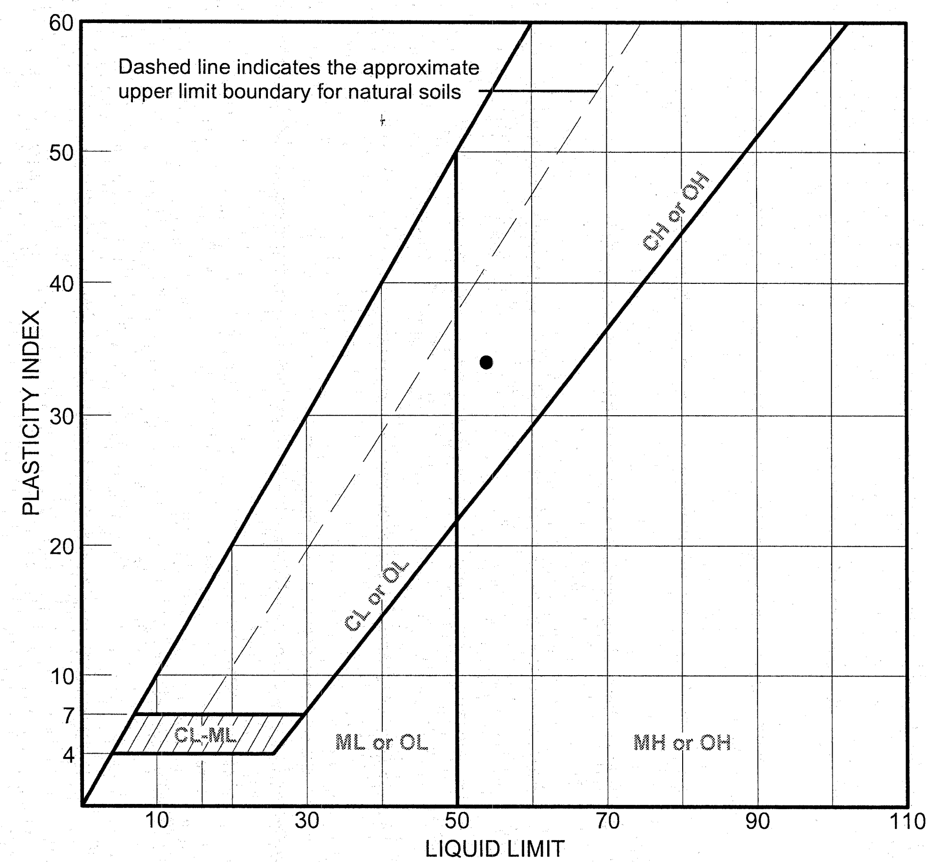
	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	216	-172	0.2328	184	-202	0.2316	-0.0012	-0.0144
4	229	-181	0.2460	207	-230	0.2622	0.0162	-0.0132
6	245	-203	0.2688	222	-242	0.2784	0.0096	-0.0294
8	355	-322	0.4062	342	-340	0.4092	0.0030	-0.0390
10	530	-481	0.6066	500	-512	0.6072	0.0006	-0.0420
12	586	-543	0.6774	550	-575	0.6750	-0.0024	-0.0426
14	567	-525	0.6552	542	-566	0.6648	0.0096	-0.0402
16	611	-567	0.7068	584	-606	0.7140	0.0072	-0.0498
18	674	-629	0.7818	646	-665	0.7866	0.0048	-0.0570
20	729	-681	0.8460	703	-724	0.8562	0.0102	-0.0618
22	785	-737	0.9132	759	-773	0.9192	0.0060	-0.0720
24	890	-843	1.0398	862	-883	1.0470	0.0072	-0.0780
26	987	-945	1.1592	964	-979	1.1658	0.0066	-0.0852
28	1082	-1036	1.2708	1063	-1074	1.2822	0.0114	-0.0918
30	1179	-1130	1.3854	1140	-1166	1.3836	-0.0018	-0.1032
32	1148	-1110	1.3548	1122	-1128	1.3500	-0.0048	-0.1014
34	1022	-970	1.1952	984	-999	1.1898	-0.0054	-0.0966
36	942	-894	1.1016	905	-920	1.0950	-0.0066	-0.0912
38	839	-793	0.9792	806	-810	0.9696	-0.0096	-0.0846
40	706	-655	0.8166	668	-676	0.8064	-0.0102	-0.0750
42	602	-563	0.6990	566	-589	0.6930	-0.0060	-0.0648
44	538	-483	0.6126	492	-501	0.5958	-0.0168	-0.0588
46	400	-365	0.4590	377	-378	0.4530	-0.0060	-0.0420
48	185	-153	0.2028	169	-167	0.2016	-0.0012	-0.0360
50	25	-4	0.0174	-4	-21	0.0102	-0.0072	-0.0348
52	213	-164	0.2262	173	-193	0.2196	-0.0066	-0.0276
54	218	-177	0.2370	185	-213	0.2388	0.0018	-0.0210
56	253	-202	0.2730	208	-237	0.2670	-0.0060	-0.0228
58	203	-153	0.2136	162	-190	0.2112	-0.0024	-0.0168
60	171	-125	0.1776	128	-144	0.1632	-0.0144	-0.0144
62	0	0	0.0000	0	0	0.0000	0.0000	0.0000

Appendix F

Results of Laboratory Testing

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●		B-48A	5-15ft	10/1/09	CH	Brown fat clay with sand	29.3	54	34

Client Stantec

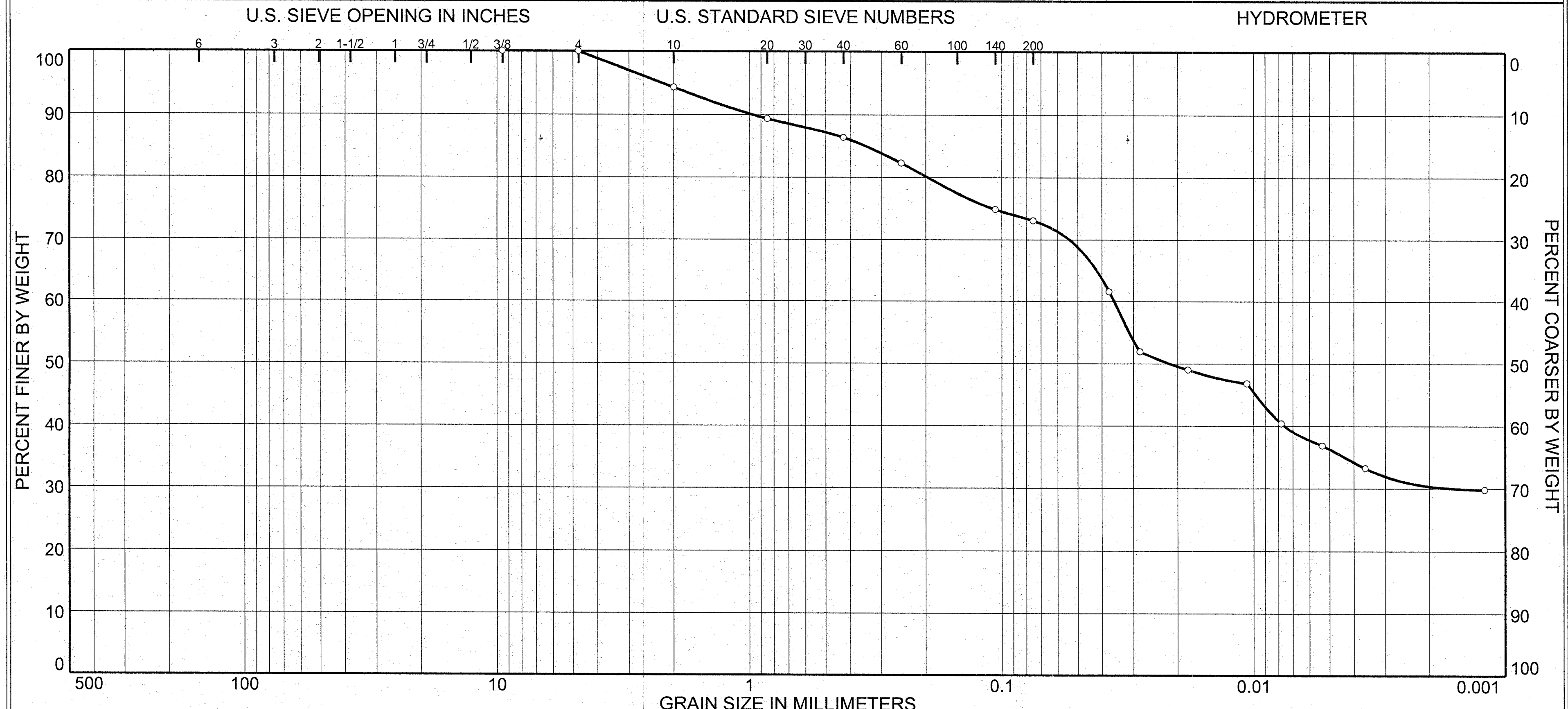
Project Cumberland Fossil Plant

Project No. GTX-1493 Lab no.

GeoTesting Express Inc.

● Moisture Content taken from bag as recieved, natural moisture content may be different

Particle Size Distribution Report ASTM D422



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	26.9	36.9	36.2

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○		B-48A	5-15ft	10/1/09	CH	Brown fat clay with sand	29.3	54	20

Client Stantec

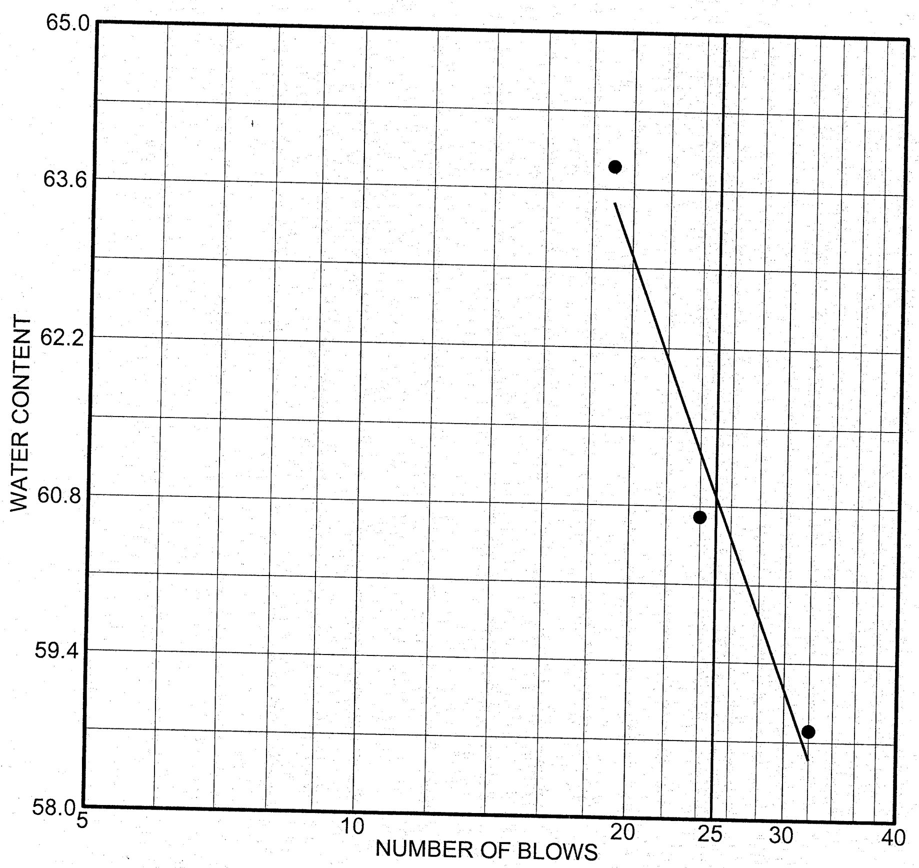
Project Cumberland Fossil Plant

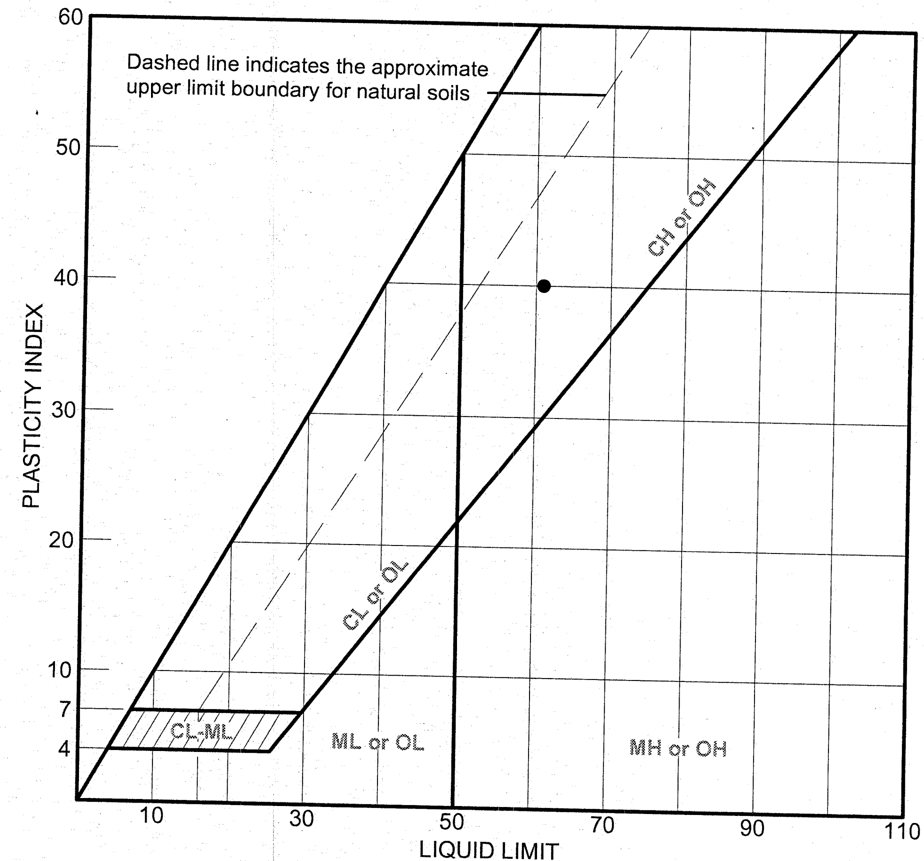
Project No. GTX-1493 Lab no.

GeoTesting Express Inc.

○ Moisture Content was taken from bag as recieved, natural moisture content may be different

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●		B-52	5-10 ft	10/07/09	CH	Sandy fat clay		61	40

Client Stantec

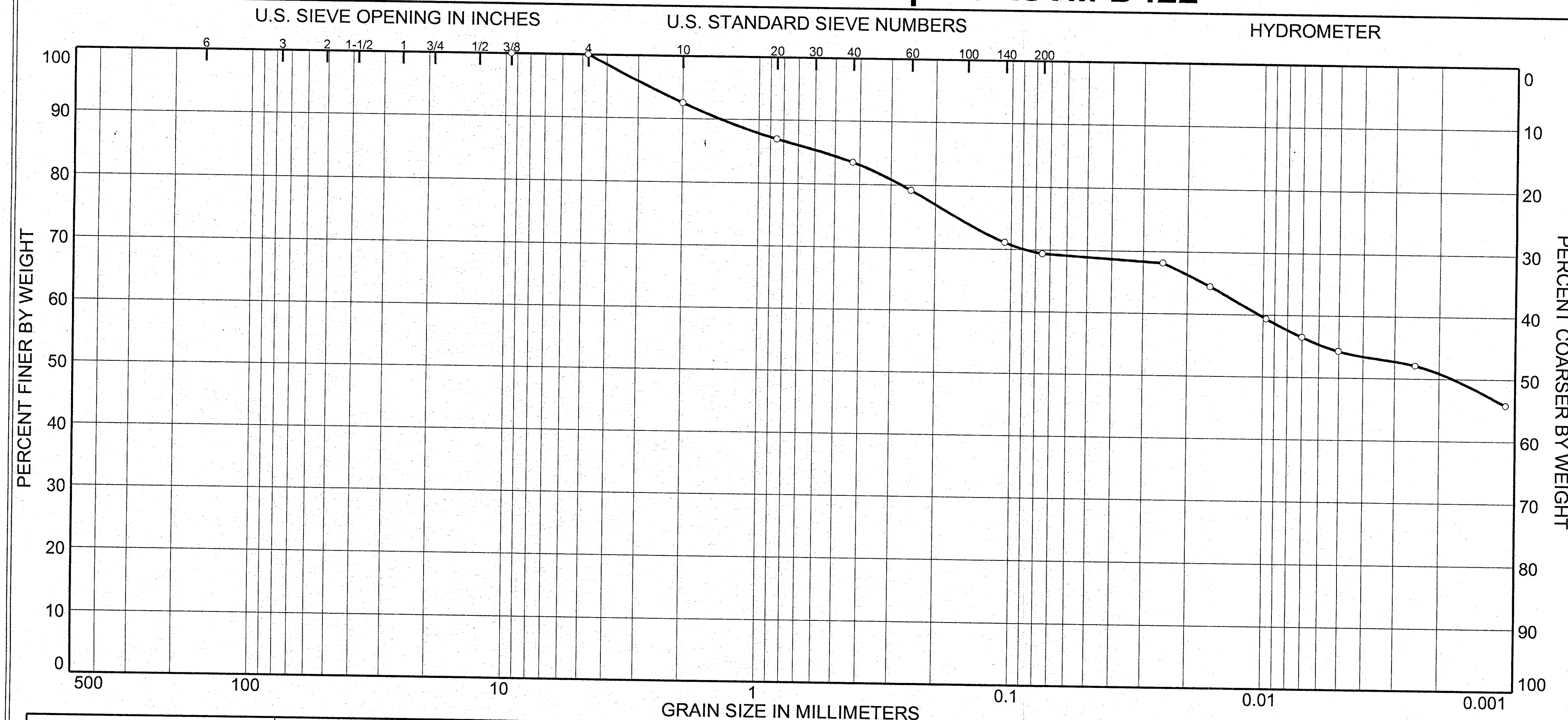
Project Cumberland Fossil Plant

Project No. 175539016 Lab no.

GeoTesting Express Inc.

●

Particle Size Distribution Report ASTM D422



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	30.6	15.1	54.3

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○		B-52	5-10 ft	10/07/09	CH	Sandy fat clay		61	21

Client Stantec

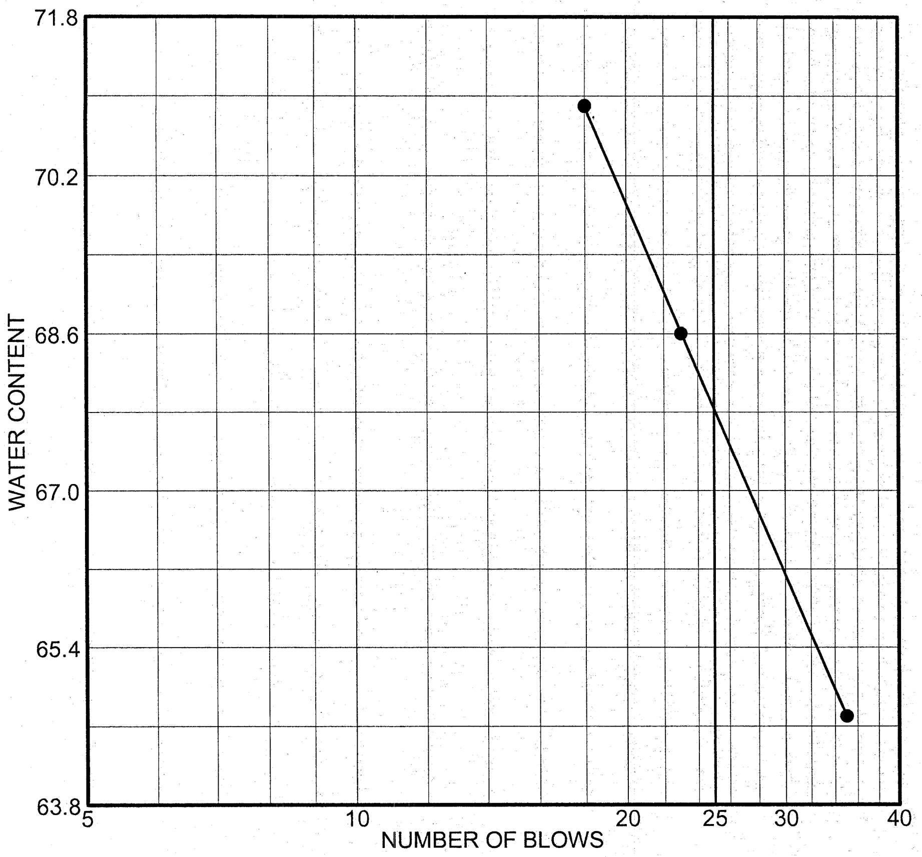
Project Cumberland Fossil Plant

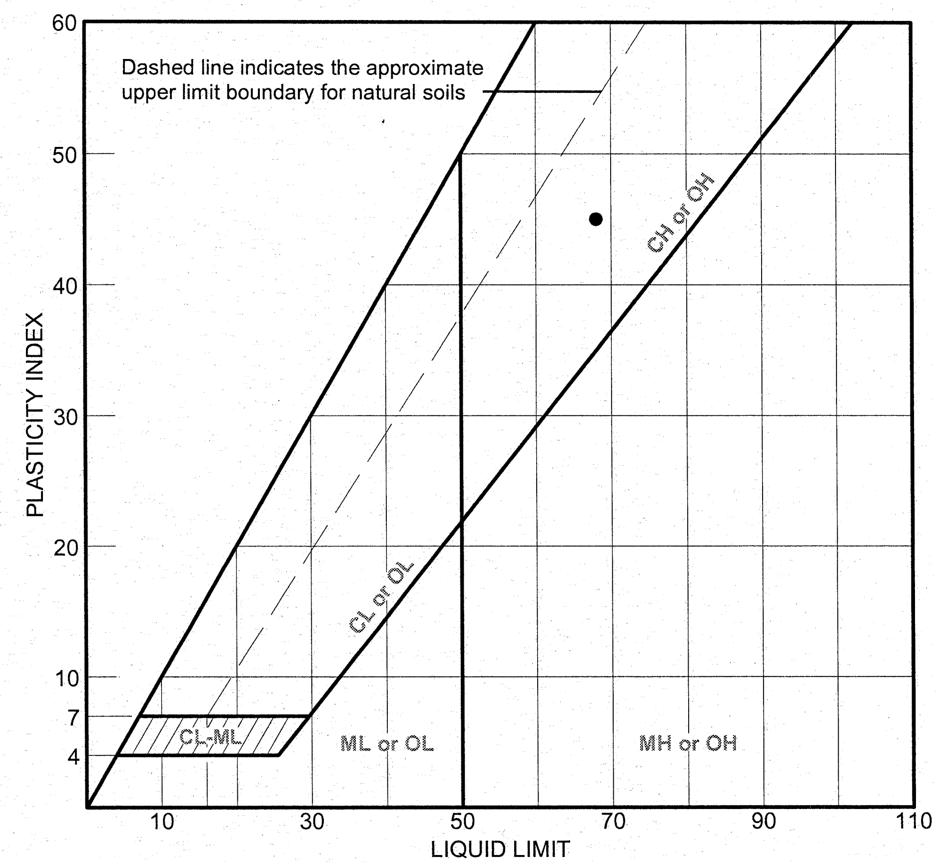
Project No. 175539016 Lab no.

GeoTesting Express Inc.

○

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●		B-58	10-20 ft	10/07/09	CH	Sandy fat clay		68	45

Client Stantec

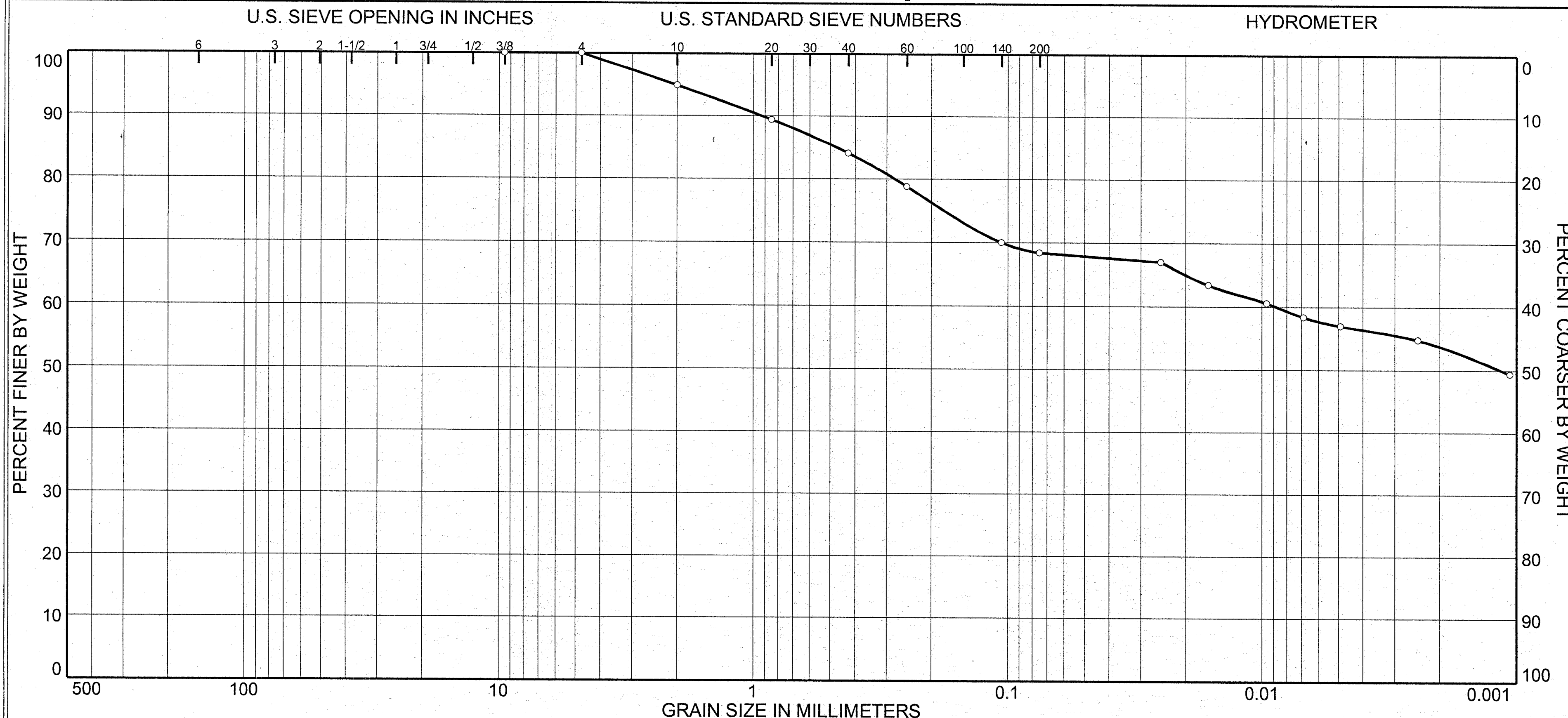
Project Cumberland Fossil Plant

Project No. 175539016 Lab no.

GeoTesting Express Inc.

●

Particle Size Distribution Report ASTM D422



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	31.6	11.3	57.1

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○		B-58	10-20 ft	10/07/09	CH	Sandy fat clay		68	23

Client Stantec

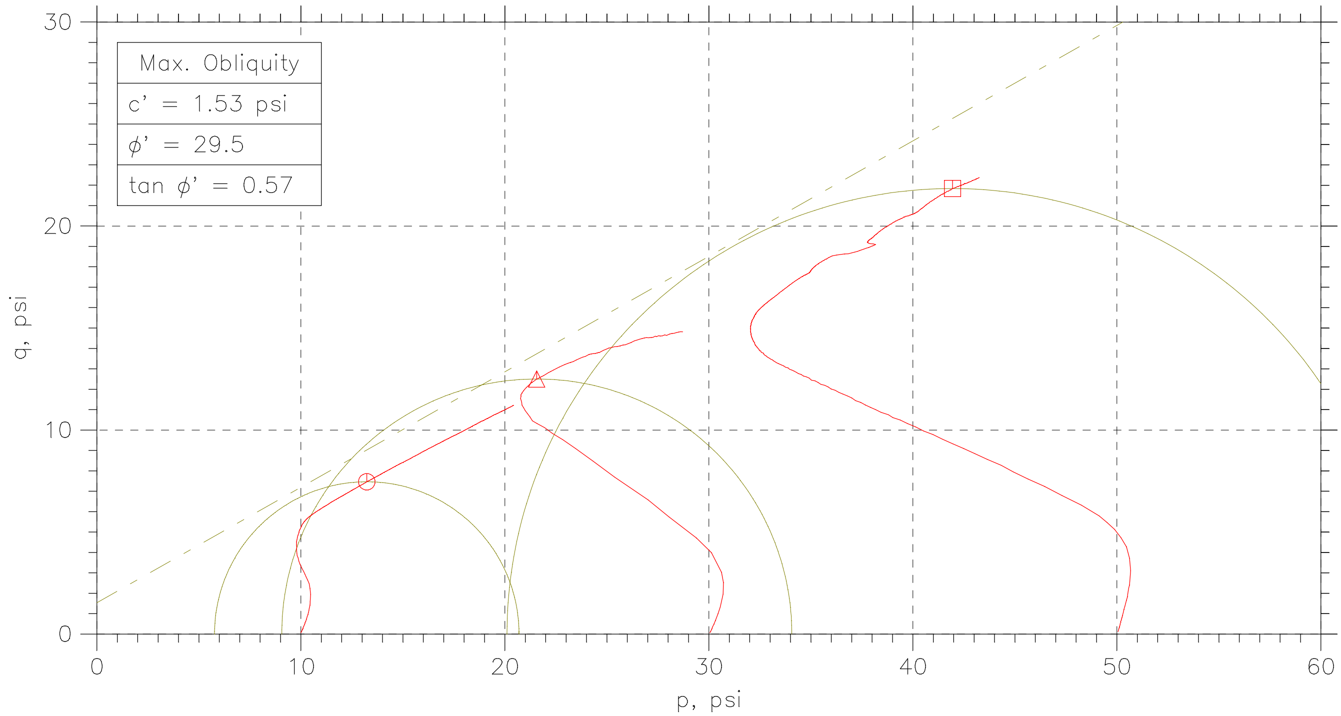
Project Cumberland Fossil Plant

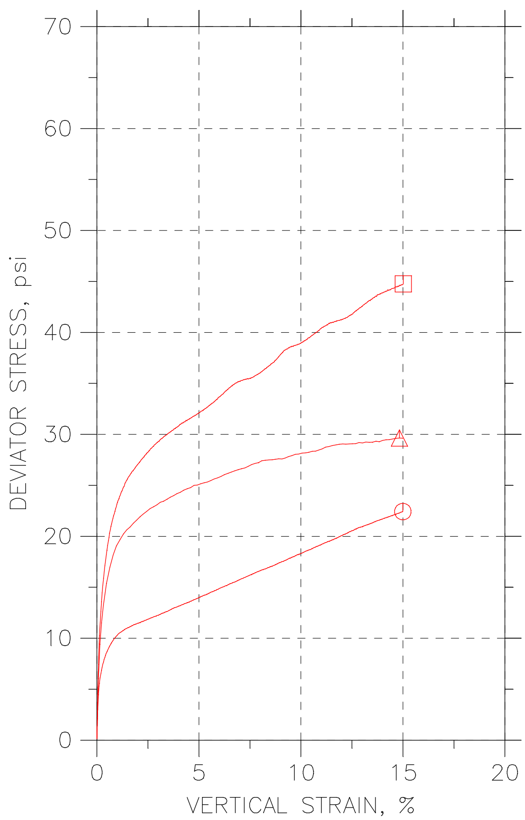
Project No. 175539016 | Lab no.

GeoTesting Express Inc.

○

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





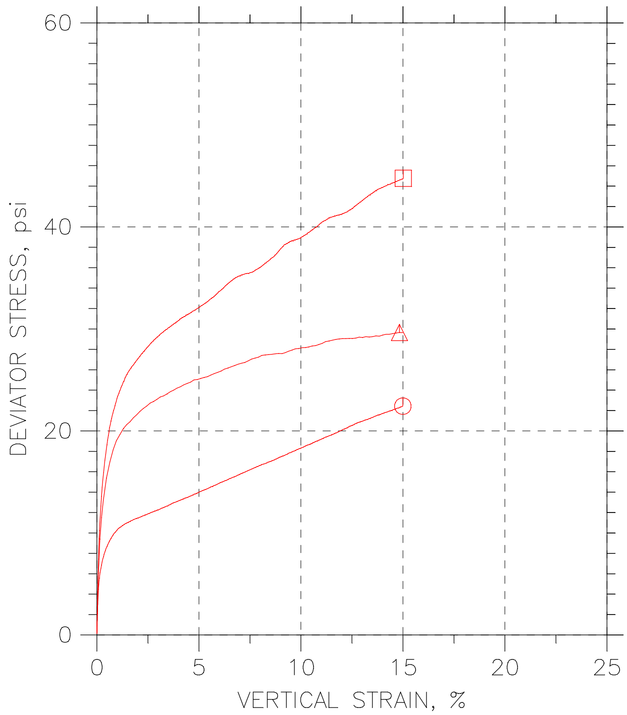
Symbol		○	△	□	
Sample No.		---	---	---	
Test No.		BA48A-1.1	B48A-1.2	B48A-1.3	
Depth		5-15'	5-15 ft	5-15'	
Initial	Diameter, in	2.863	2.859	2.849	
	Height, in	5.998	5.896	5.992	
	Water Content, %	21.0	20.9	20.6	
	Dry Density, pcf	100.2	100.	100.3	
	Saturation, %	83.0	82.1	81.5	
	Void Ratio	0.682	0.686	0.681	
Before Shear	Water Content, %	22.4	21.2	20.3	
	Dry Density, pcf	105.	107.2	108.9	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.606	0.572	0.548	
	Back Press., psi	98.44	119	97.92	
Ver. Eff. Cons. Stress, psi		9.939	29.99	49.94	
Shear Strength, psi		11.21	14.82	22.38	
Strain at Failure, %		15	14.8	15	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.96	0.95	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		54	54	54	
Plastic Limit		20	20	20	

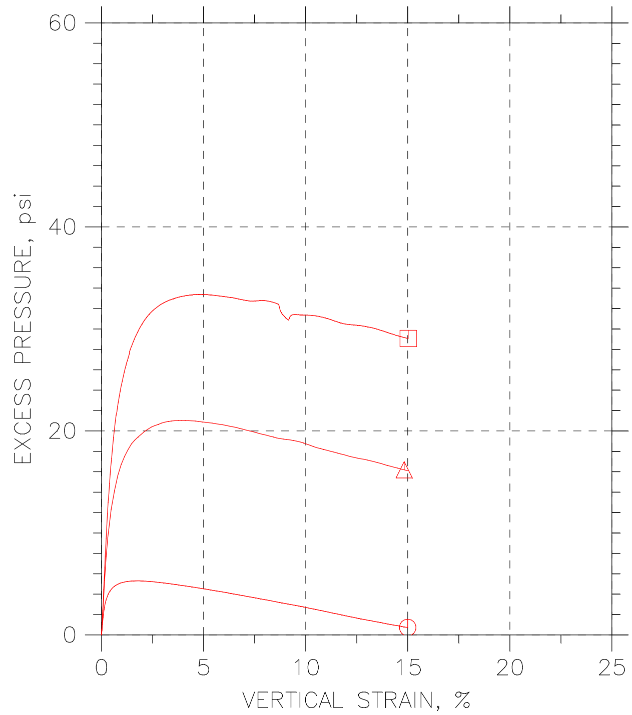
GeoTesting express
a subsidiary of Geocomp Corporation

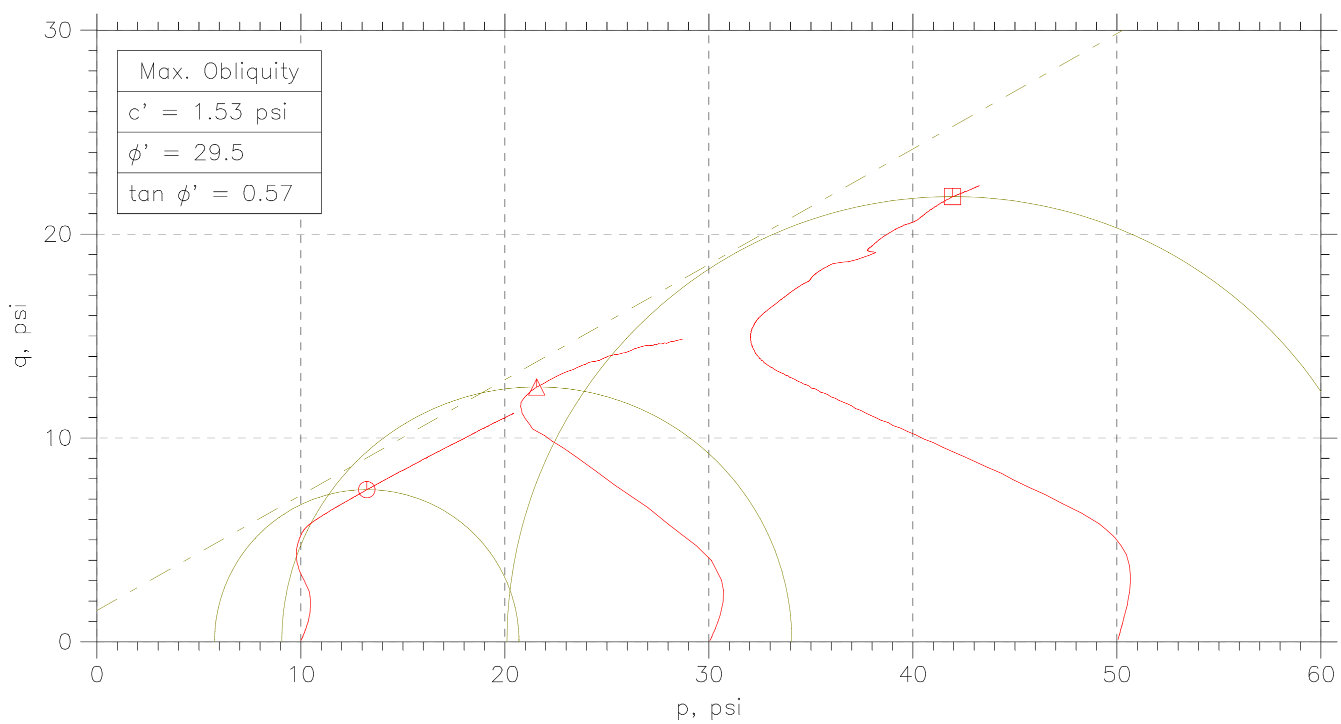
Project: Cumberland Fossil Plant
Location: ---
Project No.: GTX-1493
Boring No.: B-48A
Sample Type: Remolded
Description: Moist, brown fat clay with sand
Remarks: Compact test specimens to 95% max. density

Thu, 01-OCT-2009 09:23:15

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





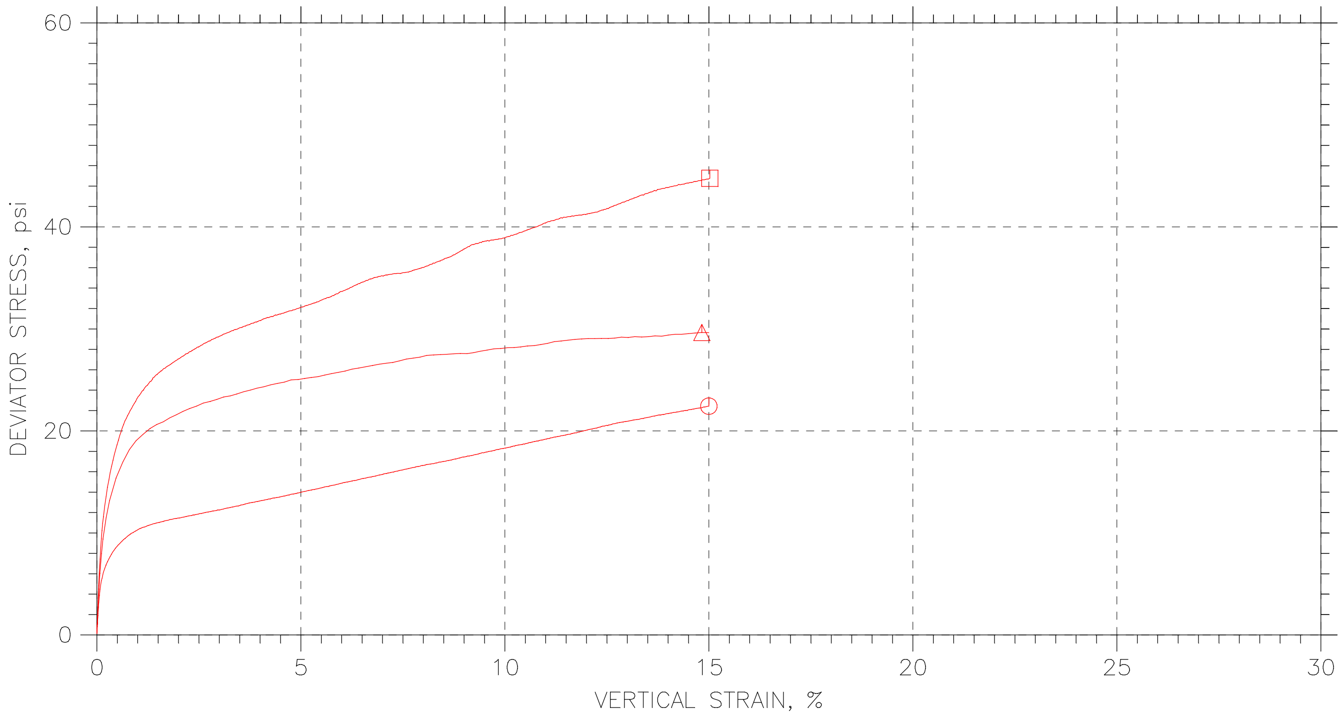


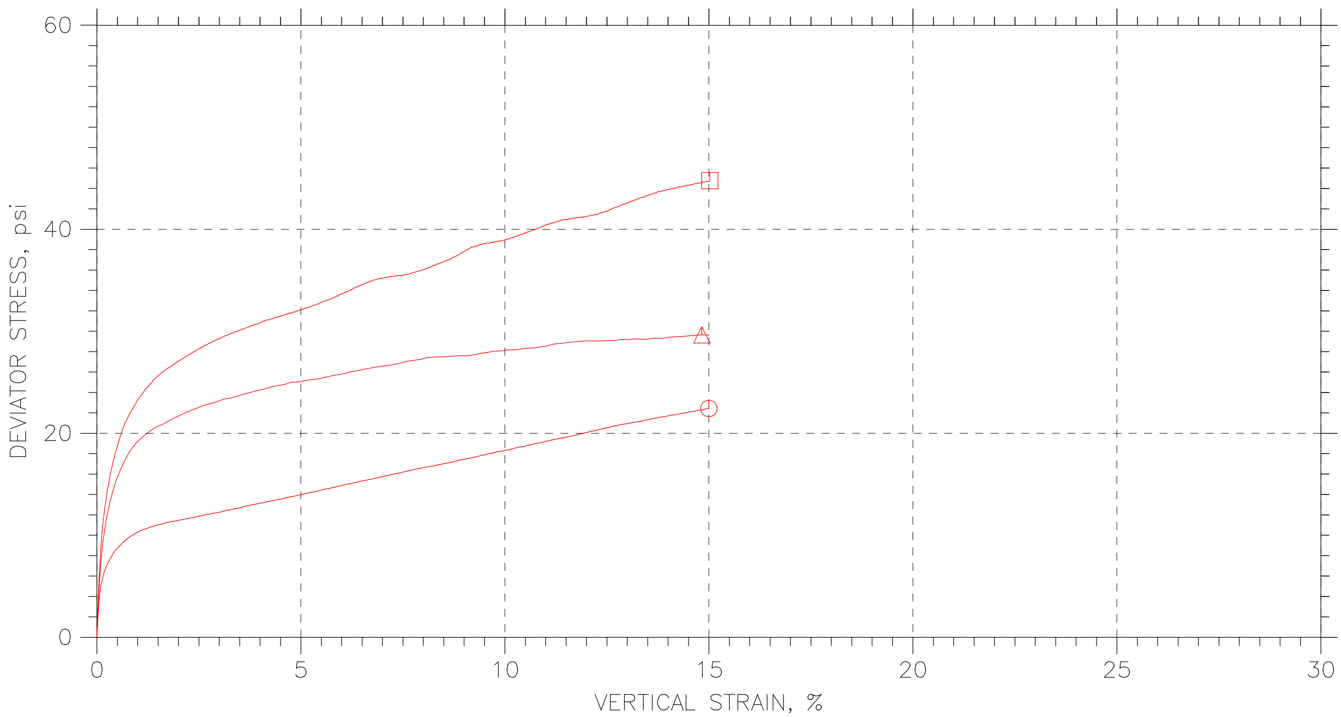
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	BA48A-1.1	5-15'	MM	9/26/09	GT		1493-B48A-1.1.dat
△	---	B48A-1.2	5-15 ft	MM	9/26/09	GT		1493-B48A-1.2.dat
□	---	B48A-1.3	5-15'	MM	9/26/09	GT		1493-B48A-1.3.dat

GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: B-48A	Sample Type: Remolded	
Description: Moist, brown fat clay with sand		
Remarks: Compact test specimens to 95% max. density		

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





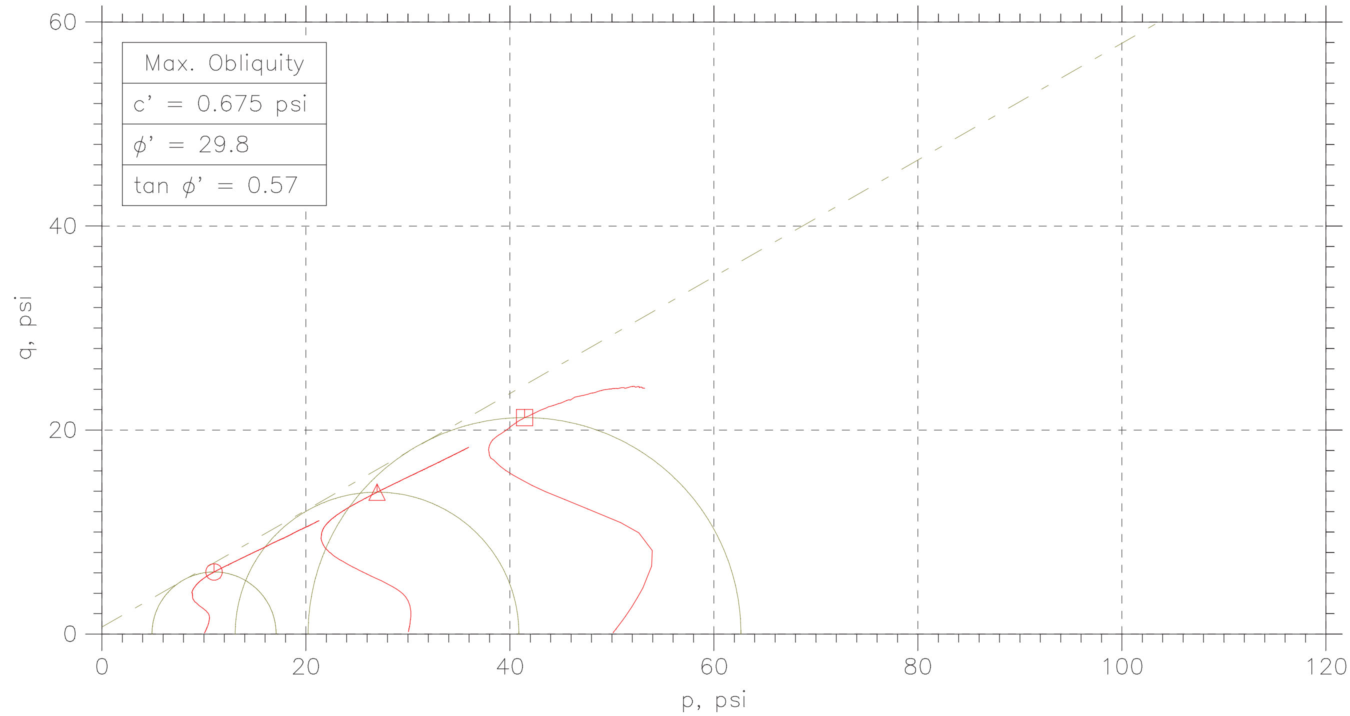
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	BA48A-1.1	5-15'	MM	9/26/09	GT		1493-B48A-1.1.dat
△	---	B48A-1.2	5-15 ft	MM	9/26/09	GT		1493-B48A-1.2.dat
□	---	B48A-1.3	5-15'	MM	9/26/09	GT		1493-B48A-1.3.dat

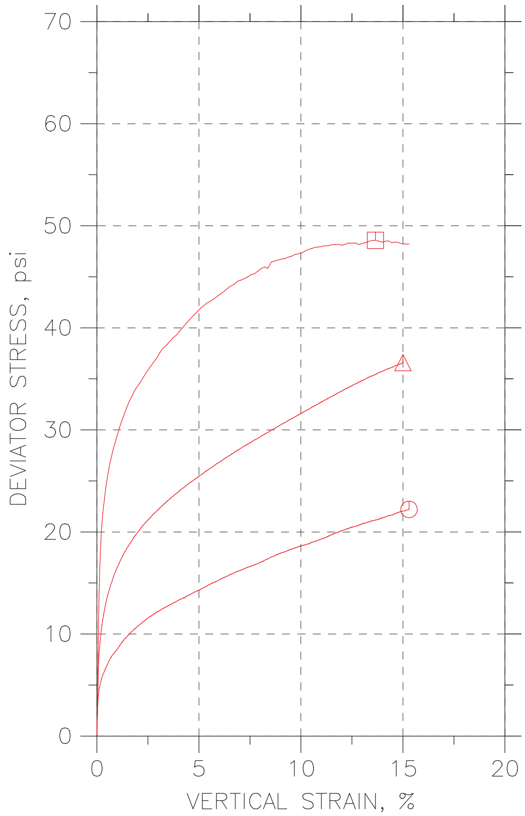
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: B-48A	Sample Type: Remolded	
Description: Moist, brown fat clay with sand		
Remarks: Compact test specimens to 95% max. density		

Thu, 01-OCT-2009 09:23:18

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





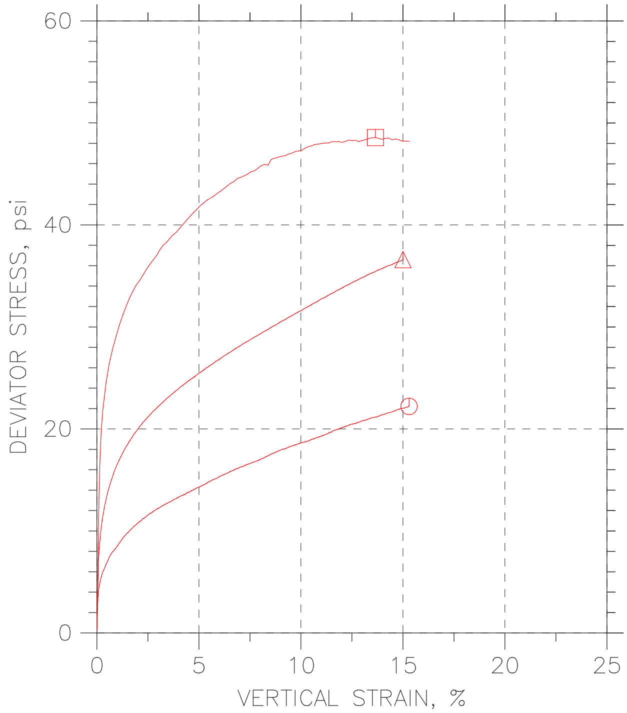
		1	2	3	
Symbol		○	△	□	
Sample No.		---	---	---	
Test No.		11.1	11.2	11.3	
Depth		5-10 ft	5-10 '	5-10 ft	
Initial	Diameter, in	2.879	2.878	2.879	
	Height, in	5.89	5.951	5.977	
	Water Content, %	23.6	23.4	23.4	
	Dry Density, pcf	96.87	96.48	96.68	
	Saturation, %	86.1	84.5	84.8	
	Void Ratio	0.74	0.747	0.744	
Before Shear	Water Content, %	23.2	21.9	20.0	
	Dry Density, pcf	103.6	105.9	109.4	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.627	0.592	0.541	
	Back Press., psi	140	119.2	101	
Ver. Eff. Cons. Stress, psi		9.972	29.82	49.99	
Shear Strength, psi		11.1	18.29	24.29	
Strain at Failure, %		15.3	15	13.7	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.96	0.95	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		61	61	61	
Plastic Limit		21	21	21	

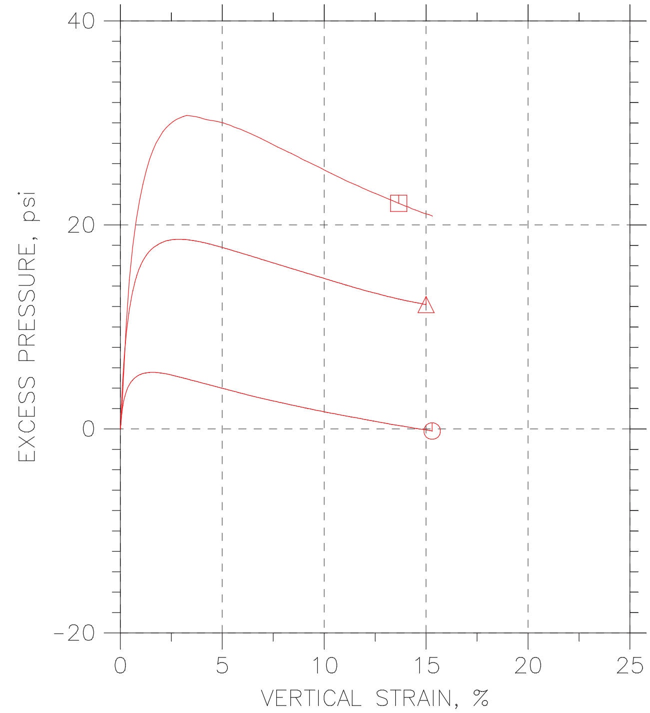
GeoTesting express
a subsidiary of Geocomp Corporation

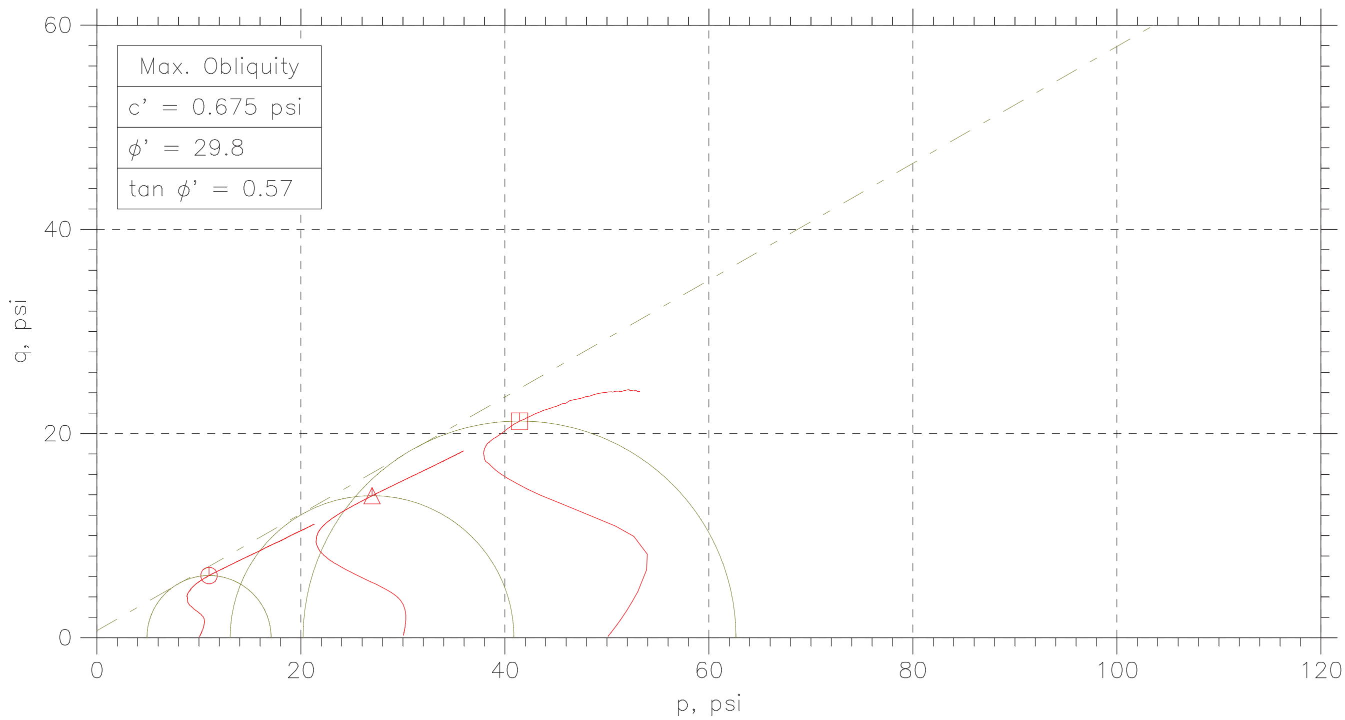
Project: Cumberland Fossil Plant	
Location: ---	
Project No.: GTX-1493	
Boring No.: B-52A	
Sample Type: Remolded	
Description: Brown Sandy fat clay	
Remarks: System 1057	

Thu, 22-OCT-2009 17:06:19

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







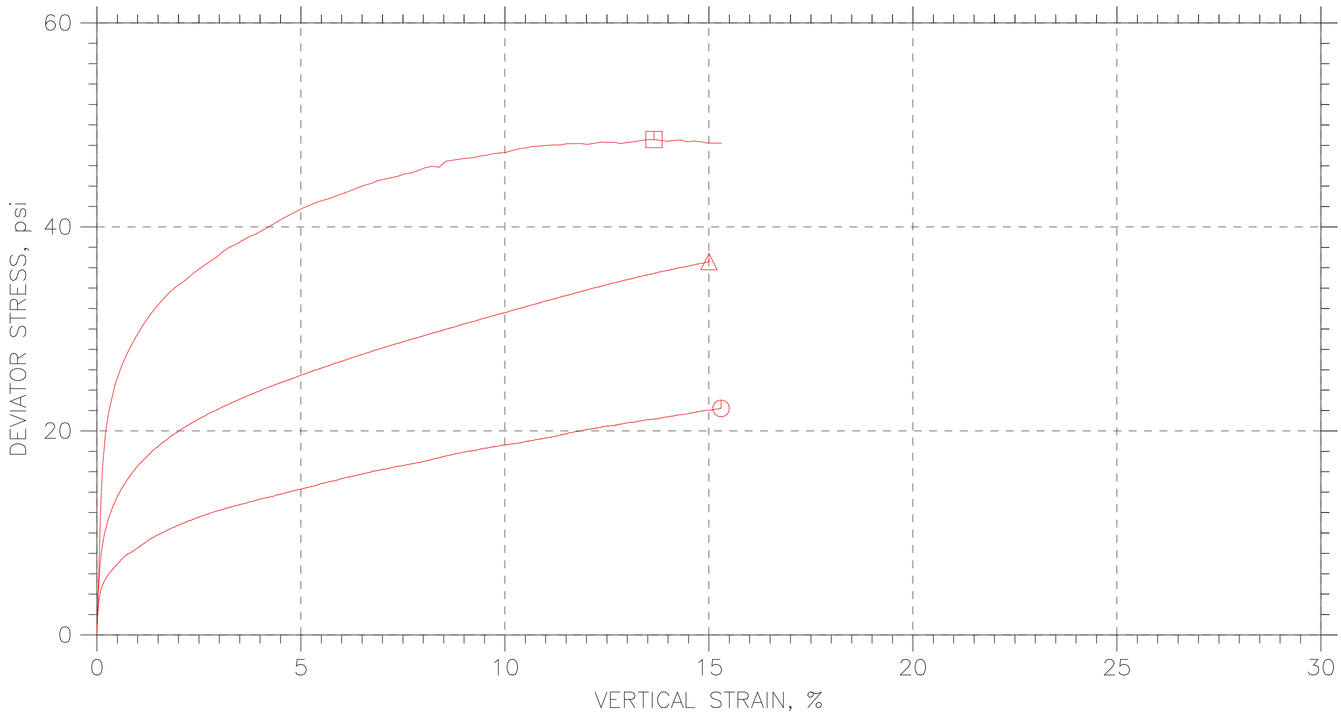
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	11.1	5-10 ft	MM	10/5/09	GT		1493-11.1.dat
△	---	11.2	5-10 '	MM	10/03/09	GT		1493 -11.2.dat
□	---	11.3	5-10 ft	MM	10/2/09	GT		1493-11.3.dat

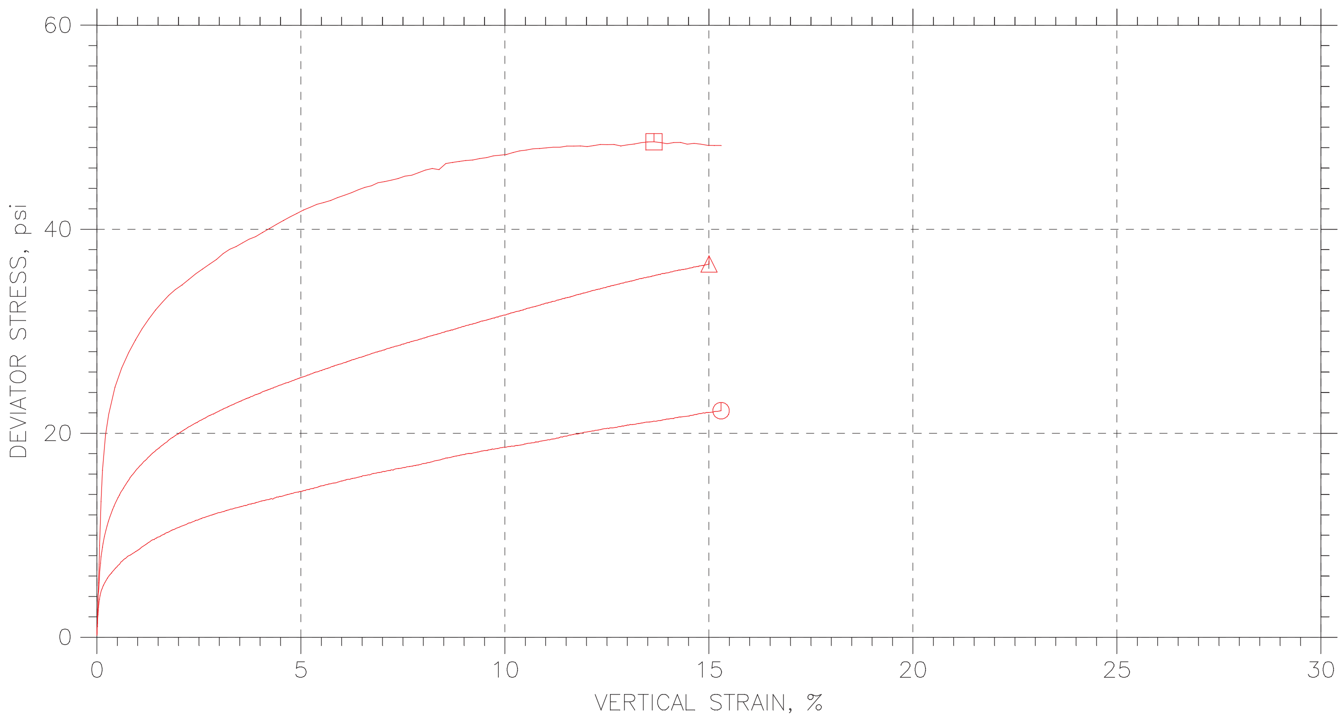
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: B-52A	Sample Type: Remolded	
Description: Brown Sandy fat clay		
Remarks: System 1057		

Thu, 22-OCT-2009 17:06:20

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





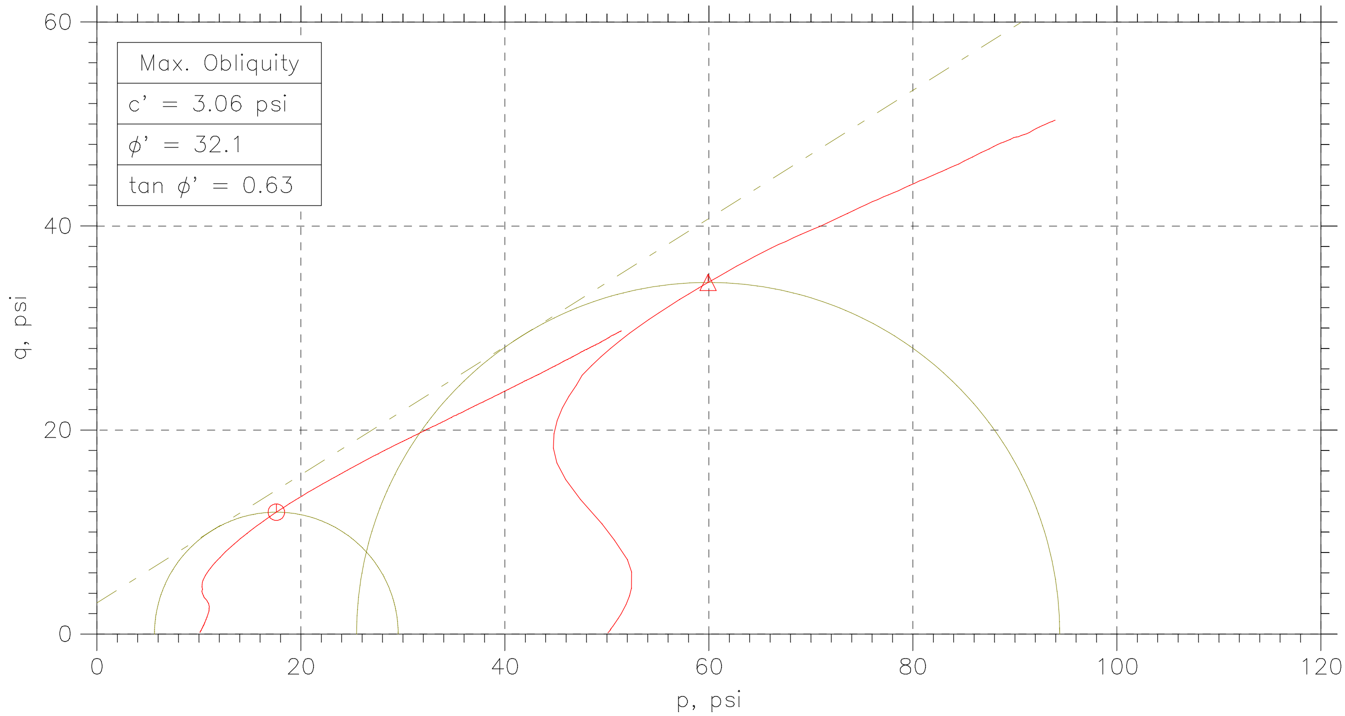
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	11.1	5-10 ft	MM	10/5/09	GT		1493-11.1.dat
△	---	11.2	5-10 '	MM	10/03/09	GT		1493 -11.2.dat
□	---	11.3	5-10 ft	MM	10/2/09	GT		1493-11.3.dat

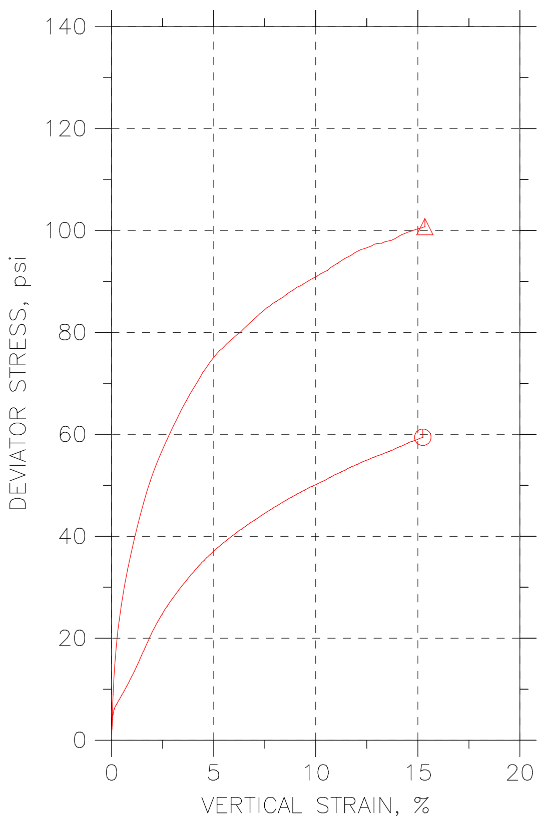
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: B-52A	Sample Type: Remolded	
Description: Brown Sandy fat clay		
Remarks: System 1057		

Thu, 22-OCT-2009 17:06:21

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





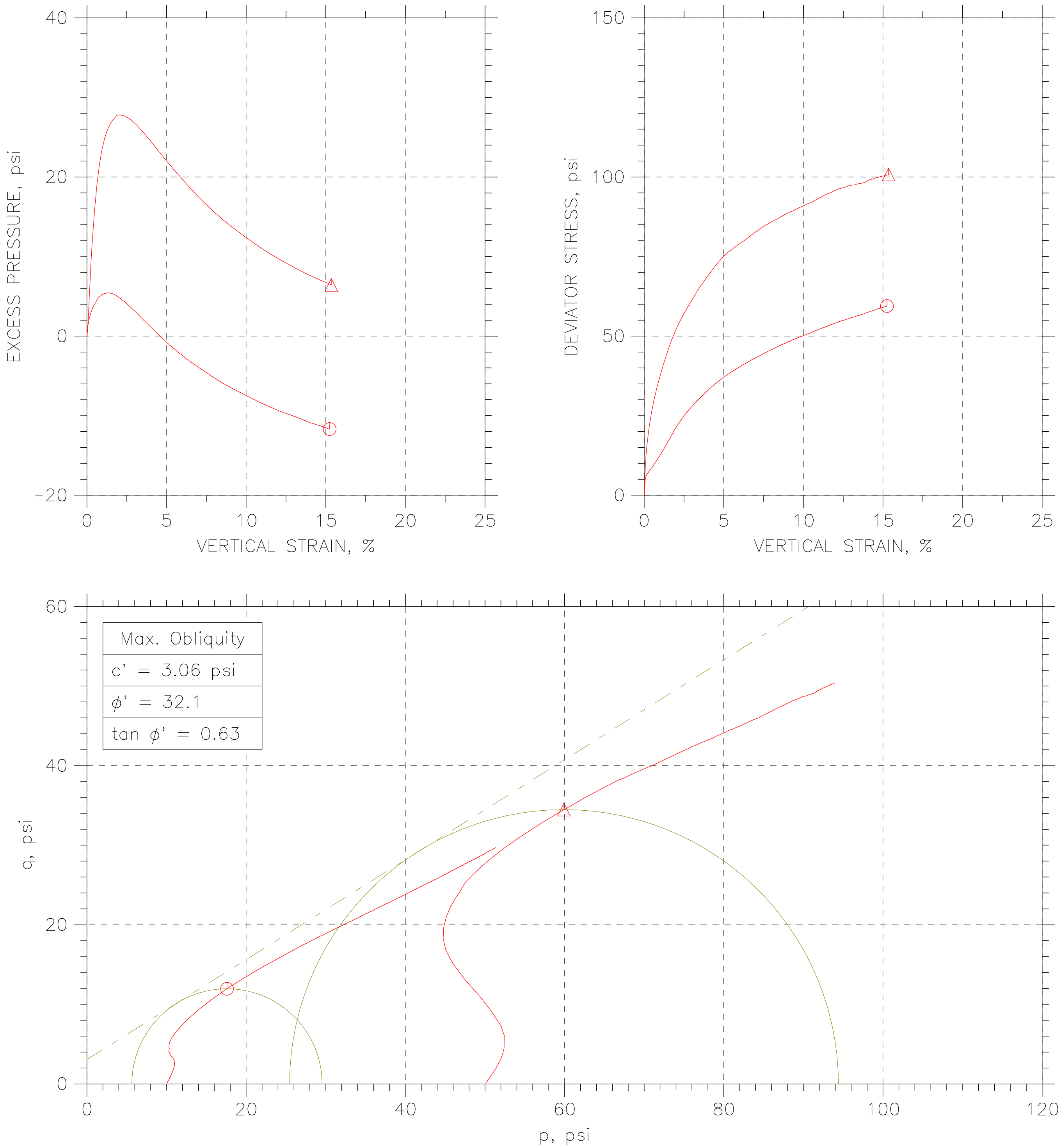
Symbol		○	△		
Sample No.		---	---		
Test No.		2.1	2.2		
Depth		30.6-31.2	31.3-31.8'		
Initial	Diameter, in	2.824	2.849		
	Height, in	6.028	6.063		
	Water Content, %	20.3	19.4		
	Dry Density, pcf	110.	109.4		
	Saturation, %	102.7	96.9		
	Void Ratio	0.533	0.541		
Before Shear	Water Content, %	20.2	18.6		
	Dry Density, pcf	109.	112.1		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.546	0.503		
	Back Press., psi	140	101		
Ver. Eff. Cons. Stress, psi		9.972	49.99		
Shear Strength, psi		29.72	50.37		
Strain at Failure, %		15.2	15.3		
Strain Rate, %/min		0.03	0.016		
B-Value		0.95	0.95		
Estimated Specific Gravity		2.7	2.7		
Liquid Limit		---	---		
Plastic Limit		---	---		

GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant
Location: ---
Project No.: GTX-1493
Boring No.: 54A
Sample Type: Remolded
Description: Brown Silty lean clay with sand
Remarks: System 1057

Wed, 07-OCT-2009 16:53:24

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



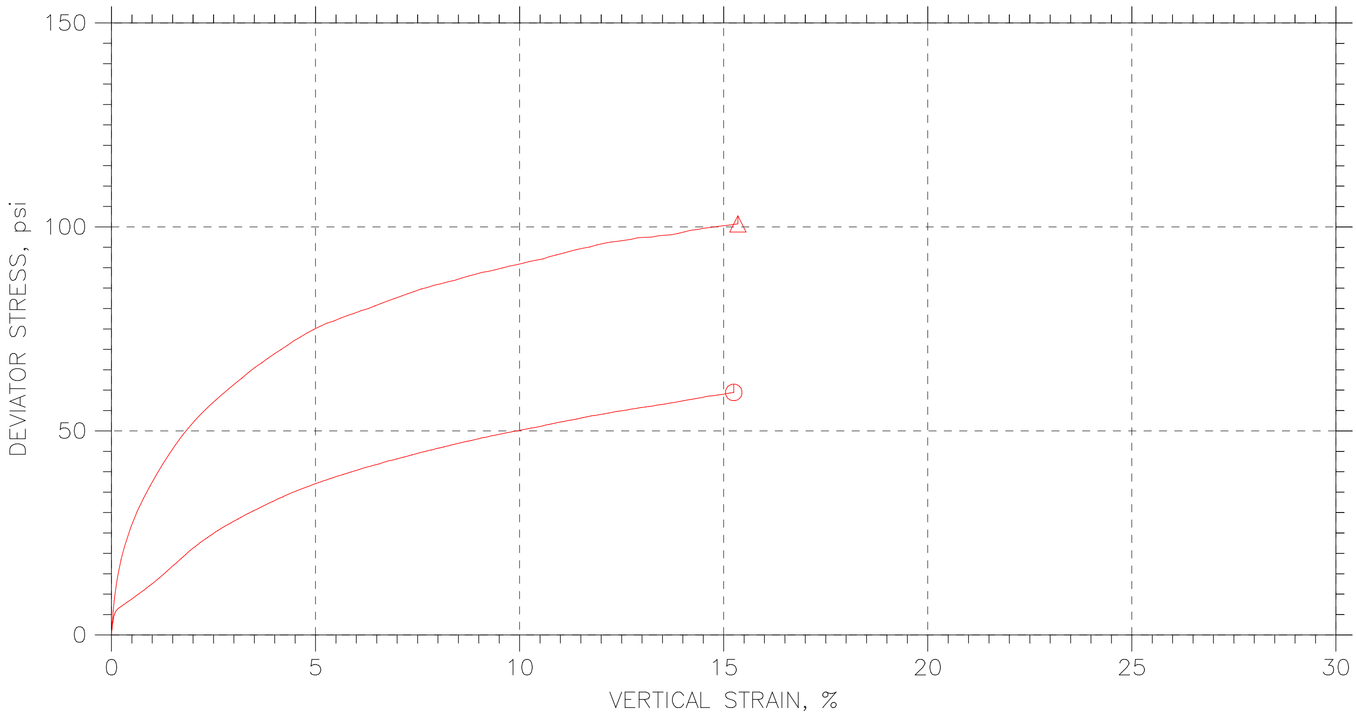
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	2.1	30.6-31.2	MM	9/29/09	GT		1493-2.1.dat
△	---	2.2	31.3-31.8'	MM	9/29/09	GT		1493-2.2.dat

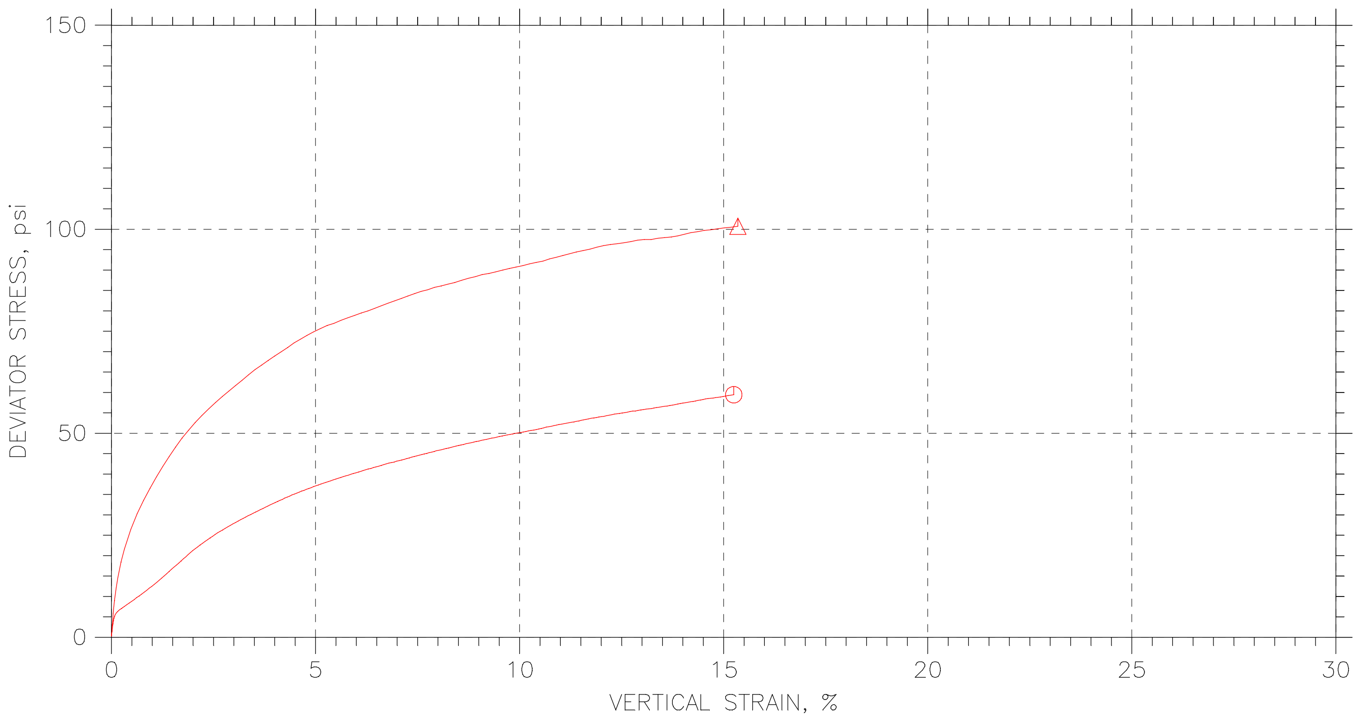
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: 54A	Sample Type: Remolded	
Description: Brown Silty lean clay with sand		
Remarks: System 1057		

Wed, 07-OCT-2009 16:53:25

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





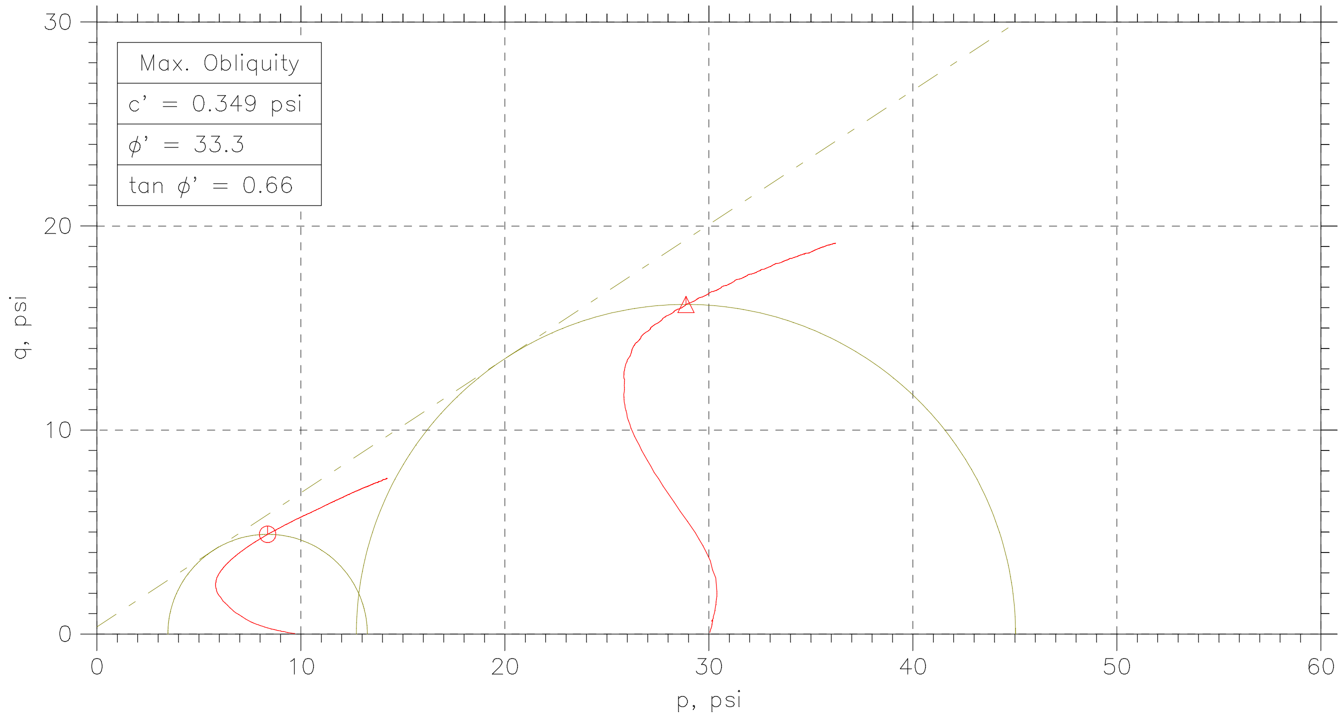
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	2.1	30.6-31.2	MM	9/29/09	GT		1493-2.1.dat
△	---	2.2	31.3-31.8'	MM	9/29/09	GT		1493-2.2.dat

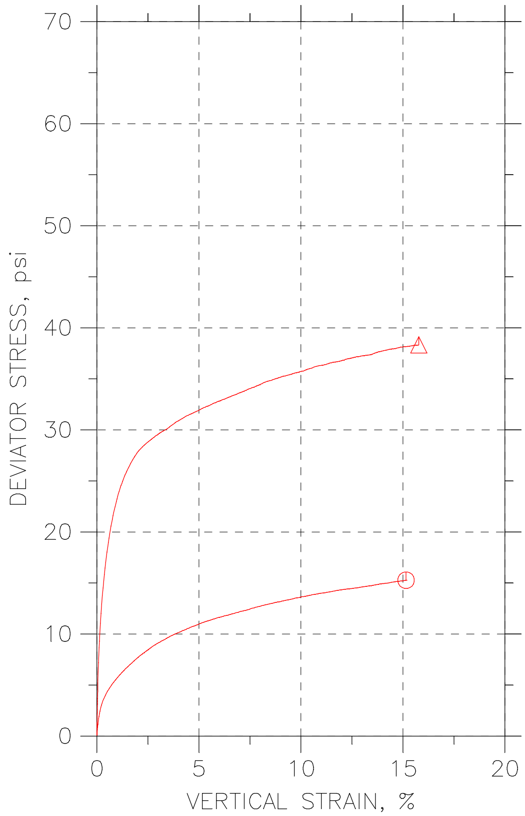
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: 54A	Sample Type: Remolded	
Description: Brown Silty lean clay with sand		
Remarks: System 1057		

Wed, 07-OCT-2009 16:53:26

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



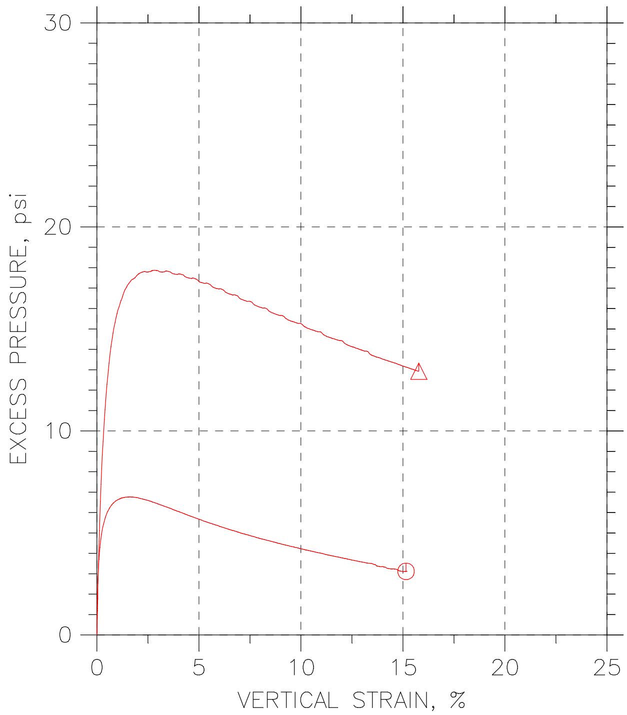


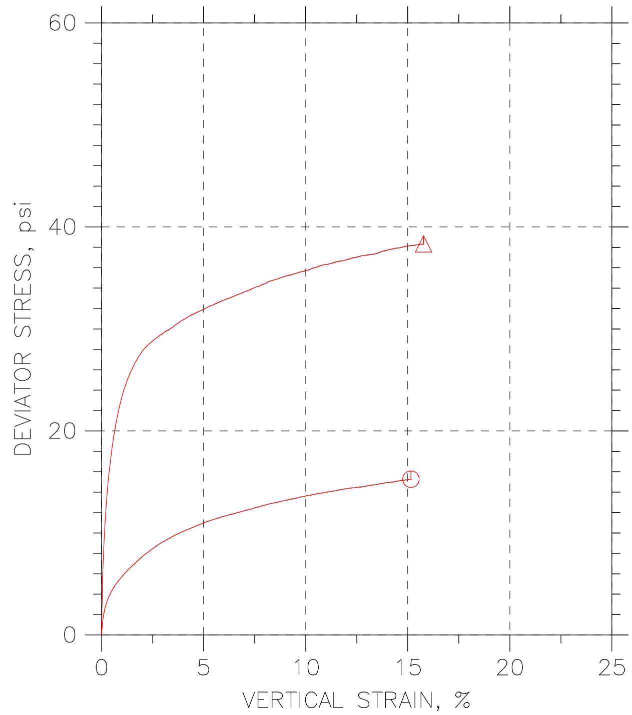
	Symbol	○	△		
	Sample No.	---	---		
	Test No.	3.1	3.2		
	Depth	45.2-45.8	45.8-46.4		
Initial	Diameter, in	2.848	2.834		
	Height, in	6.099	6.001		
	Water Content, %	24.9	23.2		
	Dry Density, pcf	99.97	102.1		
	Saturation, %	98.1	96.3		
	Void Ratio	0.686	0.651		
Before Shear	Water Content, %	25.2	23.1		
	Dry Density, pcf	100.3	103.8		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.68	0.624		
	Back Press., psi	71.61	80.29		
	Ver. Eff. Cons. Stress, psi	9.687	29.97		
	Shear Strength, psi	7.635	19.17		
	Strain at Failure, %	15.2	15.8		
	Strain Rate, %/min	0.016	0.016		
	B-Value	0.95	0.95		
	Estimated Specific Gravity	2.7	2.7		
	Liquid Limit	---	---		
	Plastic Limit	---	---		

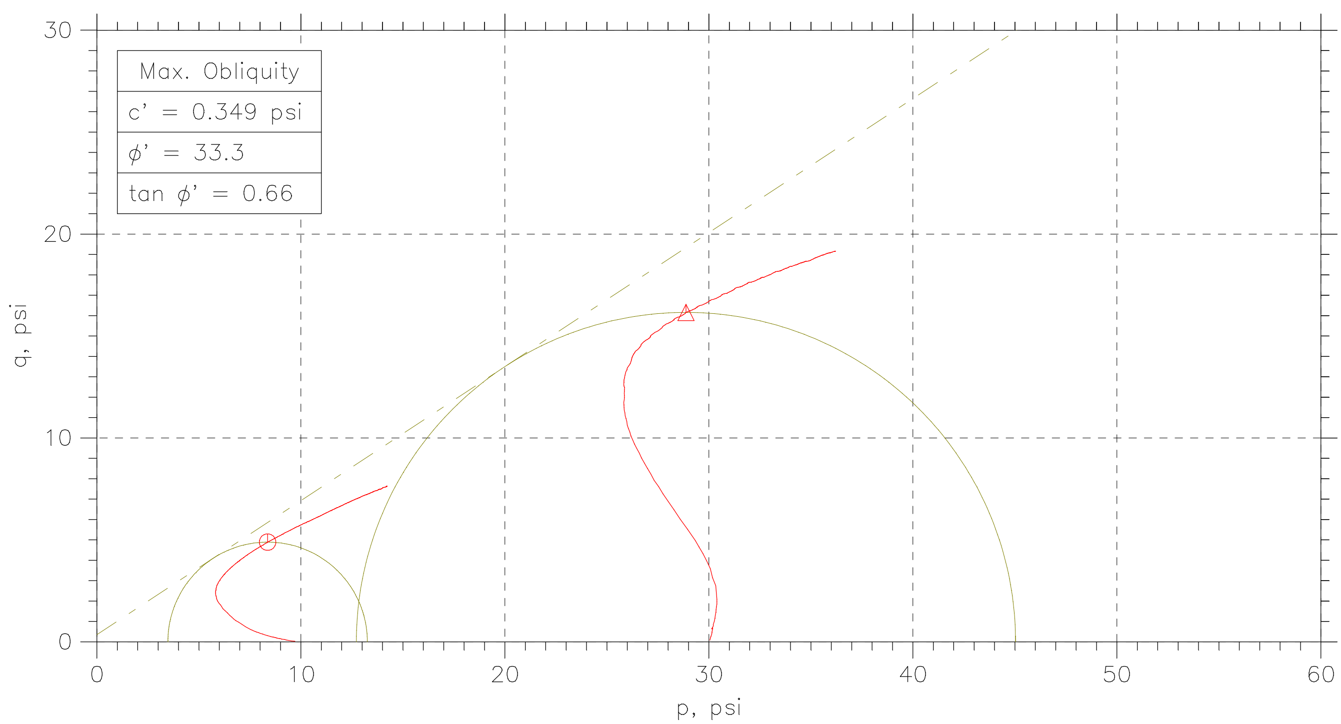
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant
Location: ---
Project No.: GTX-1493
Boring No.: 54A
Sample Type: Remolded
Description: Brown Lean clay
Remarks: 2054

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







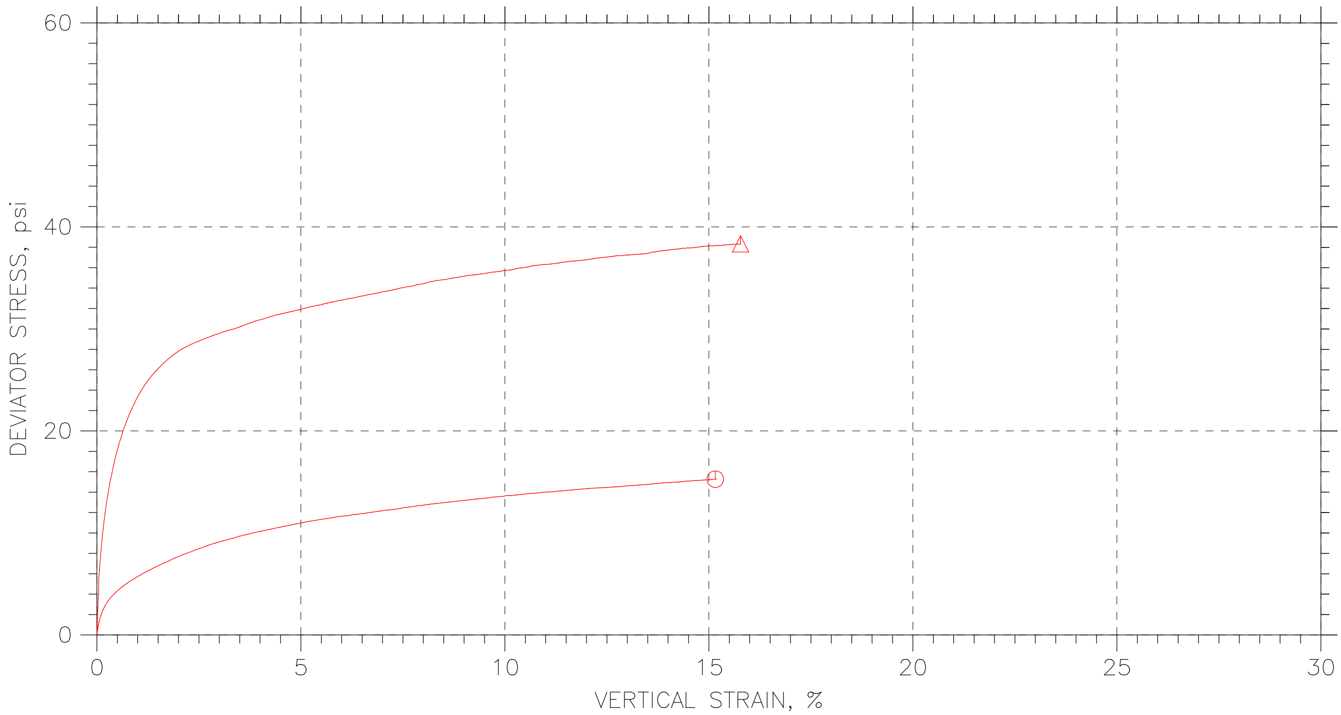
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	3.1	45.2-45.8	MM	10/01/09	GT		1493 -3.1.dat
△	---	3.2	45.8-46.4	MM	10/02/09	GT		1493 -3.2.dat

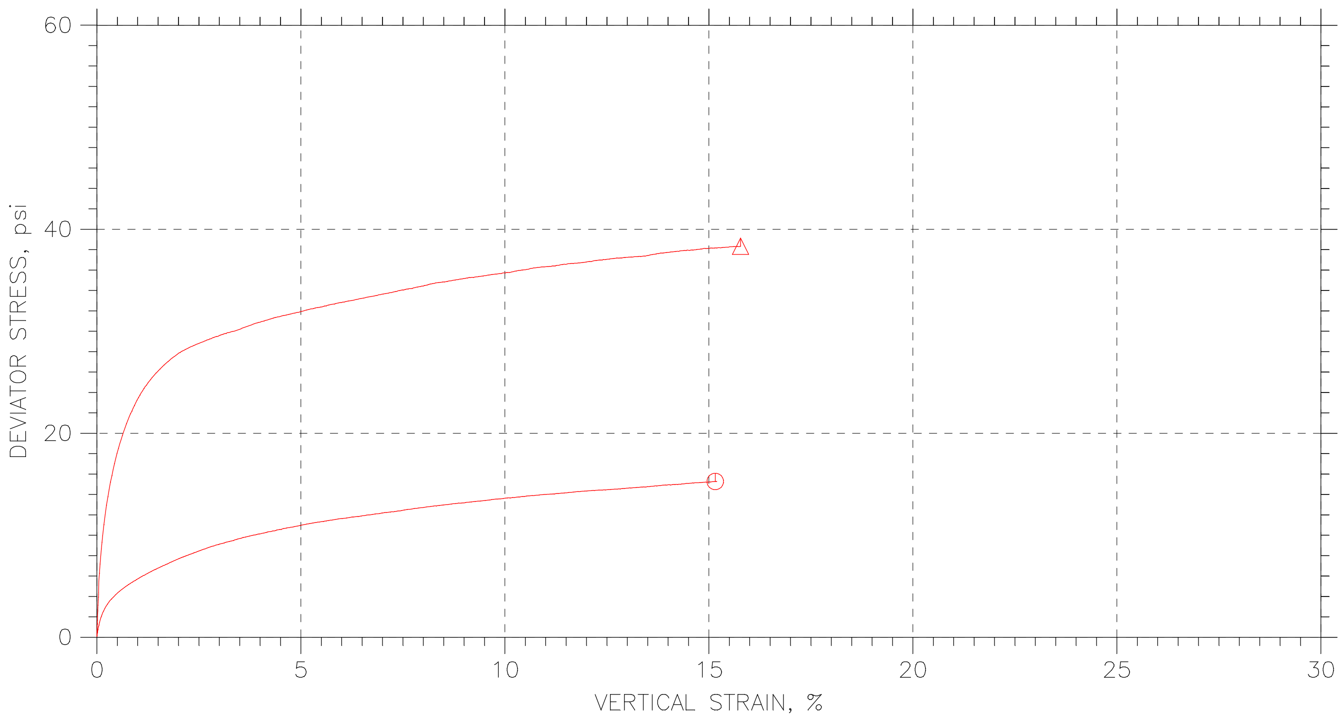
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: 54A	Sample Type: Remolded	
Description: Brown Lean clay		
Remarks: 2054		

Thu, 08-OCT-2009 09:51:45

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





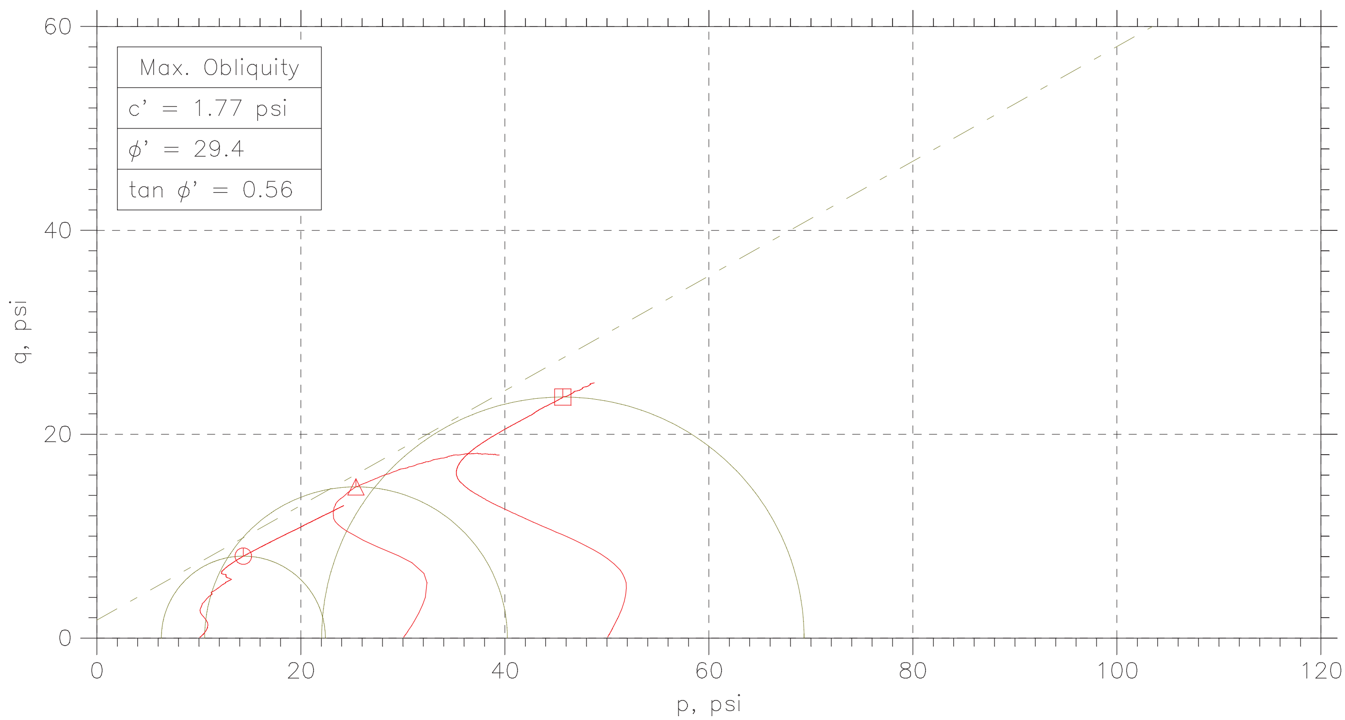
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	3.1	45.2-45.8	MM	10/01/09	GT		1493 -3.1.dat
△	---	3.2	45.8-46.4	MM	10/02/09	GT		1493 -3.2.dat

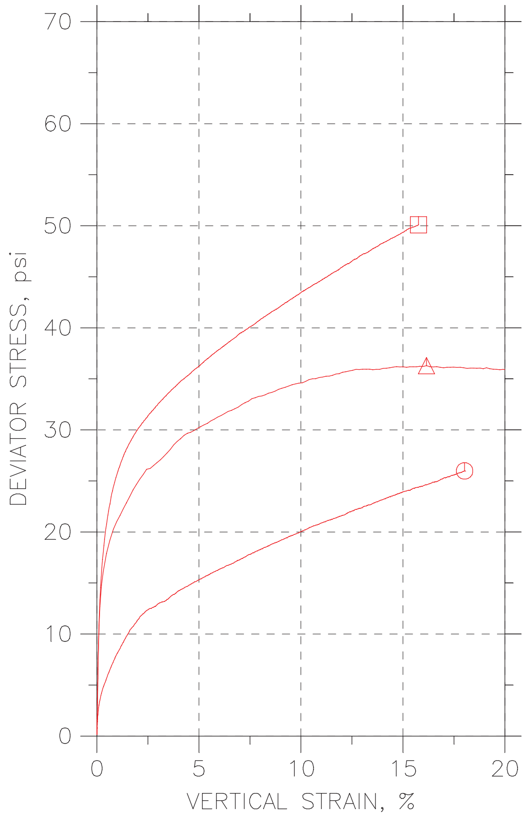
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: 54A	Sample Type: Remolded	
Description: Brown Lean clay		
Remarks: 2054		

Thu, 08-OCT-2009 09:51:47

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





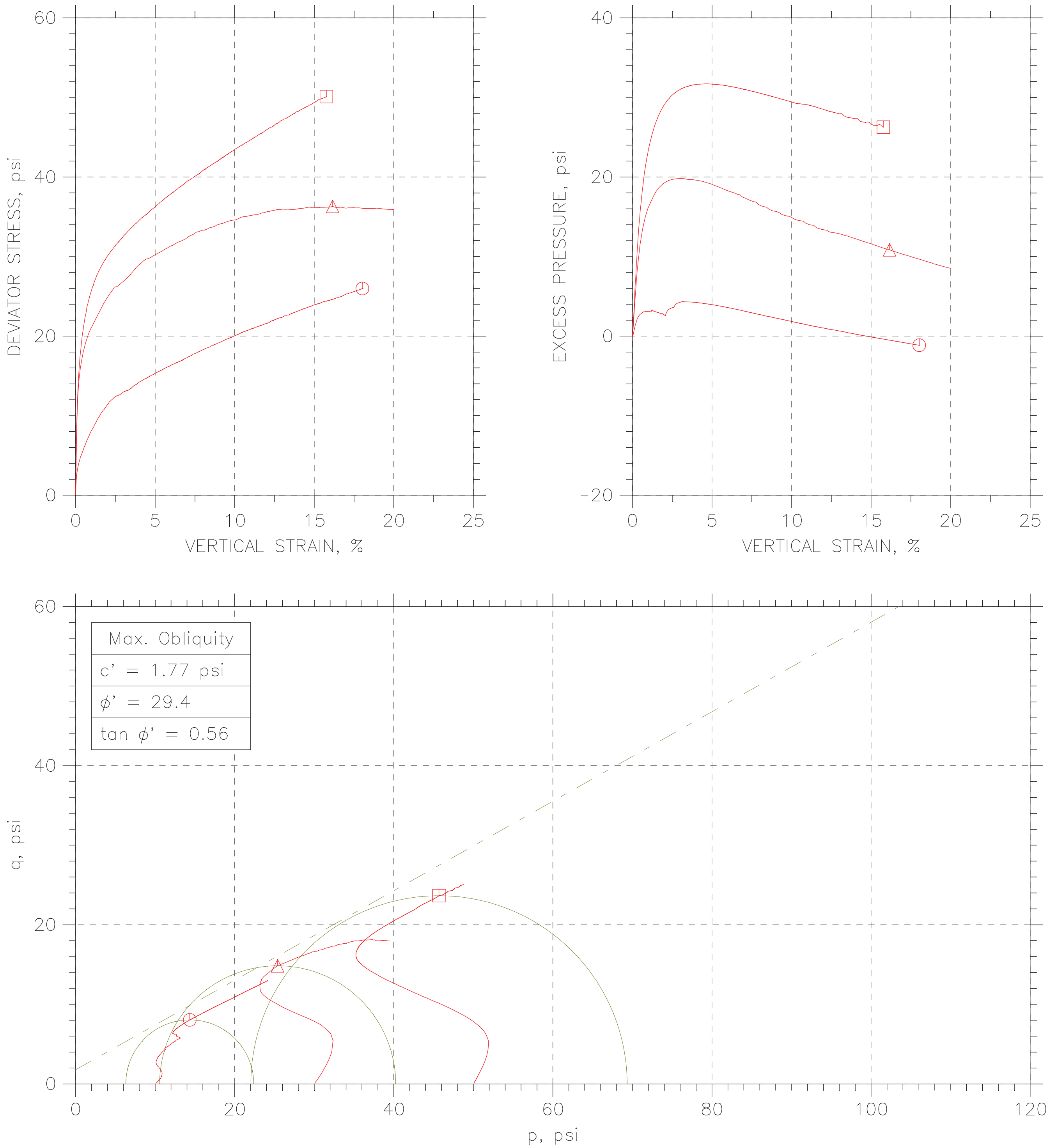
Symbol		○	△	□	
Sample No.		---	---	---	
Test No.		9.1	9.2	9.3	
Depth		10-20 ft	10-20 ft	10-20 ft	
Initial	Diameter, in	2.848	2.846	2.834	
	Height, in	6.019	5.946	6.021	
	Water Content, %	23.5	23.4	23.6	
	Dry Density, pcf	97.37	98.75	98.72	
	Saturation, %	86.7	89.3	90.1	
	Void Ratio	0.731	0.707	0.707	
Before Shear	Water Content, %	24.9	24.2	22.8	
	Dry Density, pcf	100.9	101.9	104.4	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.671	0.654	0.615	
	Back Press., psi	139.6	119	74.23	
Ver. Eff. Cons. Stress, psi		10.01	29.99	49.98	
Shear Strength, psi		12.99	18.15	25.05	
Strain at Failure, %		18	16.2	15.8	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.95	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		68	68	68	
Plastic Limit		23	23	23	

GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant
Location: ---
Project No.: GTX-1493
Boring No.: B-58
Sample Type: Remolded
Description: Brown Sandy fat clay
Remarks: System 1057

Thu, 22-OCT-2009 16:37:00

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



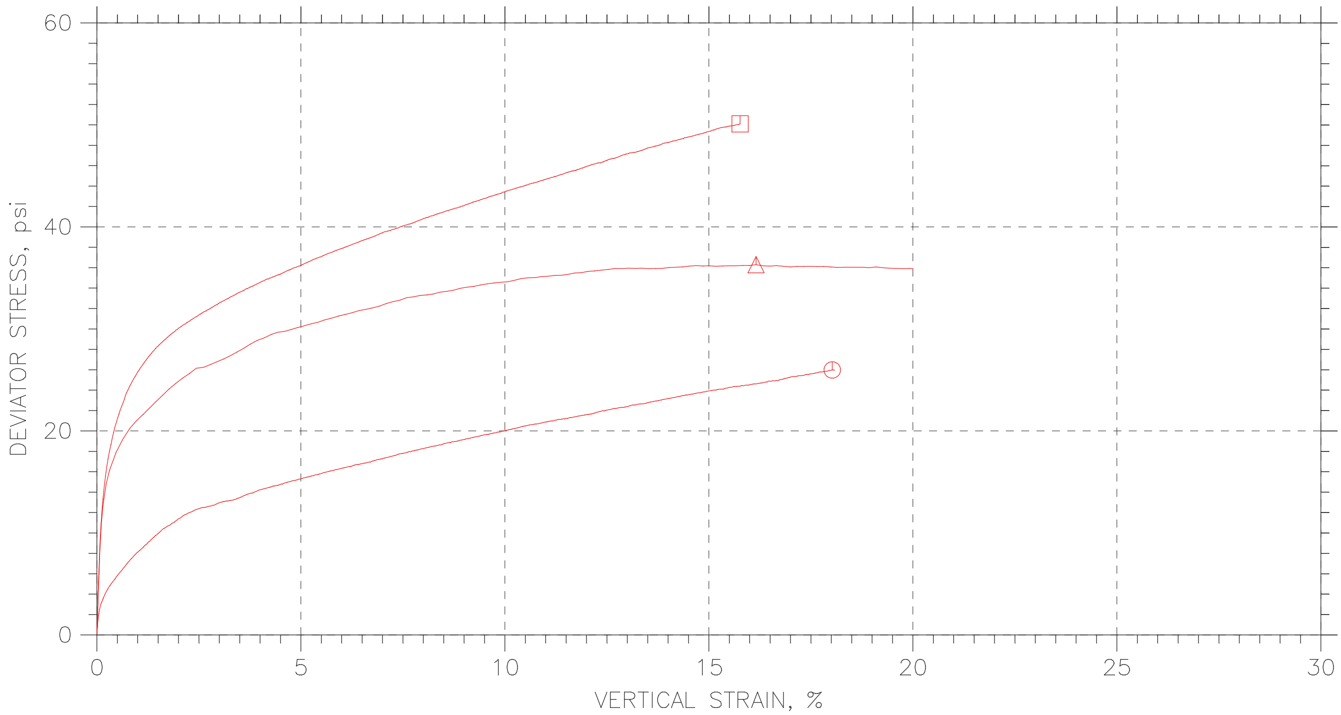
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	9.1	10-20 ft	MM	10/6/09	GT		1493-9.1.dat
△	---	9.2	10-20 ft	MM	10/05/09	GT		1493-9.2.dat
□	---	9.3	10-20 ft	MM	10/05/09	GT		1493 -9.3.dat

