FINAL REPORT

Dam Safety Assessment of CCW Impoundments

TVA PARADISE FOSSIL POWER PLANT

United States Environmental Protection Agency
Washington, DC

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O'BRIEN & GERE
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REPORT

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TVA Paradise Fossil Plant

Prepared for:
US Environmental Protection Agency
Washington, DC

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1. INTRODUCTION

1.1. GENERAL

In response to the coal combustion waste (CCW) impoundment failure at the TVA/Kingston coal-fired electric generating station in December of 2008, the U. S. Environmental Protection Agency (USEPA) has initiated a nationwide program of structural integrity and safety assessments of coal combustion residuals impoundments or "management units". A CCW management unit is defined as a surface impoundment or similar diked or bermed management unit or management units designated as landfills that receive liquid-borne material and are used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Management units also include inactive impoundments that have not been formally closed in compliance with applicable federal or state closure/reclamation regulations. The U.S. EPA has authorized O'Brien & Gere to provide site specific impoundment assessments at selected facilities. This project is being conducted in accordance with the terms of BPA# EP10W000673, Order EP-B11S-00079, dated August 11, 2011.

1.2. PROJECT PURPOSE AND SCOPE

The purpose of this work is to provide Dam Safety Assessment of CCW management units, including the following:

- Identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures
- Note the extent of deterioration, status of maintenance, and/or need for immediate repair
- Evaluate conformity with current design and construction practices
- Determine the hazard potential classification for units not currently classified by the management unit owner or by state or federal agencies

O'Brien & Gere's scope of services for this project includes performing a site specific dam safety assessment of all CCW management units at the subject facility. Specifically, the scope includes the following tasks:

- Perform a review of pertinent records (prior inspections, engineering reports, drawings, etc.) made available at the time of the site visit (or shortly thereafter) to review previously documented conditions and safety issues and gain an understanding of the original design and modifications of the facility.
- Perform a site visit and visual inspection of each CCW management unit and complete the visual inspection checklist to document conditions observed.
- Perform an evaluation of the adequacy of the outlet works, structural stability, quality and adequacy of the management unit's inspection, maintenance, and operations procedures.
- Identify critical infrastructure within 5 miles down gradient of management units.
- Evaluate the risks and effects of potential overtopping and evaluate effects of flood loading on the management units.
- Immediate notification of conditions requiring emergency or urgent corrective action.
- Identify all environmental permits issued for the management units
- Identify all leaks, spills, or releases of any kind from the management units within the last 5 years.
- Prepare a report summarizing the findings of the assessment, conclusions regarding the safety and structural integrity, recommendations for maintenance and corrective action, and other action items as appropriate.

This report addresses the above issues for the following CCW Impoundment Units at Tennessee Valley Authority (TVA) Paradise Fossil power plant in Muhlenberg County, Kentucky:

- Scrubber Sludge Complex
- Peabody Ash Pond
- Slag Ponds 2A & B

The above impoundments are owned and operated by TVA. In the course of this assessment, O'Brien & Gere obtained information from representatives of TVA and its consultants, Stantec Consulting Services, Inc.

2. PROJECT/FACILITY DESCRIPTION

The Paradise Fossil Plant is located along the southwestern side of the Green River along State Route 176 near the Town of Drakesboro, Kentucky. The center of the Paradise plant is situated at approximate latitude 37.251937 degrees, and longitude -86.989962 degrees. A Site Location Map is included as Figure 1. The coal-fired power plant was constructed from 1963 through 1970 and includes three generating units producing a total of about 2,273 megawatts of electricity. The plant consumes about 20,000 tons of coal per day. Coal combustion residual waste that is produced during power generation is managed on-site with three active CCW impoundments, as follows:

- Scrubber Sludge Complex—A gypsum and fly ash impoundment composed of up to four individual cells
- Peabody Ash Pond—A fly ash impoundment composed of up to two individual cells
- Slag Ponds 2A & 2B—A boiler slag impoundment composed of up to three individual cells

This safety assessment report summarizes the September 21, 2011 inspection of the above management units at the Paradise Fossil Plant.

2.1. MANAGEMENT UNIT IDENTIFICATION

The location of the CCW impoundments inspected during this safety assessment is identified on Figure 2 – Facility Layout Plan.

2.1.1. Scrubber Sludge Complex

The Scrubber Sludge Complex (SSC) consists of two adjoining ponds—East Pond and West Pond—separated by a divider dike. Water in the East and West Ponds is routed to a decanting weir which discharges water via spillway pipes to the Upper Stilling Pond, located in the southeastern corner of the complex. The Upper Stilling Pond discharges into the Lower Stilling Pond, which serves as a final settling basin prior to discharge of decant water into a ditch that conveys the water to Peabody Ash Pond located about a half mile east of the SSC. All four of the individual impoundments that make up the Scrubber Sludge Complex were assessed.

The primary features of the SSC are shown on Figure 3A. The SSC was originally constructed in 1985 to 1986 when the original exterior dike was constructed. Upon reaching capacity, the original impoundment was expanded vertically in 1996 using the rim ditching method of excavating and stacking the accumulated CCW solids and using this dewatered material to construct new dikes on upstream setbacks from the original outer dike. Coal combustion residuals stored in the pond consists of a combination of gypsum and fly ash that is wet sluiced into the pond via influent lines located at the northeastern corner of the impoundment.

2.1.2. Peabody Ash Pond

The Peabody Ash Pond is located within the southeastern quadrant of the Paradise facility, as shown on Figure 2. The Peabody Ash Pond commenced operations in 1997. It consists of an approximately 137 acre impoundment that is partially incised to the west with earth dikes forming the northern, eastern and southern perimeter. Jacobs Creek borders the toe of the eastern dike. An internal divider dike separates the main pond from the stilling pond located on the north end of the impoundment. Both the main pond and the stilling pond were assessed. The primary features of the Peabody Ash Pond are shown on Figure 3B.

The Peabody Ash Pond receives sluiced fly ash flows that enter the pond near the southwest corner of the impoundment. Decant water flows through an open channel in the internal divider dike to the stilling pond. From the stilling pond, decant water is discharged to Jacobs Creek to the north of the impoundment via three RCP riser structures located in the stilling pond. The discharge is authorized by Kentucky Pollutant Discharge Elimination System (KYPDES) permit no. KY0004201 at Outfall No. 001.

2.1.3. Slag Ponds 2A/2B and Stilling Pond

Slag Ponds 2A/2B are located adjacent to the northwest of the main power plant, as shown on Figure 2. Slag Ponds 2A/2B consists of a combination incised/diked impoundments separated by an internal divider dike. As shown on Figure 3C, Ponds 2A and 2B are situated to the west and east of the divider dike, respectively. Pond

2A is primarily an incised impoundment while Pond 2B is has earth dikes on the north, east, and south sides. Pond 2A receives sluiced boiler slag inflows at the south end and serves as the primary solids collection pond. The accumulated slag is excavated and stockpiled at the south end of the pond for dewatering, then it is loaded on trucks and removed from the site for beneficial re-use. Water collected in Pond 2A passes through culvert pipes that penetrate the divider dike and discharge into Pond 2B. Water collected in Pond 2B flows over a concrete overflow spillway into the stilling pond. Water in the stilling pond is decanted into 3 RCP riser pipes which outfall into the Green River at KYPDES Permit No. 4201 Outfall No. 002.

2.2. HAZARD POTENTIAL CLASSIFICATION

The Commonwealth of Kentucky classifies dams or embankments in accordance with the Kentucky Revised Statutes (KRS) and Kentucky Administrative Regulations (KAR). The regulations are administrated by the Kentucky Department for Environmental Protection (KDEP), Division of Water, Dam Safety and Floodplain Compliance Section of the Water Infrastructure Branch. The KRS defines a dam as any structure that is 25 feet in height, measured from the outboard toe to the crest of the dam, or has a minimum impounding capacity of 50 acre-feet or more at the top of the structure (KRS Chapter 151.100).

The KDEP Dam Safety Section does not regulate any of the subject impoundments at the Paradise Fossil Plant. In the absence of a State Hazard Potential Classification, the FEMA guidelines, *Hazard Potential Classification System for Dams* (2004) have been applied in this assessment to recommend a hazard potential classification for each of the following impoundments.

2.2.1. Scrubber Sludge Complex, Peabody Ash Pond, Slag Ponds 2A/2B

TVA and their consultants, Stantec, Inc., have assigned each of the three subject impoundments a *Significant* hazard potential classification.

The definitions for the four hazard potentials (Less than Low, Low, Significant and High) to be used in this assessment are included in the EPA CCW checklist found in Appendix A. Based on the checklist definitions and as a result of this assessment, the hazard potential rating recommended for the Scrubber Sludge Complex, Peabody Ash Pond, and Slag Ponds 2A/2B is **SIGNIFICANT**, which is recommended primarily due to the potential for release of CCW into the Green River and its tributaries and the environmental impacts associated with such a potential release**.** Loss of human life and/or damage to critical infrastructure or lifeline facilities in the event of a dike breach is unlikely. The nearest downstream town is at least 5 miles away. Environmental impacts to waters of the U.S. are likely due to the proximity of the impoundments to the Green River and its tributaries.

Note that the hazard potential recommendation was upgraded from Low to Significant after the site visit. After additional evaluation and review of data in the office, O'Brien & Gere made the decision to upgrade the hazard classification to Significant, as described above. The Visual Inspection Checklists in Appendix A have been updated to reflect this classification change.

2.3. IMPOUNDING STRUCTURE DETAILS

The following sections summarize the structural components and basic operations of the three subject impoundments. The location of the impoundments on the plant grounds is shown on Figure 2.

2.3.1. Embankment Configuration

<u>Scrubber Sludge Complex</u>

East and West Ponds
The features of the Scrubber Sludge Complex are shown in Figure 3A. The Scrubber Sludge Complex is a diked earthen embankment structure that impounds an area of approximately 255 acres. The impoundment is divided into two ponds, the East Pond and the West Pond, by a gypsum/flyash internal divider dike. Two stilling ponds are situated below and south of the East Pond. The SSC is diked on the majority of its perimeter except along the west and a portion of the north sides, where it ties into high ground. The SSC has been raised several times since its original construction in the mid-1980's as evidenced by the benches in the outboard slope. Each bench

represents a dike raising constructed using the upstream offset method of construction in which a new dike crest is formed by rim ditching and wet stacking accumulated gypsum/flyash solids above the impoundment pool. The original perimeter dike consists of an earthen dike, which was raised to an initial crest elevation of about 484 feet. Based on the topographic survey of 2009, the dike crest ranged from about EL 520 to 525 around the East Pond and about EL 510 to EL 512 feet around the West Pond. In general, the outboard slopes of the dikes are inclined at 2.8H:1V or flatter. The southern dike below the West pond is the highest at approximately 62 feet above the outboard toe of slope.

Upper Stilling Pond
As shown in Figure 3A, the Upper Stilling Pond is located topographically down-gradient of the East Pond. The Upper Stilling Pond can be described as a combination diked and incised impoundment with the highest embankment along the south side. This earthen dike represents the original starter dike for the scrubber sludge complex. The southern embankment of the Upper Stilling Pond has a maximum height of approximately 34 feet, with outboard slopes inclined at approximately 3H:1V.

Lower Stilling Pond
The Lower Stilling Pond is located to the southeast and is topographically down-gradient of the Upper Stilling Pond. This pond is used for final clarification of water before discharge. According to topographic mapping, the Lower Stilling Pond is primarily an incised impoundment, but does have a relatively short section of earthen dike (10 to 12 feet high) at the northeastern corner of the pond.

<u>Peabody Ash and Stilling Ponds</u>

The features of the Peabody Ash and Stilling Ponds are shown in Figure 3B. The Peabody Ash and Stilling Ponds are side-hill impoundments that are formed by earth dikes along the north, south, and east sides. The stilling pond is separated from the main ash pond by an internal divider dike. The west side ties into high ground. The surface area of the impoundment is approximately 137 acres. The dikes consist of earthen embankments with outboard slopes ranging from 3H:1V and 4H:1V according to design drawings; however, visual inspections indicate much steeper slopes along portions of the east dike. The eastern and southern dikes were raised once from the original outboard dike using compacted earth fill. The current crest elevation is approximately EL 408 feet and the maximum height is approximately 18 feet.

<u>Slag Ponds 2A/2B and Stilling Pond</u>

The features of Slag Ponds 2A/2B and stilling pond are shown in Figure 3C. These three hydraulically-connected ponds consist of combined incised/diked impoundments with a total surface area of approximately 32 acres. The three ponds are separated by divider dikes; Pond 2A is west of the divider dike and Pond 2B is east of the divider dike. The stilling pond is situated to the east of a divider dike along the southeastern corner of Pond 2B. With the exception of the divider dike, Pond 2A is incised below surrounding grades. Pond 2B is formed by perimeter earthen (clay) dikes with a maximum height of 10 feet. Outboard slopes were designed at 3H:1V. Pond 2B is impounded with earth dikes on all sides except the south. The maximum embankment height is approximately 24 feet along the east side with approximately 3H:1V exterior slopes. The stilling pond has an outer earthen dike along its east side with maximum height of approximately 20 feet and maximum slope of 2H:1V.

2.3.2. Type of Materials Impounded

<u>Scrubber Sludge Complex</u>

Currently, influent into the scrubber sludge complex includes water with CCW consisting of co-mingled fly ash and gypsum. Approximately 900,000 dry tons of scrubber gypsum are sluiced to the scrubber sludge complex each year. The scrubber sludge slurry is discharged into the north end of the East Pond.

<u>Peabody Ash Pond</u>

The influent into the Peabody Ash Pond consists of sluiced fly ash and approximately 230,000 dry tons of fly ash are sluiced to Peabody Ash Pond each year. The fly ash flows into the southwest portion of the pond via a long ditch. The Peabody Ash Pond receives decanted water flows from the Scrubber Sludge Complex Stilling Pond as well as direct fly ash slurry flows from the plant.

Slag Ponds 2A/2B

Slag Ponds 2A/2B are used for settling of sluiced boiler slag. Based on TVA records, approximately 350 tons of boiler slag is sluiced to Slag Pond 2A each year. The majority of the accumulated slag is removed from the pond and distributed for beneficial use.

2.3.3. Outlet Works

Scrubber Sludge Complex

The East Pond of the Scrubber Sludge Complex decants water to a 48-inch diameter semi-circular bituminous-coated corrugated metal pipe (CMP) riser with stop logs to control flow and pool elevation (Photo 13). At the time of the site visit, the West Pond had been dewatered and a new three-sided concrete weir with stop logs and 18-inch diameter HDPE outlet pipe had just been completed and was soon to be put into service (Photo 11).

The weir structures discharge into horizontal outlet pipes that penetrate the upper dikes to outfall into the stilling pond (Photo 7). At the time of the site visit, we observed that several older concrete pipe penetrations had been taken out of service and recently filled with grout. New HDPE conduit had been recently installed.

Peabody Ash Pond

The outlet structure for Peabody Ash Pond consists of three 48-inch diameter RCP riser weirs with CMP skimmers located within the northeast corner of the stilling pond. The vertical risers transition into horizontal outlet pipes that discharge into Jacobs Creek about 360 feet to the northeast (Photo 25).

Slag Ponds 2A/2B

The outlet works for Slag Ponds 2A/2B consist of a series of pipes, open channel spillway, and vertical riser weirs. Water flows from Pond 2A to Pond 2B via two 48-inch culverts and a 60-inch RCP culvert (Photos 30, 31). Water from Pond 2B flows into the stilling pond via a concrete lined trapezoidal channel spillway (Photo 37). The stilling pond outlet consists of three 48-inch RCP risers that decant water to the Green River (Photo 39) via underground RCP piping.

3. RECORDS REVIEW

A review of the available records related to design, construction, operation and inspection of the Ash Pond was performed as part of this assessment. The documents provided by TVA are listed below:

Table 3.1 *Summary of Documents Reviewed*

Document	Dates	By	Description
TVA Letter to USEPA	3/25/2009	TVA	Correspondence to EPA's request for information regarding CCW impoundments
Report of Phase I Facility Assessment—Kentucky Plants*	7/24/2009	Stantec	Engineering assessment of impoundments based on visual inspections and records review
Report of Geotechnical Exploration—Peabody Ash Pond*	2/09/2010	Stantec	Geotechnical assessment and stability analysis of dikes
Final Report of Geotechnical Exploration –Scrubber Sludge Complex*	7/14/2010	Stantec	Geotechnical assessment and stability analysis of dikes
Seepage Action Plan	6/12/2010	Stantec	Plan for identification, corrective action, and monitoring of seepage
Hazard Classification Review	10/04/2011	Stantec	Hazard classification per FEMA guidelines
KPDES Permit No. 4201	04/27/2004	Kentucky DEP	Water discharge permit
Report of Hydrologic and Hydraulic Analysis—Scrubber Sludge Complex and Peabody Ash Pond Area*	6/25/2010	Stantec	Evaluation of freeboard, capacity, and hydraulic operation of spillways for various storm events
Report of Hydrologic and Hydraulic Analysis—Coal Yard Area and Red Water Ponds (Slag Ponds 2A/2B)*	3/12/2010	Stantec	Evaluation of freeboard, capacity, and hydraulic operation of spillways for various storm events
Coal Combustion Products Facility Safety, Emergency Action Plan	11/15/2010	TVA	Emergency Action Plan for coal combustion waste impoundments
Letter Report—Results of Pseudostatic Slope Stability Analysis*	2/15/2012	Stantec	Seismic stability analysis of impoundment slopes
Letter Report—Slag Ponds 2A and 2B Dike Slope Stability *	6/18/2012	Stantec	Static stability analysis of impoundment slopes
Liquefaction Potential Assessment	10/03/2012	Stantec	Evaluation of liquefaction potential for the Scrubber Sludge Complex

* Includes a historical records section review within the document

3.1. ENGINEERING DOCUMENTS

Review of the above documents revealed information on the design details, construction chronology, and modifications of the Paradise CCW impoundments, which are summarized below.

<u>Scrubber Sludge Complex</u>

- The Scrubber Sludge Complex was originally constructed in 1986

- Operated as a wet gypsum pond until 1996 when capacity was reached and gypsum stacking began
- Setback gypsum dikes were constructed above previously hydraulically placed gypsum
- In 2008, a "blow out" occurred in the southwest portion of the West Pond dike (outboard slope), but no releases of impounded CCW material occurred.
- The slope blow out was stabilized using a 15 foot high, 250 feet long buttress of rip rap
- Other minor slope sloughs have been noted and repaired
- In 2009, TVA retained Stantec to perform Phase I Assessments of all impoundments
- Based on the findings in the Phase I Assessments, Stantec recommended, and TVA completed, several short term improvements such as rock buttresses, seepage filters, improvements to surface drainage system, and slope regrading to improve stability of the gypsum stack
- A geotechnical evaluation, slope stability and seepage analyses were completed by Stantec in 2010
- Stantec's studies concluded that slope stability of the gypsum stack was marginal due to uncontrolled seepage conditions.
- Stantec recommends rock toe buttresses and changes to rim-ditch method to improve seepage conditions and stability factors of safety.
- TVA has followed Stantec recommendations and completed repairs to bring stability factors of safety to recommended minimum of 1.5 for long-term steady state seepage condition.
- Pseudostatic slope stability analyses indicate the dikes to be stable (FS=1) during a 2500-year return period earthquake.
- Liquefaction potential assessment by Stantec for the Scrubber Sludge Complex indicates liquefaction will not occur for the 2,500-year earthquake.
- Stantec recommends phasing out the wet sluicing operation to the Scrubber Sludge Complex and a new dry storage facility put into operation.

Peabody Ash Pond

- Peabody Ash Pond was constructed and put into operation in 1997
- No releases or significant failures have occurred at this facility
- The existing south and eastern dikes were constructed above pre-existing dikes constructed generally of clayey mine spoil, originally built to support coal strip mining operations
- The original mine spoil dikes were raised by 8 feet in 1997 to raise the crest above the 100-yr flood elevation.
- Upon recommendation from Stantec, TVA completed removal of dense vegetation from the inboard slopes and armoring of these slopes using filter fabric and rip rap in 2009.
- A steep portion of the original east mine spoil dike located at the north end of the pond experienced a shallow slough, which was repaired by TVA in August 2009 using filter fabric overlain by rip rap.
- A geotechnical evaluation, slope stability and seepage analyses were completed by Stantec in 2010.
- Stantec's studies concluded that slope stability factors of safety were above the recommended minimum of 1.5 for long-term steady state seepage conditions. Factor of safety against piping due to seepage through the dikes was acceptable.
- Stantec recommended clearing and flattening and armoring of the steep slopes of the original dike where the slope is steeper than 2.5:1V. This recommendation has not been completed as of this writing.

Slag Ponds 2A/2B

- The slag ponds were put into operation sometime in the mid 1960's at the time of plant startup for use as flyash sluice ponds.
- The divider dike was constructed in 1967 to form the two ponds 2A and 2B.
- In 1971, operations were modified to sluice only bottom ash to Slag Ponds 2A/2B.
- No releases or significant failures have occurred at this facility.
- Stantec's Phase I assessment revealed erosion problems on the inboard slopes and some minor instabilities primarily on internal divider dikes.
- Internal divider dikes were generally steeper than designed.

- Excessive vegetation and trees on the east dike outboard slopes was noted.
- Available freeboard appeared to be insufficient.
- Several inactive spillways were noted which had not been abandoned or abandonment documentation was not available.

3.1.1. Stormwater Inflows

O'Brien & Gere understands that the spillway design flood (SDF) of all of TVA's CCW impoundments classified as significant or high hazard potential is the 100% Probable Maximum Flood (PMF). According to hydrologic & hydraulic analyses for existing conditions completed by Stantec in 2010, the following conclusions were reached regarding stormwater inflow into the subject CCW impoundments:

Scrubber Sludge Complex & Peabody Ash Pond

- The hydrology and hydraulics of the Scrubber Sludge Complex and Peabody Ash Pond was evaluated for the 1-yr, 10-yr, and 100-yr frequency storms at 24-hr durations and the probable maximum precipitation (PMP) storm at 6-hr duration.
- The Scrubber Sludge Complex, Lower Stilling Pond dike overtops given the 10-year, 24-hr and lower frequency storm events mainly due to a low section in the embankment that was modified to help with drainage of the haul road on the crest.
- Peabody Ash Pond dike overtops in the Probable Maximum Precipitation (PMP) event, but capacity is not exceeded for the other, more frequent events evaluated.
- All other impoundments that are part of the Scrubber Sludge Complex and Peabody Ash Pond hydrology and hydraulics system can contain all anticipated stormwater inflows up to and including the 6-hr, PMP event.
- Stantec has recommended incorporation of emergency overflow spillways for the Scrubber Sludge Complex's Upper and Lower Stilling Pond, and the Peabody Ash Pond to reduce the risk of an overtopping event and possible embankment breach due to overtopping.

Slag Ponds 2A/2B and Stilling Pond

- The hydrology and hydraulics of the Slag Pond 2A/2B and associated stilling pond was evaluated for the 1-yr, 10-yr, and 100-yr frequency storms at 24-hr durations and the probable maximum precipitation (PMP) storm at 6-hr duration.
- Based on the modeling, the three ponds associated with the Slag Pond 2A/2B unit will likely overtop during the PMP event, but appear capable of passing the other storm events analyzed without overtopping.
- Stantec has recommended that TVA consider establishing an emergency overflow spillway in their long term plans for this impoundment.
- FEMA flood insurance maps indicate the 100-yr flood elevation of the Green River to be at approximately EL 400 feet. Topographic information indicates the crest of the stilling pond's 20-ft. high outer dike to be at approximately EL 413 feet. Flooding of the Green River is not expected to have an adverse effect on the structural integrity of the outer dikes.

3.1.2. Stability Analyses

The most recent stability analyses of the subject impoundment dikes were performed by Stantec as documented in their 2010 geotechnical engineering reports for the Scrubber Sludge Complex and Peabody Ash Pond. Pseduostatic (seismic) stability analyses of SSC, PAP, and Slag Ponds 2A/2B were documented in Stantec's letter report dated February 15, 2012. A letter report dated June 18, 2012, also prepared by Stantec, was provided to present static stability analyses of Slag Pond 2B and Slag Stilling Pond embankments. Our interpretations of the findings presented in these reports are summarized below:

Scrubber Sludge Complex

- Certain outboard dike slopes of the east and west ponds were found to be marginally stable in 2010 due to uncontrolled seepage.
- Stantec recommended multiple stabilization measures such as placement of rock toe buttresses, flattening of slopes, armoring of slopes with rock filters, better compaction of upper gypsum stack dikes, and off-set of rim ditches from outer edge of upper dike crest to lower phreatic surface.
- Other improvements included proper abandonment of unused outlet pipes or those of questionable integrity that penetrate the dikes, improved surface drainage, and establishment of vegetation on slopes.
- Stantec's geotechnical and slope stability analyses on as-built slopes incorporating the stabilization measures discussed above indicated factors of safety of critical sections to meet the accepted static stability criteria of 1.5 or greater for embankment dams.
- Stantec concluded that, with the above improvements and careful monitoring, the facility could continue to be used for a few years, but the facility should be closed in the near future.
- Pseudostatic analysis indicates satisfactory stability for the 2% probability of exceedence in 50 years earthquake.
- A liquefaction potential assessment completed by Stantec indicates the soil/CCW materials forming/underlying the Scrubber Sludge Complex are not susceptible to liquefaction during the 2,500-year earthquake.

The following table provides a summary of the most recent slope stability analyses completed for the Scrubber Sludge Complex, as documented in a report entitled *Final Report of Geotechnical Exploration, Scrubber Sludge Complex* prepared by Stantec, dated June 14, 2010. In addition, the pseudostatic slope stability analysis was completed by Stantec and documented in a letter report dated February 15, 2012.

Table 3.2—Summary of Slope Stability Analyses—Scrubber Sludge Complex

Section	Load Case	Analysis Date	Calculated Factor of Safety		Required Factor of Safety
			Before Repairs	After Repairs*	
AA'—West Pond South Slope	Long Term	June 2010	1.5	1.5	1.5
BB'—West Pond East Slope	Long Term	June 2010	1.3	1.5	1.5
CC'—East Pond South Slope	Long Term	June 2010	1.2	1.5	1.5
DD'—East Pond East Slope	Long Term	June 2010	1.0	1.5	1.5
EE'—East Pond North Slope	Long Term	June 2010	1.5	1.5	1.5
GG'—East Pond East Slope	Pseudostatic	February 2012	NA	1.0	1.0

* All repairs have been completed as of the date of this report

Peabody Ash Pond

- Stantec performed static and pseudostatic stability analyses of the critical embankment sections, based on current subsurface conditions and slope geometry.
- Slope stability factors of safety were found to meet accepted standards for inboard and outboard slopes.
- Armoring of the steep bank along the toe of the east dike was recommended to reduce the potential for sloughing.
- Pseudostatic analysis indicates satisfactory stability for the 2% probability of exceedence in 50 years earthquake.

The following table provides a summary of the most recent slope stability analyses completed for the Peabody Ash Pond, as documented in a report entitled *Report of Geotechnical Exploration, Peabody Ash Pond* prepared by Stantec, dated February 9, 2010. In addition, the pseudostatic slope stability analysis was completed by Stantec and documented in a letter report dated February 15, 2012.

Table 3.3—Summary of Slope Stability Analyses—Peabody Ash Pond

Section	Load Case	Analysis Date	Calculated Factor of Safety	Required Factor of Safety
AA'—Downstream Slope	Long Term	February 2010	1.7	1.5
AA'—Upstream Slope	Long Term	February 2010	2.2	1.5
AA'—Downstream Slope	Pseudostatic	February 2012	1.0	1.0

Slag Pond 2A/2B

- Pseudostatic analysis of the Slag Pond 2B/Stilling Pond outboard slope geometry indicates satisfactory stability for the 2% probability of exceedence in 50 years earthquake.
- Static slope stability was also assessed and found to meet minimum stability criteria based on current embankment geometry and records of soil stratigraphy and shear strength data.

The following table provides a summary of the most recent slope stability analyses completed for the Slag Ponds 2A/2B and associated slag stilling pond, as documented in a letter report prepared by Stantec, dated June 20, 2012. In addition, the pseudostatic slope stability analysis was completed by Stantec and documented in a letter report dated February 15, 2012.

Table 3.4—Summary of Slope Stability Analyses—Slag Ponds 2A/2B

Section	Load Case	Analysis Date	Calculated Factor of Safety	Required Factor of Safety
Slag Pond 2B/Downstream Slope	Long Term	June 2012	4.39	1.5
Slag Stilling Pond/Downstream Slope	Long Term	June 2012	2.29	1.5
Slag Stilling Pond/Downstream Slope	Pseudostatic	February 2012	1.1	1.0

In summary, no indications of slope distress were observed during the visual inspection of the subject impoundments. O'Brien & Gere has reviewed the thorough stability analyses prepared by Stantec and concurs with their conclusions that the slope stability of all subject impoundments meet accepted static and pseudostatic stability factors of safety for embankment dams under normal loading conditions. In addition, a liquefaction potential assessment prepared by Stantec indicates the materials forming/underlying the Scrubber Sludge Complex are not susceptible to liquefaction and O'Brien & Gere concurs with these findings, based on our review of the liquefaction potential assessment Copies of the Stantec stability analyses and liquefaction potential assessment are included in Appendix C.

3.1.3. Modifications from Original Construction

Scrubber Sludge Complex

The original construction of the Scrubber Sludge Complex was completed in 1986. Gypsum slurry was impounded from 1986 to 1996. In 1996, Gypsum stacking by the rim-ditch method began. In 2009 through present, modifications included several measures to improve stability as discussed previously.

Peabody Ash Pond

The original outboard dike forming the impoundment was constructed during strip mining operations prior to TVA ownership. In 1997, the Peabody Ash Pond was constructed by raising the original strip mining dikes a total of eight feet. In addition, the internal dividing dike separating the main ash pond from the stilling pond was constructed in 1997. Recent modifications/improvements (2009-2010) include armoring of inboard freeboard slopes subject to wave erosion and armoring of shallow sloughs on a portion of the outboard eastern dike slopes.

3.1.4. Instrumentation

Prior to TVA's and Stantec's work in 2009-2010, no instrumentation was present at any of the subject impoundments. During the geotechnical explorations conducted at the Scrubber Sludge Complex and the Peabody Ash Pond, permanent instrumentation has been installed, including standpipe piezometers and slope inclinometers.

Scrubber Sludge Complex

A total of twelve piezometers and six slope inclinometers have been installed at key sections within the Scrubber Sludge Complex dikes. The instrumentation data was used in the seepage and slope stability analyses performed by Stantec. The data is being monitored on a regular basis as part of routine structural integrity inspections.

Peabody Ash Pond

A total of nine standpipe piezometers have been installed at key sections within the Peabody Ash Pond dikes. The instrumentation data was used in the seepage and slope stability analyses performed by Stantec. The data is being monitored on a regular basis as part of routine structural integrity inspections.

Slag Ponds 2A/2B

Based on the information provided for this assessment, no instrumentation is present within the dikes forming Slag Ponds 2A/2B.

3.2. PREVIOUS INSPECTIONS

The most recent and comprehensive impoundment inspections were performed by Stantec in 2009 during their Phase I Assessment program. The results of these inspections prompted several corrective action measures to improve cited conditions such as poor surface drainage, uncontrolled seepage, slope instability, erosion, undesirable and insufficient vegetative cover, and outlet structure performance. The following is a summary of the notable conditions cited in the Phase I Assessment Report (June 2009, Stantec) for each of the subject impoundments:

Scrubber Sludge Complex

- Saturated conditions observed on the majority of dike slopes due to uncontrolled seepage.
- Toe drains apparently not working to prevent seepage to dike slope face.
- History of slope sloughing and one 250 ft long by 15 ft high blowout or slough on a section of the west pond dike. Blowout was repaired with riprap.
- Poor surface drainage along intermediate slope benches resulting in standing water and flow down the slope face.
- Evidence of improperly abandoned spillway pipes penetrating the dike with active seepage or leakage evident at the downstream end.
- Minimal available freeboard above the water pool.
- Evidence of slope sloughing on north outboard dike of the East Pond.
- Heavy vegetation on lower portion of outboard slopes.
- Multiple erosion channels in dike slopes due to inadequate vegetation cover.

Based on our discussions with representatives of TVA and Stantec and our observations during the visual inspection, TVA has implemented corrective action to mitigate all of the notable deficiencies cited in Stantec's 2009 Phase I Assessment of the Scrubber Sludge Complex.

Peabody Ash Pond

- Trees and brush growing on lower portion of outboard slope of the east dike.

- Steep slopes along outboard lower portion of east dike. Slopes steeper than indicated by design drawings. History of a slough/slide in lower portion of the east dike outboard slope near the stilling pond.
- Some wave erosion on interior slopes.

Based on our discussions with representatives of TVA and Stantec and our observations during our visual inspection, TVA has implemented corrective action to repair the slope slide cited above. The trees and brush on the lower portion of the east slope have not yet been cleared. The interior slopes have been armored with riprap to protect against wave action.

Slag Ponds 2A/2B

- Severe erosion with a few small slumps/slides along inboard slopes of dikes.
- Inboard dike slope steeper than indicated in design drawings.
- Insufficient and unwanted vegetation growing on inboard dike slopes.
- Minimal available freeboard.
- Trees and brush present on outboard slope of east dike.
- Cracks present in concrete flume from Pond 2B to Stilling Pond.

Based on our discussions with representatives of TVA and Stantec and our observations during our visual inspection, TVA has implemented corrective action to repair the erosion and sloughs on the interior dikes by armoring the problem areas with riprap. The trees and brush on the lower portion of the east slope were cleared shortly after O'Brien & Gere's site visit in September 2011, based on photographs sent by TVA to O'Brien & Gere. Cracks in the concrete flume had not yet been repaired at the time of our site visit.

3.3. OPERATOR INTERVIEWS

Numerous plant and Authority personnel took part in the inspection proceedings along with representatives of Kentucky Department of Environmental Protection-Division of Water and a representative of TVA's geotechnical consultant, Stantec Consulting Services, Inc. The following is a list of participants for the September 2011 inspection of the Scrubber Sludge Complex, Peabody Ash Pond, and Slag Ponds 2A/2B:

Name	Affiliation
Scott Turnbow	TVA
Tina Jarquin	TVA Coal Combustion Products (CCP)
Patrick Hjelm	TVA
Emma Taul	TVA
Richard Marks	TVA CCP
Dave Robinson	TVA
Darlene Keller	TVA
George Keil	TVA CCP
J. Cedric Adams	TVA CCP
Chris Buttram	TVA CCP
Dan Back, PE	Stantec
Greg Jones	TVA
Steve Shamblin	TVA RHO&M
Jason Decker	TVA
Billy Sabin	TVA
Mortaza Rabiee	KYDEP
Glen Alexander	KYDEP
Dreher Whetstone, PE	O'Brien & Gere
Timothy W. Kraus, PE	O'Brien & Gere

Facility personnel provided a good working knowledge of the CCW impoundments, provided general plant operation background and provided requested historical documentation. In addition to the facility personnel, TVA's geotechnical engineering consultant from Stantec provided additional information from previous impoundment inspections, geotechnical studies, and recent corrective action/improvement measures that have been completed. These personnel also accompanied O'Brien & Gere staff throughout the visual inspections to answer questions and to provide additional information as needed in the field.

4. VISUAL INSPECTION

The following sections summarize the inspection of the Scrubber Sludge Complex, Peabody Ash Pond, and Slag Ponds 2A/2B, which occurred on September 21, 2011. At the time of the inspection, O'Brien & Gere completed an EPA inspection checklist for each of the above facilities, which was submitted electronically to EPA on October 6, 11, and 14, 2011. Copies of the completed inspection checklists are included as Appendix A.

4.1. GENERAL

The weather on the dates of the inspection was partly cloudy and approximately 75 degrees. The visual inspection consisted of a thorough site walk along the perimeter of the impoundment dikes and other portions of the impoundments to observe outlet structures and general facility operations. O'Brien & Gere team members made observations along the toe, outboard slope, and crest of the dikes, and along exposed portions of the inboard slopes. We also observed the inlet/outlet structures and current operation.

Photos of relevant features and conditions observed during the inspection were taken by O'Brien & Gere and are provided in Appendix B. Aerial photographs depicting the layout and locations and orientation of the photographs are included as Figures 3A, 3B, and 3C.

4.2. SUMMARY OF FINDINGS

<u>Scrubber Sludge Complex</u>

The following observations were made during the inspection:

- Sluiced fly ash and gypsum slurry enters the northeast corner of the east pond and is routed through excavated ditches.
- The West Pond had been dewatered prior to inspection in order to install a new outlet structure (Photo 12).
- Rock slope armoring, seepage filters, and slope toe buttresses had recently been completed at the time of the inspection (Photos 1, 3).
- New outlet structures and piping had been recently put into service at the time of inspection (Photos 11, 13).
- Newly established grass was beginning to take root on the slopes.
- Roadways were surfaced with gravel and were well maintained.
- Significant construction/operations activity was observed within the upper east and west pond and on the gypsum stack crest.
- A few minor seeps or wet areas were observed near the toe of the southern "starter" (outermost) dike (Photo 9).
- Larger seepage areas had been covered with a reverse-graded filter to reduce vertical exit gradients and prevent migration of fine-grained dike soils and reduce the potential for piping/internal erosion.

<u>Peabody Ash Pond</u>

The following observations were made during the visual inspection of Peabody Ash Pond:

- The dike crest was covered with a well-maintained gravel roadway with grassed shoulders.
- The inboard slopes were clear of vegetation and armored with well-maintained riprap (Photo 21).
- The outboard slopes were covered with well-maintained grass.
- Tree and brush growth were present on the lower portion of the outboard east dike (Photo 23).
- Outboard slopes of the lower portion of the east dike were steep with a water body at the toe (Photo 23).
- A recent slough of this lower toe had occurred and had been repaired by covering with filter geotextile and riprap (Photo 20).
- The outlet structures appeared to be in good condition and functioning normally (Photo 18, 19).

Slag Pond 2A/2B

The following observations were made during the visual inspection of Slag Ponds 2A/2B:

- Boiler slag/bottom ash is wet sluiced into the south end of Pond 2A. Heavy equipment is used to dredge and stock pile the bottom ash for off-site beneficial re-use.
- A divider dike separates Slag Ponds 2A/2B. The crest of the dike serves as a road and appeared well maintained and covered with slag (Photo 27).
- The inboard slopes of the 2A/2B divider dike were either grassed or armored with riprap. Eroded portions of the inboard slopes had been repaired with filter geotextile overlain with riprap.
- Two or three small erosion gullies were evident in the crest/inboard slopes near the north end of the divider dike (Photo 28).
- Water from Pond 2A is conveyed through a double 48-inch RCP and a single 60-inch RCP culvert that penetrates the upper portion of the divider dike (Photo 30, 31).
- The inboard slopes of Pond 2B were armored with riprap to protect from wave action erosion
- An apparent seep was observed beyond the northeast toe of the dike (Photo 36). The area had standing water but no apparent flow.
- High weed and brush vegetation and a few trees are present on the outboard eastern dike slope of Pond 2B beyond the perimeter chain link fence.
- A trapezoidal concrete flume conveys water from Pond 2B into the stilling pond. A few cracks were observed in the concrete flume (Photo 27).
- A pump station, which is used to transfer water to other plant processes, is positioned within the stilling pond.
- A patch of overgrown vegetation was present on the inboard slope of the stilling pond to the north of the pump station.
- One or two animal burrows were observed in the freeboard area of the western inboard slope of the stilling pond and Pond 2B divider dike(Photo 38).

5. CONCLUSIONS

Scrubber Sludge Complex

Based on the ratings defined in the USEPA Task Order Performance Work Statement (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual inspection, the overall condition of the Scrubber Sludge Complex is considered to be **FAIR**. This rating is given primarily due to the potential for the Lower Stilling Pond to overtop during the 10-year, 24 hr. storm event, as documented in Stantec's 2010 Hydrology and Hydraulics Analysis Report. Based on the conditions observed at the time of inspection, acceptable performance is expected under normal and seismic loading conditions; however, the potential for overtopping of the Lower Stilling Pond during the 10-yr storm indicates inadequate storage and/or spillway capacity for the Lower Stilling Pond, which needs to be addressed. Potential embankment overtopping could result in a breach of the Lower Stilling Pond embankment; however, O'Brien & Gere does not believe this potential occurrence to represent an imminent endangerment to human health and environment given its remote location, and low CCW solids content, and mostly incised configuration of this impoundment.

Stantec has concluded that this facility can be operated safely for a few more years, provided that the new operations and maintenance plans are followed closely. O'Brien & Gere understands that TVA intends to formally close the facility in the near future and transition disposal of the scrubber sludge to a dry storage landfill. Maintenance and improvement measures that should be addressed in the near future include the following:

- Design and construct emergency overflow spillway to safely pass the 100% PMF spillway design flood.
- Raise low-lying portion of the Lower Stilling Pond dike, as appropriate, in conjunction with spillway construction to reduce the potential for overtopping during major storm events.

In general accordance with Stantec's recommendations, TVA has implemented significant remedial measures in the past two to three years to address serious deficiencies identified at the Scrubber Sludge Complex and to bring stability factors of safety up to accepted standards.

Peabody Ash Pond

Based on the ratings defined in the USEPA Task Order Performance Work Statement (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual inspection, the overall condition of the Peabody Ash Pond is considered to be **FAIR**. This rating is given due to the potential for the Peabody Ash Pond to overtop during the PMP storm event, as documented in Stantec's 2010 Hydrology and Hydraulics Analysis Report. Based on the conditions observed at the time of inspection, acceptable performance is expected under normal and seismic loading conditions. Storm events of magnitude exceeding the 100-year, 24-hour storm, which the Peabody Ash Pond can handle in its current configuration, are rare and the risk of an embankment breach due to overtopping is very low. O'Brien & Gere does not believe this potential occurrence represents an imminent endangerment to human health and represents a low risk to the environment, given the low probability of occurrence.

Maintenance and improvement measures that should be addressed in the near future include the following:

- Clear trees and vegetation on lower outboard slope of east dike.
- Armor lower outboard slope of east dike with riprap where steeper than 2.5H:1V.
- Design and construct an emergency overflow spillway to safely pass the spillway design flood.

Upon Stantec's recommendations, TVA has implemented significant remedial measures in the past two to three years to address deficiencies identified at the Peabody Ash Pond to maintain the structural integrity of the embankment.

Slag Ponds 2A/2B

Based on the ratings defined in the USEPA Task Order Performance Work Statement (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual inspection, the overall condition of Slag Ponds 2A/2B and the Stilling Pond is considered to be **FAIR**. This rating is given due to the potential for the Slag Stilling Pond to overtop during the PMP storm event, as documented in Stantec's 2010 Hydrology and Hydraulics Analysis Report. Based on the conditions observed at the time of inspection, acceptable performance is expected under normal and seismic loading conditions. Storm events of magnitude exceeding the 100-year, 24-hour storm, which the Slag Stilling Pond can handle in its current configuration, are rare and the risk of an embankment breach due to overtopping is very low. O'Brien & Gere does not believe this potential occurrence represents an imminent endangerment to human health and represents a low risk to the environment, given the low probability of occurrence.

Maintenance and improvement measures that should be addressed in the near future include the following:

- Clear trees and vegetation on lower outboard slope of east dike of Slag Pond 2B and Stilling Pond. Based on photographs taken after our site visit, this recommended clearing was completed by TVA.
- Monitor apparent seep at northeast corner toe of Slag Pond 2B.
- Repair erosion along edge of crest at north end of divider dike.
- Design and construct an emergency overflow spillway to safely pass the spillway design flood.

Spillway design floods have not been established for the subject management units based on the Hazard Classification of the impoundments. Based on information provided in the H&H reports prepared by Stantec, the Peabody Ash Pond and the Slag Ponds 2A/2B Stilling Pond overtop during the PMP storm event. The Scrubber Sludge Complex Lower Stilling Pond overtops in the 10-yr., 24-hr. event. An appropriate spillway design flood should be established for each and modifications to the embankments and/or outlet works should be made as necessary to pass the spillway design flood. The design and construction of emergency overflow spillways, as recommended in Stantec's 2010 Hydrology and Hydraulics Analysis Report, would address this need.

TVA has made significant programmatic changes to their operations and maintenance procedures in order to implement a more proactive and preventative approach to ensuring the structural integrity of their CCW impoundments. TVA performs frequent inspections and monitoring to identify, document, and repair new deficiencies early so that they do not develop into more serious problems.

Since implementation of the new programmatic O&M procedures, the plant's Coal Combustion Products staff maintains design and construction documents and inspection reports in a well organized manner for future reference. The plant operations personnel have received training in dam safety inspections and are performing daily, monthly, quarterly, and annual internal inspections, supported by periodic inspections by a private consultant (Stantec). TVA has implemented a formal emergency action plan for all of its CCW impoundments that provides detailed procedures for TVA personnel to follow upon indication of possible, impending, or actual failure of a CCW impoundment. Based on these findings, we are of the opinion that the operations and maintenance procedures being practiced at the subject impoundments are satisfactory.

6. RECOMMENDATIONS

Based on the findings of our visual inspection and review of the available records for the PAF Scrubber Sludge Complex, Peabody Ash Pond, and Slag Ponds 2A/2B, O'Brien & Gere recommends that additional maintenance of the embankments be performed to correct the erosion, drainage, and other miscellaneous deficiencies cited above. In addition, installation of emergency overflow spillways at each of the management units is recommended to safeguard against overtopping during a PMP storm event.

6.1. URGENT ACTION ITEMS

None of the recommendations are considered to be urgent, since the issues noted above do not appear to threaten the structural integrity of the dikes in the near term. However, O'Brien & Gere recommends that the low section of the Lower Stilling Pond embankment be raised within one year to provide minimum storage capacity for the of the 100-yr storm.

6.2. LONG TERM IMPROVEMENT

The deficient conditions observed during the inspection do not require immediate attention, but should be implemented in the near future as part of a regular maintenance plan. The recommended maintenance/improvement actions are provided below:

<u>Scrubber Sludge Complex</u>

- Design and construct an emergency overflow spillway for the Lower Stilling Pond to safely pass the spillway design flood (100% PMF)
- Raise low portion of Lower Stilling Pond dike as appropriate in conjunction with the design of the emergency overflow spillway

O'Brien & Gere understands that TVA intends to design and construct features to safely pass the 100% PMF.

<u>Peabody Ash Pond</u>

- Clear trees and vegetation on lower outboard slope of east dike
- Armor lower outboard slope of east dike with riprap where steeper than 2.5H:1V
- Establish appropriate spillway design flood given the Hazard Classification of each unit
- Design and construct emergency overflow spillway to safely pass the appropriate spillway design flood

O'Brien & Gere understands that TVA intends to design and construct features to safely pass the 100% PMF with adequate freeboard and conveyance, and that TVA intends to implement the above maintenance type recommendations as part of an upcoming remediation project.

<u>Slag Ponds 2A/2B</u>

- Clear trees and vegetation on lower outboard slope of east dike of Slag Pond 2B/Stilling Pond
- Repair erosion along edge of crest at north end of divider dike
- Seal cracks in open channel spillway that conveys flow from Pond 2B to the Stilling Pond
- Design and construct emergency overflow spillway to safely pass the spillway design flood

O'Brien & Gere understands that TVA intends to design and construct features to safely pass the 100% PMF with adequate freeboard and conveyance, and that TVA has completed the recommended clearing and erosion repairs, and plans to seal the cracks in the concrete spillway in the near future.

6.3. MONITORING AND FUTURE INSPECTION

O'Brien & Gere recommends continued internal inspections by personnel trained in dam safety and periodic inspections by independent licensed dam safety engineers on at least a biennial basis. The small seep identified at the northeastern outboard toe of Pond 2B should be evaluated and monitored in accordance with TVA's Seepage Action Plan.

6.4. TIME FRAME FOR COMPLETION OF REPAIRS/IMPROVEMENTS

The majority of the identified deficiencies for the subject impoundments were noted in the previous impoundment inspections and engineering evaluations by TVA and Stantec. Based on our conversations with representatives of TVA and Stantec, engineering designs for corrective action such as seepage filters, erosion repairs, slope repair, etc. are completed in a timely manner in consideration of the severity of the problem as it relates to the structural integrity of the impoundment. Based on the findings of this assessment, O'Brien & Gere believes that TVA and its consultants are addressing maintenance and deficiency repairs in a proactive manner and within a reasonable time frame. We recommend that the owner continue this good practice going forward.

6.5. CERTIFICATION STATEMENT

I acknowledge that the Scrubber Sludge Complex, Peabody Ash Pond, and Slag Ponds 2A/2B/Stilling Pond CCW management units referenced herein were personally inspected by me on September 21, 2011. The structural soundness condition of each of the above listed units is classified as **FAIR**.

Signature: ______________________ Date: 18 JANUARY 2013

Timothy W. Kraus, PE
KY PE # 16209

STATE OF KENTUCKY
TIMOTHY W. KRAUS
16,209
LICENSED
PROFESSIONAL ENGINEER

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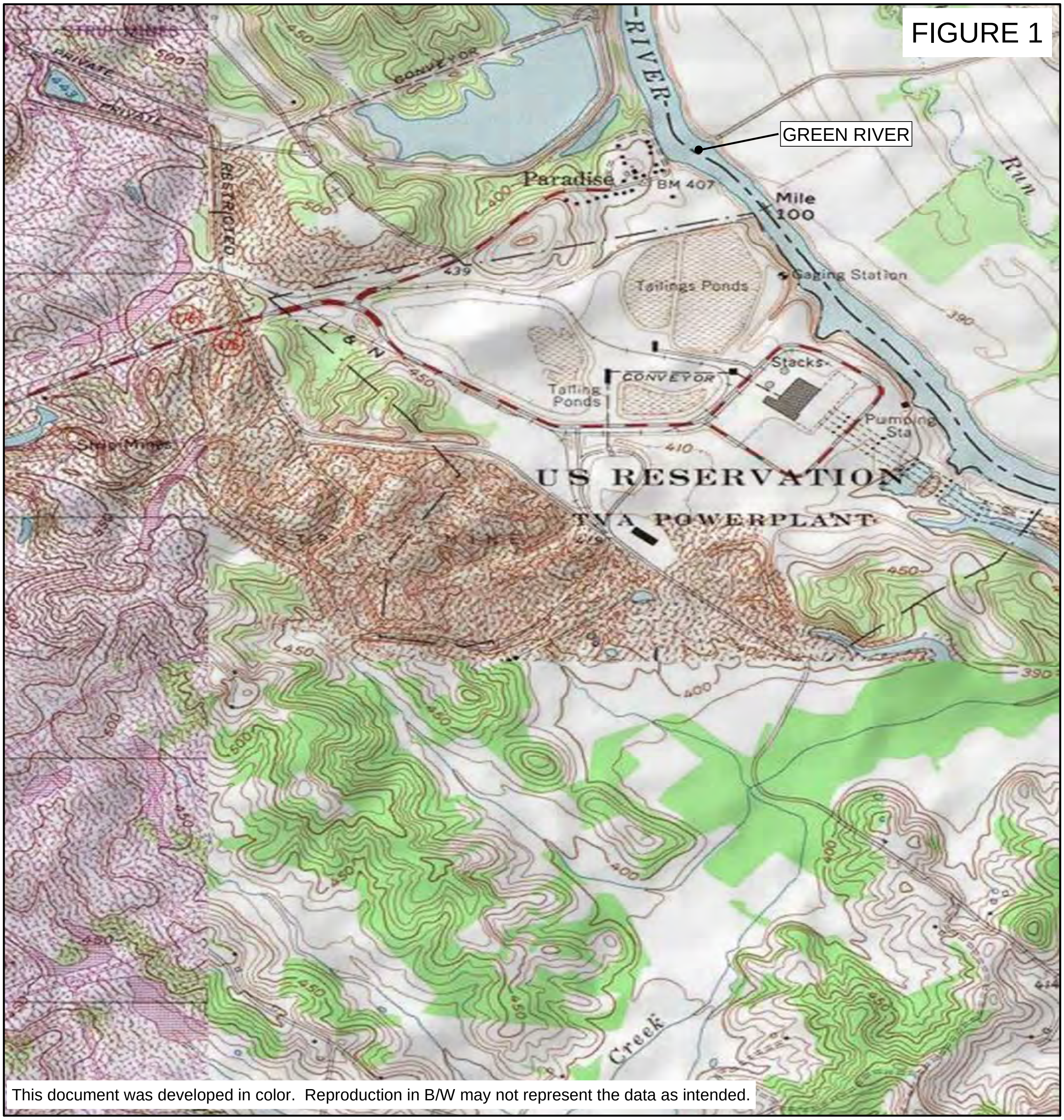
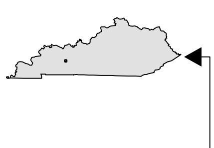
PLOTDATE:1/18/2013 DRK



ADAPTED FROM: CENTRAL CITY EAST, PARADISE, DRAKESBORO, AND ROCHESTER USGS QUADRANGLES

TENNESSEE VALLEY AUTHORITY
PARADISE FOSSIL PLANT
DRAKESBORO, KENTUCKY



MAP LOCATION

N

SITE LOCATION

0 | 1,000 | 2,000 | 4,000 | 6,000 | 8,000

Feet

JANUARY 2013
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1:24,000

O'BRIEN & GERE

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FIGURE 2

N

LEGEND

SITE FEATURE

TENNESSEE VALLEY AUTHORITY
PARADISE FOSSIL PLANT
DRAKESBORO, KENTUCKY

SITE LAYOUT

0 1,000 2,000 4,000
Feet

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PLOTDATE: 1/18/2013 DRK

FIGURE 3A

N

LEGEND

SITE FEATURE

INTERNAL CELL BOUNDARY

PHOTO LOCATION/ DIRECTION

TENNESSEE VALLEY AUTHORITY
PARADISE FOSSIL PLANT
DRAKESBORO, KENTUCKY

SCRUBBER SLUDGE COMPLEX PHOTO LOCATION MAP

0 300 600 1,200
Feet

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PLOTDATE: 1/18/2013 DRK

FIGURE 3B

N

LEGEND

SITE FEATURE

18 PHOTO LOCATION/ DIRECTION

TENNESSEE VALLEY AUTHORITY
PARADISE FOSSIL PLANT
DRAKESBORO, KENTUCKY

PEABODY ASH POND PHOTO LOCATION MAP

0 200 400 800
Feet

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FIGURE 3C

N

LEGEND

SITE FEATURE

25 PHOTO LOCATION/ DIRECTION

TENNESSEE VALLEY AUTHORITY
PARADISE FOSSIL PLANT
DRAKESBORO, KENTUCKY

SLAG PONDS 2A/2B PHOTO LOCATION MAP

0 100 200 400
Feet

JANUARY 2013
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APPENDIX A

Visual Inspection Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	TVA Paradise Plant	Date:	9/21/11
Unit Name:	Scrubber sludge Complex	Operator's Name:	TVA
Unit I.D.:		Hazard Potential Classification:	High Significant ~~Low~~
Inspector's Name:	D. Whetstone/T. Kraus		

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	See Below		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	475.9		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	475.9		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	NA		Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	480.8		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?	✓		Is water exiting outlet flowing clear?	✓	
7. Is the embankment currently under construction?	✓		21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	✓		From underdrain?	✓	
9. Trees growing on embankment? (If so, indicate largest diameter below)			At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?	✓	
12. Are decant trashracks clear and in place?	✓		From downstream foundation area?	✓	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?		✓	23. Water against downstream toe?	✓	
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1. TVA perform daily, weekly, monthly, quarterly, and annual inspections. A formal annual inspection report is prepared.

2. & 3. Outfall from upper stilling pond. Water surface elevations at top of complex is variable and top-most diking was under construction.

7. The upper-most dike around the gypsum stack was under construction to reconfigure upper settling ponds.

21. Large seepage filters and rock toe buttresses along outer dike toe at gypsum stack. Seepage and slope stability is under control.

23. Upper stilling pond at toe of gypsum stack.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # KY0004201 INSPECTOR D. Whetstone
Date 9/21/11

Impoundment Name Scurbber Sludge Complex (Gypsum Stack)
Impoundment Company TVA
EPA Region 4
State Agency (Field Office) Address KY Dept. of Env. Protection – Division of Water
14 Reily Road, Frankford KY 40601

Name of Impoundment ____________
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ________ Update __________

	Yes	No
Is impoundment currently under construction?	X	
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Settling and storage of flue gas scrubber residuals (gypsum and flyash)

Nearest Downstream Town : Name Rockport, KY
Distance from the impoundment 7.3 miles
Impoundment
Location: Longitude 37 Degrees 14 Minutes 38.85 Seconds
Latitude 87 Degrees 60 Minutes 07.41 Seconds
State KY County Muhlenberg

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency?____________

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

~~X~~ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

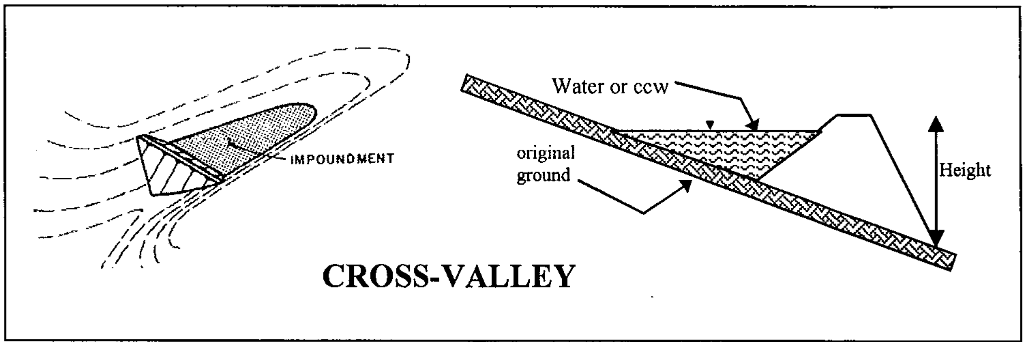
✓ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

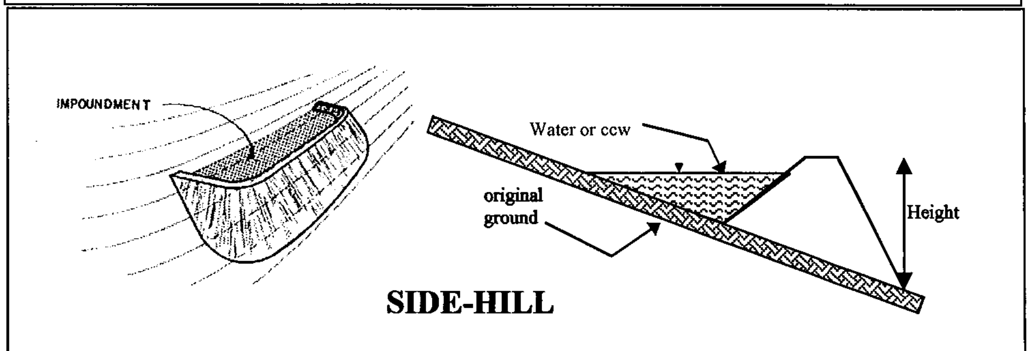
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

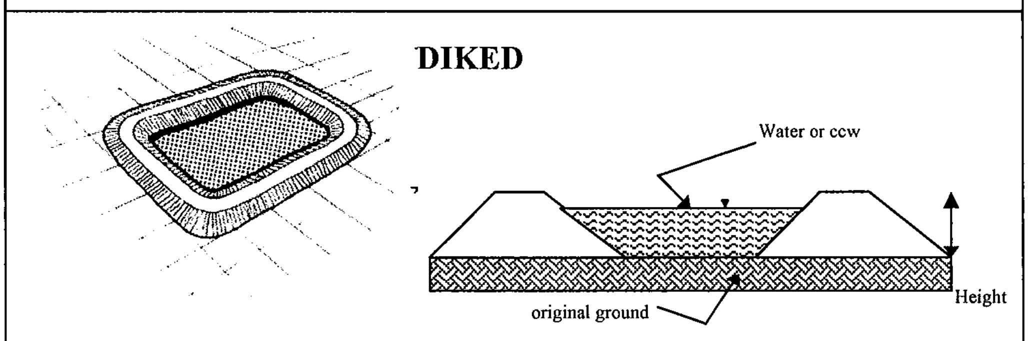
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

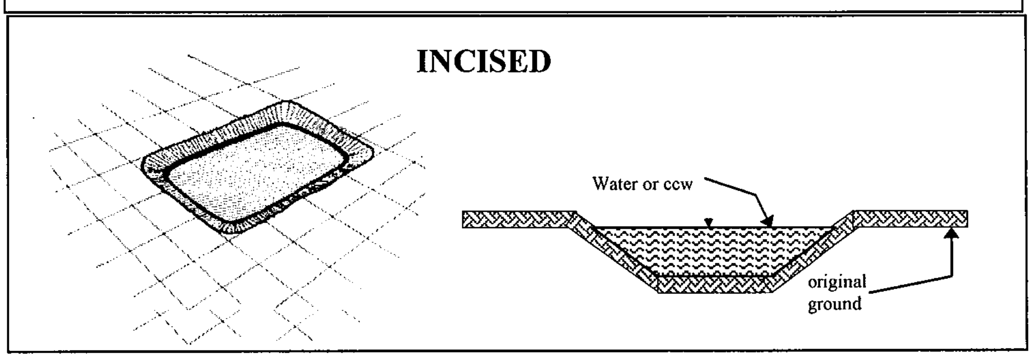
A breach is not expected to cause loss of life or significant economic damage. Releases would most likely be retained on owner's property. The facility is in a rural area. Releases could impact nearby waterways causing environmental damage; therefore, the rating was updated to Significant.

CONFIGURATION:









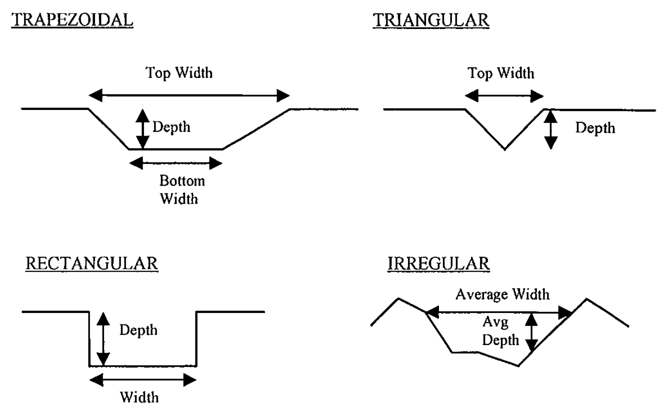
_____ Cross-Valley
_X___ Side-Hill
_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height _62______ feet Embankment Material __Outer Dike – Clay_
Pool Area _______12.4_______ acres Liner ______None__________________
Current Freeboard _4.9________ feet Liner Permeability ______--_______________

TYPE OF OUTLET (Mark all that apply)

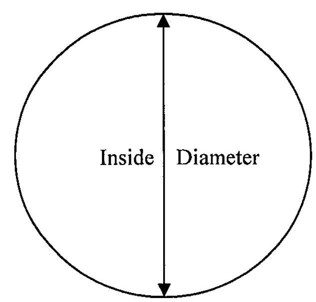
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width



_X__ **Outlet**

_48"_ inside diameter transitions to 36" diameter at outfall



Material
_____ corrugated metal
_____ welded steel
_X__ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES _X____ NO _______

_____ **No Outlet**

_____ **Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By ___________TVA___________________________

EPA Form XXXX-XXX, Jan 09

Has there ever been a failure at this site? YES __________ NO __X________

If So When? ___________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ____X____ NO _______

If So When? __________2009________________

IF So Please Describe: At the time of Stantec's Phase I Assessment in 2009 uncontrolled seepage and poor drainage conditions were observed along slopes of all dikes. TVA has since taken aggressive actions to filter and control seepage, stabilize slopes, and instrument and monitor phreatic lines and slope movement.

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ____X____ NO ______

If so, which method (e.g., piezometers, gw pumping,...)? Piezometers and reconfiguration of gypsum stack dikes

If so Please Describe : Given the extensive uncontrolled seepage problems cited on previous page, TVA has taken aggressive action to install permanent piezometers and inclinometers to monitor the phreatic line within the dikes and monitor slope movement. TVA has also modified their previous rim ditching method of sluicing and stacking flue gas scrubber sludge so as to move the rim ditch away from the crest of the dike in an effort to lower the phreatic line in the upper dikes. In addition, extensive seepage filters and rock (riprap) toe buttresses have been installed to get seepage under control and stabilize slopes.

Additional Inspection Questions

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

Intermediate bench dikes were built over sluiced gypsum and gypsum flyash materials. Outer/starter dike was not built over above materials.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No

From the site visit or from photographic documentation, was there evidence of prior releases, failure, or patchwork on the dikes?

Yes. Extensive slope toe buttresses have been constructed along most of the dikes using riprap. In the past, there has been documented slope sloughing and "blow outs" which have prompted the toe buttressing work. All slopes appeared to be in stable condition at time of inspection.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	TVA Paradise Plant	Date:	9/21/11
Unit Name:	Peabody Ash Pond and Stilling Pond	Operator's Name:	TVA
Unit I.D.:		Hazard Potential Classification:	High Significant ~~Low~~
Inspector's Name:	D. Whetstone/T. Kraus		

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No
1. Frequency of Company's Dam Inspections?	See Below	
2. Pool elevation (operator records)?	404.1	
3. Decant inlet elevation (operator records)?	404.1	
4. Open channel spillway elevation (operator records)?	NA	
5. Lowest dam crest elevation (operator records)?	406.9	
6. If instrumentation is present, are readings recorded (operator records)?	✓	
7. Is the embankment currently under construction?		✓
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?		
9. Trees growing on embankment? (If so, indicate largest diameter below)	✓	
10. Cracks or scarps on crest?		✓
11. Is there significant settlement along the crest?		✓
12. Are decant trashracks clear and in place?	✓	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓
14. Clogged spillways, groin or diversion ditches?		✓
15. Are spillway or ditch linings deteriorated?		✓
16. Are outlets of decant or underdrains blocked?		✓
17. Cracks or scarps on slopes?		✓

	Yes	No
18. Sloughing or bulging on slopes?		✓
19. Major erosion or slope deterioration?		✓
20. Decant Pipes:		
Is water entering inlet, but not exiting outlet?		✓
Is water exiting outlet, but not entering inlet?		✓
Is water exiting outlet flowing clear?	✓	
21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
From underdrain?	NA	
At isolated points on embankment slopes?	✓	
At natural hillside in the embankment area?		✓
Over widespread areas?		✓
From downstream foundation area?		✓
"Boils" beneath stream or ponded water?		✓
Around the outside of the decant pipe?		✓
22. Surface movements in valley bottom or on hillside?		✓
23. Water against downstream toe?	✓	
24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1. TVA performs daily, weekly, monthly, quarterly and annual inspections. A formal inspection report is prepared annually.

9. 12" diameter trees with heavy brush on outboard slope of original eastern dike.

~~8. Unknown~~

19. Some erosion rills in outboard slope below intermediate bench of east dike.

21. One or two very small wet areas in downstream area on intermediate bench. No flow observed. This could be due to poor drainage conditions.

23. Cut channel for diversion of Jacob's Creek is present along the northern portion of the east dike toe.

EPA FORM -XXXX

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # KY0004201 INSPECTOR D. Whetstone/T. Kraus

Date 9/21/11

Impoundment Name Peabody Ash Pond and Stilling Pond

Impoundment Company TVA

EPA Region 4

State Agency (Field Office) Address KY Dept. of Env. Protection – Div. of Water
14 Reily Road, Frankfort, KY 40601

Name of Impoundment ______
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ______ Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Settling and storage of flyash

Nearest Downstream Town : Name Rockport, KY

Distance from the impoundment 5.8 miles

Impoundment Location:

Longitude 37 Degrees 14 Minutes 32.7 Seconds

Latitude 86 Degrees 58 Minutes 47.9 Seconds

State KY County Muhlenberg

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency? ______

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

~~X~~ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

✓ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

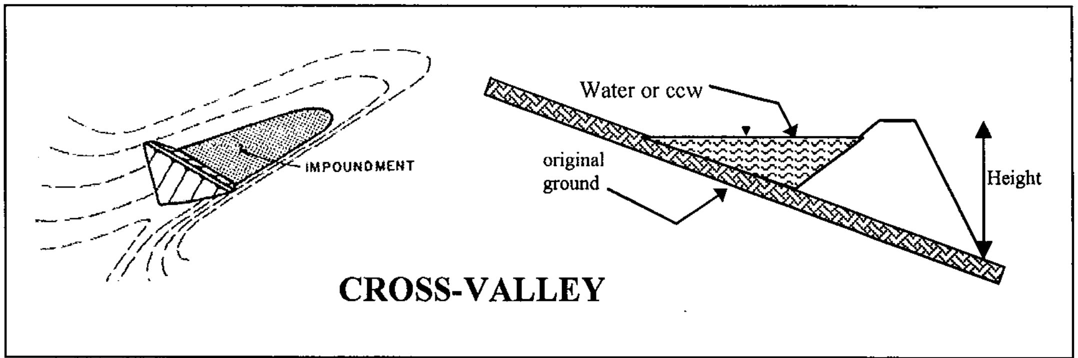
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

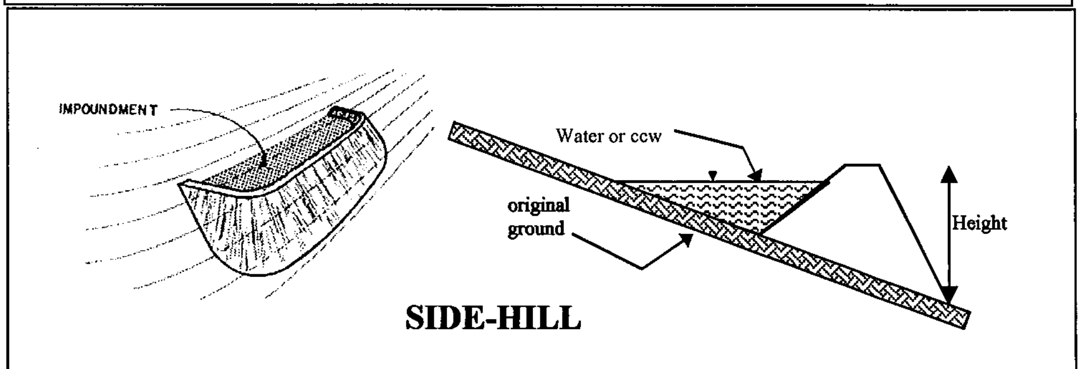
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

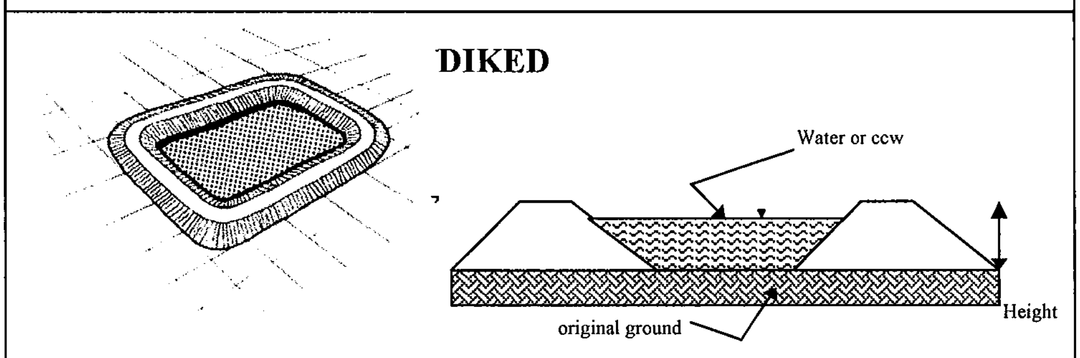
Dike is relatively low at 18 feet +/-. Releases would likely be contained on facility property. TVA Paradise Plant location is in a rural area.

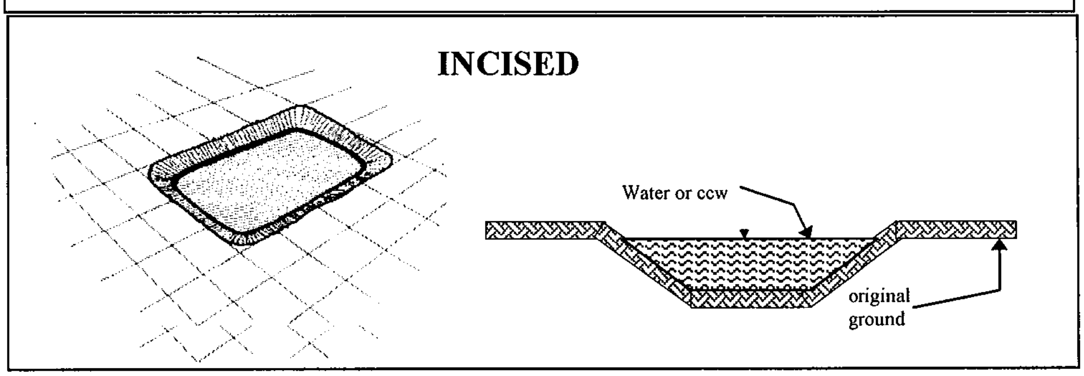
Releases could impact nearby waterways causing environmental damage; therefore, the rating was updated to Significant.

CONFIGURATION:







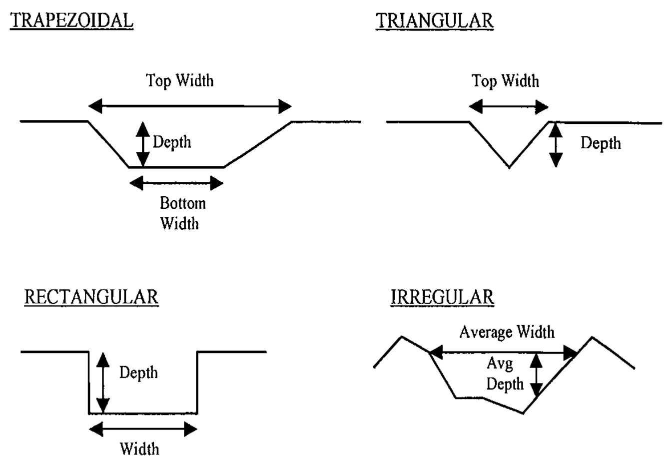


_____ Cross-Valley
_X___ Side-Hill
_____ Diked
_____ Incised (form completion optional) _____ Combination Incised/Diked
Embankment Height _18______ feet Embankment Material __Clay_______
Pool Area _113.9____________ acres Liner ______None_________________
Current Freeboard _2.8_________ feet Liner Permeability ________________
5.2 for stilling pond

TYPE OF OUTLET (Mark all that apply)

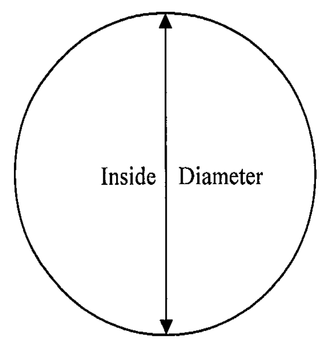
_NA_ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width



_X_ **Outlet**

3 @ 48” inside diameter – Riser Spillway
3 @ 36” inside diameter – Outlet Conduit



Material
_____ corrugated metal
_____ welded steel
_X_ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify)
____

Is water flowing through the outlet? YES _X_ NO ______

_____ **No Outlet**

_____ **Other Type of Outlet** (specify) ______________________________

The Impoundment was Designed By _TVA In-House________________________

Has there ever been a failure at this site? YES ___________ NO __X________

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES _______ NO __X______

If So When? ___________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO __X__

If so, which method (e.g., piezometers, gw pumping,...)? ________________________

If so Please Describe : ____

Additional Inspection Questions

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No,

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

NO

From the site visit or from photographic documentation, was there evidence of prior releases, failure, or patchwork on the dikes?

A surficial slide on the outboard slope of the eastern dike near the stilling pond had been repaired with riprap. TVA reports no releases occurred due to this surficial slide.

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name:	TVA Paradise Plant	Date:	9/21/11
Unit Name:	Slag Pond 2A/2B and Slag Stilling Pond	Operator's Name:	TVA
Unit I.D.:		Hazard Potential Classification:	High Significant ~~Low~~
Inspector's Name:	D. Whetstone/T. Kraus		

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	See Below		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	411.3 to 411.7		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	411.3		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	NA		Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	413.9		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)? NA			Is water exiting outlet flowing clear?	✓	
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?			From underdrain?		✓
9. Trees growing on embankment? (If so, indicate largest diameter below)	✓		At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	✓		From downstream foundation area?	✓	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?		✓	23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1. TVA perform daily, weekly, monthly, quarterly, and annual inspections. A formal annual inspection report is prepared.

2. Slag Pond 2A and 2B, respectively.

8. Unknown

9. A few trees on outboard slope of east dike 4-6" max. diameter.

21. Apparent seep/wet area in downstream area beyond toe of north dike of Slag Pond 2B.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # KY0004201 INSPECTOR D. Whetstone
Date 9/21/11

Impoundment Name Slag Ponds 2A and 2B
Impoundment Company TVA
EPA Region 4
State Agency (Field Office) Address KY Dept. of Env. Protection – Division of Water
14 Reily Road, Frankford KY 40601

Name of Impoundment ______
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ______ Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Settling and storage of bottom ash/boiler slag

Nearest Downstream Town : Name Rockport, KY
Distance from the impoundment 5.5 miles
Impoundment
Location: Longitude 37 Degrees 15 Minutes 53 Seconds
Latitude 86 Degrees 58 Minutes 53 Seconds
State KY County Muhlenberg

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency? ______

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

~~_X_~~___ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

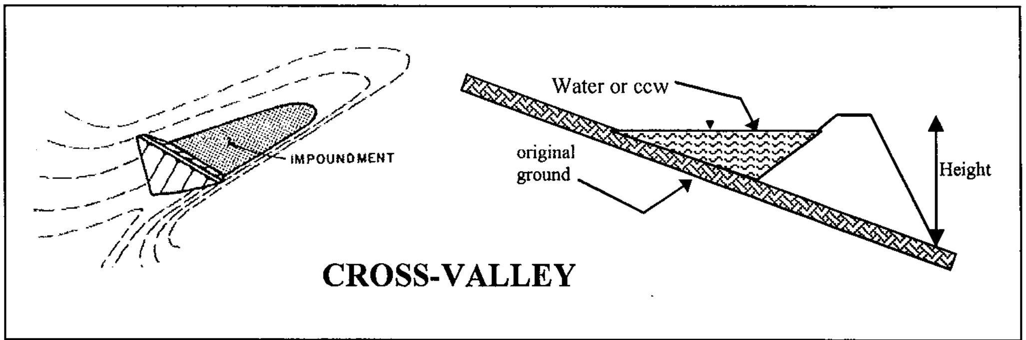
__✓__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

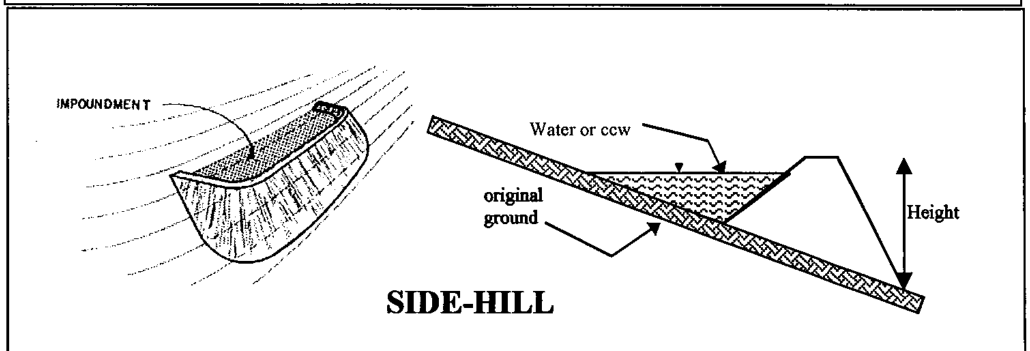
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

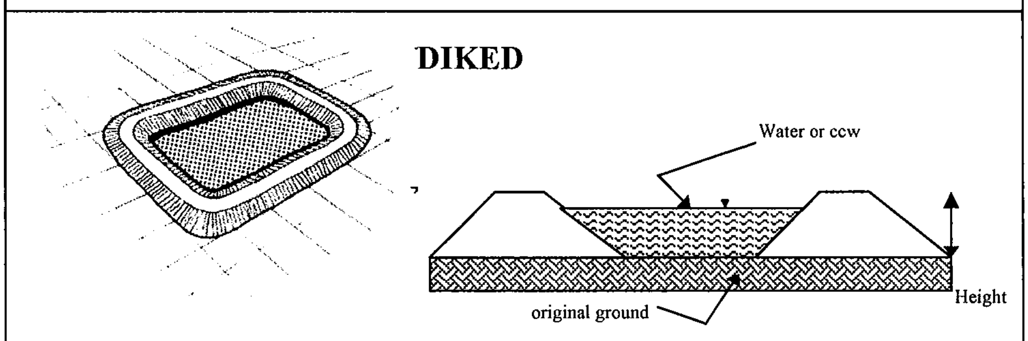
DESCRIBE REASONING FOR HAZARD RATING CHOSEN: Dike is relatively low. Site is in a rural area. Impacts would likely be limited to owner.

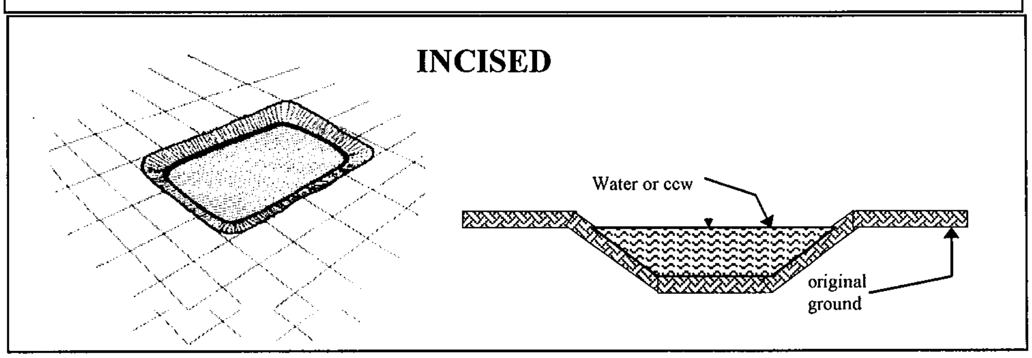
Releases could impact nearby waterways causing environmental damage; therefore, the rating was updated to Significant.

CONFIGURATION:





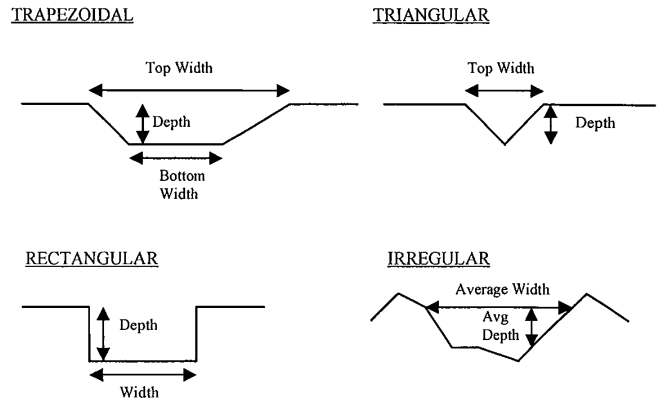




_____ Cross-Valley
_____ Side-Hill
_____ Diked
_____ Incised (form completion optional)
_X___ Combination Incised/Diked – 2A is incised on N, S, and W sides

Embankment Height _24______ feet Embankment Material __Clay_______
Pool Area ________16.8_______ acres Liner ______None________________
Current Freeboard _2.2 – 3.0___ feet Liner Permeability ______--_________

TYPE OF OUTLET (Mark all that apply) Pond 2B to stilling pond

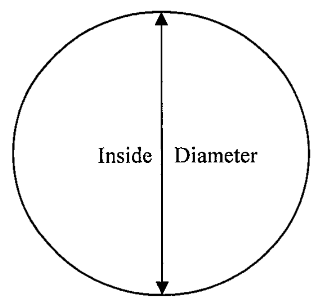


_X___ **Open Channel Spillway**
_X___ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_5.5__ depth
_16___ bottom (or average) width
_38___ top width

_X___ **Outlet** from stilling pond to Green River

_3 @ 36 inside diameter Riser pipe weir



Material
_____ corrugated metal
_____ welded steel
_X___ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES __X_____ NO _______

_____ **No Outlet**

_____ **Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By ___________TVA__________________________
____

EPA Form XXXX-XXX, Jan 09

Has there ever been a failure at this site? YES ___________ NO __X_________

If So When? ______________________________

If So Please Describe : ____

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Has there ever been significant seepages at this site? YES _______ NO __X_______

If So When? ___________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO _X___

If so, which method (e.g., piezometers, gw pumping,...)? ________________________

If so Please Describe : ____

Additional Inspection Questions

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

Unknown

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No

From the site visit or from photographic documentation, was there evidence of prior releases, failure, or patchwork on the dikes?

No

APPENDIX B

Photographs

PHOTOGRAPHIC LOG

O'BRIEN & GERE

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant – Scrubber Sludge Complex	Location: Drakesboro, Kentucky

Orientation: NE

Description: View of reverse graded filter placed over active seep at toe of East Pond dike.

Date: 9/21/11

Photo Number: 1

Photographer: DDW

Orientation: NW

Description: Riprap armoring of lower slope of east dike. Note inclinometer and piezometer instrumentation in the background.

Date: 9/21/11

Photo Number: 2

Photographer: DDW

PHOTOGRAPHIC LOG

O'BRIEN & GERE

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant—Scrubber Sludge Complex	Location: Drakesboro, Kentucky

Orientation: SW

Description: Rock buttress at toe of south dike of East Pond

Date: 9/21/11

Photo Number: 3

Photographer: DDW

Orientation: N

Description: Piezometer instrumentation station

Date: 9/21/11

Photo Number: 4

Photographer: Tim Kraus

PHOTOGRAPHIC LOG

Client: US EPA | Project Number: 46122

Site Name: Paradise Fossil Plant – Scrubber Sludge Complex | Location: Drakesboro, Kentucky

Orientation: SE--down

Description: Outlet culvert from Upper to Lower Stilling Pond

Date: 9/21/11

Photo Number: 5

Photographer: DDW

Orientation: W

Description: View toward the west along the south dike of the west pond. Note good grass cover and riprap lined drainage ditch at toe. Active seep at toe beyond ditch.

Date: 9/21/11

Photo Number: 6

Photographer: Tim Kraus

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122
Site Name:	Paradise Fossil Plant – Scrubber Sludge Complex	Location:	Drakesboro, Kentucky

Orientation: SW

Description: Primary discharge from East Pond to Upper Stilling Pond

Date: 9/21/11

Photo Number: 7

Photographer: DDW

Orientation:

Description: Properly abandoned pipe penetration. Vertical pipes are grout and vent pipes.

Date: 9/21/11

Photo Number: 8

Photographer: DDW

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant – Scrubber Sludge Complex	Location: Drakesboro, Kentucky

Orientation: N

Description: Active seep at toe of West Pond regularly monitored for changing conditions.

Date: 9/21/11

Photo Number: 9

Photographer: DDW

Orientation: SW

Description: Newly constructed drainage swale along toe of slope. Properly graded to prevent standing water at toe.

Date: 9/21/11

Photo Number: 10

Photographer: DDW

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant – Scrubber Sludge Complex	Location: Drakesboro, Kentucky

Orientation: S

Description: New West Pond decanting structure /spillway

Date: 9/21/11

Photo Number: 11

Photographer: DDW

Orientation: NW

Description: Dewatered West Pond.

Date: 9/21/11

Photo Number: 12

Photographer: DDW

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant—Scrubber Sludge Complex	Location: Drakesboro, Kentucky

Orientation:

Description: East Pond decant structure/ spillway

Date: 9/21/11

Photo Number: 13

Photographer: DDW

Orientation: E

Description: Rim ditching in East Pond. Gypsum stacked dike crest is on right.

Date: 9/21/11

Photo Number: 14

Photographer: DDW

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122
Site Name:	Paradise Fossil Plant—Scrubber Sludge Complex	Location:	Drakesboro, Kentucky

Orientation: E

Description: Overview of compacted gypsum/flyash forming crest of East Pond. Upper stilling basin shown in right side of image

Date: 9/21/11

Photo Number: 15

Photographer: DDW

Orientation: S

Description: Slope armoring and seepage mitigation on north slope of East Pond.

Date: 9/21/11

Photo Number: 16

Photographer: DDW

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122
Site Name:	Paradise Fossil Plant—Scrubber Sludge Complex	Location:	Drakesboro, Kentucky

Orientation: NW

Description: Stockpiles of filter materials for emergency seepage control action

Date: 9/21/11

Photo Number: 17

Photographer: DDW

Orientation:

Date:

Photo Number:

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant-Peabody Ash Pond	Location: Drakesboro, Kentucky

Orientation: S	
Description: Three vertical riser outlet structures within the Peabody Ash Stilling Pond	
Date: 9/21/11	
Photo Number: 18	
Photographer: Tim Kraus	
Orientation:	
Description: Inside one of three outlet structures to Peabody Ash Stilling	
Date: 9/21/11	
Photo Number: 19	
Photographer: Tim Kraus	

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant-Peabody Ash Pond	Location: Drakesboro, Kentucky

Orientation: E

Description: Repair of slope sloughing on lower slope of east dike.

Date: 9/21/11

Photo Number: 20

Photographer: DDW

Orientation: N

Description: View along east dike. Note inboard slope armoring

Date: 9/21/11

Photo Number: 21

Photographer: Tim Kraus

PHOTOGRAPHIC LOG

Client: US EPA | Project Number: 46122

Site Name: Paradise Fossil Plant-Peabody Ash Pond | Location: Drakesboro, Kentucky

Orientation:

Description: Typical standpipe piezometer installation

Date: 9/21/11

Photo Number: 22

Photographer: DDW

Orientation:

Description: Heavy trees and brush along lower slope of east dike.

Date: 9/21/11

Photo Number: 23

Photographer: DDW

PHOTOGRAPHIC LOG

O'BRIEN & GERE

Client: US EPA | Project Number: 46122

Site Name: Paradise Fossil Plant-Peabody Ash Pond | Location: Drakesboro, Kentucky

Orientation: NW Description: Ash slurry flow entering west side of Peabody Ash Pond Date: 9/21/11 Photo Number: 24 Photographer: DDW	
Orientation: NE Description: Outlet structure discharge into Jacob's Creek Date: 9/21/11 Photo Number: 25 Photographer: DDW	

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122
Site Name:	Paradise Fossil Plant—Slag Ponds 2A/2B	Location:	Drakesboro, Kentucky

Orientation: N

Description: View of divider dike between Slag Ponds 2A(L) and 2B(R)

Date: 9/21/11

Photo Number: 26

Photographer: DDW

Orientation: N

Description: Inboard slope of Pond 2A looking north along dividing dike.

Date: 9/21/11

Photo Number: 27

Photographer: DDW

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant—Slag Ponds 2A/2B	Location: Drakesboro, Kentucky

Orientation: S

Description: Erosion of divider dike crest along Pond 2B side.

Date: 9/21/11

Photo Number: 28

Photographer: Tim Kraus

Orientation: S

Description: Slag Pond 2A – Overview picture of the Slag Pond to the West (Pond 2A)

Date: 9/21/11

Photo Number: 29

Photographer: Tim Kraus

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant—Slag Ponds 2A/2B	Location: Drakesboro, Kentucky

Orientation: S

Description: 60” Concrete pipe outlet from slag pond 2A to pond 2B.

Date: 9/21/11

Photo Number: 30

Photographer: Tim Kraus

Orientation: N

Description: 48” Pipes in foreground from pond 2A to pond 2B. Total of three pipes: two 48 inch and one 60 inch concrete pipe.

Date: 9/21/11

Photo Number: 31

Photographer: Tim Kraus

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant—Slag Ponds 2A/2B	Location: Drakesboro, Kentucky

Orientation: S	
Description: Outlet side of the 60" reinforced concrete pipe into pond 2B.	
Date: 9/21/11	
Photo Number: 32	
Photographer: Tim Kraus	
Orientation: S	
Description: Overview shot of slag pond 2B – with yellow skimmer buoys.	
Date: 9/21/11	
Photo Number: 33	
Photographer: Tim Kraus	

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant—Slag Ponds 2A/2B	Location: Drakesboro, Kentucky

Orientation: E

Description: Slag Pond 2B – to the left of previous picture

Date: 9/21/11

Photo Number: 34

Photographer: Tim Kraus

Orientation: N

Description: Slag pond 2B, to the left of previous picture. Pump station in background.

Date: 9/21/11

Photo Number: 35

Photographer: Tim Kraus

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122
Site Name:	Paradise Fossil Plant Paradise Fossil Plant—Slag Ponds 2A/2B	Location:	Drakesboro, Kentucky

Orientation: N Description: Wet area/seep at toe of north dike, Pond 2B Date: 9/21/11 Photo Number: 36 Photographer: DDW	
Orientation: Description: Open channel spillway from pond 2B to the stilling pond. Note cracking of concrete. Date: 9/21/11 Photo Number: 37 Photographer: Tim Kraus	

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Paradise Fossil Plant—Slag Ponds 2A/2B	Location: Drakesboro, Kentucky

Orientation:

Description:
Animal burrow in freeboard section of stilling pond inboard slope

Date: 9/21/11

Photo Number: 38

Photographer: DDW

Orientation:

Description:
Inside of one of three outlet structures from the stilling pond.

Date: 9/21/11

Photo Number: 39

Photographer: Tim Kraus

APPENDIX C
Stability Analysis Documentation

Report of Geotechnical Exploration

Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

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Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

February 9, 2010

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February 9, 2010 rpt_001_175569069

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

Re: Report of Geotechnical Exploration
Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

Dear Mr. Snider:

Stantec Consulting Services Inc. (Stantec) has completed a geotechnical exploration of the Peabody Ash Pond at the Paradise Fossil Plant. Our report, transmitted herewith, includes discussions of general site conditions, scope of work performed, subsurface conditions and results of laboratory testing and engineering analyses. The report also includes a review of historical documentation provided by TVA, and our conclusions and recommendations relative to the conditions encountered at the site. These services were performed under Engineering Service Request ESR/TAO 951 in accordance with the terms and provisions established in our System-Wide Services Agreement dated July 30, 2009.

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

Sincerely,

STANTEC CONSULTING SERVICES INC.

Sharath C. Vemuri, PE
Geotechnical Engineer

Hugo R. Aparicio, PE
Principal

/rdr

Report of Geotechnical Exploration

Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

February 9, 2010

Report of Geotechnical Exploration

Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

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Executive Summary

Stantec has completed a geotechnical exploration of the Peabody Ash Pond at Paradise Fossil Plant. Stantec's scope of work consisted of reviewing pertinent historical documentation provided by TVA, field observations, geotechnical exploration, engineering analyses and providing recommendations to perform certain improvements to the facility.

The Peabody Ash Pond consists of a main pond and an adjoining stilling pond. It is approximately 137 acres in area and partially enclosed by a 1.0-mile long dike with a maximum height of approximately 18 feet. The pond was built in 1997 on a previously strip mined and reclaimed area. It is our understanding that the previous strip mining operations left earthen fill dikes along the southern and eastern sides of the pond, next to Jacobs Creek. The approximate crest elevation of the earth dikes is 400 feet. TVA raised these dikes to 408 feet (current elevation) in 1997 for using the site as a fly-ash disposal pond. Reasonably complete design and as-built drawing information was provided by TVA, however, no information documenting engineering analysis, project specific material testing and construction quality assurance records were available for review.

The geotechnical exploration conducted by Stantec consisted of advancing 19 borings, performing field testing, installing piezometers (PZs) to monitor phreatic levels, and laboratory testing of soil samples. The exploration encountered mine-spoil deposits (lean clays) as the dike material in every boring and confirmed that this material was utilized to construct the initial dike during strip mining operations and subsequent containment dike built by TVA in 1997.

Seepage analysis was performed on a typical cross section of the dike using a finite element seepage model developed based on estimated material properties of the predominant soils. Steady-state conditions were assumed to estimate total hydraulic head values at selected nodal points and compared to values measured in the piezometers. Attempt to adjust the hydraulic properties of the subsurface materials to develop a seepage model that matches actual PZ readings was fairly successful. A minimum factor of safety of 9.5 against piping was obtained from the seepage analysis.

Slope stability of the dike was evaluated using two-dimensional limit equilibrium method of analysis, assuming static, long-term and fully drained conditions within the existing dike. Slope stability analysis was performed for a typical cross section of the dike using SLOPE/W and shear strength parameters selected based on laboratory testing. The minimum factor of safety against sliding obtained from the slope stability analysis is 1.7.

It is recommended that certain improvements be performed along the exterior slope of the dike. All the improvements are actually related to the small dike constructed during strip mining operations that preceded the development of the ash pond. After removing dense vegetation, the top of the dike should be reshaped such that positive grade is provided. There are areas where the slope of the small dike toes out along a steep bank of the Jacobs Creek channel. The corrective measures will likely include flattening of the slopes and armoring using sand and crushed limestone filter.

It is our understanding that at some point in future, TVA plans to increase the height of the dike to elevation 420 feet for creating additional storage capacity. Stantec recommends that the height of the dike be increased only after the geotechnical recommendations presented in this report are properly addressed. It is also recommended that a detailed engineering analysis (seepage and slope stability) be performed for this case prior to raising the dike.

Report of Geotechnical Exploration

Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

1. Introduction

1.1. General

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

1.2. Facilities Assessment Project

Stantec's scope of work for the facilities assessment project was divided into four (4) main phases designated as Phases 1 through 4. Phase 1 was sub-divided into two phases, 1A and 1B. A brief description of Stantec's scope of work for each of the phases is presented in the following paragraphs.

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

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

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

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

- Phase 4 – Dam safety training for TVA Staff and preparation of operation manuals.

At the time of this writing, Phase 1 of the assessment was completed at all fossil plants and Phase 2 was being implemented at several facilities located within the different plants. Phase 1 report recommended that Phase 2 evaluations include geotechnical exploration and hydraulic/hydrologic assessment. This report addresses the results of Phase 2 geotechnical exploration of Peabody Ash Pond facility located within the Paradise Fossil Plant.

2. Paradise Fossil Plant

2.1. General

The Paradise Fossil Plant is located in western Kentucky on the banks of Green River near the town of Drakesboro, Kentucky. The plant can be accessed by taking State Route 176 northeast from Drakesboro. Figure 1 shows the approximate location of the plant.

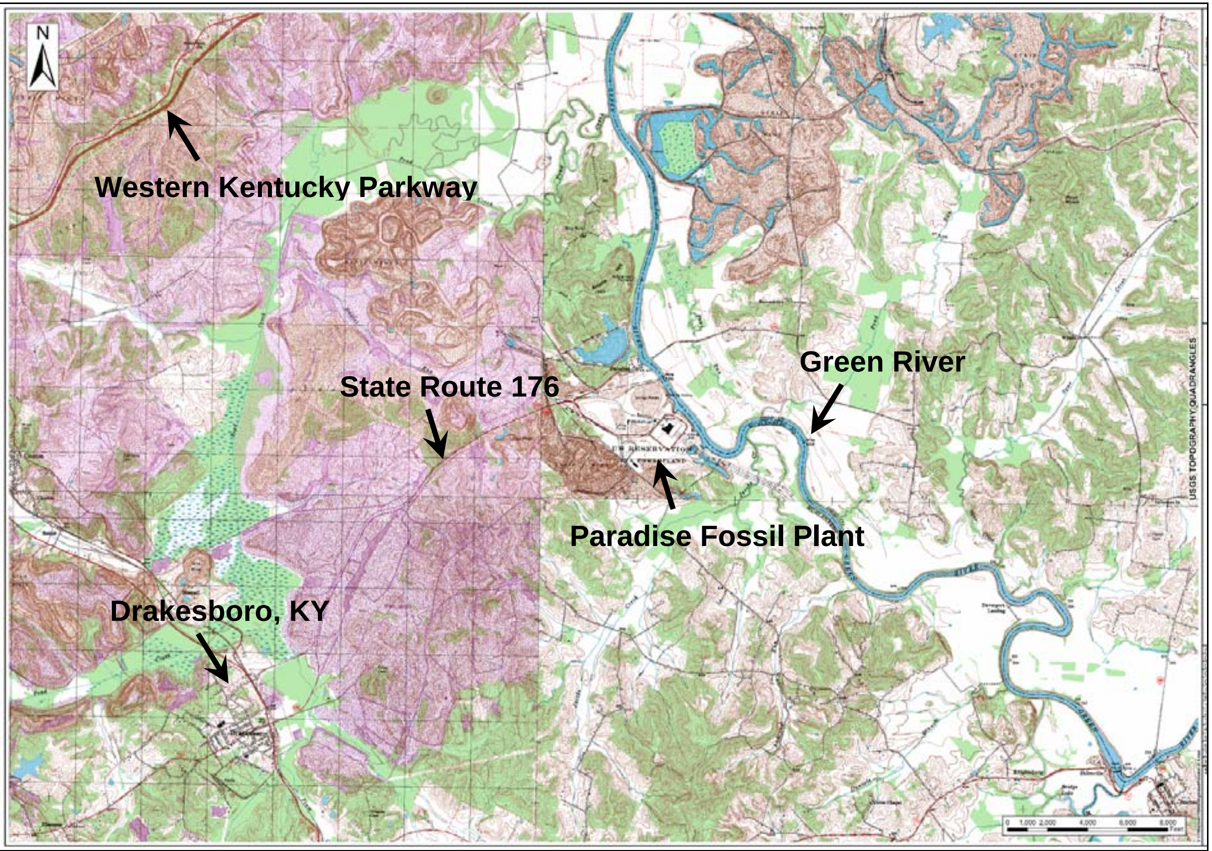


Figure 1. Approximate Site Location

2.2. Power Generation

Paradise Fossil Plant has three generating units completed between 1963 and 1970, and three large natural-draft cooling towers to provide cooling water. The plant generates 14 billion kilowatt-hours of electricity a year, enough to supply more than 930,000 homes. The winter net dependable generating capacity is 2,273 megawatts and the plant consumes approximately 20,000 tons of coal a day.

3. Peabody Ash Pond

The Peabody Ash Pond is located in the southeast corner of the Paradise facility (see Figure 2). The Peabody Ash Pond is bordered by Jacobs Creek along the east side, two lagoons belonging to the Green River watershed on the south, hilly and grassy areas along the west and Jacobs Creek Ash Disposal Pond on the north. Based on the historic documents reviewed (see Table 1), the construction of the dike took place sometime during 1997. The pond was put into operation in September 1997. The facility consists of a main pond and a stilling pond. The layout of the two ponds is presented in Figure 3.

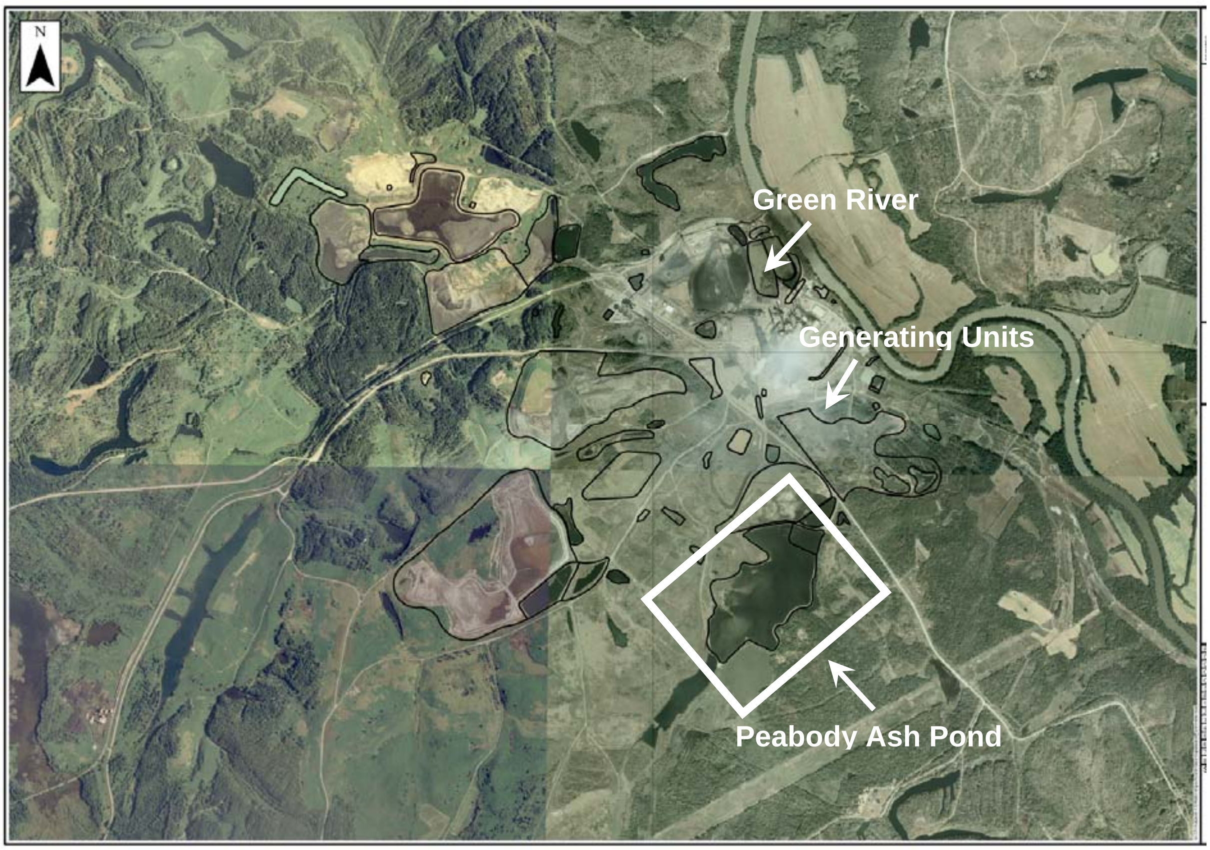


Figure 2. Location of Peabody Ash Pond

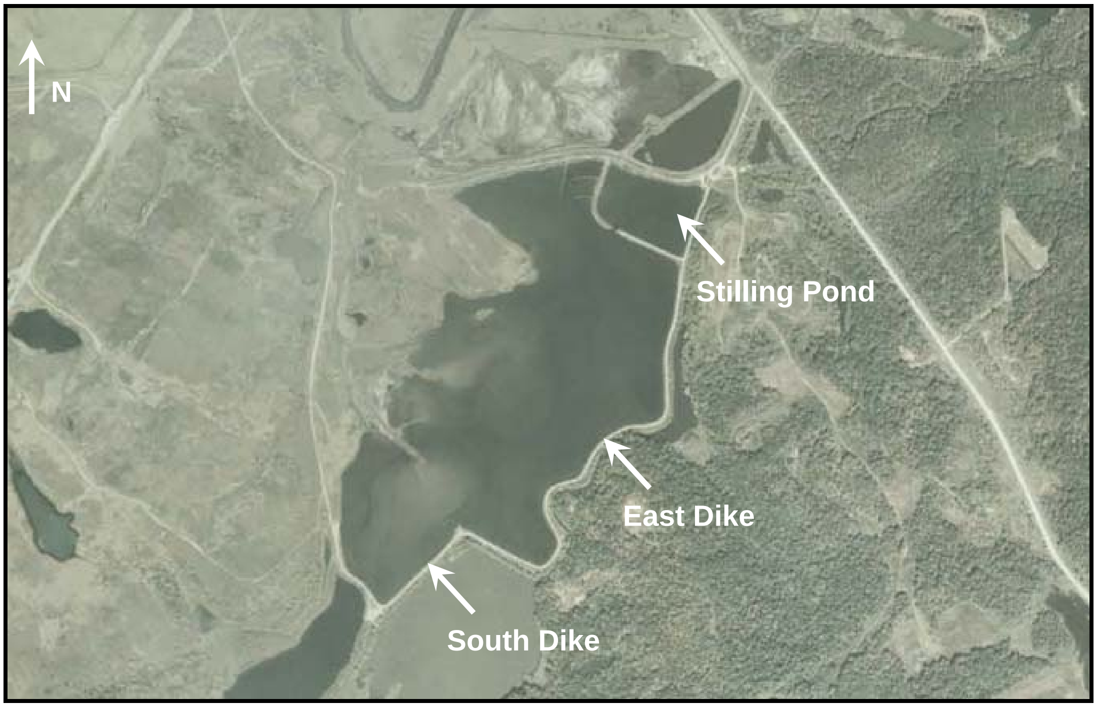


Figure 3. Peabody Ash Pond Complex

Table 1 presents key details relative to the development and dimensions of the facility.

Table 1. Details of Peabody Ash Pond

Item	Value
Construction	1996-97
Surface Area	137 Acres
Current Maximum Height	18 feet
Current Elevation of Dike	408 feet
Planned Final Elevation of Dike	420 feet
Current Overall Dike Length	5,500 feet

4. Scope of Work

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

a. Review of Available Information

b. Review of General Site Geology and Coal Mining Records

c. Subsurface Exploration

d. Field Instrumentation and Monitoring

e. Surveying

f. Laboratory Testing

g. Review of Existing Conditions and Ongoing repairs

h. Engineering Analyses

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

5. Review of Available Information

5.1. General

As part of the Phase 1 of facilities assessment project, Stantec reviewed all the documents provided by TVA pertaining to the Peabody Ash Pond. However, only the documents listed below (in Table 2) were considered relevant to the geotechnical exploration.

Table 2. List of Documents Reviewed for Geotechnical Exploration

Reference No.[1]	Document Name	Type of Document	Dated	Agency	TVA Reference No.
1	Environmental Assessment Report	Report	March, 1989	TVA	NA[2]
2	Jacobs Creek Ash Disposal Area Extension	Design Drawings	January, 1996 & February, 1997	TVA	10W3274 1 through 6
3	PAF Draft Report on Fly Ash Expansion from Jerry Glover to Phil Pfeifer	Report	March 29, 1998	TVA	NA[2]
4	Annual Inspection of Waste Disposal Areas[3]	Reports	FY'96 to FY'08	TVA	NA[2]

(1) Presented as attachments in this order in Appendix A
(2) Not Applicable
(3) Copies of annual reports received from TVA are not included with the report due to space constraints

5.2. Site History

The documents listed in Table 2 were used to gain an understanding of key events related to the planning, construction and operation of the Peabody Ash Pond. These events are listed in Table 3 in chronological order.

Table 3. Summary of Events

Date*	Event
March, 1988	Environmental Site Assessment for new Peabody Ash Pond
January, 1996	Initial Issue of General Plan Drawings
February, 1997	Revisions to General Plan Drawings
Feb, 1997 -Sep, 1997	Construction of Peabody Ash Pond
September, 1997	Peabody Ash Pond put into operation

*-All dates listed are approximate based on Stantec's review of available documents

Based on the historic documentation reviewed, the Peabody Ash Pond site was built on land that was previously strip mined and reclaimed. The land was originally not owned by TVA and was purchased sometime between 1988 and 1996 and later turned into fly ash disposal area. The previous strip mining operations left earthen fill dikes along the southern and eastern sides with approximate crest elevation of 400 feet. It is our understanding that the existing dikes left over from strip mining operations were too low to allow the pond to be operated above the 100-year flood elevation. In order to meet the environmental standards at that time, and for the pond to be totally above the 100-year flood elevation (while allowing enough retention time for suspended solids), TVA raised the dikes to crest elevation 408 feet. A divider dike was constructed in the northeast portion of the area to form a stilling pool. Figure 5 provides a schematic representation of dike construction obtained from the historic drawing number 10W3274-3 (dated January, 1996) provided by TVA. A copy of this drawing is also presented in Appendix A.

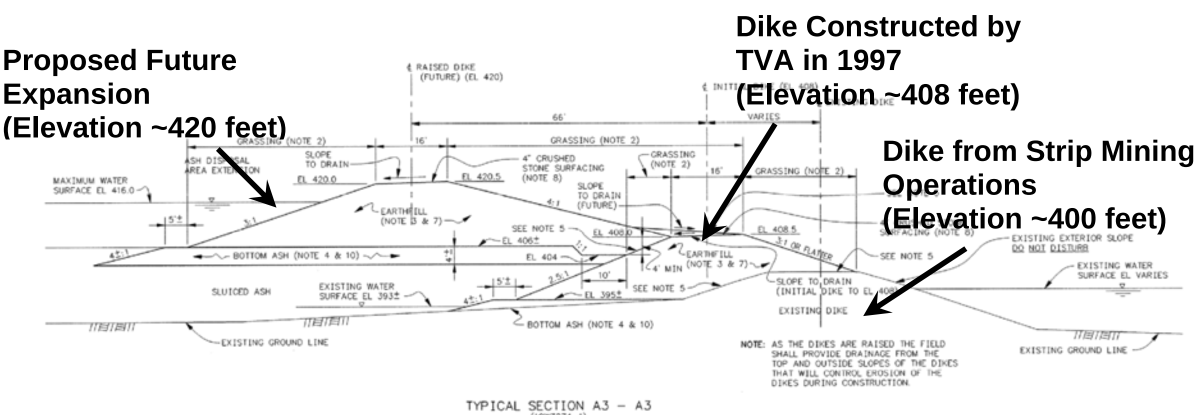


Figure 4. Cross Section of Dike from Historic Drawing No. 10W3274-3

5.3. 2009 Renovations and Existing Conditions

In February, 2009 the east and south dike interior slopes had dense phragmites growth. Despite the vegetative growth, over the years wave action had eroded most of the interior slope above and below the normal pool elevation. Based on work plans issued by Stantec, the interior slopes were repaired by TVA in June, 2009. The repairs included removal of vegetation along the interior slopes followed by armoring using filter fabric and Class II channel lining.

The exterior slopes consist of dense brush, weeds and tall trees with some intermingled grass. Tall trees were mostly noted along the original dike that was left undisturbed when the impounding dike was constructed. Most of the trees are 12 inch diameter or less, but some larger trees were also noted. There are two areas where the small earthen fill dike formed during past strip mining operations has slopes that toe out or transition into a drainage channel with a steep bank. While the historical information (Figure 5) shows the slope of the small earthen dike as 3:1, today there are areas where the channel bank slope is steeper. In one area near the northeast corner of the pond (see Figure 6), the steep slope resulted in some sloughing.

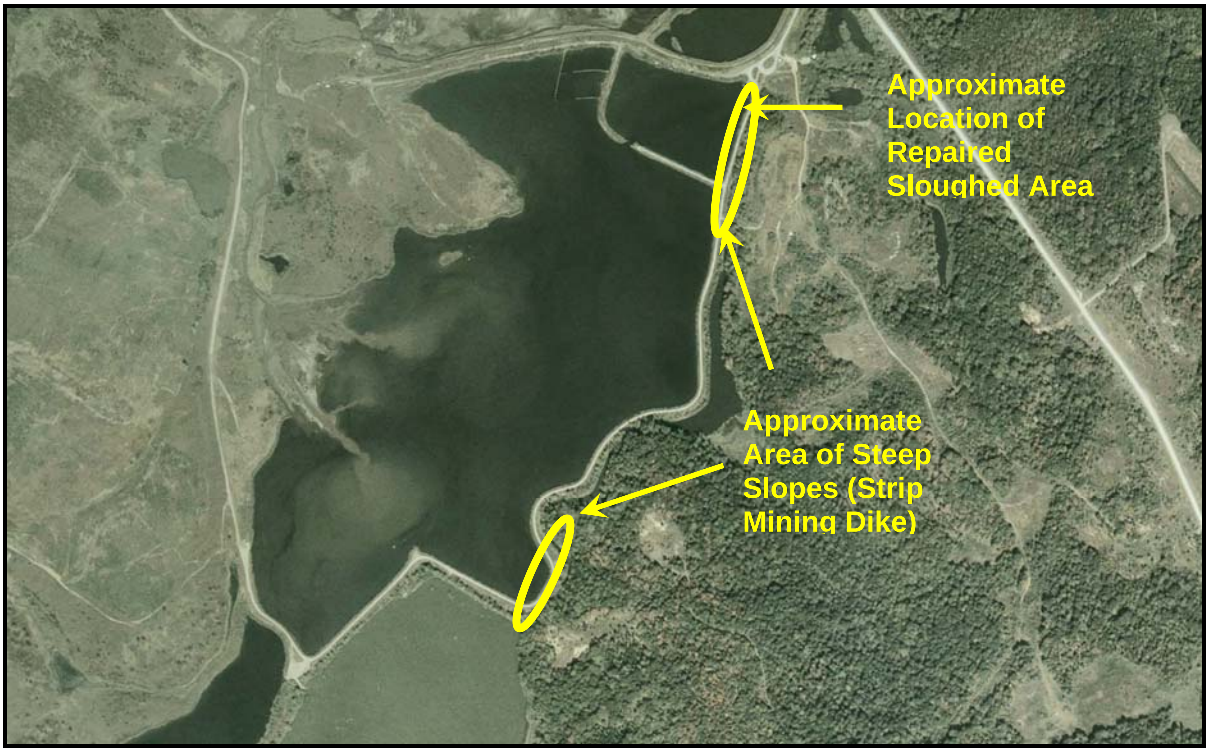


Figure 5. Approximate Location of Repaired Sloughed Area

The sloughed area was approximately 35 feet in width and 10 feet in height extending from the top of original dike (at elevation 400 feet) to the toe of the slope (at elevation 390 feet). Following an issuance of work plan by Stantec, the sloughed area was repaired by TVA. Repair measured consisted of removing vegetation and loose material in the area and slope armoring using filter fabric and Class II channel lining. The work was completed in August, 2009.

Also, there are isolated areas along the top of this earthen dike where standing water occurs due to lack of proper grade. Standing water was observed after certain precipitation events.

6. General Site Geology

6.1. Geology

The Paradise Fossil Plant is underlain by coal rich Pennsylvanian age bedrock formations. Extensive strip mining operations performed prior to the construction of the plant have significantly altered the topography and geology within the vicinity of the plant and, as such, large areas of the plant are underlain by deep mine spoil deposits.

According to the USGS Geologic Map of the Rochester Quadrangle (1974), the Peabody Ash Pond vicinity is underlain by alluvium deposits and bedrock belonging to the Sturgis and Carbondale Formations, in general order of descending geology. The Sturgis Formation is described as consisting of inter layered sandstone, shale, coal, underclay, limestone and siltstone. The coal seams listed within this formation in descending order are known as No. 13 and No. 12. The mapping also shows one unnamed seam above No. 13 seam. The Carbondale Formation generally consists of cyclic sequences of fine-grained sandstone, sandy shale, coal, and silty underclay. This formation contains in descending order the No. 11, No. 10, No. 9, No. 7 and No.6 coal seams. No. 11 seam was mapped as the top of the formation.

The No. 13 seam is shown outcropping within the footprint of the site, while an unnamed seam outcropped southwest of the site (see Figure 4). According to the topographic information shown in the geologic map, the site was developed over what used to be the floodplain of Jacobs Creek and one of its tributaries. The floodplain is shown to have contained alluvial deposits generally consisting of gravel, sand, silt, and clay.

6.2. Coal Mining

Extensive coal mining has occurred in the Peabody Ash Pond vicinity over the years (see Table 4). Coal seams mined in the vicinity include West Kentucky Coal Bed Numbers 9, 10 and 11 associated with the Carbondale Formation and West Kentucky Coal Bed Numbers 12 and 13 associated with the Sturgis Formation. There have also been numerous rider coal seams and unnamed coal seams mined in the vicinity of the power plant. Mine maps obtained from the Kentucky Mine Mapping Information System are presented along with the aerial mapping in Appendix I.

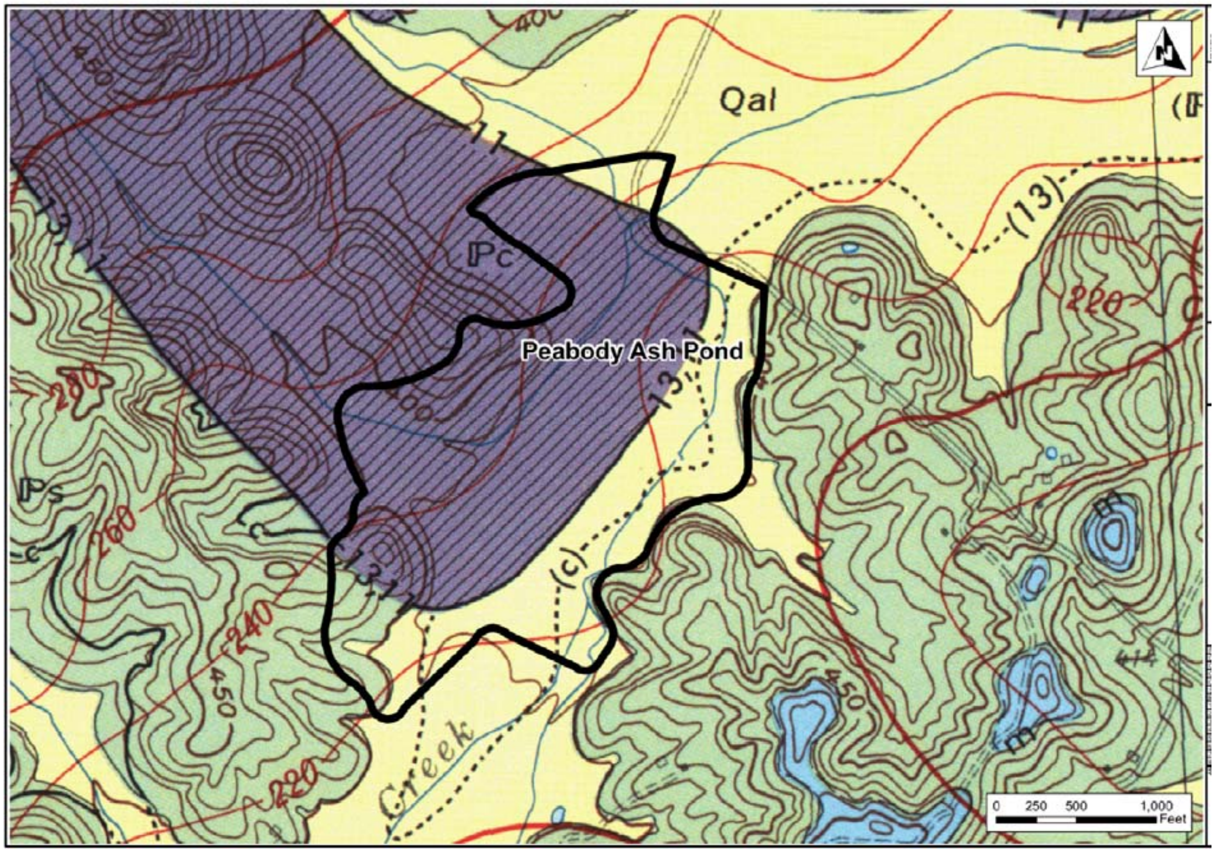


Figure 6. Geologic Map of Peabody Ash Pond (Source: USGS)

Table 4. Mining Activity in the Area of Scrubber Sludge Complex

Seam No.(1)	State File No.(s)	Type(2)	Company	Date(s) Mined	Seam(s) Mined	Type of Mining(3)
580	02106	SRC	Pittsburg & Midway Coal	1960-79	9,10,11,12,13	Surface
585	02106	SRC	Pittsburg & Midway Coal	1960-79	9,10,11,12,13	Surface
590	00825-2	STC	Peabody Coal Co.	1962-81	9,11,12,13	Surface
	00825-2	STC	Peabody Coal Co.	1962-81	9,11,12,13	Surface
600	05877-15	UTC	Peabody Coal Company	1974-91	9	Deep

(1) In descending elevation;

(2) SRC=Surface Rail Coal, STC = Surface Truck Coal, UTC=Underground Truck Coal, NA=Not Available;

(3) Surface = Area Surface Mining, Deep = Room and Pillar (or) Room and Rib Underground Mining

7. Subsurface Exploration

7.1. General

Fieldwork for the geotechnical exploration was performed by Stantec during the months of August and September, 2009. The field work consisted of advancing a total of nineteen (19) borings at the project site. Boring locations were staked and surveyed by Stantec. The locations of the borings and their corresponding elevations are given on the boring layout drawing presented in Appendix B. The subsurface exploration was performed using 4¼ inch (ID) hollow stem augers following a carbide tipped tooth bit. Rock coring was performed using NQ size coring equipment.

Standard Penetration Testing (SPT) was performed in all of the borings at continuous depth intervals. A standard penetration test consists of dropping a 140-pound hammer to drive a split-barrel sampler 18 inches. The consistency or relative density of the soil material is estimated by the number of blows it takes to drive the split spoon sampler the last 12 inches. This method is typically used to obtain soil samples, estimate the consistency or relative density of the soil and also to estimate the vertical limits of the subsurface soil horizons. The results of SPT testing are presented on the boring logs included in Appendix B and D.

Undisturbed Shelby tube samples of soils were also obtained from various borings at selected depth intervals. All Shelby tube samples were sealed with caps in the field and transported to laboratory for testing. A list of recovered samples, including sample depths and percent recovery is presented on the boring logs in Appendix B. In addition, disturbed bag samples of auger cuttings were also obtained during the subsurface exploration for further laboratory testing.

Upon completion of the drilling and sampling procedures, the boreholes were either backfilled with auger cuttings or well backfill materials (if piezometer was installed). A geologist was present on-site throughout the drilling and sampling operations. The geologist directed the drill crew, logged the subsurface materials encountered during the exploration and collected soil and rock samples. Particular attention was given to soil's color, texture, moisture content and consistency or relative density. Samples will be available for review up to thirty (30) days following the submittal of final version of this report, at which time the samples will be discarded unless prior arrangements for storage have been made.

7.2. Summary of Borings

A boring layout drawing is presented on a drawing included in Appendix B. Typed boring logs are presented in Appendix B and D. Summary of boring information is presented in Table 5, where all measurements are expressed in feet.

Table 5. Summary of Borings

Boring No.	Top of Hole (Elevation)	Bottom of Hole (Elevation)	Bottom of Hole (Feet)	Top of Rock* (Elevation)	Begin Core (Elevation)	Length of Core (Feet)
STN-1	411.2	364.7	46.5	No Refusal	- -	- -
STN-2	408.6	367.1	41.5	No Refusal	- -	- -
STN-3	408.5	346.5	62.0	353.5	352.0	5.5
STN-4	407.9	361.4	46.5	No Refusal	- -	- -
STN-5	407.9	361.4	46.5	No Refusal	- -	- -
STN-6	407.8	372.4	35.4	377.0	- -	- -
STN-7	401.4	376.9	24.5	378.4	- -	- -
STN-8	408.4	372.5	35.9	378.4	- -	- -
STN-9	407.8	373.8	34.0	380.8	- -	- -
STN-10	Not Drilled					

Table 5. Summary of Borings

Boring No.	Top of Hole (Elevation)	Bottom of Hole (Elevation)	Bottom of Hole (Feet)	Top of Rock* (Elevation)	Begin Core (Elevation)	Length of Core (Feet)
STN-11	408.4	363.1	45.3	368.4	- -	- -
STN-12	408.5	362.0	46.5	362.6	- -	- -
STN-13	Not Drilled					
STN-14	408.3	370.1	38.2	No Refusal	- -	- -
STN-15	407.9	372.0	35.9	375.9	- -	- -
STN-16	400.1	375.6	24.5	376.1	- -	- -
STN-17	407.8	361.3	46.5	No Refusal	- -	- -
STN-18	408.0	361.5	46.5	No Refusal	- -	- -
STN-19	Not Drilled					
STN-20	408.3	342.6	65.7	348.1	348.1	5.5
STN-21	408.6	362.1	46.5	No Refusal	- -	- -
STN-22	405.7	375.7	30.0	No Refusal	- -	- -

*- Approximate, actual determination cannot be made without rock coring.

7.3. Subsurface Soil Conditions

The subsurface conditions encountered in different borings consisted of mine-spoils (Soil 1 and Soil 2) underlain by alluvial deposits (Soil 4, Soil 5 and Soil 6) belonging to the Jacobs Creek flood plain. Bottom Ash (Soil 3) was also encountered in several borings beneath Soil 1.

Soil 1 encountered in different borings consisted of mine-spoil. Soil 1 can be visually described as lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments. Laboratory tests classified Soil 1 as CL according to Unified Soil Classification System (USCS) and A-6(7) or A-6(8) according to American Association of State Highway and Transportation Officials (AASHTO) soil classification system.

Soil 2 encountered in different borings consisted of mine-spoil. Soil 2 can be visually described as lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments. Laboratory tests classified Soil 2 as SC or CL according to USCS and A-6(4) or A-6(14) according to AASHTO soil classification system.

Soil 3 encountered in only few of the borings consisted of bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments.

Soil 4 consisted of clayey sand, brown to grayish brown, moist to wet and loose to medium dense. Laboratory tests classified Soil 4 as SC according to USCS and A-4(0) and A-4(1) according to AASHTO soil classification system.

Soil 5 consisted of lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments. Laboratory tests classified Soil 5 as SC or CL according to USCS and A-6(4) or A-6(14) according to AASHTO soil classification system.

Soil 6 can be visually described as lean clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments. Laboratory tests classified Soil 6 as SC or CL according to USCS and A-6(4) or A-6(14) according to AASHTO soil classification system.

7.4. Bedrock Conditions

Rock coring was performed in Borings STN-3 and STN-20. The top of rock was at elevations 353.5 feet in STN-3 and 348.1 feet in STN-20. Bedrock encountered in STN-3 and STN-20 can be described as shale, light gray and moderately hard. The rock core recovery percentage was 95 percent in STN-3 and 100 percent in STN-20. Rock Quality Designation (RQD) values were 62 percent and 66 percent in STN-3 and STN-20, respectively.

7.5. Subsurface Water

Subsurface water was encountered in most of the borings advanced during this exploration. The water level reading was taken after the boring had been drilled and before the installation of instrumentation. The depths to water noted immediately after drilling are shown on the boring logs presented in Appendix B and D. Additional water level readings were obtained from piezometers installed in some of the borings as discussed in the following section of this report.

8. Field Instrumentation and Monitoring

8.1. General

As part of the geotechnical exploration, Stantec installed nine (9) piezometers in the boreholes. The following paragraphs provide additional details regarding the instrumentation and monitoring program.

8.2. Instrumentation

The instrumentations installed as part of the geotechnical exploration were standpipe piezometers (PZ) consisting of a 5-feet long perforated screen attached to riser pipe. The annulus around the perforated screen was filled with sand and a bentonite seal was placed above and below the sand layer to isolate the reading zone. Above the isolated zone, the annular space between the riser pipe and the borehole was backfilled to the surface with bentonite grout to prevent vertical migration of water. The riser pipe was terminated slightly below ground level (approximately 0.2 feet) and protected with a flush mount metal cover. Table 6 provides a summary of the piezometers installed. Appendix C presents the PZ Instrumentation Details.

Table 6. Summary of Instrumentation*

Boring No.	ID
STN-1	PZ-1
STN-6	PZ-6
STN-7	PZ-7
STN-12	PZ-12
STN-15	PZ-15
STN-16	PZ-16
STN-18	PZ-18
STN-21	PZ-21
STN-22	PZ-22

*-All instruments installed are piezometers

8.3. Monitoring

Stantec began a monitoring program upon installation of instruments listed above. The purpose of the monitoring program was to obtain periodic water level readings (from PZs) using a water level indicator. Stantec's schedule for monitoring program is presented in Table 7. Results of monitoring program are presented in Appendix F.

Table 7. Instrumentation Reading Schedule

Month	Reading No.	Tentatively Scheduled	Actual Date	Status
1	1	September 14, 2009	September 21, 2009	Complete
2	2	October 12, 2009	October 20, 2009	Complete
3	3	November 16, 2009	November 16, 2009	Complete
4	4	December 14, 2009	December 13, 2009	Complete
5	5	January 11, 2010	January 18, 2010	Complete
6	6	February 15, 2010		Scheduled

9. Laboratory Testing

The soil samples obtained from the boreholes were subjected to laboratory tests in general accordance with ASTM standard testing procedures. Detailed results of laboratory testing are presented in Appendix F. A summary of laboratory tests performed is presented in Table 8.

Table 8. Summary of Laboratory Tests Performed

Serial No.	Testing for	Standard
1	Natural Moisture Content	ASTM D 2216
2	Atterberg Limits	ASTM D 4318
3	Specific Gravity	ASTM D 422
4	Particle Size Analysis	ASTM D 854
5	Shear Strength	ASTM D 4767, ASTM D 2850
6	Permeability	ASTM D 5084

10. Review of Completed Repairs

As part of a facilities assessment project, Stantec has been assisting TVA with repairs associated with wave erosion along interior slopes and isolated exterior slope sloughing and maintenance for the Peabody Ash Pond. Repairs performed over the past few months included slope stabilization measures and slope armoring. Stantec has issued two work plans associated with the repairs as summarized in Table 9.

Table 9. Dike Repair Work Plans at Peabody Ash Pond

No.[1]	Location	Type of Disturbance	Repair Type	Work plan Issued	Work Completed
1	East and South Dikes	Erosion of Interior Slopes	Slope Armoring	April 30, 2009	June 26, 2009
2	East Dike	Sloughing of Exterior Slope	Slope Armoring	July 15, 2009	August 12, 2009

11. Engineering Analyses

11.1. General

Based on the review of available information, results of geotechnical exploration and results of laboratory testing, Stantec performed engineering analyses of the Peabody Ash Pond. This included seepage and slope stability analysis of typical cross section of the dike. The analysis procedure and results of the analyses are presented in the following paragraphs.

11.2. Seepage Analysis

11.2.1. Background

The objective of seepage analysis was to understand the total head (and pore water pressure) distribution within a given cross section of the dike for slope subsequent stability analysis. Seepage analysis was performed using SEEP/W, a numerical software tool developed by Geo-Slope International Inc. SEEP/W is a finite element software product for analyzing groundwater seepage and pore-water pressure distribution problems within porous materials such as soil and rock.

The first step in the seepage analysis was to develop a cross section of the dike. Stantec utilized boring logs, historic drawings and survey information to estimate the subsurface horizons at each cross section. SEEP/W uses the concept of regions and points to define the geometry of a problem and to facilitate discretization (or meshing) of the problem. Upon estimating the geometry of the model, material properties were assigned for the *Saturated/Unsaturated Model* offered in SEEP/W. The next step in the process was to define boundary conditions. All boundary conditions were applied to region points and region lines. Upon defining the boundary conditions, the model was analyzed using *Steady State* seepage analysis option available in SEEP/W based on the assumption that the boundary conditions are constant over time. Specific details regarding the analysis procedure are presented in the following sections.

11.2.2. Typical Cross-Section

Seepage analysis was performed for a typical cross section (AA') taken through borings STN-21 and STN-22. The typical cross section was generally representative of the remaining portions of the dike. The subsurface soil horizons for the cross section were estimated based on the information gathered from the borings, historic cross section from drawing number 10W3274-3 (Figure 4) and straight interpolation between borings.

11.2.3. Material Properties

The material properties used for seepage analysis are presented in Table 10.

Table 10. Material Properties for Seepage Analysis

Soil Horizon	Saturated k_v (cm/s)	Ratio k_h / k_v	Specific Gravity G_s	Void Ratio e	Volumetric Water Content		Estimated From
					Saturated (ft^3/ft^3)	Residual (ft^3/ft^3)	
Soil 1: Lean Clay with Sand	1.0e-7	10	2.72	0.40	0.29	0.02	Results of Laboratory Testing
Soil 2: Lean Clay with Sand	1.0e-7	10	2.72	0.40	0.29	0.02	Assumed same as Soil 1
Hydraulically Placed Ash	3.0e-5	50	2.31	0.85	0.46	0.04	TVA – Kingston Fossil Plant
Soil 4: Clayey Sand	1.1e-7	20	2.67	0.47	0.32	0.02	Results of Laboratory Testing
Soil 6: Silty Clay	5.8E-8	50	2.7	0.60	0.38	0.03	Results of Laboratory Testing

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

11.2.4. Results

Detailed results of seepage analysis are presented in Appendix H. Table 11 presents a comparison of the SEEP/W results (total head) with the measurements taken from the piezometers.

Table 11. Total Head Measurements*

Cross-Section	Piezometer	SEEP/W Value (feet)	Field PZ Value on 11/16/2009	Difference Average Field Measurement
A-A'	PZ-21	400.9	401.2	0.3
	PZ-22	400.3	401.5	1.2

The results from the seepage analysis were also utilized to calculate the factor of safety against piping. Summary of computed exit gradients and factor of safety against piping are presented in Table 12.

Table 12. Summary of Factor of Safety Against Piping

Cross Section	Vertical Gradient (i_v) at Critical Exit Point	Material	Critical Gradient (i_{crit})	F_{piping}
A-A'	0.13	Soil 2: Lean Clay with Sand	1.23	9.5

11.3. Stability Analysis

11.3.1. General

The stability of the existing dike slope2 (for typical cross-section) was evaluated using SLOPE/W Computer Program. Factor of safety against sliding was calculated using Spencer's method.

11.3.2. Material Properties

The material properties used for slope stability analysis are presented in Table 13.

Table 13. Material Properties for SLOPE/W

Soil Horizon	Unit Weight (pcf)		Effective Shear Strength Parameters	
	γ_{moist}	γ_{sat}	c' (psf)	ϕ' (degrees)
Soil 1: Lean Clay with Sand	138	139	0	32
Soil 2: Lean Clay with Sand	138	139	0	32
Hydraulically Placed Ash	100	107	0	25
Soil 4: Clayey Sand	129	133	0	30
Soil 6: Silty Clay	126	129	0	30

11.3.3. Results

The computed factors of safety are presented in Table 14. Results of slope stability analysis are presented in Appendix H.

Table 14. Summary of Factors of Safety Against Sliding

Cross-Section	Down Stream Side	Up Stream Side
A-A'	1.7	2.2

12. Conclusions and Recommendations

12.1. General

The conclusions and recommendations that follow are based on the review of project documentation made available by TVA, site visits, results of the geotechnical exploration and results of engineering analyses reported herein. If additional information becomes available or site conditions change, Stantec should be notified so that appropriate adjustments can be made to the conclusions and recommendations contained herein.

12.2. Subsurface Conditions

The subsurface conditions noted during the exploration are consistent with site history in that mine-spoils belonging to strip mine operations and alluvial deposits belonging to Jacobs Creek were noted in almost all of the borings. Soils 1 and 2 were mine-spoil materials classified as lean clays with sand. Specifically, Soil 1 was used as earthen fill for constructing the Peabody Ash Pond dike sometime during 1997. Soil 2 was used as earthen fill to construct the dike during previous strip mining operations. Soil 3 was bottom ash material placed as foundation material during the 1997 dike construction by TVA (See Figure 4). Soils 4, 5 and 6 were alluvial soils belonging to the Jacobs Creek flood plain. The elevation of top of rock ranged from approximately 354 feet in the northern portion of the site to approximately 348 feet in the southern portion of the site. The cored portion of the bedrock consisted of Shale described as light gray and moderately hard.

12.3. Seepage and Slope Stability of Typical Cross Section

The seepage analysis of typical cross section indicates a factor of safety against piping of 9.5. The factor of safety against sliding obtained from the slope stability analysis of this cross section ranges from 1.7 to 2.2.

12.4. Drain Channel Bank below Strip Mine Earth Dike

As indicated in Section 5 of this report, the Peabody Ash Pond was built on land previously strip mined and reclaimed. The strip mining operations left small earth dikes along the southern and eastern sides of the facility that toe out along a drainage channel. The ash pond dikes were built as an extension of these earth dikes as shown in Figure 4. There are two areas (see Figure 5) where the toe of the strip mine dike transitions into a steep drain channel bank, presumably created as a result of channel flow scouring. It is possible that similar scouring caused sloughing of the same earth dike near the northeast side of the ash pond, which was repaired in 2009.

It is recommended that the drainage channel adjacent to the strip mine dike be armored where the channel bank slope is steeper than 2.5H:1V. If left unattended, these areas may eventually cause sloughing similar to the one observed near the northeast side of the ash pond. The repair work should begin by mowing the dense vegetation covering these areas. After proper inspection of the mowed surfaces, the vegetation in bank areas to be repaired should be stripped. The corrective measures will likely include flattening of the slopes and armoring using sand and crushed limestone filter.

As described in Section 5 of this report, the top of the strip mine earth dike remains wet probably due to poor grade conditions. It is recommended that these areas be regraded to promote positive drainage.

12.6 Closure

The scope of Stantec's services did not include an environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, surface water or groundwater at the project site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of the client.

The conclusions and recommendations presented herein are based on information gathered from the boring advanced during this exploration 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 and beyond borings.

Appendix A

Historic Documents

Reference No. 1

Environmental Assessment

L15697

M62 8806 0 948

Jon M. Loney, Assistant to the Manager (Environmental Matters and Program Support), Office of Natural Resources and Economic Development, 1D 53 OCH-K
Paul Wade, Director of Fossil and Hydro Power, LP 3S 58K-C

JUN 17 1988

PARADISE FOSSIL PLANT - ENVIRONMENTAL ASSESSMENT (EA) FOR A FLY ASH DREDGE POND

References: 1. Your memorandum to me dated March 30, 1988, on the above subject (M01 880331 747)

2. Memorandum from Wally Carpenter to G. Leon Massey dated June 6, 1988, on the subject, "Johnsonville and Paradise Fossil Plants - Environmental Review for Proposed Fly Ash Dredge Ponds"(copy attached)

After review of the referenced memorandums, we request that you begin work on all items immediately. Internal Service Agreements for each work group will be approved upon receipt as discussed between John Albright, of this division, and Sherry Murphy, of the Division of Air and Water Resources. The revised scope of work for Paradise in reference 2 is appropriate and brings the total amount for the EA to $40,000 including overheads. The EA needs to be complete by the time the FY 1989 budget is submitted to the Board.

If you have additional questions, please contact Mr. Albright at extension 3505 in Chattanooga.

Paul Wade

RECEIVED
OFFICE OF PLANT MANAGER
PARADISE FOSSIL PLANT
JUN 20 88

	N	ACT	REP
ASST MGR			
OPER SUPV			
MECH SUPV			
RESULTS SUPV			
SAFETY			
ASST MGR ENGR			
ASST MGR WP			
OPER SUPV WP			
MECH SUPV WP			
RESULTS WP			
ADMN SUPV			
FILES			
PLANT MGR			
ANSW BY	DATE		

CND:JTT:JGA:CDR
Attachment
cc (Attachment):
RIMS, LP 3S 127H-C
R. D. Yeargan, Paradise
Joe L. Currie, LP 3S 63H-C

John
6-7-88
Please review & handle if you approve
Leon

G. Leon Massey, Supervisor, Waste Planning, BR 2S 108B-C

Wally Carpenter, Project Manager, Engineering Laboratory, ENG LAB-N

June 6, 1988

JOHNSONVILLE AND PARADISE FOSSIL PLANTS - ENVIRONMENTAL REVIEW FOR PROPOSED FLY ASH DREDGE PONDS

Per your request to Wally Carpenter, the proposals to develop a data base and prepare a detailed evaluation of impacts to groundwater resources at these two plants has been revised. We understand these revisions were necessary to complete the environmental reviews more quickly and that additional data, where needed, will be obtained in the design phase. Attached are revised proposals including cost estimates to complete work activities.

Funding of the activities for each of the listed organizations needs to be set up very quickly if these activities are to be completed by July. Attached is a list of contacts for each organization requiring funding. By copy of this memorandum, the Engineering Laboratory requests each of these organizations to review the revised scope of work activities and funding allocated for adequacy. Please contact Wally Carpenter at 632-1883 if you have any questions regarding these projects.

Wally Carpenter

WGC:TSM
Attachments
cc (Attachments):
David J. Anderson, LA PSC 1-C
Herbert Barnard, Jr., T218 NFDC-M
Charles E. Bohac, 270 HB-C
Lora M. Dawson, 200 HB-C
John L. Furgurson, 143 EB-K
Donald L. Malone, 200 HB-C
Dennis L. Meinert, EDB-M
Sherry T. Murphy, 114 EB-K
Sandra S. Robertson, 293 HB-C
John L. Rose, Jr., LA PSC 1-C
Phyllis M. Russell, 2F 69 OCH-K
Robin M. Scheib, T109ANFDC-M
Lisa A. Stinson, 108 EB-K
David M. Varnell, 150 401B-C

Prepared by Wally Carpenter

ATTACHMENT 1

Tennessee Valley Authority
Office of Natural Resources and Economic Development
Division of Air and Water Resources
Engineering Laboratory

JOHNSONVILLE FOSSIL PLANT

ENVIRONMENTAL ASSESSMENT FOR PROPOSED DREDGE POND

Report No. WR28-3-30-102

Prepared by
Wallace G. Carpenter

Norris, Tennessee
May 1988

0827R

EXECUTIVE SUMMARY

The Engineering Laboratory proposes to provide a groundwater assessment to describe possible effects of the development of a new dredge pond for fly ash disposal at Johnsonville Fossil Plant. Background conditions will be evaluated, site properties characterized and design options evaluated, to determine if impacts to local groundwater may occur. Based upon the information obtained, an environmental assessment (EA) will be provided describing any suspected impacts to groundwater and mitigative measures that may be necessary.

JOHNSONVILLE FOSSIL PLANT
ENVIRONMENTAL ASSESSMENT FOR PROPOSED DREDGE POND

INTRODUCTION

The Johnsonville site contains soils of unconsolidated alluvial and terrace deposits consisting of sand, tan clay, and gravel. These deposits range in thickness from 0 to 32 feet across the site. Geologic formations underlying the terrace deposits include the Fort Payne Chert, Chattanooga Shale, and Camden Chert. The Mississippian regional aquifer and the Devonian-Ordovician regional aquifer are known to be in the area with the latter most likely to be affected by TVA ash disposal facilities. This aquifer is in the Camden Chert which in some locations is protected by the Chattanooga Shale (a nonwater-bearing unit).

In order to determine the potential impact of the proposed dredge pond, the existing groundwater quality, and site soils will be evaluated. The regional groundwater flow patterns will be defined to the extent possible. The anticipated ash leachate composition will be estimated and the local attenuation zone will be characterized.

Assessment

The following approach will be used to complete the assessment:

1. Groundwater hydrology and chemistry data from existing wells will be reviewed. Offsite well locations will be identified and if possible groundwater data will be obtained from these wells.

2. Soil characteristic will be examined, some boring have been conducted at the site and some hydraulic data are available.

3. Chemical composition of ash samples will be determined and leachate test of the dredged ash will be performed. The data obtained and other literature data will be used to predict leachate quality.

4. Design features of the proposed dredge pond will be evaluated to determine the potential of leachate to migrate into the groundwater. Details of the proposed design will be needed from Fossil and Hydro Power.

5. Based on the waste characterization, soil properties, site groundwater quality, regional flow conditions, and proposed design features the WQB and ENG LAB will predict the potential for leachate migration into the groundwater. The assessment will provide a basis for determining potential groundwater impacts and design considerations necessary for ash disposal on the site.

Detailed modeling which would predict specific groundwater flow and the direction and amount of leachate flux including attenuation processes would not be a part of the assessment phase although it could be considered for the design phase.

Cost

Following is a cost breakdown for the proposed activities:

Organization/Activity	Cost[a]
Field Operations/ Collect ash (2 samples) and groundwater samples (3 samples)	2,500
Central Laboratory Services Branch/ Ash elemental analysis (3 samples)	900
Chemical Research Branch/ Soil mineral analysis (2 samples)	1,100
Mapping Services Branch/ Develop site maps	1,320
Laboratory Branch/ Water quality analyses Ash extractions (3 samples)	780
Water Quality Branch/ Groundwater quality evaluation Leachate attenuation analyses	7,300
Engineering Laboratory - Project Management Geohydraulic evaluation Leachate migration analyses Design evaluation	11,700
Total	25,600

a. Cost estimates are total, direct plus indirect.

ATTACHMENT 2

Proposal for Paradise Fossil Plant
Environmental Assessment - Water Resources

Although groundwater quality at the Paradise reservation is generally believed to be uniformly poor, the potential charges in groundwater quality resulting from the proposed fly ash dredging activity for the three sites being considered for development will be evaluated. Available water quality data will be examined to describe the groundwater resources of the areas. Topography of the three areas will be evaluated to attempt to ascertain general groundwater movements. Leachate data will be examined to evaluate the impacts to groundwater for the three sites.

Cost estimates for these activities are as follows:

Organization/Activity		Cost[a]
Field Operations/ Collect ash (3 samples) and groundwater samples (4 samples)		3,700
Mapping Services Branch/ Develop site maps		2,700
Laboratory Branch/ Water quality analyses Ash extractions		1,040
Central Laboratory Services Branch/ Ash elemental analyses		900
Water Quality Branch/ Water quality assessment		4,000
Engineering Laboratory/ Hydrogeologic assessment		4,000
	Total Direct	16,340

a. Cost estimates are total, direct plus indirect.

1300 + 360 OH = 1660 total for Arch.

0827R

64 (03-9-85)

UNITED STATES GOVERNMENT

Memorandum

331 147

TENNESSEE VALLEY AUTHORITY

DIV. OF FOSSIL & HYDRO POW

MAR 31 '88

	Note	Action	Reply
PW xc		3/31	
RLC			
CND	✓		
JFF			
GFH			
REH			
GLM			
RMG			
WSH			
JTT	✓		
ALC xc		3/31	
JBS			
RMS xc		3/31	

xlc - Paradise 4/4

TO : Paul Wade, Director of Fossil and Hydro Power, LP 3S 58K-C

FROM : Jon M. Loney, Assistant to the Manager (Environmental Matters and Program Support), Office of Natural Resources and Economic Development, 1D53 OCH-K

DATE : March 30, 1988

SUBJECT: PARADISE FOSSIL PLANT - ENVIRONMENTAL ASSESSMENT (EA) FOR A FLY ASH DREDGE POND

MB2 871118 804
(CND; JTT; SGA; CDR)

As requested in your November 30, 1987, memorandum, the Office of Natural Resources and Economic Development has prepared the following workplans and cost estimates for the work necessary to collect data and prepare the draft material for the subject EA.

ARCHAEOLOGY/WILDLIFE/WETLANDS

Activities: All three sites under review for a fly ash dredge pond are within areas previously disturbed by mining activities; therefore no archaeological impacts are anticipated. Those areas, however, especially numbers 1 and 3, contain strip mine ponds which have supported the development of wetlands. In this otherwise degraded environment, with vast denuded areas interspersed with patches of ruderal species, these ponds and wetlands are biologically rich, as measured by biomass and species diversity. It has been TVA's practice since 1979 to protect these areas to the extent practicable from adverse impacts. A field inspection will be conducted to determine wetland status, i.e., size, function, and importance. Based on this data, we will then determine whether the proposed project impact would be acceptable or nonacceptable. In previous wetlands assessments of the Paradise area, we have generally concluded that in most cases the loss of wetlands, although serious, is unavoidable. We expect our findings will be similar for the three proposed sites.

Cost: Field survey and writeup of results: Four man-days $1,300

WATER RESOURCES

Activities: Although groundwater quality at the Paradise reservation is generally believed to be uniformly poor, the potential changes in groundwater quality resulting from the proposed fly ash dredging activity for the three sites will be evaluated. The possibility of a water quality gradient at the Paradise site such that one of the sites might have groundwater of higher quality than the other sites will be evaluated. The proposed dredge ponds might affect existing groundwater and surface water flow patterns, possibly further degrading either of the two. For these reasons, groundwater aspects should be investigated prior to the construction of a dredge pond.

Wells exist in the area of site 2. No wells exist in the areas of sites 1 and 3. Therefore, it is proposed that a well be drilled in each of the areas of sites 1 and 3. Water quality samples will be taken and analyses performed for new wells at sites 1 and 3 and for one of the existing wells near site 2. The water quality data and a review of the drilling records for as many of the existing wells as possible will be used to assess the relative quality of the water and the ability to attenuate leachate beneath the three sites.

Water level readings from as many of the existing wells as possible will be obtained. This water level information will be used to assess the general groundwater flow patterns at the site.

Cost:

Mapping services	$ 2,000
Drilling wells	10,000
Logging wells	2,000
Sampling wells	2,000
Laboratory analysis	2,000
Hydrogeologic assessment	3,000
Water quality assessment	3,000
Total	$24,000

FISHERIES

The evaluation of the direct impact of fly ash dredging on fisheries at the three sites and preparation of the fisheries portion of the EA will involve site visits, examination and evaluation of existing data for the area, fisheries surveys (net and seine studies and electrofishing), and project meetings.

Fisheries and Aquatic Ecology Branch--Preliminary site evaluation, examination and evaluation of existing data (where available), meetings with the Divisions of Fossil and Hydro Power and Services and Field Operations, and preparation of the fisheries section of the EA.

Division of Services and Field Operations--Approximately two man-weeks of effort sampling the fish fauna at site 1. This will include experimental gill nets, seines, and electrofishing surveys, if feasible.

Cost:

Fisheries and Aquatic Ecology Branch	$12,000
Division of Services and Field Operations	6,000
Total	$18,000

AIR QUALITY

No survey work is required for the air quality review. Therefore, instead of a workplan the following assessment is provided for inclusion in the EA.

> Construction of the proposed dredge pond will result in temporary fugitive dust emissions from clearing and grading during site preparation. Gasoline and diesel fueled equipment and vehicles used in construction will emit minor amounts of combustion pollutants, such as particulates, carbon monoxide, and nitrogen oxides. If debris cleared from the site is disposed of by open burning, additional small amounts of particulates and carbon monoxide will be released. Any open burning will be conducted in accordance with applicable State and local regulations.
>
> Air quality impacts during operation will depend on the method of disposal. Material will be hydraulically dredged and conveyed to the new pond by pipe. Any air emissions from transport will be negligible. If either area 1 or 3 is chosen, all material will be handled and ponded wet. Fugitive dust from such operations will be minimal. If area 2 is chosen, stacking will be necessary. Material in the disposal pile will initially be wet. As necessary, the pile will be wetted to reduce dust emissions. Surfaces will be revegetated as soon as practicable, and the active area of the pile will be kept as small as possible to further reduce dust.
>
> With proper mitigation, this project should not significantly impact air quality.

FLOODPLAIN

No survey work is required for the floodplain review. Therefore, instead of a workplan the following assessment is provided for inclusion in the EA.

> Sites 1 and 2 are subject to flooding from Jacobs Creek. The 1-percent-chance (100-year) and 0.2-percent-chance (500-year) elevations on Jacobs Creek at the sites are 404 and 407 respectively. Site 3 is subject to flooding from the Green River with 1- and 0.2-percent-chance flood elevations of 403 and 406 respectively. Therefore, all three of the candidate sites are located outside the limits of the identified

45315

Paul Wade
March 30, 1988

PARADISE FOSSIL PLANT - ENVIRONMENTAL ASSESSMENT (EA) FOR A FLY ASH DREDGE POND

1-percent-chance (100-year) and 0.2-percent-chance (500-year) floodplains and would therefore be consistent with the requirements of Executive Order 11988 and TVA's floodplain management policy. Normal site drainage practice would be followed in providing drainage from the local site area.

Jon M Loney

FMM:ADR
cc: Files, ONRED, SE45 OCH-K
R. T. Allen, 2F73 OCH-K
J. L. Furgurson, 143 EB-K

Prepared by Frederick M. Massingill

4228D

RECEIVED
OFFICE OF PLANT MANAGER
PARADISE FOSSIL PLANT

APR 0[illegible] '88

	IN	ACT	REP
ASST MGR	✓		
OPER SUPV			
MECH SUPV			
RESULTS SUPV			
SAFETY			
ASST MGR ENGR			
ASST MGR WP			
OPER SUPV WP			
MECH SUPV WP			
RESULTS WP			
ADMN SUPV			
FILES			
PLANT MGR			
ANSW BY	DATE		

Jon
JPB

TVA 64 (OS-9-65) (OP-WP-5-85)

UNITED STATES GOVERNMENT

Memorandum

A60 890224 003

TENNESSEE VALLEY AUTHORITY

TO : M. Paul Schmierbach, Manager of Environmental Quality, SPB 2S 201P-K

FROM : W. G. Ruffner, Manager of Environmental Affairs, LP 3S 39F-C

DATE : MAR 1 1989

SUBJECT: PARADISE FOSSIL PLANT - JACOBS CREEK ASH POND - DREDGE POND ENVIRONMENTAL ASSESSMENT (EA)

This is in response to your subject memorandum to W. H. Thompson dated January 6, 1989 (A60 890210 006). Attached is a copy of the final EA which has been revised to reflect changes agreed to between our staffs and OGC.

W. G. Ruffner

GGP:ECM:AJH
Attachments
cc (Attachments):
RIMS, MR 4N 72A-C
Dennis Allen, Paradise
E. S. Christenbury, ET 11B 33H-K
R. L. Moates, BR 2N 75A-C
W. M. Pearse, BR 4N 40A-C
W. H. Thompson, LP 3S 58K-C

2509k

DRAFT ENVIRONMENTAL ASSESSMENT

DEVELOPMENT OF DREDGED ASH DISPOSAL AREA PARADISE FOSSIL PLANT

Introduction

Paradise Steam-Electric Plant (PAF) is a 3-unit, 2,558-MWe coal-fired facility in Muhlenberg County, Kentucky. The plant is located on the west bank of the Green River at Green River Mile 100.5. Construction for units 1 and 2 began in November 1959, and commercial operation begin in May and November 1963. Each of these units has a nameplate rating of 704 MWe each. In February 1970, unit 3 was accepted for commercial operation. Fly ash from this plant is sluiced to a settling pond, with supernatant discharged at an average flow of 53.19 cfs to Jacobs Creek, a small tributary of the Green River.

This project is to construct a dredge pond near the Jacobs Creek ash pond capable of storing at least $1x10^6$ cubic yards of fly ash dredged from the ash pond. This will provide approximately 10 years of additional fly ash storage in the fly ash pond. Effluent from the dredge pond will be returned to the Jacobs Creek ash pond for discharge to Jacobs Creek.

Approximately 245 acres of land will be purchased under this project for the dredge pond although the pond itself will constitute only about 50 acres. Construction is expected to begin in June 1989, and dredging in February 1990. Based on the latest pond volume survey and forecasted operation, Paradise would be without fly ash storage space in November 1990 without this project.

This assessment is to evaluate the environmental consequences associated with the purchase and development of a new offsite area for dredged ash disposal at PAF.

Alternatives Considered

The selection of an environmentally acceptable disposal alternative was based on the following criteria:

1. A storage volume equivalent to a minimum $1x10^6$ cubic yards.
2. The proximity of the site to the active ash pond.
3. The cost of site development and operation.

4. An area that has favorable physical properties for ensuring no significant impacts to the environmental resources, including groundwater, surface water, biota, and cultural resources.

In the selection of a site for development of additional ash disposal, the following alternatives have been considered.

Alternative 1--Construct two dredge cells in the old scrubber landfill area.

Under this option two small dredge cells would be constructed in the old scrubber landfill area. Each cell would be filled three times by dredging. Each area would be reclaimed twice between dredgings by dewatering the ash and stacking the reclaimed ash on high ground in the old scrubber landfill. The total costs associated with this option are $3,932,131. This is the highest cost option because of the high costs associated with reclaiming ash and moving it to other areas between dredging operations.

Alternative 2--Construct two dredge areas, one in the old scrubber landfill area, the other on an additional 245-acre tract.

Under this option dikes would be constructed in the old scrubber landfill area sufficient to contain 331,000 cubic yards of dredged material. In addition, a 245-acre tract of land would be purchased. This area would be developed to contain the balance of 669,000 cubic yards of dredged material on 50 acres of the site. The total costs associated with this option are $2,692,000. The costs associated with this option are less than for alternative 1 because the ash would not have to be moved from the dredging areas to other areas for permanent disposal. However, this option is higher in cost than alternative 3 because of the need to construct more diked areas.

Alternative 3--Develop one dredged ash disposal area.

Under this option, three potential sites were considered (see figure 1). The preferred site is on a 245-acre tract of land which would be purchased. Dikes capable of storing the entire 1 million cubic yards of material to be dredged would be constructed to contain a 50-acre dredge pond. This is the least investment alternative and is the proposed project. The total costs associated with this option are $2,389,000. This option is less costly because there is no need to reclaim and haul ash to other areas for permanent disposal and it is more economical from a construction standpoint to develop one larger area than two small areas.

Alternative 4--No action

The no action alternative is infeasible because free water volume must be restored in the ash pond if the plant is to continue uninterrupted operation. Paradise Steam Plant is one of TVA's largest and most reliable plants and is essential to base load operation.

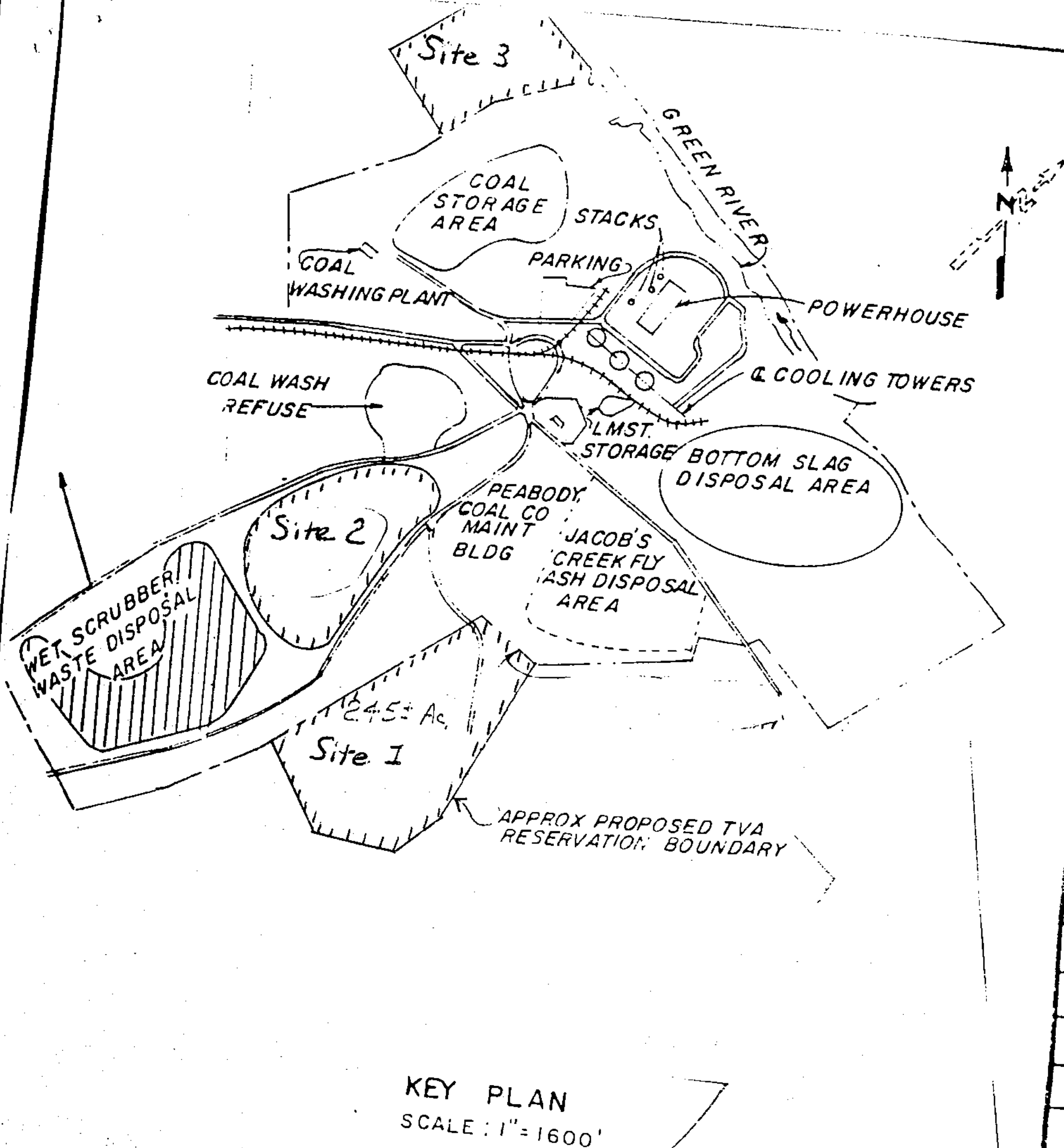


Figure 1

PARADISE FOSSIL PLANT
CONSTRUCT DREDGE POND AND DREDGE ASH POND

Potential Sites Considered

Site 1--Although the total acreage of this site is a little larger than each of the other two sites considered, site 1 would require development of the smallest area for the dredge pond. This site consists of land that was previously strip mined and has been reclaimed leaving a small pond of approximately 3.4 acres surrounded by open grassland. Part of this area is a depression bounded by hills or ridges about 50 feet in elevation along two sides and would require much less diking for construction of the 50-acre area to contain the desired dredge volume. Although this land is not currently a part of the TVA reservation, one of the two owners has indicated a willingness to sell approximately 169 acres of the 245-acre tract required by TVA.

Site 2--This area is a 140±-acre site west of the Jacobs Creek ash pond which was used for a short time for stacking of scrubber sludge wastes. It consists of previously mined lands which were reclaimed and is now open grassland. Two small hollows were left in the area which contain small ponds. This area was discussed in a previous EA for development of coal-wash refuse and scrubber sludge disposal areas. The area is on a fairly flat elevation about 100 feet above the ash pond elevation and would therefore require much more diking than the other two areas considered in order to contain the ash volume to be dredged in this project.

Site 3--This 100±-acre area is at the northern boundary of the current reservation adjacent to the Green River. It consists primarily of mined land which has been reclaimed. Strip mine pits in the area were left as part of the reclamation process. This area was considered in a previous EA for use as a permanent coal-wash fines refuse and dredge material disposal area. At that time the lake had already been partially filled with dredge materials from construction of a nearby coal barge docking facility. The area is currently used for disposal of miscellaneous dredged materials when required. Although development of this area would not require a great deal of diking to contain the desired volume of dredged ash, use of this area is complicated by other factors. Its remote distance from the active ash pond and its location on the other side of the plant would make it very difficult and costly to construct dredge lines to this site. It would also be difficult or impossible to reroute dredge pond return flow back to the existing ash pond. It is uncertain whether the water from this pond could meet NPDES permit limits enabling it to be discharged directly to the river without further treatment.

Preferred Alternative

Based on consideration of the engineering and economic factors discussed above, the preferred alternative is to construct the 50-acre dredge settling pond on site 1. This site will be purchased by TVA and developed for the disposal of $1x10^6$ cubic yards of dredged ash. Dikes will be constructed from the best locally available material based on soil tests, probably obtained from a borrow area in the nearby scrubber stacking area. The top of the dikes will be at 460 feet of elevation (see figure 2). This area now drains toward upper Jacobs Creek. Return flow from dredging will be routed back to the ash pond and will flow by gravity through the existing natural drainage for the area adjacent to the preferred site. Diking will prevent flows into the upper Jacobs Creek area.

Upon completion of construction, piping will be assembled from the ash pond dredge to the dredge area. The estimated time to complete the dredging of $1x10^6$ cubic yards of ash from the active ash pond is approximately ten months. After completion of dredging the ash would be allowed to dewater and the area would be contoured to promote natural rainwater runoff. The ash will then be covered and seeded in accordance with State closure requirements. Appropriate erosion control features will be included in the design to allow for an environmentally acceptable final closure.

Completion of this project will restore approximately 10 years of storage volume to the active ash pond.

Consideration of the environmental factors associated with the use of the three areas considered is discussed in the following sections.

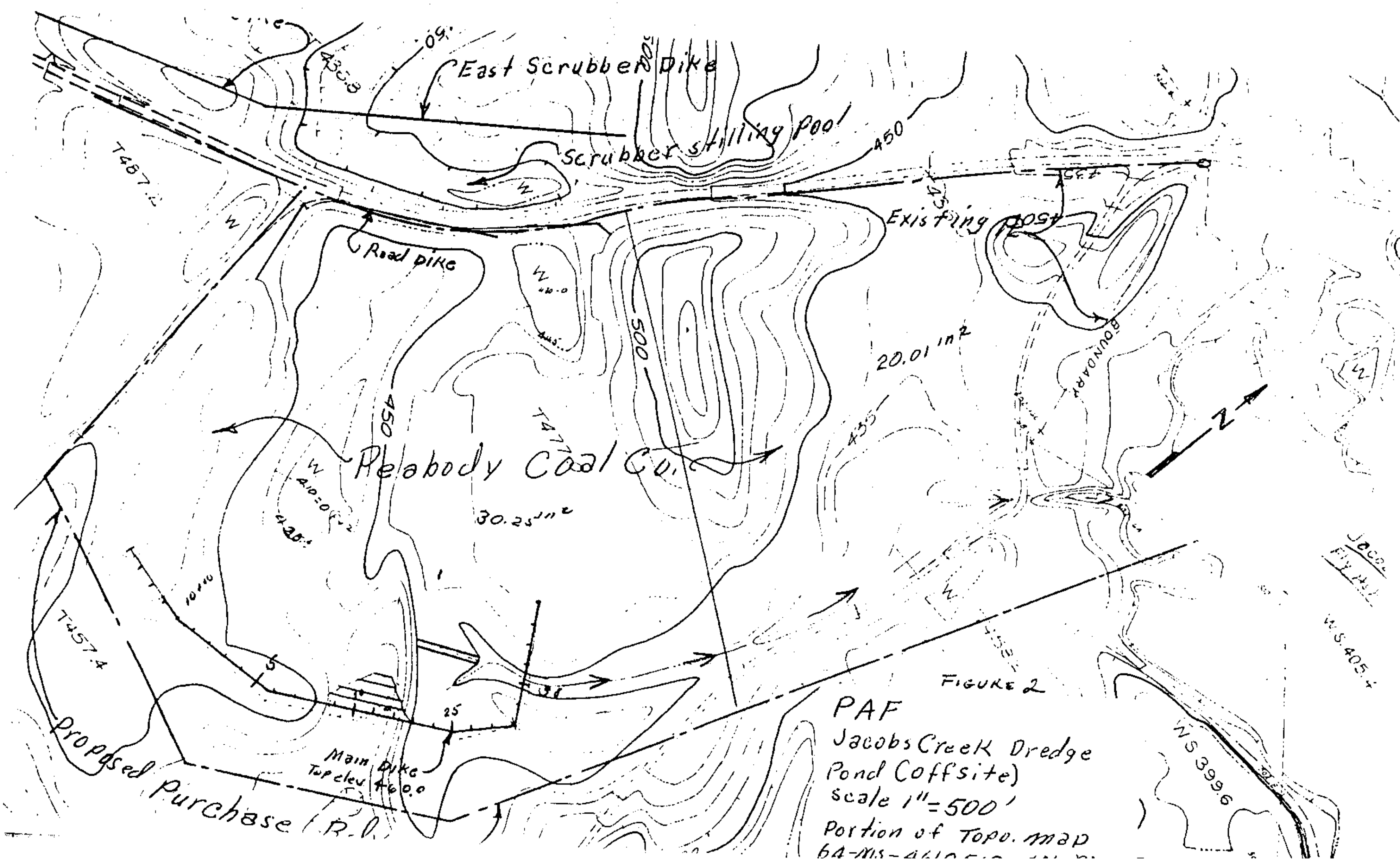


FIGURE 2

PAF
Jacobs Creek Dredge Pond (offsite)
scale 1" = 500'
Portion of Topo. map

GROUNDWATER QUALITY ASSESSMENT

Introduction

Paradise is located on the western bank of the Green River in Muhlenburg County, Kentucky. The area is underlain by Pennsylvanian Age sandstone and shales. The plant area is unique in the TVA system in that approximately half of the land surface is covered by spoil from surface strip mining of coal. Overburden in these areas consists of up to 75 feet of spoil composed of sandy, gravelly clay, mixed with rock fragments. In unmined areas remaining around the plant, an average of 15 feet of unconsolidated materials overlie the bedrock. This original unconsolidated overburden consists of terrace deposits, alluvial clays and silts, and residuum.

Groundwater at Paradise occurs in the fractures of the fine- to coarse-grained sandstone of the Pennsylvanian Age under semiconfined conditions. The only significant water-bearing units within the Pennsylvanian Age regional aquifer are the Lisman Formation and the deeply buried Caseyville Formation. Coal-stripping operations have removed the Lisman Formation in most of the upland areas. Where sandstone units of the Lisman Formation exist they receive direct infiltration and are susceptible to contamination from the surface. The Caseyville Formation has a potential for high well yields; however, since this aquifer occurs at considerable depth there is little likelihood that it will be developed.

Existing Groundwater Data

Table 1 shows mean values for parameters monitored in 1981, 1982, and 1983 from wells at the Paradise site. Figure 3 shows the locations of the monitoring wells. A review of the data shows iron and manganese concentrations are very high for some of the wells compared to the Drinking Water Standards (DWS), but concentrations could be elevated because of the metal casings used for some of the wells. Groundwater quality has been degraded at Paradise as indicated by the high concentration of residue, calcium, sulfate, and conductivity in table 1. In addition, the pH of all the wells was outside the DWS range of 6.5 to 8.5.

Figure 4 compares the composition of the well samples on the basis of equivalents (concentration/[atomic weight x valence]). The equivalent concentration of cations should equal the equivalent concentration of anions (the heights of the bars in figure 4 should be equal). Part of the discrepancy between anions and cations observed in figure 4 is because the iron and manganese concentrations were neglected. Some of the wells were cased with metal pipe and, therefore, the metals data in some wells might be unreliable. The comparisons of figure 4 are, therefore, based on the mineral content of the samples excluding iron and manganese.

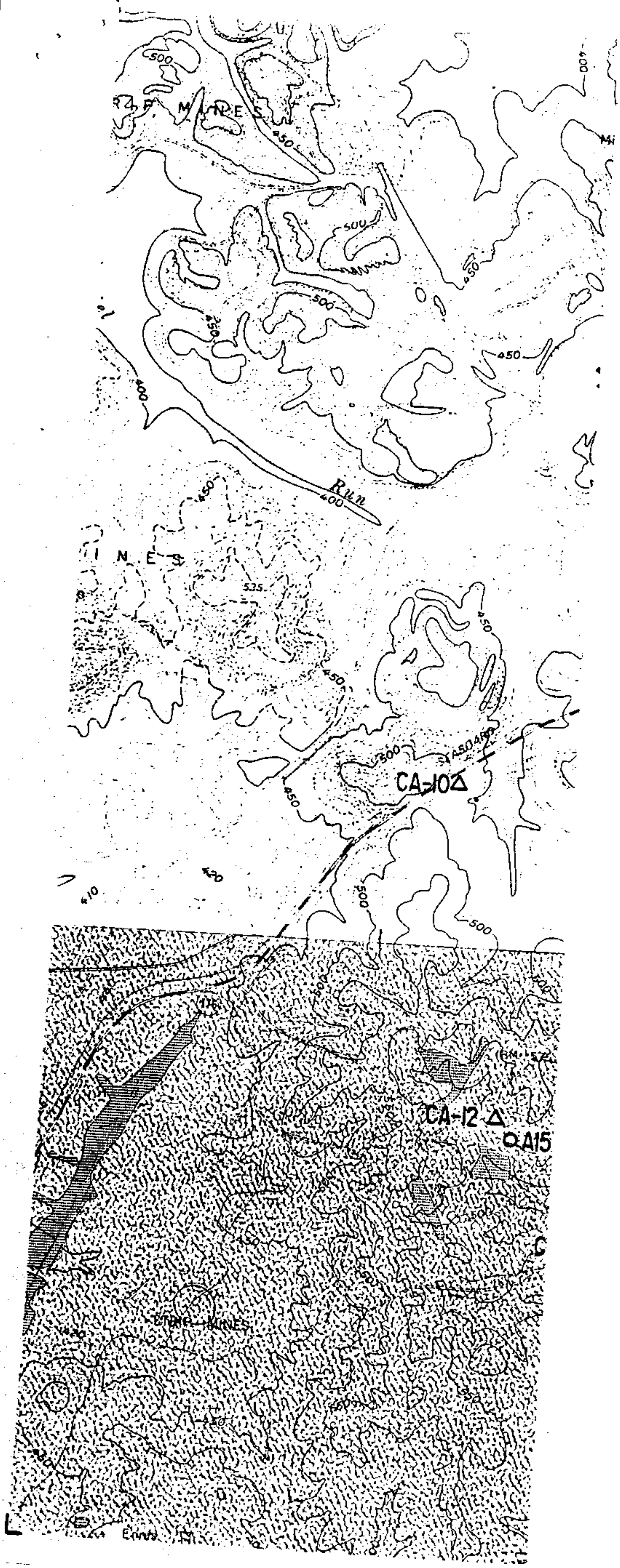
Figure 4 shows that calcium generally is the predominate cation in most wells although magnesium constitutes a slightly larger portion of the cations in well B5 than the rest of the wells. Sulfate is the predominate anion followed by the carbonates in all the wells

Table 1

PARADISE GROUNDWATER QUALITY

Well	Conductivity µmhos/cm	pH std units	Total Alkalinity mg/L as $CaCO_3$	Ca mg/L	Mg mg/L	Cl mg/L	SO_4 mg/L	Residue mg/L	Mo µg/L	Sr µg/L
A1	1,017	6.0	337	147	6.1	115	323	947		
A1(8/88)	1,700	6.6	355	230	80	190	360	1,100	<20	590
A9	3,367	6.1	706	527	287	11.7	2,133	3,500		
A9(8/88)	3,320	6.8	713	450	280	24	1,900	2,800	<20	3,300
A15	3,173	6.2	680	397	150	5.5	1,500	3,200		
A16	4,383	6.4	950	270	170	14	2,100	3,833		
B5	3,620	6.4	533	510	310	9	2,300	3,733		
B7	1,100	10.0	138	15	2.4	4.5	347	697		
B10	3,673	5.6	490	647	175	16	2,100	3,567		
Pond A (8/88)	2,500	6.3	159	260	140	15	1,500	2,600	<20	1,500
Pond B (8/88)	540	7.0	540	260	190	27	2,100	3,400	<20	4,200
DWS		6.5-8.5					250	500		

Well	As µg/L	Ba µg/L	Be µg/L	Cr µg/L	Cu µg/L	Fe µg/L	Pb µg/L	Mn µg/L	Ni µg/L	Zn µg/L	Sb µg/L	Al µg/L	Se µg/L	Co µg/L	Cd µg/L	Li µg/L
A1	2	243	8	<1	17	13,300	1.3	46,300	52	3,500	<1	83	<1			
A1(8/88)	4	80		1	<10	27,000	14	29,000	14		<50	<50	<1	49	110	<10
A9	3	237	7	<1	20	3,167	1.3	2,267	15	2,033	<1	113	<1			
A9(8/88)	5	30		3	80	12,000	190	3,000	11		<50	240	<1	6	54	56
A15	4	177	8	<1	17	3,000	3	1,500	13	100	<1	83	<1			
A16	<1	140	7	1.7	27	910	2	1,367	9	337	<1	93	<1			
B5	7	280	8	<1	17	4,100	4.3	2,800	46	3,417	<1	83.31	<1			
B7	8	100	7.7	2	13	200	10.8	20	2	63	<1	330	<1			
B10	1	550	8.3	1.7	43	73,300	1.3	38,000	127	987	<1	83	<1			
Pond A (8/88)	2	120		2	160	5,400	3	7,000	170		<50	70	<1	100	.5	56
Pond B (8/88)	4	160		<1	160	900	2	1,200	<1		<50	<50	1	<1	0.4	85
DWS	50	1,000		50	1,000	300	50	50		5,000			10		10	



PARADISE FOSSIL FUEL PLANT

0 ½ 1 MILE

1000 0 1000 2000 3000 4000 5000 6000

1 0 1 KM

CONTOUR INTERVAL 10 FEET
DASHED LINES REPRESENT HALF-INTERVAL CONTOUR

Plant site area revised from aerial photography dated July 1985

Figure 3

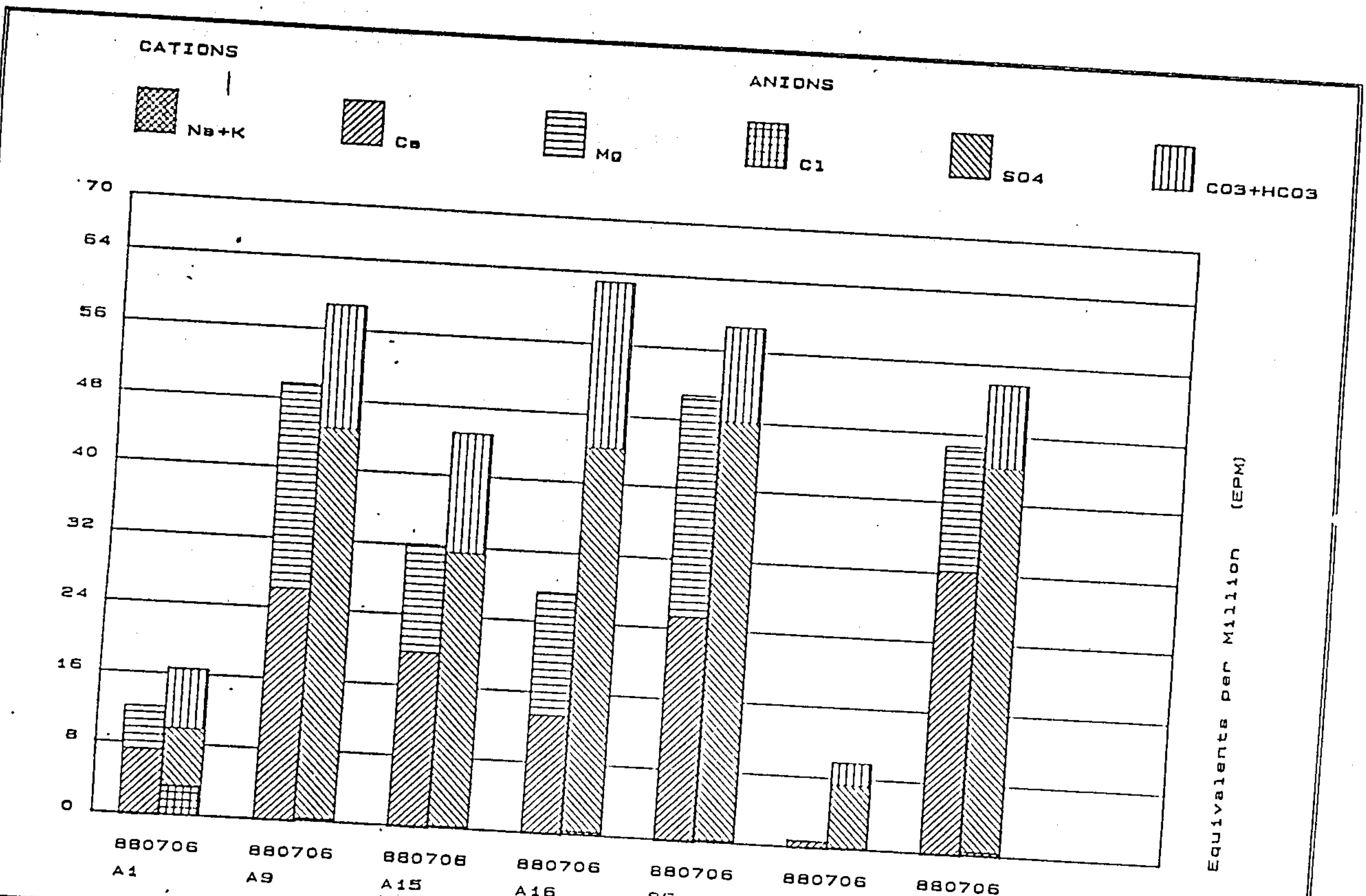
WELL SITES

O Sampling Wells
Δ Monitoring Wells

All wells not useable at present for sampling.

Compiled by Mappin

FIGURE 4



PARADISE ENVIRONMENTAL ASSESSMENT
AVERAGE CONCENTRATIONS

1981-1983 DATA

Well A1 is somewhat different from the rest of the wells in that chloride, sulfate, and bicarbonate all contribute about equal amounts to the anion total. Wells A1 and B7 are distinct from the rest of the wells in that the residue (TDS) concentration is much lower than the rest. This is indicated by the shortness of the bars in figure 4. Well B7 is distinct from all the other wells in that its pH was 10 while the pH of all the rest of the wells was approximately 6.

Additional groundwater data were collected to confirm the discussion above. These data are also shown in table 1. Wells A1 and A9 were sampled as well as two ponds. Pond A is the pond found at Site 3 while Pond B is the pond at Site 1. The August 1988 data for Wells A1 and A9 compare within the order of magnitudes established during the 1981-83 period with the exception of Mg and Ba in well A1 and Ba and Fe in well A9 indicating the water quality at these two locations has been relatively stable. The pond data are of interest because they lie within the ranges of the well data. This indicates that, with the exception of iron and zinc, the well data are probably reliable. However, the 1988 analysis showed that cadmium was higher than the DWS in wells A1 and A9. The cadmium levels in the ponds were below the DWS. This suggests that the cadmium in the groundwater is already high. The lower cadmium levels in the ponds might be the result of the oxidizing conditions provided by the exchange with the atmosphere or simply a cadmium concentration gradient in the groundwater under the plant site. Further data will be needed to determine whether cadmium is naturally occurring in the strip mine areas. Although the casings possibly increased the iron and zinc concentrations for some of the wells (A1 and A9 in particular) the pond data indicates that iron concentrations in the groundwater are indeed high. The pond data also confirms that the groundwater beneath the plant site is generally of poor quality.

Groundwater Hydrology

Groundwater occurs on the Paradise site in the Lisman Formation where present and in the spoils remaining from strip mine operations. The Lisman Formation in the vicinity of the plant has been disturbed to the point that it is not considered usable as a water source. The deeper Caseyville Formation is expected to receive little use because of its depth and is not of concern in this evaluation because low permeability formations exist between it and overlying groundwaters.

Groundwater found in the upper strata is derived from local precipitation and generally conforms to topography. Depth to groundwater in the wells located on the site range from 6 to 22 feet below surface. There are numerous ponds and lagoons (many are abandoned strip mine pits) in the area that are directly influenced by the groundwater. Several TVA ponds also influence groundwater elevations and local groundwater movement patterns. Groundwater gradients in the plant site areas indicate movement is toward the Green River and Jacobs Creek drainage basins.

Proposed dredge pond sites 1 and 3 are abandoned strip mine pits. The water in these ponds is believed to be in direct connection with area groundwater.

Leachate Quality

The expected quality of leachate from the dredged ash was estimated in three ways.

The first estimate was based upon an EP Toxicity Test performed on a composite of three samples obtained from the existing fly ash pond. The EP Toxicity Test is an extraction performed over 24 hours at pH 5. The results from the composite sample are shown in table 2. If the fly ash extract were to exceed the maximum concentration shown in table 2, it would be classified as a hazardous waste. Table 2 shows the fly ash to be nonhazardous.

The second estimate of leachate quality was obtained from an examination of the ash pond effluent quality shown in table 3. Table 3 was based on data collected during the period 1973 to 1974 and 1985 to 1988 and is presented to show the typical concentration ranges.

Because the ash pond effluent is more oxidized than the leachate, the ash pond effluent concentrations will be lower for most species. Even so, a review of data for the period 1976 through 1980 indicated the ash pond concentrations of cadmium, iron, and manganese exceeded the DWS during each of the five years. The EP Toxicity extract shown in table 2 also shows cadmium above the DWS. Table 3 also shows the ash pond water to have been of very low pH in 1973-74, lower than the pH 5 which is the basis for the EP Toxicity Testing. Solubility of most metals generally increases with lower pH. For example, the pH of the ash pond has risen significantly since the mid-1970s primarily due to diversion of the bottom ash pond discharge into the fly ash pond. As a result, several of the metal concentrations in the 1985 to 1988 period are observed to be less than in the period 1973 to 1974. It is uncertain whether the pH of the leachate will reflect the acidic nature of the ash pond characteristic of the mid-1970s or the more neutral pH of the mid-1980s. Generally, however, the pH at the bottom of ash ponds where the leachate originates is lower than the ash pond discharge. Acidic conditions could result in the leachates from the dredge pond that contains some metal concentrations in excess of the DWS. In order to determine how the dredged ash will behave, data will be collected from an interim internal dredge cell within the ash pond which will be conducted during November and December of 1988.

Table 2

EP TOXICITY TEST RESULTS - PARADISE
FLY ASH COMPOSITE

Analysis Performed	Result	Maximum Concentration Before Declared Hazardous Waste	DWS
Arsenic, RCRA extract, µg/L	<100	5,000	50
Selenium, RCRA extract, µg/L	<100	1,000	10
Cadmium, RCRA extract, µg/L	17	1,000	10
Lead, RCRA extract, µg/L	70	5,000	50
Barium, RCRA extract, µg/L	300	100,000	1,000
Chromium, RCRA extract, µg/L	<50	5,000	50
Silver, RCRA extract, µg/L	<10	5,000	50
Mercury, RCRA extract, µg/L	<2	2,000	2
pH on RCRA Waste, std. units	7.9	≤2 or ≥12.5	6.5-8.5

A third estimate was derived from an analysis of the elemental composition of the ash itself. The elemental composition of the ash composite sample taken from the ash pond (table 4) was used as input to a prerelease version of FOWL (Fossil-Fuel Waste Leachate Computer Code) to generate an estimate of leachate quality. FOWL is the Electric Power Research Institute's computer code which calculates the quantities, aqueous concentrations, and release durations of selected inorganic elements leached from fossil fuel wastes. The code uses a thermodynamic approach to calculate the aqueous concentration of elements which are in equilibrium with the solid phase of the elements in the fly ash matrix. Table 5 shows the predictions made by FOWL for a pH range of 4 to 8 which is the pH range of the ash pond over the past 15 years.

Table 3

PARADISE FLY ASH POND EFFLUENT CHARACTERISTICS

Parameters	Minimum	Average	Maximum
Flow, gal/min	3,100	6,212.5	8,800
Alkalinity, phenol, mg/L as $CaCO_3$	0	0	0
Conductivity, µmhos/cm	615	810	1,125
Hardness, total, mg/L as $CaCO_3$	185	261.5	520
pH, std. units	3.6/6.2	4.4	6.3/8.4
Solids, dissolved, mg/L	141	508	820
Solids, suspended, mg/L	2	62.5	256
Aluminum, mg/L	3.6/.12	7.2/.29	8.8/.76
Ammonia, mg/L as N	0.02	0.43	1.4
Arsenic, mg/L	<0.005/.002	0.010/.004	0.023/.008
Barium, mg/L	0.2	0.3	0.4
Beryllium, mg/L	<0.01	0.01	0.02
Cadmium, mg/L	0.023/<.001	0.037/.004	0.052/.008
Calcium, mg/L	94	136	180
Chloride, mg/L	5	7	14
Chromium, mg/L	0.012/.004	0.067/.002	0.17/.001
Copper, mg/L	0.16/.009	0.31/.012	0.45/.009
Cyanide, mg/L	<0.01	<0.10	<0.01
Iron, mg/L	0.33/.001	1.44/.950	6.6/5.2
Lead, mg/L	<0.01	0.06/.001	0.2/.003
Magnesium, mg/L	9.4	14	20
Manganese, mg/L	0.29/.047	0.48/.29	0.63/.52
Mercury, mg/L	<0.0002	0.0003	0.0006
Nickel, mg/L	0.06/.004	1.1/.026	0.13/.062
Phosphate, total, mg/L as P	<0.01	0.02	0.06
Selenium, mg/L	<0.001	0.002/.005	0.004/.012
Silica, mg/L	10	12.6	15
Silver, mg/L	<0.01	<0.01	<0.01
Sulfate, mg/L	240	358	440
Zinc, mg/L	1.1/.01	1.51/.042	2.7/0.12

Single values are data from the 1973 to 1974 period.
Values above the slash are from the 1973 to 1974 period.
Values below the slash are from the 1985 to 1988 period.

Table 4

PARADISE ASH ANALYSIS

Element		Composition (mg/kg)
Al	=	129200.000
Ba	=	380.000
Ca	=	11100.000
Cr	=	190.000
Mo	=	38.000
Si	=	221100.000
Sr	=	170.000
S	=	800.000
As	=	107.000
B	=	513.000
Cd	=	5.000
Cu	=	150.000
Fe	=	166900.000
Mg	=	5100.000
Na	=	3000.000
Ni	=	120.000
Se	=	5.000
Zn	=	440.000

Composite of three samples taken from Paradise fly ash pond in July 1988.

WRC 0100K

Table 5

FOWL LEACHATE CONCENTRATIONS PREDICTIONS

Constituent	DWS	Leachate Concentration pH = 4	pH = 6	pH = 8
Al, µg/L		4037	149	822
Ba, µg/L	1000	254	253	253
Ca, mg/L		395	394	394
Cr, µg/L	50	40	2	2
Mo, µg/L		1879	679	672
Si, mg/L		26	26	27
Sr, µg/L		1624	1616	1620
SO_4, mg/L	250	960	945	945
As, µg/L	50	109	99	99
B, µg/L		2856	3907	5343
Cd, µg/L	10	34	2	2
Cu, µg/L	1000	244	4	4
Fe, µg/L	300	511	21	5
Mg, mg/L		8	2	1
Na, mg/L		8	11	14
Ni, µg/L		197	13	9
Se, µg/L	10	1	41	104
Zn, µg/L	5000	747	10	10
TDS, mg/L	500	772		761

FOWL predicts the highest concentrations of most elements at pH 4 and the lowest at pH 8. The exception is selenium which increases with pH and shows the potential for exceeding the DWS at the higher pH's. FOWL suggests that strontium concentrations will exceed 1 mg/L which is confirmed by the well and pond data shown in table 1 in the EA.

No field data exist to compare to the FOWL predictions for molybdenum and boron both of which are predicted to exceed 1 mg/L. FOWL also indicates increased cadmium concentrations at the low end of the pH range. Should leachate pH be more near 6 than 4, cadmium concentrations should not be elevated. Although FOWL predicts arsenic concentrations in excess of the DWS, FOWL is not very useful for predicting concentrations below 100 µg/L and therefore its arsenic estimate should be discounted.

Ranking of Alternative Sites

Although the groundwater is of poor quality across the site, areas near wells A1 and B7 are probably where water quality has been degraded the least. However, the water quality even in these areas is inferior to river water quality and, therefore, would not likely be developed as a water supply source.

Because the ash leachate will likely contain elements which will exceed the DWS, attenuation of the metals such as cadmium through adsorption or precipitation would be desirable. Adsorption would be facilitated if some soil separated the bottom of the dredge pond from the groundwater. Precipitation would be facilitated if the pH of the leachate could be raised.

Proposed sites 1 and 3 would offer no potential for attenuation if wastes were discharged directly into the existing ponds because the fly ash would be in direct contact with the groundwater. There would be no soil to adsorb some of the metals in the leachate and the pH would be expected to remain low, thus removing the potential for much precipitation.

Site 2 could more easily be constructed with soil between the pond bottom and the groundwater. In addition, the groundwater near site 2 is high in pH and the nearby wet scrubber sludge area is also expected to have an elevating effect on the pH of groundwater beneath sites 1 and 2. Therefore, leachate percolating into the groundwater at sites 1 and 2 might have its pH raised by the groundwater and this could help precipitate metals.

Control of dredge pond hydrology could also be accomplished on site 2. Leachate flux rates to groundwater cannot be calculated without site-specific data, but are estimated to be very large, several hundred thousand gallons per year or greater. Because of precipitation, this flux rate would continue indefinitely until the site is covered to prevent infiltration. However, the dredge pond could be drained following the dredging activity, thus substantially decreasing the leachate flux to groundwater.

Conclusion

Groundwater resources in the Paradise area have been contaminated by strip mine spoil deposits and by onsite coal and waste handling. The degree of additional contamination that will result from development of a new fly ash dredge pond cannot be accurately determined; however, increased concentrations of several metals have been determined to be possible. Any impacts to groundwater will be localized, with increased fluxes to the Green River and/or Jacobs Creek.

Sites 1 and 3 are strip mine pits and are believed to be directly connected with area groundwater. These sites may be less desirable from an environmental standpoint unless specific design considerations are included to lessen groundwater impacts.

Site 2 is located in the Jacobs Creek drainage basin on a gentle slope. The bottom of the dredge pond could be developed above the groundwater table. Drainage of the dredge pond could be accomplished following dredge activities to reduce the flux of groundwater pollutants.

Jacobs Creek is largely comprised of flows from strip mine drainage and the active ash pond. Water quality of the creek is improving as stabilization of strip mine lands occur. Protection of groundwater quality and recharge to surface streams should be provided to the extent practicable.

SURFACE WATER

There is the potential for some adverse impacts to surface water quality from surface water runoff during the period of dredge pond construction. However, with the implementation of "Best Management Practices" (BMPs) to control surface water runoff, these impacts would be short term and relatively minor.

During operation, the use of BMPs to control surface water runoff from the exterior pond dikes would ensure that no significant surface water impacts result. Routing of the dredge pond discharges through the existing ash pond for subsequent discharges through the currently permitted ash pond outfall should not significantly alter the quality of the current ash pond discharges. The discharges of dredge pond waters in this manner would have no significant impact on the quality of the receiving surface waters.

Thus it can be concluded the construction and operation of the proposed dredge pond would have no significant adverse impacts on the quality of the surface water in the Paradise area.

AQUATIC ECOLOGY

Examination of available information for the region and an onsite survey showed lakes capable of sustaining fish populations at two of the sites and seepage ponds at the third.

Pond A (site 3) located adjacent to PAF on the north drains directly to the Green River. This lake has been partially filled with dredge spoil removed from the coal barge docking facility. Although approximately 40 percent of the original lake has been filled, the gentle contours of the area around the remaining portion of pond A make it attractive to local anglers. The remainder of pond A is bordered on the northwest by the proposed road which provides access to a proposed concrete launch ramp on the Green River. Surveys taken during June 1988 and in 1985/1986 showed the pond A fish assemblage (primarily bluegill and largemouth bass) to be limited in numbers and in poor condition.

Site 2 is located in an area already impacted by scrubber sludge. The entire area has been diked and recontoured from the post-mining land use plan in order to serve its new role. Fish surveys made in ponds at site 2 in 1981 showed a small pond assemblage typical of the region. However, most of these ponds have been removed; therefore site 2 would have the least fisheries impact of the three proposed areas.

