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Coal Combustion Residue Impoundment
Round 11 - Dam Assessment Report

Allen Fossil Plant

Tennessee Valley Authority
Memphis, Tennessee

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

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INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The release of over five million cubic yards of coal combustion residue from the Tennessee Valley Authority's Kingston, Tennessee facility in December 2008, which flooded more than 300 acres of land and damaged homes and property, is a wake-up call for diligence on coal combustion residue disposal units. A first step toward this goal is to assess the stability and functionality of the ash impoundments and other units, then quickly take any needed corrective measures.

This assessment of the stability and functionality of the Allen Fossil Plant coal combustion residue management units is based on a review of available documents and on the site assessment conducted by Dewberry personnel on September 19, 2011. We found the supporting technical documentation to be generally adequate, although there is some deficiency (Section 1.1.3). As detailed in Section 1.2.5, there are 5 minor recommendations based on field observations that may help to maintain a safe and trouble-free operation.

In summary, the Allen Fossil Plant CCR management unit, East Ash Pond, is **POOR** for continued safe and reliable operation. The rating is influenced by indicated substandard seismic stability performance and lack of acceptable seismic stability analyses, as well as lack of some other critical engineering data for the dikes that impound this CCR pond. On July 31, 2012, TVA informed USEPA that seismic stability analyses for the Allen Plant would be submitted to USEPA by the middle of September 2012. There are no other recognized existing or potential management unit safety deficiencies. The inactive West Ash Pond was not rated.

PURPOSE AND SCOPE

The U.S. Environmental Protection Agency (EPA) is investigating the potential for catastrophic failure of Coal Combustion Surface Impoundments (i.e., management unit) from occurring at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present), status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency. The initiative will address management units that are classified as having a Less-than-Low, Low, Significant, or High Hazard Potential ranking (for Classification, see pp. 3-8 of the 2004 Federal Guidelines for Dam Safety).

In early 2009, the EPA sent letters to coal-fired electric utilities seeking information on the safety of surface impoundments and similar facilities that receive liquid-borne material that store or dispose of coal combustion residue. This letter was issued under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e), to assist the Agency in assessing the structural stability and functionality of such management units, including which facilities should be visited to perform a safety assessment of the berms, dikes, and dams used in the construction of these impoundments.

EPA requested that utility companies identify all management units including surface impoundments or similar diked or bermed management units or management units designated as landfills that receive liquid-borne material 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. Utility companies provided information on the size, design, age and the amount of material placed in the units (See Appendix C).

The purpose of this report is **to evaluate the condition and potential of residue release from management units and to determine the hazard potential classification**. This evaluation included a site visit. Prior to conducting the site visit, a two-person team reviewed the information submitted to EPA, reviewed any relevant publicly available information from state or federal agencies regarding the unit hazard potential classification (if any) and accepted information provided via telephone communication with the management unit owner. Also, after the field visit, additional information was received by Dewberry & Davis LLC about the East Ash Pond that was reviewed and used in preparation of this report.

This report presents the opinion of the assessment team as to the potential of catastrophic failure and reports on the condition of the management unit(s).

Note: The terms "embankment", "berm", "dike" and "dam" are used interchangeably within this report, as are the terms "pond", "basin", and "impoundment".

LIMITATIONS

The assessment of dam safety reported herein is based on field observations and review of readily available information provided by the owner/operator of the subject coal combustion residue management unit(s). Qualified Dewberry engineering personnel performed the field observations and review and made the assessment in conformance with the required scope of work and in accordance with reasonable and acceptable engineering practices. No other warranty, either written or implied, is made with regard to our assessment of dam safety.

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1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

The following conclusions pertain principally to the East Ash Pond at the Allen Fossil Plant. There also is an inactive West Ash Pond at the plant, which impounds no water. The West Ash Pond has been viewed in the field but no technical documentation is available for the dike embankments that enclose this pond. Conclusions are based on visual observations from a one-day site visit on September 19, 2011, and review of technical documentation provided by the Tennessee Valley authority (TVA).

1.1.1 Conclusions Regarding the Structural Soundness of the Management Unit(s)

Based on a review of the engineering data provided by TVA's technical staff and Dewberry engineers' observations during the site visit, the East Ash Pond dike embankments, spillway and outlets appear to be structurally sound under static loading conditions. Furnished seismic stability technical documentation shows that the dike embankments are substandard. The embankments are shown to fail at TVA's adopted design criterion, which is the nominal 500-year return period event (10 percent probability of exceedance in 50 years), but to meet the safety criterion (FS = 1.0) for return period events as low as 250 years. By way of comparison, this is a shorter return period than the historical New Madrid earthquakes (approximately 450 years return period) and far below that (2,475 years return period) required by the USEPA. TVA is conducting more rigorous analyses of seismic stability for the design earthquake required by USEPA. The results of those analyses are not yet available. Liquefaction potential and excessive deformation potential under seismic loading are unknown. However, based on Dewberry's review of the available boring information, the soils do not appear to be of the type that would be highly susceptible to liquefaction. Thus, qualitatively, there may be low probability of failure of the dikes due to liquefaction under earthquake loading. TVA has indicated that liquefaction potential will be addressed as part of a comprehensive risk/consequences-based evaluation of seismic failure risks being conducted in closure design.

From visual assessment in the field the inactive West Ash Pond dike embankments and outlet structure appeared to be stable under the prevailing normal static conditions in which it impounds no water. Even though this pond is inactive, TVA should continue surveillance and maintenance of the dike embankments and ensure that the inactive pond does not impound water.

1.1.2 Conclusions Regarding the Hydrologic/Hydraulic Safety of the Management Unit(s)

Furnished documentation shows that the East Ash Pond under current conditions should be able to pass the full 6-hour PMP event without overtopping the perimeter dike. Therefore, on the basis of furnished hydrologic/hydraulic documentation, the East Ash Pond has satisfactory hydrologic/hydraulic safety.

Simple calculations show that the empty inactive West Ash Pond could safely contain 100 percent of the rainfall of the 6-hour PMP over its catchment area. Therefore, in its current condition the inactive West Ash Pond appears to have satisfactory hydrologic safety.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

The supporting technical documentation for the East Ash Pond is generally adequate, except for documentation relating to performance of the dike embankments under seismic loading. Engineering documentation reviewed is referenced in this report and selected parts of the documentation are included in Appendix A. The documentation provided for seismic slope stability analysis is inadequate, and there is some inadequacy in other technical documentation due to the current lack of analyses or assessments of the effects of the very soft foundation soils, as well as lack of assessment of liquefaction potential. As previously noted, TVA will address liquefaction potential as part of a comprehensive risk/consequences-based evaluation of seismic failure risks being conducted in closure design. The potential effects of the very soft foundation soils should also be included in that evaluation. In addition, the reasoning for the horizontal seismic coefficient (k_h) used in the pseudo-static slope stability analysis should be clarified, if the pseudo-static method is used in further analyses. As previously noted, TVA is conducting more rigorous analyses of seismic stability for the design earthquake required by USEPA. TVA has informed USEPA that seismic stability analyses for the Allen Plant would be submitted to USEPA by the middle of September 2012.

For the inactive West Ash Pond there currently appears to be no need for technical documentation as long as this pond remains inactive and does not impound a significant amount of water. However, if this pond should be brought back into service, stability and seepage analyses and hydrologic/hydraulic analysis should be performed to evaluate and document its safety for in-service scenarios.

1.1.4 Conclusions Regarding the Description of the Management Unit(s)

The description of the management units provided by TVA is an accurate representation of what Dewberry observed in the field.

1.1.5 Conclusions Regarding the Field Observations

Dewberry staff was provided access to all areas in the vicinity of the management units required to conduct a thorough field observation. The visible parts of the dike embankments, spillway, and outlet structures were observed to have no signs of overstress, significant settlement, shear failure, or other signs of instability. The dike embankments visually appeared structurally sound. There are no apparent indications of unsafe conditions or conditions needing emergency remedial action. Some minor maintenance is needed (see Subsection 1.2.5)

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

The current maintenance and methods of operation appear to be adequate for the CCR management units. There was no evidence of significant undocumented embankment repairs or prior releases observed during the field inspection.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The surveillance program is adequate. The piezometer monitoring program is adequate. In the absence of problem or suspect conditions, there is no need for additional performance monitoring instrumentation at this time.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

The East Ash Pond is <u>POOR</u> for continued safe and reliable operation. No existing or potential management unit safety deficiencies are recognized in the field assessment and review of furnished operations, maintenance, surveillance, and monitoring information. Acceptable performance is expected under applicable static loading conditions and hydrologic conditions in accordance with the applicable criteria. The rating is influenced by indicated substandard seismic stability performance, inadequate seismic slope stability analyses, and lack of some critical engineering data for the dikes that impound this CCR pond. Implementation of recommendations as presented below would help improve the rating.

The inactive West Ash Pond is not rated at this time.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

Recommendations for physical or operational modifications to enhance structural stability are deferred until the results of additional seismic stability analyses and other documentation relating to performance of the dike embankments under seismic loading have been provided for review, along with any needed plan for remediation that may be proposed by TVA. See Subsection 1.2.3 for recommendations regarding supporting technical documentation.

1.2.2 Recommendations Regarding the Hydrologic/Hydraulic Safety

No recommendations for physical or operational modifications to enhance hydrologic/hydraulic capacity appear warranted at this time. See Subsection 1.2.3 for recommendations regarding potential supporting technical documentation for the West Ash Pond.

1.2.3 Recommendations Regarding the Supporting Technical Documentation

For the East Ash Pond:

1) Perform appropriate seismic stability analyses that use the USEPA design earthquake criterion for Significant hazard impoundments (i.e., earthquake with 2,475-year return period). Provide the basis and reasoning for the "design" seismic coefficient used in further pseudo-static slope stability analysis or perform a higher level of analysis that uses more sophisticated methods.

2) Review/evaluate liquefaction potential and, if necessary, perform a quantitative liquefaction analysis.