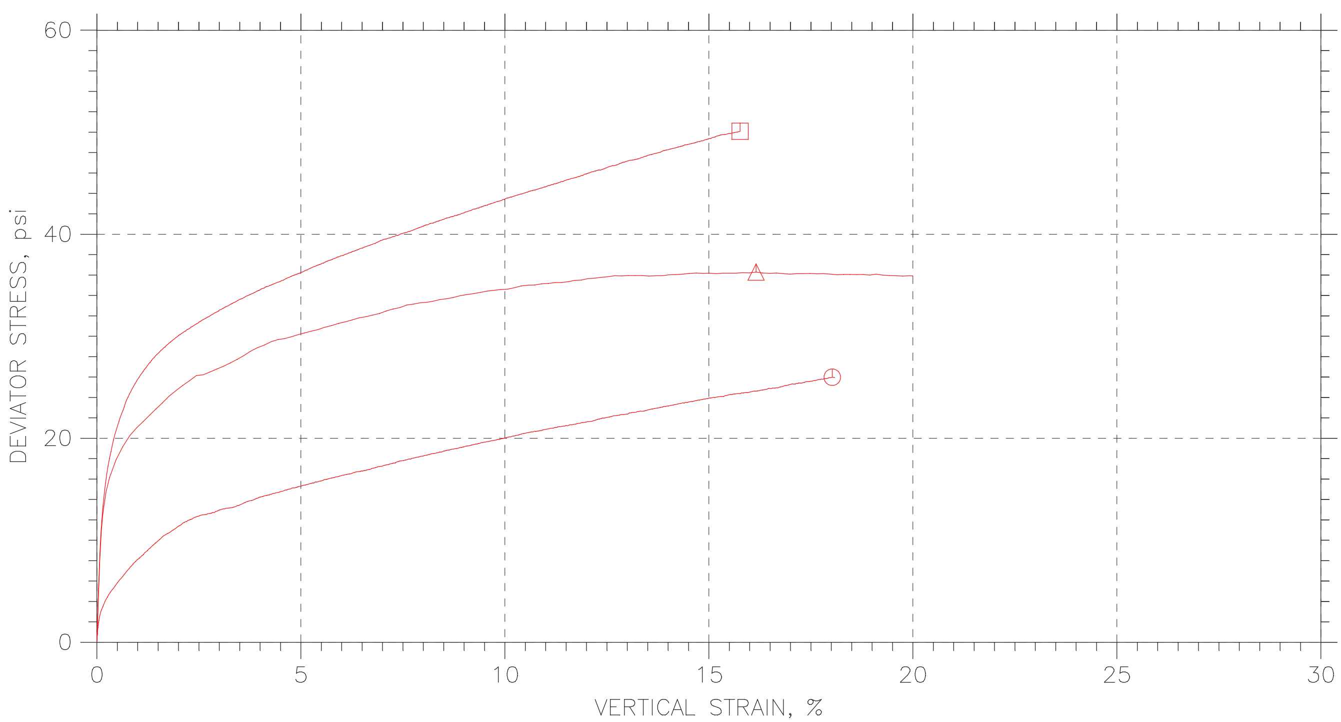
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: B-58	Sample Type: Remolded	
Description: Brown Sandy fat clay		
Remarks: System 1057		

Thu, 22-OCT-2009 16:37:01

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



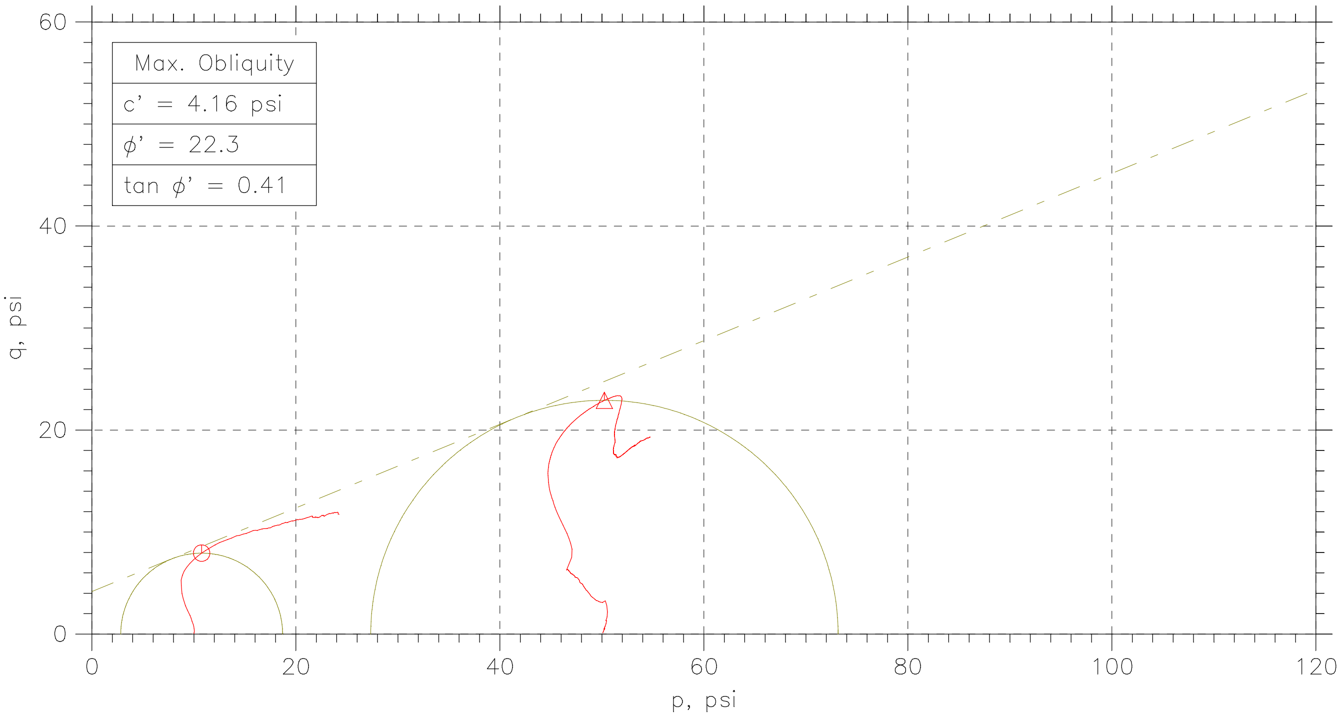


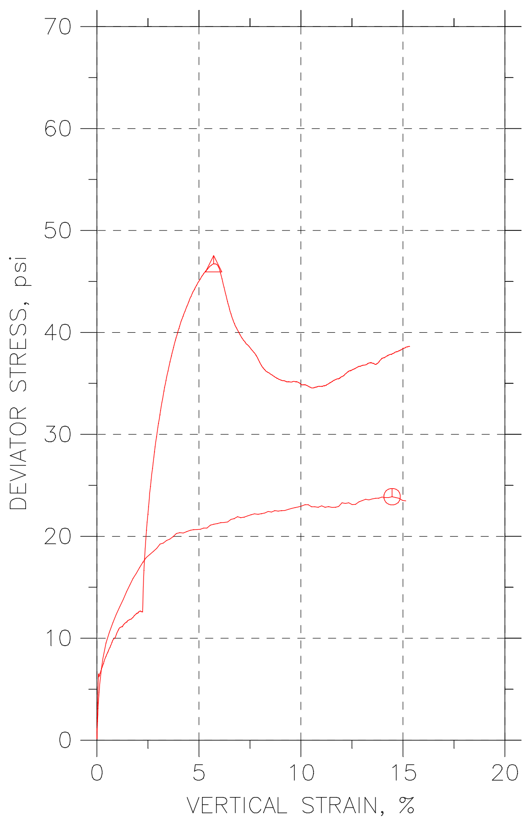
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	9.1	10-20 ft	MM	10/6/09	GT		1493-9.1.dat
△	---	9.2	10-20 ft	MM	10/05/09	GT		1493-9.2.dat
□	---	9.3	10-20 ft	MM	10/05/09	GT		1493 -9.3.dat

GeoTesting express a subsidiary of Geocomp Corporation	Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
	Boring No.: B-58	Sample Type: Remolded	
	Description: Brown Sandy fat clay		
	Remarks: System 1057		

Thu, 22-OCT-2009 16:37:02

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





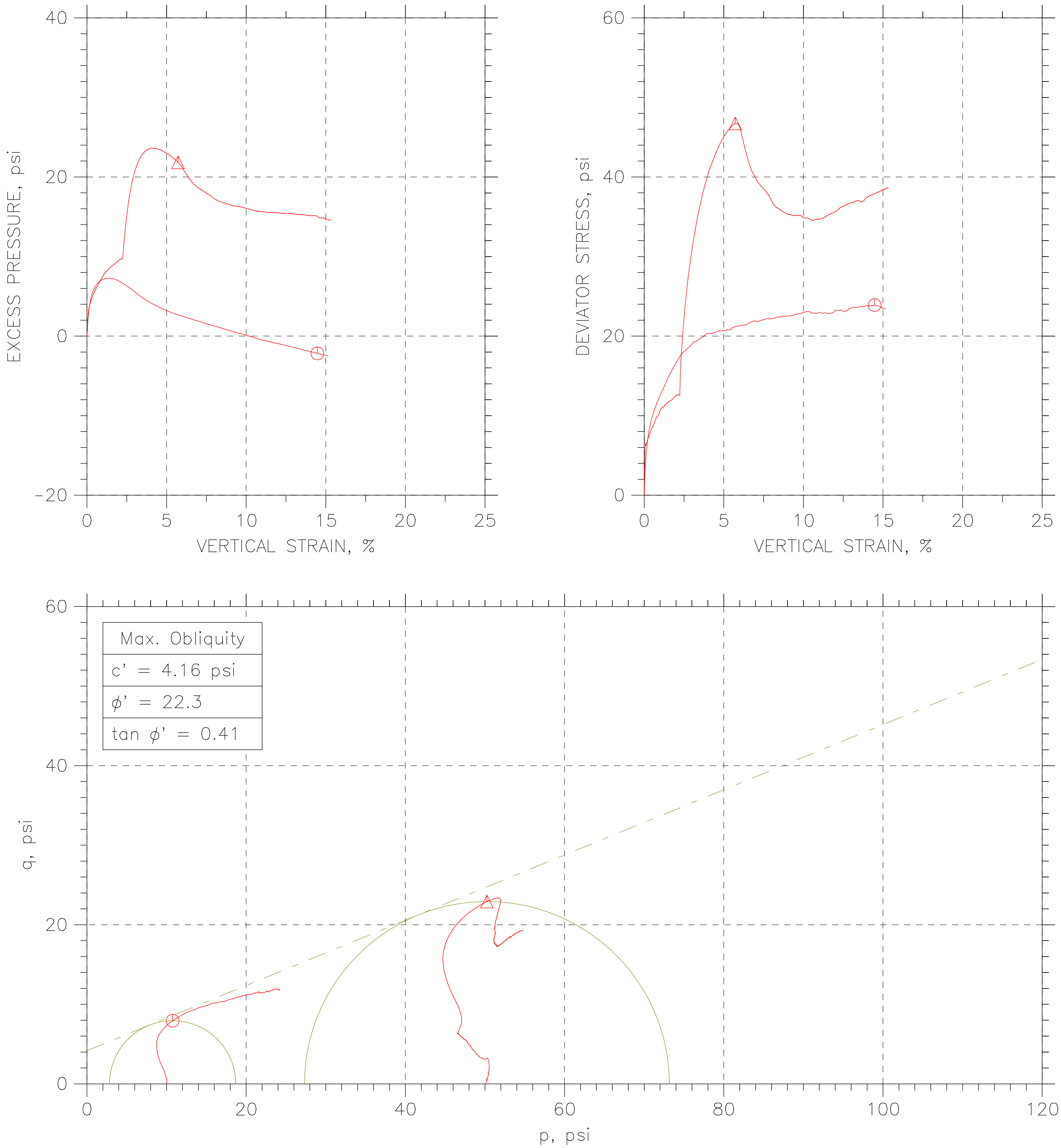
		○	△		
Symbol		○	△		
Sample No.		---	---		
Test No.		6.1	6.2		
Depth		26.0-26.5	26.5-27.0		
Initial	Diameter, in	2.875	2.853		
	Height, in	5.83	6		
	Water Content, %	27.9	25.7		
	Dry Density, pcf	92.13	98.88		
	Saturation, %	90.7	98.6		
	Void Ratio	0.83	0.705		
Before Shear	Water Content, %	30.1	25.8		
	Dry Density, pcf	92.94	99.32		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.814	0.697		
	Back Press., psi	140	89.42		
Ver. Eff. Cons. Stress, psi		9.96	49.98		
Shear Strength, psi		11.95	23.36		
Strain at Failure, %		14.5	5.72		
Strain Rate, %/min		0.016	0.016		
B-Value		0.96	0.95		
Estimated Specific Gravity		2.7	2.7		
Liquid Limit		---	---		
Plastic Limit		---	---		

GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant
Location: ---
Project No.: GTX-1493
Boring No.: 58A
Sample Type: UD
Description: Gray Brown lean clay
Remarks: System 1062

Thu, 08-OCT-2009 11:03:02

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



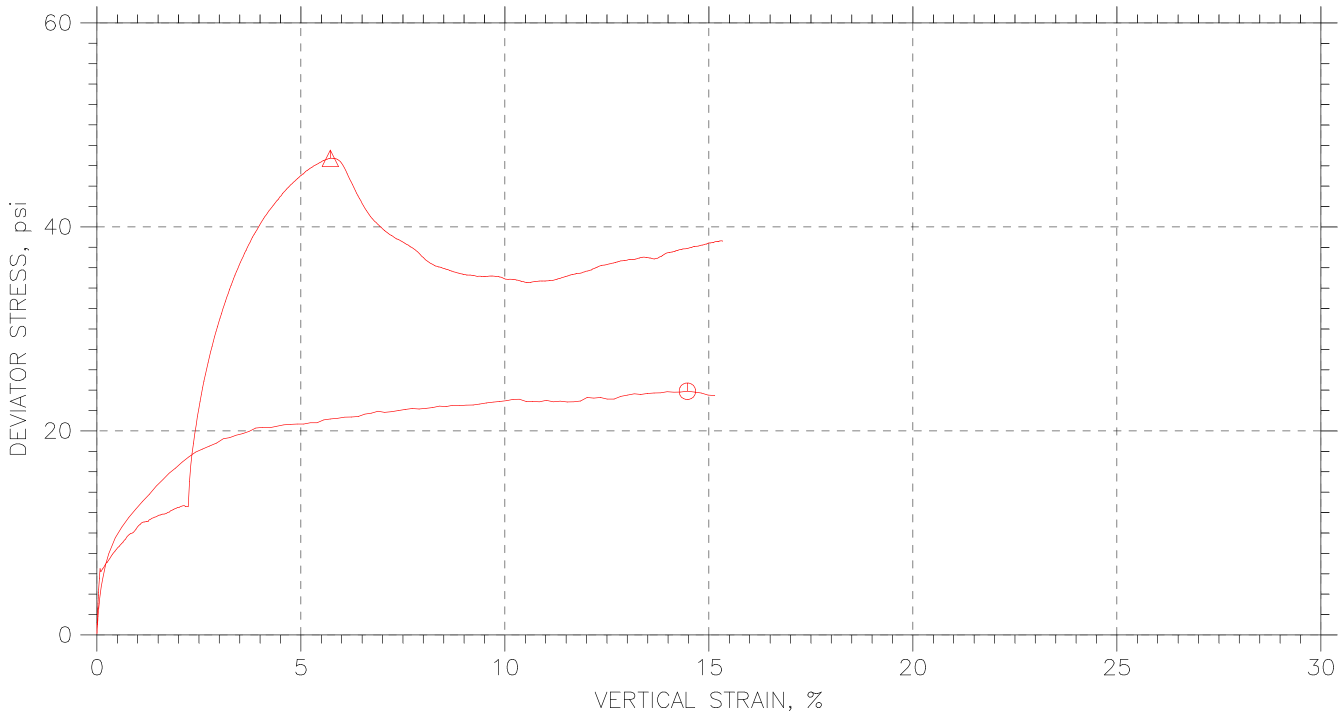
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	6.1	26.0-26.5	MM	9/30/09	GT		1493-6.1.dat
△	---	6.2	26.5-27.0	MM	9/30/09	GT		1493 - 6.2.dat

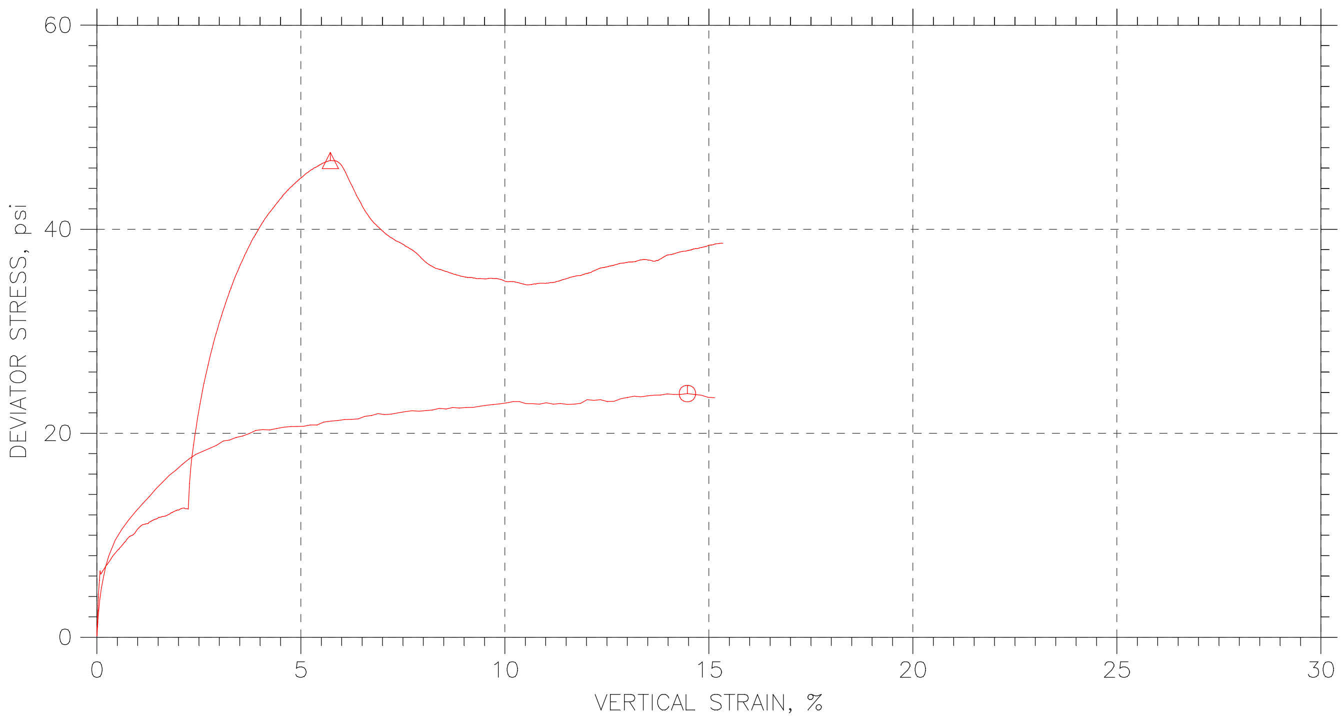
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: 58A	Sample Type: UD	
Description: Gray Brown lean clay		
Remarks: System 1062		

Thu, 08-OCT-2009 11:03:03

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⦶	---	6.1	26.0-26.5	MM	9/30/09	GT		1493-6.1.dat
△	---	6.2	26.5-27.0	MM	9/30/09	GT		1493 - 6.2.dat

GeoTesting express
a subsidiary of Geocomp Corporation

Project: Cumberland Fossil Plant	Location: ---	Project No.: GTX-1493
Boring No.: 58A	Sample Type: UD	
Description: Gray Brown lean clay		
Remarks: System 1062		

Thu, 08-OCT-2009 11:03:05

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1493*	Tested By	*JM*
Project Name	*Cumberland Fossil Plant*	Test Date	*9/30/2009*
Boring No.	*48A*	Reviewed By	*MM*
Sample No.	*----*	Review Date	*10/4/2009*
Sample Depth	*5-15 ft*	Lab No.	*---*
Sample Description	*Brown Sandy fat clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*Remolded*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*22.1*
Wet Unit Weight, pcf:	*122.2*
Dry Unit Weight, pcf:	*100.1*
Compaction, %:	*94.8*
Hydraulic Conductivity, cm/sec. @20 °C	***2.8E-08***

Remarks: ______________________________

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1493*	Tested By	*JM*
Project Name	*Cumberland Fossil Plant*	Test Date	*10/5/2009*
Boring No.	*52A*	Reviewed By	*MM*
Sample No.	*----*	Review Date	*10/9/2009*
Sample Depth	*5-10 ft*	Lab No.	*---*
Sample Description	*Brown Sandy fat clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*Remolded*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*24.5*
Wet Unit Weight, pcf:	*120.6*
Dry Unit Weight, pcf:	*96.8*
Compaction, %:	*94.8*
Hydraulic Conductivity, cm/sec. @20 °C	***3.5E-08***

Remarks:

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1493*	Tested By	*JM*
Project Name	*Cumberland Fossil Plant*	Test Date	*9/24/2009*
Boring No.	*53A*	Reviewed By	*MM*
Sample No.	*----*	Review Date	*9/29/2009*
Sample Depth	*43.8-44.2*	Lab No.	*---*
Sample Description	*Gray-Brown sandy lean clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*27.2*
Wet Unit Weight, pcf:	*120.6*
Dry Unit Weight, pcf:	*94.9*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***7.4E-08***

Remarks: ______________________

GeoTesting Express

HYDRAULIC CONDUCTIVITY

Project No.	*GTX 1493*	Tested By	*JM*
Project Name	*Cumberland Fossil Plant CUF*	Test Date	*9/23/2009*
Boring No.	*54A*	Reviewed By	*mm*
Sample No.	*---*	Review Date	*10/2/2009*
Sample Depth	*30-30.6 ft*		
Sample Description	*Gray brown lean clay*		

ASTM D5084 - Falling Head

Sample Type:	*Ud*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*31.1*
Wet Unit Weight, pcf:	*127.4*
Dry Unit Weight, pcf:	*97.1*
Compaction, %:	*N/A*
Effective Confining Pressure, psi	*5.0*
Hydraulic Conductivity, cm/sec. @20 °C	***6.5E-08***

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1493*	Tested By	*JM*
Project Name	*Cumberland Fossil Plant*	Test Date	*10/5/2009*
Boring No.	*58*	Reviewed By	*MM*
Sample No.	*----*	Review Date	*10/9/2009*
Sample Depth	*10-20 ft*	Lab No.	*---*
Sample Description	*Brown Sandy fat clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*Remolded*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*23.1*
Wet Unit Weight, pcf:	*121.1*
Dry Unit Weight, pcf:	*98.4*
Compaction, %:	*95.4*
Hydraulic Conductivity, cm/sec. @20 °C	***2.7E-08***

Remarks:

HYDRAULIC CONDUCTIVITY

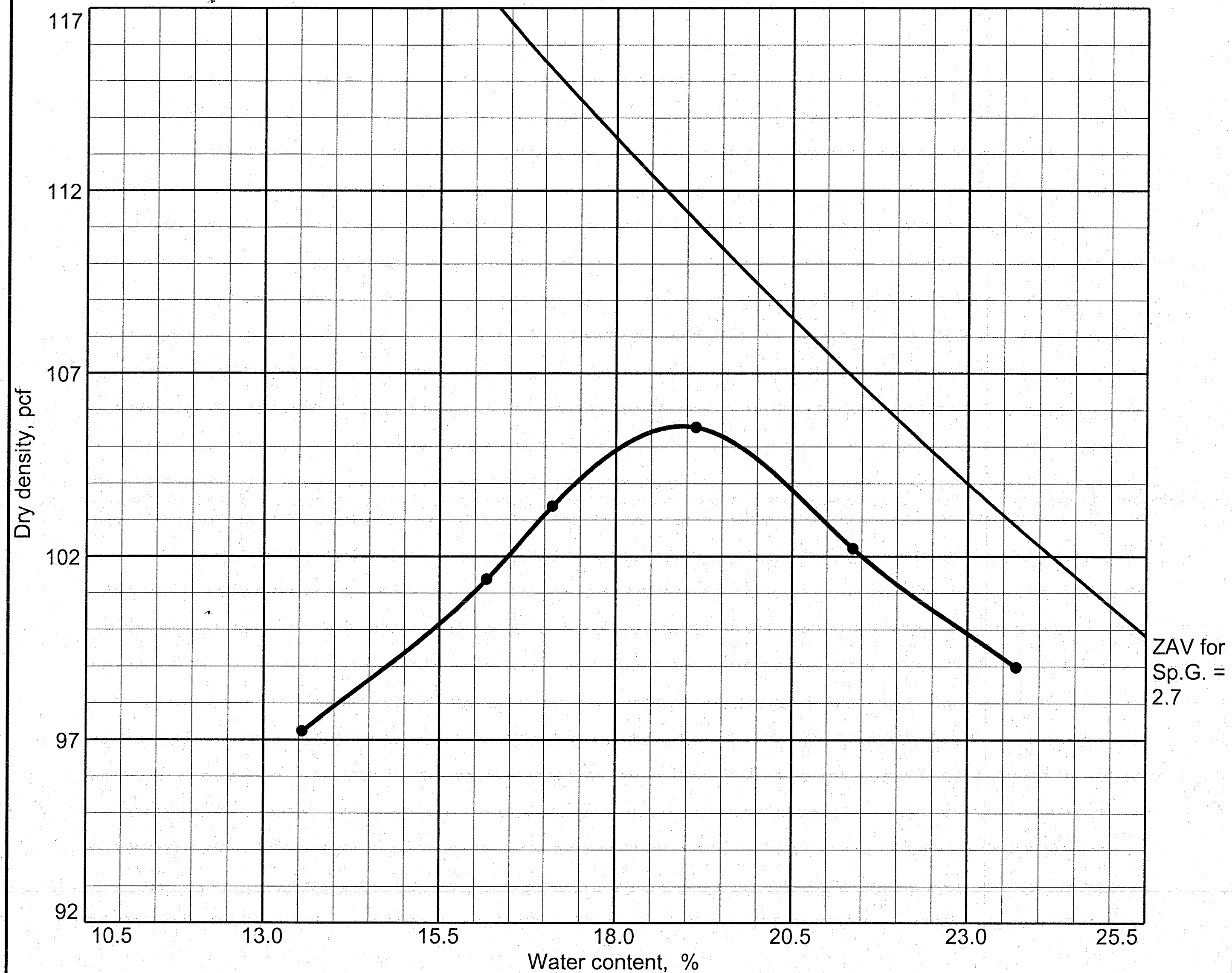
Project No.	*GTX-1493*	Tested By	*JM*
Project Name	*Cumberland Fossil Plant*	Test Date	*9/22/2009*
Boring No.	*58A*	Reviewed By	*MM*
Sample No.	*----*	Review Date	*9/27/2009*
Sample Depth	*25.4-26.0 ft*	Lab No.	*---*
Sample Description	*Gray-Brown sandy lean clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*30.8*
Wet Unit Weight, pcf:	*127.5*
Dry Unit Weight, pcf:	*97.4*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***6.3E-08***

Remarks:

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
5-15ft	CH	A-7-6(24)	29.3	2.7	54	34	0.0	73.1

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 105.6 pcf Optimum moisture = 18.9 %	Brown fat clay with sand

Project No. GTX-1493 **Client:** Stantec

Project: Cumberland Fossil Plant

● **Source:** **Sample No.:** B-48A **Elev./Depth:** 5-15ft

Remarks:

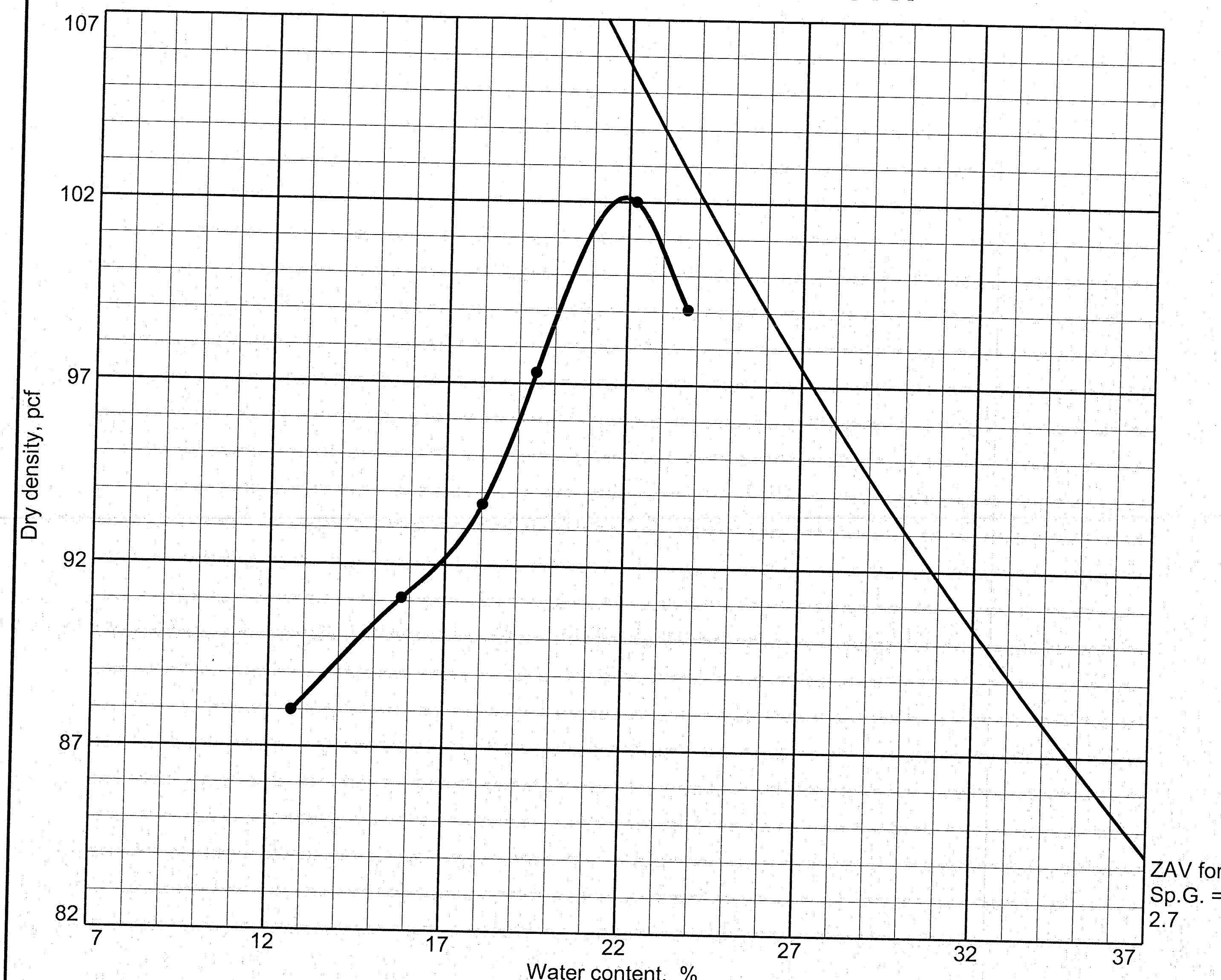
Moisture Content was take from bag as recieved, natural moisture content may be different

COMPACTION TEST REPORT

GeoTesting Express Inc.

Lab no.

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
5-10 ft	CH	A-7-6(27)		2.7	61	40	0.0	69.4

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 102.1 pcf	Sandy fat clay
Optimum moisture = 21.9 %	

Project No. 175539016 **Client:** Stantec

Project: Cumberland Fossil Plant

● **Source:** **Sample No.:** B-52 **Elev./Depth:** 5-10 ft

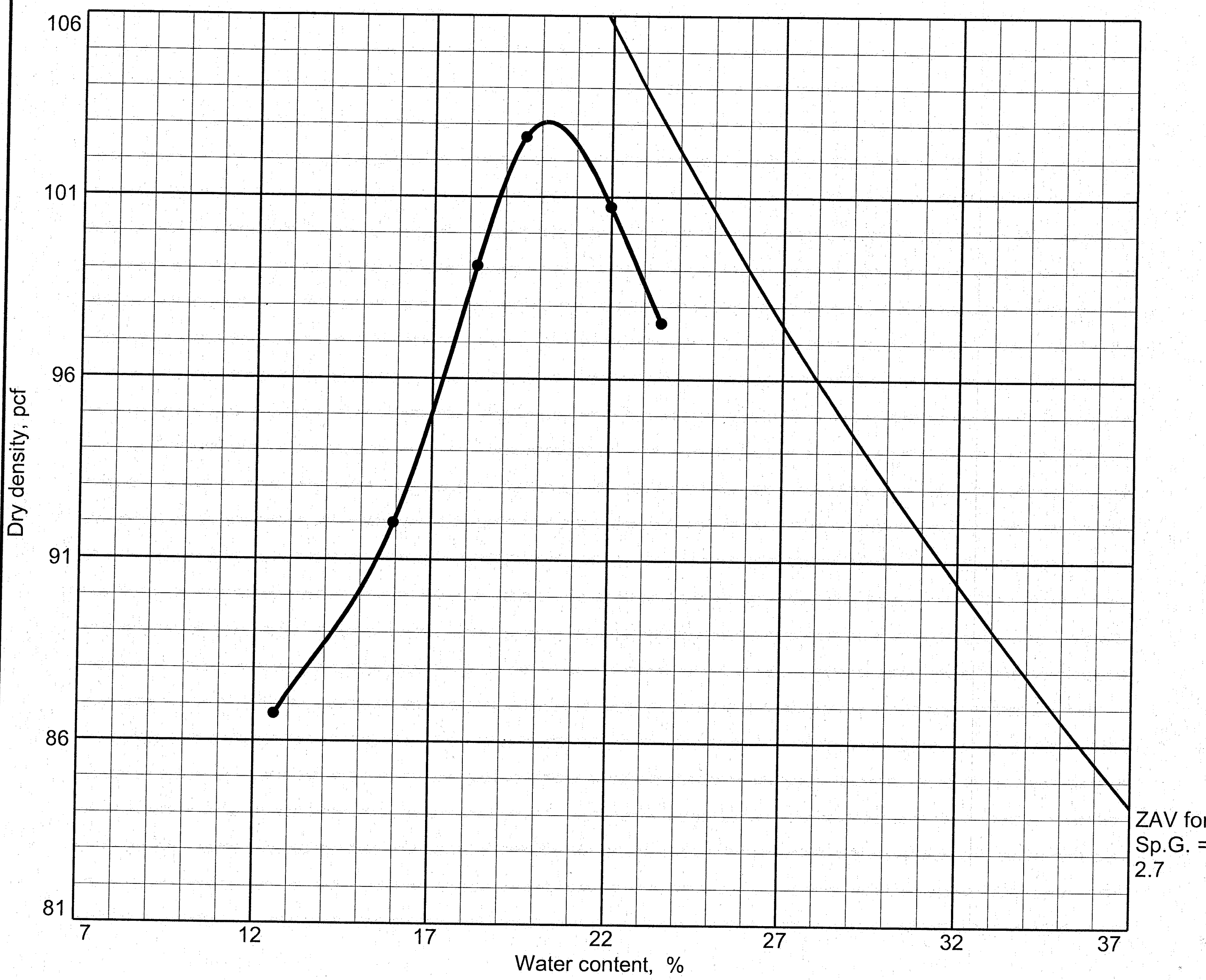
Remarks:

COMPACTION TEST REPORT

GeoTesting Express Inc.

Lab no.

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
10-20 ft	CH	A-7-6(30)		2.7	68	45	0.0	68.4

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 103.1 pcf	Sandy fat clay
Optimum moisture = 20.2 %	

Project No. 175539016 **Client:** Stantec

Project: Cumberland Fossil Plant

● **Source:** **Sample No.:** B-58 **Elev./Depth:** 10-20 ft

Remarks:

COMPACTION TEST REPORT

GeoTesting Express Inc.

Lab no.

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016
Tested By
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
47, 0.0'-1.5'	1	8/4/09	Hom	3/4"			No	21.90	132.49	113.88	20.2
47, 1.5'-3.0'	3	8/4/09	Hom	3/8"			No	25.85	173.32	153.64	15.4
47, 3.0'-4.5'	4	8/4/09	Hom	3/8"			No	26.01	183.44	160.18	17.3
47, 4.5'-6.0'	5	8/4/09	Hom	3/8"			No	26.05	151.59	132.37	18.1
47, 6.0'-7.5'	6	8/4/09	Hom	3/8"			No	21.79	122.09	105.99	19.1
47, 7.5'-9.0'	7	8/4/09	Hom	No. 4			Yes	21.61	146.45	124.47	21.4
47, 9.0'-10.5'	8	8/4/09	Hom	No. 4			Yes	26.05	243.65	203.58	22.6
47, 10.5'-12.0'	9	8/4/09	Hom	No. 4			No	21.67	130.70	105.96	29.4
47, 12.0'-13.5'	10	8/4/09	Hom	3/8"			No	25.93	212.46	172.00	27.7
47, 13.5'-15.0'	11	8/4/09	Hom	3/8"			No	22.09	187.39	155.61	23.8
47, 15.0'-16.5'	12	8/4/09	Hom	3/8"			No	21.82	175.57	145.35	24.5
47, 16.5'-18.0'	14	8/4/09	Hom	No. 4			Yes	25.99	184.88	157.84	20.5
47, 18.0'-19.5'	15	8/4/09	Hom	No. 4			Yes	21.44	154.91	127.66	25.7
47, 19.5'-21.0'	16	8/4/09	Hom	No. 4			Yes	26.07	219.52	184.07	22.4
47, 21.0'-22.5'	17	8/4/09	Len	No. 4			Yes	25.69	162.62	135.22	25.0
47, 22.5'-24.0'	18	8/4/09	Hom	No. 4			Yes	25.86	178.72	150.21	22.9
47, 24.0'-25.5'	19	8/4/09	Hom	No. 4			Yes	25.74	170.34	144.14	22.1
47, 25.5'-27.0'	20	8/4/09	Hom	3/4"			No	25.73	171.63	141.49	26.0
47, 27.0'-28.5'	21	8/4/09	Hom	No. 4			Yes	26.13	179.47	143.46	30.7
47, 28.5'-30.0'	22	8/4/09	Hom	No. 4			Yes	26.03	162.03	132.06	28.3
47, 31.0'-32.5'	23	8/4/09	Hom	3/8"			No	25.84	168.88	136.92	28.8
47, 33.5'-35.0'	24	8/4/09	Hom	No. 4			Yes	25.82	181.33	139.50	36.8
47, 36.0'-37.5'	25	8/4/09	Hom	No. 4			Yes	26.09	172.72	136.66	32.6
47, 38.5'-40.0'	26	8/4/09	Hom	3/8"			No	25.96	167.17	131.24	34.1
47, 40.4'-40.5'	27	8/4/09	Hom	3/4"			No	25.75	46.98	46.44	2.6
48, 0.0'-1.5'	28	8/4/09	Hom	3/4"			No	25.56	155.93	142.38	11.6
48, 1.5'-3.0'	29	8/4/09	Hom	3/4"			No	21.84	141.79	121.15	20.8
48, 3.0'-4.5'	31	8/4/09	Hom	3/4"			No	26.19	145.27	122.55	23.6

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
48, 4.5'-6.0'	32	8/4/09	Hom	3/4"			No	26.01	157.79	136.93	18.8
48, 6.0'-7.5'	33	8/4/09	Hom	3/4"			No	26.28	158.49	137.99	18.4
48, 7.5'-9.0'	34	8/4/09	Hom	No. 4			No	25.59	67.46	61.81	15.6
48, 9.0'-10.5'	35	8/4/09	Hom	3/4"			No	26.20	183.67	157.24	20.2
48, 10.5'-12.0'	36	8/4/09	Hom	3/8"			No	26.13	173.74	145.25	23.9
48, 12.0'-13.5'	37	8/4/09	Hom	3/4"			No	26.23	185.32	158.84	20.0
48, 13.5'-15.0'	38	8/4/09	Hom	3/8"			No	25.75	170.48	144.31	22.1
48, 15.0'-16.5'	39	8/4/09	Hom	3/4"			No	25.59	191.60	158.29	25.1
48, 16.5'-18.0'	40	8/4/09	Hom	3/4"			No	26.17	175.05	151.76	18.5
48, 18.0'-19.5'	42	8/5/09	Hom	No. 4			No	25.58	98.46	85.12	22.4
48, 19.5'-21.0'	43	8/5/09	Hom	No. 4			No	26.16	129.63	109.70	23.9
48, 21.0'-22.5'	44	8/5/09	Hom	3/4"			No	25.75	157.14	145.63	9.6
48, 22.5'-24.0'	45	8/5/09	Hom	3/8"			No	26.00	166.82	140.08	23.4
48, 24.0'-25.5'	46	8/5/09	Hom	3/8"			No	26.22	216.18	187.36	17.9
48, 25.5'-27.0'	47	8/5/09	Hom	3/8"			No	26.26	186.97	158.55	21.5
48, 27.0'-27.9'	48	8/5/09	Hom	3/4"			No	26.11	140.72	123.29	17.9
48, 28.5'-28.8' NO RECOVERY	49	8/5/09									
48, 31.0'-32.5'	50	8/5/09	Hom	3/8"			No	26.14	152.28	130.56	20.8
48, 33.5'-33.7'	51	8/5/09	Hom	3/8"			No	25.60	125.14	99.59	34.5
48, 36.0'-37.5'	52	8/5/09	Hom	No. 4			Yes	26.00	160.39	133.80	24.7
48, 38.5'-40.0'	53	8/5/09	Hom	No. 4			No	26.18	135.74	112.77	26.5
48, 41.0'-42.5'	54	8/5/09	Hom	No. 4			Yes	26.07	156.62	128.43	27.5
48, 43.5'-45.0'	55	8/5/09	Hom	No. 4			Yes	26.08	183.72	153.22	24.0
48, 46.0'-47.5'	56	8/5/09	Hom	No. 4			No	25.87	141.81	115.67	29.1
48, 48.5'-49.9'	57	8/5/09	Hom	3/8"			No	25.86	163.25	140.46	19.9
48, 51.0'-52.5'	58	8/5/09	Hom	No. 4			No	25.72	128.74	106.79	27.1
48, 53.5'-54.8'	59	8/5/09	Hom	No. 4			Yes	25.71	173.68	143.03	26.1
49, 0.0'-1.5'	60	8/6/09	Lam	3/4"			No	21.90	122.36	102.71	24.3
49, 1.5'-3.0'	61	8/6/09	Hom	3/4"			No	26.12	148.84	122.17	27.8
49, 3.0'-4.5'	62	8/6/09	Hom	3/8"			No	25.72	148.32	126.50	21.7
49, 4.5'-6.0'	63	8/6/09	Hom	No. 10			Yes	21.58	126.92	109.46	19.9

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
49, 6.0'-7.5'	64	8/6/09	Hom	No. 10			Yes	21.58	123.72	106.72	20.0
49, 7.5'-9.0'	65	8/6/09	Hom	No. 10			Yes	22.11	132.83	112.16	23.0
49, 9.0'-10.5'	66	8/6/09	Hom	No. 10			Yes	21.82	98.06	84.49	21.7
49, 10.5'-12.0'	67	8/6/09	Hom	No. 4			No	25.98	135.34	112.04	27.1
49, 12.0'-13.5'	68	8/6/09	Hom	No. 4			No	25.55	134.08	110.87	27.2
49, 13.5'-15.0'	69	8/6/09	Hom	No. 4			No	25.73	139.14	117.50	23.6
49, 15.0'-16.5'	70	8/6/09	Hom	No. 4			No	26.08	154.16	124.07	30.7
49, 16.5'-18.0'	71	8/6/09	Hom	No. 4			No	25.85	152.16	122.39	30.8
49, 18.0'-19.5'	72	8/6/09	Hom	No. 4			No	21.62	116.54	94.97	29.4
49, 19.5'-21.0'	73	8/6/09	Hom	No. 4			No	21.64	148.40	118.37	31.0
49, 21.0'-22.5'	74	8/6/09	Hom	No. 10			Yes	21.81	116.32	94.86	29.4
49, 22.5'-24.0'	75	8/6/09	Hom	No. 4			Yes	25.59	160.31	127.77	31.8
49, 24.0'-25.5'	76	8/6/09	Hom	No. 4			Yes	26.06	170.57	134.78	32.9
49, 26.0'-27.5'	77	8/6/09	Hom	No. 4			No	25.97	153.96	123.70	31.0
49, 28.5'-30.0'	78	8/6/09	Hom	No. 4			No	26.04	151.76	121.46	31.8
49, 31.0'-32.5'	79	8/6/09	Hom	No. 4			Yes	25.99	158.99	127.16	31.5
49, 33.5'-35.0'	80	8/6/09	Hom	No. 4			No	25.86	155.30	123.72	32.3
49, 36.0'-37.5'	81	8/6/09	Hom	No. 10			Yes	21.90	106.15	87.83	27.8
49, 38.5'-40.0'	82	8/6/09	Hom	No. 10			Yes	30.84	140.74	114.36	31.6
49, 41.0'-42.5'	83	8/6/09	Hom	No. 10			Yes	26.42	154.04	128.15	25.4
49, 43.5'-45.0'	84	8/6/09	Len	No. 10			Yes	25.96	185.90	152.14	26.8
49, 46.0'-47.5'	85	8/6/09	Hom	No. 10			Yes	25.72	228.10	174.00	36.5
49, 48.5'-50.0'	86	8/6/09	Hom	3/8"			No	26.29	234.50	190.41	26.9
49, 51.0'-52.5'	87	8/6/09	Hom	3/8"			No	26.15	210.99	161.87	36.2
49, 53.5'-55.0'	88	8/6/09	Hom	No. 10			Yes	25.63	224.47	181.00	28.0
49, 56.0'-57.5'	89	8/6/09	Hom	3/8"			No	26.11	218.06	178.40	26.0
49, 58.5'-60.0'	90	8/6/09	Hom	3/8"			No	26.02	215.47	182.65	21.0
49, 61.0'-62.5'	91	8/6/09	Hom	3/4"			No	26.03	205.53	175.15	20.4
49, 63.5'-64.1'	92	8/6/09	Hom	3/4"			No	25.88	240.22	219.08	10.9
50, 0.0'-1.5'	93	8/6/09	Hom	No. 4			Yes	21.91	140.19	123.17	16.8
50, 1.5'-3.0'	94	8/6/09	Hom	3/4"			No	26.12	170.30	151.27	15.2

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
50, 3.0'-4.5'	95	8/6/09	Hom	3/8"			No	21.80	142.59	119.11	24.1
50, 4.5'-6.0'	96	8/6/09	Hom	3/8"			No	21.02	131.16	111.28	22.0
50, 6.0'-7.5'	97	8/6/09	Hom	No. 4			Yes	26.55	151.52	127.72	23.5
50, 7.5'-9.0'	98	8/6/09	Hom	3/8"			No	21.12	130.92	109.98	23.6
50, 9.0'-10.5'	99	8/6/09	Hom	No. 4			No	21.79	142.82	118.82	24.7
50, 10.5'-12.0'	100	8/6/09	Hom	No. 4			No	21.70	136.32	116.88	20.4
50, 12.0'-13.5'	101	8/6/09	Hom	No. 4			Yes	25.98	146.97	126.19	20.7
50, 13.5'-15.0'	102	8/6/09	Hom	No. 4			Yes	26.34	165.40	139.87	22.5
50, 15.0'-16.5'	103	8/6/09	Hom	No. 4			Yes	21.53	144.51	122.04	22.4
50, 16.5'-18.0'	104	8/6/09	Hom	3/8"			No	21.43	113.15	98.03	19.7
50, 18.0'-19.5'	105	8/6/09	Hom	3/8"			No	20.97	129.09	111.77	19.1
50, 19.5'-21.0'	106	8/6/09	Hom	3/8"			No	26.17	216.81	184.72	20.2
50, 21.0'-22.5'	107	8/6/09	Hom	3/4"			No	21.91	187.79	174.54	8.7
50, 22.5'-24.0'	108	8/6/09	Hom	3/4"			No	26.38	184.63	157.99	20.2
50, 24.0'-25.5'	109	8/6/09	Hom	3/8"			No	21.79	163.74	139.52	20.6
50, 25.5'-27.0'	110	8/6/09	Hom	3/8"			No	21.33	147.53	117.40	31.4
50, 27.0'-28.5'	111	8/6/09	Hom	No. 4			No	21.87	141.25	115.11	28.0
50, 28.5'-30.0'	112	8/6/09	Hom	No. 4			No	21.38	90.33	70.58	40.1
50, 31.0'-32.5'	113	8/6/09	Hom	No. 4			No	21.76	138.57	106.10	38.5
50, 33.5'-35.0' NO RECOVERY	114	8/6/09									
50, 36.0'-37.3' NO RECOVERY	115	8/6/09									
51, 0.0'-1.5'	116	8/6/09	Hom	No. 4			Yes	25.87	168.36	144.32	20.3
51, 1.5'-3.0'	118	8/6/09	Hom	No. 4			Yes	21.05	159.02	144.32	11.9
51, 3.0'-4.5'	119	8/6/09	Hom	No. 4			Yes	25.88	178.67	153.61	19.6
51, 4.5'-6.0'	120	8/6/09	Hom	No. 4			Yes	20.98	149.89	129.58	18.7
51, 6.0'-7.5'	121	8/6/09	Hom	No. 4			Yes	25.90	188.47	161.02	20.3
51, 7.5'-9.0'	122	8/6/09	Hom	No. 4			Yes	21.40	153.70	134.41	17.1
51, 9.0'-10.5'	123	8/6/09	Hom	No. 4			Yes	25.60	170.94	147.62	19.1
51, 10.5'-12.0'	124	8/6/09	Hom	No. 4			Yes	26.24	168.51	143.53	21.3
51, 12.0'-13.5'	125	8/6/09	Hom	No. 4			Yes	26.37	166.97	143.34	20.2
51, 13.5'-15.0'	126	8/6/09	Hom	No. 4			No	20.99	136.39	117.58	19.5

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016
Tested By
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
51, 15.0'-16.5'	127	8/6/09	Hom	No. 4			Yes	25.96	176.59	152.38	19.2
51, 16.5'-18.0'	128	8/6/09	Hom	No. 4			Yes	21.60	150.60	129.49	19.6
51, 18.0'-19.5'	129	8/6/09	Hom	No. 4			No	21.38	139.53	119.87	20.0
51, 19.5'-21.0'	130	8/6/09	Hom	No. 4			Yes	21.34	159.48	135.76	20.7
51, 21.0'-22.5'	131	8/6/09	Hom	No. 4			No	21.80	130.96	112.06	20.9
51, 23.5'-25.0'	132	8/6/09	Hom	3/8"			No	25.93	177.59	152.14	20.2
51, 26.0'-27.5'	133	8/6/09	Hom	3/8"			No	26.08	170.50	142.09	24.5
51, 28.5'-30.0'	134	8/6/09	Hom	No. 4			No	21.53	137.41	113.15	26.5
51, 31.0'-31.3'	136	8/6/09	Hom	3/4"			No	21.50	141.66	118.39	24.0
51, 33.5'-35.0'	137	8/6/09	Hom	No. 4			Yes	22.15	157.97	129.31	26.7
51, 36.0'-37.5'	138	8/6/09	Hom	No. 4			Yes	21.87	160.33	129.65	28.5
51, 38.5'-40.0'	139	8/6/09	Hom	No. 4			Yes	21.50	162.82	130.99	29.1
51, 41.0'-42.5'	140	8/6/09	Len	No. 4			Yes	21.40	182.74	149.22	26.2
51, 43.5'-45.0'	141	8/6/09	Len	No. 4			Yes	22.01	154.64	126.88	26.5
51, 46.0'-47.5'	142	8/6/09	Hom	No. 4			Yes	21.67	175.25	143.17	26.4
51, 48.5'-50.0'	143	8/6/09	Hom	No. 4			Yes	21.66	160.58	126.91	32.0
51, 51.0'-52.5'	144	8/6/09	Hom	3/8"			No	21.12	194.70	159.13	25.8
51, 53.5'-55.0'	146	8/6/09	Hom	3/8"			No	21.95	206.38	169.89	24.7
51, 56.0'-57.5'	147	8/6/09	Hom	3/8"			No	25.64	244.87	206.67	21.1
51, 58.5'-60.0'	148	8/6/09	Hom	3/4"			No	21.73	219.50	184.23	21.7
51, 61.0'-62.5'	149	8/6/09	Hom	3/8"			No	25.43	224.22	192.41	19.1
51, 63.5'-65.0'	150	8/6/09	Hom	3/8"			No	21.21	162.19	139.03	19.7
51, 66.0'-66.4'	151	8/6/09	Len	3/8"			No	21.55	155.77	138.76	14.5
52, 0.0'-1.5'	152	8/6/09	Hom	3/8"			No	21.29	152.82	133.37	17.4
52, 1.5'-3.0'	153	8/6/09	Hom	No. 4			No	22.12	140.31	118.24	23.0
52, 3.0'-4.5'	155	8/6/09	Hom	No. 4			No	25.31	151.64	124.80	27.0
52, 4.5'-6.0'	156	8/6/09	Hom	No. 4			No	22.12	134.82	113.76	23.0
52, 6.0'-7.5'	157	8/18/09	Hom	3/8"			No	25.17	165.88	141.53	20.9
52, 7.5'-9.0'	158	8/18/09	Hom	3/8"			No	26.14	166.42	140.93	22.2
52, 9.0'-10.5'	159	8/18/09	Hom	3/8"			No	21.05	136.79	112.22	26.9
52, 10.5'-12.0'	160	8/18/09	Hom	3/8"			No	26.21	158.70	135.74	21.0

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016
Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
52, 12.0'-13.5'	161	8/18/09	Hom	3/8"			No	26.08	159.87	134.21	23.7
52, 13.5'-15.0'	162	8/18/09	Hom	3/8"			No	26.02	168.00	144.69	19.6
52, 15.0'-16.5'	163	8/18/09	Hom	No. 4			Yes	26.10	151.20	127.58	23.3
52, 16.5'-18.0'	164	8/18/09	Hom	3/8"			No	25.72	178.82	157.62	16.1
52, 18.0'-18.9'	165	8/18/09	Hom	3/8"			No	22.10	156.27	135.67	18.1
52, 19.5'-21.0'	166	8/18/09	Hom	No. 4			Yes	26.25	208.32	194.88	8.0
52, 21.0'-22.5'	167	8/18/09	Hom	3/8"			No	21.41	151.02	130.90	18.4
52, 22.5'-24.0'	169	8/18/09	Hom	3/8"			No	21.62	151.42	121.96	29.4
52, 24.0'-25.5'	170	8/18/09	Hom	3/8"			No	21.75	166.48	130.06	33.6
52, 25.5'-27.0'	171	8/18/09	Hom	3/8"			No	20.91	126.09	107.79	21.1
52, 27.0'-28.5'	172	8/18/09	Hom	3/8"			No	21.51	138.34	115.94	23.7
52, 28.5'-30.0'	173	8/18/09	Hom	3/8"			No	20.99	120.06	110.43	10.8
52, 31.0'-32.5'	174	8/18/09	Hom	3/8"			No	25.95	180.05	149.92	24.3
52, 33.5'-35.0'	175	8/18/09	Hom	3/8"			No	26.52	199.73	167.91	22.5
52, 36.0'-37.5'	176	8/18/09	Hom	3/4"			No	25.91	110.37	100.23	13.6
52, 38.5'-40.0'	177	8/18/09	Hom	3/8"			No	26.05	197.88	169.84	19.5
52, 41.0'-42.5'	178	8/18/09	Len	No. 4			Yes	26.24	182.50	147.00	29.4
52, 43.5'-45.0'	179	8/18/09	Hom	No. 4			Yes	21.68	150.08	123.78	25.8
52, 46.0'-47.5'	180	8/18/09	Hom	No. 10			Yes	21.48	151.37	125.47	24.9
52, 48.5'-50.0'	181	8/18/09	Hom	No. 10			Yes	26.32	161.83	134.37	25.4
52, 51.0'-52.5'	182	8/18/09	Hom	No. 10			Yes	25.96	200.28	162.91	27.3
52, 53.5'-55.0'	183	8/18/09	Hom	No. 10			Yes	25.89	196.89	159.70	27.8
52, 56.0'-57.5'	184	8/18/09	Hom	No. 10			Yes	21.10	184.11	147.71	28.7
52, 58.5'-60.0'	185	8/18/09	Hom	No. 10			Yes	21.96	158.42	128.91	27.6
52, 61.0'-62.5'	186	8/18/09	Len	No. 10			Yes	26.23	211.62	171.83	27.3
52, 63.5'-65.0'	187	8/18/09	Hom	3/8"			No	25.94	232.72	177.54	36.4
52, 66.0'-67.5'	188	8/18/09	Hom	3/8"			No	21.29	184.71	150.10	26.9
52, 68.5'-70.0'	190	8/18/09	Hom	3/8"			No	21.80	119.97	99.54	26.3
52, 71.0'-72.5'	191	8/18/09	Hom	3/4"			No	21.05	143.42	124.47	18.3
52, 73.5'-75.0'	192	8/18/09	Hom	3/4"			No	21.87	169.14	139.87	24.8
52, 76.0'-77.5'	193	8/18/09	Hom	3/8"			No	20.96	135.45	115.06	21.7

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
52, 78.5'-80.0'	194	8/18/09	Hom	3/8"			No	22.07	79.18	71.20	16.2
52, 81.0'-81.8'	195	8/18/09	Hom	3/4"			No	25.70	211.84	187.39	15.1
52, 83.5'-83.7'	196	8/18/09	Hom	3/8"			No	21.38	117.22	107.51	11.3
53, 0.0'-1.5'	197	8/18/09	Hom	3/8"			No	25.94	168.52	142.74	22.1
53, 1.5'-3.0'	198	8/18/09	Hom	3/8"			No	25.65	196.04	169.70	18.3
53, 3.0'-4.5'	199	8/18/09	Hom	3/8"			No	26.10	184.05	150.50	27.0
53, 4.5'-6.0'	200	8/18/09	Hom	3/8"			No	25.86	176.09	144.61	26.5
53, 6.0'-7.5'	201	8/18/09	Hom	3/8"			No	21.89	170.57	148.95	17.0
53, 7.5'-9.0'	202	8/18/09	Hom	3/8"			No	26.40	179.91	151.15	23.1
53, 9.0'-10.5'	203	8/18/09	Hom	3/8"			No	20.98	139.82	114.36	27.3
53, 10.5'-12.0'	204	8/18/09	Hom	3/8"			No	21.41	135.69	116.26	20.5
53, 12.0'-13.5'	205	8/18/09	Hom	3/8"			No	26.06	182.96	155.24	21.5
53, 13.5'-15.0'	206	8/18/09	Hom	3/8"			No	26.24	178.43	150.61	22.4
53, 15.0'-16.5'	207	8/18/09	Hom	No. 4			Yes	21.01	166.43	141.94	20.3
53, 16.5'-18.0'	208	8/18/09	Hom	No. 4			No	21.70	79.21	68.35	23.3
53, 18.0'-19.5'	209	8/18/09	Hom	No. 4			Yes	26.12	200.19	172.97	18.5
53, 19.5'-21.0'	210	8/18/09	Hom	No. 4			No	21.52	120.31	105.21	18.0
53, 21.0'-22.5'	211	8/18/09	Hom	3/8"			No	26.35	165.95	136.53	26.7
53, 22.5'-24.0'	212	8/18/09	Hom	3/8"			No	21.73	141.64	115.53	27.8
53, 24.0'-25.5'	213	8/18/09	Hom	3/8"			No	22.35	134.48	111.27	26.1
53, 25.5'-27.0' NO RECOVERY	214	8/18/09									
54, 0.0'-1.5'	215	8/18/09	Hom	3/8"			No	21.51	137.38	116.31	22.2
54, 1.5'-3.0'	216	8/18/09	Hom	3/8"			No	21.30	143.33	122.75	20.3
54, 3.0'-4.5'	217	8/18/09	Hom	3/8"			No	25.85	160.61	131.44	27.6
54, 4.5'-6.0'	218	8/18/09	Hom	3/8"			No	25.48	208.63	170.72	26.1
54, 6.0'-7.5'	219	8/18/09	Hom	3/8"			No	21.48	130.51	111.46	21.2
54, 7.5'-9.0'	220	8/18/09	Hom	3/8"			No	21.25	168.17	141.45	22.2
54, 9.0'-10.5'	221	8/18/09	Hom	3/8"			No	22.06	157.06	132.51	22.2
54, 10.5'-12.0'	222	8/18/09	Hom	3/8"			No	21.66	156.18	131.28	22.7
54, 12.0'-13.5'	223	8/18/09	Hom	3/8"			No	21.56	165.47	142.21	19.3
54, 13.5'-15.0'	224	8/18/09	Hom	3/8"			No	25.16	179.36	152.45	21.1

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
54, 15.0'-16.5'	225	8/18/09	Hom	3/8"			No	21.26	190.47	156.70	24.9
54, 16.5'-18.0'	226	8/18/09	Hom	3/8"			No	25.60	197.70	164.00	24.3
54, 18.0'-19.5'	227	8/18/09	Hom	3/8"			No	21.73	162.84	145.86	13.7
54, 19.5'-21.0'	228	8/18/09	Hom	3/8"			No	25.29	169.62	147.73	17.9
54, 21.0'-22.5'	229	8/18/09	Hom	3/8"			No	21.34	173.02	148.43	19.3
54, 22.5'-24.0'	230	8/18/09	Hom	No. 4			Yes	21.38	171.49	149.14	17.5
54, 24.0'-25.5'	231	8/18/09	Hom	No. 4			Yes	21.48	195.47	171.37	16.1
54, 25.5'-27.0'	232	8/18/09	Hom	3/4"			No	22.14	110.21	99.97	13.2
54, 27.0'-28.5'	233	8/18/09	Hom	No. 4			Yes	22.04	170.83	147.87	18.2
54, 28.5'-30.0'	234	8/18/09	Hom	No. 4			Yes	21.99	176.52	149.59	21.1
54, 30.0'-31.5'	235	8/18/09	Len	No. 4			Yes	21.70	190.88	163.23	19.5
54, 31.5'-33.0'	236	8/18/09	Len	No. 4			Yes	21.16	166.96	139.51	23.2
54, 33.0'-34.5'	237	8/18/09	Len	No. 4			Yes	25.96	209.68	176.29	22.2
54, 34.5'-36.0'	238	8/18/09	Hom	No. 4			Yes	22.11	162.26	139.34	19.6
54, 36.0'-37.5'	239	8/18/09	Hom	No. 4			Yes	21.69	170.73	143.55	22.3
54, 37.5'-39.0'	240	8/18/09	Hom	No. 4			Yes	21.21	170.22	144.38	21.0
54, 39.0'-40.5'	241	8/18/09	Hom	No. 4			Yes	21.11	165.49	140.47	21.0
54, 40.5'-42.0'	242	8/18/09	Hom	No. 4			Yes	20.96	178.46	149.97	22.1
54, 42.0'-43.5'	243	8/18/09	Hom	No. 4			Yes	22.57	175.13	150.06	19.7
54, 43.5'-45.0'	244	8/18/09	Len	No. 4			Yes	26.17	201.96	170.41	21.9
54, 45.0'-46.5'	245	8/18/09	Len	No. 4			Yes	20.95	158.94	132.40	23.8
54, 47.5'-49.0'	246	8/18/09	Len	No. 4			Yes	21.19	171.05	141.31	24.8
54, 50.0'-51.5'	247	8/18/09	Hom	3/8"			No	25.98	199.67	166.41	23.7
54, 52.5'-54.0'	248	8/18/09	Hom	No. 4			Yes	21.80	173.58	142.55	25.7
54, 55.0'-56.5'	249	8/18/09	Hom	No. 4			Yes	25.91	206.95	167.07	28.3
54, 57.5'-59.0'	250	8/18/09	Hom	No. 4			No	21.29	144.97	111.65	36.9
54, 60.0'-61.5'	251	8/18/09	Len	No. 4			Yes	26.13	203.27	163.68	28.8
54, 62.5'-64.0'	252	8/18/09	Len	No. 4			Yes	25.96	221.90	183.32	24.5
54, 65.0'-66.5'	253	8/18/09	Len	No. 4			Yes	20.88	180.68	146.98	26.7
54, 67.5'-69.0'	254	8/18/09	Hom	3/8"			No	26.11	225.72	177.73	31.7
54, 70.0'-71.5'	255	8/18/09	Hom	3/8"			No	26.01	215.18	176.84	25.4

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
54, 72.5'-74.0'	256	8/18/09	Hom	3/8"			No	21.62	160.09	129.86	27.9
54, 75.0'-76.5'	257	8/18/09	Hom	3/4"			No	26.07	215.95	179.33	23.9
54, 77.5'-79.0'	258	8/18/09	Hom	3/4"			No	21.26	198.09	170.18	18.7
54, 80.0'-81.5'	259	8/18/09	Hom	3/4"			No	25.57	233.43	204.62	16.1
54, 82.5'-84.0'	260	8/18/09	Hom	No. 4			Yes	20.93	178.64	150.00	22.2
54, 85.0'-86.5'	261	8/18/09	Hom	3/4"			No	25.32	211.78	186.62	15.6
54, 87.5'-89.0'	262	8/18/09	Hom	3/4"			No	21.33	205.60	179.94	16.2
54, 90.0'-90.1' NO RECOVERY	263	8/18/09									
55, 0.0'-1.5'	265	8/7/09	Hom	3/8"			No	21.54	101.08	87.17	21.2
55, 1.5'-3.0'	266	8/7/09	Hom	3/8"			No	21.74	84.67	76.83	14.2
55, 3.0'-4.5'	267	8/7/09	Hom	3/8"			No	21.47	112.58	97.59	19.7
55, 4.5'-6.0'	268	8/7/09	Hom	3/8"			No	21.89	92.18	79.60	21.8
55, 6.0'-7.5'	269	8/7/09	Hom	3/8"			No	22.09	90.10	77.62	22.5
55, 7.5'-9.0'	270	8/7/09	Hom	No. 4			No	25.93	119.16	101.50	23.4
55, 9.0'-10.5'	272	8/7/09	Hom	No. 4			No	21.51	69.76	61.62	20.3
55, 10.5'-12.0'	273	8/7/09	Hom	No. 4			No	25.91	95.84	83.03	22.4
55, 12.0'-13.5'	274	8/7/09	Hom	No. 4			No	21.13	86.02	73.38	24.2
55, 13.5'-15.0'	275	8/7/09	Hom	3/4"			No	26.59	92.21	80.99	20.6
55, 15.0'-16.5'	276	8/7/09	Hom	3/4"			No	21.79	74.89	66.06	19.9
55, 16.5'-18.0'	277	8/7/09	Hom	3/4"			No	21.05	94.72	80.60	23.7
55, 18.0'-19.5'	278	8/7/09	Hom	No. 4			No	26.40	109.17	94.39	21.7
55, 19.5'-21.0'	279	8/7/09	Hom	No. 4			Yes	21.00	151.78	126.72	23.7
55, 21.0'-22.5'	280	8/7/09	Hom	3/4"			No	26.01	128.97	113.24	18.0
55, 22.5'-24.0'	281	8/7/09	Hom	3/4"			No	21.78	111.59	97.17	19.1
55, 24.0'-25.5'	283	8/7/09	Hom	3/4"			No	21.09	89.52	79.22	17.7
55, 25.5'-28.5'	284	8/7/09	Hom	3/4"			No	32.04	129.79	109.90	25.5
55, 28.5'-31.0'	285	8/7/09	Hom	3/4"			No	21.55	99.96	80.22	33.6
55, 31.0'-33.5'	286	8/7/09	Hom	3/4"			No	30.94	67.18	60.10	24.3
55, 33.5'-36.0'	287	8/7/09	Hom	3/4"			No	21.05	110.04	93.14	23.4
55, 36.0'-38.5' LITTLE RECOVERY	288	8/7/09	Hom	1 1/2"							
55, 38.5'-41.0'	289	8/7/09	Hom	3/4"			No	21.38	91.49	77.42	25.1

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016
Tested By
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
55, 41.0'-43.5'	290	8/7/09	Hom	3/4"			No	26.12	147.29	121.12	27.5
55, 43.5'-46.0'	291	8/7/09	Hom	No. 4			No	21.91	92.81	65.04	64.4
55, 46.0'-48.5'	292	8/7/09	Hom	3/4"			No	30.88	161.56	131.76	29.5
55, 48.5'-51.0'	293	8/7/09	Hom	3/4"			No	21.31	139.82	114.49	27.2
55, 51.0'-53.5'	294	8/7/09	Hom	3/4"			No	31.85	156.34	139.22	15.9
55, 53.5'-56.0'	295	8/7/09	Hom	3/4"			No	32.29	170.85	132.89	37.7
55, 56.0'-58.5'	296	8/7/09	Hom	3/4"			No	21.92	112.76	86.21	41.3
55, 58.5'-61.0'	297	8/7/09	Hom	3/4"			No	32.12	151.34	116.05	42.0
55, 61.0'-63.5'	298	8/7/09	Hom	3/4"			No	31.66	188.78	143.56	40.4
55, 63.5'-66.0'	299	8/7/09	Hom	3/8"			No	32.33	185.53	126.30	63.0
55, 66.0'-68.5'	300	8/7/09	Hom	3/8"			No	32.12	180.91	123.35	63.1
55, 68.5'-71.0'	301	8/7/09	Hom	3/8"			No	30.97	181.99	139.30	39.4
55, 71.0'-73.5'	302	8/7/09	Hom	3/8"			No	20.86	207.54	128.05	74.2
55, 73.5'-75.0'	303	8/7/09	Hom	3/8"			No	31.09	188.60	146.29	36.7
55, 75.0'-75.1'	304	8/7/09	Hom	1 1/2"			No	25.90	52.57	47.76	22.0
58, 0.0'-1.5'	305	8/7/09	Hom	3/4"			No	25.96	174.09	154.25	15.5
58, 1.5'-3.0'	307	8/7/09	Hom	3/4"			No	32.17	115.23	100.81	21.0
58, 3.0'-4.5'	308	8/7/09	Hom	3/8"			No	26.42	159.07	135.24	21.9
58, 4.5'-6.0'	309	8/7/09	Hom	3/8"			No	21.03	151.14	126.01	23.9
58, 6.0'-7.5'	310	8/7/09	Hom	3/8"			No	31.94	134.16	113.41	25.5
58, 7.5'-9.0'	311	8/7/09	Hom	3/4"			No	21.49	101.57	90.61	15.9
58, 9.0'-10.5'	312	8/7/09	Hom	3/8"			No	32.54	142.11	116.87	29.9
58, 10.5'-12.0'	313	8/7/09	Hom	3/8"			No	20.89	84.96	76.07	16.1
58, 12.0'-13.5'	314	8/7/09	Hom	3/4"			No	32.53	86.58	79.10	16.1
58, 13.5'-15.0'	315	8/7/09	Hom	3/4"			No	30.70	118.45	101.85	23.3
58, 15.0'-16.5'	316	8/7/09	Hom	3/4"			No	31.98	132.08	115.52	19.8
58, 16.5'-18.0'	317	8/7/09	Hom	3/8"			No	32.29	147.11	128.03	19.9
58, 18.0'-19.5'	318	8/7/09	Hom	3/8"			No	32.20	107.81	95.29	19.8
58, 19.5'-21.0'	319	8/7/09	Hom	3/8"			No	22.52	134.18	109.16	28.9
58, 21.0'-22.5'	320	8/7/09	Hom	3/8"			No	21.42	129.30	104.56	29.8
58, 22.5'-24.0'	321	8/7/09	Hom	No. 4			No	32.38	92.53	79.28	28.3

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
58, 24.0'-25.5'	322	8/7/09	Hom	No. 4			No	26.09	146.22	121.46	26.0
58, 25.5'-27.0'	323	8/7/09	Hom	3/8"			No	26.08	186.61	159.22	20.6
58, 27.0'-28.5'	324	8/7/09	Hom	No. 4			No	26.20	147.53	117.37	33.1
58, 28.5'-30.0'	325	8/7/09	Hom	3/8"			No	21.48	116.96	89.32	40.7
58, 30.0'-31.5'	326	8/7/09	Hom	3/8"			No	32.23	171.86	114.24	70.3
58, 32.5'-34.0'	328	8/7/09	Hom	3/8"			No	26.28	124.28	94.77	43.1
58, 35.0'-36.5'	329	8/7/09	Hom	3/8"			No	32.05	135.92	101.83	48.9
58, 37.5'-39.0'	330	8/7/09	Hom	3/4"			No	26.07	157.23	135.06	20.3
58, 40.0'-41.5'	331	8/7/09	Hom	3/4"			No	21.17	121.87	88.84	48.8
58, 42.5'-44.0'	333	8/7/09	Hom	3/4"			No	25.16	135.59	106.69	35.4
58, 45.0'-46.5'	334	8/7/09	Hom	3/4"			No	21.47	110.38	88.00	33.6
58, 47.5'-49.0'	335	8/7/09	Hom	3/4"			No	26.16	182.07	141.24	35.5
58, 50.0'-51.5'	336	8/7/09	Hom	3/4"			No	21.30	179.65	157.08	16.6
58, 52.5'-54.0'	337	8/7/09	Hom	3/4"			No	25.97	187.19	139.98	41.4
58, 55.0'-56.5'	338	8/7/09	Hom	3/4"			No	26.33	186.96	167.18	14.0
58, 57.5'-58.1'	339	8/7/09	Hom	3/4"			No	21.36	152.62	137.07	13.4
58, 60.0'-60.2'	340	8/7/09	Hom	3/4"			No	22.16	109.71	104.20	6.7
59, 0.0'-1.5'	341	8/7/09	Hom	3/4"			No	25.32	191.95	168.57	16.3
59, 1.5'-3.0'	342	8/7/09	Hom	1 1/2"			No	25.65	158.83	123.16	36.6
59, 3.0'-4.5'	343	8/7/09	Hom	1 1/2"			No	21.71	97.75	74.74	43.4
59, 4.5'-6.0'	345	8/7/09	Hom	3/4"			No	25.59	105.33	80.59	45.0
59, 6.0'-7.5'	346	8/7/09	Hom	3/4"			No	21.54	104.04	83.40	33.4
59, 7.5'-9.0'	347	8/7/09	Hom	3/4"			No	21.12	106.87	87.19	29.8
59, 9.0'-10.5'	348	8/7/09	Hom	3/4"			No	25.38	99.40	79.78	36.1
59, 10.5'-12.0'	349	8/7/09	Hom	1 1/2"			No	21.03	81.11	64.97	36.7
59, 12.0'-13.5'	350	8/7/09	Hom	3/8"			No	26.34	119.92	87.97	51.8
59, 13.5'-15.0'	351	8/7/09	Hom	3/8"			No	25.86	151.48	108.71	51.6
59, 15.0'-16.5'	352	8/7/09	Hom	3/8"			No	26.16	141.02	105.08	45.5
59, 16.5'-18.0'	353	8/7/09	Hom	No. 4			No	26.19	150.74	103.46	61.2
59, 18.0'-19.5'	354	8/19/09	Hom	3/8"			No	21.17	149.47	109.79	44.8
59, 19.5'-21.0'	355	8/19/09	Hom	3/8"			No	21.06	138.62	98.75	51.3

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
59, 21.0'-23.5'	356	8/19/09	Hom	3/8"			No	25.36	154.51	111.84	49.3
59, 23.5'-26.0'	357	8/19/09	Hom	No. 4			Yes	26.07	160.05	128.53	30.8
59, 26.0'-28.5'	358	8/19/09	Hom	No. 4			Yes	26.07	182.20	144.38	32.0
59, 28.5'-31.0'	359	8/19/09	Hom	3/8"			No	25.65	176.64	142.14	29.6
59, 31.0'-33.5'	360	8/19/09	Hom	No. 4			Yes	25.96	156.99	128.15	28.2
59, 33.5'-35.0' NO RECOVERY	361	8/19/09									
60, 0.0'-1.5'	362	8/19/09	Hom	3/8"			No	26.27	192.94	169.07	16.7
60, 1.5'-3.0'	364	8/19/09	Hom	3/8"			No	25.90	141.91	128.59	13.0
60, 3.0'-4.5'	365	8/19/09	Hom	No. 4			No	21.29	92.45	79.87	21.5
60, 4.5'-6.0'	366	8/19/09	Hom	3/8"			No	20.82	169.83	143.34	21.6
60, 6.0'-7.5'	367	8/19/09	Hom	3/8"			No	21.39	157.74	130.00	25.5
60, 7.5'-9.0'	368	8/19/09	Hom	3/8"			No	26.13	156.45	130.76	24.6
60, 9.0'-10.5'	369	8/19/09	Hom	3/8"			No	26.35	160.98	133.62	25.5
60, 10.5'-12.0'	370	8/19/09	Hom	3/8"			No	21.49	163.65	136.48	23.6
60, 12.0'-13.5'	371	8/19/09	Hom	No. 4			Yes	22.45	156.99	133.11	21.6
60, 13.5'-15.0'	372	8/19/09	Hom	3/8"			No	26.45	172.04	143.59	24.3
60, 15.0'-16.5'	373	8/19/09	Hom	3/8"			No	21.07	169.95	134.42	31.3
60, 16.5'-18.0'	374	8/19/09	Hom	No. 4			Yes	25.75	194.17	149.95	35.6
60, 18.0'-19.5'	376	8/19/09	Hom	No. 4			No	26.05	155.21	122.87	33.4
60, 19.5'-21.0'	377	8/19/09	Hom	3/4"			No	26.15	166.89	135.89	28.2
60, 21.0'-22.5'	378	8/19/09	Hom	No. 4			No	25.96	151.53	120.81	32.4
60, 22.5'-24.0'	379	8/19/09	Hom	No. 4			No	26.19	163.59	123.06	41.8
60, 24.0'-25.5'	380	8/19/09	Hom	No. 4			Yes	25.58	174.17	133.67	37.5
60, 25.5'-27.0'	381	8/19/09	Hom	No. 10			Yes	25.68	147.14	112.28	40.3
60, 27.0'-28.5'	382	8/19/09	Hom	No. 4			Yes	26.32	171.43	129.32	40.9
60, 28.5'-30.0'	383	8/19/09	Hom	No. 10			Yes	25.84	182.46	137.97	39.7
60, 30.0'-31.5'	384	8/19/09	Hom	No. 4			Yes	26.23	185.99	146.22	33.1
60, 31.5'-33.0'	385	8/19/09	Hom	No. 4			Yes	25.69	181.75	138.31	38.6
60, 33.0'-34.5'	387	8/19/09	Hom	3/8"			No	26.08	146.48	111.41	41.1
60, 34.5'-36.0'	388	8/19/09	Hom	No. 4			No	26.00	159.73	125.58	34.3
60, 36.0'-37.5'	389	8/19/09	Hom	No. 4			Yes	25.69	185.65	154.79	23.9

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
60, 37.5'-39.0'	390	8/19/09	Hom	No. 10			Yes	26.10	211.28	176.64	23.0
60, 39.0'-40.5'	391	8/19/09	Hom	No. 4			Yes	21.87	183.82	146.55	29.9
60, 40.5'-42.0'	392	8/19/09	Hom	No. 4			Yes	25.85	171.33	141.56	25.7
60, 42.0'-43.5'	393	8/19/09	Hom	No. 10			Yes	25.97	187.36	151.69	28.4
60, 43.5'-43.6'	394	8/19/09	Hom	3/4"			No	22.02	75.40	74.03	2.6
61, 4.5'-6.0'	395	8/19/09	Hom	3/4"			No	21.53	190.67	187.37	2.0
61, 6.0'-7.5'	396	8/19/09	Hom	3/8"			No	25.96	175.39	147.87	22.6
61, 7.5'-9.0' NO RECOVERY	397	8/19/09									
61, 9.0'-10.5'	398	8/19/09	Hom	No. 4			Yes	26.07	179.44	149.83	23.9
61, 10.5'-12.0'	399	8/19/09	Hom	3/8"			No	25.71	175.32	146.73	23.6
61, 12.0'-13.5'	400	8/19/09	Hom	No. 4			Yes	26.10	202.17	168.99	23.2
61, 13.5'-15.0'	401	8/19/09	Hom	No. 4			No	26.20	164.48	126.10	38.4
61, 15.0'-16.5'	402	8/19/09	Hom	No. 4			Yes	26.56	213.60	178.63	23.0
61, 16.5'-18.0'	403	8/19/09	Hom	No. 4			Yes	26.09	203.95	165.99	27.1
61, 18.0'-19.5'	404	8/19/09	Hom	No. 4			Yes	26.03	181.07	141.73	34.0
61, 19.5'-21.0'	405	8/19/09	Hom	No. 4			Yes	25.90	166.34	130.39	34.4
61, 21.0'-22.5'	406	8/19/09	Hom	3/4"			No	25.93	192.11	160.94	23.1
61, 22.5'	407	8/19/09	Hom	No. 4			No	21.93	123.50	99.16	31.5
62, 0.0'-1.5'	408	8/5/09	Hom	3/8"			No	25.97	129.53	111.59	21.0
62, 1.5'-3.0'	409	8/5/09	Hom	3/8"			No	25.86	154.90	136.35	16.8
62, 3.0'-4.5'	410	8/5/09	Hom	3/4"			No	20.85	103.64	89.41	20.8
62, 4.5'-6.0'	411	8/5/09	Hom	3/4"			No	26.42	139.48	121.50	18.9
62, 6.0'-7.5'	412	8/5/09	Hom	3/4"			No	22.64	125.90	107.15	22.2
62, 7.5'-9.0'	413	8/5/09	Hom	3/8"			No	21.46	77.79	67.07	23.5
62, 9.0'-10.5'	414	8/5/09	Hom	3/8"			No	21.36	113.80	97.27	21.8
62, 10.5'-12.0'	415	8/5/09	Hom	3/8"			No	20.99	113.54	99.47	17.9
62, 12.0'-13.5'	416	8/5/09	Hom	3/8"			No	31.99	117.24	100.46	24.5
62, 13.5'-15.0' NO RECOVERY	417	8/5/09									
62, 15.0'-16.5'	418	8/5/09	Hom	3/8"			No	32.00	100.18	86.77	24.5
62, 16.5'-18.0'	419	8/5/09	Hom	3/8"			No	32.30	145.96	128.75	17.8
62, 18.0'-19.5'	420	8/5/09	Hom	3/4"			No	21.58	131.69	117.08	15.3

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016
Tested By

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
62, 19.5'-19.9'	421	8/5/09	Hom	3/4"			No	32.36	177.20	163.09	10.8
62, 21.0'-21.4'	422	8/5/09	Hom	3/4"			No	32.25	204.81	183.37	14.2
62, 22.5'-23.8'	423	8/5/09	Hom	3/8"			No	32.86	140.55	108.78	41.8
50 A, 33.5'-35.0'	424	8/5/09	Hom	3/8"			No	32.08	135.37	109.73	33.0
50 A, 36.0' NO RECOVERY	425	8/5/09									
50 A, 43.5'-45.0' NO RECOVERY	426	8/5/09									
50 A, 46.0'-47.3'	427	8/5/09	Hom	3/4"			No	30.91	93.70	83.30	19.9
50 A, 48.5'-50.0'	428	8/5/09	Hom	3/4"			No	25.94	160.24	127.89	31.7
50 A, 51.0'-52.5'	429	8/5/09	Hom	3/8"			No	31.62	130.31	103.98	36.4
50 A, 54.0' NO RECOVERY	430	8/5/09									
50 A, 56.0'-57.5'	431	8/5/09	Hom	3/8"			No	21.38	113.98	93.14	29.0
50 A, 58.5'-60.0'	432	8/5/09	Hom	3/8"			No	32.10	139.93	116.24	28.2
50 A, 61.0'-62.5'	433	8/5/09	Hom	No. 4			Yes	30.94	205.81	163.90	31.5
50 A, 63.5'-65.0'	434	8/5/09	Hom	3/8"			No	21.70	196.25	159.80	26.4
50 A, 66.0'-67.5'	435	8/5/09	Hom	3/8"			No	21.02	151.41	123.87	26.8
50 A, 68.5'-70.0'	436	8/5/09	Hom	No. 4			No	26.12	145.50	118.62	29.1
50 A, 71.0'-72.5'	437	8/5/09	Hom	No. 4			Yes	30.91	175.65	140.37	32.2
50 A, 73.5'-75.0'	438	8/5/09	Hom	3/4"			No	21.07	124.12	107.60	19.1
50 A, 76.0'-77.5'	439	8/5/09	Hom	1 1/2"			No	21.88	103.77	83.13	33.7
50 A, 78.5'-80.0'	440	8/5/09	Hom	3/4"			No	21.67	106.83	88.66	27.1
50 A, 81.0'-82.5'	441	8/5/09	Hom	3/4"			No	21.00	97.80	77.47	36.0
50 A, 83.5'-85.0'	442	8/5/09	Hom	3/4"			No	32.02	101.81	85.70	30.0
50 A, 86.0'-87.5'	443	8/5/09	Hom	1 1/2"			No	31.75	129.44	107.22	29.4
50 A, 88.5'-90.0'	444	8/5/09	Hom	3/4"			No	32.28	132.21	111.77	25.7
53 A, 29.5'-31.0'	445	8/5/09	Hom	3/4"			No	21.32	105.25	88.05	25.8
53 A, 31.0'-33.5'	446	8/5/09	Hom	No. 4			Yes	30.96	163.98	139.70	22.3
53 A, 33.5'-38.5'	447	8/5/09	Hom	No. 4			Yes	26.07	176.49	143.75	27.8
53 A, 38.5'-41.0'	448	8/5/09	Hom	No. 4			No	32.46	136.41	114.46	26.8
53 A, 41.0'-46.0'	449	8/5/09	Hom	No. 4			No	31.94	124.53	105.97	25.1
53 A, 46.0'-48.5'	450	8/5/09	Hom	No. 4			No	26.22	69.04	60.25	25.8
53 A, 48.5'-51.0'	451	8/5/09	Hom	No. 4			No	21.52	131.49	102.55	35.7

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Ash pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
53 A, 51.0'-53.5'	452	8/5/09	Hom	3/8"			No	21.56	149.12	117.80	32.5
53 A, 53.5'-56.0'	453	8/5/09	Hom	3/8"			No	21.83	167.11	142.77	20.1
53 A, 56.0'-58.5'	454	8/5/09	Hom	3/8"			No	21.47	148.34	125.37	22.1
53 A, 58.5'-61.0'	455	8/5/09	Hom	No. 4			No	20.98	108.43	92.75	21.8
53 A, 61.0'-63.5'	456	8/5/09	Hom	3/4"			No	21.47	79.45	66.29	29.4
53 A, 63.5'-66.0'	457	8/5/09	Hom	3/4"			No	26.12	85.91	73.67	25.7
53 A, 66.0'-68.5'	458	8/5/09	Hom	1 1/2"			No	25.61	195.09	167.61	19.4
53 A, 68.5'-71.0'	459	8/5/09	Hom	1 1/2"			No	25.89	263.29	224.75	19.4
53 A, 71.0'-73.5'	460	8/5/09	Hom	3/4"			No	21.31	78.22	64.84	30.7
53 A, 73.5'-76.0'	461	8/5/09	Hom	3/4"			No	21.50	133.62	111.53	24.5
53 A, 76.0'-78.5'	462	8/5/09	Hom	3/4"			No	21.24	166.39	137.71	24.6
53 A, 78.5'-81.0'	463	8/5/09	Hom	3/4"			No	21.91	144.09	112.27	35.2
53 A, 81.0'-83.5'	464	8/5/09	Hom	3/4"			No	25.27	168.62	136.78	28.6
53 A, 83.5'-86.0'	465	8/5/09	Hom	3/4"			No	25.93	192.54	148.49	35.9
53 A, 86.0'-88.5'	466	8/5/09	Hom	3/4"			No	30.86	162.16	122.32	43.6
53 A, 88.5'-91.0'	467	8/5/09	Hom	3/4"			No	32.25	204.56	152.27	43.6
53 A, 91.0'-93.5'	468	8/5/09	Hom	3/4"			No	21.89	151.59	112.39	43.3
53 A, 93.5'-95.0'	469	8/5/09	Hom	3/4"			No	21.09	185.07	126.67	55.3
54 A, 6.0'-8.0' NO RECOVERY	470	8/19/09									
54 A, 8.0'-9.4' NO RECOVERY	471	8/19/09									
54 A, 22.0'-24.0' NO RECOVERY	472	8/19/09									
54 A, 30.0'-32.0' NO RECOVERY	473	8/19/09									
54 A, 45.0'-47.0' NO RECOVERY	474	8/19/09									
59 A, 38.0' NO RECOVERY	475	8/19/09									

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Fossil Plant - Ash Pond

Project Number 175539016
Tested By
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
56, 0.0'-1.5'	477	8/20/09	Hom	No. 4			Yes	26.32	154.09	139.90	12.5
56, 1.5'-3.0'	478	8/20/09	Hom	No. 4			Yes	25.63	156.73	136.06	18.7
56, 3.0'-4.5'	479	8/20/09	Hom	No. 4			Yes	25.70	149.41	126.43	22.8
56, 4.5'-6.0'	480	8/20/09	Hom	No. 4			No	25.58	137.67	117.72	21.7
56, 6.0'-7.5'	481	8/20/09	Hom	No. 4			Yes	25.69	156.93	132.50	22.9
56, 7.5'-9.0'	482	8/20/09	Hom	No. 4			Yes	25.89	172.30	141.56	26.6
56, 9.0'-10.5'	483	8/20/09	Hom	3/8"			No	26.06	147.54	125.19	22.5
56, 10.5'-12.0'	484	8/20/09	Hom	No. 4			No	26.08	143.52	123.19	20.9
56, 12.0'-13.5'	485	8/20/09	Hom	No. 4			Yes	26.07	162.43	136.70	23.3
56, 13.5'-15.0'	486	8/20/09	Hom	3/8"			No	26.02	181.87	152.03	23.7
56, 15.0'-16.5'	487	8/20/09	Hom	3/8"			No	26.10	151.31	127.73	23.2
56, 16.5'-18.0'	488	8/20/09	Hom	No. 4			Yes	25.66	164.71	138.81	22.9
56, 18.0'-19.5'	489	8/20/09	Hom	No. 4			No	25.94	64.49	57.53	22.0
56, 19.5'-21.0'	490	8/20/09	Hom	No. 4			No	26.12	102.91	89.15	21.8
56, 21.0'-22.5'	491	8/20/09	Hom	No. 4			No	25.81	100.63	84.99	26.4
56, 22.5'-24.0'	492	8/20/09	Hom	No. 4			Yes	26.28	155.19	135.88	17.6
56, 24.0'-25.5'	493	8/20/09	Hom	No. 4			Yes	25.95	161.19	140.79	17.8
56, 25.5'-27.0'	494	8/20/09	Hom	No. 10			Yes	25.67	144.45	126.49	17.8
56, 27.0'-28.5'	495	8/20/09	Hom	No. 4			Yes	26.28	145.50	126.85	18.5
56, 28.5'-30.0'	496	8/20/09	Hom	3/8"			No	26.08	134.95	108.87	31.5
56, 30.0'-31.5'	497	8/20/09	Hom	3/8"			No	25.92	135.36	112.87	25.9
56, 31.5'-33.0'	498	8/20/09	Hom	3/8"			No	26.21	158.38	140.30	15.8
56, 33.0'-34.5'	499	8/20/09	Hom	3/8"			No	25.98	133.95	102.37	41.3
56, 34.5'-36.0'	501	8/20/09	Hom	No. 4			No	26.17	145.42	107.30	47.0
56, 36.0'-37.5'	502	8/20/09	Hom	3/8"			No	25.89	137.17	114.40	25.7
56, 37.5'-39.0'	503	8/20/09	Hom	3/8"			No	26.19	122.59	97.99	34.3
56, 39.0'-40.5'	504	8/20/09	Hom	3/8"			No	26.52	173.99	141.52	28.2
56, 40.5'-42.0'	505	8/20/09	Hom	3/8"			No	25.96	157.99	128.07	29.3

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Fossil Plant - Ash Pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
56, 42.0'-43.5'	506	8/21/09	Hom	3/4"			No	21.36	164.14	131.53	29.6
56, 43.5'-45.0'	507	8/21/09	Hom	No. 4			Yes	20.83	187.76	129.04	54.3
56, 45.0'-46.5'	508	8/21/09	Hom	3/4"			No	21.63	163.38	111.41	57.9
56, 46.5'-48.0'	509	8/21/09	Hom	3/8"			No	21.46	160.48	125.14	34.1
56, 48.0'-49.5'	510	8/21/09	Hom	3/8"			No	21.23	153.69	110.61	48.2
56, 49.5'-51.0'	511	8/21/09	Hom	3/8"			No	21.11	160.07	105.13	65.4
56, 52.5'-54.0'	512	8/21/09	Hom	3/4"			No	26.05	217.99	178.28	26.1
56, 55.0'-56.5'	513	8/21/09	Hom	No. 4			No	26.08	176.43	119.56	60.8
56, 57.5'-59.0'	514	8/21/09	Hom	3/8"			No	26.05	229.74	164.35	47.3
56, 60.0'-61.5'	515	8/21/09	Hom	3/8"			No	22.50	174.82	134.73	35.7
56, 62.5'-64.0'	516	8/21/09	Hom	3/4"			No	25.94	208.88	169.04	27.8
56, 65.0'-66.5'	517	8/21/09	Hom	3/4"			No	25.70	248.14	203.43	25.2
56, 67.5'-69.0'	518	8/21/09	Hom	3/8"			No	21.61	188.57	137.80	43.7
56, 70.0'-71.5'	519	8/21/09	Hom	3/8"			No	20.99	171.31	134.79	32.1
56, 72.5'-74.0'	520	8/21/09	Hom	3/4"			No	26.33	257.60	206.33	28.5
56, 75.0'-75.7'	521	8/21/09	Hom	3/4"			No	20.96	146.30	141.80	3.7
57, 0.0'-1.5'	522	8/21/09	Hom	3/4"			No	21.97	183.86	172.32	7.7
57, 1.5'-2.3'	523	8/21/09	Hom	3/4"			No	26.29	225.91	208.00	9.9
57, 3.0'-4.5'	524	8/21/09	Hom	3/8"			No	26.08	170.68	147.18	19.4
57, 4.5'-6.0'	525	8/21/09	Hom	3/8"			No	26.02	167.01	138.55	25.3
57, 6.0'-7.5'	526	8/21/09	Hom	No. 4			Yes	25.84	188.72	153.40	27.7
57, 7.5'-9.0'	528	8/21/09	Hom	No. 4			No	21.50	146.64	118.84	28.6
57, 9.0'-10.5'	529	8/21/09	Hom	No. 4			Yes	21.53	159.79	132.04	25.1
57, 10.5'-12.0'	530	8/21/09	Hom	3/8"			No	22.14	157.02	131.16	23.7
57, 12.0'-13.5'	531	8/21/09	Hom	3/8"			No	21.47	153.35	127.56	24.3
57, 13.5'-15.0'	532	8/21/09	Hom	No. 4			No	21.91	136.09	111.44	27.5
57, 15.0'-16.5'	533	8/21/09	Hom	No. 4			Yes	21.46	151.91	126.16	24.6
57, 16.5'-18.0'	534	8/21/09	Hom	No. 4			Yes	21.78	147.14	122.12	24.9
57, 18.0'-19.5'	535	8/21/09	Hom	No. 4			No	26.22	165.40	122.12	45.1
57, 19.5'-21.0'	536	8/21/09	Hom	3/8"			No	26.08	210.05	172.80	25.4
57, 21.0'-22.5'	537	8/21/09	Hom	No. 4			Yes	25.92	196.73	161.04	26.4

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Fossil Plant - Ash Pond

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
57, 22.5'-24.0'	538	8/21/09	Hom	No. 4			No	21.46	136.24	106.22	35.4
57, 24.0'-25.5'	539	8/21/09	Hom	No. 4			Yes	21.89	152.10	125.61	25.5
57, 25.5'-27.0'	540	8/21/09	Hom	No. 4			Yes	21.36	154.51	122.14	32.1
57, 27.0'-28.5'	541	8/21/09	Hom	No. 4			No	21.12	160.74	112.37	53.0
57, 28.5'-30.0'	542	8/21/09	Hom	No. 4			Yes	25.40	170.33	136.61	30.3
57, 30.0'-30.7'	543	8/21/09	Hom	No. 4			Yes	22.22	166.82	136.68	26.3
57, 32.5'-34.0'	544	8/21/09	Hom	3/8"			No	25.33	201.82	157.04	34.0
57, 35.0'-36.5'	545	8/21/09	Hom	No. 4			Yes	21.20	205.36	145.19	48.5
57, 37.5'-39.0'	546	8/21/09	Hom	3/4"			No	26.13	227.25	195.18	19.0
57, 40.0'-41.5'	547	8/21/09	Hom	3/8"			No	25.59	223.76	175.67	32.0
57, 42.5'-44.0'	548	8/21/09	Hom	3/8"			No	26.10	210.79	148.41	51.0
57, 45.0'-46.5'	549	8/21/09	Hom	3/8"			No	20.95	175.41	141.71	27.9
57, 47.5'-49.0'	550	8/21/09	Hom	3/8"			No	21.40	180.02	120.95	59.3
57, 50.0'-50.9'	551	8/21/09	Hom	3/4"			No	21.29	197.32	154.14	32.5
57, 52.5'-54.0'	552	8/21/09	Hom	3/8"			No	21.09	189.28	133.02	50.3
57, 55.0'-56.5'	553	8/21/09	Hom	3/8"			No	20.91	160.91	111.70	54.2
57B, 57.5'-59.0'	554	8/21/09	Hom	3/8"			No	26.04	199.44	151.55	38.2
57B, 60.0'-61.5'	555	8/21/09	Hom	3/8"			No	25.94	187.77	140.39	41.4
57B, 62.5'-64.0'	556	8/21/09	Hom	3/8"			No	25.94	209.13	160.90	35.7
57B, 65.0'-66.5'	557	8/21/09	Hom	3/8"			No	26.13	121.57	92.53	43.7

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name: Cumberland Fossil Plant - Ash and Gypsum Stacks

Project Number: 175539016
Tested By:

Test Method: ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
23, 0.0'-1.5'	558	8/25/09	Hom	No. 10			Yes	25.88	164.51	153.43	8.7
23, 1.5'-3.0'	559	8/25/09	Hom	No. 10			Yes	26.25	187.90	173.78	9.6
23, 3.0'-4.5'	560	8/25/09	Hom	No. 10			Yes	26.26	181.51	164.46	12.3
23, 4.5'-6.0'	561	8/25/09	Hom	No. 10			Yes	25.93	171.90	158.15	10.4
23, 6.0'-7.5'	562	8/25/09	Hom	No. 10			Yes	26.15	185.01	166.70	13.0
23, 7.5'-9.0'	563	8/25/09	Hom	No. 10			Yes	26.66	181.76	162.12	14.5
23, 9.0'-10.5'	564	8/25/09	Hom	No. 10			Yes	25.81	196.56	177.32	12.7
23, 10.5'-12.0'	565	8/25/09	Hom	No. 10			Yes	25.94	178.51	159.61	14.1
23, 12.0'-13.5'	566	8/25/09	Hom	No. 10			Yes	26.00	204.00	179.07	16.3
23, 13.5'-15.0'	567	8/25/09	Hom	No. 10			Yes	26.07	203.52	172.36	21.3
23, 15.0'-16.5'	568	8/25/09	Hom	No. 10			Yes	25.66	196.47	167.21	20.7
23, 16.5'-18.0'	569	8/25/09	Hom	No. 10			Yes	25.70	195.90	162.65	24.3
23, 18.0'-19.5'	570	8/25/09	Hom	No. 10			Yes	26.22	203.05	169.46	23.5
23, 19.5'-21.0'	571	8/25/09	Hom	3/4"			No	25.91	236.49	232.24	2.1
23, 21.0'-22.5'	572	8/25/09	Hom	No. 10			Yes	25.98	183.15	142.03	35.4
23, 22.5'-24.0'	573	8/25/09	Hom	No. 10			Yes	26.09	193.83	150.00	35.4
23, 24.0'-25.5'	574	8/25/09	Hom	No. 10			Yes	26.02	182.02	140.67	36.1
23, 25.5'-27.0'	575	8/25/09	Hom	No. 10			Yes	26.10	194.68	155.09	30.7
23, 27.0'-28.5'	576	8/25/09	Hom	No. 10			Yes	26.26	188.57	145.32	36.3
23, 28.5'-30.0'	577	8/25/09	Hom	No. 10			Yes	25.95	194.46	157.30	28.3
23, 30.0'-31.5'	578	8/25/09	Hom	No. 10			Yes	25.91	184.65	139.84	39.3
23, 31.5'-33.0'	579	8/25/09	Hom	No. 10			Yes	26.04	204.37	160.96	32.2
23, 33.0'-34.5'	580	8/25/09	Hom	No. 10			Yes	25.69	185.92	141.26	38.6
23, 34.5'-36.0'	581	8/25/09	Hom	No. 10			Yes	25.58	224.36	174.88	33.1
23, 36.0'-37.5'	582	8/25/09	Hom	No. 10			Yes	25.63	187.02	137.67	44.0
23, 37.5'-39.0'	583	8/25/09	Hom	No. 10			Yes	25.69	190.09	131.71	55.1
23, 39.0'-40.5'	584	8/25/09	Hom	No. 10			Yes	26.29	175.64	127.98	46.9
23, 40.5'-42.0'	585	8/25/09	Hom	No. 10			Yes	26.06	235.10	178.95	36.7

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Fossil Plant - Ash and Gypsum Stacks

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
23, 42.0'-43.5'	586	8/25/09	Hom	No. 10			Yes	32.08	187.17	147.70	34.1
23, 43.5'-45.0'	587	8/25/09	Hom	No. 10			Yes	30.87	163.92	128.14	36.8
23, 45.0'-46.5'	588	8/25/09	Hom	No. 10			Yes	32.31	121.25	92.96	46.6
23, 46.5'-48.0'	589	8/25/09	Hom	No. 10			Yes	30.72	113.99	86.59	49.0
23, 48.0'-49.5'	590	8/25/09	Hom	No. 10			Yes	31.76	103.28	78.82	52.0
23, 49.5'-51.0'	591	8/25/09	Hom	No. 10			Yes	32.07	117.90	88.59	51.9
23, 51.0'-52.5'	592	8/25/09	Hom	No. 10			Yes	32.29	107.35	82.48	49.6
23, 52.5'-54.0'	593	8/25/09	Hom	No. 10			Yes	30.94	111.02	84.89	48.4
23, 54.0'-55.5'	594	8/25/09	Hom	No. 10			Yes	30.73	160.67	114.83	54.5
23, 55.5'-57.0'	595	8/25/09	Hom	No. 10			Yes	31.01	164.45	115.65	57.7
23, 57.0'-58.5'	596	8/25/09	Hom	No. 10			Yes	32.30	117.46	89.80	48.1
23, 58.5'-60.0'	597	8/25/09	Hom	No. 10			Yes	32.12	140.84	107.81	43.6
23, 60.0'-61.5'	598	8/25/09	Hom	No. 10			Yes	31.81	113.62	89.20	42.6
23, 61.5'-63.0'	599	8/25/09	Hom	No. 10			Yes	30.91	109.44	80.06	59.8
23, 63.0'-64.5'	600	8/25/09	Hom	No. 10			Yes	32.23	120.78	91.87	48.5
23, 64.5'-66.0'	601	8/25/09	Hom	No. 10			Yes	32.14	116.00	86.55	54.1
23, 66.0'-67.5'	602	8/25/09	Hom	No. 10			Yes	31.04	126.04	106.86	25.3
23, 67.5'-69.0'	603	8/25/09	Hom	No. 10			Yes	32.09	107.01	92.77	23.5
23, 69.0'-70.5'	604	8/25/09	Hom	No. 10			Yes	31.92	114.39	97.59	25.6
23, 70.5'-72.0'	605	8/25/09	Hom	No. 10			Yes	32.47	118.68	101.75	24.4
23, 72.0'-73.5'	606	8/25/09	Hom	No. 10			Yes	30.71	146.47	123.11	25.3
23, 75.0'-76.5'	607	8/25/09	Hom	No. 10			Yes	32.14	112.19	95.65	26.0
23, 77.5'-79.0'	608	8/25/09	Hom	No. 4			Yes	30.66	153.78	131.66	21.9
23, 80.0'-81.5'	609	8/25/09	Hom	No. 4			No	31.94	150.34	128.18	23.0
23, 82.5'-84.0'	610	8/25/09	Hom	3/8"			No	31.92	154.79	133.02	21.5
23, 85.0'-86.5'	611	8/25/09	Hom	3/8"			No	32.47	176.65	147.85	25.0
23, 87.5'-89.0'	612	8/25/09	Hom	3/8"			No	31.77	160.95	141.21	18.0
23, 90.0'-91.5'	613	8/25/09	Hom	3/8"			No	30.56	176.61	149.36	22.9
23, 92.5'-94.0'	614	8/25/09	Hom	3/8"			No	32.12	161.58	142.02	17.8
23, 95.0'-96.5'	615	8/25/09	Hom	3/8"			No	32.23	159.90	132.61	27.2
23, 97.5'-98.8'	616	8/25/09	Hom	3/8"			No	30.99	169.86	148.62	18.1

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Fossil Plant - Ash and Gypsum Stacks

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
23, 99.4'-99.5'	617	8/25/09	Hom	3/8"			No	32.32	72.67	69.58	8.3
31, 0.0'-1.5'	618	8/25/09	Hom	No. 4			No	31.92	130.65	121.67	10.0
31, 1.5'-3.0'	619	8/25/09	Hom	No. 4			No	32.31	119.83	114.70	6.2
31, 3.0'-4.5'	620	8/25/09	Hom	No. 4			No	31.67	111.84	106.39	7.3
31, 4.5'-6.0'	621	8/25/09	Hom	No. 4			No	30.64	133.39	125.38	8.5
31, 6.0'-7.5'	622	8/25/09	Hom	No. 4			No	91.82	130.98	124.84	18.6
31, 7.5'-9.0'	623	8/25/09	Hom	No. 4			Yes	30.97	138.75	131.61	7.1
31, 9.0'-10.5'	624	8/25/09	Hom	No. 4			Yes	25.95	143.37	133.80	8.9
31, 10.5'-11.8'	625	8/25/09	Hom	No. 4			No	21.38	124.32	111.64	14.0
31, 12.0'-13.5'	626	8/25/09	Hom	No. 4			No	21.73	108.92	100.54	10.6
31, 13.5'-14.7'	627	8/25/09	Hom	No. 4			No	21.35	125.20	113.16	13.1
31, 15.0'-16.2'	628	8/25/09	Hom	No. 4			No	21.20	138.62	118.58	20.6
31, 16.5'-17.8'	629	8/25/09	Hom	No. 4			No	20.90	103.68	90.16	19.5
31, 18.0'-19.5'	630	8/25/09	Hom	No. 4			No	22.31	124.73	107.27	20.6
31, 19.5'-21.0'	631	8/25/09	Hom	3/8"			No	22.04	98.32	94.81	4.8
31, 21.0'-22.5'	632	8/25/09	Hom	No. 10			Yes	21.19	100.85	94.28	9.0
31, 22.5'-24.0'	633	8/25/09	Hom	No. 10			Yes	21.66	133.35	119.39	14.3
31, 24.0'-25.5'	634	8/25/09	Hom	No. 4			Yes	26.17	169.12	150.28	15.2
31, 25.5'-27.0'	635	8/25/09	Hom	3/4"			No	21.15	153.50	135.13	16.1
31, 27.0'-28.5'	636	8/25/09	Hom	3/8"			No	20.93	185.83	167.89	12.2
31, 28.5'-30.0'	637	8/25/09	Hom	No. 4			Yes	21.19	149.44	133.86	13.8
31, 30.0'-31.5'	638	8/25/09	Hom	3/8"			No	21.63	156.30	134.56	19.3
31, 31.5'-33.0'	639	8/25/09	Hom	No. 4			No	21.62	141.02	110.58	34.2
31, 33.0'-34.5'	640	8/25/09	Hom	No. 4			No	75.93	156.16	124.81	64.1
31, 34.5'-36.0'	641	8/25/09	Hom	No. 4			No	21.38	113.01	86.12	41.5
31, 36.0'-37.5'	642	8/25/09	Hom	3/8"			No	25.70	174.95	145.40	24.7
31, 37.5'-39.0'	643	8/25/09	Hom	3/8"			No	21.55	161.50	129.26	29.9
31, 39.0'-40.5'	644	8/25/09	Hom	No. 4			Yes	25.75	180.62	140.84	34.6
31, 40.5'-42.0'	645	8/25/09	Hom	No. 4			Yes	25.56	187.93	143.84	37.3
31, 42.0'-43.5'	646	8/25/09	Hom	No. 10			Yes	22.14	107.33	83.49	38.9
31, 43.5'-45.0'	647	8/25/09	Hom	No. 10			Yes	21.42	126.57	98.90	35.7

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Fossil Plant - Ash and Gypsum Stacks