Site 1 contains a teardrop shaped lake of about 1.4 ha (3.4 ac) area. Approximately 60 percent of the shoreline had dense stands of _Typha_, but with good access around the perimeter of the lake. The water was quite clear provided the deep substrate (>2 feet) was undisturbed. The central portion of the lake was over five meters in depth and free of submersed vegetation; whereas the edges had dense growth of _Mirophyllum sp._ (water milfoil).

Fish samples were collected using experimental gill nets, electrofishing, and hook and line capture. Seining was not attempted because of the soft deep substrate. The fishery in site 1 lake was comprised primarily of stunted largemouth bass and bluegill. The small size and poor condition of the largemouth bass highlighted the poor fishery. This condition may have been alleviated if local anglers could have removed some fish from the pond; however, this site is behind a locked gate.

In summary, the fishery at site 1 is limited primarily because there has been little or no exploitation of the stocked populations. This has resulted in stunted populations with poor recreational value. At site 2 there would be little fisheries impact. Site 3, although containing a limited fishery, does receive local fishing use. Because of the existing and potential for enhanced recreation and natural resource value of the lakes of sites 1 and 3, development of site 2 for the fly ash pond is preferable from the standpoint of fisheries impacts.

Because intermittent chronic toxicity has occurred in previous studies of ashpond effluent at Paradise Steam Plant, some level of toxicity could occur during the dredging project. The biota of lower Jacobs Creek could be impacted by low pH discharges or metals resuspended from sediments disturbed during dredging. However, significant adverse impacts to the biota of Jacobs Creek are not expected. To verify the no significant adverse impact assumption, TVA will conduct a 7-day static renewal toxicity test using Ceriodaphnia and larval fathead minnows during the interim internal dredging operation and evaluate changes from baseline toxicity. If significant increases in toxicity are detected, recommendations will be developed for future work.

Additionally, previous studies showed that chronic toxicity was indicated for the 24-hour samples and this toxicity increased (although not linearly) with increasing retention time (there were no notable differences in routine chemical parameters). Due to possible differences between the laboratory-scale test and actual ash pond conditions, the time effect of dredging on toxicity of the ash pond discharge can best be determined in ambient conditions. Accordingly follow-up toxicity studies will be conducted upon completion of the dredging operation to evaluate the differences in toxicity resulting from the increased ash pond volume. If toxicity is identified, appropriate corrective action will be implemented as required by TVA's NPDES permit.

WETLANDS

A wetlands inspection was carried out at Paradise Fossil Plant to determine the status of wetlands known to exist on three areas proposed for a new fly ash dredge pond. Wetlands on these areas have changed very little since initial inspections were carried out in 1980. Ponds on all sites have remained in an open water condition. Submergent or floating-leaved aquatic bed wetlands which often evolve on ponds of this type have not developed. Algae and aquatic moss have developed along certain areas of shoreline where sunlight penetration has encouraged the growth of some biomass. Wetlands that surround the ponds on all three sites are classified (Cowardin, et al., 1979) as:

System - Palustrine

Class - Emergent Wetland

Subclass - Persistent

Water Regime Modifier - Semipermanently Flooded

Other Modifier - Excavated

The major wetland species that have developed around these ponds are common reed (*Phragmites communis*), common cattail (*Typha latifolia*), and slender spike rush (*Eleocharis acicularis*). These are essentially the same species observed on these ponds the last eight years.

Ponds on any of the sites should not be considered rare, unique, unusual, or significant wetlands. They do, however, contribute to the wildlife resources of the area by providing habitat for migrant-wintering and resident waterfowl, shore birds, wading birds, and marsh birds. These ponds are also the most biologically active and productive parts of all three sites where the surrounding terrestial habitat is principally monotypic open grasslands.

In addition to wetlands which have developed around the ponds, other smaller wetlands have developed sporadically across each site. Opportunistic wetlands have developed where topographic depressions, disrupted drainage ways, and constructed drain ways were created during the reclamation process. These small wetlands do not contribute to wildlife significantly but are important to the eventual recovery of disturbed habitat. These wetlands, like all wetlands on the site, are biologically healthy and contribute to higher quality runoff from each area.

Site 1: This is the smallest of all three sites selected for the fly ash dredge pond. The site contains an open water pond of approximately 3.4 acres, surrounded by open grassland. Emergent wetlands are present along the edge of the pond and along a small ditch that drains into the north end.

Development of site 1 will not impact any significant wetland habitats. There will be some loss of migrant-wintering waterfowl, shore bird, wading bird, and marsh bird habitat. There would also be some loss of resident Canada goose habitat.

Site 2: Site 2 is almost entirely open grassland with a small pond located on the north and west boundaries. Both ponds are less than one acre in size and support emergent wetlands along the shallow shoreline. The pond on the north boundary supports a good stand of slender spike rush which is excellent waterfowl, marsh, and shore bird food. This is the only pond on the three sites where this particular wetland plant was identified. The two ponds on site 2 provide only very limited habitat for any wetland wildlife species because of their small size and the amount of present disturbance on and near the site.

Site 3: Site 3 contains the largest pond of the three areas. This pond, which is approximately 8 to 10 acres in size, supports emergent wetlands along most of the shoreline and provides habitat for migrant-wintering and resident waterfowl, shore birds, wading birds, and marsh birds. This pond is big enough and biologically productive enough to attract large numbers of these species. It appears to support a healthy food chain as evidenced by large numbers of aquatic invertebrates, reptiles, and amphibians and the evidence of heavy fishing pressure along the shoreline. The majority of the runoff that empties into the pond on site 3 enters from a large wetland situated in a cove at the base of a ridge just north of site 3. This wetland is an important feature of the habitat surrounding site 3 and should be left undisturbed if this site is developed.

The development of a new fly ash dredge pond will not impact significant wetlands or wetland habitat on any of the selected sites and there is no practicable alternative to impacting these deminimus wetlands. The areas surrounding these sites support habitat similar to that which would be disturbed for the fly ash dredge pond. In addition, open water habitat which would be principally disturbed on sites 1 and 3 appears to have recently undergone considerable expansion just west of site 2. Thus, from the wetlands viewpoint, site 2 is the preferred site for development of a fly ash dredge pond. The development of this site would result in the fewest impacts to wetlands and, thus, be consistent with TVA policy on implementation of Executive Order 11990, Protection of Wetlands. Site 3 is the least desirable site due to the presence of the highest quality wetlands and wetland habitats of the three selected sites.

WILDLIFE

Terrestrial habitat on the three sites is almost entirely open grasslands with some portions supporting shrubby tree growth. The major herbaceous species are fescues (Festuca sp.) and Sericea lespedeza (Lespedeza curreata). The existing ecotone is presently providing habitat for small furbearers, rodents, reptiles, and bird life, such as eastern meadowlark and horned lark, which prefer open grasslands and are abundant on all the areas. The existing terrestrial habitat is also attractive feeding ground for several raptor species, such as American kestrel, red-tailed hawk, and northern harrier. These areas are also expected to attract other predators, such as foxes and coyotes, which will utilize the abundant rodent populations. There is evidence of white-tailed deer use of the site, and the grasslands have attracted a good population of resident Canada geese which are nesting around several of the ponds.

The ponds and surrounding wetland habitat support a variety of organisms from the bottom of the food chain up. The ponds, particularly on site 3, are inhabited by substantial numbers of aquatic insects, fish, amphibians, and reptiles. This, in turn, has attracted a variety of resident and migratory avian wetland wildlife species. The emergent vegetation along the shoreline has further encouraged wildlife by providing cover, food, and nesting habitat for many passerines, wading birds, shore birds, and marsh birds.

There are no known threatened or endangered or other sensitive species which would be affected by the proposal. The development of a new fly ash dredge pond will not impact significant wildlife habitat on any of the selected sites. The areas surrounding these sites support habitat similar to that which would be disturbed for the fly ash dredge pond. Site 2 is the most disturbed of the three selected areas. The site is bordered on three sides by heavily used roads; large conveyor machines are presently on the area; and parts of the site do not appear to have been completely reclaimed. Therefore, from a wildlife standpoint site 2 is the preferred site for development of a fly ash dredge pond. The development of this site would result in the fewest impacts to wildlife habitats. Site 3 is the least desirable site due to the presence of the highest quality wildlife habitats of the three selected sites.

CULTURAL RESOURCES

The proposed fly ash pond would not affect cultural resources at any of the three sites. All three sites proposed for the fly ash pond have been previously altered by mining to the extent that investigations for cultural resources are not warranted. A historical site, Old Airdrie

Furnace, is located downstream of Paradise at Green River mile 99L. Site 3 is bordered on the northwest by a proposed road which would provide access to the furnace. No adverse effects on this historic site would result from development of the dredge pond at this location provided access to the furnace is maintained.

AIR QUALITY

Construction of the proposed dredge pond will result in temporary fugitive dust emissions from clearing and grading during site preparation. Gasoline and diesel fueled equipment and vehicles used in construction will emit minor amounts of combustion pollutants, such as particulates, carbon monoxide, and nitrogen oxides. If debris cleared from the site is disposed of by open burning, additional small amounts of particulates and carbon monoxide will be released. Any open burning will be conducted in accordance with applicable State and local regulations.

Air quality impacts during operation will depend on the method of disposal. Material will be hydraulically dredged and conveyed to the new pond by pipe. Any air emissions from transport will be negligible. If either site 1 or 3 is chosen, all material will be handled and ponded wet. Fugitive dust from such operations will be minimal. If site 2 is chosen, stacking will be necessary. Material in the disposal pile will initially be wet. As necessary, the pile will be wetted to reduce dust emissions. Surfaces will be revegetated as soon as practical, and the active area of the pile will be kept as small as possible to further reduce dust.

With proper mitigation, this project should not significantly impact air quality.

FLOODPLAIN

All three of the candidate sites are located outside the limits of the identified 1-percent chance (100-year) and 0.2-percent chance (500-year) floodplains and would therefore be consistent with the requirements of Executive Order 11988 and TVA's floodplain management policy. Normal site drainage practice would be followed in providing drainage from the local site area.

CONCLUSION

Although use of site 2 would result in the least environmental impacts, none of the sites considered support unique or irreplaceable environmental resources or habitats. Site 3 contains the best wildlife habitat, highest quality wetlands habitats, and the best fishery resource. No significant environmental impacts will result from the development of any of these areas provided proper considerations are incorporated into design of the facility to protect groundwater resources from further degradation and commonly accepted best management techniques are used during construction, operation, and reclamation to prevent erosion and air quality impacts.

COMMITMENTS

1. Water quality data will be collected from the discharge of the internal ash pond dredge cell to determine whether dredged ash will revert to more acidic conditions when isolated from the main body of the ash pond and its neutralizing effects. Changes in indicator metal concentrations and pH will be monitored over the 4- to 6-week dredge operation with at least two sample collections. If statistically significant changes in metals concentrations or pH drops of 1.5 units or greater occur, the analysis of leachate impacts on groundwater resources will be reevaluated.

2. A 7-day static renewal toxicity test using Ceriodaphnia and larval fathead minnows will be conducted during the interim internal dredging operation to evaluate changes from baseline toxicity. If significant increases in toxicity are detected, recommendations will be developed for future work. If water quality data collected under commitment 1 indicates drops in pH of more than 1.5 units, the 7-day static renewal toxicity tests will be repeated.

3. Follow-up toxicity studies will be conducted upon completion of the dredging operation to evaluate the differences in toxicity resulting from the increased ash pond volume. If significant toxicity is identified, appropriate corrective action will be implemented.

4. The ponded area in site 1 will be filled so that the pond bottom is two feet above the existing groundwater level. Fill will consist of material approved by the State of Kentucky geologist. The discharge ditch will meet applicable State requirements.

5. The dredge pond will be drained, sloped, covered, and reseeded to decrease surface infiltration that could produce surface seeps and/or the leachate flux to groundwater. This work will be performed within a reasonable time after completion of dredging activities.

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4/1099

William H. Thompson, Vice President of Power Production, LP 3S 58K-C

M. Paul Schmierbach, Manager of Environmental Quality, SPB 2S 201P-K

JAN 0? 1989

PARADISE FOSSIL PLANT - JACOBS CREEK ASH POND - DREDGE POND ENVIRONMENTAL ASSESSMENT (EA)

References: 1. Memorandum, W. G. Ruffner to M. Paul Schmierbach, December 13, 1988

2. Memorandum, W. G. Ruffner to M. Paul Schmierbach, December 7, 1988

This memorandum is in response to your December 13 request for formal approval of the dredge pond EA.

The Environmental Quality Staff (EQS) has reviewed the draft EA submitted on December 2 and subsequent revisions submitted by you on December 7 and December 13. The commitment list now appears to be complete and we will proceed to prepare a "Finding of No Significant Impact."

Please prepare and submit to EQS, a final version of the EA incorporating the comments noted on the attached draft. The American National Standards Institute number assigned to this document is TVA/RDG/EQS-89/1.

If you have any questions, please contact Richard M. Shane at extension 6654 or Dale V. Wilhelm at extension 6693 in Knoxville.

Original signed by
M. Paul Schmierbach
M. Paul Schmierbach

RMS:DVW:DKT
Attachment
cc (Attachment):
Files, EQS, SPB 2S 242P-K
E. S. Christenbury, ET 11B 33H-K
W. W. Dorroh, Paradise Fossil Plant
J. T. Shields, 514 CEB-K

Prepared by Richard M. Shane and Dale V. Wilhelm

RECEIVED
OFFICE OF PLANT MANAGER
PARADISE FOSSIL PLANT
JAN 1 1 '89

DRAFT ENVIRONMENTAL ASSESSMENT

DEVELOPMENT OF DREDGED ASH DISPOSAL AREA
PARADISE FOSSIL PLANT

Introduction

Paradise Steam-Electric Plant (PAF) is a 3-unit, 2,558-MWe coal-fired facility in Muhlenberg County, Kentucky. The plant is located on the west bank of the Green River at Green River Mile 100.5. Construction for units 1 and 2 began in November 1959, and commercial operation begin in May and November 1963. Each of these units has a nameplate rating of 704 MWe each. In February 1970, unit 3 was accepted for commercial operation. Fly ash from this plant is sluiced to a settling pond, with supernatant discharged at an average flow of 53.19 cfs to Jacobs Creek, a small tributary of the Green River.

This project is to construct a dredge pond near the Jacobs Creek ash pond capable of storing at least 1×10^6 cubic yards of fly ash dredged from the ash pond. This will provide approximately 10 years of additional fly ash storage in the fly ash pond. Effluent from the dredge pond will be returned to the Jacobs Creek ash pond for discharge to Jacobs Creek. (NPDES No. KY0004201, Discharge No. 001)

Approximately 245 acres of land will be purchased under this project for the dredge pond although the pond itself will constitute only about 50 acres. Construction is expected to begin in June 1989, and dredging in February 1990. Based on the latest pond volume survey and forecasted operation, Paradise would be without fly ash storage space in November 1990 without this project.

This assessment is to evaluate the environmental consequences associated with the purchase and development of a new offsite area for dredged ash disposal operation at PAF.

Alternatives Considered

The selection of an environmentally acceptable disposal alternative was based on the following criteria:

1. A storage volume equivalent to a minimum $1x10^6$ cubic yards.

2. The proximity of the site to the active ash pond.

3. The cost of site development and operation.

4. An area that has favorable physical properties for ensuring no significant impacts to the environmental resources, including groundwater, surface water, biota, and cultural resources.

In the selection of a site for development of additional ash disposal, the following alternatives have been considered.

Alternative 1—Construct two dredge cells in the old scrubber landfill area.

Under this option two small dredge cells would be constructed in the old scrubber landfill area. Each cell would be filled three times by dredging. Each area would be reclaimed twice between dredgings by dewatering the ash and stacking the reclaimed ash on high ground in the old scrubber landfill. The total costs associated with this option are $3,932,131. This is the highest cost option because of the high costs associated with reclaiming ash and moving it to other areas between dredging operations.

Alternative 2—Construct two dredge areas, one in the old scrubber landfill area, the other on an additional 245-acre tract.

Under this option dikes would be constructed in the old scrubber landfill area sufficient to contain 531,000 cubic yards of dredged material. In addition, a 245-acre tract of land would be purchased. This area would be developed to contain the balance of 669,000 cubic yards of dredged material on 50 acres of the site. The total costs associated with this option are $2,692,000. The costs associated with this option are less than for alternative 1 because the ash would not have to be moved from the dredging areas to other areas for permanent disposal. However, this option is higher in cost than alternative 3 because of the need to construct more diked areas.

Alternative 3—Develop one dredged ash disposal area.

Under this option, three potential sites were considered (see figure 1). The preferred site is on a 245-acre tract of land which would be purchased. Dikes capable of storing the entire 1 million cubic yards of material to be dredged would be constructed to contain a 50-acre dredge pond. This is the least investment alternative and is the proposed project. The total costs associated with this option are $2,389,000. This option is less costly because there is no need to reclaim and haul ash to other areas for permanent disposal and it is more economical from a construction standpoint to develop one larger area than two small areas.

Alternative 4—No action

The no action alternative is infeasible because free water volume must be restored in the ash pond if the plant is to continue uninterrupted operation. Paradise Steam Plant is one of TVA's largest and most reliable plants and is essential to base load operation.

Figure 1

CONSTRUCT DREDGE POND AND DREDGE ASH POND

Potential Sites Considered

Site 1—Although the total acreage of this site is a little larger than each of the other two sites considered, site 1 would require development of the smallest area for the dredge pond. This site consists of land that was previously strip mined and has been reclaimed leaving a small pond of approximately 3.4 acres surrounded by open grassland. Part of this area is a depression bounded by hills or ridges about 50 feet in elevation along two sides and would require much less diking for construction of the 50-acre area to contain the desired dredge volume. Although this land is not currently a part of the TVA reservation, one of the two owners has indicated a willingness to sell approximately 169 acres of the 245-acre tract required by TVA.

Site 2—This area is a 140-acre site west of the Jacobs Creek ash pond which was used for a short time for stacking of scrubber sludge wastes. It consists of previously mined lands which were reclaimed and is now open grassland. Two small hollows were left in the area which contain small ponds. This area was discussed in a previous EA for development of coal-wash refuse and scrubber sludge disposal areas. The area is on a fairly flat elevation about 100 feet above the ash pond elevation and would therefore require much more diking than the other two areas considered in order to contain the ash volume to be dredged in this project.

Site 3—This 100-acre area is at the northern boundary of the current reservation adjacent to the Green River. It consists primarily of mined land which has been reclaimed. Strip mine pits in the area were left as part of the reclamation process. This area was considered in a previous EA for use as a permanent coal-wash fines refuse and dredge material disposal area. At that time the lake had already been partially filled with dredge materials from construction of a nearby coal barge docking facility. The area is currently used for disposal of miscellaneous dredged materials when required. Although development of this area would not require a great deal of diking to contain the desired volume of dredged ash, use of this area is complicated by other factors. Its remote distance from the active ash pond and its location on the other side of the plant would make it very difficult and costly to construct dredge lines to this site. It would also be difficult or impossible to reroute dredge pond return flow back to the existing ash pond. It is uncertain whether the water from this pond could meet NPDES permit limits enabling it to be discharged directly to the river without further treatment.

Preferred Alternative

Based on consideration of the engineering and economic factors discussed above, the preferred alternative is to construct the 50-acre dredge settling pond ~~on~~ at site 1. This site will be purchased by TVA and developed for the disposal of $1x10^6$ cubic yards of dredged ash. Dikes will be constructed from the best locally available material based on soil tests, probably obtained from a borrow area in the nearby scrubber stacking area. The top of the dikes will be at 460 feet of elevation (see figure 2). This area now drains toward upper Jacobs Creek. Return flow from dredging will be routed back to the ash pond and will flow by gravity through the existing natural drainage for the area adjacent to the preferred site. Diking will prevent flows into the upper Jacobs Creek area.

Upon completion of construction, piping will be ~~assembled~~ laid from the ash pond dredge to the dredge area. The estimated time to complete the dredging of $1x10^6$ cubic yards of ash from the active ash pond is approximately ten months. After completion of dredging the ash would be allowed to dewater and the area would be contoured to promote natural rainwater runoff. The ash will then be covered and seeded in accordance with State closure requirements. Appropriate erosion control features will be included in the design to allow for an environmentally acceptable final closure.

Completion of this project will restore approximately 10 years of storage volume to the active ash pond.

Consideration of the environmental factors associated with the use of the three areas considered is discussed in the following sections.

Figure 2

Reference No. 2

Draft Report
Peabody Ash Pond
Expansion 1998

I. INTRODUCTION

The Paradise Fossil Plant is located on the west bank of the Green River at mile 100 in Muhlenberg County, Kentucky. The plant is located in western Kentucky, 5 miles east of Drakesboro. Paradise Fossil Plant has three units. Units 1 and 2 went into commercial operation in 1963. They had a rated capacity of 1300MW and were uprated to 1408MW in 1965. Unit 3 became operational in 1970 with an added rated capacity of 1150MW to give an overall plant capacity of 2558MW. With cyclone firing of the boilers, the units produce approximately 80% bottom ash which is tapped from the bottom of the furnace and 20% fly ash. Electrostatic precipitators remove the fly ash from the flue gas. The fly ash is collected in hoppers under the precipitators and conveyed pneumatically by a dry vacuum system to an elevated separator tank. Water jet exhausters located at the tanks mix the fly ash with water. The ash and water slurry from all three units is then pumped to the ash disposal areas.

II. HISTORICAL DEVELOPMENT

Four fly ash disposal areas were initially designated to receive fly ash from Units 1 and 2. By 1967, Area No.1 and Area No. 3 were filled and graded to proper elevations. Area No. 1 is currently part of the coal storage yard and Area No. 3 is the site of Coal Yard Drainage Basin No. 3 and plant parking. During this time, Area No. 2 was being sluiced into. The original dikes for this area were at EL 406 and designed with extra width at the top for future dike raisings. By late 1967, Area No. 2 was divided into two areas, Area 2A and Area 2B, by a 1200-ft dike to facilitate better settling time. At this time, several dikes were relocated outward and raised a few feet in several sections. In

1968, Area No. 4 was being sluiced into. Area 4 was filled in 1970 and is currently part of the coal storage yard.

In 1970, Area No. 2 dikes were raised to EL 416 to provide for additional ash storage. It was anticipated that after Unit 3 began operation in 1970, Area 2A and 2B would provide storage for only an additional 2 ½ months. Consequently, an ash reclaiming hopper for loading ash, located at the south end of ponds 2A and 2B, and an overland ash conveying system were constructed and used to transfer ash from Area 2 to nearby abandoned strip mine pits south of the plant for disposal.

During the design phase of the plant Units 1 and 2, preliminary studies had been made of the Jacobs Creek Area, located approximately ½ mile south of the plant, to utilize this area for future ash disposal. In 1970/71, the Jacobs Creek Fly Ash Disposal Area pond was constructed, with the original dikes, left from strip mining operation, raised to approximately EL 411. The Jacobs Creek Fly Ash Disposal Area received only sluiced fly ash.

After 1971, only bottom ash was received at Areas 2A and 2B and the overland conveyor system continued in use for bottom ash storage at the mine pits until the early 1980s. In the early1980s, TVA marketed its bottom ash to Reed Minerals for use in shingles and as a sand blasting material. Since this time, Reed Minerals has reclaimed all the bottom ash from Area 2A and 2B for their use.

In 1981, the plant began raising Jacobs Creek Ash Disposal Area dikes to EL 420 to add more storage to the area. Then, in 1988, an internal dredge pond, Dredge Cell A, was constructed inside the pond to provide additional storage. Fly ash from the Jacobs Creek Fly Ash Disposal Area was dredged to this area and was discontinued by 1991.

During this time, another internal dredge cell, Dredge Cell B, had been constructed and also dredged into. In 1993, the east dredge cell, located approximately ½ mile west of Jacobs Creek Fly Ash Disposal Area, was constructed to accept dredged fly ash from Jacobs Creek Fly Ash Disposal Area. The plant stopped dredging into this area by 1994.

III. SITE DESCRIPTION

The area for the Jacobs Creek Fly Ash Pond Area Extension is adjacent to and south of the existing Jacobs Creek Ash Disposal Area. Changes to the existing conditions of this area were required to make the area adequate for use as a sluiced ash disposal area. The existing dikes left from previous strip mining operations along the southern anc eastern portions of the area were too low to allow the pond to be operated above the year flood elevation. In order to meet environmental standards, it is necessary for t pond to be totally contained above the 100-year flood elevation and allow enough retention time for suspended solids to settle out before discharging to open waters. Therefore, dikes were raised from approximate elevation 400 to elevation 408 and tie into the existing Jacobs Creek Ash Disposal Area south dike. The breach through the existing dikes near the southeast corner (Peabody KPDES permitted discharge) was closed and the Paradise Fossil Plant KPDES discharge was relocated to near the existing Jacobs Creek Fly Ash Disposal Area in accordance with state and Corps of Engineer requests during the permitting process. Dike roads have a crushed stone surfacing and dike slopes have established vegetative cover. A channel was constructed at the west end of the existing south dike to allow inflow into the new pond from the existing Jacobs Creek Ash Disposal Area pond. A divider dike was constructed in the northeast portion of the area to form a stilling pool. A channel through the divider dike and floating boom were installed on the south end of the divider dike. This allows for proper settlement of suspended solids before discharging through three spillway and skimmer structures and through three 36" diameter concrete pipes to Jacobs Creek. Stairs were constructed from the top of dike to the outlets for ease in taking samples for environmental monitoring.

IV. ASH DISPOSAL OPTIONS

There were several options considered before the Fly Ash Pond Area Expansion was considered to be the least cost solution to the depleting ash storage problem.

Option A

Dredging 350,000 cubic yards of material to the existing east/west dredge cells was considered. This option extended the life of ash disposal only 3 ½ years to June 2002. The cost of the project was estimated to be $1,840,000.

Option B

The construction of a dry collection system and dry stacking operation was considered. The capital costs for this option were extremely high at an estimated cost of $41,000,000. It was also determined that the cyclone furnace does not produce the quantity of fly ash necessary to support a dry collection system.

Option C

Raising the internal dredge cells in Jacobs Creek Fly Ash Disposal Area and dry stacking fly ash in this area was considered. This option would cost an estimated $8,500,000. A solid waste permit would also be required in this case.

300168

Option D

The construction of a new ash pond south of the scrubber pond was considered. Fly ash material would be dredged here, then reclaimed and dry stacked. This option was considered not to be feasible due to the location of environmental wetlands on the site.

Option E

Constructing the Jacobs Creek Fly Ash Pond Expansion Area was chosen as the least cost option at an estimated $1,100,000.

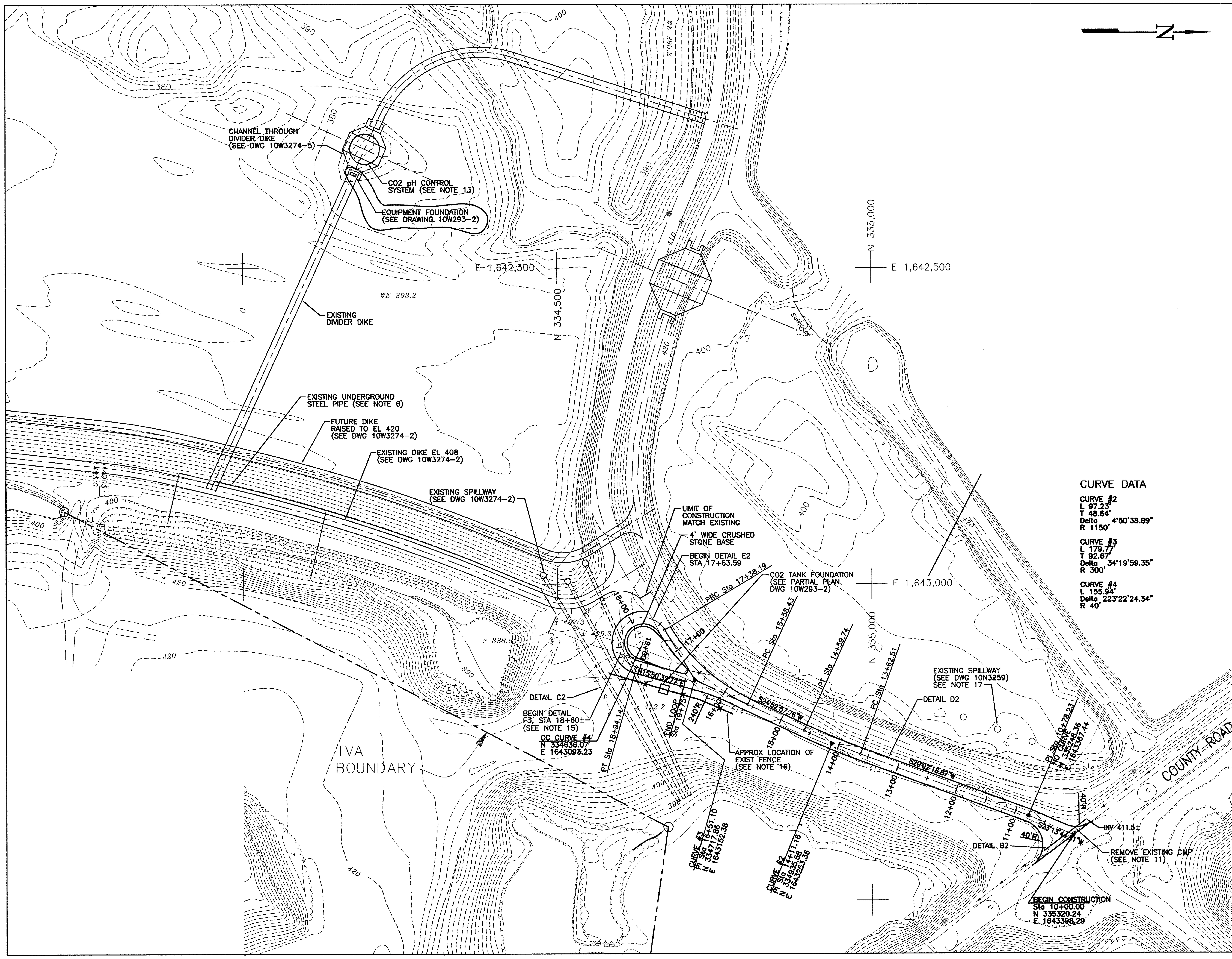
V. COSTS OF PROJECT

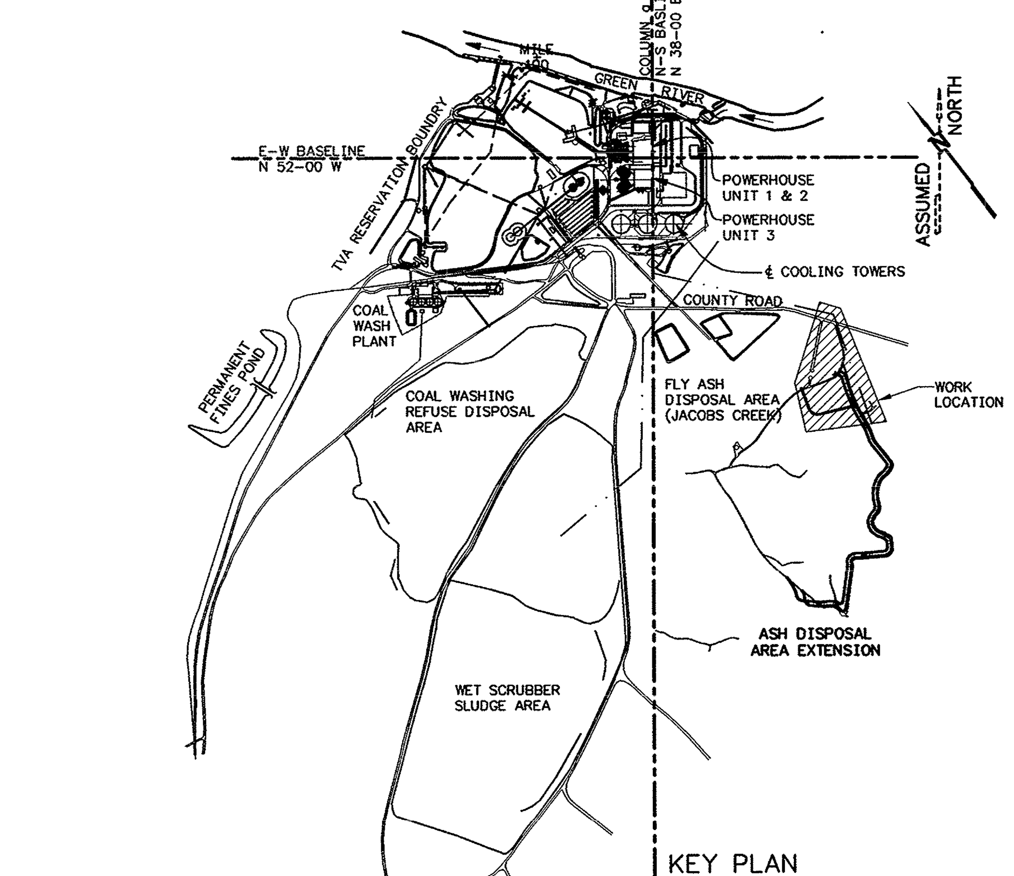
VI. PROJECTED USE OF SITE

Based on current generation projection for the next 15 years average high load coal burn forecast, it has been determined that the projected amount of fly ash produced which is sluiced into the active ash disposal area is 108,173 cubic yards per year. Based on this projection, the Fly Ash Pond Area Expansion will have a storage capacity of approximately 18 years, with the existing dikes at elevation 408. A second lift to raise the dikes to elevation 420 can provide additional ash storage capacity of approximately 21 years. At this time, the north dike of the Fly Ash Pond Area Expansion will be breached and a floating boom installed so that the Jacobs Creek Ash Disposal Area stilling pool and discharge structures will be utilized.

Reference No. 3

Peabody Ash Pond
And Stilling Pond
Drawings





NOTES:

1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH TVA SPECIFICATION T-1, UNLESS NOTED OTHERWISE.
2. SECTION NUMBERS REFER DIRECTLY TO TVA SPECIFICATION T-1, UNLESS NOTED OTHERWISE.
3. VERIFY AMPLE CLEARANCE UNDER OVERHEAD ELECTRICAL LINES FOR CONSTRUCTION EQUIPMENT. NOTIFY CONSTRUCTION MANAGER BEFORE ANY WORK STARTS BENEATH OVERHEAD ELECTRICAL LINES.
4. EXISTING TOPOGRAPHY AND FUTURE DEVELOPMENT WERE TAKEN FROM TVA DRAWINGS 64MS461K512(D) F5 R0 AND 10W3274-2. COORDINATES ARE BASED ON KENTUCKY RECTANGULAR COORDINATE SYSTEM, SOUTH ZONE, 1927 NORTH AMERICAN DATUM (NAD).
5. INSTALL ALL SILT FENCES SHOWN ON THE DRAWINGS PRIOR TO EXCAVATION AND GRADING ACTIVITIES. SILT FENCE SHALL CONFORM TO KENTUCKY DOT STANDARD SPECIFICATION FOR ROAD AND BRIDGE CONSTRUCTION SECTION 213.04.02.
6. THE LOCATION OF EXISTING UNDERGROUND UTILITIES IS APPROXIMATE, AND BASED ON A SURVEY PERFORMED BY UNDERGROUND LOCATORS OF NASHVILLE, INC., MARCH 2000. THE CONTRACTOR SHALL EXERCISE CAUTION WHEN PERFORMING EXCAVATIONS FOR THIS PROJECT, AND STOP WORK IN THE EVENT ANY BURIED OBJECTS ARE ENCOUNTERED. FOR ANY WORK IN A PUBLIC ROAD RIGHT OF WAY, CALL 1-800-752-6007 (CONFIRMATION NUMBER 20001301322) TO LOCATE ANY UNDERGROUND UTILITIES.
7. MATERIAL FOR CRUSHED STONE BASE SHALL BE AS SPECIFIED IN SECTION 1032.
8. SCARIFY EXISTING ROADWAY TO A DEPTH OF 3 INCHES PRIOR TO PLACING NEW CRUSHED STONE BASE. PREPARE EXISTING ROADBED IN ACCORDANCE WITH SECTION 220.
9. PLACE CRUSHED STONE BASE (6 IN MINIMUM THICKNESS) IN ACCORDANCE WITH SECTION 305.
10. GEOTEXTILE PLACED BENEATH ROADWAY SHALL BE WOVEN FABRIC, CLASS C, IN ACCORDANCE WITH SECTION 571.
11. REMOVE EXISTING 18 IN. DIA. CMP AND REPLACE WITH NEW CONCRETE PIPE IN ACCORDANCE WITH SECTION 1250, CLASS III PIPE. PLACE PIPE ON EXISTING SLOPE AND LENGTH TO BE DETERMINED BY FIELD.
12. NEW FENCE SHALL BE GALVANIZED CHAIN LINK IN ACCORDANCE WITH KENTUCKY DOT STANDARD SPECIFICATION FOR ROADS AND BRIDGES SECTION 722. FENCE SHALL BE 6 FT HIGH, WITH A 4 FT WIDE SLIDING GATE CENTERED ON THE CONCRETE TANK FOUNDATION. GATE SHALL BE FURNISHED WITH A LATCH AND KEY PADLOCK. CONCRETE FOR FENCE POSTS AND GUARD POSTS TO BE THE SAME AS THE CONCRETE TANK FOUNDATION.
13. CO2 TANK AND DELIVERY APPURTENANCES SHALL BE SUPPLIED AND INSTALLED BY BOC GASES, MURRAY HILL, NJ. CO2 DELIVERY PIPE SHALL BE FIELD ROUTED.
14. ALL NON-FERROUS UNDERGROUND UTILITIES INSTALLED FOR THIS PROJECT SHALL HAVE UNDERGROUND WARNING TAPE CONSISTING OF A SOLID ALUMINUM CORE, A COATED IMPRINT, AND A REINFORCED PROTECTIVE PLASTIC JACKET BONDED TO THE FOIL CORE. THE TAPE SHALL STATE THE FOLLOWING: CAUTION – UNDERGROUND CARBON DIOXIDE GAS LINE.
15. PLACE EXCESS SPOIL MATERIAL, IF NEEDED, INSIDE THE UNPAVED AREA BOUNDED BY THE ROAD TO PROVIDE POSITIVE DRAINAGE. SEED ALL DISTURBED AREAS (INCLUDING THE AREA INSIDE THE NEWLY CONSTRUCTED ROAD) IN ACCORDANCE WITH SECTION 580.
16. REMOVE EXISTING FENCE AS NECESSARY TO FACILITATE CONSTRUCTION OF CO2 TANK FOUNDATION.
17. FIELD TO VERIFY LOCATION OF EXISTING SPILLWAYS AND UNDERGROUND CONCRETE PIPES. DO NOT INSTALL UTILITY POLES WHERE UNDERGROUND CONCRETE PIPES ARE LOCATED BENEATH THE ROAD (APPROXIMATELY BETWEEN STATIONS 11+00 AND 13+00).

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 1	5/30/01	DRS	RT	WML	WML	REP	LAN		PAF074		D
PCN PAF074; ADD CONCRETE EQUIPMENT FOUNDATION AT DIVIDER DIKE.											
R 0	4-18-00	GB	JGA	DRS	DRS				PAF074		D
PCN PAF074, INITIAL ISSUE FOR U3 FUEL SWITCH PROJECT.											

DISCIPLINE INTERFACE

SCALE: 1" = 60' EXCEPT AS NOTED

YARD

UNIT 3 FUEL SWITCH PROJECT DISCHARGE POND CONDITIONING ACCESS ROAD AND PLAN

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
G. BHATT	J.G.ASHWORTH	D.R. SMITH	D.R. SMITH	R.E. PURKEY	L.A. NASH	

PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R12	DATE 4-18-00	64	C	10W293-1	R 1

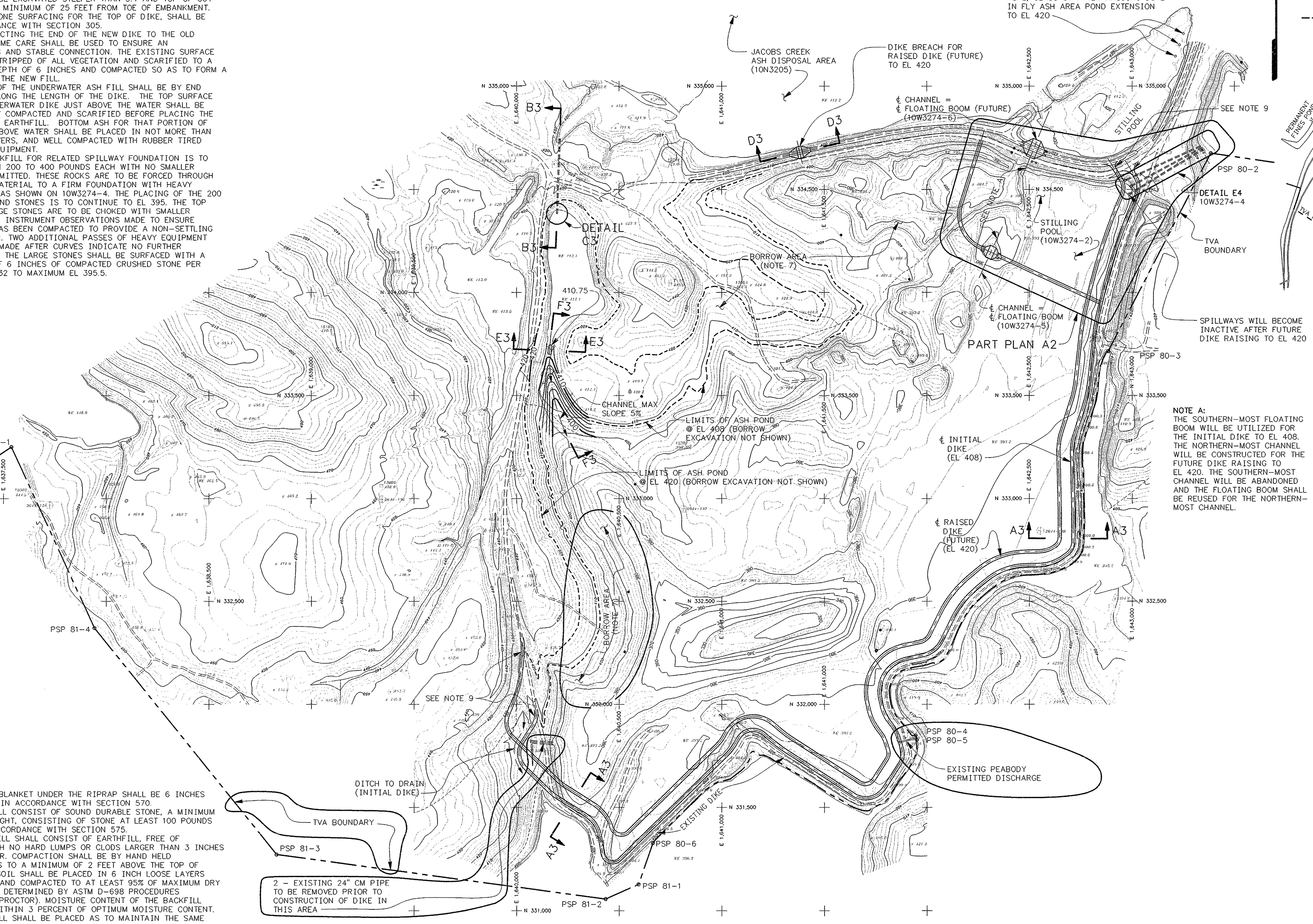
PARSONS 1
TASK COMPLETED BY: REV NO.

PLOT FACTOR:1:60
W_TVA
FILENAME: 10W293-1.DWG

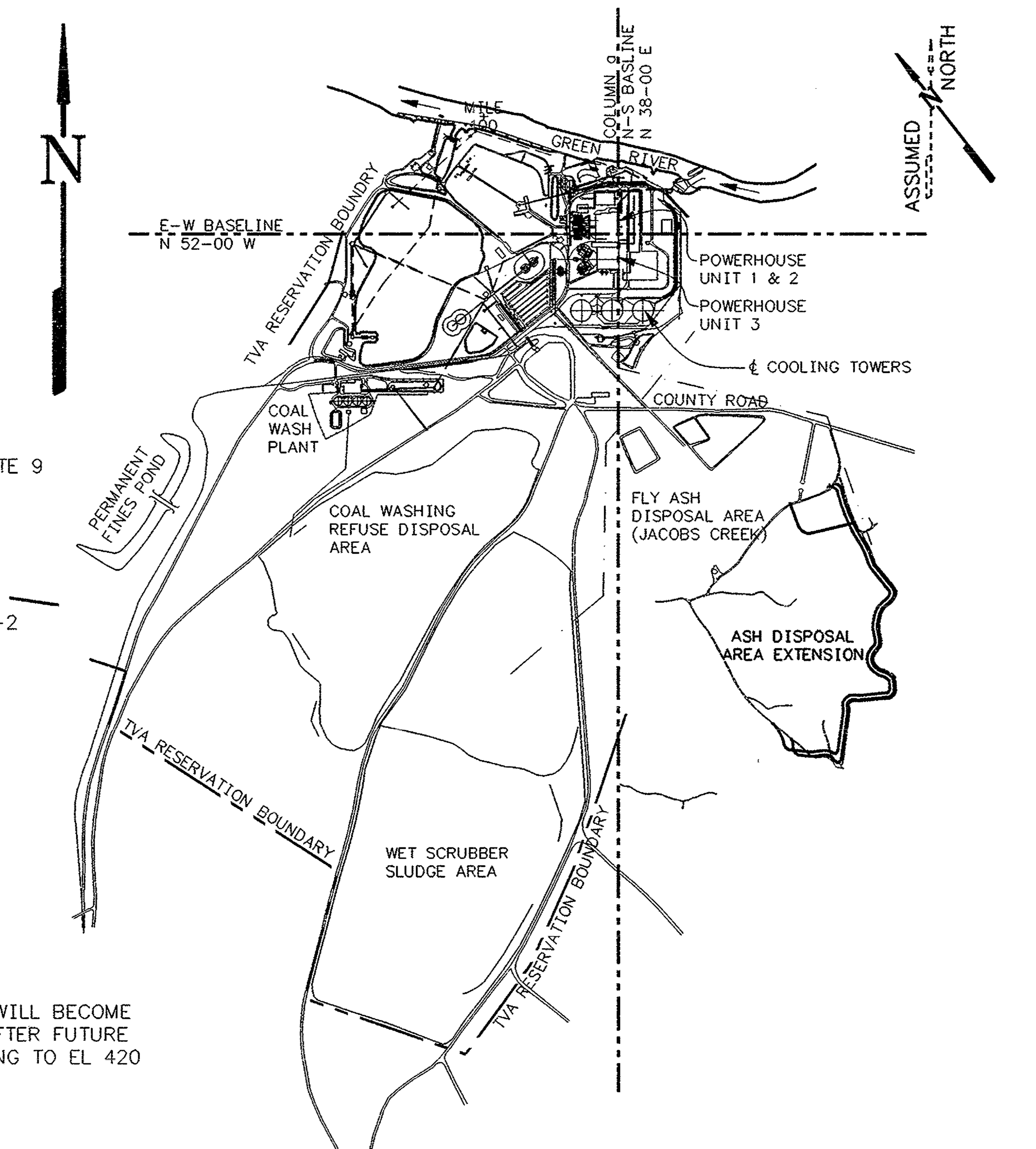
C.A.D. DRAWING
DO NOT ALTER MANUALLY

7. EARTH BORROW MATERIAL FOR THE DIKES SHALL BE OBTAINED FROM THE NORTHWEST CORNER OF THE FLY ASH POND EXTENSION AREA. FOR THE INITIAL DIKE TO EL 408, THE BORROW MATERIAL SHALL BE TAKEN BELOW EL 410, AS MUCH AS POSSIBLE, TO ALLOW THE REMAINING BORROW MATERIAL TO BE UTILIZED FOR THE FUTURE DIKE RAISING TO EL 420. CUT SLOPES ADJACENT TO EMBANKMENTS (EXISTING OR NEW DIKE) SHALL NOT BE EXCAVATED STEEPER THAN 3:1 AND TOP OF CUT SHALL BE A MINIMUM OF 25 FEET FROM TOE OF EMBANKMENT.
8. CRUSHED STONE SURFACING FOR THE TOP OF DIKE, SHALL BE IN ACCORDANCE WITH SECTION 305.
9. WHEN CONNECTING THE END OF THE NEW DIKE TO THE OLD DIKE, EXTREME CARE SHALL BE USED TO ENSURE AN IMPERVIOUS AND STABLE CONNECTION. THE EXISTING SURFACE SHALL BE STRIPPED OF ALL VEGETATION AND SCARIFIED TO A MINIMUM DEPTH OF 6 INCHES AND COMPACTED SO AS TO FORM A BOND WITH THE NEW FILL.
10. PLACEMENT OF THE UNDERWATER ASH FILL SHALL BE BY END DUMPING ALONG THE LENGTH OF THE DIKE. THE TOP SURFACE OF THE UNDERWATER DIKE JUST ABOVE THE WATER SHALL BE THOROUGHLY COMPACTED AND SCARIFIED BEFORE PLACING THE OVERLAYING EARTHFILL. BOTTOM ASH FOR THAT PORTION OF THE DIKE ABOVE WATER SHALL BE PLACED IN NOT MORE THAN 9-INCH LAYERS, AND WELL COMPACTED WITH RUBBER TIRED HAULING EQUIPMENT.
11. INITIAL ROCKFILL FOR RELATED SPILLWAY FOUNDATION IS TO WEIGH FROM 200 TO 400 POUNDS EACH WITH NO SMALLER STONES PERMITTED. THESE ROCKS ARE TO BE FORCED THROUGH THE SOFT MATERIAL TO A FIRM FOUNDATION WITH HEAVY EQUIPMENT AS SHOWN ON 10W3274-4. THE PLACING OF THE 200 TO 400 POUND STONES IS TO CONTINUE TO EL 395. THE TOP OF THE LARGE STONES ARE TO BE CHOKED WITH SMALLER STONES AND INSTRUMENT OBSERVATIONS MADE TO ENSURE ROCKFILL HAS BEEN COMPACTED TO PROVIDE A NON-SETTLING FOUNDATION. TWO ADDITIONAL PASSES OF HEAVY EQUIPMENT ARE TO BE MADE AFTER CURVES INDICATE NO FURTHER SETTLEMENT. THE LARGE STONES SHALL BE SURFACED WITH A MINIMUM OF 6 INCHES OF COMPACTED CRUSHED STONE PER SECTION 1032 TO MAXIMUM EL 395.5.

18. WATER LEVEL MONITOR SHALL BE "POLECAT" RADAR BASED NONCONTACT LEVEL MONITORING DEVICE AS MANUFACTURED BY REMOTE DATA SYSTEMS, INC., P.O. BOX 2522, WILMINGTON, N.C. 28402 (910-313-0105). CALCULATOR AND SOFTWARE ARE NOT REQUIRED (PAF ALREADY HAS THESE). MONITOR TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.



GENERAL PLAN



KEY PLAN
SCALE 1" = 1600'

NOTES:
1. ALL WORK SHALL BE IN ACCORDANCE WITH THE T-1 SPECIFICATIONS UNLESS OTHERWISE NOTED.
2. DIKE SLOPES SHALL BE SEEDED WITH TYPE 8, MIXTURE 1 FOR FALL PLANTING OR TYPE 6 MIXTURE 1 FOR SPRING PLANTING. GRASSED AREAS ARE TO BE FERTILIZED AND MULCHED IN ACCORDANCE WITH SECTIONS 580 AND 582.
3. EARTHFILL SHALL CONSIST OF SOIL PLACED IN LAYERS WHOSE COMPACTED THICKNESS DOES NOT EXCEED 18 INCHES. EARTHFILL SHALL BE UNIFORMLY COMPACTED WITH A SMOOTH WHEEL VIBRATORY ROLLER TO AT LEAST 95% OF MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-698 PROCEDURES (STANDARD PROCTOR). MOISTURE CONTENT OF THE EARTHFILL SHALL BE WITHIN ±3% OF OPTIMUM MOISTURE CONTENT. NO ROCKS LARGER THAN 10 INCHES IN DIAMETER SHALL BE PLACED WITHIN THE DIKE FILL. IN-PLACE DENSITY TESTS USING THE SAND CONE (ASTM D1556) RUBBER BALLOON (ASTM D2167) OR NUCLEAR (ASTM D2922) TEST METHODS SHALL BE MADE AT A RATE OF AT LEAST ONE TEST PER EACH 5,000 CUBIC YARDS OF EARTH FILL PLACED OR A MINIMUM OF ONE TEST PER DAY THAT EARTH FILL IS PLACED. IF NUCLEAR METHODS ARE USED, SUFFICIENT NUMBERS OF SAND CONE OR RUBBER BALLOON TESTS SHALL BE PERFORMED TO CORRELATE AND VERIFY THE NUCLEAR GAUGE RESULTS.
4. BOTTOM ASH FILL SHALL BE TAKEN FROM THE WASTE STOCKPILE PRODUCED BY REED MINERALS DIVISION OF HARSCO CORPORATION. THE COARSER OF THE TWO GRADES OF WASTE MATERIAL SHALL BE USED FOR FILL.
5. BEFORE PLACING NEW FILL ON EXISTING DIKE, SURFACES SHALL BE STRIPPED OF ALL VEGETATION, CRUSHED STONE, AND LOOSE MATERIAL, SCARIFIED, AND NEW FILL ROLLED TO BOND WITH EXISTING FILL.
6. TOP OF DIKE MUST BE MAINTAINED A MINIMUM OF 4-FOOT ABOVE THE ELEVATION OF THE WATER IN THE ASH DISPOSAL AREA.

12. THE FILTER BLANKET UNDER THE RIPRAP SHALL BE 6 INCHES THICK AND IN ACCORDANCE WITH SECTION 570.
13. RIPRAP SHALL CONSIST OF SOUND DURABLE STONE, A MINIMUM OF 50% WEIGHT, CONSISTING OF STONE AT LEAST 100 POUNDS EACH IN ACCORDANCE WITH SECTION 575.
14. PIPE BACKFILL SHALL CONSIST OF EARTHFILL, FREE OF DEBRIS WITH NO HARD LUMPS OR CLODS LARGER THAN 3 INCHES IN DIAMETER. COMPACTION SHALL BE BY HAND HELD COMPACTORS TO A MINIMUM OF 2 FEET ABOVE THE TOP OF PIPE. THE SOIL SHALL BE PLACED IN 6 INCH LOOSE LAYERS (MAXIMUM) AND COMPACTED TO AT LEAST 95% OF MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-698 PROCEDURES (STANDARD PROCTOR). MOISTURE CONTENT OF THE BACKFILL SHALL BE WITHIN 3 PERCENT OF OPTIMUM MOISTURE CONTENT. THE BACKFILL SHALL BE PLACED AS TO MAINTAIN THE SAME ELEVATION ON BOTH SIDES OF THE PIPE.
15. CRUSHED STONE SHALL BE IN ACCORDANCE WITH SECTION 1032.
16. CONCRETE PIPE SHALL BE IN ACCORDANCE WITH SECTION 460.
17. HEAVY CONTOUR LINES REPRESENT FINISHED GRADE. LIGHTER CONTOUR LINES REPRESENT EXISTING GRADE (TOPOGRAPHIC DATA FROM PHOTOGRAPHY DATED FEBRUARY 22, 1995).

MT
R1

		CMM	MGH	JDP	JLG	KWB	RGJ				
R 1	2-12-97	CMM	MGH	JDP	JLG	KWB	RGJ	WDH	423F		D
ADD TVA BOUNDARY FOR ASH POND EXPANSION; MINOR REVISIONS											
R 0	1-4-96	CLM	MGH	JDP	JLG	KWB	RGJ	WDH	423F		D
INITIAL ISSUE											
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

DISCIPLINE INTERFACE
1
2
3
4

SCALE: 1" = 200' EXCEPT AS NOTED

YARD

JACOBS CREEK
ASH DISPOSAL AREA EXTENSION
GENERAL PLAN

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
C.L.MOUNT	M.G.HRANEK	J.D.PARIS	J.L.GLOVER	K.W.BURNETT	R.G.JOHNSON	W.D.HALL

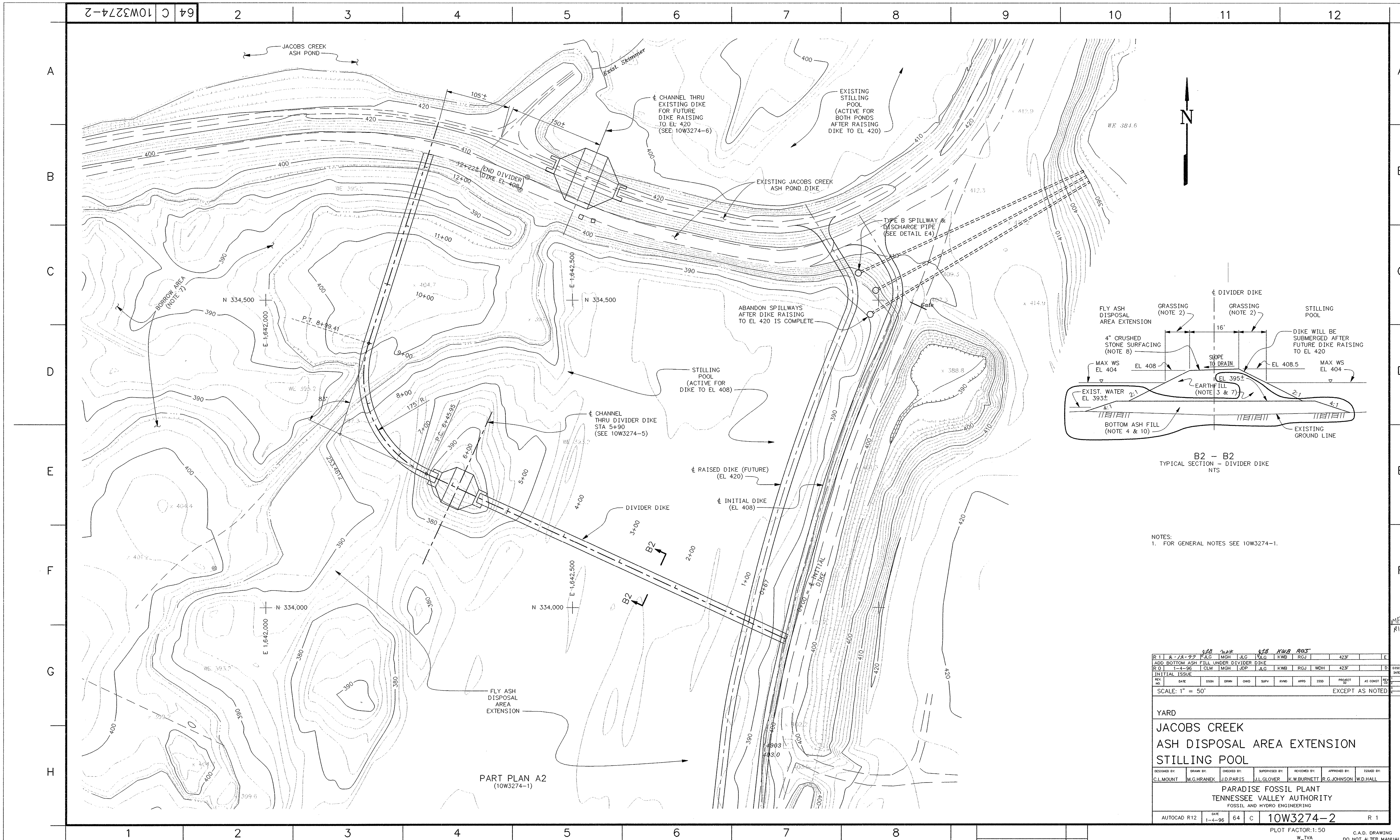
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R12	DATE 1-4-96	64	C	10W3274-1	R 1

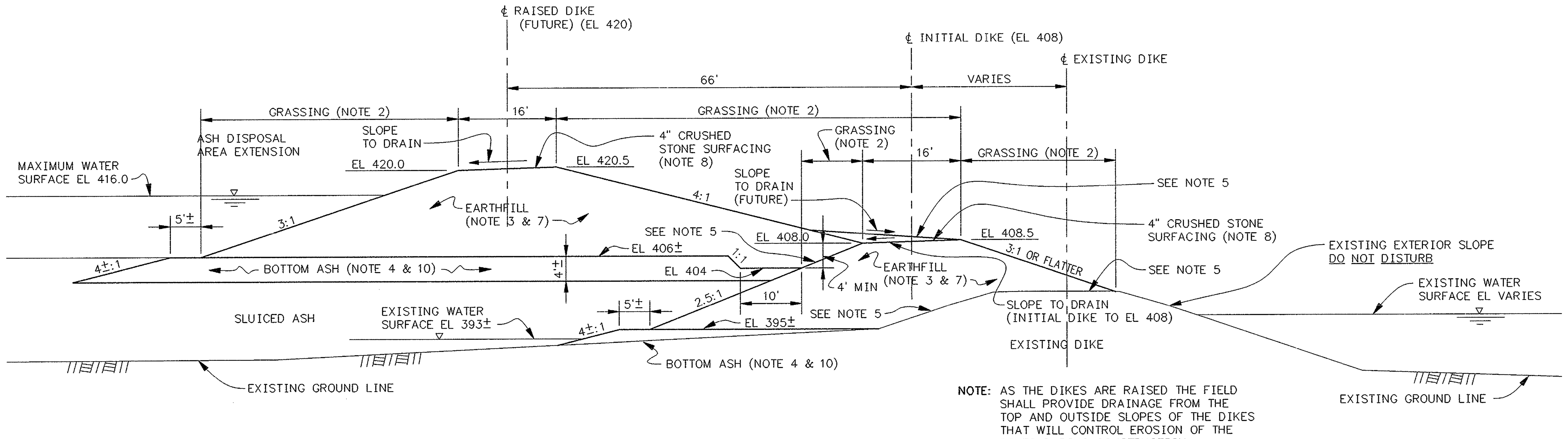
PLOT FACTOR:1:200
W_TVA
FILENAME: PF32741.DWG

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.


JACOBS CREEK ASH POND
105'±
50'±
Exist. Skimmer
℄ CHANNEL THRU EXISTING DIKE FOR FUTURE DIKE RAISING TO EL 420 (SEE 10W3274-6)
EXISTING STILLING POOL (ACTIVE FOR BOTH PONDS AFTER RAISING DIKE TO EL 420)
12+22± END DIVIDER DIKE EL 408
EXISTING JACOBS CREEK ASH POND DIKE
TYPE B SPILLWAY & DISCHARGE PIPE (SEE DETAIL E4)
BORROW AREA (NOTE 2)
N 334,500
E 1,642,000
E 1,642,500
P.T. 8+39.41
ABANDON SPILLWAYS AFTER DIKE RAISING TO EL 420 IS COMPLETE
STILLING POOL (ACTIVE FOR DIKE TO EL 408)
175' R.
P.C. 6+45.95
℄ CHANNEL THRU DIVIDER DIKE STA 5+90 (SEE 10W3274-5)
℄ RAISED DIKE (FUTURE) (EL 420)
℄ INITIAL DIKE (EL 408)
DIVIDER DIKE
B2
N 334,000
0+00 = ℄ INITIAL DIKE
FLY ASH DISPOSAL AREA EXTENSION
PART PLAN A2 (10W3274-1)
N
℄ DIVIDER DIKE
FLY ASH DISPOSAL AREA EXTENSION
GRASSING (NOTE 2)
GRASSING (NOTE 2)
STILLING POOL
16'
4" CRUSHED STONE SURFACING (NOTE 8)
DIKE WILL BE SUBMERGED AFTER FUTURE DIKE RAISING TO EL 420
SLOPE TO DRAIN
MAX WS EL 404
EL 408
EL 408.5
MAX WS EL 404
EL 395±
EARTHFILL (NOTE 3 & 7)
EXIST. WATER EL 393±
2:1
4:1
2:1
4:1
BOTTOM ASH FILL (NOTE 4 & 10)
EXISTING GROUND LINE
B2 – B2
TYPICAL SECTION – DIVIDER DIKE
NTS
NOTES:
1. FOR GENERAL NOTES SEE 10W3274-1.
R 1 | 2-12-97 | JLG | MGH | JLG | JLG | KWB | RGJ | | 423F | | E
ADD BOTTOM ASH FILL UNDER DIVIDER DIKE
R 0 | 1-4-96 | CLM | MGH | JDP | JLG | KWB | RGJ | WDH | 423F | | D
INITIAL ISSUE
REV. NO. | DATE | DSGN | DRWN | CHKD | SUPV | RVWD | APPD | ISSD | PROJECT ID | AS CONST | REV CD
DISCIPLINE INTERFACE
SCALE: 1" = 50' EXCEPT AS NOTED
YARD
JACOBS CREEK
ASH DISPOSAL AREA EXTENSION
STILLING POOL
DESIGNED BY: C.L.MOUNT
DRAWN BY: M.G.HRANEK
CHECKED BY: J.D.PARIS
SUPERVISED BY: J.L.GLOVER
REVIEWED BY: K.W.BURNETT
APPROVED BY: R.G.JOHNSON
ISSUED BY: W.D.HALL
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING
AUTOCAD R12 | DATE 1-4-96 | 64 | C | 10W3274-2 | R 1
PLOT FACTOR:1:50
W_TVA
FILENAME: PF32742.DWG
C.A.D. DRAWING
DO NOT ALTER MANUALLY
TASK COMPLETED BY: | REV NO.

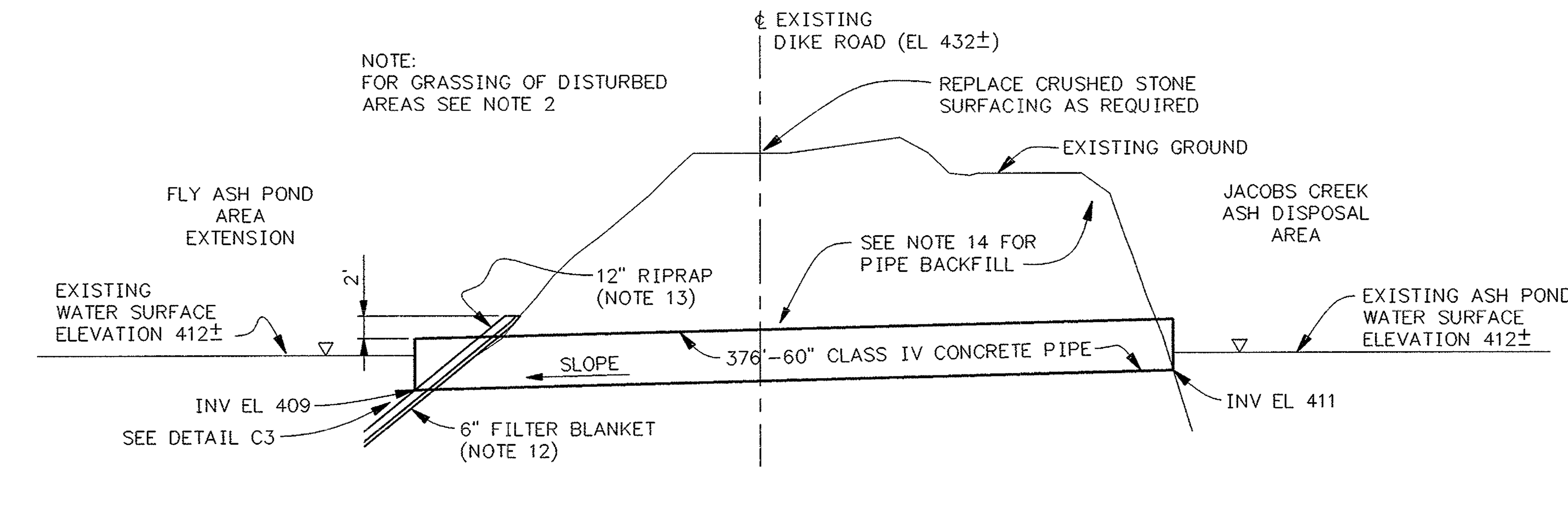
64 C 10W3274-3



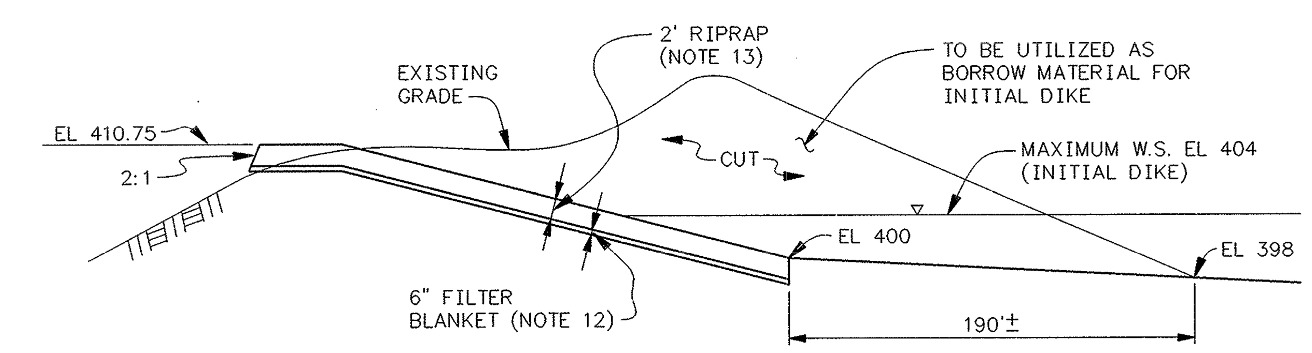
NOTE: AS THE DIKES ARE RAISED THE FIELD SHALL PROVIDE DRAINAGE FROM THE TOP AND OUTSIDE SLOPES OF THE DIKES THAT WILL CONTROL EROSION OF THE DIKES DURING CONSTRUCTION.

TYPICAL SECTION A3 – A3
(10W3274–1)

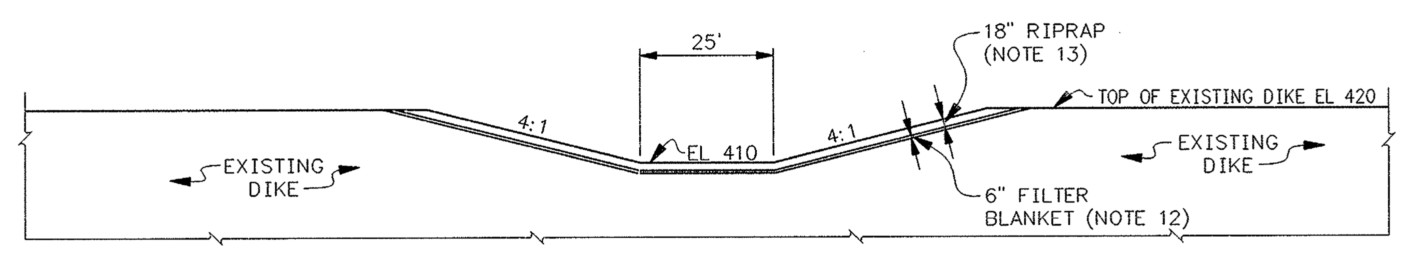
NOTE:
FOR GRASSING OF DISTURBED AREAS SEE NOTE 2



B3 – B3
(10W3274–1)
1" = 10' VERT
1" = 50' HORIZ

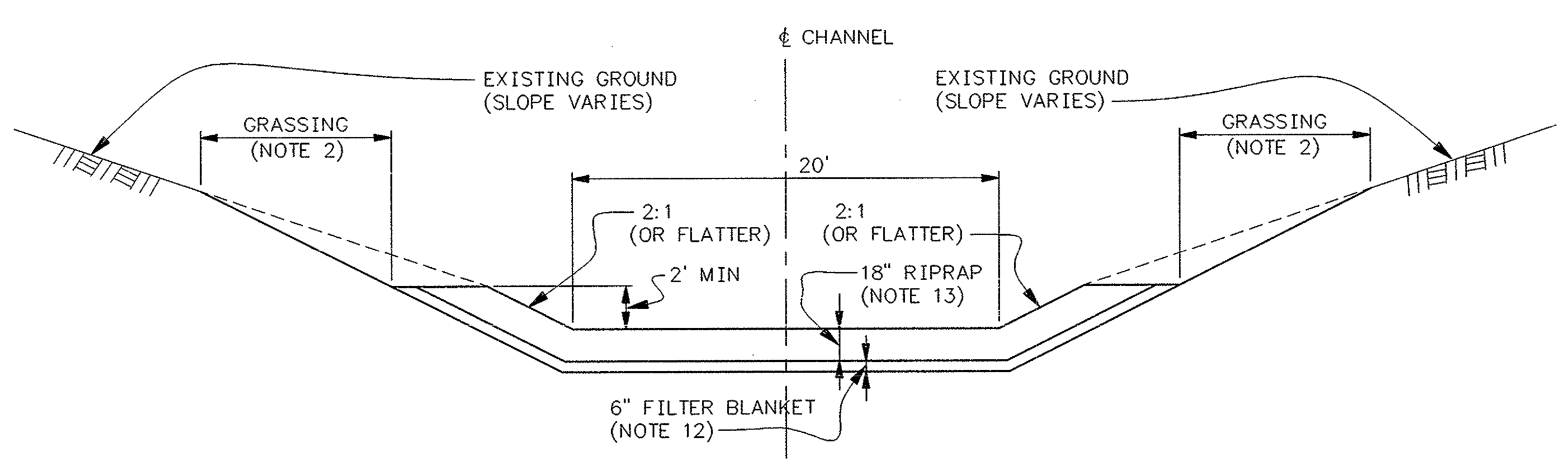


F3 – F3
(10W3274–1)
1" = 10' VERT
1" = 50' HORIZ

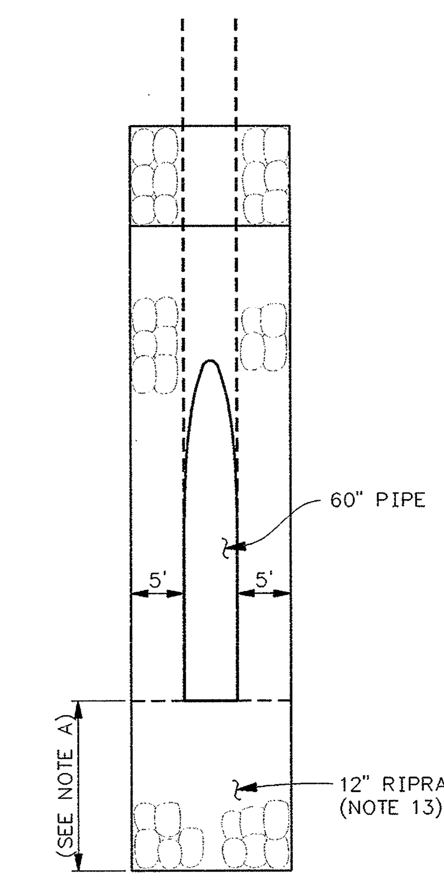


D3 – D3
DIKE BREACH (FUTURE)
(10W3274–1)
1" = 20'

NOTES:
1. FOR GENERAL NOTES SEE 10W3274–1.



E3 – E3
(10W3274–1)
1" = 5'



NOTE A:
PLACE RIPRAP ALONG SLOPE TO BOTTOM OF POND AND EXTEND RIPRAP OUT 5' ALONG BOTTOM.

DETAIL C3
(10W3274–1)

R 0 | 1-4-96 | CLM | MGH | JDP | JLG | KWB | RGJ | WDH | 423F
INITIAL ISSUE
REV NO. | DATE | DSGN | DRWN | CHKD | SUPV | RVWD | APPD | ISSD | PROJECT ID | AS CONST | REV ID

SCALE: 1" = 10' EXCEPT AS NOTED

YARD
JACOBS CREEK
ASH DISPOSAL AREA EXTENSION
SECTIONS & DETAILS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
C.L.MOUNT	M.G.HRANEK	J.D.PARIS	J.L.GLOVER	K.W.BURNETT	R.G.JOHNSON	W.D.HALL

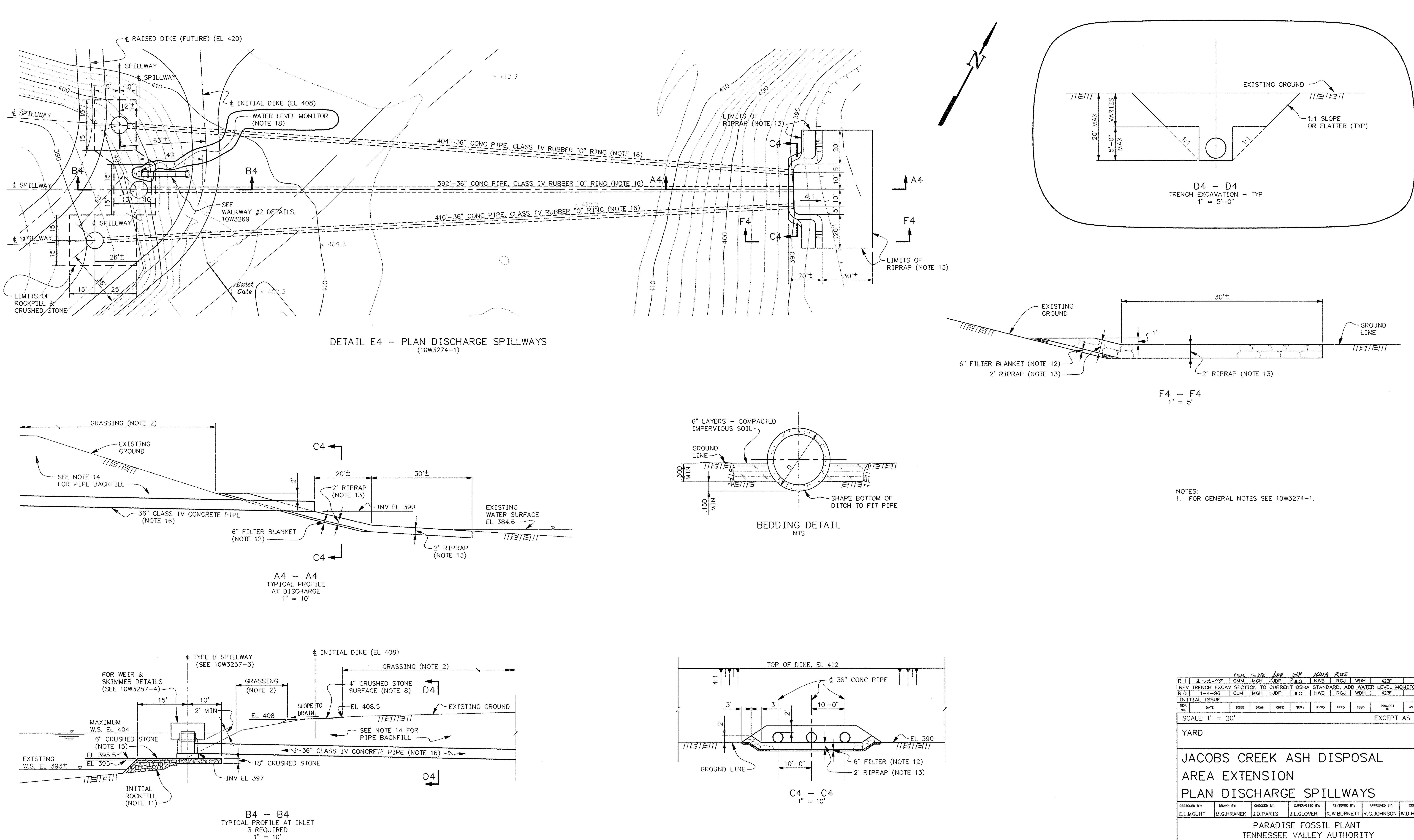
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R12 | DATE 1-4-96 | 64 | C | 10W3274–3 | R 0

PLOT FACTOR:1:120
W_TVA
FILENAME: PF32743.DWG

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.



NOTES:
1. FOR GENERAL NOTES SEE 10W3274–1.

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 1	2-12-97	CMM	MGH	JDP	JLG	KWB	RGJ	WDH	423F		E
REV TRENCH EXCAV SECTION TO CURRENT OSHA STANDARD. ADD WATER LEVEL MONITOR.											
R 0	1–4–96	CLM	MGH	JDP	JLG	KWB	RGJ	WDH	423F		D
INITIAL ISSUE											

SCALE: 1" = 20' EXCEPT AS NOTED

YARD

JACOBS CREEK ASH DISPOSAL AREA EXTENSION PLAN DISCHARGE SPILLWAYS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
C.L.MOUNT	M.G.HRANEK	J.D.PARIS	J.L.GLOVER	K.W.BURNETT	R.G.JOHNSON	W.D.HALL

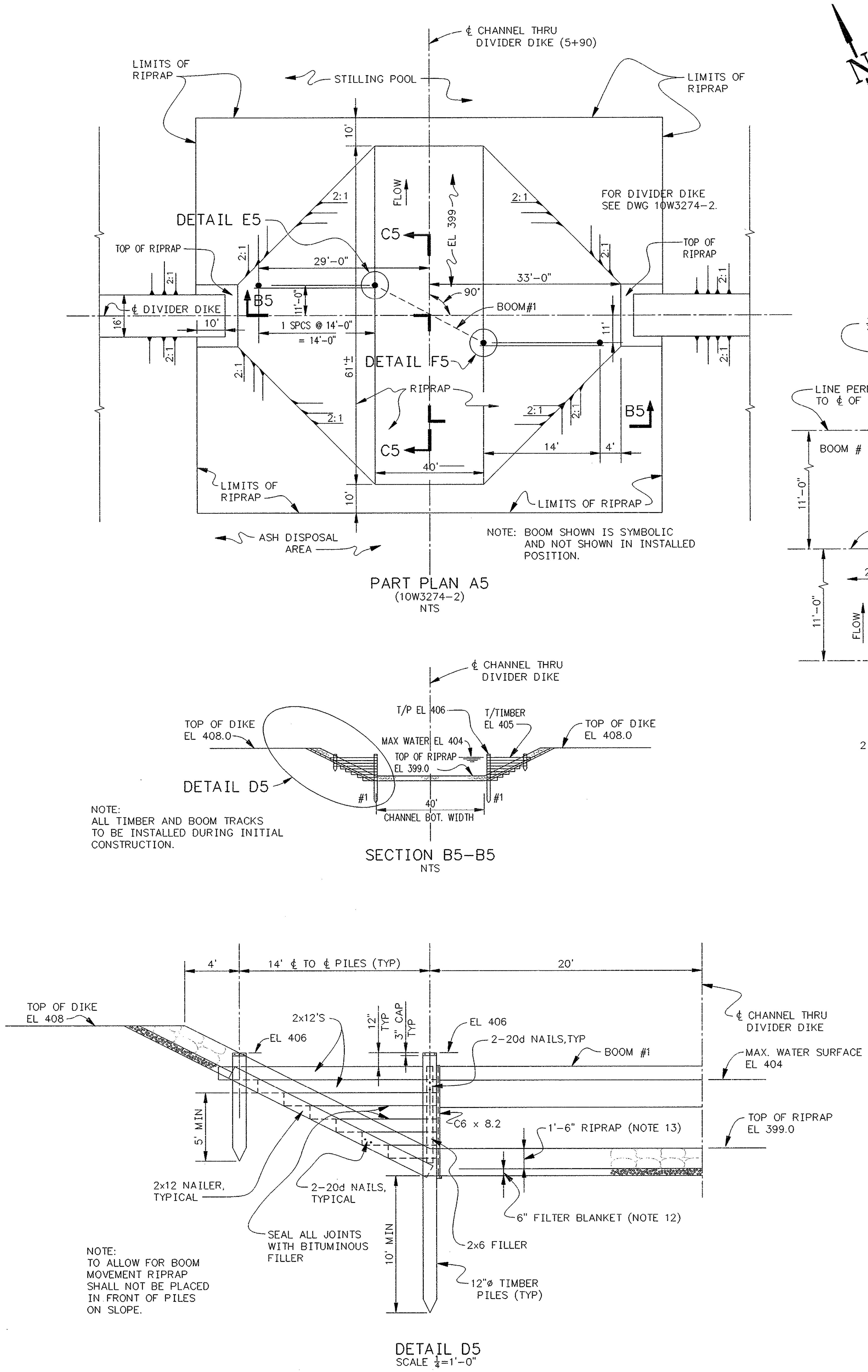
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

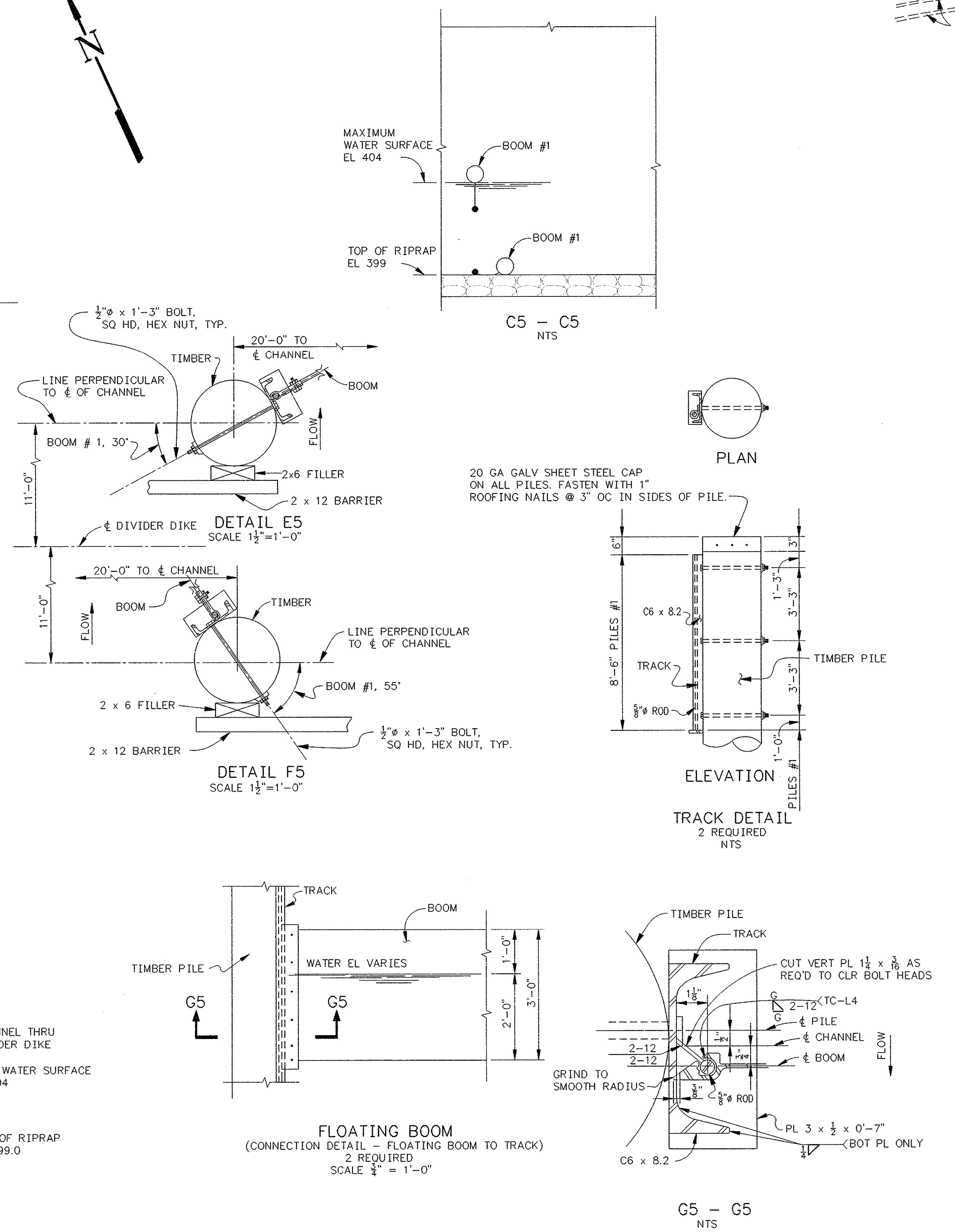
AUTOCAD R12 | DATE 1–4–96 | 64 | C | 10W3274–4 | R 1

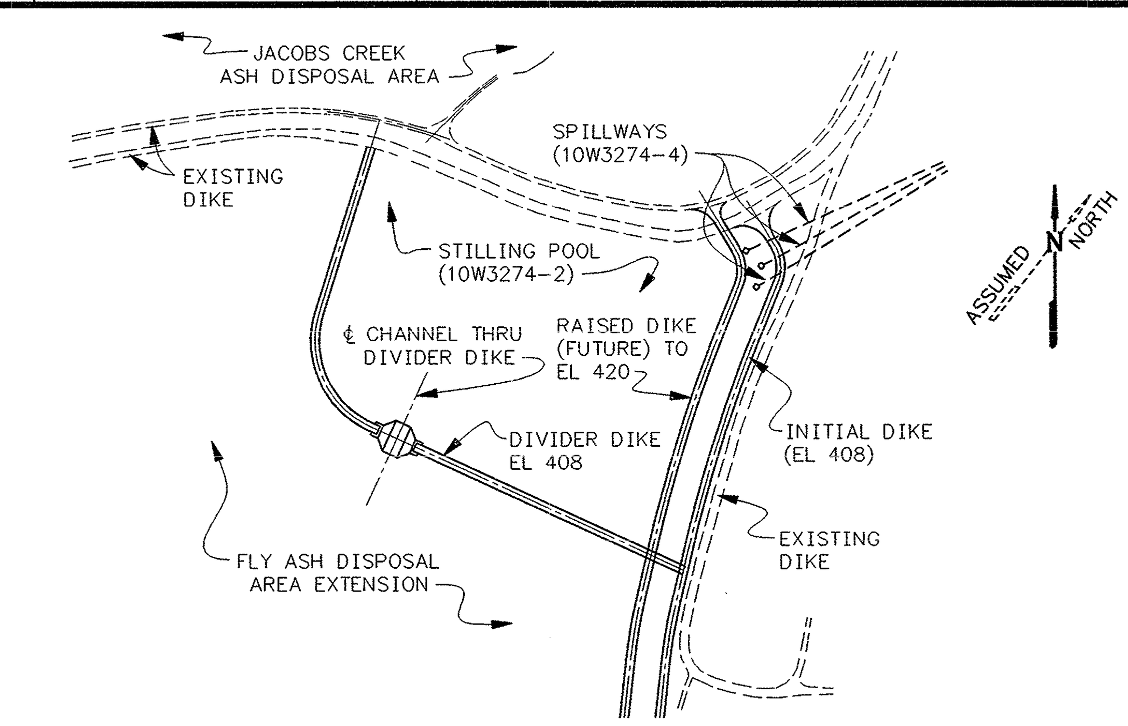
PLOT FACTOR:240
W_TVA
FILENAME: PF32744.DWG

C.A.D. DRAWING
DO NOT ALTER MANI

TASK COMPLETED BY: | REV NO.







FLOATING BOOM			
ITEM	NO	TOTAL LENGTH	REMARKS
BOOM #1	1	50'-0"	

BILL OF FIELD MATERIALS REQUIRED

ITEM	SIZE	NO	LENGTH	QUANITY
TIMBER (NAILER)	2 x 12 ROUGH	2	16'-0"	32 LF
BARRIER	2 x 12 ROUGH	10	16'-0"	160 LF
FILLER	2 x 6 ROUGH	2	8'-0"	16 LF
PILING(CLASS B CREOSOTED)				
	12" Ø	2	20'-0"	40 LF
	12" Ø	2	8'-0"	16 LF
HARDWARE				
BOLTS-CHANNEL TO PILE	½"ØSQHD,HEX NUT	6	1'-3"	EACH
OGEE WASHERS	FOR ½"Ø BOLTS	6		EACH
ROOFING NAILS			0'-1"	2 LBS
NAILS	20 D COMMON			4 LBS
STEEL				
C6 x 8.2		2	8'-6"	140 LBS
PL	3 x ½ x 0'-7"	2		6 LBS
PL	1¼ x 3/16 x 8'-6"	2		14 LBS
5/8" Ø ROD		2	8'-6"	12 LBS
GALV SHEET STEEL	20 GAGE			25 LBS

NOTES:
1. MATERIALS:
   ALL MATERIALS TO BE FURNISHED AND FABRICATED BY TVA'S CONSTRUCTION PARTNER.
2. BOLTS TO BE ASTM A307.
3. ALL METAL PARTS TO BE ASTM A36 AND GALVANIZED.
4. TIMBER TO BE COMMERICIALLY TREATED ROUGH SAWN PINE.
5. FOR FIELD WELDING SEE TVA SPEC G29C.
6. ALL WELDS SHALL BE MADE WITH AWS A5.1 E70 SERIES ELECTRODES OR EQUIVALENT ELECTRODES FOR OTHER PROCESSES.
7. ALL WELDS SHALL BE VISUALLY INSPECTED IN ACCORDANCE WITH THE LATEST STRUCTURAL WELDING CODE D1.1.
8. FOR GENERAL NOTES SEE 10W3274-1.

MF
R1

		JLG	MGH		JLG	KWB	RGJ				
R 1	2-12-97	JLG	MGH	JLG	JLG	KWB	RGJ		423F		E
REVISE NOTE 4											
R 0	1-4-96	CLM	MGH	JDP	JLG	KWB	RGJ	WDH	423F		D
INITIAL ISSUE											
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

DISCIPLINE INTERFACE
1
2
3
4

SCALE: 1"=20' EXCEPT AS NOTED

YARD

JACOBS CREEK ASH DISPOSAL AREA EXTENSION FLOATING BOOM – DIKE EL TO 408

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
C.L.MOUNT	M.G.HRANEK	J.D.PARIS	J.L.GLOVER	K.W.BURNETT	R.G.JOHNSON	W.D.HALL

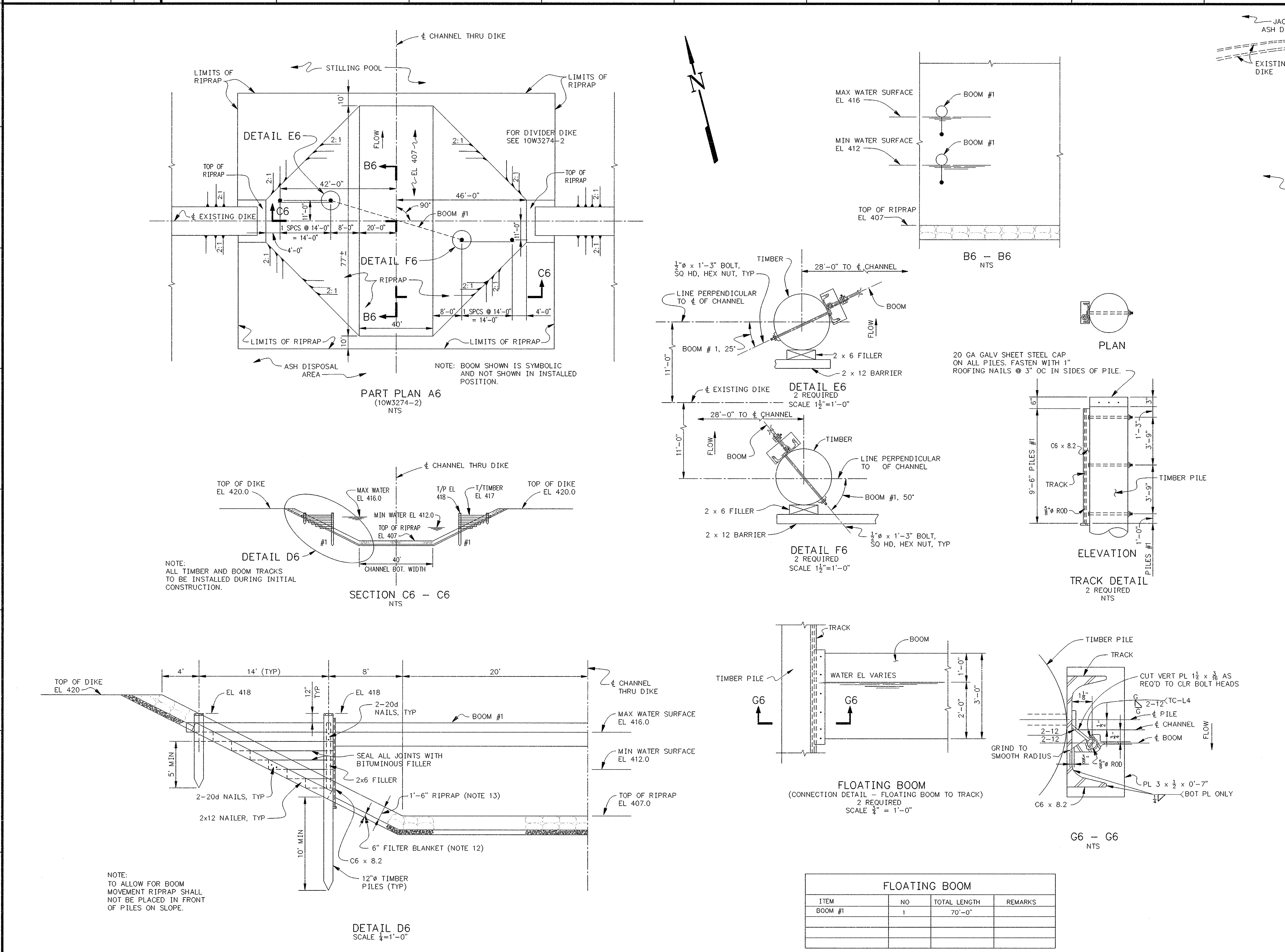
PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R12	DATE 1-4-96	64	C	10W3274-5	R 1

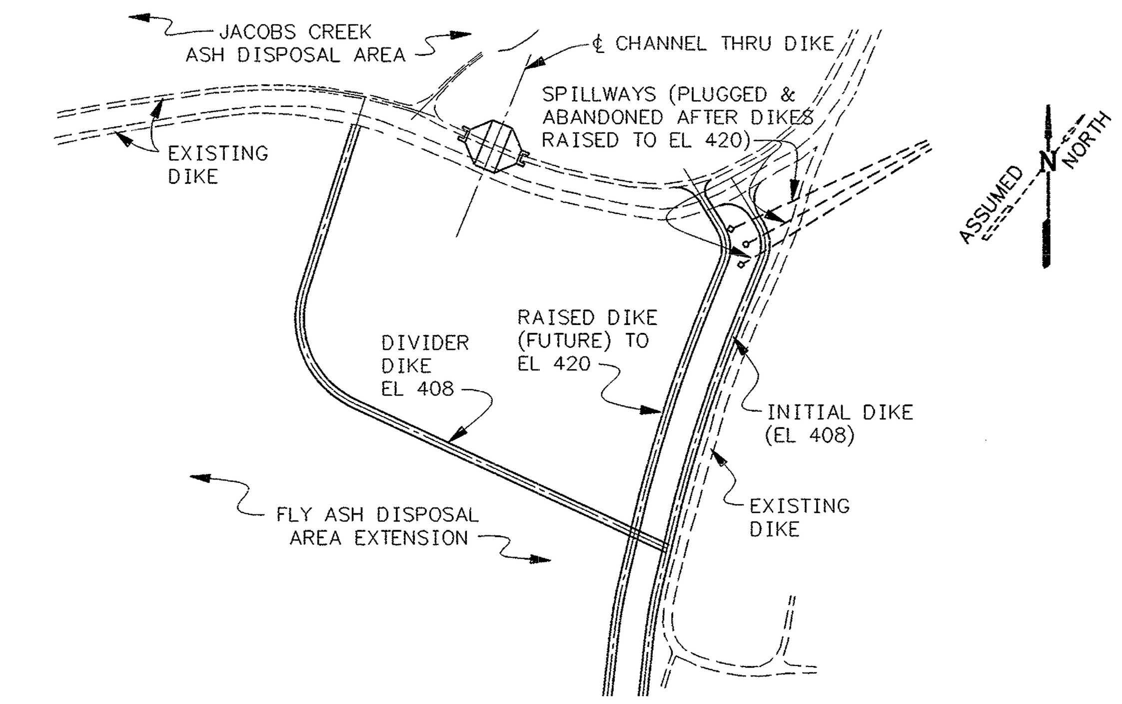
PLOT FACTOR:1:1
W_TVA
FILENAME: PF32745.DWG

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: REV NO.



FLOATING BOOM			
ITEM	NO	TOTAL LENGTH	REMARKS
BOOM #1	1	70'-0"	



LOCATION PLAN
SCALE 1" = 200'

BILL OF FIELD MATERIALS REQUIRED				
ITEM	SIZE	NO	LENGTH	QUANITY
TIMBER (NAILER)	2 x 12 ROUGH	2	16'-0"	32 LF
BARRIER	2 x 12 ROUGH	10	16'-0"	160 LF
FILLER	2 x 6 ROUGH	2	8'-0"	16 LF
PILING(CLASS B CREOSOTED)				
	12" Ø	2	20'-0"	40
	12" Ø	2	8'-0"	16 LF
HARDWARE				
BOLTS-CHANNEL TO PILE	½"Ø SQHD,HEX NUT	6	1'-3"	EACH
OGEE WASHERS	FOR ½"Ø BOLTS	6		EACH
ROOFING NAILS			0'-1"	2 LBS
NAILS	20 D COMMON			4 LBS
STEEL				
C6 x 8.2		2	9'-6"	156 LBS
PL	3 x ½ x 0'-7"	2		6 LBS
PL	1¼ x 3/16 x 9'-6"	2		16 LBS
⅝" Ø ROD		2	9'-6"	14 LBS
GALV SHEET STEEL	20 GAGE			25 LBS

NOTES:
1. MATERIALS:
   ALL MATERIALS TO BE FURNISHED AND FABRICATED BY TVA'S CONSTRUCTION PARTNER.
2. BOLTS TO BE ASTM A307.
3. ALL METAL PARTS TO BE ASTM A36 AND GALVANIZED.
4. TIMBER TO BE COMMERICIALLY TREATED ROUGH SAWN PINE.
5. FOR FIELD WELDING SEE TVA SPEC G29C.
6. ALL WELDS SHALL BE MADE WITH AWS A5.1 E70 SERIES ELECTRODES OR EQUIVALENT ELECTRODES FOR OTHER PROCESSES.
7. ALL WELDS SHALL BE VISUALLY INSPECTED IN ACCORDANCE WITH THE LATEST STRUCTURAL WELDING CODE D1.1.
8. FOR GENERAL NOTES SEE 10W3274-1.

MF
R1

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 1	2-12-97	JLG	MGH	JLG	JLG	KWB	RGJ		423F		E
REVISE NOTE 4											
R 0	1-4-96	CLM	MGH	JDP	JLG	KWB	RGJ	WDH	423F		D
INITIAL ISSUE											

DISCIPLINE INTERFACE

SCALE: 1"=20' EXCEPT AS NOTED

YARD

JACOBS CREEK ASH DISPOSAL AREA EXTENSION FLOATING BOOM - DIKE EL TO 420

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
C.L.MOUNT	M.G.HRANEK	J.D.PARIS	J.L.GLOVER	K.W.BURNETT	R.G.JOHNSON	W.D.HALL

PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R12 | DATE 1-4-96 | 64 | C | 10W3274-6 | R 1

PLOT FACTOR:1:1
W_TVA
FILENAME: PF32746.DWG

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.

Appendix B

Boring Layout and Typed Logs of Boring

64 | C | 10W710-01

NOTES:

1. The topographic basemap shown on this drawing was developed by Stantec using electronic drawings titled "PA000112.dwg and PA000008.dwg" provided by TVA. The information is believed to be approximate and should not be used for construction purposes.
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 there-from. 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	Elevation (Feet)
STN-1	334,559.32	1,641,085.25	411.2
STN-2	334,677.03	1,641,570.83	408.6
STN-3	334,754.96	1,642,063.67	408.5
STN-4	334,653.35	1,642,483.20	407.9
STN-5	334,543.94	1,643,012.25	407.9
STN-6	334,117.67	1,642,904.88	407.8
STN-7	334,110.95	1,642,925.61	401.4
STN-8	333,625.59	1,642,796.92	408.4
STN-9	333,133.89	1,642,703.74	407.8
STN-11	332,681.40	1,642,510.51	408.4
STN-12	332,482.84	1,642,158.00	408.5
STN-14	332,172.87	1,641,803.35	408.3
STN-15	331,736.99	1,641,846.45	407.9
STN-16	331,729.49	1,641,903.96	400.1
STN-17	331,715.59	1,641,415.12	407.8
STN-18	331,767.22	1,641,030.49	408.0
STN-20	331,411.04	1,640,675.64	408.3
STN-21	331,553.80	1,640,209.81	408.6
STN-22	331,536.19	1,640,178.58	405.7

LEGEND

STN-1 ○ Soil Boring with Standard Penetration Tests and/or Undisturbed (Shelby) Tube Samples

STN-3 ◉ Soil Boring with Standard Penetration Tests and/or Undisturbed (Shelby) Tube Samples and Rock Core

RECORD DRAWING

PLOT DATE: 08/18/2010 USER: FLYNN, RENEE
V:\1755\ACTIVE\175569068\GEOTECH\REVO_RECORD\10W710-01.DWG

For Supporting Design Calculations see FPGPAFFESCDX00000020100006

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
–											
R 0	08/18/10	SV	JRF	SV	SV	SV	HRA	TJ	–	–	–
RECORD DRAWING											

DISCIPLINE INTERFACE
1
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4

SCALE: 1"=200' EXCEPT AS NOTED

YARD
–

PEABODY ASH POND
GEOTECHNICAL EXPLORATION
BORING LAYOUT

STATE OF KENTUCKY
HUGO R. APARICIO
17148
LICENSED PROFESSIONAL ENGINEER

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
S. VEMURI	R. FLYNN	S. VEMURI	S. VEMURI	S. VEMURI	H. APARICIO	T. JOHNSON

Stantec

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1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
Tel. 859.422.3000
Fax 859.422.3100
www.stantec.com

PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 08/18/10	64	C	10W710-01	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

Stantec

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-1** Total Depth 46.5 ft
County	Muhlenberg	Surface Elevation	411.2 ft
Project Type	Geotechnical Exploration	Date Started	8/24/09 Completed 8/24/09
Supervisor	R. Riker Driller J. Felts	Depth to Water	14.4 ft Date/Time 8/24/09
Logged By	B. Bline	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
411.2	0.0	Top of Hole							
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	0.7	7-7-7	11	
				SPT-2	1.5 - 3.0	1.3	4-5-7	--	
				ST-1	3.0 - 5.0	1.6		--	
				SPT-3	6.0 - 7.5	1.0	5-2-3	22	
402.5	8.7			SPT-4	7.5 - 9.0	0.3	2-1-2	--	
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		ST-2	9.0 - 11.0	1.5		--	
				SPT-5	12.0 - 13.5	1.1	0-0-0	30	
				SPT-6	13.5 - 15.0	0.2	1-1-2	--	Some coal fragments
				SPT-7	15.0 - 16.5	0.1	1-2-2	23	
				SPT-8	17.5 - 19.0	1.3	2-2-3	--	
				SPT-9	20.0 - 21.5	0.8	0-0-2	29	
				SPT-10	22.5 - 24.0	1.2	0-0-2	--	

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-1** Total Depth 46.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments *(Continued)*		SPT-11	25.6 - 26.5	0.8	0-0-2	19	Higher percentage of coal fragments with depth
				SPT-12	27.5 - 29.0	1.1	0-1-2	--	
				SPT-13	30.0 - 31.5	0.9	1-1-2	25	
				SPT-14	32.5 - 34.0	1.1	0-6-4	--	
				SPT-15	35.0 - 36.5	1.5	2-3-5	20	
				SPT-16	37.5 - 39.0	1.4	2-3-4	--	
				SPT-17	40.0 - 41.5	1.4	2-2-3	22	
				SPT-18	42.5 - 44.0	1.5	3-3-4	--	
364.7	46.5			SPT-19	45.0 - 46.5	1.5	0-0-3	21	
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175569069.GPJ FMSM-GRAPHIC LOG.GDT 12/17/09

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-2** Total Depth 41.5 ft
County	Muhlenberg	Surface Elevation	408.6 ft
Project Type	Geotechnical Exploration	Date Started	8/13/09 Completed 8/13/09
Supervisor	R. Riker Driller M. Wethington	Depth to Water	27.5 ft Date/Time 8/13/09
Logged By	R. Riker	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
408.6	0.0	Top of Hole							
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	0.6	3-4-8	--	
				SPT-2	1.5 - 3.0	0.2	6-7-8	15	
				SPT-3	3.0 - 4.5	0.1	7-6-6	--	
				SPT-4	4.5 - 6.0	0.9	4-3-4	18	
402.6	6.0								
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-5	6.0 - 7.5	1.4	8-3-4	--	
				SPT-6	7.5 - 9.0	0.7	1-1-1	34	
				SPT-7	9.0 - 10.5	1.5	5-2-3	--	
				SPT-8	10.5 - 12.0	1.5	6-2-2	37	
				SPT-9	12.0 - 13.5	1.5	1-1-4	--	
				SPT-10	13.5 - 15.0	1.4	1-1-1	34	
				SPT-11	15.0 - 16.5	1.5	3-3-4	--	
				SPT-12	17.5 - 19.0	1.5	2-2-3	24	
				SPT-13	20.0 - 21.5	1.5	1-3-5	--	

Project Number	175569069	Location	Paradise Fossil Plant		
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-2**	Total Depth	41.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments *(Continued)*		SPT-14	22.5 - 24.0	1.5	6-7-6	27	
				SPT-15	25.0 - 26.5	1.2	4-4-7	--	
				SPT-16	27.5 - 29.0	0.2	6-26-29	11	very gravelly from 28.5' to 30.0'
				SPT-17	30.0 - 31.5	1.0	2-3-5	--	
				SPT-18	32.5 - 34.0	1.1	3-4-6	24	
				SPT-19	35.0 - 36.5	1.0	4-3-7	--	
				SPT-20	37.5 - 39.0	1.5	1-3-6	20	
367.1	41.5			SPT-21	40.0 - 41.5	1.1	2-2-3	--	
		No Refusal / Bottom of Hole							

Stantec

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-3** Total Depth 62.0 ft
County	Muhlenberg	Surface Elevation	408.5 ft
Project Type	Geotechnical Exploration	Date Started	8/12/09 Completed 8/12/09
Supervisor	R. Riker Driller M. Wethington	Depth to Water	Dry Date/Time 8/12/09
Logged By	R. Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
408.5	0.0	Top of Hole						
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments	SPT-1	0.0 - 1.5	1.0	3-6-10	13	
			SPT-2	1.5 - 3.0	0.9	6-6-7	--	
			SPT-3	3.0 - 4.5	0.8	7-7-9	14	
			SPT-4	4.5 - 6.0	0.8	3-5-6	--	
			SPT-5	6.0 - 7.5	1.3	4-5-6	15	
			SPT-6	7.5 - 9.0	0.6	2-6-4	--	
			SPT-7	9.0 - 10.5	0.4	12-3-4	--	
			SPT-8	10.5 - 12.0	0.6	4-4-3	12	
			SPT-9	12.0 - 13.5	1.2	2-2-3	14	
			SPT-10	13.5 - 15.0	0.4	9-10-12	--	
			SPT-11	15.0 - 16.5	0.5	4-6-3	16	
391.5	17.0							
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments	SPT-12	17.5 - 19.0	1.4	1-1-2	--	
			SPT-13	20.0 - 21.5	1.3	2-4-6	20	

Project Number	175569069	Location	Paradise Fossil Plant		
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-3**	Total Depth	62.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments *(Continued)*		SPT-14	22.5 - 24.0	1.5	1-1-2	--	
				SPT-15	25.0 - 26.5	1.3	2-3-3	20	Bulk sample from 25' to 27.5'
				SPT-16	27.5 - 29.0	1.5	2-2-4	--	
				SPT-17	30.0 - 31.5	1.2	2-4-3	24	Organic odor with wood chips from 27.3' to 35.0'
				SPT-18	32.5 - 34.0	1.4	2-4-4	--	
				SPT-19	35.0 - 36.5	1.5	2-2-3	24	
				SPT-20	37.5 - 39.0	1.5	1-2-3	--	
				SPT-21	40.0 - 41.5	1.5	2-8-7	26	
				SPT-22	42.5 - 44.0	1.5	1-1-3	--	
				SPT-23	45.0 - 46.5	1.1	5-5-6	23	

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-3** Total Depth 62.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
353.5	55.0	**Soil 2:** MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments *(Continued)*						
		Shale, light gray, moderately hard, weathered	SPT-24	55.0 - 56.5	1.1	17-47-47	--	Began Core
346.5	62.0			5.5	5.2	95	62.0	Fracture from 59.8' to 59.9'; Fracture from 57.8' to 57.9'; Suet Zone from 56.8' to 57.0'

Bottom of Hole

Top of Rock = 55.0
Elevation (353.5)

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-4** Total Depth 46.5 ft
County	Muhlenberg	Surface Elevation	407.9 ft
Project Type	Geotechnical Exploration	Date Started	9/2/09 Completed 9/2/09
Supervisor	R. Riker Driller J. Wethington	Depth to Water	27.0 ft Date/Time 9/2/09
Logged By	M. Jones	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
407.9	0.0	Top of Hole							
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	1.3	6-5-10	12	
				SPT-2	1.5 - 3.0	1.4	10-14-14	--	
				SPT-3	3.0 - 4.5	1.5	4-8-9	--	
				SPT-4	4.5 - 6.0	0.8	1-1-3	16	
				SPT-5	6.0 - 7.5	1.0	3-5-8	--	No recovery possible due to coarse ground wedged
				SPT-6	7.5 - 9.0	0.8	6-7-6	16	
				SPT-7	9.0 - 10.5	0.0	8-7-5	--	
				SPT-8	10.5 - 12.0	0.4	4-3-5	15	
				SPT-9	12.0 - 13.5	0.0	3-7-10	--	
392.9	15.0			SPT-10	13.5 - 15.0	0.0	5-7-8	--	
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-11	15.0 - 16.5	1.5	WOT-WOT-3	--	
				SPT-12	17.5 - 19.0	0.4	2-3-4	23	
									Wood fragments
				SPT-13	20.0 - 21.5	1.5	2-2-4	--	
									Organics from 20' to 24'
				SPT-14	22.5 - 24.0	1.5	WOT-WOT-3	34	
382.9	25.0								

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant		
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-4**	Total Depth	46.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 5: Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments		SPT-15	25.0 - 26.5	1.5	WOT-3	--	
				SPT-16	27.5 - 29.0	1.5	WOT-3	32	
				SPT-17	30.0 - 31.5	1.5	4-6-7	--	
				SPT-18	32.5 - 34.0	1.5	4-5-7	27	
372.9	35.0								
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		SPT-19	35.0 - 36.5	1.5	4-5-7	--	
				SPT-20	37.5 - 39.0	1.5	2-2-4	30	
				SPT-21	40.0 - 41.5	1.5	3-4-4	--	
				SPT-22	42.5 - 44.0	1.5	WOT-WOT-3	57	
				SPT-23	45.0 - 46.5	1.5	1-WOT-2	--	
361.4	46.5								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175569069.GPJ FMSM-GRAPHIC LOG.GDT 12/17/09

Project Number	175569069	Location	Paradise Fossil Plant		
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-5**	Total Depth	46.5 ft
County	Muhlenberg	Surface Elevation	407.9 ft		
Project Type	Geotechnical Exploration	Date Started	9/6/09	Completed	9/6/09
Supervisor	R. Riker Driller J. Wethington	Depth to Water	12.0 ft	Date/Time	9/6/09
Logged By	M. Jones	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
407.9	0.0	Top of Hole							
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	1.1	7-4-5	17	
				SPT-2	1.5 - 3.0	0.8	6-6-8	--	
				SPT-3	3.0 - 4.5	0.9	2-4-4	20	
				SPT-4	4.5 - 6.0	1.5	1-1-3	--	
				SPT-5	6.0 - 7.5	1.5	2-3-4	15	
				SPT-6	7.5 - 9.0	0.5	1-2-3	--	
				SPT-7	9.0 - 10.5	0.8	2-4-7	--	
397.4	10.5								
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-8	10.5 - 12.0	0.7	3-3-4	15	
				SPT-9	12.0 - 13.5	0.8	3-5-7	15	
				SPT-10	13.5 - 15.0	1.2	3-3-5	--	
392.4	15.5								
		Soil 3: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments		SPT-11	15.0 - 16.5	1.3	WOT	37	
390.4	17.5								
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-12	17.5 - 19.0	1.5	1-4-3	--	
				SPT-13	20.0 - 21.5	1.3	2-5-4	20	
				SPT-14	22.5 - 24.0	0.5	5-7-11	--	
382.9	25.0								

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant		
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-5**	Total Depth	46.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Soil 5: Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments		SPT-15	25.0 - 26.5	1.5	5-7-9	26	
				SPT-16	27.5 - 29.0	1.5	WOT-WOT-2	--	
				SPT-17	30.0 - 31.5	1.5	2-3-6	25	
				SPT-18	32.5 - 34.0	1.5	2-5-7	--	
				SPT-19	35.0 - 36.5	1.5	3-4-4	28	
370.9	37.0								
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		SPT-20	37.5 - 39.0	1.5	3-4-4	--	
				SPT-21	40.0 - 41.5	0.0	1-2-3	--	
				SPT-22	42.5 - 44.0	1.5	1-2-3	--	
361.4	46.5								
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Stantec

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-6** Total Depth 35.4 ft
County	Muhlenberg	Surface Elevation	407.8 ft
Project Type	Geotechnical Exploration	Date Started	8/27/09 Completed 8/27/09
Supervisor	R. Riker Driller J. Felts	Depth to Water	11.0 ft Date/Time 8/27/09
Logged By	B. Bline	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
407.8	0.0	Top of Hole							
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	0.7	11-9-8	--	
				SPT-2	1.5 - 3.0	1.1	6-5-4	12	
				SPT-3	3.0 - 4.5	0.6	3-3-3	--	
				ST-1	4.5 - 6.5			--	Tube deformed throw away, advanced 1.1'
				ST-2	6.5 - 8.5	1.3		--	
				SPT-4	8.0 - 9.5	0.4	23-10-10	13	
398.3	9.5								
		Soil 4: Clayey sand, brown to grayish brown, moist to wet and loose to medium dense		SPT-5	9.5 - 11.0	1.2	3-3-3	--	
				ST-3	11.0 - 13.0	2.0		--	
				SPT-6	13.5 - 15.0	1.5	0-0-0	21	
				SPT-7	15.0 - 16.5	0.7	0-0-1	--	
391.3	16.5								
		Soil 5: Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments		SPT-8	17.5 - 19.0	0.7	0-0-2	21	
				SPT-9	20.0 - 21.5	1.1	0-1-3	--	
385.8	22.0								

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-6** Total Depth 35.4 ft

Lithology Elevation	Depth	Description	Overburden Rock Core	Sample # RQD	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois.Cont. % Run Depth	Remarks
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments *(Continued)*		SPT-10	22.5 - 24.0	0.9	0-0-0	28	
				SPT-11	25.0 - 26.5	0.0	0-0-0	--	
				SPT-12	27.5 - 29.0	1.5	0-0-2	26	
377.0	30.8			SPT-13	30.0 - 31.5	1.5	9-10-13	--	
		Bedrock (augered)		SPT-14	32.5 - 34.0	1.4	10-25-50	14	
372.4	35.4			SPT-15	35.0 - 35.4		50+	--	

No Refusal /
Bottom of Hole

Top of Rock = 30.8
Elevation (377.0)

Stantec

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-7** Total Depth 24.5 ft
County	Muhlenberg	Surface Elevation	401.4 ft
Project Type	Geotechnical Exploration	Date Started	8/25/09 Completed 8/25/09
Supervisor	S. Lange Driller J. Bowerman	Depth to Water	13.0 ft Date/Time 8/25/09
Logged By	S. Lange	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
401.4	0.0	Top of Hole						
399.9	1.5	**Soil 4:** Clayey sand, brown to grayish brown, moist to wet and loose to medium dense	SPT-1	0.0 - 1.5	1.0	2-4-5	28	
		Soil 5: Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments	SPT-2	1.5 - 3.0	1.0	1-6-11	--	
			SPT-3	3.0 - 4.5	1.0	3-3-4	11	
			ST-1	4.5 - 6.5	1.3		--	
			SPT-4	6.5 - 8.0	1.0	3-3-4	--	
			SPT-5	8.0 - 9.5	1.0	1-2-2	22	
			ST-2	9.5 - 11.5	1.7		--	
			SPT-6	11.5 - 13.0	1.0	WOT	--	
387.4	14.0		SPT-7	13.0 - 14.5	1.0	1-2-3	16	
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments	SPT-8	15.5 - 17.0	1.5	2-3-5	--	
			SPT-9	18.0 - 19.5	1.0	4-5-3	19	
			SPT-10	20.5 - 22.0	1.3	8-12-17	--	

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Stantec

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-7** Total Depth 24.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
378.4	23.0								
376.9	24.5	Bedrock (augered)		SPT-11	23.0 - 24.5	1.3	13-28-50+	7	
		Auger Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175569069.GPJ FMSM-GRAPHIC LOG.GDT 12/17/09

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-8** Total Depth 35.9 ft
County	Muhlenberg	Surface Elevation	408.4 ft
Project Type	Geotechnical Exploration	Date Started	8/11/09 Completed 8/11/09
Supervisor	R. Riker Driller M. Wethington	Depth to Water	12.0 ft Date/Time 8/11/09
Logged By	R. Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
408.4	0.0	Top of Hole							
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	0.6	106-6-8	--	
				SPT-2	1.5 - 3.0	0.8	3-5-9	15	
				SPT-3	3.0 - 4.5	1.2	3-3-6	--	
				SPT-4	4.5 - 6.0	0.9	4-4-8	15	Many shale gravels from 4.5' to 6.0'
				SPT-5	6.0 - 7.5	0.9	3-9-12	--	
				SPT-6	7.5 - 9.0	0.2	3-8-4	14	
				SPT-7	9.0 - 10.5	1.5	2-5-9	--	
				SPT-8	10.5 - 12.0	1.0	2-3-5	17	
395.5	12.9			SPT-9	12.0 - 13.5	1.4	4-13-14	--	
		Soil 3: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments		SPT-10	13.5 - 15.0	1.4	6-12-14	16	
				SPT-11	15.0 - 16.5	0.7	2-2-3	--	
391.9	16.5								
		Soil 4: Clayey sand, brown to grayish brown, moist to wet and loose to medium dense		SPT-12	17.5 - 19.0	0.5	1-1-2	16	
				SPT-13	20.0 - 21.5	1.1	7-2-3	--	

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-8** Total Depth 35.9 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
385.9	22.5								
384.4	24.0	**Soil 5:** Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments		SPT-14	22.5 - 24.0	1.5	WOT	28	
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		SPT-15	25.0 - 26.5	1.5	WOT	--	
				SPT-16	27.5 - 29.0	1.3	8-6-16	20	
378.4	30.0								
		Bedrock (augered)		SPT-17	30.0 - 31.5	1.6	29-49-50	--	
				SPT-18	32.5 - 34.0	1.5	16-39-47	10	
372.5	35.9			SPT-19	35.0 - 35.9	0.6	25-50+	--	

No Refusal /
Bottom of Hole

Top of Rock = 30.0
Elevation (378.4)

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-9** Total Depth 34.0 ft
County	Muhlenberg	Surface Elevation	407.8 ft
Project Type	Geotechnical Exploration	Date Started	9/1/09 Completed 9/1/09
Supervisor	R. Riker Driller J. Wethington	Depth to Water	13.0 ft Date/Time 9/1/09
Logged By	M. Jones	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
407.8	0.0	Top of Hole							
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	0.3	4-5-6	14	
				SPT-2	1.5 - 3.0	0.6	5-5-11	--	
				SPT-3	3.0 - 4.5	1.0	4-7-5	15	
				SPT-4	4.5 - 6.0	0.7	4-5-4	--	
				SPT-5	6.0 - 7.5	1.2	4-7-50/0.4	16	
				SPT-6	7.5 - 9.0			--	Boulders from 7.0' to 9.0'
				SPT-7	9.0 - 10.5	0.2	14-13-10	--	
				SPT-8	10.5 - 12.0	0.9	6-9-9	15	
394.8	13.0			SPT-9	12.0 - 13.5	1.1	6-13-25	16	
		Soil 3: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments		SPT-10	13.5 - 15.0	1.5	21-36-31	--	
				SPT-11	15.0 - 16.5	1.5	5-6-10	16	
				SPT-12	17.5 - 19.0	1.3	1-WOT	--	
387.8	20.0								
				SPT-13	20.0 - 21.5	1.2	WOT	26	

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant		
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-9**	Total Depth	34.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 5: Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments *(Continued)*		SPT-14	22.5 - 24.0	1.5	WOT-1	--	
				SPT-15	25.0 - 26.5	1.5	4-6-8	19	
380.8	27.0								
		Bedrock (augered)		SPT-16	27.5 - 29.0	1.5	7-37-62	--	
				SPT-17	30.0 - 31.5	1.5	14-54-50	13	
				SPT-18	32.5 - 34.0	1.5	17-54-50	--	
373.8	34.0								

No Refusal /
Bottom of Hole

Top of Rock = 27.0
Elevation (380.8)

STANTEC/FMSM_LEGACY 175569069.GPJ FMSM-GRAPHIC LOG.GDT 12/17/09

SUBSURFACE LOG

Stantec

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-11** Total Depth 45.3 ft
County	Muhlenberg	Surface Elevation	408.4 ft
Project Type	Geotechnical Exploration	Date Started	8/11/09 Completed 8/11/09
Supervisor	R. Riker Driller M. Wethington	Depth to Water	13.5 ft Date/Time 8/11/09
Logged By	R. Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden Sample # / Rock Core RQD	Depth Run	Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
408.4	0.0	Top of Hole						
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments	SPT-1	0.0 - 1.5	0.9	6-7-7	--	
			SPT-2	1.5 - 3.0	3.9	7-6-8	13	
			SPT-3	3.0 - 4.5	0.9	10-7-7	--	
			SPT-4	4.5 - 6.0	0.7	4-30-8	12	
			SPT-5	6.0 - 7.5	0.4	3-6-10	--	
			SPT-6	7.5 - 9.0	0.1	6-4-5	11	
			SPT-7	9.0 - 10.5	0.5	3-6-2	--	
			SPT-8	10.5 - 12.0	0.6	4-4-5	17	
394.9	13.5		SPT-9	12.0 - 13.5	1.1	7-8-11	--	
		Soil 3: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments	SPT-10	13.5 - 15.0	1.5	9-13-14	14	
390.9	17.5		SPT-11	15.0 - 16.5	1.5	10-7-8	--	
388.4	20.0	**Soil 4:** Clayey sand, brown to grayish brown, moist to wet and loose to medium dense	SPT-12	17.5 - 19.0	0.5	1-2-1	22	
385.9	22.5	**Soil 3:** Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments	SPT-13	20.0 - 21.5	0.4	1-1-1	--	
			SPT-14	22.5 - 24.0	1.5	1-2-3	24	

STANTEC/FMSM_LEGACY 175569069.GPJ FMSM-GRAPHIC LOG.GDT 12/17/09

Project Number	175569069	Location	Paradise Fossil Plant		
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-11**	Total Depth	45.3 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments *(Continued)*		SPT-15	25.0 - 26.5	1.5	2-4-6	--	
				SPT-16	27.5 - 29.0	1.4	3-4-6	27	
378.4	30.0								
		Soil 4: Clayey sand, brown to grayish brown, moist to wet and loose to medium dense		SPT-17	30.0 - 31.5	1.3	3-4-8	--	
				SPT-18	32.5 - 34.0	1.5	6-8-10	16	
373.4	35.0								
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		SPT-19	35.0 - 36.5	1.1	2-6-13	--	
				SPT-20	37.5 - 39.0	1.3	16-30-45	17	
368.4	40.0								
		Bedrock (augered)		SPT-21	40.0 - 41.0	0.8	11-50+	--	
				SPT-22	42.5 - 43.5	0.5	50+	8	
363.1	45.3			SPT-23	45.0 - 45.3	0.3	50+	--	

No Refusal /
Bottom of Hole

Top of Rock = 40.0
Elevation (368.4)

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-12** Total Depth 46.5 ft
County	Muhlenberg	Surface Elevation	408.5 ft
Project Type	Geotechnical Exploration	Date Started	8/17/09 Completed 8/18/09
Supervisor	R. Riker Driller J. Felts	Depth to Water	14.4 ft Date/Time 8/18/09
Logged By	B. Bline	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
408.5	0.0	Top of Hole							
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	1.2	7-9-8	--	
				SPT-2	3.0 - 4.5	0.3	37-11-4	2	
				SPT-3	4.5 - 6.0	1.1	4-4-7	--	
				ST-1	6.0 - 8.0	2.0		--	
				SPT-4	8.0 - 9.5	1.5	2-4-2	15	
				SPT-5	9.5 - 11.0	0.8	0-1-7	--	
				SPT-6	11.0 - 12.5	1.1	2-4-7	14	
394.1	14.4								
		Soil 3: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments		SPT-7	15.0 - 16.5	1.2	7-16-7	--	
				SPT-8	18.5 - 20.0	0.1	3-1-0	20	
387.0	21.5								
				SPT-9	22.5 - 24.0	1.5	0-0-0	--	

STANTEC/FMSM_LEGACY 175569069.GPJ FMSM-GRAPHIC LOG.GDT 12/17/09

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-12** Total Depth 46.5 ft

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments *(Continued)*		ST-2	25.0 - 27.0	2.0		--	
				SPT-10	27.5 - 29.0	1.5	0-0-0	22	
				SPT-11	30.0 - 31.5	1.5	0-1-6	--	
376.5	32.0								
		Soil 5: Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments		SPT-12	32.5 - 34.0	1.5	4-16-24	18	
				SPT-13	35.0 - 36.5	0.9	6-10-14	--	
				SPT-14	37.5 - 39.0	1.5	6-9-15	17	
368.5	40.0								
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		SPT-15	40.0 - 41.5	0.7	0-6-5	--	
				SPT-16	42.5 - 44.0	0.8	4-9-10	18	
362.6	45.9			SPT-17	45.0 - 46.0	0.9	23-50-0.4	--	
362.0	46.5	Bedrock (augered)							

No Refusal /
Bottom of Hole

Top of Rock = 45.9
Elevation (362.6)

![Stantec]

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant		
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-14**	Total Depth	38.2 ft
County	Muhlenberg	Surface Elevation	408.3 ft		
Project Type	Geotechnical Exploration	Date Started	8/11/09	Completed	8/11/09
Supervisor	R. Riker Driller J. Felts	Depth to Water	14.5 ft	Date/Time	8/11/09
Logged By	B. Bline	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
408.3	0.0	Top of Hole						
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments	SPT-1	0.0 - 1.5	1.1	4-5-4	--	
			SPT-2	1.5 - 3.0	0.8	2-2-3	17	
			SPT-3	3.0 - 4.5	1.4	5-3-6	--	
			SPT-4	4.5 - 6.0	1.5	4-4-5	14	
			SPT-5	6.0 - 7.5	1.3	3-3-3	--	
			SPT-6	7.5 - 9.0	1.2	4-6-10	10	
			SPT-7	9.0 - 10.5	1.3	4-3-5	--	
			SPT-8	10.5 - 12.0	1.7	6-6-8	11	
			SPT-9	12.0 - 13.5	0.3	18-12-14	--	
394.8	13.5							
		Soil 3: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments	SPT-10	13.5 - 15.0	1.5	8-10-12	15	
			SPT-11	15.0 - 16.5	1.5	8-9-11	--	
			SPT-12	17.5 - 19.0	1.2	4-6-6	14	
			SPT-13	20.0 - 21.5	0.0	0-0-0	--	

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-14** Total Depth 38.2 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 3: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments *(Continued)*		SPT-14	22.5 - 24.0	0.5	0-0-0	23	
				SPT-15	25.0 - 26.5	1.0	0-0-0	--	
380.8	27.5								
		Soil 4: Clayey sand, brown to grayish brown, moist to wet and loose to medium dense		SPT-16	27.5 - 29.0	0.7	0-1-0	21	
				SPT-17	30.0 - 31.5	1.0	0-1-4	--	
375.8	32.5								
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments Shale, light gray, very thin bedded		SPT-18	32.5 - 34.0	0.8	4-6-12	18	
				SPT-19	35.0 - 36.5	0.5	35-50-0.2	--	
370.1	38.2			SPT-20	37.5 - 38.2	0.7	40-50-0.2	11	

Auger Refusal /
Bottom of Hole

Top of Rock = 38.2
Elevation (370.1)

STANTEC/FMSM_LEGACY 175569069.GPJ FMSM-GRAPHIC LOG.GDT 12/17/09

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-15** Total Depth 35.9 ft
County	Muhlenberg	Surface Elevation	407.9 ft
Project Type	Geotechnical Exploration	Date Started	8/25/09 Completed 8/25/09
Supervisor	R. Riker Driller J. Felts	Depth to Water	14.0 ft Date/Time 8/25/09
Logged By	B. Bline	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
407.9	0.0	Top of Hole							
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	1.1	12-12-10	9	
				SPT-2	1.5 - 3.0	1.3	8-7-6	--	
				SPT-3	3.0 - 4.5	0.9	4-5-5	8	
				ST-1	4.5 - 6.5	1.7		--	Bottom of tube is wet
				SPT-4	6.5 - 8.0	1.5	12-29-8	--	Shale cobble from 7.0' to 7.5'
				SPT-5	8.0 - 9.5	1.0	2-5-9	13	
				SPT-6	9.5 - 11.0	1.2	1-3-6	--	
				ST-2	11.0 - 13.0	1.5		--	
393.9	14.0			SPT-7	13.5 - 15.0	0.9	0-4-6	21	
		Soil 3: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments		SPT-8	15.0 - 16.5	0.9	1-3-5	--	
390.4	17.5								
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		SPT-9	17.5 - 19.0	0.6	1-1-2	20	
				SPT-10	20.0 - 21.5	1.3	0-1-4	--	

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-15** Total Depth 35.9 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments *(Continued)*		SPT-11	22.5 - 24.0	1.5	2-0-0	24	
				SPT-12	25.0 - 26.5	1.1	1-0-0	--	
				SPT-13	27.5 - 29.0	1.5	0-0-2	17	
				SPT-14	30.0 - 31.5	1.5	3-5-8	--	
375.9	32.0								
		Bedrock (augered)		SPT-15	32.5 - 34.0	0.9	21-50-0.4	13	
				SPT-16	35.0 - 35.9	0.9	20-50-0.4	--	
372.0	35.9								

No Refusal /
Bottom of Hole

Top of Rock = 32.0
Elevation (375.9)

Stantec

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-16** Total Depth 24.5 ft
County	Muhlenberg	Surface Elevation	400.1 ft
Project Type	Geotechnical Exploration	Date Started	8/25/09 Completed 8/25/09
Supervisor	S. Lange Driller J. Bowerman	Depth to Water	14.0 ft Date/Time 8/25/09
Logged By	S. Lange	Depth to Water	N/A Date/Time N/A

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
400.1	0.0	Top of Hole							
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	1.0	2-3-6	--	
				SPT-2	1.5 - 3.0	1.0	7-8-5	11	
				SPT-3	3.0 - 4.5	1.0	2-3-3	--	
395.1	5.0								
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		ST-1	4.5 - 6.5	2.0		--	
				SPT-4	6.5 - 8.0	1.3	1-3-3	17	
				SPT-5	8.0 - 9.5	0.5	WOT-1-1	--	
				ST-2	9.5 - 11.5	2.0		--	
				SPT-6	11.5 - 13.0	1.3	WOT-1-1	24	
				SPT-7	13.0 - 14.5	1.3	WOT-WOT-1	--	
				SPT-8	15.5 - 17.0	1.3	WOT	28	
				SPT-9	18.0 - 19.5	1.0	1-4-8	--	
				SPT-10	20.5 - 22.0	1.3	13-15-15	14	

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-16** Total Depth 24.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
376.1	24.0			SPT-11	23.0 - 24.5	1.3	36-30	--	
375.6	24.5	Bedrock (augered)							

No Refusal /
Bottom of Hole

Top of Rock = 24.0
Elevation (376.1)

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-17** Total Depth 46.5 ft
County	Muhlenberg	Surface Elevation	407.8 ft
Project Type	Geotechnical Exploration	Date Started	8/11/09 Completed 8/12/09
Supervisor	R. Riker Driller J. Felts	Depth to Water	25.0 ft Date/Time 8/12/09
Logged By	B. Bline	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
407.8	0.0	Top of Hole						
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments	SPT-1	0.0 - 1.5	1.4	6-12-4	10	
			SPT-2	1.5 - 3.0	1.5	7-8-9	--	
			SPT-3	3.0 - 4.5	1.5	2-4-3	14	
			SPT-4	4.5 - 6.0	1.5	4-13-12	--	Shale cobble from 5.2' to 5.7'
			SPT-5	6.0 - 7.5	1.5	5-6-8	11	
			SPT-6	7.5 - 9.0	1.2	2-4-5	--	
			SPT-7	9.0 - 10.5	1.2	3-5-8	13	
395.8	12.0		SPT-8	10.5 - 12.0	1.5	3-6-12	--	
		Soil 4: Clayey sand, brown to grayish brown, moist to wet and loose to medium dense	SPT-9	12.0 - 13.5	1.5	3-7-7	12	
392.8	15.0		SPT-10	13.5 - 15.0	1.5	2-3-6	--	
		Soil 5: Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments	SPT-11	15.0 - 16.5	1.5	3-6-7	16	
			SPT-12	17.5 - 19.0	1.5	3-3-5	--	
			SPT-13	20.0 - 21.5	1.5	2-3-3	23	
385.3	22.5							
			SPT-14	22.5 - 24.0	0.8	0-1-2	--	

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-17** Total Depth 46.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments *(Continued)*		SPT-15	25.0 - 26.5	1.5	5-8-8	21	
				SPT-16	27.5 - 29.0	1.5	2-4-7	--	
				SPT-17	30.0 - 31.5	1.5	1-4-5	24	
				SPT-18	32.5 - 34.0	1.5	1-3-4	--	
				SPT-19	35.0 - 36.5	1.5	0-0-0	35	
				SPT-20	37.5 - 39.0	1.5	0-0-0	--	
				SPT-21	40.0 - 41.5		0-0-1	30	
				SPT-22	42.5 - 44.0	1.5	1-0-1	--	
361.3	46.5			SPT-23	45.0 - 46.5	1.5	0-1-2	30	
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175569069.GPJ FMSM-GRAPHIC LOG.GDT 12/17/09

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-18** Total Depth 46.5 ft
County	Muhlenberg	Surface Elevation	408.0 ft
Project Type	Geotechnical Exploration	Date Started	8/13/09 Completed 8/14/09
Supervisor	R. Riker Driller J. Felts	Depth to Water	20.0 ft Date/Time 8/14/09
Logged By	B. Bline	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
408.0	0.0	Top of Hole							
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments		SPT-1	0.0 - 1.5	1.1	6-11-7	--	
				ST-1	2.0 - 4.0	1.3		--	
402.5	5.5			SPT-2	4.0 - 5.5	1.1	2-3-4	15	
401.0	7.0	**Soil 4:** Clayey sand, brown to grayish brown, moist to wet and loose to medium dense		SPT-3	5.5 - 7.0	1.2	1-2-4	--	
		Soil 5: Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments		ST-2	7.0 - 9.0	1.3		--	
				SPT-4	9.0 - 10.5	0.9	0-0-2	19	
				SPT-5	10.5 - 12.0	0.3	0-0-0	--	
				SPT-6	12.0 - 13.5	1.5	0-1-1	23	
				SPT-7	13.5 - 15.0	1.5	0-1-1	--	
				SPT-8	15.0 - 16.5	1.2	0-1-2	22	
				SPT-9	17.5 - 19.0	1.5	0-2-2	--	
				SPT-10	20.0 - 21.5	1.5	0-0-0	26	
				SPT-11	22.5 - 24.0	1.5	2-7-8	--	

STANTEC/FMSM_LEGACY 175569069.GPJ FMSM-GRAPHIC LOG.GDT 12/17/09

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-18** Total Depth 46.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
				ST-3	24.0 - 26.0	2.0		--	
381.0	27.0								
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		SPT-12	27.5 - 29.0	1.5	0-2-2	--	
				SPT-13	30.0 - 31.5	1.5	1-3-4	29	
				SPT-14	32.5 - 34.0	1.5	0-2-2	--	
				SPT-15	35.0 - 36.5	1.5	0-1-2	44	
				SPT-16	37.5 - 39.0	1.5	0-0-1	--	
				SPT-17	40.0 - 41.5	1.5	0-0-0	20	
				SPT-18	42.5 - 44.0	1.3	0-0-0	--	
				SPT-19	45.0 - 46.5	1.5	0-0-0	25	
361.5	46.5								
		No Refusal / Bottom of Hole							

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-20** Total Depth 65.7 ft
County	Muhlenberg	Surface Elevation	408.3 ft
Project Type	Geotechnical Exploration	Date Started	8/12/09 Completed 8/13/09
Supervisor	R. Riker Driller J. Felts	Depth to Water	27.0 ft Date/Time 8/12/09
Logged By	B. Bline	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
408.3	0.0	Top of Hole						
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments	SPT-1	0.0 - 1.5	1.1	8-4-9	10	
			SPT-2	1.5 - 3.0	1.4	5-8-6	--	
			SPT-3	3.0 - 4.5	1.5	6-11-9	10	
			SPT-4	4.5 - 6.0	1.5	7-11-12	--	
			SPT-5	6.0 - 7.5	1.5	6-4-4	14	
			SPT-6	7.5 - 9.0	1.5	3-5-6	--	
			SPT-7	9.0 - 10.5	1.5	3-7-8	12	
			SPT-8	10.5 - 12.0	1.5	3-6-8	--	
395.3	13.0		SPT-9	12.0 - 13.5	1.2	1-1-1	17	Shale/Coal fragments from 12.0' to 12.4'
		Soil 5: Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments	SPT-10	13.5 - 15.0	1.1	0-0-0	--	
			SPT-11	15.0 - 16.5	1.5	0-0-0	23	
			SPT-12	17.5 - 19.0	0.0	0-1-2	--	
			SPT-13	20.0 - 21.5	0.4	0-0-2	20	Some angular gravel from 20.0' to 22.5'

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-20** Total Depth 65.7 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Soil 5: Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments *(Continued)*		SPT-14	22.5 - 24.0	1.1	2-3-3	--	
				SPT-15	25.0 - 26.5	1.5	1-2-3	18	
380.8	27.5	**Soil 4:** Clayey sand, brown to grayish brown, moist to wet and loose to medium dense		SPT-16	27.5 - 29.0	1.4	12-18-19	--	Sandy clay form 27.7' to 35.5'
				SPT-17	30.0 - 31.5	1.5	2-5-6	19	
				SPT-18	32.5 - 34.0	1.5	3-3-5	--	
373.3	35.0	**Soil 6:** Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		SPT-19	35.0 - 36.5	1.5	1-2-2	21	
				SPT-20	37.5 - 39.0	1.5	0-0-0	--	
				SPT-21	40.0 - 41.5	1.5	0-0-0	33	
				SPT-22	42.5 - 44.0	1.5	0-0-0	--	
				SPT-23	45.0 - 46.5	1.5	1-1-2	26	

Project Number	175569069	Location	Paradise Fossil Plant		
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-20**	Total Depth	65.7 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments *(Continued)*							
				SPT-24	55.0 - 56.5	1.1	18-23-45	--	
348.1	60.2								Began Core
		Shale, light gray, moderately hard, weathered							
342.6	65.7				5.5	5.5	100	65.7	

Bottom of Hole

Top of Rock = 60.2
Elevation (348.1)

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-21** Total Depth 46.5 ft
County	Muhlenberg	Surface Elevation	408.6 ft
Project Type	Geotechnical Exploration	Date Started	8/15/09 Completed 8/17/09
Supervisor	R. Riker Driller J. Felts	Depth to Water	42.5 ft Date/Time 8/17/09
Logged By	B. Bline	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
408.6	0.0	Top of Hole						
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments	SPT-1	0.0 - 1.5	1.1	9-11-11	--	
			ST-1	2.0 - 4.0	2.0		--	
			SPT-2	4.0 - 5.5	1.5	4-9-15	12	
			SPT-3	5.5 - 7.0	1.4	3-6-8	--	
			ST-2	7.0 - 8.5	1.1		--	
			ST-3	8.5 - 10.5	1.4		--	
			SPT-4	10.5 - 12.0	0.9	1-3-3	13	
			SPT-5	12.0 - 13.5	1.2	1-2-3	--	
			SPT-6	13.5 - 15.0	1.2	3-2-1	13	
			SPT-7	15.0 - 16.5	1.4	2-4-8	--	
391.1	17.5							
		Soil 4: Clayey sand, brown to grayish brown, moist to wet and loose to medium dense	SPT-8	17.5 - 19.0	1.5	2-4-4	15	
			SPT-9	20.0 - 21.5	1.5	2-3-4	--	
			SPT-10	22.5 - 24.0	1.4	6-11-10	10	Sandstone this spoon only

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-21** Total Depth 46.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Soil 4: Clayey sand, brown to grayish brown, moist to wet and loose to medium dense *(Continued)*		SPT-11	25.0 - 26.5	1.4	2-4-4	--	
				SPT-12	27.5 - 29.0	1.4	1-3-6	13	
				SPT-13	30.0 - 31.5	1.5	8-12-12	--	
				SPT-14	32.5 - 34.0	1.5	4-7-12	14	
				SPT-15	35.0 - 36.5	1.1	4-7-10	--	Decomposed sandstone in spoon tip
				SPT-16	37.5 - 39.0	1.4	5-8-7	11	High percentage of shale fragments
368.6	40.0								
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		SPT-17	40.0 - 41.5	1.5	3-6-6	--	
				SPT-18	42.5 - 44.0	1.3	3-7-5	19	Decomposing weathered shale from 42.5' to 46.5'
				SPT-19	45.0 - 46.5	1.1	7-4-8	--	
362.1	46.5								
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-22** Total Depth 30.0 ft
County	Muhlenberg	Surface Elevation	405.7 ft
Project Type	Geotechnical Exploration	Date Started	8/24/09 Completed 8/24/09
Supervisor	S. Lange Driller J. Bowerman	Depth to Water	22.0 ft Date/Time 8/24/09
Logged By	S. Lange	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
405.7	0.0	Top of Hole						
		Soil 1: MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments	SPT-1	0.0 - 1.5	1.0	4-4-4	12	
			SPT-2	1.5 - 3.0	1.0	3-3-3	--	
			SPT-3	3.0 - 4.5	0.5	2-2-3	12	
400.0	5.7		ST-1	4.5 - 6.5	1.5		--	
		Soil 2: MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments	SPT-4	6.5 - 8.0	1.0	1-2-2	--	
			SPT-5	8.0 - 9.5	0.0	1-2-2	--	
			ST-2	9.5 - 11.5	1.4		--	
394.2	11.5							
		Soil 4: Clayey sand, brown to grayish brown, moist to wet and loose to medium dense	SPT-6	11.5 - 13.0	1.0	WOT-5-7	--	
			SPT-7	13.0 - 14.5	0.5	2-2-3	14	
			SPT-8	15.5 - 17.0	0.5	1-3-3	--	
			SPT-9	18.0 - 19.5	0.5	5-6-6	11	
			SPT-10	20.5 - 22.0	1.0	4-8-7	--	

STANTEC/FMSM_LEGACY 175569069.GPJ FMSM-GRAPHIC LOG.GDT 12/22/09

Project Number	175569069	Location	Paradise Fossil Plant
Project Name	TVA - PAF Peabody Ash Pond	Boring No.	**STN-22** Total Depth 30.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
382.7	23.0								
		Soil 6: Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments		SPT-11	23.0 - 24.5	0.5	WOT-1-2	20	
				SPT-12	25.5 - 27.0	1.3	2-9-30	--	Shale fragments from 28.5' to 30.0'
375.7	30.0			SPT-13	28.6 - 30.0	1.0	3-16-19	12	

No Refusal / Bottom of Hole

Appendix C

Instrumentation Layout and Logs

NOTES:

1. The topographic basemap shown on this drawing was developed by Stantec using electronic drawings titled "PA000112.dwg and PA000008.dwg" provided by TVA. The information is believed to be approximate and should not be used for construction purposes.
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 there-from. 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

Instrument	Northing	Easting	Elevation (Feet)
STN-1	334,559.32	1,641,085.25	411.2
STN-6	334,117.67	1,642,904.88	407.8
STN-7	334,110.95	1,642,925.61	401.4
STN-12	332,482.84	1,642,158.00	408.5
STN-15	331,736.99	1,641,846.45	407.9
STN-16	331,729.49	1,641,903.96	400.1
STN-18	331,767.22	1,641,030.49	408.0
STN-21	331,553.80	1,640,209.81	408.6
STN-22	331,536.19	1,640,178.58	405.7

LEGEND

STN-1 ▢ Piezometer Location

RECORD DRAWING

For Supporting Design Calculations see FPGPAFFESCDX00000020100006

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	08/18/10	SV	JRF	SV	SV	SV	HRA	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE
1
2
3
4

SCALE: 1"=200' EXCEPT AS NOTED

YARD
–

PEABODY ASH POND GEOTECHNICAL EXPLORATION INSTRUMENTATION PLAN

STATE OF KENTUCKY
HUGO R. APARICIO
17148
LICENSED PROFESSIONAL ENGINEER

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
S. VEMURI	R. FLYNN	S. VEMURI	S. VEMURI	S. VEMURI	H. APARICIO	T. JOHNSON

Stantec Consulting Services Inc.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
Tel. 859.422.3000
Fax 859.422.3100
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PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

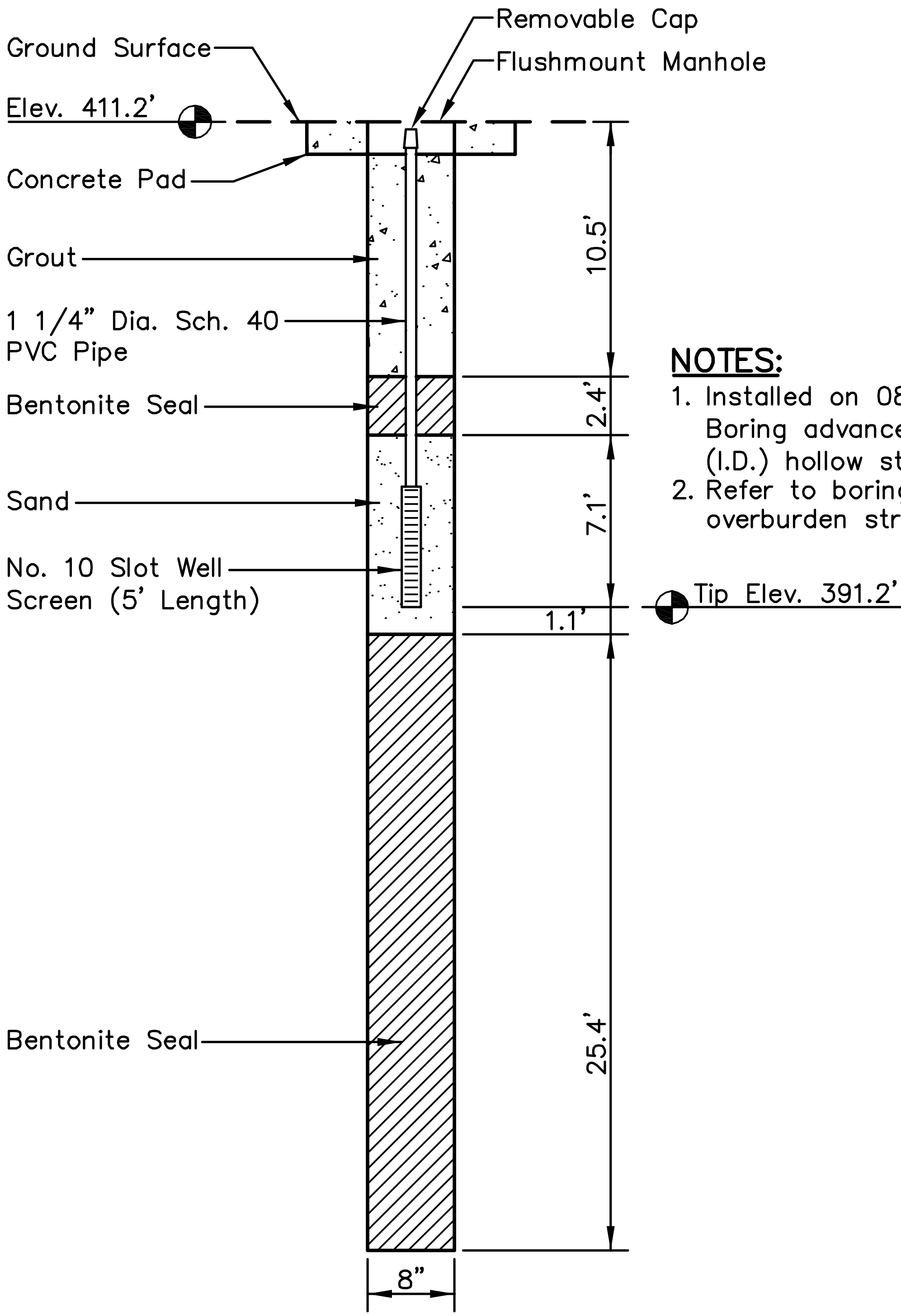
AUTOCAD R 2000 | DATE 08/18/10 | 64 | C | 10W710-02 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

64 C 10W710-02



NOTES:

1. Installed on 08/25/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 11/17/2009 USER: ELLISON, DOC
V:\1755\ACTIVE\175569069\GEOTECHNICAL\DRAWING\INSTRUMENT\69060C-PAF-301-PZ01.DWG

LOCATION:

Northing: 334,559.32
Easting: 1,641,085.25
Ground Elevation: 411.2 feet

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

PIEZOMETER STN-1
GEOTECHNICAL EXPLORATION
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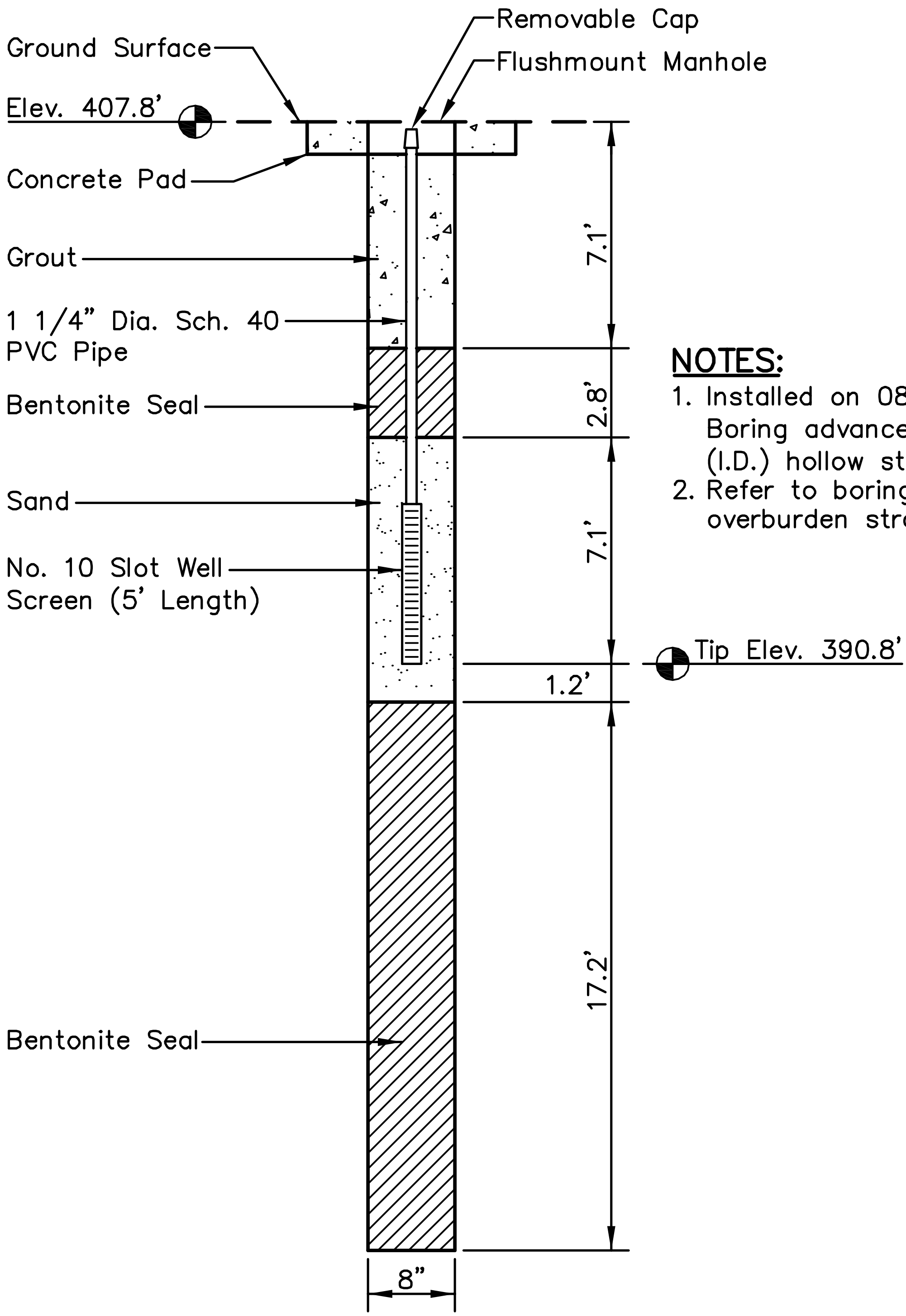
CHECKED BY	SV	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 08/27/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 11/17/2009 USER: ELLISON, DOC
V:\1755\ACTIVE\175569069\GEOTECHNICAL\DRAWING\INSTRUMENT\69060C-PAF-301-PZ06.DWG

LOCATION:

Northing: 334,117.67
Easting: 1,642,904.88
Ground Elevation: 407.8 feet

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

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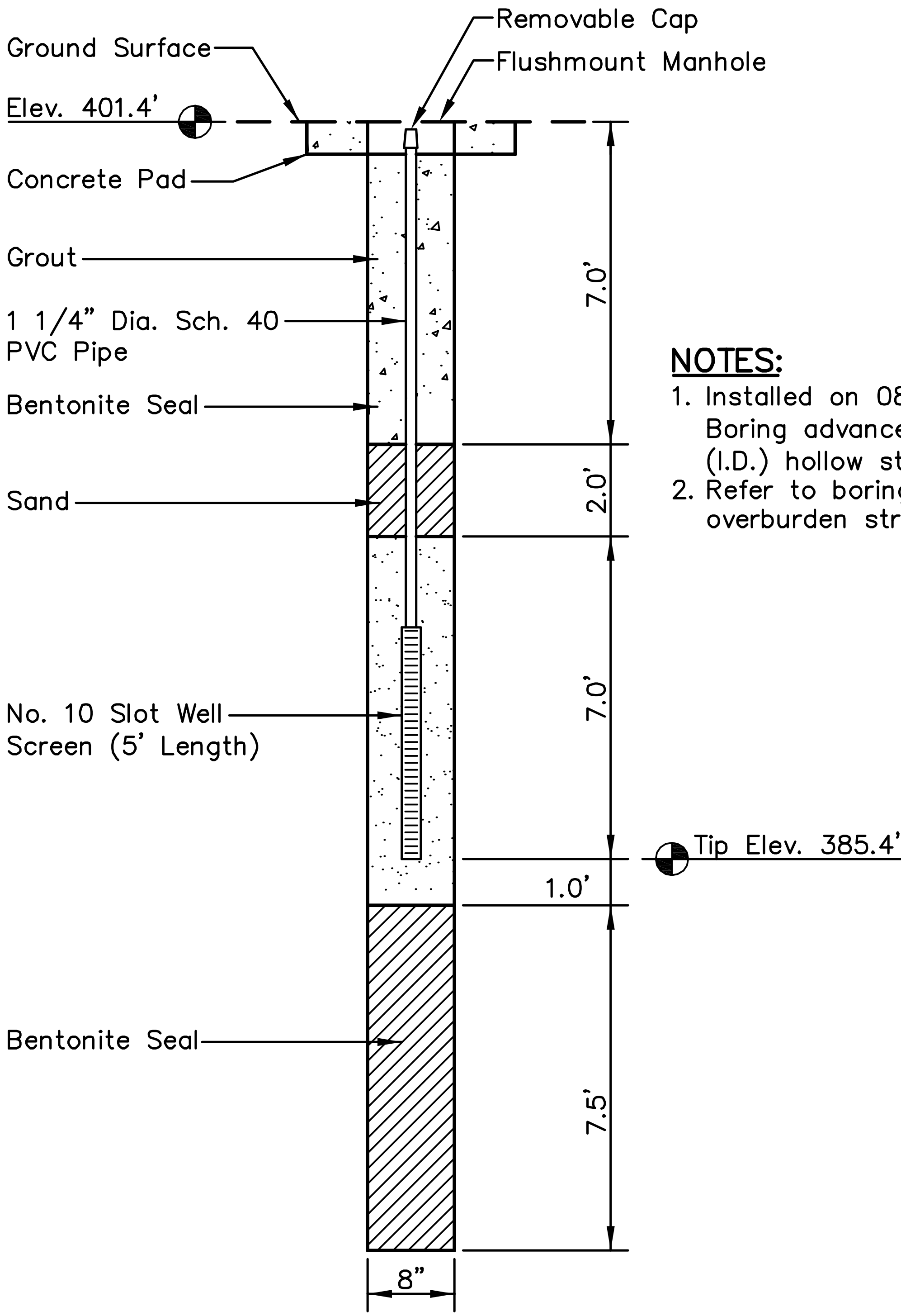
CHECKED BY	SV	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 08/25/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

Northing: 334,110.95
Easting: 1,642,925.61
Ground Elevation: 401.4 feet

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

PIEZOMETER STN-7
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CHECKED BY	SV	SCALE	NTS	2.	4.	

PLOT DATE: 11/17/2009 USER: ELLISON, DOC
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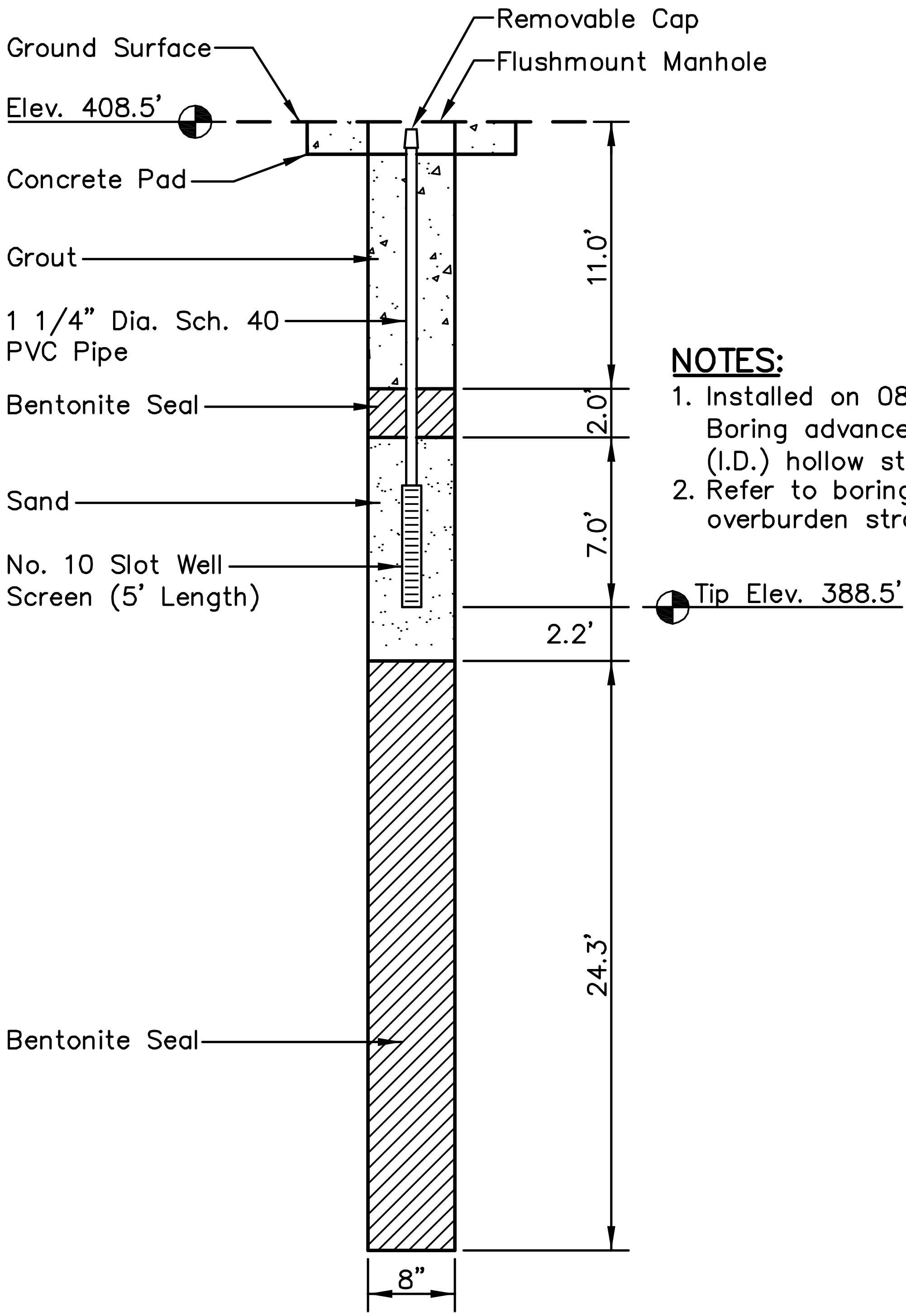

NOTES:

1. Installed on 08/18/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

Northing: 332,482.84
Easting: 1,642,158.00
Ground Elevation: 408.5 feet

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

PIEZOMETER STN-12
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CHECKED BY	SV	SCALE	NTS	2.	4.	

PLOT DATE: 11/17/2009 USER: ELLISON, DOC
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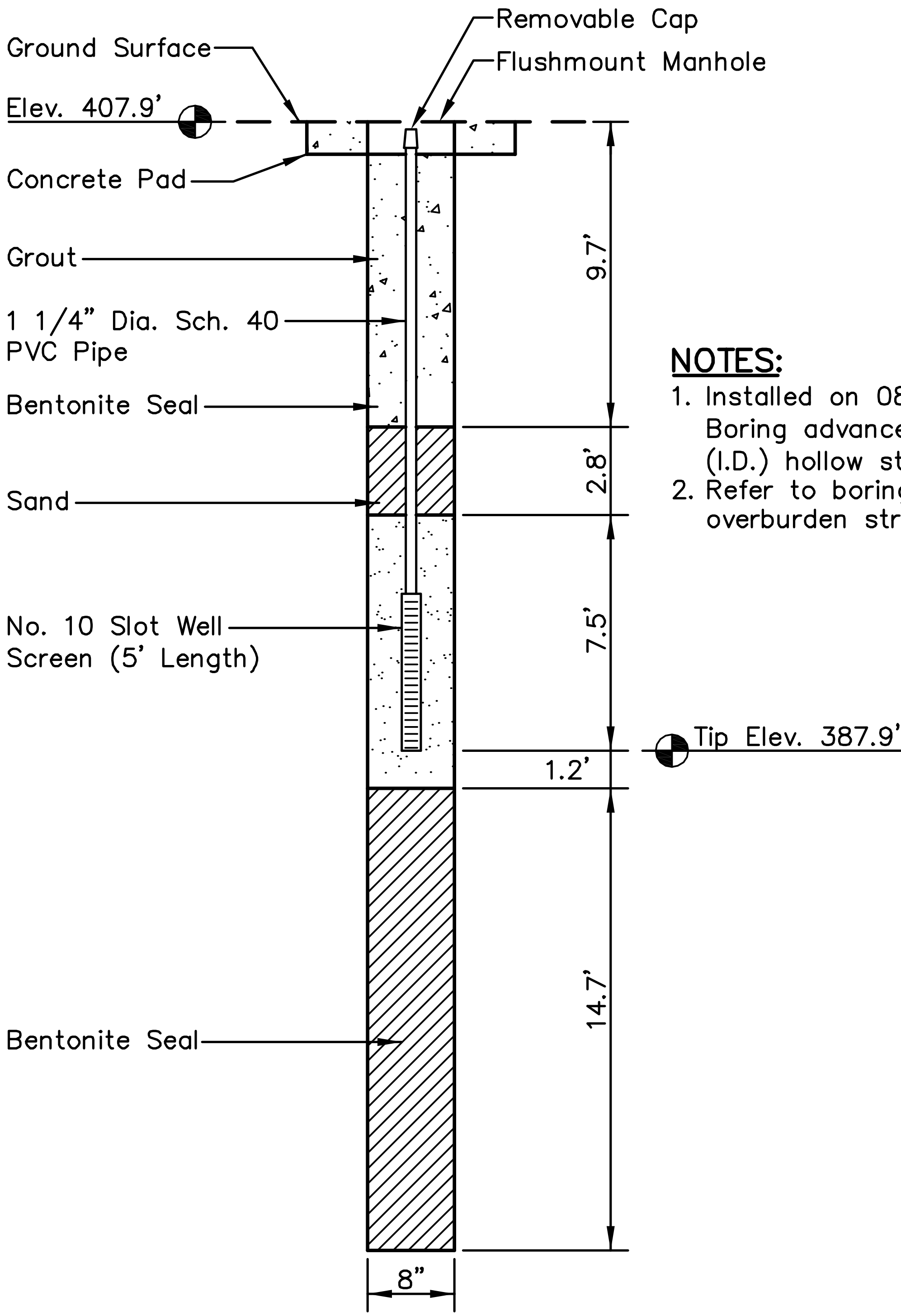

NOTES:

1. Installed on 08/26/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 11/17/2009 USER: ELLISON, DOC
V:\1755\ACTIVE\175569069\GEOTECHNICAL\DRAWING\INSTRUMENT\69060C-PAF-301-PZ15.DWG

LOCATION:

Northing: 331,736.99
Easting: 1,641,846.45
Ground Elevation: 407.9 feet

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

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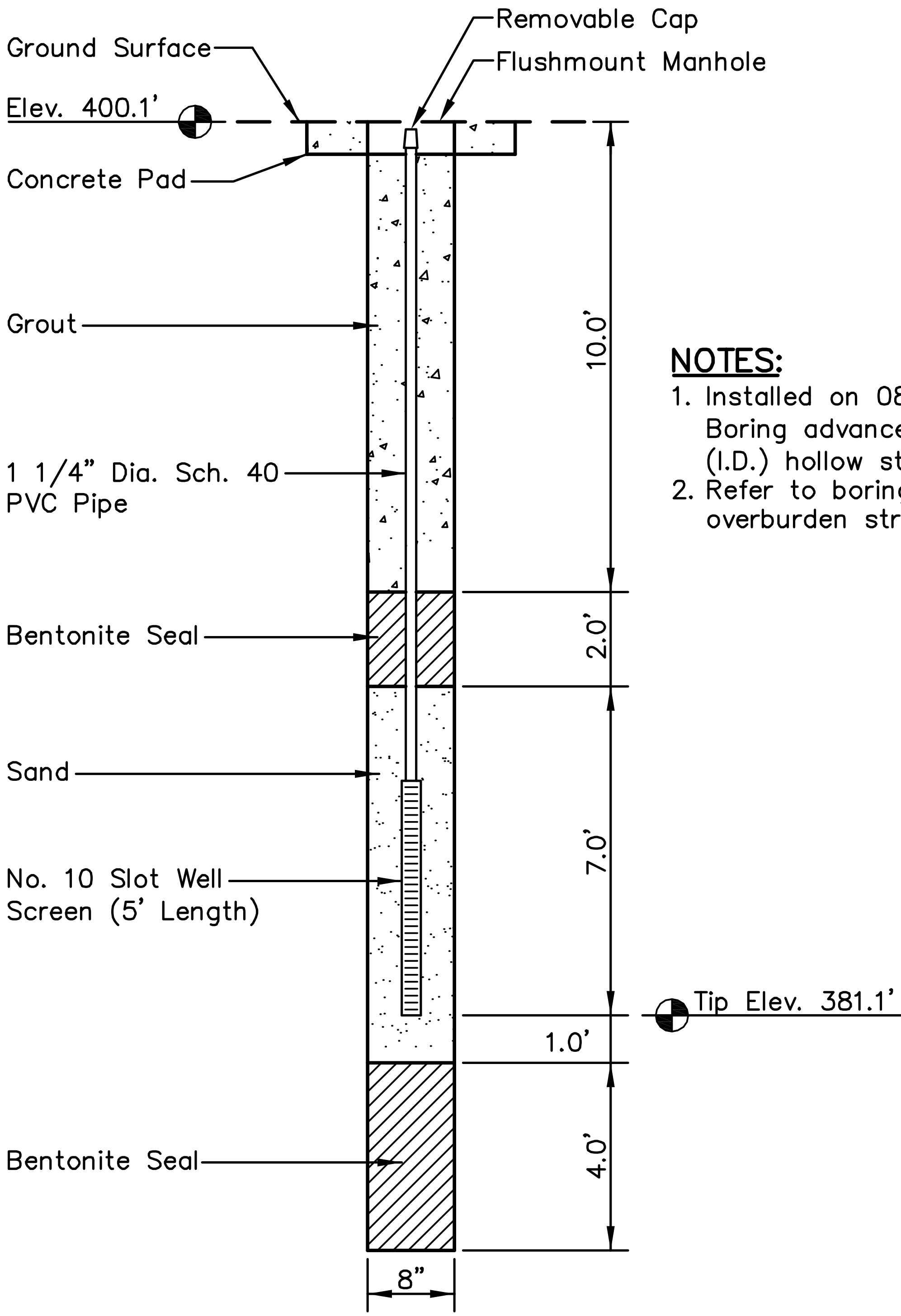
CHECKED BY	SV	SCALE	NTS	2.	4.		



NOTES:

1. Installed on 08/25/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 11/17/2009 USER: ELLISON, DOC
V:\1755\ACTIVE\175569069\GEOTECHNICAL\DRAWING\INSTRUMENT\69060C-PAF-301-PZ16.DWG

LOCATION:

Northing: 331,729.49
Easting: 1,641,903.96
Ground Elevation: 400.1 feet

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

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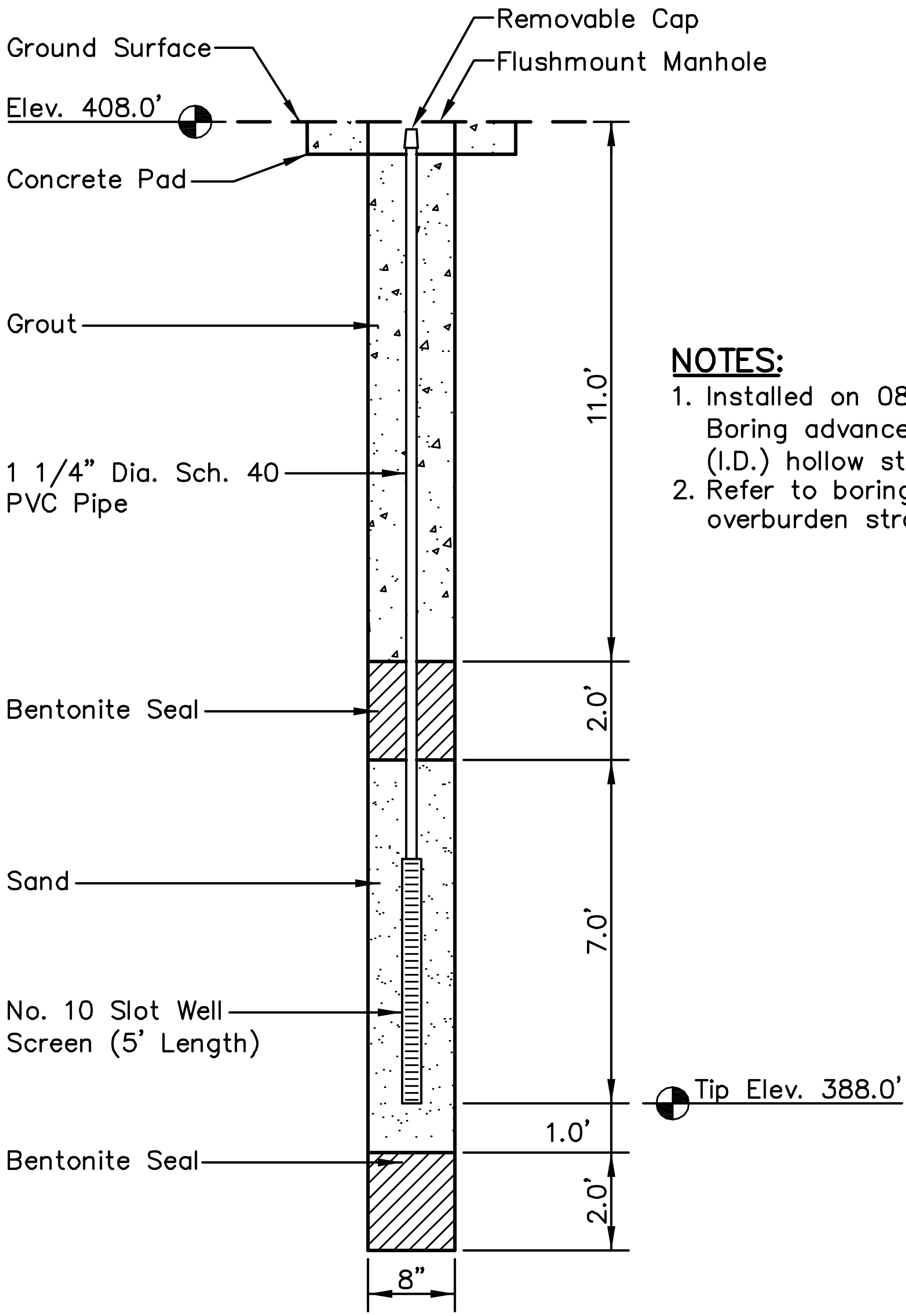
CHECKED BY	SV	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 08/15/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 11/17/2009 USER: ELLISON, DOC
V:\1755\ACTIVE\175569069\GEOTECHNICAL\DRAWING\INSTRUMENT\69060C-PAF-301-PZ18.DWG

LOCATION:

Northing: 331,767.22
Easting: 1,641,030.49
Ground Elevation: 408.0 feet

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

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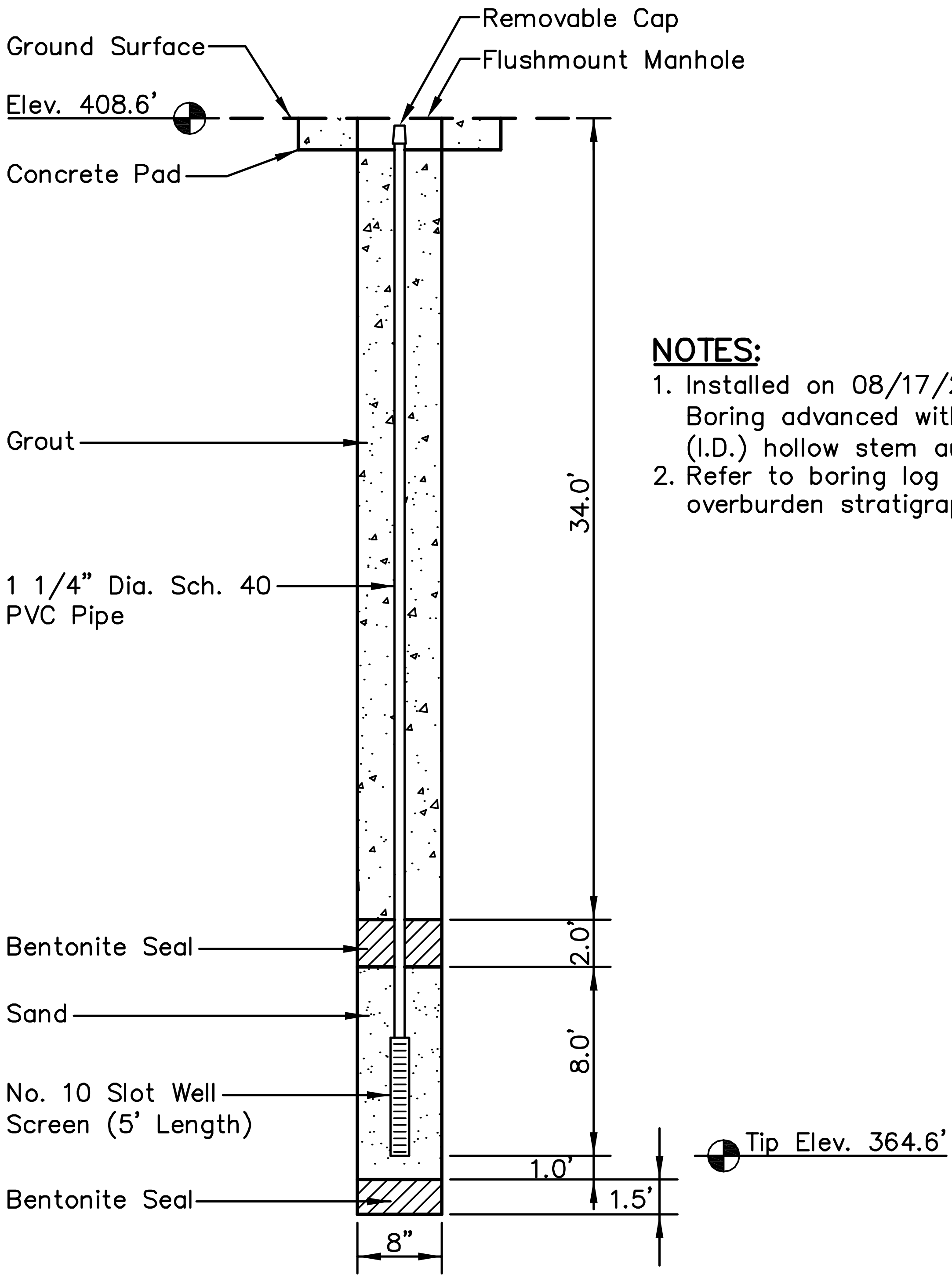

NOTES:

1. Installed on 08/17/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 11/17/2009 USER: ELLISON, DOC
V:\1755\ACTIVE\175569069\GEOTECHNICAL\DRAWING\INSTRUMENT\69060C-PAF-301-PZ21.DWG

LOCATION:

Northing: 331,553.80
Easting: 1,640,209.81
Ground Elevation: 408.6 feet

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

PIEZOMETER STN-21
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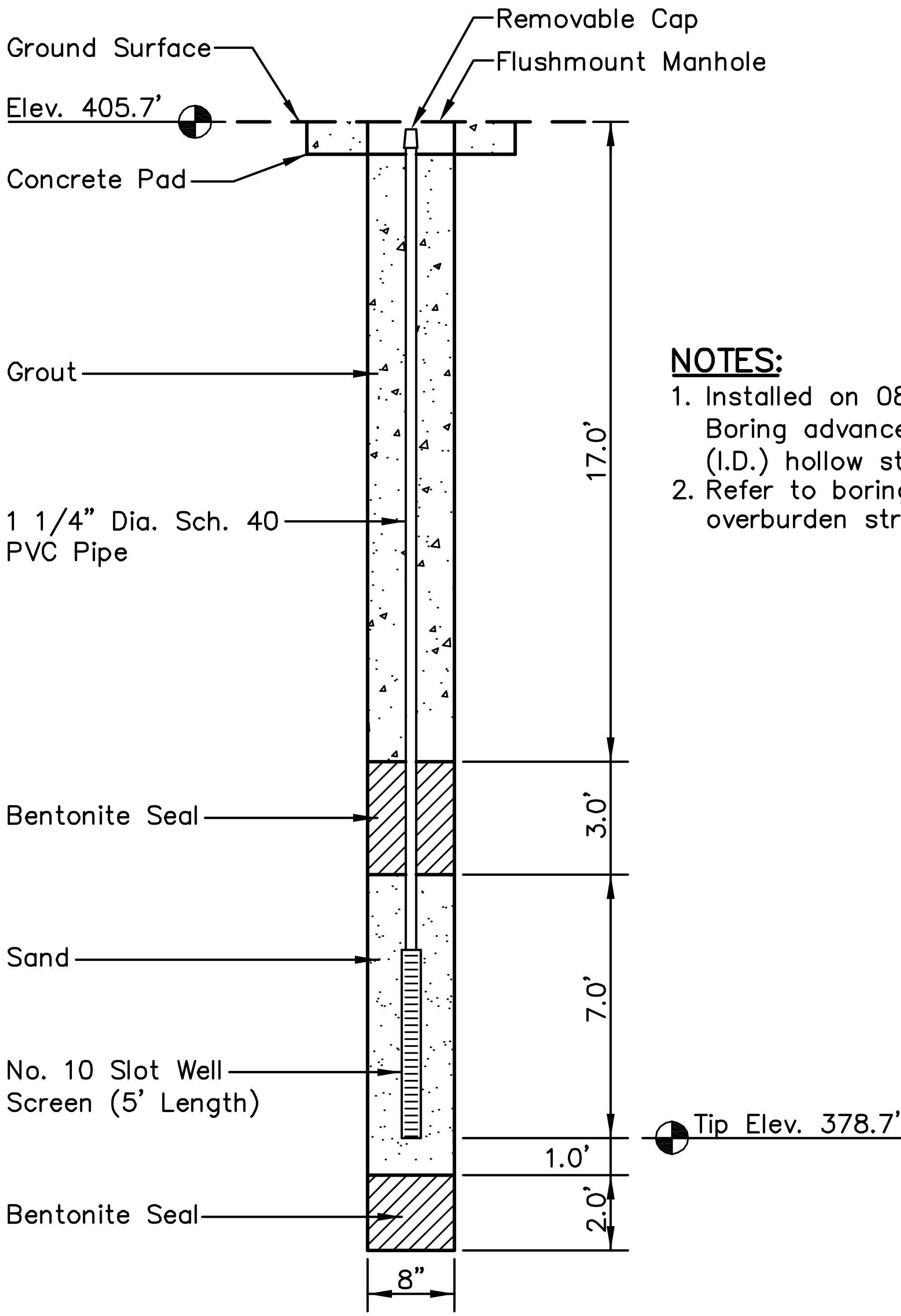
CHECKED BY	SV	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 08/24/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 11/17/2009 USER: ELLISON, DOC
V:\1755\ACTIVE\175569069\GEOTECHNICAL\DRAWING\INSTRUMENT\69060C-PAF-301-PZ22.DWG

LOCATION:

Northing: 331,536.19
Easting: 1,640,178.58
Ground Elevation: 405.7 feet

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

PIEZOMETER STN-22
GEOTECHNICAL EXPLORATION
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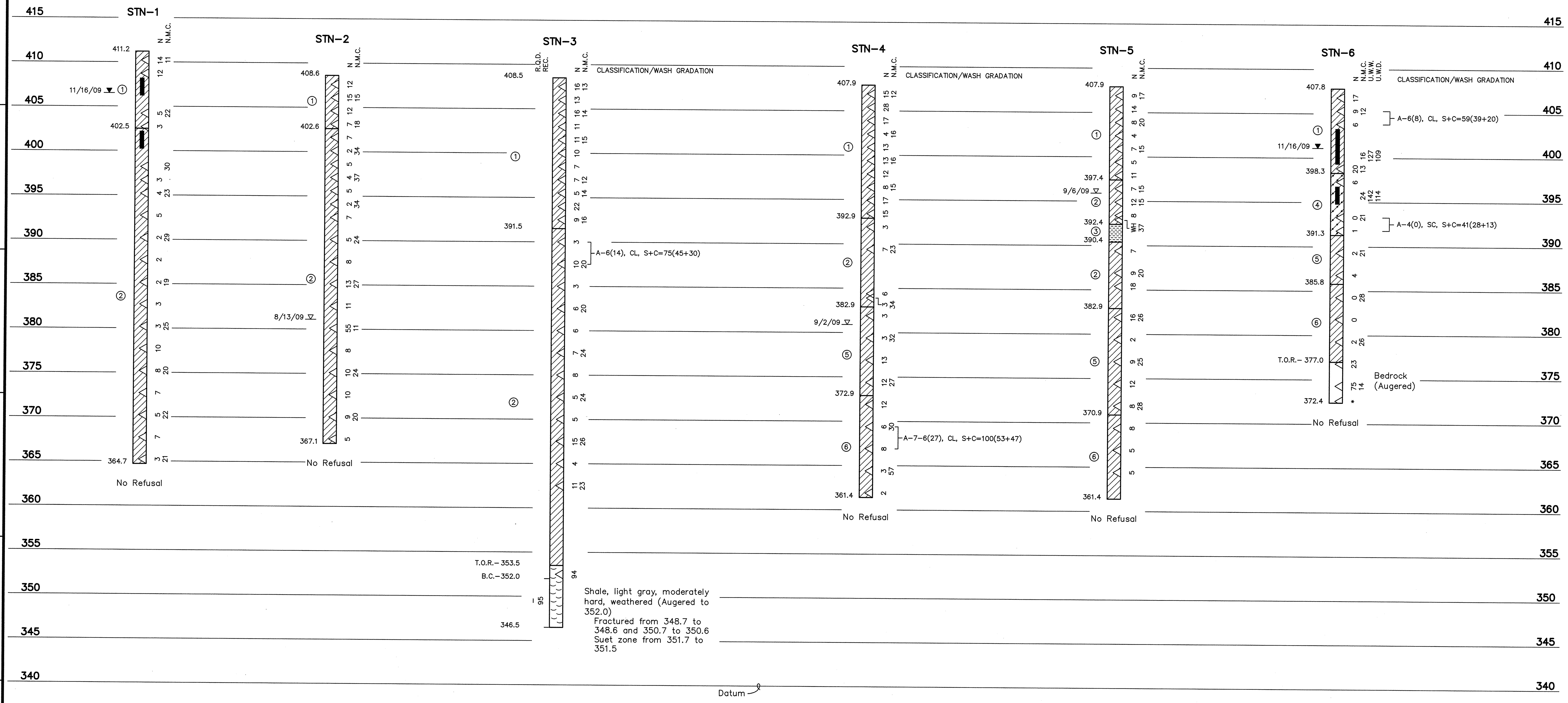
CHECKED BY	SV	SCALE	NTS	2.	4.	

Appendix D

Graphical Logs of Borings



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

LEGEND

① MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments

② MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments

③ BOTTOM ASH: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments

④ Clayey sand, brown to grayish brown, moist to wet and loose to medium dense

⑤ Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments

⑥ Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count (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)
8/11/09 ▽	Water Level 30 minutes after Drilling and Date Recorded
11/16/09 ▼	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.

NOTE:
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.

RECORD DRAWING

PLOT DATE: 08/18/2010 USER: FLYNN, RENEE
V:\1755\ACTIVE\175569069\GEOTECHNICAL\DRAWING\GEOTECH\VIEWS\RECORD\10W710-03.DWG

For Supporting Design Calculations see FPGPAFFESCDX00000020100006

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	08/18/10	SV	JRF	AM	SV	SV	HRA	TJ	–	–	–

R 0: RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' (VERTICAL ONLY) EXCEPT AS NOTED

YARD
–

PEABODY ASH POND
GEOTECHNICAL EXPLORATION
LOGS OF BORINGS

STATE OF KENTUCKY · HUGO R. APARICIO 17148 · LICENSED PROFESSIONAL ENGINEER

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
S. VEMURI	R. FLYNN	A. MORGAN	S. VEMURI	S. VEMURI	H. APARICIO	T. JOHNSON

Stantec Consulting Services Inc.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
Tel. 859.422.3000
Fax 859.422.3100
www.stantec.com

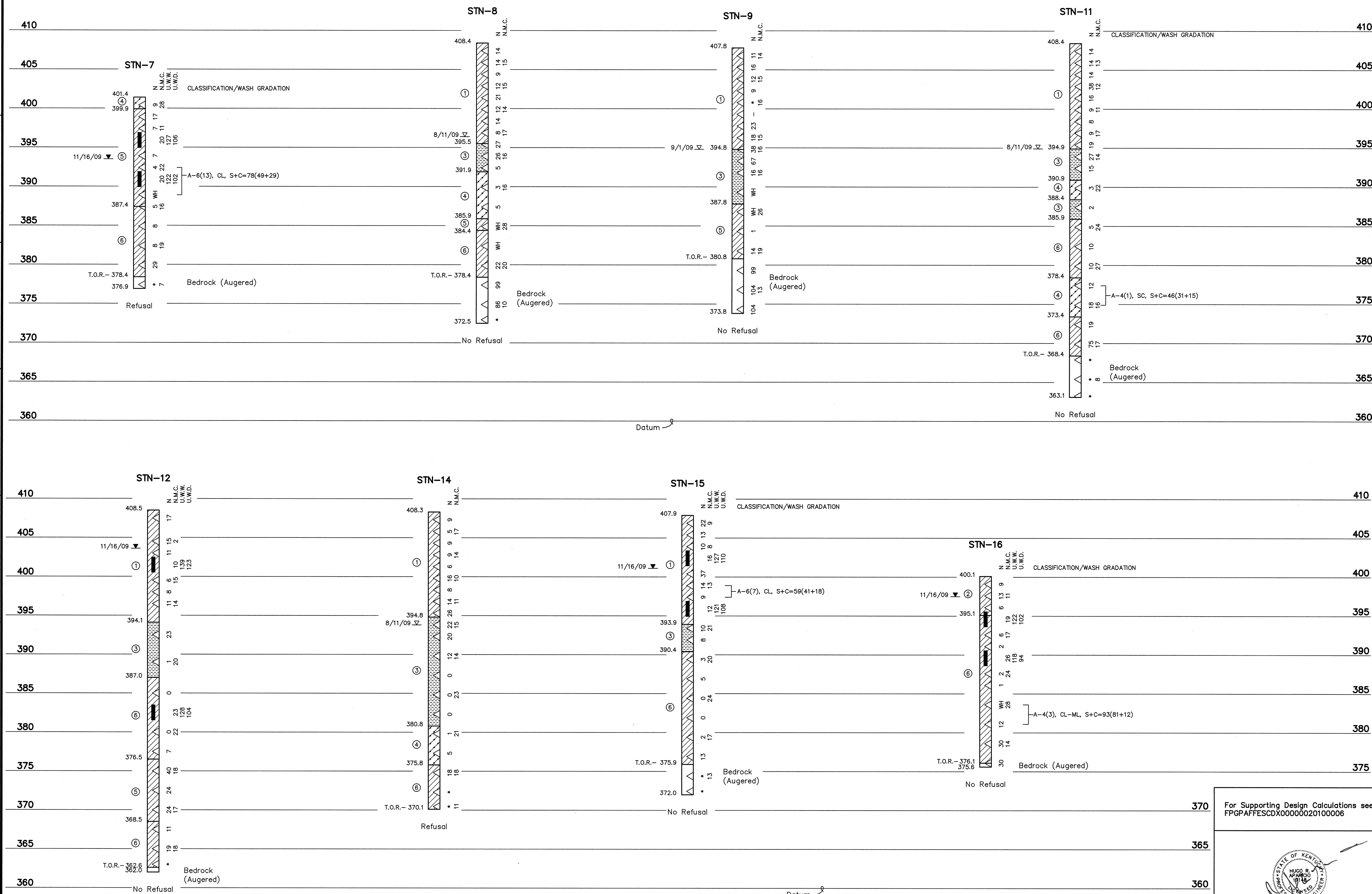
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 08/18/10	64	C	10W710-03	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

① MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments

② MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments

③ BOTTOM ASH: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments

④ Clayey sand, brown to grayish brown, moist to wet and loose to medium dense

⑤ Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments

⑥ Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count (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)
8/11/09 ▽	Water Level 30 minutes after Drilling and Date Recorded
11/16/09 ▼	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.

NOTE:
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.

