Stantec

Report of Geotechnical Exploration and Evaluation of Slope Stability

Northern Perimeter Dike
East Active Ash Pond
Allen Fossil Plant
Shelby County, Tennessee

Stantec Consulting Services Inc.
One Team. Infinite Solutions
100 Westwood Place, Suite 420
Brentwood, TN 37027
Tel: (615) 885-1144 • Fax: (615) 885-1102
www.stantec.com

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

March 25, 2010

Stantec

Stantec Consulting Services Inc.
100 Westwood Place, Suite 420
Brentwood, TN 37027
Tel: (615) 885-1144
Fax: (615) 885-1102

March 25, 2010

rpt_003_172679016

PATRICK V. KISER
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 111395
STATE OF TENNESSEE

3/25/2010

Mr. Barry Snider, PE
Tennessee Valley Authority
1101 Market Street
LP 5E-C
Chattanooga, Tennessee 37402

Re:
Report of Geotechnical Exploration and Evaluation of Slope Stability
Northern Perimeter Dike
East Active Ash Pond
Allen Fossil Plant
Shelby County, Tennessee

Dear Mr. Snider:

As requested, Stantec Consulting Services Inc. (Stantec) has completed the geotechnical exploration and evaluation of the stability of the northern perimeter dike (US Army Corps of Engineers Levee) at the Allen Fossil Plant located in Memphis, Shelby County, Tennessee. This report documents the subsurface conditions, results of laboratory testing, findings from historical document reviews, results of our seepage and slope stability analyses, and our conclusions and recommendations. These services were performed under Engineering Service Request ESR 909 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, feel free to contact our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Shaikh Z. Rahman, PE
Project Engineer

Patrick V. Kiser, PE
Project Manager/Senior Associate

/lp

Enclosures: 1

Report of Geotechnical Exploration and Evaluation of Slope Stability

Northern Perimeter Dike
East Active Ash Pond
Allen Fossil Plant
Shelby County, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

March 25, 2010

Report of Geotechnical Exploration and Evaluation of Slope Stability

Northern Perimeter Dike
East Active Ash Pond
Allen Fossil Plant
Shelby County, Tennessee

Table of Contents

Section **Page No.**

Table of Contents
(Continued)

List of Tables

Table of Contents
(Continued)

List of Figures

List of Appendixes

Executive Summary

Stantec Consulting Services Inc. (Stantec) has completed the geotechnical exploration and stability evaluation for the northern perimeter dike of the East Ash Pond at the Tennessee Valley Authority's (TVA) Allen Fossil Plant. The northern perimeter dike was originally constructed by the US Army Corps of Engineers (USACE) in the early 1960's as a flood protection levee along the Mississippi River and its backwaters and tributaries. TVA constructed a three-foot thick impervious liner on the interior slope of the levee to facilitate the impoundment of the east ash pond and stilling pond as part of the expansion of the disposal area in the early 1970's. A slough occurred on the interior slope of the dike on April 03, 2009, apparently resulting from previous dredging operations excavating portions of this impervious layer. Subsequent to the slough, the USACE, Memphis District requested TVA investigate the potential for past dredging operations impacting other portions of the dike, develop dredging guidelines to reduce the potential for dredging into the dike cross-sections, and evaluate the stability of the dike/levee with the impounded ash pond pool. The purpose of this study was to evaluate dike stability under the current dam safety criteria. To this end, Stantec reviewed historical documents to gain an understanding of the construction of the northern perimeter dike and subsequent development of the east ash disposal area; developed and executed a geotechnical exploration to provide information as to the type, strength, and permeability of the dike materials and foundation soils; installed and monitored piezometers to develop an understanding of steady-state piezometric surface; and performed seepage and slope stability analyses to evaluate the stability of the dike for long-term and rapid drawdown conditions.

The analyses were focused on two cross-sections of the dike. The cross-sectional geometry and subsurface profiles were established using data from the drilling and laboratory testing programs and historical documents such as design drawings and memoranda provided by TVA. Stantec estimated material properties such as unit weight, saturated hydraulic conductivity, horizontal to vertical permeability ratio, and drained shear strength parameters for the dike and foundation soils based on the results of field and laboratory testing, published data, and Stantec's experience with like materials in similar settings and applications. The soil parameters selected for use in the seepage and stability analyses are tabulated in the report.

Stantec performed seepage and slope stability analyses for the following loading conditions:

1. Steady-state seepage at the ash pond normal pool elevation of 230 feet

2. Steady-state seepage at the ash pond maximum storage pool elevation of 233 feet

3. Steady-state seepage at maximum surcharge pool elevation of 237 feet and

4. Rapid drawdown analyses from the McKellar Lake design flood elevation of 232.5 feet to median lake water elevation of 185 feet.

Seepage analyses were performed at the two referenced dike cross-sections in order to estimate the magnitude of seepage gradients for the evaluation of piping potential, and pore water pressures within the embankment and foundation soils used in slope stability analyses. Stantec developed the seepage model based on the previously defined cross-sectional geometry and the estimated hydraulic properties of the principal soil horizons. The analyses were performed using SEEP/W, a finite element program tailored for modeling water seepage conditions in soil and rock. SEEP/W uses cross-section geometry, boundary conditions and soil properties provided by the user to compute the total hydraulic head at nodal points within the modeled cross-section. The seepage model was iteratively "calibrated" to reflect field conditions by adjusting applicable boundary conditions at each cross-section and varying the estimated hydraulic properties of soil until the total head calculated at piezometer tip elevations were in reasonable agreement with corresponding piezometer reading. Graphical output from the seepage analyses are presented in Appendix F of this report.

The results from the seepage analyses were also examined to identify conditions where piping and soil erosion might develop due to seepage forces. To quantify the potential for piping, Stantec evaluated upward, vertical exit gradients in the area of the dike toe. Factors of safety against piping, computed for the surficial 3 to 5 feet of soil in these areas, varied from 4.45 to more than 5.00 for the previously stated loading conditions. Based on USACE design criteria for dams (EM 1110-2-1901), the target minimum factor of safety against piping is 3.0. The results of the seepage analyses conducted for the two referenced cross-sections indicate the north dike meets this criterion.

Stantec performed slope stability analyses for static, long-term conditions using conventional two-dimensional, limit equilibrium methods. For the long-term analyses, steady-state seepage pressure calculated by SEEP/W is mapped directly to SLOPE/W model for use in slope stability analysis. Factors of safety were computed using Spencer’s method of analysis for circular slip surfaces. The trial slip surfaces were subsequently optimized to find critical slip surface and the corresponding critical factor of safety. Long-term analyses were performed using fully drained material properties.

The two referenced cross-sections were evaluated for potential deep-seated slides (global stability), that would threaten partial to total loss of the impoundment, as well as more shallow slip surfaces that are generally more maintenance-type issues. The analyses also evaluated the factors of safety for failures on the interior slope of the dike. The results indicate factors of safety for global stability range from 1.62 to 2.17 for the loading conditions described above while the factors of safety for the maintenance-type failures range from 1.44 to 2.30. Stantec understands TVA established a minimum factor of safety of 1.5 for long term conditions using the guidelines presented in USACE Manual EM 1110-2-1902. Considering both deep-seated and shallow failure mechanisms for the loading conditions at the normal and maximum storage pool elevations, the slope stability results show that the northern perimeter dike meets this criterion. The factor of safety of 1.44 reported herein was calculated for a shallow, maintenance type failure for steady state seepage conditions at the maximum surcharge pool elevation of 237 feet, the crest elevation of the dike. However, the referenced USACE Manual recommends a minimum factor of safety of 1.4 for maximum surcharge pool events. As such, Stantec does not recommend implementing measures to increase the factor of safety against shallow, maintenance type failures for a maximum surcharge pool event.

Stantec performed rapid drawdown analyses at the two dike cross-sections using the three-stage analysis method recommended by the USACE. For each cross-section, Stantec performed separate seepage analyses using SEEP/W for the design flood elevation condition as well as the drawdown condition. The pore water pressures calculated by SEEP/W were imported into the UTEXAS4 computer program to perform the stability calculations. The results of the rapid drawdown analysis indicate the factors of safety of the exterior slope vary from 1.63 to 1.74. The minimum factor of safety for rapid drawdown recommended by the USACE (EM 1110-2-1902) varies from 1.1 and 1.3. Based on Stantec's analysis, the northern perimeter dike exhibits acceptable factors of safety for rapid drawdown.

Stantec understands TVA is planning to convert the Allen plant systems to dry handling of fly ash, which will significantly reduce the fly ash combustion product storage role for the ash pond and stilling pond. Stantec anticipates the ash pond and stilling pond configuration will be modified in association with the conversion and reduced storage needs. The assessment of the northern perimeter dike and the associated recommendations are based on this understanding of the future plant operations.

In conclusion, the current configuration of the northern perimeter dike/USACE levee exhibits acceptable factors of safety for piping and slope stability under the loading conditions discussed herein. As such, Stantec recommends TVA implement their routine dam safety program to manage risks associated with operating the ash pond and stilling pond impoundments until the facility is converted to dry storage and/or closed. The monitoring and inspection program should include water level measurements in the piezometers on a monthly basis. Additionally, TVA should implement dredging guidelines to reduce the potential for future dredging operations excavating portions of the northern perimeter dike/USACE levee including the erection and/or installation of visible markers for reference.

This report provides detailed discussions of the scope of work performed as part of this study; results of the historic document review, subsurface exploration, and laboratory testing program; assumptions, methodologies and results of the engineering analyses; and Stantec's conclusions and recommendations for future actions.

Report of Geotechnical Exploration and Evaluation of Slope Stability

Northern Perimeter Dike
East Active Ash Pond
Allen Fossil Plant
Shelby County, Tennessee

1. Introduction

1.1. General

Subsequent to the failure of the dredge cell at the Kingston Fossil Plant in December of 2008, the Tennessee Valley Authority (TVA) contracted with Stantec Consulting Services Inc. (Stantec) to perform stability evaluations for the coal combustion byproduct (CCB) storage facilities at each of its eleven active and one inactive coal fired power plants. Initial efforts consisted of site visits with TVA personnel and review of historical documents to provide recommendations for immediate risk reduction measures and to identify sites/facilities that require further evaluation. The final reports for these efforts, labeled as Phase I of the stability evaluations, were submitted in June of 2009. In general, these reports recommended conducting geotechnical explorations for CCB disposal facilities and performing engineering analyses of existing configurations for comparison against current dam safety criteria.

1.2. Facility Layout and CCB Storage

The Allen Fossil Plant consists of a centrally located power plant, an active ash disposal area to the east and an inactive ash disposal area to the west. The east disposal area, originally commissioned in 1967 and expanded in the mid to late 1970's, consists of the East Active Ash Pond, East Dredge Cell, and East Stilling Pond. Figure 1 provides an overview of the east disposal area. The northern perimeter dike for this disposal area was originally constructed by the US Army Corps of Engineers (USACE) in the early 1960's as a flood protection levee along the Mississippi River and its backwaters and tributaries. TVA constructed a three-foot thick impervious liner on the interior slope of the levee to facilitate the impoundment of the east ash pond and stilling pond as part of the expansion of the disposal area in the early 1970's.

The plant currently operates by sluicing fly ash and bottom ash through pipes and then into an open channel that subsequently drains into the East Active Ash Pond. Periodic dredging operations excavate ash from the pond for temporary storage in the East Dredge Cell. Reed Minerals reclaims the ash for use as off-site structural fill. A spillway near the southeast corner of the ash pond discharges water from the ash pond into the East Stilling Pond. Two 36-inch reinforced concrete pipes, located at the north end of the stilling pond, penetrate the north dike to discharge water into McKellar Lake. Additionally, two auxiliary pipes penetrate the eastern perimeter dike and serve as emergency spillways to drain water from the stilling pond into a discharge channel that empties into the Horn Lake Cutoff. The auxiliary spillways are only used when the water level in McKellar Lake is too high to discharge.

Allen Fossil Plant
Northern Perimeter Dike
East Active Ash Pond
Shelby County, Tennessee

Stantec

Figure 1. Overview of East Active Ash Pond, East Dredge Cell, and East Stilling Pond

Stantec understands TVA has decided to switch from wet to dry methods for CCB handling and storage. The east ash disposal area will be closed as part of this conversion process. However, a schedule for the conversion of the Allen Fossil Plant has not been established to date.

1.3. Background

TVA contacted Stantec on Friday afternoon, April 3, 2009 and requested that Stantec personnel be dispatched to the Allen Fossil Plant to support their efforts addressing a slough of an interior dike slope. The subject slough was located on the inside face of the north dike. The extent of the slope instability appeared to be localized to a 17 foot long section located within a larger area, approximately 60 feet in length, of a previously excavated section of dike. Stantec coordinated with TVA personnel to assess the extent of the slough, and develop and execute plans for corrective action to provide short-term stability of the slope until permanent repair plans could be developed and implemented. Stantec developed a report containing observations, corrective actions, and recommendations for further action and submitted it to TVA on April 15, 2009. Subsequent to implementation of the short-term corrective actions, TVA contacted the USACE, Memphis District to discuss the slough and permanent repair options for the subject containment dike.

Subsequent to TVA's communication with USACE, Memphis District, the District's Levee Safety Program Manager has requested the following actions be taken in order to assess the impact of dredging operations on the pond liner, if any, as well as to evaluate the loading of the pond on the stability of the dike/levee.

1. Develop cross sections of the levee on 500 foot intervals. The cross-sections should extend a minimum of 100 feet from both the landside and riverside toes of the embankment.

2. Drill geotechnical borings along the cross-sections. The borings should be drilled on the crest and near the landside and riverside toes of the levee.

3. Review the survey and geotechnical data to evaluate the presence and condition of the ash pond liner and provide recommendations regarding repair or replacement of the liner.

4. Perform slope stability analyses on the landside and riverside levee slopes to determine if the additional loading on the levee from to the ash pond is impacting levee stability.

5. Based on the slope stability analysis, determine if the levee geometry needs to be altered to provide the required factor of safety against failure.

6. Excavate the sloughed area and restore the levee section with compacted clay material as directed by the USACE, Memphis District.

7. Develop a No-Dredging or excavation line which shall not be closer than 100' of the levee toe.

On Wednesday May 27, 2009, TVA, USACE and Stantec met on site to discuss the noted actions, the proposed geotechnical investigation, instrumentation monitoring program, engineering analysis, and project deliverables.

Stantec submitted a dredging guideline to TVA on December 11, 2009 outlining setback distances for various dredging operations in the East Ash Pond. Stantec also submitted a geotechnical engineering report on December 11, 2009 regarding the evaluation of impervious liner on the interior slope of the northern perimeter dike. The current report discusses the seepage and slope stability analyses results and Stantec's recommendation regarding the long-term stability of the dike.

1.4. Scope of Work

This report addresses the geotechnical exploration performed to support Stantec's engineering evaluation of the northern perimeter dike of the East Ash Pond. As outlined in ESR 909, the scope of work for this effort included the following tasks:

- Review of available documentation to support the development of a work plan for the geotechnical exploration and engineering evaluations.
- Survey services to develop dike cross-sections – performed by TVA surveyors.
- Development and planning of the geotechnical exploration to collect data for slope stability analysis of the northern perimeter dike of East Active Ash Pond.
- Execution of a drilling program to develop the subsurface lithology and to obtain samples for subsequent laboratory testing.
- Installation of piezometers for monitoring water levels in the perimeter dikes and foundation soils.
- Perform laboratory testing to develop strength and permeability data to support engineering analyses.
- Instrumentation monitoring program to observe the fluctuations of water levels in the installed piezometers over a period of six months.
- Perform seepage and slope stability analyses of the dike in accordance with the recommendations and criteria outlined in the USACE Engineering and Design Manuals EM1110-2-1913 (Design and Construction of Levees) and EM 1110-2-1902 (Slope Stability). Stantec coordinated with the USACE, Memphis District to determine the critical loading conditions. The anticipated loading conditions to be evaluated in the stability analyses are as follows:
    a) Static analysis under steady-state seepage conditions at the maximum storage pool elevation in the ash pond.
    b) Static analysis at the maximum surcharge pool elevation in the ash pond.
    c) Rapid drawdown using the 500 year flood elevation for McKellar Lake.
- Develop a geotechnical report documenting the scope of work, outlining the results of the exploration, discussing the engineering analyses, and providing recommendations regarding slope stability.

The report addressing the geotechnical exploration and evaluation of the stability of the eastern perimeter dike of the east stilling pond is provided under separate cover.

2. General Site Description and Geologic Setting

2.1. Site Location and Description

The Allen Fossil Plant is located in the southwest corner of Tennessee, just west of the city of Memphis. The plant is situated on the south shore of McKellar Lake and on the eastern bank of the Mississippi River. The local topography is relatively level, with the constructed dikes rising about 20 to 25 feet above the surrounding terrain. Based on available drawings dating back to the time of the construction of the USACE levee (Serial No. 16362, Drawing 1, dated February 12, 1960), the natural ground elevation within the east disposal area varied from about 206 to 218 feet above Mean Sea Level (MSL) prior to excavating native materials for construction of the flood control structure.

The northern perimeter dike is aligned approximately parallel with the south shore of McKellar Lake in a general east-west direction. The length of the dike, from the northeast corner of the stilling pond to the northwest corner of the dredge cell, is about 2,500 feet. The scope of this stability evaluation encompasses roughly the eastern 1,500 feet of the dike serving as the northern perimeter of the East Active Ash Pond and East Stilling Pond.

2.2. Geologic Setting

Available geologic mapping, “Geologic Map of the Tennessee Portion of the Fletcher Lake Quadrangle, Tennessee”, published by the Tennessee Department of Conservation, Division of Geology, 1978, indicates the plant and surrounding areas are underlain by artificial fills and Quaternary age alluvial deposits. The fill generally consists of alluvium dredged from the flood plain (or loess in select locations) and varies in thickness from a few feet beneath residential areas to tens of feet beneath industrial areas in the floodplain of the river. Thickness of the alluvium consists of irregular lenses of fine sand, silt, and clay in the upper part, and coarse sands, gravelly sands, and sandy gravels in the lower part. Thickness of the alluvium varies from about 45 to 90 feet adjacent to the loess bluffs along the eastern edge of the quadrangle to as much as 175 feet well out in the flood plain. The mapping indicates the alluvium is underlain by a series of highly consolidated clays and dense sands comprising the Claiborne Group.

The East Disposal Area is situated on the east side of the main plant and bounded to the east by Ensley Engineering Yard, to the north by McKellar Lake, and to the south by the railroad. This area is delineated as 'Tailing Pond' on the referenced geologic mapping. Specifically, the mapping indicates this area is underlain by the above described alluvial deposits and is surrounded by artificial fills constructed to support development of the plant, railroad, and USACE flood protection system.

3. Review of Available Information

3.1. General

As part of the Phase 1 site assessments, Stantec engineers and geologists reviewed documents provided by TVA with the objective of developing an understanding of the development and history of the plant and CCB storage facilities. The documents reviewed include design drawings, design and construction memoranda, aerial photographs, survey/topographical data, and annual inspection reports. The following documents were reviewed as part of this assessment:

- Drawing No.1, Serial No. 16362, USACE, Memphis District: Dike Work, Memphis Harbor Project, Mississippi River, Item No. L-725, Sheet 1
- Drawing No. 10W224: Ash Disposal Area West of Powerhouse Sheet 2
- Drawing No. 10W225: Ash Disposal Area East of Powerhouse Sheet 1
- Drawing No. 10N226: Ash Disposal Area East of Powerhouse Sheet 2
- Drawing No. 10N227: Ash Disposal Area East of Powerhouse Sheet 3
- Drawing No. 10N228: Ash Disposal Area East of Powerhouse Sheet 1, 2, 4
- "Allen Steam Plant – Ash Disposal Areas Dikes Raising –Soil Investigation", TVA Memorandum by Gene Farmer (Chief, Construction Services Branch) to G. L. Buchanan (Chief, Civil Engineering and Design Branch) , May 2, 1975.
- "Allen Steam Plant – Ash Disposal Areas Dikes Raising – Construction Information", TVA Memorandum by G. L. Buchanan to Gene Farmer, July 24, 1975.
- 2009 survey Drawing No.461 K 552(D) R.0
- Allen Fossil Plant Annual Ash Disposal Area Inspection Reports from 1967 to 2009 (Draft), except for 1990, 1991, and 1992 since they were not available.
- Deed and Bill of Sale made by the City of Memphis, Tennessee and Memphis, Light, Gas, and Water Division to the Tennessee Valley Authority and United States of America, 1984.
- Excerpts from “Hydrogeological Report for the Ensley Berm Project” – by John E. Monroe, P.E., U.S. Army Corps of Engineers, Memphis District, September 10, 1990.

3.2. Development of East Ash Disposal Area

The USACE constructed the northern perimeter dike as a flood control levee in the early 1960’s using soils excavated from the area that is now the East Active Ash Pond. As such, the materials used to construct the dike consist of low plasticity silts, silty lean clays, silty sands, and sandy silts.

Based on USACE (Drawing 1) Serial No. 16362 the constructed dike was approximately 20 feet tall, with a 25-foot wide crest, 3½ to 5H:1V (Horizontal:Vertical) embankment slopes. The crest elevation was approximately 237 feet above Mean Sea Level (MSL). The levee design cross-section depicted on the referenced USACE drawing is presented in Figure 2.

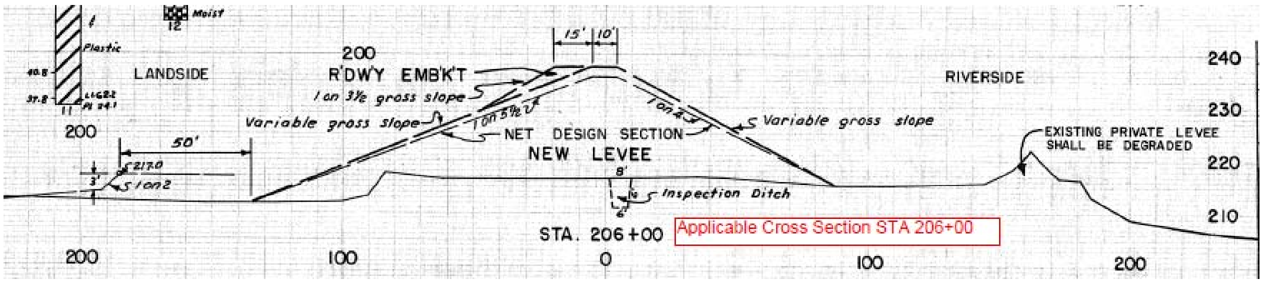


Figure 2. Levee Design Cross-Section from USACE (Drawing 1) Serial No. 16362

Based on available drawings, an embankment had already been constructed to support the railroad along what is now the south side of the east ash disposal area.

Starting in the late 1960's, bottom ash was sluiced into the east ash disposal area via a discharge point in the northwest corner. The disposal area was bounded by higher ground on the east and water was drained from the area via an open channel entering the Horn Lake Cutoff through pipes beneath the railroad embankment. An outside private company reclaimed the bottom ash from the disposal area, processed the material, and sold it off-site. In late 1969, the plant began sluicing fly ash into the east disposal area via a separate pipe system also discharging into the northwest corner of pond. As such, a skimmer system was constructed in 1970 to reduce the possibility for finer ash materials entering the Horn Lake Cutoff. The 1970 inspection report recommended expanding the pond, building a raised dike along the east end of the area, and installing spillways and skimmers. Design for the pond expansion was completed in 1975 and construction began in 1976.

As part of the expansion, TVA constructed a three-foot thick impervious layer on the interior slope of the northern perimeter dike to faciliate the impoundment of the east ash pond and stilling pond. TVA also constructed the eastern perimeter dike, the divider dike, and installed the McKellar Lake spillway and Horn Lake Cutoff auxiliary spillway. Stantec's review of historic documentation did not determine an impoundment date for the east ash pond or stilling pond, but the noted construction tasks had been completed and the ponds were in operation at the time of the 1978 annual inspection.

Based on a review of available design plans (Drawings 10N225 and 10N226), the impervious layer was to extend from the toe of the interior slope up to the crest of the dike. Specifications for the materials to be used to construct the impervious layer were provided in the TVA memoranda authored by Gene Farmer and G.L. Buchanan. Based on these documents, the soils used to construct the impervious layer should have consisted of low plasticity silts, lean clays, silty sands or sandy silts with at least 35% fines (particles passing the #200 sieve i.e. silt and clay). To construct this layer, these materials should have been compacted to at least 95 percent of the materials maximum standard Proctor dry density at ±3 percent optimum moisture content. Similar to the USACE levee, available drawings and documentation also indicate the impervious layer was constructed using borrow soils from the current pond area. Figure 3 depicts the design cross-section for the modified levee geometry with the impervious layer constructed on the interior slope.

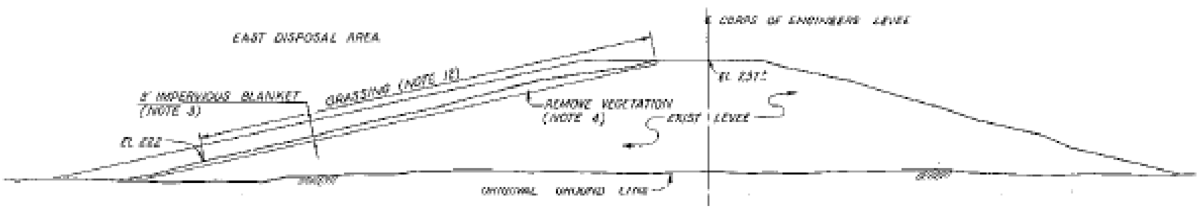


Figure 3 Section D-D’ from TVA Drawing No. 10N226

4. Subsurface Exploration

4.1. General

Stantec prepared a subsurface exploration program based on a review of historic documents, geologic mapping, aerial photography, available topographic mapping, and site observations. A summary of the proposed boring locations was sent to TVA for field staking. The boring locations and surface elevations were established in the field by TVA survey personnel.

The subsurface exploration program consisted of drilling and sampling eight soil test borings along the crest and near the exterior toe of the northern perimeter dike. These borings (STN-1 through STN-8) were extended to depths of about 40 to 60 feet below the existing ground surface utilizing both truck-mounted and track-mounted drill rigs between July 14 and July 19, 2009. Seven (7) hand-auger borings were advanced on October 12, 2009 at various locations along the interior dike slope to further evaluate the near-surface soils. The hand-auger borings (HA-1 through HA-7) were extended about 5 to 12 feet below grade. The boring layout in Appendix A depicts the locations of the borings on a plan view of the east disposal area. Table 1 provides a summary of the borings advanced as part of the subject geotechnical exploration. All measurements are expressed in feet.

Table 1. Summary of Borings

Boring No.	Northing*	Easting*	Surface Elevation*	Boring Termination Depth	Bottom of Hole Elevation
STN-1	274580.31	762195.58	215.3	40.0	175.3
STN-2	274441.99	762201.92	238.8	60.0	178.8
STN-3	274411.16	762192.94	234.6	40.5	194.1
STN-4	274367.46	762679.46	237.5	60.0	177.5
STN-5	274364.82	763202.51	217.5	40.5	177.0
STN-6	274263.61	763180.87	238.3	60.0	178.3
STN-7	274235.39	763163.82	235.6	41.0	194.6
STN-8	274166.09	763641.32	237.5	60.5	177.0
HA-1	274226.34	763209.32	235.7	7.0	228.7
HA-2	274202.98	763201.48	230.5	5.0	225.5
HA-3	274265.91	762999.17	234.2	5.0	229.2
HA-4	274333.93	762669.73	233.6	5.0	228.6
HA-5	274409.74	762201.44	233.7	5.0	228.7
HA-6	274395.67	762191.04	232.5	12.0	220.5
HA-7	274398.58	762201.29	232.4	6.0	226.4
HA-8	274392.70	762251.17	232.1	8.0	224.1

*Coordinates and Elevations were provided by TVA. The coordinate datum is the Tennessee Lambert Ground and the elevation datum is the NGVD29

In general, continuous standard penetration (SP) tests were performed in each of the borings to provide information as to the consistency or density of the dike and foundation materials and to obtain samples for subsequent laboratory testing. Thin-wall Shelby tube samples were also obtained at select locations within cohesive or moderately cohesive soil materials to obtain relatively undisturbed samples for laboratory strength and permeability testing. Disturbed samples were also obtained from the hand auger borings at one-foot intervals of depth using a bucket sampler. A Stantec geologist or geotechnical engineer was on site full time with each rig to observe the drilling operations, prepare field logs, collect soil samples, document piezometer and slope inclinometer installation activities; and adjust the drilling and sampling program as warranted by site and subsurface conditions. The field geologist/engineer logged the materials obtained from SP testing and Shelby tube sampling, paying particular attention to the texture, color, moisture content, plasticity, and consistency/density of the materials encountered. Typed boring logs are included in Appendix B.

Both automatic and safety hammers were used to perform SP tests in the borings advanced as part of this exploration. In SP testing, the number of blows required to advance a standard two-inch (outer diameter) split barrel sampler the last 12 inches of the typical total 18 inch penetration by means of a 140 pound hammer with a free fall of 30 inches, is the standard penetration resistance value (N). This value is used to estimate the in situ relative density of cohesionless soils and the consistency of cohesive materials. Standard correlations for SP test have historically been based upon blow counts using a safety hammer (rope/cat-head) system, generally estimated to be about 60 percent efficient. Thus, most correlations report values termed as N_{60} data. The efficiency of the automatic hammers used for this exploration was estimated to be about 80 percent based on previous efficiency test of Stantec drill rigs equipped with automatic hammers, thus requiring a correction for hammer efficiency. As such, Stantec corrected the blow counts resulting from SP testing using the automatic hammer. The correction of the SP data is discussed in further detail in Section 5.3.2 of this report.

Piezometers were installed at or near each of the borings to assist in developing an understanding of the piezometric surface for use in the seepage and slope stability analyses. The piezometers were constructed from 1-inch diameter Schedule 40 PVC riser pipe and 5-foot long No. 10 slot well screens. The annular backfill consisted of a sand filter pack to some distance above the screen followed by a minimum two-foot bentonite seal. After allowing the bentonite to hydrate, the remaining annulus was backfilled with cement-bentonite grout tremmied into place. Piezometer construction along the crest of the dike was completed with a concrete surface pad and flush mounted cover. However, the piezometers located along the toe of the Ash Pond Dike incorporated aluminum risers to promote visibility and were protected by concrete-filled steel bollards. Appendix C provides an instrumentation layout depicting the locations of the piezometers. Piezometer installation logs are also provided in Appendix C.

4.2. Subsurface Conditions

Based on the results of the drilling program, subsurface conditions at the site can be generalized as outlined in Table 2 below. The subsurface lithology, SP blow counts, and laboratory test data are shown on individual boring logs in Appendix B as well as graphic logs included in Appendix A. The descriptions of the soils indicated on the typed boring logs in Appendix B are in general accordance with the USCS and the group symbols are shown on the graphic boring logs depicted on the cross-section in Appendix A.

Table 2. Generalized Subsurface Conditions

Approximate Elevation	Materials	Consistency/Density
El. 237 to El. 215	Dike fill – consists of sandy silt, silty sand, silty clay, sandy clay, and lean clay	Stiff to very stiff / medium dense
El. 215 to El. 175 (termination depth)	Alluvium – Irregularly bedded sandy silt, silty sand, silt, lean clay, sand, and fat clay	Very soft to stiff / very loose to medium dense

In general, the embankment materials primarily consist of brown to gray, moist sandy silt (ML), silty sand (SM) and silty clay (CL-ML) with lenses of lean and fat clay clays (CL, CH). N_{60}-values from SP testing within the dike range from 4 to 57 blows per foot (bpf) with the majority ranging between 6 to 29 bpf. Based on N_{60}-values, the fine-grained fill materials vary from a medium stiff to very stiff and the more sandy materials vary from medium dense to dense.

The foundation alluvium can be further generalized into three primary strata – an approximate five-foot thick sandy silt (ML) extending from El. 215 to El. 210, a 30-foot thick lean (CL) and fat clay (CH) from El. 210 to El. 180 and a sandy silt (ML) to silty sand (SM) strata from El. 180 to boring termination depth of about El. 175.

The upper sandy silt (ML) stratum is primarily brown to gray-brown, moist to very moist with lenses of clay and sand. N_{60}-values from SP testing in this stratum range between 1 and 31 bpf with the majority ranging between 5 to 16 bpf. Based on N_{60}-values, the upper sandy silt exhibited a medium stiff to very stiff consistency.

The lean (CL) and fat clay (CH) strata are primarily brown to gray-brown, moist to very moist, with lenses of silt and sand. N_{60}-values from SP testing in these strata range between 0 and 20 bpf with the majority ranging between 3 to 11 bpf. Based on N_{60}-values, the clays are soft to stiff in consistency.

The bottom sandy silt (ML) to silty sand (SM) strata are primarily brown to gray, moist to saturated, with lenses of clay. N_{60}-values from SP testing within this horizon range between 0 and 32 bpf with the majority ranging between 5 to 29 bpf. Based on N_{60}-values, the bottom sandy silt to silty sand exhibits a medium stiff to very stiff consistency or a loose to medium density.

4.3. Laboratory Test Data

4.3.1. General

Stantec performed laboratory tests in accordance with applicable ASTM soil testing standards. The laboratory testing program consisted of natural moisture content determinations, sieve and hydrometer analyses, Atterberg limits, specific gravity determinations, consolidated-undrained triaxial compression tests, and permeability tests. The results of the testing program were used to select/derive appropriate parameters for the seepage and slope stability analyses. The results of these laboratory tests are provided in Appendix D and depicted on the graphical boring logs presented in Appendix A.

4.3.2. Natural Moisture Content and Laboratory Classification Testing

Natural moisture content determinations (ASTM D 2216) were performed on all soil samples recovered from SP test and Shelby tube sampling. The results of the natural moisture content tests are presented on the graphical boring logs in Appendix A and typed boring logs in Appendix B.

Soil classification tests consisting of sieve and hydrometer analyses (ASTM D 422), Atterberg Limits (ASTM D 4318), and specific gravity determinations (ASTM D 854) were performed on combined SP test samples from representative soil horizons and select specimens trimmed from Shelby tube sampling. Generalized soil classifications based on these test results are discussed in Section 4.2 of this report.

In general, soils with relatively low plasticity, e.g. silt, silty clay etc., have low moisture content in comparison with lean and fat clays. This is evident in our laboratory test results where sandy silts and silty clays with relatively low plasticity exhibited low moisture contents. The fill soils in the dike exhibited relatively lower moisture content than the foundation soils, indicative of moisture control at the time fill placement. The lean and fat clays typically contain higher percent fines as evident by the gradation analysis test results. The results of the natural moisture content and laboratory classification tests are summarized in Table 3 below.

Table 3. Summary of Natural Moisture Content and Classification Testing

Horizon	Predominant USCS Classification	Water Content Typical Range	Liquid Limit	Plasticity Index	% Passing #200 Sieve
Dike Fill Soils	ML, SM, CL-ML	10% to 24%	NP to 30	NP to 9	40 to 86
Sandy Silt	ML	19% to 42%	NP to 23	NP to 2	40 to 70
Alluvial Clay	CL, CH,	24% to 56%	25 to 73	6 to 51	50 to 96
Silt to Sandy Silt	ML, SM	25% to 41%	26 to 30	3 to 8	40 to 97

NP – Non Plastic

4.3.3. Consolidated-Undrained Triaxial Testing

Stantec performed consolidated-undrained (CU) triaxial testing with pore pressure measurements (ASTM D 4767) on selected six-inch specimens extruded from the Shelby tubes to establish effective-stress shear-strength parameters modeling in slope stability analyses. Table 4 provides a summary of the CU triaxial test results.

Table 4. Consolidated-Undrained Triaxial Compression Test Results

Boring No.	Approx. Sample Elevation (ft)	Textural Classification	Wet Unit Weight (lb/ft^3)	Effective Strength		Liquid Limit	Plasticity Index
				c' tsf	Φ' degree		
STN-1	198 to 200	Fat Clay	105	0.11	26	92	64
STN-1 and STN-2	193 to 195 and 201 to 203	Lean Clay	110 to 115	0.36	21	34 to 47	13 to 26
STN-1	186.5 to 188.5	Lean Clay	110	0.03	32	38	18
STN-3A*	230.5 to 233.5	Dike Fill – Sandy Silt	120	0.11	33	28	7
STN-9**	184.5 to 191.5	Fat Clay	105	0.08	28	73	47

* STN-3A is an offset boring drilled adjacent to STN-3 to obtain undisturbed samples for subsequent lab testing.
** STN-9 was drilled on the eastern perimeter dike, addressed in a separate report.

Based on the results of the triaxial testing, the effective internal angle of friction for the alluvial clay soils and silty to sandy lean clays in the embankment varies from about 21 to 33 degrees and the effective cohesion varies from 0.03 to 0.36 tons per square foot (60 to 720 pounds per square foot). The only CU test performed on dike fill material exhibited a friction angle of 33 degrees. Our attempt to collect more Shelby tube samples within the dike failed due to high sand and silt content within the dike soils. The native lean and fat clays exhibited friction angle values between 21 and 32 degrees. Generally, soils with higher internal angle of friction and lower cohesion can be attributed to increased percentages of silt and sand in the samples selected for testing while lower internal angle of friction and higher cohesion are generally associated with higher percentages of clay. This is evident in the test results of native lean and fat clays.

4.3.4. Laboratory Permeability Testing

Falling head permeability tests (ASTM D5084) were performed on select extruded tube specimens and remolded samples of dike fill material. The remolded samples consisted of multiple SP test samples or hand auger samples combined and compacted to a wet density of 115 pcf and moisture content in the range of 16 to 22 percent. Table 5 summarizes the test results.

Table 5. Permeability Test Results

Boring No.	Depth (ft)	In-Situ Water Content (%)	Initial Water Content (%)	Initial Dry unit Weight, pcf	Textural Classification	Average Hydraulic Conductivity, k (cm/s)
STN-1	34.6 – 35.1	36	36	84	Lean Clay	7.04E-08
STN-2	36.6 – 37.1	35	35	85	Lean Clay	5.17E-08
STN-2A	10.0 – 10.5	25	25	96	Fill-Silty Clay	1.35E-07
STN-6	9.0 – 15.0	22	22	94	Fill-Silty Sand	3.66E-05*
STN-7	30.0 – 30.5	16	16	110	Sandy Clay**	9.11E-06**
STA-8A	5.0 – 5.5	18	18	109	Fill-Silty Clay	1.47E-07
STN-9***	28.6 – 29.1	46	36	84	Fat Clay	2.00E-08
HA-1	2.0 – 4.0	20	20	95	Fill-Sandy Silt	3.9E-05*
HA-4	2.0 – 5.0	21	21	95	Fill-Sandy Silt	4.26E-05*
HA-5	1.0 – 3.0	21	20	95	Fill-Sandy Silt	8.34E-05*
HA-9***	3.0 – 6.0	12	17	98	Fill-Sandy Silt	5.38E-05**

* Performed on remolded samples compacted to dry density between 94 and 96 pcf. In-situ dry density and hydraulic conductivity may vary.
**Sample most likely obtained from a sandy clay seam within a fat clay layer.
***STN-9 and HA-9 were performed on the eastern perimeter dike, addressed in a separate report.

Historical test data obtained from TVA memorandum (by G.L. Buchanan), performed on on-site sandy silt and silty sand core materials at the time of constructing the impervious layer on the interior slope of the northern perimeter dike, shows hydraulic conductivity values of these soils vary from 7.4E-06 to 8.40E-07 cm/s. Unit weight of these soils vary from 107 to 113 pcf. In comparison with these test results, relatively higher hydraulic conductivity values were obtained in the permeability tests of the samples remolded to dry densities of about 94 to 95 pcf. Based on the TVA memorandum by G.L. Buchanan, the core materials (on-site sandy silt and silty sand of type I, II, III and V) with over 30 percent fines have a maximum dry density in the range of 107 to 113 pcf. Therefore, the tested samples were remolded to only about 85 to 90 percent of the materials reported maximum dry Proctor density and likely resulted in the higher permeability values. The proctor test data was not available at the time of performing these permeability tests. Subsequent permeability tests performed on undisturbed tube samples obtained from the offset borings STN-2A and STN-8A, consisting of dike fill materials (CL-ML, ML), exhibited hydraulic conductivity between 1.35E-07 and 1.47E-07 cm/s. These two test results correlate well with TVA test data for on-site soils and additional permeability data for dike materials provided by USACE. Permeability testing performed by the USACE on silty soils from about 2 miles east of the ash pond during construction of the northern perimeter dike/flood control levee indicates the hydraulic conductivity of these materials is on the order of 5.0E-06 to 1.5E-07 centimeters per second.

4.4. Slug Test Data

Slug tests were performed at each piezometer location to evaluate in-situ hydraulic conductivity of the soil. This test involves adding or removing a measured quantity of water (slug) to a static column of water in a well (piezometer) and measuring the resulting changes in water level at a predetermined interval. The changes in water level are recorded until the equilibrium is restored, i.e. water level in the well returns to its original static condition. The slug tests were performed in general accordance with ASTM D4044 entitled “Standard Test Method for (Field Procedure) for Instantaneous Change In Head (Slug) Tests for Determining Hydraulic Properties of Aquifers.”

For materials with lower permeability, more accurate results are generally obtained by using an in-well transducer to collect periodic water level versus time measurements. The transducer is placed in the well below the pre-test water level a sufficient depth to permit testing. An instrument (data-logger) records water depth above the transducer before, during, and after the "slug" is introduced. The "slug" is introduced suddenly (raising the water level) and a series of water level versus time measurements are made as the water level moves toward an equilibrium situation.

During the initial field exploration, Stantec installed 5-foot long, 1-inch (0.0417 feet) diameter, schedule 40 PVC piezometer screens at each PZ location. To conduct the slug tests, a Stantec field engineer lowered a transducer into the piezometer, added water to the riser pipe, and used a data logger to automatically collect measurements at pre-programmed time intervals. The recorded data from the data-logger was analyzed by AQTESOLVE software from HydroSOLVE, Inc. (www.actesolve.com). The Bouwer-Rice solution method was used in the analysis for an unconfined aquifer. An Anisotropy Ratio ($K_{vertical}/K_{horizontal}$) of 1 was assumed for each PZ location. Results of the slug test are summarized in Table 6 and individual slug test result sheets are provided in Appendix E.

Table 6. Slug Test Results

PZ No.	Depth of PZ Tip (ft)	Saturated Aquifer Thickness (ft)	Static Water Column Height (ft)	Total Well Penetration Depth (ft)	Initial Displacement (ft)	Soil Classification at the PZ Tip	Average Hydraulic Conductivity k (cm/s)
PZ-1	40.2	26.0	22.3	22.3	6.0	Lean Clay	1.40E-04
PZ-2	19.7	16.7	3.5	5.0	0.6	Fill - Silty Clay	1.12E-06
PZ-3	20.1	5.4	5.4	17.1	1.5	Fill - Silty Sand	4.05E-05
PZ-4	19.2	4.0	3.4	5.0	0.1	Fill - Lean Clay	3.30E-04
PZ-5	38.2	24.6	20.6	20.6	2.4	Silty Sand	3.62E-04
PZ-6	17.9	0.4	0.4	5.0	0.4	Fill - Silty Sand	5.30E-03*
PZ-7	15.6	0.1	0.0	5.0	0.4	Fill - Silty Sand	5.38E-02*
PZ-8	19.1	11.6	0.4	4.0	0.4	Fill - Silty Sand	2.53E-04*
PZ-9	41.0	19.2	19.2	19.2	2.9	Fat Clay	3.63E-06
PZ-10	13.1	11.7	12.8	5.0	0.4	Fill - Silty Sand	1.08E-06
PZ-11	14.4	14.3	0.4	5.0	0.3	Fill - Silty Sand	3.08E-04*
PZ-12	43.1	18.6	17.8	17.8	2.5	Silty Sand	4.97E-05
PZ-13	17.7	18.0	6.6	6.6	1.6	Fill - Silty Sand	3.72E-06
PZ-14	19.5	11.8	11.8	11.8	1.5	Fill - Lean Clay	1.38E-04

PZ-9, 10, 11, 12, 13, and 14 were installed to assist in the evaluation of the eastern perimeter dike addressed in a separate report.
*Performed in a dry or near-dry piezometer. Actual in-situ hydraulic conductivity may vary.

The slug tests were performed on November 17, 2009. Prior to slug testing, water level readings were collected at each piezometer location. Based on the piezometer readings, we conclude that PZ-6, PZ-7, PZ-8 and PZ-11 were dry or near dry on the day of slug testing (within 0.36 foot of tip elevation). The slug test results confirmed this assumption where the slug water in these piezometers receded within ½ to 2 minutes, indicative of a dry well. Test time in the remaining piezometers varied between 3.5 and 85 minutes.

The results of the slug tests indicate the permeability of the dike and foundation soils are highly variable. Even within the dike, the hydraulic conductivity values vary by two orders of magnitude. The boring logs reinforce the variability of the dike materials indicating that although the bulk of the dike is constructed of sandy silt and silty sand, there are layers of lean and silty clay, and sand lenses throughout.

4.5. Instrumentation Monitoring Program

Piezometers were installed at/near the sample borings to monitor water levels in the dike and foundation soils. Long-term piezometer readings provide an estimate of the piezometric surface fluctuation at this site. Since their installation, thirteen (13) sets of readings have been recorded. Table 7 summarizes the data and individual piezometer readings are included in Appendix C.

Table 7. Piezometer Data

PZ No.	Surface Elevation	Top of Casing Elevation	Depth of PZ Tip	PZ Tip Elevation	Range of Measured Depths (from 7/20/09 to 2/2/10)		Ranged of Observed Water Elevations (from 7/20/09 to 2/2/10)	
					Min.	Max.	Min.	Max.
PZ-1	215.5	218.2	40.2	178.0	10.8	29.7	188.5	207.5
PZ-2	238.8	238.7	19.7	219.0	16.0	18.1	220.6	222.7
PZ-3	234.5	237.4	20.1	217.4	10.9	14.7	222.8	226.5
PZ-4	237.6	237.3	19.2	218.1	15.5	19.1	218.2	221.8
PZ-5	218.0	220.7	38.2	182.5	12.3	26.6	194.1	208.4
PZ-6	238.5	238.4	17.9	220.5	17.8	18.0	220.4*	220.6**
PZ-7	235.5	235.4	15.5	219.9	11.8	16.0	219.4*	223.7
PZ-8	237.8	237.7	19.1	218.6	19.0	19.1	218.5*	218.7**
PZ-9	221.2	224.2	41.0	183.2	8.4	19.4	204.8	215.9
PZ-10	237.4	237.1	13.1	224.1	10.1	12.4	224.7	227.0
PZ-11	237.9	237.8	14.3	223.5	14.2	14.3	223.5*	223.6**
PZ-12	217.2	220.1	43.1	177.0	19.9	30.8	189.3	200.2
PZ-13	237.2	237.0	17.7	219.3	10.5	15.2	221.4	226.5
PZ-14	236.6	236.4	19.5	216.9	6.7	9.3	227.2	229.7
McKellar Lake							170.05†	213.85†
Mississippi River							178.95‡	218.50‡

*Water level measured was most likely trapped water at the bottom of the piezometer.
**Water elevation is apparently below the piezometer tip elevation.
†Source: USACE, Ensley Engineer Yard Gauge MS129 located in Lake McKellar from 8/24/08 to 2/2/10.
‡Source: USACE, Mississippi River Gauge MS126 – Memphis from 8/24/08 to 2/2/10.

Based on the measured water levels at PZ-4, PZ-6, PZ-7, PZ-8, and PZ-11, set within the dike, we conclude that these piezometers were dry or near dry at the time of reading. The bottom of the piezometer screen is about 0.36 feet higher than the depth of the piezometer tip. Therefore, Stantec considered water levels consistently measured within 0.36 feet of the piezometer tip elevation to be water trapped in the bottom cap and not a true measurement of the piezometric surface. Among these five piezometers, PZ-6, PZ-8, and PZ-11 are considered dry piezometers since the readings in these piezometers varied only about 0.1 to 0.2 feet in the past eight months. Readings at PZ-4 and PZ-7 show water level above or below the bottom of screen elevations, indicative of fluctuations in the piezometric surface at those locations. The remaining piezometer readings within the dike varied between 2 and 5 feet, reflective of small fluctuations in the dredge cell, ash pond, and stilling pond pool levels.

The piezometer readings in the foundation soils (PZ-1, PZ-5, PZ-9 and PZ-12) varied between 11 to 19 feet, reflective of the fluctuations in McKellar Lake.

5. Engineering Analyses

5.1. General

Stantec performed both seepage and slope stability analyses at two cross-sections of the dike. Section A-A', at borings STN-1 through STN-3, is located at the northeast corner of the East Dredge Cell. Section B–B', at borings STN-5 through STN-7, is located approximately 315 feet west of the divider dike through the repaired slough area discussed in section 1.3 of this report. The locations of these cross-sections are shown on the boring layout diagram provided in Appendix A.

Stantec developed the dike geometry at each cross-section using survey data provided by TVA, design drawings, and site observations. Relatively wider profiles in the upstream and downstream sides of the dike were required to improve the accuracy of the seepage model. The upstream profiles (pond side) were extended using TVA survey data. The downstream profiles were extended using Shelby County GIS contours (prepared in 2006). Therefore, these profiles should be considered accurate only to the degree by the means and method used to define them.

Stantec developed the subsurface profile at each cross section based on the results of the drilling and laboratory testing discussed herein and historical information of the dike construction and development. It should be noted that dike construction records including fill placement, compaction and as-built configurations, etc. were not available for review. As a result, generalizations in the soil parameters for the dike and the dike cross-section geometry were required to construct the seepage and stability models. Generalized subsurface profiles are shown on cross-sections included in Appendix A. Stantec derived the soil permeability and strength parameters used in the seepage and slope stability analysis based on the field and laboratory test data, historical information, and our experience with similar soils and CCB materials. The selection process for material properties used in the analyses is discussed in detail in Sections 5.2.1 and 5.3.2 of this report.

The analyses performed as part of this study evaluated the dike/levee stability at the following loading conditions:

1. Steady-state seepage at the normal ash pond pool elevation of 230 feet;
2. Steady-state seepage at the maximum ash pond storage pool elevation of 233 feet;
3. Steady-state seepage at the estimated maximum ash pond surcharge pool elevation of 237 feet; and
4. Rapid drawdown analysis (from design flood El. 232.5 to normal lake El. 185)

Among the four loading conditions, 2, 3 and 4 were requested by the USACE, Memphis District. The water levels representing normal and maximum storage pool elevations were established based on information from plant personnel and from the 'Deed and Bill of Sale' documents, respectively. The surcharge pool elevation was estimated from the existing top -of-dike elevations. The design flood elevation for rapid drawdown analysis was provided by the USACE, Memphis District. McKellar Lake normal pool elevation was established from historical river gauge data provided by the USACE, Memphis District. Discussions on seepage and slope stability analyses are provided in Sections 5.2, 5.3 and 5.4 of this report. Results of these analyses are included in Appendix F.

Stantec performed the seepage and static, long-term slope stability analyses using the GeoStudio 7.14 software package developed by GEO-SLOPE International, Ltd. of Calgary, Alberta, Canada (www.geo-slope.com). This package includes SEEP/W and SLOPE/W modules for seepage and slope stability analysis, respectively. The rapid drawdown analyses were performed using UTEXAS 4 and SEEP/W software. UTEXAS 4 is a general-purpose limit-equilibrium software for slope stability analysis developed by Dr. Stephen G. Wright of Shinoak Software, Austin, Texas (www.shinoak.com). The analyses were performed in accordance with the recommendations and criteria outlined in the USACE Design Manuals EM 1110-2-1902 "Slope Stability" and EM 1110-2-1913 "Design and Construction of Levees".

5.2. Seepage Analysis

5.2.1. SEEP/W Model

Seepage analyses were performed at the two referenced cross-sections to estimate the effect of seepage pressure on the stability of the dike slope and foundation soil. The analyses were performed using SEEP/W, a finite element program tailored for modeling water seepage conditions in soil and rock.

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 program divides a two-dimensional problem space, e.g. a dike cross-section, into a number of quadrilateral and triangular elements of specified 'mesh size' connected by nodes, then uses a finite-element numerical methodology to calculate seepage properties (such as pore water pressure, total head, etc.) at individual nodes to solve the entire cross-section. The software also includes material models that allow tracking both saturated and unsaturated flows, including the transition in seepage characteristics for soils that become saturated or unsaturated during the problem simulation.

The analyses were performed for steady-state seepage for both saturated and unsaturated flows. In the steady-state seepage analysis, it is assumed that the water levels on both upstream and downstream side of the dike remain constant. With this assumption, SEEP/W locates the piezometric surface for unconfined seepage through the dike. The cross-sections modeled with SEEP/W were subsequently analyzed for slope stability (Sections 5.3 and 5.4).

5.2.2. Seepage Properties

Stantec derived material properties for the seepage analyses based on available laboratory test results and field slug test data. If no data was available, the material properties were estimated based on typical values for similar soils. The material properties modeled in the seepage analyses are summarized in Table 8.

Table 8. Material Properties for SEEP/W Analysis

Soil Horizon	Saturated Hydraulic Conductivity k_v (cm/s)	Anisotropy Ratio k_h / k_v	Specific Gravity G_s	Void Ratio e	Volumetric Water Content		Basis
					Saturated (%)	Residual (%)	
Hydraulically Placed Ash	3.0E-5	50	2.31	0.85	46	0.04	Parsons E&C
Compacted Ash	3.0E-5	25	2.31	0.85	46	0.04	Parsons E&C
Dike Fill Core	9.0E-7	4	2.65	0.66	39	0.01	Laboratory Data (STN-2A & 8A), TVA Memoranda
Native Sandy Silt	1.5E-7	25	2.65	0.68	40	0.01	Laboratory Data (STN-2A & 8A), USACE Test Data, TVA Memoranda
Native Lean and Fat Clay	6.0E-8	20	2.68	0.90	47	0.02	Laboratory Data (STN-1,2,7 & 9)
Native Sandy Silt to Silty Sand	1.0E-6	50	2.69	0.65	49	0.01	Slug Test Data, TVA Memorandum and NAVFAC

Note: Horizontal permeability of materials, k_h and ratio of k_v/k_h were used in the SEEP/W analysis

Engineering judgment is very important in selecting appropriate hydraulic properties for soil. Hydraulic conductivity of soil can vary over several orders of magnitude for various soil horizons, often with substantial anisotropy (seepage in horizontal versus vertical directions). Laboratory test samples often do not represent high variability within a large soil deposit. An iterative process of parametric calibration was used in these analyses to arrive at the final estimate of the seepage properties. Results from trial seepage analyses were compared with field data (measured piezometric levels and the depth of groundwater in the borings) in order to verify the accuracy of the model. The material properties shown in Table 8 represent a solution matrix that closely matches the field data on all cross-sections. The results of the seepage analysis are discussed in Section 5.2.4.

Saturated vertical hydraulic conductivity values (k_v) were selected using available field and laboratory test data, historical test data from TVA and USACE, published data and our experience with similar soils. Typical values were selected for materials where laboratory test data were not available. The value of k_v selected for the alluvial sandy silt to silty sand foundation deposit is one example where engineering judgment was critical to the selection of appropriate material properties. Laboratory permeability tests were conducted on undisturbed Shelby tube samples of predominantly cohesive soils within this deposit because intact tube specimens of the more silty and sandy materials could not be obtained during field sampling. However, the conductivity of this layer will be closer to that of the more predominant silty to sandy materials.

The ratio of horizontal hydraulic conductivity (k_h) to vertical hydraulic conductivity (k_v) was estimated based on Stantec's understanding of the placement/desposition of these materials. An isotropic material would have $k_h/k_v = 1$, while deposits of horizontally layered soils, such as alluvial deposits, might have values as high as $k_h/k_v = 100$. Relatively high ratios were assumed for the hydraulically placed ash ($k_h/k_v = 50$), compacted ash ($k_h/k_v = 25$) and native sandy silt (k_h/k_v = 50), reflective of periodic deposition of materials with different gradations. Such deposits typically exhibit much greater permeability in the horizontal direction than in the vertical direction. A relatively modest value (k_h/k_v = 4) was assumed for the dike fill soils, which was reportedly compacted in horizontal lifts.

The SEEP/W program is structured to analyze seepage through saturated and unsaturated soils. To represent the change in hydraulic conductivity due to de-saturation of each soil, SEEP/W implements a model based on two functions – a hydraulic conductivity function and a volumetric water content function. Three parameters are needed to define these two functions: the saturated hydraulic conductivity, saturated water content, and residual water content (water content of air dried soil). Of these three parameters, only the residual water contents were estimated for each soil. The estimated residual water content values in Table 8 are based on Rawls et al. (1982) and Stantec's experience with similar materials at other TVA sites.

5.2.3. Boundary Conditions

Boundary conditions for steady-state seepage at loading conditions 1, 2, and 3 outlined in Section 5.1 are discussed in the following paragraphs. The boundary conditions used for the rapid drawdown analysis are discussed in Section 5.4.3.

Static water levels upstream and downstream of the dike were used in steady-state seepage analyses. The upstream boundary condition values used in these analyses are based on the normal pool elevation, the maximum storage pool elevation, and the estimated maximum surcharge pool elevation. The normal pool elevation for the ash pond and dredge cell was obtained from TVA Allen Fossil Plant personnel and from TVA's 'Free Water Volume Report', respectively. The sluice ditch water elevation was interpolated from water elevations between the ash pond and dredge cell. The maximum storage pool elevation for the ash pond was established from the Deed and Bill of Sale documents for the property where it is stipulated that the ash fill in the pond shall not exceed elevation 233 feet above MSL. The maximum surcharge pool elevation was estimated from the existing top of dike elevations. Based on TVA survey data, the top of dike elevation varies from 237 to 240 feet above MSL. A lower value of 237 was used as the maximum surcharge pool elevation.

On the upstream side (south), the ash pond and the dredge cell are the primary source of water. Water in the sluice ditch is also a contributor that was considered for cross-section A-A'. These boundary conditions were applied at the surface of ash on the upstream side of the dike (see Appendix F for demonstrations). Since Stantec did not have any information about piezometric heads at the pond subsurface, Stantec did not apply any boundary condition on the upstream vertical boundary. Instead, the upstream profile was extended 900 feet from the crest of the dike. Due to the relatively large distance of the upstream profile, Stantec estimates the absence of a vertical boundary condition will have a negligible impact on seepage conditions at the dike. The results of the seep analysis show the model matches closely with the field piezometer data, indicative of the validity of these assumptions.

On the downstream side, the 'Potential Seepage Face' boundary condition is applied on the downstream slope and toe where it is assumed that no flux will be added or removed in these areas. At the end of first iteration, SEEP/W checks the nodes along the Potential Seepage Face for positive pressure indicative of water ponding which is not possible along the face of the slope. Physically, it means water wants to leave through these nodes but the boundary condition prohibits the model from doing so. In subsequent iterations, SEEP/W assigns total head at these nodes equal to elevation head that allows the water to seep out and flow along the slope. The McKellar Lake water elevation was selected from historical river gauge data provided by the USACE, Memphis District. According to the Mississippi River gauge data at the Ensley Engineer Yard (MS 129), dating from August 24, 2008 to December 31, 2009, the water elevation in McKellar Lake fluctuated between 170.1 and 213.9 feet above MSL. A median value of 185 MSL was used as the normal lake elevation.

Table 9. Summary of the Boundary Conditions Modeled in the Seepage Analyses

Upstream Boundary Condition	Value and Location	Downstream Boundary Condition	Value and Location
Normal Pool			
Ash Pond Water Elevation for Normal Storage Pool Level	Total Head – 230 ft. Applied along the upslope at El. 230 ft. downwards, and along the surface of hydraulic ash	Potential Seepage Face	Total Flux – 0 cfs. Applied along the down slope and toe where no standing water is expected
Dredge Cell Water Elevation for Normal Storage Pool Level	Total Head – 232 ft. Applied on the surface of dredged ash	McKellar Lake Water Elevation	Total Head – 185 ft. Applied on the downstream boundary from El. 185 ft. downwards
Sluice Ditch Water Elevation for Normal Storage Pool Level	Total Head – 231 ft. Applied on the surface of the sluiced ash		
Maximum Storage Pool			
Ash Pond Water Elevation for Maximum Storage Pool Level	Total Head – 233 ft. Applied along the upslope at El. 233 ft. downwards, and along the surface of the hydraulic ash	Potential Seepage Face	Total Flux – 0 cfs. Applied along the down slope and toe where no standing water is expected
Dredge Cell Water Elevation for Maximum Storage Pool Level	Total Head – 234 ft. Applied on the surface of dredged ash	McKellar Lake Water Elevation	Total Head – 185 ft. Applied on the downstream boundary from El. 185 ft. downwards
Sluice Ditch Water Elevation for Maximum Storage Pool Level	Total Head – 233 ft. Applied on the surface of the sluiced ash		
Maximum Surcharge Pool			
Ash Pond Water Elevation for Surcharge Pool Level	Total Head – 237 ft. Applied along the upslope at El. 237 ft. downwards, and along the surface of the hydraulic ash	Potential Seepage Face	Total Flux – 0 cfs. Applied along the down slope and toe where no standing water is expected
Dredge Cell Water Elevation for Surcharge Pool Level	Total Head – 237 ft. Applied on the surface of dredged ash	McKellar Lake Water Elevation	Total Head – 185 ft. Applied on the downstream boundary from El. 185 ft. downwards
Sluice Ditch Water Elevation for Surcharge Pool Level	Total Head – 237 ft. Applied on the surface of the sluiced ash		

5.2.4. Seepage Analysis Results

Steady-state seepage analyses were performed for cross-sections A – A' and B – B'. The material properties and boundary conditions were varied in these analysis until a reasonable match was obtained between the model and field data. Specifically, the saturated hydraulic conductivity of the foundation sandy silt to silty sand was varied, as was the k_h/k_v ratio for all materials. After several iterations, the soil parameters were within the expected range.

Results of the SEEP/W analyses of the two cross-sections are presented in Appendix F. These plots show the finite element mesh, material horizons, and boundary conditions used in each analysis. The results are shown in contour plots of total head, pore water pressure, and vertical gradients of flow vectors. The vertical gradients were used to calculate maximum exit gradients and the potential for soil piping (Section 5.2.4.3). For the slope stability analyses (Section 5.3), the pore water pressures along a trial slip surfaces were determined by interpolation between the nodal pore pressures predicted by the SEEP/W model.

The piezometric surface (line of zero pore water pressure) is shown on the plots in Appendix F. In SEEP/W, the location of the piezometric surface is found by interpolation between positive pore water pressures of saturated soil and negative pore pressures or suction in the unsaturated soil zone above. In the SEEP/W formulation, seepage flows are tracked in both the saturated and unsaturated zones. Hence, the top flow line in the SEEP/W results will be above the phreatic line. In more traditional seepage analyses, where unsaturated flows are ignored, the top flow line and the piezometric surface coincide. Hence, while the more complete unsaturated flow formulation in SEEP/W gives a reasonable prediction about the location and shape of the piezometric surface, the results are often different than what would be obtained with a solution that considers saturated flow only. Furthermore, the pore water pressures in the stability analysis are determined from the full finite element solution, and not just from the depth below the piezometric surface.

5.2.4.1. Comparison with Field Data

Results from the SEEP/W model were compared to the piezometer readings installed in both northern and eastern perimeter dikes. Data from 10 piezometers at five modeled cross-sections were used in this evaluation (two cross-sections on the northern perimeter dike and three on the eastern perimeter dike). Nodes were placed in the model at the same location and elevation as the piezometer tip was installed in the field. The total head predicted at the node was compared to the corresponding piezometer reading.

As previously discussed, twelve sets of piezometer data were collected in the past seven months. Figure 4 shows a comparison between the maximum and minimum piezometer readings over the past seven months and the SEEP/W predicted total head at these piezometer locations.

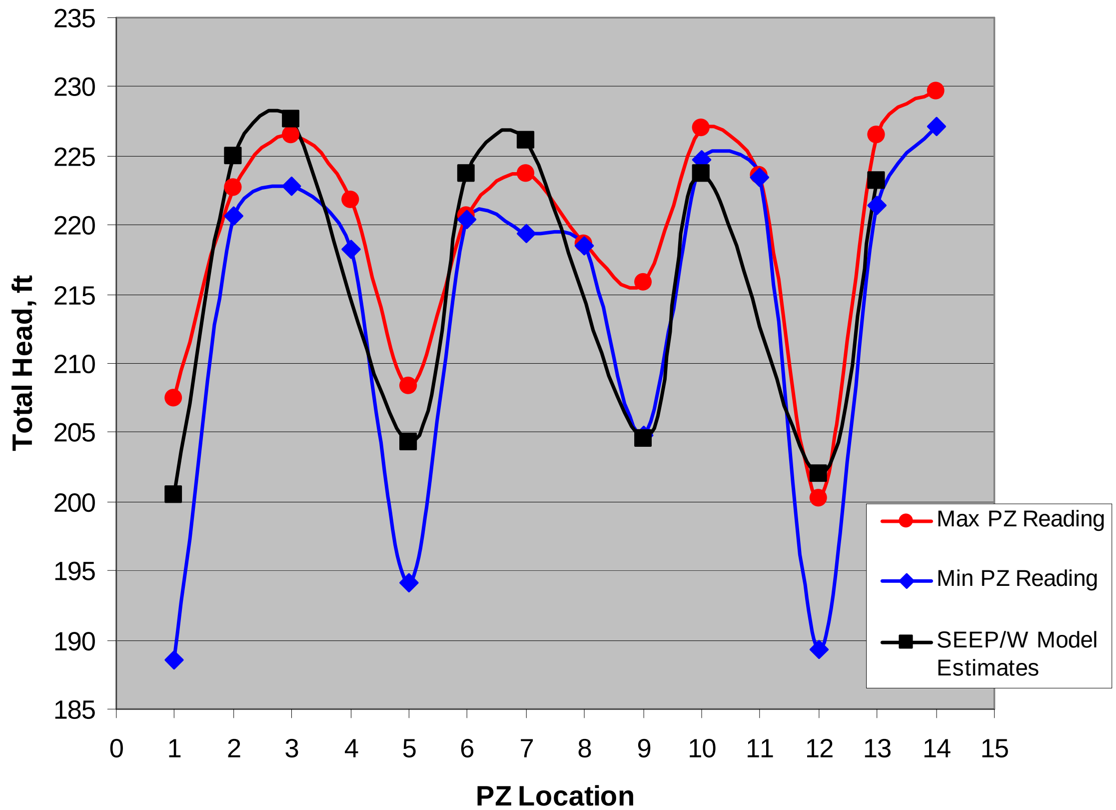


Figure 4. Comparison between the field piezometer readings and total head predicted by the SEEP/W model

The difference between field measurements of total head and the model predictions varies from 0.2 feet at PZ-9 to 12.8 feet at PZ-12. In general, the model matches closely with the piezometers installed within the dike and varies with piezometers installed relatively deep in the foundation soils. This is due to the fact that the piezometers within the dike primarily reflect fluctuations in the ash pond and stilling pond and the deeper piezometers reflect fluctuations in McKellar Lake. In the past seven months, the pond water level fluctuated roughly between about elevations 229 feet and 230 feet; however, the lake water fluctuated between about elevations 177 feet and 205 feet. The model assumes a steady-state condition upstream and downstream and could be tailored to closely match a particular set of piezometer readings. The degree of deviation between the model prediction and the actual piezometer reading is a factor of seasonal fluctuations of groundwater table and river levels, precipitation, material properties, sluice discharge volume, and accuracy of the field data.

The results from the seepage model were also compared with groundwater observed in the borings at the time of drilling operations. Figure 5 shows the comparison between SEEP/W predicted piezometric surface elevation and groundwater readings (at the time of drilling) at seven (7) boring locations at these cross-sections. It should be noted that the observed water levels are below the predicted piezometric surface. This may result from having insufficient time for the borehole water levels to reach equilibrium, as well as intercepting subsurface strata with varying piezometric levels.

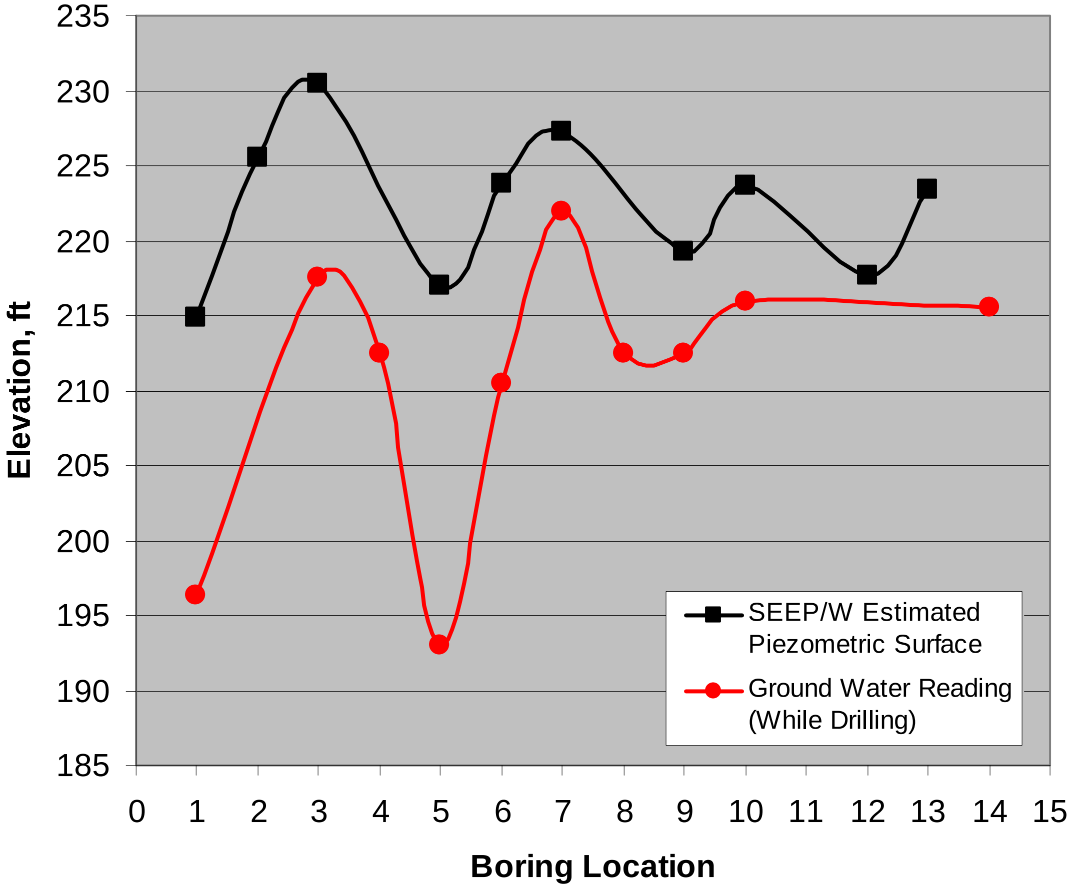


Figure 5. Comparison between the borehole water levels and the piezometric surface predicted by the SEEP/W Model

5.2.4.2. Critical Exit Gradients

Seepage forces, resulting from hydrodynamic drag on the soil particles, can destabilize earth structures. Seepage water exiting at the downstream slope or toe can lead to the initiation of soil erosion and piping, which has caused numerous dam failures in the past. Hydraulic gradients, computed at points where seepage exits onto the ground surface, can be evaluated to understand the potential severity of this problem. The factor of safety with respect to soil piping (FS_{piping}) is defined as:

$$FS_{piping} = \frac{i_{crit}}{i} \qquad \textbf{Eqn. 1}$$

Where:

i = the vertical gradient of a flow vector at exit
i_{crit} = critical gradient, a material property of the soil

The critical gradient (i_{crit}) is related to the submerged unit weight of the soil and can be computed as:

$$i_{crit} = \frac{\gamma_{sub}}{\gamma_w} = \frac{G_s - 1}{1 + e} \quad \textbf{Eqn. 2}$$

Where:

γ_{sub}	=	the submerged unit weight of the soil
γ_w	=	is the unit weight of water,
G_s	=	the specific gravity of the soil particles
e	=	the void ratio.

For nearly all soils, the critical gradient usually varies between 0.6 and 1.4, with a typical value near 1.0.

Where FS_{piping} = 1, the effective stress is zero and the near-surface soils are subject to piping or heaving. Note that Eqn. 1 is valid only for vertical seepage that exits to the ground surface. If the phreatic surface is buried, then the FS_{piping} will be greater than 1.0 even when $i = i_{crit}$.

5.2.4.3. Seepage Gradients

Contour plots of the hydraulic gradients computed from the SEEP/W solutions are shown for each modeled cross-section in Appendix F. Large gradients and significant seepage can be seen at various locations within the cross-sections, but the concern is for areas where these gradients can initiate 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. Away from the ground surface, the potential movement of material due to seepage forces is arrested by the adjacent soil. Hence, the evaluation of seepage gradients within the dike is focused on areas near the ground surface on the downstream side of the dike.

In order to locate areas of maximum seepage pressure, contour plots of vertical gradient (i) were generated using a SEEP/W utility function. When turned on, this function can plot contours of maximum vertical gradient within a cross-section. Areas with higher vertical gradient will be shown in gradually darker colors (green to red) in SEEP/W generated models. Results of these models with vertical gradients are attached in Appendix F. The maximum vertical gradient is usually located at the downstream slope toe where the piezometric surface is near the ground surface. Within a region of maximum vertical gradient, the element with highest vertical gradient, usually a surface element at the toe of the slope, was determined using another SEEP/W utility function. The vertical gradient is calculated from the difference in total head (Δh) between two nodes of the element divided by the distance between these two nodes (ℓ). The critical gradient (i_{crit}) is determined from the material properties using Equation 2. The factor of safety against piping is then calculated using Equation 1. The factors of safety against piping were computed based on the exit gradients from the SEEP/W model and critical gradients determined from the soil properties are summarized in Table 10.

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

Cross-Section	Vertical Gradient (i) at Critical Exit Point*	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}	Pool Elevation
A – A’	Negative, Downward Flow Vector	Downstream Slope Toe	Foundation Sandy Silt	0.98	> 5.00	Normal Pool
	Negative, Downward Flow Vector	Downstream Slope Toe	Foundation Sandy Silt	0.98	> 5.00	Maximum Storage Pool
	0.09	Downstream Slope Toe	Foundation Sandy Silt	0.98	10.88	Surcharge Pool
B – B’	Negative, Downward Flow Vector	Downstream Slope Toe	Fill - Sandy Silt	0.98	> 5.00	Normal Pool
	Negative, Downward Flow Vector	Downstream Slope Toe	Fill - Sandy Silt	0.98	> 5.00	Maximum Storage Pool
	0.22	Downstream Slope Toe	Fill - Sandy Silt	0.98	4.45	Surcharge Pool

*Gradient of a flow vector is considered negative when the flow is downward

According to the USACE design criteria in EM 1110-2-1901, the factor of safety against piping should be at least 3.0. Hence, cross-sections A–A’ and B-B’ meet the design factor safety for piping.

5.3. Slope Stability Analyses

The stability of the dike was evaluated using static limit equilibrium methods as implemented in the SLOPE/W module. With SLOPE/W, the distribution of pore water pressures within the earth mass is mapped directly from corresponding SEEP/W analysis. The unit weight and shear strength properties used in the stability analyses are discussed in Section 5.3.2 of this report.

5.3.1. Limit Equilibrium Methods in SLOPE/W

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

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

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 strength parameters (cohesion and friction angle), as a function of the total or effective normal stress.

Spencer's solution procedure (1967), which satisfies both moment and force equilibrium, 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 circular and noncircular potential failure surfaces can be evaluated. The trial slip surfaces were subsequently optimized to find critical slip surface and corresponding critical factor of safety. Optimization was performed using an optimization routine in SLOPE/W that incrementally alters a portion of the slip surface, usually within a certain soil horizon for circular failure pattern, to optimize the solution generating non-circular, curved failure surface. The results of the slope stability analyses discussed in Section 5.3.3, and depicted graphically on the cross-sections in Appendix A, represent factors of safety computed from the optimized, circular slip surface routine.

5.3.2. Strength Parameter Selection

The northern perimeter dike was originally constructed as a flood control levee in the early 1960's. The levee geometry was modified in the late 1970's to accomodate the ash pond and stilling pond impundments and has been in its current cross-sectional geometry (slopes and crest elevation) for about 30 years. Hence, excess pore pressures generated in the underlying soil during construction have had sufficient time to dissipate and steady state seepage conditions have developed within the dike. Additionally, the current analyses will focus only on static conditions (no earthquake or other dynamic loads). For these conditions, only soil unit weights and drained strength parameters (c' and Φ') are needed.

Drained shear strength (S_d) of the soil can be determined from effective stress strength parameters using the following equations:

$$S_d = c' + \sigma' \tan \phi' \qquad \textbf{Eqn. 4}$$

$$\sigma' = \sigma - u \qquad \textbf{Eqn. 5}$$

Where:

c'	=	the effective cohesion
ϕ'	=	the effective angle of internal friction
σ'	=	the effective stress
σ	=	the total stress and
u	=	the pore water pressure

Uncemented (granular) soils exhibit no strength at σ'=0, corresponding to c' = 0. In the case of unsaturated fine grained sands, suction results in apparent cohesion, but this component of strength is lost upon saturation. Over a large pressure range, most granular soils have a curved strength envelope. Fitting a straight line through segments of a curved failure envelope can result in c' > 0, but the values are applicable only over the specified range of effective stress.

For normally consolidated, saturated clays, the Mohr-Coulomb failure envelope exhibits c' = 0. At effective stresses below the pre-consolidation pressure, overconsolidated clays have a curved failure envelope that can be represented with a straight line having c' > 0. ` overconsolidated clays in the field are often fissured and the in situ c' is significantly smaller than values determined from testing of small samples in the laboratory. To avoid progressive failures in overconsolidated, stiff fissured clays, remolded soil samples are recommended for testing; this generally results in "fully softened" strengths with c' = 0. Thus, in the absence of particle cementation/bonding, long term (drained) shearing resistance related to c’ > 0 is considered unreliable. In routine geotechnical design practice, values of c’ = 0 are usually assumed for both normally and overconsolidated saturated clays, and for uncemented granular soils. Detailed testing and characterization of a particular soil, coupled with careful application of the fitted strength envelopes, are necessary where values of c’ are used in a stability evaluation. For these analyses, c’ = 0 were used for all soils.

When surficial soils have c’ = 0, shallow sliding parallel to the ground surface will be the critical failure mechanism (lowest factor of safety) found in a slope stability analysis. However, apparent cohesion in unsaturated soils and/or weak cementation is often sufficient to prevent shallow sliding. This mode of failure, which might require periodic maintenance, is considered to be less critical in a stability analysis. For deep seated failures, the assumption of c’ = 0 is routinely used for all soils.

The soil parameters used for the dike and existing foundation materials were derived using both current and historical laboratory test data (consolidated undrained triaxial tests, direct shear tests, standard penetration test data, and classification test data) and Stantec’s experience with these materials in similar applications.

Strength parameters for hydraulic and compacted ash are based on test results from AECOM and Law Engineering, Inc., performed for the TVA Fossil Plant at Kingston, Tennessee. The parameters for the dike fill soils (sandy silt to silty sand) are based on laboratory testing performed as part of this study as well as TVA test results (consolidated-undrained triaxial test, consolidated-drained triaxial tests, and direct shear tests) performed on near surface on-site soils prior to the construction of the eastern perimeter dike. Stantec’s borings and classification test data on dike soils confirm materials types reported in the TVA memorandum.

Stantec performed five consolidated undrained triaxial tests on the dike material and on foundation soils and the results are summarized in Table 5 of this report. To select the representative strengths for each horizon, the methodology outlined in the US Army Corps of Engineers Engineer Manual EM 1110-2-1902 was used as a guide. Failure stresses measured in the laboratory tests were expressed in terms of "p’-q" values, $[p' = 0.5(\sigma_1' + \sigma_3'), q = 0.5(\sigma_1' - \sigma_3')]$, then envelopes were conservatively fit through the data. In general, the selected strength parameters represent a failure envelope where about two-thirds of the test data falls above the envelope. Strength parameter selection charts using “p’-q” plots are included in Appendix G.

The foundation sandy silt to silty sand, generally encountered at elevation 180 feet or below, typically exhibited a medium stiff to very stiff consistency or loose to medium density (N_{60}-values in the range of 5 to 29 blows per foot) with high moisture contents. The strength and unit weight parameters for these soil horizons were determined from published correlations between SP test blow counts (N_{60}), relative density, and effective friction angle Φ’. However, as discussed in Section 4.1 of this report, much of the SP testing was performed using an automatic hammer and were corrected prior to applying them in correlations with other soil index properties. The correction for hammer efficiency is a direct ratio of relative efficiencies as follows:

$$N_{60} = N_{80}\left(\frac{80}{60}\right) \quad \textbf{Eqn. 6}$$

Stantec also corrected standardized N_{60} values resulting from SP testing within these materials for the effect of overburden pressure prior to using the data in conjunction with correlations for non-cohesive soil parameters. The N_{60} values were standardized to vertical effective overburden stresses of 2,000 pounds per-square foot. This calculation requires an effective unit weight for each soil horizon multiplied by the depth of the soil horizon. The relationship between the correction factor, C_N, and the effective overburden stress, σ', was based on a relationship proposed by Liao and Whitman as referenced in Seed and Harder [1990]:

$$C_N = \frac{1}{\sqrt{\sigma'}} \quad \textbf{Eqn. 7}$$

Where:

C_N = correction factor for overburden stress
σ' = vertical effective overburden stress (tsf)

Consequently, the standardized corrected N-value, $(N')_{60}$ is equal to:

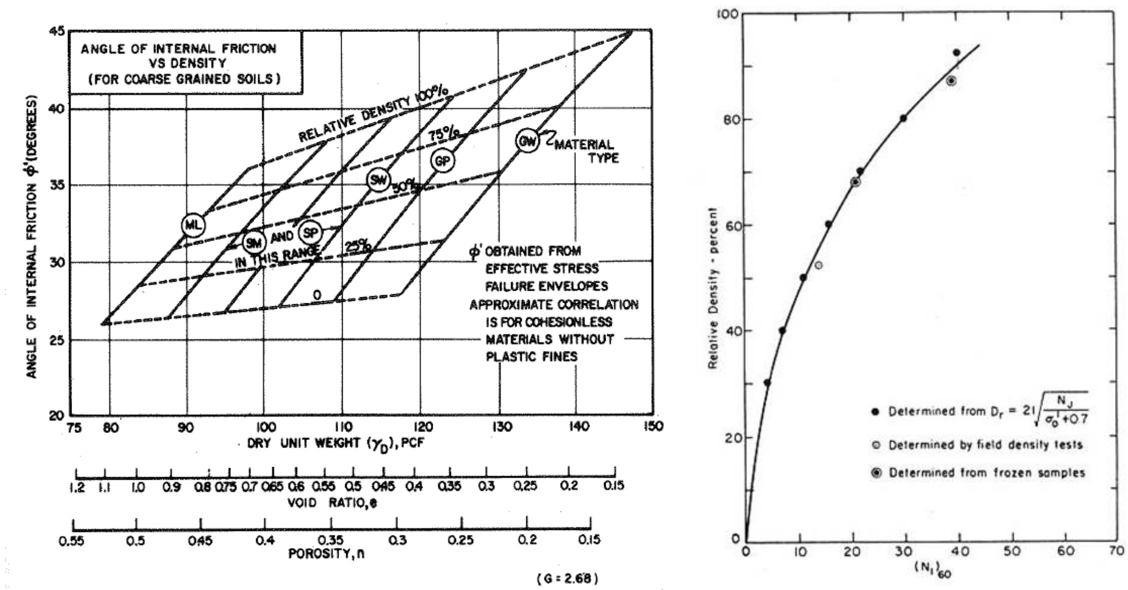
$$(N')_{60} = C_N N_{60} \quad \textbf{Eqn. 8}$$

Where:

C_N = correction factor for overburden stress
$(N')_{60}$ = standardized N-value

The N-values presented on the graphical boring logs in Appendix A and typed boring logs in Appendix B are the raw data and do not reflect corrections for hammer efficiency or overburden stress.

The N'_{60} values were used to obtain relative densities based on relationships developed by Tokimatsu and Seed (1988) as shown in Figure 6 below. NAVFAC (1982) presents a relationship using relative density and specific soil types to correlate angle of internal friction, unit weight, and void ratio as shown in Figure 6 below. Soil classifications for the correlations are based on laboratory testing results and visual classifications performed by the on-site geotechnical engineer or geologist during the drilling process. Once the relationships for the angle of internal friction, unit weight, and void ratio were established, the in-situ unit weight was calculated based upon the natural moisture content.



From NAVFAC (1982) From Tokimatsu and Seed (1988)

Figure 6. Charts used to Correlate N_{60} to ϕ'

Typical N_{60} values for the sandy silt to silty sand horizon are in the range of 5 to 29 blows per foot (bpf). As such, the unit weight of this soil horizon was estimated to vary between 105 to 125 pcf with a drained friction angle of 27º to 33º. Representative values of a unit weight of 115 pcf and an effective friction angle value of 28º were selected for these strata.

The soil parameters for the dike and generalized foundation soil horizons modeled in the slope stability analyses are summarized in Table 11 and shown on the cross-sections in Appendix A.

Table 11. Selected Strength parameters for Stability Analysis

Soil Horizon	Saturated Unit Weight (pcf)	Effective Stress Strength Parameters	
		C' (psf)	ϕ' (degrees)
Dike Fill – Sandy Silt, Silty Sand	125	0	31
Hydraulically Placed Ash	105	0	25
Compacted Ash – Dredge Cell	110	0	30
Rip-Rap	140	0	38
Foundation Sandy Silt	125	0	30
Foundation Lean and Fat Clay	115	0	26
Sandy Silt to Silty Sand	115	0	28

5.3.3. Slope Stability Results

Using the strength parameters listed in Table 11, in conjunction with the results of the seepage analyses, the existing dike slopes were analyzed at the two referenced cross-sections of the northern perimeter dike. The failure surfaces were generated using the "Grid and Radius" method where a wide variation of trial slip surfaces can be generated with a defined grid of possible circle centers and a defined range of radii.

Where the surface of the slope is composed of cohesionless (c' = 0) materials, an infinite slope failure (shallow sliding parallel to the surface) will be critical. While solutions were obtained for this case, there is less concern for this potential failure mechanism. 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 and can be repaired. To force the search routine to evaluate deeper failure mechanisms, the surfaces were generated using a minimum depth of 10 feet for the slip surface.

The cross-sections in Appendix A depict the modeled shear-strength parameters, predicted failure surfaces, and associated factors of safety. The results of the analyses are included in Appendix F and summarized in Table 12 below.

Table 12. Summary of Computed Factors of Safety for Slope Stability

Cross-Section	Exterior Slope Global Failure	Exterior Slope Maintenance Failure	Interior Slope Failure	Pool Elevation
A – A'	1.97	2.17	2.60	Normal Pool
	1.85	1.80	2.43	Max. Storage Pool
	1.62	1.44	3.43	Max. Surcharge Pool
B – B'	2.17	2.30	2.44	Normal Pool
	1.93	1.95	2.71	Max. Storage Pool
	1.64	1.65	3.26	Max. Surcharge Pool

The term 'Global Failure' is used in the table above to refer to deep seated failure circle that would threaten partial or total loss of the pond impoundment. The term 'Maintenance Failure' refers to relatively shallow slides that while not detrimental to the overall stability of the dike, could progress into failures that could threaten the pond if not repaired. The interior slope failures are generally maintenance type failures.

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, instead merely indicate that the dam shall be "stable". Based on discussions with TVA and to be in accordance with current prevailing practices, a minimum factor of safety of 1.5 was established for long term conditions using the guidelines presented in USACE Manual EM 1110-2-1902 "Slope Stability".

The results of our stability analyses show that north dike slopes generally meet the established criteria for a long-term factor of safety of 1.5. The lowest factor of safety of 1.44 was calculated for surcharge pool elevation on the exterior slope (north) of cross-section A-A' and is associated with a maintenance type not global failure. The referenced USACE manual recommends a minimum factor of safety of 1.4 for maximum surcharge pool events. As such, Stantec does not recommend implementing measures to increase the factor of safety against shallow, maintenance type failures for a maximum surcharge pool event.

5.4. Rapid Drawdown Analyses

Rapid drawdown analyses were performed for the exterior slopes at cross sections A-A' and B-B'. The exterior slope may become saturated during a prolonged high flood event in McKellar Lake. If subsequently the lake water recedes faster than the pore water can escape, the excess pore water pressure can reduce the stability of the slope. For analysis purposes, it is assumed that the drawdown is rapid and no drainage occurs in the dike materials.

The USACE design manual EM 1110-2-1902 "Slope Stability" describes two rapid drawdown analysis procedures. The first method was developed by the Corps of Engineers and referred to as "US Army Corps of Engineers', 1970" procedure. The second method was developed by Lowe and Karafiath (1960), and modified by Wright and Duncan (1987), and by Duncan, Wright, and Wong (1990). The second method is usually referred to as "Improved Method for Rapid Drawdown Analysis" or "Three-Stage Rapid Drawdown Analysis". The three-stage method simplified the analysis procedure and accounts more accurately for shear strength in zones where drained strength is lower than undrained strength. The second method is recommended by the USACE.

Stantec performed rapid drawdown analyses using both SEEP/W and UTEXAS 4 software. Stantec initially performed a rapid drawdown analyses using SLOPE/W. However, it was found that, for some instances, the SLOPE/W calculated rapid drawdown factor of safety was higher than the long-term, steady state factor safety for the same cross-section, which is not correct. This is a limitation associated with SLOPE/W. In the SLOPE/W specified three-stage method, the user defines two piezometric lines - for high flood and drawdown water elevations. The program calculates pore water pressure assuming hydrostatic conditions. Therefore, on the downstream slope, the calculated hydrostatic pressure would be lower than corresponding seepage pressure. And on the upstream side, the calculated hydrostatic pressure would be higher than the seepage pressure. In order to circumvent these limitations, Stantec performed the three-stage analysis using UTEXAS where seepage pressure calculated by SEEP/W was imported to UTEXAS at two stages, for before and after drawdown conditions.

For each cross section, Stantec performed seepage analyses using SEEP/W for high flood conditions as well as the drawdown condition. The pore water pressure calculated by SEEP/W at various nodes was saved as data files and subsequently incorporated into the UTEXAS input files. Among other things, UTEXAS requires user to define cross-section geometry, material properties and pore water pressure. UTEXAS imports nodal coordinates and corresponding pore pressures generated by SEEP/W and interpolates between the nodes to calculate pore pressure for the entire cross-section. Subsequent steps calculate the factor of safety using Spencer's method for circular failure. The three-stage rapid drawdown analyses method is described in the following report section.

5.4.1. Three-Stage Rapid Drawdown Analysis Method

The three-stages of this analysis method are summarized as follows:

1. The first stage involves the stability analysis of the dike before drawdown, at the high flood elevation. Pore water pressure in the dike and foundation materials are calculated using steady-state seepage condition. Both effective normal stress (σ_c') and shear stress at consolidation (τ_c) are calculated along the potential failure

surface to determine the undrained shear strength for materials that do not drain freely. These stresses represent the anisotropic consolidation stresses prior to drawdown, and are used to calculate the undrained shear strength for soils without free drainage. The effective normal stress is calculated by dividing the total normal force (N) on the base of each slice by the length of the base (Δl) and subtracting the pore water pressure, as shown in Equation 9.

$$\sigma_c' = \frac{N}{\Delta l} - u \qquad \textbf{Eqn. 9}$$

The shear stress at consolidation τ_c is calculated by dividing the shear force (S) on the base of each slice by the length of the base, as shown in equation 10.

$$\tau_c = \frac{S}{\Delta l} \qquad \textbf{Eqn. 10}$$

2. The second stage involves the stability analysis after rapid drawdown. The pore water pressures in the dike and foundation materials are obtained by the steady-state condition after rapid drawdown. Undrained shear strengths are estimated based on the consolidation stresses calculated in the first stage and are used to compute the factor of safety. The effective normal stress obtained from stage two together with the effective strength parameters are used to compute the drained (effective) strength along the slip surface.

   In the second stage of the computations, UTEXAS4 uses an interpolation scheme to determine the undrained shear strength of anisotropically consolidated soils. The interpolation is based on two (2) limiting strength envelopes, representing a fully drained strength and the undrained strength of an isotropically consolidated soil sample. Both of these input envelopes represent a relationship between the shear strength and the effective normal consolidation stress on the failure plane. The envelopes correspond to effective principal stress ratios (K_c=σ'_1/σ'_3) at consolidation of K_f and 1, respectively, where K_f is equal to (1+ sinϕ')/(1- sinϕ') at c' = 0. These envelopes are defined by an intercept (d_{Kc}) and a slope (ψ_{Kc}). The envelope corresponding to K_c=K_f is identical to the conventional effective stress shear strength envelope. Thus, its intercept ($d_{Kc=Kf}$) is the same as the effective stress cohesion value (c') and its slope ($\psi_{Kc=kf}$) is the same as the effective stress friction angle (ϕ'). The K_c=1 envelope can be derived from the total stress cohesion value (c) and the total stress friction angle (ϕ), as determined from conventional CU triaxial compression tests. When c and ϕ are obtained from a line drawn tangent to the total stress Mohr's circles, the relationships among the intercept ($d_{Kc=1}$) and slope ($\psi_{Kc=1}$) of the K_c=1 envelope, the total stress c and ϕ, and the effective stress ϕ' are:

$$d_{k_c=1} = c\left(\frac{\cos\phi\cos\phi'}{1-\sin\phi}\right) \qquad \textbf{Eqn. 11}$$

$$\psi_{k_c=1} = \tan^{-1}\left(\frac{\sin\phi\cos\phi'}{1-\sin\phi}\right)$$ **Eqn. 12**

UTEXAS4 requires user imputs for c , ϕ, $d_{Kc=1}$, $\psi_{Kc=1}$ values for each soil horizon.