3) If it is determined that liquefaction is not likely, review/investigate the very soft to soft soils in the alluvial foundation beneath the dike embankments, evaluate deformation potential during the design earthquake, and assess the impact of any such deformation on the stability of the embankment.

If future plans call for re-activating the West Ash Pond, perform all required engineering analyses and develop all necessary technical documentation to demonstrate its ability for continued safe and reliable operation before it is brought back into service.

1.2.4 Recommendations Regarding the Description of the Management Unit(s)

No recommendations appear warranted at this time.

1.2.5 Recommendations Regarding the Field Observations

Based on the field observations, some recommendations are provided as follows:

1) Repair gully erosion on the divider dike;

2) Add crushed stone surfacing material in worn shallow depression on the dike crest south side where haul trucks turn into the dredge cell;

3) Avoid mowing the slopes when the ground is still wet from rainfall to minimize mower ruts on the slopes;

4) Observe over time the wet area at the toe of the north side exterior slope to verify that the puddle is not due to seepage. If the water source is found to be seepage, then repair the slope with an inverted filter. If the water is not from seepage, then re-grade or fill the slight depression with crushed stone surfacing material.

5) Paint corroded metal parts and hardware at the spillway in the divider dike and on the gates and gate-operators at the discharge end of the primary outlet conduits.

1.2.6 Recommendations Regarding Continued Safe and Reliable Operation

No additional recommendations appear warranted at this time.

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

*Stanley W. Notestine, Dewberry
*Fred Tucker, Dewberry
*John Dizer, TVA
Glen Civera, TVA
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*Scott Turnbow, TVA
*Shannon Bennett, TVA
*R.J. Rodocker, TVA
*Jacob Horton, TVA
*Griffin Lifsey, TVA
*Patrick Kiser, Stantec
*Steven Field, Stantec

*Participated in dike field observations

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein was assessed on September 19, 2011.

Stanley W. Notestine, P.E.
Registered, TN 11369

Fred Tucker, P.E.

2.0 DESCRIPTION OF THE COAL COMBUSTION RESIDUE MANAGEMENT UNIT(S)

2.1 LOCATION AND GENERAL DESCRIPTION

The Allen Fossil Plant (Allen) is physically located on the south bank of Lake McKellar in the southwest part of Memphis, Tennessee, and lies approximately 3 miles west southwest of interstate highway I-55 at its closest point. The Allen Plant draws cooling water from Lake McKellar. The lake is the principal receiving body for discharge from the Stilling Pond cell of the active East Ash Pond. See Appendix A Doc 01 for the location of the Allen Fossil Plant site on an aerial map.

The Allen Fossil Plant has one active CCR management unit, the East Ash Pond. The pond is designed and permitted to contain fly ash, bottom ash/boiler slag, storm water, and plant process water. As its name implies, the East Ash Pond lies on the east side of the plant generating facilities; the coal pile lies between them. The East Ash Pond has three areas, including a dredge cell in the western part, an ash pond in the central part, and a stilling pond in the eastern part that is a separate cell formed by an interior dike constructed of ash on the west side of the stilling pond. The sluice lines from the plant discharge into the northwest portion of the dredge cell area and water is channeled to the ash pond area. All drainage from the dredge cell/ash pond areas is to the stilling pond through a concrete discharge structure in the interior divider dike near the south end of the dike. Discharge from the stilling pond is to Lake McKellar through two discharge pipes through the north perimeter dike near the northeast corner; there are two additional discharge pipes through the east perimeter near the northeast corner that can be used for emergency discharge to a cutoff channel to Horn Lake to the south. The normal water level in the stilling pond is currently maintained 4 feet lower than the water level in the ash pond. See Appendix A Doc 02 for an aerial view of the East Ash Pond, dike locations, and other features.

On the west side of the generating facilities there is an inactive ash pond called the West Ash Pond; this pond has been inactive since 1992. It was the original ash pond for the plant, which was used until 1978 when sluicing of ash into the pond was discontinued. However, in May 1991 ash sluicing was reactivated after excavating and hauling 173,000 cubic yards of ash from the pond to use for fill in a US Army Corps of Engineers (COE) levee. Ash sluicing was again discontinued in October 1992. Water was pumped out, and the pond has remained inactive since that time. In the field the West Ash Pond appeared to still have substantial unused storage volume remaining. It was also observed to contain no impounded water, even though there currently is no way for storm water to flow out of the pond area. The top of the precast concrete pipe riser outlet located at the west end of the pond appeared to be at least 16 feet above the current dry pond bottom. See Appendix A Doc 03 for an aerial view of the West Ash Pond, dike locations, and other features.

Table 2.1 shows a summary of the size and dimensions of the ash pond perimeter dikes.

Table 2.1: Summary of Perimeter Dike Dimensions and Size		
	East Ash Pond	**West Ash Pond**
Maximum Dike Height (ft)	25 N. Side	28 N. Side
Minimum Crest Width (ft)	20 E. Side	18 N. Side
Approximate Length (ft)	8,600[1]	3,550
Steepest Side Slope (inside) H:V	3:1 E. Side	3:1 N., E., W. Sides
Steepest Side Slope (outside) H:V	3:1 E., S. Sides	2.5:1 N. Side

[1]*Around all cells including E. Stilling Pond; excludes divider dike, which is 1,450.'*

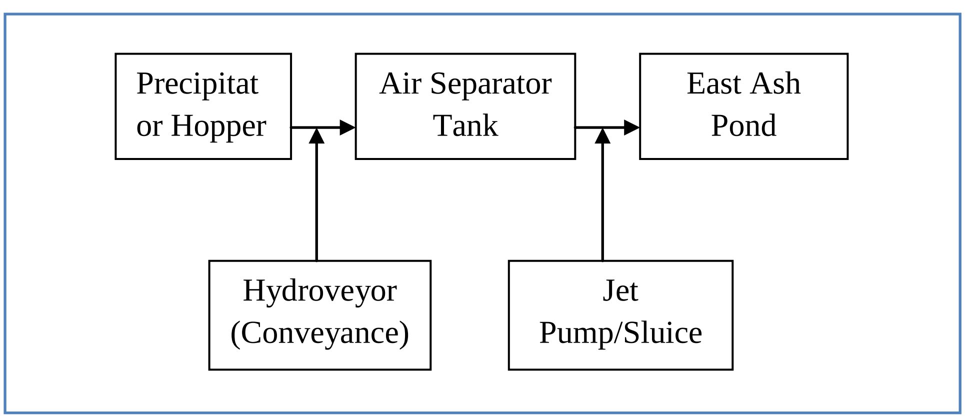
Since the West Ash Pond no longer impounds water or a substantial volume of ash and is inactive, this report principally covers the active East Ash Pond.

2.2 COAL COMBUSTION RESIDUE HANDLING

2.2.1 Fly Ash

Fly ash is collected and sluiced to the East Ash Pond via a closed system process. Fly ash collected in a precipitator hopper is removed with a hydroveyor to an air separator tank, where ash slurry is created. A jet pump is used to convey the slurry through a sluice line (pipe) to the ash pond. There is one fly-ash sluice line for each of the three boilers at Allen. Settled fly ash in the Dredge Cell of the ash pond is excavated into piles to drain and dry out. During the dry season, the dried fly ash is loaded onto trucks and hauled to a nearby site where it is used as structural fill. Some residual fly ash not captured by excavation in the Dredge Cell eventually settles in the central part of the ash pond. See Image 2.1 for the general fly ash collection flow path.

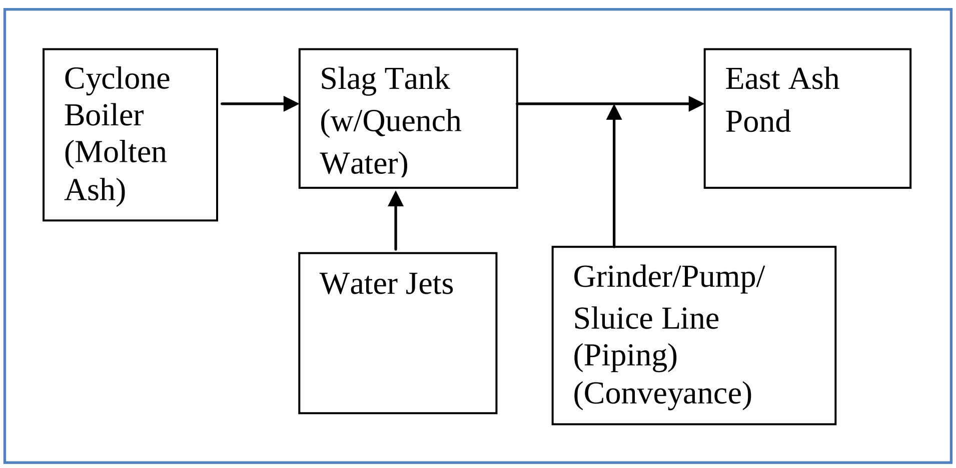
Image 2.1: Fly Ash Collection System Flow Path



2.2.2 Bottom Ash

In the Cyclone Boilers used at Allen, boiler slag is the predominant combustion residual that accumulates in the boilers along with some bottom ash. The CCR becomes molten and flows through an orifice in the bottom of the furnace and into the slag tank, which contains quench water. The molten ash fractures into granular pellets upon contact with the quench water. Although TVA did not specifically list process equipment such as water jets and clinker grinders, it is presumed that such equipment is used to facilitate removal of slag from the tank and grind it into suitable size for efficient sluicing. The boiler slag/bottom ash is formed into a slurry and sluiced, presumably with a jet pump, through a pipe to the ash pond. There is one boiler slag/bottom-ash sluice line for each of the three boilers at Allen. The boiler slag/bottom ash handling system is a closed system process. Settled boiler slag/bottom ash in the Dredge Cell of the ash pond is excavated into piles to drain and dry out. The dried material is sold for beneficial reuse, accounting for approximately 90 percent of the boiler slag/bottom ash sluiced to the pond on an annual basis. See Image 2.2 for general boiler slag/bottom ash collection flow path.