RECORD DRAWING

For Supporting Design Calculations see FPGPAFFESCDX00000020100006

R 0 08/18/10 SV JRF AM SV SV HRA TJ
RECORD DRAWING

SCALE: 1"=5' (VERTICAL ONLY) EXCEPT AS NOTED

YARD

PEABODY ASH POND
GEOTECHNICAL EXPLORATION
LOGS OF BORINGS

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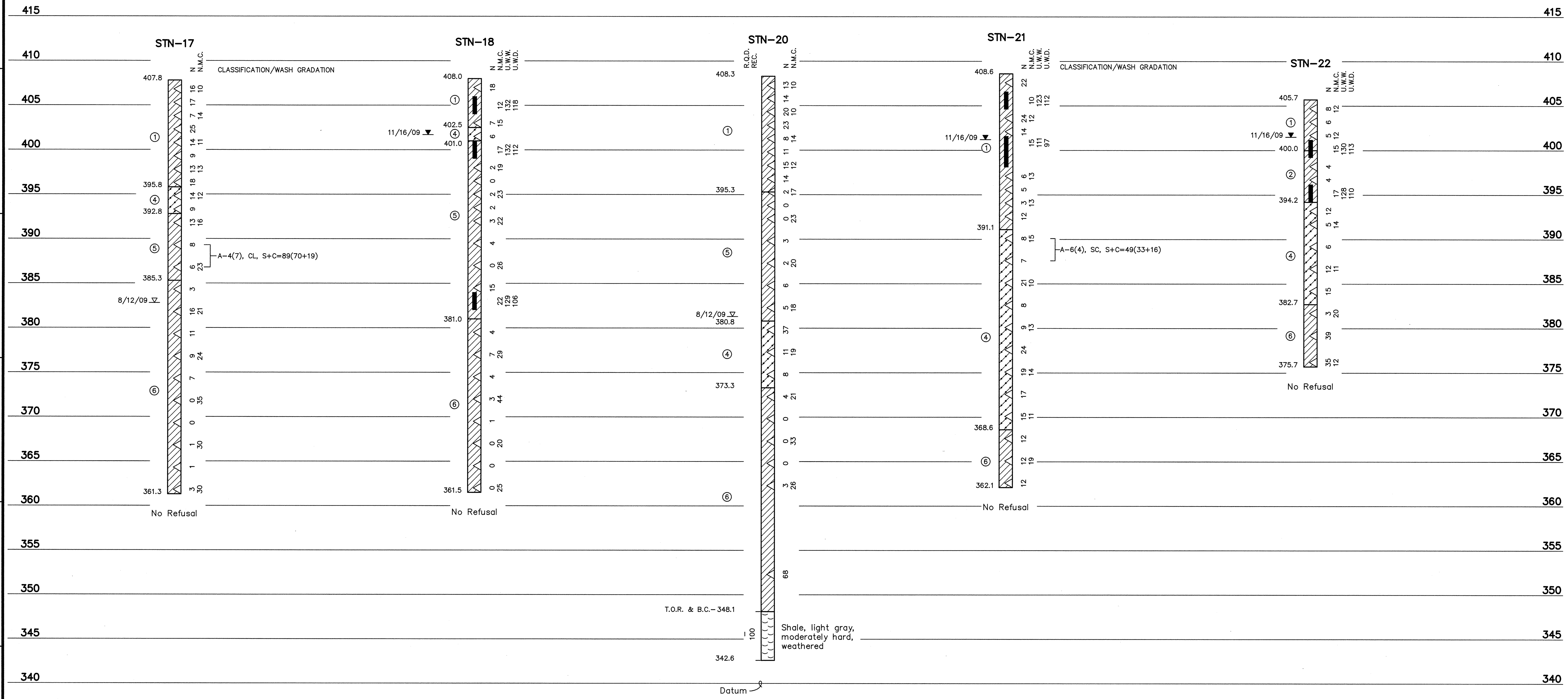
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 08/18/10 | 64 | C | 10W710-04 | R 0

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

64 | C | 10W710-05



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

LEGEND

①	MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments
②	MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments
③	BOTTOM ASH: Bottom ash with sand, black to dark brown, wet, loose to very loose and with fine to gravel sized coal fragments
④	Clayey sand, brown to grayish brown, moist to wet and loose to medium dense
⑤	Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments
⑥	Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments
WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count (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)
8/11/09 ▽	Water Level 30 minutes after Drilling and Date Recorded
11/16/09 ▼	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.)
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REC.	Recovery (%)
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No Refusal	No Refusal Encountered
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RECORD DRAWING

For Supporting Design Calculations see FPGPAFFESCDX00000020100006

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R –	–	–	–	–	–	–	–	–	–	–
R 0	08/18/10	SV	JRF	AM	SV	SV	HRA	TJ	–	–

RECORD DRAWING

SCALE: 1"=5' (VERTICAL ONLY) EXCEPT AS NOTED

YARD
–

PEABODY ASH POND
GEOTECHNICAL EXPLORATION
LOGS OF BORINGS

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PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 08/18/10 | 64 | C | 10W710–05 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

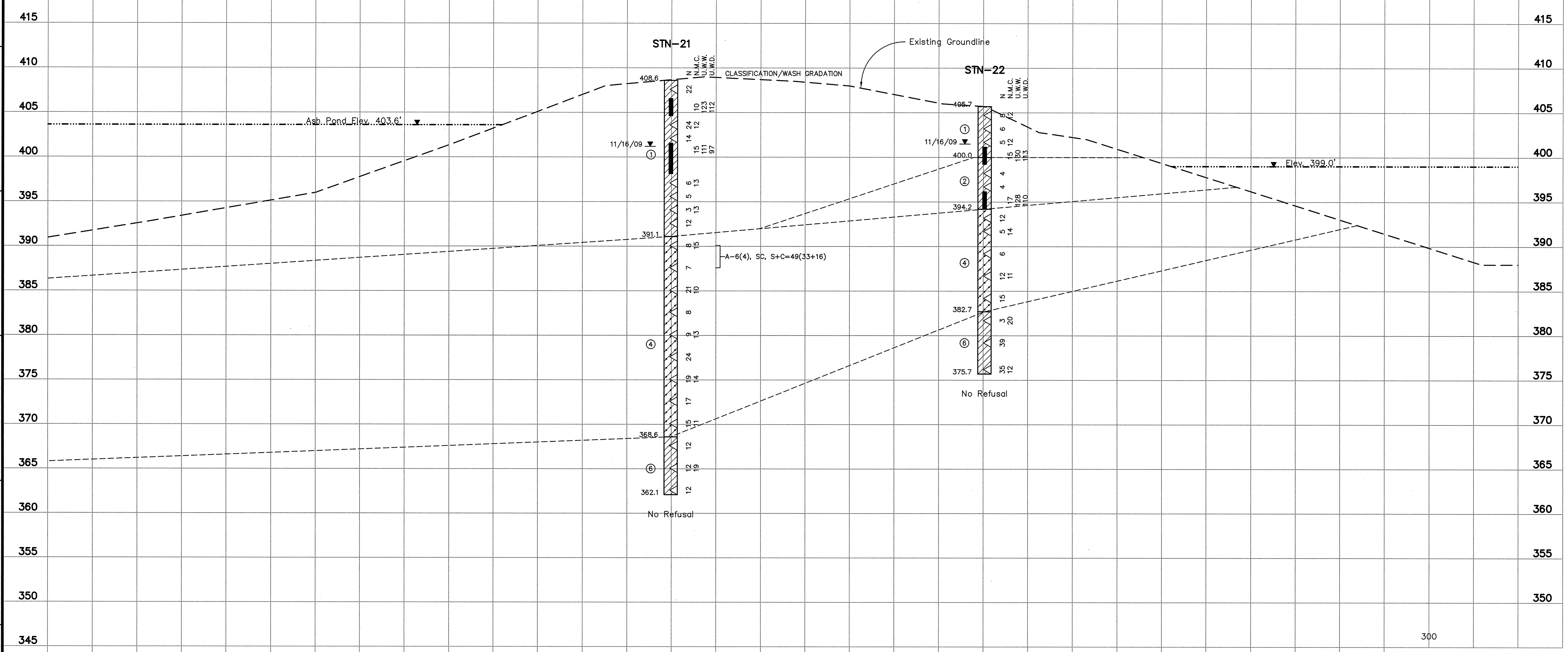
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

Appendix E

Typical Cross Section

64 | C | 10W710-06



CROSS SECTION A–A'
SCALE: 1"=5'

LEGEND

① MINESPOIL: Lean clay with intermediate sand lenses, brown to gray with some reddish mottling, moist to wet, soft to very stiff and with heterogeneous mixture of coal, shale, and chert fragments

② MINESPOIL: Lean clay with sand, olive gray to grayish brown with intermittent orange mottling, moist to wet, stiff to very stiff and with heterogeneous mixture of coal, shale, and chert fragments

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④ Clayey sand, brown to grayish brown, moist to wet and loose to medium dense

⑤ Lean clay, light to dark brown with orange mottling, moist to wet, soft to stiff and with occasional chert fragments

⑥ Silty clay, gray to brownish gray with some orange mottling, moist to wet, very soft to stiff, with some silt and traces of sand and occasional traces of coal and chert fragments

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count (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)
8/11/09 ▽	Water Level 30 minutes after Drilling and Date Recorded
11/16/09 ▼	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.

NOTE:

The subsurface soil horizons in between borings and beyond borings are in general based on straight line interpolation and straight line extension, respectively. The ground line shown below water (down stream side) is also approximate. No hydrographic survey of down stream pool was performed. No warranties can be made regarding the continuity of conditions between and beyond borings.

RECORD DRAWING

For Supporting Design Calculations see FPGPAFFESCDX00000020100006

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	08/18/10	SV	JRF	AM	SV	SV	HRA	TJ	–	–
RECORD DRAWING										

SCALE: 1"=5' (VERTICAL ONLY) EXCEPT AS NOTED

YARD

PEABODY ASH POND
GEOTECHNICAL EXPLORATION
CROSS SECTION A–A'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
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FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 08/18/10 | 64 | C | 10W710–06 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

Appendix F

Piezometer Readings

Stantec

PIEZOMETER
Summary Report
Paradise Fossil Plant:
Peabody Ash Pond
13246 State Route 176
175569069

		9/21/2009				10/20/2009				11/16/2009			
Location	Piezometer	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)	Surface Elevation (ft)	Stickup (ft)	Depth Measurement(ft)	Water Elevation (ft)
STN-1	PZ-1	411.1	-0.2			411.1	-0.2	4.3	406.6	411.1	-0.2	4.4	406.5
STN-6	PZ-6	407.8	-0.2	6.4	401.3	407.8	-0.2	6.5	401.1	407.8	-0.2	6.6	401.1
STN-7	PZ-7	401.4	-0.2	7.7	393.5	401.4	-0.2	11.4	389.8	401.4	-0.2	7.7	393.5
STN-12	PZ-12	408.5	-0.2			408.5	-0.2	4.7	403.6	408.5	-0.2	4.7	403.6
STN-15	PZ-15	407.9	-0.2	6.3	401.4	407.9	-0.2	6.5	401.2	407.9	-0.2	6.6	401.1
STN-16	PZ-16	400.1	-0.2	2.5	397.4	400.1	-0.2	2.0	397.9	400.1	-0.2	2.3	397.5
STN-18	PZ-18	408.0	-0.2			408.0	-0.2	6.4	401.5	408.0	-0.2	6.2	401.7
STN-21	PZ-21	408.6	-0.2	6.1	402.3	408.6	-0.2	6.8	401.6	408.6	-0.2	7.1	401.2
STN-22	PZ-22	405.7	-0.3	4.8	400.7	405.7	-0.3	3.8	401.6	405.7	-0.3	4.0	401.5

Appendix G

Results of Laboratory Testing

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name TVA- PAF Peabody Ash Pond

Project Number 175569069
Tested By JF

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
STN-1, 0.0'-1.5'	1	10/29/09	Hom	3/8"			No	44.98	137.06	128.02	10.9
STN-1, 6.0'-7.5'	3	10/29/09	Hom	3/8"			No	44.71	184.10	159.42	21.5
STN-1, 12.0'-13.5'	5	10/29/09	Hom	No. 4			No	44.31	161.27	134.34	29.9
STN-1, 15.0'-16.5'	7	10/29/09	Hom	1 1/2"			No	49.14	104.31	93.86	23.4
STN-1, 20.0'-21.5'	9	10/29/09	Hom	3/8"			No	42.15	114.15	98.11	28.7
STN-1, 25.0'-26.5'	11	10/29/09	Hom	1 1/2"			No	51.25	143.32	128.58	19.1
STN-1, 30.0'-31.5'	13	10/29/09	Hom	No. 10			Yes	44.46	156.92	134.81	24.5
STN-1, 35.0'-36.5'	15	10/29/09	Hom	No. 10			Yes	51.67	176.76	155.73	20.2
STN-1, 40.0'-41.5'	17	10/29/09	Hom	1 1/2"			No	31.07	116.03	100.59	22.2
STN-1, 45.0'-46.5'	19	10/29/09	Hom	3/8"			No	39.60	143.83	125.48	21.4
STN-2, 1.5'-3.0'	21	10/27/09		3/4"			No	20.88	47.05	43.59	15.2
STN-2, 4.5'-6.0'	23	10/27/09	Hom	1 1/2"			No	23.41	80.59	71.71	18.4
STN-2, 7.5'-9.0'	25	10/27/09	Hom	No. 10			Yes	22.40	77.86	63.79	34.0
STN-2, 13.5'-15.0'	27	10/27/09	Hom	No. 4			No	21.52	71.19	58.59	34.0
STN-2, 17.5'-19.0'	29	10/27/09	Hom	No. 10			Yes	21.72	71.94	62.18	24.1
STN-2, 22.5'-24.0'	31	10/27/09	Hom	No. 4			No	21.58	65.54	56.13	27.2
STN-2, 27.5'-29.0'	33	10/27/09		1 1/2"			No	21.84	30.88	29.97	11.2
STN-2, 32.5'-34.0'	35	10/27/09	Hom	No. 4			No	21.70	96.22	81.88	23.8
STN-2, 37.5'-39.0'	37	10/27/09	Hom	No. 4			No	21.39	86.66	75.77	20.0
STN-3, 0.0'-1.5'	39	10/27/09	Hom	1 1/2"			No	45.49	138.24	127.28	13.4
STN-3, 3.0'-4.5'	41	10/27/09	Hom	3/4"			No	46.23	187.33	169.57	14.4
STN-3, 6.0'-7.5'	43	10/27/09	Len	1 1/2"			No	77.69	270.13	245.17	14.9
STN-3, 12.0'-13.5'	45	10/27/09	Hom	1 1/2"			No	48.89	210.57	190.80	13.9
STN-3, 15.0'-16.5'	47	10/27/09	Hom	1 1/2"			No	73.92	173.00	159.71	15.5
STN-3, 20.0'-21.5'	49	10/27/09	Hom	3/4"			No	77.90	232.32	206.31	20.3
STN-3, 25.0'-26.5'	51	10/27/09	Hom	3/8"			No	20.48	62.14	55.23	19.9
STN-3, 30.0'-31.5'	53	10/27/09	Hom	No. 4			Yes	73.10	258.85	223.49	23.5
STN-3, 35.0'-36.5'	55	10/27/09	Hom	3/8"			No	72.47	267.44	230.20	23.6

Moisture Content of Soil
ASTM D 2216

Project Name TVA- PAF Peabody Ash Pond

Project Number 175569069
Tested By JF

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
STN-3, 40.0'-41.5'	57	10/27/09	Hom	1 1/2"			No	76.49	209.73	182.08	26.2
STN-3, 45.0'-46.5'	59	10/27/09	Hom	3/4"			No	21.23	89.29	76.47	23.2
STN-4, 1.5'-3.0'	62	10/26/09	Len	1 1/2"			No	75.86	191.03	178.40	12.3
STN-4, 4.5'-6.0'	64	10/26/09	Hom	3/8"			No	47.73	159.99	144.20	16.4
STN-4, 7.5'-9.0'	66	10/26/09	Hom	1 1/2"			No	43.80	162.51	146.15	16.0
STN-4, 13.5'-15.0' No sample	68	10/26/09									
STN-4, 17.5'-19.0'	70	10/26/09	Hom	3/4"			No	49.21	143.46	125.82	23.0
STN-4, 22.5'-24.0'	72	10/26/09	Hom	No. 4			Yes	71.78	230.68	190.23	34.1
STN-4, 27.5'-29.0'	74	10/26/09		No. 10			Yes	69.30	257.78	212.30	31.8
STN-4, 32.5'-34.0'	76	10/26/09	Hom	3/8"			No	53.19	187.84	159.47	26.7
STN-4, 37.5'-39.0'	78	10/26/09	Hom	No. 10			Yes	73.22	233.62	196.64	30.0
STN-4, 42.5'-44.0'	80	10/26/09	Hom	No. 10			Yes	70.66	222.76	167.80	56.6
STN-5, 0.0'-1.5'	82	10/26/09	Hom	3/8"			No	21.73	65.82	59.53	16.6
STN-5, 3.0'-4.5'	84	10/26/09	Hom	3/8"			No	18.80	68.84	60.53	19.9
STN-5, 6.0'-7.5'	86	10/26/09	Hom	1 1/2"			No	20.97	60.74	55.53	15.1
STN-5, 12.0'-13.5'	88	10/27/09	Hom	1 1/2"			No	47.99	180.56	163.67	14.6
STN-5, 15.0'-16.5'	90	10/27/09	Hom	3/8"			No	46.42	153.88	125.07	36.6
STN-5, 20.0'-21.5'	92	10/27/09		3/4"			No	48.94	154.41	137.22	19.5
STN-5, 25.0'-26.5'	94	10/27/09	Hom	No. 4			No	44.12	137.09	117.69	26.4
STN-5, 30.0'-31.5'	96	10/27/09	Hom	No. 4			No	47.21	137.63	119.81	24.5
STN-5, 35.0'-36.5'	98	10/27/09	Hom	No. 10			Yes	45.60	144.46	122.94	27.8
STN-5, 40.0'-41.5' No Sample	100	11/2/09									
STN-6, 1.5'-3.0'	103	10/29/09	Hom	3/4"			No	41.44	160.41	147.33	12.4
STN-6, 8.0'-9.5'	105	10/29/09	Hom	3/8"			No	49.09	116.97	109.29	12.8
STN-6, 13.5'-15.0'	107	10/29/09		3/4"			No	22.99	82.69	72.36	20.9
STN-6, 17.5'-19.0'	109	10/29/09	Hom	No. 4			No	19.65	62.33	55.06	20.5
STN-6, 22.5'-24.0'	111	10/29/09	Hom	No. 10			Yes	19.75	67.83	57.42	27.6
STN-6, 27.5'-29.0'	113	10/29/09	Hom	3/4"			No	21.16	79.65	67.51	26.2
STN-6, 32.5'-34.0'	115	10/29/09	Hom	No. 10			Yes	20.21	69.16	63.04	14.3
STN-7, 0.0'-1.5'	117	10/29/09	Hom	3/4"			No	19.92	67.03	56.84	27.6
STN-7, 3.0'-4.5'	119	10/29/09	Hom	No. 4			No	20.25	74.12	68.61	11.4

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name TVA- PAF Peabody Ash Pond

Project Number 175569069
Tested By JF

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
STN-7, 8.0'-9.5'	121	10/29/09	Hom	3/4"			No	21.73	74.27	64.84	21.9
STN-7, 13.0'-14.5'	123	10/29/09	Hom	No. 4			No	20.62	72.34	65.17	16.1
STN-7, 18.0'-19.5'	125	10/29/09	Hom	No. 4			No	22.85	78.29	69.62	18.5
STN-7, 23.0'-24.5'	127	10/29/09	Hom	No. 10			Yes	22.27	78.35	74.57	7.2
STN-8, 1.5'-3.0'	129	10/27/09	Hom	No. 4			No	22.90	80.72	73.20	15.0
STN-8, 4.5'-6.0'	131	10/27/09	Hom	1 1/2"			No	21.04	65.22	59.60	14.6
STN-8, 7.5'-9.0'	133	10/27/09	Hom	3/4"			No	18.98	63.03	57.75	13.6
STN-8, 13.5'-15.0'	135	10/27/09		3/4"			No	21.73	72.73	65.69	16.0
STN-8, 17.5'-19.0'	137	10/27/09	Hom	No. 4			No	21.53	87.59	78.29	16.4
STN-8, 22.5'-24.0'	139	10/27/09	Hom	No. 10			Yes	21.49	93.30	77.52	28.2
STN-8, 27.5'-29.0'	141	10/27/09	Len	No. 4			No	21.69	81.10	71.14	20.1
STN-8, 32.5'-34.0'	143	10/27/09	Hom	No. 4			No	21.53	92.65	86.01	10.3
STN-9, 0.0'-1.5'	145	10/27/09		1 1/2"			No	18.76	61.21	55.95	14.1
STN-9, 3.0'-4.5'	147	10/27/09	Hom	3/4"			No	21.78	83.58	75.41	15.2
STN-9, 6.0'-7.5'	149	10/27/09	Hom	3/4"			No	22.57	72.92	66.13	15.6
STN-9, 12.0'-13.5'	151	10/27/09		3/8"			No	21.85	91.45	82.05	15.6
STN-9, 15.0'-16.5'	153	10/27/09		1 1/2"			No	21.27	95.58	85.30	16.1
STN-9, 20.0'-21.5'	155	10/27/09	Hom	3/8"			No	22.91	97.85	82.42	25.9
STN-9, 25.0'-26.5'	157	10/27/09	Hom	3/4"			No	21.82	80.79	71.25	19.3
STN-9, 30.0'-31.5'	159	10/27/09	Hom	3/8"			No	21.79	92.88	85.00	12.5
STN-11, 1.5'-3.0'	162	10/27/09	Hom	3/4"			No	23.22	80.65	73.89	13.3
STN-11, 4.5'-6.0'	164	10/27/09	Hom	3/4"			No	20.81	69.67	64.27	12.4
STN-11, 7.5'-9.0'	166	10/27/09		3/4"			No	22.95	47.78	45.43	10.5
STN-11, 13.5'-13.9'	168A	10/27/09		3/4"			No	21.62	83.65	74.79	16.7
STN-11, 13.9'-15.0'	168B	10/27/09		3/4"			No	21.46	69.17	63.33	13.9
STN-11, 17.5'-19.0'	170	10/27/09		3/8"			No	21.68	79.16	68.69	22.3
STN-11, 22.5'-24.0'	172	10/27/09		3/4"			No	21.93	82.50	70.94	23.6
STN-11, 27.5'-29.0'	174	10/27/09	Hom	No. 10			Yes	21.44	75.13	63.83	26.7
STN-11, 32.5'-34.0'	176	10/27/09		No. 4			No	20.62	74.24	66.98	15.7
STN-11, 37.5'-39.0'	178	10/27/09	Hom	No. 4			No	22.56	80.53	72.04	17.2
STN-11, 42.5'-44.0'	180	10/27/09	Hom	No. 10			Yes	21.99	69.65	66.23	7.7

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Moisture Content of Soil
ASTM D 2216

Project Name TVA- PAF Peabody Ash Pond

Project Number 175569069
Tested By JF

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
STN-12, 0.0'-1.5' No Sample	182	11/1/09									
STN-12, 3.0'-4.5'	184	10/29/09		1 1/2"			No	46.98	112.68	111.53	1.8
STN-12, 8.0'-9.5'	186	10/29/09	Hom	1 1/2"			No	40.69	173.52	156.21	15.0
STN-12, 11.0'-12.5'	188	10/29/09	Hom	3/4"			No	43.84	186.09	168.68	13.9
STN-12, 18.5'-20.0'	190	10/29/09		3/4"			No	44.08	84.85	77.96	20.3
STN-12, 27.5'-29.0'	192	10/29/09	Hom	No. 10			Yes	44.93	163.57	142.38	21.7
STN-12, 32.5'-34.0'	194	10/29/09	Hom	No. 4			Yes	43.74	198.60	175.36	17.7
STN-12, 37.5'-39.0'	196	10/29/09		1 1/2"			No	43.80	169.34	151.59	16.5
STN-12, 42.5'-44.0'	198	10/29/09	Hom	1 1/2"			No	44.21	172.75	153.22	17.9
STN-14, 1.5'-3.0'	201	10/28/09	Hom	3/4"			No	73.75	203.98	184.66	17.4
STN-14, 4.5'-6.0'	203	10/28/09	Hom	3/4"			No	75.71	263.14	240.00	14.1
STN-14, 7.5'-9.0'	205	10/28/09	Hom	1 1/2"			No	74.34	261.12	243.83	10.2
STN-14, 10.5'-12.0'	207	10/28/09	Lam	1 1/2"			No	71.71	182.31	171.66	10.7
STN-14, 13.5'-15.0'	209	10/28/09		3/4"			No	71.16	202.72	185.32	15.2
STN-14, 17.5'-19.0'	211	10/28/09		No. 4			Yes	74.15	209.38	192.52	14.2
STN-14, 22.5'-24.0'	213	10/28/09		3/8"			No	73.27	169.23	151.20	23.1
STN-14, 27.5'-29.0'	215	10/28/09		3/8"			No	70.60	208.04	184.58	20.6
STN-14, 32.5'-34.0'	217	10/28/09	Len	No. 4			Yes	72.74	208.04	187.50	17.9
STN-14, 37.5'-39.0'	219	10/28/09	Lam	No. 4			Yes	76.90	253.30	235.97	10.9
STN-15, 0.0'-1.5'	220	10/29/09	Hom	3/4"			No	23.33	78.34	73.72	9.2
STN-15, 3.0'-4.5'	222	10/29/09	Hom	3/4"			No	22.03	78.33	74.18	8.0
STN-15, 8.0'-9.5'	224	10/29/09	Hom	1 1/2"			No	22.44	72.58	66.72	13.2
STN-15, 13.5'-15.0'	226	10/29/09		3/4"			No	24.79	85.28	74.87	20.8
STN-15, 17.5'-19.0'	228	10/29/09	Hom	No. 4			No	22.71	77.93	68.91	19.5
STN-15, 22.5'-24.0'	230	10/29/09	Hom	No. 10			Yes	21.54	82.00	70.44	23.6
STN-15, 27.5'-29.0'	232	10/29/09	Hom	3/8"			No	21.86	92.92	82.51	17.2
STN-15, 32.5'-34.0'	234	10/29/09	Hom	No. 4			No	23.14	89.29	81.77	12.8
STN-16, 1.5'-3.0'	237	10/29/09	Len	No. 4			Yes	75.51	187.39	176.67	10.6
STN-16, 6.5'-8.0'	239	10/29/09	Hom	No. 10			Yes	70.59	235.76	212.41	16.5
STN-16, 11.5'-13.0'	241	10/29/09	Hom	No. 10			Yes	71.48	157.97	141.09	24.2
STN-16, 15.5'-17.0'	243	10/29/09	Hom	No. 10			Yes	75.12	190.92	165.49	28.1

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name TVA- PAF Peabody Ash Pond

Project Number 175569069
Tested By JF

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
STN-16, 20.5'-22.0'	245	10/29/09	Hom	No. 4			Yes	69.84	208.84	191.72	14.0
STN-17, 0.0'-1.5'	247	10/28/09	Len	3/4"			No	47.11	193.00	179.36	10.3
STN-17, 3.0'-4.5'	249	10/28/09	Hom	3/4"			No	50.46	144.51	132.74	14.3
STN-17, 6.0'-7.5'	251	10/28/09	Hom	3/4"			No	44.63	185.36	171.72	10.7
STN-17, 9.0'-10.5'	253	10/28/09	Hom	3/8"			No	46.82	194.00	177.54	12.6
STN-17, 12.0'-13.5'	255	10/28/09		No. 4			Yes	41.53	171.93	157.99	12.0
STN-17, 15.0'-16.5'	257	10/28/09	Hom	No. 10			Yes	50.04	174.18	156.93	16.1
STN-17, 20.0'-21.5'	259	10/28/09	Hom	No. 10			Yes	44.54	176.86	152.55	22.5
STN-17, 25.0'-26.5'	261	10/28/09	Hom	No. 10			Yes	47.75	191.06	165.81	21.4
STN-17, 30.0'-31.5'	263	10/28/09	Hom	No. 4			No	44.38	157.18	135.32	24.0
STN-17, 35.0'-36.5'	265	10/28/09	Hom	No. 10			Yes	49.52	156.43	128.73	35.0
STN-17, 40.0'-41.5'	267	10/28/09	Hom	No. 10			Yes	47.70	157.38	131.92	30.2
STN-17, 45.0'-46.5'	269	10/28/09	Hom	No. 10			Yes	43.56	140.56	117.96	30.4
STN-18, 4.0'-5.5'	271	10/28/09	Hom	No. 4			Yes	44.58	183.21	165.05	15.1
STN-18, 9.0'-10.5'	273	10/28/09	Hom	3/8"			No	43.59	189.46	165.95	19.2
STN-18, 12.0'-13.5'	275	10/28/09	Len	No. 4			No	44.62	152.45	131.98	23.4
STN-18, 15.0'-16.5'	277	10/28/09		1 1/2"			No	50.86	155.02	136.28	21.9
STN-18, 20.0'-21.5'	279	10/28/09		No. 10			Yes	51.39	164.32	141.02	26.0
STN-18, 25.0'-26.5' No sample	281	10/28/09									
STN-18, 30.0'-31.5'	283	10/28/09	Hom	No. 10			Yes	44.05	168.94	140.97	28.9
STN-18, 35.0'-36.5'	285	10/28/09	Hom	No. 10			Yes	43.76	154.74	120.86	43.9
STN-18, 40.0'-41.5'	287	10/28/09	Hom	No. 10			Yes	47.56	188.34	165.26	19.6
STN-18, 45.0'-46.5'	289	10/28/09	Hom	No. 10			Yes	22.40	100.19	84.72	24.8
STN-20, 0.0'-1.5'	290	10/28/09	Len	3/8"			No	46.95	192.82	179.14	10.3
STN-20, 3.0'-4.5'	292	10/28/09	Len	1 1/2"			No	74.19	269.30	252.08	9.7
STN-20, 6.0'-7.5'	294	10/28/09	Len	1 1/2"			No	76.13	237.60	217.23	14.4
STN-20, 9.0'-10.5'	296	10/28/09	Hom	3/4"			No	43.90	181.24	166.08	12.4
STN-20, 12.0'-13.5'	298	10/28/09	Hom	3/4"			No	71.17	280.95	250.36	17.1
STN-20, 15.0'-16.5'	300	10/28/09	Hom	No. 10			Yes	70.13	217.19	190.03	22.7
STN-20, 20.0'-21.5'	302	10/28/09	Hom	1 1/2"			No	70.74	164.42	148.71	20.1
STN-20, 25.0'-26.5'	304	10/28/09	Len	3/8"			No	69.38	208.07	186.58	18.3

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name TVA- PAF Peabody Ash Pond

Project Number 175569069
Tested By JF

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

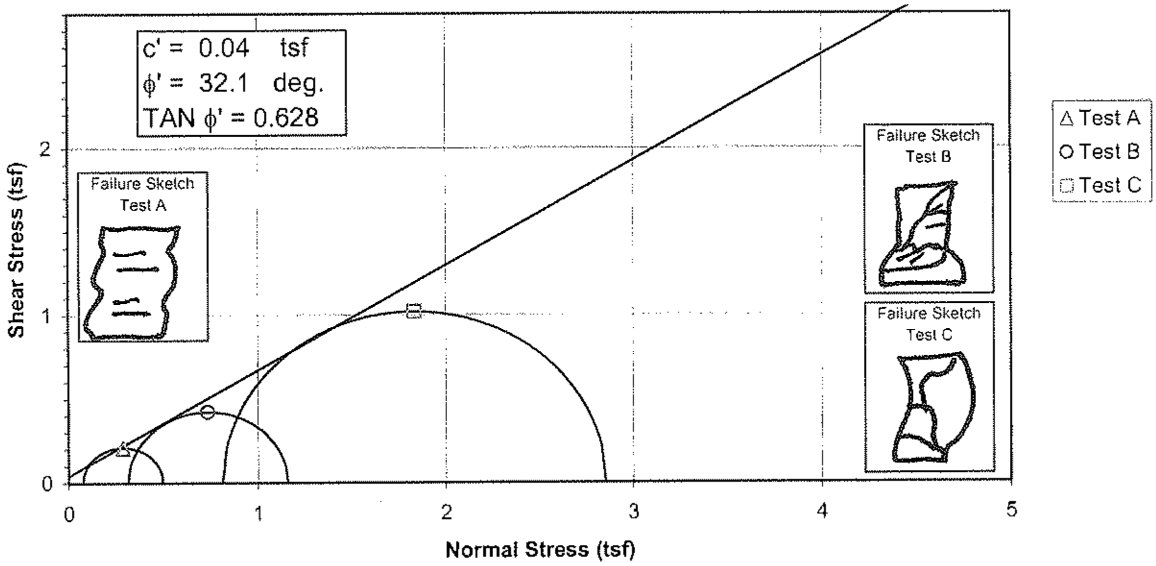
Test Method ASTM

Material Type: Stratified, Laminated, Lensed, Homogeneous

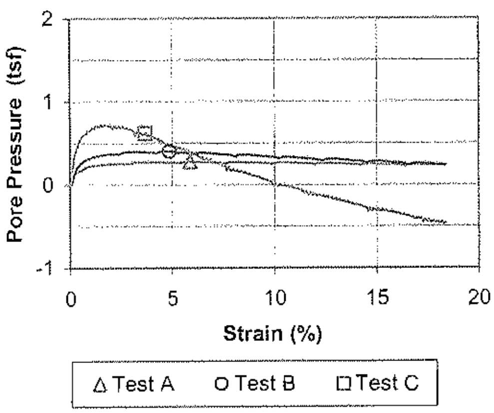
Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
STN-20, 30.0'-31.5'	306	10/28/09		No. 4			Yes	71.79	217.79	194.84	18.7
STN-20, 35.0'-36.5'	308	10/28/09		No. 10			Yes	71.20	269.40	235.29	20.8
STN-20, 40.0'-41.5'	310	10/28/09	Hom	No. 10			Yes	70.30	189.35	159.84	33.0
STN-20, 45.0'-46.5'	312	10/28/09	Hom	No. 10			Yes	49.87	150.29	129.52	26.1
STN-21, 4.0'-5.5'	315	10/28/09	Hom	No. 4			Yes	72.20	249.52	230.87	11.8
STN-21, 10.5'-12.0'	317	10/28/09	Hom	3/4"			No	72.89	252.02	231.06	13.3
STN-21, 13.5'-15.0'	319	10/28/09	Hom	1 1/2"			No	72.23	230.08	211.39	13.4
STN-21, 17.5'-19.0'	321	10/28/09	Hom	3/4"			No	70.39	193.11	176.86	15.3
STN-21, 22.5'-24.0'	323	10/29/09	Hom	3/4"			No	71.34	271.86	253.63	10.0
STN-21, 27.5'-29.0'	325	10/29/09		1 1/2"			No	77.11	225.27	208.25	13.0
STN-21, 32.5'-34.0'	327	10/29/09	Hom	1 1/2"			No	75.08	254.35	232.16	14.1
STN-21, 37.5'-39.0'	329	10/29/09		1 1/2"			No	49.45	181.21	168.25	10.9
STN-21, 42.5'-44.0'	331	10/29/09		3/4"			No	44.88	164.06	144.70	19.4
STN-22, 0.0'-1.5'	333	10/30/09		3/4"			No	76.72	144.10	137.00	11.8
STN-22, 3.0'-4.5'	335	10/30/09		1 1/2"			No	76.10	105.21	102.09	12.0
STN-22, 8.0'-9.5' No Recovery	337	10/30/09									
STN-22, 13.0'-14.5'	339	10/30/09		3/4"			No	75.83	171.28	159.82	13.6
STN-22, 18.0'-19.5'	341	10/30/09	Hom	3/4"			No	72.00	190.18	178.22	11.3
STN-22, 23.0'-24.5'	343	10/30/09		1 1/2"			No	74.70	151.09	138.65	19.5
STN-22, 28.5'-30.0'	345	10/30/09	Hom	1 1/2"			No	71.63	234.96	216.91	12.4
STN-2, 10.5'-12.0'	347	10/30/09	Hom	No. 10			Yes	45.22	149.94	121.48	37.3
STN-3, 10.5'-12.0'	349	10/30/09	Hom	1 1/2"			No	71.11	177.22	165.75	12.1
STN-4, 10.5'-12.0'	351	10/30/09	Len	3/4"			No	70.82	217.33	198.47	14.8
STN-5, 10.5'-12.0'	353	10/30/09	Hom	No. 4			No	43.89	137.76	125.30	15.3
STN-8, 10.5'-12.0'	355	10/30/09	Hom	3/8"			No	39.73	124.93	112.71	16.7
STN-9, 10.5'-12.0'	357	10/30/09	Len	3/4"			No	40.80	137.15	124.52	15.1
STN-11, 10.5'-12.0'	359	10/30/09	Hom	1 1/2"			No	47.54	116.45	106.55	16.8

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	11.4	12.5	13.0	
	Dry Density PCF	γ_{d_o}	108.2	111.8	116.8	
	Saturation %	S_o	55.4	67.2	80.0	
	Void Ratio	e_o	0.552	0.502	0.438	
After Shear	Water content %	W_f	18.1	15.2	14.1	
	Dry Density PCF	γ_{d_f}	113.0	119.2	121.7	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.486	0.409	0.379	
	Final Back Pressure TSF	u_c	6.12	5.76	5.04	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.08	0.31	0.82	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	0.42	0.84	2.03	
Time to (σ1'-σ3')max min.		t_f	30.2	25.9	176.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.859	2.860	2.836	
Initial Height, in.		H_o	5.977	6.091	5.949	

Controlled - Strain Test

Description of Specimens Lean Clay (CL), gray, moist, firm, mine spoil

	Type of Specimen	Undisturbed	Type of test	$\overline{R}$	
LL	PL	PI	Gs 2.69	Project	PAF - Peabody Ash Pond
Remarks:				Boring No.	STN-21 (M1), STN-15 (M1), STN-6 (M1)
				Sample No.	1
				Depth Elev.	2.8'-3.4', 5.3'-5.9', 6.5'-7.4'
				Laboratory	Stantec — Date 12-19-09

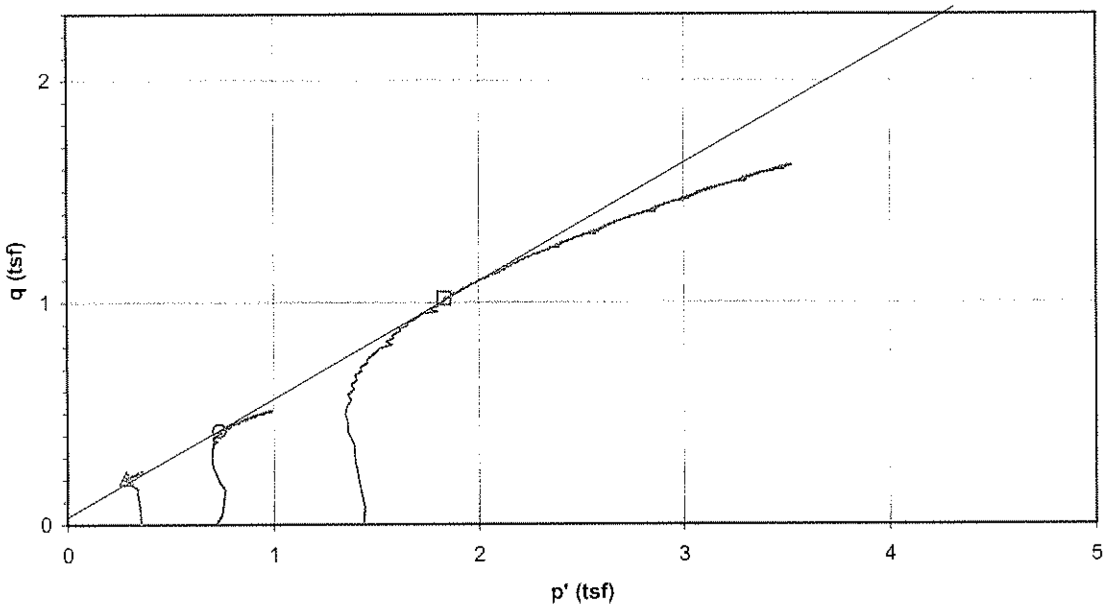
TRIAXIAL COMPRESSION TEST REPORT

KDG GV

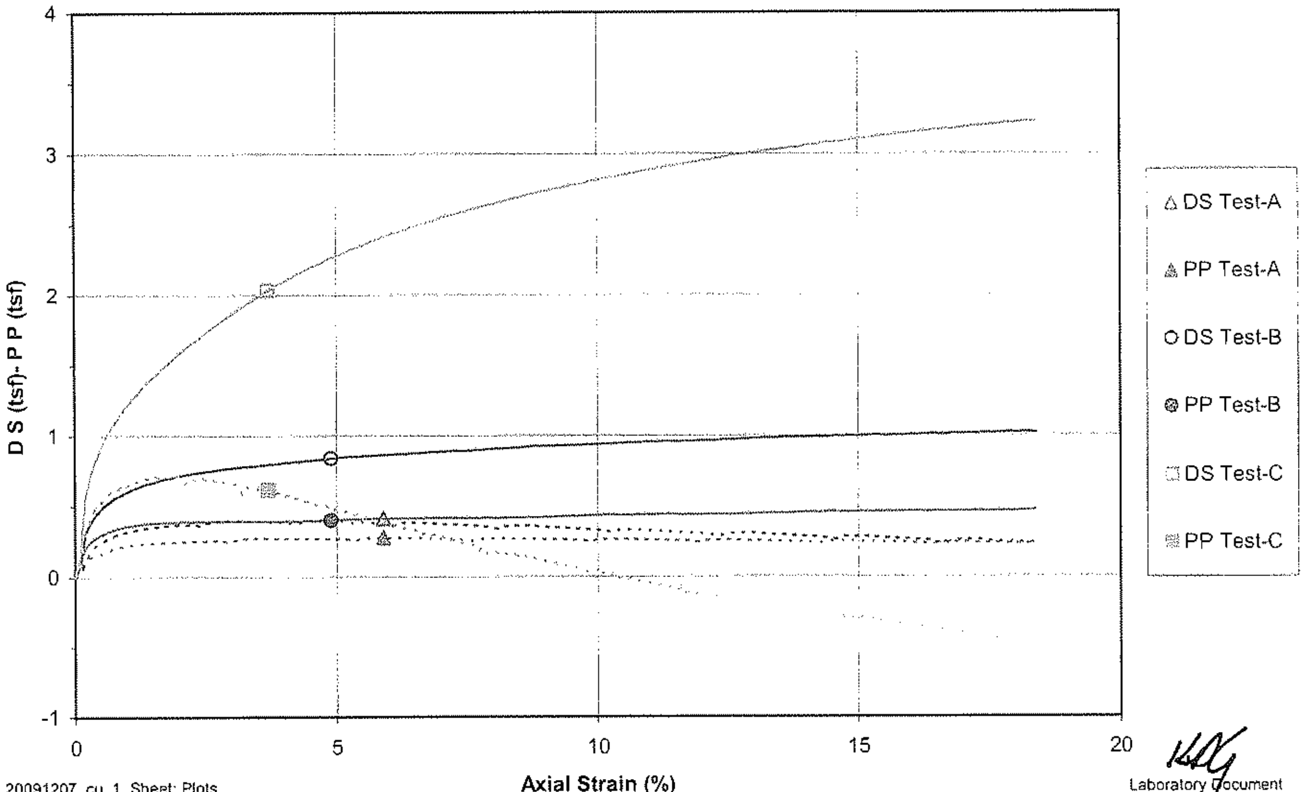
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project: PAF - Peabody Ash Pond
Project No.: 175569069
Sample ID: STN-21 (M1), 2.8'-3.3' & STN-15 (M1), 5.3'-5.8' & STN-6 (M1), 6.5'-7.0'
Test Number: 1
Failure Criterion: Maximum Effective Principal Stress Ratio
ϕ' = 32.1 deg.
c' = 0.04 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



File: frm_20091207_cu_1 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-21 (M1), 2.8'-3.3'	Test Number	CU-1A
Visual Description	Lean Clay (CL), gray, moist, firm, mine spoil	Prepared By	MC
Undisturbed	Source STN-21 (M1), 2.8'-3.4'	Date	12-8-2009

Specific Gravity 2.69 ASTM D854 Method A Liquid Limit N/A Plastic Limit N/A Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.859	1	5.967	Sample	38.3635 (V_o)	Wet Weight (g)	1214.11
Middle	2.861	2	5.962	Solids	24.7317 (VS_o)	Dry Weight (g)	1090.27
Bottom	2.856	3	6.018	Water	7.5568 (Vw_o)	Wet Unit Weight (pcf)	120.6
Avg.	2.8587 (D_o)	4	5.963	Voids	13.6318 (Vv_o)	Dry Unit Weight (pcf)	108.3
Area (in^2)	6.4183 (A_o)	Avg. (H_o)	5.9773	Degree of Saturation (%)	55.4 (S_o)		
Moisture Content (%)	11.4	Final Trimmings		Void Ratio	0.551		

Saturation

Set Up & Saturated: Wet xx Dry

Back Pressure Saturated to: 85 (psi) Final Pore Pressure Parameter B 0.96

Set up By KDG

Date 12-9-09

Panel Board Number C

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1413	Initial	24.63 (in.)	Initial	10.08 (in.)	Specimen Height (in.)	5.9433 (H_s)
Final	0.1753	Final	0 (in.)	Final	11.94 (in.)	Area (in^2) Method A	6.3448 (A_s)
Change	-0.0340 (ΔH_o)	Change	-24.63 (in.)	Change	1.86 (in.)	Specimen Volume (in^3)	37.71 (Vs)

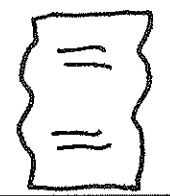
Consolidation

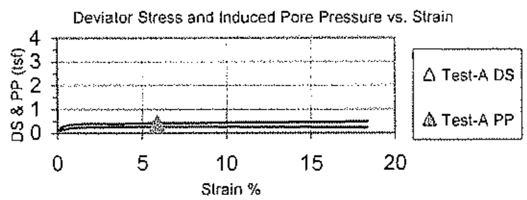
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1753	Initial	0.87 (in.)	Initial	16.17 (in.)	Chamber	90
Final	0.1965	Final	6.20 (in.)	Final	10.38 (in.)	Back	85
Change	-0.0212 (ΔH_c)	Change	-5.33 (in.)	Change	-5.79 (in.)	Lateral	5 (σ_3)
Height (in.)	5.9221 (H_c)			Volume (in^3)	36.7539 (V_c)		
Area (in^3) Method B	6.2063 (A_c)			Volume - Water (in^3)	12.0223 (VWc)	t_{50} (min.)	1.591
Diameter (in.)	2.8111 (D_c)			Water Content (%)	18.1		
Dry Density (pcf)	113.0			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.486

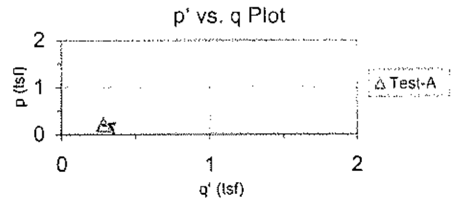
After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.351 (in.)	Wet Weight (g)	1287.29	Corrected Deviator	0.42 σ_d (tsf)
Wet weight (g)	1287.29 (WWf)	Dry Weight (g)	1090.27	Major Principal	0.50 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.327 (in.)	Tare Weight (g)	0.00	Minor Principal	0.08 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.196
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	5.90
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch







Comments: KDG

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-15 (M1), 5.3'-5.8'	Test Number	CU-1B
Visual Description	Lean Clay (CL), gray, moist, firm, mine spoil	Prepared By	MC
Undisturbed	Source STN-15 (M1), 5.3'-5.9'	Date	12-8-2009

Specific Gravity 2.69 ASTM D854 Method A   Liquid Limit N/A   Plastic Limit N/A   Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in3)		Specimen	
Top	2.880	1	6.093	Sample	39.1781 (V_o)	Wet Weight (g)	1292.68
Middle	2.855	2	6.091	Solids	26.0555 (VS_o)	Dry Weight (g)	1148.63
Bottom	2.850	3	6.090	Water	8.7900 (Vw_o)	Wet Unit Weight (pcf)	125.7
Avg.	2.8617 (D_o)	4	6.092	Voids	13.1226 (Vv_o)	Dry Unit Weight (pcf)	111.7
Area (in^2)	6.4317 (A_o)	Avg. (H_o)	6.0914	Degree of Saturation (%)	67.0 (S_o)		
Moisture Content (%)	12.5	Final Trimmings		Void Ratio	0.504		

Saturation

Set Up & Saturated: Wet xx Dry ____   Set up By KDG

Back Pressure Saturated to: 80 (psi)   Final Pore Pressure Parameter B 0.98   Date 12-9-09

Panel Board Number B

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1563	Initial	16.74 (in.)	Initial	10.88 (in.)	Specimen Height (in.)	6.0710 (H_s)
Final	0.1767	Final	0 (in.)	Final	14.57 (in.)	Area (in^2) Method A	6.3885 (A_s)
Change	-0.0204 (ΔH_o)	Change	-16.74 (in.)	Change	3.69 (in.)	Specimen Volume (in^3)	38.78 (V_s)

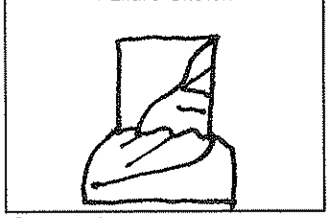
Consolidation

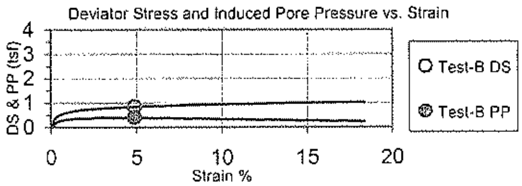
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1767	Initial	2.11 (in.)	Initial	17.74 (in.)	Chamber	90
Final	0.2018	Final	8.99 (in.)	Final	10.03 (in.)	Back	80
Change	-0.0251 (ΔH_c)	Change	-6.88 (in.)	Change	-7.71 (in.)	Lateral	10 (σ_3)
Height (in.)	6.0459 (H_c)			Volume (in^3)	36.7146 (V_c)		
Area (in^3) Method B	6.0727 (A_c)			Volume - Water (in^3)	10.6591 (VWc)	D_{50} (min.)	1.257
Diameter (in.)	2.7806 (D_c)			Water Content (%)	15.2		
Dry Density (pcf)	119.2			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.409

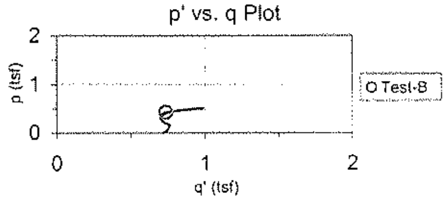
After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.75 (in.)	Wet Weight (g)	1323.31	Corrected Deviator	0.84 σ_d (tsf)
Wet weight (g)	1323.31 (WWf)	Dry Weight (g)	1148.63	Major Principal	1.16 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.726 (in.)	Tare Weight (g)	0.00	Minor Principal	0.31 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.191
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	4.91
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch







Comments: ______

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-6 (M1), 6.5'-7.0'	Test Number	CU-1C
Visual Description	Lean Clay with Sand (CL), gray, moist, firm, mine spoil	Prepared By	MC
Undisturbed	Source STN-6 (M1), 6.5'-7.4'	Date	12-8-2009

Specific Gravity 2.69 ASTM D854 Method A | Liquid Limit N/A | Plastic Limit N/A | Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in³)		Specimen	
Top	2.856	1	5.941	Sample	37.5512 (V_o)	Wet Weight (g)	1301.68
Middle	2.837	2	5.955	Solids	26.1283 (VS_o)	Dry Weight (g)	1151.84
Bottom	2.812	3	5.956	Water	9.1434 (Vw_o)	Wet Unit Weight (pcf)	132.1
Avg.	2.8350 (D_o)	4	5.944	Voids	11.4229 (Vv_o)	Dry Unit Weight (pcf)	116.9
Area (in²)	6.3124 (A_o)	Avg. (H_o)	5.9488	Degree of Saturation (%)	80.0 (S_o)		
Moisture Content (%)	13.0	Final Trimmings		Void Ratio	0.437		

Saturation

Set Up & Saturated: Wet xx Dry ____ | Set up By KDG

Back Pressure Saturated to: 70 (psi) | Final Pore Pressure Parameter B 0.97 | Date 12-9-09

Panel Board Number A

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1315	Initial	16.33 (in.)	Initial	12.23 (in.)	Specimen Height (in.)	5.9504 (H_s)
Final	0.1299	Final	9.46 (in.)	Final	12.46 (in.)	Area (in²) Method A	6.3158 (A_s)
Change	0.0016 (ΔH_o)	Change	-6.87 (in.)	Change	0.23 (in.)	Specimen Volume (in³)	37.58 (V_s)

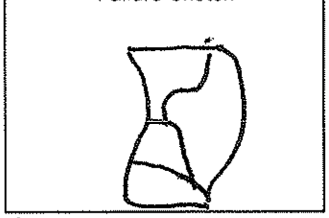
Consolidation

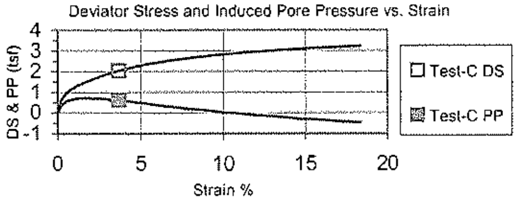
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1299	Initial	1.61 (in.)	Initial	17.28 (in.)	Chamber	90
Final	0.1667	Final	6.37 (in.)	Final	12.16 (in.)	Back	70
Change	-0.0368 (ΔH_c)	Change	-4.76 (in.)	Change	-5.12 (in.)	Lateral	20 (σ_3)
Height (in.)	5.9136 (H_c)			Volume (in³)	36.0424 (V_c)		
Area (in³) Method B	6.0949 (A_c)			Volume - Water (in³)	9.9141 (VWc)	D_{50} (min.)	16
Diameter (in.)	2.7857 (D_c)			Water Content (%)	14.1		
Dry Density (pcf)	121.7			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.379

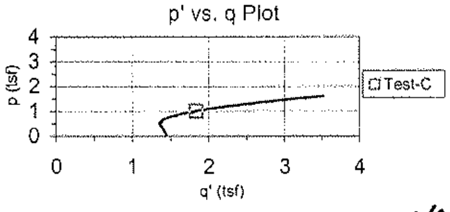
After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.376 (in.)	Wet Weight (g)	1314.31	Corrected Deviator	2.03 σ_d (tsf)
Wet weight (g)	1314.31 (WWf)	Dry Weight (g)	1151.84	Major Principal	2.85 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.352 (in.)	Tare Weight (g)	0.00	Minor Principal	0.82 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.021
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	3.70
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch







Comments: ____

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values				
Height	5.922 (in.)	15.042 (cm)	Height	4.833 (in.)	Tested By	KDG	Project Number: 175569069
Diameter	2.811 (in)	7.140 (cm)	Dia. avg.	3.258 (in)	Date	12-10-09	Test Number: CU-1A
Area	6.207 (in²)	40.043 (cm²)	Area avg.	8.335 (in²)	Press No.	1	Data File ID: 1A
					Panel No.	C	Lateral Pressure (psi): 5.0
							Chember Pressure - σ_3 (psi): 90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	13.7	-0.021	85.1	5.922	0.00	40.0429	0.0	0.000	0.000	0.360	0.360	0.356	0.358	0.002	1.011
0:00:40	24.0	-0.015	85.9	5.916	0.11	40.0857	10.3	0.119	0.119	0.479	0.415	0.293	0.354	0.061	1.419
0:01:12	31.6	-0.009	86.6	5.910	0.20	40.1241	17.9	0.208	0.207	0.567	0.454	0.243	0.348	0.105	1.867
0:01:43	35.4	-0.003	87.0	5.904	0.30	40.1642	21.7	0.251	0.250	0.610	0.469	0.216	0.343	0.127	2.177
0:02:13	38.0	0.003	87.3	5.898	0.40	40.2048	24.3	0.281	0.280	0.640	0.481	0.198	0.340	0.142	2.434
0:02:42	40.0	0.009	87.4	5.892	0.50	40.2451	26.2	0.303	0.302	0.662	0.494	0.189	0.341	0.153	2.621
0:03:11	41.5	0.015	87.5	5.887	0.60	40.2847	27.7	0.320	0.319	0.679	0.505	0.182	0.343	0.161	2.769
0:03:43	42.8	0.021	87.8	5.880	0.70	40.3262	29.1	0.336	0.334	0.694	0.493	0.156	0.325	0.169	3.167
0:04:12	43.7	0.027	88.0	5.875	0.80	40.3658	30.0	0.346	0.344	0.704	0.494	0.147	0.320	0.174	3.367
0:04:42	44.6	0.032	88.1	5.869	0.90	40.4067	30.9	0.356	0.353	0.713	0.495	0.138	0.316	0.179	3.592
0:05:14	45.4	0.038	88.2	5.863	1.00	40.4478	31.7	0.364	0.362	0.722	0.497	0.132	0.314	0.183	3.778
0:05:45	45.9	0.045	88.2	5.857	1.10	40.4902	32.1	0.369	0.366	0.726	0.498	0.127	0.312	0.185	3.904
0:06:15	46.3	0.050	88.3	5.851	1.20	40.5295	32.6	0.374	0.371	0.731	0.497	0.122	0.309	0.187	4.077
0:06:44	46.8	0.056	88.3	5.845	1.30	40.5710	33.1	0.379	0.376	0.736	0.500	0.120	0.310	0.190	4.159
0:07:15	47.2	0.062	88.4	5.839	1.40	40.6116	33.5	0.384	0.380	0.740	0.501	0.117	0.309	0.192	4.277
0:07:43	47.5	0.068	88.4	5.833	1.50	40.6529	33.7	0.386	0.382	0.742	0.501	0.115	0.308	0.193	4.351
0:08:14	47.7	0.074	88.4	5.827	1.61	40.6964	34.0	0.388	0.384	0.744	0.500	0.112	0.306	0.194	4.460
0:08:45	48.0	0.080	88.5	5.821	1.71	40.7376	34.3	0.391	0.387	0.747	0.501	0.110	0.305	0.195	4.544
0:09:14	48.0	0.086	88.5	5.815	1.80	40.7769	34.2	0.390	0.386	0.746	0.498	0.108	0.303	0.195	4.604
0:09:46	48.3	0.092	88.5	5.809	1.91	40.8215	34.6	0.394	0.390	0.750	0.500	0.107	0.303	0.197	4.686
0:10:17	48.5	0.098	88.5	5.803	2.00	40.8620	34.8	0.396	0.391	0.751	0.500	0.106	0.303	0.197	4.735
0:10:47	48.8	0.104	88.6	5.798	2.10	40.9022	35.1	0.399	0.394	0.754	0.502	0.104	0.303	0.199	4.813
0:11:16	48.5	0.109	88.6	5.792	2.20	40.9440	34.8	0.395	0.390	0.750	0.497	0.103	0.300	0.197	4.826
0:11:47	49.0	0.116	88.6	5.786	2.31	40.9878	35.3	0.400	0.394	0.754	0.500	0.102	0.301	0.199	4.921
0:12:18	48.7	0.121	88.6	5.780	2.40	41.0273	35.0	0.397	0.391	0.751	0.496	0.101	0.298	0.197	4.911
0:12:51	49.1	0.128	88.6	5.774	2.50	41.0718	35.3	0.400	0.394	0.754	0.497	0.099	0.298	0.199	5.000
0:13:22	49.2	0.133	88.6	5.768	2.60	41.1127	35.4	0.401	0.394	0.754	0.497	0.099	0.298	0.199	5.010
0:13:53	49.2	0.139	88.6	5.762	2.70	41.1547	35.5	0.401	0.395	0.755	0.498	0.099	0.299	0.199	5.008
0:14:26	49.1	0.145	88.6	5.756	2.81	41.1988	35.4	0.400	0.393	0.753	0.498	0.101	0.300	0.198	4.916
0:14:55	49.3	0.151	88.6	5.750	2.90	41.2395	35.6	0.402	0.394	0.754	0.502	0.104	0.303	0.199	4.831
0:15:26	49.4	0.157	88.5	5.744	3.00	41.2818	35.7	0.402	0.395	0.755	0.506	0.108	0.307	0.199	4.694
0:15:59	49.5	0.163	88.7	5.738	3.10	41.3252	35.8	0.403	0.395	0.755	0.490	0.091	0.291	0.200	5.377
0:16:30	49.4	0.169	88.8	5.733	3.20	41.3665	35.7	0.401	0.393	0.753	0.485	0.087	0.286	0.199	5.552
0:17:01	49.4	0.175	88.8	5.727	3.30	41.4091	35.6	0.400	0.392	0.752	0.481	0.085	0.283	0.198	5.654
0:17:34	49.7	0.180	88.8	5.721	3.40	41.4521	35.9	0.403	0.395	0.755	0.482	0.083	0.283	0.199	5.778
0:18:06	49.7	0.186	88.9	5.715	3.50	41.4951	36.0	0.404	0.395	0.755	0.481	0.082	0.282	0.199	5.840
0:18:38	49.7	0.192	88.9	5.709	3.60	41.5390	35.9	0.402	0.393	0.753	0.479	0.082	0.281	0.199	5.837
0:19:10	49.6	0.198	88.8	5.703	3.70	41.5822	35.9	0.401	0.392	0.752	0.480	0.085	0.282	0.198	5.675
0:19:41	49.8	0.204	88.8	5.697	3.80	41.6251	36.1	0.403	0.394	0.754	0.481	0.084	0.282	0.199	5.747
0:20:11	50.0	0.210	88.8	5.691	3.90	41.6685	36.2	0.404	0.395	0.755	0.483	0.084	0.284	0.199	5.717
0:20:41	49.9	0.216	88.8	5.685	4.00	41.7110	36.2	0.403	0.394	0.754	0.481	0.084	0.283	0.199	5.731
0:21:12	50.2	0.222	88.8	5.679	4.10	41.7550	36.5	0.406	0.396	0.756	0.485	0.085	0.285	0.200	5.731
0:21:42	50.3	0.228	88.8	5.673	4.20	41.7994	36.5	0.407	0.396	0.756	0.485	0.085	0.285	0.200	5.696
0:22:13	50.2	0.234	88.8	5.667	4.30	41.8428	36.4	0.405	0.394	0.754	0.483	0.085	0.284	0.199	5.692
0:22:42	50.5	0.240	88.8	5.662	4.40	41.8854	36.8	0.409	0.398	0.758	0.486	0.085	0.286	0.201	5.741
0:23:11	50.6	0.246	88.8	5.656	4.50	41.9294	36.8	0.408	0.397	0.757	0.487	0.086	0.286	0.201	5.687
0:23:42	50.5	0.252	88.8	5.650	4.60	41.9741	36.8	0.408	0.397	0.757	0.486	0.086	0.286	0.200	5.659
0:24:10	50.9	0.257	88.8	5.644	4.70	42.0177	37.1	0.411	0.400	0.760	0.489	0.086	0.288	0.202	5.687
0:24:40	51.3	0.263	88.8	5.638	4.80	42.0622	37.6	0.416	0.404	0.764	0.494	0.086	0.290	0.204	5.727
0:25:10	51.3	0.269	88.8	5.632	4.90	42.1060	37.5	0.415	0.403	0.763	0.493	0.086	0.289	0.203	5.707
0:25:40	51.3	0.275	88.8	5.626	5.00	42.1499	37.5	0.414	0.402	0.762	0.493	0.087	0.290	0.203	5.672
0:26:12	51.8	0.281	88.8	5.620	5.10	42.1956	38.1	0.419	0.407	0.767	0.498	0.088	0.293	0.205	5.678
0:26:42	52.0	0.287	88.7	5.614	5.20	42.2394	38.2	0.421	0.408	0.768	0.502	0.090	0.296	0.206	5.565
0:27:12	52.0	0.293	88.7	5.608	5.30	42.2840	38.3	0.421	0.408	0.768	0.505	0.093	0.299	0.206	5.421
0:27:42	52.2	0.299	88.6	5.602	5.40	42.3283	38.5	0.423	0.409	0.769	0.511	0.098	0.305	0.207	5.211
0:28:13	52.4	0.305	88.8	5.596	5.50	42.3737	38.7	0.424	0.411	0.771	0.499	0.084	0.291	0.207	5.917
0:28:42	52.5	0.311	88.8	5.590	5.60	42.4182	38.8	0.425	0.412	0.772	0.499	0.083	0.291	0.208	5.975
0:29:10	52.8	0.317	88.9	5.585	5.70	42.4633	39.0	0.427	0.413	0.773	0.497	0.080	0.288	0.209	6.227
0:29:41	53.0	0.323	88.9	5.579	5.80	42.5087	39.3	0.430	0.415	0.775	0.497	0.078	0.288	0.210	6.344
0:30:12	53.0	0.329	88.9	5.573	5.90	42.5537	39.3	0.430	0.415	0.775	0.497	0.078	0.287	0.209	6.389

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

	Consolidation Values			Final Values					
Height	5.922 (in.)	15.042 (cm)	Height	4.833 (in.)	Tested By	KDG	Project Number	175569069
Diameter	2.811 (in)	7.140 (cm)	Dia. avg.	3.258 (in)	Date	12-10-09	Test Number	CU-1A
Area	6.207 (in²)	40.043 (cm²)	Area avg.	8.335 (in²)	Press No.	1	Data File ID	1A
					Panel No.	C	Lateral Pressure (psi)	5.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:30:42	53.1	0.335	88.9	5.567	6.00	42.6003	39.4	0.430	0.415	0.775	0.497	0.078	0.287	0.209	6.370
0:31:12	53.0	0.340	88.9	5.561	6.10	42.6448	39.3	0.429	0.414	0.774	0.497	0.080	0.289	0.209	6.220
0:31:44	53.1	0.346	88.9	5.555	6.20	42.6894	39.4	0.429	0.414	0.774	0.499	0.081	0.290	0.209	6.146
0:32:14	53.2	0.352	88.9	5.549	6.30	42.7352	39.4	0.429	0.414	0.774	0.498	0.081	0.290	0.209	6.157
0:32:44	53.3	0.358	88.8	5.543	6.40	42.7811	39.5	0.430	0.414	0.774	0.501	0.083	0.292	0.209	6.037
0:33:17	53.5	0.364	88.8	5.537	6.50	42.8274	39.7	0.431	0.415	0.775	0.502	0.083	0.293	0.210	6.040
0:33:47	53.7	0.370	88.8	5.531	6.60	42.8727	40.0	0.434	0.418	0.778	0.505	0.083	0.294	0.211	6.055
0:34:18	53.8	0.376	88.8	5.525	6.70	42.9183	40.0	0.434	0.417	0.777	0.505	0.084	0.295	0.211	6.008
0:34:50	54.0	0.382	88.8	5.519	6.80	42.9648	40.2	0.435	0.419	0.779	0.508	0.085	0.297	0.211	5.954
0:35:22	54.0	0.388	88.8	5.513	6.90	43.0110	40.3	0.436	0.419	0.779	0.508	0.086	0.297	0.211	5.929
0:35:53	53.9	0.394	88.8	5.508	7.00	43.0566	40.2	0.434	0.417	0.777	0.509	0.088	0.298	0.210	5.780
0:36:24	54.2	0.400	88.8	5.502	7.10	43.1034	40.5	0.437	0.420	0.780	0.511	0.088	0.300	0.212	5.808
0:36:54	54.3	0.406	88.8	5.496	7.20	43.1498	40.6	0.437	0.419	0.779	0.512	0.089	0.301	0.212	5.738
0:37:26	54.3	0.411	88.8	5.490	7.30	43.1959	40.6	0.437	0.419	0.779	0.512	0.089	0.301	0.212	5.731
0:37:58	54.1	0.417	88.7	5.484	7.40	43.2428	40.4	0.434	0.416	0.776	0.511	0.092	0.302	0.210	5.577
0:38:29	54.2	0.423	88.6	5.478	7.50	43.2894	40.4	0.434	0.416	0.776	0.522	0.102	0.312	0.210	5.102
0:39:01	54.1	0.429	88.6	5.472	7.60	43.3356	40.4	0.434	0.415	0.775	0.518	0.100	0.309	0.209	5.194
0:39:34	54.4	0.435	88.7	5.466	7.70	43.3836	40.7	0.436	0.417	0.777	0.516	0.095	0.305	0.210	5.424
0:40:05	54.4	0.441	88.8	5.460	7.80	43.4304	40.6	0.435	0.416	0.776	0.507	0.087	0.297	0.210	5.798
0:40:36	54.6	0.447	88.8	5.454	7.90	43.4767	40.9	0.438	0.418	0.778	0.507	0.085	0.296	0.211	5.969
0:41:09	54.7	0.453	88.8	5.448	8.00	43.5255	40.9	0.437	0.418	0.778	0.506	0.084	0.295	0.211	6.007
0:41:38	54.6	0.459	88.8	5.442	8.10	43.5718	40.9	0.436	0.416	0.776	0.504	0.084	0.294	0.210	6.028
0:42:09	54.7	0.465	88.8	5.436	8.20	43.6195	41.0	0.437	0.417	0.777	0.505	0.084	0.295	0.210	5.993
0:42:40	55.1	0.471	88.8	5.431	8.30	43.6672	41.4	0.441	0.420	0.780	0.508	0.084	0.296	0.212	6.039
0:43:11	55.1	0.477	88.8	5.425	8.40	43.7145	41.4	0.440	0.420	0.780	0.511	0.087	0.299	0.212	5.862
0:43:40	55.0	0.482	88.8	5.419	8.50	43.7617	41.3	0.439	0.418	0.778	0.510	0.088	0.299	0.211	5.796
0:44:10	55.3	0.488	88.8	5.413	8.60	43.8094	41.5	0.441	0.420	0.780	0.511	0.088	0.300	0.212	5.820
0:44:39	55.5	0.494	88.8	5.407	8.70	43.8575	41.7	0.442	0.421	0.781	0.515	0.090	0.302	0.212	5.734
0:45:10	55.5	0.500	88.8	5.401	8.80	43.9077	41.8	0.443	0.421	0.781	0.514	0.089	0.302	0.212	5.763
0:45:40	55.7	0.506	88.7	5.395	8.90	43.9550	41.9	0.444	0.422	0.782	0.517	0.091	0.304	0.213	5.669
0:46:09	55.9	0.512	88.7	5.389	9.00	44.0026	42.2	0.446	0.424	0.784	0.519	0.091	0.305	0.214	5.688
0:46:40	56.0	0.518	88.7	5.383	9.10	44.0520	42.2	0.446	0.423	0.783	0.519	0.092	0.306	0.214	5.635
0:47:09	56.1	0.524	88.7	5.377	9.20	44.0991	42.4	0.447	0.424	0.784	0.520	0.092	0.306	0.214	5.640
0:47:40	56.5	0.530	88.7	5.371	9.30	44.1486	42.8	0.451	0.428	0.788	0.525	0.094	0.310	0.216	5.605
0:48:11	56.4	0.536	88.7	5.366	9.40	44.1964	42.7	0.449	0.426	0.786	0.524	0.094	0.309	0.215	5.575
0:48:40	56.6	0.542	88.7	5.360	9.50	44.2449	42.9	0.451	0.428	0.788	0.527	0.096	0.311	0.216	5.511
0:49:11	57.0	0.548	88.6	5.353	9.60	44.2957	43.3	0.455	0.431	0.791	0.532	0.097	0.315	0.217	5.472
0:49:41	57.1	0.554	88.6	5.348	9.70	44.3443	43.4	0.455	0.431	0.791	0.535	0.100	0.317	0.218	5.356
0:50:10	57.3	0.560	88.5	5.342	9.80	44.3933	43.6	0.456	0.432	0.792	0.541	0.105	0.323	0.218	5.162
0:50:39	57.5	0.565	88.5	5.336	9.90	44.4414	43.8	0.458	0.434	0.794	0.549	0.111	0.330	0.219	4.945
0:51:08	57.8	0.571	88.7	5.330	10.00	44.4906	44.1	0.461	0.436	0.796	0.535	0.095	0.315	0.220	5.646
0:51:38	57.9	0.577	88.7	5.324	10.10	44.5402	44.2	0.461	0.436	0.796	0.534	0.094	0.314	0.220	5.668
0:52:09	58.2	0.583	88.7	5.318	10.20	44.5921	44.5	0.464	0.439	0.799	0.533	0.091	0.312	0.221	5.866
0:52:38	58.3	0.589	88.7	5.312	10.30	44.6411	44.6	0.464	0.439	0.799	0.534	0.091	0.312	0.221	5.886
0:53:10	58.0	0.595	88.7	5.306	10.40	44.6898	44.3	0.461	0.435	0.795	0.530	0.091	0.310	0.220	5.843
0:53:41	58.1	0.601	88.7	5.300	10.50	44.7389	44.4	0.462	0.436	0.796	0.531	0.091	0.311	0.220	5.833
0:54:12	58.4	0.607	88.7	5.294	10.60	44.7897	44.6	0.463	0.437	0.797	0.534	0.093	0.313	0.221	5.768
0:54:44	58.4	0.613	88.7	5.288	10.70	44.8410	44.7	0.463	0.437	0.797	0.535	0.094	0.314	0.220	5.702
0:55:16	58.7	0.619	88.7	5.282	10.80	44.8921	44.9	0.466	0.439	0.799	0.538	0.095	0.316	0.221	5.669
0:55:45	58.7	0.625	88.7	5.277	10.90	44.9413	44.9	0.465	0.438	0.798	0.538	0.096	0.317	0.221	5.616
0:56:17	58.9	0.631	88.7	5.271	11.00	44.9920	45.2	0.467	0.440	0.800	0.541	0.097	0.319	0.222	5.582
0:56:49	59.0	0.636	88.6	5.265	11.10	45.0423	45.3	0.468	0.441	0.801	0.542	0.098	0.320	0.222	5.540
0:57:20	59.0	0.642	88.6	5.259	11.20	45.0924	45.3	0.467	0.439	0.799	0.542	0.099	0.321	0.222	5.473
0:57:51	59.4	0.648	88.6	5.253	11.30	45.1441	45.7	0.471	0.443	0.803	0.546	0.099	0.323	0.223	5.502
0:58:21	59.4	0.654	88.6	5.247	11.40	45.1940	45.6	0.470	0.442	0.802	0.544	0.099	0.322	0.223	5.495
0:58:53	59.2	0.660	88.6	5.241	11.50	45.2454	45.5	0.468	0.440	0.800	0.544	0.101	0.323	0.222	5.387
0:59:25	59.2	0.666	88.6	5.235	11.60	45.2967	45.5	0.467	0.439	0.799	0.544	0.102	0.323	0.221	5.339
0:59:56	59.4	0.672	88.6	5.229	11.70	45.3476	45.7	0.468	0.440	0.800	0.547	0.104	0.325	0.222	5.272
1:00:28	59.5	0.678	88.5	5.223	11.80	45.3989	45.8	0.469	0.440	0.800	0.549	0.106	0.327	0.222	5.194
1:01:00	59.5	0.684	88.5	5.217	11.90	45.4508	45.7	0.468	0.439	0.799	0.551	0.109	0.330	0.221	5.058

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.922 (in.)	15.042 (cm)	Height	4.833 (in.)	Date	12-10-09	Test Number	CU-1A
Diameter	2.811 (in)	7.140 (cm)	Dia. avg.	3.258 (in)	Press No.	1	Data File ID	1A
Area	6.207 (in^2)	40.043 (cm^2)	Area avg.	8.335 (in^2)	Panel No.	C	Lateral Pressure (psi)	5.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
1:01:31	59.5	0.690	88.4	5.212	12.00	45.5016	45.8	0.468	0.438	0.798	0.558	0.116	0.337	0.221	4.816
1:02:02	59.7	0.695	88.6	5.206	12.10	45.5530	45.9	0.469	0.439	0.799	0.545	0.102	0.324	0.222	5.324
1:02:35	59.9	0.702	88.6	5.200	12.20	45.6061	46.2	0.471	0.441	0.801	0.544	0.100	0.322	0.222	5.465
1:03:04	59.9	0.707	88.6	5.194	12.30	45.6571	46.2	0.470	0.440	0.800	0.542	0.098	0.320	0.222	5.508
1:03:35	60.2	0.713	88.6	5.188	12.40	45.7095	46.4	0.472	0.442	0.802	0.543	0.098	0.321	0.223	5.557
1:04:06	60.3	0.719	88.6	5.182	12.50	45.7631	46.6	0.474	0.443	0.803	0.546	0.098	0.321	0.223	5.553
1:04:37	60.3	0.725	88.6	5.176	12.60	45.8150	46.6	0.473	0.442	0.802	0.544	0.099	0.322	0.223	5.511
1:05:05	60.4	0.731	88.6	5.170	12.70	45.8660	46.7	0.473	0.442	0.802	0.545	0.100	0.323	0.223	5.465
1:05:36	60.7	0.737	88.6	5.164	12.80	45.9210	47.0	0.476	0.444	0.804	0.550	0.102	0.326	0.224	5.384
1:06:05	60.8	0.743	88.6	5.158	12.90	45.9732	47.0	0.476	0.444	0.804	0.550	0.103	0.326	0.224	5.364
1:06:34	60.8	0.749	88.6	5.152	13.00	46.0241	47.1	0.476	0.444	0.804	0.551	0.104	0.327	0.224	5.327
1:07:03	61.1	0.755	88.6	5.147	13.10	46.0770	47.4	0.478	0.446	0.806	0.553	0.104	0.329	0.225	5.332
1:07:34	61.3	0.761	88.5	5.141	13.20	46.1304	47.5	0.479	0.447	0.807	0.555	0.105	0.330	0.225	5.299
1:08:04	61.4	0.767	88.5	5.135	13.30	46.1838	47.7	0.480	0.448	0.808	0.557	0.106	0.332	0.226	5.262
1:08:33	61.6	0.772	88.5	5.129	13.40	46.2369	47.9	0.481	0.448	0.808	0.560	0.108	0.334	0.226	5.192
1:09:05	61.5	0.779	88.5	5.123	13.50	46.2923	47.8	0.480	0.447	0.807	0.559	0.108	0.333	0.225	5.178
1:09:36	61.7	0.785	88.5	5.117	13.60	46.3455	47.9	0.481	0.448	0.808	0.560	0.108	0.334	0.226	5.169
1:10:05	61.9	0.790	88.5	5.111	13.70	46.3986	48.2	0.483	0.449	0.809	0.563	0.110	0.336	0.227	5.130
1:10:35	62.2	0.796	88.5	5.105	13.80	46.4515	48.5	0.485	0.451	0.811	0.565	0.110	0.337	0.228	5.151
1:11:06	62.4	0.802	88.5	5.099	13.90	46.5066	48.7	0.487	0.453	0.813	0.568	0.111	0.340	0.228	5.097
1:11:34	62.5	0.808	88.4	5.093	14.00	46.5590	48.8	0.488	0.453	0.813	0.571	0.114	0.342	0.228	5.024
1:12:03	62.8	0.814	88.4	5.087	14.10	46.6138	49.1	0.490	0.455	0.815	0.576	0.117	0.346	0.229	4.934
1:12:33	62.8	0.820	88.3	5.081	14.20	46.6690	49.1	0.489	0.454	0.814	0.579	0.121	0.350	0.229	4.777
1:13:03	62.9	0.826	88.3	5.075	14.30	46.7225	49.2	0.489	0.454	0.814	0.578	0.120	0.349	0.229	4.820
1:13:32	63.3	0.832	88.5	5.069	14.40	46.7775	49.6	0.493	0.458	0.818	0.571	0.110	0.341	0.231	5.206
1:14:02	63.5	0.838	88.5	5.064	14.50	46.8323	49.8	0.495	0.459	0.819	0.570	0.107	0.339	0.231	5.308
1:14:34	63.6	0.844	88.5	5.058	14.60	46.8874	49.9	0.494	0.459	0.819	0.570	0.108	0.339	0.231	5.300
1:15:06	63.6	0.850	88.5	5.052	14.70	46.9427	49.9	0.494	0.458	0.818	0.567	0.106	0.337	0.231	5.356
1:15:35	63.7	0.855	88.5	5.046	14.80	46.9971	50.0	0.494	0.458	0.818	0.568	0.106	0.337	0.231	5.344
1:16:06	63.7	0.861	88.5	5.040	14.90	47.0513	50.0	0.494	0.457	0.817	0.568	0.107	0.337	0.231	5.321
1:16:38	63.9	0.867	88.5	5.034	15.00	47.1089	50.1	0.495	0.458	0.818	0.571	0.110	0.341	0.231	5.212
1:17:07	64.1	0.873	88.5	5.028	15.10	47.1627	50.4	0.497	0.460	0.820	0.574	0.111	0.342	0.232	5.193
1:17:38	64.0	0.879	88.5	5.022	15.20	47.2177	50.3	0.496	0.458	0.818	0.573	0.111	0.342	0.231	5.156
1:18:11	63.9	0.885	88.4	5.016	15.29	47.2732	50.2	0.494	0.456	0.816	0.573	0.113	0.343	0.230	5.073
1:18:42	64.3	0.891	88.4	5.010	15.40	47.3299	50.6	0.497	0.459	0.819	0.577	0.114	0.345	0.232	5.080
1:19:13	64.6	0.897	88.4	5.004	15.50	47.3861	50.8	0.499	0.461	0.821	0.579	0.114	0.347	0.232	5.066
1:19:44	64.5	0.903	88.4	4.998	15.60	47.4415	50.8	0.498	0.459	0.819	0.578	0.115	0.346	0.232	5.032
1:20:16	64.5	0.909	88.4	4.993	15.70	47.4977	50.8	0.497	0.458	0.818	0.578	0.116	0.347	0.231	4.986
1:20:48	64.7	0.915	88.4	4.986	15.80	47.5558	51.0	0.498	0.459	0.819	0.580	0.116	0.348	0.232	4.979
1:21:18	65.0	0.920	88.4	4.981	15.89	47.6105	51.3	0.501	0.462	0.822	0.583	0.117	0.350	0.233	4.988
1:21:52	65.0	0.927	88.4	4.975	16.00	47.6687	51.3	0.501	0.461	0.821	0.583	0.118	0.350	0.232	4.943
1:22:22	65.0	0.932	88.3	4.969	16.10	47.7245	51.3	0.500	0.460	0.820	0.584	0.120	0.352	0.232	4.866
1:22:54	65.2	0.938	88.3	4.963	16.20	47.7820	51.5	0.501	0.461	0.821	0.587	0.122	0.355	0.233	4.800
1:23:26	65.2	0.944	88.2	4.957	16.30	47.8393	51.5	0.500	0.460	0.820	0.590	0.126	0.358	0.232	4.679
1:23:58	65.3	0.950	88.2	4.951	16.40	47.8966	51.6	0.501	0.461	0.821	0.597	0.133	0.365	0.232	4.499
1:24:29	65.5	0.956	88.3	4.945	16.50	47.9541	51.8	0.502	0.461	0.821	0.586	0.121	0.353	0.233	4.854
1:25:00	65.5	0.962	88.4	4.939	16.60	48.0110	51.8	0.502	0.461	0.821	0.582	0.117	0.349	0.232	4.979
1:25:31	65.8	0.968	88.4	4.933	16.69	48.0678	52.1	0.504	0.463	0.823	0.581	0.115	0.348	0.233	5.063
1:26:00	65.7	0.974	88.4	4.927	16.79	48.1252	51.9	0.502	0.460	0.820	0.579	0.115	0.347	0.232	5.033
1:26:31	65.8	0.980	88.4	4.921	16.90	48.1852	52.1	0.503	0.461	0.821	0.580	0.115	0.348	0.233	5.046
1:27:00	66.1	0.986	88.4	4.916	17.00	48.2423	52.3	0.504	0.463	0.823	0.581	0.115	0.348	0.233	5.065
1:27:30	66.0	0.992	88.4	4.910	17.09	48.2997	52.2	0.503	0.461	0.821	0.581	0.116	0.348	0.232	5.007
1:27:59	66.3	0.998	88.4	4.904	17.20	48.3590	52.6	0.506	0.464	0.824	0.586	0.118	0.352	0.234	4.952
1:28:29	66.4	1.004	88.3	4.898	17.30	48.4177	52.7	0.506	0.464	0.824	0.587	0.119	0.353	0.234	4.922
1:28:58	66.5	1.009	88.3	4.892	17.40	48.4757	52.8	0.506	0.463	0.823	0.587	0.120	0.354	0.234	4.888
1:29:28	66.5	1.015	88.3	4.886	17.50	48.5340	52.8	0.506	0.463	0.823	0.587	0.121	0.354	0.233	4.870
1:29:59	66.8	1.021	88.3	4.880	17.60	48.5936	53.1	0.508	0.465	0.825	0.589	0.120	0.354	0.234	4.908
1:30:30	66.7	1.027	88.3	4.874	17.70	48.6523	53.0	0.507	0.463	0.823	0.589	0.123	0.356	0.233	4.805
1:30:59	66.9	1.033	88.3	4.868	17.79	48.7109	53.1	0.507	0.464	0.824	0.590	0.122	0.356	0.234	4.822
1:31:30	67.1	1.039	88.3	4.862	17.90	48.7705	53.3	0.508	0.464	0.824	0.592	0.124	0.358	0.234	4.774

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	5.922 (in.)	15.042 (cm)	Height	4.833 (in.)	Tested By	KDG
Diameter	2.811 (in)	7.140 (cm)	Dia. avg.	3.258 (in)	Date	12-10-09
Area	6.207 (in^2)	40.043 (cm^2)	Area avg.	8.335 (in^2)	Press No.	1
					Panel No.	C

Project Number	175669069
Test Number	CU-1A
Data File ID	1A
Lateral Pressure (psi)	5.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
1:32:01	67.2	1.045	88.3	4.856	18.00	48.8303	53.5	0.509	0.465	0.825	0.590	0.121	0.355	0.235	4.887
1:32:30	67.4	1.051	88.3	4.850	18.09	48.8892	53.6	0.510	0.466	0.826	0.593	0.123	0.358	0.235	4.807
1:33:00	67.5	1.057	88.3	4.844	18.20	48.9496	53.8	0.511	0.466	0.826	0.594	0.124	0.359	0.235	4.781
1:33:29	67.9	1.063	88.3	4.839	18.30	49.0096	54.2	0.514	0.469	0.829	0.598	0.125	0.362	0.236	4.773
1:33:59	68.3	1.069	88.2	4.833	18.40	49.0698	54.6	0.517	0.472	0.832	0.603	0.127	0.365	0.238	4.741

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values				
Height	6.046 (in.)	15.357 (cm)	Height	4.933 (in.)	Tested By	KDG	Project Number: 175569069
Diameter	2.781 (in)	7.063 (cm)	Dia. avg.	3.415 (in)	Date	12-10-09	Test Number: CU-1B
Area	6.073 (in^2)	39.181 (cm^2)	Area avg.	9.159 (in^2)	Press No.	1	Data File ID: 1B
					Panel No.	B	Lateral Pressure (psi): 10.0
							Chamber Pressure - σ_3 (psi): 90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Aree (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	12.8	-0.022	80.0	6.046	0.00	39.1808	0.0	0.000	0.000	0.720	0.720	0.717	0.718	0.002	1.005
0:00:49	19.7	-0.015	80.2	6.039	0.11	39.2234	6.9	0.081	0.081	0.801	0.789	0.704	0.747	0.042	1.120
0:01:25	38.8	-0.009	81.5	6.034	0.20	39.2598	26.0	0.308	0.307	1.027	0.919	0.609	0.764	0.155	1.510
0:01:57	45.5	-0.003	82.5	6.028	0.30	39.2997	32.7	0.387	0.386	1.106	0.927	0.538	0.733	0.195	1.724
0:02:30	50.4	0.003	83.1	6.022	0.40	39.3392	37.6	0.444	0.443	1.163	0.943	0.497	0.720	0.223	1.899
0:03:01	53.9	0.009	83.5	6.015	0.50	39.3794	41.1	0.485	0.484	1.204	0.955	0.468	0.712	0.244	2.041
0:03:32	56.7	0.015	83.8	6.009	0.61	39.4194	43.9	0.518	0.516	1.236	0.966	0.446	0.706	0.260	2.165
0:04:02	59.0	0.021	84.1	6.003	0.71	39.4595	46.2	0.545	0.543	1.263	0.975	0.428	0.702	0.273	2.276
0:04:33	61.4	0.027	84.2	5.997	0.80	39.4974	48.6	0.572	0.570	1.290	0.987	0.414	0.701	0.287	2.384
0:05:03	62.8	0.033	84.4	5.991	0.90	39.5375	50.0	0.588	0.585	1.305	0.994	0.405	0.699	0.294	2.455
0:05:35	64.6	0.039	84.5	5.985	1.00	39.5785	51.8	0.608	0.606	1.326	1.004	0.395	0.700	0.304	2.540
0:06:05	66.1	0.045	84.6	5.979	1.10	39.6171	53.3	0.626	0.623	1.343	1.013	0.387	0.700	0.313	2.617
0:06:37	67.5	0.051	84.7	5.973	1.21	39.6598	54.7	0.641	0.638	1.358	1.020	0.379	0.700	0.321	2.692
0:07:08	68.9	0.057	84.8	5.967	1.30	39.6978	56.1	0.657	0.653	1.373	1.029	0.373	0.701	0.328	2.763
0:07:40	69.9	0.063	84.9	5.961	1.40	39.7389	57.1	0.669	0.665	1.385	1.035	0.366	0.700	0.334	2.826
0:08:09	70.6	0.069	85.0	5.955	1.50	39.7782	57.8	0.676	0.672	1.392	1.037	0.362	0.700	0.338	2.867
0:08:40	71.7	0.075	85.0	5.949	1.60	39.8192	58.9	0.688	0.684	1.404	1.047	0.359	0.703	0.344	2.913
0:09:12	72.8	0.081	85.1	5.943	1.71	39.8605	60.0	0.699	0.695	1.415	1.053	0.355	0.704	0.349	2.969
0:09:43	73.5	0.088	85.1	5.937	1.81	39.9012	60.7	0.707	0.703	1.423	1.057	0.351	0.704	0.353	3.010
0:10:14	74.0	0.093	85.2	5.931	1.90	39.9409	61.2	0.712	0.707	1.427	1.059	0.349	0.704	0.355	3.039
0:10:47	75.0	0.100	85.2	5.925	2.01	39.9834	62.2	0.723	0.718	1.438	1.067	0.346	0.706	0.361	3.088
0:11:17	75.8	0.105	85.2	5.919	2.10	40.0220	63.0	0.732	0.726	1.446	1.074	0.344	0.709	0.365	3.120
0:11:49	76.4	0.112	85.2	5.913	2.20	40.0629	63.6	0.739	0.733	1.453	1.082	0.346	0.714	0.368	3.131
0:12:19	77.0	0.118	85.2	5.907	2.30	40.1038	64.2	0.745	0.739	1.459	1.090	0.348	0.719	0.371	3.136
0:12:50	77.5	0.124	85.1	5.900	2.41	40.1466	64.7	0.750	0.744	1.464	1.100	0.353	0.727	0.374	3.116
0:13:22	78.2	0.130	85.3	5.895	2.50	40.1863	65.4	0.757	0.751	1.471	1.090	0.335	0.713	0.377	3.249
0:13:54	78.5	0.136	85.4	5.888	2.60	40.2281	65.7	0.759	0.753	1.473	1.084	0.328	0.706	0.378	3.304
0:14:24	79.2	0.142	85.5	5.882	2.70	40.2694	66.4	0.767	0.760	1.480	1.087	0.323	0.705	0.382	3.363
0:14:57	79.8	0.148	85.6	5.876	2.81	40.3126	67.0	0.773	0.766	1.486	1.089	0.319	0.704	0.385	3.408
0:15:28	80.4	0.154	85.6	5.870	2.91	40.3531	67.6	0.779	0.772	1.492	1.092	0.317	0.705	0.387	3.443
0:15:58	80.5	0.160	85.6	5.864	3.00	40.3938	67.7	0.780	0.772	1.492	1.092	0.317	0.704	0.388	3.451
0:16:32	81.2	0.166	85.6	5.858	3.11	40.4370	68.4	0.787	0.779	1.499	1.100	0.318	0.709	0.391	3.463
0:17:04	81.6	0.172	85.6	5.852	3.21	40.4790	68.8	0.790	0.782	1.502	1.104	0.319	0.711	0.393	3.466
0:17:36	81.8	0.178	85.6	5.846	3.30	40.5199	69.0	0.792	0.784	1.504	1.107	0.320	0.713	0.394	3.462
0:18:08	82.1	0.184	85.6	5.840	3.40	40.5614	69.3	0.794	0.786	1.506	1.109	0.320	0.714	0.394	3.469
0:18:40	82.5	0.190	85.6	5.834	3.51	40.6048	69.7	0.799	0.790	1.510	1.114	0.320	0.717	0.397	3.477
0:19:12	82.9	0.196	85.5	5.828	3.60	40.6460	70.1	0.802	0.793	1.513	1.117	0.321	0.719	0.398	3.485
0:19:44	83.4	0.202	85.5	5.822	3.70	40.6873	70.6	0.807	0.798	1.518	1.125	0.324	0.725	0.401	3.473
0:20:16	83.7	0.209	85.5	5.816	3.81	40.7313	70.9	0.809	0.800	1.520	1.128	0.325	0.726	0.402	3.474
0:20:47	84.3	0.214	85.5	5.810	3.90	40.7721	71.5	0.816	0.806	1.526	1.136	0.326	0.731	0.405	3.480
0:21:19	84.7	0.221	85.5	5.804	4.01	40.8160	71.9	0.819	0.809	1.529	1.136	0.324	0.730	0.406	3.508
0:21:49	85.0	0.227	85.4	5.798	4.11	40.8591	72.2	0.822	0.812	1.532	1.148	0.333	0.741	0.408	3.448
0:22:19	85.5	0.233	85.3	5.792	4.21	40.9008	72.7	0.826	0.816	1.536	1.158	0.338	0.748	0.410	3.421
0:22:50	85.8	0.239	85.4	5.786	4.30	40.9429	73.0	0.829	0.818	1.538	1.156	0.334	0.745	0.411	3.459
0:23:22	86.4	0.245	85.5	5.779	4.41	40.9875	73.6	0.835	0.824	1.544	1.149	0.322	0.735	0.413	3.569
0:23:50	86.6	0.251	85.6	5.774	4.50	41.0291	73.8	0.836	0.825	1.545	1.147	0.319	0.733	0.414	3.601
0:24:22	87.1	0.257	85.6	5.767	4.61	41.0723	74.3	0.841	0.829	1.549	1.147	0.315	0.731	0.416	3.646
0:24:53	87.4	0.263	85.6	5.761	4.71	41.1155	74.6	0.844	0.833	1.553	1.150	0.314	0.732	0.418	3.666
0:25:23	87.8	0.269	85.6	5.755	4.81	41.1588	75.0	0.847	0.836	1.556	1.153	0.314	0.733	0.419	3.675
0:25:53	88.4	0.275	85.6	5.749	4.91	41.2019	75.6	0.853	0.840	1.560	1.159	0.315	0.737	0.422	3.682
0:26:24	88.8	0.281	85.6	5.743	5.00	41.2444	76.0	0.857	0.845	1.565	1.167	0.319	0.743	0.424	3.661
0:26:58	89.3	0.287	85.6	5.737	5.11	41.2897	76.5	0.862	0.849	1.569	1.171	0.318	0.744	0.426	3.678
0:27:25	89.7	0.293	85.5	5.731	5.20	41.3317	76.9	0.865	0.852	1.572	1.177	0.322	0.749	0.428	3.657
0:27:57	90.0	0.299	85.3	5.725	5.31	41.3764	77.2	0.867	0.854	1.574	1.193	0.336	0.765	0.429	3.553
0:28:29	90.1	0.305	85.4	5.719	5.41	41.4205	77.3	0.867	0.854	1.574	1.187	0.330	0.758	0.429	3.600
0:29:00	90.6	0.311	85.5	5.713	5.51	41.4637	77.8	0.872	0.858	1.578	1.189	0.327	0.758	0.431	3.633
0:29:31	90.8	0.317	85.4	5.707	5.61	41.5082	78.0	0.874	0.860	1.580	1.195	0.331	0.763	0.432	3.605
0:30:02	91.0	0.323	85.3	5.701	5.71	41.5515	78.2	0.875	0.861	1.581	1.199	0.335	0.767	0.432	3.581
0:30:32	91.5	0.329	85.3	5.695	5.80	41.5953	78.7	0.880	0.865	1.585	1.205	0.337	0.771	0.434	3.579
0:31:03	91.5	0.335	85.3	5.689	5.90	41.6394	78.7	0.879	0.864	1.584	1.208	0.341	0.775	0.434	3.542

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	6.046 (in.)	15.357 (cm)	Height	4.933 (in.)	Date	12-10-09	Test Number	CU-1B
Diameter	2.781 (in)	7.063 (cm)	Dia. avg.	3.415 (in)	Press No.	1	Data File ID	1B
Area	6.073 (in²)	39.181 (cm²)	Area avg.	9.159 (in²)	Panel No.	B	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:31:35	91.8	0.342	85.2	5.683	6.01	41.6850	79.0	0.881	0.866	1.586	1.219	0.349	0.784	0.435	3.494
0:32:07	92.2	0.347	85.0	5.677	6.10	41.7282	79.4	0.885	0.870	1.590	1.230	0.357	0.794	0.437	3.446
0:32:39	92.4	0.354	85.3	5.671	6.21	41.7732	79.6	0.886	0.870	1.590	1.210	0.336	0.773	0.437	3.601
0:33:11	92.4	0.360	85.4	5.665	6.31	41.8185	79.6	0.885	0.870	1.590	1.208	0.334	0.771	0.437	3.611
0:33:43	93.0	0.366	85.4	5.659	6.41	41.8627	80.2	0.891	0.875	1.595	1.211	0.332	0.772	0.439	3.644
0:34:14	93.3	0.372	85.3	5.653	6.51	41.9072	80.5	0.893	0.877	1.597	1.215	0.335	0.775	0.440	3.629
0:34:46	93.5	0.378	85.4	5.647	6.61	41.9520	80.7	0.895	0.878	1.598	1.215	0.333	0.774	0.441	3.646
0:35:18	93.8	0.384	85.4	5.640	6.71	41.9973	81.0	0.897	0.880	1.600	1.218	0.334	0.776	0.442	3.644
0:35:49	94.5	0.390	85.3	5.634	6.80	42.0417	81.7	0.903	0.886	1.606	1.228	0.338	0.783	0.445	3.632
0:36:21	94.5	0.396	85.3	5.628	6.91	42.0875	81.7	0.902	0.885	1.605	1.229	0.340	0.785	0.444	3.610
0:36:53	94.9	0.402	85.2	5.622	7.01	42.1330	82.1	0.906	0.888	1.608	1.234	0.342	0.788	0.446	3.605
0:37:24	95.1	0.408	85.2	5.616	7.11	42.1783	82.3	0.908	0.890	1.610	1.238	0.344	0.791	0.447	3.596
0:37:56	95.5	0.414	85.2	5.610	7.21	42.2245	82.7	0.910	0.892	1.612	1.242	0.346	0.794	0.448	3.592
0:38:28	95.6	0.420	85.2	5.604	7.31	42.2688	82.8	0.911	0.893	1.613	1.245	0.348	0.796	0.448	3.573
0:39:00	95.8	0.426	85.1	5.598	7.41	42.3142	83.0	0.912	0.894	1.614	1.248	0.351	0.799	0.449	3.559
0:39:32	96.0	0.432	85.1	5.592	7.51	42.3605	83.2	0.913	0.894	1.614	1.251	0.353	0.802	0.449	3.545
0:40:05	96.3	0.438	85.1	5.586	7.61	42.4075	83.5	0.916	0.897	1.617	1.254	0.354	0.804	0.450	3.541
0:40:37	96.7	0.444	85.1	5.580	7.71	42.4538	83.9	0.919	0.900	1.620	1.259	0.356	0.808	0.452	3.538
0:41:09	96.9	0.450	85.0	5.574	7.81	42.4992	84.1	0.920	0.901	1.621	1.263	0.359	0.811	0.452	3.518
0:41:40	97.4	0.456	84.9	5.568	7.91	42.5443	84.6	0.925	0.905	1.625	1.272	0.364	0.818	0.454	3.494
0:42:12	97.8	0.462	84.9	5.562	8.01	42.5905	85.0	0.928	0.908	1.628	1.281	0.370	0.825	0.455	3.465
0:42:44	98.0	0.469	84.7	5.556	8.11	42.6386	85.2	0.929	0.909	1.629	1.292	0.379	0.836	0.456	3.404
0:43:14	98.2	0.475	85.0	5.550	8.21	42.6848	85.4	0.930	0.910	1.630	1.275	0.362	0.819	0.457	3.524
0:43:44	98.6	0.481	85.0	5.544	8.31	42.7299	85.8	0.933	0.913	1.633	1.274	0.358	0.816	0.458	3.558
0:44:16	98.8	0.487	85.1	5.537	8.41	42.7786	86.0	0.934	0.914	1.634	1.273	0.356	0.815	0.458	3.573
0:44:47	99.2	0.493	85.1	5.531	8.51	42.8247	86.4	0.938	0.917	1.637	1.274	0.354	0.814	0.460	3.601
0:45:16	99.5	0.499	85.1	5.525	8.61	42.8709	86.7	0.941	0.919	1.639	1.276	0.354	0.815	0.461	3.606
0:45:47	100.0	0.505	85.1	5.519	8.71	42.9184	87.2	0.945	0.923	1.643	1.281	0.354	0.818	0.463	3.615
0:46:18	100.5	0.511	85.0	5.513	8.81	42.9657	87.7	0.949	0.927	1.647	1.288	0.357	0.822	0.465	3.604
0:46:47	100.3	0.517	85.0	5.507	8.91	43.0126	87.5	0.946	0.924	1.644	1.290	0.363	0.826	0.464	3.558
0:47:17	100.8	0.523	84.9	5.501	9.01	43.0592	88.0	0.951	0.928	1.648	1.297	0.365	0.831	0.466	3.554
0:47:49	101.0	0.529	84.9	5.495	9.11	43.1070	88.2	0.951	0.929	1.649	1.297	0.365	0.831	0.466	3.551
0:48:20	101.1	0.535	84.9	5.489	9.21	43.1538	88.3	0.951	0.928	1.648	1.300	0.369	0.835	0.466	3.526
0:48:52	101.5	0.541	84.8	5.483	9.31	43.2026	88.7	0.954	0.931	1.651	1.305	0.371	0.838	0.467	3.520
0:49:22	101.5	0.547	84.8	5.477	9.41	43.2498	88.7	0.953	0.930	1.650	1.306	0.373	0.840	0.467	3.501
0:49:54	101.7	0.553	84.8	5.471	9.51	43.2982	88.9	0.955	0.932	1.652	1.310	0.375	0.843	0.467	3.491
0:50:25	101.8	0.559	84.8	5.465	9.61	43.3458	89.0	0.954	0.930	1.650	1.311	0.377	0.844	0.467	3.475
0:50:56	102.0	0.565	84.7	5.459	9.71	43.3945	89.2	0.956	0.932	1.652	1.314	0.378	0.846	0.468	3.474
0:51:27	102.6	0.571	84.7	5.453	9.81	43.4416	89.8	0.961	0.936	1.656	1.321	0.381	0.851	0.470	3.467
0:51:59	102.7	0.577	84.7	5.447	9.91	43.4903	89.9	0.961	0.937	1.657	1.324	0.384	0.854	0.470	3.449
0:52:28	102.9	0.583	84.6	5.441	10.01	43.5376	90.1	0.962	0.937	1.657	1.327	0.386	0.856	0.470	3.436
0:52:59	103.2	0.590	84.6	5.435	10.11	43.5866	90.4	0.965	0.940	1.660	1.332	0.389	0.861	0.471	3.421
0:53:32	103.4	0.596	84.5	5.429	10.21	43.6361	90.6	0.966	0.940	1.660	1.340	0.396	0.868	0.472	3.382
0:54:04	103.6	0.602	84.4	5.423	10.31	43.6842	90.8	0.966	0.941	1.661	1.347	0.403	0.875	0.472	3.340
0:54:35	104.0	0.608	84.6	5.417	10.41	43.7327	91.2	0.970	0.944	1.664	1.335	0.387	0.861	0.474	3.447
0:55:07	104.2	0.614	84.7	5.411	10.51	43.7819	91.4	0.971	0.945	1.665	1.332	0.384	0.858	0.474	3.470
0:55:39	104.9	0.620	84.7	5.404	10.61	43.8315	92.1	0.977	0.950	1.670	1.337	0.383	0.860	0.477	3.487
0:56:10	104.6	0.626	84.7	5.398	10.71	43.8809	91.8	0.973	0.946	1.666	1.334	0.384	0.859	0.475	3.474
0:56:42	104.9	0.632	84.7	5.392	10.81	43.9295	92.1	0.975	0.948	1.668	1.337	0.385	0.861	0.476	3.472
0:57:14	105.5	0.638	84.6	5.386	10.91	43.9791	92.7	0.980	0.953	1.673	1.342	0.386	0.864	0.478	3.479
0:57:44	105.9	0.644	84.6	5.380	11.01	44.0271	93.1	0.983	0.955	1.675	1.348	0.389	0.869	0.479	3.462
0:58:16	106.0	0.650	84.5	5.374	11.11	44.0776	93.2	0.983	0.956	1.676	1.352	0.393	0.872	0.479	3.440
0:58:48	106.1	0.656	84.5	5.368	11.21	44.1284	93.3	0.983	0.955	1.675	1.353	0.395	0.874	0.479	3.426
0:59:20	106.5	0.662	84.5	5.362	11.31	44.1782	93.7	0.987	0.959	1.679	1.358	0.396	0.877	0.481	3.429
0:59:52	106.5	0.668	84.5	5.356	11.41	44.2274	93.7	0.985	0.956	1.676	1.359	0.399	0.879	0.480	3.403
1:00:24	106.7	0.674	84.4	5.350	11.51	44.2769	93.9	0.986	0.957	1.677	1.362	0.401	0.882	0.480	3.393
1:00:56	106.9	0.680	84.4	5.344	11.61	44.3265	94.1	0.987	0.958	1.678	1.365	0.403	0.884	0.481	3.387
1:01:30	107.2	0.686	84.4	5.338	11.71	44.3780	94.4	0.990	0.961	1.681	1.369	0.405	0.887	0.482	3.379
1:02:02	107.2	0.692	84.3	5.332	11.81	44.4282	94.4	0.988	0.958	1.678	1.369	0.407	0.888	0.481	3.363
1:02:34	107.4	0.699	84.3	5.326	11.91	44.4787	94.6	0.989	0.959	1.679	1.373	0.410	0.892	0.481	3.344

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	6.046 (in.)	15.357 (cm)	Height	4.933 (in.)	Date	12-10-09	Test Number	CU-1B
Diameter	2.781 (in)	7.063 (cm)	Dia. avg.	3.415 (in)	Press No.	1	Data File ID	1B
Area	6.073 (in^2)	39.181 (cm^2)	Area avg.	9.159 (in^2)	Panel No.	B	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
1:03:04	107.9	0.704	84.3	5.320	12.01	44.5287	95.1	0.993	0.963	1.683	1.378	0.412	0.895	0.483	3.348
1:03:36	108.2	0.711	84.2	5.314	12.11	44.5796	95.4	0.995	0.965	1.685	1.389	0.421	0.905	0.484	3.302
1:04:07	108.3	0.717	84.2	5.308	12.21	44.6297	95.5	0.995	0.964	1.684	1.388	0.421	0.905	0.484	3.299
1:04:37	108.5	0.723	84.1	5.302	12.31	44.6803	95.7	0.996	0.965	1.685	1.396	0.428	0.912	0.484	3.264
1:05:09	108.9	0.729	84.1	5.296	12.41	44.7327	96.1	0.999	0.968	1.688	1.397	0.426	0.912	0.486	3.278
1:05:40	109.2	0.735	84.3	5.290	12.51	44.7834	96.4	1.001	0.970	1.690	1.386	0.413	0.900	0.487	3.358
1:06:10	109.2	0.741	84.3	5.283	12.61	44.8355	96.4	1.000	0.969	1.689	1.383	0.411	0.897	0.486	3.367
1:06:40	109.7	0.747	84.3	5.277	12.71	44.8861	96.9	1.003	0.972	1.692	1.384	0.409	0.897	0.488	3.385
1:07:11	110.2	0.753	84.3	5.271	12.81	44.9379	97.4	1.008	0.976	1.696	1.388	0.408	0.898	0.490	3.398
1:07:41	110.2	0.759	84.3	5.265	12.91	44.9903	97.4	1.007	0.975	1.695	1.388	0.410	0.899	0.489	3.387
1:08:11	110.8	0.765	84.3	5.259	13.01	45.0415	98.0	1.011	0.979	1.699	1.392	0.410	0.901	0.491	3.397
1:08:42	110.8	0.771	84.2	5.253	13.11	45.0933	98.0	1.010	0.978	1.698	1.396	0.415	0.905	0.491	3.366
1:09:12	111.4	0.777	84.2	5.247	13.21	45.1460	98.6	1.015	0.983	1.703	1.403	0.417	0.910	0.493	3.363
1:09:42	111.4	0.783	84.2	5.241	13.31	45.1968	98.6	1.014	0.981	1.701	1.404	0.419	0.911	0.492	3.350
1:10:14	111.5	0.789	84.1	5.235	13.41	45.2493	98.7	1.014	0.981	1.701	1.406	0.421	0.914	0.492	3.335
1:10:46	112.0	0.795	84.1	5.229	13.51	45.3025	99.2	1.018	0.984	1.704	1.411	0.423	0.917	0.494	3.336
1:11:17	112.4	0.801	84.1	5.223	13.61	45.3549	99.6	1.021	0.987	1.707	1.415	0.425	0.920	0.495	3.330
1:11:46	112.4	0.807	84.1	5.217	13.71	45.4063	99.6	1.020	0.986	1.706	1.416	0.427	0.922	0.495	3.316
1:12:17	112.7	0.813	84.0	5.211	13.81	45.4589	99.9	1.022	0.988	1.708	1.420	0.429	0.924	0.495	3.311
1:12:48	112.8	0.819	84.0	5.205	13.91	45.5117	100.0	1.022	0.987	1.707	1.421	0.430	0.926	0.495	3.302
1:13:19	112.8	0.825	84.0	5.199	14.01	45.5647	100.0	1.021	0.986	1.706	1.423	0.433	0.928	0.495	3.284
1:13:51	113.1	0.832	84.0	5.193	14.11	45.6183	100.3	1.022	0.987	1.707	1.425	0.434	0.930	0.495	3.281
1:14:23	113.4	0.838	83.9	5.187	14.21	45.6723	100.6	1.024	0.989	1.709	1.430	0.438	0.934	0.496	3.266
1:14:53	113.6	0.844	83.9	5.181	14.31	45.7252	100.8	1.025	0.989	1.709	1.434	0.442	0.938	0.496	3.248
1:15:25	113.5	0.850	83.8	5.174	14.41	45.7793	100.7	1.023	0.987	1.707	1.438	0.448	0.943	0.495	3.211
1:15:56	114.1	0.856	83.7	5.168	14.51	45.8325	101.3	1.028	0.992	1.712	1.449	0.454	0.951	0.498	3.194
1:16:27	114.6	0.862	83.7	5.163	14.61	45.8847	101.8	1.031	0.995	1.715	1.452	0.453	0.953	0.499	3.202
1:16:59	114.3	0.868	83.9	5.156	14.71	45.9402	101.5	1.027	0.991	1.711	1.435	0.441	0.938	0.497	3.255
1:17:30	115.1	0.874	83.9	5.150	14.81	45.9925	102.3	1.034	0.998	1.718	1.437	0.436	0.937	0.500	3.294
1:18:02	115.1	0.880	83.9	5.144	14.91	46.0475	102.3	1.033	0.996	1.716	1.435	0.436	0.936	0.500	3.294
1:18:34	115.3	0.886	84.0	5.138	15.01	46.1018	102.5	1.034	0.997	1.717	1.435	0.435	0.935	0.500	3.299
1:19:04	115.6	0.892	83.9	5.132	15.11	46.1555	102.7	1.035	0.998	1.718	1.437	0.436	0.937	0.500	3.295
1:19:35	115.7	0.898	83.9	5.126	15.21	46.2100	102.9	1.035	0.998	1.718	1.437	0.436	0.937	0.500	3.296
1:20:08	116.3	0.904	83.9	5.120	15.31	46.2662	103.5	1.040	1.002	1.722	1.446	0.440	0.943	0.503	3.283
1:20:40	116.4	0.910	83.8	5.114	15.41	46.3211	103.6	1.040	1.002	1.722	1.449	0.444	0.946	0.502	3.265
1:21:11	116.2	0.916	83.8	5.108	15.51	46.3744	103.4	1.037	0.999	1.719	1.449	0.447	0.948	0.501	3.241
1:21:44	116.5	0.922	83.8	5.102	15.61	46.4298	103.7	1.038	0.999	1.719	1.451	0.448	0.949	0.501	3.238
1:22:16	116.9	0.928	83.8	5.096	15.71	46.4846	104.1	1.042	1.003	1.723	1.456	0.450	0.953	0.503	3.236
1:22:50	116.9	0.934	83.7	5.090	15.81	46.5400	104.1	1.040	1.001	1.721	1.456	0.451	0.954	0.502	3.225
1:23:21	117.1	0.940	83.7	5.084	15.91	46.5954	104.3	1.041	1.001	1.721	1.458	0.453	0.955	0.502	3.219
1:23:54	117.4	0.947	83.7	5.078	16.01	46.6517	104.6	1.042	1.003	1.723	1.461	0.456	0.958	0.503	3.208
1:24:26	117.8	0.953	83.6	5.072	16.11	46.7070	105.0	1.046	1.006	1.726	1.467	0.458	0.962	0.504	3.205
1:24:56	118.0	0.959	83.6	5.066	16.21	46.7617	105.2	1.046	1.006	1.726	1.468	0.459	0.964	0.505	3.198
1:25:27	118.4	0.965	83.6	5.060	16.31	46.8175	105.6	1.049	1.008	1.728	1.474	0.462	0.968	0.506	3.191
1:25:59	118.8	0.971	83.5	5.053	16.41	46.8753	106.0	1.052	1.011	1.731	1.479	0.465	0.972	0.507	3.181
1:26:30	118.8	0.977	83.3	5.047	16.51	46.9313	106.0	1.050	1.009	1.729	1.492	0.479	0.985	0.506	3.113
1:27:01	118.9	0.983	83.4	5.041	16.61	46.9877	106.1	1.050	1.009	1.729	1.490	0.478	0.984	0.506	3.120
1:27:30	119.2	0.989	83.3	5.035	16.71	47.0431	106.4	1.052	1.010	1.730	1.498	0.484	0.991	0.507	3.096
1:28:01	119.7	0.995	83.6	5.029	16.81	47.1002	106.9	1.055	1.013	1.733	1.480	0.464	0.972	0.508	3.193
1:28:32	119.9	1.001	83.6	5.023	16.92	47.1578	107.1	1.056	1.014	1.734	1.478	0.460	0.969	0.509	3.210
1:29:00	119.9	1.007	83.6	5.017	17.01	47.2132	107.1	1.054	1.012	1.732	1.475	0.460	0.968	0.508	3.208
1:29:31	120.1	1.013	83.6	5.011	17.11	47.2708	107.3	1.056	1.013	1.733	1.475	0.458	0.967	0.508	3.218
1:30:01	120.3	1.019	83.6	5.005	17.21	47.3268	107.5	1.057	1.014	1.734	1.475	0.458	0.966	0.509	3.223
1:30:33	120.5	1.025	83.6	4.999	17.32	47.3862	107.7	1.057	1.014	1.734	1.476	0.458	0.967	0.509	3.221
1:31:03	120.9	1.031	83.6	4.993	17.41	47.4427	108.1	1.059	1.016	1.736	1.482	0.462	0.972	0.510	3.205
1:31:34	121.0	1.037	83.5	4.987	17.51	47.5000	108.2	1.060	1.016	1.736	1.484	0.465	0.974	0.510	3.195
1:32:06	121.1	1.043	83.5	4.981	17.61	47.5572	108.3	1.059	1.015	1.735	1.486	0.468	0.977	0.509	3.179
1:32:36	121.6	1.049	83.5	4.975	17.72	47.6163	108.8	1.062	1.018	1.738	1.492	0.470	0.981	0.511	3.174
1:33:07	121.9	1.056	83.5	4.969	17.82	47.6746	109.1	1.064	1.020	1.740	1.493	0.470	0.981	0.512	3.179
1:33:38	122.3	1.061	83.4	4.963	17.91	47.7316	109.5	1.067	1.022	1.742	1.498	0.472	0.985	0.513	3.172

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	6.046 (in.)	15.357 (cm)	Height	4.933 (in.)	Tested By	KDG
Diameter	2.781 (in)	7.063 (cm)	Dia. avg.	3.415 (in)	Date	12-10-09
Area	6.073 (in^2)	39.181 (cm^2)	Area avg.	9.159 (in^2)	Press No.	1
					Panel No.	B

Project Number	175569069
Test Number	CU-1B
Data File ID	1B
Lateral Pressure (psi)	10.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
1:34:09	122.0	1.068	83.4	4.957	18.02	47.7908	109.2	1.063	1.018	1.738	1.497	0.475	0.986	0.511	3.150
1:34:38	122.4	1.074	83.4	4.951	18.11	47.8483	109.6	1.065	1.020	1.740	1.500	0.476	0.988	0.512	3.150
1:35:10	122.8	1.080	83.4	4.945	18.21	47.9067	110.0	1.067	1.022	1.742	1.504	0.479	0.991	0.513	3.143
1:35:42	122.8	1.086	83.3	4.939	18.31	47.9651	110.0	1.066	1.021	1.741	1.503	0.479	0.991	0.512	3.138
1:36:13	122.9	1.092	83.3	4.933	18.41	48.0245	110.1	1.067	1.021	1.741	1.505	0.481	0.993	0.512	3.128

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.914 (in.)	15.020 (cm)	Height	4.826 (in.)	Date	12-9-09	Test Number	CU-1C
Diameter	2.786 (in)	7.076 (cm)	Dia. avg.	3.271 (in)	Press No.	1	Data File ID	1C
Area	6.095 (in^2)	39.324 (cm^2)	Area avg.	8.401 (in^2)	Panel No.	A	Lateral Pressure (psi)	20.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
0:00:00	13.2	-0.021	70.1	5.914	0.00	39.3240	0.0	0.000	0.000	1.440	1.440	1.435	1.437	0.003	1.004
0:05:56	24.9	-0.015	70.9	5.908	0.10	39.3636	11.7	0.138	0.138	1.578	1.515	1.372	1.444	0.072	1.104
0:11:34	60.7	-0.009	74.5	5.902	0.20	39.4032	47.5	0.561	0.560	2.000	1.682	1.116	1.399	0.283	1.507
0:16:20	74.3	-0.003	75.7	5.896	0.30	39.4427	61.1	0.720	0.720	2.160	1.754	1.029	1.392	0.362	1.704
0:21:07	83.5	0.003	76.8	5.890	0.40	39.4827	70.3	0.827	0.826	2.266	1.779	0.947	1.363	0.416	1.878
0:25:46	91.2	0.009	77.5	5.884	0.50	39.5216	77.9	0.917	0.916	2.356	1.824	0.903	1.363	0.460	2.020
0:30:33	97.6	0.015	78.2	5.878	0.60	39.5613	84.4	0.992	0.991	2.431	1.849	0.853	1.351	0.498	2.168
0:35:16	103.1	0.021	78.5	5.872	0.70	39.6013	89.9	1.056	1.054	2.494	1.888	0.829	1.358	0.530	2.278
0:39:50	108.0	0.027	78.6	5.866	0.80	39.6429	94.8	1.112	1.110	2.550	1.938	0.823	1.381	0.558	2.356
0:44:19	112.7	0.033	79.2	5.860	0.90	39.6810	99.5	1.166	1.164	2.604	1.949	0.780	1.364	0.585	2.500
0:49:03	116.9	0.039	79.1	5.854	1.00	39.7213	103.7	1.214	1.212	2.652	2.003	0.786	1.394	0.608	2.548
0:53:47	120.9	0.045	79.6	5.849	1.10	39.7614	107.7	1.260	1.257	2.697	2.011	0.749	1.380	0.631	2.686
0:58:31	124.5	0.050	79.5	5.843	1.20	39.8015	111.2	1.300	1.297	2.737	2.060	0.758	1.409	0.651	2.718
1:03:14	128.3	0.056	79.9	5.837	1.30	39.8419	115.1	1.343	1.340	2.780	2.069	0.724	1.397	0.673	2.858
1:07:57	131.7	0.062	79.7	5.831	1.40	39.8821	118.5	1.382	1.379	2.819	2.122	0.738	1.430	0.692	2.874
1:12:43	134.8	0.068	80.0	5.825	1.50	39.9229	121.6	1.416	1.413	2.853	2.135	0.717	1.426	0.709	2.978
1:17:27	138.2	0.074	79.9	5.819	1.60	39.9638	125.0	1.454	1.450	2.890	2.185	0.730	1.457	0.728	2.995
1:22:10	141.2	0.080	80.1	5.813	1.70	40.0036	127.9	1.487	1.483	2.923	2.203	0.715	1.459	0.744	3.081
1:26:51	144.1	0.086	80.0	5.807	1.80	40.0449	130.9	1.520	1.516	2.956	2.244	0.723	1.483	0.760	3.104
1:31:36	147.1	0.092	80.0	5.801	1.90	40.0853	133.8	1.553	1.548	2.988	2.276	0.723	1.500	0.777	3.148
1:36:25	150.1	0.098	79.9	5.795	2.00	40.1262	136.9	1.586	1.581	3.021	2.311	0.725	1.518	0.793	3.189
1:41:05	153.1	0.104	79.3	5.789	2.10	40.1672	139.9	1.619	1.614	3.054	2.389	0.770	1.580	0.810	3.103
1:45:54	156.0	0.110	79.9	5.784	2.20	40.2082	142.8	1.652	1.646	3.086	2.378	0.726	1.552	0.826	3.274
1:50:24	158.3	0.115	79.6	5.778	2.30	40.2493	145.1	1.677	1.671	3.111	2.427	0.750	1.589	0.838	3.234
1:54:59	161.1	0.121	79.9	5.772	2.40	40.2910	147.9	1.706	1.701	3.141	2.433	0.727	1.580	0.853	3.346
1:59:40	164.0	0.127	79.6	5.766	2.50	40.3319	150.8	1.739	1.733	3.173	2.486	0.748	1.617	0.869	3.324
2:04:19	166.5	0.133	79.8	5.760	2.60	40.3733	153.3	1.765	1.759	3.199	2.499	0.735	1.617	0.882	3.399
2:08:55	169.1	0.139	79.5	5.754	2.70	40.4147	155.9	1.793	1.787	3.227	2.548	0.756	1.652	0.896	3.370
2:13:27	171.5	0.145	79.6	5.748	2.80	40.4561	158.3	1.819	1.812	3.252	2.568	0.750	1.659	0.909	3.423
2:18:10	173.9	0.151	79.3	5.742	2.90	40.4982	160.7	1.845	1.838	3.278	2.611	0.768	1.690	0.921	3.398
2:22:41	176.3	0.157	79.2	5.736	3.00	40.5398	163.1	1.871	1.864	3.304	2.643	0.774	1.709	0.934	3.413
2:27:15	179.2	0.163	79.2	5.730	3.10	40.5815	165.9	1.902	1.894	3.334	2.675	0.776	1.725	0.950	3.447
2:31:54	181.0	0.169	78.3	5.724	3.20	40.6232	167.7	1.920	1.912	3.352	2.759	0.842	1.801	0.959	3.277
2:36:35	183.2	0.175	79.0	5.718	3.30	40.6656	170.0	1.944	1.936	3.376	2.732	0.791	1.761	0.970	3.455
2:41:28	185.3	0.180	78.6	5.713	3.40	40.7073	172.1	1.966	1.958	3.398	2.783	0.820	1.801	0.981	3.393
2:46:24	188.1	0.186	78.8	5.707	3.50	40.7495	174.9	1.995	1.987	3.427	2.798	0.806	1.802	0.996	3.471
2:51:22	190.1	0.192	78.4	5.701	3.60	40.7916	176.9	2.016	2.007	3.447	2.846	0.833	1.839	1.006	3.415
2:56:01	192.5	0.198	78.7	5.695	3.70	40.8341	179.3	2.041	2.032	3.472	2.853	0.815	1.834	1.019	3.500
3:00:45	194.5	0.204	78.3	5.689	3.80	40.8764	181.3	2.063	2.053	3.493	2.903	0.845	1.874	1.029	3.436
3:05:33	196.7	0.210	78.4	5.683	3.90	40.9192	183.5	2.086	2.076	3.516	2.914	0.833	1.873	1.041	3.499
3:10:25	198.3	0.216	78.0	5.677	4.00	40.9617	185.1	2.101	2.091	3.531	2.959	0.863	1.911	1.048	3.429
3:15:16	200.7	0.222	78.1	5.671	4.10	41.0042	187.4	2.126	2.115	3.555	2.974	0.854	1.914	1.060	3.484
3:20:07	202.6	0.228	77.8	5.665	4.20	41.0477	189.4	2.146	2.135	3.575	3.020	0.880	1.950	1.070	3.434
3:24:57	204.3	0.234	77.8	5.659	4.30	41.0898	191.0	2.162	2.151	3.591	3.034	0.877	1.956	1.078	3.458
3:29:42	206.4	0.240	77.5	5.654	4.40	41.1328	193.2	2.184	2.173	3.613	3.077	0.899	1.988	1.089	3.422
3:34:30	208.4	0.246	77.5	5.648	4.50	41.1762	195.2	2.204	2.193	3.633	3.099	0.901	2.000	1.099	3.441
3:39:22	209.9	0.251	77.2	5.642	4.60	41.2192	196.7	2.219	2.208	3.648	3.132	0.919	2.025	1.107	3.409
3:44:08	211.5	0.257	77.0	5.636	4.70	41.2623	198.3	2.234	2.223	3.663	3.163	0.935	2.049	1.114	3.382
3:48:46	213.6	0.263	77.0	5.630	4.80	41.3061	200.4	2.256	2.244	3.684	3.183	0.934	2.058	1.125	3.409
3:53:30	215.5	0.269	76.5	5.624	4.90	41.3489	202.3	2.274	2.262	3.702	3.239	0.971	2.105	1.134	3.334
3:58:17	216.8	0.275	76.7	5.618	5.00	41.3925	203.6	2.287	2.274	3.714	3.234	0.954	2.094	1.140	3.390
4:03:05	218.4	0.281	76.4	5.612	5.10	41.4360	205.2	2.303	2.290	3.730	3.278	0.983	2.131	1.148	3.336
4:07:50	220.3	0.287	76.5	5.606	5.20	41.4798	207.1	2.321	2.308	3.748	3.283	0.970	2.127	1.157	3.386
4:12:48	222.0	0.293	76.2	5.600	5.30	41.5238	208.8	2.338	2.325	3.765	3.325	0.995	2.160	1.165	3.341
4:17:32	223.4	0.299	76.3	5.594	5.40	41.5675	210.1	2.351	2.337	3.777	3.328	0.985	2.156	1.171	3.378
4:22:22	225.0	0.305	75.9	5.588	5.50	41.6116	211.7	2.366	2.353	3.793	3.373	1.015	2.194	1.179	3.322
4:27:14	226.6	0.310	76.0	5.583	5.60	41.6552	213.4	2.382	2.368	3.808	3.379	1.006	2.192	1.187	3.361
4:32:06	228.4	0.316	75.7	5.577	5.70	41.6994	215.2	2.399	2.385	3.825	3.422	1.032	2.227	1.195	3.317
4:36:53	229.5	0.322	75.7	5.571	5.80	41.7438	216.3	2.410	2.395	3.835	3.427	1.026	2.227	1.200	3.339
4:41:45	231.1	0.328	75.4	5.565	5.90	41.7883	217.9	2.425	2.410	3.850	3.467	1.052	2.260	1.208	3.296

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG		
Height	5.914 (in.)	15.020 (cm)	Height	4.826 (in.)	Date	12-9-09	Project Number	175569069
Diameter	2.786 (in)	7.076 (cm)	Dia. avg.	3.271 (in)	Press No.	1	Test Number	CU-1C
Area	6.095 (in^2)	39.324 (cm^2)	Area avg.	8.401 (in^2)	Panel No.	A	Data File ID	1C
							Lateral Pressure (psi)	20.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
4:46:38	232.6	0.334	75.4	5.559	6.00	41.8327	219.4	2.439	2.424	3.864	3.477	1.048	2.262	1.215	3.319
4:51:20	233.6	0.340	75.2	5.553	6.10	41.8769	220.6	2.450	2.435	3.875	3.509	1.069	2.289	1.220	3.282
4:56:06	234.9	0.346	75.1	5.547	6.20	41.9217	221.7	2.459	2.444	3.884	3.525	1.075	2.300	1.225	3.278
5:00:53	236.6	0.352	74.9	5.541	6.30	41.9664	223.4	2.475	2.459	3.899	3.554	1.089	2.321	1.232	3.263
5:05:34	238.1	0.358	74.6	5.535	6.40	42.0113	224.8	2.489	2.473	3.913	3.589	1.111	2.350	1.239	3.230
5:10:12	239.4	0.364	74.6	5.529	6.50	42.0561	226.2	2.501	2.485	3.925	3.595	1.105	2.350	1.245	3.252
5:14:51	240.5	0.370	74.1	5.523	6.60	42.1011	227.2	2.510	2.494	3.934	3.646	1.147	2.396	1.249	3.178
5:19:31	242.3	0.375	74.5	5.518	6.70	42.1461	229.0	2.527	2.510	3.950	3.634	1.119	2.377	1.258	3.248
5:24:11	243.4	0.381	74.1	5.512	6.80	42.1917	230.2	2.537	2.520	3.960	3.670	1.144	2.407	1.263	3.207
5:28:53	244.6	0.387	74.3	5.506	6.90	42.2367	231.4	2.547	2.530	3.970	3.668	1.133	2.400	1.268	3.238
5:33:32	246.1	0.393	73.9	5.500	7.00	42.2822	232.9	2.561	2.544	3.984	3.709	1.160	2.434	1.274	3.198
5:38:12	247.5	0.399	73.9	5.494	7.10	42.3275	234.2	2.573	2.556	3.996	3.717	1.156	2.436	1.280	3.215
5:42:49	248.1	0.405	73.6	5.488	7.20	42.3734	234.9	2.578	2.560	4.000	3.744	1.178	2.461	1.283	3.177
5:47:26	249.6	0.411	73.7	5.482	7.30	42.4194	236.3	2.591	2.573	4.013	3.753	1.175	2.464	1.289	3.194
5:52:09	251.0	0.417	73.4	5.476	7.40	42.4647	237.8	2.604	2.586	4.026	3.783	1.192	2.488	1.296	3.173
5:56:49	251.8	0.423	73.2	5.470	7.50	42.5104	238.6	2.610	2.591	4.031	3.804	1.208	2.506	1.298	3.150
6:01:34	253.6	0.429	73.2	5.464	7.60	42.5563	240.4	2.627	2.608	4.048	3.823	1.209	2.516	1.307	3.161
6:06:27	254.3	0.435	72.4	5.458	7.70	42.6028	241.1	2.632	2.613	4.053	3.883	1.265	2.574	1.309	3.069
6:11:23	255.9	0.441	73.0	5.453	7.80	42.6493	242.7	2.646	2.626	4.066	3.858	1.226	2.542	1.316	3.147
6:16:16	256.9	0.446	72.4	5.447	7.90	42.6950	243.7	2.654	2.634	4.074	3.909	1.270	2.590	1.320	3.078
6:21:03	257.9	0.452	72.7	5.441	8.00	42.7417	244.7	2.662	2.642	4.082	3.891	1.243	2.567	1.324	3.130
6:25:52	259.5	0.458	72.3	5.435	8.10	42.7878	246.3	2.676	2.656	4.096	3.936	1.275	2.605	1.331	3.088
6:30:46	260.2	0.464	72.5	5.429	8.20	42.8345	247.0	2.681	2.661	4.101	3.927	1.261	2.594	1.333	3.114
6:35:29	261.7	0.470	72.2	5.423	8.30	42.8810	248.5	2.694	2.674	4.114	3.964	1.285	2.624	1.339	3.085
6:40:27	262.8	0.476	72.4	5.417	8.40	42.9278	249.5	2.703	2.682	4.122	3.958	1.270	2.614	1.344	3.115
6:45:28	263.9	0.482	72.0	5.411	8.50	42.9752	250.7	2.713	2.692	4.132	3.995	1.298	2.647	1.349	3.078
6:50:19	265.1	0.488	72.2	5.405	8.60	43.0217	251.9	2.722	2.701	4.141	3.990	1.284	2.637	1.353	3.108
6:55:07	266.1	0.494	71.8	5.399	8.70	43.0688	252.9	2.730	2.709	4.149	4.027	1.313	2.670	1.357	3.066
6:59:58	267.4	0.500	71.9	5.393	8.80	43.1162	254.2	2.741	2.719	4.159	4.026	1.301	2.663	1.362	3.094
7:04:54	268.3	0.506	71.6	5.388	8.90	43.1634	255.1	2.748	2.726	4.166	4.059	1.327	2.693	1.366	3.058
7:09:44	269.3	0.511	71.7	5.382	8.99	43.2106	256.1	2.756	2.734	4.174	4.059	1.320	2.690	1.370	3.075
7:14:24	270.6	0.517	71.4	5.376	9.09	43.2581	257.4	2.767	2.745	4.185	4.089	1.339	2.714	1.375	3.053
7:19:23	271.6	0.523	71.4	5.370	9.19	43.3058	258.4	2.775	2.752	4.192	4.094	1.337	2.716	1.379	3.062
7:24:18	272.5	0.529	71.2	5.364	9.29	43.3534	259.3	2.781	2.758	4.198	4.120	1.357	2.738	1.382	3.037
7:29:03	273.7	0.535	71.2	5.358	9.39	43.4013	260.5	2.791	2.768	4.208	4.126	1.353	2.740	1.386	3.049
7:34:02	274.9	0.541	71.0	5.352	9.50	43.4495	261.7	2.800	2.777	4.217	4.153	1.371	2.762	1.391	3.029
7:38:55	275.7	0.547	70.9	5.346	9.59	43.4975	262.5	2.806	2.782	4.222	4.161	1.374	2.767	1.394	3.029
7:43:43	276.6	0.553	70.7	5.340	9.69	43.5454	263.4	2.812	2.788	4.228	4.180	1.387	2.783	1.397	3.014
7:48:39	277.5	0.559	70.6	5.334	9.79	43.5936	264.3	2.819	2.795	4.235	4.199	1.399	2.799	1.400	3.001
7:53:31	278.9	0.565	70.6	5.328	9.89	43.6419	265.7	2.831	2.807	4.247	4.212	1.400	2.806	1.406	3.008
7:58:20	279.8	0.570	69.8	5.323	9.99	43.6904	266.6	2.837	2.812	4.252	4.273	1.455	2.864	1.409	2.936
8:03:06	280.8	0.576	70.3	5.317	10.09	43.7389	267.5	2.844	2.819	4.259	4.240	1.415	2.827	1.412	2.996
8:08:00	281.8	0.582	69.8	5.311	10.19	43.7877	268.6	2.853	2.827	4.267	4.287	1.455	2.871	1.416	2.947
8:12:52	283.0	0.588	70.2	5.305	10.29	43.8368	269.8	2.862	2.837	4.277	4.267	1.425	2.846	1.421	2.994
8:17:43	283.4	0.594	69.8	5.299	10.39	43.8853	270.2	2.863	2.837	4.277	4.297	1.454	2.876	1.421	2.954
8:22:27	284.8	0.600	70.0	5.293	10.49	43.9343	271.6	2.875	2.849	4.289	4.292	1.438	2.865	1.427	2.985
8:27:16	285.7	0.606	69.7	5.287	10.59	43.9836	272.5	2.881	2.854	4.294	4.321	1.461	2.891	1.430	2.957
8:32:03	286.7	0.612	69.9	5.281	10.69	44.0330	273.5	2.888	2.862	4.302	4.312	1.445	2.878	1.433	2.984
8:36:45	287.5	0.618	69.5	5.275	10.79	44.0820	274.3	2.894	2.867	4.307	4.346	1.474	2.910	1.436	2.949
8:41:30	289.0	0.624	69.7	5.269	10.89	44.1315	275.8	2.906	2.879	4.319	4.345	1.461	2.903	1.442	2.974
8:46:16	289.7	0.630	69.4	5.263	10.99	44.1811	276.5	2.910	2.883	4.323	4.372	1.484	2.928	1.444	2.946
8:50:55	290.7	0.636	69.4	5.258	11.09	44.2306	277.5	2.918	2.890	4.330	4.379	1.484	2.931	1.448	2.951
8:55:37	291.8	0.641	69.2	5.252	11.19	44.2807	278.6	2.926	2.898	4.338	4.399	1.496	2.947	1.452	2.941
9:00:23	292.8	0.647	69.2	5.246	11.29	44.3308	279.6	2.933	2.905	4.345	4.406	1.496	2.951	1.455	2.945
9:05:04	293.4	0.653	69.0	5.240	11.39	44.3803	280.2	2.936	2.908	4.348	4.423	1.510	2.966	1.457	2.929
9:09:50	294.4	0.659	68.6	5.234	11.49	44.4304	281.2	2.943	2.915	4.355	4.464	1.544	3.004	1.460	2.891
9:14:44	295.7	0.665	68.9	5.228	11.59	44.4810	282.5	2.954	2.925	4.365	4.449	1.519	2.984	1.465	2.929
9:19:33	296.2	0.671	68.3	5.222	11.69	44.5311	283.0	2.955	2.926	4.366	4.493	1.561	3.027	1.466	2.877
9:24:19	297.4	0.677	68.7	5.216	11.79	44.5815	284.1	2.964	2.935	4.375	4.472	1.532	3.002	1.470	2.919
9:29:14	298.2	0.683	68.3	5.210	11.89	44.6322	285.0	2.969	2.940	4.380	4.507	1.562	3.034	1.472	2.885

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.914 (in.)	15.020 (cm)	Height	4.826 (in.)	Date	12-9-09	Test Number	CU-1C
Diameter	2.786 (in)	7.076 (cm)	Dia. avg.	3.271 (in)	Press No.	1	Data File ID	1C
Area	6.095 (in^2)	39.324 (cm^2)	Area avg.	8.401 (in^2)	Panel No.	A	Lateral Pressure (psi)	20.0
							Chamber Pressure - σ_3 (psi)	90

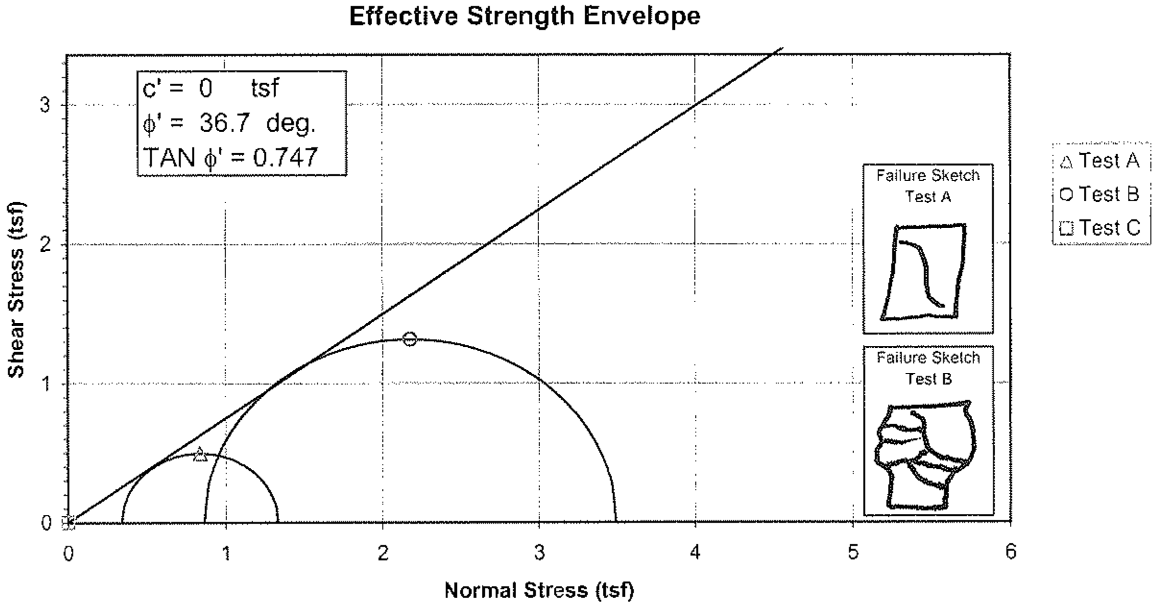
Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
9:34:11	299.3	0.689	68.6	5.204	11.99	44.6832	286.1	2.977	2.947	4.387	4.496	1.544	3.020	1.476	2.912
9:38:57	300.2	0.695	68.2	5.198	12.09	44.7335	287.0	2.984	2.954	4.394	4.529	1.570	3.050	1.479	2.885
9:43:58	300.9	0.701	68.4	5.193	12.19	44.7845	287.7	2.987	2.957	4.397	4.520	1.558	3.039	1.481	2.901
9:48:54	301.9	0.706	68.1	5.187	12.29	44.8354	288.7	2.995	2.964	4.404	4.548	1.579	3.064	1.485	2.880
9:53:55	303.0	0.712	68.2	5.181	12.39	44.8872	289.8	3.002	2.971	4.411	4.543	1.566	3.054	1.488	2.901
9:58:47	304.0	0.718	67.9	5.175	12.49	44.9381	290.7	3.009	2.978	4.418	4.571	1.589	3.080	1.491	2.877
10:03:45	305.3	0.724	68.2	5.169	12.59	44.9894	292.1	3.019	2.988	4.428	4.564	1.571	3.068	1.496	2.905
10:08:49	306.2	0.730	67.8	5.163	12.69	45.0414	293.0	3.024	2.993	4.433	4.597	1.599	3.098	1.499	2.875
10:13:48	306.7	0.736	68.0	5.157	12.79	45.0925	293.5	3.027	2.995	4.435	4.586	1.585	3.086	1.500	2.892
10:18:50	307.5	0.742	67.6	5.151	12.89	45.1444	294.3	3.031	2.999	4.439	4.618	1.613	3.115	1.502	2.862
10:23:51	308.8	0.748	67.8	5.145	12.99	45.1962	295.6	3.041	3.009	4.449	4.612	1.597	3.104	1.507	2.887
10:28:51	309.3	0.754	67.4	5.139	13.09	45.2479	296.1	3.043	3.010	4.450	4.639	1.624	3.132	1.508	2.857
10:33:43	310.5	0.760	67.6	5.133	13.19	45.3002	297.3	3.051	3.019	4.459	4.635	1.611	3.123	1.512	2.877
10:38:38	311.2	0.766	67.3	5.128	13.29	45.3523	298.0	3.055	3.022	4.462	4.662	1.635	3.149	1.514	2.851
10:43:36	312.0	0.771	67.4	5.122	13.39	45.4045	298.8	3.060	3.027	4.467	4.657	1.624	3.140	1.516	2.867
10:48:35	312.5	0.777	67.1	5.116	13.49	45.4570	299.3	3.062	3.029	4.469	4.681	1.648	3.164	1.517	2.841
10:53:29	313.6	0.783	67.2	5.110	13.59	45.5096	300.4	3.070	3.036	4.476	4.682	1.641	3.162	1.521	2.853
10:58:30	314.6	0.789	66.9	5.104	13.69	45.5623	301.4	3.076	3.042	4.482	4.707	1.660	3.184	1.524	2.836
11:03:25	315.3	0.795	67.0	5.098	13.79	45.6151	302.0	3.079	3.045	4.485	4.705	1.655	3.180	1.525	2.843
11:08:19	315.9	0.801	66.7	5.092	13.89	45.6685	302.6	3.082	3.047	4.487	4.727	1.674	3.200	1.526	2.823
11:13:17	316.8	0.807	66.8	5.086	13.99	45.7214	303.6	3.088	3.053	4.493	4.729	1.671	3.200	1.529	2.831
11:18:16	317.8	0.813	66.6	5.080	14.09	45.7742	304.6	3.094	3.059	4.499	4.749	1.684	3.217	1.532	2.819
11:23:12	318.5	0.819	66.6	5.074	14.19	45.8277	305.2	3.097	3.062	4.502	4.753	1.686	3.219	1.534	2.819
11:28:06	319.6	0.825	66.4	5.068	14.29	45.8811	306.4	3.105	3.070	4.510	4.772	1.697	3.235	1.537	2.811
11:33:05	320.7	0.831	66.4	5.062	14.39	45.9351	307.5	3.113	3.077	4.517	4.783	1.701	3.242	1.541	2.812
11:37:57	321.5	0.836	66.3	5.057	14.49	45.9884	308.3	3.117	3.081	4.521	4.792	1.706	3.249	1.543	2.809
11:42:49	322.0	0.842	65.6	5.051	14.59	46.0420	308.8	3.119	3.083	4.523	4.844	1.757	3.301	1.544	2.758
11:47:45	322.9	0.848	66.1	5.045	14.69	46.0960	309.6	3.124	3.087	4.527	4.811	1.719	3.265	1.546	2.799
11:52:44	323.9	0.854	65.6	5.039	14.79	46.1503	310.7	3.130	3.093	4.533	4.854	1.755	3.304	1.549	2.766
11:57:36	324.7	0.860	66.0	5.033	14.89	46.2047	311.5	3.135	3.098	4.538	4.829	1.727	3.278	1.551	2.797
12:02:23	325.6	0.866	65.6	5.027	14.99	46.2586	312.4	3.141	3.103	4.543	4.862	1.753	3.308	1.554	2.773
12:07:14	326.4	0.872	66.0	5.021	15.09	46.3134	313.2	3.144	3.107	4.547	4.842	1.730	3.286	1.556	2.799
12:12:02	326.8	0.878	65.6	5.015	15.19	46.3676	313.6	3.145	3.107	4.547	4.867	1.754	3.311	1.556	2.774
12:16:48	328.0	0.884	65.9	5.009	15.29	46.4228	314.8	3.153	3.115	4.555	4.852	1.732	3.292	1.560	2.802
12:21:37	329.0	0.890	65.6	5.003	15.39	46.4774	315.8	3.160	3.121	4.561	4.886	1.760	3.323	1.563	2.777
12:26:30	329.8	0.896	65.7	4.997	15.49	46.5325	316.6	3.164	3.125	4.565	4.877	1.746	3.311	1.565	2.793
12:31:15	330.3	0.901	65.4	4.992	15.59	46.5872	317.1	3.165	3.127	4.567	4.904	1.772	3.338	1.566	2.767
12:36:15	331.5	0.907	65.6	4.986	15.69	46.6426	318.2	3.173	3.134	4.574	4.896	1.757	3.327	1.570	2.786
12:41:11	332.5	0.913	65.3	4.980	15.79	46.6983	319.3	3.180	3.140	4.580	4.922	1.777	3.349	1.573	2.771
12:46:04	333.0	0.919	65.4	4.974	15.89	46.7534	319.8	3.180	3.141	4.581	4.914	1.768	3.341	1.573	2.780
12:50:54	333.8	0.925	65.2	4.968	15.99	46.8089	320.5	3.184	3.145	4.585	4.937	1.788	3.363	1.575	2.762
12:55:50	335.0	0.931	65.3	4.962	16.09	46.8647	321.8	3.193	3.153	4.593	4.937	1.779	3.358	1.579	2.775
13:00:52	335.6	0.937	65.1	4.956	16.19	46.9207	322.3	3.195	3.154	4.594	4.956	1.796	3.376	1.580	2.759
13:05:44	336.5	0.943	65.1	4.950	16.29	46.9767	323.3	3.200	3.160	4.600	4.959	1.794	3.376	1.583	2.765
13:10:38	337.2	0.949	64.9	4.944	16.39	47.0330	324.0	3.203	3.163	4.603	4.975	1.807	3.391	1.584	2.753
13:15:46	338.2	0.955	65.0	4.938	16.49	47.0899	325.0	3.209	3.168	4.608	4.976	1.803	3.389	1.587	2.760
13:20:39	338.3	0.961	64.8	4.932	16.59	47.1457	325.1	3.207	3.166	4.606	4.987	1.817	3.402	1.585	2.746
13:25:36	339.2	0.967	64.6	4.927	16.69	47.2025	326.0	3.212	3.170	4.610	5.004	1.828	3.416	1.588	2.737
13:30:43	339.9	0.972	64.7	4.921	16.79	47.2587	326.7	3.215	3.173	4.613	5.001	1.823	3.412	1.589	2.743
13:35:47	340.4	0.978	64.2	4.915	16.89	47.3155	327.2	3.216	3.174	4.614	5.034	1.855	3.445	1.590	2.714
13:40:48	341.5	0.984	64.5	4.909	16.99	47.3726	328.3	3.223	3.181	4.621	5.020	1.834	3.427	1.593	2.737
13:46:03	342.3	0.990	64.4	4.903	17.09	47.4301	329.1	3.227	3.184	4.624	5.033	1.844	3.439	1.595	2.730
13:51:08	343.6	0.996	64.5	4.897	17.19	47.4871	330.4	3.235	3.192	4.632	5.037	1.839	3.438	1.599	2.739
13:56:05	344.1	1.002	63.7	4.891	17.29	47.5441	330.9	3.236	3.194	4.634	5.089	1.891	3.490	1.599	2.692
14:01:09	345.1	1.008	64.3	4.885	17.39	47.6017	331.9	3.242	3.199	4.639	5.055	1.851	3.453	1.602	2.731
14:06:11	345.8	1.014	63.8	4.879	17.49	47.6596	332.6	3.245	3.202	4.642	5.096	1.889	3.493	1.603	2.698
14:11:14	346.7	1.020	64.2	4.873	17.59	47.7173	333.5	3.250	3.206	4.646	5.071	1.860	3.465	1.606	2.727
14:16:11	347.4	1.026	63.7	4.867	17.69	47.7755	334.2	3.252	3.209	4.649	5.106	1.893	3.500	1.607	2.698
14:21:10	348.3	1.031	64.1	4.862	17.79	47.8333	335.1	3.258	3.213	4.653	5.086	1.867	3.477	1.609	2.724
14:26:13	349.2	1.037	63.7	4.856	17.89	47.8920	335.9	3.262	3.217	4.657	5.118	1.896	3.507	1.611	2.700

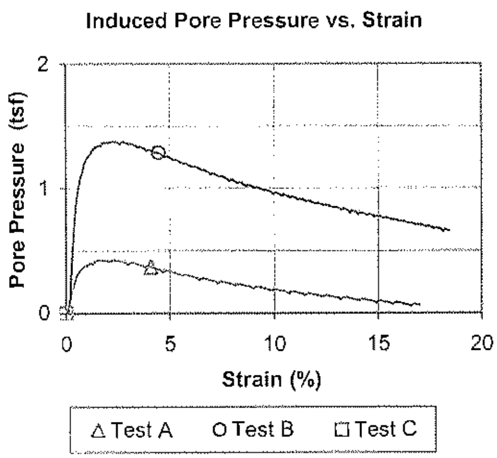
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG		Project Number	175569069
Height	5.914 (in.)	15.020 (cm)	Height	4.826 (in.)	Date	12-9-09		Test Number	CU-1C
Diameter	2.786 (in)	7.076 (cm)	Dia. avg.	3.271 (in)	Press No.	1		Data File ID	1C
Area	6.095 (in^2)	39.324 (cm^2)	Area avg.	8.401 (in^2)	Panel No.	A		Lateral Pressure (psi)	20.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
14:31:10	349.5	1.043	63.9	4.850	17.99	47.9502	336.3	3.261	3.216	4.656	5.101	1.879	3.490	1.611	2.715
14:36:11	350.4	1.049	63.5	4.844	18.09	48.0086	337.2	3.266	3.221	4.661	5.131	1.905	3.518	1.613	2.694
14:41:17	351.5	1.055	63.8	4.838	18.19	48.0675	338.3	3.272	3.227	4.667	5.116	1.884	3.500	1.616	2.716
14:46:21	351.9	1.061	63.4	4.832	18.29	48.1257	338.6	3.272	3.227	4.667	5.144	1.912	3.528	1.616	2.691
14:51:29	352.4	1.067	63.7	4.826	18.39	48.1846	339.2	3.274	3.228	4.668	5.128	1.895	3.511	1.617	2.707

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C
Initial Data	Water content %	W_o	19.3	18.2	######
	Dry Density PCF	γd_o	106.8	111.2	######
	Saturation %	S_o	90.1	95.2	######
	Void Ratio	e_o	0.578	0.515	######
After Shear	Water content %	W_f	21.1	14.6	######
	Dry Density PCF	γd_f	107.3	120.8	######
	Saturation %	S_f	100.0	100.0	######
	Void Ratio	e_f	0.571	0.395	######
	Final Back Pressure TSF	u_c	5.76	4.32	0.00
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.34	0.87	0.00
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	0.99	2.62	0.00
Time to (σ1'-σ3')max min.		t_f	48.5	102.9	0.0
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	0.00
Initial Diameter, in.		D_o	2.872	2.836	######
Initial Height, in.		H_o	6.008	5.975	######

Controlled - Strain Test

Description of Specimens Sandy Lean Clay (CL), red brown, moist, firm

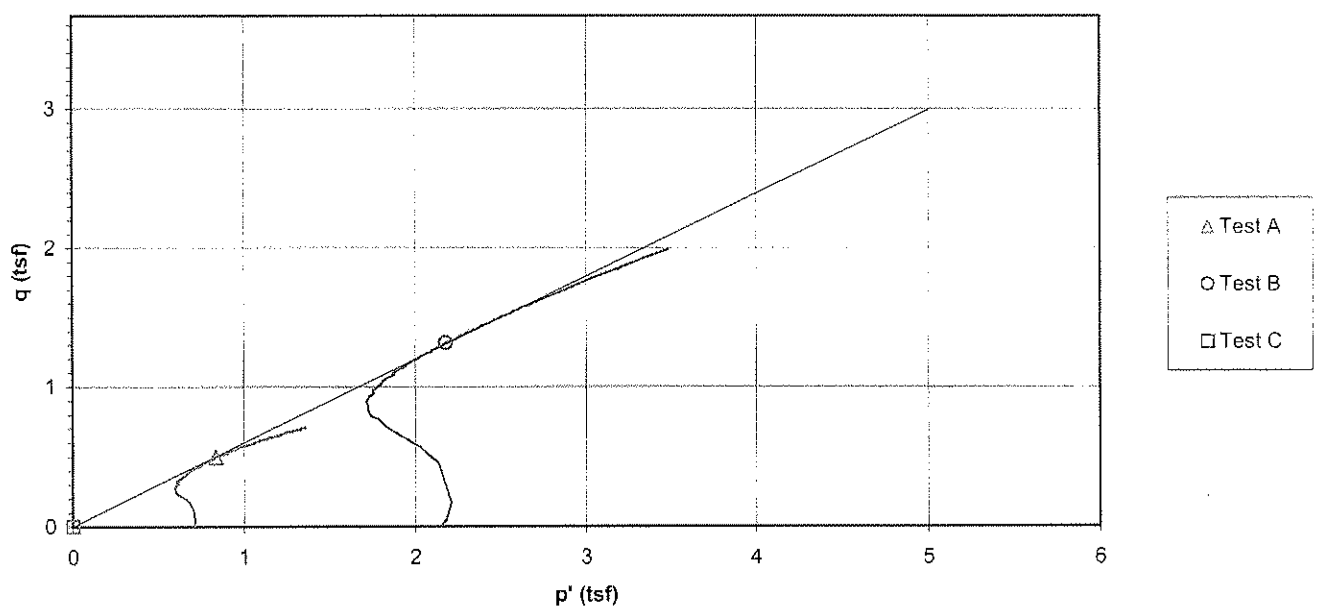
			Type of Specimen	Undisturbed	Type of test $\bar{R}$
LL	PL	PI	Gs 2.7	Project	PAF - Peabody Ash Pond
Remarks:				Boring No.	STN-18 (N1), STN-6 (N1)
					Sample No. 2
				Depth Elev.	8.4'-8.9', 11.2'-11.7'
				Laboratory	Stantec
				Date 12-22-09	

TRIAXIAL COMPRESSION TEST REPORT

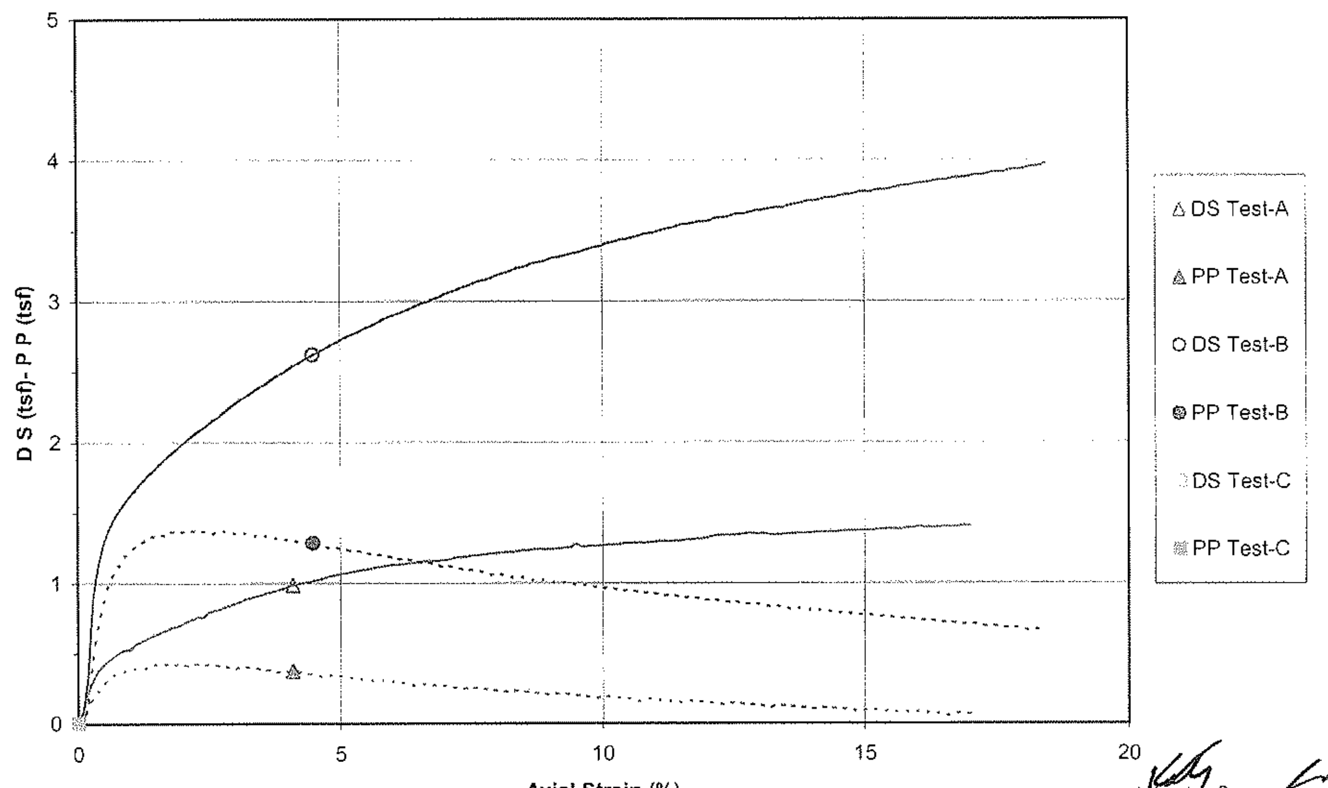
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	PAF - Peabody Ash Pond	Project No.	175569069
Sample ID	STN-18 (N-1), 8.4'-8.9 & STN-6 (N1), 11.2'-11.7'	Test Number	2
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 36.7 deg.	c' =	0.00 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



File: frm_20091207_cu_2 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Consolidated Undrained Triaxial Test

ASTM D4767-04

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-18 (N-1), 8.4'-8.9	Test Number	CU-2A
Visual Description	Sandy Lean Clay (CL), red brown, moist, firm	Prepared By	CM
Undisturbed	Source STN-18, (N-1), 8.4'-9.0'	Date	12-9-2009

Specific Gravity 2.70 ASTM D854 Method A — Liquid Limit N/A — Plastic Limit N/A — Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.876	1	6.012	Sample	39.0283 (V_o)	Wet Weight (g)	1301.76
Middle	2.859	2	6.009	Solids	24.6650 (VS_o)	Dry Weight (g)	1091.37
Bottom	2.893	3	6.013	Water	12.8380 (Vw_o)	Wet Unit Weight (pcf)	127.1
Avg.	2.8760 (D_o)	4	5.998	Voids	14.3633 (Vv_o)	Dry Unit Weight (pcf)	106.5
Area (in^2)	6.4963 (A_o)	Avg. (H_o)	6.0078	Degree of Saturation (%)	89.4 (S_o)		
Moisture Content (%)	19.3	Final Trimmings		Void Ratio	0.582		

Saturation

Set Up & Saturated: Wet xx Dry ____ — Set up By KDG

Back Pressure Saturated to: 80 (psi) — Final Pore Pressure Parameter B 0.96 — Date 11-9-09

Panel Board Number D

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1268	Initial	16.65 (in.)	Initial	11.76 (in.)	Specimen Height (in.)	6.0033 (H_s)
Final	0.1313	Final	9.94 (in.)	Final	8.74 (in.)	Area (in^2) Method A	6.4866 (A_s)
Change	-0.0045 (ΔH_o)	Change	-6.71 (in.)	Change	-3.02 (in.)	Specimen Volume (in^3)	38.94 (Vs)

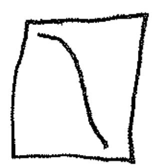
Consolidation

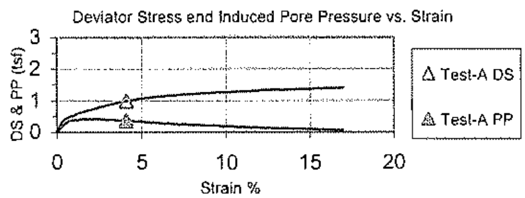
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1313	Initial	1.37 (in.)	Initial	17.17 (in.)	Chamber	90
Final	0.1556	Final	4.18 (in.)	Final	14.04 (in.)	Back	80
Change	-0.0243 (ΔH_c)	Change	-2.81 (in.)	Change	-3.13 (in.)	Lateral	10 (σ_3)
Height (in.)	5.9790 (H_c)			Volume (in^3)	38.7484 (V_c)		
Area (in^3) Method B	6.4808 (A_c)			Volume - Water (in^3)	14.0834 (VWc)	t_{50} (min.)	1.603
Diameter (in.)	2.8726 (D_c)			Water Content (%)	21.1		
Dry Density (pcf)	107.3			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.571

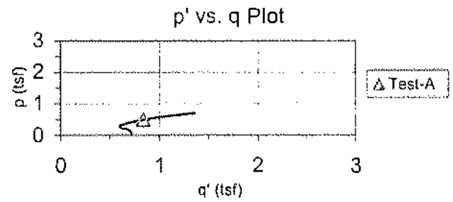
After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.25 (in.)	Wet Weight (g)	1322.17	Corrected Deviator	0.99 σ_d (tsf)
Wet weight (g)	1322.17 (WWf)	Dry Weight (g)	1091.37	Major Principal	1.33 $\sigma_{1'f}$ (tsf)
Corrected Diameter	3.226 (in.)	Tare Weight (g)	0.00	Minor Principal	0.34 $\sigma_{3'f}$ (tsf)
				Rate of Strain (% / min.)	0.083
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	4.10
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch







Comments:

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-6 (N1), 11.2'-11.7'	Test Number	CU-2B
Visual Description	Sandy Lean Clay (CL), brown, wet, very soft	Prepared By	KDG
Undisturbed	Source STN-6 (N1), 11.2'-11.8'	Date	12-16-2009

Specific Gravity 2.70 ASTM D854 Method A Liquid Limit N/A Plastic Limit N/A Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in3)		Specimen	
Top	2.849	1	5.967	Sample	37.7942 (V_o)	Wet Weight (g)	1301.97
Middle	2.829	2	5.964	Solids	24.9015 (VS_o)	Dry Weight (g)	1101.84
Bottom	2.836	3	5.966	Water	12.2121 (Vw_o)	Wet Unit Weight (pcf)	131.2
Avg.	2.8380 (D_o)	4	6.002	Voids	12.8927 (Vv_o)	Dry Unit Weight (pcf)	111.1
Area (in^2)	6.3258 (A_o)	Avg. (H_o)	5.9746	Degree of Saturation (%)	94.7 (S_o)		
Moisture Content (%)	18.2	Final Trimmings		Void Ratio	0.518		

Saturation

Set Up & Saturated: Wet xx Dry ____ Set up By KDG

Back Pressure Saturated to: 60 (psi) Final Pore Pressure Parameter B 0.96 Date 12-17-09

Panel Board Number B

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1297	Initial	16.72 (in.)	Initial	12.24 (in.)	Specimen Height (in.)	5.9631 (H_s)
Final	0.1412	Final	15.42 (in.)	Final	9.61 (in.)	Area (in^2) Method A	6.3014 (A_s)
Change	-0.0115 (ΔH_o)	Change	-1.30 (in.)	Change	-2.63 (in.)	Specimen Volume (in^3)	37.58 (V_s)

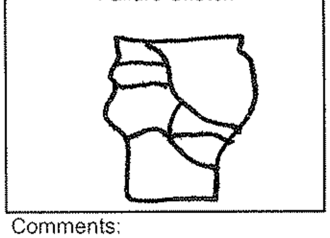
Consolidation

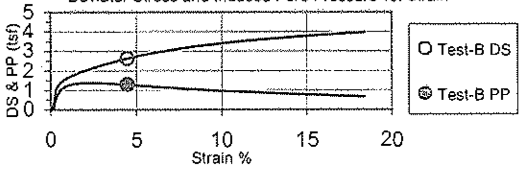
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1412	Initial	1.71 (in.)	Initial	17.61 (in.)	Chamber	90
Final	0.1862	Final	9.11 (in.)	Final	10.22 (in.)	Back	60
Change	-0.0450 (ΔH_c)	Change	-7.40 (in.)	Change	-7.39 (in.)	Lateral	30 (σ_3)
Height (in.)	5.9181 (H_c)			Volume (in^3)	34.7387 (V_c)		
Area (in^3) Method B	5.8699 (A_c)			Volume - Water (in^3)	9.8372 (VW_c)	D_{50} (min.)	4.481
Diameter (in.)	2.7338 (D_c)			Water Content (%)	14.6		
Dry Density (pcf)	120.8			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.395

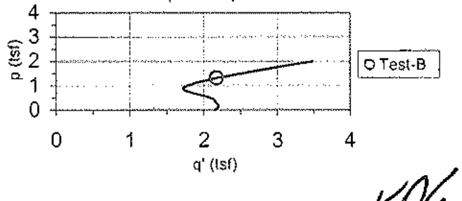
After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.352 (in.)	Wet Weight (g)	1263.05	Corrected Deviator	2.62 σ_d (tsf)
Wet weight (g)	1263.05 (WWf)	Dry Weight (g)	1101.84	Major Principal	3.50 $\sigma_1'{}_f$ (tsf)
Corrected Diameter	3.328 (in.)	Tare Weight (g)	0.00	Minor Principal	0.87 $\sigma_3'{}_f$ (tsf)
				Rate of Strain (% / min.)	0.042
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	4.49
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch







Comments:

KDG

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.979 (in.)	15.187 (cm)	Height	4.962 (in.)	Date	12-10-09	Test Number	CU-2A
Diameter	2.873 (in)	7.297 (cm)	Dia. avg.	3.218 (in)	Press No.	2	Data File ID	2A
Area	6.481 (in²)	41.814 (cm²)	Area avg.	8.134 (in²)	Panel No.	D	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
0:00:00	13.8	0.003	80.1	5.979	0.00	41.8141	0.0	0.000	0.000	0.720	0.720	0.714	0.717	0.003	1.008
0:00:41	22.0	0.009	80.7	5.973	0.10	41.8576	8.2	0.091	0.091	0.811	0.767	0.671	0.719	0.048	1.144
0:01:38	33.7	0.015	81.7	5.967	0.20	41.8992	19.9	0.221	0.221	0.941	0.825	0.598	0.712	0.113	1.378
0:02:53	41.9	0.021	82.6	5.961	0.30	41.9415	28.2	0.312	0.311	1.031	0.850	0.533	0.691	0.159	1.595
0:04:07	48.0	0.027	83.3	5.955	0.40	41.9825	34.2	0.379	0.378	1.098	0.866	0.483	0.674	0.192	1.794
0:05:20	51.8	0.033	84.0	5.949	0.50	42.0252	38.0	0.420	0.419	1.139	0.853	0.429	0.641	0.212	1.991
0:06:33	54.6	0.039	84.5	5.943	0.60	42.0668	40.8	0.451	0.450	1.170	0.848	0.393	0.620	0.228	2.159
0:07:46	57.1	0.045	84.9	5.937	0.70	42.1096	43.3	0.479	0.477	1.197	0.849	0.367	0.608	0.241	2.317
0:08:59	59.7	0.051	85.1	5.931	0.80	42.1523	45.9	0.506	0.504	1.224	0.861	0.352	0.606	0.255	2.450
0:10:10	61.8	0.057	85.3	5.925	0.90	42.1947	48.0	0.529	0.527	1.247	0.871	0.339	0.605	0.266	2.573
0:11:23	61.5	0.063	85.3	5.919	1.00	42.2369	47.7	0.525	0.523	1.243	0.864	0.335	0.599	0.264	2.575
0:12:36	65.3	0.069	85.5	5.913	1.10	42.2800	51.5	0.567	0.564	1.284	0.891	0.321	0.606	0.285	2.775
0:13:47	66.9	0.075	85.6	5.907	1.20	42.3222	53.2	0.584	0.581	1.301	0.904	0.317	0.611	0.293	2.850
0:15:03	68.8	0.081	85.6	5.901	1.31	42.3677	55.0	0.604	0.601	1.321	0.926	0.320	0.623	0.303	2.894
0:16:14	70.7	0.087	85.9	5.895	1.41	42.4100	56.9	0.624	0.621	1.341	0.923	0.297	0.610	0.313	3.106
0:17:24	72.0	0.093	85.9	5.889	1.51	42.4533	58.2	0.638	0.634	1.354	0.932	0.292	0.612	0.320	3.187
0:18:33	73.8	0.099	86.0	5.883	1.60	42.4947	60.0	0.656	0.653	1.373	0.949	0.291	0.620	0.329	3.260
0:19:48	75.0	0.105	85.9	5.877	1.70	42.5386	61.2	0.670	0.665	1.385	0.963	0.292	0.628	0.336	3.297
0:20:59	76.7	0.111	85.9	5.871	1.81	42.5828	62.9	0.687	0.683	1.403	0.981	0.293	0.637	0.344	3.347
0:22:10	77.6	0.117	85.9	5.865	1.90	42.6245	63.8	0.696	0.691	1.411	0.991	0.294	0.642	0.348	3.371
0:23:23	79.3	0.123	85.9	5.859	2.00	42.6687	65.5	0.714	0.709	1.429	1.012	0.297	0.654	0.357	3.410
0:24:34	81.0	0.129	85.8	5.853	2.10	42.7128	67.2	0.732	0.726	1.446	1.036	0.304	0.670	0.366	3.405
0:25:44	82.5	0.135	85.9	5.847	2.20	42.7549	68.7	0.747	0.742	1.462	1.041	0.293	0.667	0.374	3.546
0:26:58	84.2	0.141	86.0	5.841	2.30	42.7994	70.4	0.765	0.759	1.479	1.055	0.290	0.672	0.382	3.639
0:28:11	83.8	0.147	85.9	5.835	2.40	42.8441	70.1	0.760	0.755	1.475	1.056	0.296	0.676	0.380	3.570
0:29:24	87.5	0.153	85.9	5.829	2.50	42.8876	73.7	0.799	0.793	1.513	1.094	0.295	0.695	0.399	3.704
0:30:35	88.5	0.159	85.8	5.823	2.60	42.9310	74.8	0.810	0.804	1.524	1.109	0.299	0.704	0.405	3.702
0:31:45	89.5	0.165	85.8	5.817	2.70	42.9746	75.7	0.819	0.813	1.533	1.121	0.303	0.712	0.409	3.703
0:32:59	91.2	0.171	85.7	5.811	2.80	43.0198	77.4	0.836	0.830	1.550	1.142	0.307	0.725	0.418	3.721
0:34:09	92.1	0.177	85.6	5.805	2.90	43.0642	78.3	0.846	0.839	1.559	1.158	0.314	0.736	0.422	3.689
0:35:23	93.9	0.183	85.4	5.799	3.00	43.1088	80.1	0.864	0.857	1.577	1.191	0.329	0.760	0.431	3.623
0:36:33	94.8	0.189	85.7	5.794	3.10	43.1522	81.1	0.874	0.866	1.586	1.182	0.310	0.746	0.436	3.811
0:37:47	96.7	0.195	85.7	5.787	3.20	43.1985	82.9	0.892	0.885	1.605	1.201	0.311	0.756	0.445	3.863
0:38:55	97.8	0.201	85.6	5.782	3.30	43.2415	84.0	0.903	0.895	1.615	1.216	0.315	0.766	0.451	3.859
0:40:08	98.8	0.207	85.5	5.776	3.40	43.2861	85.0	0.913	0.905	1.625	1.232	0.321	0.777	0.455	3.834
0:41:19	99.8	0.213	85.5	5.770	3.50	43.3317	86.0	0.923	0.914	1.634	1.247	0.327	0.787	0.460	3.810
0:42:32	101.2	0.219	85.4	5.763	3.60	43.3772	87.4	0.937	0.929	1.649	1.266	0.332	0.799	0.467	3.815
0:43:45	102.0	0.225	85.3	5.757	3.70	43.4228	88.3	0.945	0.936	1.656	1.280	0.338	0.809	0.471	3.789
0:44:56	103.5	0.231	85.2	5.752	3.80	43.4674	89.7	0.959	0.950	1.670	1.304	0.348	0.826	0.478	3.748
0:46:07	104.2	0.237	85.2	5.746	3.90	43.5126	90.4	0.967	0.957	1.677	1.306	0.344	0.825	0.481	3.803
0:47:17	105.9	0.242	85.3	5.740	4.00	43.5569	92.1	0.983	0.974	1.694	1.320	0.341	0.831	0.490	3.872
0:48:28	107.1	0.248	85.2	5.734	4.10	43.6022	93.3	0.995	0.985	1.705	1.334	0.343	0.838	0.495	3.889
0:49:41	108.2	0.255	85.2	5.728	4.20	43.6493	94.4	1.006	0.996	1.716	1.350	0.349	0.849	0.501	3.870
0:50:54	108.8	0.261	85.1	5.722	4.31	43.6955	95.0	1.011	1.000	1.720	1.362	0.356	0.859	0.503	3.824
0:52:05	109.6	0.266	85.0	5.716	4.40	43.7401	95.8	1.019	1.008	1.728	1.375	0.361	0.868	0.507	3.806
0:53:16	110.5	0.272	84.9	5.710	4.50	43.7861	96.7	1.027	1.017	1.737	1.388	0.366	0.877	0.511	3.794
0:54:26	111.6	0.278	84.8	5.704	4.60	43.8310	97.8	1.037	1.026	1.746	1.405	0.373	0.889	0.516	3.767
0:55:37	112.5	0.284	84.6	5.698	4.70	43.8777	98.8	1.047	1.035	1.755	1.430	0.389	0.909	0.520	3.679
0:56:50	114.0	0.291	84.8	5.692	4.81	43.9249	100.2	1.061	1.049	1.769	1.428	0.374	0.901	0.527	3.823
0:57:58	114.8	0.296	84.8	5.686	4.90	43.9699	101.0	1.068	1.057	1.777	1.437	0.374	0.906	0.531	3.837
0:59:09	115.6	0.302	84.8	5.680	5.00	44.0155	101.9	1.076	1.064	1.784	1.447	0.377	0.912	0.535	3.836
1:00:20	116.3	0.308	84.6	5.674	5.10	44.0626	102.5	1.082	1.069	1.789	1.460	0.385	0.923	0.537	3.789
1:01:30	117.0	0.314	84.6	5.668	5.20	44.1088	103.2	1.088	1.076	1.796	1.473	0.391	0.932	0.541	3.764
1:02:41	118.1	0.320	84.5	5.662	5.30	44.1553	104.4	1.099	1.086	1.806	1.488	0.396	0.942	0.546	3.759
1:03:52	118.8	0.326	84.4	5.656	5.40	44.2020	105.0	1.105	1.092	1.812	1.499	0.402	0.950	0.549	3.732
1:05:02	119.3	0.332	84.3	5.650	5.50	44.2494	105.5	1.109	1.096	1.816	1.511	0.409	0.960	0.551	3.692
1:06:13	120.2	0.338	84.3	5.644	5.60	44.2959	106.4	1.117	1.104	1.824	1.520	0.411	0.966	0.555	3.698
1:07:24	121.1	0.344	84.4	5.638	5.70	44.3425	107.3	1.126	1.112	1.832	1.523	0.406	0.964	0.559	3.756
1:08:34	121.7	0.350	84.3	5.632	5.80	44.3895	107.9	1.130	1.116	1.836	1.529	0.407	0.968	0.561	3.753
1:09:45	122.5	0.356	84.3	5.626	5.90	44.4366	108.7	1.137	1.123	1.843	1.542	0.414	0.978	0.564	3.727

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.979 (in.)	15.187 (cm)	Height	4.962 (in.)	Date	12-10-09	Test Number	CU-2A
Diameter	2.873 (in)	7.297 (cm)	Dia. avg.	3.218 (in)	Press No.	2	Data File ID	2A
Area	6.481 (in²)	41.814 (cm²)	Area avg.	8.134 (in²)	Panel No.	D	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
1:10:56	123.3	0.362	84.2	5.620	6.00	44.4836	109.5	1.145	1.131	1.851	1.555	0.419	0.987	0.568	3.711
1:12:09	123.5	0.368	84.1	5.614	6.10	44.5326	109.7	1.146	1.131	1.851	1.561	0.425	0.993	0.568	3.676
1:13:17	124.1	0.374	84.0	5.608	6.20	44.5791	110.3	1.151	1.136	1.856	1.570	0.429	1.000	0.571	3.661
1:14:31	124.8	0.380	84.0	5.602	6.30	44.6275	111.0	1.156	1.141	1.861	1.581	0.434	1.008	0.573	3.640
1:15:41	125.3	0.386	83.8	5.596	6.40	44.6749	111.5	1.161	1.145	1.865	1.599	0.449	1.024	0.575	3.566
1:16:52	126.0	0.392	83.9	5.590	6.50	44.7221	112.3	1.167	1.152	1.872	1.595	0.438	1.017	0.579	3.642
1:18:03	126.7	0.398	83.9	5.584	6.60	44.7698	112.9	1.173	1.157	1.877	1.599	0.436	1.018	0.581	3.665
1:19:16	126.9	0.404	83.9	5.578	6.70	44.8189	113.2	1.174	1.158	1.878	1.602	0.439	1.021	0.582	3.652
1:20:26	126.8	0.410	83.8	5.572	6.80	44.8663	113.0	1.172	1.155	1.875	1.605	0.444	1.025	0.580	3.611
1:21:37	127.5	0.416	83.8	5.566	6.90	44.9139	113.7	1.177	1.161	1.881	1.616	0.450	1.033	0.583	3.592
1:22:50	127.9	0.422	83.7	5.560	7.00	44.9629	114.1	1.180	1.163	1.883	1.623	0.454	1.038	0.584	3.575
1:24:01	128.6	0.428	83.6	5.554	7.10	45.0105	114.8	1.186	1.169	1.889	1.632	0.458	1.045	0.587	3.564
1:25:14	130.0	0.434	83.6	5.548	7.20	45.0591	116.2	1.199	1.182	1.902	1.651	0.464	1.058	0.594	3.561
1:26:25	130.5	0.440	83.3	5.542	7.30	45.1076	116.7	1.203	1.185	1.905	1.670	0.479	1.075	0.596	3.486
1:27:38	130.9	0.446	83.6	5.536	7.40	45.1570	117.1	1.206	1.188	1.908	1.656	0.462	1.059	0.597	3.582
1:28:51	131.8	0.452	83.6	5.530	7.50	45.2057	118.0	1.214	1.196	1.916	1.665	0.463	1.064	0.601	3.595
1:30:04	132.0	0.458	83.6	5.524	7.60	45.2555	118.2	1.214	1.196	1.916	1.666	0.464	1.065	0.601	3.589
1:31:15	132.6	0.464	83.5	5.518	7.70	45.3035	118.9	1.220	1.202	1.922	1.677	0.470	1.074	0.604	3.569
1:32:28	133.2	0.470	83.4	5.512	7.80	45.3534	119.4	1.224	1.205	1.925	1.686	0.475	1.080	0.605	3.551
1:33:41	133.7	0.476	83.3	5.506	7.90	45.4030	119.9	1.228	1.209	1.929	1.694	0.479	1.087	0.607	3.535
1:34:51	134.1	0.482	83.3	5.501	8.00	45.4512	120.3	1.231	1.212	1.932	1.700	0.483	1.092	0.609	3.520
1:36:04	134.8	0.488	83.2	5.494	8.10	45.5013	121.0	1.237	1.218	1.938	1.716	0.493	1.104	0.612	3.484
1:37:15	135.3	0.494	83.2	5.489	8.20	45.5504	121.5	1.240	1.221	1.941	1.713	0.487	1.100	0.613	3.519
1:38:28	135.5	0.500	83.3	5.482	8.30	45.6010	121.7	1.241	1.221	1.941	1.710	0.483	1.096	0.613	3.539
1:39:39	136.2	0.506	83.3	5.477	8.40	45.6503	122.4	1.247	1.226	1.946	1.716	0.484	1.100	0.616	3.545
1:40:50	136.9	0.512	83.2	5.471	8.50	45.6993	123.1	1.253	1.233	1.953	1.728	0.490	1.109	0.619	3.528
1:42:03	137.2	0.518	83.2	5.465	8.60	45.7500	123.4	1.255	1.234	1.954	1.732	0.493	1.113	0.620	3.515
1:43:16	137.9	0.524	83.1	5.458	8.71	45.8013	124.1	1.260	1.239	1.959	1.742	0.498	1.120	0.622	3.501
1:44:26	138.4	0.530	83.0	5.453	8.80	45.8511	124.6	1.264	1.243	1.963	1.749	0.501	1.125	0.624	3.491
1:45:37	138.0	0.535	83.0	5.447	8.90	45.9000	124.2	1.258	1.237	1.957	1.748	0.506	1.127	0.621	3.457
1:46:50	138.6	0.541	82.8	5.441	9.00	45.9509	124.8	1.263	1.241	1.961	1.767	0.520	1.144	0.624	3.398
1:48:03	138.7	0.548	83.0	5.435	9.10	46.0020	125.0	1.263	1.241	1.961	1.751	0.505	1.128	0.623	3.471
1:49:16	139.5	0.554	83.0	5.429	9.20	46.0531	125.7	1.270	1.247	1.967	1.757	0.504	1.130	0.627	3.487
1:50:27	140.0	0.559	83.0	5.423	9.30	46.1026	126.2	1.273	1.250	1.970	1.760	0.505	1.133	0.628	3.489
1:51:40	140.7	0.565	82.9	5.417	9.40	46.1542	126.9	1.279	1.256	1.976	1.774	0.512	1.143	0.631	3.462
1:52:51	142.8	0.571	82.8	5.411	9.50	46.2046	129.1	1.299	1.276	1.996	1.798	0.516	1.157	0.641	3.483
1:54:01	141.2	0.577	82.8	5.405	9.60	46.2555	127.4	1.281	1.258	1.978	1.783	0.519	1.151	0.632	3.432
1:55:17	141.5	0.583	82.7	5.399	9.70	46.3082	127.7	1.282	1.259	1.979	1.788	0.523	1.155	0.632	3.417
1:56:28	142.3	0.589	82.6	5.393	9.80	46.3585	128.5	1.289	1.265	1.985	1.802	0.531	1.166	0.635	3.394
1:57:41	142.5	0.595	82.6	5.387	9.90	46.4101	128.7	1.289	1.266	1.986	1.806	0.535	1.170	0.636	3.378
1:58:54	142.5	0.601	82.7	5.381	10.00	46.4615	128.8	1.289	1.265	1.985	1.795	0.525	1.160	0.635	3.420
2:00:07	143.3	0.607	82.7	5.375	10.10	46.5133	129.5	1.295	1.270	1.990	1.800	0.524	1.162	0.638	3.434
2:01:20	143.5	0.613	82.6	5.369	10.20	46.5651	129.7	1.296	1.271	1.991	1.807	0.530	1.169	0.638	3.408
2:02:33	143.7	0.619	82.6	5.363	10.30	46.6171	129.9	1.296	1.271	1.991	1.811	0.534	1.172	0.639	3.392
2:03:46	144.6	0.625	82.5	5.357	10.40	46.6686	130.8	1.303	1.278	1.998	1.821	0.537	1.179	0.642	3.389
2:05:00	145.2	0.631	82.5	5.351	10.50	46.7208	131.4	1.308	1.283	2.003	1.829	0.540	1.185	0.644	3.385
2:06:15	145.1	0.637	82.4	5.345	10.60	46.7745	131.4	1.306	1.280	2.000	1.833	0.547	1.190	0.643	3.353
2:07:26	145.7	0.643	82.2	5.339	10.70	46.8257	131.9	1.310	1.284	2.004	1.851	0.561	1.206	0.645	3.298
2:08:41	145.5	0.649	82.4	5.333	10.81	46.8795	131.7	1.306	1.280	2.000	1.831	0.545	1.188	0.643	3.358
2:09:55	146.4	0.655	82.5	5.327	10.90	46.9309	132.6	1.314	1.288	2.008	1.835	0.542	1.189	0.647	3.385
2:11:08	146.9	0.661	82.4	5.321	11.00	46.9832	133.1	1.317	1.291	2.011	1.840	0.544	1.192	0.648	3.383
2:12:23	147.6	0.667	82.4	5.315	11.11	47.0378	133.8	1.323	1.296	2.016	1.852	0.551	1.201	0.651	3.364
2:13:36	147.6	0.673	82.3	5.309	11.20	47.0899	133.8	1.322	1.295	2.015	1.855	0.554	1.205	0.650	3.345
2:14:52	147.9	0.679	82.3	5.303	11.30	47.1436	134.1	1.323	1.296	2.016	1.858	0.557	1.207	0.651	3.338
2:16:05	148.2	0.685	82.2	5.297	11.40	47.1962	134.5	1.325	1.297	2.017	1.865	0.562	1.214	0.651	3.317
2:17:18	148.6	0.691	82.1	5.291	11.50	47.2499	134.8	1.327	1.299	2.019	1.877	0.572	1.224	0.652	3.281
2:18:31	149.4	0.697	82.2	5.285	11.60	47.3021	135.6	1.333	1.305	2.025	1.871	0.560	1.216	0.655	3.339
2:19:47	149.8	0.703	82.2	5.279	11.70	47.3566	136.0	1.336	1.307	2.027	1.871	0.558	1.215	0.657	3.352
2:21:00	150.2	0.709	82.2	5.273	11.80	47.4098	136.4	1.338	1.310	2.030	1.874	0.559	1.217	0.658	3.353
2:22:16	150.7	0.715	82.1	5.267	11.90	47.4644	136.9	1.341	1.312	2.032	1.883	0.565	1.224	0.659	3.331

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.979 (in.)	15.187 (cm)	Height	4.962 (in.)	Date	12-10-09	Test Number	CU-2A
Diameter	2.873 (in)	7.297 (cm)	Dia. avg.	3.218 (in)	Press No.	2	Data File ID	2A
Area	6.481 (in^2)	41.814 (cm^2)	Area avg.	8.134 (in^2)	Panel No.	D	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strein (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
2:23:31	151.5	0.721	82.1	5.261	12.01	47.5192	137.7	1.347	1.319	2.039	1.893	0.569	1.231	0.662	3.328
2:24:45	153.0	0.727	82.1	5.255	12.10	47.5726	139.2	1.361	1.332	2.052	1.909	0.572	1.241	0.669	3.339
2:25:58	153.8	0.733	82.0	5.249	12.21	47.6272	140.0	1.367	1.338	2.058	1.919	0.576	1.248	0.672	3.331
2:27:08	154.0	0.739	81.9	5.243	12.30	47.6799	140.2	1.367	1.337	2.057	1.926	0.583	1.255	0.672	3.302
2:28:22	154.4	0.745	82.0	5.237	12.40	47.7351	140.7	1.370	1.340	2.060	1.925	0.579	1.252	0.673	3.324
2:29:32	154.3	0.751	82.0	5.231	12.50	47.7889	140.5	1.367	1.337	2.057	1.917	0.574	1.245	0.671	3.339
2:30:45	155.0	0.757	82.0	5.225	12.60	47.8436	141.2	1.372	1.342	2.062	1.922	0.574	1.248	0.674	3.346
2:31:58	155.6	0.763	81.9	5.219	12.70	47.8994	141.8	1.377	1.346	2.066	1.931	0.580	1.256	0.676	3.332
2:33:12	156.5	0.769	81.9	5.213	12.81	47.9550	142.7	1.384	1.353	2.073	1.941	0.583	1.262	0.679	3.331
2:34:22	156.2	0.775	81.9	5.207	12.91	48.0100	142.4	1.379	1.348	2.068	1.939	0.585	1.262	0.677	3.312
2:35:33	156.5	0.781	81.8	5.201	13.00	48.0640	142.7	1.380	1.349	2.069	1.944	0.590	1.267	0.677	3.297
2:36:44	156.8	0.787	81.8	5.196	13.10	48.1194	143.0	1.382	1.350	2.070	1.950	0.594	1.272	0.678	3.284
2:37:54	156.2	0.793	81.5	5.190	13.20	48.1747	142.4	1.375	1.343	2.063	1.958	0.609	1.284	0.674	3.213
2:39:05	156.1	0.799	81.8	5.184	13.30	48.2300	142.3	1.372	1.340	2.060	1.935	0.590	1.262	0.673	3.281
2:40:18	156.4	0.805	81.8	5.177	13.40	48.2869	142.6	1.373	1.341	2.061	1.936	0.589	1.262	0.673	3.286
2:41:27	157.2	0.811	81.8	5.172	13.50	48.3415	143.4	1.380	1.347	2.067	1.943	0.590	1.267	0.676	3.292
2:42:40	157.5	0.817	81.7	5.166	13.60	48.3987	143.8	1.381	1.348	2.068	1.950	0.596	1.273	0.677	3.272
2:43:50	158.1	0.823	81.7	5.160	13.70	48.4542	144.3	1.385	1.352	2.072	1.957	0.599	1.278	0.679	3.265
2:45:04	158.3	0.829	81.6	5.154	13.81	48.5112	144.5	1.385	1.352	2.072	1.961	0.603	1.282	0.679	3.253
2:46:14	158.7	0.834	81.6	5.148	13.90	48.5664	144.9	1.388	1.354	2.074	1.966	0.606	1.286	0.680	3.243
2:47:27	159.1	0.841	81.5	5.142	14.00	48.6237	145.3	1.390	1.356	2.076	1.974	0.612	1.293	0.681	3.224
2:48:38	159.8	0.846	81.5	5.136	14.10	48.6796	146.0	1.394	1.361	2.081	1.979	0.613	1.296	0.683	3.230
2:49:51	159.7	0.853	81.6	5.130	14.21	48.7376	145.9	1.392	1.358	2.078	1.967	0.603	1.285	0.682	3.260
2:51:04	160.3	0.859	81.6	5.124	14.31	48.7945	146.5	1.396	1.362	2.082	1.972	0.604	1.288	0.684	3.264
2:52:18	160.3	0.865	81.5	5.118	14.41	48.8516	146.5	1.394	1.360	2.080	1.974	0.609	1.291	0.683	3.243
2:53:28	160.8	0.870	81.5	5.112	14.50	48.9069	147.1	1.398	1.363	2.083	1.981	0.612	1.296	0.684	3.238
2:54:41	161.5	0.876	81.5	5.106	14.60	48.9643	147.7	1.403	1.368	2.088	1.988	0.615	1.302	0.687	3.232
2:55:55	162.0	0.882	81.4	5.100	14.70	49.0216	148.2	1.406	1.371	2.091	1.994	0.617	1.306	0.688	3.229
2:57:08	162.3	0.888	81.4	5.094	14.80	49.0799	148.5	1.407	1.371	2.091	1.999	0.622	1.310	0.689	3.215
2:58:21	162.5	0.894	81.1	5.088	14.90	49.1374	148.8	1.408	1.372	2.092	2.016	0.638	1.327	0.689	3.159
2:59:34	162.8	0.900	81.4	5.082	15.00	49.1952	149.1	1.409	1.373	2.093	1.997	0.619	1.308	0.689	3.228
3:00:47	163.2	0.906	81.4	5.076	15.10	49.2526	149.4	1.410	1.374	2.094	1.997	0.617	1.307	0.690	3.235
3:02:03	163.5	0.912	81.4	5.070	15.21	49.3126	149.7	1.412	1.375	2.095	2.000	0.619	1.309	0.690	3.232
3:03:16	164.4	0.918	81.3	5.064	15.31	49.3708	150.6	1.419	1.382	2.102	2.012	0.624	1.318	0.694	3.223
3:04:29	164.6	0.924	81.3	5.058	15.40	49.4284	150.8	1.419	1.382	2.102	2.015	0.627	1.321	0.694	3.211
3:05:42	165.2	0.930	81.3	5.052	15.50	49.4864	151.4	1.423	1.386	2.106	2.021	0.630	1.326	0.696	3.209
3:06:55	165.1	0.936	81.2	5.046	15.60	49.5456	151.3	1.420	1.383	2.103	2.021	0.633	1.327	0.694	3.194
3:08:08	165.2	0.942	81.0	5.040	15.70	49.6044	151.4	1.420	1.382	2.102	2.032	0.645	1.339	0.694	3.152
3:09:21	166.5	0.948	81.2	5.034	15.80	49.6633	152.7	1.430	1.392	2.112	2.030	0.632	1.331	0.699	3.211
3:10:35	166.7	0.954	81.2	5.028	15.91	49.7227	152.9	1.430	1.392	2.112	2.028	0.630	1.329	0.699	3.217
3:11:48	167.8	0.960	81.2	5.022	16.00	49.7815	154.0	1.438	1.400	2.120	2.036	0.630	1.333	0.703	3.230
3:13:01	167.6	0.966	81.2	5.016	16.11	49.8420	153.8	1.435	1.397	2.117	2.037	0.635	1.336	0.701	3.208
3:14:14	167.8	0.972	81.1	5.010	16.21	49.9013	154.0	1.435	1.396	2.116	2.041	0.639	1.340	0.701	3.192
3:15:25	167.6	0.978	81.1	5.004	16.30	49.9597	153.9	1.432	1.393	2.113	2.040	0.642	1.341	0.699	3.179
3:16:38	168.4	0.984	81.0	4.998	16.41	50.0202	154.7	1.438	1.398	2.118	2.051	0.647	1.349	0.702	3.169
3:17:49	168.7	0.990	81.0	4.992	16.50	50.0787	154.9	1.438	1.398	2.118	2.055	0.651	1.353	0.702	3.158
3:19:02	169.2	0.996	80.8	4.986	16.60	50.1396	155.4	1.441	1.401	2.121	2.069	0.662	1.365	0.704	3.127
3:20:15	169.1	1.002	81.1	4.980	16.71	50.2010	155.3	1.439	1.399	2.119	2.048	0.644	1.346	0.702	3.180
3:21:26	169.8	1.008	81.1	4.974	16.80	50.2599	156.0	1.443	1.403	2.123	2.051	0.643	1.347	0.704	3.192
3:22:39	170.5	1.014	81.0	4.968	16.91	50.3211	156.8	1.449	1.408	2.128	2.060	0.646	1.353	0.707	3.187
3:23:52	170.7	1.020	81.0	4.962	17.01	50.3822	157.0	1.449	1.408	2.128	2.063	0.650	1.357	0.707	3.175