3. The third stage of computation compares the drained and undrained strengths at each slice base along the potential failure surface. Steady-state pore water pressures corresponding to the low water level (after drawdown) are used to calculate the drained strength in the third stage calculation. The undrained strength is estimated in the second stage. The smaller of the drained and undrained strengths is chosen to compute the final factor of safety.

5.4.2. Material Properties

Selection of the effective stress parameters are previously discussed in Section 5.3.2 of this report. The total stress parameters are selected using similar methodology. Properties for the dike fill soils and native sandy silt to silty sand were obtained from Stantec's laboratory test data (STN-3) and from TVA memorandum. Properties for foundation lean and fat clays were obtained from Stantec's laboratory CU test data. Properties of hydraulically placed ash were obtained from AECOM and LAW test reports. The selected material properties for rapid drawdown analysis are shown in Table 13.

Table 13. Selected Strength Parameters for Rapid Drawdown Analysis

Soil Horizon	Saturated Unit Weight (pcf)	Effective Stress Parameters		Total Stress Parameters		Derived Strength Parameters	
		$d_{Kc=Kf}$ =c' (psf)	$\psi_{Kc=Kf}$ =ϕ' (degree)	c (psf)	ϕ (degree)	$d_{Kc=1}$ (psf)	$\psi_{Kc=1}$ (degree)
Dike Fill – Sandy Silt, Silty Sand	125	0	31	200	22	254.16	27.18
Hydraulically Placed Ash	105	0	25	0	10	0	10.78
Compacted Ash – Dredged Cell	110	0	30	0	30	0	30
Rip-Rap	140	0	38	0	38	0	38
Foundation Sandy Silt	125	0	30	200	22	256.79	27.41
Foundation Lean and Fat Clay	115	0	26	400	12	443.97	13.27
Sandy Silt to Silty Sand	115	0	28	200	12	218.07	13.05

5.4.3. Boundary Conditions

Boundary conditions were required for steady-state seepage analyses performed as part of the rapid drawdown analysis. Two separate seepage analyses were performed – for the design flood level and for the drawdown level at McKellar Lake. For each of these downstream water levels, the upstream water level was assumed to be at maximum storage pool elevation. This is based on the assumption that the discharge volume from the stilling pond would be reduced when the water level in McKellar Lake is at high flood elevation. Water levels in the dredge cell and sluice ditch were extrapolated from the ash pond water elevation. The design flood elevation for the levee was obtained from USACE, Memphis District. The boundary conditions are shown in Table 14. Location of these boundary conditions are shown on the result sheets included in Appendix C.

Table 14. Boundary Conditions for Rapid Drawdown Analysis

Upstream Boundary Condition	Value and Location	Downstream Boundary Condition	Value and Location
Ash Pond Water Elevation for Maximum Storage Pool Elevation	Total Head – 233 ft. Applied along the upslope at El. 233 downwards, and along the surface of the hydraulic ash	Potential Seepage Face	Total Flux – 0 cfs. Applied along the down slope and toe where no standing water is expected
Dredge Cell Water Elevation for Maximum Storage Pool Level	Total Head – 234 ft. Applied on the surface of Dredge Cell	McKellar Lake Design Flood Level	Total Head – 232.5 ft. Applied on the downstream profile boundary from El. 232.5 downwards.
Sluice Ditch Water Elevation for Maximum Storage Pool Level	Total Head – 233 ft. Applied on the surface of the sluice ditch	McKellar Lake Drawdown Level	Total Head – 185 ft. Applied on the downstream profile boundary from El. 185 downwards.

As mentioned earlier, the maximum storage pool elevation for the ash pond was established from the 'Deed and Bill of Sale' documents for the property. The design flood elevation is a 500-year flood event.

5.4.4. Analysis Results

Using the strength parameters listed in Table 13, in conjunction with the results of the seepage analyses, the existing northern perimeter dike geometry was analyzed at cross-sections A-A' and B-B'. The results are summarized in Table 15 below. The calculated factors of safety along with the soil parameters are shown on the output plots included in Appendix F.

Table 15. Computed Factors of Safety for Rapid Drawdown

Cross-Section	Exterior Slope Global Failure
Section A-A’	1.63
Section B-B’	1.74

According to USACE Manual EM 1110-2-1902 “Slope Stability”, the required minimum factor of safety for rapid drawdown condition is between 1.1 and 1.3. Based on Stantec’s analysis, the downstream slope meets this criterion.

6. Conclusions

The conclusions and recommendations that follow are based upon Stantec’s understanding of the facility as outlined herein. This understanding of the facility was 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 engineering analyses.

Seepage analyses were performed to identify conditions where piping (erosion) might develop on the downstream slope of the dike due to seepage forces. The results of seepage analyses did not identify any critical areas of potential piping. The calculated factors of safety against piping for various loading conditions vary from 4.45 to more than 5.00. Therefore, the analyzed cross-sections meet the USACE (EM 1110-2-1901) design criteria of 3.0 or greater.

The results of static, long-term slope stability analyses indicate the factors of safety against sliding primarily vary from 1.62 to 2.71 for the analyzed loading conditions (see Table 12), meeting the USACE criteria of 1.5. However, the analyses indicate the factor of safety for a shallow, maintenance type failure on the exterior slope at cross-section A – A’ is 1.44 for the maximum surcharge pool loading condition. USACE Manual EM 111-2-1902, “Slope Stability”, recommends a minmum fact or safety of 1.4 for maximum surcharge pool events. As such, Stantec does not recommend implementing measures to increase the factor of safety against shallow, maintenance type failures for a maximum surcharge pool event.

The results of the rapid drawdown analyses at cross-sections A-A’ and B-B’ indicate the exterior slope of the northern perimeter dike exhibits a factor of safety between 1.6 and 1.7 for the design flood event elevation of 232.5 feet. According to USACE Engineering Manual EM 1110-2-1902, the required minimum factor of safety for rapid drawdown condition is between 1.1 and 1.3. Based on Stantec’s analysis, the northern perimeter dike meets this criterion.

Based on historical documents, Stantec understands that TVA constructed a 3-foot impervious layer on the interior (south) slope of the USACE levee/northern perimeter dike to facilitate the impoundment of the East Active Ash Pond and East Stilling Pond. The April 03, 2009 slough on the interior slope of the dike apparently resulted from previous dredging operations excavating portions of this impervious layer. Subsequent to the slough, the USACE, Memphis District requested TVA to investigate the potential for past dredging operations impacting other portions of the dike, develop dredging guidelines in order to reduce the potential for dredging into the dike cross-sections, and evaluate the stability of the dike/levee with the impounded ash pond pool. Stantec's field exploration also identified an area adjacent to the sluice ditch at cross section A-A' where previous excavation activities appear to have extended into the dike cross-section. However, the results of the seepage and slope stability analyses indicate the factors of safety for piping and global stability failure exceed the Corps recommended values of 3.0 and 1.5, respectively. Therefore, based on the results of these analyses and visual observations, Stantec concludes that the apparent excavations into the levee/dike cross-section have not reduced the factors of safety below the minimum recommended values or significantly altered the seepage conditions in the dike.

The root cause analysis of the December 22, 2008 dredge cell pond failure at TVA's Kingston Fossil Plant identified the four following destabilizing factors contributing to the breach of the containment dike and failure of the facility. Stantec's scope of work included a review the historic documentation, results of the drilling and laboratory testing program, and current dike configuration with respect to these contributing factors to asses the potential for these conditions to exist at the eastern perimeter dike.

- Weak Silt/Ash Foundation – Not present, the levee was constructed prior to the impoundment of the east ash pond. The slack-water environment present at the Kingston plant that allowed the very fine ash particles to settle out of suspension beneath the perimeter dike alignment was not present at this site. Additionally, the subsurface exploration and laboratory testing program did not indicate the presence of such materials at the dike/native material interface.

- Hydraulically Placed, Loose, Wet Ash – Not present, the levee was constructed prior to the impoundment of the east ash pond. Ash was not encountered beneath the dike in any of the borings drilled as part of this exploration.

- Increased Loads Due to Embankment/Fill Height – Not applicable for the dike section north of the ash pond and stilling pond since sluiced ash from the ash pond is periodically dredged into the dredge cell. This scenario is possible at cross-section A-A', located at the northeast corner of the dredge cell. However, based on site topography and visual observations, ash from the dredge cell is usually stacked on the west, between the dredge cell and coal yard. Therefore, the stacked ash does not have much impact at the analyzed cross-section.

- Embankment Geometry Setback – This factor is not applicable because the northern perimeter dike is a single tier.

7. Recommendations

Stantec understands TVA is planning to convert the Allen plant systems to dry handling of fly ash, which will significantly reduce the fly ash combustion storage role for the ash pond and stilling pond. Stantec anticipates the ash pond and stilling pond configuration will be modified in association with the conversion and reduced storage needs. The assessment of the northern perimeter dike and associated recommendations are based on this understanding of the future plant operations.

The current configuration of the northern perimeter dike/USACE levee exhibits acceptable factors of safety for piping and slope stability under the loading conditions discussed herein. As such, Stantec recommends TVA implement their routine dam safety program to manage risks associated with operating the ash pond and stilling pond impoundments until the facility is converted to dry storage and/or closed. The monitoring and inspection program should include water level measurements in the piezometers on a monthly basis. Additionally, TVA should implement dredging guidelines to reduce the potential for future dredging operations excavating portions of the northern perimeter dike/USACE levee including the erection and/or installation of visible markers for reference.

8. Limitations of Study

The scope of this evaluation was limited to consider only the potential risks to the northern perimeter dike from excessive seepage and slope instability. This assessment did not consider potential failure modes related to spillway capacity and overtopping, seepage along penetrations through the embankment (including the buried spillway pipes), vegetation on the dike face, performance of the internal divider dike, or other possible mechanisms.

The stability of the dike during a potential earthquake was not analyzed. It should be noted, the seismic risk at this site (likelihood of experiencing a large magnitude earthquake) is high because of its proximity to the New Madrid Seismic Zone.

9. Closure

These conclusions and recommendations are based on data and subsurface conditions from the borings advanced during this investigation using that degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. No warranties can be made regarding the continuity of conditions between borings.

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.

It should be noted that construction records indicating the methods used to construct the northern perimeter dike, as-built dike configurations, etc. were not available for review. As a result, consideration should be given to some of the generalizations made in this report with regards to dike construction and geometry prior to using this data in future evaluations.

10. References

The following is a list of documents referenced in this report and/or used to evaluate the stability of the eastern perimeter dike:

<u>Slope Stability</u>, Department of the Army, US Army Corps of Engineers, Engineering Manual EM 1110-2-1902, October 31, 2003.

<u>Geotechnical Investigations</u>, Department of the Army, US Army Corps of Engineers, Engineering Manual EM 1110-1-1804, January 1, 2001.

<u>Seepage Analysis and Control for Dams CH 1</u>, Department of the Army, US Army Corps of Engineers, Engineering Manual EM 1110-1-1901, April 30, 1993.

Soil Mechanic Design Manual 7.1, Department of the Navy – Navy Facilities Engineering Command, May 1982.

Transactions of the American Society of Agricultural Engineers, Rawls, W. J., Brakensiek, D. L., and Saxton, K. E. (1982), Estimation of Soil Water Properties, Vol. 25, No. 5, pp. 1316 – 1320 & 1328.

Evaluation of settlements in sands due to earthquake shaking, Journal of Geotechnical Engineering, ASCE, Vol. 113, No. 8, August, pp. 861-878. Tokimatsu, K., and Seed, H. B. (1987).

Overburden Correction Factors for SPT in Sand, Liao, S.C. and Whitman, R.V. JGED, ASCE, Vol. 112, No. 3, pp. 373-377, 1985 as referenced in Seed and Harder, "SPT Based Analysis of Cyclic Pore Pressure Generation and Undrained Residual Strength", Volume 2 Memorial Symposium Proceedings, pp. 361-362, May 1990.

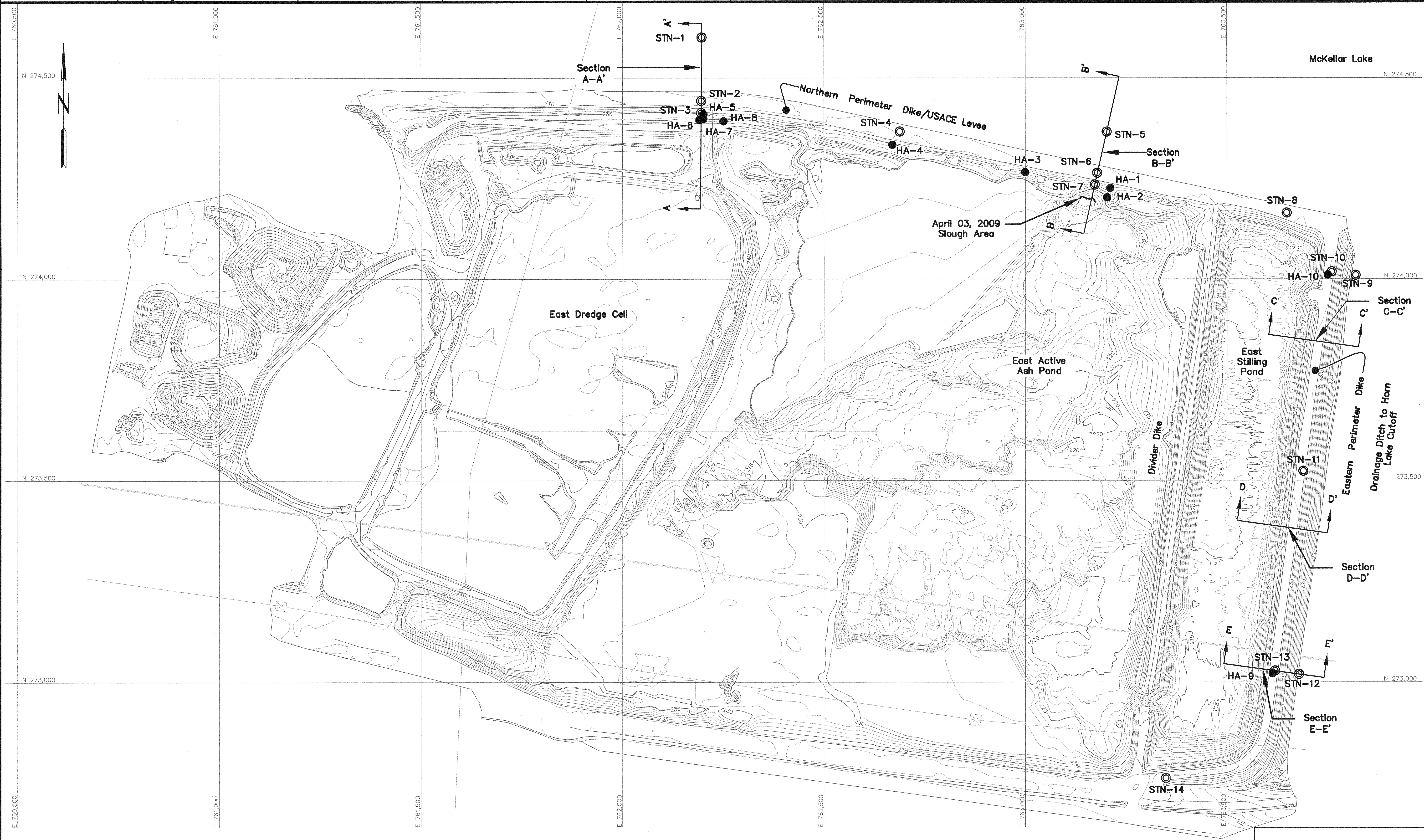
A Method of Analysis of Embankments assuming Parallel Interslice Forces, Geotechnique, Vol 17 (1), pp. 11-26, Spencer, E. (1967).

Seepage Analysis Summary Report: Dredge Cell III – Calibration, Seepage Failure, Future Dredge Cell to 900 Foot Elevation and Seepage and Slope Stability Analysis for 842 Permit Elevation, TVA Report prepared for the Kingston Fossil Plant by Greg McNulty, Ph.D., PE, PG, Parsons E & C, May 2005.

Root Cause Analysis of TVA Kingston Dredge Cell Pond Failure from December 22, 2008, AECOM, June 12, 2009.

Appendix A

Boring Layout & Dike Cross-Sections



LEGEND

- ◎ Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests (Piezometers Installed)
- ● Hand Auger Boring

NOTES:

1. The topographic mapping presented on this drawing was provided to Stantec by TVA Surveying and Project Services. This plan view was prepared to support development of the geotechnical exploration program and should not be used for construction.
2. The geotechnical information and data furnished herein are not intended as representation or warranties but are furnished for information only. It shall be distinctly understood that the Owner or Engineer will not be responsible for any deduction, interpretation or conclusion drawn therefrom. The information is made available in order that the Contractor may have ready access to the same information available to the Owner and the Engineer and is not part of this contract.

BORING LOCATION TABLE

BORING	NORTHING	EASTING	ELEV. (FT.)
STN-1	274,600.73	762,196.97	215.3
STN-2	274,443.30	762,195.73	238.8
STN-3	274,413.31	762,195.54	234.6
STN-4	274,366.97	762,687.88	237.5
STN-5	274,366.34	763,200.60	217.5
STN-6	274,264.03	763,177.15	238.3
STN-7	274,234.70	763,171.06	235.6
STN-8	274,165.16	763,646.95	237.5
STN-9	274,009.16	763,820.47	221.2
STN-10	274,018.24	763,758.37	236.9
STN-11	273,523.29	763,688.16	237.8
STN-12	273,018.83	763,676.83	216.7
STN-13	273,020.21	763,618.05	236.9
STN-14	272,761.34	763,347.91	236.5

HAND AUGER BORING LOCATION TABLE

BORING	NORTHING	EASTING	ELEV. (FT.)
HA-1	274,226.34	763,209.32	235.7
HA-2	274,202.98	763,201.48	230.5
HA-3	274,265.91	762,999.17	234.2
HA-4	274,333.93	762,669.73	233.6
HA-5	274,409.74	762,201.44	233.7
HA-6	274,395.67	762,191.04	232.5
HA-7	274,398.58	762,201.29	232.4
HA-8	274,392.70	762,251.17	232.1
HA-9	273,021.67	763,612.37	237.0
HA-10	274,010.59	763,748.55	237.2

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

PATRICK V. KISER REGISTERED ENGINEER AGRICULTURE COMMERCE No. 111395 STATE OF TENNESSEE
3/25/2010

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	03/25/10	PVK	PS	SF	HRA	HRA	PVK	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=100' EXCEPT AS NOTED

YARD
–

GEOTECHNICAL EXPLORATION USACE LEVEE – EAST ASH POND BORING LAYOUT

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

Stantec Consulting Services Inc.
100 Westwood Place Suite 420
Brentwood, Tennessee
37027-5044
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-01 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

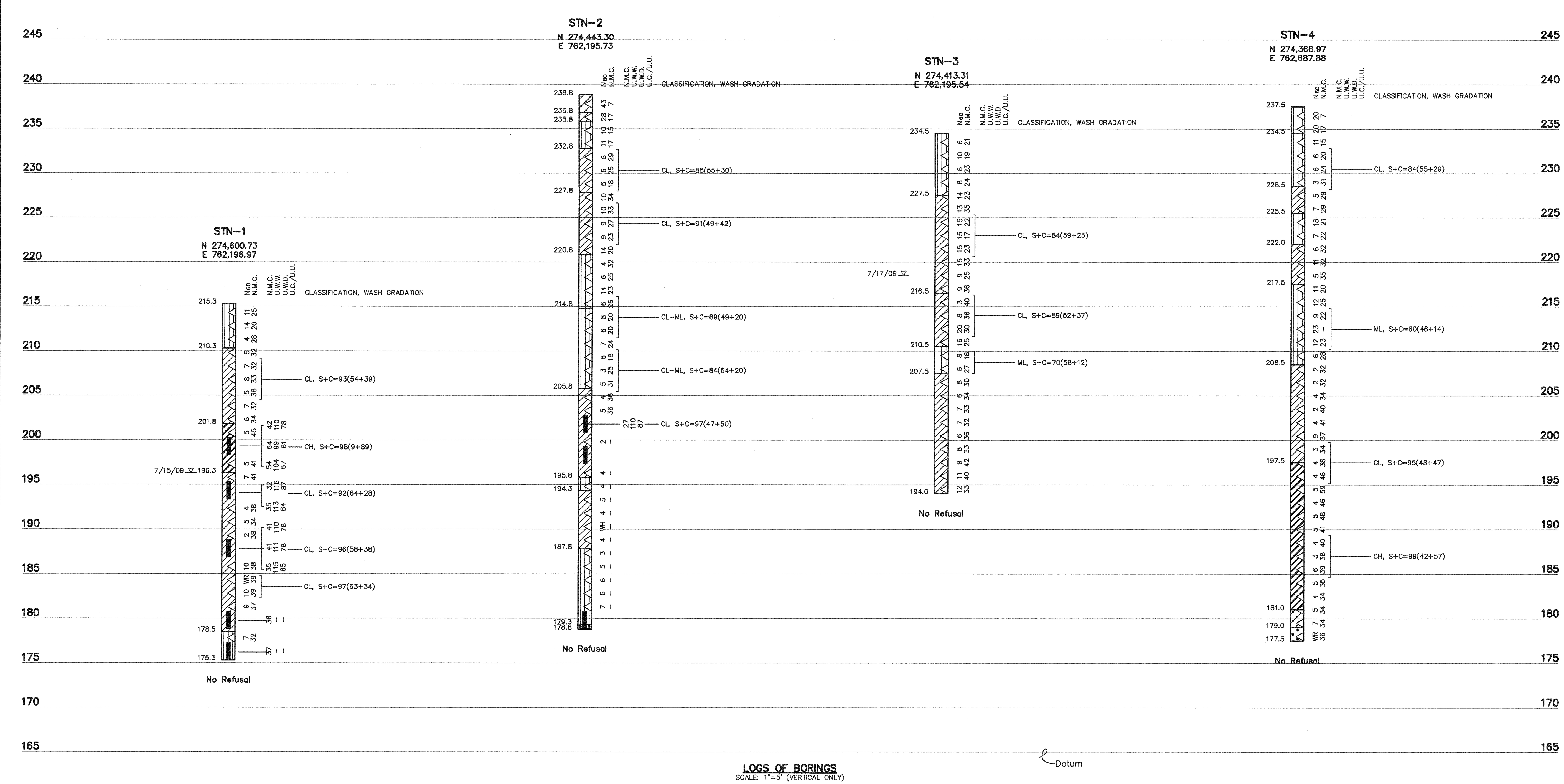
PLOT FACTOR:XX
TJ

C.A.D. DRAWING DO NOT ALTER MANUALLY

Consolidated Undrained Triaxial Test Results			
Location	STN-1	STN-1	STN-1
Depth	15.0'-15.5'	15.7'-16.2'	16.3'-16.8'
$\bar{\Phi}$	26.20°		
$\bar{c}$	220.00 p.s.f.		

Consolidated Undrained Triaxial Test Results			
Location	STN-1	STN-1	STN-2
Depth	20.0'-20.6'	20.7'-21.2'	36.0'-36.5'
$\bar{\Phi}$	21.10°		
$\bar{c}$	720.00 p.s.f.		

Consolidated Undrained Triaxial Test Results			
Location	STN-1	STN-1	STN-1
Depth	26.5'-27.0'	27.0'-27.5'	27.5'-28.0'
$\bar{\Phi}$	31.60°		
$\bar{c}$	60.00 p.s.f.		



LOGS OF BORINGS
SCALE: 1"=5' (VERTICAL ONLY)

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH	Weight of Hammer
WR	Weight of Rods
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
U.C./U.U.	Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

NOTES:

1. The boring logs and related information shown on this drawing 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. Any correlations shown between borings are generally based on straight line interpolation. Actual conditions between borings are unknown and may differ from those shown.

2. The subsurface information and data furnished herein are not intended as representation or warranties but are furnished for information only. It shall be distinctly understood that the Owner, Engineer or Geotechnical Engineer will not be responsible for any deduction, interpretation or conclusion drawn therefrom by the Contractor. The information is made available in order that the Contractor may have ready access to the same information available to the Owner, Engineer and Geotechnical Engineer and is not part of this contract.

Consolidated Undrained Triaxial Test Results			
Location	STN-3A	STN-3A	STN-3A
Depth	4.0'-4.5'	4.6'-5.1'	6.6'-7.1'
$\bar{\Phi}$	33.10°		
$\bar{c}$	220.00 p.s.f.		

Summary of Offset Borings

BORING NO.	NORTHING	EASTING	SURFACE ELEV. (FT.)	BORING TYPE	UNDISTURBED SAMPLE INTERVALS
PZ-2	274441.99	762201.92	238.8	SAMPLE/ PIEZOMETER	10'-12' 18'-20'
PZ-3	274411.16	762192.94	234.5	SAMPLE/ PIEZOMETER	4'-6' 6'-8'
PZ-4	274367.46	762679.46	237.5	PIEZOMETER	N/A

For Supporting Design Calculations See FPGALFFESCDX00000020100002

PATRICK V. KISER — REGISTERED ENGINEER — STATE OF TENNESSEE — 3/25/2010

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Brentwood, Tennessee 37027-5044
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD
R0	03/25/10	PVK	PS	SF	HRA	HRA	PVK	TJ

ISSUED FOR REVIEW

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
USACE LEVEE – EAST ASH POND
LOGS OF BORINGS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

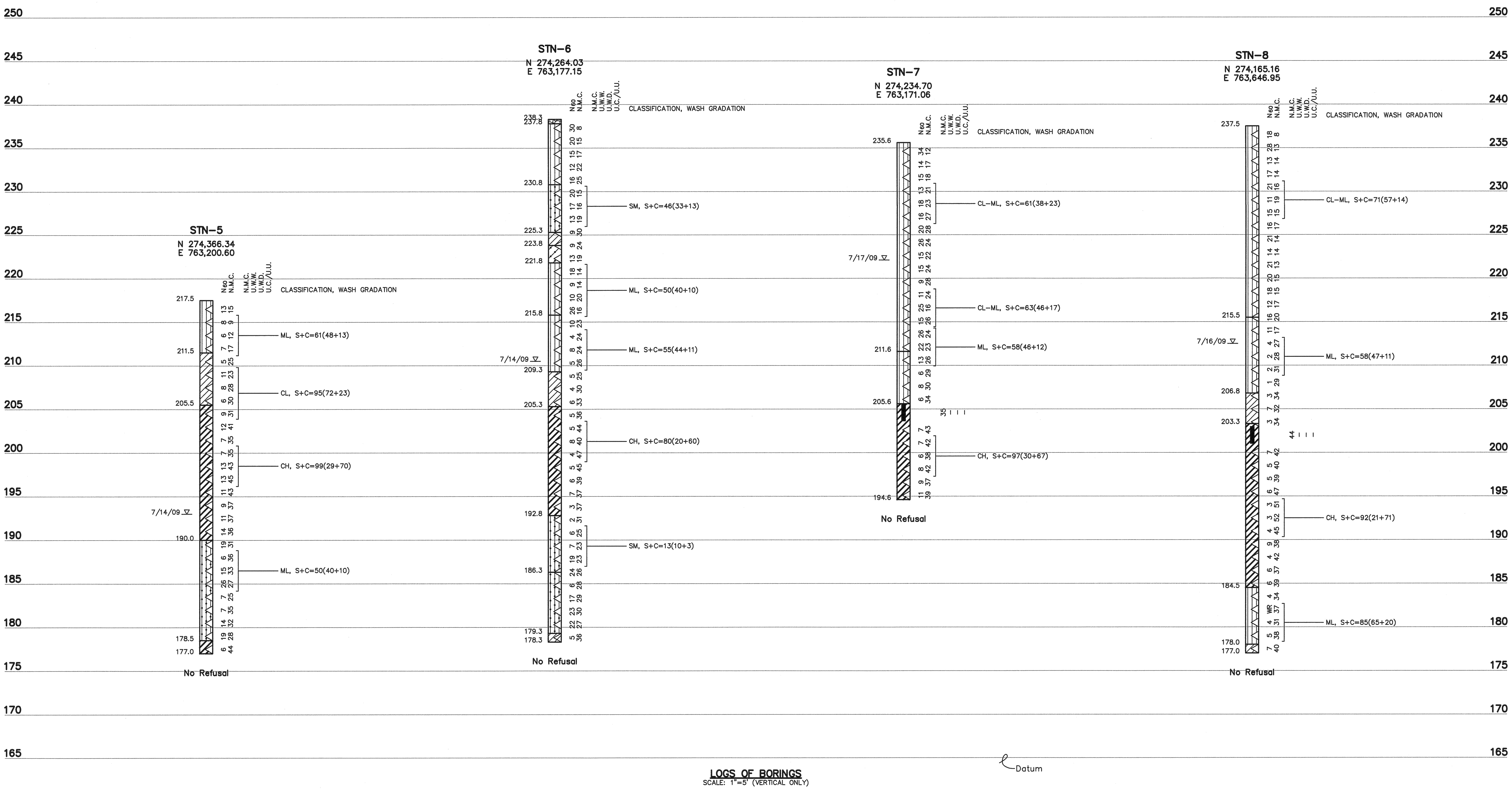
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-02 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



LOGS OF BORINGS
SCALE: 1"=5' (VERTICAL ONLY)

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH	Weight of Hammer
WR	Weight of Rods
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
U.C./U.U.	Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

NOTES:

1. The boring logs and related information shown on this drawing 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. Any correlations shown between borings are generally based on straight line interpolation. Actual conditions between borings are unknown and may differ from those shown.

2. The subsurface information and data furnished herein are not intended as representation or warranties but are furnished for information only. It shall be distinctly understood that the Owner, Engineer or Geotechnical Engineer will not be responsible for any deduction, interpretation or conclusion drawn therefrom by the Contractor. The information is made available in order that the Contractor may have ready access to the same information available to the Owner, Engineer and Geotechnical Engineer and is not part of this contract.

Summary of Offset Borings

BORING NO.	NORTHING	EASTING	SURFACE ELEV. (FT.)	BORING TYPE	UNDISTURBED SAMPLE INTERVALS
PZ-6	274263.61	763180.87	238.5	PIEZOMETER	N/A
PZ-7	274235.39	763163.82	235.5	PIEZOMETER	N/A
PZ-8	274166.09	763641.32	237.8	SAMPLE/ PIEZOMETER	5'-7'

For Supporting Design Calculations See FPGALFFESCDX00000020100002

PATRICK V. KISER, REGISTERED ENGINEER, AGRICULTURE, STATE OF TENNESSEE — 3/25/2010

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Brentwood, Tennessee 37027-5044
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	03/25/10	PVK	PS	SF	HRA	HRA	PVK	TJ	–	–

ISSUED FOR REVIEW

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
USACE LEVEE – EAST ASH POND
LOGS OF BORINGS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

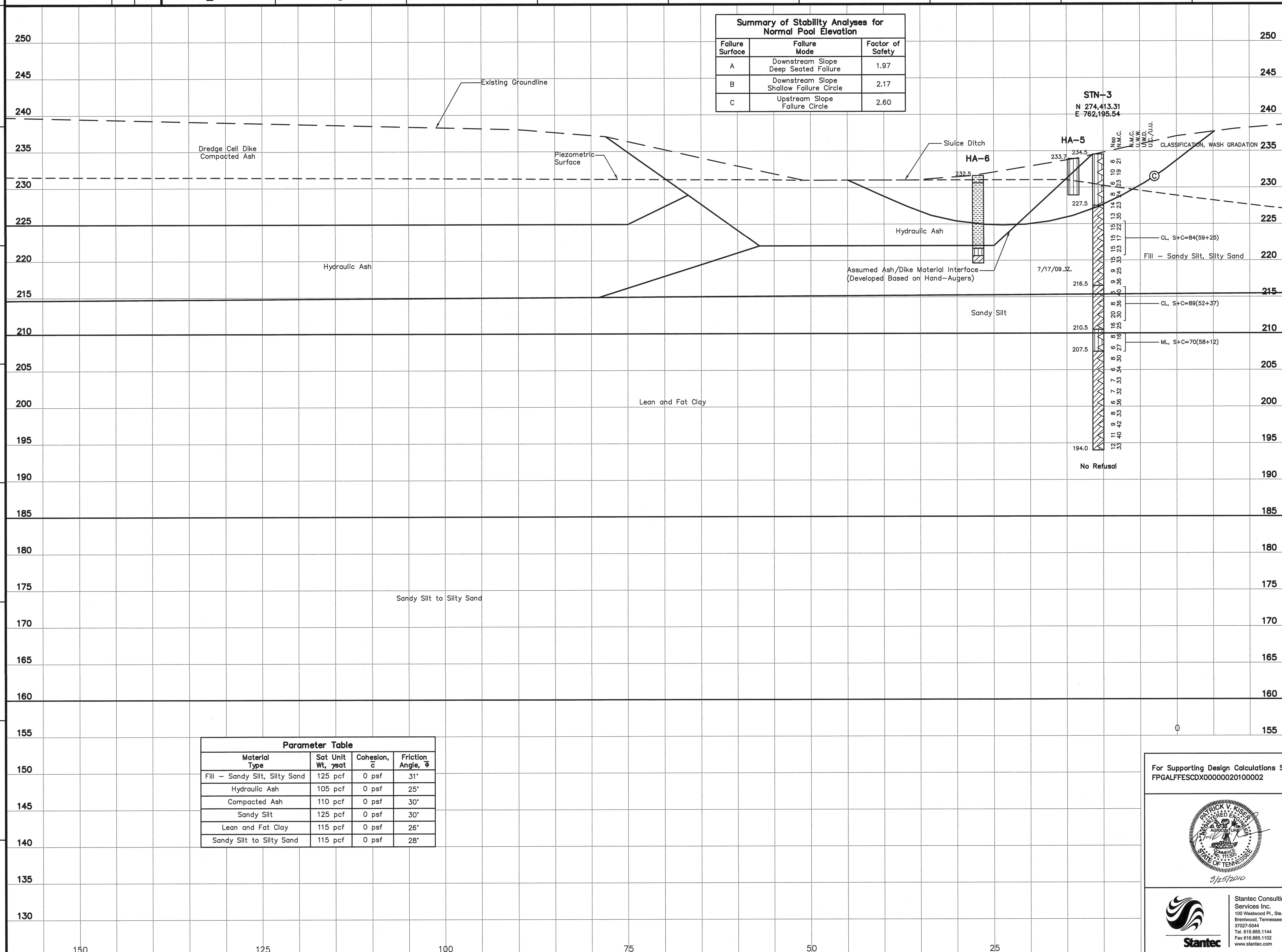
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-03 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



Summary of Stability Analyses for Normal Pool Elevation

Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	1.97
B	Downstream Slope Shallow Failure Circle	2.17
C	Upstream Slope Failure Circle	2.60

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, c̄	Friction Angle, Φ
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°
Hydraulic Ash	105 pcf	0 psf	25°
Compacted Ash	110 pcf	0 psf	30°
Sandy Silt	125 pcf	0 psf	30°
Lean and Fat Clay	115 pcf	0 psf	26°
Sandy Silt to Silty Sand	115 pcf	0 psf	28°

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH	Weight of Hammer
WR	Weight of Rods
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
U.C./U.U.	Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	03/25/10	PVK	PS	SF	HRA	HRA	PVK	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
–

GEOTECHNICAL EXPLORATION
USACE LEVEE – EAST ASH POND
CROSS SECTION A–A'

PATRICK V. KISER REGISTERED ENGINEER AGRICULTURE COMMERCE No. 111395 STATE OF TENNESSEE
3/25/2010

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Brentwood, Tennessee
37027-5044
Tel. 615.885.1144
Fax 616.885.1102
www.stantec.com

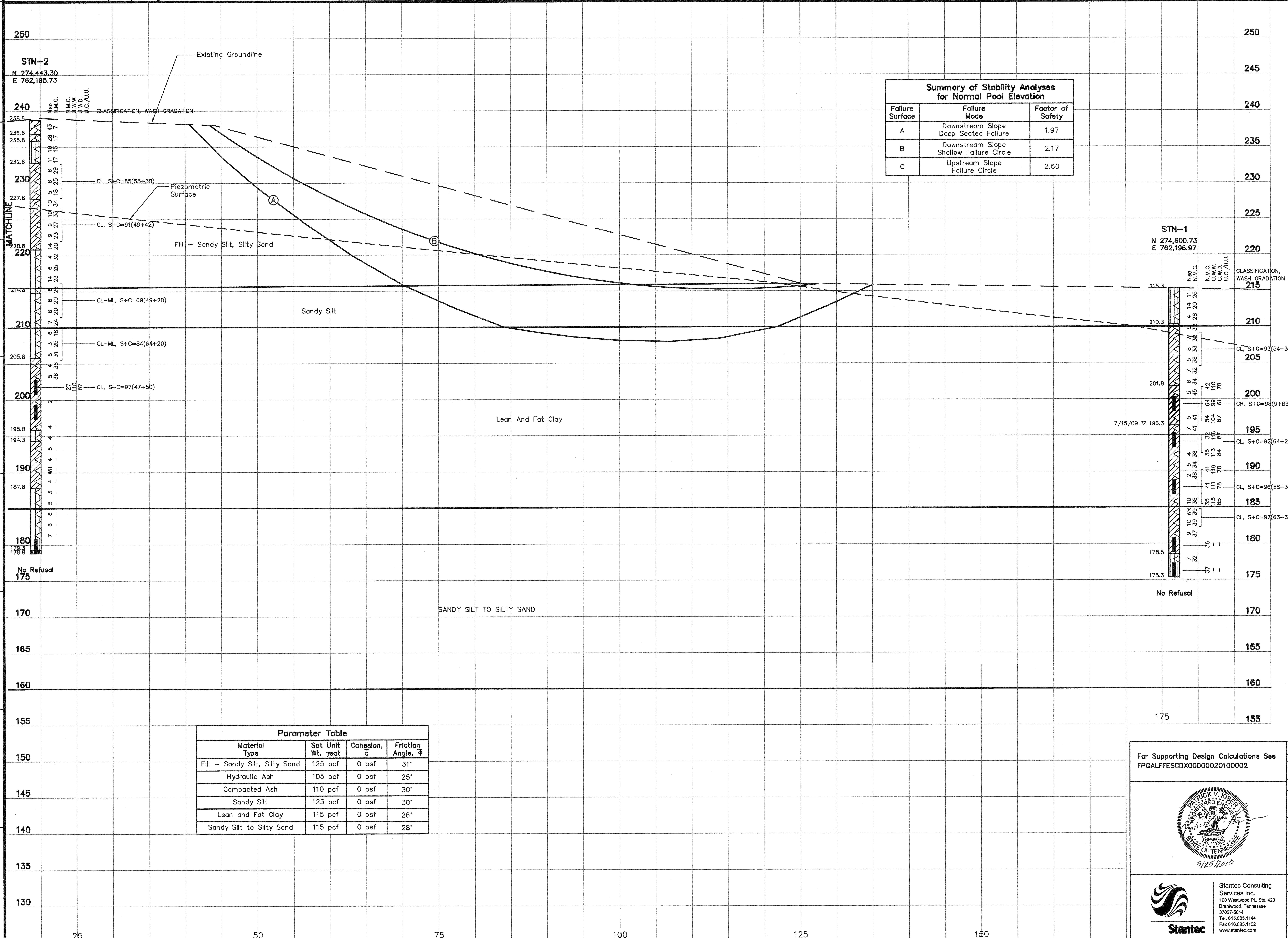
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504–04 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



Summary of Stability Analyses for Normal Pool Elevation

Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	1.97
B	Downstream Slope Shallow Failure Circle	2.17
C	Upstream Slope Failure Circle	2.60

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, c	Friction Angle, Φ
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°
Hydraulic Ash	105 pcf	0 psf	25°
Compacted Ash	110 pcf	0 psf	30°
Sandy Silt	125 pcf	0 psf	30°
Lean and Fat Clay	115 pcf	0 psf	26°
Sandy Silt to Silty Sand	115 pcf	0 psf	28°

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH — Weight of Hammer
WR — Weight of Rods
◁ — Standard Penetration Test Interval
■ — Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu.ft.)
U.W.D. — Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. — Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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
* — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

PATRICK V. KISER — REGISTERED ENGINEER — AGRICULTURE — STATE OF TENNESSEE — No. 111395
3/25/2010

R 0 | 03/25/10 | PVK | PS | SF | HRA | HRA | PVK | TJ
RECORD DRAWING

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST

SCALE: 1"=5' — EXCEPT AS NOTED

YARD
–

GEOTECHNICAL EXPLORATION
USACE LEVEE – EAST ASH POND
CROSS SECTION A-A'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Brentwood, Tennessee
37027-5044
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-05 | R 0

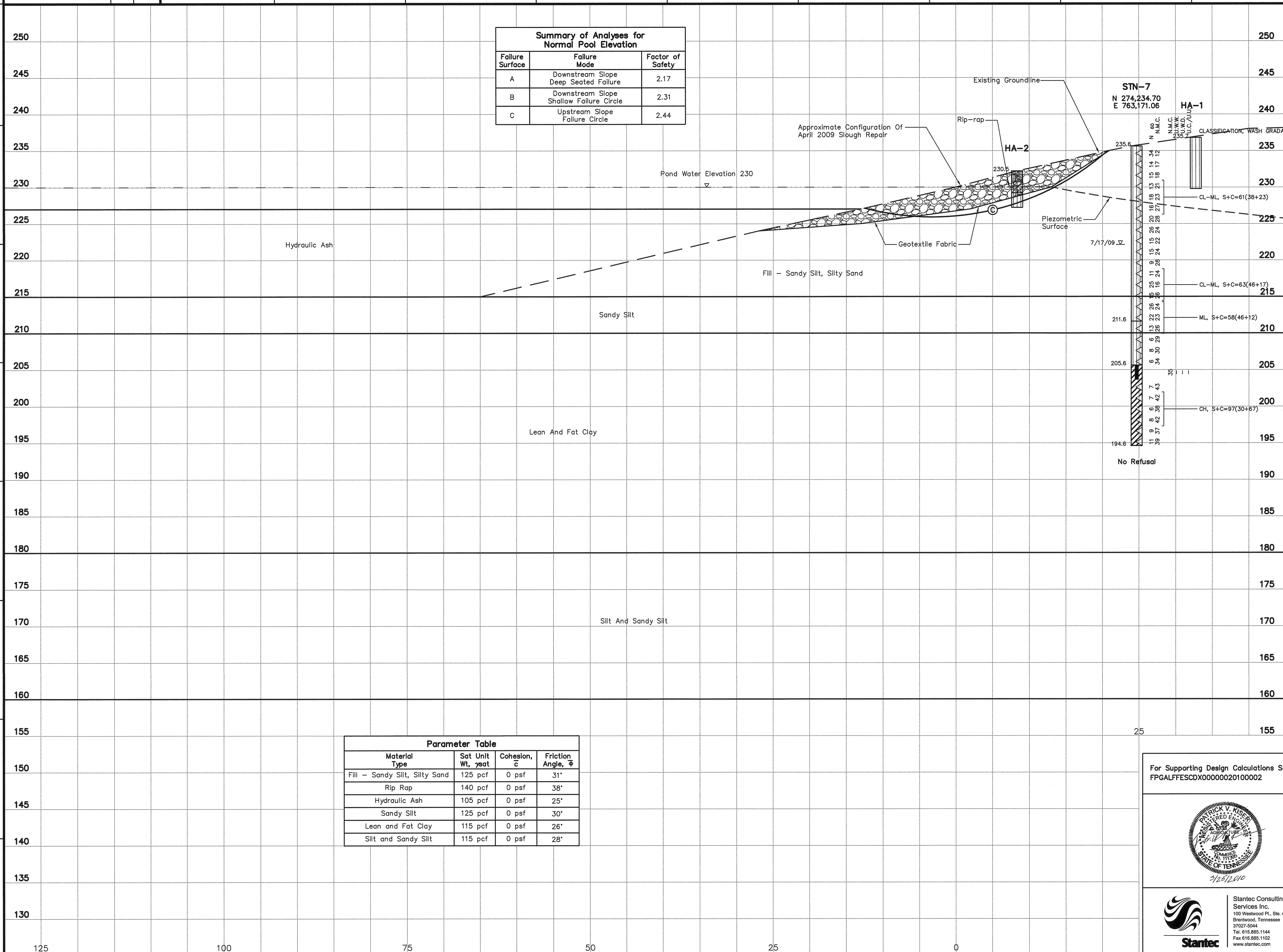
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

Summary of Analyses for Normal Pool Elevation

Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	2.17
B	Downstream Slope Shallow Failure Circle	2.31
C	Upstream Slope Failure Circle	2.44



Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, c	Friction Angle, Φ
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°
Rip Rap	140 pcf	0 psf	38°
Hydraulic Ash	105 pcf	0 psf	25°
Sandy Silt	125 pcf	0 psf	30°
Lean and Fat Clay	115 pcf	0 psf	26°
Silt and Sandy Silt	115 pcf	0 psf	28°

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH	Weight of Hammer
WR	Weight of Rods
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
U.C./U.U.	Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	03/25/10	PVK	PS	SF	HRA	HRA	PVK	TJ	–	–

R 0 RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD –

GEOTECHNICAL EXPLORATION
USACE LEVEE – EAST ASH POND
CROSS SECTION B-B'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Brentwood, Tennessee 37027-5044
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

Patrick V. Kiser, Registered Engineer, State of Tennessee — 3/25/2010

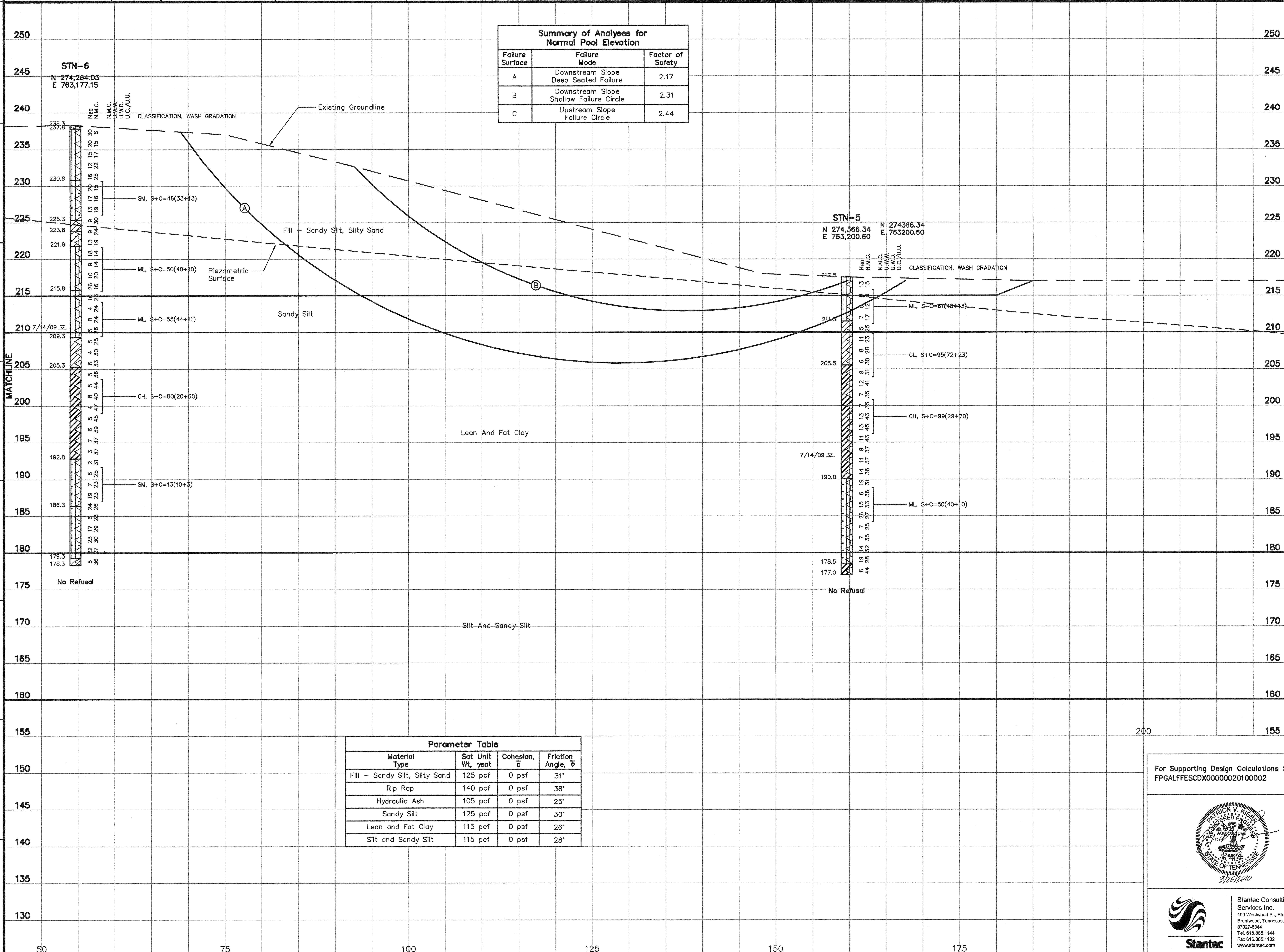
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-06 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



Summary of Analyses for Normal Pool Elevation

Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	2.17
B	Downstream Slope Shallow Failure Circle	2.31
C	Upstream Slope Failure Circle	2.44

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, c̄	Friction Angle, Φ̄
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°
Rip Rap	140 pcf	0 psf	38°
Hydraulic Ash	105 pcf	0 psf	25°
Sandy Silt	125 pcf	0 psf	30°
Lean and Fat Clay	115 pcf	0 psf	26°
Silt and Sandy Silt	115 pcf	0 psf	28°

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH	Weight of Hammer
WR	Weight of Rods
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
U.C./U.U.	Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	03/25/10 RECORD DRAWING	PVK	PS	SF	HRA	HRA	PVK	TJ	–	–

SCALE: 1"=5' EXCEPT AS NOTED

YARD
–

GEOTECHNICAL EXPLORATION USACE LEVEE – EAST ASH POND CROSS SECTION B-B'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

PATRICK V. KISER, REGISTERED ENGINEER, STATE OF TENNESSEE — 3/25/2010

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Brentwood, Tennessee 37027-5044
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

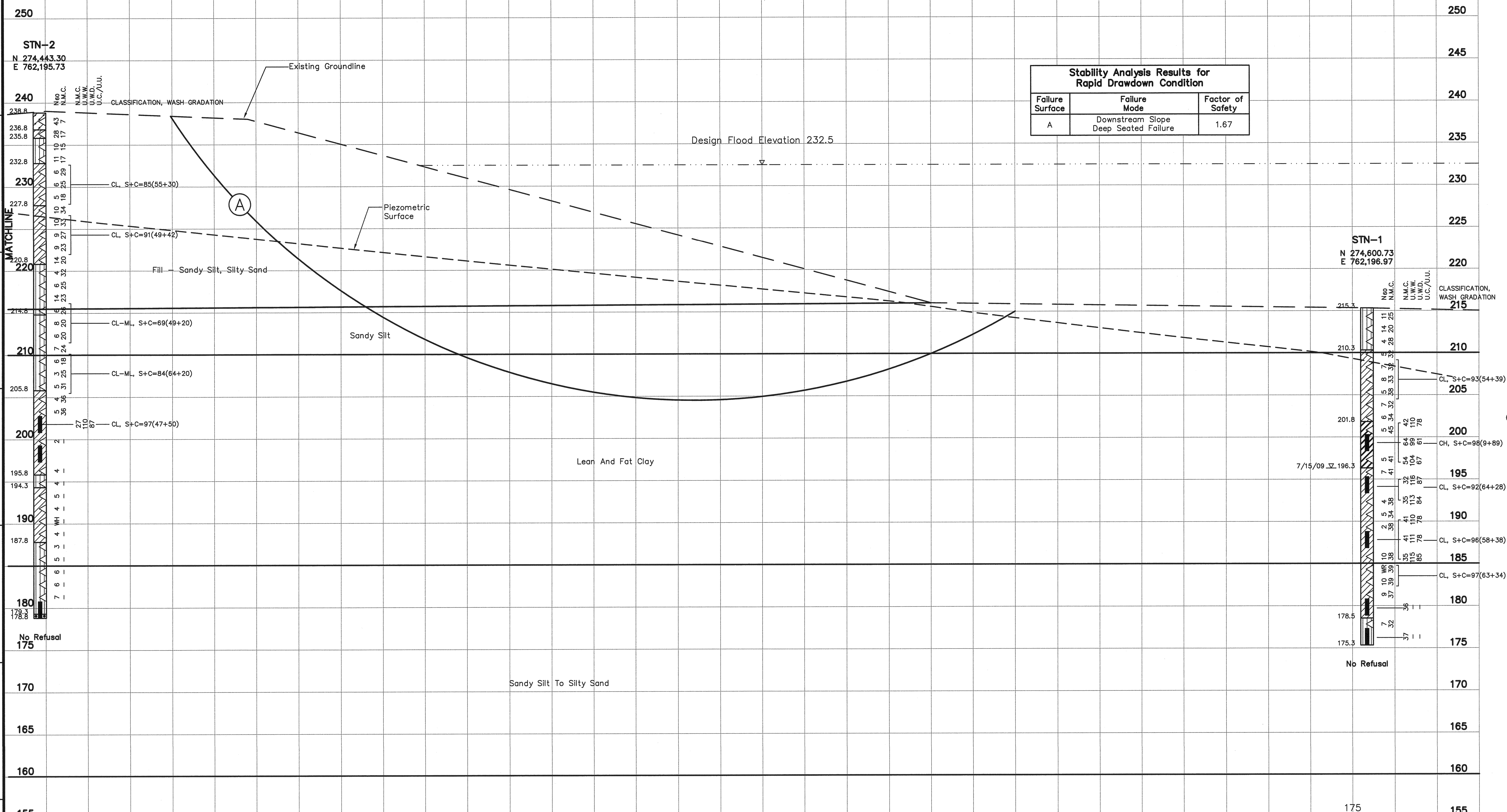
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-07 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



Stability Analysis Results for Rapid Drawdown Condition		
Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	1.67

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH — Weight of Hammer
WR — Weight of Rods
◁ — Standard Penetration Test Interval
■ — Undisturbed Thin–Walled (Shelby) Tube Sample
N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu.ft.)
U.W.D. — Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. — Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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
* — Standard Penetration Test (SPT) terminated per ASTM D 1586–99. Refer to typed boring log.

RECORD DRAWING

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, $\bar{c}$	Friction Angle, $\bar{\Phi}$	Total Stress Parameters		Undrained Strength Parameters	
				dKc=Kf	ΨKc=Kf	dKc=1	ΨKc=1
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°	200 psf	22°	254.6 psf	27.18°
Hydraulic Ash	105 pcf	0 psf	25°	0 psf	10°	0 psf	10.78°
Compacted Ash	110 pcf	0 psf	30°	0 psf	30°	0 psf	30°
Sandy Silt	125 pcf	0 psf	30°	200 psf	22°	256.79 psf	27.41°
Lean and Fat Clay	115 pcf	0 psf	26°	400 psf	12°	443.97 psf	13.27°
Sandy Silt to Silty Sand	115 pcf	0 psf	28°	200 psf	12°	218.07 psf	13.05°

For Supporting Design Calculations See FPGALFFESCDX00000020100002

PATRICK V. KISER — REGISTERED ENGINEER — AGRICULTURE — STATE OF TENNESSEE
3/25/2010

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD
R 0	03/25/10	PVK	PS	SF	HRA	HRA	PVK	TJ

RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
USACE LEVEE – EAST ASH POND
CROSS SECTION A–A'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Brentwood, Tennessee 37027-5044
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504–08 | R 0

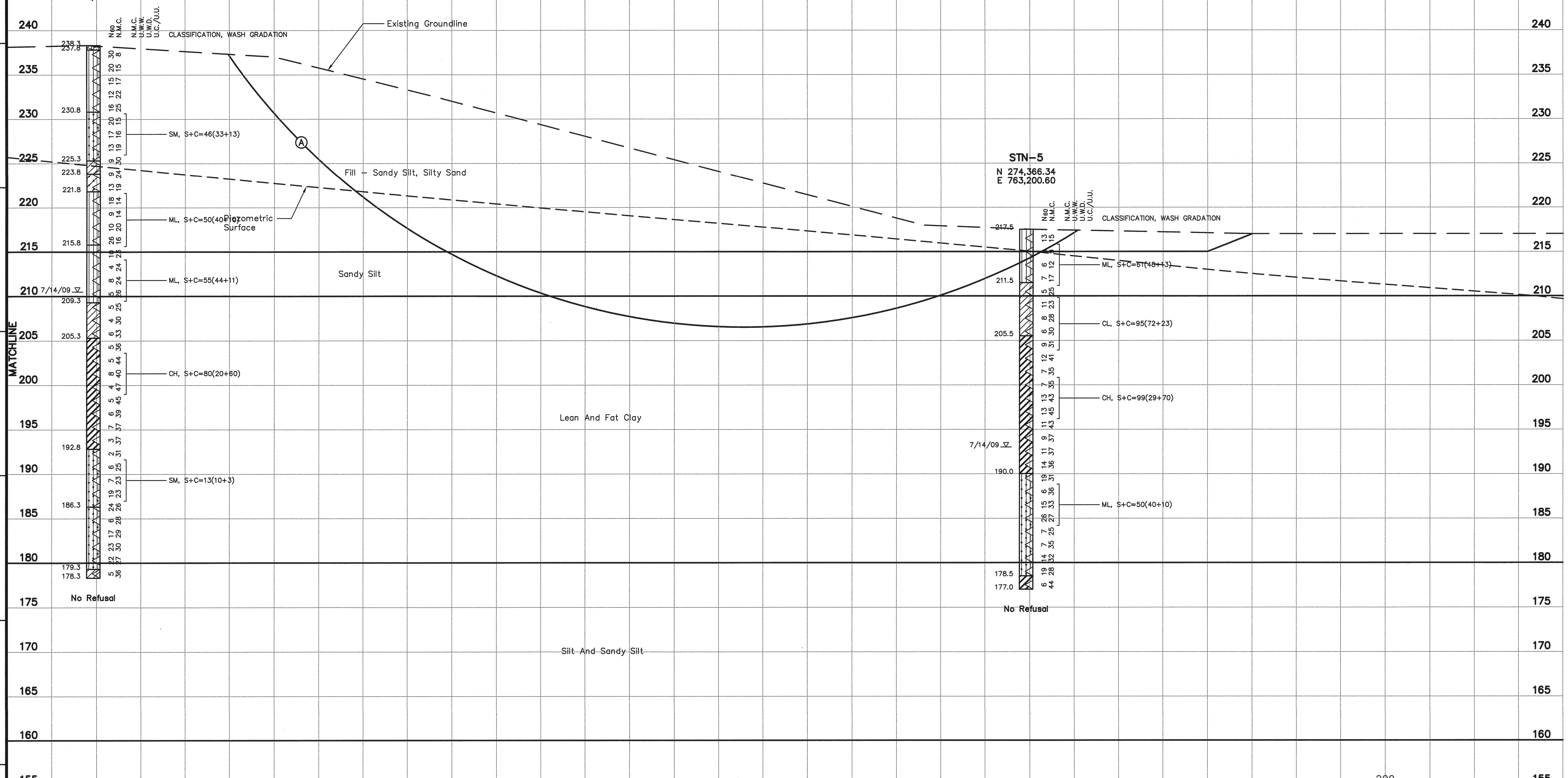
PLOT FACTOR:XX W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC 0
TASK COMPLETED BY: REV NO.

Stability Analysis Results for Rapid Drawdown Condition

Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	1.74



LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH Weight of Hammer
WR Weight of Rods
◁ Standard Penetration Test Interval
■ Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
U.W.W. Unit Weight Wet (lbs./cu.ft.)
U.W.D. Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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
* Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, $\bar{c}$	Friction Angle, $\bar{\Phi}$	Total Stress Parameters dKc=Kf	Total Stress Parameters ΨKc=Kf	Undrained Strength Parameters dKc=1	Undrained Strength Parameters ΨKc=1
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°	200 psf	22°	254.6 psf	27.18°
Rip Rap	140 pcf	0 psf	38°	0 psf	38°	0 psf	38°
Hydraulic Ash	105 pcf	0 psf	25°	0 psf	10°	0 psf	10.78°
Sandy Silt	125 pcf	0 psf	30°	200 psf	22°	256.79 psf	27.41°
Lean and Fat Clay	115 pcf	0 psf	26°	400 psf	12°	443.97 psf	13.27°
Sandy Silt to Silty Sand	115 pcf	0 psf	28°	200 psf	12°	218.07 psf	13.05°

For Supporting Design Calculations See FPGALFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	03/25/10	PVK	PS	SF	HRA	HRA	PVK	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
–

GEOTECHNICAL EXPLORATION USACE LEVEE – EAST ASH POND CROSS SECTION B-B'

PATRICK V. KISER REGISTERED ENGINEER AGRICULTURE COMMERCE No. 111395 STATE OF TENNESSEE
3/25/2010

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Brentwood, Tennessee
37027-5044
Tel. 615.885.1144
Fax 616.885.1102
www.stantec.com

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-09 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

Appendix B

Typed Boring Logs

Stantec

SUBSURFACE LOG

Project No.	172679016	Location	N 274600.73, E 762196.97 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-1** Total Depth 40.0 ft
Location	Memphis, Tennessee	Surface Elevation	215.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	7/15/09 Completed 7/15/09
Supervisor	Patrick Kiser Driller J. Wethington	Depth to Water	19.0 ft Date/Time 7/15/09
Logged By	Craig Millhollin	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
215.3'	0.0'	Top of Hole							
		SANDY SILT, brown, moist, medium to stiff		SPT-1	0.0 - 1.5	1.0	2-4-7	25	Boring advanced using 3 1/4" Hollow Stem Augers
				SPT-2	1.5 - 3.0	1.0	8-5-9	20	
				SPT-3	3.0 - 4.5	1.5	3-2-2	28	
210.3'	5.0'			SPT-4	4.5 - 6.0	1.3	3-2-3	32	
		LEAN CLAY, brown, moist to very moist, medium stiff to stiff, some fine sand		SPT-5	6.0 - 7.5	1.2	4-3-4	32	
				SPT-6	7.5 - 9.0	1.3	4-3-5	33	LL-42, PI-22 93% passing #200
				SPT-7	9.0 - 10.5	1.5	3-4-1	38	
				SPT-8	10.5 - 12.0	1.0	3-3-4	32	
201.8'	13.5'			SPT-9	12.0 - 13.5	1.3	2-2-4	34	
		FAT CLAY, brown, moist, medium stiff		SPT-10	13.5 - 15.0	1.5	2-2-3	45	
				ST-1	15.0 - 17.0	2.0		63	LL-92, PI-64 98% passing #200
196.3'	19.0'			SPT-11	17.0 - 18.5	1.5	2-2-3	41	
		LEAN CLAY, gray, moist to saturated, soft to stiff, some fine grained sand		SPT-12	18.5 - 20.0	1.5	3-4-3	41	
				ST-2	20.0 - 22.0	2.0		35	LL-34, PI-13 92% passing #200
				SPT-13	22.0 - 23.5	1.5	1-2-2	38	
				SPT-14	23.5 - 25.0	1.5	2-3-2	34	
				SPT-15	25.0 - 26.5	1.5	1-1-1	38	
				ST-3	26.5 - 28.5	2.0		41	LL-38, PI-18 96% passing #200
				SPT-16	28.5 - 30.0	1.5	5-5-5	38	
				SPT-17	30.0 - 31.5	1.0	WOR-WOR-WOR	39	LL-41, PI-19 97% passing #200
				SPT-18	31.5 - 33.0	1.5	WOR-WOR-10	39	
				SPT-19	33.0 - 34.5	1.5	4-5-4	37	

Project No.	172679016	Location	N 274600.73, E 762196.97 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-1** Total Depth 40.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
				ST-4	34.5 - 36.5	2.0		36	
178.5'	36.8'								
		SANDY SILT, gray, very moist, medium stiff to stiff, some clay		SPT-20	36.5 - 38.0	1.5	4-3-4	32	
				ST-5	38.0 - 40.0	1.4		37	
175.3'	40.0'								

No Refusal /
Bottom of Hole

WOR = Weight of Rods

Slotted screen piezometer installed, tip elevation 178.0 ft above mean sea level.
1 ft bentonite plug, 1.4 ft sand seat, followed by 5 ft slotted screen with sand pack to 8.1 ft above screen, and 3.3 ft bentonite seal on top. Grout in the upper 21.1 ft (to top of hole).

Stantec

SUBSURFACE LOG

Project No.	172679016	Location	N 274443.30, E 762195.73 (NAD27)		
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-2**	Total Depth	60.0 ft
Location	Memphis, Tennessee	Surface Elevation	238.8 ft. (NGVD29)		
Project Type	Geotechnical Exploration	Date Started	7/14/09	Completed	7/15/09
Supervisor	Patrick Kiser Driller G. Thompson	Depth to Water	N/A	Date/Time	N/A
Logged By	Briggs Evans	Automatic Hammer ☒	Safety Hammer ☐	Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
238.8'	0.0'	Top of Hole						
236.8'	2.0'	FILL-CLAYEY SAND, brown, slightly moist, dense, some gravel	SPT-1	0.0 - 1.5	1.5	11-18-25	7	Boring advanced using 3 1/4" Hollow Stem Augers
235.8'	3.0'	FILL-SANDY CLAY, dark gray, moist, very stiff	SPT-2	1.5 - 3.0	0.5	11-15-13	17	
232.8'	6.0'	FILL-SANDY SILT, gray to dark gray, moist, stiff	SPT-3	3.0 - 4.5	1.2	7-5-5	15	
			SPT-4	4.5 - 6.0	1.0	3-4-7	17	Clay lense from 5.7' to 5.8'
227.8'	11.0'	FILL-LEAN CLAY, gray, moist, medium stiff, some fine grained sand	SPT-5	6.0 - 7.5	1.5	1-3-3	29	LL-33, PI-16 85% passing #200
			SPT-6	7.5 - 9.0	1.5	2-2-4	25	
			SPT-7	9.0 - 10.5	1.0	1-2-3	18	
220.8'	18.0'	FILL-SANDY CLAY, gray to dark gray, moist to very moist, medium stiff to stiff	SPT-8	10.5 - 12.0	1.2	2-4-6	34	
			SPT-9	12.0 - 13.5	1.5	4-5-5	33	
			SPT-10	13.5 - 15.0	1.5	2-3-6	27	LL-38, PI-21 91% passing #200
			SPT-11	15.0 - 16.5	1.5	3-4-5	23	
			SPT-12	16.5 - 18.0	1.5	6-7-7	20	
214.8'	24.0'	FILL-SANDY SILT, dark gray to gray, moist to saturated, soft to stiff	SPT-13	18.0 - 19.5	1.5	WOH-2-2	32	
			SPT-14	19.5 - 21.0	1.5	WOH-3-3	25	
			SPT-15	21.0 - 22.5	1.5	4-7-7	23	
			SPT-16	22.5 - 24.0	1.5	2-3-3	26	
205.8'	33.0'	SANDY SILT, dark gray to gray, moist to saturated, soft to stiff	SPT-17	24.0 - 25.5	1.5	3-4-4	20	LL-23, PI-4 69% passing #200
			SPT-18	25.5 - 27.0	1.5	3-3-3	20	
			SPT-19	27.0 - 28.5	1.5	3-3-4	24	Wet at 28'
			SPT-20	28.5 - 30.0	1.0	WOR-3-3	18	LL-26, PI-5 84% passing #200
			SPT-21	30.0 - 31.5	1.5	WOR-2-1	25	Saturated at 30' Sandy clay from 30.2' to 30.7'
			SPT-22	31.5 - 33.0	1.5	WOH-2-3	31	
		LEAN CLAY, gray tan, moist, soft to medium soft, trace fine sand	SPT-23	33.0 - 34.5	1.5	WOR-1-3	36	

Stantec

SUBSURFACE LOG

Project No.	172679016	Location	N 274443.30, E 762195.73 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-2** Total Depth 60.0 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, gray tan, moist, soft to medium soft, trace fine sand *(Continued)*		SPT-24	34.5 - 36.0	1.5	WOR-2-3	36	
				ST-1	36.0 - 38.0	2.0		39	LL-47, PI-26 97% passing #200
				SPT-25	38.0 - 39.5	1.1	WOR-WOH-2	--	
				ST-2	39.5 - 41.5	1.8		--	
195.8'	43.0'			SPT-26	41.5 - 43.0	1.3	WOH-2-2	--	
194.3'	44.5'	SILT, gray, moist to wet, soft, some fine grained sand		SPT-27	43.0 - 44.5	1.5	2-2-2	--	
		LEAN CLAY, gray to dark gray, moist to saturated, very soft to medium stiff		SPT-28	44.5 - 46.0	1.0	WOH-2-3	--	
				SPT-29	46.0 - 47.5	1.5	WOH-2-2	--	
				SPT-30	47.5 - 49.0	1.3	WOH-WOH-WOH	--	
				SPT-31	49.0 - 50.5	1.5	1-2-2	--	
187.8'	51.0'	CLAYEY SILT, dark gray, moist to wet, soft to medium stiff, trace fine grained sand		SPT-32	50.5 - 52.0	1.5	2-1-2	--	
				SPT-33	52.0 - 53.5	1.5	WOH-2-3	--	
				SPT-34	53.5 - 55.0	1.5	WOH-3-3	--	
				SPT-35	55.0 - 56.5	1.5	WOH-2-4	--	
				SPT-36	56.5 - 58.0	1.5	3-3-4	--	
179.3'	59.5'			ST-3	58.0 - 60.0	1.5		--	
178.8'	60.0'	SAND, light gray, wet, fine grained							
		No Refusal / Bottom of Hole							

WOH = Weight of Hammer
WOR = Weight of Rods

Boring backfilled with bentonite grout.
Slotted screen piezometer installed in offset boring 4' east, tip elevation 219.0 ft above mean sea level.
1 ft sand seat, followed by 5 ft slotted screen with sand pack to 8.3 ft above screen, and 4.7 ft bentonite seal on top.
Grout in the upper1.6 ft (to top of hole).

Two Shelby Tubes were collected from an off set boring:
ST-1 10'-12'; ST-2 18'-20'

SUBSURFACE LOG

Project No.	172679016	Location	N 274413.31, E 762195.54 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-3** Total Depth 40.5 ft
Location	Memphis, Tennessee	Surface Elevation	234.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	7/17/09 Completed 7/17/09
Supervisor	Patrick Kiser Driller J. Wethington	Depth to Water	16.0 ft Date/Time 7/17/09
Logged By	Craig Millhollin	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
234.5'	0.0'	Top of Hole							
		FILL - SANDY SLIT, grayish brown, moist, medium stiff to stiff		SPT-1	0.0 - 1.5	1.0	1-3-3	21	Boring advanced using 3 1/4" Hollow Stem Augers
				SPT-2	1.5 - 3.0	1.3	5-5-5	19	
				SPT-3	3.0 - 4.5	1.0	3-2-4	23	
				SPT-4	4.5 - 6.0	0.9	3-2-6	24	
227.5'	7.0'			SPT-5	6.0 - 7.5	1.5	5-6-8	23	
		FILL - SILTY CLAY, grayish brown, moist to very moist, stiff to very stiff		SPT-6	7.5 - 9.0	1.5	7-6-7	35	
				SPT-7	9.0 - 10.5	1.5	3-5-10	22	
				SPT-8	10.5 - 12.0	1.0	5-7-8	17	LL-29, PI-9 84% passing #200
				SPT-9	12.0 - 13.5	1.2	6-6-9	23	
				SPT-10	13.5 - 15.0	1.5	9-6-9	33	
				SPT-11	15.0 - 16.5	1.5	4-5-4	25	
216.5'	18.0'			SPT-12	16.5 - 18.0	1.2	4-5-4	36	
		LEAN CLAY, gray, moist to saturated, soft to very stiff, some silt		SPT-13	18.0 - 19.5	0.9	1-1-2	40	
				SPT-14	19.5 - 21.0	1.5	4-4-4	36	LL-36, PI-20 89% passing #200
				SPT-15	21.0 - 22.5	1.0	5-7-13	30	
210.5'	24.0'			SPT-16	22.5 - 24.0	1.5	10-7-9	25	
		SANDY SILT, gray, saturated, medium stiff to stiff		SPT-17	24.0 - 25.5	0.4	3-3-5	16	
207.5'	27.0'			SPT-18	25.5 - 27.0	0.9	3-3-3	27	LL-23, PI-2 70% passing #200
		LEAN CLAY, gray, moist to saturated, medium stiff to stiff, with silt and sand		SPT-19	27.0 - 28.5	1.5	3-4-4	30	Silt layer from 27.5' to 28'
				SPT-20	28.5 - 30.0	1.2	3-3-3	34	
				SPT-21	30.0 - 31.5	1.5	3-4-3	33	
				SPT-22	31.5 - 33.0	1.2	3-3-4	32	Silt layer from 32.0' to 32.5'
				SPT-23	33.0 - 34.5	1.5	1-1-5	36	

Project No.	172679016	Location	N 274413.31, E 762195.54 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-3** 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, gray, moist to saturated, medium stiff to stiff, with silt and sand *(Continued)*		SPT-24	34.5 - 36.0	1.5	5-5-3	33	
				SPT-25	36.0 - 37.5	1.5	3-4-5	42	
				SPT-26	37.5 - 39.0	1.3	5-5-6	40	
194.0'	40.5'			SPT-27	39.0 - 40.5	1.5	5-5-7	33	
		No Refusal / Bottom of Hole							

Boring backfilled with bentonite grout.
Slotted screen piezometer installed in offset boring 3' west, tip elevation 217.4 ft above mean sea level.
0.6 ft sand seat, followed by 5 ft slotted screen with sand pack to 2.6 ft above screen, and 2.5 ft bentonite seal on top.
Grout in the upper 7 ft (to top of hole).

Two Shelby Tube Samples collected from an off set boring:

ST-1 4'-6'
ST-2 6'-8'

Stantec

SUBSURFACE LOG

Project No.	172679016	Location	N 274366.97, E 762687.88 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-4** Total Depth 60.0 ft
Location	Memphis, Tennessee	Surface Elevation	237.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	7/15/09 Completed 7/16/09
Supervisor	Patrick Kiser Driller G. Thompson	Depth to Water	N/A Date/Time N/A
Logged By	Briggs Evans	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description (Overburden / Rock Core)	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
237.5'	0.0'	Top of Hole						
		FILL - SANDY SILT, tan to brown, slightly moist to moist, very stiff	SPT-1	0.0 - 1.5	1.5	10-10-10	7	Boring advanced using 3 1/4" Hollow Stem Augers Clay lense from 1.5' to 1.9'
234.5'	3.0'		SPT-2	1.5 - 3.0	1.2	5-8-12	17	
		FILL-SANDY SILT, grayish brown, moist, soft to stiff	SPT-3	3.0 - 4.5	1.5	6-5-6	15	
			SPT-4	4.5 - 6.0	0.0	3-3-3	20	
			SPT-5	6.0 - 7.5	0.0	3-3-3	24	LL-33, PI-15 84% passing #200
228.5'	9.0'		SPT-6	7.5 - 9.0	0.8	2-1-2	31	
		FILL-LEAN CLAY, gray, moist, medium stiff	SPT-7	9.0 - 10.5	1.5	2-2-3	29	
225.5'	12.0'		SPT-8	10.5 - 12.0	1.5	3-3-4	29	
		FILL-SANDY SILT, gray, moist, medium stiff to very stiff	SPT-9	12.0 - 13.5	1.5	7-12-6	21	
222.0'	15.5'		SPT-10	13.5 - 15.0	1.5	3-4-3	22	
		FILL-SANDY CLAY, gray, moist, medium stiff to stiff	SPT-11	15.0 - 16.5	1.5	2-3-3	32	
			SPT-12	16.5 - 18.0	1.5	3-5-6	32	
217.5'	20.0'		SPT-13	18.0 - 19.5	1.5	2-2-3	35	
		SANDY SILT, light gray to gray, moist to saturated, medium stiff to very stiff	SPT-14	19.5 - 21.0	1.3	2-5-6	20	
			SPT-15	21.0 - 22.5	1.3	4-5-7	25	
			SPT-16	22.5 - 24.0	1.0	3-3-6	22	Sandy clay lense from 23.0' to 23.2'
			SPT-17	24.0 - 25.5	1.5	4-11-12	--	60% passing #200
			SPT-18	25.5 - 27.0	1.2	3-6-6	23	Clayey from 26.5' to 27.0'
208.5'	29.0'		SPT-19	27.0 - 28.5	1.5	3-2-4	28	
		LEAN TO FAT CLAY, tan, wet, soft to stiff, with fine grained sand	SPT-20	28.5 - 30.0	1.5	WOH-1-1	32	
			SPT-21	30.0 - 31.5	1.0	WOH-WOR-2	32	
			SPT-22	31.5 - 33.0	1.5	2-2-2	34	
			SPT-23	33.0 - 34.5	1.5	WOR-WOR-2	40	

Project No.	172679016	Location	N 274366.97, E 762687.88 (NAD27)		
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-4**	Total Depth	60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		LEAN TO FAT CLAY, tan, wet, soft to stiff, with fine grained sand *(Continued)*		SPT-24	34.5 - 36.0	1.5	WOR-2-2	41	
				SPT-25	36.0 - 37.5	1.5	3-4-5	37	
				SPT-26	37.5 - 39.0	1.5	WOH-1-2	34	
197.5'	40.0'			SPT-27	39.0 - 40.5	1.5	1-1-3	38	LL-47, PI-26 95% passing #200
		FAT CLAY, gray, moist to very moist, soft to medium stiff, with fine grained sand		SPT-28	40.5 - 42.0	1.2	1-2-2	46	
				SPT-29	42.0 - 43.5	1.5	2-2-3	59	
				SPT-30	43.5 - 45.0	1.5	WOH-2-2	46	
				SPT-31	45.0 - 46.5	1.5	WOH-3-2	48	
				SPT-32	46.5 - 48.0	1.0	WOH-3-2	41	
				SPT-33	48.0 - 49.5	1.5	WOH-2-2	40	
				SPT-34	49.5 - 51.0	1.5	WOH-1-2	38	LL-55, PI-35 99% passing #200
				SPT-35	51.0 - 52.5	1.5	3-3-3	39	
				SPT-36	52.5 - 54.0	1.5	WOH-2-3	35	
				SPT-37	54.0 - 55.5	1.5	WOH-2-2	34	
181.0'	56.5'			SPT-38	55.5 - 57.0	1.5	WOH-2-3	34	
179.0'	58.5'	CLAYEY SAND, gray, saturated, very loose, fine grained		SPT-39	57.0 - 58.5	1.5	2-4-3	34	
177.5'	60.0'	SAND, tan, saturated, very loose, medium to fine grained		SPT-40	58.5 - 60.0	0.4	WOR-WOR-WOR	36	
		No Refusal / Bottom of Hole							

WOH = Weight of Hammer
WOR = Weight of Rods

Boring backfilled with bentonite grout.
Slotted screen piezometer installed in offset boring 4' east, tip elevation 218.1 ft above mean sea level.
0.8 ft sand seat, followed by 5 ft slotted screen with sand pack to 9.4 ft above screen, and 4 ft bentonite seal on top.
Grout in the upper 1 ft (to top of hole).

SUBSURFACE LOG

Project No.	172679016	Location	N 274366.34, E 763200.60 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-5** Total Depth 40.5 ft
Location	Memphis, Tennessee	Surface Elevation	217.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	7/14/09 Completed 7/14/09
Supervisor	Patrick Kiser Driller J. Wethington	Depth to Water	24.5 ft Date/Time 7/14/09
Logged By	Craig Millhollin	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology Elevation	Depth	Description	Overburden Sample # / Rock Core RQD	Depth Run	Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
217.5'	0.0'	Top of Hole						
		Fill - SANDY SILT, brown, moist, medium stiff to stiff	SPT-1	0.0 - 1.5	1.1	3-6-7	15	Boring advanced using 3 1/4" Hollow Stem Augers
			SPT-2	1.5 - 3.0	1.1	5-4-4	9	
			SPT-3	3.0 - 4.5	1.4	3-3-3	12	LL-23, PI-3 61% passing #200
211.5'	6.0'		SPT-4	4.5 - 6.0	1.5	3-3-4	17	
		LEAN CLAY, silty, brown, moist, medium stiff to stiff	SPT-5	6.0 - 7.5	1.4	2-2-3	25	Wet from 7.0' to 7.2'
			SPT-6	7.5 - 9.0	1.0	3-4-7	23	
			SPT-7	9.0 - 10.5	1.4	2-3-5	28	
205.5'	12.0'		SPT-8	10.5 - 12.0	1.2	2-2-4	30	LL-33, PI-11 95% passing #200
		FAT CLAY, brown to tan, moist to very moist, medium stiff to stiff	SPT-9	12.0 - 13.5	1.4	2-3-6	31	
			SPT-10	13.5 - 15.0	1.4	5-5-7	41	
			SPT-11	15.0 - 16.5	1.1	2-3-4	35	
			SPT-12	16.5 - 18.0	1.5	2-3-4	35	
			SPT-13	18.0 - 19.5	1.3	5-6-7	43	LL-68, PI-46 99% passing #200
			SPT-14	19.5 - 21.0	1.0	6-6-7	45	
			SPT-15	21.0 - 22.5	0.9	5-4-7	43	
			SPT-16	22.5 - 24.0	1.5	2-4-5	37	
			SPT-17	24.0 - 25.5	1.3	3-5-6	37	Wet at 24.5'
190.0'	27.5'		SPT-18	25.5 - 27.0	1.3	6-6-8	36	
		SILTY SAND, brown to gray, very moist, loose to medium dense, fine grained	SPT-19	27.0 - 28.5	1.2	5-7-12	31	Clay layer from 28.5' to 30.0'
			SPT-20	28.5 - 30.0	1.4	1-1-5	36	
			SPT-21	30.0 - 31.5	1.3	3-3-12	33	50% passing #200
			SPT-22	31.5 - 33.0	1.5	10-12-14	27	
			SPT-23	33.0 - 34.5	1.5	6-4-3	25	

Project No.	172679016	Location	N 274366.34, E 763200.60 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-5** Total Depth 40.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		SILTY SAND, brown to gray, very moist, loose to medium dense, fine grained *(Continued)*		SPT-24	34.5 - 36.0	1.2	3-3-4	35	
				SPT-25	36.0 - 37.5	1.5	3-6-8	32	
178.5'	39.0'			SPT-26	37.5 - 39.0	1.0	11-10-9	28	
177.0'	40.5'	FAT CLAY, gray, wet, medium stiff, with sand and silt		SPT-27	39.0 - 40.5	1.3	3-3-3	44	

No Refusal /
Bottom of Hole

Slotted screen piezometer installed, tip elevation 182.5 ft above mean sea level.
1 ft bentonite plug, 4 ft sand seat, followed by 5 ft slotted screen with sand pack to 3.7 ft above screen, and 2.8 ft bentonite seal on top. Grout in the upper 24 ft (to top of hole).

Project No.	172679016	Location	N 274264.03, E 763177.15 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-6** Total Depth 60.0 ft
Location	Memphis, Tennessee	Surface Elevation	238.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	7/14/09 Completed 7/14/09
Supervisor	Patrick Kiser Driller G. Thompson	Depth to Water	28.0 ft Date/Time 7/14/09
Logged By	Briggs Evans	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
238.3'	0.0'	Top of Hole							
237.8'	0.5'	GRAVEL		SPT-1	0.0 - 1.5	1.5	10-15-15	8	Boring advanced using 3 1/4" Hollow Stem Augers
		FILL - SANDY SILT, dark gray to gray, moist, stiff to very stiff		SPT-2	1.5 - 3.0	0.9	10-11-9	15	Clay from 1.5' to 2.0'
				SPT-3	3.0 - 4.5	1.2	6-9-6	17	
				SPT-4	4.5 - 6.0	1.5	4-5-7	22	
230.8'	7.5'			SPT-5	6.0 - 7.5	1.2	5-5-11	25	
		FILL - SILTY SAND, gray, moist, medium dense, fine grained		SPT-6	7.5 - 9.0	1.0	4-7-13	15	
				SPT-7	9.0 - 10.5	1.5	5-8-9	16	46% passing #200
				SPT-8	10.5 - 12.0	1.5	5-7-6	19	
225.3'	13.0'			SPT-9	12.0 - 13.5	1.5	5-4-5	30	Wet from 12.0' to 12.4'
223.8'	14.5'	FILL - SANDY CLAY, brown, moist, stiff		SPT-10	13.5 - 15.0	1.0	5-6-3	24	
221.8'	16.5'	FILL - CLAYEY SAND, dark gray, moist, medium dense, fine grained		SPT-11	15.0 - 16.5	1.2	3-6-7	19	
		FILL - SANDY SILT, gray, moist, stiff to very stiff		SPT-12	16.5 - 18.0	1.5	7-9-9	14	
				SPT-13	18.0 - 19.5	1.2	2-4-5	14	50% passing #200
				SPT-14	19.5 - 21.0	1.5	3-5-5	20	
215.8'	22.5'			SPT-15	21.0 - 22.5	1.5	5-13-13	16	Clay lense from 20.7' to 21.0' Clay lense from 21.5' to 21.6'
		SANDY SILT, dark gray, moist, medium stiff to stiff		SPT-16	22.5 - 24.0	1.0	2-5-5	23	
				SPT-17	24.0 - 25.5	1.2	2-2-2	24	
				SPT-18	25.5 - 27.0	1.2	4-4-4	24	55% passing #200
209.3'	29.0'			SPT-19	27.0 - 28.5	1.5	3-3-2	26	Saturated at 28.0'
		LEAN CLAY, dark gray, moist, medium stiff, some fine grained sand		SPT-20	28.5 - 30.0	1.0	WOH-2-3	25	
				SPT-21	30.0 - 31.5	1.0	1-2-2	30	
205.3'	33.0'			SPT-22	31.5 - 33.0	1.0	2-3-3	33	
				SPT-23	33.0 - 34.5	1.4	1-2-3	36	

Project No.	172679016	Location	N 274264.03, E 763177.15 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-6** Total Depth 60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		FAT CLAY, tan and gray, moist to wet, soft to stiff, trace fine grained sand *(Continued)*		SPT-24	34.5 - 36.0	1.5	1-2-3	44	
				SPT-25	36.0 - 37.5	1.5	3-4-4	40	LL-76, PI-50 80% passing #200
				SPT-26	37.5 - 39.0	1.5	1-2-2	47	
				SPT-27	39.0 - 40.5	1.5	2-2-3	45	
				SPT-28	40.5 - 42.0	1.5	2-2-4	39	
				SPT-29	42.0 - 43.5	1.5	3-4-3	37	Silt lense from 42.8' to 43.1'
				SPT-30	43.5 - 45.0	1.5	2-1-2	37	
192.8'	45.5'	SAND, tan, saturated, very loose to medium dense, medium to fine grained		SPT-31	45.0 - 46.5	0.8	WOR-WOR-2	31	
				SPT-32	46.5 - 48.0	1.5	1-3-3	25	
				SPT-33	48.0 - 49.5	1.5	3-3-4	23	Drilling mud added at 48.0' 13% passing #200
				SPT-34	49.5 - 51.0	1.5	6-7-12	23	
186.3'	52.0'	SILTY SAND, gray, saturated, loose to medium dense, fine grained		SPT-35	51.0 - 52.5	1.5	6-10-14	26	
				SPT-36	52.5 - 54.0	1.5	3-3-3	28	
				SPT-37	54.0 - 55.5	1.5	2-7-10	29	
				SPT-38	55.5 - 57.0	1.5	4-9-14	30	
				SPT-39	57.0 - 58.5	1.0	10-12-10	27	
179.3'	59.0'	LEAN CLAY, gray, moist, medium stiff, with fine grained sand		SPT-40	58.5 - 60.0	1.5	3-3-2	36	
178.3'	60.0'	No Refusal / Bottom of Hole							

WOH = Weight of Hammer
WOR = Weight of Rods

Boring backfilled with bentonite grout.
Slotted screen piezometer installed in offset boring 4' east, tip elevation 220.5 ft above mean sea level.
1.1 ft sand seat, followed by 5 ft slotted screen with sand pack to 6 ft above screen, and 5.3 ft bentonite seal on top.
Grout in the upper 1.7 ft (to top of hole).

Stantec

SUBSURFACE LOG

Project No.	172679016	Location	N 274234.70, E 763171.06 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-7** Total Depth 41.0 ft
Location	Memphis, Tennessee	Surface Elevation	235.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	7/17/09 Completed 7/18/09
Supervisor	Patrick Kiser Driller J. Wethington	Depth to Water	13.5 ft Date/Time 7/17/09
Logged By	Craig Millhollin	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
235.6'	0.0'	Top of Hole							
		FILL - SANDY SILT, with clay, gray to brown, moist, stiff to very stiff		SPT-1	0.0 - 1.5	0.3	5-16-18	12	Boring advanced using 3 1/4" Hollow Stem Augers
				SPT-2	1.5 - 3.0	1.0	9-7-7	17	
				SPT-3	3.0 - 4.5	1.5	9-8-7	18	
				SPT-4	4.5 - 6.0	1.3	5-7-6	21	
				SPT-5	6.0 - 7.5	1.2	9-9-9	23	LL-24, PI-6 61% passing #200
				SPT-6	7.5 - 9.0	1.3	5-5-11	27	
				SPT-7	9.0 - 10.5	1.5	10-7-13	28	Clay layer from 9.5' to 9.8'
				SPT-8	10.5 - 12.0	0.5	15-14-12	24	
				SPT-9	12.0 - 13.5	0.7	5-7-8	22	Wet at 13.5'
				SPT-10	13.5 - 15.0	1.5	7-6-9	24	
				SPT-11	15.0 - 16.5	1.5	3-3-6	28	
				SPT-12	16.5 - 18.0	0.9	3-4-7	24	
				SPT-13	18.0 - 19.5	1.1	12-12-13	16	LL-22, PI-5 63% passing #200
				SPT-14	19.5 - 21.0	1.5	5-7-8	26	
				SPT-15	21.0 - 22.5	1.1	11-12-14	24	
211.6'	24.0'			SPT-16	22.5 - 24.0	1.4	8-11-11	23	58% passing #200
		SANDY SILT, gray, moist to very moist, medium stiff to stiff		SPT-17	24.0 - 25.5	1.5	5-5-8	26	
				SPT-18	25.5 - 27.0	1.5	3-3-3	29	
				SPT-19	27.0 - 28.5	0.9	3-4-4	30	
205.6'	30.0'			SPT-20	28.5 - 30.0	0.9	3-3-3	34	
		FAT CLAY, gray, moist to very moist, medium stiff to stiff		ST-1	30.0 - 32.0	1.0		35	
				SPT-21	32.0 - 33.5	1.2	3-4-3	43	
				SPT-22	33.5 - 35.0	0.9	3-3-4	42	

Project No.	172679016	Location	N 274234.70, E 763171.06 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-7** Total Depth 41.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		FAT CLAY, gray, moist to very moist, medium stiff to stiff *(Continued)*		SPT-23	35.0 - 36.5	1.5	1-1-5	38	LL-63, PI-42 97% passing #200
				SPT-24	36.5 - 38.0	1.5	5-5-3	42	
				SPT-25	38.0 - 39.5	1.5	3-4-5	37	
194.6'	41.0'			SPT-26	39.5 - 41.0	1.5	5-5-6	39	

No Refusal /
Bottom of Hole

Boring backfilled with bentonite grout.
Slotted screen piezometer installed in offset boring 3' west, tip elevation 219.9 ft above mean sea level.
2 ft sand seat, followed by 5 ft slotted screen with sand pack to 4.5 ft above screen, and 5 ft bentonite seal on top.
Grout in the upper 1.1 ft (to top of hole).