Image 2.2: Boiler Slag/Bottom Ash Collection System Flow Path



2.2.3 Boiler Slag

See Subsection 2.2.2 above.

2.2.4 Flue Gas Desulfurization Sludge

Allen does not have equipment used for flue gas desulfurization sludge (FGD) collection, handling and disposition.

2.3 SIZE AND HAZARD CLASSIFICATION

Size classification is based on storage capacity (of water) and maximum dam height, see Table 2.2a. See Tables 2.1 and 2.3 for embankment height and estimated pond storage capacity (East Ash Pond).

The East Ash Pond currently has a Small Size Classification according to the USACE Size Classification criteria. However, it is noted that the capacity for water storage (to top of dike) would exceed 1,000 acre feet if a substantial volume of ash (on the order of 365 acre-feet or 589,000 cubic yards) were permanently removed; this would increase the size classification to Intermediate, based on available water storage capacity.

Table 2.2a: Size Classification (USACE ER 1110-2-106)		
	Impoundment	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

The Allen ash pond embankments are not regulated for dam safety by a federal or state agency. Therefore, the ash ponds do not have federal or state hazard classifications. The TVA has assigned a Significant Hazard potential classification for the East Ash Pond. Dewberry concurs with this hazard potential classification on the basis of the hazard potential classification system adopted by USEPA. The classification system and the hazard potential determination are presented on the field observation checklist for the Allen East Ash Pond, included in Appendix B (also see Table 2.2b). The basis is that failure of the East Ash Pond perimeter dike embankment would discharge CCR into the adjacent Lake McKellar and low-lying shoreline areas. Failure would not likely cause loss of life but would cause environmental damage and possible disruption of the important waterway to the Memphis Port at Presidents Island.

Table 2.2b: Hazard Classification (FEMA Federal Guidelines for Dam Safety)		
	Loss of Human Life	**Economic, Environmental, Lifeline Losses**
Low	None Expected	Low and generally limited to owner
Significant	None Expected	Yes
High	Probable. One or more expected	Yes (but not necessary for classification)

Since the West Ash Pond is inactive and does not impound water, no size and hazard potential determinations have been made.

2.4 AMOUNT AND TYPE OF RESIDUALS CURRENTLY CONTAINED IN THE UNIT(S) AND MAXIMUM CAPACITY

Figures on the amount of CCRs stored in the ash ponds were not provided. However, the amount of CCRs currently stored in the East Ash Pond was roughly estimated along with total volume capacity and remaining volume capacity, as summarized in Table 2.3 with other data. No estimates were made for the inactive West Ash Pond. However, it appeared in the field to have substantial remaining volume capacity. When the West Ash Pond was reactivated in 1991, while the East Ash Pond was taken off-line, the West Ash Pond received sluiced ash for 18 months before it was again deactivated. The CCRs included fly ash and boiler slag/bottom ash.

Table 2.3: Estimated Capacity and other Data for the Unit	
East Ash Pond	
Surface Area (acre)[1]	80
Current Amount of Ash Stored (acre-feet)	990 (v. approx.)
Current Remaining Volume Capacity (level to top of dike) (acre-feet)	300 (v. approx.)[2]
Total Volume Capacity (level to top of dike) (acre-feet)	1,230 (v. approx.)
Minimum Crest Elevation (feet)	237.5 (236.5 Stilling Pond)
Normal Pond Level (feet)	230 (226 Stilling Pond)

[1] *Includes 10 acres for the separate Stilling Pond*
[2] *Excludes Stilling Pond Vol Capacity of 152 acre-feet (v. approx.)*

The current daily amount of ash sluiced to the East Ash Pond is 450 tons, including 90 tons of fly ash and 360 tons of boiler slag/bottom ash. TVA's projected ash disposal amounts through the year 2015 are summarized in Appendix A Doc 04. TVA plans to eventually close the wet disposal pond and dispose of dried ash (and gypsum after scrubbers are installed) in a permitted landfill. TVA's Master Strategy for the Allen plant is provided in Appendix A Doc 05.

2.5 PRINCIPAL PROJECT STRUCTURES

2.5.1 Earth Embankment

The East Ash Pond is formed by a perimeter dike and one divider dike that separates the stilling pond at the east end from the intermediate ash pond area and the dredge cell at the west end, as illustrated in the aerial view of the East Ash Pond in Appendix A Doc 02. The perimeter dike embankment is constructed primarily of sandy silt. The divider dike embankment is constructed of compacted bottom ash. A summary of the perimeter dike dimensions is presented in Table 2.1. The table gives the minimum crest dimension and maximum (steepest) slopes. The crest width actually varies from the 20 feet minimum shown in the table; for example it is 30 to 40 feet wide along most of the north side and is more than 100 feet wide on the south side. The crest on the south side accommodates a railroad siding. The perimeter dike exterior slope varies to as flat as 3.5 horizontal (H) to 1 vertical (V), and the interior slope varies to as flat as 4 H to 1 V. The divider dike crest width ranges from 22 to 25 feet, and both side slopes of the divider dike are typically 2 H to 1 V. A topographic plan of the East Ash Pond is shown on the Boring Plan and Instrumentation Plan included in Appendix A Doc 06. Cross sectional views of the perimeter and divider dikes are illustrated by the analysis sections included in Appendix A Doc 07 and Doc 08.

The dimensions for the West Ash Pond perimeter dike are also summarized in Table 2.1. These dimensions exclude the east part of the original pond footprint, where a Chemical Pond now exists as shown on the aerial view of the West Ash Pond in Appendix A Doc 03.

2.5.2 Outlet Structures

Water in the ash pond area flows into the stilling pond through a concrete spillway located in the divider dike near its south end. The concrete spillway has 2 bays that can be fitted with stop-log gates over the concrete weirs and skimmer plates in the forebays. No drawing was provided for this structure. In the field the south bay appeared to be on the order of 8 feet wide and the north bay somewhat less. The stop-log gate remains in place in the north bay to force all flow through the south bay (with stop-log gate removed). It is understood from TVA personnel that this is done to allow more efficient pH adjustment of water flowing into the stilling pond.

The stilling pond has four decant structures, each consisting of 48-inch diameter reinforced concrete pipe (RCP) risers with bottom discharge into 36-inch diameter conduits that pass through the perimeter dike. Two of these are the primary spillways that pass through the north perimeter dike to discharge into a concrete-lined flume leading to Lake McKeller. The other two decant structures are emergency spillways that pass through the east perimeter dike to discharge to the Horn Lake Cutoff, which is a channel that leads to Horn Lake to the south. All the riser overflows are fitted with skimmers. The two primary spillway conduits are fitted with sluice gates at the outlet ends. The gates are closed only to prevent backflow when the water in Lake McKeller threatens to rise above the discharge elevation during floods. There also are three 18-inch diameter DR-17 high density polyethylene (HDPE) siphon pipes, which were installed to provide dewatering of the stilling pond during construction of improvements that had recently been made. The stilling pond outlet structures are shown in the remedial improvements plans; selected drawings from the plans are included in Appendix A Doc 09 for reference.

2.6 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

"Critical" infrastructure includes facilities such as schools, hospitals, fire stations, police stations, etc. There are some 29 such facilities that may be considered critical or potentially critical infrastructure located within a 5-mile radius of the plant. These facilities are noted on the 5-mile radius map and accompanying listing of the critical infrastructure included in Appendix A Doc 01. Most are located in Memphis on what appears to be higher ground in an arc extending from southeast to northeast of the plant and a few are across the Mississippi River in West Memphis, Arkansas. None of these facilities would be threatened or directly impacted by failure of the dikes at the Allen plant. In general, the land use around Allen is industrial. Flood and CCR released from a postulated failure of the East Ash Pond perimeter dike would primarily impact Lake McKellar and/or the Horn Lake Cutoff channel and surrounding low-lying ground.

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

3.1 SUMMARY OF REPORTS ON THE SAFETY OF THE MANAGEMENT UNIT

Soon after the December 2008 failure of the CCR impoundment facility at the Kingston Fossil Plant, TVA engaged Stantec Consulting Services Inc. (Stantec) to visit and assess all of TVA's CCR impoundment facilities, including the ash-pond dikes at the Allen Fossil Plant. Stantec's initial field assessment was conducted on February 17, 2009 and subsequently reported in a Phase 1 report, which is included in Appendix A Doc 10 for reference. The Phase 1 report did not identify any conditions or issues that would immediately threaten the stability and safety of the dikes at the East Ash Pond or the West Ash Pond. The Phase 1 report listed a number of notable observations and concerns and gave maintenance recommendations that are routine in nature, as well as Phase 2 engineering and programmatic recommendations (see the Phase 1 report). The engineering recommendations centered on evaluating current conditions and preparing record drawings. Stantec recommended that hydrologic and hydraulic analyses be performed for the East Ash Pond (stilling pond), as well as the inactive West Ash Pond. Stantec's Phase 1 field assessment noted an area of standing water along the outside toe of the east side perimeter dike of the East Ash Pond (stilling pond), but could not determine if it was due to seepage because of dense vegetation in the subject toe area. Stantec also noted dense vegetation and trees in the interior of the West Ash Pond and on the outside slope of the north side perimeter dike of the West Ash Pond.

Stantec has performed additional engineering studies since the Phase 1 assessment. Furnished documentation reviewed includes Stantec's: "Report of Geotechnical Exploration and Evaluation of Slope Stability Northern Perimeter Dike East Active Ash Pond" dated March 25, 2010, "Geotechnical Report for the Evaluation of Dike Stability Remedial Measures for the Eastern Perimeter Dike East Stilling Pond" dated May 11, 2011, and "Results of Seismic Stability Analysis" dated October 3, 2011. See Section 7.0 for discussion of structural stability. Stantec has also prepared a "Seepage Action Plan (SAP)" dated June 25, 2010 that provides guidelines for controlling different levels of seepage, should seepage be observed in routine inspections. Maintenance has been performed at both the East and West Ash Ponds, and remedial improvements have been made at the stilling pond of the East Ash Pond as a result of engineering studies, as described in Subsection 4.1.3.