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.918 (in.)	15.032 (cm)	Height	4.827 (in.)	Date	12-19-09	Test Number	CU-2B
Diameter	2.734 (in)	6.944 (cm)	Dia. avg.	3.173 (in)	Press No.	1	Data File ID	2B
Area	5.870 (in^2)	37.872 (cm^2)	Area avg.	7.909 (in^2)	Panel No.	B	Lateral Pressure (psi)	30.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	12.7	-0.024	60.1	5.918	0.00	37.8725	0.0	0.000	0.000	2.160	2.160	2.150	2.155	0.005	1.005
0:00:49	19.6	-0.018	60.3	5.912	0.10	37.9119	6.8	0.084	0.084	2.244	2.231	2.137	2.184	0.047	1.044
0:02:44	39.6	-0.012	61.7	5.906	0.20	37.9491	26.9	0.330	0.329	2.489	2.380	2.041	2.211	0.170	1.166
0:05:32	85.7	-0.006	66.6	5.900	0.30	37.9869	73.0	0.893	0.892	3.052	2.590	1.687	2.138	0.451	1.535
0:07:54	104.8	0.000	69.7	5.894	0.40	38.0251	92.1	1.126	1.125	3.285	2.596	1.461	2.028	0.567	1.777
0:10:24	117.3	0.005	72.2	5.889	0.50	38.0622	104.6	1.278	1.276	3.436	2.568	1.282	1.925	0.643	2.004
0:12:57	125.7	0.011	73.9	5.883	0.60	38.1004	113.0	1.379	1.377	3.537	2.548	1.161	1.854	0.694	2.195
0:15:18	132.3	0.017	75.0	5.877	0.70	38.1388	119.6	1.458	1.457	3.617	2.544	1.078	1.811	0.733	2.361
0:17:35	137.3	0.023	75.7	5.871	0.80	38.1780	124.6	1.518	1.516	3.676	2.553	1.027	1.790	0.763	2.486
0:19:54	141.9	0.029	76.7	5.865	0.90	38.2159	129.1	1.571	1.569	3.729	2.534	0.955	1.744	0.790	2.654
0:22:15	146.2	0.035	77.3	5.859	1.00	38.2539	133.5	1.622	1.620	3.780	2.547	0.917	1.732	0.815	2.777
0:24:32	149.9	0.041	77.7	5.853	1.10	38.2942	137.2	1.665	1.663	3.823	2.561	0.888	1.724	0.836	2.884
0:26:41	153.7	0.047	77.9	5.847	1.20	38.3311	140.9	1.710	1.707	3.867	2.586	0.869	1.728	0.858	2.975
0:28:57	157.1	0.053	78.3	5.841	1.30	38.3701	144.4	1.750	1.747	3.907	2.597	0.841	1.719	0.878	3.090
0:31:14	160.4	0.059	78.6	5.835	1.40	38.4088	147.7	1.788	1.785	3.945	2.615	0.821	1.718	0.897	3.187
0:33:25	163.3	0.064	78.7	5.830	1.50	38.4475	150.6	1.821	1.817	3.977	2.640	0.813	1.727	0.914	3.249
0:35:46	166.5	0.070	78.8	5.824	1.60	38.4872	153.8	1.858	1.854	4.014	2.669	0.805	1.737	0.932	3.316
0:38:00	169.7	0.076	78.7	5.818	1.70	38.5267	156.9	1.894	1.890	4.050	2.711	0.811	1.761	0.950	3.341
0:40:13	172.5	0.082	79.1	5.812	1.79	38.5646	159.8	1.927	1.922	4.082	2.716	0.784	1.750	0.966	3.463
0:42:28	175.3	0.088	79.1	5.806	1.89	38.6038	162.6	1.958	1.953	4.113	2.746	0.782	1.764	0.982	3.510
0:44:50	178.1	0.094	79.1	5.800	2.00	38.6444	165.3	1.989	1.984	4.144	2.776	0.782	1.779	0.997	3.550
0:47:02	180.6	0.100	79.1	5.794	2.09	38.6824	167.9	2.018	2.013	4.173	2.809	0.786	1.797	1.012	3.576
0:49:14	183.4	0.106	79.2	5.788	2.19	38.7221	170.6	2.049	2.044	4.204	2.832	0.778	1.805	1.027	3.640
0:51:27	186.3	0.112	79.3	5.782	2.29	38.7613	173.6	2.082	2.077	4.237	2.861	0.774	1.817	1.043	3.696
0:53:46	188.3	0.118	79.2	5.776	2.39	38.8017	175.6	2.104	2.098	4.258	2.886	0.778	1.832	1.054	3.708
0:56:03	190.7	0.123	79.1	5.771	2.49	38.8406	178.0	2.131	2.125	4.285	2.918	0.783	1.851	1.067	3.725
0:58:16	193.6	0.129	78.9	5.765	2.59	38.8804	180.8	2.163	2.156	4.316	2.965	0.799	1.882	1.083	3.713
1:00:32	195.7	0.135	79.2	5.759	2.69	38.9202	183.0	2.186	2.179	4.339	2.964	0.774	1.869	1.095	3.828
1:02:58	198.9	0.141	79.2	5.753	2.79	38.9609	186.2	2.222	2.215	4.375	3.006	0.781	1.894	1.113	3.849
1:05:16	201.5	0.147	79.1	5.747	2.89	39.0003	188.8	2.250	2.243	4.403	3.039	0.785	1.912	1.127	3.870
1:07:35	203.9	0.153	78.9	5.741	2.99	39.0401	191.2	2.277	2.269	4.429	3.075	0.796	1.935	1.140	3.864
1:09:53	206.6	0.159	79.0	5.735	3.09	39.0803	193.9	2.307	2.299	4.459	3.101	0.792	1.947	1.155	3.915
1:12:12	208.5	0.165	79.0	5.729	3.19	39.1206	195.7	2.326	2.318	4.478	3.121	0.793	1.957	1.164	3.936
1:14:36	210.7	0.171	78.8	5.723	3.29	39.1610	198.0	2.351	2.343	4.503	3.156	0.803	1.980	1.176	3.930
1:16:57	213.5	0.177	78.7	5.717	3.39	39.2016	200.7	2.381	2.372	4.532	3.193	0.810	2.001	1.191	3.941
1:19:17	215.5	0.182	78.6	5.712	3.49	39.2418	202.7	2.402	2.393	4.553	3.227	0.823	2.025	1.202	3.920
1:21:39	217.3	0.188	78.7	5.706	3.59	39.2823	204.5	2.421	2.412	4.572	3.236	0.813	2.024	1.211	3.978
1:24:02	220.0	0.194	78.6	5.700	3.69	39.3231	207.2	2.451	2.441	4.601	3.274	0.823	2.048	1.226	3.980
1:26:24	222.3	0.200	78.4	5.694	3.79	39.3639	209.5	2.475	2.466	4.626	3.307	0.832	2.069	1.238	3.977
1:28:44	224.3	0.206	78.2	5.688	3.89	39.4049	211.5	2.496	2.486	4.646	3.347	0.850	2.098	1.248	3.936
1:31:03	226.5	0.212	78.4	5.682	3.99	39.4455	213.8	2.520	2.510	4.670	3.358	0.838	2.098	1.260	4.008
1:33:23	229.1	0.218	78.3	5.676	4.09	39.4871	216.4	2.548	2.538	4.698	3.392	0.844	2.118	1.274	4.020
1:35:46	230.9	0.224	78.2	5.670	4.19	39.5284	218.1	2.566	2.555	4.715	3.418	0.853	2.135	1.283	4.009
1:38:09	232.7	0.230	78.0	5.664	4.29	39.5689	220.0	2.585	2.574	4.734	3.448	0.864	2.156	1.292	3.992
1:40:30	235.2	0.236	78.0	5.658	4.39	39.6102	222.4	2.611	2.600	4.760	3.472	0.862	2.167	1.305	4.026
1:42:53	237.2	0.242	78.0	5.653	4.49	39.6518	224.4	2.632	2.621	4.781	3.496	0.865	2.181	1.315	4.040
1:45:17	238.8	0.247	77.8	5.647	4.59	39.6931	226.1	2.649	2.637	4.797	3.524	0.877	2.200	1.324	4.020
1:47:39	240.7	0.253	77.7	5.641	4.69	39.7345	228.0	2.668	2.656	4.816	3.552	0.886	2.219	1.333	4.011
1:50:01	243.0	0.259	77.5	5.635	4.79	39.7759	230.3	2.692	2.680	4.840	3.590	0.900	2.245	1.345	3.991
1:52:22	244.8	0.265	77.6	5.629	4.89	39.8175	232.1	2.711	2.698	4.858	3.601	0.892	2.246	1.354	4.036
1:54:43	246.5	0.271	77.5	5.623	4.99	39.8595	233.8	2.728	2.715	4.875	3.627	0.902	2.265	1.363	4.020
1:57:00	248.7	0.277	77.3	5.617	5.08	39.9014	236.0	2.750	2.737	4.897	3.659	0.911	2.285	1.374	4.015
1:59:17	250.6	0.283	77.2	5.611	5.18	39.9434	237.9	2.769	2.756	4.916	3.691	0.925	2.308	1.383	3.991
2:01:36	252.1	0.289	77.2	5.605	5.28	39.9855	239.4	2.783	2.770	4.930	3.699	0.919	2.309	1.390	4.025
2:03:52	253.8	0.295	77.1	5.600	5.38	40.0274	241.1	2.800	2.787	4.947	3.723	0.926	2.325	1.398	4.019
2:06:06	255.9	0.300	77.0	5.594	5.48	40.0697	243.2	2.822	2.808	4.968	3.754	0.936	2.345	1.409	4.011
2:08:24	257.4	0.306	76.9	5.588	5.58	40.1123	244.7	2.837	2.823	4.983	3.778	0.945	2.362	1.416	3.997
2:10:42	259.2	0.312	76.8	5.582	5.68	40.1545	246.5	2.855	2.840	5.000	3.801	0.951	2.376	1.425	3.997
2:13:02	261.3	0.318	76.8	5.576	5.78	40.1974	248.6	2.876	2.861	5.021	3.820	0.949	2.384	1.435	4.026
2:15:22	263.3	0.324	76.7	5.570	5.88	40.2394	250.6	2.896	2.881	5.041	3.850	0.959	2.405	1.446	4.015

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.918 (in.)	15.032 (cm)	Height	4.827 (in.)	Date	12-19-09	Test Number	CU-2B
Diameter	2.734 (in)	6.944 (cm)	Dia. avg.	3.173 (in)	Press No.	1	Data File ID	2B
Area	5.870 (in²)	37.872 (cm²)	Area avg.	7.909 (in²)	Panel No.	B	Lateral Pressure (psi)	30.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
2:17:42	264.8	0.330	76.6	5.564	5.98	40.2822	252.1	2.910	2.895	5.055	3.872	0.967	2.420	1.453	4.004
2:19:56	266.1	0.336	76.4	5.558	6.08	40.3251	253.4	2.922	2.906	5.066	3.898	0.981	2.439	1.458	3.972
2:22:12	267.6	0.342	76.4	5.552	6.18	40.3676	254.8	2.935	2.920	5.080	3.906	0.976	2.441	1.465	4.002
2:24:35	269.3	0.348	76.4	5.546	6.28	40.4106	256.6	2.952	2.936	5.096	3.928	0.981	2.455	1.473	4.002
2:26:55	271.0	0.354	76.2	5.540	6.38	40.4541	258.2	2.968	2.952	5.112	3.952	0.990	2.471	1.481	3.992
2:29:09	272.6	0.359	76.1	5.535	6.48	40.4969	259.8	2.984	2.967	5.127	3.978	1.000	2.489	1.489	3.976
2:31:29	274.4	0.365	76.0	5.529	6.58	40.5399	261.7	3.002	2.985	5.145	4.002	1.006	2.504	1.498	3.977
2:33:51	275.6	0.371	76.1	5.523	6.68	40.5832	262.9	3.012	2.995	5.155	4.009	1.004	2.507	1.502	3.992
2:36:15	277.5	0.377	75.9	5.517	6.78	40.6269	264.8	3.031	3.014	5.174	4.039	1.015	2.527	1.512	3.979
2:38:38	278.8	0.383	75.8	5.511	6.88	40.6705	266.1	3.042	3.025	5.185	4.058	1.023	2.541	1.517	3.966
2:41:01	280.9	0.389	75.5	5.505	6.98	40.7137	268.2	3.063	3.045	5.205	4.096	1.041	2.568	1.528	3.936
2:43:23	282.4	0.395	75.7	5.499	7.08	40.7577	269.7	3.077	3.059	5.219	4.099	1.030	2.564	1.535	3.980
2:45:44	283.7	0.401	75.6	5.493	7.18	40.8014	270.9	3.088	3.070	5.230	4.117	1.038	2.578	1.540	3.968
2:48:07	285.5	0.407	75.5	5.487	7.28	40.8454	272.8	3.106	3.087	5.247	4.143	1.046	2.595	1.549	3.961
2:50:30	287.2	0.413	75.3	5.481	7.38	40.8896	274.5	3.121	3.103	5.263	4.169	1.056	2.613	1.556	3.946
2:52:49	288.4	0.418	75.3	5.476	7.48	40.9334	275.7	3.132	3.113	5.273	4.178	1.055	2.617	1.561	3.959
2:55:09	290.1	0.424	75.3	5.470	7.58	40.9773	277.4	3.148	3.129	5.289	4.196	1.057	2.626	1.569	3.970
2:57:33	291.7	0.430	75.2	5.464	7.68	41.0216	279.0	3.162	3.143	5.303	4.221	1.068	2.644	1.576	3.952
2:59:52	292.7	0.436	75.1	5.458	7.78	41.0661	280.0	3.170	3.150	5.310	4.236	1.076	2.656	1.580	3.937
3:02:16	293.9	0.442	74.8	5.452	7.88	41.1103	281.2	3.180	3.160	5.320	4.264	1.093	2.678	1.585	3.900
3:04:34	295.9	0.448	75.0	5.446	7.98	41.1548	283.2	3.200	3.180	5.340	4.270	1.080	2.675	1.595	3.952
3:07:00	297.3	0.454	74.9	5.440	8.08	41.1995	284.5	3.211	3.191	5.351	4.291	1.090	2.690	1.601	3.938
3:09:21	298.6	0.460	74.8	5.434	8.18	41.2443	285.8	3.223	3.202	5.362	4.309	1.097	2.703	1.606	3.928
3:11:42	300.0	0.466	74.6	5.428	8.28	41.2892	287.2	3.235	3.214	5.374	4.336	1.112	2.724	1.612	3.898
3:14:04	302.0	0.472	74.7	5.422	8.38	41.3342	289.2	3.254	3.232	5.392	4.345	1.103	2.724	1.621	3.940
3:16:25	302.8	0.477	74.6	5.417	8.47	41.3790	290.1	3.260	3.238	5.398	4.358	1.110	2.734	1.624	3.926
3:18:45	304.1	0.483	74.4	5.411	8.57	41.4241	291.3	3.270	3.248	5.408	4.380	1.121	2.751	1.629	3.906
3:21:09	306.0	0.489	74.3	5.405	8.67	41.4695	293.3	3.288	3.266	5.426	4.410	1.133	2.772	1.638	3.891
3:23:31	307.1	0.495	74.4	5.399	8.77	41.5146	294.3	3.297	3.274	5.434	4.411	1.126	2.768	1.642	3.917
3:25:53	307.9	0.501	74.3	5.393	8.87	41.5602	295.1	3.302	3.280	5.440	4.420	1.130	2.775	1.645	3.912
3:28:17	309.3	0.507	74.2	5.387	8.97	41.6066	296.5	3.314	3.291	5.451	4.441	1.139	2.790	1.651	3.898
3:30:38	311.0	0.513	74.0	5.381	9.07	41.6517	298.2	3.329	3.306	5.466	4.465	1.149	2.807	1.658	3.887
3:33:02	311.8	0.519	74.1	5.375	9.17	41.6978	299.0	3.335	3.311	5.471	4.467	1.145	2.806	1.661	3.900
3:35:20	312.8	0.525	74.0	5.369	9.27	41.7427	300.0	3.342	3.319	5.479	4.478	1.149	2.813	1.664	3.897
3:37:40	314.2	0.531	73.9	5.364	9.37	41.7887	301.5	3.355	3.331	5.491	4.500	1.159	2.829	1.671	3.884
3:40:01	315.2	0.536	73.8	5.358	9.47	41.8348	302.5	3.362	3.338	5.498	4.515	1.167	2.841	1.674	3.870
3:42:22	316.3	0.542	73.8	5.352	9.57	41.8808	303.6	3.371	3.347	5.507	4.523	1.166	2.845	1.678	3.878
3:44:39	317.8	0.548	73.8	5.346	9.67	41.9271	305.1	3.383	3.359	5.519	4.536	1.167	2.852	1.685	3.886
3:46:57	319.4	0.554	73.7	5.340	9.77	41.9737	306.7	3.397	3.373	5.533	4.558	1.175	2.867	1.691	3.879
3:49:17	320.5	0.560	73.6	5.334	9.87	42.0197	307.8	3.406	3.381	5.541	4.573	1.182	2.878	1.696	3.869
3:51:35	321.6	0.566	73.4	5.328	9.97	42.0664	308.9	3.414	3.389	5.549	4.596	1.198	2.897	1.699	3.838
3:53:54	323.5	0.572	73.5	5.322	10.07	42.1138	310.8	3.432	3.406	5.566	4.602	1.185	2.894	1.708	3.882
3:56:13	324.7	0.578	73.4	5.316	10.17	42.1597	311.9	3.440	3.415	5.575	4.617	1.192	2.905	1.712	3.873
3:58:29	325.7	0.584	73.4	5.310	10.27	42.2069	313.0	3.448	3.422	5.582	4.631	1.198	2.915	1.716	3.864
4:00:46	327.1	0.590	73.1	5.305	10.37	42.2534	314.4	3.460	3.433	5.593	4.658	1.214	2.936	1.722	3.836
4:03:08	327.9	0.595	73.3	5.299	10.47	42.3005	315.1	3.464	3.438	5.598	4.650	1.202	2.926	1.724	3.869
4:05:29	329.1	0.601	73.2	5.293	10.57	42.3482	316.3	3.474	3.447	5.607	4.665	1.208	2.936	1.728	3.862
4:07:49	330.4	0.607	73.1	5.287	10.67	42.3950	317.6	3.484	3.457	5.617	4.682	1.215	2.948	1.733	3.854
4:10:07	331.9	0.613	73.0	5.281	10.77	42.4424	319.2	3.497	3.470	5.630	4.707	1.227	2.967	1.740	3.837
4:12:28	333.0	0.619	73.1	5.275	10.87	42.4897	320.2	3.504	3.477	5.637	4.706	1.219	2.963	1.744	3.860
4:14:54	333.8	0.625	73.0	5.269	10.97	42.5377	321.0	3.509	3.482	5.642	4.715	1.223	2.969	1.746	3.854
4:17:17	335.1	0.631	72.9	5.263	11.07	42.5855	322.4	3.520	3.492	5.652	4.735	1.233	2.984	1.751	3.841
4:19:43	336.5	0.637	72.7	5.257	11.17	42.6328	323.8	3.532	3.503	5.663	4.757	1.243	3.000	1.757	3.827
4:22:06	337.8	0.643	72.8	5.251	11.27	42.6810	325.0	3.541	3.513	5.673	4.760	1.237	2.998	1.761	3.848
4:24:28	338.7	0.649	72.8	5.245	11.37	42.7289	326.0	3.547	3.519	5.679	4.769	1.240	3.005	1.764	3.845
4:26:53	340.5	0.654	72.7	5.240	11.47	42.7770	327.7	3.562	3.533	5.693	4.792	1.248	3.020	1.772	3.838
4:29:15	341.6	0.660	72.5	5.234	11.57	42.8252	328.9	3.571	3.542	5.702	4.810	1.258	3.034	1.776	3.823
4:31:39	342.2	0.666	72.6	5.228	11.66	42.8737	329.5	3.573	3.544	5.704	4.808	1.254	3.031	1.777	3.835
4:34:03	343.3	0.672	72.6	5.222	11.76	42.9217	330.6	3.582	3.552	5.712	4.818	1.256	3.037	1.781	3.836
4:36:27	344.6	0.678	72.4	5.216	11.86	42.9706	331.9	3.592	3.562	5.722	4.836	1.264	3.050	1.786	3.825

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG		
Height	5.918 (in.)	15.032 (cm)	Height	4.827 (in.)	Date	12-19-09	Project Number	175569069
Diameter	2.734 (in)	6.944 (cm)	Dia. avg.	3.173 (in)	Press No.	1	Test Number	CU-2B
Area	5.870 (in^2)	37.872 (cm^2)	Area avg.	7.909 (in^2)	Panel No.	8	Data File ID	2B
							Lateral Pressure (psi)	30.0
							Chamber Pressure - σ_3 (psi)	90

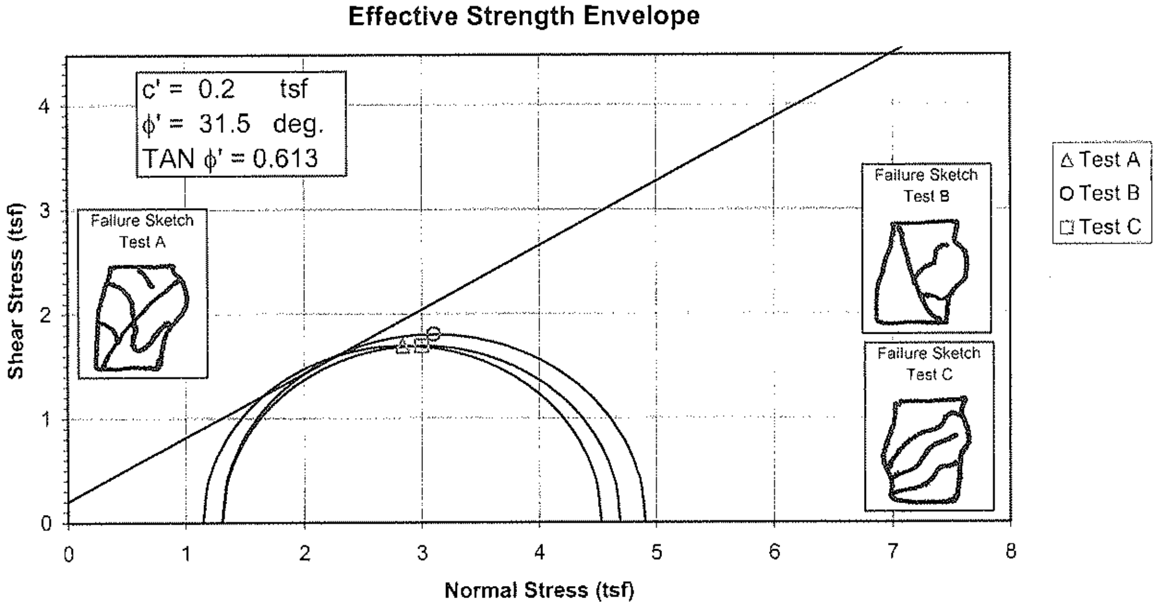
Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
4:38:51	345.2	0.684	72.3	5.210	11.96	43.0192	332.5	3.594	3.564	5.724	4.847	1.273	3.060	1.787	3.808
4:41:15	345.9	0.690	72.4	5.204	12.06	43.0683	333.2	3.598	3.567	5.727	4.848	1.270	3.059	1.789	3.816
4:43:38	347.9	0.696	72.3	5.198	12.16	43.1171	335.2	3.615	3.584	5.744	4.867	1.273	3.070	1.797	3.824
4:46:01	348.8	0.702	72.2	5.192	12.26	43.1659	336.1	3.620	3.589	5.749	4.879	1.279	3.079	1.800	3.814
4:48:24	349.6	0.708	72.1	5.186	12.36	43.2151	336.8	3.625	3.593	5.753	4.891	1.287	3.089	1.802	3.799
4:50:44	350.8	0.713	72.1	5.181	12.46	43.2644	338.0	3.633	3.602	5.762	4.900	1.288	3.094	1.806	3.804
4:53:09	352.4	0.719	72.1	5.175	12.56	43.3137	339.6	3.646	3.614	5.774	4.910	1.286	3.098	1.812	3.819
4:55:32	353.0	0.725	72.0	5.169	12.66	43.3633	340.2	3.648	3.616	5.776	4.920	1.293	3.107	1.813	3.804
4:57:55	353.6	0.731	71.9	5.163	12.76	43.4122	340.9	3.651	3.619	5.779	4.930	1.301	3.115	1.815	3.790
5:00:19	355.2	0.737	71.9	5.157	12.86	43.4619	342.4	3.664	3.631	5.791	4.947	1.306	3.126	1.821	3.789
5:02:45	356.3	0.743	71.9	5.151	12.96	43.5118	343.6	3.672	3.639	5.799	4.950	1.301	3.126	1.824	3.804
5:05:10	357.1	0.749	71.8	5.145	13.06	43.5618	344.3	3.676	3.643	5.803	4.960	1.308	3.134	1.826	3.793
5:07:34	358.2	0.755	71.7	5.139	13.16	43.6121	345.5	3.684	3.650	5.810	4.976	1.315	3.146	1.830	3.783
5:09:55	359.5	0.761	71.6	5.133	13.26	43.6617	346.7	3.693	3.659	5.819	4.993	1.324	3.159	1.835	3.771
5:12:21	360.2	0.767	71.7	5.128	13.36	43.7120	347.4	3.696	3.662	5.822	4.988	1.316	3.152	1.836	3.791
5:14:42	360.5	0.773	71.6	5.122	13.46	43.7629	347.8	3.695	3.661	5.821	4.995	1.323	3.159	1.836	3.774
5:17:06	362.2	0.778	71.5	5.116	13.56	43.8129	349.5	3.709	3.675	5.835	5.016	1.331	3.173	1.843	3.769
5:19:28	363.4	0.784	71.2	5.110	13.66	43.8635	350.7	3.717	3.683	5.843	5.047	1.354	3.200	1.847	3.728
5:21:50	364.4	0.790	71.5	5.104	13.76	43.9141	351.7	3.724	3.689	5.849	5.030	1.331	3.180	1.850	3.780
5:24:10	365.7	0.796	71.4	5.098	13.86	43.9651	353.0	3.733	3.698	5.858	5.047	1.338	3.192	1.854	3.771
5:26:30	367.2	0.802	71.3	5.092	13.96	44.0162	354.5	3.745	3.709	5.869	5.063	1.343	3.203	1.860	3.769
5:28:49	367.8	0.808	71.1	5.086	14.06	44.0669	355.1	3.747	3.711	5.871	5.081	1.360	3.221	1.861	3.736
5:31:13	368.6	0.814	71.3	5.080	14.16	44.1183	355.9	3.751	3.715	5.875	5.071	1.346	3.209	1.863	3.767
5:33:29	370.3	0.820	71.2	5.074	14.26	44.1694	357.6	3.764	3.728	5.888	5.090	1.352	3.221	1.869	3.766
5:35:52	371.1	0.826	71.2	5.068	14.36	44.2210	358.4	3.769	3.732	5.892	5.098	1.356	3.227	1.871	3.761
5:38:09	371.9	0.831	71.0	5.063	14.46	44.2728	359.1	3.772	3.735	5.895	5.116	1.370	3.243	1.873	3.734
5:40:26	373.3	0.837	71.1	5.057	14.56	44.3241	360.6	3.783	3.746	5.906	5.117	1.361	3.239	1.878	3.759
5:42:47	374.5	0.843	71.1	5.051	14.66	44.3762	361.8	3.791	3.754	5.914	5.127	1.363	3.245	1.882	3.762
5:45:07	375.1	0.849	71.0	5.045	14.76	44.4279	362.4	3.793	3.756	5.916	5.137	1.371	3.254	1.883	3.746
5:47:28	376.4	0.855	70.8	5.039	14.86	44.4802	363.6	3.801	3.764	5.924	5.155	1.381	3.268	1.887	3.733
5:49:46	378.0	0.861	70.9	5.033	14.95	44.5319	365.2	3.814	3.776	5.936	5.162	1.376	3.269	1.893	3.752
5:52:09	378.2	0.867	70.9	5.027	15.05	44.5841	365.5	3.812	3.774	5.934	5.161	1.377	3.269	1.892	3.748
5:54:33	378.9	0.873	70.8	5.021	15.15	44.6368	366.2	3.815	3.777	5.937	5.171	1.384	3.277	1.893	3.736
5:56:55	380.4	0.879	70.7	5.015	15.25	44.6894	367.6	3.825	3.787	5.947	5.186	1.392	3.290	1.898	3.729
5:59:19	381.3	0.885	70.7	5.010	15.35	44.7417	368.6	3.831	3.792	5.952	5.192	1.390	3.291	1.901	3.736
6:01:49	381.8	0.891	70.7	5.004	15.45	44.7952	369.1	3.831	3.792	5.952	5.192	1.390	3.291	1.901	3.736
6:04:12	383.2	0.896	70.6	4.998	15.55	44.8473	370.5	3.841	3.802	5.962	5.210	1.398	3.304	1.906	3.727
6:06:41	384.6	0.902	70.5	4.992	15.65	44.9016	371.9	3.851	3.812	5.972	5.227	1.405	3.316	1.911	3.720
6:09:06	385.8	0.908	70.5	4.986	15.75	44.9535	373.1	3.859	3.820	5.980	5.232	1.403	3.317	1.915	3.730
6:11:32	386.4	0.914	70.5	4.980	15.85	45.0072	373.7	3.861	3.821	5.981	5.235	1.404	3.319	1.916	3.729
6:13:57	387.7	0.920	70.4	4.974	15.95	45.0602	375.0	3.870	3.829	5.989	5.249	1.410	3.330	1.920	3.724
6:16:25	388.7	0.926	70.3	4.968	16.05	45.1137	376.0	3.875	3.835	5.995	5.262	1.417	3.339	1.922	3.714
6:18:51	389.8	0.932	70.3	4.962	16.15	45.1678	377.0	3.881	3.841	6.001	5.266	1.415	3.341	1.925	3.720
6:21:17	390.5	0.938	70.3	4.956	16.25	45.2217	377.8	3.885	3.844	6.004	5.270	1.416	3.343	1.927	3.721
6:23:41	391.9	0.944	70.2	4.950	16.35	45.2751	379.2	3.894	3.853	6.013	5.286	1.423	3.354	1.932	3.715
6:26:07	393.1	0.949	70.1	4.945	16.45	45.3293	380.4	3.902	3.860	6.020	5.301	1.431	3.366	1.935	3.706
6:28:30	393.5	0.955	70.1	4.939	16.55	45.3830	380.8	3.902	3.860	6.020	5.301	1.431	3.366	1.935	3.705
6:30:52	394.7	0.961	70.1	4.933	16.65	45.4373	382.0	3.909	3.867	6.027	5.306	1.429	3.368	1.938	3.713
6:33:21	396.0	0.967	70.1	4.927	16.75	45.4928	383.3	3.917	3.875	6.035	5.321	1.436	3.379	1.943	3.705
6:35:45	396.5	0.973	70.0	4.921	16.85	45.5463	383.8	3.918	3.875	6.035	5.328	1.443	3.385	1.943	3.693
6:38:10	397.3	0.979	69.9	4.915	16.95	45.6013	384.6	3.922	3.879	6.039	5.334	1.445	3.390	1.945	3.691
6:40:35	398.8	0.985	70.0	4.909	17.05	45.6558	386.1	3.932	3.889	6.049	5.341	1.442	3.392	1.949	3.703
6:43:05	400.1	0.991	69.9	4.903	17.15	45.7111	387.3	3.940	3.897	6.057	5.356	1.449	3.403	1.954	3.696
6:45:29	400.3	0.997	69.8	4.897	17.25	45.7660	387.6	3.938	3.895	6.055	5.360	1.456	3.408	1.952	3.683
6:47:53	401.6	1.003	69.7	4.892	17.35	45.8211	388.9	3.947	3.903	6.063	5.372	1.459	3.416	1.956	3.681
6:50:22	403.3	1.008	69.8	4.886	17.45	45.8768	390.5	3.958	3.914	6.074	5.379	1.455	3.417	1.962	3.697
6:52:44	403.8	1.014	69.7	4.880	17.55	45.9319	391.0	3.959	3.914	6.074	5.386	1.462	3.424	1.962	3.685
6:55:07	404.4	1.020	69.6	4.874	17.65	45.9873	391.7	3.960	3.916	6.076	5.395	1.469	3.432	1.963	3.671
6:57:33	406.1	1.026	69.5	4.868	17.75	46.0433	393.4	3.973	3.928	6.088	5.411	1.473	3.442	1.969	3.673
6:59:57	407.0	1.032	69.6	4.862	17.85	46.0989	394.3	3.977	3.932	6.092	5.410	1.468	3.439	1.971	3.685

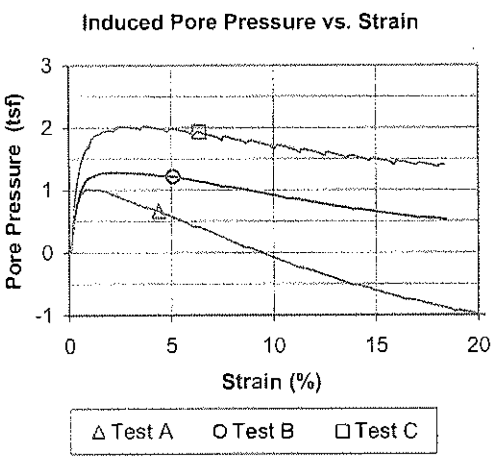
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values						
Height	5.918 (in.)	15.032 (cm)		Height	4.827 (in.)	Tested By	KDG		Project Number	175569069
Diameter	2.734 (in)	6.944 (cm)		Dia. avg.	3.173 (in)	Date	12-19-09		Test Number	CU-2B
Area	5.870 (in^2)	37.872 (cm^2)		Area avg.	7.909 (in^2)	Press No.	1		Data File ID	2B
						Panel No.	B		Lateral Pressure (psi)	30.0
									Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
7:02:21	407.5	1.038	69.5	4.856	17.95	46.1557	394.8	3.977	3.932	6.092	5.416	1.475	3.445	1.971	3.673
7:04:43	409.0	1.044	69.4	4.850	18.05	46.2114	396.3	3.988	3.942	6.102	5.434	1.482	3.458	1.976	3.667
7:07:05	410.6	1.050	69.2	4.844	18.14	46.2675	397.9	3.999	3.953	6.113	5.460	1.497	3.478	1.982	3.648
7:09:28	411.3	1.056	69.4	4.838	18.24	46.3243	398.5	4.000	3.954	6.114	5.445	1.481	3.463	1.982	3.677
7:11:49	412.5	1.062	69.3	4.833	18.34	46.3804	399.7	4.007	3.961	6.121	5.459	1.488	3.474	1.986	3.669
7:14:14	414.4	1.067	69.2	4.827	18.44	46.4371	401.6	4.022	3.975	6.135	5.480	1.495	3.488	1.993	3.666

Failure Criterion: Maximum Effective Principal Stress Ratio





			A	B	C	
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	20.7	23.1	23.4	
	Dry Density PCF	γ_{d_o}	104.3	100.8	100.1	
	Saturation %	S_o	91.4	93.3	92.9	
	Void Ratio	e_o	0.609	0.667	0.677	
After Shear	Water content %	W_f	20.5	23.2	23.1	
	Dry Density PCF	γ_{d_f}	108.3	103.4	103.5	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.551	0.625	0.622	
	Final Back Pressure TSF	u_c	4.68	3.96	3.24	
Minor Principal Stress TSF @ failure		σ_3'f	1.15	1.30	1.31	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	3.40	3.60	3.38	
Time to (σ1'-σ3')max min.		t_f	18.6	21.3	73.5	
Ultimate Deviator Stress, t/sq ft		$(\sigma1'-\sigma3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.885	2.878	2.880	
Initial Height, in.		H_o	5.940	5.941	6.007	

Controlled - Strain Test

Description of Specimens Lean Clay (CL), gray brown, moist, firm

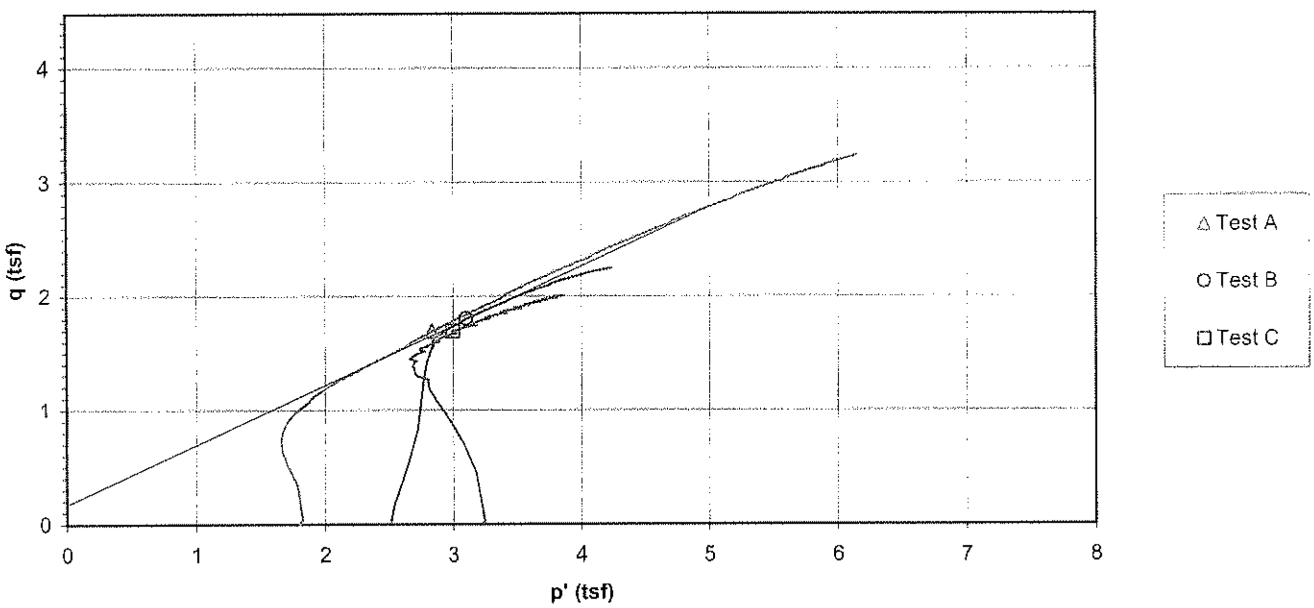
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.69	Project	PAF - Peabody Ash Pond
Remarks:					
		Boring No.	STN-18 (N2)	Sample No.	3
		Depth Elev.	24.2'-24.7', 24.8'-25.3', 25.4'-25.9'		
		Laboratory	Stantec	Date	12-19-09

TRIAXIAL COMPRESSION TEST REPORT

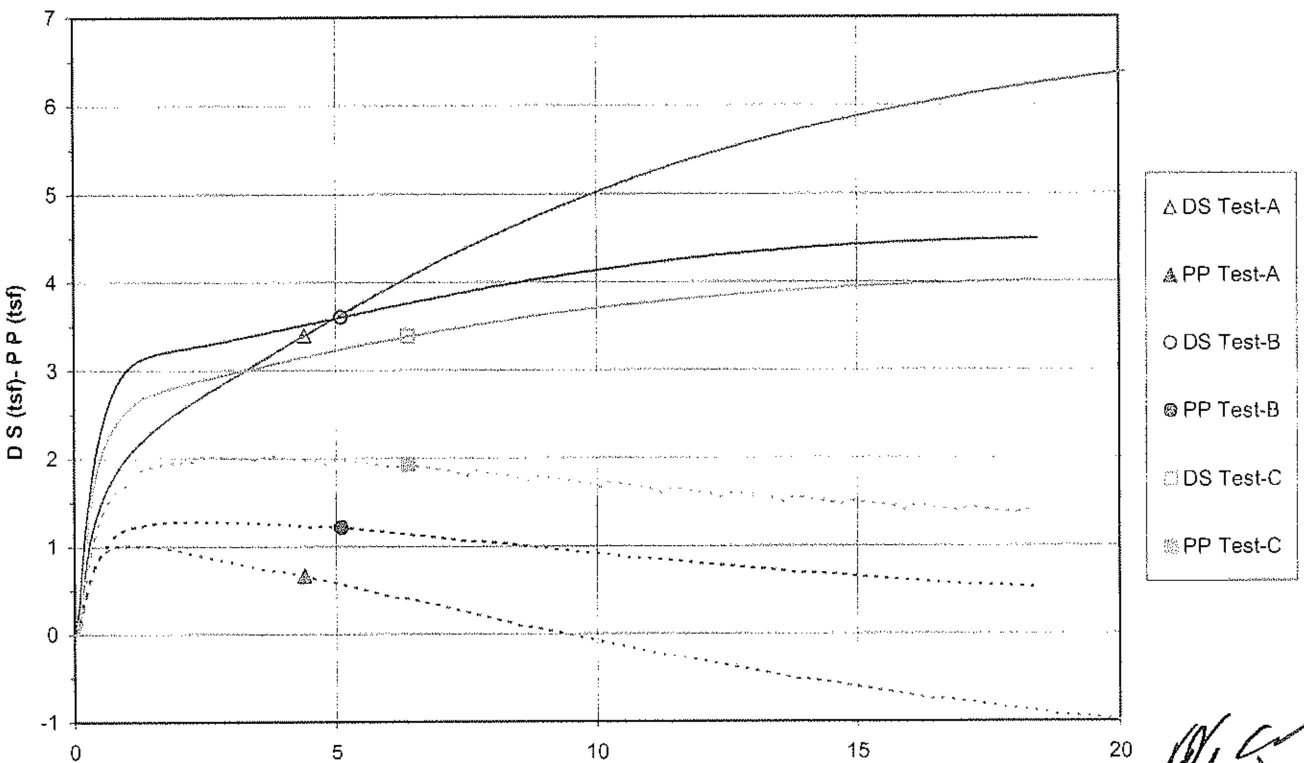
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	PAF - Peabody Ash Pond	Project No.	175569069
Sample ID	STN-18 (N2), 24.2'-24.7' & STN-18 (N2), 24.8'-25.3' & STN-18 (N2), 25.4'-25.9'	Test Number	3
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 31.5 deg.	c' =	0.20 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



File: frm_20091207_cu_3 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-18 (N2), 24.2'-24.7'	Test Number	CU-3A
Visual Description	Lean Clay (CL), gray brown, moist, firm	Prepared By	MC
Undisturbed	Source STN-18 (N2), 24.2'-24.8'	Date	12-9-2009

Specific Gravity 2.69 ASTM D854 Method A   Liquid Limit N/A   Plastic Limit N/A   Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.879	1	5.894	Sample	38.7469 (V_o)	Wet Weight (g)	1283.25
Middle	2.892	2	5.921	Solids	24.1149 (VS_o)	Dry Weight (g)	1063.08
Bottom	2.875	3	5.969	Water	13.4349 (Vw_o)	Wet Unit Weight (pcf)	126.2
Avg.	2.8820 (D_o)	4	5.975	Voids	14.6320 (Vv_o)	Dry Unit Weight (pcf)	104.5
Area (in^2)	6.5235 (A_o)	Avg. (H_o)	5.9396	Degree of Saturation (%)	91.8 (S_o)		
Moisture Content (%)	20.7	Final Trimmings		Void Ratio	0.607		

Saturation

Set Up & Saturated: Wet xx Dry ____   Set up By KDG

Back Pressure Saturated to: 65 (psi)   Final Pore Pressure Parameter B 0.99   Date 12-10-09

Panel Board Number B

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1408	Initial	16.77 (in.)	Initial	11.39 (in.)	Specimen Height (in.)	5.9386 (H_s)
Final	0.1418	Final	13.05 (in.)	Final	9.3 (in.)	Area (in^2) Method A	6.5213 (A_s)
Change	-0.0010 (ΔH_o)	Change	-3.72 (in.)	Change	-2.09 (in.)	Specimen Volume (in^3)	38.73 (Vs)

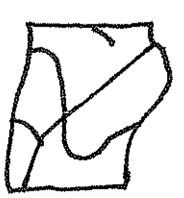
Consolidation

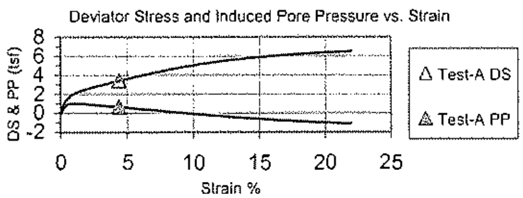
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1418	Initial	1.17 (in.)	Initial	17.03 (in.)	Chamber	90
Final	0.1727	Final	4.05 (in.)	Final	14.02 (in.)	Back	65
Change	-0.0309 (ΔH_c)	Change	-2.88 (in.)	Change	-3.01 (in.)	Lateral	25 (σ_3)
Height (in.)	5.9077 (H_c)			Volume (in^3)	37.3936 (V_c)		
Area (in^3) Method B	6.3296 (A_c)			Volume - Water (in^3)	13.2787 (VWc)	t_{50} (min.)	0.738
Diameter (in.)	2.8389 (D_c)			Water Content (%)	20.5		
Dry Density (pcf)	108.3			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.551

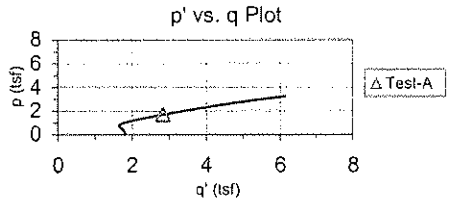
After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.459 (in.)	Wet Weight (g)	1280.69	Corrected Deviator	3.40 σ_d (tsf)
Wet weight (g)	1280.69 (WWf)	Dry Weight (g)	1063.08	Major Principal	4.53 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.435 (in.)	Tare Weight (g)	0.00	Minor Principal	1.15 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.244
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	4.40
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch







Comments: ____

KDG

File: frm_20091207_cu_3 Sheet: Specimen-A
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-18 (N2), 24.8'-25.3'	Test Number	CU-3B
Visual Description	Lean Clay (CL), gray brown, moist, firm	Prepared By	MC
Undisturbed	Source STN-18 (N2), 24.8'-25.4'	Date	12-9-2009

Specific Gravity 2.69 ASTM D854 Method A | Liquid Limit N/A | Plastic Limit N/A | Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in3)		Specimen	
Top	2.885	1	5.948	Sample	38.6646 (V_o)	Wet Weight (g)	1258.47
Middle	2.875	2	5.945	Solids	23.1849 (VS_o)	Dry Weight (g)	1022.08
Bottom	2.876	3	5.927	Water	14.4244 (Vw_o)	Wet Unit Weight (pcf)	124.0
Avg.	2.8787 (D_o)	4	5.944	Voids	15.4797 (Vv_o)	Dry Unit Weight (pcf)	100.7
Area (in^2)	6.5084 (A_o)	Avg. (H_o)	5.9408	Degree of Saturation (%)	93.2 (S_o)		
Moisture Content (%)	23.1	Final Trimmings		Void Ratio	0.668		

Saturation

Set Up & Saturated: Wet xx Dry ____ | Set up By KDG

Back Pressure Saturated to: 55 (psi) | Final Pore Pressure Parameter B 0.99 | Date 12-10-09

Panel Board Number C

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1508	Initial	16.03 (in.)	Initial	11.89 (in.)	Specimen Height (in.)	5.9427 (H_s)
Final	0.1489	Final	11.11 (in.)	Final	10.7 (in.)	Area (in^2) Method A	6.5125 (A_s)
Change	0.0019 (ΔH_o)	Change	-4.92 (in.)	Change	-1.19 (in.)	Specimen Volume (in^3)	38.70 (V_s)

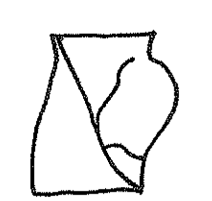
Consolidation

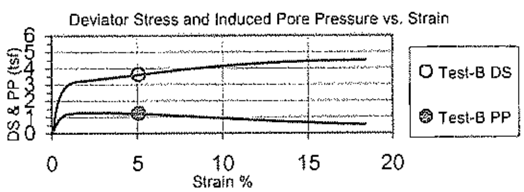
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1489	Initial	1.21 (in.)	Initial	17.47 (in.)	Chamber	90
Final	0.206	Final	5.08 (in.)	Final	12.29 (in.)	Back	55
Change	-0.0571 (ΔH_c)	Change	-3.87 (in.)	Change	-5.18 (in.)	Lateral	35 (σ_3)
Height (in.)	5.8856 (H_c)			Volume (in^3)	37.6667 (V_c)		
Area (in^3) Method B	6.3999 (A_c)			Volume - Water (in^3)	14.4817 (VWc)	D_{50} (min.)	0.626
Diameter (in.)	2.8546 (D_c)			Water Content (%)	23.2		
Dry Density (pcf)	103.4			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.625

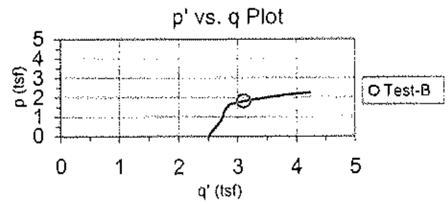
After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.382 (in.)	Wet Weight (g)	1259.41	Corrected Deviator	3.60 σ_d (tsf)
Wet weight (g)	1259.41 (WWf)	Dry Weight (g)	1022.08	Major Principal	4.91 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.358 (in.)	Tare Weight (g)	0.00	Minor Principal	1.30 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.247
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	5.11
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch







Comments:

Consolidated Undrained Triaxial Test
ASTM D4767-04

Stantec

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-18 (N2), 25.4'-25.9'	Test Number	CU-3C
Visual Description	Lean Clay (CL), brown, moist, firm	Prepared By	MC
Undisturbed	Source STN-18 (M2), 25.4'-26.0'	Date	12-9-2009

Specific Gravity 2.69 ASTM D854 Method A Liquid Limit N/A Plastic Limit N/A Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.875	1	6.015	Sample	39.1288 (V_o)	Wet Weight (g)	1268.89
Middle	2.879	2	6.011	Solids	23.3264 (VS_o)	Dry Weight (g)	1028.32
Bottom	2.886	3	5.999	Water	14.6797 (Vw_o)	Wet Unit Weight (pcf)	123.5
Avg.	2.8800 (D_o)	4	6.001	Voids	15.8024 (Vv_o)	Dry Unit Weight (pcf)	100.1
Area (in^2)	6.5144 (A_o)	Avg. (H_o)	6.0065	Degree of Saturation (%)	92.9 (S_o)		
Moisture Content (%)	23.4	Final Trimmings		Void Ratio	0.677		

Saturation

Set Up & Saturated: Wet xx Dry ____ Set up By CSM

Back Pressure Saturated to: 45 (psi) Final Pore Pressure Parameter B 0.95 Date 12-11-09

Panel Board Number A

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1987	Initial	16.84 (in.)	Initial	11.01 (in.)	Specimen Height (in.)	5.9952 (H_s)
Final	0.21	Final	11.98 (in.)	Final	10.04 (in.)	Area (in^2) Method A	6.4898 (A_s)
Change	-0.0113 (ΔH_o)	Change	-4.86 (in.)	Change	-0.97 (in.)	Specimen Volume (in^3)	38.91 (V_s)

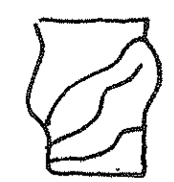
Consolidation

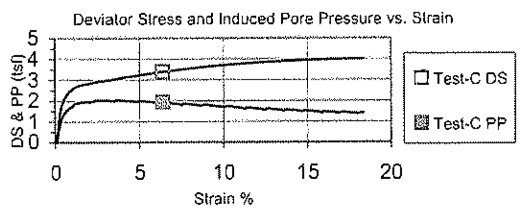
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.21	Initial	1.13 (in.)	Initial	17.06 (in.)	Chamber	90
Final	0.2803	Final	6.65 (in.)	Final	11.16 (in.)	Back	45
Change	-0.0703 (ΔH_c)	Change	-5.52 (in.)	Change	-5.90 (in.)	Lateral	45 (σ_3)
Height (in.)	5.9249 (H_c)			Volume (in^3)	37.8334 (V_c)		
Area (in^3) Method B	6.3855 (A_c)			Volume - Water (in^3)	14.5070 (VW_c)	D_{50} (min.)	2.764
Diameter (in.)	2.8514 (D_c)			Water Content (%)	23.1		
Dry Density (pcf)	103.5			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.622

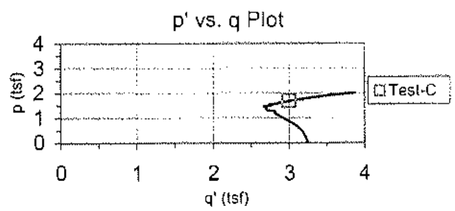
After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.403 (in.)	Wet Weight (g)	1266.06	Corrected Deviator	3.38 σ_d (tsf)
Wet weight (g)	1266.06 (WWf)	Dry Weight (g)	1028.32	Major Principal	4.70 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.379 (in.)	Tare Weight (g)	0.00	Minor Principal	1.31 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.089
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	6.40
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch







Comments: ____

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.908 (in.)	15.006 (cm)	Height	4.608 (in.)	Date	12-11-09	Test Number	CU-3A
Diameter	2.839 (in)	7.211 (cm)	Dia. avg.	3.335 (in)	Press No.	1	Data File ID	3A
Area	6.330 (in²)	40.839 (cm²)	Area avg.	8.737 (in²)	Panel No.	B	Lateral Pressure (psi)	25.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
0:00:00	11.8	-0.232	64.9	5.908	0.00	40.8386	0.0	0.000	0.000	1.800	1.800	1.808	1.804	-0.004	0.996
0:00:33	19.2	-0.226	65.1	5.902	0.10	40.8809	7.4	0.084	0.084	1.884	1.866	1.790	1.828	0.038	1.042
0:01:07	71.5	-0.220	69.8	5.896	0.20	40.9206	59.7	0.678	0.678	2.478	2.123	1.453	1.788	0.335	1.461
0:01:38	104.7	-0.214	73.6	5.890	0.30	40.9633	92.8	1.054	1.053	2.853	2.229	1.184	1.706	0.523	1.883
0:02:04	124.8	-0.208	75.7	5.884	0.40	41.0034	112.9	1.281	1.280	3.080	2.305	1.033	1.669	0.636	2.232
0:02:31	140.4	-0.202	77.0	5.878	0.50	41.0444	128.6	1.457	1.455	3.255	2.382	0.934	1.658	0.724	2.550
0:02:57	153.9	-0.196	77.9	5.872	0.60	41.0866	142.1	1.608	1.607	3.407	2.469	0.870	1.670	0.799	2.837
0:03:23	165.3	-0.190	78.4	5.866	0.70	41.1280	153.4	1.735	1.733	3.533	2.557	0.832	1.695	0.863	3.074
0:03:47	174.2	-0.184	78.8	5.860	0.80	41.1681	162.4	1.834	1.832	3.632	2.634	0.809	1.722	0.912	3.253
0:04:13	182.5	-0.178	78.9	5.854	0.90	41.2105	170.7	1.926	1.924	3.724	2.713	0.797	1.755	0.958	3.403
0:04:39	190.3	-0.172	78.9	5.848	1.00	41.2530	178.5	2.012	2.010	3.810	2.798	0.797	1.797	1.001	3.513
0:05:04	196.4	-0.167	78.9	5.843	1.10	41.2942	184.6	2.078	2.076	3.876	2.869	0.801	1.835	1.034	3.581
0:05:30	202.6	-0.161	78.7	5.837	1.21	41.3368	190.7	2.146	2.143	3.943	2.945	0.811	1.878	1.067	3.634
0:05:54	207.5	-0.155	78.9	5.831	1.31	41.3786	195.7	2.199	2.196	3.996	2.988	0.800	1.894	1.094	3.735
0:06:20	213.1	-0.148	78.8	5.824	1.41	41.4222	201.3	2.259	2.256	4.056	3.050	0.802	1.926	1.124	3.803
0:06:45	217.9	-0.143	78.6	5.819	1.50	41.4619	206.0	2.311	2.307	4.107	3.108	0.809	1.959	1.150	3.842
0:07:10	222.3	-0.137	78.7	5.813	1.60	41.5031	210.4	2.358	2.354	4.154	3.162	0.816	1.989	1.173	3.876
0:07:34	226.6	-0.131	78.5	5.807	1.70	41.5454	214.8	2.404	2.400	4.200	3.217	0.825	2.021	1.196	3.899
0:07:59	231.0	-0.125	78.4	5.801	1.80	41.5884	219.2	2.450	2.446	4.246	3.273	0.835	2.054	1.219	3.921
0:08:24	235.3	-0.119	78.3	5.795	1.90	41.6302	223.5	2.496	2.492	4.292	3.329	0.845	2.087	1.242	3.938
0:08:49	239.2	-0.113	78.1	5.789	2.01	41.6750	227.4	2.537	2.532	4.332	3.383	0.859	2.121	1.262	3.938
0:09:11	243.1	-0.107	77.9	5.783	2.10	41.7160	231.3	2.578	2.573	4.373	3.438	0.873	2.155	1.282	3.939
0:09:34	246.6	-0.102	77.7	5.778	2.20	41.7579	234.8	2.615	2.609	4.409	3.490	0.888	2.189	1.301	3.928
0:10:00	250.7	-0.095	77.5	5.771	2.31	41.8038	238.9	2.657	2.651	4.451	3.546	0.903	2.225	1.322	3.928
0:10:24	254.0	-0.090	77.3	5.766	2.40	41.8440	242.2	2.691	2.685	4.485	3.594	0.916	2.255	1.339	3.922
0:10:48	258.2	-0.084	77.1	5.760	2.50	41.8876	246.3	2.734	2.728	4.528	3.649	0.928	2.289	1.360	3.931
0:11:13	261.9	-0.078	76.9	5.754	2.61	41.9309	250.1	2.773	2.767	4.567	3.699	0.940	2.320	1.379	3.934
0:11:38	264.9	-0.072	76.7	5.748	2.71	41.9753	253.0	2.803	2.797	4.597	3.743	0.954	2.349	1.394	3.922
0:12:01	268.4	-0.066	76.6	5.742	2.80	42.0162	256.5	2.839	2.832	4.632	3.789	0.965	2.377	1.412	3.928
0:12:26	272.1	-0.060	76.4	5.736	2.91	42.0605	260.3	2.877	2.870	4.670	3.840	0.978	2.409	1.431	3.928
0:12:49	275.5	-0.054	76.3	5.730	3.00	42.1022	263.7	2.912	2.906	4.705	3.885	0.988	2.436	1.449	3.932
0:13:14	278.6	-0.049	76.1	5.725	3.10	42.1456	266.8	2.943	2.936	4.736	3.931	1.003	2.467	1.464	3.918
0:13:39	282.2	-0.043	75.9	5.719	3.20	42.1896	270.4	2.980	2.972	4.772	3.982	1.018	2.500	1.482	3.913
0:14:05	286.0	-0.036	75.7	5.712	3.31	42.2347	274.2	3.019	3.011	4.811	4.034	1.031	2.532	1.501	3.912
0:14:29	289.2	-0.031	75.5	5.707	3.41	42.2784	277.4	3.051	3.042	4.842	4.080	1.045	2.562	1.517	3.904
0:14:53	293.2	-0.025	75.3	5.701	3.50	42.3210	281.3	3.091	3.083	4.883	4.131	1.057	2.594	1.537	3.910
0:15:17	296.6	-0.019	75.1	5.695	3.60	42.3644	284.8	3.126	3.117	4.917	4.181	1.072	2.626	1.555	3.902
0:15:43	300.3	-0.013	74.9	5.689	3.71	42.4103	288.5	3.163	3.154	4.954	4.236	1.090	2.663	1.573	3.886
0:16:08	303.8	-0.007	74.9	5.683	3.81	42.4545	292.0	3.198	3.189	4.989	4.267	1.086	2.677	1.591	3.929
0:16:31	307.4	-0.001	74.8	5.677	3.90	42.4973	295.5	3.234	3.224	5.024	4.308	1.091	2.700	1.608	3.947
0:16:57	310.9	0.005	74.7	5.671	4.01	42.5428	299.1	3.269	3.259	5.059	4.353	1.102	2.727	1.626	3.951
0:17:22	314.4	0.011	74.5	5.665	4.10	42.5860	302.5	3.303	3.293	5.093	4.399	1.113	2.756	1.643	3.952
0:17:47	317.7	0.017	74.4	5.659	4.20	42.6311	305.8	3.336	3.326	5.126	4.444	1.127	2.785	1.659	3.945
0:18:11	321.4	0.023	74.2	5.653	4.31	42.6763	309.6	3.373	3.363	5.163	4.490	1.135	2.813	1.678	3.956
0:18:35	324.8	0.028	74.1	5.648	4.40	42.7193	313.0	3.407	3.396	5.196	4.534	1.145	2.839	1.694	3.958
0:19:00	327.9	0.034	73.9	5.642	4.50	42.7642	316.0	3.436	3.425	5.225	4.578	1.161	2.870	1.709	3.944
0:19:24	331.6	0.040	73.7	5.636	4.60	42.8099	319.8	3.474	3.462	5.262	4.630	1.176	2.903	1.727	3.938
0:19:49	335.2	0.046	73.5	5.630	4.71	42.8553	323.4	3.509	3.498	5.298	4.680	1.190	2.935	1.745	3.931
0:20:14	338.6	0.052	73.3	5.624	4.80	42.8998	326.7	3.541	3.530	5.330	4.725	1.203	2.964	1.761	3.928
0:20:38	341.9	0.058	73.1	5.618	4.91	42.9450	330.0	3.573	3.561	5.361	4.768	1.214	2.991	1.777	3.927
0:21:03	345.5	0.064	72.9	5.612	5.01	42.9906	333.7	3.609	3.597	5.397	4.817	1.228	3.022	1.795	3.924
0:21:28	349.1	0.070	72.8	5.606	5.10	43.0352	337.3	3.644	3.632	5.432	4.865	1.241	3.053	1.812	3.920
0:21:52	352.2	0.076	72.5	5.600	5.21	43.0811	340.4	3.674	3.661	5.461	4.911	1.258	3.085	1.827	3.904
0:22:17	355.7	0.082	72.3	5.594	5.31	43.1273	343.9	3.708	3.695	5.495	4.958	1.271	3.115	1.844	3.900
0:22:40	359.3	0.087	72.2	5.589	5.40	43.1709	347.4	3.742	3.729	5.529	5.004	1.282	3.143	1.861	3.902
0:23:06	362.9	0.093	72.0	5.583	5.50	43.2177	351.1	3.778	3.764	5.564	5.054	1.298	3.176	1.878	3.895
0:23:31	366.0	0.099	71.8	5.577	5.60	43.2631	354.1	3.806	3.793	5.593	5.098	1.313	3.205	1.892	3.883
0:23:56	369.7	0.105	71.6	5.571	5.70	43.3090	357.8	3.842	3.828	5.628	5.147	1.327	3.237	1.910	3.879
0:24:22	373.5	0.111	71.3	5.565	5.81	43.3562	361.6	3.879	3.864	5.664	5.200	1.343	3.271	1.928	3.872
0:24:45	376.3	0.117	71.1	5.559	5.90	43.4010	364.4	3.905	3.890	5.690	5.241	1.358	3.299	1.941	3.859

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG		
Height	5.908 (in.)	15.006 (cm)	Height	4.608 (in.)	Date	12-11-09	Project Number	175569069
Diameter	2.839 (in)	7.211 (cm)	Dia. avg.	3.335 (in)	Press No.	1	Test Number	CU-3A
Area	6.330 (in^2)	40.839 (cm^2)	Area avg.	8.737 (in^2)	Panel No.	B	Data File ID	3A
							Lateral Pressure (psi)	25.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:25:10	379.6	0.123	70.9	5.553	6.01	43.4461	367.8	3.936	3.921	5.721	5.290	1.376	3.333	1.957	3.844
0:25:33	383.3	0.129	70.7	5.547	6.10	43.4928	371.5	3.972	3.957	5.757	5.342	1.393	3.367	1.974	3.835
0:25:58	386.9	0.135	70.7	5.541	6.20	43.5394	375.0	4.005	3.990	5.790	5.376	1.393	3.384	1.991	3.858
0:26:23	390.1	0.141	70.6	5.535	6.31	43.5875	378.3	4.036	4.020	5.820	5.408	1.396	3.402	2.006	3.875
0:26:46	393.6	0.147	70.5	5.529	6.40	43.6328	381.8	4.069	4.053	5.853	5.450	1.404	3.427	2.023	3.881
0:27:11	397.4	0.153	70.3	5.523	6.51	43.6806	385.5	4.104	4.088	5.888	5.498	1.417	3.457	2.040	3.880
0:27:35	400.4	0.159	70.1	5.517	6.61	43.7275	388.5	4.132	4.116	5.916	5.540	1.432	3.486	2.054	3.869
0:27:59	403.7	0.164	69.9	5.512	6.70	43.7731	391.8	4.162	4.146	5.946	5.583	1.444	3.513	2.069	3.865
0:28:22	407.0	0.170	69.8	5.506	6.80	43.8201	395.2	4.194	4.177	5.977	5.627	1.457	3.542	2.085	3.861
0:28:47	410.8	0.176	69.6	5.500	6.90	43.8676	398.9	4.229	4.212	6.012	5.673	1.469	3.571	2.102	3.862
0:29:12	413.7	0.182	69.4	5.494	7.01	43.9149	401.8	4.255	4.238	6.038	5.715	1.485	3.600	2.115	3.848
0:29:35	417.5	0.188	69.2	5.488	7.10	43.9614	405.7	4.291	4.274	6.074	5.765	1.499	3.632	2.133	3.845
0:30:00	420.5	0.194	69.0	5.482	7.20	44.0085	408.7	4.318	4.301	6.101	5.808	1.515	3.661	2.147	3.834
0:30:25	423.1	0.200	68.7	5.476	7.30	44.0563	411.3	4.341	4.323	6.123	5.846	1.531	3.689	2.158	3.818
0:30:49	426.5	0.206	68.5	5.470	7.40	44.1041	414.6	4.371	4.353	6.153	5.891	1.545	3.718	2.173	3.812
0:31:13	429.8	0.212	68.4	5.464	7.50	44.1512	418.0	4.402	4.384	6.184	5.931	1.555	3.743	2.188	3.814
0:31:39	433.3	0.218	68.2	5.458	7.61	44.2005	421.4	4.433	4.415	6.215	5.978	1.571	3.775	2.204	3.805
0:32:03	436.0	0.224	68.0	5.452	7.71	44.2493	424.2	4.458	4.439	6.239	6.017	1.586	3.802	2.216	3.794
0:32:27	438.8	0.229	67.8	5.447	7.80	44.2952	427.0	4.483	4.464	6.264	6.055	1.599	3.827	2.228	3.786
0:32:51	442.1	0.235	67.6	5.441	7.90	44.3434	430.3	4.512	4.493	6.293	6.099	1.614	3.856	2.242	3.779
0:33:17	445.5	0.241	67.4	5.435	8.01	44.3936	433.6	4.542	4.522	6.322	6.143	1.629	3.886	2.257	3.772
0:33:42	448.0	0.247	67.2	5.429	8.11	44.4419	436.1	4.563	4.544	6.344	6.181	1.645	3.913	2.268	3.757
0:34:05	451.4	0.253	67.0	5.423	8.20	44.4881	439.5	4.594	4.574	6.374	6.225	1.659	3.942	2.283	3.753
0:34:30	454.7	0.259	66.8	5.417	8.30	44.5367	442.8	4.624	4.603	6.403	6.268	1.672	3.970	2.298	3.748
0:34:55	457.5	0.265	66.5	5.411	8.40	44.5852	445.7	4.648	4.628	6.428	6.309	1.689	3.999	2.310	3.736
0:35:19	460.1	0.271	66.3	5.405	8.51	44.6352	448.2	4.670	4.649	6.449	6.349	1.708	4.028	2.321	3.718
0:35:44	463.6	0.277	66.0	5.399	8.61	44.6850	451.7	4.701	4.680	6.480	6.399	1.727	4.063	2.336	3.706
0:36:09	466.9	0.283	66.0	5.393	8.71	44.7340	455.0	4.730	4.709	6.509	6.429	1.728	4.078	2.350	3.721
0:36:32	469.2	0.288	65.9	5.388	8.80	44.7812	457.3	4.749	4.728	6.528	6.455	1.735	4.095	2.360	3.720
0:36:57	472.6	0.294	65.8	5.382	8.91	44.8317	460.8	4.779	4.758	6.558	6.494	1.744	4.119	2.375	3.723
0:37:22	475.7	0.300	65.6	5.376	9.01	44.8815	463.9	4.806	4.784	6.584	6.533	1.756	4.144	2.388	3.720
0:37:46	478.4	0.306	65.5	5.370	9.11	44.9306	466.6	4.829	4.807	6.607	6.566	1.767	4.167	2.400	3.715
0:38:10	480.6	0.312	65.3	5.364	9.21	44.9789	468.7	4.846	4.824	6.624	6.597	1.781	4.189	2.408	3.704
0:38:35	484.4	0.318	65.1	5.358	9.31	45.0287	472.5	4.880	4.857	6.657	6.641	1.792	4.216	2.425	3.706
0:38:59	487.1	0.324	64.9	5.352	9.41	45.0784	475.3	4.903	4.880	6.680	6.676	1.804	4.240	2.436	3.700
0:39:24	489.5	0.330	64.7	5.346	9.51	45.1288	477.6	4.921	4.898	6.698	6.709	1.818	4.264	2.445	3.690
0:39:47	492.3	0.336	64.5	5.340	9.60	45.1774	480.5	4.946	4.922	6.722	6.748	1.834	4.291	2.457	3.680
0:40:13	495.3	0.342	64.3	5.334	9.71	45.2300	483.5	4.970	4.947	6.747	6.787	1.848	4.318	2.469	3.672
0:40:38	498.3	0.348	64.2	5.328	9.81	45.2799	486.4	4.995	4.972	6.772	6.823	1.859	4.341	2.482	3.670
0:41:01	500.6	0.353	64.0	5.323	9.90	45.3283	488.8	5.014	4.990	6.790	6.857	1.875	4.366	2.491	3.658
0:41:26	503.8	0.359	63.8	5.317	10.00	45.3783	492.0	5.042	5.017	6.817	6.896	1.886	4.391	2.505	3.656
0:41:51	506.8	0.365	63.6	5.311	10.11	45.4302	494.9	5.066	5.041	6.841	6.932	1.899	4.415	2.517	3.651
0:42:15	509.4	0.371	63.5	5.305	10.21	45.4805	497.5	5.087	5.062	6.862	6.963	1.909	4.436	2.527	3.648
0:42:40	511.9	0.377	63.3	5.299	10.31	45.5319	500.0	5.106	5.081	6.881	6.998	1.925	4.461	2.537	3.636
0:43:04	514.9	0.383	63.1	5.293	10.41	45.5814	503.1	5.132	5.107	6.907	7.036	1.937	4.486	2.550	3.633
0:43:28	517.9	0.389	62.9	5.287	10.51	45.6330	506.1	5.157	5.131	6.931	7.071	1.948	4.510	2.562	3.630
0:43:53	520.2	0.395	62.8	5.281	10.61	45.6851	508.4	5.174	5.149	6.949	7.102	1.961	4.531	2.570	3.622
0:44:16	523.4	0.401	62.6	5.275	10.71	45.7349	511.6	5.201	5.175	6.975	7.141	1.973	4.557	2.584	3.619
0:44:41	526.2	0.407	62.4	5.269	10.81	45.7878	514.3	5.223	5.197	6.997	7.175	1.985	4.580	2.595	3.614
0:45:05	528.2	0.412	62.2	5.264	10.90	45.8370	516.3	5.238	5.212	7.012	7.202	1.998	4.600	2.602	3.604
0:45:29	530.6	0.419	62.0	5.257	11.01	45.8904	518.7	5.256	5.230	7.030	7.237	2.015	4.626	2.611	3.591
0:45:53	533.7	0.424	61.8	5.252	11.11	45.9404	521.9	5.283	5.256	7.056	7.277	2.029	4.653	2.624	3.587
0:46:17	536.3	0.430	61.6	5.246	11.21	45.9925	524.5	5.302	5.275	7.075	7.313	2.045	4.679	2.634	3.576
0:46:42	538.4	0.436	61.5	5.240	11.31	46.0458	526.5	5.317	5.290	7.090	7.336	2.054	4.695	2.641	3.572
0:47:05	541.3	0.442	61.5	5.234	11.41	46.0971	529.5	5.341	5.313	7.113	7.357	2.052	4.704	2.653	3.586
0:47:30	544.1	0.448	61.4	5.228	11.51	46.1490	532.3	5.363	5.335	7.135	7.386	2.058	4.722	2.664	3.588
0:47:55	546.5	0.454	61.3	5.222	11.61	46.2017	534.7	5.381	5.353	7.153	7.414	2.068	4.741	2.673	3.584
0:48:18	548.4	0.460	61.1	5.216	11.71	46.2535	536.5	5.394	5.365	7.165	7.437	2.080	4.759	2.679	3.576
0:48:43	551.3	0.466	61.0	5.210	11.81	46.3064	539.5	5.417	5.389	7.189	7.472	2.091	4.781	2.690	3.573
0:49:08	553.8	0.472	60.9	5.204	11.91	46.3591	542.0	5.436	5.407	7.207	7.498	2.098	4.798	2.700	3.574

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.908 (in.)	15.006 (cm)	Height	4.608 (in.)	Date	12-11-09	Test Number	CU-3A
Diameter	2.839 (in)	7.211 (cm)	Dia. avg.	3.335 (in)	Press No.	1	Data File ID	3A
Area	6.330 (in²)	40.839 (cm²)	Area avg.	8.737 (in²)	Panel No.	B	Lateral Pressure (psi)	25.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:49:32	555.6	0.478	60.7	5.198	12.01	46.4123	543.8	5.448	5.419	7.219	7.522	2.111	4.816	2.705	3.564
0:49:56	558.5	0.483	60.5	5.193	12.11	46.4635	546.7	5.471	5.441	7.241	7.555	2.121	4.838	2.717	3.562
0:50:20	561.0	0.489	60.3	5.187	12.21	46.5163	549.2	5.490	5.460	7.260	7.588	2.135	4.861	2.726	3.554
0:50:45	563.1	0.495	60.2	5.181	12.31	46.5701	551.3	5.504	5.474	7.274	7.613	2.147	4.880	2.733	3.547
0:51:08	565.1	0.501	60.0	5.175	12.40	46.6219	553.3	5.518	5.488	7.288	7.641	2.160	4.901	2.740	3.537
0:51:34	568.0	0.507	59.9	5.169	12.51	46.6777	556.2	5.541	5.510	7.310	7.673	2.171	4.922	2.751	3.535
0:51:58	570.2	0.513	59.7	5.163	12.61	46.7296	558.4	5.556	5.526	7.326	7.700	2.182	4.941	2.759	3.529
0:52:23	572.4	0.519	59.6	5.157	12.71	46.7830	560.6	5.572	5.541	7.341	7.725	2.192	4.959	2.766	3.524
0:52:47	574.8	0.525	59.4	5.151	12.81	46.8387	562.9	5.589	5.557	7.357	7.753	2.204	4.978	2.775	3.518
0:53:12	577.6	0.531	59.3	5.145	12.91	46.8919	565.8	5.610	5.579	7.379	7.784	2.213	4.999	2.786	3.517
0:53:35	579.5	0.537	59.1	5.139	13.01	46.9439	567.7	5.623	5.591	7.391	7.807	2.224	5.016	2.792	3.511
0:54:00	581.2	0.543	58.9	5.133	13.11	46.9997	569.4	5.633	5.601	7.401	7.831	2.238	5.035	2.797	3.499
0:54:23	584.1	0.548	58.8	5.128	13.21	47.0527	572.2	5.655	5.623	7.423	7.861	2.246	5.054	2.808	3.500
0:54:48	586.3	0.554	58.7	5.122	13.31	47.1063	574.5	5.671	5.638	7.438	7.886	2.256	5.071	2.815	3.496
0:55:13	588.3	0.560	58.5	5.116	13.41	47.1621	576.4	5.683	5.651	7.451	7.913	2.270	5.091	2.822	3.486
0:55:37	590.6	0.566	58.3	5.110	13.51	47.2172	578.8	5.700	5.667	7.467	7.940	2.281	5.110	2.830	3.482
0:56:02	593.2	0.572	58.2	5.104	13.61	47.2725	581.3	5.718	5.685	7.485	7.970	2.293	5.132	2.839	3.476
0:56:26	595.2	0.578	58.0	5.098	13.71	47.3253	583.4	5.732	5.699	7.499	7.997	2.306	5.152	2.845	3.468
0:56:50	596.8	0.584	57.7	5.092	13.81	47.3798	584.9	5.741	5.707	7.507	8.024	2.325	5.175	2.850	3.451
0:57:15	599.7	0.590	57.7	5.086	13.91	47.4354	587.9	5.763	5.729	7.529	8.046	2.325	5.185	2.861	3.461
0:57:40	601.8	0.596	57.7	5.080	14.01	47.4912	590.0	5.777	5.743	7.543	8.059	2.324	5.191	2.867	3.468
0:58:04	603.4	0.602	57.6	5.074	14.11	47.5474	591.6	5.786	5.751	7.551	8.074	2.330	5.202	2.872	3.465
0:58:28	605.9	0.608	57.5	5.068	14.21	47.6010	594.1	5.804	5.769	7.569	8.100	2.338	5.219	2.881	3.464
0:58:52	608.1	0.614	57.4	5.062	14.31	47.6576	596.3	5.818	5.783	7.583	8.121	2.346	5.233	2.888	3.462
0:59:17	610.2	0.619	57.3	5.057	14.41	47.7129	598.3	5.831	5.796	7.596	8.143	2.355	5.249	2.894	3.458
0:59:42	612.0	0.625	57.2	5.051	14.51	47.7697	600.2	5.842	5.807	7.607	8.164	2.365	5.264	2.900	3.453
1:00:05	614.6	0.631	57.1	5.045	14.61	47.8244	602.8	5.861	5.825	7.625	8.189	2.372	5.281	2.909	3.452
1:00:30	616.7	0.637	56.9	5.039	14.71	47.8817	604.8	5.874	5.838	7.638	8.213	2.383	5.296	2.915	3.447
1:00:55	618.6	0.643	56.7	5.033	14.81	47.9386	606.8	5.886	5.850	7.650	8.237	2.395	5.316	2.921	3.439
1:01:18	620.7	0.649	56.6	5.027	14.91	47.9940	608.8	5.899	5.863	7.663	8.260	2.405	5.333	2.927	3.434
1:01:43	622.9	0.655	56.5	5.021	15.01	48.0524	611.0	5.913	5.876	7.676	8.284	2.415	5.349	2.934	3.430
1:02:06	624.8	0.661	56.3	5.015	15.11	48.1062	612.9	5.925	5.888	7.688	8.305	2.425	5.365	2.940	3.425
1:02:31	626.5	0.667	56.2	5.009	15.21	48.1641	614.6	5.934	5.897	7.697	8.324	2.435	5.379	2.945	3.419
1:02:54	629.1	0.673	56.0	5.003	15.31	48.2191	617.3	5.953	5.915	7.715	8.353	2.446	5.399	2.954	3.415
1:03:19	631.1	0.679	55.9	4.997	15.41	48.2772	619.2	5.964	5.927	7.727	8.373	2.454	5.414	2.959	3.411
1:03:44	632.8	0.684	55.8	4.992	15.51	48.3342	620.9	5.974	5.936	7.736	8.392	2.464	5.428	2.964	3.406
1:04:08	634.8	0.690	55.7	4.986	15.61	48.3922	623.0	5.986	5.948	7.748	8.409	2.468	5.439	2.970	3.406
1:04:33	637.1	0.696	55.6	4.980	15.71	48.4503	625.2	6.001	5.962	7.762	8.433	2.478	5.455	2.977	3.403
1:04:58	638.8	0.702	55.5	4.974	15.81	48.5064	627.0	6.010	5.972	7.772	8.451	2.487	5.469	2.982	3.398
1:05:22	640.3	0.708	55.3	4.968	15.91	48.5647	628.4	6.017	5.979	7.779	8.469	2.498	5.483	2.985	3.390
1:05:47	642.6	0.714	55.2	4.962	16.01	48.6229	630.8	6.032	5.993	7.793	8.493	2.508	5.500	2.993	3.387
1:06:12	645.0	0.720	55.0	4.956	16.11	48.6808	633.1	6.048	6.008	7.808	8.520	2.519	5.519	3.000	3.382
1:06:36	646.7	0.726	54.9	4.950	16.21	48.7390	634.9	6.057	6.018	7.818	8.538	2.528	5.533	3.005	3.377
1:07:01	648.1	0.732	54.6	4.944	16.31	48.7982	636.3	6.063	6.023	7.823	8.561	2.545	5.553	3.008	3.363
1:07:26	650.8	0.738	54.5	4.938	16.41	48.8555	638.9	6.081	6.041	7.841	8.590	2.556	5.573	3.017	3.360
1:07:49	652.8	0.743	54.5	4.933	16.51	48.9126	640.9	6.093	6.053	7.853	8.598	2.553	5.576	3.023	3.368
1:08:15	654.2	0.750	54.5	4.926	16.61	48.9736	642.4	6.099	6.059	7.859	8.604	2.553	5.578	3.025	3.370
1:08:38	656.3	0.755	54.5	4.921	16.71	49.0303	644.5	6.112	6.072	7.872	8.623	2.559	5.591	3.032	3.370
1:09:03	658.8	0.761	54.4	4.915	16.81	49.0889	647.0	6.129	6.088	7.888	8.643	2.563	5.603	3.040	3.372
1:09:28	660.6	0.767	54.3	4.909	16.91	49.1492	648.7	6.138	6.096	7.896	8.659	2.570	5.615	3.044	3.369
1:09:52	662.0	0.773	54.2	4.903	17.01	49.2086	650.2	6.144	6.103	7.903	8.674	2.579	5.627	3.047	3.363
1:10:17	664.8	0.779	54.1	4.897	17.11	49.2686	652.9	6.162	6.121	7.921	8.697	2.584	5.640	3.056	3.366
1:10:42	666.7	0.785	54.0	4.891	17.21	49.3274	654.9	6.174	6.132	7.932	8.715	2.591	5.653	3.062	3.364
1:11:06	668.2	0.791	53.9	4.885	17.31	49.3867	656.4	6.180	6.138	7.938	8.733	2.602	5.667	3.065	3.356
1:11:30	670.0	0.797	53.7	4.879	17.41	49.4454	658.2	6.190	6.147	7.947	8.752	2.612	5.682	3.070	3.351
1:11:54	672.3	0.803	53.6	4.873	17.51	49.5056	660.5	6.204	6.161	7.961	8.774	2.620	5.697	3.077	3.348
1:12:19	673.9	0.809	53.5	4.867	17.61	49.5663	662.1	6.211	6.169	7.969	8.789	2.628	5.709	3.080	3.344
1:12:44	675.3	0.814	53.3	4.862	17.71	49.6265	663.4	6.216	6.173	7.973	8.805	2.639	5.722	3.083	3.336
1:13:08	677.6	0.820	53.2	4.856	17.81	49.6877	665.7	6.230	6.187	7.987	8.826	2.647	5.737	3.090	3.334
1:13:33	679.2	0.826	53.1	4.850	17.91	49.7482	667.4	6.238	6.194	7.994	8.840	2.654	5.747	3.093	3.331

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	5.908 (in.)	15.006 (cm)	Height	4.608 (in.)	Tested By	KDG
Diameter	2.839 (in)	7.211 (cm)	Dia. avg.	3.335 (in)	Date	12-11-09
Area	6.330 (in^2)	40.839 (cm^2)	Area avg.	8.737 (in^2)	Press No.	1
					Panel No.	B

Project Number	175569069
Test Number	CU-3A
Data File ID	3A
Lateral Pressure (psi)	25.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
1:13:58	681.0	0.832	53.0	4.844	18.01	49.8085	669.1	6.247	6.203	8.003	8.857	2.662	5.759	3.098	3.327
1:14:22	682.4	0.838	52.9	4.838	18.11	49.8701	670.6	6.252	6.208	8.008	8.872	2.671	5.772	3.100	3.321
1:14:47	684.7	0.844	52.8	4.832	18.21	49.9313	672.9	6.266	6.222	8.022	8.892	2.678	5.785	3.107	3.320
1:15:12	686.4	0.850	52.7	4.826	18.31	49.9929	674.6	6.274	6.230	8.030	8.907	2.685	5.796	3.111	3.317
1:15:36	688.0	0.856	52.6	4.820	18.41	50.0542	676.1	6.281	6.236	8.036	8.923	2.695	5.809	3.114	3.312
1:16:00	689.9	0.862	52.4	4.814	18.51	50.1136	678.1	6.292	6.247	8.047	8.943	2.704	5.823	3.120	3.308
1:16:25	692.2	0.868	52.4	4.808	18.61	50.1749	680.4	6.305	6.260	8.060	8.963	2.710	5.837	3.126	3.307
1:16:49	693.6	0.873	52.2	4.803	18.71	50.2370	681.8	6.311	6.265	8.065	8.979	2.721	5.850	3.129	3.299
1:17:13	695.0	0.879	52.0	4.797	18.81	50.2986	683.2	6.316	6.270	8.070	8.997	2.735	5.866	3.131	3.289
1:17:37	697.2	0.885	51.8	4.791	18.91	50.3606	685.4	6.328	6.282	8.082	9.022	2.748	5.885	3.137	3.283
1:18:01	698.6	0.891	52.0	4.785	19.01	50.4228	686.8	6.333	6.287	8.087	9.017	2.737	5.877	3.140	3.294
1:18:25	699.9	0.897	51.9	4.779	19.11	50.4863	688.1	6.337	6.291	8.091	9.026	2.743	5.884	3.142	3.291
1:18:49	702.2	0.903	51.9	4.773	19.21	50.5478	690.3	6.350	6.304	8.104	9.042	2.746	5.894	3.148	3.292
1:19:13	703.9	0.909	51.8	4.767	19.31	50.6112	692.0	6.358	6.311	8.111	9.055	2.751	5.903	3.152	3.291
1:19:38	705.7	0.915	51.8	4.761	19.41	50.6738	693.9	6.367	6.320	8.120	9.066	2.753	5.909	3.156	3.293
1:20:02	707.3	0.921	51.6	4.755	19.51	50.7363	695.5	6.374	6.327	8.127	9.080	2.761	5.921	3.159	3.288
1:20:26	709.2	0.927	51.6	4.749	19.61	50.8003	697.4	6.383	6.336	8.136	9.094	2.767	5.931	3.164	3.287
1:20:51	711.1	0.933	51.5	4.743	19.71	50.8636	699.3	6.393	6.345	8.145	9.110	2.773	5.942	3.168	3.285
1:21:16	712.3	0.939	51.4	4.737	19.81	50.9277	700.5	6.396	6.348	8.148	9.123	2.783	5.953	3.170	3.278
1:21:39	714.4	0.944	51.3	4.732	19.91	50.9897	702.5	6.407	6.358	8.158	9.140	2.790	5.965	3.175	3.276
1:22:04	716.3	0.950	51.1	4.726	20.01	51.0540	704.5	6.416	6.368	8.168	9.157	2.798	5.978	3.180	3.273
1:22:28	717.8	0.956	51.1	4.720	20.11	51.1192	706.0	6.422	6.373	8.173	9.167	2.802	5.984	3.182	3.272
1:22:53	718.9	0.962	50.9	4.714	20.21	51.1833	707.0	6.424	6.374	8.174	9.180	2.814	5.997	3.183	3.263
1:23:18	721.3	0.968	50.9	4.708	20.31	51.2488	709.4	6.437	6.388	8.188	9.198	2.818	6.008	3.190	3.264
1:23:41	722.8	0.974	50.8	4.702	20.41	51.3098	710.9	6.443	6.393	8.193	9.208	2.823	6.015	3.193	3.262
1:24:06	723.7	0.980	50.7	4.696	20.51	51.3754	711.8	6.443	6.393	8.193	9.216	2.832	6.024	3.192	3.255
1:24:30	725.8	0.986	50.6	4.690	20.61	51.4402	713.9	6.454	6.404	8.204	9.234	2.838	6.036	3.198	3.253
1:24:55	728.1	0.992	50.5	4.684	20.71	51.5057	716.2	6.466	6.416	8.216	9.250	2.842	6.046	3.204	3.255
1:25:20	729.4	0.998	50.4	4.678	20.81	51.5706	717.5	6.470	6.419	8.219	9.262	2.850	6.056	3.206	3.249
1:25:44	730.4	1.004	50.3	4.672	20.91	51.6370	718.6	6.471	6.420	8.220	9.273	2.861	6.067	3.206	3.241
1:26:08	732.7	1.009	50.2	4.667	21.01	51.7006	720.8	6.483	6.432	8.232	9.290	2.865	6.078	3.212	3.242
1:26:32	734.1	1.015	50.1	4.661	21.11	51.7667	722.3	6.488	6.436	8.236	9.301	2.873	6.087	3.214	3.238
1:26:56	735.0	1.021	50.0	4.655	21.21	51.8312	723.1	6.488	6.436	8.236	9.309	2.881	6.095	3.214	3.231
1:27:21	736.8	1.027	49.8	4.649	21.31	51.8972	725.0	6.496	6.444	8.244	9.327	2.891	6.109	3.218	3.226
1:27:45	738.9	1.033	49.7	4.643	21.41	51.9637	727.1	6.506	6.454	8.254	9.345	2.899	6.122	3.223	3.224
1:28:10	740.1	1.039	49.6	4.637	21.51	52.0318	728.3	6.508	6.456	8.256	9.354	2.906	6.130	3.224	3.219
1:28:34	741.0	1.045	49.7	4.631	21.61	52.0968	729.1	6.508	6.455	8.255	9.348	2.901	6.124	3.224	3.223
1:28:58	743.2	1.051	49.7	4.625	21.71	52.1626	731.4	6.520	6.467	8.267	9.359	2.900	6.129	3.230	3.228
1:29:23	745.0	1.057	49.7	4.619	21.81	52.2310	733.1	6.527	6.474	8.274	9.369	2.903	6.136	3.233	3.227
1:29:46	745.7	1.063	49.6	4.613	21.91	52.2959	733.9	6.526	6.472	8.272	9.372	2.908	6.140	3.232	3.223
1:30:10	747.6	1.068	49.6	4.608	22.01	52.3629	735.8	6.534	6.480	8.280	9.385	2.912	6.148	3.236	3.223

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.886 (in.)	14.949 (cm)	Height	4.800 (in.)	Date	12-11-09	Test Number	CU-3B
Diameter	2.855 (in)	7.251 (cm)	Dia. avg.	3.260 (in)	Press No.	1	Data File ID	3B
Area	6.400 (in²)	41.292 (cm²)	Area avg.	8.347 (in²)	Panel No.	C	Lateral Pressure (psi)	35.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	13.2	-0.020	55.1	5.886	0.00	41.2918	0.0	0.000	0.000	2.520	2.520	2.516	2.518	0.002	1.001
0:00:32	39.2	-0.014	56.8	5.879	0.10	41.3351	26.0	0.292	0.292	2.812	2.687	2.391	2.539	0.148	1.124
0:01:07	110.7	-0.008	60.7	5.873	0.21	41.3775	97.5	1.096	1.095	3.615	3.207	2.109	2.658	0.549	1.521
0:01:38	160.1	-0.001	63.6	5.867	0.31	41.4209	146.8	1.648	1.648	4.168	3.552	1.901	2.727	0.826	1.869
0:02:05	192.4	0.004	65.8	5.862	0.40	41.4589	179.2	2.010	2.009	4.529	3.753	1.740	2.746	1.006	2.157
0:02:31	216.1	0.010	67.5	5.856	0.50	41.5012	202.8	2.273	2.272	4.792	3.898	1.623	2.761	1.138	2.402
0:02:59	237.6	0.016	68.9	5.850	0.61	41.5433	224.4	2.511	2.510	5.030	4.031	1.518	2.774	1.257	2.656
0:03:25	253.0	0.022	69.9	5.844	0.71	41.5854	239.8	2.681	2.680	5.200	4.129	1.446	2.788	1.342	2.856
0:03:52	265.9	0.028	70.7	5.838	0.80	41.6269	252.7	2.823	2.821	5.341	4.212	1.388	2.800	1.412	3.035
0:04:18	275.5	0.034	71.3	5.832	0.91	41.6693	262.2	2.926	2.924	5.444	4.277	1.349	2.813	1.464	3.170
0:04:44	282.5	0.039	71.6	5.826	1.00	41.7108	269.2	3.001	2.999	5.519	4.325	1.322	2.823	1.501	3.271
0:05:10	287.9	0.045	71.9	5.821	1.10	41.7528	274.6	3.059	3.056	5.576	4.364	1.304	2.834	1.530	3.346
0:05:35	292.2	0.051	72.0	5.815	1.21	41.7962	278.9	3.103	3.100	5.620	4.398	1.294	2.846	1.552	3.399
0:05:59	295.3	0.057	72.2	5.809	1.31	41.8380	282.0	3.135	3.131	5.651	4.419	1.284	2.852	1.568	3.442
0:06:24	297.3	0.063	72.4	5.803	1.41	41.8813	284.1	3.154	3.151	5.671	4.419	1.264	2.842	1.577	3.495
0:06:49	299.5	0.069	72.6	5.797	1.51	41.9231	286.2	3.175	3.171	5.691	4.430	1.256	2.843	1.587	3.529
0:07:13	301.3	0.075	72.7	5.791	1.61	41.9669	288.0	3.192	3.188	5.708	4.441	1.249	2.845	1.596	3.555
0:07:38	302.9	0.081	72.7	5.785	1.71	42.0084	289.6	3.206	3.202	5.722	4.449	1.244	2.847	1.603	3.577
0:08:04	304.0	0.087	72.8	5.779	1.81	42.0516	290.7	3.215	3.210	5.730	4.456	1.242	2.849	1.607	3.589
0:08:29	305.5	0.093	72.8	5.773	1.91	42.0976	292.3	3.228	3.224	5.744	4.466	1.239	2.853	1.614	3.605
0:08:52	306.9	0.098	72.8	5.767	2.01	42.1378	293.7	3.241	3.236	5.756	4.475	1.236	2.856	1.620	3.621
0:09:15	307.9	0.104	72.8	5.762	2.11	42.1800	294.7	3.249	3.244	5.764	4.483	1.236	2.860	1.624	3.627
0:09:39	309.1	0.110	72.8	5.756	2.21	42.2234	295.8	3.258	3.253	5.773	4.495	1.238	2.866	1.628	3.630
0:10:03	310.8	0.116	72.8	5.750	2.31	42.2674	297.6	3.274	3.268	5.788	4.507	1.236	2.871	1.636	3.648
0:10:28	311.9	0.122	72.8	5.744	2.41	42.3109	298.7	3.283	3.277	5.797	4.517	1.236	2.876	1.640	3.654
0:10:53	313.0	0.128	72.8	5.738	2.51	42.3548	299.7	3.290	3.284	5.804	4.526	1.238	2.882	1.644	3.656
0:11:17	314.5	0.134	72.8	5.732	2.61	42.4005	301.2	3.304	3.297	5.817	4.538	1.237	2.888	1.650	3.668
0:11:41	316.2	0.140	72.8	5.726	2.71	42.4415	303.0	3.319	3.313	5.833	4.553	1.236	2.895	1.658	3.683
0:12:06	317.2	0.146	72.8	5.720	2.81	42.4853	304.0	3.327	3.320	5.840	4.563	1.239	2.901	1.662	3.682
0:12:30	318.3	0.151	72.8	5.714	2.91	42.5291	305.1	3.336	3.329	5.849	4.574	1.242	2.908	1.666	3.684
0:12:55	320.3	0.158	72.8	5.708	3.01	42.5745	307.1	3.354	3.347	5.867	4.592	1.242	2.917	1.675	3.698
0:13:20	321.7	0.163	72.7	5.703	3.11	42.6167	308.5	3.366	3.358	5.878	4.604	1.242	2.923	1.681	3.706
0:13:44	322.8	0.169	72.7	5.697	3.21	42.6612	309.5	3.374	3.366	5.886	4.614	1.244	2.929	1.685	3.708
0:14:08	324.4	0.175	72.7	5.691	3.31	42.7050	311.2	3.388	3.380	5.900	4.631	1.247	2.939	1.692	3.713
0:14:34	325.9	0.181	72.6	5.685	3.41	42.7509	312.7	3.401	3.393	5.913	4.646	1.250	2.948	1.698	3.718
0:14:58	327.4	0.187	72.6	5.679	3.51	42.7949	314.1	3.413	3.405	5.925	4.660	1.252	2.956	1.704	3.723
0:15:22	328.4	0.193	72.6	5.673	3.61	42.8386	315.2	3.421	3.413	5.933	4.672	1.256	2.964	1.708	3.720
0:15:46	330.3	0.199	72.5	5.667	3.71	42.8835	317.1	3.438	3.429	5.949	4.692	1.259	2.975	1.717	3.727
0:16:11	332.2	0.205	72.5	5.661	3.81	42.9286	319.0	3.455	3.446	5.966	4.710	1.260	2.985	1.725	3.738
0:16:34	333.4	0.210	72.4	5.655	3.91	42.9730	320.2	3.465	3.455	5.975	4.723	1.264	2.993	1.729	3.737
0:16:58	334.8	0.216	72.4	5.649	4.01	43.0176	321.5	3.476	3.466	5.986	4.738	1.268	3.003	1.735	3.736
0:17:21	336.6	0.222	72.3	5.643	4.11	43.0629	323.3	3.491	3.481	6.001	4.757	1.272	3.015	1.743	3.740
0:17:46	338.1	0.228	72.3	5.637	4.22	43.1091	324.8	3.504	3.494	6.014	4.775	1.278	3.026	1.749	3.737
0:18:10	339.2	0.234	72.1	5.632	4.32	43.1541	325.9	3.512	3.501	6.021	4.792	1.287	3.040	1.753	3.724
0:18:32	341.0	0.240	72.1	5.626	4.41	43.1975	327.8	3.528	3.517	6.037	4.813	1.292	3.053	1.761	3.725
0:18:56	342.4	0.246	72.0	5.620	4.51	43.2441	329.2	3.540	3.529	6.049	4.828	1.295	3.062	1.766	3.727
0:19:20	343.4	0.252	72.1	5.614	4.61	43.2884	330.2	3.547	3.536	6.056	4.829	1.289	3.059	1.770	3.745
0:19:43	345.5	0.258	72.1	5.608	4.71	43.3344	332.2	3.565	3.553	6.073	4.847	1.289	3.068	1.779	3.759
0:20:08	347.2	0.264	72.1	5.602	4.82	43.3818	334.0	3.580	3.568	6.088	4.863	1.292	3.078	1.786	3.765
0:20:31	348.1	0.269	72.0	5.596	4.91	43.4256	334.8	3.585	3.574	6.094	4.873	1.296	3.085	1.789	3.760
0:20:56	349.8	0.275	71.9	5.590	5.02	43.4728	336.5	3.600	3.587	6.107	4.892	1.301	3.097	1.796	3.760
0:21:20	351.6	0.281	71.9	5.585	5.11	43.5175	338.4	3.616	3.604	6.124	4.911	1.303	3.107	1.804	3.768
0:21:45	353.0	0.287	71.8	5.578	5.22	43.5648	339.8	3.627	3.614	6.134	4.926	1.309	3.118	1.809	3.764
0:22:10	354.6	0.293	71.7	5.573	5.32	43.6109	341.4	3.640	3.627	6.147	4.946	1.315	3.130	1.815	3.762
0:22:34	356.0	0.299	71.6	5.567	5.42	43.6566	342.7	3.651	3.637	6.157	4.963	1.322	3.143	1.821	3.754
0:22:58	358.0	0.305	71.6	5.561	5.52	43.7027	344.7	3.668	3.654	6.174	4.984	1.326	3.155	1.829	3.758
0:23:23	358.9	0.311	71.5	5.555	5.62	43.7492	345.6	3.674	3.660	6.180	4.999	1.335	3.167	1.832	3.745
0:23:46	360.5	0.317	71.4	5.549	5.72	43.7952	347.3	3.687	3.673	6.193	5.018	1.341	3.179	1.839	3.743
0:24:11	362.5	0.323	71.3	5.543	5.82	43.8422	349.2	3.704	3.690	6.210	5.040	1.346	3.193	1.847	3.744
0:24:37	364.2	0.329	71.2	5.537	5.92	43.8894	351.0	3.718	3.704	6.224	5.058	1.351	3.204	1.854	3.745

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.886 (in.)	14.949 (cm)	Height	4.800 (in.)	Date	12-11-09	Test Number	CU-3B
Diameter	2.855 (in)	7.251 (cm)	Dia. avg.	3.260 (in)	Press No.	1	Data File ID	3B
Area	6.400 (in²)	41.292 (cm²)	Area avg.	8.347 (in²)	Panel No.	C	Lateral Pressure (psi)	35.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:25:01	365.6	0.334	71.2	5.531	6.02	43.9361	352.3	3.729	3.714	6.234	5.075	1.357	3.216	1.859	3.740
0:25:25	367.1	0.340	71.1	5.526	6.12	43.9814	353.9	3.742	3.727	6.247	5.094	1.364	3.229	1.865	3.735
0:25:50	368.6	0.346	71.0	5.520	6.22	44.0289	355.4	3.753	3.738	6.258	5.112	1.370	3.241	1.871	3.732
0:26:14	370.3	0.352	70.9	5.514	6.32	44.0762	357.1	3.767	3.752	6.272	5.130	1.375	3.253	1.878	3.731
0:26:39	371.5	0.358	70.8	5.508	6.42	44.1253	358.2	3.775	3.759	6.279	5.148	1.385	3.266	1.882	3.718
0:27:02	373.3	0.364	70.7	5.502	6.52	44.1716	360.0	3.790	3.774	6.294	5.167	1.389	3.278	1.889	3.720
0:27:27	374.9	0.370	70.6	5.496	6.62	44.2189	361.7	3.804	3.788	6.308	5.185	1.394	3.290	1.896	3.720
0:27:50	376.2	0.376	70.6	5.490	6.72	44.2650	363.0	3.813	3.797	6.317	5.200	1.400	3.300	1.900	3.715
0:28:15	377.6	0.381	70.4	5.484	6.82	44.3129	364.4	3.824	3.807	6.327	5.219	1.408	3.314	1.906	3.706
0:28:40	379.5	0.387	70.4	5.478	6.92	44.3606	366.3	3.840	3.823	6.343	5.240	1.414	3.327	1.913	3.707
0:29:04	380.8	0.393	70.3	5.472	7.02	44.4092	367.6	3.849	3.832	6.352	5.256	1.420	3.338	1.918	3.702
0:29:29	381.9	0.399	70.2	5.467	7.12	44.4564	368.7	3.856	3.839	6.359	5.272	1.429	3.350	1.921	3.689
0:29:54	383.9	0.405	70.0	5.461	7.22	44.5056	370.6	3.872	3.855	6.375	5.298	1.440	3.369	1.929	3.680
0:30:18	385.6	0.411	70.0	5.455	7.32	44.5522	372.3	3.886	3.868	6.388	5.314	1.442	3.378	1.936	3.685
0:30:43	387.0	0.417	69.8	5.449	7.42	44.6006	373.7	3.897	3.879	6.399	5.333	1.451	3.392	1.941	3.675
0:31:08	388.0	0.423	69.7	5.443	7.52	44.6489	374.7	3.903	3.885	6.405	5.351	1.463	3.407	1.944	3.658
0:31:32	390.1	0.429	69.7	5.437	7.62	44.6972	376.8	3.920	3.902	6.422	5.369	1.464	3.417	1.953	3.668
0:31:57	391.7	0.435	69.7	5.431	7.72	44.7457	378.5	3.933	3.914	6.434	5.378	1.460	3.419	1.959	3.683
0:32:22	392.8	0.441	69.7	5.425	7.82	44.7963	379.5	3.940	3.921	6.441	5.388	1.464	3.426	1.962	3.681
0:32:45	394.4	0.446	69.6	5.419	7.92	44.8442	381.1	3.952	3.933	6.453	5.406	1.470	3.438	1.968	3.679
0:33:10	396.1	0.452	69.5	5.413	8.02	44.8934	382.9	3.966	3.947	6.467	5.426	1.475	3.451	1.975	3.677
0:33:33	397.5	0.458	69.5	5.408	8.12	44.9422	384.2	3.975	3.956	6.476	5.439	1.480	3.459	1.980	3.676
0:33:57	398.4	0.464	69.3	5.402	8.22	44.9914	385.2	3.981	3.961	6.481	5.452	1.487	3.469	1.982	3.667
0:34:20	400.2	0.470	69.3	5.396	8.32	45.0399	387.0	3.996	3.975	6.495	5.469	1.490	3.480	1.990	3.670
0:34:45	401.7	0.476	69.2	5.390	8.42	45.0898	388.4	4.006	3.985	6.505	5.487	1.498	3.493	1.995	3.663
0:35:08	402.7	0.482	69.1	5.384	8.52	45.1383	389.5	4.013	3.992	6.512	5.502	1.507	3.505	1.998	3.652
0:35:32	404.6	0.488	69.0	5.378	8.62	45.1886	391.3	4.027	4.006	6.526	5.523	1.513	3.518	2.005	3.650
0:35:56	406.4	0.494	68.9	5.372	8.73	45.2393	393.1	4.041	4.020	6.540	5.541	1.518	3.530	2.012	3.651
0:36:20	407.3	0.500	68.8	5.366	8.82	45.2883	394.0	4.046	4.024	6.544	5.554	1.526	3.540	2.014	3.640
0:36:43	408.7	0.505	68.7	5.360	8.92	45.3377	395.4	4.056	4.034	6.554	5.570	1.532	3.551	2.019	3.636
0:37:08	410.4	0.512	68.6	5.354	9.03	45.3892	397.2	4.069	4.047	6.567	5.589	1.538	3.563	2.025	3.634
0:37:31	411.6	0.517	68.5	5.349	9.12	45.4378	398.3	4.076	4.054	6.574	5.603	1.545	3.574	2.029	3.627
0:37:55	412.4	0.523	68.4	5.343	9.22	45.4869	399.2	4.080	4.058	6.578	5.615	1.554	3.585	2.031	3.614
0:38:19	414.3	0.529	68.4	5.337	9.33	45.5395	401.1	4.095	4.073	6.593	5.634	1.558	3.596	2.038	3.616
0:38:43	415.7	0.535	68.3	5.331	9.42	45.5880	402.5	4.105	4.082	6.602	5.650	1.564	3.607	2.043	3.612
0:39:07	416.9	0.541	68.2	5.325	9.52	45.6385	403.7	4.113	4.090	6.610	5.664	1.570	3.617	2.047	3.607
0:39:32	418.0	0.547	68.1	5.319	9.63	45.6915	404.8	4.119	4.096	6.616	5.678	1.579	3.628	2.050	3.597
0:39:56	419.7	0.553	68.0	5.313	9.73	45.7403	406.4	4.132	4.108	6.628	5.694	1.582	3.638	2.056	3.599
0:40:20	420.7	0.559	67.9	5.307	9.83	45.7910	407.5	4.138	4.114	6.634	5.707	1.589	3.648	2.059	3.591
0:40:45	422.1	0.565	67.8	5.301	9.93	45.8434	408.8	4.147	4.123	6.643	5.724	1.597	3.660	2.063	3.584
0:41:08	423.6	0.570	67.7	5.295	10.03	45.8938	410.4	4.158	4.134	6.654	5.740	1.603	3.671	2.069	3.581
0:41:33	424.7	0.576	67.7	5.290	10.13	45.9438	411.5	4.165	4.140	6.660	5.753	1.609	3.681	2.072	3.576
0:41:58	426.0	0.582	67.6	5.284	10.23	45.9951	412.8	4.173	4.149	6.669	5.768	1.615	3.691	2.076	3.570
0:42:22	427.2	0.588	67.5	5.278	10.33	46.0468	414.0	4.181	4.156	6.676	5.783	1.623	3.703	2.080	3.562
0:42:47	428.9	0.594	67.4	5.272	10.43	46.0998	415.7	4.193	4.167	6.687	5.801	1.630	3.715	2.086	3.559
0:43:12	430.1	0.600	67.2	5.266	10.53	46.1513	416.9	4.200	4.175	6.695	5.817	1.639	3.728	2.089	3.549
0:43:36	431.2	0.606	67.1	5.260	10.63	46.2036	417.9	4.206	4.181	6.701	5.834	1.649	3.741	2.092	3.537
0:44:00	432.9	0.612	67.0	5.254	10.73	46.2555	419.7	4.219	4.193	6.713	5.855	1.658	3.756	2.098	3.532
0:44:25	434.2	0.618	67.0	5.248	10.83	46.3075	421.0	4.227	4.201	6.721	5.857	1.653	3.755	2.102	3.544
0:44:48	435.3	0.623	67.0	5.242	10.93	46.3581	422.1	4.234	4.207	6.727	5.865	1.654	3.760	2.105	3.545
0:45:13	436.4	0.629	67.0	5.236	11.03	46.4111	423.1	4.239	4.213	6.733	5.876	1.659	3.768	2.108	3.541
0:45:37	437.6	0.635	66.9	5.230	11.13	46.4642	424.3	4.247	4.220	6.740	5.886	1.663	3.774	2.112	3.540
0:46:01	438.9	0.641	66.9	5.225	11.23	46.5144	425.7	4.255	4.228	6.748	5.898	1.667	3.783	2.116	3.539
0:46:26	439.9	0.647	66.8	5.219	11.33	46.5675	426.6	4.260	4.233	6.753	5.910	1.674	3.792	2.118	3.531
0:46:51	441.3	0.653	66.7	5.213	11.43	46.6205	428.1	4.270	4.242	6.762	5.925	1.679	3.802	2.123	3.529
0:47:15	442.7	0.659	66.6	5.207	11.53	46.6730	429.5	4.279	4.251	6.771	5.939	1.684	3.811	2.127	3.527
0:47:41	443.9	0.665	66.5	5.201	11.63	46.7264	430.7	4.286	4.258	6.778	5.953	1.692	3.822	2.131	3.519
0:48:05	444.6	0.671	66.4	5.195	11.73	46.7798	431.3	4.287	4.259	6.779	5.964	1.701	3.832	2.131	3.506
0:48:29	446.3	0.676	66.3	5.189	11.83	46.8318	433.1	4.300	4.271	6.791	5.980	1.705	3.842	2.137	3.508
0:48:53	447.7	0.682	66.3	5.183	11.93	46.8853	434.4	4.309	4.280	6.800	5.992	1.709	3.851	2.142	3.506

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	5.886 (in.)	14.949 (cm)	Height	4.800 (in.)	Tested By	KDG
Diameter	2.855 (in)	7.251 (cm)	Dia. avg.	3.260 (in)	Date	12-11-09
Area	6.400 (in^2)	41.292 (cm^2)	Area avg.	8.347 (in^2)	Press No.	1
					Panel No.	C

Project Number	175569069
Test Number	CU-3B
Data File ID	3B
Lateral Pressure (psi)	35.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:49:18	448.1	0.688	66.2	5.177	12.03	46.9404	434.8	4.308	4.278	6.798	5.999	1.717	3.858	2.141	3.494
0:49:41	449.5	0.694	66.1	5.172	12.13	46.9927	436.3	4.317	4.288	6.808	6.014	1.723	3.869	2.146	3.491
0:50:06	451.0	0.700	66.0	5.165	12.24	47.0492	437.7	4.326	4.297	6.817	6.027	1.727	3.877	2.150	3.490
0:50:30	452.2	0.706	65.9	5.160	12.34	47.1019	438.9	4.333	4.303	6.823	6.040	1.733	3.886	2.153	3.485
0:50:53	452.6	0.712	65.8	5.154	12.44	47.1557	439.4	4.333	4.303	6.823	6.047	1.741	3.894	2.153	3.474
0:51:17	454.3	0.718	65.8	5.148	12.53	47.2095	441.0	4.344	4.314	6.834	6.062	1.745	3.904	2.159	3.474
0:51:40	455.2	0.724	65.7	5.142	12.63	47.2632	441.9	4.348	4.317	6.837	6.072	1.751	3.911	2.160	3.468
0:52:03	455.8	0.730	65.6	5.136	12.74	47.3182	442.5	4.349	4.318	6.838	6.079	1.757	3.918	2.161	3.460
0:52:27	457.4	0.736	65.5	5.130	12.84	47.3728	444.2	4.360	4.329	6.849	6.094	1.762	3.928	2.166	3.459
0:52:49	458.5	0.741	65.5	5.124	12.93	47.4251	445.2	4.366	4.334	6.854	6.104	1.766	3.935	2.169	3.456
0:53:12	459.3	0.747	65.4	5.118	13.03	47.4805	446.1	4.368	4.337	6.857	6.113	1.772	3.943	2.170	3.449
0:53:36	460.5	0.753	65.3	5.112	13.14	47.5358	447.2	4.375	4.343	6.863	6.124	1.777	3.950	2.173	3.446
0:53:59	461.7	0.759	65.3	5.107	13.23	47.5890	448.5	4.382	4.350	6.870	6.135	1.781	3.958	2.177	3.444
0:54:24	462.5	0.765	65.2	5.101	13.34	47.6454	449.3	4.385	4.353	6.873	6.144	1.788	3.966	2.178	3.437
0:54:47	463.1	0.771	65.1	5.095	13.43	47.7003	449.9	4.386	4.353	6.873	6.153	1.796	3.974	2.178	3.426
0:55:12	465.0	0.777	65.0	5.089	13.54	47.7574	451.8	4.399	4.366	6.886	6.168	1.799	3.983	2.185	3.429
0:55:35	465.4	0.783	64.9	5.083	13.63	47.8106	452.2	4.398	4.365	6.885	6.175	1.806	3.990	2.184	3.419
0:56:00	466.4	0.789	64.8	5.077	13.74	47.8678	453.2	4.402	4.369	6.889	6.187	1.814	4.000	2.186	3.410
0:56:24	467.7	0.795	64.7	5.071	13.84	47.9225	454.5	4.410	4.377	6.897	6.203	1.823	4.013	2.190	3.403
0:56:48	469.0	0.801	64.6	5.065	13.94	47.9800	455.7	4.417	4.383	6.903	6.215	1.828	4.021	2.193	3.400
0:57:12	469.5	0.806	64.7	5.059	14.04	48.0337	456.2	4.417	4.383	6.903	6.208	1.821	4.014	2.193	3.408
0:57:36	470.4	0.812	64.6	5.054	14.14	48.0904	457.2	4.421	4.386	6.906	6.216	1.825	4.021	2.195	3.405
0:58:01	472.1	0.818	64.6	5.047	14.24	48.1477	458.9	4.432	4.397	6.917	6.227	1.826	4.026	2.200	3.411
0:58:26	472.8	0.824	64.6	5.042	14.34	48.2045	459.6	4.433	4.399	6.919	6.231	1.829	4.030	2.201	3.407
0:58:49	473.3	0.830	64.5	5.036	14.44	48.2588	460.1	4.433	4.398	6.918	6.236	1.835	4.036	2.201	3.399
0:59:14	474.6	0.836	64.5	5.030	14.54	48.3166	461.3	4.440	4.405	6.925	6.247	1.839	4.043	2.204	3.397
0:59:38	475.8	0.842	64.4	5.024	14.64	48.3740	462.6	4.447	4.411	6.931	6.256	1.841	4.049	2.207	3.398
1:00:03	476.3	0.848	64.3	5.018	14.74	48.4319	463.1	4.446	4.411	6.931	6.263	1.849	4.056	2.207	3.388
1:00:25	477.4	0.853	64.2	5.012	14.84	48.4853	464.1	4.451	4.415	6.935	6.274	1.855	4.065	2.210	3.382
1:00:50	478.9	0.860	64.2	5.006	14.94	48.5442	465.6	4.460	4.424	6.944	6.286	1.859	4.073	2.214	3.382
1:01:14	479.5	0.866	64.1	5.000	15.04	48.6026	466.2	4.461	4.424	6.944	6.292	1.864	4.078	2.214	3.376
1:01:38	479.8	0.871	64.0	4.995	15.14	48.6576	466.5	4.459	4.422	6.942	6.296	1.870	4.083	2.213	3.366
1:02:02	481.2	0.877	64.0	4.989	15.24	48.7170	468.0	4.467	4.430	6.950	6.308	1.874	4.091	2.217	3.366
1:02:27	482.1	0.883	63.9	4.983	15.34	48.7748	468.8	4.470	4.433	6.953	6.314	1.878	4.096	2.218	3.362
1:02:52	482.8	0.889	63.9	4.977	15.44	48.8324	469.6	4.472	4.434	6.954	6.320	1.882	4.101	2.219	3.358
1:03:16	483.7	0.895	63.8	4.971	15.54	48.8902	470.4	4.474	4.437	6.957	6.330	1.890	4.110	2.220	3.349
1:03:41	485.0	0.901	63.7	4.965	15.64	48.9476	471.8	4.482	4.444	6.964	6.340	1.892	4.116	2.224	3.351
1:04:06	485.7	0.907	63.7	4.959	15.74	49.0049	472.4	4.483	4.445	6.965	6.345	1.896	4.121	2.224	3.346
1:04:32	486.6	0.913	63.6	4.953	15.84	49.0657	473.4	4.486	4.448	6.968	6.353	1.901	4.127	2.226	3.342
1:04:55	487.3	0.918	63.5	4.947	15.94	49.1229	474.0	4.487	4.449	6.969	6.360	1.908	4.134	2.226	3.333
1:05:20	488.4	0.925	63.5	4.941	16.04	49.1828	475.2	4.493	4.454	6.974	6.367	1.910	4.139	2.229	3.334
1:05:43	488.9	0.930	63.4	4.935	16.14	49.2403	475.6	4.492	4.453	6.973	6.371	1.914	4.143	2.228	3.328
1:06:08	489.2	0.936	63.3	4.930	16.24	49.2999	476.0	4.490	4.450	6.970	6.375	1.921	4.148	2.227	3.319
1:06:31	490.8	0.942	63.3	4.924	16.34	49.3578	477.6	4.500	4.460	6.980	6.387	1.924	4.156	2.232	3.320
1:06:56	491.7	0.948	63.2	4.918	16.44	49.4187	478.5	4.502	4.462	6.982	6.392	1.926	4.159	2.233	3.319
1:07:19	492.2	0.954	63.2	4.912	16.54	49.4767	478.9	4.501	4.461	6.981	6.396	1.932	4.164	2.232	3.311
1:07:43	493.2	0.960	63.1	4.906	16.64	49.5368	479.9	4.505	4.465	6.985	6.405	1.937	4.171	2.234	3.307
1:08:07	494.1	0.966	63.0	4.900	16.74	49.5959	480.9	4.509	4.468	6.988	6.413	1.941	4.177	2.236	3.304
1:08:30	494.6	0.972	63.0	4.894	16.84	49.6550	481.4	4.508	4.467	6.987	6.417	1.946	4.181	2.235	3.297
1:08:53	495.3	0.978	62.9	4.888	16.95	49.7166	482.0	4.509	4.468	6.988	6.425	1.954	4.189	2.236	3.289
1:09:16	496.5	0.983	62.8	4.883	17.04	49.7747	483.3	4.515	4.474	6.994	6.437	1.959	4.198	2.239	3.285
1:09:40	497.2	0.989	62.8	4.876	17.15	49.8379	484.0	4.516	4.474	6.994	6.439	1.961	4.200	2.239	3.284
1:10:02	497.6	0.995	62.8	4.871	17.24	49.8950	484.4	4.514	4.473	6.993	6.433	1.957	4.195	2.238	3.287
1:10:26	498.9	1.001	62.8	4.865	17.35	49.9573	485.6	4.520	4.478	6.998	6.436	1.956	4.197	2.241	3.291
1:10:49	499.4	1.007	62.8	4.859	17.44	50.0162	486.2	4.520	4.478	6.998	6.439	1.957	4.198	2.241	3.290
1:11:14	499.9	1.013	62.8	4.853	17.55	50.0790	486.7	4.519	4.476	6.996	6.442	1.962	4.202	2.240	3.284
1:11:37	500.9	1.019	62.7	4.847	17.65	50.1401	487.7	4.523	4.480	7.000	6.448	1.964	4.206	2.242	3.283
1:12:01	501.8	1.025	62.7	4.841	17.74	50.1998	488.5	4.525	4.482	7.002	6.452	1.966	4.209	2.243	3.282
1:12:25	502.3	1.031	62.6	4.835	17.85	50.2629	489.1	4.524	4.481	7.001	6.454	1.969	4.212	2.242	3.277
1:12:49	503.1	1.037	62.6	4.829	17.95	50.3244	489.8	4.526	4.483	7.003	6.462	1.976	4.219	2.243	3.271

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	5.886 (in.)	14.949 (cm)	Height	4.800 (in.)	Tested By	KDG
Diameter	2.855 (in)	7.251 (cm)	Dia. avg.	3.260 (in)	Date	12-11-09
Area	6.400 (in^2)	41.292 (cm^2)	Area avg.	8.347 (in^2)	Press No.	1
					Panel No.	C

Project Number	175569069
Test Number	CU-3B
Data File ID	3B
Lateral Pressure (psi)	35.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
1:13:13	504.0	1.043	62.5	4.823	18.05	50.3864	490.8	4.529	4.486	7.006	6.468	1.979	4.223	2.245	3.269
1:13:37	504.7	1.048	62.5	4.818	18.15	50.4460	491.5	4.530	4.486	7.006	6.471	1.981	4.226	2.245	3.267
1:14:00	505.0	1.054	62.4	4.812	18.25	50.5073	491.7	4.527	4.483	7.003	6.475	1.988	4.231	2.243	3.257
1:14:25	505.9	1.060	62.3	4.806	18.35	50.5707	492.6	4.530	4.485	7.005	6.480	1.991	4.236	2.244	3.254
1:14:49	506.3	1.066	62.3	4.800	18.45	50.6329	493.1	4.529	4.484	7.004	6.484	1.996	4.240	2.244	3.248

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.925 (in.)	15.049 (cm)	Height	4.835 (in.)	Date	12-14-09	Test Number	CU-3C
Diameter	2.851 (in)	7.243 (cm)	Dia. avg.	3.272 (in)	Press No.	1	Data File ID	3C
Area	6.386 (in²)	41.199 (cm²)	Area avg.	8.408 (in²)	Panel No.	A	Lateral Pressure (psi)	45.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Diel Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	13.2	-0.021	45.1	5.925	0.00	41.1992	0.0	0.000	0.000	3.240	3.240	3.236	3.238	0.002	1.001
0:00:57	17.3	-0.015	45.2	5.919	0.11	41.2431	4.1	0.046	0.046	3.286	3.276	3.226	3.251	0.025	1.016
0:02:47	92.5	-0.009	52.0	5.913	0.20	41.2823	79.4	0.894	0.893	4.133	3.632	2.734	3.183	0.449	1.328
0:04:16	139.8	-0.004	57.1	5.907	0.30	41.3233	126.6	1.424	1.424	4.664	3.797	2.369	3.083	0.714	1.603
0:05:40	169.9	0.003	60.7	5.901	0.40	41.3659	156.7	1.762	1.761	5.001	3.876	2.111	2.993	0.882	1.836
0:06:53	190.1	0.008	63.1	5.895	0.50	41.4062	176.9	1.986	1.985	5.225	3.924	1.935	2.930	0.995	2.028
0:08:05	205.2	0.014	65.1	5.889	0.60	41.4488	192.0	2.154	2.152	5.392	3.953	1.796	2.875	1.078	2.201
0:09:18	217.1	0.020	66.4	5.883	0.70	41.4902	203.9	2.286	2.284	5.524	3.987	1.698	2.842	1.144	2.347
0:10:26	226.3	0.026	67.5	5.878	0.80	41.5313	213.1	2.386	2.384	5.624	4.012	1.623	2.817	1.194	2.471
0:11:35	233.5	0.032	68.1	5.871	0.90	41.5740	220.3	2.464	2.462	5.702	4.041	1.575	2.808	1.233	2.566
0:12:47	240.1	0.038	68.6	5.865	1.00	41.6165	226.9	2.536	2.533	5.773	4.080	1.543	2.812	1.269	2.645
0:13:55	245.4	0.044	70.1	5.860	1.10	41.6587	232.2	2.592	2.589	5.829	4.026	1.433	2.729	1.297	2.810
0:15:05	249.5	0.050	70.7	5.854	1.20	41.7000	236.4	2.636	2.633	5.873	4.025	1.389	2.707	1.318	2.899
0:16:14	253.8	0.056	71.1	5.848	1.30	41.7414	240.6	2.680	2.677	5.917	4.045	1.364	2.704	1.341	2.967
0:17:22	256.5	0.062	71.3	5.842	1.40	41.7854	243.4	2.708	2.705	5.945	4.057	1.348	2.703	1.354	3.009
0:18:34	259.1	0.068	71.5	5.836	1.50	41.8285	245.9	2.733	2.730	5.970	4.069	1.335	2.702	1.367	3.049
0:19:38	260.9	0.073	71.7	5.830	1.60	41.8688	247.7	2.751	2.747	5.987	4.069	1.317	2.693	1.376	3.089
0:20:46	263.2	0.079	71.9	5.824	1.70	41.9111	250.0	2.774	2.770	6.010	4.077	1.303	2.690	1.387	3.129
0:21:55	265.3	0.085	72.0	5.818	1.80	41.9543	252.2	2.795	2.790	6.030	4.093	1.298	2.695	1.397	3.153
0:23:00	266.8	0.091	72.1	5.812	1.90	41.9979	253.6	2.808	2.803	6.043	4.100	1.292	2.696	1.404	3.172
0:24:04	268.7	0.097	72.2	5.806	2.00	42.0395	255.5	2.826	2.821	6.061	4.108	1.283	2.696	1.413	3.203
0:25:15	270.6	0.103	72.2	5.800	2.10	42.0834	257.5	2.845	2.840	6.080	4.128	1.284	2.706	1.422	3.214
0:26:20	272.0	0.109	72.0	5.795	2.20	42.1258	258.8	2.856	2.851	6.091	4.149	1.293	2.721	1.428	3.208
0:27:24	273.6	0.115	72.5	5.789	2.30	42.1685	260.4	2.872	2.866	6.106	4.130	1.259	2.694	1.435	3.280
0:28:32	275.5	0.121	72.9	5.783	2.40	42.2124	262.3	2.889	2.883	6.123	4.116	1.229	2.672	1.444	3.350
0:29:37	276.9	0.127	73.1	5.777	2.50	42.2561	263.7	2.902	2.896	6.136	4.117	1.217	2.667	1.450	3.384
0:30:45	278.4	0.133	73.0	5.771	2.60	42.2990	265.2	2.915	2.909	6.149	4.137	1.224	2.681	1.457	3.380
0:31:52	280.0	0.139	72.9	5.765	2.70	42.3425	266.9	2.931	2.924	6.164	4.157	1.229	2.693	1.464	3.382
0:32:57	281.7	0.144	73.0	5.759	2.80	42.3851	268.5	2.945	2.939	6.179	4.164	1.221	2.692	1.471	3.410
0:34:04	283.0	0.150	73.0	5.753	2.90	42.4289	269.9	2.957	2.950	6.190	4.180	1.225	2.702	1.477	3.412
0:35:11	284.4	0.156	72.9	5.747	3.00	42.4730	271.2	2.969	2.962	6.202	4.199	1.232	2.716	1.483	3.407
0:36:18	286.2	0.162	72.9	5.741	3.10	42.5168	273.0	2.986	2.979	6.219	4.217	1.234	2.725	1.491	3.417
0:37:25	287.7	0.168	72.8	5.735	3.20	42.5614	274.5	2.999	2.991	6.231	4.231	1.235	2.733	1.498	3.425
0:38:32	288.6	0.174	72.7	5.730	3.30	42.6042	275.4	3.006	2.998	6.238	4.245	1.243	2.744	1.501	3.415
0:39:43	290.5	0.180	72.7	5.723	3.40	42.6495	277.3	3.024	3.016	6.256	4.268	1.248	2.758	1.510	3.420
0:40:52	291.9	0.186	72.3	5.718	3.50	42.6928	278.7	3.036	3.027	6.267	4.303	1.272	2.787	1.516	3.384
0:42:01	293.4	0.192	72.9	5.712	3.60	42.7374	280.3	3.049	3.041	6.281	4.277	1.232	2.755	1.522	3.471
0:43:10	295.2	0.198	73.1	5.706	3.70	42.7818	282.0	3.065	3.057	6.297	4.275	1.214	2.745	1.530	3.520
0:44:18	297.1	0.204	73.2	5.700	3.80	42.8263	283.9	3.082	3.073	6.313	4.286	1.209	2.748	1.539	3.546
0:45:27	298.8	0.210	73.0	5.694	3.90	42.8703	285.6	3.098	3.089	6.329	4.314	1.221	2.767	1.546	3.533
0:46:34	300.0	0.215	72.9	5.688	4.00	42.9145	286.8	3.108	3.098	6.338	4.330	1.228	2.779	1.551	3.527
0:47:42	301.4	0.221	72.8	5.682	4.10	42.9595	288.2	3.120	3.110	6.350	4.351	1.237	2.794	1.557	3.518
0:48:51	303.2	0.227	72.8	5.676	4.20	43.0041	290.0	3.136	3.126	6.366	4.370	1.240	2.805	1.565	3.524
0:49:58	304.6	0.233	72.7	5.670	4.30	43.0487	291.4	3.148	3.137	6.377	4.390	1.248	2.819	1.571	3.516
0:51:05	305.8	0.239	72.6	5.664	4.40	43.0938	292.7	3.158	3.147	6.387	4.405	1.253	2.829	1.576	3.514
0:52:15	307.3	0.245	72.5	5.658	4.50	43.1399	294.2	3.171	3.160	6.400	4.425	1.261	2.843	1.582	3.509
0:53:20	308.9	0.251	72.5	5.653	4.60	43.1841	295.7	3.184	3.173	6.413	4.438	1.261	2.850	1.589	3.520
0:54:28	310.4	0.257	72.2	5.646	4.70	43.2307	297.2	3.197	3.185	6.425	4.469	1.279	2.874	1.595	3.494
0:55:34	311.5	0.263	71.9	5.641	4.80	43.2753	298.3	3.205	3.194	6.434	4.501	1.303	2.902	1.599	3.454
0:56:41	313.4	0.269	72.2	5.635	4.90	43.3203	300.2	3.222	3.210	6.450	4.499	1.284	2.891	1.607	3.503
0:57:49	314.9	0.275	72.6	5.629	5.00	43.3666	301.7	3.235	3.223	6.463	4.479	1.252	2.865	1.614	3.579
0:58:56	316.2	0.281	72.6	5.623	5.10	43.4119	303.0	3.245	3.233	6.473	4.487	1.250	2.869	1.619	3.589
1:00:02	317.8	0.287	72.5	5.617	5.20	43.4572	304.6	3.260	3.247	6.487	4.513	1.262	2.888	1.626	3.576
1:01:10	319.5	0.293	72.4	5.611	5.30	43.5036	306.3	3.274	3.262	6.502	4.534	1.269	2.902	1.633	3.574
1:02:16	320.5	0.298	72.2	5.605	5.40	43.5492	307.4	3.282	3.269	6.509	4.552	1.279	2.916	1.637	3.559
1:03:25	322.0	0.304	72.2	5.599	5.50	43.5952	308.8	3.294	3.281	6.521	4.569	1.284	2.927	1.642	3.557
1:04:31	324.0	0.310	72.0	5.593	5.60	43.6413	310.8	3.312	3.298	6.538	4.597	1.294	2.945	1.651	3.552
1:05:39	324.9	0.316	71.9	5.587	5.70	43.6874	311.8	3.318	3.305	6.545	4.611	1.303	2.957	1.654	3.540
1:06:47	326.0	0.322	71.8	5.581	5.80	43.7342	312.8	3.326	3.312	6.552	4.628	1.311	2.970	1.658	3.529
1:07:55	327.5	0.328	71.7	5.576	5.90	43.7809	314.3	3.339	3.324	6.564	4.648	1.320	2.984	1.664	3.522

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values			Tested By	KDG		
Height	5.925 (in.)	15.049 (cm)		Height	4.835 (in.)		Date	12-14-09	Project Number	175569069
Diameter	2.851 (in)	7.243 (cm)		Dia. avg.	3.272 (in)		Press No.	1	Test Number	CU-3C
Area	6.386 (in²)	41.199 (cm²)		Area avg.	8.408 (in²)		Panel No.	A	Data File ID	3C
									Lateral Pressure (psi)	45.0
									Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
1:09:01	329.1	0.334	71.5	5.570	6.00	43.8271	315.9	3.352	3.338	6.578	4.671	1.329	3.000	1.671	3.514
1:10:11	330.0	0.340	71.1	5.564	6.10	43.8740	316.8	3.358	3.343	6.583	4.705	1.358	3.031	1.674	3.465
1:11:18	331.3	0.346	71.6	5.558	6.20	43.9207	318.1	3.368	3.353	6.593	4.682	1.325	3.004	1.679	3.534
1:12:25	333.4	0.352	71.8	5.552	6.30	43.9676	320.2	3.387	3.372	6.612	4.684	1.309	2.996	1.688	3.580
1:13:32	335.0	0.358	71.8	5.546	6.40	44.0140	321.8	3.400	3.384	6.624	4.696	1.307	3.001	1.694	3.592
1:14:38	336.0	0.364	71.6	5.540	6.50	44.0616	322.8	3.407	3.391	6.631	4.718	1.322	3.020	1.698	3.568
1:15:44	337.2	0.369	71.5	5.534	6.59	44.1079	324.0	3.416	3.400	6.640	4.736	1.332	3.034	1.702	3.555
1:16:50	338.7	0.375	71.4	5.528	6.69	44.1552	325.5	3.428	3.412	6.652	4.755	1.339	3.047	1.708	3.550
1:17:58	339.9	0.381	71.3	5.522	6.80	44.2028	326.7	3.437	3.420	6.660	4.773	1.349	3.061	1.712	3.539
1:19:05	341.2	0.387	71.1	5.516	6.90	44.2505	328.1	3.447	3.431	6.671	4.794	1.359	3.077	1.717	3.527
1:20:09	343.0	0.393	71.1	5.510	6.99	44.2977	329.9	3.463	3.446	6.686	4.814	1.364	3.089	1.725	3.529
1:21:16	344.1	0.399	70.9	5.505	7.09	44.3453	330.9	3.470	3.453	6.693	4.831	1.374	3.102	1.729	3.517
1:22:22	345.2	0.405	70.8	5.499	7.19	44.3931	332.0	3.478	3.460	6.700	4.847	1.382	3.114	1.732	3.507
1:23:28	346.7	0.411	70.6	5.493	7.30	44.4416	333.5	3.489	3.472	6.712	4.870	1.394	3.132	1.738	3.494
1:24:32	348.0	0.417	70.4	5.487	7.40	44.4895	334.8	3.499	3.481	6.721	4.900	1.415	3.157	1.743	3.464
1:25:40	348.6	0.423	69.8	5.481	7.50	44.5380	335.4	3.502	3.484	6.724	4.940	1.452	3.196	1.744	3.403
1:26:46	350.3	0.429	70.8	5.475	7.59	44.5853	337.1	3.516	3.497	6.737	4.884	1.383	3.134	1.751	3.532
1:27:53	352.0	0.435	70.9	5.469	7.69	44.6332	338.8	3.530	3.511	6.751	4.892	1.377	3.135	1.758	3.553
1:29:03	353.1	0.441	70.7	5.463	7.80	44.6822	339.9	3.538	3.519	6.759	4.912	1.389	3.151	1.761	3.536
1:30:11	354.3	0.446	70.6	5.457	7.89	44.7304	341.1	3.546	3.527	6.767	4.931	1.400	3.165	1.766	3.523
1:31:19	355.6	0.452	70.4	5.451	7.99	44.7788	342.4	3.555	3.536	6.776	4.952	1.412	3.182	1.770	3.508
1:32:27	357.1	0.458	70.3	5.445	8.10	44.8281	343.9	3.567	3.548	6.788	4.971	1.420	3.196	1.776	3.502
1:33:33	358.4	0.464	70.2	5.439	8.19	44.8761	345.2	3.577	3.557	6.797	4.988	1.427	3.208	1.781	3.495
1:34:40	359.4	0.470	70.0	5.434	8.29	44.9251	346.2	3.583	3.563	6.803	5.004	1.436	3.220	1.784	3.483
1:35:48	360.8	0.476	70.0	5.428	8.39	44.9741	347.6	3.594	3.573	6.813	5.020	1.442	3.231	1.789	3.481
1:36:56	362.4	0.482	69.8	5.422	8.49	45.0233	349.3	3.607	3.587	6.827	5.042	1.451	3.247	1.795	3.474
1:38:05	363.3	0.488	69.6	5.416	8.59	45.0732	350.2	3.612	3.592	6.832	5.061	1.466	3.264	1.798	3.453
1:39:10	364.4	0.494	69.3	5.410	8.69	45.1220	351.2	3.620	3.599	6.839	5.093	1.490	3.292	1.801	3.418
1:40:18	365.9	0.500	69.7	5.404	8.79	45.1714	352.7	3.631	3.609	6.849	5.074	1.461	3.267	1.807	3.474
1:41:26	367.1	0.506	69.9	5.398	8.90	45.2217	353.9	3.639	3.617	6.857	5.068	1.446	3.257	1.811	3.505
1:42:31	368.1	0.512	69.9	5.392	8.99	45.2706	354.9	3.646	3.624	6.864	5.073	1.445	3.259	1.814	3.511
1:43:38	369.4	0.517	69.7	5.386	9.09	45.3204	356.2	3.655	3.633	6.873	5.097	1.460	3.278	1.819	3.492
1:44:46	371.1	0.523	69.6	5.380	9.19	45.3699	357.9	3.669	3.646	6.886	5.119	1.468	3.293	1.825	3.486
1:45:54	372.0	0.529	69.5	5.374	9.29	45.4201	358.8	3.674	3.651	6.891	5.132	1.477	3.304	1.828	3.476
1:47:00	372.7	0.535	69.3	5.368	9.39	45.4706	359.6	3.677	3.654	6.894	5.148	1.490	3.319	1.829	3.456
1:48:07	374.4	0.541	69.2	5.362	9.49	45.5202	361.2	3.690	3.667	6.907	5.166	1.496	3.331	1.835	3.454
1:49:15	375.4	0.547	69.2	5.357	9.59	45.5703	362.2	3.696	3.673	6.913	5.178	1.501	3.339	1.839	3.450
1:50:22	376.0	0.553	69.0	5.351	9.69	45.6212	362.8	3.698	3.674	6.914	5.194	1.515	3.354	1.839	3.428
1:51:28	377.5	0.559	68.9	5.345	9.79	45.6713	364.3	3.710	3.686	6.926	5.212	1.522	3.367	1.845	3.424
1:52:36	378.8	0.565	68.7	5.339	9.89	45.7222	365.6	3.718	3.694	6.934	5.230	1.532	3.381	1.849	3.414
1:53:44	379.5	0.571	68.4	5.333	9.99	45.7734	366.3	3.722	3.697	6.937	5.257	1.555	3.406	1.851	3.380
1:54:50	380.3	0.577	68.2	5.327	10.09	45.8239	367.1	3.725	3.701	6.941	5.276	1.572	3.424	1.852	3.357
1:55:58	382.0	0.583	68.9	5.321	10.19	45.8755	368.9	3.739	3.714	6.954	5.235	1.517	3.376	1.859	3.451
1:57:06	382.8	0.589	69.0	5.315	10.29	45.9264	369.6	3.743	3.718	6.958	5.236	1.514	3.375	1.861	3.458
1:58:14	383.8	0.594	68.8	5.309	10.39	45.9774	370.6	3.748	3.723	6.963	5.251	1.524	3.388	1.864	3.446
1:59:19	385.2	0.600	68.7	5.303	10.49	46.0284	372.0	3.758	3.732	6.972	5.272	1.535	3.403	1.868	3.434
2:00:27	386.4	0.606	68.6	5.297	10.59	46.0805	373.2	3.766	3.740	6.980	5.288	1.543	3.415	1.872	3.427
2:01:34	387.2	0.612	68.5	5.291	10.69	46.1321	374.0	3.770	3.744	6.984	5.299	1.551	3.425	1.874	3.416
2:02:39	388.0	0.618	68.2	5.285	10.79	46.1833	374.8	3.774	3.748	6.988	5.325	1.573	3.449	1.876	3.385
2:03:45	389.6	0.624	68.3	5.280	10.89	46.2348	376.4	3.785	3.759	6.999	5.326	1.563	3.444	1.882	3.408
2:04:52	390.4	0.630	68.0	5.274	10.99	46.2870	377.2	3.789	3.763	7.003	5.350	1.583	3.467	1.884	3.379
2:05:58	391.0	0.636	67.8	5.268	11.09	46.3393	377.8	3.791	3.764	7.004	5.364	1.596	3.480	1.884	3.361
2:07:03	392.3	0.642	67.6	5.262	11.19	46.3914	379.2	3.800	3.773	7.013	5.391	1.613	3.502	1.889	3.341
2:08:10	393.4	0.648	67.1	5.256	11.29	46.4435	380.3	3.807	3.780	7.020	5.430	1.646	3.538	1.892	3.299
2:09:17	394.2	0.654	68.0	5.250	11.39	46.4959	381.1	3.811	3.783	7.023	5.374	1.587	3.481	1.894	3.387
2:10:22	395.7	0.660	68.0	5.244	11.49	46.5487	382.6	3.822	3.794	7.034	5.378	1.581	3.479	1.899	3.403
2:11:26	396.8	0.665	68.0	5.238	11.59	46.6005	383.6	3.828	3.800	7.040	5.387	1.583	3.485	1.902	3.404
2:12:34	397.4	0.671	67.8	5.232	11.69	46.6532	384.2	3.830	3.801	7.041	5.406	1.601	3.504	1.903	3.377
2:13:41	398.5	0.677	67.7	5.226	11.79	46.7062	385.3	3.836	3.808	7.048	5.421	1.609	3.515	1.906	3.370
2:14:46	399.8	0.683	67.6	5.220	11.89	46.7593	386.6	3.845	3.816	7.056	5.436	1.616	3.526	1.910	3.364

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values					
Height	5.925 (in.)	15.049 (cm)		Height	4.835 (in.)	Tested By	KDG	Project Number	175569069
Diameter	2.851 (in)	7.243 (cm)		Dia. avg.	3.272 (in)	Date	12-14-09	Test Number	CU-3C
Area	6.386 (in^2)	41.199 (cm^2)		Area avg.	8.408 (in^2)	Press No.	1	Data File ID	3C
						Panel No.	A	Lateral Pressure (psi)	45.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
2:15:54	400.5	0.689	67.4	5.214	11.99	46.8126	387.3	3.847	3.818	7.058	5.447	1.625	3.536	1.911	3.352
2:17:03	401.6	0.695	67.3	5.208	12.09	46.8662	388.4	3.854	3.825	7.065	5.460	1.631	3.546	1.914	3.347
2:18:10	402.4	0.701	67.2	5.203	12.19	46.9194	389.2	3.857	3.827	7.067	5.472	1.640	3.556	1.916	3.336
2:19:19	403.7	0.707	67.1	5.197	12.29	46.9737	390.5	3.866	3.836	7.076	5.492	1.652	3.572	1.920	3.325
2:20:27	404.4	0.713	66.8	5.191	12.39	47.0260	391.2	3.869	3.839	7.079	5.517	1.674	3.595	1.921	3.296
2:21:34	405.2	0.719	66.7	5.185	12.49	47.0801	392.0	3.872	3.842	7.082	5.527	1.681	3.604	1.923	3.288
2:22:39	406.6	0.725	67.3	5.179	12.59	47.1334	393.4	3.881	3.850	7.090	5.490	1.636	3.563	1.927	3.356
2:23:49	407.7	0.731	67.3	5.173	12.69	47.1879	394.5	3.887	3.857	7.097	5.492	1.631	3.561	1.930	3.367
2:24:57	408.7	0.737	67.2	5.167	12.79	47.2419	395.5	3.893	3.862	7.102	5.508	1.642	3.575	1.933	3.355
2:26:05	409.2	0.742	67.0	5.161	12.89	47.2963	396.0	3.893	3.862	7.102	5.522	1.656	3.589	1.933	3.334
2:27:12	410.5	0.748	66.9	5.155	12.99	47.3496	397.3	3.901	3.870	7.110	5.536	1.662	3.599	1.937	3.331
2:28:20	411.2	0.754	66.9	5.149	13.09	47.4047	398.0	3.904	3.872	7.112	5.543	1.667	3.605	1.938	3.326
2:29:26	412.0	0.760	66.6	5.143	13.19	47.4590	398.8	3.907	3.875	7.115	5.561	1.681	3.621	1.940	3.307
2:30:32	413.1	0.766	66.6	5.137	13.29	47.5137	399.9	3.913	3.881	7.121	5.573	1.687	3.630	1.943	3.303
2:31:40	414.1	0.772	66.5	5.132	13.39	47.5682	400.9	3.919	3.886	7.126	5.582	1.692	3.637	1.945	3.299
2:32:48	414.7	0.778	66.2	5.126	13.49	47.6231	401.5	3.921	3.888	7.128	5.602	1.710	3.656	1.946	3.276
2:33:54	415.4	0.784	65.8	5.120	13.59	47.6787	402.2	3.923	3.890	7.130	5.636	1.742	3.689	1.947	3.235
2:35:01	416.6	0.790	66.5	5.114	13.69	47.7332	403.4	3.930	3.897	7.137	5.592	1.691	3.641	1.951	3.307
2:36:10	417.6	0.796	66.7	5.108	13.79	47.7890	404.4	3.935	3.902	7.142	5.587	1.681	3.634	1.953	3.324
2:37:17	418.0	0.802	66.6	5.102	13.89	47.8442	404.8	3.935	3.901	7.141	5.587	1.682	3.634	1.953	3.322
2:38:23	419.0	0.807	66.4	5.096	13.99	47.8996	405.8	3.939	3.906	7.146	5.607	1.698	3.653	1.955	3.303
2:39:32	420.0	0.813	66.3	5.090	14.09	47.9561	406.8	3.944	3.910	7.150	5.619	1.705	3.662	1.957	3.296
2:40:42	420.7	0.819	66.3	5.084	14.19	48.0122	407.5	3.947	3.912	7.152	5.626	1.710	3.668	1.958	3.291
2:41:48	421.4	0.825	66.1	5.078	14.29	48.0683	408.2	3.949	3.915	7.155	5.643	1.724	3.684	1.959	3.273
2:42:55	423.0	0.831	66.0	5.072	14.39	48.1247	409.8	3.959	3.925	7.165	5.657	1.729	3.693	1.964	3.273
2:44:01	423.3	0.837	65.9	5.066	14.49	48.1799	410.2	3.959	3.923	7.163	5.664	1.736	3.700	1.964	3.262
2:45:08	423.9	0.843	65.7	5.060	14.59	48.2366	410.7	3.959	3.924	7.164	5.679	1.751	3.715	1.964	3.243
2:46:15	425.0	0.849	65.4	5.054	14.69	48.2941	411.8	3.965	3.929	7.169	5.708	1.774	3.741	1.967	3.217
2:47:21	426.3	0.855	65.9	5.049	14.79	48.3499	413.1	3.973	3.938	7.178	5.680	1.739	3.710	1.971	3.267
2:48:27	427.2	0.861	66.0	5.043	14.89	48.4070	414.0	3.977	3.941	7.181	5.670	1.725	3.697	1.972	3.287
2:49:31	427.6	0.867	66.0	5.037	14.99	48.4630	414.4	3.976	3.940	7.180	5.670	1.726	3.698	1.972	3.285
2:50:36	428.9	0.873	65.9	5.031	15.09	48.5204	415.7	3.984	3.947	7.187	5.687	1.735	3.711	1.976	3.277
2:51:42	429.4	0.879	65.7	5.025	15.19	48.5769	416.2	3.984	3.947	7.187	5.698	1.746	3.722	1.976	3.263
2:52:47	429.8	0.884	65.6	5.019	15.29	48.6344	416.6	3.983	3.946	7.186	5.705	1.755	3.730	1.975	3.251
2:53:54	431.3	0.890	65.6	5.013	15.39	48.6926	418.2	3.993	3.956	7.196	5.719	1.759	3.739	1.980	3.251
2:55:01	431.9	0.896	65.5	5.007	15.49	48.7500	418.7	3.994	3.956	7.196	5.726	1.766	3.746	1.980	3.243
2:56:06	432.3	0.902	65.3	5.001	15.59	48.8076	419.1	3.993	3.955	7.195	5.734	1.775	3.755	1.980	3.231
2:57:11	433.1	0.908	65.2	4.995	15.69	48.8654	419.9	3.996	3.958	7.198	5.745	1.784	3.764	1.981	3.221
2:58:19	434.1	0.914	65.0	4.989	15.79	48.9229	420.9	4.000	3.962	7.202	5.767	1.800	3.783	1.983	3.203
2:59:26	434.8	0.920	64.5	4.984	15.89	48.9810	421.6	4.003	3.964	7.204	5.804	1.835	3.820	1.984	3.162
3:00:35	435.6	0.926	65.4	4.978	15.99	49.0403	422.4	4.005	3.967	7.207	5.740	1.770	3.755	1.985	3.244
3:01:41	436.9	0.932	65.3	4.972	16.09	49.0979	423.7	4.013	3.974	7.214	5.758	1.779	3.769	1.989	3.236
3:02:48	437.6	0.938	65.2	4.966	16.19	49.1562	424.4	4.015	3.975	7.215	5.762	1.782	3.772	1.990	3.233
3:03:56	437.8	0.944	65.3	4.960	16.29	49.2153	424.7	4.012	3.973	7.213	5.757	1.780	3.768	1.989	3.234
3:05:02	438.9	0.950	65.2	4.954	16.39	49.2737	425.7	4.018	3.978	7.218	5.771	1.789	3.780	1.991	3.226
3:06:11	439.7	0.956	65.1	4.948	16.49	49.3331	426.5	4.020	3.980	7.220	5.780	1.796	3.788	1.992	3.219
3:07:19	440.1	0.961	64.9	4.942	16.59	49.3916	426.9	4.019	3.979	7.219	5.787	1.804	3.795	1.992	3.208
3:08:25	440.8	0.967	64.8	4.936	16.69	49.4507	427.6	4.021	3.980	7.220	5.797	1.812	3.804	1.992	3.199
3:09:33	441.9	0.973	64.8	4.930	16.79	49.5108	428.7	4.027	3.986	7.226	5.808	1.817	3.813	1.995	3.195
3:10:43	442.4	0.979	64.5	4.924	16.89	49.5708	429.2	4.026	3.985	7.225	5.824	1.834	3.829	1.995	3.175
3:11:52	442.9	0.985	64.7	4.918	16.99	49.6298	429.7	4.026	3.985	7.225	5.812	1.823	3.817	1.995	3.189
3:12:59	444.0	0.991	65.0	4.912	17.09	49.6900	430.8	4.032	3.990	7.230	5.796	1.802	3.799	1.997	3.217
3:14:07	445.1	0.997	65.0	4.907	17.19	49.7502	431.9	4.037	3.995	7.235	5.797	1.797	3.797	2.000	3.226
3:15:15	445.2	1.003	64.9	4.901	17.29	49.8093	432.1	4.033	3.992	7.232	5.805	1.809	3.807	1.998	3.209
3:16:24	445.7	1.009	64.7	4.895	17.39	49.8723	432.5	4.033	3.991	7.231	5.814	1.819	3.816	1.997	3.196
3:17:28	447.2	1.015	64.7	4.889	17.49	49.9300	434.0	4.042	3.999	7.239	5.824	1.821	3.823	2.002	3.199
3:18:37	447.9	1.021	64.6	4.883	17.59	49.9905	434.7	4.044	4.001	7.241	5.836	1.830	3.833	2.003	3.188
3:19:46	448.1	1.027	64.5	4.877	17.69	50.0520	434.9	4.041	3.998	7.238	5.839	1.837	3.838	2.001	3.179
3:20:52	448.9	1.032	64.4	4.871	17.79	50.1118	435.8	4.044	4.000	7.240	5.848	1.843	3.845	2.002	3.173
3:22:01	449.8	1.038	64.3	4.865	17.89	50.1729	436.6	4.046	4.003	7.243	5.860	1.853	3.857	2.004	3.162

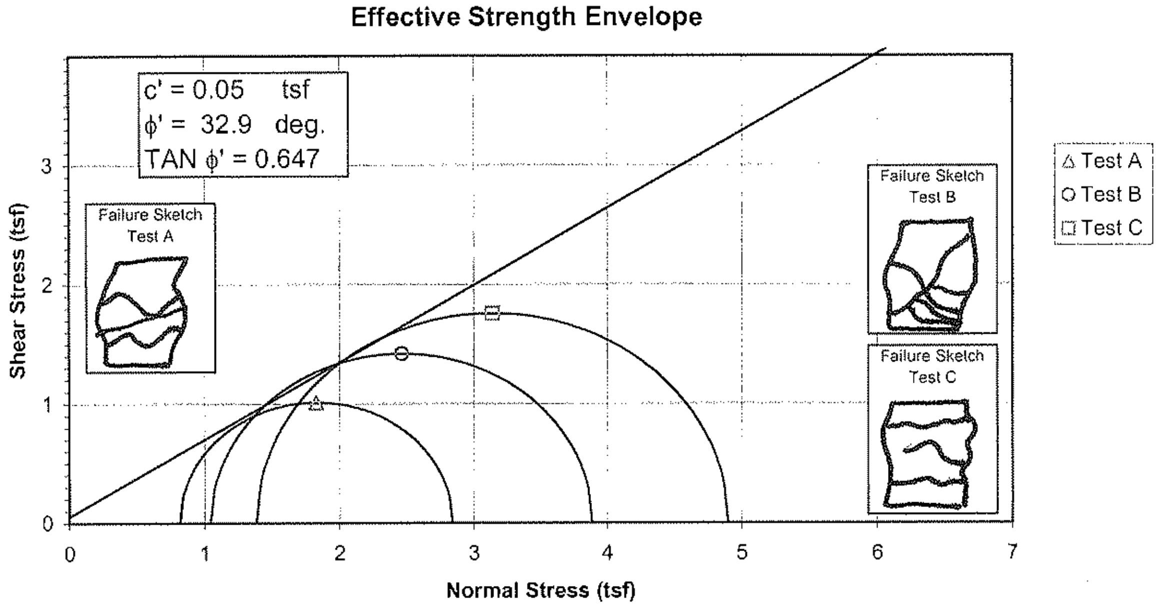
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

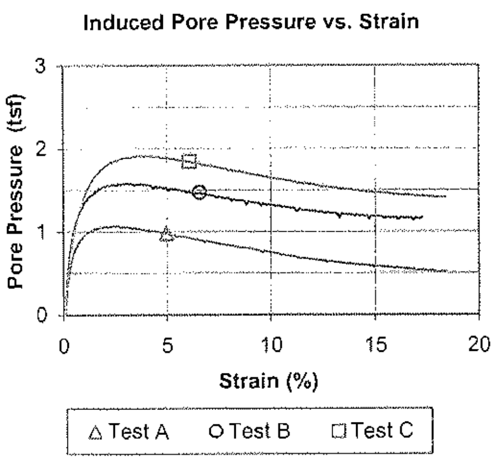
Consolidation Values			Final Values			
Height	5.925 (in.)	15.049 (cm)	Height	4.835 (in.)	Tested By	KDG
Diameter	2.851 (in)	7.243 (cm)	Dia. avg.	3.272 (in)	Date	12-14-09
Area	6.386 (in^2)	41.199 (cm^2)	Area avg.	8.408 (in^2)	Press No.	1
					Panel No.	A

Project Number	175569069
Test Number	CU-3C
Data File ID	3C
Lateral Pressure (psi)	45.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
3:23:08	450.4	1.044	64.0	4.859	17.99	50.2338	437.2	4.047	4.003	7.243	5.877	1.870	3.873	2.004	3.144
3:24:14	450.7	1.050	64.2	4.853	18.09	50.2954	437.5	4.045	4.001	7.241	5.859	1.854	3.856	2.002	3.160
3:25:22	452.1	1.056	64.6	4.847	18.19	50.3571	438.9	4.053	4.008	7.248	5.845	1.832	3.838	2.006	3.190
3:26:32	452.8	1.062	64.6	4.841	18.29	50.4192	439.6	4.054	4.010	7.250	5.842	1.828	3.835	2.007	3.196
3:27:39	453.3	1.068	64.5	4.835	18.39	50.4810	440.1	4.054	4.009	7.249	5.853	1.839	3.846	2.007	3.182

Failure Criterion: Maximum Effective Principal Stress Ratio





			A	B	C	
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	23.4	22.5	24.8	
	Dry Density PCF	γ_{d_o}	100.2	107.6	99.5	
	Saturation %	S_o	94.8	110.3	98.6	
	Void Ratio	e_o	0.658	0.543	0.669	
After Shear	Water content %	W_f	19.5	17.3	18.6	
	Dry Density PCF	γ_{d_f}	109.4	113.7	111.0	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.518	0.460	0.496	
	Final Back Pressure TSF	u_c	4.68	3.96	3.24	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.82	1.05	1.38	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	2.02	2.84	3.51	
Time to (σ1'-σ3')max min.		t_f	263.7	285.0	340.8	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.887	2.810	2.860	
Initial Height, in.		H_o	5.808	5.531	5.993	

Controlled - Strain Test					
Description of Specimens	Lean Clay with Sand (CL), gray brown, wet, soft				
	Type of Specimen	Undisturbed	Type of test	$\bar{R}$	
LL	PL	PI	Gs 2.66	Project	PAF - Peabody Ash Pond
Remarks:					
	Boring No.	STN-12 (N3)	Sample No.	4	
	Depth Elev.	26.3'-26.8', 25.0'-25.5', 25.7'-26.2'			
	Laboratory	Stantec	Date	12-22-09	
	TRIAXIAL COMPRESSION TEST REPORT				

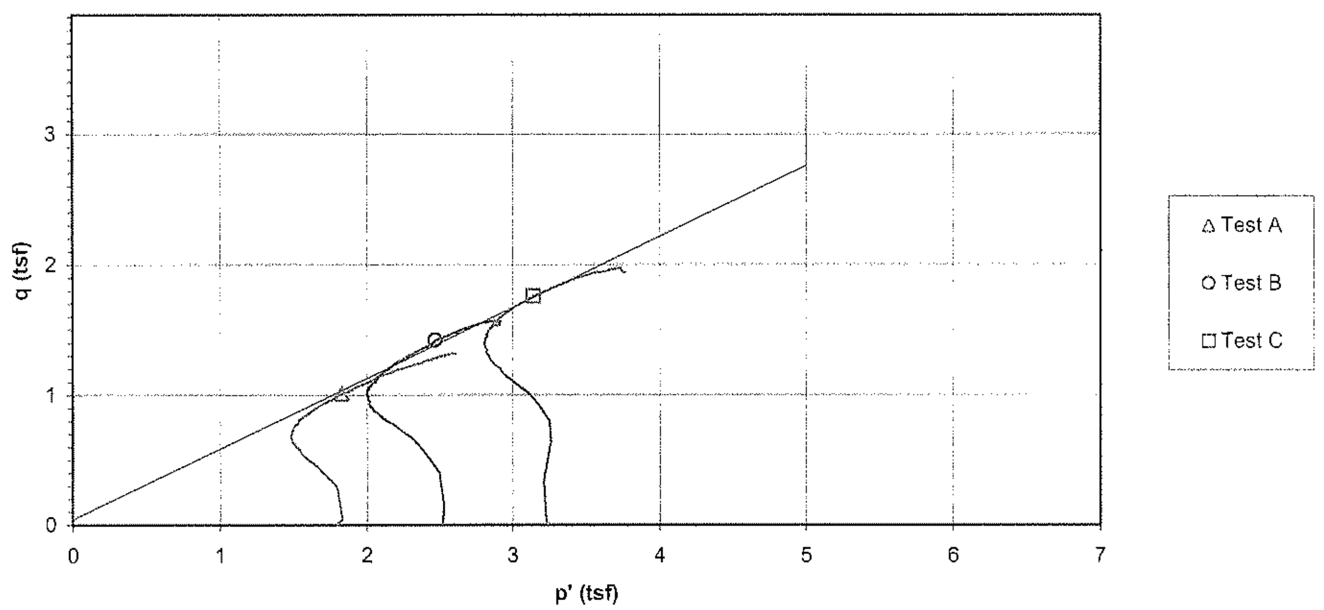
KDG

Laboratory Document
Prepared By: MW
Approved BY: TLK

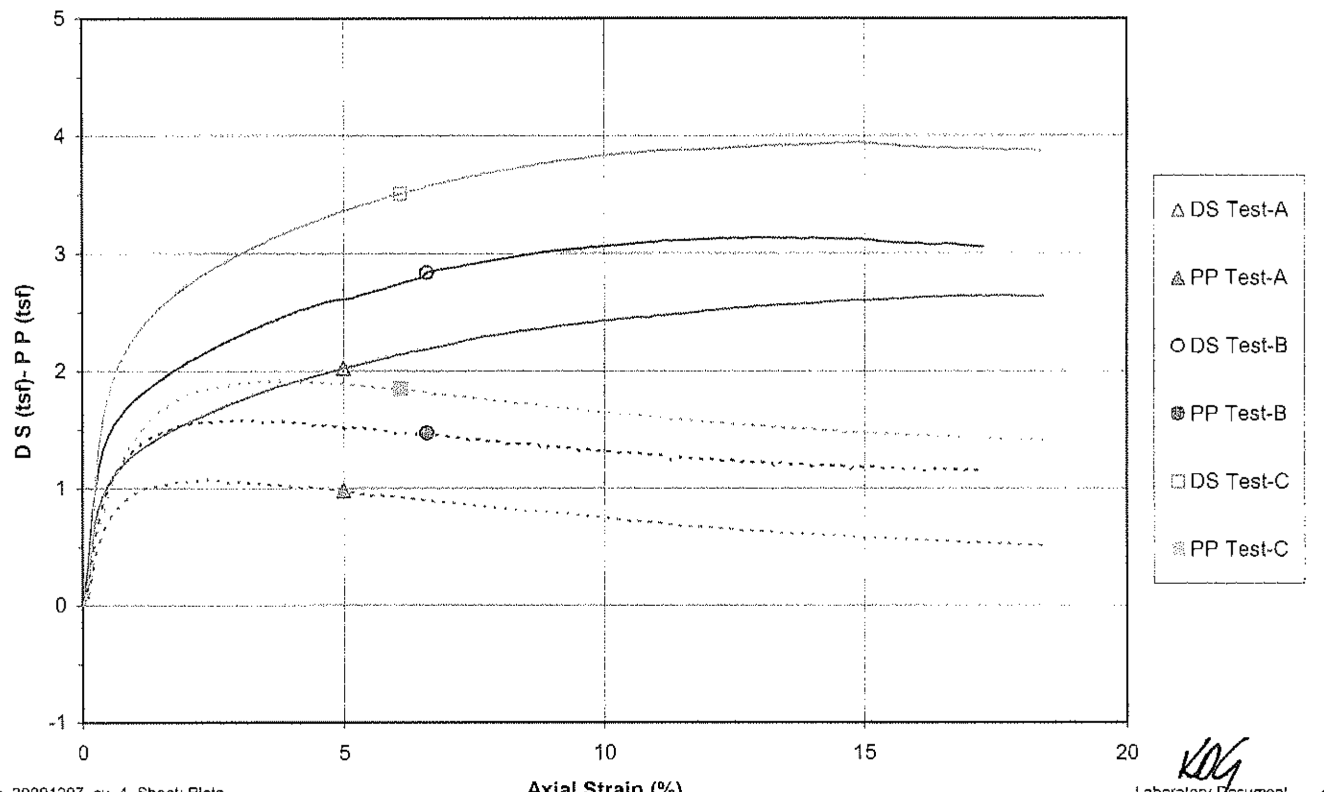
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	PAF - Peabody Ash Pond	Project No.	175569069
Sample ID	STN-12 (N3), 26.3'-26.8' & STN-12 (N3), 25.0'-25.5' & STN-12 (N3), 25.7'-26.2'	Test Number	4
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 32.9 deg.	c' =	0.05 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



Stantec

Consolidated Undrained Triaxial Test

ASTM D4767-04

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-12 (N3), 26.3'-26.8'	Test Number	CU-4A
Visual Description	Lean Clay with Sand (CL), gray brown, wet, soft	Prepared By	MC
Undisturbed	Source STN-12 (N3), 26.3'-27.0'	Date	12-9-2009

Specific Gravity 2.66 ASTM D854 Method A   Liquid Limit N/A   Plastic Limit N/A   Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.871	1	5.880	Sample	37.9836 (V_o)	Wet Weight (g)	1233.66
Middle	2.889	2	5.739	Solids	22.9254 (VS_o)	Dry Weight (g)	999.37
Bottom	2.897	3	5.844	Water	14.2965 (Vw_o)	Wet Unit Weight (pcf)	123.7
Avg.	2.8857 (D_o)	4	5.770	Voids	15.0582 (Vv_o)	Dry Unit Weight (pcf)	100.2
Area (in^2)	6.5401 (A_o)	Avg. (H_o)	5.8078	Degree of Saturation (%)	94.9 (S_o)		
Moisture Content (%)	23.4	Final Trimmings		Void Ratio	0.657		

Saturation

Set Up & Saturated: Wet xx Dry ____   Set up By KDG

Back Pressure Saturated to: 65 (psi)   Final Pore Pressure Parameter B 0.97   Date 12-14-09

Panel Board Number B

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1258	Initial	17.21 (in.)	Initial	11.6 (in.)	Specimen Height (in.)	5.7739 (H_s)
Final	0.1597	Final	16.27 (in.)	Final	7.86 (in.)	Area (in^2) Method A	6.4633 (A_s)
Change	-0.0339 (ΔH_o)	Change	-0.94 (in.)	Change	-3.74 (in.)	Specimen Volume (in^3)	37.32 (Vs)

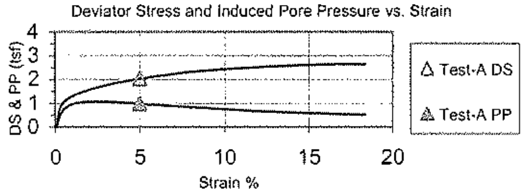
Consolidation

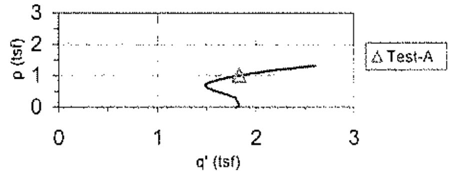
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1597	Initial	1.57 (in.)	Initial	17.21 (in.)	Chamber	90
Final	0.207	Final	9.52 (in.)	Final	8.04 (in.)	Back	65
Change	-0.0473 (ΔH_c)	Change	-7.95 (in.)	Change	-9.17 (in.)	Lateral	25 (σ_3)
Height (in.)	5.7266 (H_c)			Volume (in^3)	34.7908 (V_c)		
Area (in^3) Method B	6.0753 (A_c)			Volume - Water (in^3)	11.8654 (VWc)	t_{50} (min.)	27
Diameter (in.)	2.7812 (D_c)			Water Content (%)	19.5		
Dry Density (pcf)	109.4			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.518

After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.29 (in.)	Wet Weight (g)	1193.82	Corrected Deviator	2.02 σ_d (tsf)
Wet weight (g)	1193.82 (WWf)	Dry Weight (g)	999.37	Major Principal	2.84 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.266 (in.)	Tare Weight (g)	0.00	Minor Principal	0.82 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.019
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	5.00
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch





Comments: KDG

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-12 (N3), 25.0'-25.5'	Test Number	CU-4B
Visual Description	Lean Clay with Sand (CL), brown, wet, soft	Prepared By	MC
Undisturbed	Source STN-12 (N3), 25.0'-25.7'	Date	12-9-2009

Specific Gravity 2.66 ASTM D854 Method A Liquid Limit N/A Plastic Limit N/A Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in3)		Specimen	
Top	2.809	1	5.514	Sample	34.3268 (V_o)	Wet Weight (g)	1186.73
Middle	2.805	2	5.515	Solids	22.2215 (VS_o)	Dry Weight (g)	968.68
Bottom	2.819	3	5.519	Water	13.3051 (Vw_o)	Wet Unit Weight (pcf)	131.7
Avg.	2.8110 (D_o)	4	5.578	Voids	12.1053 (Vv_o)	Dry Unit Weight (pcf)	107.5
Area (in^2)	6.2060 (A_o)	Avg. (H_o)	5.5312	Degree of Saturation (%)	109.9 (S_o)		
Moisture Content (%)	22.5	Final Trimmings		Void Ratio	0.545		

Saturation

Set Up & Saturated: Wet xx Dry ____ Set up By KDG

Back Pressure Saturated to: 55 (psi) Final Pore Pressure Parameter B 0.98 Date 12-11-09

Panel Board Number D

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1126	Initial	16.49 (in.)	Initial	9.95 (in.)	Specimen Height (in.)	5.4368 (H_s)
Final	0.207	Final	16.73 (in.)	Final	4.83 (in.)	Area (in^2) Method A	5.9905 (A_s)
Change	-0.0944 (ΔH_o)	Change	0.24 (in.)	Change	-5.12 (in.)	Specimen Volume (in^3)	32.57 (V_s)

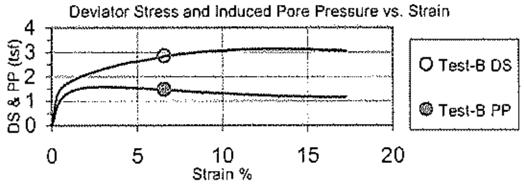
Consolidation

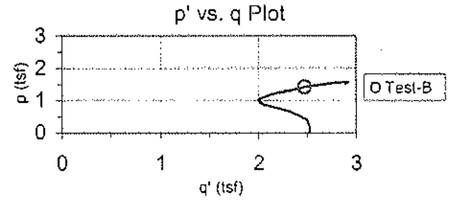
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.207	Initial	1.13 (in.)	Initial	17.73 (in.)	Chamber	90
Final	0.2295	Final	14.93 (in.)	Final	2.67 (in.)	Back	55
Change	-0.0225 (ΔH_c)	Change	-13.80 (in.)	Change	-15.06 (in.)	Lateral	35 (σ_3)
Height (in.)	5.4143 (H_c)			Volume (in^3)	32.4463 (V_c)		
Area (in^3) Method B	5.9927 (A_c)			Volume - Water (in^3)	10.2248 (VWc)	D_{50} (min.)	180
Diameter (in.)	2.7623 (D_c)			Water Content (%)	17.3		
Dry Density (pcf)	113.7			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.460

After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.265 (in.)	Wet Weight (g)	1136.25	Corrected Deviator	2.84 σ_d (tsf)
Wet weight (g)	1136.25 (WWf)	Dry Weight (g)	968.68	Major Principal	3.89 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.241 (in.)	Tare Weight (g)	0.00	Minor Principal	1.05 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.030
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	6.60
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch





Comments: KDG

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	PAF - Peabody Ash Pond	Project Number	175569069
Sample Identification	STN-12 (N3), 25.7'-26.2'	Test Number	CU-4C
Visual Description	Lean Clay (CL), gray brown, wet, soft	Prepared By	MC
Undisturbed	Source STN-12 (N3), 25.7'-26.2'	Date	12-9-2009

Specific Gravity 2.66 ASTM D854 Method A Liquid Limit N/A Plastic Limit N/A Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.865	1	6.022	Sample	38.5691 (V_o)	Wet Weight (g)	1254.79
Middle	2.852	2	5.995	Solids	23.0639 (VS_o)	Dry Weight (g)	1005.41
Bottom	2.871	3	6.028	Water	15.2174 (Vw_o)	Wet Unit Weight (pcf)	123.9
Avg.	2.8627 (D_o)	4	5.926	Voids	15.5052 (Vv_o)	Dry Unit Weight (pcf)	99.3
Area (in^2)	6.4362 (A_o)	Avg. (H_o)	5.9925	Degree of Saturation (%)	98.1 (S_o)		
Moisture Content (%)	24.8	Final Trimmings		Void Ratio	0.672		

Saturation

Set Up & Saturated: Wet xx Dry ____ Set up By KDG

Back Pressure Saturated to: 45 (psi) Final Pore Pressure Parameter B 0.99 Date 12-14-09

Panel Board Number C

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1415	Initial	16.76 (in.)	Initial	11.91 (in.)	Specimen Height (in.)	5.8997 (H_s)
Final	0.2343	Final	16.81 (in.)	Final	8.05 (in.)	Area (in^2) Method A	6.2337 (A_s)
Change	-0.0928 (ΔH_o)	Change	0.05 (in.)	Change	-3.86 (in.)	Specimen Volume (in^3)	36.78 (V_s)

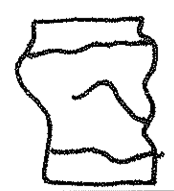
Consolidation

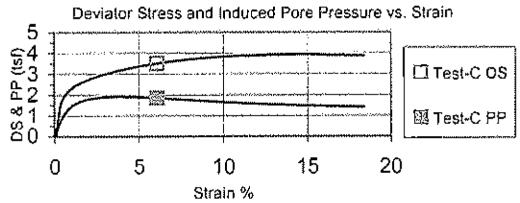
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.2343	Initial	1.73 (in.)	Initial	17.94 (in.)	Chamber	90
Final	0.2948	Final	15.25 (in.)	Final	4.04 (in.)	Back	45
Change	-0.0605 (ΔH_c)	Change	-13.52 (in.)	Change	-13.90 (in.)	Lateral	45 (σ_3)
Height (in.)	5.8392 (H_c)			Volume (in^3)	34.4968 (V_c)		
Area (in^3) Method B	5.9078 (A_c)			Volume - Water (in^3)	11.4329 (VWc)	D_{50} (min.)	110
Diameter (in.)	2.7426 (D_c)			Water Content (%)	18.6		
Dry Density (pcf)	111.0			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.496

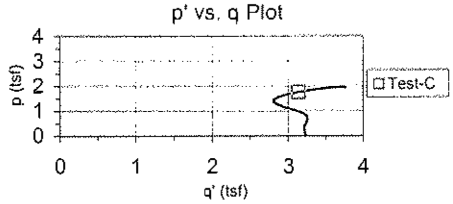
After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.302 (in.)	Wet Weight (g)	1192.77	Corrected Deviator	3.51 σ_d (tsf)
Wet weight (g)	1192.77 (WWf)	Dry Weight (g)	1005.41	Major Principal	4.90 $\sigma_1'{}_f$ (tsf)
Corrected Diameter	3.278 (in.)	Tare Weight (g)	0.00	Minor Principal	1.38 $\sigma_3'{}_f$ (tsf)
				Rate of Strain (% / min.)	0.018
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	6.10
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch







Comments:

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG		
Height	5.727 (in.)	14.546 (cm)	Height	4.672 (in.)	Date	12-16-09	Project Number	175569069
Diameter	2.781 (in)	7.065 (cm)	Dia. avg.	3.194 (in)	Press No.	1	Test Number	CU-4A
Area	6.076 (in²)	39.198 (cm²)	Area avg.	8.010 (in²)	Panel No.	B	Data File ID	CU-4B
							Lateral Pressure (psi)	25.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Correctad Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	12.0	-0.020	65.0	5.727	0.00	39.1976	0.0	0.000	0.000	1.800	1.800	1.802	1.801	-0.001	0.999
0:07:33	19.3	-0.014	65.1	5.721	0.10	39.2386	7.3	0.087	0.087	1.887	1.879	1.794	1.837	0.042	1.047
0:13:40	61.4	-0.009	69.1	5.715	0.20	39.2764	49.4	0.585	0.585	2.385	2.090	1.507	1.799	0.291	1.387
0:18:58	80.3	-0.003	71.9	5.709	0.30	39.3162	68.3	0.807	0.807	2.607	2.105	1.300	1.703	0.402	1.619
0:24:07	91.5	0.003	73.7	5.704	0.40	39.3552	79.5	0.939	0.938	2.738	2.113	1.176	1.645	0.468	1.796
0:29:17	99.3	0.009	75.1	5.698	0.50	39.3950	87.3	1.031	1.030	2.830	2.104	1.076	1.590	0.514	1.955
0:34:51	105.5	0.014	76.0	5.692	0.60	39.4350	93.4	1.102	1.100	2.900	2.109	1.010	1.560	0.549	2.087
0:39:58	110.6	0.020	76.6	5.686	0.70	39.4744	98.6	1.161	1.159	2.959	2.124	0.967	1.545	0.579	2.197
0:45:21	114.7	0.026	77.3	5.681	0.80	39.5144	102.7	1.208	1.206	3.006	2.119	0.914	1.517	0.602	2.317
0:50:46	118.8	0.032	77.7	5.675	0.90	39.5540	106.8	1.255	1.253	3.053	2.137	0.886	1.512	0.626	2.412
0:55:40	121.6	0.037	78.2	5.669	1.00	39.5943	109.6	1.287	1.285	3.085	2.134	0.851	1.492	0.642	2.508
1:01:02	125.0	0.043	78.4	5.664	1.10	39.6344	113.0	1.326	1.323	3.123	2.153	0.832	1.493	0.661	2.588
1:06:12	127.7	0.049	78.8	5.658	1.20	39.6745	115.7	1.356	1.353	3.153	2.160	0.808	1.484	0.676	2.672
1:11:28	130.4	0.055	78.9	5.652	1.30	39.7153	118.3	1.386	1.382	3.182	2.178	0.798	1.488	0.690	2.731
1:16:27	133.1	0.060	79.0	5.646	1.40	39.7550	121.0	1.416	1.412	3.212	2.202	0.792	1.497	0.705	2.781
1:21:36	135.4	0.066	79.3	5.641	1.50	39.7950	123.4	1.442	1.438	3.238	2.210	0.773	1.491	0.718	2.859
1:27:02	137.6	0.072	79.3	5.635	1.60	39.8356	125.6	1.467	1.463	3.263	2.231	0.770	1.501	0.730	2.896
1:32:01	140.0	0.077	79.5	5.629	1.70	39.8764	127.9	1.492	1.488	3.288	2.241	0.755	1.498	0.743	2.968
1:37:14	141.9	0.083	79.5	5.623	1.80	39.9170	129.9	1.513	1.508	3.308	2.260	0.754	1.507	0.753	2.999
1:42:32	144.2	0.089	79.6	5.618	1.90	39.9576	132.2	1.538	1.534	3.334	2.280	0.748	1.514	0.766	3.049
1:47:30	146.0	0.095	79.6	5.612	2.00	39.9982	134.0	1.558	1.553	3.353	2.297	0.746	1.522	0.776	3.079
1:53:04	148.1	0.100	79.6	5.606	2.10	40.0396	136.1	1.581	1.575	3.375	2.324	0.751	1.537	0.787	3.096
1:58:20	150.1	0.106	79.7	5.601	2.20	40.0800	138.0	1.601	1.596	3.396	2.334	0.740	1.537	0.797	3.155
2:03:50	151.7	0.112	79.7	5.595	2.30	40.1221	139.7	1.619	1.613	3.413	2.355	0.744	1.549	0.806	3.167
2:08:56	153.8	0.118	79.8	5.589	2.40	40.1630	141.8	1.642	1.636	3.436	2.365	0.731	1.548	0.817	3.235
2:14:24	155.4	0.123	79.7	5.583	2.50	40.2034	143.4	1.659	1.652	3.452	2.390	0.739	1.565	0.825	3.232
2:19:39	157.4	0.129	79.8	5.578	2.60	40.2450	145.4	1.680	1.673	3.473	2.406	0.735	1.570	0.836	3.275
2:24:48	159.3	0.135	79.7	5.572	2.70	40.2866	147.3	1.700	1.694	3.494	2.434	0.742	1.588	0.846	3.282
2:29:59	160.9	0.140	79.5	5.566	2.80	40.3278	148.9	1.717	1.710	3.510	2.467	0.759	1.613	0.854	3.251
2:35:10	162.7	0.146	79.7	5.560	2.90	40.3695	150.7	1.736	1.729	3.529	2.469	0.742	1.606	0.864	3.328
2:40:01	164.2	0.152	79.6	5.555	3.00	40.4110	152.2	1.751	1.744	3.544	2.493	0.751	1.622	0.871	3.319
2:45:06	165.7	0.158	79.7	5.549	3.10	40.4534	153.7	1.767	1.759	3.559	2.503	0.745	1.624	0.879	3.360
2:50:20	167.5	0.163	79.5	5.543	3.20	40.4944	155.5	1.786	1.778	3.578	2.535	0.758	1.646	0.888	3.343
2:55:16	169.3	0.169	79.5	5.538	3.30	40.5363	157.3	1.805	1.796	3.596	2.550	0.756	1.653	0.897	3.375
3:00:22	170.9	0.175	79.4	5.532	3.40	40.5783	158.8	1.820	1.812	3.612	2.574	0.764	1.669	0.905	3.369
3:05:35	172.5	0.181	79.4	5.526	3.50	40.6202	160.5	1.837	1.829	3.629	2.588	0.761	1.675	0.913	3.399
3:10:33	173.9	0.186	79.3	5.520	3.60	40.6626	161.9	1.851	1.842	3.642	2.611	0.771	1.691	0.920	3.388
3:15:40	175.6	0.192	79.3	5.515	3.70	40.7049	163.6	1.869	1.860	3.660	2.628	0.769	1.698	0.929	3.416
3:20:47	177.0	0.198	79.2	5.509	3.80	40.7472	165.0	1.883	1.873	3.673	2.651	0.779	1.715	0.936	3.403
3:25:52	178.1	0.203	79.2	5.503	3.90	40.7894	166.1	1.894	1.864	3.684	2.658	0.776	1.717	0.941	3.426
3:31:02	179.7	0.209	79.0	5.497	4.00	40.8321	167.6	1.909	1.899	3.699	2.692	0.795	1.743	0.949	3.388
3:36:15	181.1	0.215	79.1	5.492	4.10	40.8748	169.1	1.924	1.913	3.713	2.696	0.784	1.740	0.956	3.439
3:41:22	182.1	0.221	78.8	5.486	4.20	40.9174	170.1	1.933	1.922	3.722	2.726	0.806	1.766	0.960	3.383
3:46:34	183.6	0.226	79.0	5.480	4.30	40.9602	171.6	1.948	1.937	3.737	2.728	0.793	1.761	0.968	3.441
3:51:54	184.9	0.232	78.9	5.474	4.40	41.0033	172.9	1.961	1.950	3.750	2.746	0.797	1.771	0.974	3.445
3:57:13	186.1	0.238	78.9	5.469	4.50	41.0462	174.1	1.973	1.961	3.761	2.761	0.801	1.781	0.980	3.445
4:02:21	187.4	0.244	78.8	5.463	4.60	41.0891	175.3	1.984	1.973	3.773	2.775	0.804	1.789	0.986	3.453
4:07:36	188.7	0.249	78.8	5.457	4.70	41.1321	176.7	1.997	1.986	3.786	2.794	0.810	1.802	0.992	3.451
4:13:07	190.1	0.255	78.7	5.452	4.80	41.1755	178.0	2.011	1.999	3.799	2.808	0.811	1.810	0.999	3.462
4:18:22	191.2	0.261	78.6	5.446	4.90	41.2186	179.2	2.021	2.009	3.809	2.829	0.821	1.825	1.004	3.444
4:23:43	192.7	0.266	78.6	5.440	5.00	41.2620	180.7	2.037	2.024	3.824	2.843	0.821	1.832	1.011	3.465
4:29:11	194.0	0.272	78.4	5.434	5.10	41.3056	182.0	2.049	2.036	3.836	2.869	0.834	1.851	1.017	3.438
4:34:36	194.8	0.278	78.4	5.429	5.20	41.3492	182.8	2.055	2.043	3.843	2.876	0.835	1.856	1.020	3.443
4:39:44	196.1	0.284	78.1	5.423	5.30	41.3929	184.1	2.068	2.054	3.854	2.912	0.860	1.886	1.026	3.388
4:44:54	197.4	0.289	78.2	5.417	5.40	41.4367	185.4	2.080	2.067	3.867	2.911	0.846	1.879	1.033	3.440
4:50:07	198.4	0.295	77.9	5.411	5.50	41.4806	186.4	2.089	2.076	3.876	2.943	0.869	1.906	1.037	3.386
4:55:25	199.9	0.301	78.1	5.406	5.60	41.5245	187.9	2.104	2.090	3.890	2.945	0.856	1.901	1.044	3.438
5:00:39	201.2	0.307	78.0	5.400	5.70	41.5685	189.2	2.116	2.102	3.902	2.963	0.862	1.912	1.050	3.435
5:05:53	202.2	0.312	78.0	5.394	5.80	41.6127	190.2	2.125	2.111	3.911	2.975	0.866	1.920	1.055	3.436
5:11:07	203.0	0.318	77.9	5.389	5.90	41.6569	190.9	2.131	2.117	3.917	2.984	0.869	1.927	1.058	3.433

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.727 (in.)	14.546 (cm)	Height	4.672 (in.)	Date	12-16-09	Test Number	CU-4A
Diameter	2.781 (in)	7.065 (cm)	Dia. avg.	3.194 (in)	Press No.	1	Data File ID	CU-4B
Area	6.076 (in^2)	39.198 (cm^2)	Araa avg.	8.010 (in^2)	Panel No.	B	Lateral Pressure (psi)	25.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
5:16:28	204.8	0.324	77.8	5.383	6.00	41.7012	192.8	2.150	2.135	3.935	3.009	0.876	1.943	1.067	3.436
5:21:46	205.6	0.330	77.8	5.377	6.10	41.7459	193.6	2.157	2.141	3.941	3.016	0.876	1.946	1.070	3.442
5:27:12	206.6	0.335	77.7	5.371	6.20	41.7902	194.6	2.166	2.150	3.950	3.036	0.888	1.962	1.074	3.419
5:32:27	208.3	0.341	77.7	5.366	6.30	41.8349	196.3	2.182	2.166	3.966	3.051	0.887	1.969	1.082	3.441
5:37:40	208.9	0.347	77.5	5.360	6.40	41.8798	196.9	2.186	2.170	3.970	3.067	0.899	1.983	1.084	3.412
5:43:06	209.7	0.352	77.5	5.354	6.50	41.9246	197.7	2.193	2.177	3.977	3.073	0.898	1.986	1.087	3.421
5:48:28	210.6	0.358	77.3	5.348	6.60	41.9693	198.6	2.200	2.184	3.984	3.094	0.912	2.003	1.091	3.392
5:53:52	211.9	0.364	77.4	5.343	6.71	42.0149	199.9	2.213	2.196	3.996	3.103	0.909	2.006	1.097	3.415
5:59:10	212.9	0.370	77.1	5.337	6.80	42.0598	200.9	2.221	2.204	4.004	3.131	0.929	2.030	1.101	3.371
6:04:28	213.8	0.375	77.2	5.331	6.90	42.1046	201.7	2.228	2.211	4.011	3.129	0.920	2.024	1.105	3.402
6:09:44	215.2	0.381	77.2	5.325	7.00	42.1501	203.2	2.242	2.224	4.024	3.147	0.924	2.035	1.111	3.406
6:15:04	216.2	0.387	77.1	5.320	7.10	42.1953	204.2	2.251	2.233	4.033	3.158	0.927	2.042	1.116	3.408
6:20:21	217.3	0.393	77.1	5.314	7.20	42.2409	205.3	2.260	2.242	4.042	3.170	0.930	2.050	1.120	3.410
6:25:31	218.7	0.398	77.0	5.308	7.31	42.2869	206.7	2.273	2.255	4.055	3.193	0.939	2.066	1.127	3.399
6:30:36	219.9	0.404	77.0	5.303	7.40	42.3322	207.8	2.283	2.265	4.065	3.202	0.939	2.071	1.131	3.409
6:35:40	220.8	0.410	76.8	5.297	7.50	42.3780	208.8	2.291	2.272	4.072	3.219	0.949	2.084	1.135	3.393
6:40:44	222.0	0.415	76.8	5.291	7.60	42.4239	210.0	2.302	2.283	4.083	3.231	0.949	2.090	1.141	3.403
6:45:49	223.3	0.421	76.7	5.285	7.71	42.4700	211.2	2.313	2.294	4.094	3.249	0.957	2.103	1.146	3.394
6:50:56	223.9	0.427	76.7	5.280	7.81	42.5163	211.9	2.318	2.298	4.098	3.253	0.957	2.105	1.148	3.401
6:55:56	224.6	0.433	76.6	5.274	7.91	42.5624	212.5	2.322	2.302	4.102	3.268	0.967	2.118	1.150	3.378
7:01:06	225.7	0.438	76.6	5.268	8.01	42.6089	213.7	2.332	2.312	4.112	3.275	0.964	2.120	1.155	3.396
7:06:12	226.4	0.444	76.4	5.262	8.11	42.6555	214.4	2.337	2.317	4.117	3.292	0.977	2.134	1.157	3.371
7:11:19	227.4	0.450	76.5	5.257	8.21	42.7014	215.4	2.346	2.325	4.125	3.297	0.974	2.136	1.162	3.386
7:16:38	228.4	0.456	76.3	5.251	8.31	42.7481	216.3	2.353	2.333	4.133	3.318	0.987	2.152	1.165	3.363
7:21:53	229.3	0.461	76.3	5.245	8.41	42.7949	217.3	2.361	2.340	4.140	3.323	0.984	2.153	1.169	3.375
7:27:03	229.8	0.467	76.1	5.240	8.51	42.8414	217.8	2.364	2.343	4.143	3.342	1.001	2.172	1.171	3.339
7:32:18	230.9	0.473	76.2	5.234	8.61	42.8882	218.9	2.373	2.351	4.151	3.340	0.990	2.165	1.175	3.372
7:37:40	231.7	0.478	76.1	5.228	8.71	42.9353	219.7	2.379	2.358	4.158	3.355	0.998	2.176	1.178	3.360
7:42:59	232.0	0.484	76.1	5.222	8.81	42.9827	220.0	2.380	2.358	4.158	3.357	1.000	2.179	1.178	3.356
7:48:13	233.1	0.490	76.1	5.217	8.91	43.0296	221.1	2.390	2.367	4.167	3.368	1.002	2.185	1.183	3.360
7:53:37	233.8	0.496	76.0	5.211	9.01	43.0772	221.8	2.394	2.372	4.172	3.378	1.008	2.193	1.185	3.351
7:58:59	234.6	0.501	76.0	5.205	9.11	43.1246	222.6	2.400	2.377	4.177	3.384	1.009	2.196	1.188	3.355
8:04:20	235.6	0.507	75.8	5.199	9.21	43.1722	223.6	2.409	2.386	4.186	3.404	1.020	2.212	1.192	3.338
8:09:47	236.3	0.513	75.9	5.194	9.31	43.2196	224.3	2.414	2.390	4.190	3.406	1.018	2.212	1.194	3.347
8:15:17	237.1	0.519	75.7	5.188	9.41	43.2672	225.1	2.419	2.395	4.195	3.425	1.031	2.228	1.197	3.321
8:20:41	237.7	0.524	75.7	5.182	9.51	43.3153	225.7	2.423	2.399	4.199	3.428	1.030	2.229	1.199	3.327
8:26:13	238.5	0.530	75.4	5.177	9.61	43.3630	226.5	2.429	2.405	4.205	3.455	1.052	2.254	1.202	3.284
8:31:47	239.4	0.536	75.6	5.171	9.71	43.4112	227.4	2.436	2.412	4.212	3.450	1.040	2.245	1.205	3.317
8:37:06	239.7	0.542	75.5	5.165	9.81	43.4595	227.6	2.436	2.411	4.211	3.453	1.044	2.248	1.205	3.309
8:42:21	241.1	0.547	75.4	5.159	9.91	43.5075	229.1	2.448	2.424	4.224	3.471	1.049	2.260	1.211	3.308
8:47:47	242.1	0.553	75.4	5.154	10.01	43.5560	230.1	2.456	2.432	4.232	3.479	1.049	2.264	1.215	3.317
8:53:01	242.2	0.559	75.3	5.148	10.11	43.6046	230.2	2.455	2.430	4.230	3.488	1.060	2.274	1.214	3.290
8:58:13	243.1	0.564	75.3	5.142	10.21	43.6529	231.1	2.462	2.436	4.236	3.496	1.061	2.278	1.217	3.294
9:03:42	244.0	0.570	75.1	5.136	10.31	43.7017	232.0	2.468	2.443	4.243	3.512	1.071	2.291	1.221	3.280
9:09:03	244.5	0.576	75.1	5.131	10.41	43.7509	232.5	2.471	2.445	4.245	3.514	1.071	2.293	1.222	3.283
9:14:20	245.0	0.582	74.9	5.125	10.51	43.7995	233.0	2.473	2.447	4.247	3.532	1.087	2.310	1.223	3.251
9:19:51	246.3	0.587	75.0	5.119	10.61	43.8491	234.3	2.485	2.458	4.258	3.537	1.080	2.308	1.228	3.274
9:25:05	246.3	0.593	74.9	5.114	10.71	43.8974	234.3	2.482	2.455	4.255	3.542	1.089	2.316	1.227	3.254
9:30:32	246.9	0.599	74.9	5.108	10.81	43.9468	234.9	2.485	2.458	4.258	3.546	1.089	2.318	1.228	3.255
9:36:02	247.2	0.605	74.9	5.102	10.91	43.9963	235.2	2.486	2.459	4.259	3.548	1.090	2.319	1.229	3.254
9:41:30	248.7	0.610	74.7	5.096	11.01	44.0459	236.7	2.499	2.472	4.272	3.569	1.098	2.333	1.235	3.249
9:46:54	248.7	0.616	74.8	5.091	11.11	44.0953	236.7	2.496	2.469	4.269	3.565	1.098	2.331	1.233	3.247
9:52:14	249.9	0.622	74.6	5.085	11.21	44.1451	237.8	2.505	2.478	4.278	3.586	1.110	2.348	1.238	3.230
9:57:39	250.3	0.627	74.6	5.079	11.31	44.1949	238.3	2.507	2.479	4.279	3.588	1.110	2.349	1.239	3.231
10:03:04	251.1	0.633	74.3	5.073	11.41	44.2445	239.1	2.513	2.485	4.285	3.613	1.130	2.371	1.242	3.198
10:08:19	251.4	0.639	74.4	5.068	11.51	44.2946	239.4	2.514	2.485	4.285	3.604	1.121	2.363	1.242	3.215
10:13:43	252.2	0.645	74.3	5.062	11.61	44.3457	240.2	2.519	2.490	4.290	3.617	1.128	2.372	1.244	3.205
10:19:00	253.4	0.650	74.3	5.056	11.71	44.3949	241.4	2.528	2.499	4.299	3.625	1.128	2.376	1.249	3.215
10:24:11	253.6	0.656	74.3	5.050	11.81	44.4454	241.6	2.528	2.498	4.298	3.627	1.130	2.379	1.248	3.209
10:29:23	254.9	0.662	74.2	5.045	11.91	44.4959	242.9	2.538	2.509	4.309	3.643	1.135	2.389	1.254	3.208

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values				Project Number	175569069
Height	5.727 (in.)	14.546 (cm)	Height	4.672 (in.)	Tested By	KDG	Test Number	CU-4A
Diameter	2.781 (in)	7.065 (cm)	Dia. avg.	3.194 (in)	Date	12-16-09	Data File ID	CU-4B
Area	6.076 (in²)	39.198 (cm²)	Area avg.	8.010 (in²)	Press No.	1	Lateral Pressure (psi)	25.0
					Panel No.	B	Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
10:34:42	255.7	0.668	74.2	5.039	12.01	44.5469	243.7	2.544	2.514	4.314	3.648	1.135	2.392	1.256	3.213
10:39:52	256.0	0.673	74.1	5.033	12.11	44.5974	244.0	2.544	2.514	4.314	3.656	1.144	2.400	1.256	3.197
10:45:07	257.1	0.679	74.2	5.028	12.21	44.6480	245.1	2.553	2.523	4.323	3.662	1.141	2.401	1.260	3.209
10:50:25	257.7	0.685	74.0	5.022	12.31	44.6989	245.7	2.556	2.525	4.325	3.674	1.151	2.412	1.262	3.193
10:55:39	258.4	0.690	74.1	5.016	12.41	44.7500	246.4	2.560	2.529	4.329	3.675	1.147	2.411	1.264	3.203
11:00:51	259.5	0.696	73.9	5.010	12.51	44.8014	247.4	2.568	2.537	4.337	3.694	1.159	2.427	1.268	3.188
11:06:15	259.9	0.702	74.0	5.005	12.61	44.8526	247.9	2.570	2.538	4.338	3.692	1.155	2.424	1.268	3.195
11:11:36	260.1	0.708	73.6	4.999	12.71	44.9042	248.1	2.569	2.538	4.338	3.713	1.177	2.445	1.268	3.154
11:16:52	261.1	0.713	73.8	4.993	12.81	44.9561	249.0	2.576	2.544	4.344	3.705	1.163	2.434	1.271	3.186
11:22:19	262.0	0.719	73.8	4.987	12.91	45.0073	250.0	2.583	2.551	4.351	3.712	1.163	2.438	1.275	3.192
11:27:45	262.5	0.725	73.8	4.982	13.01	45.0591	250.5	2.585	2.553	4.353	3.720	1.169	2.444	1.276	3.183
11:33:06	262.9	0.731	73.8	4.976	13.11	45.1111	250.8	2.586	2.553	4.353	3.720	1.168	2.444	1.276	3.184
11:38:31	263.3	0.736	73.7	4.970	13.21	45.1629	251.3	2.588	2.555	4.355	3.729	1.176	2.453	1.277	3.170
11:44:00	264.2	0.742	73.7	4.965	13.31	45.2150	252.2	2.594	2.561	4.361	3.731	1.172	2.452	1.280	3.183
11:49:33	264.8	0.748	73.5	4.959	13.41	45.2671	252.8	2.597	2.563	4.363	3.746	1.185	2.466	1.281	3.162
11:55:08	265.3	0.754	73.6	4.953	13.51	45.3199	253.3	2.599	2.565	4.365	3.745	1.181	2.463	1.282	3.170
12:00:43	265.9	0.759	73.5	4.947	13.61	45.3723	253.9	2.602	2.568	4.368	3.756	1.192	2.475	1.283	3.154
12:06:22	266.1	0.765	73.5	4.942	13.71	45.4246	254.1	2.601	2.567	4.367	3.753	1.187	2.470	1.283	3.161
12:11:58	267.0	0.771	73.5	4.936	13.81	45.4774	255.0	2.607	2.573	4.373	3.759	1.187	2.473	1.286	3.166
12:17:38	267.6	0.776	73.4	4.930	13.91	45.5304	255.6	2.610	2.576	4.376	3.769	1.195	2.482	1.287	3.154
12:23:13	267.9	0.782	73.5	4.924	14.01	45.5833	255.9	2.610	2.575	4.375	3.765	1.191	2.478	1.287	3.161
12:28:49	268.5	0.788	73.3	4.919	14.11	45.6363	256.5	2.614	2.579	4.379	3.781	1.204	2.492	1.289	3.141
12:34:27	269.6	0.794	73.3	4.913	14.21	45.6896	257.6	2.622	2.587	4.387	3.784	1.199	2.492	1.292	3.156
12:39:53	270.5	0.799	73.2	4.907	14.31	45.7428	258.5	2.627	2.592	4.392	3.799	1.209	2.504	1.295	3.142
12:45:24	270.6	0.805	73.3	4.901	14.41	45.7969	258.6	2.625	2.590	4.390	3.792	1.205	2.498	1.294	3.148
12:50:55	271.7	0.811	73.3	4.896	14.51	45.8500	259.7	2.634	2.598	4.398	3.800	1.204	2.502	1.298	3.156
12:56:25	272.0	0.817	73.2	4.890	14.61	45.9040	260.0	2.634	2.598	4.398	3.807	1.211	2.509	1.298	3.144
13:01:52	272.4	0.822	73.2	4.884	14.71	45.9576	260.4	2.634	2.598	4.398	3.805	1.208	2.507	1.298	3.148
13:07:29	273.3	0.828	73.1	4.879	14.81	46.0115	261.3	2.641	2.604	4.404	3.820	1.218	2.519	1.301	3.137
13:13:00	273.6	0.834	73.1	4.873	14.91	46.0658	261.6	2.640	2.603	4.403	3.816	1.214	2.515	1.301	3.142
13:18:34	273.2	0.840	72.9	4.867	15.01	46.1202	261.1	2.633	2.596	4.396	3.829	1.235	2.532	1.297	3.101
13:24:07	274.1	0.845	73.0	4.861	15.11	46.1740	262.1	2.640	2.602	4.402	3.822	1.221	2.521	1.300	3.129
13:29:45	274.9	0.851	73.0	4.856	15.21	46.2286	262.9	2.645	2.607	4.407	3.826	1.221	2.524	1.303	3.133
13:35:22	275.2	0.857	73.0	4.850	15.31	46.2836	263.2	2.645	2.607	4.407	3.832	1.227	2.529	1.302	3.123
13:40:45	275.5	0.862	73.0	4.844	15.41	46.3379	263.5	2.644	2.606	4.406	3.830	1.226	2.528	1.302	3.125
13:46:17	276.8	0.868	72.9	4.838	15.51	46.3929	264.8	2.654	2.615	4.415	3.846	1.233	2.539	1.307	3.121
13:51:38	276.9	0.874	72.9	4.833	15.61	46.4481	264.9	2.652	2.613	4.413	3.841	1.229	2.535	1.306	3.125
13:57:05	277.2	0.880	72.8	4.827	15.71	46.5029	265.2	2.652	2.613	4.413	3.853	1.242	2.547	1.306	3.103
14:02:31	278.5	0.885	72.8	4.821	15.81	46.5582	266.5	2.662	2.622	4.422	3.857	1.236	2.547	1.310	3.120
14:07:57	278.8	0.891	72.6	4.816	15.91	46.6139	266.8	2.662	2.622	4.422	3.870	1.249	2.560	1.310	3.097
14:13:17	279.5	0.897	72.8	4.810	16.01	46.6694	267.4	2.665	2.625	4.425	3.864	1.241	2.552	1.312	3.115
14:18:37	280.1	0.903	72.8	4.804	16.11	46.7249	268.1	2.668	2.628	4.428	3.868	1.242	2.555	1.313	3.116
14:23:52	280.5	0.908	72.7	4.798	16.21	46.7808	268.4	2.668	2.628	4.428	3.874	1.248	2.561	1.313	3.105
14:29:10	281.0	0.914	72.7	4.793	16.31	46.8367	269.0	2.670	2.630	4.430	3.873	1.245	2.559	1.314	3.111
14:34:22	281.5	0.920	72.6	4.787	16.41	46.8927	269.5	2.672	2.631	4.431	3.881	1.251	2.566	1.315	3.102
14:39:37	282.0	0.925	72.7	4.781	16.51	46.9493	270.0	2.674	2.633	4.433	3.881	1.249	2.565	1.316	3.107
14:44:58	282.6	0.931	72.6	4.775	16.61	47.0055	270.6	2.677	2.636	4.436	3.889	1.255	2.572	1.317	3.099
14:50:10	283.3	0.937	72.6	4.770	16.71	47.0617	271.3	2.680	2.639	4.439	3.891	1.254	2.572	1.319	3.104
14:55:39	283.7	0.943	72.5	4.764	16.81	47.1182	271.7	2.681	2.639	4.439	3.901	1.264	2.582	1.319	3.087
15:01:04	284.0	0.948	72.5	4.758	16.91	47.1749	272.0	2.681	2.639	4.439	3.897	1.259	2.578	1.319	3.094
15:06:18	284.0	0.954	72.3	4.752	17.01	47.2323	272.0	2.678	2.635	4.435	3.910	1.276	2.593	1.317	3.064
15:11:37	284.5	0.960	72.4	4.747	17.11	47.2893	272.5	2.679	2.637	4.437	3.901	1.266	2.583	1.317	3.082
15:17:06	285.5	0.966	72.4	4.741	17.21	47.3464	273.5	2.686	2.643	4.443	3.909	1.267	2.588	1.321	3.084
15:22:16	285.0	0.971	72.4	4.735	17.31	47.4033	273.0	2.678	2.635	4.435	3.902	1.269	2.585	1.317	3.076
15:27:40	285.8	0.977	72.4	4.730	17.41	47.4609	273.8	2.682	2.639	4.439	3.904	1.267	2.585	1.319	3.082
15:33:10	286.4	0.983	72.3	4.724	17.51	47.5184	274.4	2.685	2.642	4.442	3.913	1.273	2.593	1.320	3.074
15:38:31	286.5	0.989	72.3	4.718	17.61	47.5767	274.5	2.683	2.639	4.439	3.910	1.272	2.591	1.319	3.073
15:43:56	287.3	0.994	72.2	4.712	17.71	47.6341	275.2	2.687	2.643	4.443	3.920	1.279	2.599	1.321	3.066
15:49:26	287.5	1.000	72.3	4.707	17.81	47.6921	275.5	2.686	2.641	4.441	3.914	1.274	2.594	1.320	3.072
15:54:55	287.5	1.006	72.1	4.701	17.91	47.7500	275.5	2.683	2.638	4.438	3.923	1.286	2.605	1.318	3.050