Stantec

SUBSURFACE LOG

Project No.	172679016	Location	N 274165.16, E 763646.95 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-8** Total Depth 60.5 ft
Location	Memphis, Tennessee	Surface Elevation	237.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	7/16/09 Completed 7/17/09
Supervisor	Patrick Kiser Driller G. Thompson	Depth to Water	25.0 ft Date/Time 7/16/09
Logged By	Briggs Evans	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
237.5'	0.0'	Top of Hole							
		FILL - SANDY SILT, gray, moist, stiff to very stiff		SPT-1	0.0 - 1.5	1.5	6-8-10	8	Boring advanced using 3 1/4" Hollow Stem Augers
				SPT-2	1.5 - 3.0	1.5	10-13-15	13	
				SPT-3	3.0 - 4.5	1.5	4-7-6	14	Wood fragments at 4'
				SPT-4	4.5 - 6.0	1.2	3-7-10	14	
				SPT-5	6.0 - 7.5	1.5	9-11-10	16	
				SPT-6	7.5 - 9.0	1.5	4-5-6	19	LL-25, PI-6 71% passing #200
				SPT-7	9.0 - 10.5	1.5	4-6-9	15	
				SPT-8	10.5 - 12.0	1.4	3-7-9	17	
				SPT-9	12.0 - 13.5	1.5	9-10-11	14	
				SPT-10	13.5 - 15.0	1.5	4-6-8	14	
				SPT-11	15.0 - 16.5	1.1	5-12-9	13	
				SPT-12	16.5 - 18.0	1.5	6-9-11	15	
				SPT-13	18.0 - 19.5	1.4	4-8-10	15	
				SPT-14	19.5 - 21.0	1.3	3-5-7	17	
215.5'	22.0'			SPT-15	21.0 - 22.5	1.5	7-8-8	20	
		SANDY SILT, gray, moist to saturated, very soft to stiff		SPT-16	22.5 - 24.0	1.3	3-6-5	17	
				SPT-17	24.0 - 25.5	1.5	2-2-2	27	
				SPT-18	25.5 - 27.0	1.2	WOH-1-1	28	58% passing #200
				SPT-19	27.0 - 28.5	1.5	WOR-1-1	31	
				SPT-20	28.5 - 30.0	1.5	WOR-WOR-1	29	
206.8'	30.7'			SPT-21	30.0 - 31.5	1.0	WOR-WOH-3	34	
		LEAN CLAY, gray, moist, soft to medium stiff, trace fine grained sand		SPT-22	31.5 - 33.0	1.3	3-3-4	32	
203.3'	34.2'			SPT-23	33.0 - 34.5	1.5	2-2-1	34	

SUBSURFACE LOG

Project No.	172679016	Location	N 274165.16, E 763646.95 (NAD27)
Project Name	Allen Fossil Plant (TVA)	Boring No.	**STN-8** Total Depth 60.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		FAT CLAY, gray with tan, moist to wet, soft to stiff, some fine grained sand *(Continued)*		ST-1	34.5 - 36.5	2.0		44	
				SPT-24	36.5 - 38.0	1.5	2-3-4	42	
				SPT-25	38.0 - 39.5	1.3	WOH-2-3	40	
				SPT-26	39.5 - 41.0	1.5	1-3-2	39	
				SPT-27	41.0 - 42.5	1.5	3-3-3	47	
				SPT-28	42.5 - 44.0	1.5	WOR-1-2	51	
				SPT-29	44.0 - 45.5	1.5	WPR-1-2	52	LL-79, PI-55 92% passing #200
				SPT-30	45.5 - 47.0	1.5	WOR-2-2	45	
				SPT-31	47.0 - 48.5	1.5	3-4-5	38	
				SPT-32	48.5 - 50.0	1.5	WOH-2-2	42	
				SPT-33	50.0 - 51.5	1.5	1-3-3	37	
184.5'	53.0'			SPT-34	51.5 - 53.0	1.5	WOH-2-4	39	
		SILT, with sand, gray, very moist to saturated, very soft to medium stiff		SPT-35	53.0 - 54.5	1.5	WOR-2-2	34	
				SPT-36	54.5 - 56.0	1.5	WOR-WOR-WOR	37	
				SPT-37	56.0 - 57.5	1.5	WOR-2-2	31	LL-26, PI-4 85% passing #200
				SPT-38	57.5 - 59.0	1.5	WOH-1-4	38	
178.0'	59.5'								
177.0'	60.5'	CLAY, gray, moist, medium stiff, some fine grained sand		SPT-39	59.0 - 60.5	1.5	WOH-3-4	40	

No Refusal /
Bottom of Hole

WOH = Weight of Hammer
WOR = Weight of Rods

Boring backfilled with bentonite grout.
Slotted screen piezometer installed in offset boring 4' east, tip elevation 218.6 ft above mean sea level.
1 ft sand seat, followed by 5 ft slotted screen with sand pack to 7.8 ft above screen, and 5.2 ft bentonite seal on top.
Grout in the upper 1.2 ft (to top of hole).

One Shelby Tube Sample collected from an off set boring: ST-1 5'-7'

Stantec

SUBSURFACE LOG

Project No.	172679016	Location	N 274226.34, E 763209.32 (NAD27)
Project Name	ALLEN FOSSIL PLANT (TVA)	Boring No.	**HA-1** Total Depth 7.0 ft
Location	Memphis, Tennessee	Surface Elevation	235.7 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	10/12/09 Completed 10/12/09
Supervisor	Patrick Kiser Driller Briggs Evans	Depth to Water	N/A Date/Time N/A
Logged By	Shaikh Rahman	Automatic Hammer ☐ Safety Hammer ☐ Other ☐	

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
235.7'	0.0'	Top of Hole							
		FILL - SANDY SILT, grayish brown to brown, moist			0.0 - 1.0			24	Boring advanced with a hand auger. LL - 29, PI - 6 68% passing #200
					1.0 - 2.0			19	LL - 25, PI - 4 62% passing #200
					2.0 - 3.0			--	
		3" lean clay seam at 3.5'			3.0 - 4.0			--	
					4.0 - 5.0			--	
					5.0 - 6.0			21	LL - 30, PI - 13 74% passing #200
		6" lean clay seam at 6.5'			6.0 - 7.0			20	LL - 23, PI - 5 62% passing #200
228.7'	7.0'								
		No Refusal / Bottom of Hole							

FMSM_LEGACY 172679016_HA.GPJ FMSM.GDT 12/11/09

SUBSURFACE LOG

Stantec

Project No.	172679016	Location	N 274202.98, E 763201.48 (NAD27)
Project Name	ALLEN FOSSIL PLANT (TVA)	Boring No.	HA-2 — Total Depth 5.0 ft
Location	Memphis, Tennessee	Surface Elevation	230.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	10/12/09 — Completed 10/12/09
Supervisor	Patrick Kiser — Driller Briggs Evans	Depth to Water	1.0 ft — Date/Time 10/12/09
Logged By	Shaikh Rahman	Automatic Hammer ☐	Safety Hammer ☐ Other ☐

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
230.5'	0.0'	Top of Hole						
		TOPSOIL, with roots Water at 1'		0.0 - 1.0			--	Boring advanced with a hand auger
229.0'	1.5'			1.0 - 2.0			--	
		FILL - SILTY CLAY, gray, moist to very moist		2.0 - 3.0			26	LL - 26, PI - 6 74% passing #200
227.5'	3.0'							
		FILL - SANDY SILT, gray, moist to very moist		3.0 - 4.0			--	
				4.0 - 5.0			--	
225.5'	5.0'							

No Refusal /
Bottom of Hole

SUBSURFACE LOG

Project No.	172679016	Location	N 274265.91, E 762999.17 (NAD27)
Project Name	ALLEN FOSSIL PLANT (TVA)	Boring No.	**HA-3** Total Depth 5.0 ft
Location	Memphis, Tennessee	Surface Elevation	234.2 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	10/12/09 Completed 10/12/09
Supervisor	Patrick Kiser Driller Briggs Evans	Depth to Water	N/A Date/Time N/A
Logged By	Shaikh Rahman	Automatic Hammer ☐ Safety Hammer ☐ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
234.2'	0.0'	Top of Hole							
233.9'	0.3'	TOPSOIL							Boring advanced with a hand auger
		FILL - SANDY SILT, brown to grayish brown, moist			0.0 - 1.0			--	
					1.0 - 2.0			19	LL - 23, PI - 6 55% passing #200
					2.0 - 3.0			--	
					3.0 - 4.0			--	
		with silty clay at 4'			4.0 - 5.0			20	LL - 25, PI - 6 66% passing #200
229.2'	5.0'								

No Refusal /
Bottom of Hole

Stantec

SUBSURFACE LOG

Project No.	172679016	Location	N 274333.93, E 762669.73 (NAD27)
Project Name	ALLEN FOSSIL PLANT (TVA)	Boring No.	**HA-4** Total Depth 5.0 ft
Location	Memphis, Tennessee	Surface Elevation	233.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	10/12/09 Completed 10/12/09
Supervisor	Patrick Kiser Driller Briggs Evans	Depth to Water	N/A Date/Time N/A
Logged By	Shaikh Rahman	Automatic Hammer ☐ Safety Hammer ☐ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
233.6'	0.0'	Top of Hole							
233.3'	0.3'	TOPSOIL							
		FILL - SANDY SILT, brown, moist			0.0 - 1.0			--	Boring advanced with a hand auger LL - 23, PI - 4 61% passing #200
					1.0 - 2.0			20	
					2.0 - 3.0			--	
					3.0 - 4.0			27	63% passing #200
					4.0 - 5.0			--	
228.6'	5.0'								
		No Refusal / Bottom of Hole							

Stantec

SUBSURFACE LOG

Project No.	172679016	Location	N 274409.74, E 762201.44 (NAD27)
Project Name	ALLEN FOSSIL PLANT (TVA)	Boring No.	**HA-5** Total Depth 5.0 ft
Location	Memphis, Tennessee	Surface Elevation	233.7 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	10/12/09 Completed 10/12/09
Supervisor	Patrick Kiser Driller Briggs Evans	Depth to Water	N/A Date/Time N/A
Logged By	Shaikh Rahman	Automatic Hammer ☐ Safety Hammer ☐ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
233.7'	0.0'	Top of Hole							
		FILL - SANDY SILT, grayish brown, moist			0.0 - 1.0			19	Boring advanced with a hand auger LL - 26, PI - 4 58% passing #200
					1.0 - 2.0			--	
					2.0 - 3.0			--	
					3.0 - 4.0			29	LL - 25, PI - 6 55% passing #200
					4.0 - 5.0			--	
228.7'	5.0'								
		No Refusal / Bottom of Hole							

FMSM_LEGACY 172679016_HA.GPJ FMSM.GDT 12/11/09

SUBSURFACE LOG

Project No.	172679016	Location	N 274395.67, E 762191.04 (NAD27)
Project Name	ALLEN FOSSIL PLANT (TVA)	Boring No.	**HA-6** Total Depth 12.0 ft
Location	Memphis, Tennessee	Surface Elevation	232.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	10/12/09 Completed 10/12/09
Supervisor	Patrick Kiser Driller Briggs Evans	Depth to Water	0.1 ft Date/Time 10/12/09
Logged By	Shaikh Rahman	Automatic Hammer ☐ Safety Hammer ☐ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
232.5'	0.0'	Top of Hole							
231.5'	1.0'	FILL - FLY ASH AND BOTTOM ASH, with sand, silt and roots, grayish brown, saturated			0.0 - 1.0			--	Boring advanced with a hand auger
222.5'	10.0'	FILL - FLY ASH AND BOTTOM ASH, grayish brown, saturated, soft			8.0 - 9.0			--	
					9.0 - 10.0			--	
221.5'	11.0'	FILL - SANDY SILT, grayish brown, very moist			10.0 - 11.0			29	
220.5'	12.0'	FILL - LEAN CLAY, brown, moist, stiff to very stiff			11.0 - 12.0			26	LL - 39, PI - 20 95% passing #200
		No Refusal / Bottom of Hole							

Stantec

SUBSURFACE LOG

Project No.	172679016	Location	N 374398.58, E 762201.29 (NAD27)
Project Name	ALLEN FOSSIL PLANT (TVA)	Boring No.	**HA-7** Total Depth 6.0 ft
Location	Memphis, Tennessee	Surface Elevation	232.4 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	10/12/09 Completed 10/12/09
Supervisor	Patrick Kiser Driller Briggs Evans	Depth to Water	0.1 ft Date/Time 10/12/09
Logged By	Shaikh Rahman	Automatic Hammer ☐ Safety Hammer ☐ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
232.4'	0.0'	Top of Hole						
231.4'	1.0'	FILL - FLY ASH AND BOTTOM ASH, with sand, silt and roots, grayish brown, saturated						Boring advanced using a hand auger
228.4'	4.0'	FILL - FLY ASH AND BOTTOM ASH, grayish brown, saturated						
227.4'	5.0'	FILL - SILTY CLAY, grayish brown, very moist		4.0 - 5.0			--	
226.4'	6.0'	FILL - LEAN CLAY, grayish brown, moist		5.0 - 6.0			31	LL - 35, PI - 17 85% passing #200
		No Refusal / Bottom of Hole						

SUBSURFACE LOG

Project No.	172679016	Location	N 274392.70, E 762251.17 (NAD27)
Project Name	ALLEN FOSSIL PLANT (TVA)	Boring No.	**HA-8** Total Depth 8.0 ft
Location	Memphis, Tennessee	Surface Elevation	232.1 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	10/12/09 Completed 10/12/09
Supervisor	Patrick Kiser Driller Briggs Evans	Depth to Water	0.1 ft Date/Time 10/12/09
Logged By	Shaikh Rahman	Automatic Hammer ☐ Safety Hammer ☐ Other ☐	

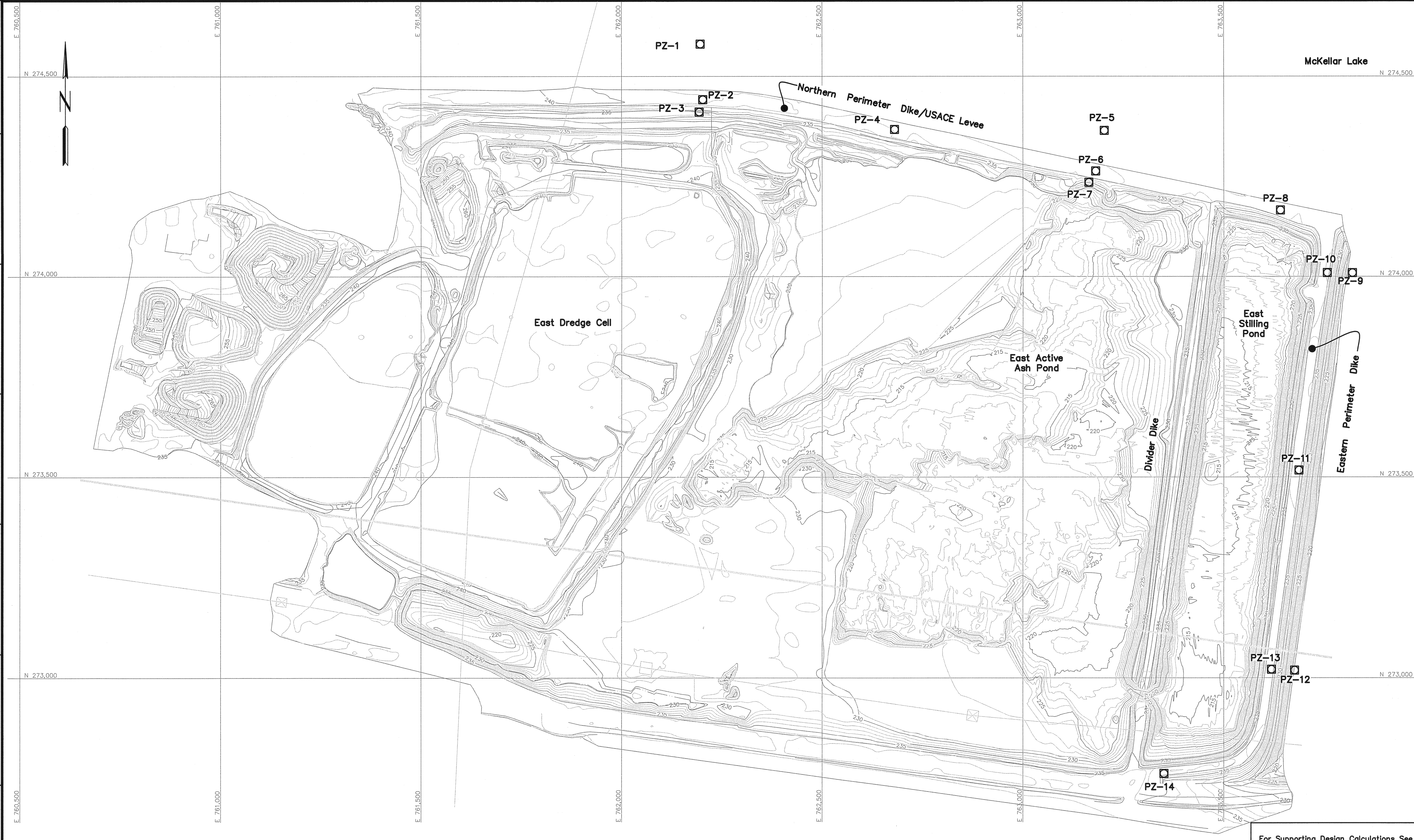
Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
232.1'	0.0'	Top of Hole							
231.1'	1.0'	FILL - FLY ASH AND BOTTOM ASH, with sand, silt and roots, grayish brown, saturated							Boring advanced using a hand auger
225.1'	7.0'	FILL - FLY ASH AND BOTTOM ASH, grayish brown, saturated			7.0 - 7.0			--	
224.6'	7.5'	FILL - SILTY CLAY, grayish brown, very moist							
224.1'	8.0'	FILL - LEAN CLAY, with silt, grayish brown, moist			7.5 - 8.0			18	LL - 43, PI - 25 96% passing #200
		No Refusal / Bottom of Hole							

Appendix C

Instrumentation Monitoring Program

- Instrumentation Layout
- Piezometer Installation Details
- Piezometer Data

Instrumentation Layout



LEGEND

PZ-14 ▢ Piezometer

NOTES:

1. The topographic mapping presented on this drawing was provided to Stantec by TVA Surveying and Project Services. This plan view was prepared to support development of the geotechnical exploration program and should not be used for construction.
2. The geotechnical information and data furnished herein are not intended as representation or warranties but are furnished for information only. It shall be distinctly understood that the Owner or Engineer will not be responsible for any deduction, interpretation or conclusion drawn therefrom. The information is made available in order that the Contractor may have ready access to the same information available to the Owner and the Engineer and is not part of this contract.

INSTRUMENTATION LOCATION TABLE				
BORING	NORTHING	EASTING	TOP OF CASING ELEV. (FT.)	CONCRETE PAD ELEV. (FT.)
PZ-1	274,580.31	762,195.58	218.2	215.5
PZ-2	274,441.99	762,201.92	238.7	238.8
PZ-3	274,411.16	762,192.94	237.4	234.5
PZ-4	274,367.46	762,679.46	237.3	237.5
PZ-5	274,364.82	763,202.51	220.7	218.0
PZ-6	274,263.61	763,180.87	238.4	238.5
PZ-7	274,235.39	763,163.82	235.4	235.5
PZ-8	274,166.09	763,641.32	237.7	237.8
PZ-9	274,009.16	763,820.47	224.2	221.2
PZ-10	274,009.41	763,758.03	237.1	237.4
PZ-11	273,517.12	763,687.47	237.8	237.9
PZ-12	273,018.83	763,676.83	220.1	217.2
PZ-13	273,020.94	763,619.04	237.0	237.2
PZ-14	272,761.04	763,351.79	236.4	236.6

RECORD DRAWING

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

For Supporting Design Calculations See FPGALFFESCDX00000020100002

PATRICK V. KISER REGISTERED ENGINEER AGRICULTURE STATE OF TENNESSEE No. 111393
3/25/2010

R 0 03/25/10 PVK PS SF HRA HRA PVK TJ
RECORD DRAWING
REV. NO. | DATE | DSGN | DRWN | CHKD | SUPV | RVWD | APPD | ISSD | PROJECT ID | AS CONST

SCALE: 1"=100' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
USACE LEVEE – EAST ASH POND
INSTRUMENTATION LAYOUT

DESIGNED BY: P. KISER | DRAWN BY: P. SILPACHARN | CHECKED BY: S. FIELD | SUPERVISED BY: H. APARICIO | REVIEWED BY: H. APARICIO | APPROVED BY: P. KISER | ISSUED BY: T. JOHNSON

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

Stantec Consulting Services Inc.
100 Westwood Place Suite 420
Brentwood, Tennessee 37027-5044
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

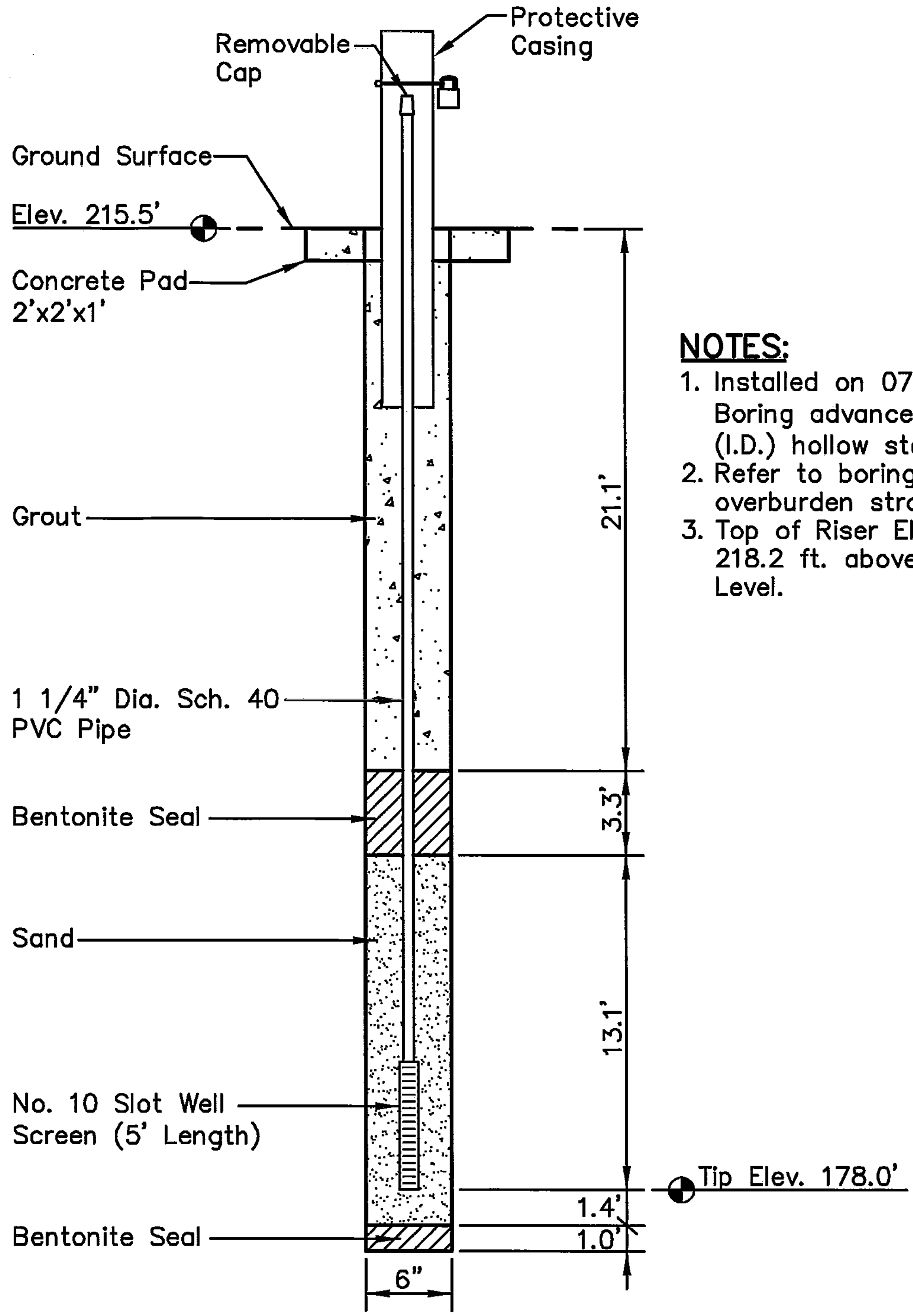
AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-10 | R 0

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

STANTEC 0
TASK COMPLETED BY: REV NO.

38 C 10W504-10

Piezometer Installation Details



NOTES:

1. Installed on 07/15/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 218.2 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ1.DWG

LOCATION:

Northing: 274580.31
Easting: 762195.58
Ground Elevation: 215.5 feet

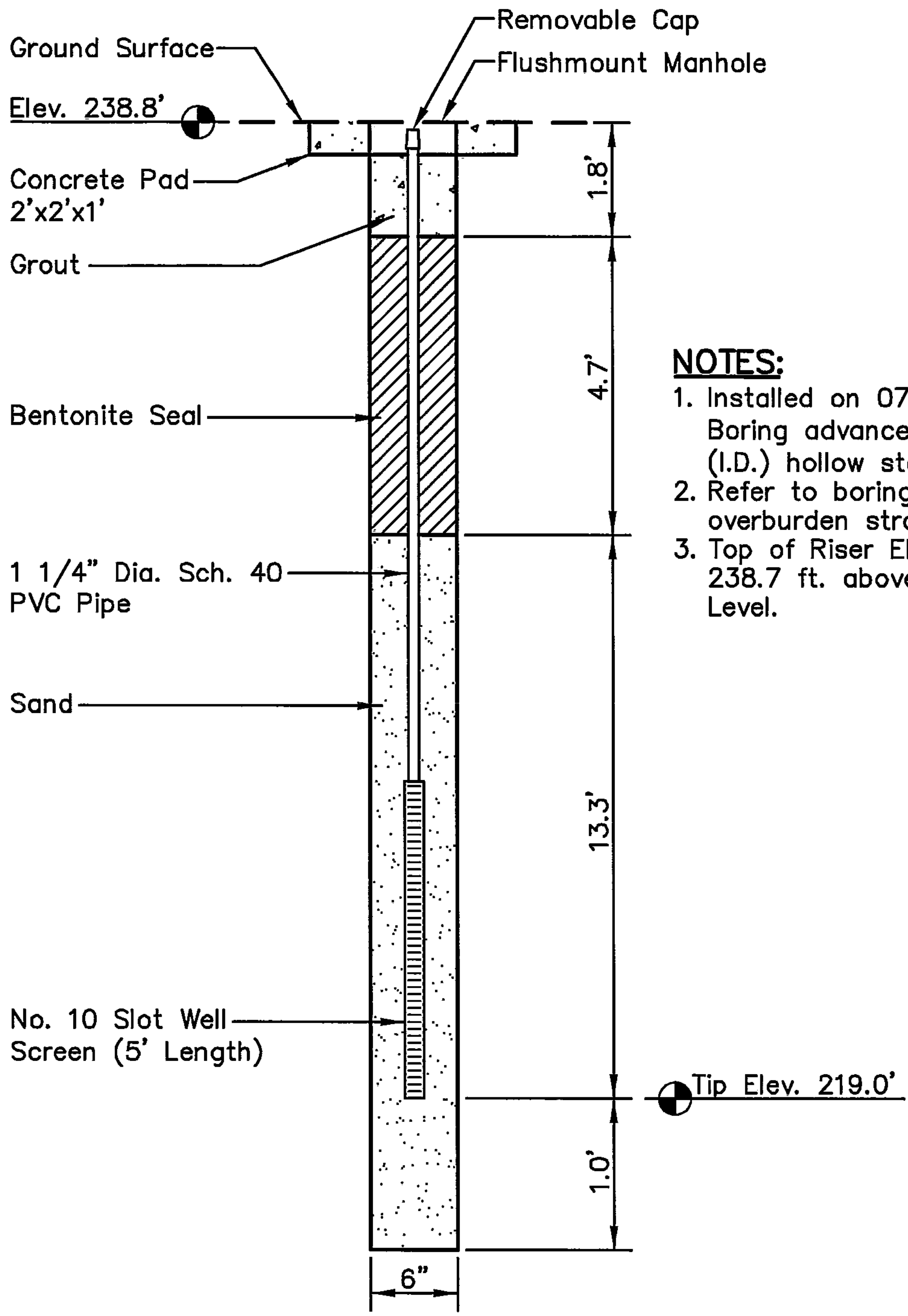
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-1
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE	AUG., 2009	REVISED		SHEET
CHECKED BY	PW	PROJ. NO.	172679016	1. 11/04/09	3.	1 OF 1
CHECKED BY	BE	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 07/15/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 238.7 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ2.DWG

LOCATION:

Northing: 274441.99
Easting: 762201.92
Ground Elevation: 238.8 feet

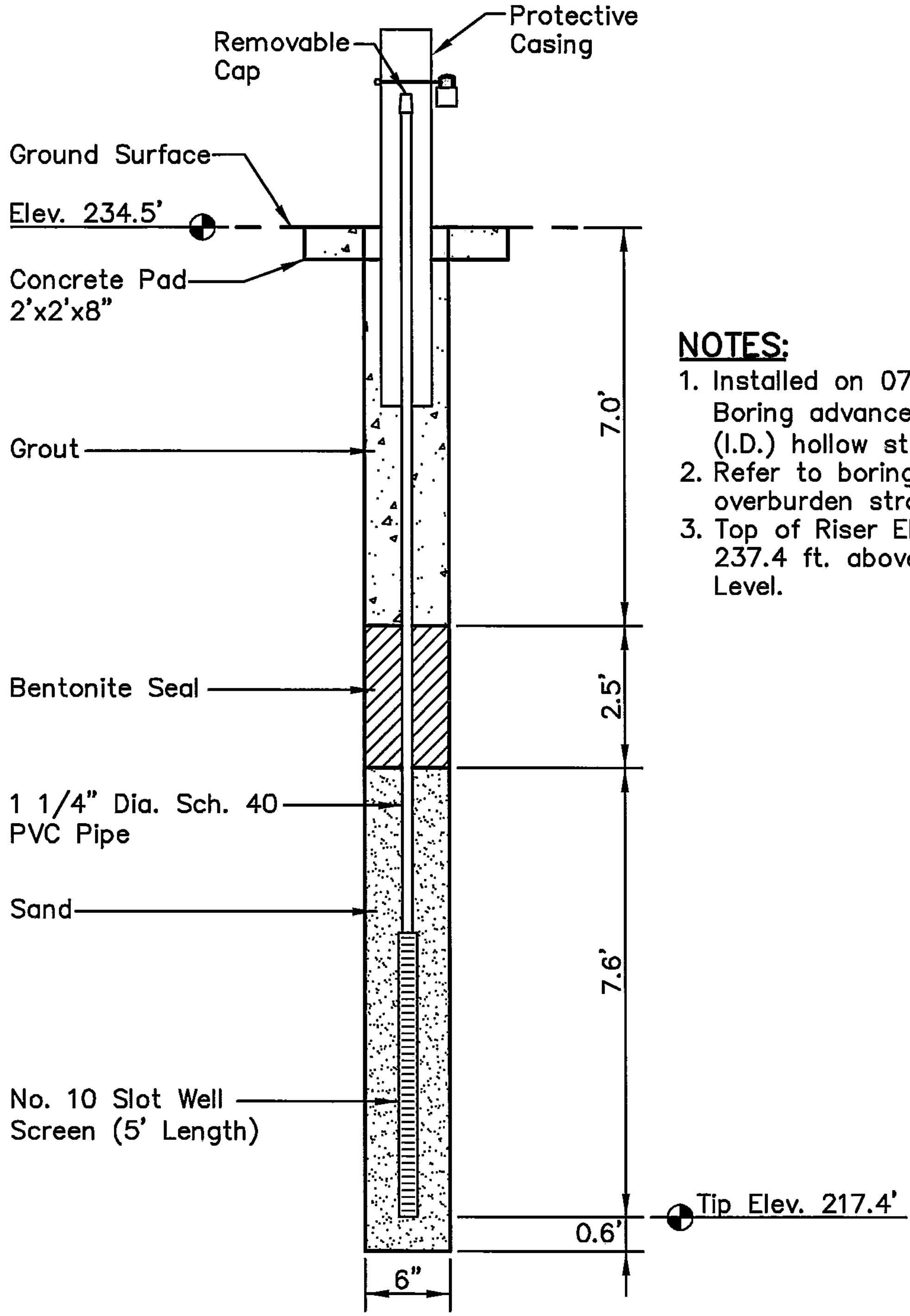
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-2
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY PS	DATE AUG., 2009	REVISED			SHEET
CHECKED BY PW	PROJ. NO. 172679016	1. 11/04/09	3.		1 OF 1
CHECKED BY BE	SCALE NTS	2.	4.		



NOTES:

1. Installed on 07/17/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 237.4 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B–ALF–PZ3.DWG

LOCATION:

Northing: 274411.16
Easting: 762192.94
Ground Elevation: 234.5 feet

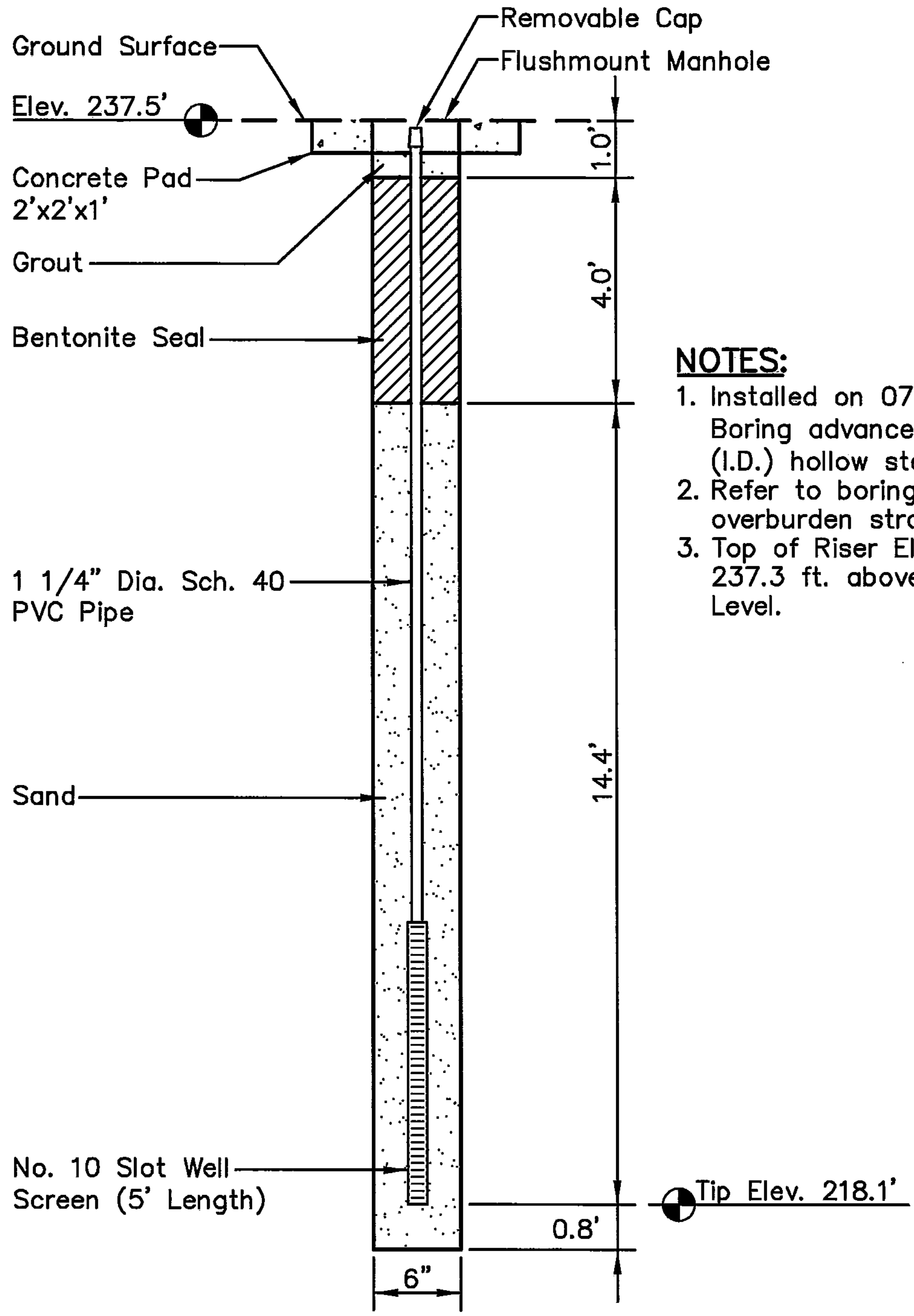
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-3
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE AUG., 2009	REVISED			SHEET
CHECKED BY	PW	PROJ. NO. 172679016	1.	11/04/09	3.	1 OF 1
CHECKED BY	BE	SCALE NTS	2.		4.	



NOTES:

1. Installed on 07/16/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 237.3 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ4.DWG

LOCATION:

Northing: 274367.46
Easting: 762679.46
Ground Elevation: 237.5 feet

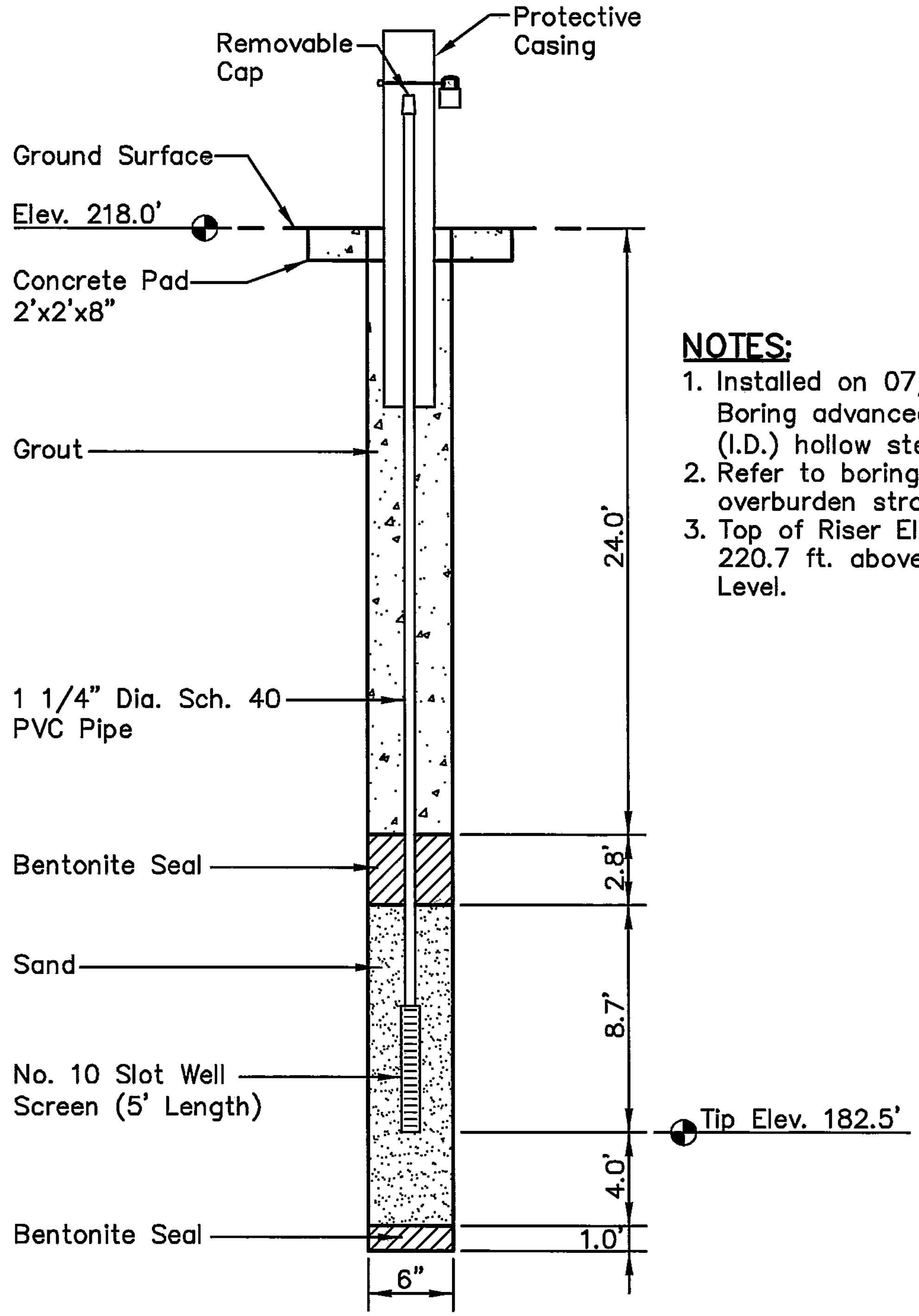
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-4
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE	AUG., 2009	REVISED		SHEET
CHECKED BY	PW	PROJ. NO.	172679016	1. 11/04/09	3.	1 OF 1
CHECKED BY	BE	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 07/14/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 220.7 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ5.DWG

LOCATION:

Northing: 274364.82
Easting: 763202.51
Ground Elevation: 218.0 feet

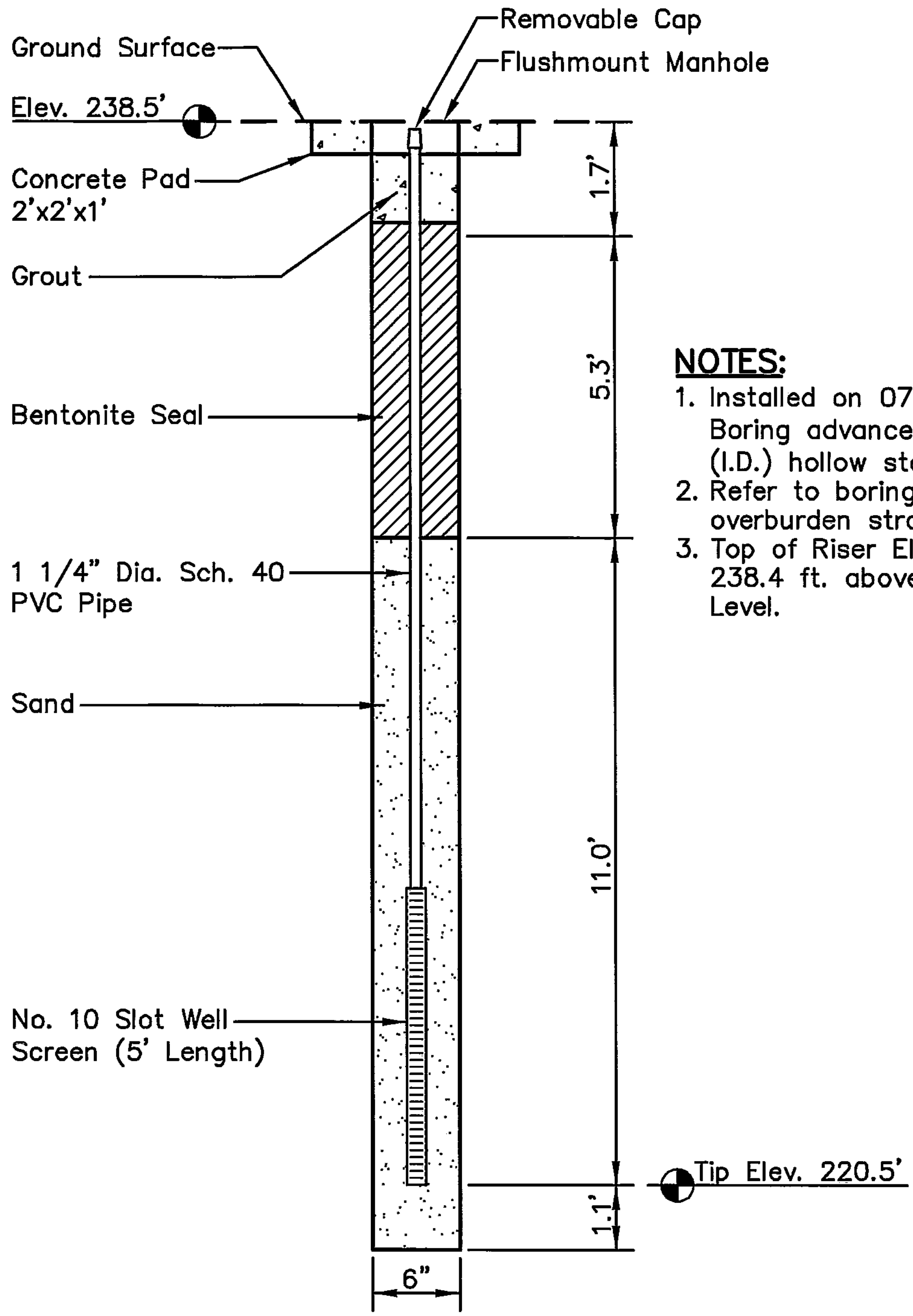
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-5
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY PS	DATE AUG., 2009	REVISED		SHEET
CHECKED BY PW	PROJ. NO. 172679016	1. 11/04/09	3.	1 OF 1
CHECKED BY BE	SCALE NTS	2.	4.	



NOTES:

1. Installed on 07/14/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 238.4 ft. above Mean Sea Level.

LOCATION:
Northing: 274263.61
Easting: 763180.87
Ground Elevation: 238.5 feet

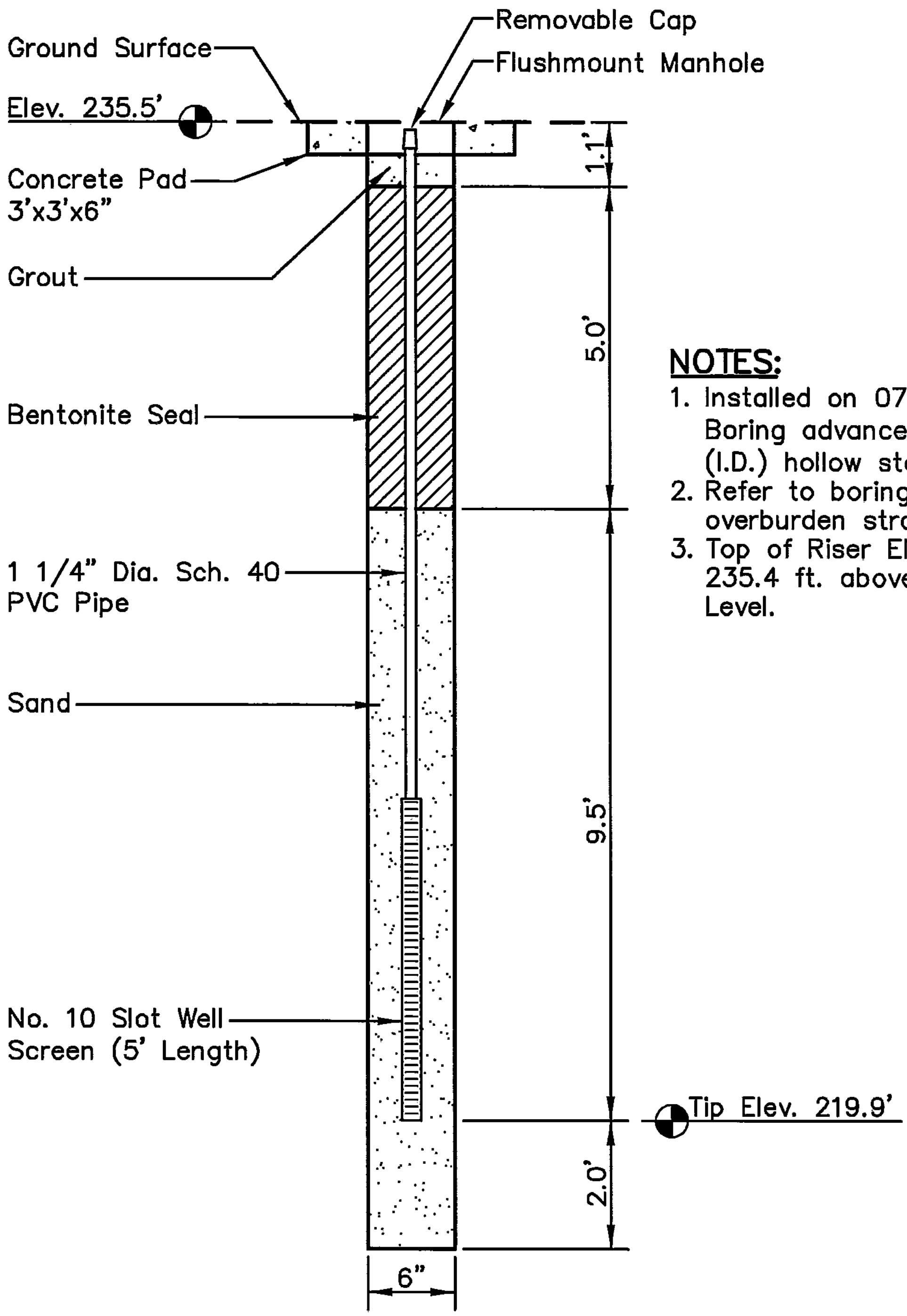
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-6
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE	AUG., 2009	REVISED			SHEET
CHECKED BY	PW	PROJ. NO.	172679016	1. 11/04/09	3.		1 OF 1
CHECKED BY	BE	SCALE	NTS	2.	4.		



NOTES:

1. Installed on 07/18/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 235.4 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ7.DWG

LOCATION:

Northing: 274235.39
Easting: 763163.82
Ground Elevation: 235.5 feet

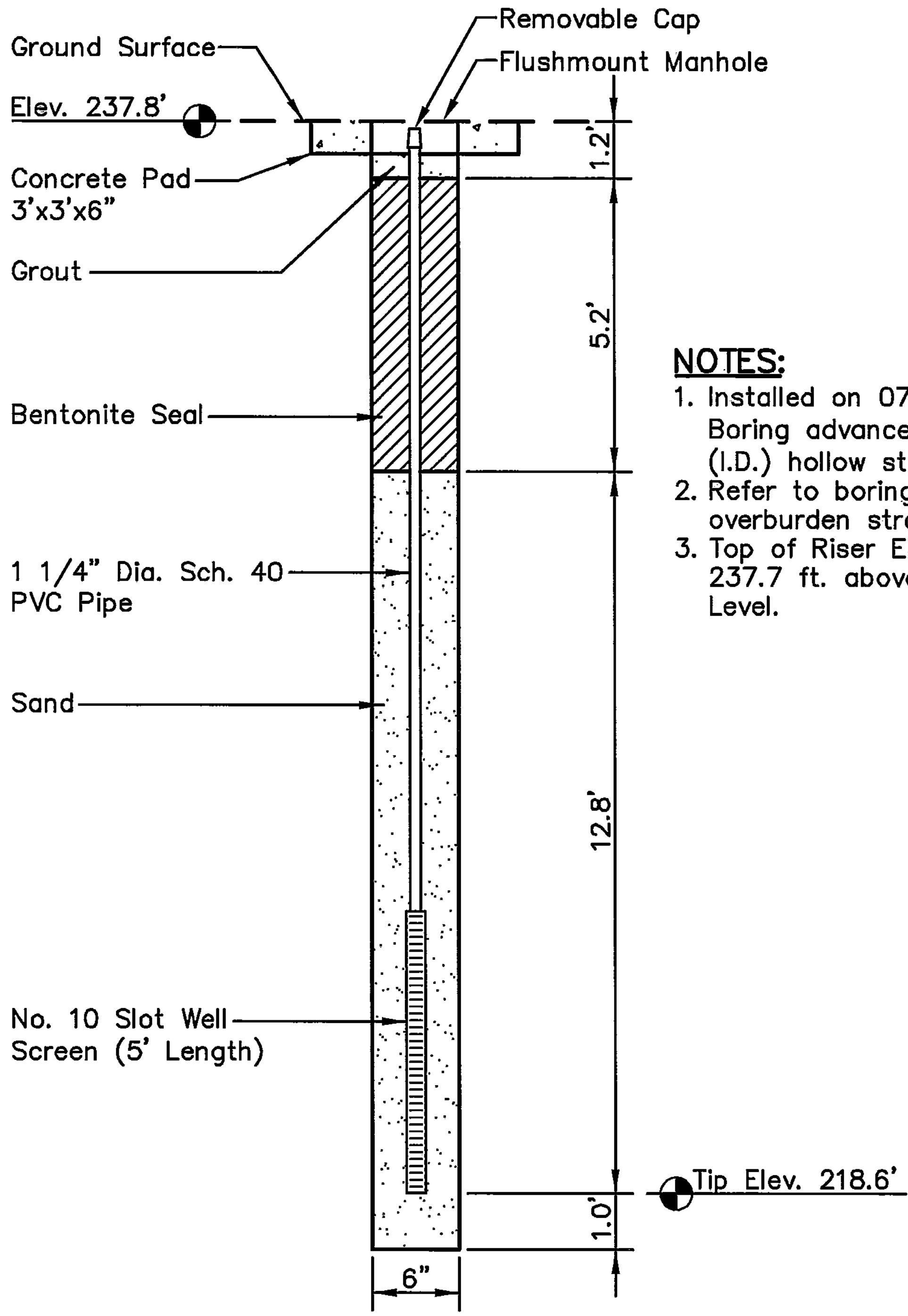
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-7
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE	AUG., 2009	REVISED		SHEET
CHECKED BY	PW	PROJ. NO.	172679016	1. 11/04/09	3.	1 OF 1
CHECKED BY	BE	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 07/17/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 237.7 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ8.DWG

LOCATION:

Northing: 274166.09
Easting: 763641.32
Ground Elevation: 237.8 feet

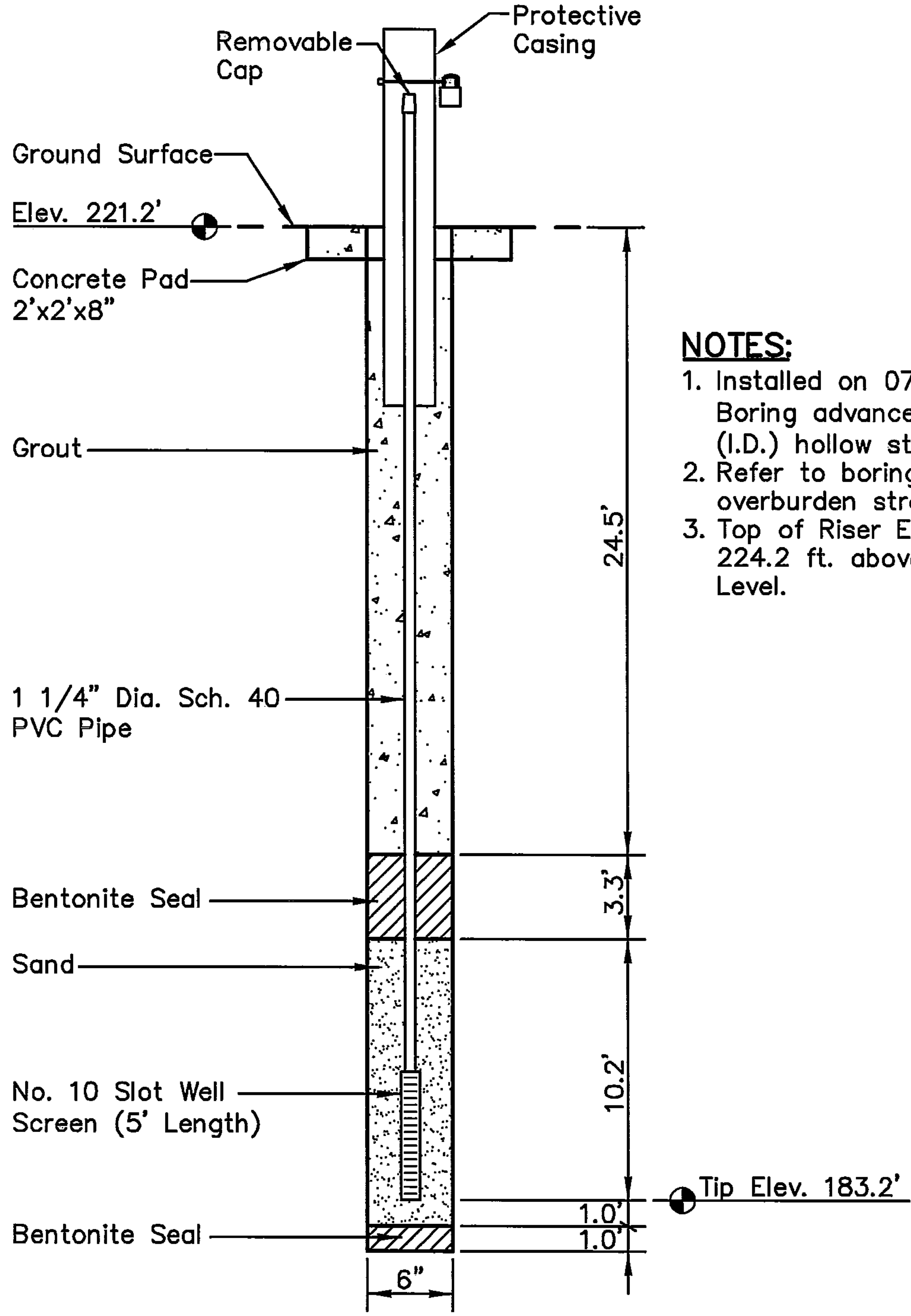
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-8
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE	AUG., 2009	REVISED		SHEET
CHECKED BY	PW	PROJ. NO.	172679016	1. 11/04/09	3.	1 OF 1
CHECKED BY	BE	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 07/16/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 224.2 ft. above Mean Sea Level.

LOCATION:

Northing: 274009.16
Easting: 763820.47
Ground Elevation: 221.2 feet

Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

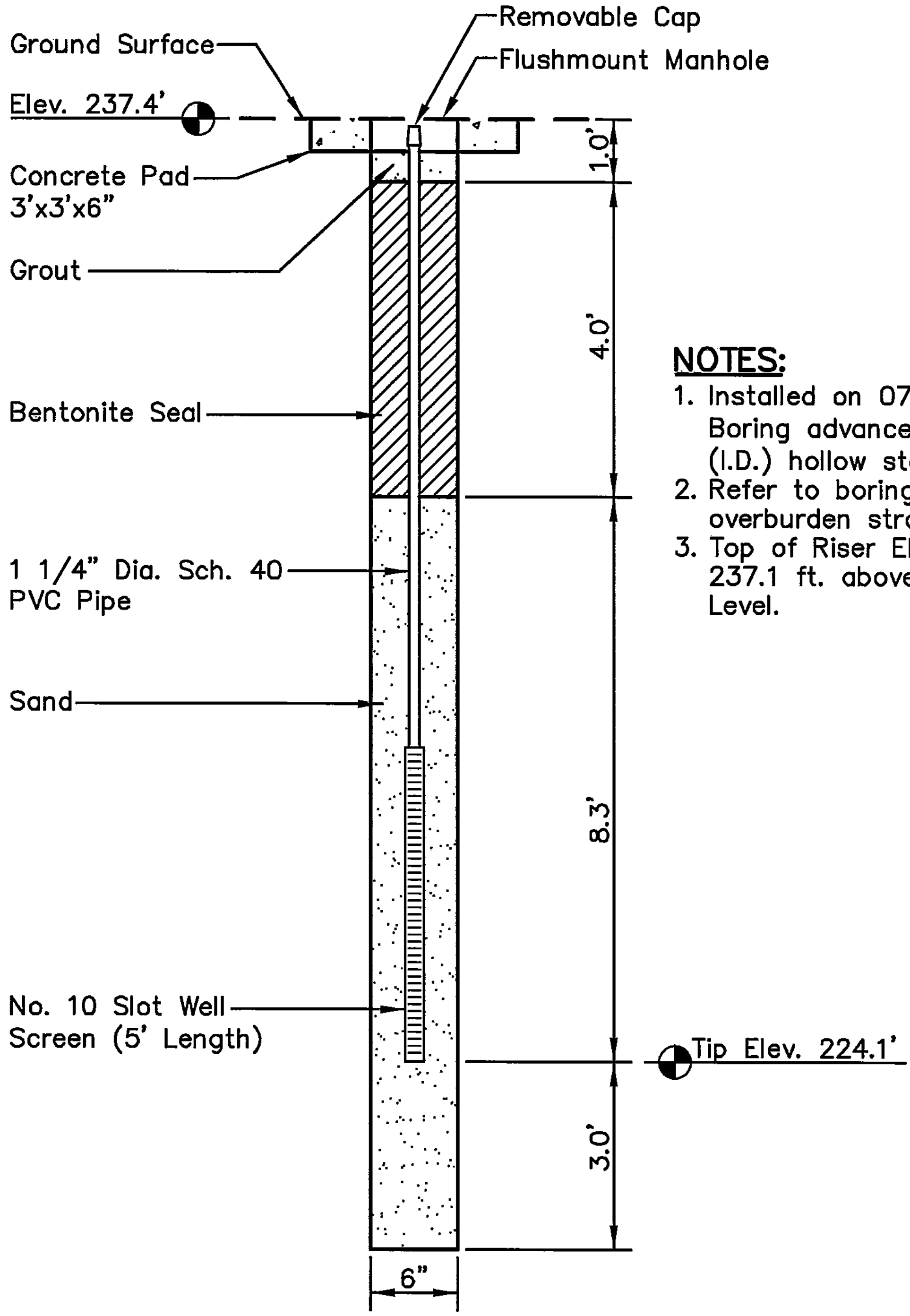
PIEZOMETER STN-9
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE	AUG., 2009	REVISED		SHEET
CHECKED BY	PW	PROJ. NO.	172679016	1. 11/04/09	3.	1 OF 1
CHECKED BY	BE	SCALE	NTS	2.	4.	

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ9.DWG



NOTES:

1. Installed on 07/18/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 237.1 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ10.DWG

LOCATION:

Northing: 274009.41
Easting: 763758.03
Ground Elevation: 237.4 feet

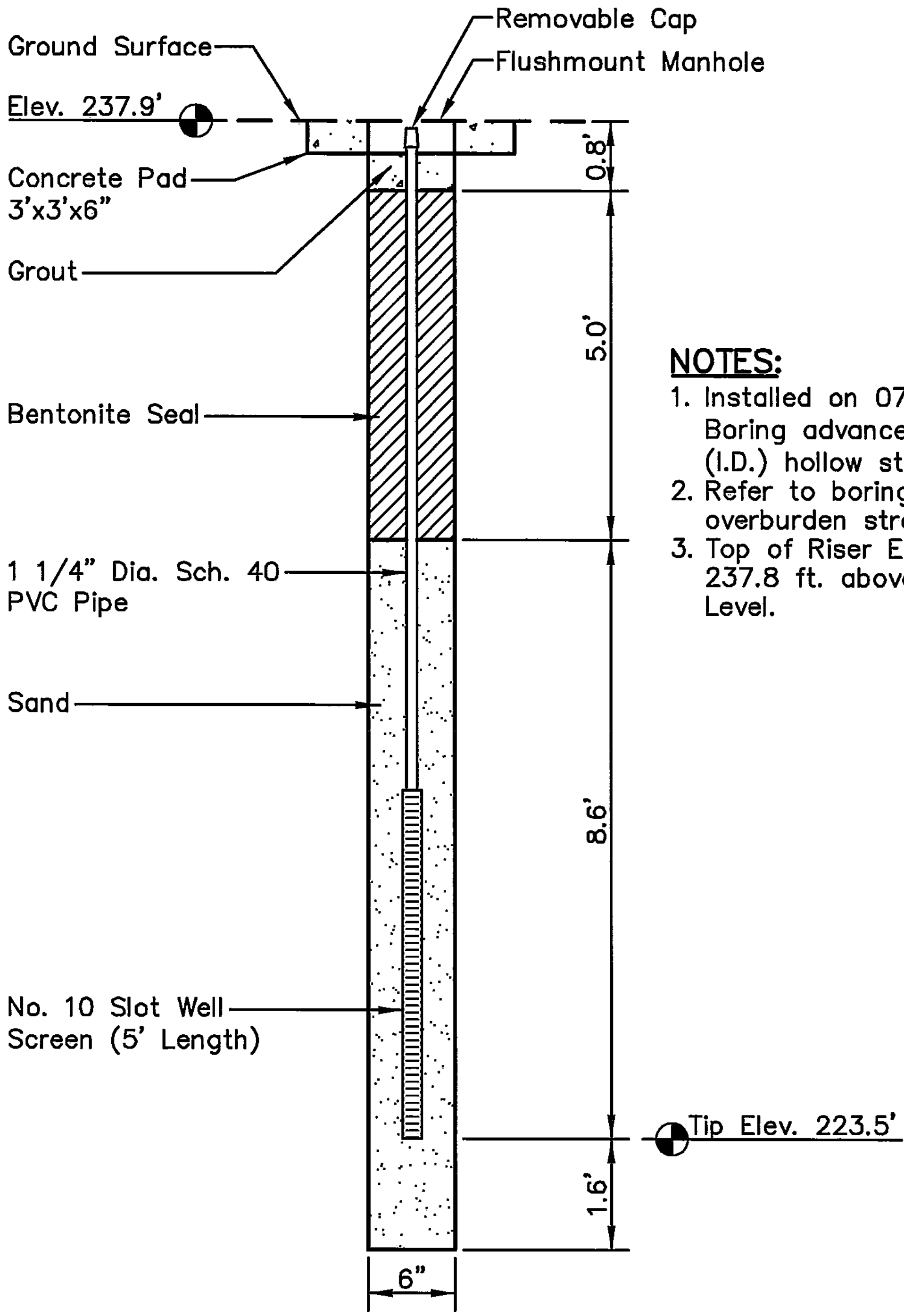
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-10
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE AUG., 2009	REVISED		SHEET
CHECKED BY	PW	PROJ. NO. 172679016	1. 11/04/09	3.	1 OF 1
CHECKED BY	BE	SCALE NTS	2.	4.	



NOTES:

1. Installed on 07/18/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 237.8 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ11.DWG

LOCATION:

Northing: 273517.12
Easting: 763687.47
Ground Elevation: 237.9 feet

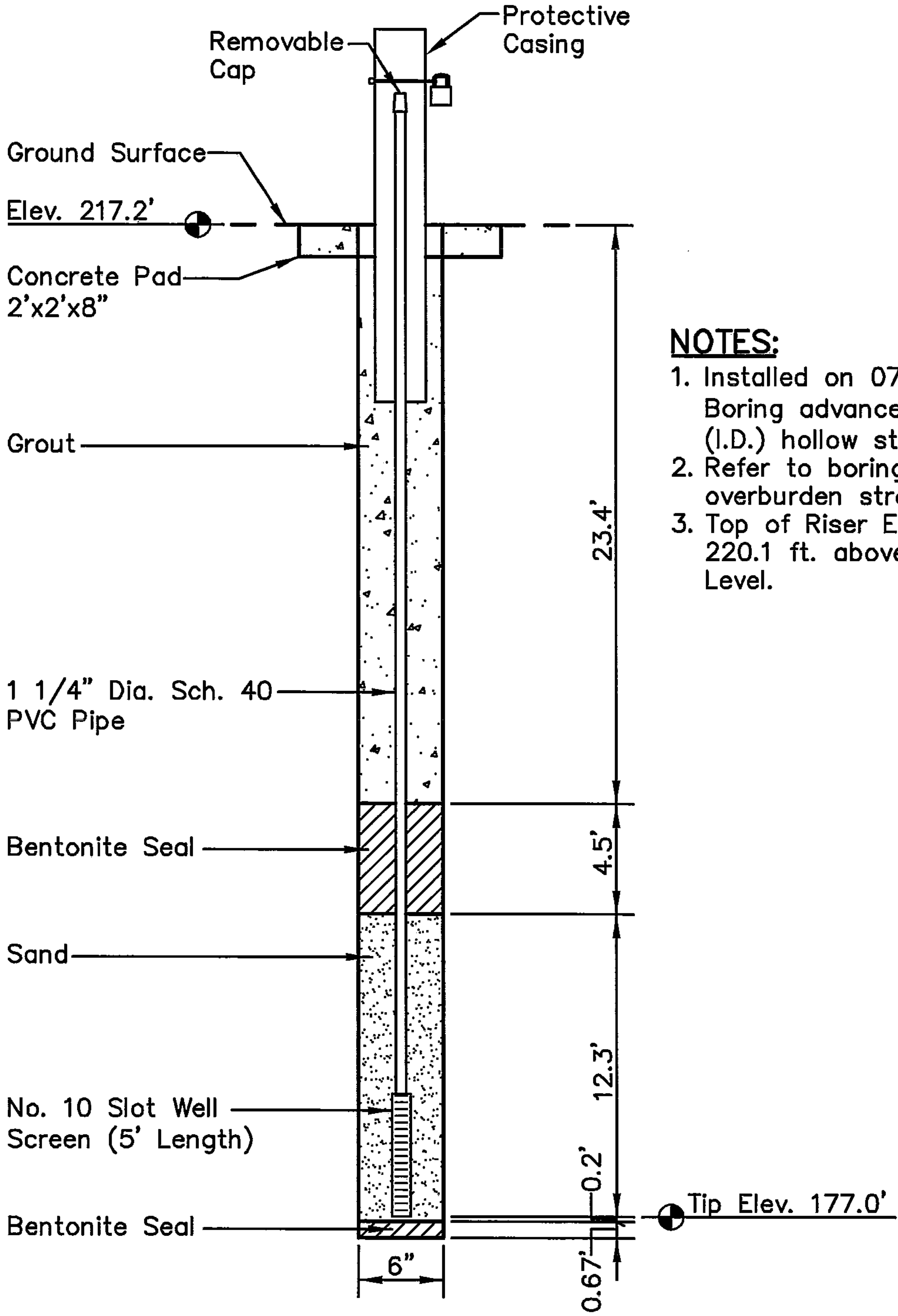
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-11
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE AUG., 2009	REVISED			SHEET
CHECKED BY	PW	PROJ. NO. 172679016	1. 11/04/09	3.		1 OF 1
CHECKED BY	BE	SCALE NTS	2.	4.		



NOTES:

1. Installed on 07/19/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 220.1 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ12.DWG

LOCATION:

Northing: 273018.83
Easting: 763676.83
Ground Elevation: 217.2 feet

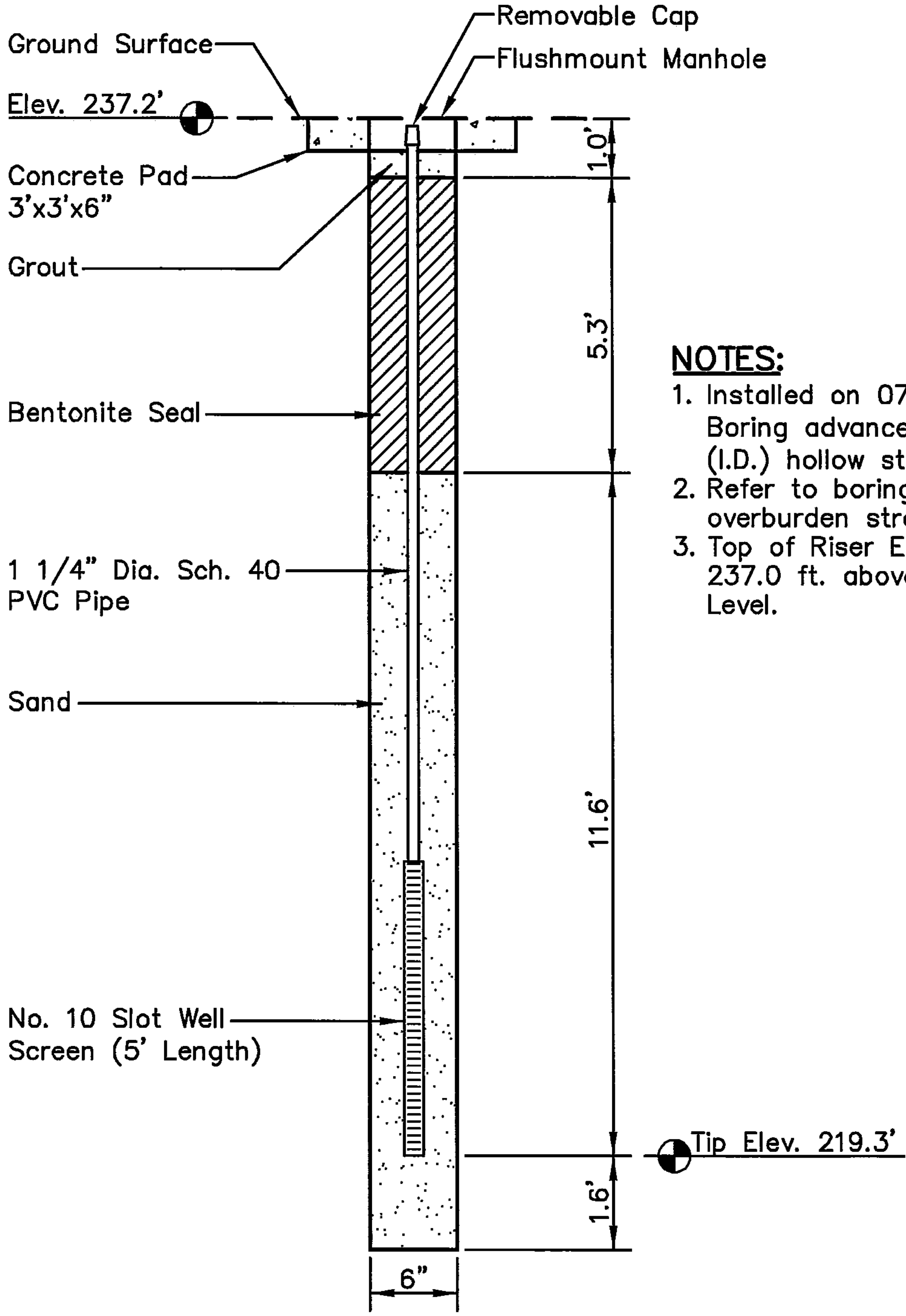
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-12
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE	AUG., 2009	REVISED		SHEET
CHECKED BY	PW	PROJ. NO.	172679016	1. 11/04/09	3.	1 OF 1
CHECKED BY	BE	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 07/18/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 237.0 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ13.DWG

LOCATION:

Northing: 273020.94
Easting: 763619.04
Ground Elevation: 237.2 feet

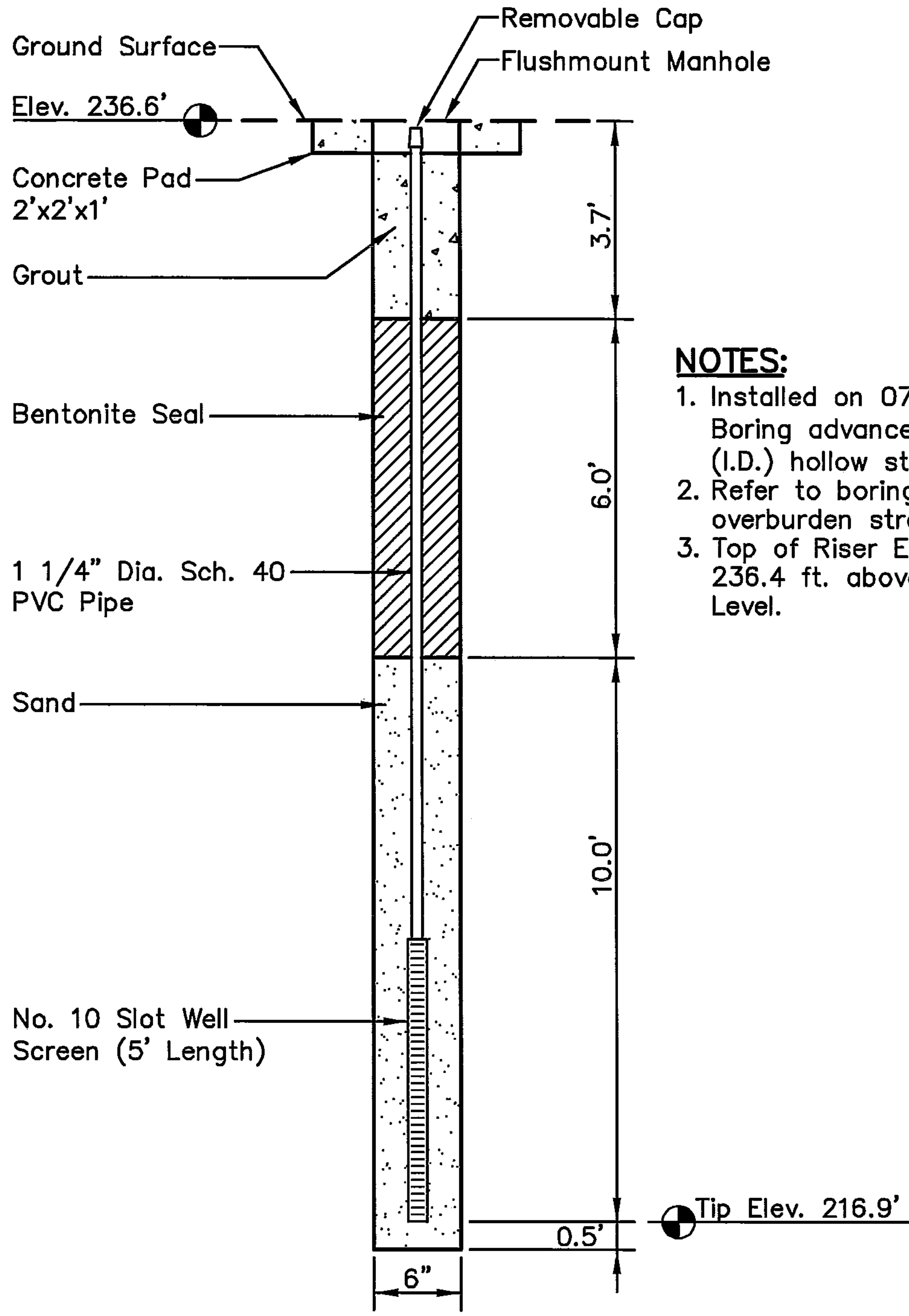
Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-13
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY PS	DATE AUG., 2009	REVISED		SHEET
CHECKED BY PW	PROJ. NO. 172679016	1. 11/04/09	3.	1 OF 1
CHECKED BY BE	SCALE NTS	2.	4.	



NOTES:

1. Installed on 07/19/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.
3. Top of Riser Elevation = 236.4 ft. above Mean Sea Level.

PLOT DATE: 11/04/2009 USER: SILPACHARN, PRAYUTH (BILLY)
V:\1726\ACTIVE\172679016\ENVIRONMENTAL\DRAWING\GEOTECH\INSTRUMENT\79016B-ALF-PZ14.DWG

LOCATION:

Northing: 272761.04
Easting: 763351.79
Ground Elevation: 236.6 feet

Locations to be provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD 29

PIEZOMETER STN-14
EAST FLY ASH POND
ALLEN FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Nashville, Tennessee
37027-5044
615-885-1144
www.stantec.com

DRAWN BY	PS	DATE	AUG., 2009	REVISED		SHEET
CHECKED BY	PW	PROJ. NO.	172679016	1. 11/04/09	3.	1 OF 1
CHECKED BY	BE	SCALE	NTS	2.	4.	

Piezometer Data

Stantec

Allen Fossil Plant
2574 Steam Plant Rd
Memphis,TN
Stantec Project No. 172679016 and 172679032

					7/20/2009		8/3/2009		8/13/2009		8/31/2009		9/11/2009	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	25.85	192.39	26.54	191.70	25.90	192.34	28.78	189.46	29.71	188.53
STN-2	19.65	238.78	238.69	219.04	18.03	220.66	17.56	221.13	17.30	221.39	18.07	220.62	17.94	220.75
STN-3	20.07	234.52	237.44	217.37	13.12	224.32	12.46	224.98	13.50	223.94	14.66	222.78	12.78	224.66
STN-4	19.20	237.55	237.32	218.12	17.85	219.47	17.79	219.53	15.50	221.82	19.09	218.23	19.12	218.20
STN-5	38.18	218.04	220.69	182.51	24.57	196.12	24.64	196.05	23.70	196.99	26.20	194.49	26.58	194.11
STN-6	17.94	238.47	238.41	220.47	17.85	220.56	17.84	220.57	17.80	220.61	17.86	220.55	17.85	220.56
STN-7	15.56	235.53	235.44	219.88	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
STN-8	19.05	237.75	237.67	218.62	Dry	Dry	19.02	218.65	19.03	218.64	19.04	218.63	Dry	Dry
STN-9	41.00	221.15	224.19	183.19	8.41	215.88	10.06	214.13	10.40	213.79	10.76	213.43	10.93	213.26
STN-10	13.05	237.39	237.10	224.05	Dry	Dry	11.00	226.10	11.70	225.40	12.21	224.89	12.42	224.68
STN-11	14.35	237.93	237.81	223.46	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
STN-12	43.10	217.16	220.08	176.98	27.60	192.06	28.32	191.76	27.60	192.48	30.02	190.06	30.77	189.31
STN-13	17.68	237.24	236.96	219.28	15.19	221.42	12.05	224.91	11.60	225.36	Damaged	NM	11.88	225.08
STN-14	19.50	236.64	236.44	216.94	8.27	228.05	6.71	229.73	6.90	229.54	8.07	228.37	8.79	227.65
Mississippi River Gauge MS126 - Memphis						192.33		192.81		190.58		187.49		185.07
McKellar Lake Pool Elevation						189.55		189.05		187.85		184.05		182.65

220.4	Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.
Dry	The PZ was dry at depth so no water level was measured.
NM	Not Measured. PZ Riser was damaged by a construction equipment. It was subsequently fixed and surveyed

Stantec

Allen Fossil Plant
2574 Steam Plant Rd
Memphis,TN
Stantec Project No. 172679016 and 172679032

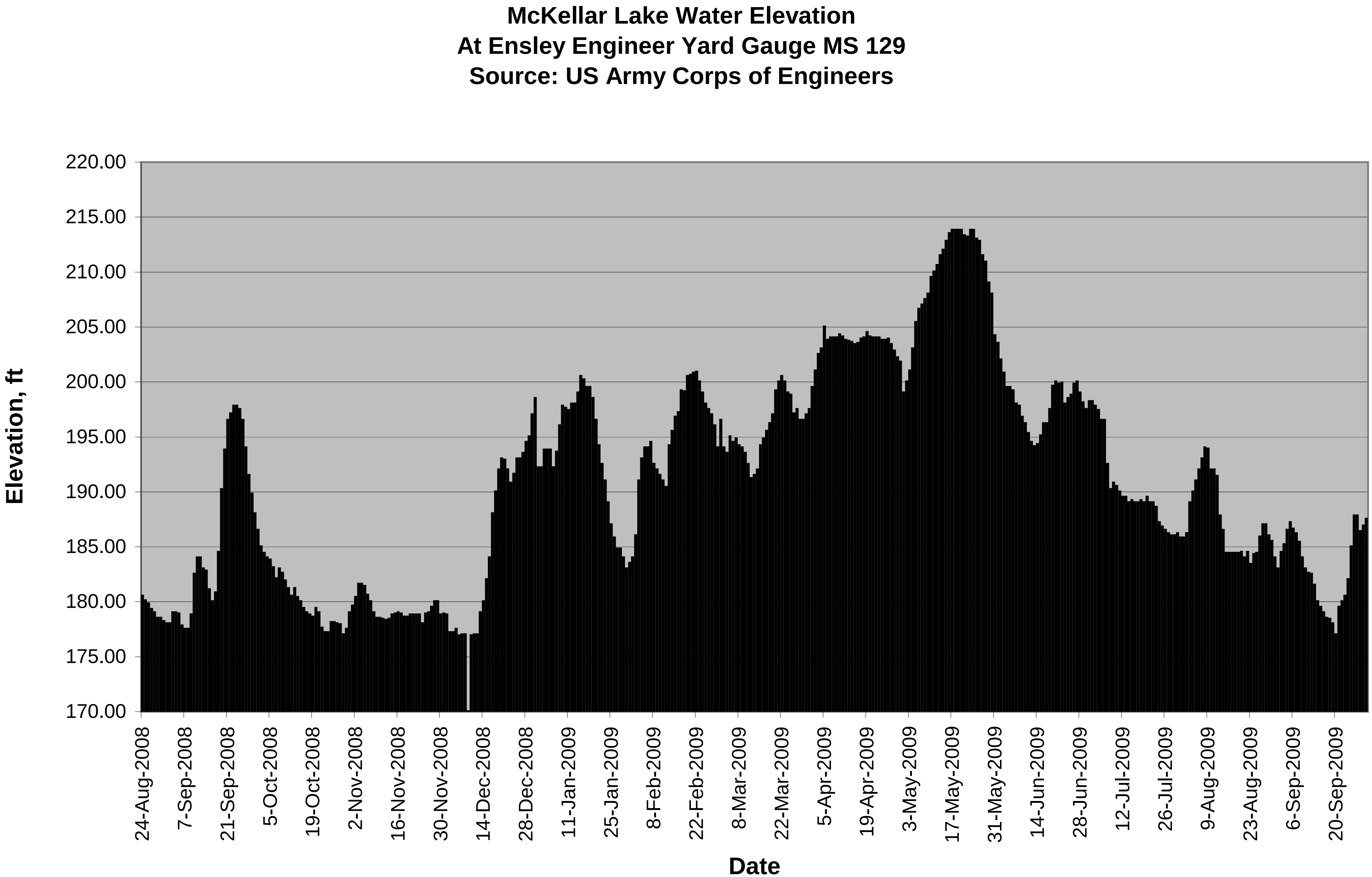
					10/12/2009		11/2/2009		11/11/2009		11/17/2009		12/11/2009	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	24.19	194.05	15.58	202.66	13.98	204.26	17.19	201.05	19.23	199.01
STN-2	19.65	238.78	238.69	219.04	16.80	221.89	15.97	222.72	16.26	222.43	16.50	222.19	17.68	221.01
STN-3	20.07	234.52	237.44	217.37	11.97	225.47	10.98	226.46	11.68	225.76	11.99	225.45	12.02	225.42
STN-4	19.20	237.55	237.32	218.12	17.27	220.05	15.57	221.75	16.03	221.29	16.11	221.21	17.48	219.84
STN-5	38.18	218.04	220.69	182.51	25.23	195.46	16.02	204.67	14.38	206.31	17.21	203.48	20.45	200.24
STN-6	17.94	238.47	238.41	220.47	17.86	220.55	17.85	220.56	17.94	220.47	17.93	220.48	17.94	220.47
STN-7	15.56	235.53	235.44	219.88	Dry	Dry	Dry	Dry	15.90	219.54	15.58	219.86	15.90	219.54
STN-8	19.05	237.75	237.67	218.62	19.05	218.62	Dry	Dry	19.14	218.53	19.04	218.63	19.06	218.61
STN-9	41.00	221.15	224.19	183.19	11.40	212.79	11.66	212.53	18.80	205.39	18.31	205.88	19.39	204.80
STN-10	13.05	237.39	237.10	224.05	11.25	225.85	10.14	226.96	11.32	225.78	10.68	226.42	11.89	225.21
STN-11	14.35	237.93	237.81	223.46	14.19	223.62	14.22	223.59	14.28	223.53	14.30	223.51	14.20	223.61
STN-12	43.10	217.16	220.08	176.98	30.29	189.79	24.41	195.67	21.90	198.18	23.47	196.61	25.44	194.64
STN-13	17.68	237.24	236.96	219.28	11.42	225.54	10.45	226.51	11.01	225.95	11.09	225.87	12.54	224.42
STN-14	19.50	236.64	236.44	216.94	7.98	228.46	7.63	228.81	8.19	228.25	8.42	228.02	8.98	227.46
Mississippi River Gauge MS126 - Memphis						192.45		206.19		207.44		201.13		198.96
McKellar Lake Pool Elevation						189.75		202.05		203.05		198.05		195.55

220.4	Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.
Dry	The PZ was dry at depth so no water level was measured.

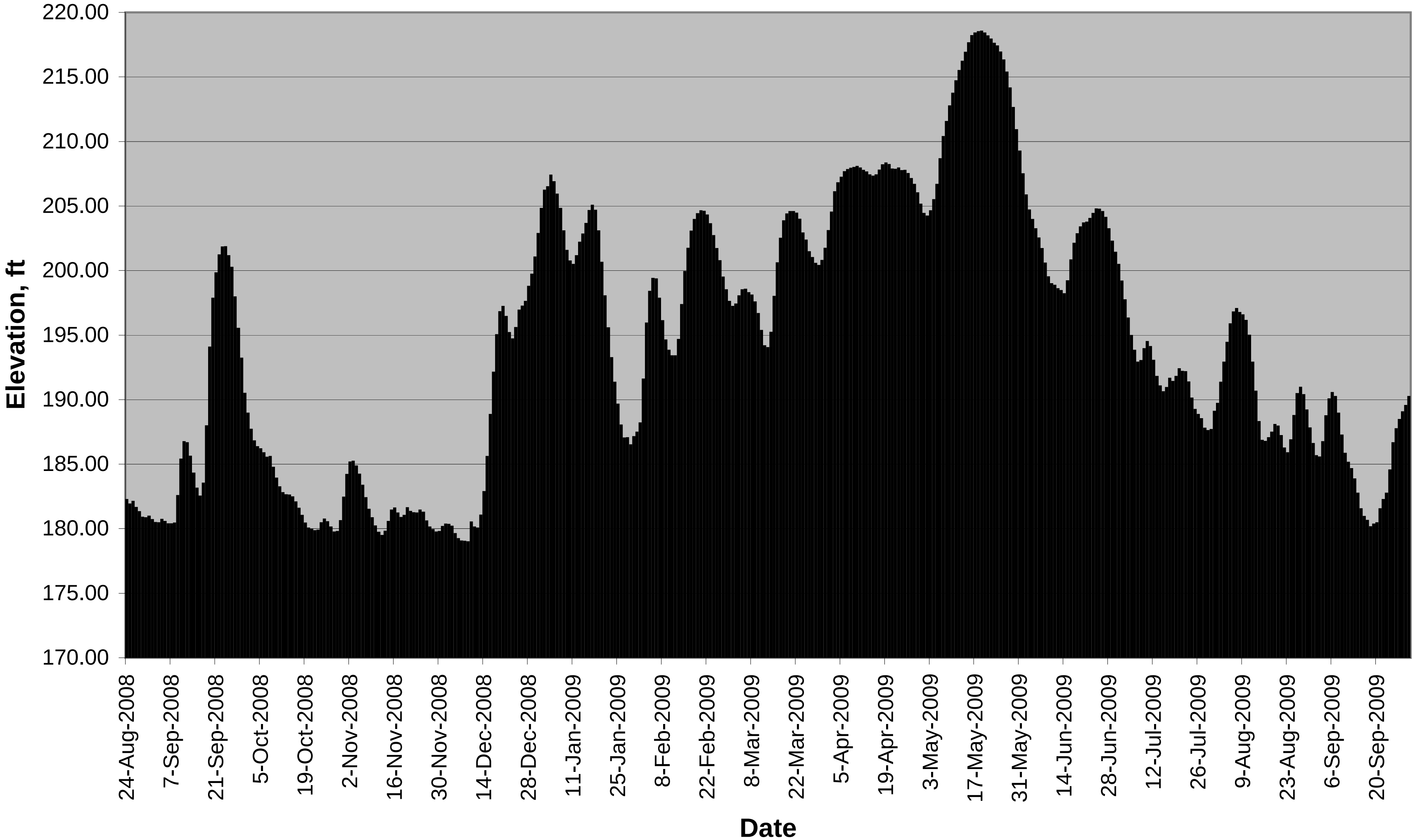
Allen Fossil Plant
2574 Steam Plant Rd
Memphis,TN
Stantec Project No. 172679016 and 172679032

					1/12/2010		**2/2/2010**		**2/25/2010**					
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	20.98	197.26	10.76	207.48	19.54	198.70				
STN-2	19.65	238.78	238.69	219.04	17.87	220.82	16.79	221.90	14.79	223.90				
STN-3	20.07	234.52	237.44	217.37	12.48	224.96	10.90	226.54	11.41	226.03				
STN-4	19.20	237.55	237.32	218.12	17.61	219.71	16.83	220.49	16.19	221.13				
STN-5	38.18	218.04	220.69	182.51	21.57	199.12	12.28	208.41	18.87	201.82				
STN-6	17.94	238.47	238.41	220.47	17.97	220.44	17.97	220.44	17.94	220.47				
STN-7	15.56	235.53	235.44	219.88	13.52	221.92	11.75	223.69	11.13	224.31				
STN-8	19.05	237.75	237.67	218.62	19.07	218.60	19.07	218.60	19.05	218.62				
STN-9	41.00	221.15	224.19	183.19	17.81	206.38	18.18	206.01	16.54	207.65				
STN-10	13.05	237.39	237.10	224.05	12.12	224.98	10.13	226.97	10.27	226.83				
STN-11	14.35	237.93	237.81	223.46	14.24	223.57	14.32	223.49	14.27	223.54				
STN-12	43.10	217.16	220.08	176.98	25.05	195.03	19.86	200.22	23.57	196.51				
STN-13	17.68	237.24	236.96	219.28	12.46	224.50	11.79	225.17	11.45	225.51				
STN-14	19.50	236.64	236.44	216.94	9.28	227.16	8.47	227.97	8.15	228.29				
Mississippi River Gauge MS126 - Memphis						193.53		212.72		196.42				
McKellar Lake Pool Elevation						190.75		208.55						

220.4	Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.
Dry	The PZ was dry at depth so no water level was measured.