A furnished daily report dated August 4, 2011, monthly inspection report dated August 10, 2011, and quarterly inspection report dated May 22, 2011, prepared by

TVA personnel indicate no major structural or operational issues. See Appendix A Doc 11 for typical quarterly and monthly inspection reports, as well as daily field reports. No significant deterioration was indicated in the documentation reviewed. Stantec's 2011 annual inspection report dated April 4, 2011, indicated no major structural or operational issues. Observations typically were of eroded areas caused by surface runoff and wave erosion, bare spots lacking good vegetative growth (at West Ash Pond), animal burrows, some standing water at the outside toe of the north side perimeter dike at both the East Ash Pond (outside dredge cell) and the West Ash Pond, possible seep area at standing water along outside toe of the east side perimeter dike of the East Ash Pond (stilling pond), and a 25-foot long shallow tension crack and slough on the inside slope of the east side perimeter dike of the East Ash Pond (stilling pond). Stantec provided recommendations for repair or monitoring of all these conditions.

3.2 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

Discharge from the impoundments is regulated by the Tennessee Department of Environment and Conservation (TDEC). The Allen Fossil Plant has been issued a National Pollutant Discharge Elimination System Permit No. TN0005355 with effective date of January 1, 2008 and expiration date of August 3, 2010. TVA reapplied for the permit before the expiration date and is awaiting response from TDEC Division of Water Control.

3.3 SUMMARY OF SPILL/RELEASE INCIDENTS

Data reviewed by Dewberry indicate that there have been small releases of ash slurry due to piping gasket leaks, associated with the East Ash Pond operations. There is no information describing these releases or subsequent cleanup.

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

The Allen Fossil Plant was built in the 1950s by the Memphis Light, Gas, and Water Division. TVA leased the plant beginning in 1965 and purchased it in 1984. No construction records of the original East Ash Pond or West Ash Pond are available. Therefore, little is known of the original construction other than the approximate time frames that the ponds were built. TVA historical information indicates that the West Ash Pond was built sometime between 1955 and 1963 and was the original pond used for wet disposal of sluiced ash. The East Ash Pond was originally constructed in the 1960s and began to receive sluiced ash in 1969. The northern perimeter dike of the East Ash Pond was originally constructed by the USACE in the early 1960s to serve as a flood-control levee. Material for levee construction was obtained from within the footprint of the East Ash Pond. The northern perimeter dike (levee) was made a part of the East Ash Pond when the pond was expanded in the early 1970s. Before incorporating it, however, the upstream (inside) face of the levee was covered with a 3-foot thick clay liner, apparently as a design measure to minimize potential seepage through the levee. The dike embankments at both the West Ash Pond and the East Ash Pond were constructed to crest elevations that currently exist. That is, the dikes have not been raised since original construction. The original East Ash Pond did not include the area that is now occupied by the stilling pond.

4.1.2 Significant Changes/Modifications in Design since Original Construction

The only significant change to the East Ash Pond was expansion in 1978 to include the 10 acres now occupied by the stilling basin at the east end. The expansion included construction of the current portion of the perimeter dike around the stilling pond, the divider dike, the two primary spillways to Lake McKellar, and the two auxiliary spillways to the Horn Lake Cutoff. Since there appears to be no vestiges of the original east side perimeter dike, it is speculated that the soil in this dike may have been reused in the new portion of perimeter dike around the stilling pond, but there is no furnished information to confirm this.

In 1977 the Chemical Pond at the plant was constructed in a portion of the West Ash Pond footprint at the east end. The Chemical Pond was constructed to have a surface area of 3 acres, maximum dike height of 14 feet, and dike length of 700 feet. The West Ash Pond was first deactivated in 1978, but was temporarily reactivated for approximately 18 months beginning in May 1991, when the East Ash Pond was taken off-line. Prior to sluicing ash into the West Ash Pond, 173,000 cubic yards of ash were removed and used by the U.S. Army Corps of Engineers (USACE) as levee fill material. The West Ash Pond was once again deactivated in October 1992 and has been inactive since that time.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

Recent remedial improvements have been made at the East Ash Pond (stilling pond) to permanently lower the normal operating water level by 4 feet (from elevation 230 feet to 226 feet msl) for the purpose of improving a deficient slope stability factor of safety of the outside slope of the east side perimeter dike to meet or exceed a criterion of 1.5, as well as improve stability against potential piping (internal erosion) due to seepage. The work principally included lowering the principal and emergency riser overflow elevations and other measures to allow this construction, such as: installing additional stop logs on the concrete weir of the divider dike, installing a sediment control curtain, constructing a riprap blanket on the east slope of the divider dike, and installing siphons for lowering the stilling pond water level to elevation 224 feet msl during construction. See the selected drawings of the remedial improvement plans in Appendix A Doc 09.

A small slump or slough occurred on the inside slope of the north side perimeter dike of the East Ash Pond in 2009; it was repaired with riprap and crushed stone. The slump had occurred during excavation of the interior rim ditch, which over-steepened the slope and caused it to locally slump down. Because there was concern that the excavation penetrated the 3-foot thick impermeable layer that had been placed on the interior slope of the dike (levee) during development of the East Ash Pond, the TVA and the USACE requested that Stantec perform an investigation to evaluate the effect of the known excavations through the layer, determine if excavations have been made elsewhere through the layer, and determine their limits. Stantec's investigation, which included test borings and laboratory testing, as well as installation of piezometers, found that the soil material in the dike embankment itself meets the specification requirements for the material used in the 3-foot liner. Stantec's evaluation, based on visual observation of no seepage at the toe and review of piezometer monitoring data, indicated that the phreatic surface through the dike remained below the dike toe. Stantec concluded that "*although the impermeable layer has been compromised in some areas, it does not appear to have altered the impervious nature of the dike*." Stantec recommended continued monitoring to check for seepage and to check for changes in the phreatic line or for signs of instability. The investigation is presented in a report by Stantec titled, "Geotechnical Engineering Report – Evaluation of East Ash Pond Liner" dated December 11, 2009.

Investigation of a depression that had developed in the ash surface in the dredge cell of the East Ash Pond in early December 2010 led to the discovery of damage to the active 30-inch diameter ductile iron pipe (DIP) sanitary sewer line that passes under the cell. Plans to construct a temporary bypass with a 30-inch HDPE line were developed by Stantec, as shown by selected drawings in Appendix A Doc 12. Construction of the bypass had been essentially completed by the time of Dewberry's site visit.

In November 2010 a riprap blanket was installed on most of the inside slope of the south side perimeter dike of East Ash Pond to repair and protect against wave erosion.

There has been no significant repairs/rehabilitation made to the inactive West Ash Pond since original construction, although there has been significant recent vegetation maintenance to clear a thick growth of bushes and trees on the dry interior of the pond and on the outside slope of the north side perimeter dike.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

Furnished documents do not include the original operational procedures. The ponds are man-made basins designed and operated primarily to contain fly ash, boiler slag/bottom ash, ash sluice water, storm water, and plant process water. It is presumed that both the West Ash Pond and East Ash Pond were originally operated as wet ponds wherein CCR wastes were transported and placed by sluicing with water into the ponds, the suspended particles were allowed to settle out, and the water detained temporarily in the pond for neutralization and equalization prior to discharge through the gravity-flow overflow structures. It is further presumed that interior ditches/swales were maintained to promote drainage.

4.2.2 Significant Changes in Operational Procedures since Original Startup

The manner of transporting and placing the fly ash and boiler slag/bottom ash into the East Ash Pond by the wet sluicing method has basically not changed since original startup. A significant change in operational procedures since original startup includes separating off the western part of the pond with ash embankments and constructing a diversion trench to create a dredge cell for excavating and stacking the ash in piles or rows for drying. This change occurred in January 2005.

4.2.3 Current Operational Procedures

The East Ash Pond continues to receive sluiced fly ash, boiler slag/bottom ash, sluice water, storm water, and plant process water, as in the past. Currently, the boiler slag/bottom ash is excavated and dewatered at the dredge cell and sold for beneficial reuse. Reportedly 90 percent of it is sold. The fly ash also is excavated and dewatered at the dredge cell. The dried fly ash is beneficially used in a structural fill project at the nearby Frank Pidgeon Industrial Park, which is owned by the Memphis and Shelby County Port Commission. Even though most of the ash is now reused, a small percentage of the ash bypasses the dredging operation and flows to the ash settling area in the central part of the East Ash Pond.

4.2.4 Other Notable Events since Original Startup

During the time frame that the West Ash Pond was re-activated, the East Ash Pond was taken off-line and 453,000 cubic yards of ash were removed from this pond. The ash material removed from both ponds was used as fill material in a USACE levee.

5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Stanley W. Notestine, P.E. and Fred Tucker, P.E. performed a site visit on Monday, September 19, 2011 in company with the participants listed in Section 1.3.1.

The site visit began at 09:00 AM. The weather conditions during the visit were cloudy with intermittent light rainfall and mild temperatures. Ground conditions were wet. Photographs were taken of conditions observed. Please refer to the "Coal Combustion Dam Assessment Checklist Form" in Appendix B for additional information concerning the ponds. Selected photographs are included here for ease of visual reference. Digital photographs were taken by Dewberry personnel during the site visit and provided to TVA.

The visual assessment concluded the dikes were in satisfactory condition with no significant findings.

5.2 EARTH EMBANKMENT

5.2.1 Crest

The crest of the East Ash Pond (EAP) perimeter dike is accessible by automobile. The crest of the perimeter dike south side was observed to be extra wide, accommodating the ash/gravel-surfaced crest road as well as railroad siding, as shown in Photo 5.1. This photo also shows water ponded in a wide shallow depression. The shallow depression appeared to be due to wear of the surface caused by haul trucks turning into the dredge cell. A more typical view of the crest condition is shown by Photo 5.2, which is a view of the crest on the perimeter dike north side. Overall, the perimeter dike crest was observed to be in good condition. No major depressions (caused by settlement), sags, tension cracks, or other signs of significant settlement or mass soil movement were observed.