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	5.727 (in.)	14.546 (cm)	Height	4.672 (in.)	Tested By	KDG
Diameter	2.781 (in)	7.065 (cm)	Dia. avg.	3.194 (in)	Date	12-16-09
Area	6.076 (in^2)	39.198 (cm^2)	Area avg.	8.010 (in^2)	Press No.	1
					Panel No.	B

Project Number	175569069
Test Number	CU-4A
Data File ID	CU-4B
Lateral Pressure (psi)	25.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
16:00:33	287.7	1.011	72.2	4.695	18.01	47.8085	275.7	2.682	2.637	4.437	3.915	1.280	2.598	1.318	3.058
16:06:13	288.1	1.017	72.1	4.689	18.11	47.8672	276.1	2.682	2.637	4.437	3.921	1.286	2.603	1.318	3.050
16:11:51	288.3	1.023	72.2	4.684	18.21	47.9255	276.3	2.681	2.635	4.435	3.919	1.285	2.602	1.317	3.049
16:17:23	288.5	1.029	72.2	4.678	18.31	47.9842	276.5	2.679	2.634	4.434	3.916	1.284	2.600	1.316	3.049
16:23:00	289.3	1.034	72.1	4.672	18.41	48.0430	277.3	2.684	2.638	4.438	3.928	1.291	2.609	1.318	3.042

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.414 (in.)	13.752 (cm)	Height	4.479 (in.)	Date	12-19-09	Test Number	CU-4B
Diameter	2.762 (in)	7.016 (cm)	Dia. avg.	3.179 (in)	Press No.	2	Data File ID	4B6
Area	5.993 (in^2)	38.665 (cm^2)	Area avg.	7.935 (in^2)	Panel No.	D	Lateral Pressure (psi)	35.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	14.2	0.001	55.0	5.414	0.00	38.6647	0.0	0.000	0.000	2.520	2.520	2.517	2.519	0.001	1.001
0:06:30	39.0	0.007	57.0	5.409	0.10	38.7046	24.8	0.298	0.297	2.817	2.678	2.378	2.528	0.150	1.126
0:13:35	81.0	0.012	60.9	5.403	0.20	38.7441	66.8	0.802	0.801	3.321	2.899	2.095	2.497	0.402	1.384
0:17:56	109.5	0.018	64.8	5.398	0.31	38.7836	95.3	1.142	1.142	3.662	2.960	1.816	2.388	0.572	1.630
0:22:05	125.1	0.023	67.1	5.392	0.41	38.8229	110.9	1.328	1.327	3.847	2.981	1.652	2.317	0.665	1.805
0:26:17	135.4	0.029	69.0	5.387	0.51	38.8622	121.2	1.450	1.449	3.969	2.963	1.512	2.238	0.726	1.960
0:30:33	143.3	0.034	70.4	5.381	0.61	38.9022	129.1	1.543	1.541	4.061	2.957	1.413	2.185	0.772	2.093
0:34:44	148.6	0.040	71.4	5.376	0.71	38.9431	134.4	1.605	1.603	4.123	2.942	1.336	2.139	0.803	2.202
0:38:55	153.8	0.045	72.4	5.370	0.81	38.9817	139.6	1.665	1.663	4.183	2.933	1.267	2.100	0.833	2.314
0:43:09	158.2	0.051	73.0	5.365	0.92	39.0221	144.0	1.716	1.714	4.234	2.941	1.224	2.082	0.858	2.403
0:47:22	161.9	0.056	73.8	5.359	1.02	39.0622	147.7	1.758	1.756	4.276	2.926	1.167	2.046	0.879	2.506
0:51:36	165.6	0.062	74.1	5.354	1.12	39.1028	151.4	1.800	1.797	4.317	2.943	1.143	2.043	0.900	2.575
0:55:33	168.7	0.067	74.7	5.348	1.22	39.1420	154.5	1.835	1.832	4.352	2.939	1.104	2.021	0.917	2.662
0:59:58	171.7	0.073	75.0	5.343	1.32	39.1828	157.5	1.869	1.866	4.386	2.950	1.082	2.016	0.934	2.727
1:04:10	174.8	0.078	75.1	5.337	1.42	39.2230	160.6	1.904	1.900	4.420	2.973	1.070	2.021	0.952	2.779
1:08:23	177.6	0.084	75.6	5.332	1.52	39.2631	163.4	1.935	1.932	4.452	2.973	1.039	2.006	0.967	2.862
1:12:39	180.6	0.089	75.7	5.326	1.63	39.3038	166.4	1.969	1.965	4.485	2.997	1.030	2.013	0.984	2.911
1:17:02	183.3	0.095	76.1	5.321	1.73	39.3442	169.1	1.998	1.994	4.514	2.999	1.002	2.000	0.998	2.992
1:21:18	185.8	0.100	76.2	5.315	1.83	39.3855	171.5	2.025	2.021	4.541	3.017	0.994	2.006	1.012	3.036
1:25:56	188.5	0.106	76.5	5.310	1.93	39.4266	174.2	2.055	2.050	4.570	3.029	0.976	2.002	1.027	3.105
1:30:17	191.1	0.111	76.5	5.304	2.03	39.4666	176.8	2.084	2.079	4.599	3.054	0.972	2.013	1.041	3.140
1:34:50	193.1	0.117	76.7	5.299	2.14	39.5086	178.9	2.106	2.100	4.620	3.064	0.961	2.013	1.052	3.189
1:39:16	195.5	0.122	76.7	5.293	2.24	39.5490	181.3	2.132	2.126	4.646	3.088	0.959	2.024	1.065	3.220
1:43:35	198.1	0.128	76.7	5.288	2.34	39.5901	183.8	2.159	2.153	4.673	3.112	0.956	2.034	1.078	3.257
1:48:03	200.0	0.133	76.8	5.282	2.44	39.6327	185.8	2.180	2.174	4.694	3.127	0.951	2.039	1.088	3.289
1:52:24	202.3	0.139	76.6	5.277	2.54	39.6742	188.1	2.204	2.198	4.718	3.165	0.964	2.065	1.100	3.282
1:56:49	204.8	0.144	76.9	5.271	2.64	39.7143	190.6	2.231	2.225	4.745	3.171	0.943	2.057	1.114	3.361
2:01:08	206.7	0.150	76.8	5.266	2.75	39.7570	192.5	2.252	2.245	4.765	3.197	0.950	2.074	1.124	3.366
2:05:31	208.9	0.155	77.0	5.260	2.85	39.7978	194.7	2.275	2.267	4.787	3.209	0.938	2.074	1.135	3.419
2:09:50	210.7	0.161	76.8	5.255	2.95	39.8386	196.5	2.294	2.286	4.806	3.233	0.944	2.088	1.144	3.426
2:14:06	212.9	0.166	77.0	5.249	3.05	39.8802	198.7	2.316	2.309	4.829	3.249	0.937	2.093	1.156	3.466
2:18:27	214.6	0.172	76.9	5.244	3.15	39.9223	200.4	2.334	2.326	4.846	3.271	0.942	2.106	1.165	3.473
2:22:50	216.9	0.177	76.9	5.238	3.25	39.9638	202.7	2.358	2.350	4.870	3.293	0.940	2.117	1.177	3.503
2:27:14	218.7	0.183	76.9	5.233	3.35	40.0061	204.5	2.377	2.368	4.888	3.312	0.941	2.126	1.186	3.521
2:31:37	220.9	0.188	76.7	5.227	3.45	40.0483	206.6	2.399	2.391	4.911	3.354	0.960	2.157	1.197	3.493
2:36:10	223.0	0.194	76.9	5.222	3.56	40.0909	208.8	2.422	2.413	4.933	3.358	0.942	2.150	1.208	3.563
2:40:34	224.2	0.199	76.8	5.216	3.66	40.1333	210.0	2.433	2.424	4.944	3.379	0.953	2.166	1.213	3.546
2:44:52	226.2	0.205	76.9	5.211	3.76	40.1749	212.0	2.454	2.444	4.964	3.390	0.943	2.167	1.223	3.593
2:49:16	228.1	0.210	76.8	5.205	3.86	40.2172	213.8	2.472	2.463	4.983	3.419	0.953	2.186	1.233	3.586
2:53:42	230.0	0.216	76.8	5.200	3.96	40.2603	215.7	2.492	2.482	5.002	3.434	0.949	2.192	1.242	3.617
2:58:05	231.6	0.221	76.7	5.194	4.07	40.3036	217.4	2.508	2.498	5.018	3.456	0.955	2.205	1.250	3.619
3:02:24	233.7	0.227	76.7	5.189	4.17	40.3468	219.5	2.530	2.519	5.039	3.481	0.959	2.220	1.261	3.630
3:06:40	234.5	0.232	76.6	5.183	4.27	40.3882	220.3	2.537	2.526	5.046	3.494	0.965	2.230	1.264	3.620
3:10:58	236.2	0.238	76.1	5.178	4.37	40.4311	222.0	2.553	2.542	5.062	3.543	0.998	2.270	1.272	3.550
3:15:14	237.9	0.243	76.5	5.172	4.47	40.4742	223.7	2.570	2.559	5.079	3.534	0.973	2.253	1.281	3.633
3:19:30	239.4	0.249	76.3	5.167	4.57	40.5178	225.2	2.585	2.573	5.093	3.562	0.986	2.274	1.288	3.614
3:23:32	240.9	0.254	76.4	5.161	4.67	40.5603	226.6	2.598	2.587	5.107	3.567	0.977	2.272	1.295	3.650
3:27:48	242.0	0.260	76.3	5.156	4.77	40.6035	227.7	2.608	2.596	5.116	3.587	0.989	2.288	1.299	3.629
3:31:57	242.9	0.265	76.3	5.150	4.88	40.6478	228.7	2.616	2.604	5.124	3.595	0.989	2.292	1.303	3.637
3:36:03	243.4	0.271	76.2	5.145	4.98	40.6904	229.2	2.619	2.607	5.127	3.601	0.991	2.296	1.305	3.633
3:40:14	244.1	0.276	75.8	5.139	5.08	40.7338	229.9	2.625	2.612	5.132	3.636	1.021	2.329	1.307	3.560
3:44:30	245.3	0.282	76.1	5.134	5.18	40.7783	231.1	2.635	2.622	5.142	3.625	1.000	2.313	1.312	3.623
3:48:49	247.1	0.287	76.0	5.128	5.28	40.8217	232.9	2.652	2.639	5.159	3.651	1.009	2.330	1.321	3.618
3:53:10	248.6	0.293	76.1	5.123	5.38	40.8652	234.4	2.667	2.654	5.174	3.659	1.003	2.331	1.328	3.649
3:57:26	249.7	0.298	75.9	5.117	5.49	40.9091	235.5	2.677	2.663	5.183	3.681	1.015	2.348	1.333	3.627
4:01:39	251.5	0.304	75.9	5.112	5.59	40.9528	237.2	2.694	2.680	5.200	3.695	1.012	2.354	1.341	3.650
4:05:55	252.4	0.309	75.8	5.106	5.69	40.9973	238.2	2.702	2.687	5.207	3.712	1.022	2.367	1.345	3.633
4:10:17	253.8	0.315	75.7	5.101	5.79	41.0412	239.6	2.715	2.700	5.220	3.731	1.028	2.379	1.352	3.630
4:14:38	255.6	0.320	75.7	5.095	5.89	41.0864	241.4	2.732	2.717	5.237	3.749	1.029	2.389	1.360	3.643
4:18:59	257.0	0.326	75.4	5.090	5.99	41.1301	242.8	2.745	2.730	5.250	3.785	1.052	2.418	1.366	3.598

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG		
Height	5.414 (in.)	13.752 (cm)	Height	4.479 (in.)	Date	12-19-09	Project Number	175569069
Diameter	2.762 (in)	7.016 (cm)	Dia. avg.	3.179 (in)	Press No.	2	Test Number	CU-4B
Area	5.993 (in^2)	38.665 (cm^2)	Area avg.	7.935 (in^2)	Panel No.	D	Data File ID	4BB
							Lateral Pressure (psi)	35.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
4:23:19	258.6	0.331	75.6	5.084	6.10	41.1744	244.4	2.760	2.745	5.265	3.784	1.036	2.410	1.374	3.651
4:27:43	260.0	0.337	75.4	5.079	6.20	41.2195	245.8	2.773	2.757	5.277	3.810	1.050	2.430	1.380	3.628
4:32:01	261.4	0.342	75.5	5.073	6.30	41.2641	247.2	2.785	2.770	5.290	3.819	1.046	2.433	1.386	3.650
4:36:25	262.8	0.348	75.3	5.068	6.40	41.3087	248.6	2.798	2.782	5.302	3.841	1.056	2.449	1.393	3.636
4:40:50	264.1	0.353	75.3	5.062	6.50	41.3534	249.9	2.810	2.793	5.313	3.853	1.057	2.455	1.398	3.646
4:44:57	268.2	0.359	75.4	5.057	6.60	41.3982	254.0	2.852	2.836	5.356	3.888	1.049	2.468	1.419	3.706
4:47:50	269.6	0.364	75.1	5.051	6.71	41.4436	255.4	2.866	2.849	5.369	3.922	1.070	2.496	1.426	3.664
4:50:43	271.0	0.370	75.2	5.046	6.81	41.4894	256.8	2.878	2.861	5.381	3.926	1.062	2.494	1.432	3.696
4:53:31	271.8	0.375	75.1	5.040	6.91	41.5341	257.5	2.883	2.866	5.386	3.941	1.072	2.506	1.434	3.677
4:56:22	272.8	0.381	75.0	5.035	7.01	41.5793	258.6	2.892	2.875	5.395	3.957	1.080	2.518	1.439	3.665
4:59:13	273.7	0.386	74.9	5.029	7.11	41.6249	259.5	2.899	2.881	5.401	3.968	1.084	2.526	1.442	3.661
5:02:03	274.6	0.392	74.9	5.024	7.21	41.6705	260.4	2.905	2.887	5.407	3.974	1.084	2.529	1.445	3.666
5:04:54	276.0	0.397	74.9	5.018	7.31	41.7162	261.8	2.918	2.900	5.420	3.994	1.091	2.542	1.451	3.661
5:07:47	276.8	0.403	74.6	5.013	7.42	41.7623	262.6	2.924	2.905	5.425	4.019	1.111	2.565	1.454	3.619
5:10:38	277.7	0.408	74.8	5.007	7.52	41.8079	263.5	2.931	2.912	5.432	4.011	1.096	2.554	1.457	3.659
5:13:26	278.8	0.414	74.7	5.002	7.62	41.8543	264.6	2.939	2.920	5.440	4.027	1.104	2.566	1.461	3.647
5:16:15	279.9	0.419	74.5	4.996	7.72	41.8995	265.7	2.949	2.929	5.449	4.046	1.114	2.580	1.466	3.633
5:19:01	280.8	0.425	74.5	4.991	7.82	41.9457	266.6	2.955	2.935	5.455	4.052	1.114	2.583	1.469	3.637
5:21:51	281.9	0.430	74.5	4.985	7.92	41.9926	267.7	2.964	2.944	5.464	4.062	1.115	2.588	1.474	3.644
5:24:42	282.9	0.436	74.4	4.980	8.03	42.0387	268.7	2.972	2.952	5.472	4.076	1.122	2.599	1.477	3.633
5:27:30	283.6	0.441	74.1	4.974	8.13	42.0849	269.3	2.976	2.956	5.476	4.104	1.145	2.624	1.479	3.583
5:30:21	285.0	0.447	74.3	4.969	8.23	42.1321	270.8	2.988	2.968	5.488	4.098	1.127	2.612	1.485	3.635
5:33:11	285.8	0.452	74.2	4.963	8.33	42.1781	271.6	2.994	2.973	5.493	4.111	1.135	2.623	1.488	3.622
5:36:02	286.8	0.458	74.1	4.958	8.43	42.2251	272.6	3.002	2.981	5.501	4.128	1.144	2.636	1.492	3.607
5:38:55	287.8	0.463	74.2	4.952	8.53	42.2723	273.6	3.010	2.988	5.508	4.131	1.140	2.635	1.496	3.625
5:41:44	288.7	0.469	74.1	4.947	8.64	42.3191	274.5	3.016	2.995	5.515	4.142	1.145	2.643	1.499	3.619
5:44:35	289.7	0.474	74.0	4.941	8.74	42.3661	275.5	3.024	3.002	5.522	4.158	1.153	2.655	1.503	3.607
5:47:25	290.8	0.480	73.4	4.936	8.84	42.4134	276.6	3.033	3.010	5.530	4.211	1.198	2.704	1.507	3.516
5:50:14	291.4	0.485	74.0	4.930	8.94	42.4607	277.2	3.036	3.013	5.533	4.171	1.155	2.663	1.508	3.612
5:52:57	292.5	0.491	73.9	4.925	9.04	42.5078	278.3	3.044	3.021	5.541	4.186	1.162	2.674	1.512	3.602
5:55:48	293.2	0.496	73.7	4.919	9.14	42.5557	279.0	3.048	3.025	5.545	4.200	1.173	2.686	1.514	3.582
5:58:34	294.0	0.502	73.8	4.914	9.24	42.6032	279.8	3.054	3.031	5.551	4.201	1.168	2.685	1.517	3.597
6:01:22	294.6	0.507	73.7	4.908	9.35	42.6510	280.4	3.057	3.034	5.554	4.211	1.175	2.693	1.518	3.585
6:04:13	295.5	0.513	73.6	4.903	9.45	42.6991	281.3	3.063	3.040	5.560	4.222	1.180	2.701	1.521	3.579
6:07:01	295.6	0.518	73.2	4.897	9.55	42.7470	281.4	3.061	3.037	5.557	4.246	1.206	2.726	1.520	3.520
6:09:47	296.8	0.524	73.6	4.892	9.65	42.7956	282.6	3.070	3.046	5.566	4.232	1.183	2.707	1.524	3.578
6:12:36	298.1	0.529	73.5	4.886	9.75	42.8431	283.8	3.081	3.056	5.576	4.249	1.190	2.719	1.530	3.571
6:15:24	298.1	0.535	73.3	4.881	9.85	42.8914	283.9	3.078	3.053	5.573	4.256	1.201	2.729	1.528	3.545
6:18:12	299.1	0.540	73.4	4.875	9.96	42.9399	284.9	3.085	3.060	5.580	4.257	1.195	2.726	1.531	3.564
6:21:03	299.8	0.546	73.3	4.870	10.06	42.9882	285.5	3.089	3.063	5.583	4.266	1.200	2.733	1.533	3.555
6:23:51	300.5	0.551	73.2	4.864	10.16	43.0368	286.3	3.094	3.068	5.588	4.277	1.206	2.742	1.536	3.546
6:26:42	301.2	0.557	73.1	4.859	10.26	43.0855	286.9	3.097	3.071	5.591	4.294	1.220	2.757	1.537	3.520
6:29:35	301.7	0.562	73.2	4.853	10.36	43.1345	287.4	3.099	3.073	5.593	4.283	1.207	2.745	1.538	3.548
6:32:26	302.6	0.568	73.2	4.848	10.46	43.1835	288.4	3.106	3.080	5.600	4.295	1.213	2.754	1.541	3.541
6:35:19	303.3	0.573	73.0	4.842	10.57	43.2326	289.1	3.109	3.083	5.603	4.313	1.227	2.770	1.543	3.514
6:38:12	304.3	0.579	73.1	4.837	10.67	43.2821	290.1	3.117	3.090	5.610	4.310	1.218	2.764	1.546	3.540
6:41:08	304.8	0.584	73.0	4.831	10.77	43.3312	290.6	3.118	3.091	5.611	4.319	1.225	2.772	1.547	3.526
6:44:01	305.5	0.590	72.9	4.826	10.87	43.3800	291.3	3.123	3.095	5.615	4.331	1.233	2.782	1.549	3.513
6:46:59	306.1	0.595	72.9	4.820	10.97	43.4302	291.9	3.125	3.098	5.618	4.333	1.232	2.782	1.550	3.516
6:49:52	307.0	0.601	72.9	4.815	11.07	43.4792	292.8	3.131	3.104	5.624	4.340	1.234	2.787	1.553	3.517
6:52:52	308.0	0.606	72.7	4.809	11.18	43.5292	293.8	3.139	3.111	5.631	4.356	1.243	2.800	1.557	3.505
6:55:48	308.0	0.612	72.2	4.804	11.28	43.5789	293.8	3.135	3.107	5.627	4.390	1.280	2.835	1.555	3.430
6:58:44	308.7	0.617	72.7	4.798	11.38	43.6291	294.5	3.139	3.110	5.630	4.361	1.248	2.805	1.557	3.495
7:01:37	309.2	0.623	72.6	4.793	11.48	43.6787	295.0	3.141	3.112	5.632	4.369	1.254	2.812	1.557	3.483
7:04:35	309.8	0.628	72.4	4.787	11.58	43.7288	295.6	3.143	3.114	5.634	4.384	1.267	2.826	1.559	3.460
7:07:33	310.2	0.634	72.5	4.782	11.68	43.7797	296.0	3.143	3.114	5.634	4.377	1.260	2.819	1.558	3.473
7:10:31	311.1	0.639	72.5	4.776	11.78	43.8296	296.9	3.150	3.121	5.641	4.387	1.263	2.825	1.562	3.473
7:13:31	311.7	0.645	72.4	4.771	11.89	43.8802	297.4	3.152	3.122	5.642	4.396	1.271	2.833	1.563	3.459
7:16:29	311.9	0.650	72.4	4.765	11.99	43.9311	297.7	3.151	3.121	5.641	4.392	1.268	2.830	1.562	3.463
7:19:30	312.6	0.656	72.4	4.760	12.09	43.9821	298.3	3.154	3.124	5.644	4.397	1.270	2.833	1.563	3.462

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values		Tested By	KDG	Project Number	175569069
Height	5.414 (in.)	13.752 (cm)		Height	4.479 (in.)	Date	12-19-09	Test Number	CU-4B
Diameter	2.762 (in)	7.016 (cm)		Dia. avg.	3.179 (in)	Press No.	2	Data File ID	4BB
Area	5.993 (in²)	38.665 (cm²)		Area avg.	7.935 (in²)	Panel No.	D	Lateral Pressure (psi)	35.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
7:22:23	313.5	0.661	72.3	4.754	12.19	44.0328	299.3	3.160	3.130	5.650	4.406	1.274	2.840	1.566	3.459
7:25:21	313.8	0.667	72.1	4.749	12.29	44.0840	299.6	3.160	3.129	5.649	4.419	1.288	2.853	1.566	3.432
7:28:17	314.1	0.672	72.3	4.743	12.39	44.1345	299.9	3.160	3.129	5.649	4.406	1.275	2.841	1.566	3.457
7:31:15	314.9	0.678	72.2	4.738	12.50	44.1859	300.7	3.164	3.133	5.653	4.419	1.284	2.851	1.568	3.443
7:34:08	314.9	0.683	72.0	4.732	12.60	44.2370	300.7	3.161	3.129	5.649	4.430	1.298	2.864	1.566	3.413
7:37:04	315.2	0.689	72.1	4.727	12.70	44.2890	301.0	3.160	3.129	5.649	4.418	1.286	2.852	1.566	3.434
7:40:04	316.0	0.694	72.1	4.721	12.80	44.3407	301.8	3.165	3.133	5.653	4.426	1.291	2.859	1.568	3.429
7:43:00	316.6	0.700	72.0	4.716	12.90	44.3919	302.4	3.167	3.135	5.655	4.437	1.299	2.868	1.569	3.416
7:45:51	316.9	0.705	72.0	4.710	13.00	44.4436	302.7	3.167	3.135	5.655	4.432	1.295	2.864	1.569	3.422
7:48:46	317.5	0.711	72.0	4.705	13.10	44.4955	303.2	3.169	3.136	5.656	4.437	1.298	2.868	1.569	3.418
7:51:39	317.5	0.716	71.9	4.699	13.21	44.5479	303.3	3.166	3.132	5.652	4.439	1.303	2.871	1.568	3.405
7:54:30	318.0	0.722	71.2	4.694	13.31	44.5999	303.7	3.167	3.133	5.653	4.487	1.351	2.919	1.568	3.321
7:57:21	318.0	0.727	71.9	4.688	13.41	44.6521	303.8	3.163	3.130	5.650	4.435	1.302	2.869	1.566	3.405
8:00:12	318.4	0.733	71.8	4.683	13.51	44.7047	304.2	3.164	3.130	5.650	4.442	1.309	2.875	1.566	3.393
8:03:02	319.1	0.738	71.7	4.677	13.61	44.7576	304.9	3.168	3.133	5.653	4.452	1.316	2.884	1.568	3.384
8:05:48	318.9	0.744	71.8	4.672	13.71	44.8099	304.7	3.161	3.127	5.647	4.439	1.309	2.874	1.565	3.391
8:08:37	319.4	0.749	71.8	4.666	13.82	44.8629	305.2	3.163	3.129	5.649	4.445	1.313	2.879	1.566	3.384
8:11:25	319.7	0.755	71.7	4.661	13.92	44.9156	305.5	3.163	3.128	5.648	4.450	1.320	2.885	1.565	3.372
8:14:13	320.8	0.760	71.5	4.655	14.02	44.9689	306.6	3.170	3.135	5.655	4.473	1.335	2.904	1.569	3.351
8:17:02	320.5	0.766	71.7	4.650	14.12	45.0219	306.3	3.164	3.129	5.649	4.449	1.318	2.883	1.566	3.376
8:19:47	320.9	0.771	71.6	4.644	14.22	45.0754	306.7	3.164	3.128	5.648	4.455	1.323	2.889	1.566	3.366
8:22:33	321.3	0.777	71.5	4.639	14.32	45.1290	307.1	3.164	3.128	5.648	4.461	1.330	2.896	1.566	3.354
8:25:22	321.4	0.782	71.6	4.633	14.43	45.1825	307.2	3.161	3.125	5.645	4.451	1.323	2.887	1.564	3.363
8:28:07	321.7	0.788	71.6	4.628	14.53	45.2362	307.5	3.161	3.124	5.644	4.455	1.328	2.891	1.564	3.355
8:30:53	322.0	0.793	71.5	4.622	14.63	45.2899	307.7	3.160	3.123	5.643	4.458	1.332	2.895	1.563	3.346
8:33:39	321.9	0.799	71.1	4.617	14.73	45.3440	307.7	3.156	3.119	5.639	4.485	1.363	2.924	1.561	3.290
8:36:27	322.9	0.804	71.6	4.611	14.83	45.3978	308.6	3.161	3.124	5.644	4.455	1.328	2.891	1.563	3.355
8:39:13	323.5	0.810	71.5	4.606	14.93	45.4519	309.3	3.164	3.126	5.646	4.464	1.334	2.899	1.565	3.345
8:41:57	322.8	0.815	71.3	4.600	15.04	45.5069	308.6	3.153	3.116	5.636	4.461	1.343	2.902	1.559	3.322
8:44:40	323.5	0.821	71.5	4.595	15.14	45.5609	309.2	3.156	3.118	5.638	4.454	1.333	2.893	1.561	3.342
8:47:28	322.7	0.826	71.4	4.589	15.24	45.6159	308.5	3.144	3.106	5.626	4.446	1.337	2.892	1.555	3.325
8:50:16	322.5	0.832	71.3	4.584	15.34	45.6708	308.3	3.139	3.101	5.621	4.447	1.344	2.896	1.552	3.309
8:53:02	322.7	0.837	71.0	4.578	15.44	45.7252	308.5	3.137	3.098	5.618	4.467	1.366	2.916	1.551	3.271
8:55:48	322.5	0.843	71.3	4.573	15.54	45.7801	308.3	3.131	3.092	5.612	4.439	1.344	2.891	1.547	3.303
8:58:34	322.9	0.848	71.3	4.567	15.64	45.8354	308.7	3.132	3.092	5.612	4.444	1.349	2.897	1.548	3.294
9:01:22	323.2	0.854	71.2	4.562	15.75	45.8908	308.9	3.130	3.091	5.611	4.449	1.356	2.902	1.547	3.282
9:04:08	323.3	0.859	71.2	4.556	15.85	45.9458	309.1	3.128	3.088	5.608	4.442	1.351	2.896	1.546	3.289
9:06:54	323.7	0.865	71.3	4.551	15.95	46.0012	309.5	3.128	3.088	5.608	4.441	1.350	2.896	1.546	3.290
9:09:44	324.3	0.870	71.2	4.545	16.05	46.0569	310.1	3.131	3.091	5.611	4.448	1.354	2.901	1.547	3.285
9:12:30	323.7	0.876	71.0	4.540	16.15	46.1127	309.4	3.120	3.080	5.600	4.453	1.371	2.912	1.541	3.249
9:15:16	323.7	0.881	71.3	4.534	16.25	46.1687	309.5	3.118	3.077	5.597	4.428	1.348	2.888	1.540	3.285
9:18:07	324.2	0.887	71.2	4.529	16.35	46.2247	310.0	3.118	3.078	5.598	4.433	1.353	2.893	1.540	3.277
9:20:57	324.9	0.892	71.1	4.523	16.46	46.2811	310.7	3.121	3.080	5.600	4.442	1.359	2.900	1.541	3.269
9:23:51	325.9	0.898	71.2	4.518	16.56	46.3374	311.7	3.128	3.086	5.606	4.442	1.353	2.898	1.545	3.283
9:26:41	325.8	0.903	71.2	4.512	16.66	46.3939	311.6	3.123	3.082	5.602	4.439	1.354	2.897	1.542	3.277
9:29:32	325.6	0.909	71.1	4.507	16.76	46.4504	311.4	3.118	3.076	5.596	4.437	1.358	2.898	1.539	3.266
9:32:23	325.6	0.914	70.9	4.501	16.86	46.5074	311.4	3.113	3.071	5.591	4.452	1.379	2.915	1.537	3.230
9:35:09	325.6	0.920	71.2	4.496	16.96	46.5640	311.4	3.110	3.067	5.587	4.424	1.353	2.889	1.535	3.268
9:38:02	325.6	0.925	71.1	4.490	17.07	46.6219	311.4	3.106	3.063	5.583	4.425	1.359	2.892	1.533	3.256
9:40:52	325.9	0.931	71.1	4.485	17.17	46.6787	311.7	3.105	3.062	5.582	4.429	1.364	2.896	1.532	3.246
9:43:41	325.9	0.936	71.2	4.479	17.27	46.7358	311.7	3.101	3.058	5.578	4.415	1.354	2.885	1.530	3.260

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values		Tested By	KDG	Project Number	175569069
Height	5.839 (in.)	14.832 (cm)		Height	4.765 (in.)	Date	12-15-09	Test Number	CU-4C
Diameter	2.743 (in)	6.967 (cm)		Dia. avg.	3.195 (in)	Press No.	1	Data File ID	4C
Area	5.908 (in²)	38.117 (cm²)		Area avg.	8.017 (in²)	Panel No.	C	Lateral Pressure (psi)	45.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Aree (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	12.5	-0.019	45.1	5.839	0.00	38.1171	0.0	0.000	0.000	3.240	3.240	3.233	3.236	0.004	1.002
0:05:59	21.1	-0.013	45.9	5.833	0.10	38.1562	8.6	0.105	0.104	3.344	3.285	3.173	3.229	0.056	1.035
0:12:18	68.3	-0.007	50.1	5.827	0.20	38.1938	55.8	0.679	0.679	3.919	3.555	2.870	3.213	0.343	1.239
0:19:09	117.6	-0.001	53.6	5.822	0.30	38.2318	105.1	1.278	1.277	4.517	3.903	2.618	3.261	0.642	1.491
0:25:03	143.4	0.005	55.9	5.816	0.40	38.2712	130.9	1.590	1.589	4.829	4.049	2.453	3.251	0.798	1.651
0:30:40	159.3	0.010	58.0	5.810	0.50	38.3089	146.8	1.782	1.780	5.020	4.092	2.305	3.198	0.894	1.776
0:36:17	171.7	0.016	59.8	5.804	0.60	38.3474	159.2	1.930	1.929	5.169	4.112	2.176	3.144	0.968	1.890
0:41:38	181.4	0.022	61.2	5.798	0.70	38.3860	168.8	2.045	2.043	5.283	4.125	2.074	3.099	1.025	1.989
0:47:14	189.5	0.028	62.7	5.792	0.80	38.4250	177.0	2.142	2.140	5.380	4.112	1.965	3.038	1.073	2.092
0:52:39	196.0	0.034	63.8	5.787	0.90	38.4634	183.5	2.218	2.216	5.456	4.111	1.888	2.999	1.111	2.178
0:57:57	201.5	0.040	64.8	5.781	1.00	38.5023	188.9	2.282	2.279	5.519	4.100	1.813	2.957	1.143	2.261
1:03:27	207.5	0.045	65.7	5.775	1.10	38.5418	194.9	2.352	2.349	5.589	4.107	1.751	2.929	1.178	2.345
1:08:52	212.1	0.051	66.2	5.769	1.20	38.5806	199.5	2.405	2.402	5.642	4.121	1.712	2.917	1.204	2.407
1:14:21	216.1	0.057	67.0	5.763	1.30	38.6193	203.6	2.451	2.448	5.688	4.108	1.653	2.880	1.227	2.485
1:19:36	220.2	0.063	67.5	5.757	1.40	38.6585	207.7	2.498	2.495	5.735	4.119	1.617	2.868	1.251	2.547
1:25:17	224.4	0.069	68.2	5.752	1.50	38.6979	211.9	2.546	2.542	5.782	4.118	1.569	2.844	1.275	2.625
1:30:51	227.9	0.075	68.5	5.746	1.60	38.7371	215.3	2.585	2.581	5.821	4.137	1.549	2.843	1.294	2.670
1:36:37	231.1	0.081	69.0	5.740	1.70	38.7769	218.5	2.621	2.616	5.856	4.139	1.516	2.827	1.312	2.731
1:42:21	234.6	0.086	69.3	5.734	1.80	38.8160	222.0	2.660	2.655	5.895	4.152	1.490	2.821	1.331	2.787
1:47:55	237.7	0.092	69.5	5.728	1.90	38.8557	225.2	2.695	2.690	5.930	4.173	1.476	2.824	1.349	2.828
1:53:43	240.6	0.098	69.9	5.722	2.00	38.8952	228.0	2.726	2.721	5.961	4.174	1.446	2.810	1.364	2.887
1:59:32	243.1	0.104	70.1	5.717	2.10	38.9351	230.6	2.754	2.749	5.989	4.192	1.436	2.814	1.378	2.919
2:05:05	246.7	0.110	70.4	5.711	2.20	38.9749	234.1	2.793	2.788	6.028	4.203	1.408	2.806	1.397	2.984
2:10:35	248.9	0.115	70.5	5.705	2.30	39.0146	236.3	2.817	2.811	6.051	4.221	1.403	2.812	1.409	3.009
2:16:08	251.3	0.121	70.7	5.699	2.40	39.0546	238.7	2.842	2.836	6.076	4.232	1.388	2.810	1.422	3.048
2:21:34	254.1	0.127	70.9	5.693	2.50	39.0946	241.5	2.873	2.866	6.106	4.252	1.378	2.815	1.437	3.085
2:27:09	256.5	0.133	70.9	5.687	2.60	39.1352	243.9	2.898	2.892	6.132	4.275	1.377	2.826	1.449	3.106
2:32:47	258.6	0.139	71.1	5.682	2.70	39.1750	246.0	2.920	2.914	6.154	4.280	1.360	2.820	1.460	3.148
2:38:20	261.0	0.145	71.2	5.676	2.80	39.2153	248.4	2.946	2.939	6.179	4.303	1.357	2.830	1.473	3.171
2:44:04	263.5	0.151	71.4	5.670	2.90	39.2560	251.0	2.973	2.966	6.206	4.315	1.342	2.828	1.486	3.215
2:49:45	265.8	0.156	71.3	5.664	3.00	39.2964	253.2	2.997	2.989	6.229	4.339	1.343	2.841	1.498	3.231
2:55:20	267.6	0.162	71.4	5.658	3.10	39.3368	255.0	3.015	3.007	6.247	4.350	1.337	2.843	1.507	3.255
3:00:54	270.0	0.168	71.5	5.652	3.20	39.3774	257.4	3.040	3.032	6.272	4.373	1.335	2.854	1.519	3.277
3:06:39	272.1	0.174	71.4	5.646	3.30	39.4183	259.6	3.062	3.054	6.294	4.398	1.337	2.867	1.530	3.290
3:12:13	274.0	0.180	71.6	5.641	3.40	39.4590	261.5	3.082	3.073	6.313	4.406	1.326	2.866	1.540	3.322
3:17:54	275.8	0.186	71.5	5.635	3.50	39.5003	263.3	3.100	3.091	6.331	4.429	1.331	2.880	1.549	3.327
3:23:30	278.5	0.191	71.7	5.629	3.60	39.5408	266.0	3.128	3.119	6.359	4.443	1.318	2.880	1.563	3.372
3:28:58	280.3	0.197	71.6	5.623	3.70	39.5820	267.8	3.146	3.137	6.377	4.470	1.326	2.898	1.572	3.370
3:34:30	282.1	0.203	71.6	5.617	3.80	39.6230	269.5	3.163	3.153	6.393	4.484	1.323	2.903	1.580	3.389
3:40:01	284.2	0.209	71.6	5.611	3.90	39.6643	271.7	3.185	3.175	6.415	4.505	1.323	2.914	1.591	3.405
3:45:31	286.1	0.215	71.5	5.606	4.00	39.7056	273.6	3.204	3.194	6.434	4.531	1.330	2.930	1.600	3.407
3:50:55	287.9	0.221	71.6	5.600	4.10	39.7476	275.4	3.222	3.211	6.451	4.540	1.322	2.931	1.609	3.435
3:56:13	289.7	0.226	71.6	5.594	4.20	39.7886	277.1	3.239	3.228	6.468	4.563	1.328	2.946	1.618	3.435
4:01:43	291.4	0.232	71.6	5.588	4.30	39.8304	278.8	3.255	3.244	6.484	4.576	1.324	2.950	1.626	3.455
4:07:04	293.3	0.238	71.5	5.582	4.40	39.8721	280.7	3.274	3.263	6.503	4.601	1.330	2.966	1.635	3.458
4:12:23	294.7	0.244	71.5	5.576	4.50	39.9136	282.2	3.287	3.276	6.516	4.617	1.335	2.976	1.641	3.460
4:17:47	296.9	0.250	71.5	5.571	4.60	39.9555	284.4	3.310	3.298	6.538	4.639	1.333	2.986	1.653	3.479
4:23:15	298.7	0.256	71.3	5.565	4.70	39.9974	286.1	3.326	3.315	6.555	4.665	1.343	3.004	1.661	3.473
4:28:41	300.2	0.261	71.4	5.559	4.80	40.0393	287.6	3.340	3.328	6.568	4.673	1.338	3.006	1.668	3.493
4:34:08	302.2	0.267	71.3	5.553	4.90	40.0814	289.7	3.360	3.348	6.588	4.699	1.344	3.022	1.678	3.496
4:39:38	303.9	0.273	71.4	5.547	5.00	40.1237	291.4	3.377	3.364	6.604	4.712	1.340	3.026	1.686	3.515
4:45:08	305.1	0.279	71.2	5.541	5.10	40.1661	292.6	3.387	3.374	6.614	4.733	1.351	3.042	1.691	3.502
4:50:28	306.8	0.285	71.2	5.535	5.20	40.2085	294.2	3.402	3.389	6.629	4.747	1.351	3.049	1.698	3.515
4:55:56	308.6	0.291	71.2	5.530	5.30	40.2508	296.0	3.420	3.406	6.646	4.768	1.355	3.061	1.707	3.520
5:01:29	309.7	0.297	71.1	5.524	5.40	40.2932	297.2	3.429	3.416	6.656	4.784	1.361	3.073	1.711	3.514
5:06:55	311.1	0.302	71.0	5.518	5.50	40.3362	298.5	3.442	3.428	6.668	4.800	1.365	3.083	1.717	3.516
5:12:29	312.9	0.308	70.9	5.512	5.60	40.3787	300.4	3.459	3.445	6.685	4.829	1.377	3.103	1.726	3.507
5:18:08	314.5	0.314	71.0	5.506	5.70	40.4217	302.0	3.474	3.459	6.699	4.837	1.371	3.104	1.733	3.529
5:23:34	315.8	0.320	70.8	5.500	5.80	40.4645	303.2	3.485	3.470	6.710	4.860	1.382	3.121	1.739	3.515
5:29:09	317.5	0.326	70.9	5.495	5.90	40.5074	304.9	3.501	3.486	6.726	4.871	1.379	3.125	1.746	3.534

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.839 (in.)	14.832 (cm)	Height	4.765 (in.)	Date	12-15-09	Test Number	CU-4C
Diameter	2.743 (in)	6.967 (cm)	Dia. avg.	3.195 (in)	Press No.	1	Data File ID	4C
Area	5.908 (in^2)	38.117 (cm^2)	Area avg.	8.017 (in^2)	Panel No.	C	Lateral Pressure (psi)	45.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
5:34:59	318.6	0.332	70.7	5.489	6.00	40.5506	306.1	3.510	3.494	6.734	4.890	1.388	3.139	1.751	3.523
5:40:47	320.1	0.337	70.8	5.483	6.10	40.5939	307.5	3.523	3.508	6.748	4.899	1.385	3.142	1.757	3.538
5:46:28	321.4	0.343	70.6	5.477	6.20	40.6372	308.9	3.534	3.519	6.759	4.922	1.396	3.159	1.763	3.526
5:52:11	323.1	0.349	70.6	5.471	6.30	40.6804	310.5	3.549	3.534	6.774	4.936	1.396	3.166	1.770	3.537
5:58:02	324.2	0.355	70.5	5.465	6.40	40.7239	311.6	3.558	3.542	6.782	4.954	1.405	3.179	1.775	3.527
6:03:47	325.5	0.361	70.4	5.460	6.50	40.7674	313.0	3.570	3.553	6.793	4.969	1.409	3.189	1.780	3.527
6:09:24	327.3	0.367	70.4	5.454	6.60	40.8113	314.7	3.586	3.569	6.809	4.990	1.414	3.202	1.788	3.529
6:15:15	328.5	0.372	70.1	5.448	6.70	40.8549	315.9	3.596	3.579	6.819	5.020	1.434	3.227	1.793	3.500
6:21:05	329.8	0.378	70.2	5.442	6.80	40.8988	317.3	3.607	3.590	6.830	5.020	1.423	3.222	1.799	3.528
6:26:40	330.9	0.384	70.0	5.436	6.90	40.9430	318.3	3.616	3.598	6.838	5.045	1.440	3.243	1.803	3.504
6:32:24	332.4	0.390	70.1	5.430	7.00	40.9868	319.9	3.629	3.611	6.851	5.053	1.435	3.244	1.809	3.522
6:38:09	333.6	0.396	69.9	5.425	7.10	41.0309	321.0	3.638	3.620	6.860	5.072	1.445	3.259	1.814	3.511
6:43:53	334.7	0.402	69.9	5.419	7.20	41.0750	322.2	3.647	3.629	6.869	5.081	1.445	3.263	1.818	3.517
6:49:35	336.0	0.407	69.8	5.413	7.30	41.1193	323.4	3.658	3.639	6.879	5.101	1.454	3.278	1.823	3.507
6:55:27	337.5	0.413	69.9	5.407	7.40	41.1639	325.0	3.671	3.652	6.892	5.110	1.451	3.280	1.830	3.523
7:01:16	338.3	0.419	69.7	5.401	7.50	41.2083	325.8	3.676	3.657	6.897	5.128	1.463	3.295	1.832	3.504
7:07:04	339.1	0.425	69.6	5.395	7.60	41.2528	326.6	3.681	3.662	6.902	5.135	1.466	3.300	1.835	3.503
7:12:49	340.8	0.431	69.5	5.390	7.70	41.2974	328.3	3.697	3.677	6.917	5.157	1.472	3.315	1.842	3.502
7:18:37	341.8	0.437	69.5	5.384	7.80	41.3425	329.2	3.703	3.684	6.924	5.164	1.474	3.319	1.845	3.504
7:24:14	342.6	0.443	69.4	5.378	7.90	41.3872	330.1	3.709	3.689	6.929	5.179	1.483	3.331	1.848	3.492
7:29:56	343.8	0.448	69.2	5.372	8.00	41.4321	331.2	3.717	3.697	6.937	5.205	1.501	3.353	1.852	3.468
7:35:41	345.0	0.454	69.3	5.366	8.10	41.4774	332.5	3.727	3.707	6.947	5.205	1.491	3.348	1.857	3.491
7:41:24	345.9	0.460	69.1	5.360	8.20	41.5225	333.3	3.733	3.712	6.952	5.221	1.502	3.362	1.859	3.476
7:47:00	346.6	0.466	69.1	5.354	8.30	41.5677	334.1	3.737	3.716	6.956	5.226	1.503	3.365	1.862	3.477
7:52:35	348.0	0.472	69.0	5.349	8.40	41.6133	335.5	3.749	3.727	6.967	5.245	1.510	3.377	1.867	3.473
7:58:16	349.4	0.478	69.1	5.343	8.50	41.6585	336.9	3.760	3.739	6.979	5.254	1.508	3.381	1.873	3.485
8:03:49	350.1	0.483	68.9	5.337	8.60	41.7043	337.5	3.764	3.742	6.982	5.269	1.520	3.394	1.874	3.467
8:09:18	351.6	0.489	69.0	5.331	8.70	41.7500	339.0	3.776	3.754	6.994	5.277	1.516	3.396	1.881	3.482
8:14:52	352.6	0.495	68.8	5.325	8.80	41.7959	340.0	3.783	3.761	7.001	5.294	1.526	3.410	1.884	3.468
8:20:23	353.2	0.501	68.7	5.319	8.90	41.8416	340.7	3.786	3.764	7.004	5.304	1.534	3.419	1.885	3.459
8:25:52	354.5	0.507	68.7	5.314	9.00	41.8876	341.9	3.796	3.773	7.013	5.317	1.536	3.426	1.890	3.460
8:31:34	355.7	0.513	68.5	5.308	9.10	41.9337	343.2	3.805	3.782	7.022	5.337	1.547	3.442	1.895	3.449
8:37:14	356.6	0.519	68.6	5.302	9.20	41.9803	344.0	3.811	3.788	7.028	5.338	1.544	3.441	1.897	3.458
8:42:43	357.3	0.524	68.4	5.296	9.30	42.0262	344.8	3.815	3.792	7.032	5.354	1.555	3.455	1.899	3.443
8:48:33	358.2	0.530	68.4	5.290	9.40	42.0729	345.6	3.820	3.796	7.036	5.355	1.552	3.454	1.902	3.451
8:54:16	358.9	0.536	68.3	5.284	9.50	42.1195	346.4	3.824	3.800	7.040	5.370	1.563	3.466	1.903	3.436
8:59:49	359.7	0.542	68.3	5.279	9.60	42.1656	347.1	3.828	3.804	7.044	5.375	1.564	3.470	1.905	3.436
9:05:35	360.8	0.548	68.2	5.273	9.70	42.2126	348.3	3.837	3.812	7.052	5.392	1.573	3.482	1.910	3.428
9:11:16	362.0	0.553	68.2	5.267	9.80	42.2591	349.5	3.845	3.821	7.061	5.400	1.573	3.487	1.914	3.434
9:17:03	362.8	0.559	68.0	5.261	9.90	42.3062	350.2	3.849	3.824	7.064	5.412	1.581	3.496	1.916	3.424
9:22:46	363.6	0.565	67.9	5.255	10.00	42.3534	351.1	3.855	3.829	7.069	5.431	1.595	3.513	1.918	3.406
9:28:27	364.9	0.571	68.0	5.249	10.10	42.4001	352.4	3.864	3.839	7.079	5.433	1.587	3.510	1.923	3.424
9:34:18	365.3	0.577	67.8	5.244	10.20	42.4474	352.7	3.864	3.838	7.078	5.443	1.598	3.520	1.923	3.407
9:40:05	365.9	0.583	67.8	5.238	10.30	42.4946	353.4	3.867	3.841	7.081	5.447	1.599	3.523	1.924	3.406
9:45:56	367.3	0.589	67.7	5.232	10.40	42.5421	354.7	3.877	3.851	7.091	5.463	1.605	3.534	1.929	3.404
9:51:53	367.8	0.594	67.7	5.226	10.50	42.5900	355.3	3.879	3.852	7.092	5.462	1.602	3.532	1.930	3.409
9:57:37	368.2	0.600	67.6	5.220	10.60	42.6375	355.7	3.879	3.852	7.092	5.473	1.614	3.543	1.930	3.391
10:03:29	369.2	0.606	67.6	5.214	10.70	42.6852	356.6	3.885	3.858	7.098	5.475	1.609	3.542	1.933	3.401
10:09:22	369.9	0.612	67.5	5.208	10.80	42.7332	357.4	3.889	3.862	7.102	5.490	1.621	3.555	1.934	3.387
10:15:15	371.0	0.618	67.5	5.203	10.90	42.7810	358.5	3.897	3.869	7.109	5.497	1.621	3.559	1.938	3.392
10:21:02	371.8	0.624	67.4	5.197	11.00	42.8295	359.2	3.900	3.872	7.112	5.509	1.630	3.570	1.940	3.380
10:26:57	372.4	0.629	67.3	5.191	11.10	42.8771	359.9	3.903	3.875	7.115	5.515	1.634	3.574	1.941	3.376
10:32:40	373.1	0.635	67.3	5.185	11.20	42.9254	360.5	3.905	3.877	7.117	5.522	1.637	3.579	1.942	3.372
10:38:30	373.2	0.641	67.0	5.179	11.30	42.9738	360.6	3.902	3.874	7.114	5.533	1.653	3.593	1.940	3.348
10:44:22	374.2	0.647	67.2	5.173	11.40	43.0223	361.7	3.909	3.880	7.120	5.530	1.643	3.586	1.944	3.366
10:50:11	374.7	0.653	67.0	5.168	11.50	43.0712	362.1	3.910	3.881	7.121	5.541	1.653	3.597	1.944	3.352
10:56:00	374.9	0.659	67.1	5.162	11.60	43.1198	362.4	3.908	3.879	7.119	5.537	1.652	3.594	1.943	3.353
11:01:41	375.5	0.664	66.9	5.156	11.70	43.1689	362.9	3.910	3.880	7.120	5.548	1.661	3.604	1.944	3.341
11:07:31	376.0	0.670	67.0	5.150	11.80	43.2179	363.5	3.911	3.881	7.121	5.544	1.656	3.600	1.944	3.348
11:13:15	376.7	0.676	66.9	5.144	11.90	43.2669	364.2	3.914	3.884	7.124	5.556	1.665	3.611	1.946	3.337

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175569069
Height	5.839 (in.)	14.832 (cm)	Height	4.765 (in.)	Date	12-15-09	Test Number	CU-4C
Diameter	2.743 (in)	6.967 (cm)	Dia. avg.	3.195 (in)	Press No.	1	Data File ID	4C
Area	5.908 (in^2)	38.117 (cm^2)	Area avg.	8.017 (in^2)	Panel No.	C	Lateral Pressure (psi)	45.0
							Chamber Pressure - σ_3 (psi)	90

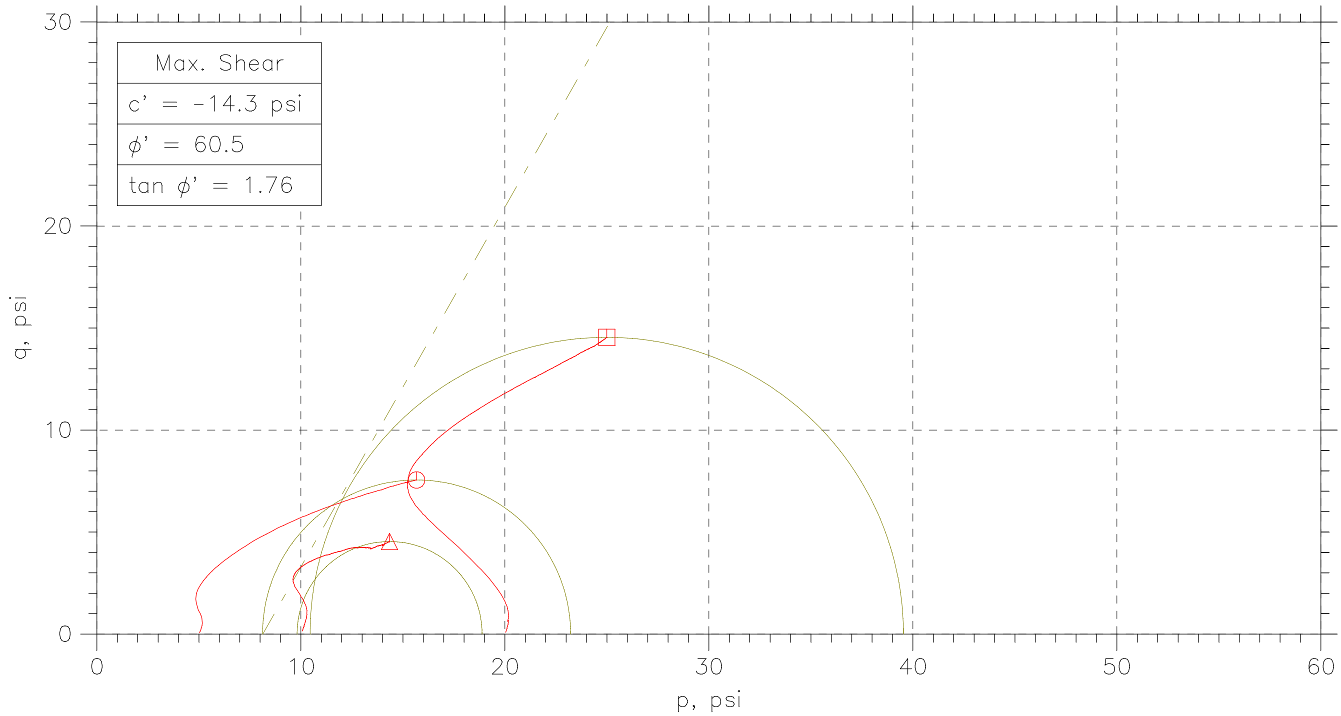
Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
11:18:58	376.9	0.682	66.9	5.138	12.00	43.3162	364.3	3.911	3.881	7.121	5.554	1.666	3.610	1.944	3.333
11:24:34	378.0	0.688	66.8	5.133	12.10	43.3651	365.5	3.919	3.888	7.128	5.567	1.672	3.620	1.948	3.330
11:30:21	378.5	0.694	66.7	5.127	12.20	43.4146	365.9	3.919	3.889	7.129	5.571	1.675	3.623	1.948	3.325
11:35:57	379.1	0.700	66.7	5.121	12.30	43.4643	366.5	3.921	3.890	7.130	5.577	1.680	3.629	1.949	3.319
11:41:47	380.2	0.705	66.5	5.115	12.40	43.5139	367.6	3.929	3.897	7.137	5.595	1.691	3.643	1.952	3.309
11:47:35	380.7	0.711	66.6	5.109	12.50	43.5632	368.1	3.930	3.898	7.138	5.592	1.687	3.640	1.953	3.315
11:53:18	381.6	0.717	66.5	5.103	12.60	43.6135	369.0	3.934	3.902	7.142	5.603	1.694	3.649	1.955	3.308
11:58:59	382.1	0.723	66.5	5.098	12.70	43.6630	369.5	3.935	3.903	7.143	5.603	1.693	3.648	1.955	3.310
12:04:48	382.6	0.729	66.4	5.092	12.80	43.7137	370.1	3.937	3.905	7.145	5.612	1.701	3.657	1.956	3.300
12:10:25	383.4	0.735	66.4	5.086	12.90	43.7633	370.8	3.940	3.908	7.148	5.612	1.697	3.655	1.957	3.307
12:16:05	384.1	0.740	66.3	5.080	13.00	43.8137	371.5	3.943	3.910	7.150	5.625	1.707	3.666	1.959	3.294
12:21:46	385.3	0.746	66.3	5.074	13.10	43.8643	372.7	3.951	3.918	7.158	5.628	1.703	3.665	1.963	3.305
12:27:28	385.7	0.752	66.3	5.068	13.20	43.9146	373.1	3.951	3.918	7.158	5.634	1.709	3.671	1.962	3.297
12:33:15	385.8	0.758	66.2	5.062	13.30	43.9661	373.3	3.948	3.914	7.154	5.638	1.716	3.677	1.961	3.285
12:38:54	387.0	0.764	66.2	5.057	13.40	44.0161	374.4	3.956	3.922	7.162	5.644	1.715	3.680	1.964	3.290
12:44:31	387.2	0.770	66.0	5.051	13.50	44.0670	374.7	3.954	3.920	7.160	5.654	1.728	3.691	1.963	3.273
12:50:14	387.5	0.775	66.1	5.045	13.60	44.1183	375.0	3.952	3.918	7.158	5.647	1.722	3.684	1.962	3.280
12:55:51	388.1	0.781	66.0	5.039	13.70	44.1693	375.5	3.953	3.919	7.159	5.655	1.730	3.692	1.963	3.270
13:01:35	389.1	0.787	66.0	5.033	13.80	44.2205	376.5	3.959	3.925	7.165	5.656	1.724	3.690	1.966	3.280
13:07:24	389.3	0.793	65.9	5.027	13.90	44.2717	376.8	3.957	3.922	7.162	5.663	1.734	3.699	1.965	3.266
13:13:02	389.9	0.799	65.9	5.022	14.00	44.3233	377.4	3.959	3.924	7.164	5.663	1.732	3.697	1.965	3.269
13:18:55	390.7	0.805	65.9	5.016	14.10	44.3748	378.2	3.963	3.927	7.167	5.673	1.739	3.706	1.967	3.263
13:24:45	391.5	0.810	65.9	5.010	14.20	44.4267	379.0	3.967	3.931	7.171	5.674	1.736	3.705	1.969	3.268
13:30:28	391.9	0.816	65.7	5.004	14.30	44.4784	379.4	3.966	3.930	7.170	5.684	1.747	3.716	1.969	3.254
13:36:24	392.9	0.822	65.7	4.998	14.40	44.5303	380.4	3.972	3.936	7.176	5.689	1.746	3.718	1.971	3.258
13:42:12	393.8	0.828	65.7	4.992	14.50	44.5830	381.2	3.976	3.940	7.180	5.695	1.748	3.721	1.973	3.258
13:48:06	393.8	0.834	65.5	4.987	14.60	44.6347	381.3	3.972	3.936	7.176	5.704	1.761	3.733	1.971	3.239
13:54:02	394.4	0.840	65.6	4.981	14.70	44.6870	381.9	3.974	3.937	7.177	5.699	1.755	3.727	1.972	3.247
14:00:04	395.7	0.845	65.5	4.975	14.80	44.7394	383.2	3.982	3.945	7.185	5.714	1.762	3.738	1.976	3.243
14:06:01	396.1	0.851	65.6	4.969	14.90	44.7921	383.5	3.981	3.944	7.184	5.707	1.756	3.731	1.975	3.250
14:11:49	395.6	0.857	65.5	4.963	15.00	44.8449	383.1	3.972	3.934	7.174	5.708	1.767	3.738	1.971	3.231
14:17:44	396.5	0.863	65.6	4.957	15.10	44.8981	384.0	3.977	3.939	7.179	5.705	1.759	3.732	1.973	3.243
14:23:40	396.3	0.869	65.5	4.952	15.20	44.9505	383.8	3.970	3.931	7.171	5.706	1.767	3.737	1.969	3.229
14:29:30	396.2	0.875	65.5	4.946	15.30	45.0039	383.6	3.964	3.925	7.165	5.696	1.764	3.730	1.966	3.230
14:35:18	396.5	0.881	65.4	4.940	15.40	45.0570	384.0	3.963	3.924	7.164	5.703	1.772	3.737	1.965	3.219
14:41:11	396.8	0.886	65.4	4.934	15.50	45.1101	384.2	3.960	3.921	7.161	5.697	1.768	3.732	1.964	3.222
14:46:58	397.0	0.892	65.3	4.928	15.60	45.1636	384.5	3.959	3.919	7.159	5.702	1.776	3.739	1.963	3.211
14:52:51	396.5	0.898	65.3	4.922	15.70	45.2176	384.0	3.949	3.909	7.149	5.696	1.780	3.738	1.958	3.200
14:58:40	397.2	0.904	65.3	4.916	15.80	45.2711	384.6	3.951	3.911	7.151	5.698	1.780	3.739	1.959	3.202
15:04:34	397.5	0.910	65.1	4.911	15.90	45.3249	385.0	3.950	3.910	7.150	5.708	1.791	3.749	1.958	3.187
15:10:27	397.4	0.916	65.2	4.905	16.00	45.3788	384.8	3.944	3.903	7.143	5.694	1.783	3.739	1.955	3.193
15:16:13	397.8	0.921	65.1	4.899	16.10	45.4336	385.3	3.943	3.903	7.143	5.701	1.791	3.746	1.955	3.183
15:21:57	398.3	0.927	65.2	4.893	16.20	45.4872	385.7	3.943	3.902	7.142	5.695	1.786	3.741	1.955	3.189
15:27:49	398.1	0.933	65.1	4.887	16.30	45.5417	385.6	3.937	3.896	7.136	5.696	1.793	3.745	1.951	3.176
15:33:29	398.5	0.939	65.1	4.881	16.40	45.5966	386.0	3.936	3.895	7.135	5.693	1.791	3.742	1.951	3.179
15:39:14	399.4	0.945	65.1	4.876	16.50	45.6504	386.9	3.940	3.899	7.139	5.701	1.795	3.748	1.953	3.176
15:45:00	399.8	0.951	65.2	4.870	16.60	45.7052	387.3	3.940	3.898	7.138	5.694	1.789	3.741	1.953	3.183
15:50:41	399.6	0.956	65.0	4.864	16.70	45.7601	387.0	3.933	3.891	7.131	5.697	1.800	3.748	1.949	3.166
15:56:20	400.4	0.962	65.1	4.858	16.80	45.8158	387.8	3.936	3.894	7.134	5.697	1.795	3.746	1.951	3.173
16:01:55	400.9	0.968	65.0	4.852	16.90	45.8704	388.3	3.936	3.894	7.134	5.702	1.801	3.751	1.950	3.166
16:07:38	400.9	0.974	64.9	4.846	17.00	45.9256	388.4	3.932	3.889	7.129	5.707	1.811	3.759	1.948	3.152
16:13:11	401.6	0.980	65.0	4.841	17.10	45.9809	389.1	3.934	3.891	7.131	5.701	1.803	3.752	1.949	3.162
16:18:47	401.8	0.986	64.9	4.835	17.20	46.0365	389.2	3.931	3.888	7.128	5.705	1.810	3.757	1.948	3.152
16:24:29	402.1	0.991	64.9	4.829	17.30	46.0923	389.6	3.930	3.887	7.127	5.697	1.804	3.751	1.947	3.159
16:30:00	402.3	0.997	64.8	4.823	17.40	46.1485	389.8	3.927	3.883	7.123	5.703	1.812	3.757	1.945	3.147
16:35:34	403.0	1.003	64.9	4.817	17.50	46.2042	390.4	3.929	3.885	7.125	5.698	1.806	3.752	1.946	3.156
16:41:03	403.4	1.009	64.8	4.811	17.60	46.2600	390.9	3.929	3.885	7.125	5.704	1.812	3.758	1.946	3.147
16:46:37	403.0	1.015	64.8	4.805	17.70	46.3166	390.4	3.920	3.875	7.115	5.696	1.814	3.755	1.941	3.141
16:52:08	404.2	1.021	64.8	4.800	17.80	46.3728	391.7	3.927	3.882	7.122	5.704	1.815	3.760	1.945	3.143
16:57:36	405.0	1.027	64.7	4.794	17.90	46.4291	392.4	3.930	3.885	7.125	5.717	1.825	3.771	1.946	3.133

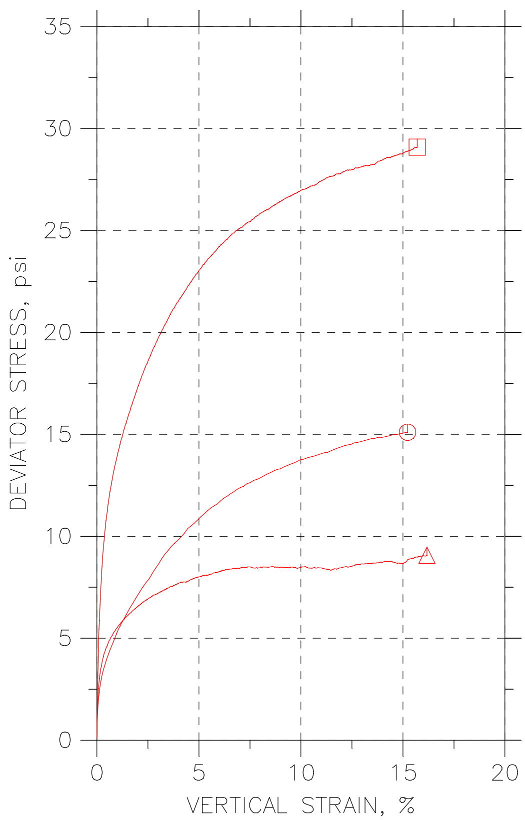
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values					
Height	5.839 (in.)	14.832 (cm)	Height	4.765 (in.)	Tested By	KDG	Project Number	175569069
Diameter	2.743 (in)	6.967 (cm)	Dia. avg.	3.195 (in)	Date	12-15-09	Test Number	CU-4C
Area	5.908 (in^2)	38.117 (cm^2)	Area avg.	8.017 (in^2)	Press No.	1	Data File ID	4C
					Panel No.	C	Lateral Pressure (psi)	45.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
17:03:06	404.7	1.032	64.8	4.788	18.00	46.4858	392.2	3.923	3.878	7.118	5.702	1.818	3.760	1.942	3.137
17:08:42	405.7	1.038	64.7	4.782	18.10	46.5424	393.1	3.928	3.882	7.122	5.710	1.821	3.766	1.945	3.136
17:14:29	405.6	1.044	64.8	4.776	18.20	46.5998	393.1	3.922	3.877	7.117	5.701	1.817	3.759	1.942	3.137
17:20:20	405.8	1.050	64.7	4.770	18.30	46.6564	393.3	3.919	3.873	7.113	5.703	1.823	3.763	1.940	3.128
17:28:02	405.8	1.056	64.8	4.765	18.40	46.7139	393.3	3.915	3.869	7.109	5.694	1.818	3.756	1.938	3.132

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		**STN-7**	**STN-7**	**STN-7**	
Test No.		1.1	1.2	1.3	
Depth		5.4-6.0	6.0-6.5	12.4-13.0	
Initial	Diameter, in	2.854	2.833	2.821	
	Height, in	6.257	5.698	6.337	
	Water Content, %	18.2	25.0	21.4	
	Dry Density, pcf	110.5	99.78	106.7	
	Saturation, %	93.3	98.0	99.8	
	Void Ratio	0.525	0.689	0.579	
Before Shear	Water Content, %	19.9	26.7	20.7	
	Dry Density, pcf	109.7	98.01	108.1	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.537	0.72	0.559	
	Back Press., psi	142	140.6	80.37	
Ver. Eff. Cons. Stress, psi		4.973	9.917	19.95	
Shear Strength, psi		7.551	4.534	14.54	
Strain at Failure, %		15.2	16.2	15.7	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.96	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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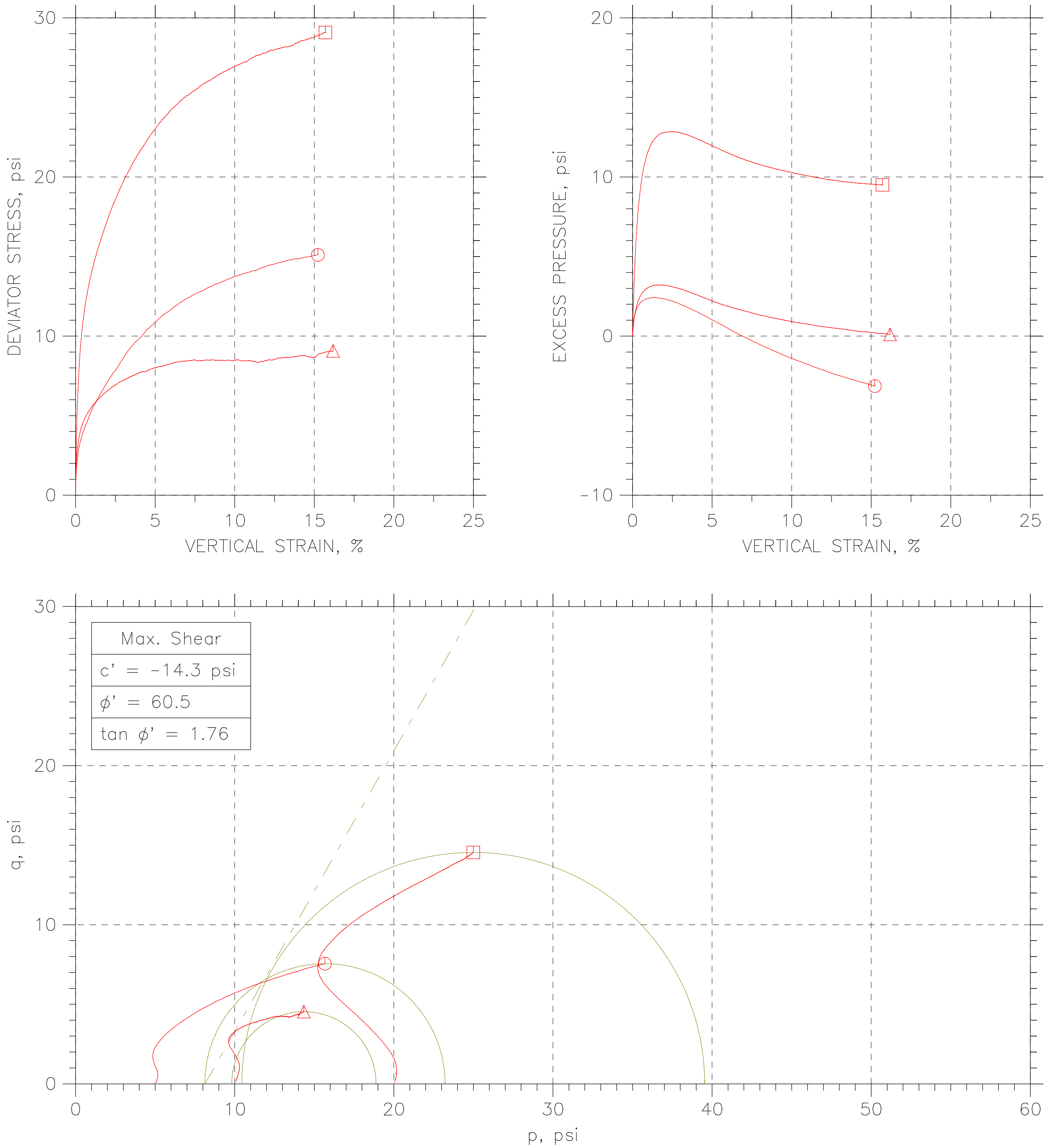
Project: Peabody Ash Pond
Location: ---
Project No.: GTX-1503
Boring No.: STN-7
Sample Type: UD
Description: Brown lean clay with sand
Remarks: System 1062

Fri, 04-DEC-2009 10:50:40

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-4	1.1	5.4-6.0	jm	11/5/09	mm		1503-1.1.dat
△	ST-4	1.2	6.0-6.5	JM	11/4/09	MM		1503-1.2.dat
□	STN-15	1.3	12.4-13.0	JM	11/4/09	MM		1503-1.3.dat

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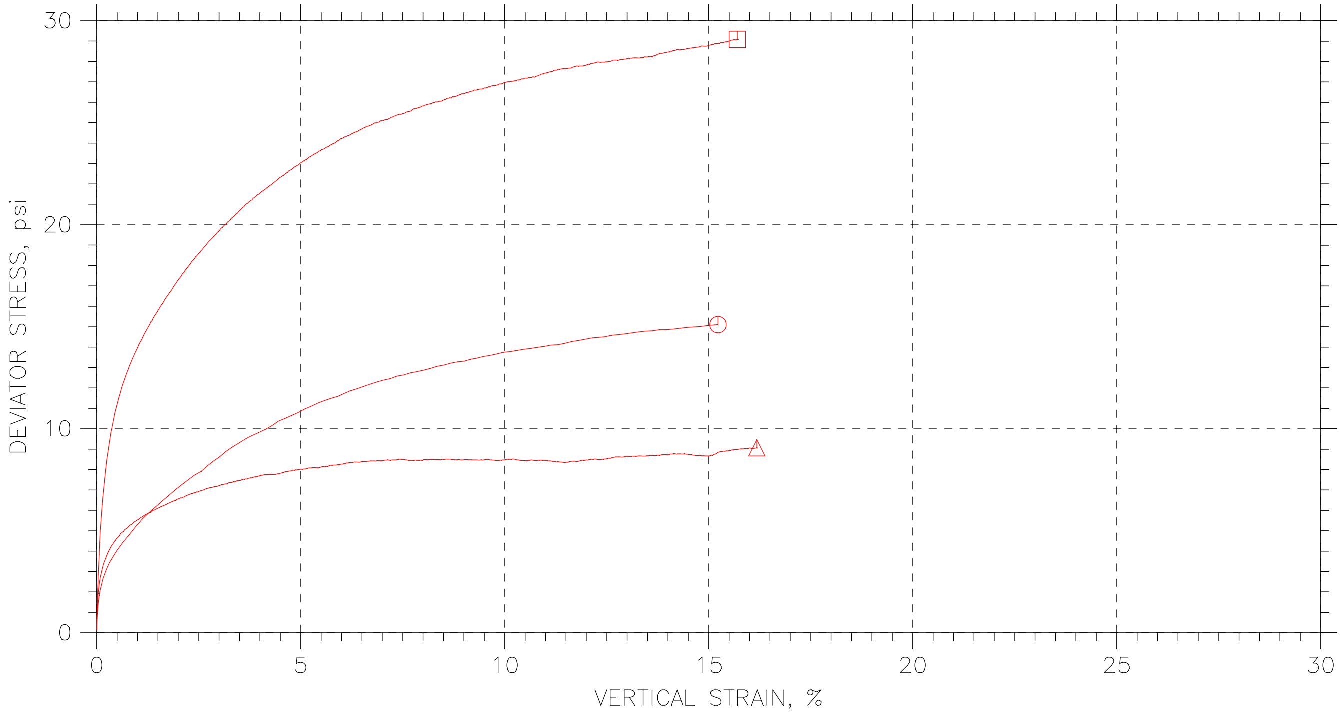
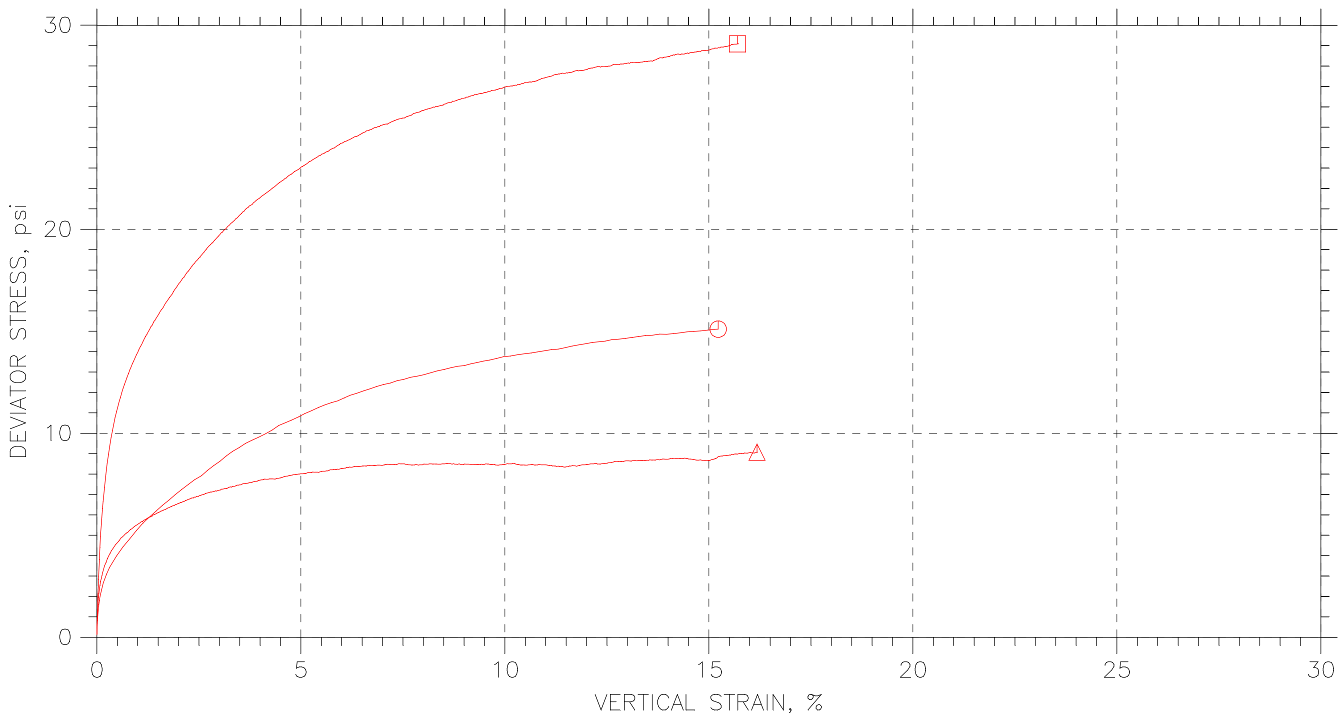
Project: Peabody Ash Pond	Location: ---	Project No.: GTX-1503
Boring No.: STN-7	Sample Type: UD	
Description: Brown lean clay with sand		
Remarks: System 1062		

Fri, 04-DEC-2009 10:50:41

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-4	1.1	5.4-6.0	jm	11/5/09	mm		1503-1.1.dat
△	ST-4	1.2	6.0-6.5	JM	11/4/09	MM		1503-1.2.dat
□	STN-15	1.3	12.4-13.0	JM	11/4/09	MM		1503-1.3.dat

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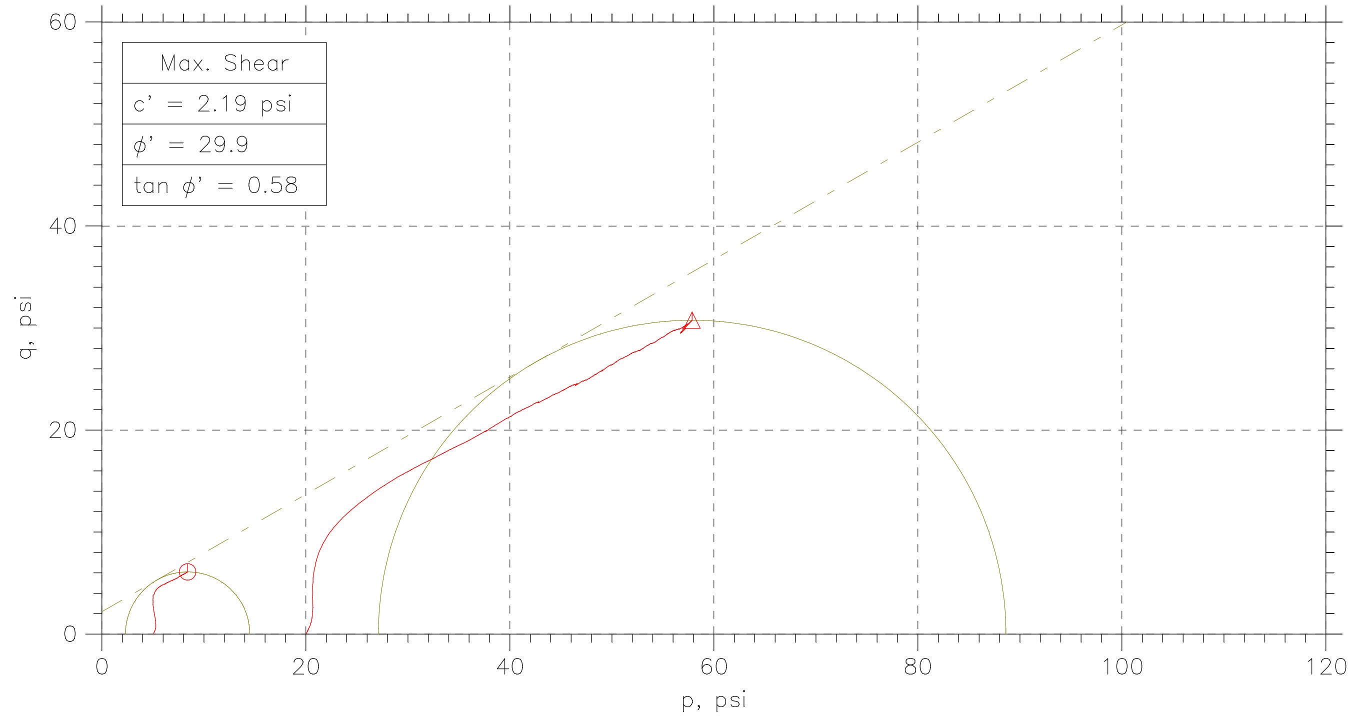
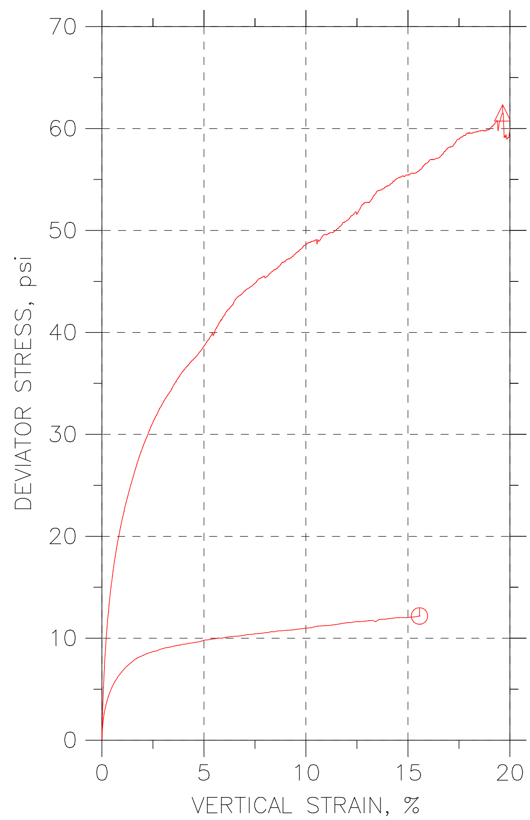
Project: Peabody Ash Pond	Location: ---	Project No.: GTX-1503
Boring No.: STN-7	Sample Type: UD	
Description: Brown lean clay with sand		
Remarks: System 1062		

Fri, 04-DEC-2009 10:50:42

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△		
Sample No.		**STN-15**	STN-15		
Test No.		2.1	2.3		
Depth		5.9-6.5	12.4-13.0		
Initial	Diameter, in	2.844	2.854		
	Height, in	5.513	5.668		
	Water Content, %	13.0	12.7		
	Dry Density, pcf	115.8	121.5		
	Saturation, %	76.9	88.5		
	Void Ratio	0.455	0.387		
Before Shear	Water Content, %	14.4	13.2		
	Dry Density, pcf	121.5	124.2		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.388	0.357		
	Back Press., psi	146.3	131		
Ver. Eff. Cons. Stress, psi		4.982	19.98		
Shear Strength, psi		6.092	30.76		
Strain at Failure, %		15.6	19.6		
Strain Rate, %/min		0.016	0.016		
B-Value		0.96	0.95		
Estimated Specific Gravity		2.7	2.7		
Liquid Limit		---	---		
Plastic Limit		---	---		

GeoTesting express, a subsidiary of Geocomp Corporation	Project: Peabody Ash Pond
	Location: ---
	Project No.: GTX-1503
	Boring No.: STN-15
	Sample Type: UD
	Description: Brown lean clay with sand
	Remarks: System 1062

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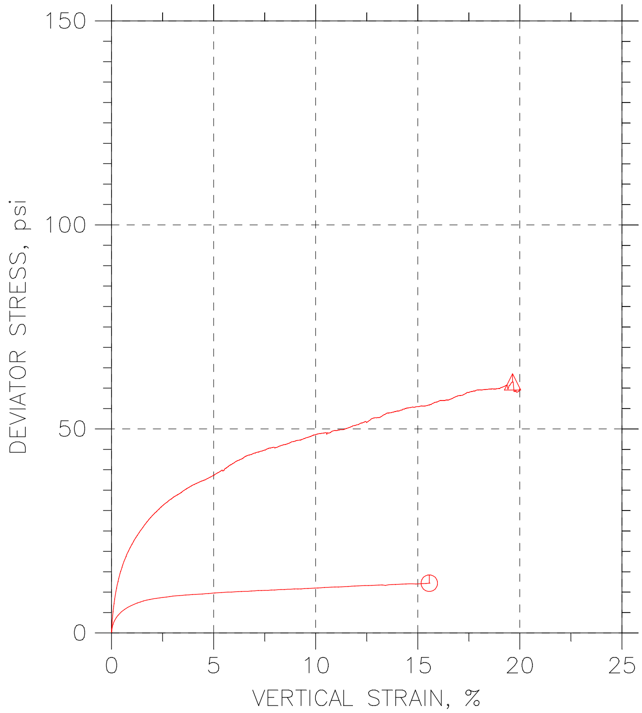
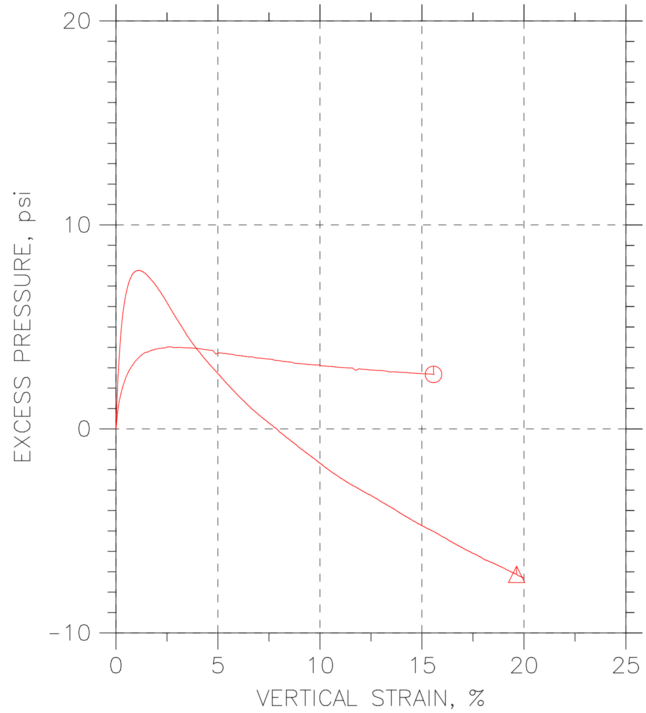
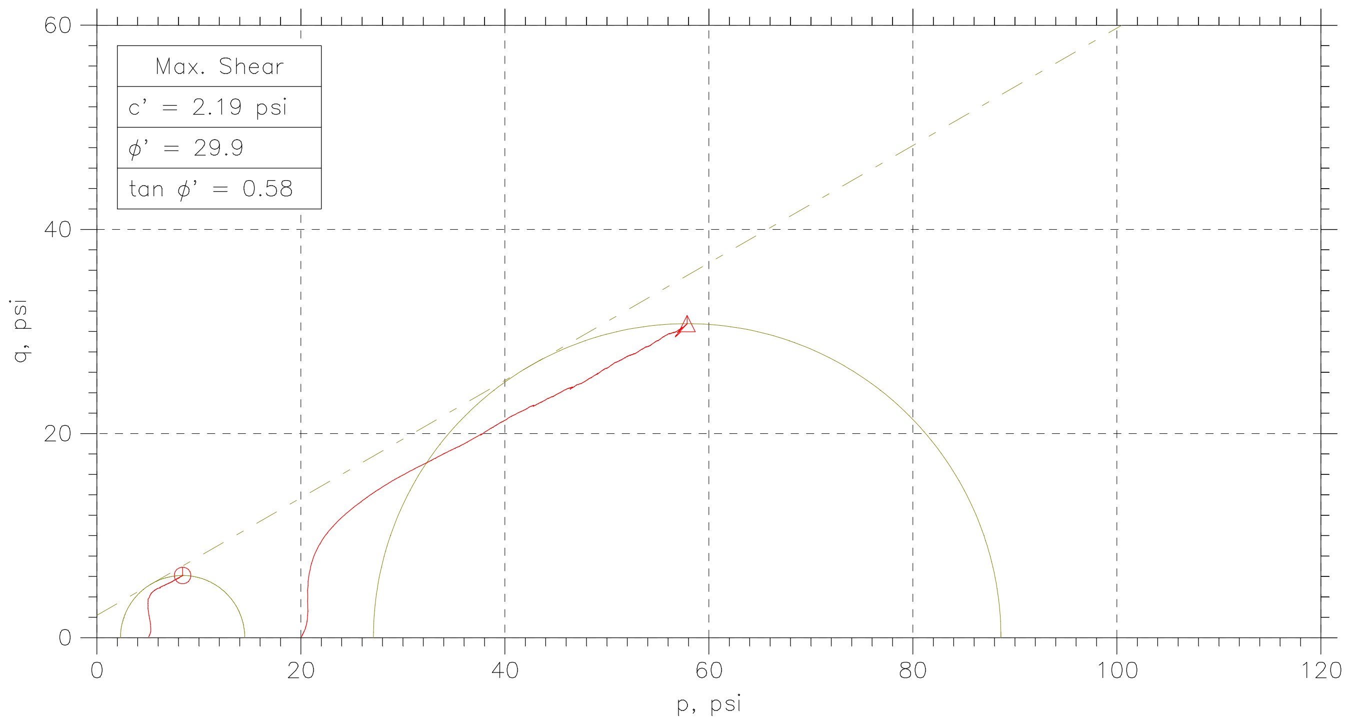
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-1	2.1	5.9-6.5	jm	11/6/09	mm		1503-2.1.dat
△	STN-15	2.3	12.4-13.0	jm	11/6/09	mm		1503-2.3.dat

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Project: Peabody Ash Pond	Location: ---	Project No.: GTX-1503
Boring No.: STN-15	Sample Type: UD	
Description: Brown lean clay with sand		
Remarks: System 1062		

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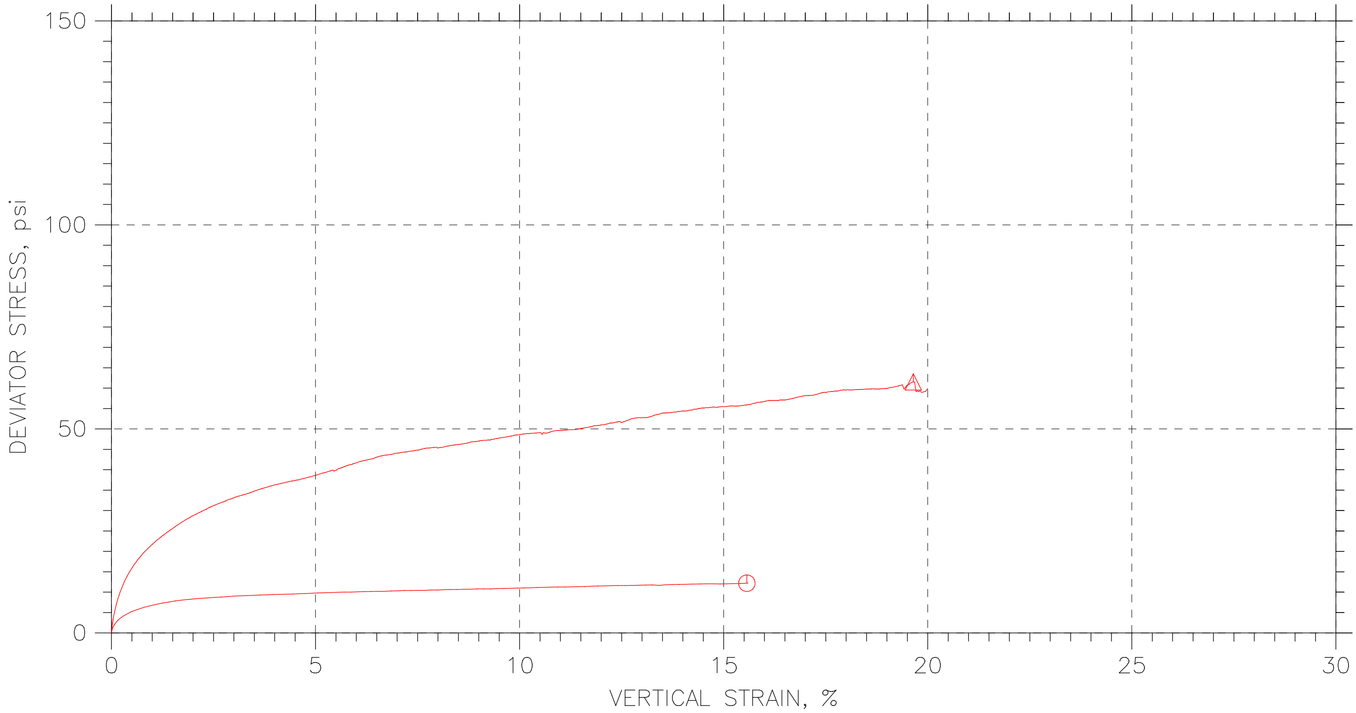
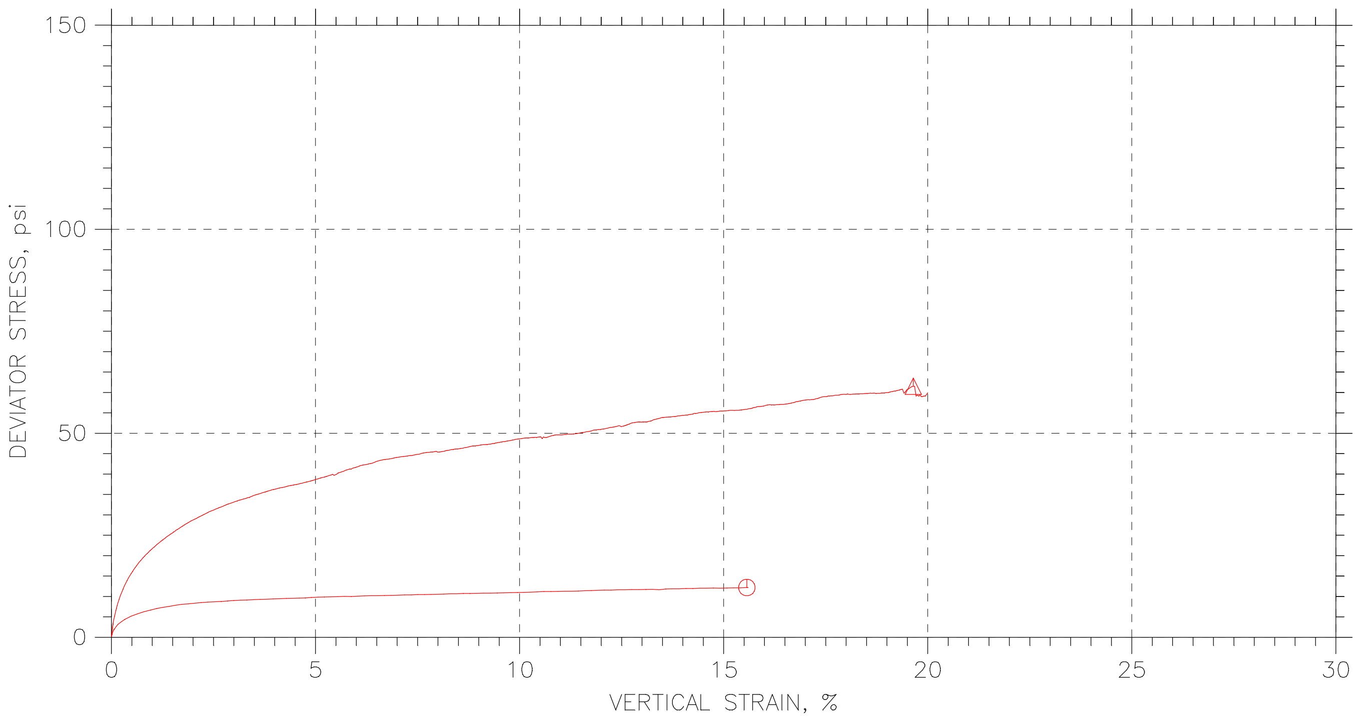
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-1	2.1	5.9-6.5	jm	11/6/09	mm		1503-2.1.dat
△	STN-15	2.3	12.4-13.0	jm	11/6/09	mm		1503-2.3.dat

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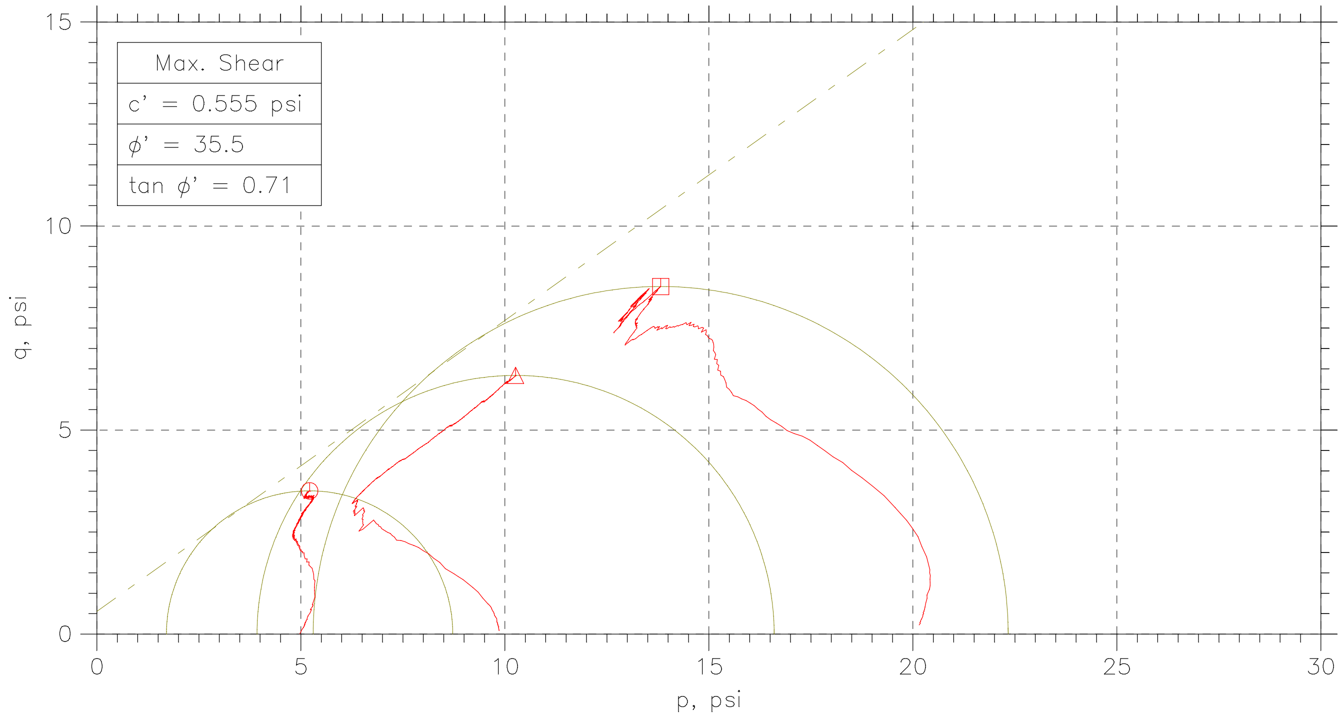
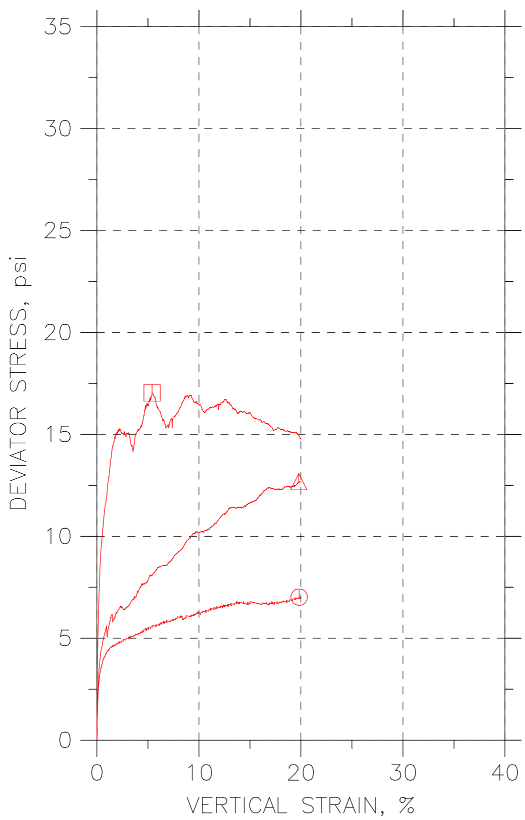
Project: Peabody Ash Pond	Location: ---	Project No.: GTX-1503
Boring No.: STN-15	Sample Type: UD	
Description: Brown lean clay with sand		
Remarks: System 1062		

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		STN-16	STN-16	STN-16	
Test No.		3.1	3.2	3.3	
Depth		9.7-10.4	10.4-11.0	11.0-11.5	
Initial	Diameter, in	1.413	2.838	2.818	
	Height, in	3.184	5.705	6.012	
	Water Content, %	33.0	33.3	40.9	
	Dry Density, pcf	85.6	86.42	79.52	
	Saturation, %	92.0	94.7	98.6	
	Void Ratio	0.969	0.95	1.12	
Before Shear	Water Content, %	30.9	30.8	35.8	
	Dry Density, pcf	91.9	91.98	85.72	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.834	0.832	0.966	
	Back Press., psi	122.1	116.1	131.1	
Ver. Eff. Cons. Stress, psi		4.966	9.778	19.93	
Shear Strength, psi		3.509	6.337	8.518	
Strain at Failure, %		19.8	19.8	5.41	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.95	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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Project: Peabody Ash Pond	
Location: ---	
Project No.: GTX-1503	
Boring No.: STN-16	
Sample Type: UD	
Description: Gray-Brown Sandy lean clay	
Remarks: 2054	

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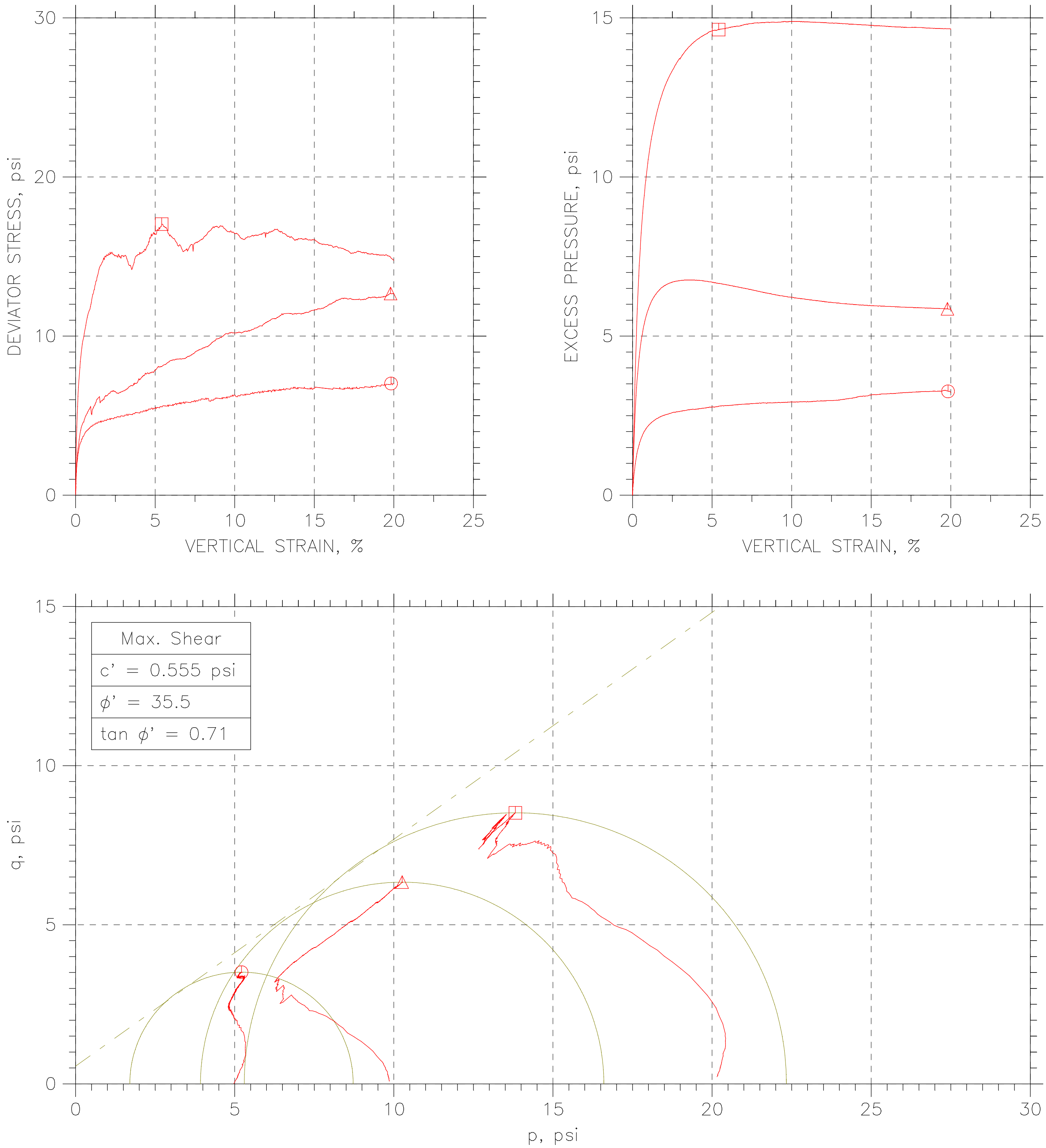
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	st-7	3.1	9.7-10.4	JM	11/13/09	MM		1503-3.1.dat
△	st-7	3.2	10.4-11.0	jm	11/13/09	mm		1503-3.2.dat
□	st-7	3.3	11.0-11.5	jm	11/10/09	mm		1503-3.3.dat

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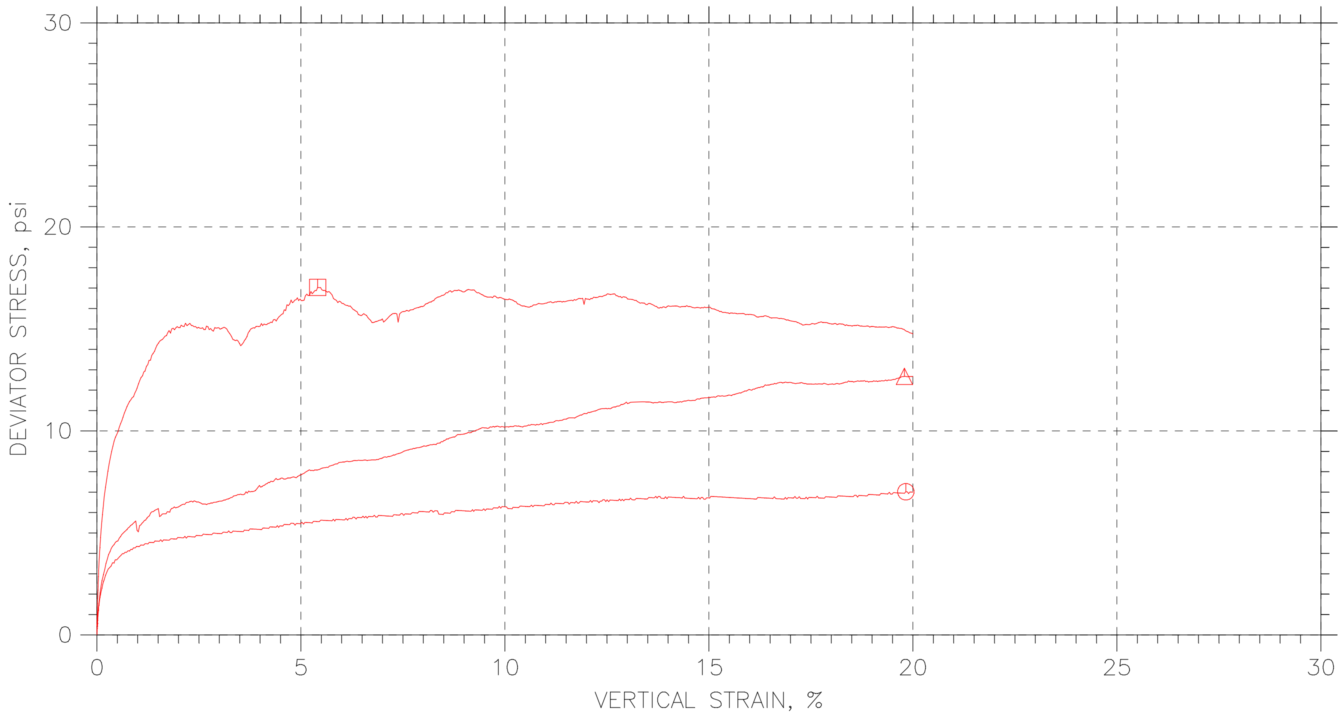
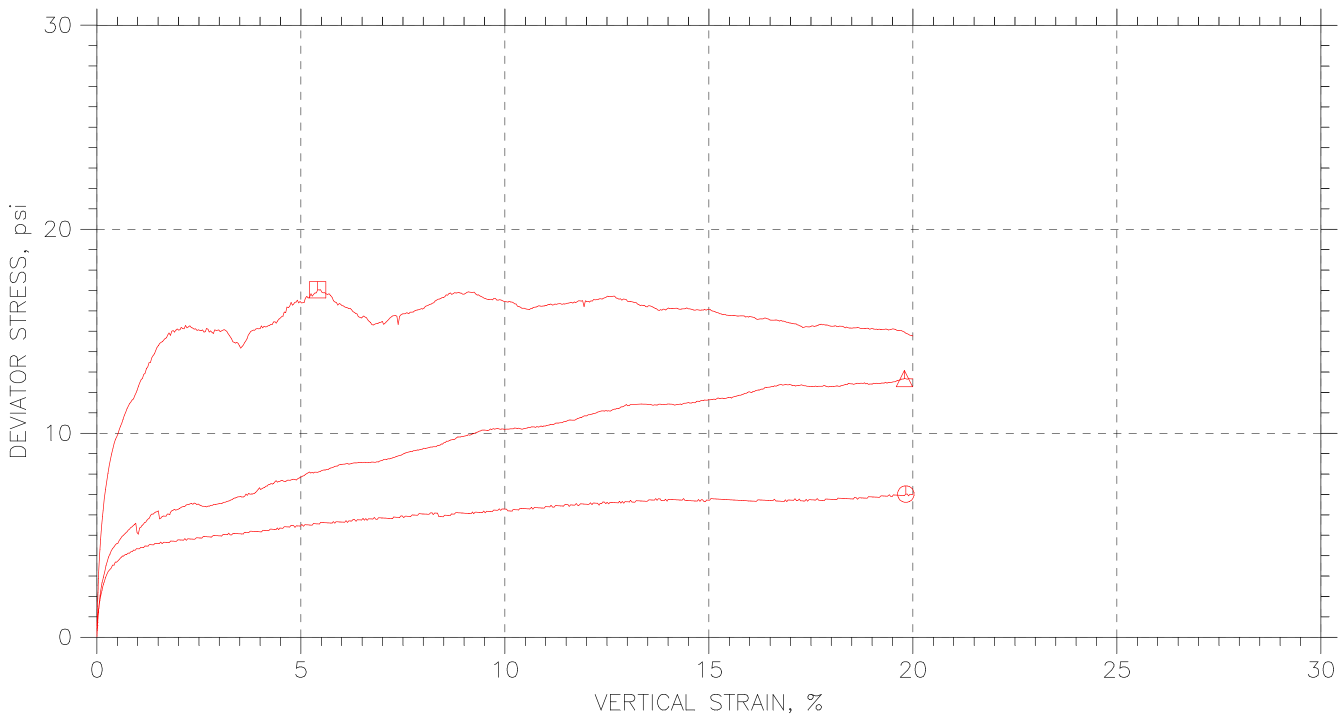
Project: Peabody Ash Pond	Location: ---	Project No.: GTX-1503
Boring No.: STN-16	Sample Type: UD	
Description: Gray-Brown Sandy lean clay		
Remarks: 2054		

Fri, 04-DEC-2009 10:48:18

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	st-7	3.1	9.7-10.4	JM	11/13/09	MM		1503-3.1.dat
△	st-7	3.2	10.4-11.0	jm	11/13/09	mm		1503-3.2.dat
□	st-7	3.3	11.0-11.5	jm	11/10/09	mm		1503-3.3.dat

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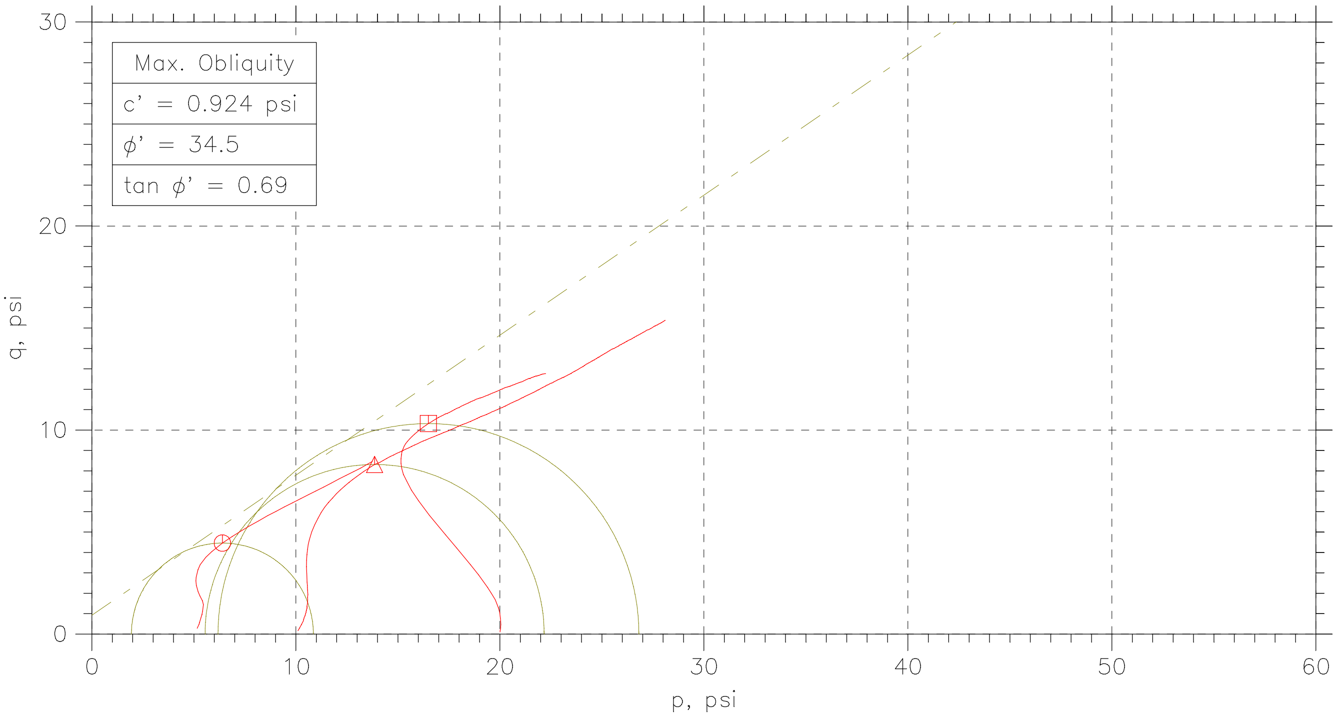
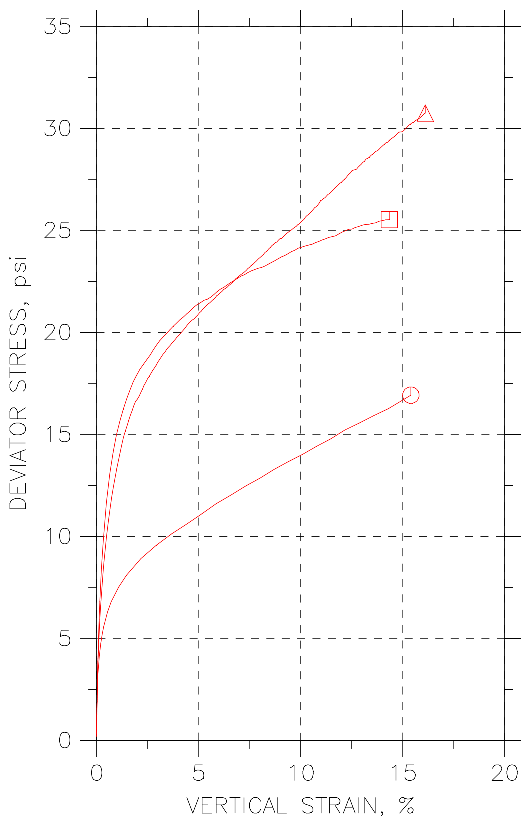
Project: Peabody Ash Pond	Location: ---	Project No.: GTX-1503
Boring No.: STN-16	Sample Type: UD	
Description: Gray-Brown Sandy lean clay		
Remarks: 2054		

Fri, 04-DEC-2009 10:48:19

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



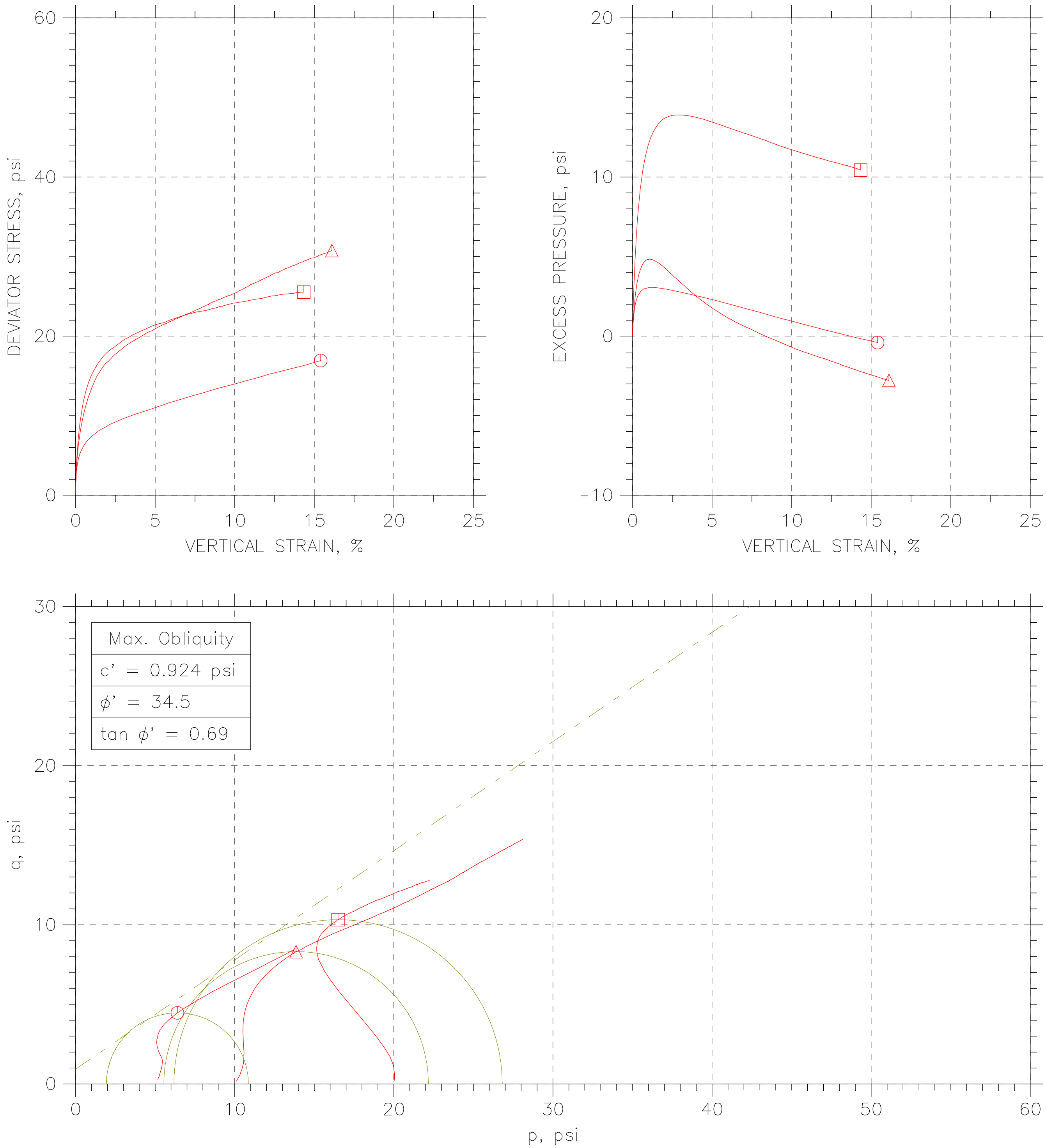


Symbol	○	△	□	
Sample No.	STN-21	STN-21	STN-22	
Test No.	4.1	4.2	4.3	
Depth	3.4-4.0	9.4-10.0	11.0-11.5	
Initial: Diameter, in	2.834	2.87	2.85	
Initial: Height, in	5.941	5.957	6.548	
Initial: Water Content, %	12.4	14.0	14.1	
Initial: Dry Density, pcf	115.5	116.3	121.6	
Initial: Saturation, %	72.6	84.2	98.9	
Initial: Void Ratio	0.459	0.449	0.386	
Before Shear: Water Content, %	16.5	15.5	13.7	
Before Shear: Dry Density, pcf	116.5	118.9	123.1	
Before Shear: Saturation*, %	100.0	100.0	100.0	
Before Shear: Void Ratio	0.446	0.418	0.369	
Before Shear: Back Press., psi	147.1	95.47	122.1	
Ver. Eff. Cons. Stress, psi	4.879	9.94	19.91	
Shear Strength, psi	8.46	15.38	12.76	
Strain at Failure, %	15.4	16.1	14.3	
Strain Rate, %/min	0.016	0.016	0.016	
B-Value	0.95	0.96	0.96	
Estimated Specific Gravity	2.7	2.7	2.7	
Liquid Limit	---	---	---	
Plastic Limit	---	---	---	

GeoTesting express, a subsidiary of Geocomp Corporation	
	Project: Peabody Ash Pond
	Location: ---
	Project No.: GTX-1503
	Boring No.: STN-21
	Sample Type: UD
	Description: Brown lean clay with sand
	Remarks: System 1062

Fri, 13-NOV-2009 14:44:18

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	4.1	3.4-4.0	jm	11/10/09	mm		1503-4.1.dat
△	---	4.2	9.4-10.0	JM	11/10/09	MM		1503-4.2.dat
□	st-7	4.3	11.0-11.5	jm	11/9/09	mm		1503-4.3.dat

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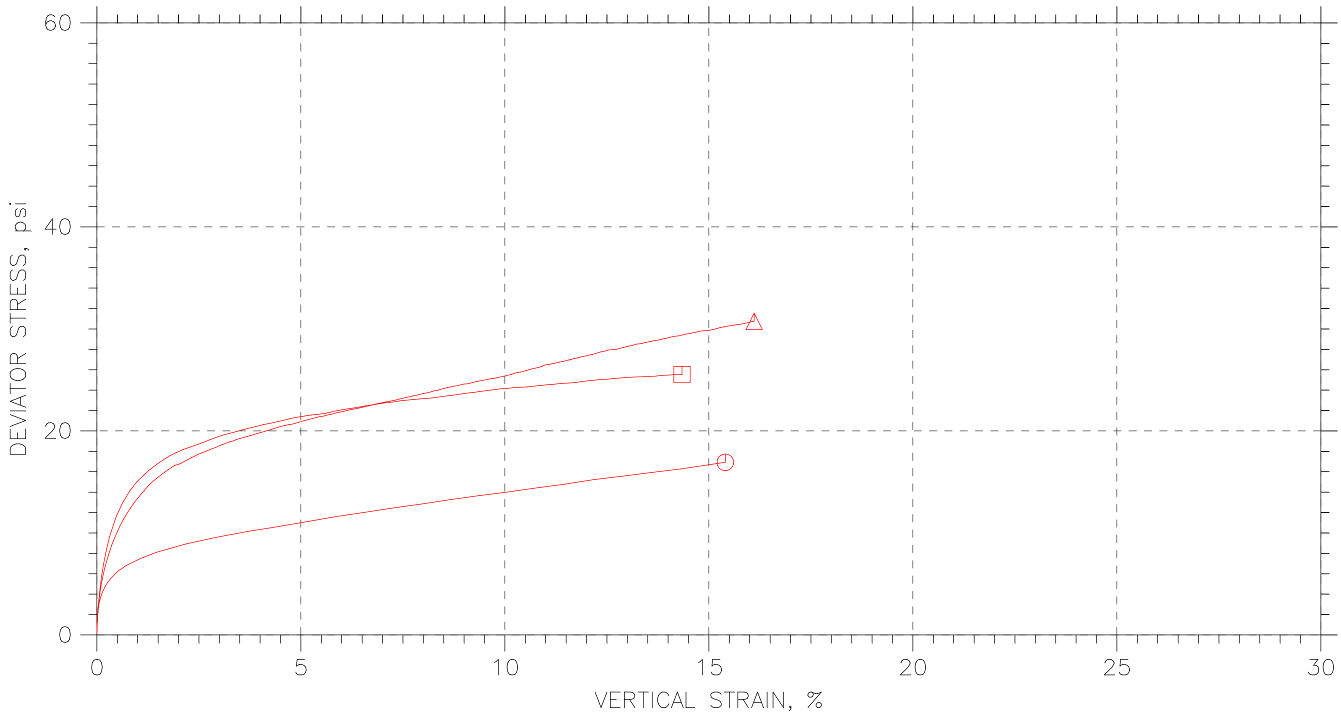
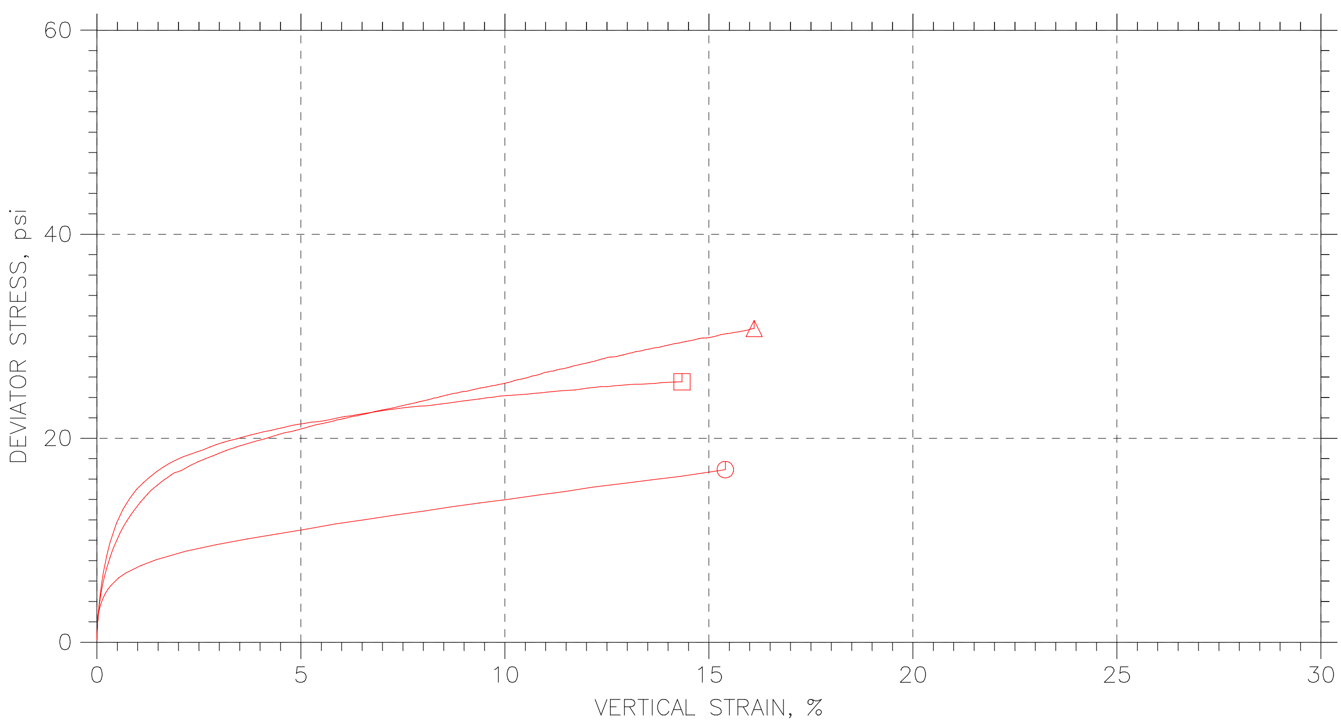
Project: Peabody Ash Pond	Location: ---	Project No.: GTX-1503
Boring No.: STN-21	Sample Type: UD	
Description: Brown lean clay with sand		
Remarks: System 1062		

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	---	4.1	3.4-4.0	jm	11/10/09	mm		1503-4.1.dat
△	---	4.2	9.4-10.0	JM	11/10/09	MM		1503-4.2.dat
□	st-7	4.3	11.0-11.5	jm	11/9/09	mm		1503-4.3.dat

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Project: Peabody Ash Pond	Location: ---	Project No.: GTX-1503
Boring No.: STN-21	Sample Type: UD	
Description: Brown lean clay with sand		
Remarks: System 1062		

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HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1503*	Tested By	*JM*
Project Name	*Peabody Ash Pond*	Test Date	*11//4/09*
Boring No.	*STN-6*	Reviewed By	*mm*
Sample No.	*ST-3*	Review Date	*11/8/2009*
Sample Depth	*12.4-13'*	Lab No.	*1*
Sample Description	*Brown silty sandy clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*19.3*
Wet Unit Weight, pcf:	*126.6*
Dry Unit Weight, pcf:	*106.1*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***1.1E-07***

Remarks: ______________________

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1503	Tested By	JM
Project Name	Peabody Ash Pond	Test Date	11//4/09
Boring No.	STN-6	Reviewed By	mm
Sample No.	ST-3	Review Date	11/08/09
Sample Depth	12.4-13'	Lab No.	1
Sample Description	Brown silty sandy clay		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	A-17
Location 1	2.866	Location 1	2.870	Dry Soil+Pan, grams	512.22
Location 2	2.787	Location 2	2.870	Pan Weight, grams	6.64
Location3	2.765	Location 3	2.870		
Average	2.806	Average	2.870	Moisture Content, %	19.3
		Wet Soil + Tare, grams	603.33	Wet Unit Weight, pcf	126.6
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	106.1

Remarks:

Chamber Pressure, psi	65
Back Pressure, psi	60
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				300	3.7	104.7	3.40	104.1	1.4E-07	22	1.3E-07
				700	3.7	104.7	3.00	103.4	1.2E-07	22	1.1E-07
				1050	3.7	104.7	2.70	102.8	1.2E-07	22	1.1E-07
				1400	3.7	104.7	2.40	102.2	1.2E-07	22	1.1E-07
				1600	3.7	104.7	2.30	102	1.1E-07	22	1.1E-07

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	106.1	N/A	Vertical

Avg. k at 20 °C 1.1E-07 cm/sec

a = area of burette in cm² | Ha = initial inlet head in cm | H_b = final inlet head in cm | a = 0.16 cm²

L = length of sample in cm | H_1 = initial outlet head in cm | H_2 = final outlet head in cm | A = 41.74 cm²

A = area of sample in cm² | t = time in seconds | L = 7.13 cm

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1503	Tested By	JM
Project Name	Peabody Ash Pond	Test Date	11/14/09
Boring No.	STN-7	Reviewed By	MM
Sample No.	ST-2	Review Date	11/07/09
Sample Depth	11.8-12.4	Lab No.	2
Sample Description	Brown lean clay		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	B-44
Location 1	2.831	Location 1	2.873	Dry Soil+Pan, grams	499.22
Location 2	2.830	Location 2	2.873	Pan Weight, grams	7.88
Location3	2.829	Location 3	2.873		
Average	2.830	Average	2.873	Moisture Content, %	17.4
		Wet Soil + Tare, grams	577.00	Wet Unit Weight, pcf	119.8
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	102.0

Remarks:

Chamber Pressure, psi	65
Back Pressure, psi	60
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				960	7.5	106.3	7.70	106.2	4.4E-08	22	4.2E-08
				4800	7.5	106.3	9.00	106	5.3E-08	24	4.8E-08
				8400	7.5	106.3	9.70	105.7	4.7E-08	24	4.3E-08
				16090	7.5	106.3	11.90	105.1	5.0E-08	24	4.5E-08
				28000	7.5	106.3	15.30	104.3	5.1E-08	24	4.7E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	102.0	N/A	Vertical

Avg. k at 20 °C 4.5E-08 cm/sec

a = area of burette in cm²   Ha = initial inlet head in cm H_b = final inlet head in cm

L = length of sample in cm H_1 = initial outlet head in cm H_2 = final outlet head in cm

A = area of sample in cm²   t = time in seconds

a = 0.16 cm²
A = 41.82 cm²
L = 7.19 cm

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	***GTX-1503***	Tested By	***JM***
Project Name	***Peabody Ash Pond***	Test Date	***11/14/2009***
Boring No.	***STN-7***	Reviewed By	***MM***
Sample No.	***ST-2***	Review Date	***11/7/2009***
Sample Depth	***11.8-12.4***	Lab No.	***2***
Sample Description	***Brown lean clay***		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*17.4*
Wet Unit Weight, pcf:	*119.8*
Dry Unit Weight, pcf:	*102.0*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***4.5E-08***

Remarks: ______________________________

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1503	Tested By	JM
Project Name	Peabody Ash Pond	Test Date	11/04/09
Boring No.	STN-16	Reviewed By	MM
Sample No.	ST-1	Review Date	11/08/09
Sample Depth	4.5-5.1 ft	Lab No.	3
Sample Description			

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	A-12
Location 1	2.708	Location 1	2.844	Dry Soil+Pan, grams	474.33
Location 2	2.710	Location 2	2.843	Pan Weight, grams	9.66
Location3	2.709	Location 3	2.845		
Average	2.709	Average	2.844	Moisture Content, %	18.8
		Wet Soil + Tare, grams	552.12	Wet Unit Weight, pcf	122.2
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	102.9

Remarks:

Chamber Pressure, psi	65
Back Pressure, psi	60
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				940	5.1	100.8	5.30	100.6	6.0E-08	22	5.7E-08
				1600	5.1	100.8	5.40	100.4	6.2E-08	22	5.9E-08
				2300	5.1	100.8	5.60	100.3	6.1E-08	22	5.9E-08
				5500	5.1	100.8	6.40	99.8	5.9E-08	22	5.7E-08
				8600	5.1	100.8	7.50	99.5	6.2E-08	22	5.9E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	102.9	N/A	Vertical

Avg. k at 20 °C 5.8E-08 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 40.98 cm²
L = 6.88 cm

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1503*	Tested By	*JM*
Project Name	*Peabody Ash Pond*	Test Date	*11/4/2009*
Boring No.	*STN-16*	Reviewed By	*MM*
Sample No.	*ST-1*	Review Date	*11/8/2009*
Sample Depth	*4.5-5.1 ft*	Lab No.	*3*
Sample Description			

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*18.8*
Wet Unit Weight, pcf:	*122.2*
Dry Unit Weight, pcf:	*102.9*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***5.8E-08***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1503	Tested By	JM
Project Name	Peabody Ash Pond	Test Date	11/04/09
Boring No.	STN-16	Reviewed By	MM
Sample No.	ST-1	Review Date	11/09/09
Sample Depth	5.7-6.3 ft	Lab No.	4
Sample Description			

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	G-8
Location 1	3.006	Location 1	2.870	Dry Soil+Pan, grams	572.33
Location 2	2.981	Location 2	2.870	Pan Weight, grams	9.59
Location3	2.994	Location 3	2.870		
Average	2.994	Average	2.870	Moisture Content, %	17.5
		Wet Soil + Tare, grams	661.45	Wet Unit Weight, pcf	130.1
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	110.7

Remarks:

Chamber Pressure, psi	65
Back Pressure, psi	60
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				60000	8.6	105.4	19.50	92.8	6.8E-08	22	6.5E-08
				84000	8.6	105.4	22.10	89.6	6.3E-08	22	6.0E-08
				96000	8.6	105.4	24.80	87.4	6.6E-08	22	6.3E-08
				150000	8.6	105.4	31.50	80.8	6.6E-08	22	6.3E-08
				220000	8.6	105.4	39.20	74.4	6.7E-08	22	6.4E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	tube	110.7	NA	Vertical

Avg. k at 20 °C 6.3E-08 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 41.74 cm²
L = 7.60 cm

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1503*	Tested By	*JM*
Project Name	*Peabody Ash Pond*	Test Date	*11/4/2009*
Boring No.	*STN-16*	Reviewed By	*MM*
Sample No.	*ST-1*	Review Date	*11/9/2009*
Sample Depth	*5.7-6.3 ft*	Lab No.	*4*
Sample Description			

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*Tube*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*17.5*
Wet Unit Weight, pcf:	*130.1*
Dry Unit Weight, pcf:	*110.7*
Compaction, %:	*NA*
Hydraulic Conductivity, cm/sec. @20 °C	***6.3E-08***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1503	Tested By	JM
Project Name	Peabody Ash Pond	Test Date	11/08/09
Boring No.	STN-21	Reviewed By	MM
Sample No.	ST-1	Review Date	11/12/09
Sample Depth	2.2-2.8 ft	Lab No.	4
Sample Description	Brown sandy silty clay		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	LP-2
Location 1	2.801	Location 1	2.840	Dry Soil+Pan, grams	546.22
Location 2	2.890	Location 2	2.840	Pan Weight, grams	9.82
Location3	2.850	Location 3	2.840		
Average	2.847	Average	2.840	Moisture Content, %	10.3
		Wet Soil + Tare, grams	591.88	Wet Unit Weight, pcf	125.0
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	113.3

Remarks:

Chamber Pressure, psi	65
Back Pressure, psi	60
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				1800	7.7	94.5	8.90	94	1.6E-07	22	1.5E-07
				2200	7.7	94.5	9.40	94	1.7E-07	22	1.6E-07
				10600	7.7	94.5	14.40	89	2.0E-07	22	1.9E-07
				14000	7.7	94.5	15.80	88	1.9E-07	22	1.8E-07
				19000	7.7	94.5	16.30	86	1.6E-07	22	1.6E-07

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	111.8	N/A	Vertical

Avg. k at 20 °C 1.7E-07 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 40.87 cm²
L = 7.23 cm

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1503*	Tested By	*JM*
Project Name	*Peabody Ash Pond*	Test Date	*11/08/09*
Boring No.	*STN-21*	Reviewed By	*MM*
Sample No.	*ST-1*	Review Date	*11/12/09*
Sample Depth	*2.2-2.8 ft*	Lab No.	*5*
Sample Description	*Brown sandy silty clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*10.3*
Wet Unit Weight, pcf:	*125.0*
Dry Unit Weight, pcf:	*113.3*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***1.7E-07***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1503	Tested By	JM
Project Name	Peabody Ash Pond	Test Date	11/08/09
Boring No.	STN-22	Reviewed By	MM
Sample No.	ST-1	Review Date	11/12/09
Sample Depth	5.5-6 ft	Lab No.	6
Sample Description	Brown sandy silty clay		

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Sample Data

Length, in		Diameter, in		Pan No.	M-2
Location 1	2.750	Location 1	2.870	Dry Soil+Pan, grams	532.01
Location 2	2.770	Location 2	2.870	Pan Weight, grams	7.95
Location3	2.798	Location 3	2.870		
Average	2.773	Average	2.870	Moisture Content, %	14.9
		Wet Soil + Tare, grams	602.19	Wet Unit Weight, pcf	127.9
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	111.3

Remarks:

Chamber Pressure, psi	65
Back Pressure, psi	60
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				660	9.7	102.3	9.90	102.1	8.9E-08	22	8.5E-08
				1500	9.7	102.3	10.20	101.9	8.8E-08	22	8.4E-08
				1800	9.7	102.3	10.30	101.8	9.0E-08	22	8.6E-08
				3900	9.7	102.3	10.90	101.2	8.7E-08	22	8.3E-08
				6200	9.7	102.3	11.50	100.5	8.6E-08	22	8.2E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	111.3	N/A	Vertical

Avg. k at 20 °C 8.4E-08 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 41.74 cm²
L = 7.04 cm

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1503*	Tested By	*JM*
Project Name	*Peabody Ash Pond*	Test Date	*11/8/2009*
Boring No.	*STN-22*	Reviewed By	*MM*
Sample No.	*ST-1*	Review Date	*11/12/2009*
Sample Depth	*5.5-6 ft*	Lab No.	*6*
Sample Description	*Brown sandy silty clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*14.9*
Wet Unit Weight, pcf:	*127.9*
Dry Unit Weight, pcf:	*111.3*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***8.4E-08***

Remarks: ______________________

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Summary of Soil Tests

M1

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-15, 8.0'-9.5', 9.5'-11.0'	Lab ID	378
County	Muhlenberg, Ky	Date Received	11-11-09
Sample Type	SPT Comp	Date Reported	11-20-09

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	100.0
3/4"	19	87.9
3/8"	9.5	81.0
No. 4	4.75	77.3
No. 10	2	70.4
No. 40	0.425	64.2
No. 200	0.075	58.9
	0.02	47.3
	0.005	30.8
	0.002	18.4
estimated	0.001	10.0

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

Range	ASTM (%)	AASHTO (%)
Gravel	22.7	29.6
Coarse Sand	6.9	6.2
Medium Sand	6.2	---
Fine Sand	5.3	5.3
Silt	28.1	40.5
Clay	30.8	18.4

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 35
Plastic Limit: 19
Plasticity Index: 16
Activity Index: 0.89

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.73

Classification

Unified Group Symbol: CL
Group Name: Gravelly lean clay with sand

AASHTO Classification: A-6 (7)

Comments:

Reviewed by: RJ

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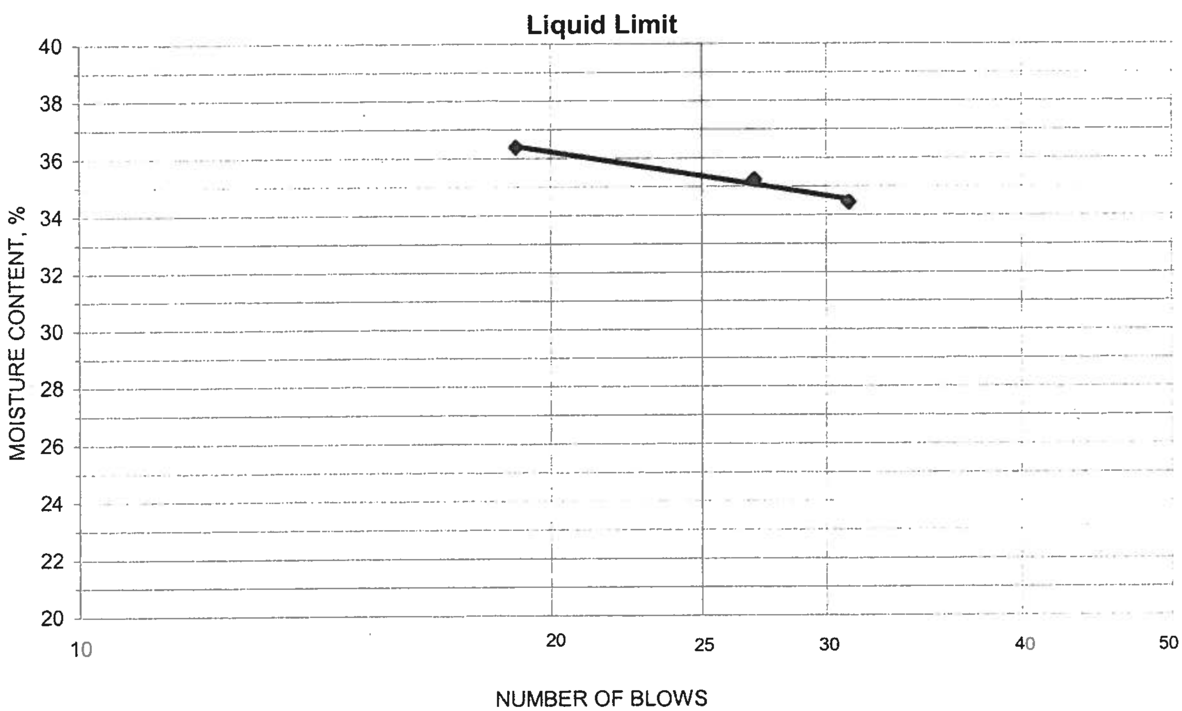
ATTERBERG LIMITS

Project	TVA - PAF Peabody Ash Pond	Project No.	175569069
Source	STN-15, 8.0'-9.5', 9.5'-11.0'	Lab ID	378
		% + No. 40	36
Tested By	mc	Test Method	ASTM D 4318 Method A
Date Received	11-11-2009		
Test Date	11-19-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
19.04	17.17	11.74	31	34.4	35
19.05	16.88	10.72	27	35.2	
19.56	17.25	10.90	19	36.4	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.37	17.23	11.13	18.7	19	16
18.15	16.99	10.91	19.1		

Remarks:

Reviewed By RJ

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Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - PAF Peabody Ash Pond
Source: STN-15, 8.0'-9.5', 9.5'-11.0'

Project Number: 175569069
Lab ID: 378

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: 11-13-2009
Date Received: 11-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	87.9
3/8"	81.0
No. 4	77.3
No. 10	70.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.73

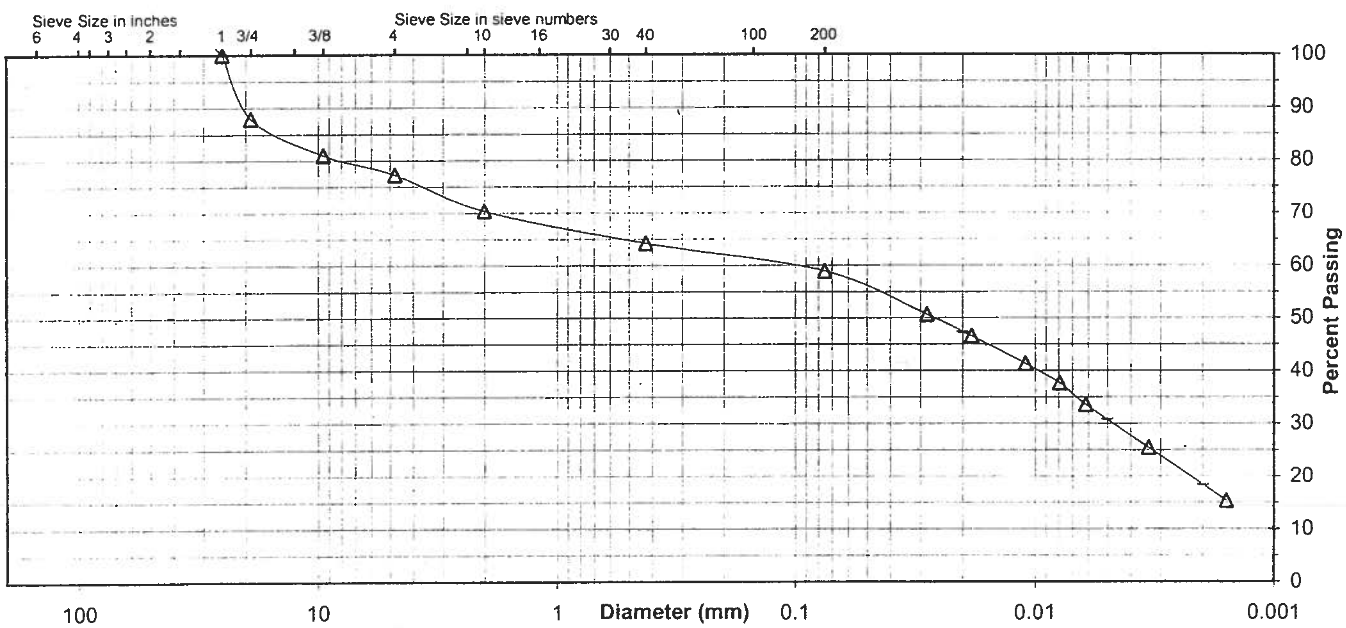
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	64.2
No. 200	58.9
0.02 mm	47.3
0.005 mm	30.8
0.002 mm	18.4
0.001 mm	10.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	12.1	10.6	6.9	6.2	5.3	28.1	30.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	29.6	6.2	5.3	40.5	18.4



Comments ______

Reviewed By RJ

File: frm_175569069_sum_378.xls Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

MV

Summary of Soil Tests

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-6, 1.5'-3.0', 3.0'-4.5'	Lab ID	366
County	Muhlenberg, Ky	Date Received	11-11-09
Sample Type	SPT Comp	Date Reported	11-20-09

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	90.3
No. 4	4.75	82.6
No. 10	2	72.5
No. 40	0.425	65.5
No. 200	0.075	58.6
	0.02	47.0
	0.005	31.0
	0.002	19.7
estimated	0.001	11.0

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

Range	ASTM (%)	AASHTO (%)
Gravel	17.4	27.5
Coarse Sand	10.1	7.0
Medium Sand	7.0	---
Fine Sand	6.9	6.9
Silt	27.6	38.9
Clay	31.0	19.7

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

Liquid Limit: 37
Plastic Limit: 18
Plasticity Index: 19
Activity Index: 0.95

Moisture-Density Relationship
Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio
Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity
Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.73

Classification
Unified Group Symbol: CL
Group Name: Sandy lean clay with gravel

AASHTO Classification: A-6 (8)

Comments:

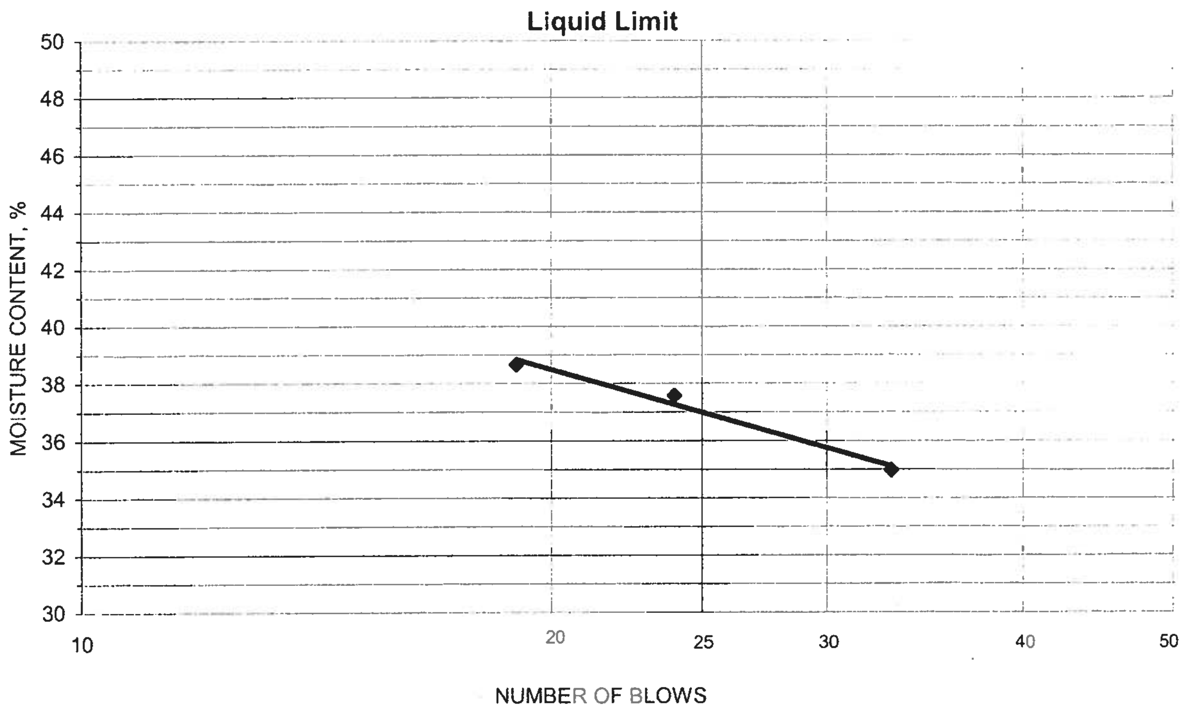
Reviewed by: RJ

Stantec

ATTERBERG LIMITS

Project	TVA - PAF Peabody Ash Pond	Project No.	175569069
Source	STN-6, 1.5'-3.0', 3.0'-4.5'	Lab ID	366
		% + No. 40	34
Tested By	mc	Test Method ASTM D 4318 Method A	Date Received 11-11-2009
Test Date	11-19-2009	Prepared Dry	

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
18.83	16.83	11.11	33	35.0	
18.79	16.63	10.88	24	37.6	
19.86	17.46	11.25	19	38.6	37



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
18.39	17.26	11.13	18.4	18	19
18.49	17.35	11.08	18.2		

Remarks: ______________________

Reviewed By RJ

Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - PAF Peabody Ash Pond
Source: STN-6, 1.5'-3.0', 3.0'-4.5'

Project Number: 175569069
Lab ID: 366

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: 11-13-2009
Date Received: 11-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	90.3
No. 4	82.6
No. 10	72.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.73

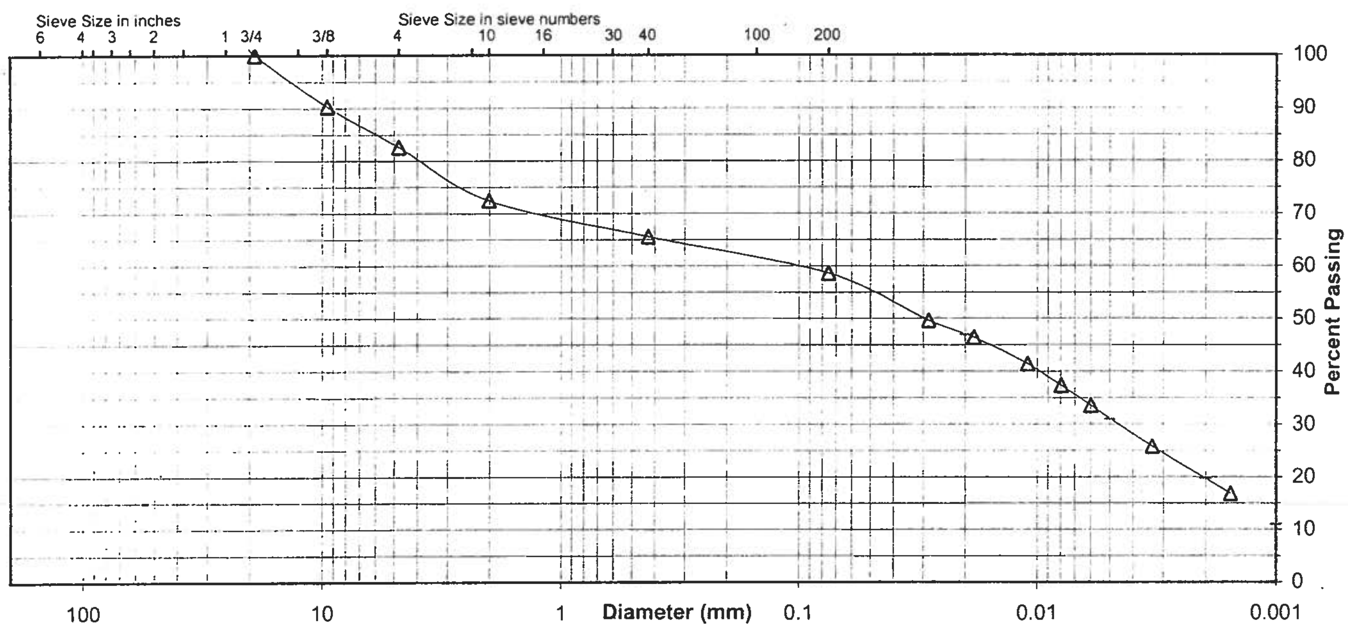
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	65.5
No. 200	58.6
0.02 mm	47.0
0.005 mm	31.0
0.002 mm	19.7
0.001 mm	11.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	17.4	10.1	7.0	6.9	27.6	31.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	27.5	7.0	6.9	38.9	19.7



Comments

Reviewed By RJ

Stantec

Summary of Soil Tests

M2

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-21, 17.5'-19.0', 20.0'-21.5'	Lab ID	387
County	Muhlenberg, Ky	Date Received	11-11-09
Sample Type	SPT Comp	Date Reported	11-20-09

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	100.0
3/8"	9.5	88.8
No. 4	4.75	82.4
No. 10	2	69.3
No. 40	0.425	61.8
No. 200	0.075	49.0
	0.02	37.9
	0.005	26.1
	0.002	15.8
estimated	0.001	9.0

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

Range	ASTM (%)	AASHTO (%)
Gravel	17.6	30.7
Coarse Sand	13.1	7.5
Medium Sand	7.5	---
Fine Sand	12.8	12.8
Silt	22.9	33.2
Clay	26.1	15.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 31
Plastic Limit: 16
Plasticity Index: 15
Activity Index: 0.94

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: SC
Group Name: Clayey sand with gravel

AASHTO Classification: A-6 (4)

Comments:

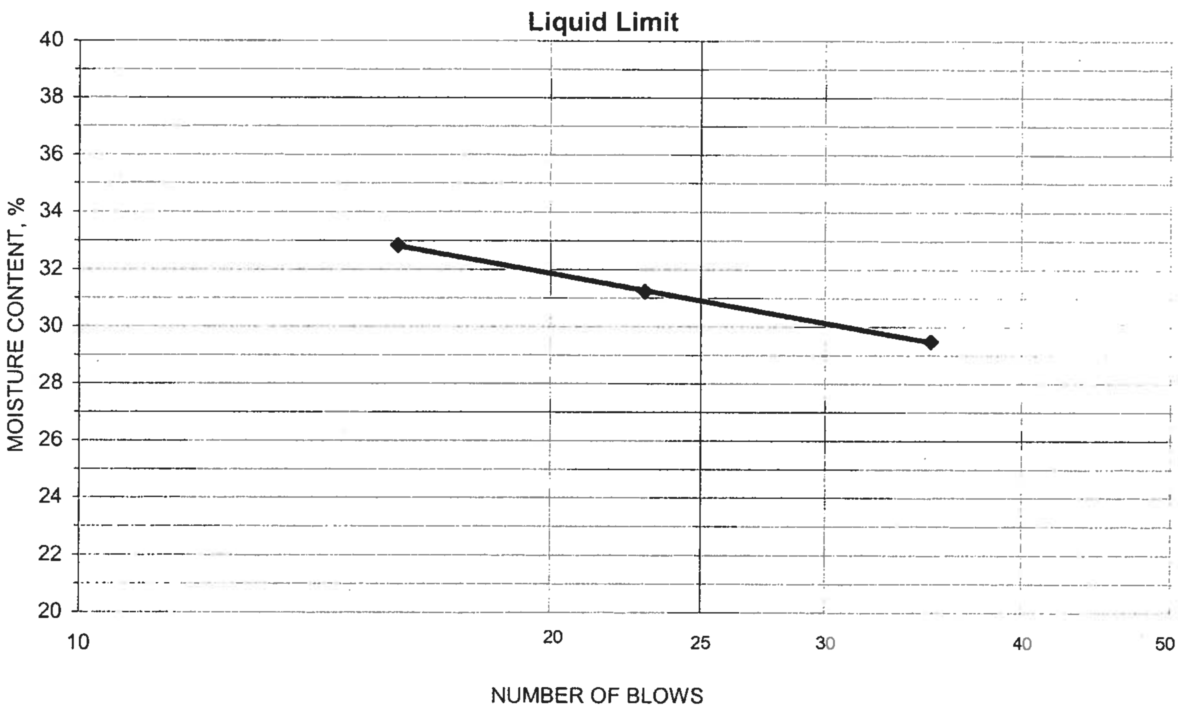
Reviewed by: RJ

Stantec

ATTERBERG LIMITS

Project	TVA - PAF Peabody Ash Pond	Project No.	175569069
Source	STN-21, 17.5'-19.0', 20.0'-21.5'	Lab ID	387
		% + No. 40	38
Tested By	mc	Test Method	ASTM D 4318 Method A
Date Received	11-11-2009		
Test Date	11-19-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
20.03	17.99	11.07	35	29.5	31
19.40	17.43	11.12	23	31.2	
18.86	16.90	10.93	16	32.8	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.39	17.39	11.21	16.2	16	15
18.37	17.35	11.16	16.5		

Remarks:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-21, 17.5'-19.0', 20.0'-21.5'	Lab ID	387

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: 11-12-2009
Date Received 11-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	88.8
No. 4	82.4
No. 10	69.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.71

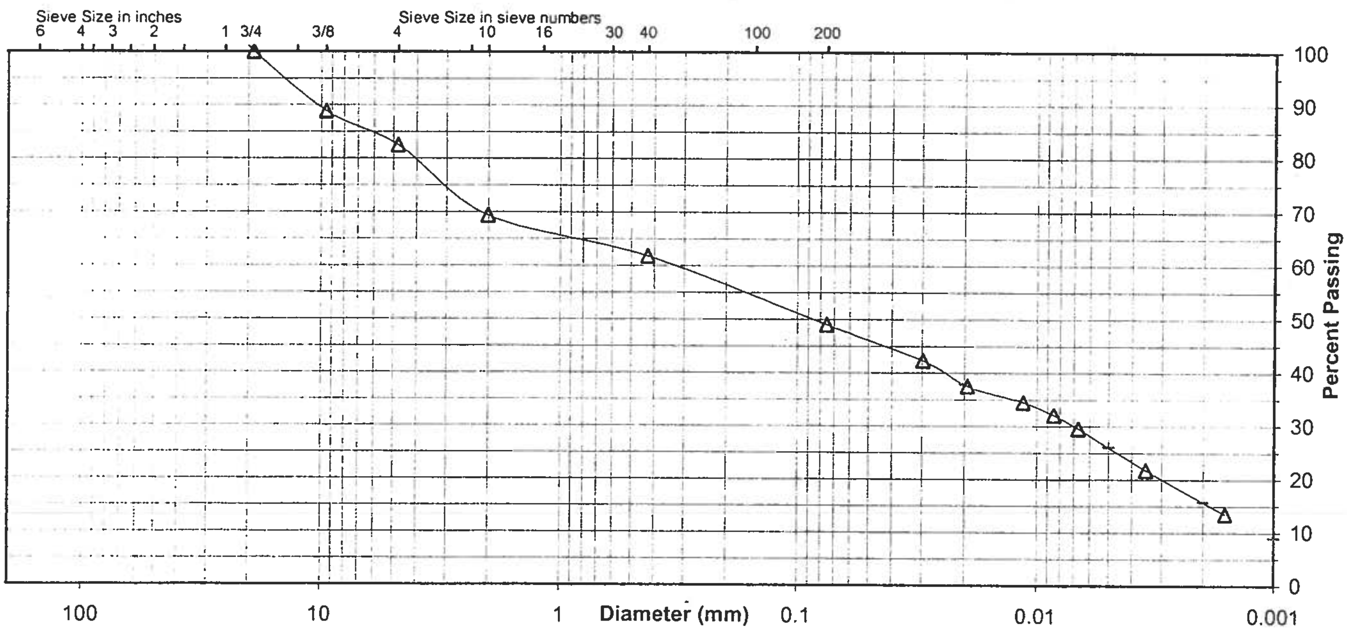
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	61.8
No. 200	49.0
0.02 mm	37.9
0.005 mm	26.1
0.002 mm	15.8
0.001 mm	9.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	17.6	13.1	7.5	12.8	22.9	26.1

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	30.7	7.5	12.8	33.2	15.8



Comments

Reviewed By RJ

File: frm_175569069_sum_387.xls Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

M2

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Summary of Soil Tests

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-3, 17.5'-19.0', 20.0'-21.5'	Lab ID	360
County	Muhlenberg, Ky	Date Received	11-11-09
Sample Type	SPT Comp	Date Reported	11-20-09

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	98.4
No. 4	4.75	97.9
No. 10	2	90.3
No. 40	0.425	85.7
No. 200	0.075	75.3
	0.02	59.7
	0.005	39.0
	0.002	30.1
estimated	0.001	25.0

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

Range	ASTM (%)	AASHTO (%)
Gravel	2.1	9.7
Coarse Sand	7.6	4.6
Medium Sand	4.6	---
Fine Sand	10.4	10.4
Silt	36.3	45.2
Clay	39.0	30.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 37
Plastic Limit: 16
Plasticity Index: 21
Activity Index: 0.70

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.68

Classification

Unified Group Symbol: CL
Group Name: Lean clay with sand

AASHTO Classification: A-6 (14)

Comments:

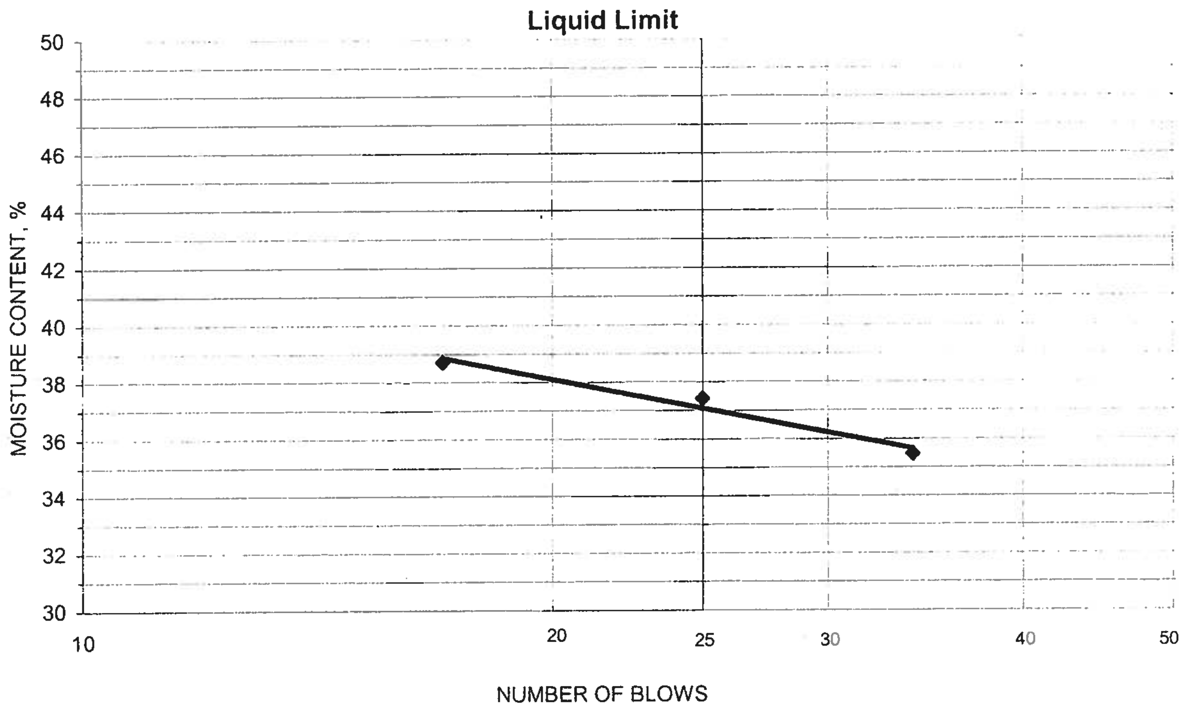
Reviewed by: RJ

Stantec

ATTERBERG LIMITS

Project	TVA - PAF Peabody Ash Pond	Project No.	175569069
Source	STN-3, 17.5'-19.0', 20.0'-21.5'	Lab ID	360
		% + No. 40	14
Tested By	MC	Test Method	ASTM D 4318 Method A
Date Received	11-11-2009		
Test Date	11-19-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
19.25	17.20	11.42	34	35.5	37
19.77	17.57	11.69	25	37.4	
19.48	17.27	11.56	17	38.7	



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
19.41	18.35	11.70	15.9	16	21
19.10	18.02	11.39	16.3		

Remarks:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - PAF Peabody Ash Pond
Source: STN-3, 17.5'-19.0', 20.0'-21.5'

Project Number: 175569069
Lab ID: 360

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: 11-12-2009
Date Received: 11-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.4
No. 4	97.9
No. 10	90.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.68

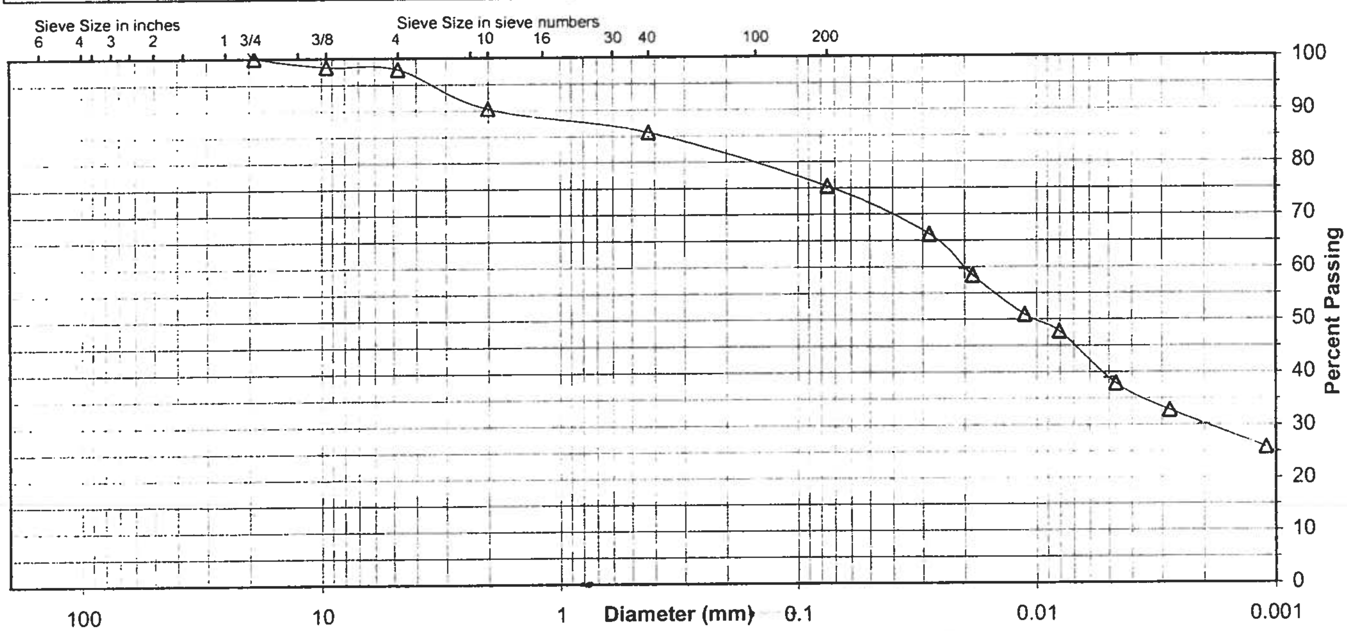
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	85.7
No. 200	75.3
0.02 mm	59.7
0.005 mm	39.0
0.002 mm	30.1
0.001 mm	25.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	2.1	7.6	4.6	10.4	36.3	39.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	9.7	4.6	10.4	45.2	30.1



Comments

Reviewed By RJ

File: frm_175569069_sum_360.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

N1

Project Name	TVA - PAF Peabody Ash Pond
Source	STN-6, 13.5'-15.0', 15.0'-16.5'
County	Muhlenberg, Ky
Sample Type	SPT Comp
Project Number	175569069
Lab ID	369
Date Received	11-11-09
Date Reported	11-20-09

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	99.2
No. 10	2	98.8
No. 40	0.425	88.0
No. 200	0.075	40.8
	0.02	30.6
	0.005	17.7
	0.002	13.1
estimated	0.001	10.0

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

Range	ASTM (%)	AASHTO (%)
Gravel	0.8	1.2
Coarse Sand	0.4	10.8
Medium Sand	10.8	---
Fine Sand	47.2	47.2
Silt	23.1	27.7
Clay	17.7	13.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 22
Plastic Limit: 14
Plasticity Index: 8
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

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.67

Classification

Unified Group Symbol: SC
Group Name: Clayey sand

AASHTO Classification: A-4 (0)

Comments:

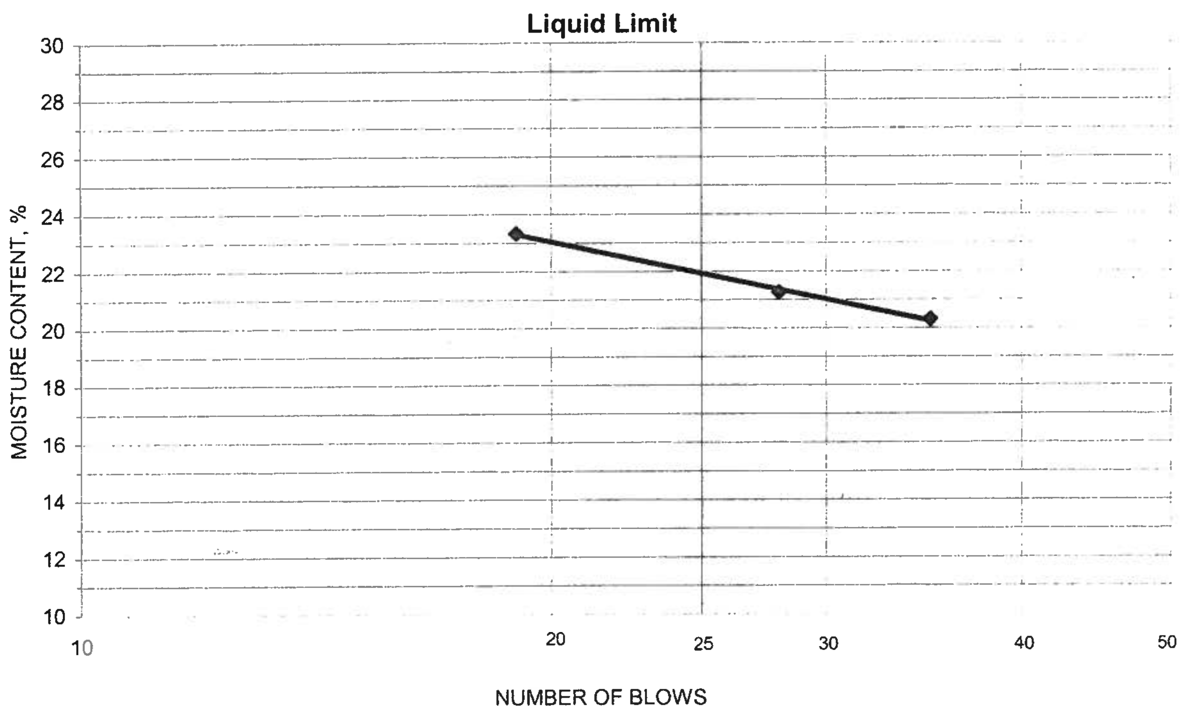
Reviewed by: RJ

Stantec

ATTERBERG LIMITS

Project	TVA - PAF Peabody Ash Pond	Project No.	175569069
Source	STN-6, 13.5'-15.0', 15.0'-16.5'	Lab ID	369
		% + No. 40	12
Tested By	mc	Test Method	ASTM D 4318 Method A
Date Received	11-11-2009		
Test Date	11-19-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
20.68	19.08	11.20	35	20.3	
21.36	19.56	11.09	28	21.3	
20.43	18.65	11.02	19	23.3	22



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
19.29	18.34	11.62	14.1	14	8
19.31	18.33	11.68	14.7		

Remarks:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - PAF Peabody Ash Pond
Source: STN-6, 13.5'-15.0', 15.0'-16.5'

Project Number: 175569069
Lab ID: 369

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: 11-12-2009
Date Received: 11-11-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.2
No. 10	98.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.67

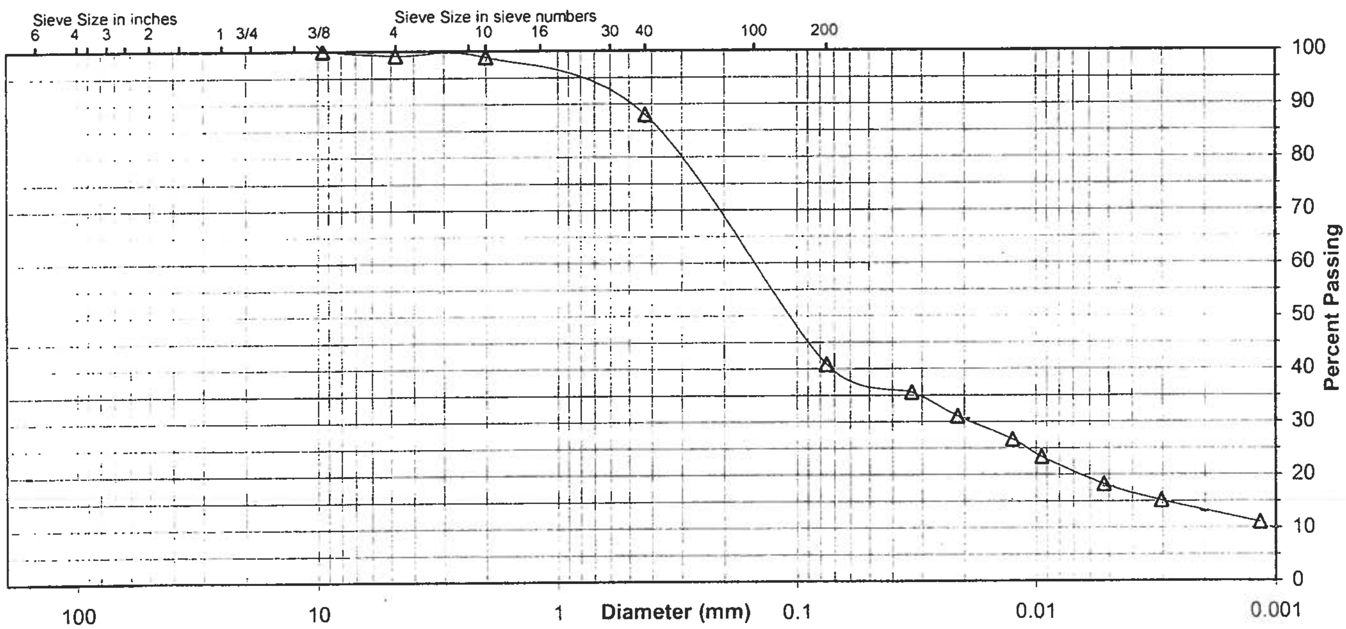
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	88.0
No. 200	40.8
0.02 mm	30.6
0.005 mm	17.7
0.002 mm	13.1
0.001 mm	10.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.8	0.4	10.8	47.2	23.1	17.7

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	1.2	10.8	47.2	27.7	13.1



Comments

Reviewed By RJ

Stantec

Summary of Soil Tests

N\

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-11, 30.0'-31.5', 32.5'-34.0'	Lab ID	375
County	Muhlenberg, Ky	Date Received	11-11-09
Sample Type	SPT Comp	Date Reported	11-20-09

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	100.0
No. 40	0.425	89.3
No. 200	0.075	45.4
	0.02	34.9
	0.005	20.7
	0.002	14.5
estimated	0.001	10.0

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

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	10.7
Medium Sand	10.7	---
Fine Sand	43.9	43.9
Silt	24.7	30.9
Clay	20.7	14.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 21
Plastic Limit: 12
Plasticity Index: 9
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: 2.63

Classification

Unified Group Symbol: SC
Group Name: Clayey sand

AASHTO Classification: A-4 (1)

Comments:

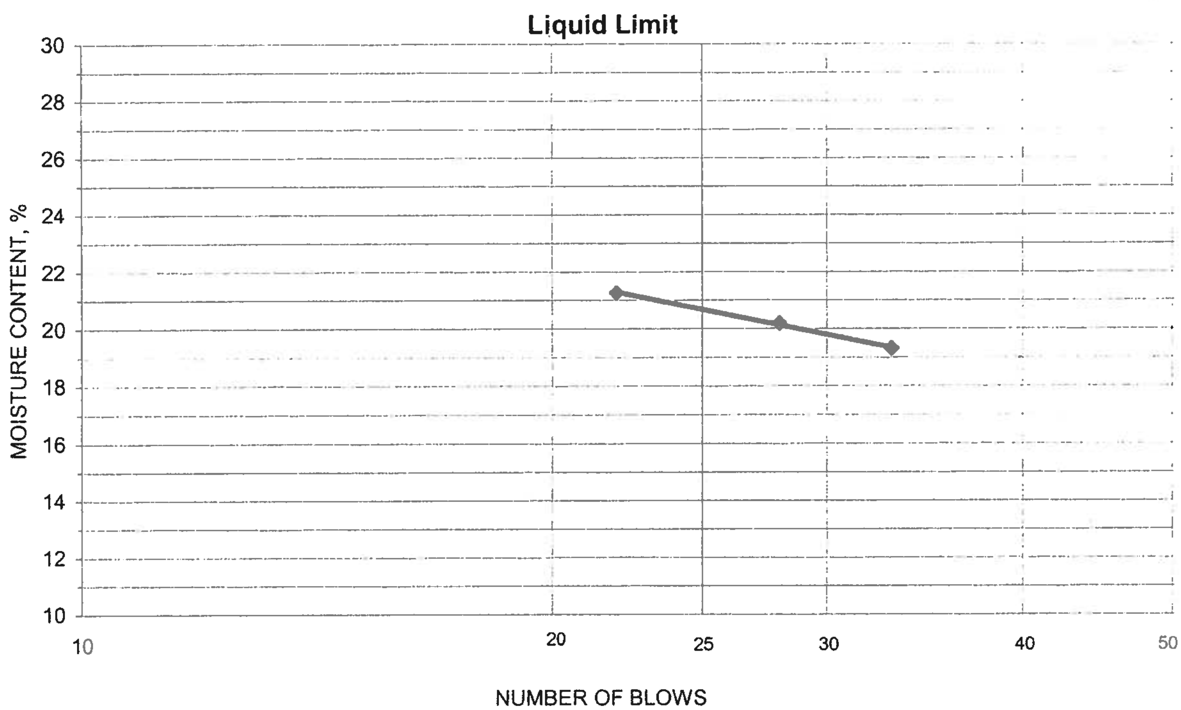
Reviewed by: RJ

Stantec

ATTERBERG LIMITS

Project	TVA - PAF Peabody Ash Pond	Project No.	175569069
Source	STN-11, 30.0'-31.5', 32.5'-34.0'	Lab ID	375
		% + No. 40	11
Tested By	mc	Test Method	ASTM D 4318 Method A
Date Received	11-11-2009		
Test Date	11-19-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
18.83	17.57	11.04	33	19.3	21
19.33	17.95	11.11	28	20.2	
21.06	19.30	11.02	22	21.3	



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
18.62	17.82	10.99	11.7	12	9
18.72	17.91	11.16	12.0		

Remarks:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - PAF Peabody Ash Pond
Source: STN-11, 30.0'-31.5', 32.5'-34.0'

Project Number: 175569069
Lab ID: 375

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

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

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: CM
Test Date: 11-12-2009
Date Received: 11-11-2009

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: 2.63

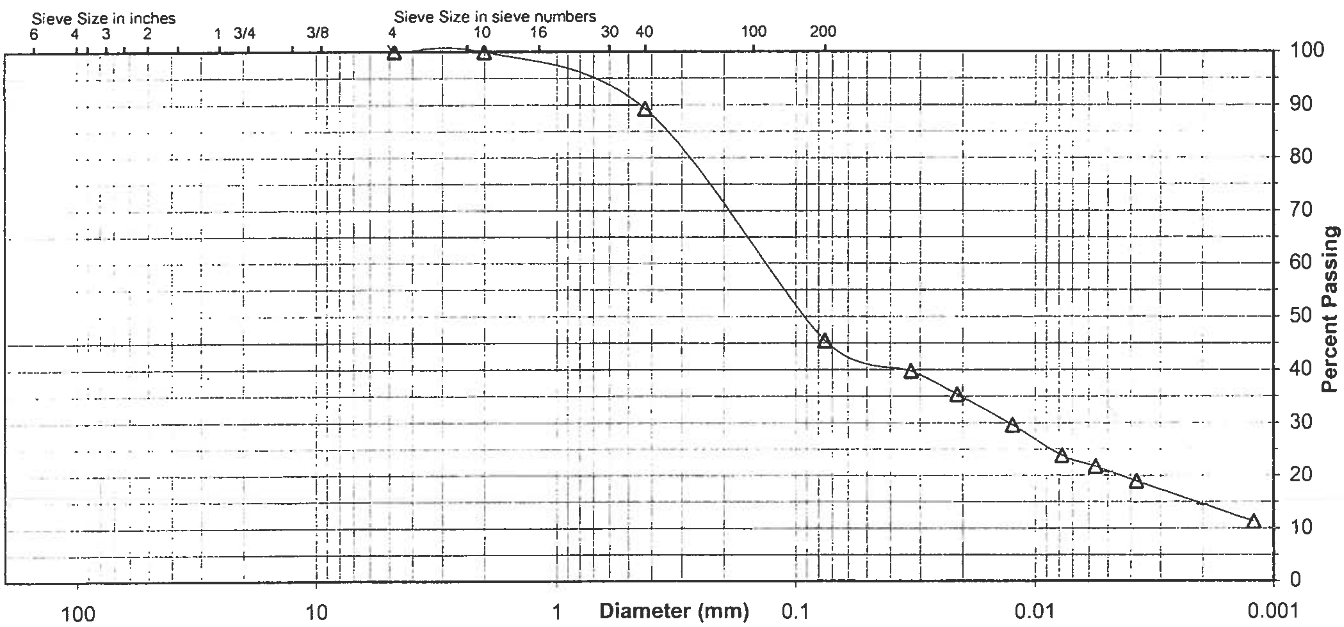
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	89.3
No. 200	45.4
0.02 mm	34.9
0.005 mm	20.7
0.002 mm	14.5
0.001 mm	10.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	10.7	43.9	24.7	20.7

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	10.7	43.9	30.9	14.5



Comments

Reviewed By RJ

Stantec

Summary of Soil Tests

N2

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-17, 17.5'-19.0', 20.0'-21.5'	Lab ID	384
County	Muhlenberg, Ky	Date Received	11-11-09
Sample Type	SPT Comp	Date Reported	11-20-09

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	98.7
No. 200	0.075	89.6
	0.02	64.8
	0.005	28.1
	0.002	19.2
estimated	0.001	14.0

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

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	1.3
Medium Sand	1.3	---
Fine Sand	9.1	9.1
Silt	61.5	70.4
Clay	28.1	19.2

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 29
Plastic Limit: 20
Plasticity Index: 9
Activity Index: 0.47

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-4 (7)

Comments:

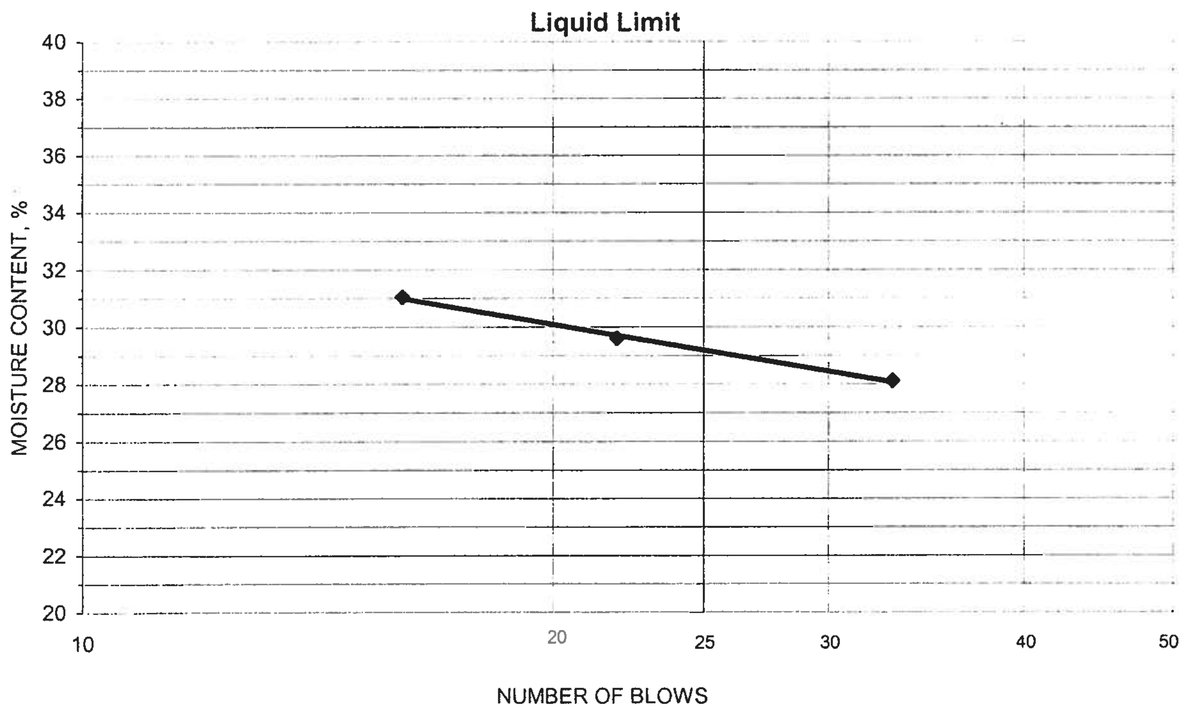
Reviewed by: RJ

Stantec

ATTERBERG LIMITS

Project	TVA - PAF Peabody Ash Pond	Project No.	175569069
Source	STN-17, 17.5'-19.0', 20.0'-21.5'	Lab ID	384
		% + No. 40	1
Tested By	MC	Test Method	ASTM D 4318 Method A
Date Received	11-11-2009		
Test Date	11-19-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
19.83	17.93	11.17	33	28.1	
19.18	17.31	10.99	22	29.6	
18.75	16.90	10.94	16	31.0	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
18.67	17.44	11.19	19.7	20	9
18.22	17.03	10.88	19.3		

Remarks:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-17, 17.5'-19.0', 20.0'-21.5'	Lab ID	384

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: CM
Test Date: 11-12-2009
Date Received 11-11-2009

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

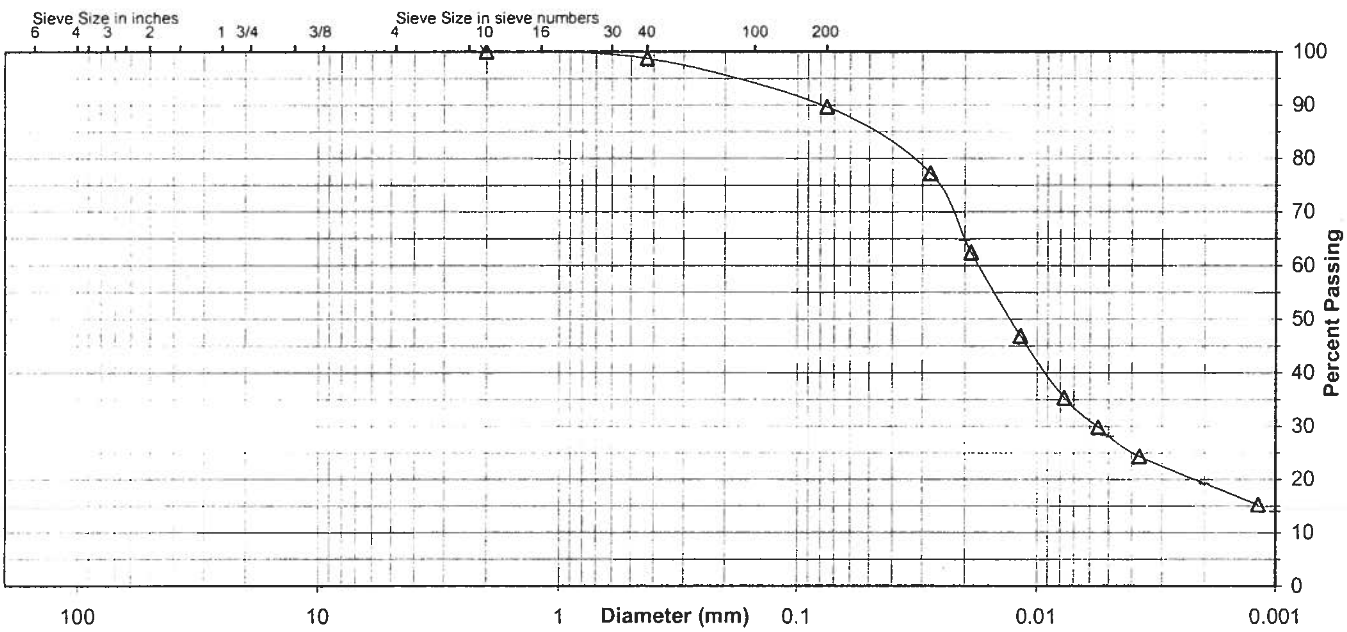
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.7
No. 200	89.6
0.02 mm	64.8
0.005 mm	28.1
0.002 mm	19.2
0.001 mm	14.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	0.0	1.3	9.1	61.5	28.1

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.0	1.3	9.1	70.4	19.2



Comments

Reviewed By RJ

Stantec

N2

Summary of Soil Tests

Project Name: TVA - PAF Peabody Ash Pond
Source: STN-7, 8.0'-9.5', 11.5'-13.0'
County: Muhlenberg, Ky
Sample Type: SPT Comp

Project Number: 175569069
Lab ID: 372
Date Received: 11-11-09
Date Reported: 11-20-09

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	100.0
3/4"	19	96.0
3/8"	9.5	96.0
No. 4	4.75	96.0
No. 10	2	95.3
No. 40	0.425	90.2
No. 200	0.075	78.2
	0.02	62.1
	0.005	39.2
	0.002	29.3
estimated	0.001	22.0

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

Range	ASTM (%)	AASHTO (%)
Gravel	4.0	4.7
Coarse Sand	0.7	5.1
Medium Sand	5.1	---
Fine Sand	12.0	12.0
Silt	39.0	48.9
Clay	39.2	29.3

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 37
Plastic Limit: 19
Plasticity Index: 18
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

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.73

Classification

Unified Group Symbol: CL
Group Name: Lean clay with sand

AASHTO Classification: A-6 (13)

Comments:

Reviewed by: RJ

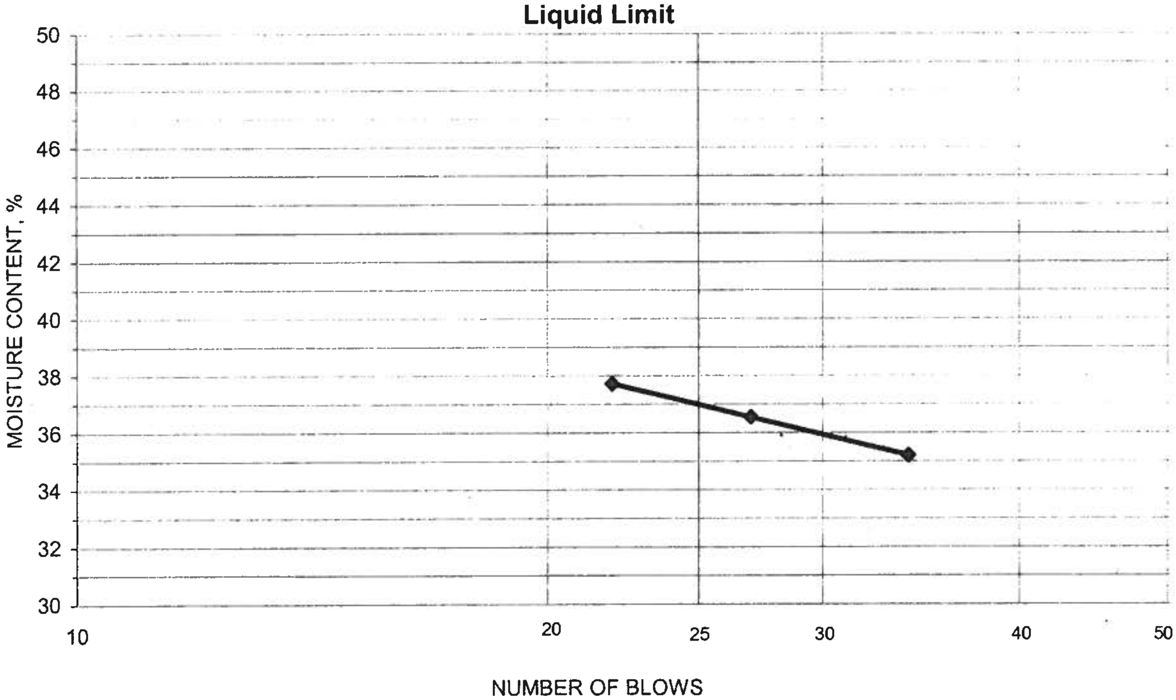
Stantec

ATTERBERG LIMITS

Project	TVA - PAF Peabody Ash Pond	Project No.	175569069
Source	STN-7, 8.0'-9.5', 11.5'-13.0'	Lab ID	372
		% + No. 40	10
Tested By	mc	Test Method	ASTM D 4318 Method A
Date Received	11-11-2009		
Test Date	11-19-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
18.85	16.83	11.09	34	35.2	
19.36	17.12	10.99	27	36.5	
19.10	16.89	11.03	22	37.7	37

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
18.58	17.39	11.19	19.2	19	18
18.47	17.30	11.12	18.9		

Remarks:

Reviewed By RJ

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Particle-Size Analysis of Soils
ASTM D 422

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-7, 8.0'-9.5', 11.5'-13.0'	Lab ID	372

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: 11-12-2009
Date Received 11-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	96.0
3/8"	96.0
No. 4	96.0
No. 10	95.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.73

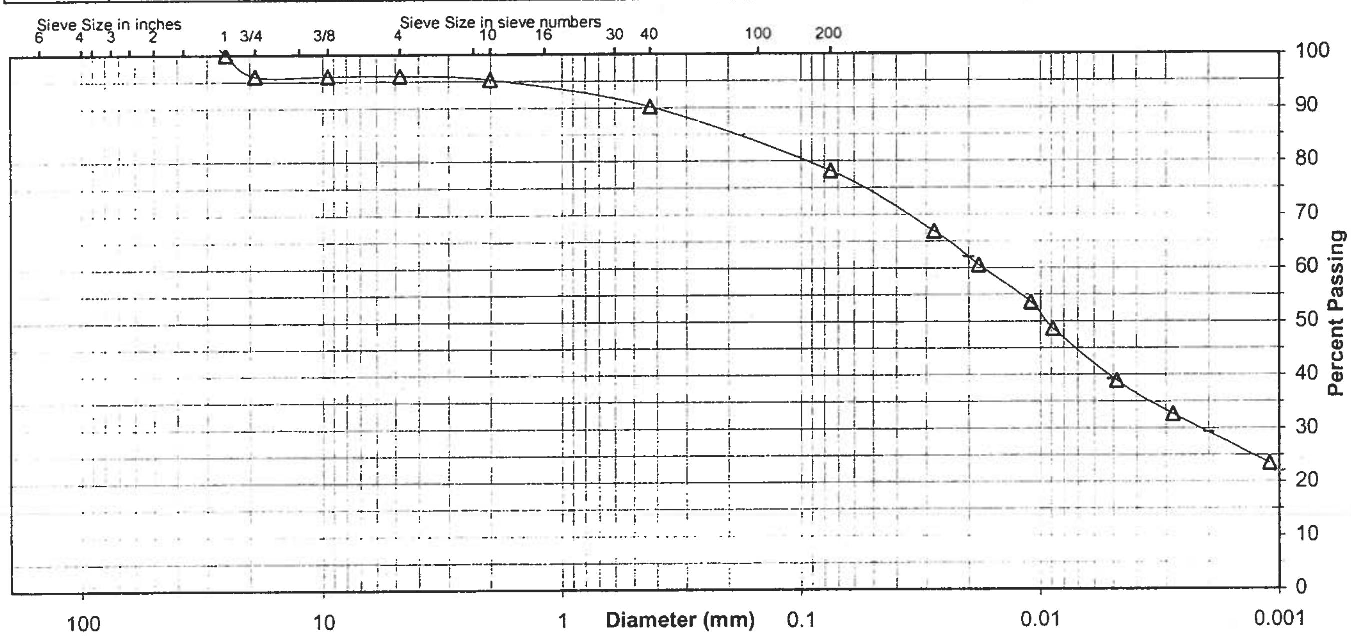
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	90.2
No. 200	78.2
0.02 mm	62.1
0.005 mm	39.2
0.002 mm	29.3
0.001 mm	22.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	4.0	0.0	0.7	5.1	12.0	39.0	39.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	4.7	5.1	12.0	48.9	29.3



Comments ____________________

Reviewed By RJ

Stantec

Summary of Soil Tests

N3

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-4, 37.5'-39.0', 40.0'-41.5'	Lab ID	363
County	Muhlenberg, Ky	Date Received	11-11-09
Sample Type	SPT Comp	Date Reported	11-20-09

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	
No. 10	2	100.0
No. 40	0.425	99.9
No. 200	0.075	99.6
	0.02	94.2
	0.005	66.7
	0.002	47.1
estimated	0.001	35.0

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	0.3	0.3
Silt	32.9	52.5
Clay	66.7	47.1

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 46

Plastic Limit: 22

Plasticity Index: 24

Activity Index: 0.51

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.76

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-7-6 (27)

Comments:

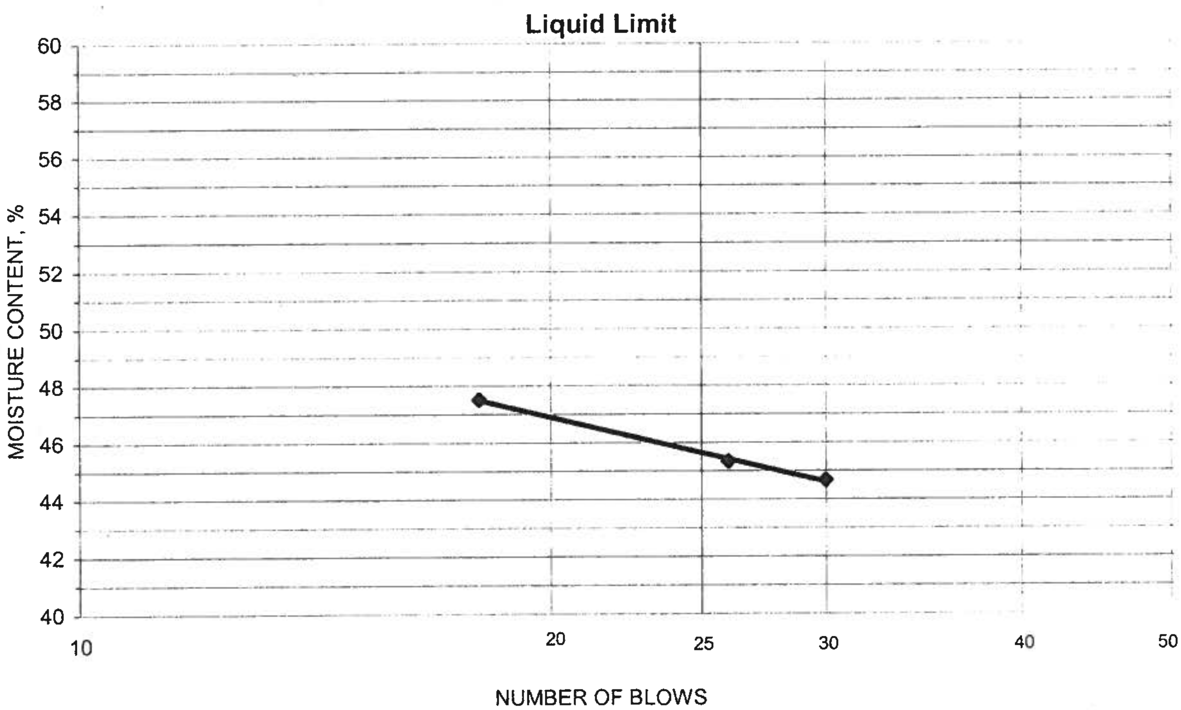
Reviewed by: RJ

Stantec

ATTERBERG LIMITS

Project	TVA - PAF Peabody Ash Pond	Project No.	175569069
Source	STN-4, 37.5'-39.0', 40.0'-41.5'	Lab ID	363
		% + No. 40	0
Tested By	MC	Test Method	ASTM D 4318 Method A
Date Received	11-11-2009		
Test Date	11-19-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
18.33	16.20	11.50	26	45.3	46
19.69	17.14	11.43	30	44.7	
18.86	16.48	11.47	18	47.5	



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
18.77	17.48	11.62	22.0	22	24
18.49	17.21	11.38	22.0		

Remarks:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - PAF Peabody Ash Pond
Source: STN-4, 37.5'-39.0', 40.0'-41.5'

Project Number: 175569069
Lab ID: 363

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

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

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

Tested By: CM
Test Date: 11-12-2009
Date Received: 11-11-2009

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: 2.76

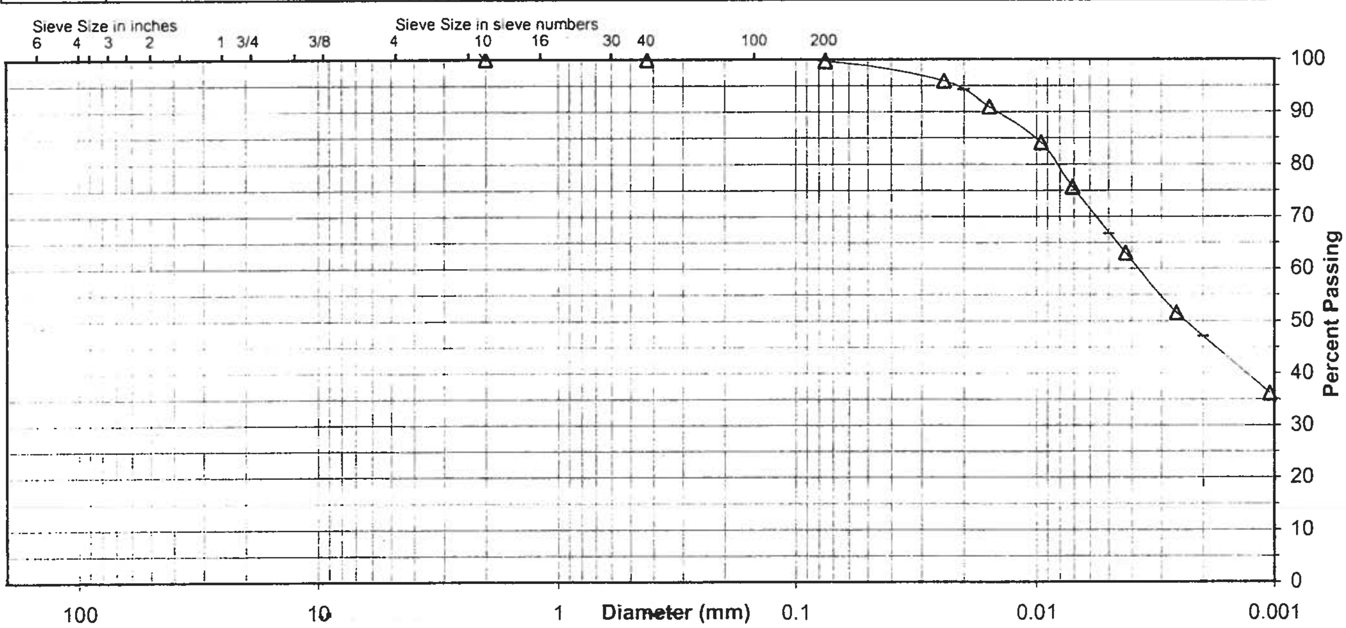
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.9
No. 200	99.6
0.02 mm	94.2
0.005 mm	66.7
0.002 mm	47.1
0.001 mm	35.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.1	0.3	32.9	66.7

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.1	0.3	52.5	47.1



Comments

Reviewed By RJ

Stantec

Summary of Soil Tests

N3

Project Name	TVA - PAF Peabody Ash Pond	Project Number	175569069
Source	STN-16, 15.5'-17.0', 18.0'-19.5'	Lab ID	381
County	Muhlenberg, Ky	Date Received	11-11-09
Sample Type	SPT Comp	Date Reported	11-20-09

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	99.9
No. 200	0.075	92.1
	0.02	47.7
	0.005	17.7
	0.002	11.5
estimated	0.001	8.0

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

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.1
Medium Sand	0.1	---
Fine Sand	7.8	7.8
Silt	74.4	80.6
Clay	17.7	11.5

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 23

Plastic Limit: 17

Plasticity Index: 6

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-ML

Group Name: Silty clay

AASHTO Classification: A-4 (3)

Comments:

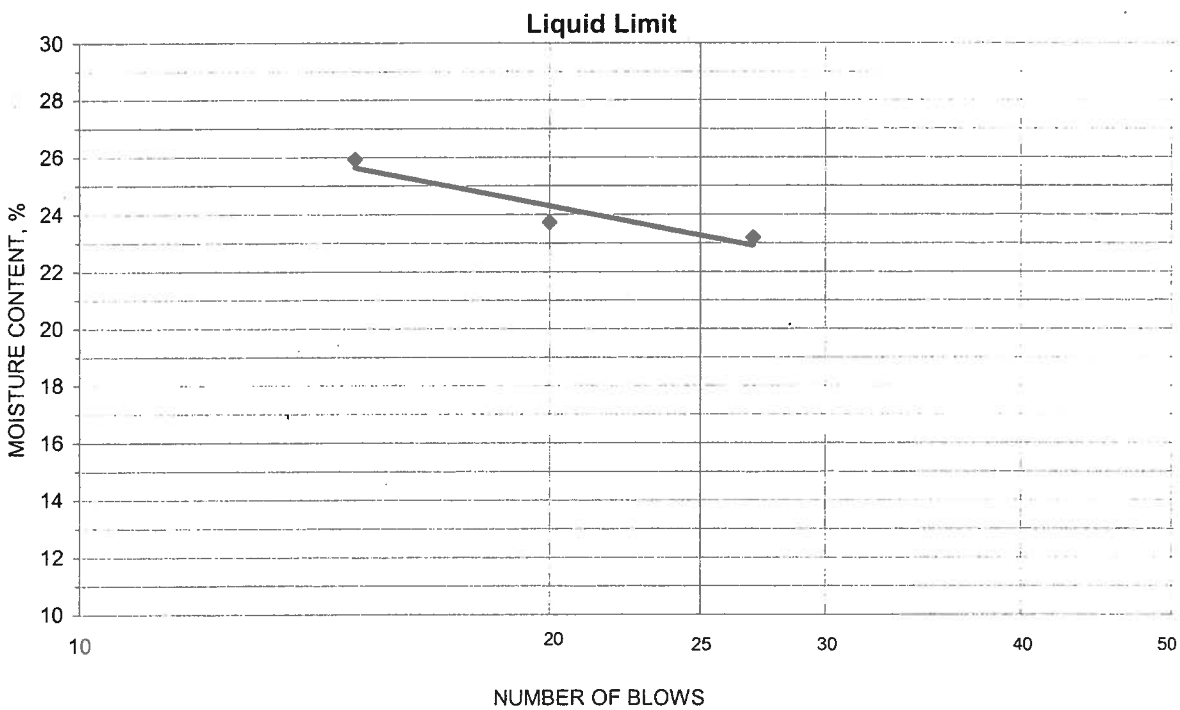
Reviewed by: RJ

Stantec

ATTERBERG LIMITS

Project	TVA - PAF Peabody Ash Pond	Project No.	175569069
Source	STN-16, 15.5'-17.0', 18.0'-19.5'	Lab ID	381
		% + No. 40	0
Tested By	mc	Test Method	ASTM D 4318 Method A
Date Received	11-11-2009		
Test Date	11-19-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
16.98	15.85	11.49	15	25.9	
18.94	17.50	11.43	20	23.7	
20.23	18.57	11.41	27	23.2	23



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
19.26	18.15	11.77	17.4	17	6
18.75	17.67	11.45	17.4		

Remarks:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - PAF Peabody Ash Pond
Source: STN-16, 15.5'-17.0', 18.0'-19.5'

Project Number: 175569069
Lab ID: 381

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: CM
Test Date: 11-12-2009
Date Received: 11-11-2009

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

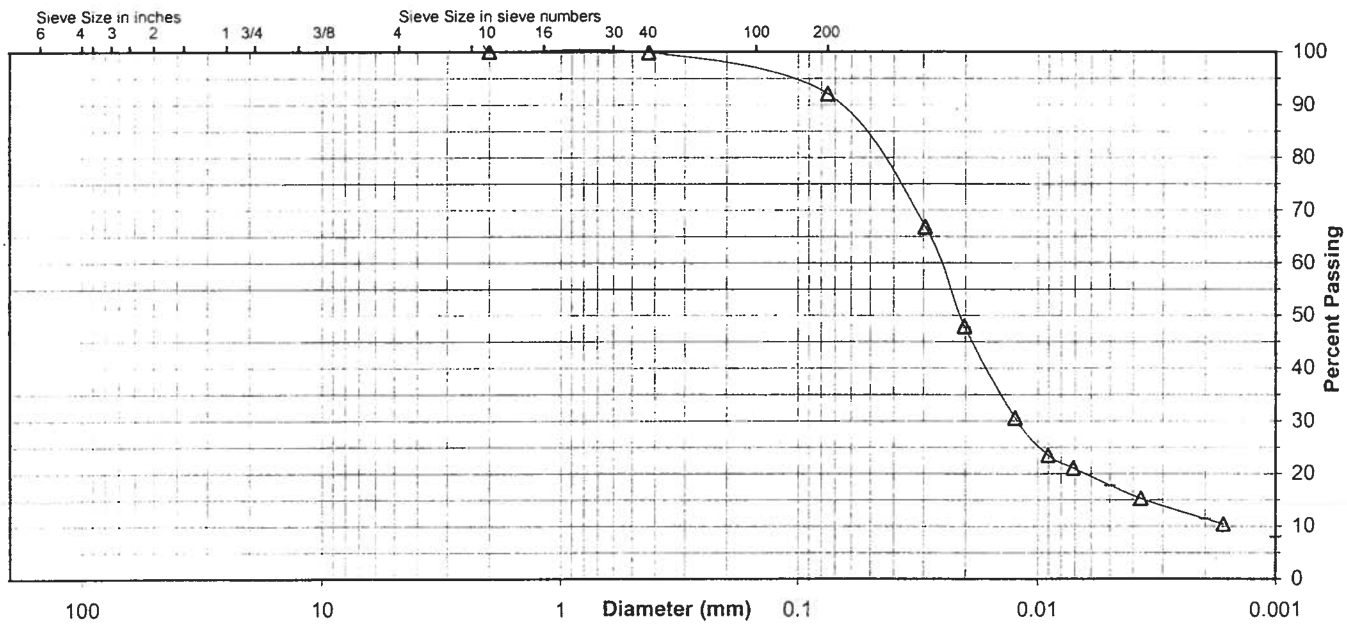
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	99.9
No. 200	92.1
0.02 mm	47.7
0.005 mm	17.7
0.002 mm	11.5
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	0.0	0.1	7.8	74.4	17.7

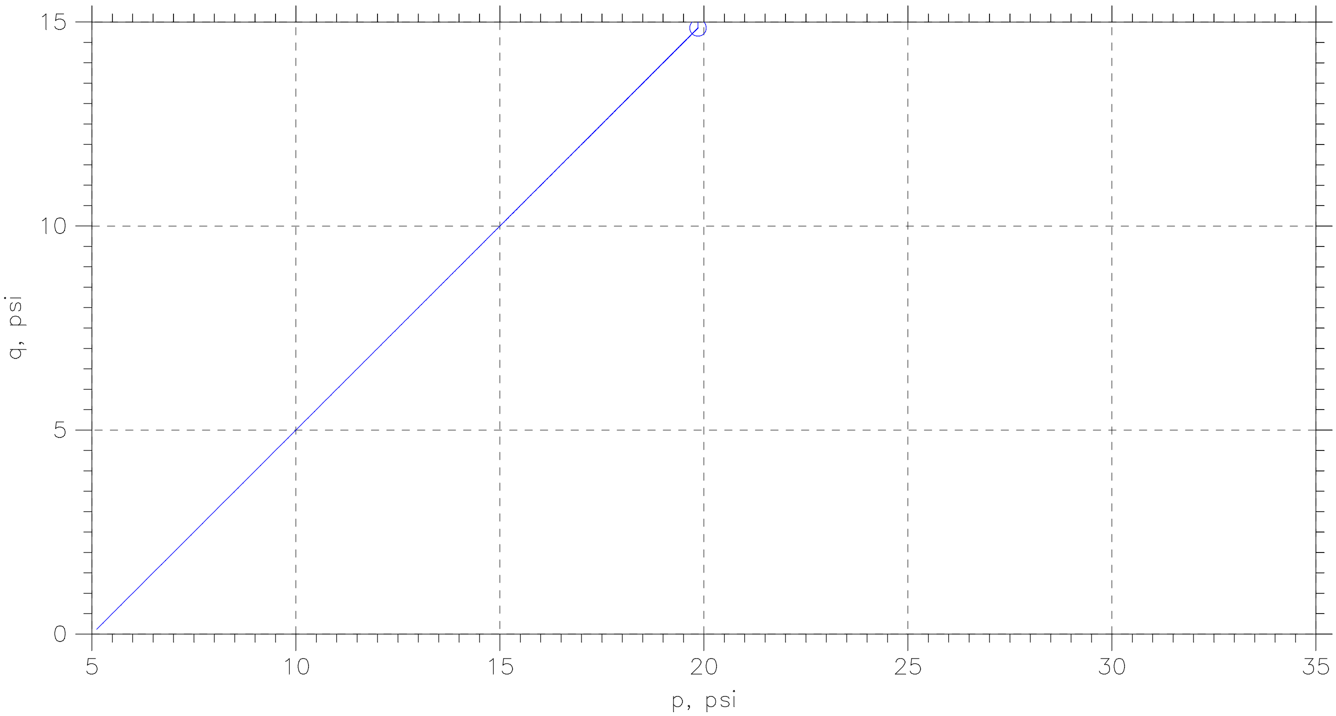
AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.1	7.8	80.6	11.5

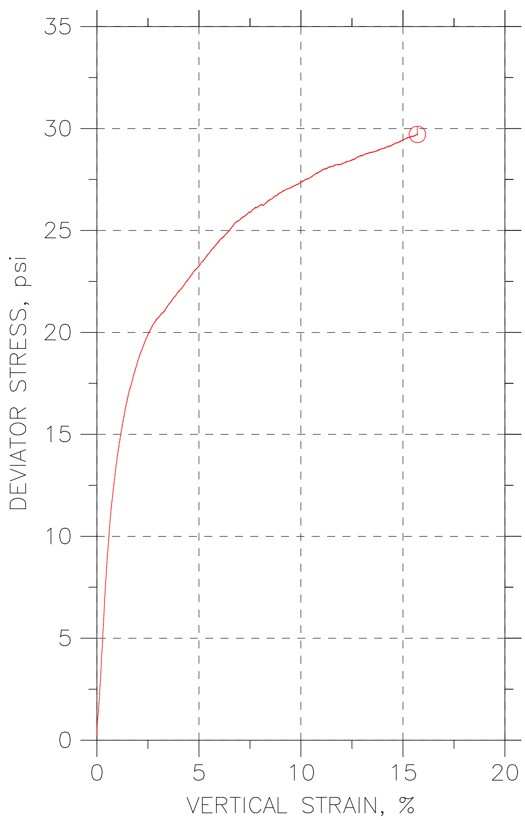


Comments

Reviewed By RJ

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850





Symbol	○			
Sample No.	**STN-22, ST-1**			
Test No.	7.1			
Depth	6.0-6.5			
Tested by	jm			
Test Date	11/19/09			
Checked by	mm			
Check Date				
Diameter, in	2.854			
Height, in	5.797			
Water Content, %	13.6			
Dry Density, pcf	119.3			
Saturation, %	89.0			
Void Ratio	0.413			
Confining Stress, psi	5			
Undrained Strength, psi	14.86			
Max. Dev. Stress, psi	29.71			
Strain at Failure, %	15.7			
Strain Rate, %/min	1			
Estimated Specific Gravity	2.7			
Liquid Limit	---			
Plastic Limit	---			
Plasticity Index	---			

GeoTesting express
the groundwork for success

Project: Peabody Ash Pond	
Location: ---	
Project No.: GTX-1503	
Boring No.: STN-6	
Sample Type: UD	
Description: Gray-Brown Lean clay with sand	
Remarks: 2054	

Phase calculations based on start and end of test.