McKellar Lake Water Elevation
At Ensley Engineer Yard Gauge MS 129
Source: US Army Corps of Engineers
Elevation, ft
220.00
215.00
210.00
205.00
200.00
195.00
190.00
185.00
180.00
175.00
170.00
24-Aug-2008
7-Sep-2008
21-Sep-2008
5-Oct-2008
19-Oct-2008
2-Nov-2008
16-Nov-2008
30-Nov-2008
14-Dec-2008
28-Dec-2008
11-Jan-2009
25-Jan-2009
8-Feb-2009
22-Feb-2009
8-Mar-2009
22-Mar-2009
5-Apr-2009
19-Apr-2009
3-May-2009
17-May-2009
31-May-2009
14-Jun-2009
28-Jun-2009
12-Jul-2009
26-Jul-2009
9-Aug-2009
23-Aug-2009
6-Sep-2009
20-Sep-2009
Date

Mississippi River Water Elevation
At Mississippi River Gauge MS 126
Source: US Army Corps of Engineers



Appendix D

Laboratory Test Data

- Laboratory Classification Testing
- Consolidated Undrained Triaxial Testing
- Laboratory Permeability Testing

Laboratory Classification Testing

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant	Project Number	172679016
Source	STN-1, 6.0'-7.5', 7.5'-9.0', 9.0'-10.5'	Lab ID	637
County	Memphis, TN	Date Received	9-9-09
Sample Type	SPT Comp	Date Reported	10-21-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	100.0
No. 10	2	96.1
No. 40	0.425	96.0
No. 200	0.075	92.7
	0.02	68.7
	0.005	39.2
	0.002	29.5
estimated	0.001	26.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	3.9
Coarse Sand	3.9	0.1
Medium Sand	0.1	---
Fine Sand	3.3	3.3
Silt	53.5	63.2
Clay	39.2	29.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 42
Plastic Limit: 20
Plasticity Index: 22
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

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-7-6 (22)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-1, 6.0'-7.5', 7.5'-9.0', 9.0'-10.5'

Project Number: 172679016
Lab ID: 637

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded
Particle Hardness: Hard and Durable

Tested By: cm
Test Date: 10-15-2009
Date Received: 09-09-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	96.1

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

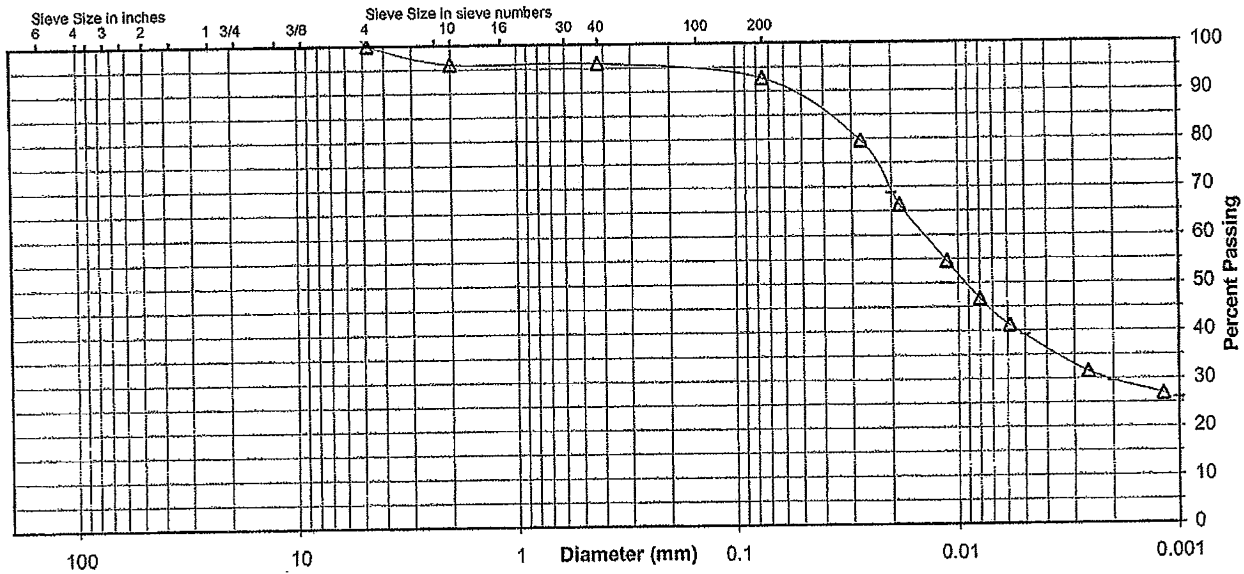
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	96.0
No. 200	92.7
0.02 mm	68.7
0.005 mm	39.2
0.002 mm	29.5
0.001 mm	26.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	3.9	0.1	3.3	53.5	39.2

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	3.9	0.1	3.3	63.2	29.5



Comments ______

Reviewed By ______

File: frm_172679016_sum_637 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant (TVA)
Source: STN-1, 15.7'-16.2'

Project Number: 172679016
Lab ID: 487B

County: Memphis, TN
Sample Type: ST

Date Received: 8-7-09
Date Reported: 10-22-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 60.2

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	
3/8"	9.5	100.0
No. 4	4.75	100.0
No. 10	2	99.9
No. 40	0.425	99.5
No. 200	0.075	98.5
	0.02	98.4
	0.005	89.6
	0.002	75.0
estimated	0.001	60.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.1
Coarse Sand	0.1	0.4
Medium Sand	0.4	---
Fine Sand	1.0	1.0
Silt	8.9	23.5
Clay	89.6	75.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 92
Plastic Limit: 28
Plasticity Index: 64
Activity Index: 0.85

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: Fat clay

AASHTO Classification: A-7-6 (74)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-1, 15.7'-16.2'

Project Number: 172679016
Lab ID: 487B

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: JF
Test Date: 10-09-2009
Date Received: 08-07-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	100.0
No. 10	99.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

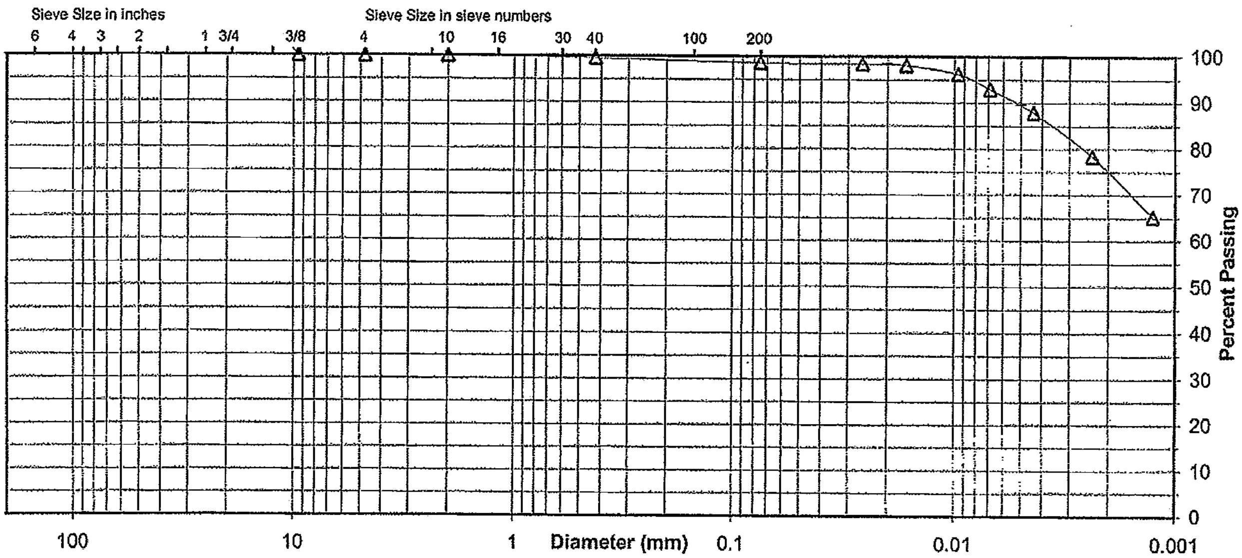
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.5
No. 200	98.5
0.02 mm	98.4
0.005 mm	89.6
0.002 mm	75.0
0.001 mm	60.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.1	0.4	1.0	8.9	89.6

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.1	0.4	1.0	23.5	75.0



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-1, 20.1'-20.6'	Lab ID	488A
County	Memphis, TN	Date Received	8-7-09
Sample Type	ST	Date Reported	10-22-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 41.4

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	
No. 4	4.75	100.0
No. 10	2	100.0
No. 40	0.425	99.7
No. 200	0.075	91.7
	0.02	43.1
	0.005	28.2
	0.002	22.6
estimated	0.001	17.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.3
Medium Sand	0.3	---
Fine Sand	8.0	8.0
Silt	63.5	69.1
Clay	28.2	22.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 34

Plastic Limit: 21

Plasticity Index: 13

Activity Index: 0.57

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 (12)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-1, 20.1'-20.6'

Project Number: 172679016
Lab ID: 488A

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: bwt
Test Date: 09-24-2009
Date Received: 08-07-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

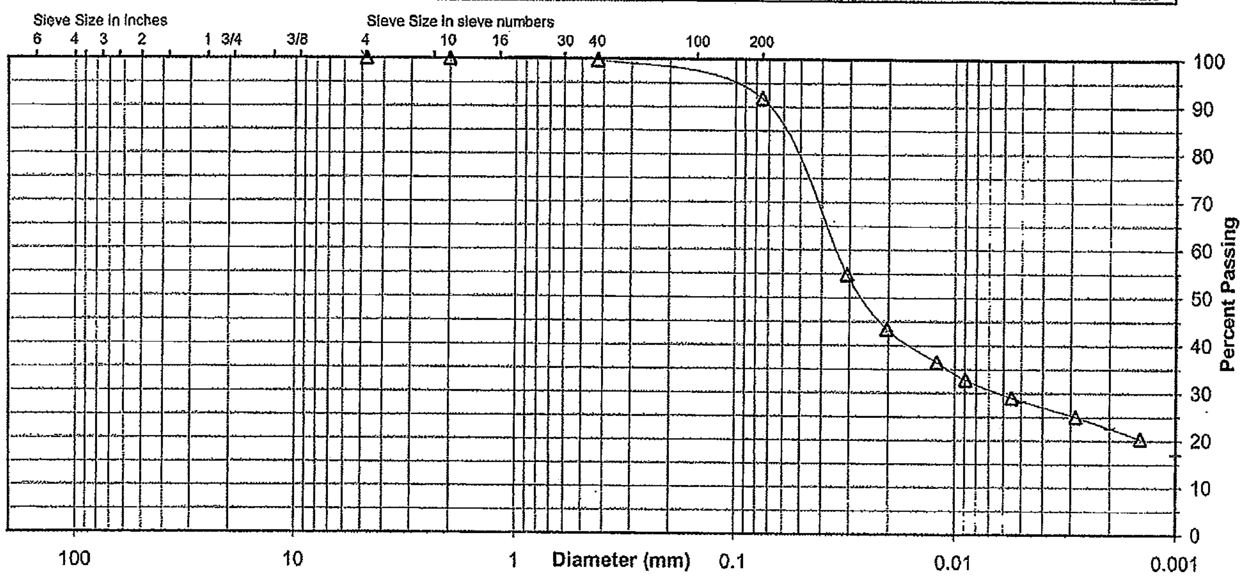
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.7
No. 200	91.7
0.02 mm	43.1
0.005 mm	28.2
0.002 mm	22.6
0.001 mm	17.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.3	8.0	63.5	28.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.3	8.0	69.1	22.6



Comments

Reviewed By

File: frm_172679016_sum_488a.xls Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-1, 27.0'-27.5'	Lab ID	489B
County	Memphis, TN	Date Received	8-7-09
Sample Type	ST	Date Reported	10-22-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 36.3

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	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	99.8
No. 40	0.425	99.6
No. 200	0.075	95.7
	0.02	61.3
	0.005	37.5
	0.002	27.6
estimated	0.001	22.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.2
Coarse Sand	0.2	0.2
Medium Sand	0.2	---
Fine Sand	3.9	3.9
Silt	58.2	68.1
Clay	37.5	27.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 38

Plastic Limit: 20

Plasticity Index: 18

Activity Index: 0.64

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: Lean clay

AASHTO Classification: A-6 (18)

Comments:

Reviewed by:

File: frm_172679016_sum_489b.xls Sheet: Summary
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-1, 27.0'-27.5'

Project Number: 172679016
Lab ID: 489B

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: JF
Test Date: 10-09-2009
Date Received: 08-07-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	99.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.68

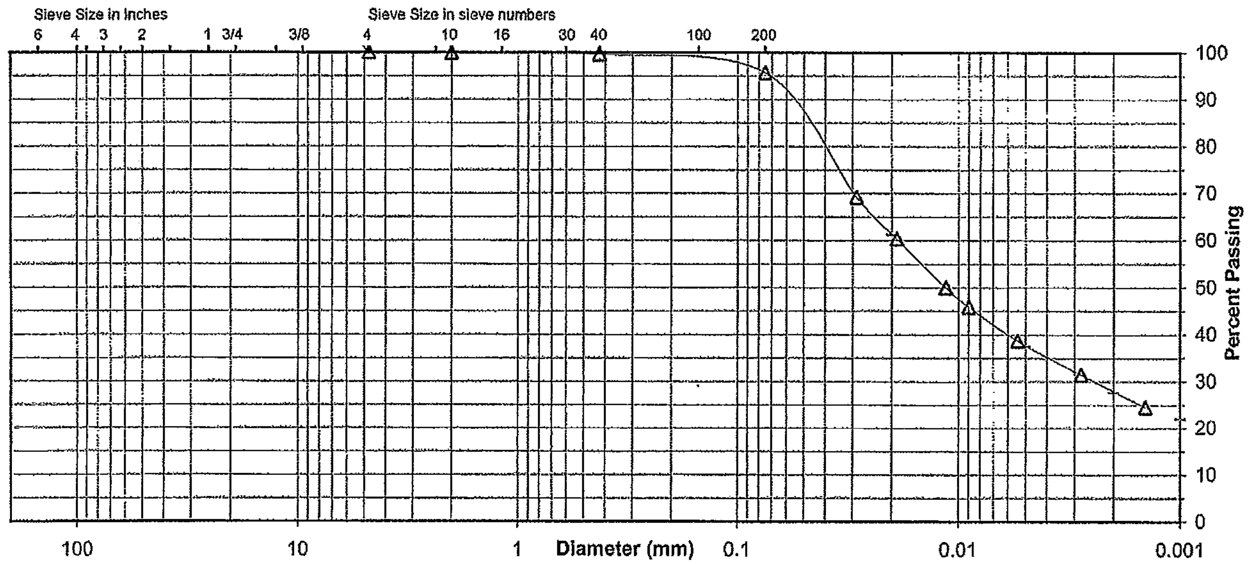
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.6
No. 200	95.7
0.02 mm	61.3
0.005 mm	37.5
0.002 mm	27.6
0.001 mm	22.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.2	0.2	3.9	58.2	37.5

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.2	0.2	3.9	68.1	27.6



Comments

Reviewed By

File: frm_172679016_sum_489b.xls Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-1, 30.0'-31.5', 31.5'-33.0'	Lab ID	17
County	Memphis, TN	Date Received	8-7-09
Sample Type	SPT Comp	Date Reported	10-20-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	100.0
No. 10	2	99.3
No. 40	0.425	99.1
No. 200	0.075	97.5
	0.02	60.2
	0.005	34.2
	0.002	26.5
estimated	0.001	23.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.7
Coarse Sand	0.7	0.2
Medium Sand	0.2	---
Fine Sand	1.6	1.6
Silt	63.3	71.0
Clay	34.2	26.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 41
Plastic Limit: 22
Plasticity Index: 19
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: 2.68

Classification

Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-7-6 (20)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-1, 30.0'-31.5', 31.5'-33.0'	Lab ID	17

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: JF
Test Date: 09-08-2009
Date Received 08-07-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	99.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.68

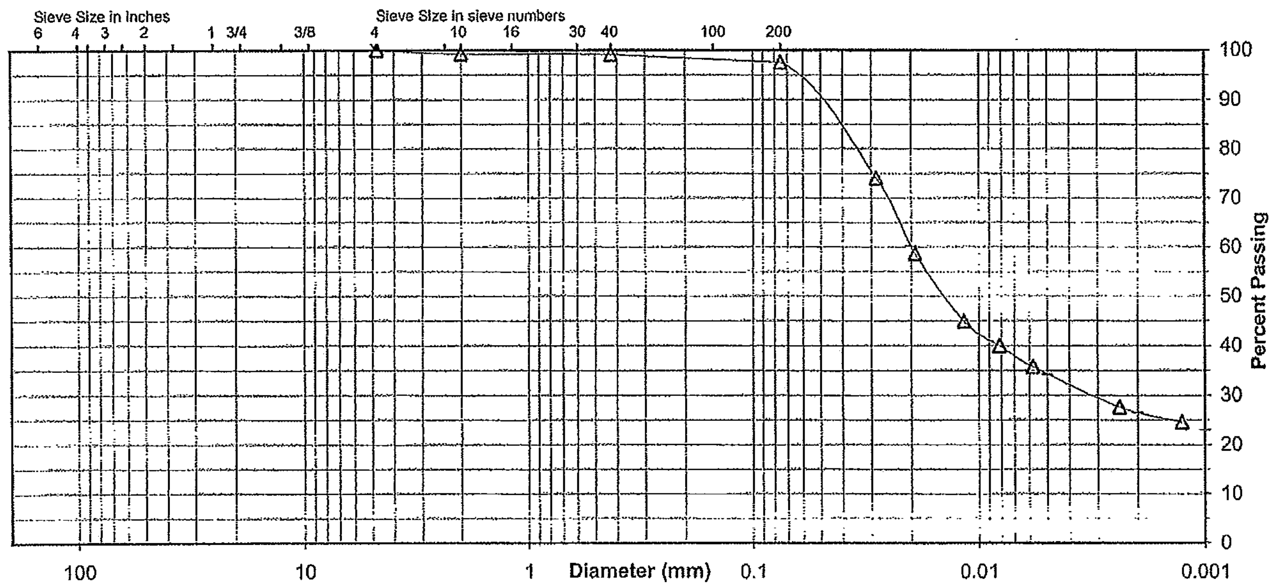
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.1
No. 200	97.5
0.02 mm	60.2
0.005 mm	34.2
0.002 mm	26.5
0.001 mm	23.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.7	0.2	1.6	63.3	34.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.7	0.2	1.6	71.0	26.5



Comments ______________________

Reviewed By ______

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant (TVA)
Project Number: 172679016
Source: STN-2, 6.0'-7.5', 7.5'-9.0', 9.0'-10.5'
Lab ID: 222
County: Memphis, TN
Date Received: 8-7-09
Sample Type: SPT Comp
Date Reported: 10-20-09

Test Results

Natural Moisture Content
Test Not Performed
Moisture Content (%): N/A

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	99.9
No. 10	2	99.6
No. 40	0.425	98.6
No. 200	0.075	84.8
	0.02	49.0
	0.005	29.4
	0.002	22.5
estimated	0.001	21.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.1	0.4
Coarse Sand	0.3	1.0
Medium Sand	1.0	---
Fine Sand	13.8	13.8
Silt	55.4	62.3
Clay	29.4	22.5

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 33
Plastic Limit: 17
Plasticity Index: 16
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: 2.69

Classification
Unified Group Symbol: CL
Group Name: Lean clay with sand
AASHTO Classification: A-6 (12)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-2, 6.0'-7.5', 7.5'-9.0', 9.0'-10.5'

Project Number: 172679016
Lab ID: 222

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: JF
Test Date: 09-02-2009
Date Received: 08-07-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.9
No. 10	99.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.69

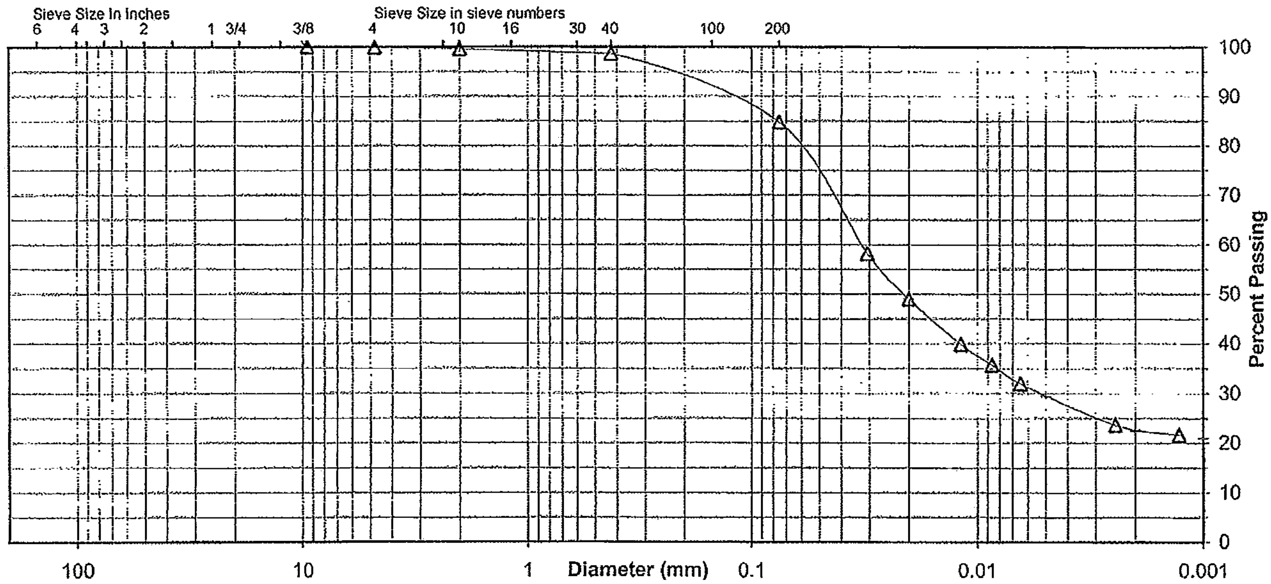
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.6
No. 200	84.8
0.02 mm	49.0
0.005 mm	29.4
0.002 mm	22.5
0.001 mm	21.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.1	0.3	1.0	13.8	55.4	29.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.4	1.0	13.8	62.3	22.5



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant
Project Number: 172679016
Source: STN-2, 12.0'-13.5', 13.5'-15.0', 15.0'-16.5'
Lab ID: 696

County: Memphis, TN
Date Received: 9-9-09
Sample Type: SPT Comp
Date Reported: 10-22-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	99.9
No. 10	2	99.9
No. 40	0.425	99.6
No. 200	0.075	91.0
	0.02	67.6
	0.005	41.9
	0.002	34.1
estimated	0.001	29.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.1	0.1
Coarse Sand	0.0	0.3
Medium Sand	0.3	---
Fine Sand	8.6	8.6
Silt	49.1	56.9
Clay	41.9	34.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 38
Plastic Limit: 17
Plasticity Index: 21
Activity Index: 0.62

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

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-6 (19)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-2, 12.0'-13.5', 13.5'-15.0', 15.0'-16.5'

Project Number: 172679016
Lab ID: 696

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: ps
Test Date: 10-15-2009
Date Received: 09-09-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.9
No. 10	99.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

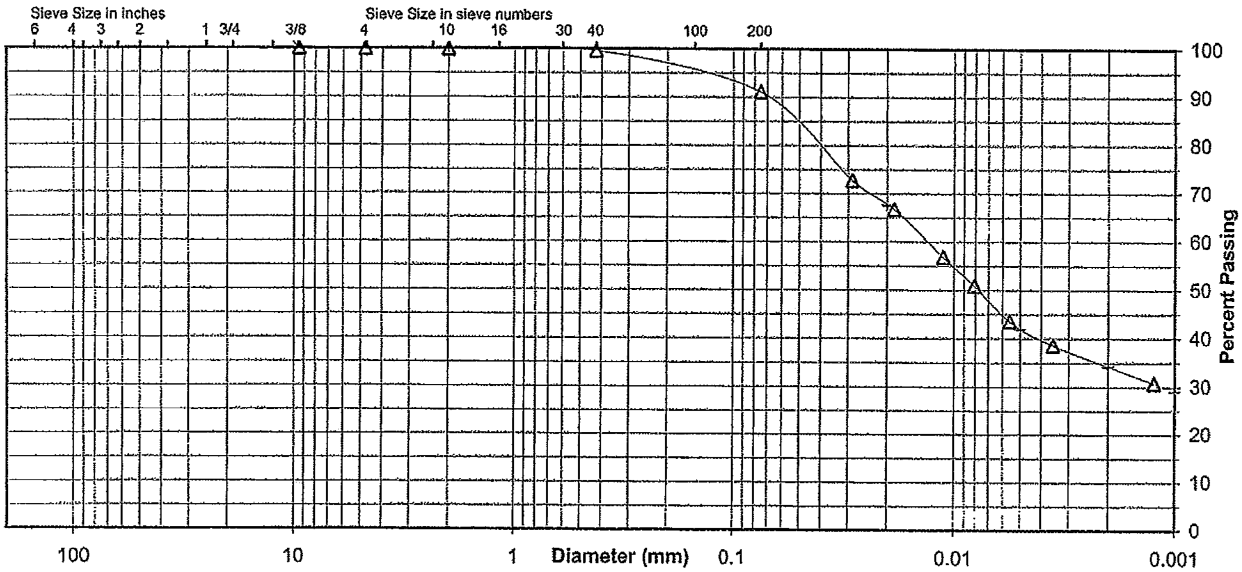
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	99.6
No. 200	91.0
0.02 mm	67.6
0.005 mm	41.9
0.002 mm	34.1
0.001 mm	29.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.1	0.0	0.3	8.6	49.1	41.9

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.1	0.3	8.6	56.9	34.1



Comments

Reviewed By

File: frm_172679016_sum_696.xls Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant
Source: STN-2, 22.5'-24.0', 24.0'-25.5', 25.5'-27.0'

Project Number: 172679016
Lab ID: 700

County: Memphis, TN
Sample Type: SPT Comp

Date Received: 9-9-09
Date Reported: 10-21-09

Test Results

Natural Moisture Content

Test Not Performed
Moisture Content (%): N/A

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	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	100.0
No. 10	2	99.6
No. 40	0.425	99.2
No. 200	0.075	69.4
	0.02	34.2
	0.005	20.3
	0.002	16.2
estimated	0.001	14.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.4
Coarse Sand	0.4	0.4
Medium Sand	0.4	---
Fine Sand	29.8	29.8
Silt	49.1	53.2
Clay	20.3	16.2

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 23
Plastic Limit: 19
Plasticity Index: 4
Activity Index: 0.25

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

Estimated
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL-ML
Group Name: Sandy silty clay
AASHTO Classification: A-4 (1)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-2, 22.5'-24.0', 24.0'-25.5', 25.5'-27.0'

Project Number: 172679016
Lab ID: 700

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: JF
Test Date: 10-15-2009
Date Received: 09-09-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	100.0
No. 10	99.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

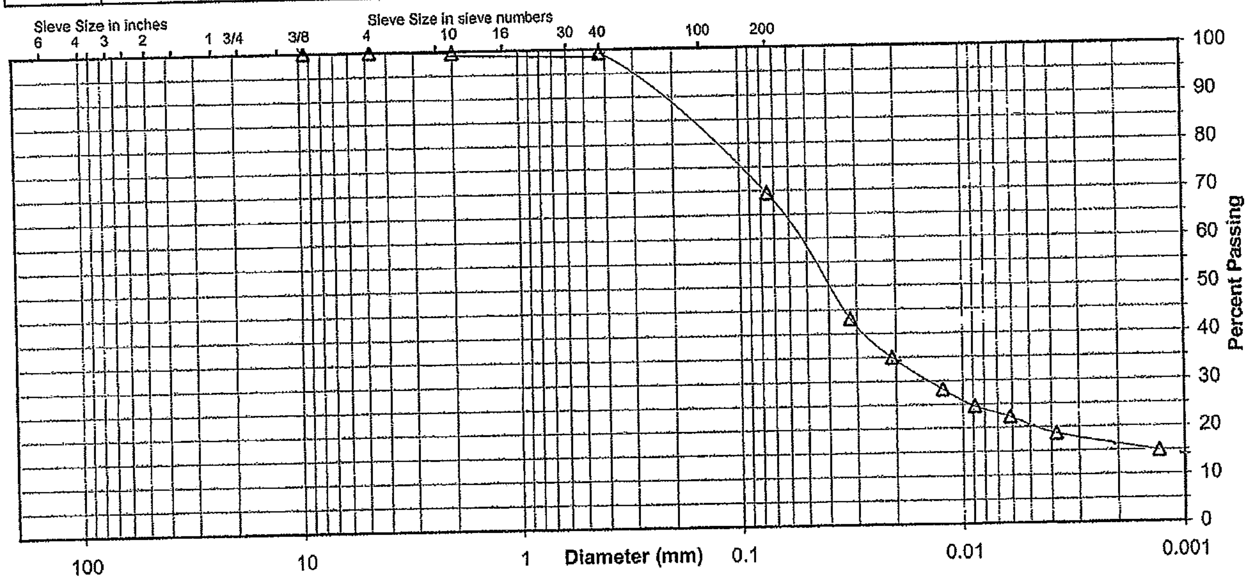
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	99.2
No. 200	69.4
0.02 mm	34.2
0.005 mm	20.3
0.002 mm	16.2
0.001 mm	14.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.4	0.4	29.8	49.1	20.3

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.4	0.4	29.8	53.2	16.2



Comments ______________________

Reviewed By ______

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-2, 28.5'-30.0', 30.0'-31.5', 31.5'-33.0'	Lab ID	238
County	Memphis, TN	Date Received	8-7-09
Sample Type	SPT Comp	Date Reported	10-20-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Sieve Size	Particle Size (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	99.8
No. 40	0.425	99.7
No. 200	0.075	84.4
	0.02	37.8
	0.005	20.0
	0.002	15.1
estimated	0.001	13.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.2
Coarse Sand	0.2	0.1
Medium Sand	0.1	---
Fine Sand	15.3	15.3
Silt	64.4	69.3
Clay	20.0	15.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 26
Plastic Limit: 21
Plasticity Index: 5
Activity Index: 0.33

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: CL-ML
Group Name: Silty clay with sand

AASHTO Classification: A-4 (3)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Project Number: 172679016
Source: STN-2, 28.5'-30.0', 30.0'-31.5', 31.5'-33.0'
Lab ID: 238

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: JF
Test Date: 09-08-2009
Date Received: 08-07-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	99.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.68

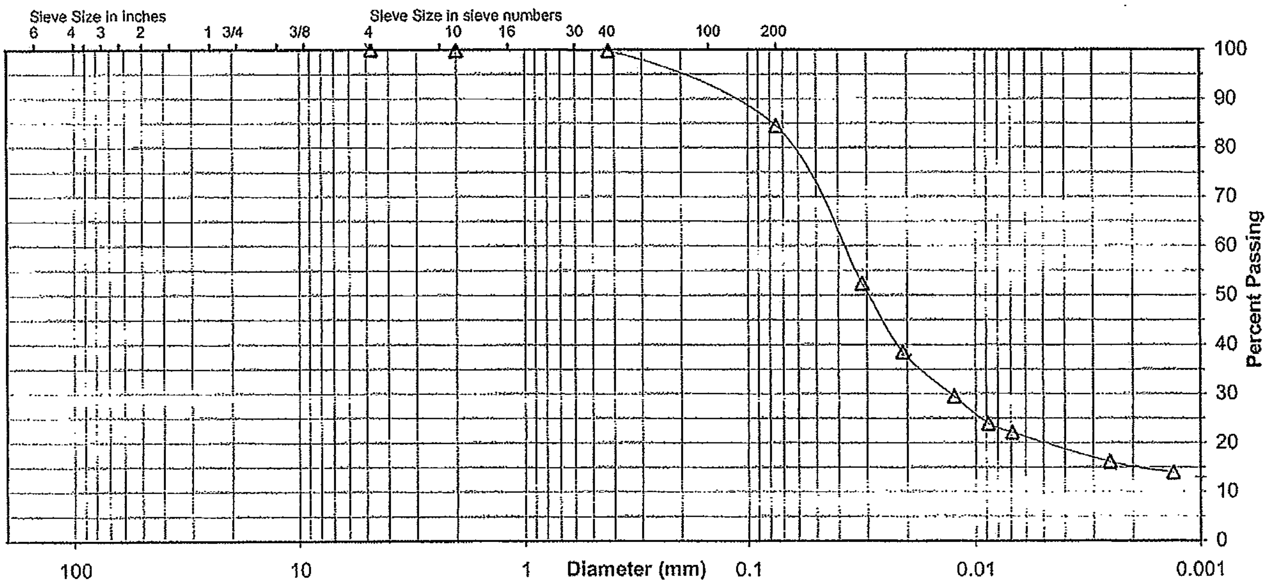
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.7
No. 200	84.4
0.02 mm	37.8
0.005 mm	20.0
0.002 mm	15.1
0.001 mm	13.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.2	0.1	15.3	64.4	20.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.2	0.1	15.3	69.3	15.1



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-2, 36.0'-36.5'	Lab ID	492A
County	Memphis, TN	Date Received	8-7-09
Sample Type	ST	Date Reported	10-22-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 39.1

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	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	99.6
No. 40	0.425	98.9
No. 200	0.075	97.2
	0.02	85.9
	0.005	50.0
	0.002	38.2
estimated	0.001	34.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.4
Coarse Sand	0.4	0.7
Medium Sand	0.7	---
Fine Sand	1.7	1.7
Silt	47.2	59.0
Clay	50.0	38.2

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 47
Plastic Limit: 21
Plasticity Index: 26
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: Lean clay

AASHTO Classification: A-7-6 (28)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-2, 36.0'-36.5'

Project Number: 172679016
Lab ID: 492A

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded
Particle Hardness: Hard and Durable

Tested By: JF
Test Date: 09-30-2009
Date Received: 08-07-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	99.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.69

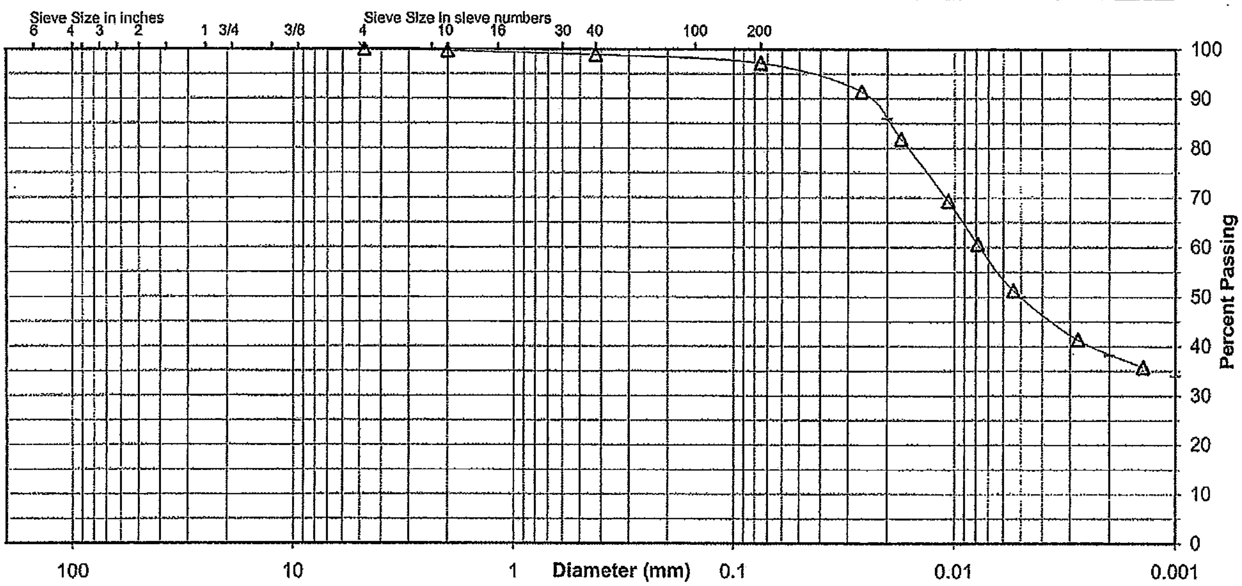
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.9
No. 200	97.2
0.02 mm	85.9
0.005 mm	50.0
0.002 mm	38.2
0.001 mm	34.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.4	0.7	1.7	47.2	50.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.4	0.7	1.7	59.0	38.2



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant - TVA, Memphis, Tennessee	Project Number	172679016
Source	STN-2A, 10.0'-10.5'	Lab ID	789
County	Memphis, TN	Date Received	12-16-09
Sample Type	ST	Date Reported	1-15-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 25.0

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	
No. 4	4.75	100.0
No. 10	2	100.0
No. 40	0.425	99.7
No. 200	0.075	86.3
	0.02	47.1
	0.005	27.3
	0.002	21.4
estimated	0.001	18.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.3
Medium Sand	0.3	---
Fine Sand	13.4	13.4
Silt	59.0	64.9
Clay	27.3	21.4

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 30

Plastic Limit: 21

Plasticity Index: 9

Activity Index: 0.43

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: in situ

Specific Gravity at 20° Celsius: 2.68

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-4 (7)

Comments:

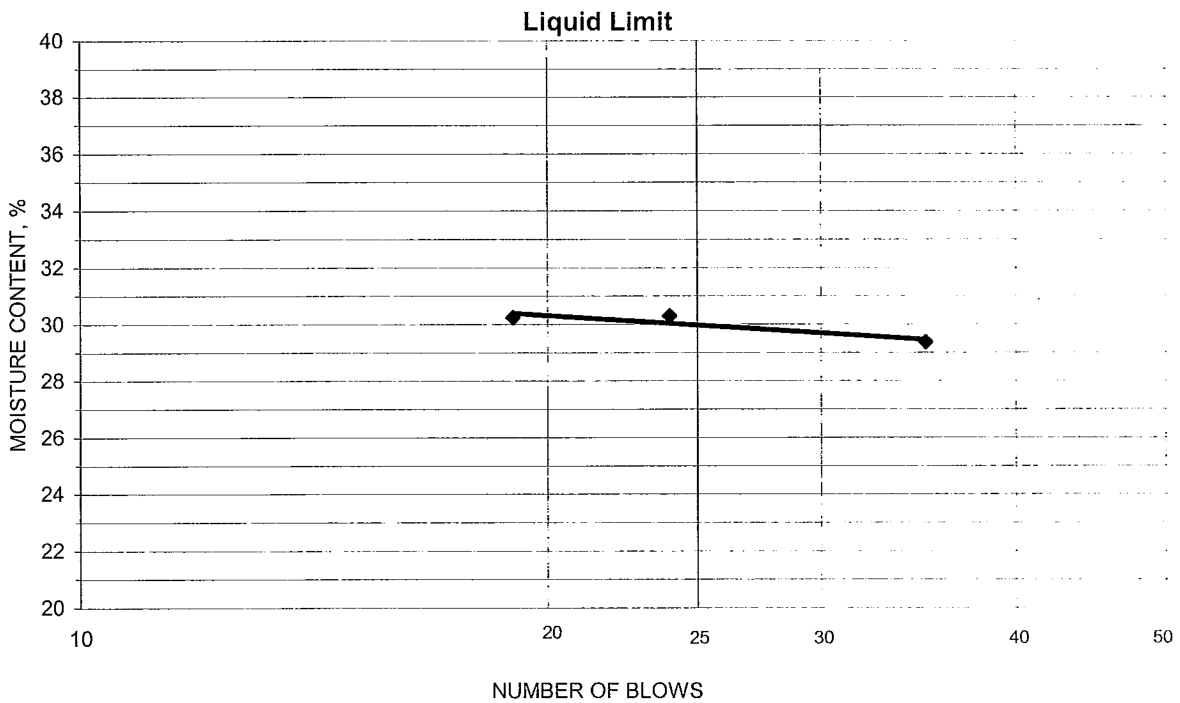
Reviewed by:

Stantec

ATTERBERG LIMITS

Project	Allen Fossil Plant - TVA, Memphis, Tennessee	Project No.	172679016
Source	STN-2A, 10.0'-10.5'	Lab ID	789
		% + No. 40	0
Tested By	KWS	Test Method	ASTM D 4318 Method A
Date Received	12-16-2009		
Test Date	01-12-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
20.05	17.96	10.84	35	29.4	30
19.19	17.34	11.23	24	30.3	
20.29	18.18	11.20	19	30.2	



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
18.65	17.37	11.15	20.6	21	9
18.36	17.10	11.01	20.7		

Remarks:

Reviewed By

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant - TVA, Memphis, Tennessee
Source: STN-2A, 10.0'-10.5'

Project Number: 172679016
Lab ID: 789

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: JF
Test Date: 01-08-2010
Date Received: 12-16-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.68

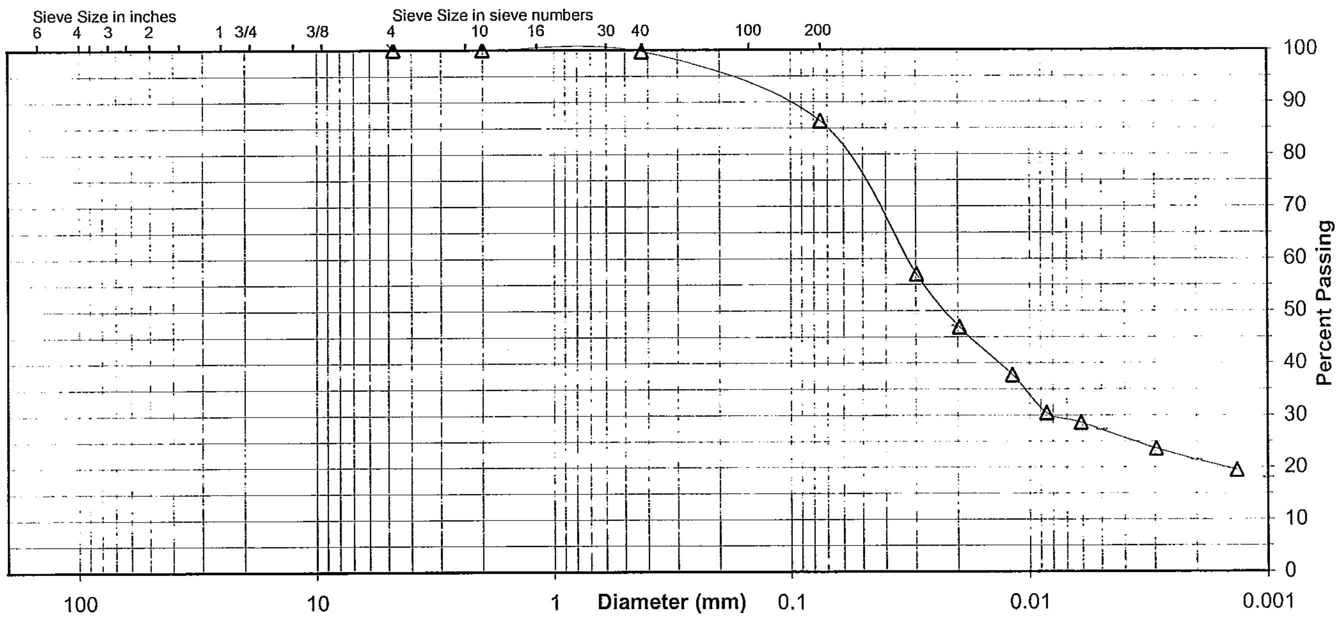
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.7
No. 200	86.3
0.02 mm	47.1
0.005 mm	27.3
0.002 mm	21.4
0.001 mm	18.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.3	13.4	59.0	27.3

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.3	13.4	64.9	21.4



Comments ______

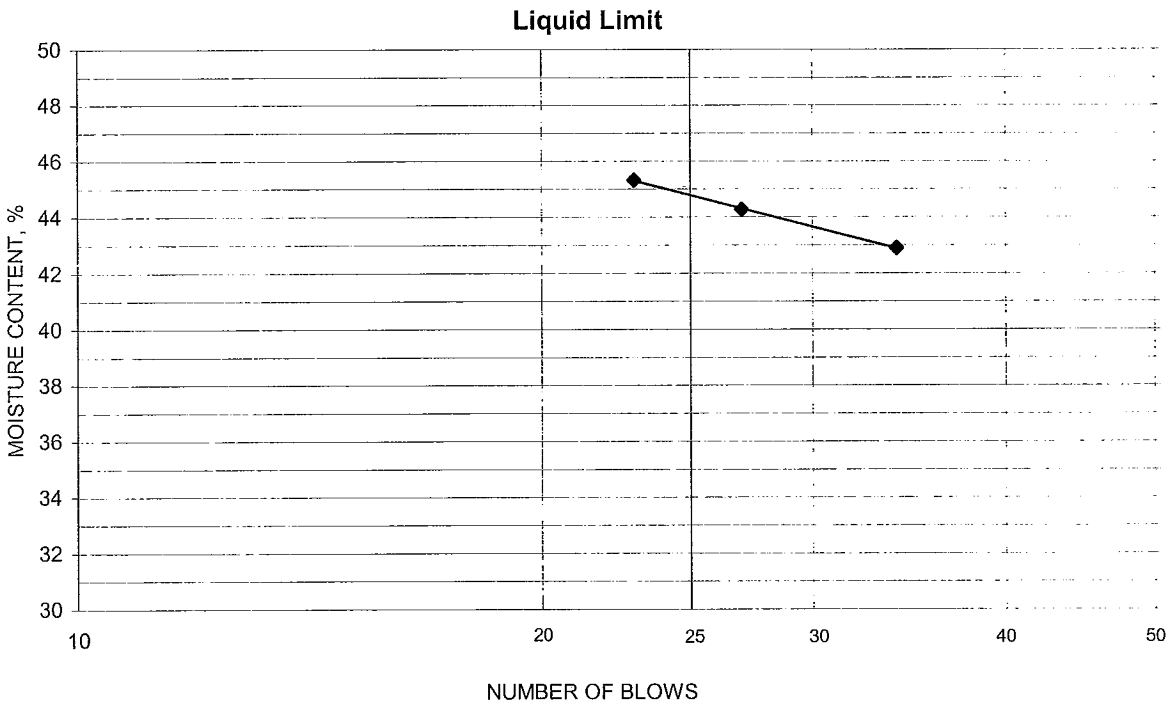
Reviewed By ______

Stantec

ATTERBERG LIMITS

Project	Allen Fossil Plant - TVA, Memphis, Tennessee	Project No.	172679016
Source	STN-2A, 18.0'-20.0'	Lab ID	790
Tested By	KWS Test Method ASTM D 4318 Method A	% + No. 40	31
Test Date	01-06-2010 Prepared Dry	Date Received	12-16-2009

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
18.01	15.93	11.08	34	42.9	45
19.02	16.55	10.97	27	44.3	
19.72	17.06	11.19	23	45.3	



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
17.72	16.70	11.11	18.2	18	27
17.90	16.79	10.84	18.7		

Remarks:

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant (TVA) — Project Number: 172679016
Source: STN-3, 9.0'-10.5', 10.5'-12.0', 12.0'-13.5' — Lab ID: 262

County: Memphis, TN — Date Received: 8-7-09
Sample Type: SPT Comp — Date Reported: 10-20-09

Test Results

Natural Moisture Content
Test Not Performed
Moisture Content (%): N/A

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	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.9
No. 10	2	99.8
No. 40	0.425	99.0
No. 200	0.075	83.8
	0.02	44.0
	0.005	24.7
	0.002	18.3
estimated	0.001	15.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.1	0.2
Coarse Sand	0.1	0.8
Medium Sand	0.8	---
Fine Sand	15.2	15.2
Silt	59.1	65.5
Clay	24.7	18.3

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 29
Plastic Limit: 20
Plasticity Index: 9
Activity Index: 0.50

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-4 (6)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-3, 9.0'-10.5', 10.5'-12.0', 12.0'-13.5'

Project Number: 172679016
Lab ID: 262

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: JF
Test Date: 09-08-2009
Date Received: 08-07-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.9
No. 10	99.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.67

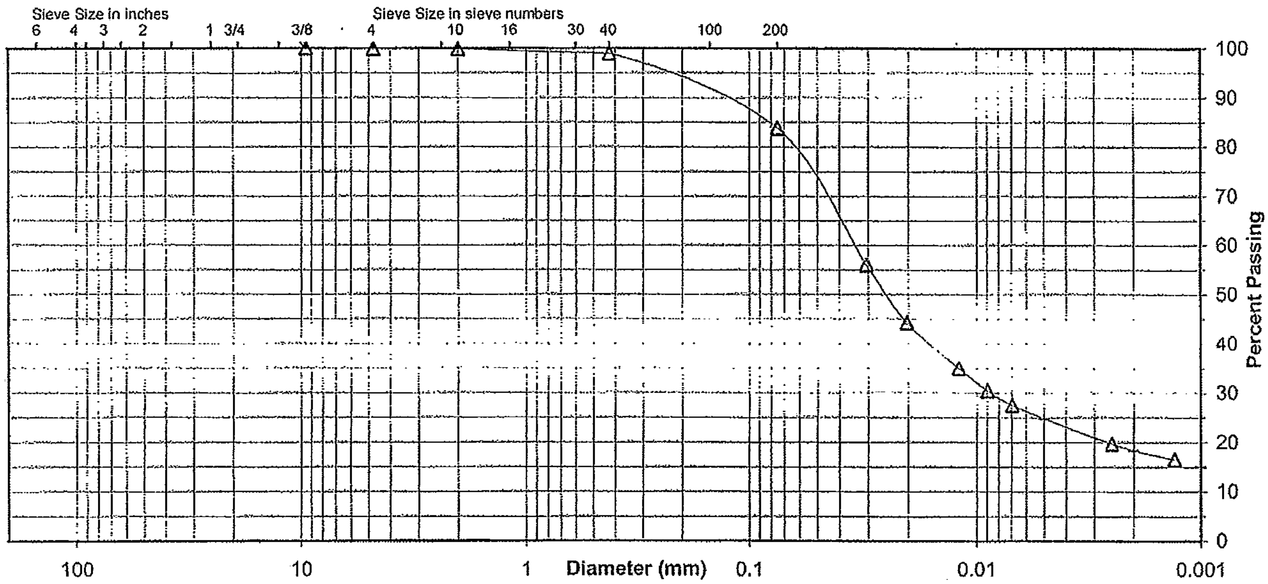
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.0
No. 200	83.8
0.02 mm	44.0
0.005 mm	24.7
0.002 mm	18.3
0.001 mm	15.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.1	0.1	0.8	15.2	59.1	24.7

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.2	0.8	15.2	65.5	18.3



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant
Source: STN-3, 18.0'-19.5', 19.5'-21.0', 21.0'-22.5'
County: Memphis, TN
Sample Type: SPT Comp

Project Number: 172679016
Lab ID: 712
Date Received: 9-9-09
Date Reported: 10-21-09

Test Results

Natural Moisture Content

Test Not Performed
Moisture Content (%): N/A

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	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	98.7
No. 40	0.425	98.5
No. 200	0.075	88.6
	0.02	57.0
	0.005	37.1
	0.002	28.9
estimated	0.001	24.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	1.3
Coarse Sand	1.3	0.2
Medium Sand	0.2	---
Fine Sand	9.9	9.9
Silt	51.5	59.7
Clay	37.1	28.9

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 36
Plastic Limit: 16
Plasticity Index: 20
Activity Index: 0.69

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

Estimated
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:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-3, 18.0'-19.5', 19.5'-21.0', 21.0'-22.5'

Project Number: 172679016
Lab ID: 712

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: ford
Test Date: 10-15-2009
Date Received: 09-09-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	98.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

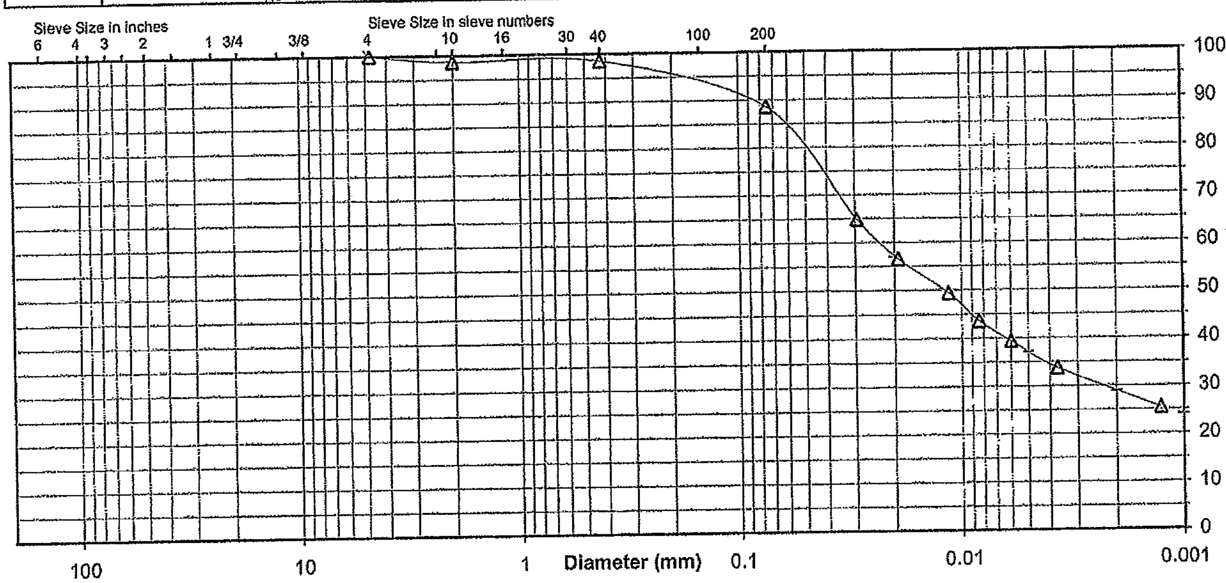
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.5
No. 200	88.6
0.02 mm	57.0
0.005 mm	37.1
0.002 mm	28.9
0.001 mm	24.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	1.3	0.2	9.9	51.5	37.1

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	1.3	0.2	9.9	59.7	28.9



Comments ____________

Reviewed By ____________

File: frm_172679016_sum_712 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant	Project Number	172679016
Source	STN-3, 24.0'-25.5', 25.5'-27.0'	Lab ID	716
County	Memphis, TN	Date Received	9-9-09
Sample Type	SPT Comp	Date Reported	10-21-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.9
No. 200	0.075	70.2
	0.02	22.0
	0.005	12.5
	0.002	9.7
estimated	0.001	8.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.1
Medium Sand	0.1	---
Fine Sand	29.7	29.7
Silt	57.7	60.5
Clay	12.5	9.7

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 23
Plastic Limit: 21
Plasticity Index: 2
Activity Index: 0.20

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

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: ML
Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-3, 24.0'-25.5', 25.5'-27.0'

Project Number: 172679016
Lab ID: 716

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: ford
Test Date: 10-15-2009
Date Received: 09-09-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

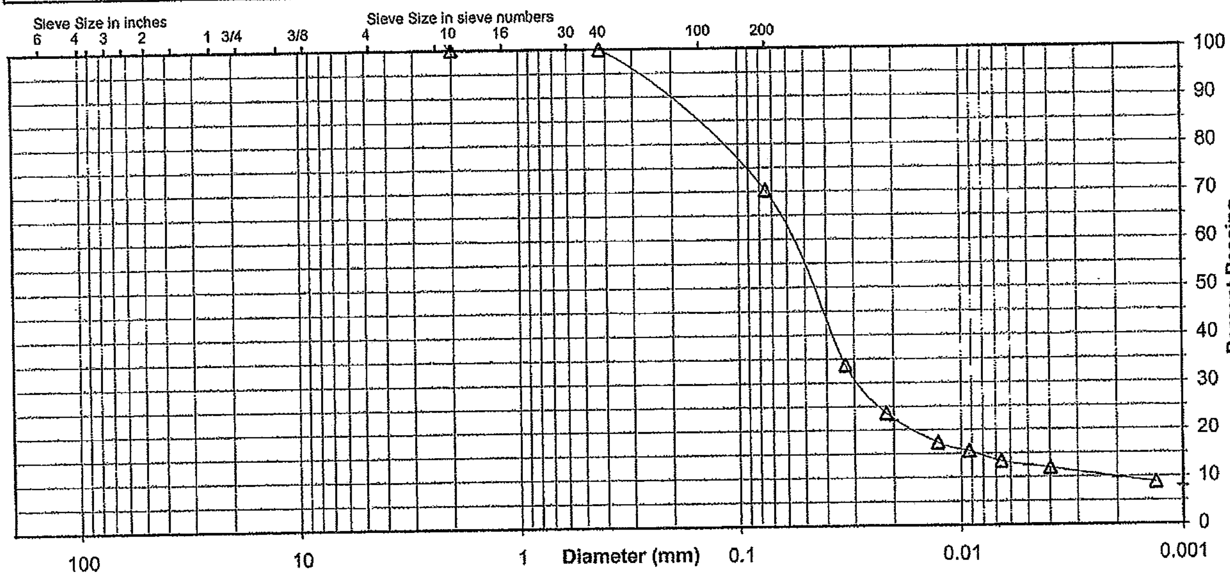
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.9
No. 200	70.2
0.02 mm	22.0
0.005 mm	12.5
0.002 mm	9.7
0.001 mm	8.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	0.0	0.1	29.7	57.7	12.5

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.0	0.1	29.7	60.5	9.7



Comments ______________________

Reviewed By ______

File: frm_172679016_sum_716 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant - TVA, Memphis, Tennessee	Project Number	172679016
Source	STN-3A, 4.0'-4.5'	Lab ID	792A
County	Memphis, TN	Date Received	12-16-09
Sample Type	ST	Date Reported	1-15-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 20.5

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	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.4
No. 200	0.075	78.2
	0.02	39.3
	0.005	21.3
	0.002	18.1
estimated	0.001	14.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.6
Medium Sand	0.6	---
Fine Sand	21.2	21.2
Silt	56.9	60.1
Clay	21.3	18.1

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 29

Plastic Limit: 20

Plasticity Index: 9

Activity Index: 0.50

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: in situ

Specific Gravity at 20° Celsius: 2.64

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-4 (6)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant - TVA, Memphis, Tennessee
Source: STN-3A, 4.0'-4.5'

Project Number: 172679016
Lab ID: 792A

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: JF
Test Date: 01-12-2009
Date Received: 12-16-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.64

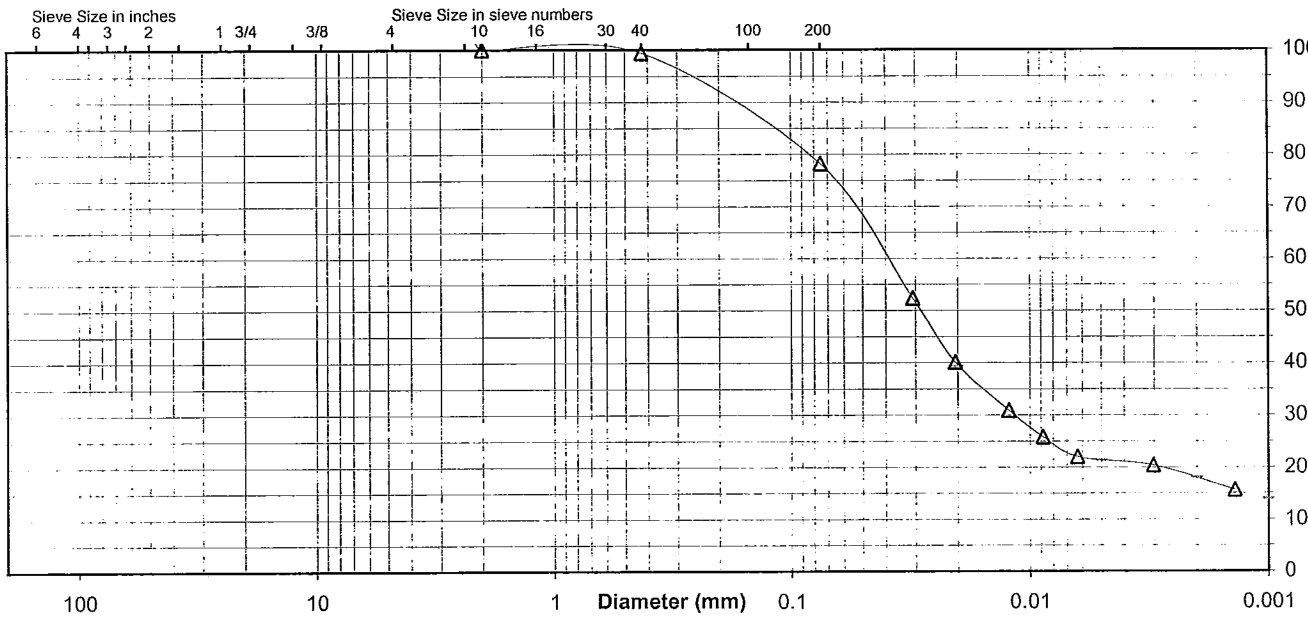
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.4
No. 200	78.2
0.02 mm	39.3
0.005 mm	21.3
0.002 mm	18.1
0.001 mm	14.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.6	21.2	56.9	21.3

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.6	21.2	60.1	18.1



Comments ______________________

Reviewed By ______

File: frm_172679016_sum_792a Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

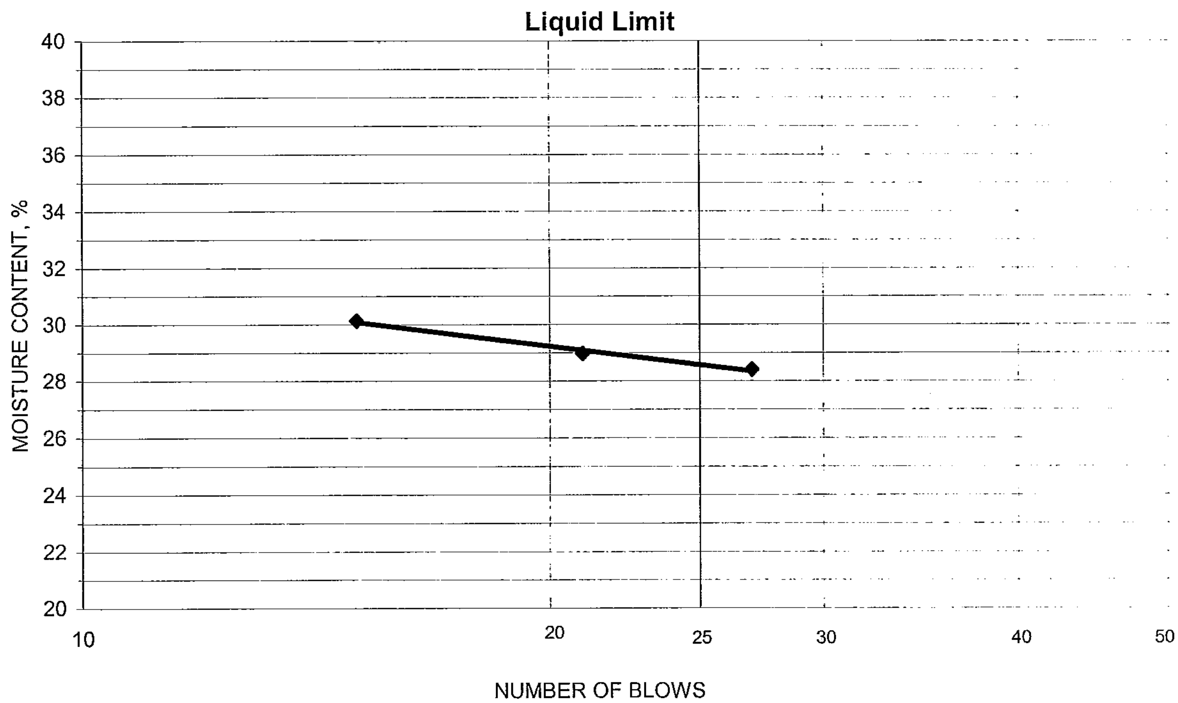
ATTERBERG LIMITS

Project: Allen Fossil Plant - TVA, Memphis, Tennessee
Source: STN-3A, 4.0'-4.5'

Project No. 172679016
Lab ID 792A
% + No. 40 1
Date Received 12-16-2009

Tested By CSM
Test Method ASTM D 4318 Method A
Test Date 01-13-2010
Prepared Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
23.55	20.64	10.98	15	30.1	
24.74	21.65	10.98	21	29.0	
26.21	22.87	11.11	27	28.4	29



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
19.34	17.94	11.14	20.6	20	9
19.50	18.11	11.16	20.0		

Remarks:

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant - TVA, Memphis, Tennessee
Project Number: 172679016
Source: STN-3A, 6.6'-7.1'
Lab ID: 793A

County: Memphis, TN
Date Received: 12-16-09
Sample Type: ST
Date Reported: 1-15-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 24.5

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	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.8
No. 200	0.075	76.6
	0.02	35.1
	0.005	20.4
	0.002	16.0
estimated	0.001	13.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.2
Medium Sand	0.2	---
Fine Sand	23.2	23.2
Silt	56.2	60.6
Clay	20.4	16.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 27
Plastic Limit: 22
Plasticity Index: 5
Activity Index: 0.31

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: in situ
Specific Gravity at 20° Celsius: 2.68

Classification

Unified Group Symbol: ML
Group Name: Silt with sand

AASHTO Classification: A-4 (3)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant - TVA, Memphis, Tennessee
Source: STN-3A, 6.6'-7.1'

Project Number: 172679016
Lab ID: 793A

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: JF
Test Date: 01-12-2010
Date Received: 12-16-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.68

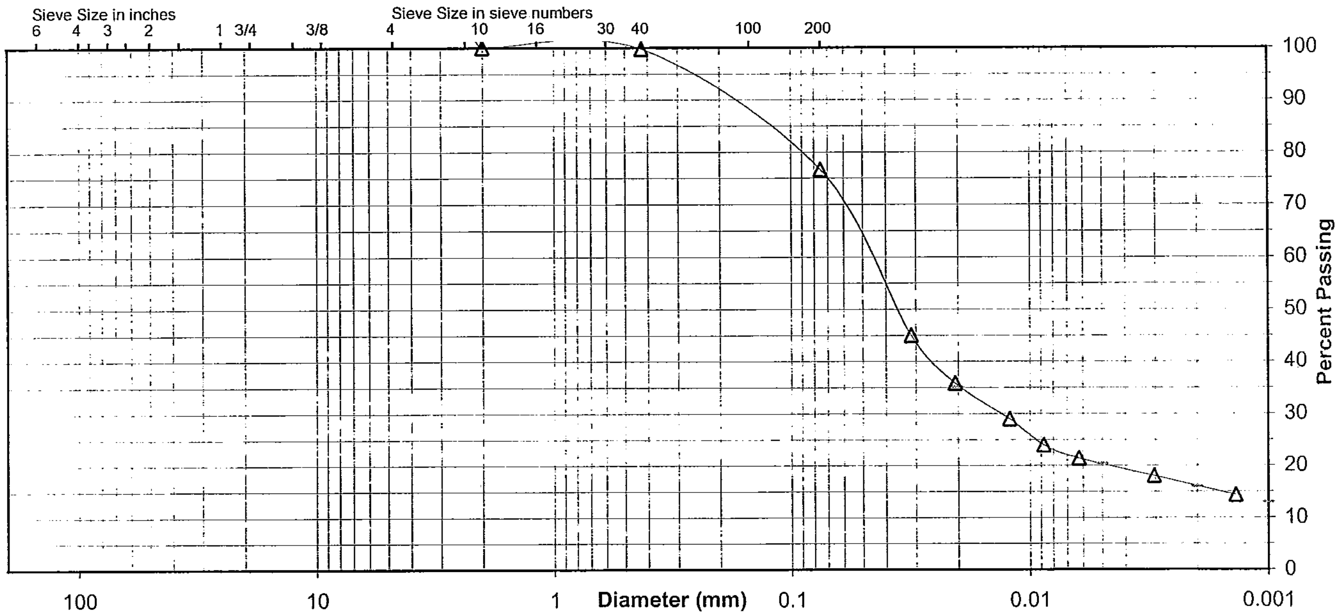
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.8
No. 200	76.6
0.02 mm	35.1
0.005 mm	20.4
0.002 mm	16.0
0.001 mm	13.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.2	23.2	56.2	20.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.2	23.2	60.6	16.0



Comments

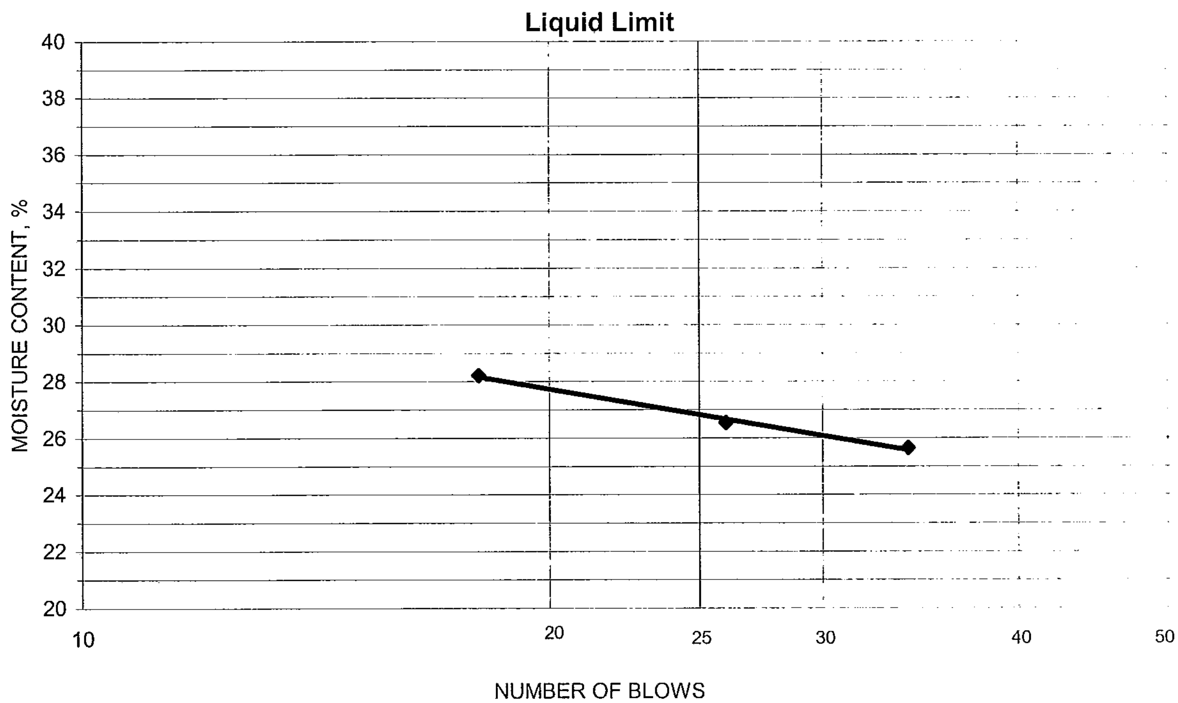
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Allen Fossil Plant - TVA, Memphis, Tennessee	Project No.	172679016
Source	STN-3A, 6.6'-7.1'	Lab ID	793A
		% + No. 40	0
Tested By	CSM	Test Method	ASTM D 4318 Method A
Date Received	12-16-2009		
Test Date	01-13-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
25.89	22.88	11.14	34	25.6	27
26.60	23.38	11.24	26	26.5	
25.81	22.60	11.22	18	28.2	



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
18.86	17.48	11.05	21.5	22	5
19.00	17.59	11.09	21.7		

Remarks:

Reviewed By

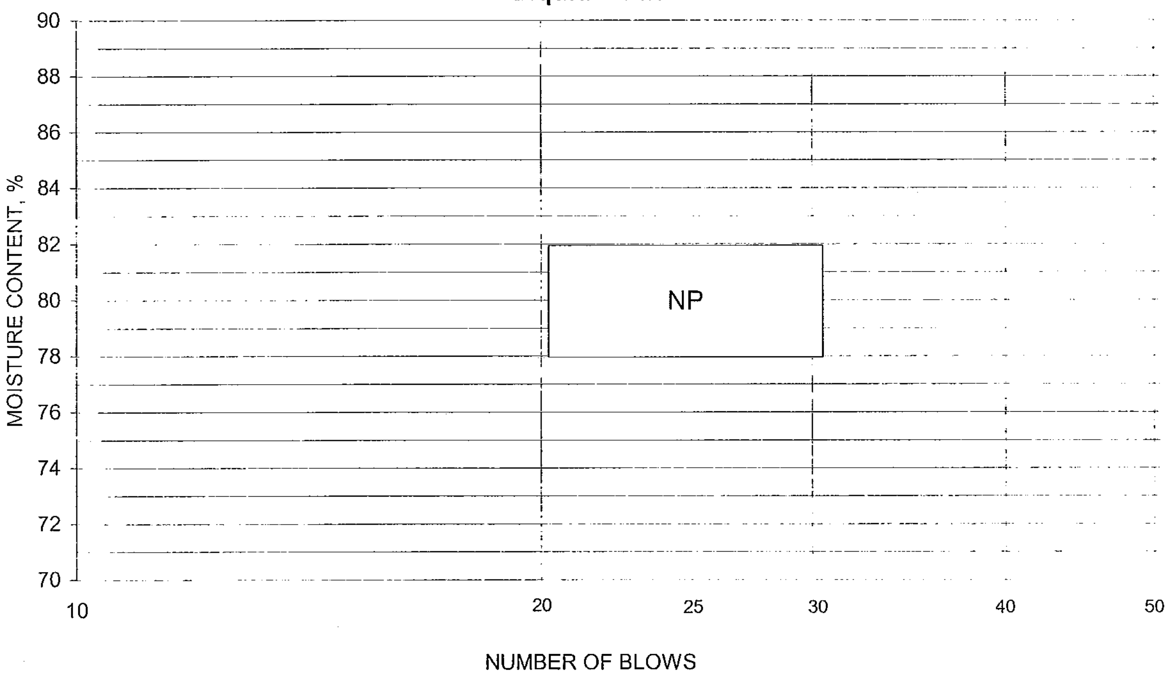
Stantec

ATTERBERG LIMITS

Project	Allen Fossil Plant - TVA, Memphis, Tennessee	Project No.	172679016
Source	STN-3A, 4.0'-6.0'	Lab ID	792
Tested By	CSM Test Method ASTM D 4318 Method A	% + No. 40	22
Test Date	01-05-2010 Prepared Dry	Date Received	12-16-2009

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 [signature]

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant (TVA)
Project Number: 172679016
Source: STN-4, 4.5'-6.0', 6.0'-7.5', 7.5'-9.0'
Lab ID: 288
County: Memphis, TN
Date Received: 8-7-09
Sample Type: SPT Comp
Date Reported: 10-20-09

Test Results

Natural Moisture Content

Test Not Performed
Moisture Content (%): N/A

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	95.1
No. 40	0.425	94.4
No. 200	0.075	84.2
	0.02	49.8
	0.005	28.9
	0.002	22.5
estimated	0.001	21.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	1.0	4.9
Coarse Sand	3.9	0.7
Medium Sand	0.7	---
Fine Sand	10.2	10.2
Silt	55.3	61.7
Clay	28.9	22.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 33
Plastic Limit: 18
Plasticity Index: 15
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: 2.68

Classification

Unified Group Symbol: CL
Group Name: Lean clay with sand
AASHTO Classification: A-6 (12)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-4, 4.5'-6.0', 6.0'-7.5', 7.5'-9.0'

Project Number: 172679016
Lab ID: 288

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: JF
Test Date: 09-08-2009
Date Received: 08-07-2009

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	95.1

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.68

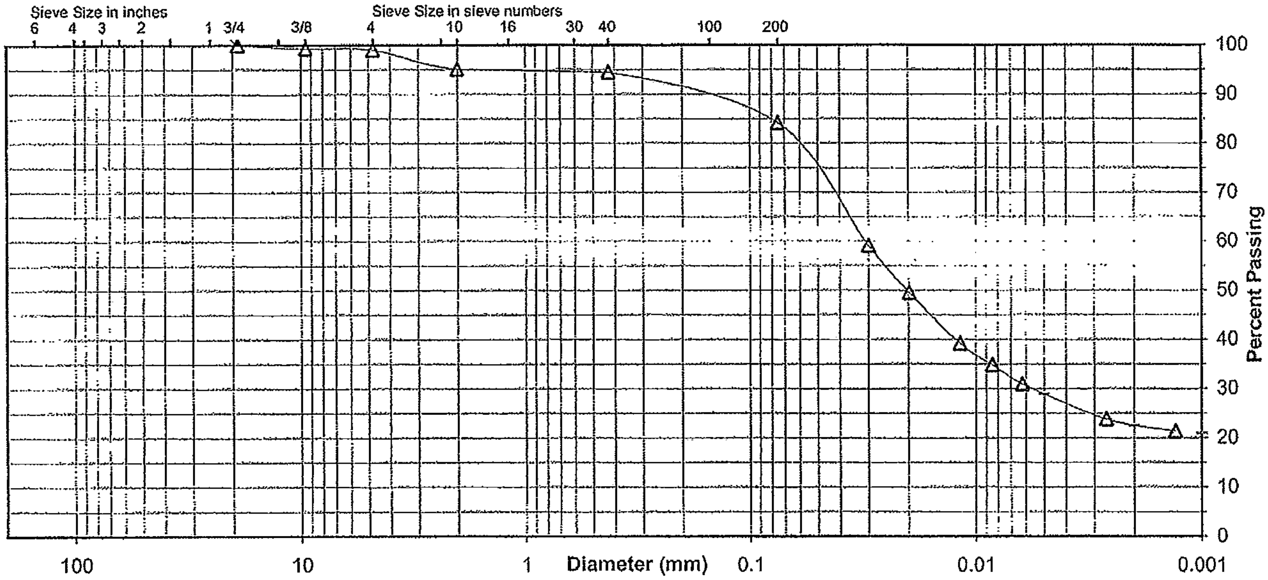
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	94.4
No. 200	84.2
0.02 mm	49.8
0.005 mm	28.9
0.002 mm	22.5
0.001 mm	21.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	1.0	3.9	0.7	10.2	55.3	28.9

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	4.9	0.7	10.2	61.7	22.5



Comments ______

Reviewed By ______

File: frm_172679016_sum_288 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant
Source: STN-4, 22.5'-24.0', 24.0'-25.5', 25.5'-27.0'
County: Memphis, TN
Sample Type: SPT Comp

Project Number: 172679016
Lab ID: 719
Date Received: 9-9-09
Date Reported: 10-21-09

Test Results

Natural Moisture Content
Test Not Performed
Moisture Content (%): N/A

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	100.0
No. 10	2	99.7
No. 40	0.425	99.4
No. 200	0.075	59.8
	0.02	25.8
	0.005	14.1
	0.002	11.5
estimated	0.001	10.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.3
Coarse Sand	0.3	0.3
Medium Sand	0.3	---
Fine Sand	39.6	39.6
Silt	45.7	48.3
Clay	14.1	11.5

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
Estimated
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification
Unified Group Symbol: ML
Group Name: Sandy silt
AASHTO Classification: A-4 (0)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-4, 22.5'-24.0', 24.0'-25.5', 25.5'-27.0'

Project Number: 172679016
Lab ID: 719

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: JF
Test Date: 10-16-2009
Date Received: 09-09-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	100.0
No. 10	99.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

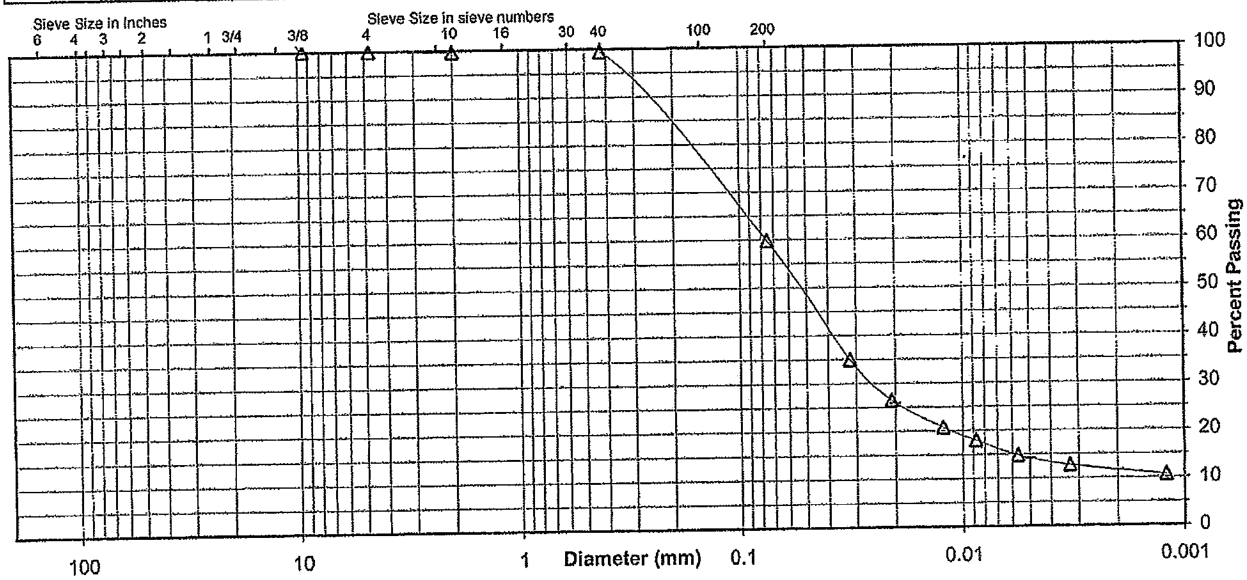
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.4
No. 200	59.8
0.02 mm	25.8
0.005 mm	14.1
0.002 mm	11.5
0.001 mm	10.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	0.3	0.3	39.6	45.7	14.1

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.3	0.3	39.6	48.3	11.5



Comments ______________________

Reviewed By ______

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant	Project Number	172679016
Source	STN-4, 37.5'-39.0', 39.0'-40.5', 40.5'-42.0'	Lab ID	723
County	Memphis, TN	Date Received	9-9-09
Sample Type	SPT Comp	Date Reported	10-22-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	100.0
No. 10	2	95.4
No. 40	0.425	95.2
No. 200	0.075	94.7
	0.02	76.7
	0.005	46.8
	0.002	36.6
estimated	0.001	32.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	4.6
Coarse Sand	4.6	0.2
Medium Sand	0.2	---
Fine Sand	0.5	0.5
Silt	47.9	58.1
Clay	46.8	36.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 47
Plastic Limit: 21
Plasticity Index: 26
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

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-7-6 (27)

Comments:

Reviewed by: [signature]

File: frm_172679016_sum_723.xls Sheet: Summary
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Allen Fossil Plant	Project Number	172679016
Source	STN-4, 37.5'-39.0', 39.0'-40.5', 40.5'-42.0'	Lab ID	723

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: JF
Test Date: 10-16-2009
Date Received 09-09-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	95.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

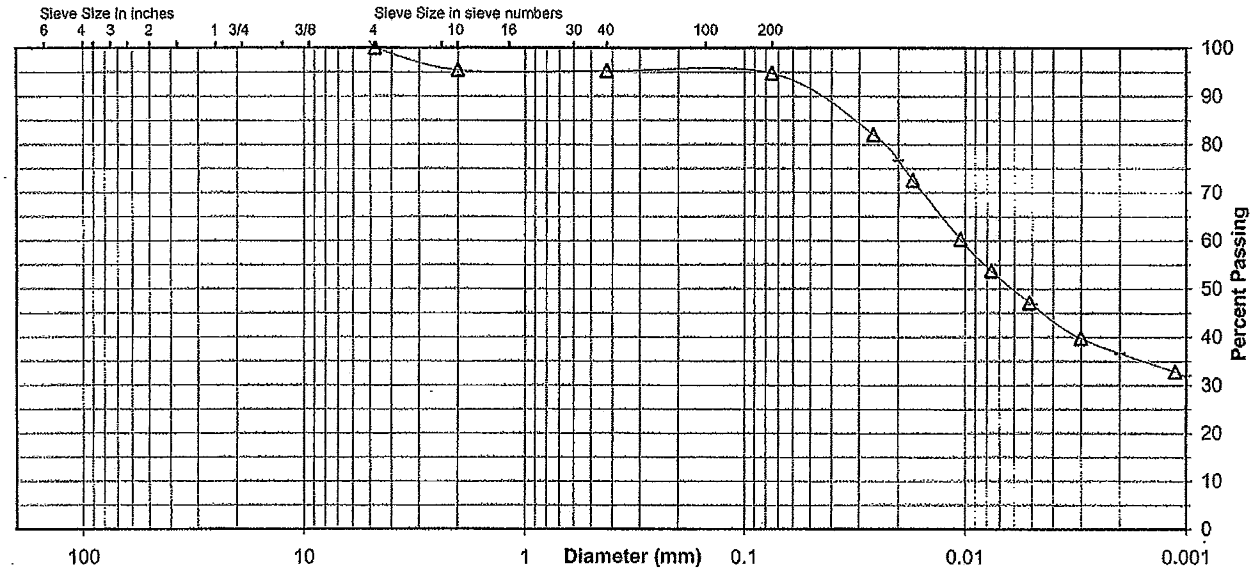
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	95.2
No. 200	94.7
0.02 mm	76.7
0.005 mm	46.8
0.002 mm	36.6
0.001 mm	32.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	4.6	0.2	0.5	47.9	46.8

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	4.6	0.2	0.5	58.1	36.6



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-4, 48.0'-49.5', 49.5'-51.0', 51.0'-52.5'	Lab ID	318
County	Memphis, TN	Date Received	8-7-09
Sample Type	SPT Comp	Date Reported	10-21-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.7
No. 200	0.075	99.4
	0.02	83.6
	0.005	57.2
	0.002	45.8
estimated	0.001	39.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.3
Medium Sand	0.3	---
Fine Sand	0.3	0.3
Silt	42.2	53.6
Clay	57.2	45.8

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 55

Plastic Limit: 20

Plasticity Index: 35

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: 2.70

Classification

Unified Group Symbol: CH

Group Name: Fat clay

AASHTO Classification: A-7-6 (39)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-4, 48.0'-49.5', 49.5'-51.0', 51.0'-52.5'

Project Number: 172679016
Lab ID: 318

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: bwt
Test Date: 09-23-2009
Date Received: 08-07-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

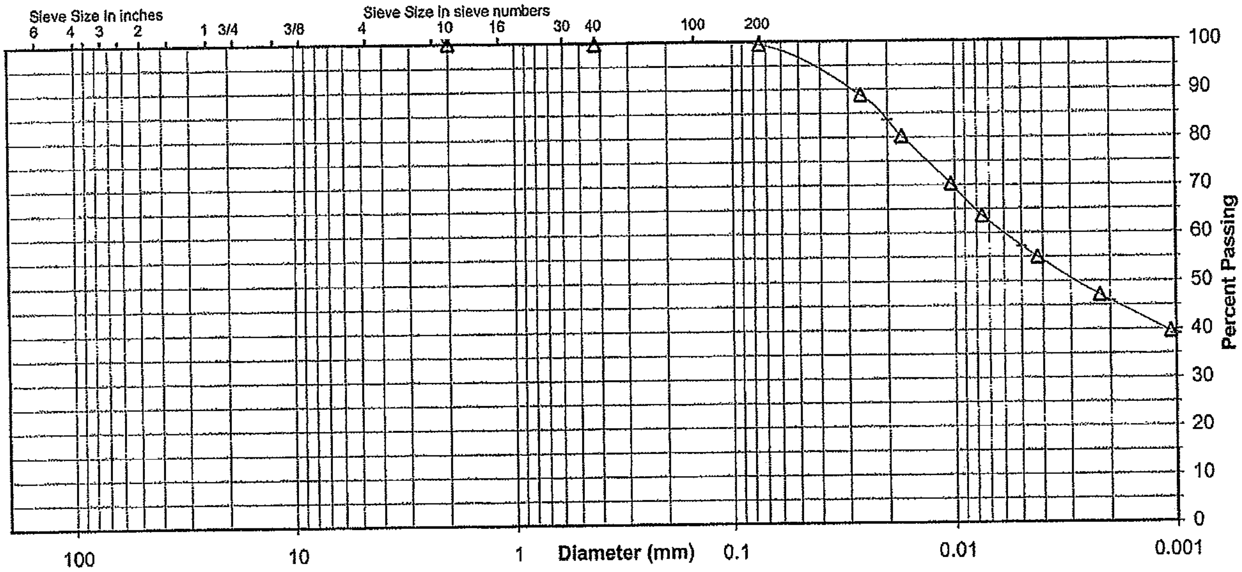
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.7
No. 200	99.4
0.02 mm	83.6
0.005 mm	57.2
0.002 mm	45.8
0.001 mm	39.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.3	0.3	42.2	57.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.3	0.3	53.6	45.8



Comments ______

Reviewed By ______

File: frm_172679016_sum_318 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant (TVA)
Source: STN-5, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0'
Project Number: 172679016
Lab ID: 328

County: Memphis, TN
Sample Type: SPT Comp
Date Received: 8-7-09
Date Reported: 10-20-09

Test Results

Natural Moisture Content

Test Not Performed
Moisture Content (%): N/A

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	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	100.0
No. 40	0.425	99.6
No. 200	0.075	61.0
	0.02	21.3
	0.005	12.8
	0.002	9.9
estimated	0.001	9.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.4
Medium Sand	0.4	---
Fine Sand	38.6	38.6
Silt	48.2	51.1
Clay	12.8	9.9

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 23
Plastic Limit: 20
Plasticity Index: 3
Activity Index: 0.30

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: ML
Group Name: Sandy silt

AASHTO Classification: A-4 (0)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-5, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0'	Lab ID	328

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: JF
Test Date: 09-02-2009
Date Received 08-07-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.67

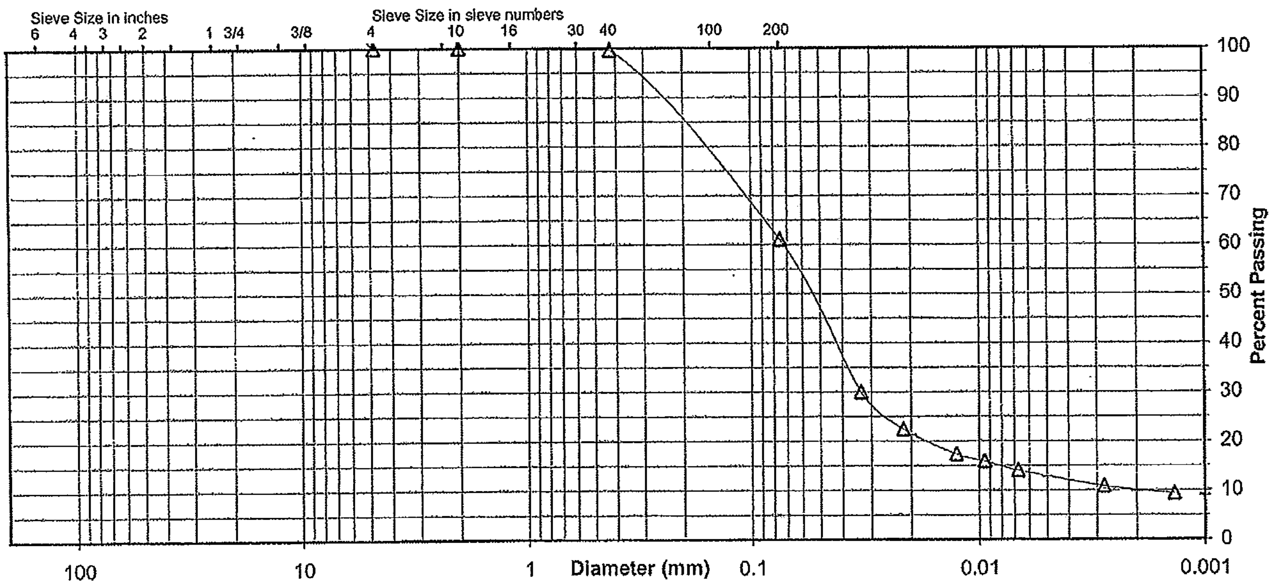
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.6
No. 200	61.0
0.02 mm	21.3
0.005 mm	12.8
0.002 mm	9.9
0.001 mm	9.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.4	38.6	48.2	12.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.4	38.6	51.1	9.9



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant
Source: STN-5, 7.5'-9.0', 9.0'-10.5', 10.5'-12.0'

County: Memphis, TN
Sample Type: SPT Comp

Project Number: 172679016
Lab ID: 727

Date Received: 9-9-09
Date Reported: 10-21-09

Test Results

Natural Moisture Content
Test Not Performed
Moisture Content (%): N/A

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	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	99.6
No. 40	0.425	99.5
No. 200	0.075	95.5
	0.02	51.9
	0.005	23.1
	0.002	17.8
estimated	0.001	14.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.4
Coarse Sand	0.4	0.1
Medium Sand	0.1	---
Fine Sand	4.0	4.0
Silt	72.4	77.7
Clay	23.1	17.8

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 33
Plastic Limit: 22
Plasticity Index: 11
Activity Index: 0.61

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
Estimated
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification
Unified Group Symbol: CL
Group Name: Lean clay
AASHTO Classification: A-6 (11)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-5, 7.5'-9.0', 9.0'-10.5', 10.5'-12.0'

Project Number: 172679016
Lab ID: 727

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: ford
Test Date: 10-15-2009
Date Received: 09-09-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	99.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

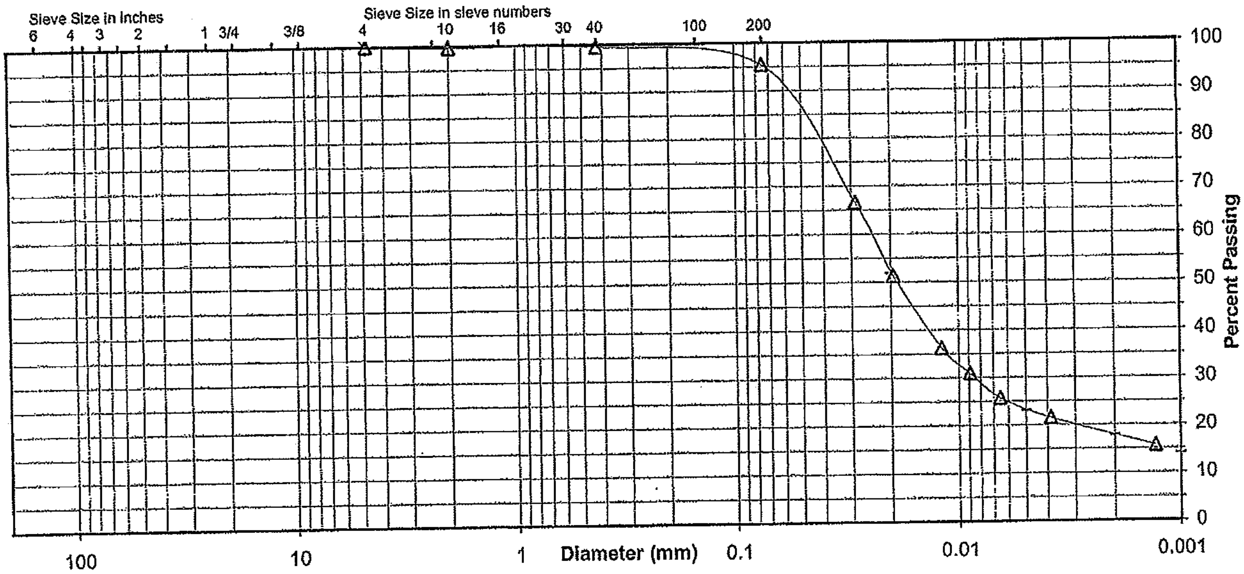
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.5
No. 200	95.5
0.02 mm	51.9
0.005 mm	23.1
0.002 mm	17.8
0.001 mm	14.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.4	0.1	4.0	72.4	23.1