The crest of the divider dike between the perimeter dike south side and the spillway was observed to be eroded at the south end, as shown in Photo 5.3. The crest of the divider dike between the spillway and the perimeter dike north side appeared to be in satisfactory condition.

The crest of the inactive West Ash Pond perimeter dike was observed to be in satisfactory condition.

Photo 5.1: EAP Perimeter dike crest south side, looking east. Note ponded water.

Photo 5.2: EAP Perimeter dike crest north side, looking east.

Photo 5.3: EAP Divider dike crest south end, looking north. Note gully erosion in the bottom ash embankment.

5.2.2 Inside Slope and Pond Area

The visible parts of the inside slopes of the East Ash Pond perimeter dike above ash and water levels were observed to be in satisfactory condition with no areas of major erosion and no obvious signs of slumps, slides, bulges, tension cracks, or animal holes. No woody vegetation was observed on the inside slopes. The inside slope of the perimeter dike south side was observed to be heavily armored with the riprap that was placed in 2010 to protect against wave erosion, as shown in Photo 5.4. The inside slope of the perimeter dike east side of stilling basin was observed to have a well-maintained cover of grass, as shown in Photo 5.5. Formerly, the normal water level was maintained 4 feet higher than observed during the site visit. Evidence of the higher water level was visible by a line of minor wave-wash erosion on the inside slopes around the stilling pond. The area of slump repair on the upper part of the inside slope of the perimeter dike north side was observed to be in satisfactory condition, as shown in Photo 5.6. The lower part of the inside slopes in most of the East Ash Pond are covered with settled ash.

Photo 5.4: EAP Perimeter dike inside slope south side, looking east. Note riprap that was placed in 2010 to protect against wave erosion.

Photo 5.5: EAP Perimeter dike inside slope east side (stilling pond), looking north.

Photo 5.6: EAP Perimeter dike inside slope north side, looking east southeast in area of recent slump repair. Note crushed stone material used in the repair.

Photo 5.7: EAP Divider dike slope east side, looking southwest. Note minor gully erosion in slope above riprap blanket.

The slopes of the divider dike were observed to be steeper than those of the perimeter dike. The slope on the stilling basin side of the divider dike was observed to have a partial-height blanket of small riprap that was placed during recent remedial construction. The remaining surfaces of the divider dike slopes (and most of the crest) were observed to be covered with a thin layer of crushed stone. Minor gully erosion in the slope of this ash embankment above the new riprap blanket was observed, as shown in Photo 5.7. The fly ash excavation operation was observed in the dredge cell, as shown in Photo 5.8. The visible part of the sanitary sewer temporary bypass recently constructed in the dredge cell was observed where it ties into the manhole in the south part of the dredge cell, as shown in Photo 5.9. A view of the ash sluice lines to the East Ash Pond were observed, as shown in Photo 5.10.

Photo 5.8: EAP Excavation of fly ash in dredge cell, looking south. Note greenish stockpile of boiler slag/bottom ash in background.

Photo 5.9: EAP South end of temporary bypass construction for active sanitary sewer under dredge cell.

Photo 5.10: EAP View of ash sluice lines and plant process water line (leftmost) extending from the plant to the active pond, looking east. Rightmost line is abandoned.

Photo 5.11: WAP Typical view perimeter inside slope west side, viewed north.

Photo 5.12: WAP Typical view of inactive pond area, viewed south.

Photo 5.13: WAP View of apparent ash fill at east end of pond, viewed southeast. Note stone piles as deterrent for Least Tern nesting.

At the West Ash Pond (WAP) the inside slopes were observed to have a well-maintained cover of grass, as shown by the typical view in Photo 5.11. The inside slopes were in satisfactory condition. The interior of the inactive pond was observed to have some scattered trees, but the area was clear of brush and undergrowth and covered with a well-maintained grass cover, as shown in Photo 5.12. It was observed that the eastern part had been filled in with what appeared to be dry ash, as shown in Photo 5.13. The piles of stones on the barren surface had been placed to discourage nesting of the Least Tern in close proximity to the plant.

5.2.3 Outside Slope and Toe

The outside slopes of the East Ash Pond perimeter dike were observed to be in satisfactory condition with no areas of major erosion and no obvious signs of slumps, slides, bulges, tension cracks, significant seepage, or animal holes. No woody vegetation was observed on the outside slopes. A view of the outside slope of the perimeter dike east side is shown in Photo 5.14 and is typical of the outside slopes. The area of a previously observed seep, posted with a sign, at the toe of the perimeter dike east side is shown in Photo 5.15. At the time of the site visit there appeared to be no seep or wet soil in this area, although tall grass and weeds in the area hindered clear observation. TVA personnel indicated that the adjacent area to the east is a natural wetland that has standing water during the wet season. A minor mower rut was observed on the outside slope of the perimeter dike north side, as shown in Photo 5.16.

Photo 5.14: EAP Perimeter dike outside slope east side, looking north.

Photo 5.15: EAP Perimeter dike outside toe east side, identified seep area.

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Photo 5.16: EAP Perimeter dike outside slope north side, looking west. Note mower rut.

Surface water was observed in a puddle at the one location along the outside toe of the perimeter dike north side, as shown in Photo 5.17. There appeared to be no flowing seepage associated with this puddle.

Photo 5.17: EAP Perimeter dike outside toe north side. Note ponded water.

Photo 5.18: WAP Perimeter dike outside slope north side. Note dumpsters for cleanup of debris from spring flooding.

At the West Ash Pond the outside slopes were observed to be in satisfactory condition. The outside slope of the perimeter dike north side was observed to have a well-maintained cover of grass, as shown in Photo 5.18. At the time of the site visit debris from flooding earlier in the year was still being removed from the slope and placed in dumpsters, visible in Photo 5.18. It was observed that the outside slopes on the north and west sides of West Ash Pond are the only well-defined exterior slopes around this pond. The chemical pond and filled areas exist on the east side. The south side is a broad relatively level area that extends over to the municipal waste water treatment plant. The rim elevation on this side is higher than the dike crest on the north side. Even on the west side the outside slope does not have substantial height above the outside toe area, which appeared to be a broad fill extending to a low brushy and wooded area to the west.

5.2.4 Abutments and Groin Areas

Since the ponds are formed within a ring dike system, there are no natural abutments. No significant erosion or displacements were observed where the divider dike intersects the perimeter dike embankments at the East Ash Pond or at the inside bends in the perimeter dikes at both the East Ash Pond and the West Ash Pond.

5.3 OUTLET STRUCTURES

5.3.1 Spillway and Overflow Structures

The visible parts of the spillway and overflow structures at the East Ash Pond were observed to be in satisfactory condition. Water was flowing into the stilling pond through the south bay of the spillway in the divider dike, as shown in Photo 5.19. The concrete spillway structure appeared to be sound. Much of the metalwork (e.g., handrails, skimmer plates, channel guides, etc.) was observed to be rusty but currently sound and functional. No obvious sinkholes or dropouts were observed in the ash embankment fill next to the sides of the spillway structure.

All that could be seen of the overflow risers at the north end of the stilling pond were the skimmers on top of the risers, as shown in Photo 5.20. The skimmers appeared to be new or newly refurbished.

The old overflow riser at the West Ash Pond is shown in Photo 5.21. The RCP sections that form the riser were observed to be weathered, but they appeared sound. The skimmer structure had been taken off the top of the riser, along with a metal-grate walkway, to allow placement of an extra section of pipe on top of the riser to raise the overflow elevation. TVA personnel indicated that this was done to prevent reverse overflow into the pond from backflow during extreme flood events when water levels in the Mississippi River and Lake McKellar are elevated, as occurred earlier this year.

Photo 5.19: EAP South bay of concrete spillway in divider dike, discharging into stilling pond.

Photo 5.20: EAP View of skimmers atop overflow risers in stilling pond, looking south.

Photo 5.21: WAP View of old overflow riser in inactive pond, looking east. Note extra RCP section on top of riser.

5.3.2 Primary Outlet Conduits

Photo 5.22: EAP View of outlet ends of primary spillway conduits, looking south.

At the East Ash Pond (stilling pond) water that overflows the two 48-inch diameter primary riser structures discharges through two 36-inch diameter RCP conduits that pass through the perimeter dike north side to outfall into the flume that leads to Lake McKellar. Water was discharging from these primary outlet conduits at the time of the site visit, as shown in Photo 5.22. The concrete-lined flume is shown in Photo 5.23. The primary conduits were observed to be lined with polyvinyl chloride (PVC). The conduits appeared to be sound and functional. No sinkholes or dropouts were observed along the alignment of the conduits through the dike embankment. The concrete end wall structure with mounted floodgates appeared sound, although the metal gates and hardware were observed to be rusty. One of the operator stem guide brackets (for west gate) was observed to be bent down. TVA personnel indicated that the floodgates normally remain open and are closed only to prevent backflow when Lake McKellar is elevated during extreme floods. The concrete-line flume was observed to have some cracks and surface deterioration but appeared to be functional.

Photo 5.23: EAP View of flume to Lake McKellar, looking north. Note outlet ends of siphons.

At the West Ash Pond the end of the outlet conduit was not observed. However, no evidence of past sinkholes or dropouts was observed along the alignment of the conduit through the perimeter dike west side.

5.3.3 Emergency Outlet Conduits

Water that overflows the two 48-inch diameter emergency riser structures discharges through two 36-inch diameter RCP conduits that pass through the perimeter dike east side to outfall into a ditch that leads to the Horn Lake Cutoff channel. The outlet ends of the two emergency outlet conduits were observed to be more than half submerged, as shown in Photo 5.24. No water was flowing through these conduits at the time of the site visit. TVA personnel indicated that preferences are to pump from the stilling pond rather than discharge through the emergency conduits, when the floodgates have to be closed at the primary outlet conduits. These emergency conduits were observed to be lined with PVC and appeared to be sound and functional. No sinkholes or dropouts were observed along the alignment of the emergency conduits through the dike embankment. The blanket of small riprap used for erosion control around the outlet ends of the emergency conduits was observed to be in satisfactory condition.