Project Number 175539016

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

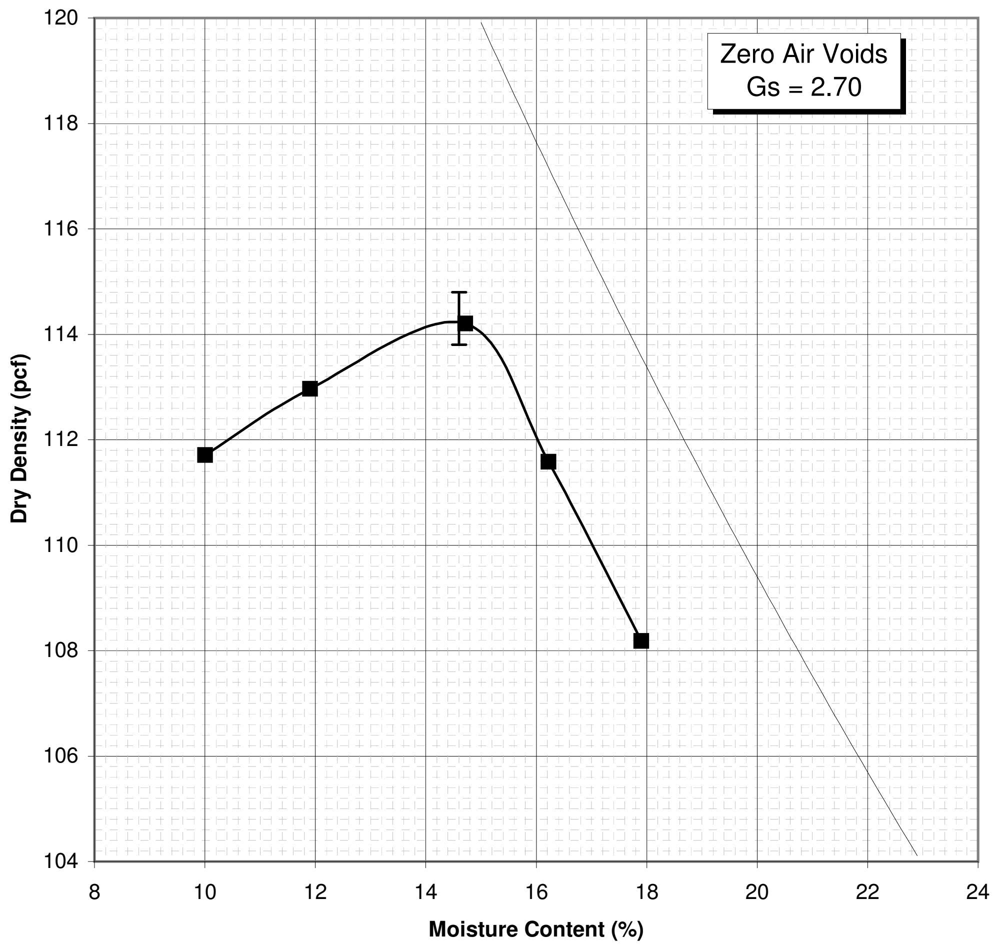
Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
31, 45.0'-46.5'	648	8/25/09	Hom	No. 10			Yes	21.32	76.83	61.35	38.7
31, 46.5'-48.0'	649	8/25/09	Hom	No. 10			Yes	21.50	108.53	78.83	51.8
31, 48.0'-49.5'	650	8/25/09	Hom	No. 10			Yes	21.83	107.29	80.15	46.5
31, 49.5'-51.0'	651	8/25/09	Hom	No. 10			Yes	21.44	103.95	77.65	46.8
31, 51.0'-52.5'	652	8/25/09	Hom	No. 10			Yes	21.61	109.04	78.10	54.8
31, 52.5'-54.0'	653	8/25/09	Hom	No. 10			Yes	21.23	80.10	60.87	48.5
31, 54.0'-55.5'	654	8/25/09	Hom	No. 10			Yes	21.55	107.74	82.08	42.4
31, 55.5'-57.0'	655	8/25/09	Hom	No. 10			Yes	21.21	107.24	84.76	35.4
31, 57.0'-58.5'	656	8/25/09	Hom	No. 10			Yes	25.58	140.73	107.62	40.4
31, 58.5'-60.0'	657	8/25/09	Hom	No. 10			Yes	25.33	108.34	85.66	37.6
31, 60.0'-61.5'	658	8/25/09	Hom	No. 10			Yes	25.25	139.87	100.95	51.4
31, 61.5'-63.0'	659	8/25/09	Hom	No. 10			Yes	21.50	100.36	76.51	43.4
31, 63.0'-64.5'	660	8/25/09	Len	No. 10			Yes	21.42	108.30	87.70	31.1
31, 64.5'-66.0'	661	8/25/09	Hom	No. 10			Yes	26.07	111.56	95.03	24.0
31, 66.0'-67.5'	662	8/25/09	Hom	No. 10			Yes	21.22	126.42	107.94	21.3
31, 67.5'-69.0'	663	8/25/09	Hom	No. 10			Yes	20.94	118.76	101.23	21.8
31, 69.0'-69.8'	664	8/25/09	Hom	No. 4			Yes	26.33	192.45	156.27	27.8

Moisture-Density Data Sheet

Project: Cumberland Fossil Plant- Gypsum and Ash stacks
Project No.: 175539016
Source: Fill Soil
Sample No.: 476
Sample Description: lean clay with gravel, brown, moist
Nmc: 14.2 %
Visual Notes: N/A
Test Method: ASTM D 698 - Method A
Prepared: Dry   Oversized Fraction: < 5 %   Rammer: Mechanical
Gs - Fines: Assumed

Mold Weight 4125 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
5970	1845	401.26	371.27	71.49	10.0	111.7
6023	1898	373.49	341.26	70.61	11.9	113.0
6092	1967	432.80	386.96	75.46	14.7	114.2
6072	1947	419.10	368.16	54.13	16.2	111.6
6040	1915	385.63	338.11	72.69	17.9	108.2



Maximum Dry Density 114.3 PCF
Optimum Moisture Content 14.6 %

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	47, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.	Lab ID	2
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-21-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 21.4

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	98.1
No. 4	4.75	97.7
No. 10	2	97.4
No. 40	0.425	93.3
No. 200	0.075	88.6
	0.02	72.3
	0.005	44.7
	0.002	38.7
estimated	0.001	29.8

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	2.3	2.6
Coarse Sand	0.3	4.1
Medium Sand	4.1	---
Fine Sand	4.7	4.7
Silt	43.9	49.9
Clay	44.7	38.7

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 40

Plastic Limit: 21

Plasticity Index: 19

Activity Index: 0.49

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-6 (17)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 47, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13
Lab ID: 2

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-05-2009
Date Received: 08-04-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.1
No. 4	97.7
No. 10	97.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

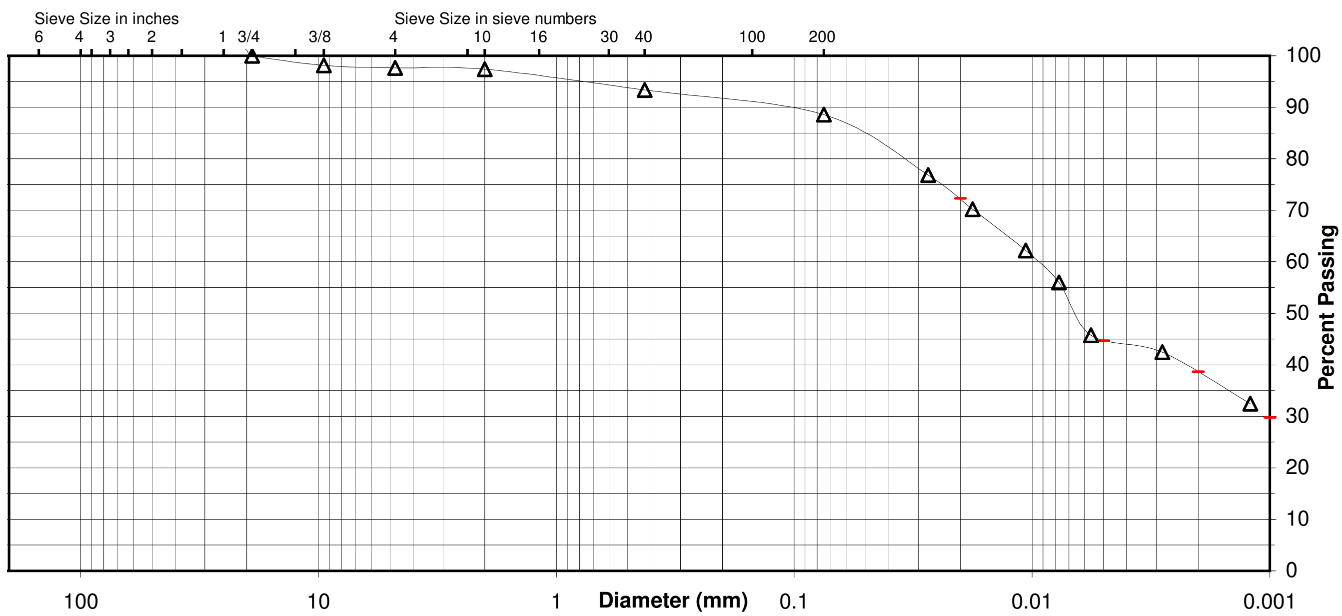
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	93.3
No. 200	88.6
0.02 mm	72.3
0.005 mm	44.7
0.002 mm	38.7
0.001 mm	29.8

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	2.3	0.3	4.1	4.7	43.9	44.7

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	2.6	4.1	4.7	49.9	38.7



Comments ______

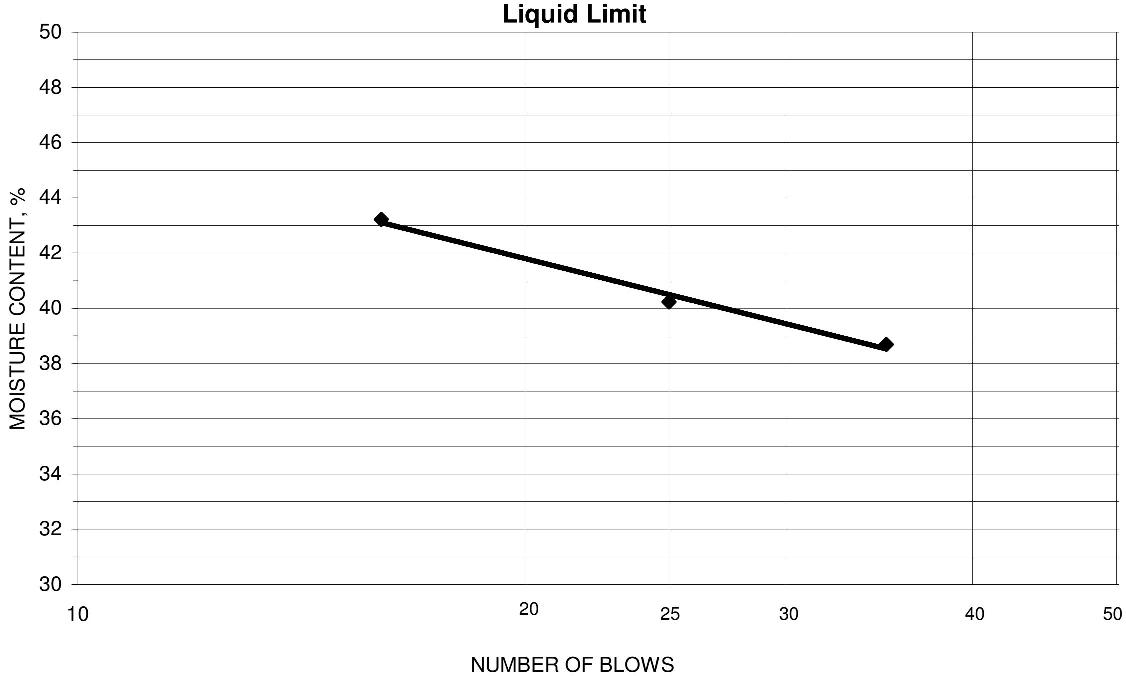
Reviewed By ______

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	47, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0',	Lab ID	2
		% + No. 40	7
Tested By	BB	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-07-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
27.27	23.97	15.44	35	38.7	
23.42	19.88	11.08	25	40.2	
22.87	19.14	10.51	16	43.2	40

Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
22.67	20.57	10.57	21.0	21	19
21.91	19.96	10.58	20.8		

Remarks: ______________________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	47, 16.5'-18.0', 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 22.5'-24.0', 2	Lab ID	13
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-19-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 25.2

Particle Size Analysis
Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	99.1
No. 4	4.75	98.7
No. 10	2	98.6
No. 40	0.425	95.2
No. 200	0.075	89.6
	0.02	63.7
	0.005	45.4
	0.002	37.1
estimated	0.001	30.7

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	1.3	1.4
Coarse Sand	0.1	3.4
Medium Sand	3.4	---
Fine Sand	5.6	5.6
Silt	44.2	52.5
Clay	45.4	37.1

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 45
Plastic Limit: 18
Plasticity Index: 27
Activity Index: 0.73

Moisture-Density Relationship
Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio
Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity
Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.67

Classification
Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-7-6 (25)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 47, 16.5'-18.0', 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 22.5'-24.0', 24.0'-25.5', 25.5'-2
Lab ID: 13

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-05-2009
Date Received 08-04-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	99.1
No. 4	98.7
No. 10	98.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.67

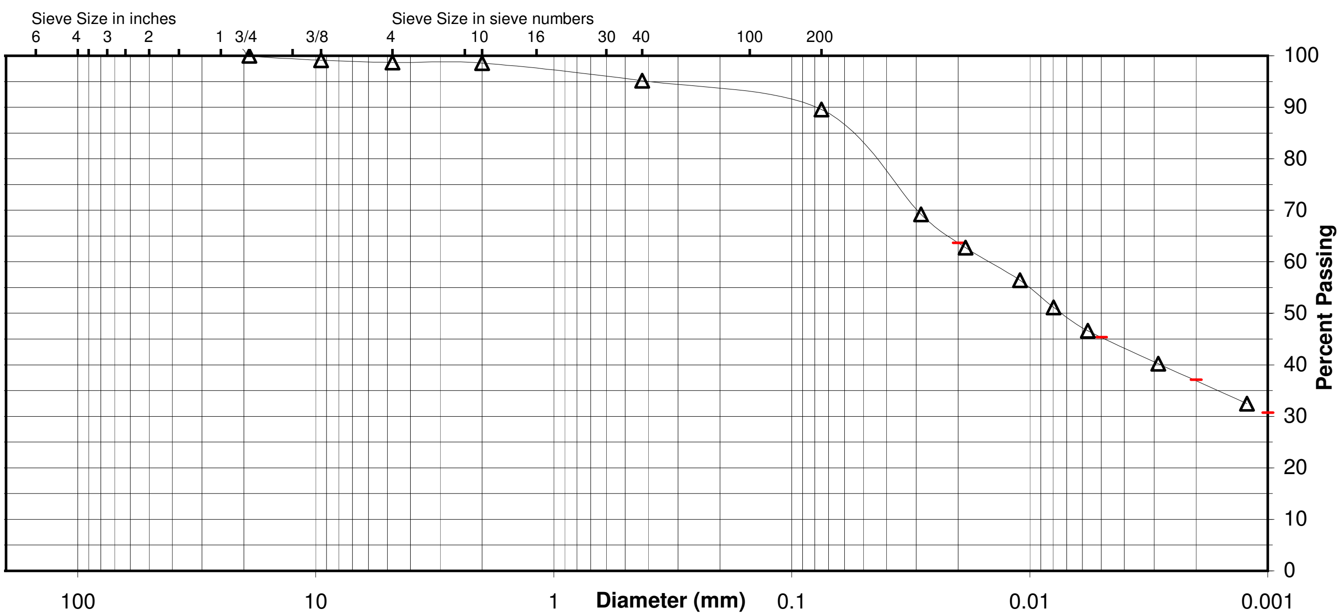
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	95.2
No. 200	89.6
0.02 mm	63.7
0.005 mm	45.4
0.002 mm	37.1
0.001 mm	30.7

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	1.3	0.1	3.4	5.6	44.2	45.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	1.4	3.4	5.6	52.5	37.1



Comments

Reviewed By

File: frm_175539016_sum_13 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

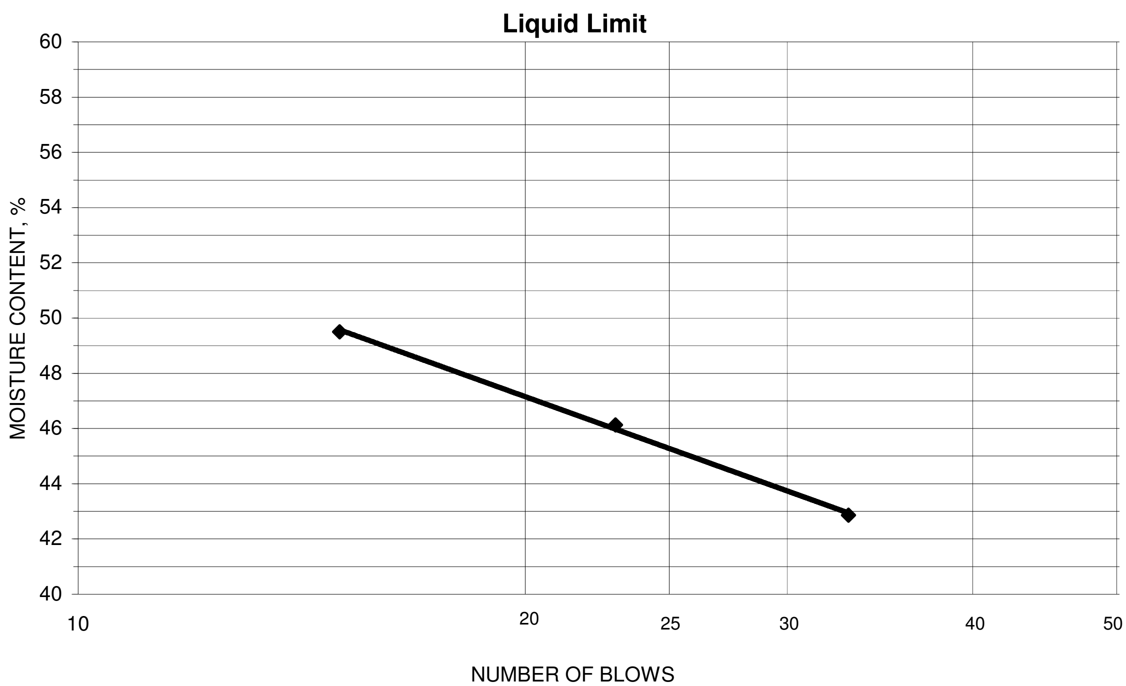
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	47, 16.5'-18.0', 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 22.5'-24.0', 24.0'-25.5	Lab ID	13
		% + No. 40	5
Tested By	BB	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-12-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
21.69	18.39	10.69	33	42.9	45
21.75	18.23	10.60	23	46.1	
24.15	19.69	10.68	15	49.5	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
24.38	22.28	10.88	18.4	18	27
23.57	21.59	10.66	18.1		

Remarks: ______________________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 48, 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', '
Lab ID: 30

County: Stewart
Date Received: 8-4-09
Sample Type: SPT Comp
Date Reported: 8-19-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 20.9

Particle Size Analysis
Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size: Sieve Size	Particle Size: (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	96.6
3/8"	9.5	89.5
No. 4	4.75	83.5
No. 10	2	81.6
No. 40	0.425	74.5
No. 200	0.075	65.3
	0.02	49.7
	0.005	35.2
	0.002	30.3
estimated	0.001	27.8

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	16.5	18.4
Coarse Sand	1.9	7.1
Medium Sand	7.1	---
Fine Sand	9.2	9.2
Silt	30.1	35.0
Clay	35.2	30.3

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 49
Plastic Limit: 17
Plasticity Index: 32
Activity Index: 1.07

Moisture-Density Relationship
Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio
Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity
Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.76

Classification
Unified Group Symbol: CL/CH
Group Name: Sandy lean clay with gravel

AASHTO Classification: A-7-6 (18)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 48, 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-
Lab ID: 30

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-05-2009
Date Received: 08-04-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	96.6
3/8"	89.5
No. 4	83.5
No. 10	81.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.76

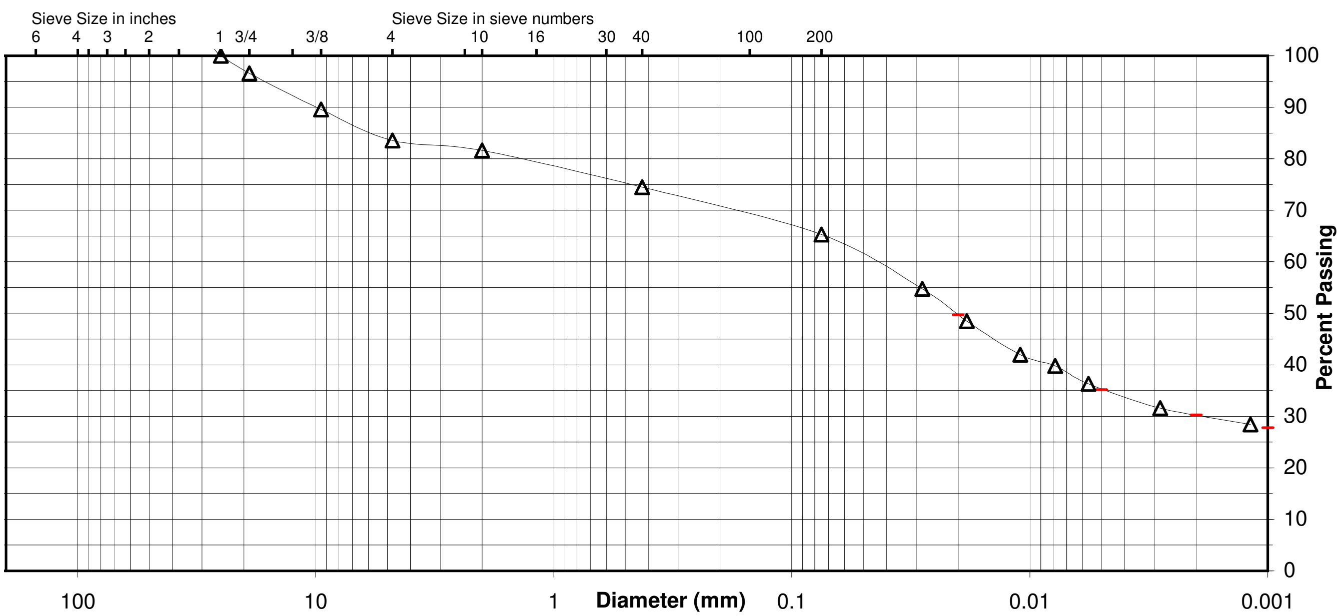
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	74.5
No. 200	65.3
0.02 mm	49.7
0.005 mm	35.2
0.002 mm	30.3
0.001 mm	27.8

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	3.4	13.1	1.9	7.1	9.2	30.1	35.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	18.4	7.1	9.2	35.0	30.3



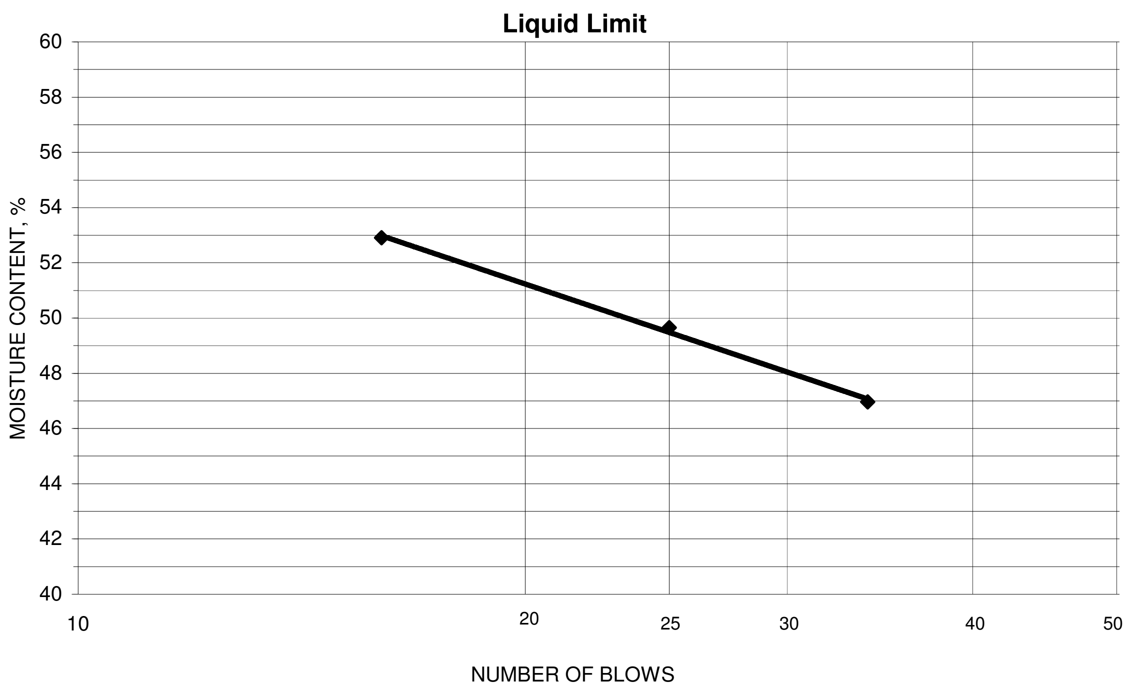
Comments ______

Reviewed By ______

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	48, 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.	Lab ID	30
		% + No. 40	26
Tested By	BB Test Method ASTM D 4318 Method A	Date Received	08-04-2009
Test Date	08-12-2009 Prepared Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
21.60	18.12	10.71	34	47.0	49
21.54	17.94	10.69	25	49.7	
23.16	18.98	11.08	16	52.9	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
22.11	20.52	11.06	16.8	17	32
22.93	21.19	11.02	17.1		

Remarks: __________

Reviewed By __________

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	48, 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 22.5'-24.0', 24.0'-25.5', 2	Lab ID	41
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-19-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 21.3

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	90.9
3/4"	19	75.6
3/8"	9.5	66.5
No. 4	4.75	56.3
No. 10	2	48.4
No. 40	0.425	34.2
No. 200	0.075	32.2
	0.02	28.9
	0.005	20.6
	0.002	17.7
estimated	0.001	16.1

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	43.7	51.6
Coarse Sand	7.9	14.2
Medium Sand	14.2	---
Fine Sand	2.0	2.0
Silt	11.6	14.5
Clay	20.6	17.7

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 52

Plastic Limit: 18

Plasticity Index: 34

Activity Index: 1.89

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: GC

Group Name: Clayey gravel with sand

AASHTO Classification: A-2-7 (4)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Cumberland Ash pond	Project Number	175539016
Source	48, 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 22.5'-24.0', 24.0'-25.5', 25.5'-27.0', 27.0'-2	Lab ID	41

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-05-2009
Date Received 08-04-2009

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	90.9
3/4"	75.6
3/8"	66.5
No. 4	56.3
No. 10	48.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

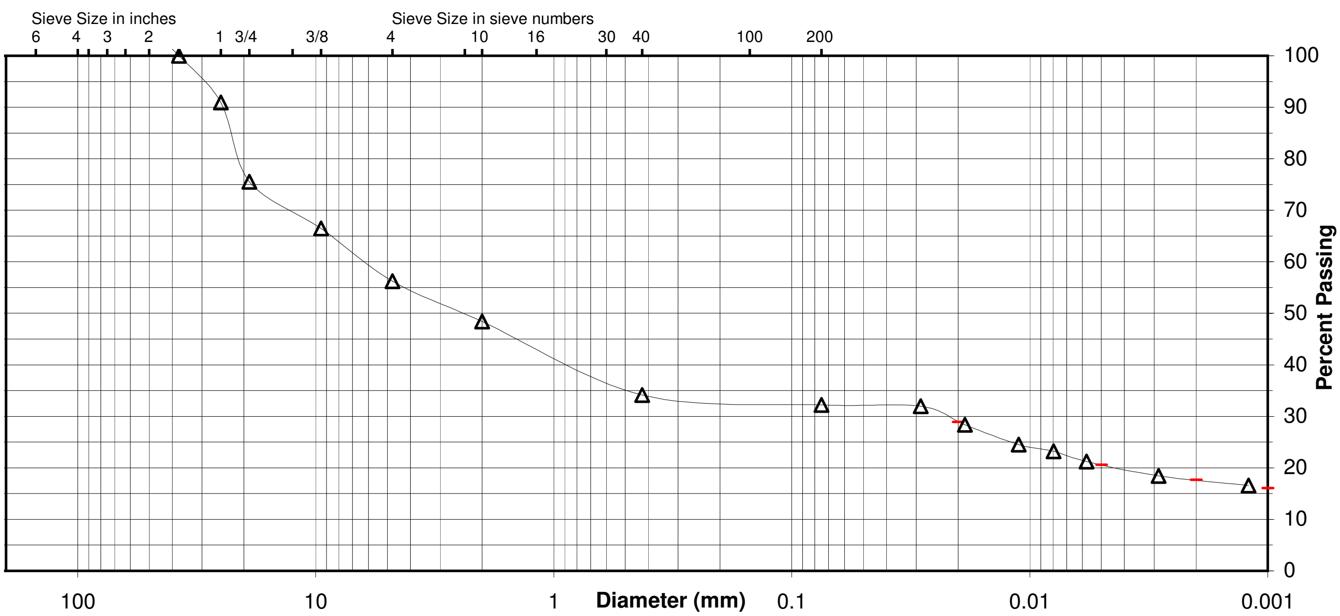
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	34.2
No. 200	32.2
0.02 mm	28.9
0.005 mm	20.6
0.002 mm	17.7
0.001 mm	16.1

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	24.4	19.3	7.9	14.2	2.0	11.6	20.6

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	51.6	14.2	2.0	14.5	17.7



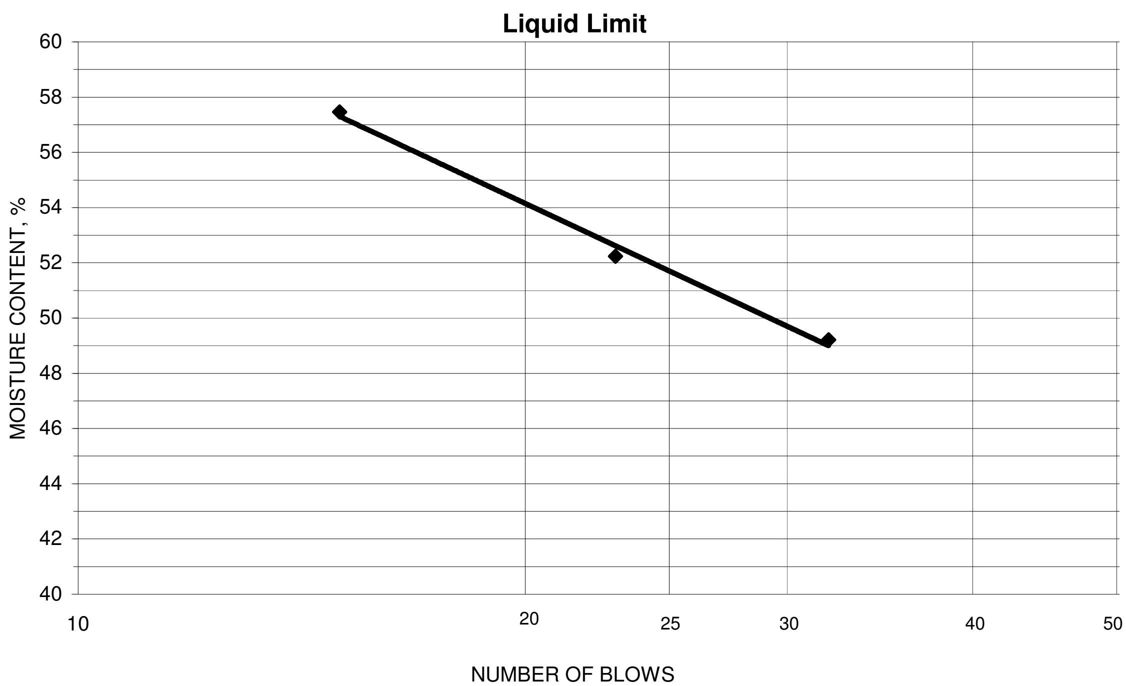
Comments

Reviewed By

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	48, 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 22.5'-24.0', 24.0'-25.5', 25.5'-27.(	Lab ID	41
		% + No. 40	66
Tested By	BB	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-10-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
22.48	18.73	11.11	32	49.2	52
26.53	22.80	15.66	23	52.2	
20.91	17.33	11.10	15	57.5	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
21.33	19.74	10.90	18.0	18	34
20.63	19.10	10.68	18.2		

Remarks:

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 51, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.
Lab ID: 117

County: Stewart
Date Received: 8-4-09
Sample Type: SPT Comp
Date Reported: 8-21-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 18.8

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	99.3
No. 4	4.75	99.0
No. 10	2	99.0
No. 40	0.425	95.9
No. 200	0.075	80.8
	0.02	56.7
	0.005	35.1
	0.002	28.8
estimated	0.001	24.4

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	1.0	1.0
Coarse Sand	0.0	3.1
Medium Sand	3.1	---
Fine Sand	15.1	15.1
Silt	45.7	52.0
Clay	35.1	28.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 35
Plastic Limit: 18
Plasticity Index: 17
Activity Index: 0.59

Moisture-Density Relationship

Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.67

Classification

Unified Group Symbol: CL
Group Name: Lean clay with sand

AASHTO Classification: A-6 (13)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 51, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13
Lab ID: 117

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-06-2009
Date Received 08-04-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	99.3
No. 4	99.0
No. 10	99.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.67

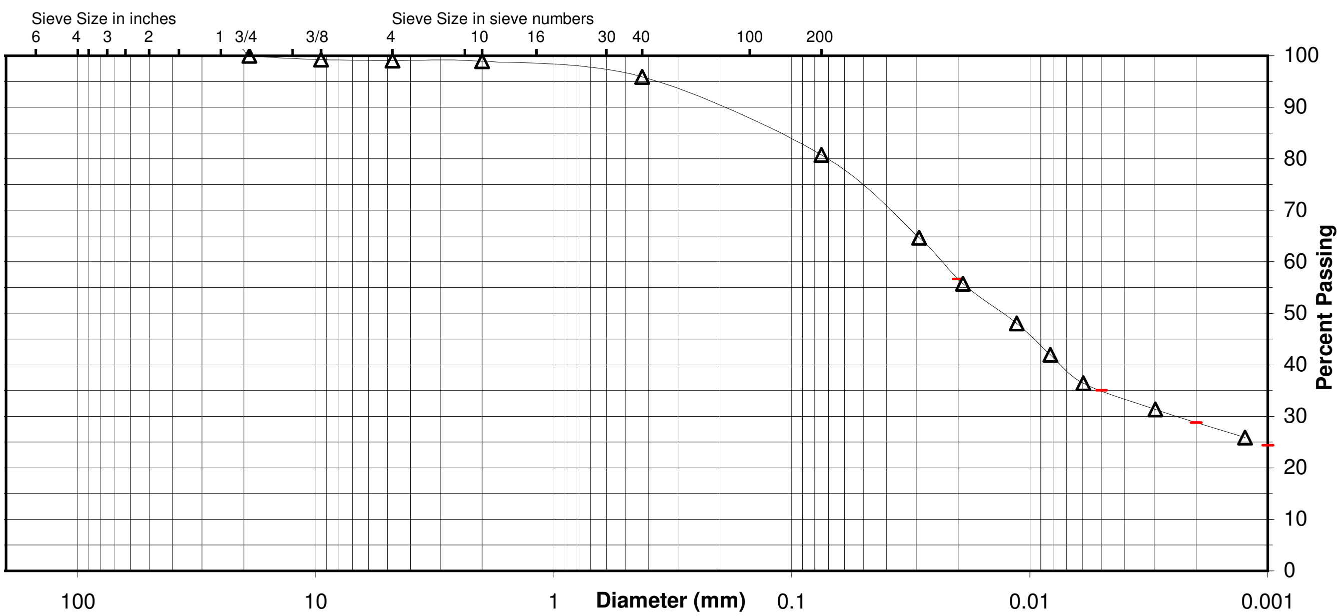
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	95.9
No. 200	80.8
0.02 mm	56.7
0.005 mm	35.1
0.002 mm	28.8
0.001 mm	24.4

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	1.0	0.0	3.1	15.1	45.7	35.1

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	1.0	3.1	15.1	52.0	28.8



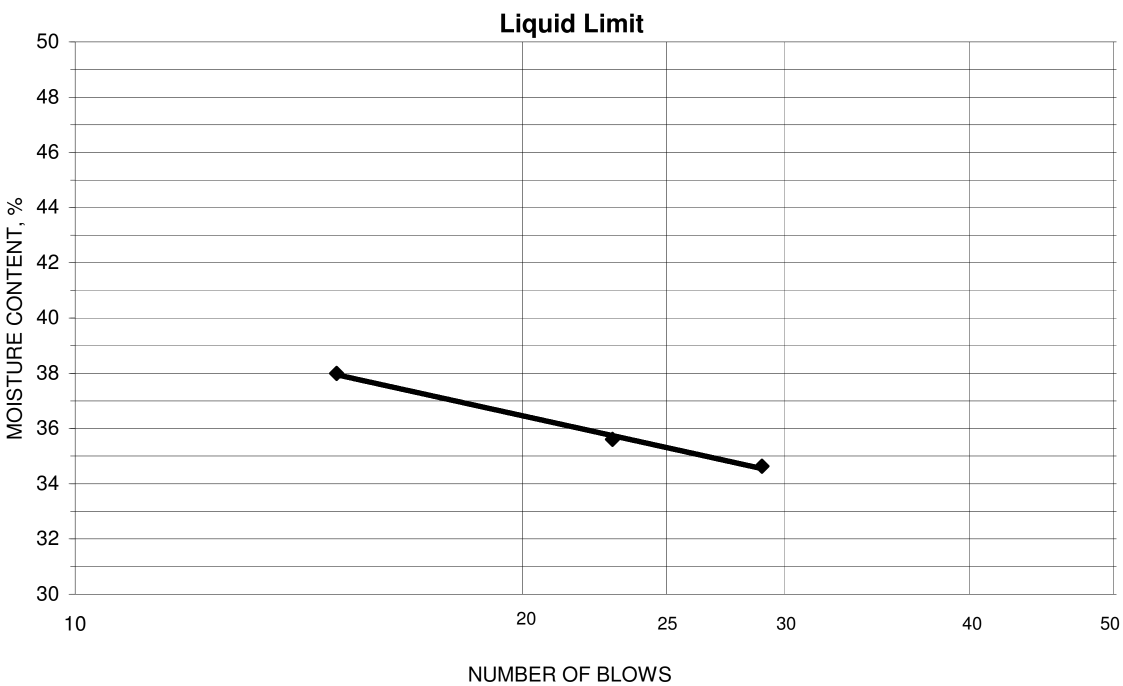
Comments

Reviewed By

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	51, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0',	Lab ID	117
		% + No. 40	4
Tested By	BB	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-11-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
22.33	19.32	10.63	29	34.6	35
23.40	20.16	11.06	23	35.6	
22.29	19.22	11.14	15	38.0	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
22.53	20.72	10.58	17.9	18	17
26.05	23.80	11.04	17.6		

Remarks:

Reviewed By

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	51, 31.0'-31.3', 33.5'-35.0', 36.0'-37.5', 38.5'-40.0', 41.0'-42.5', 4	Lab ID	135
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-21-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 27.4

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.8
No. 10	2	99.8
No. 40	0.425	98.9
No. 200	0.075	91.5
	0.02	57.4
	0.005	26.7
	0.002	20.9
estimated	0.001	16.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.2	0.2
Coarse Sand	0.0	0.9
Medium Sand	0.9	---
Fine Sand	7.4	7.4
Silt	64.8	70.6
Clay	26.7	20.9

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 30

Plastic Limit: 20

Plasticity Index: 10

Activity Index: 0.48

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.62

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-4 (9)

Comments:

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Cumberland Ash pond	Project Number	175539016
Source	51, 31.0'-31.3', 33.5'-35.0', 36.0'-37.5', 38.5'-40.0', 41.0'-42.5', 43.5'-45.0', 46.0'-4	Lab ID	135

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Soft

Tested By: KAF
Test Date: 08-06-2009
Date Received 08-04-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.8
No. 10	99.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.62

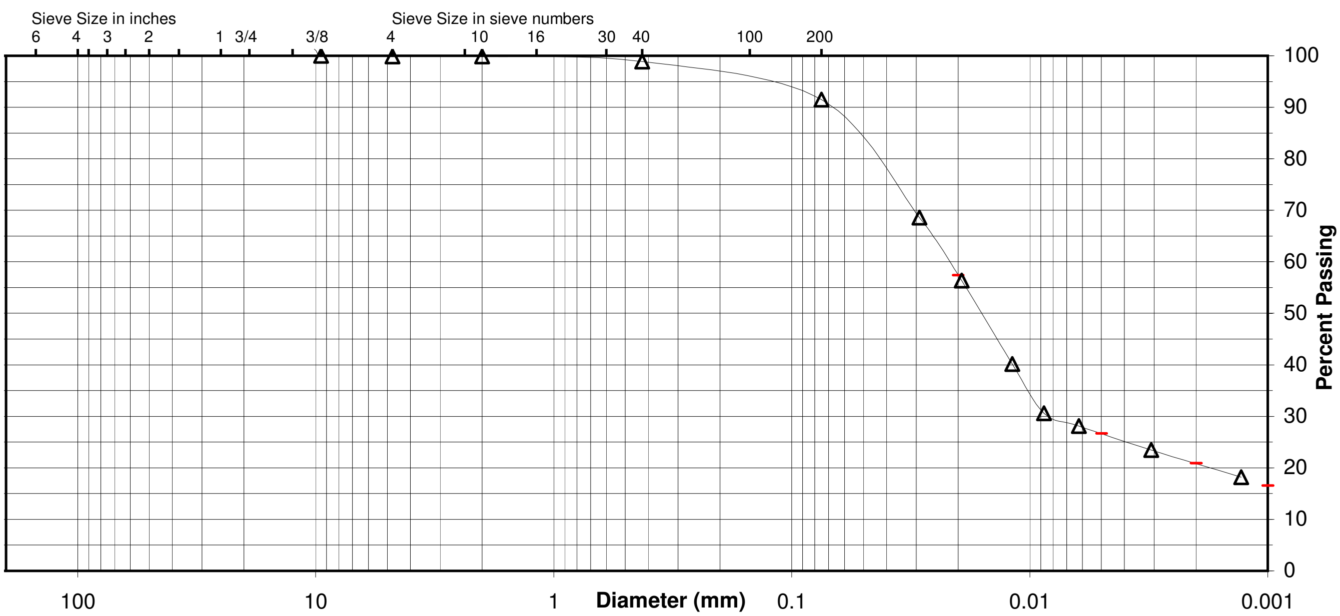
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.9
No. 200	91.5
0.02 mm	57.4
0.005 mm	26.7
0.002 mm	20.9
0.001 mm	16.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.2	0.0	0.9	7.4	64.8	26.7

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.2	0.9	7.4	70.6	20.9



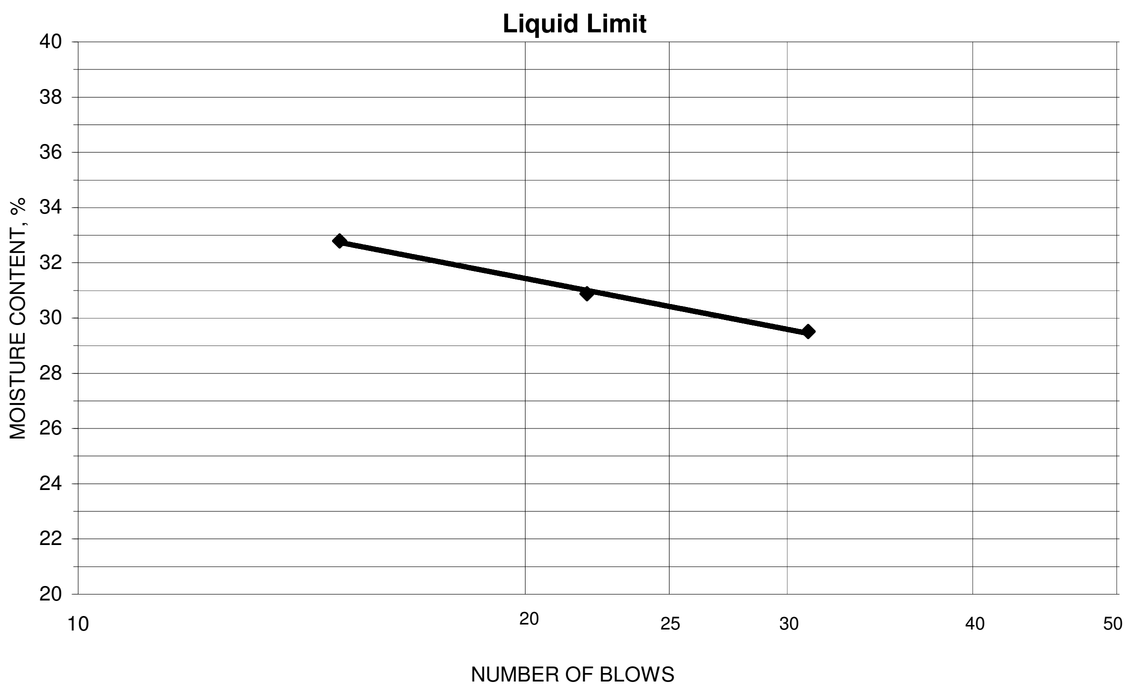
Comments

Reviewed By

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	51, 31.0'-31.3', 33.5'-35.0', 36.0'-37.5', 38.5'-40.0', 41.0'-42.5', 43.5'-45.(	Lab ID	135
		% + No. 40	1
Tested By	BB	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-11-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
23.95	20.89	10.52	31	29.5	30
22.62	19.78	11.12	15	32.8	
21.77	19.25	11.09	22	30.9	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
27.13	24.29	10.51	20.6	20	10
24.76	22.44	11.03	20.3		

Remarks: ______________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 51, 53.5'-55.0', 56.0'-57.5', 58.5'-60.0', 61.0'-62.5'
Lab ID: 145

County: Stewart
Date Received: 8-4-09
Sample Type: SPT Comp
Date Reported: 8-19-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 21.7

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	96.9
3/8"	9.5	80.8
No. 4	4.75	67.0
No. 10	2	54.2
No. 40	0.425	29.4
No. 200	0.075	18.3
	0.02	11.8
	0.005	7.3
	0.002	6.0
estimated	0.001	4.6

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	33.0	45.8
Coarse Sand	12.8	24.8
Medium Sand	24.8	---
Fine Sand	11.1	11.1
Silt	11.0	12.3
Clay	7.3	6.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.66

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-1-b (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Ash pond
Source: 51, 53.5'-55.0', 56.0'-57.5', 58.5'-60.0', 61.0'-62.5'

Project Number: 175539016
Lab ID: 145

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-06-2009
Date Received: 08-04-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	96.9
3/8"	80.8
No. 4	67.0
No. 10	54.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.66

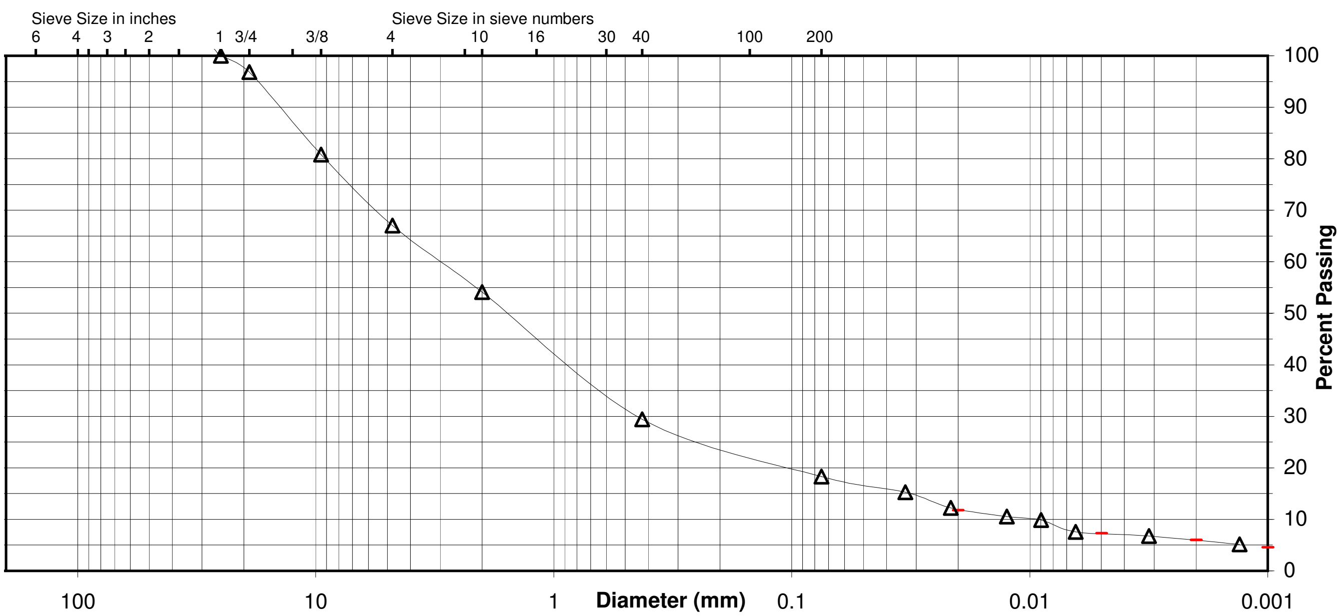
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	29.4
No. 200	18.3
0.02 mm	11.8
0.005 mm	7.3
0.002 mm	6.0
0.001 mm	4.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	3.1	29.9	12.8	24.8	11.1	11.0	7.3

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	45.8	24.8	11.1	12.3	6.0



Comments

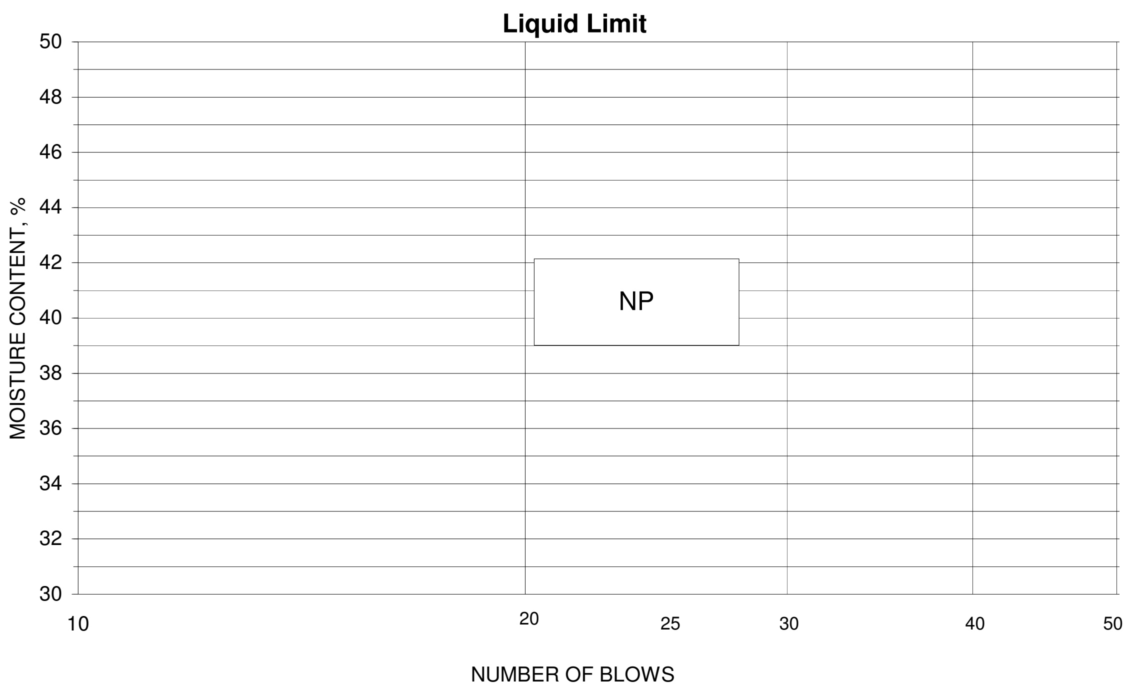
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	51, 53.5'-55.0', 56.0'-57.5', 58.5'-60.0', 61.0'-62.5'	Lab ID	145
		% + No. 40	71
Tested By	BB	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-07-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: ______________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 52, 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', '
Lab ID: 154

County: Stewart
Date Received: 8-4-09
Sample Type: SPT Comp
Date Reported: 8-19-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 22.4

Particle Size Analysis
Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	95.0
3/4"	19	95.0
3/8"	9.5	90.1
No. 4	4.75	85.3
No. 10	2	81.6
No. 40	0.425	72.2
No. 200	0.075	60.5
	0.02	46.4
	0.005	32.9
	0.002	29.5
estimated	0.001	26.9

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	14.7	18.4
Coarse Sand	3.7	9.4
Medium Sand	9.4	---
Fine Sand	11.7	11.7
Silt	27.6	31.0
Clay	32.9	29.5

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 46
Plastic Limit: 17
Plasticity Index: 29
Activity Index: 0.97

Moisture-Density Relationship
Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio
Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity
Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.74

Classification
Unified Group Symbol: CL
Group Name: Sandy lean clay

AASHTO Classification: A-7-6 (15)

Comments:

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name: Cumberland Ash pond — Project Number: 175539016

Source: 52, 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'- — Lab ID: 154

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422

Prepared using: ASTM D 421

Particle Shape: Angular

Particle Hardness: Hard and Durable

Tested By: KAF

Test Date: 08-06-2009

Date Received: 08-04-2009

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	95.0
3/4"	95.0
3/8"	90.1
No. 4	85.3
No. 10	81.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.74

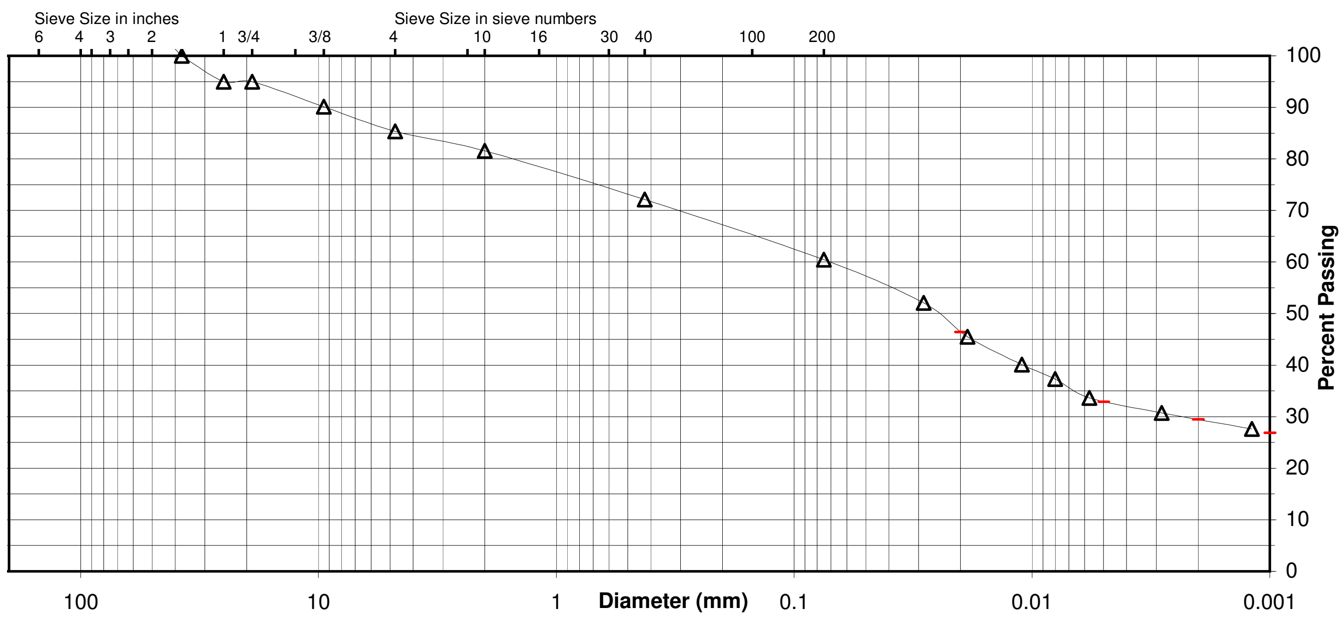
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	72.2
No. 200	60.5
0.02 mm	46.4
0.005 mm	32.9
0.002 mm	29.5
0.001 mm	26.9

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	5.0	9.7	3.7	9.4	11.7	27.6	32.9

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	18.4	9.4	11.7	31.0	29.5



Comments

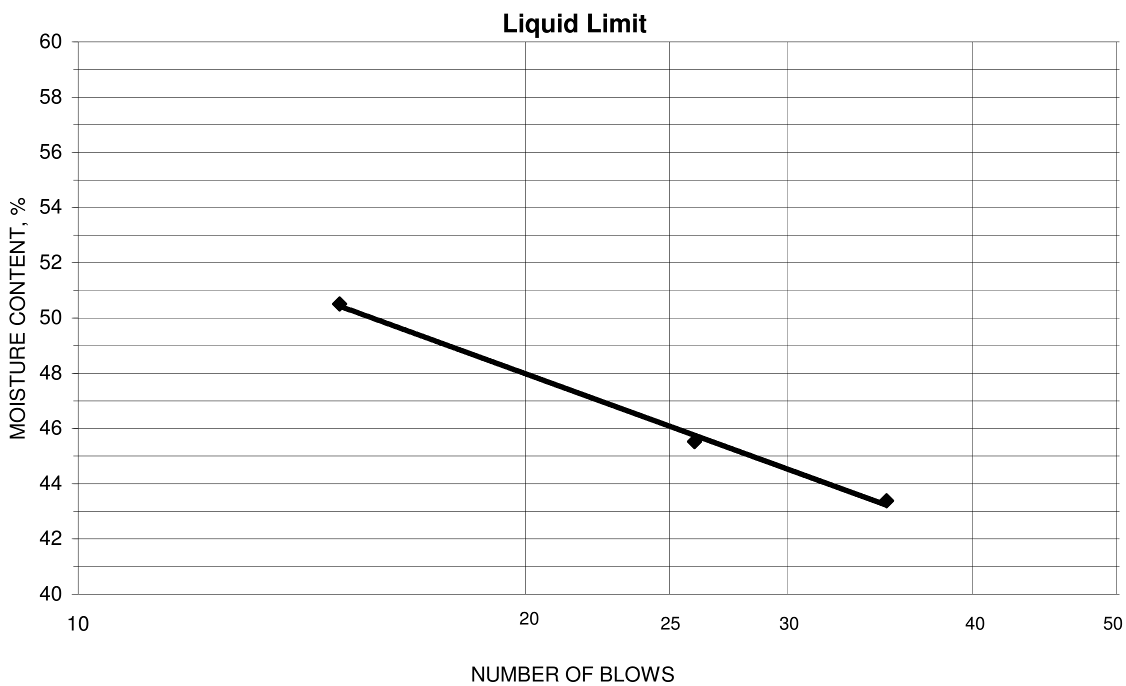
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	52, 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.	Lab ID	154
		% + No. 40	28
Tested By	BB	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-07-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
22.46	18.51	10.69	15	50.5	46
22.18	18.57	10.64	26	45.5	
22.86	19.29	11.06	35	43.4	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
27.90	25.42	10.51	16.6	17	29
29.31	26.68	11.04	16.8		

Remarks: ______________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	52, 22.5'-24.0', 24.0'-25.5', 25.5'-27.0', 27.0'-28.5', 28.5'-30.0', 3	Lab ID	168
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-19-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 22.8

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	93.7
No. 4	4.75	86.8
No. 10	2	82.9
No. 40	0.425	73.8
No. 200	0.075	67.1
	0.02	54.6
	0.005	41.1
	0.002	34.8
estimated	0.001	31.2

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	13.2	17.1
Coarse Sand	3.9	9.1
Medium Sand	9.1	---
Fine Sand	6.7	6.7
Silt	26.0	32.3
Clay	41.1	34.8

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 48

Plastic Limit: 16

Plasticity Index: 32

Activity Index: 0.91

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.71

Classification

Unified Group Symbol: CL

Group Name: Sandy lean clay

AASHTO Classification: A-7-6 (19)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Cumberland Ash pond	Project Number	175539016
Source	52, 22.5'-24.0', 24.0'-25.5', 25.5'-27.0', 27.0'-28.5', 28.5'-30.0', 31.0'-32.5', 33.5'-3	Lab ID	168

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-06-2009
Date Received 08-04-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	93.7
No. 4	86.8
No. 10	82.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.71

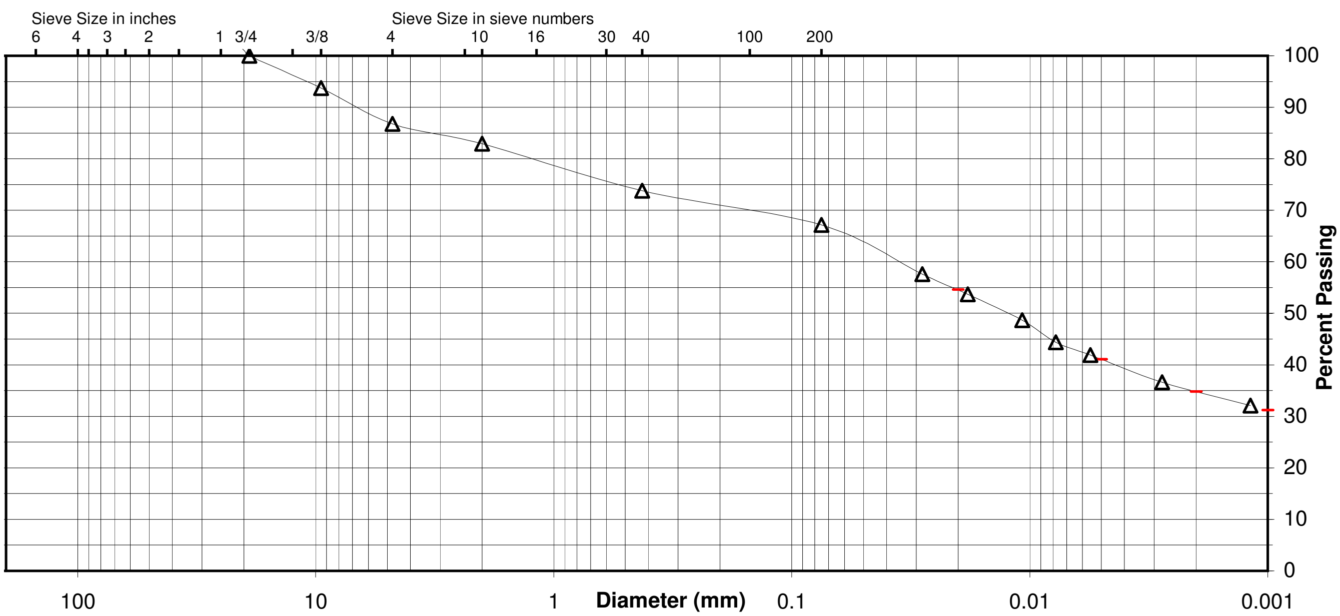
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	73.8
No. 200	67.1
0.02 mm	54.6
0.005 mm	41.1
0.002 mm	34.8
0.001 mm	31.2

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	13.2	3.9	9.1	6.7	26.0	41.1

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	17.1	9.1	6.7	32.3	34.8



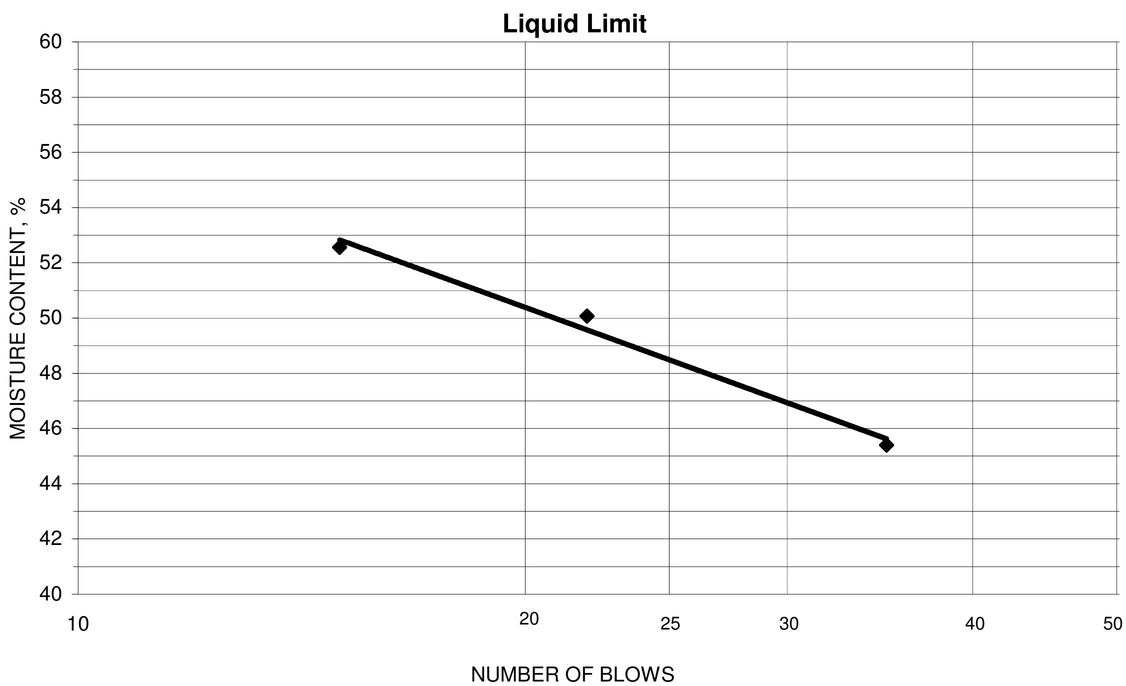
Comments

Reviewed By

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	52, 22.5'-24.0', 24.0'-25.5', 25.5'-27.0', 27.0'-28.5', 28.5'-30.0', 31.0'-32.!	Lab ID	168
		% + No. 40	26
Tested By	BB	Test Method	ASTM D 4318 Method A
		Date Received	08-04-2009
Test Date	08-11-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
21.74	18.43	11.14	35	45.4	48
22.27	18.54	11.09	22	50.1	
21.23	17.74	11.10	15	52.6	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
26.83	24.71	10.82	15.3	16	32
25.80	23.73	11.03	16.3		

Remarks: ______________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	52, 68.5'-70.0', 71.0'-72.5', 73.5'-75.0', 76.0'-77.5', 78.5'-80.0'	Lab ID	189
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-19-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 21.5

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	95.7
3/4"	19	88.5
3/8"	9.5	55.4
No. 4	4.75	41.2
No. 10	2	31.3
No. 40	0.425	19.0
No. 200	0.075	11.9
	0.02	8.0
	0.005	5.1
	0.002	4.0
estimated	0.001	3.1

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	58.8	68.7
Coarse Sand	9.9	12.3
Medium Sand	12.3	---
Fine Sand	7.1	7.1
Silt	6.8	7.9
Clay	5.1	4.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.66

Classification

Unified Group Symbol: GP-GM

Group Name: Poorly graded gravel with silt and sand

AASHTO Classification: A-1-a (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 52, 68.5'-70.0', 71.0'-72.5', 73.5'-75.0', 76.0'-77.5', 78.5'-80.0'
Lab ID: 189

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-06-2009
Date Received: 08-04-2009

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	95.7
3/4"	88.5
3/8"	55.4
No. 4	41.2
No. 10	31.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.66

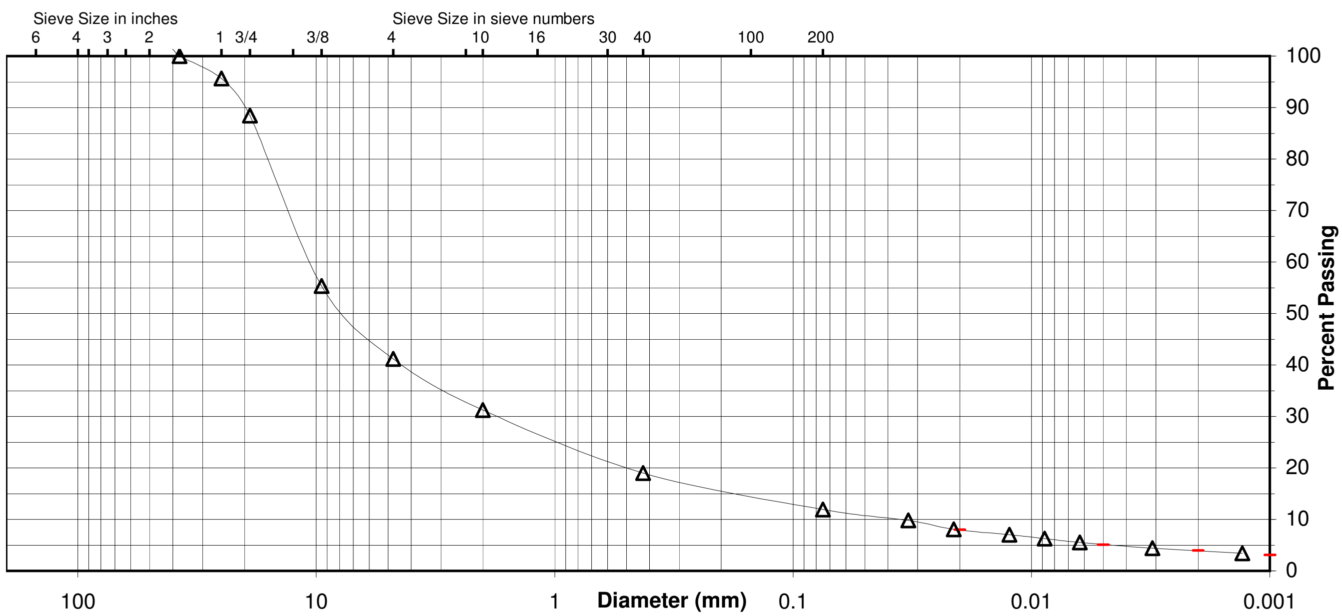
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	19.0
No. 200	11.9
0.02 mm	8.0
0.005 mm	5.1
0.002 mm	4.0
0.001 mm	3.1

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	11.5	47.3	9.9	12.3	7.1	6.8	5.1

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	68.7	12.3	7.1	7.9	4.0



Comments

Reviewed By

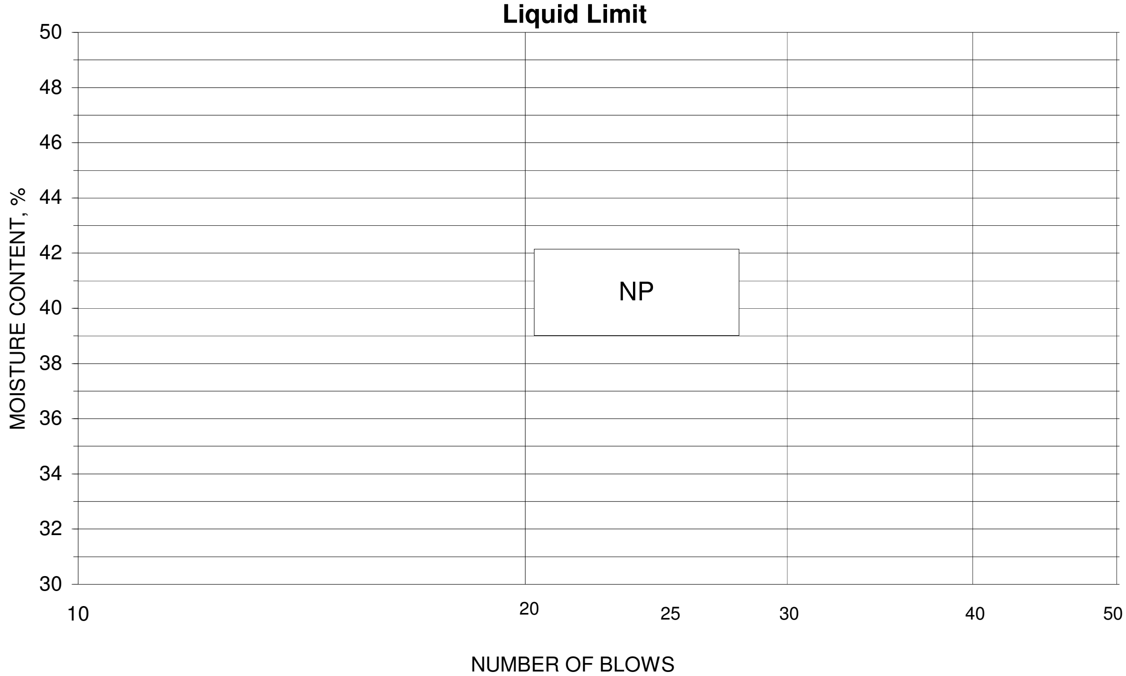
ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	52, 68.5'-70.0', 71.0'-72.5', 73.5'-75.0', 76.0'-77.5', 78.5'-80.0'	Lab ID	189
		% + No. 40	81

Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	08-04-2009
Test Date	08-11-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit

Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: ______________________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	55, 0.0'-1.5', 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5'	Lab ID	264
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-19-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 19.9

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	94.9
3/8"	9.5	82.7
No. 4	4.75	77.0
No. 10	2	74.4
No. 40	0.425	68.0
No. 200	0.075	59.6
	0.02	47.6
	0.005	34.6
	0.002	30.0
estimated	0.001	26.2

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	23.0	25.6
Coarse Sand	2.6	6.4
Medium Sand	6.4	---
Fine Sand	8.4	8.4
Silt	25.0	29.6
Clay	34.6	30.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 52

Plastic Limit: 20

Plasticity Index: 32

Activity Index: 1.07

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.65

Classification

Unified Group Symbol: CH

Group Name: Gravelly fat clay with sand

AASHTO Classification: A-7-6 (16)

Comments:

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 55, 0.0'-1.5', 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5'
Lab ID: 264

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-06-2009
Date Received: 08-04-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	94.9
3/8"	82.7
No. 4	77.0
No. 10	74.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.65

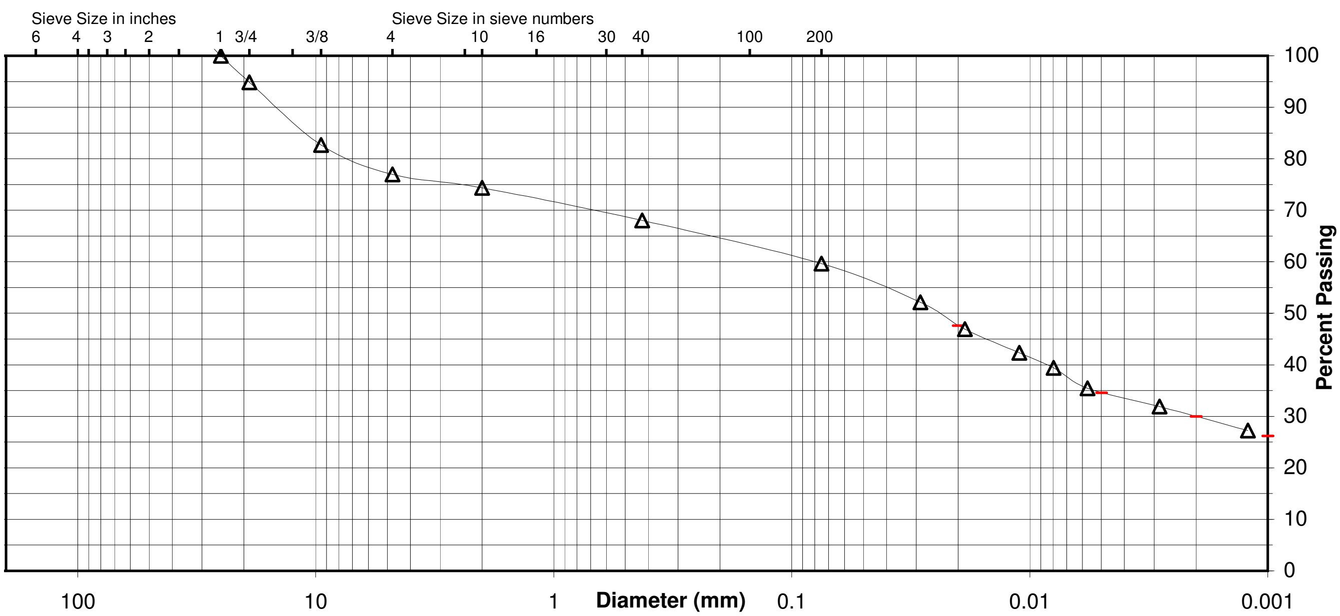
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	68.0
No. 200	59.6
0.02 mm	47.6
0.005 mm	34.6
0.002 mm	30.0
0.001 mm	26.2

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	5.1	17.9	2.6	6.4	8.4	25.0	34.6

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	25.6	6.4	8.4	29.6	30.0



Comments

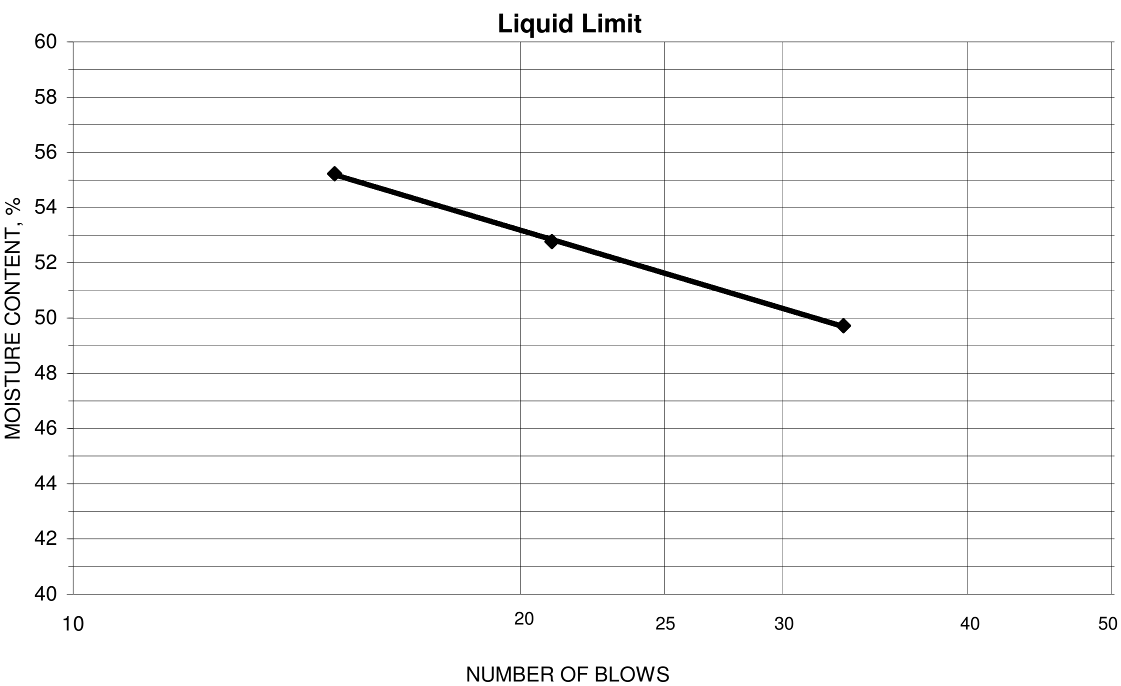
Reviewed By

Stantec

ATTERBERG LIMITS

Project: Cumberland Ash pond
Source: 55, 0.0'-1.5', 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5'
Tested By: BB
Test Date: 08-10-2009
Test Method: ASTM D 4318 Method A
Prepared: Dry
Project No.: 175539016
Lab ID: 264
% + No. 40: 32
Date Received: 08-04-2009

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
21.87	18.30	11.12	33	49.7	52
22.58	18.49	10.74	21	52.8	
22.21	18.09	10.63	15	55.2	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
21.66	19.86	11.03	20.4	20	32
20.30	18.65	10.55	20.4		

Remarks:

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	55, 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-15.0', 15.0'-16.5', 16	Lab ID	271
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-21-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 21.8

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	94.9
No. 4	4.75	92.4
No. 10	2	91.0
No. 40	0.425	85.5
No. 200	0.075	75.5
	0.02	56.9
	0.005	37.4
	0.002	30.1
estimated	0.001	24.8

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	7.6	9.0
Coarse Sand	1.4	5.5
Medium Sand	5.5	---
Fine Sand	10.0	10.0
Silt	38.1	45.4
Clay	37.4	30.1

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 42

Plastic Limit: 17

Plasticity Index: 25

Activity Index: 0.83

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.65

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-7-6 (18)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Cumberland Ash pond	Project Number	175539016
Source	55, 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-15.0', 15.0'-16.5', 16.5'-18.0', 18.0'-1!	Lab ID	271

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-10-2009
Date Received 08-04-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	94.9
No. 4	92.4
No. 10	91.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.65

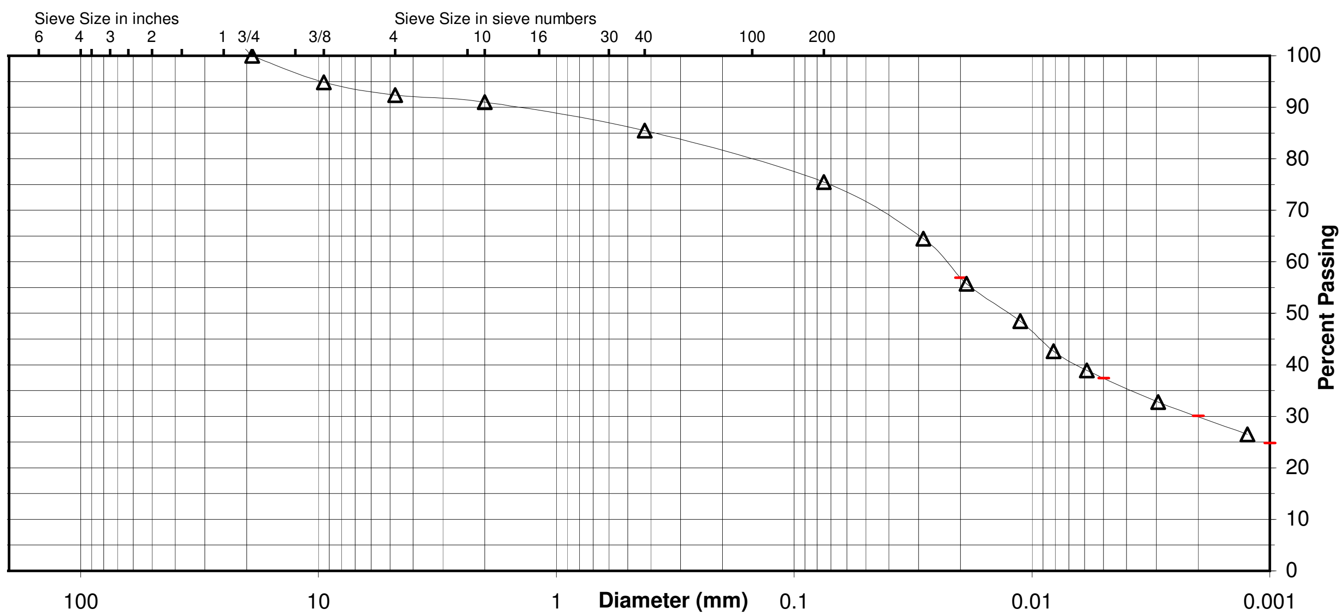
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	85.5
No. 200	75.5
0.02 mm	56.9
0.005 mm	37.4
0.002 mm	30.1
0.001 mm	24.8

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	7.6	1.4	5.5	10.0	38.1	37.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	9.0	5.5	10.0	45.4	30.1



Comments

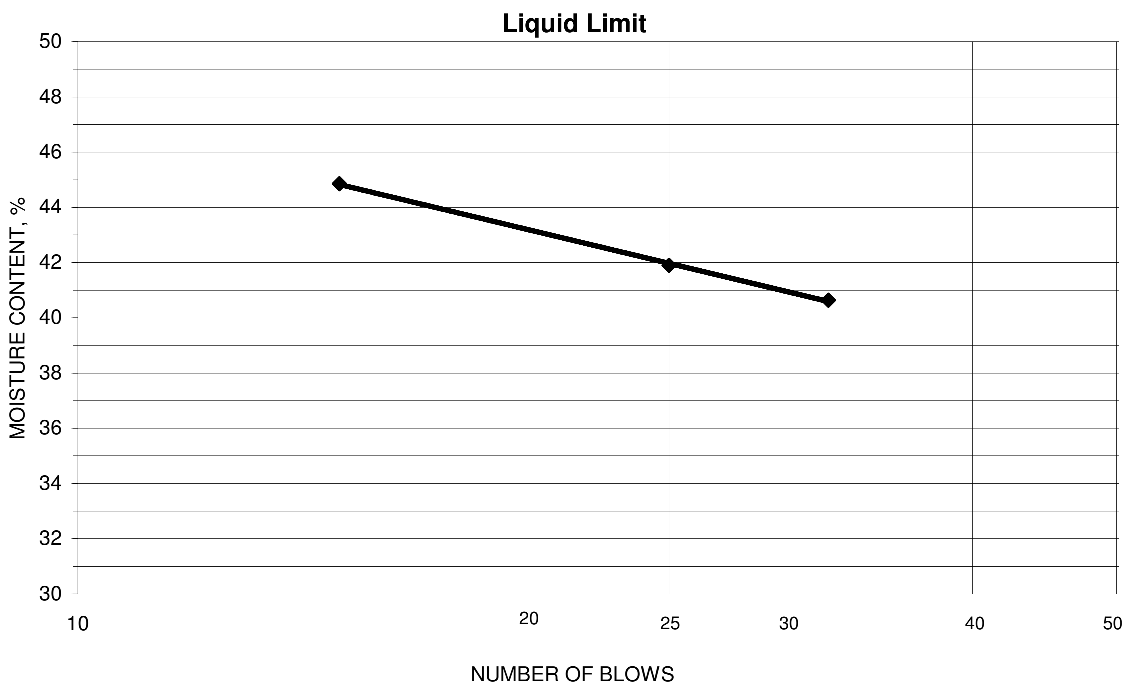
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	55, 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-15.0', 15.0'-16.5', 16.5'-18.0'	Lab ID	271
		% + No. 40	14
Tested By	KAF	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-14-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
37.96	29.64	11.09	15	44.9	42
39.98	31.45	11.09	25	41.9	
36.52	29.18	11.12	32	40.6	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
26.58	24.27	10.62	16.9	17	25
25.72	23.58	11.01	17.0		

Remarks:

Reviewed By

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	55, 24.0'-25.5', 25.5'-28.5', 28.5'-31.0', 31.0'-33.5', 33.5'-36.0', 3	Lab ID	282
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-21-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 30.1

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	95.0
3/4"	19	77.7
3/8"	9.5	64.1
No. 4	4.75	53.7
No. 10	2	46.5
No. 40	0.425	38.8
No. 200	0.075	35.3
	0.02	28.5
	0.005	19.4
	0.002	15.9
estimated	0.001	13.2

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	46.3	53.5
Coarse Sand	7.2	7.7
Medium Sand	7.7	---
Fine Sand	3.5	3.5
Silt	15.9	19.4
Clay	19.4	15.9

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 45

Plastic Limit: 25

Plasticity Index: 20

Activity Index: 1.25

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.65

Classification

Unified Group Symbol: GC

Group Name: Clayey gravel with sand

AASHTO Classification: A-2-7 (2)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Cumberland Ash pond	Project Number	175539016
Source	55, 24.0'-25.5', 25.5'-28.5', 28.5'-31.0', 31.0'-33.5', 33.5'-36.0', 36.0'-38.5', 38.5'-4	Lab ID	282

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-10-2009
Date Received 08-04-2009

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	95.0
3/4"	77.7
3/8"	64.1
No. 4	53.7
No. 10	46.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.65

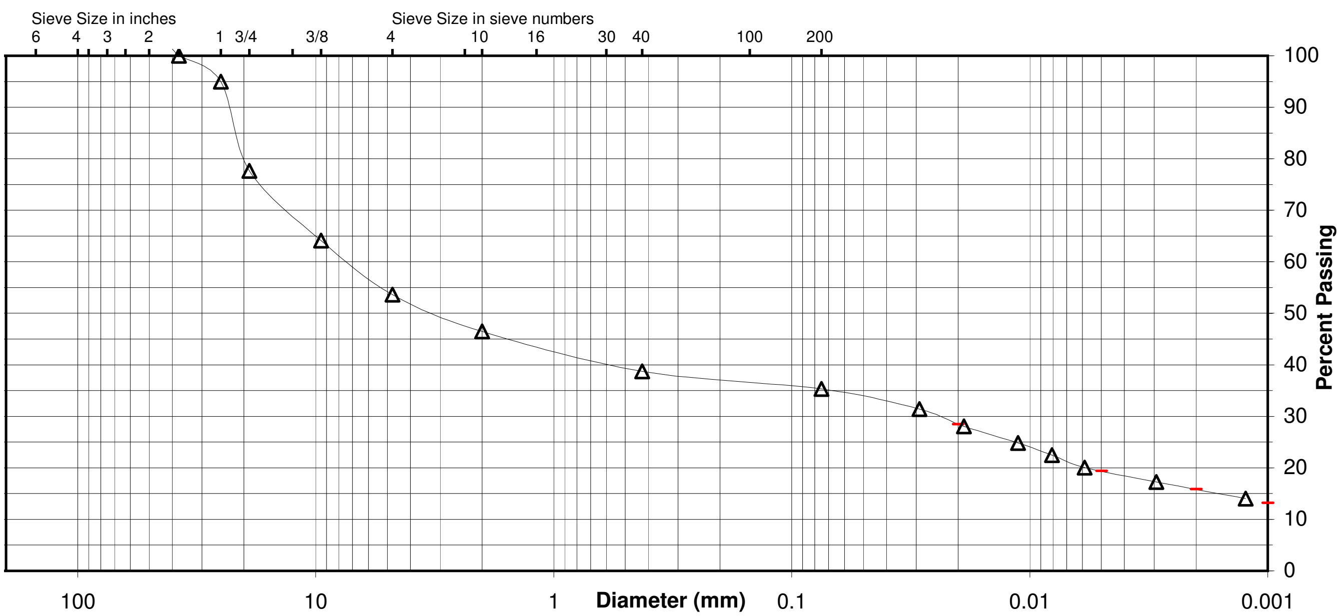
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	38.8
No. 200	35.3
0.02 mm	28.5
0.005 mm	19.4
0.002 mm	15.9
0.001 mm	13.2

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	22.3	24.0	7.2	7.7	3.5	15.9	19.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	53.5	7.7	3.5	19.4	15.9



Comments

Reviewed By

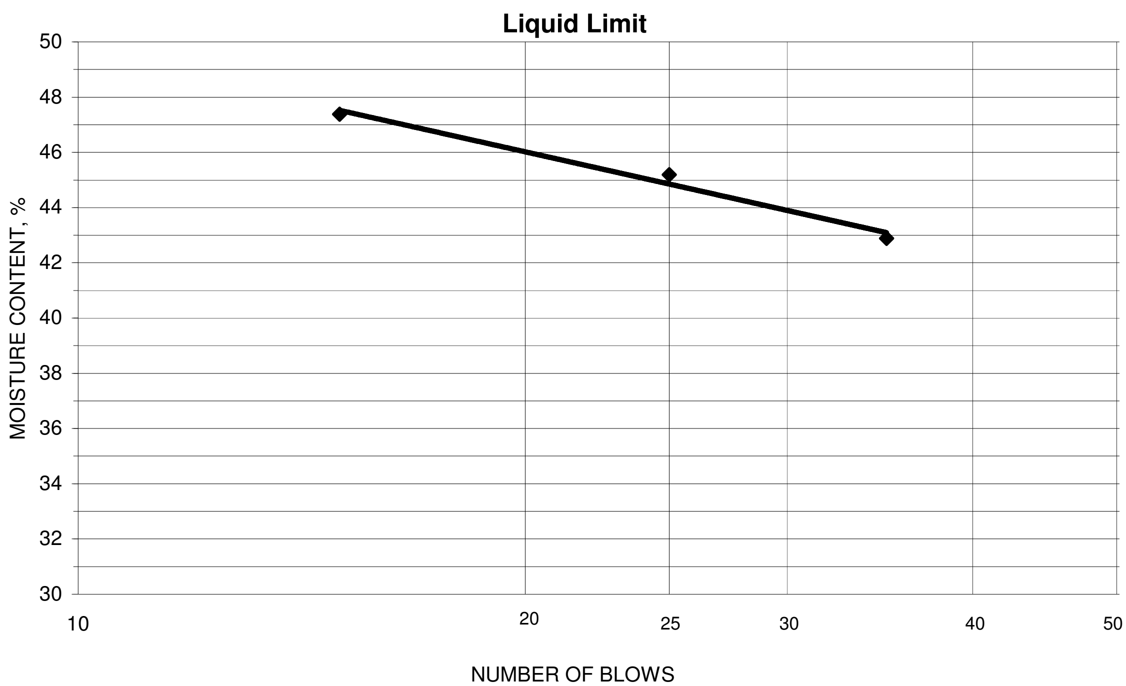
Stantec

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	55, 24.0'-25.5', 25.5'-28.5', 28.5'-31.0', 31.0'-33.5', 33.5'-36.0', 36.0'-38.5	Lab ID	282
		% + No. 40	61
Tested By	KAF	Date Received	08-04-2009
Test Date	08-13-2009		

Test Method ASTM D 4318 Method A
Prepared Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
33.48	26.14	10.65	15	47.4	45
35.41	27.84	11.09	25	45.2	
37.83	29.78	11.01	35	42.9	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
22.73	20.27	10.53	25.3	25	20
21.80	19.63	11.02	25.2		

Remarks: ______________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name	Cumberland Fossil Plant - Ash Pond	Project Number	175539016
Source	56, 34.5'-36.0', 36.0'-37.5', 37.5'-39.0'	Lab ID	500
County	Stewart	Date Received	8-21-09
Sample Type	SPT Comp	Date Reported	9-1-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 35.7

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	95.7
3/4"	19	91.6
3/8"	9.5	78.6
No. 4	4.75	69.2
No. 10	2	62.8
No. 40	0.425	54.0
No. 200	0.075	49.2
	0.02	37.5
	0.005	22.7
	0.002	16.8
estimated	0.001	14.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	30.8	37.2
Coarse Sand	6.4	8.8
Medium Sand	8.8	---
Fine Sand	4.8	4.8
Silt	26.5	32.4
Clay	22.7	16.8

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 41

Plastic Limit: 28

Plasticity Index: 13

Activity Index: 0.76

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.73

Classification

Unified Group Symbol: GM

Group Name: Silty gravel with sand

AASHTO Classification: A-7-6 (4)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Cumberland Fossil Plant - Ash Pond	Project Number	175539016
Source	56, 34.5'-36.0', 36.0'-37.5', 37.5'-39.0'	Lab ID	500

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-26-2009
Date Received 08-21-2009

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	95.7
3/4"	91.6
3/8"	78.6
No. 4	69.2
No. 10	62.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.73

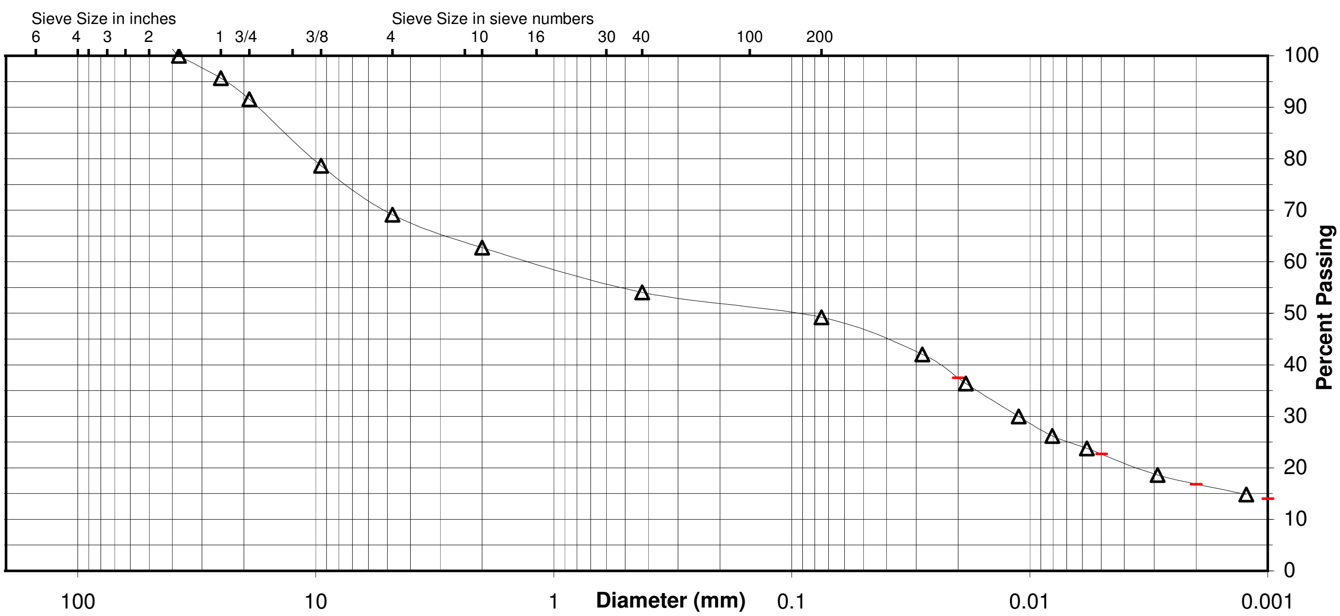
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	54.0
No. 200	49.2
0.02 mm	37.5
0.005 mm	22.7
0.002 mm	16.8
0.001 mm	14.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	8.4	22.4	6.4	8.8	4.8	26.5	22.7

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	37.2	8.8	4.8	32.4	16.8



Comments ______

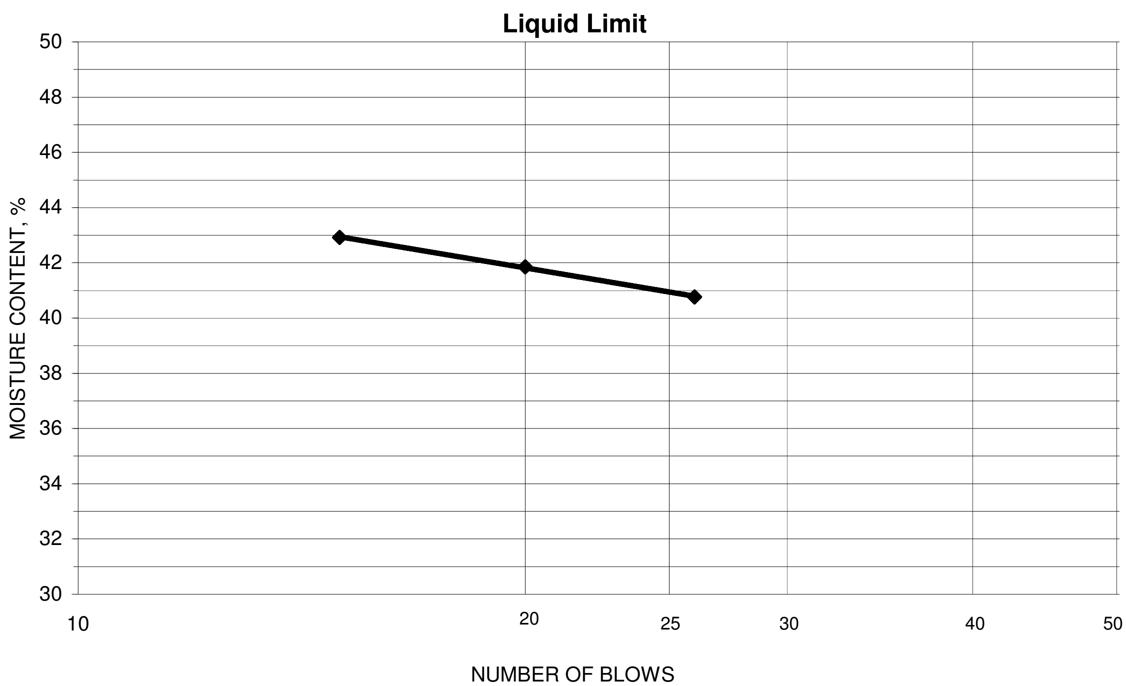
Reviewed By ______

Stantec

ATTERBERG LIMITS

Project	Cumberland Fossil Plant - Ash Pond	Project No.	175539016
Source	56, 34.5'-36.0', 36.0'-37.5', 37.5'-39.0'	Lab ID	500
		% + No. 40	46
Tested By	BB	Test Method	ASTM D 4318 Method A
Date Received	08-21-2009		
Test Date	09-01-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
26.10	22.94	15.39	20	41.9	
23.30	19.63	11.08	15	42.9	
23.09	19.49	10.66	26	40.8	41



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
22.26	19.82	11.05	27.8	28	13
25.30	23.12	15.21	27.6		

Remarks: __________

Reviewed By __________

Stantec

Summary of Soil Tests

Project Name	Cumberland Fossil Plant - Ash Pond	Project Number	175539016
Source	57, 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-15.0', 15.0'	Lab ID	527
County	Stewart	Date Received	8-21-09
Sample Type	SPT Comp	Date Reported	9-1-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 25.5

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	98.4
3/4"	19	96.4
3/8"	9.5	95.7
No. 4	4.75	95.3
No. 10	2	95.2
No. 40	0.425	87.0
No. 200	0.075	66.3
	0.02	45.0
	0.005	27.6
	0.002	18.6
estimated	0.001	13.4

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	4.7	4.8
Coarse Sand	0.1	8.2
Medium Sand	8.2	---
Fine Sand	20.7	20.7
Silt	38.7	47.7
Clay	27.6	18.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 34

Plastic Limit: 21

Plasticity Index: 13

Activity Index: 0.68

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.69

Classification

Unified Group Symbol: CL

Group Name: Sandy lean clay

AASHTO Classification: A-6 (7)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Fossil Plant - Ash Pond
Project Number: 175539016
Source: 57, 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-15.0', 15.0'-16.5', 16.5'-18.0
Lab ID: 527

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-26-2009
Date Received: 08-21-2009

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	98.4
3/4"	96.4
3/8"	95.7
No. 4	95.3
No. 10	95.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.69

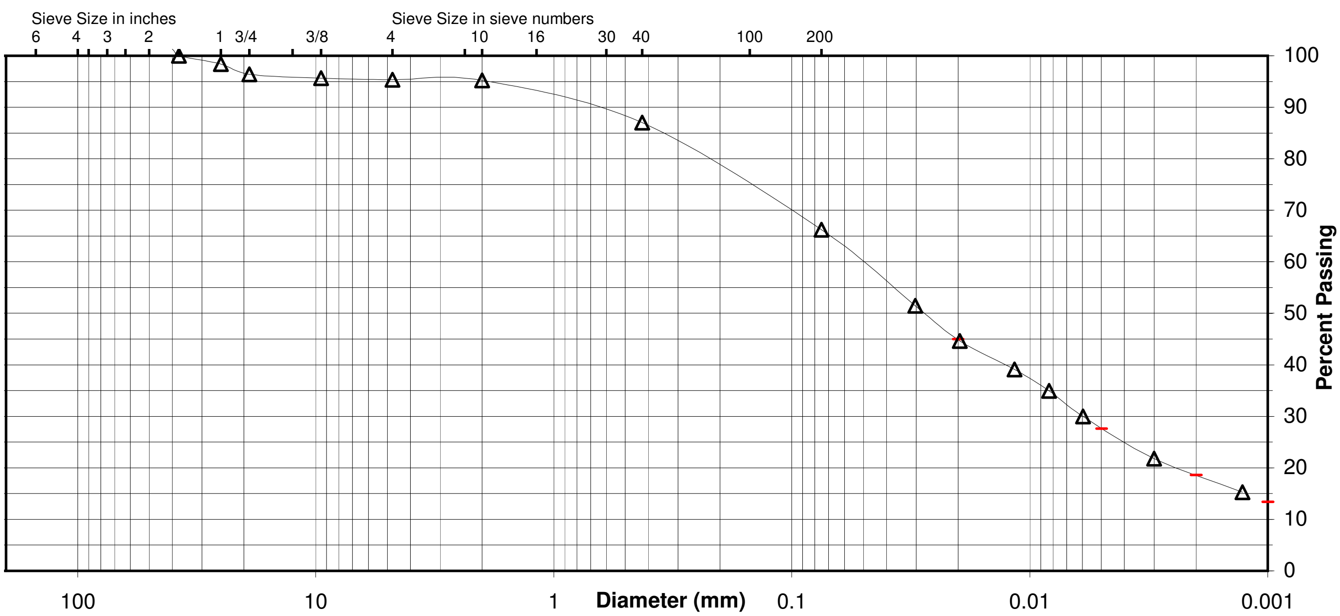
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	87.0
No. 200	66.3
0.02 mm	45.0
0.005 mm	27.6
0.002 mm	18.6
0.001 mm	13.4

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	3.6	1.1	0.1	8.2	20.7	38.7	27.6

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	4.8	8.2	20.7	47.7	18.6



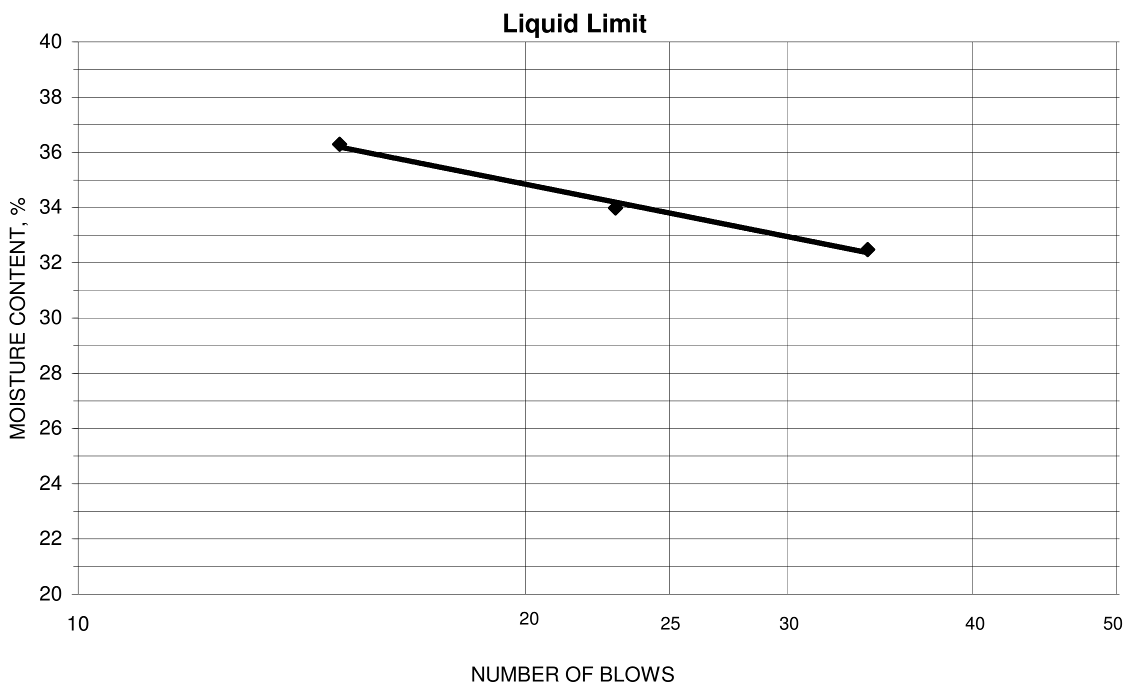
Comments

Reviewed By

ATTERBERG LIMITS

Project	Cumberland Fossil Plant - Ash Pond	Project No.	175539016
Source	57, 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-15.0', 15.0'-16.5', 1	Lab ID	527
		% + No. 40	13
Tested By	BB	Test Method	ASTM D 4318 Method A
Date Received	08-21-2009		
Test Date	08-27-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
22.43	19.32	10.75	15	36.3	34
23.32	20.21	11.06	23	34.0	
23.46	20.43	11.10	34	32.5	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
28.17	25.14	10.57	20.8	21	13
27.74	24.78	10.61	20.9		

Remarks: ____________________

Reviewed By ____________

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	58, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.	Lab ID	306
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-19-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 21.3

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	98.7
3/8"	9.5	95.4
No. 4	4.75	92.5
No. 10	2	88.6
No. 40	0.425	79.9
No. 200	0.075	64.2
	0.02	52.8
	0.005	41.9
	0.002	37.9
estimated	0.001	34.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	7.5	11.4
Coarse Sand	3.9	8.7
Medium Sand	8.7	---
Fine Sand	15.7	15.7
Silt	22.3	26.3
Clay	41.9	37.9

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 54

Plastic Limit: 18

Plasticity Index: 36

Activity Index: 0.95

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.68

Classification

Unified Group Symbol: CH

Group Name: Sandy fat clay

AASHTO Classification: A-7-6 (21)

Comments:

Particle-Size Analysis of Soils

ASTM D 422

Project Name: Cumberland Ash pond | Project Number: 175539016
Source: 58, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13 | Lab ID: 306

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-11-2009
Date Received: 08-04-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	98.7
3/8"	95.4
No. 4	92.5
No. 10	88.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.68

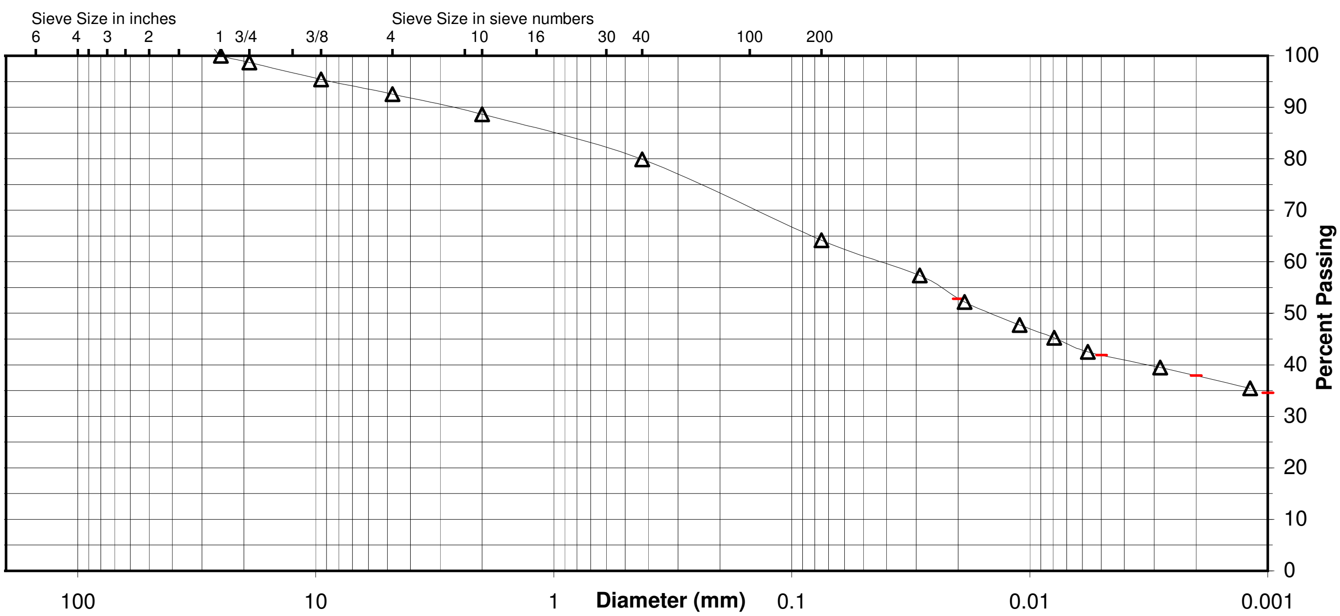
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	79.9
No. 200	64.2
0.02 mm	52.8
0.005 mm	41.9
0.002 mm	37.9
0.001 mm	34.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	1.3	6.2	3.9	8.7	15.7	22.3	41.9