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.4	0.1	4.0	77.7	17.8



Comments ______________________

Reviewed By ______

File: frm_172679016_sum_727 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Summary of Soil Tests

Stantec

Project Name: Allen Fossil Plant (TVA)
Source: STN-5, 16.5'-18.0', 18.0'-19.5', 19.5'-21.0'
County: Memphis, TN
Sample Type: SPT Comp

Project Number: 172679016
Lab ID: 339
Date Received: 8-7-09
Date Reported: 10-21-09

Test Results

Natural Moisture Content

Test Not Performed
Moisture Content (%): N/A

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	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	100.0
No. 200	0.075	99.3
	0.02	95.6
	0.005	70.5
	0.002	55.4
estimated	0.001	49.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.0
Medium Sand	0.0	---
Fine Sand	0.7	0.7
Silt	28.8	43.9
Clay	70.5	55.4

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 68
Plastic Limit: 22
Plasticity Index: 46
Activity Index: 0.84

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: CH
Group Name: Fat clay

AASHTO Classification: A-7-6 (52)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-5, 16.5'-18.0', 18.0'-19.5', 19.5'-21.0'

Project Number: 172679016
Lab ID: 339

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: PS
Test Date: 09-25-2009
Date Received: 08-07-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.71

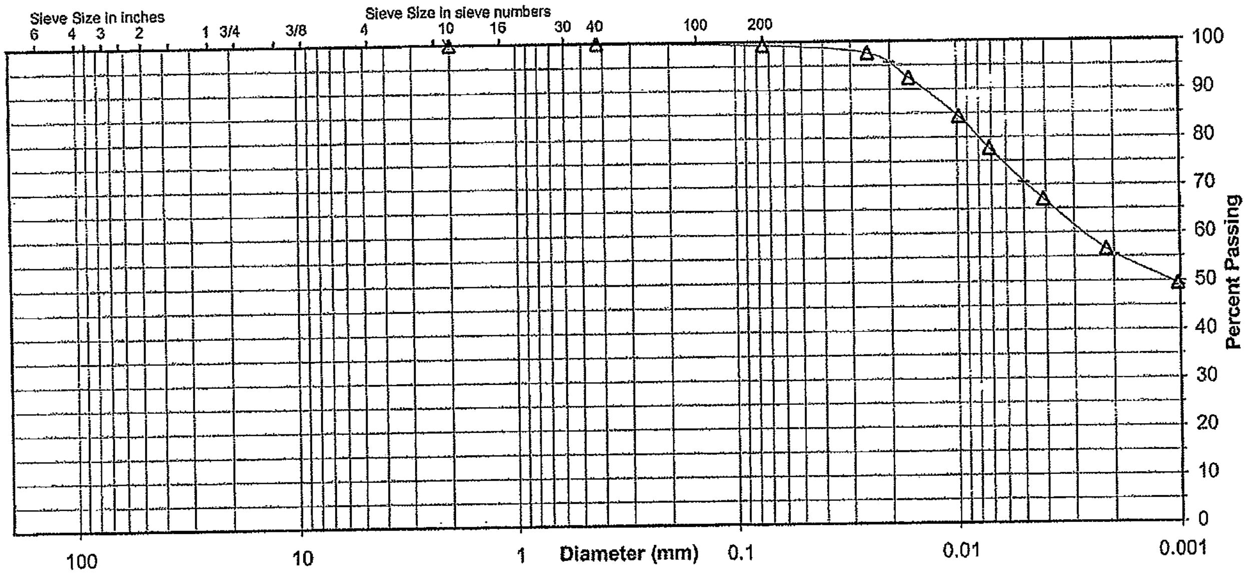
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	100.0
No. 200	99.3
0.02 mm	95.6
0.005 mm	70.5
0.002 mm	55.4
0.001 mm	49.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	0.0	0.0	0.7	28.8	70.5

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.0	0.0	0.7	43.9	55.4



Comments ______

Reviewed By ______

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant	Project Number	172679016
Source	STN-5, 28.5'-30.0', 30.0'-31.5', 31.5'-33.0'	Lab ID	731
County	Memphis, TN	Date Received	9-9-09
Sample Type	SPT Comp	Date Reported	10-22-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	100.0
No. 10	2	99.9
No. 40	0.425	99.8
No. 200	0.075	50.1
	0.02	16.2
	0.005	10.0
	0.002	8.3
estimated	0.001	6.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.1
Coarse Sand	0.1	0.1
Medium Sand	0.1	---
Fine Sand	49.7	49.7
Silt	40.1	41.8
Clay	10.0	8.3

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

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: ML
Group Name: Sandy silt

AASHTO Classification: A-4 (0)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-5, 28.5'-30.0', 30.0'-31.5', 31.5'-33.0'

Project Number: 172679016
Lab ID: 731

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded
Particle Hardness: Hard and Durable

Tested By: CM
Test Date: 10-16-2009
Date Received: 09-09-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	99.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

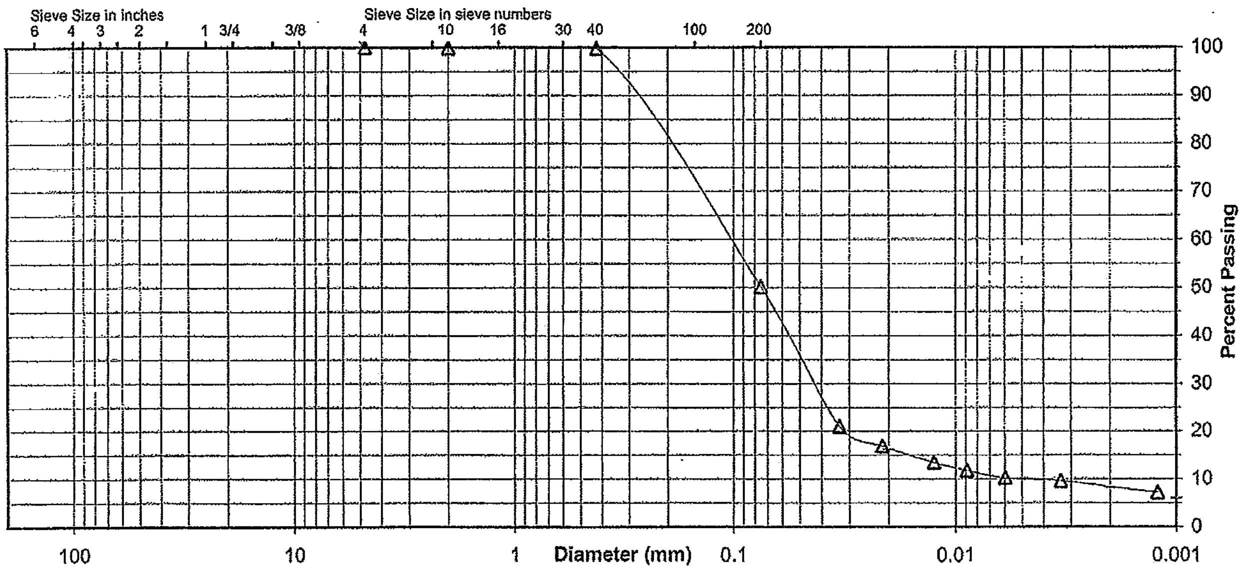
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.8
No. 200	50.1
0.02 mm	16.2
0.005 mm	10.0
0.002 mm	8.3
0.001 mm	6.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	0.1	0.1	49.7	40.1	10.0

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.1	0.1	49.7	41.8	8.3



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-6, 7.5'-9.0', 9.0'-10.5', 10.5'-12.0'	Lab ID	361
County	Memphis, TN	Date Received	8-7-09
Sample Type	SPT Comp	Date Reported	10-21-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	100.0
No. 10	2	99.9
No. 40	0.425	98.8
No. 200	0.075	45.9
	0.02	21.3
	0.005	12.6
	0.002	10.0
estimated	0.001	8.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.1
Coarse Sand	0.1	1.1
Medium Sand	1.1	---
Fine Sand	52.9	52.9
Silt	33.3	35.9
Clay	12.6	10.0

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: 2.69

Classification

Unified Group Symbol: SM

Group Name: Silty sand

AASHTO Classification: A-4 (0)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-6, 7.5'-9.0', 9.0'-10.5', 10.5'-12.0'

Project Number: 172679016
Lab ID: 361

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: eed Input-Sieve
Test Date: 09-23-2009
Date Received: 08-07-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	100.0
No. 10	99.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.69

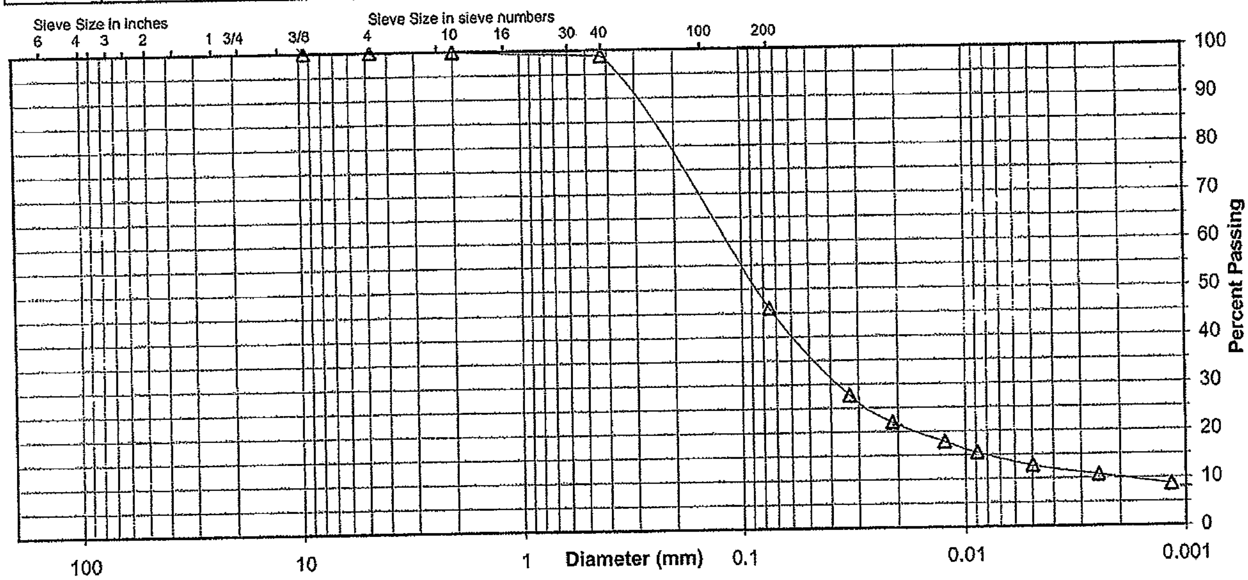
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.8
No. 200	45.9
0.02 mm	21.3
0.005 mm	12.6
0.002 mm	10.0
0.001 mm	8.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.1	1.1	52.9	33.3	12.6

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.1	1.1	52.9	35.9	10.0



Comments ______

Reviewed By ______

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant	Project Number	172679016
Source	STN-6, 16.5'-18.0', 18.0'-19.5', 19.5'-21.0', 21.0'-22.5'	Lab ID	735
County	Memphis, TN	Date Received	9-9-09
Sample Type	SPT Comp	Date Reported	10-22-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	100.0
No. 10	2	99.8
No. 40	0.425	99.1
No. 200	0.075	50.5
	0.02	19.1
	0.005	10.8
	0.002	9.0
estimated	0.001	7.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.2
Coarse Sand	0.2	0.7
Medium Sand	0.7	---
Fine Sand	48.6	48.6
Silt	39.7	41.5
Clay	10.8	9.0

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

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: ML
Group Name: Sandy silt

AASHTO Classification: A-4 (0)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-6, 16.5'-18.0', 18.0'-19.5', 19.5'-21.0', 21.0'-22.5'

Project Number: 172679016
Lab ID: 735

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded
Particle Hardness: Hard and Durable

Tested By: CM
Test Date: 10-16-2009
Date Received: 09-09-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	99.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

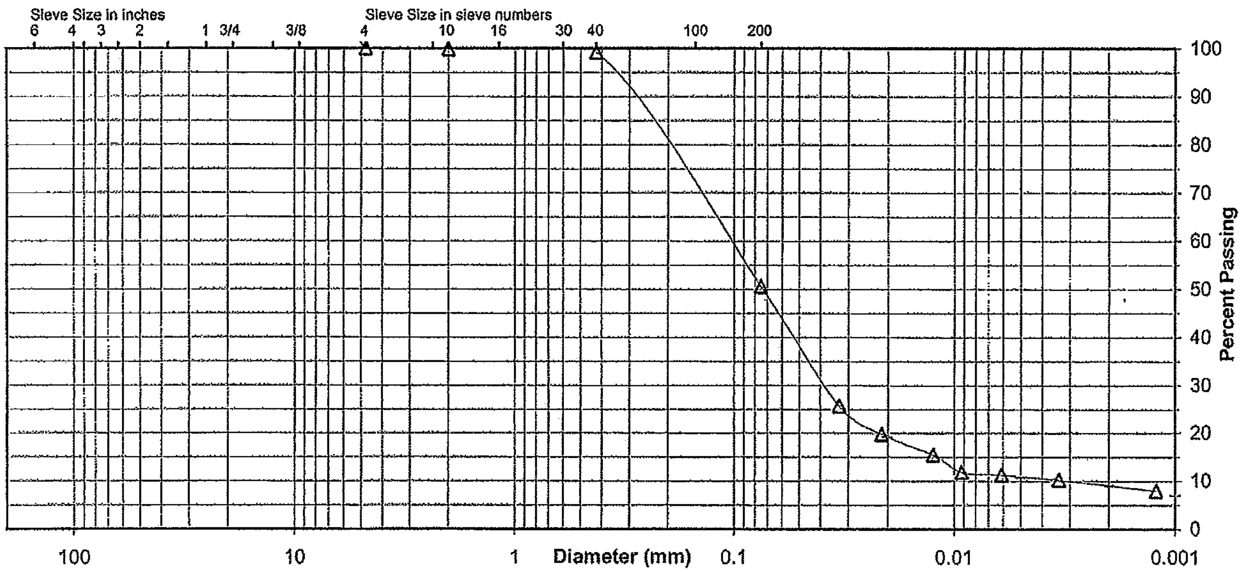
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.1
No. 200	50.5
0.02 mm	19.1
0.005 mm	10.8
0.002 mm	9.0
0.001 mm	7.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.2	0.7	48.6	39.7	10.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.2	0.7	48.6	41.5	9.0



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant	Project Number	172679016
Source	STN-6, 24.0'-25.5', 25.5'-27.0', 27.0'-28.5'	Lab ID	740
County	Memphis, TN	Date Received	9-9-09
Sample Type	SPT Comp	Date Reported	10-21-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.7
No. 200	0.075	54.9
	0.02	21.3
	0.005	11.4
	0.002	9.5
estimated	0.001	8.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.3
Medium Sand	0.3	---
Fine Sand	44.8	44.8
Silt	43.5	45.4
Clay	11.4	9.5

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

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: ML
Group Name: Sandy silt

AASHTO Classification: A-4 (0)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-6, 24.0'-25.5', 25.5'-27.0', 27.0'-28.5'

Project Number: 172679016
Lab ID: 740

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: JF
Test Date: 10-16-2009
Date Received: 09-09-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

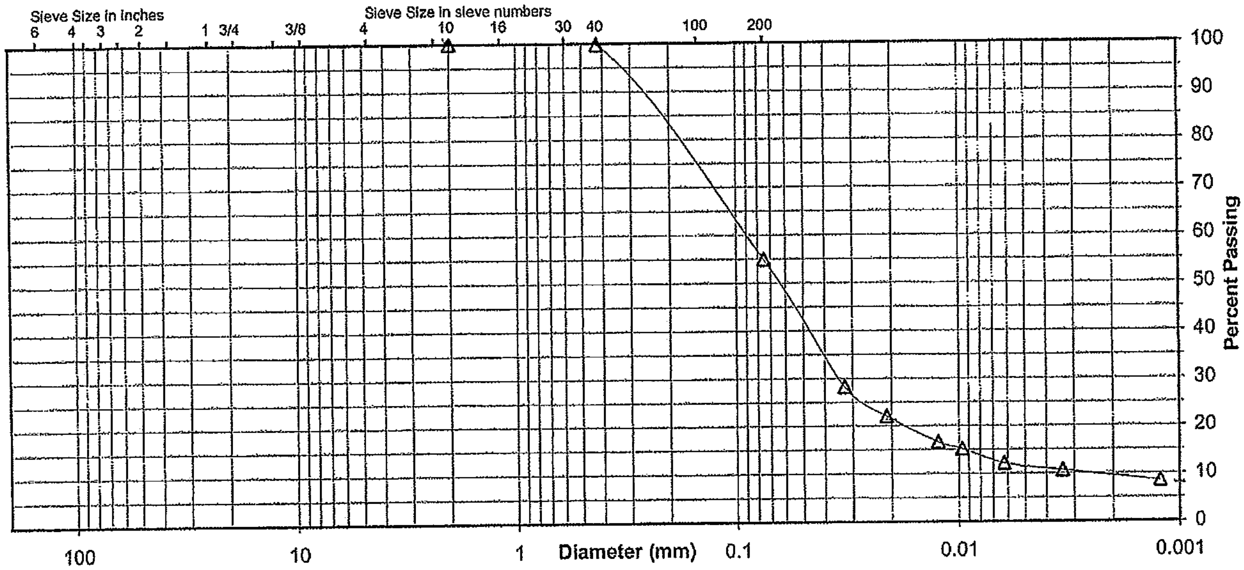
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.7
No. 200	54.9
0.02 mm	21.3
0.005 mm	11.4
0.002 mm	9.5
0.001 mm	8.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	0.0	0.3	44.8	43.5	11.4

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.0	0.3	44.8	45.4	9.5



Comments ______

Reviewed By ______

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant	Project Number	172679016
Source	STN-6, 34.5'-36.0', 36.0'-37.5', 37.5'-39.0'	Lab ID	744
County	Memphis, TN	Date Received	9-9-09
Sample Type	SPT Comp	Date Reported	10-22-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	100.0
No. 10	2	80.2
No. 40	0.425	80.2
No. 200	0.075	79.8
	0.02	78.2
	0.005	59.7
	0.002	46.8
estimated	0.001	38.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	19.8
Coarse Sand	19.8	0.0
Medium Sand	0.0	---
Fine Sand	0.4	0.4
Silt	20.1	33.0
Clay	59.7	46.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 76
Plastic Limit: 26
Plasticity Index: 50
Activity Index: 1.06

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

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CH
Group Name: Fat clay with sand

AASHTO Classification: A-7-6 (43)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Allen Fossil Plant	Project Number	172679016
Source	STN-6, 34.5'-36.0', 36.0'-37.5', 37.5'-39.0'	Lab ID	744

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: JF
Test Date: 10-16-2009
Date Received 09-09-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	80.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

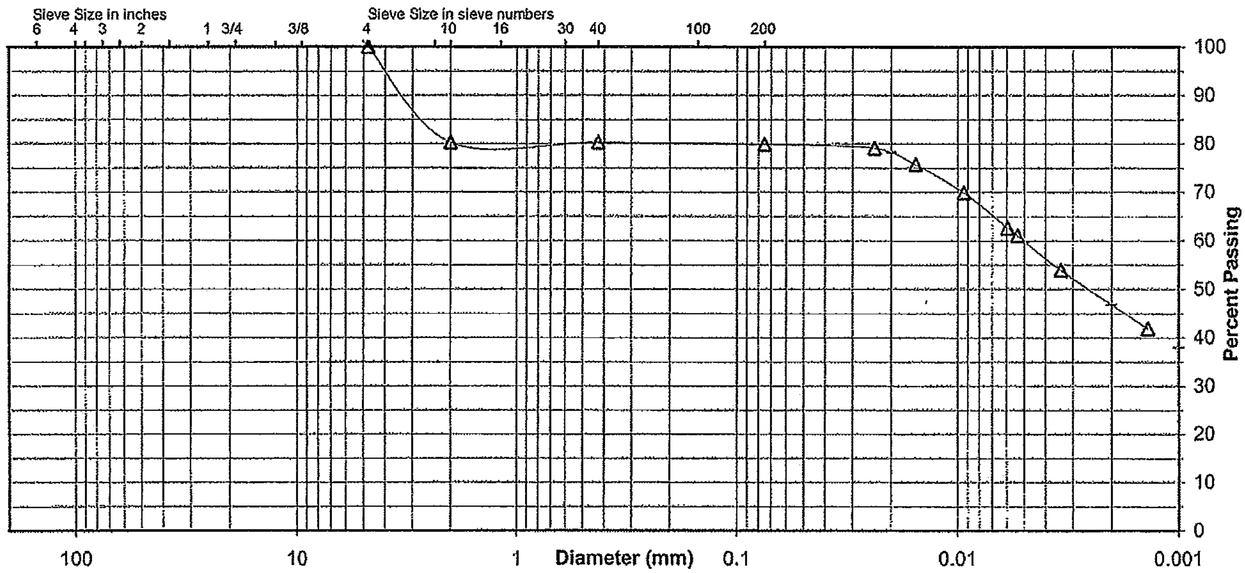
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	80.2
No. 200	79.8
0.02 mm	78.2
0.005 mm	59.7
0.002 mm	46.8
0.001 mm	38.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	19.8	0.0	0.4	20.1	59.7

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	19.8	0.0	0.4	33.0	46.8



Comments ____________________

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-6, 46.5'-48.0', 48.0'-49.5', 49.5'-51.0'	Lab ID	388
County	Memphis, TN	Date Received	8-7-09
Sample Type	SPT Comp	Date Reported	10-20-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.5
No. 200	0.075	13.0
	0.02	4.1
	0.005	3.0
	0.002	2.5
estimated	0.001	1.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.5
Medium Sand	0.5	---
Fine Sand	86.5	86.5
Silt	10.0	10.5
Clay	3.0	2.5

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: 2.67

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-6, 46.5'-48.0', 48.0'-49.5', 49.5'-51.0'	Lab ID	388

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: JF
Test Date: 09-15-2009
Date Received 08-07-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.67

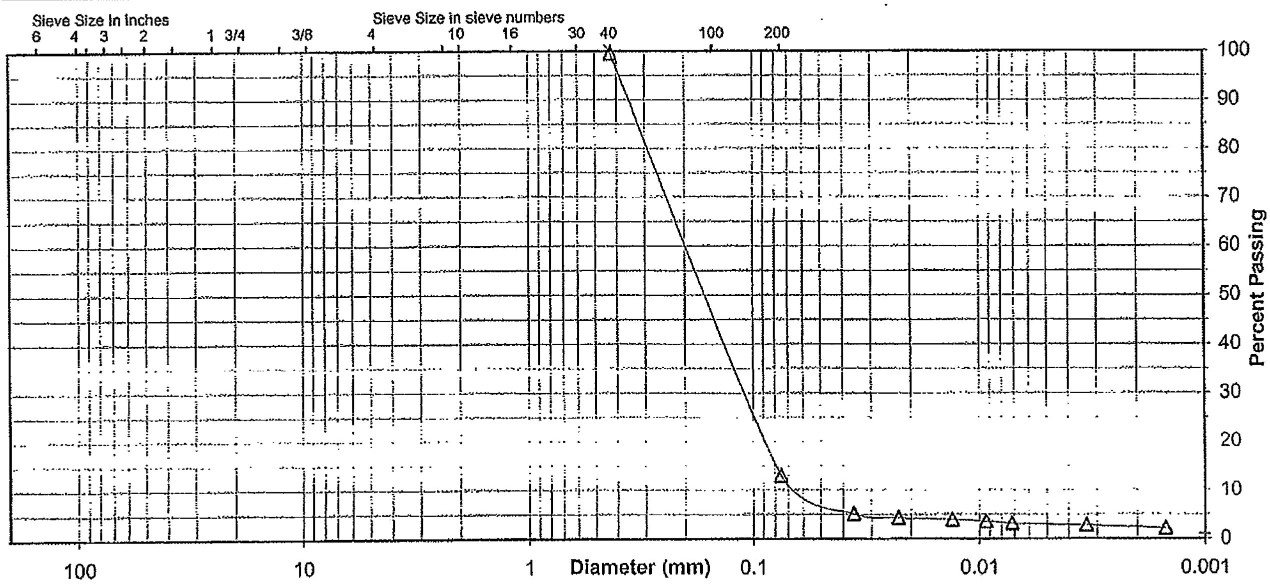
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.5
No. 200	13.0
0.02 mm	4.1
0.005 mm	3.0
0.002 mm	2.5
0.001 mm	1.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.5	86.5	10.0	3.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.5	86.5	10.5	2.5



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant (TVA)
Source: STN-7, 4.5'-6.0', 6.0'-7.5', 7.5'-9.0'

Project Number: 172679016
Lab ID: 401

County: Memphis, TN
Sample Type: SPT Comp

Date Received: 8-7-09
Date Reported: 10-21-09

Test Results

Natural Moisture Content

Test Not Performed
Moisture Content (%): N/A

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	
3/4"	19	100.0
3/8"	9.5	99.4
No. 4	4.75	99.0
No. 10	2	98.0
No. 40	0.425	95.6
No. 200	0.075	61.1
	0.02	36.6
	0.005	23.0
	0.002	17.9
estimated	0.001	16.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	1.0	2.0
Coarse Sand	1.0	2.4
Medium Sand	2.4	---
Fine Sand	34.5	34.5
Silt	38.1	43.2
Clay	23.0	17.9

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 24
Plastic Limit: 18
Plasticity Index: 6
Activity Index: 0.33

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: 2.69

Classification

Unified Group Symbol: CL-ML
Group Name: Sandy silty clay

AASHTO Classification: A-4 (1)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant (TVA)
Source: STN-7, 4.5'-6.0', 6.0'-7.5', 7.5'-9.0'

Project Number: 172679016
Lab ID: 401

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: eed Input-Sieve
Test Date: 09-23-2009
Date Received: 08-07-2009

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	99.0
No. 10	98.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.69

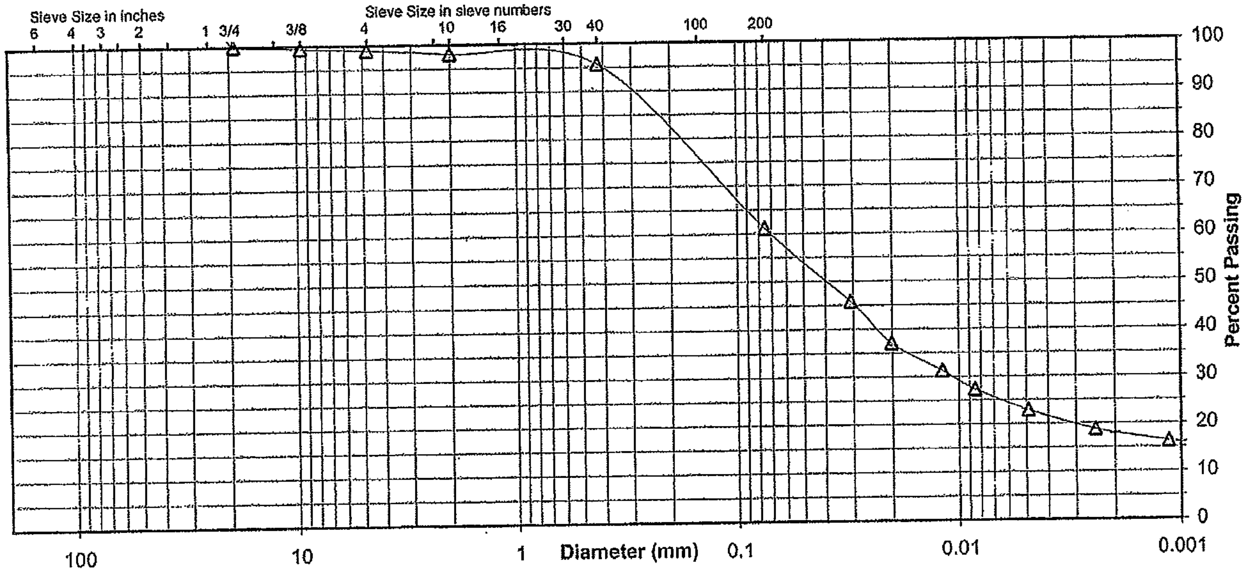
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	95.6
No. 200	61.1
0.02 mm	36.6
0.005 mm	23.0
0.002 mm	17.9
0.001 mm	16.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	1.0	1.0	2.4	34.5	38.1	23.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	2.0	2.4	34.5	43.2	17.9



Comments ______

Reviewed By ______

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant
Source: STN-7, 16.5'-18.0', 18.0'-19.5', 19.5'-21.0'

Project Number: 172679016
Lab ID: 748

County: Memphis, TN
Sample Type: SPT Comp

Date Received: 9-9-09
Date Reported: 10-21-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	99.9
No. 10	2	99.7
No. 40	0.425	98.7
No. 200	0.075	63.5
	0.02	32.7
	0.005	16.8
	0.002	12.8
estimated	0.001	10.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.1	0.3
Coarse Sand	0.2	1.0
Medium Sand	1.0	---
Fine Sand	35.2	35.2
Silt	46.7	50.7
Clay	16.8	12.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 22
Plastic Limit: 17
Plasticity Index: 5
Activity Index: 0.38

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

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL-ML
Group Name: Sandy silty clay

AASHTO Classification: A-4 (1)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-7, 16.5'-18.0', 18.0'-19.5', 19.5'-21.0'

Project Number: 172679016
Lab ID: 748

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: ps
Test Date: 10-15-2009
Date Received: 09-09-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.9
No. 10	99.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

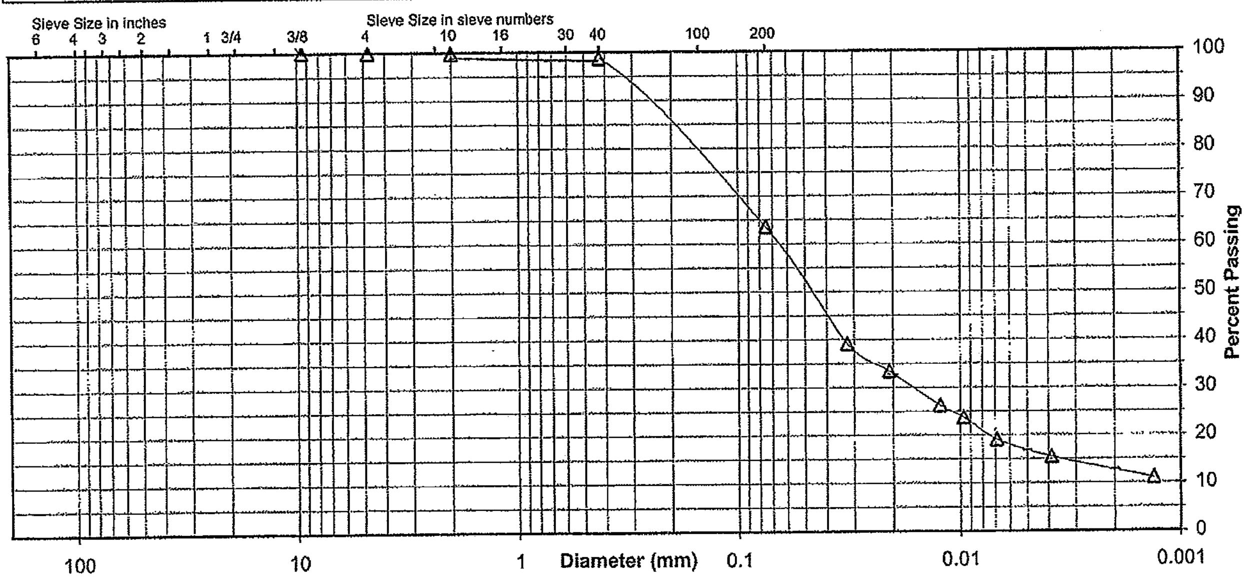
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.7
No. 200	63.5
0.02 mm	32.7
0.005 mm	16.8
0.002 mm	12.8
0.001 mm	10.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.1	0.2	1.0	35.2	46.7	16.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.3	1.0	35.2	50.7	12.8



Comments ______

Reviewed By ______

File: frm_172679016_sum_748 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant	Project Number	172679016
Source	STN-7, 21.0'-22.5', 22.5'-24.0', 24.0'-25.5'	Lab ID	752
County	Memphis, TN	Date Received	9-9-09
Sample Type	SPT Comp	Date Reported	10-22-09

Test Results

Natural Moisture Content
Test Not Performed
Moisture Content (%): N/A

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	100.0
No. 10	2	99.9
No. 40	0.425	99.5
No. 200	0.075	58.3
	0.02	23.6
	0.005	12.5
	0.002	9.2
estimated	0.001	8.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.1
Coarse Sand	0.1	0.4
Medium Sand	0.4	---
Fine Sand	41.2	41.2
Silt	45.8	49.1
Clay	12.5	9.2

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
Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification
Unified Group Symbol: ML
Group Name: Sandy silt

AASHTO Classification: A-4 (0)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-7, 21.0'-22.5', 22.5'-24.0', 24.0'-25.5'

Project Number: 172679016
Lab ID: 752

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: CM
Test Date: 10-15-2009
Date Received: 09-09-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	100.0
No. 10	99.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

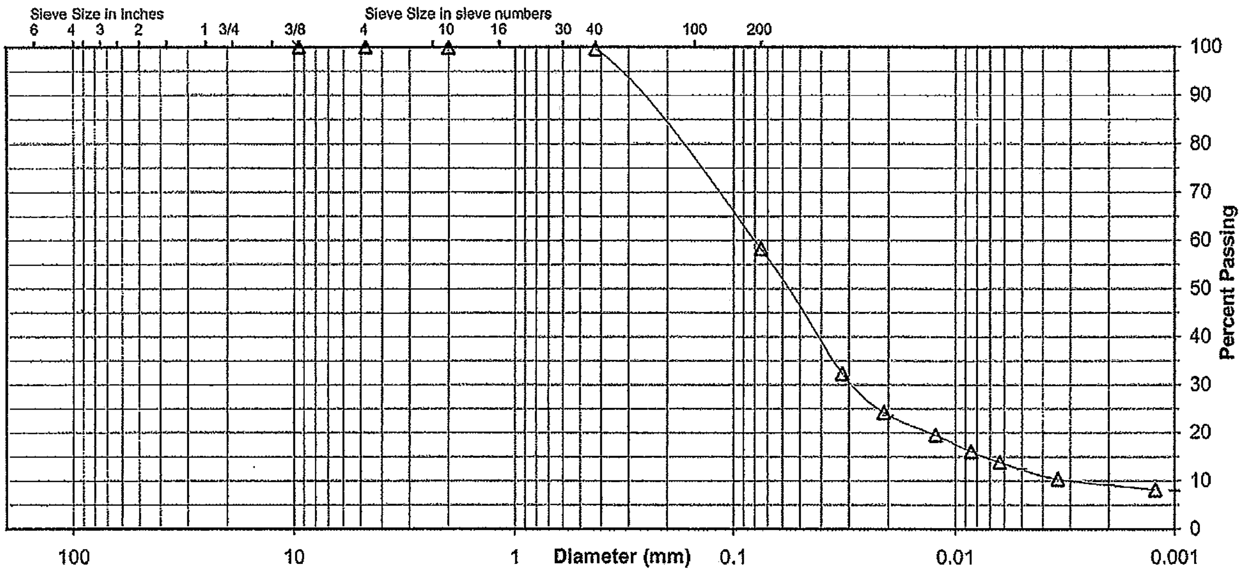
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.5
No. 200	58.3
0.02 mm	23.6
0.005 mm	12.5
0.002 mm	9.2
0.001 mm	8.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.1	0.4	41.2	45.8	12.5

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.1	0.4	41.2	49.1	9.2



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-7, 33.5'-35.0', 35.0'-36.5', 36.5'-38.0'	Lab ID	420
County	Memphis, TN	Date Received	8-7-09
Sample Type	SPT Comp	Date Reported	10-22-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	99.7
No. 10	2	99.3
No. 40	0.425	98.9
No. 200	0.075	96.8
	0.02	88.6
	0.005	66.9
	0.002	52.3
estimated	0.001	44.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.3	0.7
Coarse Sand	0.4	0.4
Medium Sand	0.4	---
Fine Sand	2.1	2.1
Silt	29.9	44.5
Clay	66.9	52.3

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 63
Plastic Limit: 21
Plasticity Index: 42
Activity Index: 0.81

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: Fat clay

AASHTO Classification: A-7-6 (46)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-7, 33.5'-35.0', 35.0'-36.5', 36.5'-38.0'	Lab ID	420

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: eed Input-Sieve
Test Date: 09-23-2009
Date Received 08-07-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.7
No. 10	99.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

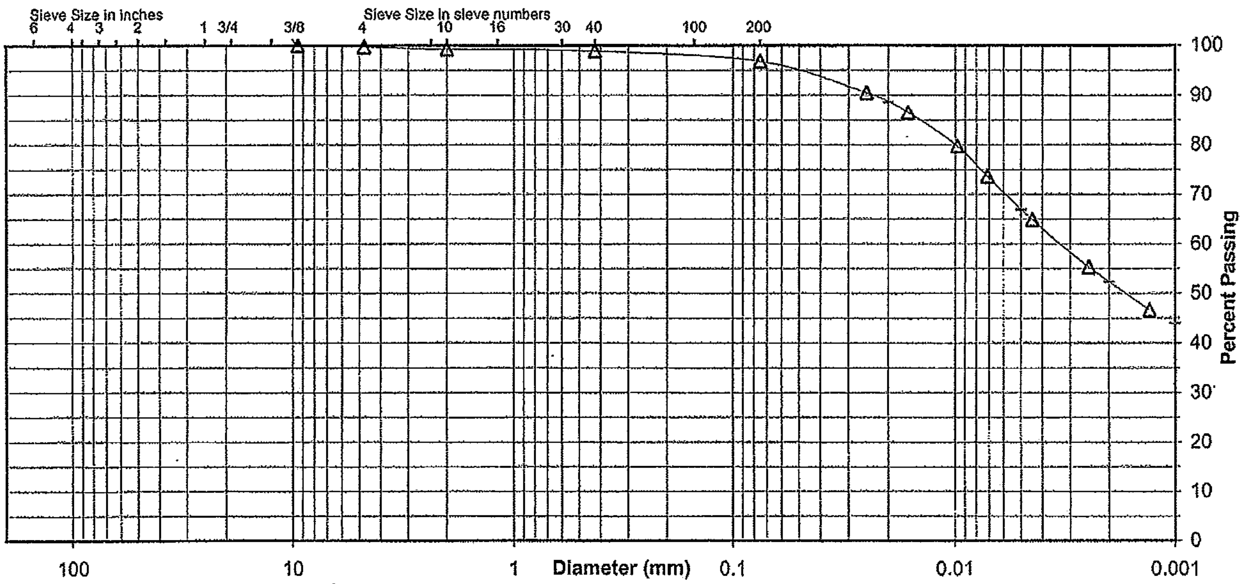
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.9
No. 200	96.8
0.02 mm	88.6
0.005 mm	66.9
0.002 mm	52.3
0.001 mm	44.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.3	0.4	0.4	2.1	29.9	66.9

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.7	0.4	2.1	44.5	52.3



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant
Source: STN-8, 6.0'-7.5', 7.5'-9.0', 9.0'-10.5'
County: Memphis, TN
Sample Type: SPT Comp

Project Number: 172679016
Lab ID: 756
Date Received: 9-9-09
Date Reported: 10-21-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	99.9
No. 10	2	99.6
No. 40	0.425	98.0
No. 200	0.075	70.8
	0.02	31.6
	0.005	14.3
	0.002	10.6
estimated	0.001	8.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.1	0.4
Coarse Sand	0.3	1.6
Medium Sand	1.6	---
Fine Sand	27.2	27.2
Silt	56.5	60.2
Clay	14.3	10.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 25
Plastic Limit: 19
Plasticity Index: 6
Activity Index: 0.55

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

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL-ML
Group Name: Silty clay with sand

AASHTO Classification: A-4 (2)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-8, 6.0'-7.5', 7.5'-9.0', 9.0'-10.5'

Project Number: 172679016
Lab ID: 756

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: ford
Test Date: 10-15-2009
Date Received: 09-09-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.9
No. 10	99.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

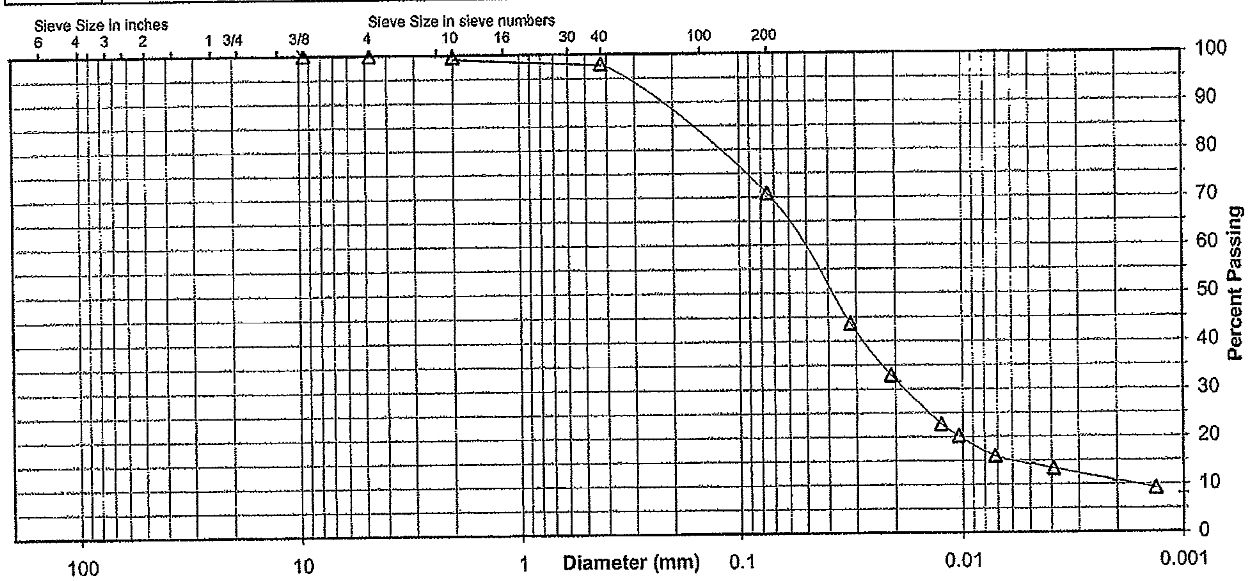
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.0
No. 200	70.8
0.02 mm	31.6
0.005 mm	14.3
0.002 mm	10.6
0.001 mm	8.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.1	0.3	1.6	27.2	56.5	14.3

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.4	1.6	27.2	60.2	10.6



Comments ______

Reviewed By ______

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant
Source: STN-8, 24.0'-25.5', 25.5'-27.0', 27.0'-28.5'
County: Memphis, TN
Sample Type: SPT Comp

Project Number: 172679016
Lab ID: 760
Date Received: 9-9-09
Date Reported: 10-21-09

Test Results

Natural Moisture Content
Test Not Performed
Moisture Content (%): N/A

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	
3/4"	19	100.0
3/8"	9.5	99.8
No. 4	4.75	99.8
No. 10	2	99.8
No. 40	0.425	99.7
No. 200	0.075	58.4
	0.02	20.1
	0.005	11.2
	0.002	8.9
estimated	0.001	8.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.2	0.2
Coarse Sand	0.0	0.1
Medium Sand	0.1	---
Fine Sand	41.3	41.3
Silt	47.2	49.5
Clay	11.2	8.9

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
Estimated
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification
Unified Group Symbol: ML
Group Name: Sandy silt
AASHTO Classification: A-4 (0)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-8, 24.0'-25.5', 25.5'-27.0', 27.0'-28.5'

Project Number: 172679016
Lab ID: 760

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: JF
Test Date: 10-16-2009
Date Received: 09-09-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	99.8
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: 2.7

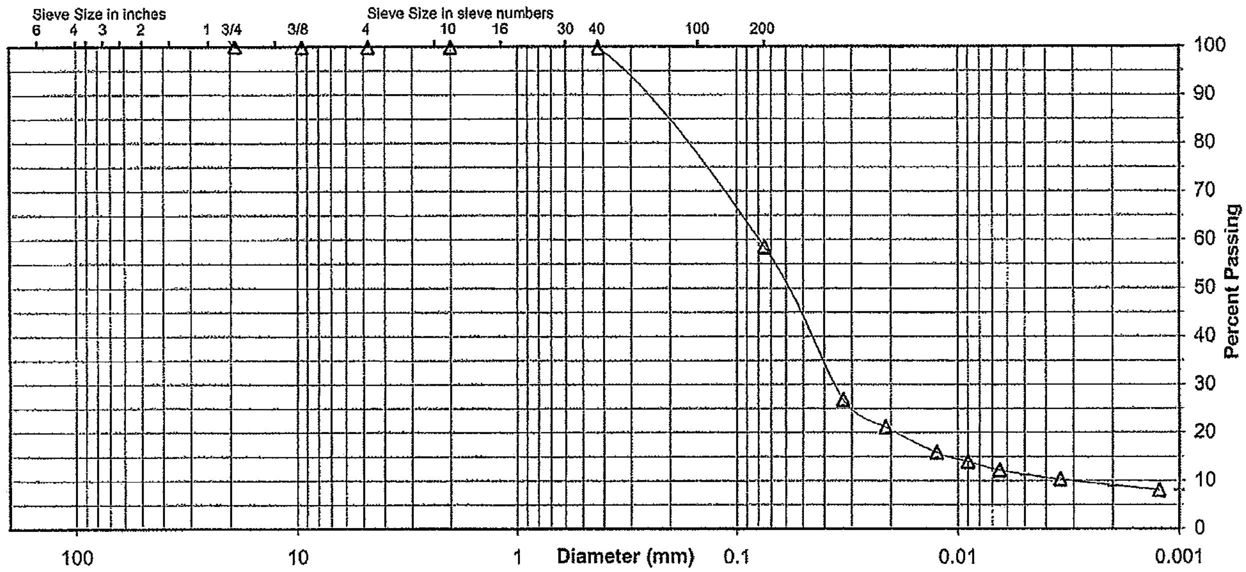
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.7
No. 200	58.4
0.02 mm	20.1
0.005 mm	11.2
0.002 mm	8.9
0.001 mm	8.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.2	0.0	0.1	41.3	47.2	11.2

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.2	0.1	41.3	49.5	8.9



Comments

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant
Source: ~~STN-8, 42.5'-44.0', 44.0'-45.5', 45.5'-47.0'~~
County: Memphis, TN
Sample Type: SPT Comp

Project Number: 172679016
Lab ID: 764
Date Received: 9-9-09
Date Reported: 10-21-09

Test Results

Natural Moisture Content
Test Not Performed
Moisture Content (%): N/A

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	
No. 4	4.75	100.0
No. 10	2	92.2
No. 40	0.425	92.2
No. 200	0.075	91.6
	0.02	90.8
	0.005	70.4
	0.002	57.1
estimated	0.001	49.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	7.8
Coarse Sand	7.8	0.0
Medium Sand	0.0	---
Fine Sand	0.6	0.6
Silt	21.2	34.5
Clay	70.4	57.1

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 79
Plastic Limit: 24
Plasticity Index: 55
Activity Index: 0.96

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
Estimated
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification
Unified Group Symbol: CH
Group Name: Fat clay
AASHTO Classification: A-7-6 (57)

Comments:

Reviewed by: [signature]

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant
Source: STN-8, 42.5'-44.0', 44.0'-45.5', 45.5'-47.0'

Project Number: 172679016
Lab ID: 764

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: JF
Test Date: 10-16-2009
Date Received: 09-09-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	92.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

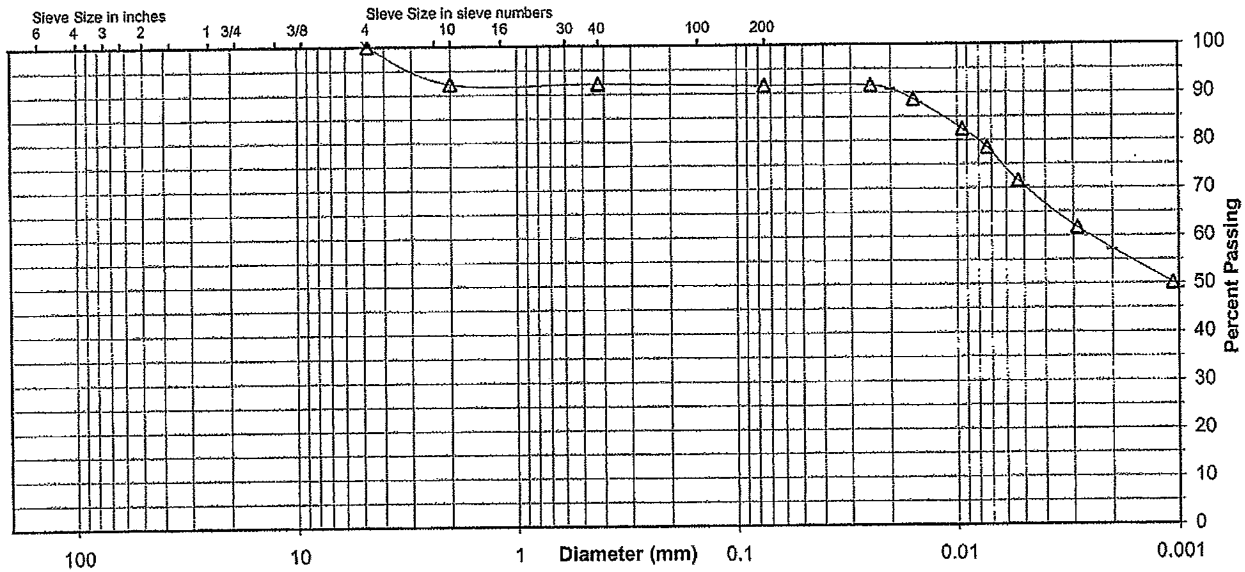
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	92.2
No. 200	91.6
0.02 mm	90.8
0.005 mm	70.4
0.002 mm	57.1
0.001 mm	49.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	7.8	0.0	0.6	21.2	70.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	7.8	0.0	0.6	34.5	57.1



Comments ______

Reviewed By ______

Stantec

Summary of Soil Tests

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-8, 54.5'-56.0', 56.0'-57.5', 57.5'-59.0'	Lab ID	461
County	Memphis, TN	Date Received	8-7-09
Sample Type	SPT Comp	Date Reported	10-20-09

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

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	
No. 4	4.75	100.0
No. 10	2	99.9
No. 40	0.425	99.8
No. 200	0.075	85.0
	0.02	33.2
	0.005	20.3
	0.002	16.3
estimated	0.001	15.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.0
Coarse Sand	0.1	0.1
Medium Sand	0.1	---
Fine Sand	14.8	14.8
Silt	64.8	68.8
Clay	20.3	16.3

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 26

Plastic Limit: 22

Plasticity Index: 4

Activity Index: 0.25

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: 2.68

Classification

Unified Group Symbol: ML

Group Name: Silt with sand

AASHTO Classification: A-4 (2)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Allen Fossil Plant (TVA)	Project Number	172679016
Source	STN-8, 54.5'-56.0', 56.0'-57.5', 57.5'-59.0'	Lab ID	461

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: JF
Test Date: 09-15-2009
Date Received 08-07-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	99.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.68

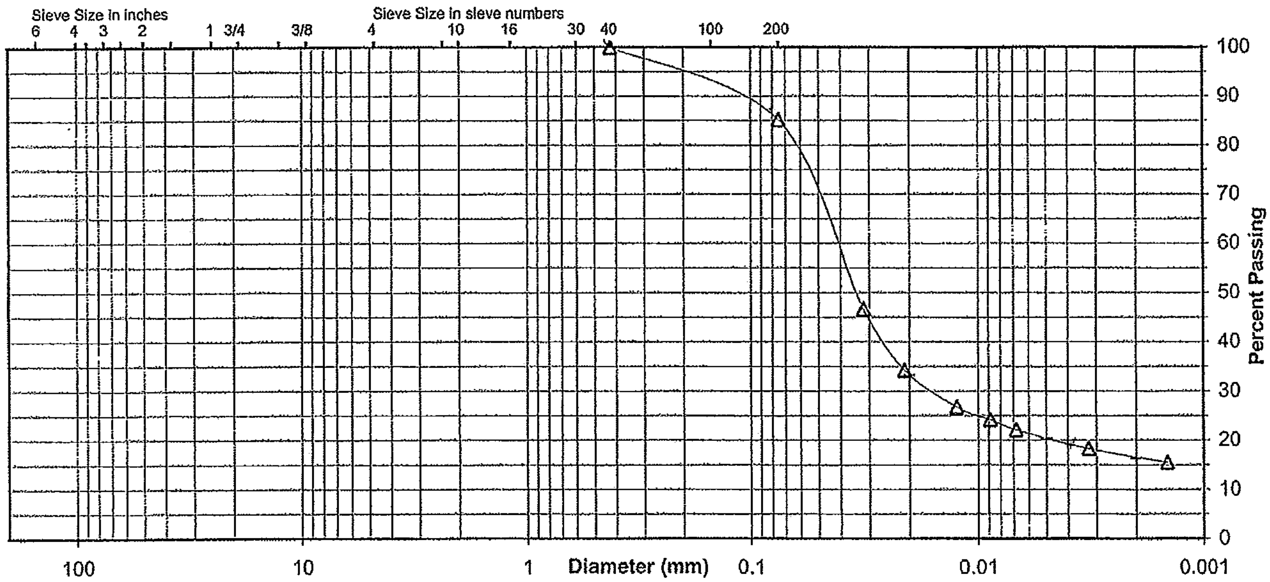
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.8
No. 200	85.0
0.02 mm	33.2
0.005 mm	20.3
0.002 mm	16.3
0.001 mm	15.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	0.0	0.1	14.8	64.8	20.3

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.0	0.1	14.8	68.8	16.3



Comments ____________________

Reviewed By ____

Stantec

Summary of Soil Tests

Project Name: Allen Fossil Plant - TVA, Memphis, Tennessee
Project Number: 172679016
Source: STN-8A, 5.0'-5.5'
Lab ID: 794A

County: Memphis, TN
Date Received: 12-16-09
Sample Type: ST
Date Reported: 1-15-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 16.8

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	
3/8"	9.5	100.0
No. 4	4.75	99.7
No. 10	2	99.5
No. 40	0.425	97.7
No. 200	0.075	83.8
	0.02	43.6
	0.005	19.6
	0.002	15.2
estimated	0.001	12.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.3	0.5
Coarse Sand	0.2	1.8
Medium Sand	1.8	---
Fine Sand	13.9	13.9
Silt	64.2	68.6
Clay	19.6	15.2

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 30
Plastic Limit: 22
Plasticity Index: 8
Activity Index: 0.53

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: in situ
Specific Gravity at 20° Celsius: 2.64

Classification

Unified Group Symbol: CL
Group Name: Lean clay with sand

AASHTO Classification: A-4 (6)

Comments:

Reviewed by:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Allen Fossil Plant - TVA, Memphis, Tennessee
Source: STN-8A, 5.0'-5.5'

Project Number: 172679016
Lab ID: 794A

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: JF
Test Date: 01-09-2010
Date Received: 12-16-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.7
No. 10	99.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.64

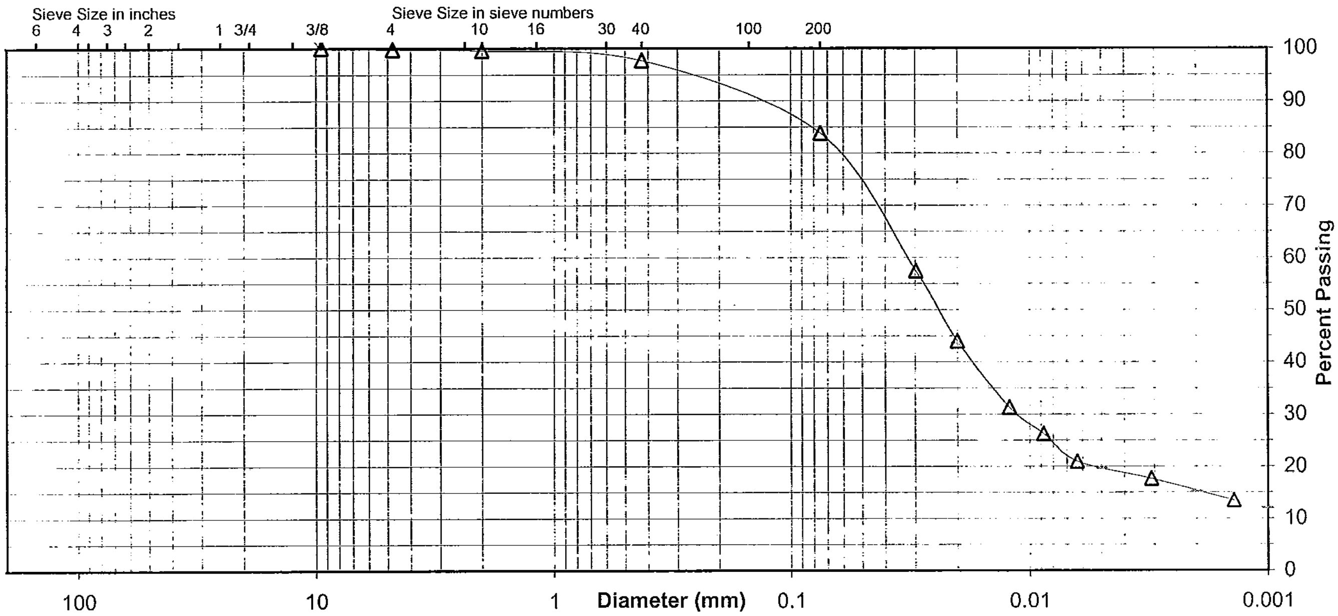
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	97.7
No. 200	83.8
0.02 mm	43.6
0.005 mm	19.6
0.002 mm	15.2
0.001 mm	12.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.3	0.2	1.8	13.9	64.2	19.6

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.5	1.8	13.9	68.6	15.2



Comments ______________________

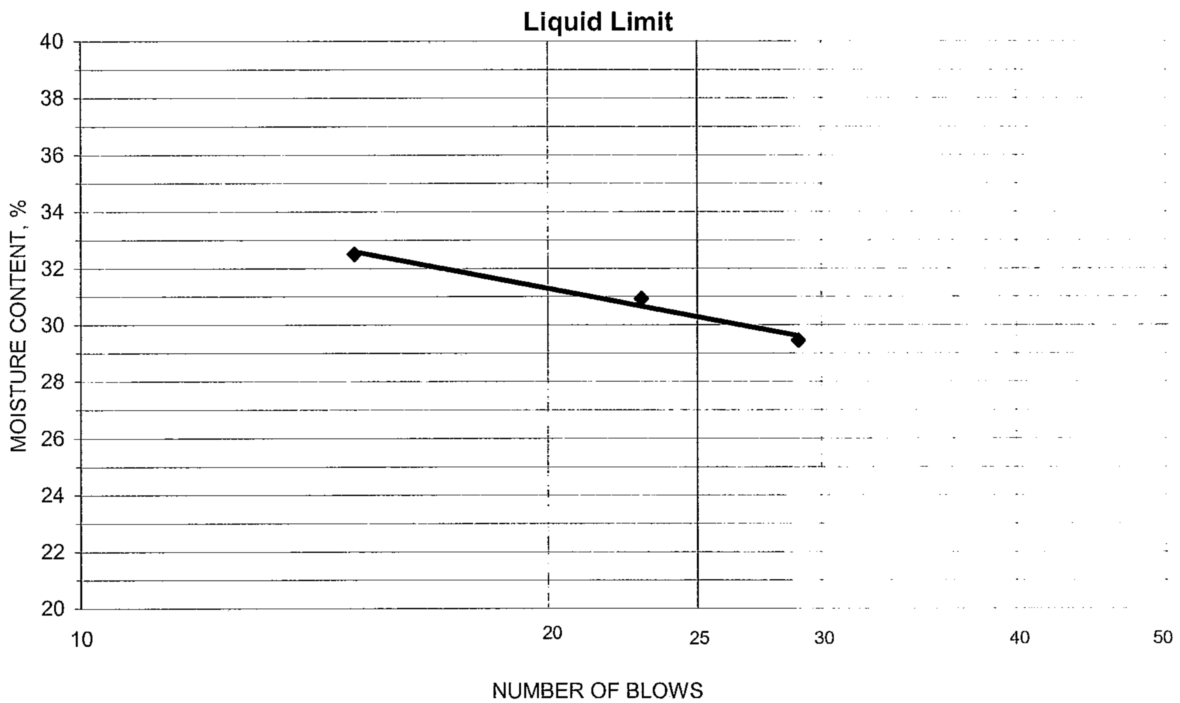
Reviewed By ______

Stantec

ATTERBERG LIMITS

Project	Allen Fossil Plant - TVA, Memphis, Tennessee	Project No.	172679016
Source	STN-8A, 5.0'-5.5'	Lab ID	794A
		% + No. 40	2
Tested By	KWS	Test Method	ASTM D 4318 Method A
Date Received	12-16-2009		
Test Date	01-12-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
20.55	18.41	11.14	29	29.4	30
21.16	18.78	11.08	23	30.9	
21.19	18.74	11.20	15	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
18.54	17.20	11.03	21.7	22	8
18.62	17.27	11.19	22.2		

Remarks:

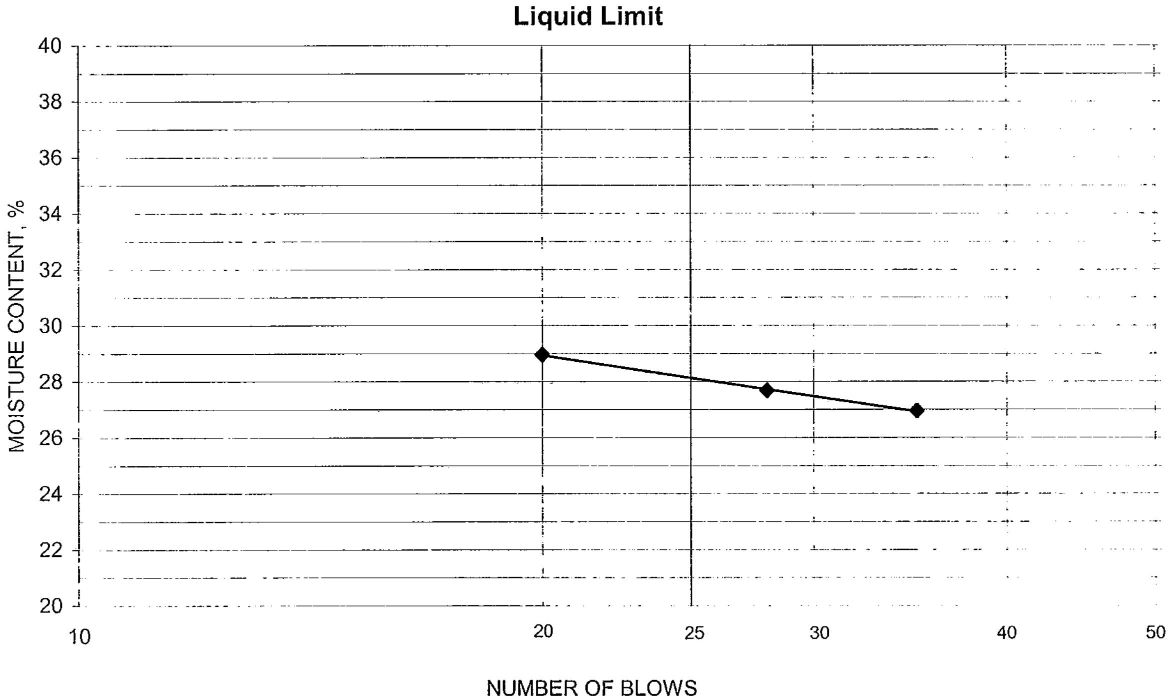
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Allen Fossil Plant - TVA, Memphis, Tennessee	Project No.	172679016
Source	STN-8A, 5.0'-7.0'	Lab ID	794
Tested By	KWS Test Method ASTM D 4318 Method A	% + No. 40	36
Test Date	01-07-2010 Prepared Dry	Date Received	12-16-2009

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
23.98	21.38	11.73	35	26.9	28
21.22	18.94	10.70	28	27.7	
23.56	20.72	10.91	20	29.0	



PLASTIC LIMIT AND PLASTICITY INDEX

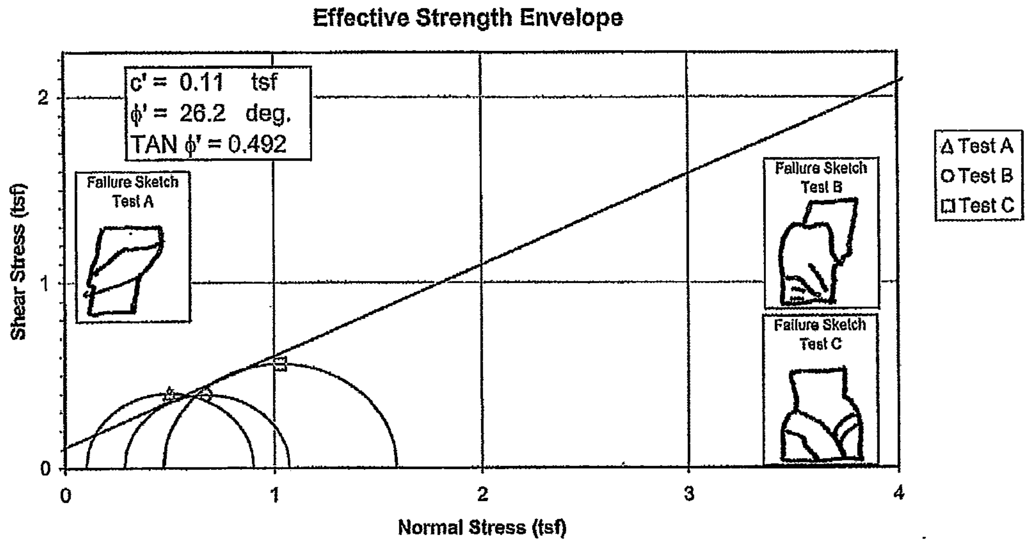
Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.23	16.96	11.12	21.7	22	6
18.19	16.90	10.89	21.5		

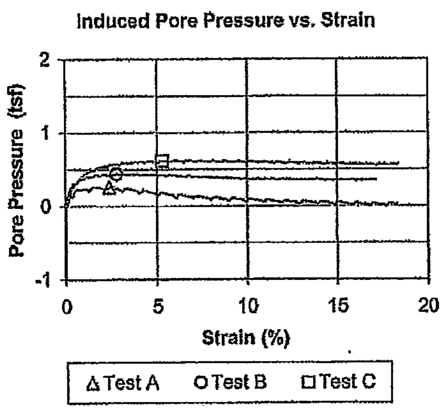
Remarks:

Reviewed By

Consolidated Undrained Triaxial Testing

Failure Criterion: Maximum Effective Principal Stress Ratio



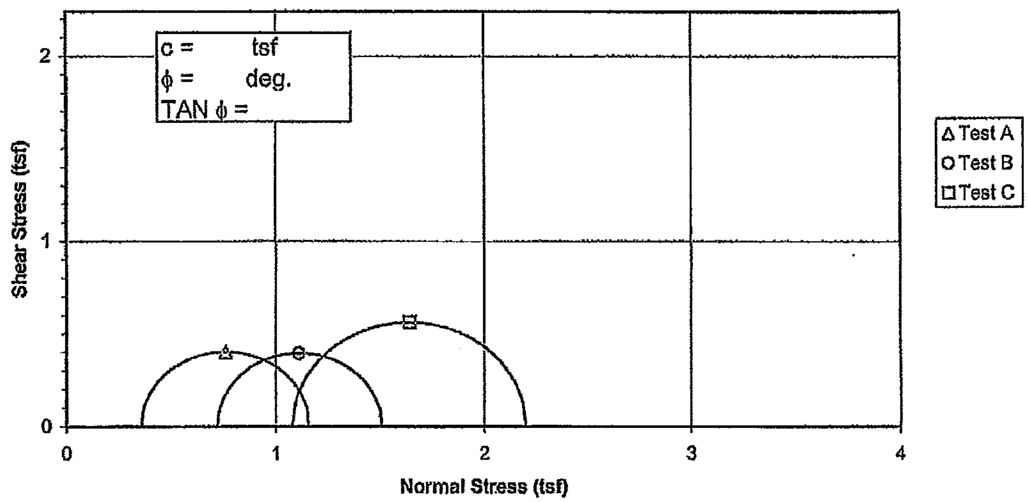


Specimen No.			A	B	C	
Initial Data	Water content %	W_o	42.3	63.5	53.5	
	Dry Density PCF	γ_{d_o}	77.6	60.8	67.5	
	Saturation %	S_o	96.8	96.2	96.1	
	Void Ratio	e_o	1.188	1.795	1.514	
After Shear	Water content %	W_f	41.7	62.4	50.8	
	Dry Density PCF	γ_{d_f}	79.6	63.0	71.3	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	1.134	1.696	1.381	
	Final Back Pressure TSF	u_c	6.12	5.76	5.40	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.10	0.28	0.47	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	0.80	0.79	1.12	
Time to (σ1'-σ3')max min.		t_f	33.9	79.7	107.9	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	0.57	0.91	
Initial Diameter, in.		D_o	2.878	2.877	2.876	
Initial Height, in.		H_o	6.013	6.035	6.000	

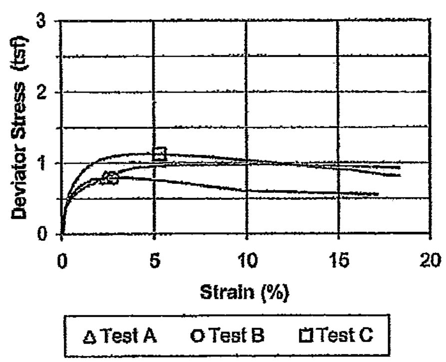
Controlled - Strain Test							
Description of Specimens	Fat Clay (CH), gray brown, moist, firm						
				Type of Specimen	Undisturbed	Type of test	$\overline{R}$
LL 92	PL 28	PI 64	Gs 2.72	Project	Allen Fossil Plant (TVA)		
Remarks:							
				Boring No.	STN-1	Sample No.	3
				Depth Elev.	15.0'-15.5', 15.7'-16.2', 16.3'-16.8'		
				Laboratory	Stantec	Date	9-25-09
				TRIAXIAL COMPRESSION TEST REPORT			

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	42.3	63.5	53.5	
	Dry Density PCF	γ_{d_o}	77.6	60.8	67.5	
	Saturation %	S_o	96.8	96.2	96.1	
	Void Ratio	e_o	1.188	1.795	1.514	
After Shear	Water content %	W_f	41.7	62.4	50.8	
	Dry Density PCF	γ_{d_f}	79.6	63.0	71.3	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	1.134	1.696	1.381	
	Final Back Pressure TSF	u_o	6.12	5.76	5.40	
Minor Principal Stress TSF		σ_3	0.36	0.72	1.08	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	0.80	0.79	1.12	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	33.9	79.7	107.9	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	0.57	0.91	
Initial Diameter, in.		D_o	2.878	2.877	2.876	
Initial Height, in.		H_o	6.013	6.035	6.000	

Controlled - Strain Test

Description of Specimens: Fat Clay (CH), gray brown, moist, firm

							Type of Specimen	Undisturbed	Type of test $\bar{R}$
LL	92	PL	28	PI	64	Gs	2.72	Project	Allen Fossil Plant (TVA)

Remarks:

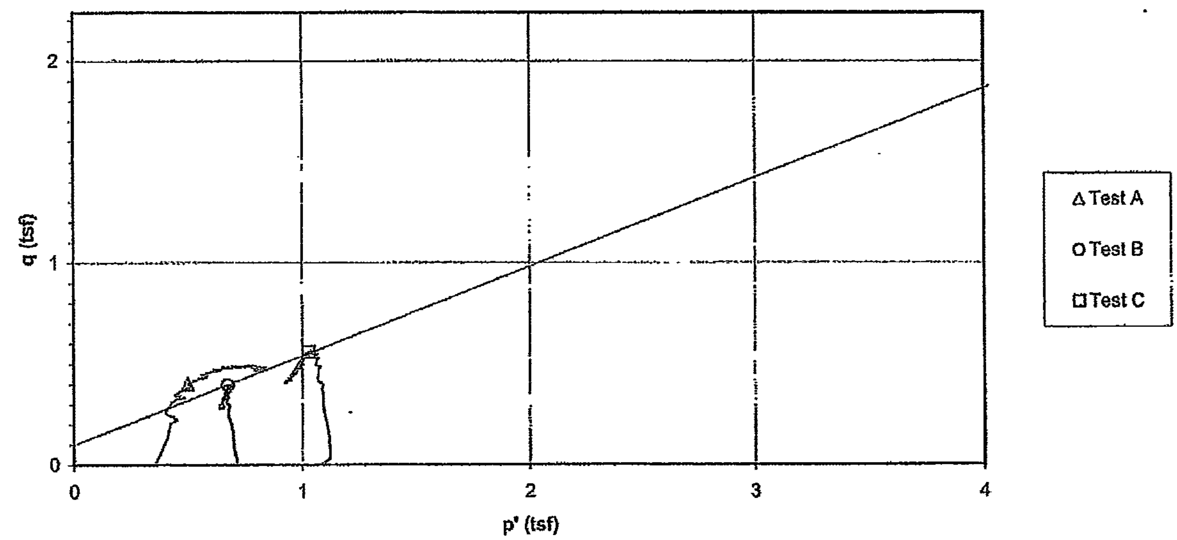
Boring No.	STN-1 — Sample No. 3
Depth Elev.	15.0'-15.5', 15.7'-16.2', 16.3'-16.8'
Laboratory	Stantec — Date 9-25-09

TRIAXIAL COMPRESSION TEST REPORT

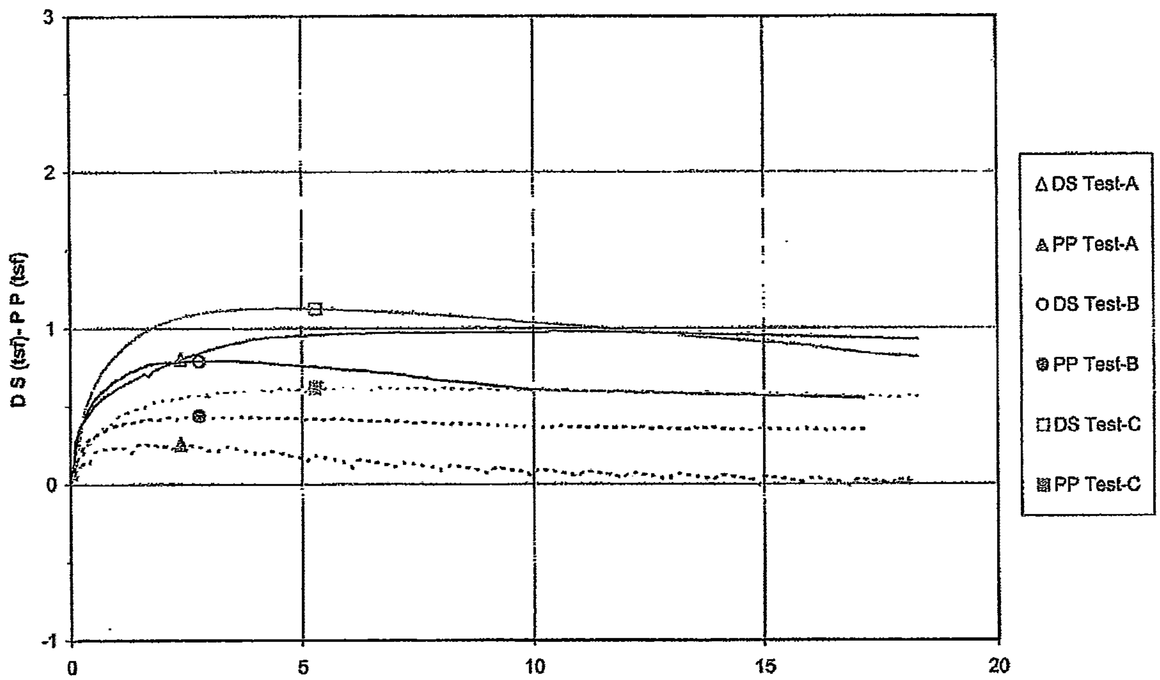
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Allen Fossil Plant (TVA)	Project No.	172679016
Sample ID	STN-1, 15.0'-15.5' & STN-1, 15.7'-16.2' & STN-1, 16.3'-16.8'	Test Number	3
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 26.2 deg.	c' =	0.11 tsf

p' vs. q Plot



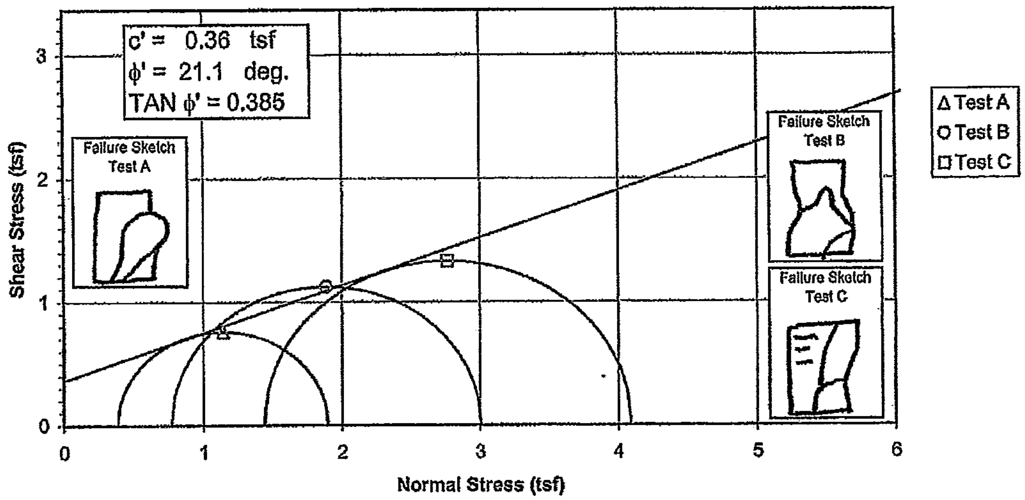
Deviator Stress and Induced Pore Pressure vs. Axial Strain



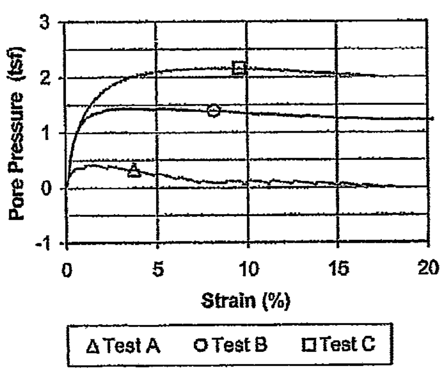
Axial Strain (%)

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



Specimen No.			A	B	C
Initial Data	Water content %	W_o	32.2	35.1	27.2
	Dry Density PCF	γ_{d_o}	87.6	83.9	86.6
	Saturation %	S_o	95.2	95.1	78.5
	Void Ratio	e_o	0.903	0.986	0.924
After Shear	Water content %	W_f	27.9	29.9	29.7
	Dry Density PCF	γ_{d_f}	95.6	92.7	93.0
	Saturation %	S_f	100.0	100.0	100.0
	Void Ratio	e_f	0.744	0.799	0.792
	Final Back Pressure TSF	u_c	5.76	4.32	2.88
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.39	0.77	1.44
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.51	2.23	2.65
Time to (σ1'-σ3')max min.		t_f	45.6	49.7	667.8
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a
Initial Diameter, in.		D_o	2.867	2.871	2.882
Initial Height, in.		H_o	6.037	5.953	6.141

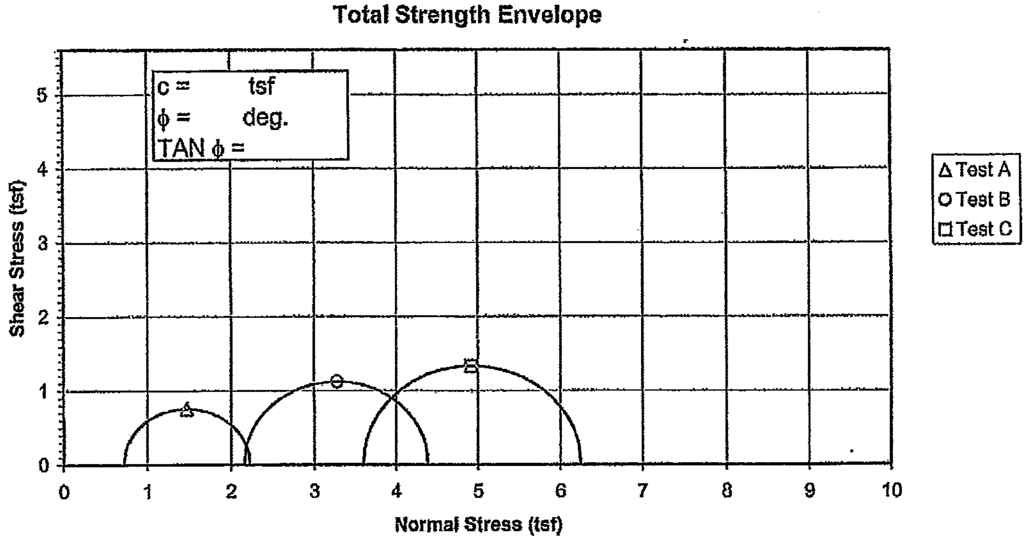
Controlled - Strain Test							
Description of Specimens	Lean Clay (CL), gray, moist, firm						
				Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.67	Project	Allen Fossil Plant (TVA)		
Remarks:							
				Boring No.	STN-1, STN-2	Sample No.	1
				Depth Elev.	20.1'-20.6', 20.7'-21.2', 36.0'-36.5'		
				Laboratory	Stantec	Date	9-25-09
				TRIAXIAL COMPRESSION TEST REPORT			

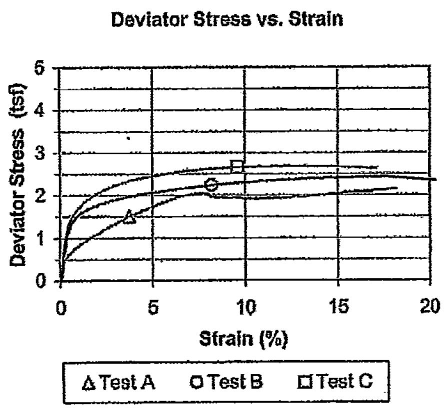
File: 172679016_cu_1 Sheet: CE_Final-E
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	32.2	35.1	27.2	
	Dry Density PCF	γ_{d_o}	87.6	83.9	86.6	
	Saturation %	S_o	95.2	95.1	78.5	
	Void Ratio	e_o	0.903	0.986	0.924	
After Shear	Water content %	W_f	27.9	29.9	29.7	
	Dry Density PCF	γ_{d_f}	95.6	92.7	93.0	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.744	0.799	0.792	
	Final Back Pressure TSF	u_o	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	1.51	2.23	2.65	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	45.6	49.7	667.8	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.867	2.871	2.882	
Initial Height, in.		H_o	6.037	5.953	6.141	

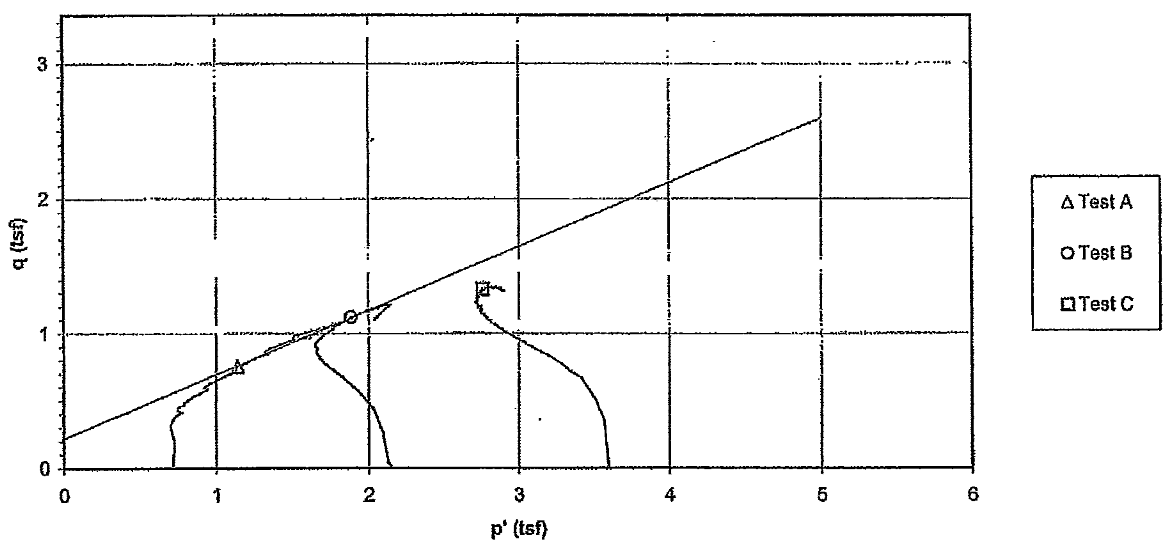
Controlled - Strain Test

Description of Specimens	Lean Clay (CL), gray, moist, firm						
				Type of Specimen	Undisturbed	Type of test	$\overline{R}$
LL	PL	PI	Gs 2.67	Project	Allen Fossil Plant (TVA)		
Remarks:							
				Boring No.	STN-1, STN-2	Sample No.	1
				Depth Elev.	20.1'-20.6', 20.7'-21.2', 36.0'-36.5'		
				Laboratory	Stantec	Date	9-25-09
				TRIAXIAL COMPRESSION TEST REPORT			

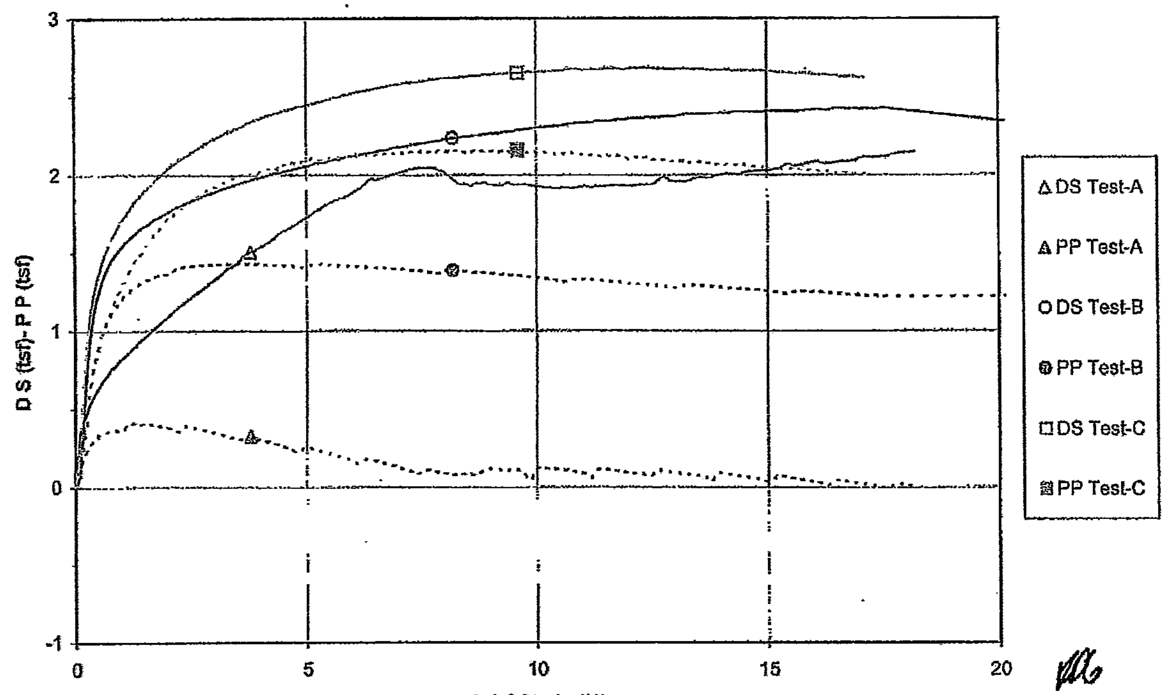
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project: Allen Fossil Plant (TVA) — Project No. 172679016
Sample ID: STN-1, 20.1'-20.6' & STN-1, 20.7'-21.2' & STN-2, 36.0'-36.5' — Test Number 1
Failure Criterion: Maximum Effective Principal Stress Ratio — ϕ' = 28.4 deg. — c' = 0.25 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



Axial Strain (%)

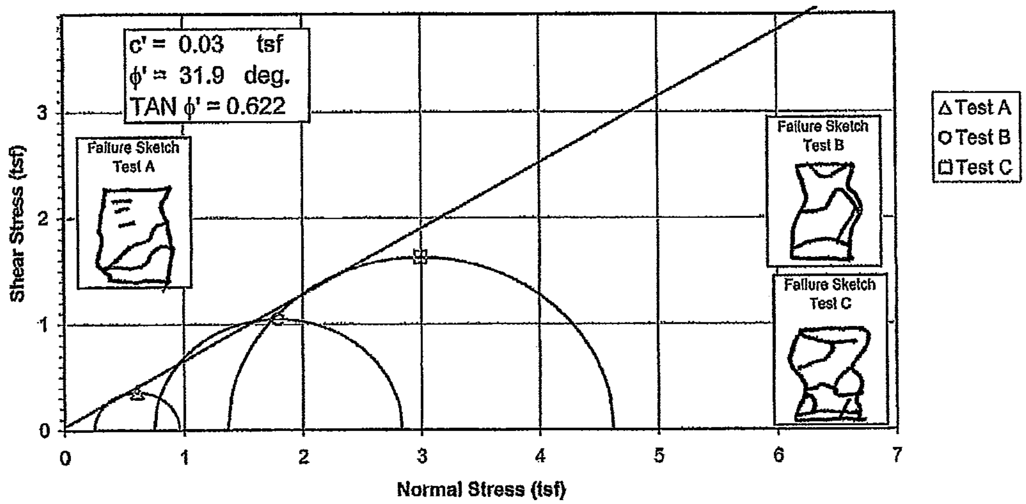
File: 172679016_cu_1 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

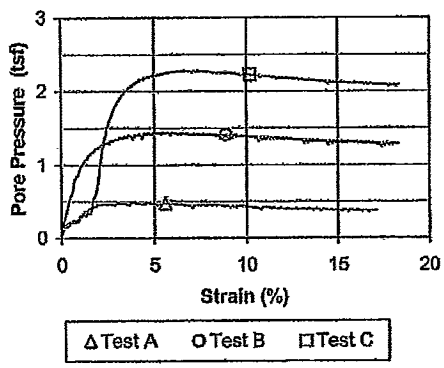
Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	41.3	41.2	35.4	
	Dry Density PCF	γ_{d_o}	78.3	78.8	85.2	
	Saturation %	S_o	97.3	98.4	98.3	
	Void Ratio	e_o	1.137	1.122	0.965	
After Shear	Water content %	W_f	32.7	29.5	25.8	
	Dry Density PCF	γ_{d_f}	89.1	93.4	98.9	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.877	0.792	0.691	
	Final Back Pressure TSF	u_o	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.25	0.75	1.37	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	0.72	2.08	3.25	
Time to (σ1'-σ3')max min.		t_f	769.3	382.4	457.2	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.848	2.843	2.860	
Initial Height, in.		H_o	5.954	5.940	5.976	

Controlled - Strain Test

Description of Specimens Lean Clay (CL), gray, moist, soft

LL 38	PL 20	PI 18	Gs 2.68

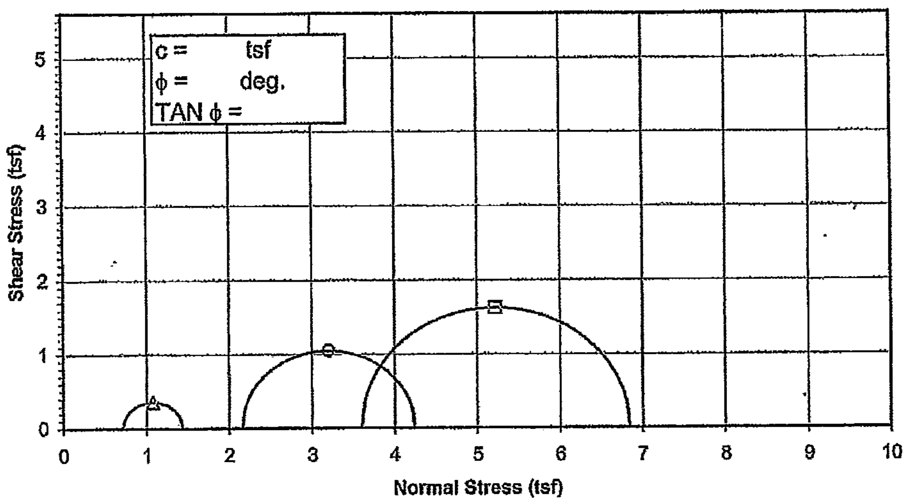
Remarks:

Type of Specimen	Undisturbed	Type of test	$\bar{R}$
Project	Allen Fossil Plant (TVA)		
Boring No.	STN-1	Sample No.	2
Depth Elev.	26.5'-27.0', 27.0'-27.5', 27.5'-28.0'		
Laboratory	Stantec	Date	9-25-09

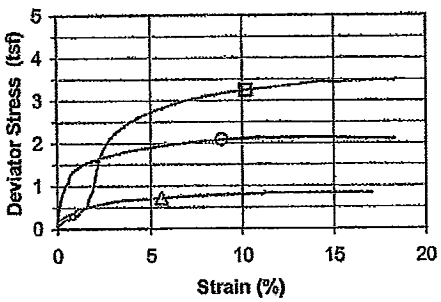
TRIAXIAL COMPRESSION TEST REPORT

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



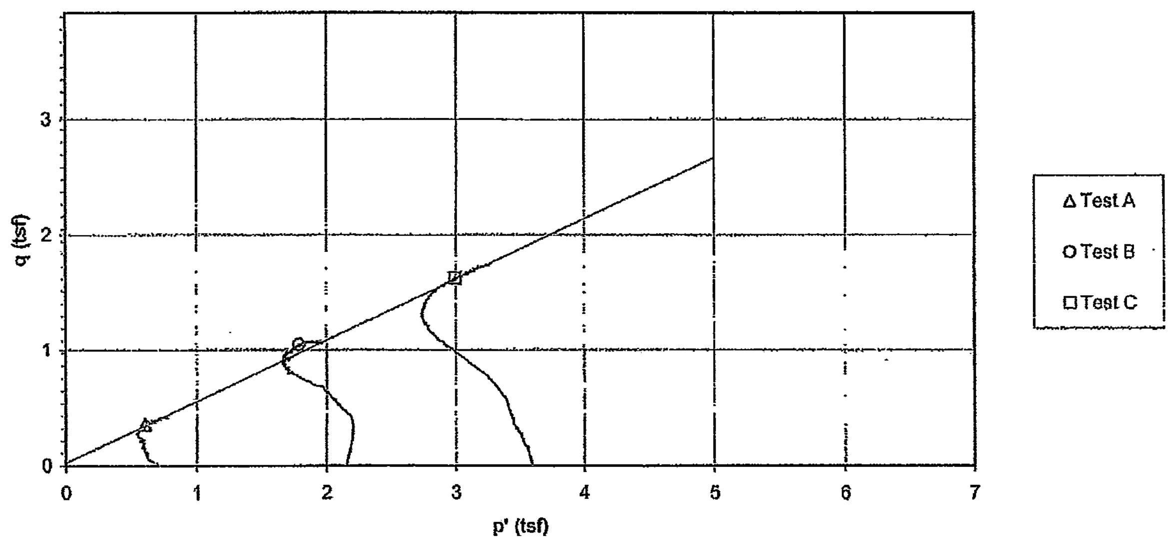
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	41.3	41.2	35.4	
	Dry Density PCF	γ_{d_o}	78.3	78.8	85.2	
	Saturation %	S_o	97.3	98.4	98.3	
	Void Ratio	e_o	1.137	1.122	0.965	
After Shear	Water content %	W_f	32.7	29.5	25.8	
	Dry Density PCF	γ_{d_f}	89.1	93.4	98.9	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.877	0.792	0.691	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	0.72	2.08	3.25	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	769.3	382.4	457.2	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.848	2.843	2.860	
Initial Height, in.		H_o	5.954	5.940	5.976	

Controlled - Strain Test							
Description of Specimens	Lean Clay (CL), gray, moist, soft						
				Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL 38	PL 20	PI 18	Gs 2.68	Project	Allen Fossil Plant (TVA)		
Remarks:							
				Boring No.	STN-1	Sample No.	2
				Depth Elev.	26.5'-27.0', 27.0'-27.5', 27.5'-28.0'		
				Laboratory	Stantec	Date	9-25-09
				TRIAXIAL COMPRESSION TEST REPORT			

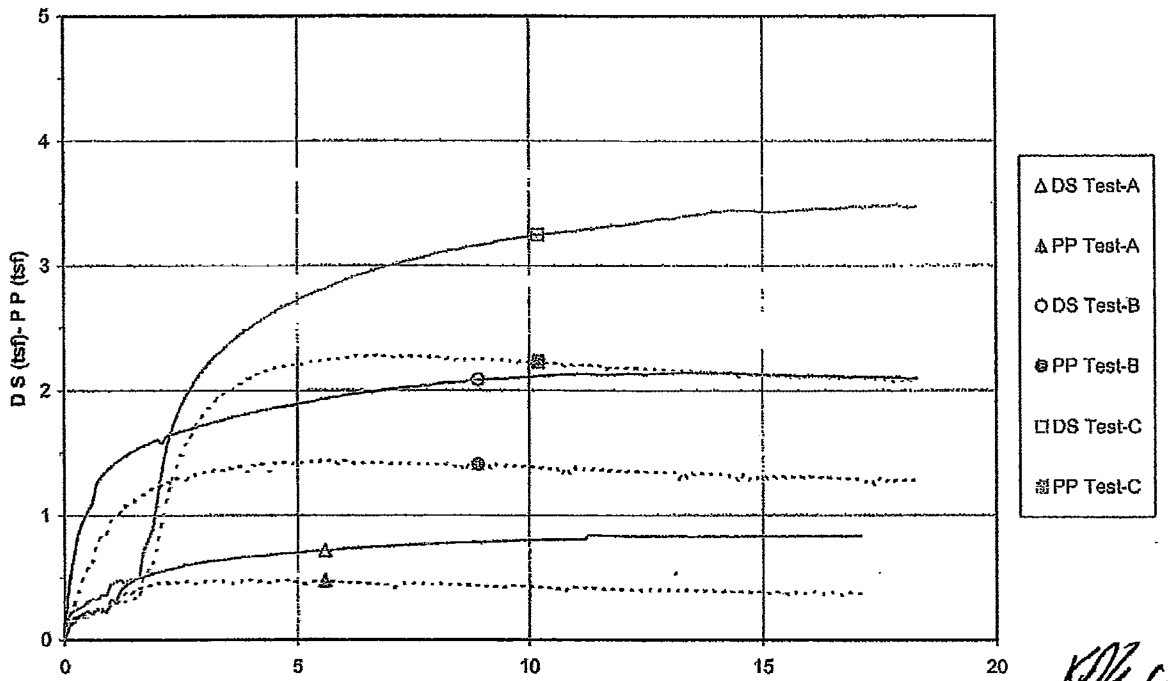
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project: Allen Fossil Plant (TVA) — Project No. 172679016
Sample ID: STN-1, 26.5'-27.0' & STN-1, 27.0'-27.5' & STN-1, 27.5'-28.0' — Test Number 2
Failure Criterion: Maximum Effective Principal Stress Ratio — ϕ' = 31.9 deg. — c' = 0.03 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

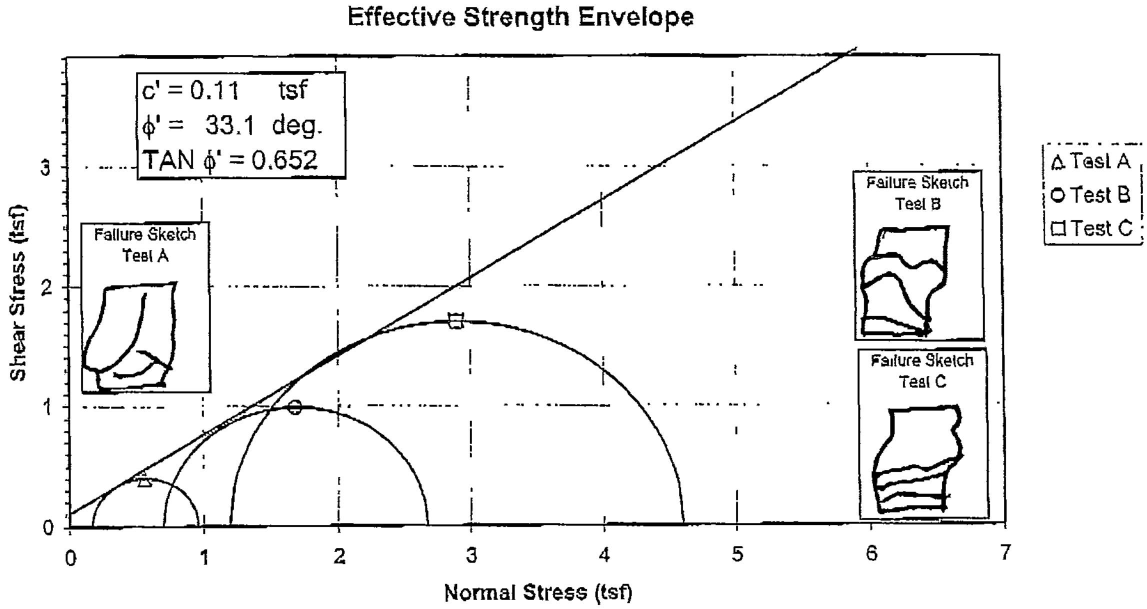


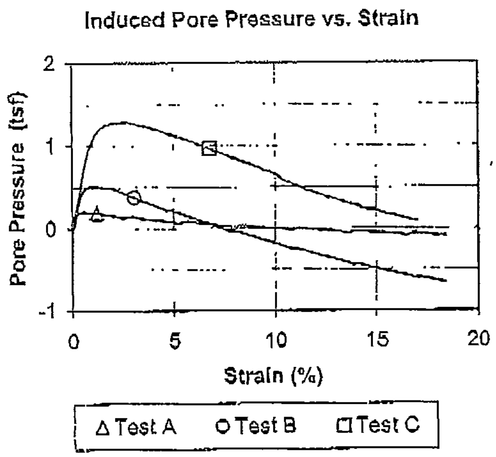
File: 172679016_cu_2 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C
Initial Data	Water content %	W_0	22.7	23.3	25.0
	Dry Density PCF	γ_{d_0}	98.3	102.7	96.7
	Saturation %	S_o	88.7	101.8	93.7
	Void Ratio	e_o	0.676	0.604	0.704
After Shear	Water content %	W_f	24.7	23.1	23.1
	Dry Density PCF	γ_{d_f}	99.7	102.4	102.4
	Saturation %	S_f	100.0	100.0	100.0
	Void Ratio	e_f	0.653	0.609	0.610
	Final Back Pressure TSF	u_c	6.12	5.40	4.32
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.16	0.70	1.20
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	0.79	1.97	3.40
Time to (σ1'-σ3')max min.		t_f	8.1	15.8	155.0
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a
Initial Diameter, in.		D_o	2.862	2.845	2.859
Initial Height, in.		H_o	5.903	6.250	5.760

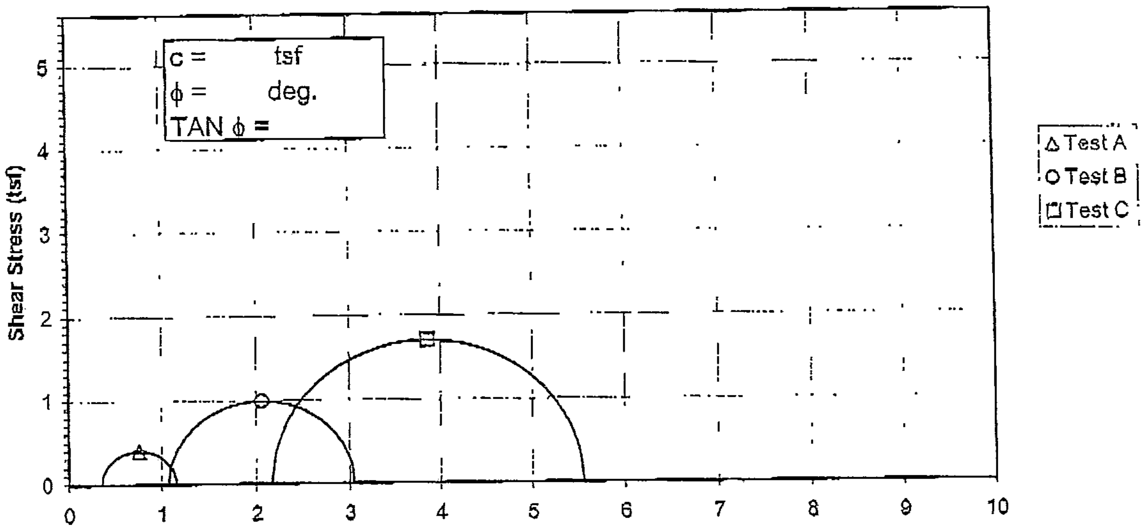
Controlled - Strain Test

Description of Specimens	Sandy Lean Clay (CL), brown, moist, firm					
				Type of Specimen	Undisturbed	Type of test R̄
LL	PL	PI	Gs 2.64	Project	Allen Fossil Plant - TVA, Memphis, Tennessee	
Remarks:						
				Boring No.	STN-3A	Sample No. 5
				Depth Elev.	4.0'-4.5', 4.6'-5.1', 6.6'-7.1'	
				Laboratory	Stantec	Date 1-12-10
				TRIAXIAL COMPRESSION TEST REPORT		

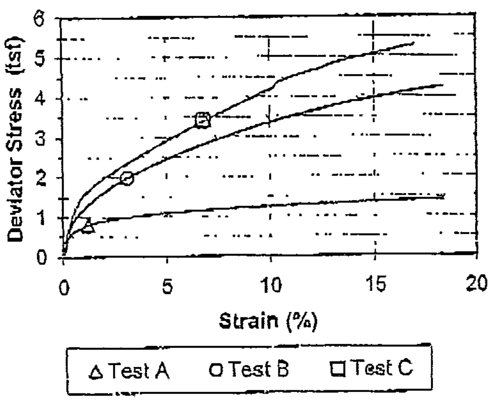
KDG

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	22.7	23.3	25.0	
	Dry Density PCF	γ_{d_o}	98.3	102.7	96.7	
	Saturation %	S_o	88.7	101.6	93.7	
	Void Ratio	e_o	0.676	0.604	0.704	
After Shear	Water content %	W_f	24.7	23.1	23.1	
	Dry Density PCF	γ_{d_f}	99.7	102.4	102.4	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.653	0.609	0.610	
	Final Back Pressure TSF	u_c	6.12	5.40	4.32	
Minor Principal Stress TSF		σ_3	0.36	1.08	2.16	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	0.79	1.97	3.40	
Time to $(\sigma_1-\sigma_3)_{Max}$ min.		t_f	8.1	15.8	155.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.862	2.845	2.859	
Initial Height, in.		H_o	5.903	6.250	5.760	

Controlled - Strain Test

Description of Specimens	Sandy Lean Clay (CL), brown, moist, firm				
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.64	Project	Allen Fossil Plant - TVA, Memphis, Tennessee
Remarks:					
		Boring No.	STN-3A	Sample No.	5
		Depth Elev.	4.0'-4.5', 4.6'-5.1', 6.6'-7.1'		
		Laboratory	Stantec	Date	1-12-10
		TRIAXIAL COMPRESSION TEST REPORT			

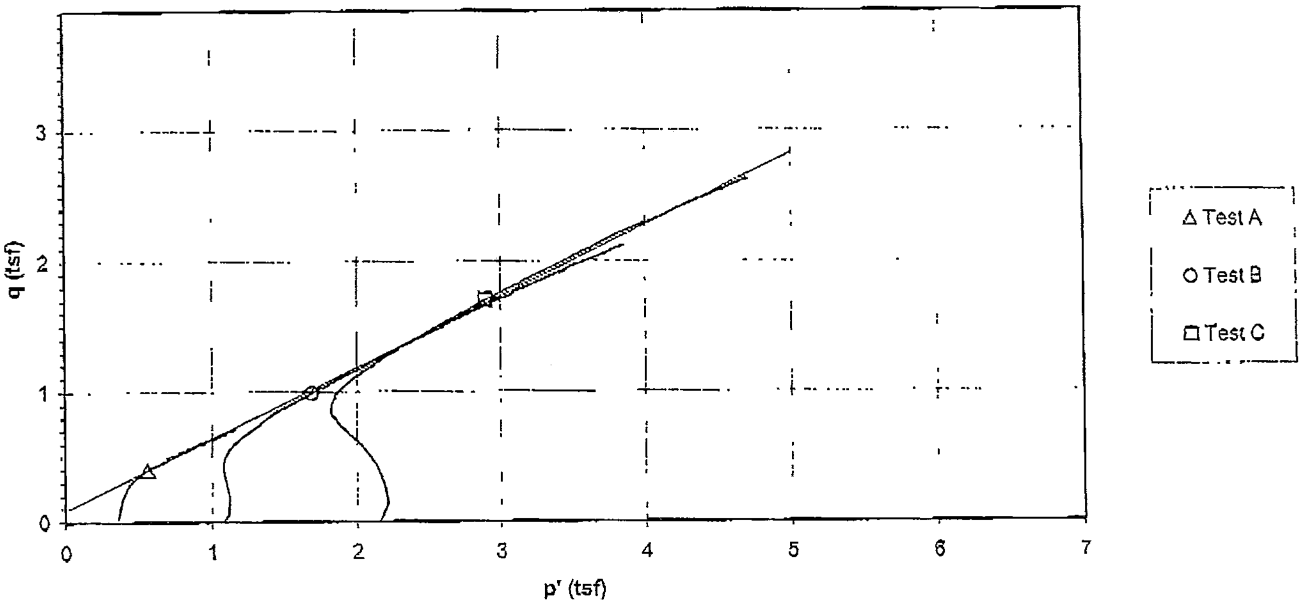
F06

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

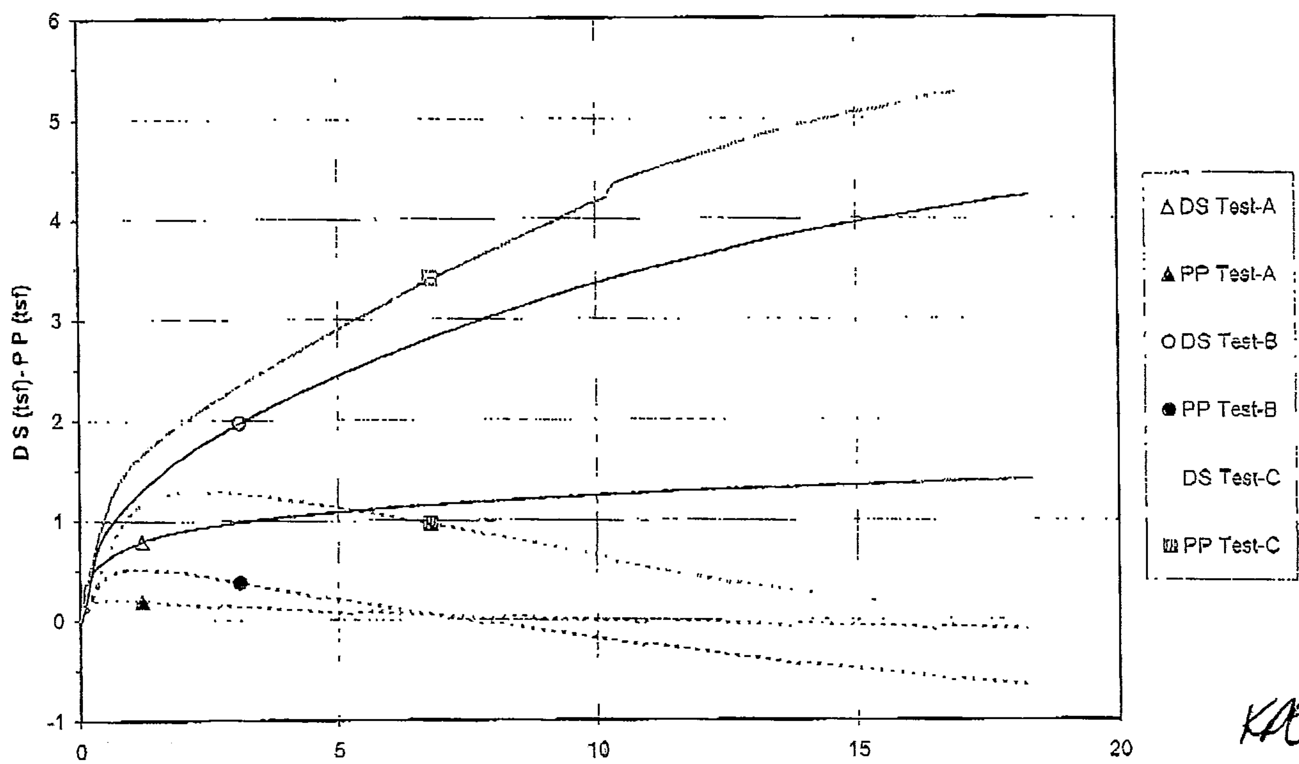
Project: Allen Fossil Plant - TVA, Memphis, Tennessee
Sample ID: STN-3A, 4.0'-4.5' & STN-3A, 4.6'-5.1' & STN-3A, 6.6'-7.1'
Failure Criterion: Maximum Effective Principal Stress Ratio ϕ' = 33.1 deg.

Project No. 172679016
Test Number 5
c' = 0.11 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



KAS

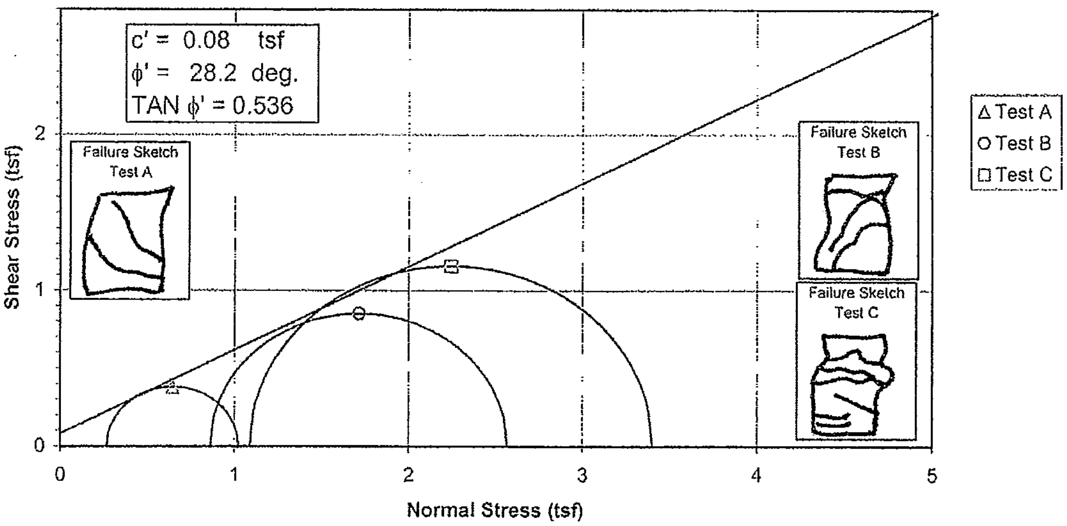
File. 172679016_cu_5 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2006

Stantec Consulting Services Inc.

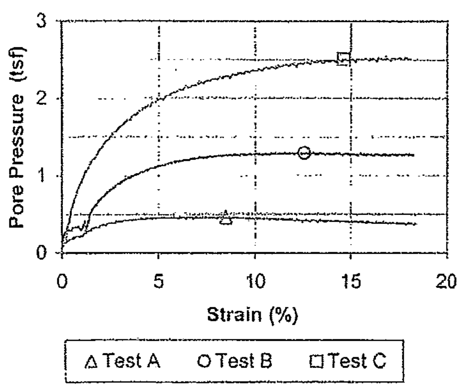
Laboratory Document
Prepared By. MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



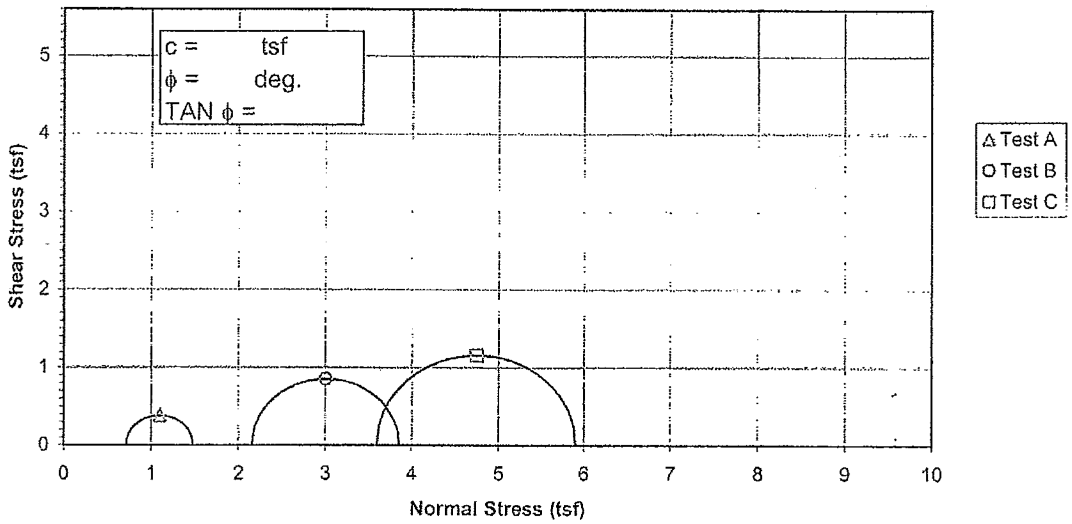
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	45.3	54.1	55.5	
	Dry Density PCF	γ_{d_o}	80.4	67.1	65.1	
	Saturation %	S_o	113.9	98.0	95.7	
	Void Ratio	e_o	1.051	1.457	1.532	
After Shear	Water content %	W_f	36.5	42.4	38.1	
	Dry Density PCF	γ_{d_f}	83.9	77.8	82.1	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.964	1.119	1.006	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.27	0.86	1.09	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	0.76	1.70	2.31	
Time to $(\sigma1'-\sigma3')$max min.		t_f	231.3	377.1	413.6	
Ultimate Deviator Stress, t/sq ft		$(\sigma1'-\sigma3')_{ult}$	n/a	1.67	2.30	
Initial Diameter, In.		D_o	2.866	2.866	2.873	
Initial Height, In.		H_o	6.038	6.033	5.994	

Controlled - Strain Test

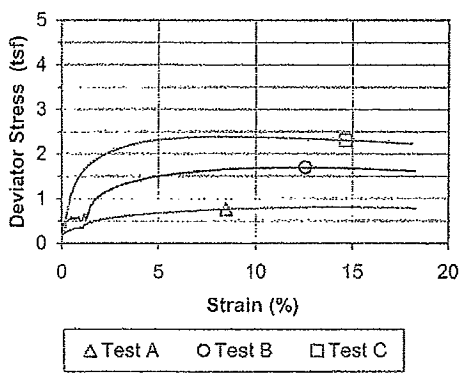
Description of Specimens	Lean Clay (CL), gray, moist, firm				
	Type of Specimen	Undisturbed		Type of test	$\bar{R}$
LL	PL	PI	Gs 2.64	Project	Allen Fossil Plant (TVA)
Remarks:					
	Boring No.	STN-9	Sample No.	4	
	Depth Elev.	28.0'-28.5', 36.0'-36.5', 36.5'-37.0'			
	Laboratory	Stantec	Date	10-6-09	
	TRIAXIAL COMPRESSION TEST REPORT				

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	45.3	54.1	55.5	
	Dry Density PCF	γ_{d_o}	80.4	67.1	65.1	
	Saturation %	S_o	113.9	98.0	95.7	
	Void Ratio	e_o	1.051	1.457	1.532	
After Shear	Water content %	W_f	36.5	42.4	38.1	
	Dry Density PCF	γ_{d_f}	83.9	77.8	82.1	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.964	1.119	1.006	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	0.76	1.70	2.31	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	231.3	377.1	413.6	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	1.67	2.30	
Initial Diameter, in.		D_o	2.866	2.866	2.873	
Initial Height, in.		H_o	6.038	6.033	5.994	

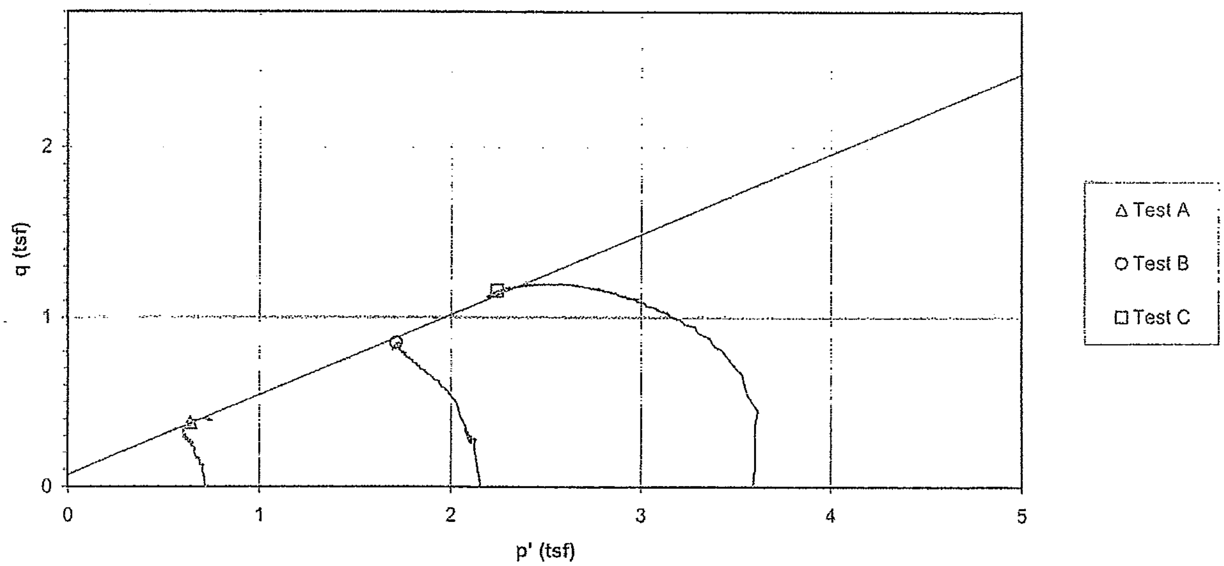
Controlled - Strain Test

Description of Specimens	Lean Clay (CL), gray, moist, firm				
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.64	Project	Allen Fossil Plant (TVA)
Remarks:					
		Boring No.	STN-9	Sample No.	4
		Depth Elev.	28.0'-28.5', 36.0'-36.5', 36.5'-37.0'		
		Laboratory	Stantec	Date	10-6-09
		TRIAXIAL COMPRESSION TEST REPORT			

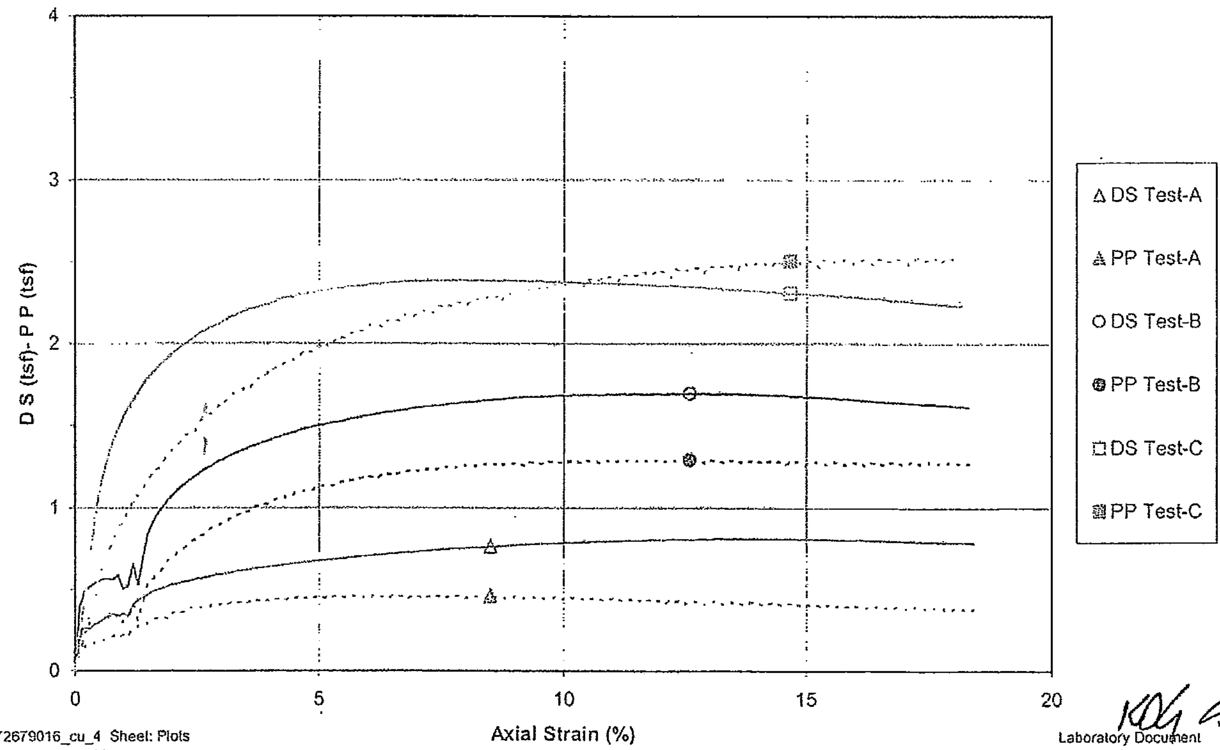
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Allen Fossil Plant (TVA)	Project No.	172679016
Sample ID	STN-9, 28.0'-28.5' & STN-9, 36.0'-36.5' & STN-9, 36.5'-37.0'	Test Number	4
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 28.2 deg.	c' =	0.08 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



File: 172679016_cu_4 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Laboratory Permeability Testing

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

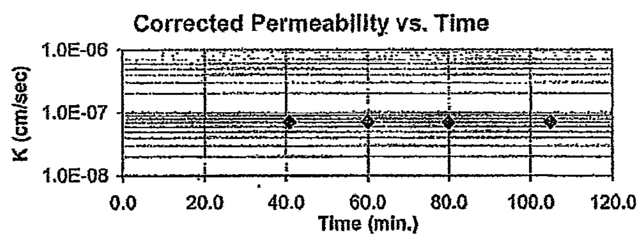
Project Name Allen Fossil Plant (TVA) — Project No. 172679016
Source STN-1, 34.5'-36.5' — Test ID 490
Visual Classification Lean Clay (CL), gray brown, wet, soft — Prepared By KDG
Undisturbed XX — Specific Gravity 2.67 ASTM D854-A — Date 9-14-09
Maximum Dry Density (pcf) ______ — Percent of Maximum ______
Permeant: De-aired tap water
Selection and Preparation Comments: ______

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 19 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	1.4891	1.3690	1.3691	Chamber	75
Diameter (in.)	2.7977		2.8062	Influent	70
Moisture Content (%)	36.4		31.3	Effluent	65
Dry Unit Weight (pcf)	84.0		90.8		
Void Ratio	0.985		0.836		
Degree of Saturation (%)	98.6		100.0		
Trimmings MC (%)	37.9				

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
9-17-09	7:59	70.0	22.21	3.36	0	---	---	---	---
9-17-09	8:40	70.0	21.40	4.32	2.46E+03	7.2E-10	7.2E-08	7.0E-10	7.0E-08
9-17-09	8:59	70.0	21.03	4.77	1.14E+03	7.3E-10	7.3E-08	7.1E-10	7.1E-08
9-17-09	9:19	70.0	20.63	5.21	1.20E+03	7.1E-10	7.1E-08	7.0E-10	7.0E-08
9-17-09	9:44	70.0	20.14	5.78	1.50E+03	7.3E-10	7.3E-08	7.1E-10	7.1E-08



A gradient of approximately 92.7 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 7.04E-10 cm/s 7.04E-08
Average Hydraulic Conductivity @ 20° C (last run) m/s 7.04E-10 cm/s 7.04E-08

Reviewed by: ______

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

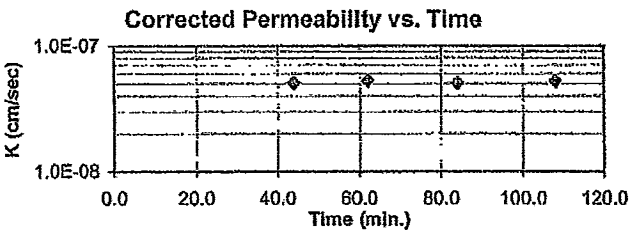
Project Name Allen Fossil Plant (TVA) — Project No. 172679016
Source STN-2, 36.0'-38.0' — Test ID 492B
Visual Classification Lean Clay (CL), gray brown, moist, firm — Prepared By KDG
Undisturbed XX — Specific Gravity 2.69 ASTM D854-A — Date 9-14-09
Maximum Dry Density (pcf) ____ — Percent of Maximum ____
Permeant: De-aired tap water
Selection and Preparation Comments: ____

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 19 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	1.4779	1.4586	1.4586	Chamber	75
Diameter (in.)	2.8033		2.7945	Influent	70
Moisture Content (%)	34.6		34.9	Effluent	65
Dry Unit Weight (pcf)	85.3		86.9		
Void Ratio	0.970		0.932		
Degree of Saturation (%)	95.9		100.7		
Trimmings MC (%)	37.7				

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
9-17-09	7:55	70.0	22.44	3.33	0	---	---	---	---
9-17-09	8:39	70.0	21.85	4.02	2.64E+03	5.2E-10	5.2E-08	5.1E-10	5.1E-08
9-17-09	8:57	70.0	21.61	4.32	1.08E+03	5.4E-10	5.4E-08	5.3E-10	5.3E-08
9-17-09	9:19	70.0	21.32	4.66	1.32E+03	5.2E-10	5.2E-08	5.1E-10	5.1E-08
9-17-09	9:43	70.0	20.99	5.04	1.44E+03	5.4E-10	5.4E-08	5.3E-10	5.3E-08



A gradient of approximately 93.4 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 5.17E-10 cm/s 5.17E-08
Average Hydraulic Conductivity @ 20° C (last run) m/s 5.17E-10 cm/s 5.17E-08

Reviewed by: ____

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name: Allen Fossil Plant - TVA, Memphis, Tennessee
Source: STN-2A, 10.0'-12.0', TI - 10.0'-10.5'
Visual Classification: Silty Clay (CL-ML), gray, moist, firm
Undisturbed: XX
Specific Gravity: 2.68 ASTM D854-A
Maximum Dry Density (pcf):

Project No. 172679016
Test ID 789
Prepared By KDG
Date 1-7-10
Percent of Maximum

Permeant: De-aired tap water
Selection and Preparation Comments:

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

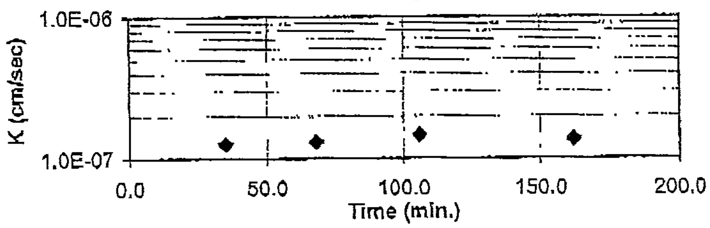
	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4529	2.4182	2.4228
Diameter (in.)	2.8030		2.7798
Moisture Content (%)	25.4		25.6
Dry Unit Weight (pcf)	96.2		99.0
Void Ratio	0.740		0.690
Degree of Saturation (%)	92.1		99.6
Trimmings MC (%)	27.8		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
1-8-10	12:40	72.0	21.32	4.16	0	—	—	—	—
1-8-10	13:15	72.0	21.13	4.36	2.10E+03	1.3E-09	1.3E-07	1.3E-09	1.3E-07
1-8-10	13:48	72.0	20.93	4.54	1.98E+03	1.4E-09	1.4E-07	1.3E-09	1.3E-07
1-8-10	14:26	72.0	20.69	4.79	2.28E+03	1.6E-09	1.6E-07	1.5E-09	1.5E-07
1-8-10	15:22	72.0	20.36	5.13	3.36E+03	1.4E-09	1.4E-07	1.4E-09	1.4E-07

Corrected Permeability vs. Time



A gradient of approximately 56.3 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 1.35E-09 cm/s 1.35E-07
Average Hydraulic Conductivity @ 20° C (last run) m/s 1.35E-09 cm/s 1.35E-07

Reviewed by: [signature]

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name: Allen Fossil Plant East Ash Pond — Project No. 172679016
Source: STN-6, 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-15.0' — Test ID 93
Visual Classification: Silty, Clayey Sand (SC-SM), brown — Prepared By KDG
Compacted: 0 in. spacer — Specific Gravity 2.64 ASTM D854-A — Date 10-22-09
Maximum Dry Density (pcf) 94.3 — Percent of Maximum 99.5

Permeant: De-aired tap water
Selection and Preparation Comments:

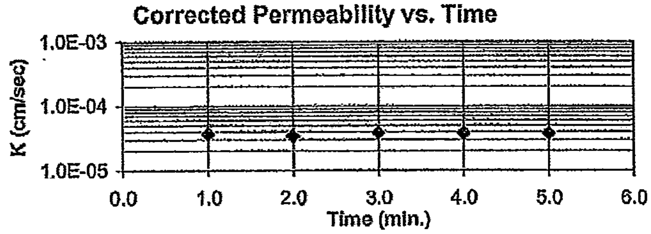
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 19 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	1.3811	1.3349	1.3369	Chamber	72
Diameter (in.)	2.8013		2.7863	Influent	67
Moisture Content (%)	22.0		26.3	Effluent	65
Dry Unit Weight (pcf)	93.9		98.0		
Void Ratio	0.756		0.682		
Degree of Saturation (%)	76.8		101.7		
Trimmings MC (%)	24.0				

Applied Head Difference (psi): 2
Back Pressure Saturated to (psi): 65
Maximum Effective Consolidation Stress (psi): 7
Minimum Effective Consolidation Stress (psi): 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
10-23-09	11:18	70.0	14.75	10.33	0	---	---	---	---
10-23-09	11:19	70.0	13.64	11.46	6.00E+01	3.7E-07	3.7E-05	3.6E-07	3.6E-05
10-23-09	11:20	70.0	12.64	12.46	6.00E+01	3.5E-07	3.5E-05	3.4E-07	3.4E-05
10-23-09	11:21	70.0	11.59	13.55	6.00E+01	3.9E-07	3.9E-05	3.8E-07	3.8E-05
10-23-09	11:22	70.0	10.56	14.56	6.00E+01	3.9E-07	3.9E-05	3.8E-07	3.8E-05
10-23-09	11:23	70.0	9.58	15.52	6.00E+01	3.8E-07	3.8E-05	3.7E-07	3.7E-05

Corrected Permeability vs. Time



A gradient of approximately 99.9 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) — m/s 3.66E-07 — cm/s 3.66E-05
Average Hydraulic Conductivity @ 20° C (last run) — m/s 3.66E-07 — cm/s 3.66E-05

Reviewed by: KDG

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name Allen Fossil Plant (TVA) — Project No. 172679016
Source STN-7, 30.0'-32.0' — Test ID 495
Visual Classification Sandy Lean Clay with Gravel (CL), gray, wet, soft — Prepared By KDG
Undisturbed XX — Specific Gravity 2.66 ASTM D854-A — Date 9-14-09
Maximum Dry Density (pcf) ______ — Percent of Maximum ______
Permeant: De-aired tap water
Selection and Preparation Comments: ______

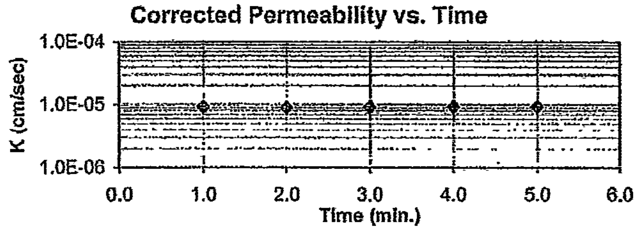
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	2.4535	2.3895	2.3909	Chamber	75
Diameter (in.)	2.7903		2.7747	Influent	70
Moisture Content (%)	16.3		16.1	Effluent	65
Dry Unit Weight (pcf)	110.5		114.6		
Void Ratio	0.503		0.449		
Degree of Saturation (%)	85.9		95.3		
Trimmings MC (%)	22.9				

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
9-16-09	12:55	70.0	18.94	5.99	0	---	---	---	---
9-16-09	12:56	70.0	18.55	6.39	6.00E+01	9.4E-08	9.4E-06	9.1E-08	9.1E-06
9-16-09	12:57	70.0	18.16	6.77	6.00E+01	9.2E-08	9.2E-06	8.9E-08	8.9E-06
9-16-09	12:58	70.0	17.77	7.16	6.00E+01	9.4E-08	9.4E-06	9.1E-08	9.1E-06
9-16-09	12:59	70.0	17.38	7.55	6.00E+01	9.4E-08	9.4E-06	9.2E-08	9.2E-06
9-16-09	13:00	70.0	16.99	7.94	6.00E+01	9.5E-08	9.5E-06	9.2E-08	9.2E-06

Corrected Permeability vs. Time



A gradient of approximately 56.2 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 9.11E-08 cm/s 9.11E-06
Average Hydraulic Conductivity @ 20° C (last run) m/s 9.11E-08 cm/s 9.11E-06

Reviewed by: ______

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name: Allen Fossil Plant - TVA, Memphis, Tennessee
Project No.: 172679016
Source: STN-8A, 5.0'-7.0', TI - 5.0'-5.5'
Test ID: 794A
Visual Classification: Silty Clay (CL), gray, moist, firm
Prepared By: KDG
Undisturbed: XX
Specific Gravity: 2.64 ASTM D854-A
Date: 1-7-10
Maximum Dry Density (pcf): ______
Percent of Maximum: ______

Permeant: De-aired tap water
Selection and Preparation Comments: ______

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

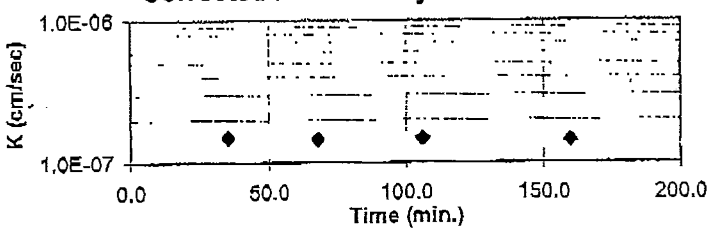
	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4588	2.4324	2.4345
Diameter (in.)	2.8050		2.8088
Moisture Content (%)	17.8		18.9
Dry Unit Weight (pcf)	109.4		110.2
Void Ratio	0.506		0.496
Degree of Saturation (%)	93.0		100.8
Trimmings MC (%)	17.2		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi): 5
Back Pressure Saturated to (psi): 65
Maximum Effective Consolidation Stress (psi): 10
Minimum Effective Consolidation Stress (psi): 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
1-8-10	12:40	72.0	21.23	4.35	0	—	—	---	---
1-8-10	13:15	72.0	21.03	4.62	2.10E+03	1.6E-09	1.6E-07	1.5E-09	1.5E-07
1-8-10	13:48	72.0	20.82	4.84	1.98E+03	1.6E-09	1.6E-07	1.5E-09	1.5E-07
1-8-10	14:26	72.0	20.57	5.09	2.28E+03	1.6E-09	1.6E-07	1.5E-09	1.5E-07
1-8-10	15:20	72.0	20.25	5.46	3.24E+03	1.5E-09	1.5E-07	1.4E-09	1.4E-07

Corrected Permeability vs. Time



A gradient of approximately 56.1 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 1.47E-09 cm/s 1.47E-07
Average Hydraulic Conductivity @ 20° C (last run) m/s 1.47E-09 cm/s 1.47E-07

Reviewed by: KDG

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5084-03

Project Name: Allen Fossil Plant East Ash Pond — Project No. 172679016
Source: HA-1, 2.0'-3.0', 3.0'-4.0' — Test ID 94
Visual Classification: Poorly Graded Sand with Silt (SP-SM), brown — Prepared By KDG
Compacted: 0 in. spacer — Specific Gravity 2.67 ASTM D854-A — Date 10-22-09
Maximum Dry Density (pcf) 95.8 — Percent of Maximum 99.4

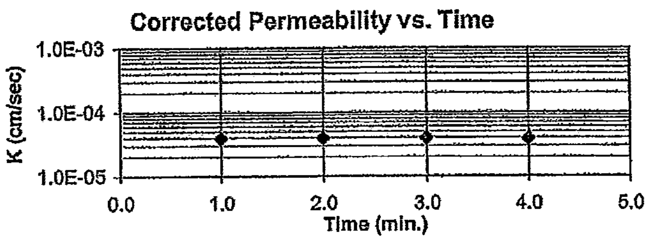
Permeant: De-aired tap water
Selection and Preparation Comments:

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 19 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	1.3921	1.3552	1.3556	Chamber	71
Diameter (in.)	2.8017		2.7666	Influent	66
Moisture Content (%)	19.7		25.4	Effluent	65
Dry Unit Weight (pcf)	95.2		100.3		
Void Ratio	0.750		0.662		
Degree of Saturation (%)	70.1		102.4		
Trimmings MC (%)	19.8				

Applied Head Difference (psi): 1
Back Pressure Saturated to (psi): 65
Maximum Effective Consolidation Stress (psi): 6
Minimum Effective Consolidation Stress (psi): 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
10-23-09	12:43	70.0	19.17	6.24	0	---	---	---	---
10-23-09	12:44	70.0	18.59	6.82	6.00E+01	4.0E-07	4.0E-05	3.9E-07	3.9E-05
10-23-09	12:45	70.0	18.03	7.38	6.00E+01	4.0E-07	4.0E-05	3.9E-07	3.9E-05
10-23-09	12:46	70.0	17.52	7.94	6.00E+01	4.0E-07	4.0E-05	3.9E-07	3.9E-05
10-23-09	12:47	70.0	17.00	8.43	6.00E+01	4.0E-07	4.0E-05	3.9E-07	3.9E-05



A gradient of approximately 99.1 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 3.89E-07 cm/s 3.89E-05
Average Hydraulic Conductivity @ 20° C (last run) m/s 3.89E-07 cm/s 3.89E-05

Reviewed by: KDG

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5084-03

Project Name: Allen Fossil Plant East Ash Pond — Project No. 172679016
Source: HA-4, 2.0'-3.0', 4.0'-5.0' — Test ID 95
Visual Classification: Poorly Graded Sand with Silt (SP-SM), brown — Prepared By KDG
Compacted: 0 in. spacer — Specific Gravity 2.65 ASTM D854-A — Date 10-22-09
Maximum Dry Density (pcf) 95.8 — Percent of Maximum 99.0

Permeant: De-aired tap water
Selection and Preparation Comments:

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 19 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

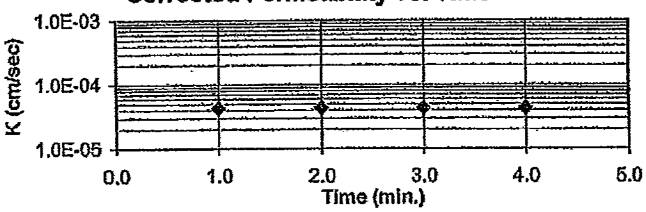
	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	1.3821	1.3274	1.3276
Diameter (in.)	2.8030		2.7740
Moisture Content (%)	21.0		24.1
Dry Unit Weight (pcf)	94.8		100.8
Void Ratio	0.744		0.641
Degree of Saturation (%)	74.8		99.6
Trimmings MC (%)	20.2		

Final Pressures (psi)	
Chamber	71
Influent	66
Effluent	65

Applied Head Difference (psi) 1
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 6
Minimum Effective Consolidation Stress (psi) 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
10-23-09	10:34	68.0	17.76	7.73	0	---	---	---	---
10-23-09	10:35	68.0	17.13	8.36	6.00E+01	4.2E-07	4.2E-05	4.2E-07	4.2E-05
10-23-09	10:36	68.0	16.53	8.98	6.00E+01	4.3E-07	4.3E-05	4.3E-07	4.3E-05
10-23-09	10:37	68.0	15.94	9.54	6.00E+01	4.2E-07	4.2E-05	4.2E-07	4.2E-05
10-23-09	10:38	68.0	15.38	10.08	6.00E+01	4.3E-07	4.3E-05	4.3E-07	4.3E-05

Corrected Permeability vs. Time



A gradient of approximately 99.8 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 4.26E-07 cm/s 4.26E-05
Average Hydraulic Conductivity @ 20° C (last run) m/s 4.26E-07 cm/s 4.26E-05

Reviewed by: KDG

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name Allen Fossil Plant East Ash Pond | Project No. 172679016
Source HA-5, 1.0'-2.0', 2.0'-3.0' | Test ID 96
Visual Classification Poorly Graded Sand (SP), brown | Prepared By KDG
Compacted 0 in. spacer | Specific Gravity 2.66 ASTM D854-A | Date 10-22-09
Maximum Dry Density (pcf) 95.8 | Percent of Maximum 99.7

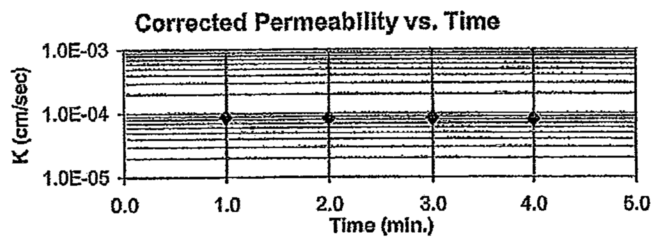
Permeant: De-aired tap water
Selection and Preparation Comments:

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 19 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	1.3809	1.3494	1.3500	Chamber	71
Diameter (in.)	2.8010		2.7761	Influent	66
Moisture Content (%)	20.5		24.1	Effluent	65
Dry Unit Weight (pcf)	95.5		99.4		
Void Ratio	0.739		0.670		
Degree of Saturation (%)	73.7		95.6		
Trimmings MC (%)	21.4				

Applied Head Difference (psi) 1
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 6
Minimum Effective Consolidation Stress (psi) 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
10-23-09	9:45	68.0	16.75	7.88	0	---	---	---	---
10-23-09	9:46	68.0	15.53	9.14	6.00E+01	8.7E-07	8.7E-05	8.7E-07	8.7E-05
10-23-09	9:47	68.0	14.44	10.23	6.00E+01	8.4E-07	8.4E-05	8.4E-07	8.4E-05
10-23-09	9:48	68.0	13.45	11.23	6.00E+01	8.3E-07	8.3E-05	8.3E-07	8.3E-05
10-23-09	9:49	68.0	12.56	12.08	6.00E+01	8.0E-07	8.0E-05	8.0E-07	8.0E-05



A gradient of approximately 99.9 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 8.34E-07 cm/s 8.34E-05
Average Hydraulic Conductivity @ 20° C (last run) m/s 8.34E-07 cm/s 8.34E-05

Reviewed by: KDG

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name Allen Fossil Plant East Ash Pond — Project No. 172679016
Source HA-9, 3.0'-4.0', 5.0'-6.0' — Test ID 97
Visual Classification Poorly Graded Sand with Silt (SP-SM), brown — Prepared By KDG
Compacted 0 in. spacer — Specific Gravity 2.66 ASTM D854-A — Date 10-22-09
Maximum Dry Density (pcf) 99.1 — Percent of Maximum 98.5
Permeant: De-aired tap water
Selection and Preparation Comments:

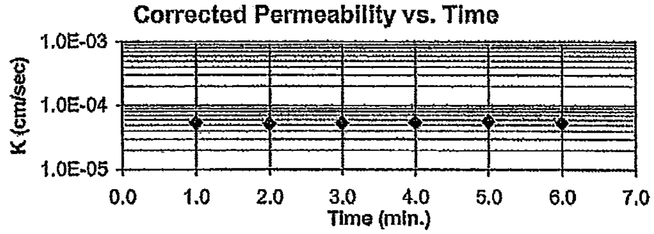
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 19 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	1.3890	1.3525	1.3527	Chamber	71
Diameter (in.)	2.8020		2.7642	Influent	66
Moisture Content (%)	16.8		22.7	Effluent	65
Dry Unit Weight (pcf)	97.7		103.0		
Void Ratio	0.701		0.612		
Degree of Saturation (%)	63.8		98.8		
Trimmings MC (%)	17.4				

Applied Head Difference (psi) 1
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 6
Minimum Effective Consolidation Stress (psi) 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
10-23-09	13:10	70.0	20.63	4.96	0	---	---	---	---
10-23-09	13:11	70.0	19.84	5.73	6.00E+01	5.4E-07	5.4E-05	5.3E-07	5.3E-05
10-23-09	13:12	70.0	19.13	6.46	6.00E+01	5.3E-07	5.3E-05	5.2E-07	5.2E-05
10-23-09	13:13	70.0	18.43	7.16	6.00E+01	5.4E-07	5.4E-05	5.3E-07	5.3E-05
10-23-09	13:14	70.0	17.78	7.84	6.00E+01	5.5E-07	5.5E-05	5.3E-07	5.3E-05
10-23-09	13:15	70.0	17.10	8.47	6.00E+01	5.7E-07	5.7E-05	5.6E-07	5.6E-05
10-23-09	13:16	70.0	16.51	9.05	6.00E+01	5.4E-07	5.4E-05	5.3E-07	5.3E-05

Corrected Permeability vs. Time



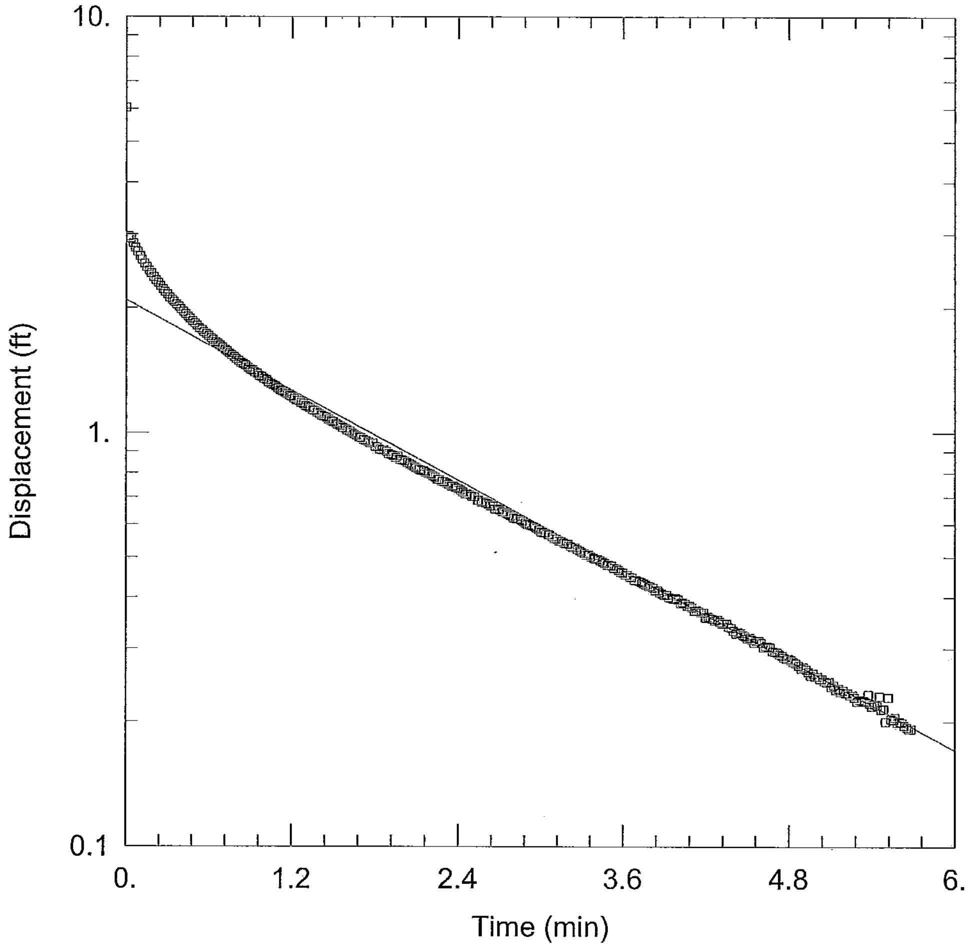
A gradient of approximately 99.4 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 5.38E-07 cm/s 5.38E-05
Average Hydraulic Conductivity @ 20° C (last run) m/s 5.33E-07 cm/s 5.33E-05

Reviewed by: KDG

Appendix E

Slug Test Data



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-1.aqt
Date: 11/18/09 Time: 14:58:47

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-1
Test Date: 11/11/09

AQUIFER DATA

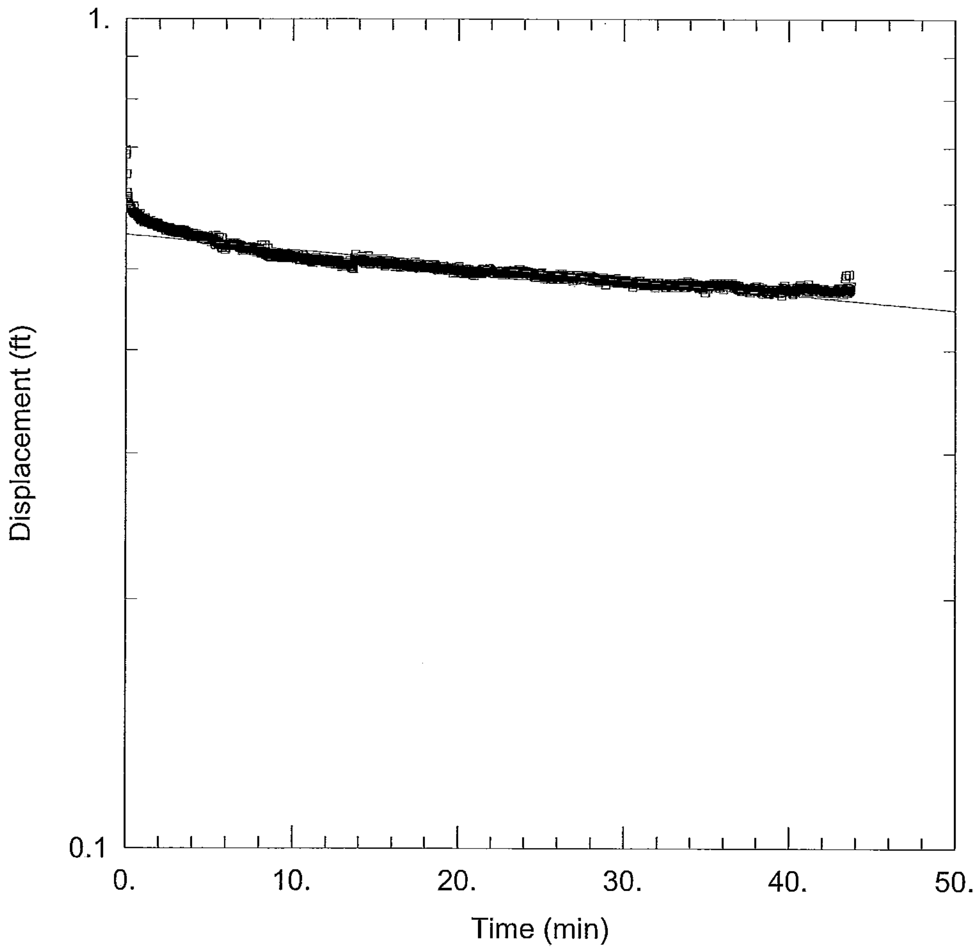
Saturated Thickness: 26.02 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (STN-1)

Initial Displacement: 6.041 ft
Total Well Penetration Depth: 22.32 ft
Casing Radius: 0.0417 ft
Static Water Column Height: 22.32 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001399 cm/sec
y0 = 2.089 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-2.aqt
Date: 11/18/09 Time: 14:57:47

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-2
Test Date: 11/11/09

AQUIFER DATA

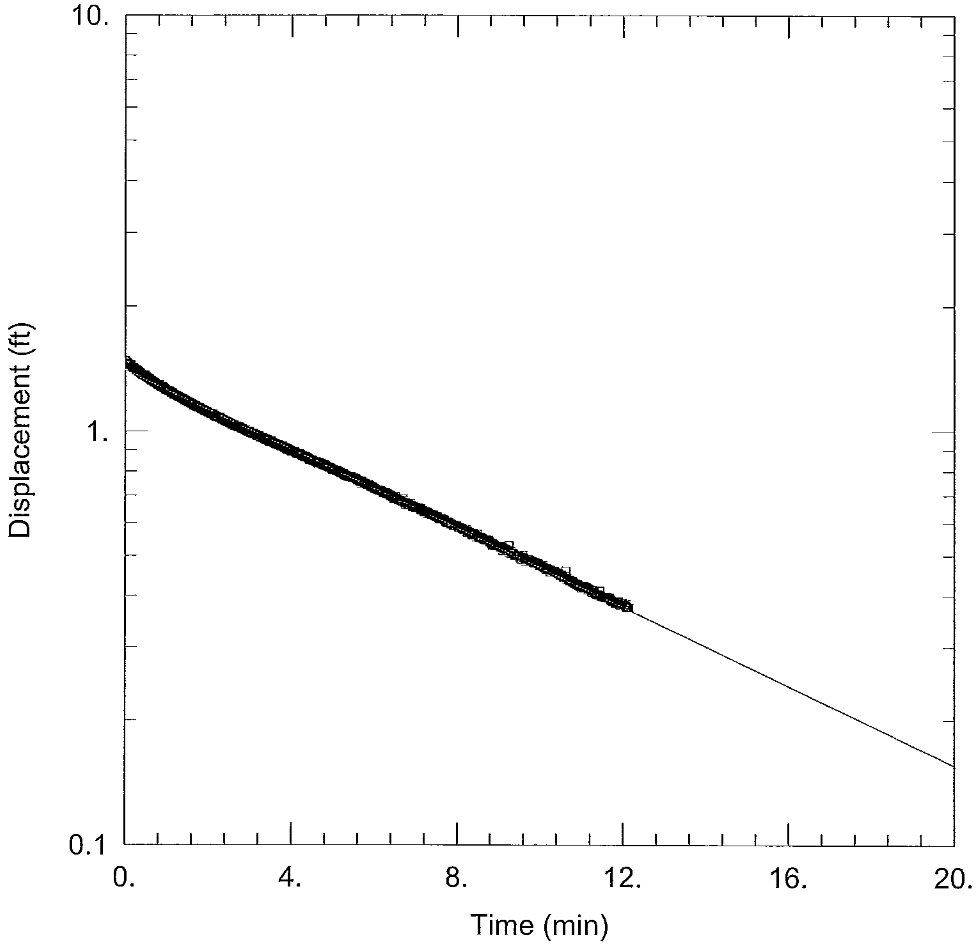
Saturated Thickness: 16.74 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (STN-2)

Initial Displacement: 0.602 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.0417 ft
Static Water Column Height: 3.54 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.116E-6 cm/sec
y0 = 0.5507 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-3.aqt
Date: 11/18/09 Time: 14:56:51

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-3
Test Date: 11/11/09

AQUIFER DATA

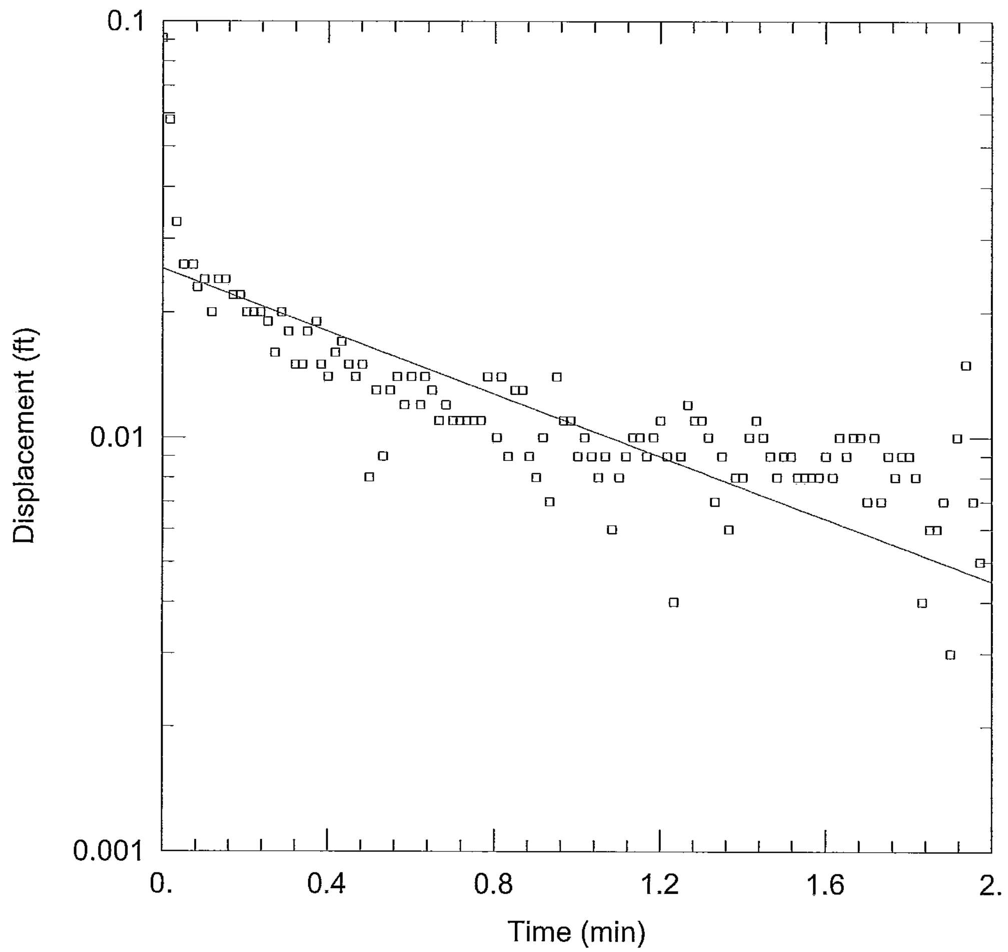
Saturated Thickness: 5.42 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (STN-3)

Initial Displacement: 1.482 ft
Total Well Penetration Depth: 17.1 ft
Casing Radius: 0.0417 ft
Static Water Column Height: 5.42 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 4.048E-5 cm/sec
y0 = 1.405 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-4.aqt
Date: 11/18/09 Time: 15:00:12

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-4
Test Date: 11/11/09

AQUIFER DATA

Saturated Thickness: 3.97 ft Anisotropy Ratio (Kz/Kr): 1.

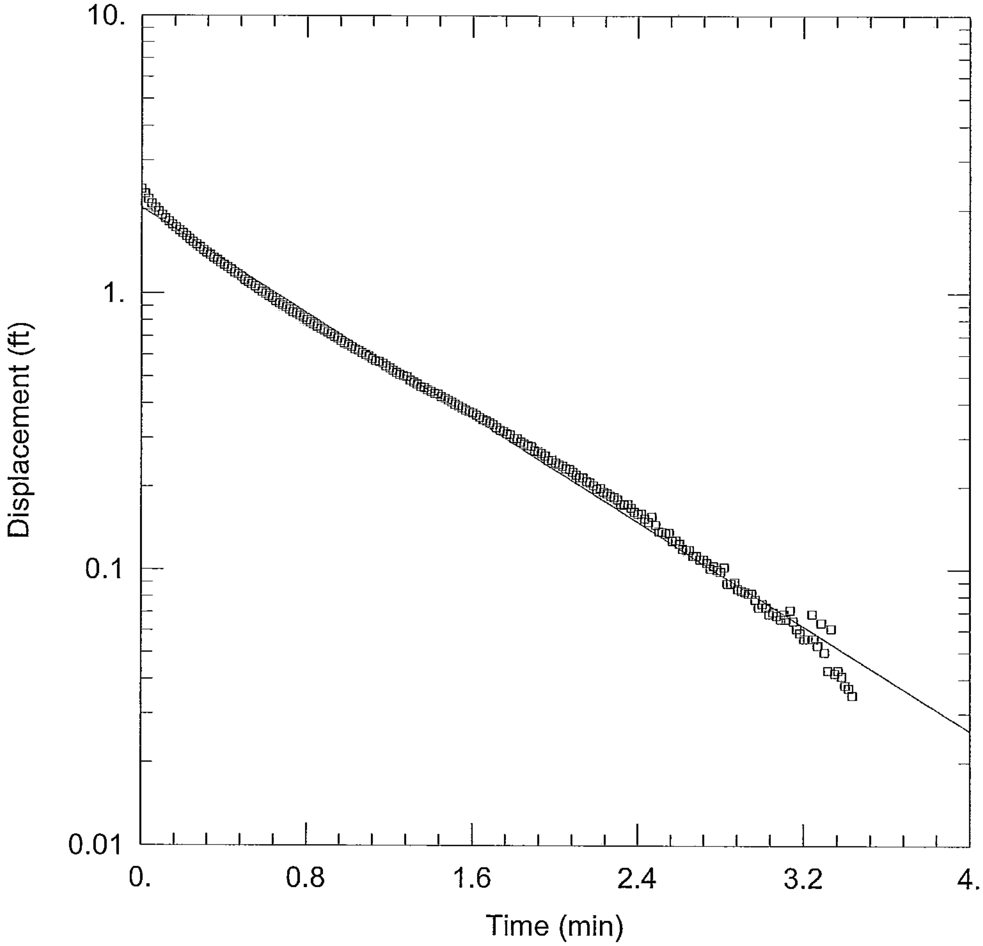
WELL DATA (STN-4)

Initial Displacement: 0.091 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.0417 ft
Static Water Column Height: 3.37 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0003297 cm/sec y0 = 0.02549 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-5.aqt
Date: 11/18/09 Time: 14:55:40

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-5
Test Date: 11/11/09

AQUIFER DATA

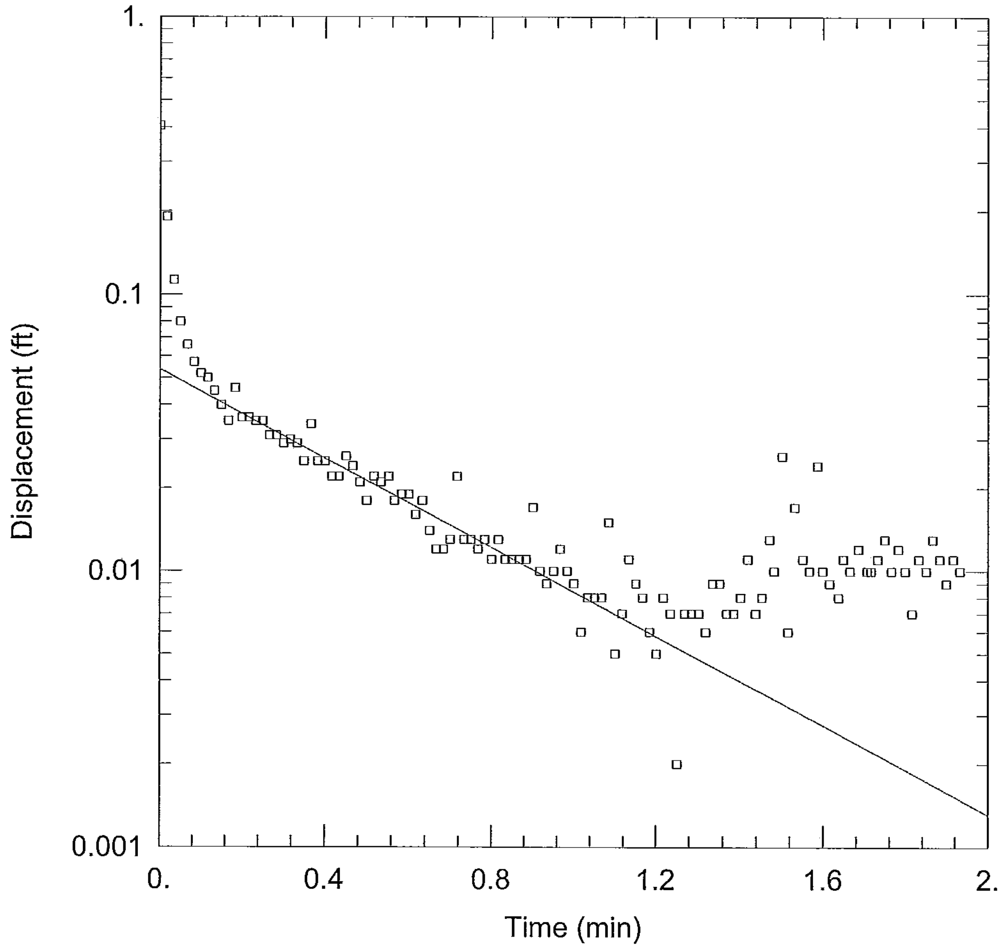
Saturated Thickness: 24.62 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (STN-5)

Initial Displacement: 2.369 ft
Total Well Penetration Depth: 20.62 ft
Casing Radius: 0.0417 ft
Static Water Column Height: 20.62 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0003618 cm/sec
y0 = 2.035 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-6.aqt
Date: 11/18/09 Time: 14:54:34

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-6
Test Date: 11/11/09

AQUIFER DATA

Saturated Thickness: 0.4 ft
Anisotropy Ratio (Kz/Kr): 1.

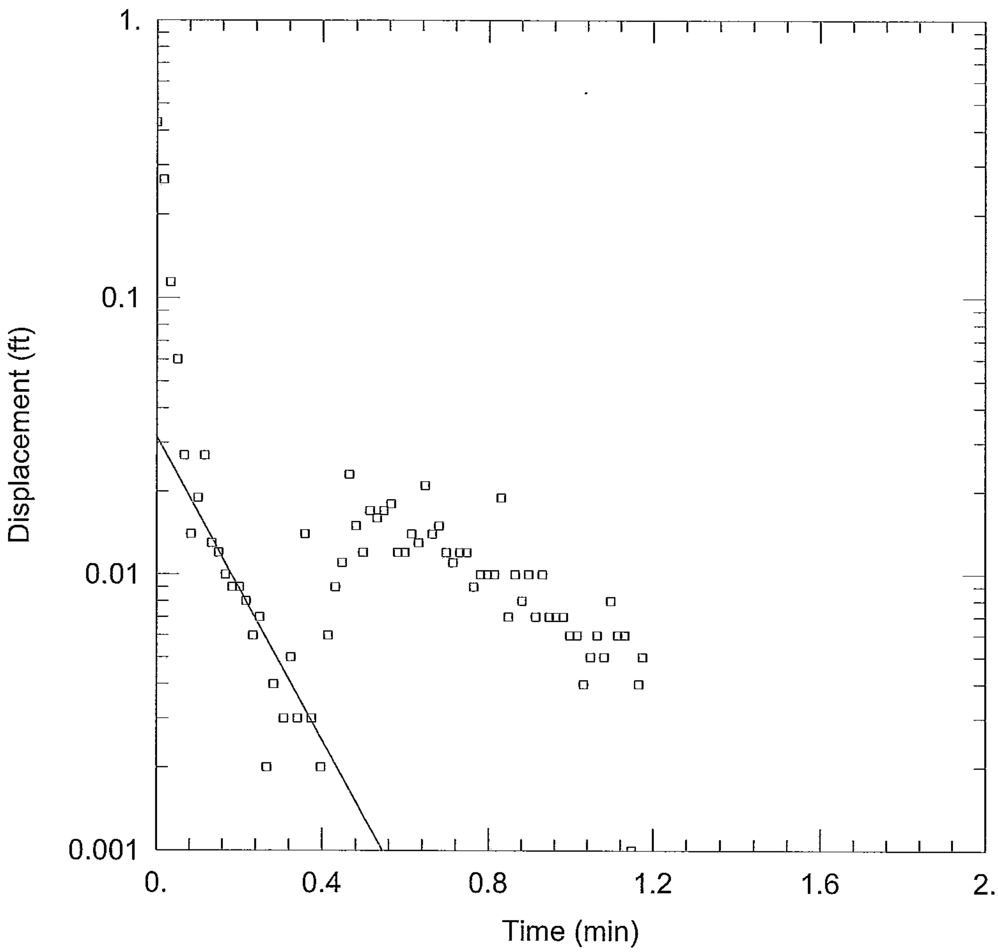
WELL DATA (STN-6)

Initial Displacement: 0.405 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.0417 ft
Static Water Column Height: 0.4 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.005303 cm/sec
y0 = 0.05384 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-7.aqt
Date: 11/18/09 Time: 14:02:39

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-7
Test Date: 11/11/09

AQUIFER DATA

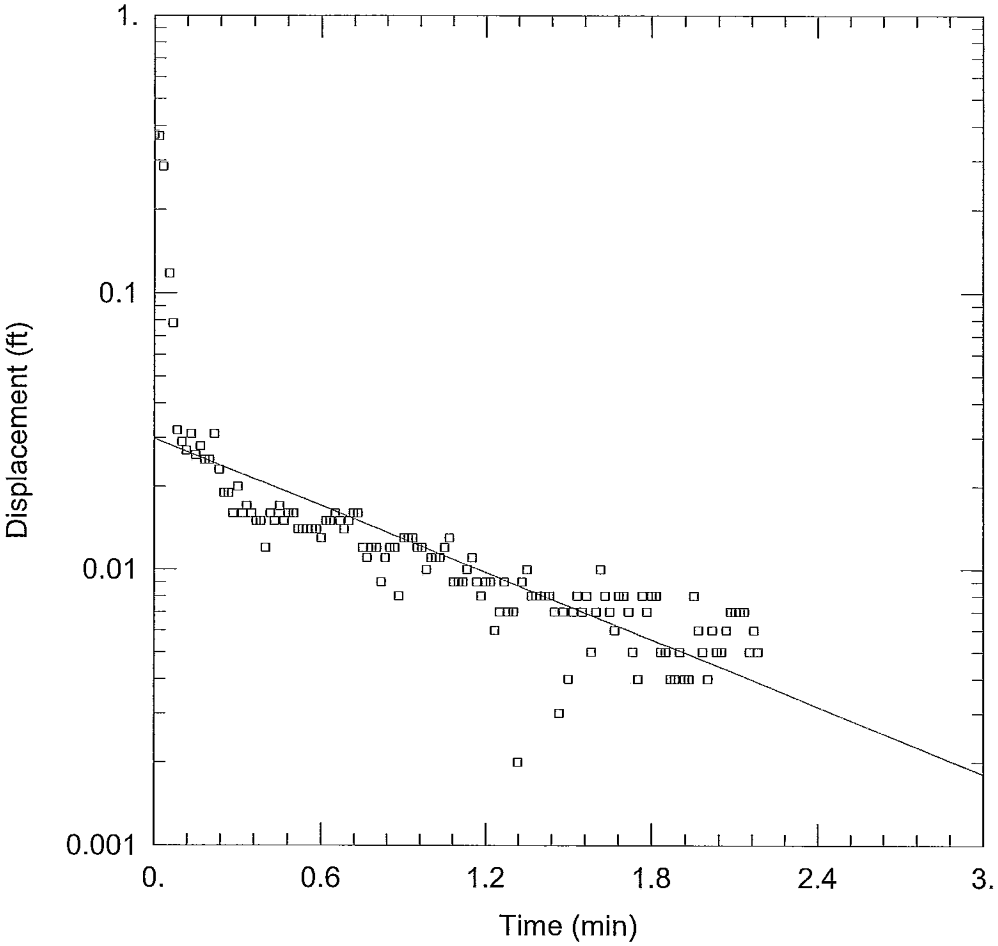
Saturated Thickness: 0.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (STN-7)

Initial Displacement: 0.428 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.0417 ft
Static Water Column Height: 0. ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.05384 cm/sec
y0 = 0.03159 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-8.aqt
Date: 11/18/09 Time: 14:09:36

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-8
Test Date: 11/11/09

AQUIFER DATA

Saturated Thickness: 11.56 ft Anisotropy Ratio (Kz/Kr): 1.

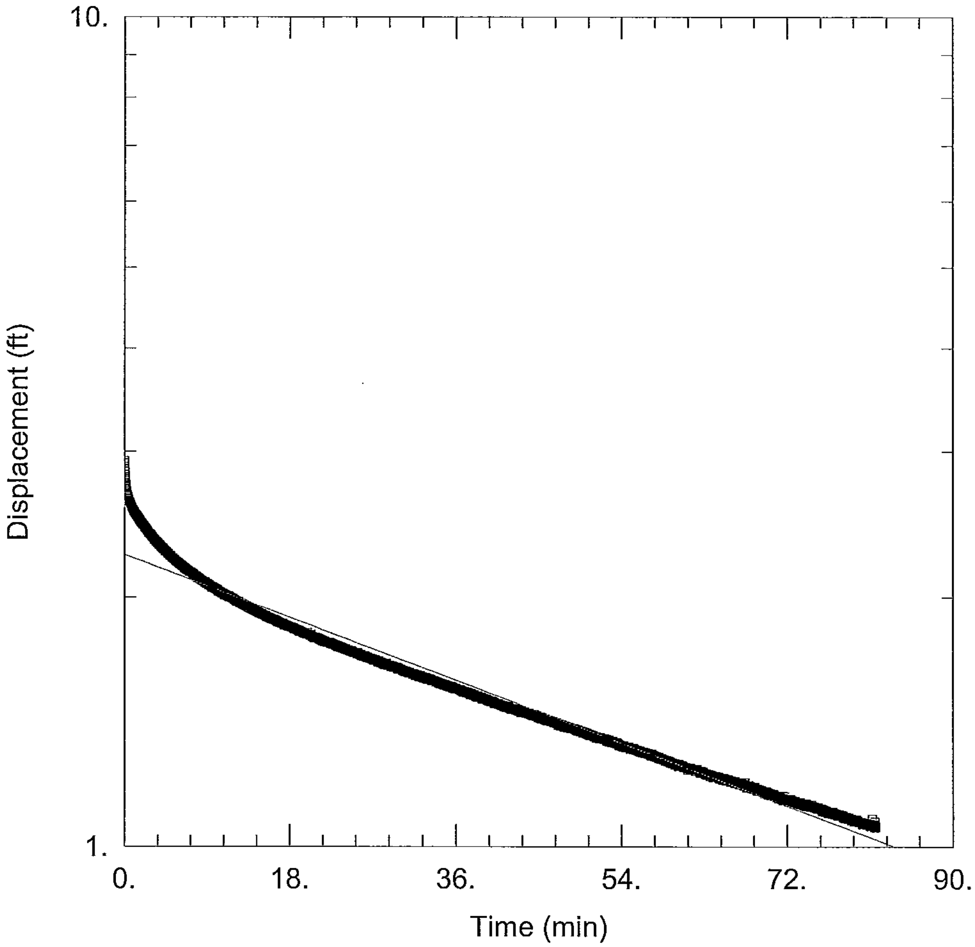
WELL DATA (STN-8)

Initial Displacement: 0.372 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.0417 ft
Static Water Column Height: 0.4 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0002531 cm/sec y0 = 0.02985 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-9.aqt
Date: 11/18/09 Time: 14:15:58

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-9
Test Date: 11/11/09

AQUIFER DATA

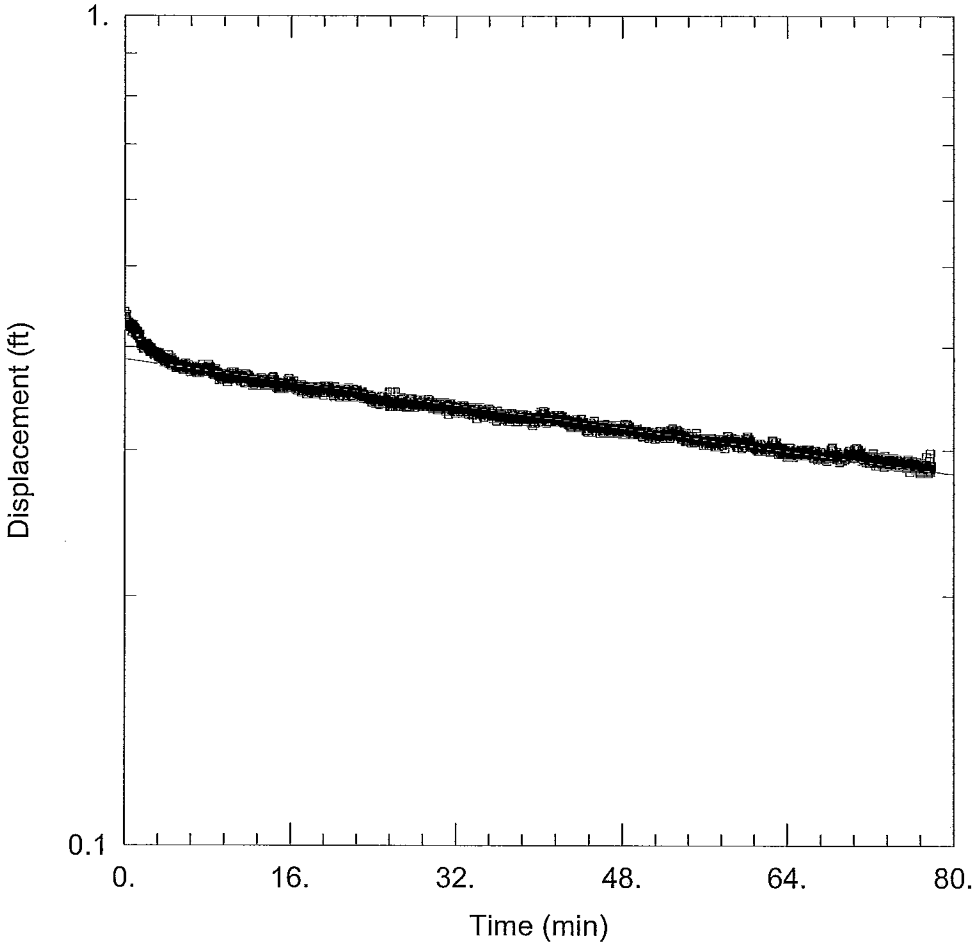
Saturated Thickness: 19.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (STN-9)

Initial Displacement: 2.924 ft
Total Well Penetration Depth: 19.2 ft
Casing Radius: 0.0417 ft
Static Water Column Height: 19.2 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 3.63E-6 cm/sec
y0 = 2.252 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-10.aqt
Date: 11/18/09 Time: 14:20:23

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-10
Test Date: 11/11/09

AQUIFER DATA

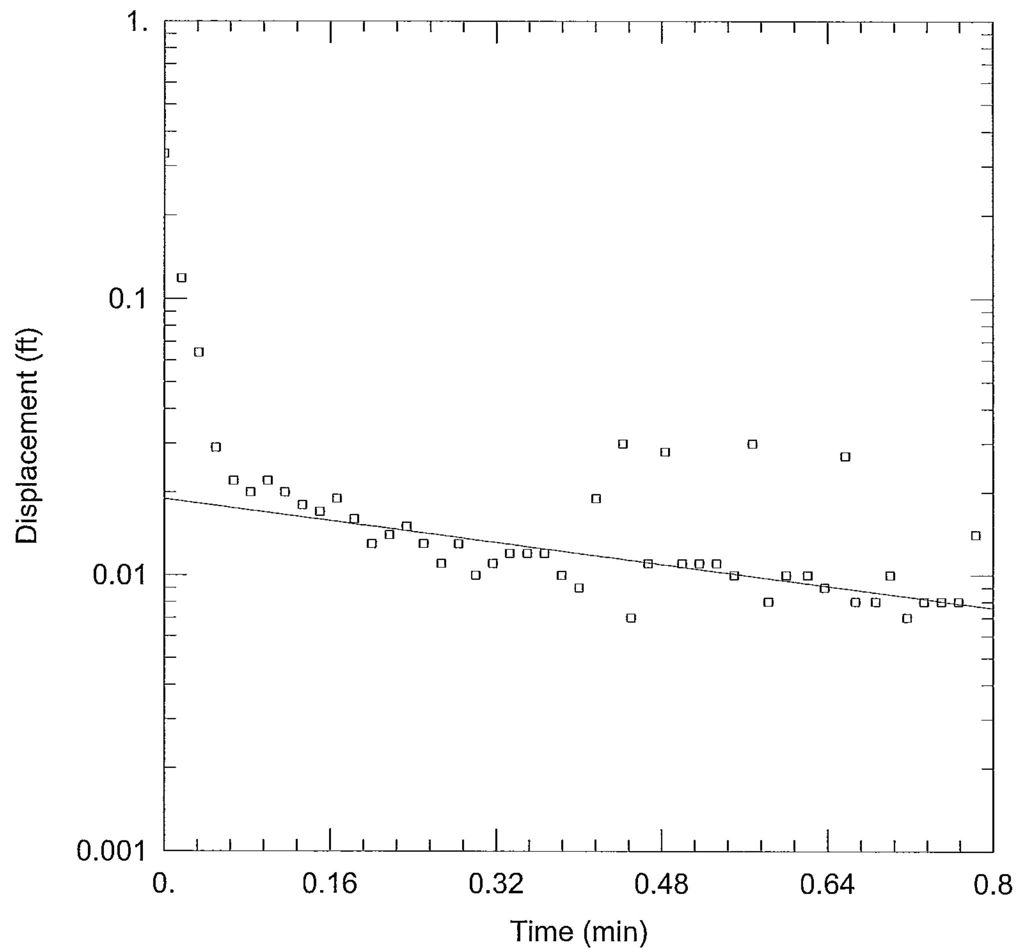
Saturated Thickness: 11.68 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (STN-10)

Initial Displacement: 0.441 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.0417 ft
Static Water Column Height: 12.8 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.08E-6 cm/sec
y0 = 0.3867 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-11.aqt
Date: 11/18/09 Time: 14:26:28

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-11
Test Date: 11/11/09

AQUIFER DATA

Saturated Thickness: 14.3 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (STN-11)

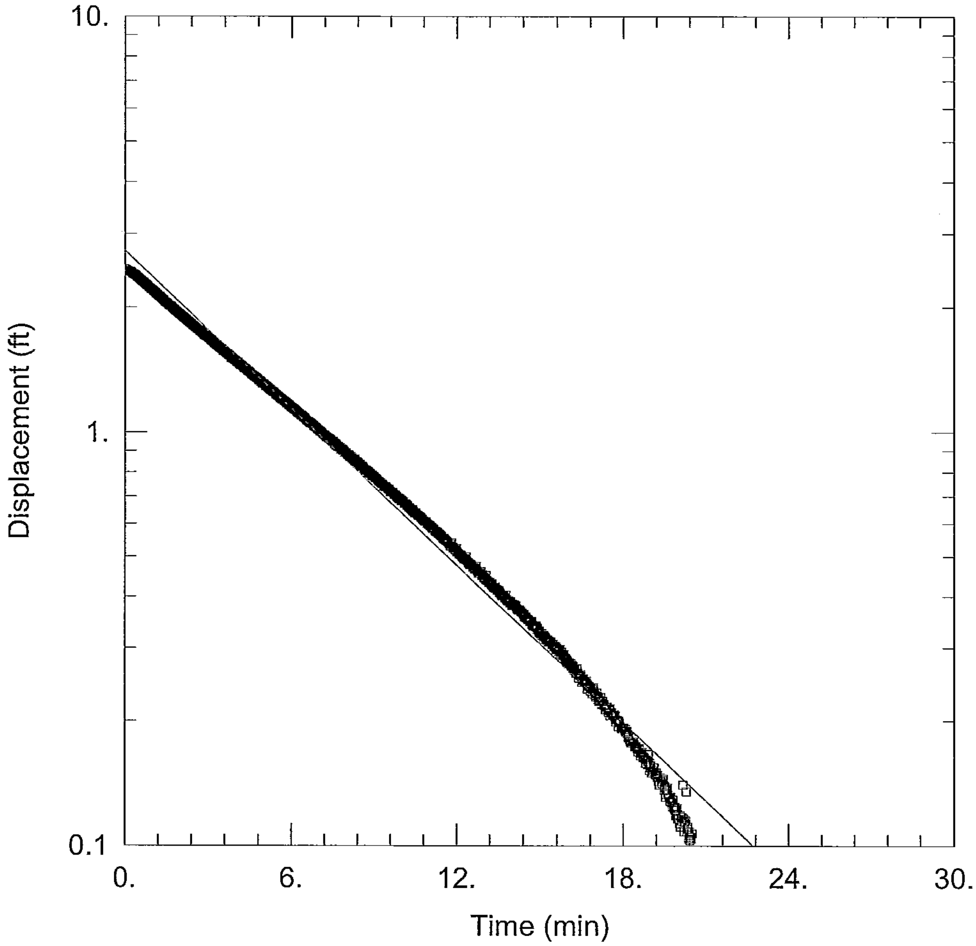
Initial Displacement: 0.332 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.0417 ft

Static Water Column Height: 0.42 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0003075 cm/sec
y0 = 0.01892 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-12.aqt
Date: 11/18/09
Time: 14:31:19

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-12
Test Date: 11/11/09

AQUIFER DATA

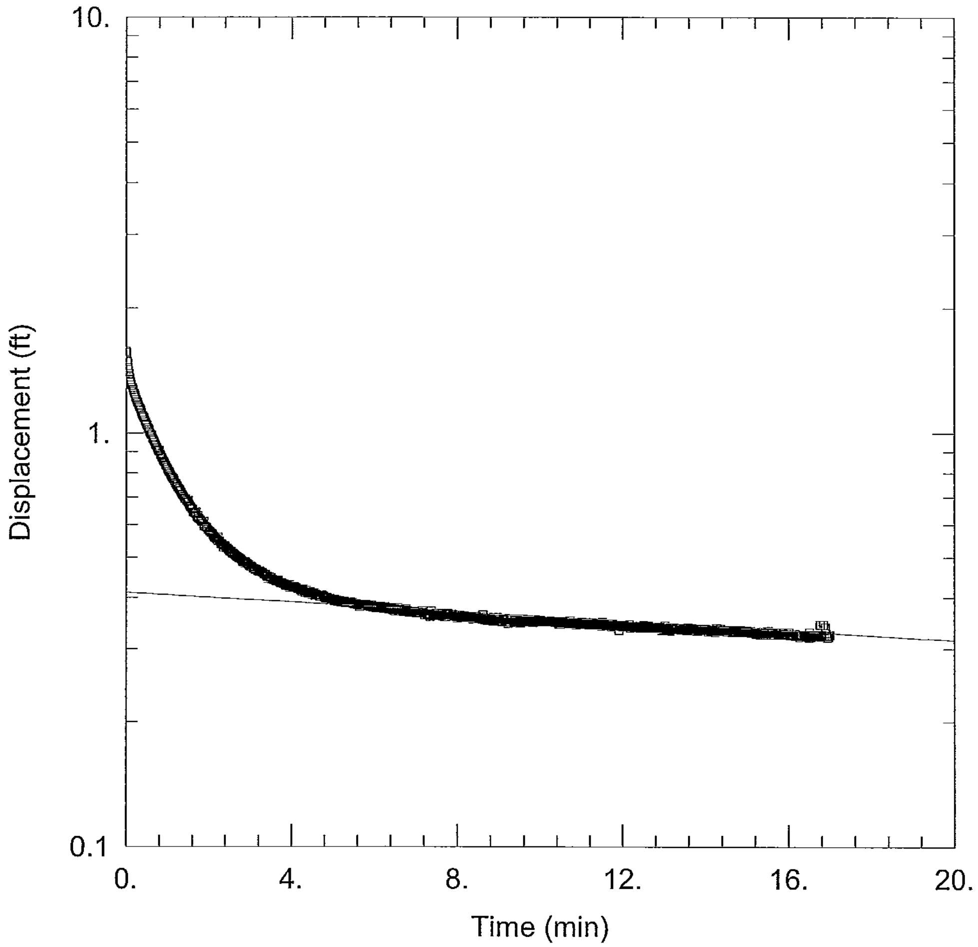
Saturated Thickness: 18.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (STN-12)

Initial Displacement: 2.473 ft
Total Well Penetration Depth: 17.8 ft
Casing Radius: 0.0417 ft
Static Water Column Height: 17.8 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 4.965E-5 cm/sec
y0 = 2.736 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-13.aqt
Date: 11/18/09 Time: 14:36:11

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-13
Test Date: 11/11/09

AQUIFER DATA

Saturated Thickness: 17.99 ft
Anisotropy Ratio (Kz/Kr): 1.