Photo 5.24: EAP View of outlet ends of emergency spillway conduits, looking west.

5.3.4 Low Level Outlet (Siphons)

None of the overflow structures has a low level outlet. However, there are three 18-inch diameter HDPE siphon pipes that were installed to lower the stilling pond to elevation 224 feet msl during construction of remedial improvements at the stilling pond and will remain in place. The siphons and associated gate valves are shown in Photos 5.25 and 5.26 (see also outlet ends of siphons in Photo 5.23). The siphons and associated gates and hardware were observed to be in satisfactory condition.

Photo 5.25: EAP Partial view of siphons, looking west.

Photo 5.26: EAP Gate valves in siphons, looking west.

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record

No documentation has been provided about the maximum water surface elevations in the ash ponds. Both the active East Ash Pond and the inactive West Ash Pond are contained within perimeter dikes and do not receive off-site natural drainage. Therefore, they do not receive flood inflows from off-site. The source of water into the ash ponds is sluicing water, plant drainage, and Coal Yard runoff to the East Ash Pond and minor plant drainage to the West Ash Pond, plus precipitation that falls directly into the ponds. Historic climate data available on-line from the National Weather Service (NWS) indicate that the highest recorded 24-hour precipitation in the Memphis area since original construction of the ash ponds was 6.84 inches on November 28-29, 2001, which at the time was the highest recorded in the previous 50 years of record; the total for the multi-day storm was 10.67 inches. Near record flooding of the Mississippi River occurred in the Memphis area in early May 2011, causing Lake McKellar to rise to high levels that encroached substantially onto the outside slopes of the perimeter dikes of both the East Ash Pond and the West Ash Pond, primarily on the north side. From high water marks indicated by some remaining flood debris on the slopes, it appeared that the elevated water level in Lake McKellar reached up to approximately one-third the height of the north side exterior slope of the East Ash Pond perimeter dike and more than mid height of the north side exterior slope of the West Ash Pond perimeter dike.

6.1.2 Inflow Design Flood

For the “small” size and “significant” hazard potential classification assigned to the East Ash Pond dikes, the USACE hydrologic evaluation guidelines (ER-1110-2-106 26 Sept 1979 “Recommended Guidelines for the Safety Inspection of Dams”) recommend a spillway design flood (SDF) of 100-year frequency to 1/2 Probable Maximum Flood (1/2 PMF), where the magnitude selected most closely relates to the involved risk. For comparison, the Tennessee Dam Safety Laws and Regulations (2007) require (for existing dams) use of a Freeboard Design Storm of 1/3 Probable Maximum Precipitation (1/3 PMP) (6-hour duration) to develop the design flood.

Stantec performed a hydrologic and hydraulic (H & H) analysis of the East Ash Pond, including the separate ash and stilling ponds. The analysis is presented in the H & H report dated September 30, 2010, which is included in Appendix A Doc 13 for reference. Their analysis evaluated the performance of the ash and stilling ponds for the 1-, 10-, 25-, 50- and 100-year 24-hour SCS Type II storms and the 6-hour PMP. The results of the analysis for the 6-hour PMP indicate the following:

- Ash pond pool el 234.8 ft, leaves 2.7 ft freeboard
- Stilling pond pool el 232.7 ft, leaves 3.8 ft freeboard
- Stilling pond tailwater el 225.0 ft

No inflow design flood has been provided for the inactive West Ash Pond.

6.1.3 Spillway Rating

Spillway rating curves were developed by Stantec for the East Ash Pond spillway and outlet structures. Rating curves for the ash pond and the stilling pond for each storm event are presented in Appendix C of Stantec's H & H report (see Appendix A Doc 13).

A spillway rating for the West Ash Pond outlet structure has not been provided, which reflects the assumption that there is no outflow from the pond during the design storm.

6.1.4 Downstream Flood Analysis

No downstream flood analysis has been provided for the ash ponds. A general qualitative analysis based on field observations and review of available data is as follows:

Failure of the East Ash Pond perimeter dike would most likely occur through the east side or north side and discharge water and coal combustion residue onto low-lying outside toe areas. Water released through a breach in the dike would likely carry eroded ash into Lake McKellar causing environmental damage, as well as property damage, and potentially disrupting Memphis Port traffic. The failure would not likely cause loss of life.

If the West Ash Pond impounds a large volume of storm water during a rain event, or become active, then failure of the West Ash Pond perimeter dike would most likely occur through the north side with consequences similar to those described above.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

The hydrologic/hydraulic documentation for the East Ash Pond is adequate. No hydrologic/hydraulic analyses have been provided for the inactive West Ash Pond. However, rigorous analyses are not be needed to document hydrologic safety of the inactive West Ash Pond, which is contained within a perimeter dike system and does not receive off-site natural drainage. Simple calculations summarized in the following section should be sufficient.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

For assessment purposes the appropriate design storm for the East Ash Pond may be taken as 1/3 PMP, 6-hour duration (see Subsection 6.1.2). Stantec's analysis shows that the East Ash Pond under current conditions should be able to pass the full 6-hour PMP event without overtopping the perimeter dike. Therefore, on the basis of furnished hydrologic/hydraulic documentation, the East Ash Pond has satisfactory hydrologic/hydraulic safety. However, Stantec noted that if the weir at the spillway between the ash pond and stilling pond is raised to elevation 231 ft msl, the ash pond could overtop during the 6-hour PMP event and advised that a minimum 6-foot freeboard be maintained in the ash pond area. Stantec further noted that during a closure scenario the stilling pond would not be able to pass the 6-hour PMP event and advised that consideration be given to installing an emergency spillway between the stilling pond and Lake McKellar for the closure condition, or close both the ash pond area and the stilling pond area at the same time.

The West Ash Pond does not impound water and, according to TVA personnel, storm water does not gradually build up in it, even though there is no mechanism for storm water to flow out of the pond. It is assumed that the pond bottom has high infiltration capacity. As it currently exists, the pond bottom appears to be at least 15 feet below the dike crest north side. The inactive pond does not receive uncontrolled inflows from off-site. By inspection, the empty West Ash Pond could safely contain 100 percent of the rainfall depth (29.8 inches or approximately 2.5 feet) of the 6-hour PMP over its catchment area. Therefore, in its current condition the inactive West Ash pond appears to have satisfactory hydrologic safety. However, if this pond should be brought back into service, hydrologic/hydraulic analysis should be performed to evaluate and document its safety for in-service scenarios.

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

TVA's consultant, Stantec performed geotechnical explorations and analyses of the East Ash Pond, focusing mainly on the north perimeter dike and the east perimeter dike, since these appear to have the more critical embankments. The divider dike was also investigated under the scenario of permanently lowering the normal water level in the stilling pond to 226 feet msl while maintaining 230 feet msl in the ash pond. Stantec's stability assessment included analyses of static slope stability, seepage/piping potential, and simplified seismic slope stability using the pseudo-static method[1]. Computer software programs commonly used in the geotechnical profession were used in the analyses. The exploration results and/or analyses are presented in the following Stantec reports:

1. "Report of Geotechnical Exploration and Evaluation of Slope Stability - Eastern Perimeter Dike East Stilling Pond" dated February 4, 2010.

2. "Report of Geotechnical Exploration and Evaluation of Slope Stability - Northern Perimeter Dike East Active Ash Pond" dated March 25, 2010.

3. "Report of Geotechnical Exploration and Evaluation of Slope Stability – Remedial Measures for Eastern Perimeter Dike East Stilling Pond" dated May 11, 2011.

4. "Results of Seismic Slope Stability Analysis Active CCP Disposal facilities - Allen Fossil Plant" dated October 3, 2011.

[1] The pseudostatic method is a simplified method for determining seismic slope stability that is based on the same approach (i.e., limit equilibrium) used in analyzing static slope stability. In current practice, the pseudostatic method of analysis is used primarily as a screening tool to help assess whether an embankment dam or slope requires a more detailed seismic slope analysis. The pseudostatic method ignores cyclic loading of the earthquake, but accounts for seismicity by applying an equivalent static force on the slope. In the limit equilibrium approach bearing capacity and stress-strain relationship of the soil is not considered, so the method should not be used for sensitive clays and other materials that lose shear strength during an earthquake or loose soils located below the groundwater table subject to liquefaction.

The load cases analyzed for the northern perimeter dike included:

1. Static steady-state seepage, ash pond normal pool el 230 ft
2. Static steady-state seepage, ash pond max storage pool el 233 ft
3. Static steady-state seepage, ash pond max surcharge pool el 237 ft
4. Rapid drawdown from the McKellar Lake design flood el 232.5 ft to median lake water surface el 185 ft
5. Earthquake w/ horiz seismic coef = 0.127g, normal pool el 230 ft

The load cases initially analyzed for the eastern perimeter dike included cases 1 and 2 above. However, unacceptable factors of safety were obtained in both the slope stability analysis and the seepage analysis. Consequently, the normal water level in the stilling pond was lowered to 226 feet msl and load cases 1 and 5 were re-analyzed.

The divider dike was analyzed for the following static slope stability conditions:

1. Long term, original configuration, upper pool el 230 ft, lower pool el 226 ft
2. Long term, original configuration w/ 4-ft riprap blanket on east toe, upper pool el 230 ft, lower pool el 226 ft
3. Short term (construction) condition, original configuration, upper pool el 230 ft, lower pool el 225 ft (for construction)
4. Short term (construction) condition, original configuration w/ 4-ft riprap blanket on east toe, upper pool el 230 ft, lower pool el 225 ft (for construction)

The various static stability analyses are illustrated in the analysis sections in Appendix A, Doc 07 and Doc 08. The pseudo-static analysis is summarized and illustrated in Enclosure B of Stantec's October 3, 2011 report; this enclosure is included in Appendix A, Doc 14 for reference.

No stability documentation has been provided for the inactive West Ash Pond dike embankments.