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	11.4	8.7	15.7	26.3	37.9



Comments ______________________

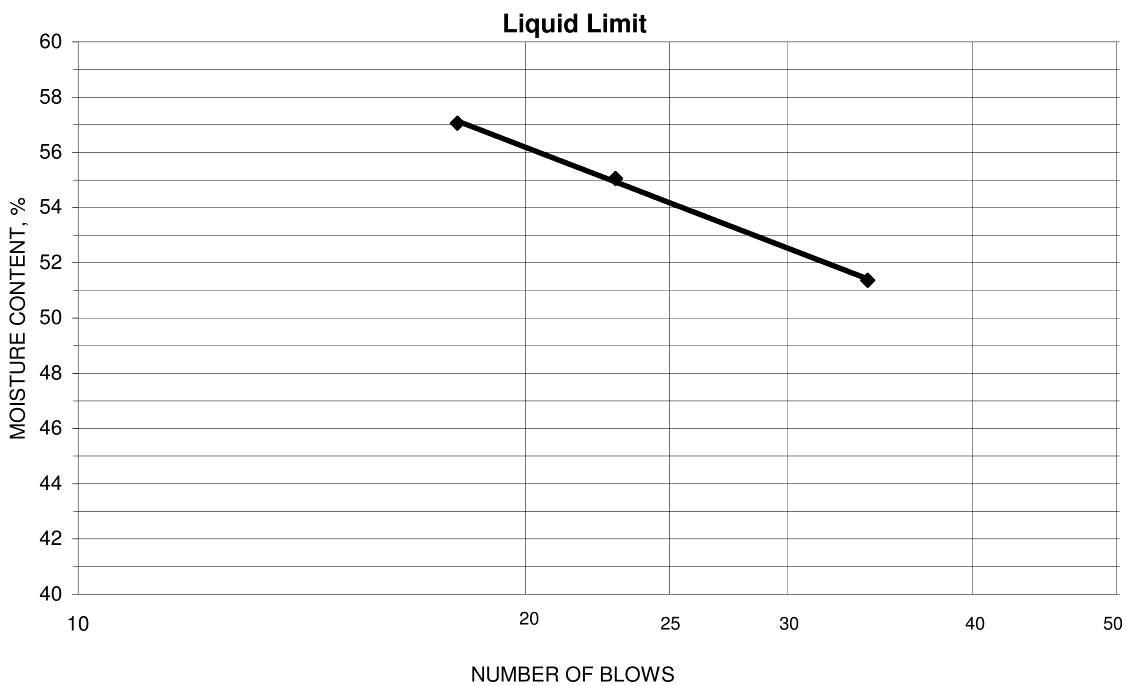
Reviewed By ______________

Stantec

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	58, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0',	Lab ID	306
		% + No. 40	20
Tested By	KAF	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-13-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
34.86	26.05	10.61	18	57.1	54
34.97	26.47	11.03	23	55.1	
35.36	27.11	11.05	34	51.4	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
27.44	24.92	11.01	18.1	18	36
25.61	23.41	11.03	17.8		

Remarks: ______________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	58, 32.5'-34.0', 35.0'-36.5', 37.5'-39.0'	Lab ID	327
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-19-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 37.4

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	95.7
3/8"	9.5	91.6
No. 4	4.75	82.2
No. 10	2	73.5
No. 40	0.425	55.4
No. 200	0.075	42.1
	0.02	36.3
	0.005	27.0
	0.002	23.5
estimated	0.001	21.3

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	17.8	26.5
Coarse Sand	8.7	18.1
Medium Sand	18.1	---
Fine Sand	13.3	13.3
Silt	15.1	18.6
Clay	27.0	23.5

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 68

Plastic Limit: 36

Plasticity Index: 32

Activity Index: 1.33

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.68

Classification

Unified Group Symbol: SM

Group Name: Silty sand with gravel

AASHTO Classification: A-7-5 (8)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 58, 32.5'-34.0', 35.0'-36.5', 37.5'-39.0'
Lab ID: 327

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-11-2009
Date Received: 08-04-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	95.7
3/8"	91.6
No. 4	82.2
No. 10	73.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.68

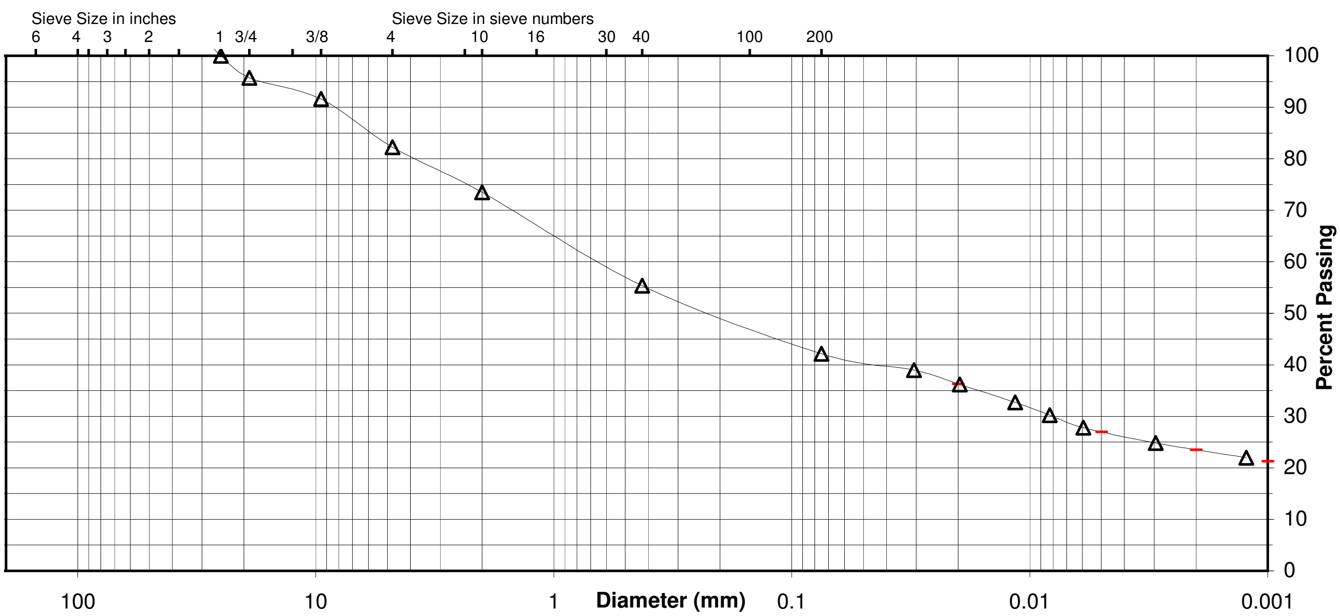
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	55.4
No. 200	42.1
0.02 mm	36.3
0.005 mm	27.0
0.002 mm	23.5
0.001 mm	21.3

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	4.3	13.5	8.7	18.1	13.3	15.1	27.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	26.5	18.1	13.3	18.6	23.5



Comments

Reviewed By

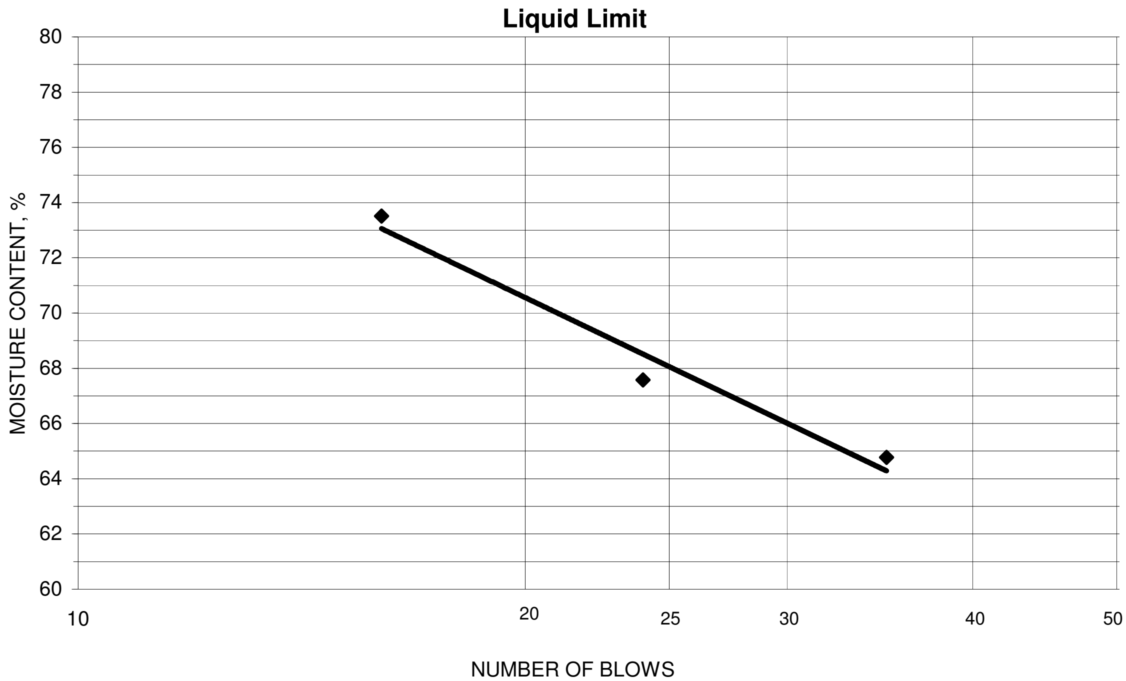
ATTERBERG LIMITS

Project: Cumberland Ash pond
Source: 58, 32.5'-34.0', 35.0'-36.5', 37.5'-39.0'

Project No. 175539016
Lab ID 327
% + No. 40 45
Date Received 08-04-2009

Tested By: KAF
Test Method: ASTM D 4318 Method A
Test Date: 08-14-2009
Prepared: Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
32.17	23.04	10.62	16	73.5	68
33.19	24.29	11.12	24	67.6	
34.32	25.20	11.12	35	64.8	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
28.92	24.19	11.06	36.0	36	32
26.58	22.48	11.04	35.8		

Remarks:

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	58, 42.5'-44.0', 45.0'-46.5', 47.5'-49.0', 50.0'-51.5', 52.5'-54.0', 5	Lab ID	332
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-19-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 27.1

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	98.1
3/4"	19	94.4
3/8"	9.5	82.5
No. 4	4.75	74.3
No. 10	2	68.3
No. 40	0.425	55.9
No. 200	0.075	45.5
	0.02	39.6
	0.005	28.2
	0.002	24.1
estimated	0.001	20.9

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	25.7	31.7
Coarse Sand	6.0	12.4
Medium Sand	12.4	---
Fine Sand	10.4	10.4
Silt	17.3	21.4
Clay	28.2	24.1

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 57

Plastic Limit: 23

Plasticity Index: 34

Activity Index: 1.42

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.67

Classification

Unified Group Symbol: SC

Group Name: Clayey sand with gravel

AASHTO Classification: A-7-6 (11)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Ash pond — Project Number: 175539016
Source: 58, 42.5'-44.0', 45.0'-46.5', 47.5'-49.0', 50.0'-51.5', 52.5'-54.0', 55.0'-56.5', 57.5'-! — Lab ID: 332

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-11-2009
Date Received 08-04-2009

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	98.1
3/4"	94.4
3/8"	82.5
No. 4	74.3
No. 10	68.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.67

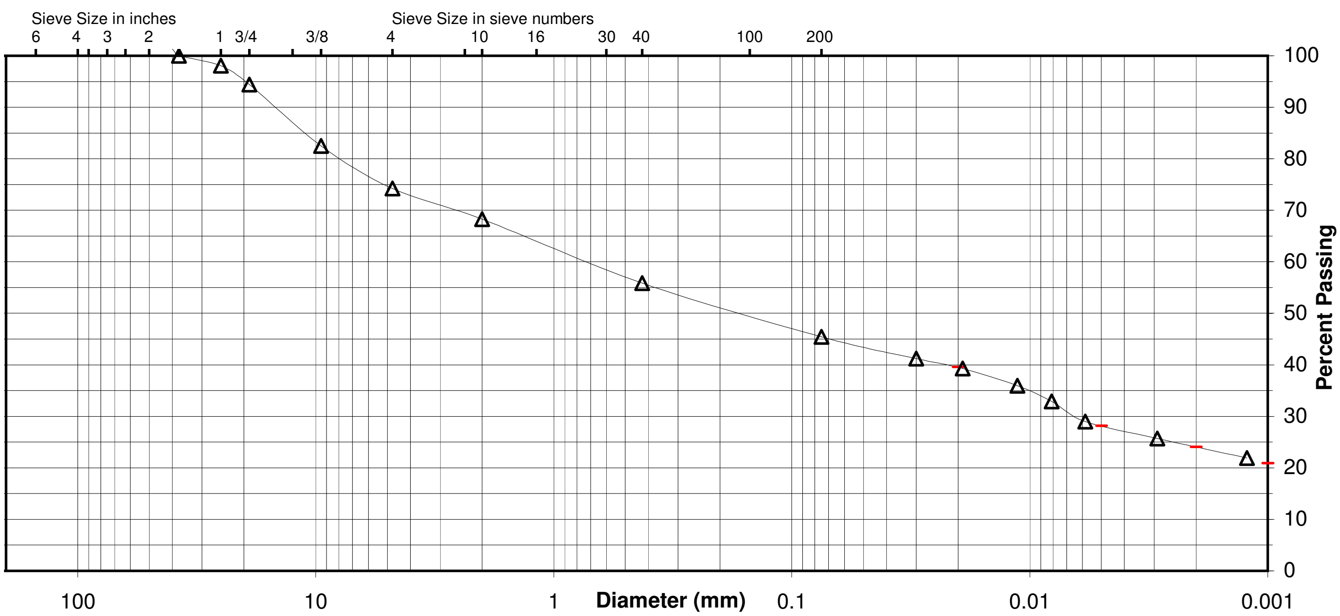
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	55.9
No. 200	45.5
0.02 mm	39.6
0.005 mm	28.2
0.002 mm	24.1
0.001 mm	20.9

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	5.6	20.1	6.0	12.4	10.4	17.3	28.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	31.7	12.4	10.4	21.4	24.1



Comments

Reviewed By

File: frm_175539016_sum_332 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

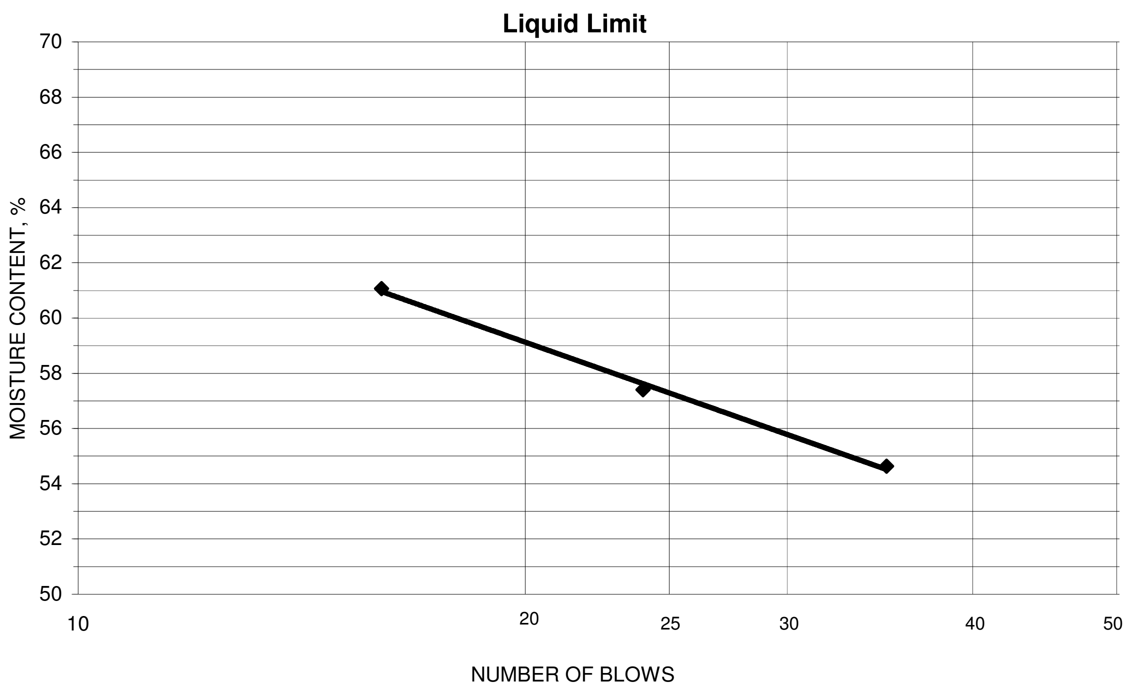
Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	58, 42.5'-44.0', 45.0'-46.5', 47.5'-49.0', 50.0'-51.5', 52.5'-54.0', 55.0'-56.!	Lab ID	332
		% + No. 40	44
Tested By	KAF	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-14-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
34.18	25.27	10.68	16	61.1	57
36.78	27.24	10.62	24	57.4	
39.42	29.40	11.06	35	54.6	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
25.59	22.79	10.51	22.8	23	34
25.66	22.92	11.05	23.1		

Remarks: ____________________

Reviewed By ____________

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	59, 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5	Lab ID	344
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-20-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 43.5

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	93.6
3/4"	19	92.7
3/8"	9.5	86.1
No. 4	4.75	78.0
No. 10	2	69.9
No. 40	0.425	57.4
No. 200	0.075	50.3
	0.02	43.9
	0.005	37.8
	0.002	34.4
estimated	0.001	32.2

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	22.0	30.1
Coarse Sand	8.1	12.5
Medium Sand	12.5	---
Fine Sand	7.1	7.1
Silt	12.5	15.9
Clay	37.8	34.4

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 72

Plastic Limit: 25

Plasticity Index: 47

Activity Index: 1.38

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.67

Classification

Unified Group Symbol: CH

Group Name: Sandy fat clay with gravel

AASHTO Classification: A-7-6 (18)

Comments:

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Cumberland Ash pond	Project Number	175539016
Source	59, 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-15.0', 15.	Lab ID	344

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-11-2009
Date Received 08-04-2009

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	93.6
3/4"	92.7
3/8"	86.1
No. 4	78.0
No. 10	69.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.67

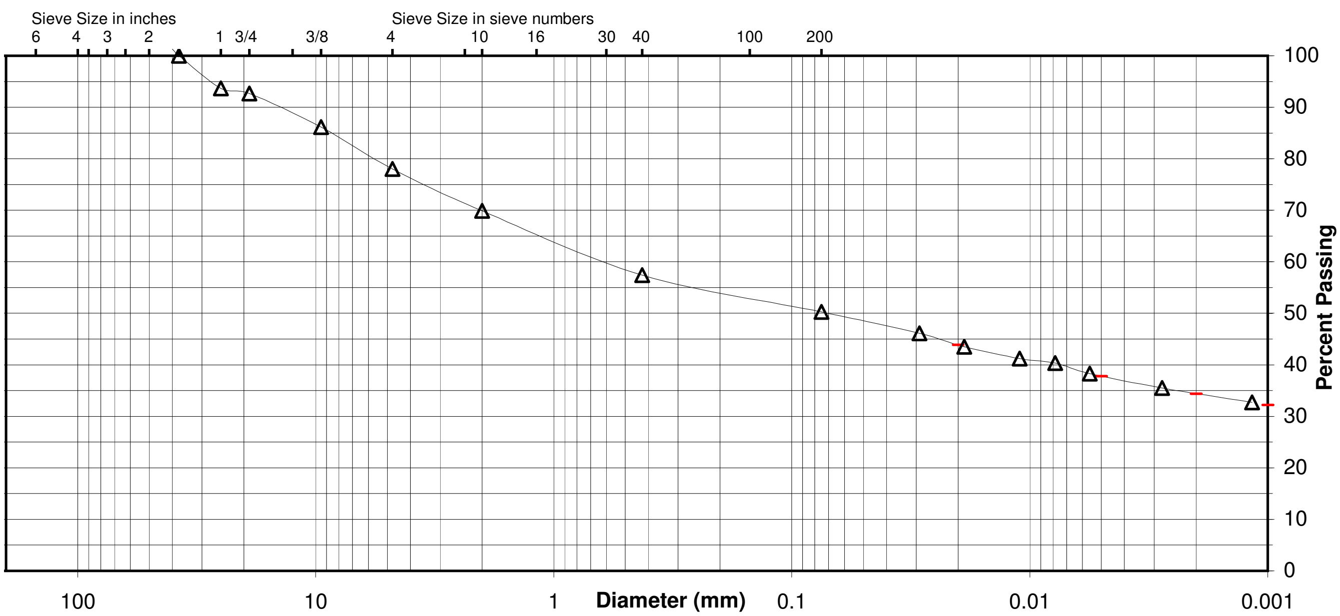
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	57.4
No. 200	50.3
0.02 mm	43.9
0.005 mm	37.8
0.002 mm	34.4
0.001 mm	32.2

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	7.3	14.7	8.1	12.5	7.1	12.5	37.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	30.1	12.5	7.1	15.9	34.4



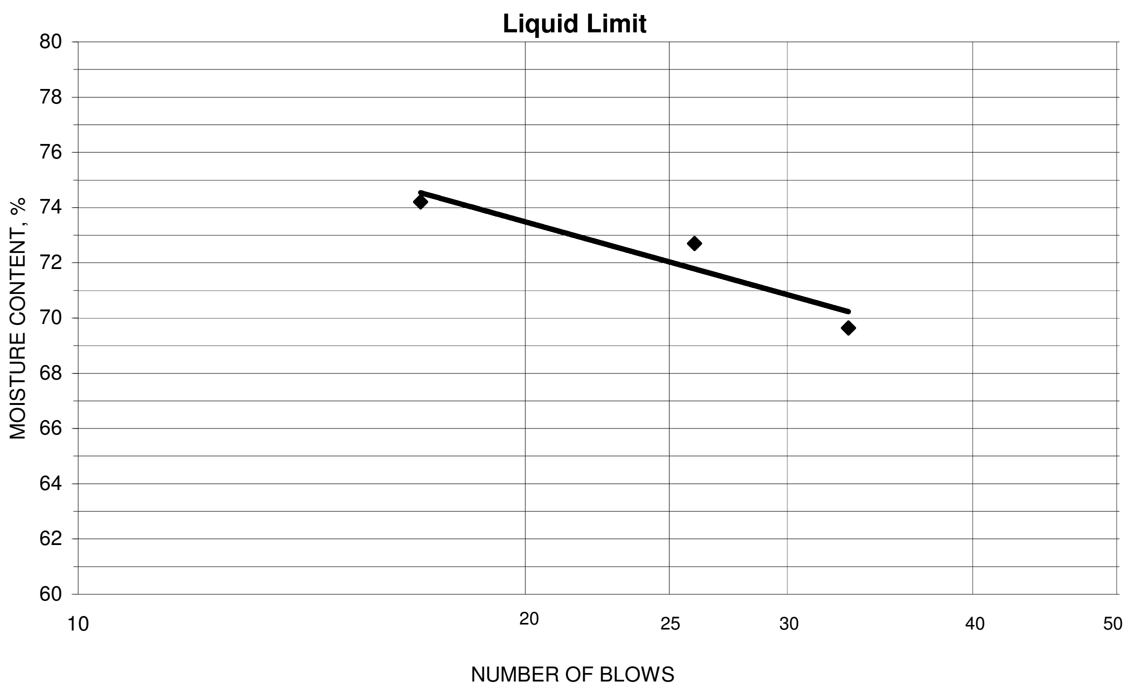
Comments

Reviewed By

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	59, 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-1	Lab ID	344
		% + No. 40	43
Tested By	KAF	Test Method	ASTM D 4318 Method A
Date Received	08-04-2009		
Test Date	08-13-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
35.97	25.21	10.71	17	74.2	
35.11	24.99	11.07	26	72.7	
34.27	24.75	11.08	33	69.6	72



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
26.91	23.60	10.59	25.4	25	47
27.12	23.82	10.88	25.5		

Remarks: __________

Reviewed By __________

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	60, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.	Lab ID	363
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-19-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 22.4

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	97.9
3/8"	9.5	96.4
No. 4	4.75	93.5
No. 10	2	91.1
No. 40	0.425	83.9
No. 200	0.075	66.5
	0.02	51.5
	0.005	40.5
	0.002	35.7
estimated	0.001	32.3

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	6.5	8.9
Coarse Sand	2.4	7.2
Medium Sand	7.2	---
Fine Sand	17.4	17.4
Silt	26.0	30.8
Clay	40.5	35.7

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 52

Plastic Limit: 16

Plasticity Index: 36

Activity Index: 1.00

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CH

Group Name: Sandy fat clay

AASHTO Classification: A-7-6 (22)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 60, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13
Lab ID: 363

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-11-2009
Date Received: 08-04-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	97.9
3/8"	96.4
No. 4	93.5
No. 10	91.1

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

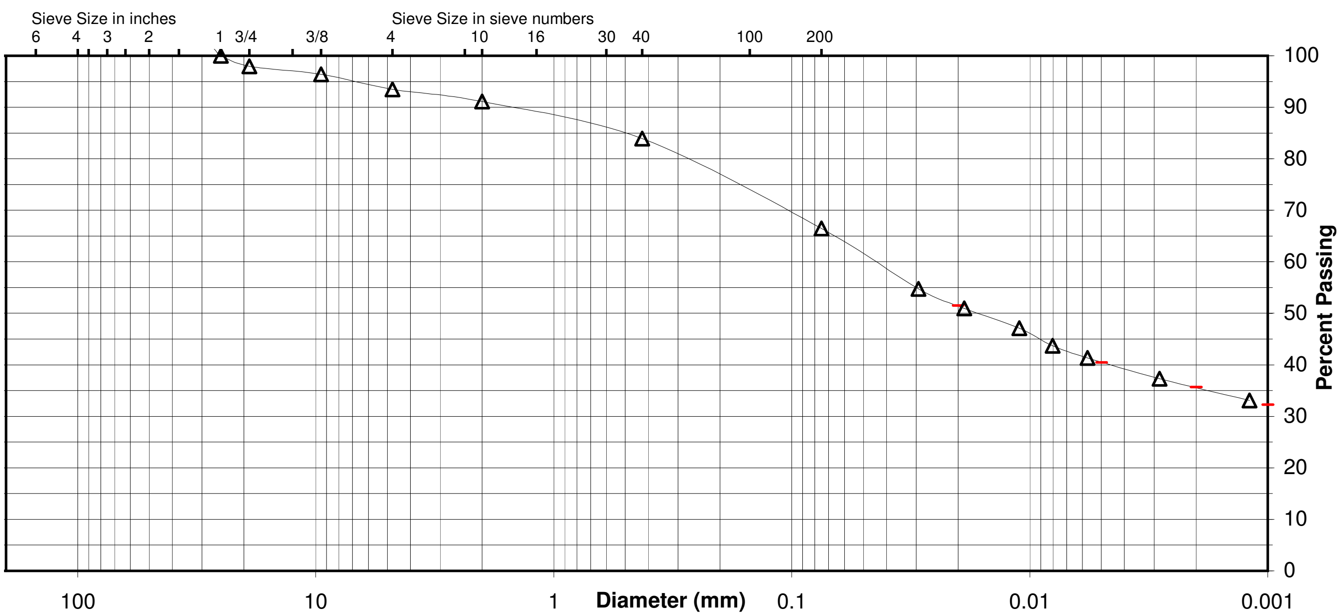
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	83.9
No. 200	66.5
0.02 mm	51.5
0.005 mm	40.5
0.002 mm	35.7
0.001 mm	32.3

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	2.1	4.4	2.4	7.2	17.4	26.0	40.5

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	8.9	7.2	17.4	30.8	35.7



Comments ______

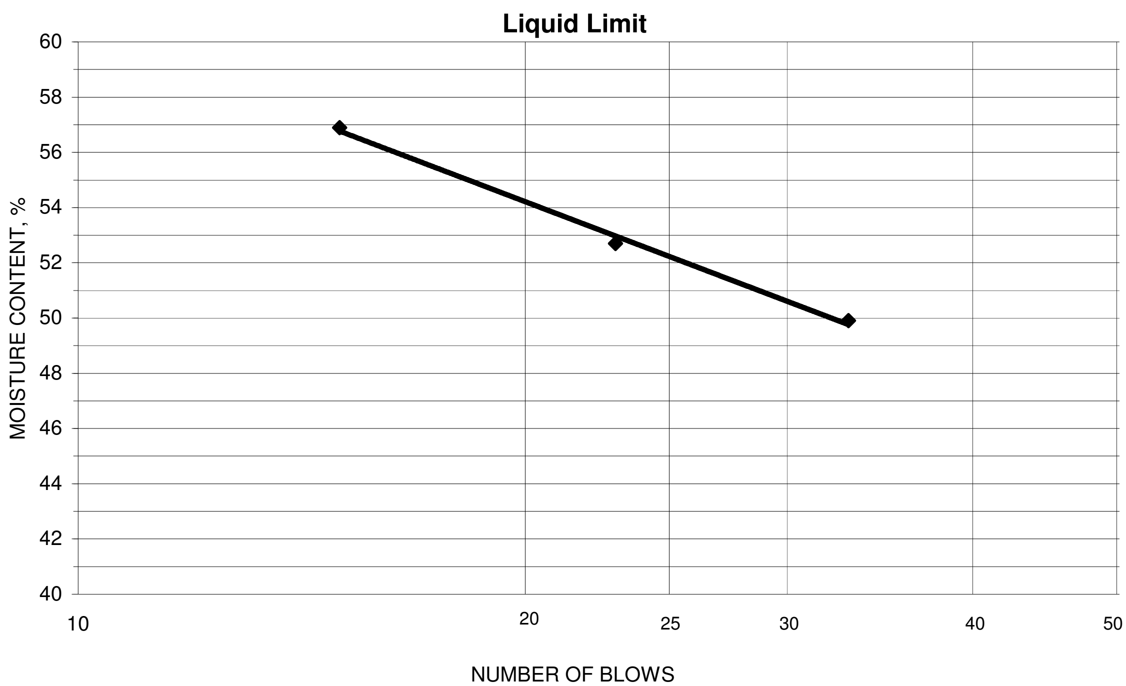
Reviewed By ______

Stantec

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	60, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0',	Lab ID	363
		% + No. 40	16
Tested By	KAF	Test Method	ASTM D 4318 Method A
		Date Received	08-04-2009
Test Date	08-13-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
32.97	24.88	10.66	15	56.9	52
35.74	27.06	10.59	23	52.7	
36.24	27.87	11.10	33	49.9	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
25.05	23.09	11.12	16.4	16	36
25.19	23.19	11.07	16.5		

Remarks: ______________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 60, 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 22.5'-24.0', 24.0'-25.5', 2
Lab ID: 375

County: Stewart
Date Received: 8-4-09
Sample Type: SPT Comp
Date Reported: 8-20-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 36.4

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	99.4
No. 4	4.75	98.9
No. 10	2	98.2
No. 40	0.425	93.5
No. 200	0.075	89.9
	0.02	74.3
	0.005	65.0
	0.002	60.3
estimated	0.001	56.8

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	1.1	1.8
Coarse Sand	0.7	4.7
Medium Sand	4.7	---
Fine Sand	3.6	3.6
Silt	24.9	29.6
Clay	65.0	60.3

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 69
Plastic Limit: 27
Plasticity Index: 42
Activity Index: 0.70

Moisture-Density Relationship

Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.66

Classification

Unified Group Symbol: CH
Group Name: Fat clay

AASHTO Classification: A-7-6 (43)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Cumberland Ash pond
Project Number: 175539016
Source: 60, 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 22.5'-24.0', 24.0'-25.5', 25.5'-27.0', 27.0'-2
Lab ID: 375

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-11-2009
Date Received 08-04-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	99.4
No. 4	98.9
No. 10	98.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.66

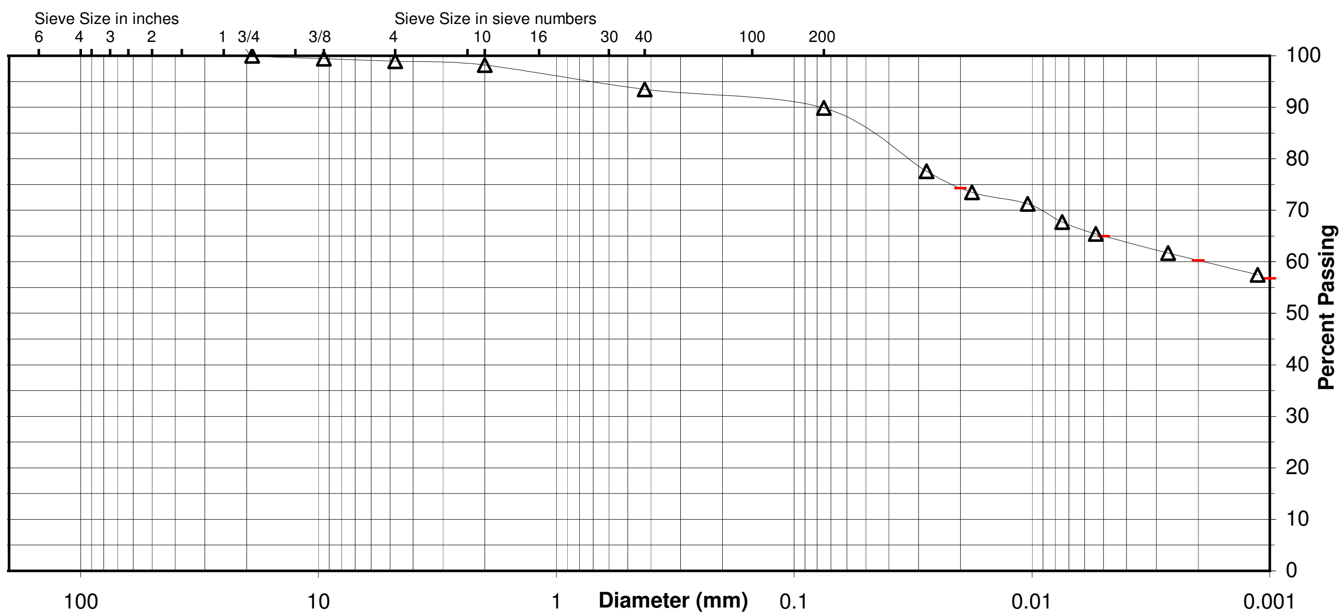
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	93.5
No. 200	89.9
0.02 mm	74.3
0.005 mm	65.0
0.002 mm	60.3
0.001 mm	56.8

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	1.1	0.7	4.7	3.6	24.9	65.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	1.8	4.7	3.6	29.6	60.3



Comments

Reviewed By

File: frm_175539016_sum_375 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

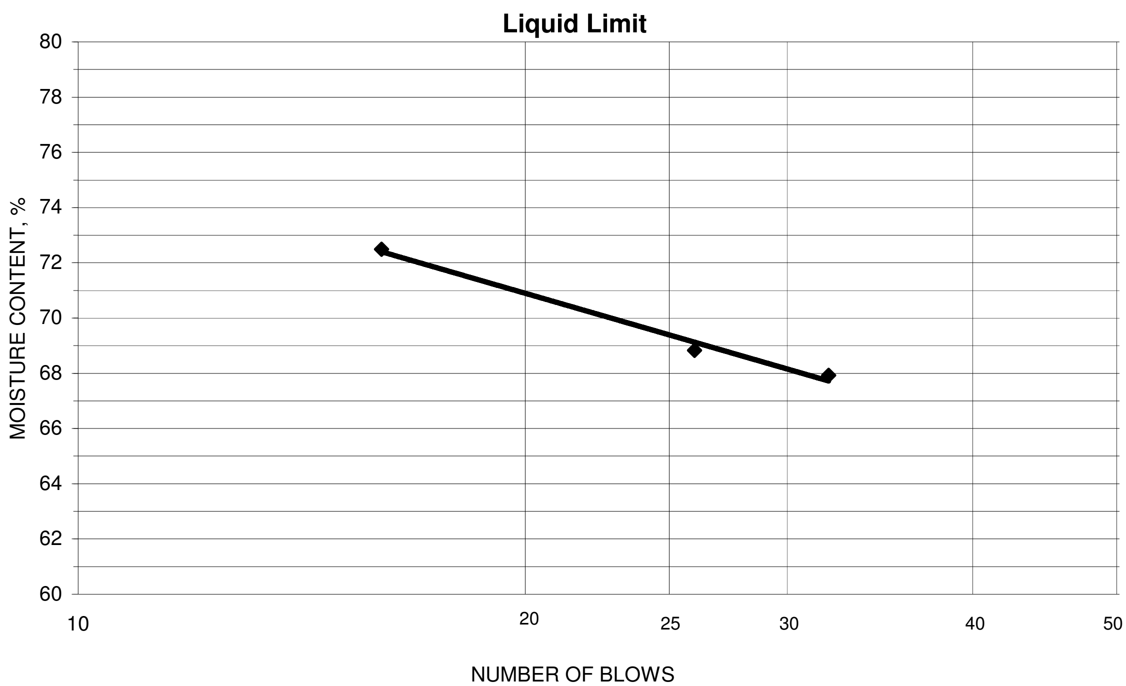
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Cumberland Ash pond	Project No.	175539016
Source	60, 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 22.5'-24.0', 24.0'-25.5', 25.5'-27.(	Lab ID	375
		% + No. 40	7
Tested By	KAF Test Method ASTM D 4318 Method A	Date Received	08-04-2009
Test Date	08-17-2009 Prepared Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
33.90	24.15	10.70	16	72.5	69
35.79	25.72	11.09	26	68.8	
33.68	24.53	11.06	32	67.9	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
23.52	20.81	10.60	26.5	27	42
25.72	22.64	11.01	26.5		

Remarks:

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Cumberland Ash pond	Project Number	175539016
Source	60, 33.0'-34.5', 34.5'-36.0', 36.0'-37.5', 37.5'-39.0', 39.0'-40.5', 4	Lab ID	386
County	Stewart	Date Received	8-4-09
Sample Type	SPT Comp	Date Reported	8-20-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 29.7

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	98.8
No. 4	4.75	98.1
No. 10	2	97.8
No. 40	0.425	93.8
No. 200	0.075	90.7
	0.02	75.9
	0.005	62.0
	0.002	53.9
estimated	0.001	47.5

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	1.9	2.2
Coarse Sand	0.3	4.0
Medium Sand	4.0	---
Fine Sand	3.1	3.1
Silt	28.7	36.8
Clay	62.0	53.9

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 68
Plastic Limit: 23
Plasticity Index: 45
Activity Index: 0.83

Moisture-Density Relationship

Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.68

Classification

Unified Group Symbol: CH
Group Name: Fat clay

AASHTO Classification: A-7-6 (46)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Stantec

Project Name	Cumberland Ash pond	Project Number	175539016
Source	60, 33.0'-34.5', 34.5'-36.0', 36.0'-37.5', 37.5'-39.0', 39.0'-40.5', 40.5'-42.0'	Lab ID	386

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 08-11-2009
Date Received 08-04-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.8
No. 4	98.1
No. 10	97.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.68

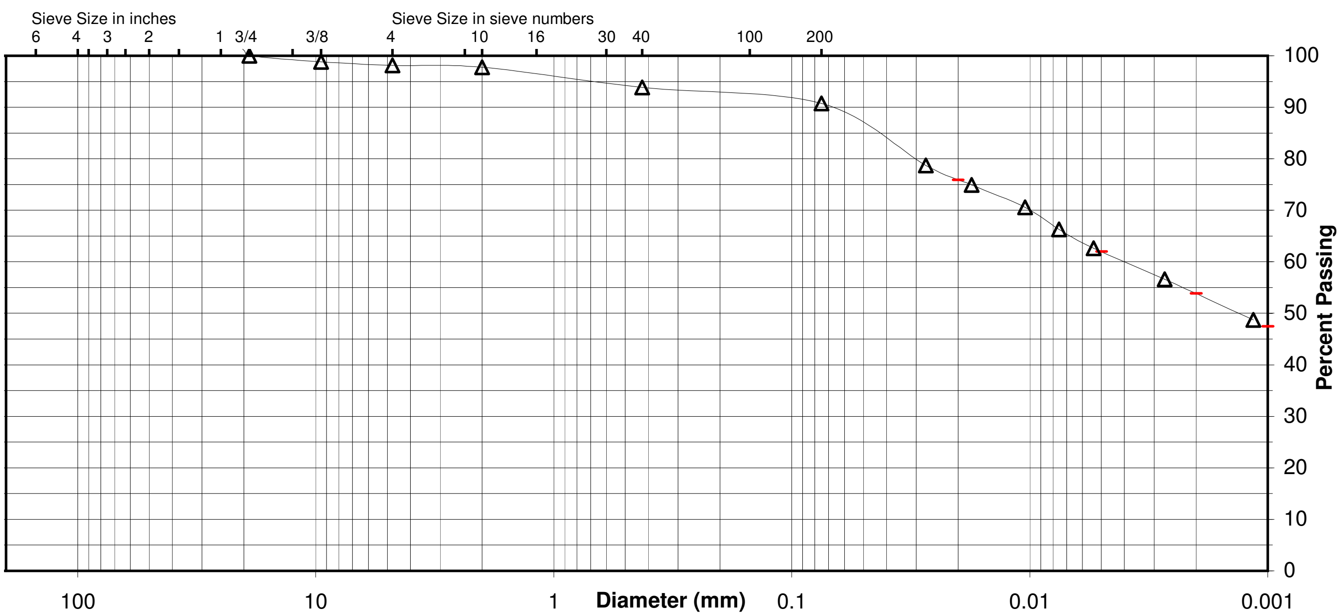
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	93.8
No. 200	90.7
0.02 mm	75.9
0.005 mm	62.0
0.002 mm	53.9
0.001 mm	47.5

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	1.9	0.3	4.0	3.1	28.7	62.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	2.2	4.0	3.1	36.8	53.9



Comments

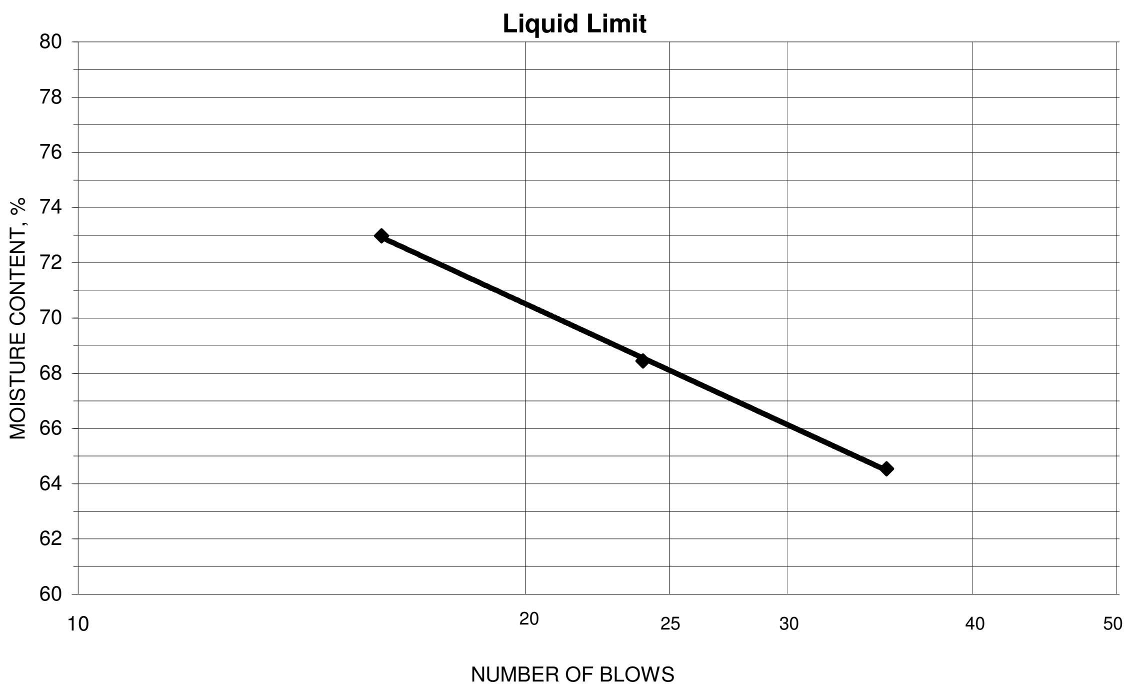
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Cumberland Ash pond			Project No.	175539016
Source	60, 33.0'-34.5', 34.5'-36.0', 36.0'-37.5', 37.5'-39.0', 39.0'-40.5', 40.5'-42.(			Lab ID	386
				% + No. 40	6
Tested By	KAF	Test Method	ASTM D 4318 Method A	Date Received	08-04-2009
Test Date	08-13-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
33.45	24.00	11.05	16	73.0	68
33.43	24.34	11.06	24	68.4	
35.59	25.98	11.09	35	64.5	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
23.06	20.72	10.60	23.1	23	45
23.29	20.97	10.96	23.2		

Remarks: ____________________

Reviewed By ____________

Stantec

Summary of Soil Tests

Project Name	Cumberland Fossil Plant- Gypsum and Ash stacks	Project Number	175539016
Source	Fill Soil	Lab ID	665
County	Stewart	Date Received	9-1-09
Sample Type	Bag	Date Reported	9-9-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 14.2

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	100.0
1 1/2"	37.5	95.5
1"	25	88.6
3/4"	19	85.9
3/8"	9.5	80.0
No. 4	4.75	75.3
No. 10	2	70.6
No. 40	0.425	63.0
No. 200	0.075	53.2
	0.02	39.4
	0.005	27.3
	0.002	23.2
estimated	0.001	21.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	24.7	29.4
Coarse Sand	4.7	7.6
Medium Sand	7.6	---
Fine Sand	9.8	9.8
Silt	25.9	30.0
Clay	27.3	23.2

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 33

Plastic Limit: 18

Plasticity Index: 15

Activity Index: 0.65

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.68

Classification

Unified Group Symbol: CL

Group Name: Gravelly lean clay with sand

AASHTO Classification: A-6 (5)

Comments:

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Cumberland Fossil Plant- Gypsum and Ash stacks	Project Number	175539016
Source	Fill Soil	Lab ID	665

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: BB
Test Date: 09-03-2009
Date Received 09-01-2009

Maximum Particle size: 2" Sieve

Sieve Size	% Passing
3"	
2"	100.0
1 1/2"	95.5
1"	88.6
3/4"	85.9
3/8"	80.0
No. 4	75.3
No. 10	70.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.68

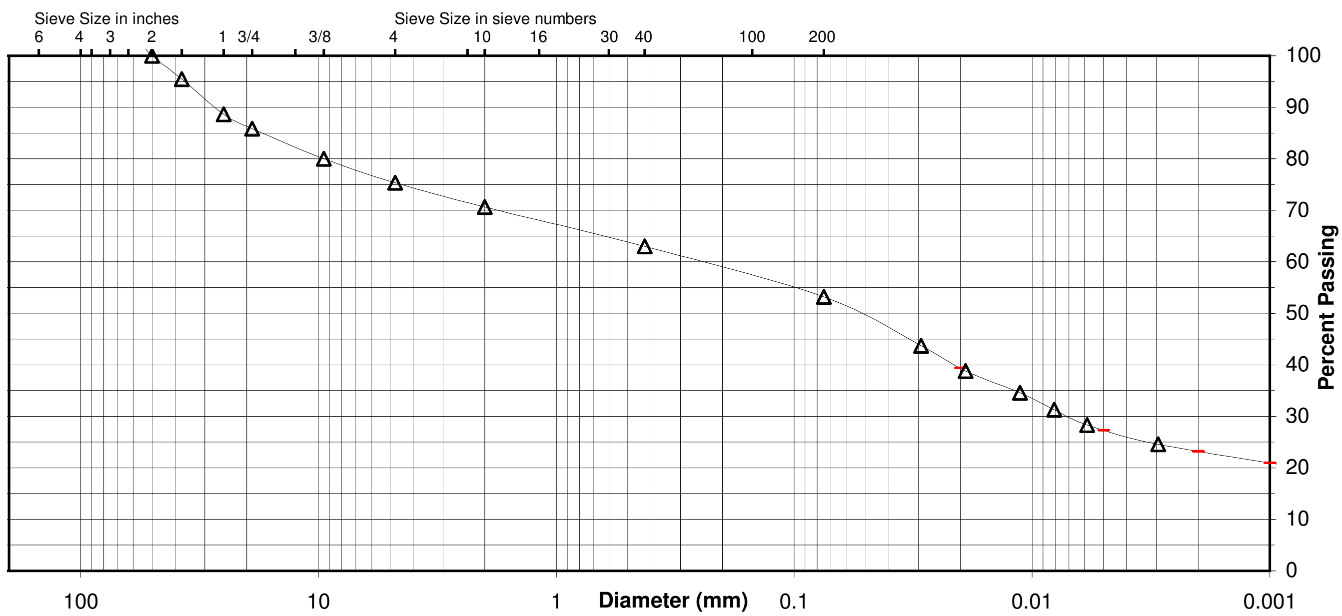
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	63.0
No. 200	53.2
0.02 mm	39.4
0.005 mm	27.3
0.002 mm	23.2
0.001 mm	21.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	14.1	10.6	4.7	7.6	9.8	25.9	27.3

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	29.4	7.6	9.8	30.0	23.2



Comments

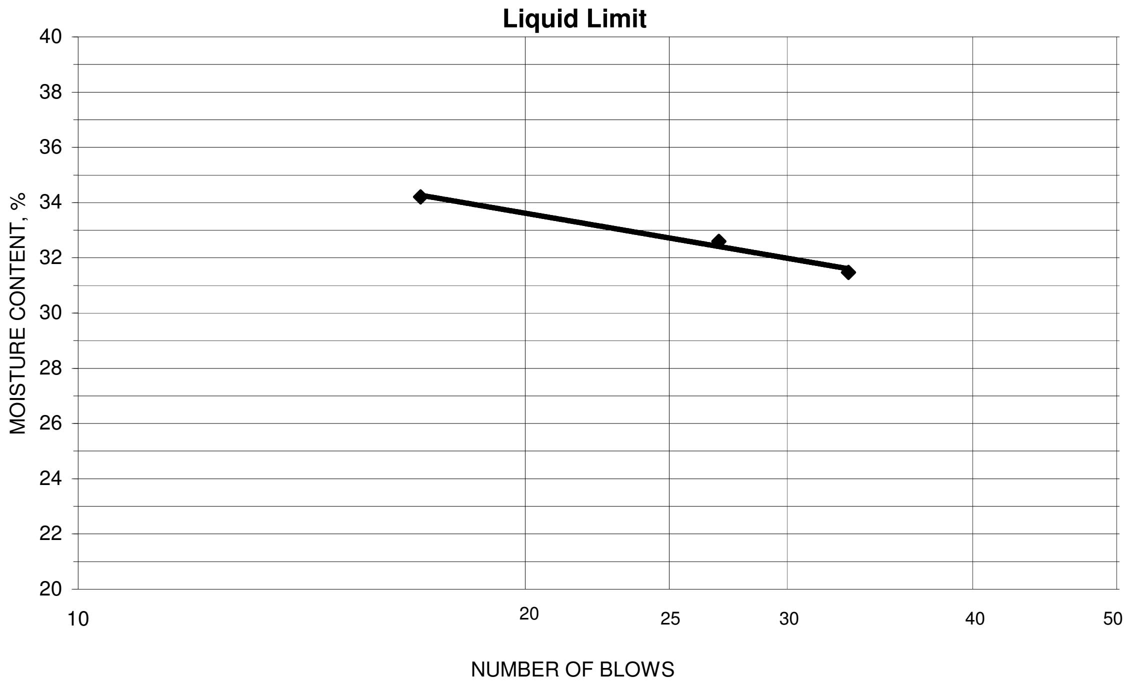
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Cumberland Fossil Plant- Gypsum and Ash stacks	Project No.	175539016
Source	Fill Soil	Lab ID	665
		% + No. 40	37
Tested By	BB Test Method ASTM D 4318 Method A	Date Received	09-01-2009
Test Date	09-03-2009 Prepared Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
30.55	25.67	10.70	27	32.6	33
22.19	19.54	11.12	33	31.5	
20.25	17.91	11.07	17	34.2	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
19.67	18.39	11.00	17.3	18	15
18.39	17.28	11.03	17.8		

Remarks: __________

Reviewed By __________

Appendix G

Material Properties Calculation

OBJECTIVE:

As part of a TVA system-wide review, Stantec is performing a geotechnical exploration of the existing Ash Pond at the Cumberland Fossil Plant. This calculation summarizes the basis of the material properties selected for the geotechnical analyses.

SITE OVERVIEW:

The Cumberland Fossil Plant was constructed between 1968 and 1973. It has two coal-fired generating units and produces roughly 750,000 tons of coal combustion byproducts (CCBs) in the forms of fly ash and bottom ash each year. Sulfur dioxide scrubbers were installed on the units in 1994. The synthetic gypsum byproduct generated by the scrubbers is marketed as a building material. However, any unsold gypsum (of the approximately one million tons produced each year) must be disposed by the plant.

The CCB storage facilities are located in the southern and southwestern areas of the plant and consist of aboveground cellular systems for dry fly ash, sluiced bottom ash, and sluiced/stacked gypsum. The stacks and retention ponds cover approximately 340 acres. The layout of these structures is shown on Figures 1 and 2 in Attachment 1. The structures include the Gypsum Stack Complex, the Dry Fly Ash Stack Area, the Bottom Ash Area, the Retention Pond, and the Stilling Pond. The Retention Pond and the Stilling Pond are jointly considered the Ash Pond Complex.

GIVEN:

- Data from a geotechnical exploration performed by Stantec between July and August 2009 (Stantec 2010). Field data include standard penetration tests (SPTs), visual soil classification, and visual assessment of existing site conditions. Disturbed and undisturbed soil samples were sent for laboratory testing to determine in-situ unit weight, density, and moisture conditions, strength and permeability, and soil classification testing.
- Compiled data from related TVA facilities with similar material property assumptions and from similar Stantec project experience.

ASSUMPTIONS:

Eight soil horizons were identified based on historical construction data, geotechnical boring logs, and laboratory testing. Classifications are based on the Unified Soil Classification System (USCS). Below is a brief description of each horizon based on the field exploration:

- Fly Ash – Classifies as silt (ML) or silt with sand/silty sand. Light gray to black or gray brown, silt to clay-sized grains, dry to wet. Soft to medium stiff. Can be saturated, possibly hydraulically placed. (Stantec, 2009a).

- Dike 1 – The original perimeter dike. A crushed stone roadbed approximately 0.5-feet thick may be present. Approximate top of dike elevation is 380 feet. Stantec (2010) identified this zone in most borings surrounding the Ash Pond and Stilling Ponds just above natural ground.

  - Dike 1 (Lean Clay) – Lean clay or sandy lean clay (CL) with coarse sand or trace fine gravel. The soil varies from gray to brown with red brown, mottled light greenish gray, and olive brown. It is soft to very stiff and damp to moist.

  - Dike 1 (Fat Clay) – Fat clay (CH) with trace to some coarse sand and fine gravel. The soil is red brown to gray with mottling. It is soft to very stiff and damp to moist. This material was identified on the downstream toe on the north side of the Ash Pond and along the eastern border with the plant area.

- Dike 2 – The raised dike upstream of the original perimeter dike. It has a crushed stone surface between 0.2- and 0.9-feet deep. Dike 2 was identified by Stantec (2010) along the outside perimeter of the Ash Pond and the Stilling Pond. It is not found in the divider dikes between the Dry Fly Ash Stack and the Retention Pond. The approximate top of dike elevation is 395 feet.

  - Dike 2 (Lean Clay) – Sandy lean clay, silty clay, clayey gravel with sand, some to no sand and fine gravel (CL). The soil is red brown, olive yellow/brown, dark gray, brown with some mottling. It is soft to very stiff and damp to wet. Some borings noted interbedded cobbles and boulders, and granular lenses. A minor fly ash zone and a minor organic zone were each noted in a boring.

  - Dike 2 (Fat Clay) – Fat clay or sandy fat clay (CH) with little to some coarse sand and chert gravel. The soil is dark red brown and brown. It is medium stiff to very stiff and damp to moist. Some borings noted sand lenses. This material was identified on the inboard toe of the dike on the eastern half of the Ash Pond.

- Alluvial (Clay) – Lean clay (CL) with trace to some sand and gravel. The soil is red brown, dark gray, dark olive, and brown with some mottling. It is very soft to very stiff and damp to wet. Some borings noted cobble zones and weathered rock fragments. Fat alluvial clay (CH) was noted in B-60.

- Alluvial (Granular) – A sand and gravel zone with fines. The material classifies as a clayey gravel with sand (GC), silty sand (SM), gravel with silt and sand (GP-GM), and silty gravel (GM). Colors vary between red brown, olive yellow, brown, and gray with some mottling. It is moist to wet, very loose to dense, and medium to fine grained.

- Bedrock – Limestone (80 percent) with zones of highly weathered shale (20 percent). Limestone is hard, gray, and water stained with close fracture spacing. Shale is highly weathered, fissile, brown, and eroded. Some clay seams were noted.

Boring logs and geotechnical laboratory results are not included in this calculation but are appendices to the main report (Stantec, 2010). Summary tables of the geotechnical laboratory testing for Stantec (2010) are included in Attachment 2. They are organized by boring, depth, and assumed soil horizon. The first table summarizes all permeability and shear strength testing data. The subsequent two tables list all results by laboratory and assumed material type.

ANALYSIS:

Key properties for slope stability analyses, including unit weight and drained shear strength parameters, were estimated for each soil horizon. Additional properties required for the seepage and piping analyses, such as saturated hydraulic conductivity and horizontal to vertical permeability ratio are also included.

Initial estimates were developed from the available Stantec (2010) geotechnical field and laboratory data. Field data include standard penetration tests (SPTs), visual soil classification, and visual assessment of existing site conditions. Laboratory testing was performed on disturbed (SPT and bulk) and undisturbed (Shelby tube) samples. Table 1 lists the geotechnical laboratory testing and associated ASTM methods performed for Stantec (2010).

Table 1. Geotechnical Laboratory Testing

Test Description	ASTM Method
Consolidated-undrained (CU or R) triaxial with porewater measurements	D 4767
Falling-head permeability	D 5084, Method C
Specific gravity	D 854
Particle size analysis with hydrometer	D 421, 422
Atterberg limits	D 4318, Method A
Moisture-density relationships using standard Proctor	D 698, Method A
Natural moisture content	D 2216

The initial material property estimates were then compared to the material properties selected for Stantec's geotechnical exploration at the Gypsum Stack Complex and the Dry Ash Stack (Stantec, 2009b) and adjusted as needed. The estimates were also compared to compiled data from related TVA facilities with similar materials, to data from similar Stantec projects, and published typical values based on soil types.

The Stantec (2010) consolidated-undrained triaxial test results were based on the maximum principal effective stress ratio (maximum value of σ'_1/σ'_3) or the point of maximum obliquity. This stress condition is where the slope of the failure envelope through the origin of stress has its maximum slope (maximum ϕ for c=0). In routine practice, this failure criterion is used in undrained laboratory tests.

Note that a small amount of effective cohesion was used for the clay dikes and the alluvial clay. Any cementation in the CCBs was neglected. Laboratory tests on a few discreet samples (Stantec 2009b) from the stack will not yield a complete understanding of the cementation in the stacks.

Additional field data from Stantec (2010) was incorporated by creating histograms of the uncorrected SPT blow counts by material type. The histograms are included as Attachment 3. Table 2 is an overview of the Stantec (2010) uncorrected SPT blow count (N) values.

Table 2. Uncorrected SPT N Value by Soil Type*

N (Blow Counts)	Min	Max	Average	Mode	No. of Samples
Fly Ash	0	72	11	0	308**
Alluvial Clay	0	74	13	2	126
Alluvial Granular	0	52	19	21	83
Dike 1 (Lean)	2	46	15	8	87
Dike 1 (Fat)	3	51	16	16	44
Dike 2 (Lean)	3	55	15	10	90
Dike 2 (Fat)	5	42	14	15	65

* Stantec (2010)

** From field investigation for Stantec (2009b). No new sluiced fly ash data was included for this study.

Particle size analyses and Atterberg limits were averaged to estimate D_{10}, D_{60}, and liquid limit for the seepage model. Undisturbed test sample results were averaged to supply specific gravity (G_s) and void ratio (e) values for the piping factor of safety calculations.

The saturated volumetric water content (θ_{sat}) was calculated using the laboratory-calculated void ratio (e) where θ_{sat} = e/1+e. Residual volumetric water content (θ_r) was assumed from typical values based on material type (Rawls et al, 1982). The degree of volume compressibility, m_v, was estimated using typical values by soil type based on Bell (2000). The referenced pages for typical values are included in this calculation as Attachment 4.

Please note that the software used for the seepage model works in terms of feet per second for hydraulic conductivity and an anisotropy ratio of $k_{vertical}/k_{horizontal}$.

<u>Soil Horizons</u>:

1. Fly Ash (Sluiced)

During the Stantec (2010) field investigation, fly ash was generally not encountered in the dike borings.

Some accumulation of sluiced fly ash is assumed to be in the Ash Pond for the geotechnical slope stability and seepage models. Data from Stantec (2009b) was used to determine soil values for the analyses. No additional testing was performed during Stantec (2010) on sluiced fly ash material.

Moist unit weights for the sluiced fly ash were estimated using the Stantec (2009b) undisturbed samples. Typical blow counts for the sluiced fly ash were 0 to 3 (0 to 4 corrected for automatic hammer or N_{60}). Approximately 1/5 of the samples thought to be sluiced fly ash had blow counts of 0. Roughly ¾ of the samples had blow counts of 13 or less (N_{60} = 17). A discussion of the historical and recent shear strength testing is discussed in Stantec (2009a). Tables 3, 4, and 5 include the values used on the current analyses. The lab summary table details the hydraulic conductivity and geotechnical testing results in Attachment 5 (Stantec 2009a).

Table 3. Fly Ash (Sluiced) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009b)	B-43A (29.0-31.0), B-35A (46.0-48.0)	103.3	0	39.6
	SPT N_{60} values – empirical (sluiced fly ash)			<28
	SPT N_{60} values – empirical (sluiced fly ash/bottom ash)			<28-30.1
	CPT N_{60} minimum, maximum, and average (2, 17, and 9) (fly ash)			13, 30, 22
Stantec (2010)	**Selected Parameters for Stability Analyses**	100	0	22

Table 4. Seepage Model and Piping Material Properties

Material Type	D_{10} (mm)	D_{60} (mm)	Liquid Limit	M_v	Residual Water Content	Saturated Water Content	Specific Gravity, G_s	Void Ratio, e
Fly Ash - Sluiced	0.004	0.049	0	6.2218E-05	0.015	0.3548	2.50	0.550

Table 5. Model Soil Hydraulic Conductivity

Material Type	K_{sat} (cm/sec)	K_{sat} (ft/sec)*	Anisotropy	K_h (ft/sec)
Fly Ash - Sluiced	8.41E-05	2.76E-06	0.02	1.38E-04

(*K_v assumed from testing – average of CPT and laboratory testing (Stantec (2009b))

2. Dike 1 (Lean Clay)
Dike 1 (Fat Clay)

Stantec (2010) breaks Dike 1 into two zones: lean and fat clay. However, testing was not sufficient to separately define the two soil types. As needed, generalized Dike 1 properties were estimated.

Moist unit weights for Dike 1 was estimated using the Stantec (2010) undisturbed samples. The moist unit weight of Dike 1 ranged from 117.9 to 125.7 pcf with an average over five measurements of 121.2 pcf. Typical blow counts for Dike 1 (Lean Clay) were 2 to 46 with an average of 15. For Dike 1 (Fat Clay), typical blow counts ranged from 3 to 51 with an average of 16.

Shear strength testing for Dike 1 (Lean Clay) was used for Dike 1 (Fat Clay). The typical blow counts for the substrata suggest similar shear strengths. The wet unit weight was adjusted to reflect the plasticity difference. Tables 6 and 7 summarize the Dike 1 shear strength properties used for the stability models.

Table 6. Dike 1 (Lean Clay) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2010)	STN-54A, 30.6'-31.2'	117.8	220.3	22.3
	STN-54A, 31.2'-31.8'	124.3		
Stantec (2010)	**Selected Parameters for Stability Analyses**	123	200	22

Table 7. Dike 1 (Fat Clay) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2010)	**Selected Parameters for Stability Analyses**	119	200	22

Attachment 2 includes the Stantec (2010) laboratory testing summary tables. Particle size analyses, Atterberg limits, determined specific gravities, and void ratios from undisturbed soil samples are listed supporting Tables 8 and 9 discussing the model parameters for the seepage analyses and the piping factor of safety calculation.

Hydraulic conductivity test results for Dike 1 are also listed in Table 9. The anisotropy parameter is assumed for constructed clay dikes based on experience from similar Stantec project sites. Adjustments may have been made to the model assumptions to reflect measured piezometer levels in the field. The assumed value for hydraulic conductivity of Dike 1 (Lean Clay) is more conservative than the laboratory testing results.

Table 8. Seepage Model and Piping Material Properties

Material Type	D_{10} (mm)	D_{60} (mm)	Liquid Limit	M_v	Residual Water Content	Saturated Water Content	Specific Gravity, G_s	Void Ratio, e
Clay Dike 1 - Lean Clay	0.001	0.1	38	3.0000E-06	0.06	0.413	2.67	0.704
Clay Dike 1 - Fat Clay	0.001	0.05	69	1.4358E-05	0.09	0.415	2.67	0.709

Table 9. Model Soil Hydraulic Conductivity

Boring	Depth (ft)	Material Type	K_{sat} (cm/sec)	K_{sat} (ft/sec)*	Anisotropy	K_h (ft/sec)
STN-48A	26.0-26.5	Dike 1 – Lean Clay	6.3e-8			
STN-58	10-20	Dike 2 (Fat), Dike 1 (Lean)	2.7e-8			
Selected Parameters		Clay Dike 1 - Lean Clay	6.50E-07	2.13E-08	0.1	2.13E-07
		Clay Dike 1 - Fat Clay	2.70E-08	8.86E-10	0.1	8.86E-09

(*K_v assumed from testing)

3. Dike 2 (Lean Clay)
4. Dike 2 (Fat Clay)

Stantec (2010) breaks Dike 2 into two zones: lean and fat clay. Atterberg limits from undisturbed samples show liquid limits between 46 and 68 with an average of 55. Average blow counts for Dike 2 were 15 and 14 for lean and fat clay, respectively.

Moist unit weights were estimated using the Stantec (2010) undisturbed samples. The moist unit weight of Dike 2 (lean clay) ranged from 114.9 to 132.0 pcf with an average over four measurements of 123.8

pcf. Dike 2 (fat clay) ranged from 115.2 to 127.4 pcf with an average over three measurements of 122.1 pcf. Unit weights for the lean and fat clay Dike 1 soils were also considered when selecting the model assumptions.

The field and laboratory data would suggest the two clay substrata should have similar strength properties due to the narrow range of testing results. Tables 10 and 11 summarize the shear strength testing results and model parameters for Dike 2.

Table 10. Dike 2 (Lean Clay) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2010)	STN-54A, 30.6'-31.2'	132.3	220.3	32.1
	STN-54A, 31.2'-31.8'	130.6		
Stantec (2010)	STN-48A, Bulk	121.2	220.3	29.5
		120.9		
		121.0		
Stantec (2010)	STN-52A, Bulk	119.7	97.2	29.8
		119.1		
		119.3		
Stantec (2010)	**Selected Parameters for Stability Analyses**	123	200	32

Table 11. Dike 2 (Fat Clay) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2010)	STN-58, Bulk	120.3	254.9	29.4
		121.9		
		122.0		
Stantec (2010)	**Selected Parameters for Stability Analyses**	119	200	29

Please refer to Attachment 2 for the Stantec (2010) laboratory testing summary tables supporting Table 12 geotechnical testing results. Hydraulic conductivity test results for Dike 2 are also listed in Table 13. The anisotropy parameter is assumed for constructed clay dikes based on experience from similar Stantec project sites.

Table 12. Seepage Model and Piping Material Properties

Material Type	D_{10} (mm)	D_{60} (mm)	Liquid Limit	M_v	Residual Water Content	Saturated Water Content	Specific Gravity, G_s	Void Ratio, e
Clay Dike 2 - Lean Clay	0.001	0.075	48	3.0000E-06	0.08	0.351	2.71	0.540
Clay Dike 2 - Fat Clay	0.001	0.043	54	1.4358E-05	0.09	0.351	2.71	0.540

Table 13. Model Soil Hydraulic Conductivity

Material Type	Boring	Depth (ft)	K_{sat} (cm/sec)	K_{sat} (ft/sec)*	Anisotropy	K_h (ft/sec)
Clay Dike 2 - Lean Clay	STN-48A	5-15 (Bulk)	2.8e-8			
	STN-52A	5-10 (Bulk)	3.5e-8			
	STN-54A	30.0-30.6	6.5e-8			
Clay Dike 2 - Lean Clay	**Selected Parameters**		4.27E-08	1.40E-09	0.1	1.40E-08
Clay Dike 2 - Fat Clay	STN-58	10-20 (Bulk)	2.7e-8			
Clay Dike 2 - Fat Clay	**Selected Parameters**		2.70E-08	8.86E-10	0.1	8.86E-09

(*K_v assumed from testing)

5. Alluvial (Clay)
6. Alluvial (Granular)

Field investigations for Stantec (2010 and 2009b) suggested two primary layers: alluvial (clay) and alluvial (granular). The alluvial material showed increased sand and gravel percentages in zones classifying as silty gravel with sand or poorly graded clayey gravel. This would also be logical based on the nearby meandering creek channel.

Moist unit weights for alluvial (clay) were estimated using the Stantec (2010) undisturbed samples. The moist unit weights ranged from 100.7 to 127.2 pcf with an average over 10 measurements of 118.3 pcf. Average blow counts for alluvial (clay) and alluvial (granular) were 13 and 19, respectively. Undisturbed samples of the alluvial (granular) layer were not available. The soil properties used were based on

Stantec (2009b) and empirical values. Tables 14 and 15 summarize the shear strength testing results and model parameters for the alluvial soils.

Table 14. Alluvial (Clay) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2010)	STN-54A, 45.2-46.4	124.9	220.3	33.3
	STN-54A, 45.2-46.4	125.8		
Stantec (2010)	**Selected Parameters for Stability Analyses**	124	200	33

Table 15. Alluvial (Granular) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2010)	**Selected Parameters for Stability Analyses**	130	0	32

Please refer to Attachment 2 for the Stantec (2010) laboratory testing summary tables supporting Table 16 geotechnical testing results. Hydraulic conductivity test results for alluvial soils are also listed in Table 17. The anisotropy parameter is assumed for alluvial soils based on experience from similar Stantec project sites.

Table 16. Seepage Model and Piping Material Properties

Material Type	D_{10} (mm)	D_{60} (mm)	Liquid Limit	M_v	Residual Water Content	Saturated Water Content	Specific Gravity, G_s	Void Ratio, e
Alluvial – Clay	0.001	0.1	47	4.7860E-05	0.07	0.401	2.67	0.667
Alluvial – Granular	0.001	6	0	2.3925E-06	0.02	0.27	2.68	0.370

Table 17. Model Soil Hydraulic Conductivity

Material Type	Boring	Depth (ft)	K_{sat} (cm/sec)	K_{sat} (ft/sec)*	Anisotropy	K_h (ft/sec)
Alluvial – Clay	STN-53A	43.8-43.2	7.4e-8			
Alluvial – Clay	**Selected Parameters**		7.41E-08	2.43E-09	0.05	4.86E-08
Alluvial – Granular	**Selected Parameters**		1.00E-04	3.28E-06	0.05	6.56E-05

(*K_v assumed from testing)

7. Bedrock

This shale and limestone layer will be modeled as largely impenetrable layer in the slope stability and seepage models. The weaker, shallower materials will control the slope stability. Low hydraulic conductivity of the rock layer is conservative, forcing more seepage through the alluvial and dike soils. The seepage model results were compared to field piezometric readings along the dike to try to reflect what was happening in the field.

Table 18. Seepage Model and Piping Material Properties

Material Type	D_{10} (mm)	D_{60} (mm)	Liquid Limit	M_v	Residual Water Content	Saturated Water Content	Specific Gravity, G_s	Void Ratio, e
Bedrock	--	--	--	0.0000E+00	0	0.05	--	--

Table 19. Model Soil Hydraulic Conductivity

Material Type	K_{sat} (cm/sec)	K_{sat} (ft/sec)*	Anisotropy	K_h (ft/sec)
Bedrock	3.05E-11	1.00E-12	0.1	1.00E-11

(*K_v assumed from testing)

CONCLUSIONS:

Table 20 summarizes the recommended soil material properties for the slope stability analyses. Tables 21 and 22 summarize the recommended soil material properties for the seepage model and piping analyses. Care should still be taken when applying these properties to specific model cross sections. Field investigation data varying greatly from these recommended properties should be discussed with the project team prior to performing the analyses.

Table 20. Slope Stability Model Material Properties

Material Type	Unit Weight, γ (pcf)	Effective Stress	
		Cohesion, c' (psf)	Friction Angle, ϕ' (deg)
Clay Dike 1 - Lean Clay**	123	200	22
Clay Dike 1 - Fat Clay	119	200	22
Clay Dike 2 - Lean Clay***	123	200	32
Clay Dike 2 - Fat Clay	119	220	29
Fly Ash - Sluiced	100	0	22
Alluvial – Clay*	124	200	33
Alluvial – Granular	130	0	32
Bedrock	Impenetrable		

* Covers Alluvial (Clay) or Alluvial (Fat)
** Covers Dike 1 (Clay), Dike 1 (Lean), or Dike 1 (Lean) - Gravel
*** Covers Dike 2 (Lean) or Dike 2 (Lean) - Gravel

Table 21. Seepage Model and Piping Material Properties

Material Type	D_{10} (mm)	D_{60} (mm)	Liquid Limit	M_v	Residual Water Content	Saturated Water Content	Specific Gravity, G_s	Void Ratio, e
Clay Dike 1 - Lean Clay	0.001	0.1	38	3.0000E-06	0.06	0.413	2.67	0.704
Clay Dike 1 - Fat Clay	0.001	0.05	69	1.4358E-05	0.09	0.415	2.67	0.709
Clay Dike 2 - Lean Clay	0.001	0.075	48	3.0000E-06	0.08	0.351	2.71	0.540
Clay Dike 2 - Fat Clay	0.001	0.043	54	1.4358E-05	0.09	0.351	2.71	0.540
Fly Ash - Sluiced	0.004	0.049	0	6.2218E-05	0.015	0.3548	2.50	0.550
Alluvial – Clay	0.001	0.1	47	4.7860E-05	0.07	0.401	2.67	0.667
Alluvial – Granular	0.001	6	0	2.3925E-06	0.02	0.27	2.68	0.370
Bedrock	--	--	--	0.0000E+00	0	0.05	--	--

Table 22. Model Soil Hydraulic Conductivity

Material Type	K_{sat} (cm/sec)	K_{sat} (ft/sec)*	Anisotropy	K_h (ft/sec)
Clay Dike 1 - Lean Clay	6.50E-07	2.13E-08	0.1	2.13E-07
Clay Dike 1 - Fat Clay	2.70E-08	8.86E-10	0.1	8.86E-09
Clay Dike 2 - Lean Clay	4.27E-08	1.40E-09	0.1	1.40E-08
Clay Dike 2 - Fat Clay	2.70E-08	8.86E-10	0.1	8.86E-09
Fly Ash - Sluiced	8.41E-05	2.76E-06	0.02	1.38E-04
Alluvial – Clay	7.41E-08	2.43E-09	0.05	4.86E-08
Alluvial – Granular	1.00E-04	3.28E-06	0.05	6.56E-05
Bedrock	3.05E-11	1.00E-12	0.1	1.00E-11

(*K_v assumed from testing)

REFERENCES:

Bell, F. G. (2000). *Engineering Properties of Soils and Rocks.* 4th ed. Wiley-Blackwell. pp. 22.

Peck, R. B., Hanson, W. E., and Thornburn, T. H. (1974). *Foundation Engineering*. 2nd ed., John Wiley and Sons, New York.

Rawls, W. J., D. L. Brakensiek, K. E. Saxton (1982). "Estimation of Soil Water Properties." Transactions of the ASAE (Vol. 25, No. 5, pp. 1316-1320 & 1328). Published by the American Society of Agricultural Engineers, St. Joseph, Michigan.

Stantec Consulting Services Inc. (2010). *Report of Geotechnical Exploration and Slope Stability Evaluation. Ash Pond. Cumberland Fossil Plant. Stewart County, Tennessee.* Prepared for Tennessee Valley Authority. Chattanooga, Tennessee. February.

Stantec Consulting Services Inc. (2009a). "Cumberland Fossil Plant, Gypsum Stack Complex and Dry Ash Stack, Soil Properties for Analyses." October 13th. Calculation. Appendix to Stantec (2009b).

Stantec Consulting Services Inc. (2009b). *Report of Geotechnical Exploration. Dry Ash and Gypsum Stacking Facility. Cumberland Fossil Plant. Stewart County, Tennessee.* Prepared for Tennessee Valley Authority. Chattanooga, Tennessee. December.

Stantec Consulting Services Inc. (2009c). "Selection of Shear Strength Parameters for Geotechnical Stability Analyses. TVA Coal Combustion Products Storage Facilities." Version 1.0. Work in Progress, For Discussion Purposes Only. June 15.

Attachment 1
Figures

STANTEC CONSULTING SERVICES INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Proposed Boring Plan - Ash Pond

Tennessee Valley Authority
Cumberland Fossil Plant
Cumberland, Stewart County, Tennessee

PROJECT NO.	175539016
DATE	JULY 2009
DRAWN BY	ANP
CHECKED BY	SH
CHECKED BY	
SCALE	AS SHOWN
REVISED	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

SHEET

1 OF 1

V:\1755\active\175539016\gis\mxd\proposed_boring_plan_ash_pond_CUF_revised.mxd

STANTEC
CONSULTING
SERVICES INC.

1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Proposed Boring Plan
Dry Ash Stack & Gypsum Disposal Area

Tennessee Valley Authority
Cumberland Fossil Plant
Cumberland, Stewart County, Tennessee

PROJECT NO.	171468118
DATE	March 27, 2009
DRAWN BY	DLF
CHECKED BY	
CHECKED BY	
SCALE	1:6000
REVISED	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

ENCLOSURE

Attachment 2
Geotechnical Laboratory
Summary Tables

Cumberland Fossil Plant
Ash Pond Laboratory Results Summary
Project No. 175539016

				Particle Size					Atterberg Limits				Standard Proctor			Classification										CU Triaxial							
Hole	Depth	Sample Type	Material	Gravel	Sand	Silt	Clay	Gs	LL	PL	PI	AI	w_{opt} (%)	γ_{dmax} (pcf)	MC	USCS	Group Name	AASHTO	FHP, 2.8" (cm/s)	FHP, 2.8" (ft/s)	w_0 (%)	γ_t (pcf)	γ_d (pcf)	% Compaction		S_{r0} (%)	e_0	γ_{w0} (pcf)	w_0 (%)	γ_{d0} (pcf)	c' (psi)	c' (psf)	ϕ' (deg)
47	16.5-32.5	comp	Alluvial (Clay)	1.3	9.1	44.2	45.4	2.67	45	18	27	0.73			25.2	CL	Lean clay	A-7-6 (25)															
51	31-50	comp	Alluvial (Clay)	0.2	8.3	64.8	26.7	2.62	30	20	10	0.48			27.4	CL	Lean Clay	A-4 (9)															
52	22.5-42.5	comp	Alluvial (Clay)	13.2	19.7	26	41.1	2.71	48	16	32	0.91			22.8	CL	Sandy Lean Clay	A-7-6 (19)															
53A	43.8-44.2	ST	Alluvial (Clay)																7.40E-08	2.43E-09	27.2	120.6	94.9		Gray-brown sandy lean clay								
54A	45.2-46.4	ST	Alluvial (Clay)																							98.1	0.686	124.9	24.9	99.97	0.349	220.3	33.3
54A	45.2-46.4	ST	Alluvial (Clay)																							96.3	0.651	125.8	23.2	102.1			
60	33-42	comp	Alluvial (Fat Clay)	1.9	7.4	28.7	62	2.68	68	23	45	0.83			29.7	CH	Fat Clay	A-7-6 (46)															
51	53.5-62.5	comp	Alluvial (Granular)	33	48.7	11	7.3	2.66	NP	NP	NP	NP			21.7	SM	Silty Sand with Gravel	A-1-b (0)															
52	68.5-80	comp	Alluvial (Granular)	58.8	29.3	6.8	5.1	2.66	NP	NP	NP	NP			21.5	GP-GM	Poorly graded gravel with silt and sand	A-1-a (0)															
55	24-48.5	comp	Alluvial (Granular)	46.3	18.4	15.9	19.4	2.65	45	25	20	1.25			30.1	GC	Clayey gravel with sand	A-2-7 (2)															
56	34.5-39	comp	Alluvial (Granular)	30.8	20	26.5	22.7	2.73	41	28	13	0.76			35.7	GM	Silty gravel with sand	A-7-6 (4)															
58	32.5-39	comp	Alluvial (Granular)	17.8	40.1	15.1	27	2.68	68	36	32	1.33			37.4	SM	Silty Sand with Gravel	A-7-5 (8)															
58	42.5-58.1	comp	Alluvial (Granular)	25.7	28.8	17.3	28.2	2.67	57	23	34	1.42			27.1	SC	Clayey Sand with Gravel	A-7-6 (11)															
58	60 - 60.2	SPT	Alluvial (Granular)												6.7																		
47	0-13.5	comp	Dike 1 (Clay)	2.3	9.1	43.9	44.7	2.70	40	21	19	0.49			21.4	CL	Lean clay	A-6 (17)															
51	1.5-18	comp	Dike 1 (Clay)	1	18.2	45.7	35.1	2.67	35	18	17	0.59			18.8	CL	Lean Clay with Sand	A-6 (13)															
55	0-7.5	comp	Dike 1 (Clay)	23	17.4	25	34.6	2.65	52	20	32	1.07			19.9	CH	Gravelly Fat Clay with Sand	A-7-6 (16)															
55	9-19.5	comp	Dike 1 (Clay)	7.6	16.9	38.1	37.4	2.65	42	17	25	0.83			21.8	CL	Lean Clay with Sand	A-7-6 (18)															
59	4.5-18	comp	Dike 1 (Fat)	22	27.7	12.5	37.8	2.67	72	25	47	1.38			43.5	CH	Sandy fat clay with Gravel	A-7-6 (18)															
60	18-31.5	comp	Dike 1 (Fat)	1.1	9	24.9	65	2.66	69	27	42	0.70			36.4	CH	Fat Clay	A-7-6 (43)															
57	7.5-18	comp	Dike 1 (Lean)	4.7	29	38.7	27.6	2.69	34	21	13	0.68			25.5	CL	Sandy lean clay	A-6 (7)															
58A	25.4-26.0	ST	Dike 1 (Lean)																6.30E-08	2.07E-09	30.8	127.5	97.4		Gray-brown sandy lean clay	90.7	0.83	117.8	27.9	92.13	4.16	220.3	22.3
58A	25.4-26.0	ST	Dike 1 (Lean)																							98.6	0.705	124.3	25.7	98.88			
58	1.5-13.5	comp	Dike 2 (Fat)	7.5	28.3	22.3	41.9	2.68	54	18	36	0.95			21.3	CH	Sandy Fat Clay	A-7-6 (21)															
60	1.5-15	comp	Dike 2 (Fat)	6.5	27	26	40.5	2.70	52	16	36	1.00			22.4	CH	Sandy Fat Clay	A-7-6 (22)															
58	10-20	Bulk	Dike 2 (Fat), Dike 1 (Lean @16)	0	31.6	11.3	57.1	2.7	68	23	45		20.2	103.1		CH	Fat Clay	A-7-6 (30)	2.70E-08	8.86E-10	23.1	121.1	98.4	95.4	Brown sandy fat clay	86.7	0.731	120.3	23.5	97.37	1.77	254.9	29.4
58	10-20	Bulk	Dike 2 (Fat), Dike 1 (Lean @16)																							89.3	0.707	121.9	23.4	98.75			
58	10-20	Bulk	Dike 2 (Fat), Dike 1 (Lean @16)																							90.1	0.707	122.0	23.6	98.72			
48	1.5-16.5	comp	Dike 2 (Lean)	16.5	18.2	30.1	35.2	2.76	49	17	32	1.07			20.9	CL/CH	Sandy lean clay with gravel	A-7-6 (18)															
52	1.5-18	comp	Dike 2 (Lean)	14.7	24.8	27.6	32.9	2.74	46	17	29	0.97			22.4	CL	Sandy Lean Clay	A-7-6 (15)															
48A	5-15	Bulk	Dike 2 (Lean)	0	26.9	36.9	36.2	2.7	54	20	34		18.9	105.6	29.3	CH	Fat Clay	A-7-6 (24)	2.80E-08	9.19E-10	22.1	122.2	100.1	94.8	Brown fat clay with sand	83.0	0.682	121.2	21.0	100.2	1.53	220.3	29.5
48A	5-15	Bulk	Dike 2 (Lean)																							82.1	0.686	120.9	20.9	100.0			
48A	5-15	Bulk	Dike 2 (Lean)																							81.5	0.681	121.0	20.6	100.3			
52A	5-10	Bulk	Dike 2 (Lean)	0	30.6	15.1	54.3	2.7	61	21	40		21.9	102.1		CH	Fat Clay	A-7-6 (27)	3.50E-08	1.15E-09	24.5	120.6	96.8	94.8	Brown sandy fat clay	86.1	0.74	119.7	23.6	96.87	0.675	97.2	29.8
52A	5-10	Bulk	Dike 2 (Lean)																							84.5	0.747	119.1	23.4	96.48			
52A	5-10	Bulk	Dike 2 (Lean)																							84.8	0.744	119.3	23.4	96.68			
54 A	22 - 24	ST	Dike 2 (Lean)																														
54A	30.0-30.6	ST	Dike 2 (Lean)																6.50E-08	2.13E-09	31.1	127.4	97.1		Gray brown lean clay								
54A	30.6-31.8	ST	Dike 2 (Lean)																						Brown silty lean clay with sand	102.7	0.533	132.3	20.3	110	3.06	220.3	32.1
54A	30.6-31.8	ST	Dike 2 (Lean)																							96.9	0.541	130.6	19.4	109.4			
48	18-33.7	comp	Dike 2 (Lean) - Gravel	43.7	24.1	11.6	20.6	2.70	52	18	34	1.89			21.3	GC	Clayey gravel with sand	A-2-7 (4)															
	fill soil		Fill					2.70					14.6	114.3	14.2																		
	fill soil		Fill	24.7	22.1	25.9	27.3	2.68	33	18	15	0.65			14.2	CL	Gravelly lean clay with sand	A-6 (5)															

Cumberland Fossil Plant
Stantec Ash Pond Laboratory Results
Project No. 175539016

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
1	47	0 - 1.5	SPT	Dike 1 (Clay)	1													20.2			
3	47	1.5 - 3	SPT	Dike 1 (Clay)	1					1	1				1			15.4			
4	47	3 - 4.5	SPT	Dike 1 (Clay)	1					1	1				1			17.3			
5	47	4.5 - 6	SPT	Dike 1 (Clay)	1					1	1				1			18.1			
6	47	6 - 7.5	SPT	Dike 1 (Clay)	1					1	1				1			19.1			
7	47	7.5 - 9	SPT	Dike 1 (Clay)	1					1	1				1			21.4			
8	47	9 - 10.5	SPT	Dike 1 (Clay)	1					1	1				1			22.6			
9	47	10.5 - 12	SPT	Dike 1 (Clay)	1					1	1				1			29.4			
10	47	12 - 13.5	SPT	Dike 1 (Clay)	1					1	1				1			27.7			
2	47	0-13.5	comp	Dike 1 (Clay)	1	2.3	9.1	43.9	44.7	100	2.70	40	21	19	0.49			21.4	CL	Lean clay	A-6 (17)
11	47	13.5 - 15	SPT	Dike 1 (Clay)														23.8			
12	47	15 - 16.5	SPT	Dike 1 (Clay)														24.5			
14	47	16.5 - 18	SPT	Dike 1 (Clay)	2					2	2				2			20.5			
15	47	18 - 19.5	SPT	Dike 1 (Clay)	2					2	2				2			25.7			
16	47	19.5 - 21	SPT	Alluvial (Clay)	2					2	2				2			22.4			
17	47	21 - 22.5	SPT	Alluvial (Clay)	2					2	2				2			25			
18	47	22.5 - 24	SPT	Alluvial (Clay)	2					2	2				2			22.9			
19	47	24 - 25.5	SPT	Alluvial (Clay)	2					2	2				2			22.1			
20	47	25.5 - 27	SPT	Alluvial (Clay)	2					2	2				2			26			
21	47	27 - 28.5	SPT	Alluvial (Clay)	2					2	2				2			30.7			
22	47	28.5 - 30	SPT	Alluvial (Clay)	2					2	2				2			28.3			
23	47	31 - 32.5	SPT	Alluvial (Clay)	2					2	2				2			28.8			
13	47	16.5-32.5	comp	Alluvial (Clay)	2	1.3	9.1	44.2	45.4	100	2.67	45	18	27	0.73			25.2	CL	Lean clay	A-7-6 (25)
24	47	33.5 - 35	SPT	Alluvial (Clay)														36.8			
25	47	36 - 37.5	SPT	Alluvial (Clay)														32.6			
26	47	38.5 - 40	SPT	Alluvial (Clay)														34.1			
27	47	40.4 - 40.5	SPT	Alluvial (Clay)														2.6			
28	48	0 - 1.5	SPT	Dike 2 (Lean)														11.6			
29	48	1.5 - 3	SPT	Dike 2 (Lean)	3													20.8			
31	48	3 - 4.5	SPT	Dike 2 (Lean)	3					3	3				3			23.6			
32	48	4.5 - 6	SPT	Dike 2 (Lean)	3					3	3				3			18.8			
33	48	6 - 7.5	SPT	Dike 2 (Lean)	3					3	3				3			18.4			
34	48	7.5 - 9	SPT	Dike 2 (Lean)	3					3	3				3			15.6			
35	48	9 - 10.5	SPT	Dike 2 (Lean)	3					3	3				3			20.2			
36	48	10.5 - 12	SPT	Dike 2 (Lean)	3					3	3				3			23.9			
37	48	12 - 13.5	SPT	Dike 2 (Lean)	3					3	3				3			20			
38	48	13.5 - 15	SPT	Dike 2 (Lean)	3					3	3				3			22.4			
39	48	15 - 16.5	SPT	Dike 2 (Lean)	3					3	3				3			25.1			
30	48	1.5-16.5	comp	Dike 2 (Lean)	3	16.5	18.2	30.1	35.2	100	2.76	49	17	32	1.07			20.9	CL/CH	Sandy lean clay with gravel	A-7-6 (18)
40	48	16.5 - 18	SPT	Dike 2 (Lean)														18.5			
42	48	18 - 19.5	SPT	Dike 2 (Lean) - Gravel	4					4	4				4			22.4			
43	48	19.5 - 21	SPT	Dike 2 (Lean) - Gravel	4					4	4				4			23.9			
44	48	21 - 22.5	SPT	Dike 2 (Lean) - Gravel	4					4	4				4			9.6			
45	48	22.5 - 24	SPT	Dike 2 (Lean) - Gravel	4					4	4				4			23.4			
46	48	24 - 25.5	SPT	Dike 2 (Lean) - Gravel	4					4	4				4			17.9			
47	48	25.5 - 27	SPT	Dike 2 (Lean) - Gravel	4					4	4				4			21.5			
48	48	27 - 27.9	SPT	Dike 2 (Lean) - Gravel	4					4	4				4			17.9			

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
49	48	28.5 - 28.8	SPT	Dike 2 (Lean) - Gravel	4					4	4				4			NR			
50	48	31 - 32.5	SPT	Dike 2 (Lean) - Gravel	4					4	4				4			20.8			
51	48	33.5 - 33.7	SPT	Dike 2 (Lean) - Gravel	4					4	4				4			34.5			
41	48	18-33.7	comp	Dike 2 (Lean) - Gravel	4	43.7	24.1	11.6	20.6	100	2.70	52	18	34	1.89			21.3	GC	Clayey gravel with sand	A-2-7 (4)
52	48	36 - 37.5	SPT	Alluvial (Granular)														24.7			
53	48	38.5 - 40	SPT	Alluvial (Granular)														26.5			
54	48	41 - 42.5	SPT	Alluvial (Granular)														27.5			
55	48	43.5 - 45	SPT	Alluvial (Granular)														24			
56	48	46 - 47.5	SPT	Alluvial (Granular)														29.1			
57	48	48.5 - 49.9	SPT	Alluvial (Granular)														19.9			
58	48	51 - 52.5	SPT	Alluvial (Granular)														27.1			
59	48	53.5 - 54.8	SPT	Alluvial (Granular)														26.1			
	48 A	5-15	BAG	Dike 2 (Lean)						X	X				x		x		x		
60	49	0 - 1.5	SPT	Dike 1 (Clay)														24.3			
61	49	1.5 - 3	SPT	Dike 1 (Clay)														27.8			
62	49	3 - 4.5	SPT	Dike 1 (Clay)														21.7			
63	49	4.5 - 6	SPT	Dike 1 (Clay)														19.9			
64	49	6 - 7.5	SPT	Dike 1 (Clay)														20			
65	49	7.5 - 9	SPT	Dike 1 (Clay)														23			
66	49	9 - 10.5	SPT	Dike 1 (Clay)														21.7			
67	49	10.5 - 12	SPT	Dike 1 (Clay)														27.1			
68	49	12 - 13.5	SPT	Dike 1 (Clay)														27.2			
69	49	13.5 - 15	SPT	Dike 1 (Clay)														23.6			
70	49	15 - 16.5	SPT	Dike 1 (Clay)														30.7			
71	49	16.5 - 18	SPT	Dike 1 (Clay)														30.8			
72	49	18 - 19.5	SPT	Dike 1 (Clay)														29.4			
73	49	19.5 - 21	SPT	Alluvial (Clay)														31			
74	49	21 - 22.5	SPT	Alluvial (Clay)														29.4			
75	49	22.5 - 24	SPT	Alluvial (Clay)														31.8			
76	49	24 - 25.5	SPT	Alluvial (Clay)														32.9			
77	49	26 - 27.5	SPT	Alluvial (Clay)														31			
78	49	28.5 - 30	SPT	Alluvial (Clay)														31.8			
79	49	31 - 32.5	SPT	Alluvial (Clay)														31.5			
80	49	33.5 - 35	SPT	Alluvial (Clay)														32.3			
81	49	36 - 37.5	SPT	Alluvial (Clay)														27.8			
82	49	38.5 - 40	SPT	Alluvial (Clay)														31.6			
83	49	41 - 42.5	SPT	Alluvial (Clay)														25.4			
84	49	43.5 - 45	SPT	Alluvial (Clay)														26.8			
85	49	46 - 47.5	SPT	Alluvial (Granular)														36.5			
86	49	48.5 - 50	SPT	Alluvial (Granular)														26.9			
87	49	51 - 52.5	SPT	Alluvial (Granular)														36.2			
88	49	53.5 - 55	SPT	Alluvial (Clay)														28			
89	49	56 - 57.5	SPT	Alluvial (Clay)														26			
90	49	58.5 - 60	SPT	Alluvial (Clay)														21			
91	49	61 - 62.5	SPT	Alluvial (Clay)														20.4			
92	49	63.5 - 64.1	SPT	Alluvial (Clay)														10.9			

Cumberland Fossil Plant
Stantec Ash Pond Laboratory Results
Project No. 175539016

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
93	50	0 - 1.5	SPT	Dike 2 (Lean)														16.8			
94	50	1.5 - 3	SPT	Dike 2 (Lean)														15.2			
95	50	3 - 4.5	SPT	Dike 2 (Lean)														24.1			
96	50	4.5 - 6	SPT	Dike 2 (Lean)														22			
97	50	6 - 7.5	SPT	Dike 2 (Lean)														23.5			
98	50	7.5 - 9	SPT	Dike 2 (Lean)														23.6			
99	50	9 - 10.5	SPT	Dike 2 (Lean)														24.7			
100	50	10.5 - 12	SPT	Dike 2 (Lean)														20.4			
101	50	12 - 13.5	SPT	Dike 2 (Lean)														20.7			
102	50	13.5 - 15	SPT	Dike 2 (Lean)														22.5			
103	50	15 - 16.5	SPT	Dike 2 (Lean)														22.4			
104	50	16.5 - 18	SPT	Dike 2 (Lean)														19.7			
105	50	18 - 19.5	SPT	Dike 2 (Lean)														19.1			
106	50	19.5 - 21	SPT	Dike 2 (Lean) - Gravel														20.2			
107	50	21 - 22.5	SPT	Dike 2 (Lean) - Gravel														8.7			
108	50	22.5 - 24	SPT	Dike 2 (Lean) - Gravel														20.2			
109	50	24 - 25.5	SPT	Dike 2 (Lean) - Gravel														20.6			
110	50	25.5 - 27	SPT	Dike 2 (Lean) - Gravel														31.4			
111	50	27 - 28.5	SPT	Dike 2 (Lean) - Gravel														28			
112	50	28.5 - 30	SPT	Dike 2 (Lean) - Gravel														40.1			
113	50	31 - 32.5	SPT	Dike 2 (Lean) - Gravel														38.5			
114	50	33.5 - 35	SPT	Dike 2 (Lean) - Gravel														NR			
115	50	36 - 37.3	SPT	Dike 2 (Lean) - Gravel														NR			
424	50 A	33.5 - 35	SPT	Dike 2 (Lean) - Gravel														33			
425	50 A	36 - 36	SPT	Dike 2 (Lean) - Gravel														NR			
426	50 A	43.5 - 45	SPT	Alluvial (Clay)														NR			
427	50 A	46 - 47.3	SPT	Alluvial (Clay)														19.9			
428	50 A	48.5 - 50	SPT	Alluvial (Clay)														31.7			
429	50 A	51 - 52.5	SPT	Alluvial (Clay)														36.4			
430	50 A	54 - 54	SPT	Alluvial (Clay)														NR			
431	50 A	56 - 57.5	SPT	Alluvial (Clay)														29			
432	50 A	58.5 - 60	SPT	Alluvial (Clay)														28.2			
433	50 A	61 - 62.5	SPT	Alluvial (Clay)														31.5			
434	50 A	63.5 - 65	SPT	Alluvial (Clay)														26.4			
435	50 A	66 - 67.5	SPT	Alluvial (Clay)														26.8			
436	50 A	68.5 - 70	SPT	Alluvial (Clay)														29.1			
437	50 A	71 - 72.5	SPT	Alluvial (Clay)														32.2			
438	50 A	73.5 - 75	SPT	Alluvial (Clay)														19.1			
439	50 A	76 - 77.5	SPT	Alluvial (Clay)														33.7			
440	50 A	78.5 - 80	SPT	Alluvial (Clay)														27.1			
441	50 A	81 - 82.5	SPT	Alluvial (Clay)														36			
442	50 A	83.5 - 85	SPT	Alluvial (Clay)														30			
443	50 A	86 - 87.5	SPT	Alluvial (Clay)														29.4			
444	50 A	88.5 - 90	SPT	Alluvial (Clay)														25.7			
	50 B	15-17	ST	Dike 2 (Lean)																	

Cumberland Fossil Plant
Stantec Ash Pond Laboratory Results
Project No. 175539016

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
116	51	0 - 1.5	SPT	Dike 1 (Clay)														20.3			
118	51	1.5 - 3	SPT	Dike 1 (Clay)	5					5	5				5			11.9			
119	51	3 - 4.5	SPT	Dike 1 (Clay)	5					5	5				5			19.6			
120	51	4.5 - 6	SPT	Dike 1 (Clay)	5					5	5				5			18.7			
121	51	6 - 7.5	SPT	Dike 1 (Clay)	5					5	5				5			20.3			
122	51	7.5 - 9	SPT	Dike 1 (Clay)	5					5	5				5			17.1			
123	51	9 - 10.5	SPT	Dike 1 (Clay)	5					5	5				5			19.1			
124	51	10.5 - 12	SPT	Dike 1 (Clay)	5					5	5				5			21.3			
125	51	12 - 13.5	SPT	Dike 1 (Clay)	5					5	5				5			20.2			
126	51	13.5 - 15	SPT	Dike 1 (Clay)	5					5	5				5			19.5			
127	51	15 - 16.5	SPT	Dike 1 (Clay)	5					5	5				5			19.2			
128	51	16.5 - 18	SPT	Dike 1 (Clay)	5					5	5				5			19.6			
117	51	1.5-18	comp	Dike 1 (Clay)	5	1	18.2	45.7	35.1	100	2.67	35	18	17	0.59			18.8	CL	Lean Clay with Sand	A-6 (13)
129	51	18 - 19.5	SPT	Dike 1 (Clay)														20			
130	51	19.5 - 21	SPT	Alluvial (Clay)														20.7			
131	51	21 - 22.5	SPT	Alluvial (Clay)														20.9			
132	51	23.5 - 25	SPT	Alluvial (Clay)														20.2			
133	51	26 - 27.5	SPT	Alluvial (Clay)														24.5			
134	51	28.5 - 30	SPT	Alluvial (Clay)														26.5			
136	51	31 - 31.3	SPT	Alluvial (Clay)	6					6	6				6			24			
137	51	33.5 - 35	SPT	Alluvial (Clay)	6					6	6				6			26.7			
138	51	36 - 37.5	SPT	Alluvial (Clay)	6					6	6				6			28.5			
139	51	38.5 - 40	SPT	Alluvial (Clay)	6					6	6				6			29.1			
140	51	41 - 42.5	SPT	Alluvial (Clay)	6					6	6				6			26.2			
141	51	43.5 - 45	SPT	Alluvial (Clay)	6					6	6				6			26.5			
142	51	46 - 47.5	SPT	Alluvial (Clay)	6					6	6				6			26.4			
143	51	48.5 - 50	SPT	Alluvial (Clay)	6					6	6				6			32			
135	51	31-50	comp	Alluvial (Clay)	6	0.2	8.3	64.8	26.7	100	2.62	30	20	10	0.48			27.4	CL	Lean Clay	A-4 (9)
144	51	51 - 52.5	SPT	Alluvial (Granular)														25.8			
146	51	53.5 - 55	SPT	Alluvial (Granular)	7					7	7				7			24.7			
147	51	56 - 57.5	SPT	Alluvial (Granular)	7					7	7				7			21.1			
148	51	58.5 - 60	SPT	Alluvial (Granular)	7					7	7				7			21.7			
149	51	61 - 62.5	SPT	Alluvial (Granular)	7					7	7				7			19.1			
145	51	53.5-62.5	comp	Alluvial (Granular)	7	33	48.7	11	7.3	100	2.66	NP	NP	NP	NP			21.7	SM	Silty Sand with Gravel	A-1-b (0)
150	51	63.5 - 65	SPT	Alluvial (Granular)														19.7			
151	51	66 - 66.4	SPT	Alluvial (Granular)														14.5			
152	52	0 - 1.5	SPT	Dike 2 (Lean)														17.4			
153	52	1.5 - 3	SPT	Dike 2 (Lean)	8													23			
155	52	3 - 4.5	SPT	Dike 2 (Lean)	8					8	8				8			27			
156	52	4.5 - 6	SPT	Dike 2 (Lean)	8					8	8				8			23			
157	52	6 - 7.5	SPT	Dike 2 (Lean)	8					8	8				8			20.9			
158	52	7.5 - 9	SPT	Dike 2 (Lean)	8					8	8				8			22.2			
159	52	9 - 10.5	SPT	Dike 2 (Lean)	8					8	8				8			26.9			
160	52	10.5 - 12	SPT	Dike 2 (Lean)	8					8	8				8			21			
161	52	12 - 13.5	SPT	Dike 2 (Lean)	8					8	8				8			23.7			
162	52	13.5 - 15	SPT	Dike 2 (Lean)	8					8	8				8			19.6			

Cumberland Fossil Plant
Stantec Ash Pond Laboratory Results
Project No. 175539016

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
163	52	15 - 16.5	SPT	Dike 2 (Lean)	8					8	8				8			23.3			
164	52	16.5 - 18	SPT	Dike 2 (Lean)	8					8	8				8			16.1			
154	52	1.5-18	comp	Dike 2 (Lean)	8	14.7	24.8	27.6	32.9	100	2.74	46	17	29	0.97			22.4	CL	Sandy Lean Clay	A-7-6 (15)
165	52	18 - 18.9	SPT	Dike 2 (Lean)														18.1			
166	52	19.5 - 21	SPT	Dike 2 (Lean) - Gravel														8			
167	52	21 - 22.5	SPT	Dike 2 (Lean) - Gravel														18.4			
169	52	22.5 - 24	SPT	Dike 2 (Lean) - Gravel	9					9	9				9			29.4			
170	52	24 - 25.5	SPT	Dike 2 (Lean) - Gravel	9					9	9				9			33.6			
171	52	25.5 - 27	SPT	Dike 2 (Lean) - Gravel	9					9	9				9			21.1			
172	52	27 - 28.5	SPT	Dike 2 (Lean) - Gravel	9					9	9				9			23.7			
173	52	28.5 - 30	SPT	Dike 2 (Lean) - Gravel	9					9	9				9			10.8			
174	52	31 - 32.5	SPT	Dike 2 (Lean) - Gravel	9					9	9				9			24.3			
175	52	33.5 - 35	SPT	Dike 2 (Lean) - Gravel	9					9	9				9			22.5			
176	52	36 - 37.5	SPT	Alluvial (Clay)	9					9	9				9			13.6			
177	52	38.5 - 40	SPT	Alluvial (Clay)	9					9	9				9			19.5			
178	52	41 - 42.5	SPT	Alluvial (Clay)	9					9	9				9			29.4			
168	52	22.5-42.5	comp	Alluvial (Clay)	9	13.2	19.7	26	41.1	100	2.71	48	16	32	0.91			22.8	CL	Sandy Lean Clay	A-7-6 (19)
179	52	43.5 - 45	SPT	Alluvial (Clay)														25.8			
180	52	46 - 47.5	SPT	Alluvial (Clay)														24.9			
181	52	48.5 - 50	SPT	Alluvial (Clay)														25.4			
182	52	51 - 52.5	SPT	Alluvial (Clay)														27.3			
183	52	53.5 - 55	SPT	Alluvial (Clay)														27.8			
184	52	56 - 57.5	SPT	Alluvial (Clay)														28.7			
185	52	58.5 - 60	SPT	Alluvial (Clay)														27.6			
186	52	61 - 62.5	SPT	Alluvial (Clay)														27.3			
187	52	63.5 - 65	SPT	Alluvial (Clay)														36.4			
188	52	66 - 67.5	SPT	Alluvial (Clay)														26.9			
190	52	68.5 - 70	SPT	Alluvial (Granular)	10					10	10				10			26.3			
191	52	71 - 72.5	SPT	Alluvial (Granular)	10					10	10				10			18.3			
192	52	73.5 - 75	SPT	Alluvial (Granular)	10					10	10				10			24.8			
193	52	76 - 77.5	SPT	Alluvial (Granular)	10					10	10				10			21.7			
194	52	78.5 - 80	SPT	Alluvial (Granular)	10					10	10				10			16.2			
189	52	68.5-80	comp	Alluvial (Granular)	10	58.8	29.3	6.8	5.1	100	2.66	NP	NP	NP	NP			21.5	GP-GM	Poorly graded gravel with silt and sand	A-1-a (0)
195	52	81 - 81.8	SPT	Alluvial (Granular)														15.1			
196	52	83.5 - 83.7	SPT	Alluvial (Granular)														11.3			
	52 A	5-10	BAG	Dike 2 (Lean)						x					x				x		
197	53	0 - 1.5	SPT	Dike 1 (Clay)														22.1			
198	53	1.5 - 3	SPT	Dike 1 (Clay)														18.3			
199	53	3 - 4.5	SPT	Dike 1 (Clay)														27			
200	53	4.5 - 6	SPT	Dike 1 (Clay)														26.5			
201	53	6 - 7.5	SPT	Dike 1 (Clay)														17			
202	53	7.5 - 9	SPT	Dike 1 (Clay)														23.1			
203	53	9 - 10.5	SPT	Dike 1 (Clay)														27.3			
204	53	10.5 - 12	SPT	Dike 1 (Clay)														20.5			
205	53	12 - 13.5	SPT	Dike 1 (Clay)														21.5			
206	53	13.5 - 15	SPT	Dike 1 (Clay)														22.4			

Cumberland Fossil Plant
Stantec Ash Pond Laboratory Results
Project No. 175539016

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
207	53	15 - 16.5	SPT	Dike 1 (Clay)														20.3			
208	53	16.5 - 18	SPT	Dike 1 (Clay)														23.3			
209	53	18 - 19.5	SPT	Dike 1 (Clay)														18.5			
210	53	19.5 - 21	SPT	Dike 1 (Clay)														18			
211	53	21 - 22.5	SPT	Dike 1 (Clay)														26.7			
212	53	22.5 - 24	SPT	Dike 1 (Clay)														27.8			
213	53	24 - 25.5	SPT	Dike 1 (Clay)														26.1			
214	53	25.5 - 27	SPT	Dike 1 (Clay)														NR			
	53 A	8-10	ST	Dike 1 (Clay)																	
445	53 A	29.5 - 31	SPT	Alluvial (Clay)														25.8			
446	53 A	31 - 33.5	SPT	Alluvial (Clay)														22.3			
447	53 A	33.5 - 38.5	SPT	Alluvial (Clay)														27.8			
448	53 A	38.5 - 41	SPT	Alluvial (Clay)														26.8			
449	53 A	41 - 46	SPT	Alluvial (Clay)														25.1			
	53 A	43-45	ST	Alluvial (Clay)																	
450	53 A	46 - 48.5	SPT	Alluvial (Clay)														25.8			
451	53 A	48.5 - 51	SPT	Alluvial (Granular)														35.7			
452	53 A	51 - 53.5	SPT	Alluvial (Granular)														32.5			
453	53 A	53.5 - 56	SPT	Alluvial (Granular)														20.1			
454	53 A	56 - 58.5	SPT	Alluvial (Granular)														22.1			
455	53 A	58.5 - 61	SPT	Alluvial (Granular)														21.8			
456	53 A	61 - 63.5	SPT	Alluvial (Granular)														29.4			
457	53 A	63.5 - 66	SPT	Alluvial (Granular)														25.7			
458	53 A	66 - 68.5	SPT	Alluvial (Granular)														19.4			
459	53 A	68.5 - 71	SPT	Alluvial (Granular)														19.4			
460	53 A	71 - 73.5	SPT	Alluvial (Granular)														30.7			
461	53 A	73.5 - 76	SPT	Alluvial (Granular)														24.5			
462	53 A	76 - 78.5	SPT	Alluvial (Granular)														24.6			
463	53 A	78.5 - 81	SPT	Alluvial (Granular)														35.2			
464	53 A	81 - 83.5	SPT	Alluvial (Granular)														28.6			
465	53 A	83.5 - 86	SPT	Alluvial (Granular)														35.9			
466	53 A	86 - 88.5	SPT	Alluvial (Granular)														43.6			
467	53 A	88.5 - 91	SPT	Alluvial (Granular)														43.6			
468	53 A	91 - 93.5	SPT	Alluvial (Granular)														43.3			
469	53 A	93.5 - 95	SPT	Alluvial (Granular)														55.3			
215	54	0 - 1.5	SPT	Dike 2 (Fat)														22.2			
216	54	1.5 - 3	SPT	Dike 2 (Fat)														20.3			
217	54	3 - 4.5	SPT	Dike 2 (Fat)														27.6			
218	54	4.5 - 6	SPT	Dike 2 (Fat)														26.1			
219	54	6 - 7.5	SPT	Dike 2 (Fat)														21.2			
220	54	7.5 - 9	SPT	Dike 2 (Fat)														22.2			
221	54	9 - 10.5	SPT	Dike 2 (Fat)														22.2			
222	54	10.5 - 12	SPT	Dike 2 (Fat)														22.7			
223	54	12 - 13.5	SPT	Dike 2 (Fat)														19.3			
224	54	13.5 - 15	SPT	Dike 2 (Fat)														21.1			
225	54	15 - 16.5	SPT	Dike 2 (Fat)														24.9			