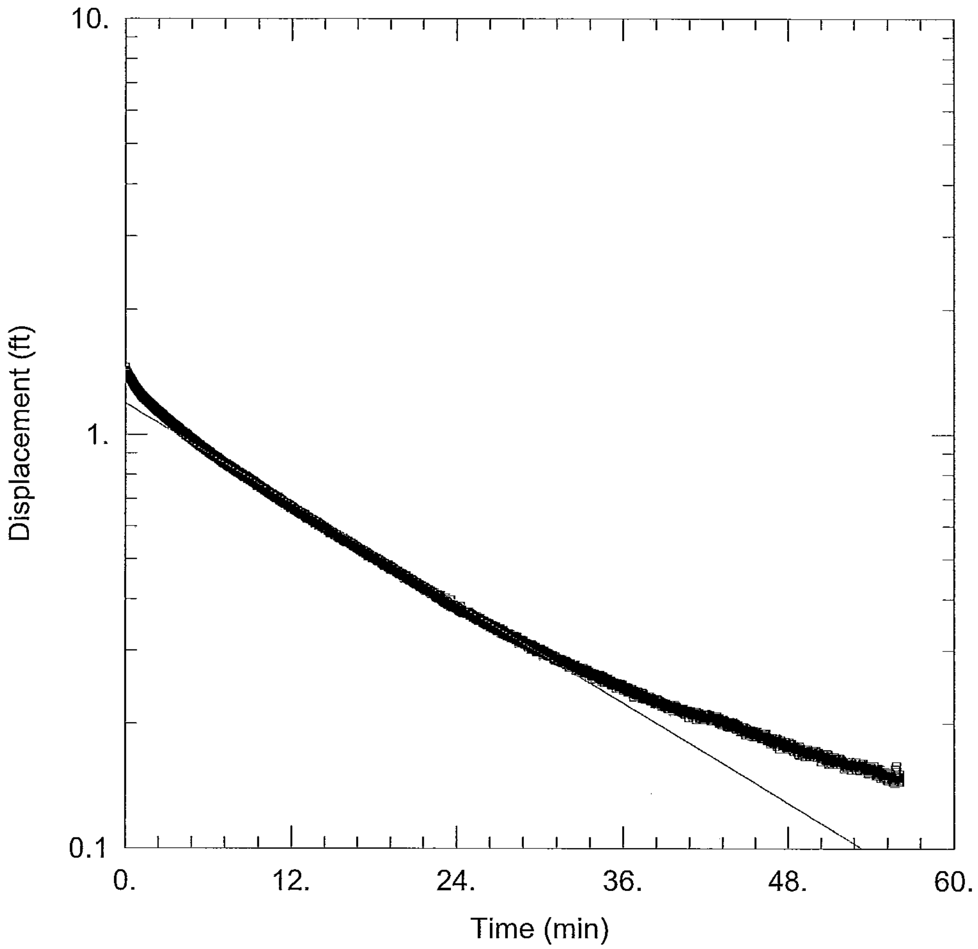
WELL DATA (STN-13)

Initial Displacement: 1.573 ft
Total Well Penetration Depth: 6.59 ft
Casing Radius: 0.0417 ft
Static Water Column Height: 6.59 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 3.717E-6 cm/sec
y0 = 0.4112 ft



ALLEN FOSSIL PLANT

Data Set: Z:\172679016\Slug Test\AQTESOLV files\STN-14.aqt
Date: 11/18/09 Time: 14:52:19

PROJECT INFORMATION

Company: Stantec
Client: TVA
Project: 172679016
Location: Allen
Test Well: STN-14
Test Date: 11/11/09

AQUIFER DATA

Saturated Thickness: 11.81 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (STN-14)

Initial Displacement: 1.45 ft
Total Well Penetration Depth: 11.81 ft
Casing Radius: 0.0417 ft
Static Water Column Height: 11.81 ft
Screen Length: 5. ft
Well Radius: 0.0417 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001377 cm/sec
y0 = 1.191 ft

Appendix F

Results of Seepage and Slope Stability Analyses

- Cross-Section A-A’
- Cross-Section B-B’

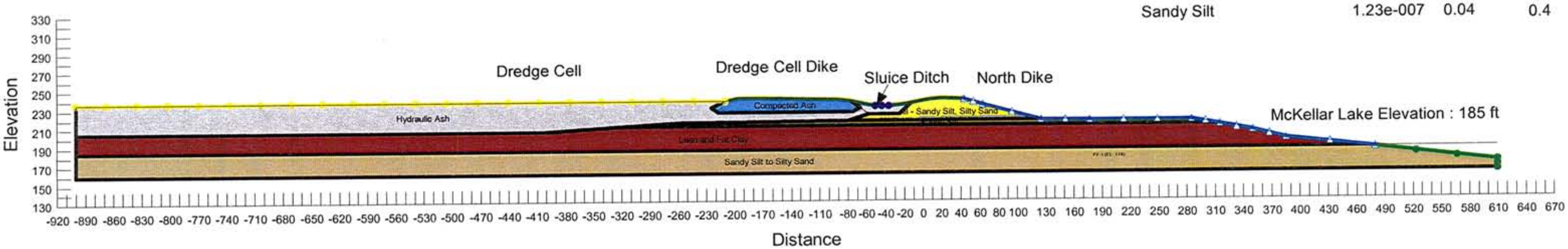
Cross-Section A-A’

Steady-State Seepage at Section A-A'
For Normal Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Sluice Ditch Water Elevation - 231 ft
Dredge Cell Water Elevation - 232
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



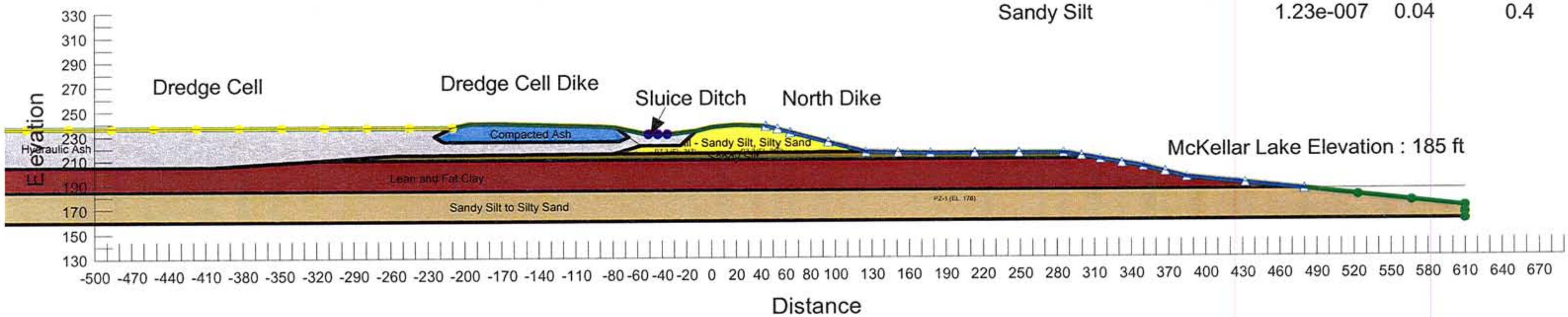
Subsurface Profile and Boundary Condition

Steady-State Seepage at Section A-A'
For Normal Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Sluice Ditch Water Elevation - 231 ft
Dredge Cell Water Elevation - 232
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



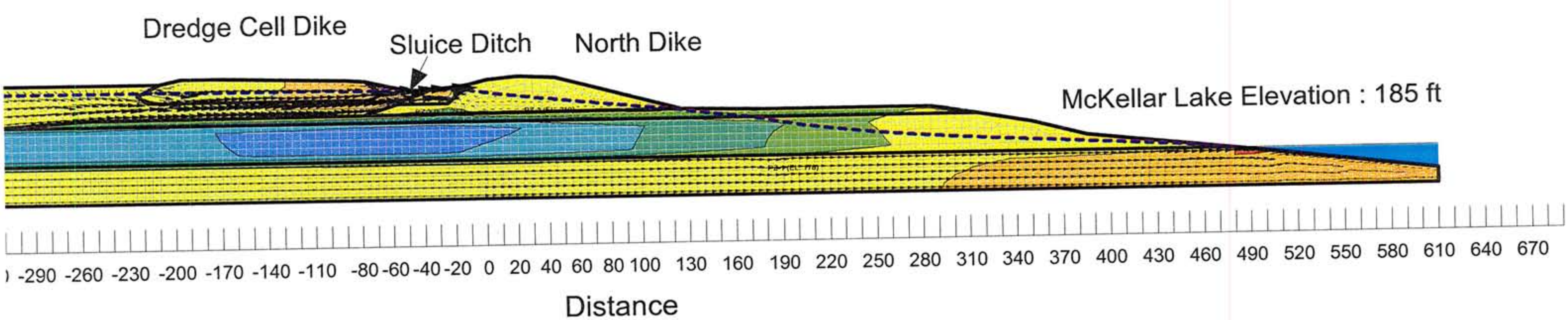
Finite Element Mesh, Flow Vectors and Piezometric Surface

Steady-State Seepage at Section A-A'
For Normal Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

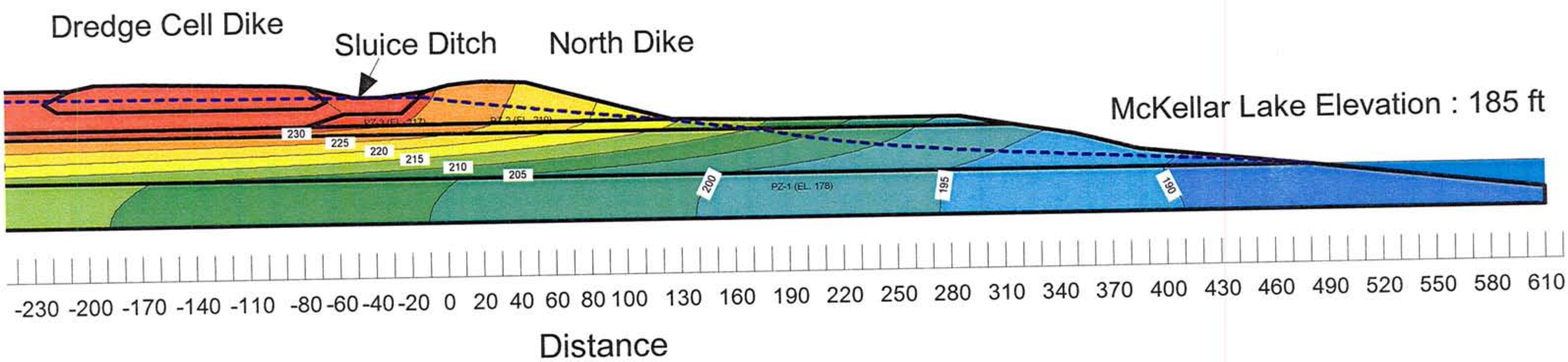
Boundary Conditions:
Sluice Ditch Water Elevation - 231 ft
Dredge Cell Water Elevation - 232
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

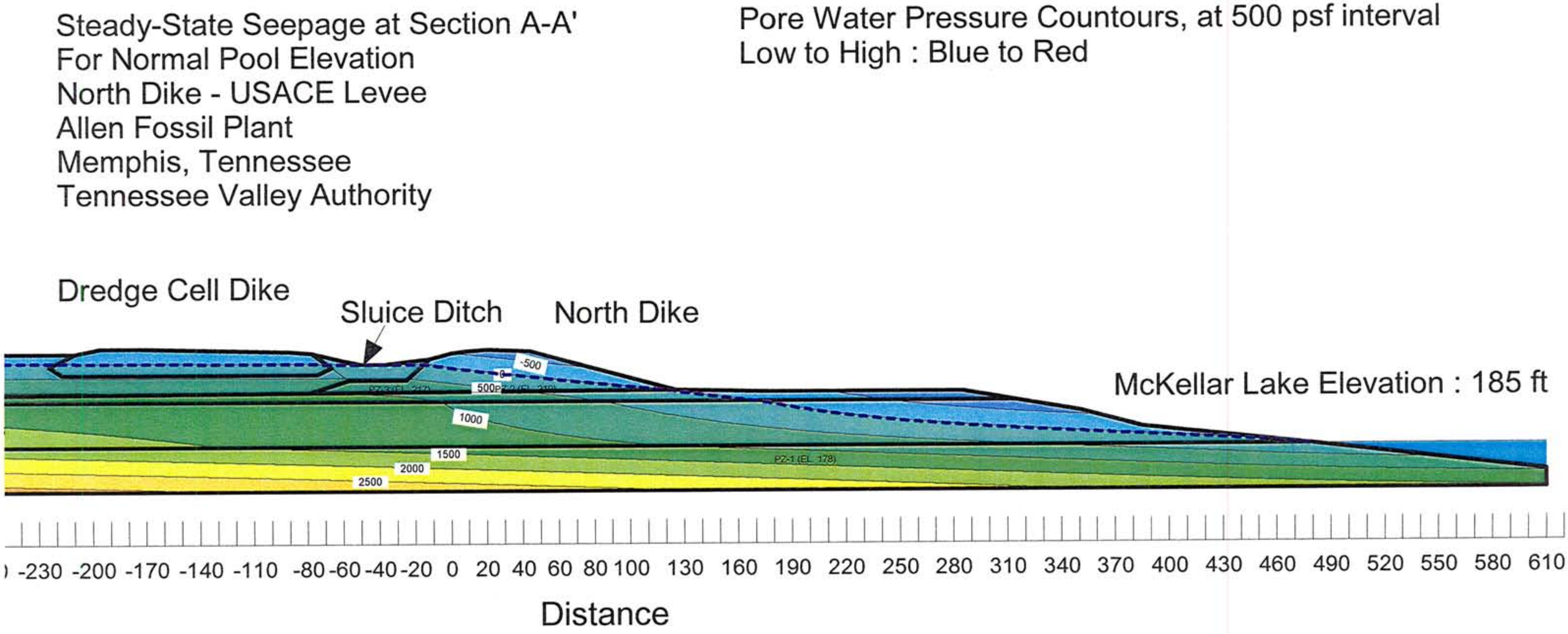
Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



Steady-State Seepage at Section A-A'
For Normal Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Total Head Countours, at 5-foot interval
Low to High : Blue to Red

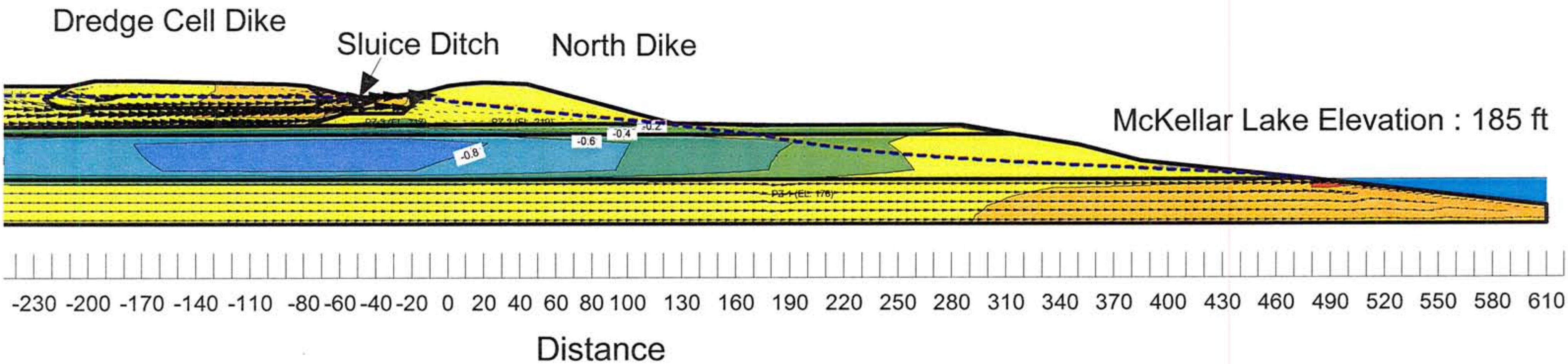




Steady-State Seepage at Section A-A'
For Normal Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority
Pore Water Pressure Countours, at 500 psf interval
Low to High : Blue to Red
Dredge Cell Dike
Sluice Ditch
North Dike
McKellar Lake Elevation : 185 ft
-500
0
500
1000
1500
2000
2500
PZ-1 (EL 178)
-230 -200 -170 -140 -110 -80 -60 -40 -20 0 20 40 60 80 100 130 160 190 220 250 280 310 340 370 400 430 460 490 520 550 580 610
Distance

Steady-State Seepage at Section A-A'
For Normal Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Vertical Gradient Countours, at 0.2 interval
Low to High : Blue to Red

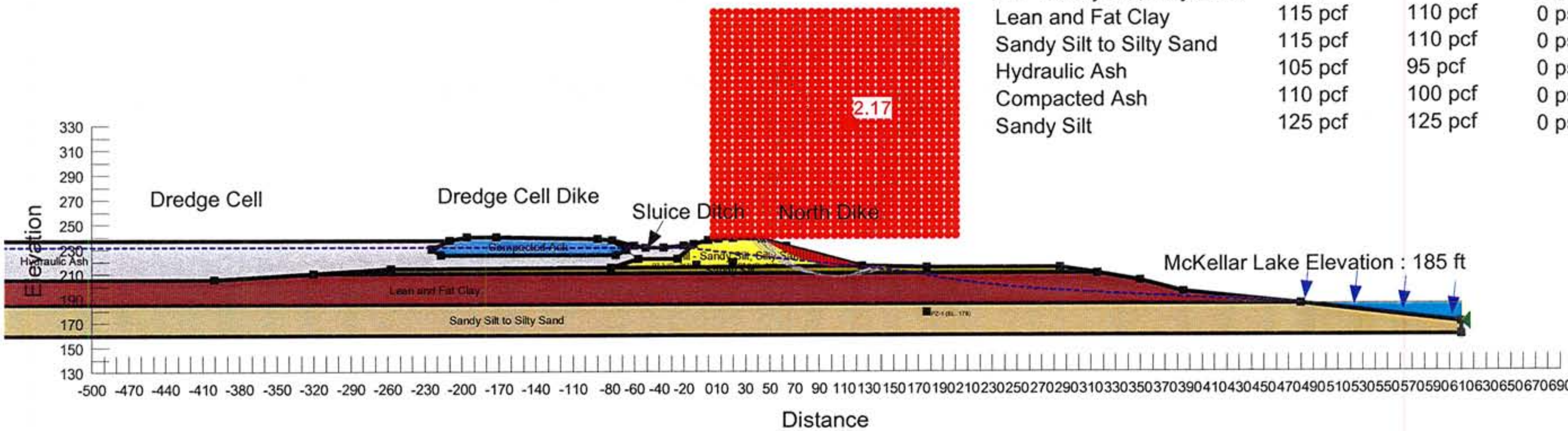


Downstream Shallow Failure Circle

Slope Stability Analysis at Section A-A'
For Normal Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt to Silty Sand	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Compacted Ash	110 pcf	100 pcf	0 psf	30 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

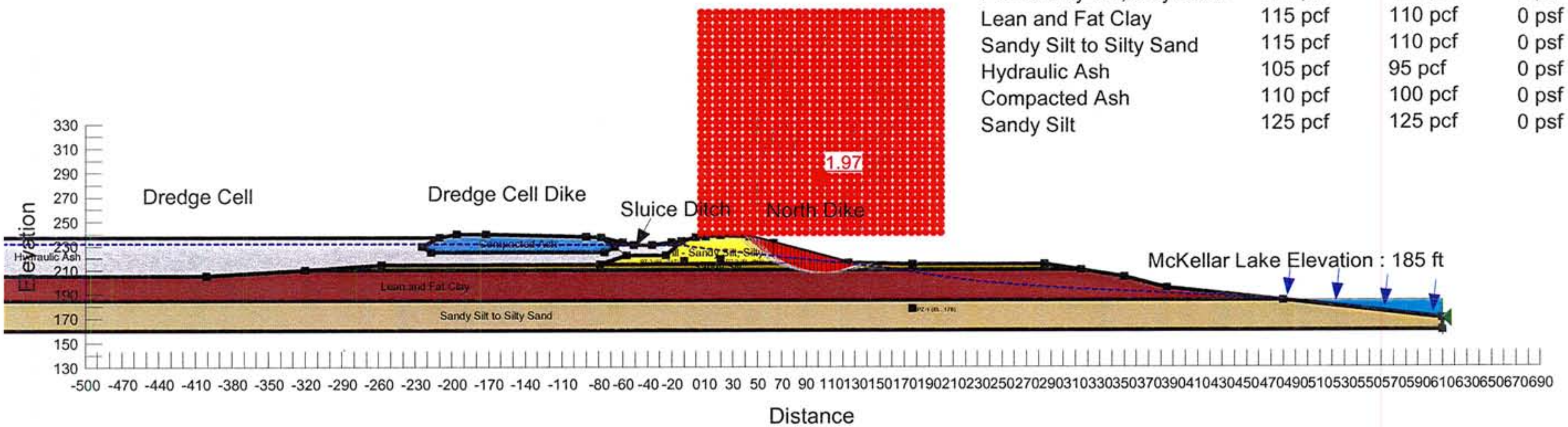


Downstream Deep Failure Circle

Slope Stability Analysis at Section A-A' DF
For Normal Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt to Silty Sand	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Compacted Ash	110 pcf	100 pcf	0 psf	30 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

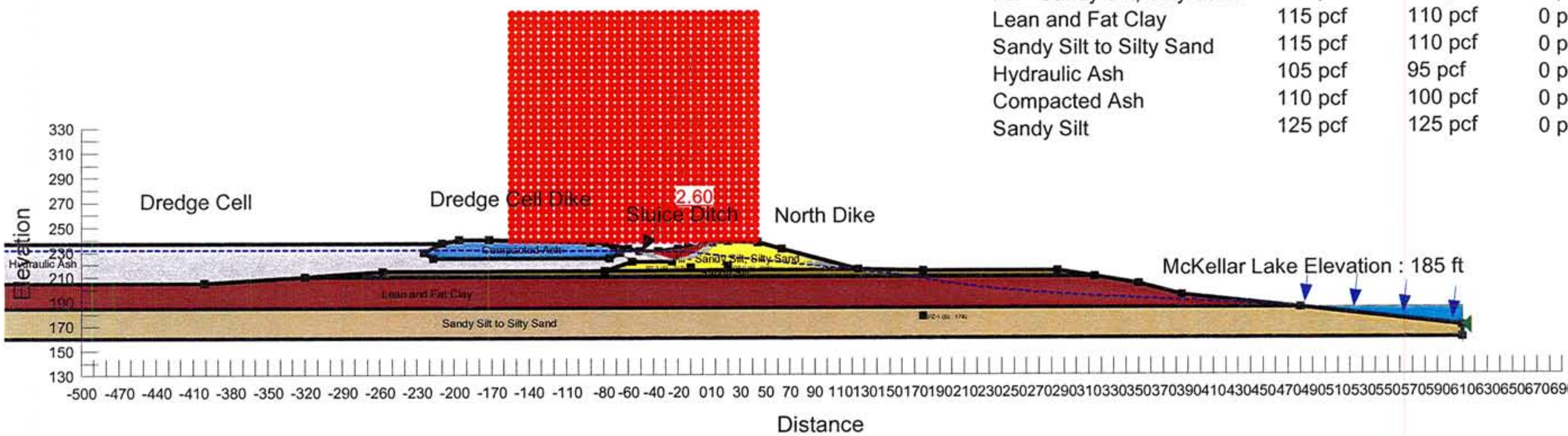


Upstream Shallow Failure Circle

Slope Stability Analysis at Section A-A' UF
For Normal Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt to Silty Sand	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Compacted Ash	110 pcf	100 pcf	0 psf	30 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

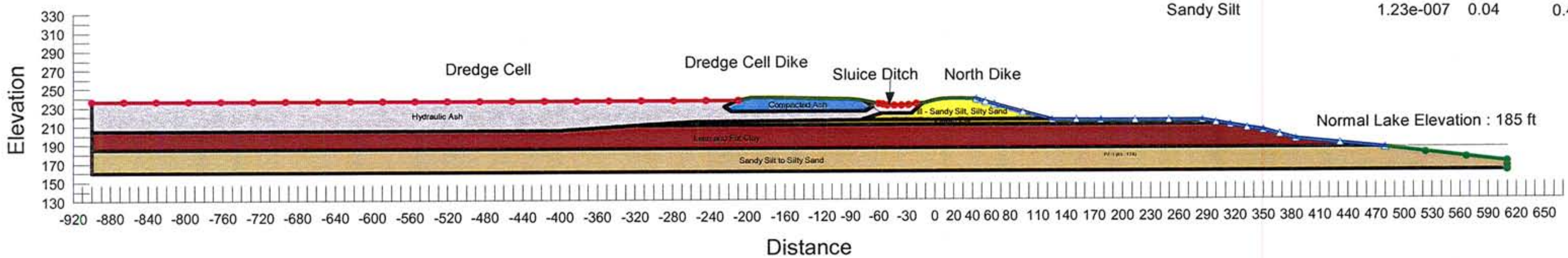


Steady-State Seepage at Section A-A'
For Maximum Storage Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Sluice Ditch Water Elevation - 233 ft
Dredge Cell Water Elevation - 234
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



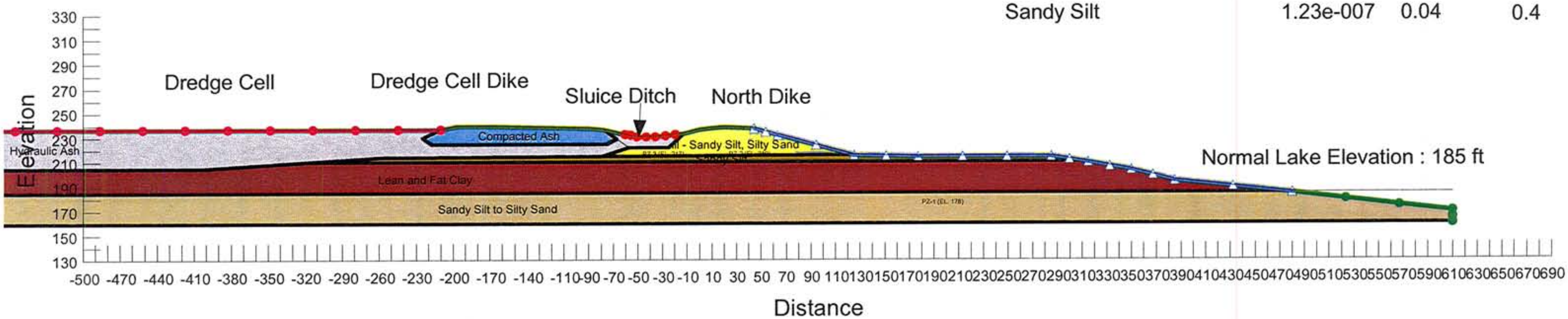
Subsurface Profile and Boundary Condition

Steady-State Seepage at Section A-A'
For Maximum Storage Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Sluice Ditch Water Elevation - 233 ft
Dredge Cell Water Elevation - 234
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



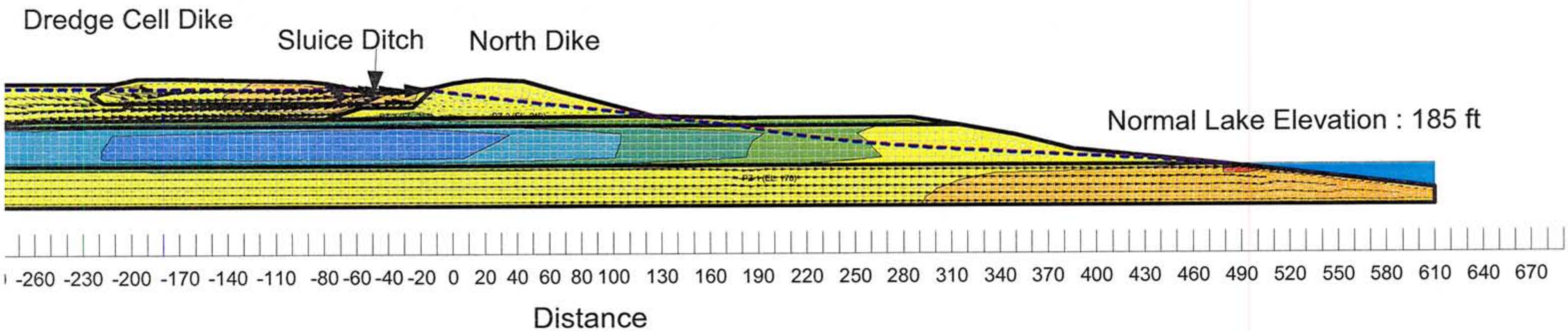
Finite Element Mesh, Flow Vector and Piezometric Surface

Steady-State Seepage at Section A-A'
For Maximum Storage Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

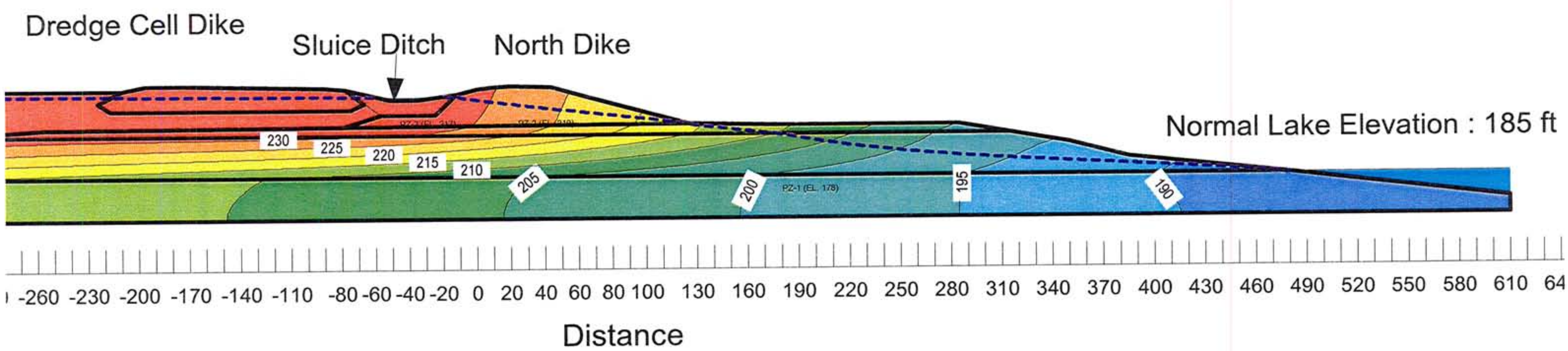
Boundary Conditions:
Sluice Ditch Water Elevation - 233 ft
Dredge Cell Water Elevation - 234
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



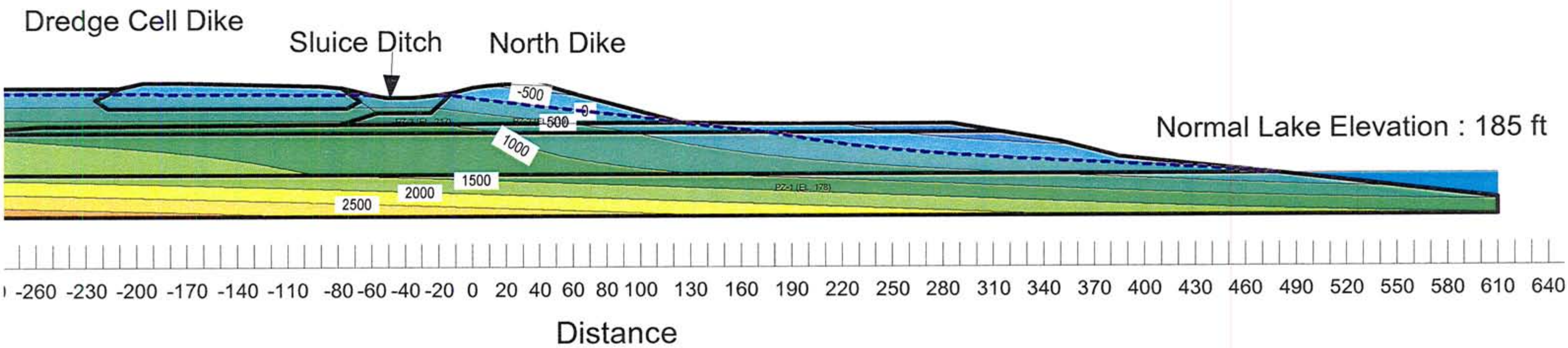
Steady-State Seepage at Section A-A'
For Maximum Storage Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

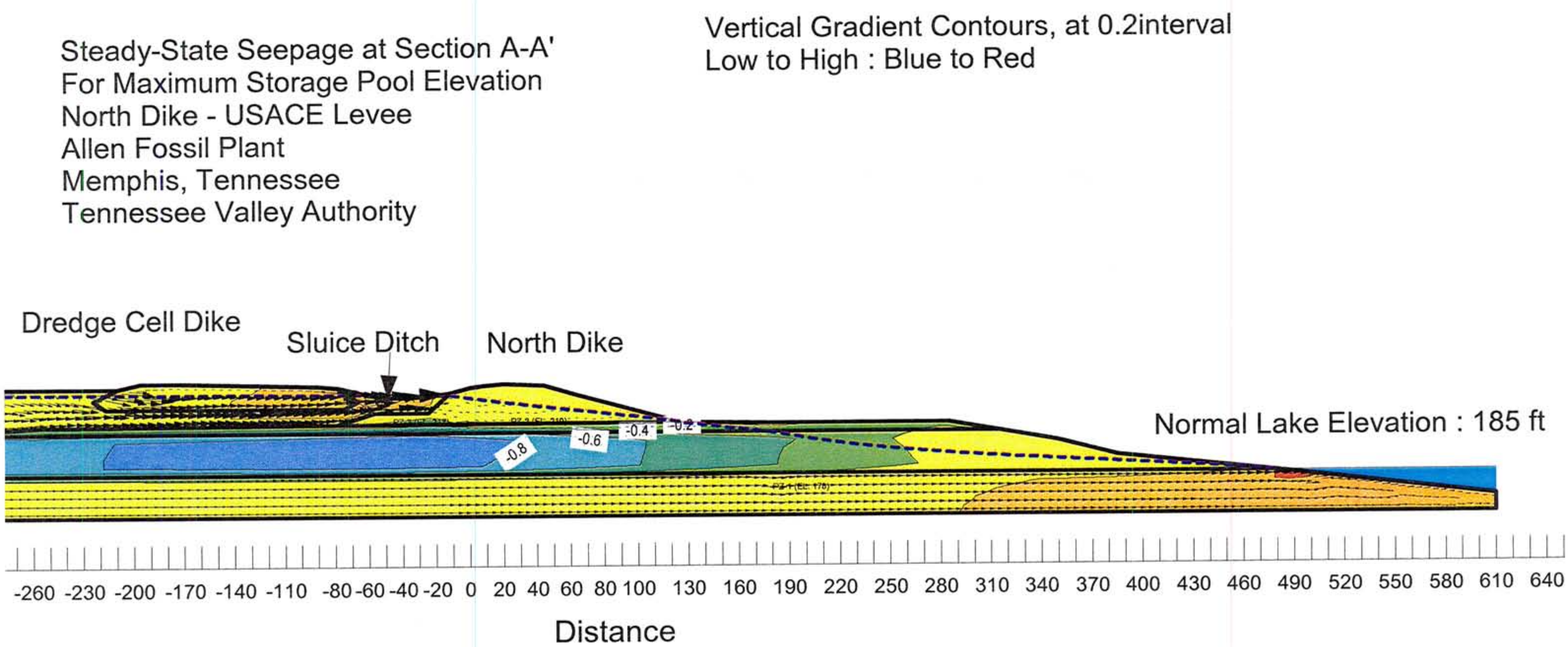
Total Head Contours, at 5-foot interval
Low to High : Blue to Red



Steady-State Seepage at Section A-A'
For Maximum Storage Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Pore Water Pressure Contours, at 500 psf interval
Low to High : Blue to Red



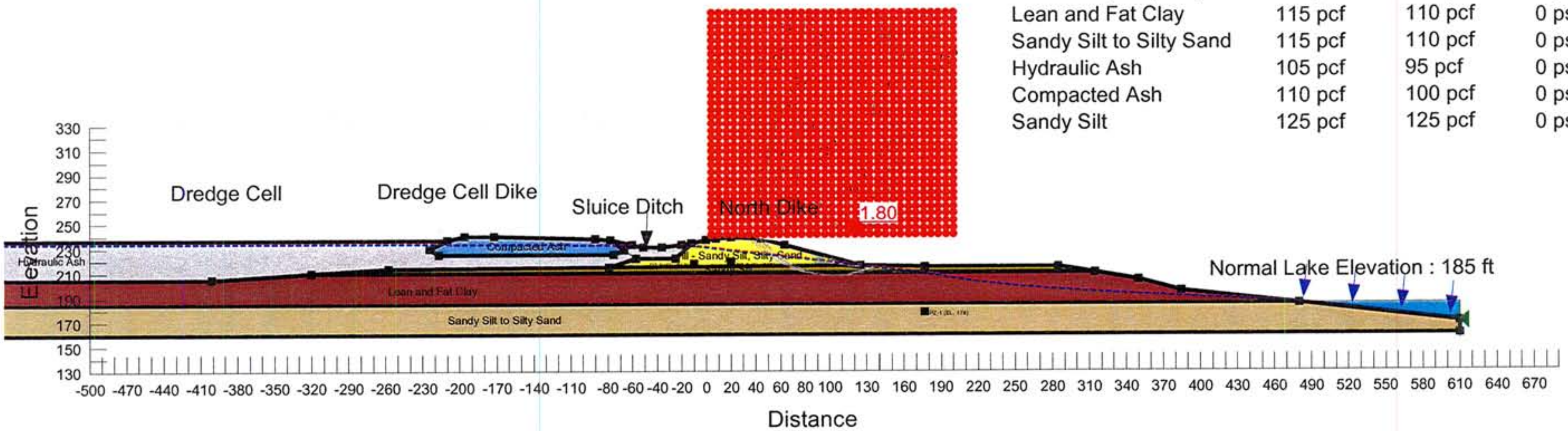

Steady-State Seepage at Section A-A'
For Maximum Storage Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority
Vertical Gradient Contours, at 0.2interval
Low to High : Blue to Red
Dredge Cell Dike
Sluice Ditch
North Dike
Normal Lake Elevation : 185 ft
-0.8
-0.6
-0.4
-0.2
-260 -230 -200 -170 -140 -110 -80 -60 -40 -20 0 20 40 60 80 100 130 160 190 220 250 280 310 340 370 400 430 460 490 520 550 580 610 640
Distance

Downstream Shallow Failure Circle

Slope Stability Analysis at Section A-A'
For Maximum Storage Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt to Silty Sand	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Compacted Ash	110 pcf	100 pcf	0 psf	30 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

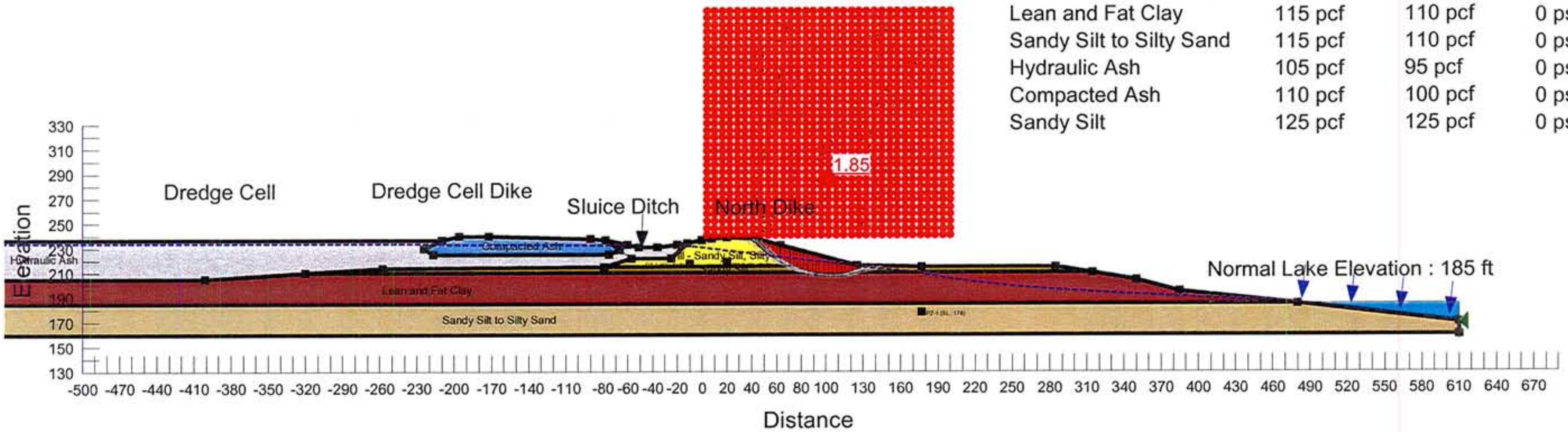


Downstream Deep Failure Circle

Slope Stability Analysis at Section A-A' DF
For Maximum Storage Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt to Silty Sand	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Compacted Ash	110 pcf	100 pcf	0 psf	30 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

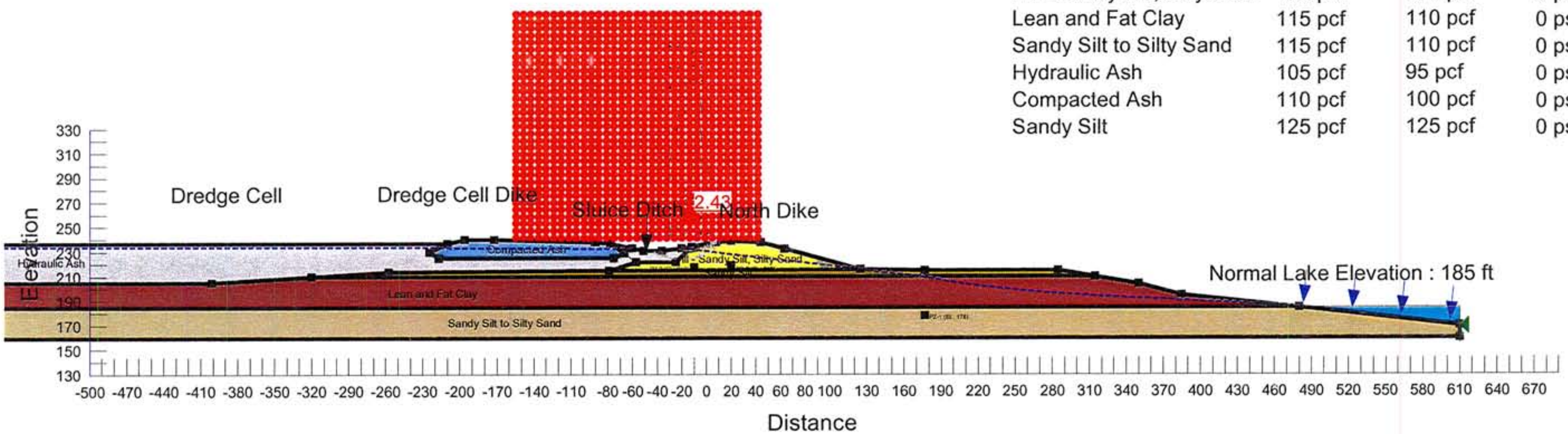


Upstream Shallow Failure Circle

Slope Stability Analysis at Section A-A' UF
For Maximum Storage Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt to Silty Sand	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Compacted Ash	110 pcf	100 pcf	0 psf	30 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

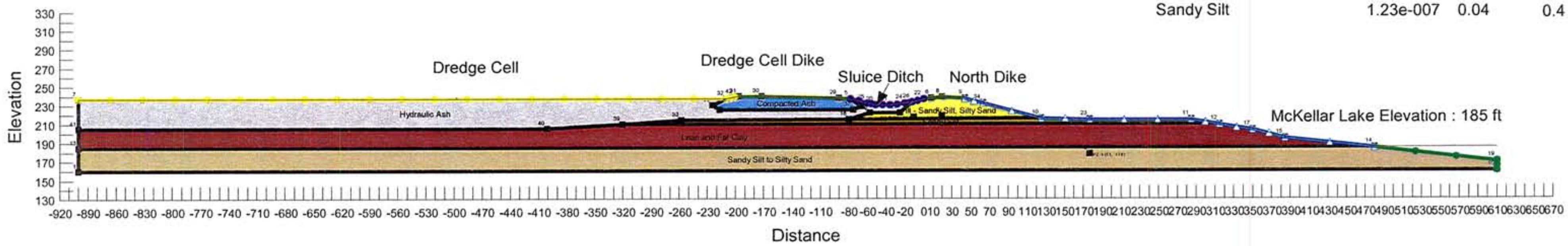


Steady-State Seepage at Section A-A'
For Surcharge Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Sluice Ditch Water Elevation - 237 ft
Dredge Cell Water Elevation - 239
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



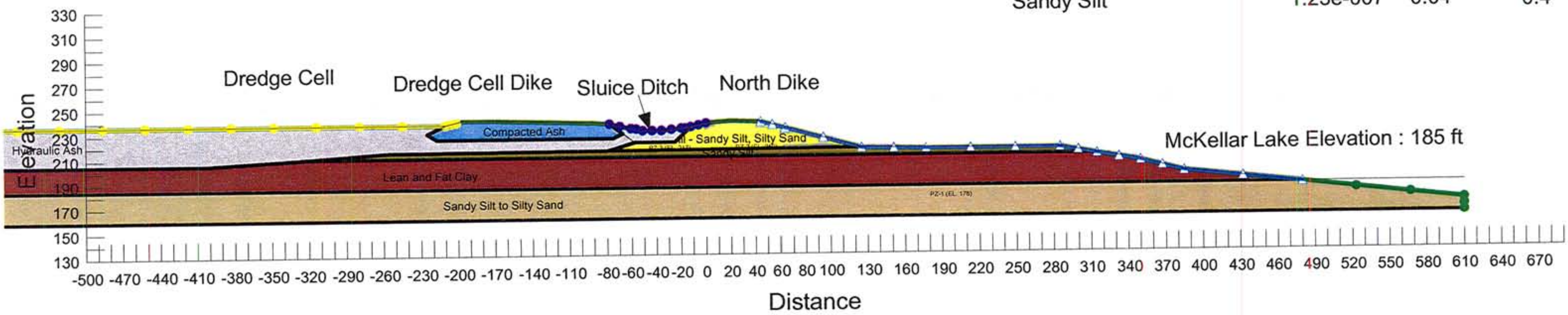
Subsurface Profile and Boundary Condition

Steady-State Seepage at Section A-A'
For Surcharge Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Sluice Ditch Water Elevation - 237 ft
Dredge Cell Water Elevation - 239
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



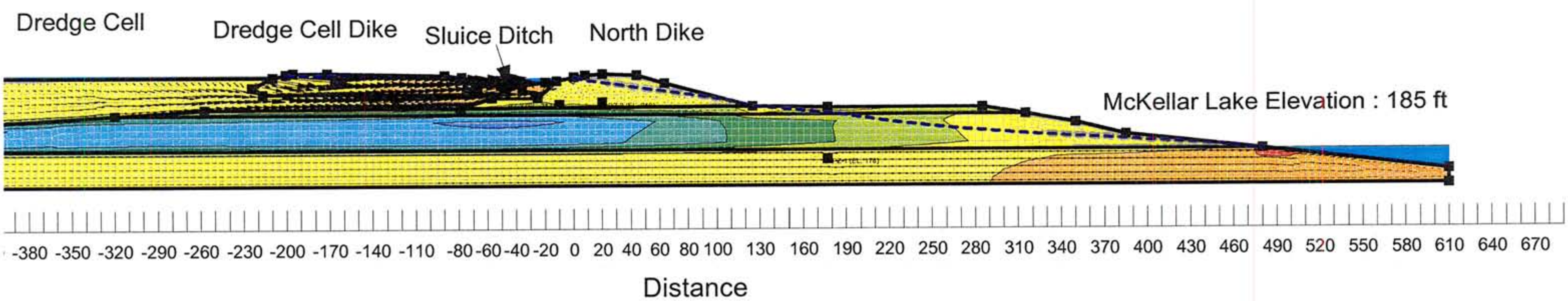
Finite Element Mesh, Flow Vector and Piezometric Surface

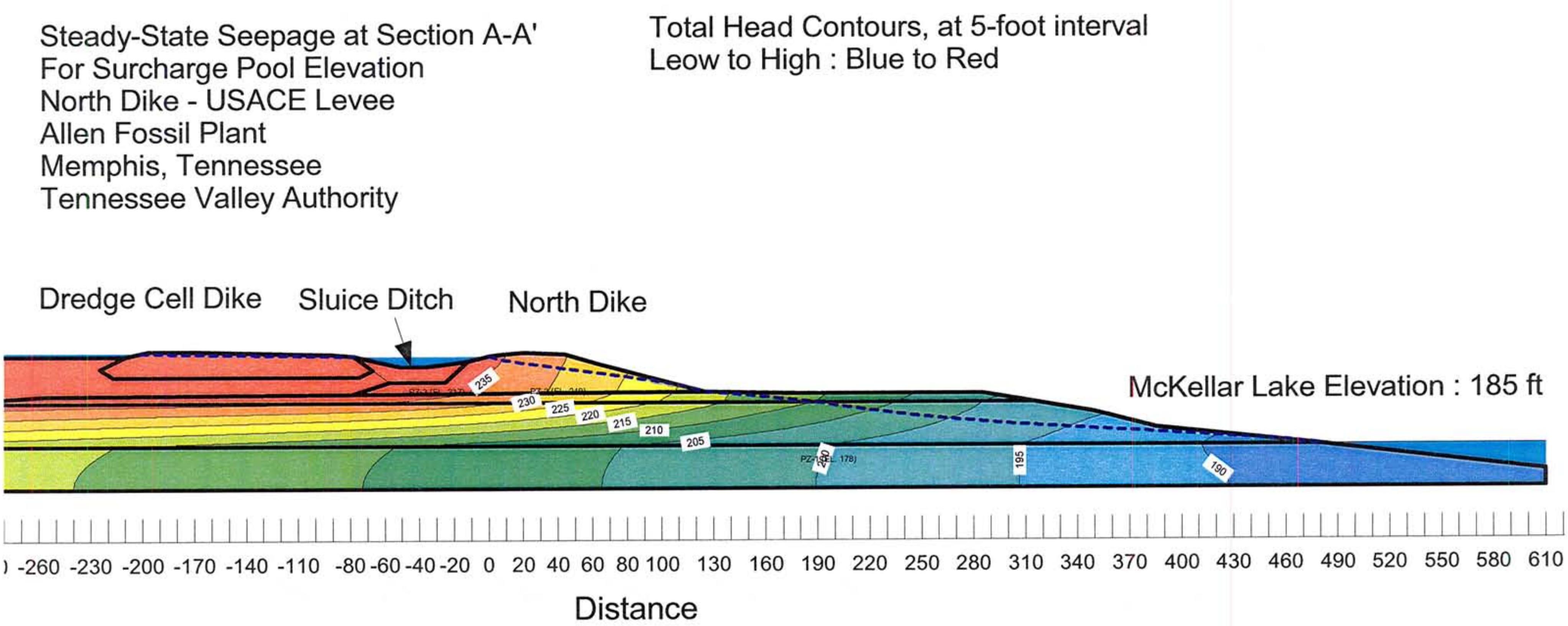
Steady-State Seepage at Section A-A'
For Surcharge Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Boundary Conditions:
Sluice Ditch Water Elevation - 237 ft
Dredge Cell Water Elevation - 239
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

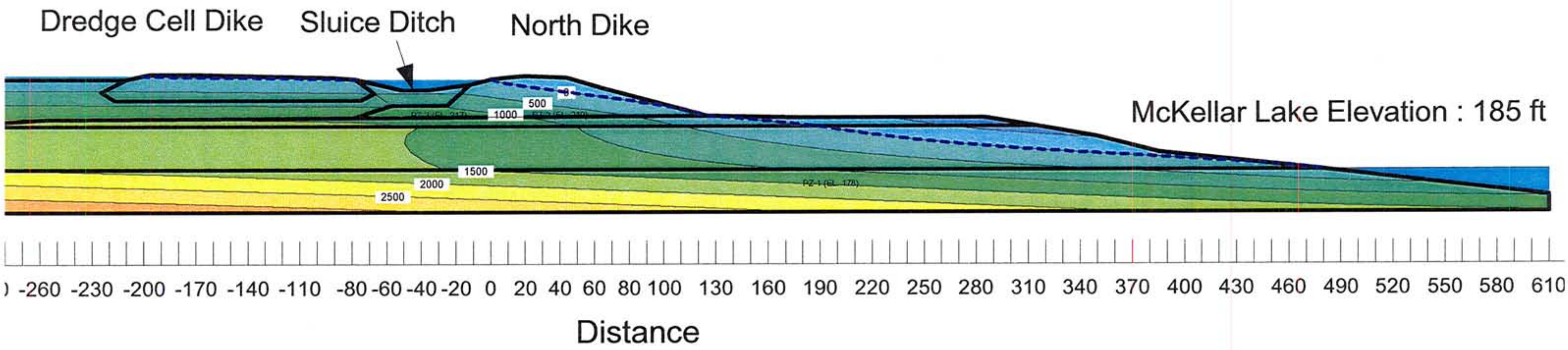
Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4

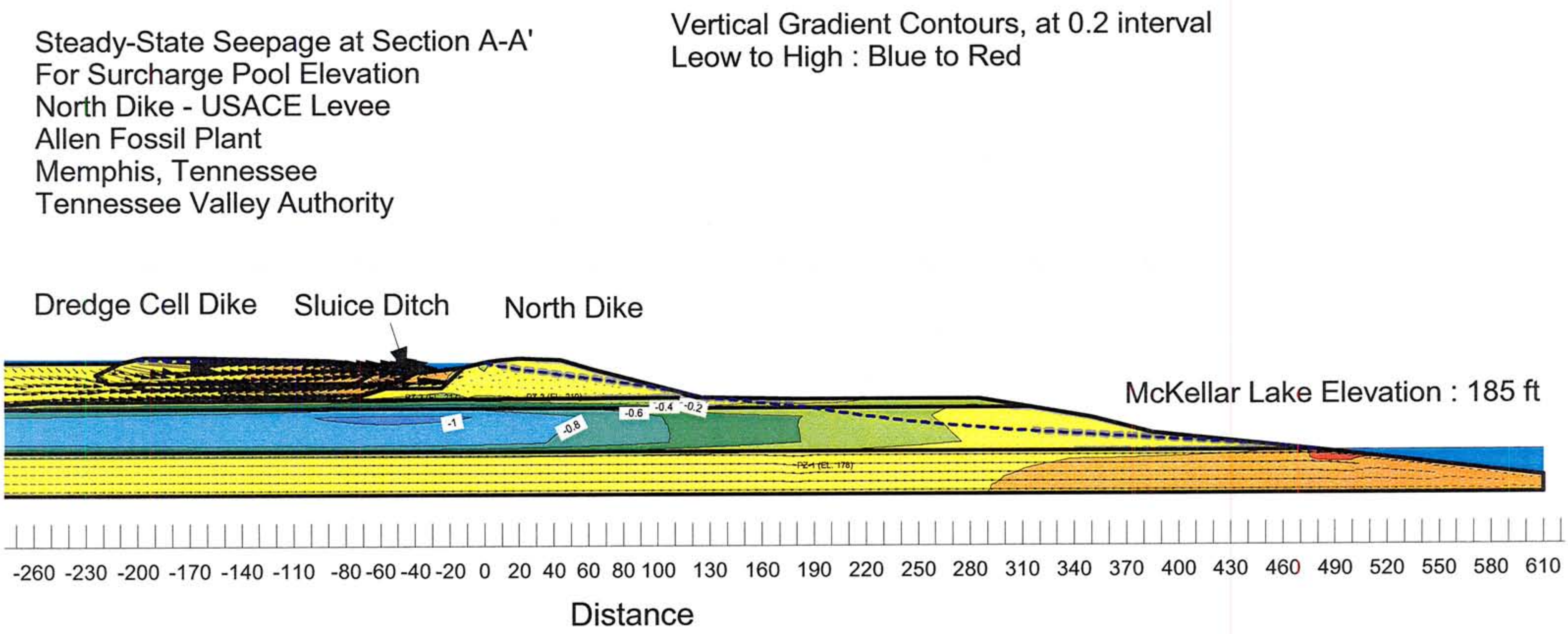



Steady-State Seepage at Section A-A'
For Surcharge Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority
Total Head Contours, at 5-foot interval
Leow to High : Blue to Red
Dredge Cell Dike
Sluice Ditch
North Dike
McKellar Lake Elevation : 185 ft
235
230
225
220
215
210
205
195
190
-260 -230 -200 -170 -140 -110 -80 -60 -40 -20 0 20 40 60 80 100 130 160 190 220 250 280 310 340 370 400 430 460 490 520 550 580 610
Distance

Steady-State Seepage at Section A-A'
For Surcharge Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Pore Water Pressure Contours, at 500 psf interval
Leow to High : Blue to Red





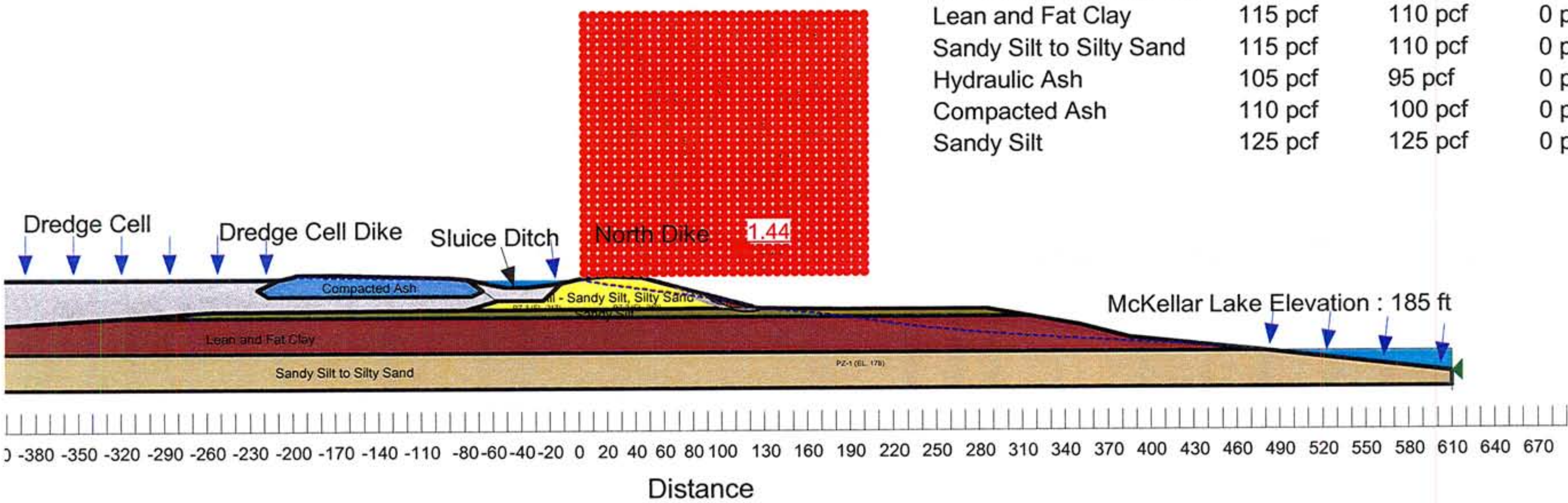
Steady-State Seepage at Section A-A'
For Surcharge Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority
Vertical Gradient Contours, at 0.2 interval
Leow to High : Blue to Red
Dredge Cell Dike
Sluice Ditch
North Dike
McKellar Lake Elevation : 185 ft
-1
-0.8
-0.6
-0.4
-0.2
-260 -230 -200 -170 -140 -110 -80 -60 -40 -20 0 20 40 60 80 100 130 160 190 220 250 280 310 340 370 400 430 460 490 520 550 580 610
Distance

Downstream Shallow Failure Circle

Slope Stability Analysis at Section A-A'
For Surcharge Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt to Silty Sand	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Compacted Ash	110 pcf	100 pcf	0 psf	30 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

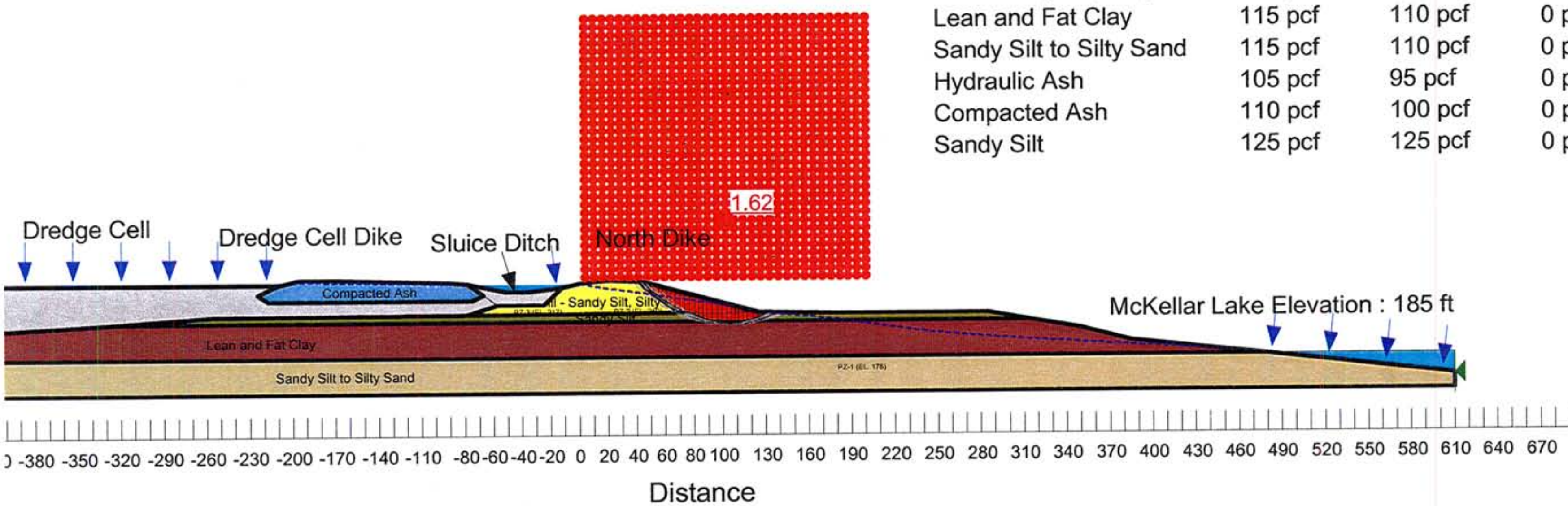


Downstream Deep Failure Circle

Slope Stability Analysis at Section A-A' DF
For Surcharge Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt to Silty Sand	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Compacted Ash	110 pcf	100 pcf	0 psf	30 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

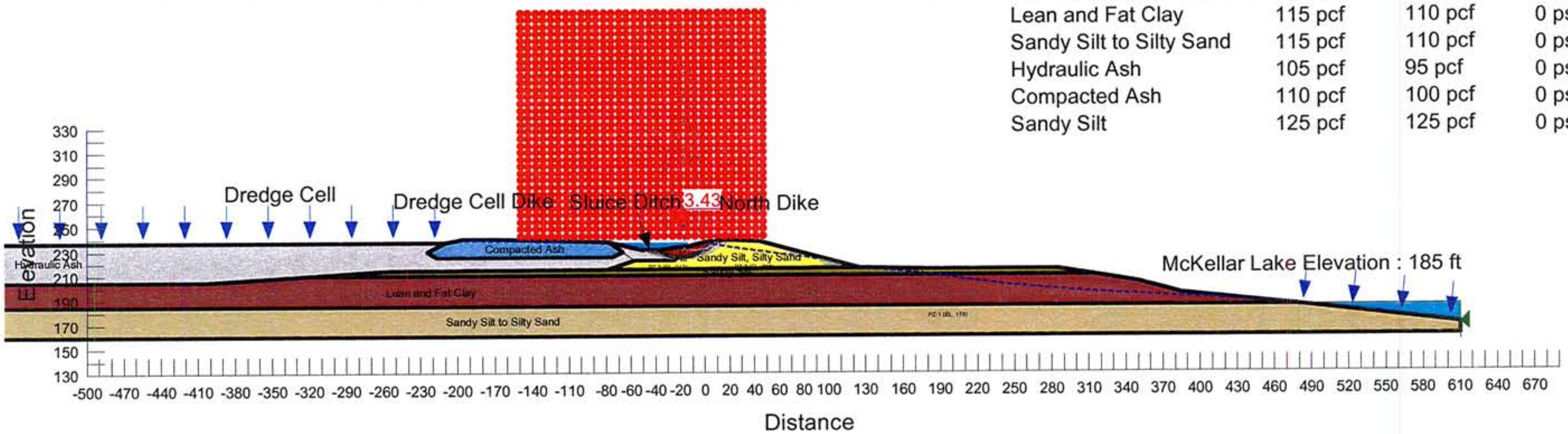


Upstream Shallow Failure Circle

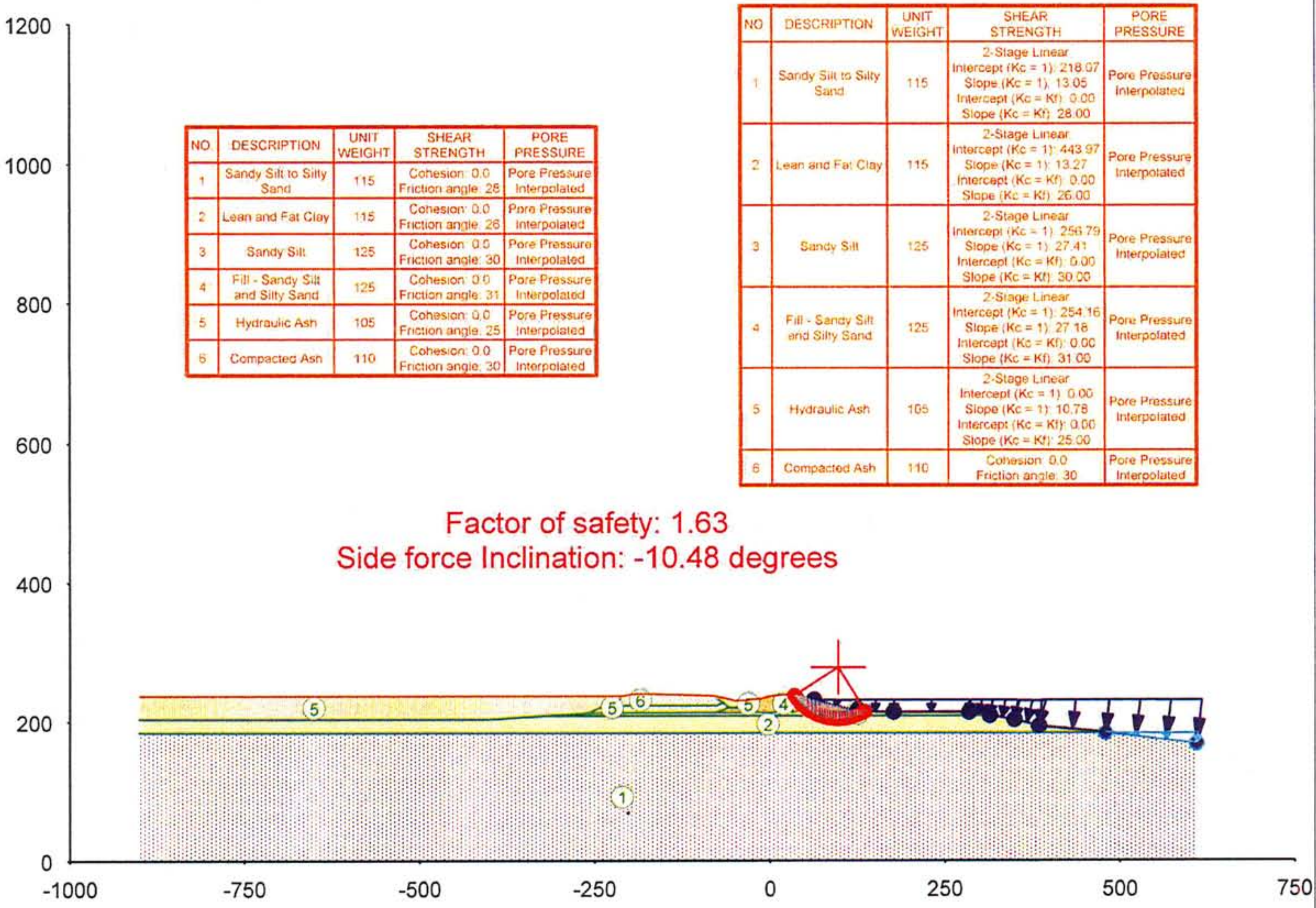
Slope Stability Analysis at Section A-A' UF
For Surcharge Pool Elevation
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt to Silty Sand	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Compacted Ash	110 pcf	100 pcf	0 psf	30 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °



TVA Allen Plant SECTION A-A' - Rapid Drawdown Analysis



NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Sandy Silt to Silty Sand	115	Cohesion: 0.0 Friction angle: 28	Pore Pressure Interpolated
2	Lean and Fat Clay	115	Cohesion: 0.0 Friction angle: 26	Pore Pressure Interpolated
3	Sandy Silt	125	Cohesion: 0.0 Friction angle: 30	Pore Pressure Interpolated
4	Fill - Sandy Silt and Silty Sand	125	Cohesion: 0.0 Friction angle: 31	Pore Pressure Interpolated
5	Hydraulic Ash	105	Cohesion: 0.0 Friction angle: 25	Pore Pressure Interpolated
6	Compacted Ash	110	Cohesion: 0.0 Friction angle: 30	Pore Pressure Interpolated

NO	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Sandy Silt to Silty Sand	115	2-Stage Linear Intercept (Kc = 1): 218.07 Slope (Kc = 1): 13.05 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 28.00	Pore Pressure Interpolated
2	Lean and Fat Clay	115	2-Stage Linear Intercept (Kc = 1): 443.97 Slope (Kc = 1): 13.27 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 26.00	Pore Pressure Interpolated
3	Sandy Silt	125	2-Stage Linear Intercept (Kc = 1): 256.79 Slope (Kc = 1): 27.41 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 30.00	Pore Pressure Interpolated
4	Fill - Sandy Silt and Silty Sand	125	2-Stage Linear Intercept (Kc = 1): 254.16 Slope (Kc = 1): 27.18 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 31.00	Pore Pressure Interpolated
5	Hydraulic Ash	105	2-Stage Linear Intercept (Kc = 1): 0.00 Slope (Kc = 1): 10.78 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 25.00	Pore Pressure Interpolated
6	Compacted Ash	110	Cohesion: 0.0 Friction angle: 30	Pore Pressure Interpolated

Factor of safety: 1.63
Side force Inclination: -10.48 degrees

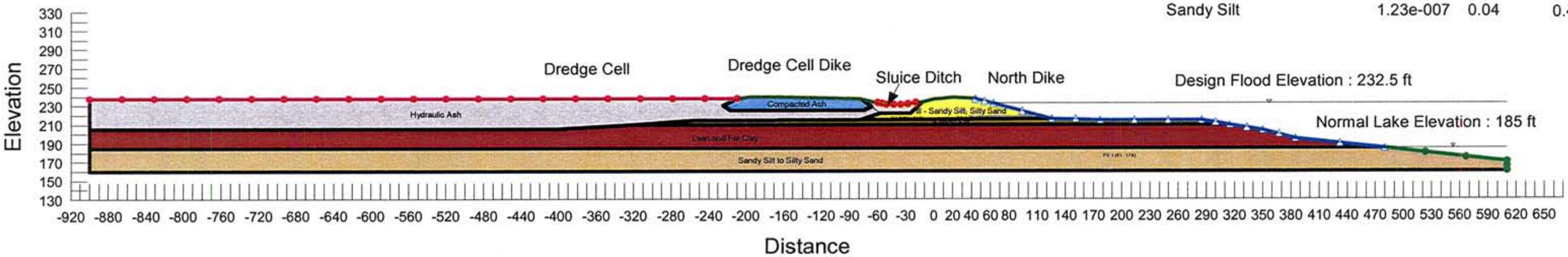
Date: Tue Feb 02 2010 Filename: Section AA-RDD-Type 1.UT4 Time: 14:15:41

Steady-State Seepage at Section A-A'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Sluice Ditch Water Elevation - 233 ft
Dredge Cell Water Elevation - 234
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



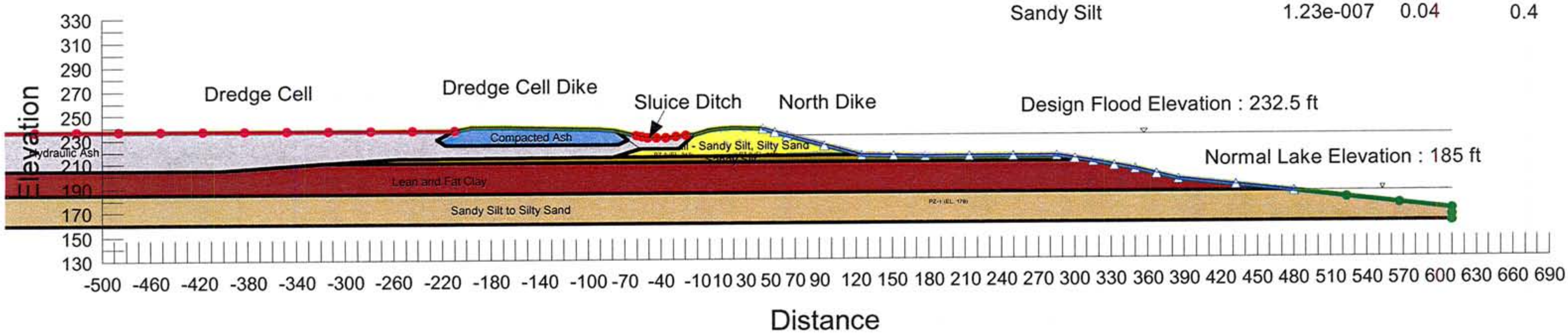
Subsurface Profile and Boundary Condition

Steady-State Seepage at Section A-A'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Boundary Conditions:
Sluice Ditch Water Elevation - 233 ft
Dredge Cell Water Elevation - 234
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



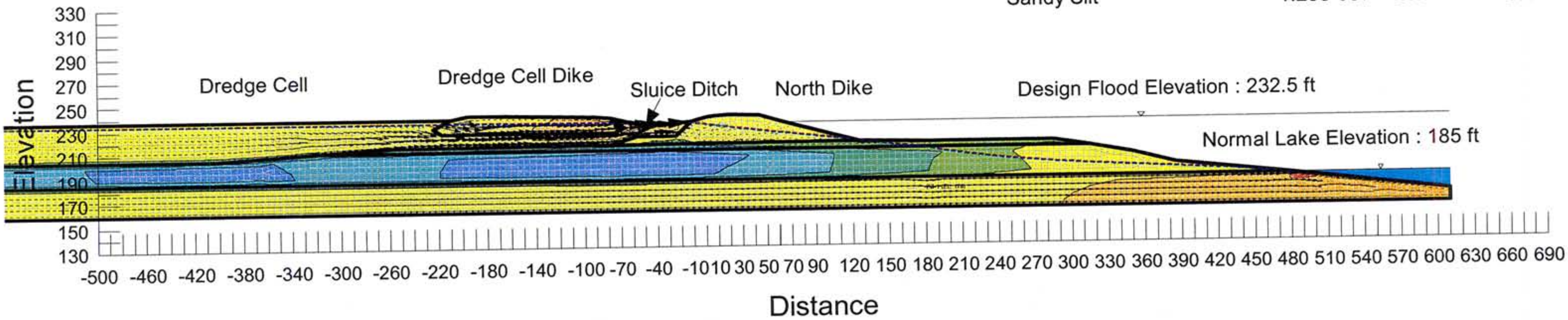
Finite Element Mesh, Flow Vector and Piezometric Surface

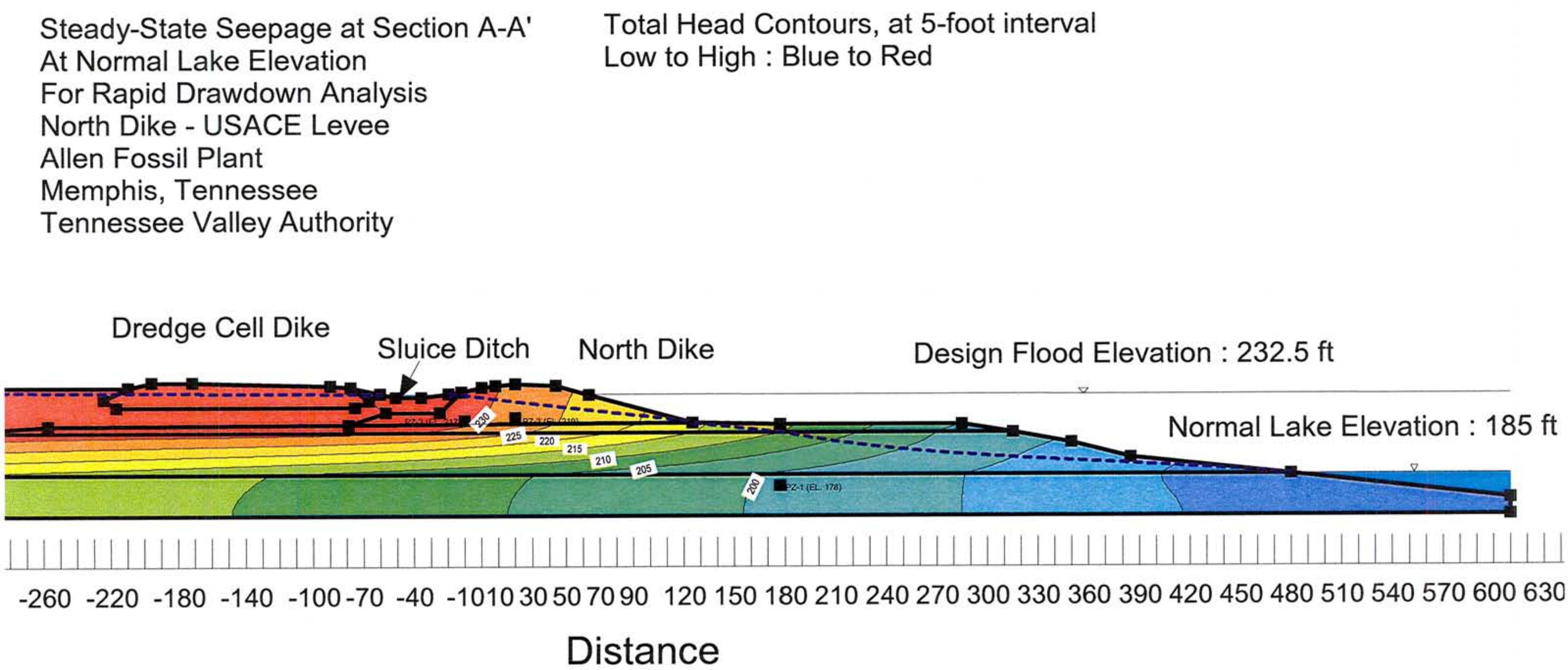
Steady-State Seepage at Section A-A'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Boundary Conditions:
Sluice Ditch Water Elevation - 233 ft
Dredge Cell Water Elevation - 234
Lake McKellar Water Elevation - 185 ft
Potential Seepage Face Total Flux - 0 ft

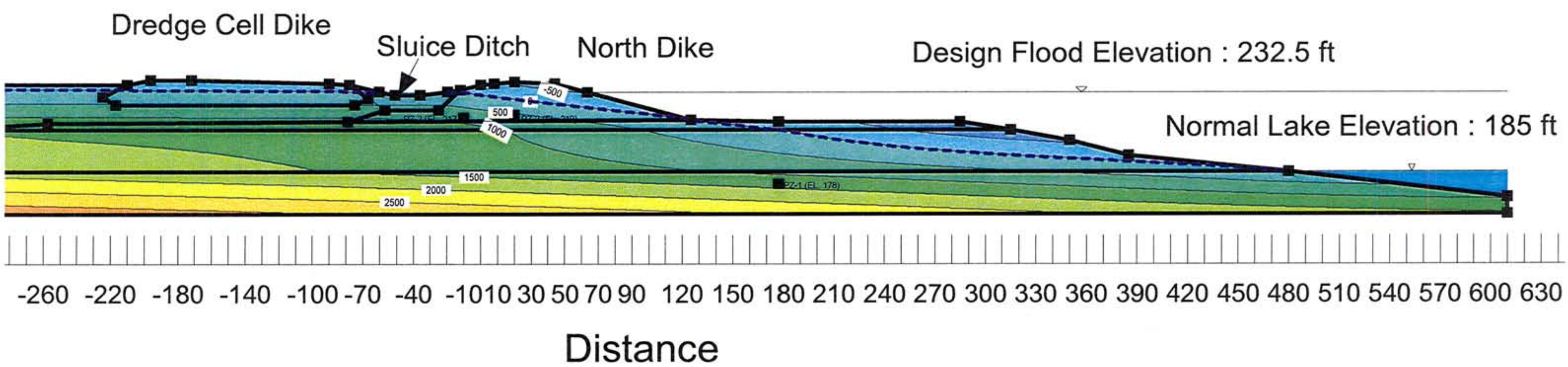
Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4




Steady-State Seepage at Section A-A'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority
Total Head Contours, at 5-foot interval
Low to High : Blue to Red
Dredge Cell Dike
Sluice Ditch
North Dike
Design Flood Elevation : 232.5 ft
Normal Lake Elevation : 185 ft
230
225
220
215
210
205
200
PZ-1 (EL. 178)
-260 -220 -180 -140 -100 -70 -40 -10 10 30 50 70 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540 570 600 630
Distance

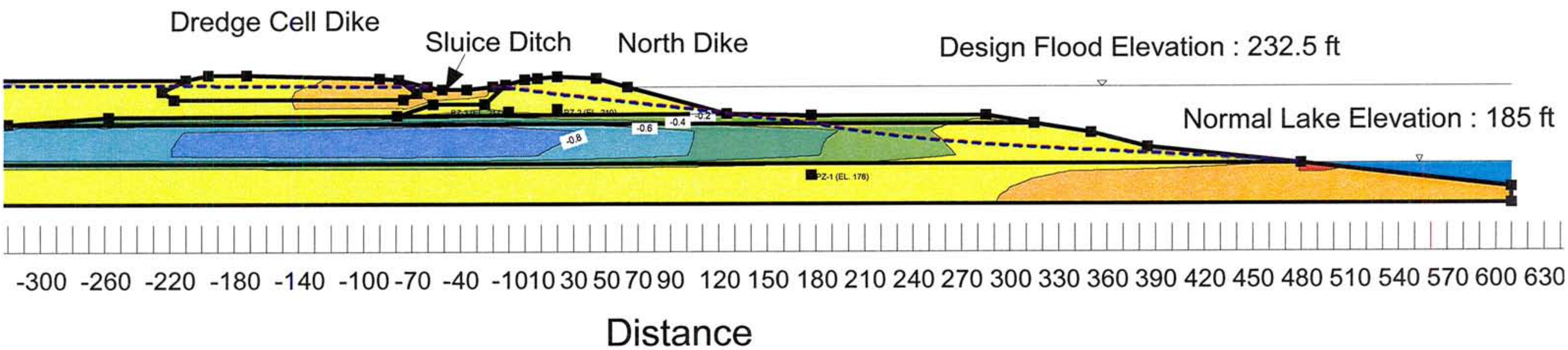
Steady-State Seepage at Section A-A'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Pore Water Pressure Contours, at 500 psf interval
Low to High : Blue to Red



Steady-State Seepage at Section A-A'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Vertical Gradient Contours, at 0.2 interval
Low to High : Blue to Red

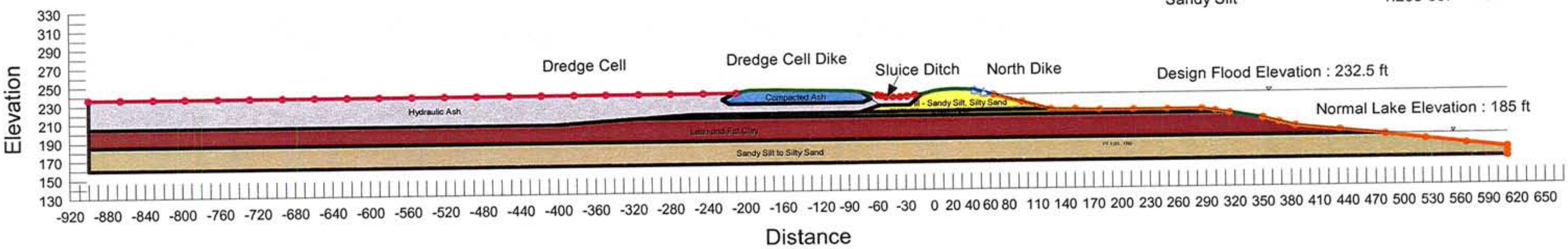


Steady-State Seepage at Section A-A' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Sluice Ditch Water Elevation - 233 ft
Dredge Cell Water Elevation - 234
Design Flood Elevation - 232.5 ft
Potential Seepage Face Total Flux - 0 ft

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



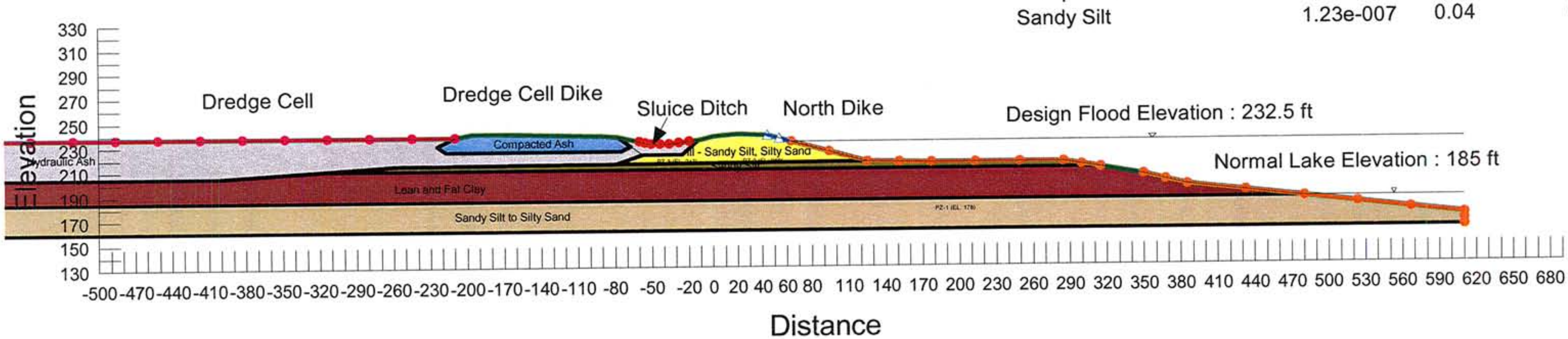
Subsurface Profile and Boundary Condition