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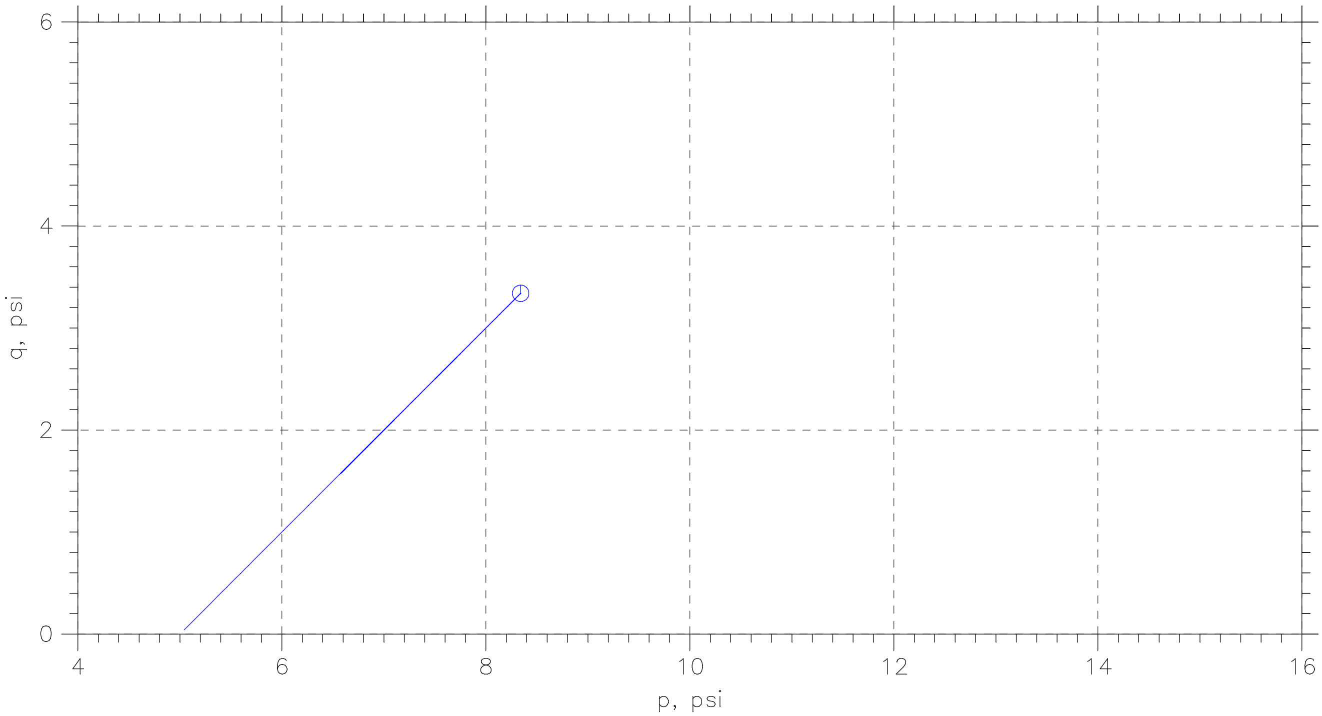
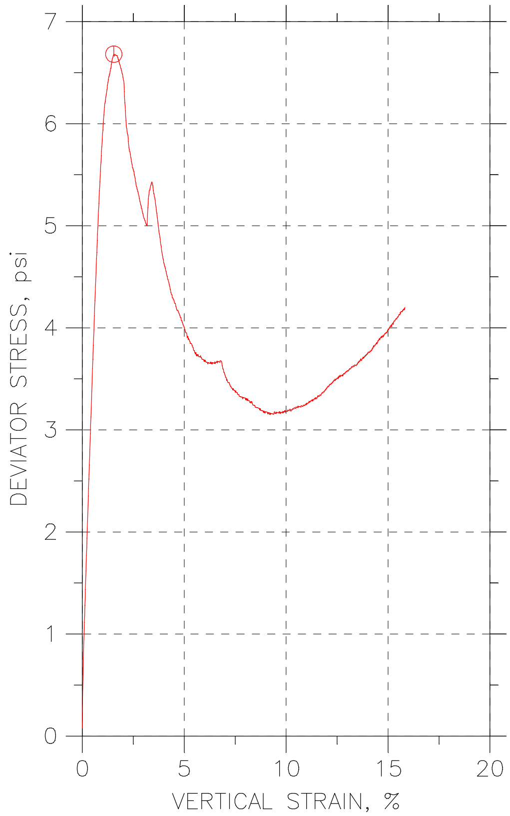
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850





Symbol	○			
Sample No.	STN-16, ST-1			
Test No.	6.1			
Depth	5.1-5.7			
Tested by	jm			
Test Date	11/19/09			
Checked by	mm			
Check Date				
Diameter, in	2.841			
Height, in	6.334			
Water Content, %	25.0			
Dry Density, pcf	101.			
Saturation, %	100.8			
Void Ratio	0.669			
Confining Stress, psi	5			
Undrained Strength, psi	3.341			
Max. Dev. Stress, psi	6.681			
Strain at Failure, %	1.54			
Strain Rate, %/min	1			
Estimated Specific Gravity	2.7			
Liquid Limit	---			
Plastic Limit	---			
Plasticity Index	---			

GeoTesting express
the groundwork for success

Project: Peabody Ash Pond
Location: ---
Project No.: GTX-1503
Boring No.: STN-16
Sample Type: UD
Description: Gray-Brown Lean clay with sand
Remarks: 2054

Phase calculations based on start and end of test.

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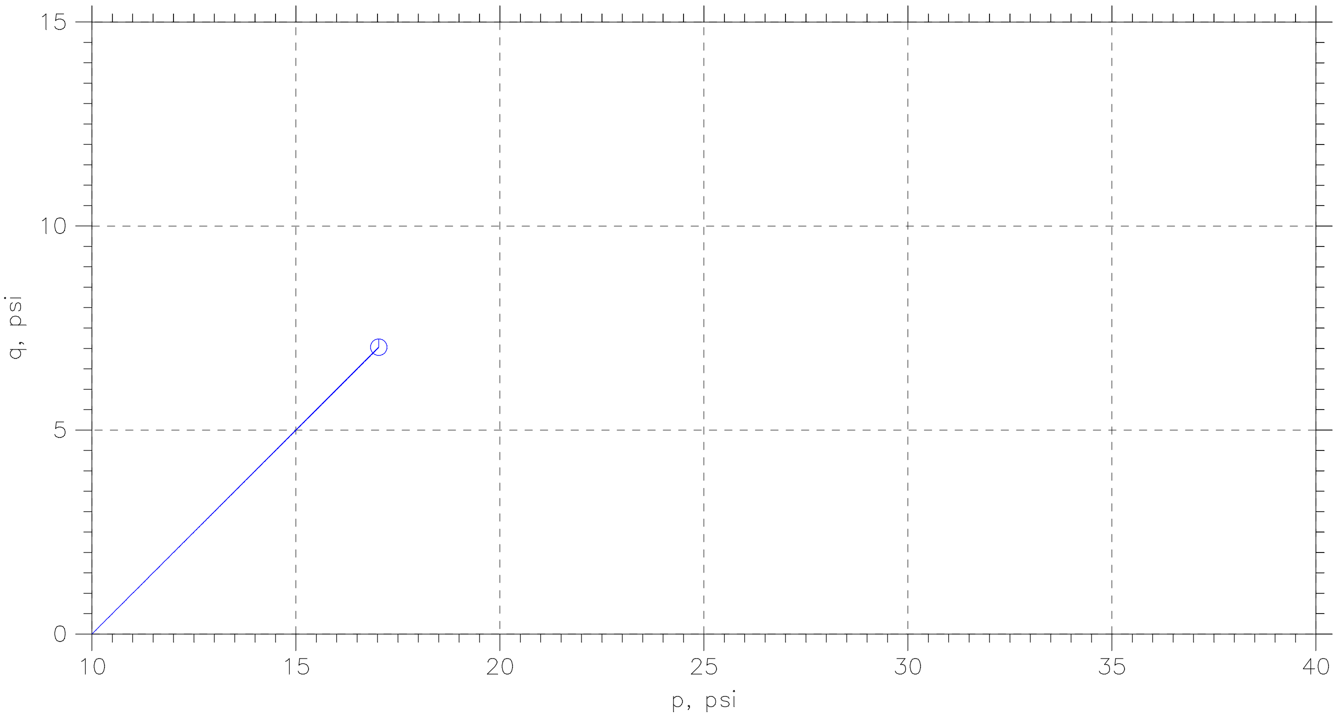
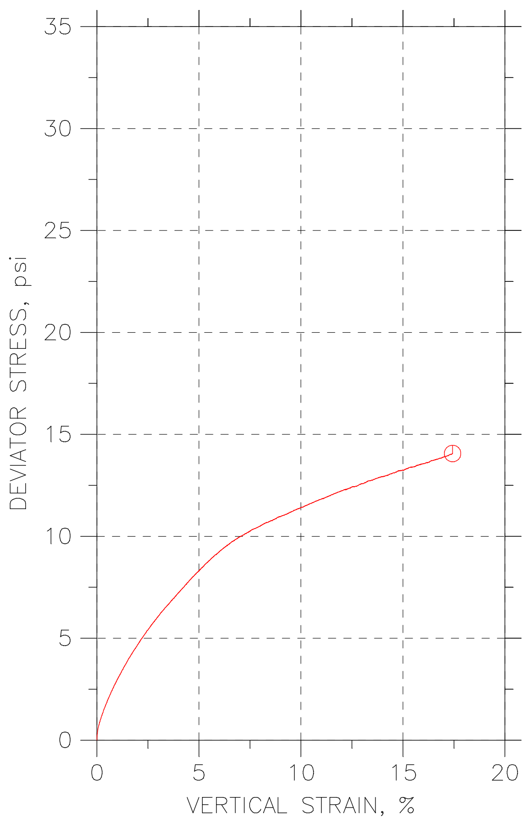
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850





Symbol				
Sample No.	**STN-6, ST-2**			
Test No.	5.1			
Depth	11.8-12.4			
Tested by	jm			
Test Date	11/19/09			
Checked by	mm			
Check Date				
Diameter, in	2.775			
Height, in	5.914			
Water Content, %	19.3			
Dry Density, pcf	115.			
Saturation, %	111.9			
Void Ratio	0.465			
Confining Stress, psi	10			
Undrained Strength, psi	7.031			
Max. Dev. Stress, psi	14.06			
Strain at Failure, %	17.4			
Strain Rate, %/min	1			
Estimated Specific Gravity	2.7			
Liquid Limit	---			
Plastic Limit	---			
Plasticity Index	---			

GeoTesting express
the groundwork for success

Project: Peabody Ash Pond
Location: ---
Project No.: GTX-1503
Boring No.: STN-6
Sample Type: UD
Description: Gray-Brown Lean clay with sand
Remarks: 2054

Phase calculations based on start and end of test.

Mon, 23-NOV-2009 12:05:26

Appendix H

Results of Engineering Analysis

SEEP/W Analysis
Section A-A'
Peabody Ash Pond

Paradise Fossil Plant
Tennessee Valley Authority

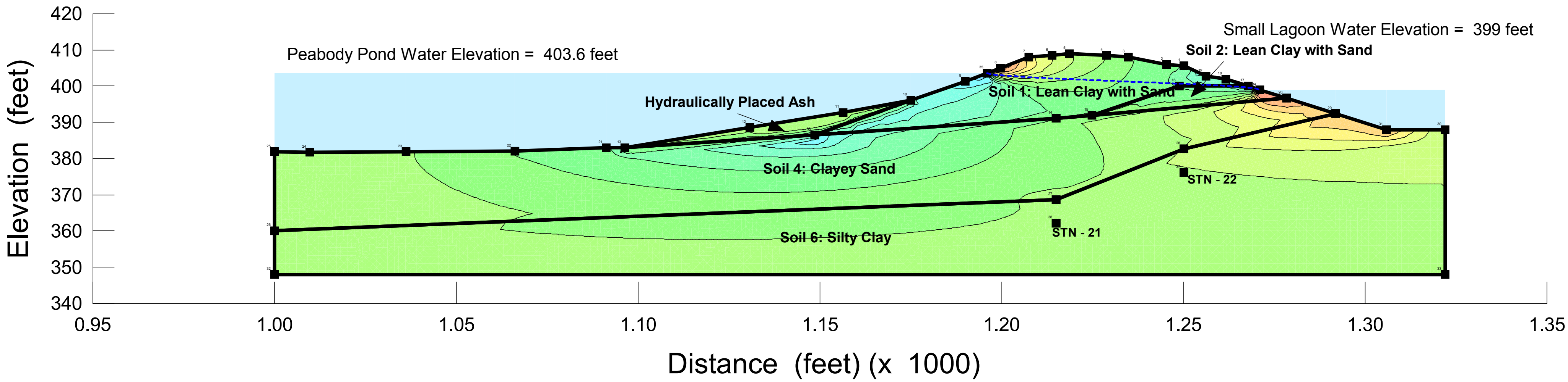
December 2009
Method: Steady-State Seepage

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Piping Potential
Maximum occurs at (1271.1,399)
Total Head = 399.0 ft
At (1270.48,395.99)
Total Head = 399.39 ft
dH = 0.39 ft   dl = 3.01 ft
i = 0.13   i(criticial) = 1.23
FSpiping = 9.5

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Soil 1: Lean Clay with Sand	3.3e-008	0.1	0.29
Soil 2: Lean Clay with Sand	3.3e-008	0.1	0.29
Soil 4: Clayey Sand	7.2e-008	0.05	0.32
Soil 6: Silty Clay	9.5e-008	0.02	0.38
Hydraulically Placed Ash	5e-005	0.02	0.46

Existing Condition



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Slope Stability
Section A-A'
Peabody Ash Pond

Paradise Fossil Plant
Tennessee Valley Authority

Factor of Safety: 1.7

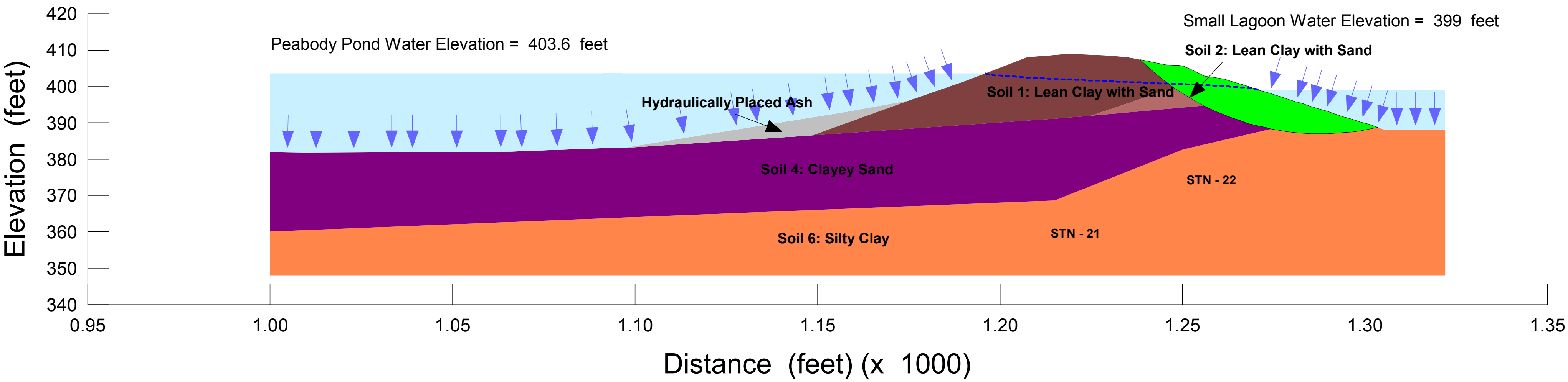
Center: (1288, 457.5) ft
Radius: 70.5 ft

December 2009
Method: Modified Spencer

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Soil 1: Lean Clay with Sand	138	139	0	32
Soil 2: Lean Clay with Sand	138	139	0	32
Soil 4: Clayey Sand	129	133	0	30
Soil 6: Silty Clay	126	129	0	30
Hydraulically Placed Ash	100	107	0	25

Existing Condition



Directory: V:\1755\active\175569069\geotechnical\analysis\Engineering Analysis\Seepage_Stability\Dec_16 Analysis\A-A'_Down Stream.gsz

Slope Stability
Section A-A'
Peabody Ash Pond

Paradise Fossil Plant
Tennessee Valley Authority

December 2009
Method: Modified Spencer

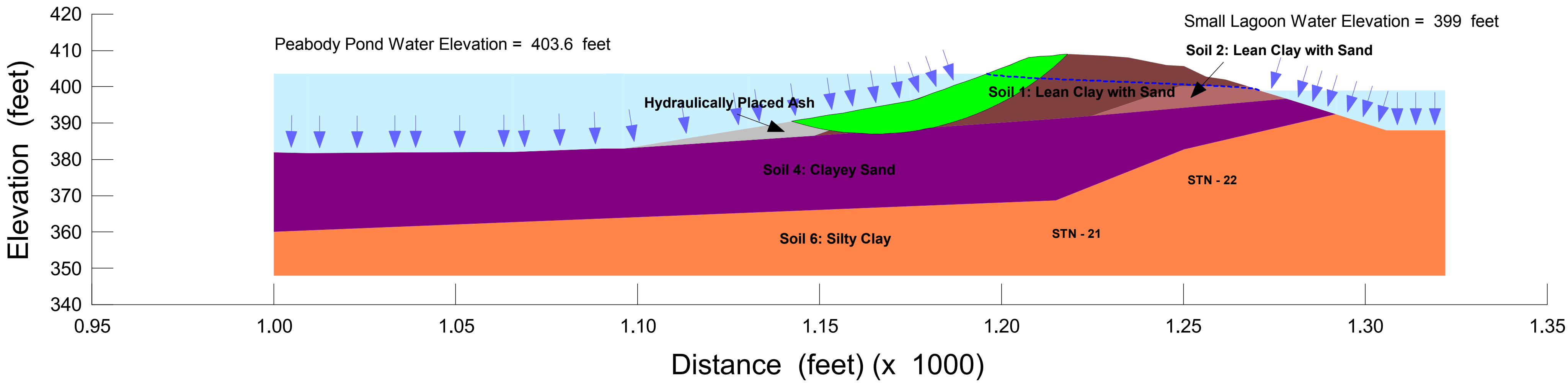
Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Factor of Safety: 2.2

Center: (1165, 462.5) ft
Radius: 75.5 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Soil 1: Lean Clay with Sand	138	139	0	32
Soil 2: Lean Clay with Sand	138	139	0	32
Soil 4: Clayey Sand	129	133	0	30
Soil 6: Silty Clay	126	129	0	30
Hydraulically Placed Ash	100	107	0	25

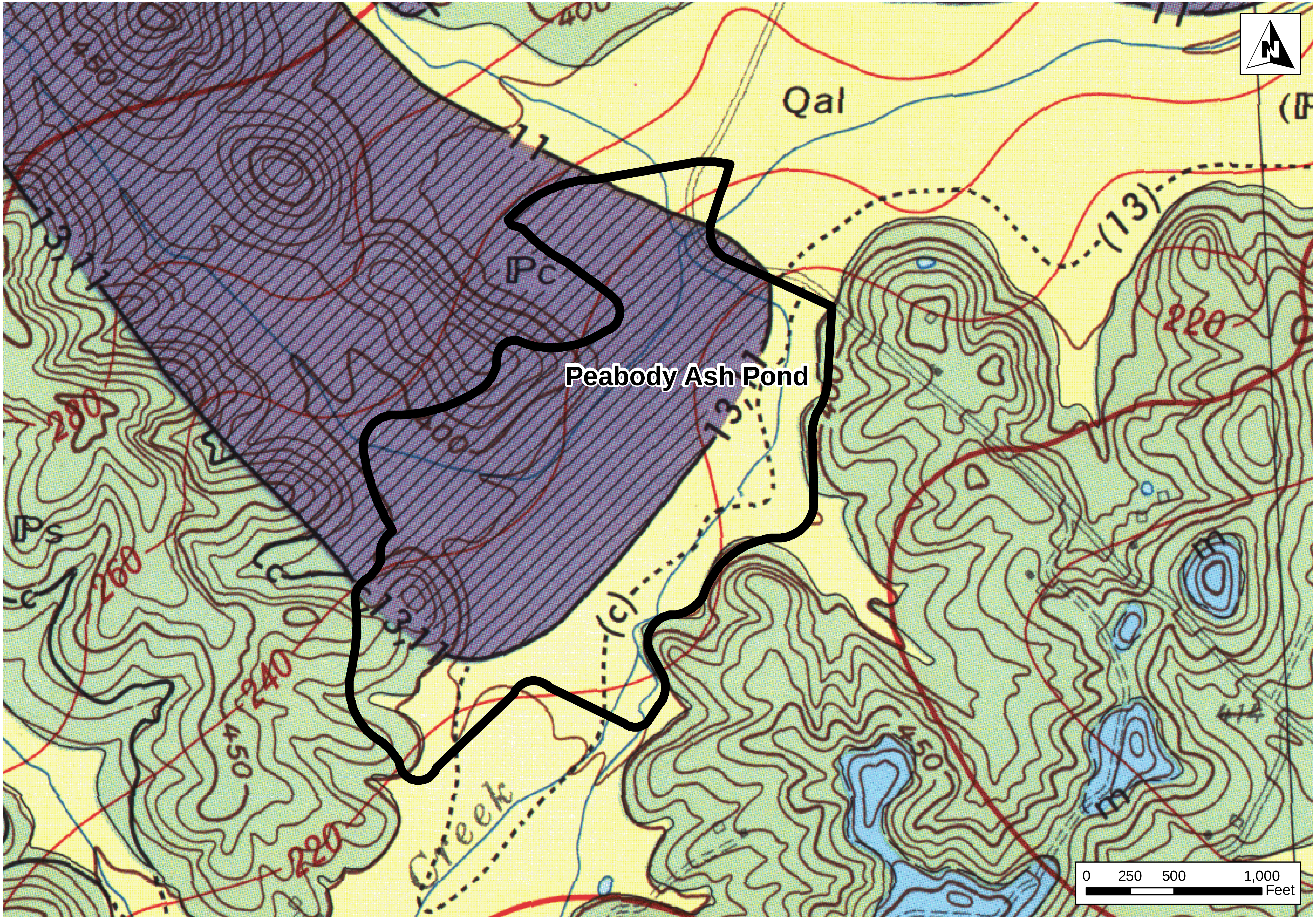
Existing Condition



Directory: V:\1755\active\175569069\geotechnical\analysis\Engineering Analysis\Seepage_Stability\Dec_16 Analysis\A-A'_Up Stream.gsz

Appendix I

Mine Maps



STANTEC CONSULTING SERVICES INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Geologic Map

Phase 2 Assessment
Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

PROJECT NO.	175569069
DATE	NOVEMBER 2009
DRAWN BY	BSJ
CHECKED BY	SV
CHECKED BY	
SCALE	1" = 500'
REVISED	
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SHEET

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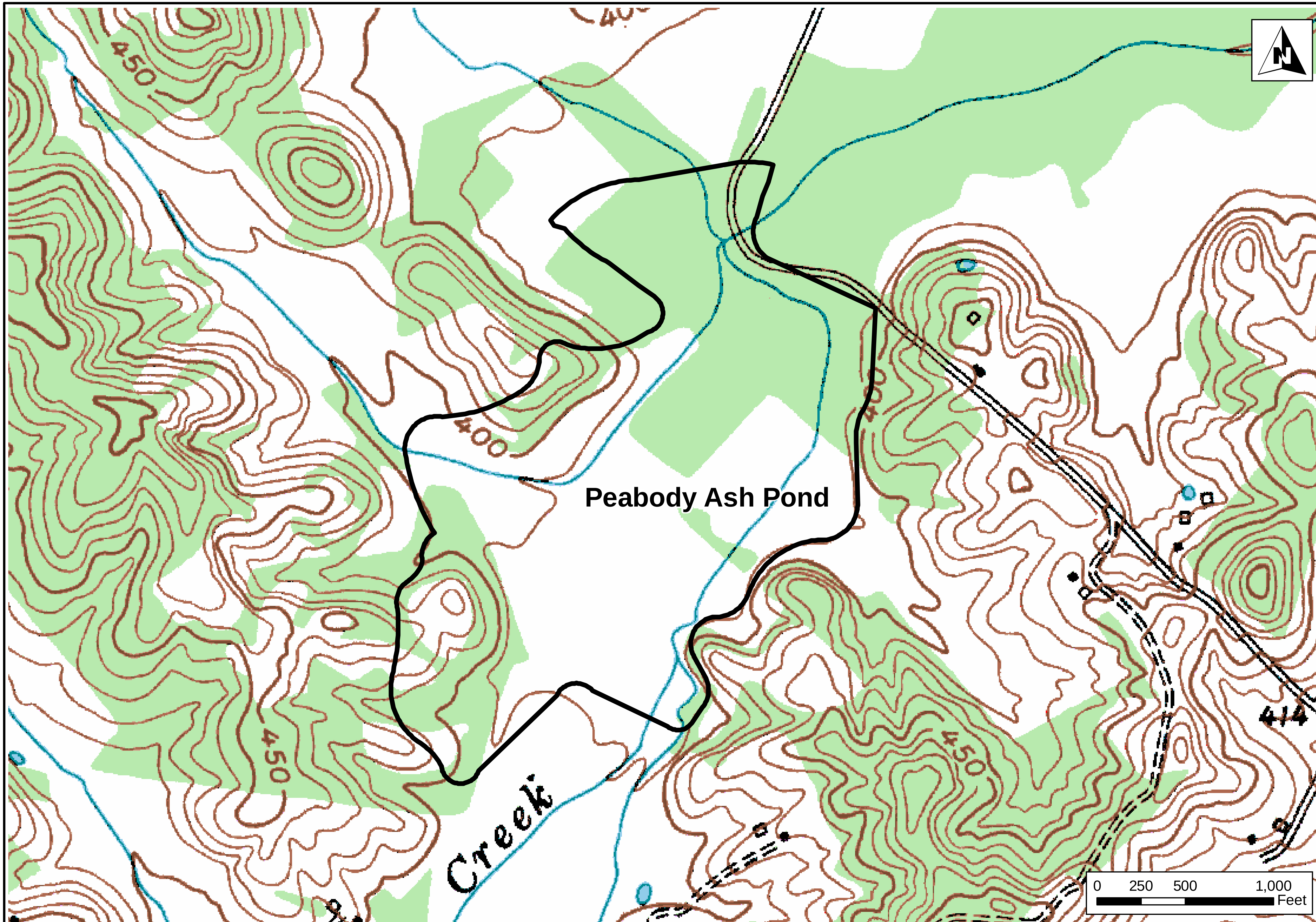

STANTEC CONSULTING SERVICES INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Topographic Map

Phase 2 Assessment
Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

PROJECT NO.	175569069
DATE	NOVEMBER 2009
DRAWN BY	BSJ
CHECKED BY	SV
CHECKED BY	
SCALE	1" = 500'
REVISED	
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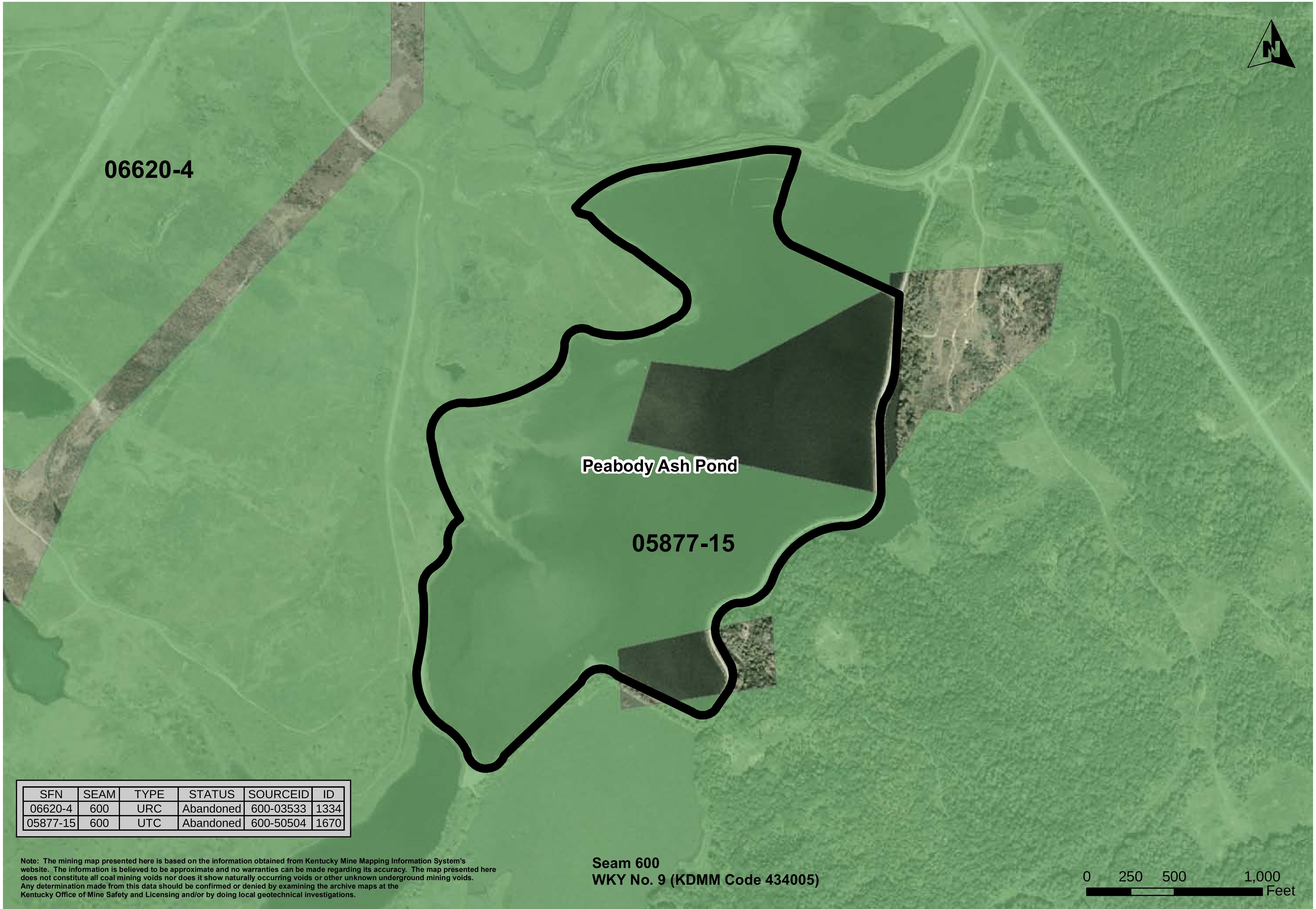
SHEET

1 OF 1



SFN	SEAM	TYPE	STATUS	SOURCEID	ID
06620-4	600	URC	Abandoned	600-03533	1334
05877-15	600	UTC	Abandoned	600-50504	1670

Note: The mining map presented here is based on the information obtained from Kentucky Mine Mapping Information System's website. The information is believed to be approximate and no warranties can be made regarding its accuracy. The map presented here does not constitute all coal mining voids nor does it show naturally occurring voids or other unknown underground mining voids. Any determination made from this data should be confirmed or denied by examining the archive maps at the Kentucky Office of Mine Safety and Licensing and/or by doing local geotechnical investigations.

Seam 600
WKY No. 9 (KDMM Code 434005)

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40511-2050
859-422-3000

Stantec

Mine Map

Phase 2 Assessment
Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

PROJECT NO.	175569069
DATE	DECEMBER 2009
DRAWN BY	AMG
CHECKED BY	SV
CHECKED BY	
SCALE	1" = 500'
REVISED	
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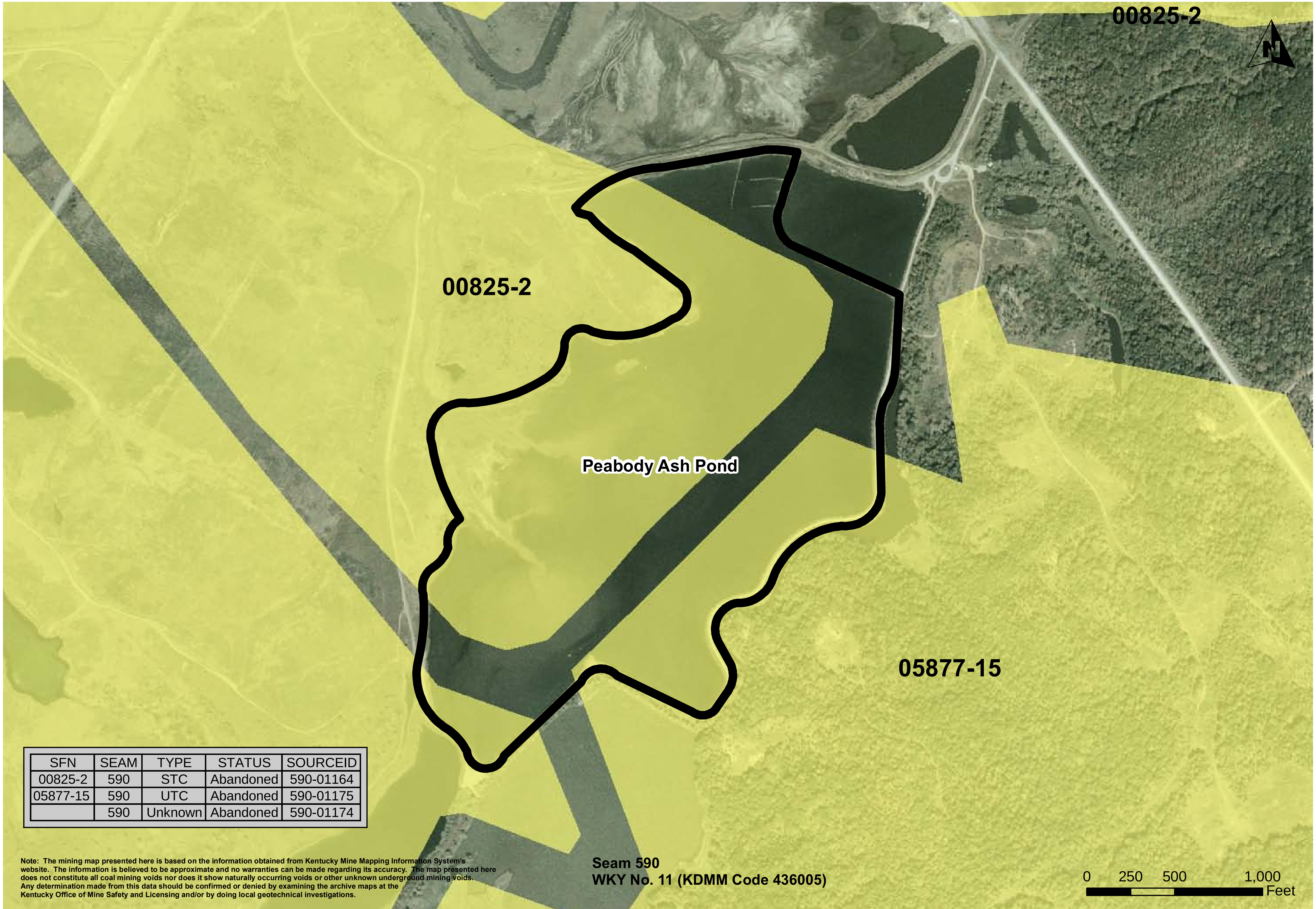
1 OF 4



SFN	SEAM	TYPE	STATUS	SOURCEID
00825-2	590	STC	Abandoned	590-01164
05877-15	590	UTC	Abandoned	590-01175
	590	Unknown	Abandoned	590-01174

Note: The mining map presented here is based on the information obtained from Kentucky Mine Mapping Information System's website. The information is believed to be approximate and no warranties can be made regarding its accuracy. The map presented here does not constitute all coal mining voids nor does it show naturally occurring voids or other unknown underground mining voids. Any determination made from this data should be confirmed or denied by examining the archive maps at the Kentucky Office of Mine Safety and Licensing and/or by doing local geotechnical investigations.

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SERVICES INC.

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Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Mine Map

Phase 2 Assessment
Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

PROJECT NO.	175569040
DATE	DECEMBER 2009
DRAWN BY	AMG
CHECKED BY	SV
CHECKED BY	
SCALE	1" = 500'
REVISED	
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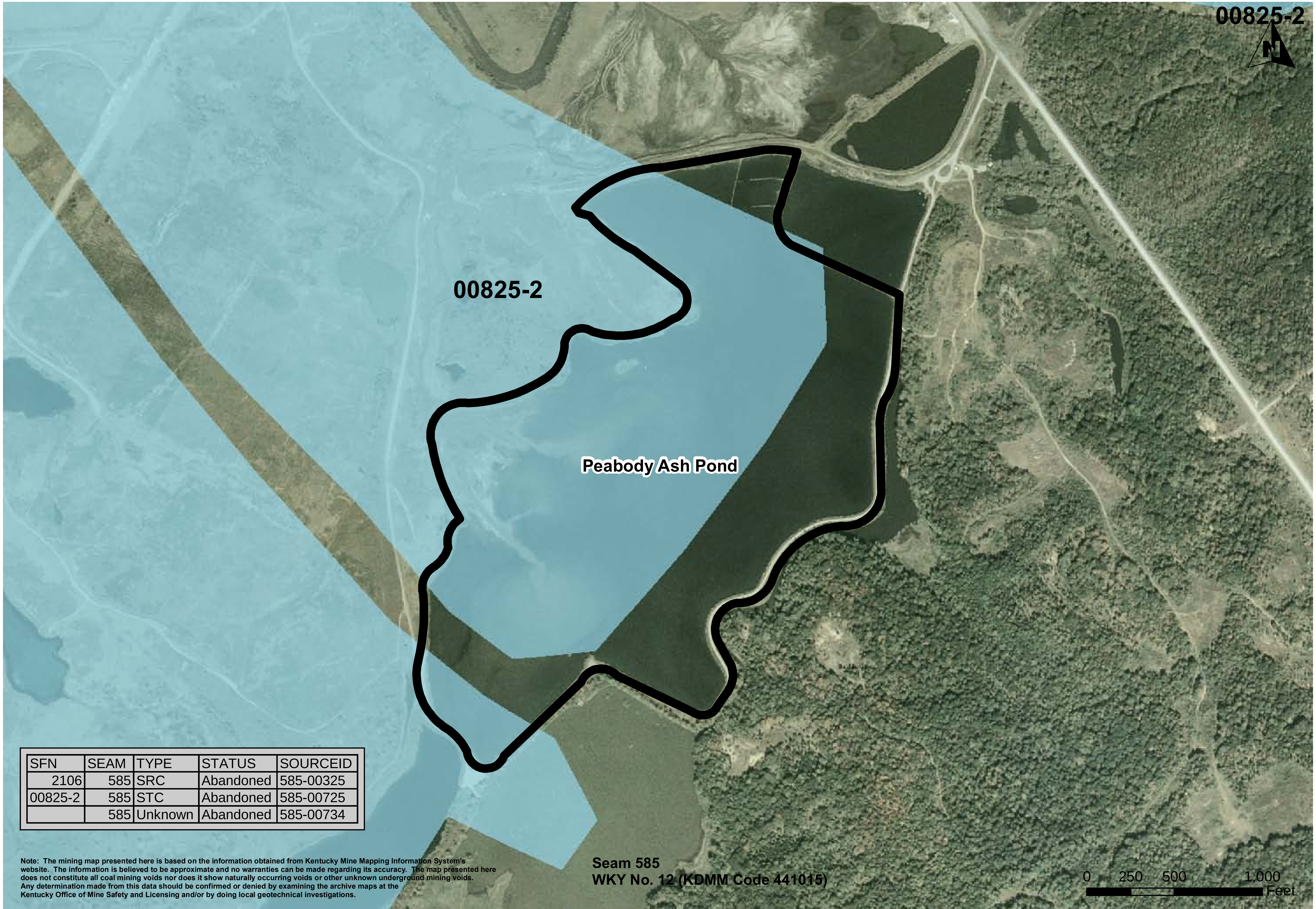
SHEET



SFN	SEAM	TYPE	STATUS	SOURCEID
2106	585	SRC	Abandoned	585-00325
00825-2	585	STC	Abandoned	585-00725
	585	Unknown	Abandoned	585-00734

Note: The mining map presented here is based on the information obtained from Kentucky Mine Mapping Information System's website. The information is believed to be approximate and no warranties can be made regarding its accuracy. The map presented here does not constitute all coal mining voids nor does it show naturally occurring voids or other unknown underground mining voids. Any determination made from this data should be confirmed or denied by examining the archive maps at the Kentucky Office of Mine Safety and Licensing and/or by doing local geotechnical investigations.

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SERVICES INC.

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Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Mine Map

Phase 2 Assessment
Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

PROJECT NO.	175569069
DATE	DECEMBER 2009
DRAWN BY	AMG
CHECKED BY	SV
CHECKED BY	
SCALE	1" = 500'
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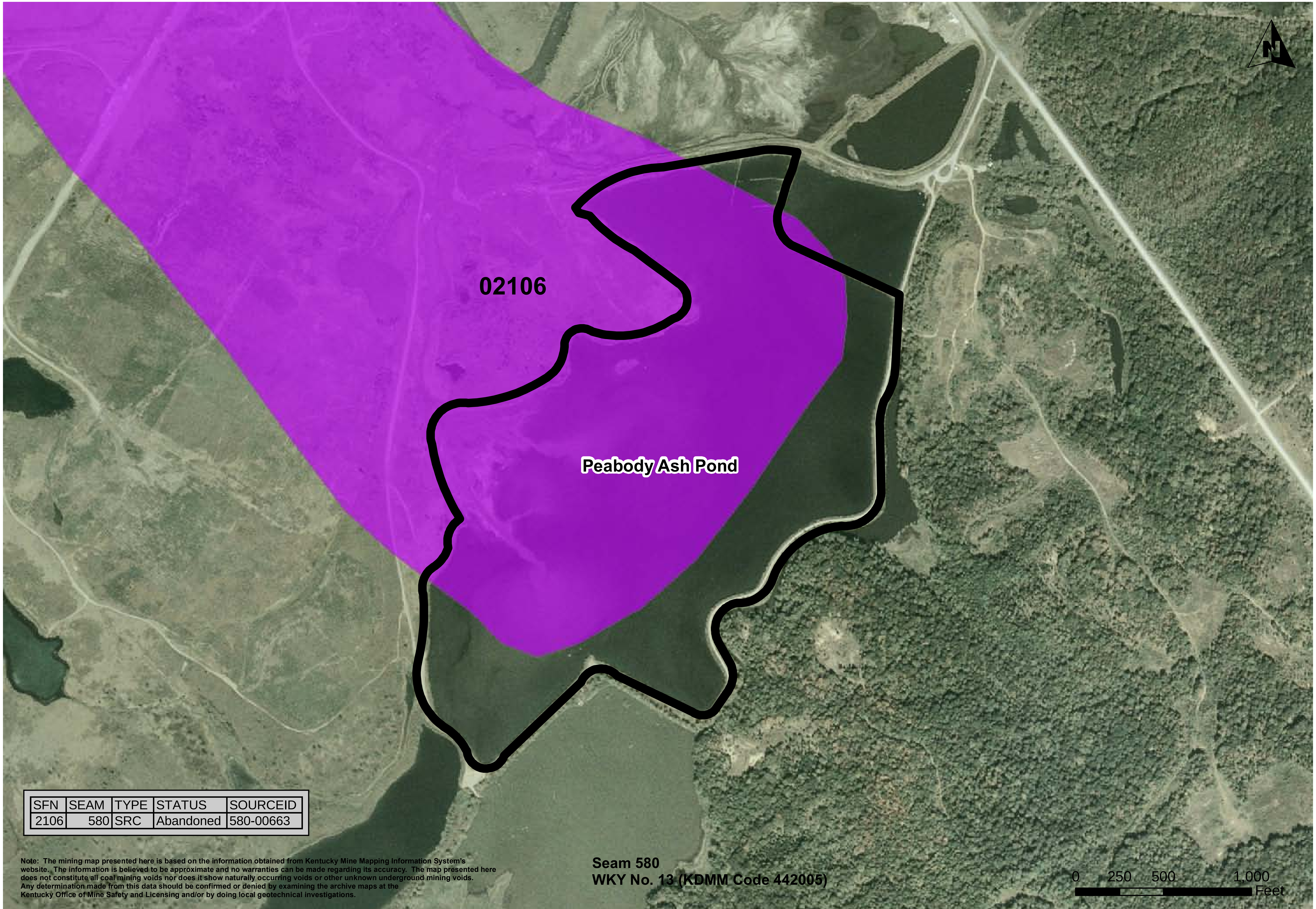
3 OF 4



SFN	SEAM	TYPE	STATUS	SOURCEID
2106	580	SRC	Abandoned	580-00663

Note: The mining map presented here is based on the information obtained from Kentucky Mine Mapping Information System's website. The information is believed to be approximate and no warranties can be made regarding its accuracy. The map presented here does not constitute all coal mining voids nor does it show naturally occurring voids or other unknown underground mining voids. Any determination made from this data should be confirmed or denied by examining the archive maps at the Kentucky Office of Mine Safety and Licensing and/or by doing local geotechnical investigations.

STANTEC CONSULTING SERVICES INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Mine Map

Phase 2 Assessment
Peabody Ash Pond
Paradise Fossil Plant
Muhlenberg County, Kentucky

PROJECT NO.	175569069
DATE	DECEMBER 2009
DRAWN BY	AMG
CHECKED BY	SV
CHECKED BY	
SCALE	1" = 500'
REVISED	
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SHEET

Stantec

Stantec Consulting Services Inc.
10509 Timberwood Circle Suite 100
Louisville, KY 40223-5301
Tel: (502) 212-5000
Fax: (502) 212-5055

February 15, 2012 ltr_002_175551015

Mr. Michael S. Turnbow
Tennessee Valley Authority
1101 Market Street, LP 2G-C
Chattanooga, Tennessee 37402-2801

Re: Results of Pseudostatic Slope Stability Analysis
Active CCP Disposal Facilities
BRF, COF, GAF, JSF, JOF, KIF, PAF, and WCF

Dear Mr. Turnbow:

As requested, Stantec Consulting Services Inc. (Stantec) has conducted pseudostatic slope stability analyses for ground motion levels corresponding to a return period of 2,500 years to support the U.S. Environmental Protection Agency's assessment of TVA's CCP disposal facilities. The results for Bull Run (BFR), Colbert (COF), Gallatin (GAF), John Sevier (JSF), Johnsonville (JOF), Kingston (KIF), Paradise (PAF), and Widows Creek (WCF) are provided in this letter.

Approach

The analyses were performed for current conditions using pseudostatic stability methods, where the added inertial load from an earthquake is assumed to be represented by a simple horizontal pseudostatic coefficient. Specifics related to the analyses/approach are as follows:

- Subsurface data was obtained from the Stantec's recent geotechnical studies performed in 2009 and 2010 time frame.

- SLOPE/W software (from GEO-SLOPE International, Inc.) was used to perform the calculations.

- One existing SLOPE/W cross-section model per disposal facility was selected from the previous studies for analysis. For simplicity and conservatism, the selected sections represent the facility's lowest current static (long-term) factor of safety. The SLOPE/W models were updated to reflect any significant mitigations or operational changes that have occurred since completion of Stantec's geotechnical studies.

- Undrained shear strength parameters were used.

- Ground motion levels corresponding to a return period of 2,500 years (or approximate exceedance probability of 2% in 50 years) was used for selection of a horizontal seismic coefficient. For simplicity, the horizontal seismic coefficient was selected to equal the total hazard peak ground acceleration (rock) for 2,500 year return periods as shown in plant-specific tables (Tables 13 through 23) of TVA's March 28, 2011 region-specific seismic hazard study performed by AMEC Geomatrix, Inc.

- A target factor of safety (FS) of 1.0 was considered for comparing results.

Results

The results of the pseudostatic stability analyses are enclosed (summary spreadsheet, SLOPE/W cross-sections, and plan views showing cross-section locations). The results indicate factors of safety greater than or equal to the target of 1.0.

Stantec appreciates the opportunity to provide these services. If you have questions, or if we can provide additional information, please let us know.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Randy L. Roberts

Randy L. Roberts, PE
Principal

Enclosures

/cdm

Pseudostatic Stability Analysis Summary - TVA Active CCP Disposal Facilities

BRF, COF, GAF, JSF, JOF, KIF, PAF, WCF

Plant	CCP Disposal Facility		Cross-Section	2,500 yr Return	
	Name	Type		PGA (g)	Factor of Safety
BRF	Gypsum Disposal Area 2A	Wet Stack	I	0.131	1.0
	Fly Ash Disposal Area 2	Impoundment	S		1.4
	Bottom Ash Disposal Area 1	Stack	D		1.1
COF	Disposal Area 5 Stack	Stack	I	0.138	1.0
	Disposal Area 5 Stilling Basin	Impoundment	J		1.2
	Ash Pond 4	Impoundment	D		1.0
GAF	Ash Pond A	Impoundment	K	0.108	1.0
	Ash Pond E	Impoundment	B		1.3
JSF	Bottom Ash Pond	Impoundment	I	0.115	2.2
JOF	Ash Disposal Area 2	Impoundment	K	0.254	1.0
KIF	Stilling Pond	Impoundment	132+37	0.115	1.0
PAF	Slag Ponds 2A and 2B	Impoundment	Typical	0.157	1.1
	Scrubber Sludge Complex	Impoundment	G		1.0
	Peabody Ash Pond	Impoundment	A		1.0
WCF	Gypsum Stack	Wet Stack	F	0.1	1.5
	Dredge Cell (Old Scrubber Sludge Pond)	Impoundment	D		1.1
	Main Ash Pond	Impoundment	J		1.4

Paradise Fossil Plant
(PAF)

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

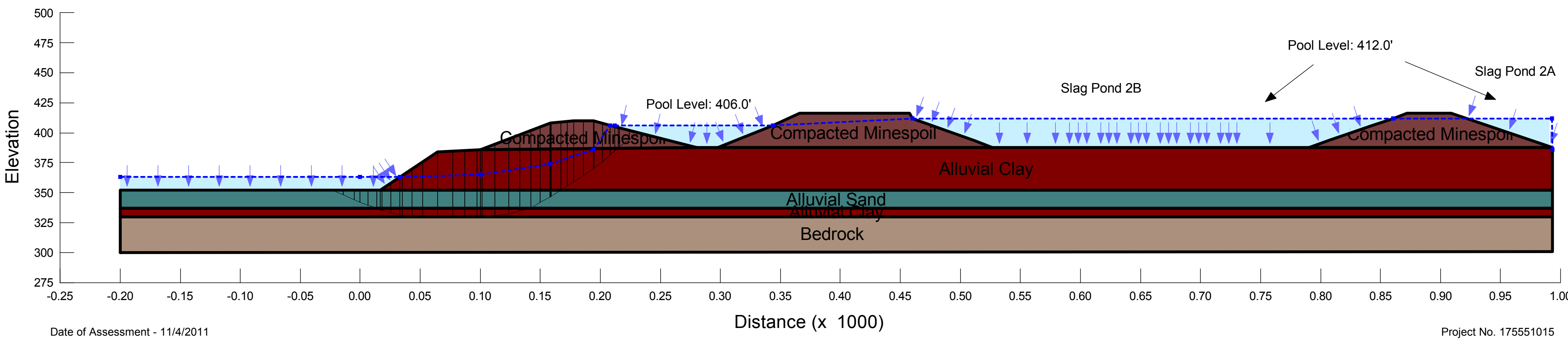
Section - Slag Pond 2B
Paradise Fossil Plant
Drakesboro, Kentucky

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Unit Weight	Cohesion	Friction Angle
Compacted Minespoil	125 pcf	120 psf	22.6 °
Alluvial Clay	125 pcf	975 psf	12.9 °
Alluvial Sand	120 pcf	1000 psf	19.2 °

Factor of Safety: 1.1

Horizontal Sesmic Coefficient Kh = 0.157 g
2500 year Return Period Event



Date of Assessment - 11/4/2011

Project No. 175551015

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section G - Scrubber Sludge Complex
Paradise Fossil Plant
Drakesboro, Kentucky

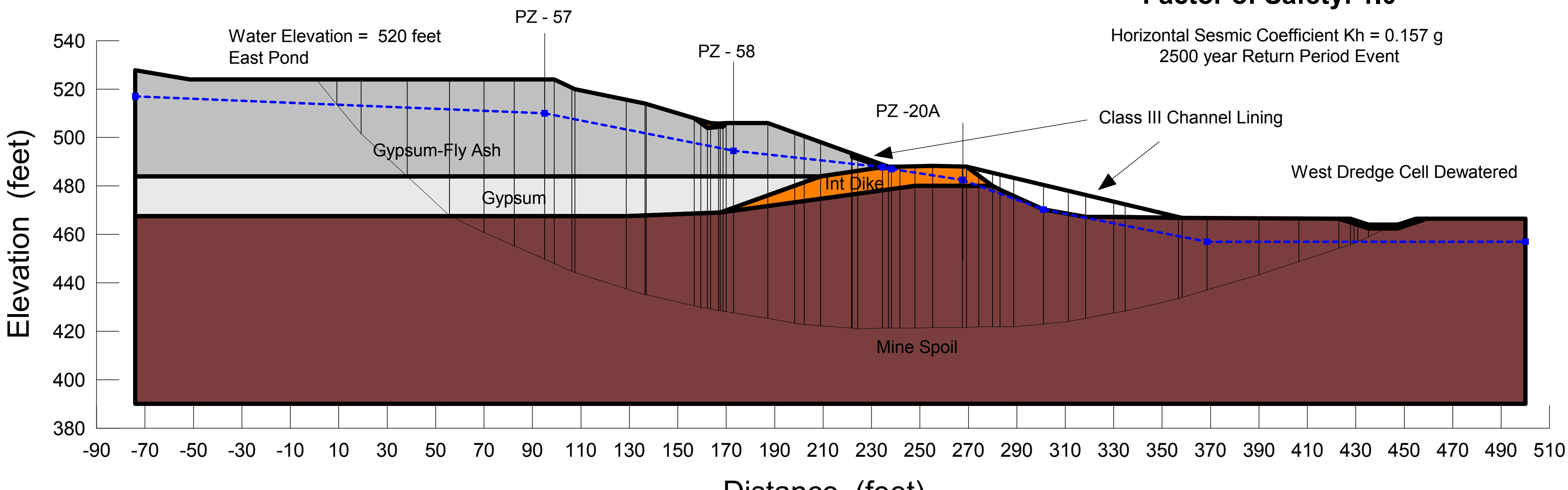
Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Gypsum	120	0	35
Gypsum-Fly Ash	115	0	35
Mine Spoil	135	400	18
Compacted Mine Spoil	135	120	22.6
Int Dike	110	120	22.6
Class III Channel	110	0	40

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Factor of Safety: 1.0

Horizontal Sesmic Coefficient Kh = 0.157 g
2500 year Return Period Event



Date of Assessment - 12/13/11

Project No. 175551015

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section A - Peabody Ash Pond
Paradise Fossil Plant
Drakesboro, Kentucky

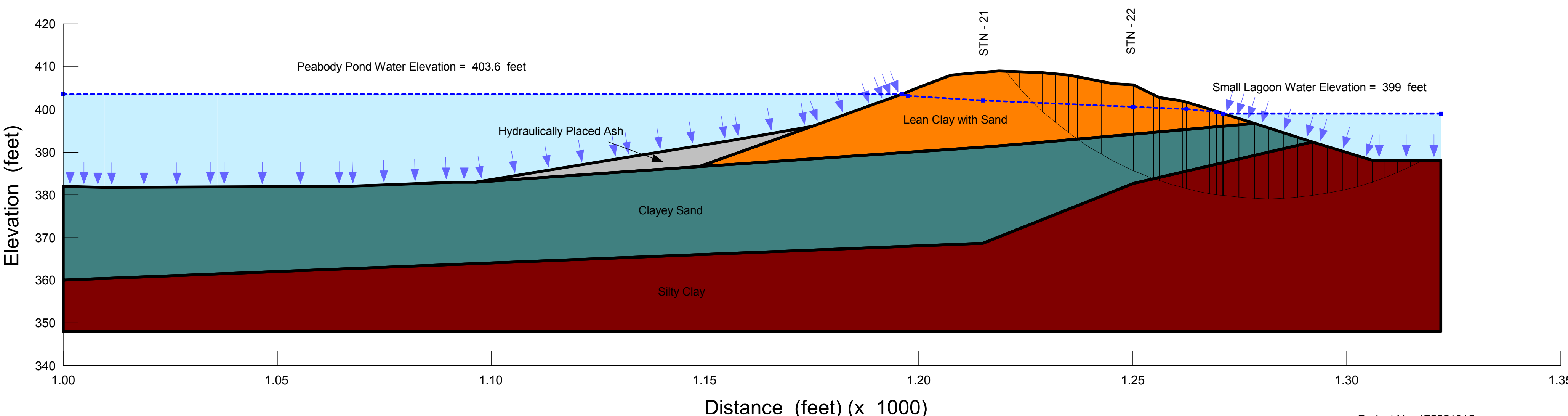
Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Lean Clay with Sand	139 pcf	0 psf	25 °
Hydraulically Placed Ash	107 pcf	100 psf	18.4 °
Clayey Sand	133 pcf	120 psf	21 °
Silty Clay	129 pcf	120 psf	20 °

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Factor of Safety: 1.0

Horizontal Seismic Coefficient Kh = 0.157 g
2500 year Return Period Event



Date of Assessment - 11/4/2011

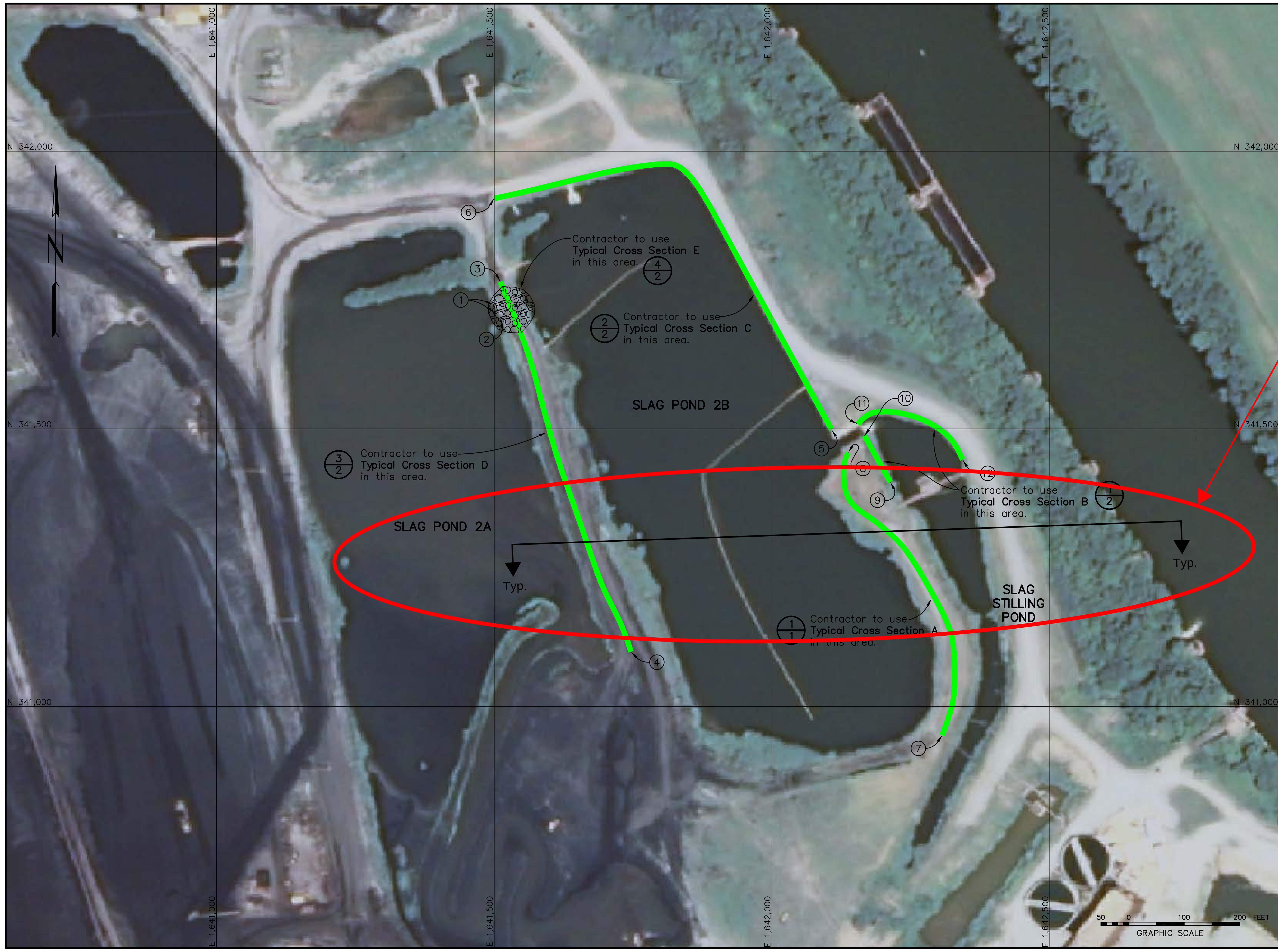
Project No. 175551015

KEYNOTES

1. Existing 48" Pipe (2).
2. Existing 60" Pipe.
3. Begin Slope Improvements (Both sides)
   N 341,765.19
   E 1,641,511.25
4. End Slope Improvements (Both sides)
   N 341,099.61
   E 1,641,746.04
5. Begin Class II Channel Lining at Concrete Flume (Pool side, Slag Pond 2B)
   N 341,499.29
   E 1,642,107.18
6. End Class II Channel Lining (Pool side, Slag Pond 2B)
   N 341,915.20
   E 1,641,500.55
7. Begin Class II Channel Lining (Pool side, Slag Pond 2B)
   N 340,948.45
   E 1,642,306.10
8. End Class II Channel Lining at concrete flume (Pool side, Slag Pond 2B)
   N 341,482.01
   E 1,642,120.86
9. Begin Class III Channel Lining (Pool side, Slag Stilling Pond)
   N 341,404.43
   E 1,642,212.95
10. End Class III Channel Lining at Concrete Flume (Pool side, Slag Stilling Pond)
    N 341,487.93
    E 1,642,166.15
11. Begin Class III Channel Lining at Concrete Flume (Pool side, Slag Stilling Pond)
    N 341,509.20
    E 1,642,154.45
12. End Class III Channel Lining (Pool side, Slag Stilling Pond)
    N 341,445.91
    E 1,642,343.78

NOTES:

1. Horizontal datum of coordinates shown is NAD27 Kentucky State Plane South Zone (feet).
2. Vertical datum is NGVD29.



PLAN – COAL YARD SLAG POND 2B AND SLAG STILLING POND
SCALE: 1"=100'

Paradise Fossil Plant, Slag Ponds 2A and 2B. Approximate Location of Cross Section (Typical) used to perform pseudostatic slope stability analysis.

NOTE:

Slope improvements involving cut within 10 feet of structures shall be avoided. The slope may be improved through the placement of Class II Channel Lining where feasible under the direction of TVA.

EXCESS MATERIAL DISPOSAL NOTE:

Excess material produced by improvements shown hereon shall be disposed of at a disposal facility on–site as directed by the TVA PAF plant personnel.

UTILITY NOTE:

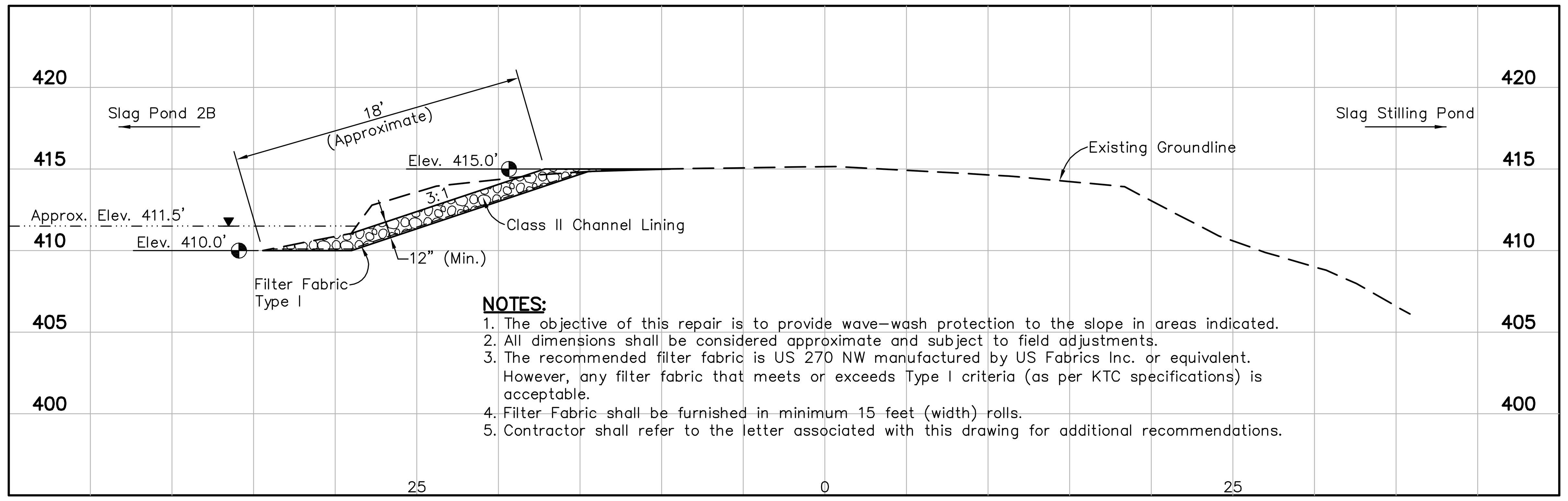
The location, sizes and types of any utilities or substructures shown hereon shall be considered approximate. Stantec does not warranty or guarantee that the utility information shown hereon is accurate or complete. Any Contractor, Owner or designer using information shown is hereby forewarned that any excavation upon this site may result in the discovery of additional underground utilities not shown hereon.

Prior to any design or construction in the vicinity of any improvements shown hereon, the Contractor shall coordinate with TVA PAF Plant personnel to determine the location of all utilities within the area. The Contractor shall be responsible for locating all utilities, making arrangements regarding relocation and/or protection as necessary, and maintaining utility service throughout the course of the work.

Ponds located within the fenced portions of the Plant are situated in areas with numerous above–ground and underground utilities.

FOR INFORMATION ONLY
This Drawing which has been previously submitted to TVA is provided for Information Only.

Section or Detail No.
Sheet Where Shown
REFERENCE KEY



NOTES:

1. The objective of this repair is to provide wave–wash protection to the slope in areas indicated.
2. All dimensions shall be considered approximate and subject to field adjustments.
3. The recommended filter fabric is US 270 NW manufactured by US Fabrics Inc. or equivalent. However, any filter fabric that meets or exceeds Type I criteria (as per KTC specifications) is acceptable.
4. Filter Fabric shall be furnished in minimum 15 feet (width) rolls.
5. Contractor shall refer to the letter associated with this drawing for additional recommendations.

1/1 TYPICAL CROSS SECTION A – SLOPE IMPROVEMENT WITH CLASS II CHANNEL LINING (SLAG POND 2B)
SCALE: 1"=5'

ISSUED FOR CONSTRUCTION

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	12/21/09	MMM	BFS	JDK	ELC	ELC	ELC	TJ	–	–	–

ISSUED FOR CONSTRUCTION

DISCIPLINE INTERFACE: 1, 2, 3, 4

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
–

COAL YARD SLAG PONDS 2A, 2B AND SLAG STILLING POND – SLOPE IMPROVEMENTS–PLAN AND SECTIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
M. MEEHAN	B. SAMS	J. KEELING	E. CAUDILL	E. CAUDILL	E. CAUDILL	T. JOHNSON

Stantec Consulting Services Inc.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
Tel. 859.422.3000
Fax 859.422.3100
www.stantec.com

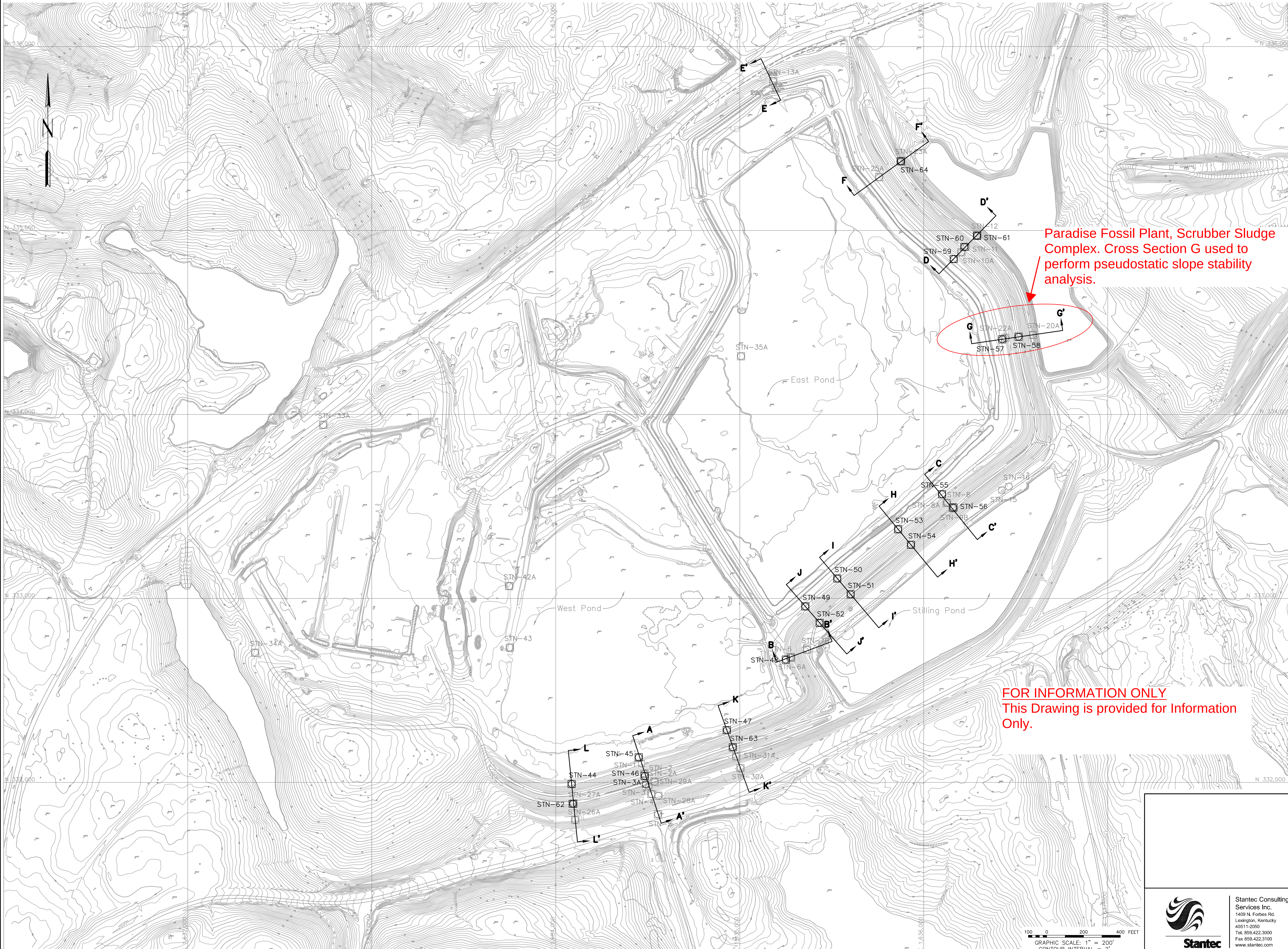
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 12/21/09 | 64 | C | 10W709–01 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



NOTES:

1. THE TOPOGRAPHIC BASEMAP SHOWN ON THIS DRAWING WAS DEVELOPED BY STANTEC USING AN ELECTRONIC DRAWING PROVIDED BY TVA IN MARCH, 2010. THE INFORMATION IS BELIEVED TO BE APPROXIMATE AND SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.
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 THERE FROM. 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

INSTRUMENT	NORTHING	EASTING	GROUND SURFACE ELEVATION (FEET)	PIEZOMETER TIP ELEVATION (FEET)
STN-1*	332,102.89	1,634,466.78	509.9	NA
STN-2	332,046.91	1,634,482.61	494.3	437.1
STN-2A	332,046.91	1,634,482.61	494.3	468.9
STN-3*	331,980.02	1,634,505.77	483.5	NA
STN-3A*	331,989.56	1,634,489.16	489.8	NA
STN-4	331,937.06	1,634,520.16	467.6	420.7
STN-5	331,826.79	1,634,555.94	452.0	399.3
STN-6	332,682.25	1,635,277.08	510.9	413.1
STN-6A	332,677.36	1,635,279.66	511.0	472.6
STN-7B	332,721.84	1,635,366.07	486.8	474.4
STN-8*	333,522.45	1,636,128.32	510.2	NA
STN-8A	333,519.21	1,636,124.51	510.2	452.3
STN-9B	333,490.39	1,636,156.12	497.5	455.5
STN-10A	334,881.85	1,636,204.33	514.0	465.7
STN-11*	334,909.50	1,636,230.61	504.5	NA
STN-12	334,974.78	1,636,288.23	494.4	464.4
STN-13A	335,811.89	1,635,182.62	525.1	504.0
STN-15*	333,588.73	1,636,423.97	480.9	NA
STN-16*	333,609.25	1,636,462.16	481.1	NA
STN-20A	334,433.28	1,636,592.28	489.7	470.7
STN-22A	334,417.64	1,636,443.36	519.4	490.4
STN-23A	335,379.92	1,635,873.53	501.8	470.0
STN-25A	335,289.98	1,635,757.90	523.3	489.5
STN-26A	331,796.20	1,634,106.29	471.4	454.1
STN-27A	331,884.74	1,634,097.38	492.2	470.3
STN-28A	331,927.41	1,634,557.82	470.2	454.2
STN-29A	332,004.37	1,634,537.00	489.1	470.9
STN-30A	332,077.28	1,635,004.16	470.5	455.6
STN-31A	332,141.29	1,634,981.22	487.0	468.9
STN-33A	333,944.10	1,632,737.00	527.2	478.3
STN-34A	332,705.10	1,632,367.00	510.9	485.6
STN-35A	334,316.70	1,635,007.00	520.4	496.6
STN-42	333,067.40	1,633,747.00	515.5	470.7
STN-42A	333,067.40	1,633,747.00	515.7	500.7
STN-43	332,733.20	1,633,751.00	513.5	487.9
STN-44	331,991.72	1,634,086.60	510.0	498.1
STN-45	332,136.33	1,634,450.96	517.0	501.0
STN-46	332,034.92	1,634,483.72	496.1	486.1
STN-47	332,284.56	1,634,929.95	516.5	490.5
STN-48	332,667.56	1,635,250.39	519.9	485.1
STN-49	332,956.89	1,635,356.31	523.9	501.0
STN-50	333,108.69	1,635,530.13	524.0	502.0
STN-51	333,022.54	1,635,602.72	498.9	486.9
STN-52	332,867.62	1,635,433.99	495.9	481.5
STN-53	333,376.37	1,635,860.86	523.5	504.1
STN-54	333,291.99	1,635,930.41	500.6	487.1
STN-55	333,566.60	1,636,099.43	523.7	514.7
STN-56	333,494.76	1,636,161.26	500.0	482.0
STN-57	334,409.01	1,636,426.68	524.9	511.9
STN-58	334,422.92	1,636,515.29	506.7	480.1
STN-59	334,845.21	1,636,162.73	525.6	512.0
STN-60	334,911.36	1,636,220.95	508.0	496.7
STN-61	334,971.36	1,636,290.43	494.4	485.4
STN-62	331,883.99	1,634,092.50	491.9	480.1
STN-63	332,191.18	1,634,962.04	494.5	487.0
STN-64	335,375.88	1,635,876.57	502.0	485.4

* DENOTES SLOPE INCLINOMETER

LEGEND

- EXISTING PIEZOMETER (INSTALLED SEPT. 2010)
- EXISTING SLOPE INCLINOMETER (INSTALLED SEPT. 2010)
- EXISTING PIEZOMETER (PREVIOUSLY INSTALLED)
- EXISTING SLOPE INCLINOMETER (PREVIOUSLY INSTALLED)

SCALE: 1"=200' EXCEPT AS NOTED

GRAPHIC SCALE: 1" = 200'
CONTOUR INTERVAL = 2'

YARD
SCRUBBER SLUDGE COMPLEX

GEOTECHNICAL EXPLORATION INSTRUMENTATION PLAN

Stantec Consulting Services Inc.
1409 N. Forbes Rd.
Lexington, Kentucky 40511-2050
Tel. 859.422.3000
Fax 859.422.3100
www.stantec.com

PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 64 | C | XXWXXX-01 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:200
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

NOTES:

1. The topographic basemap shown on this drawing was developed by Stantec using electronic drawings titled "PA000112.dwg and PA000008.dwg" provided by TVA. The information is believed to be approximate and should not be used for construction purposes.
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 there–from. 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	Elevation (Feet)
STN–1	334,559.32	1,641,085.25	411.2
STN–2	334,677.03	1,641,570.83	408.6
STN–3	334,754.96	1,642,063.67	408.5
STN–4	334,653.35	1,642,483.20	407.9
STN–5	334,543.94	1,643,012.25	407.9
STN–6	334,117.67	1,642,904.88	407.8
STN–7	334,110.95	1,642,925.61	401.4
STN–8	333,625.59	1,642,796.92	408.4
STN–9	333,133.89	1,642,703.74	407.8
STN–11	332,681.40	1,642,510.51	408.4
STN–12	332,482.84	1,642,158.00	408.5
STN–14	332,172.87	1,641,803.35	408.3
STN–15	331,736.99	1,641,846.45	407.9
STN–16	331,729.49	1,641,903.96	400.1
STN–17	331,715.59	1,641,415.12	407.8
STN–18	331,767.22	1,641,030.49	408.0
STN–20	331,411.04	1,640,675.64	408.3
STN–21	331,553.80	1,640,209.81	408.6
STN–22	331,536.19	1,640,178.58	405.7

LEGEND

STN–1 ◎ Soil Boring with Standard Penetration Tests and/or Undisturbed (Shelby) Tube Samples

STN–3 ◉ Soil Boring with Standard Penetration Tests and/or Undisturbed (Shelby) Tube Samples and Rock Core

FOR INFORMATION ONLY
This Record Drawing which has been previously submitted to TVA is provided for Information Only.

RECORD DRAWING

100 0 200 400 FEET
GRAPHIC SCALE: 1" = 200'
CONTOUR INTERVAL = 2'

For Supporting Design Calculations see FPGPAFFESCDX00000020100006

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	08/18/10	SV	JRF	SV	SV	SV	HRA	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=200' EXCEPT AS NOTED

YARD
–

PEABODY ASH POND
GEOTECHNICAL EXPLORATION
BORING LAYOUT

STATE OF KENTUCKY HUGO R. APARICIO 17148 LICENSED PROFESSIONAL ENGINEER

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
S. VEMURI	R. FLYNN	S. VEMURI	S. VEMURI	S. VEMURI	H. APARICIO	T. JOHNSON

Stantec Consulting Services Inc.
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PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 08/18/10 | 64 | C | 10W710–01 | R 0

DISCIPLINE INTERFACE 1 2 3 4

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 08/18/2010

Stantec

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

June 20, 2012 let_002_paf_175551015

Mr. Chris Buttram, PE
Tennessee Valley Authority
Fossil Power Group
1101 Market Street, MS LP 2G-C
Chattanooga, Tennessee 37402

Re: Impoundment Assessments for EPA
Slag Ponds 2A and 2B Dike Slope Stability
Paradise Fossil Plant
Paradise, Muhlenberg County, Kentucky

Dear Mr. Buttram:

As requested, Stantec has reviewed the layout of Slag Ponds 2A and 2B at Paradise Fossil Plant (PAF), including pond dike heights and side slopes, with the purpose of selecting dike areas considered more critical in terms of their slope stability. Based on this review, Stantec performed a static stability analysis of the eastern dike of Slag Pond 2B based on information provided by TVA. Slag Ponds 2A and 2B are located northwest of the power plant with the Green River running along the eastern limits of the Slag Pond 2B (see figure 1).

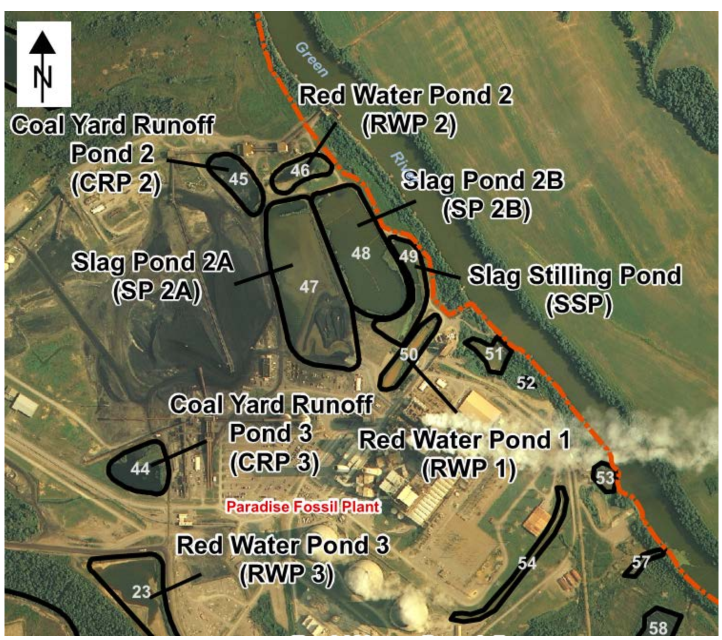


Figure 1. Location of Slag Ponds 2A and 2B

TVA has previously provided a report titled "Paradise Steam Plant – Coal Receiving Facility – Soil Investigation for Ash Pond Dike Adjacent to Barge Dock Cells" dated May 5, 1983 and basemapping dated March 6, 2010. The soil investigation report included boring logs for borings drilled along the eastern dike of Slag Pond 2B and associated material testing. The soil investigation report is provided as an attachment to this letter.

TVA provided a layout of the borings advanced during the 1983 soil investigation. The layout was prepared by TVA using the coordinates provided in the soil investigation report. Stantec reviewed the boring layout, boring logs, available basemapping and historical drawings. Based on this information, it appears that the dike along the eastern side of the Slag Pond 2B was relocated (moved toward the west away from Green River) to its current configuration sometime after 1983. The borings were drilled along the dike before it was relocated. For the purposes of this analysis, it is assumed that the boring log and laboratory testing information is still representative of the materials at the site.

Stantec has reviewed the boring information and laboratory testing data provided in the soil investigation report. According to this information, the Slag Pond 2B east dike was constructed using mine spoil material placed over alluvial deposits consisting of sands and clays. Stantec selected effective stress parameters for the compacted mine spoil, alluvial clay, and alluvial sand materials using the available boring logs and triaxial testing information. Consolidated undrained triaxial compression test results were available for six samples from three of the drilled borings.

The subsurface materials were divided into eight strata, as defined in the soil investigation report. The reviewed triaxial tests were performed on the following layers of material: F (earthfill or mine spoil dike material), A1 (alluvial sandy clay), A2 (alluvial sandy clay) and A4 (alluvial silty sand).

One triaxial test result was available for the earthfill (dike) material. Stantec used the friction angle and one half the value of the cohesion obtained from the triaxial test to perform stability analysis. Triaxial test results from three samples were available for the alluvial clay material. Stantec averaged the friction angles and the cohesion of the three tests and used the resulting values to run the stability analysis. Two triaxial test results were available for the alluvial sand material. Stantec reviewed the values, and determined that the friction angle for the A4 sand material was more indicative of typical alluvial sand. Stantec chose to use no cohesion for the alluvial sand. A summary of the material properties used for the static stability analysis are provided in Table 1.

Table 1. Material Properties for Static Stability Analysis

Material	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg.)
Compacted Minespoil	125	610	23.6
Alluvial Clay	125	140	32.1
Alluvial Sand	120	0	32.1

Using the provided basemapping, Stantec prepared two representative cross-sections of the Slag Pond 2B eastern side. One cross-section cuts through boring SS-5 (see attached plan view of borings). The other cross-section cuts through the eastern dike of the Slag Stilling Pond. The cross-sections were then modeled in the SLOPE/W software, which is available from GEO-SLOPE International, Ltd., of Calgary, Alberta, Canada (www.geo-slope.com). SLOPE/W is a special-purpose computer code designed to analyze the stability of earth slopes using two-dimensional, limit equilibrium methods. Subsurface conditions through the cross-sections were modeled using the boring logs and groundwater elevation provided in the soil investigation report.

The static stability analysis was performed for a global failure through the eastern dike of the Slag Pond 2B for one cross-section and through the eastern dike of the Slag Stilling Pond for the other cross-section. The results of the static stability analysis are provided in table 2 and also as an attachment to this letter.

Table 2. Static Slope Stability Analysis Results

Global Failure Location	Factor of Safety
Slag Pond 2B	4.39
Slag Stilling Pond	2.29

We appreciate this opportunity to provide these engineering services. If you have any questions or require additional information, please contact us.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Hugo R. Aparicio, PE
Principal

/rdr

Attachment 1

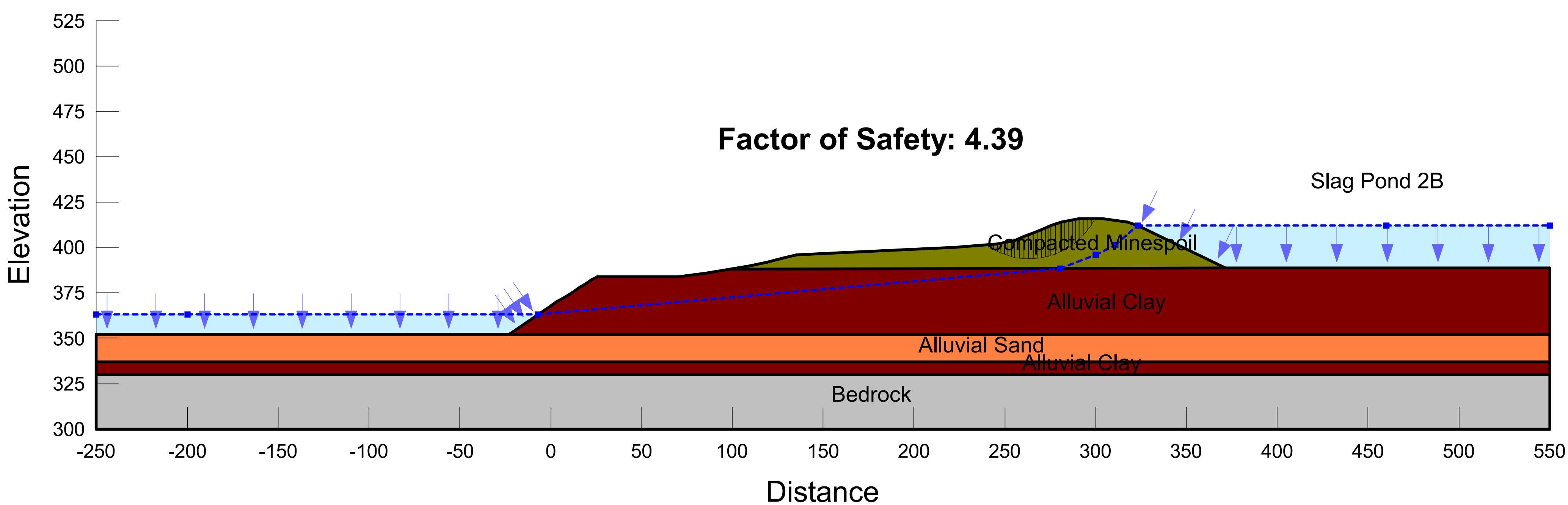
Stability Analysis

Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section - Slag Pond 2B
Global Stability Failure
Paradise Fossil Plant
Drakesboro, Kentucky

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Unit Weight	Cohesion	Friction Angle
Compacted Minespoil	125 pcf	610 psf	23.6 °
Alluvial Clay	125 pcf	140 psf	32.1 °
Alluvial Sand	120 pcf	0 psf	32.1 °



Date of Assessment - 06/18/2012

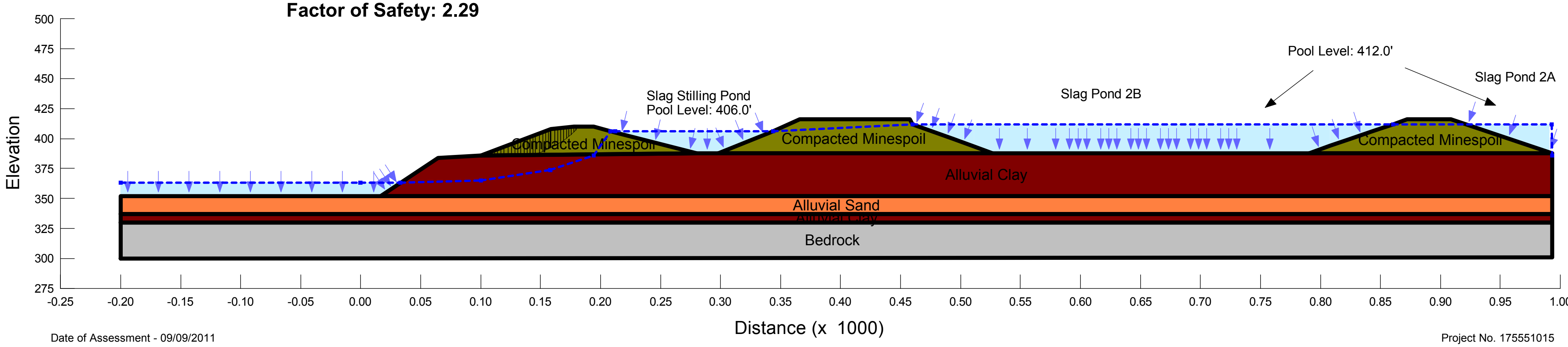
Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section - Slag Stilling Pond
Global Stability Failure
Paradise Fossil Plant
Drakesboro, Kentucky

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Unit Weight	Cohesion	Friction Angle
Compacted Minespoil	125 pcf	610 psf	23.6 °
Alluvial Clay	125 pcf	140 psf	32.1 °
Alluvial Sand	120 pcf	0 psf	32.1 °

Factor of Safety: 2.29

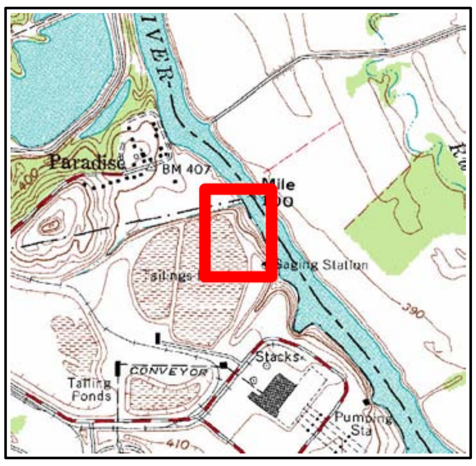


Date of Assessment - 09/09/2011

Project No. 175551015

Attachment 2

Boring Layout



LEGEND

Splitspoon Boring (Drilled March 1983)

By-Products Disposal Feature Designation

This Is A Draft Plot
For Visual Representation Only

0 20 40 80 120 160 Feet

PARADISE FOSSIL PLANT

BY-PRODUCTS DISPOSAL
SOIL PROFILE
SPLITSPOON BORINGS
MARCH 1983

Plotting Date: 06/13/2012

Page 1 of 1

Attachment 3

Soil Investigation Report

TVA 64 (OS-9-69)

UNITED STATES GOVERNMENT

Memorandum

CSC 830504 301

TENNESSEE VALLEY AUTHORITY

TO : O. P. Thornton, Fossil Design Projects Manager, 102 SPT-K (2)

FROM : Frank Van Meter, Chief, Construction Services Branch, 500 SPT-K

DATE : May 5, 1983

830510F0301 (100)

SUBJECT: PARADISE STEAM PLANT - COAL RECEIVING FACILITY - SOIL INVESTIGATION FOR ASH POND DIKE ADJACENT TO BARGE DOCK CELLS - EN DES SCHEDULE NO. 64.22

The investigation initiated by FDP 830318 003 has been completed. The purpose of the study was to determine if the slope stability of the site is sufficient to allow elimination of a proposed sheet pile retaining wall.

The field exploration was completed between March 21 and 29, 1983. Borings were advanced by dry methods with CME-55 and Mobile B-50 drills equipped with 3-3/8-in. and 6-in. id hollow stem augers. A total of 695 lin ft was drilled and sampled. Sampling conformed with ASTM D 1586 and D 1587. Borings were backfilled with tamped native clays.

Site Conditions

Four SPT borings were drilled near the outer edge of the dike crest at an elevation of about 410. These borings had an average depth of 77 ft. Four parallel borings with an average depth of about 58 ft were drilled along the dike toe which has an average surface elevation of about 390. Undisturbed borings were located within 5 ft of their companion SPT borings. (See the plan.)

Profile

The soil profile from the surface consists of embankment fill overlying a series of in-place alluvial strata which persist to bedrock or the depths drilled. Details of these strata are summarized in table 1 and on the attached cross sections and bar profiles. These strata are identified and cross referenced as F and A1 through A7.

PARADISE STEAM PLANT - COAL RECEIVING FACILITY - SOIL INVESTIGATION FOR ASH POND DIKE ADJACENT TO BARGE DOCK CELLS - EN DES SCHEDULE NO. 64.22

The embankment fill (F) under the crest appears well compacted, whereas the thinner fill under the toe is apparently random with lean clays being predominant. Clayey gravel, cobble, and boulder shot rock are also locally present.

The alluvium generally consists of an orderly sequence of strata, most of which persist across the site (A1 through A7). These strata, starting with brown sandy clays of medium plasticity (A1) gradually grade downward into stratified soils of decreasing plasticity until nonplastic silty or poorly graded sands are encountered. Under the toe the sands persist to bedrock. Under the crest the sands grade downward into basal silts or clays of low plasticity. Parallel to the dike the bed interfaces are essentially horizontal. Normal to the dike the strata dip slightly, either toward or away from the river. In judging the strata interfaces as shown on the cross sections, it should be emphasized that the information is based on 5-ft sampling intervals and the actual conditions are likely more complex. However, the general trends are consistent and appear to be reliable.

General weaknesses occur under the crest borings concentrated in strata A1 through A3 between elevations 355 and 370. Weaknesses under the toe borings exist in strata A1 and A2 between elevations 350 and 380.

Bedrock was encountered under the southeastern portion of the site, rising from elevation 326.5 at SS-3 to elevation 349.0 at SS-7. Rock was not encountered under the northwestern corner of the site to the depths drilled.

Water Levels

Water level readings are tabulated below. The reading at SS-1 was taken inside the augers before the boring was complete. This boring, as well as SS-8, collapsed on existing augers as did SS-6 and SS-7 before the 24 h reading.

PARADISE STEAM PLANT - COAL RECEIVING FACILITY - SOIL INVESTIGATION FOR ASH POND DIKE ADJACENT TO BARGE DOCK CELLS - EN DES SCHEDULE NO. 64.22

Location	Water Elevation		
	In auger	1 h	24 h
SS-1	356.6	--	--
SS-2	--	362.0	363.8
SS-3	--	371.3	374.0
SS-4	--	362.7	363.8
SS-5	--	363.7	369.7
SS-6	--	372.7	--
SS-7	--	378.0	--
SS-8	--	--	--

The apparent water gradient trends to the northeast or approximately toward the river.

Laboratory Testing

Embankment soils (F) have dry densities ranging from 101.9 to 118.2 pcf and an average dry density of 110.1 pcf. Void ratios vary from 0.426 to 0.655 and average 0.541. A triaxial R test at NMC conducted on a clay in the lower range of penetration resistance (N = 10) shows a friction angle of 23.6 degrees and cohesion of 0.61 tsf.

The alluvial foundation soils show a wide range of properties. The upper strata, A1 and A2, have average dry densities of about 98.0 pcf and average void ratios of about 0.704. A triaxial R (NMC) on A1 soil shows a friction angle of 23.1 degrees and cohesion of 0.69. A comparable sample tested saturated has an effective friction angle of 11.9 degrees and cohesion of 0.63 tsf, with an effective friction angle of 32.1 degrees and cohesion of 0.04. The A2 soils tested under triaxial R saturated conditions have an average apparent friction angle and cohesion of 13.4 degrees and 0.27 tsf respectively. Corresponding values for effective friction angle and cohesion average 32.1 degrees and 0.09 tsf.

An A3 type soil sample having a dry density of 99.2 pcf and a void ratio of 0.674. It yields a friction angle of 27.9 degrees and a cohesion of 0.05 tsf under R (NMC) test conditions. The A4 soils have an average dry density of 98.7 pcf and an average void ratio of 0.681. Saturated R tests show variable results. Apparent friction angles vary from 19.2 to 34.5 degrees and cohesion varies from 1.18 to 1.94 tsf. The companion effective parameters range from 21.0 to 32.1 degrees and 0.33 to 1.34 tsf. The A5 stratum soils have a dry density of 89.0 pcf and a void ratio of 0.840.

PARADISE STEAM PLANT - COAL RECEIVING FACILITY - SOIL INVESTIGATION FOR ASH POND DIKE ADJACENT TO BARGE DOCK CELLS - EN DES SCHEDULE NO. 64.22

Summary

The site is characterized by embankment fill soils overlying in-place alluvium which extends to bedrock or the depths drilled. The embankment soils underlying the dike crest are relatively firm, predominantly well compacted lean clays. The embankment soils along and near the toe appear to be spoil fill. The alluvial foundation soils subdivide into a gradational sequence of seven more or less distinct strata. They vary from upper sandy clays of medium plasticity downward into layers of decreasing plasticity until nonplastic silty or poorly-graded sands are encountered. Under the toe the sands extend to bedrock, but under the crest the sands grade downward into a basal unit of silt or clay of low plasticity and stiff consistencies.

General and persistent relative weaknesses occur between elevations 350 and 380 predominantly in the A1, A2, and A3 strata. These weaknesses are confirmed by both SPT results and laboratory strength testing. The sandy A4 and A5 strata are highly variable with loose to dense relative densities indicated by SPT results. Density and shear strength tests reflect this variability.

Frank Van Meter

Frank Van Meter

WHC:HPM:ASY
Attachments
cc (Attachments):
R. O. Barnett, W9D224 C-K
W. H. Childres, SME-K
MEDS, W5B63 C-K

Principally prepared by H. P. Matthews, extension 2771.

Tabulations

Table 1

PARADISE STEAM PLANT

SUMMARY OF SPT PROFILE DATA

Strata Designation	General Description	Typical Soil Class Symbol	Average LL %	Average PI %	Average NMC %	N-Value max	N-Value min	N-Value avg
F	Earthfill, locally contains cobble to boulder sizes	CL GC GW-GC	34	16	14.1	49	9	20
A1	Brown, homogeneous alluvial sandy clay of medium plasticity	CL	29	12	23.0	16	3	7
A2	Gray homogeneous alluvial sandy clay of low plasticity	CL	26	9	23.8	12	3	6
A3	Gray stratified alluvial sandy clayey silt	CL-ML	22	4	25.1	8	4	6
A4	Gray stratified alluvial silty sand	SM	NP	NP	26.8	44	7	20
A5	Gray stratified alluvial poorly graded sand	SP	NP	NP	22.0	49	8	25
A6	Gray stratified alluvial sandy clayey silt	CL-ML	22	4	19.1	17	10	14
A7	Gray stratified alluvial sandy clay of low plasticity	CL	26	9	23.6	11	10	10

Table 2

PARADISE STEAM PLANT

COAL RECEIVING FACILITY

SUMMARY OF LABORATORY TEST DATA

Elevation	Soil Symbol	Soil Type	Nat Moist. %	Nat Moist. % Sat.	Std Penetr	Grain-Size Analysis: Gravel %	Sand %	Silt %	Clay %	D_{10} mm	Atterb Limits: Liq Limit %	Plastic. Index %	Dry Dens. pcf	Void Ratio	Natural Moisture Triaxial R: ϕ deg	c tsf	Saturated Triaxial R: Apparent ϕ deg	Apparent c tsf	Effective ϕ deg	Effective c tsf
Boring No. US-1; Location 2075.14W; 1580.85N; Surface Elevation 387.6																				
372.6-370.7	ML	A3	22.8	90.1	4	0	45	37	18	—	21	3	99.2	.674	27.9	0.05				
362.6-361.0	SM	A4	24.6	97.5	3	0	51	35	14	0.0027	NP	NP	99.3	.673						
352.6-350.2	SM	A4	27.5	92.8	7	0	79	15	6	0.0120	NP	NP	92.2	.779			19.2	1.94	21.0	1.34
347.6-345.7	SP-SM	A5	31.1	97.1	11	0	93	3	4	0.0894	NP	NP	89.0	.840						
Boring No. US-3; Location 1914.2W; 1476.5N; Surface Elevation 408.5																				
395.5-393.3	CL	F	13.2	83.8	17	16	20	34	30	—	37	18	118.2	.426						
388.5-386.4	CL	F	20.5	84.5	10	0	13	55	32	—	31	12	101.9	.655	23.6	0.61				
378.5-376.2	CL	A1	26.7	96.3	8	0	12	55	33	—	33	14	95.2	.735						
368.5-366.1	CL	A1	24.7	94.5	9	0	18	54	28	—	30	12	98.7	.702			11.9	0.63	32.1	0.04
358.5-356.9	SM	A4	22.9	94.3	8	0	80	13	7	0.0103	NP	NP	100.8	.646						
353.5-351.1	SM	A4	25.1	92.4	20	0	78	14	8	0.0084	NP	NP	95.6	.714						
338.5-336.9	SM	A4	20.4	92.9	17	2	50	34	14	0.0031	NP	NP	105.4	.591			34.5	1.18	32.1	0.33
Boring No. US-6; Location 1519.9W; 1390.4N; Surface Elevation 392.2																				
382.2-380.3	CL	A1	21.5	85.8	9	0	6	62	32	—	33	13	99.9	.674	23.1	0.69				
377.2-376.4	CL	A1	24.9	92.2	7	0	3	64	33	—	35	15	97.2	.724						
374.2-371.7	CL	A1	25.8	99.1	7	0	5	62	33	—	34	15	98.4	.699						
367.2-364.8	CL	A2	25.8	94.8	3	0	15	54	31	—	30	13	97.0	.732			13.3	0.57	32.9	0.06
362.2-359.8	CL	A2	26.0	99.3	5	0	9	62	29	—	30	11	98.2	.703						
352.2-350.8	CL	A2	23.5	94.4	4	0	18	53	29	—	30	12	100.3	.668			13.5	0.26	31.3	0.11

Drawings

DOCUMENT LOCATION NOTICE

MEDSNO 830510F0301 – CARD # 1 through 5

ACC # CSB830504301

DOCNO ________ SHT ____ REV ________

THE FOLLOWING DOCUMENT WAS LARGER THAN 8½ x 11 AND HAS BEEN FILMED FULL SIZE ON 35mm FILM AND IS AVAILABLE ON APERTURE CARDS AT THE LOCATIONS LISTED BELOW.

35mm FILM LOCATIONS

MICROGRAPHICS UNIT, SL-38 C-K, x-4800
MEDS SERVICE CENTER, W8B94 C-K

DOCUMENT CONTROL UNITS (DCU) (for outside Knoxville)

Soil Profiles

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE LEGEND AND SYMBOLS

DEPTH 1"=5'	EL	SPT (N)	LOG	W	LL	PI	X	REMARKS OR TEST RESULTS
Boring Depth and Scale	Elevation	Blows/Foot (SS Boring)	Lab Soil Type	Moisture Content	Liquid Limit	Plasticity Index	Soil Letter	

LEGEND

- Topsoil
- CL,etc — Soil Type (Unified Classification)
- Mat'l — Notation of Soil Not Sampled (SS, PA, HA Logs)
- (Core) Type — Bedrock (Note Core if Cored)
- Assumed Material — Refusal (Impractical to Penetrate with Boring Equipment Used)
- Watertable (Date)
- Explanation of UD Sampling Limits if Applicable

BORING SYMBOLS

SS - 2" OD Splitspoon Boring
SPT - Standard Penetration Test Blows Per Foot with 2" Splitspoon
UD - Undisturbed Sample Boring
PA - Power Auger Boring
HA - Hand Auger Boring
TP - Test Pit or Trench

IN BLOCKS BESIDE UD BORING SAMPLES		
Test	Engineering Test Results	
Q, R, R̄, S	Friction Angle (Degrees)	Cohesion (tsf)
UC	Unconfined Compressive Strength (tsf)	Sensitivity Ratio
C	Compression Index	Preconsolidation Pressure (tsf)
k	Coefficient of Permeability (cm/sec x 10^{-4})	

Example: Blocks as Required:

Q	12.0	0.62	R	19.6	0.21	S	34.0	0
UC	4.0	2.6	C	0.27	2.0	k	5.6	

SOIL TEST SYMBOLS

Q - Unconsolidated-Undrained Triaxial Compression
R - Consolidated-Undrained Triaxial Compression
R̄ - Effective Consolidated-Undrained Triaxial Compression
S - Consolidated-Drained Direct Shear
UC - Unconfined Compression
C - Consolidation
k - Permeability
X - Letter Identification of Soil Type. Lower Case (a, etc.), By Index Tests. Capital (A, etc.), Subjected to Additional Tests.

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE LEGEND AND SYMBOLS

DEPTH 1" 5'	EL	SPT (N)	LOG	W	LL	PI	X	REMARKS OR TEST RESULTS
Boring Depth and Scale	Elevation	Blows/Foot (SS Boring)	Lab Soil Type	Moisture Content	Liquid Limit	Plasticity Index	Soil Letter	

LEGEND

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- CL, etc — Soil Type (Unified Classification)
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X - Letter Identification of Soil Type. Lower Case (a, etc.), By Index Tests. Capital (A, etc.), Subjected to Additional Tests.

SINGLETON MATERIALS ENGINEERING LABORATORY

FIELD LOG ABBREVIATIONS

Typical Name	Abbreviation	Lithology and Mineralogy	Abbreviation
Sandy gravel	sd Gv	Bedrock	br
Silty gravel	si Gv	Chert	cht
Clayey gravel	cl Gv	Dolomite	dol
Sand	Sd	Limestone	ls
Silty sand	si Sd	Manganese	mn
Clayey sand	cl Sd	Micaceous	mic
Sandy silt	sd Si	Pyrite	py
Clayey silt	cl Si	Quartz	qtz
Fat silt	ft Si	Sandstone	ss
Sandy clay	sd Cl	Shale	sh
Silty clay	si Cl		
Medium clay	md Cl	**Color**	
Fat clay	ft Cl		
Cobble	Cob	Black	blk
Boulder	Bld	Blue	blu
Topsoil	TS	Brown	brn
Riprap	RR	Cream	crm
		Dark	dk
Name Modifiers		Gray	gy
		Green	grn
Clean	cln	Light	lt
Coarse	crs	Mottled	mott
Dirty	dty	Pink	pk
Fine	fn	Red	r
Organic	org	Tan	tn
Poorly graded	pgd	White	wht
Well graded	wgd	Yellow	yel
Gravel Shape		**Moisture**	
Angular	ang	Dry	d
Platy	plty	Moist	mst
Rounded	rd	Very moist	V mst
Subangular	sb ang	Wet	w
Subrounded	sb rd		

Structure	Abbreviation	Consistency	Abbreviation
Blocky	blky	Dense	dns
Fissured	fis	Firm	f
Homogeneous	homo	Hard	hd
Laminated	lam	Loose	lse
Saprolitic	sapr	Soft	s
Shaly	shly	Stiff	stf
Slickensided	slsid	Very stiff	v stf
Stratified	strat		

Origin	
Alluvial	all
Colluvial	coll
Loess	lss
Residual	resd

General Modifiers	
Alternating	altng
Angle	}
Augering	augg
Contaminated	cont
Dip	dp
Debris	dbr
Discontinued	Disc
Drilling mud	mud
Elevation	El
Feet	ft
Fill	fl
High	H
Horizontal	hor
Inch	in
Inclusion	inc
Incomplete recovery	IR
Low	L
Medium	Med
Original	orig
Rough	rou
Small	sm
Thick	thk
Thin	thn
Trace	tr
Variable	var
Vertical	vert
Weathered	wth
With	w/

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-1 STATION: 1580.85N RANGE: 2075.14W SURFACE EL: 387.8
DATE DRILLED: 3/22/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
	385						
5		25	GC	17.1	33	15	GV SD SI, ±30% FN MD SB ANG LS GV, ROOTS, GY BRN, FL, W
	380						
10		6	CL	21.4	30	12	SD SI, BRN, W, HOMO, ALL (ORIG SOIL)
	375						
15		4	CL	22.2	30	12	SD SI, BRN GY, W, HOMO, ALL
	370						
20		5	CL	23.8	27	10	SD SI, BRN&R, W, HOMO, ALL
	365						
25		3	CL	23.0	27	10	SD SI, BRN&TN, LAM, V W, ALL
	360						
30		4	CL-ML	21.7	22	4	SD SI, GY, V W, HOMO, ALL
	355						
35							
1''=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P.	FEATURE: COAL RECEIVING FACILITY
BORING: SS-1 STATION: 1580.85N	RANGE: 2075.14W SURFACE EL: 387.6
DATE DRILLED: 3/22/83 TO	PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
	350	7	CL-ML	28.1	22	4	SD SI, GY, V W, HOMO, ALL
40	345	11	SM	34	NP	NP	SI SD, GY, ROOTS, V W, ALL
45	340	13	SP	15.3	NP	NP	GV SD, ±40% SB ANG TO SB RD LS GV, CRS, BRN, V W, ALL
50	335	49	SP	10.2	NP	NP	GV CL SD, ±20% FN SB ANG LS GV, GY&WHT&R, CRS, W, ALL
55	330	22	SP	17.0	NP	NP	SI SD, ±3% FN SB ANG LS GV, CRS, GY&BRN, W, ALL
60	325						EL 331.1
65	320						
70							
1''=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-2 STATION: 1511.5N RANGE: 2004.9W SURFACE EL: 410.4
DATE DRILLED: 3/22/83 TO 3/23/83 PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
	410						
5	405	22	CL	14.6	33	15	SI CL, BRN, MST, FL
10	400	23	CL	12.8	33	15	SI CL, ±10% FN ANG LS GV, BRN, MST, FL
15	395	22	CL	17.2	33	15	SI CL, TR COAL GV, BRN, MST, FL
20	390	17	CL	18.1	33	15	SI CL, BRN, MST, FL
25	385	49		8.1			SD GV, GY, MST DEGDD BY D FL
30	380	6	CL	24.5	30	12	SI CL, BRN, V MST, HOMO, ALL (ORIG SOIL)
35							

1''=5'

*Lab. Classif.

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-2 STATION: 1511.5N RANGE: 2084.9W SURFACE EL: 410.4
DATE DRILLED: 3/22/83 TO 3/23/83 PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
	375	10	CL	22.9	30	12	SI CL, BRN, V MST, HOMO, ALL
40	370	9	CL	21.7	30	12	IR, SI CL, BRN, V MST, HOMO, ALL
45	365	5	CL	21.7	32	14	SD SI, GY, V MST, HOMO, ALL
50	360	6	CL	21.9	25	8	SD SI-SI CL, SD STRAT, GY, MST, ALL
55	355	13	SM	27.8	NP	NP	SI SD, STRAT, GY, W, ALL
60	350	8	SP	43.9	NP	NP	SI SD, SI CL-STRAT, GY, W, ORG DBR, ALL
65	345	19	SM	22.5	NP	NP	SI SD, SI CL-STRAT, GY, W, ALL
70							

1''=5'

*Lab. Classif.

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-2 STATION: 1511.5N RANGE: 2084.9W SURFACE EL: 410.4
DATE DRILLED: 3/22/83 TO 3/23/83 PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
	340	12	ML	21.2	NP	NP	SI SD, STRAT, GY, W, ALL
75	335	36	SM	15.5	NP	NP	SD SI, ±20% FN SB ANG-SB RD GV, GY, V MST, ALL
80	330	8	CL	24.0	26	9	SI CL, ±5% FN COAL GV, GY, V MST, ALL
							EL 328.9
85	325						
90	320						
95	315						
100	310						
105							
1''=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-3 STATION: 1476.5N RANGE: 1914.2W SURFACE EL: 408.5
DATE DRILLED: 3/23/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
	405						
5		24	CL	16.7	35	17	SI CL, ±5% ANG FN GV, BRN&GY& BLK, MST, FL
	400						
10		22	CL	7.3	36	17	SI CL, ±10% FN GV, GY, MST, FL
	395						
15		17	CL	9.6	36	17	SI CL, ±10% FN GV, GY, MST, FL
	390						
20		10	CL	12.9	36	17	SI CL, ±20% FN ANG LS & COAL GV, GY, MST, FL
	385						
25		13	GC	16.5	33	15	SI CL, ±20% FN ANG LS & COAL GV, GY, MST, FL
	380						
30		6	CL	25.4	30	12	SI CL, BRN, MST, ALL (ORIG SOIL)
	375						
35							

1''=5'

*Lab. Classif.

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVI'' FACILITY
BORING: SS-3 STATION: 1476.5N RANGE: 1914.2W SURF EL: 408.5
DATE DRILLED: 3/23/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
		10	CL	25.9	30	12	SI CL, BRN, MST, ALL
	370						
40							
		9	CL	23.8	27	10	SI CL, BRN, MST, ALL
	365						
45							
		7	CL	23.7	27	10	SI CL, BRN&GY, MOTT, MST, ALL
	360						
50							
		8	CL-ML	21.5	22	4	SD SI CL, GY, MST, ALL
	355						
55							
		20	SM	23.9	NP	NP	SI SD, GY&TN, V MST, ALL
	350						
60							
		11	CL-ML	26.1	22	4	SI SD & SD SI-STRAT, GY, V MST, ALL
	345						
65							
		15	SM	26.1	NP	NP	SI SD, & SD SI-STRAT, GY, MST, ALL
	340						
70							
1''=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-3 STATION: 1476.5N RANGE: 1814.2W SURFACE EL: 408.5
DATE DRILLED: 3/23/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
		17	CL-ML	22.2	22	4	SD CL SI & SI SD-STRAT, GY, V MST, ALL
	335						
75							
		10	CL-ML	21.0	22	4	SI CL, GY, V MST, ALL
	330						
80							
		63	CL-ML	14.2	22	4	SI CL, GY&BRN, MST, LAM RESD, WTH BR
	325						EL 326.5
85							
	320						
90							
	315						
95							
	310						
100							
	305						
105							
1''=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-4 STATION: 1527.3N RANGE: 1895.7W SURFACE EL: 391.3
DATE DRILLED: 3/23/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
	390						
5	385	20		6.1			GV SI CL, ±30% SB ANG LS GV, GY, D, FL, IR
10	380	12		10.8	33	14	CL SI, GY, LAM, D, FL, IR
15	375	7		17.2			CL SI, GY, ±5% SB ANG LS GV, D, FL, IR
		5		20.9	32	14	SI CL, GY, HOMO, MST, ORIG SOIL
20	370	3		25.7	32	14	SI CL, GY, HOMO, MST, ORIG SOIL
25	365	8		27.2	25	8	SI CL, GY&BRN, V MST, HOMO
30	360	6		28.2	25	8	SI CL, GY&BRN. V MST, HOMO
35							
1''=5'		* Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SPLITSPOON BORING)

SHEET 2 OF 2

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-4 STATION: 1527.3N RANGE: 1895.7W SURFACE EL: 391.3
DATE DRILLED: 3/23/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
	355	6	CL	26.6	25	8	SD SI CL, GY&BRN, ROOTS, V MST, HOMO
40	350	8	ML	26.2	NP	NP	SD SI, GY, W, HOMO
45	345	7	ML	46.5	NP	NP	SD SI, LAM, ORG, GY&BLK, V MST
50	340	21	ML	32.5	NP	NP	SI SD, ±5% SB ANG LS GV, CRS, GY, V W
55	335	30	SM	15.9	NP	NP	GV SI SD, ±20% SB ANG LS GV, GY, CRS, V W
60	330	34	SM	23.4	NP	NP	SI SD, ±3% FN SB ANG LS GV, W/COB, CRS, GY, V W
							EL 329.8
65	325						
70							
1"=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-5 STATION: 1458.0N RANGE: 1707.0W SURFACE EL: 389.7
DATE DRILLED: 3/24/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
5	385	9		21.6	27	10	SI CL, BRN, MST, HOMO, FL
10	380	6		23.2	30	12	SI CL, BRN, MST, HOMO, ALL (ORIG SOIL)
15	375	4		25.0	30	12	SI CL, BRN, MST, HOMO, ALL
20	370	4		25.6	30	12	SI CL, BRN&TN, V MST, HOMO, ALL
25	365	4		24.2	30	12	SI CL, BRN&GY, V MST, HOMO, ALL
30	360	4		22.9	25	8	SD SI, GY, W, HOMO, ALL
35	355						

1''=5'

*Lab. Classif.

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-5 STATION: 1458.8N RANGE: 1707.8W SURFACE EL: 389.7
DATE DRILLED: 3/24/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
		7	SM	53.2	NP	NP	SI SD W/SH, LAM, FN, GY, W, ALL
40	350	13	SM	30.9	NP	NP	SI SD W/SH, LAM, FN, GY, W, ALL
45	345	18	SM	23.2	NP	NP	SI SD W/SH, LAM, FN, GY, W, ALL
50	340	57	SM	20.7	NP	NP	SD SI, ±5% FN SB ANG LS GV, GY, MST, ALL
55	335	19	CL-ML	16.6	22	4	SI CL, GY, V MST, HOMO, ALL
60	330	100	SM	14.3	NP	NP	SD SI CL, ±5% SB ANG LS GV, GRN&GY, MST, RESID
							EL 329.2
65	325						
70	320						

1''=5'

*Lab. Classif.

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-6 STATION: 1382.7N RANGE: 1735.5W SURFACE EL: 409.2
DATE DRILLED: 3/24/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
5	405	13	CL	14.8	35	17	SI CL, ±5% FN ANG COAL GV, GY-BRN, MST, FL
10	400	30	CL	9.8	35	17	SI CL, ±10% FN ANG LS GV, GY-BRN, MST, FL
15	395	49	CL	12.4	36	17	SI CL, ±15% FN ANG LS GV, GY-BRN, MST, FL
20	390	16	CL	16.2	26	9	SI CL, BRN, MST, ALL
25	385	11	CL	24.7	32	14	SI CL, BRN, MST, ALL
30	380	15	CL	22.4	30	12	SI CL, BRN, MST, ALL
35	375						

1''=5'

*Lab. Classif.

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-6 STATION: 1382.7N RANGE: 1735.5W SURFACE EL: 409.2
DATE DRILLED: 3/24/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
		9	CL	24.1	30	12	SI CL, GY-BRN MOTT, MST, HOMO, ALL
40	370	11	CL	24.7	27	10	SI CL, GY-BRN MOTT, MST, HOMO, ALL
45	365	5	CL	23.7	27	10	SD CL, LAM, V MST, ALL
50	360	12	CL	21.5	25	8	SI CL-SD SI, STRAT, BRN-GY, V MST, ALL
55	355	8	CL-SM	26.8	22	4	SD SI-FN SD STRAT, GY, V MST, ALL
60	350	20	SM	23.5	NP	NP	SI SD, GY-BLK, CRS, W, ALL
65	345	44	SM	14.0	NP	NP	SI SD-SI CL STRAT, GY, V MST, ALL
70	340						
1''=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-6 STATION: 1382.7N RANGE: 1735.5W SURFACE EL: 409.2
DATE DRILLED: 3/24/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
		11	CL	24.8	26	9	SI CL, GY, V MST, ALL
75	335	10	CL	22.3	26	9	SI CL, GY, V MST, ALL
80	330	39	SM	16.7	NP	NP	IR, WTH SS
							EL 326.7
85	325						
90	320						
95	315						
100	310						
105	305						
1''=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FEATURE
BORING: SS-7 STATION: 1312.5N RANGE: 1548.3W SURFACE EL: 409.8
DATE DRILLED: 3/25/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
5	405	15	CL	12.3	35	17	SD SI, ±2% SB RD LS GV, GY&R, D, FL
10	400	14	CL	14.3	35	17	SD SI, LAM W/COAL, GY&BLK, D, FL, IR
15	395	13	CL	18.2	33	15	SI CL, YEL, MST, FL
20	390	11	CL	15.4	36	17	SD SI, WHT&YEL&GY, D, HOMO, FL
25	385	7	CL	22.9	30	12	SI CL, GY&BRN, MST, HOMO, ALL
30	380	7	CL	23.8	30	12	SI CL, BRN&TN, V MST, HOMO, ALL
35	375						

1''=5'

* Lab. Classif.

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FEATURE
BORING: SS-7 STATION: 1312.5N RANGE: 1548.3W SURFACE EL: 409.8
DATE DRILLED: 3/25/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
		7	CL	24.2	30	12	SI CL, BRN&GY, V MST, HOMO, ALL
40	370	5	CL	25.0	27	10	SI CL, BRN, W, HOMO, ALL
45	365	5	CL	22.1	27	10	SD SI, BRN&CRM, W, HOMO, ALL
50	360	4	CL ML	27.0	22	4	SD SI, VERT LAM, GY, W, ALL
55	355	7	CL ML	24.1	22	4	SD SI CL, GY, W, HOMO, ALL
60	350	50	SM	11.1	NP	NP	SD SI, STRAT W/SH, CRS, GY, V MST, ALL
							EL 349.0
65	345						
70	340						

1''=5' *Lab. Classif.

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-8 STATION: 1390.4N RANGE: 1519.9W SURFACE EL: 392.2
DATE DRILLED: 3/24/83 TO 3/25/83 PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
	390						
5		14	CL	21.8	41	18	SI CL, BRN&TN, MST, HOMO, FL
	385						
10		9	CL	22.1	27	10	SI CL, BRN&TN, MST, HOMO, ALL
	380						
15		7	CL	23.6	27	10	SI CL, BRN&TN, MST, HOMO, ALL
	375						
20		7	CL	25.6	30	12	SI CL, BRN&TN, V MST, HOMO, ALL
	370						
25		3	CL	25.9	30	12	SI CL, BRN&GY, V MST, HOMO, ALL
	365						
30		5	CL	26.6	26	9	SI CL, GY, V MST, HOMO, ALL
	360						
35							
1''=5'		* Lab. Classif.					

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SPLITSPOON BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: SS-8 STATION: 1390.4N RANGE: 1519.9W SURFACE EL: 392.2
DATE DRILLED: 3/24/83 TO 3/25/83 PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	FIELD DESCRIPTION
	355	3	CL	22.1	26	9	SI CL, GY, W, HOMO, ALL
40	350	4	CL	22.6	26	9	SI CL, GY, W, HOMO, ALL
45	345	8	CL	20.2	26	9	SI CL, GY, V MST, HOMO, ALL
50	340	24	SM	21.0	NP	NP	SI SD, STRAT W/SH, SS, GY&BRN, CRS, MST, RESD
55							EL 338.5
	335						
60	330						
65	325						
70							
1''=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (UNDISTURBED BORING)

SHEET 1 OF 2

PROJECT: PARADISE S.P.   FEATURE: COAL RECEIVING FACILITY
BORING: US-1   STATION: RANGE: SURFACE EL: 387.6
DATE DRILLED: 3/28/83 TO   PREPARED BY: MHD   CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	DESCRIPTION (ENGINEERING TEST RESULTS)
							0.0-8.0' ROU AUGG - BLDS
	385						
5							
	380						
10							
	375						
15			ML	22.8	21	3	SI CL, BRN, MST, F, ALL R(NMC) 27.9 0.05
	370						
20							
	365						
25			SM	24.6	NP	NP	SI CL, BRN, MST, F, ALL
	360						
30							
	355						
35							
1''=5'		* Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (UNDISTURBED BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: US-1 STATION: RANGE: SURFACE EL: 387.6
DATE DRILLED: 3/28/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	DESCRIPTION (ENGINEERING TEST RESULTS)
			SM	27.5	NP	NP	SI SD, GY, MST, STRAT, ALL R(SAT) 18.2 1.84 R̄(SAT) 21.0 1.34
	350						
40			SP-SM	31.1	NP	NP	SI SD-SD SI STRAT, GY, MST, SOFT, ALL (0.5 FILL-UP)
	345						EL 345.6
45							
	340						
50							
	335						
55							
	330						
60							
	325						
65							
	320						
70							
1''=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (UNDISTURBED BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY

BORING: US-3 STATION: 1476.5N RANGE: 1914.2W SURFACE EL: 408.5

DATE DRILLED: 3/28/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	DESCRIPTION (ENGINEERING TEST RESULTS)
	405						
5							
	400						
10							
	395						
15			CL	13.2	37	18	GV SD SI, ±10% SB RD LS, HD, GY, D
	390						
20			CL	20.5	31	12	SI CL, BRN, MST, STF R(NMC) 23.6 0.61
	385						
25							
	380						
30			CL	26.7	33	14	SI CL, BRN, V MST, S
	375						
35							
1''=5'		*Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (UNDISTURBED BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: US-3 STATION: 1476.5N RANGE: 1914.2W SURFACE EL: 408.5
DATE DRILLED: 3/28/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	DESCRIPTION (ENGINEERING TEST RESULTS)
	370						
40			CL	24.7	30	12	SI CL, BRN&TN, W, S R(SAT) 11.9 0.63 R̄(SAT) 32.1 0.04
	365						
45							
	360						
50			SM	22.9	NP	NP	SI SD, R&BRN&TN, FN, S, V W
	355						
55			SM	25.1	NP	NP	SI SD, BRN&GY, FN, S, V W
	350						
60							
	345						
65							
	340						
70			SM	20.4			SI SD, GV, GN S, VW R(SAT) 34.5 1.18 R̄(SAT) 32.1 0.33
1''=5'		* Lab. Classif.					EL 338.8

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

SOIL PROFILE (UNDISTURBED BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: US-8 STATION: 1390.4N RANGE: 1519.9W SURFACE EL: 392.2
DATE DRILLED: 3/29/83 TO PREPARED BY: MHD CHECKED BY: HPM

DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	DESCRIPTION (ENGINEERING TEST RESULTS)
	390						
5							
	385						
10							
	380		CL	21.5	33	13	SI CL, BRN&TN, S, MST R(NMC) 23.1 0.69
15							
	375		CL	24.9	35	15	SI CL, BRN&TN, S, MST, IR
20			CL	25.8	34	15	SI CL, BRN&TN, F, V MST
	370						
25							
	365		CL	25.8	30	13	SI CL, GY, F, V MST R(SAT) 13.3 0.57 R̄(SAT) 32.9 0.06
30							
	360		CL	26.0	30	12	SI CL, GY, S, W
35							
1''=5'		* Lab. Classif.					

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (UNDISTURBED BORING)

PROJECT: PARADISE S.P. FEATURE: COAL RECEIVING FACILITY
BORING: US-8 STATION: 1390.4N RANGE: 519.9W SURFACE EL: 392.2
DATE DRILLED: 3/29/83 TO PREPARED BY: MHD CHECKED BY: HPM

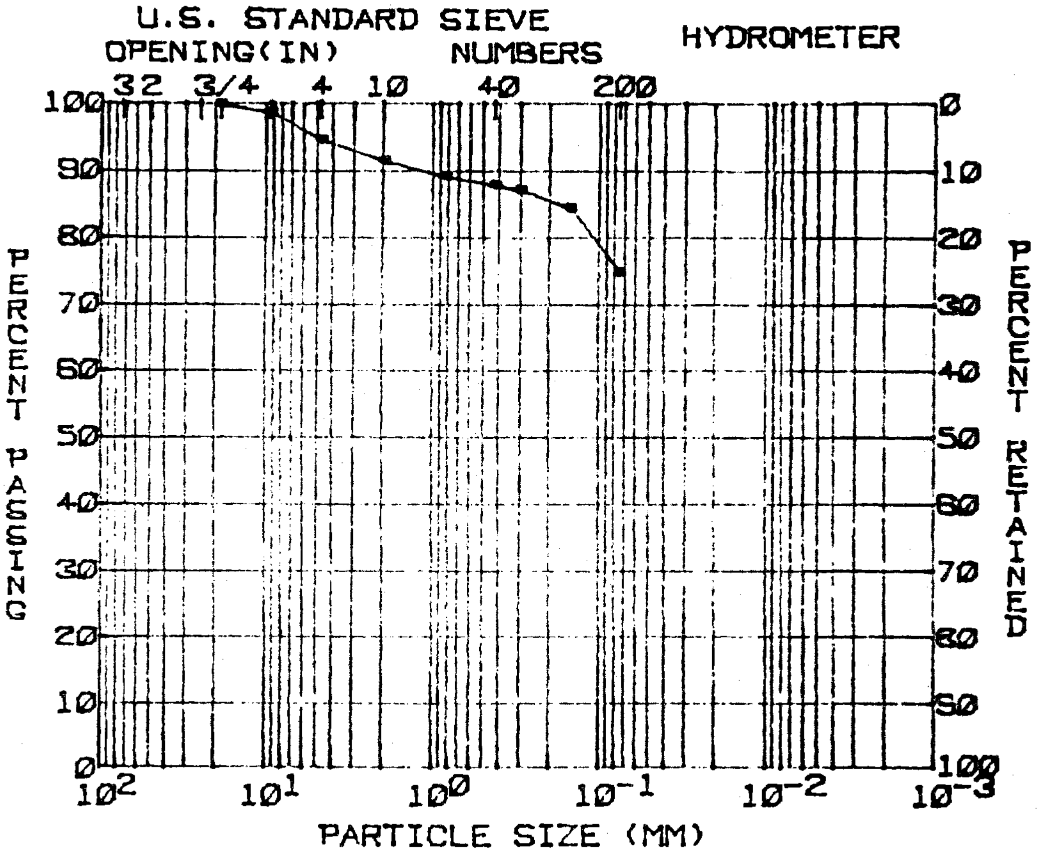
DEPTH ft.	EL	SPT (N)	* LOG	W	LL	PI	DESCRIPTION (ENGINEERING TEST RESULTS)
	355						
40							
			CL	23.5	30	12	SD SI CL, GY, V MST, S R(SAT) 13.5 0.26 R̄(SAT) 31.3 0.11
	350						
45							EL 349.7
	345						
50							
	340						
55							
	335						
60							
	330						
65							
	325						
70							
1''=5'		* Lab. Classif.					

Particle Size Analysis

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION:
RANGE :

BORING: SS 1-8
EL. :
SAMPLE: GR.2
DATE : 3-30-83



GRAVEL(%) = 5
SAND(%) = 20
SILT(%) = 75
CLAY(%) = 0

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF = --

SOIL SYMBOL = CL
MOISTURE(%) = --
SP. GR. = 2.65

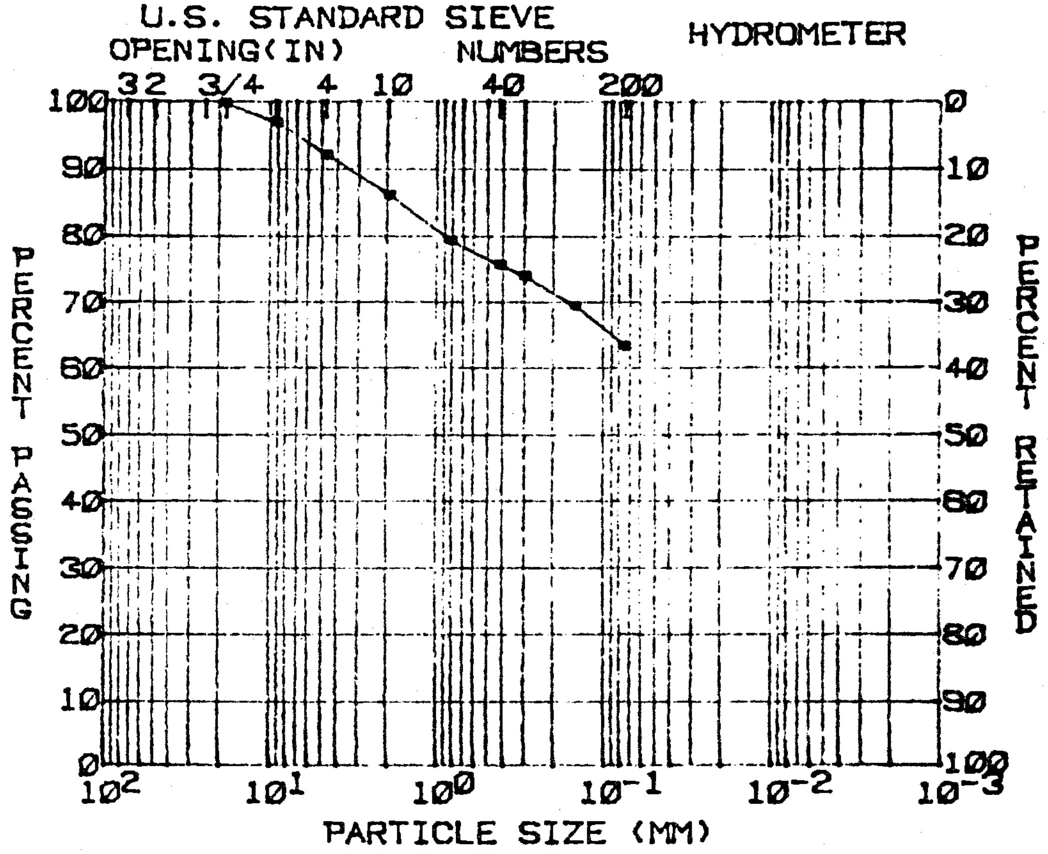
L.L.(%) = 33
P.I.(%) = 15

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:
RANGE :

BORING:SS 1-8
EL. :
SAMPLE:GR.3
DATE :3-30-83



GRAVEL(%)= 7
SAND(%) = 29
SILT(%) = 63
CLAY(%) = 1

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= --
SP. GR. = 2.65

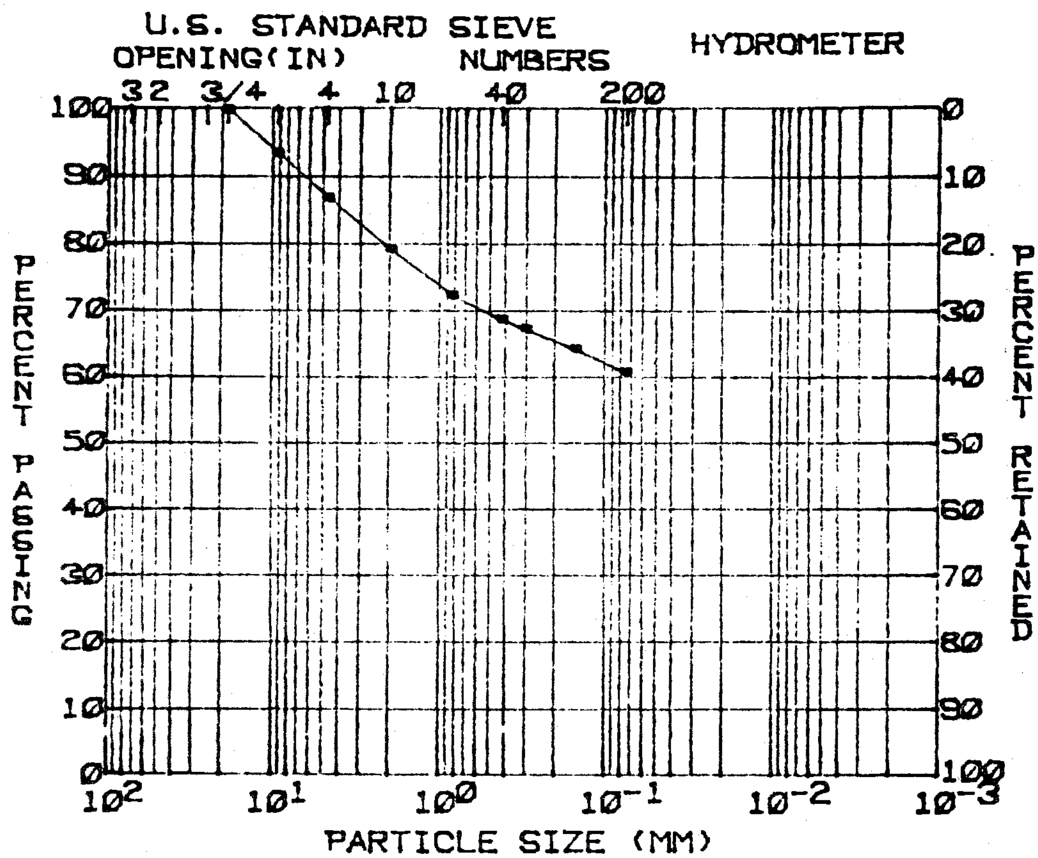
L.L.(%) = 35
P.I.(%) = 17

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:
RANGE :

BORING:SS 1-8
EL. :
SAMPLE:GR.4
DATE :3-30-83



GRAVEL(%)= 13
SAND(%) = 27
SILT(%) = 60
CLAY(%) = 0

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= --
SP. GR. = 2.65

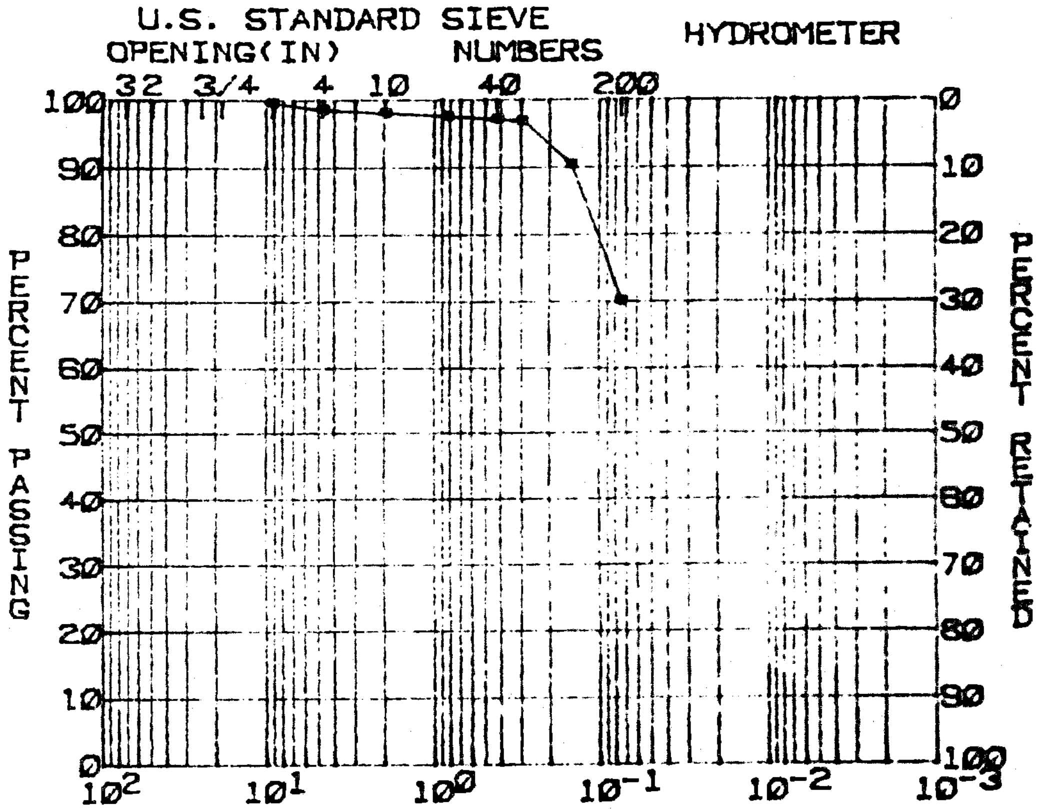
L.L.(%) = 36
P.I.(%) = 17

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:
RANGE :

BORING:SS 1-8
EL. :
SAMPLE:GR.5
DATE :3-30-83



GRAVEL(%)= 1
SAND(%) = 29
SILT(%) = 70
CLAY(%) = 0

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= --
SP. GR. = 2.65

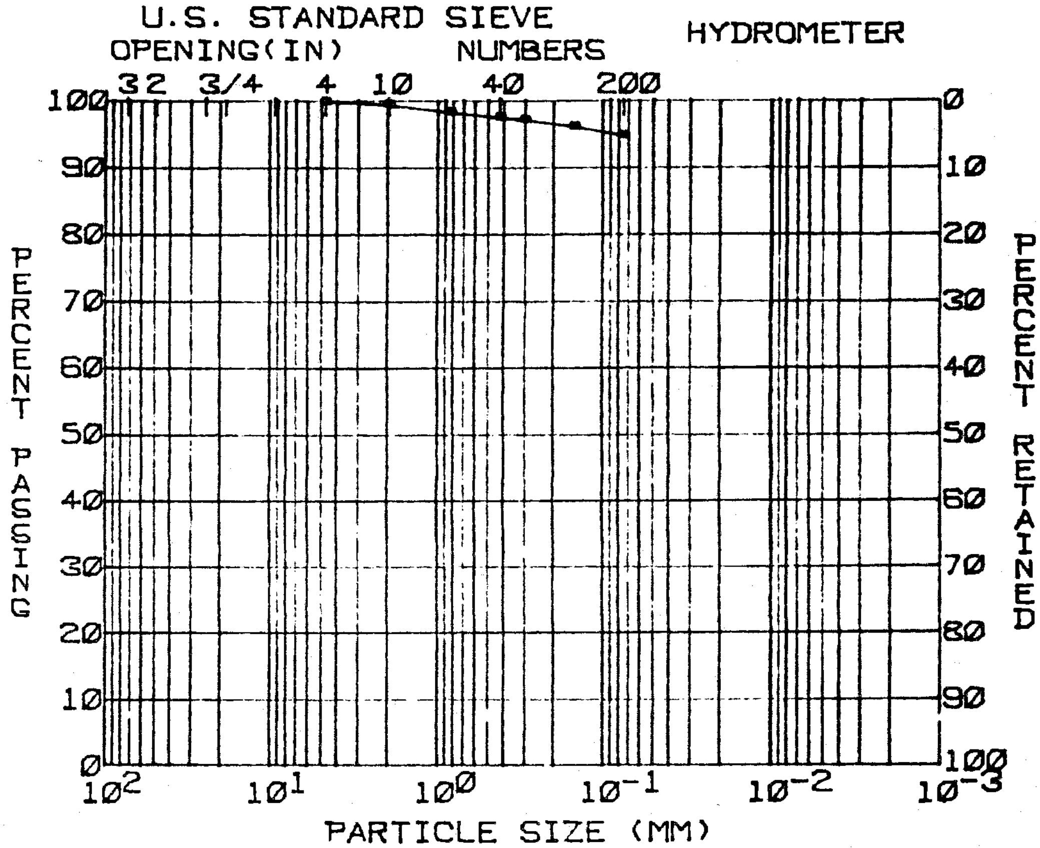
L.L.(%) = 28
P.I.(%) = 9

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION:
RANGE :

BORING: SS 1-8
EL. :
SAMPLE: GR.6
DATE : 3-31-83



GRAVEL(%) = 0
SAND(%) = 5
SILT(%) = 95
CLAY(%) = 0

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF = --

SOIL SYMBOL = CL
MOISTURE(%) = --
SP. GR. = 2.65

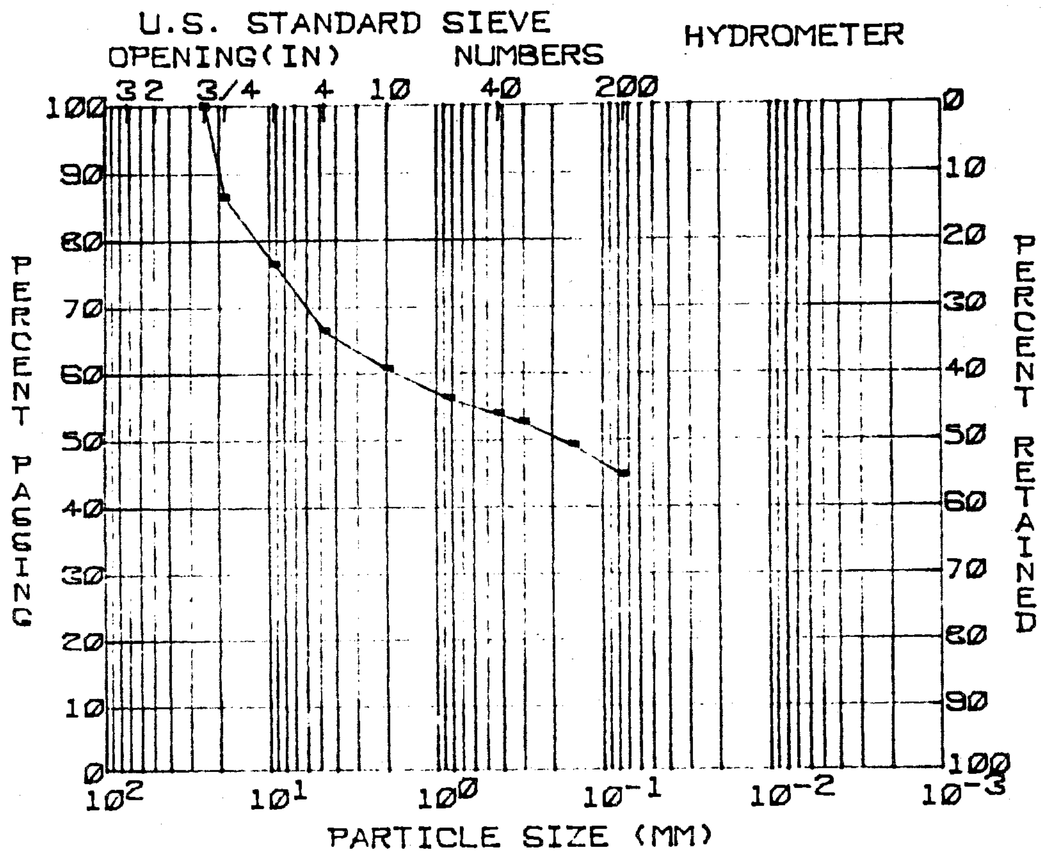
L.L.(%) = 41
P.I.(%) = 18

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION:
RANGE :

BORING: SS 1-8
EL. :
SAMPLE: GR.8
DATE : 3-31-83



GRAVEL(%) = 33
SAND(%) = 22
SILT(%) = 45
CLAY(%) = 0

D10(MM) = 0.0004
D30(MM) = 0.0083
D60(MM) = 1.6092
COEF UNIF> 100

SOIL SYMBOL = GC
MOISTURE(%) = --
SP. GR. = 2.65

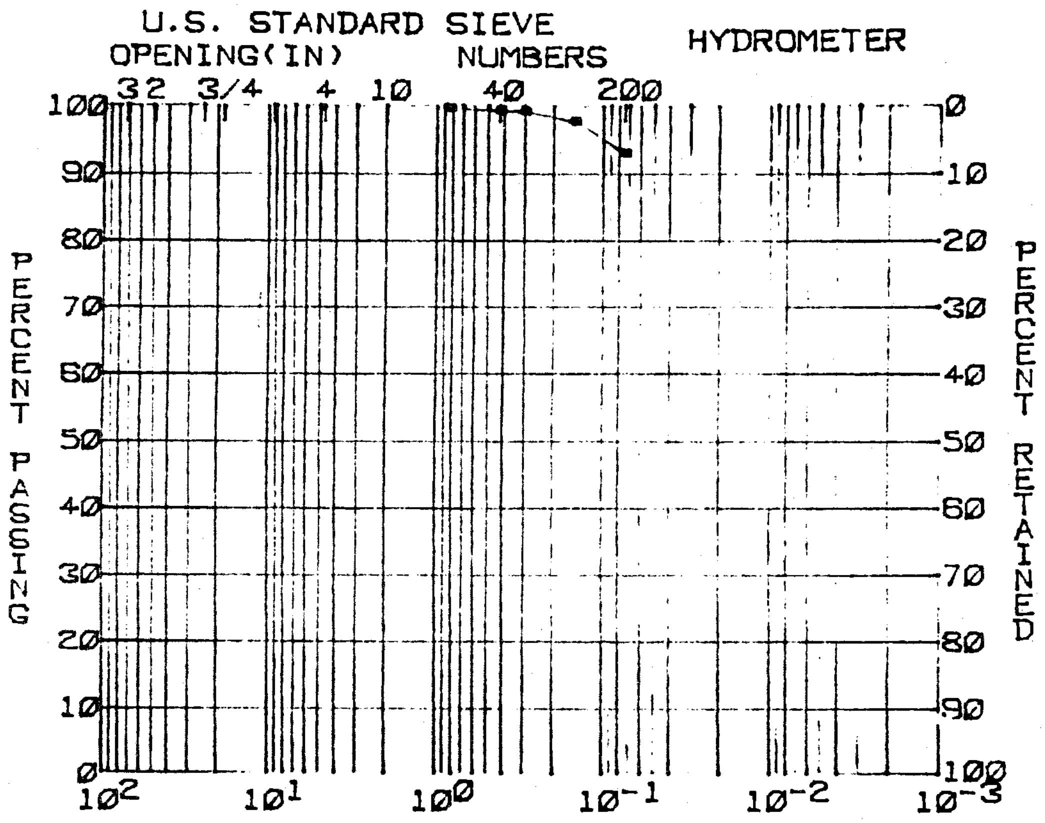
L.L.(%) = 33
P.I.(%) = 15

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION:
RANGE :

BORING: SS 1-8
EL. :
SAMPLE: GR.8
DATE : 3-31-83



GRAVEL(%) = 0
SAND(%) = 7
SILT(%) = 93
CLAY(%) = 0

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF = --

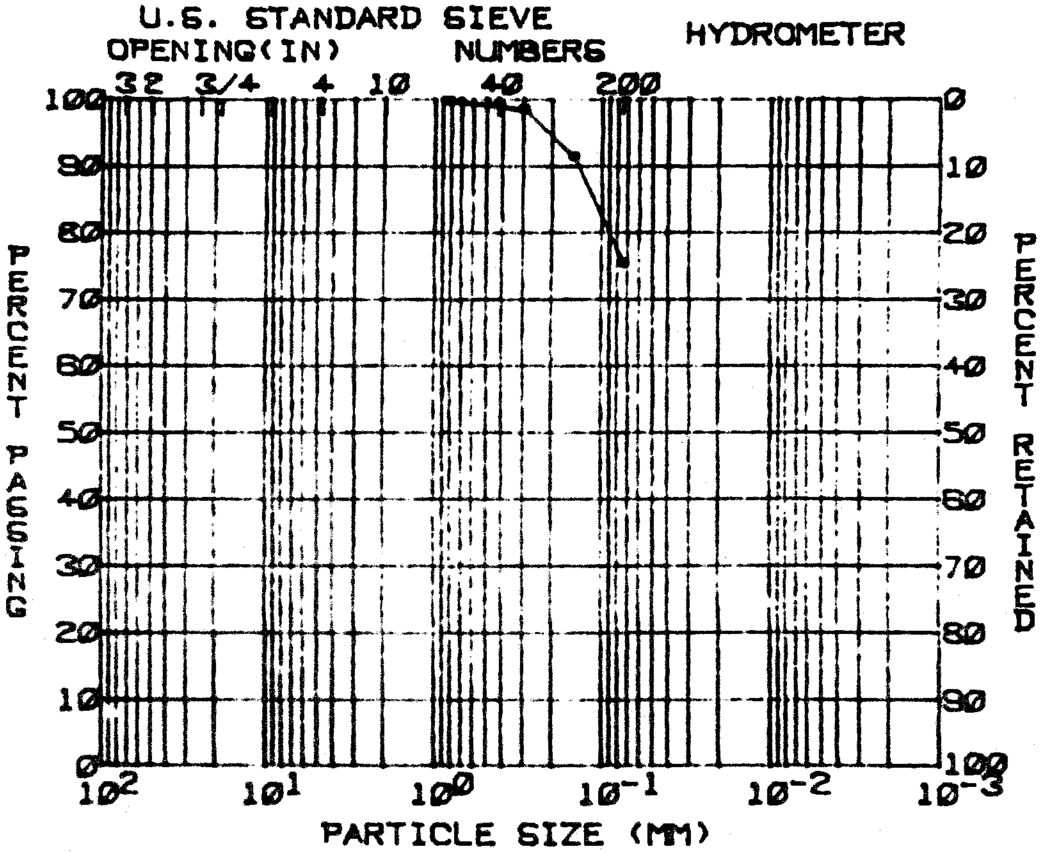
SOIL SYMBOL = CL
MOISTURE(%) = --
SP. GR. = 2.65

L.L.(%) = 32
P.I.(%) = 14

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P. BORING:SS 1-8
FEATURE:COAL RCVG FACIL EL. :
STATION: SAMPLE:GR.10
RANGE : DATE :4-4-83



GRAVEL(%)= 0 D10(MM) = --
SAND(%) = 24 D30(MM) = --
SILT(%) = 76 D60(MM) = --
CLAY(%) = 0 COEF UNIF= --

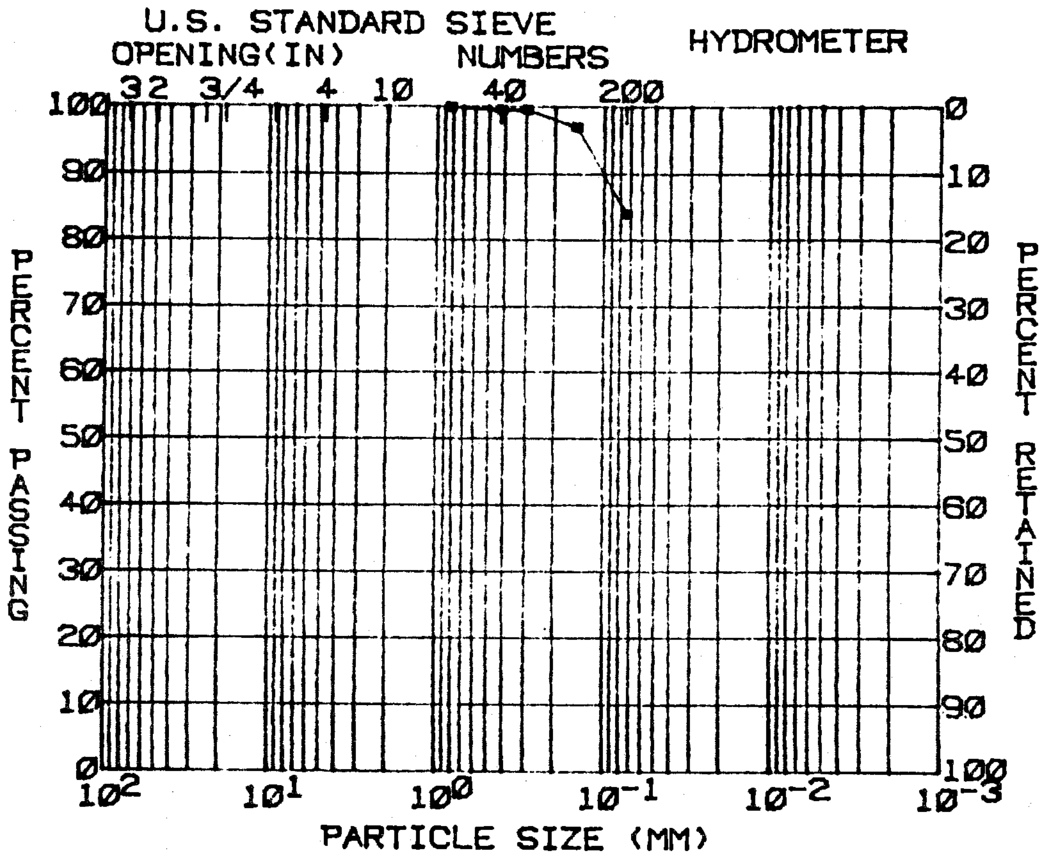
SOIL SYMBOL= CL L.L.(%) = 27
MOISTURE(%)= -- P.I.(%) = 10
SP. GR. = 2.65

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:
RANGE :

BORING:SS 1-8
EL. :
SAMPLE:GR.11
DATE :4-4-83



GRAVEL(%) = 0
SAND(%) = 16
SILT(%) = 84
CLAY(%) = 0

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= --
SP. GR. = 2.65

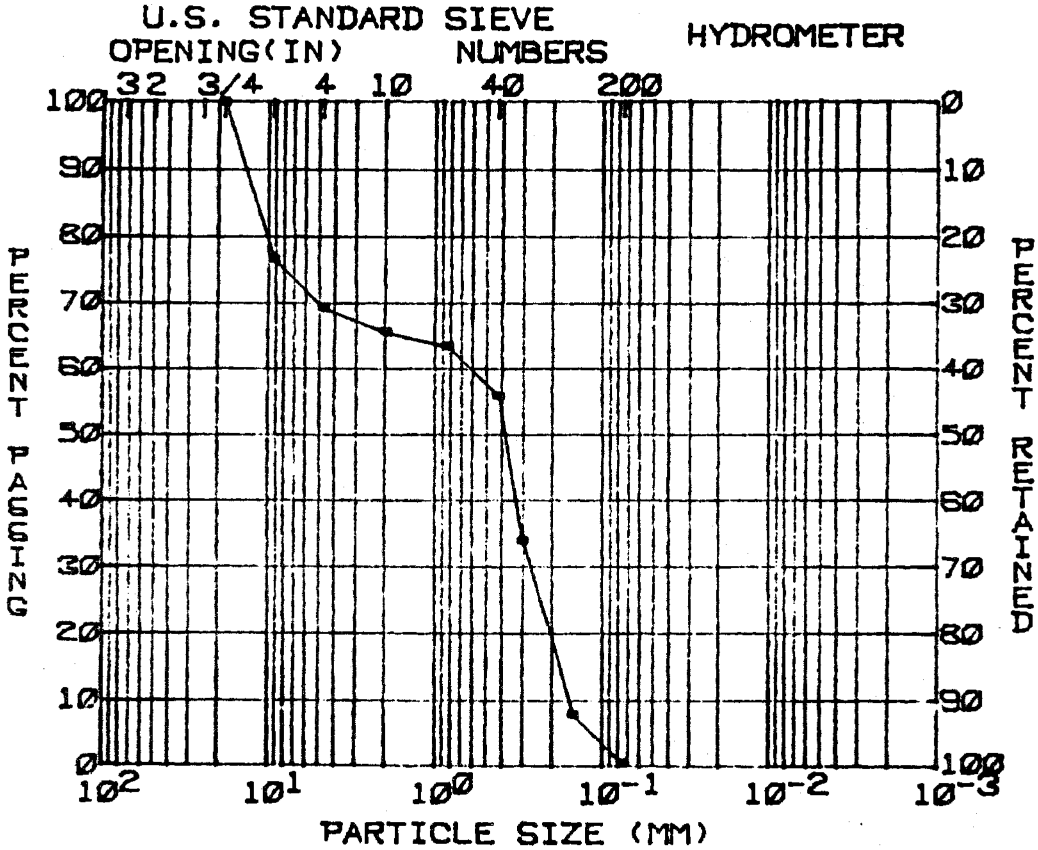
L.L.(%) = 30
P.I.(%) = 12

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:
RANGE :

BORING:SS 1-8
EL. :
SAMPLE:GR.12
DATE :4-4-83



GRAVEL(%)= 31
SAND(%) = 69
SILT(%) = 0
CLAY(%) = 0

D10(MM) = 0.1582
D30(MM) = 0.2688
D60(MM) = 0.6115
COEF UNIF= 3.9

SOIL SYMBOL= SP
MOISTURE(%)= --
SP. GR. = 2.65

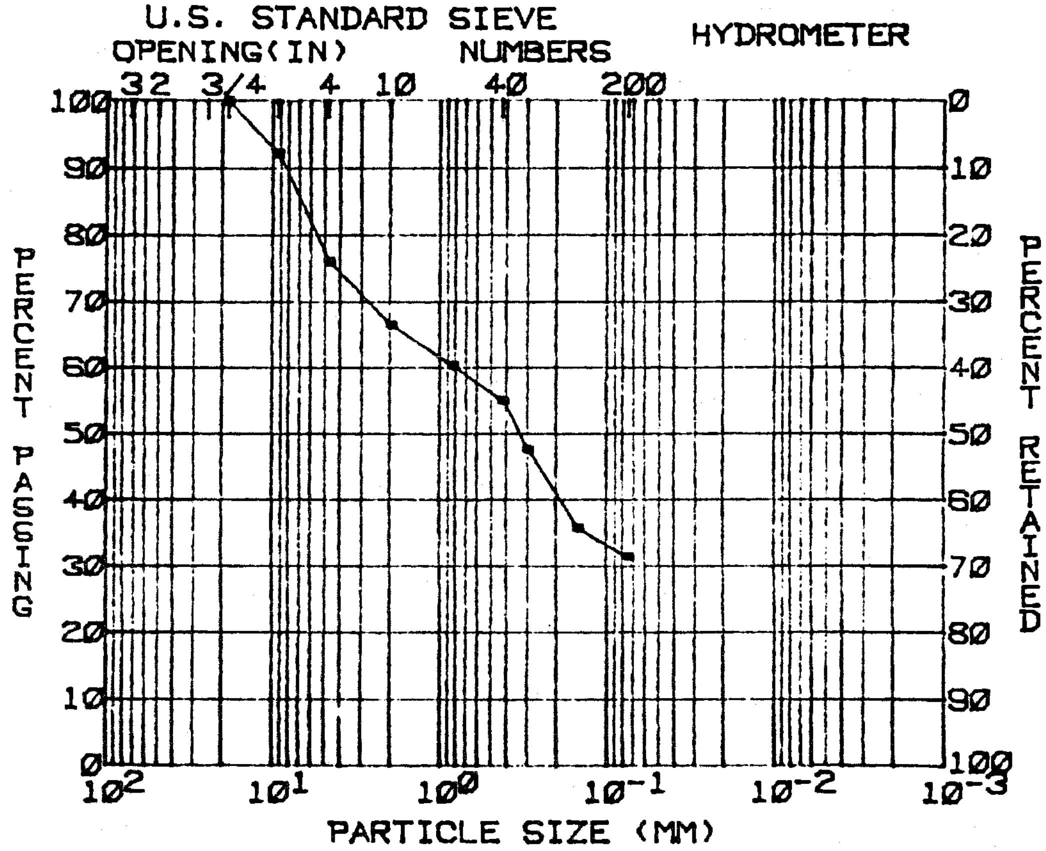
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION:
RANGE :

BORING: SS 1-8
EL. :
SAMPLE: GR.13
DATE : 4-4-83



GRAVEL(%) = 23
SAND(%) = 45
SILT(%) = 32
CLAY(%) = 0

D10(MM) = 0.0026
D30(MM) = 0.0583
D60(MM) = 0.7720
COEF UNIF> 100

SOIL SYMBOL = SM
MOISTURE(%) = --
SP. GR. = 2.65

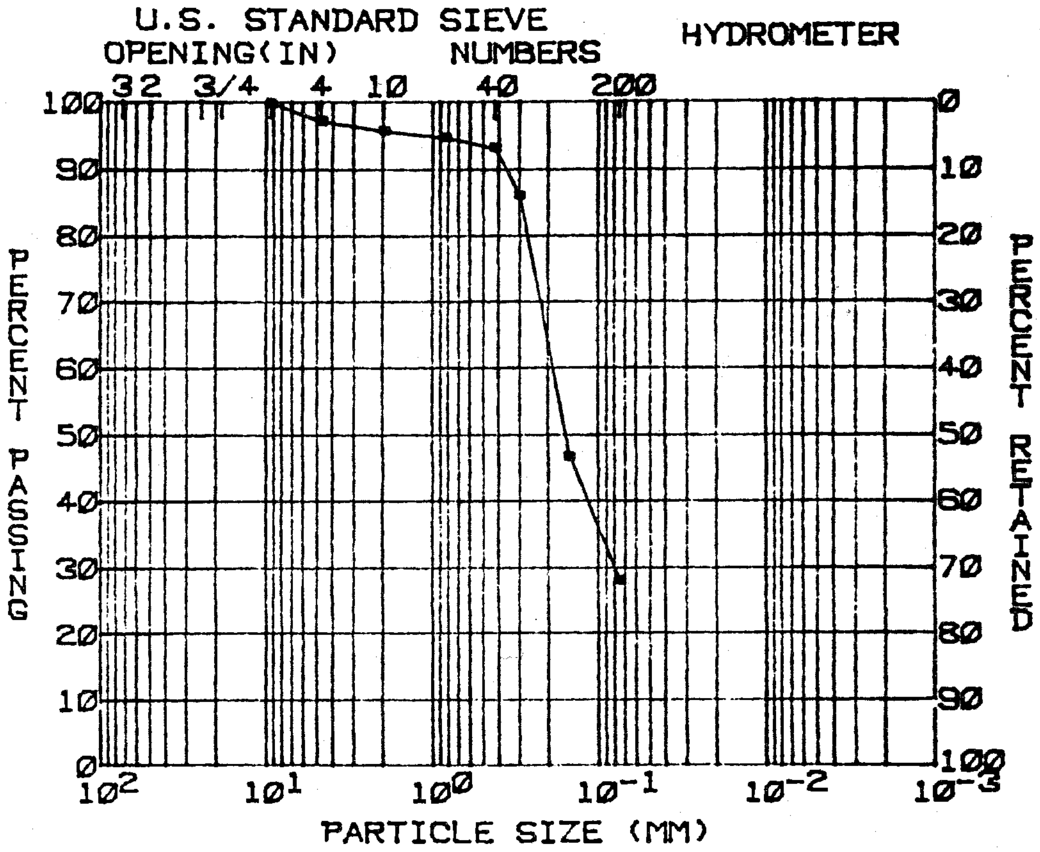
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:
RANGE :

BORING:SS 1-8
EL. :
SAMPLE:GR.14
DATE :4-4-83



GRAVEL(%)= 2
SAND(%) = 70
SILT(%) = 28
CLAY(%) = 0

D10(MM) = 0.0382
D30(MM) = 0.0803
D60(MM) = 0.1891
COEF UNIF= 5.0

SOIL SYMBOL= SM
MOISTURE(%)= --
SP. GR. = 2.65

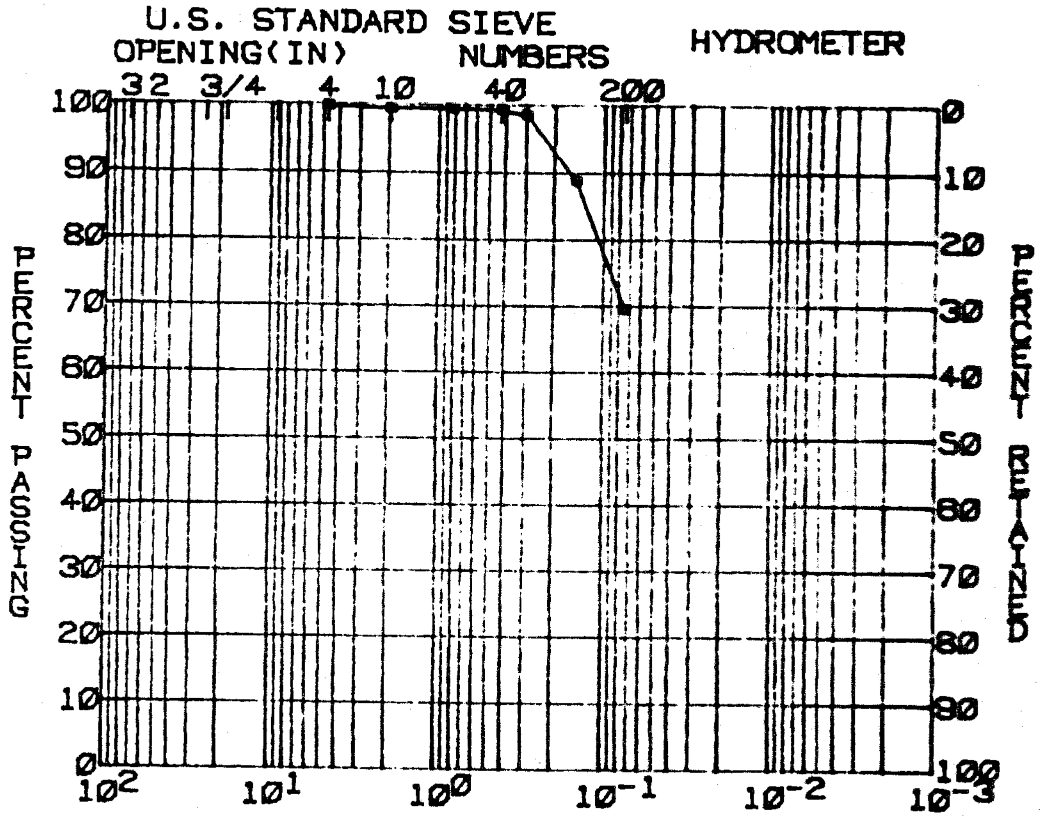
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:
RANGE :

BORING:SS 1-8
EL. :
SAMPLE:GR.15
DATE :4-4-83



GRAVEL(%)= 0
SAND(%) = 30
SILT(%) = 70
CLAY(%) = 0

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= --
SP. GR. = 2.65

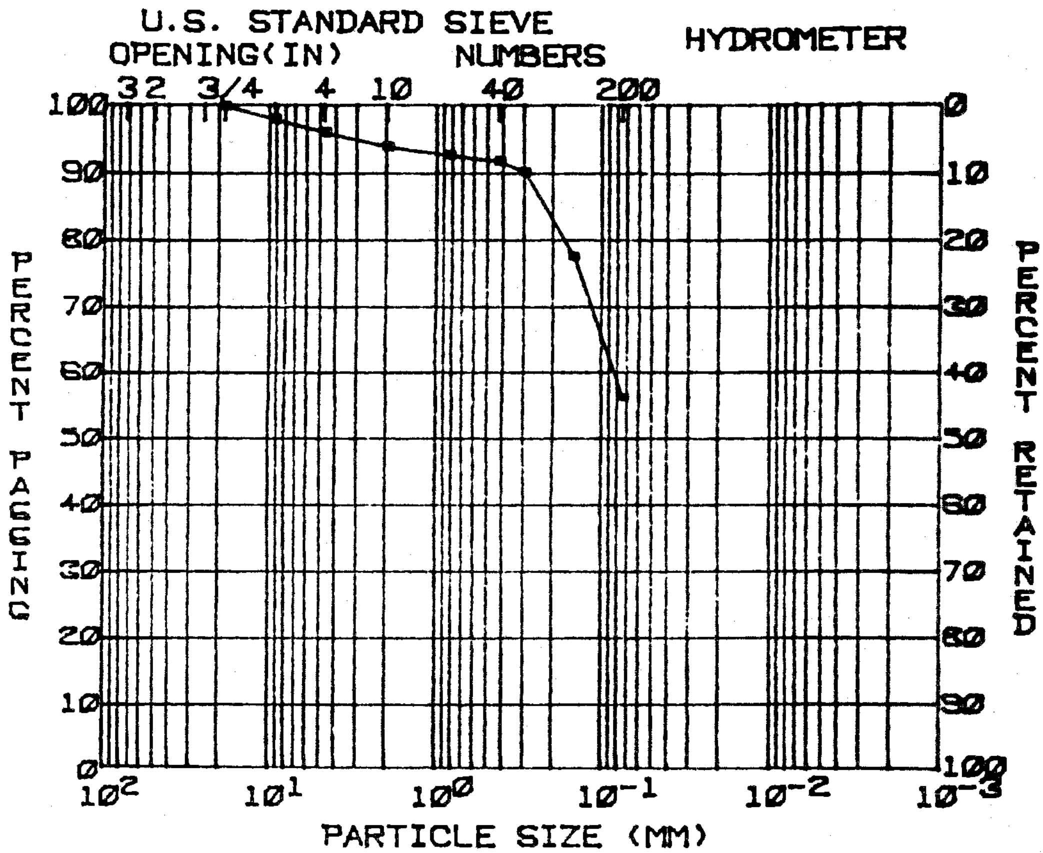
L.L.(%) = 25
P.I.(%) = 8

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION:
RANGE :