Cumberland Fossil Plant
Stantec Ash Pond Laboratory Results
Project No. 175539016

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
226	54	16.5 - 18	SPT	Dike 2 (Fat)														24.3			
227	54	18 - 19.5	SPT	Dike 2 (Lean)														13.7			
228	54	19.5 - 21	SPT	Dike 2 (Lean)														17.9			
229	54	21 - 22.5	SPT	Dike 2 (Lean)														19.3			
230	54	22.5 - 24	SPT	Dike 2 (Lean)														17.5			
231	54	24 - 25.5	SPT	Dike 2 (Lean)														16.1			
232	54	25.5 - 27	SPT	Dike 2 (Lean)														13.2			
233	54	27 - 28.5	SPT	Dike 2 (Lean)														18.2			
234	54	28.5 - 30	SPT	Dike 2 (Lean)														21.1			
235	54	30 - 31.5	SPT	Dike 2 (Lean)														19.5			
236	54	31.5 - 33	SPT	Dike 2 (Lean)														23.2			
237	54	33 - 34.5	SPT	Dike 2 (Lean)														22.2			
238	54	34.5 - 36	SPT	Dike 2 (Lean)														19.6			
239	54	36 - 37.5	SPT	Alluvial (Clay)														22.3			
240	54	37.5 - 39	SPT	Alluvial (Clay)														21			
241	54	39 - 40.5	SPT	Alluvial (Clay)														21			
242	54	40.5 - 42	SPT	Alluvial (Clay)														22.1			
243	54	42 - 43.5	SPT	Alluvial (Clay)														19.7			
244	54	43.5 - 45	SPT	Alluvial (Clay)														21.9			
245	54	45 - 46.5	SPT	Alluvial (Clay)														23.8			
246	54	47.5 - 49	SPT	Alluvial (Clay)														24.8			
247	54	50 - 51.5	SPT	Alluvial (Clay)														23.7			
248	54	52.5 - 54	SPT	Alluvial (Clay)														25.7			
249	54	55 - 56.5	SPT	Alluvial (Clay)														28.3			
250	54	57.5 - 59	SPT	Alluvial (Clay)														36.9			
251	54	60 - 61.5	SPT	Alluvial (Clay)														28.8			
252	54	62.5 - 64	SPT	Alluvial (Clay)														24.5			
253	54	65 - 66.5	SPT	Alluvial (Clay)														26.7			
254	54	67.5 - 69	SPT	Alluvial (Granular)														31.7			
255	54	70 - 71.5	SPT	Alluvial (Granular)														25.4			
256	54	72.5 - 74	SPT	Alluvial (Granular)														27.9			
257	54	75 - 76.5	SPT	Alluvial (Granular)														23.9			
258	54	77.5 - 79	SPT	Alluvial (Granular)														18.7			
259	54	80 - 81.5	SPT	Alluvial (Granular)														16.1			
260	54	82.5 - 84	SPT	Alluvial (Clay)														22.2			
261	54	85 - 86.5	SPT	Alluvial (Granular)														15.6			
262	54	87.5 - 89	SPT	Alluvial (Granular)														16.2			
263	54	90 - 90.1	SPT	Alluvial (Granular)														NR			
470	54 A	6 - 8	ST	Dike 2 (Fat)														NR			
471	54 A	8 - 9.4	ST	Dike 2 (Fat)														NR			
472	54 A	22 - 24	ST	Dike 2 (Lean)														NR			
473	54 A	30 - 32	ST	Dike 2 (Lean)														NR			
474	54 A	45 - 47	ST	Alluvial (Clay)														NR			
265	55	0 - 1.5	SPT	Dike 1 (Clay)	11					11	11				11			21.2			
266	55	1.5 - 3	SPT	Dike 1 (Clay)	11					11	11				11			14.2			
267	55	3 - 4.5	SPT	Dike 1 (Clay)	11					11	11				11			19.7			

Cumberland Fossil Plant
Stantec Ash Pond Laboratory Results
Project No. 175539016

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
268	55	4.5 - 6	SPT	Dike 1 (Clay)	11					11	11				11			21.8			
269	55	6 - 7.5	SPT	Dike 1 (Clay)	11					11	11				11			22.5			
264	55	0-7.5	comp	Dike 1 (Clay)	11	23	17.4	25	34.6	100	2.65	52	20	32	1.07			19.9	CH	Gravelly Fat Clay with Sand	A-7-6 (16)
270	55	7.5 - 9	SPT	Dike 1 (Clay)														23.4			
272	55	9 - 10.5	SPT	Dike 1 (Clay)	12					12	12				12			20.3			
273	55	10.5 - 12	SPT	Dike 1 (Clay)	12					12	12				12			22.4			
274	55	12 - 13.5	SPT	Dike 1 (Clay)	12					12	12				12			24.2			
275	55	13.5 - 15	SPT	Dike 1 (Clay)	12					12	12				12			20.6			
276	55	15 - 16.5	SPT	Dike 1 (Clay)	12					12	12				12			19.9			
277	55	16.5 - 18	SPT	Dike 1 (Clay)	12					12	12				12			23.7			
278	55	18 - 19.5	SPT	Dike 1 (Clay)	12					12	12				12			21.7			
271	55	9-19.5	comp	Dike 1 (Clay)	12	7.6	16.9	38.1	37.4	100	2.65	42	17	25	0.83			21.8	CL	Lean Clay with Sand	A-7-6 (18)
279	55	19.5 - 21	SPT	Dike 1 (Clay)														23.7			
280	55	21 - 22.5	SPT	Alluvial (Granular)														18			
281	55	22.5 - 24	SPT	Alluvial (Granular)														19.1			
283	55	24 - 25.5	SPT	Alluvial (Granular)	13					13	13				13			17.7			
284	55	25.5 - 28.5	SPT	Alluvial (Granular)	13					13	13				13			25.5			
285	55	28.5 - 31	SPT	Alluvial (Granular)	13					13	13				13			33.6			
286	55	31 - 33.5	SPT	Alluvial (Granular)	13					13	13				13			24.3			
287	55	33.5 - 36	SPT	Alluvial (Granular)	13					13	13				13			23.4			
288	55	36 - 38.5	SPT	Alluvial (Granular)	13					13	13				13			LR			
289	55	38.5 - 41	SPT	Alluvial (Granular)	13					13	13				13			25.1			
290	55	41 - 43.5	SPT	Alluvial (Granular)	13					13	13				13			27.5			
291	55	43.5 - 46	SPT	Alluvial (Granular)	13					13	13				13			64.4			
292	55	46 - 48.5	SPT	Alluvial (Granular)	13					13	13				13			29.5			
282	55	24-48.5	comp	Alluvial (Granular)	13	46.3	18.4	15.9	19.4	100	2.65	45	25	20	1.25			30.1	GC	Clayey gravel with sand	A-2-7 (2)
293	55	48.5 - 51	SPT	Alluvial (Granular)														27.2			
294	55	51 - 53.5	SPT	Alluvial (Granular)														15.9			
295	55	53.5 - 56	SPT	Alluvial (Granular)														37.7			
296	55	56 - 58.5	SPT	Alluvial (Granular)														41.3			
297	55	58.5 - 61	SPT	Alluvial (Granular)														42			
298	55	61 - 63.5	SPT	Alluvial (Granular)														40.4			
299	55	63.5 - 66	SPT	Alluvial (Granular)														63			
300	55	66 - 68.5	SPT	Alluvial (Granular)														63.1			
301	55	68.5 - 71	SPT	Alluvial (Granular)														39.4			
302	55	71 - 73.5	SPT	Alluvial (Granular)														74.2			
303	55	73.5 - 75	SPT	Alluvial (Granular)														36.7			
304	55	75 - 75.1	SPT	Alluvial (Granular)														22			
477	56	0-1.5	SPT	Dike 2 (Fat)														12.5			
478	56	1.5-3	SPT	Dike 2 (Fat)														18.7			
479	56	3-4.5	SPT	Dike 2 (Fat)														22.8			
480	56	4.5-6	SPT	Dike 2 (Fat)														21.7			
481	56	6-7.5	SPT	Dike 2 (Fat)														22.9			
482	56	7.5-9	SPT	Dike 2 (Fat)														26.6			
483	56	9-10.5	SPT	Dike 2 (Fat)														22.5			
484	56	10.5-12	SPT	Dike 2 (Fat)														20.9			
485	56	12-13.5	SPT	Dike 2 (Fat)														23.3			

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
486	56	13.5-15	SPT	Dike 2 (Fat)														23.7			
487	56	15-16.5	SPT	Dike 2 (Fat)														23.2			
488	56	16.5-18	SPT	Dike 2 (Fat)														22.9			
489	56	18-19.5	SPT	Dike 2 (Fat)														22			
490	56	19.5-21	SPT	Dike 2 (Fat)														21.8			
491	56	21-22.5	SPT	Dike 2 (Fat)														26.4			
492	56	22.5-24	SPT	Dike 2 (Fat)														17.6			
493	56	24-25.5	SPT	Dike 2 (Fat)														17.8			
494	56	25.5-27	SPT	Dike 2 (Fat)														17.8			
495	56	27-28.5	SPT	Dike 2 (Fat)														18.5			
496	56	28.5-30	SPT	Dike 2 (Fat)														31.5			
497	56	30-31.5	SPT	Dike 2 (Fat)														25.9			
498	56	31.5-33	SPT	Dike 2 (Fat)														15.8			
499	56	33-34.5	SPT	Dike 2 (Fat)														41.3			
501	56	34.5-36	SPT	Alluvial (Granular)	1					1	1				1			47			
502	56	36-37.5	SPT	Alluvial (Granular)	1					1	1				1			25.7			
503	56	37.5-39	SPT	Alluvial (Granular)	1					1	1				1			34.3			
500	56	34.5-39	comp	Alluvial (Granular)	1	30.8	20	26.5	22.7	100	2.73	41	28	13	0.76			35.7	GM	Silty gravel with sand	A-7-6 (4)
504	56	39-40.5	SPT	Alluvial (Clay)														28.2			
505	56	40.5-42	SPT	Alluvial (Clay)														29.3			
506	56	42-43.5	SPT	Alluvial (Clay)														29.6			
507	56	43.5-45	SPT	Alluvial (Clay)														54.3			
508	56	45-46.5	SPT	Alluvial (Clay)														57.9			
509	56	46.5-48	SPT	Alluvial (Clay)														34.1			
510	56	48-49.5	SPT	Alluvial (Clay)														48.2			
511	56	49.5-51	SPT	Alluvial (Clay)														65.4			
512	56	52.5-54	SPT	Alluvial (Clay)														26.1			
513	56	55-56.5	SPT	Alluvial (Clay)														60.8			
514	56	57.5-59	SPT	Alluvial (Clay)														47.3			
515	56	60-61.5	SPT	Alluvial (Clay)														35.7			
516	56	62.5-64	SPT	Alluvial (Clay)														27.8			
517	56	65-66.5	SPT	Alluvial (Clay)														25.2			
518	56	67.5-69	SPT	Alluvial (Clay)														43.7			
519	56	70-71.5	SPT	Alluvial (Clay)														32.1			
520	56	72.5-74	SPT	Alluvial (Clay)														28.5			
521	56	75-75.7	SPT	Alluvial (Clay)														3.7			
	56 A	6-10	BAG	Dike 2 (Fat)																	
522	57	0-1.5	SPT	Dike 1 (Lean) - Fill														7.7			
523	57	1.5-2.3	SPT	Dike 1 (Lean) - Fill														9.9			
524	57	3-4.5	SPT	Dike 1 (Lean)														19.4			
525	57	4.5-6	SPT	Dike 1 (Lean)														25.3			
526	57	6-7.5	SPT	Dike 1 (Lean)														27.7			
528	57	7.5-9	SPT	Dike 1 (Lean)	2													28.6			
529	57	9-10.5	SPT	Dike 1 (Lean)	2					2	2				2			25.1			
530	57	10.5-12	SPT	Dike 1 (Lean)	2					2	2				2			23.7			
531	57	12-13.5	SPT	Dike 1 (Lean)	2					2	2				2			24.3			

Cumberland Fossil Plant
Stantec Ash Pond Laboratory Results
Project No. 175539016

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
532	57	13.5-15	SPT	Dike 1 (Lean)	2					2	2				2			27.5			
533	57	15-16.5	SPT	Dike 1 (Lean)	2					2	2				2			24.6			
534	57	16.5-18	SPT	Dike 1 (Lean)	2					2	2				2			24.9			
527	57	7.5-18	comp	Dike 1 (Lean)	2	4.7	29	38.7	27.6	100	2.69	34	21	13	0.68			25.5	CL	Sandy lean clay	A-6 (7)
535	57	18-19.5	SPT	Dike 1 (Lean)														45.1			
536	57	19.5-21	SPT	Dike 1 (Lean)														25.4			
537	57	21-22.5	SPT	Dike 1 (Lean)														26.4			
538	57	22.5-24	SPT	Dike 1 (Lean)														35.4			
539	57	24-25.5	SPT	Dike 1 (Lean)														25.5			
540	57	25.5-27	SPT	Dike 1 (Lean)														32.1			
541	57	27-28.5	SPT	Alluvial (Clay)														53			
542	57	28.5-30	SPT	Alluvial (Clay)														30.3			
543	57	30-30.7	SPT	Alluvial (Clay)														26.3			
544	57	32.5-34	SPT	Alluvial (Clay)														34			
545	57	35-36.5	SPT	Alluvial (Clay)														48.5			
546	57	37.5-39	SPT	Alluvial (Clay)														19			
547	57	40-41.5	SPT	Alluvial (Clay)														32			
548	57	42.5-44	SPT	Alluvial (Clay)														51			
549	57	45-46.5	SPT	Alluvial (Clay)														27.9			
550	57	47.5-49	SPT	Alluvial (Clay)														59.3			
551	57	50-50.9	SPT	Alluvial (Clay)														32.5			
552	57	52.5-54	SPT	Alluvial (Clay)														50.3			
553	57	55-56.5	SPT	Alluvial (Clay)														54.2			
	57 A	5-7	ST	Dike 1 (Lean)																	
	57 A	10-12	ST	Dike 1 (Lean)																	
554	57B	57.5-59	SPT	Alluvial (Clay)														38.2			
555	57B	60-61.5	SPT	Alluvial (Clay)														41.4			
556	57B	62.5-64	SPT															35.7			
557	57B	65-66.5	SPT															43.7			
	58	10-20	BAG	Dike 2 (Fat), Dike 1 (Lean @16-20)						x					x				x		
305	58	0 - 1.5	SPT	Dike 2 (Fat)														15.5			
307	58	1.5 - 3	SPT	Dike 2 (Fat)	14					14	14				14			21			
308	58	3 - 4.5	SPT	Dike 2 (Fat)	14					14	14				14			21.9			
309	58	4.5 - 6	SPT	Dike 2 (Fat)	14					14	14				14			23.9			
310	58	6 - 7.5	SPT	Dike 2 (Fat)	14					14	14				14			25.5			
311	58	7.5 - 9	SPT	Dike 2 (Fat)	14					14	14				14			15.9			
312	58	9 - 10.5	SPT	Dike 2 (Fat)	14					14	14				14			29.9			
313	58	10.5 - 12	SPT	Dike 2 (Fat)	14					14	14				14			16.1			
314	58	12 - 13.5	SPT	Dike 2 (Fat)	14					14	14				14			16.1			
306	58	1.5-13.5	comp	Dike 2 (Fat)	14	7.5	28.3	22.3	41.9	100	2.68	54	18	36	0.95			21.3	CH	Sandy Fat Clay	A-7-6 (21)
315	58	13.5 - 15	SPT	Dike 2 (Fat)														23.3			
316	58	15 - 16.5	SPT	Dike 2 (Fat)														19.8			
317	58	16.5 - 18	SPT	Dike 1 (Lean)														19.9			
318	58	18 - 19.5	SPT	Dike 1 (Lean)														19.8			
319	58	19.5 - 21	SPT	Dike 1 (Lean)														28.9			

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
320	58	21 - 22.5	SPT	Dike 1 (Lean)														29.8			
321	58	22.5 - 24	SPT	Dike 1 (Lean)														28.3			
322	58	24 - 25.5	SPT	Dike 1 (Lean)														26			
323	58	25.5 - 27	SPT	Dike 1 (Lean)														20.6			
324	58	27 - 28.5	SPT	Dike 1 (Lean)														33.1			
325	58	28.5 - 30	SPT	Dike 1 (Lean)														40.7			
326	58	30 - 31.5	SPT	Dike 1 (Lean)														70.3			
328	58	32.5 - 34	SPT	Alluvial (Granular)	15					15	15				15			43.1			
329	58	35 - 36.5	SPT	Alluvial (Granular)	15					15	15				15			48.9			
330	58	37.5 - 39	SPT	Alluvial (Granular)	15					15	15				15			20.3			
327	58	32.5-39	comp	Alluvial (Granular)	15	17.8	40.1	15.1	27	100	2.68	68	36	32	1.33			37.4	SM	Silty Sand with Gravel	A-7-5 (8)
331	58	40 - 41.5	SPT	Alluvial (Granular)														48.8			
333	58	42.5 - 44	SPT	Alluvial (Granular)	16					16	16				16			35.4			
334	58	45 - 46.5	SPT	Alluvial (Granular)	16					16	16				16			33.6			
335	58	47.5 - 49	SPT	Alluvial (Granular)	16					16	16				16			35.5			
336	58	50 - 51.5	SPT	Alluvial (Granular)	16					16	16				16			16.6			
337	58	52.5 - 54	SPT	Alluvial (Granular)	16					16	16				16			41.4			
338	58	55 - 56.5	SPT	Alluvial (Granular)	16					16	16				16			14			
339	58	57.5 - 58.1	SPT	Alluvial (Granular)	16					16	16				16			13.4			
332	58	42.5-58.1	comp	Alluvial (Granular)	16	25.7	28.8	17.3	28.2	100	2.67	57	23	34	1.42			27.1	SC	Clayey Sand with Gravel	A-7-6 (11)
340	58	60 - 60.2	SPT	Alluvial (Granular)														6.7			
	58 A	5-7	ST	Dike 2 (Fat)																	
	58 A	15-17	ST	Dike 2 (Fat), Dike 1 (Lean)																	
	58 A	25-27	ST	Dike 1 (Lean)																	
	58 A	35-37	ST	Alluvial (Granular)																	
	58 A	45-47	ST	Alluvial (Granular)																	
341	59	0 - 1.5	SPT	Dike 1 (Fat)														16.3			
342	59	1.5 - 3	SPT	Dike 1 (Fat)														36.6			
343	59	3 - 4.5	SPT	Dike 1 (Fat)														43.4			
345	59	4.5 - 6	SPT	Dike 1 (Fat)	17					17	17				17			45			
346	59	6 - 7.5	SPT	Dike 1 (Fat)	17					17	17				17			33.4			
347	59	7.5 - 9	SPT	Dike 1 (Fat)	17					17	17				17			29.8			
348	59	9 - 10.5	SPT	Dike 1 (Fat)	17					17	17				17			36.1			
349	59	10.5 - 12	SPT	Dike 1 (Fat)	17					17	17				17			36.7			
350	59	12 - 13.5	SPT	Dike 1 (Fat)	17					17	17				17			51.8			
351	59	13.5 - 15	SPT	Dike 1 (Fat)	17					17	17				17			51.6			
352	59	15 - 16.5	SPT	Dike 1 (Fat)	17					17	17				17			45.5			
353	59	16.5 - 18	SPT	Dike 1 (Fat)	17					17	17				17			61.2			
344	59	4.5-18	comp	Dike 1 (Fat)	17	22	27.7	12.5	37.8	100	2.67	72	25	47	1.38			43.5	CH	Sandy fat clay with Gravel	A-7-6 (18)
354	59	18 - 19.5	SPT	Dike 1 (Fat)														44.8			
355	59	19.5 - 21	SPT	Dike 1 (Fat)														51.3			
356	59	21 - 23.5	SPT	Dike 1 (Fat)														49.3			
357	59	23.5 - 26	SPT	Dike 1 (Fat)														30.8			
358	59	26 - 28.5	SPT	Dike 1 (Fat)														32			
359	59	28.5 - 31	SPT	Dike 1 (Fat)														29.6			
360	59	31 - 33.5	SPT	Dike 1 (Fat)														28.2			

Cumberland Fossil Plant
Stantec Ash Pond Laboratory Results
Project No. 175539016

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
361	59	33.5 - 35	SPT	Dike 1 (Fat)														NR			
475	59 A	38 - 38	SPT	Alluvial (Fat Clay)														NR			
362	60	0 - 1.5	SPT	Dike 2 (Fat)														16.7			
364	60	1.5 - 3	SPT	Dike 2 (Fat)	18					18	18				18			13			
365	60	3 - 4.5	SPT	Dike 2 (Fat)	18					18	18				18			21.5			
366	60	4.5 - 6	SPT	Dike 2 (Fat)	18					18	18				18			21.6			
367	60	6 - 7.5	SPT	Dike 2 (Fat)	18					18	18				18			25.5			
368	60	7.5 - 9	SPT	Dike 2 (Fat)	18					18	18				18			24.6			
369	60	9 - 10.5	SPT	Dike 2 (Fat)	18					18	18				18			25.5			
370	60	10.5 - 12	SPT	Dike 2 (Fat)	18					18	18				18			23.6			
371	60	12 - 13.5	SPT	Dike 2 (Fat)	18					18	18				18			21.6			
372	60	13.5 - 15	SPT	Dike 2 (Fat)	18					18	18				18			24.3			
363	60	1.5-15	comp	Dike 2 (Fat)	18	6.5	27	26	40.5	100	2.70	52	16	36	1.00			22.4	CH	Sandy Fat Clay	A-7-6 (22)
373	60	15 - 16.5	SPT	Dike 2 (Fat)														31.3			
374	60	16.5 - 18	SPT	Dike 1 (Fat)														35.6			
376	60	18 - 19.5	SPT	Dike 1 (Fat)	19					19	19				19			33.4			
377	60	19.5 - 21	SPT	Dike 1 (Fat)	19					19	19				19			28.2			
378	60	21 - 22.5	SPT	Dike 1 (Fat)	19					19	19				19			32.4			
379	60	22.5 - 24	SPT	Dike 1 (Fat)	19					19	19				19			41.8			
380	60	24 - 25.5	SPT	Dike 1 (Fat)	19					19	19				19			37.5			
381	60	25.5 - 27	SPT	Dike 1 (Fat)	19					19	19				19			40.3			
382	60	27 - 28.5	SPT	Dike 1 (Fat)	19					19	19				19			40.9			
383	60	28.5 - 30	SPT	Dike 1 (Fat)	19					19	19				19			39.7			
384	60	30 - 31.5	SPT	Dike 1 (Fat)	19					19	19				19			33.1			
375	60	18-31.5	comp	Dike 1 (Fat)	19	1.1	9	24.9	65	100	2.66	69	27	42	0.70			36.4	CH	Fat Clay	A-7-6 (43)
385	60	31.5 - 33	SPT	Dike 1 (Fat)														38.6			
387	60	33 - 34.5	SPT	Alluvial (Fat Clay)	20					20	20				20			41.1			
388	60	34.5 - 36	SPT	Alluvial (Fat Clay)	20					20	20				20			34.3			
389	60	36 - 37.5	SPT	Alluvial (Fat Clay)	20					20	20				20			23.9			
390	60	37.5 - 39	SPT	Alluvial (Fat Clay)	20					20	20				20			23			
391	60	39 - 40.5	SPT	Alluvial (Fat Clay)	20					20	20				20			29.9			
392	60	40.5 - 42	SPT	Alluvial (Fat Clay)	20					20	20				20			25.7			
386	60	33-42	comp	Alluvial (Fat Clay)	20	1.9	7.4	28.7	62	100	2.68	68	23	45	0.83			29.7	CH	Fat Clay	A-7-6 (46)
393	60	42 - 43.5	SPT	Alluvial (Fat Clay)														28.4			
394	60	43.5 - 43.6	SPT	Alluvial (Fat Clay)														2.6			
395	61	4.5 - 6	SPT	Dike 1 (Fat)														2			
396	61	6 - 7.5	SPT	Dike 1 (Fat)														22.6			
397	61	7.5 - 9	SPT	Dike 1 (Fat)														NR			
398	61	9 - 10.5	SPT	Dike 1 (Fat)														23.9			
399	61	10.5 - 12	SPT	Dike 1 (Fat)														23.6			
400	61	12 - 13.5	SPT	Dike 1 (Fat)														23.2			
401	61	13.5 - 15	SPT	Dike 1 (Fat)														38.4			
402	61	15 - 16.5	SPT	Dike 1 (Fat)														23			
403	61	16.5 - 18	SPT	Dike 1 (Fat)														27.1			
404	61	18 - 19.5	SPT	Dike 1 (Fat)														34			

Cumberland Fossil Plant
Stantec Ash Pond Laboratory Results
Project No. 175539016

						Particle Size						Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	Particle Size	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
405	61	19.5 - 21	SPT	Dike 1 (Fat)														34.4			
406	61	21 - 22.5	SPT	Dike 1 (Fat)														23.1			
407	61	22.5 - 22.5	SPT	Dike 1 (Fat)														31.5			
408	62	0 - 1.5	SPT	Dike 2 (Fat)														21			
409	62	1.5 - 3	SPT	Dike 2 (Fat)														16.8			
410	62	3 - 4.5	SPT	Dike 2 (Fat)														20.8			
411	62	4.5 - 6	SPT	Dike 2 (Fat)														18.9			
412	62	6 - 7.5	SPT	Dike 2 (Fat)														22.2			
413	62	7.5 - 9	SPT	Dike 2 (Fat)														23.5			
414	62	9 - 10.5	SPT	Dike 2 (Fat)														21.8			
415	62	10.5 - 12	SPT	Dike 2 (Fat)														17.9			
416	62	12 - 13.5	SPT	Dike 2 (Fat)														24.5			
417	62	13.5 - 15	SPT	Dike 1 (Fat)														NR			
418	62	15 - 16.5	SPT	Dike 1 (Fat)														24.5			
419	62	16.5 - 18	SPT	Dike 1 (Fat)														17.8			
420	62	18 - 19.5	SPT	Dike 1 (Fat)														15.3			
421	62	19.5 - 19.9	SPT	Dike 1 (Fat)														10.8			
422	62	21 - 21.4	SPT	Dike 1 (Fat)														14.2			
423	62	22.5 - 23.8	SPT	Dike 1 (Fat)														41.8			
	62 A	5-10	BAG	Dike 2 (Fat)																	
476		fill soil									2.70					14.6	114.3	14.2			
665		fill soil				24.7	22.1	25.9	27.3	100	2.68	33	18	15	0.65			14.2	CL	Gravelly lean clay with sand	A-6 (5)

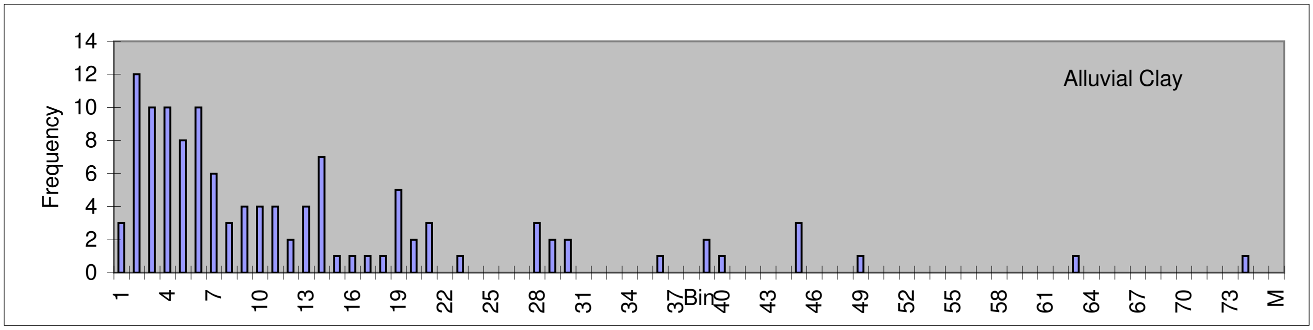
Cumberland Fossil Plant
External Ash Pond Laboratory Test Results
Project No. 175539016

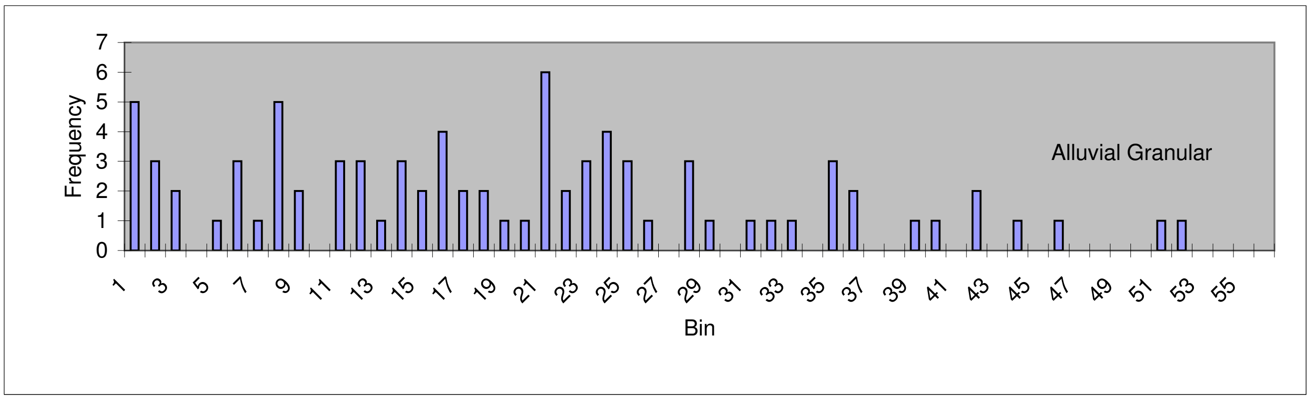
						Particle Size							Atterberg Limits				Standard Proctor			Classification		
Sample No.	Hole	Depth	Sample Type	Material	Composite	Gravel	Sand	Silt	Clay	%> No. 4	%< No. 200	Gs	LL	PL	PI	AI	w_{opt} (%)	g_{dmax} (pcf)	MC	USCS	Group Name	AASHTO
	B-48A	5-15	Bulk	Dike 2 (Lean)		0	26.9	36.9	36.2	0	73.1	2.7	54	20	34		18.9	105.6	29.3	CH	Fat Clay	A-7-6 (24)
	B-52A	5-10	Bulk	Dike 2 (Lean)		0	30.6	15.1	54.3	0	69.4	2.7	61	21	40		21.9	102.1		CH	Fat Clay	A-7-6 (27)
	B-53A	43.8-44.2	ST	Alluvial (Clay)																		
	B-54A	30.0-30.6	ST	Dike 2 (Lean)																		
	B-54A	30.6-31.8	ST	Dike 2 (Lean)																		
	B-54A	45.2-46.4	ST	Alluvial (Clay)																		
	B-58	10-20	Bulk	Dike 2 (Fat)		0	31.6	11.3	57.1	0	68.4	2.7	68	23	45		20.2	103.1		CH	Fat Clay	A-7-6 (30)
				Dike 1 (Lean @ 16-20)																		
	B-58A	25.4-26.0	ST	Dike 1 (Lean)																		

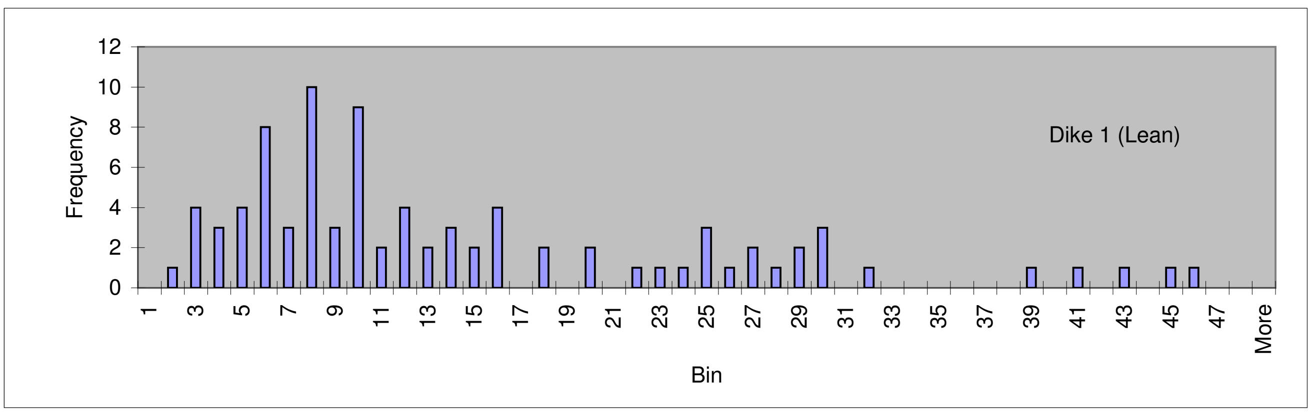
	Permeability						
Hole	CU, ST	FHP, 2.8"	w_0 (%)	γ_t (pcf)	γ_d (pcf)	% Compaction	
B-48A		$2.8*10^{-8}$	22.1	122.2	100.1	94.8	Remolded
B-52A		$3.5*10^{-8}$	24.5	120.6	96.8	94.8	Remolded
B-53A		$7.4*10^{-8}$	27.2	120.6	94.9		UD
B-54A		$6.5*10^{-8}$	31.1	127.4	97.1		UD
B-54A							
B-54A							
B-58		$2.7*10^{-8}$	23.1	121.1	98.4	95.4	Remolded
B-58A		$6.3*10^{-8}$	30.8	127.5	97.4		UD

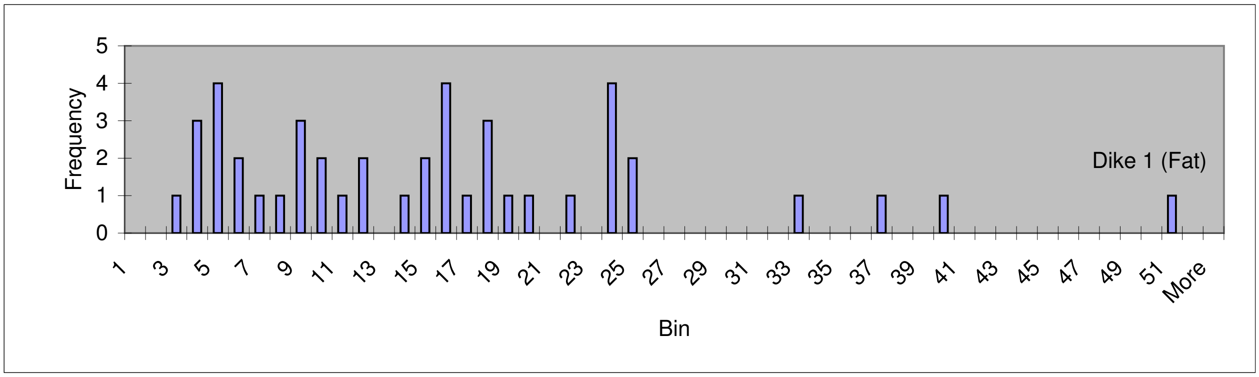
	CU Triaxial														
Hole		G_s	S_{r0} (%)	e_0	γ_{w0} (pcf)	w_0 (%)	γ_{d0} (pcf)	Lateral Pressure (psi)	e_c	w_c (%)	γ_{dc} (pcf)	c' (psi)	c' (psf)	ϕ' (deg)	tan ϕ' (deg)
B-48A	Brown fat cl	2.7*	83.0	0.682	121.2	21.0	100.2	9.939	0.606	22.4	105				
		2.7*	82.1	0.686	120.9	20.9	100.0	29.99	0.572	21.2	107.2				
		2.7*	81.5	0.681	121.0	20.6	100.3	49.94	0.548	20.3	108.9	1.53	220.3	29.5	0.57
B-52A	Brown sand	2.7*	86.1	0.74	119.7	23.6	96.87	9.972	0.627	23.2	103.6				
		2.7*	84.5	0.747	119.1	23.4	96.48	29.82	0.592	21.9	105.9				
		2.7*	84.8	0.744	119.3	23.4	96.68	49.99	0.541	20	109.4	0.675	97.2	29.8	0.57
B-53A	Gray-brown sandy lean clay														
B-54A	Gray brown lean clay														
B-54A	Brown silty	2.7*	102.7	0.533	132.3	20.3	110	9.972	0.546	20.2	109				
		2.7*	96.9	0.541	130.6	19.4	109.4	49.99	0.503	18.6	112.1	3.06	220.3	32.1	0.63
B-54A		2.7*	98.1	0.686	124.9	24.9	99.97	9.687	0.68	25.2	100.3				
		2.7*	96.3	0.651	125.8	23.2	102.1	29.97	0.624	23.1	103.8	0.349	220.3	33.3	0.66
B-58	Brown sand	2.7*	86.7	0.731	120.3	23.5	97.37	10.01	0.671	24.9	100.9				
		2.7*	89.3	0.707	121.9	23.4	98.75	29.99	0.654	24.2	101.9				
		2.7*	90.1	0.707	122.0	23.6	98.72	49.98	0.615	22.8	104.4	1.77	254.9	29.4	0.56
B-58A	Gray-brown	2.7*	90.7	0.83	117.8	27.9	92.13	9.96	0.814	30.1	92.94				
		2.7*	98.6	0.705	124.3	25.7	98.88	49.98	0.697	25.8	99.32	4.16	220.3	22.3	0.41

Attachment 3
Soil N-Count Histograms

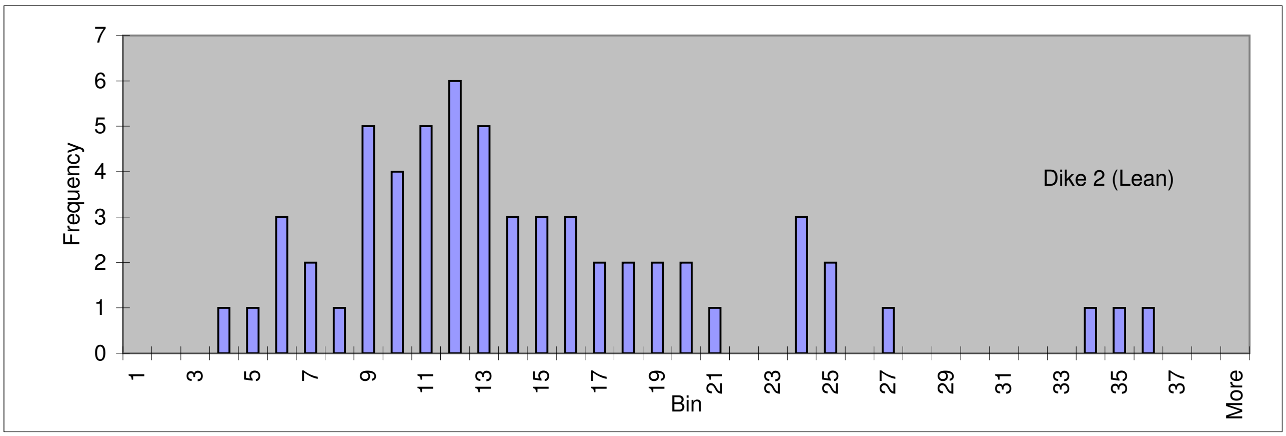

Alluvial Clay
Frequency
Bin


Alluvial Granular
Frequency
Bin

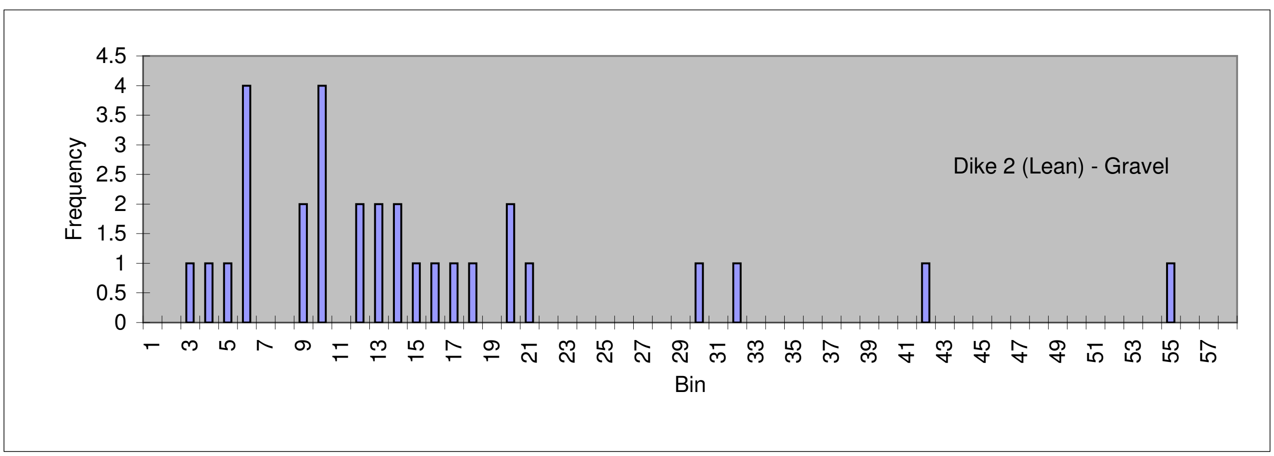

Dike 1 (Lean)
Frequency
Bin



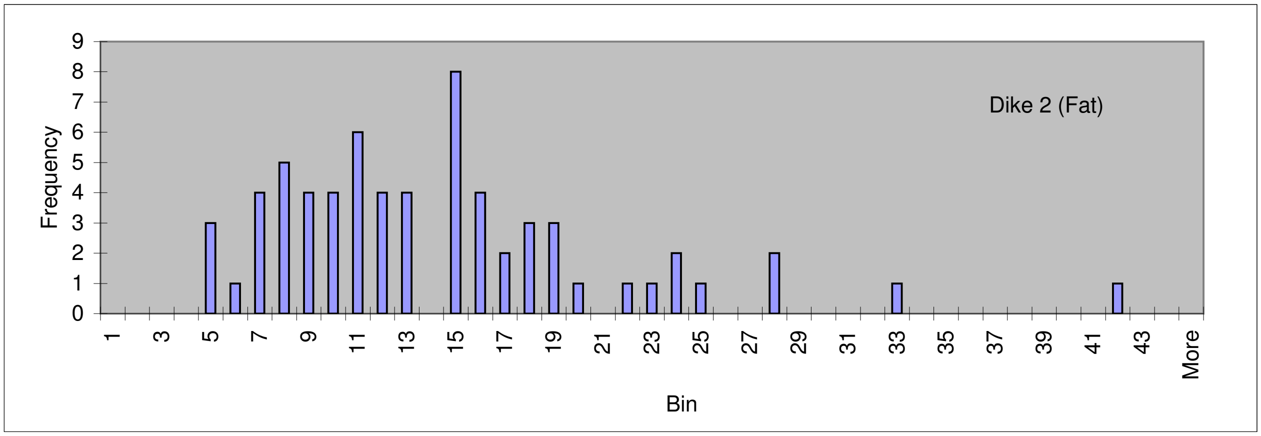
Frequency
Bin
Dike 1 (Fat)
More

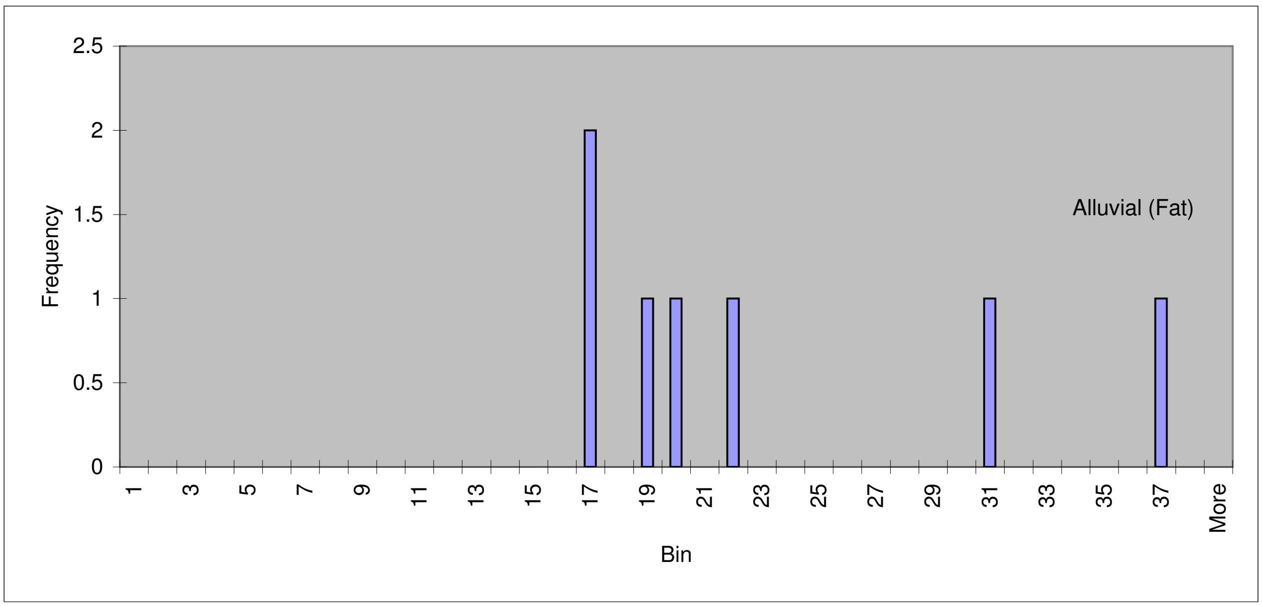


Frequency
Bin
Dike 2 (Lean)
More



Frequency
Bin
Dike 2 (Lean) - Gravel


Dike 2 (Fat)
Frequency
Bin
0
1
2
3
4
5
6
7
8
9
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
41
43
More


Alluvial (Fat)
Frequency
Bin
0
0.5
1
1.5
2
2.5
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
More

Attachment 4
Technical References

Rawls et al (1982)

TABLE 2. HYDROLOGIC SOIL PROPERTIES CLASSIFIED BY SOIL TEXTURE

Texture class	Sample size	Total porosity (θ), cm³/cm³	Residual saturation (θ_r), cm³/cm³	Effective porosity (θ_e), cm³/cm³	Bubbling pressure (ψ_b) Arithmetic, cm	Bubbling pressure (ψ_b) Geometric,† cm	Pore size distribution (λ) Arithmetic	Pore size distribution (λ) Geometric†	Water retained at −0.33 bar tension, cm³/cm³	Water retained at −15 bar tension, cm³/cm³	Saturated Hydraulic Conductivity‡ (K_s) cm/h
Sand	762	0.437** (0.374–0.500)	0.020 (0.001–0.039)	0.417 (0.354–0.480)	15.98 (0.24–31.72)	7.26 (1.36–38.74)	0.694 (0.298–1.090)	0.592 (0.334–1.051)	0.091 (0.018–0.164)	0.033 (0.007–0.059)	21.00
Loamy sand	338	0.437 (0.368–0.506)	0.035 (0.003–0.067)	0.401 (0.329–0.473)	20.58 (0.0–45.20)	8.69 (1.80–41.85)	0.553 (0.234–0.872)	0.474 (0.271–0.827)	0.125 (0.060–0.190)	0.055 (0.019–0.091)	6.11
Sandy loam	666	0.453 (0.351–0.555)	0.041 (0.0–0.106)	0.412 (0.283–0.541)	30.20 (0.0–64.01)	14.66 (3.45–62.24)	0.378 (0.140–0.616)	0.322 (0.186–0.558)	0.207 (0.126–0.288)	0.095 (0.031–0.159)	2.59
Loam	383	0.463 (0.375–0.551)	0.027 (0.0–0.074)	0.434 (0.334–0.534)	40.12 (0.0–100.3)	11.15 (1.63–76.40)	0.252 (0.086–0.418)	0.220 (0.137–0.355)	0.270 (0.195–0.345)	0.117 (0.069–0.165)	1.32
Silt loam	1206	0.501 (0.420–0.582)	0.015 (0.0–0.058)	0.486 (0.394–0.578)	50.87 (0.0–109.4)	20.76 (3.58–120.4)	0.234 (0.105–0.363)	0.211 (0.136–0.326)	0.330 (0.258–0.402)	0.133 (0.078–0.188)	0.68
Sandy clay loam	498	0.398 (0.332–0.464)	0.068 (0.0–0.137)	0.330 (0.235–0.425)	59.41 (0.0–123.4)	28.08 (5.57–141.5)	0.319 (0.079–0.559)	0.250 (0.125–0.502)	0.255 (0.186–0.324)	0.148 (0.085–0.211)	0.43
Clay loam	366	0.464 (0.409–0.519)	0.075 (0.0–0.174)	0.390 (0.279–0.501)	56.43 (0.0–124.3)	25.89 (5.80–115.7)	0.242 (0.070–0.414)	0.194 (0.100–0.377)	0.318 (0.250–0.386)	0.197 (0.115–0.279)	0.23
Silty clay loam	689	0.471 (0.418–0.524)	0.040 (0.0–0.118)	0.432 (0.347–0.517)	70.33 (0.0–143.9)	32.56 (6.68–158.7)	0.177 (0.039–0.315)	0.151 (0.090–0.253)	0.366 (0.304–0.428)	0.208 (0.138–0.278)	0.15
Sandy clay	45	0.430 (0.370–0.490)	0.109 (0.0–0.205)	0.321 (0.207–0.435)	79.48 (0.0–179.1)	29.17 (4.96–171.6)	0.223 (0.048–0.398)	0.168 (0.078–0.364)	0.339 (0.245–0.433)	0.239 (0.162–0.316)	0.12
Silty clay	127	0.479 (0.425–0.533)	0.056 (0.0–0.136)	0.423 (0.334–0.512)	76.54 (0.0–159.6)	34.19 (7.04–166.2)	0.150 (0.040–0.260)	0.127 (0.074–0.219)	0.387 (0.332–0.442)	0.250 (0.193–0.307)	0.09
Clay	291	0.475 (0.427–0.523)	0.090 (0.0–0.195)	0.385 (0.269–0.501)	85.60 (0.0–176.1)	37.30 (7.43–187.2)	0.165 (0.037–0.293)	0.131 (0.068–0.253)	0.396 (0.326–0.466)	0.272 (0.208–0.336)	0.06

* First line is the mean value.
Second line is ± one standard deviation about the mean
† Antilog of the log mean
‡ Obtained from Fig. 2

water retention at specific matric potentials to (a) percent sand, silt, clay, organic matter content, and bulk density; (b) percent sand, silt, and clay, organic matter, bulk density and 15 bar water retention; and (c) percent particle size content, organic matter, bulk density, and 1/3 and 15 bar water retention. These levels of analysis demonstrate the predictive ability achieved by adding factors which require more costly and/or time consuming laboratory procedures to the standard soil survey data analysis. For example, particle size distribution and organic matter data are the least expensive data to obtain while 1/3 bar water retention and bulk density data are the most expensive. The 15 bar water retention value is an intermediate cost item.

The three levels of regression equations are summarized in Table 3 for the 12 matric potentials reported in the Gupta and Larson (1979) paper. The addition of the 15 bar water retention value and both the 1/3 and 15 bar water retention values to the percent sand, silt and clay, bulk density and organic matter content markedly increased the accuracy (Table 3). In general, the 1/3 bar water retention value was more significant for the matric potentials between 0 and −1/3 bar and the 15 bar water retention was significant for the matric potentials between −1/3 and the −15 bar.

The data base used to develop the equations in Table 3 included 2,541 soils horizons with a wide range of sand (mean 56 percent, range 0.1-99 percent), silt (mean 26 percent, range 0.1-93 percent), clay (mean 18 percent, range 0.1-94 percent), organic matter (mean 0.66 percent, range 0.1-12.5 percent), bulk density (mean 1.42 gm/cm³, range 0.1-2.09 percent). Most agricultural soils, including both expanding (montmorillonite) and nonexpanding (kolinite, illite, chlorite, and vermiculite) type clay minerals are represented.

HYDRAULIC CONDUCTIVITY

A generalized set of unsaturated hydraulic conductivity values was defined for the USDA soil texture classes (SCS, 1975) by combining the results of numerous experiments reported in the literature. Table 4 contains the principle references from which the unsaturated hydraulic conductivity data were obtained. The generalized conductivity curves were obtained by first digitizing the many reference curves by enough points to adequately define them by straight line segments. Using information from the reference or standard soil survey reports, these data were classed and sorted according to the USDA soil texture classes. An average representative curve was estimated by visual analyses for each soil texture class. Some minor adjustments of the average curves were made to provide a uniform family of relationships as shown in Fig. 2.

Generalized curves given in Fig. 2 cannot accurately define the conductivity of any particular soil based only on texture. Each soil will have other characteristics which will cause deviation. However, the degree of definition provided by textural sorting shows that this is a major determinant. Thus, these relationships will provide adequate estimates for applications where more detailed data are not available.

Saturated Hydraulic Conductivity Relationship

The saturated hydraulic conductivities given in Table 2 were taken from Fig. 2. Using the saturated hydraulic conductivity data set compiled by Mualem (1976) a set of mean saturated hydraulic conductivity values were developed according to soil texture and compared with those in Table 2. The Mualem values were similar to those in Table 2, further verifying the representativeness of the saturated hydraulic conductivities in Table 2.

Brutsaert (1967) derived a saturated conductivity relationship by substituting the Brooks and Corey equation into the Childs, Collis-George (1950) permeability in-

Bell (2000)

Table 1.17 Range of compressibility of fine soils.
(a) Compressibility index

Soil type	Range C_c	Degree of compressibility
Soft clay	Over 0.3	Very high
Clay	0.3–0.15	High
Silt	0.15–0.075	Medium
Sandy clay	Less than 0.075	Low

(b) Coefficient of volume compressibility. Some typical values of coefficient of volume compressibility.

Coefficient of volume compressibility (m^2 MN^{-1})	Degree of compressibility	Soil types
Above 1.5	Very high	Organic alluvial clays and peats
0.3–1.5	High	Normally consolidated alluvial clays
0.1–0.3	Medium	Varved and laminated clays Firm to stiff clays
0.05–0.1	Low	Very stiff or hard clays Tills
Below 0.05	Very low	Heavily overconsolidated tills

consolidated clays is related to their liquid limit, the relationship between the two being expressed as:

$$C_c = 0.009(\mathrm{LL} - 10) \tag{1.11}$$

This relationship does not apply to highly organic clays, to where the liquid limit exceeds 100% or to where the liquid limit is exceeded by the natural moisture content. The coefficient of volume compressibility is defined as the volume change per unit volume per unit increase in load. The value of m_v for a given soil depends upon the stress range over which it is determined. Anon (1990) recommended that it should be calculated for a pressure increment of 100 kPa in excess of the effective overburden pressure on the soil at the depth in question. Some typical values of m_v are given in Table 1.17b.

The compressibility of a soil is dependent on the average rate of compression and the soil structure has a substantial time-dependent resistance to compression. At the instant when a load, p, on a layer of clay is suddenly increased by Δp, the thickness of the layer remains unchanged. Hence, the application of the load, Δp, produces an equal increase, Δu, in the hydrostatic pressure of the pore water. As time proceeds, the excess pore water pressure is dissipated gradually and finally disappears, whilst the grain-to-grain pressure simultaneously increases from an initial value p to $p + \Delta p$. The ratio between the decrease of the void ratio, Δe, at time, t, and the ultimate decrease, Δe_1, represents the degree of consolidation, U, at time, t:

$$U = 100\,\frac{\Delta e}{\Delta e_1} \tag{1.12}$$

With a given thickness, H, of a layer of clay the degree of consolidation at time, t, depends exclusively on the coefficient of consolidation, c_v:

Attachment 5
Stantec (2009a)
Reference Tables

Geotechnical Laboratory Summary

			Shelby Tube Extractions (UC Summary Sheet)			CU Triaxial								Moisture-Density Relationship		Atterberg Limits				Particle Size Analysis (ASTM) (%)									Permeability
Boring	Depth (ft)	Material Type	γ_{w0} (pcf)	w_0 (%)	γ_{d0} (pcf)	G_s	S_{r0} (%)	e_0	γ_{w0} (pcf)	w_0 (%)	γ_{d0} (pcf)	c' (psf)	ϕ' (deg)	γ_{dmax} (pcf)	ω_{opt} (%)	LL	PL	PI	Activity Index	Gravel *(3"- 4.75 mm) (> No. 4)*	Coarse Sand *(4.75-2 mm) (No. 4-No. 10)*	Medium Sand *(2-0.425 mm) (No. 10-No. 40)*	Fine Sand *(0.425 - 0.075 mm) (No. 40-No. 200)*	Silt *(0.075-0.005 mm) (<No. 200)*	Clay *(<0.005 mm)*	USCS	Group Name	AASHTO	Avg. k (20°C) (cm/s)
B-5	18.0-20.0	Dike 1	119.1	24.3	95.8	2.64	89.3	0.719	119.2	24.3	95.9	320	28.7																
B-5	18.0-20.0	Dike 1	121.5	27.2	95.5	2.64	95.3	0.699	121.5	25.2	97																		
B-9A	25.5-27.5	Dike 1	126.9	24.9	101.6																								
B-21B	59.0-61.0	Dike 1		31.1																									
B-21B	59.0-61.0	Dike 1		22.5																									
B-29A	29.0-31.0	Dike 1	124.3	23.8	100.3	2.7*	94.1	0.646	125.4	22.5	102.4	16.4	36.8																
B-29A	29.0-31.0	Dike 1	125.6	20.1	104.6	2.7*	97	0.595	128.3	21.4	105.7																		
B-63A	5.0-7.0	Dike 1		19.9																									
B-63A	8.0-10.0	Dike 1	125.2	27.1	98.5							1000	17.7																
B-63A	8.0-10.0	Dike 1	126.3	20.4	104.8																								
B-63A	5.0-7.0	Dike 1	120.2	22.1	98.5																								
B-6	24.0-34.5	Dike 1		31.1		2.68										56	20	36	1.57	42.5	6.3	8.5	2.2	15.0	25.5	GC	Clayey gravel with sand	A-7-6 (8)	
B-8	1.5-19.5	Dike 1		15.8		2.64										36	19	17	0.57	1.3	0.8	7.4	4.9	49.0	36.6	CL	Lean clay	A-6 (14)	
B-14	1.5-18.0	Dike 1														44	19	25											
B-26	1.5-13.5	Dike 1														44	17	27											
B-26	15.0-21.0	Dike 1/Alluvial Clay														38	16	22											
B-30	0.0-7.5	Dike 1														46	20	26											
B-30	9.0--16.5	Dike 1														36	19	17											
B-34	0.0-6.0	Dike 1														44	18	26											
B-34	7.5-16.5	Dike 1														36	17	19											
B-3A	8.0-10.0	Dike 2	127.4	19.4	106.7																								
B-3A	14.0-16.0	Dike 2	125.2	25.1	100.1																								
B-3A	14.0-16.0	Dike 2	115.9	28.8	90.0																								
B-9A	3.0-5.0	Dike 2		17.3																									
B-9A	13.0-15.0	Dike 2		21.0																									
B-9B	6.0-8.0	Dike 2	129.6	22.2	106.0																								7.00E-08
B-9B	9.5-11.5	Dike 2	131.4	20.9	108.7																								2.30E-08
B-9B	14.0-16.0	Dike 2		21.7																									
B-21B	15.0-17.0	Dike 2		25.1																									
B-21B	20.0-22.0	Dike 2	128.1	24.6	102.8																								1.80E-08
B-29A	17.0-19.0	Dike 2	123.4	25.8	98.1																								2.20E-08
B-29B	12.0-13.4	Dike 2	124.6	20.0	103.8	2.7*	102.4	0.675	126.4	25.6	100.6																		
B-29B	12.0-13.4	Dike 2	131.3	21.4	108.2	2.7*	99.9	0.507	132.8	18.8	111.8	0	36.5																
B-29B	14.5-16.5	Dike 2	127.5	18.3	107.7	2.7*	98.7	0.466	134.6	17	115																		
B-37A	19.5-21.5	Dike 2	117.1	30.0	90.1																								
B-37A	19.5-21.5	Dike 2		34.9																									
B-37B	8.0-10.0	Dike 2	128.4	22.1	105.2																								
B-37B	11.0-12.4	Dike 2	133.1	18.5	112.3																								1.40E-08
B-37B	11.0-12.4	Dike 2	127.8	18.9	107.5																								
B-6	0.0-10.0	Dike 2		24.3		2.55										55	18	37	0.93	6.0	4.3	7.9	13.9	22.4	45.5	CH	Sandy fat clay	A-7-6 (23)	
B-9	0.0-6.0	Dike 2		20.3		2.70										50	17	33	0.92	8.8	3.1	6.2	13.2	27.7	41.0	CH/CL	Sandy fat clay	A-7-6 (21)	
B-9	9.0-12.0	Dike 2		22.2		2.68										51	19	32	0.78	4.9	2.4	3.8	5.9	34.3	48.7	CH/CL	Fat clay with sand	A-7-6 (27)	
B-12	15.0	Dike 2		21.2		2.77										51	18	33	0.94	10.8	2.6	6.2	7.4	32.0	41.0	CH/CL	Fat clay with sand	A-7-6 (23)	
B-21	0.0-9.0	Dike 2		23.6		2.81										49	18	31	0.97	6.8	3.3	7.1	12.2	33.1	37.5	CL/CH	Lean clay with sand	A-7-6 (21)	
B-21	12.0-18.0	Dike 2		91.1		2.78										56	20	36	0.77	0.7	2.1	6.1	5.5	31.8	53.8	CH	Fat clay	A-7-6 (33)	
B-25	10.5-18.0	Dike 2		21.5		2.54								104.4	18.4	58	22	36	0.72	0.3	1.8	3.9	6.3	30.3	57.4	CH	Fat clay	A-7-6 (34)	
B-29	0.3-10.0	Dike 2		12.6		2.58										46	21	25	0.48	4.4	3.0	7.6	7.7	21.2	56.1	CL	Lean clay with sand	A-7-6 (19)	
B-29	10.4-14.5	Dike 2		24.8		2.57										46	17	29	0.63	8.4	3.5	7.3	7.3	21.9	51.6	CL	Lean clay with sand	A-7-6 (20)	
B-37	6.0-14.5	Dike 2		16.3		2.61								112.0	16.6	53	18	35	0.63	0.6	0.3	2.1	3.2	28.8	65.0	CH	Fat clay	A-7-6 (35)	
B-42	4.5-15.0	Dike 2														44	18	26											
B-19C	17.5-19.5	Dike 3	128.7	12.4	114.5	2.7*	88.8	0.547	128.6	18	109																		
B-19C		Dike 3				2.7*	92.6	0.687	123.5	23.6	99.89	0	31																
B-19C	10.5-12.5	Dike 3	125.9	17.5	107.1	2.7*	89.3	0.633	124.8	20.9	103.2																		
B-19C	15.0-16.0	Dike 3		18.8																									
B-19C	20.0-22.0	Dike 3	127.3	13.8	111.8																								3.20E-08
B-22C	22.0-24.0	Dike 3		27.3																									
B-24C	10.0-11.6	Dike 3		14.7																									
B-28A	8.0-9.5	Dike 3		18.6																									
B-28C	14.5-16.5	Dike 3	121.9	20.0	101.6																								
B-36A	13.0-14.6	Dike 3	128.7	14.9	112.0																								
B-36B	10.8-12.8	Dike 3		20.8																									
B-36B	13.0-13.7	Dike 3		12.7																									
B-36B	19.0-21.0	Dike 3	123.3	29.7	95.1																								
B-43A	20.0-22.0	Dike 3		27.3																									
B-19	7.5-25.5	Dike 3		19.8		2.78										48	19	29	1.32	26.2	6.6	9.4	8.8	22.5	26.5	GC	Clayey gravel with sand	A-7-6 (10)	
B-22	6.0-13.5, ...	Dike 3		14.3		2.72										36	18	18	1.38	44.6	6.7	10.1	6.4	15.5	16.7	GC	Clayey gravel with sand	A-2-6 (1)	
B-24	4.5-22.5	Dike 3		16.4		2.51										39	19	20	1.05	30.2	7.5	10.1	7.3	21.5	23.4	GC	Clayey gravel with sand	A-6 (5)	
B-28	1.5-15.0	Dike 3		6.5		2.66								124.3	11.0	36	17	19	0.63	23.2	7.9	12.7	8.7	11.7	35.8	SC	Clayey sand with gravel	A-6 (5)	
B-32	1.5-16.5	Dike 3		16.0		2.63										40	17	23	1.15	32.8	6.7	9.1	6.9	20.1	24.4	GC	Clayey gravel with sand	A-6 (6)	
B-5	20.0-22.0	Alluvial Clay		25.2																									
B-15B	46.0-48.0	Alluvial Clay	120.3	26.5	95.1																								2.30E-08
B-15B	46.0-48.0	Alluvial Clay	121.4	26.9	95.6																								
B-29A	50.0-52.0	Alluvial Clay	110.0	33.1	82.7																								6.60E-09
B-29A	50.0-52.0	Alluvial Clay	112.9	30.3	86.6																								
B-43A	47.0-49.0	Alluvial Clay	128.0	20.2	106.4																								
B-43A	50.0-52.0	Alluvial Clay	123.7	25.6	98.5	2.67	98.6	0.657	125.0	24.3	100.6	440	30.3																
B-43A	50.0-52.0	Alluvial Clay	125.0	24.2	100.6	2.67	96.9	0.677	123.9	24.6	99.4																		

Geotechnical Laboratory Summary

			Extractions (UC Summary Sheet)			CU Triaxial								Moisture-Density Relationship		Atterberg Limits				Particle Size Analysis (ASTM) (%)									Permeability
Boring	Depth (ft)	Material Type	γ_{w0} (pcf)	w_0 (%)	γ_{d0} (pcf)	G_s	S_{r0} (%)	e_0	γ_{w0} (pcf)	w_0 (%)	γ_{d0} (pcf)	c' (psf)	ϕ' (deg)	γ_{dmax} (pcf)	ω_{opt} (%)	LL	PL	PI	Activity Index	Gravel *(3"- 4.75 mm) (> No. 4)*	Coarse Sand *(4.75-2 mm) (No. 4-No. 10)*	Medium Sand *(2-0.425 mm) (No. 10-No. 40)*	Fine Sand *(0.425 - 0.075 mm) (No. 40-No. 200)*	Silt *(0.075-0.005 mm) (<No. 200)*	Clay *(<0.005 mm)*	USCS	Group Name	AASHTO	Avg. k (20°C) (cm/s)
B-2	55.0-69.0	Alluvial Clay		26.9		2.56										36	20	16	0.62	0.0	0.0	1.3	3.6	59.3	35.8	CL	Lean clay	A-6 (16)	
B-4	43.5-56.5	Alluvial Clay		27.2		2.53										40	21	19	0.59	0.0	0.0	4.4	3.5	47.7	44.4	CL	Lean clay	A-6 (18)	
B-6	36.0-44.0	Alluvial Clay		26.5		2.55										37	18	19	0.66	1.9	0.3	4.1	3.6	53.8	36.3	CL	Lean clay	A-6 (17)	
B-11	15.0-36.0	Alluvial Clay		20.8		2.66										41	24	17	0.5	4.5	0.5	2.2	3.1	47.8	41.9	CL	Lean clay	A-7-6 (17)	
B-12	35.0-46.5	Alluvial Clay		25.5		2.64										40	19	21	0.62	3.7	1.3	2.8	3.4	42.8	46.0	CL	Lean clay	A-6 (19)	
B-33	30.0-39.0	Alluvial Clay		22.8		2.62										35	23	12	0.57	8.0	1.7	4.9	10.7	46.7	28.0	CL	Lean clay with sand	A-6 (8)	
B-42	21.0-34.0	Alluvial Clay														49	18	31											
B-12	60.0-69.0	Alluvial Granular		19.8		2.62											NP		N/A	45.6	10.2	12.7	10.1	14.3	7.1	GM	Silty gravel with sand	A-1-b (0)	
B-14	40.0-49.0	Alluvial Granular		23.4		2.70											NP		N/A	18.8	8.6	36.9	18.9	12.2	4.6	SM	Silty sand with gravel	A-1-b (0)	
B-14	52.5-64.0	Alluvial Granular		21.0		2.70											NP		N/A	53.0	8.6	15.7	6.4	9.1	7.2	GM	Silty gravel with sand	A-1-b (0)	
B-22	75.0-89.0	Alluvial Granular		21.9		2.66											NP		N/A	54.2	15.4	15.5	5.1	5.7	4.1	GP-GC	Poorly graded clayey gravel	A-1-a (0)	
B-17A	32.0-34.0	Fly Ash (Sluiced)		30.9																									
B-17A	32.0-34.0	Fly Ash (Sluiced)	106.2	27.4	83.4																								7.00E-07
B-17A	70.0-72.0	Fly Ash (Sluiced)	104.1	41.1	73.8																								6.50E-07
B-28	52.0-54.0	Fly Ash (Sluiced)	97.4	57.1	62.0																								
B-28A	50.0-52.0	Fly Ash (Sluiced)	100.7	41.4	71.2																								
B-28A	52.0-54.0	Fly Ash (Sluiced)	101.9	52.3	66.9																								
B-35A	37.0-38.0	Fly Ash (Sluiced)		47.5																									
B-36A	24.0-26.0	Fly Ash (Sluiced)		45.1																									
B-36A	44.0-46.0	Fly Ash (Sluiced)	102.8	40.5	73.2																								6.60E-07
B-37A	24.0-26.0	Fly Ash (Sluiced)		53.2																									
B-43A	29.0-31.0	Fly Ash (Sluiced)	104.6	32.0	79.3	2.47	97.5	1.134	104.5	44.8	72.2																		
B-43A	29.0-31.0	Fly Ash (Sluiced)	100.6	39.7	72.0	2.47	94	1.262	100.9	48	68.2	0	39.6																
B-35A	46.0-48.0	Fly Ash (Sluiced)	104.8	46.0	71.8	2.47	100.2	1.174	104.6	47.6	70.9																		
B-18	15.0-34.5	Fly Ash (Sluiced)		37.2		2.58											NP		N/A	4.8	0.1	4.5	16.6	61.0	13.0	ML	Silt with sand	A-4 (0)	
B-19	28.5-49.0	Fly Ash (Sluiced)		30.3		2.46											NP		N/A	2.0	0.8	5.8	11.4	68.3	11.7	ML	Silt with sand	A-4 (0)	
B-24	27.0-51.5	Fly Ash (Sluiced)		44.8		2.44											NP		N/A	0.2	0.1	7.1	14.6	64.3	13.7	ML	Silt with sand	A-4 (0)	
B-32	20.0-49.0	Fly Ash (Sluiced)		34.6		2.52											NP		N/A	2.6	1.3	9.9	6.9	69.7	9.6	ML	Silt with sand	A-4 (0)	
B-37	7.5-21.0	Fly Ash (Sluiced)		23.1		2.62										45	18	27	0.71	2.6	2.0	4.3	4.7	41.1	45.3	CL	Lean clay	A-7-6 (24)	
B-4	1.5-31.5	Fly Ash (Sluiced)		40.7		2.42											NP		N/A	2.4	3.1	14.6	7.4	58.6	13.9	ML	Silt with sand	A-4 (0)	
B-41	24.0-34.5	Fly Ash (Sluiced)		26.2		2.52											NP		N/A	0.3	0.8	15.2	16.4	42.9	24.4	ML	Sandy silt	A-4 (0)	
B-45	25.0-39.6	Fly Ash (Sluiced)		35.7		2.71											NP		N/A	8.3	9.4	17.0	23.4	25.3	16.6	SM	Silty sand	A-4 (0)	
B-17A	50.0-52.0	BA-FA (Sluiced)		20.0																									
B-21B	25.0-27.0	BA-FA (Sluiced)		16.3																									
B-21B	48.0-50.0	BA-FA (Sluiced)	125.0	25.2	99.8																								
B-24C	3.5-4.8	BA-FA (Sluiced)		15.6																									
B-2	4.5-39.0	BA-FA (Sluiced)		25.9		2.62											NP		N/A	15.0	11.8	21.4	17.9	30.0	3.9	SM	Silty sand with gravel	A-2-4 (0)	
B-18	0.0-7.5	BA-FA (Sluiced)		14.4		2.61											NP		N/A	8.9	8.4	25.1	18.1	32.4	7.1	SM	Silty sand	A-4 (0)	
B-21	18.0-30.0	BA-FA (Sluiced)		22.9		2.61											NP		N/A	20.6	16.5	28.4	17.9	12.8	3.8	SM	Silty sand with gravel	A-1-b (0)	
B-22	28.5-49.5	BA-FA (Sluiced)		33.6		2.55											NP		N/A	7.6	5.4	14.3	16.7	46.5	9.5	ML	Sandy silt	A-4 (0)	
B-41	0.1-2.1	Gypsum		7.2																									
B-20	0.0-15.0	Gypsum		15.7		2.31											NP		N/A	0.0	0.0	6.4	6.5	83.2	3.9	ML	Silt	A-4 (0)	
B-35	1.5-22.5	Gypsum		10.6		2.94											NP		N/A	0.4	0.1	11.1	7.2	76.1	5.1	ML	Silt with sand	A-4 (0)	
B-41	0.0-12.9	Gypsum		22.1		2.31											NP		N/A	0.0	0.2	2.0	6.2	67.5	24.1	ML	Silt	A-4 (0)	
B-45	3.0-9.0	Gypsum		16.1		2.36											NP		N/A	0.2	0.1	2.0	5.4	70.8	21.5	ML	Silt	A-4 (0)	
	Gypsum Bulk	Gypsum				2.75*								86.3	35.1														8.10E-08
	Gypsum Rejects Bulk	Gypsum Rejects				2.73								86.2	35.2	33	32	1		0.0	7.4			86.1	6.5	ML		A-4 (0)	5.30E-07
	Gypsum Rejects Bulk	Gypsum Rejects				2.7*	72.6	1.08	104.5	29.1	80.97																		
						2.5*	76.2	0.947	103.3	28.9	80.17	90.9	42.5																
						2.7*	72	1.1	103.9	29.2	80.41																		
	Gypsum Rejects Bulk	Gypsum Rejects				2.7*	67.4	1.09	102.7	27.2	80.71																		
						2.7*	66.9	1.09	102.5	26.9	80.79	0.0	44																
						2.7*	66.8	1.09	102.5	26.9	80.75																		
	Bottom Ash Bulk	Bottom Ash				2.5*								103.7	17.2														2.30E-06
	Bottom Ash Bulk	Bottom Ash				2.7*	48.3	0.923	102.1	16.5	87.66																		
						2.5*	53.8	0.782	102.3	16.8	87.57	0	44																
						2.7*	47.5	0.913	102.3	16.1	88.12																		
	Bottom Ash Bulk	Bottom Ash				2.7*	48.3	0.923	102.1	16.5	87.66	261	41																
						2.7*	47.5	0.913	102.3	16.1	88.12																		
	Fly Ash Bulk	Fly Ash				2.5*								83.6	32.7														4.20E-07
	Fly Ash Bulk					2.5*	61.2	1.37	87.8	33.6	65.75																		
						2.5*	62	1.36	88.4	33.8	66.09	14.3	36																
						2.5*	63.3	1.36	89.0	34.4	66.21																		

* G_s is assumed.

	Permeability Summary										
								t_{50} chart from CPT Application Guide			
	CPT	El (ft)	El of Test (ft)	Material Type	k_h (ft/s)	Assumed kh/kv	Assumed kv/kh	**Avg. k_v (20ºC) (cm/s)**	ft/s	**Visual Description**	
	CPT15	430.0	344.1	Alluvial (Clay)	4.30E-09						
	CPT5	380.0	350.7	Alluvial (Clay)	7.50E-08						
	CPT14C	405.0	353.2	FA (Sluiced)/Alluvial (Clay)	6.50E-09						
	CPT16	430.0	343.9	FA (Sluiced)/Alluvial (Clay)	1.70E-08						
	CPT16	430.0	350.4	FA (Sluiced)/Alluvial (Clay)	6.70E-08						
	CPT22	425.0	362.9	FA (Sluiced)/Alluvial (Clay)	7.90E-09						
	CPT26	425.0	368.5	FA/BA (Sluiced)	2.00E-08						
1605A	B-15B		46.0-48.0	Alluvial Clay				2.30E-08	7.54593E-10	Lean Clay (CL), gray, moist, firm	brown lean clay
1617A	B-29A		50.0-52.0	Alluvial Clay				6.60E-09	2.16535E-10	Fat Clay (CH), brown, moist, firm	brown lean clay, 50.2-50.7
					2.82E-08	**58.1650**	**0.0172**	**1.48E-08**	**4.86E-10**		
	CPT3	380.0	367.1	Dike 1	2.80E-09						
	CPT4	380.0	367.8	Dike 1							
	CPT5	380.0	368.4	Dike 1	7.80E-09						
	CPT5	380.0	375.1	Dike 1	2.20E-07						
	CPT6	380.0	367.1	Dike 1	1.40E-07						
1262	B-9B		6.0-8.0	Dike 2				7.00E-08	2.29659E-09	Fat Clay with Gravel (CH), red brown, moist, firm	brown lean clay, 6-6.9
1263	B-9B		9.5-11.5	Dike 2				2.30E-08	7.54593E-10	Lean Clay with Gravel (CL), light brown, moist, firm	brown lean clay, 10.1-10.6
1610	B-21B		20.0-22.0	Dike 2				1.80E-08	5.90551E-10	Fat Clay (CH), red brown, moist, firm	brown lean clay
1615	B-29A		17.0-19.0	Dike 2				2.20E-08	7.21785E-10	Gravelly Lean Clay (CL), brown, moist, soft to firm	brown lean clay
1624A	B-37B		11.0-12.4	Dike 2				1.40E-08	4.59318E-10	Lean Clay (CL), brown, moist, firm	brown lean clay
1629	B-19C		20.0-22.0	Dike 3				3.20E-08	1.04987E-09	Sandy Fat Clay (CH), brown, moist, firm	brown lean clay
					9.27E-08	**94.6583**	**0.0106**	**2.98E-08**	**9.79E-10**		
	CPT14C	405.0	368.9	FA (Sluiced)	2.10E-06						
	CPT14C	405.0	375.9	FA (Sluiced)	4.60E-06						
	CPT14C	405.0	385.3	FA (Sluiced)	7.20E-07						
	CPT15	430.0	370.5	FA (Sluiced)	9.80E-07						
	CPT15	430.0	376.6	FA (Sluiced)	9.40E-07						
	CPT16	430.0	373.0	FA (Sluiced)	1.50E-06						
	CPT16	430.0	378.6	FA (Sluiced)	2.30E-06						
	CPT18	425.0	386.0	FA (Sluiced)	3.70E-06						
	CPT20	425.0	388.7	FA (Sluiced)	4.60E-06						
	CPT22	425.0	372.3	FA (Sluiced)	6.40E-06						
	CPT22	425.0	383.0	FA (Sluiced)	2.10E-06						
	CPT23	425.0	366.0	FA (Sluiced)	4.60E-06						
	CPT23	425.0	370.6	FA (Sluiced)	6.00E-06						
	CPT25	425.0	376.9	FA (Sluiced)	5.30E-06						
	CPT25	425.0	386.2	FA (Sluiced)	9.10E-07						
	CPT25	425.0	390.8	FA (Sluiced)	1.30E-06						
	CPT15	430.0	357.3	FA (Sluiced)/Alluvial (Clay)	2.20E-06						
	CPT18	425.0	376.4	FA (Sluiced)/Alluvial (Clay)	4.30E-06						

	Permeability Summary										
								t_{50} chart from CPT Application Guide			
	CPT	El (ft)	El of Test (ft)	Material Type	k_h (ft/s)	Assumed kh/kv	Assumed kv/kh	**Avg. k_v (20ºC) (cm/s)**	ft/s	**Visual Description**	
1606B	B-17A		32.0-34.0	Fly Ash (Sluiced)				7.00E-07	2.29659E-08	Silt (ML), black, moist, firm, fly ash	gray silt - ASH, 32.7-33.2
1608	B-17A		70.0-72.0	Fly Ash (Sluiced)				6.50E-07	2.13255E-08	Silt (ML), gray, moist, firm, flyash	gray silt - ASH, 70-70.5
1620	B-36A		44.0-46.0	Fly Ash (Sluiced)				6.60E-07	2.16535E-08	Silt (ML), black, wet, soft, fly ash	gray silt - ASH, 44.7-45.2
	CPT14	405.0	373.2	FA/BA (Sluiced)	2.90E-06						
	CPT14	405.0	386.6	FA/BA (Sluiced)	9.70E-07						
	CPT17	400.0	372.9	FA/BA (Sluiced)	1.00E-06						
	CPT17	400.0	385.1	FA/BA (Sluiced)	2.10E-06						
	CPT26	425.0	371.7	FA/BA (Sluiced)	2.20E-07						
	CPT26	425.0	378.9	FA/BA (Sluiced)	4.60E-06	1.2000	0.8333	3.83E-06	1.25766E-07		
					2.76E-06	**57.6738**	**0.0173**	**1.46E-06**	**4.79E-08**		
	CPT15	430.0	406.4	FA (Stacked)	1.30E-06						
	CPT16	430.0	406.4	FA (Stacked)	8.00E-06			2.20E-05	7.22E-07		
1636			Fly Ash Bulk	Fly Ash				4.20E-07	1.37795E-08		
					4.65E-06	**12.6434**	**0.0791**	**1.12E-05**	**3.68E-07**		
					1.97E-06						
1635			Gypsum Bulk	Gypsum				8.10E-08	2.65748E-09		
1634			Gypsum Rejects Bulk	Gypsum Rejects				5.30E-07	1.73885E-08		
1637			Bottom Ash Bulk	Bottom Ash				2.30E-06	7.54593E-08		
								6.80E-02	0.002230971		

Appendix H

Seepage Analyses Output

Steady-State Seepage

File Information

Created By: Cooper, Paul
Revision Number: 238
Last Edited By: Rogers, Daniel
Date: 1/31/2010
Time: 12:34:30 PM
File Name: Section P.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/31/2010
Last Solved Time: 12:35:12 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Steady-State Seepage

Kind: SEEP/W
Method: Steady-State
Settings
- Include Air Flow: No

Control
- Apply Runoff: Yes

Convergence
- Convergence Type: Gauss Point K
- Convergence Settings
  - Maximum Number of Iterations: 500
  - Tolerance: 0.01
  - Maximum Change in K: 0.1
  - Rate of Change in K: 1.02
  - Minimum Change in K: 0.0001
- Equation Solver: Parallel Direct
- Potential Seepage Max # of Reviews: 10

Time
- Starting Time: 0 sec

Duration: 0 sec
Ending Time: 0 sec

Materials

Dike 1 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 1 (Lean Clay)
Vol. WC. Function: Dike 1 (Lean Clay)
K-Ratio: 0.1
K-Direction: 0 °

Dike 2 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 2 (Lean Clay)
Vol. WC. Function: Dike 2 (Lean Clay)
K-Ratio: 0.1
K-Direction: 0 °

Fly Ash (Sluiced)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Fly Ash (Sluiced)
Vol. WC. Function: Fly Ash (Sluiced)
K-Ratio: 0.02
K-Direction: 0 °

Alluvial - Clay

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Clay)
Vol. WC. Function: Alluvial (Clay)
K-Ratio: 0.05
K-Direction: 0 °

Alluvial - Granular

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Granular)
Vol. WC. Function: Alluvial (Granular)
K-Ratio: 0.05
K-Direction: 0 °

Bedrock

Model: Saturated Only
Hydraulic
K-Sat: 1e-011 ft/sec

Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 0.1
K-Direction: 0 °

Boundary Conditions

Potential Seepage Face

Review: true
Type: Total Flux (Q) 0

Ash Pond

Type: Head (H) 384.23

Wells Creek

Type: Head (H) 359

K Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 2.13e-007
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 2.13e-007)
Data Point: (0.018329807, 2.1234388e-007)
Data Point: (0.033598183, 2.1168814e-007)
Data Point: (0.061584821, 2.1103203e-007)
Data Point: (0.11288379, 2.1037498e-007)
Data Point: (0.20691381, 2.0971735e-007)
Data Point: (0.37926902, 2.0905824e-007)
Data Point: (0.6951928, 2.0839653e-007)
Data Point: (1.274275, 2.077303e-007)
Data Point: (2.3357215, 2.070555e-007)
Data Point: (4.2813324, 2.0636507e-007)
Data Point: (7.8475997, 2.0564593e-007)
Data Point: (14.384499, 2.0487454e-007)
Data Point: (26.366509, 2.0400629e-007)
Data Point: (48.329302, 2.0295363e-007)
Data Point: (88.586679, 2.016313e-007)
Data Point: (162.37767, 1.9978076e-007)
Data Point: (297.63514, 1.9457772e-007)
Data Point: (545.55948, 1.9521936e-007)
Data Point: (1000, 7.5557482e-008)
Estimation Properties
Volume Water Content Function: Dike 1 (Lean Clay)

Hydraulic K Sat: 2.13e-007 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.06 ft^3/ft^3

Dike 2 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 1.4e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 1.4e-008)
Data Point: (0.018329807, 1.3839755e-008)
Data Point: (0.033598183, 1.3679456e-008)
Data Point: (0.061584821, 1.3519067e-008)
Data Point: (0.11288379, 1.3358687e-008)
Data Point: (0.20691381, 1.3198313e-008)
Data Point: (0.37926902, 1.3037842e-008)
Data Point: (0.6951928, 1.2877185e-008)
Data Point: (1.274275, 1.2716167e-008)
Data Point: (2.3357215, 1.2554511e-008)
Data Point: (4.2813324, 1.2391694e-008)
Data Point: (7.8475997, 1.2226739e-008)
Data Point: (14.384499, 1.2057859e-008)
Data Point: (26.366509, 1.1881796e-008)
Data Point: (48.329302, 1.1692595e-008)
Data Point: (88.586679, 1.147907e-008)
Data Point: (162.37767, 1.1221098e-008)
Data Point: (297.63514, 1.0889148e-008)
Data Point: (545.55948, 1.0384296e-008)
Data Point: (1000, 9.4081422e-009)
Estimation Properties
Volume Water Content Function: Dike 2 (Lean Clay)
Hydraulic K Sat: 1.4e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.08 ft^3/ft^3

Alluvial (Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 4.86e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)

Data Point: (0.01, 4.86e-008)
Data Point: (0.018329807, 4.6081772e-008)
Data Point: (0.033598183, 4.3561857e-008)
Data Point: (0.061584821, 4.104302e-008)
Data Point: (0.11288379, 3.8524125e-008)
Data Point: (0.20691381, 3.6005291e-008)
Data Point: (0.37926902, 3.3486567e-008)
Data Point: (0.6951928, 3.0968085e-008)
Data Point: (1.274275, 2.8449893e-008)
Data Point: (2.3357215, 2.5932304e-008)
Data Point: (4.2813324, 2.3415812e-008)
Data Point: (7.8475997, 2.0901374e-008)
Data Point: (14.384499, 1.8390713e-008)
Data Point: (26.366509, 1.5886901e-008)
Data Point: (48.329302, 1.3395726e-008)
Data Point: (88.586679, 1.0927777e-008)
Data Point: (162.37767, 8.5023183e-009)
Data Point: (297.63514, 6.1503404e-009)
Data Point: (545.55948, 3.9524194e-009)
Data Point: (1000, 2.0421444e-009)

Estimation Properties

Volume Water Content Function: Alluvial (Clay)
Hydraulic K Sat: 4.86e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.07 ft^3/ft^3

Alluvial (Granular)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 6.56e-005
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 6.56e-005)
Data Point: (0.018329807, 6.559664e-005)
Data Point: (0.033598183, 6.5593247e-005)
Data Point: (0.061584821, 6.55898e-005)
Data Point: (0.11288379, 6.5586256e-005)
Data Point: (0.20691381, 6.5582531e-005)
Data Point: (0.37926902, 6.5578478e-005)
Data Point: (0.6951928, 6.5573821e-005)
Data Point: (1.274275, 6.5568056e-005)
Data Point: (2.3357215, 6.5560304e-005)
Data Point: (4.2813324, 6.5548627e-005)
Data Point: (7.8475997, 6.5529381e-005)
Data Point: (14.384499, 6.5508533e-005)
Data Point: (26.366509, 6.5443255e-005)

Data Point: (48.329302, 6.5007842e-005)
Data Point: (88.586679, 6.6743187e-005)
Data Point: (162.37767, 3.9015316e-005)
Data Point: (297.63514, 1.0152365e-005)
Data Point: (545.55948, 1.9697495e-006)
Data Point: (1000, 3.085697e-007)
Estimation Properties
Volume Water Content Function: Alluvial (Granular)
Hydraulic K Sat: 6.56e-005 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.02 ft^3/ft^3

Fly Ash (Sluiced)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 0.000138
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 0.000138)
Data Point: (0.018329807, 0.00013124901)
Data Point: (0.033598183, 0.00012449327)
Data Point: (0.061584821, 0.00011774033)
Data Point: (0.11288379, 0.0001109872)
Data Point: (0.20691381, 0.00010423397)
Data Point: (0.37926902, 9.7480512e-005)
Data Point: (0.6951928, 9.0726822e-005)
Data Point: (1.274275, 8.3972556e-005)
Data Point: (2.3357215, 7.7217303e-005)
Data Point: (4.2813324, 7.0460153e-005)
Data Point: (7.8475997, 6.3699615e-005)
Data Point: (14.384499, 5.6933028e-005)
Data Point: (26.366509, 5.0154616e-005)
Data Point: (48.329302, 4.3351508e-005)
Data Point: (88.586679, 3.6533731e-005)
Data Point: (162.37767, 2.9661049e-005)
Data Point: (297.63514, 2.2042999e-005)
Data Point: (545.55948, 1.5988106e-005)
Data Point: (1000, 1.5284174e-006)
Estimation Properties
Volume Water Content Function: Fly Ash (Sluiced)
Hydraulic K Sat: 0.000138 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.015 ft^3/ft^3

Vol. Water Content Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 3e-006 /psf
Porosity: 0.41556948
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.41308567)
Data Point: (0.018329807, 0.41308567)
Data Point: (0.033598183, 0.41308567)
Data Point: (0.061584821, 0.41308567)
Data Point: (0.11288379, 0.41308567)
Data Point: (0.20691381, 0.41308567)
Data Point: (0.37926902, 0.41308567)
Data Point: (0.6951928, 0.41308567)
Data Point: (1.274275, 0.41308567)
Data Point: (2.3357215, 0.41308567)
Data Point: (4.2813324, 0.41308567)
Data Point: (7.8475997, 0.41308567)
Data Point: (14.384499, 0.41308567)
Data Point: (26.366509, 0.41308567)
Data Point: (48.329302, 0.41308567)
Data Point: (88.586679, 0.41308567)
Data Point: (162.37767, 0.41308567)
Data Point: (297.63514, 0.41308567)
Data Point: (545.55948, 0.4125467)
Data Point: (1000, 0.38347036)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.413 ft^3/ft^3
Liquid Limit: 38 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.1
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Dike 2 (Lean Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 3e-006 /psf
Porosity: 0.35421721

Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
- Data Point: (0.01, 0.35121721)
- Data Point: (0.018329807, 0.35121721)
- Data Point: (0.033598183, 0.35121721)
- Data Point: (0.061584821, 0.35121721)
- Data Point: (0.11288379, 0.35121721)
- Data Point: (0.20691381, 0.35121721)
- Data Point: (0.37926902, 0.35121721)
- Data Point: (0.6951928, 0.35121721)
- Data Point: (1.274275, 0.35121721)
- Data Point: (2.3357215, 0.35121721)
- Data Point: (4.2813324, 0.35121721)
- Data Point: (7.8475997, 0.35121721)
- Data Point: (14.384499, 0.35121721)
- Data Point: (26.366509, 0.35121721)
- Data Point: (48.329302, 0.35121721)
- Data Point: (88.586679, 0.35121721)
- Data Point: (162.37767, 0.35121721)
- Data Point: (297.63514, 0.35121721)
- Data Point: (545.55948, 0.35121721)
- Data Point: (1000, 0.35121721)

Estimation Properties
- Vol. WC Estimation Method: Grain Size Function
- Sample Material: Clay
- Saturated Water Content: 0.351 ft^3/ft^3
- Liquid Limit: 48 %
- Diameter at 10% passing: 0.001
- Diameter at 60% passing: 0.075
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20

Alluvial (Clay)

Model: Data Point Function

Function: Vol. Water Content vs. Pore-Water Pressure
- Curve Fit to Data: 100 %
- Segment Curvature: 100 %
- Mv: 4.786e-005 /psf

Porosity: 0.46611653

Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
- Data Point: (0.01, 0.40088927)
- Data Point: (0.018329807, 0.40088927)
- Data Point: (0.033598183, 0.40088927)
- Data Point: (0.061584821, 0.40088927)
- Data Point: (0.11288379, 0.40088927)
- Data Point: (0.20691381, 0.40088927)
- Data Point: (0.37926902, 0.40088927)
- Data Point: (0.6951928, 0.40088927)
- Data Point: (1.274275, 0.40088927)
- Data Point: (2.3357215, 0.40088927)

Data Point: (4.2813324, 0.40088927)
Data Point: (7.8475997, 0.40088927)
Data Point: (14.384499, 0.40088927)
Data Point: (26.366509, 0.40088927)
Data Point: (48.329302, 0.40088927)
Data Point: (88.586679, 0.40088927)
Data Point: (162.37767, 0.40088927)
Data Point: (297.63514, 0.40088927)
Data Point: (545.55948, 0.40088927)
Data Point: (1000, 0.39828281)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.401 ft^3/ft^3
Liquid Limit: 47 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.1
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Alluvial (Granular)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 2.3925e-006 /psf

Porosity: 0.27269448
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)

Data Point: (0.01, 0.27030198)
Data Point: (0.018329807, 0.27030198)
Data Point: (0.033598183, 0.27030198)
Data Point: (0.061584821, 0.27030198)
Data Point: (0.11288379, 0.27030198)
Data Point: (0.20691381, 0.27030198)
Data Point: (0.37926902, 0.27030198)
Data Point: (0.6951928, 0.27030198)
Data Point: (1.274275, 0.27030198)
Data Point: (2.3357215, 0.27030198)
Data Point: (4.2813324, 0.27030198)
Data Point: (7.8475997, 0.27030198)
Data Point: (14.384499, 0.27030198)
Data Point: (26.366509, 0.27030198)
Data Point: (48.329302, 0.27030198)
Data Point: (88.586679, 0.27030198)
Data Point: (162.37767, 0.27030198)
Data Point: (297.63514, 0.27030198)
Data Point: (545.55948, 0.27030198)
Data Point: (1000, 0.27030198)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Silty Sand
Saturated Water Content: 0.27 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 6
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Fly Ash (Sluiced)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 6.2218e-005 /psf
Porosity: 0.37786527
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.35499418)
Data Point: (0.018329807, 0.35499418)
Data Point: (0.033598183, 0.35499418)
Data Point: (0.061584821, 0.35499418)
Data Point: (0.11288379, 0.35499418)
Data Point: (0.20691381, 0.35499418)
Data Point: (0.37926902, 0.35499418)
Data Point: (0.6951928, 0.35499418)
Data Point: (1.274275, 0.35499418)
Data Point: (2.3357215, 0.35499418)
Data Point: (4.2813324, 0.35499418)
Data Point: (7.8475997, 0.35499418)
Data Point: (14.384499, 0.35499418)
Data Point: (26.366509, 0.35499418)
Data Point: (48.329302, 0.35499418)
Data Point: (88.586679, 0.35499418)
Data Point: (162.37767, 0.35499418)
Data Point: (297.63514, 0.35499418)
Data Point: (545.55948, 0.34147401)
Data Point: (1000, 0.26813417)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Silt
Saturated Water Content: 0.3548 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.004
Diameter at 60% passing: 0.049
Maximum: 1000
Minimum: 0.01
Num. Points: 20

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section P.gsz

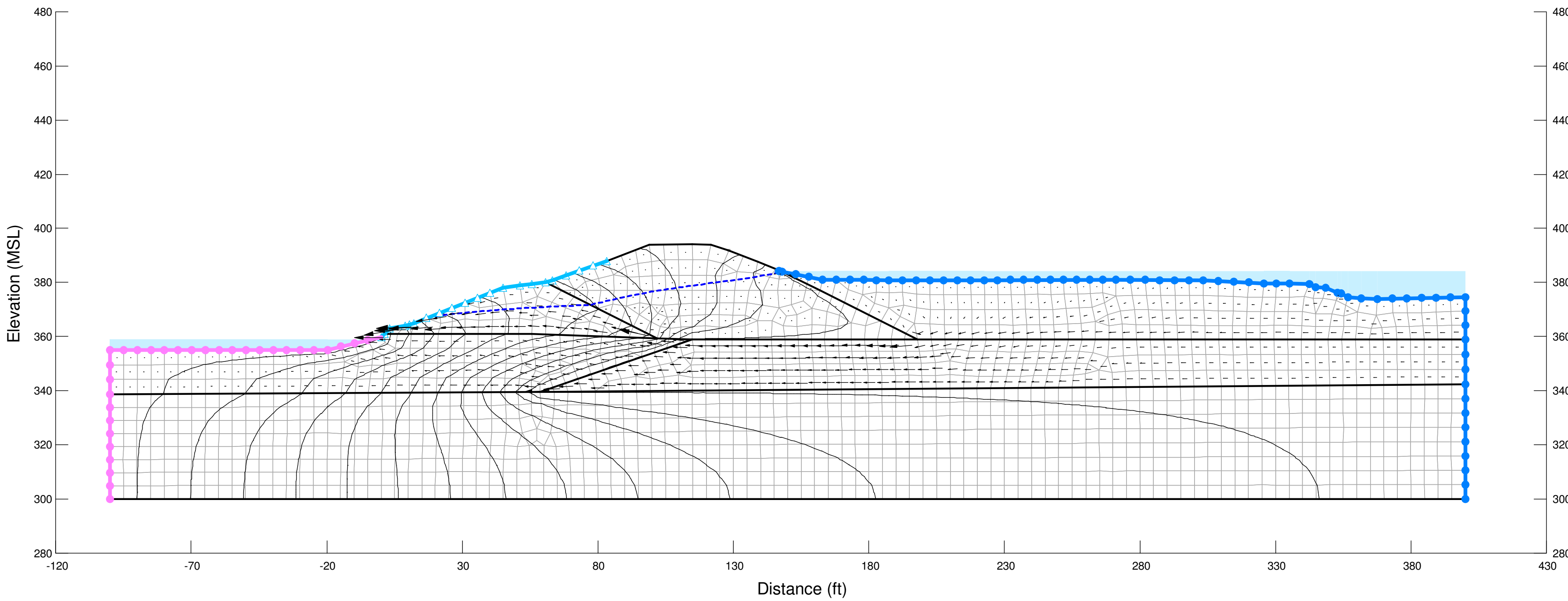
Analysis Name: Steady-State Seepage

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 12:35:12 PM

Stantec

Boundary Conditions with Mesh



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section P.gsz

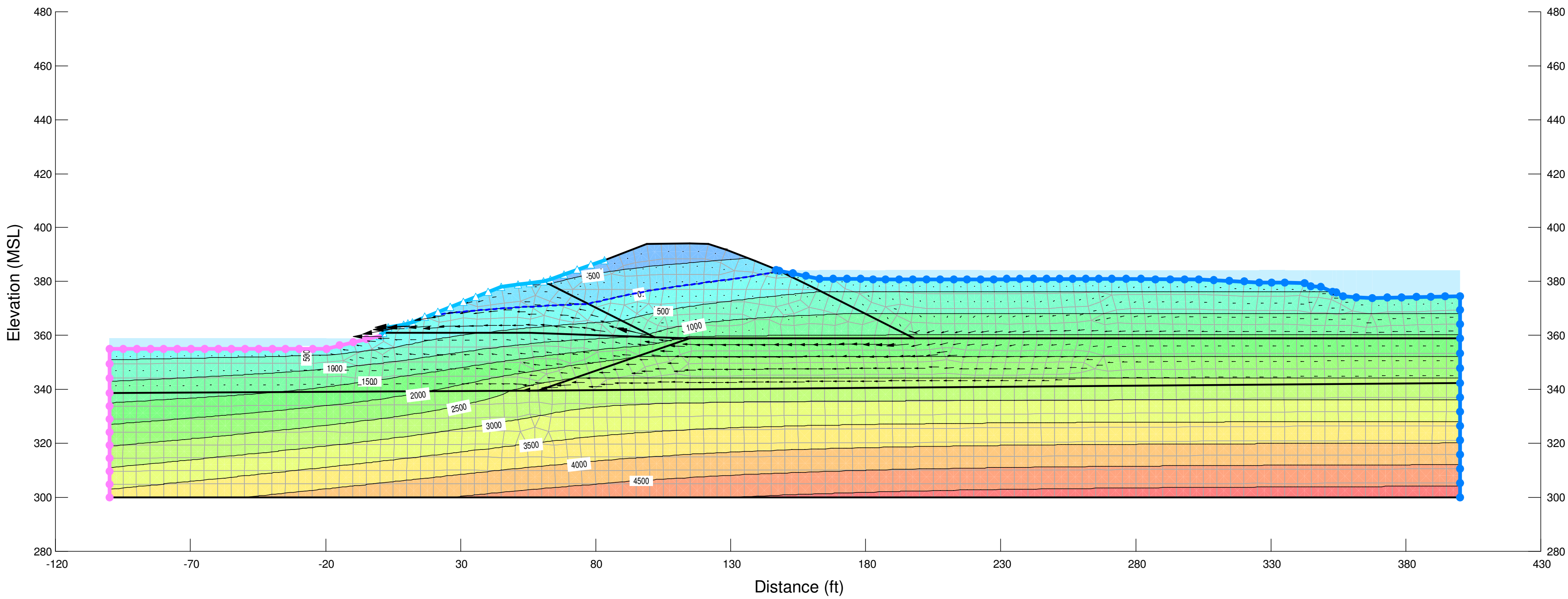
Analysis Name: Steady-State Seepage

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 12:35:12 PM

Stantec

Pore-Water Pressure (psf)



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section P.gsz

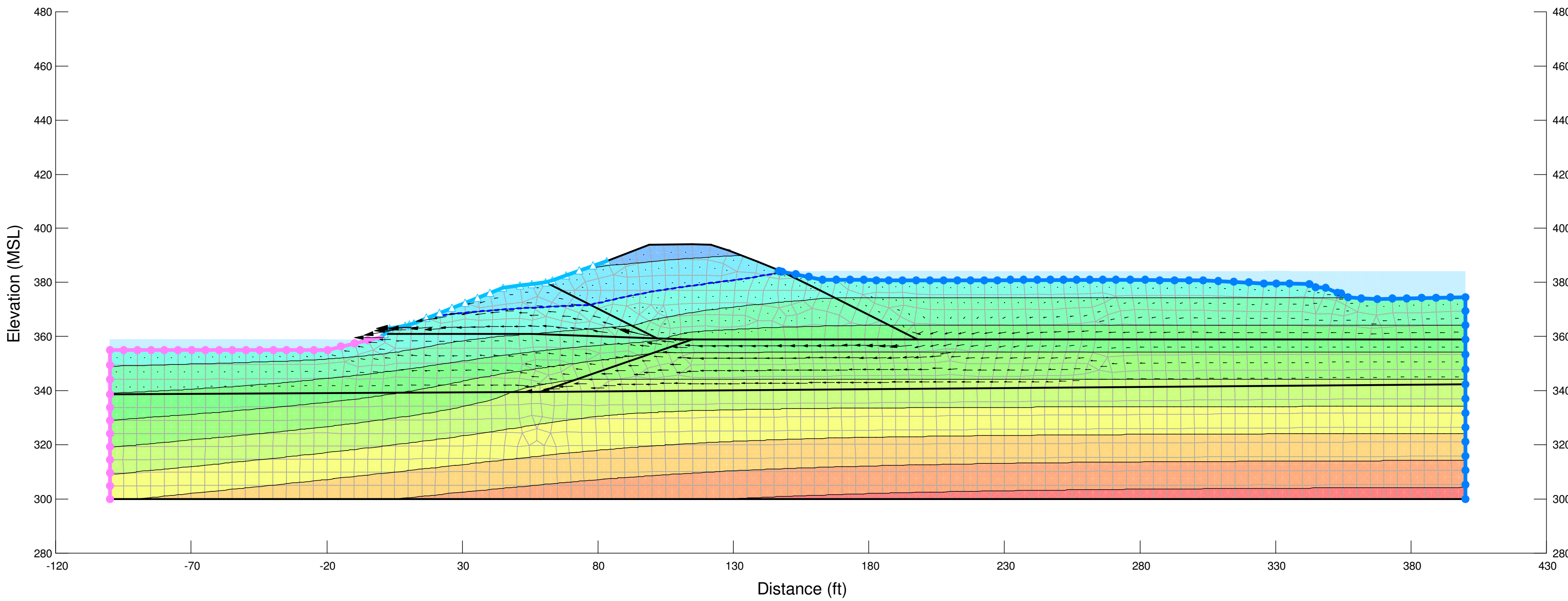
Analysis Name: Steady-State Seepage

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 12:35:12 PM

Stantec

Pressure Head (ft)



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section P.gsz

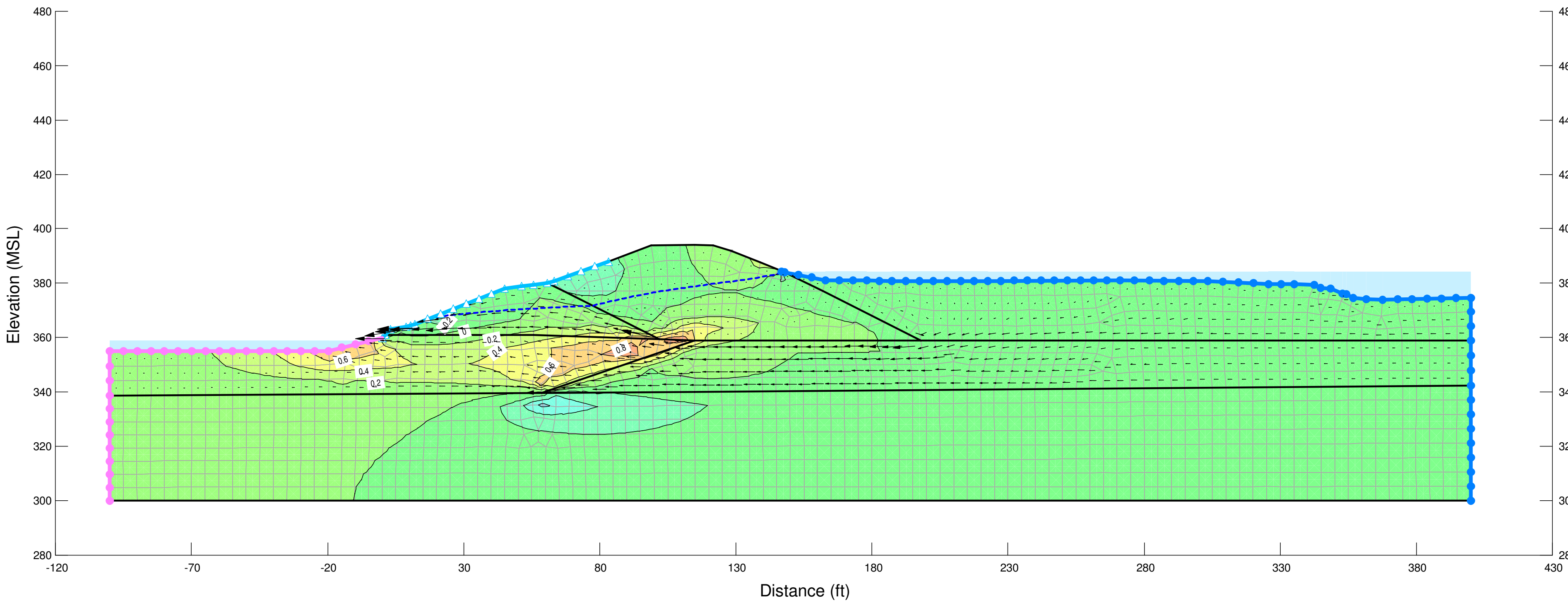
Analysis Name: Steady-State Seepage

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 12:35:12 PM

Stantec

Y-Gradient



Steady-State Seepage

File Information

Revision Number: 233
Last Edited By: Rogers, Daniel
Date: 1/12/2010
Time: 4:27:40 PM
File Name: Section Q.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/12/2010
Last Solved Time: 4:28:22 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Steady-State Seepage

Kind: SEEP/W
Method: Steady-State
Settings
- Include Air Flow: No

Control
- Apply Runoff: Yes

Convergence
- Convergence Type: Gauss Point K
- Convergence Settings
  - Maximum Number of Iterations: 500
  - Tolerance: 0.01
  - Maximum Change in K: 0.1
  - Rate of Change in K: 1.02
  - Minimum Change in K: 0.0001
- Equation Solver: Parallel Direct
- Potential Seepage Max # of Reviews: 10

Time
- Starting Time: 0 sec
- Duration: 0 sec

Ending Time: 0 sec

Materials

Dike 1 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 1 (Lean)
Vol. WC. Function: Dike 1 (Lean)
K-Ratio: 0.02
K-Direction: 0 °

Dike 2 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 2 (Lean)
Vol. WC. Function: Dike 2 (Lean)
K-Ratio: 0.01
K-Direction: 0 °

Fly Ash (Sluiced)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Fly Ash (Sluiced)
Vol. WC. Function: Fly Ash (Sluiced)
K-Ratio: 0.02
K-Direction: 0 °

Alluvial Clay

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Clay)
Vol. WC. Function: Alluvial (Clay)
K-Ratio: 0.05
K-Direction: 0 °

Alluvial Granular

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Granular)
Vol. WC. Function: Alluvial (Granular)
K-Ratio: 0.05
K-Direction: 0 °

Bedrock

Model: Saturated Only
Hydraulic
K-Sat: 1e-011 ft/sec
Volumetric Water Content: 0 ft^3/ft^3

Mv: 0 /psf
K-Ratio: 0.1
K-Direction: 0 °

Boundary Conditions

Potential Seepage Face

Review: true
Type: Total Flux (Q) 0

Ash Pond Pool (384.23 ft)