Steady-State Seepage at Section A-A' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Boundary Conditions:
Sluice Ditch Water Elevation - 233 ft
Dredge Cell Water Elevation - 234
Design Flood Elevation - 232.5 ft
Potential Seepage Face Total Flux - 0 ft

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



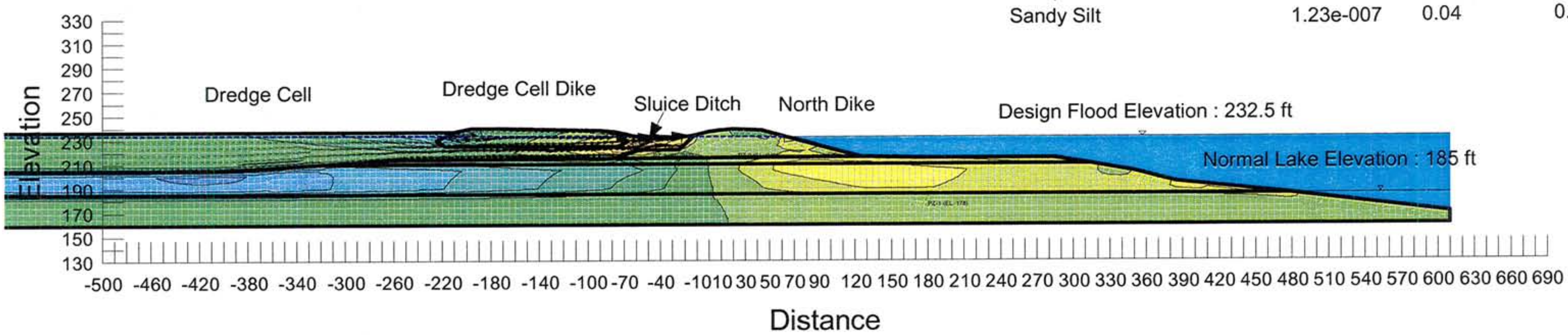
Finite Element Mesh, Flow Vector and Piezometric Surface

Steady-State Seepage at Section A-A' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

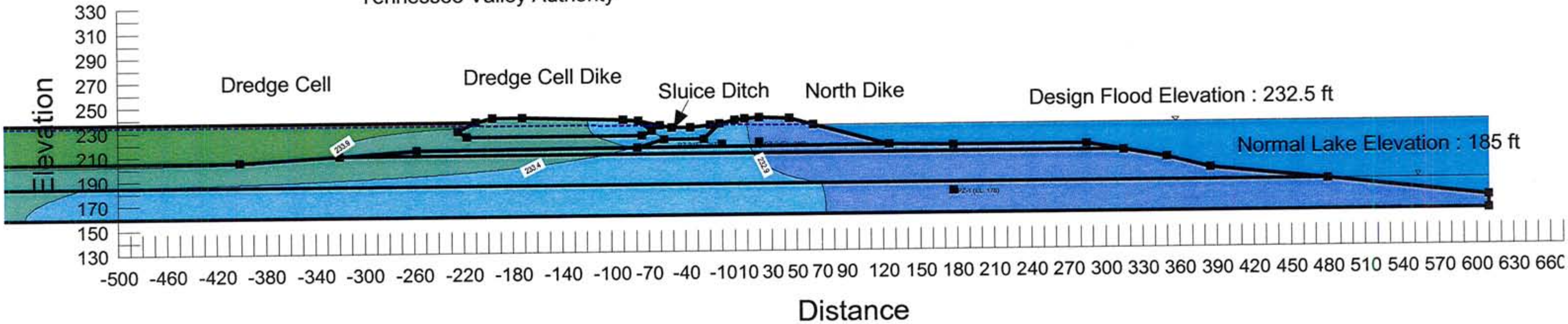
Boundary Conditions:
Sluice Ditch Water Elevation - 233 ft
Dredge Cell Water Elevation - 234
Design Flood Elevation - 232.5 ft
Potential Seepage Face Total Flux - 0 ft

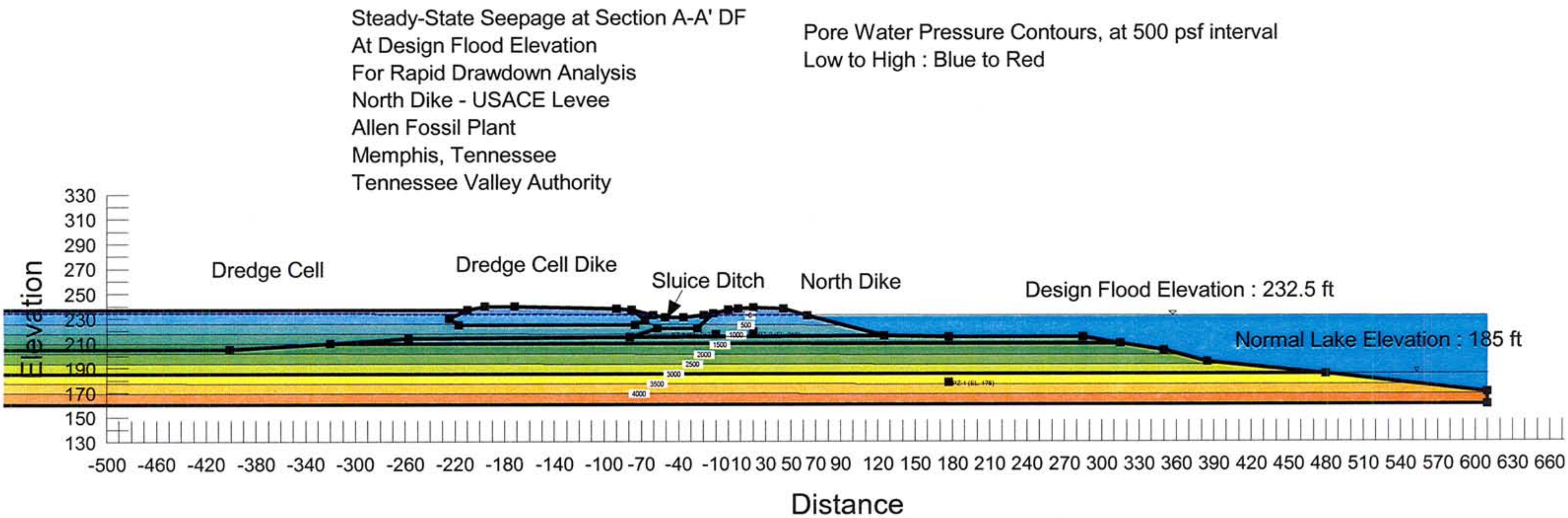
Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt to Silty Sand	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Compacted Ash	2.5e-005	0.04	0.46
Sandy Silt	1.23e-007	0.04	0.4



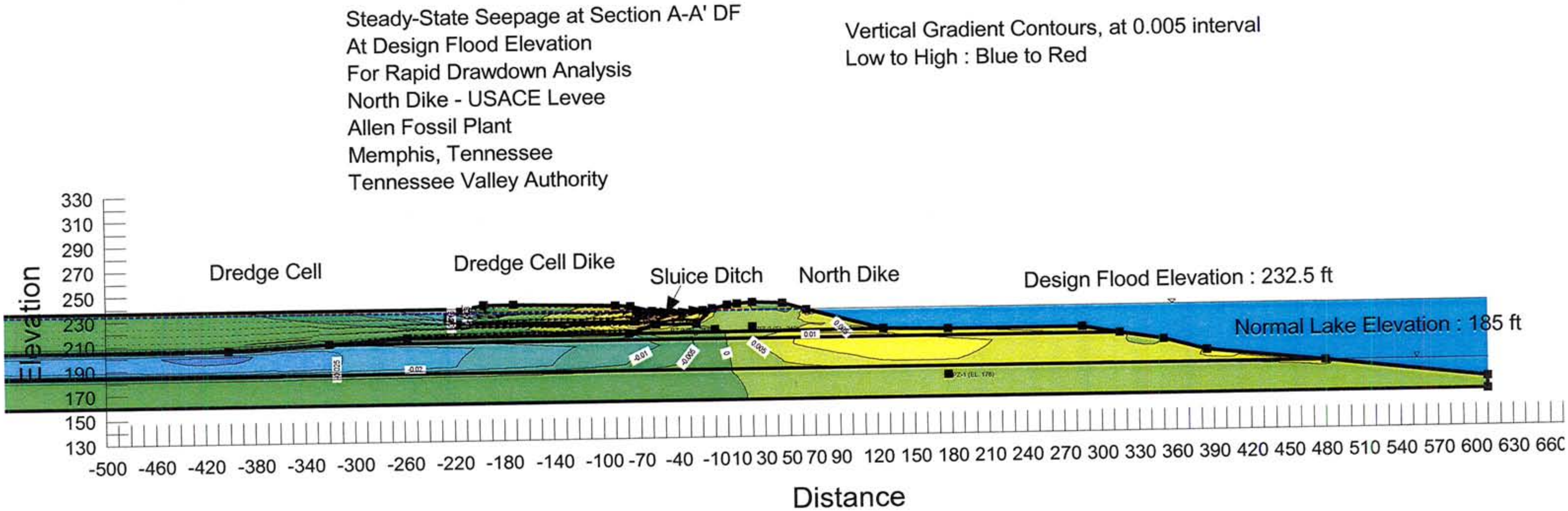
Steady-State Seepage at Section A-A' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Total Head Contours, at 0.5-foot interval
Low to High : Blue to Red





Steady-State Seepage at Section A-A' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority
Pore Water Pressure Contours, at 500 psf interval
Low to High : Blue to Red
Dredge Cell
Dredge Cell Dike
Sluice Ditch
North Dike
Design Flood Elevation : 232.5 ft
Normal Lake Elevation : 185 ft
500
1000
1500
2000
2500
3000
3500
4000
Elevation
330
310
290
270
250
230
210
190
170
150
130
-500 -460 -420 -380 -340 -300 -260 -220 -180 -140 -100 -70 -40 -10 10 30 50 70 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540 570 600 630 660
Distance



Steady-State Seepage at Section A-A' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority
Vertical Gradient Contours, at 0.005 interval
Low to High : Blue to Red
Dredge Cell
Dredge Cell Dike
Sluice Ditch
North Dike
Design Flood Elevation : 232.5 ft
Normal Lake Elevation : 185 ft
Elevation
330
310
290
270
250
230
210
190
170
150
130
-500 -460 -420 -380 -340 -300 -260 -220 -180 -140 -100 -70 -40 -10 10 30 50 70 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540 570 600 630 660
Distance

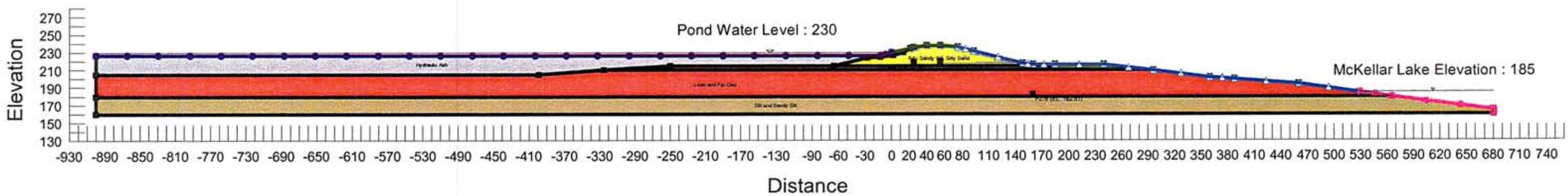
Cross-Section B-B’

Steady State Seepage at Section B-B'
For Normal Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Boundary Conditions:
Ash Pond Water Elevation - 230 ft
McKellar Lake Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



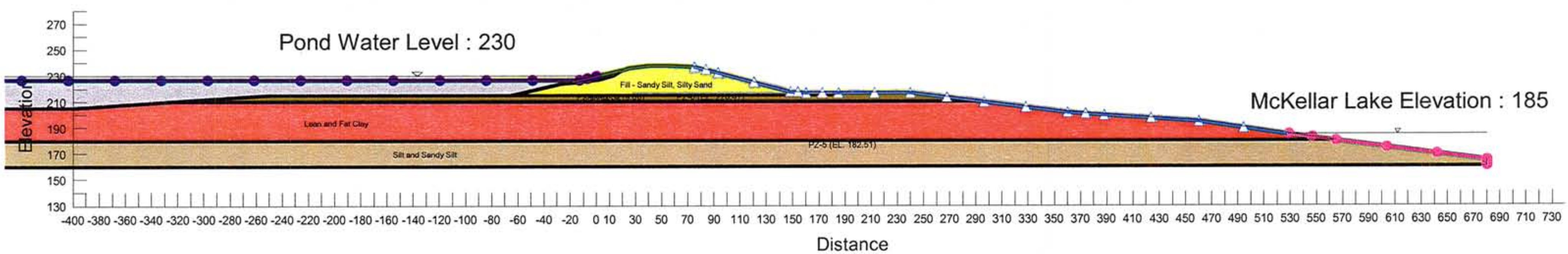
Subsurface Profile and Boundary Conditions

Steady State Seepage at Section B-B'
For Normal Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Boundary Conditions:
Ash Pond Water Elevation - 230 ft
McKellar Lake Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



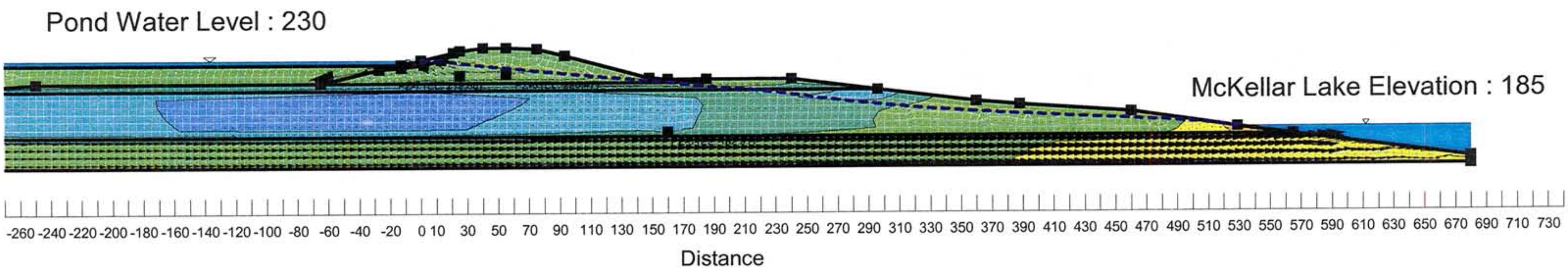
Finite Element Mesh, Flow Vectors and Piezometric Surface

Steady State Seepage at Section B-B'
For Normal Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

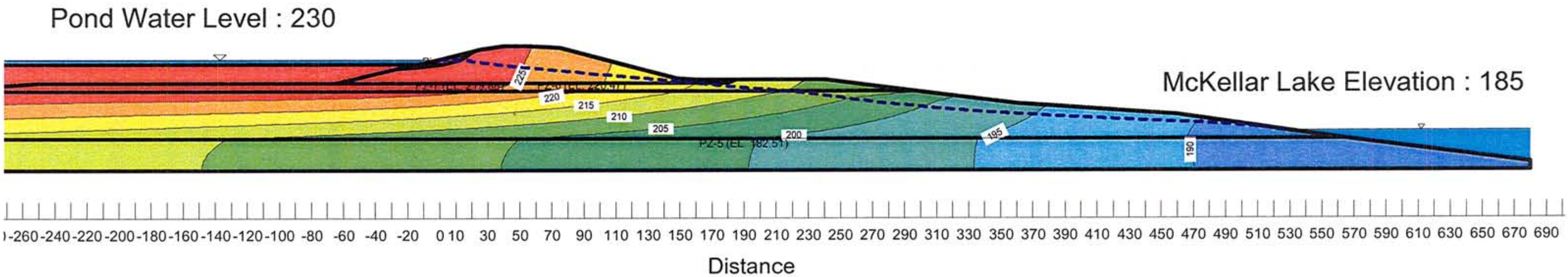
Boundary Conditions:
Ash Pond Water Elevation - 230 ft
McKellar Lake Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



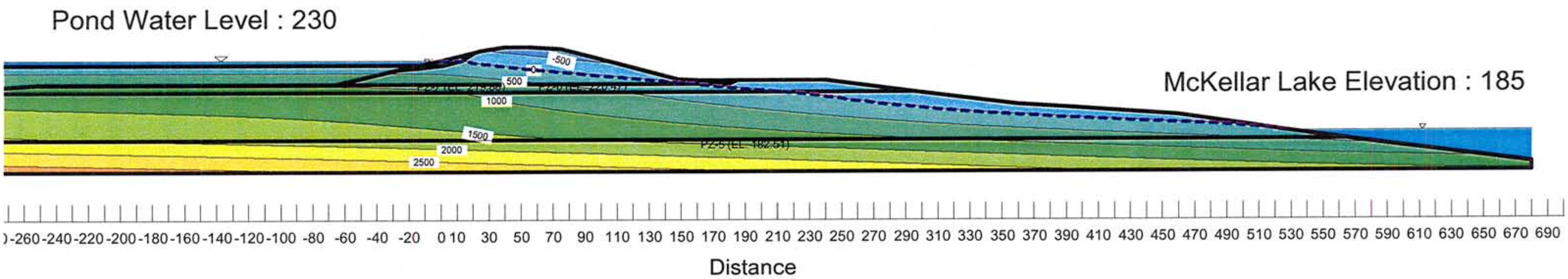
Steady State Seepage at Section B-B'
For Normal Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

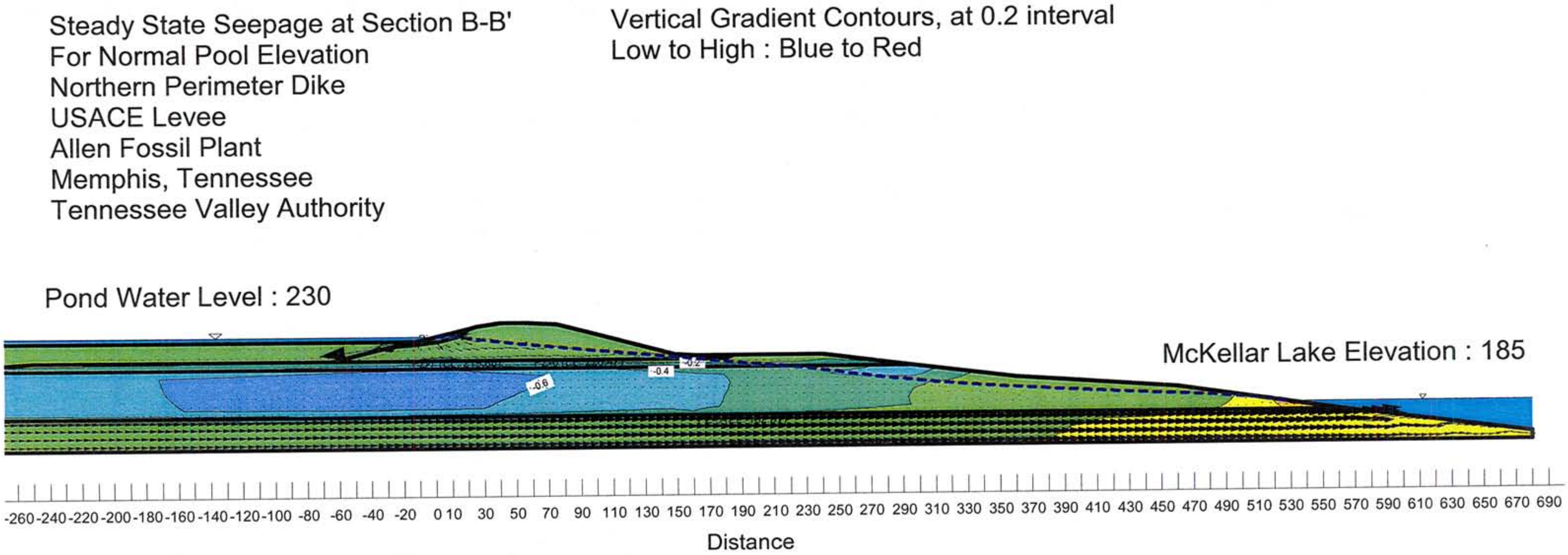
Total Head Contours, at 5-foot interval
Low to High : Blue to Red



Steady State Seepage at Section B-B'
For Normal Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Pore Water Pressure Contours, at 500-psf interval
Low to High : Blue to Red





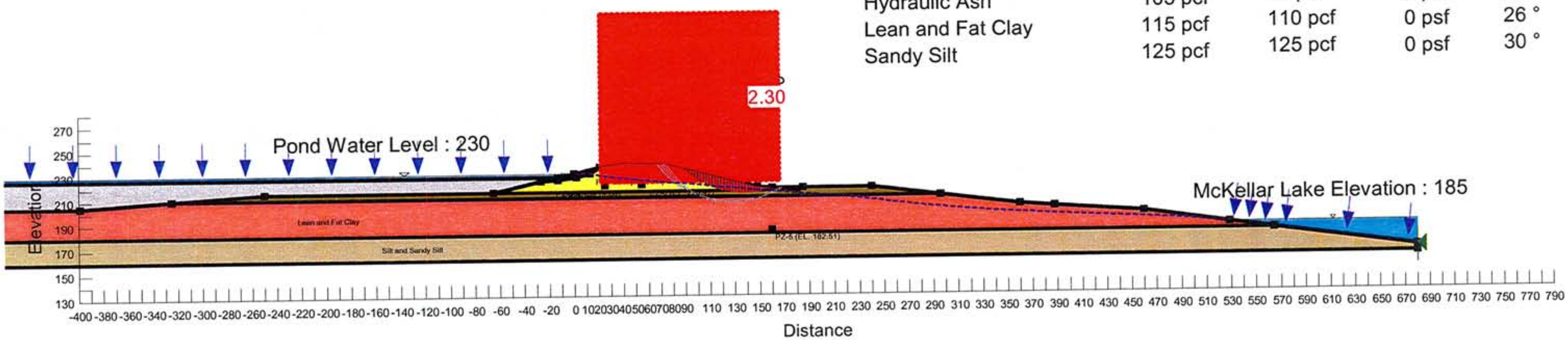
Steady State Seepage at Section B-B'
For Normal Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority
Vertical Gradient Contours, at 0.2 interval
Low to High : Blue to Red
Pond Water Level : 230
McKellar Lake Elevation : 185
-0.2
-0.4
-0.6
-260 -240 -220 -200 -180 -160 -140 -120 -100 -80 -60 -40 -20 0 10 30 50 70 90 110 130 150 170 190 210 230 250 270 290 310 330 350 370 390 410 430 450 470 490 510 530 550 570 590 610 630 650 670 690
Distance

Downstream Shallow Failure Circle

Slope Stability Analysis at Section B-B'
For Normal Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Rip Rap	140 pcf	140 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

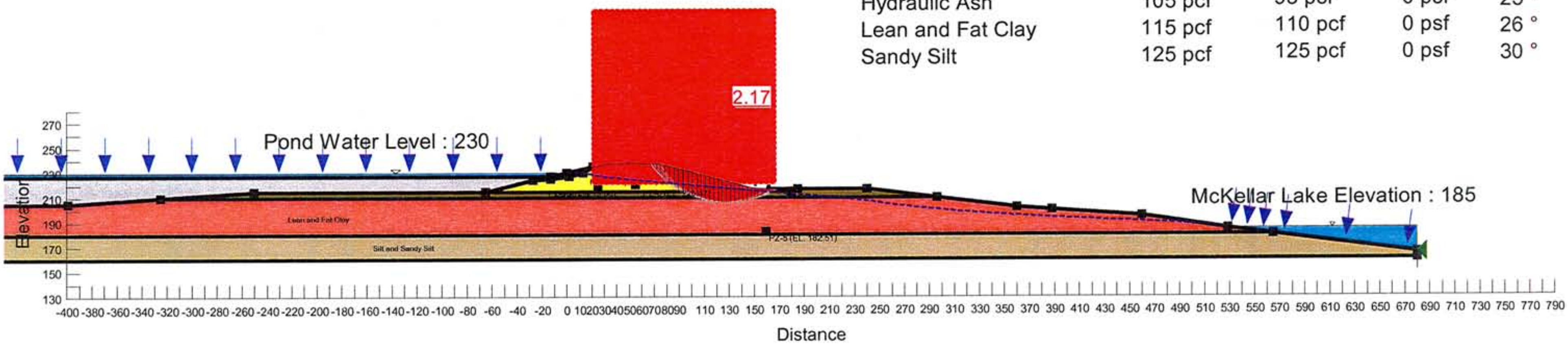


Downstream Deep Failure Circle

Slope Stability Analysis at Section B-B' DF
For Normal Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Rip Rap	140 pcf	140 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

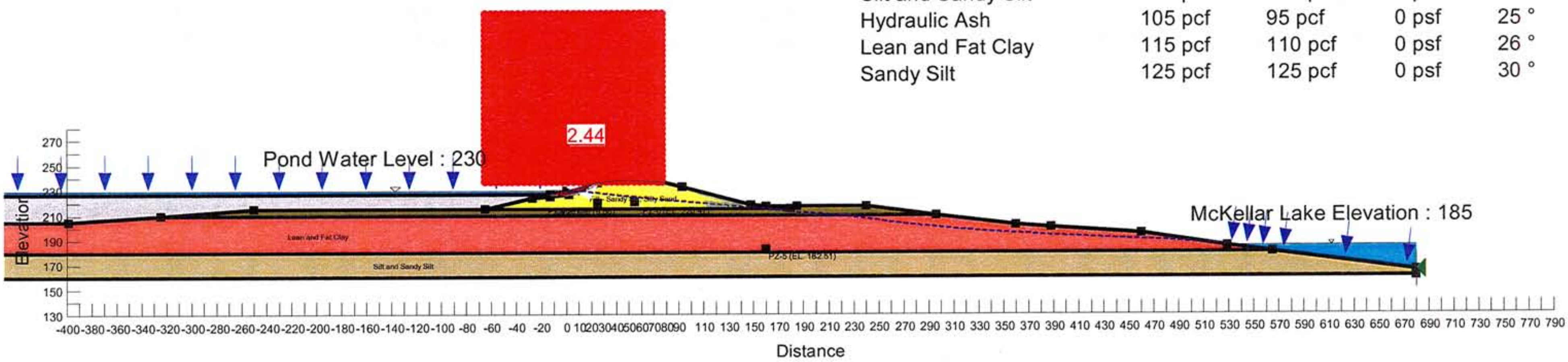


Upstream Shallow Failure Circle

Slope Stability Analysis at Section B-B' UF
For Normal Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Rip Rap	140 pcf	140 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

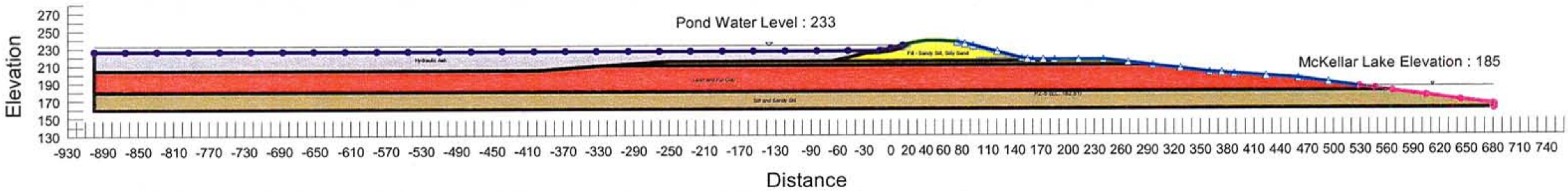


Steady State Seepage at Station B-B'
For Maximum Storage Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Ash Pond Water Elevation - 233 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



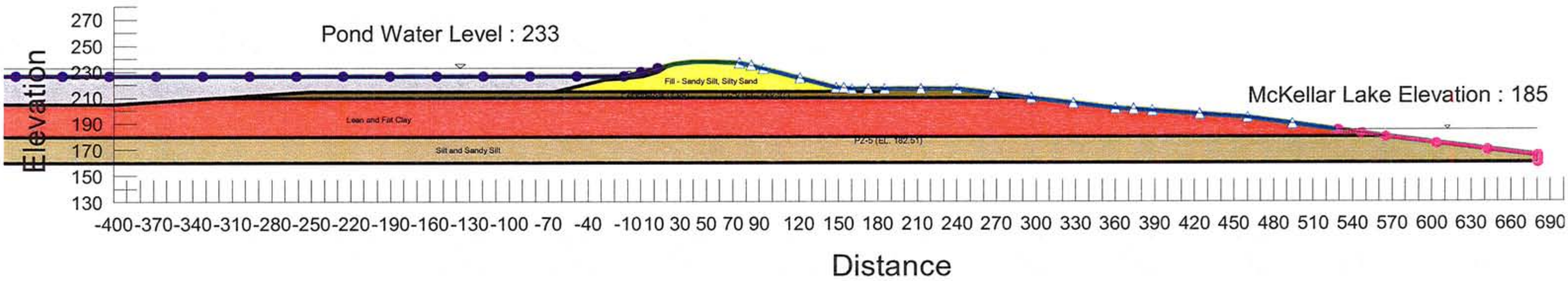
Subsurface Profile and Boundary Conditions

Steady State Seepage at Station B-B'
For Maximum Storage Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Boundary Conditions:
Ash Pond Water Elevation - 233 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



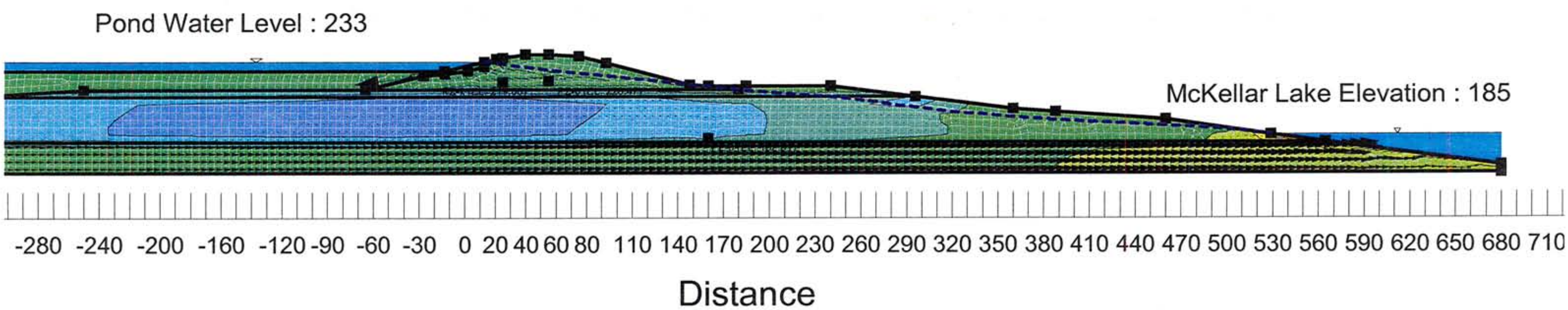
Finite Element Mesh, Flow Vector and Piezometric Surface

Steady State Seepage at Station B-B'
For Maximum Storage Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

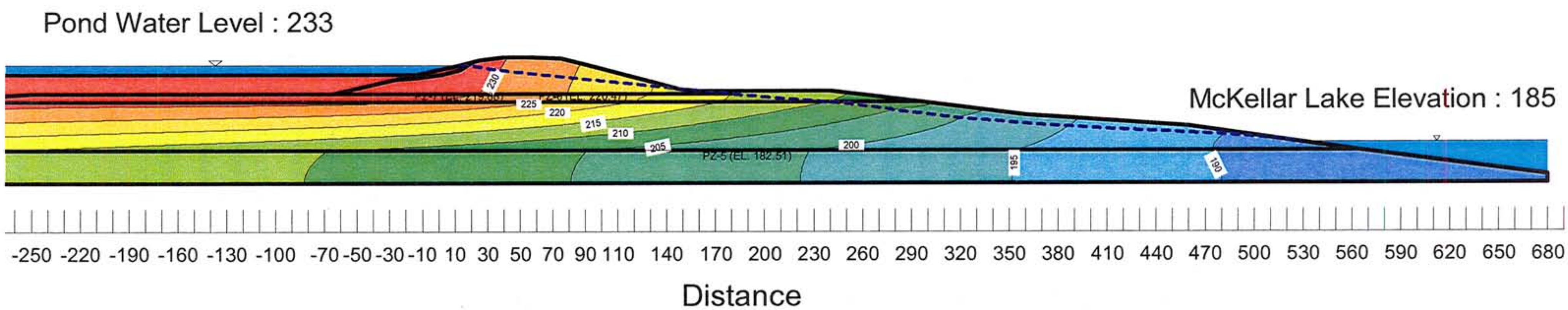
Boundary Conditions:
Ash Pond Water Elevation - 233 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



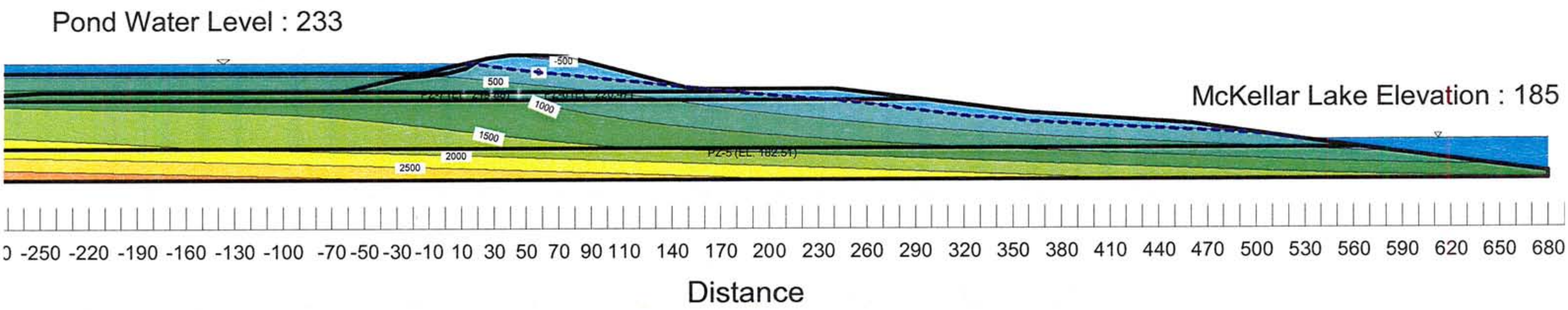
Steady State Seepage at Station B-B'
For Maximum Storage Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Total Head Contours, at 5-foot interval
Low to High : Blue to Red



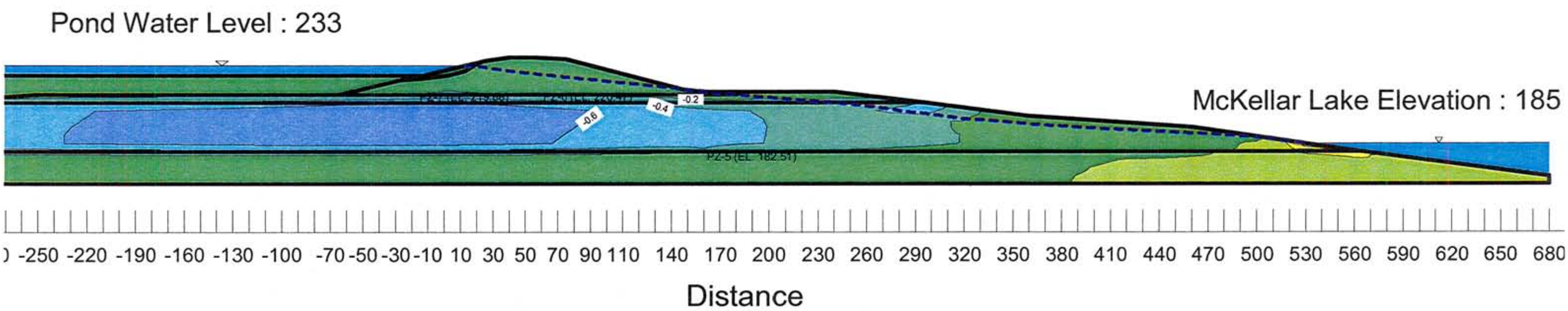
Steady State Seepage at Station B-B'
For Maximum Storage Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Pore Water Pressure Contours, at 500-psf interval
Low to High : Blue to Red



Steady State Seepage at Station B-B'
For Maximum Storage Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Vertical Gradient Contours, at 0.2 interval
Low to High : Blue to Red

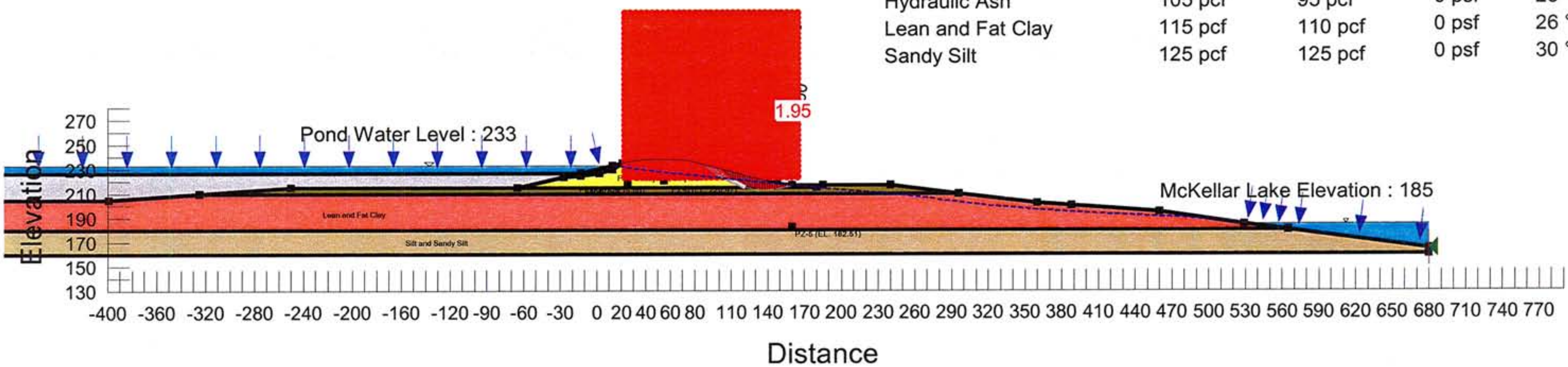


Downstream Shallow Failure Circle

Slope Stability Analysis at Section B-B'
For Maximum Storage Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Rip Rap	140 pcf	140 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

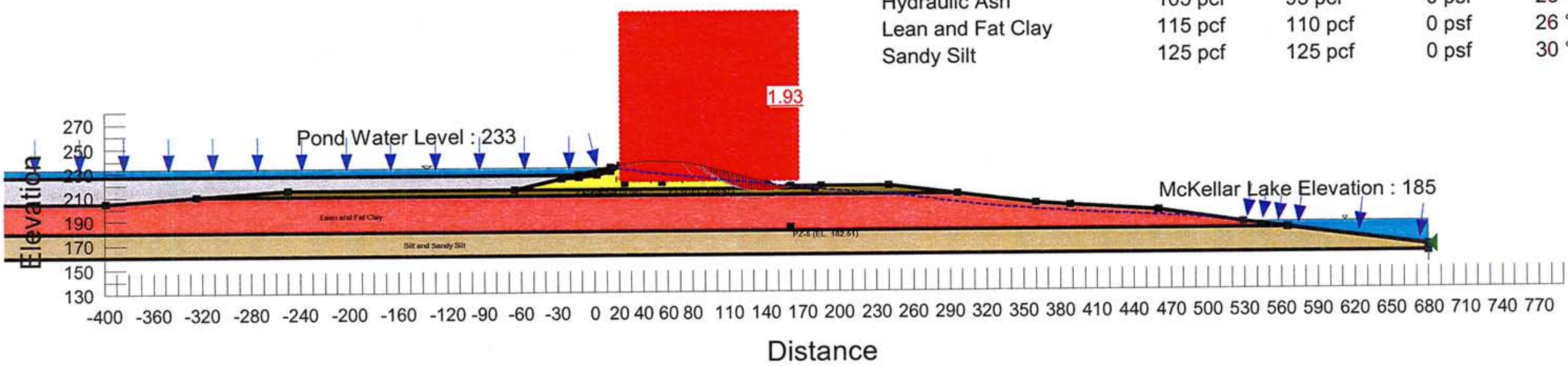


Downstream Deep Failure Circle

Slope Stability Analysis at Section B-B' DF
For Maximum Storage Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Rip Rap	140 pcf	140 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

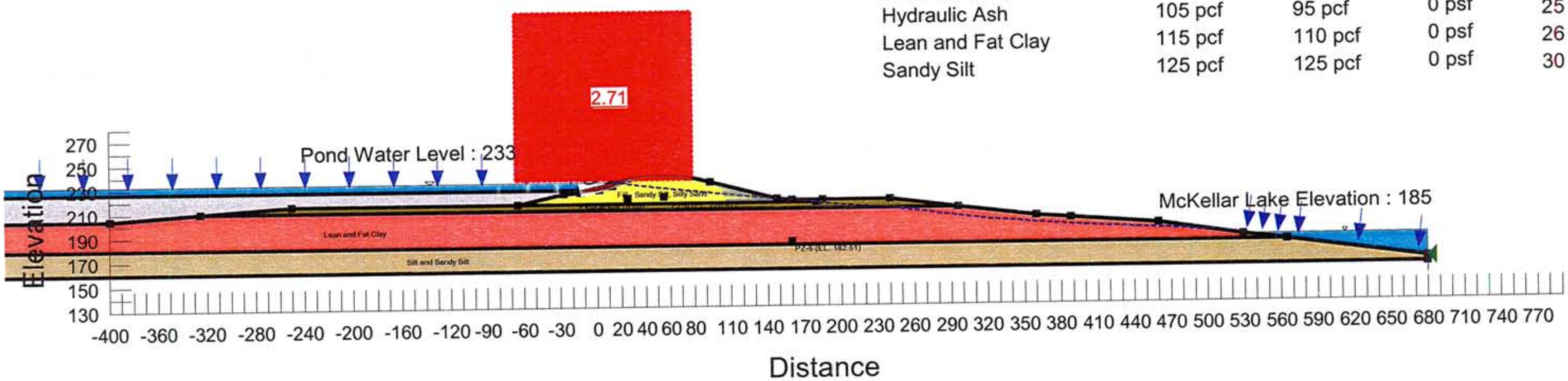


Upstream Shallow Failure Circle

Slope Stability Analysis at Section B-B' UF
For Maximum Storage Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Rip Rap	140 pcf	140 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

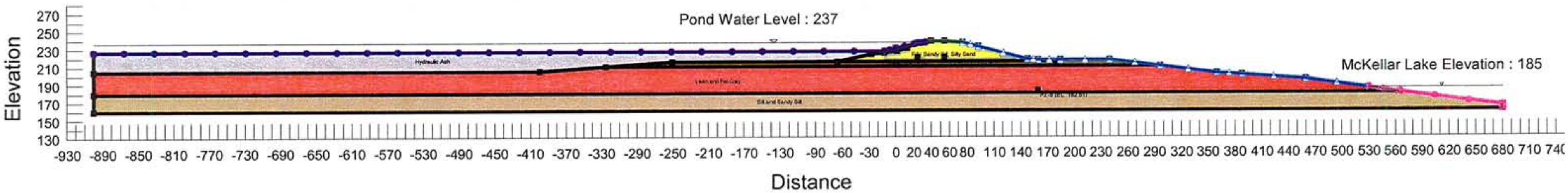


Steady State Seepage at Section B-B'
For Surcharge Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Ash Pond Water Elevation - 237 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



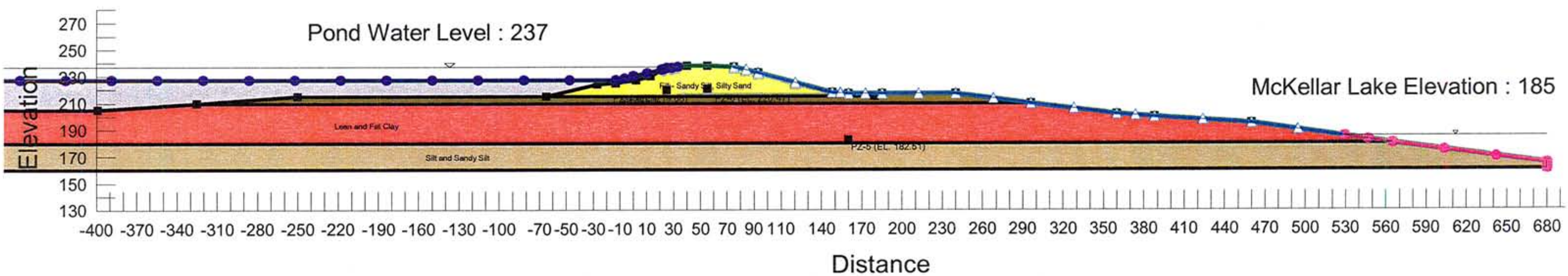
Subsurface Profile and Boundary Conditions

Steady State Seepage at Section B-B'
For Surcharge Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Boundary Conditions:
Ash Pond Water Elevation - 237 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



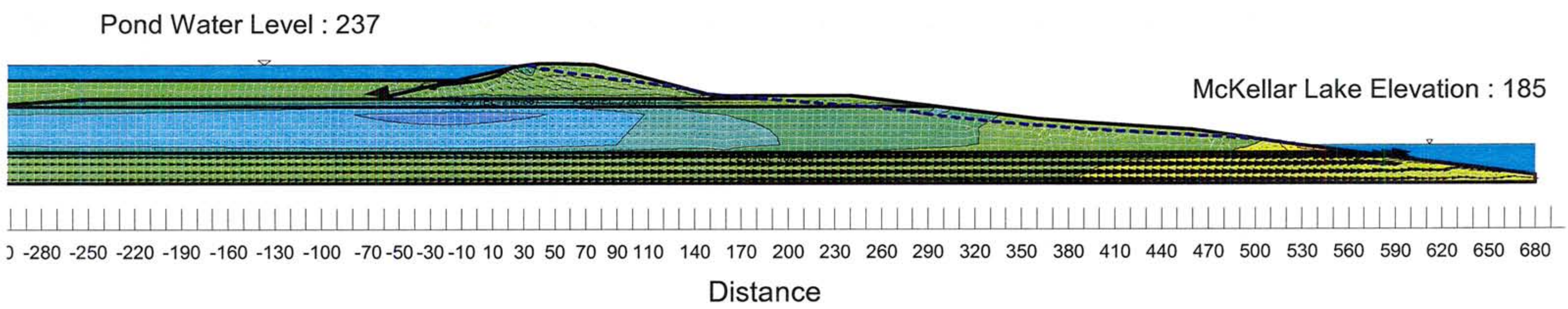
Finite Element Mesh, Flow Vector and Piezometric Surface

Steady State Seepage at Section B-B'
For Surcharge Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

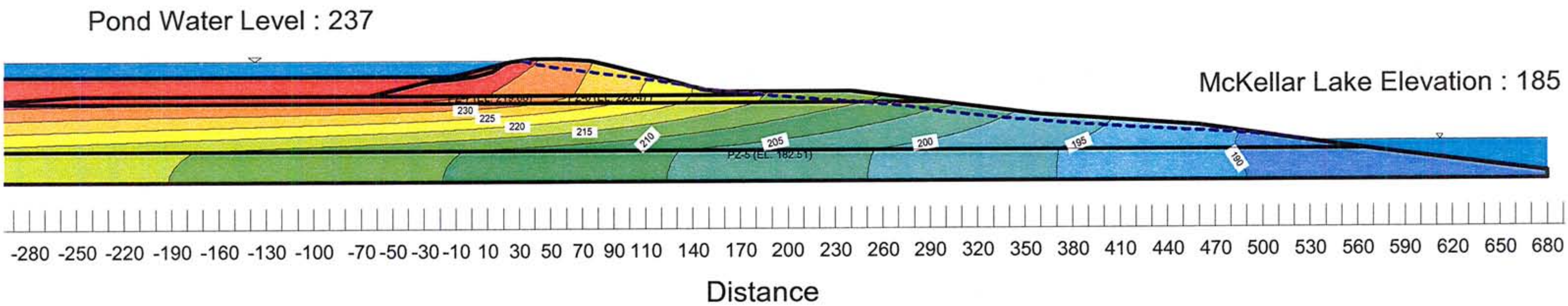
Boundary Conditions:
Ash Pond Water Elevation - 237 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



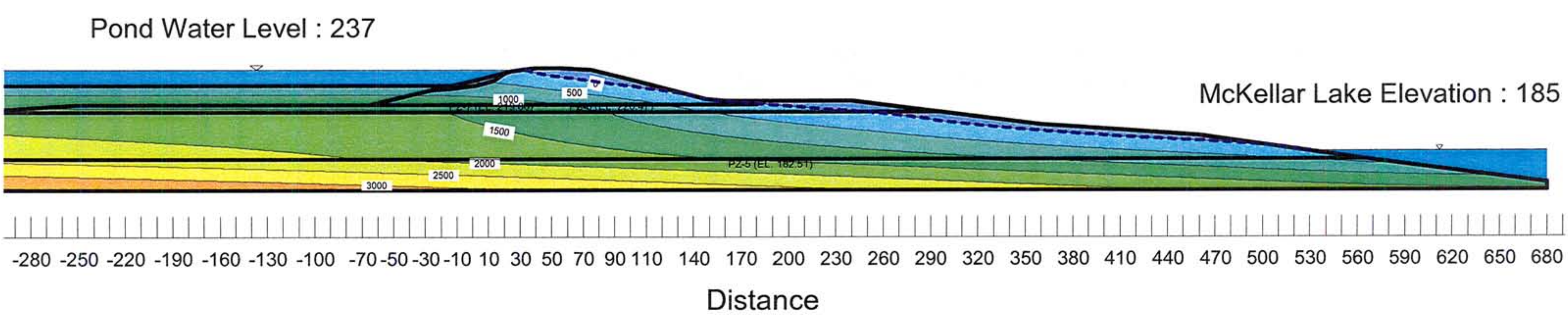
Steady State Seepage at Section B-B'
For Surcharge Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Total Head Contours, at 5-foot interval
Low to High : Blue to Red



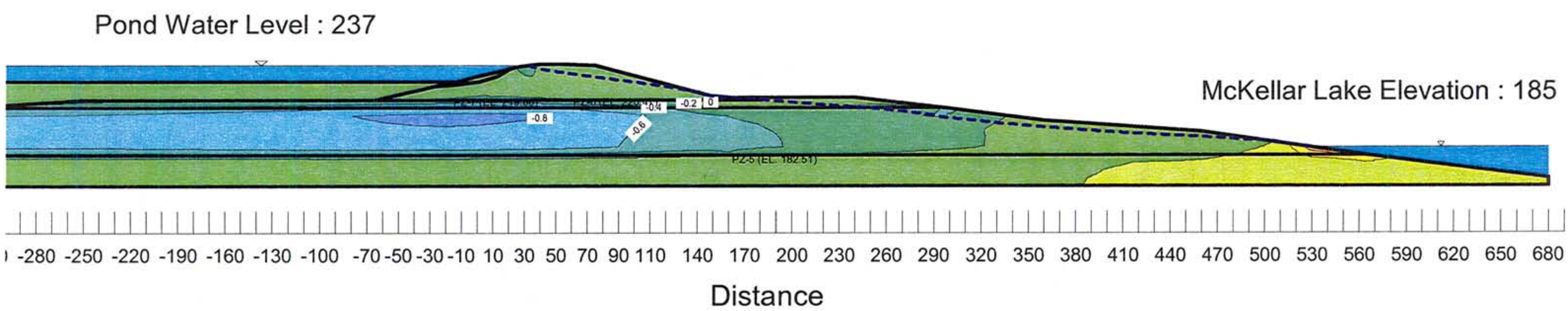
Steady State Seepage at Section B-B'
For Surcharge Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Pore Water Pressure Contours, at 500 psf interval
Low to High : Blue to Red



Steady State Seepage at Section B-B'
For Surcharge Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Vertical Gradient Contours, at 0.2 interval
Low to High : Blue to Red

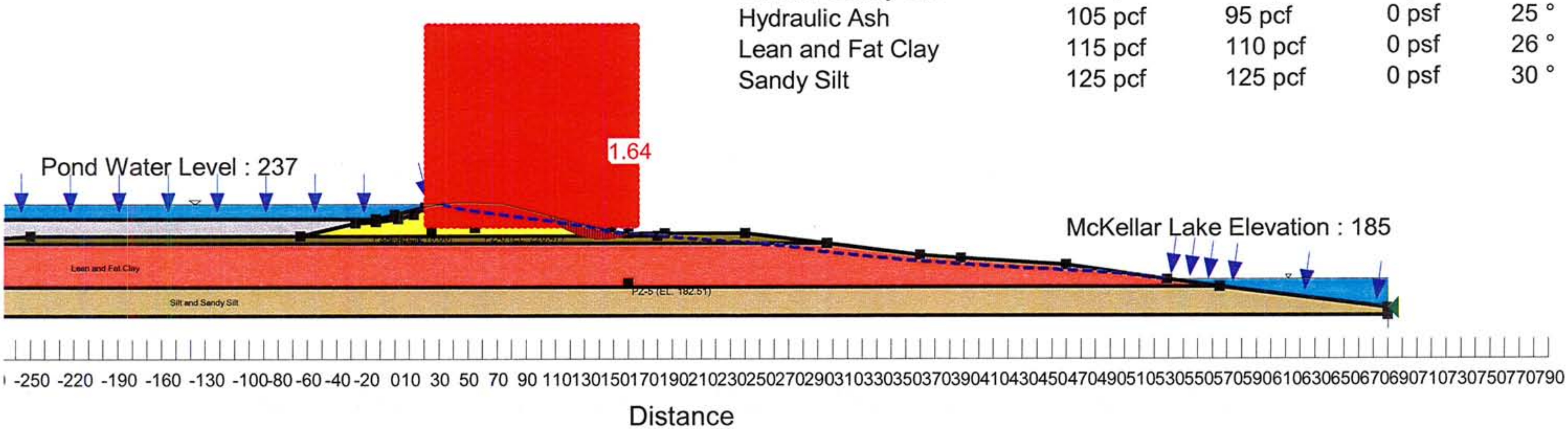


Downstream Shallow Failure Circle

Slope Stability Analysis at Section B-B'
For Surcharge Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Rip Rap	140 pcf	140 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

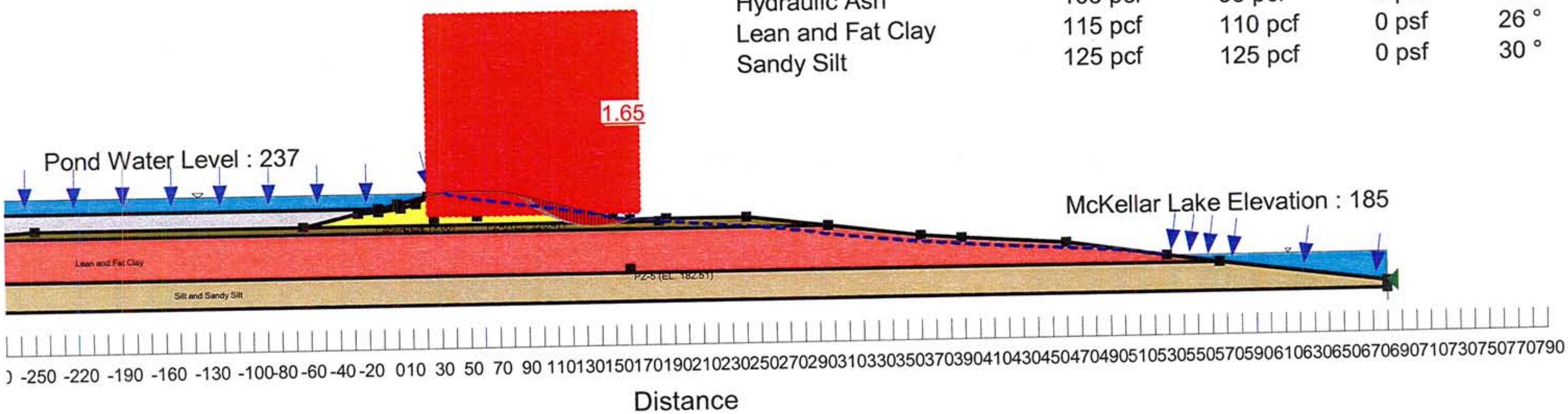


Downstream Deep Failure Circle

Slope Stability Analysis at Section B-B' DF
For Surcharge Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Rip Rap	140 pcf	140 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °

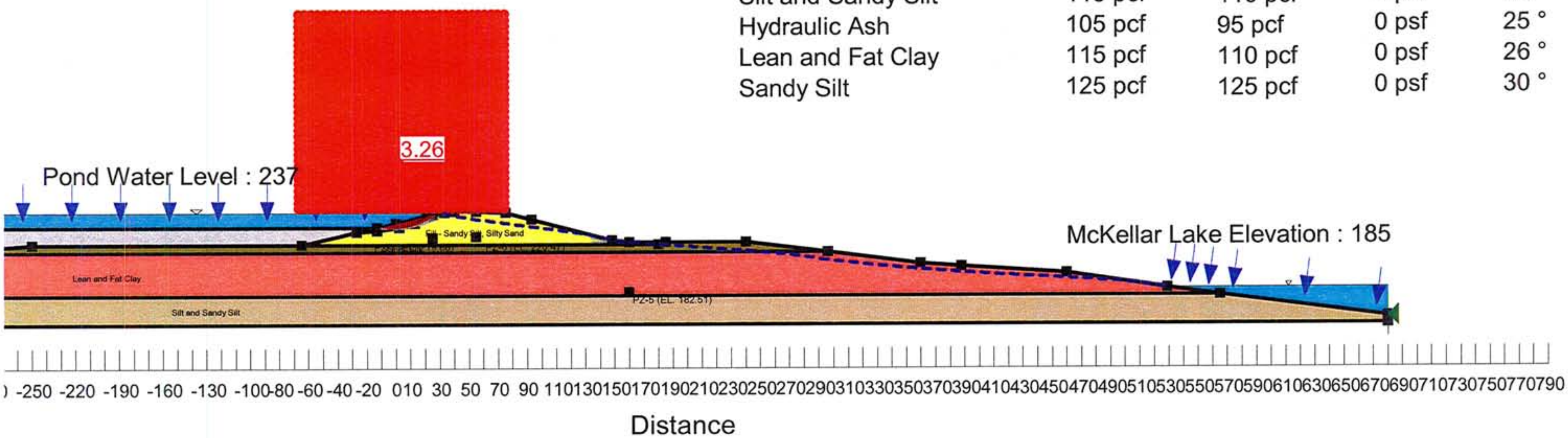


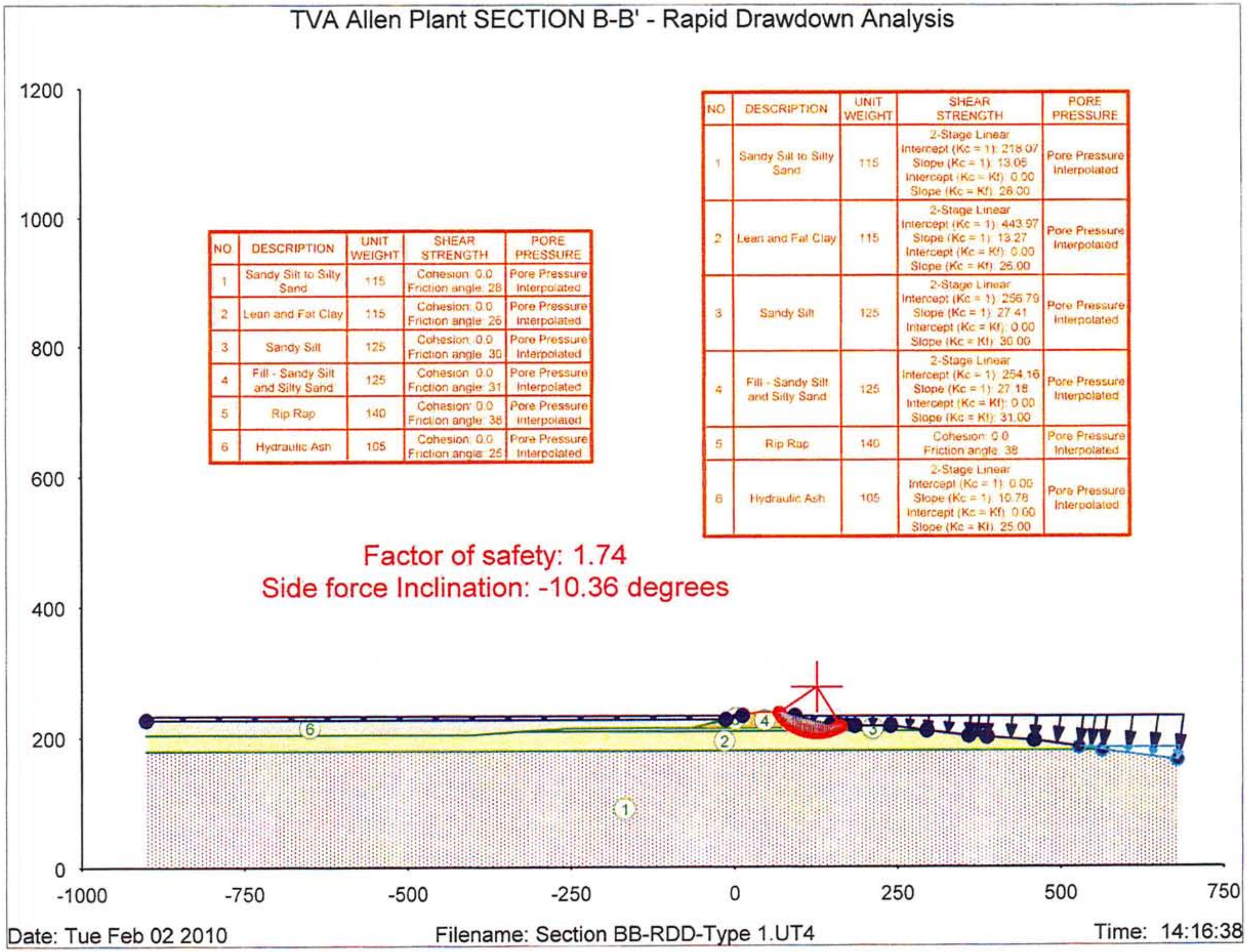
Upstream Shallow Failure Circle

Slope Stability Analysis at Section B-B' UF
For Surcharge Pool Elevation
Northern Perimeter Dike
USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	0 psf	31 °
Rip Rap	140 pcf	140 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	0 psf	28 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	25 °
Lean and Fat Clay	115 pcf	110 pcf	0 psf	26 °
Sandy Silt	125 pcf	125 pcf	0 psf	30 °





NO	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Sandy Silt to Silty Sand	115	Cohesion: 0.0 Friction angle: 28	Pore Pressure Interpolated
2	Lean and Fat Clay	115	Cohesion: 0.0 Friction angle: 26	Pore Pressure Interpolated
3	Sandy Silt	125	Cohesion: 0.0 Friction angle: 30	Pore Pressure Interpolated
4	Fill - Sandy Silt and Silty Sand	125	Cohesion: 0.0 Friction angle: 31	Pore Pressure Interpolated
5	Rip Rap	140	Cohesion: 0.0 Friction angle: 38	Pore Pressure Interpolated
6	Hydraulic Ash	105	Cohesion: 0.0 Friction angle: 25	Pore Pressure Interpolated

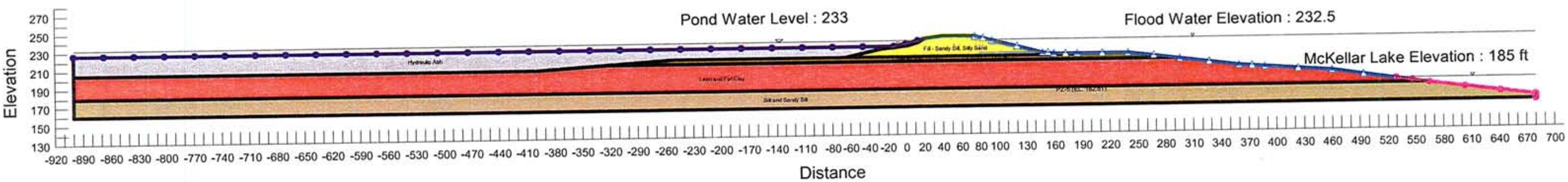
NO	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Sandy Silt to Silty Sand	115	2-Stage Linear Intercept (Kc = 1): 218.07 Slope (Kc = 1): 13.05 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 28.00	Pore Pressure Interpolated
2	Lean and Fat Clay	115	2-Stage Linear Intercept (Kc = 1): 443.97 Slope (Kc = 1): 13.27 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 26.00	Pore Pressure Interpolated
3	Sandy Silt	125	2-Stage Linear Intercept (Kc = 1): 256.79 Slope (Kc = 1): 27.41 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 30.00	Pore Pressure Interpolated
4	Fill - Sandy Silt and Silty Sand	125	2-Stage Linear Intercept (Kc = 1): 254.16 Slope (Kc = 1): 27.18 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 31.00	Pore Pressure Interpolated
5	Rip Rap	140	Cohesion: 0.0 Friction angle: 38	Pore Pressure Interpolated
6	Hydraulic Ash	105	2-Stage Linear Intercept (Kc = 1): 0.00 Slope (Kc = 1): 10.78 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 25.00	Pore Pressure Interpolated

Steady State Seepage at Station B-B'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Ash Pond Water Elevation - 233 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



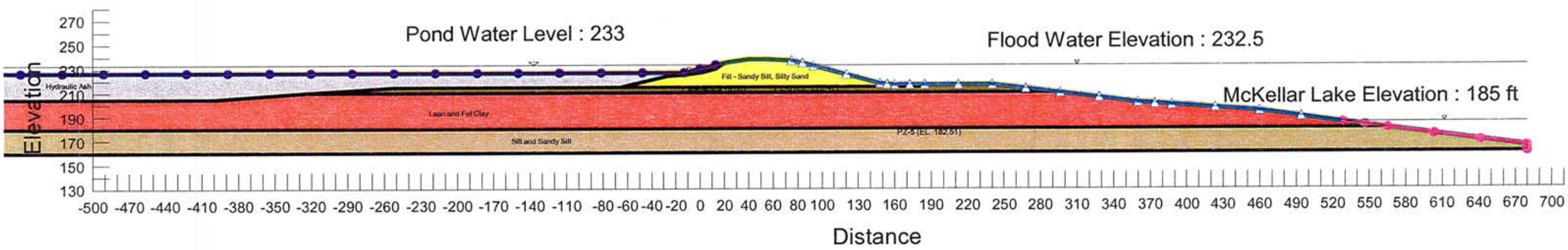
Subsurface Profile and Boundary Conditons

Steady State Seepage at Station B-B'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Ash Pond Water Elevation - 233 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



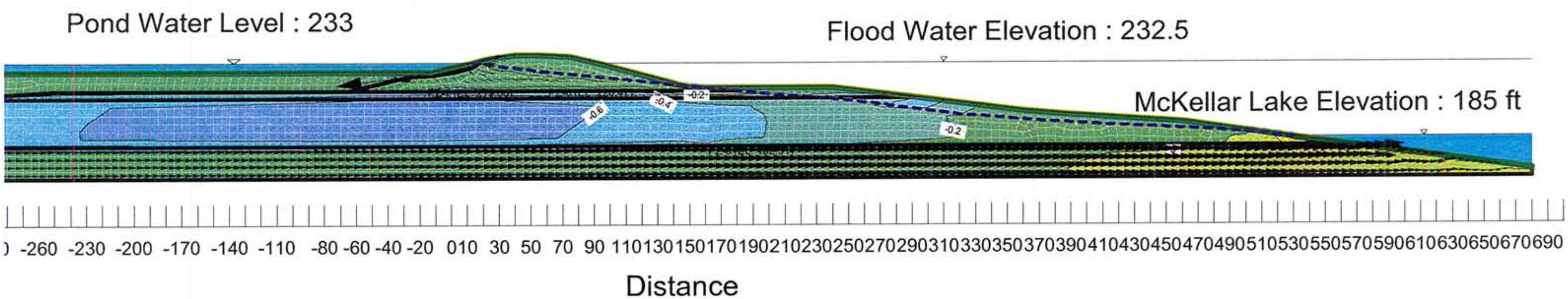
Finite Element Mesh, Flow Vector and Piezometric Surface

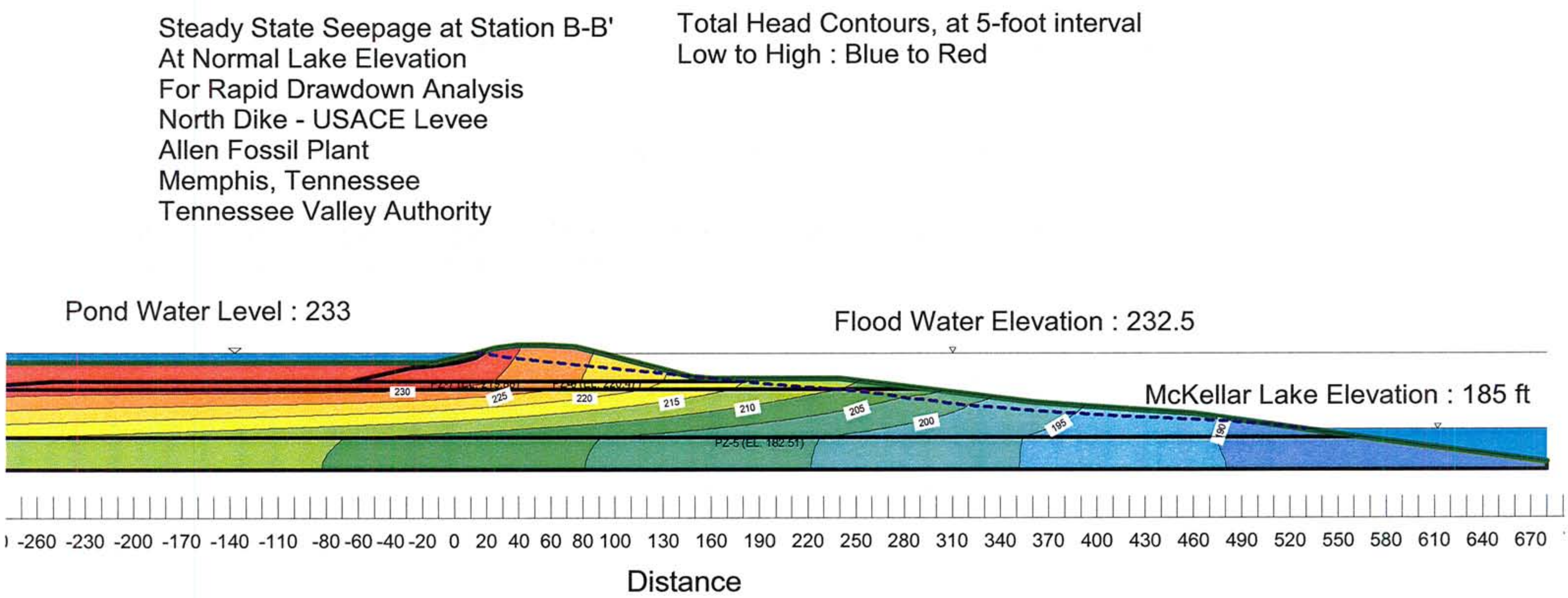
Steady State Seepage at Station B-B'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Boundary Conditions:
Ash Pond Water Elevation - 233 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4

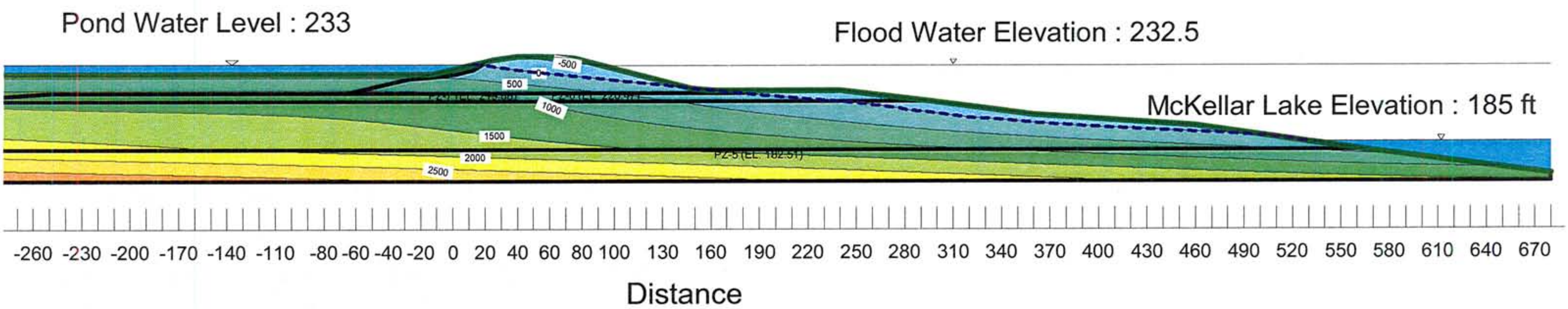




Steady State Seepage at Station B-B'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority
Total Head Contours, at 5-foot interval
Low to High : Blue to Red
Pond Water Level : 233
Flood Water Elevation : 232.5
McKellar Lake Elevation : 185 ft
230
225
220
215
210
205
200
195
190
PZ-5 (EL. 182.51)
-260 -230 -200 -170 -140 -110 -80 -60 -40 -20 0 20 40 60 80 100 130 160 190 220 250 280 310 340 370 400 430 460 490 520 550 580 610 640 670
Distance

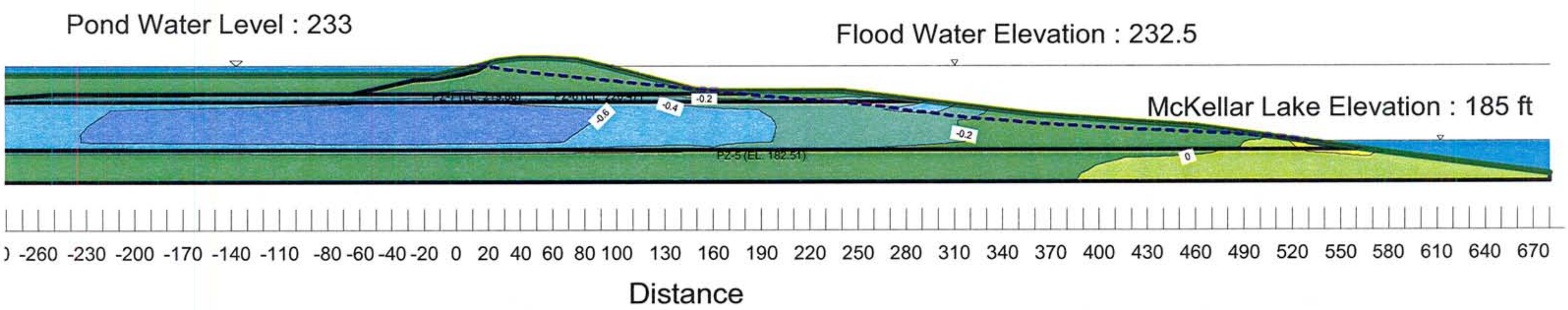
Steady State Seepage at Station B-B'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Pore Water Pressure Contours, at 500 psf interval
Low to High : Blue to Red



Steady State Seepage at Station B-B'
At Normal Lake Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Vertical Gradient Contours, at 0.2 interval
Low to High : Blue to Red

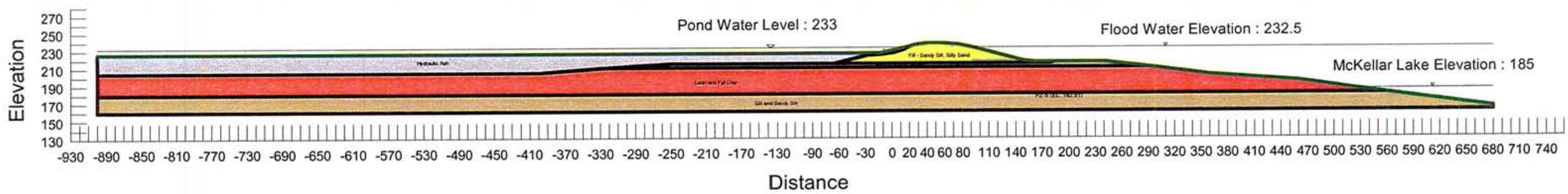


Steady State Seepage at Section B-B' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Ash Pond Water Elevation - 233 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



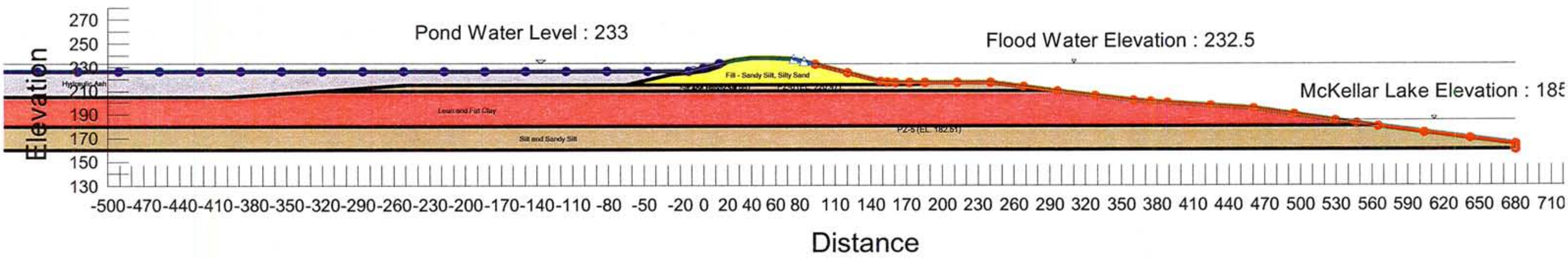
Subsurface Profile and Boundary Conditons

Steady State Seepage at Section B-B' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Ash Pond Water Elevation - 233 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



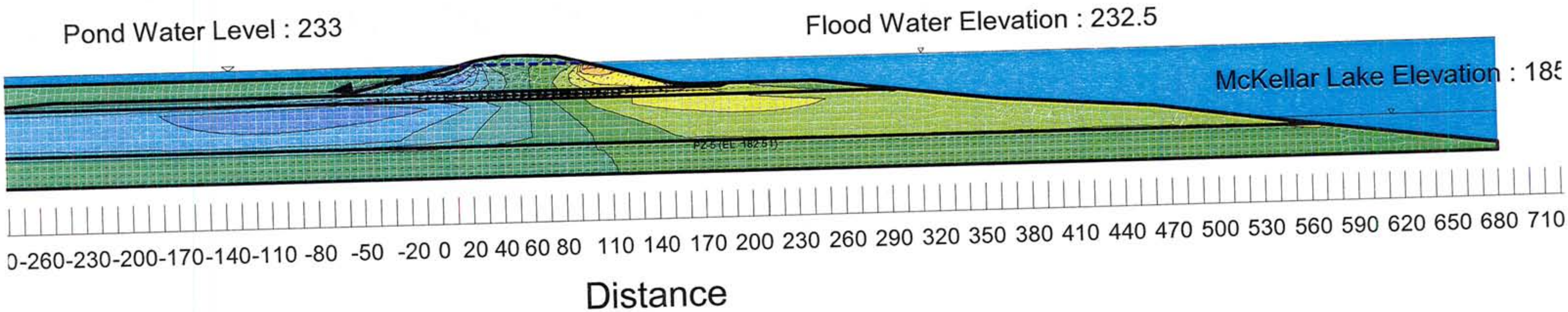
Finite Element Mesh, Flow Vector and Piezometric Surface

Steady State Seepage at Section B-B' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Boundary Conditions:
Ash Pond Water Elevation - 233 ft
Lake McKellar Water Elevation - 185
Potential Seepage Face Total Flux - 0 cu.ft/sec

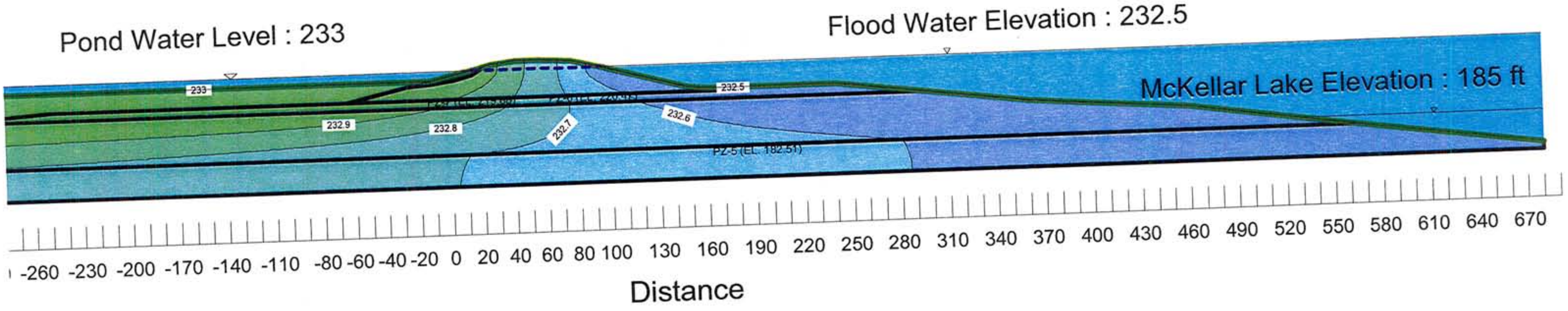
Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Kh,sat	Kv/Kh ratio	Wsat
Fill - Sandy Silt, Silty Sand	1.18e-007	0.25	0.39
Rip Rap	0.001	1	0.3
Silt and Sandy Silt	1.64e-006	0.02	0.49
Hydraulic Ash	5e-005	0.02	0.46
Lean and Fat Clay	3.94e-008	0.05	0.47
Sandy Silt	1.23e-007	0.04	0.4



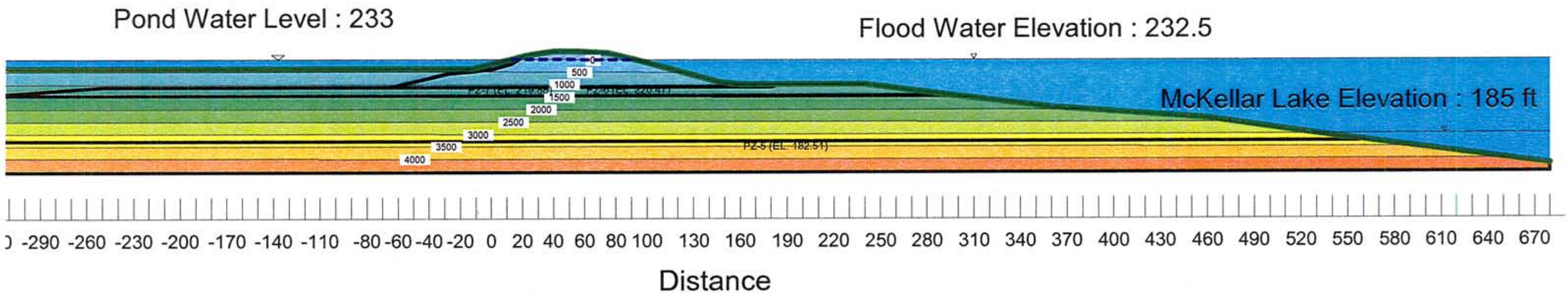
Steady State Seepage at Section B-B' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Total Head Contours, at 0.1-foot interval
Low to High : Blue to Red



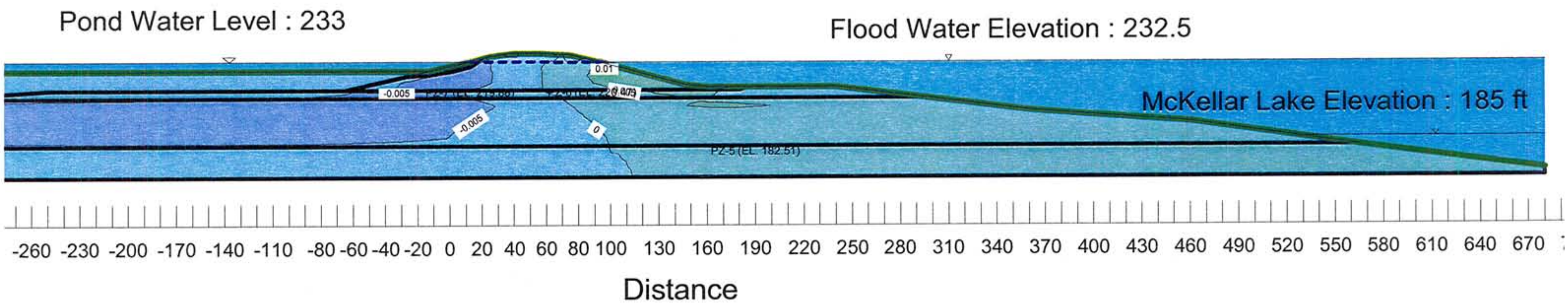
Steady State Seepage at Section B-B' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

Pore Water Pressure Contours, at 500 psf interval
Low to High : Blue to Red



Steady State Seepage at Section B-B' DF
At Design Flood Elevation
For Rapid Drawdown Analysis
North Dike - USACE Levee
Allen Fossil Plant
Memphis, Tennessee
Tennessee Valley Authority

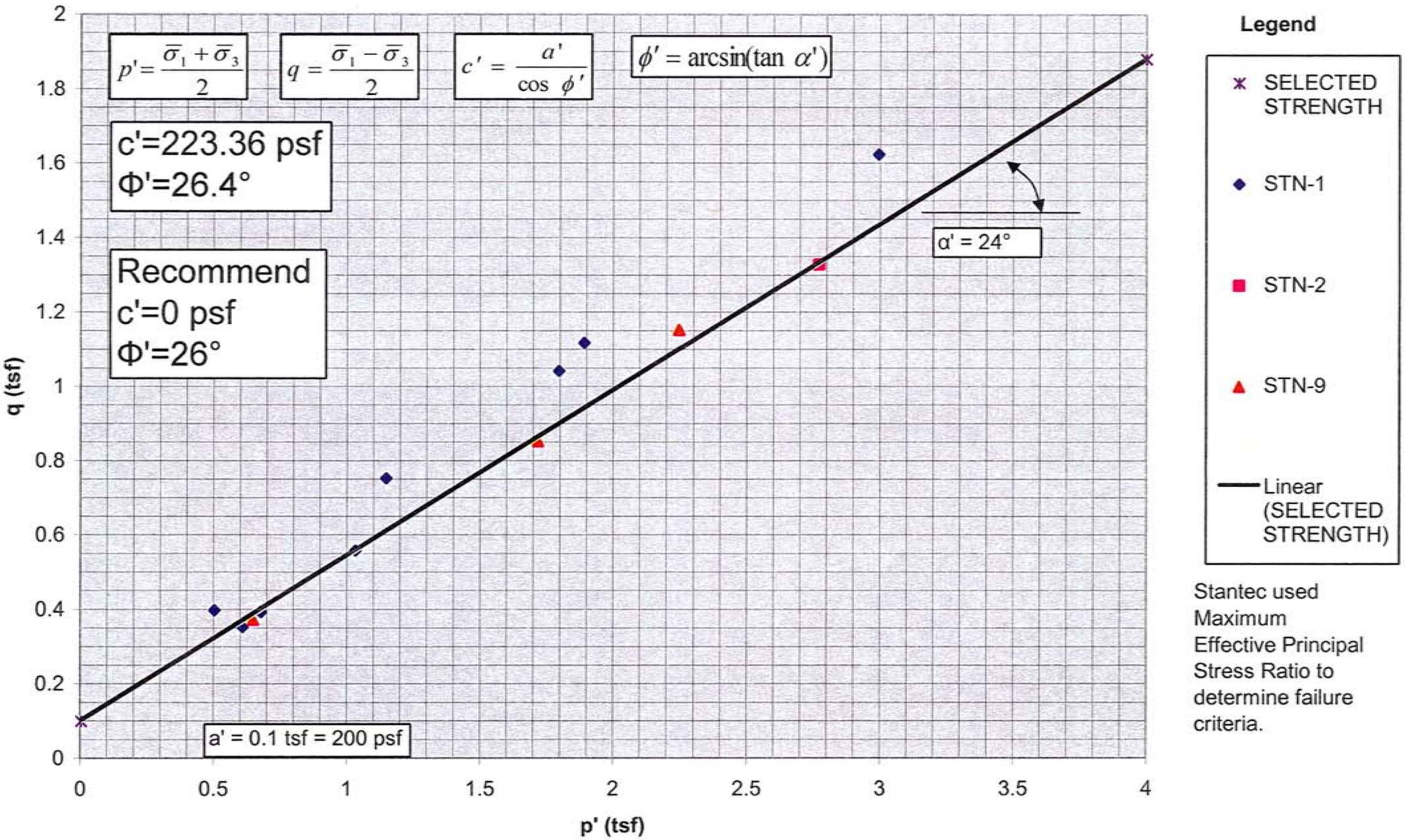
Vertical Gradient Contours, at 0.005 interval
Low to High : Blue to Red



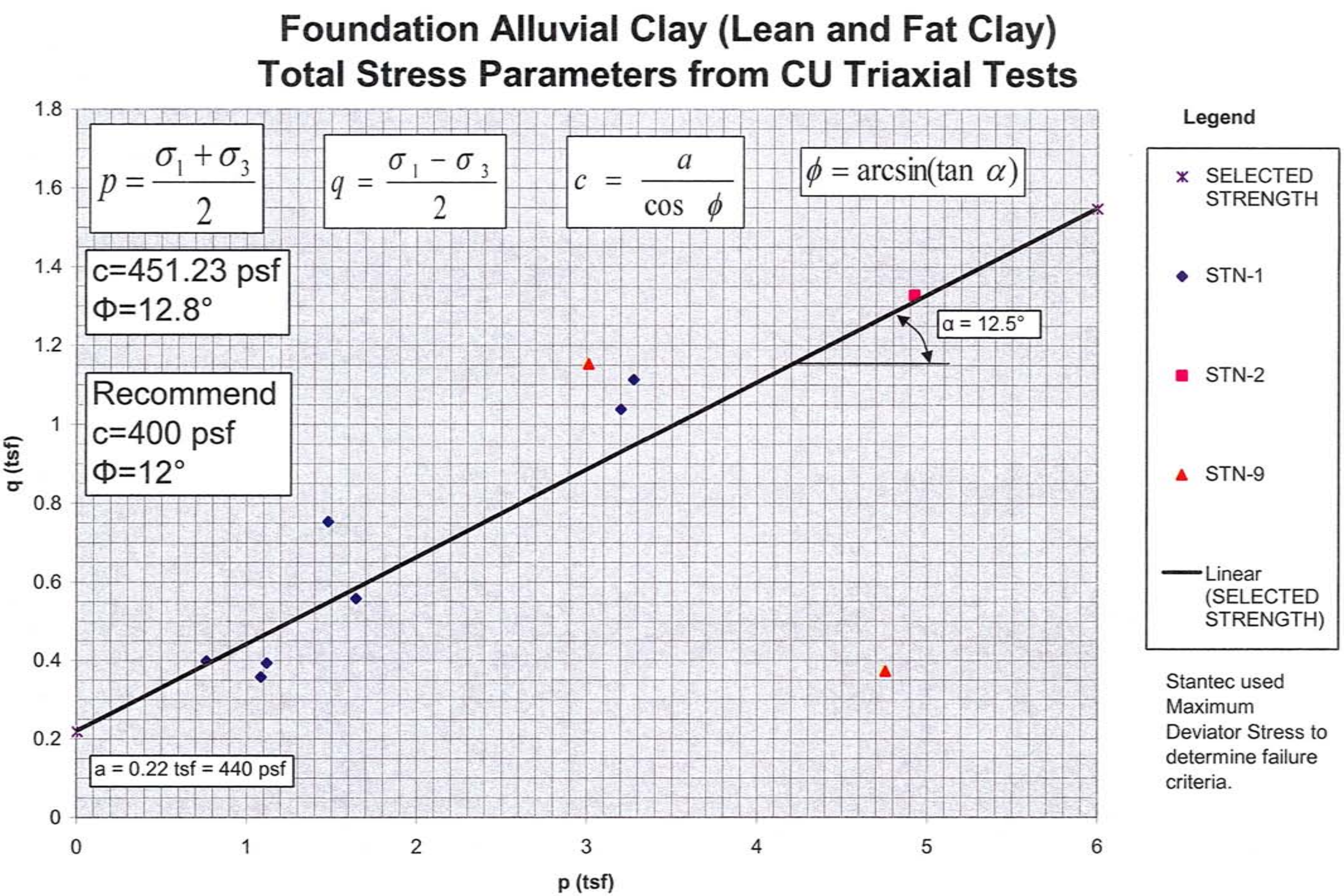
Appendix G

Strength Parameter Selection Charts

Foundation Alluvial Clay (Lean and Fat Clay)
Effective Stress Parameters from CU Triaxial Tests



Stantec used Maximum Effective Principal Stress Ratio to determine failure criteria.


Foundation Alluvial Clay (Lean and Fat Clay)
Total Stress Parameters from CU Triaxial Tests
$p = \frac{\sigma_1 + \sigma_3}{2}$
$q = \frac{\sigma_1 - \sigma_3}{2}$
$c = \frac{a}{\cos \phi}$
$\phi = \arcsin(\tan \alpha)$
c=451.23 psf
Φ=12.8°
Recommend
c=400 psf
Φ=12°
α = 12.5°
a = 0.22 tsf = 440 psf
q (tsf)
p (tsf)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
6
Legend
SELECTED STRENGTH
STN-1
STN-2
STN-9
Linear (SELECTED STRENGTH)
Stantec used Maximum Deviator Stress to determine failure criteria.