7.1.2 Design Parameters and Dam Materials

At the East Ash Pond the perimeter dike embankment soils consist of predominantly sandy silts and silty sands with the silty sands more prevalent in the northern perimeter dike (the original levee). The divider dike consists primarily of compacted bottom ash. The dikes are immediately founded on a variable thickness layer of sandy silt or silt and sandy silt underlain by a thick layer of lean and fat clays that extends down to a deeper layer of silt and sandy silt and sandy silt to silty sand. Based on laboratory testing, design properties and parameters used in the static stability analyses were as shown in the following Table 7.1:

Table 7.1: Design Properties and Parameters of Materials used in the Static Stability Analyses

Material	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Drained Strength Parameters	
			C´ (psf)	Ø´ (deg)
Dike Fill-Core	---	125	0	31
Dike Fill-Shell	---	124	0	31
Hydraulically Placed Ash	---	105	0	25
Bottom Ash	---	123	0	34
Divider Dike Fill-Sand	---	120	0	34
Riprap	---	120	0	38
Alluvial Clay	---	115	0	26
Sandy Silt to Silty Sand Alluvium	---	115	0	28

See analysis sections in Appendix A Doc 07 & Doc 08 for source of information in this table.

It appears that fully drained strength parameters were used in all the cases of static stability analysis. Design properties and parameters used in the pseudo-static stability analyses are shown in Table 7.2:

Table 7.2: Design Properties and Parameters of Materials used in the Pseudo-Static Stability Analyses

Material	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Undrained Strength Parameters	
			C (psf)	Ø (deg)
Dike Fill-Core	125	125	200	22
Dike Fill-Shell	124	124	200	22
Hydraulically Placed Ash	95	105	0	10
Compacted Ash	110	123	0	30
Riprap	115	115	0	38
Lean & Fat Clay	110	115	400	12
Silt and Sandy Silt	110	115	200	12

See analysis sections in Appendix A, Doc 14 for source of information in this table.

7.1.3 Uplift and/or Phreatic Surface Assumptions

The phreatic surface in the embankment slope stability analysis sections was assumed to extend through the embankment section down from the pond water elevation to the toe of the embankment section and from upper pond water elevation to lower pond water elevation in the case of the divider dike (see analysis sections in Appendix A Doc 07, Doc 08, and Doc 14).

From visual observations in the field, the phreatic surface was not observed to crop out on the outside slope of the dikes. A puddle of water was observed at the outside toe of the northern perimeter dike near the mid-point the north side. Based on the flat topography and worn surface of the unpaved toe access road in the area, and wet ground conditions from recent rainfall, the wet puddle appeared to be due to poor surface drainage.

7.1.4 Factors of Safety and Base Stresses

The computed factors of safety for the load cases analyzed in the slope stability analyses of the perimeter dike are shown in the Table 7.3 and Table 7.4 below for the northern perimeter dike and eastern perimeter dike, respectively. Conventional minimum FS criteria are 1.5 for static long-term stability and 1.0 for earthquake stability (by pseudo-static method). The USACE (EM 1110-2-1902) allows a minimum factor of safety of 1.4 for maximum surcharge events and minimum factors of safety of 1.1 for rapid drawdown from maximum flood pool and 1.3 for rapid drawdown from maximum storage pool. The computed minimum factors of safety for static stability of the divider dike are 1.5 or greater for the most critical section E-E' after remedial improvements, which have been made.

Table 7.3: Slope Stability Factors of Safety (Outside Slope) – Northern Perimeter Dike

Load Case	Calculated Minimum[1] Factor of Safety (FS)
1. Static Steady State, Pond El 230 Ft	1.97 Deep; 2.17 Shallow
2. Static Steady State, Pond El 233 Ft	1.85 Deep; 1.80 Shallow
3. Static Steady State, Pond El 237 Ft	1.62 Deep; 1.44 Shallow
4. Rapid Drawdown, Lake MeKellar El 232.5 Ft to El 185 Ft	1.63
5. Earthquake - 0.127g Horiz Seismic Coef, 500-yr Return Period Event	0.73
6. Earthquake - 0.06g Horiz Seismic Coef, 250-yr Return Period Event	1.00

1For the critical Section A-A'. Inside slope FS all higher than outside slope FS. *Source: Stantec reports dated March 25, 2010 and October 3, 2011*

Seepage exit gradients were computed and compared with a critical gradient of 0.98 to calculate a factor of safety against piping (FS_{piping} =

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i_{crit}/i). The minimum computed FS_{piping} = 4.45 under surcharge pool conditions (case 3 loading) for the more critical analysis section of the northern perimeter dike. The minimum computed FS_{piping} = 4.7 and 6.9 for the eastern perimeter dike and divider dike, respectively, under the new, lowered normal pool elevation of 226 feet msl that now occurs in the stilling pond after implementation of remedial improvements. Stantec adopted a minimum factor of safety criterion of 3.0 against piping. This is compatible with factor of safety criterion on the order of 2.5-3.0 proposed in 1977 by Cedergren and noted in the USACE's EM 1110-2-1901.

Table 7.4: Slope Stability Factors of Safety (Outside Slope) – Eastern Perimeter Dike After Remedial Improvements	
Load Case	**Calculated Minimum[1] Factor of Safety (FS)**
1. Static Steady State, Pond El 230 Ft	1.50 Deep; 1.50 Shallow
2. Static Steady State, Max Storage Pool	Not Analyzed
3. Static Steady State, Max Surcharge Pool	Not Analyzed
4. Rapid Drawdown	Not Analyzed
5. Earthquake - 0.127g Horiz Seismic Coeff, 500-yr Return Period Event	0.90
6. Earthquake - 0.09g Horiz Seismic Coeff, 370-yr Return Period Event	1.00

1For the critical Section E-E'. Inside slope not analyzed. *Source: Stantec reports dated May 11, 2011 and October 3, 2011*

7.1.5 Liquefaction Potential

No liquefaction potential analyses have been provided. It is understood from TVA that liquefaction potential will be addressed as part of a comprehensive risk/consequences-based evaluation of seismic failure risks being conducted in closure design. TVA's approach is described in a "Seismic Risk Assessment White Paper" provided in Stantec's report dated October 3, 2011. It is understood that Phase A of the seismic risk assessment study is currently in draft report form and is being actively peer-reviewed and that the Phase A report includes analysis/evaluation for liquefaction potential using Phase 2 geotechnical data. It is further understood that the results are being used to assess seismic failure risks for probable closure geometries.

Stantec's test borings indicate that dike embankments are generally firm and compacted. However, many of the borings indicate the presence of very soft to soft sandy silts and very soft to soft clays in the foundation layers immediately underlying the dike embankment. Thus, there appears to be some potential for deformation to occur during strong seismic shaking. Evaluation of these conditions will require a quantitative evaluation to determine the amount of potential deformation and its effects on the integrity and stability of the dike embankments. Based on currently available information, it is concluded that liquefaction potential and excessive deformation potential under seismic loading are unknown.

7.1.6 Critical Geological Conditions

The Allen Fossil Plant and ash ponds are located on the 0.62-mile thick sediment-filled trough known as the Mississippi Embayment, which approximately underlies the Mississippi Valley. The sedimentary deposits include layers of sand, silt, clay, gravel, and various mixes of these soil types. Geologic information in Stantec's reports, based on the Geologic Map of the Fletcher Lake Quadrangle, Tennessee, published by the Tennessee Department of Conservation, Division of Geology, 1978, indicates that manmade fills and Quaternary age alluvial deposits immediately underlie the plant and surrounding areas. The fill is generally composed of alluvial soil dredged from the floodplain (or loess in some areas) and is tens of feet thick in the industrial areas in the floodplain of the river. The alluvium is noted to consist of irregular lenses of fine sand, silt, and clay in the upper part and coarse sands, gravelly sands, and sandy gravels in the lower part. The alluvium varies in thickness from about 45 feet to 90 feet adjacent to the loess bluffs along the eastern edge of the quadrangle to as much as 175 feet well out into the floodplain. The alluvium is noted to be underlain by a series of highly consolidated clays and dense sands of the Claiborne Group. The East Ash Pond is noted to be underlain by the alluvial deposits and surrounded by manmade fill.

The main hazard associated with the geology of the area is the potential for the presence of very soft and very loose soils that may behave unsatisfactorily under certain cases of loading, particularly seismic loading. As previously mentioned, many of Stantec's test borings penetrated very soft to soft alluvial soils immediately beneath the East Ash Pond dike embankment.

Seismicity – The Allen Fossil Plant is located on the southeast edge of the New Madrid Seismic Zone. This zone is an area considered to have high seismic hazard, based on the historical record of strong earthquakes occurring in this area. At the edge of this zone, where the plant and ash ponds are located, the seismic hazard is considered to be moderate. From the USGS Interactive Deaggregation website, based on the USGS Seismic-Hazard Maps for Central and Eastern United States, dated 2008, the East Ash Pond is at a location anticipated to experience 0.556g peak (horizontal) ground acceleration (PGA) with a 2-percent probability of exceedance in 50 years (2,475-year exceedance return time), assuming uniform firm-rock site conditions, i.e., a site with average shear wave velocity of 2,500 feet per second (fps) in the upper 100 feet below the ground surface. For a 10 percent probability of exceedance (475-year exceedance return time) the PGA is 0.151g. The alluvial soils that form the foundation for the dike embankment would be expected to have a lower shear wave velocity than 2,500 fps; therefore, the actual PGA at the site may be different than indicated above. USGS documentation for the Memphis area indicates that the very thick sequence of sediments in the Mississippi Embayment de-amplify the strongest ground motions for rapidly oscillating waves (shorter periods) and amplifies motions for slower oscillating (longer period) waves.