Type: Head (H) 384.23

Wells Creek Water El 359 ft

Type: Head (H) 359

K Functions

Dike 1 (Lean)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 4.64e-006
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 4.64e-006)
Data Point: (0.018329807, 4.6134528e-006)
Data Point: (0.033598183, 4.5869157e-006)
Data Point: (0.061584821, 4.5603567e-006)
Data Point: (0.11288379, 4.5337861e-006)
Data Point: (0.20691381, 4.5071982e-006)
Data Point: (0.37926902, 4.4805703e-006)
Data Point: (0.6951928, 4.4538831e-006)
Data Point: (1.274275, 4.4270843e-006)
Data Point: (2.3357215, 4.4000706e-006)
Data Point: (4.2813324, 4.3726674e-006)
Data Point: (7.8475997, 4.3445481e-006)
Data Point: (14.384499, 4.315122e-006)
Data Point: (26.366509, 4.2832896e-006)
Data Point: (48.329302, 4.2469954e-006)
Data Point: (88.586679, 4.2030639e-006)
Data Point: (162.37767, 4.1448602e-006)
Data Point: (297.63514, 4.0416294e-006)
Data Point: (545.55948, 3.9502528e-006)
Data Point: (1000, 2.4315931e-006)
Estimation Properties
Volume Water Content Function: Dike 1 (Lean)
Hydraulic K Sat: 4.64e-006 ft/sec

Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.06 ft³/ft³

Dike 2 (Lean)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 1.4e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 1.4e-008)
Data Point: (0.018329807, 1.3841502e-008)
Data Point: (0.033598183, 1.3682956e-008)
Data Point: (0.061584821, 1.3524347e-008)
Data Point: (0.11288379, 1.3365851e-008)
Data Point: (0.20691381, 1.3207316e-008)
Data Point: (0.37926902, 1.304866e-008)
Data Point: (0.6951928, 1.2889801e-008)
Data Point: (1.274275, 1.273063e-008)
Data Point: (2.3357215, 1.2570815e-008)
Data Point: (4.2813324, 1.2409841e-008)
Data Point: (7.8475997, 1.2246731e-008)
Data Point: (14.384499, 1.2079701e-008)
Data Point: (26.366509, 1.1905499e-008)
Data Point: (48.329302, 1.1718188e-008)
Data Point: (88.586679, 1.1506607e-008)
Data Point: (162.37767, 1.1250676e-008)
Data Point: (297.63514, 1.0920964e-008)
Data Point: (545.55948, 1.0418615e-008)
Data Point: (1000, 9.4447797e-009)
Estimation Properties
Volume Water Content Function: Dike 2 (Lean)
Hydraulic K Sat: 1.4e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.08 ft³/ft³

Alluvial (Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 4.786e-005
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 4.786e-005)

Data Point: (0.018329807, 4.5322563e-005)
Data Point: (0.033598183, 4.2783344e-005)
Data Point: (0.061584821, 4.0245152e-005)
Data Point: (0.11288379, 3.7706958e-005)
Data Point: (0.20691381, 3.5168763e-005)
Data Point: (0.37926902, 3.2630738e-005)
Data Point: (0.6951928, 3.009295e-005)
Data Point: (1.274275, 2.7555601e-005)
Data Point: (2.3357215, 2.5019106e-005)
Data Point: (4.2813324, 2.2484135e-005)
Data Point: (7.8475997, 1.9951983e-005)
Data Point: (14.384499, 1.7425006e-005)
Data Point: (26.366509, 1.4907462e-005)
Data Point: (48.329302, 1.240735e-005)
Data Point: (88.586679, 9.9389376e-006)
Data Point: (162.37767, 7.5288407e-006)
Data Point: (297.63514, 5.2266027e-006)
Data Point: (545.55948, 3.1174951e-006)
Data Point: (1000, 1.3648433e-006)

Estimation Properties
Volume Water Content Function: Alluvial (Clay)
Hydraulic K Sat: 4.786e-005 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.07 ft^3/ft^3

Alluvial (Granular)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 6.56e-005
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 6.56e-005)
Data Point: (0.018329807, 6.5599955e-005)
Data Point: (0.033598183, 6.5599889e-005)
Data Point: (0.061584821, 6.5599786e-005)
Data Point: (0.11288379, 6.5599613e-005)
Data Point: (0.20691381, 6.5599318e-005)
Data Point: (0.37926902, 6.5598819e-005)
Data Point: (0.6951928, 6.5597653e-005)
Data Point: (1.274275, 6.5595797e-005)
Data Point: (2.3357215, 6.5601509e-005)
Data Point: (4.2813324, 6.5561273e-005)
Data Point: (7.8475997, 6.5357469e-005)
Data Point: (14.384499, 6.6547157e-005)
Data Point: (26.366509, 2.8488866e-005)
Data Point: (48.329302, 3.302432e-006)

Data Point: (88.586679, 2.3582744e-007)
Data Point: (162.37767, 2.432944e-008)
Data Point: (297.63514, 3.6817723e-009)
Data Point: (545.55948, 6.4215817e-010)
Data Point: (1000, 8.1778609e-011)
Estimation Properties
Volume Water Content Function: Alluvial (Granular)
Hydraulic K Sat: 6.56e-005 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.02 ft^3/ft^3

Fly Ash (Sluiced)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 0.000138
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 0.000138)
Data Point: (0.018329807, 0.0001368885)
Data Point: (0.033598183, 0.00013577621)
Data Point: (0.061584821, 0.00013466289)
Data Point: (0.11288379, 0.0001335475)
Data Point: (0.20691381, 0.00013242828)
Data Point: (0.37926902, 0.00013130206)
Data Point: (0.6951928, 0.00013016303)
Data Point: (1.274275, 0.00012900049)
Data Point: (2.3357215, 0.00012779495)
Data Point: (4.2813324, 0.00012651011)
Data Point: (7.8475997, 0.00012507948)
Data Point: (14.384499, 0.00012339947)
Data Point: (26.366509, 0.00012120171)
Data Point: (48.329302, 0.00011765521)
Data Point: (88.586679, 0.00011552727)
Data Point: (162.37767, 6.6817109e-005)
Data Point: (297.63514, 1.1152644e-005)
Data Point: (545.55948, 8.9103191e-007)
Data Point: (1000, 5.9862353e-008)
Estimation Properties
Volume Water Content Function: Fly Ash (Sluiced)
Hydraulic K Sat: 0.000138 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.015 ft^3/ft^3

Vol. Water Content Functions

Dike 1 (Lean)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 3e-006 /psf
Porosity: 0.41556948
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
Data Point: (0.01, 0.41308567)
Data Point: (0.018329807, 0.41308567)
Data Point: (0.033598183, 0.41308567)
Data Point: (0.061584821, 0.41308567)
Data Point: (0.11288379, 0.41308567)
Data Point: (0.20691381, 0.41308567)
Data Point: (0.37926902, 0.41308567)
Data Point: (0.6951928, 0.41308567)
Data Point: (1.274275, 0.41308567)
Data Point: (2.3357215, 0.41308567)
Data Point: (4.2813324, 0.41308567)
Data Point: (7.8475997, 0.41308567)
Data Point: (14.384499, 0.41308567)
Data Point: (26.366509, 0.41308567)
Data Point: (48.329302, 0.41308567)
Data Point: (88.586679, 0.41308567)
Data Point: (162.37767, 0.41308567)
Data Point: (297.63514, 0.41308567)
Data Point: (545.55948, 0.4125467)
Data Point: (1000, 0.38347036)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.413 ft³/ft³
Liquid Limit: 38 %
Diameter at 10% passing: 0.0001
Diameter at 60% passing: 0.1
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Dike 2 (Lean)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 3e-006 /psf
Porosity: 0.35421721

Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.35121721)
Data Point: (0.018329807, 0.35121721)
Data Point: (0.033598183, 0.35121721)
Data Point: (0.061584821, 0.35121721)
Data Point: (0.11288379, 0.35121721)
Data Point: (0.20691381, 0.35121721)
Data Point: (0.37926902, 0.35121721)
Data Point: (0.6951928, 0.35121721)
Data Point: (1.274275, 0.35121721)
Data Point: (2.3357215, 0.35121721)
Data Point: (4.2813324, 0.35121721)
Data Point: (7.8475997, 0.35121721)
Data Point: (14.384499, 0.35121721)
Data Point: (26.366509, 0.35121721)
Data Point: (48.329302, 0.35121721)
Data Point: (88.586679, 0.35121721)
Data Point: (162.37767, 0.35121721)
Data Point: (297.63514, 0.35121721)
Data Point: (545.55948, 0.35121721)
Data Point: (1000, 0.35121721)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.351 ft^3/ft^3
Liquid Limit: 48 %
Diameter at 10% passing: 0.0001
Diameter at 60% passing: 0.075
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Alluvial (Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 4.786e-005 /psf
Porosity: 0.46611653
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.40088927)
Data Point: (0.018329807, 0.40088927)
Data Point: (0.033598183, 0.40088927)
Data Point: (0.061584821, 0.40088927)
Data Point: (0.11288379, 0.40088927)
Data Point: (0.20691381, 0.40088927)
Data Point: (0.37926902, 0.40088927)
Data Point: (0.6951928, 0.40088927)
Data Point: (1.274275, 0.40088927)
Data Point: (2.3357215, 0.40088927)

Data Point: (4.2813324, 0.40088927)
Data Point: (7.8475997, 0.40088927)
Data Point: (14.384499, 0.40088927)
Data Point: (26.366509, 0.40088927)
Data Point: (48.329302, 0.40088927)
Data Point: (88.586679, 0.40088927)
Data Point: (162.37767, 0.40088927)
Data Point: (297.63514, 0.40088927)
Data Point: (545.55948, 0.40088927)
Data Point: (1000, 0.39828281)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.401 ft^3/ft^3
Liquid Limit: 47 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.1
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Alluvial (Granular)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 2.3925e-006 /psf

Porosity: 0.27269448
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)

Data Point: (0.01, 0.27030198)
Data Point: (0.018329807, 0.27030198)
Data Point: (0.033598183, 0.27030198)
Data Point: (0.061584821, 0.27030198)
Data Point: (0.11288379, 0.27030198)
Data Point: (0.20691381, 0.27030198)
Data Point: (0.37926902, 0.27030198)
Data Point: (0.6951928, 0.27030198)
Data Point: (1.274275, 0.27030198)
Data Point: (2.3357215, 0.27030198)
Data Point: (4.2813324, 0.27030198)
Data Point: (7.8475997, 0.27030198)
Data Point: (14.384499, 0.27030198)
Data Point: (26.366509, 0.27030198)
Data Point: (48.329302, 0.27030198)
Data Point: (88.586679, 0.27030198)
Data Point: (162.37767, 0.27030198)
Data Point: (297.63514, 0.27030198)
Data Point: (545.55948, 0.27030198)
Data Point: (1000, 0.27030198)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Silty Sand
Saturated Water Content: 0.27 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 6
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Fly Ash (Sluiced)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 6.2218e-005 /psf
Porosity: 0.360409
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.35460006)
Data Point: (0.018329807, 0.35460006)
Data Point: (0.033598183, 0.35460006)
Data Point: (0.061584821, 0.35460006)
Data Point: (0.11288379, 0.35460006)
Data Point: (0.20691381, 0.35460006)
Data Point: (0.37926902, 0.35460006)
Data Point: (0.6951928, 0.35460006)
Data Point: (1.274275, 0.35460006)
Data Point: (2.3357215, 0.35460006)
Data Point: (4.2813324, 0.35460006)
Data Point: (7.8475997, 0.35460006)
Data Point: (14.384499, 0.35460006)
Data Point: (26.366509, 0.35460006)
Data Point: (48.329302, 0.35460006)
Data Point: (88.586679, 0.35328934)
Data Point: (162.37767, 0.31177741)
Data Point: (297.63514, 0.23596761)
Data Point: (545.55948, 0.18417704)
Data Point: (1000, 0.15479589)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Silt
Saturated Water Content: 0.3548 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.004
Diameter at 60% passing: 0.49
Maximum: 1000
Minimum: 0.01
Num. Points: 20

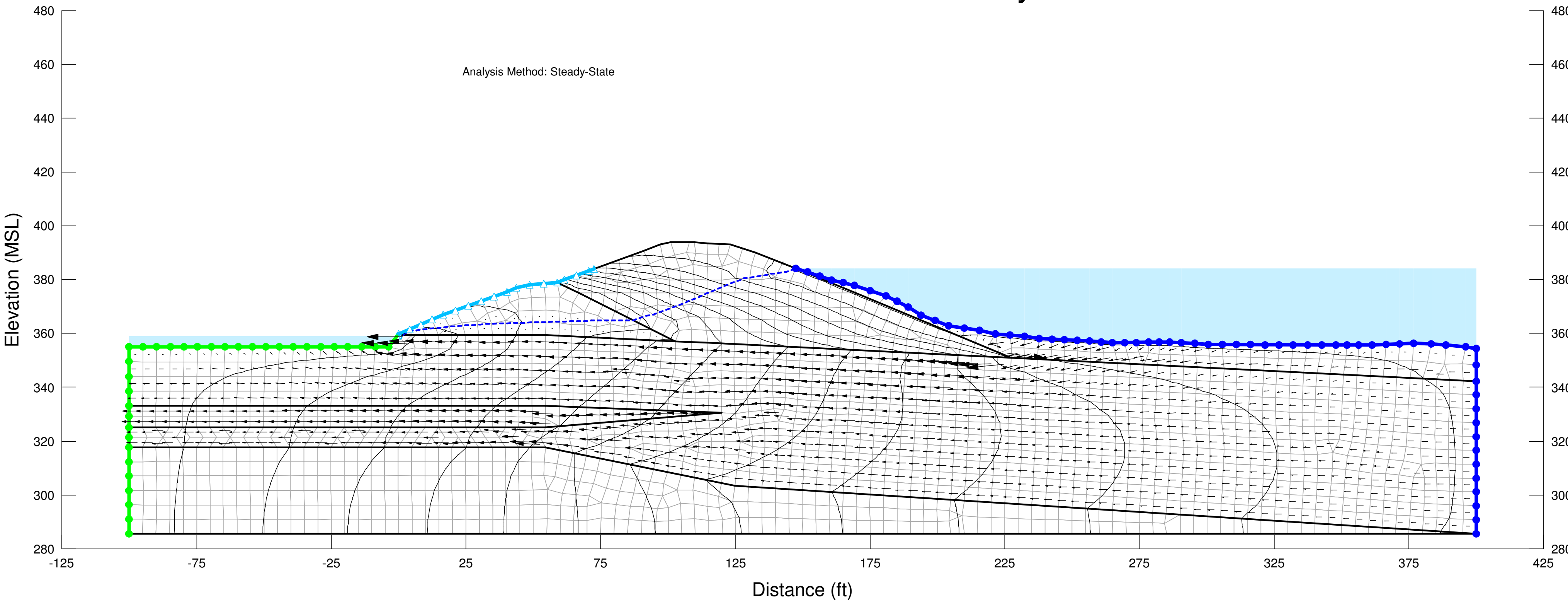
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section Q.gsz

Analysis Name: Steady-State Seepage
Last Solved on 1/12/2010 at 4:28:22 PM
Date Saved: 1/12/2010

Stantec

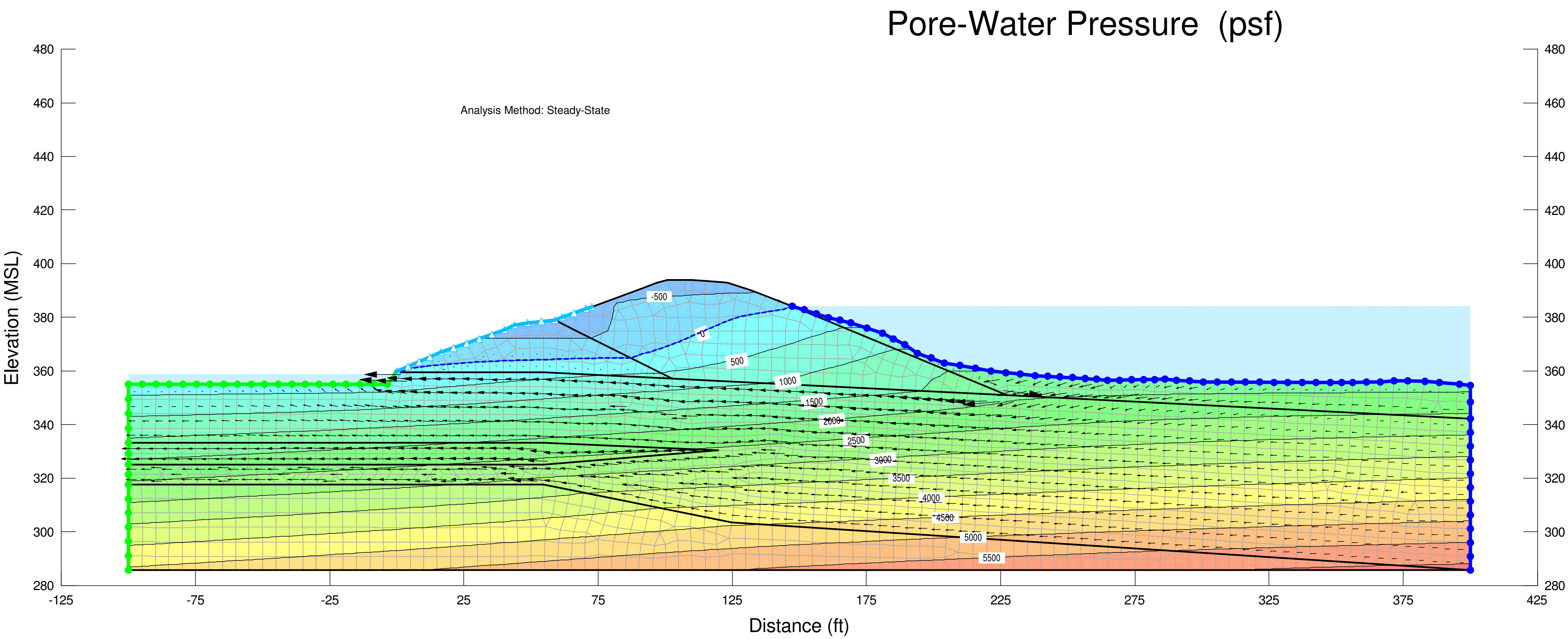
Boundary Conditions with Mesh



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section Q.gsz

Analysis Name: Steady-State Seepage
Last Solved on 1/12/2010 at 4:28:22 PM
Date Saved: 1/12/2010

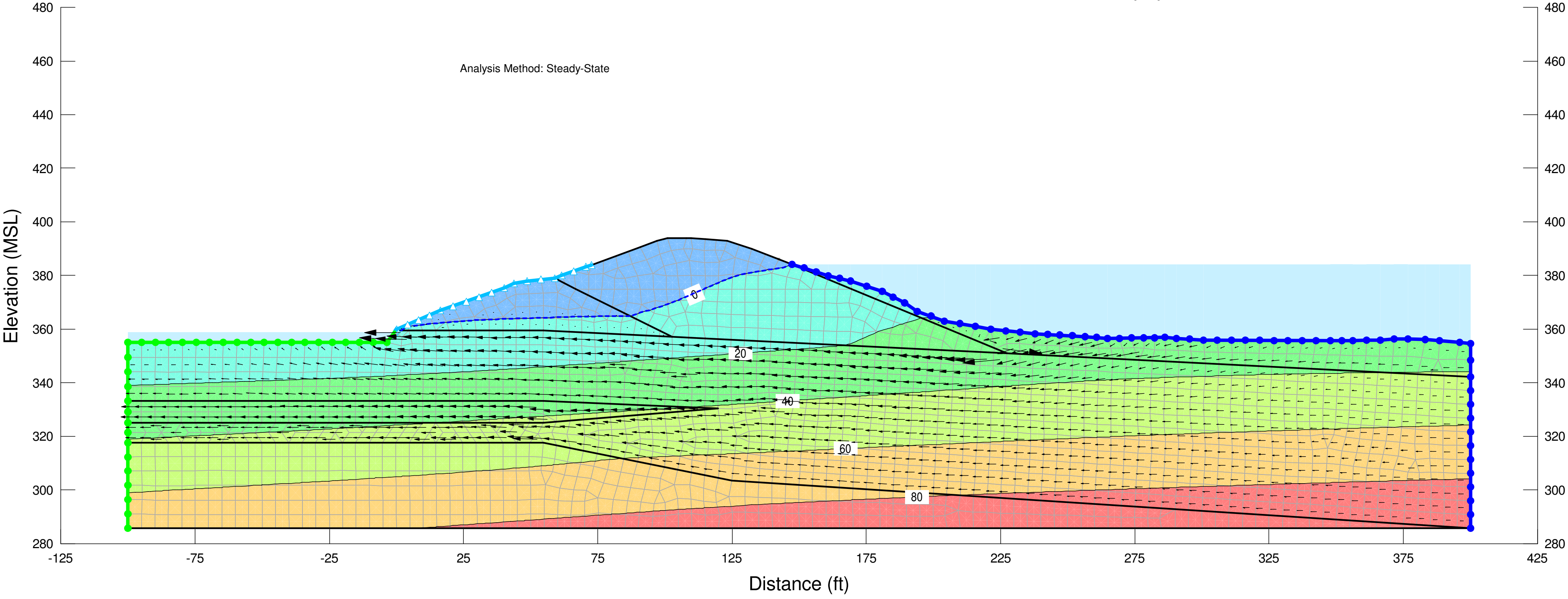


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section Q.gsz

Analysis Name: Steady-State Seepage
Last Solved on 1/12/2010 at 4:28:22 PM
Date Saved: 1/12/2010

Pressure Head (ft)

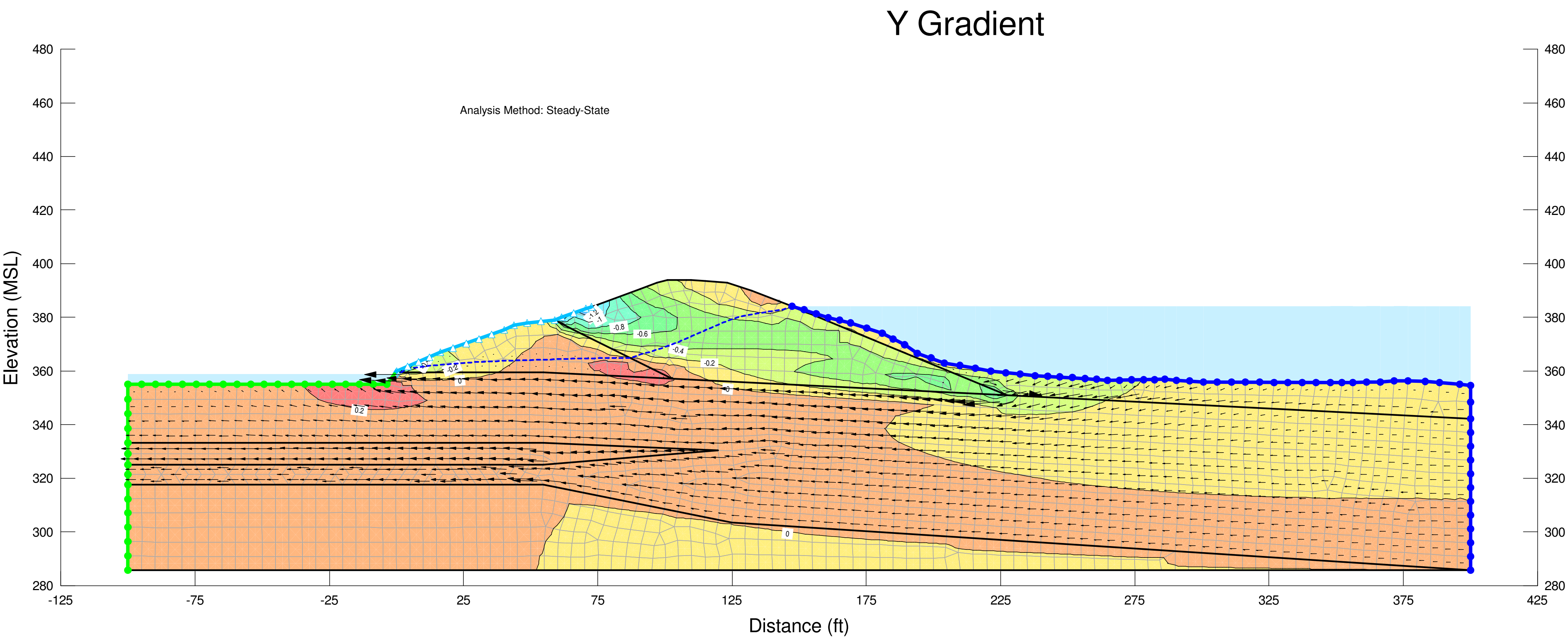


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section Q.gsz

Analysis Name: Steady-State Seepage
Last Solved on 1/12/2010 at 4:28:22 PM
Date Saved: 1/12/2010

Stantec



Steady-State Seepage

File Information

Created By: Cooper, Paul
Revision Number: 226
Last Edited By: Rogers, Daniel
Date: 1/31/2010
Time: 1:07:45 PM
File Name: Section R.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/31/2010
Last Solved Time: 1:10:06 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Steady-State Seepage

- Kind: SEEP/W
- Method: Steady-State
- Settings
  - Include Air Flow: No
- Control
  - Apply Runoff: Yes
- Convergence
  - Convergence Type: Gauss Point K
  - Convergence Settings
    - Maximum Number of Iterations: 500
    - Tolerance: 0.01
    - Maximum Change in K: 0.1
    - Rate of Change in K: 1.02
    - Minimum Change in K: 0.0001
  - Equation Solver: Parallel Direct
  - Potential Seepage Max # of Reviews: 10
- Time
  - Starting Time: 0 sec

Duration: 0 sec
Ending Time: 0 sec

Materials

Dike 1 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 1 (Lean Clay)
Vol. WC. Function: Dike 1 (Lean Clay)
K-Ratio: 0.1
K-Direction: 0 °

Dike 2 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 2 (Lean Clay)
Vol. WC. Function: Dike 2 (Lean Clay)
K-Ratio: 0.1
K-Direction: 0 °

Fly Ash (Sluiced)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Fly Ash (Sluiced)
Vol. WC. Function: Fly Ash (Sluiced)
K-Ratio: 0.02
K-Direction: 0 °

Alluvial Clay

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Clay)
Vol. WC. Function: Alluvial (Clay)
K-Ratio: 0.05
K-Direction: 0 °

Alluvial Granular

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Granular)
Vol. WC. Function: Alluvial (Granular)
K-Ratio: 0.05
K-Direction: 0 °

Bedrock

Model: Saturated Only
Hydraulic
K-Sat: 1e-011 ft/sec

Volumetric Water Content: 0.05 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 0.1
K-Direction: 0 °

Boundary Conditions

Potential Seepage Face

Review: true
Type: Total Flux (Q) 0

Ash Pond

Type: Head (H) 384.23

Wells Creek

Type: Head (H) 359.5

K Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 2.13e-007
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 2.13e-007)
Data Point: (0.018329807, 2.1234388e-007)
Data Point: (0.033598183, 2.1168814e-007)
Data Point: (0.061584821, 2.1103203e-007)
Data Point: (0.11288379, 2.1037498e-007)
Data Point: (0.20691381, 2.0971735e-007)
Data Point: (0.37926902, 2.0905824e-007)
Data Point: (0.6951928, 2.0839653e-007)
Data Point: (1.274275, 2.077303e-007)
Data Point: (2.3357215, 2.070555e-007)
Data Point: (4.2813324, 2.0636507e-007)
Data Point: (7.8475997, 2.0564593e-007)
Data Point: (14.384499, 2.0487454e-007)
Data Point: (26.366509, 2.0400629e-007)
Data Point: (48.329302, 2.0295363e-007)
Data Point: (88.586679, 2.016313e-007)
Data Point: (162.37767, 1.9978076e-007)
Data Point: (297.63514, 1.9457772e-007)
Data Point: (545.55948, 1.9521936e-007)
Data Point: (1000, 7.5557482e-008)
Estimation Properties
Volume Water Content Function: Dike 1 (Lean Clay)

Hydraulic K Sat: 2.13e-007 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.062 ft^3/ft^3

Dike 2 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 1.4e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 1.4e-008)
Data Point: (0.018329807, 1.3839712e-008)
Data Point: (0.033598183, 1.3679373e-008)
Data Point: (0.061584821, 1.3518951e-008)
Data Point: (0.11288379, 1.335855e-008)
Data Point: (0.20691381, 1.3198165e-008)
Data Point: (0.37926902, 1.3037684e-008)
Data Point: (0.6951928, 1.2877019e-008)
Data Point: (1.274275, 1.2715999e-008)
Data Point: (2.3357215, 1.2554349e-008)
Data Point: (4.2813324, 1.2391548e-008)
Data Point: (7.8475997, 1.2226602e-008)
Data Point: (14.384499, 1.2057731e-008)
Data Point: (26.366509, 1.1881667e-008)
Data Point: (48.329302, 1.1692468e-008)
Data Point: (88.586679, 1.1478944e-008)
Data Point: (162.37767, 1.1220975e-008)
Data Point: (297.63514, 1.0889028e-008)
Data Point: (545.55948, 1.0384181e-008)
Data Point: (1000, 9.408038e-009)
Estimation Properties
Volume Water Content Function: Dike 2 (Lean Clay)
Hydraulic K Sat: 1.4e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.08 ft^3/ft^3

Alluvial (Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 4.86e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)

Data Point: (0.01, 4.86e-008)
Data Point: (0.018329807, 4.6081957e-008)
Data Point: (0.033598183, 4.3562037e-008)
Data Point: (0.061584821, 4.1043284e-008)
Data Point: (0.11288379, 3.8524355e-008)
Data Point: (0.20691381, 3.6005505e-008)
Data Point: (0.37926902, 3.348676e-008)
Data Point: (0.6951928, 3.0968229e-008)
Data Point: (1.274275, 2.8450022e-008)
Data Point: (2.3357215, 2.5932423e-008)
Data Point: (4.2813324, 2.3415929e-008)
Data Point: (7.8475997, 2.0901504e-008)
Data Point: (14.384499, 1.8390826e-008)
Data Point: (26.366509, 1.5886992e-008)
Data Point: (48.329302, 1.3395802e-008)
Data Point: (88.586679, 1.0927841e-008)
Data Point: (162.37767, 8.5023705e-009)
Data Point: (297.63514, 6.1503781e-009)
Data Point: (545.55948, 3.9524429e-009)
Data Point: (1000, 2.0421567e-009)

Estimation Properties

Volume Water Content Function: Alluvial (Clay)
Hydraulic K Sat: 4.86e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.07 ft^3/ft^3

Alluvial (Granular)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 6.56e-005
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 6.56e-005)
Data Point: (0.018329807, 6.4809238e-005)
Data Point: (0.033598183, 6.4018422e-005)
Data Point: (0.061584821, 6.3227812e-005)
Data Point: (0.11288379, 6.2437049e-005)
Data Point: (0.20691381, 6.1646212e-005)
Data Point: (0.37926902, 6.0854776e-005)
Data Point: (0.6951928, 6.0062124e-005)
Data Point: (1.274275, 5.9267829e-005)
Data Point: (2.3357215, 5.8470547e-005)
Data Point: (4.2813324, 5.7667753e-005)
Data Point: (7.8475997, 5.6854825e-005)
Data Point: (14.384499, 5.6023348e-005)
Data Point: (26.366509, 5.5157894e-005)

Data Point: (48.329302, 5.4230286e-005)
Data Point: (88.586679, 5.3187637e-005)
Data Point: (162.37767, 5.1934764e-005)
Data Point: (297.63514, 5.0331243e-005)
Data Point: (545.55948, 4.7912406e-005)
Data Point: (1000, 4.3290175e-005)
Estimation Properties
Volume Water Content Function: Alluvial (Granular)
Hydraulic K Sat: 6.56e-005 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.02 ft^3/ft^3

Fly Ash (Sluiced)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 0.000138
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 0.000138)
Data Point: (0.018329807, 0.00013124899)
Data Point: (0.033598183, 0.00012449358)
Data Point: (0.061584821, 0.00011774069)
Data Point: (0.11288379, 0.00011098751)
Data Point: (0.20691381, 0.00010423412)
Data Point: (0.37926902, 9.7480653e-005)
Data Point: (0.6951928, 9.072693e-005)
Data Point: (1.274275, 8.3972583e-005)
Data Point: (2.3357215, 7.7217317e-005)
Data Point: (4.2813324, 7.046016e-005)
Data Point: (7.8475997, 6.3699627e-005)
Data Point: (14.384499, 5.6933042e-005)
Data Point: (26.366509, 5.015463e-005)
Data Point: (48.329302, 4.3351522e-005)
Data Point: (88.586679, 3.6533744e-005)
Data Point: (162.37767, 2.9661059e-005)
Data Point: (297.63514, 2.2043007e-005)
Data Point: (545.55948, 1.5988112e-005)
Data Point: (1000, 1.5284178e-006)
Estimation Properties
Volume Water Content Function: Vol. Water Content Function 9
Hydraulic K Sat: 0.000138 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.015 ft^3/ft^3

Vol. Water Content Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
- Curve Fit to Data: 100 %
- Segment Curvature: 100 %
- Mv: 3e-006 /psf

Porosity: 0.41556948
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
- Data Point: (0.01, 0.41308567)
- Data Point: (0.018329807, 0.41308567)
- Data Point: (0.033598183, 0.41308567)
- Data Point: (0.061584821, 0.41308567)
- Data Point: (0.11288379, 0.41308567)
- Data Point: (0.20691381, 0.41308567)
- Data Point: (0.37926902, 0.41308567)
- Data Point: (0.6951928, 0.41308567)
- Data Point: (1.274275, 0.41308567)
- Data Point: (2.3357215, 0.41308567)
- Data Point: (4.2813324, 0.41308567)
- Data Point: (7.8475997, 0.41308567)
- Data Point: (14.384499, 0.41308567)
- Data Point: (26.366509, 0.41308567)
- Data Point: (48.329302, 0.41308567)
- Data Point: (88.586679, 0.41308567)
- Data Point: (162.37767, 0.41308567)
- Data Point: (297.63514, 0.41308567)
- Data Point: (545.55948, 0.4125467)
- Data Point: (1000, 0.38347036)

Estimation Properties
- Vol. WC Estimation Method: Grain Size Function
- Sample Material: Clay
- Saturated Water Content: 0.413 ft^3/ft^3
- Liquid Limit: 38 %
- Diameter at 10% passing: 0.001
- Diameter at 60% passing: 0.1
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20

Dike 2 (Lean Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
- Curve Fit to Data: 100 %
- Segment Curvature: 100 %
- Mv: 3e-006 /psf

Porosity: 0.35421721

Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
- Data Point: (0.01, 0.35121721)
- Data Point: (0.018329807, 0.35121721)
- Data Point: (0.033598183, 0.35121721)
- Data Point: (0.061584821, 0.35121721)
- Data Point: (0.11288379, 0.35121721)
- Data Point: (0.20691381, 0.35121721)
- Data Point: (0.37926902, 0.35121721)
- Data Point: (0.6951928, 0.35121721)
- Data Point: (1.274275, 0.35121721)
- Data Point: (2.3357215, 0.35121721)
- Data Point: (4.2813324, 0.35121721)
- Data Point: (7.8475997, 0.35121721)
- Data Point: (14.384499, 0.35121721)
- Data Point: (26.366509, 0.35121721)
- Data Point: (48.329302, 0.35121721)
- Data Point: (88.586679, 0.35121721)
- Data Point: (162.37767, 0.35121721)
- Data Point: (297.63514, 0.35121721)
- Data Point: (545.55948, 0.35121721)
- Data Point: (1000, 0.35121721)

Estimation Properties
- Vol. WC Estimation Method: Grain Size Function
- Sample Material: Clay
- Saturated Water Content: 0.351 ft³/ft³
- Liquid Limit: 48 %
- Diameter at 10% passing: 0.001
- Diameter at 60% passing: 0.075
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20

Alluvial (Clay)

Model: Data Point Function

Function: Vol. Water Content vs. Pore-Water Pressure
- Curve Fit to Data: 100 %
- Segment Curvature: 100 %
- Mv: 4.786e-005 /psf

Porosity: 0.46611653

Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
- Data Point: (0.01, 0.40088927)
- Data Point: (0.018329807, 0.40088927)
- Data Point: (0.033598183, 0.40088927)
- Data Point: (0.061584821, 0.40088927)
- Data Point: (0.11288379, 0.40088927)
- Data Point: (0.20691381, 0.40088927)
- Data Point: (0.37926902, 0.40088927)
- Data Point: (0.6951928, 0.40088927)
- Data Point: (1.274275, 0.40088927)
- Data Point: (2.3357215, 0.40088927)

Data Point: (4.2813324, 0.40088927)
Data Point: (7.8475997, 0.40088927)
Data Point: (14.384499, 0.40088927)
Data Point: (26.366509, 0.40088927)
Data Point: (48.329302, 0.40088927)
Data Point: (88.586679, 0.40088927)
Data Point: (162.37767, 0.40088927)
Data Point: (297.63514, 0.40088927)
Data Point: (545.55948, 0.40088927)
Data Point: (1000, 0.39828281)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.401 ft^3/ft^3
Liquid Limit: 47 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.1
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Alluvial (Granular)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 2.3925e-006 /psf

Porosity: 0.27269448
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)

Data Point: (0.01, 0.27030198)
Data Point: (0.018329807, 0.27030198)
Data Point: (0.033598183, 0.27030198)
Data Point: (0.061584821, 0.27030198)
Data Point: (0.11288379, 0.27030198)
Data Point: (0.20691381, 0.27030198)
Data Point: (0.37926902, 0.27030198)
Data Point: (0.6951928, 0.27030198)
Data Point: (1.274275, 0.27030198)
Data Point: (2.3357215, 0.27030198)
Data Point: (4.2813324, 0.27030198)
Data Point: (7.8475997, 0.27030198)
Data Point: (14.384499, 0.27030198)
Data Point: (26.366509, 0.27030198)
Data Point: (48.329302, 0.27030198)
Data Point: (88.586679, 0.27030198)
Data Point: (162.37767, 0.27030198)
Data Point: (297.63514, 0.27030198)
Data Point: (545.55948, 0.27030198)
Data Point: (1000, 0.27030198)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Silty Sand
Saturated Water Content: 0.27 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 6
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Fly Ash (Sluiced)

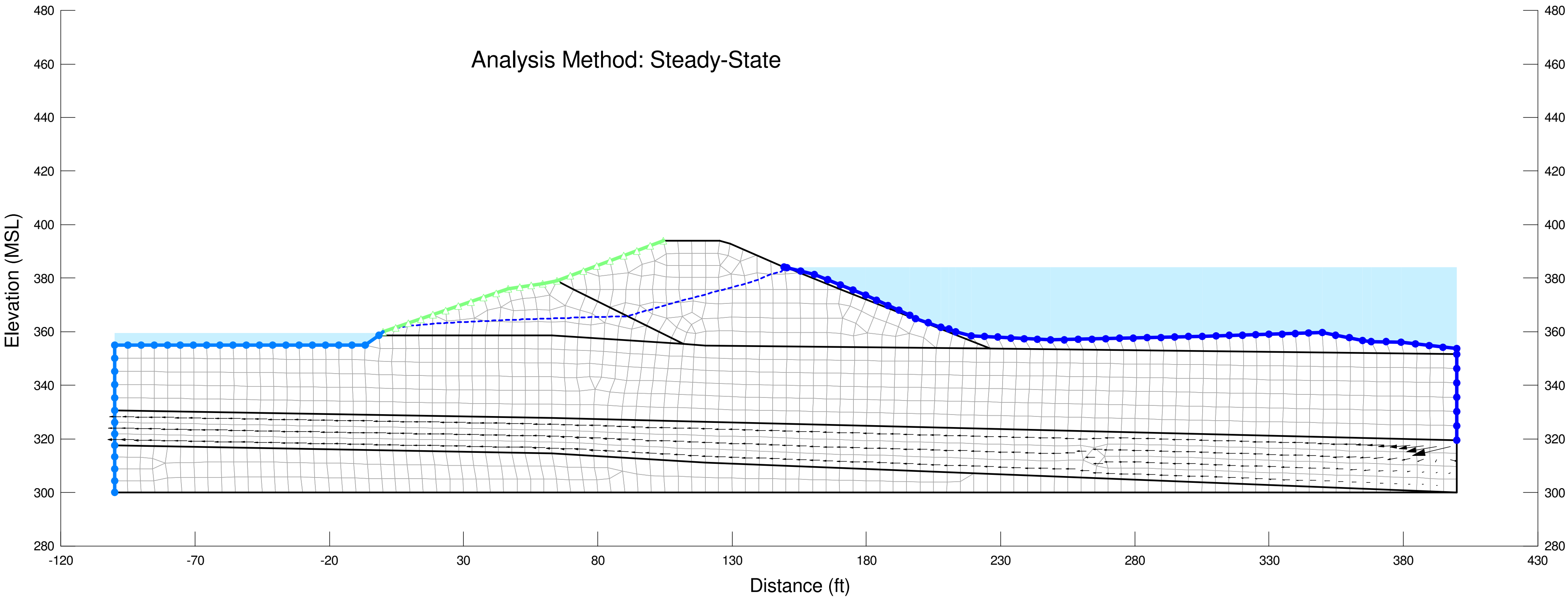
Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 6.2218e-005 /psf
Porosity: 0.37786527
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.35499418)
Data Point: (0.018329807, 0.35499418)
Data Point: (0.033598183, 0.35499418)
Data Point: (0.061584821, 0.35499418)
Data Point: (0.11288379, 0.35499418)
Data Point: (0.20691381, 0.35499418)
Data Point: (0.37926902, 0.35499418)
Data Point: (0.6951928, 0.35499418)
Data Point: (1.274275, 0.35499418)
Data Point: (2.3357215, 0.35499418)
Data Point: (4.2813324, 0.35499418)
Data Point: (7.8475997, 0.35499418)
Data Point: (14.384499, 0.35499418)
Data Point: (26.366509, 0.35499418)
Data Point: (48.329302, 0.35499418)
Data Point: (88.586679, 0.35499418)
Data Point: (162.37767, 0.35499418)
Data Point: (297.63514, 0.35499418)
Data Point: (545.55948, 0.34147401)
Data Point: (1000, 0.26813417)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Silt
Saturated Water Content: 0.3548 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.004
Diameter at 60% passing: 0.049
Maximum: 1000
Minimum: 0.01
Num. Points: 20

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section R.gsz

Analysis Name: Steady-State Seepage
Last Solved on 1/31/2010 at 1:10:06 PM
Date Saved: 1/31/2010

Boundary Conditions with Mesh



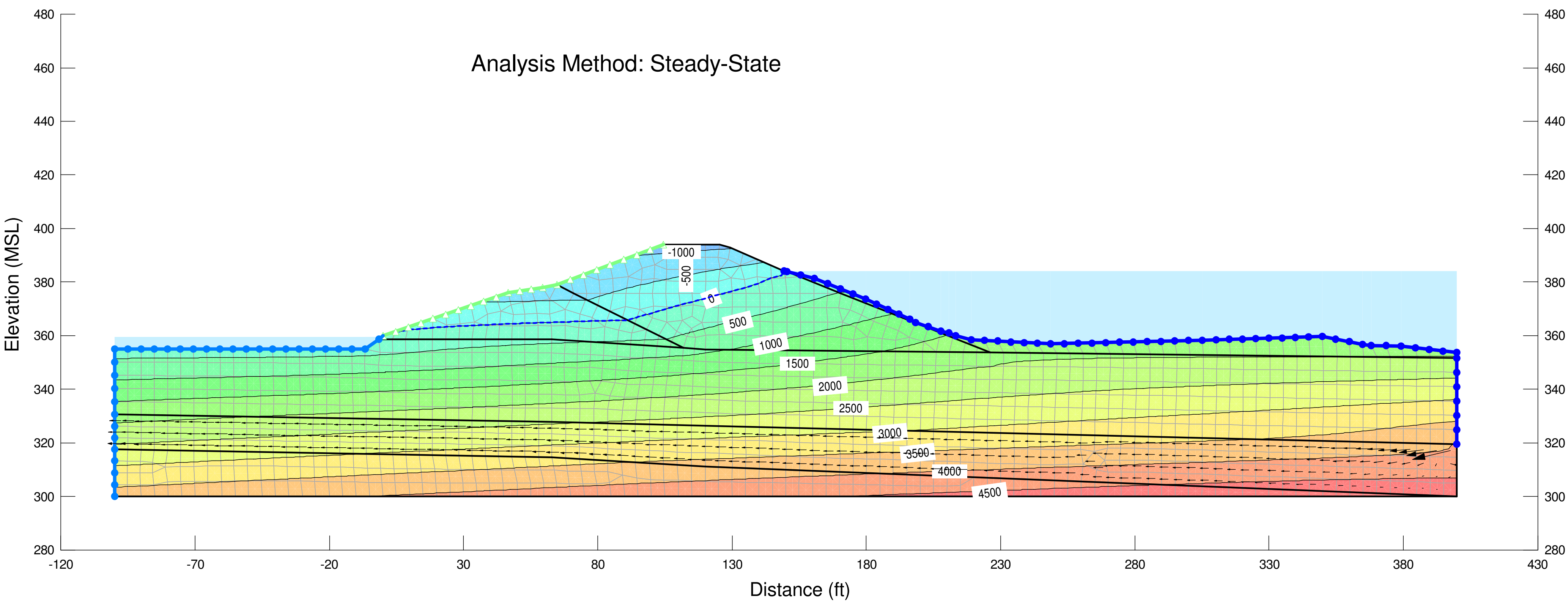
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section R.gsz

Analysis Name: Steady-State Seepage
Last Solved on 1/31/2010 at 1:10:06 PM
Date Saved: 1/31/2010

Stantec

Pore-Water Pressure

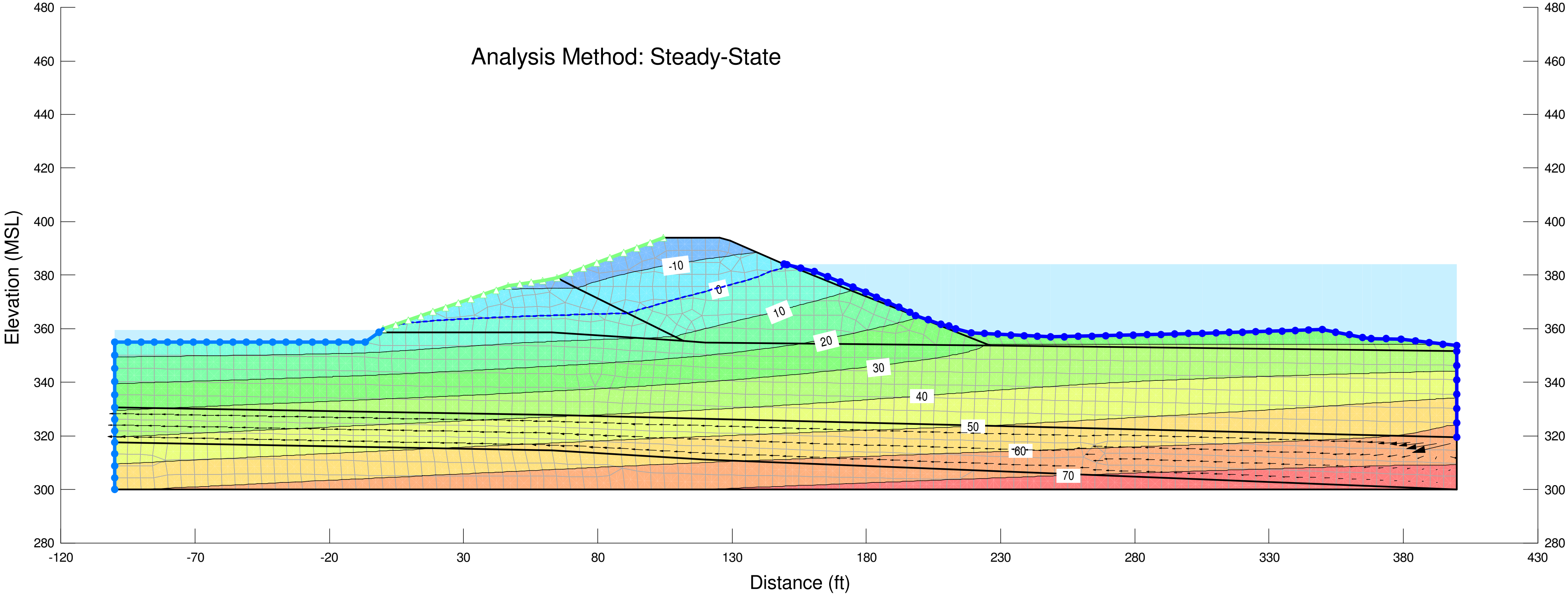


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section R.gsz

Analysis Name: Steady-State Seepage
Last Solved on 1/31/2010 at 1:10:06 PM
Date Saved: 1/31/2010

Pressure Head

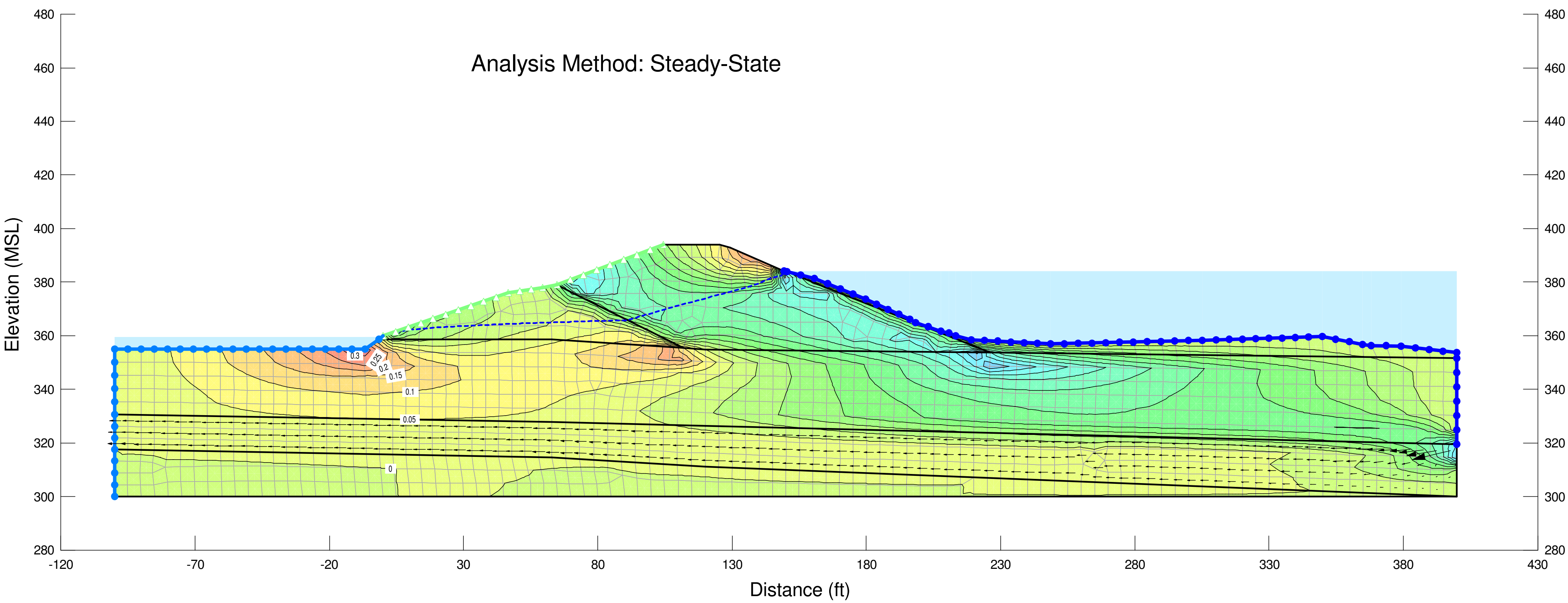


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section R.gsz

Analysis Name: Steady-State Seepage
Last Solved on 1/31/2010 at 1:10:06 PM
Date Saved: 1/31/2010

Y-Gradient



Steady-State Seepage

File Information

Created By: Cooper, Paul
Revision Number: 241
Last Edited By: Rogers, Daniel
Date: 1/21/2010
Time: 7:53:51 PM
File Name: Section S.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/21/2010
Last Solved Time: 7:54:34 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Steady-State Seepage

Kind: SEEP/W
Method: Steady-State
Settings
  Include Air Flow: No
Control
  Apply Runoff: Yes
Convergence
  Convergence Type: Gauss Point K
  Convergence Settings
    Maximum Number of Iterations: 500
    Tolerance: 0.01
    Maximum Change in K: 0.1
    Rate of Change in K: 1.02
    Minimum Change in K: 0.0001
  Equation Solver: Parallel Direct
  Potential Seepage Max # of Reviews: 10
Time
  Starting Time: 0 sec

Duration: 0 sec
Ending Time: 0 sec

Materials

Dike 1 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 1 (Lean Clay)
Vol. WC. Function: Dike 1 (Lean Clay)
K-Ratio: 0.1
K-Direction: 0 °

Dike 2 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 2 (Lean Clay)
Vol. WC. Function: Dike 2 (Lean Clay)
K-Ratio: 0.01
K-Direction: 0 °

Dike 2 (Fat Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 2 (Fat Clay)
Vol. WC. Function: Dike 2 (Fat Clay)
K-Ratio: 0.01
K-Direction: 0 °

Fly Ash (Sluiced)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Fly Ash (Sluiced)
Vol. WC. Function: Fly Ash (Sluiced)
K-Ratio: 0.02
K-Direction: 0 °

Alluvial Clay

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Clay)
Vol. WC. Function: Alluvial Clay
K-Ratio: 0.05
K-Direction: 0 °

Alluvial Granular

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Granular)

Vol. WC. Function: Alluvial Granular
K-Ratio: 0.05
K-Direction: 0 °

Bedrock

Model: Saturated Only
Hydraulic
K-Sat: 1e-011 ft/sec
Volumetric Water Content: 0.05 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 0.1
K-Direction: 0 °

Boundary Conditions

Ash Pond

Type: Head (H) 384.23

Wells Creek

Type: Head (H) 361

K Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 2.13e-007
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 2.13e-007)
Data Point: (0.018329807, 2.1234388e-007)
Data Point: (0.033598183, 2.1168814e-007)
Data Point: (0.061584821, 2.1103203e-007)
Data Point: (0.11288379, 2.1037498e-007)
Data Point: (0.20691381, 2.0971735e-007)
Data Point: (0.37926902, 2.0905824e-007)
Data Point: (0.6951928, 2.0839653e-007)
Data Point: (1.274275, 2.077303e-007)
Data Point: (2.3357215, 2.070555e-007)
Data Point: (4.2813324, 2.0636507e-007)
Data Point: (7.8475997, 2.0564593e-007)
Data Point: (14.384499, 2.0487454e-007)
Data Point: (26.366509, 2.0400629e-007)
Data Point: (48.329302, 2.0295363e-007)
Data Point: (88.586679, 2.016313e-007)
Data Point: (162.37767, 1.9978076e-007)
Data Point: (297.63514, 1.9457772e-007)

Data Point: (545.55948, 1.9521936e-007)
Data Point: (1000, 7.5557482e-008)
Estimation Properties
Volume Water Content Function: Dike 1 (Lean Clay)
Hydraulic K Sat: 2.13e-007 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.06 ft³/ft³

Dike 2 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 1.4e-007
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 1.4e-007)
Data Point: (0.018329807, 1.3839712e-007)
Data Point: (0.033598183, 1.3679373e-007)
Data Point: (0.061584821, 1.3518951e-007)
Data Point: (0.11288379, 1.335855e-007)
Data Point: (0.20691381, 1.3198165e-007)
Data Point: (0.37926902, 1.3037684e-007)
Data Point: (0.6951928, 1.2877019e-007)
Data Point: (1.274275, 1.2715999e-007)
Data Point: (2.3357215, 1.2554349e-007)
Data Point: (4.2813324, 1.2391548e-007)
Data Point: (7.8475997, 1.2226602e-007)
Data Point: (14.384499, 1.2057731e-007)
Data Point: (26.366509, 1.1881667e-007)
Data Point: (48.329302, 1.1692468e-007)
Data Point: (88.586679, 1.1478944e-007)
Data Point: (162.37767, 1.1220975e-007)
Data Point: (297.63514, 1.0889028e-007)
Data Point: (545.55948, 1.0384181e-007)
Data Point: (1000, 9.408038e-008)
Estimation Properties
Volume Water Content Function: Dike 2 (Lean Clay)
Hydraulic K Sat: 1.4e-007 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.08 ft³/ft³

Alluvial (Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 4.86e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 4.86e-008)
Data Point: (0.018329807, 4.6081772e-008)
Data Point: (0.033598183, 4.3561857e-008)
Data Point: (0.061584821, 4.104302e-008)
Data Point: (0.11288379, 3.8524125e-008)
Data Point: (0.20691381, 3.6005291e-008)
Data Point: (0.37926902, 3.3486567e-008)
Data Point: (0.6951928, 3.0968085e-008)
Data Point: (1.274275, 2.8449893e-008)
Data Point: (2.3357215, 2.5932304e-008)
Data Point: (4.2813324, 2.3415812e-008)
Data Point: (7.8475997, 2.0901374e-008)
Data Point: (14.384499, 1.8390713e-008)
Data Point: (26.366509, 1.5886901e-008)
Data Point: (48.329302, 1.3395726e-008)
Data Point: (88.586679, 1.0927777e-008)
Data Point: (162.37767, 8.5023183e-009)
Data Point: (297.63514, 6.1503404e-009)
Data Point: (545.55948, 3.9524194e-009)
Data Point: (1000, 2.0421444e-009)
Estimation Properties
Volume Water Content Function: Alluvial Clay
Hydraulic K Sat: 4.86e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.07 ft^3/ft^3

Alluvial (Granular)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 6.56e-005
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 6.56e-005)
Data Point: (0.018329807, 6.4809238e-005)
Data Point: (0.033598183, 6.4018422e-005)
Data Point: (0.061584821, 6.3227812e-005)
Data Point: (0.11288379, 6.2437049e-005)
Data Point: (0.20691381, 6.1646212e-005)
Data Point: (0.37926902, 6.0854776e-005)
Data Point: (0.6951928, 6.0062124e-005)
Data Point: (1.274275, 5.9267829e-005)
Data Point: (2.3357215, 5.8470547e-005)

Data Point: (4.2813324, 5.7667753e-005)
Data Point: (7.8475997, 5.6854825e-005)
Data Point: (14.384499, 5.6023348e-005)
Data Point: (26.366509, 5.5157894e-005)
Data Point: (48.329302, 5.4230286e-005)
Data Point: (88.586679, 5.3187637e-005)
Data Point: (162.37767, 5.1934764e-005)
Data Point: (297.63514, 5.0331243e-005)
Data Point: (545.55948, 4.7912406e-005)
Data Point: (1000, 4.3290175e-005)
Estimation Properties
Volume Water Content Function: Alluvial Granular
Hydraulic K Sat: 6.56e-005 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.02 ft^3/ft^3

Fly Ash (Sluiced)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 0.000138
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 0.000138)
Data Point: (0.018329807, 0.00013124901)
Data Point: (0.033598183, 0.00012449327)
Data Point: (0.061584821, 0.00011774033)
Data Point: (0.11288379, 0.0001109872)
Data Point: (0.20691381, 0.00010423397)
Data Point: (0.37926902, 9.7480512e-005)
Data Point: (0.6951928, 9.0726822e-005)
Data Point: (1.274275, 8.3972556e-005)
Data Point: (2.3357215, 7.7217303e-005)
Data Point: (4.2813324, 7.0460153e-005)
Data Point: (7.8475997, 6.3699615e-005)
Data Point: (14.384499, 5.6933028e-005)
Data Point: (26.366509, 5.0154616e-005)
Data Point: (48.329302, 4.3351508e-005)
Data Point: (88.586679, 3.6533731e-005)
Data Point: (162.37767, 2.9661049e-005)
Data Point: (297.63514, 2.2042999e-005)
Data Point: (545.55948, 1.5988106e-005)
Data Point: (1000, 1.5284174e-006)
Estimation Properties
Volume Water Content Function: Fly Ash (Sluiced)
Hydraulic K Sat: 0.000138 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function

Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.015 ft^3/ft^3

Dike 2 (Fat Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 8.86e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 8.86e-008)
Data Point: (0.018329807, 8.4667011e-008)
Data Point: (0.033598183, 8.0730953e-008)
Data Point: (0.061584821, 7.6795897e-008)
Data Point: (0.11288379, 7.2861087e-008)
Data Point: (0.20691381, 6.8926585e-008)
Data Point: (0.37926902, 6.4991665e-008)
Data Point: (0.6951928, 6.10567e-008)
Data Point: (1.274275, 5.7121196e-008)
Data Point: (2.3357215, 5.3184636e-008)
Data Point: (4.2813324, 4.9246187e-008)
Data Point: (7.8475997, 4.5304276e-008)
Data Point: (14.384499, 4.1356077e-008)
Data Point: (26.366509, 3.7396344e-008)
Data Point: (48.329302, 3.3415636e-008)
Data Point: (88.586679, 2.9395678e-008)
Data Point: (162.37767, 2.5304446e-008)
Data Point: (297.63514, 2.1098297e-008)
Data Point: (545.55948, 1.6607161e-008)
Data Point: (1000, 1.1464819e-008)
Estimation Properties
Volume Water Content Function: Dike 2 (Fat Clay)
Hydraulic K Sat: 8.86e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.09 ft^3/ft^3

Vol. Water Content Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 3e-006 /psf

Porosity: 0.41556948
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
- Data Point: (0.01, 0.41308567)
- Data Point: (0.018329807, 0.41308567)
- Data Point: (0.033598183, 0.41308567)
- Data Point: (0.061584821, 0.41308567)
- Data Point: (0.11288379, 0.41308567)
- Data Point: (0.20691381, 0.41308567)
- Data Point: (0.37926902, 0.41308567)
- Data Point: (0.6951928, 0.41308567)
- Data Point: (1.274275, 0.41308567)
- Data Point: (2.3357215, 0.41308567)
- Data Point: (4.2813324, 0.41308567)
- Data Point: (7.8475997, 0.41308567)
- Data Point: (14.384499, 0.41308567)
- Data Point: (26.366509, 0.41308567)
- Data Point: (48.329302, 0.41308567)
- Data Point: (88.586679, 0.41308567)
- Data Point: (162.37767, 0.41308567)
- Data Point: (297.63514, 0.41308567)
- Data Point: (545.55948, 0.4125467)
- Data Point: (1000, 0.38347036)

Estimation Properties
- Vol. WC Estimation Method: Grain Size Function
- Sample Material: Clay
- Saturated Water Content: 0.413 ft³/ft³
- Liquid Limit: 38 %
- Diameter at 10% passing: 0.001
- Diameter at 60% passing: 0.1
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20

Dike 2 (Lean Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
- Curve Fit to Data: 100 %
- Segment Curvature: 100 %
- Mv: 3e-006 /psf

Porosity: 0.35421721
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
- Data Point: (0.01, 0.35121721)
- Data Point: (0.018329807, 0.35121721)
- Data Point: (0.033598183, 0.35121721)
- Data Point: (0.061584821, 0.35121721)
- Data Point: (0.11288379, 0.35121721)
- Data Point: (0.20691381, 0.35121721)
- Data Point: (0.37926902, 0.35121721)
- Data Point: (0.6951928, 0.35121721)
- Data Point: (1.274275, 0.35121721)

Data Point: (2.3357215, 0.35121721)
Data Point: (4.2813324, 0.35121721)
Data Point: (7.8475997, 0.35121721)
Data Point: (14.384499, 0.35121721)
Data Point: (26.366509, 0.35121721)
Data Point: (48.329302, 0.35121721)
Data Point: (88.586679, 0.35121721)
Data Point: (162.37767, 0.35121721)
Data Point: (297.63514, 0.35121721)
Data Point: (545.55948, 0.35121721)
Data Point: (1000, 0.35121721)

Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.351 ft³/ft³
Liquid Limit: 48 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.075
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Alluvial Clay

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 4.786e-005 /psf
Porosity: 0.46611653
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
Data Point: (0.01, 0.40088927)
Data Point: (0.018329807, 0.40088927)
Data Point: (0.033598183, 0.40088927)
Data Point: (0.061584821, 0.40088927)
Data Point: (0.11288379, 0.40088927)
Data Point: (0.20691381, 0.40088927)
Data Point: (0.37926902, 0.40088927)
Data Point: (0.6951928, 0.40088927)
Data Point: (1.274275, 0.40088927)
Data Point: (2.3357215, 0.40088927)
Data Point: (4.2813324, 0.40088927)
Data Point: (7.8475997, 0.40088927)
Data Point: (14.384499, 0.40088927)
Data Point: (26.366509, 0.40088927)
Data Point: (48.329302, 0.40088927)
Data Point: (88.586679, 0.40088927)
Data Point: (162.37767, 0.40088927)
Data Point: (297.63514, 0.40088927)
Data Point: (545.55948, 0.40088927)
Data Point: (1000, 0.39828281)

Estimation Properties
- Vol. WC Estimation Method: Grain Size Function
- Sample Material: Clay
- Saturated Water Content: 0.401 ft³/ft³
- Liquid Limit: 47 %
- Diameter at 10% passing: 0.001
- Diameter at 60% passing: 0.1
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20

Alluvial Granular

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
- Curve Fit to Data: 100 %
- Segment Curvature: 100 %
- Mv: 2.3925e-006 /psf

Porosity: 0.27269448
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
- Data Point: (0.01, 0.27030198)
- Data Point: (0.018329807, 0.27030198)
- Data Point: (0.033598183, 0.27030198)
- Data Point: (0.061584821, 0.27030198)
- Data Point: (0.11288379, 0.27030198)
- Data Point: (0.20691381, 0.27030198)
- Data Point: (0.37926902, 0.27030198)
- Data Point: (0.6951928, 0.27030198)
- Data Point: (1.274275, 0.27030198)
- Data Point: (2.3357215, 0.27030198)
- Data Point: (4.2813324, 0.27030198)
- Data Point: (7.8475997, 0.27030198)
- Data Point: (14.384499, 0.27030198)
- Data Point: (26.366509, 0.27030198)
- Data Point: (48.329302, 0.27030198)
- Data Point: (88.586679, 0.27030198)
- Data Point: (162.37767, 0.27030198)
- Data Point: (297.63514, 0.27030198)
- Data Point: (545.55948, 0.27030198)
- Data Point: (1000, 0.27030198)

Estimation Properties
- Vol. WC Estimation Method: Grain Size Function
- Sample Material: Silty Sand
- Saturated Water Content: 0.27 ft³/ft³
- Liquid Limit: 0 %
- Diameter at 10% passing: 0.001
- Diameter at 60% passing: 6
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20

Fly Ash (Sluiced)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
 Curve Fit to Data: 100 %
 Segment Curvature: 100 %
 Mv: 6.2218e-005 /psf
Porosity: 0.37786527
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
 Data Point: (0.01, 0.35499418)
 Data Point: (0.018329807, 0.35499418)
 Data Point: (0.033598183, 0.35499418)
 Data Point: (0.061584821, 0.35499418)
 Data Point: (0.11288379, 0.35499418)
 Data Point: (0.20691381, 0.35499418)
 Data Point: (0.37926902, 0.35499418)
 Data Point: (0.6951928, 0.35499418)
 Data Point: (1.274275, 0.35499418)
 Data Point: (2.3357215, 0.35499418)
 Data Point: (4.2813324, 0.35499418)
 Data Point: (7.8475997, 0.35499418)
 Data Point: (14.384499, 0.35499418)
 Data Point: (26.366509, 0.35499418)
 Data Point: (48.329302, 0.35499418)
 Data Point: (88.586679, 0.35499418)
 Data Point: (162.37767, 0.35499418)
 Data Point: (297.63514, 0.35499418)
 Data Point: (545.55948, 0.34147401)
 Data Point: (1000, 0.26813417)
Estimation Properties
 Vol. WC Estimation Method: Grain Size Function
 Sample Material: Silt
 Saturated Water Content: 0.3548 ft^3/ft^3
 Liquid Limit: 0 %
 Diameter at 10% passing: 0.004
 Diameter at 60% passing: 0.049
 Maximum: 1000
 Minimum: 0.01
 Num. Points: 20

Dike 2 (Fat Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
 Curve Fit to Data: 100 %
 Segment Curvature: 100 %
 Mv: 1.4358e-005 /psf
Porosity: 0.36512838
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
 Data Point: (0.01, 0.35077038)
 Data Point: (0.018329807, 0.35077038)

Data Point: (0.033598183, 0.35077038)
Data Point: (0.061584821, 0.35077038)
Data Point: (0.11288379, 0.35077038)
Data Point: (0.20691381, 0.35077038)
Data Point: (0.37926902, 0.35077038)
Data Point: (0.6951928, 0.35077038)
Data Point: (1.274275, 0.35077038)
Data Point: (2.3357215, 0.35077038)
Data Point: (4.2813324, 0.35077038)
Data Point: (7.8475997, 0.35077038)
Data Point: (14.384499, 0.35077038)
Data Point: (26.366509, 0.35077038)
Data Point: (48.329302, 0.35077038)
Data Point: (88.586679, 0.35077038)
Data Point: (162.37767, 0.35077038)
Data Point: (297.63514, 0.35077038)
Data Point: (545.55948, 0.35077038)
Data Point: (1000, 0.35077038)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.351 ft³/ft³
Liquid Limit: 54 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.043
Maximum: 1000
Minimum: 0.01
Num. Points: 20

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section S.gsz

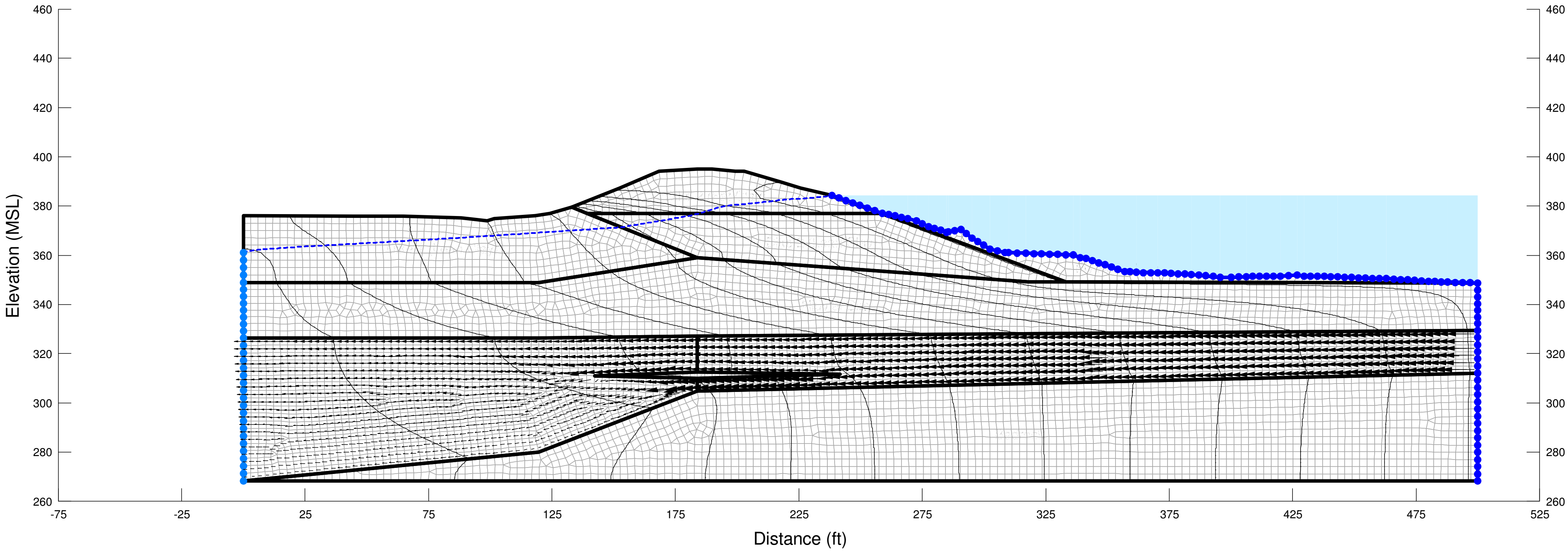
Analysis Name: Steady-State Seepage

Date Saved: 1/21/2010

Last Solved on 1/21/2010 at 7:54:34 PM

Analysis Method: Steady-State

Boundry Conditions with Mesh



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

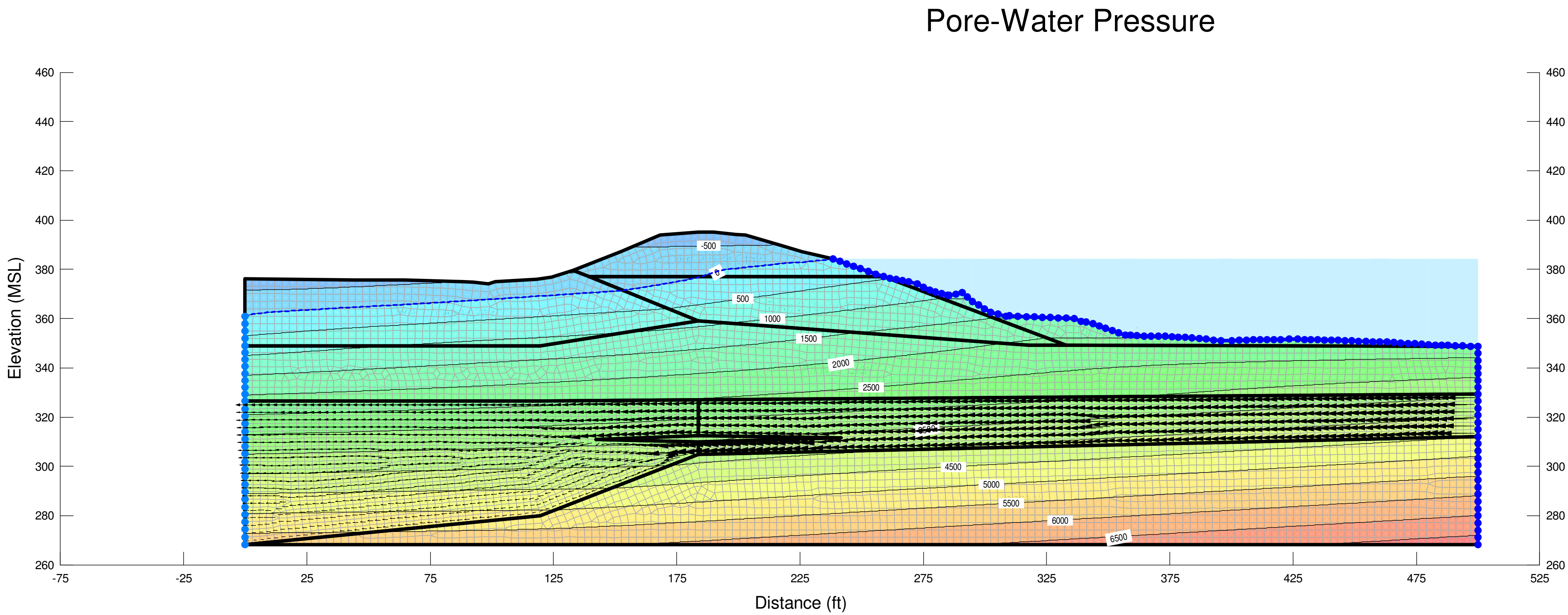
File Name: Section S.gsz

Analysis Name: Steady-State Seepage

Date Saved: 1/21/2010

Last Solved on 1/21/2010 at 7:54:34 PM

Analysis Method: Steady-State



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section S.gsz

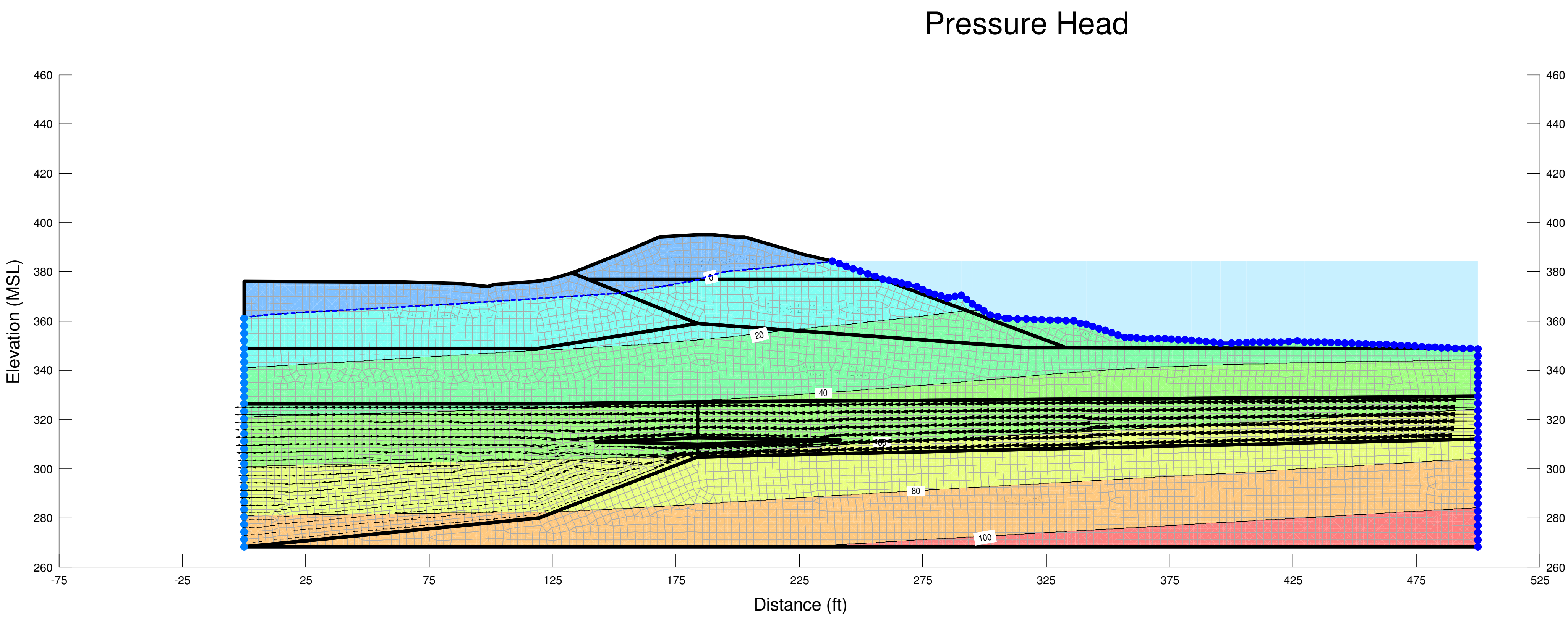
Analysis Name: Steady-State Seepage

Date Saved: 1/21/2010

Last Solved on 1/21/2010 at 7:54:34 PM

Analysis Method: Steady-State

Stantec



Stantec

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section S.gsz

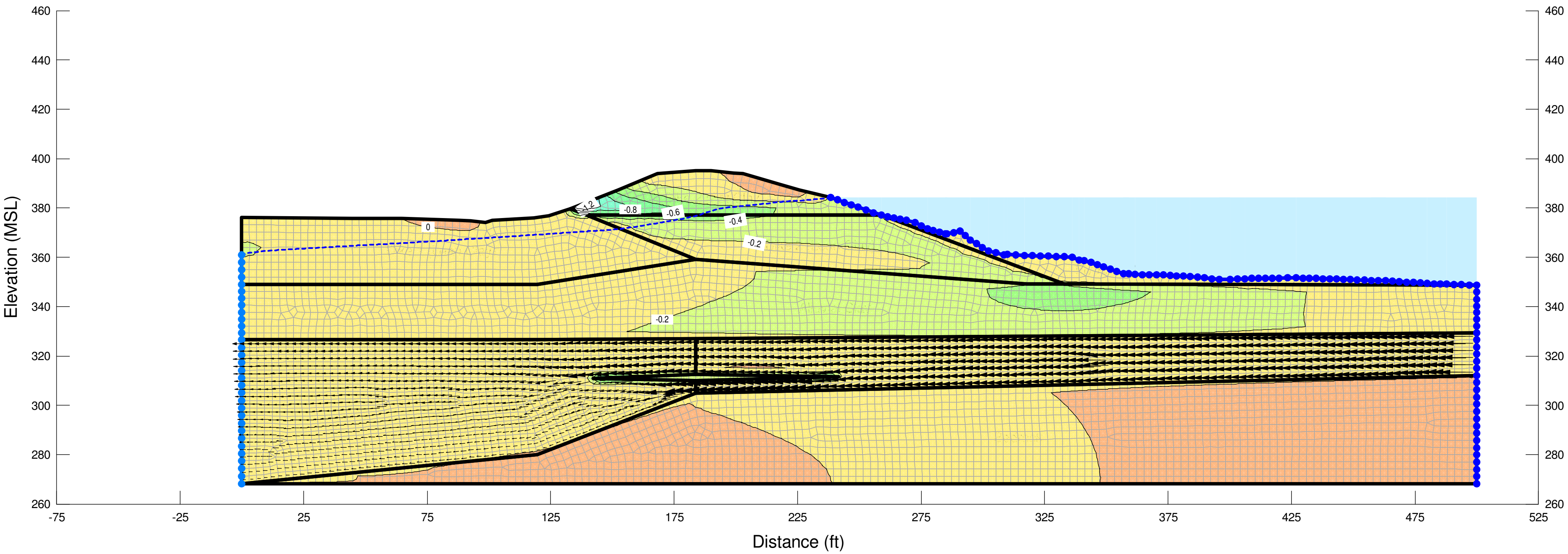
Analysis Name: Steady-State Seepage

Date Saved: 1/21/2010

Last Solved on 1/21/2010 at 7:54:34 PM

Analysis Method: Steady-State

Y-Gradient



Steady-State Seepage

File Information

Created By: Cooper, Paul
Revision Number: 243
Last Edited By: Rogers, Daniel
Date: 1/22/2010
Time: 2:02:48 PM
File Name: Section T.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/22/2010
Last Solved Time: 2:03:38 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Steady-State Seepage

Kind: SEEP/W
Method: Steady-State
Settings
- Include Air Flow: No

Control
- Apply Runoff: Yes

Convergence
- Convergence Type: Gauss Point K
- Convergence Settings
  - Maximum Number of Iterations: 500
  - Tolerance: 0.01
  - Maximum Change in K: 0.1
  - Rate of Change in K: 1.02
  - Minimum Change in K: 0.0001
- Equation Solver: Parallel Direct
- Potential Seepage Max # of Reviews: 10

Time
- Starting Time: 0 sec

Duration: 0 sec
Ending Time: 0 sec

Materials

Dike 1 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 1 (Lean Clay)
Vol. WC. Function: Dike 1 (Lean Clay)
K-Ratio: 0.1
K-Direction: 0 °

Dike 2 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 2 (Lean Clay)
Vol. WC. Function: Dike 2 (Lean Clay)
K-Ratio: 0.1
K-Direction: 0 °

Dike 2 (Fat Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 2 (Fat Clay)
Vol. WC. Function: Dike 2 (Fat Clay)
K-Ratio: 0.1
K-Direction: 0 °

Fly Ash (Sluiced)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Fly Ash (Sluiced)
Vol. WC. Function: Fly Ash (Sluiced)
K-Ratio: 0.02
K-Direction: 0 °

Alluvial Clay

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Clay)
Vol. WC. Function: Alluvial (Clay)
K-Ratio: 0.05
K-Direction: 0 °

Alluvial Granular

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Granular)

Vol. WC. Function: Alluvial (Granular)
K-Ratio: 0.05
K-Direction: 0 °

Bedrock

Model: Saturated Only
Hydraulic
K-Sat: 1e-011 ft/sec
Volumetric Water Content: 0.05 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 0.1
K-Direction: 0 °

Boundary Conditions

Potential Seepage Face

Review: true
Type: Total Flux (Q) 0

Ash Pond

Type: Head (H) 384.23

Wells Creek

Type: Head (H) 359.5

K Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 2.13e-007
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 2.13e-007)
Data Point: (0.018329807, 2.1234388e-007)
Data Point: (0.033598183, 2.1168814e-007)
Data Point: (0.061584821, 2.1103203e-007)
Data Point: (0.11288379, 2.1037498e-007)
Data Point: (0.20691381, 2.0971735e-007)
Data Point: (0.37926902, 2.0905824e-007)
Data Point: (0.6951928, 2.0839653e-007)
Data Point: (1.274275, 2.077303e-007)
Data Point: (2.3357215, 2.070555e-007)
Data Point: (4.2813324, 2.0636507e-007)
Data Point: (7.8475997, 2.0564593e-007)
Data Point: (14.384499, 2.0487454e-007)
Data Point: (26.366509, 2.0400629e-007)

Data Point: (48.329302, 2.0295363e-007)
Data Point: (88.586679, 2.016313e-007)
Data Point: (162.37767, 1.9978076e-007)
Data Point: (297.63514, 1.9457772e-007)
Data Point: (545.55948, 1.9521936e-007)
Data Point: (1000, 7.5557482e-008)

Estimation Properties

Volume Water Content Function: Dike 1 (Lean Clay)
Hydraulic K Sat: 2.13e-007 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.06 ft^3/ft^3

Dike 2 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %

K-Saturation: 1.4e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)

Data Point: (0.01, 1.4e-008)
Data Point: (0.018329807, 1.3839712e-008)
Data Point: (0.033598183, 1.3679373e-008)
Data Point: (0.061584821, 1.3518951e-008)
Data Point: (0.11288379, 1.335855e-008)
Data Point: (0.20691381, 1.3198165e-008)
Data Point: (0.37926902, 1.3037684e-008)
Data Point: (0.6951928, 1.2877019e-008)
Data Point: (1.274275, 1.2715999e-008)
Data Point: (2.3357215, 1.2554349e-008)
Data Point: (4.2813324, 1.2391548e-008)
Data Point: (7.8475997, 1.2226602e-008)
Data Point: (14.384499, 1.2057731e-008)
Data Point: (26.366509, 1.1881667e-008)
Data Point: (48.329302, 1.1692468e-008)
Data Point: (88.586679, 1.1478944e-008)
Data Point: (162.37767, 1.1220975e-008)
Data Point: (297.63514, 1.0889028e-008)
Data Point: (545.55948, 1.0384181e-008)
Data Point: (1000, 9.408038e-009)

Estimation Properties

Volume Water Content Function: Dike 2 (Lean Clay)
Hydraulic K Sat: 1.4e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.08 ft^3/ft^3

Alluvial (Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 4.86e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 4.86e-008)
Data Point: (0.018329807, 4.6081957e-008)
Data Point: (0.033598183, 4.3562037e-008)
Data Point: (0.061584821, 4.1043284e-008)
Data Point: (0.11288379, 3.8524355e-008)
Data Point: (0.20691381, 3.6005505e-008)
Data Point: (0.37926902, 3.348676e-008)
Data Point: (0.6951928, 3.0968229e-008)
Data Point: (1.274275, 2.8450022e-008)
Data Point: (2.3357215, 2.5932423e-008)
Data Point: (4.2813324, 2.3415929e-008)
Data Point: (7.8475997, 2.0901504e-008)
Data Point: (14.384499, 1.8390826e-008)
Data Point: (26.366509, 1.5886992e-008)
Data Point: (48.329302, 1.3395802e-008)
Data Point: (88.586679, 1.0927841e-008)
Data Point: (162.37767, 8.5023705e-009)
Data Point: (297.63514, 6.1503781e-009)
Data Point: (545.55948, 3.9524429e-009)
Data Point: (1000, 2.0421567e-009)
Estimation Properties
Volume Water Content Function: Alluvial (Clay)
Hydraulic K Sat: 4.86e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.07 ft^3/ft^3

Alluvial (Granular)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 6.56e-005
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 6.56e-005)
Data Point: (0.018329807, 6.4809238e-005)
Data Point: (0.033598183, 6.4018422e-005)
Data Point: (0.061584821, 6.3227812e-005)
Data Point: (0.11288379, 6.2437049e-005)
Data Point: (0.20691381, 6.1646212e-005)

Data Point: (0.37926902, 6.0854776e-005)
Data Point: (0.6951928, 6.0062124e-005)
Data Point: (1.274275, 5.9267829e-005)
Data Point: (2.3357215, 5.8470547e-005)
Data Point: (4.2813324, 5.7667753e-005)
Data Point: (7.8475997, 5.6854825e-005)
Data Point: (14.384499, 5.6023348e-005)
Data Point: (26.366509, 5.5157894e-005)
Data Point: (48.329302, 5.4230286e-005)
Data Point: (88.586679, 5.3187637e-005)
Data Point: (162.37767, 5.1934764e-005)
Data Point: (297.63514, 5.0331243e-005)
Data Point: (545.55948, 4.7912406e-005)
Data Point: (1000, 4.3290175e-005)
Estimation Properties
Volume Water Content Function: Alluvial (Granular)
Hydraulic K Sat: 6.56e-005 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.02 ft^3/ft^3

Fly Ash (Sluiced)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 0.000138
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 0.000138)
Data Point: (0.018329807, 0.00013124899)
Data Point: (0.033598183, 0.00012449358)
Data Point: (0.061584821, 0.00011774069)
Data Point: (0.11288379, 0.00011098751)
Data Point: (0.20691381, 0.00010423412)
Data Point: (0.37926902, 9.7480653e-005)
Data Point: (0.6951928, 9.072693e-005)
Data Point: (1.274275, 8.3972583e-005)
Data Point: (2.3357215, 7.7217317e-005)
Data Point: (4.2813324, 7.046016e-005)
Data Point: (7.8475997, 6.3699627e-005)
Data Point: (14.384499, 5.6933042e-005)
Data Point: (26.366509, 5.015463e-005)
Data Point: (48.329302, 4.3351522e-005)
Data Point: (88.586679, 3.6533744e-005)
Data Point: (162.37767, 2.9661059e-005)
Data Point: (297.63514, 2.2043007e-005)
Data Point: (545.55948, 1.5988112e-005)
Data Point: (1000, 1.5284178e-006)

Estimation Properties
- Volume Water Content Function: Fly Ash (Sluiced)
- Hydraulic K Sat: 0.000138 ft/sec
- Hyd. K-Function Estimation Method: Fredlund-Xing Function
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20
- Residual Water Content: 0.015 ft³/ft³

Dike 2 (Fat Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
- Curve Fit to Data: 100 %
- Segment Curvature: 100 %

K-Saturation: 8.86e-009
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
- Data Point: (0.01, 8.86e-009)
- Data Point: (0.018329807, 8.4667011e-009)
- Data Point: (0.033598183, 8.0730953e-009)
- Data Point: (0.061584821, 7.6795897e-009)
- Data Point: (0.11288379, 7.2861087e-009)
- Data Point: (0.20691381, 6.8926585e-009)
- Data Point: (0.37926902, 6.4991665e-009)
- Data Point: (0.6951928, 6.10567e-009)
- Data Point: (1.274275, 5.7121196e-009)
- Data Point: (2.3357215, 5.3184636e-009)
- Data Point: (4.2813324, 4.9246187e-009)
- Data Point: (7.8475997, 4.5304276e-009)
- Data Point: (14.384499, 4.1356077e-009)
- Data Point: (26.366509, 3.7396344e-009)
- Data Point: (48.329302, 3.3415636e-009)
- Data Point: (88.586679, 2.9395678e-009)
- Data Point: (162.37767, 2.5304446e-009)
- Data Point: (297.63514, 2.1098297e-009)
- Data Point: (545.55948, 1.6607161e-009)
- Data Point: (1000, 1.1464819e-009)

Estimation Properties
- Volume Water Content Function: Dike 2 (Fat Clay)
- Hydraulic K Sat: 8.86e-009 ft/sec
- Hyd. K-Function Estimation Method: Fredlund-Xing Function
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20
- Residual Water Content: 0.09 ft³/ft³

Vol. Water Content Functions

Dike 1 (Lean Clay)

Model: Data Point Function

Function: Vol. Water Content vs. Pore-Water Pressure
- Curve Fit to Data: 100 %
- Segment Curvature: 100 %
- Mv: 3e-006 /psf

Porosity: 0.41556948
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
- Data Point: (0.01, 0.41308567)
- Data Point: (0.018329807, 0.41308567)
- Data Point: (0.033598183, 0.41308567)
- Data Point: (0.061584821, 0.41308567)
- Data Point: (0.11288379, 0.41308567)
- Data Point: (0.20691381, 0.41308567)
- Data Point: (0.37926902, 0.41308567)
- Data Point: (0.6951928, 0.41308567)
- Data Point: (1.274275, 0.41308567)
- Data Point: (2.3357215, 0.41308567)
- Data Point: (4.2813324, 0.41308567)
- Data Point: (7.8475997, 0.41308567)
- Data Point: (14.384499, 0.41308567)
- Data Point: (26.366509, 0.41308567)
- Data Point: (48.329302, 0.41308567)
- Data Point: (88.586679, 0.41308567)
- Data Point: (162.37767, 0.41308567)
- Data Point: (297.63514, 0.41308567)
- Data Point: (545.55948, 0.4125467)
- Data Point: (1000, 0.38347036)

Estimation Properties
- Vol. WC Estimation Method: Grain Size Function
- Sample Material: Clay
- Saturated Water Content: 0.413 ft^3/ft^3
- Liquid Limit: 38 %
- Diameter at 10% passing: 0.001
- Diameter at 60% passing: 0.1
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20

Dike 2 (Lean Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
- Curve Fit to Data: 100 %
- Segment Curvature: 100 %
- Mv: 3e-006 /psf

Porosity: 0.35421721
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
- Data Point: (0.01, 0.35121721)
- Data Point: (0.018329807, 0.35121721)
- Data Point: (0.033598183, 0.35121721)
- Data Point: (0.061584821, 0.35121721)
- Data Point: (0.11288379, 0.35121721)

Data Point: (0.20691381, 0.35121721)
Data Point: (0.37926902, 0.35121721)
Data Point: (0.6951928, 0.35121721)
Data Point: (1.274275, 0.35121721)
Data Point: (2.3357215, 0.35121721)
Data Point: (4.2813324, 0.35121721)
Data Point: (7.8475997, 0.35121721)
Data Point: (14.384499, 0.35121721)
Data Point: (26.366509, 0.35121721)
Data Point: (48.329302, 0.35121721)
Data Point: (88.586679, 0.35121721)
Data Point: (162.37767, 0.35121721)
Data Point: (297.63514, 0.35121721)
Data Point: (545.55948, 0.35121721)
Data Point: (1000, 0.35121721)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.351 ft^3/ft^3
Liquid Limit: 48 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.075
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Alluvial (Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 4.786e-005 /psf
Porosity: 0.46611653
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.40088927)
Data Point: (0.018329807, 0.40088927)
Data Point: (0.033598183, 0.40088927)
Data Point: (0.061584821, 0.40088927)
Data Point: (0.11288379, 0.40088927)
Data Point: (0.20691381, 0.40088927)
Data Point: (0.37926902, 0.40088927)
Data Point: (0.6951928, 0.40088927)
Data Point: (1.274275, 0.40088927)
Data Point: (2.3357215, 0.40088927)
Data Point: (4.2813324, 0.40088927)
Data Point: (7.8475997, 0.40088927)
Data Point: (14.384499, 0.40088927)
Data Point: (26.366509, 0.40088927)
Data Point: (48.329302, 0.40088927)
Data Point: (88.586679, 0.40088927)

Data Point: (162.37767, 0.40088927)
Data Point: (297.63514, 0.40088927)
Data Point: (545.55948, 0.40088927)
Data Point: (1000, 0.39828281)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.401 ft^3/ft^3
Liquid Limit: 47 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.1
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Alluvial (Granular)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 2.3925e-006 /psf
Porosity: 0.27269448
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.27030198)
Data Point: (0.018329807, 0.27030198)
Data Point: (0.033598183, 0.27030198)
Data Point: (0.061584821, 0.27030198)
Data Point: (0.11288379, 0.27030198)
Data Point: (0.20691381, 0.27030198)
Data Point: (0.37926902, 0.27030198)
Data Point: (0.6951928, 0.27030198)
Data Point: (1.274275, 0.27030198)
Data Point: (2.3357215, 0.27030198)
Data Point: (4.2813324, 0.27030198)
Data Point: (7.8475997, 0.27030198)
Data Point: (14.384499, 0.27030198)
Data Point: (26.366509, 0.27030198)
Data Point: (48.329302, 0.27030198)
Data Point: (88.586679, 0.27030198)
Data Point: (162.37767, 0.27030198)
Data Point: (297.63514, 0.27030198)
Data Point: (545.55948, 0.27030198)
Data Point: (1000, 0.27030198)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Silty Sand
Saturated Water Content: 0.27 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 6

Maximum: 1000
Minimum: 0.01
Num. Points: 20

Fly Ash (Sluiced)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 6.2218e-005 /psf
Porosity: 0.37786527
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.35499418)
Data Point: (0.018329807, 0.35499418)
Data Point: (0.033598183, 0.35499418)
Data Point: (0.061584821, 0.35499418)
Data Point: (0.11288379, 0.35499418)
Data Point: (0.20691381, 0.35499418)
Data Point: (0.37926902, 0.35499418)
Data Point: (0.6951928, 0.35499418)
Data Point: (1.274275, 0.35499418)
Data Point: (2.3357215, 0.35499418)
Data Point: (4.2813324, 0.35499418)
Data Point: (7.8475997, 0.35499418)
Data Point: (14.384499, 0.35499418)
Data Point: (26.366509, 0.35499418)
Data Point: (48.329302, 0.35499418)
Data Point: (88.586679, 0.35499418)
Data Point: (162.37767, 0.35499418)
Data Point: (297.63514, 0.35499418)
Data Point: (545.55948, 0.34147401)
Data Point: (1000, 0.26813417)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Silt
Saturated Water Content: 0.3548 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.004
Diameter at 60% passing: 0.049
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Dike 2 (Fat Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 1.4358e-005 /psf
Porosity: 0.36512838

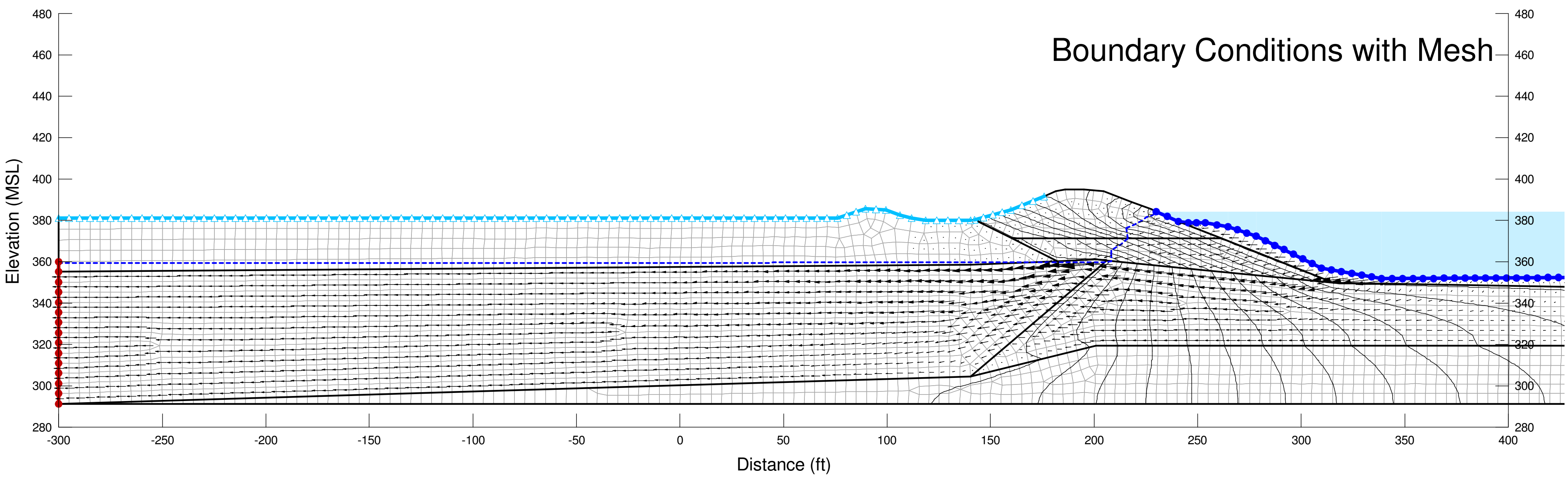
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
- Data Point: (0.01, 0.35077038)
- Data Point: (0.018329807, 0.35077038)
- Data Point: (0.033598183, 0.35077038)
- Data Point: (0.061584821, 0.35077038)
- Data Point: (0.11288379, 0.35077038)
- Data Point: (0.20691381, 0.35077038)
- Data Point: (0.37926902, 0.35077038)
- Data Point: (0.6951928, 0.35077038)
- Data Point: (1.274275, 0.35077038)
- Data Point: (2.3357215, 0.35077038)
- Data Point: (4.2813324, 0.35077038)
- Data Point: (7.8475997, 0.35077038)
- Data Point: (14.384499, 0.35077038)
- Data Point: (26.366509, 0.35077038)
- Data Point: (48.329302, 0.35077038)
- Data Point: (88.586679, 0.35077038)
- Data Point: (162.37767, 0.35077038)
- Data Point: (297.63514, 0.35077038)
- Data Point: (545.55948, 0.35077038)
- Data Point: (1000, 0.35077038)

Estimation Properties
- Vol. WC Estimation Method: Grain Size Function
- Sample Material: Clay
- Saturated Water Content: 0.351 ft^3/ft^3
- Liquid Limit: 54 %
- Diameter at 10% passing: 0.001
- Diameter at 60% passing: 0.043
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section T.gsz
Analysis Name: Steady-State Seepage
Date Saved: 1/22/2010
Last Solved on 1/22/2010 at 2:03:38 PM

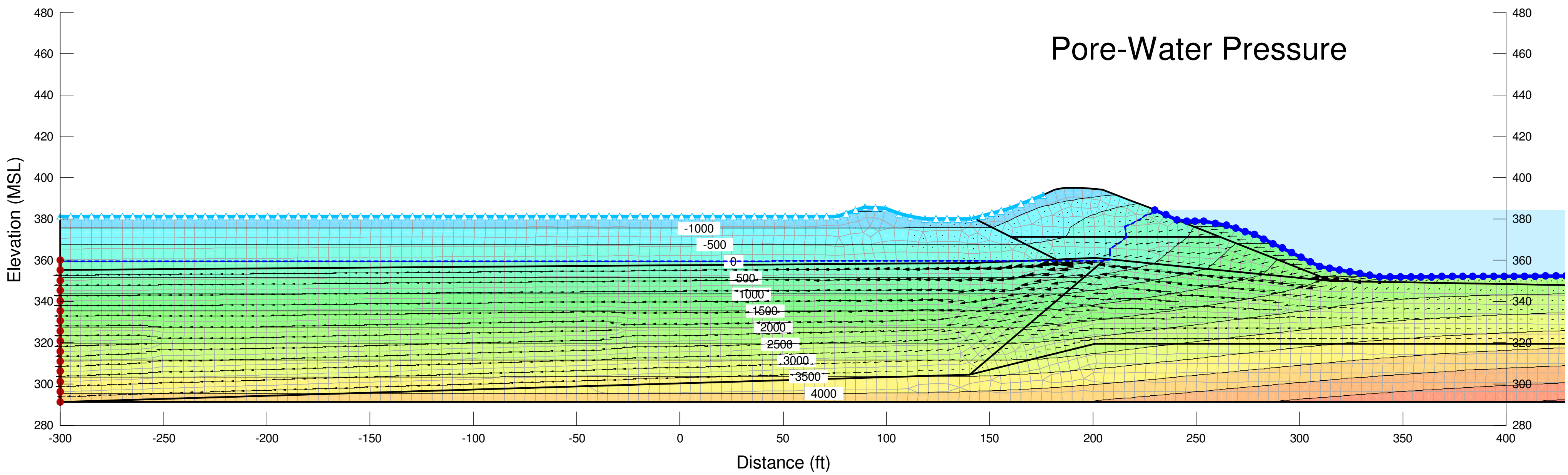
Analysis Method: Steady-State



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section T.gsz
Analysis Name: Steady-State Seepage
Date Saved: 1/22/2010
Last Solved on 1/22/2010 at 2:03:38 PM

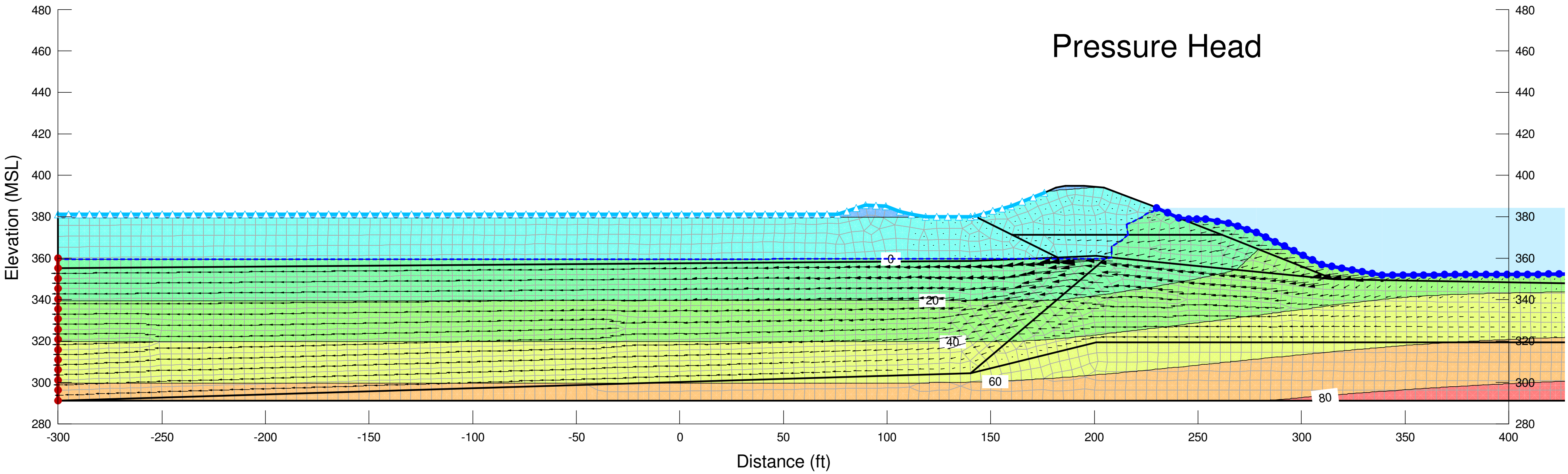
Analysis Method: Steady-State



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section T.gsz
Analysis Name: Steady-State Seepage
Date Saved: 1/22/2010
Last Solved on 1/22/2010 at 2:03:38 PM

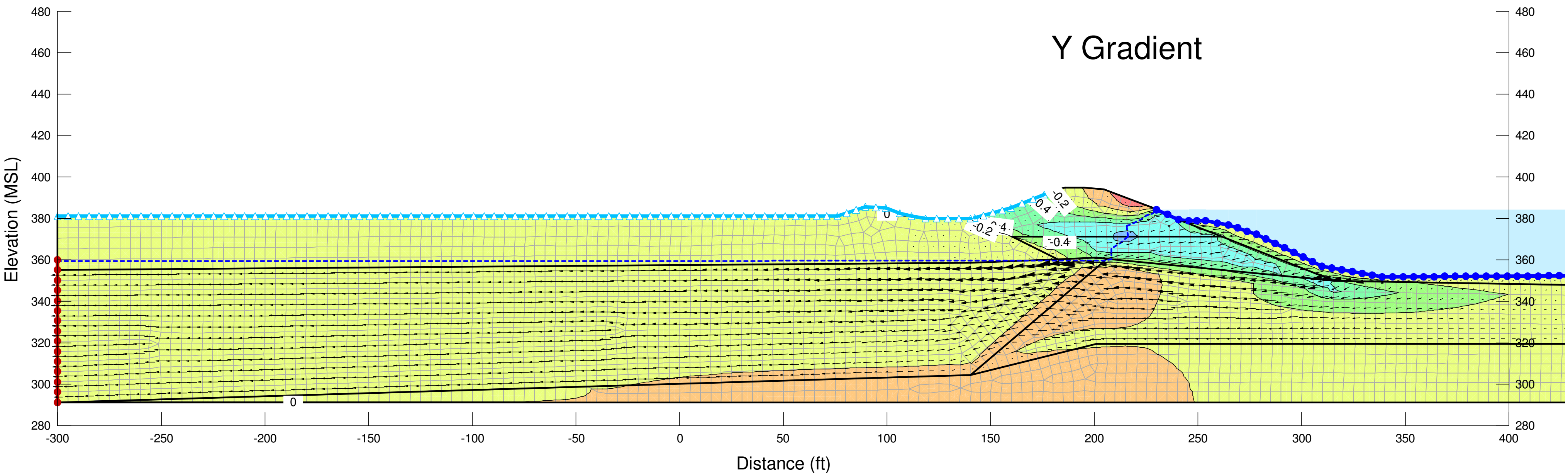
Analysis Method: Steady-State



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section T.gsz
Analysis Name: Steady-State Seepage
Date Saved: 1/22/2010
Last Solved on 1/22/2010 at 2:03:38 PM

Analysis Method: Steady-State



Steady-State Seepage

File Information

- Created By: Daniel B. Rogers
- Revision Number: 292
- Last Edited By: Rogers, Daniel
- Date: 1/31/2010
- Time: 1:45:49 PM
- File Name: Section U.gsz
- Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
- Last Solved Date: 1/31/2010
- Last Solved Time: 1:46:32 PM

Project Settings

- Length(L) Units: feet
- Time(t) Units: Seconds
- Force(F) Units: lbf
- Pressure(p) Units: psf
- Mass(M) Units: lbs
- Mass Flux Units: lbs/sec
- Unit Weight of Water: 62.4 pcf
- View: 2D

Analysis Settings

Steady-State Seepage

- Kind: SEEP/W
- Method: Steady-State
- Settings
  - Include Air Flow: No
- Control
  - Apply Runoff: Yes
- Convergence
  - Convergence Type: Gauss Point K
  - Convergence Settings
    - Maximum Number of Iterations: 500
    - Tolerance: 0.01
    - Maximum Change in K: 0.1
    - Rate of Change in K: 1.02
    - Minimum Change in K: 0.0001
  - Equation Solver: Parallel Direct
  - Potential Seepage Max # of Reviews: 10
- Time
  - Starting Time: 0 sec

Duration: 0 sec
Ending Time: 0 sec

Materials

Dike 1 (Lean Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 1 (Lean Clay)
Vol. WC. Function: Dike 1 (Lean Clay)
K-Ratio: 0.1
K-Direction: 0 °

Dike 2 (Fat Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 2 (Fat Clay)
Vol. WC. Function: Dike 2 (Fat Clay)
K-Ratio: 0.1
K-Direction: 0 °

Fly Ash (Sluiced)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Fly Ash (Sluiced)
Vol. WC. Function: Fly Ash (Sluiced)
K-Ratio: 0.02
K-Direction: 0 °

Alluvial Clay

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Clay)
Vol. WC. Function: Alluvial (Clay)
K-Ratio: 0.05
K-Direction: 0 °

Alluvial Granular

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Granular)
Vol. WC. Function: Alluvial (Granular)
K-Ratio: 0.05
K-Direction: 0 °