BORING: SS 1-8
EL. :
SAMPLE: GR.18
DATE : 4-4-83



GRAVEL(%) = 3
SAND(%) = 40
SILT(%) = 56
CLAY(%) = 1

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF = --

SOIL SYMBOL = CL-ML
MOISTURE(%) = --
SP. GR. = 2.65

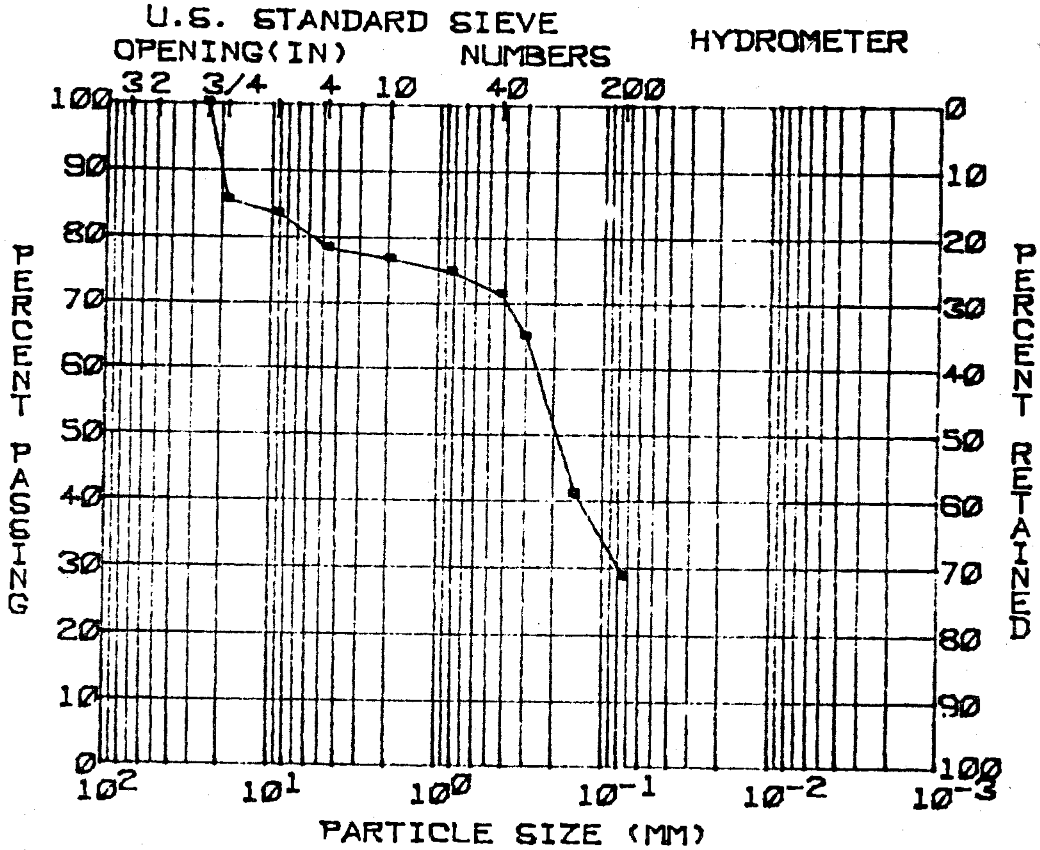
L.L.(%) = 22
P.I.(%) = 4

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:
RANGE :

BORING:SS 1-8
EL. :
SAMPLE:GR.17
DATE :4-5-83



GRAVEL(%)= 21
SAND(%) = 50
SILT(%) = 29
CLAY(%) = 0

D10(MM) = 0.0263
D30(MM) = 0.0799
D60(MM) = 0.2584
COEF UNIF= 9.7

SOIL SYMBOL= SM
MOISTURE(%)= --
SP. GR. = 2.65

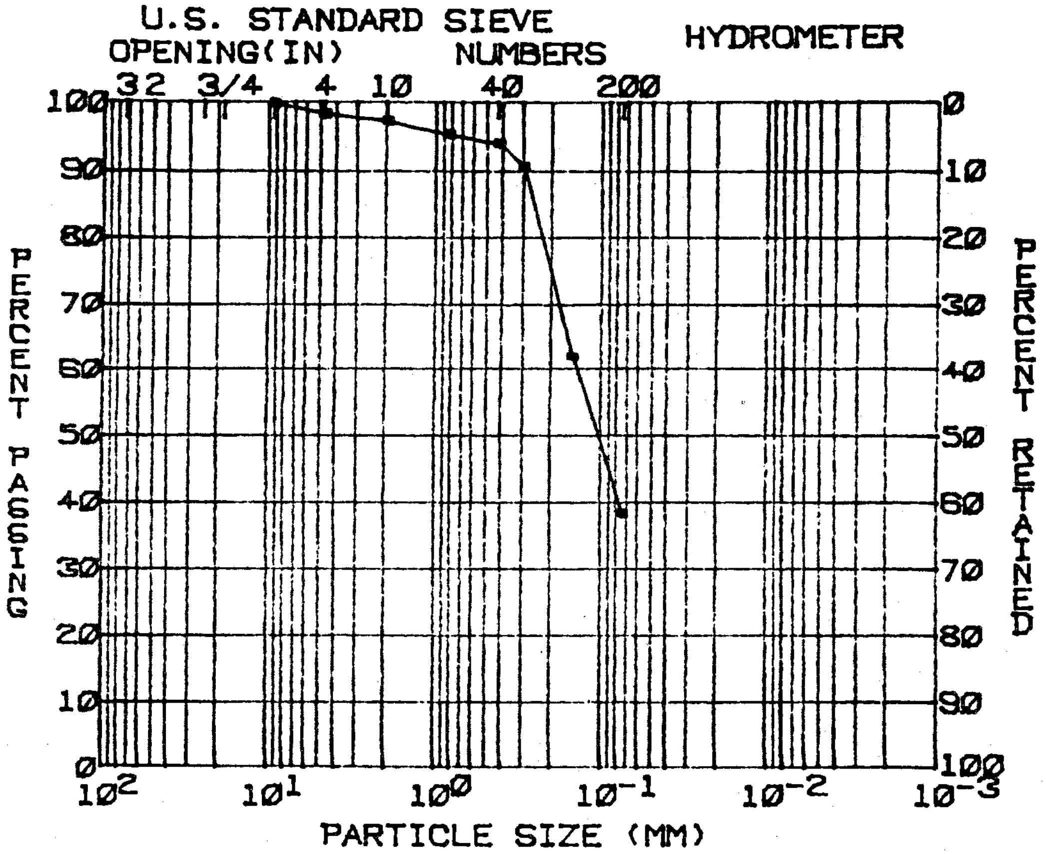
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:
RANGE :

BORING:SS 1-8
EL. :
SAMPLE:GR.18
DATE :4-4-83



GRAVEL(%)= 1
SAND(%) = 61
SILT(%) = 38
CLAY(%) = 0

D10(MM) = 0.0327
D30(MM) = 0.0586
D60(MM) = 0.1410
COEF UNIF= 4.3

SOIL SYMBOL= SM
MOISTURE(%)= --
SP. GR. = 2.65

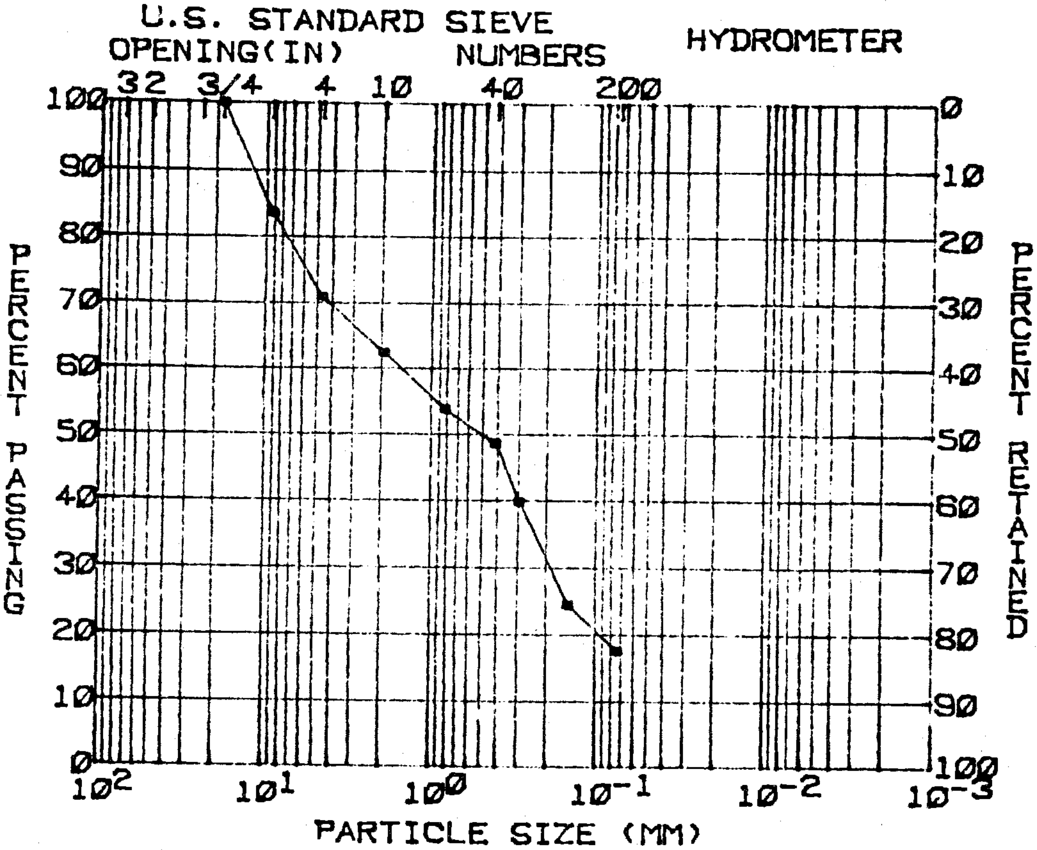
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION:
RANGE :

BORING: SS 1-8
EL. :
SAMPLE: GR.18
DATE : 4-5-83



GRAVEL(%) = 29
SAND(%) = 54
SILT(%) = 17
CLAY(%) = 0

D10(MM) = 0.0349
D30(MM) = 0.1910
D60(MM) = 1.5106
COEF UNIF = 43.2

SOIL SYMBOL = SM
MOISTURE(%) = --
SP. GR. = 2.65

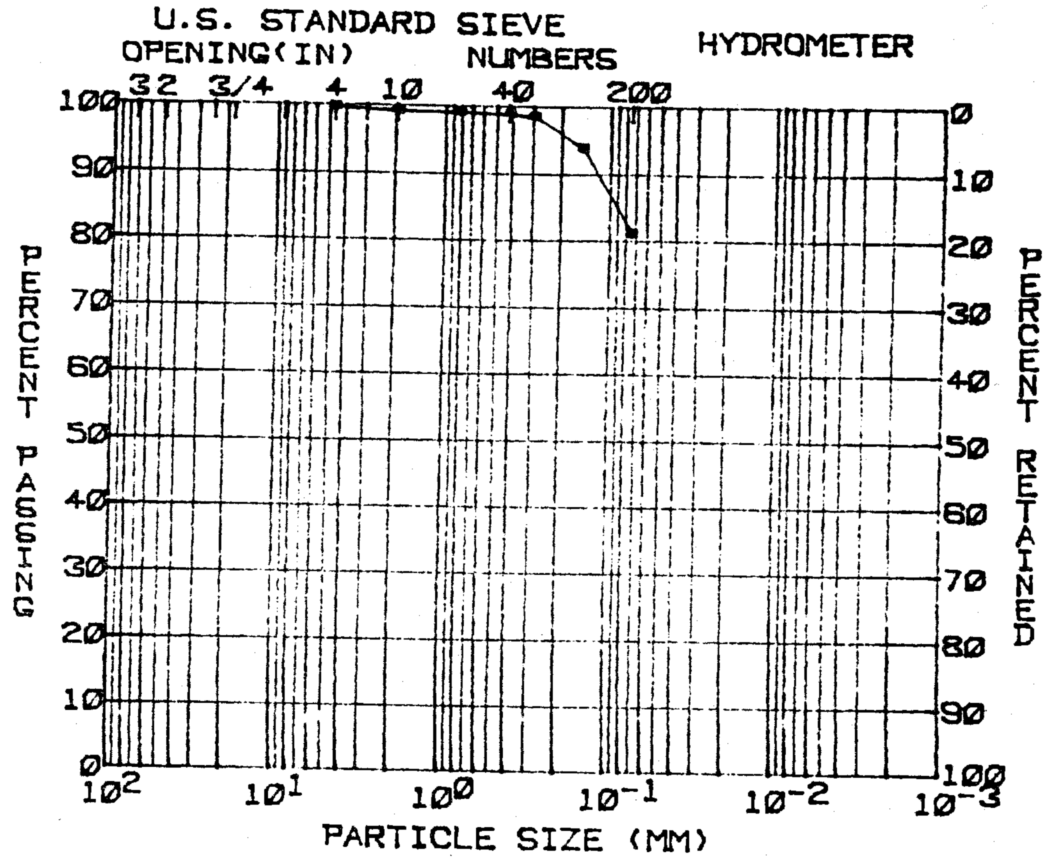
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:
RANGE :

BORING:SS 1-8
EL. :
SAMPLE:GR.20
DATE :4-5-83



GRAVEL(%) = 0
SAND(%) = 19
SILT(%) = 81
CLAY(%) = 0

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= --
SP. GR. = 2.65

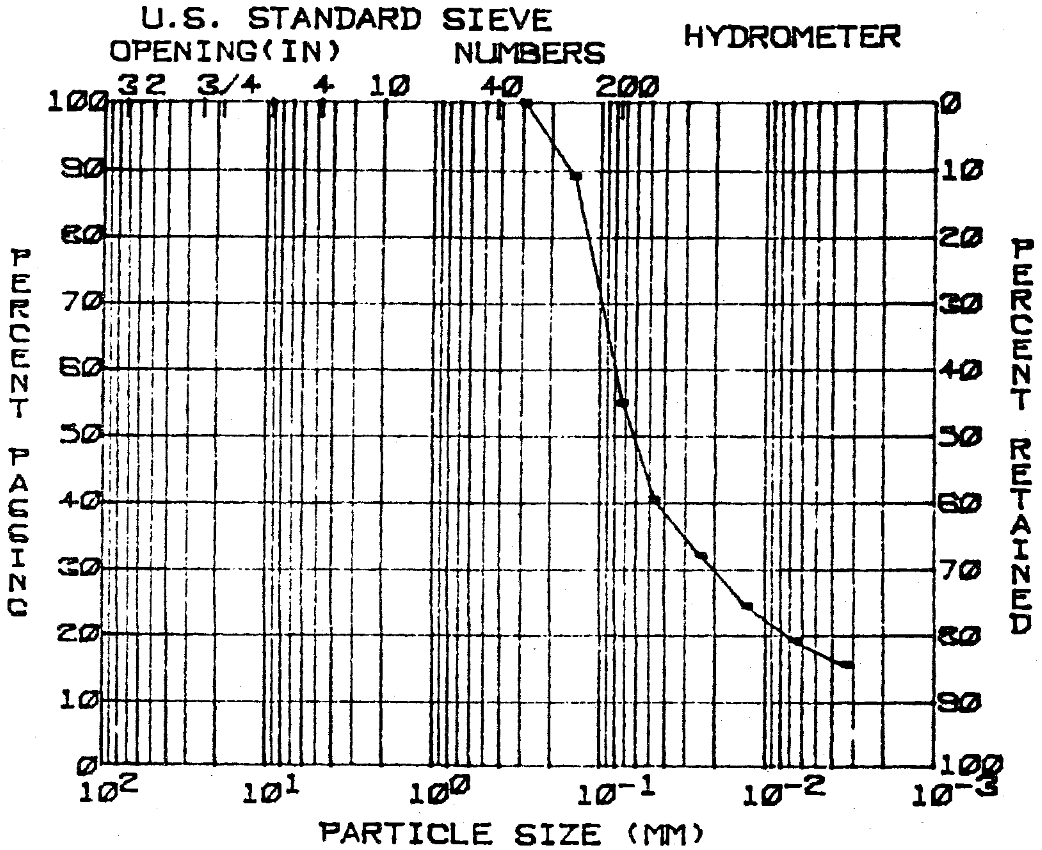
L.L.(%) = 26
P.I.(%) = 9

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACI
STATION:2075.14 W
RANGE :1580.85 N

BORING:US-1
EL. :372.8-370.7
SAMPLE:1
DATE :4-8-83



GRAVEL(%) = 0
SAND(%) = 45
SILT(%) = 37
CLAY(%) = 18

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= ML
MOISTURE(%)= 23.0
SP. GR. = 2.66

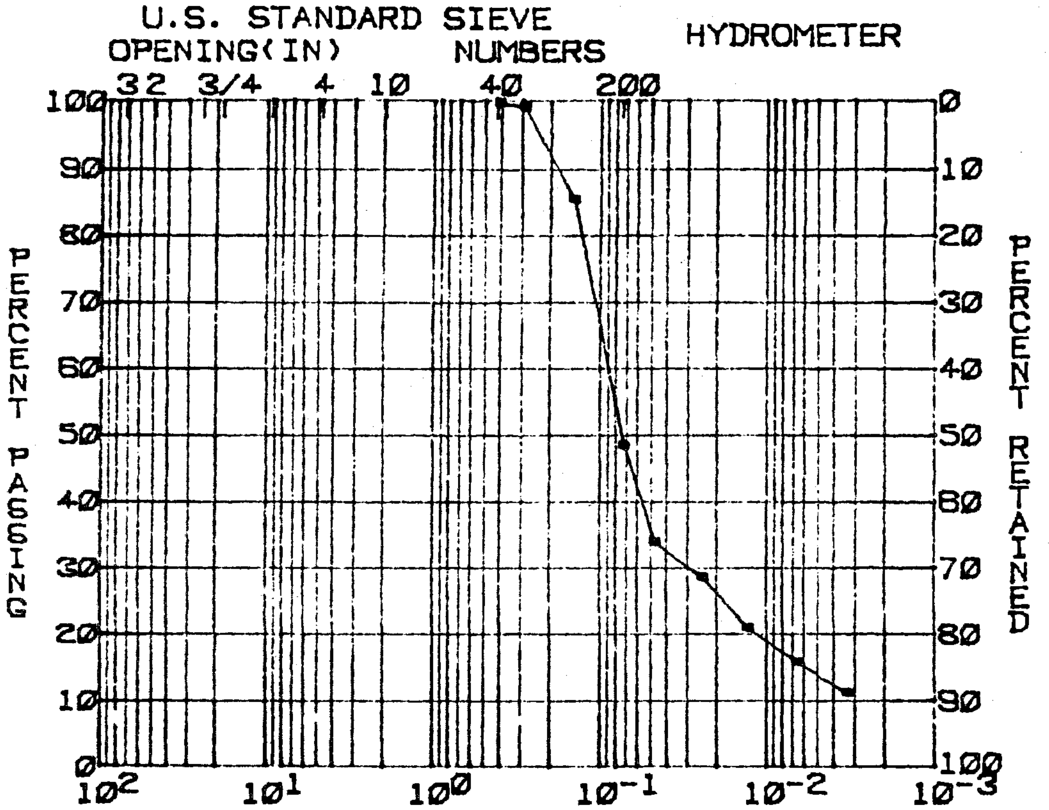
L.L.(%) = 21
P.I.(%) = 3

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:2075.14 W
RANGE :1580.85 N

BORING:US-1
EL. :362.6-361.0
SAMPLE:2
DATE :4-6-83



GRAVEL(%) = 0
SAND(%) = 51
SILT(%) = 35
CLAY(%) = 14

D10(MM) = 0.0027
D30(MM) = 0.0282
D60(MM) = 0.0924
COEF UNIF=33.8

SOIL SYMBOL= SM
MOISTURE(%)= 24.6
SP. GR. = 2.66

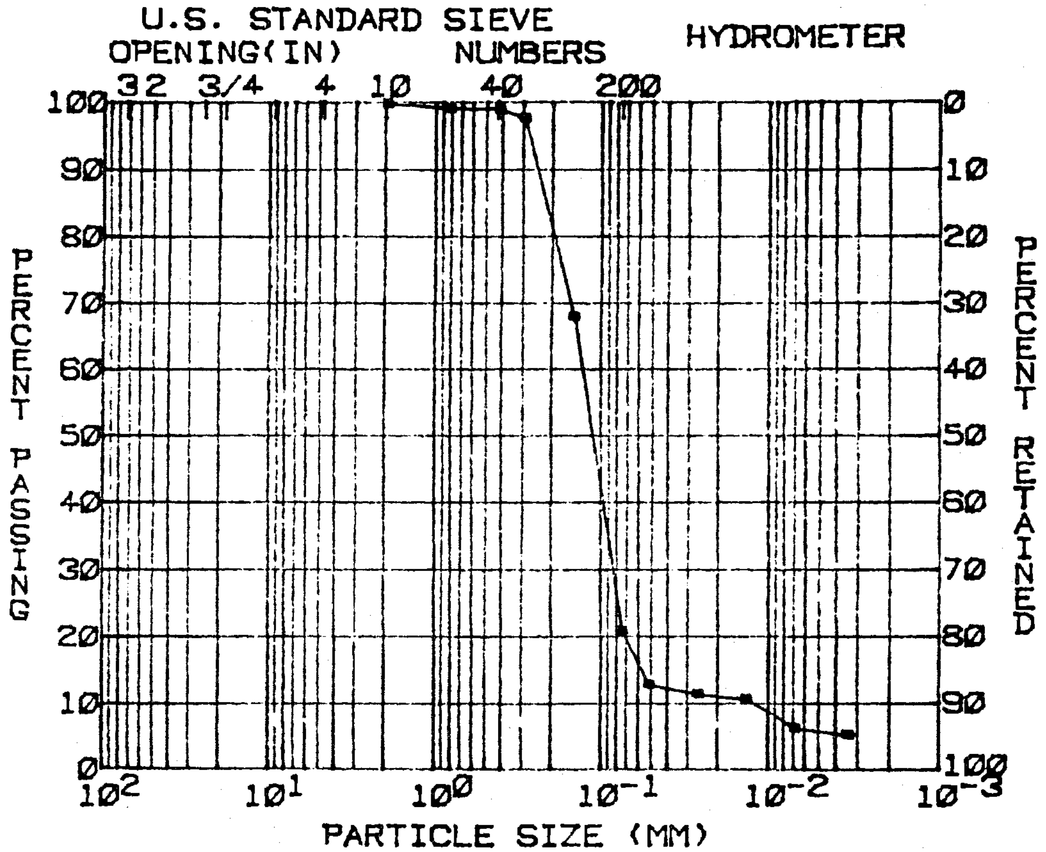
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:2075.14 W
RANGE :1580.85 N

BORING:US-1
EL. :352.6-350.2
SAMPLE:3
DATE :4-6-83



GRAVEL(%)= 0
SAND(%) = 79
SILT(%) = 15
CLAY(%) = 6

D10(MM) = 0.0120
D30(MM) = 0.0854
D60(MM) = 0.1326
COEF UNIF=11.0

SOIL SYMBOL= SM
MOISTURE(%)= 27.8
SP. GR. = 2.63

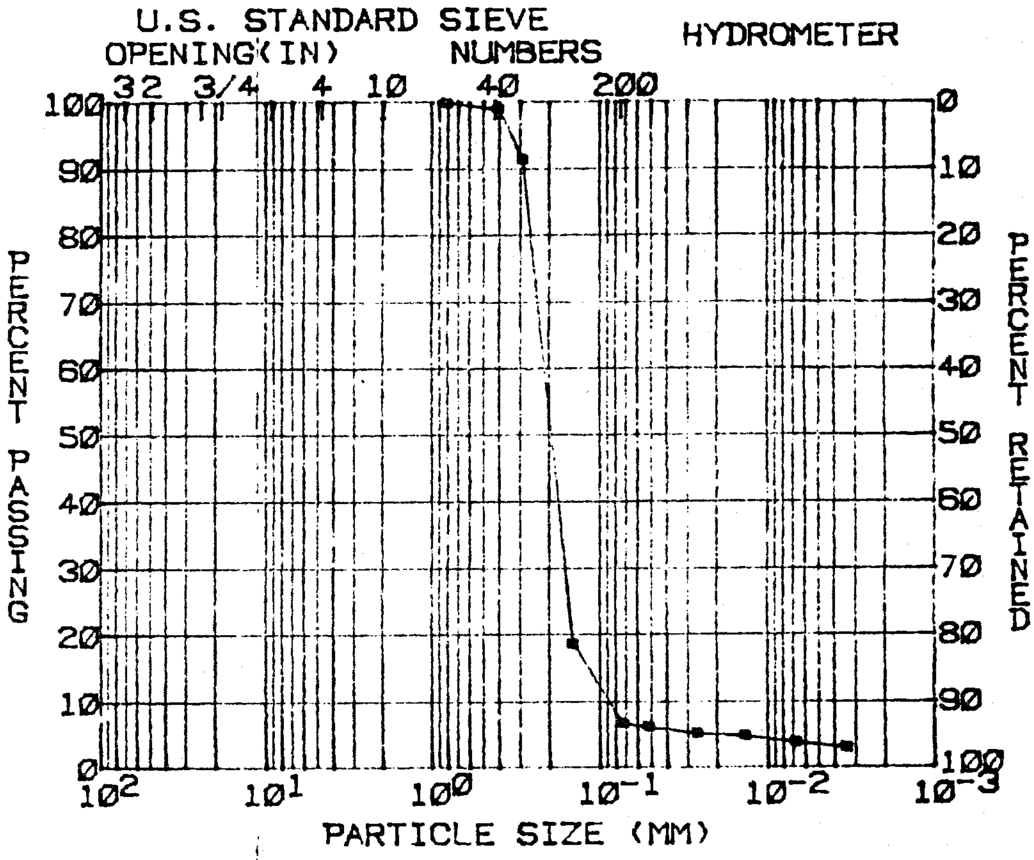
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:2075.14W
RANGE :1580.85N

BORING:US-1
EL. :347.6-345.7
SAMPLE:4
DATE :4-6-83



GRAVEL(%) = 0
SAND(%) = 93
SILT(%) = 3
CLAY(%) = 4

D10(MM) = 0.0894
D30(MM) = 0.1666
D60(MM) = 0.2216
COEF UNIF= 2.5

SOIL SYMBOL= SP-SM
MOISTURE(%)= 31.1
SP. GR. = 2.62

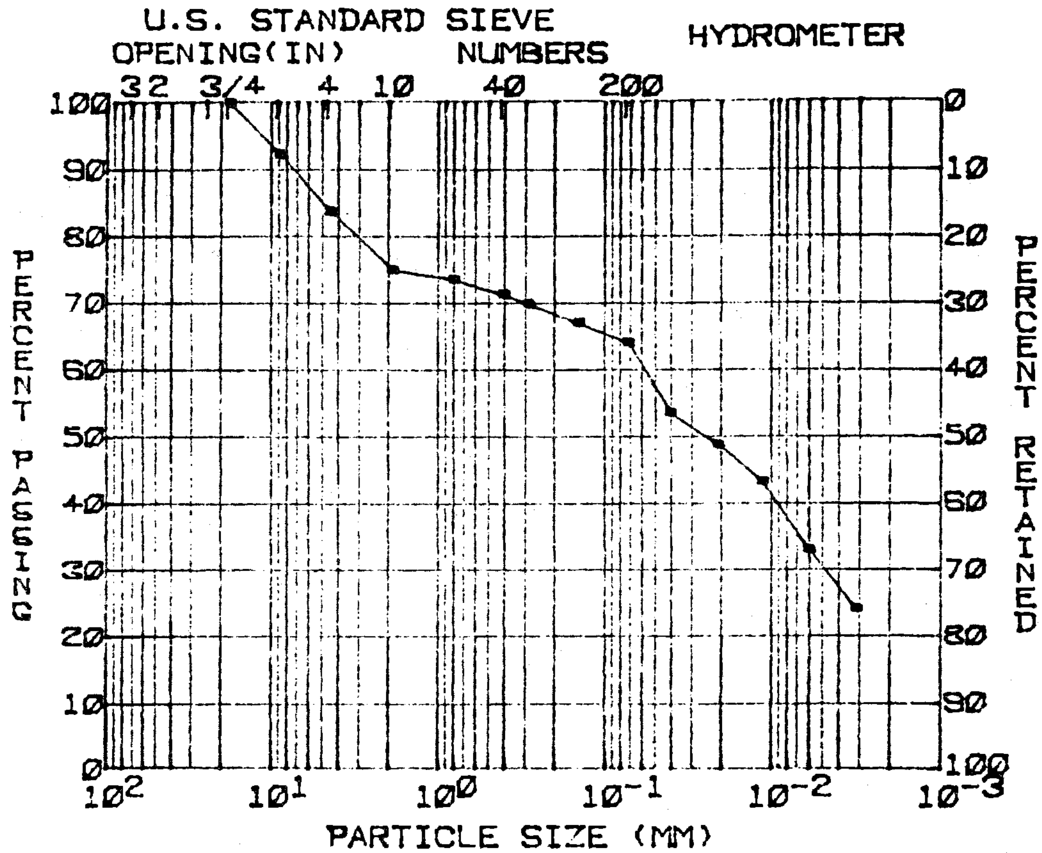
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:1914.2 W
RANGE :1476.5 N

BORING:US-3
EL. :395.5-393.3
SAMPLE:1
DATE :4-6-83



GRAVEL(%)= 16
SAND(%) = 20
SILT(%) = 34
CLAY(%) = 30

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= 13.2
SP. GR. = 2.71

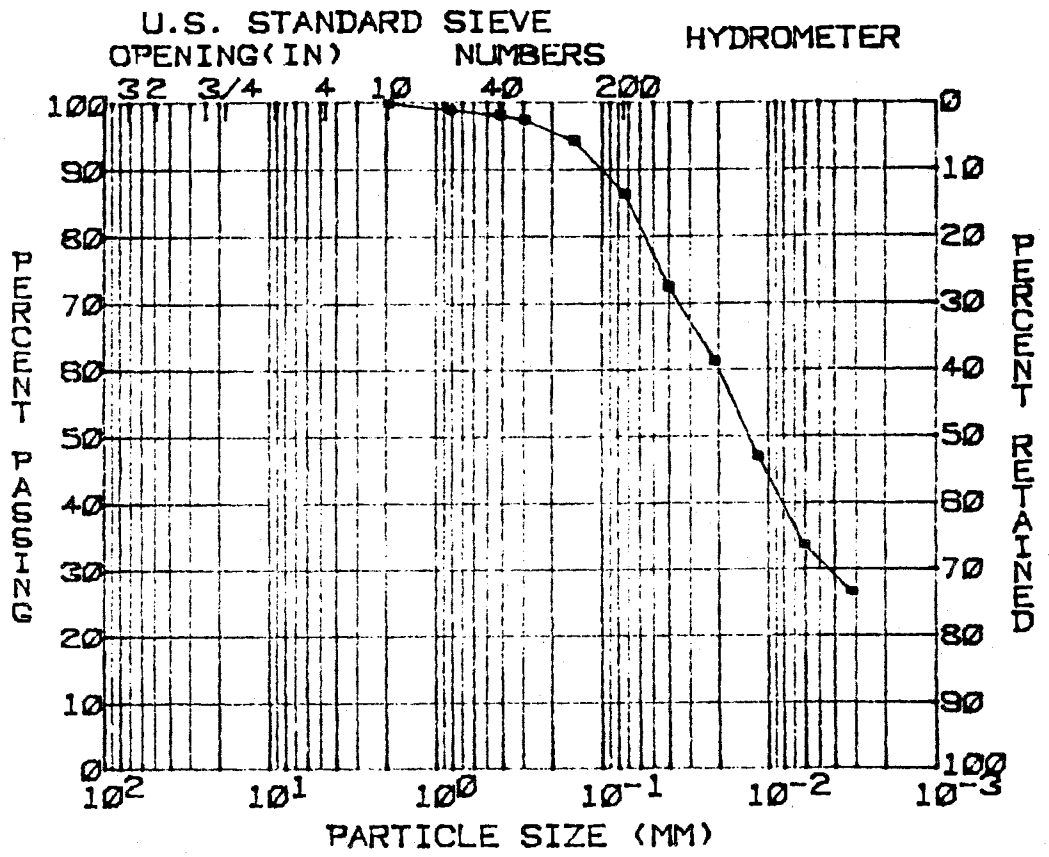
L.L.(%) = 37
P.I.(%) = 18

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:1914.2 W
RANGE :1476.5 N

BORING:US-3
EL. :388.5-386.4
SAMPLE:2
DATE :4-6-83



GRAVEL(%)= 0
SAND(%) = 13
SILT(%) = 55
CLAY(%) = 32

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= 20.6
SP. GR. = 2.70

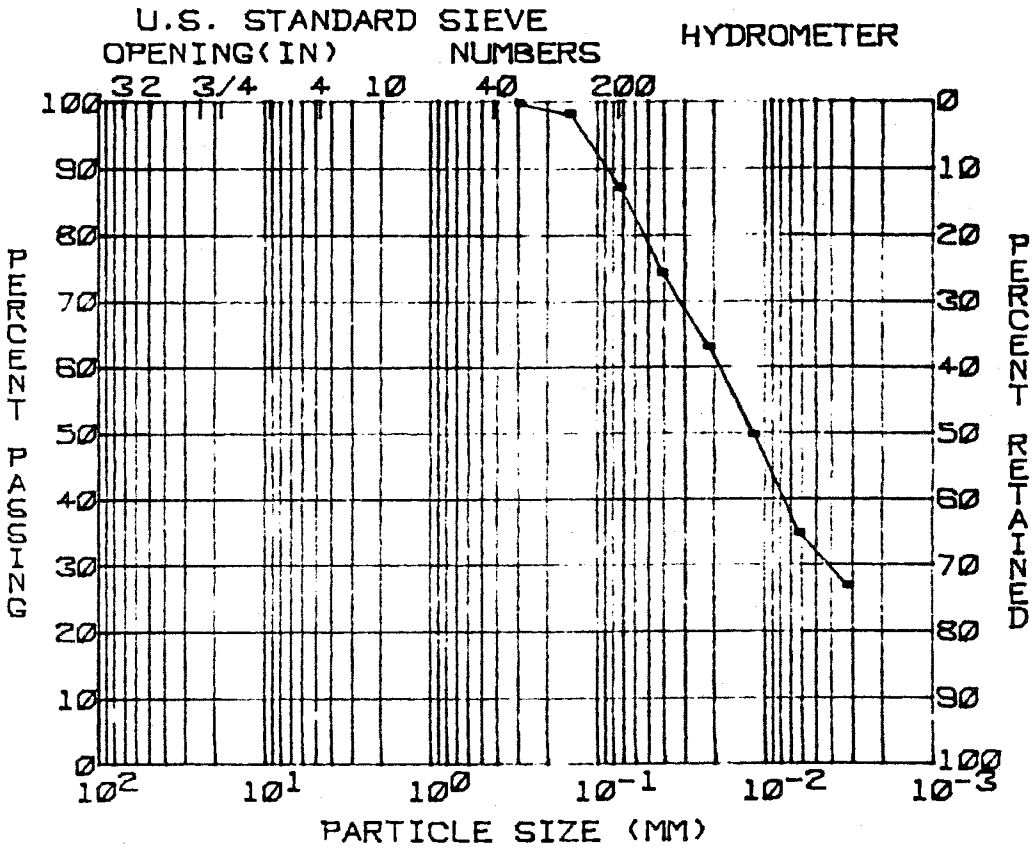
L.L.(%) = 31
P.I.(%) = 12

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL.
STATION:1914.2 W
RANGE :1476.5 N

BORING:US-3
EL. :378.5-376.2
SAMPLE:3
DATE :4-8-83



GRAVEL(%)= 0
SAND(%) = 12
SILT(%) = 55
CLAY(%) = 33

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= 26.7
SP. GR. = 2.65

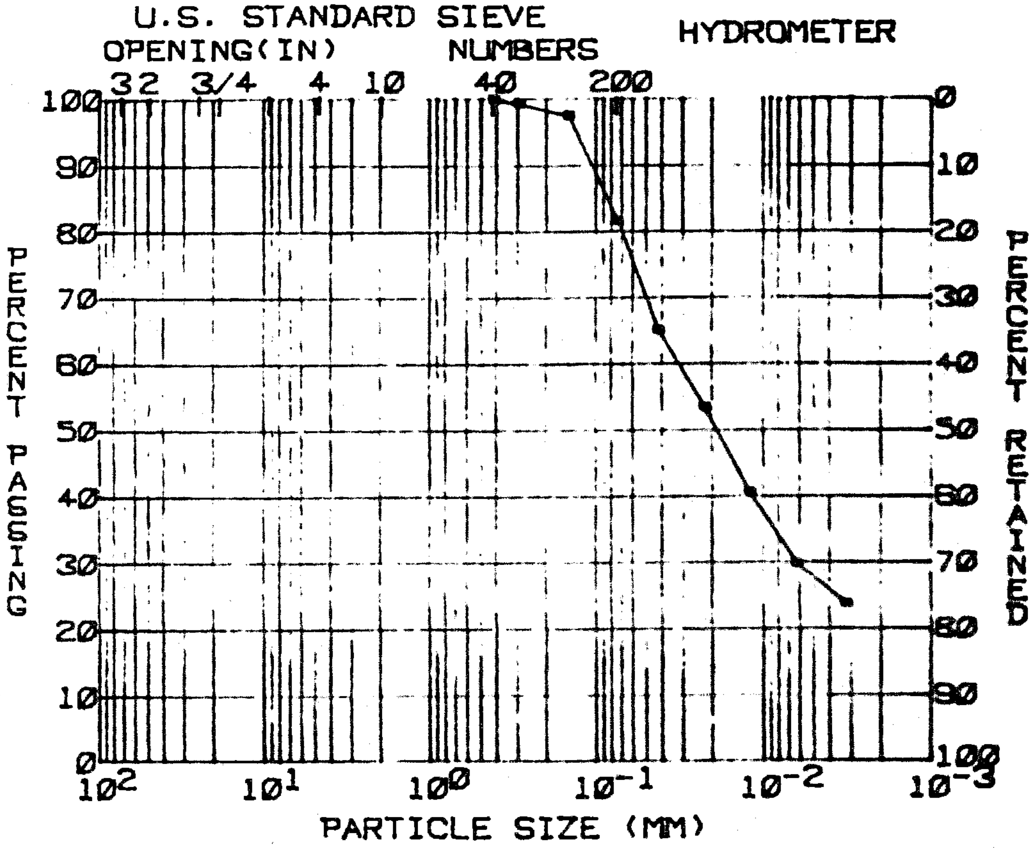
L.L.(%) = 33
P.I.(%) = 14

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:1914.2 W
RANGE :1476.5 N

BORING:US-3
EL. :368.5-366.1
SAMPLE:4
DATE :4-8-83



GRAVEL(%)= 0
SAND(%) = 18
SILT(%) = 54
CLAY(%) = 28

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= 24.8
SP. GR. = 2.69

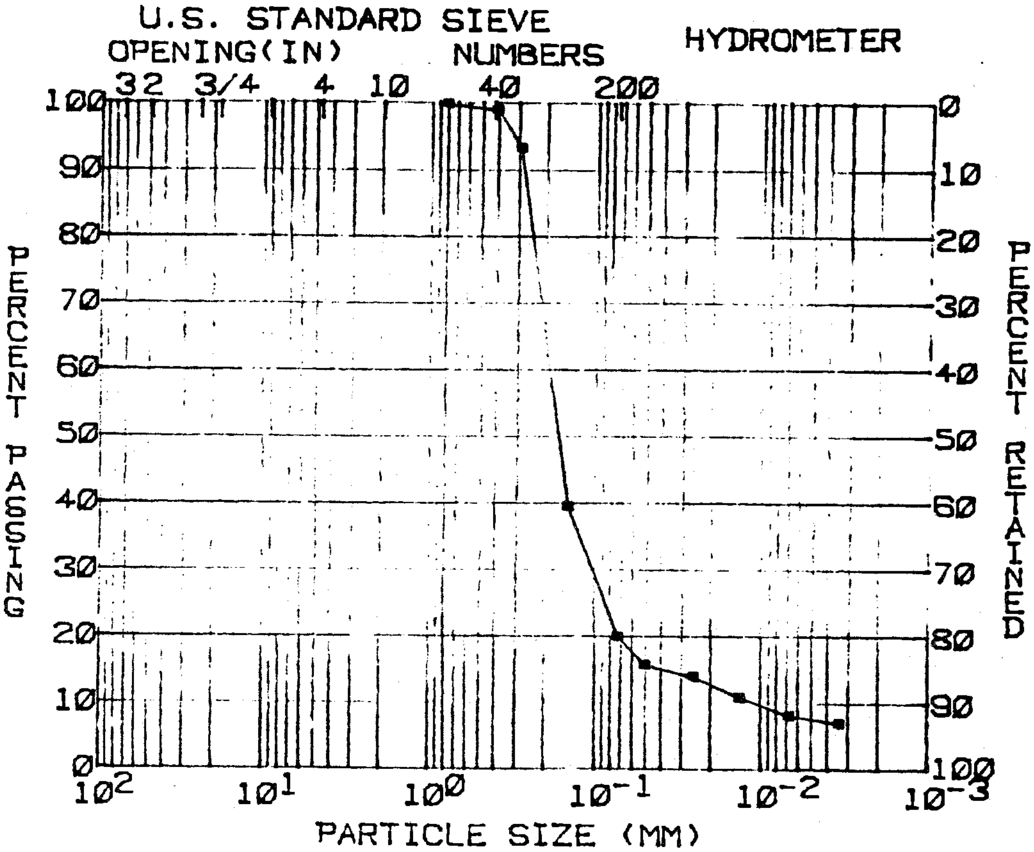
L.L.(%) = 30
P.I.(%) = 12

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION: 1914.2 W
RANGE : 1476.5 N

BORING: US-3
EL. : 358.5-358.9
SAMPLE: 5
DATE : 4-8-83



GRAVEL(%) = 0
SAND(%) = 80
SILT(%) = 13
CLAY(%) = 7

D10(MM) = 0.0103
D30(MM) = 0.1057
D60(MM) = 0.1944
COEF UNIF=18.8

SOIL SYMBOL= SM
MOISTURE(%)= 22.9
SP. GR. = 2.66

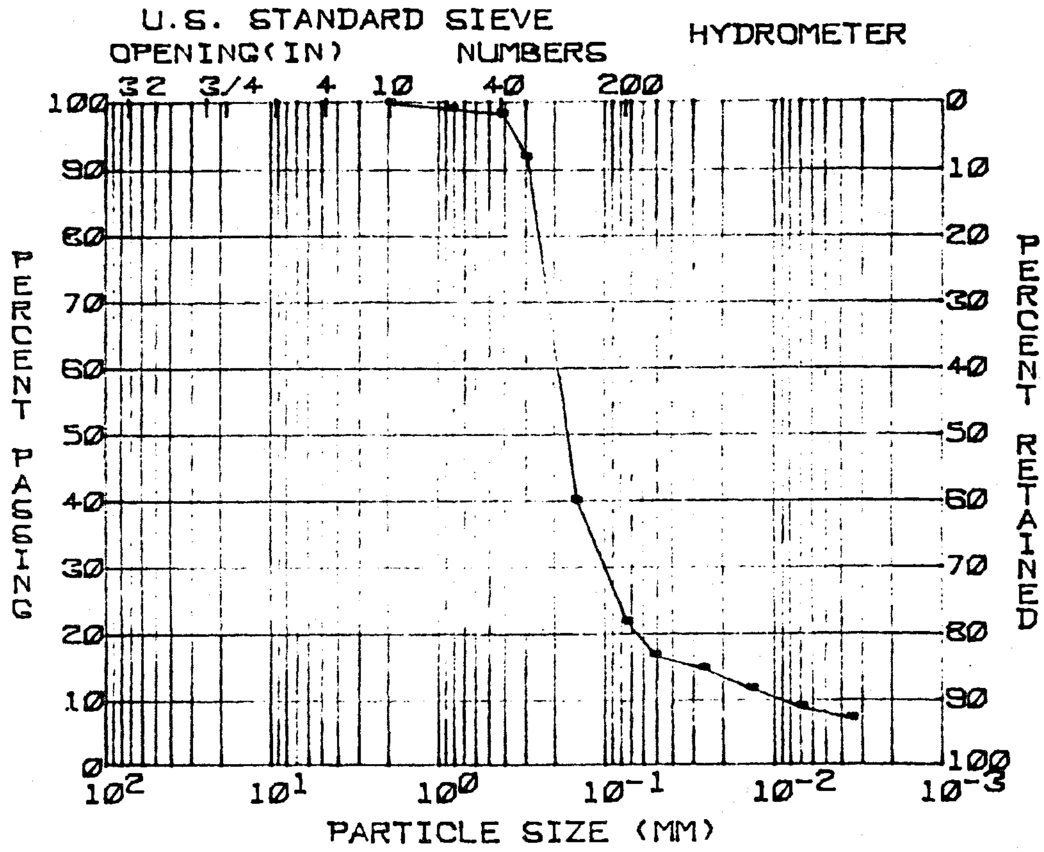
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:1914.2 W
RANGE :1476.5 N

BORING:US-3
EL. :353.5-351.1
SAMPLE:8
DATE :4-8-83



GRAVEL(%)= 0
SAND(%) = 78
SILT(%) = 14
CLAY(%) = 8

D10(MM) = 0.0084
D30(MM) = 0.1004
D60(MM) = 0.1943
COEF UNIF=23.2

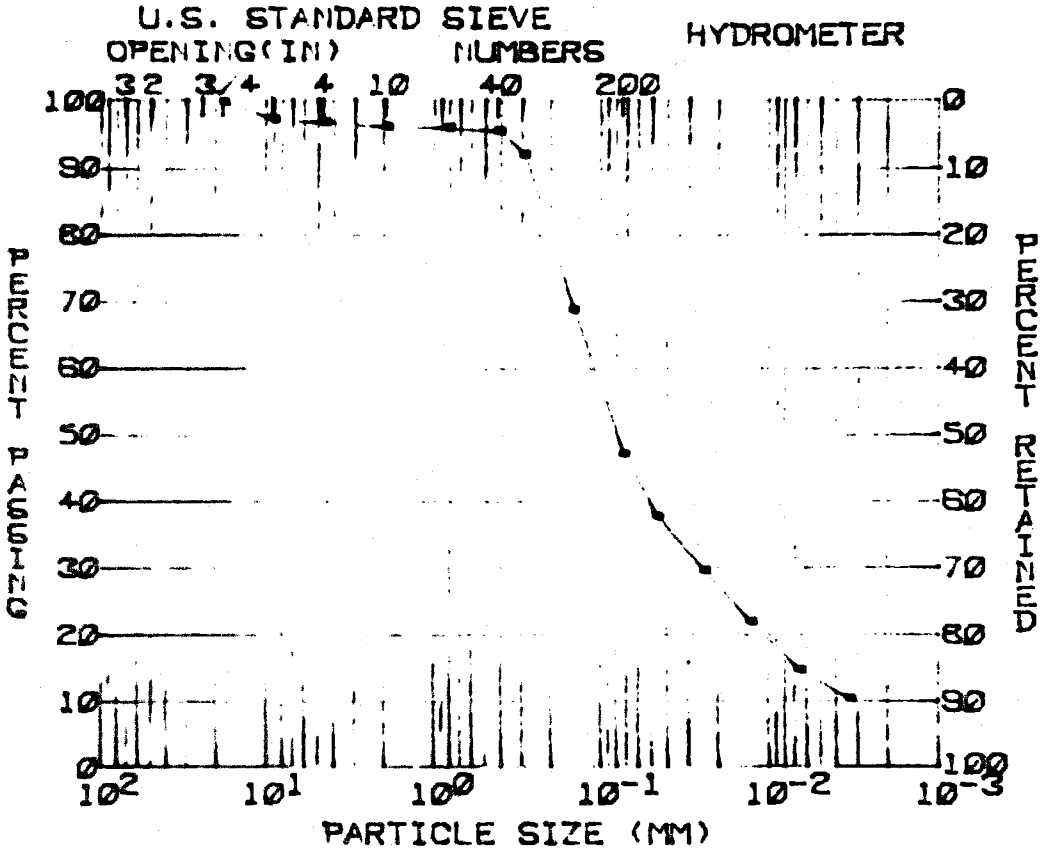
SOIL SYMBOL= SM
MOISTURE(%)= 25.1
SP. GR. = 2.63

L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P. BORING: US-3
FEATURE: COAL RCVG FACIL EL. : 338.5-338.8
STATION: 1814.2 W SAMPLE: 7
RANGE : 1478.5 N DATE : 4-8-83



GRAVEL(%) = 2
SAND(%) = 50
SILT(%) = 34
CLAY(%) = 14

D10(MM) = 0.0031
D30(MM) = 0.0240
D60(MM) = 0.1117
COEF UNIF=36.4

SOIL SYMBOL= SM
MOISTURE(%)= 20.7
SP. GR. = 2.69

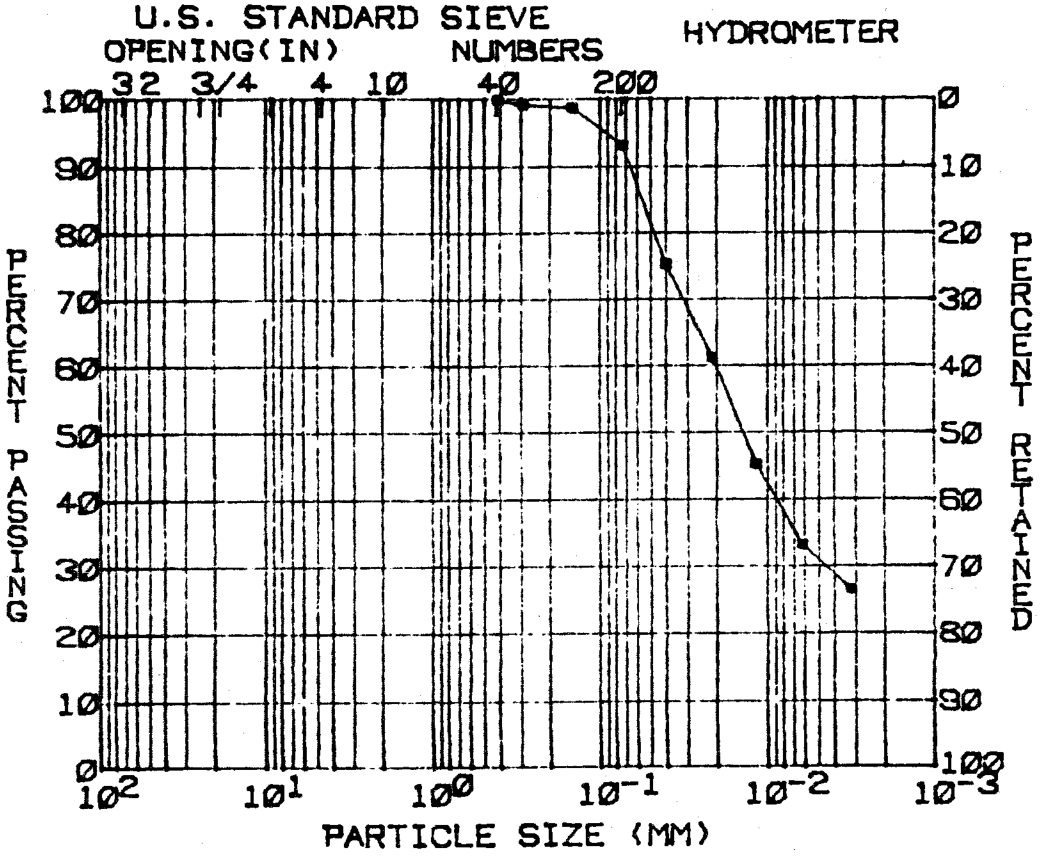
L.L.(%) = NP
P.I.(%) = NP

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARARDISE S.P.
FEATURE:COAL RCVG FACIL
STATION:1519.9 W
RANGE :1390.4 N

BORING:US-8
EL 382.2:380.3
SAMPLE:1
DATE :4-4-83



GRAVEL(%) = 0
SAND(%) = 6
SILT(%) = 62
CLAY(%) = 32

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= 21.8
SP. GR. = 2.68

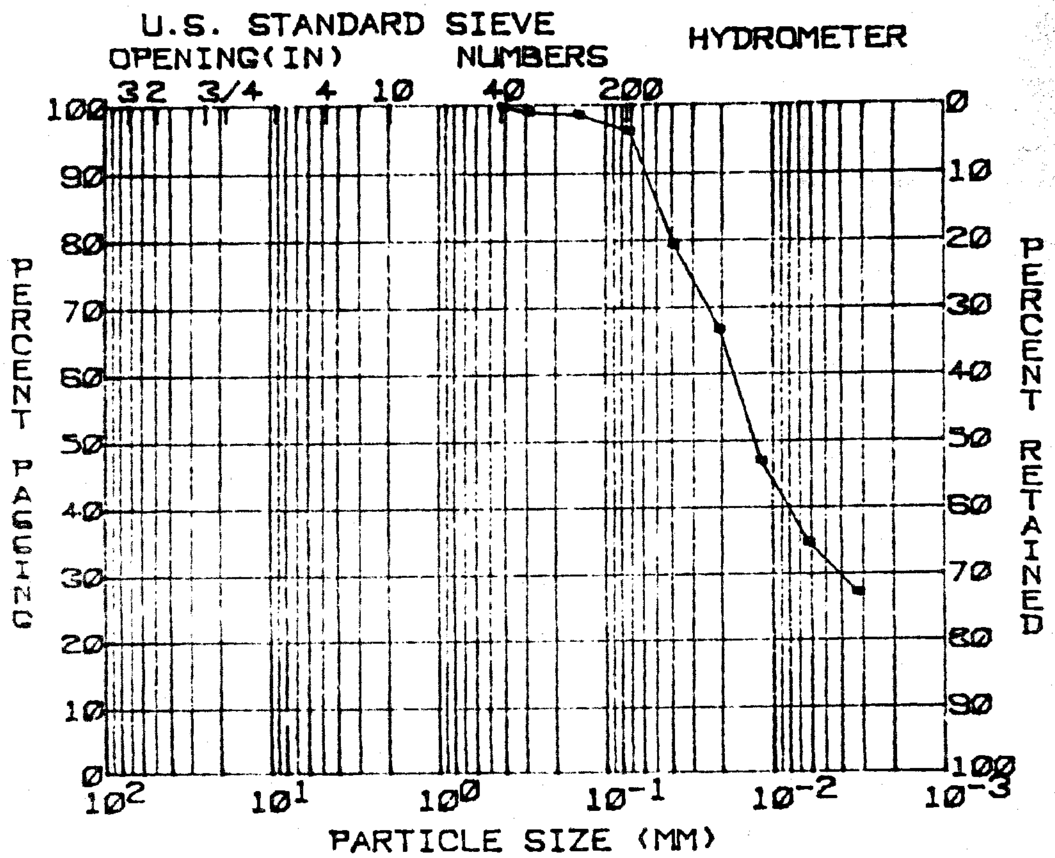
L.L.(%) = 33
P.I.(%) = 13

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:1519.9 W
RANGE :1390.4 N

BORING:US-8
EL377.2:376.4
SAMPLE:2
DATE :4-5-83



GRAVEL(%)= 0
SAND(%) = 3
SILT(%) = 64
CLAY(%) = 33

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= 24.9
SP. GR. = 2.69

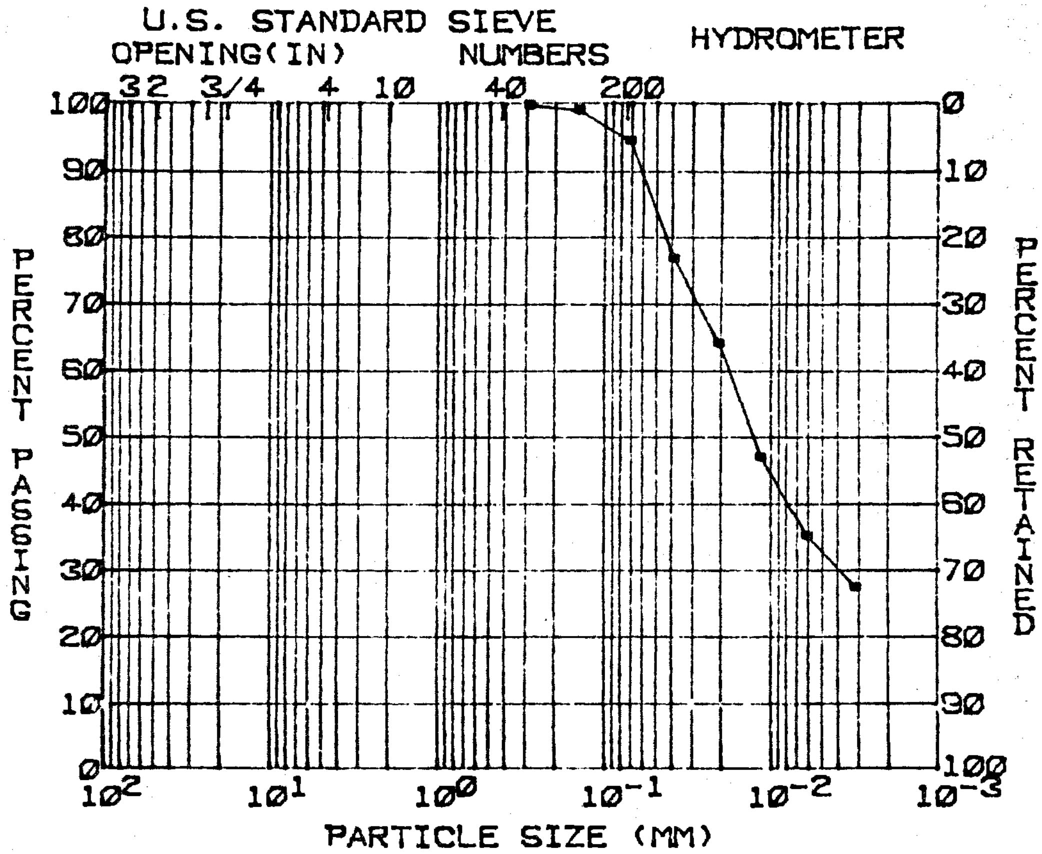
L.L.(%) = 35
P.I.(%) = 15

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION: 1519.9 W
RANGE : 1390.4 N

BORING: US-8
EL 374.2:371.7
SAMPLE: 3
DATE : 4-4-83



GRAVEL(%) = 0
SAND(%) = 5
SILT(%) = 62
CLAY(%) = 33

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF = --

SOIL SYMBOL = CL
MOISTURE(%) = 25.8
SP. GR. = 2.68

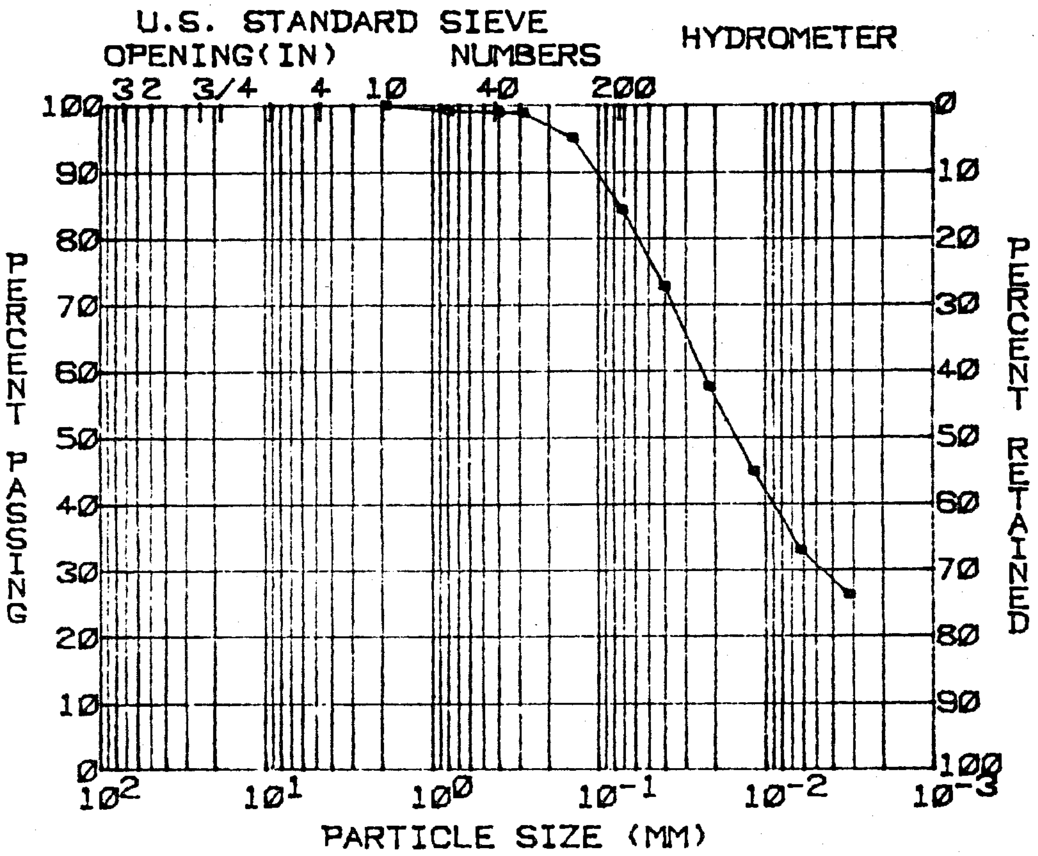
L.L.(%) = 34
P.I.(%) = 15

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:1519.9 W
RANGE :1390.4

BORING:US-8
EL 367.2:364.6
SAMPLE:4
DATE :4-4-83



GRAVEL(%)= 0
SAND(%) = 15
SILT(%) = 54
CLAY(%) = 31

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF= --

SOIL SYMBOL= CL
MOISTURE(%)= 24.6
SP. GR. = 2.69

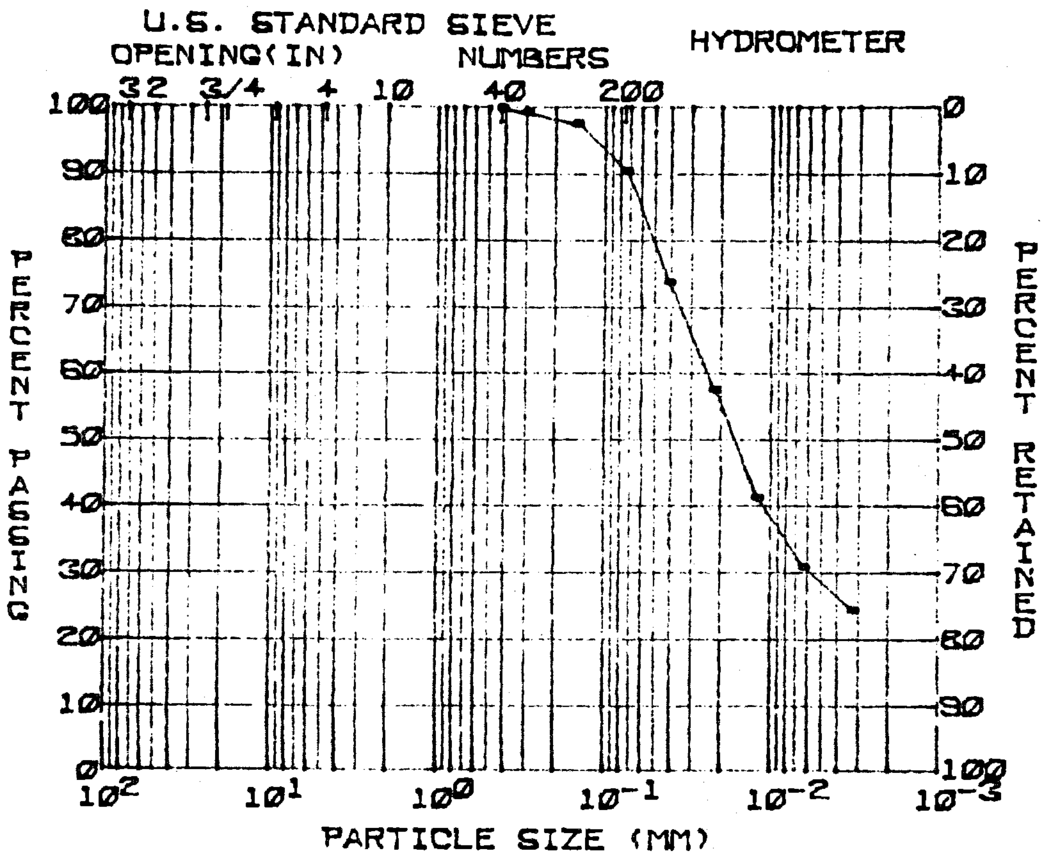
L.L.(%) = 30
P.I.(%) = 13

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION: 1519.9 W
RANGE : 1390.4 N

BORING: US-6
EL. : 382.2-359.6
SAMPLE: 5
DATE : 4-6-83



GRAVEL(%) = 0
SAND(%) = 9
SILT(%) = 62
CLAY(%) = 29

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF = --

SOIL SYMBOL = CL
MOISTURE(%) = 28.0
SP. GR. = 2.68

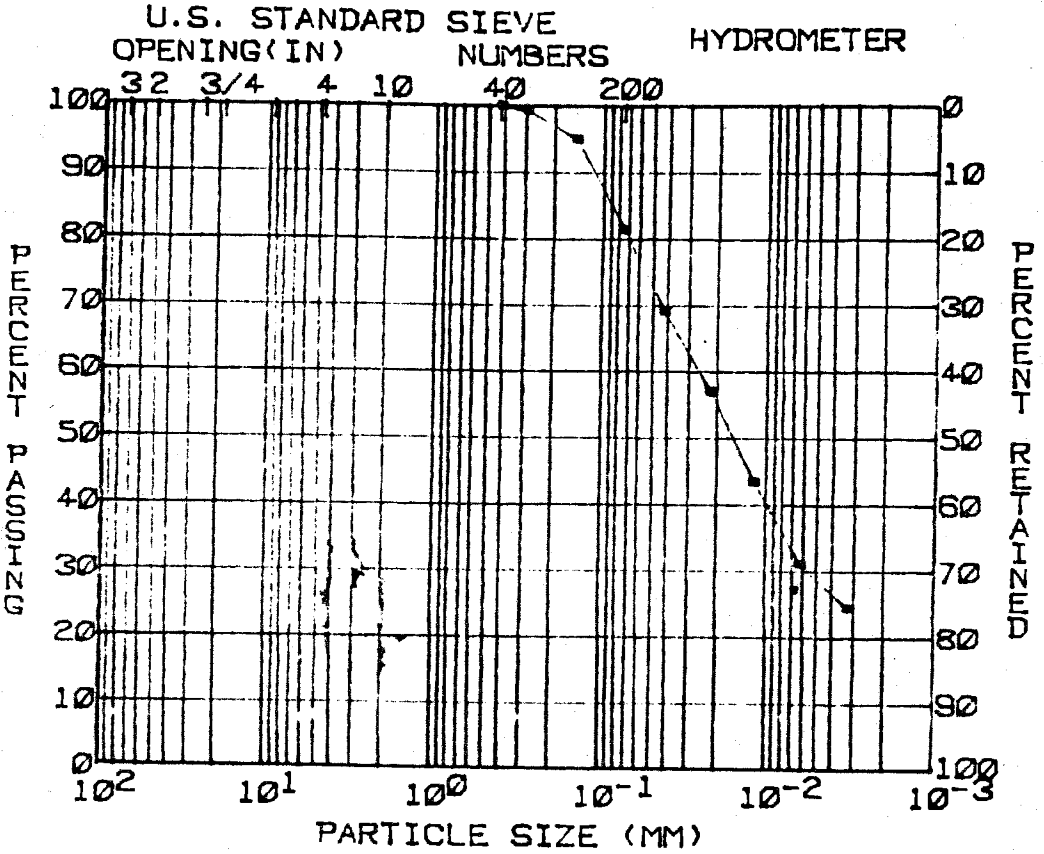
L.L.(%) = 30
P.I.(%) = 11

REMARKS:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
PARTICLE SIZE ANALYSIS

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION: 1519.9 W
RANGE : 1390.4 N

BORING: US-8
EL. : 352.2-350.8
SAMPLE: 6
DATE : 4-8-83



GRAVEL(%) = 0
SAND(%) = 18
SILT(%) = 53
CLAY(%) = 29

D10(MM) = --
D30(MM) = --
D60(MM) = --
COEF UNIF = --

SOIL SYMBOL = CL
MOISTURE(%) = 22.7
SP. GR. = 2.68

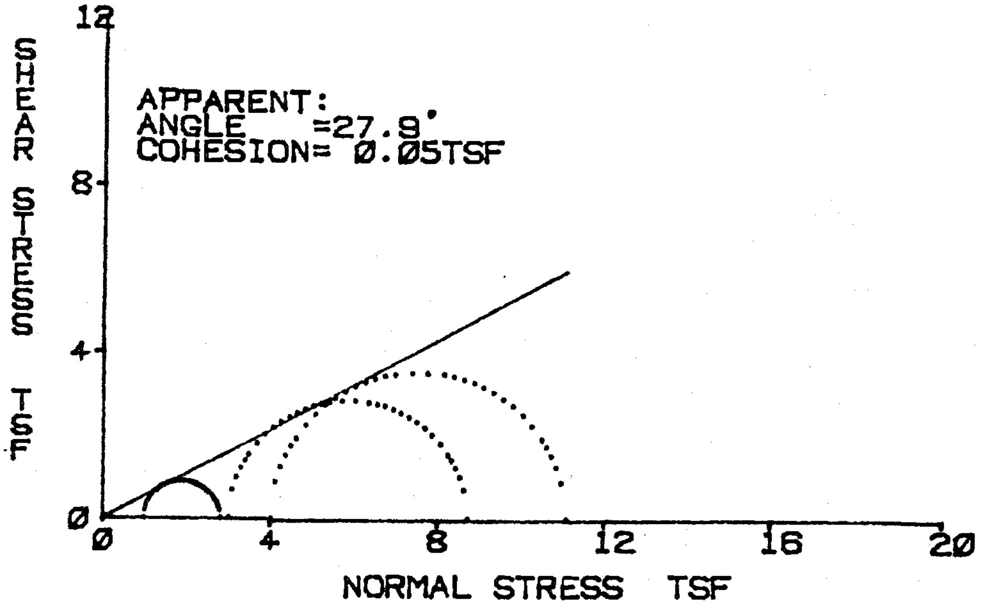
L.L.(%) = 30
P.I.(%) = 12

REMARKS:

Engineering Tests

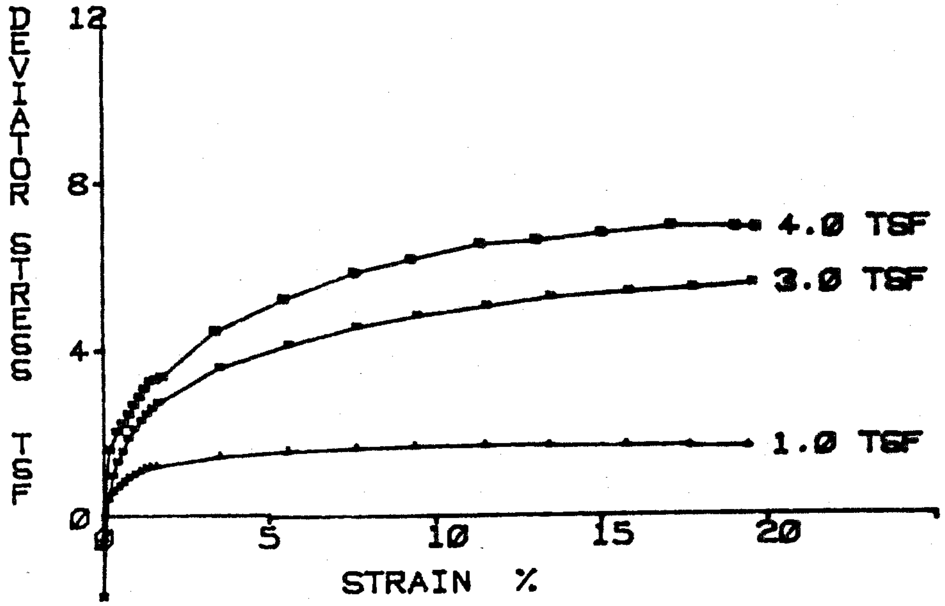
TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION(R) TEST

PROJECT:PARADISE S.P. EL. :372.1-371.6
FEATURE:COAL RCVG FACIL SAMPLE :1
STATION:2075.14 W PART :2
RANGE :1580.85 N SOIL SYM:ML
BORING :US-1 DATE :4-15-83



TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION(R) TEST

PROJECT:PARADISE S.P. EL. :372.1-371.6
FEATURE:COAL RCVG FACIL SAMPLE :1
STATION:2075.14 W PART :2
RANGE :1580.85 N SOIL SYM:ML
BORING :US-1 DATE :4-15-83



Tennessee Valley Authority
Singleton Materials Engineering Laboratory
Consolidated Undrained Triaxial Compression (R) Test

Project: PARADISE S.P.		
Feature: COAL RECEIVING FACIL		Tested By : TAL
Station: 2075.14 W	El. : 372.1-371.6	Computed By: MHD
Range : 1580.85 N	Sample: 1	Checked By : [handwritten initials]
Boring : US-1	Part : 2	Report Date: 4-15-83

Soil Sytmbol= ML	L.L.(%)= 21	P.I.(%)= 3
Sp. Gr. = 2.66	D10(mm)= 0	

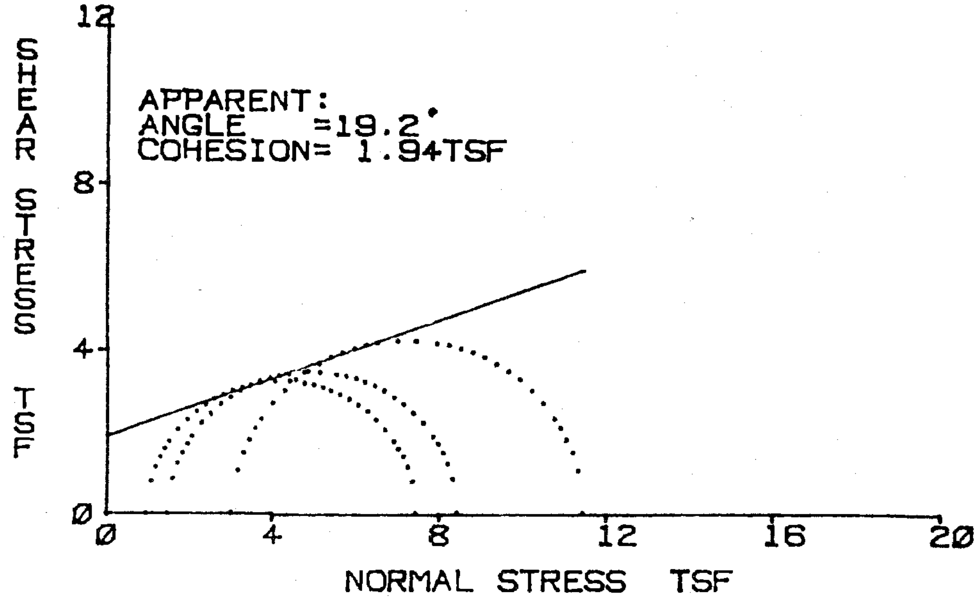
Specimen Number	1	2	3	4
Initial:				
Moisture Content(%)	22.8	22.7	22.7	0.0
Dry Density(pcf)	98.5	99.1	99.1	0.0
Void Ratio	0.686	0.675	0.676	0.000
Saturation(%)	88.6	89.4	89.3	0.0
Before Shearing:				
Moisture(%) (after satur.)	--	--	--	--
Saturation(%)	--	--	--	--
Moisture(%) (after cons.)	--	--	--	--
Void Ratio (after cons.)	--	--	--	--
Final Moisture Content(%)	21.8	19.3	18.8	0.0
Minor Principal Stress(tsf)	1.01	3.02	4.03	0.00
Major Principal Stress(tsf)	2.87	8.74	11.12	0.00
Eff. Minor Prin. Stress(tsf)	--	--	--	--
Eff. Major Prin. Stress(tsf)	--	--	--	--
Time to Failure(min.)	80	100	90	0
Rate of Strain(%/min.)	0.20	0.20	0.19	0.00
Specimen Height(in.)	3.14	3.14	3.14	3.14
Specimen Diameter(in.)	1.40	1.40	1.40	1.40

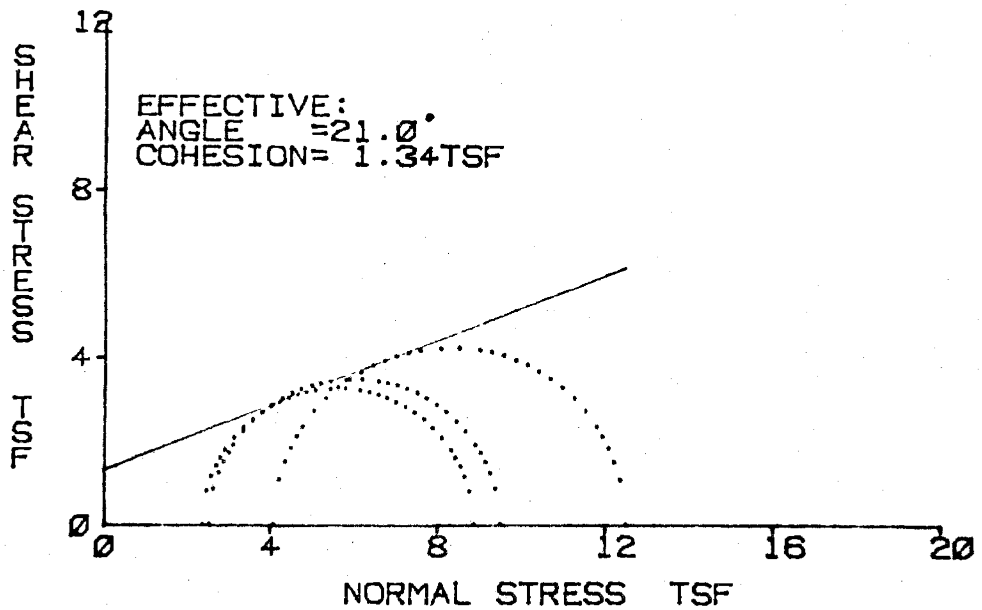
Shear Strength	Deg.	c(tsf)
Apparent	27.9	0.05
Effective	--	--

Remarks:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (R) TEST

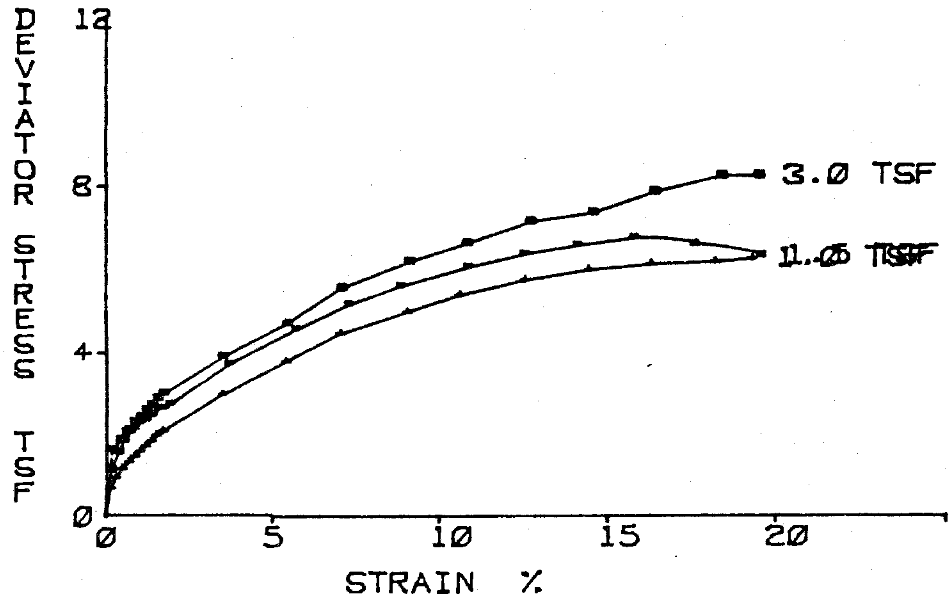
PROJECT	:PARADISE S.P.	EL.	:351.1-350.7
FEATURE	:COAL RCVG FACIL	SAMPLE	:3
STATION	:2075.14 W	PART	:5
RANGE	:1580.85 N	SOIL SYM	:SM
BORING	:US-1	DATE	:4-21-83

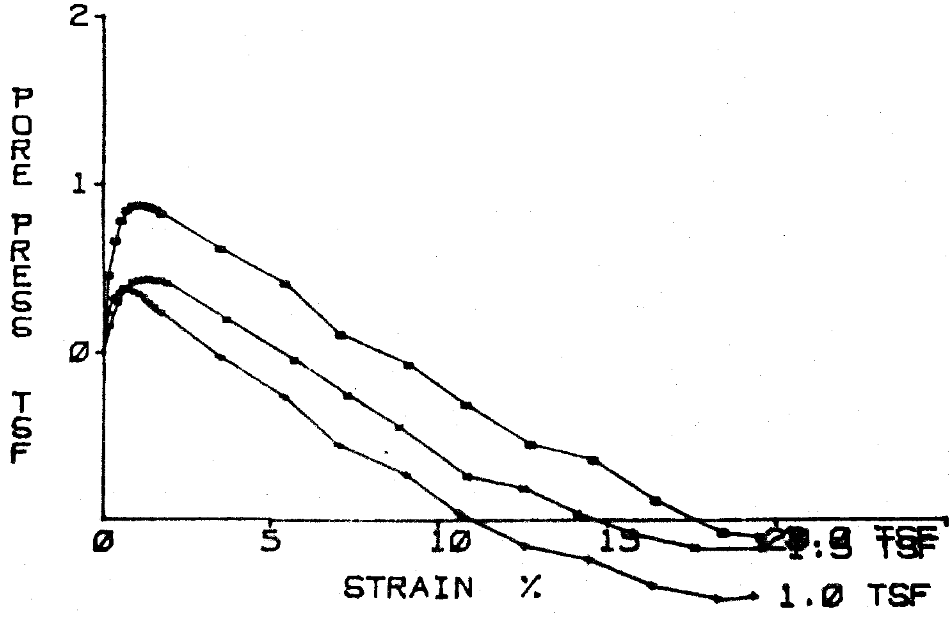




TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (R) TEST

PROJECT	:PARADISE S.P.	EL.	:351.1-35Ø.7
FEATURE	:COAL RCVG FACIL	SAMPLE	:3
STATION	:2Ø75.14 W	PART	:5
RANGE	:158Ø.85 N	SOIL SYM	:SM
BORING	:US-1	DATE	:4-21-83





Tennessee Valley Authority
Singleton Materials Engineering Laboratory
Consolidated Undrained Triaxial Compression (R) Test

Project: PARADISE S.P.
Feature: COAL RECEIVING FACIL

Station: 2075.14 W	El. : 351.1-350.7	Tested By : TAL
Range : 1560.65 N	Sample: 3	Computed By: MHD
Boring : US-1	Part : 5	Checked By : CCE
		Report Date: 4-21-85

Soil Symbol= SM	L.L.(%)= 0	P.I.(%)= 0
Sp. Gr. = 2.63	D10(mm)= 0	

Specimen Number	1	2	3	4
Initial:				
Moisture Content(%)	27.4	27.3	27.6	0.0
Dry Density(pcf)	92.7	92.7	92.3	0.0
Void Ratio	0.771	0.771	0.778	0.000
Saturation(%)	93.4	93.1	93.2	0.0
Before Shearing:				
Moisture(%) (after satur.)	29.3	29.3	29.6	0.0
Saturation(%)	100.0	100.0	100.0	0.0
Moisture(%) (after cons.)	28.7	28.0	27.7	27.7
Void Ratio (after cons.)	0.734	0.736	0.730	0.000
Final Moisture Content(%)	26.0	26.1	26.9	0.0
Minor Principal Stress(tsf)	1.01	1.51	3.02	0.00
Major Principal Stress(tsf)	7.48	8.44	11.46	0.00
Eff. Minor Prin. Stress(tsf)	2.42	2.57	4.09	0.00
Eff. Major Prin. Stress(tsf)	8.89	9.50	12.53	0.00
Time to Failure(min.)	106	90	106	0
Rate of Strain(%/min.)	0.19	0.18	0.19	0.00
Specimen Height(in.)	3.14	3.14	3.14	3.14
Specimen Diameter(in.)	1.40	1.40	1.40	1.40

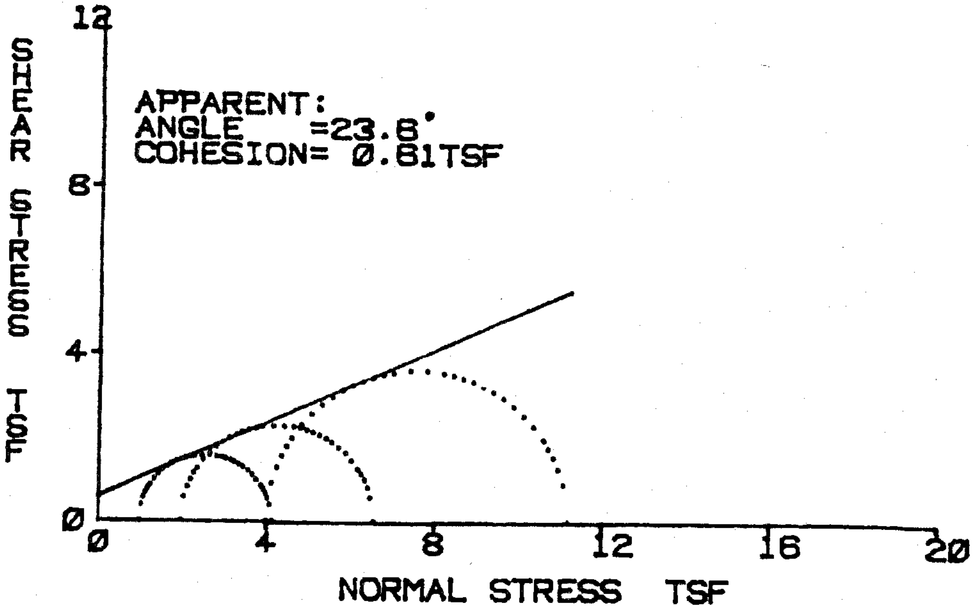
Shear Strength	Deg.	c(tsf)
Apparent	19.2	1.94
Effective	21.0	1.34

Remarks:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION(R) TEST

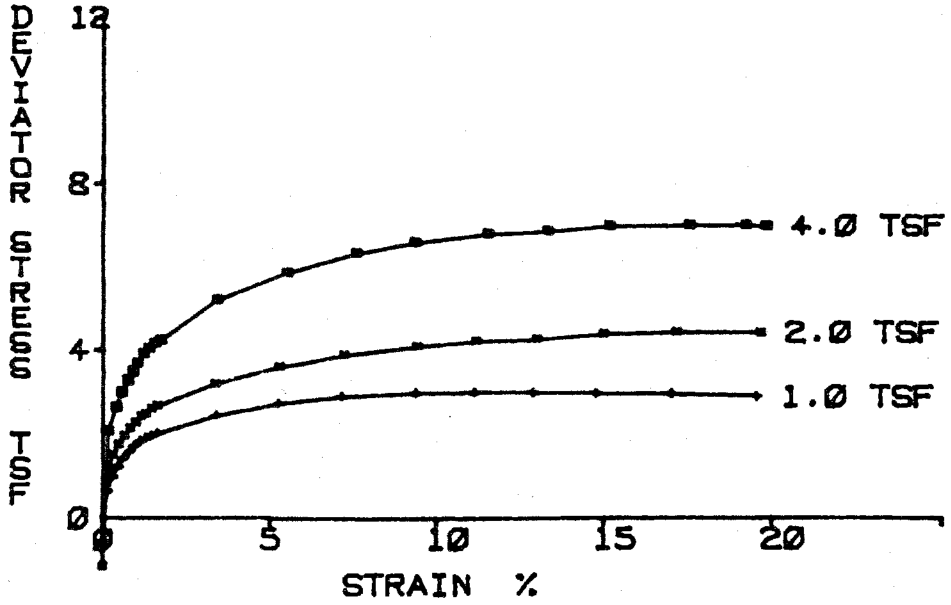
PROJECT:PARADISE S.P.
FEATURE:COAL RCVG FACIL
STATION:1914.2 W
RANGE :1476.5 N
BORING :US-3

EL. :387.9-387.4
SAMPLE :2
PART :2
SOIL SYM:CL
DATE :4-15-83



TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION(R) TEST

PROJECT:PARADISE S.P. EL. :387.9-387.4
FEATURE:COAL RCVG FACIL SAMPLE :2
STATION:1814.2 W PART :2
RANGE :1478.5 N SOIL SYM:CL
BORING :US-3 DATE :4-15-83



Tennessee Valley Authority
Singleton Materials Engineering Laboratory
Consolidated Undrained Triaxial Compression (R) Test

Project: PARADISE S.P.
Feature: COAL RECEIVING FACIL
Station: 1914.2 W
Range : 1476.5 N
Boring : US-3

El. : 387.9-387.4
Sample: 2
Part : 2

Tested By : TAL
Computed By: MHD
Checked By : OEG
Report Date: 4-15-83

Soil Symbol= CL
Sp. Gr. = 2.7

L.L.(%)= 31
D10(mm)= 0

P.I.(%)= 12

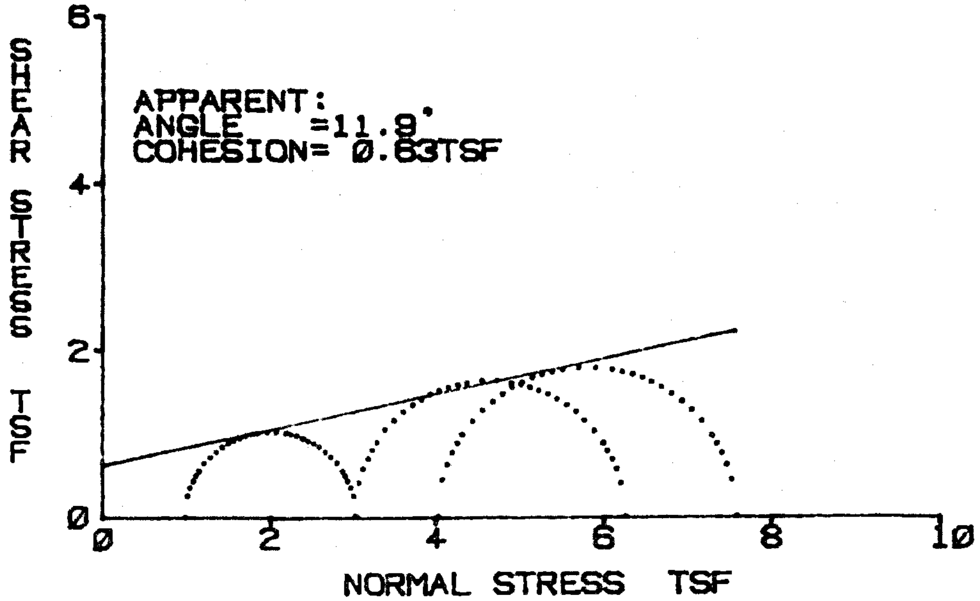
Specimen Number	1	2	3	4
Initial:				
Moisture Content(%)	20.4	20.4	20.5	0.0
Dry Density(pcf)	100.7	101.4	102.3	0.0
Void Ratio	0.674	0.662	0.646	0.000
Saturation(%)	81.7	83.2	85.6	0.0
Before Shearing:				
Moisture(%) (after satur.)	--	--	--	--
Saturation(%)	--	--	--	--
Moisture(%) (after cons.)	--	--	--	--
Void Ratio (after cons.)	--	--	--	--
Final Moisture Content(%)	21.1	19.9	19.6	0.0
Minor Principal Stress(tsf)	1.01	2.02	4.03	0.00
Major Principal Stress(tsf)	4.17	6.61	11.24	0.00
Eff. Minor Prin. Stress(tsf)	--	--	--	--
Eff. Major Prin. Stress(tsf)	--	--	--	--
Time to Failure(min.)	60	90	100	0
Rate of Strain(%/min.)	0.19	0.19	0.19	0.00
Specimen Height(in.)	3.14	3.14	3.14	3.14
Specimen Diameter(in.)	1.40	1.40	1.40	1.40

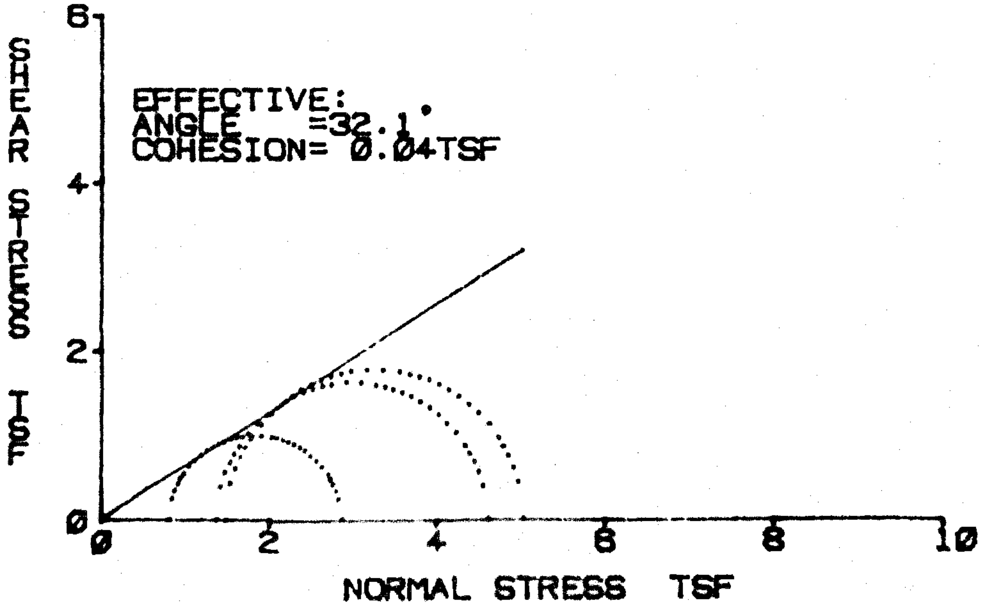
Shear Strength	Deg.	c(tsf)
Apparent	23.6	0.61
Effective	--	--

Remarks:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (R) TEST

PROJECT	:PARADISE S.P.	EL.	:388.2-387.7
FEATURE	:COAL RCVG FACIL	SAMPLE	:4
STATION	:1814.2 W	PART	:2
RANGE	:1478.5 N	SOIL SYM	:CL
BORING	:US-3	DATE	:4-14-83

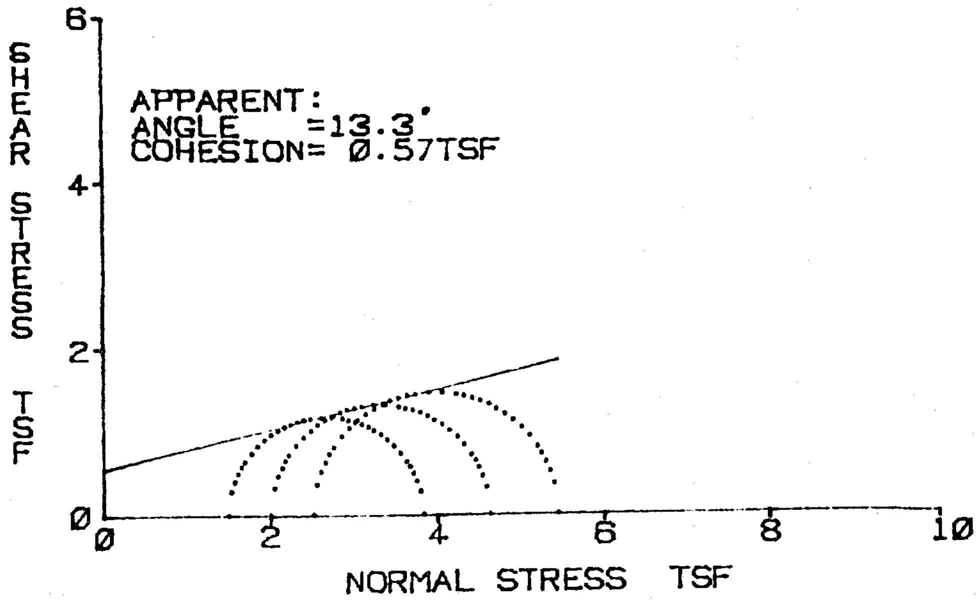


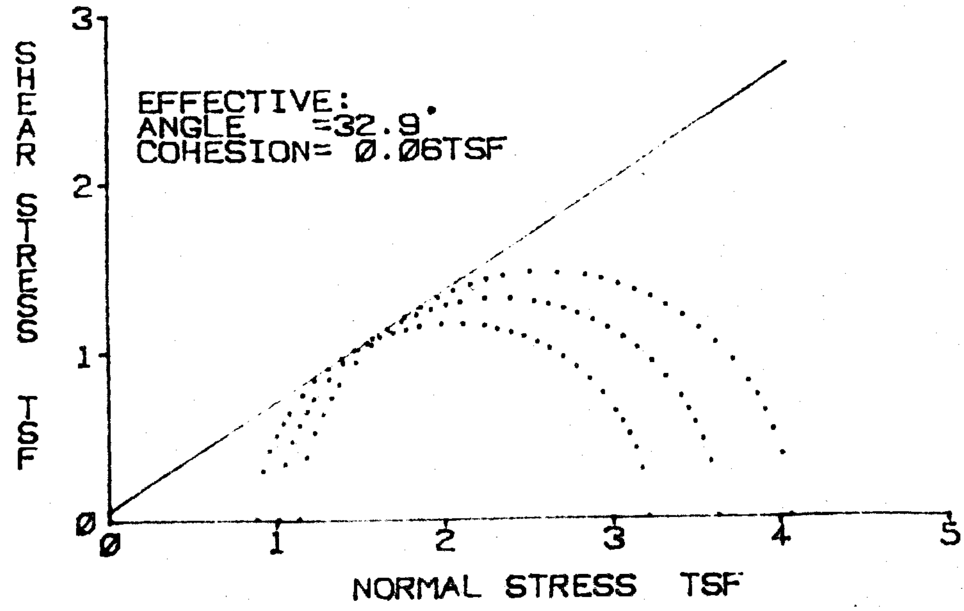


TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (R) TEST

PROJECT: PARADISE S.P.
FEATURE: COAL RCVG FACIL
STATION: 1519.9 W
RANGE: 1390.4
BORING: US-8

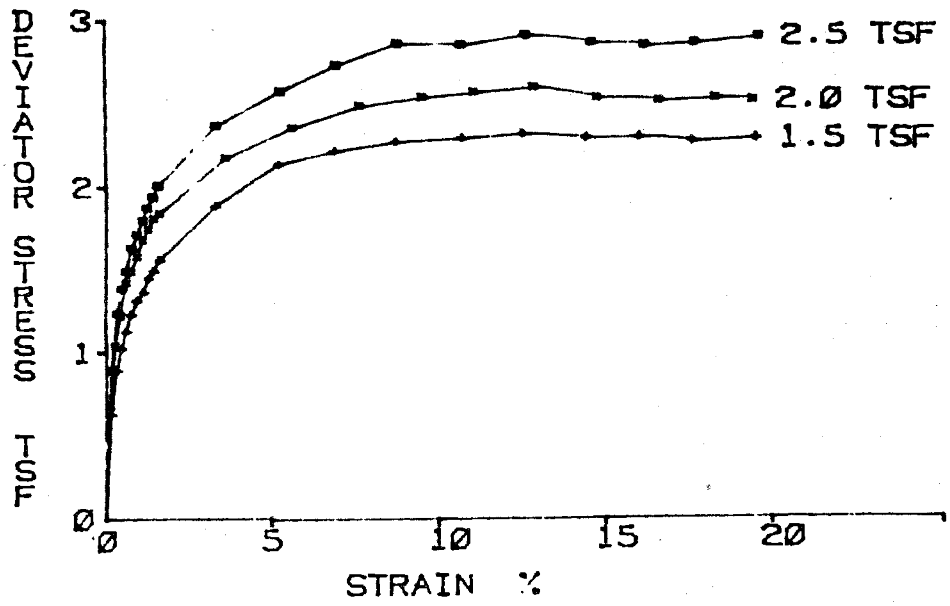
EL.: 388.8-388.3
SAMPLE: 4
PART: 2
SOIL SYM: CL
DATE: 4-22-83

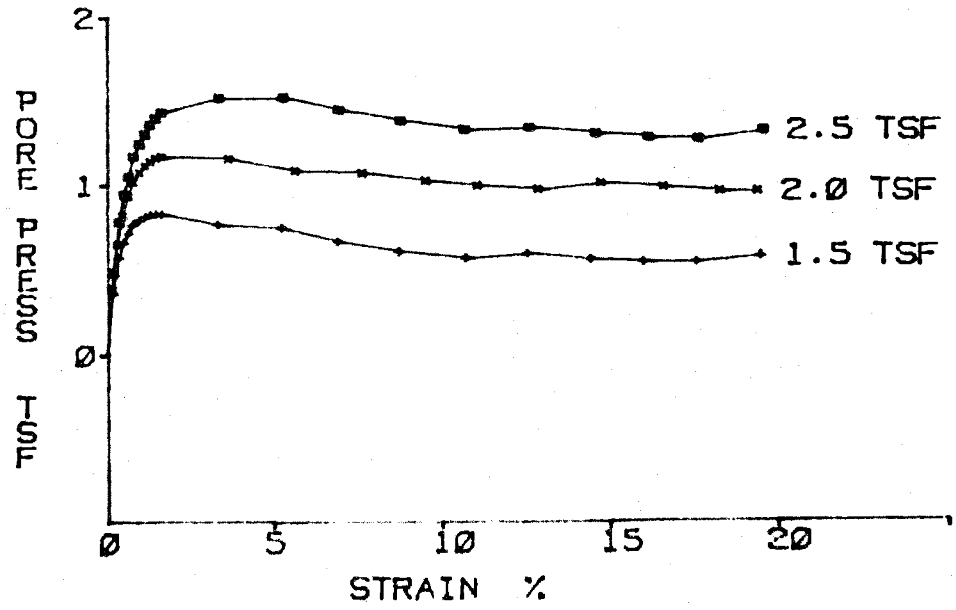




TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (R) TEST

PROJECT:PARADISE S.P. EL. :388.8-388.3
FEATURE:COAL RCVG FACIL SAMPLE :4
STATION:1519.9 W PART :2
RANGE :1390.4 SOIL SYM:CL
BORING :US-8 DATE :4-22-83





Tennessee Valley Authority
Singleton Materials Engineering Laboratory
Consolidated Undrained Triaxial Compression (R) Test

Project: PARADISE S.P.
Feature: COAL RECEIVING FACLI
Station: 1519.9 W
Range : 1390.4
Boring : US-8

El. : 366.8-366.3
Sample: 4
Part : 2

Tested By : GWD
Computed By: MHD
Checked By : CBlec
Report Date: 4-22-83

Soil Sybmool= CL
Sp. Gr. = 2.69

L.L.(%)= 30
D10(mm)= 0

P.I.(%)= 13

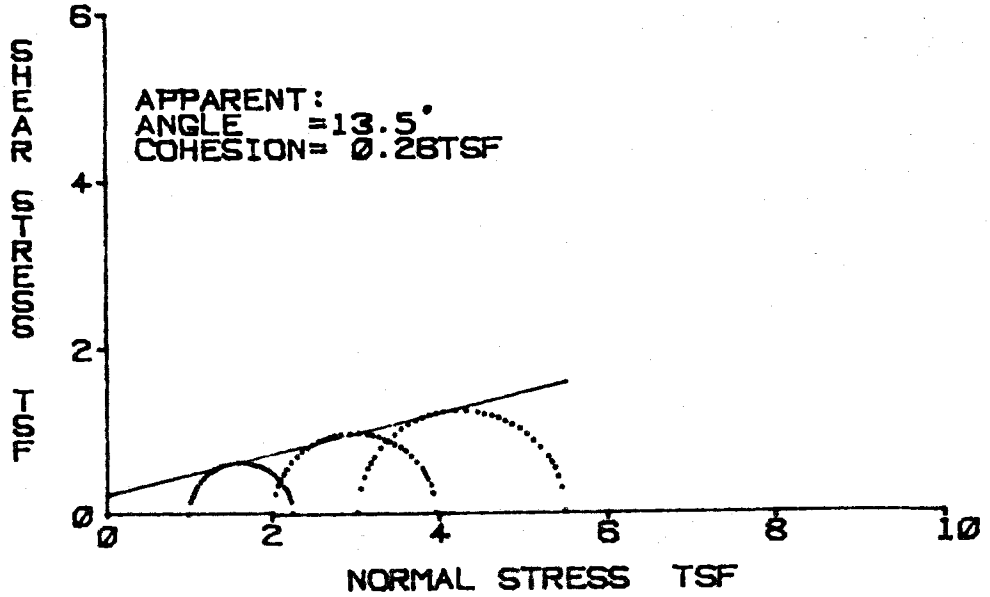
Specimen Number	1	2	3	4
Initial:				
Moisture Content(%)	26.0	26.5	26.1	0.0
Dry Density(pcf)	96.9	95.6	97.1	0.0
Void Ratio	0.732	0.756	0.729	0.000
Saturation(%)	95.6	94.2	96.1	0.0
Before Shearing:				
Moisture(%) (after satur.)	27.2	28.1	27.1	0.0
Saturation(%)	100.0	100.0	100.0	0.0
Moisture(%) (after cons.)	26.4	28.1	25.7	25.7
Void Ratio (after cons.)	0.709	0.756	0.690	0.000
Final Moisture Content(%)	24.7	24.7	23.8	0.0
Minor Principal Stress(tsf)	1.51	2.02	2.52	0.00
Major Principal Stress(tsf)	3.84	4.64	5.45	0.00
Eff. Minor Prin. Stress(tsf)	0.89	1.02	1.14	0.00
Eff. Major Prin. Stress(tsf)	3.23	3.64	4.08	0.00
Time to Failure(min.)	70	70	70	0
Rate of Strain(%/min.)	0.18	0.19	0.18	0.00
Specimen Height(in.)	3.14	3.14	3.14	3.14
Specimen Diameter(in.)	1.40	1.40	1.40	1.40

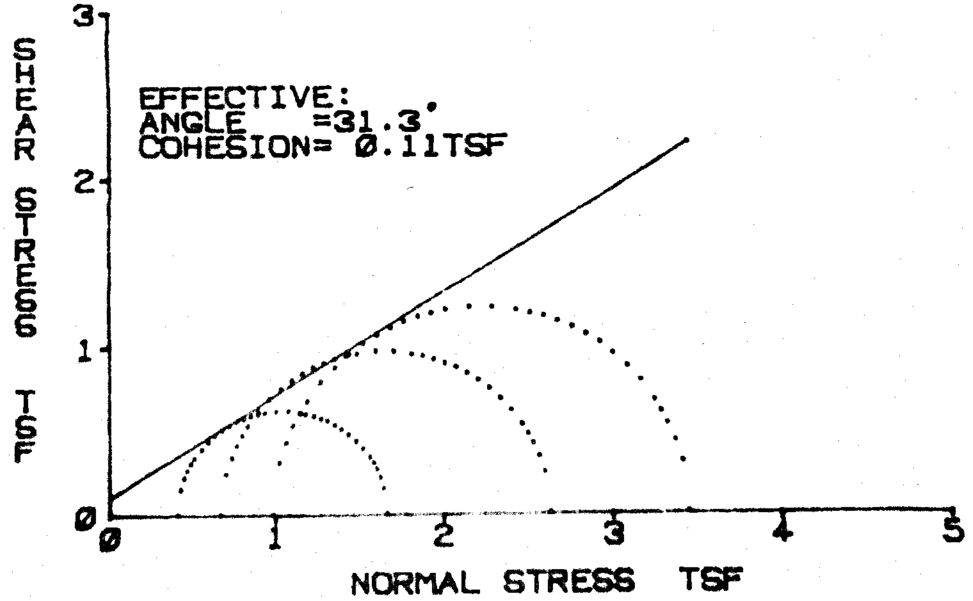
Shear Strength	Deg.	c(tsf)
Apparent	13.3	0.57
Effective	32.9	0.06

Remarks:

TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (R) TEST

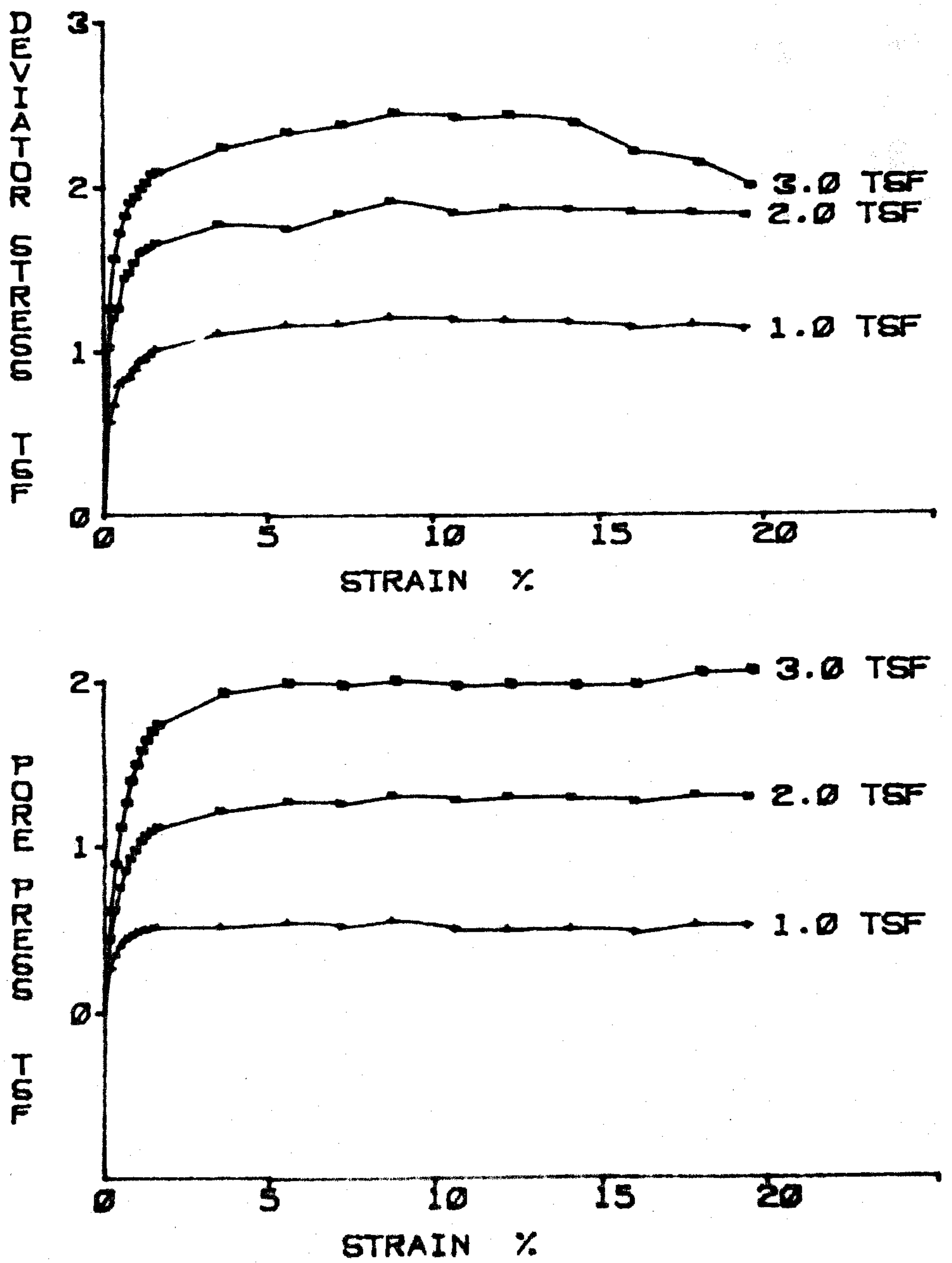
PROJECT:PARADISE S.P.	EL. :352.1-351.1
FEATURE:COAL RCVG FACIL	SAMPLE :8
STATION:1519.9 W	PART :2
RANGE :1390.4 N	SOIL SYM:CL
BORING :US-8	DATE :4-14-83





TVA SINGLETON MATERIALS ENGINEERING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (R) TEST

PROJECT: PARADISE S.P. EL. : 352.1-351.1
FEATURE: COAL RCVG FACIL SAMPLE : 8
STATION: 1519.8 W PART : 2
RANGE : 1390.4 N SOIL SYM: CL
BORING : US-8 DATE : 4-14-83



Tennessee Valley Authority
Singleton Materials Engineering Laboratory
Consolidated Undrained Triaxial Compression (R) Test

Project: PARADISE S.P.
Feature: COAL RECEIVING FACIL
Station: 1519.9 W
Range : 1590.4 N
Boring : US-8

El. : 352.1-351.1
Sample: 6
Part : 2

Tested By : TAL
Computed By: MHD
Checked By :
Report Date: 4-14-83

Soil Symbol= CL
Sp. Gr. = 2.68

L.L.(%)= 0
D10(mm)= 0

P.I.(%)= 0

Specimen Number	1	2	3	4
Initial:				
Moisture Content(%)	25.1	23.2	23.0	0.0
Dry Density(pcf)	98.0	100.9	101.8	0.0
Void Ratio	0.706	0.659	0.643	0.000
Saturation(%)	95.2	94.5	95.9	0.0
Before Shearing:				
Moisture(%) (after satur.)	26.4	24.6	24.0	0.0
Saturation(%)	100.0	100.0	100.0	0.0
Moisture(%) (after cons.)	26.2	24.0	22.8	22.8
Void Ratio (after cons.)	0.702	0.643	0.612	0.000
Final Moisture Content(%)	25.1	20.4	19.4	0.0
Minor Principal Stress(tsf)	1.01	2.02	3.02	0.00
Major Principal Stress(tsf)	2.26	3.97	5.50	0.00
Eff. Minor Prin. Stress(tsf)	0.42	0.68	0.99	0.00
Eff. Major Prin. Stress(tsf)	1.67	2.63	3.46	0.00
Time to Failure(min.)	50	50	50	0
Rate of Strain(%/min.)	0.18	0.18	0.18	0.00
Specimen Height(in.)	3.14	3.14	3.14	3.14
Specimen Diameter(in.)	1.40	1.40	1.40	1.40

Shear Strength	Deg.	c(tsf)
Apparent	13.5	0.26
Effective	31.3	0.11

Remarks:

APPENDIX D
Hydrology and Hydraulics Analysis Documentation

Report of Hydrologic and Hydraulic Analysis

Coal Yard Area and Red Water Ponds
TVA Paradise Fossil Plant
Muhlenberg County, Kentucky

Stantec Consulting Services Inc.
One Team. Infinite Solutions
1409 North Forbes Road
Lexington, KY 40511-2050
Tel: (859) 422-3000 • Fax: (859) 422-3100
www.stantec.com

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

March 12, 2010

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

March 12, 2010

rpt_002_175669016

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

Re: Report of Hydrologic and Hydraulic Analysis
Coal Yard Area and Red Water Ponds
TVA Paradise Fossil Plant
Muhlenberg County, Kentucky

Dear Mr. Snider:

Stantec Consulting Services (Stantec) has been assisting TVA with repairs associated with slope stability, drainage, and maintenance issues for the Paradise Fossil Plant (PAF) facility. During the Pond and Facility Assessment performed for the Paradise Fossil Plant beginning in May of 2009, the various ponds in the Coal Yard Area were identified for Hydrologic and Hydraulic Analysis as a part of our Phase 2 Assessment. The goal of this analysis was to develop a conceptual-level hydrologic and hydraulic runoff model of the area to help assess capacity, freeboard, and hydraulic operation of the Coal Yard Area ponds and the Red Water Ponds. Stantec modeled hydrologic and hydraulic conditions for Coal Yard Area Ponds 1-3, Red Water Ponds 1-5, Slag Ponds 2A and 2B and the Slag Stilling Pond. Results of this modeling effort and recommendations are included in the attached report. Based on current discussions with TVA, no immediately critical issues were identified; however several recommendations are provided for reducing long term risk and improving overall operations.

Please do not hesitate to contact Stantec with any questions, concerns, or clarifications.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Michelle Meehan
Michelle Meehan, EIT
Project Engineer

Erman Caudill
Erman Caudill, PE, CFM
Project Manager

/rdr

Report of Hydrologic and Hydraulic Analysis

Coal Yard Area and Red Water Ponds
TVA Paradise Fossil Plant
Muhlenberg County, Kentucky

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

March 12, 2010

Report of Hydrologic and Hydraulic Analysis

Coal Yard Area and Red Water Ponds
TVA Paradise Fossil Plant
Muhlenberg County, Kentucky

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List of Appendixes

Executive Summary

A hydrologic and hydraulic study was conducted for Slag Ponds 2A, 2B, the Slag Stilling Pond, Coal Yard Runoff Ponds 1-3 and Red Water Ponds 1-5 at the Paradise Fossil Plant. The purpose of the study was to help assess freeboard requirements, capacity, and hydraulic operation of spillway systems in relation to the structural hazard classifications that would be appropriate in Kentucky using the effective size of the facilities. In order to perform the study, site visits were conducted, TVA personnel were interviewed, historical drawings and documents were reviewed, survey data was obtained, and hydrologic/hydraulic (H&H) modeling was performed.

An H&H model was developed to simulate storm water drainage and runoff from overland areas, process discharges, and pond interconnectivity by pumps and discharge pipes based on our understanding of the geometry and design of the drainage and conveyance network. The model was used to assess the performance of the ponds during the 1-, 10-, 25-, 50-, and 100-year 24-hour SCS Type II storms as well as a 6-hour PMP.

Based on the data gathering efforts, collective review of the data available, and the modeling efforts, Stantec noted the following observations. A map and schematic showing the hydraulic connectivity and identified issues is also attached as Appendix A.

- The geometry and hydraulic connectivity for the network is generally understood by TVA, however the exact locations, size, and route for many of the conduits is not well documented.
    - Much of the modeled geometry is based on discussions with TVA personnel paired with review of historic drawings. There is a possibility that undocumented conditions in the field could vary from the model.
    - The condition of many parts of the infrastructure is generally not known and it is likely that some of the buried pipes are old, in poor condition, and may have defects or blockages that could affect performance.
    - As a general condition, the network lacks redundancy. Adequate performance appears to be dependent upon a series of operational procedures actively applied by TVA personnel. These procedures are not incorporated into the modeling and may represent increased network performance.
- Based on the modeling, none of the ponds are able to pass the PMP event through the spillway systems without using emergency overflow mechanisms or overtopping the embankments.
    - Of the ponds at risk of overtopping, there are three ponds: Red Water Pond 1, Red Water Pond 2, and the Slag Stilling Pond, that would discharge directly to the Green River if they overtopped.
- Many of the ponds cannot pass smaller events than the PMP without using emergency overflows or bypassing normal operations.
    - If pumps do not operate properly in some locations (specifically the discharges from Red Water Pond 1, the Slag Stilling Pond, and Red Water Pond 2), the potential for overtopping and discharge to the Green River is greatly increased.

- The network appears to convey typical storm events and normal process flows adequately without violating discharge constraints, however as storm events approach the 10-year 24-hour frequency specified for control by the KPDES permit, operational intervention appears to be required to avoid uncontrolled discharges. Coal Yard Runoff Pond 1 and Red Water Pond 5 appear to be most susceptible.

- For static operational conditions, according to the TVA design guidance, a minimum operational freeboard of 3 feet is required; currently the operational freeboard for many of the ponds is close to this value or slightly below. For example, for Slag Ponds 2A and 2B the normal freeboard appears to be approximately 2.5 feet. This issue appears to be related to desired level of service.

A meeting was conducted on February 25, 2010 with TVA personnel to discuss the findings of the modeling. Based on this discussion and the results of the analysis, Stantec recommends:

- The modeling and analyses developed for this study should be considered as a screening tool for further TVA consideration of these ponds. The issues identified above are believed to require long term solutions, and are generally not immediate infrastructure repairs that can be implemented without further consideration.
- TVA should evaluate the elevations around Slag Ponds 2A, 2B, and the Slag Stilling Pond to determine actual operational freeboard and create/define an overflow pathway as applicable. One way to do this is to create a low spot in the roadway that is designed to be an overflow point and is protected from scour during potential overtopping events.
- TVA should further evaluate the capacity of the three pump systems in Red Water Ponds 1 & 2 and the Slag Stilling Pond to determine the risk of un-permitted discharge.
- Stantec has provided field observations and recommendations for short-term maintenance activities and repairs. Several issues that have been addressed include: wave wash and erosion issues, a slough in Coal Yard Runoff Pond #1, stacked spillway risers, leaking pipes, improperly abandoned spillways or spillways with unknown conditions, etc. Stantec recommends TVA develop a periodic inspection program to identify and address these types of issues and incorporate the findings and ongoing repairs into a formal operations and maintenance plan for these ponds.
- Stantec recommends TVA consider operational procedures to increase redundancy in the system for more frequent storm events. The general goal would be to reduce the risk of uncontrolled discharges and potential discharge permit violations.

Report of Hydrologic and Hydraulic Analysis

Coal Yard Area and Red Water Ponds
TVA Paradise Fossil Plant
Muhlenberg County, Kentucky

1. Introduction

This study was conducted to help assess capacity and hydraulic operation of spillway systems and freeboard requirements in relation to the structural hazard classifications of the facilities. Initially, Slag Ponds 2A and 2B as well as the Slag Stilling Pond were to be evaluated. However, due to the interconnected nature of the ponds and drainage in the Coal Yard Area and the C&M Stack, and questions from TVA personnel regarding the Red Water ponds, eleven ponds were evaluated as part of this effort. These eleven ponds include Slag Ponds 2A and 2B, the Slag Stilling Pond, Red Water Ponds 1-5, and Coal Yard Area Ponds 1-3. Slag Ponds 2A and 2B are currently classified as having a low-hazard potential. The other ponds do not presently have hazard classifications. A map illustrating the evaluated ponds is included in Appendix A.

This analysis included field visits, review of historical TVA drawings and discussions with TVA personnel. During the field visits, other issues throughout the facility were noted that needed repair. These issues were incorporated into several repair packages that are in varying stages of completion. A site visit was also conducted for the C&M Stack and several erosion issues were noted. Recommendations for repairs for the C&M stack will be issued in a separate letter.

This report details the assumptions, methodology, and results of the H&H analyses for the eleven ponds analyzed.

2. Modeling Assumptions

1. Assumption: All pipes are flowing freely and are not clogged or leaking.
   Justification: This assumption is inherent in this type of analysis and is acceptable. Some of the pipes may, in actuality, be clogged with coal fines and some of the older pipes may be leaking (especially older corrugated metal pipes). Elevations and flows determined for this analysis may not be applicable in those situations.

2. Assumption: Wave action is not considered in this analysis. Overtopping is assumed to occur only when the elevation of the pond rises above the minimum surveyed crest elevation.
   Justification: In actuality, wave action would likely play a role in the overtopping of the ponds, however the current model does not take into consideration wave action.

3. Assumption: Consideration for varying tailwater conditions was not included in this analysis.
   Justification: Tailwater conditions would likely affect the elevations of ponds in cases where the downstream pipe is submerged. However the current model does not take into consideration tailwater effects.

4. Assumption: When ponds overtop, the flow often enters another pond. These relationships were assumed as follows.
   - For Red Water Ponds 3 and 4, flow is assumed to go to Jacob's Creek Ash pond in the event of the ponds overtopping.
   - For Red Water Ponds 1 & 2 and the Slag Stilling Pond, flow is assumed to go to the Green River in the event of the ponds overtopping.

   Since the Jacob's Creek Ash Pond and the Green River are not being evaluated in this model, any overflow from these ponds is considered lost to the system.
   - For Red Water Pond 5 and Coal Yard Runoff Pond 1, water is assumed to pond locally if the ponds overtop and this ponding water is not included as an inflow into any other ponds during overtopping.
   - For Coal Yard Runoff Pond 3, flow is assumed to go to Red Water Pond 1 in the event of the pond overtopping.
   - For Coal Yard Runoff Pond 2, flow is assumed to go to Red Water Pond 2 in the event of the pond overtopping.
   - For Slag Pond 2A, all overflow is assumed to flow to Slag Pond 2B and for Slag Pond 2B all overflow is assumed to flow to the Slag Stilling Pond.

   Justification: These assumptions were made based on topographic data when available. When recent topographic data was unavailable, the lowest spot in the surveyed crest of the dam was observed and overflow was assumed to flow in this direction to the next closest pond. For ponds that appear to be in relatively flat areas based on field observations, ponding of water was assumed to occur and the outflow during an overtopping event was not considered as inflow into any of the other ponds.

5. Assumption: The pool elevations captured by surveyors on May 19-20, 2009 and July 1, 2009 were considered to be the normal pool elevations and were used in the model as the starting water surface elevations.
   Justification: The surveyed pool elevations were compared to pool elevations reported in the Phase 1 B report produced by Stantec. Since the differences averaged less than 2 feet, these elevations were considered to be normal pool conditions.

6. Assumption: For Red Water Pond 4 the rim of the spillway riser could not be obtained. The rim elevation was chosen as 462.0'. The size of the pipe connecting to the emergency spillway was also unknown and was assumed to be a 36" diameter pipe.
   Justification: The elevation of the spillway was taken from Drawing No. 10W4271-7 (See Appendix B). A size for the pipe could not be found on the drawings, and so a 36" diameter pipe was assumed for modeling purposes. This conduit does not have any substantial impact on the modeling results or conclusions.

7. Assumption: The inverts of many of the pipes that were submerged could not be computed. In addition, lengths of connecting pipes were unknown for almost all cases. Lengths were assumed for ponds based on the believed alignment of the pipes. Inverts that could not be surveyed were taken from drawings whenever

possible. For Slag Ponds 2A and 2B, the downstream inverts for the 48" pipes and the 60" pipe were chosen as 409' and 408', respectively. For Red Water Pond 1 and the Slag Stilling Pond, the invert at the outlets were chosen as 396'. Slopes for pipes where inverts were not surveyed and where inverts could not be found on drawings were assumed to be 1%.
Justification: The inverts for the downstream end of the pipes in Slag Pond 2B were taken from Drawing No. 10W3290. For the Slag Stilling Pond, the outlet of the 3 36" pipes was taken from Drawing No. 10W3267-2. The invert elevation of the outlet pipe coming from Red Water Pond 1 was taken from Drawing No. 10W4290-2. Slopes calculated when inverts were known averaged about 1%. Therefore, this slope was used for pipes where inverts were unknown.

8. Assumption: The dimensions of the concrete weir are 16' by 42'.
   Justification: Dimensions were taken from Drawing No. 10W3290. The upstream and downstream elevations were surveyed.

9. Assumption: The pumping capacity for each of the pumps in the model was assumed to be equal to the pumping rate on "Paradise Fossil Plant Permit No. KY0004201 Wastewater Flow Schematic"
   Justification: The Wastewater Flow Schematic represents an average annual pumping rate and actual capacity of the pumps is likely higher. However, pump capacities were not available for the ponds at the time of this study. This assumption may result in model results that are slightly worse than actual conditions.

3. Methodology

Rainfall-runoff relationships were determined using methods described by the NRCS in "Part 360-Hydrology" of the National Engineering Handbook (NEH4). SCS Curve Number Unit Hydrograph methods were used to generate runoff hydrographs for routing through the ponds in lieu of the more complex methods described in Chapter 21 of NEH4 and commonly implemented in NRCS TR-60 based methods.

The HMS Model was developed and used to simulate runoff from the probable maximum precipitation (PMP) event in accordance with TVA design guidance. Rainfall depths for the PMP event were taken from National Weather Service Hydrometeorological Report No. 51. In addition, other design storm events were evaluated including the 1-, 10-, 25-, 50-, and 100-year events. For these events the rainfall depth was taken from NOAA Atlas 14.

A duration of 6 hours was used for the PMP analysis and 24 hours for the other rainfall depths. An SCS Type II storm distribution was assumed for all storm events as described in "Urban Hydrology for Small Watersheds, Technical Report 55 (TR-55)", Natural Resources Conservation Service 1986.

Base condition inflow due to process waters was assumed based on the water balance diagram provided by TVA. Pumping rates were also estimated from this diagram. This diagram is included in Appendix D.

4. Input Data

4.1. Watershed Parameters

The map and schematic in Appendix A show the connectivity of the eleven ponds, as understood by Stantec. Drawings used to develop the connectivity are included in Appendix B. This connectivity was used to create the hydrologic model for the Coal Yard Area and Red Water ponds. Table 4.1 lists the main hydrologic parameters of the watersheds draining to the ponds.

Table 4.1. Watershed Parameters

Pond Name	Incremental Watershed Area (acres)	Cumulative Watershed Area (acres)	Composite Curve Number	Estimated lag time (minutes)
Coal Yard Runoff Pond 1	71	71	87	9.6
Coal Yard Runoff Pond 2	39	39	91	26.1
Coal Yard Runoff Pond 3	109	109	86	23.5
Red Water Pond 1	37	425	91	14.0
Red Water Pond 2	6	77	84	5.0
Red Water Pond 3	149	237	81	21.4
Red Water Pond 4	88	88	84	23.5
Red Water Pond 5	42	42	85	14.4
Slag Pond 2A	44	585	93	24.0
Slag Pond 2B	13	598	97	10.0
Slag Stilling Pond	36	634	89	16.4

4.2. Spillway Data

All accessible spillways were surveyed by Stantec in July of 2009. Table 4.2 lists the spillway data collected for each pond.

Table 4.2. Existing Principal Spillway and Emergency Spillway Data

Pond Name	Riser Diameter	Pipe Diameter	Invert & Rim Elevations	Data Source
Coal Yard Runoff Pond 1	48” with an 8” hole	72”	Rim = 416.3’ Hole Invert = 410.3’ Pipe Invert = 400.5’	Survey Data
Coal Yard Runoff Pond 2	N/A	8” emergency drain	Invert = 409.8’	Survey Data
Coal Yard Runoff Pond 3	48”	24” RCP	Rim = 415.9’ Invert = 405.0’	Survey Data
Red Water Pond 1	8’x15’ box	72” RCP	Rim = 403.4’	Survey Data and DWG 10W4290-2
Red Water Pond 2	None	None	N/A	N/A
Red Water Pond 3	PS: 6” stand pipe and 10” stand pipe ES: No Riser	PS: 18” ES: 3 36”	Rim 6” stand pipe = 417.2’ Rim 10” stand pipe = 415.3’ Invert 18” pipe = 408.2’ Invert 3 36” pipes = 420.1’, 420.3’, 420.5’	Survey Data
Red Water Pond 4	PS: No Riser ES: 48”	PS: 12” ES: 36”	Rim ES = 462.0’ Invert PS: 448.6’ Invert ES = 450.8’	Survey Data and DWG 10W4271-7
Red Water Pond 5	14”	14”	Rim = 411.2’ Invert = 400.4’	Survey Data
Slag Pond 2A	N/A	2 48” and 1 60”	Upstream Invert 48” = 409.4’ and 410.3’ Downstream Invert 48” = 409’ Upstream Invert 60” = 409.9’ Downstream Invert 60” = 408’	Survey Data and DWG 10W3290
Slag Pond 2B	N/A Spillway consists of concrete weir		Upstream Weir Invert = 410.3’ Downstream Weir Invert = 409.6’	Survey Data
Slag Stilling Pond	3 36”	3 36”	Rim = 408.1’ Invert = 396.0’	Survey Data and DWG 10W3267-2

4.3. Pond Overflow and Normal Pool

Table 4.3 shows the overtopping elevations (surveyed minimum crest elevation) and the surveyed normal pool elevations at each pond.

Table 4.3. Pond Overflow Elevation

Pond Name	Overtopping Elevation (feet)	Normal Pool Elevation (feet)
Coal Yard Runoff Pond 1	415.4	410.4
Coal Yard Runoff Pond 2	410.4	404.9
Coal Yard Runoff Pond 3	417.5	412.3
Red Water Pond 1	409.9	395.6
Red Water Pond 2	400.3	384.5
Red Water Pond 3	426.2	415.3
Red Water Pond 4	466.2	456.7
Red Water Pond 5	412.2	406.6
Slag Pond 2A	414.3	411.8
Slag Pond 2B	414.0	411.5
Slag Stilling Pond	410.4	406.1

4.4. Stage Storage Data

Stage-storage curves were developed for each pond based on survey data provided by TVA (when available) or based on the survey data of the normal pool and the crest elevation collected by Stantec. Stage storage curves are included in Appendix C for each pond.

4.5. Spillway Rating Curves

Rating curves for the spillway systems were developed based on the geometric data available and weir, orifice, and culvert discharge relationships. Weir equations and coefficients were based on guidance provided in “Open Channel Hydraulics,” V.T. Chow, 1959. Orifice equations and coefficients will be based on guidance provided in “Handbook of Hydraulics,” E. F. Brater and H.W. King, 1976. Culvert discharge ratings were developed using procedures outlined in “Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5 (HDS-5),” U.S. Department of Transportation Federal Highway Administration (FHWA) 1985. Rating curves for each pond are attached in Appendix C.

4.6. Pump Data

Pumping rates were estimated from the water balance diagram provided by TVA entitled “Paradise Fossil Plant Permit No. KY0004201 Wastewater Flow Schematic” and revised on March 9, 2009. Flows shown on the flow schematic were converted from MGD to CFS. Pumping rates used for each of the ponds are shown in Table 4.4.

Table 4.4. Pumping Rate

Pond Name	Pumping Rate (cfs)	Pumping rate (gpm)
Coal Yard Runoff Pond 1	N/A	N/A
Coal Yard Runoff Pond 2	0.4	187
Coal Yard Runoff Pond 3	0.4	187
Red Water Pond 1	3.0	1325
Red Water Pond 2	0.07	30
Red Water Pond 3	N/A	N/A
Red Water Pond 4	N/A	N/A
Red Water Pond 5	N/A	N/A
Slag Pond 2A	N/A	N/A
Slag Pond 2B	N/A	N/A
Slag Stilling Pond	26	11,701

5. Results

Estimated peak pool elevations for the storms analyzed are shown in Table 5.1. Numbers in italics indicate that the emergency spillway is likely being utilized for the associated storm event. Numbers in bold indicate that the pond is likely overtopping for the associated storm event. Table 5.2 shows the estimated peak pond inflows associated with each event. The results shown in Tables 5.1 and 5.2 are based on the assumptions described herein and should be considered approximate. Accurate and precise data was not available and the model has not been calibrated. This model is suitable as a screening and planning tool, however Stantec does not support its use beyond the current scope of work and the context described in this report.

Table 5.1. Estimated Peak Pool Elevations

Pond Name	1-year 24-hour storm (ft)	10-year 24-hour storm (ft)	25-year 24-hour storm (ft)	50-year 24-hour storm (ft)	100-year 24-hour storm (ft)	6-hour PMP (ft)
Coal Yard Runoff Pond 1	*413.4*	**416.1**	**416.6**	**416.9**	**417.2**	**424.5**
Coal Yard Runoff Pond 2	407.1	409.3	*410.0*	**410.4**	**410.4**	**412.2**
Coal Yard Runoff Pond 3	*416.1*	*417.3*	*417.4*	**417.6**	**417.7**	**420.3**
Red Water Pond 1	*403.6*	*404.1*	*404.6*	*405.5*	*406.2*	**415.5**
Red Water Pond 2	391.3	393.8	394.2	395.4	396.7	**401.3**
Red Water Pond 3	419.3	*421.3*	*421.6*	*422.0*	*422.3*	**430.2**
Red Water Pond 4	458.5	*462.8*	*463.5*	*464.4*	*465.1*	**470.8**
Red Water Pond 5	411.5	**412.3**	**412.5**	**412.6**	**412.7**	**415.4**
Slag Pond 2A	412.0	412.2	412.3	412.4	412.5	**415.2**
Slag Pond 2B	411.7	411.8	411.9	412.0	412.0	**414.5**
Slag Stilling Pond	*409.1*	*409.9*	*410.0*	*410.1*	*410.2*	**412.2**

Table 5.2. Estimated Peak Pond Inflows

Pond Name	1-year 24-hour storm (cfs)	10-year 24-hour storm (cfs)	25-year 24-hour storm (cfs)	50-year 24-hour storm (cfs)	100-year 24-hour storm (cfs)	6-hour PMP (cfs)
Coal Yard Runoff Pond 1	150	299	355	410	450	2,758
Coal Yard Runoff Pond 2	56	105	123	141	154	952
Coal Yard Runoff Pond 3	132	275	328	382	420	2,777
Red Water Pond 1	81	149	243	350	421	3,686
Red Water Pond 2	16	32	38	45	49	977
Red Water Pond 3	159	357	433	510	566	3,973

Table 5.2. Estimated Peak Pond Inflows

Pond Name	1-year 24-hour storm (cfs)	10-year 24-hour storm (cfs)	25-year 24-hour storm (cfs)	50-year 24-hour storm (cfs)	100-year 24-hour storm (cfs)	6-hour PMP (cfs)
Red Water Pond 4	95	205	247	290	320	2,186
Red Water Pond 5	67	140	167	195	214	1,393
Slag Pond 2A	138	196	217	238	253	1,196
Slag Pond 2B	110	143	155	167	176	712
Slag Stilling Pond	141	211	237	263	282	1,412

6. Conclusions and Recommendations

Based on the data gathering and modeling efforts, several observations were made in terms of capacity and freeboard.

First, the condition of the infrastructure is generally not known and the actual conditions of most of the pipes and some of the spillways are unknown. There is a possibility that undocumented conditions in the field could vary from the model. The analysis was based on connections as they were understood from the data collected and assuming the infrastructure is well-maintained.

- Field observations were made of potential problems with the infrastructure including several stacked riser spillways, a slough on Coal Yard Runoff Pond 1, erosion in Slag Ponds 2A, 2B, and the Slag Stilling Pond, cracks in the concrete flume between Slag Pond 2B and the Slag Stilling Pond, a riser with a rim elevation above the crest elevation in Coal Yard Runoff Pond 1, and a leaking pipe from the pump in the Slag Stilling Pond to Jacob's Creek Ash Pond.
    - A repair package has been issued for wave wash protection in Slag Ponds 2A, 2B, and the Slag Stilling Pond that has since been completed.
    - A separate repair package has been issued to repair the slough in Coal Yard Runoff Pond #1.
- In addition, there is an effort currently underway to repair/replace stacked spillway risers throughout TVA's facilities.

Stantec recommends TVA develop a periodic inspection program to address these types of issues and incorporate the findings and ongoing repairs into a formal operations and maintenance plan for these ponds. Identified repairs should be incorporated in the context of other recommendations developed with TVA stakeholder input.

A second observation is that none of the ponds appear to be able to pass the PMP storm event without overtopping; however some appear to be able to pass a 100-year storm event.

- Red Water Pond 1, Red Water Pond 2, and the Slag Stilling Pond are ponds of particular concern in terms of capacity since these ponds are in close proximity to the Green River.
    - While the modeling results suggest the ponds would not overtop during a 100-year storm, there is very little freeboard for the Slag Stilling Pond.
    - TVA has also indicated that Red Water Pond 2 has overtopped in the past.
- These ponds are also concerns because modeling indicates that if the pumps for these ponds are undersized, discharge through the emergency spillway in Red Water 1 could occur for smaller events less than a 10-year 24-hour storm which could violate the plant's KPDES discharge permit.
    - If the pumps were to fail, it could overload the system and lead to overtopping of the ponds.

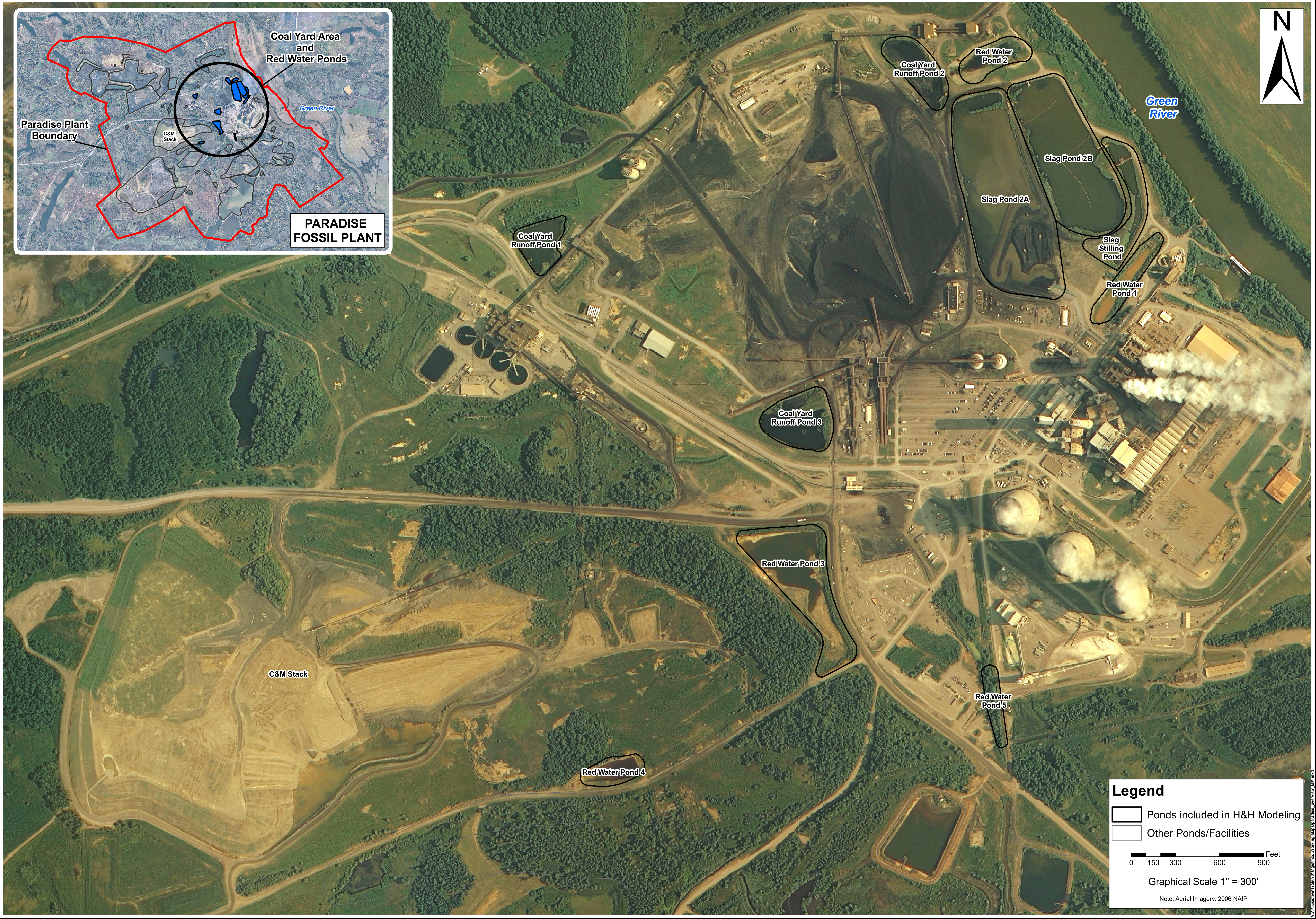
In general it appears that the network lacks redundancy and adequate performance during larger events appears to be dependent on procedures actively applied by TVA personnel. Stantec recommends that TVA assess the capacity of these three pump systems to determine the risk of un-permitted discharges. In addition, Stantec recommends TVA consider operational procedures to increase redundancy in the system for more frequent storm events. The general goal would be to reduce the risk of uncontrolled discharges and permit violations.

While many ponds appear able to pass the 100-year event, additional areas of concern include Red Water Pond 5 and Coal Yard Runoff Ponds 1 and 3 because the results of the modeling efforts indicate these ponds may have limited capacity during larger storm events and little freeboard during smaller events. These ponds also appear to utilize their emergency spillways much of the time. The ponds do not appear to pose an immediate danger in terms of un-permitted discharges, however Stantec recommends TVA assess the desired level of service of these ponds and whether or not the level of risk is acceptable.

Finally, according to the survey data collected the difference between the normal pool elevations and the crest elevations for Slag Ponds 2A and 2B are 2.5 feet. According to the TVA design guidance, this distance should be a minimum of 3 feet. If an extreme event were to occur that overloads this pond system, the Slag Stilling Pond appears to act as the downstream control point and the location where a subsequent overtopping failure could occur. Stantec recommends that TVA evaluate the elevations around Slag Pond 2A and 2B to determine if there is adequate freeboard and also create/define an overflow pathway as applicable. One way to do this is to create a low spot in the roadway that is protected from scour during potential overtopping events.

Appendix A

Map and Connectivity Schematic



STANTEC CONSULTING SERVICES INC.

1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Coal Yard Area and Red Water Ponds

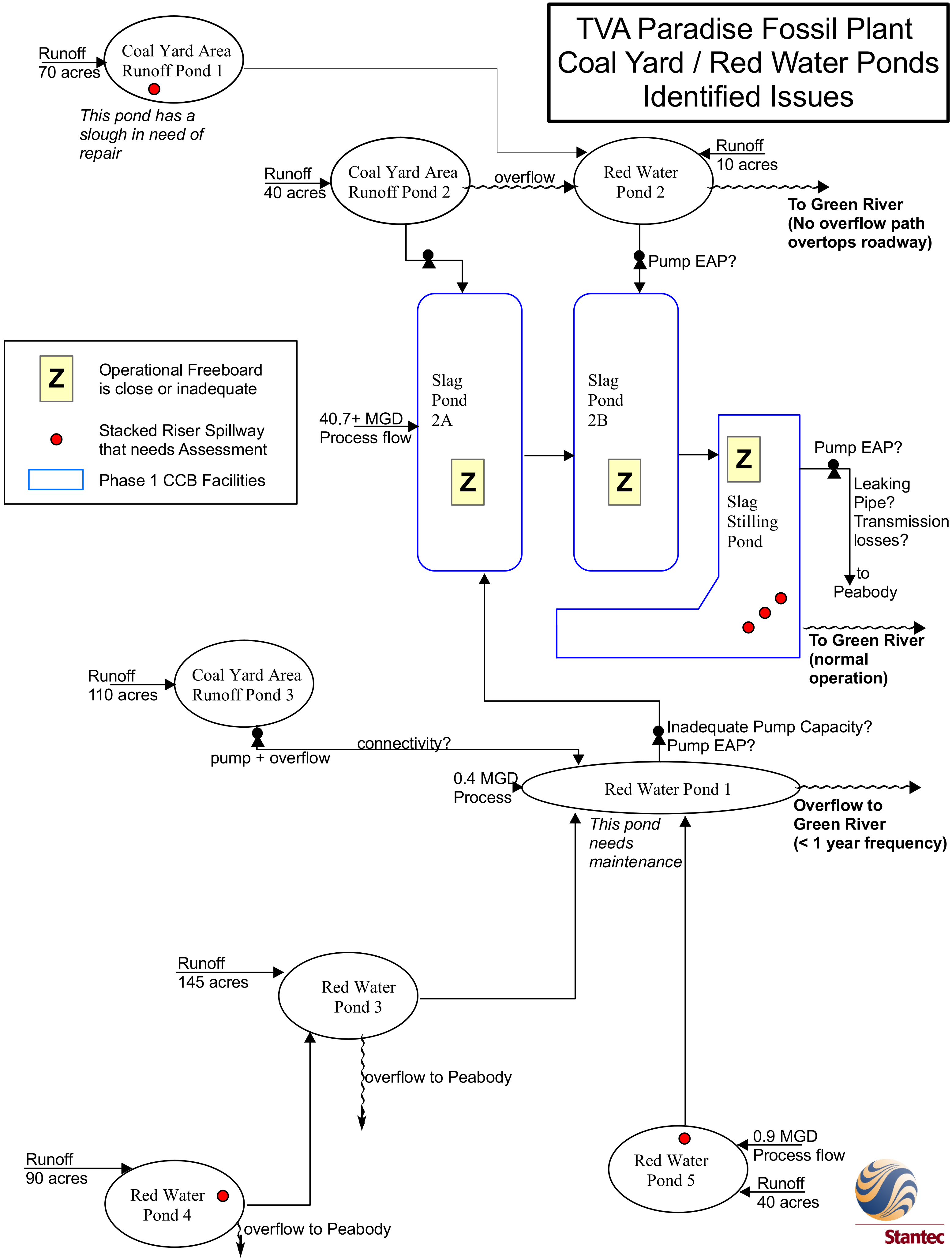
Overview Map
TVA Paradise Fossil Plant
Drakesboro, Muhlenberg County, Kentucky

PROJECT NO.	175669016
DATE	March, 2010
DRAWN BY	MM
CHECKED BY	EC
CHECKED BY	
SCALE	1" = 300'
REVISED	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

SHEET

1

TVA Paradise Fossil Plant Coal Yard / Red Water Ponds Identified Issues

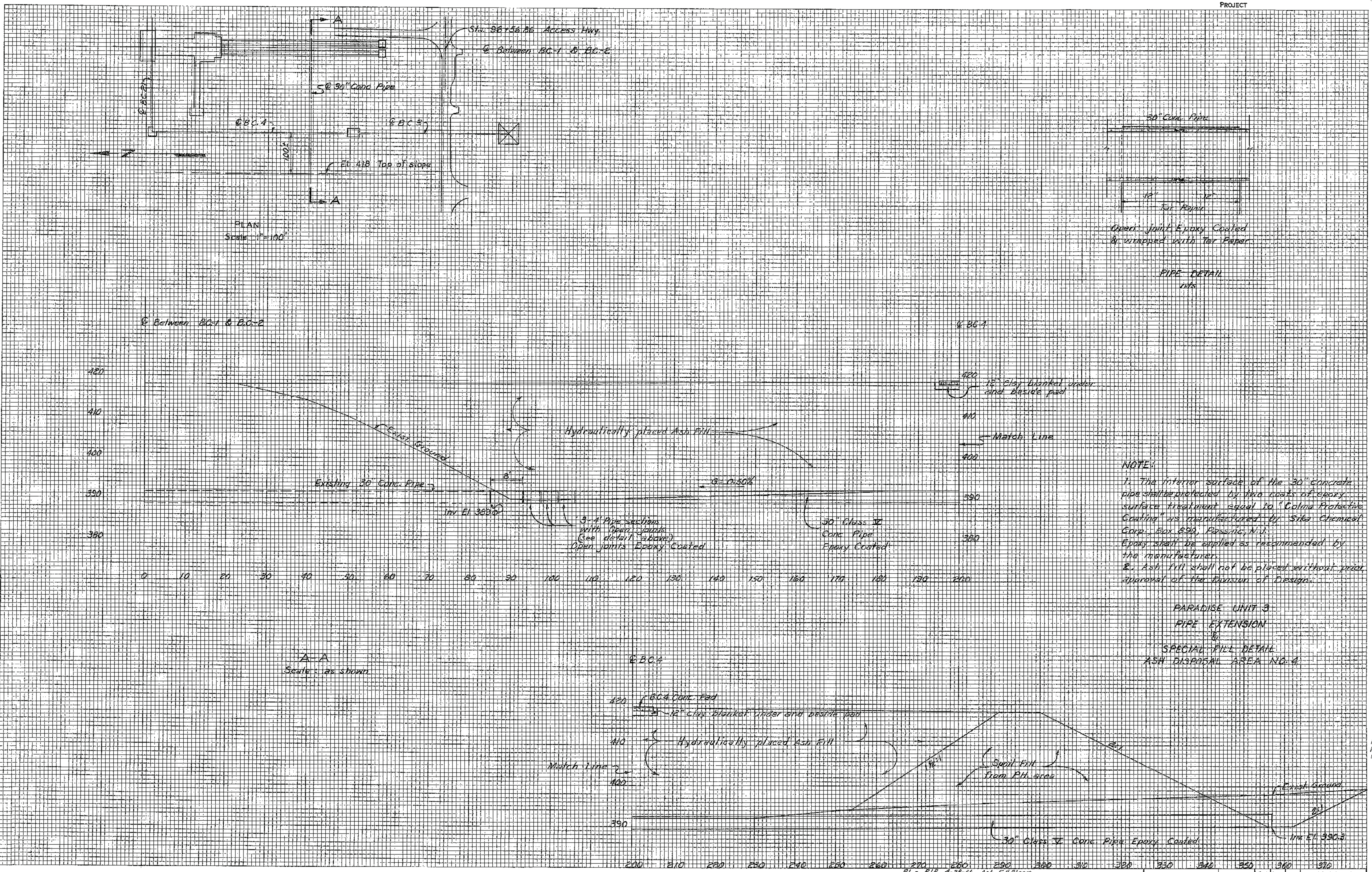


Appendix B

TVA Historical Drawings

List of Drawings

Drawing Number	Date	Title
10H3233	12/21/1965	Paradise Unit 3 Pipe Extension and Special Fill Detail Ash Disposal Area No. 4
10H3246	1/11/1968	Ash Conveyor and Road
10N209	6/11/1962	Surfacing Coal Yard Area
10N211	5/6/1960	General Grading Plan Coal Yard - Sheet 1
10N212	7/18/1960	General Grading Plan Coal Yard - Sheet 2
10N236	4/30/1963	Drainage Plan Ash Disposal Area
10N3203	7/13/1970	Ash Disposal Areas 2A & 2B, General Plan and Sections for Raising Dikes
10N3209	8/3/1971	Ash Ponds 2A & 2B Check Dam and Riprap for Spillway Outlets
10N3220	7/5/1967	Drainage Plan Ash Disposal Area
10N3223	3/26/1970	Sheet Pile for Divider Dike at Ash Areas 2A and 2B
10N3228	3/31/1972	Disposal Areas 2A & 2B Concrete Trench and Gutter for Dewatering Pumps
10N3236	7/5/1967	Fly Ash Disposal
10N3263	10/11/1972	Ash Disposal Areas 2A & 2B Dragline Trach for Ash Reclamation
10W3211	7/22/1980	General Grading Plan Coal Yard
10W3220	3/3/1971	Drainage Plan Ash Disposal Area
10W3265-1	3/18/1983	General Grading Plan Coal Yard Sheet 2
10W3265-3	3/18/1983	Coal Yard Drainage Basin Sections
10W3267-2	11/19/1984	Ash Disposal Areas 2A & 2B Sections & Details (NLDF)
10W3290	11/19/1984	Ash Disposal Areas 2A, 2B, & Stilling Pool Spillway Sections & Details
10W4203	3/21/1978	Location of Structures, Coal Receiving, Coal Washing, and Coal Handling Facility
10W4271-7	9/21/1995	Coal Washing Refuse Medium & Coarse Storage Reclamation Details
10W4290-1	4/28/1998	Redwater Containment Plan & Grading
10W4290-10	3/21/2002	Redwater Containment Sections & Details
10W4290-2	6/2/1986	Redwater Containment Sections & Details
10W4292-1	7/2/1991	Redwater Containment No. 3 Plan - Pond & Dike
10W4292-4	10/27/1992	Redwater Containment No. 3 Gravity Drain Plan and Profile
10W4292-5, 6	7/2/1991	Redwater Containment No. 3 Gravity Drain Plan and Profile
10W5250	11/26/1984	Barge Unloading Dock Channel Excavation Plan



NOTE:
1. The interior surface of the 30" concrete pipe shall be protected by two coats of epoxy surface treatment equal to "Colma Protective Coating" as manufactured by Sika Chemical Corp., Box 899, Passaic, N.J.
Epoxy shall be applied as recommended by the manufacturer.
2. Ash fill shall not be placed without prior approval of the Division of Design.

PARADISE UNIT 3
PIPE EXTENSION
&
SPECIAL FILL DETAIL
ASH DISPOSAL AREA NO. 4

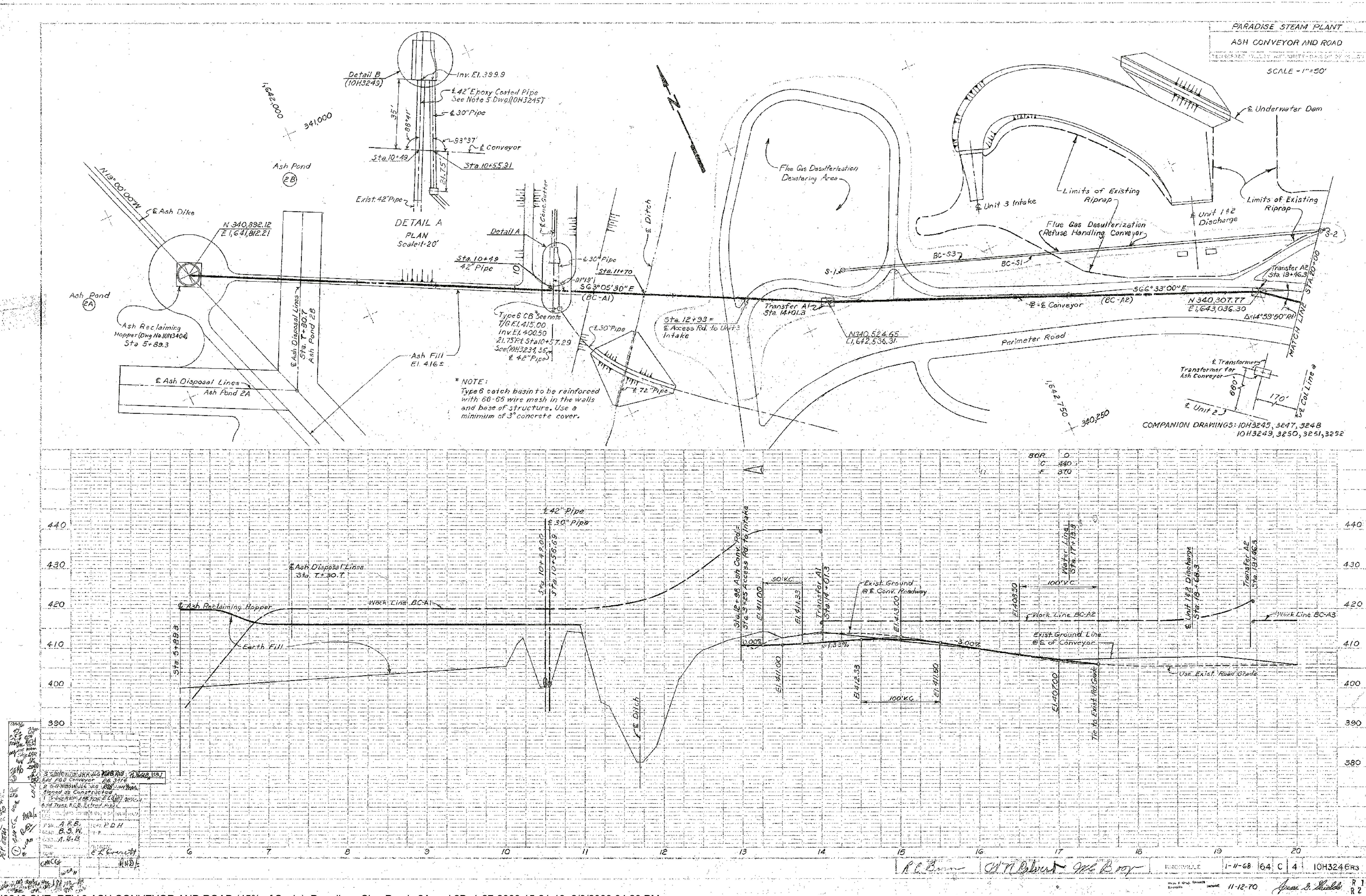
R1 - RJB, 4-28-66, Ash Fill Change
R2 BSN, 11 17 70, Signed as Constructed

KNOXVILLE	12-21-65	64	C	4	10H3233 R2

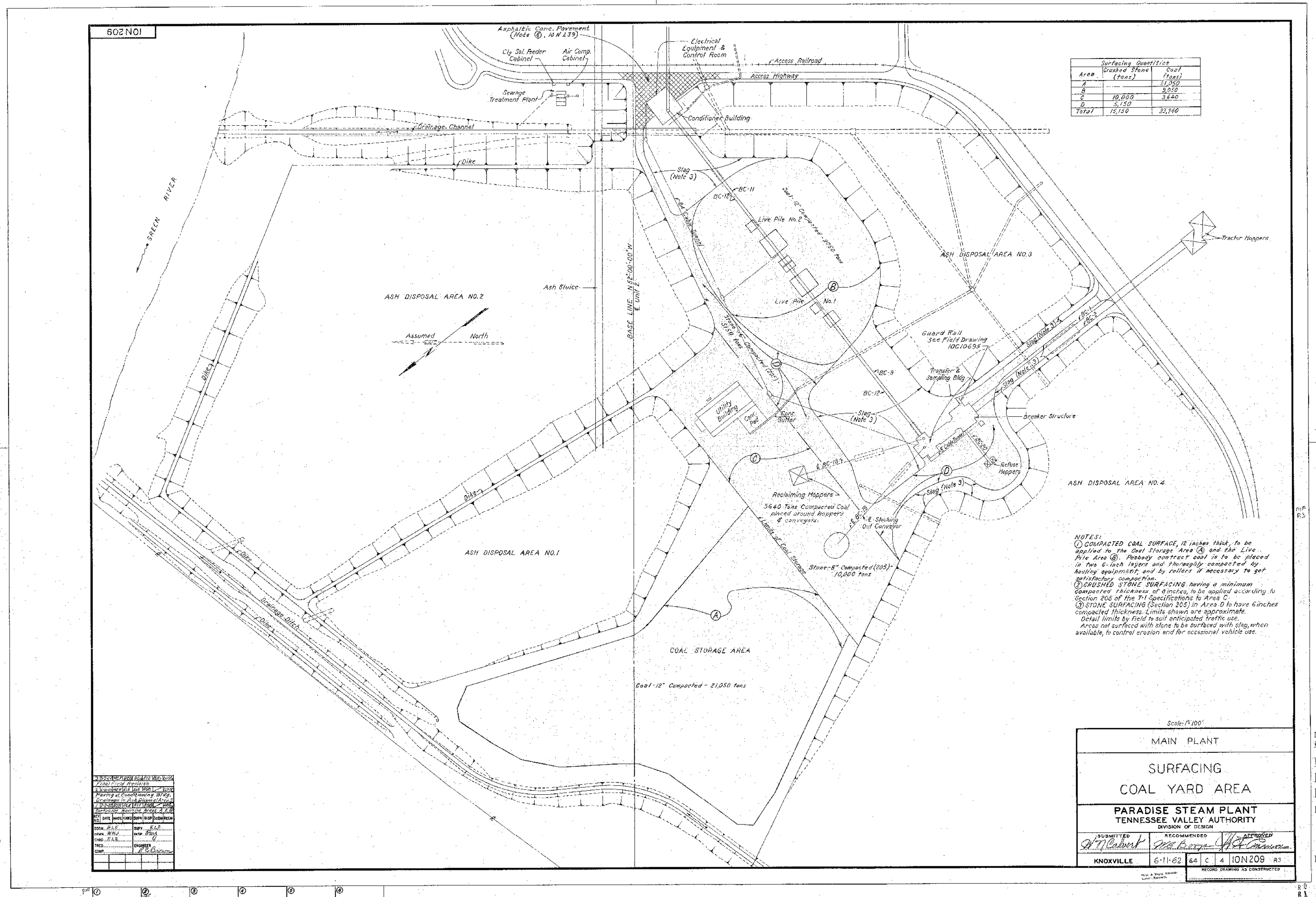
Jesse G. Shields 11-12-70

R2

PAF-10H3233-SHT -REV 2 PARADISE UNIT 3 PIPE EXTENSION AND SPECIAL FILL DETAIL ASH DISPOSAL AREA NO.4 (45% of Scale); Paradise - Slag Ponds 2A and 2B; 1-27-2009 15-21-19; 2/9/2009 04:20 PM



PAF-10H3246-SHT -REV 3 ASH CONVEYOR AND ROAD (45% of Scale); Paradise - Slag Ponds 2A and 2B; 1-27-2009 15-21-19; 2/9/2009 04:20 PM



Surfacing Quantities		
Area	Crushed Stone (tons)	Coal (tons)
A		21,050
B		9,050
C	10,000	3,640
D	5,150	
Total	15,150	33,740

NOTES:

1. COMPACTED COAL SURFACE, 12 inches thick, to be applied to the Coal Storage Area (A) and the Live Pile Area (B). Peabody contract coal is to be placed in two 6-inch layers and thoroughly compacted by hauling equipment, and by rollers if necessary to get satisfactory compaction.
2. CRUSHED STONE SURFACING having a minimum compacted thickness of 8 inches, to be applied according to Section 205 of the T-1 Specifications to Area C.
3. STONE SURFACING (Section 205) in Area D to have 6 inches compacted thickness. Limits shown are approximate.

Detail limits by Field to suit anticipated traffic use.

Areas not surfaced with stone to be surfaced with slag, when available, to control erosion and for occasional vehicle use.

MAIN PLANT

SURFACING
COAL YARD AREA

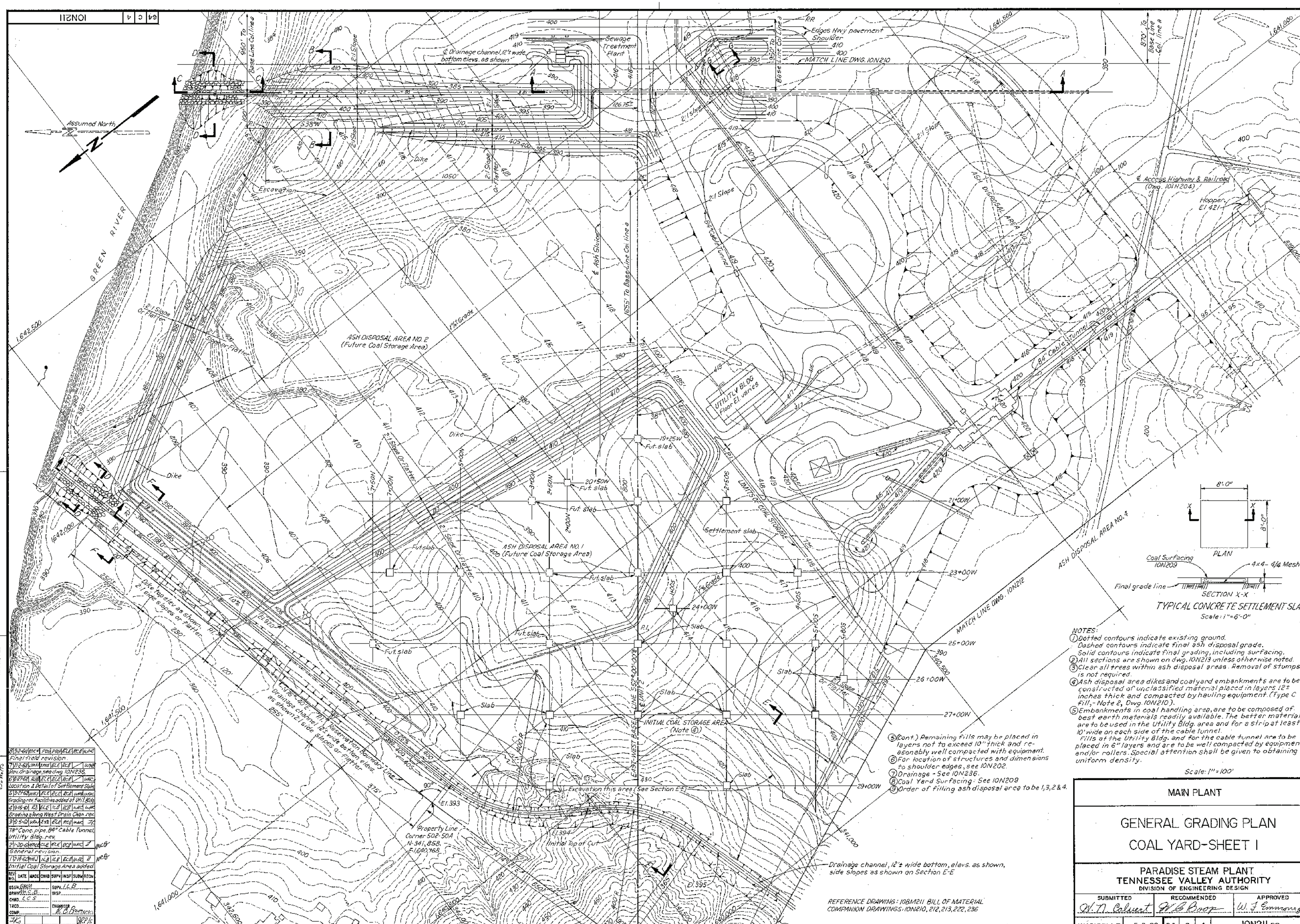
PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF DESIGN

SUBMITTED W. N. Calvert — RECOMMENDED M. B. Borge — APPROVED

KNOXVILLE | 6-11-62 | 64 | C | 4 | 10N209 R3

RECORD DRAWING AS CONSTRUCTED

PAF-10N209-SHT -REV 3 MAIN PLANT SURFACING COAL YARD AREA (36% of Scale); Paradise - Slag Ponds 2A and 2B; 1-27-2009 15-21-19; 2/9/2009 04:20 PM



NOTES:

1. Dotted contours indicate existing ground. Dashed contours indicate final ash disposal grade. Solid contours indicate final grading, including surfacing.
2. All sections are shown on dwg. 10N213 unless otherwise noted.
3. Clear all trees within ash disposal areas. Removal of stumps is not required.
4. Ash disposal area dikes and coal yard embankments are to be constructed of unclassified material placed in layers 12± inches thick and compacted by hauling equipment. (Type C Fill, - Note 2, Dwg. 10N210).
5. Embankments in coal handling area, are to be composed of best earth materials readily available. The better materials are to be used in the Utility Bldg. area and for a strip at least 10' wide on each side of the cable tunnel.
   Fills at the Utility Bldg. and for the cable tunnel are to be placed in 6" layers and are to be well compacted by equipment and/or rollers. Special attention shall be given to obtaining uniform density.

5. (Cont.) Remaining fills may be placed in layers not to exceed 10" thick and reasonably well compacted with equipment.
6. For location of structures and dimensions to shoulder edges, see 10N202.
7. Drainage - See 10N236.
8. Coal Yard Surfacing: See 10N209
9. Order of filling ash disposal area to be 1,3,2 & 4.

Scale: 1" = 100'

MAIN PLANT

GENERAL GRADING PLAN

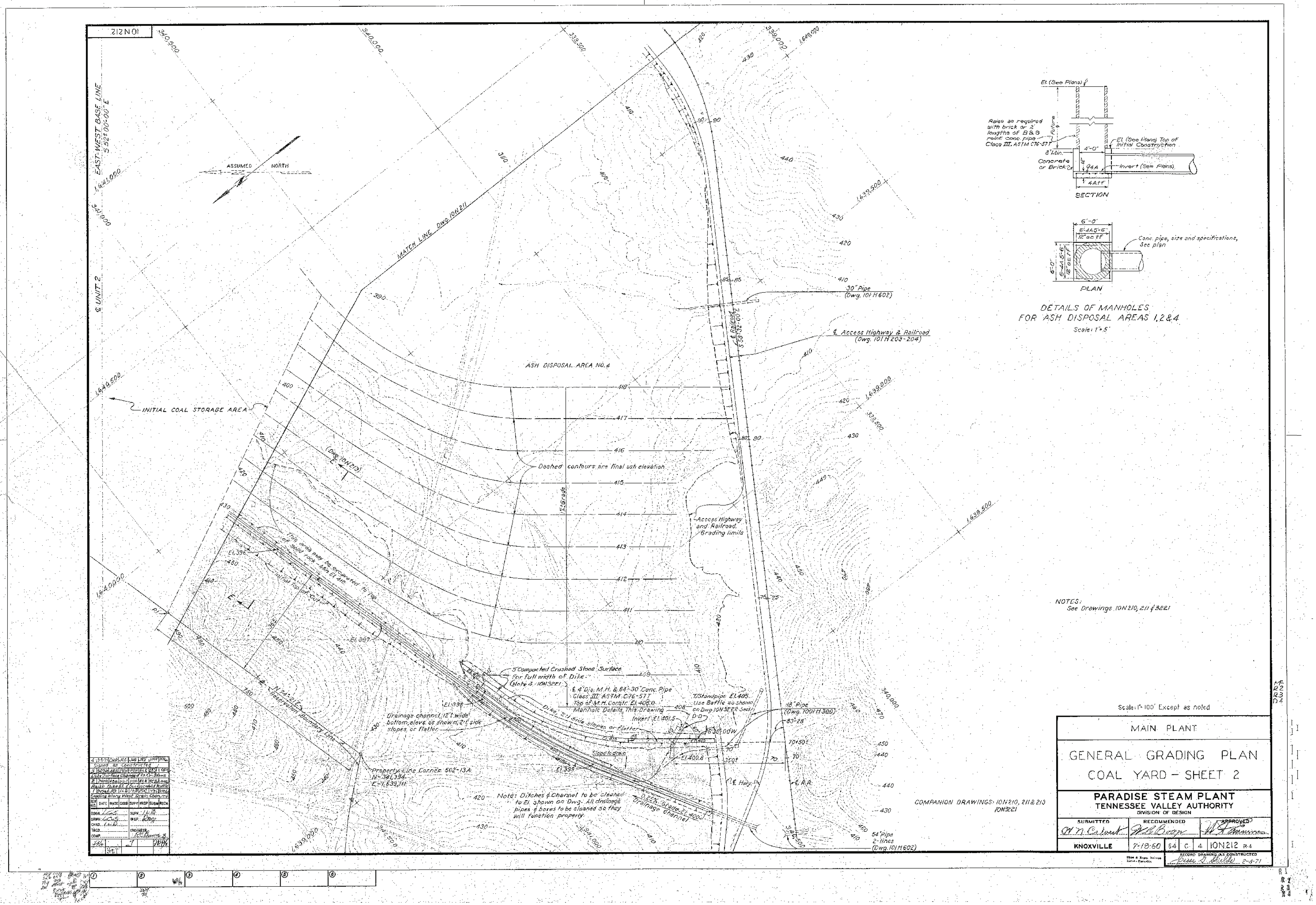
COAL YARD-SHEET 1

PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

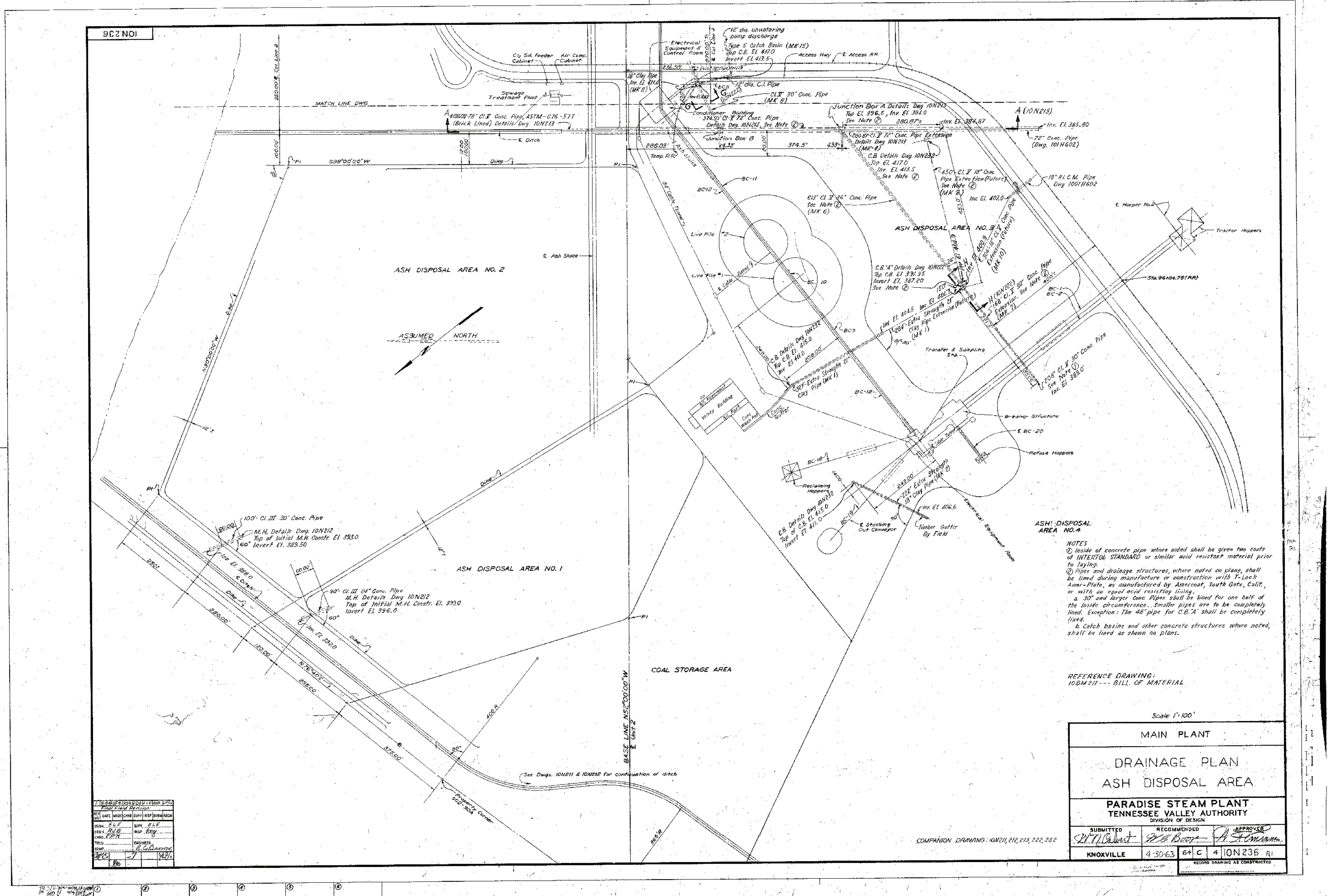
SUBMITTED	RECOMMENDED	APPROVED
W. N. Calvert	W. C. Boop	W. F. Emmons

KNOXVILLE	5-6-60	64	C	4	10N211 R8

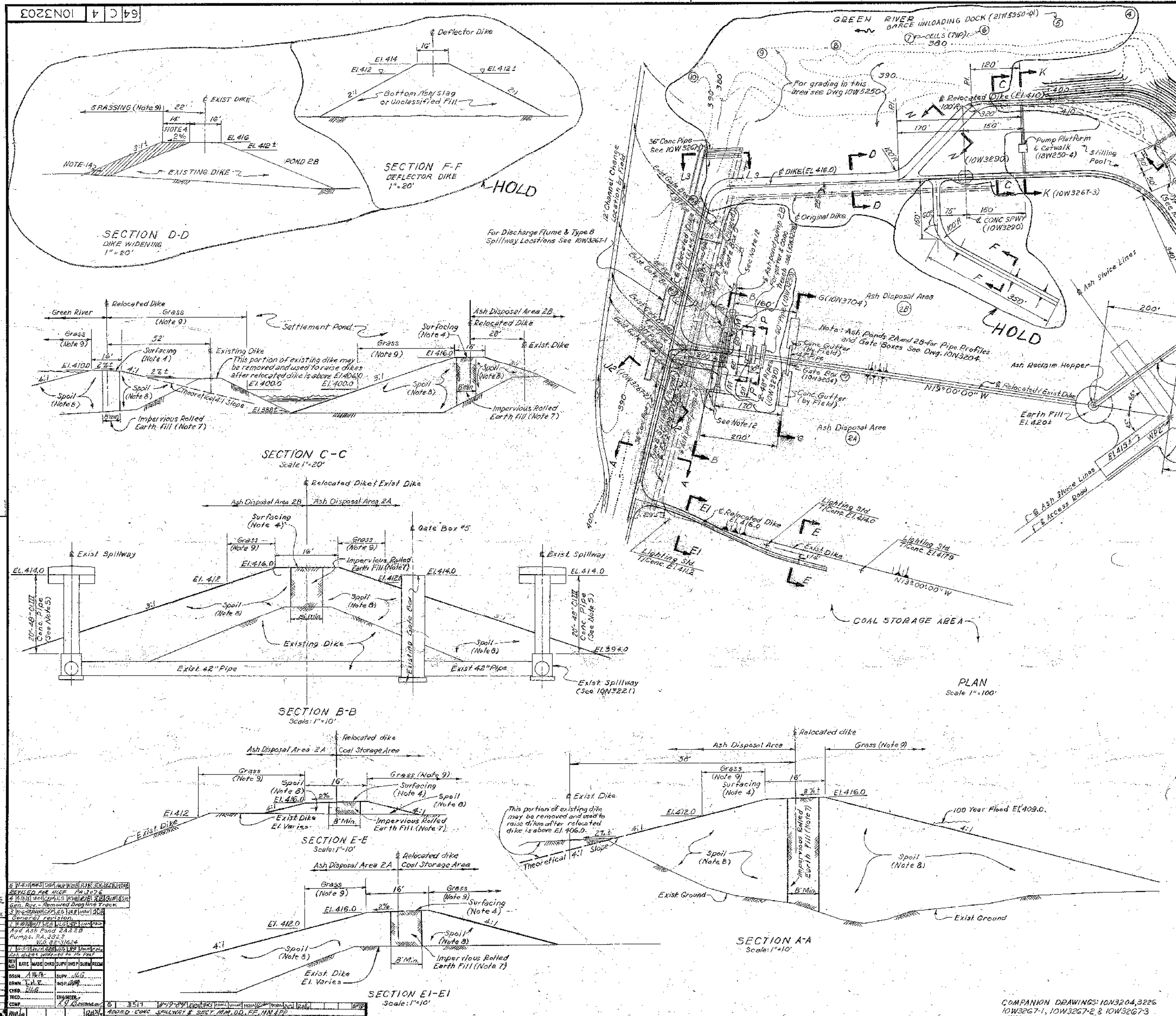
RECORD DRAWING AS CONSTRUCTED



PAF-10N212-SHT -REV 4 MAIN PLANT GENERAL GRADING PLAN COAL YARD - SHEET 2 (36% of Scale); Paradise - Slag Ponds 2A and 2B; 1-27-2009 15-21-19; 2/9/2009 04:20 PM



PAF-10N236-SHT -REV 1 MAIN PLANT DRAINAGE PLAN ASH DISPOSAL AREA (36% of Scale); Paradise - Slag Ponds 2A and 2B; 1-27-2009 15-21-19; 2/9/2009 04:20 PM



NOTES:

1. All work to be done in accordance with the T-1 Specifications.
2. Concrete shall be Class A, per Section 400, except as noted.
3. Reinforcing Steel to have 3 inches clear cover.
4. Surfacing for relocated dikes shall be 4 inches of crushed stone, per section 305, for full width of dike.
5. All pipe shall be Class III Concrete. Standpipes to be raised to El. 414.0 with 2 foot sections of concrete pipe.
6. Dike foundation shall have all weak surface soils removed to material that will easily bear the weight of loaded rubber-tired earth hauling equipment.
7. All dikes are to have a core of impervious rolled earth fill, well compacted with sheepsfoot rollers in layers of 6" compacted thickness.
8. The shells of the dikes are to be of local strip mine spoil. It is to be well compacted in layers with heavy rubber tired equipment. Rolling procedures are to be controlled to assure full coverage over the entire fill layer, from slope to slope. The rolling equipment should be as heavy as will compact the material with little lateral surface movement. Application of water may help compaction. Existing dike surfaces to be covered by fill are to be scarified and rolled with the adjacent fill to provide good bond. Test fills are to be made to determine the thickest layer that can be well compacted, as outlined in the memorandum from Parrish to Farmer dated July 1, 1970.
9. Outside slopes of dikes and other areas as indicated shall be seeded with Type G Mixture E. All grassed areas are to be fertilized and mulched in accordance with sections 580 and 582 respectively.
10. Gate Boxes and Spillways shall be set at 90° angles with the pipes.
11. The location of anchor bolts for the Drainage Gates, stem guides and wall brackets for the lifts shall be taken from the manufacturer's drawings.
12. Spillways from ash disposal areas 2A & 2B to the channel north of the disposal areas shall be used for emergency discharges only. These spillway crests shall be raised to minimum elevation 414. Skimmers shall remain on these spillways.
13. For additional notes see 10W3267-2.
14. Fill to be excavated material from river slope repair, 1984, and equipment compacted to enhance stability.

Scale: as noted

YARD

ASH DISPOSAL AREAS 2A & 2B
GENERAL PLAN & SECTIONS
FOR RAISING DIKES

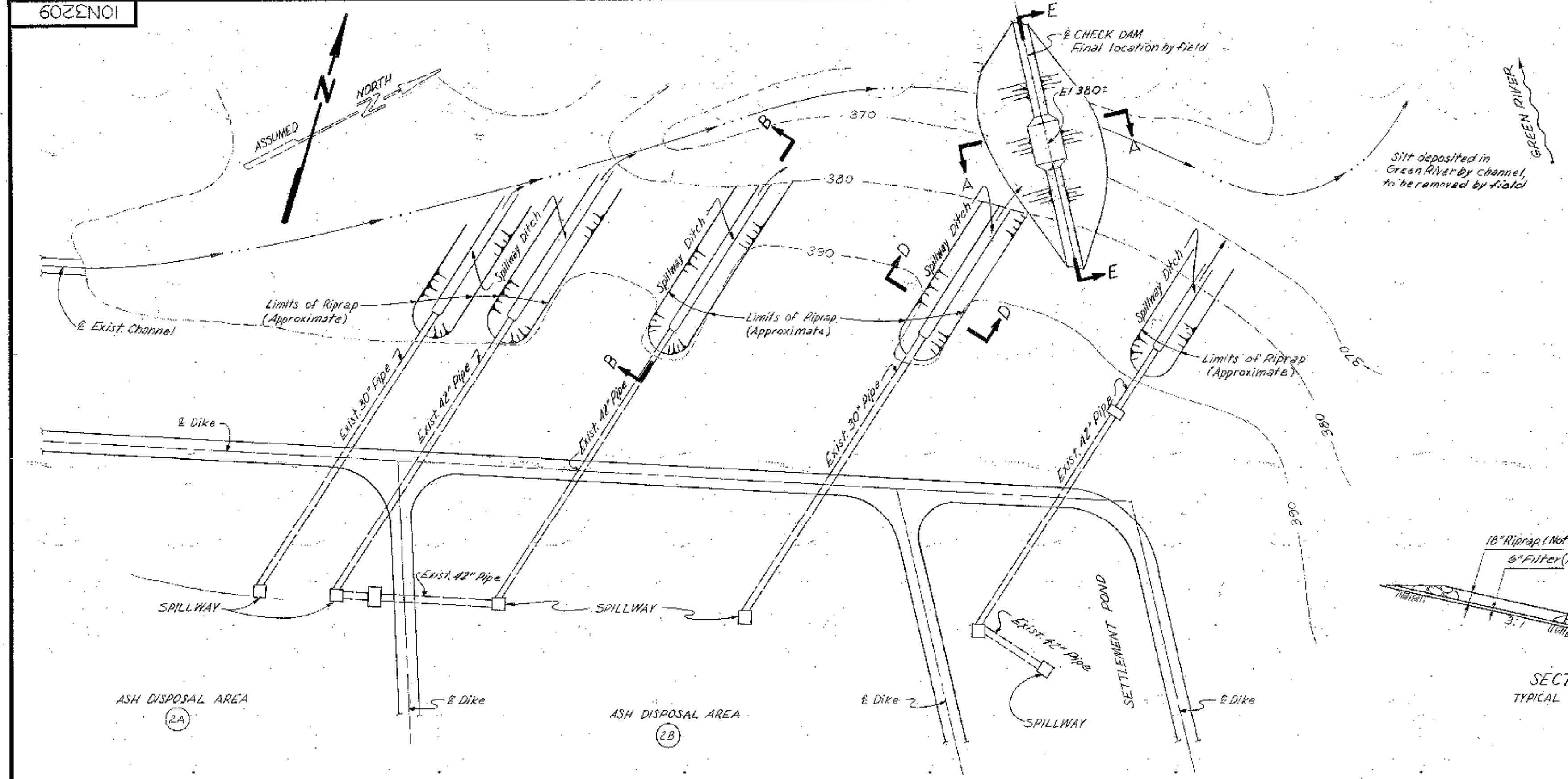
PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED

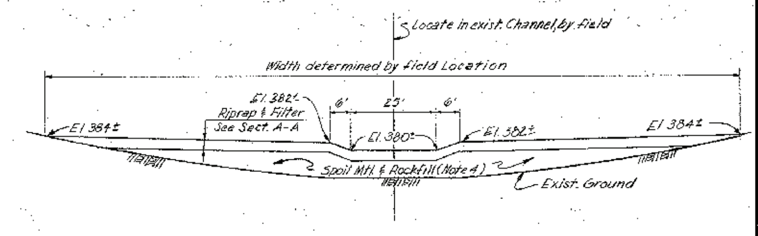
KNOXVILLE 7-13-70 64 C 4 10N3203 R6

RECORD DRAWING AS CONSTRUCTED

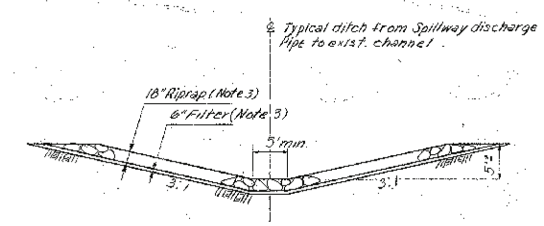
10N3209



PLAN



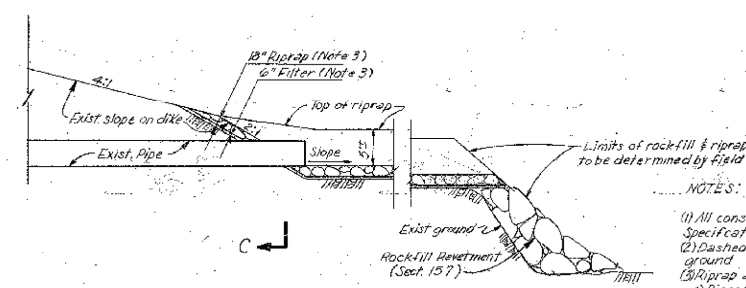
SECTION E-E
Scale 1"=20'



SECTION D-D
TYPICAL DITCH SECTION
Scale 1"=10'

APPROXIMATE QUANTITIES

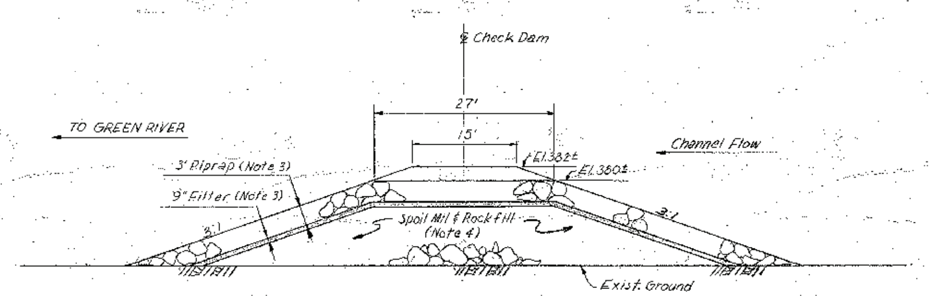
ITEM NO	DESCRIPTION	QUANTITY
157	Rockfill Revetment	1000 C.Y
830	Riprap	3250 C.Y
836	Filter	1550 Tons
	Spoil Mtl. & Rockfill	2500 C.Y.



SECTION B-B
TYPICAL RIPRAP SECTION AT PIPE OUTLETS
Scale 1"=10'

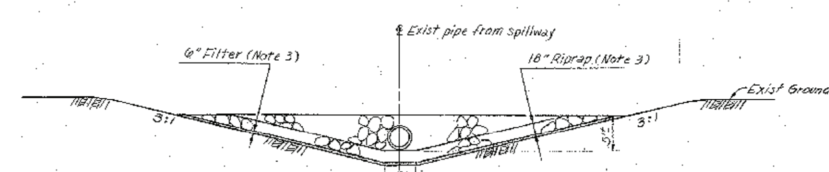
NOTES:

(1) All construction to be in accordence with the T-1 Specifcations, except as noted.
(2) Dashed contours indicate approximate existing ground
(3) Riprap and filter, per Section 830 & 836 respectively
a.) Riprap for check dam to be 3' thick with a minimum of 50% of riprap, by weight, consisting of stones of at least 400 pounds each.
b.) Riprap for ditches from spillway discharge pipes to be 18" thick with a minimum of 50% of riprap, by weight, consisting of stones of at least 200 pounds each.
(4) The core of the check dam shall be constructed with spoil material and rock fill. Compaction is to be obtained by the operation of the hauling equipment and tractors over the check dam as it is constructed. Compaction shall begin at the lowest practical elevation for the operation of the equipment.