Bedrock

Model: Saturated Only
Hydraulic
K-Sat: 1e-012 ft/sec

Volumetric Water Content: 0.05 ft³/ft³
Mv: 0 /psf
K-Ratio: 0.1
K-Direction: 0 °

Boundary Conditions

Potential Seepage Face

Review: true
Type: Total Flux (Q) 0

Ash Pond Surface Elevation

Type: Head (H) 384.23

River Surface Elevation

Type: Head (H) 359.5

K Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 2.13e-007
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 2.13e-007)
Data Point: (0.018329807, 2.1234388e-007)
Data Point: (0.033598183, 2.1168814e-007)
Data Point: (0.061584821, 2.1103203e-007)
Data Point: (0.11288379, 2.1037498e-007)
Data Point: (0.20691381, 2.0971735e-007)
Data Point: (0.37926902, 2.0905824e-007)
Data Point: (0.6951928, 2.0839653e-007)
Data Point: (1.274275, 2.077303e-007)
Data Point: (2.3357215, 2.070555e-007)
Data Point: (4.2813324, 2.0636507e-007)
Data Point: (7.8475997, 2.0564593e-007)
Data Point: (14.384499, 2.0487454e-007)
Data Point: (26.366509, 2.0400629e-007)
Data Point: (48.329302, 2.0295363e-007)
Data Point: (88.586679, 2.016313e-007)
Data Point: (162.37767, 1.9978076e-007)
Data Point: (297.63514, 1.9457772e-007)
Data Point: (545.55948, 1.9521936e-007)
Data Point: (1000, 7.5557482e-008)
Estimation Properties
Volume Water Content Function: Dike 1 (Lean Clay)

Hydraulic K Sat: 2.13e-007 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.06 ft^3/ft^3

Alluvial (Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 4.86e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 4.86e-008)
Data Point: (0.018329807, 4.6081772e-008)
Data Point: (0.033598183, 4.3561857e-008)
Data Point: (0.061584821, 4.104302e-008)
Data Point: (0.11288379, 3.8524125e-008)
Data Point: (0.20691381, 3.6005291e-008)
Data Point: (0.37926902, 3.3486567e-008)
Data Point: (0.6951928, 3.0968085e-008)
Data Point: (1.274275, 2.8449893e-008)
Data Point: (2.3357215, 2.5932304e-008)
Data Point: (4.2813324, 2.3415812e-008)
Data Point: (7.8475997, 2.0901374e-008)
Data Point: (14.384499, 1.8390713e-008)
Data Point: (26.366509, 1.5886901e-008)
Data Point: (48.329302, 1.3395726e-008)
Data Point: (88.586679, 1.0927777e-008)
Data Point: (162.37767, 8.5023183e-009)
Data Point: (297.63514, 6.1503404e-009)
Data Point: (545.55948, 3.9524194e-009)
Data Point: (1000, 2.0421444e-009)
Estimation Properties
Volume Water Content Function: Alluvial (Clay)
Hydraulic K Sat: 4.86e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.07 ft^3/ft^3

Alluvial (Granular)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 6.56e-005
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)

Data Point: (0.01, 6.56e-005)
Data Point: (0.018329807, 6.4809238e-005)
Data Point: (0.033598183, 6.4018422e-005)
Data Point: (0.061584821, 6.3227812e-005)
Data Point: (0.11288379, 6.2437049e-005)
Data Point: (0.20691381, 6.1646212e-005)
Data Point: (0.37926902, 6.0854776e-005)
Data Point: (0.6951928, 6.0062124e-005)
Data Point: (1.274275, 5.9267829e-005)
Data Point: (2.3357215, 5.8470547e-005)
Data Point: (4.2813324, 5.7667753e-005)
Data Point: (7.8475997, 5.6854825e-005)
Data Point: (14.384499, 5.6023348e-005)
Data Point: (26.366509, 5.5157894e-005)
Data Point: (48.329302, 5.4230286e-005)
Data Point: (88.586679, 5.3187637e-005)
Data Point: (162.37767, 5.1934764e-005)
Data Point: (297.63514, 5.0331243e-005)
Data Point: (545.55948, 4.7912406e-005)
Data Point: (1000, 4.3290175e-005)

Estimation Properties

Volume Water Content Function: Alluvial (Granular)
Hydraulic K Sat: 6.56e-005 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.02 ft^3/ft^3

Fly Ash (Sluiced)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 0.000138
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 0.000138)
Data Point: (0.018329807, 0.00013124901)
Data Point: (0.033598183, 0.00012449327)
Data Point: (0.061584821, 0.00011774033)
Data Point: (0.11288379, 0.0001109872)
Data Point: (0.20691381, 0.00010423397)
Data Point: (0.37926902, 9.7480512e-005)
Data Point: (0.6951928, 9.0726822e-005)
Data Point: (1.274275, 8.3972556e-005)
Data Point: (2.3357215, 7.7217303e-005)
Data Point: (4.2813324, 7.0460153e-005)
Data Point: (7.8475997, 6.3699615e-005)
Data Point: (14.384499, 5.6933028e-005)
Data Point: (26.366509, 5.0154616e-005)

Data Point: (48.329302, 4.3351508e-005)
Data Point: (88.586679, 3.6533731e-005)
Data Point: (162.37767, 2.9661049e-005)
Data Point: (297.63514, 2.2042999e-005)
Data Point: (545.55948, 1.5988106e-005)
Data Point: (1000, 1.5284174e-006)
Estimation Properties
Volume Water Content Function: Fly Ash (Sluiced)
Hydraulic K Sat: 0.000138 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.015 ft^3/ft^3

Dike 2 (Fat Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 8.86e-009
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 8.86e-009)
Data Point: (0.018329807, 8.4666934e-009)
Data Point: (0.033598183, 8.0730423e-009)
Data Point: (0.061584821, 7.6795473e-009)
Data Point: (0.11288379, 7.286077e-009)
Data Point: (0.20691381, 6.8926343e-009)
Data Point: (0.37926902, 6.499149e-009)
Data Point: (0.6951928, 6.1056576e-009)
Data Point: (1.274275, 5.7121094e-009)
Data Point: (2.3357215, 5.3184503e-009)
Data Point: (4.2813324, 4.9246054e-009)
Data Point: (7.8475997, 4.5304167e-009)
Data Point: (14.384499, 4.1355984e-009)
Data Point: (26.366509, 3.7396264e-009)
Data Point: (48.329302, 3.3415567e-009)
Data Point: (88.586679, 2.939562e-009)
Data Point: (162.37767, 2.5304396e-009)
Data Point: (297.63514, 2.1098255e-009)
Data Point: (545.55948, 1.6607128e-009)
Data Point: (1000, 1.1464795e-009)
Estimation Properties
Volume Water Content Function: Dike 2 (Fat Clay)
Hydraulic K Sat: 1.77e-009 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.09 ft^3/ft^3

Vol. Water Content Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 3e-006 /psf
Porosity: 0.41556948
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.41308567)
Data Point: (0.018329807, 0.41308567)
Data Point: (0.033598183, 0.41308567)
Data Point: (0.061584821, 0.41308567)
Data Point: (0.11288379, 0.41308567)
Data Point: (0.20691381, 0.41308567)
Data Point: (0.37926902, 0.41308567)
Data Point: (0.6951928, 0.41308567)
Data Point: (1.274275, 0.41308567)
Data Point: (2.3357215, 0.41308567)
Data Point: (4.2813324, 0.41308567)
Data Point: (7.8475997, 0.41308567)
Data Point: (14.384499, 0.41308567)
Data Point: (26.366509, 0.41308567)
Data Point: (48.329302, 0.41308567)
Data Point: (88.586679, 0.41308567)
Data Point: (162.37767, 0.41308567)
Data Point: (297.63514, 0.41308567)
Data Point: (545.55948, 0.4125467)
Data Point: (1000, 0.38347036)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.413 ft^3/ft^3
Liquid Limit: 38 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.1
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Alluvial (Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 4.786e-005 /psf
Porosity: 0.46611653

Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
- Data Point: (0.01, 0.40088927)
- Data Point: (0.018329807, 0.40088927)
- Data Point: (0.033598183, 0.40088927)
- Data Point: (0.061584821, 0.40088927)
- Data Point: (0.11288379, 0.40088927)
- Data Point: (0.20691381, 0.40088927)
- Data Point: (0.37926902, 0.40088927)
- Data Point: (0.6951928, 0.40088927)
- Data Point: (1.274275, 0.40088927)
- Data Point: (2.3357215, 0.40088927)
- Data Point: (4.2813324, 0.40088927)
- Data Point: (7.8475997, 0.40088927)
- Data Point: (14.384499, 0.40088927)
- Data Point: (26.366509, 0.40088927)
- Data Point: (48.329302, 0.40088927)
- Data Point: (88.586679, 0.40088927)
- Data Point: (162.37767, 0.40088927)
- Data Point: (297.63514, 0.40088927)
- Data Point: (545.55948, 0.40088927)
- Data Point: (1000, 0.39828281)

Estimation Properties
- Vol. WC Estimation Method: Grain Size Function
- Sample Material: Clay
- Saturated Water Content: 0.401 ft^3/ft^3
- Liquid Limit: 47 %
- Diameter at 10% passing: 0.001
- Diameter at 60% passing: 0.1
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20

Alluvial (Granular)

Model: Data Point Function

Function: Vol. Water Content vs. Pore-Water Pressure
- Curve Fit to Data: 100 %
- Segment Curvature: 100 %
- Mv: 2.3925e-006 /psf

Porosity: 0.27269448

Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
- Data Point: (0.01, 0.27030198)
- Data Point: (0.018329807, 0.27030198)
- Data Point: (0.033598183, 0.27030198)
- Data Point: (0.061584821, 0.27030198)
- Data Point: (0.11288379, 0.27030198)
- Data Point: (0.20691381, 0.27030198)
- Data Point: (0.37926902, 0.27030198)
- Data Point: (0.6951928, 0.27030198)
- Data Point: (1.274275, 0.27030198)
- Data Point: (2.3357215, 0.27030198)

Data Point: (4.2813324, 0.27030198)
Data Point: (7.8475997, 0.27030198)
Data Point: (14.384499, 0.27030198)
Data Point: (26.366509, 0.27030198)
Data Point: (48.329302, 0.27030198)
Data Point: (88.586679, 0.27030198)
Data Point: (162.37767, 0.27030198)
Data Point: (297.63514, 0.27030198)
Data Point: (545.55948, 0.27030198)
Data Point: (1000, 0.27030198)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Silty Sand
Saturated Water Content: 0.27 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 6
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Fly Ash (Sluiced)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 6.2218e-005 /psf
Porosity: 0.37786527
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.35499418)
Data Point: (0.018329807, 0.35499418)
Data Point: (0.033598183, 0.35499418)
Data Point: (0.061584821, 0.35499418)
Data Point: (0.11288379, 0.35499418)
Data Point: (0.20691381, 0.35499418)
Data Point: (0.37926902, 0.35499418)
Data Point: (0.6951928, 0.35499418)
Data Point: (1.274275, 0.35499418)
Data Point: (2.3357215, 0.35499418)
Data Point: (4.2813324, 0.35499418)
Data Point: (7.8475997, 0.35499418)
Data Point: (14.384499, 0.35499418)
Data Point: (26.366509, 0.35499418)
Data Point: (48.329302, 0.35499418)
Data Point: (88.586679, 0.35499418)
Data Point: (162.37767, 0.35499418)
Data Point: (297.63514, 0.35499418)
Data Point: (545.55948, 0.34147401)
Data Point: (1000, 0.26813417)
Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Silty Sand
Saturated Water Content: 0.3548 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.004
Diameter at 60% passing: 0.049
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Dike 2 (Fat Clay)

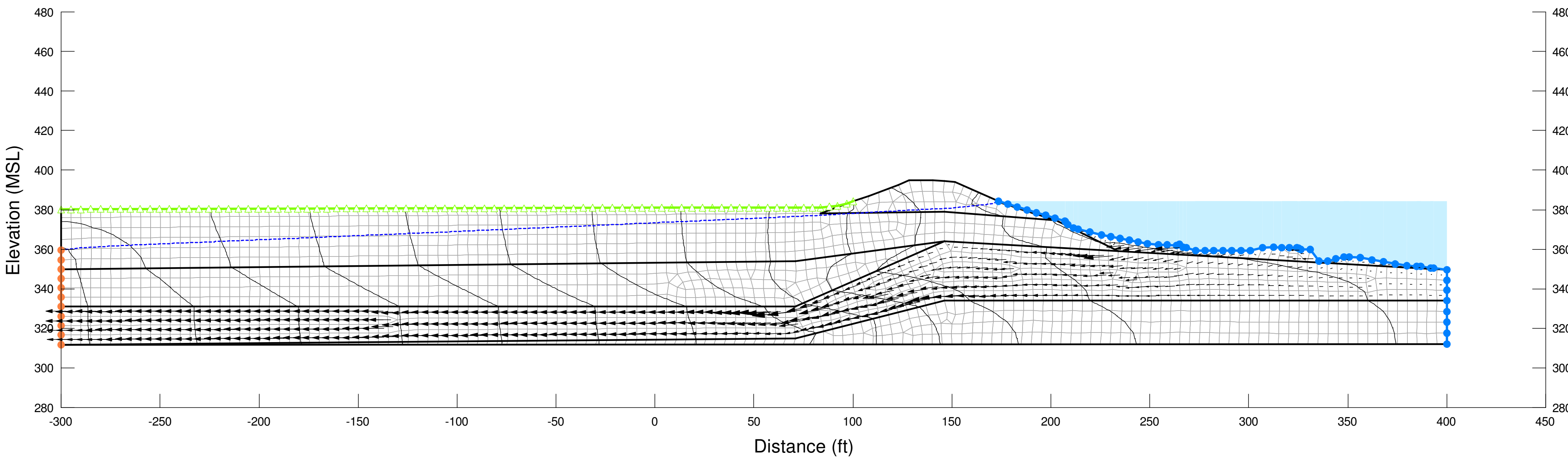
Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 1.4358e-005 /psf
Porosity: 0.36512838
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.35077038)
Data Point: (0.018329807, 0.35077038)
Data Point: (0.033598183, 0.35077038)
Data Point: (0.061584821, 0.35077038)
Data Point: (0.11288379, 0.35077038)
Data Point: (0.20691381, 0.35077038)
Data Point: (0.37926902, 0.35077038)
Data Point: (0.6951928, 0.35077038)
Data Point: (1.274275, 0.35077038)
Data Point: (2.3357215, 0.35077038)
Data Point: (4.2813324, 0.35077038)
Data Point: (7.8475997, 0.35077038)
Data Point: (14.384499, 0.35077038)
Data Point: (26.366509, 0.35077038)
Data Point: (48.329302, 0.35077038)
Data Point: (88.586679, 0.35077038)
Data Point: (162.37767, 0.35077038)
Data Point: (297.63514, 0.35077038)
Data Point: (545.55948, 0.35077038)
Data Point: (1000, 0.35077038)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.351 ft^3/ft^3
Liquid Limit: 54 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.043
Maximum: 1000
Minimum: 0.01
Num. Points: 20

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section U.gsz
Analysis Name: Steady-State Seepage
Date Saved: 1/31/2010
Last Solved on 1/31/2010 at 1:46:32 PM

Analysis Method: Steady-State

Boundary Conditions with Mesh

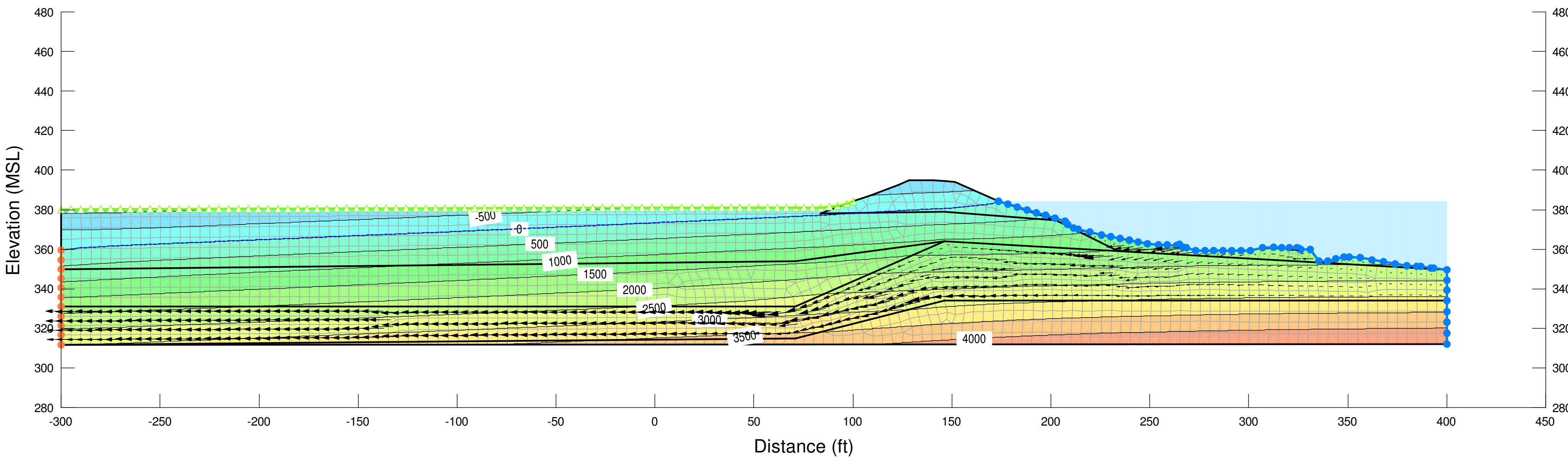


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section U.gsz
Analysis Name: Steady-State Seepage
Date Saved: 1/31/2010
Last Solved on 1/31/2010 at 1:46:32 PM

Analysis Method: Steady-State

Pore-Water Pressure



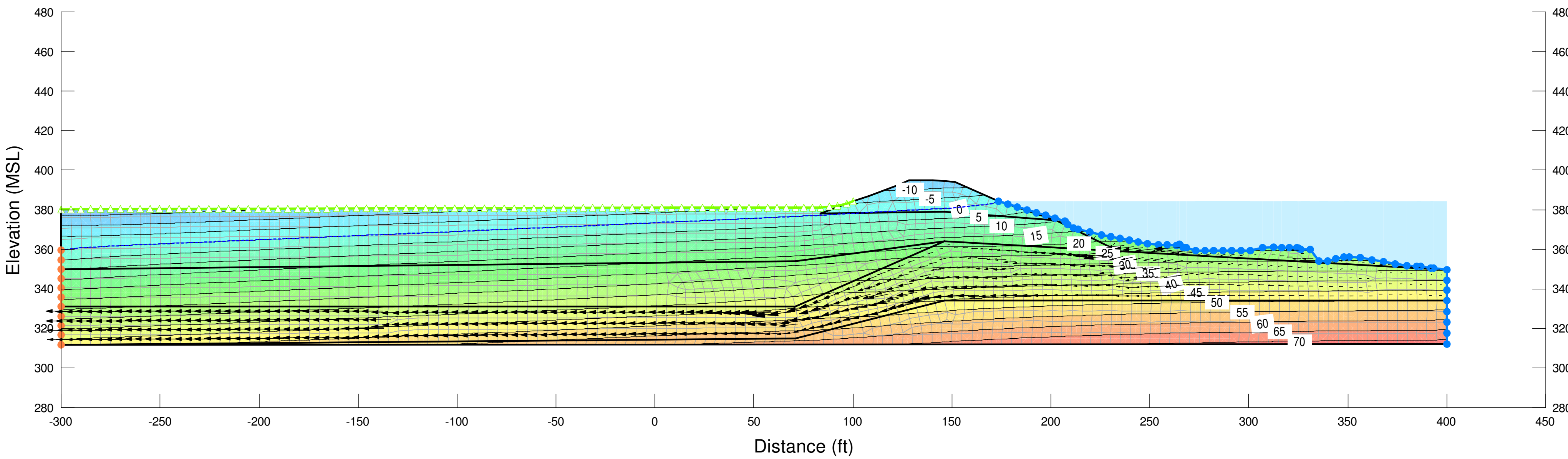
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

Stantec

File Name: Section U.gsz
Analysis Name: Steady-State Seepage
Date Saved: 1/31/2010
Last Solved on 1/31/2010 at 1:46:32 PM

Analysis Method: Steady-State

Pressure Head

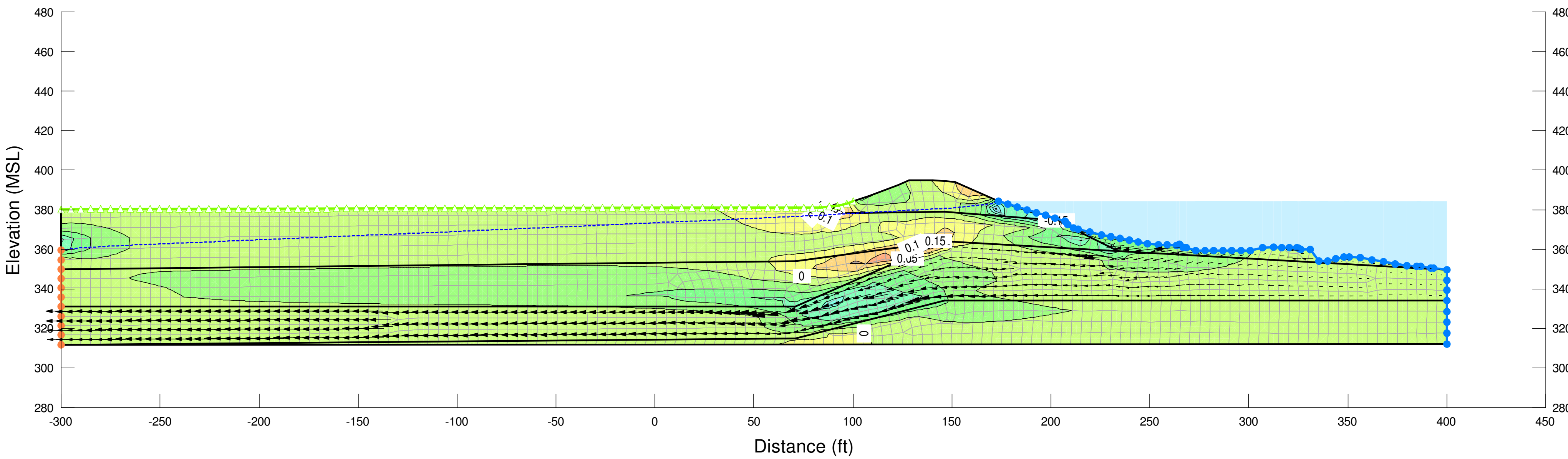


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section U.gsz
Analysis Name: Steady-State Seepage
Date Saved: 1/31/2010
Last Solved on 1/31/2010 at 1:46:32 PM

Analysis Method: Steady-State

Y Gradient



Steady-State Seepage

File Information

Created By: Cooper, Paul
Revision Number: 235
Last Edited By: Rogers, Daniel
Date: 1/31/2010
Time: 2:19:05 PM
File Name: Section V.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/31/2010
Last Solved Time: 2:19:46 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Steady-State Seepage

- Kind: SEEP/W
- Method: Steady-State
- Settings
  - Include Air Flow: No
- Control
  - Apply Runoff: Yes
- Convergence
  - Convergence Type: Gauss Point K
  - Convergence Settings
    - Maximum Number of Iterations: 500
    - Tolerance: 0.01
    - Maximum Change in K: 0.1
    - Rate of Change in K: 1.02
    - Minimum Change in K: 0.0001
  - Equation Solver: Parallel Direct
  - Potential Seepage Max # of Reviews: 10
- Time
  - Starting Time: 0 sec

Duration: 0 sec
Ending Time: 0 sec

Materials

Dike 1 (Fat Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 1 (Fat Clay)
Vol. WC. Function: Dike 1 (Fat Clay)
K-Ratio: 0.1
K-Direction: 0 °

Dike 2 (Fat Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 2 (Fat Clay)
Vol. WC. Function: Dike 2 (Fat Clay)
K-Ratio: 0.1
K-Direction: 0 °

Fly Ash (Sluiced)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Fly Ash (Sluiced)
Vol. WC. Function: Fly Ash (Sluiced)
K-Ratio: 0.02
K-Direction: 0 °

Alluvial Clay

Model: Saturated / Unsaturated
Hydraulic
K-Function: Alluvial (Clay)
Vol. WC. Function: Alluvial (Clay)
K-Ratio: 0.05
K-Direction: 0 °

Boundary Conditions

Potential Seepage Face

Review: true
Type: Total Flux (Q) 0

Ash Pond

Type: Head (H) 384.23

Ditchline

Type: Head (H) 375

K Functions

Dike 1 (Fat Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 8.86e-009
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 8.86e-009)
Data Point: (0.018329807, 8.4909248e-009)
Data Point: (0.033598183, 8.1215152e-009)
Data Point: (0.061584821, 7.7521994e-009)
Data Point: (0.11288379, 7.3829367e-009)
Data Point: (0.20691381, 7.0136766e-009)
Data Point: (0.37926902, 6.6443895e-009)
Data Point: (0.6951928, 6.2750695e-009)
Data Point: (1.274275, 5.9056454e-009)
Data Point: (2.3357215, 5.5360634e-009)
Data Point: (4.2813324, 5.1661799e-009)
Data Point: (7.8475997, 4.7957545e-009)
Data Point: (14.384499, 4.4243248e-009)
Data Point: (26.366509, 4.0510601e-009)
Data Point: (48.329302, 3.6744529e-009)
Data Point: (88.586679, 3.2916299e-009)
Data Point: (162.37767, 2.8974833e-009)
Data Point: (297.63514, 2.4844296e-009)
Data Point: (545.55948, 2.0278951e-009)
Data Point: (1000, 1.4732348e-009)
Estimation Properties
Volume Water Content Function: Dike 1 (Fat Clay)
Hydraulic K Sat: 8.86e-009 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.09 ft^3/ft^3

Alluvial (Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 4.86e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 4.86e-008)
Data Point: (0.018329807, 4.6081957e-008)
Data Point: (0.033598183, 4.3562037e-008)

Data Point: (0.061584821, 4.1043284e-008)
Data Point: (0.11288379, 3.8524355e-008)
Data Point: (0.20691381, 3.6005505e-008)
Data Point: (0.37926902, 3.348676e-008)
Data Point: (0.6951928, 3.0968229e-008)
Data Point: (1.274275, 2.8450022e-008)
Data Point: (2.3357215, 2.5932423e-008)
Data Point: (4.2813324, 2.3415929e-008)
Data Point: (7.8475997, 2.0901504e-008)
Data Point: (14.384499, 1.8390826e-008)
Data Point: (26.366509, 1.5886992e-008)
Data Point: (48.329302, 1.3395802e-008)
Data Point: (88.586679, 1.0927841e-008)
Data Point: (162.37767, 8.5023705e-009)
Data Point: (297.63514, 6.1503781e-009)
Data Point: (545.55948, 3.9524429e-009)
Data Point: (1000, 2.0421567e-009)
Estimation Properties
Volume Water Content Function: Alluvial (Clay)
Hydraulic K Sat: 4.86e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.07 ft^3/ft^3

Fly Ash (Sluiced)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 0.000138
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 0.000138)
Data Point: (0.018329807, 0.00013124899)
Data Point: (0.033598183, 0.00012449358)
Data Point: (0.061584821, 0.00011774069)
Data Point: (0.11288379, 0.00011098751)
Data Point: (0.20691381, 0.00010423412)
Data Point: (0.37926902, 9.7480653e-005)
Data Point: (0.6951928, 9.072693e-005)
Data Point: (1.274275, 8.3972583e-005)
Data Point: (2.3357215, 7.7217317e-005)
Data Point: (4.2813324, 7.046016e-005)
Data Point: (7.8475997, 6.3699627e-005)
Data Point: (14.384499, 5.6933042e-005)
Data Point: (26.366509, 5.015463e-005)
Data Point: (48.329302, 4.3351522e-005)
Data Point: (88.586679, 3.6533744e-005)
Data Point: (162.37767, 2.9661059e-005)

Data Point: (297.63514, 2.2043007e-005)
Data Point: (545.55948, 1.5988112e-005)
Data Point: (1000, 1.5284178e-006)
Estimation Properties
Volume Water Content Function: Vol. Water Content Function 9
Hydraulic K Sat: 0.000138 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.015 ft^3/ft^3

Dike 2 (Fat Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 8.86e-009
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 8.86e-009)
Data Point: (0.018329807, 8.4667011e-009)
Data Point: (0.033598183, 8.0730953e-009)
Data Point: (0.061584821, 7.6795897e-009)
Data Point: (0.11288379, 7.2861087e-009)
Data Point: (0.20691381, 6.8926585e-009)
Data Point: (0.37926902, 6.4991665e-009)
Data Point: (0.6951928, 6.10567e-009)
Data Point: (1.274275, 5.7121196e-009)
Data Point: (2.3357215, 5.3184636e-009)
Data Point: (4.2813324, 4.9246187e-009)
Data Point: (7.8475997, 4.5304276e-009)
Data Point: (14.384499, 4.1356077e-009)
Data Point: (26.366509, 3.7396344e-009)
Data Point: (48.329302, 3.3415636e-009)
Data Point: (88.586679, 2.9395678e-009)
Data Point: (162.37767, 2.5304446e-009)
Data Point: (297.63514, 2.1098297e-009)
Data Point: (545.55948, 1.6607161e-009)
Data Point: (1000, 1.1464819e-009)
Estimation Properties
Volume Water Content Function: Vol. Water Content Function 13
Hydraulic K Sat: 8.86e-009 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.09 ft^3/ft^3

Vol. Water Content Functions

Dike 1 (Fat Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
    Curve Fit to Data: 100 %
    Segment Curvature: 100 %
    Mv: 1.4358e-005 /psf
Porosity: 0.42969067
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
    Data Point: (0.01, 0.41533267)
    Data Point: (0.018329807, 0.41533267)
    Data Point: (0.033598183, 0.41533267)
    Data Point: (0.061584821, 0.41533267)
    Data Point: (0.11288379, 0.41533267)
    Data Point: (0.20691381, 0.41533267)
    Data Point: (0.37926902, 0.41533267)
    Data Point: (0.6951928, 0.41533267)
    Data Point: (1.274275, 0.41533267)
    Data Point: (2.3357215, 0.41533267)
    Data Point: (4.2813324, 0.41533267)
    Data Point: (7.8475997, 0.41533267)
    Data Point: (14.384499, 0.41533267)
    Data Point: (26.366509, 0.41533267)
    Data Point: (48.329302, 0.41533267)
    Data Point: (88.586679, 0.41533267)
    Data Point: (162.37767, 0.41533267)
    Data Point: (297.63514, 0.41533267)
    Data Point: (545.55948, 0.41533267)
    Data Point: (1000, 0.41533267)
Estimation Properties
    Vol. WC Estimation Method: Grain Size Function
    Sample Material: Clay
    Saturated Water Content: 0.415 ft^3/ft^3
    Liquid Limit: 69 %
    Diameter at 10% passing: 0.001
    Diameter at 60% passing: 0.05
    Maximum: 1000
    Minimum: 0.01
    Num. Points: 20

Alluvial (Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
    Curve Fit to Data: 100 %
    Segment Curvature: 100 %
    Mv: 4.786e-005 /psf
Porosity: 0.46611653
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
    Data Point: (0.01, 0.40088927)
    Data Point: (0.018329807, 0.40088927)

Data Point: (0.033598183, 0.40088927)
Data Point: (0.061584821, 0.40088927)
Data Point: (0.11288379, 0.40088927)
Data Point: (0.20691381, 0.40088927)
Data Point: (0.37926902, 0.40088927)
Data Point: (0.6951928, 0.40088927)
Data Point: (1.274275, 0.40088927)
Data Point: (2.3357215, 0.40088927)
Data Point: (4.2813324, 0.40088927)
Data Point: (7.8475997, 0.40088927)
Data Point: (14.384499, 0.40088927)
Data Point: (26.366509, 0.40088927)
Data Point: (48.329302, 0.40088927)
Data Point: (88.586679, 0.40088927)
Data Point: (162.37767, 0.40088927)
Data Point: (297.63514, 0.40088927)
Data Point: (545.55948, 0.40088927)
Data Point: (1000, 0.39828281)

Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.401 ft^3/ft^3
Liquid Limit: 47 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.1
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Fly Ash (Sluiced)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 6.2218e-005 /psf
Porosity: 0.37786527
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.35499418)
Data Point: (0.018329807, 0.35499418)
Data Point: (0.033598183, 0.35499418)
Data Point: (0.061584821, 0.35499418)
Data Point: (0.11288379, 0.35499418)
Data Point: (0.20691381, 0.35499418)
Data Point: (0.37926902, 0.35499418)
Data Point: (0.6951928, 0.35499418)
Data Point: (1.274275, 0.35499418)
Data Point: (2.3357215, 0.35499418)
Data Point: (4.2813324, 0.35499418)
Data Point: (7.8475997, 0.35499418)
Data Point: (14.384499, 0.35499418)

Data Point: (26.366509, 0.35499418)
Data Point: (48.329302, 0.35499418)
Data Point: (88.586679, 0.35499418)
Data Point: (162.37767, 0.35499418)
Data Point: (297.63514, 0.35499418)
Data Point: (545.55948, 0.34147401)
Data Point: (1000, 0.26813417)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Silt
Saturated Water Content: 0.3548 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.004
Diameter at 60% passing: 0.049
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Dike 2 (Fat Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 1.4358e-005 /psf
Porosity: 0.36512838
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.35077038)
Data Point: (0.018329807, 0.35077038)
Data Point: (0.033598183, 0.35077038)
Data Point: (0.061584821, 0.35077038)
Data Point: (0.11288379, 0.35077038)
Data Point: (0.20691381, 0.35077038)
Data Point: (0.37926902, 0.35077038)
Data Point: (0.6951928, 0.35077038)
Data Point: (1.274275, 0.35077038)
Data Point: (2.3357215, 0.35077038)
Data Point: (4.2813324, 0.35077038)
Data Point: (7.8475997, 0.35077038)
Data Point: (14.384499, 0.35077038)
Data Point: (26.366509, 0.35077038)
Data Point: (48.329302, 0.35077038)
Data Point: (88.586679, 0.35077038)
Data Point: (162.37767, 0.35077038)
Data Point: (297.63514, 0.35077038)
Data Point: (545.55948, 0.35077038)
Data Point: (1000, 0.35077038)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.351 ft^3/ft^3

Liquid Limit: 54 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.043
Maximum: 1000
Minimum: 0.01
Num. Points: 20

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section V.gsz

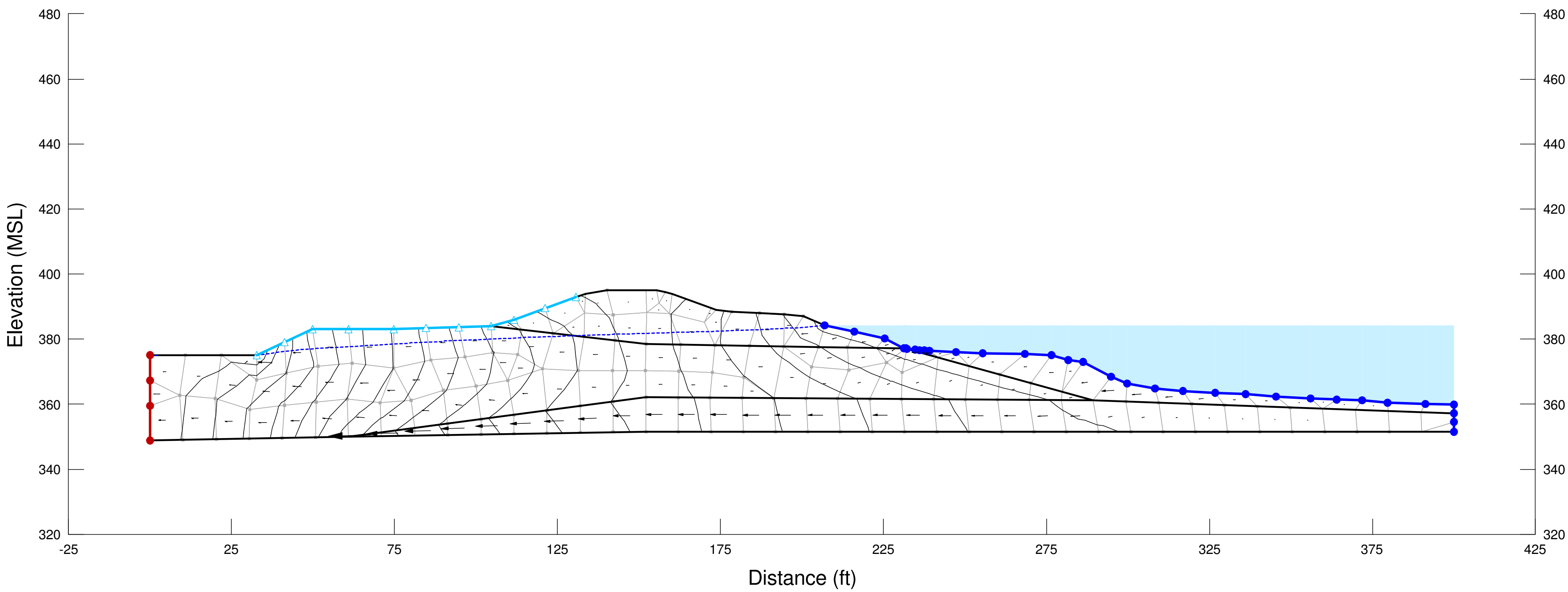
Analysis Name: Steady-State Seepage

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 2:19:46 PM

Boundary Conditions with Mesh

Analysis Method: Steady-State



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section V.gsz

Analysis Name: Steady-State Seepage

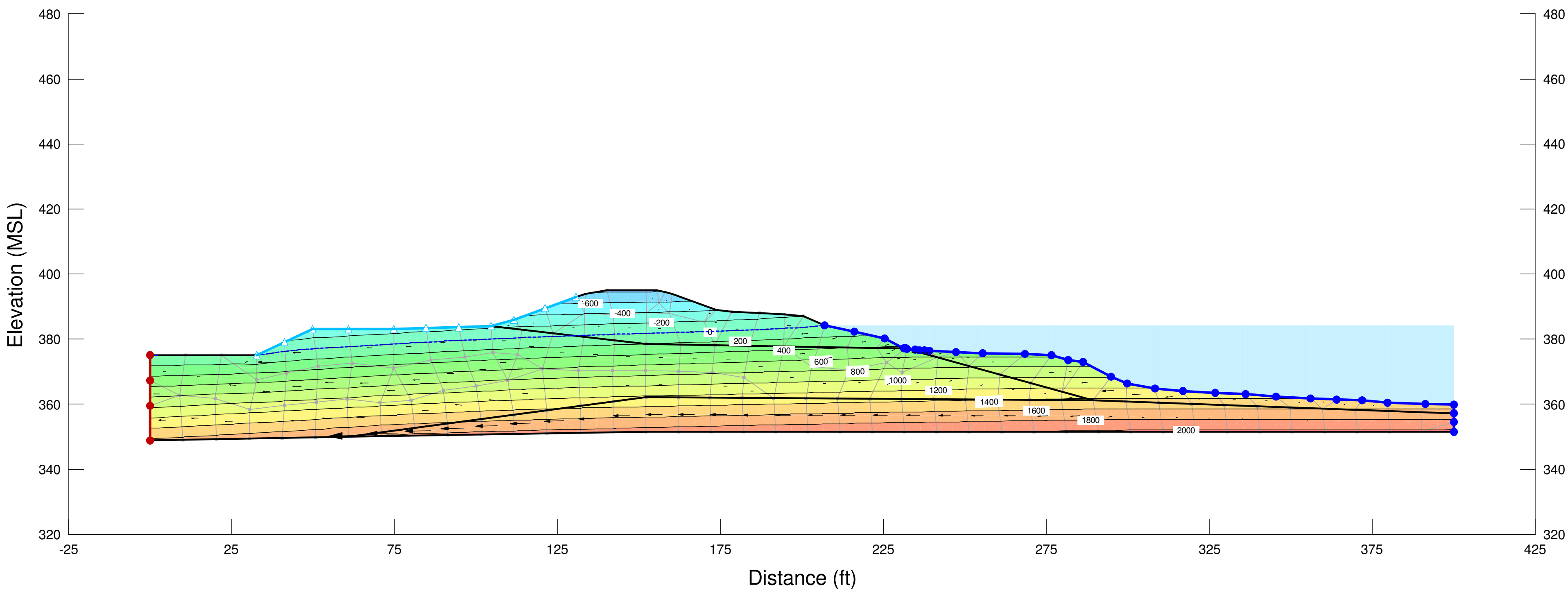
Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 2:19:46 PM

Stantec

Pore-Water Pressure

Analysis Method: Steady-State



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section V.gsz

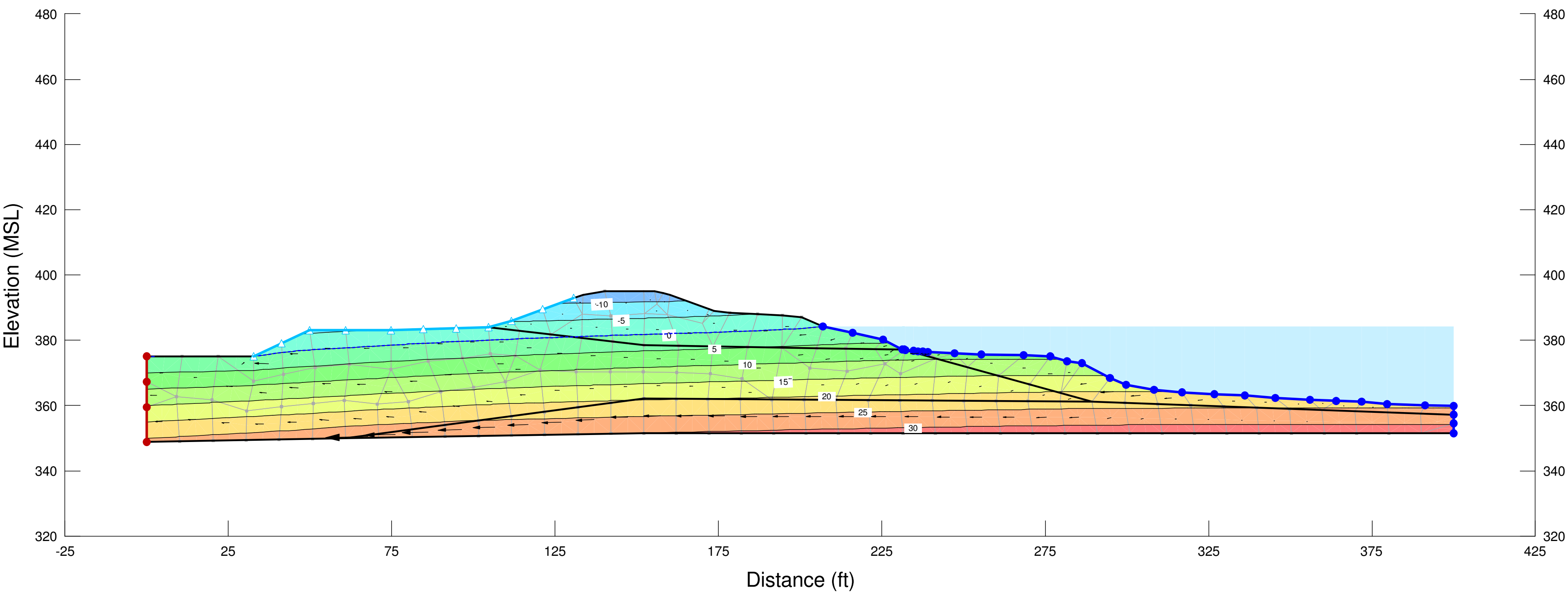
Analysis Name: Steady-State Seepage

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 2:19:46 PM

Pressure Head

Analysis Method: Steady-State



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section V.gsz

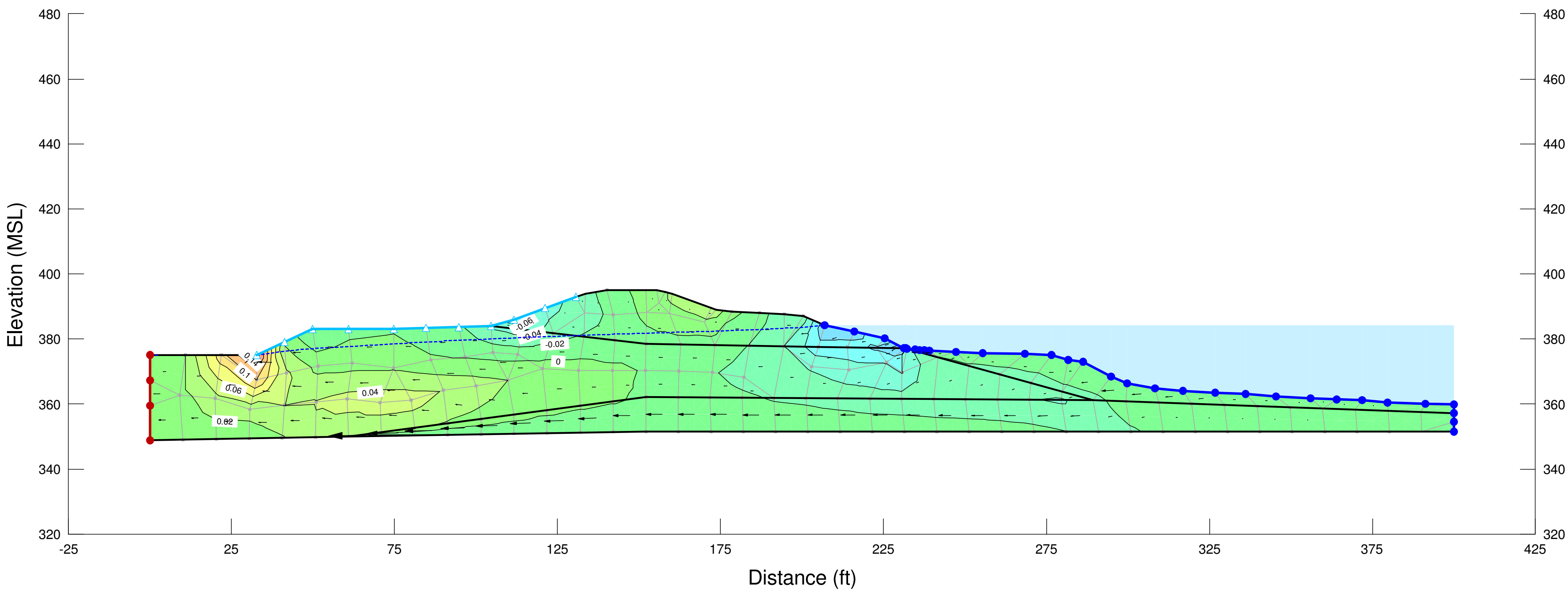
Analysis Name: Steady-State Seepage

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 2:19:46 PM

Y-Gradient

Analysis Method: Steady-State



Steady-State Seepage

File Information

- Created By: Cooper, Paul
- Revision Number: 227
- Last Edited By: Rogers, Daniel
- Date: 1/22/2010
- Time: 1:19:03 PM
- File Name: Section W.gsz
- Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
- Last Solved Date: 1/22/2010
- Last Solved Time: 3:25:00 PM

Project Settings

- Length(L) Units: feet
- Time(t) Units: Seconds
- Force(F) Units: lbf
- Pressure(p) Units: psf
- Mass(M) Units: lbs
- Mass Flux Units: lbs/sec
- Unit Weight of Water: 62.4 pcf
- View: 2D

Analysis Settings

Steady-State Seepage

- Kind: SEEP/W
- Method: Steady-State
- Settings
  - Include Air Flow: No
- Control
  - Apply Runoff: Yes
- Convergence
  - Convergence Type: Gauss Point K
  - Convergence Settings
    - Maximum Number of Iterations: 500
    - Tolerance: 0.01
    - Maximum Change in K: 0.1
    - Rate of Change in K: 1.02
    - Minimum Change in K: 0.0001
  - Equation Solver: Parallel Direct
  - Potential Seepage Max # of Reviews: 10
- Time
  - Starting Time: 0 sec

Duration: 0 sec
Ending Time: 0 sec

Materials

Dike 1 (Fat Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 1 (Lean Clay)
Vol. WC. Function: Dike 1 (Lean Clay)
K-Ratio: 0.1
K-Direction: 0 °

Dike 2 (Fat Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 1 (Fat Clay)
Vol. WC. Function: Dike 1 (Fat Clay)
K-Ratio: 0.1
K-Direction: 0 °

Fly Ash (Sluiced)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Fly Ash (Sluiced)
Vol. WC. Function: Fly Ash (Sluiced)
K-Ratio: 0.02
K-Direction: 0 °

Bedrock

Model: Saturated Only
Hydraulic
K-Sat: 1e-011 ft/sec
Volumetric Water Content: 0.05 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 0.1
K-Direction: 0 °

Boundary Conditions

Potential Seepage Face

Review: true
Type: Total Flux (Q) 0

Ash Pond

Type: Head (H) 384.23

Ditchline

Type: Head (H) 375.5

K Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
    Curve Fit to Data: 100 %
    Segment Curvature: 100 %
K-Saturation: 9.27e-007
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
    Data Point: (0.01, 9.27e-007)
    Data Point: (0.018329807, 9.241445e-007)
    Data Point: (0.033598183, 9.2129064e-007)
    Data Point: (0.061584821, 9.1843515e-007)
    Data Point: (0.11288379, 9.1557564e-007)
    Data Point: (0.20691381, 9.1271354e-007)
    Data Point: (0.37926902, 9.0984501e-007)
    Data Point: (0.6951928, 9.0696516e-007)
    Data Point: (1.274275, 9.0406567e-007)
    Data Point: (2.3357215, 9.0112887e-007)
    Data Point: (4.2813324, 8.9812403e-007)
    Data Point: (7.8475997, 8.9499425e-007)
    Data Point: (14.384499, 8.9163709e-007)
    Data Point: (26.366509, 8.8785834e-007)
    Data Point: (48.329302, 8.8327705e-007)
    Data Point: (88.586679, 8.7752214e-007)
    Data Point: (162.37767, 8.6946837e-007)
    Data Point: (297.63514, 8.4682415e-007)
    Data Point: (545.55948, 8.4961667e-007)
    Data Point: (1000, 3.2883467e-007)
Estimation Properties
    Volume Water Content Function: Dike 1 (Lean Clay)
    Hydraulic K Sat: 9.27e-007 ft/sec
    Hyd. K-Function Estimation Method: Fredlund-Xing Function
    Maximum: 1000
    Minimum: 0.01
    Num. Points: 20
    Residual Water Content: 0.06 ft^3/ft^3

Dike 1 (Fat Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
    Curve Fit to Data: 100 %
    Segment Curvature: 100 %
K-Saturation: 8.86e-009
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
    Data Point: (0.01, 8.86e-009)
    Data Point: (0.018329807, 8.4909248e-009)

Data Point: (0.033598183, 8.1215152e-009)
Data Point: (0.061584821, 7.7521994e-009)
Data Point: (0.11288379, 7.3829367e-009)
Data Point: (0.20691381, 7.0136766e-009)
Data Point: (0.37926902, 6.6443895e-009)
Data Point: (0.6951928, 6.2750695e-009)
Data Point: (1.274275, 5.9056454e-009)
Data Point: (2.3357215, 5.5360634e-009)
Data Point: (4.2813324, 5.1661799e-009)
Data Point: (7.8475997, 4.7957545e-009)
Data Point: (14.384499, 4.4243248e-009)
Data Point: (26.366509, 4.0510601e-009)
Data Point: (48.329302, 3.6744529e-009)
Data Point: (88.586679, 3.2916299e-009)
Data Point: (162.37767, 2.8974833e-009)
Data Point: (297.63514, 2.4844296e-009)
Data Point: (545.55948, 2.0278951e-009)
Data Point: (1000, 1.4732348e-009)

Estimation Properties
Volume Water Content Function: Dike 1 (Fat Clay)
Hydraulic K Sat: 8.86e-009 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.09 ft^3/ft^3

Fly Ash (Sluiced)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 0.000138
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 0.000138)
Data Point: (0.018329807, 0.00013124899)
Data Point: (0.033598183, 0.00012449358)
Data Point: (0.061584821, 0.00011774069)
Data Point: (0.11288379, 0.00011098751)
Data Point: (0.20691381, 0.00010423412)
Data Point: (0.37926902, 9.7480653e-005)
Data Point: (0.6951928, 9.072693e-005)
Data Point: (1.274275, 8.3972583e-005)
Data Point: (2.3357215, 7.7217317e-005)
Data Point: (4.2813324, 7.046016e-005)
Data Point: (7.8475997, 6.3699627e-005)
Data Point: (14.384499, 5.6933042e-005)
Data Point: (26.366509, 5.015463e-005)
Data Point: (48.329302, 4.3351522e-005)
Data Point: (88.586679, 3.6533744e-005)

Data Point: (162.37767, 2.9661059e-005)
Data Point: (297.63514, 2.2043007e-005)
Data Point: (545.55948, 1.5988112e-005)
Data Point: (1000, 1.5284178e-006)
Estimation Properties
Volume Water Content Function: Vol. Water Content Function 9
Hydraulic K Sat: 0.000138 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.015 ft^3/ft^3

Vol. Water Content Functions

Dike 1 (Lean Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 3e-006 /psf
Porosity: 0.41556948
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.41308567)
Data Point: (0.018329807, 0.41308567)
Data Point: (0.033598183, 0.41308567)
Data Point: (0.061584821, 0.41308567)
Data Point: (0.11288379, 0.41308567)
Data Point: (0.20691381, 0.41308567)
Data Point: (0.37926902, 0.41308567)
Data Point: (0.6951928, 0.41308567)
Data Point: (1.274275, 0.41308567)
Data Point: (2.3357215, 0.41308567)
Data Point: (4.2813324, 0.41308567)
Data Point: (7.8475997, 0.41308567)
Data Point: (14.384499, 0.41308567)
Data Point: (26.366509, 0.41308567)
Data Point: (48.329302, 0.41308567)
Data Point: (88.586679, 0.41308567)
Data Point: (162.37767, 0.41308567)
Data Point: (297.63514, 0.41308567)
Data Point: (545.55948, 0.4125467)
Data Point: (1000, 0.38347036)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.413 ft^3/ft^3
Liquid Limit: 38 %
Diameter at 10% passing: 0.001

Diameter at 60% passing: 0.1
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Dike 1 (Fat Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 1.4358e-005 /psf
Porosity: 0.42969067
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.41533267)
Data Point: (0.018329807, 0.41533267)
Data Point: (0.033598183, 0.41533267)
Data Point: (0.061584821, 0.41533267)
Data Point: (0.11288379, 0.41533267)
Data Point: (0.20691381, 0.41533267)
Data Point: (0.37926902, 0.41533267)
Data Point: (0.6951928, 0.41533267)
Data Point: (1.274275, 0.41533267)
Data Point: (2.3357215, 0.41533267)
Data Point: (4.2813324, 0.41533267)
Data Point: (7.8475997, 0.41533267)
Data Point: (14.384499, 0.41533267)
Data Point: (26.366509, 0.41533267)
Data Point: (48.329302, 0.41533267)
Data Point: (88.586679, 0.41533267)
Data Point: (162.37767, 0.41533267)
Data Point: (297.63514, 0.41533267)
Data Point: (545.55948, 0.41533267)
Data Point: (1000, 0.41533267)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.415 ft^3/ft^3
Liquid Limit: 69 %
Diameter at 10% passing: 0.001
Diameter at 60% passing: 0.05
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Fly Ash (Sluiced)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 6.2218e-005 /psf

Porosity: 0.37786527
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
- Data Point: (0.01, 0.35499418)
- Data Point: (0.018329807, 0.35499418)
- Data Point: (0.033598183, 0.35499418)
- Data Point: (0.061584821, 0.35499418)
- Data Point: (0.11288379, 0.35499418)
- Data Point: (0.20691381, 0.35499418)
- Data Point: (0.37926902, 0.35499418)
- Data Point: (0.6951928, 0.35499418)
- Data Point: (1.274275, 0.35499418)
- Data Point: (2.3357215, 0.35499418)
- Data Point: (4.2813324, 0.35499418)
- Data Point: (7.8475997, 0.35499418)
- Data Point: (14.384499, 0.35499418)
- Data Point: (26.366509, 0.35499418)
- Data Point: (48.329302, 0.35499418)
- Data Point: (88.586679, 0.35499418)
- Data Point: (162.37767, 0.35499418)
- Data Point: (297.63514, 0.35499418)
- Data Point: (545.55948, 0.34147401)
- Data Point: (1000, 0.26813417)

Estimation Properties
- Vol. WC Estimation Method: Grain Size Function
- Sample Material: Silt
- Saturated Water Content: 0.3548 ft^3/ft^3
- Liquid Limit: 0 %
- Diameter at 10% passing: 0.004
- Diameter at 60% passing: 0.049
- Maximum: 1000
- Minimum: 0.01
- Num. Points: 20

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section W.gsz

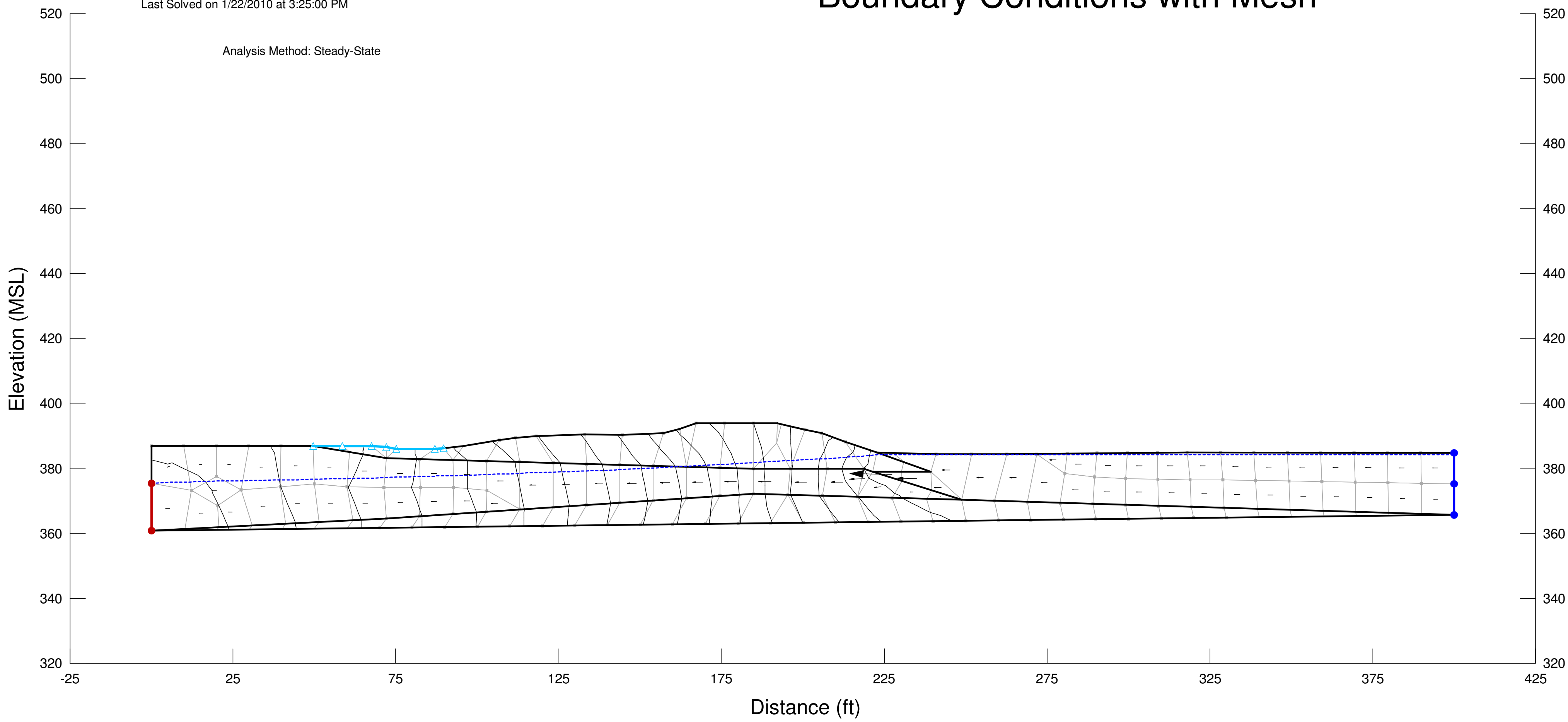
Analysis Name: Steady-State Seepage

Date Saved: 1/22/2010

Last Solved on 1/22/2010 at 3:25:00 PM

Analysis Method: Steady-State

Boundary Conditions with Mesh



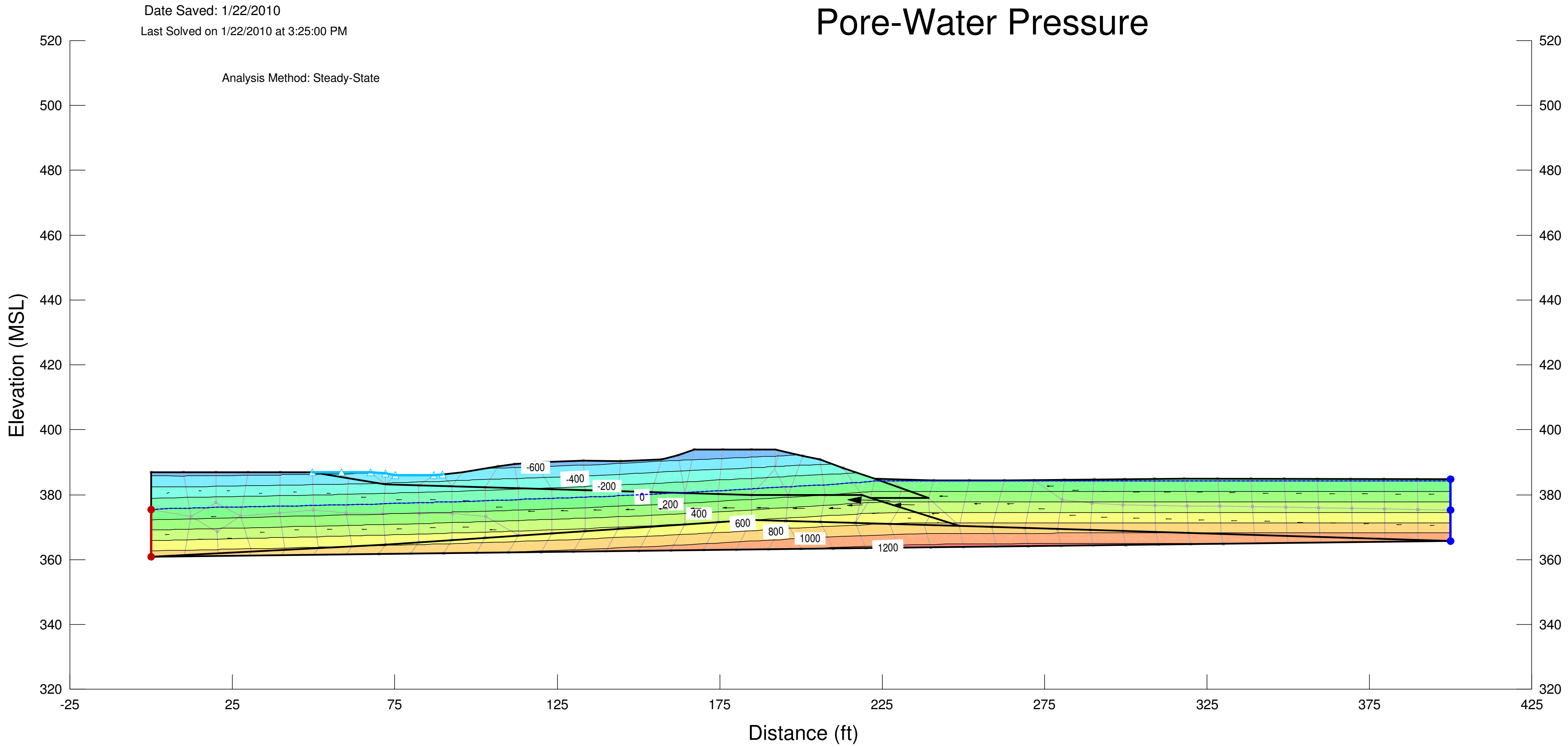
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section W.gsz

Analysis Name: Steady-State Seepage

Date Saved: 1/22/2010

Last Solved on 1/22/2010 at 3:25:00 PM



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section W.gsz

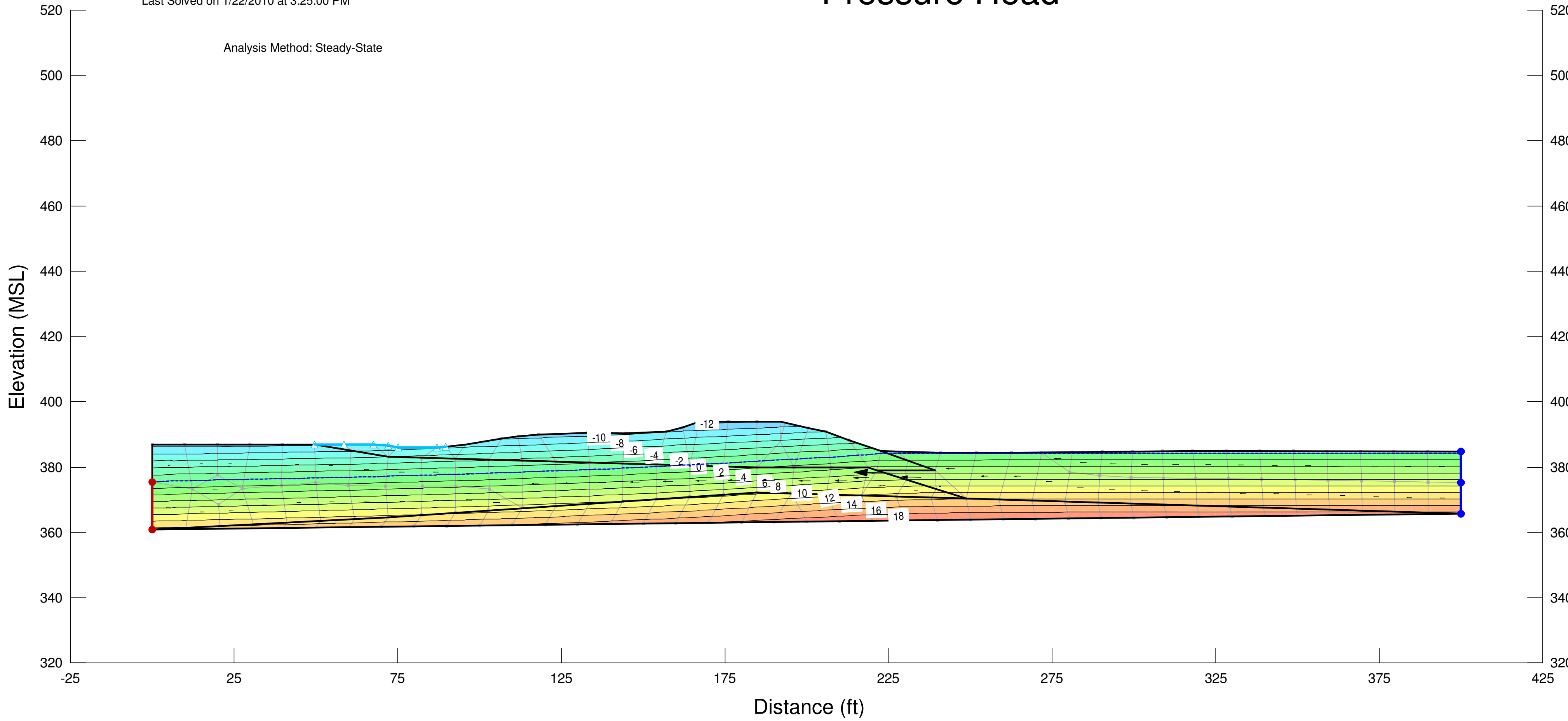
Analysis Name: Steady-State Seepage

Date Saved: 1/22/2010

Last Solved on 1/22/2010 at 3:25:00 PM

Analysis Method: Steady-State

Pressure Head



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section W.gsz

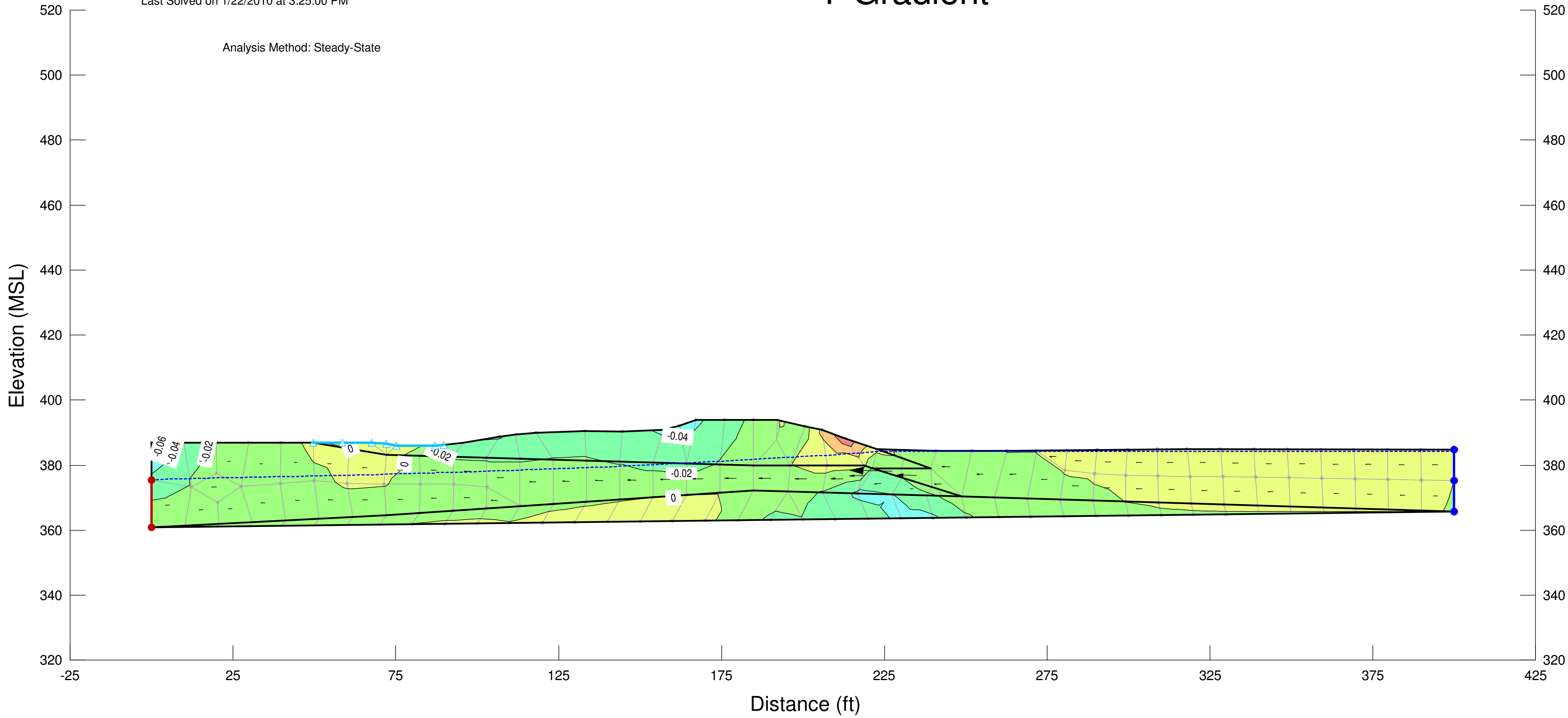
Analysis Name: Steady-State Seepage

Date Saved: 1/22/2010

Last Solved on 1/22/2010 at 3:25:00 PM

Analysis Method: Steady-State

Y-Gradient



Appendix I

Slope Stability Analyses Output

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

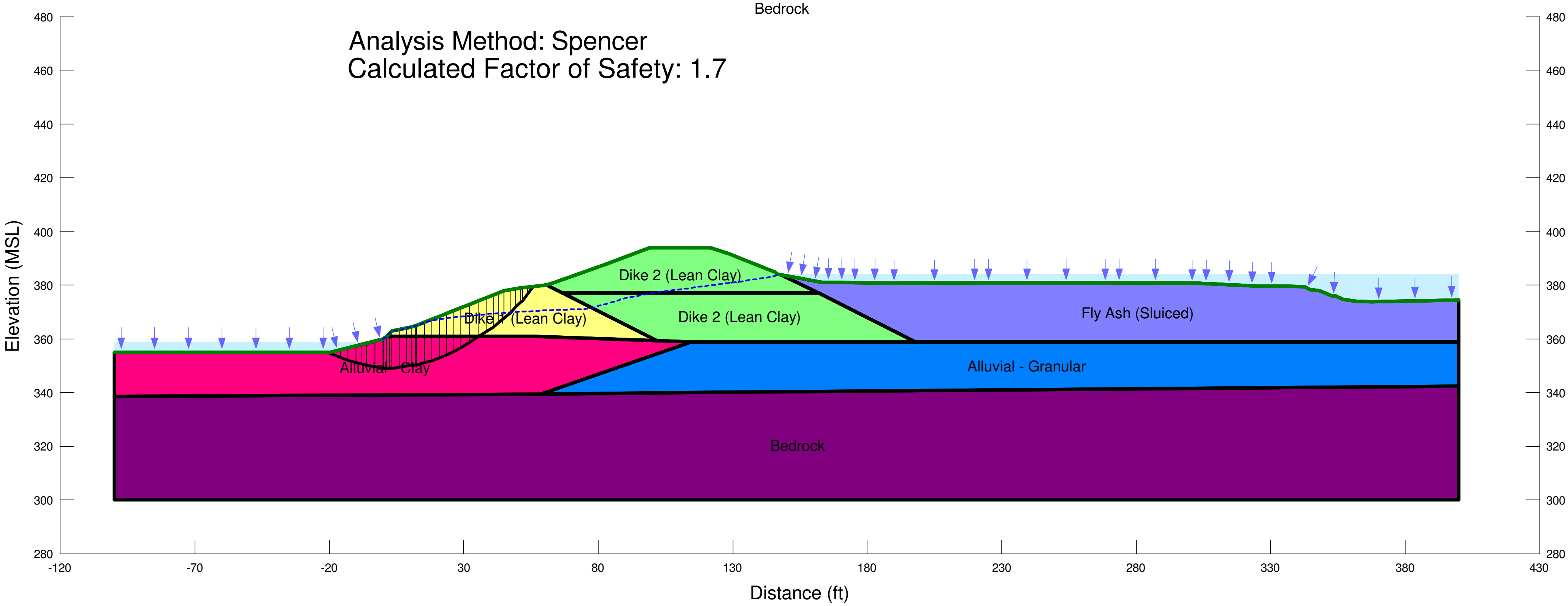
File Name: Section P.gsz

Analysis Name: Stability - Existing Condition

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 12:08:20 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial - Clay	124 pcf	200 psf	33 °
Alluvial - Granular	130 pcf	0 psf	32 °
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section P.gsz

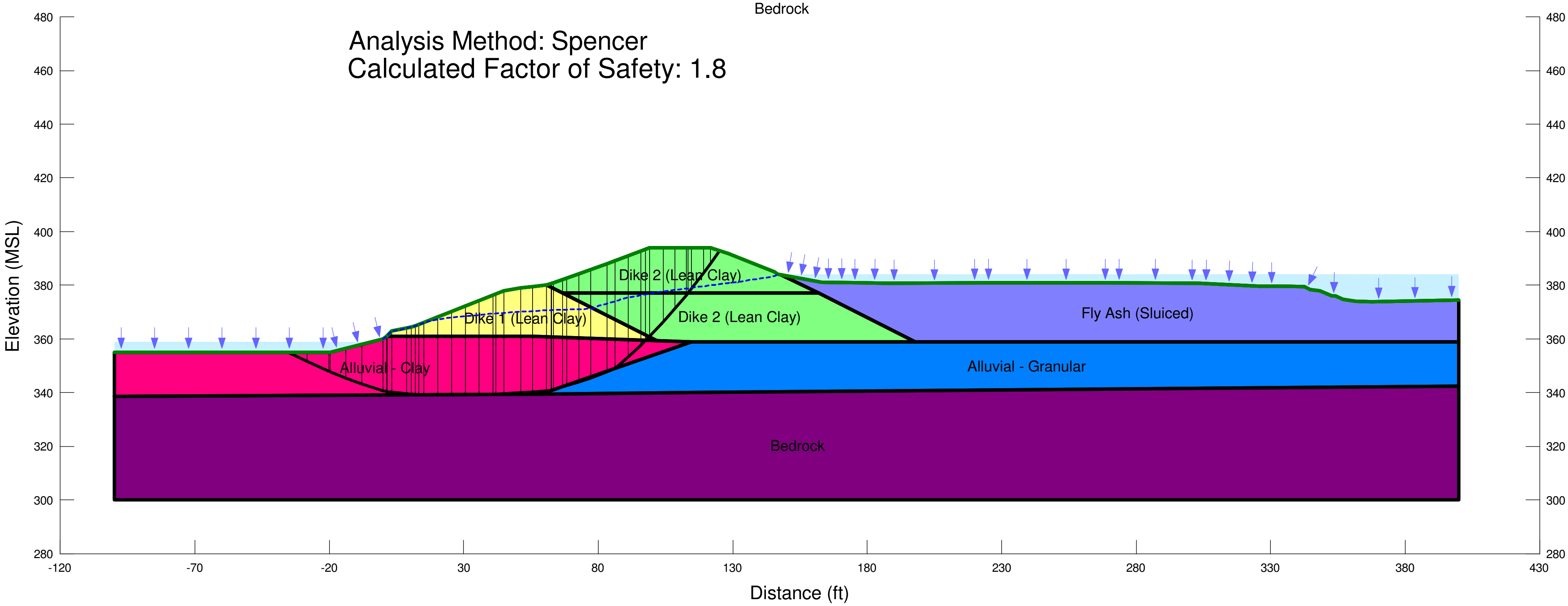
Analysis Name: Stability - Existing Condition (Deep)

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 12:09:56 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial - Clay	124 pcf	200 psf	33 °
Alluvial - Granular	130 pcf	0 psf	32 °
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

Stantec

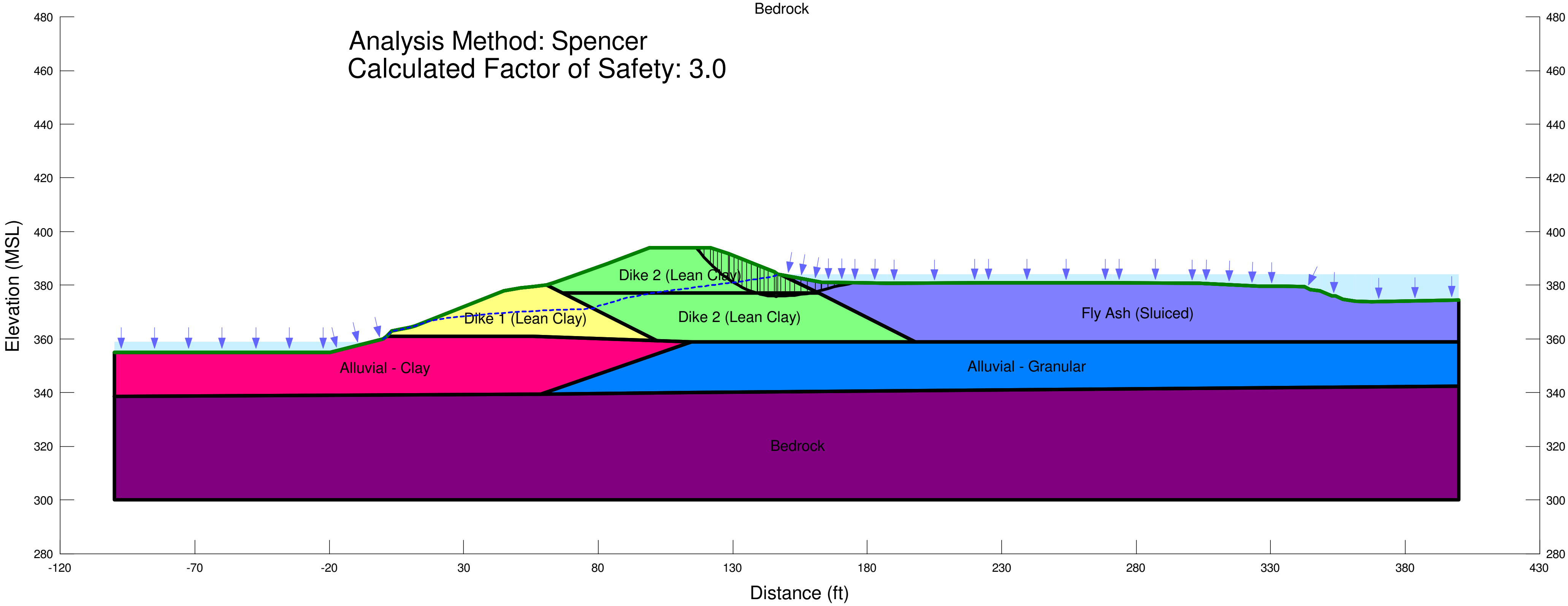
File Name: Section P.gsz

Analysis Name: Stability - Existing Condition (L2R)

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 12:20:12 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial - Clay	124 pcf	200 psf	33 °
Alluvial - Granular	130 pcf	0 psf	32 °
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section P.gsz

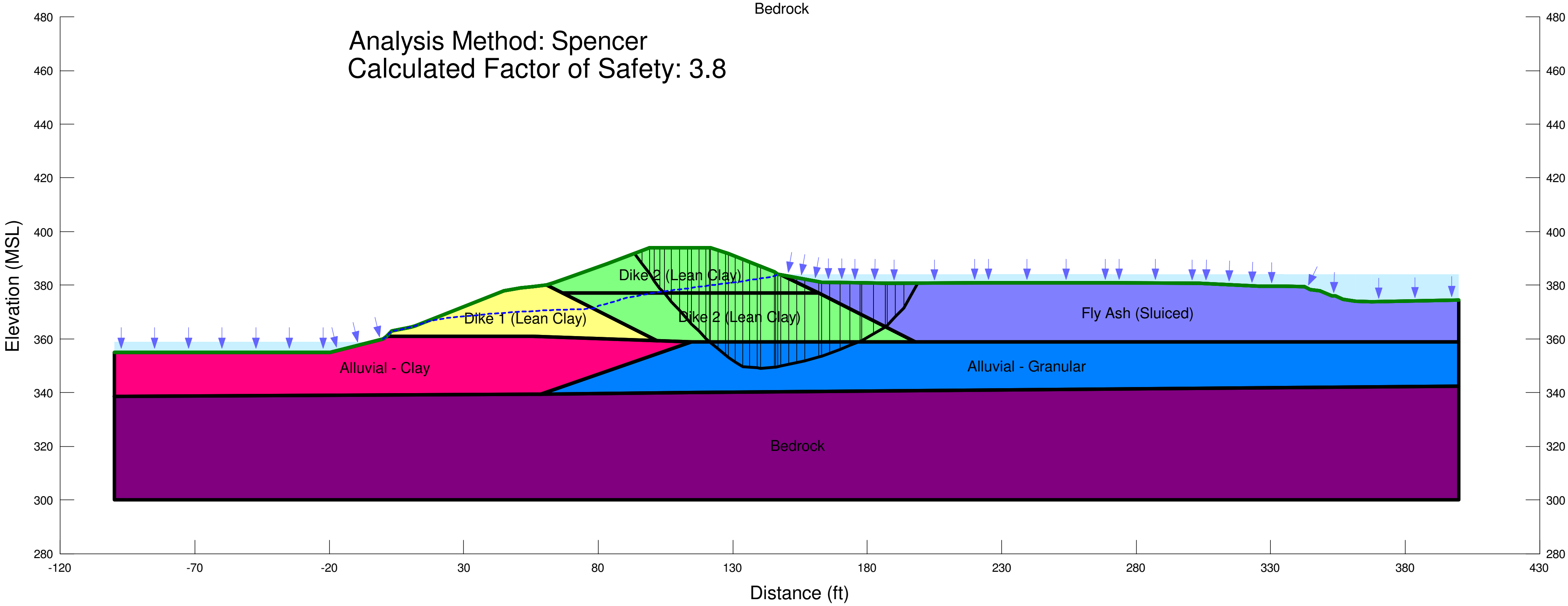
Analysis Name: Stability - Existing Condition (Deep) (L2R)

Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 12:18:00 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial - Clay	124 pcf	200 psf	33 °
Alluvial - Granular	130 pcf	0 psf	32 °
Bedrock			

Analysis Method: Spencer
Calculated Factor of Safety: 3.8



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

Stantec

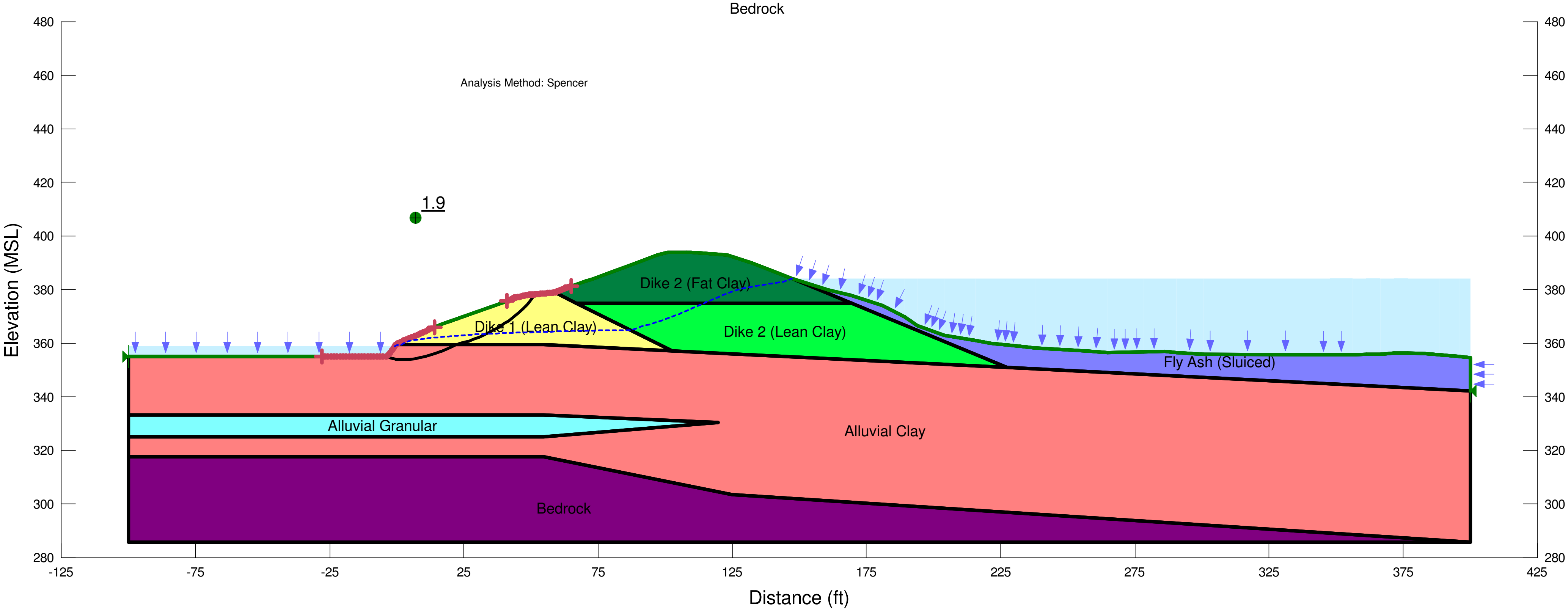
File Name: Section Q.gsz

Analysis Name: Stability - Existing Condition
Last Solved on 1/13/2010 at 9:52:26 AM
Date Saved: 1/13/2010

Calculated Factor of Safety: 1.9

Material Type	Unit Weight	Friction Angle	Cohesion
Dike 1 (Lean Clay)	123 pcf	22 °	200 psf
Dike 2 (Lean Clay)	123 pcf	32 °	200 psf
Dike 2 (Fat Clay)	119 pcf	29 °	200 psf
Fly Ash (Sluiced)	100 pcf	22 °	0 psf
Alluvial Clay	124 pcf	33 °	200 psf
Alluvial Granular	130 pcf	32 °	0 psf
Bedrock			

Analysis Method: Spencer



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section Q.gsz

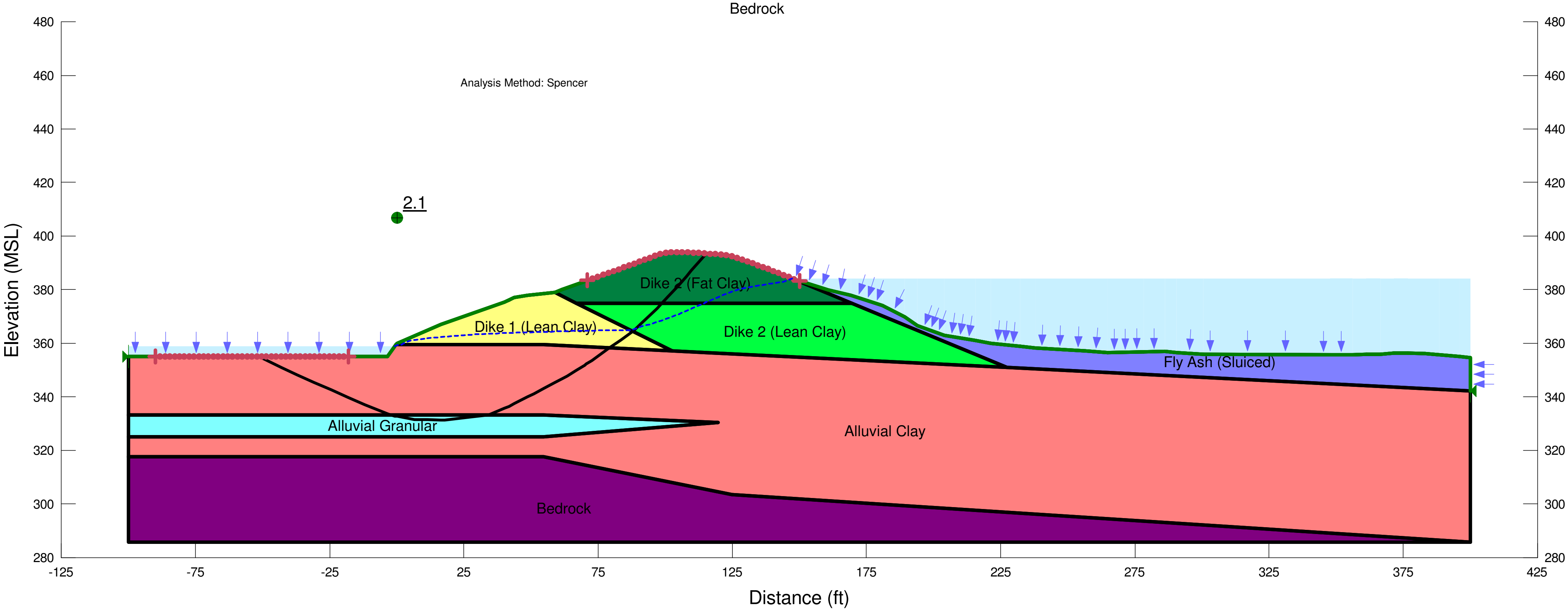
Analysis Name: Stability - Existing Condition (Deep)
Last Solved on 1/13/2010 at 9:55:30 AM
Date Saved: 1/13/2010

Stantec

Material Type	Unit Weight	Friction Angle	Cohesion
Dike 1 (Lean Clay)	123 pcf	22 °	200 psf
Dike 2 (Lean Clay)	123 pcf	32 °	200 psf
Dike 2 (Fat Clay)	119 pcf	29 °	200 psf
Fly Ash (Sluiced)	100 pcf	22 °	0 psf
Alluvial Clay	124 pcf	33 °	200 psf
Alluvial Granular	130 pcf	32 °	0 psf
Bedrock			

Calculated Factor of Safety: 2.1

Analysis Method: Spencer



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

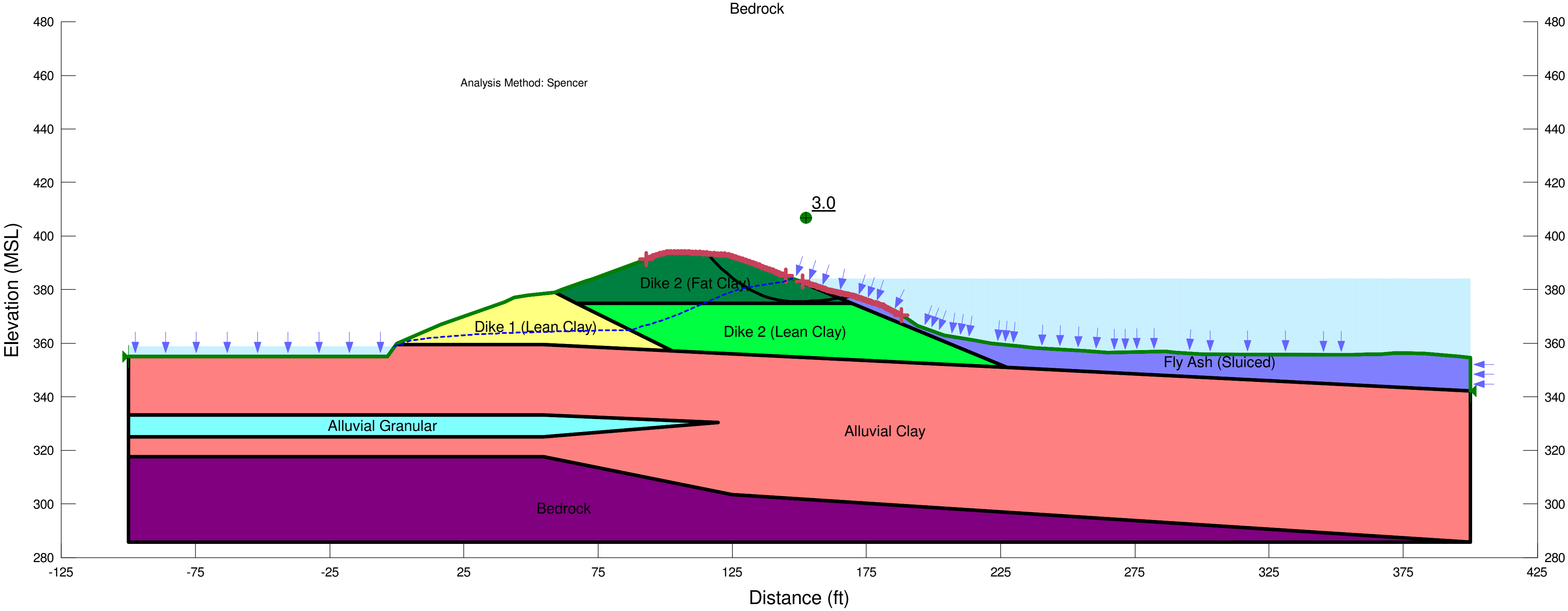
Stantec

File Name: Section Q.gsz

Analysis Name: Stability - Existing Condition (L2R)
Last Solved on 1/13/2010 at 9:58:20 AM
Date Saved: 1/13/2010

Calculated Factor of Safety: 3.0

Material Type	Unit Weight	Friction Angle	Cohesion
Dike 1 (Lean Clay)	123 pcf	22 °	200 psf
Dike 2 (Lean Clay)	123 pcf	32 °	200 psf
Dike 2 (Fat Clay)	119 pcf	29 °	200 psf
Fly Ash (Sluiced)	100 pcf	22 °	0 psf
Alluvial Clay	124 pcf	33 °	200 psf
Alluvial Granular	130 pcf	32 °	0 psf
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

Stantec

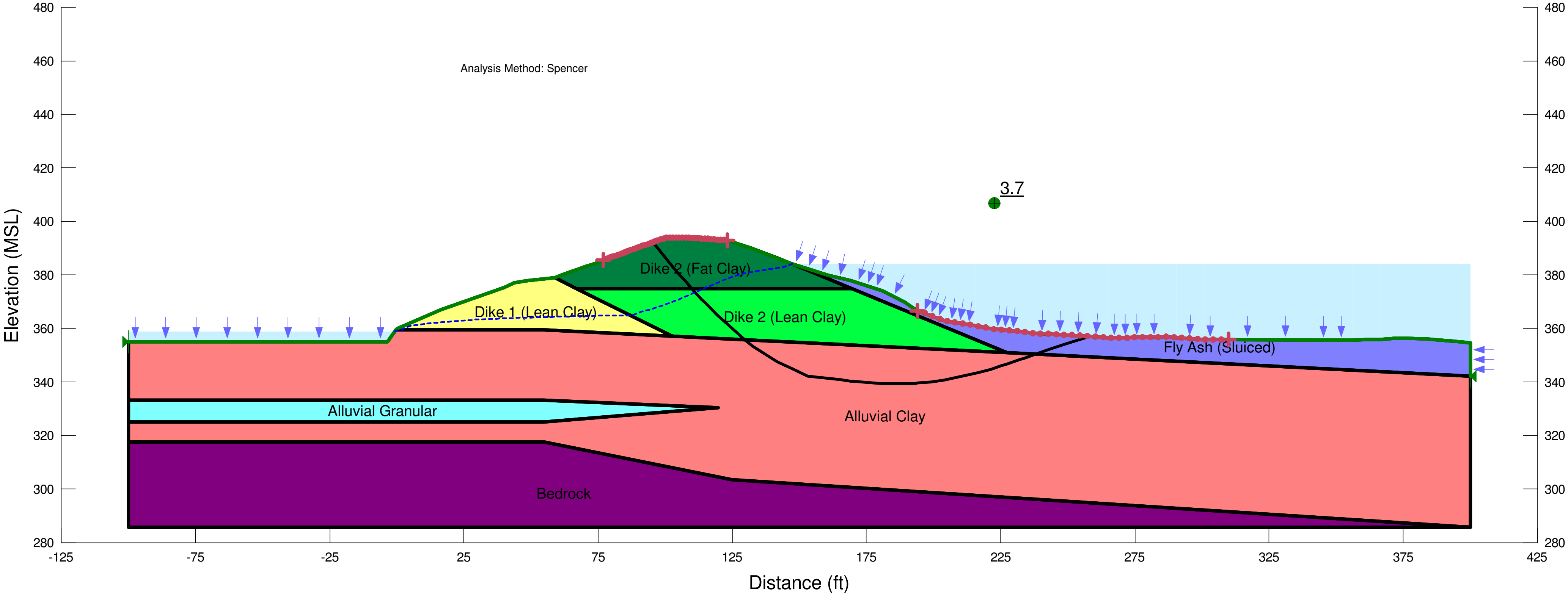
File Name: Section Q.gsz

Analysis Name: Stability - Existing Condition (L2R)(Deep)
Last Solved on 1/13/2010 at 10:03:04 AM
Date Saved: 1/13/2010

Material Type	Unit Weight	Friction Angle	Cohesion
Dike 1 (Lean Clay)	123 pcf	22 °	200 psf
Dike 2 (Lean Clay)	123 pcf	32 °	200 psf
Dike 2 (Fat Clay)	119 pcf	29 °	200 psf
Fly Ash (Sluiced)	100 pcf	22 °	0 psf
Alluvial Clay	124 pcf	33 °	200 psf
Alluvial Granular	130 pcf	32 °	0 psf
Bedrock			

Calculated Factor of Safety: 3.7

Analysis Method: Spencer

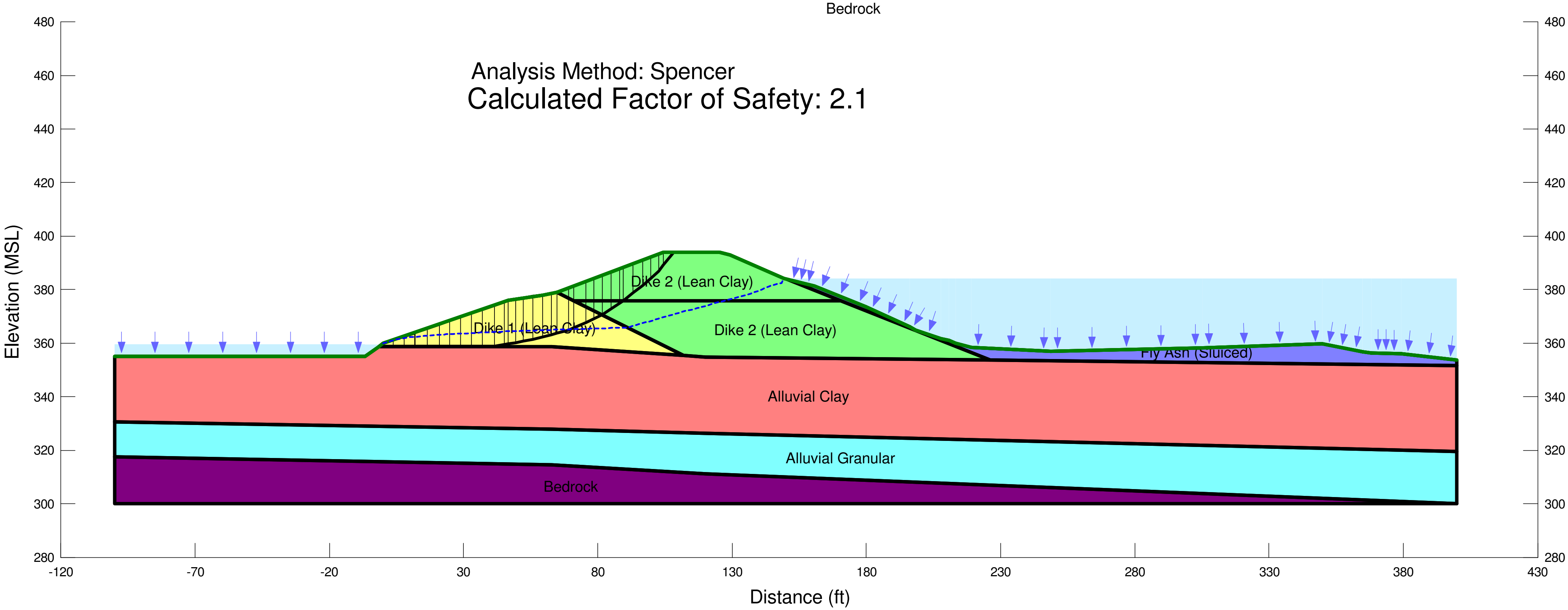


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section R.gsz

Analysis Name: Stability - Existing Condition
Last Solved on 1/31/2010 at 1:11:55 PM
Date Saved: 1/31/2010

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



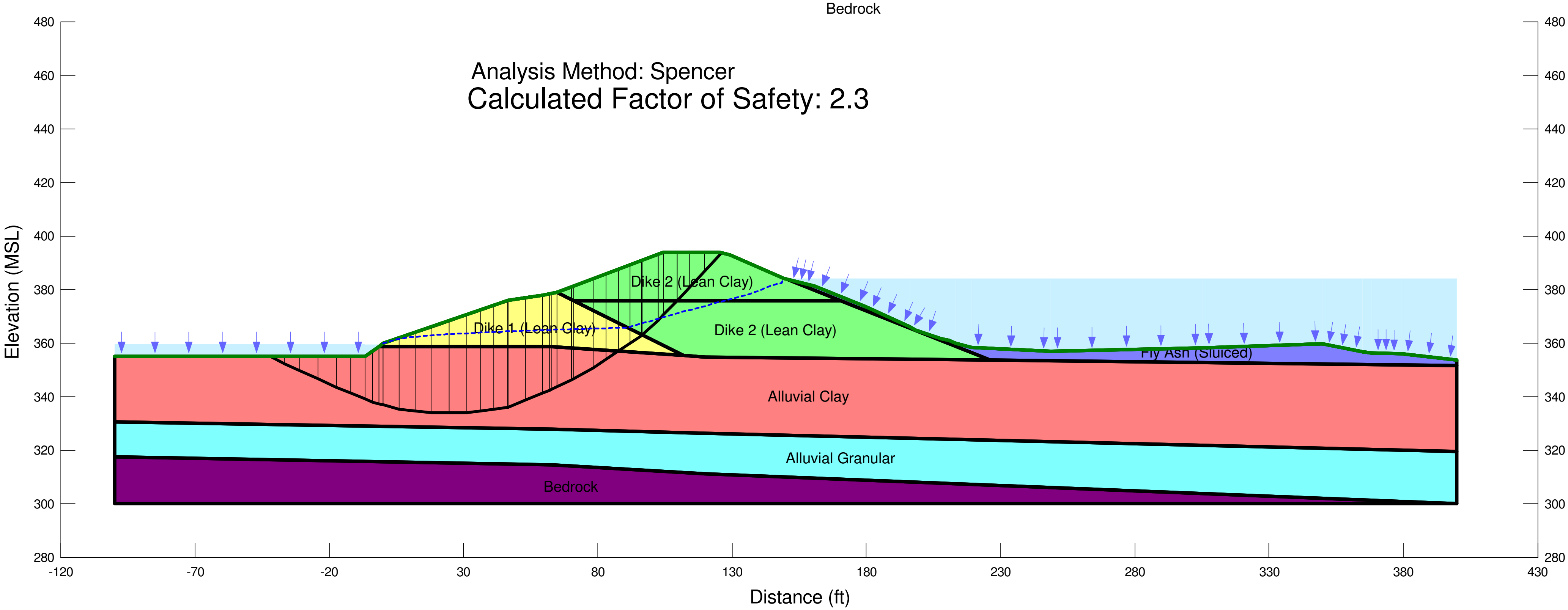
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

Stantec

File Name: Section R.gsz

Analysis Name: Stability - Existing Condition (Deep)
Last Solved on 1/31/2010 at 1:13:26 PM
Date Saved: 1/31/2010

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



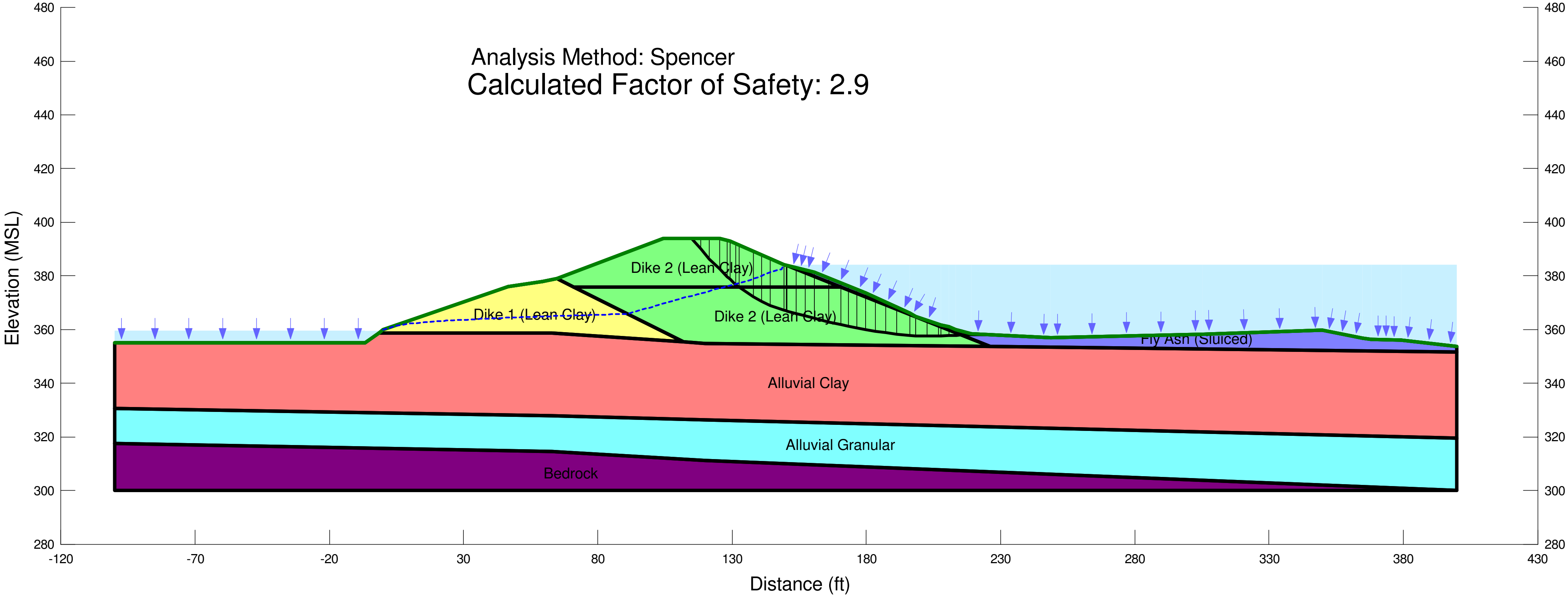
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

Stantec

File Name: Section R.gsz

Analysis Name: Stability - Existing Condition (L2R)
Last Solved on 1/31/2010 at 1:34:50 PM
Date Saved: 1/31/2010

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			

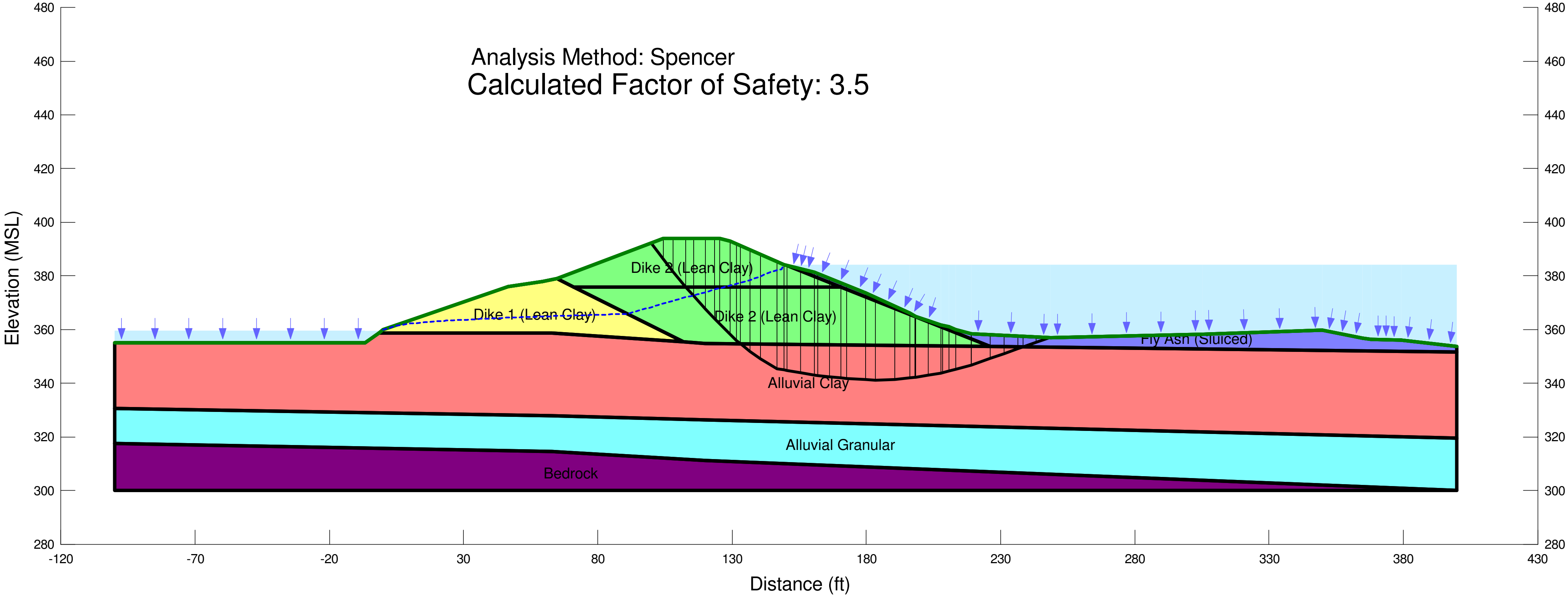


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section R.gsz

Analysis Name: Stability - Existing Condition (Deep) (L2R)
Last Solved on 1/31/2010 at 1:26:56 PM
Date Saved: 1/31/2010