SECTION A-A
Scale 1"=10'

Scale 1"=50'
except as noted



SECTION C-C
Scale 1"=10'

YARD

ASH PONDS 2A & 2B
CHECK DAM & RIPRAP
FOR SPILLWAY OUTLETS

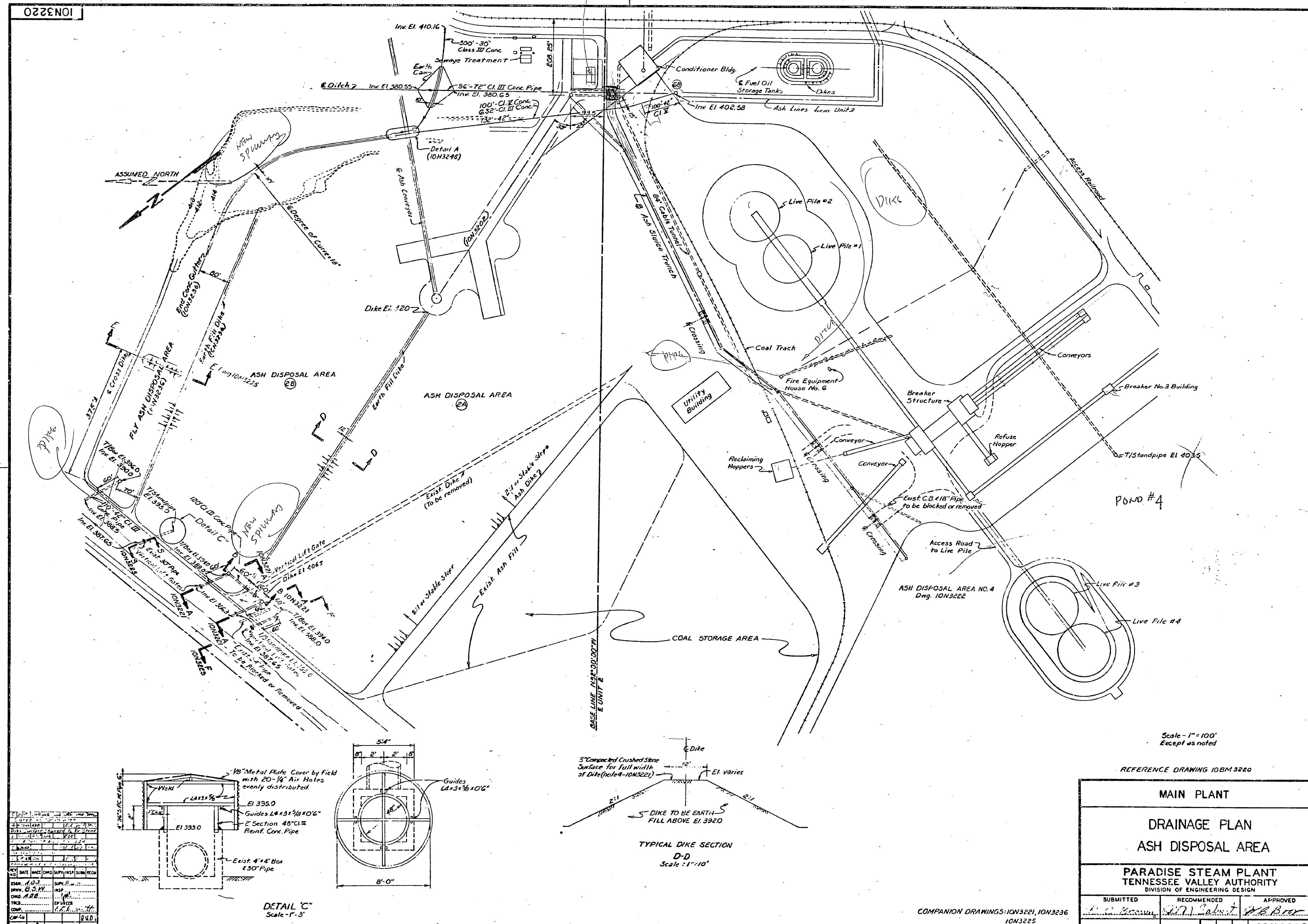
PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

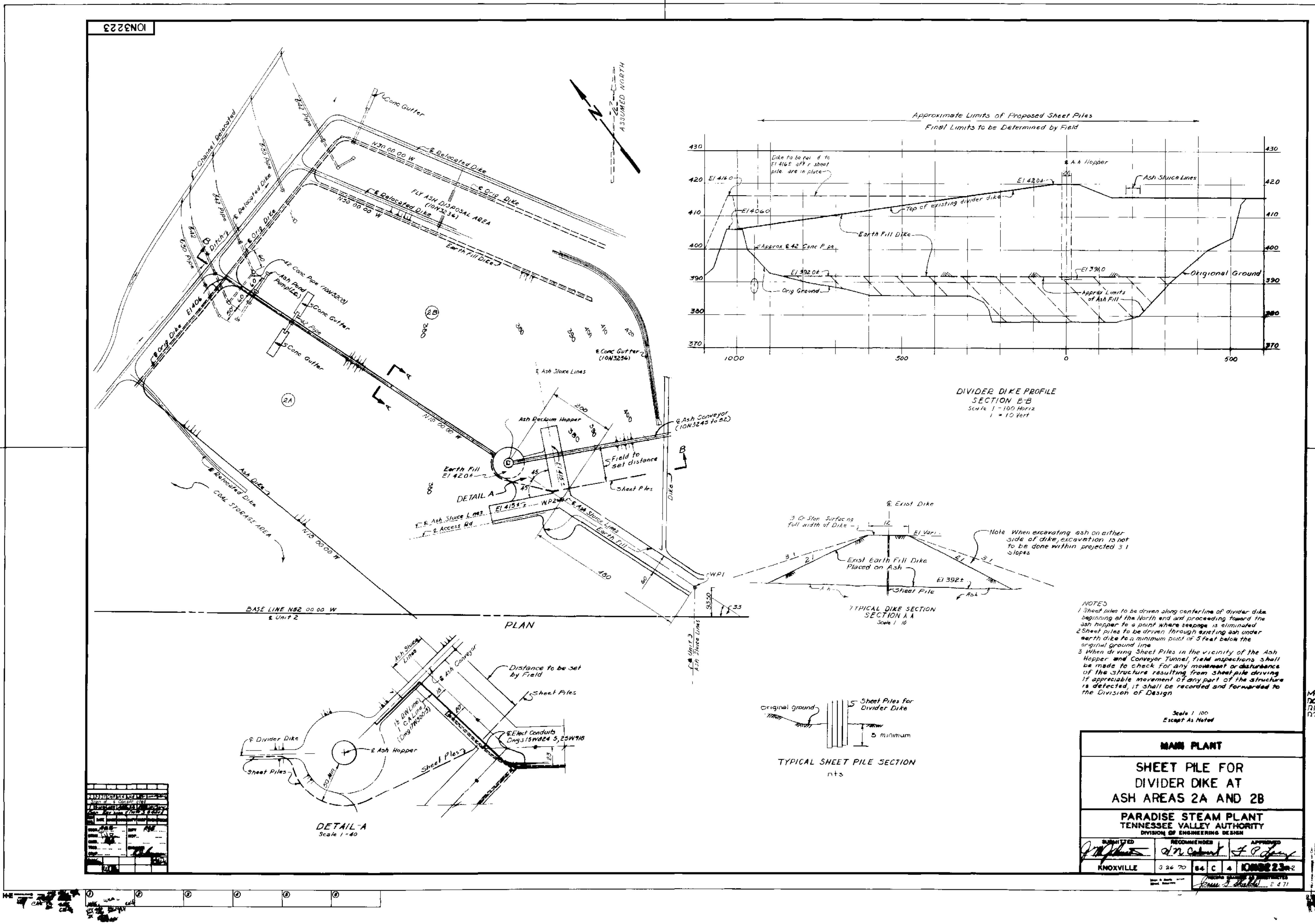
SUBMITTED	RECOMMENDED	APPROVED
J. M. Nelson	Frank D. [illegible]	[illegible]

KNOXVILLE	8-3-'71	64	C	4	10N3209R0

RECORD DRAWING AS CONSTRUCTED

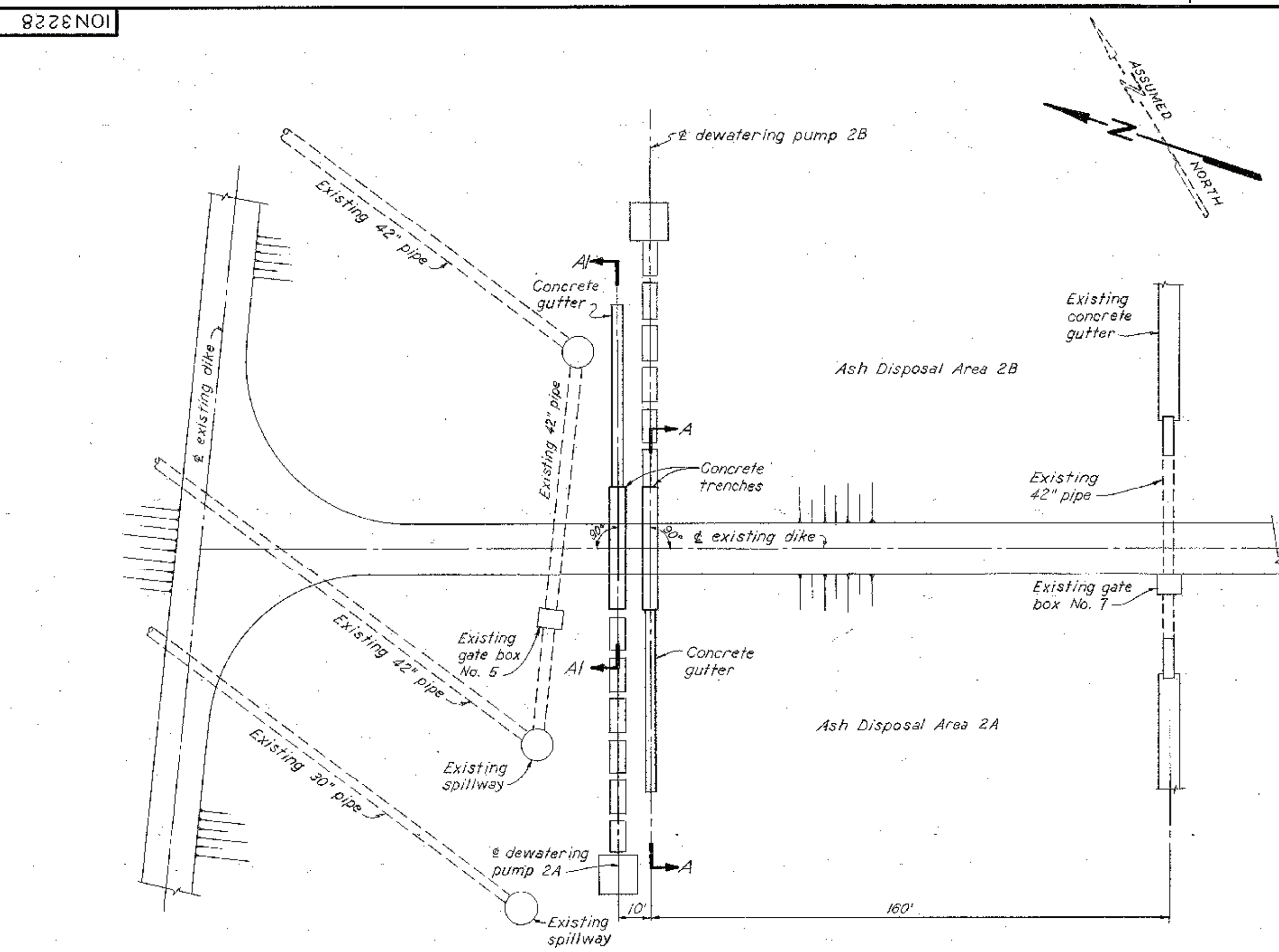
PAF-10N3209-SHT -REV 0 YARD ASH PONDS 2A & 2B CHECK DAM & RIPRAP FOR SPILLWAY OUTLETS (36% of Scale); Paradise - Slag Ponds 2A and 2B; 1-27-2009 15-21-19; 2/9/2009 04:20 PM


10N3220
ASSUMED NORTH
Inv. El. 410.16
300'-30" Class III Conc.
Sewage Treatment
Earth Canal
Ditch
Inv. El. 380.55
36"-72" Cl. III Conc. Pipe
Inv. El. 380.65
100'-Cl. V Conc.
632'-Cl. III Conc.
Detail A (10N3248)
Degree of Curve = 18°
Ash Conveyor
Dike El. 420
Earth Fill Dike
Cross Dike
FLY ASH DISPOSAL AREA
End Conc. Gutters (10N3236)
ASH DISPOSAL AREA 2B
ASH DISPOSAL AREA 2A
NEW SPILLWAY
Dike
Detail "C"
120" Cl. III Conc. Pipe
Vertical Lift Gate
Dike El. 396.5
Exist. Dike (To be removed)
2:1 or Stable Slope Ash Dike
Exist. Ash Fill
2:1 or Stable Slope
COAL STORAGE AREA
BASE LINE N48°20'00"W, & UNIT 8
Conditioner Bldg.
Fuel Oil Storage Tanks
Dikes
Inv. El. 402.58
Ash Lines from Unit 9
Access Railroad
Live Pile #2
Live Pile #1
8" Cable Tunnel
Ash Sluice Trench
Crossing
Coal Track
Fire Equipment House No. 6
Utility Building
Conveyors
Breaker Structure
Breaker No. 3 Building
Refuse Hopper
T/Standpipe El. 403.5
Conveyor
Reclaiming Hoppers
Exist. C.B. & 18" Pipe to be blocked or removed
Access Road to Live Pile
POND #4
ASH DISPOSAL AREA NO. 4 Dwg. 10N3222
Live Pile #3
Live Pile #4
Scale - 1" = 100' Except as noted
REFERENCE DRAWING 10BM3220
1/8" Metal Plate Cover by field with 20-1/4" Air Holes evenly distributed
Weld
El. 395.0
Guides L4×3×5/16×0'6"
Z Section 48" Cl. III Reinf. Conc. Pipe
El. 393.0
Exist. 4'×4' Box & 30" Pipe
DETAIL "C" Scale - 1" = 3'
5'-4"
8'-0"
Dike
3" Compacted Crushed Stone Surface for full width of Dike (note 4-10N3221)
El. varies
DIKE TO BE EARTH FILL ABOVE El. 392.0
TYPICAL DIKE SECTION D-D Scale: 1" = 10'
COMPANION DRAWINGS: 10N3221, 10N3236, 10N3225
MAIN PLANT
DRAINAGE PLAN
ASH DISPOSAL AREA
PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN
SUBMITTED
RECOMMENDED
APPROVED
KNOXVILLE
7-5-67
10N3220R5
RECORD DRAWING AS CONSTRUCTED



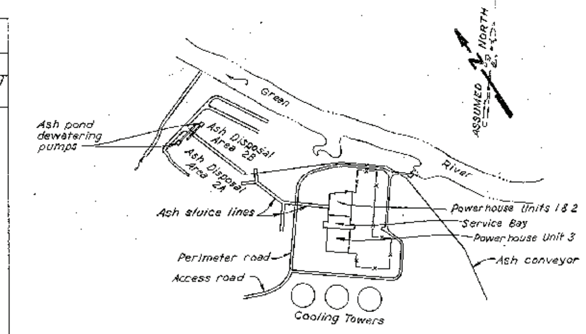
PAF-10N3223-SHT -REV 2 MAIN PLANT SHEET PILE FOR DIVIDER DIKE AT ASH AREAS 2A & 2B (37% of Scale); Paradise - Slag Ponds 2A and 2B; 1-27-2009 15-21-19; 2/9/2009 04:20 PM

10N3228

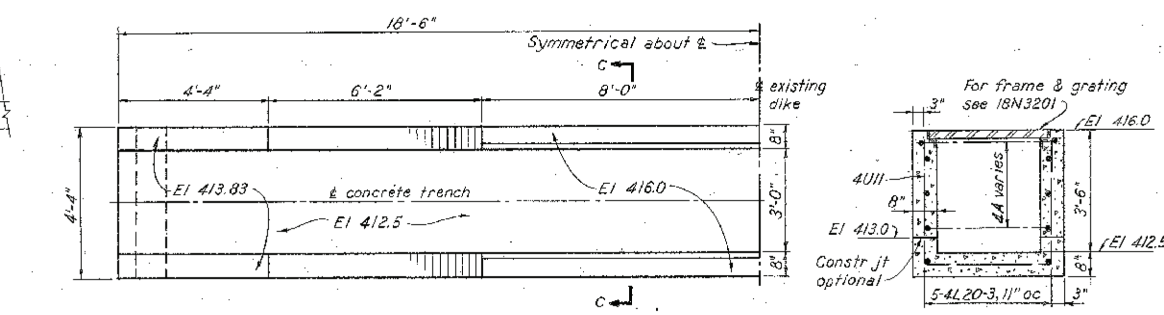


PLAN
Scale 1"=20'

REINFORCEMENT SCHEDULE									
ITEM	LOCATION	MARK	NO. UNITS	PER UNIT	TOTAL REQD	BENDING DIMENSIONS a	b	c	WEIGHT
1	Sect C-C	4L20-3	4	5	20	ex	19-3		270
2	Elevation	4A19-6	2	2	4				52
3	"	4A19-3	4	2	8				102
4	"	4A16-6	2	2	4				44
5	"	4A13-9	4	2	8				74
6	"	4U11	4	8	32	3-7	3-10	ex	234
7	"	4U10-3	4	2	8	3-2	3-10	ex	55
8	"	4U9-3	4	2	8	2-8	3-10	ex	50
9	"	4U7-6	4	2	8	1-10	3-10	ex	40
10	"	4U6-9	4	5	20	1-6	3-10	ex	92
11	"	4A3-9	4	1	4				10

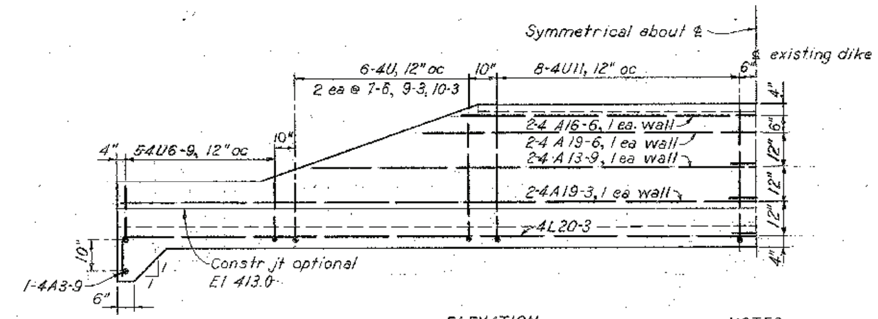


KEY PLAN
Not to scale



PART PLAN

SECTION C-C

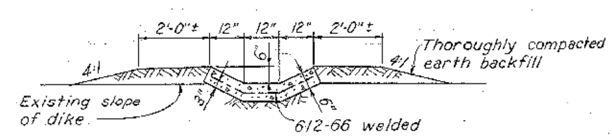


ELEVATION

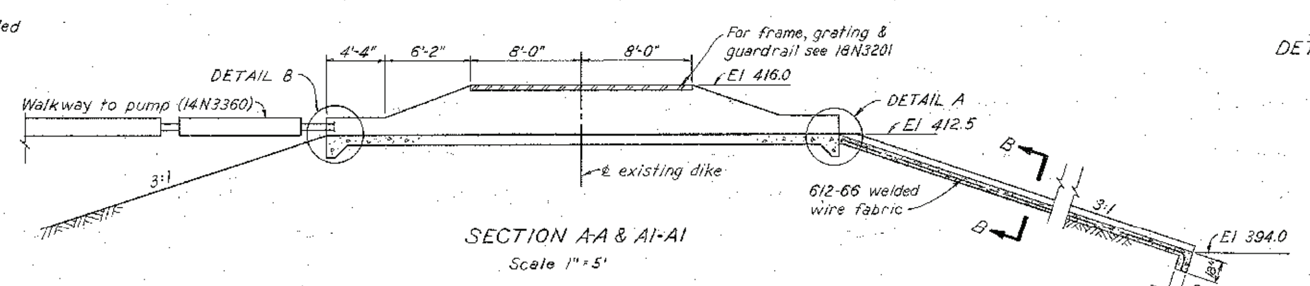
DETAIL FOR CONCRETE TRENCH
2 REQUIRED
Scale ½"=1'-0"

NOTES:
1. All work to be done in accordance with the T-1 Specifications except as noted.
2. All concrete shall be class 300.75 AFW in accordance with Construction Specification G-2.
3. All exposed concrete corners shall be ¼" radius tooled.
4. Welded wire fabric shall conform to ASTM Specification A-185, plain finish, and shall have a minimum lap distance of 8".
5. Reinforcing bars shall conform to the latest ASTM Specification A-615, Grade 60.
6. All dimensions relative to reinforcing are to the center of the reinforcement.

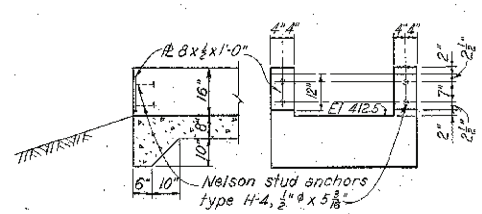
Scale as noted



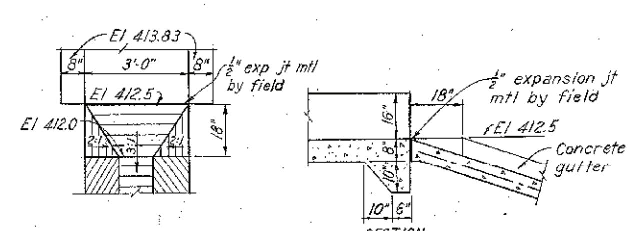
SECTION B-B
Scale ½"=1'-0"



SECTION A-A & A1-A1
Scale 1"=5'



SECTION END ELEVATION
DETAIL B
PUMP SIDE
Scale 1"=1'-0"



PLAN SECTION
DETAIL A
GUTTER SIDE
Scale 1"=1'-0"

P.A. 2823, W.O. 82-31624

REFERENCE DRAWINGS:
10BM3228 BILL OF MATERIAL
30B510 REINFORCEMENT BENDING DIAGRAM

YARD
ASH DISPOSAL AREAS 2A & 2B
CONCRETE TRENCH & GUTTER
FOR DEWATERING PUMPS

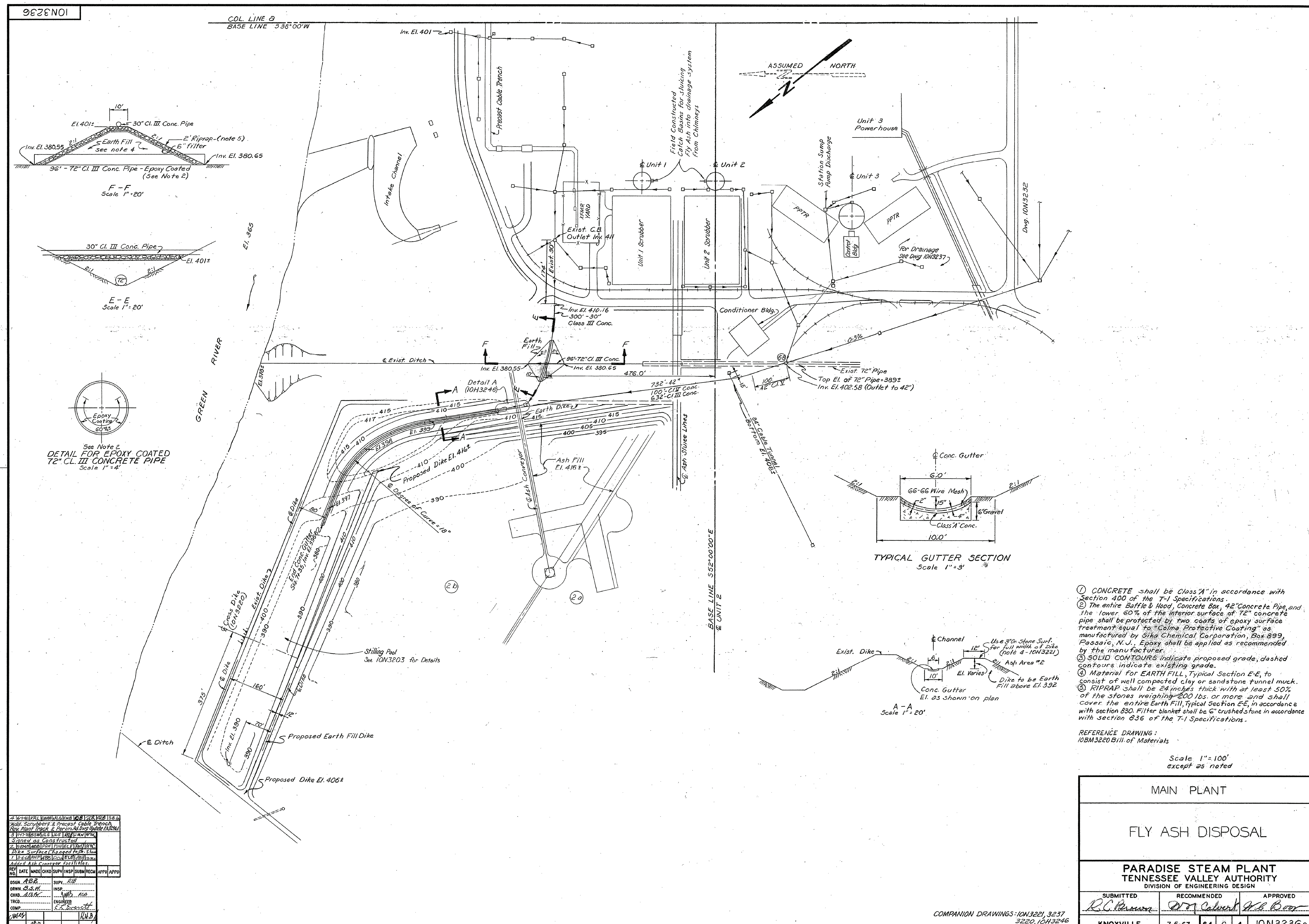
PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED
J. M. Nelson	[illegible]	[illegible]

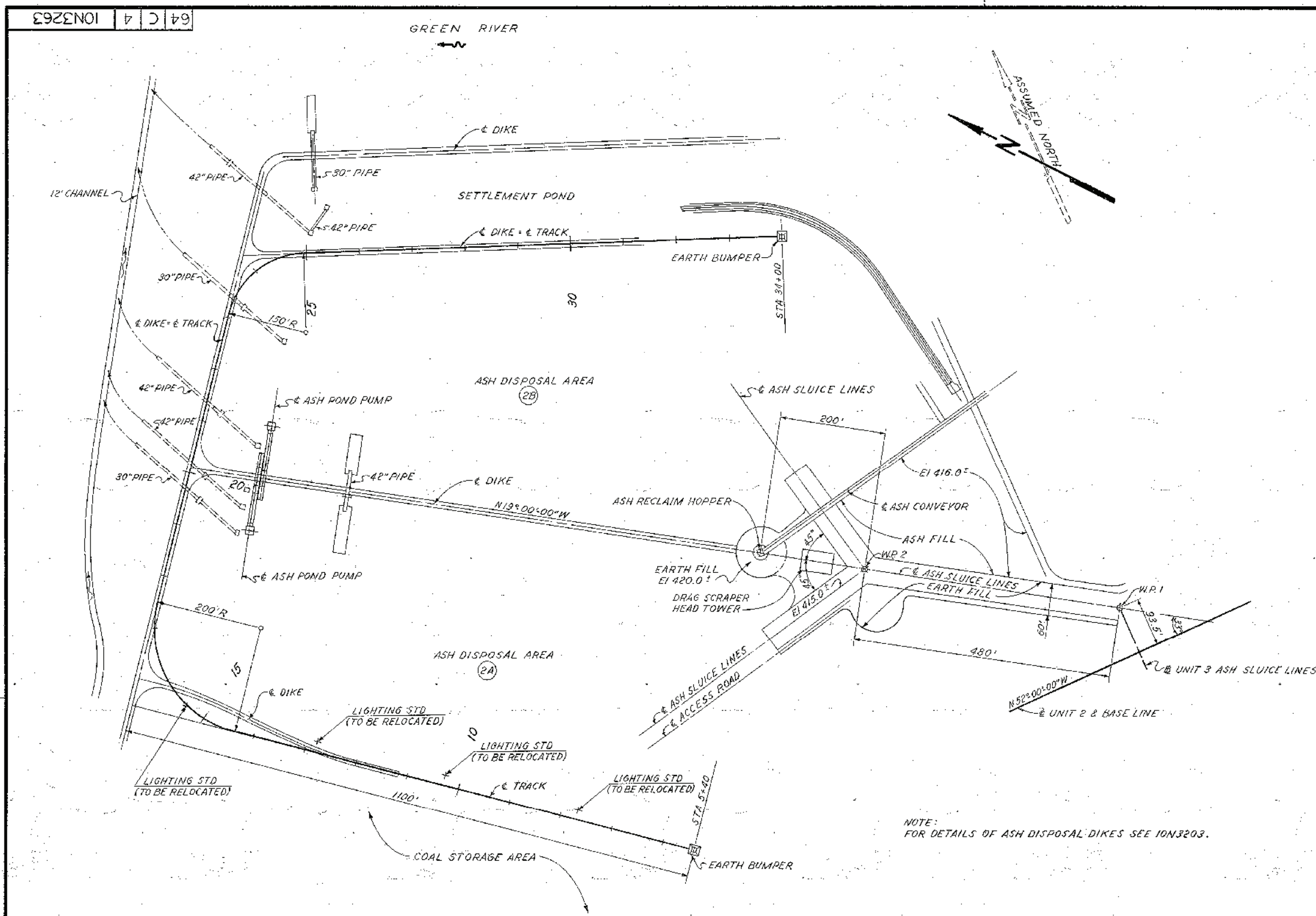
KNOXVILLE 3-31-72 | 64 | C | 4 | 10N3228 | R0

RECORD DRAWING AS CONSTRUCTED

PAF-10N3228-SHT -REV 0 YARD ASH DOSPOSAL AREAS 2A & 2B CONCRETE TRENCH & GUTTER FOR DEWATERING PUMPS (36% of Scale); Paradise - Slag Ponds 2A and 2B; 1-27-2009 15-21-19; 2/9/2009 04:20 PM

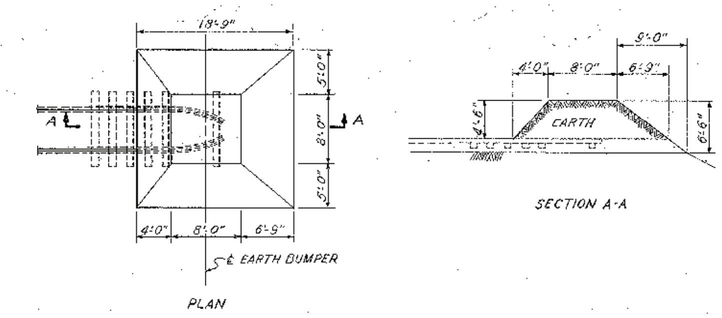


10N3236
COL. LINE 8
BASE LINE S38°00'W
ASSUMED NORTH
Inv. El. 401
Precast Cable Trench
Field Constructed Catch Basins for draining Fly Ash into drainage system from Chimneys
Unit 3 Powerhouse
℄ Unit 1
℄ Unit 2
℄ Unit 3
Station Sump Pump Discharge
Unit 1 Scrubber
Unit 2 Scrubber
PPTR
Control Bldg.
For Drainage See Dwg. 10N3237
Dwg. 10N3232
Exist. C.B. Outlet Inv. 411
Intake Channel
Conditioner Bldg.
Inv. El. 410.16
300'-30" Class III Conc.
Earth Fill
96"-72" Cl. III Conc.
Inv. El. 380.55
Inv. El. 380.65
℄ Exist. Ditch
476.0'
732'-42"
100'-Cl. IV Conc.
632'-Cl. III Conc.
Exist. 72" Pipe
Top El. of 72" Pipe = 389±
Inv. El. 402.58 (Outlet to 42")
Detail A (10H3246)
Earth Dike
Ash Fill El. 416±
Proposed Dike El. 416±
℄ Ash Conveyor
℄ Ash Sluice Lines
84' Cable Tunnel Bottom El. 406±
BASE LINE S52°00'00"E ℄ UNIT 2
GREEN RIVER
El. 365
Stilling Pool See 10N3203 for Details
Proposed Earth Fill Dike
Proposed Dike El. 406±
℄ Ditch
℄ Dike
Cross Dike (10N3220)
Exist. Dike
End Conc. Gutter
℄ Degree of Curve = 18°
Inv. El. 390
El. 401±
30" Cl. III Conc. Pipe
Earth Fill see note 4
2' Riprap-(note 5)
6" filter
Inv. El. 380.55
Inv. El. 380.65
96"-72" Cl. III Conc. Pipe - Epoxy Coated (See Note 2)
F-F
Scale 1"=20'
30" Cl. III Conc. Pipe
E-E
Scale 1"=20'
Epoxy Coating
See Note 2
DETAIL FOR EPOXY COATED 72" CL. III CONCRETE PIPE
Scale 1"=4'
℄ Conc. Gutter
6.0'
66-66 Wire Mesh
6" Gravel
Class "A" Conc.
10.0'
TYPICAL GUTTER SECTION
Scale 1"=5'
℄ Channel
Exist. Dike
Use 8" Cr. Stone Surf. for full width of Dike (note 4 - 10N3221)
Ash Area #2
El. Varies
Dike to be Earth Fill above El. 392
Conc. Gutter El. as shown on plan
A-A
Scale 1"=20'
① CONCRETE shall be Class "A" in accordance with Section 400 of the T-1 Specifications.
② The entire Baffle & Hood, Concrete Box, 42" Concrete Pipe, and the lower 60% of the interior surface of 72" concrete pipe shall be protected by two coats of epoxy surface treatment equal to "Colma Protective Coating" as manufactured by Sika Chemical Corporation, Box 899, Passaic, N.J. Epoxy shall be applied as recommended by the manufacturer.
③ SOLID CONTOURS indicate proposed grade, dashed contours indicate existing grade.
④ Material for EARTH FILL, Typical Section E-E, to consist of well compacted clay or sandstone tunnel muck.
⑤ RIPRAP shall be 24 inches thick with at least 50% of the stones weighing 200 lbs. or more and shall cover the entire Earth Fill, Typical Section E-E, in accordance with section 830. Filter blanket shall be 6" crushed stone in accordance with section 836 of the T-1 Specifications.
REFERENCE DRAWING:
10BM3220 Bill of Materials
Scale 1"=100' except as noted
Added Scrubbers & Precast Cable Trench
Signed as Constructed
Dike Surface Changed
Added Ash Conveyor Facilities.
REV NO. | DATE | MADE | CHKD | SUPV | INSP | SUBM | RECM | APPD | APPD
DSGN. | DRWN. | CHKD. | TRCD. | COMP. | SUPV. | INSP. | ENGINEER
COMPANION DRAWINGS: 10N3221, 3237, 3220, 10H3246
MAIN PLANT
FLY ASH DISPOSAL
PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN
SUBMITTED
RECOMMENDED
APPROVED
KNOXVILLE
7-5-67
64 C 4
10N3236 R4
RECORD DRAWING AS CONSTRUCTED



NOTE:
FOR DETAILS OF ASH DISPOSAL DIKES SEE 10N3203.

PLAN
SCALE 1" = 100'

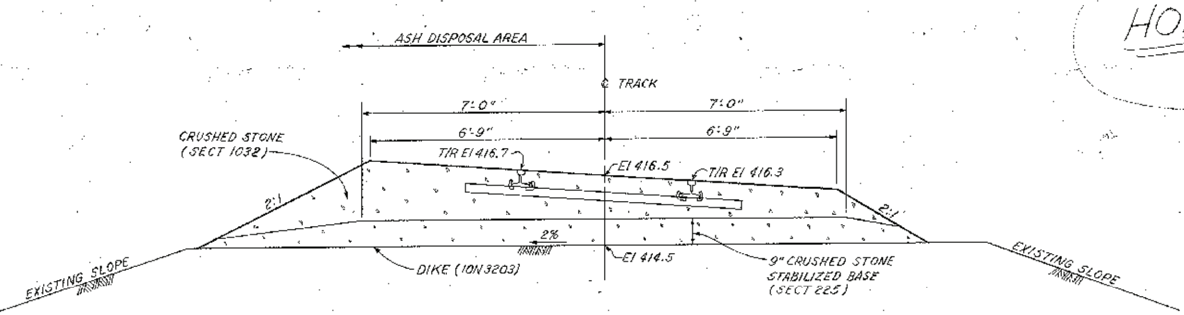


EARTH BUMPER
NTS

LENGTH OF PROJECT	
END OF PROJECT	34+00
BEGINNING OF PROJECT	5+40
NET LENGTH - LIN. FT.	2860
NET LENGTH MILES	0.54

NOTES:
1. ALL WORK SHALL BE IN ACCORDANCE WITH HIGHWAY SPECIFICATION T-1 EXCEPT AS NOTED.
2. RAILWAY TRACK AND STRUCTURES SHALL BE FOSTERAIL FASTRACK AS MFD. BY THE L.B. FOSTER COMPANY, SEVEN PARKWAY CENTER, PITTSBURG, PA. 15220, OR EQUAL.
3. ALL RAIL SHALL BE NEW AND COMPARABLE TO 100 LB. A.R.E.A RAIL.
4. FOR TRACK GAGE SEE 10H3702.

HOLD - NOT TO BE ISSUED FOR CONSTRUCTION



TYPICAL SECTION
TRACK FOR DRAGLINE
SCALE 1" = 2'

REFERENCE DRAWINGS:
10BM3263 ____ BILL OF MATERIAL

SCALE AS NOTED

COMPANION DRAWING: 10N3203

YARD

ASH DISPOSAL AREAS 2A & 2B
DRAGLINE TRACK
FOR ASH RECLAMATION

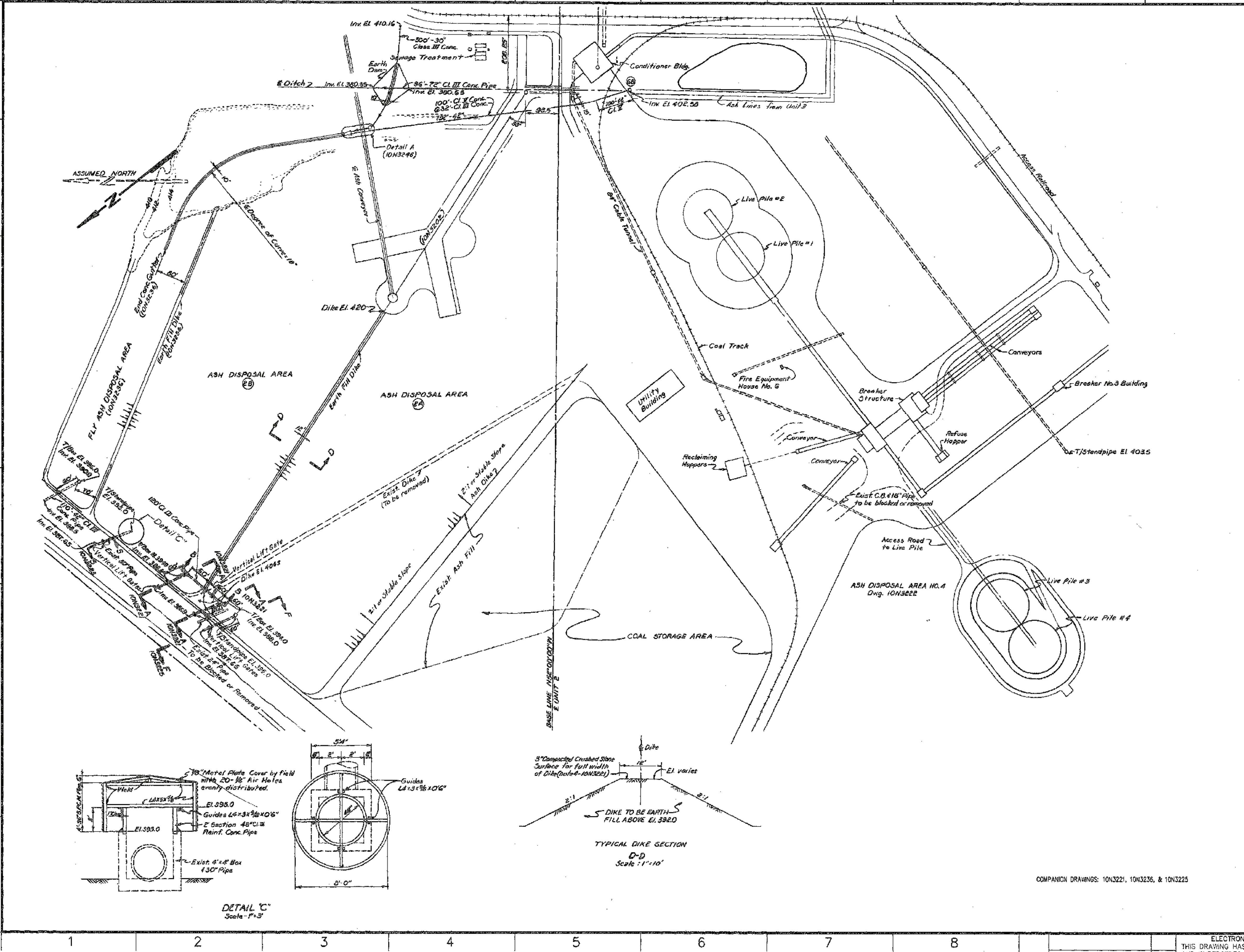
PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED
J. M. Nelson	[signature]	[signature]

KNOXVILLE 10-11-72 64 C 4 10N3263 R0

RECORD DRAWING AS CONSTRUCTED

DRAWN J.K. Fox



REFERENCE DRAWING: 10BM3220

COMPANION DRAWINGS: 10N3221, 10N3236, & 10N3225

PROJECT REVISION HISTORY

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R6			GCL	JLG	JLG	KWB	RGJ	WDH	423G	
SUPERSEDED BY 10W3220 R7.										
R5	3-3-71		CHR	PDH	PDH	ELE	JMH	WNC		
SIGNED AS CONSTRUCTED.										
R4	5-27-69		ABB	PDH	PDH	ELE	JMH	WNC		
DIKE SURFACE CHANGED TO CRUSHED STONE.										
R										
R 7	2-21-95		GCL	JLG	JLG	KWB	RGJ	WDH	423G	
REVISED FOR UNIT 3 FUEL OIL TANK REMOVAL.										

SCALE: 1"=100' EXCEPT AS NOTED

MAIN PLANT

DRAINAGE PLAN
ASH DISPOSAL AREA

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
A.B.B.	B.S.W.	A.B.B.	E.L.EVERETTE	R.C.BROWN	W.N.CALVERT	W.B.BOOP

PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

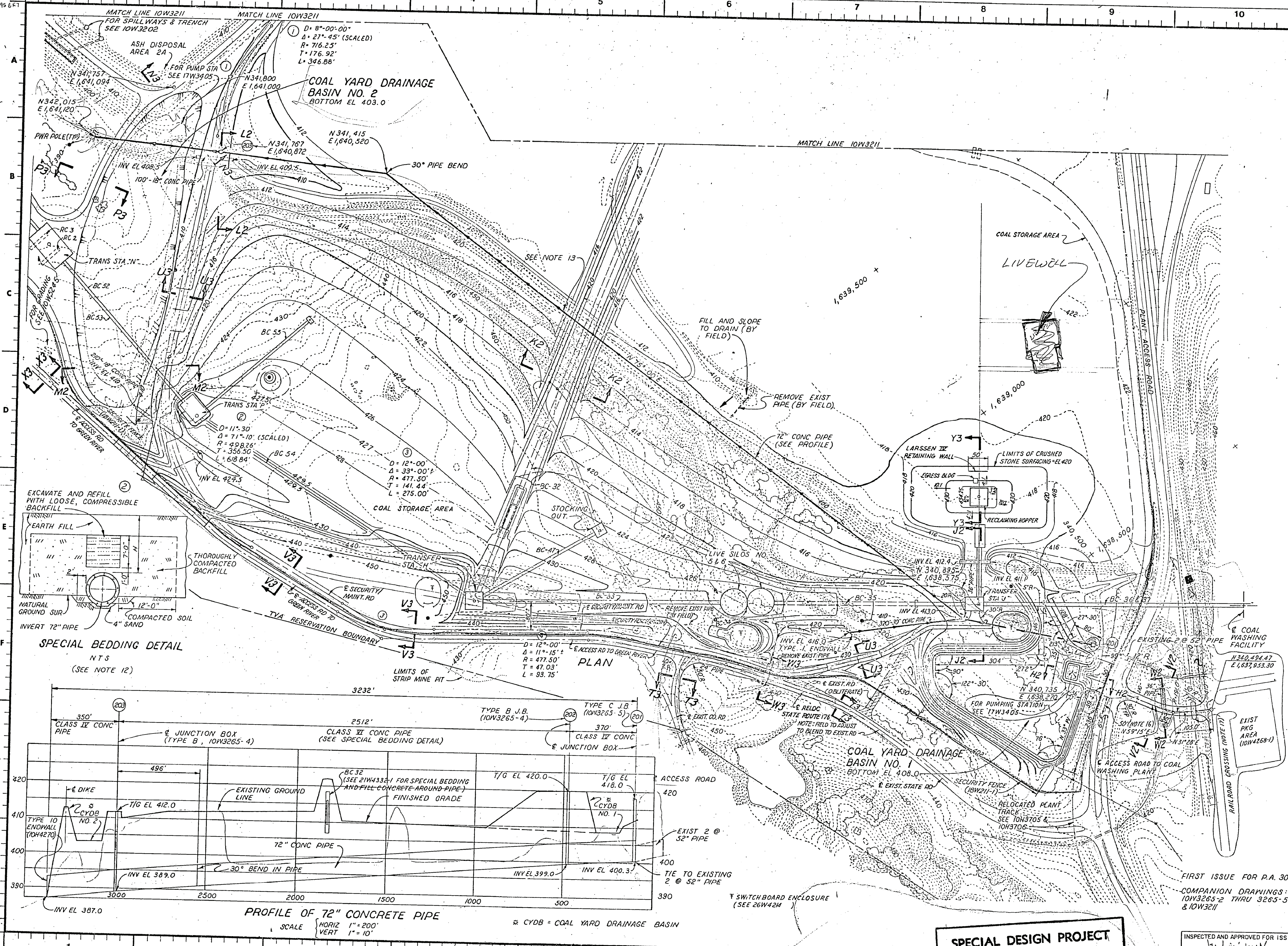
AUTOCAD R12 | DATE 7-5-67 | 64 | C | 10W3220 | R 7

ELECTRONICALLY RESTORED DRAWING
THIS DRAWING HAS BEEN COMPLETELY REDRAWN
AND SUPERSEDES :10N3220 R6

PLOT FACTOR:1=1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.



NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE T-1 SPECIFICATIONS, EXCEPT AS NOTED.
2. DASHED CONTOURS REPRESENT EXISTING GROUND. SOLID CONTOURS REPRESENT FINISHED GRADE.
3. DIKE FOUNDATIONS SHALL HAVE ALL WEAK SURFACE SOILS REMOVED TO MATERIAL THAT WILL EASILY BEAR THE WEIGHT OF LOADED RUBBER-TIRED EARTH HAULING EQUIPMENT.
4. EARTH FILL COMPACTION SHALL BE DONE WITH SHEEPSFOOT ROLLERS AND SHALL BE AT LEAST 95% OF STANDARD MAXIMUM DRY DENSITY. FILL MOISTURE SHALL BE CONTROLLED TO ACHIEVE OPTIMUM COMPACTION.
5. ALL NEW EARTH DIKE SLOPES AND OTHER DISTURBED AREAS SHALL BE SEEDED WITH TYPE 6, MIXTURE 5. ALL GRASSED AREAS TO BE FERTILIZED AND MULCHED IN ACCORDANCE WITH SECTIONS 580 & 582 RESPECTIVELY.
6. PIPE SHALL BE CLASS IV OR CLASS VI AS SHOWN ON PROFILE.
7. FILTER BLANKET, 6 INCHES THICK, SHALL CONFORM TO SECTION 836.
8. CRUSHED STONE SURFACING, 4 INCHES THICK, SHALL BE APPLIED FOR THE FULL WIDTH OF THE COAL YARD DRAINAGE BASIN DIKES IN ACCORDANCE WITH SECTION 210.
9. ROCK FILL REVETMENT SHALL CONFORM TO SECTION 157. AT LEAST 50% OF ROCK FILL SHALL CONSIST OF STONE OF SIZE GREATER THAN ONE SQUARE FOOT.
10. CONCRETE SHALL BE PLACED IN ACCORDANCE WITH GENERAL CONSTRUCTION SPECIFICATION NO. G-2. CONCRETE SHALL BE CLASS 300.75 AFW.
11. ALL REINFORCEMENT SHALL CONFORM TO ASTM SPECIFICATION A615 GRADE 60.
12. THE PIPE SHALL FIRST BE INSTALLED WITH THE REQUIREMENTS OF CLASS B BEDDING. THE FILL IS THEN COMPACTED BESIDE AND OVER THE PIPE TO AN ELEVATION ABOVE THE TOP OF THE PIPE EQUAL TO THE OUTSIDE DIAMETER OF THE PIPE PLUS ONE FOOT. A TRENCH, EQUAL IN WIDTH TO THE OUTSIDE DIAMETER OF THE PIPE, IS NEXT DUG IN THE FILL DIRECTLY OVER THE PIPE DOWN TO AN ELEVATION OF ONE FOOT ABOVE THE TOP OF THE PIPE, KEEPING THE TRENCH SIDES AS NEARLY VERTICAL AS POSSIBLE. THE TRENCH IS THEN REFILLED WITH LOOSE, HIGHLY COMPRESSIBLE SOIL. HAY, STRAW, LEAVES, OR SAWDUST MAY BE USED TO FILL THE LOWER THIRD OF THE TRENCH IF DESIRED. AFTER THE TRENCH BACKFILL IS COMPLETED, THE BALANCE OF THE EARTH FILL SHALL BE CONSTRUCTED BY NORMAL METHODS UP TO THE FINISHED GRADE OF THE EMBANKMENT.
13. KEEP 72" CONC PIPE IN EXISTING CHANNEL WHERE POSSIBLE.

FOR CONTINUATION OF NOTES SEE 10W3265-2

REV NO	ECN NO	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUBM	RECM	APPD
7		[illegible]	RDP	JAT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGRADED FOR RECLAIM HOPPER ENLARGEMENT & ADDED DRAINAGE PIPE. ADDED ACCESS RD TO EXIST COAL WASHING PLANT. PA 3252											
6				VRL							
ADD ADDITIONAL SECURITY FENCE & RELATED ROADS; P.A. 34[illegible]											
5		[illegible]	JAH	[illegible]	JAH			RJB	RJB		
REV. FIN. GRADE AT BC-54 [illegible]											
4		[illegible]									
REV. FIN. GRADE FOR BARGE UNLDNG FACILITY S.O. 90-372											
3		[illegible]		JSB	RDP						
REVISED GRADING AROUND TRANSFER STA. "J" & SWBD ENCLOSURE. S.O. 90-138											
2		11-2?-78	DAV	JSB	DAV	AEH	KWB		RJB		
MINOR REV. TO C.Y.D.B. NO. 1, & SWITCHBOARD ENCLOSURES, AND ADDED GRADING TO ACCESS RD. PA 3262											
1		3-28-?5	DAV	GRO	DAV	AEH	KWB		RJF		
MINOR REV. & ADDED RELOCATED PLANT RAILROAD P.A. 3076											

DSGN D.A. VALENTINE
DRWN J.S. BERRY
CHKD D.A. VALENTINE
SUPV [illegible]
INSP
ENGINEER K.W. Burnett

SCALE: 1" = 100' EXCEPT AS NOTED

MAIN PLANT

GENERAL GRADING PLAN
COAL YARD – SHEET 2

PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

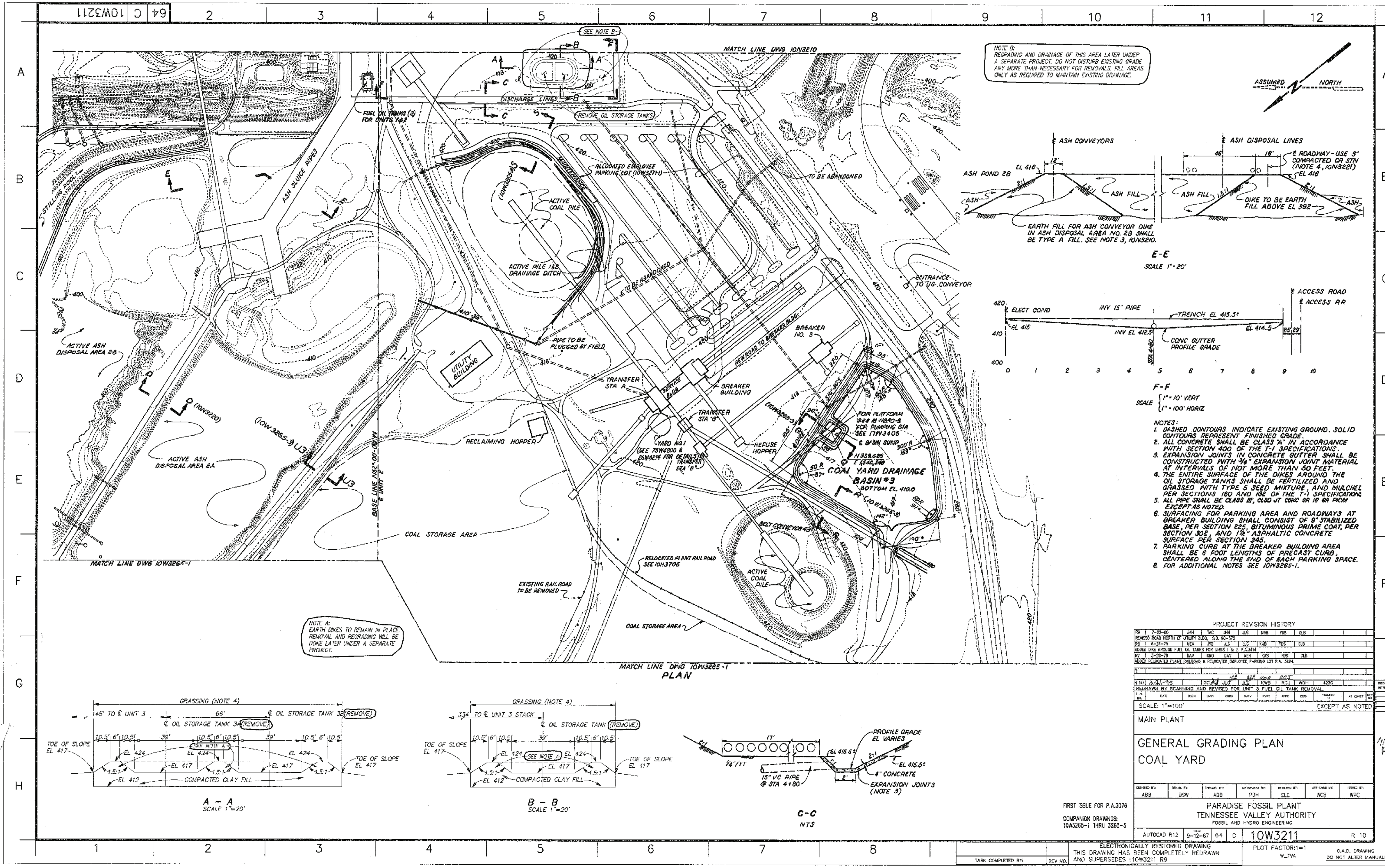
SUBMITTED Robert J. Bouma | RECOMMENDED | APPROVED

INSPECTED AND APPROVED FOR ISSUE

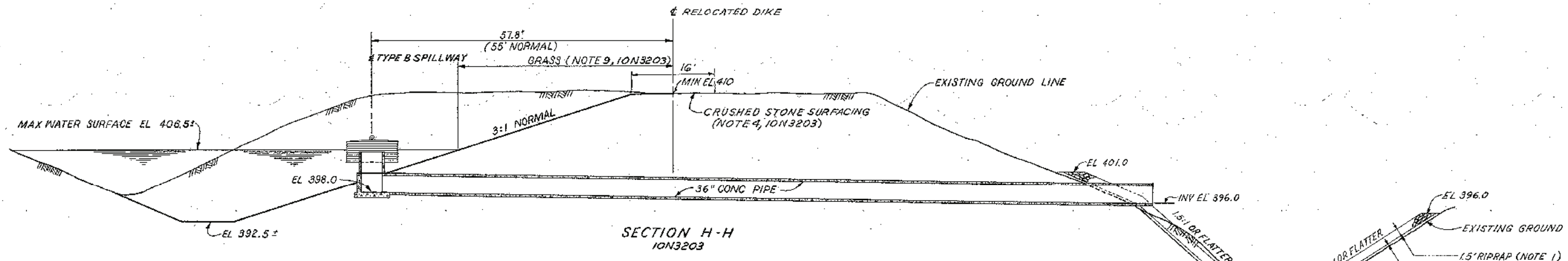
KNOXVILLE 11-4-77 | 54 | C | 10W3265-1 | R7

RECORD DRAWING AS CONSTRUCTED

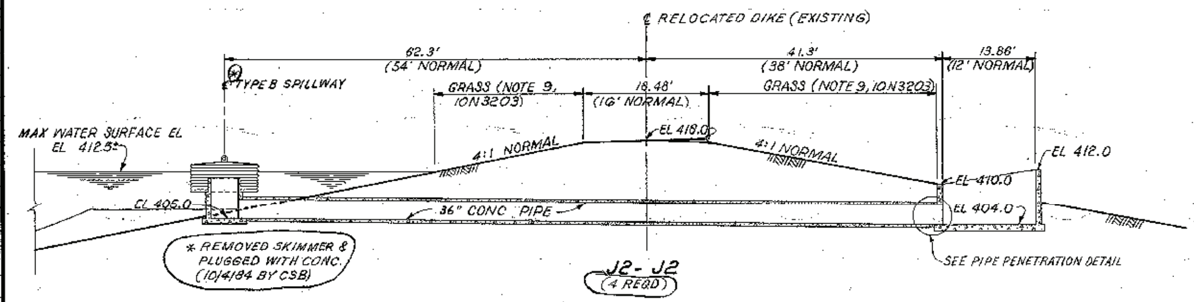
SPECIAL DESIGN PROJECT FILE COPY


NOTE B:
REGRADING AND DRAINAGE OF THIS AREA LATER UNDER A SEPARATE PROJECT. DO NOT DISTURB EXISTING GRADE ANY MORE THAN NECESSARY FOR REMOVALS. FILL AREAS ONLY AS REQUIRED TO MAINTAIN EXISTING DRAINAGE.
ASSUMED NORTH
MATCH LINE DWG 10N3210
SEE NOTE B
DISCHARGE LINES
REMOVE OIL STORAGE TANKS
FUEL OIL TANKS (3) FOR UNITS 1&2
ASH SLUICE PIPES
STILLING POOL
RELOCATED EMPLOYEE PARKING LOT (10W3271H)
ACTIVE COAL PILE
ACTIVE PILE 1&2 DRAINAGE DITCH
TO BE ABANDONED
ENTRANCE TO UG CONVEYOR
PIPE TO BE PLUGGED BY FIELD
UTILITY BUILDING
NEW ROAD TO BREAKER BLDG.
BREAKER NO. 3
TRANSFER STA A
SERVICE BLDG
BREAKER BUILDING
TRANSFER STA "G"
REFUSE HOPPER
YARD NO. 1 (SEE 75W4200 & 26W421H FOR DETAILS)
TRANSFER STA "B"
FOR PLATFORM SEE 8W840-8
FOR PUMPING STA SEE 17W3405
COAL YARD DRAINAGE BASIN #3
BOTTOM EL. 410.0
ACTIVE ASH DISPOSAL AREA 2B
ACTIVE ASH DISPOSAL AREA 2A
RECLAIMING HOPPER
COAL STORAGE AREA
BASE LINE N32°-00'-00"W
BELT CONVEYOR 45
ACTIVE COAL PILE
RELOCATED PLANT RAIL ROAD SEE 10H3706
EXISTING RAILROAD TO BE REMOVED
COAL STORAGE AREA
MATCH LINE DWG 10W3265-1
MATCH LINE DWG 10W3265-1
PLAN
NOTE A:
EARTH DIKES TO REMAIN IN PLACE. REMOVAL AND REGRADING WILL BE DONE LATER UNDER A SEPARATE PROJECT.
ASH CONVEYORS
ASH DISPOSAL LINES
ASH POND 2B
EL 416
ASH FILL
ROADWAY - USE 3" COMPACTED CR STN (NOTE 4, 10N3221)
DIKE TO BE EARTH FILL ABOVE EL 392
EARTH FILL FOR ASH CONVEYOR DIKE IN ASH DISPOSAL AREA NO. 2B SHALL BE TYPE A FILL. SEE NOTE 3, 10N3210.
E-E
SCALE 1" = 20'
ELECT COND
INV 15" PIPE
TRENCH EL 415.5±
ACCESS ROAD
ACCESS RR
EL 415
INV EL 412.5
EL 414.5
CONC GUTTER PROFILE GRADE
STA 4+80
F-F
SCALE 1" = 10' VERT
1" = 100' HORIZ
NOTES:
1. DASHED CONTOURS INDICATE EXISTING GROUND. SOLID CONTOURS REPRESENT FINISHED GRADE.
2. ALL CONCRETE SHALL BE CLASS "A" IN ACCORDANCE WITH SECTION 400 OF THE T-1 SPECIFICATIONS.
3. EXPANSION JOINTS IN CONCRETE GUTTER SHALL BE CONSTRUCTED WITH 3/4" EXPANSION JOINT MATERIAL AT INTERVALS OF NOT MORE THAN 50 FEET.
4. THE ENTIRE SURFACE OF THE DIKES AROUND THE OIL STORAGE TANKS SHALL BE FERTILIZED AND GRASSED WITH TYPE 5 SEED MIXTURE, AND MULCHED PER SECTIONS 180 AND 182 OF THE T-1 SPECIFICATIONS
5. ALL PIPE SHALL BE CLASS III, CL3O JT CONC OR 16 GA PICM EXCEPT AS NOTED.
6. SURFACING FOR PARKING AREA AND ROADWAYS AT BREAKER BUILDING SHALL CONSIST OF 9" STABILIZED BASE, PER SECTION 225, BITUMINOUS PRIME COAT, PER SECTION 302, AND 1½" ASPHALTIC CONCRETE SURFACE PER SECTION 345.
7. PARKING CURB AT THE BREAKER BUILDING AREA SHALL BE 6 FOOT LENGTHS OF PRECAST CURB, CENTERED ALONG THE END OF EACH PARKING SPACE.
8. FOR ADDITIONAL NOTES SEE 10W3265-1.
GRASSING (NOTE 4)
145' TO ℄ UNIT 3
℄ OIL STORAGE TANK 3B (REMOVE)
℄ OIL STORAGE TANK 3A (REMOVE)
TOE OF SLOPE EL 417
SEE NOTE A
EL 424
EL 417
EL 412
COMPACTED CLAY FILL
A - A
SCALE 1" = 20'
334' TO ℄ UNIT 3 STACK
℄ OIL STORAGE TANK (REMOVE)
B - B
SCALE 1" = 20'
PROFILE GRADE EL VARIES
EL 415.5±
15" VC PIPE @ STA 4+80
4" CONCRETE
EXPANSION JOINTS (NOTE 3)
C-C
NTS
FIRST ISSUE FOR P.A.3076
COMPANION DRAWINGS: 10W3265-1 THRU 3265-5
PROJECT REVISION HISTORY
R9 7-22-80 JHH TAC JHH JLG KWB FDS GLB
REVISED ROAD NORTH OF UTILITY BLDG, S.O. 90-372
R8 6-26-79 MEW JSB JLG JLG KWB FDS GLB
ADDED DIKE AROUND FUEL OIL TANKS FOR UNITS 1 & 2. P.A.3414
R7 3-28-78 DAV GRO DAV AEH KWB FDS GLB
ADDED RELOCATED PLANT RAILROAD & RELOCATED EMPLOYEE PARKING LOT P.A. 3294
R10 2-21-95 GCW JLG JLG KWB RGJ WDH 4236
REDRAWN BY SCANNING AND REVISED FOR UNIT 3 FUEL OIL TANK REMOVAL.
REV. NO. DATE DSGN DRWN CHKD SUPV RVWD APPD ISSD PROJECT ID AS CONST
DISCIPLINE INTERFACE
SCALE: 1"=100' EXCEPT AS NOTED
MAIN PLANT
GENERAL GRADING PLAN
COAL YARD
MF R10
DESIGNED BY: ABB
DRAWN BY: BSW
CHECKED BY: ABB
SUPERVISED BY: PDH
REVIEWED BY: ELE
APPROVED BY: WCB
ISSUED BY: WPC
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING
AUTOCAD R12
DATE 9-12-67
64
C
10W3211
R 10
TASK COMPLETED BY:
REV NO.
ELECTRONICALLY RESTORED DRAWING
THIS DRAWING HAS BEEN COMPLETELY REDRAWN AND SUPERSEDES : 10W3211 R9
PLOT FACTOR:1=1
W_TVA
C.A.D. DRAWING
DO NOT ALTER MANUALLY

64 | C | 10W3267-2



SECTION H-H
10N3203

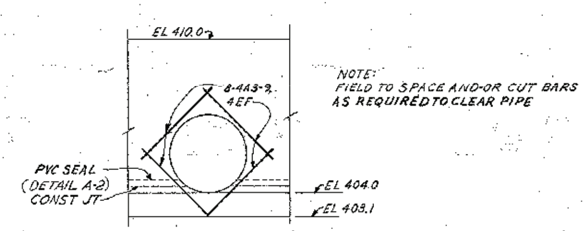


J2 - J2
(4 REQD)

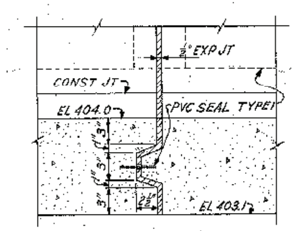
NOTES:
1. RIPRAP SHALL BE 18 INCHES THICK WITH A MINIMUM OF 50% BY WEIGHT CONSISTING OF STONES OF AT LEAST 100 POUNDS EACH. RIPRAP SHALL CONFORM TO SECTION 830.
2. FILTER BLANKET, 6 INCHES THICK, SHALL CONFORM TO SECTION 830.
3. FOR ADDITIONAL NOTES SEE 10N3203.

BENT BAR LIST - DISCHARGE FLUME

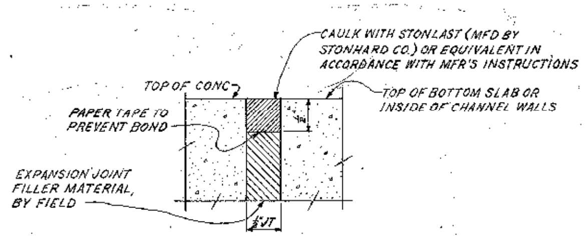
BAR MARK	NO. REQD	BENDING DIMENSIONS a	b	c	e	f	r
4L10-3	2	8-8	EX				
4L9-5	1007	8-6	EX				
4L9	2	8-3	EX				
4L8-9	2	8-0	EX				
4L8-6	2	7-9	EX				
4L8-3	2	7-6	EX				
4L8	2	7-3	EX				
4L7-9	2	7-0	EX				
4L7-6	2	6-9	EX				
4L7-3	600	6-6	EX				
4U15-9	6	1-6	13-0	EX			



PIPE PENETRATION DETAIL
TYPICAL AT CONCRETE PIPES
NTS



DETAIL A2
SCALE 1½"=1'-0"



TYPICAL EXPANSION JOINT DETAIL
FULL SCALE

FIRST ISSUE FOR PA 3076

COMPANION DWGS: 10N3203
10W3267-1, 10W3267-3

INSPECTED AND APPROVED FOR ISSUE

REV NO.	ECN NO.	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUBM	RECM	APPD
1	PA 3517 REVISED J2-J2	11-19-84		AHS					MRM		

DSGN R.W. SCHENK
DRWN G.R. OWENS
CHKD D.A. VALENTINE
SUPV BELLINGER
INSP
ENGINEER K.W. Burnett

SCALE: 1"=10' EXCEPT AS NOTED

YARD

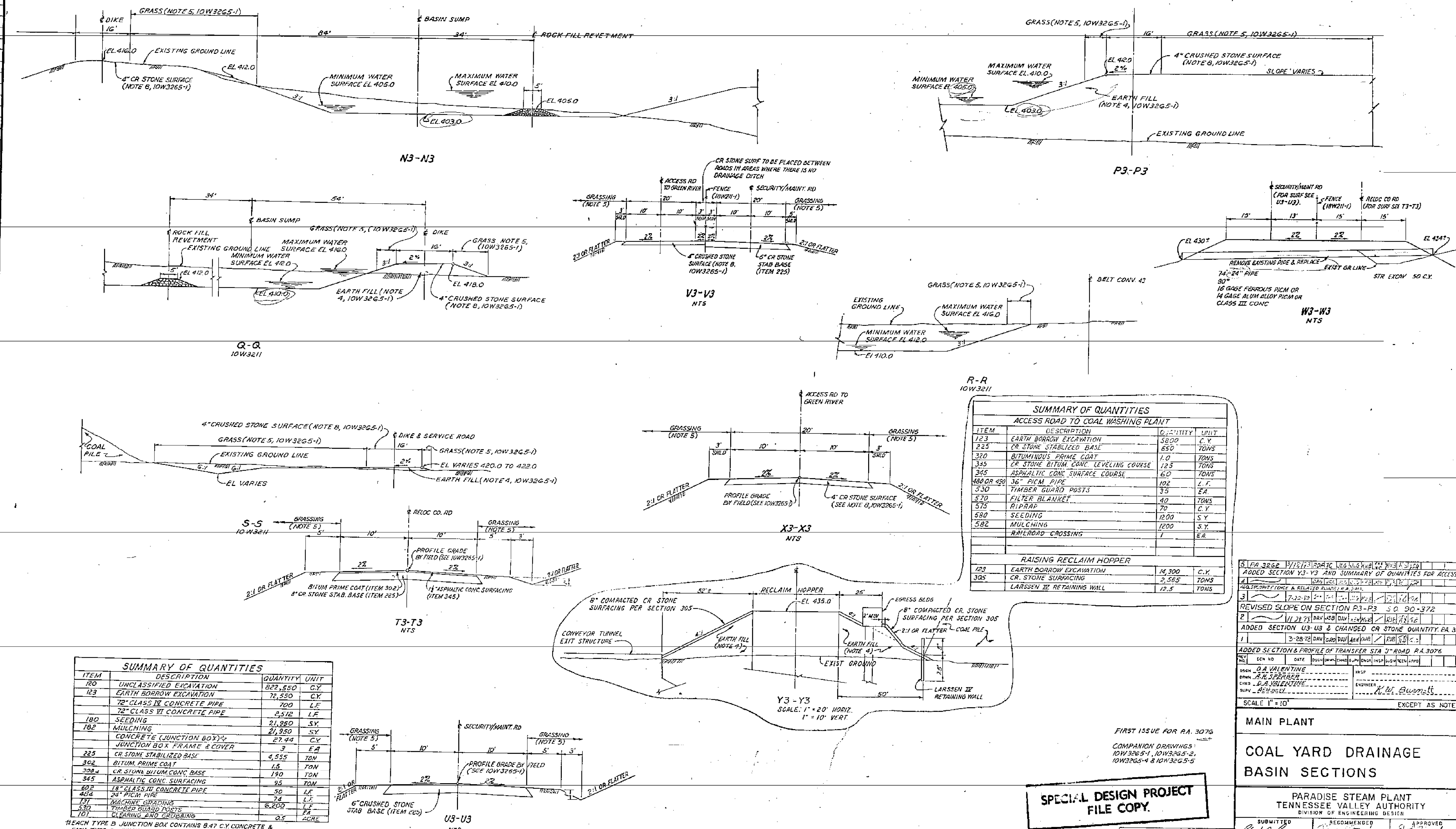
ASH DISPOSAL AREAS
2A & 2B
SECTIONS & DETAILS (NLDF)

PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED Robert J. Bowman | RECOMMENDED | APPROVED G.S. Buchanan

KNOXVILLE 11-4-77 | 64 | C | 10W3267-2 | R1

RECORD DRAWING AS CONSTRUCTED 10-18-83 R0



SUMMARY OF QUANTITIES

ACCESS ROAD TO COAL WASHING PLANT

ITEM	DESCRIPTION	QUANTITY	UNIT
123	EARTH BORROW EXCAVATION	5800	C.Y.
225	CR. STONE STABLIZED BASE	650	TONS
320	BITUMINOUS PRIME COAT	1.0	TONS
335	CR. STONE BITUM. CONC. LEVELING COURSE	125	TONS
345	ASPHALTIC CONC SURFACE COURSE	60	TONS
480 OR 490	36" PICM PIPE	102	L.F.
530	TIMBER GUARD POSTS	35	EA.
570	FILTER BLANKET	40	TONS
575	RIPRAP	70	C.Y.
580	SEEDING	1200	S.Y.
582	MULCHING	1200	S.Y.
	RAILROAD CROSSING	1	EA.

RAISING RECLAIM HOPPER

ITEM	DESCRIPTION	QUANTITY	UNIT
123	EARTH BORROW EXCAVATION	14,300	C.Y.
305	CR. STONE SURFACING	2,565	TONS
	LARSSEN IV RETAINING WALL	12.5	TONS

SUMMARY OF QUANTITIES

ITEM	DESCRIPTION	QUANTITY	UNIT
120	UNCLASSIFIED EXCAVATION	822,550	C.Y.
123	EARTH BORROW EXCAVATION	72,550	C.Y.
	72" CLASS IV CONCRETE PIPE	700	L.F.
	72" CLASS VI CONCRETE PIPE	2,512	L.F.
180	SEEDING	21,950	S.Y.
182	MULCHING	21,950	S.Y.
	CONCRETE (JUNCTION BOX)*	27.44	C.Y.
	JUNCTION BOX FRAME & COVER	3	EA
225	CR. STONE STABILIZED BASE	4,555	TON
302	BITUM. PRIME COAT	1.5	TON
308 a	CR. STONE BITUM. CONC. BASE	190	TON
345	ASPHALTIC CONC. SURFACING	95	TON
602	18" CLASS III CONCRETE PIPE	50	L.F.
484	24" PICM PIPE	74	L.F.
131	MACHINE GRADING	6,200	L.F.
530	TIMBER GUARD POSTS		EA
101	CLEARING AND GRUBBING	0.5	ACRE

*EACH TYPE B JUNCTION BOX CONTAINS 8.47 C.Y. CONCRETE & EACH TYPE C JUNCTION BOX CONTAINS 10.50 C.Y. CONRETE.

FIRST ISSUE FOR P.A. 3076

COMPANION DRAWINGS: 10W3265-1, 10W3265-2, 10W3265-4 & 10W3265-5

SPECIAL DESIGN PROJECT FILE COPY.

REV NO.	ECN NO	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUBM	RECM	APPD
5	PA 3262	3/18/83	RDA	TC	JLG	JLG	KWB		KWB		
	ADDED SECTION Y3-Y3 AND SUMMARY OF QUANTITIES FOR ACCESS RD										
4			DRG	VCL							
	ADD SECURITY FENCE & RELATED ROADS P.A. 3481										
3		7-22-80									
	REVISED SLOPE ON SECTION P3-P3 S.O. 90-372										
2		11-29-78	DAV	JSB	DAV	AEH	KWB		RJB		
	ADDED SECTION U3-U3 & CHANGED CR STONE QUANTITY. PA. 3262										
1		3-28-78	DAV	GRO	DAV	AEH	KWB		RJB		
	ADDED SECTION & PROFILE OF TRANSFER STA "J" ROAD P.A. 3076										

DSGN D.A. VALENTINE
DRWN R.H. SPERBER
CHKD D.A. VALENTINE
SUPV AEH

INSP
ENGINEER K.W. Burnett

SCALE 1" = 10' EXCEPT AS NOTED

MAIN PLANT

COAL YARD DRAINAGE BASIN SECTIONS

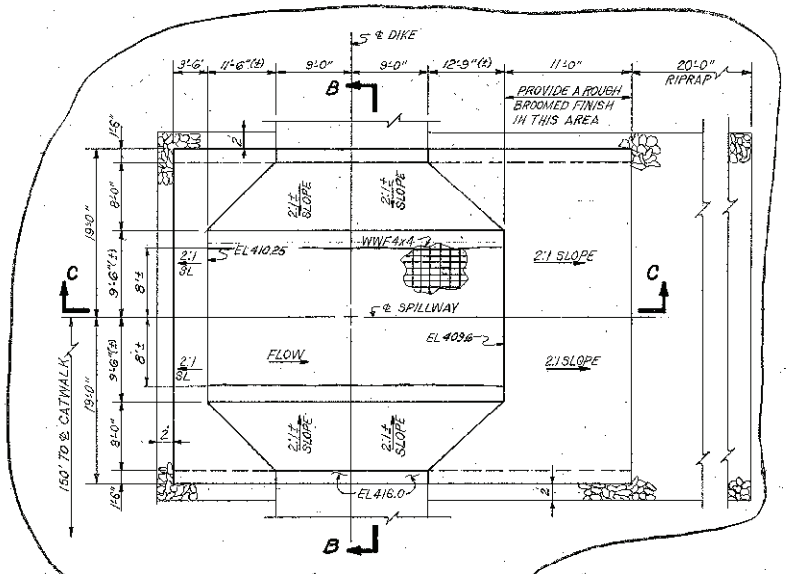
PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED | RECOMMENDED | APPROVED

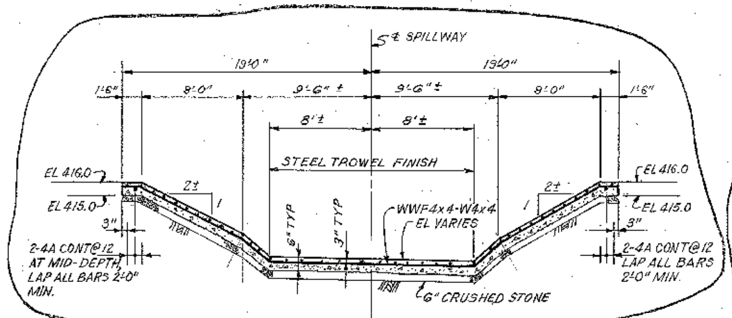
INSPECTED AND APPROVED FOR ISSUE

KNOXVILLE 11-4-77 64 C 10W3265-3 R5

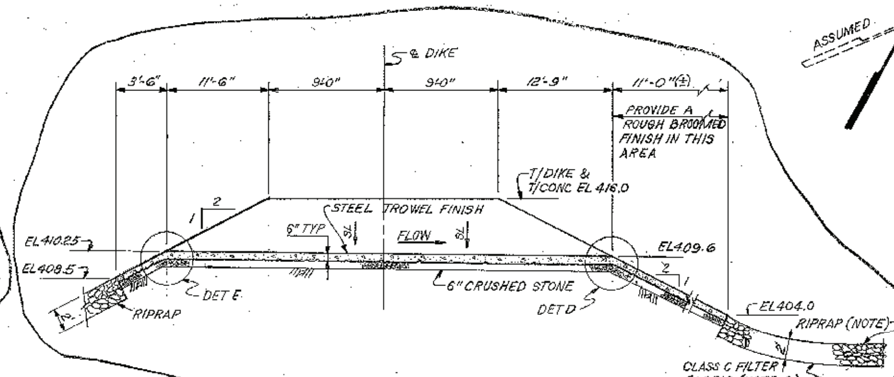
RECORD DRAWING AS CONSTRUCTED



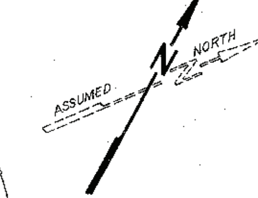
DETAIL A (10N3203)
PLAN - CONC SPILLWAY
NTS



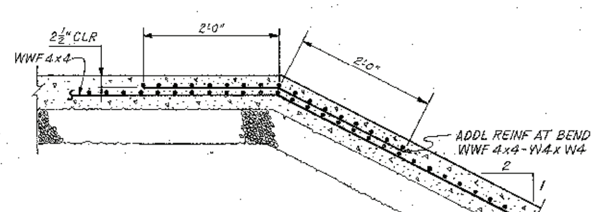
B-B
NTS



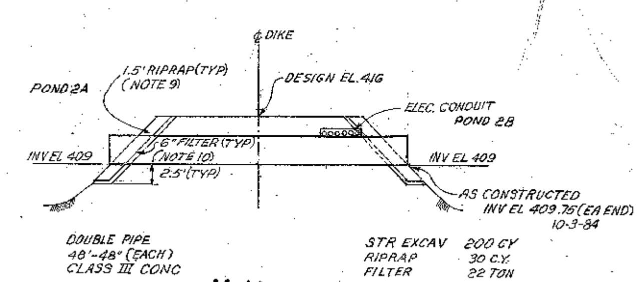
C-C
NTS



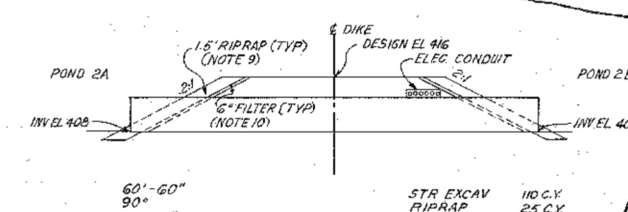
NOTES
1. ALL MATERIAL SHALL BE BY TVA FIELD.
2. CONCRETE SHALL BE 301.5 AFW PRODUCED AND PLACED IN ACCORDANCE WITH TVA CONSTRUCTION SPECIFICATION G-2.
3. ALL CONCRETE SURFACES SHALL RECEIVE A WOOD FLOAT FINISH IN ACCORDANCE WITH CONST SPEC. G-22, EXCEPT AS NOTED.
4. REINFORCING BAR SHALL BE DEFORMED BARS CONFORMING TO ASTM A615, GRADE 60.
5. WELDED WIRE FABRIC (WWF) SHALL CONFORM TO ASTM A185.
6. CONSTRUCTION JOINTS, IF NECESSARY, SHALL BE LOCATED BY FIELD.
7. CRUSHED STONE BACKFILL SHALL CONFORM TO TVA SPECIFICATION T-1, SECTION 1032.
8. CLASS C FILTER FABRIC SHALL CONFORM TO SECTION 571 OF THE T-1 SPECIFICATIONS AND INSTALLED AT DISCHARGE SLOPE ONLY.
9. RIPRAP SHALL CONSIST OF 50% OF THE STONE WEIGHING 150 POUNDS OR GREATER AND CONFORM TO SECTION 575 OF THE T-1 SPECIFICATIONS.
10. FILTER BLANKET, 6 INCHES THICK, SHALL CONFORM TO SECTION 570 OF THE T-1 SPECIFICATIONS.
11. DIKE CONSTRCTION SHALL BE IN ACCORDANCE WITH GENERAL CONSTRUCTION SPECIFICATION NO. G9, ROLLED EARTHFILL FOR DAMS.
12. DIKE FOUNDATION SHALL HAVE ALL UNSUITABLE MATERIAL REMOVED BEFORE PLACEMENT OF FILL MATERIAL. DEPTH TO BE SUFFICENT TO ENSURE AN ADEQUATE TIE.
13. ALL EMBANKMENT MATERIAL SHALL BE OBTAINED FROM SCRUBBER WET POND AREA OR BORROW AREA C.
14. EARTH FILL COMPACTION SHALL BE AT LEAST 95% OF STANDARD MAX. DRY DENSITY (ASTM D698) AS ESTABLISHED BY SMEL. FILL MOISTURE SHALL BE CONTROLLED TO ACHIEVE OPTIMUM COMPACTION. ALLOWABLE MOISTURE CONTENT DURING PLACEMENT AND COMPACTION SHALL BE BETWEEN 2% ABOVE AND 2% BELOW OPTIMUM MOISTURE CONTENT. TEST SHALL BE TAKEN EVERY 2000 C.Y. OF FILL PLACEMENT.
15. CRUSHED STONE SURFACING SECTION 305 OF THE T-1 SPECIFICATIONS.



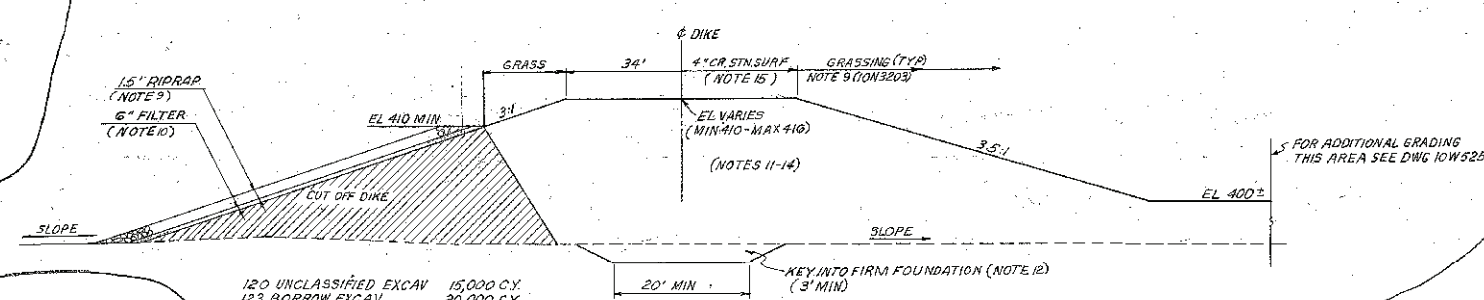
DETAIL D & E OPP HAND
1" = 1'-0"



M-M
PIPE SECTION (SEE 10N3203)
NTS



P-P
(SEE 10N3209)
1" - 10'



N-N
TYPICAL SECTION - ENCLOSURE DIKE & STILLING POOL (SEE 10N3203)
NTS

SUMMARY OF QUANTITIES

ITEM	DESCRIPTION	QUANTITY
CONCRETE SPILLWAY - DETAIL A		
120	UNCLASSIFIED EXCAVATION	300 CY
305	CRUSHED STONE	90 TONS
	CONCRETE	70 CY
425	REINFORCING STEEL	1200 LBS
575	RIPRAP	100 CY
571	CLASS C FILTER FABRIC	100 SY
OR ITEM 570	FILTER BLANKET	115 TONS
110	REMOVAL OF STRUCTURES (CONC)	100 SY
PIPE SECTION M-M		
ITEM	DESCRIPTION	QUANTITY
125	STRUCTURAL EXCAVATION	200 CY
463	48" CLASS III CONC PIPE	96' LF
570	FILTER BLANKET	22 TON
575	RIPRAP	30 CY
PIPE SECTION P-P		
125	STRUCTURAL EXCAVATION	110 C.Y.
463	60" CLASS III CONC PIPE	60 FT
570	FILTER BLANKET	13 TON
575	RIPRAP	25 C.Y.

INITIAL ISSUE PA 3517

COMPANION DRAWINGS:
10N3203

REV NO.	ECN NO.	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUBM	RECM	APPD
1	PA 3517	11-19-84									

REV. REMOVED DET F & SECTIONS G-G & H-H ADD SECT M-M & TYP SECT-ENCL. DIKE @ STILLING POOL & GENERAL REV. ADD SECT. P-P

DSGN M.T. Scott
DRWN D.E. WRIGHT
INSP
ENGINEER M.H. Miller

SCALE AS NOTED

YARD

ASH DISPOSAL AREAS 2A, 2B & STILLING POOL SPWY SECTIONS & DETAILS

PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED
M.H. Miller	R.E. Harris	R.O. Barnett

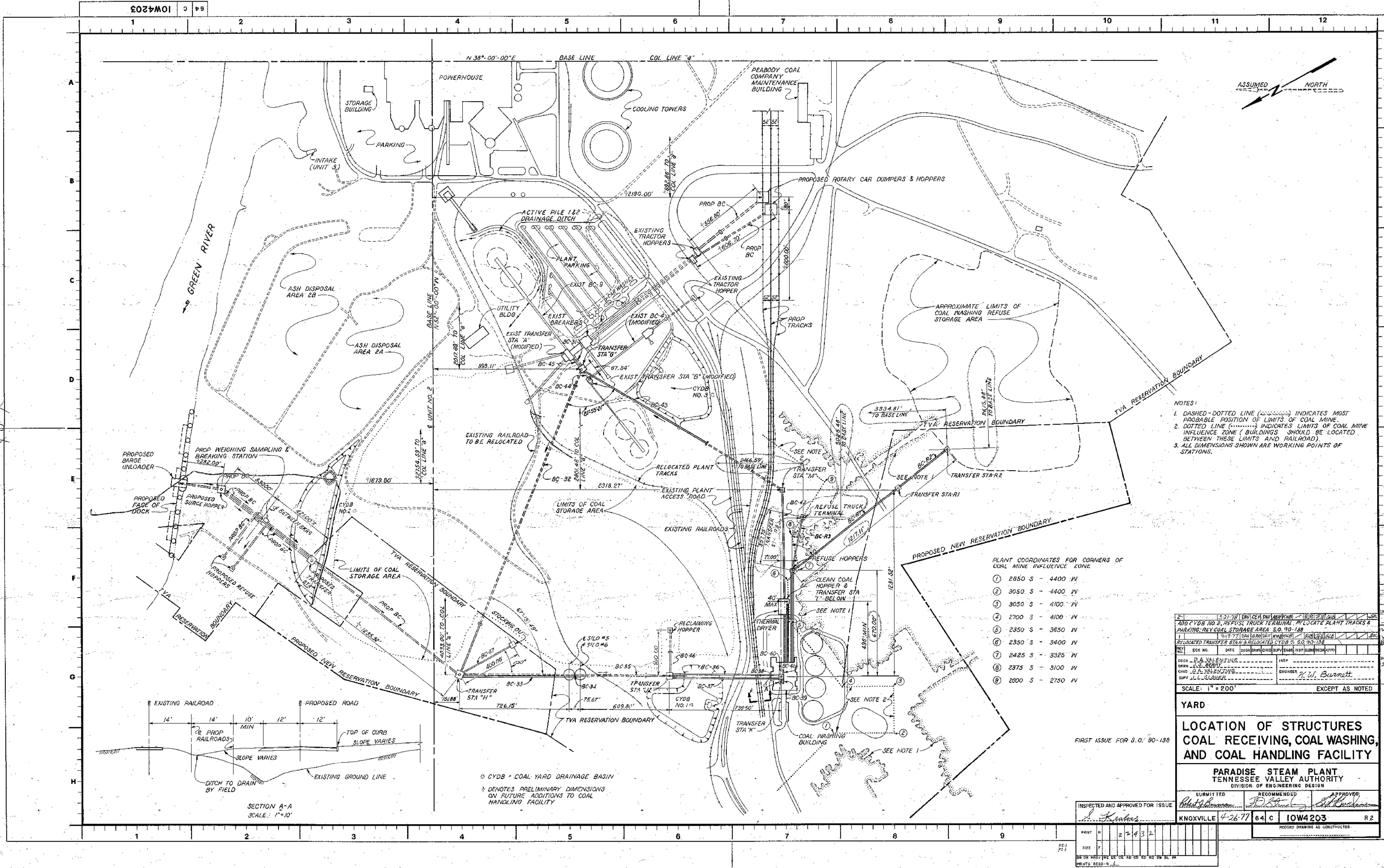
INSPECTED AND APPROVED FOR ISSUE
D.P. Thornton

KNOXVILLE 8/24/84 64 C 10W3290 R1

RECORD DRAWING AS CONSTRUCTED

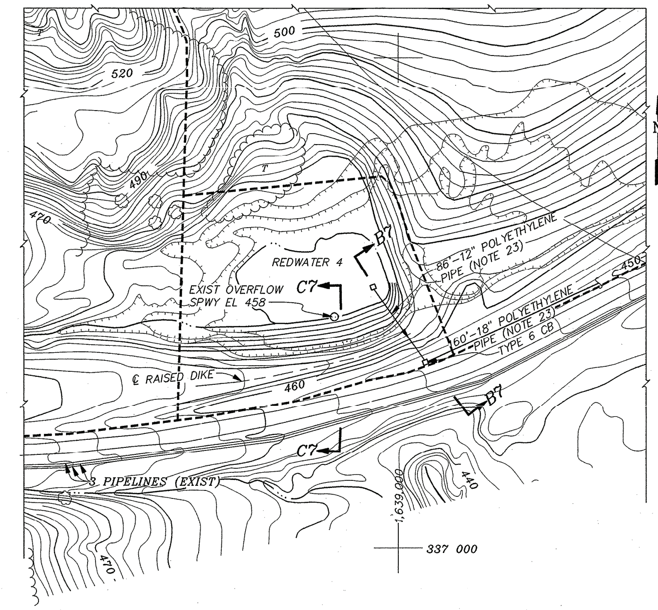
PRINT H
SIZE F
BR OR PROJ AS CE EE ME NE FD HD SD BL BW WB PW
PRINTS REQD-R

TECHNICAL INFORMATION CENTER INDEXED KNOXVILLE

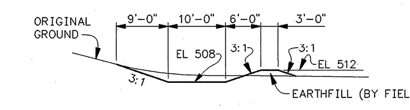


PAF-10W4203-SHT -REV 2 YARD LOCATION OF STRUCTURES COAL RECEIVING , COAL WASHING, AND COAL HANDLING FACILITY (35% of Scale); Paradise - Slag Ponds 2A and 2B; 1-27-2009 15-21-19; 2/9/2009 04:20 PM

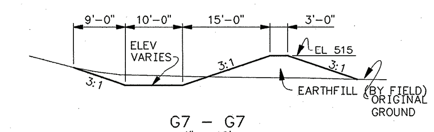
64 C 10W4271-7



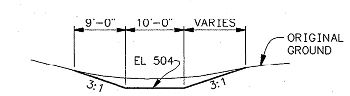
DETAIL B7
1" = 50'



F7 - F7
1" = 10'

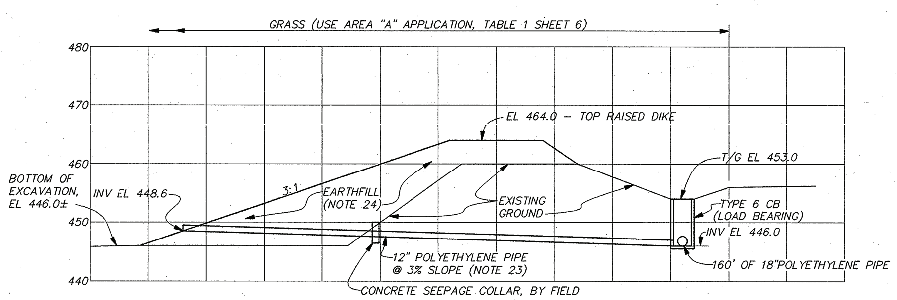


G7 - G7
1" = 10'

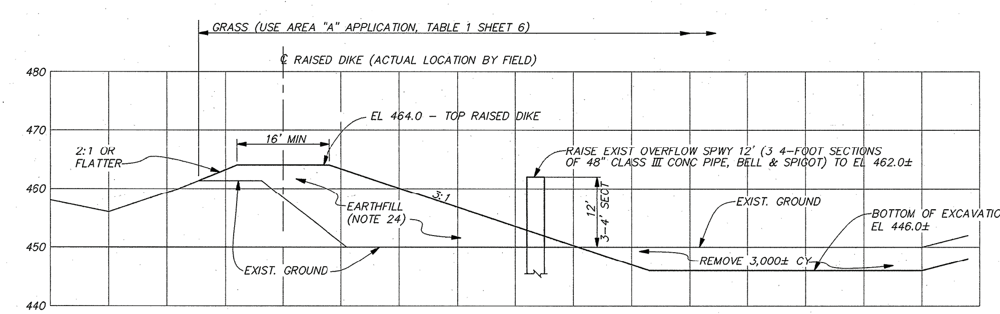


H7 - H7
1" = 10'

NOTES:
1. FOR GENERAL NOTES SEE 10W4271-5.



B7 - B7
1"=10' HORIZONTAL
1"=10' VERTICAL



C7 - C7
TYP. SECT.- RAISED DIKE @ REDWATER NO.4
1"=10' HORIZONTAL
1"=10' VERTICAL

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 1	9-21-95 AS CONSTRUCTED	GDP	GCL	JLG	JLG	KWB	RGJ	WDH	PAF018	
R 0	8-18-94 INITIAL ISSUE	JDP	GCL	JLG	JLG	KWB	RGJ	WDH	PAF018	

SCALE: NOT TO SCALE EXCEPT AS NOTED

YARD

COAL WASHING REFUSE
MEDIUM & COARSE STORAGE
RECLAMATION - DETAILS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.D.PARIS	G.C.LAWSON	J.L.GLOVER	J.L.GLOVER	K.W.BURNETT	R.G.JOHNSON	W.D.HALL

PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

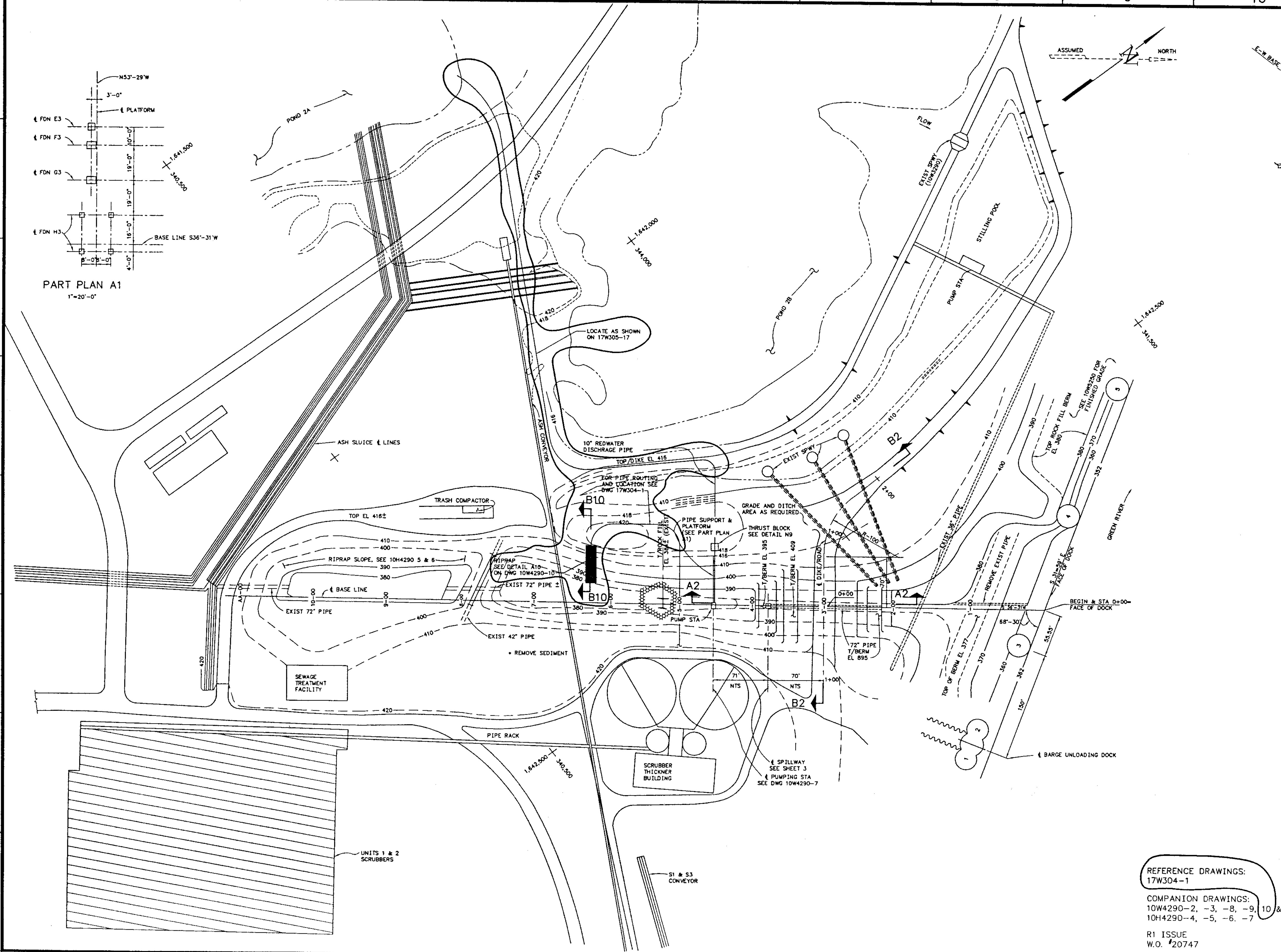
AUTOCAD R12 | DATE 8-18-94 | 64 | C | 10W4271-7 | R 1

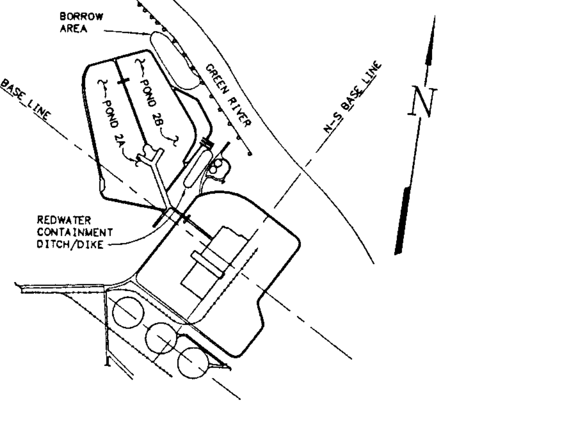
PLOT FACTOR:1=1
W_TVA
FILENAME: W4271-7.DWG

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.

MF R1





KEY PLAN
NTS

NOTES:

1. ALL WORK TO BE IN ACCORDANCE WITH T-1 SPECIFICATION UNLESS OTHERWISE NOTED.
2. ROCKFILL SHALL BE FREE OF DEBRIS, DIRT AND CONTAIN AS LITTLE SHALE AS PRACTICAL. THE ROCKFILL SHALL BE REASONABLY WELL GRADED WITH A MAXIMUM PARTICLE SIZE OF 18 INCHES. NOT MORE THAN 5% OF THE STONES BY WEIGHT SHALL PASS THE 1" SIEVE. ROCKFILL IS TO BE PLACED IN APPROXIMATELY 30" INCH LIFTS AND COMPACTED WITH A MINIMUM OF 4 COMPLETE PASSES WITH A RAY GO RASCAL 600-A VIBRATORY ROLLER OR EQUAL.
3. FILTER BLANKET SHALL BE 6" THICK AND IN ACCORDANCE WITH SECTION 570.
4. CUT AND FILL SLOPES AND DISTURBED AREA, EXCEPT THOSE COVERED WITH RIPRAP, SHALL BE SEEDED WITH TYPE 8 FOR FALL SEEDING OR TYPE 6 MIXTURE 1 FOR SPRING SEEDING SEEDED AREAS ARE TO BE FERTILIZED AND MULCHED IN ACCORDANCE WITH SECTION 580 AND 582 RESPECTIVELY.
5. CRUSHED STONE SURFACING 4 INCHES THICK, SHALL BE IN ACCORDANCE WITH SECTION 305.
6. NOTES FOR DIKE CONSTRUCTION ARE ON DWG 10W4290-2.
7. FOR MECHANICAL DRAWING SEE 17W3405-12.
8. FOR PUMPING STATION DRAWINGS SEE 10W4290-7.
9. CONCRETE SHALL BE CLASS 300.75 AFW, THE TROUGH NEED NOT BE FORMED.
10. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.
11. WELDED WIRE FABRIC LAP SPLICE SHALL BE 12 INCHES MINIMUM.
12. THE MINIMUM SLOPE STABILITY SAFETY FACTORS FOR VARIOUS LOADING CONDITIONS ARE AS LISTED BELOW:
    END OF CONSTRUCTION CONDITION >1.3
    NORMAL OPERATION CONDITION 1.5
    SUDDEN DRAWDOWN OF RIVER (RARE FLOOD) 1.3
    PARTIAL POOL >1.5
13. DASHED LINES REPRESENT EXISTION GROUND. SOLID LINES REPRESENT FINISHED GRADE.
14. FOR PIPE SUPPORT AND PLATFORM ACCESS SEE 10W4290-08, 09.

REFERENCE DRAWINGS:
17W304-1

COMPANION DRAWINGS:
10W4290-2, -3, -8, -9, 10 &
10H4290-4, -5, -6, -7

R1 ISSUE
W.O. #20747

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 5		DRS	DRF	DRS	DRS	REP	JGA		PAF072	
DCN PAF-02-92 REV 0, REVISED FOR ECOLOCHEM SYSTEM WASTE REROUTE.										
R 4	4-28-98	---	SRC	SRC	VWO	VWO	RGJ			
ELECTRONICALLY RESTORED										

DISCIPLINE INTERFACE

SCALE: 1"=50' EXCEPT AS NOTED

YARD

REDWATER CONTAINMENT PLAN & GRADING

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
CRS	AHS	PS	SF		RSP	RSP

PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

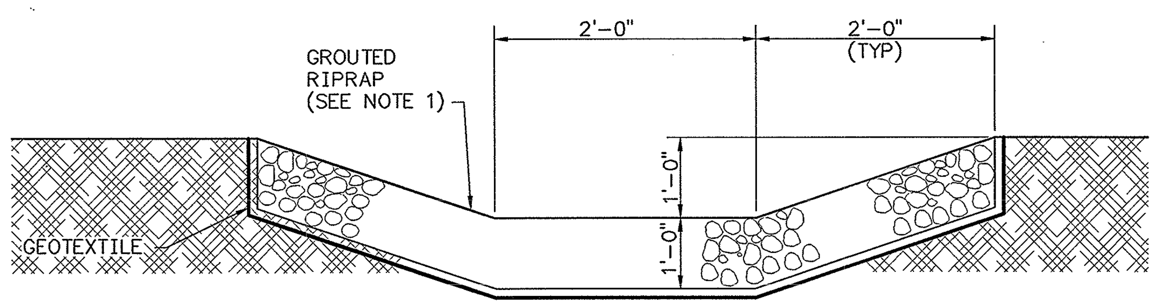
AUTOCAD R14	DATE 5/21/85	64	C	10W4290-1	R 5

PARSONS	5	ELECTRONICALLY RESTORED DRAWING THIS DRAWING HAS BEEN COMPLETELY REDRAWN AND SUPERSEDES : (10W4290-1 R3)
TASK COMPLETED BY:	REV NO.	

PLOT FACTOR:600
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

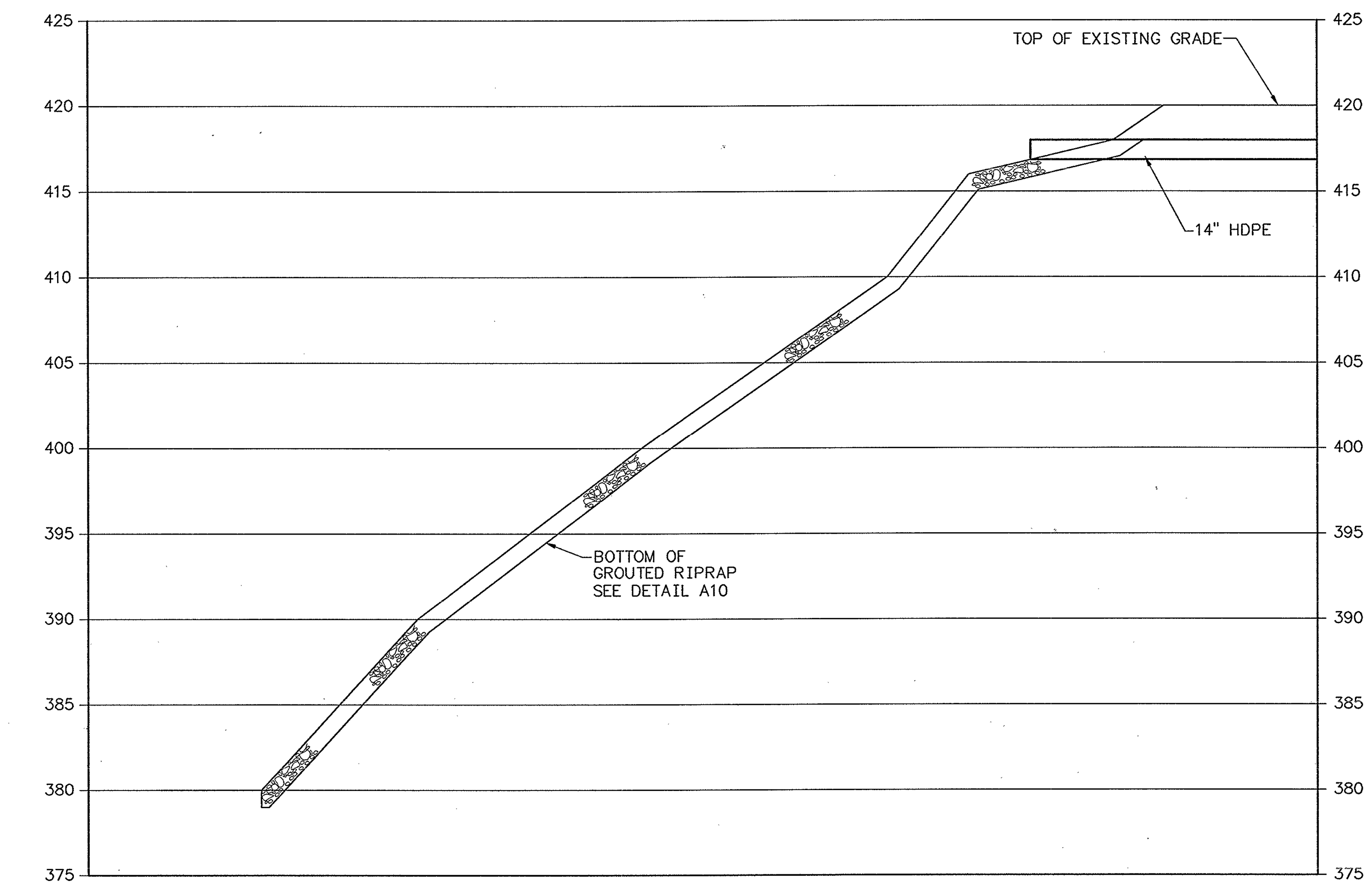
64 C 10W4290-10



NOTES:
1. GROUTED RIPRAP SHALL BE IN ACCORDANCE WITH SECTION 577.

2. GEOTEXTILE FABRIC SHALL BE A NON-WOVEN NEEDLE PUNCHED FABRIC, CLASS C, IN ACCORDANCE WITH SECTION 571.

DETAIL A10
RIPRAP CHANNEL



SECTION B10
SCALE: 1"=5'

R 0											
R 0	MAR 21 2002	DRS	DRF	DRS	DRS	REP	JGA		PAF072		D
DCN PAF-02-92 REV 0, ISSUED FOR ECOLOCHEM SYSTEM WASTE REROUTE.											
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

DISCIPLINE INTERFACE

SCALE: NOT TO SCALE EXCEPT AS NOTED

YARD

REDWATER CONTAINMENT
SECTION AND DETAILS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
DR SMITH	DR FOX	DR SMITH	DR SMITH	R.E. PURKEY	J.G. ADAIR	

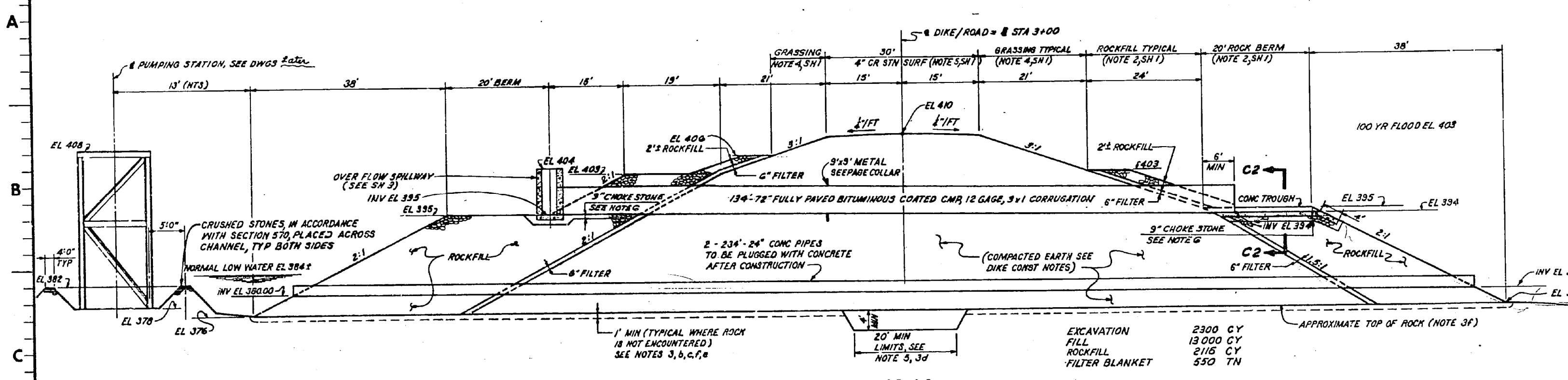
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14	DATE MAR 21 2002	64	C	10W4290-10	R 0

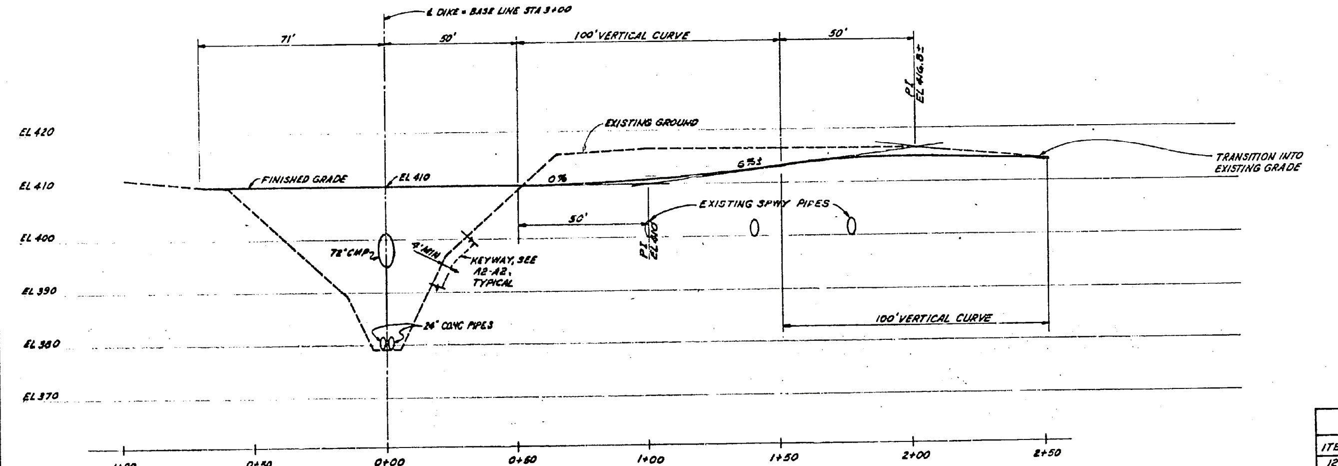
PARSONS | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:96
W_TVA

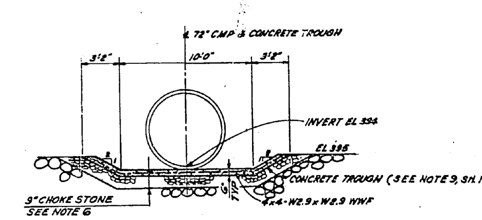
C.A.D. DRAWING
DO NOT ALTER MANUALLY



A2-A2
TYPICAL SECTION



B2-B2
1"=20' VERTICAL
1"=10' HORIZONTAL



C2-C2
¼"=1'-0"

DIKE CONSTRUCTION NOTES:

1. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH GENERAL CONSTRUCTION SPECIFICATION NO. 69, "ROLLED EARTHFILL FOR DAMS AND POWER PLANTS," EXCEPT AS NOTED.
2. ALL EXCAVATION AND FILL PLACEMENT SHALL BE DONE UNDER THE SUPERVISION OF A QUALIFIED SOILS INSPECTOR.
3. DIKE FOUNDATION PREPARATION-
   a. THE AREA FOR THE PROPOSED DIKE SHALL BE DEWATERED TO ENSURE THAT A DRY CONSTRUCTION CONDITION IS MAINTAINED AT ALL TIMES.
   b. THE AREAS FOR THE PROPOSED DIKE SHALL BE CLEARED OF ALL VEGETATION, ROOTS, AND ORGANIC TOP SOIL. IF ANY PERVIOUS SOILS ARE ENCOUNTERED BENEATH THE TOP SOIL, OE-FEP IS TO BE NOTIFIED IMMEDIATELY.
   c. SOFT SOILS, WHEN ENCOUNTERED BENEATH THE TOP SOIL SHALL ALSO BE REMOVED.
   d. ROCK SHALL BE EXCAVATED WITHIN THE LIMITS OF THE KEYWAY AS SHOWN ON A2-A2.
   e. THE ENTIRE FOUNDATION AREA SHALL BE COMPACTED WITH A SHEEPSFOOT ROLLER FOLLOWED BY A FLAT WHEELED ROLLER UNTIL THE AREA WILL SUPPORT HEAVY EQUIPMENT WITHOUT RUTTING INTO THE GROUND AND HEAVING THE AREA.
   f. PRIOR TO PLACING FILL THE FOUNDATION AREA SHALL BE SCARIFIED TO PROVIDE A GOOD BOND BETWEEN FOUNDATION AND FILL.
4. EARTH FILL NOTES:
   a. EARTH FILL SHALL BE OBTAINED FROM THE DESIGNATED AREA AS SHOWN ON KEY PLAN.
   b. EARTH FILL SHALL BE UNIFORMLY COMPACTED IN LAYERS WHICH WHEN COMPACTED DO NOT EXCEED A THICKNESS OF 6 INCHES. COMPACTION SHALL BE ACCOMPLISHED USING A SHEEPSFOOT ROLLER PULLED BY A DOZER OR A SELF-PROPELLED (SHEEPSFOOT) ROLLER (REX PACTOR 3-50, OR AN OFFICE OF ENGINEERING APPROVED EQUAL). EACH LAYER SHALL BE COMPACTED TO AT LEAST 95% OF MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698.

   ALLOWABLE MOISTURE CONTENT DURING PLACEMENT AND COMPACTION SHALL BE BETWEEN 2% ABOVE AND 2% BELOW OPTIMUM MOISTURE CONTENT. THE FAMILY-OF-COMPACTION CURVES DEVELOPED FOR BORROW AREA BY SME IS TO BE USED TO CONTROL THE EARTHFILL COMPACTION.
   c. IN-PLACE DENSITY TESTS USING THE SAND CONE (ASTM D1556) OR RUBBER BALLOON (ASTM D2167) TEST METHODS SHALL BE MADE AT A RATE OF AT LEAST ONE TEST PER EACH 2000 CUBIC YARDS OF EARTH FILL PLACED (IN-PLACED VOLUME), OR A MINIMUM OF ONE PER DAY.
5. AFTER REMOVING ALL LOOSE ROCK AND PREPARING THE DIKE FOUNDATION (NOTE 3f) NOTIFY OE FOR A FIELD INSPECTION AND APPROVAL TO PROCEED.
6. CHOKE STONE SHALL CONSIST OF SOUND DURABLE STONES RANGING IN SIZE FROM 6" DOWN TO FINES. THE CHOKE STONES SHALL BE WELL COMPACTED WITH THE 6" STONE PLACED ON TOP THE ROCKFILL AND THE REMAINING STONE PLACED IN DESCENDING ORDER ACCORDING TO SIZE.

SUMMARY OF QUANTITIES

ITEM	DESCRIPTION	QUANTITY	UNIT
120	EARTH EXCAVATION	5000	CY
123	EARTH BORROW	14,000	CY
125	EXCAV FOR STRUCTURES (EARTH)	550	CY
125	EXCAV FOR STRUCTURES (ROCK)	100	CY
305	CRUSHED STONE SURFACING	180	TON
400	CONCRETE	25	CY
425	STEEL REINFORCEMENT	1	TON
482	72" FULLY PAVED BIT. COATED	134	LF
	12 GAGE, 3x1 CORRUGATION CMP		
570	FILTER BLANKET	964	TON
575	ROCKFILL	3,150	CY
580	SEEDING	2,000	SY
582	MULCHING	2,000	SY
	PVC SEAL	BY FIELD	
	CHOKE STONE	24	CY
	24" CONC PIPE	468	LF

4290-1
2

COMPANION DRAWINGS:
10W4290-1,-3,-8,-9 &
10H4290-4,-5,-6,-7
R1 ISSUE - WO 20747

INSPECTED AND APPROVED FOR ISSUE
O.P. Thornton

2		6/2/86							
	FINAL FIELD REVISION.								
REV NO.	ECN/FCR	DATE	DSGN	DRWN	CHKD	SUPV	APPD	ISSD	
1	WO# 20737	7/11/85							
	REVISED SECTION A2-A2, QUANTITIES, ADDED CHOKE STONE								
REV NO.	ECN. NO.	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUBMITTED / RECOM / APPD / ISSD

DSGN C. W. Stallone
DRWN D. E. WRIGHT
CHKD
SUPV
INSP
ENGINEER M. H. Miller

SCALE: 1"=10' EXCEPT AS NOTED

YARD

REDWATER CONTAINMENT SECTIONS & DETAILS

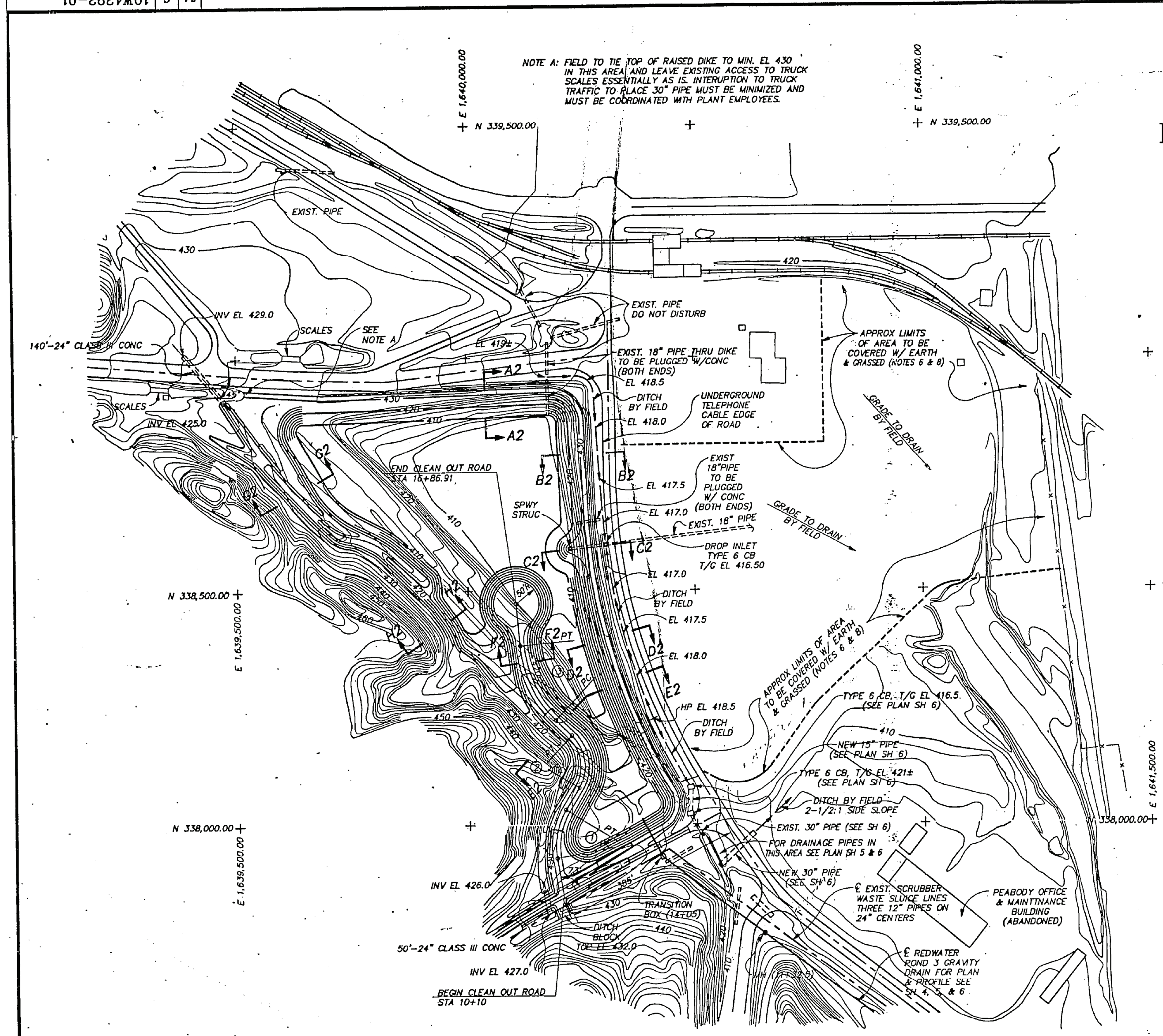
PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED M. H. Miller | RECOMMENDED R. E. Harris | APPROVED R. C. Barnett

KNOXVILLE | 5/21/85 | 64 | C | 10W4290-2 R2

RECORD DRAWING AS CONSTRUCTED 1-13-86 R2

PRINT H 2
SIZE F
BR OR PROJ AB CE EE ME NE FO HO SO SL SW WS PW
PRINTS REQD-R 2



PLAN

CURVE DATA – CLEAN OUT ROAD

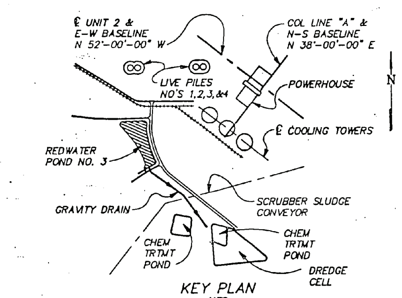
①	②	③
P.I. = 11+34.97	P.I. = 13+14.42	P.I. = 15+06.33
Δ = 41°-05'-03"	Δ = 77°-51'-56"	Δ = 41°-41'-48"
D = 38°-11'-50"	D = 63°-39'-43"	D = 22°-55'-06"
R = 150.00'	R = 90.00'	R = 250.00'
T = 56.21'	T = 72.71'	T = 95.21'
L = 107.56'	L = 122.31'	L = 181.94'
P.C. = 10+78.76	P.C. = 12+41.71	P.C. = 14+11.12
P.T. = 11+86.32	P.T. = 13+64.03	P.T. = 15+93.06

NOTES (CONTINUED):

9. TOP OF RAISED DIKE; RAISED DIKE SLOPES; BACKFILLED AREA OF GRAVITY DRAIN PIPE; CUT SLOPES; AND OTHER DISTURBED AREAS EXCEPT AS STATED IN NOTE 8, SHALL BE SEEDED (TYPE 8 MIXTURE 1 FOR FALL SEEDING OR TYPE 6 MIXTURE 1 FOR SPRING SEEDING) AND FERTILIZED IN ACCORDANCE WITH SECTION 580. THESE SEEDED AREAS ARE TO BE MULCHED IN ACCORDANCE WITH SECTION 582.
10. EXCEPT WHERE AN EXISTING CORRUGATED METAL PIPE IS BEING EXTENDED, ALL NEW DRAINAGE PIPE SHALL BE CLASS III CONCRETE IN ACCORDANCE WITH SECTION 460. ALL CORRUGATED METAL PIPE SHALL BE FULLY BITUMINOUS COATED, PICM IN ACCORDANCE WITH SECTION 480.
11. THE GRAVITY DRAIN PIPE SHALL BE A SYSTEM AS NOTED ON SHEETS 4, 5, AND 6 CONSISTING OF:
    A. 36-INCH DIAMETER ADS N-12 CORRUGATED POLYETHYLENE PIPE MEETING ASTM F667 SPECIFICATION AS MANUFACTURED BY ADVANCED DRAINAGE SYSTEMS, BRENTWOOD, TENNESSEE, PHONE (615) 373-9964 OR EQUAL.
    B. 60-INCH DIAMETER HIGH-DENSITY POLYETHYLENE (HDPE) SPIROLITE PIPE MEETING ASTM F894 SPECIFICATION AS MANUFACTURED BY PLEXCO/SPIROLITE, A DIVISION OF CHEVERON CHEMICAL CO., LITHIA SPRINGS, GEORGIA; PHONE (404) 948-1793 OR EQUAL, AND
    C. 60-INCH DIAMETER CLASS III CONCRETE PIPE IN ACCORDANCE WITH SECTION 460.

    CARE SHALL BE USED TO INSTALL THE POLYETHYLENE PIPE IN ACCORDANCE WITH MANUFACTURE'S INSTRUCTIONS AND THE PIPE BEDDING DETAILS SHOWN ON SHEET 6.
12. CONSTRUCTION EQUIPMENT SHALL NOT BE DRIVEN OVER THE POLYETHYLENE PIPE UNTIL A MINIMUM COVER OF ONE PIPE DIAMETER OVER THE PIPE IS COMPACTED TO SPECIFICATION.
13. GRAVITY DRAIN PIPE BEDDING AND BACKFILL (SEE TYPICAL BEDDING DETAILS SHEET 6).
    A. THE FOUNDATION SHALL BE SMOOTH AND COMPACTED NATIVE MATERIAL FREE FROM SHARP ROCKS AND ROOTS.
    B. THE BEDDING MATERIAL (MINIMUM 6 INCHES DEEP) SHALL CONSIST OF REED MINERAL COARSE REJECTS (OBTAINED FROM PARADISE PLANT SLAG PILE) AND BE PLACED TO BRING THE TRENCH BOTTOM TO FINAL GRADE. BEDDING MATERIAL SHALL BE COMPACTED TO A MINIMUM 95% STANDARD PROCTOR (ASTM D-698) OR 70% RELATIVE DENSITY (ASTM D-2049).
    C. THE PRIMARY BACKFILL MATERIAL SHALL CONSIST OF REED MINERAL COARSE REJECTS (OBTAINED FROM THE PARADISE PLANT SLAG PILE). PRIMARY BACKFILL MATERIAL SHALL BE COMPACTED TO A MINIMUM 85% STANDARD PROCTOR (ASTM D-698) OR A MINIMUM 60% RELATIVE DENSITY (ASTM D-2049). THIS MATERIAL IS TO BE COMPACTED IN 8-INCH LAYERS BROUGHT UP EVENLY ON BOTH SIDES OF THE PIPE.
    D. THE HAUNCHING MATERIAL (MATERIAL PLACED UNDER THE HAUNCHES OF THE PIPE) IS A PART OF THE PRIMARY BACKFILL. THIS MATERIAL SHALL BE HAND PLACED AND COMPACTED. WHILE COMPACTING THIS MATERIAL, CARE MUST BE TAKEN NOT TO DISTURB THE PIPE FROM ITS LINE AND GRADE ALIGNMENT.
    E. THE SECONDARY BACKFILL MATERIAL (MINIMUM OF 2 FEET OVER TOP OF PIPE) SHALL CONSIST OF EARTH MATERIAL FROM THE PIPE STRUCTURAL EXCAVATION OR FROM THE EXCAVATION IN REDWATER POND NO. 3. SECONDARY BACKFILL MATERIAL SHALL BE COMPACTED TO A MINIMUM 80% STANDARD PROCTOR (ASTM D-698).
14. VEHICULAR TRAFFIC OR CONSTRUCTION EQUIPMENT SHALL NOT BE ON OR CROSS OVER ANY OF THE HDPE PIPE UNTIL THE PIPE HAS A MINIMUM OF ONE PIPE DIAMETER OF COVER.
15. AS A CHECK ON THE ADEQUACY OF THE PRIMARY BACKFILL, THE 60-INCH HDPE PIPE DIAMETER DFLECTION SHALL BE MEASURED BETWEEN 30 AND 60 DAYS AFTER COMPLETION OF INSTALLATION. IF THE PIPE DIAMETER HAS DEFLECTED MORE THAN 5% (3 INCHES), REMEDIAL ACTION SHALL BE TAKEN. THIS REMEDIAL ACTION MAY BE TO REMOVE AND REPLACE PIPE OR SOME OTHER REMEDY PROPOSED BY THE CONSTRUCTOR AND APPROVED BY TVA FOSSIL AND HYDRO PROJECTS.
16. FILTER BLANKET SHALL BE 6 INCHES THICK AND SHALL CONFORM TO SECTION 570.
17. RIPRAP SHALL BE 18 INCHES THICK WITH A MINIMUM OF 50% BY WEIGHT CONSISTING OF STONES AT LEAST 100 POUNDS EACH. RIPRAP SHALL CONFORM TO SECTION 575.
18. CRUSHED STONE SURFACING FOR THE RELOCATED OR ADJUSTED ROADWAYS SHALL BE 6 INCHES THICK AND SHALL BE IN ACCORDANCE WITH SECTION 305.
19. THE CLEANOUT ROAD IS TO BE SURFACED WITH 4 TO 6 INCH SIZE STONE, WETTED AND ROLLED TO FORM A STABLE BASE WITH A 6-INCH CROWN.
20. 3" DIAMETER YELLOW REFLECTOR MARKERS SHALL BE INSTALLED TO IDENTIFY LOCATION OF 60" HDPE GRAVITY DRAIN PIPE. REFLECTORS SHALL BE LOCATED 4 FEET EACH SIDE OF THE CENTERLINE OF THE 60" PIPE AT 20-FOOT INTERVALS (ALTERNATING EACH SIDE OF THE 60" PIPE) AS SHOWN ON THE PLANS ON SHEETS 4, 5, AND 6. POSTS FOR REFLECTORS SHALL BE 6'-6" LUG U POSTS (PER SECTION 592) DRIVEN INTO THE GROUND A MINIMUM DEPTH OF 2'-4" WITH A 20 SQUARE INCH (MINIMUM) ANCHOR PLATE. TWO REFLECTORS ARE REQUIRED AT EACH POST, ONE FACING IN EACH DIRECTION (SEE TYPICAL REFLECTOR SECTION, SHEET 8).
21. TIMBER GUARD POSTS SHALL CONFORM TO SECTION 530.
22. GUARD POSTS SHALL HAVE A 1-1/2" DIAMETER HOLE DRILLED 6 INCHES BELOW TOP OF POSTS TO ALLOW 3/4" DIAMETER GALVANIZED WIRE ROPE (6X19) CONFORMING TO AASH70 M30, CLASS C TO PASS THROUGH AND BE ANCHORED TO EYE BOLT AT EACH END POST. EYE BOLTS BY FIELD SHALL CONFORM TO ASTM A489.
23. FOR THE DIKE FILL, IN-PLACE DENSITY TESTS USING THE SAND CONE (ASTM D1556) OR RUBBER BALLOON (ASTM D2167) TEST METHODS SHALL BE MADE AT A RATE OF AT LEAST ONE TEST PER EACH 2,000 CUBIC YARDS OF EARTHFILL PLACED (IN-PLACE VOLUME) OR A MINIMUM OF ONE TEST PER DAY WHEN EARTHFILL IS PLACED.

FIRST ISSUE FOR W.O. # 20604



KEY PLAN
NTS

NOTES :

1. ALL MATERIALS FURNISHED AND FABRICATED BY MODIFICATION SERVICES.
2. ALL WORK SHALL BE DONE IN ACCORDANCE WITH GENERAL CONSTRUCTION SPECIFICATION T-1 UNLESS OTHERWISE NOTED.
3. ALL EXCAVATION AND FILL PLACEMENT SHALL BE PERFORMED UNDER THE SUPERVISION OF A QUALIFIED SOILS INSPECTOR.
4. ON THE REDWATER POND NO. 3 PLAN, THE EXISTING CONTOURS ARE SHOWN WITH LIGHT LINES AND THE FINISHED CONTOURS ARE SHOWN WITH DARK LINES.
5. THE RAISED DIKE FOUNDATION PREPARATION SHALL CONSIST OF CLEARING, GRUBBING, AND REMOVING ALL ORGANIC MATERIALS AND TOPSOILS. ALL REMOVAL SHALL EXTEND TO A DEPTH THAT WILL SUPPORT HEAVY EQUIPMENT WITHOUT RUTTING OR HEAVING THE GROUND. PROIR TO THE PLACEMENT OF ANY MATERIAL, THE FOUNDATION MUST BE SCARIFIED TO OBTAIN A GOOD BOND BETWEEN THE FILL AND FOUNDATION.
6. THE EARTH BORROW SHALL BE OBTAINED FROM WITHIN THE REDWATER POND NO. 3 IN ACCORDANCE WITH THE FINISHED GRADING PLAN ON SHEET 1. ONLY SUITABLE MATERIAL IS TO BE USED FOR DIKE MATERIAL. THE REMAINING EXCAVATED MATERIAL IS TO BE USED FOR ONE FOOT COVER ON THE ABANDONED COAL STOCKPILE AREA AND AS SECONDARY BACKFILL (COVER) FOR THE GRAVITY DRAIN PIPE. NO STONE LARGER THAN 6 INCHES IN ITS LARGEST DIMENSION SHALL BE ALLOWED IN THE FILL.
7. RAISED DIKE CONSTRUCTION SHALL BE IN ACCORDANCE WITH GENERAL CONSTRUCTION SPECIFICATIONS NO. G-9 REVISION 5 ROLLED EARTHFILL FOR DAMS AND POWER PLANTS. EARTHFILL COMPACTION FOR THE RAISED DIKES SHALL BE AT LEAST 95% OF STANDARD MAXIMUM DRY DENSITY (ASTM D698). FILL MOISTURE SHALL BE CONTROLLED TO ACHIEVE OPTIMUM COMPACTION. ALLOWABLE MOISTURE CONTENT DURING PLACEMENT AND COMPACTION SHALL BE BETWEEN 3% ABOVE AND 2% BELOW OPTIMUM CONTENT. (SEE NOTE 23)
8. THE ABANDONED COAL STOCKPILE AREA EAST OF REDWATER POND NO. 3 (APPROXIMATE LIMITS SHOWN ON PLAN OF SHEET 1) SHALL BE GRADED TO DRAIN THEN COVERED WITH A MINIMUM OF 12 INCHES OF EARTH MATERIAL FROM INSIDE REDWATER POND NO. 3. THE AREA SHALL THEN BE SEEDED (TYPE 8 MIXTURE 1 FOR FALL SEEDING OR TYPE 6 MIXTURE 1 FOR SPRING SEEDING) AND FERTILIZED IN ACCORDANCE WITH SECTION 580.

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

SCALE: 1" = 100' EXCEPT AS NOTED 0

YARD

REDWATER CONTAINMENT NO. 3
PLAN – POND & DIKE

PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

DESIGN		DISCIPLINE INTERFACE		ENGINEERING APPROVAL
DESIGNED J.D.PARIS	SUPERVISED J.L.GLOVER	1	2	
DRAWN M.G.HRANEK				
CHECKED J.L.GLOVER	REVIEWED K.W.BURNETT	3	4	

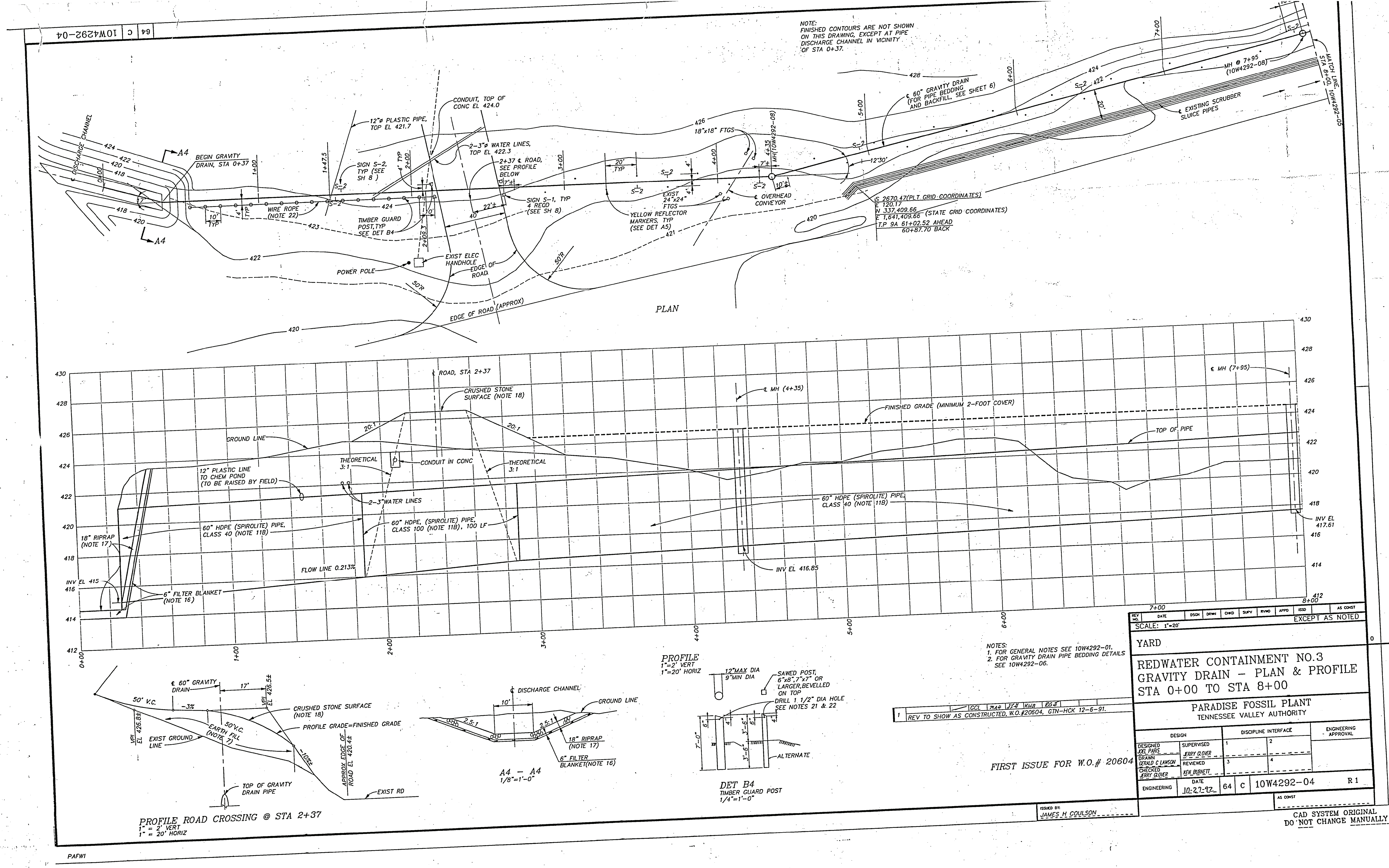
ENGINEERING	DATE 7-2-91	64	C	10W4292-01	R 0

ISSUED BY J. H. COULSON
JAMES H. COULSON

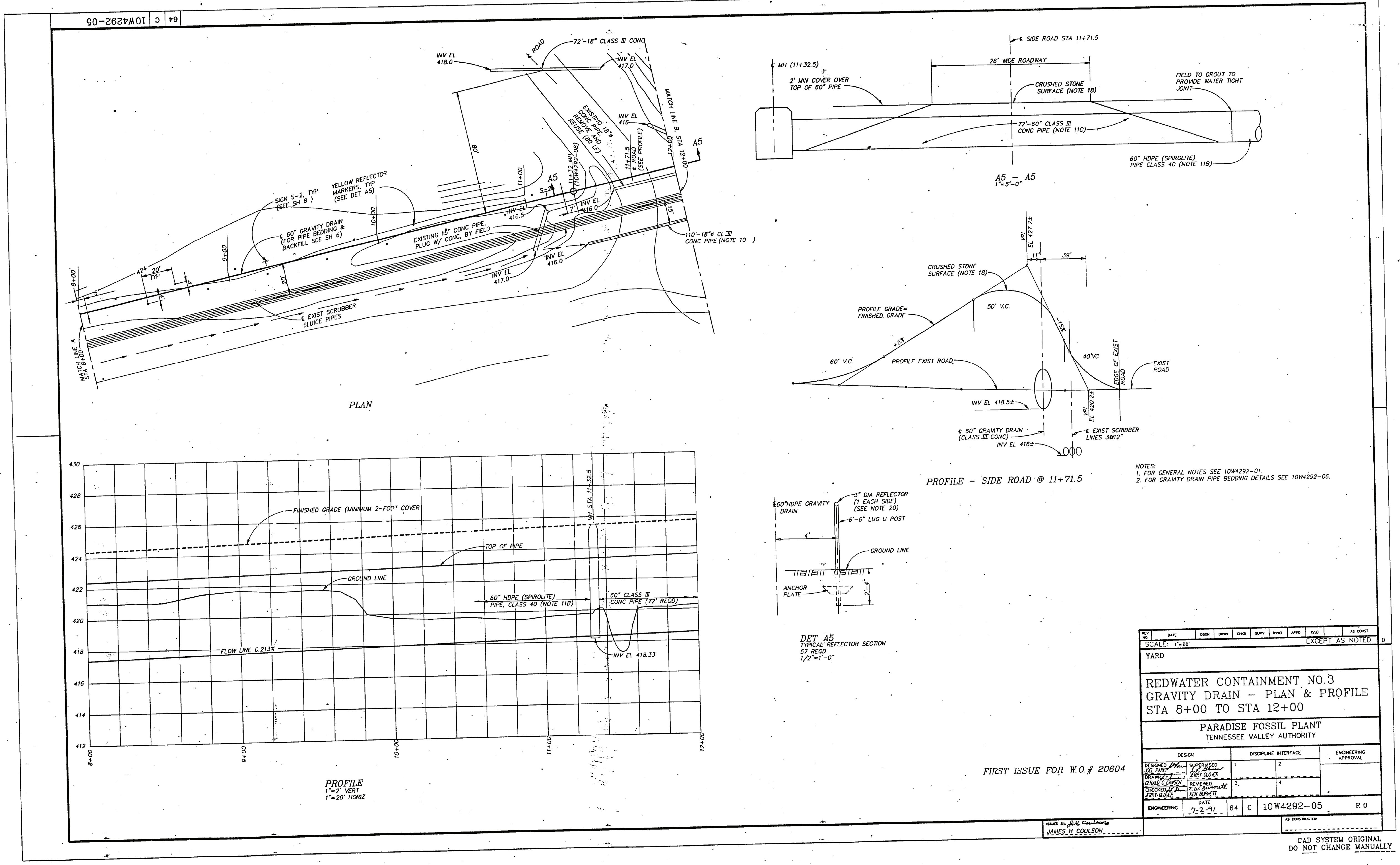
AS CONSTRUCTED

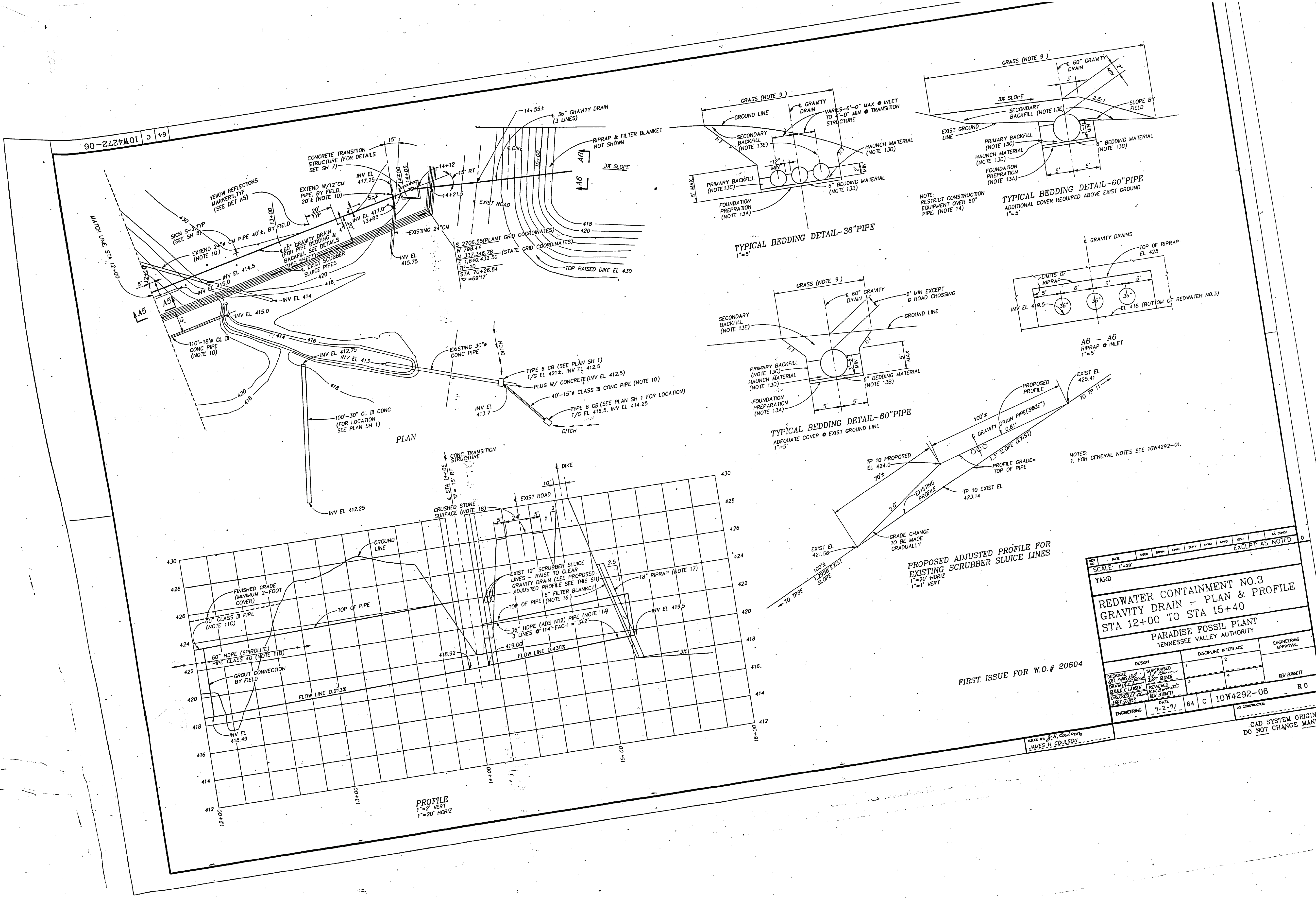
CAD SYSTEM ORIGINAL
DO NOT CHANGE MANUALLY

64 C 10W4292-01

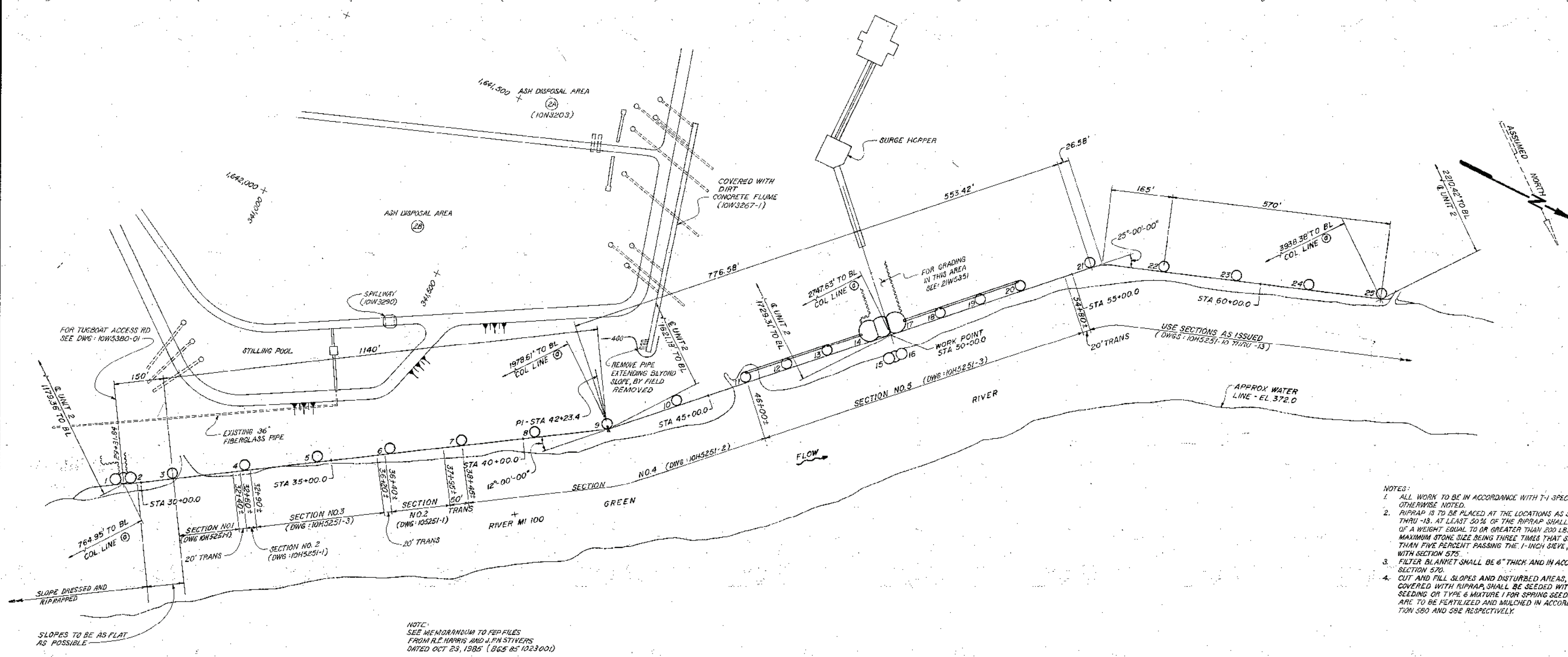


10W4292-04 C 64
NOTE:
FINISHED CONTOURS ARE NOT SHOWN ON THIS DRAWING, EXCEPT AT PIPE DISCHARGE CHANNEL IN VICINITY OF STA 0+37.
PLAN
BEGIN GRAVITY DRAIN, STA 0+37
℄ DISCHARGE CHANNEL
12"⌀ PLASTIC PIPE, TOP EL 421.7
CONDUIT, TOP OF CONC EL 424.0
2-3"⌀ WATER LINES, TOP EL 422.3
2+37 ℄ ROAD, SEE PROFILE BELOW
SIGN S-2, TYP (SEE SH 8)
SIGN S-1, TYP 4 REQD (SEE SH 8)
WIRE ROPE (NOTE 22)
TIMBER GUARD POST, TYP SEE DET B4
POWER POLE
EXIST ELEC HANDHOLE
EDGE OF ROAD
EDGE OF ROAD (APPROX)
18"x18" FTGS
EXIST 24"x24" FTGS
YELLOW REFLECTOR MARKERS, TYP (SEE DET A5)
OVERHEAD CONVEYOR
MH (10W4292-08)
℄ 60" GRAVITY DRAIN (FOR PIPE BEDDING AND BACKFILL, SEE SHEET 6)
MH @ 7+95 (10W4292-08)
℄ EXISTING SCRUBBER SLUICE PIPES
MATCH LINE, STA 8+00, 10W4292-05
S 2670.47(PLT GRID COORDINATES)
E 120.17
N 337,409.66 (STATE GRID COORDINATES)
E 1,641,409.66
T.P 9A 61+02.52 AHEAD
60+87.70 BACK
PROFILE
1"=2' VERT
1"=20' HORIZ
℄ ROAD, STA 2+37
CRUSHED STONE SURFACE (NOTE 18)
℄ MH (4+35)
℄ MH (7+95)
FINISHED GRADE (MINIMUM 2-FOOT COVER)
GROUND LINE
TOP OF PIPE
THEORETICAL 3:1
CONDUIT IN CONC
12" PLASTIC LINE TO CHEM POND (TO BE RAISED BY FIELD)
2-3" WATER LINES
60" HDPE (SPIROLITE) PIPE, CLASS 40 (NOTE 11B)
60" HDPE, (SPIROLITE) PIPE, CLASS 100 (NOTE 11B), 100 LF
18" RIPRAP (NOTE 17)
FLOW LINE 0.213%
INV EL 415
INV EL 416.85
INV EL 417.61
6" FILTER BLANKET (NOTE 16)
PROFILE ROAD CROSSING @ STA 2+37
1" = 2' VERT
1" = 20' HORIZ
℄ 60" GRAVITY DRAIN
50' V.C.
EXIST GROUND LINE
EARTH FILL (NOTE 7)
CRUSHED STONE SURFACE (NOTE 18)
PROFILE GRADE=FINISHED GRADE
APPROX EDGE OF ROAD EL 420.4±
TOP OF GRAVITY DRAIN PIPE
EXIST RD
A4 – A4
1/8"=1'-0"
℄ DISCHARGE CHANNEL
GROUND LINE
18" RIPRAP (NOTE 17)
6" FILTER BLANKET(NOTE 16)
DET B4
TIMBER GUARD POST
1/4"=1'-0"
12"MAX DIA 9"MIN DIA
SAWED POST, 6"x8",7"x7" OR LARGER,BEVELLED ON TOP
DRILL 1 1/2" DIA HOLE SEE NOTES 21 & 22
ALTERNATE
NOTES:
1. FOR GENERAL NOTES SEE 10W4292-01.
2. FOR GRAVITY DRAIN PIPE BEDDING DETAILS SEE 10W4292-06.
1 REV TO SHOW AS CONSTRUCTED, W.O.#20604, GTN-HCK 12-6-91.
FIRST ISSUE FOR W.O.# 20604
SCALE: 1"=20' EXCEPT AS NOTED
YARD
REDWATER CONTAINMENT NO.3
GRAVITY DRAIN – PLAN & PROFILE
STA 0+00 TO STA 8+00
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
DESIGNED JOEL PARIS
DRAWN GERALD C LAWSON
CHECKED JERRY GLOVER
SUPERVISED JERRY GLOVER
REVIEWED KEN BURNETT
ENGINEERING DATE 10-27-92
64 C 10W4292-04 R1
ISSUED BY: JAMES H COULSON
CAD SYSTEM ORIGINAL
DO NOT CHANGE MANUALLY
PAFW1


64 C 10W4292-05
PLAN
INV EL 418.0
72'-18" CLASS III CONC
INV EL 417.0
INV EL 416
EXISTING 18" CONC PIPE REMOVE AND REUSE (80 LF)
MATCH LINE B STA 12+00
11+32.5 MH (10W4292-08)
11+71.5 ¢ ROAD (SEE PROFILE)
SIGN S-2, TYP (SEE SH 8)
YELLOW REFLECTOR MARKERS, TYP (SEE DET A5)
¢ 60" GRAVITY DRAIN (FOR PIPE BEDDING & BACKFILL SEE SH 6)
EXISTING 15" CONC PIPE, PLUG W/ CONC. BY FIELD
INV EL 416.5
INV EL 416.0
INV EL 416.0
INV EL 417.0
110'-18"ø CL III CONC PIPE (NOTE 10)
¢ EXIST SCRUBBER SLUICE PIPES
MATCH LINE A STA 8+00
PROFILE
1"=2' VERT
1"=20' HORIZ
FINISHED GRADE (MINIMUM 2-FOOT COVER)
TOP OF PIPE
GROUND LINE
60" HDPE (SPIROLITE) PIPE, CLASS 40 (NOTE 11B)
60" CLASS III CONC PIPE (72' REQD)
FLOW LINE 0.213%
INV EL 418.33
MH STA 11+32.5
¢ MH (11+32.5)
2' MIN COVER OVER TOP OF 60" PIPE
¢ SIDE ROAD STA 11+71.5
26' WIDE ROADWAY
CRUSHED STONE SURFACE (NOTE 18)
72'-60" CLASS III CONC PIPE (NOTE 11C)
FIELD TO GROUT TO PROVIDE WATER TIGHT JOINT
60" HDPE (SPIROLITE) PIPE CLASS 40 (NOTE 11B)
A5 - A5
1"=5'-0"
PROFILE - SIDE ROAD @ 11+71.5
VPI EL 427.7±
CRUSHED STONE SURFACE (NOTE 18)
50' V.C.
PROFILE GRADE= FINISHED GRADE
60' V.C.
PROFILE EXIST ROAD
40'VC
EXIST ROAD
EDGE OF EXIST ROAD
INV EL 418.5±
VPI EL 420.2±
¢ 60" GRAVITY DRAIN (CLASS III CONC)
INV EL 416±
¢ EXIST SCRIBBER LINES 3Ø12"
DET A5
TYPICAL REFLECTOR SECTION
57 REQD
1/2"=1'-0"
¢60"HDPE GRAVITY DRAIN
3" DIA REFLECTOR (1 EACH SIDE) (SEE NOTE 20)
6"-6" LUG U POST
GROUND LINE
ANCHOR PLATE
NOTES:
1. FOR GENERAL NOTES SEE 10W4292-01.
2. FOR GRAVITY DRAIN PIPE BEDDING DETAILS SEE 10W4292-06.
FIRST ISSUE FOR W.O.# 20604
SCALE: 1"=20' EXCEPT AS NOTED
YARD
REDWATER CONTAINMENT NO.3
GRAVITY DRAIN - PLAN & PROFILE
STA 8+00 TO STA 12+00
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
DESIGN
DISCIPLINE INTERFACE
ENGINEERING APPROVAL
ENGINEERING
DATE 7-2-91
64 C 10W4292-05 R0
ISSUED BY JAMES H COULSON
CAD SYSTEM ORIGINAL
DO NOT CHANGE MANUALLY



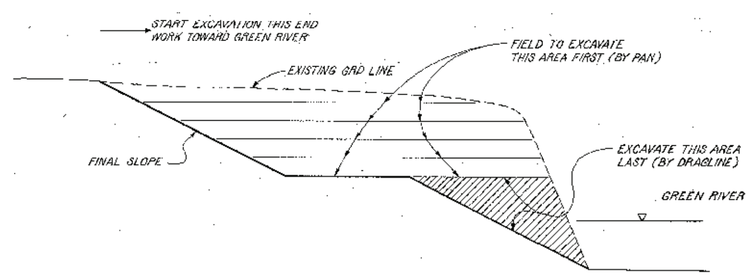
PLAN
PROFILE
1"=2' VERT
1"=20' HORIZ
TYPICAL BEDDING DETAIL-36"PIPE
1"=5'
TYPICAL BEDDING DETAIL-60"PIPE
ADDITIONAL COVER REQUIRED ABOVE EXIST GROUND
1"=5'
TYPICAL BEDDING DETAIL-60"PIPE
ADEQUATE COVER @ EXIST GROUND LINE
1"=5'
A6 - A6
RIPRAP @ INLET
1"=5'
PROPOSED ADJUSTED PROFILE FOR EXISTING SCRUBBER SLUICE LINES
1"=20' HORIZ
1"=1' VERT
NOTE:
RESTRICT CONSTRUCTION EQUIPMENT OVER 60" PIPE. (NOTE 14)
NOTES:
1. FOR GENERAL NOTES SEE 10W4292-01.
FIRST ISSUE FOR W.O.# 20604
MATCH LINE, STA 12+00
EXCEPT AS NOTED
SCALE: 1"=20'
YARD
REDWATER CONTAINMENT NO.3
GRAVITY DRAIN - PLAN & PROFILE
STA 12+00 TO STA 15+40
PARADISE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
DESIGN
DISCIPLINE INTERFACE
ENGINEERING APPROVAL
KEN BURNETT
64 C 10W4292-06 R0
JAMES H. COULSON
CAD SYSTEM ORIGINAL
DO NOT CHANGE MANUALLY



NOTES:
1. ALL WORK TO BE IN ACCORDANCE WITH T-1 SPECIFICATIONS UNLESS OTHERWISE NOTED.
2. RIPRAP IS TO BE PLACED AT THE LOCATIONS AS SHOWN ON 10H5251-1 THRU -13. AT LEAST 50% OF THE RIPRAP SHALL CONSIST OF STONES OF A WEIGHT EQUAL TO OR GREATER THAN 200 LBS EACH, WITH THE MAXIMUM STONE SIZE BEING THREE TIMES THAT SIZE AND NOT MORE THAN FIVE PERCENT PASSING THE 1-INCH SIEVE, AND IN ACCORDANCE WITH SECTION 575.
3. FILTER BLANKET SHALL BE 6" THICK AND IN ACCORDANCE WITH SECTION 570.
4. CUT AND FILL SLOPES AND DISTURBED AREAS, EXCEPT THOSE COVERED WITH RIPRAP, SHALL BE SEEDED WITH TYPE 8 FOR FALL SEEDING OR TYPE 6 MIXTURE 1 FOR SPRING SEEDING, SEEDED AREAS ARE TO BE FERTILIZED AND MULCHED IN ACCORDANCE WITH SECTION 580 AND 582 RESPECTIVELY.

SUMMARY OF QUANTITIES

ITEM NO.	DESCRIPTION	QUANTITY	UNIT
120	UNCLASSIFIED EXCAVATION	551,053	CY
	ROCK EXCAVATION	9,450	CY
575	RIPRAP	72,775	CY
570	FILTER	7,640	TON
580	SEEDING	29,345	SY
582	MULCHING	29,345	SY



EXCAVATION SEQUENCE
TYPICAL SECTION
NTS

PA NO. 3517

COMPANION DRAWINGS: 10H5251-1, -2, -3, -10 THRU -13

REV NO.	ECN/EDR	DATE	DSGN	DRWN	CHKD	RVWD	APPD	ISSD
3	PA 3517	11/26/84						
	REDRAWN. ADD EXCAV SEQ, REV QTY'S. PA NO. 3517							

DSGN J. HICKMAN
DRWN T.A. COX & A.H. SPERBER
CHKD J. HICKMAN
SUPV J. L. GLOVER
INSP
ENGINEER K. W. Burnett

SCALE: 1"=100'-0" EXCEPT AS NOTED

COAL HANDLING FACILITIES
UNITS 1-3

BARGE UNLOADING DOCK CHANNEL EXCAVATION-PLAN

PARADISE STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED | RECOMMENDED | APPROVED

INSPECTED AND APPROVED FOR ISSUE

KNOXVILLE | 64 | C | 10W5250 | RS

RECORD DRAWING AS CONSTRUCTED

TECHNICAL INFORMATION CENTER KNOXVILLE

Appendix C

Rating Curves

TVA Paradise Plant - Coal Yard Ponds Stage Storage Data and Rating Curves
Stantec Project #: 175669016

Pond Data

Coal Yard Runoff Pond 1

Stage - Storage Data

Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)
410.3	0.00	0.00	0.00
410.4	1.82	0.00	0.00
410.9	1.97	0.95	0.95
411.4	2.12	1.02	1.97
411.9	2.27	1.10	3.06
412.4	2.41	1.17	4.23
412.9	2.56	1.24	5.48
413.4	2.71	1.32	6.80
413.9	2.86	1.39	8.19
414.4	3.01	1.47	9.66
414.9	3.16	1.54	11.20
415.4	3.31	1.62	12.82
415.5	3.31	0.33	13.15
416.3	3.31	2.65	15.80
417.3	3.31	3.31	19.11
418.3	3.31	3.31	22.42
419.3	3.31	3.31	25.73
420.3	13.00	7.62	33.35
425.3			
430.3			
435.3			
440.3			
445.3			
450.3			
455.3			
460.3			
465.3			
470.3			

Stage - Discharge Rating Curve

Discharge to Red Water Pond 2									Overtopping	Composite Discharge		
48" Riser with 7.5" hole to 72" pipe												
H (hole)	Weir (hole) $Q = 3.27LH^{1.5}$	H' (hole)	Q (hole) (Hydrocalc)	H (riser)	Orifice (riser) $Q=0.51A(2gH)^{0.5}$	Weir (riser) $Q = 3.27LH^{1.5}$	H' (riser)	Pipe (riser) (Hydrocalc)	Weir $Q = 3.087LH^{1.5}$	Principal Spillway (cfs)	Auxiliary Spillway (None) (cfs)	Total Discharge (cfs)
0	0.0									0	----	0.0
0.1	0.2									0	----	0.2
0.6	3.0	1.0	1							1	----	1.4
1.1	7.4	1.5	1.8							2	----	1.8
1.6	13.0	2.0	2.2							2	----	2.2
2.1	20	2.5	2.5							3	----	2.5
2.6	27	3.0	2.8							3	----	2.8
3.1	35	3.5	3.1							3	----	3.1
3.6	44	4.0	3.3							3	----	3.3
4.1	53	4.5	3.5							4	----	3.5
4.6	63	5.0	3.8							4	----	3.8
5.1	74	5.5	3.9						0.0	4	----	3.9
5.2	76	5.6	4.0						19.5	4	----	23.5
6	94	6.4	4.3	0.0	0	0	19.4	620.0	527.1	4	----	531.4
7	119	7.4	4.7	1.0	51	6	20.4	650.0	1617.0	11	----	1628.1
8	145	8.4	5.0	2.0	72	18	21.4	665.0	3049.0	23	----	3072.2
9	173	9.4	5.3	3.0	88	33	22.4	685.0	4755.1	39	----	4793.8
10	203	10.4	5.6	4.0	101	51	23.4	700.0	6696.7	57	----	6753.6
15	373	15.4	5.6	9.0	152	173	28.4	701.0	19231.8	157	----	19389.2
20	574	20.4	5.6	14.0	189	336	33.4	702.0	35509.6	195	----	35704.5
25	802	25.4	5.6	19.0	221	531	38.4	703.0	54808.3	226	----	55034.4
30	1054	30.4	5.6	24.0	248	755	43.4	704.0	76712.4	253	----	76965.9
35	1329	35.4	5.6	29.0	272	1002	48.4	705.0	100942.3	278	----	101220.4
40	1623	40.4	5.6	34.0	295	1272	53.4	706.0	127293.1	301	----	127593.7
45	1937	45.4	5.6	39.0	316	1563	58.4	707.0	155605.9	322	----	155927.5
50	2269	50.4	5.6	44.0	336	1873	63.4	708.0	185753.1	341	----	186094.4
55	2618	55.4	5.6	49.0	354	2201	68.4	709.0	217629.3	360	----	217989.1
60	2983	60.4	5.6	54.0	372	2547	73.4	710.0	251145.4	377	----	251522.8

Interpolated or Extrapolated Value

Controlling, component of composite discharge

Coal Yard Runoff Pond 2

Stage - Storage Data

Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)
404.9	2.31	0.00	0.00
405.4	2.39	1.17	1.17
405.9	2.46	1.21	2.39
406.4	2.54	1.25	3.64
406.9	2.61	1.29	4.93
407.4	2.69	1.33	6.25
407.9	2.76	1.36	7.61
408.4	2.84	1.40	9.01
408.5	2.85	0.28	9.30
408.9	2.91	1.15	10.45
409.4	2.99	1.48	11.93
409.8	3.05	1.21	13.14
410	3.08	0.61	13.75
410.4	3.14	1.24	14.99
410.5			
411.5			
412.5			
413.5			
414.5			
415.5			
416.5			
417.5			
418.5			

Stage - Discharge Rating Curve

Discharge to Slag Pond 2A			Overtopping	Composite Discharge			
8" Emergency Flow Pipe							
H	H'	Q (Hydrocalc)	Weir $Q = 3.087LH^{1.5}$	Principal Spillway (Pump) (cfs)	Auxiliary Spillway (cfs)	Pond Overtopping (cfs)	Total Discharge (cfs)
0				0.4	0.0		0.4
0.5				0.4	0.0		0.4
1				0.4	0.0		0.4
1.5				0.4	0.0		0.4
2				0.4	0.0		0.4
2.5				0.4	0.0		0.4
3				0.4	0.0		0.4
3.5				0.4	0.0		0.4
3.6				0.4	0.0		0.4
4				0.4	0.0		0.4
4.5				0.4	0.0		0.4
4.9	0.0	0		0.4	0.1		0.5
5.1	0.2	0		0.4	0.1		0.5
5.5	0.6	0.6		0.4	0.6		1.0
5.6	0.7	1	12.2	0.4	1.0	12.2	13.6
6.6	1.7	2.2	445.2	0.4	2.2	445.2	447.8
7.6	2.7	3	1174.3	0.4	3.0	1174.3	1177.7
8.6	3.7	3.5	2106.1	0.4	3.5	2106.1	2110.1
9.6	4.7	4.1	3203.5	0.4	4.1	3203.5	3208.0
10.6	5.7	4.5	4444.3	0.4	4.5	4444.3	4449.2
11.6	6.7	5	5813.5	0.4	5.0	5813.5	5819.0
12.6	7.7	5.3	7300.2	0.4	5.3	7300.2	7305.9
13.6	8.7	5.7	8895.6	0.4	5.7	8895.6	8901.7

Interpolated or Extrapolated Value

Controlling, component of composite discharge

TVA Paradise Plant - Coal Yard Ponds Stage Storage Data and Rating Curves
Stantec Project #: 175669016

Pond Data

Coal Yard Runoff Pond 3

Stage - Storage Data / Stage - Discharge Rating Curve

Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)	Discharge to Pond 50 (RW1), 48" Riser to 24" Pipe: H	Weir Q = 3.27LH^1.5	Orifice Q=0.51A(2gH)^0.5	H'	Q (Hydrocalc)	Overtopping: Weir Q = 3.087LH^1.5	Composite Discharge: Principal Spillway (pump) (cfs)	Auxiliary Spillway (cfs)	Pond Overtopping (cfs)	Total Discharge (cfs)
412.3	2.17	0.00	0.00							0.4	0		0.4
412.8	2.35	1.13	1.13							0.4	0		0.4
413.3	2.52	1.22	2.35							0.4	0		0.4
413.8	2.70	1.30	3.65							0.4	0		0.4
414.3	2.87	1.39	5.04							0.4	0		0.4
414.8	3.05	1.48	6.52							0.4	0		0.4
415.3	3.22	1.57	8.09							0.4	0		0.4
415.8	3.40	1.65	9.74							0.4	0		0.4
415.9	3.47	0.34	10.08	0	0	0	9.6	51		0.4	0		0.4
416.3	3.57	1.41	11.49	0.4	10	32	10.0	52		0.4	10		10.8
416.8	3.75	1.83	13.32	0.9	35	48	10.5	54		0.4	35		35.5
417	3.80	0.75	14.08	1.1	47	53	10.7	55		0.4	47		47.8
417.1	3.82	0.38	14.46	1.2	54	55	10.8	55	0	0.4	54	0	54.4
417.5	3.92	0.77	14.08	1.6	83	64	11.2	56	117	0.4	56	117	173.5
418.1				2.2	134	75	11.8	57	463	0.4	57	463	520.5
419.1				3.2	235	91	12.8	60	1310	0.4	60	1310	1370.1
420.1				4.2	354	104	13.8	62	2406	0.4	62	2406	2468.5
421.1				5.2	487	115	14.8	65	3704	0.4	65	3704	3769.3
422.1				6.2	634	126	15.8	67	5177	0.4	67	5177	5244.5
423.1				7.2	793	136	16.8	70	6805	0.4	70	6805	6875.3
424.1				8.2	964	145	17.8	71.5	8576	0.4	72	8576	8647.7
425.1				9.2	1146	153	18.8	74	10478	0.4	74	10478	10551.5

Interpolated or Extrapolated Value   *Controlling, component of composite discharge*

Red Water Pond 1

Stage - Storage Data / Stage - Discharge Rating Curve

Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)	Discharge to Green River, 8' X 15' Riser to 72" Pipe: H	Weir Q = 3.27LH^1.5	Orifice Q=0.51A(2gH)^0.5	H'	Q (Hydrocalc)	Overtopping: Weir Q = 3.087LH^1.5	Composite Discharge: Principal Spillway (Pump to SP2A/2B) (cfs)	Auxilliary Spillway (cfs)	Pond Overtopping (cfs)	Total Discharge (cfs)
395.6	0.45	0.00	0.00							3.0	0		3
396.6	0.61	0.53	0.53							3.0	0		3
397.6	0.77	0.69	1.22							3.0	0		3
398.6	0.94	0.85	2.07							3.0	0		3
399.6	1.10	1.02	3.09							3.0	0		3
400.6	1.26	1.18	4.27							3.0	0		3
401.6	1.43	1.34	5.61							3.0	0		3
402.6	1.59	1.51	7.12							3.0	0		3
403.4	1.72	1.32	8.44	0.0	0	0	4.6	0		3.0	0		3
403.6	1.75	0.35	8.79	0.2	13	216	4.8	152		3.0	13		16
404.6	1.91	1.83	10.62	1.2	198	530	5.8	205		3.0	198		201
404.7	1.93	0.19	10.82	1.3	223	551	5.9	215		3.0	215		218
405.6	2.08	1.80	12.62	2.2	491	717	6.8	255		3.0	255		258
406.6	2.24	2.16	14.78	3.2	861	865	7.8	310		3.0	310		313
407.0	2.31	0.91	15.69	3.6	1027	917	8.2	330		3.0	330		333
407.6	2.40	1.41	17.10	4.2	1295	991	8.8	350		3.0	350		353
408.6	2.57	2.48	19.58	5.2	1784	1102	9.8	380		3.0	380		383
409.6	2.73	2.65	22.23	6.2	2322	1204	10.8	410		3.0	410		413
409.9	3.16	0.88	23.12	6.5	2493	1233	11.1	440		3.0	440		443
410.1				6.7	2609	1251	11.3	445	21	3.0	445	21	469
411.1				7.7	3214	1341	12.3	455	304	3.0	455	304	762
412.1				8.7	3860	1426	13.3	480	755	3.0	480	755	1238
413.1				9.7	4544	1506	14.3	510	1325	3.0	510	1325	1838
414.1				10.7	5265	1581	15.3	535	1993	3.0	535	1993	2531
415.1				11.7	6020	1654	16.3	555	2745	3.0	555	2745	3303
416.1				12.7	6808	1723	17.3	575	3574	3.0	575	3574	4152
417.1				13.7	7628	1789	18.3	600	4473	3.0	600	4473	5076
418.1				14.7	8478	1854	19.3	620	5436	3.0	620	5436	6059
419.1				15.7	9357	1916	20.3	640	6461	3.0	640	6461	7104
420.1				16.7	10266	1976	21.3	660	7542	3.0	660	7542	8205
421.1				17.7	11201	2034	22.3	680	8678	3.0	680	8678	9361
422.1				18.7	12164	2091	23.3	690	9866	3.0	690	9866	10559
423.1				19.7	13152	2146	24.3	715	11103	3.0	715	11103	11821
424.1				20.7	14166	2200	25.3	735	12389	3.0	735	12389	13127
425.1				21.7	15205	2252	26.3	750	13720	3.0	750	13720	14473
426.1				22.7	16268	2303	27.3	765	15096	3.0	765	15096	15864
427.1				23.7	17355	2354	28.3	780	16515	3.0	780	16515	17298

Interpolated or Extrapolated Value   *Controlling, component of composite discharge*

TVA Paradise Plant - Coal Yard Ponds Stage Storage Data and Rating Curves
Stantec Project #: 175669016

Pond Data

Redwater Pond 2

Stage - Storage Data

Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)
384.5	0.81	0.00	0.00
386	0.82	1.23	1.23
387	0.89	0.86	2.08
388	0.96	0.93	3.01
389	1.02	0.99	4.00
391	1.15	2.17	6.17
392	1.21	1.18	7.35
393	1.28	1.25	8.59
394	1.35	1.32	9.91
396	1.49	2.84	12.75
397	1.58	1.53	14.29
398	1.66	1.62	15.91
399	1.74	1.70	17.61
400.3	2.48	2.73	20.34
400.4			
401.4			
402.4			
403.4			
404.4			
405.4			
406.4			
407.4			
408.4			
409.4			

Stage - Discharge Rating Curve

Composite Discharge to Slag Pond 2A			
Principal Spillway (Pump) (cfs)	Auxiliary Spillway (None) (cfs)	Overtopping Weir $Q = 3.087LH^{1.5}$	Total Discharge (cfs)
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------		0
0.07	------	10	10
0.07	------	356	356
0.07	------	939	939
0.07	------	1685	1685
0.07	------	2563	2563
0.07	------	3555	3555
0.07	------	4651	4651
0.07	------	5840	5840
0.07	------	7116	7117
0.07	------	8474	8474

Interpolated or Extrapolated Value

Controlling, component of composite discharge

Red Water Pond 3

Stage - Storage Data

Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)
415.3	4.94	0.00	0.00
415.4	4.97	0.50	0.50
415.8	5.08	2.51	2.51
416.3	5.23	2.58	5.08
416.8	5.37	2.65	7.73
417.2	5.49	2.17	9.91
417.3	5.52	0.55	10.46
417.8	5.66	2.80	13.25
418.3	5.81	2.87	16.12
418.8	5.95	2.94	19.06
419.3	6.10	3.01	22.07
419.8	6.24	3.08	25.16
420.1	6.33	1.89	27.04
420.3	6.38	1.27	28.31
420.8	6.53	3.23	31.54
421.3	6.67	3.30	34.84
421.8	6.82	3.37	38.21
422.3	6.96	3.45	41.66
422.8	7.11	3.52	45.18
423.3	7.25	3.59	48.77
423.8	7.40	3.66	52.43
424.3	7.54	3.73	56.16
424.8	7.69	3.81	59.97
425.3	7.83	3.88	63.85
425.8	7.97	3.95	67.80
426.2	8.09	3.21	71.01
426.3	8.09		
427.3	8.09		
428.2	8.09		
429.2	8.09		
430.2	8.09		
431.2	8.09		
432.2	8.09		
433.2	8.09		
434.2	8.09		
435.2	8.09		

Stage - Discharge Rating Curve

Discharge to Red Water 1										Emerg. Dis. to Jacob's Creek Ash Pond		Overtopping	Composite Discharge			
6" Riser (Stand Pipe) to 18" Pipe					10" Riser (Stand Pipe) to 18" Pipe					3 36" Pipes						
H	Weir $Q = 3.27LH^{1.5}$	Orifice $Q=0.51A(2gH)^{0.5}$	H'	Q (Hydrocalc)	H	Weir $Q = 3.27LH^{1.5}$	Orifice $Q=0.51A(2gH)^{0.5}$	H'	Q (Hydrocalc)	H	Q (Hydrocalc)	Weir $Q = 3.087LH^{1.5}$	Principal Spillway (cfs)	Auxiliary Spillway (cfs)	Pond Overtopping (cfs)	Total Discharge (cfs)
					0	0.0	0	4.5	19				0	0		0
					0.1	0.3	1	4.6	19				0.3	0		0.3
					0.5	3	2	5.0	20				2	0		2
					1	9	2	5.5	21				2	0		2
					1.5	16	3	6.0	22				3	0		3
0	0	0	6.4	23	1.9	22	3	6.4	23				3	0		3
0.1	0	0	6.5	23	2	24	3	6.5	23				3	0		3
0.6	2	1	7.0	24	2.5	34	3	7.0	25				4	0		4
1.1	6	1	7.5	25	3	44	4	7.5	26				5	0		5
1.6	10	1	8.0	26	3.5	56	4	8.0	26				5	0		5
2.1	16	1	8.5	27	4	68	4	8.5	27				6	0		6
2.6	22	1	9.0	28	4.5	82	5	9.0	28				6	0		6
2.9	25	1	9.3	29	4.8	90	5	9.3	29	0.00	0		6	0		6
3.1	28	1	9.5	29	5	96	5	9.5	29	0.20	1		6	1		7
3.6	35	2	10.0	30	5.5	110	5	10.0	30	0.70	6		7	6		12
4.1	43	2	10.5	31	6	126	5	10.5	31	1.20	16		7	16		22
4.6	51	2	11.0	31	6.5	142	6	11.0	31	1.70	30		7	30		37
5.1	59	2	11.5	32	7	158	6	11.5	32	2.20	50		8	50		58
5.6	68	2	12.0	33	7.5	176	6	12.0	33	2.70	72		8	72		80
6.1	77	2	12.5	34	8	194	6	12.5	34	3.20	100		8	100		108
6.6	87	2	13.0	34	8.5	212	6	13.0	35	3.70	131		8	131		139
7.1	97	2	13.5	35	9	231	7	13.5	35	4.20	165		9	165		174
7.6	108	2	14.0	36	9.5	251	7	14.0	36	4.70	200		9	200		209
8.1	118	2	14.5	37	10	271	7	14.5	37	5.20	240		9	240		249
8.6	129	2	15.0	37	10.5	291	7	15.0	37	5.70	280		9	280		289
9	139	2	15.4	38	10.9	308	7	15.4	38	6.10	318		10	318		328
9.1	141	2	15.5	38	11	312	7	15.5	38	6.20	330	12	10	330	12	352
10.1	165	3	16.5	39	12	356	8	16.5	39	7.20	420	445	10	420	445	875
11	187	3	17.4	41	12.9	396	8	17.4	40	8.10	515	1091	11	515	1091	1617
12	213	3	18.4	42	13.9	443	8	18.4	42	9.10	615	2005	11	615	2005	2631
13	241	3	19.4	43	14.9	492	8	19.4	43	10.10	695	3087	11	695	3087	3793
14	269	3	20.4	44	15.9	542	9	20.4	44	11.10	805	4314	12	805	4314	5131
15	298	3	21.4	45	16.9	594	9	21.4	45	12.10	880	5671	12	880	5671	6563
16	329	3	22.4	46	17.9	648	9	22.4	46	13.10	950	7147	12	950	7147	8109
17	360	3	23.4	47	18.9	703	10	23.4	47	14.10	1015	8731	13	1015	8731	9759
18	392	3	24.4	48	19.9	760	10	24.4	48	15.10	1075	10419	13	1075	10419	11507

Interpolated or Extrapolated Value

Controlling, component of composite discharge

TVA Paradise Plant - Coal Yard Ponds Stage Storage Data and Rating Curves

Stantec Project #: 175669016

Pond Data

Red Water Pond 4

Stage - Storage Data / Stage - Discharge Rating Curve

				Discharge to Red Water Pond 3		Emergency Discharge to Jacob's Creek Ash Pond					Overtopping	Composite Discharge			
				12" Pipe		48" Riser and 36" Pipe									
Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)	H'	Q (Hydrocalc)	H	Weir $Q = 3.27LH^{1.5}$	Orifice $Q=0.51A(2gH)^{0.5}$	H'	Q (Hydrocalc)	Weir $Q = 3.087LH^{1.5}$	Principal Spillway (cfs)	Auxiliary Spillway (cfs)	Pond Overtopping (cfs)	Total Discharge (cfs)
448.6	0	0	0	0.0	0.0							0.0	0.0		0.0
450.8	0.00	0.00	0.00	2.2	5.5							5.5	0.0		5.5
453	0.22	0.32	0.32	4.4	8.5							8.5	0.0		8.5
454	0.44	0.47	0.47	5.4	9.5							9.5	0.0		9.5
456	0.90	1.56	1.89	7.4	11.5							11.5	0.0		11.5
456.7	0.98	1.87	2.34	8.1	12.0							12.0	0.0		12.0
457	1.02	0.96	2.85	8.4	12.5							12.5	0.0		12.5
457.2	1.04	0.50	2.84	8.6	12.5							12.5	0.0		12.5
457.7	1.08	0.73	3.58	9.1	13.0							13.0	0.0		13.0
458	1.10	0.86	3.70	9.4	13.3							13.3	0.0		13.3
459	1.17	1.46	5.04	10.4	13.5							13.5	0.0		13.5
459.2	1.15	1.35	5.05	10.6	14.0							14.0	0.0		14.0
459.7	1.19	0.83	5.87	11.1	14.3							14.3	0.0		14.3
461	1.28	2.18	7.23	12.4	14.5							14.5	0.0		14.5
461.2	1.39	0.27	7.49	12.6	15.3							15.3	0.0		15.3
461.7	1.45	0.71	8.21	13.1	15.5							15.5	0.0		15.5
462.2	1.51	1.45	9.66	13.6	15.8	0.2	4	23	14.4	140		15.8	3.7		19.4
462.7	1.57	1.51	11.17	14.1	16.0	0.7	24	42	14.9	142		16.0	24.1		40.1
463.2	1.64	1.57	12.74	14.6	16.5	1.2	54	55	15.4	145		16.5	54.0		70.5
463.7	1.70	1.64	14.38	15.1	16.8	1.7	91	66	15.9	148		16.8	66.0		82.7
464.2	1.76	1.70	16.08	15.6	17.0	2.2	134	75	16.4	150		17.0	75.1		92.1
464.7	1.82	1.76	17.84	16.1	17.3	2.7	182	83	16.9	153		17.3	83.1		100.4
465.2	1.88	1.82	19.66	16.6	17.5	3.2	235	91	17.4	155		17.5	90.5		108.0
465.7	1.94	1.88	21.54	17.1	17.8	3.7	292	97	17.9	157		17.8	97.3		115.1
466.2	2.03	1.96	23.49	17.6	18.0	4.2	354	104	18.4	162		18.0	103.7		121.7
466.3				17.7	18.3	4.3	366	105	18.5	163	6	18.3	104.9	6	129.5
467.3				18.7	18.5	5.3	501	116	19.5	166	231	18.5	116.5	231	366.5
468.3				19.7	19.0	6.3	649	127	20.5	170	611	19.0	127.0	611	756.6
469.3				20.7	19.5	7.3	810	137	21.5	175	1095	19.5	136.7	1095	1251.4
470.3				21.7	20.0	8.3	982	146	22.5	180	1666	20.0	145.8	1666	1831.6
471.3				22.7	21.0	9.3	1165	154	23.5	185	2311	21.0	154.3	2311	2486.3
472.3				23.7	21.3	10.3	1358	162	24.5	187	3023	21.3	162.4	3023	3206.7
473.3				24.7	21.5	11.3	1560	170	25.5	192	3796	21.5	170.1	3796	3987.7

Interpolated or Extrapolated Value *Controlling, component of composite discharge*

Red Water Pond 5

Stage - Storage Data / Stage - Discharge Rating Curve

				Discharge to Green River					Overtopping	Composite Discharge			
				14" Riser to 14" pipe									
Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)	H	Weir $Q = 3.27LH^{1.5}$	Orifice $Q=0.51A(2gH)^{0.5}$	H'	Q (Hydrocalc)	Weir $Q = 3.087LH^{1.5}$	Principal Spillway (cfs)	Auxiliary Spillway (cfs)	Pond Overtopping (cfs)	Total Discharge (cfs)
406.6	0.46	0.00	0.00							0	------		0
407.6	0.80	0.62	0.62							0	------		0
408.6	1.14	0.97	1.59							0	------		0
409.6	1.48	1.30	2.89							0	------		0
410.6	1.81	1.64	4.54							0	------		0
411.2	2.02	1.15	5.69	0	0	0	10.1	18		0	------		0
411.6	2.15	0.83	6.52	0.4	3	3	10.5	19		3	------		3
412.2	2.36	1.35	7.87	1.0	12	4	11.1	19		4	------		4
412.3				1.1	14	5	11.2	20	7	5	------	7	12
413.3				2.1	36	6	12.2	20	267	6	------	267	273
414.3				3.1	65	8	13.2	21	705	8	------	705	712
415.3				4.1	99	9	14.2	22	1264	9	------	1264	1272
416.3				5.1	138	10	15.2	23	1922	10	------	1922	1932
417.3				6.1	180	11	16.2	24	2667	11	------	2667	2677
418.3				7.1	227	11	17.2	25	3488	11	------	3488	3500
419.3				8.1	276	12	18.2	25	4380	12	------	4380	4392
420.3				9.1	329	13	19.2	26	5337	13	------	5337	5350
421.3				10.1	384	14	20.2	27	6356	14	------	6356	6369

Interpolated or Extrapolated Value *Controlling, component of composite discharge*

TVA Paradise Plant - Coal Yard Ponds Stage Storage Data and Rating Curves
Stantec Project #: 175669016

Pond Data

Slag Pond 2A

Stage - Storage Data | Stage - Discharge Rating Curve

				Discharge to Slag Pond 2B							Overtopping	Composite Discharge			
				2 48" pipes (elev. 410.7) and 1 60" pipe (elev. 408.5)											
Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)	H (60")	Q (60") (Hydrocalc)	H (48"-1)	Q (48"-1) Hydrocalc	H (48"-2)	Q (48"-2)	Q total	Weir $Q = 3.087LH^{1.5}$	Principal Spillway (cfs)	Auxiliary Spillway (cfs)	Pond Overtopping (cfs)	Total Discharge (cfs)
406	0.23	0.00	0.00									0	-----		0
407	0.99	0.56	0.56									0	-----		0
408	1.97	1.46	2.02									0	-----		0
408.5	2.44	1.10	3.12									0	-----		0
409	2.91	1.34	4.46									0	-----		0
409.4	3.26	1.23	5.69			0.0	0			0		0			0
409.5	3.35	0.33	6.02			0.1	0			0		0	-----		0
409.9	3.70	1.41	7.43	0	0	0.5	2			2		2	-----		2
410	3.78	0.37	7.81	0.1	0	0.6	3			3		3	-----		3
410.3	4.09	1.18	8.99	0.4	1	0.9	6	0.0	0	7		7			7
410.7	4.50	1.72	10.70	0.8	5	1.3	11	0.4	1	17		17	-----		17
411	4.81	1.40	12.10	1.1	10	1.6	17	0.7	4	31		31	-----		31
411.8	9.13	5.48	17.58	1.9	27	2.4	34	1.5	15	76		76	-----		76
412	10.18	1.93	19.51	2.1	32	2.6	39	1.7	20	91		91	-----		91
413	11.15	10.66	30.17	3.1	63	3.6	67	2.7	42	172		172	-----		172
414	15.54	13.28	43.46	4.1	100	4.6	93	3.7	70	263		263	-----		263
414.3	15.54	4.66	48.12	4.4	105	4.9	96	4.0	72	273	0.0	273	-----	0	273
415.3				5.4	145	5.9	122	5.0	100	367	355.0	367	-----	355	722
416.3				6.4	185	6.9	141	6.0	122	448	1004.1	448	-----	1004	1452
417.3				7.4	215	7.9	157	7.0	142	514	1844.7	514	-----	1845	2359
418.3				8.4	240	8.9	173	8.0	157	570	2840.0	570	-----	2840	3410
419.3				9.4	265	9.9	186	9.0	172	623	3969.1	623	-----	3969	4592
420.3				10.4	290	10.9	200	10.0	187	677	5217.5	677	-----	5217	5894
421.3				11.4	310	11.9	212	11.0	200	722	6574.8	722	-----	6575	7297
422.3				12.4	325	12.9	218	12.0	215	758	8032.8	758	-----	8033	8791

Interpolated or Extrapolated Value

Controlling, component of composite discharge

Slag Pond 2B

Stage - Storage Data | Stage - Discharge Rating Curve

				Discharge to SSP		Overtopping	Composite Discharge			
				16' wide concrete flume						
Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)	H	Weir $Q = 3.27LH^{1.5}$	Weir $Q = 3.087LH^{1.5}$	Principal Spillway (cfs)	Spillway (Pump) (cfs)	Pond Overtopping (cfs)	Total Discharge (cfs)
392.0	0.01	0.00	0.00				0	0		0
393.0	0.44	0.00	0.00				0	0		0
396.0	4.08	0.00	0.00				0	0		0
397.0	4.94	0.00	0.00				0	0		0
398.0	5.51	0.00	0.00				0	0		0
399.0	6.03	0.00	0.00				0	0		0
401.0	6.76	0.00	0.00				0	0		0
402.0	6.99	0.00	0.00				0	0		0
403.0	7.20	0.00	0.00				0	0		0
404.0	7.41	0.00	0.00				0	0		0
405.0	7.60	0.00	0.00				0	0		0
406.0	7.79	0.00	0.00				0	0		0
407.0	8.01	0.00	0.00				0	0		0
408.0	8.28	0.00	0.00				0	0		0
409.0	8.76	0.00	0.00				0	0		0
410.0	9.12	0.00	0.00				0	0		0
410.25	9.22	0.00	0.00	0.0	0		0	0		0
411.0	9.49	0.00	0.00	0.8	34		34	0		34
411.5	9.56	0.00	0.00	1.3	73		73	0		73
411.6	9.75	0.97	0.97	1.4	82		82	0		82
412.0	9.94	3.94	4.90	1.8	121		121	0		121
413.0	10.24	10.09	14.99	2.8	239		239	0		239
414.0	12.85	11.52	26.51	3.8	380		380	0		380
414.1				3.9	395	7	395	0	7	403
415.1				4.9	559	267	559	0	267	826
416.1				5.9	740	705	740	0	705	1445
417.1				6.9	938	1264	938	0	1264	2202
418.1				7.9	1151	1922	1151	0	1922	3073
419.1				8.9	1377	2667	1377	0	2667	4044
420.1				9.9	1617	3488	1617	0	3488	5106
421.1				10.9	1870	4380	1870	0	4380	6250
422.1				11.9	2134	5337	2134	0	5337	7472
423.1				12.9	2410	6356	2410	0	6356	8766
424.1				13.9	2697	7432	2697	0	7432	10128

Interpolated or Extrapolated Value

Controlling, component of composite discharge

TVA Paradise Plant - Coal Yard Ponds Stage Storage Data and Rating Curves
Stantec Project #: 175669016

Pond Data

Slag Stilling Pond

Stage - Storage Data

Elevation	Area (acres)	Incremental Storage (ac-ft)	Cumulative Storage (ac-ft)
396.0	0.00	0.00	0.00
397.0	0.02	0.00	0.00
398.0	0.18	0.00	0.00
399.0	0.29	0.00	0.00
401.0	0.48	0.00	0.00
402.0	0.60	0.00	0.00
403.0	0.73	0.00	0.00
404.0	0.89	0.00	0.00
404.7	1.00	0.00	0.00
406.0	1.22	0.00	0.00
406.1	1.23	0.00	0.00
406.1	1.22	0.00	0.00
407.0	1.33	1.15	1.15
408.0	1.42	1.37	2.52
408.1	1.43	0.14	2.66
409.0	1.52	1.33	3.99
410.4	2.78	2.96	6.95
411.1	2.78		
412.1	2.78		
413.1	2.78		
414.1	2.78		
415.1	2.78		
416.1	2.78		
417.1	2.78		
418.1	2.78		

Stage - Discharge Rating Curve

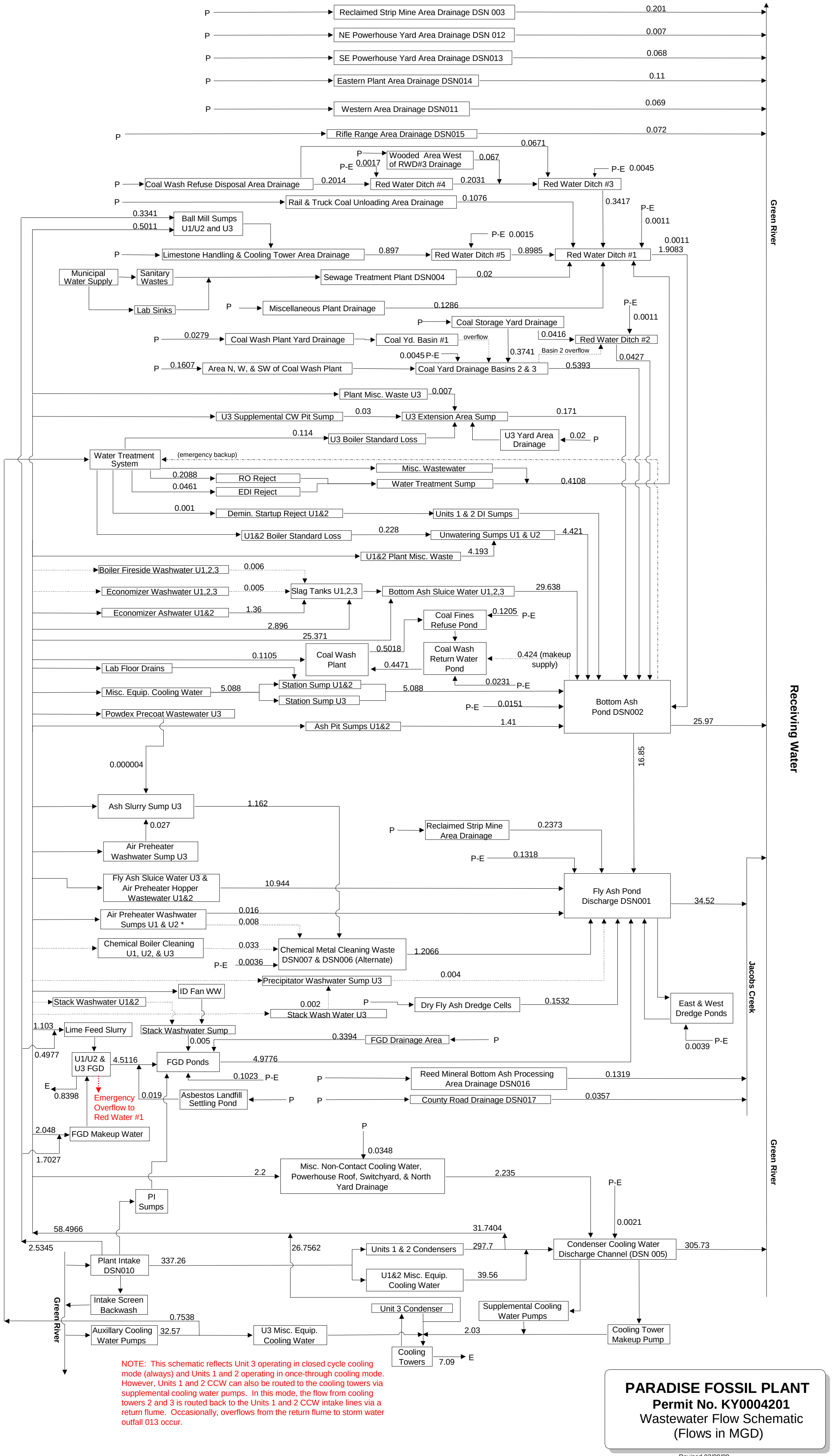
Discharge to Green River					Overtopping	Composite Discharge			
3 48" Spillway Risers to 3 36" Pipes						Principal	Auxiliary	Pond	Total
H	Weir $Q = 3.27LH^{1.5}$	Orifice $Q=0.51A(2gH)^{0.5}$	H'	Q (Hydrocalc)	Weir $Q = 3.087LH^{1.5}$	Spillway (Pump) (cfs)	Spillway (cfs)	Overtopping (cfs)	Discharge (cfs)
						26	0		26
						26	0		26
						26	0		26
						26	0		26
						26	0		26
						26	0		26
						26	0		26
						26	0		26
						26	0		26
						26	0		26
						26	0		26
						26	0		26
						26	0		26
						26	0		26
0.0	0	0	1.6	0		26	0		26
0.9	105	144	2.5	87		26	87		113
2.3	430	230	3.9	135	0	26	135		161
3.0	640	263	4.6	192	271	26	192	271	489
4.0	986	304	5.6	225	1026	26	225	1026	1277
5.0	1378	339	6.6	255	2054	26	255	2054	2335
6.0	1811	372	7.6	285	3296	26	285	3296	3607
7.0	2282	402	8.6	306	4718	26	306	4718	5050
8.0	2788	429	9.6	327	6301	26	327	6301	6655
9.0	3327	455	10.6	348	8030	26	348	8030	8405
10.0	3896	480	11.6	369	9894	26	369	9894	10289

Interpolated or Extrapolated Value

Controlling, component of composite discharge

Appendix D

Wastewater Flow Schematic



*Normally goes to ash disposal; can be routed to metal cleaning waste pond.

P-E - Precipitation less evaporation

Intermittent flow