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



Stantec

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section S.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

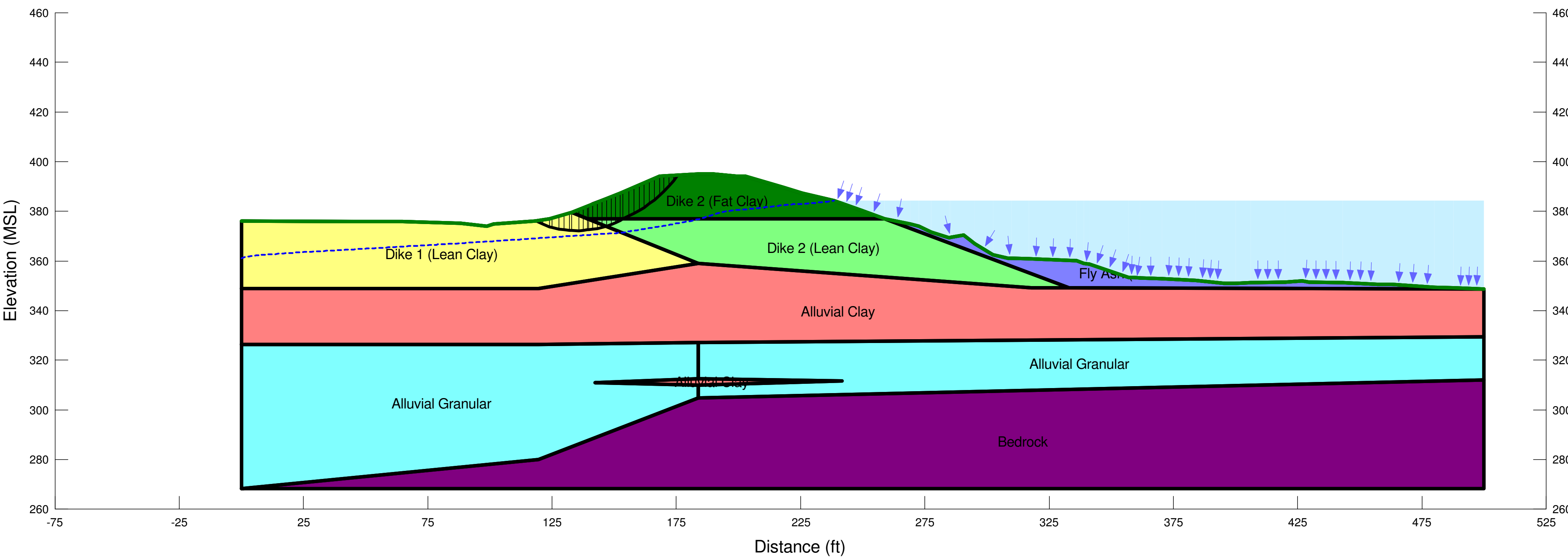
Date Saved: 1/21/2010

Last Solved on 1/21/2010 at 7:58:42 PM

Analysis Method: Spencer

Calculated Factor of Safety: 2.5

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

Stantec

File Name: Section S.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels (Deep)

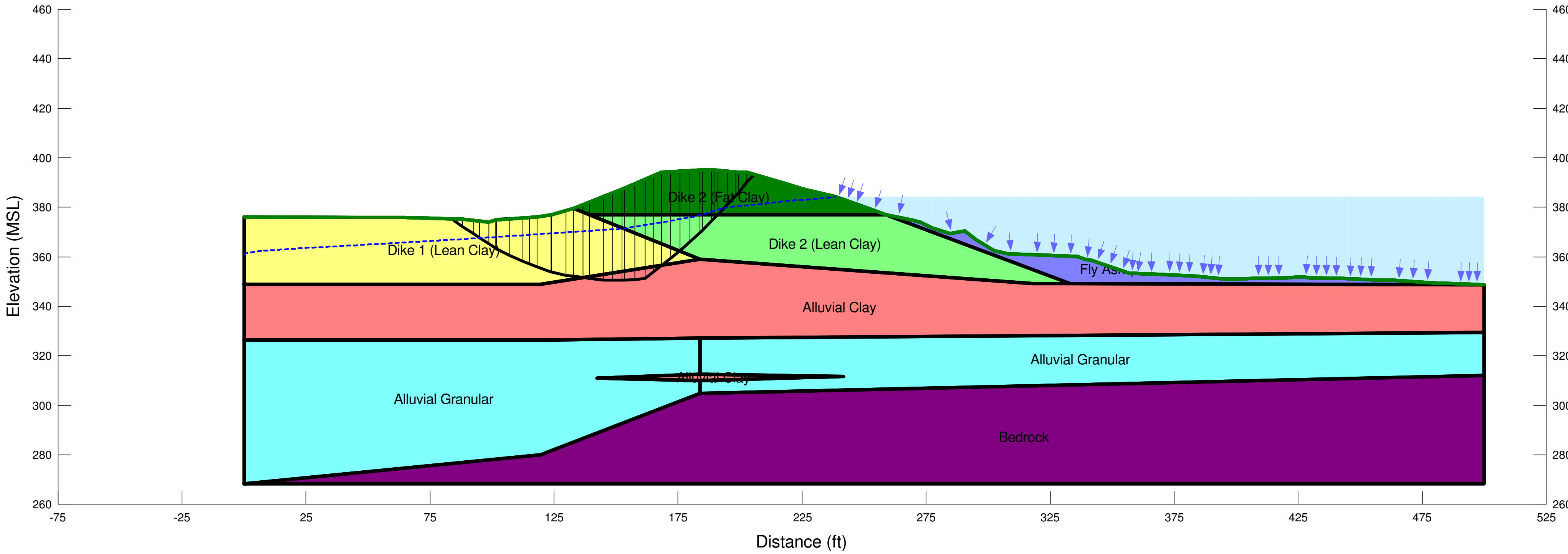
Date Saved: 1/21/2010

Last Solved on 1/21/2010 at 8:00:54 PM

Analysis Method: Spencer

Calculated Factor of Safety: 3.4

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section S.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels (L2R)

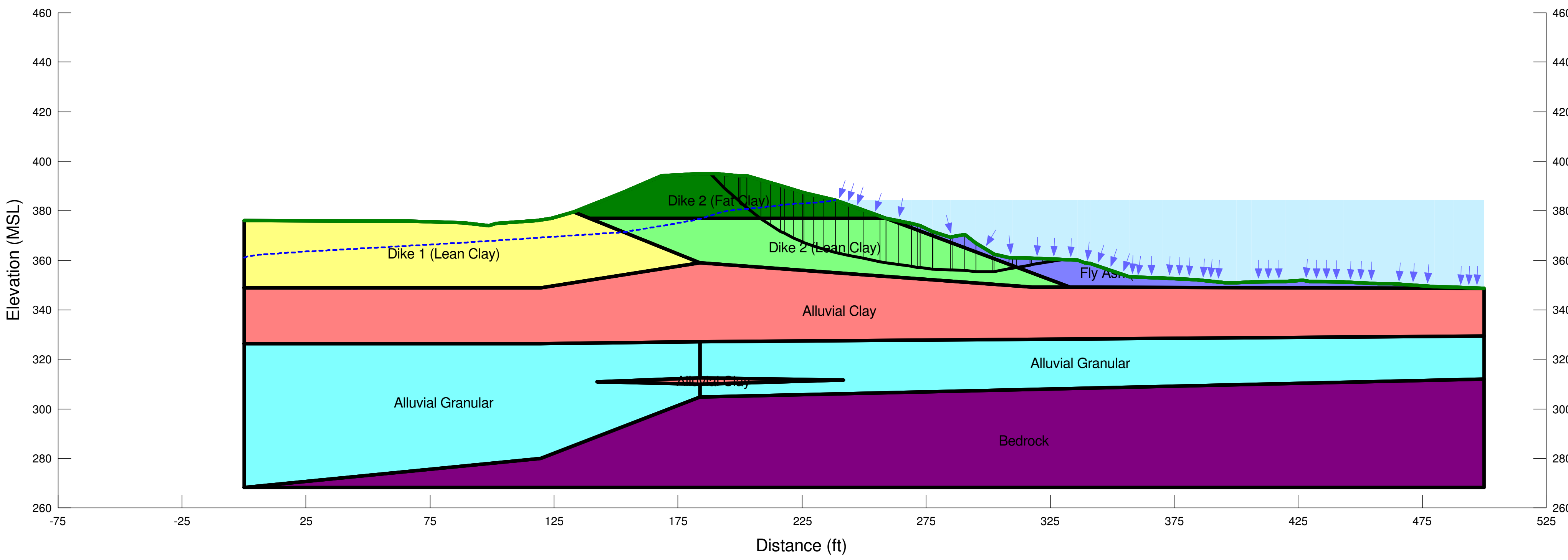
Date Saved: 1/21/2010

Last Solved on 1/21/2010 at 8:05:36 PM

Analysis Method: Spencer

Calculated Factor of Safety: 3.2

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section S.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels (Deep) (L2R)

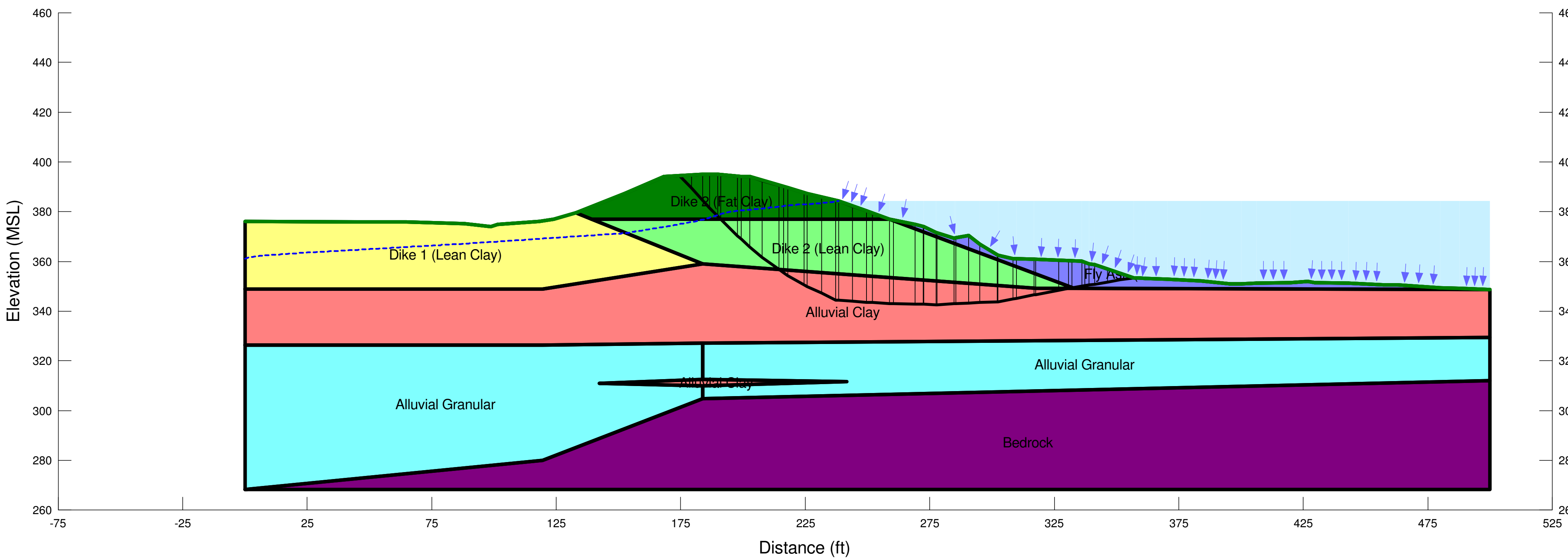
Date Saved: 1/21/2010

Last Solved on 1/21/2010 at 8:03:10 PM

Analysis Method: Spencer

Calculated Factor of Safety: 3.6

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



Stability - Existing Condition

File Information

Created By: Cooper, Paul
Revision Number: 236
Last Edited By: Rogers, Daniel
Date: 1/31/2010
Time: 12:06:28 PM
File Name: Section P.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/31/2010
Last Solved Time: 12:08:20 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition

Kind: SLOPE/W
Parent: Steady-State Seepage
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced

Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 22 °
Phi-B: 0 °

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 32 °
Phi-B: 0 °

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °

Alluvial - Clay

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 200 psf
Phi: 33 °
Phi-B: 0 °

Alluvial - Granular

Model: Mohr-Coulomb
Unit Weight: 130 pcf

Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °

Bedrock

Model: Bedrock (Impenetrable)

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-49.53475, 355.05335) ft
Left-Zone Right Coordinate: (-1, 359.64475) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (3.10803, 363) ft
Right-Zone Right Coordinate: (146.88, 384.232) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-100, 355.05335) ft
Right Coordinate: (400, 374.60838) ft

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.7	(3.558, 405.251)	41.09	(55.7899, 379.434)	(-20.7596, 355.053)
2	29685	1.7	(3.558, 405.251)	56.019	(53.1429, 379.183)	(-21.3083, 355.053)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-20.240625	354.8405	269.69501	433.32317	106.26137	200
2	Optimized	-17.826235	353.8503	398.42174	634.82905	153.5247	200
3	Optimized	-14.45986	352.61685	563.85803	815.98386	163.73243	200
4	Optimized	-11.51786	351.7045	693.75185	994.18611	195.10429	200
5	Optimized	-9.084805	351.00865	776.88224	1095.8049	207.11079	200
6	Optimized	-7.160695	350.5293	841.0803	1195.0522	229.87201	200

7	Optimized	-4.64898	350.0077	918.899	1264.0853	224.1666	200
8	Optimized	-1.54966	349.4439	1005.4019	1436.2975	279.82688	200
9	Optimized	0.09424	349.14485	1048.8425	1538.8904	318.24084	200
10	Optimized	0.68646	349.11055	1058.1512	1508.4048	292.39811	200
11	Optimized	1.74991	349.07395	1072.1018	1658.7001	380.94144	200
12	Optimized	2.71267	349.10785	1078.7166	1652.6076	372.6892	200
13	Optimized	4.526955	349.35135	1076.6267	1704.4521	407.71454	200
14	Optimized	7.360945	349.73165	1074.9131	1718.9656	418.25262	200
15	Optimized	9.649815	350.0388	1074.2983	1742.9425	434.22266	200
16	Optimized	11.2828	350.25795	1074.1178	1777.5	456.7817	200
17	Optimized	12.249705	350.3877	1073.542	1802.0393	473.09169	200
18	Optimized	13.881375	350.7895	1056.5046	1730.3151	437.57761	200
19	Optimized	16.73312	351.53785	1024.6898	1772.5766	485.68339	200
20	Optimized	19.521465	352.4354	980.20206	1703.4749	469.69888	200
21	Optimized	22.24642	353.4822	922.30735	1702.7213	506.80672	200
22	Optimized	24.94179	354.6888	850.38113	1594.8402	483.45735	200
23	Optimized	27.607575	356.05525	768.4943	1555.0151	510.77255	200
24	Optimized	30.50496	357.7039	675.83813	1431.0122	490.4158	200
25	Optimized	33.66038	359.8038	542.98638	1280.1633	478.7283	200
26	Optimized	36.73189	361.82815	423.90371	1286.7916	348.62935	200
27	Optimized	39.641105	363.5766	338.49394	1220.576	356.38429	200
28	Optimized	42.04357	365.25855	250.49029	1030.9278	315.31723	200
29	Optimized	43.991235	366.90525	161.50445	940.90691	314.89903	200
30	Optimized	46.092215	368.6816	66.655352	819.80291	304.29137	200
31	Optimized	48.21616	370.65045	-43.486402	610.41868	246.62515	200
32	Optimized	50.20976	372.6821	-160.14224	463.18042	187.13704	200
33	Optimized	51.45633	373.95245	-233.23488	369.68465	149.36229	200
34	Optimized	52.687075	375.46265	-322.42193	209.32165	84.571436	200
35	Optimized	54.649025	377.97395	-472.63446	25.225476	10.191754	200
36	Optimized	55.709965	379.33195	-554.77669	-74.205039	-29.980782	200

Slices of Slip Surface: 29685

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	29685	-20.514935	354.67575	287.64655	484.01856	127.52547	200
2	29685	-18.48901	353.77025	400.29667	639.0204	155.02901	200
3	29685	-16.02381	352.78235	531.75317	796.45163	171.89719	200
4	29685	-13.55861	351.92665	646.17198	930.5958	184.70699	200
5	29685	-11.093408	351.1969	745.60775	1043.7882	193.64065	200
6	29685	-8.6282045	350.588	820.51818	1140.3081	207.67397	200
7	29685	-6.163003	350.09595	893.89581	1216.3631	209.41268	200
8	29685	-3.6978015	349.71765	957.62293	1293.3621	218.03158	200
9	29685	-1.2326005	349.45075	1007.812	1371.3938	236.11281	200
10	29685	0.59222	349.3135	1038.8634	1480.5616	286.84216	200
11	29685	2.1472	349.25785	1060.7794	1680.623	402.53115	200
12	29685	4.526955	349.2581	1084.4217	1810.9563	471.81712	200
13	29685	7.360945	349.37905	1104.5412	1814.9328	461.3337	200
14	29685	9.649815	349.57085	1113.5852	1819.1105	458.17348	200
15	29685	11.2828	349.7722	1115.0989	1831.4742	465.21953	200
16	29685	13.33723	350.10755	1111.0764	1851.6164	480.91228	200
17	29685	15.923875	350.6297	1095.4338	1870.7439	503.49229	200
18	29685	18.51052	351.2808	1069.865	1872.0402	520.93866	200
19	29685	21.097165	352.0656	1032.9116	1855.4445	534.15912	200
20	29685	23.68381	352.99015	984.08444	1820.8286	543.38801	200
21	29685	26.270455	354.06205	922.4615	1767.7096	548.91054	200
22	29685	28.8571	355.2908	846.14904	1695.4367	551.53385	200
23	29685	31.44374	356.68835	765.03176	1604.2567	544.99908	200
24	29685	34.030385	358.26985	668.19457	1492.3693	535.22534	200
25	29685	36.61703	360.0547	549.46735	1357.5828	524.79633	200
26	29685	39.08614	361.96575	432.87041	1260.6459	334.44301	200
27	29685	41.437715	364.01075	323.77166	1104.4817	315.42731	200
28	29685	43.789285	366.3053	195.73817	924.71188	294.52449	200
29	29685	46.00532	368.7289	63.425902	712.85171	262.38506	200
30	29685	48.085815	371.3023	-83.262275	483.73193	195.44039	200
31	29685	50.16631	374.2296	-253.05567	250.45374	101.18988	200

32	29685	52.17471	377.48785	-446.44629	8.4105646	3.3980887	200

Stability - Existing Condition

Report generated using GeoStudio 2007, version 7.14. Copyright © 1991-2009 GEO-SLOPE International Ltd.

File Information

Revision Number: 238
Last Edited By: Rogers, Daniel
Date: 1/13/2010
Time: 9:50:32 AM
File Name: Section Q.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/13/2010
Last Solved Time: 9:52:26 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition

Kind: SLOPE/W
Parent: Steady-State Seepage
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 22 °
Phi-B: 0 °

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 32 °
Phi-B: 0 °

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 119 pcf
Cohesion: 200 psf
Phi: 29 °
Phi-B: 0 °

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °

Alluvial Clay

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 200 psf

Phi: 33 °
Phi-B: 0 °

Alluvial Granular

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °

Bedrock

Model: Bedrock (Impenetrable)

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-28, 355) ft
Left-Zone Right Coordinate: (14, 365.91256) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (41, 375.78242) ft
Right-Zone Right Coordinate: (65, 381.27707) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-100, 355) ft
Right Coordinate: (400, 342.32681) ft

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.9	(0.254, 423.244)	32.14978	(51.559, 378.286)	(-4.04426, 355)
2	27260	2.0	(0.254, 423.244)	68.377	(51.7928, 378.309)	(-4.00392, 355)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-3.8293455	354.9405	254.89001	377.94036	79.90983	200
2	Optimized	-2.24089	354.50075	304.53674	684.60687	246.82043	200

3	Optimized	-0.762595	354.1108	350.23958	717.60784	238.57174	200
4	Optimized	-0.473055	354.084	354.89417	764.05169	265.71	200
5	Optimized	-0.144135	354.05355	360.16686	833.9761	307.69531	200
6	Optimized	0.44611	353.99885	369.77082	897.89368	342.967	200
7	Optimized	1.8355925	353.9747	385.91819	910.57085	340.71342	200
8	Optimized	3.7223375	354.0091	397.77262	1015.0191	400.84458	200
9	Optimized	5.6381225	354.1634	400.81219	1018.5524	401.16516	200
10	Optimized	7.5829475	354.4376	393.0324	1089.0695	452.01177	200
11	Optimized	9.619125	354.84615	379.36052	1068.7732	447.70984	200
12	Optimized	11.746655	355.389	357.94589	1111.9942	489.68467	200
13	Optimized	13.70934	355.9783	332.31494	1076.2872	483.14122	200
14	Optimized	15.507175	356.61405	302.35573	1090.4985	511.82592	200
15	Optimized	16.512385	356.9695	285.34328	1097.5663	527.46378	200
16	Optimized	17.55619	357.42255	262.13704	1032.5163	500.29012	200
17	Optimized	19.431215	358.2535	219.57061	1013.4028	515.52066	200
18	Optimized	21.30624	359.0845	176.70188	994.28937	530.94753	200
19	Optimized	22.29735	359.52375	154.62524	995.07324	339.56304	200
20	Optimized	22.87655	359.7279	149.12118	1049.238	363.67079	200
21	Optimized	24.25684	360.1658	137.41845	1079.6084	380.66944	200
22	Optimized	25.966215	360.6808	121.61138	1090.251	391.3558	200
23	Optimized	27.67559	361.1958	104.06228	1100.8936	402.74599	200
24	Optimized	29.678445	361.9402	74.282999	1026.1221	384.56797	200
25	Optimized	31.97477	362.91395	30.125749	1008.7622	395.39478	200
26	Optimized	33.89761	363.8106	-15.167766	931.31203	376.27448	200
27	Optimized	35.446975	364.6302	-59.430761	904.15542	365.3025	200
28	Optimized	36.99634	365.4498	-104.19353	877.05586	354.35357	200
29	Optimized	38.96642	366.62325	-169.98357	782.13452	316.00286	200
30	Optimized	40.91414	367.8675	-242.99305	735.44814	297.14034	200
31	Optimized	42.701555	369.18175	-320.28712	627.88856	253.68345	200
32	Optimized	44.505705	370.63475	-408.04567	552.42576	223.1945	200
33	Optimized	46.122955	372.06955	-495.5382	415.08602	167.70564	200
34	Optimized	47.819345	373.70045	-595.86971	305.56277	123.45537	200
35	Optimized	48.697355	374.54455	-648.03644	248.61707	100.44782	200
36	Optimized	49.43513	375.50135	-707.22703	131.1696	52.99596	200

37	Optimized	50.851055	377.3576	-822.06415	1.8168337	0.73404847	200

Slices of Slip Surface: 27260

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	27260	-3.809174	354.9884	250.63215	303.0929	34.068411	200
2	27260	-2.8752825	354.94295	262.31108	472.6235	136.57849	200
3	27260	-1.3969875	354.89125	283.0477	546.43659	171.04675	200
4	27260	-0.473055	354.8714	294.89362	615.38312	208.12831	200
5	27260	-0.144135	354.86855	298.75997	675.01541	244.34314	200
6	27260	0.9114495	354.8765	309.66279	745.37173	282.9527	200
7	27260	2.7343485	354.91835	323.82563	829.28613	328.24989	200
8	27260	4.5572475	355.0089	330.50847	904.50743	372.75928	200
9	27260	6.3801465	355.1484	333.32969	970.90031	414.0432	200
10	27260	8.203045	355.33705	334.60212	1028.581	450.67516	200
11	27260	10.025942	355.57535	332.7332	1077.9637	483.95834	200
12	27260	11.84884	355.8638	326.41163	1119.3774	514.95797	200
13	27260	13.67174	356.20305	316.85034	1152.8481	542.90331	200
14	27260	15.49464	356.5939	303.62893	1178.643	568.2408	200
15	27260	17.264955	357.0229	286.94092	1189.1169	585.87993	200
16	27260	18.98269	357.4881	267.63588	1185.1878	595.86521	200
17	27260	20.700425	358.0019	244.87406	1175.1511	604.12895	200
18	27260	22.41816	358.5654	218.70945	1159.056	610.6682	200
19	27260	24.135895	359.17985	189.37912	1136.8639	615.30379	200
20	27260	25.9427	359.88435	160.87783	1115.127	385.54168	200
21	27260	27.838585	360.68665	131.02755	1080.9809	383.80607	200
22	27260	29.73447	361.55765	94.828998	1039.5211	381.68039	200
23	27260	31.63035	362.5003	51.643573	990.55373	379.34433	200
24	27260	33.52623	363.518	0.65353183	933.9197	377.06401	200
25	27260	35.422115	364.6147	-58.57632	872.04082	352.32736	200
26	27260	37.318	365.79485	-123.74379	803.25539	324.53625	200
27	27260	39.21388	367.06375	-196.11727	727.52412	293.93882	200
28	27260	41.05553	368.3858	-273.95139	654.74494	264.53413	200
29	27260	42.842945	369.7622	-355.12323	584.75284	236.25548	200

30	27260	44.558465	371.1731	-440.93388	493.45337	199.3681	200
31	27260	46.202095	372.6182	-529.18491	382.32326	154.46862	200
32	27260	47.845725	374.1609	-624.31614	266.69171	107.75044	200
33	27260	49.448865	375.7673	-723.65518	142.95789	57.758738	200
34	27260	51.011515	377.44275	-827.34057	11.803472	4.7689123	200

Stability - Existing Condition

File Information

Created By: Cooper, Paul
Revision Number: 226
Last Edited By: Rogers, Daniel
Date: 1/31/2010
Time: 1:07:45 PM
File Name: Section R.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/31/2010
Last Solved Time: 1:11:55 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition

Kind: SLOPE/W
Parent: Steady-State Seepage
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced

Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 22 °
Phi-B: 0 °

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 32 °
Phi-B: 0 °

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °

Alluvial Clay

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 200 psf
Phi: 33 °
Phi-B: 0 °

Alluvial Granular

Model: Mohr-Coulomb
Unit Weight: 130 pcf

Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °

Bedrock

Model: Bedrock (Impenetrable)

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-47, 355) ft
Left-Zone Right Coordinate: (44.48748, 375.22737) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (49, 376.35564) ft
Right-Zone Right Coordinate: (140.43152, 388.11609) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-100, 355) ft
Right Coordinate: (400, 353.67109) ft

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	2.1	(26.139, 472.46)	56.95689	(108.293, 394.002)	(-1.47143, 358.807)
2	28779	2.1	(26.139, 472.46)	113.486	(108.135, 394.002)	(3.79007, 361.197)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-0.735713	358.80755	52.95951	120.88953	27.44551	200
2	Optimized	1.9545065	358.80895	87.90452	249.09606	65.125611	200
3	Optimized	5.86352	358.811	134.17194	420.95014	115.86591	200
4	Optimized	9.7725335	358.813	173.22527	593.19307	169.678	200
5	Optimized	11.80411	358.81705	189.08398	667.70604	193.37587	200
6	Optimized	14.12673	358.82165	205.87356	784.72875	233.87268	200

7	Optimized	18.617835	358.82475	233.17196	983.45485	303.13397	200
8	Optimized	22.88874	358.82395	256.32619	1174.1927	370.84214	200
9	Optimized	26.939435	358.81925	274.8909	1354.8776	436.34295	200
10	Optimized	30.990125	358.8145	291.45594	1535.6613	502.69158	200
11	Optimized	35.04082	358.80975	306.86069	1716.519	569.53892	200
12	Optimized	39.236625	358.90595	315.62235	1848.1685	619.18884	200
13	Optimized	43.291515	359.2251	308.78106	1918.1742	650.23704	200
14	Optimized	45.95515	359.58855	294.2023	1926.1089	659.33307	200
15	Optimized	48.12244	359.98595	275.92479	1936.8483	671.05664	200
16	Optimized	50.89862	360.49505	251.92101	1928.1679	677.24772	200
17	Optimized	54.10194	361.16105	218.93565	1870.9462	667.45557	200
18	Optimized	57.7324	361.98395	176.68779	1841.2354	672.52089	200
19	Optimized	61.11965	362.75175	136.53784	1820.0909	680.1996	200
20	Optimized	63.727135	363.4161	100.53189	1742.5651	663.42446	200
21	Optimized	66.88536	364.35555	48.207824	1749.145	687.22324	200
22	Optimized	69.987565	365.38455	-10.077016	1678.9507	678.34013	200
23	Optimized	73.25344	366.7102	-88.064863	1668.9813	674.31222	200
24	Optimized	77.04269	368.3808	-187.71803	1579.6389	638.21555	200
25	Optimized	80.11132	369.8969	-279.83984	1542.2568	623.1122	200
26	Optimized	83.29573	371.75135	-347.01769	1321.1231	825.52936	200
27	Optimized	86.532935	373.91305	-395.49432	1232.0823	769.89049	200
28	Optimized	88.75147	375.44695	-432.18358	1117.2047	698.107	200
29	Optimized	91.207585	377.3018	-480.8826	1032.4649	645.15567	200
30	Optimized	94.91996	380.1054	-560.2451	904.4144	565.14084	200
31	Optimized	98.235455	382.8676	-653.13154	701.72607	438.48712	200
32	Optimized	101.15408	385.58845	-756.05972	564.01233	352.43402	200
33	Optimized	103.54075	388.10045	-867.40505	362.45019	226.48401	200
34	Optimized	106.3808	391.627	-1042.1951	121.23089	75.753469	200

Slices of Slip Surface: 28779

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	28779	5.579417	360.867	33.444007	179.03948	58.824391	200

2	28779	9.158106	360.2665	93.884508	422.96517	132.95722	200
3	28779	12.736795	359.78285	144.52061	644.68779	202.08066	200
4	28779	16.315485	359.41455	186.59442	845.28152	266.12686	200
5	28779	19.894175	359.16045	221.10861	1025.635	325.04977	200
6	28779	23.472865	359.01975	247.86866	1186.671	379.30076	200
7	28779	27.051555	358.9921	265.18621	1329.2143	429.89524	200
8	28779	30.630245	359.0774	274.41319	1453.8055	476.50542	200
9	28779	34.208935	359.27585	275.8367	1560.9117	519.20401	200
10	28779	37.787625	359.5881	269.37225	1651.028	558.22514	200
11	28779	41.366315	360.0151	254.45013	1724.5046	593.94056	200
12	28779	44.945005	360.5581	231.66947	1781.598	626.21177	200
13	28779	48.33601	361.1783	202.87623	1785.4076	639.38417	200
14	28779	51.53933	361.86565	168.65436	1739.1492	634.52111	200
15	28779	54.74265	362.65075	127.81345	1681.9451	627.90996	200
16	28779	57.94597	363.5357	80.225321	1613.8559	619.62696	200
17	28779	62.155115	364.8763	6.1520776	1515.6444	609.87449	200
18	28779	66.313705	366.3364	-77.004985	1444.2316	583.50744	200
19	28779	69.41591	367.56355	-148.29008	1416.0028	572.10226	200
20	28779	72.937785	369.09575	-239.25729	1369.0731	553.14143	200
21	28779	76.87934	370.97335	-351.89254	1299.8943	525.19138	200
22	28779	80.578575	372.90385	-427.76617	1188.527	742.6741	200
23	28779	84.03549	374.8745	-464.50566	1095.3238	684.43427	200
24	28779	87.63437	377.10625	-512.43273	983.30471	614.43698	200
25	28779	91.375205	379.6269	-575.85826	851.39712	532.01196	200
26	28779	95.11604	382.37345	-658.01161	703.26291	439.44744	200
27	28779	98.85688	385.3673	-763.39653	538.78727	336.67165	200
28	28779	102.5977	388.63505	-901.06371	357.89351	223.63668	200
29	28779	106.3014	392.17155	-1073.0489	105.02747	65.628449	200

Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 243
Last Edited By: Rogers, Daniel
Date: 1/21/2010
Time: 7:56:44 PM
File Name: Section S.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/21/2010
Last Solved Time: 7:58:42 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Parent: Steady-State Seepage
Method: Spencer
Settings
    PWP Conditions Source: Parent Analysis
SlipSurface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30
- Optimization Tolerance: 0.01
- Minimum Slip Surface Depth: 10 ft
- Optimization Maximum Iterations: 5000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Lean Clay)
Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 22 °
Phi-B: 0 °

Dike 2 (Lean Clay)
Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 32 °
Phi-B: 0 °

Dike 2 (Fat Clay)
Model: Mohr-Coulomb
Unit Weight: 119 pcf
Cohesion: 200 psf
Phi: 29 °
Phi-B: 0 °

Fly Ash (Sluiced)
Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °

Alluvial Clay

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 200 psf
Phi: 33 °
Phi-B: 0 °

Alluvial Granular

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °

Bedrock

Model: Bedrock (Impenetrable)

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (0, 376.13) ft
Left-Zone Right Coordinate: (146.49388, 385) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (148, 385.60027) ft
Right-Zone Right Coordinate: (232, 385.80881) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (0, 376.13) ft
Right Coordinate: (500, 348.67699) ft

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	2.5	(135.44, 418.878)	30.58291	(175.665, 394.477)	(118.578, 376.066)
2	41091	2.5	(135.44, 418.878)	46.134	(174.549, 394.406)	(118.342, 376.03)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	119.94605	375.42985	-364.58423	216.49053	87.467851	200
2	Optimized	122.72135	374.3095	-288.807	426.11255	172.16064	200
3	Optimized	124.59055	373.6663	-244.44121	578.45289	233.71014	200
4	Optimized	126.39785	373.1807	-208.84322	688.6914	278.24939	200
5	Optimized	128.832	372.71605	-172.24187	804.45136	325.01945	200
6	Optimized	131.00985	372.4399	-147.75303	932.49851	376.75386	200
7	Optimized	132.5233	372.29055	-133.0617	960.57079	388.09579	200
8	Optimized	134.3501	372.242	-123.14423	1051.7285	424.92589	200
9	Optimized	136.65805	372.2658	-115.74564	1104.9048	446.41052	200
10	Optimized	138.4693	372.388	-115.96598	1173.8718	474.27501	200
11	Optimized	139.5214	372.459	-116.05287	1214.1591	490.55213	200
12	Optimized	140.57085	372.60995	-120.85179	1192.1592	481.66359	200
13	Optimized	142.37675	372.892	-130.6287	1241.9465	501.77896	200
14	Optimized	144.2005	373.257	-145.13743	1230.4683	497.14145	200
15	Optimized	146.0857	373.71555	-164.6703	1261.6024	509.72045	200
16	Optimized	147.90625	374.3325	-186.01511	1144.0521	714.88312	200
17	Optimized	149.6186	375.09735	-209.52428	1133.0147	707.98618	200
18	Optimized	151.3951	375.9302	-235.63876	1093.502	683.29591	200
19	Optimized	152.9483	376.6903	-259.62884	1078.1264	673.68813	200
20	Optimized	154.69535	377.54525	-262.97364	1070.5336	593.40644	200
21	Optimized	156.92365	378.63575	-250.98566	1054.8936	584.73705	200
22	Optimized	159.0252	379.76895	-242.28741	978.90433	542.61553	200
23	Optimized	160.99995	380.94485	-246.82103	945.40256	524.04519	200
24	Optimized	163.0305	382.28935	-259.89017	845.46466	468.64871	200
25	Optimized	165.1169	383.80245	-292.01705	786.99218	436.23689	200
26	Optimized	167.2013	385.50535	-345.67495	653.83749	362.42804	200
27	Optimized	169.0938	387.2255	-408.72968	548.4846	304.02998	200
28	Optimized	170.9583	389.0538	-492.96588	376.57971	208.74154	200
29	Optimized	172.9847	391.1628	-602.51386	214.46649	118.88071	200
30	Optimized	174.8314	393.34735	-732.21556	25.023804	13.870921	200

Slices of Slip Surface: 41091

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	41091	119.3065	375.6697	-381.3526	144.48133	58.374245	200
2	41091	121.2353	374.9974	-334.09574	282.09197	113.97255	200
3	41091	123.1641	374.4189	-293.31525	399.40289	161.36924	200
4	41091	125.0104	373.9479	-259.28749	514.09069	207.70612	200
5	41091	126.77425	373.5745	-230.47025	628.1705	253.79736	200
6	41091	128.53815	373.2723	-205.93557	728.21303	294.21716	200
7	41091	130.30205	373.03995	-185.75516	815.30573	329.4049	200
8	41091	132.0659	372.8764	-169.40432	890.24765	359.6834	200
9	41091	134.019	372.7787	-156.21654	968.94098	391.47757	200
10	41091	136.16135	372.76245	-147.08195	1048.6718	423.69092	200
11	41091	138.3037	372.8458	-143.70876	1112.6516	449.54043	200
12	41091	140.27065	373.00675	-145.50759	1159.9196	468.63793	200
13	41091	142.06215	373.23105	-152.12137	1193.3612	482.14922	200
14	41091	143.85365	373.52715	-162.68221	1216.7413	491.5954	200
15	41091	145.64515	373.89655	-177.2365	1230.242	497.05002	200
16	41091	147.50335	374.36055	-190.759	1234.1519	771.18369	200
17	41091	149.4282	374.9276	-202.71658	1222.3986	763.83944	200
18	41091	151.353	375.5877	-219.11528	1199.7092	749.6615	200
19	41091	153.5545	376.47075	-243.63146	1162.1236	726.17543	200
20	41091	155.75425	377.4713	-253.34905	1121.489	621.65153	200
21	41091	157.67555	378.4712	-243.56366	1071.0745	593.7063	200
22	41091	159.5968	379.59045	-235.59718	1009.3222	559.47642	200
23	41091	161.51805	380.83965	-241.61628	935.95078	518.80599	200
24	41091	163.4393	382.23215	-257.09607	850.54869	471.46684	200
25	41091	165.36055	383.78515	-290.25626	752.62331	417.18591	200
26	41091	167.28185	385.52115	-346.05782	641.47671	355.57635	200
27	41091	169.2935	387.57475	-422.87702	479.52762	265.8065	200
28	41091	171.39555	390.0209	-542.80617	269.30678	149.27919	200
29	41091	173.4976	392.86825	-703.55749	47.694809	26.437664	200

Stability - Existing Condition

File Information

Created By: Cooper, Paul
Revision Number: 243
Last Edited By: Rogers, Daniel
Date: 1/22/2010
Time: 2:02:48 PM
File Name: Section T.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/22/2010
Last Solved Time: 2:05:36 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition

Kind: SLOPE/W
Parent: Steady-State Seepage
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced

Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 22 °
Phi-B: 0 °

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 32 °
Phi-B: 0 °

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 119 pcf
Cohesion: 200 psf
Phi: 29 °
Phi-B: 0 °

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °

Alluvial Clay

Model: Mohr-Coulomb
Unit Weight: 124 pcf

Cohesion: 200 psf
Phi: 33 °
Phi-B: 0 °

Alluvial Granular

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °

Bedrock

Model: Bedrock (Impenetrable)

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (34, 380.99656) ft
Left-Zone Right Coordinate: (163.95006, 386.70696) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (171, 389.62159) ft
Right-Zone Right Coordinate: (225.92962, 385.8937) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-300, 380.99) ft
Right Coordinate: (800, 354.28616) ft

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	2.9	(155.6, 417.08)	26.82845	(191.39, 394.998)	(139.256, 379.85)
2	41122	2.9	(155.6, 417.08)	40.982	(190.124, 394.998)	(138.457, 379.856)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	139.718	379.5728	-1242.1455	124.38162	50.253436	200

2	Optimized	140.86815	378.883	-1199.0801	268.10443	108.32122	200
3	Optimized	141.855	378.3533	-1165.9662	341.72641	138.06643	200
4	Optimized	143.4274	377.73745	-1127.4532	491.99287	198.77802	200
5	Optimized	145.68875	376.99185	-1080.7195	632.10597	255.38739	200
6	Optimized	147.6641	376.49835	-1049.7772	768.79214	310.61219	200
7	Optimized	149.9429	376.0457	-1021.31	868.41561	350.86268	200
8	Optimized	152.31075	375.90145	-993.46038	879.92338	487.74949	200
9	Optimized	154.46425	376.02475	-966.84942	934.21159	517.84194	200
10	Optimized	156.2675	376.16295	-946.26235	951.66917	527.51883	200
11	Optimized	157.72055	376.3161	-932.02666	979.18237	542.76965	200
12	Optimized	159.17365	376.4693	-919.91264	1006.6956	558.02046	200
13	Optimized	160.38325	376.5968	-911.52276	1038.2287	575.49954	200
14	Optimized	161.5937	376.77865	-900.52853	1037.3125	574.99173	200
15	Optimized	163.04855	377.0405	-888.82545	1076.4807	596.70297	200
16	Optimized	164.6424	377.3981	-878.28954	1068.955	592.53145	200
17	Optimized	166.37515	377.85145	-868.07232	1098.2667	608.77917	200
18	Optimized	168.2958	378.4509	-859.57387	1073.7519	595.19041	200
19	Optimized	170.40435	379.1965	-853.22454	1087.3001	602.70031	200
20	Optimized	172.4766	380.04685	-850.58833	1033.8768	573.08727	200
21	Optimized	174.5126	381.00195	-850.85512	1022.2267	566.62953	200
22	Optimized	175.64075	381.544	-852.57223	965.2456	535.04437	200
23	Optimized	176.53025	382.06485	-857.7278	950.45962	526.84837	200
24	Optimized	178.089	382.97755	-868.35736	924.6608	512.54785	200
25	Optimized	179.53365	383.9155	-883.62876	841.80342	466.61926	200
26	Optimized	180.86415	384.87865	-906.76359	803.57007	445.42616	200
27	Optimized	181.7283	385.5042	-922.11398	775.20532	429.70333	200
28	Optimized	182.7321	386.3285	-944.41896	684.47364	379.40993	200
29	Optimized	184.3419	387.6891	-987.30827	595.27904	329.96856	200
30	Optimized	185.51265	388.73035	-1026.587	495.37296	274.58972	200
31	Optimized	186.60295	389.8059	-1071.0564	410.10482	227.32481	200
32	Optimized	188.05185	391.2351	-1136.4558	287.17754	159.18511	200
33	Optimized	189.4297	392.71165	-1211.8453	143.17687	79.364235	200
34	Optimized	190.73655	394.23555	-1296.1285	19.155504	10.618069	200

Slices of Slip Surface: 41122

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	41122	139.31845	379.48245	-1236.6732	115.322	46.593112	200
2	41122	141.16685	378.7379	-1190.011	255.85048	103.3703	200
3	41122	143.11145	378.0599	-1147.5204	413.78655	167.18062	200
4	41122	145.02695	377.4976	-1112.2488	545.63337	220.45019	200
5	41122	146.94245	377.0347	-1083.1506	658.14651	265.90845	200
6	41122	148.85795	376.66785	-1060.1102	753.205	304.31457	200
7	41122	150.65605	376.40595	-1034.2451	847.25291	469.63996	200
8	41122	152.3368	376.23665	-1004.0899	906.82425	502.66089	200
9	41122	154.01755	376.13705	-976.87045	955.3485	529.55832	200
10	41122	155.6983	376.1066	-952.25119	993.54218	550.72943	200
11	41122	157.37905	376.14515	-930.61077	1021.7935	566.38939	200
12	41122	159.0598	376.2529	-913.87411	1040.6249	576.82778	200
13	41122	160.7808	376.43635	-901.23986	1065.7622	590.76162	200
14	41122	162.542	376.7	-885.49207	1096.177	607.62081	200
15	41122	164.30315	377.04285	-872.37415	1115.9487	618.58046	200
16	41122	166.0643	377.4669	-861.1078	1125.1604	623.68658	200
17	41122	167.8255	377.9748	-852.07689	1124.0175	623.05306	200
18	41122	169.5867	378.56995	-845.62726	1112.5776	616.71181	200
19	41122	171.3479	379.25645	-842.35532	1090.7112	604.59111	200
20	41122	173.1091	380.03935	-841.5099	1058.3426	586.64886	200
21	41122	174.8703	380.92495	-843.34844	1015.3152	562.79838	200
22	41122	176.714	381.97355	-852.16491	958.62992	531.37724	200
23	41122	178.64015	383.20785	-869.18895	886.78908	491.55522	200
24	41122	180.5663	384.6033	-899.18404	800.77019	443.87416	200
25	41122	182.25425	385.9646	-934.88347	701.97459	389.11087	200
26	41122	183.70395	387.26885	-973.66502	593.76551	329.1296	200
27	41122	185.15365	388.70725	-1028.7067	477.54559	264.70784	200
28	41122	186.93985	390.7243	-1116.876	300.74753	166.70708	200
29	41122	189.0625	393.4919	-1259.148	63.232902	35.05057	200

Stability - Existing Condition

File Information

Created By: Daniel B. Rogers
Revision Number: 292
Last Edited By: Rogers, Daniel
Date: 1/31/2010
Time: 1:45:49 PM
File Name: Section U.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/31/2010
Last Solved Time: 1:56:33 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition

Kind: SLOPE/W
Parent: Steady-State Seepage
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced

Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 22 °
Phi-B: 0 °

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 119 pcf
Cohesion: 200 psf
Phi: 29 °
Phi-B: 0 °

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °

Alluvial Clay

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 200 psf
Phi: 33 °
Phi-B: 0 °

Alluvial Granular

Model: Mohr-Coulomb
Unit Weight: 130 pcf

Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °

Bedrock

Model: Bedrock (Impenetrable)

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (18, 381.05658) ft
Left-Zone Right Coordinate: (107.87833, 386.9374) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (115, 389.55862) ft
Right-Zone Right Coordinate: (166.15417, 387.49536) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-300, 380.27072) ft
Right Coordinate: (400, 349.46793) ft

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	2.6	(103.95, 411.126)	30.51641	(140.911, 394.924)	(79.991, 381.003)
2	34926	2.7	(103.95, 411.126)	38.968	(139.414, 394.976)	(79.2301, 381.003)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	81.512905	379.97825	-190.06938	251.46639	101.59901	200
2	Optimized	83.361165	378.77085	-107.03648	416.5619	168.30193	200
3	Optimized	83.90132	378.46835	-86.276781	467.39717	188.84072	200
4	Optimized	84.266985	378.26355	-70.881423	533.03979	295.46878	200
5	Optimized	85.274445	377.69935	-28.604468	608.5352	245.86418	200
6	Optimized	87.34785	376.66715	46.403912	753.94674	285.86586	200

7	Optimized	89.783475	375.5611	126.01916	947.14373	331.75586	200
8	Optimized	91.65159	374.78005	182.07767	1037.7593	345.7178	200
9	Optimized	93.80589	374.02455	237.14969	1201.3714	389.57087	200
10	Optimized	96.05537	373.3324	288.36425	1303.3401	410.07687	200
11	Optimized	98.29837	372.8368	327.03221	1460.8373	458.087	200
12	Optimized	99.897945	372.49945	353.63579	1489.8137	459.04569	200
13	Optimized	101.14955	372.4205	362.89416	1553.4561	481.01826	200
14	Optimized	103.4487	372.2755	379.8842	1670.2681	521.34894	200
15	Optimized	105.46685	372.2736	386.9654	1672.3001	519.30893	200
16	Optimized	107.204	372.41475	384.13673	1726.1194	542.19619	200
17	Optimized	108.8657	372.54975	381.42795	1779.9929	565.05693	200
18	Optimized	110.51605	372.814	370.59296	1731.9445	550.02173	200
19	Optimized	112.23055	373.21365	351.50124	1756.7109	567.74157	200
20	Optimized	113.94505	373.6133	332.38111	1781.4773	585.47288	200
21	Optimized	116.04135	374.2952	296.99266	1702.4034	567.82279	200
22	Optimized	118.5195	375.2594	245.34781	1691.9864	584.47994	200
23	Optimized	120.5549	376.1953	193.86518	1575.4922	558.21353	200
24	Optimized	122.1475	377.1029	142.59622	1536.814	563.30056	200
25	Optimized	123.8504	378.0734	87.561932	1504.6143	572.52633	200
26	Optimized	124.82955	378.65295	54.491684	1358.074	526.68144	200
27	Optimized	125.6838	379.3934	12.600363	1281.9311	703.6015	200
28	Optimized	127.2472	380.7486	-63.673641	1223.0617	677.95418	200
29	Optimized	128.10425	381.5	-105.99623	1146.214	635.3568	200
30	Optimized	128.9774	382.35505	-154.4392	1073.5206	595.06219	200
31	Optimized	130.57305	383.9176	-242.8776	935.07115	518.3184	200
32	Optimized	132.17475	385.5115	-333.23943	784.88273	435.0676	200
33	Optimized	133.78245	387.1367	-425.81736	642.14894	355.94897	200
34	Optimized	135.5383	388.95315	-529.58108	474.28462	262.90026	200
35	Optimized	137.44225	390.9608	-647.94442	300.04655	166.31852	200
36	Optimized	139.3106	393.04225	-773.51144	108.92571	60.378506	200
37	Optimized	140.5688	394.52185	-864.04988	-17.730564	-9.8282119	200

Slices of Slip Surface: 34926

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	34926	80.214765	380.24585	-209.42018	223.14078	90.154725	200
2	34926	82.18409	378.82545	-113.33054	434.5327	175.5626	200
3	34926	83.402145	378.01705	-57.13696	547.79764	221.32461	200
4	34926	83.66153	377.85635	-45.966719	569.61545	230.13958	200
5	34926	84.764315	377.231	-0.64634776	669.54274	270.51282	200
6	34926	86.91791	376.0979	80.945489	835.34542	304.79736	200
7	34926	89.071505	375.1292	150.74792	973.68852	332.48958	200
8	34926	91.225095	374.3119	210.07854	1088.2445	354.80207	200
9	34926	93.42663	373.62405	260.97288	1203.9174	380.9743	200
10	34926	95.67611	373.0639	303.88094	1320.449	410.72016	200
11	34926	97.600635	372.6873	334.00709	1415.0167	436.75621	200
12	34926	99.20021	372.45695	353.88456	1493.4236	460.40366	200
13	34926	101.00905	372.2823	371.0427	1568.9371	483.98075	200
14	34926	103.0272	372.18195	384.27568	1638.9699	506.92937	200
15	34926	105.04535	372.1864	390.95802	1694.059	526.48695	200
16	34926	107.0635	372.2957	391.09145	1734.4524	542.75304	200
17	34926	109.1348	372.51925	384.2628	1763.8637	557.39493	200
18	34926	111.25925	372.8648	369.97464	1781.3765	570.24336	200
19	34926	113.3837	373.33285	348.01091	1782.5729	579.60066	200
20	34926	115.50815	373.92805	318.04539	1767.2884	585.5322	200
21	34926	117.63265	374.6566	279.87826	1734.9931	587.90456	200
22	34926	119.7571	375.52675	232.84418	1684.9841	586.7026	200
23	34926	121.88155	376.5493	176.22373	1616.2791	581.82014	200
24	34926	124.2717	377.91265	98.942261	1526.7075	576.8546	200
25	34926	126.8896	379.6657	0.099413503	1375.4347	762.36077	200
26	34926	129.1158	381.39885	-96.746159	1216.8477	674.5097	200
27	34926	130.98815	383.0944	-192.30015	1018.1229	564.35476	200
28	34926	132.8605	385.03475	-302.99333	803.95551	445.63982	200
29	34926	134.7329	387.2807	-431.88583	572.48994	317.33635	200
30	34926	136.6053	389.93175	-586.40436	321.46403	178.19042	200
31	34926	138.4777	393.1749	-783.18278	48.427254	26.843665	200

Stability - Existing Condition

File Information

Created By: Cooper, Paul
Revision Number: 235
Last Edited By: Rogers, Daniel
Date: 1/31/2010
Time: 2:19:05 PM
File Name: Section V.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/31/2010
Last Solved Time: 2:22:00 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition

Kind: SLOPE/W
Parent: Steady-State Seepage
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced

Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 119 pcf
Cohesion: 200 psf
Phi: 22 °
Phi-B: 0 °

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 119 pcf
Cohesion: 200 psf
Phi: 29 °
Phi-B: 0 °

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °

Alluvial Clay

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 200 psf
Phi: 33 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (6, 375.04) ft
Left-Zone Right Coordinate: (49.8739, 383) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (133.49044, 394) ft
Right-Zone Right Coordinate: (208.37922, 383.92517) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (0, 375.04) ft
Right Coordinate: (400, 359.838) ft

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	2.8	(72.734, 468.535)	65.86463	(158.338, 394.376)	(8.91613, 375.04)
2	448	2.9	(72.734, 468.535)	114.869	(160.138, 394.001)	(6, 375.04)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	11.215214	373.4783	108.09917	294.00801	75.112048	200
2	Optimized	15.813385	370.35485	313.59895	722.5081	165.21002	200
3	Optimized	21.72884	366.54065	574.25495	1225.567	263.14715	200
4	Optimized	29.0798	362.1571	882.56475	1784.7116	364.49097	200
5	Optimized	33.94721	359.3796	1080.1724	2225.1314	462.59347	200
6	Optimized	37.928295	357.84675	1191.7159	2526.1401	539.14236	200
7	Optimized	43.555955	356.57845	1291.4787	2911.9535	654.7143	200
8	Optimized	48.10784	356.21155	1331.3847	3119.7939	722.5642	200
9	Optimized	51.27623	356.2383	1341.4525	3217.3442	757.90942	200
10	Optimized	54.7291	356.295	1351.6683	3203.7114	748.27399	200
11	Optimized	58.843035	356.3848	1362.6284	3195.6918	740.60568	200
12	Optimized	64.50916	356.50845	1376.1837	3185.1629	730.87502	200
13	Optimized	71.4208	356.7121	1387.7365	3155.2189	714.10923	200

14	Optimized	76.340855	356.8982	1391.6757	3140.7299	706.66377	200
15	Optimized	80.44731	357.1538	1388.2065	3097.588	690.63496	200
16	Optimized	85.42507	357.54255	1377.7117	3068.1463	682.97994	200
17	Optimized	90.40283	357.9313	1366.7361	3038.7046	675.51913	200
18	Optimized	95.830945	358.3187	1355.9178	3018.7711	671.83635	200
19	Optimized	101.70944	358.70475	1346.0046	2992.6301	665.27991	200
20	Optimized	107.5165	359.08615	1335.1888	3053.918	694.41166	200
21	Optimized	111.0391	359.4248	1321.5243	3026.8681	689.00364	200
22	Optimized	113.7867	360.0554	1286.906	3063.2304	717.68162	200
23	Optimized	117.97235	361.01605	1234.2339	3127.9646	765.11687	200
24	Optimized	122.39855	362.6399	1139.429	2962.4846	736.56228	200
25	Optimized	127.0653	364.92685	1002.4074	2893.9834	764.24634	200
26	Optimized	130.08225	366.62225	900.32872	2650.3355	707.04865	200
27	Optimized	132.1322	368.27745	798.95845	2551.1267	707.92194	200
28	Optimized	136.80815	372.05295	570.65754	2253.6906	679.98949	200
29	Optimized	140.43395	374.9806	397.02679	1995.8351	645.96051	200
30	Optimized	142.8217	377.33505	256.57167	1669.0129	570.66329	200
31	Optimized	147.36925	381.94315	-19.728678	1154.4021	639.89554	200
32	Optimized	151.04265	385.8513	-255.87948	757.33181	419.79588	200
33	Optimized	153.7839	389.0545	-451.64746	472.19891	261.74413	200
34	Optimized	156.74205	392.5112	-666.79601	138.2877	76.654126	200
35	Optimized	158.24715	394.26995	-777.20217	-46.048209	-25.524939	200

Slices of Slip Surface: 448

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	448	8.68144	373.2377	120.74423	319.63848	80.358493	200
2	448	14.04432	369.8409	344.46957	768.65774	171.38314	200
3	448	19.407195	366.8403	549.30446	1148.4977	242.08976	200
4	448	24.77007	364.2015	736.59555	1470.7853	296.63192	200
5	448	30.13295	361.8976	902.47853	1738.0132	337.57791	200
6	448	35.658715	359.85605	1054.7444	2145.3922	440.65034	200
7	448	41.34736	358.0775	1188.5336	2686.2402	605.11273	200

8	448	47.036005	356.6162	1301.494	3174.7517	756.84523	200
9	448	52.635245	355.4734	1396.5866	3448.0442	828.84268	200
10	448	58.14508	354.63085	1475.271	3516.3904	824.66578	200
11	448	63.20388	354.08615	1532.277	3551.4794	815.8107	200
12	448	67.81164	353.79545	1569.4716	3559.195	803.90041	200
13	448	72.4194	353.6903	1593.545	3544.8764	788.38907	200
14	448	77.21706	353.78145	1602.8071	3513.2653	771.87522	200
15	448	82.204625	354.08525	1597.9867	3462.6075	753.35571	200
16	448	87.19219	354.60805	1577.2838	3386.7276	731.06275	200
17	448	92.17975	355.353	1541.6229	3285.9474	704.75284	200
18	448	97.167315	356.3245	1490.4107	3160.1949	674.63662	200
19	448	102.1549	357.52845	1424.0181	3009.0512	640.39495	200
20	448	108.1713	359.3325	1320.7298	2889.4718	633.81294	200
21	448	114.0779	361.39555	1200.9387	2830.1579	658.24728	200
22	448	118.8459	363.3607	1085.3395	2772.702	681.73871	200
23	448	123.61385	365.58415	953.09025	2684.7851	699.65013	200
24	448	128.3818	368.08305	803.30687	2564.9827	711.76324	200
25	448	132.1322	370.2293	674.3954	2450.035	717.40496	200
26	448	136.80815	373.2811	494.50774	2191.2379	685.52349	200
27	448	142.65345	377.4539	248.89528	1756.641	609.16882	200
28	448	148.7146	382.5144	-52.76867	1152.0625	638.59865	200
29	448	153.7839	387.16615	-333.02465	682.40912	378.26555	200
30	448	156.74205	390.22105	-521.02143	359.83555	199.4601	200
31	448	159.14715	392.8697	-687.35639	67.18986	37.243948	200

Stability - Existing Condition

File Information

Created By: Cooper, Paul
Revision Number: 227
Last Edited By: Rogers, Daniel
Date: 1/22/2010
Time: 1:19:03 PM
File Name: Section W.gsz
Directory: V:\1755\active\175539016\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 1/22/2010
Last Solved Time: 3:26:20 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition

Kind: SLOPE/W
Parent: Steady-State Seepage
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced

Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 123 pcf
Cohesion: 200 psf
Phi: 22 °
Phi-B: 0 °

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 119 pcf
Cohesion: 200 psf
Phi: 29 °
Phi-B: 0 °

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °

Bedrock

Model: Bedrock (Impenetrable)

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (49.58321, 386.97948) ft
Left-Zone Right Coordinate: (163, 392.50518) ft
Left-Zone Increment: 40

Right Projection: Range
Right-Zone Left Coordinate: (167.10528, 394) ft
Right-Zone Right Coordinate: (397, 384.77972) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (0, 387) ft
Right Coordinate: (400, 384.77052) ft

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	7.2	(129.353, 438.251)	48.31055	(191.303, 394)	(74.4848, 386.122)
2	11579	7.2	(129.353, 438.251)	75.261	(190.23, 394)	(75.16, 386.028)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	74.747405	385.87385	-537.22558	59.523669	32.994509	200
2	Optimized	76.37952	384.33135	-436.35285	263.30292	145.95119	200
3	Optimized	79.467145	381.41325	-247.52596	652.26463	263.53202	200
4	Optimized	82.647085	378.68755	-70.5676	996.9104	402.77795	200
5	Optimized	85.570755	376.4836	72.962916	1288.7184	491.19708	200
6	Optimized	88.36028	374.38075	209.70838	1584.9545	555.63551	200
7	Optimized	89.7748	373.31445	278.29942	1746.9642	593.3791	200
8	Optimized	92.77913	371.73205	381.38283	1942.1907	630.60733	200
9	Optimized	96.198685	369.9541	497.64696	2222.6228	696.93548	200
10	Optimized	99.51587	368.85925	571.54369	2368.7021	726.09914	200
11	Optimized	104.53205	367.78305	647.88062	2549.9306	768.47807	200
12	Optimized	108.1374	367.38605	680.01185	2664.1289	801.63531	200
13	Optimized	110.69375	367.3091	690.19062	2664.1124	797.51618	200
14	Optimized	113.09115	367.4708	685.30712	2676.5753	804.52458	200
15	Optimized	116.23385	367.6828	678.98359	2685.5399	810.70139	200
16	Optimized	120.67275	367.9822	670.05466	2680.2579	812.17483	200

17	Optimized	124.85555	368.2643	661.92536	2662.5953	808.32312	200
18	Optimized	128.13805	368.4857	655.90702	2648.7045	805.14243	200
19	Optimized	131.42055	368.7071	649.8583	2634.8137	801.97403	200
20	Optimized	133.27105	368.8319	646.47007	2625.8898	799.73746	200
21	Optimized	135.1873	368.96115	643.25286	2607.116	793.45222	200
22	Optimized	138.60135	369.19145	637.55415	2573.7713	782.28249	200
23	Optimized	142.01545	369.4217	631.88466	2540.4557	771.11276	200
24	Optimized	144.1077	369.5628	628.49496	2520.041	764.2342	200
25	Optimized	146.8155	369.74545	624.57862	2508.7101	761.23855	200
26	Optimized	151.4607	370.05875	617.85579	2493.6751	757.88018	200
27	Optimized	155.4585	370.3284	612.4773	2480.88	754.88369	200
28	Optimized	158.10335	370.5068	609.35643	2494.6879	761.72337	200
29	Optimized	160.55025	370.9293	590.56744	2465.2761	757.43146	200
30	Optimized	162.37955	371.3715	568.71843	2467.4607	767.14169	200
31	Optimized	164.0877	372.07905	530.09975	2398.3495	754.8219	200
32	Optimized	166.27455	373.28655	462.7104	2285.7733	736.56524	200
33	Optimized	169.4001	375.48785	337.05115	2062.6369	697.1819	200
34	Optimized	173.70455	378.6795	154.02597	1675.5821	614.74858	200
35	Optimized	176.5944	380.94495	24.770242	1396.475	760.34835	200
36	Optimized	179.27845	383.1972	-103.20863	1138.0251	630.81763	200
37	Optimized	182.88615	386.3216	-282.74098	802.96428	445.09037	200
38	Optimized	185.06685	388.21015	-392.25398	600.44708	332.83325	200
39	Optimized	186.9085	389.9024	-491.22807	414.03758	229.50478	200
40	Optimized	189.83815	392.63415	-651.87515	123.38994	68.396161	200

Slices of Slip Surface: 11579

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	11579	76.692635	384.5258	-447.82664	238.54422	132.22722	200
2	11579	80.427125	381.13735	-228.35212	679.22727	274.42563	200
3	11579	84.83077	377.63395	-0.45215519	1134.1125	458.21118	200
4	11579	88.36028	375.15415	161.31956	1462.3069	525.63299	200
5	11579	91.190135	373.4075	275.12377	1718.3726	583.11036	200

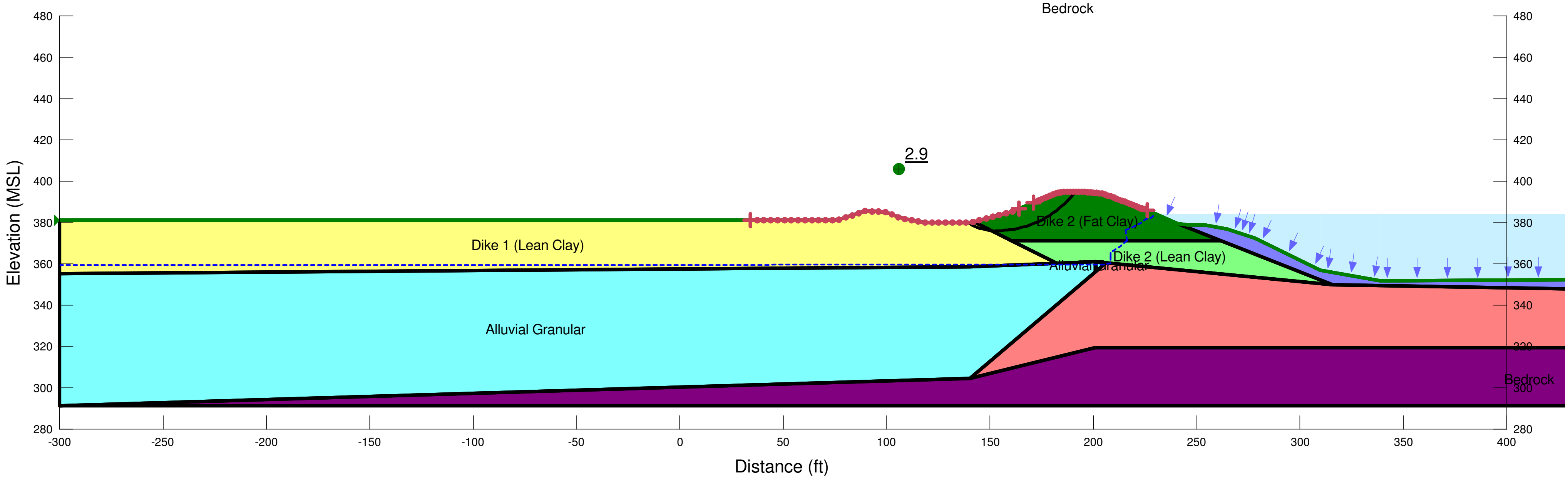
6	11579	94.194465	371.7295	384.26904	1964.3982	638.41361	200
7	11579	98.092815	369.84065	508.27597	2258.3084	707.05901	200
8	11579	102.88515	367.8449	640.5903	2585.448	785.77352	200
9	11579	106.0072	366.99305	699.77121	2626.032	778.25988	200
10	11579	109.28945	367.2144	693.04995	2653.2373	791.96711	200
11	11579	113.41715	367.4928	684.63252	2677.5116	805.17541	200
12	11579	116.55985	367.7048	678.31478	2686.5278	811.37074	200
13	11579	119.99755	367.93665	671.40214	2683.1494	812.79865	200
14	11579	123.7302	368.1884	663.99795	2667.352	809.40758	200
15	11579	127.46285	368.44015	657.12836	2651.5546	805.80052	200
16	11579	131.1955	368.6919	650.2855	2635.7573	802.18266	200
17	11579	134.967	368.9463	643.62331	2609.2667	794.17148	200
18	11579	138.77735	369.2033	637.28658	2572.0581	781.69842	200
19	11579	142.5877	369.4603	630.94985	2534.8756	769.23593	200
20	11579	146.5997	369.7309	624.88353	2509.4792	761.42608	200
21	11579	150.8133	370.0151	618.79808	2495.7455	758.33599	200
22	11579	155.0269	370.2993	612.99677	2482.2486	755.22676	200
23	11579	159.5806	370.60645	607.63367	2523.9917	774.2589	200
24	11579	162.40495	370.79695	604.30244	2585.5062	800.45828	200
25	11579	164.94385	371.98325	538.83735	2425.5833	762.29484	200
26	11579	168.79845	374.1866	415.48774	2235.3557	735.27439	200
27	11579	172.1848	376.40165	289.8213	1959.0249	674.40204	200
28	11579	175.5712	378.89255	147.37858	1652.3355	608.04205	200
29	11579	179.1208	381.84895	-21.48019	1280.41	709.74285	200
30	11579	182.8336	385.3642	-224.21223	887.36077	491.87211	200
31	11579	187.46	390.6207	-533.96318	320.11701	177.44376	200

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section T.gsz
Analysis Name: Stability - Existing Condition
Date Saved: 1/22/2010
Last Solved on 1/22/2010 at 2:05:36 PM

Analysis Method: Spencer
Calculated Factor of Safety: 2.9

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



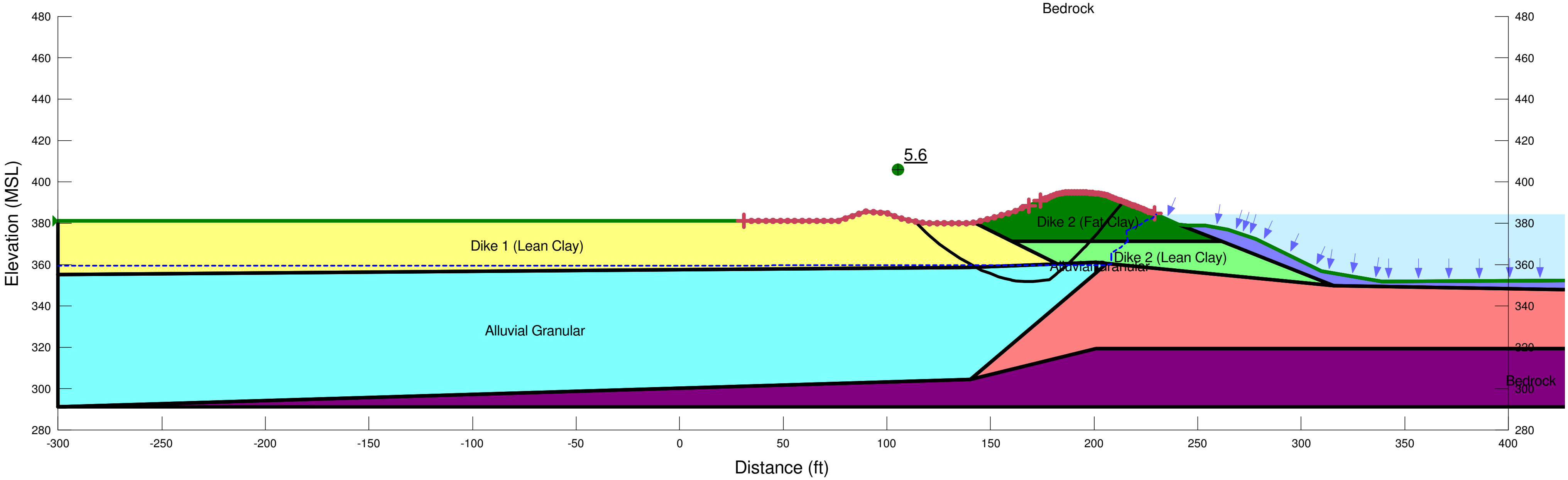
Stantec

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section T.gsz
Analysis Name: Stability - Existing Condition (Deep)
Date Saved: 1/22/2010
Last Solved on 1/22/2010 at 2:13:52 PM

Analysis Method: Spencer
Calculated Factor of Safety: 5.6

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



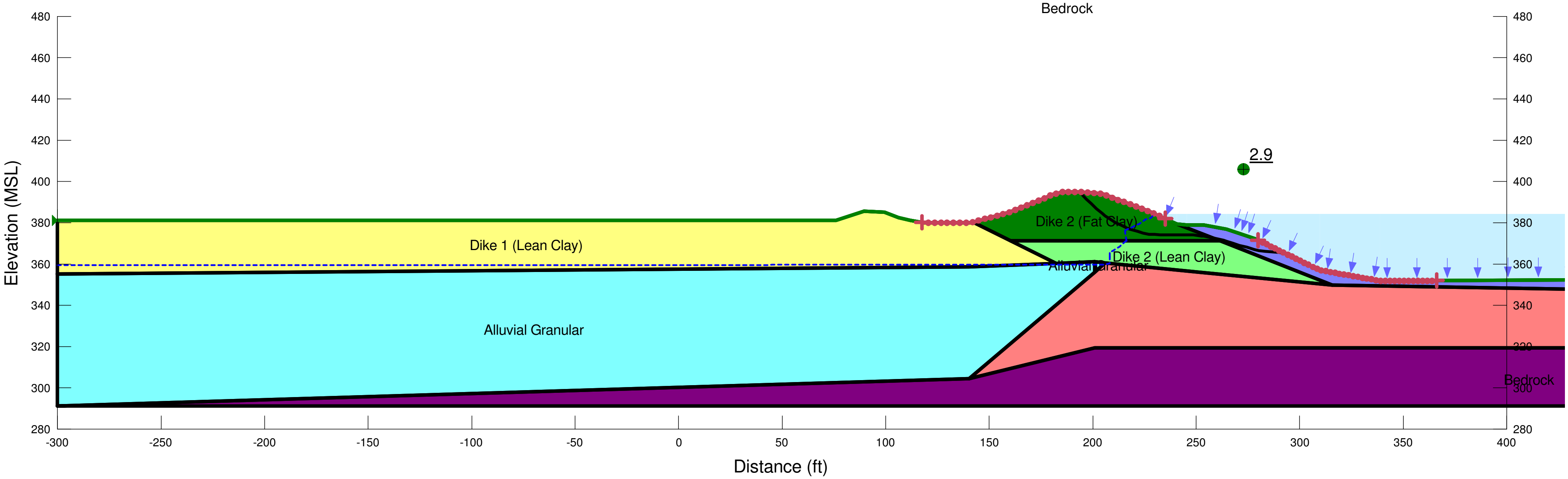
Stantec

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section T.gsz
Analysis Name: Stability - Existing Condition (L2R)
Date Saved: 1/22/2010
Last Solved on 1/22/2010 at 2:24:14 PM

Analysis Method: Spencer
Calculated Factor of Safety: 2.9

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			

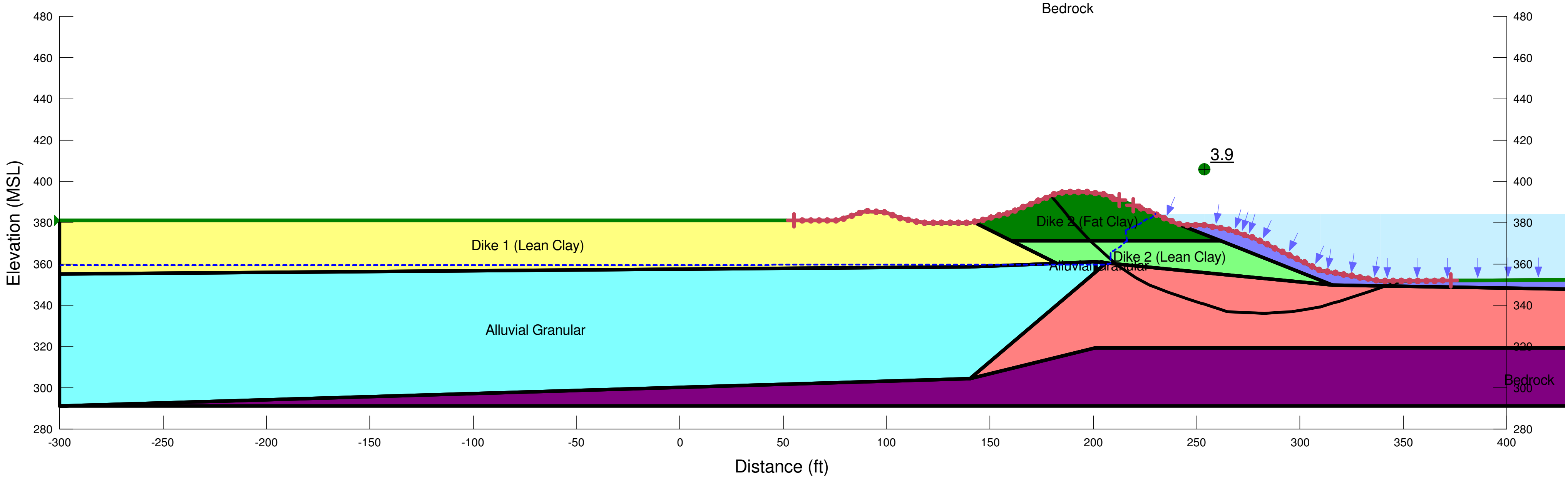


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section T.gsz
Analysis Name: Stability - Existing Condition (Deep) (L2R)
Date Saved: 1/22/2010
Last Solved on 1/22/2010 at 2:18:08 PM

Analysis Method: Spencer
Calculated Factor of Safety: 3.9

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Lean Clay)	123 pcf	200 psf	32 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

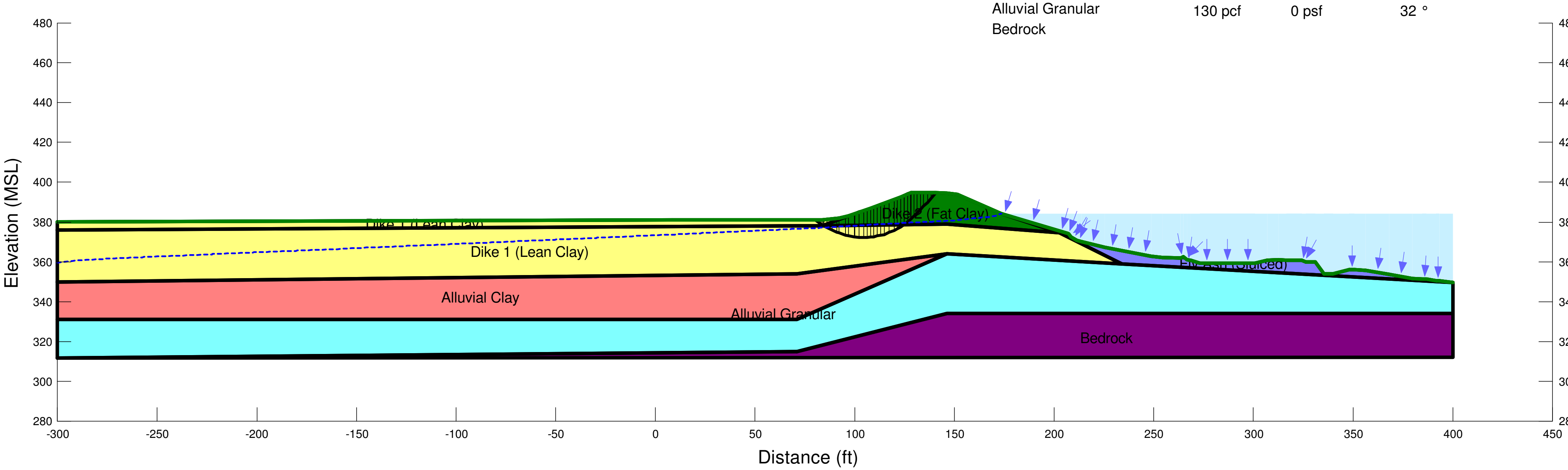
Stantec

File Name: Section U.gsz
Analysis Name: Stability - Existing Condition
Date Saved: 1/31/2010
Last Solved on 1/31/2010 at 1:56:33 PM

Analysis Method: Spencer

Calculated Factor of Safety: 2.6

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

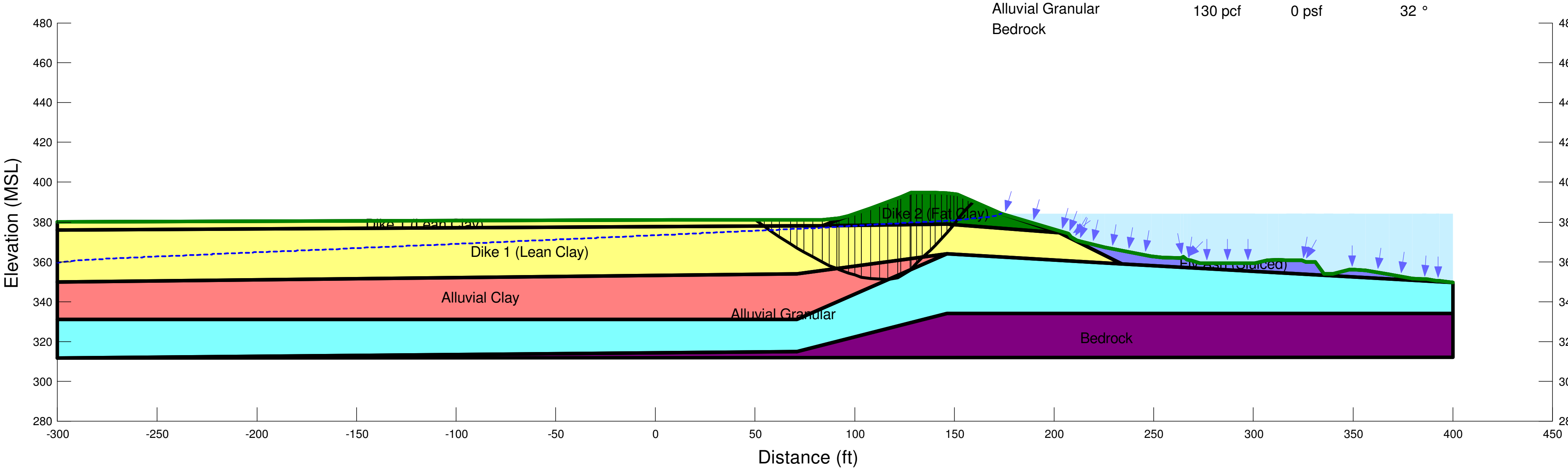
Stantec

File Name: Section U.gsz
Analysis Name: Stability - Existing Condition (Deep)
Date Saved: 1/31/2010
Last Solved on 1/31/2010 at 1:58:18 PM

Analysis Method: Spencer

Calculated Factor of Safety: 4.2

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



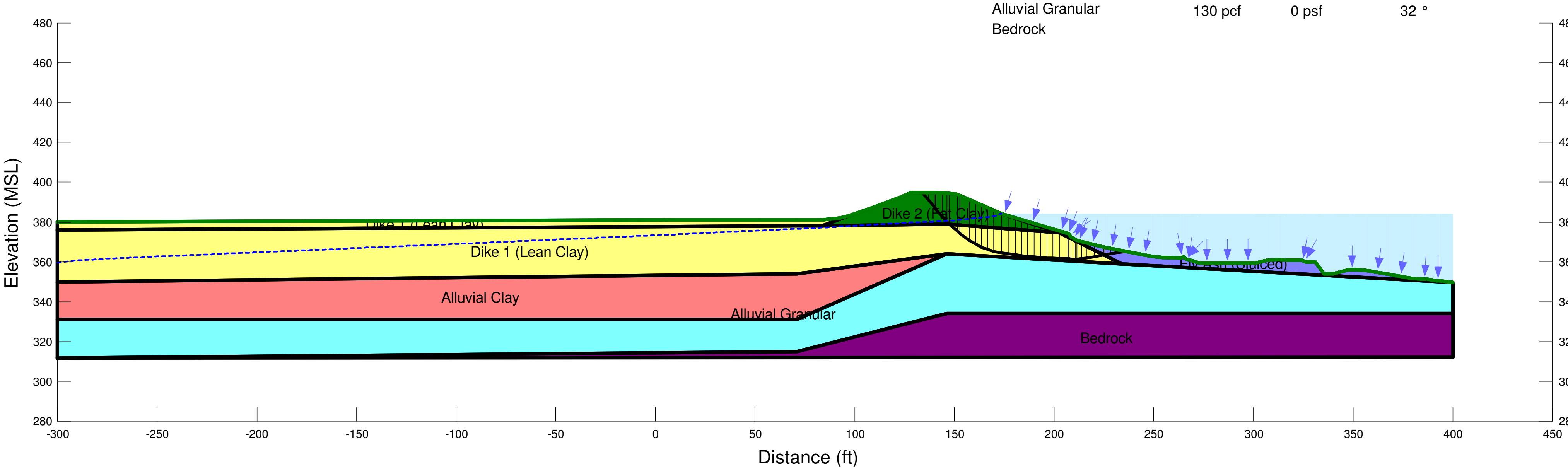
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section U.gsz
Analysis Name: Stability - Existing Condition (L2R)
Date Saved: 1/31/2010
Last Solved on 1/31/2010 at 2:05:33 PM

Analysis Method: Spencer

Calculated Factor of Safety: 2.1

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

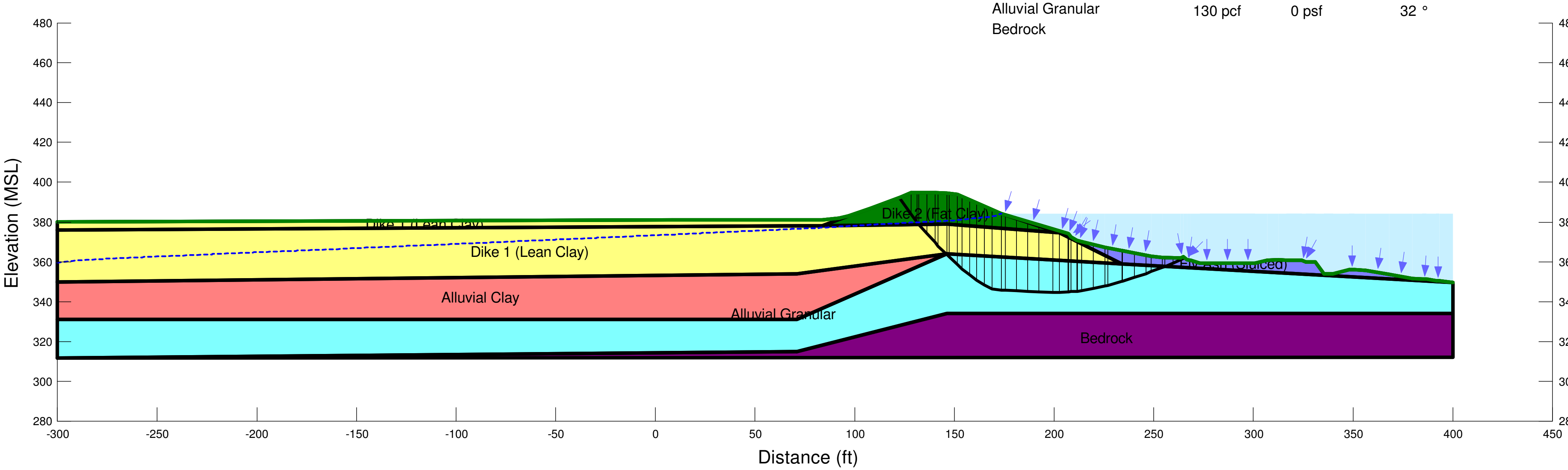
Stantec

File Name: Section U.gsz
Analysis Name: Stability - Existing Condition (Deep) (L2R)
Date Saved: 1/31/2010
Last Solved on 1/31/2010 at 2:00:11 PM

Analysis Method: Spencer

Calculated Factor of Safety: 2.7

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Lean Clay)	123 pcf	200 psf	22 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °
Alluvial Granular	130 pcf	0 psf	32 °
Bedrock			



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section V.gsz

Analysis Name: Stability - Existing Condition

Date Saved: 1/31/2010

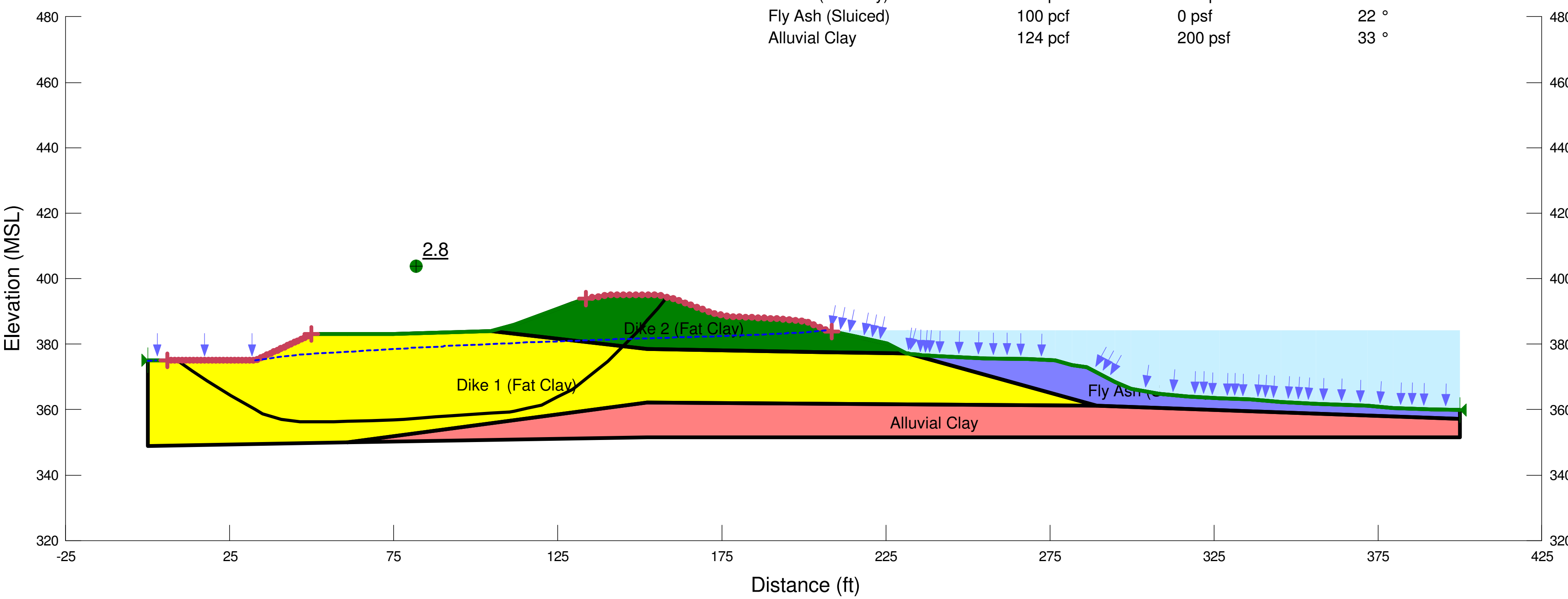
Last Solved on 1/31/2010 at 2:22:00 PM

Stantec

Analysis Method: Spencer

Calculated Factor of Safety: 2.8

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Fat Clay)	119 pcf	200 psf	22 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section V.gsz

Analysis Name: Stability - Existing Condition (Deep)

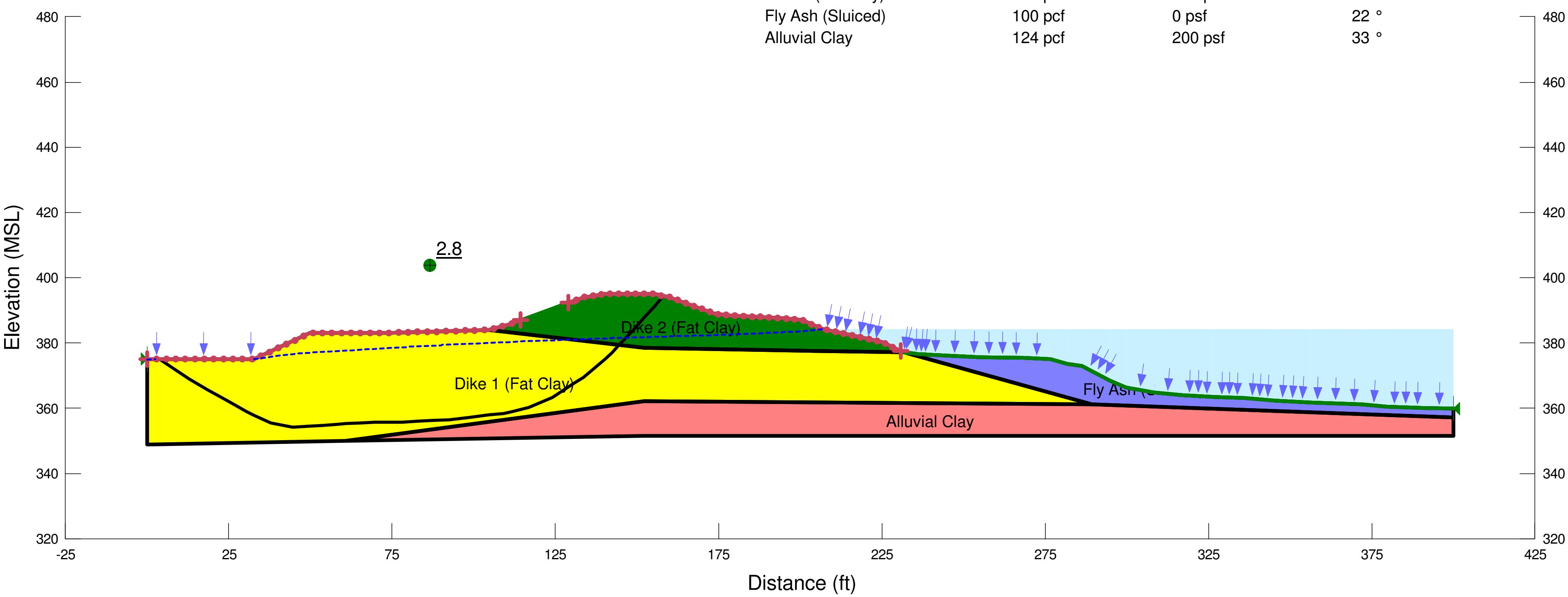
Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 2:24:07 PM

Analysis Method: Spencer

Calculated Factor of Safety: 2.8

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Fat Clay)	119 pcf	200 psf	22 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

Stantec

File Name: Section V.gsz

Analysis Name: Stability - Existing Condition (L2R)

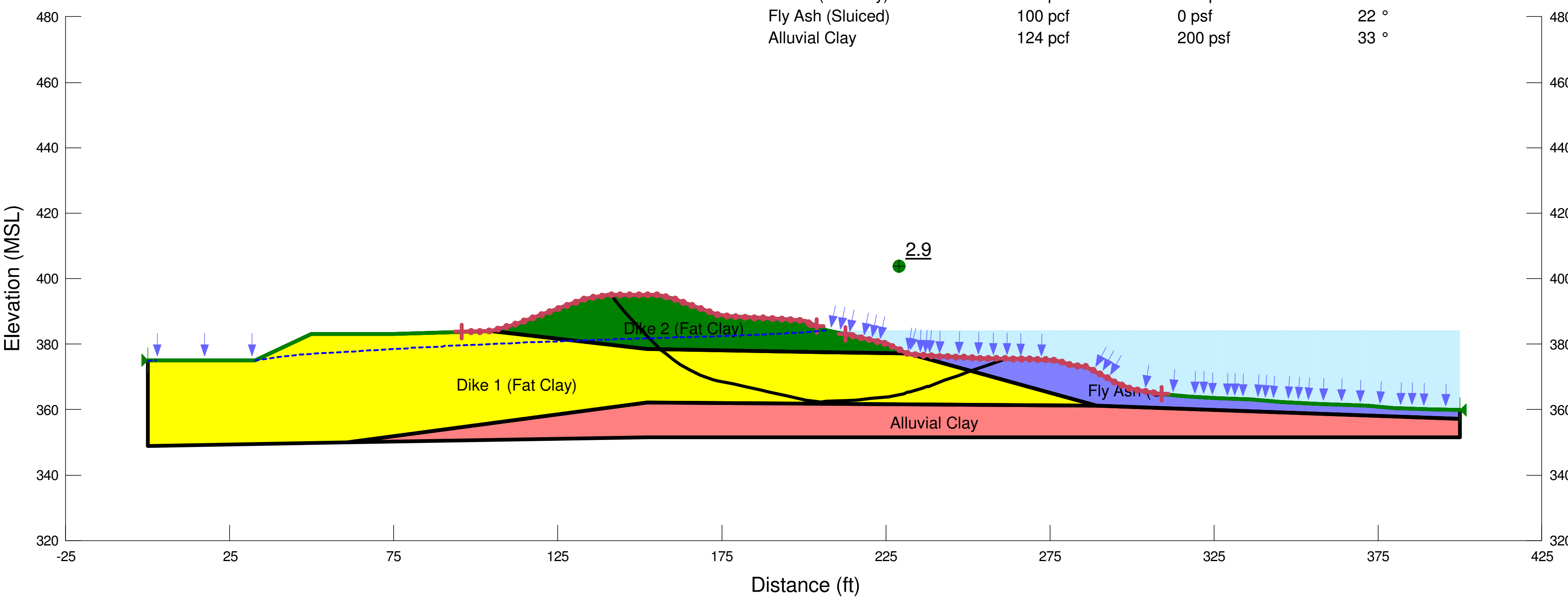
Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 2:29:28 PM

Analysis Method: Spencer

Calculated Factor of Safety: 2.9

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Fat Clay)	119 pcf	200 psf	22 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section V.gsz

Analysis Name: Stability - Existing Condition (Deep) (L2R)

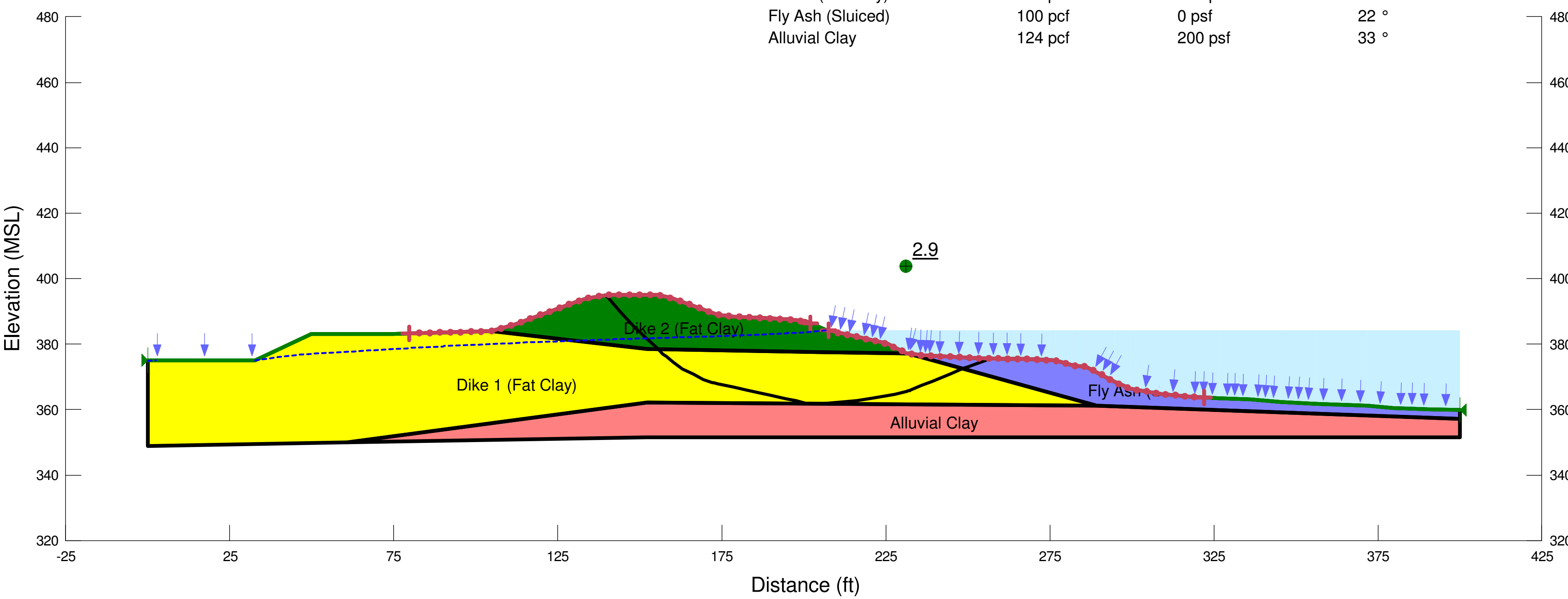
Date Saved: 1/31/2010

Last Solved on 1/31/2010 at 2:27:07 PM

Analysis Method: Spencer

Calculated Factor of Safety: 2.9

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Fat Clay)	119 pcf	200 psf	22 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Alluvial Clay	124 pcf	200 psf	33 °



Stantec

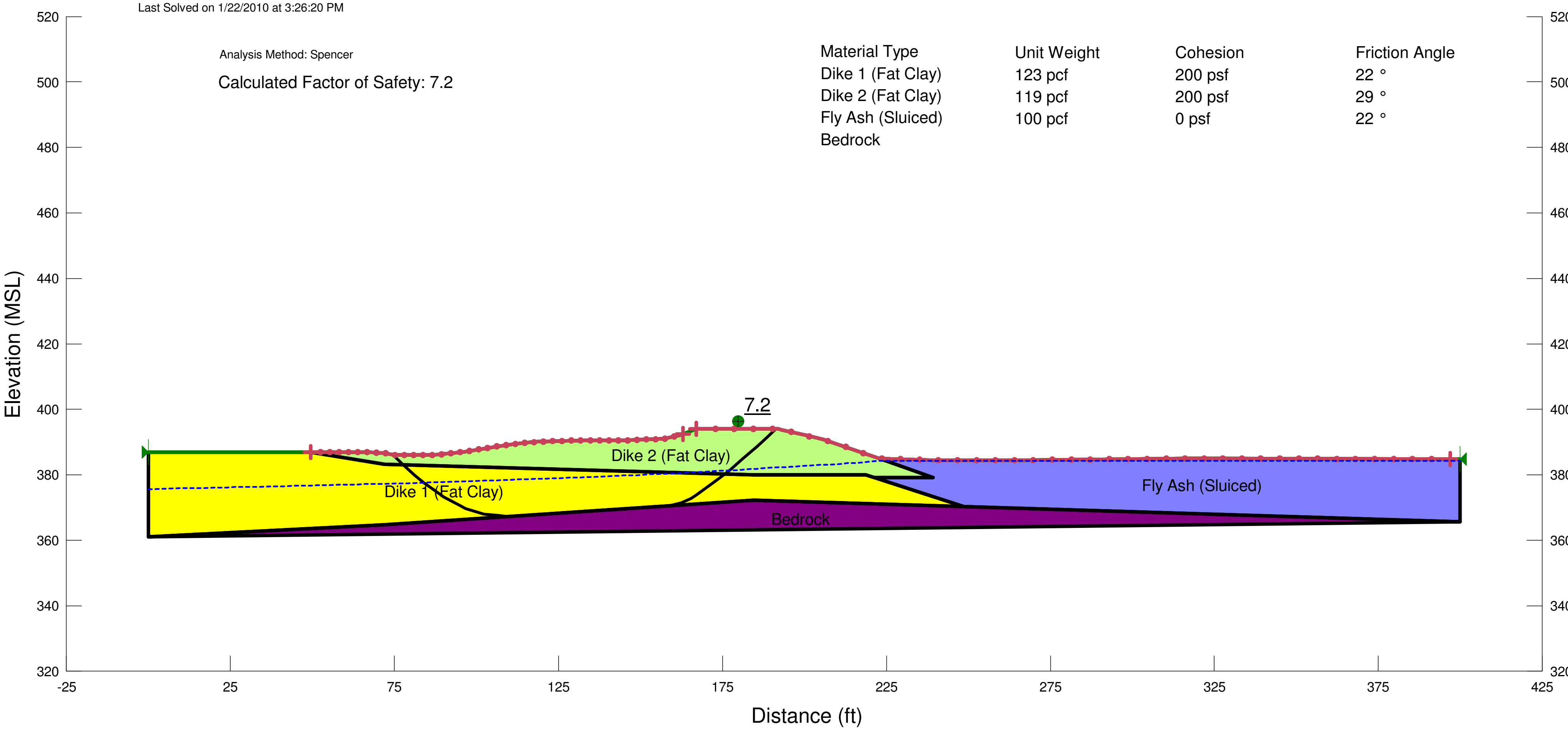
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section W.gsz

Analysis Name: Stability - Existing Condition

Date Saved: 1/22/2010

Last Solved on 1/22/2010 at 3:26:20 PM



Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Fat Clay)	123 pcf	200 psf	22 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Bedrock			

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

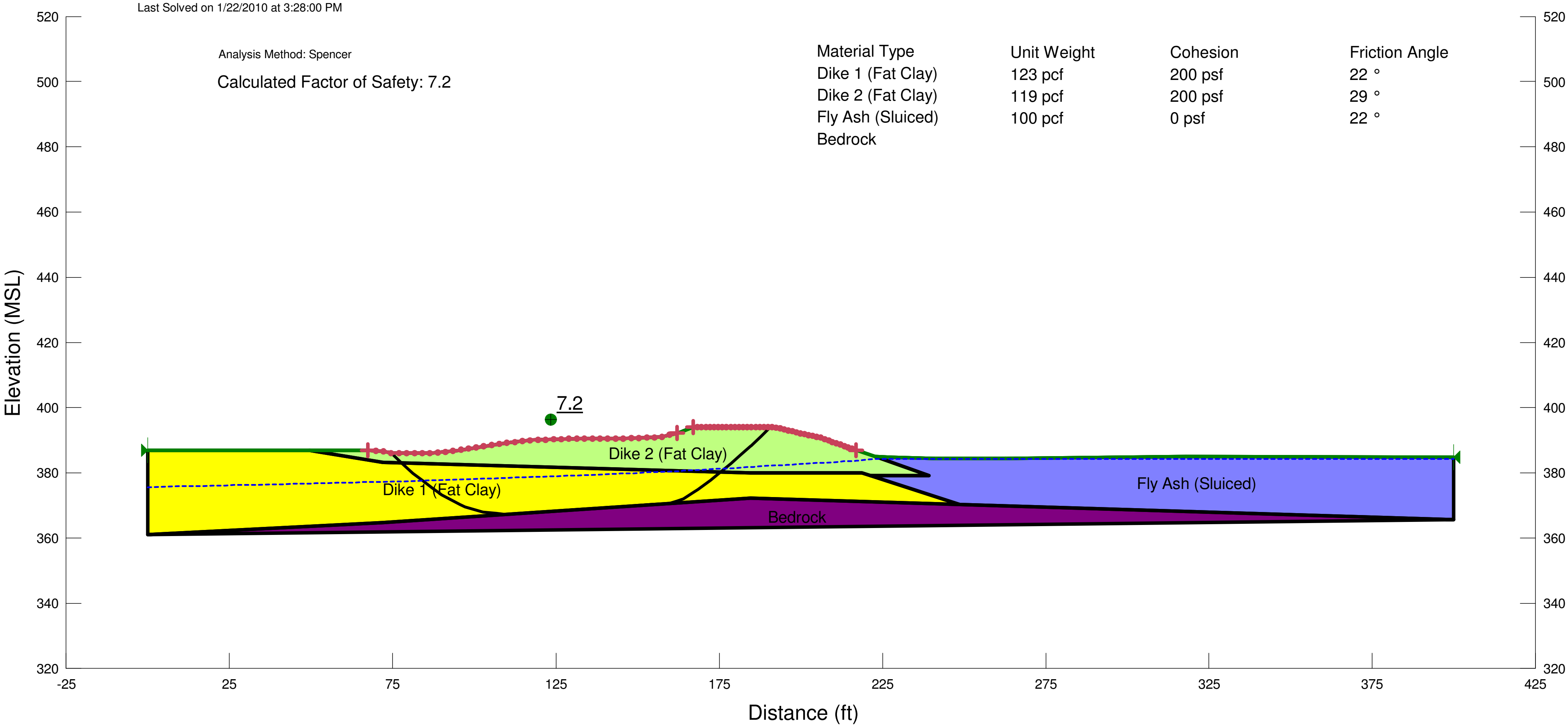
Stantec

File Name: Section W.gsz

Analysis Name: Stability - Existing Condition (Deep)

Date Saved: 1/22/2010

Last Solved on 1/22/2010 at 3:28:00 PM



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

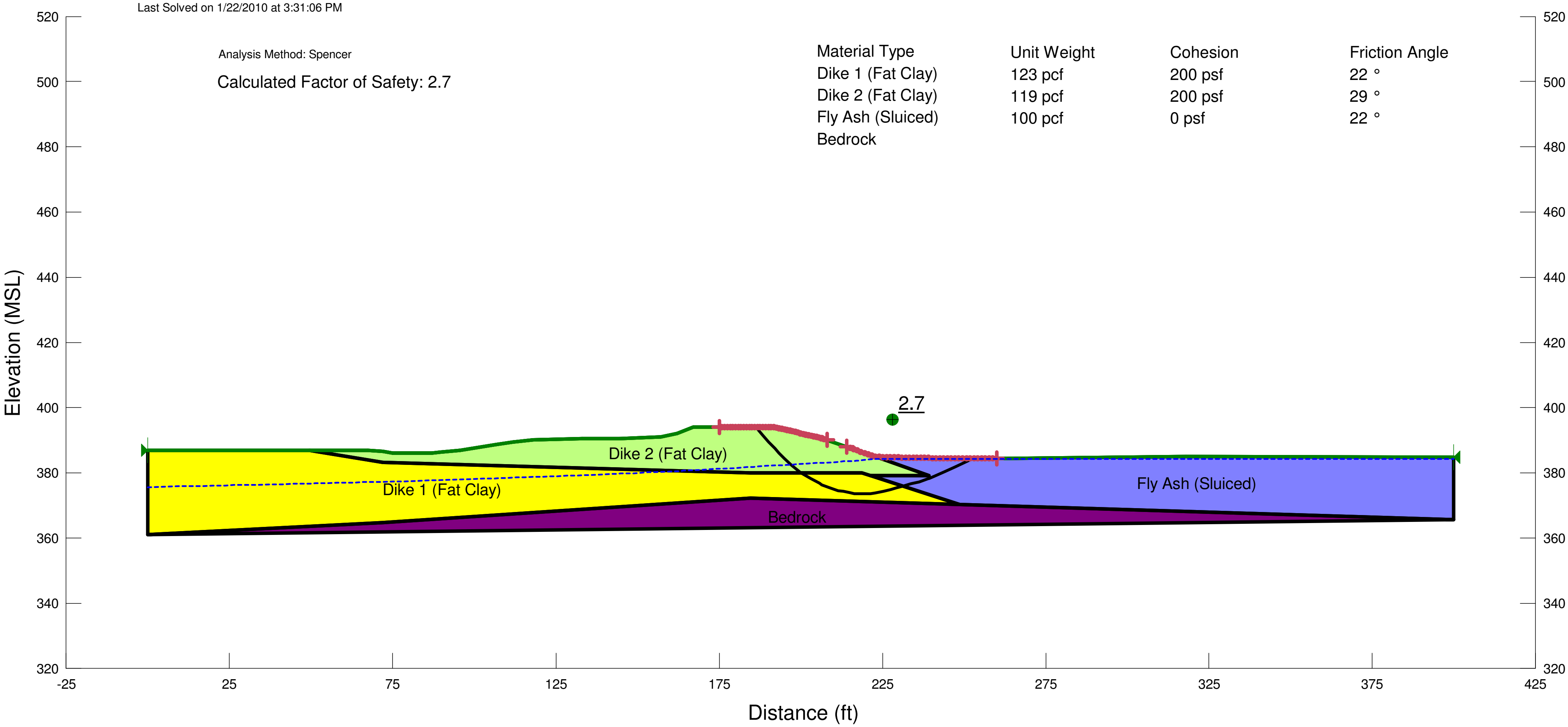
Stantec

File Name: Section W.gsz

Analysis Name: Stability - Existing Condition (L2R)

Date Saved: 1/22/2010

Last Solved on 1/22/2010 at 3:31:06 PM



Stantec

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section W.gsz

Analysis Name: Stability - Existing Condition (Deep) (L2R)

Date Saved: 1/22/2010

Last Solved on 1/22/2010 at 3:29:34 PM

Analysis Method: Spencer

Calculated Factor of Safety: 2.9

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Fat Clay)	123 pcf	200 psf	22 °
Dike 2 (Fat Clay)	119 pcf	200 psf	29 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Bedrock