TVA uses seismic hazard results from the TVA Dam Safety Seismic Hazard Model developed by AMEC Geomatrix, 2004. Values of PGA from this model for the Allen plant are 0.389g for 2,475-year exceedance return time and 0.127g for 475-year exceedance return time (rounded to 500 years in furnished analysis), which is about the expected return time for New Madrid earthquakes. The TVA values are based on “hard rock” rather than the “uniform firm-rock” site conditions assumed for the USGS Seismic-Hazard Maps. According to TVA’s documentation, the hard rock to uniform firm rock amplification factor for PGA is 1.52. Therefore the TVA PGA values would need to be multiplied by this amplification factor to compare with the USGS PGA values. Using this factor, the values are comparable.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation for the East Ash Pond dikes at the Allen Fossil Plant is adequate with respect to static slope stability and seepage analysis. The cases of loading analyzed for the eastern perimeter dike are more limited than those analyzed for the northern perimeter dike. For example, the rapid drawdown case was not analyzed even though Stantec’s hydrologic/hydraulic analyses indicate a tailwater elevation of 225 feet msl would occur on the exterior slope of the eastern perimeter dike under flooding from the 6-hour PMP, which would create rapid drawdown conditions when the tailwater subsides. The rapid drawdown case analyzed for the northern perimeter dike, which involved drawdown from a higher elevation (232.5 feet msl), resulted in a satisfactory factor of safety. Thus, it appears that the lower drawdown case for the eastern perimeter dike was reasonably considered not to be as severe and therefore no drawdown stability analysis of this slope was needed, since the slopes and soil parameters were similar. The maximum storage pool case was not analyzed for the eastern perimeter dike apparently because the revised lower normal water elevation (226 feet msl) in the stilling pond after remedial improvement measures were implemented is the maximum operating water elevation. The maximum surcharge pool case also was not analyzed for the eastern perimeter dike. This case represents the maximum flood pool condition; it apparently was not analyzed because the high tailwater elevation (225 feet msl) during PMP flooding makes it less critical than the normal pool elevation case (226 feet msl and no tailwater), due to less differential head between stilling pond maximum pool elevation and the tailwater elevation.

The documentation for seismic stability of the East Ash Pond dike embankments is inadequate. The reasoning for the horizontal seismic coefficient (k_h) used in the pseudo-static slope stability analysis is unclear. It appears that the PGA value of 0.127g for the 475-year exceedance return time from the TVA Dam Safety Seismic Hazard Model (2004) was adopted as the "design" k_h. (Note: Since the seismic coefficient actually is dimensionless, the value assumed by Stantec more properly is 0.127g/g = 0.127, as applied to the weight of a potential sliding mass.) Use of the "hard rock" PGA as the seismic coefficient for analysis of a dike founded on very thick soil deposits seems inappropriate. In addition, the seismic coefficient based on yield acceleration, k_y, which corresponds to a factor of safety of 1.0 (FS = 1.0), is actually some fraction or percentage of the PGA, depending on earthquake moment magnitude and other factors. For example, one correlation in the literature shows k_y ranging from 0.2 x PGA for magnitude 6.5 earthquake to 0.4 x PGA for magnitude 8.0 earthquake. In the "Seismic Risk Assessment White Paper" provided by TVA, it is indicated that k_h = 0.1 x PGA will be used in pseudo-static stability analyses in the closure design, which is not conservative in view of the above correlation. However, for the analysis of the Allen East Ash Pond dike embankments, it appears that k_h = 1.0 x PGA was used. This on the one hand appears very conservative, but on the other hand use of the "hard rock" PGA appears not to be conservative. As noted previously, the 475-year exceedance return time is approximately the expected return time for New Madrid earthquakes. Adopting this return time as the design basis for a Significant hazard potential facility is debatable. Nevertheless, this return time does not meet EPA requirements for seismic stability of a Significant hazard impoundment. EPA requires documentation of acceptable seismic performance of the dike embankments for an earthquake with 2 percent probability of exceedence in 50 years (2,475-year event).

The pseudo-static method of analysis is valid only when the embankment and foundation soils will not experience significant loss of shear strength during earthquake shaking. Therefore the presence of very soft to soft soils in the alluvial foundation underlying the embankments at the East Ash Pond is cause for concern.

Where they exist below the water table they could potentially develop excess pore pressures during strong earthquake shaking and experience loss of shear strength, causing deformations through plastic flow in the very soft foundation soils, which could detrimentally impact the overlying embankment. Thus, there is inadequacy in the technical documentation due to the current lack of analyses or assessments of the effects of the very soft foundation soils, as well as lack of assessment of liquefaction potential, in addition to inadequate analyses of seismic slope stability. It is noted, however, that for relatively low dikes such as the Allen dikes, the standard of practice, particularly of the time they were designed, usually did not include seismic stability analyses, deformation analyses, or liquefaction potential analyses.

No structural stability documentation is available for the inactive West Ash Pond dike embankments. There appears to be no need for this documentation as long as this pond remains inactive and does not impound a significant amount of water.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

The structural stability of the East Ash Pond dike embankments appears to be satisfactory with respect to static stability based on the following:

- Documented static slope stability analyses showing satisfactory factors of safety against both deep and shallow potential circular arc shear failures under all credible loading conditions.
- Documented seepage analyses and evaluation of exit gradients show satisfactory factors of safety against a piping failure.
- No indications of scarps, sloughs, major depressions or bulging anywhere along the slopes of the dike.
- No indications of boils, sinks, or uncontrolled seepage along the outside slope or toe of the dike.
- No major depressions and no significant vertical or horizontal alignment variations in the crest of the dike.

The furnished pseudo-static slope stability analysis results show that the East Ash Pond dike embankments are substandard with respect to seismic stability for an earthquake even less than that required by EPA for a Significant hazard impoundment. For the "design" seismic coefficient $k_h = 0.127$ (indicated as the 500-year return period event), the dike embankments at the Allen Plant are shown to have FS < 1.0, indicating failure. The dikes are shown to have FS = 1.0 (the acceptance criterion) for return times of 250 years and 370 years for the northern perimeter dike and eastern perimeter dike, respectively. The New Madrid earthquakes have a return period of approximately 450 years. Thus, these dikes are indicated to be safe for earthquakes less than the New Madrid-magnitude earthquakes and much less than required by EPA. TVA is conducting more rigorous seismic stability analyses for the design earthquake required by EPA. On July 31, 2012, TVA informed EPA that seismic stability analyses for the Allen Plant would be submitted to EPA by the middle of September 2012.

As previously concluded, liquefaction potential and excessive deformation potential under seismic loading are unknown. However, based on review of the available boring information, the soils (silts, sandy silts/silty sands, and clays) encountered in the borings do not appear to be of the type that would be highly susceptible to liquefaction. Thus, qualitatively, there may be low probability of failure of the dikes due to liquefaction under earthquake loading.

The spillway and outlet structures appeared to be in generally sound and stable condition with no evidence of significant structural deterioration of the limited visible parts of the structures that could be seen. At the East Ash Pond some of the metal parts and hardware at the spillway in the divider dike and at the floodgates at the discharge end of the primary outlet conduits were observed to be rusty. It would be prudent to perform maintenance cleaning and painting of the metal items to arrest the deterioration and protect against future corrosion.

From visual assessment in the field the inactive West Ash Pond dike embankments and outlet structure appeared to be stable under the prevailing normal static conditions in which it impounds no water. Even though this pond is inactive, TVA should continue surveillance and maintenance of the dike embankments and ensure that the inactive pond does not impound water.

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

The ash pond receives sluiced ash from both the boiler slag/bottom ash handling system and the fly ash handling system. Each of the three boilers at the plant has two sluice pipes, one for fly ash and one for boiler slag/bottom ash, running to the East Ash Pond (total of 6 sluice lines). There is an additional line that carries plant process water to the pond. All the sluice lines currently discharge into a rim ditch in the northwest part of the dredge cell at the west end of the East Ash Pond. The ash may also be sluiced into a “mini” dredge cell that lies on the west side of the main dredge cell. The Coal Yard runoff also drains to the East Ash Pond into a small cell at the southwest corner.

In the rim ditch a long-reach excavator scoops out the ash and places it in piles or rows to drain, as previously shown (Figure 5.8). After dewatering the ash is loaded onto dump trucks suitable for on-road travel and hauled to final disposition. The dried fly ash is used in a structural fill at a nearby industrial park and the dried boiler slag/bottom ash is marketed. Excavation operations in the dredge cell are restricted from getting closer than 50 feet from the alignment of the active sanitary sewer line that passes under the dredge cell, as well as transmission towers located in the pond. Dust suppression systems are used when needed on ash/gravel haul roads. Paved plant roads used by the haul trucks are kept clean with a sweeper truck. The ash excavation, drying, and hauling operations are contracted out. TVA’s written operations procedures are included in Appendix A Doc 15.

The normal water level in the central settling area of the East Ash Pond is maintained at elevation 230 feet msl, which allows for at least 7.5 feet of freeboard. The normal water level in the stilling pond has recently been lowered to 226 feet msl, which allows for at least 10.5 feet of freeboard. Water discharges are monitored according to NPDES Permit requirements; pH adjustments are made at the spillway in the divider dike.

The West Ash Pond is inactive and there currently are no operations related to ash disposal at this pond.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

Maintenance of the dike embankments and outlet works of the ash ponds, and essential operating equipment, such as the piping (ash sluice lines), pumps, and other equipment (e.g., gates, valves, etc.), are performed, as determined by routine inspections performed by plant personnel. Vegetation on the embankment slopes is scheduled to be mowed at least three times during the growing season. Any woody vegetation is removed. Erosion repairs are made and animal holes filled as needed. TVA's written maintenance procedures are included in Appendix A, Doc 15. TVA also follows written guidelines for repair of routine maintenance problems, such as gully and rill erosion repair, burrow repair, wave erosion repair, etc., as shown in Appendix A, Doc 16.

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

Based on field observations and review of operations pertaining to CCR containment, operating procedures at the active East Ash Pond appear to be adequate.

8.3.2 Adequacy of Maintenance

Maintenance of the impounding embankments and outlet works of the active East Ash Pond appears to be adequate. Maintenance of the inactive West Ash Pond currently appears to be adequate. No major maintenance issues were noted from review of dike inspection reports. Based on field observations, some minor maintenance is advised (see Subsection 1.2.5).

9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

TVA has a program of conducting, daily, weekly, monthly, quarterly, and annual inspections of the active East Ash Pond. The inspections are documented with checklist forms and written reports. Any deficiencies requiring correction or maintenance are reported and tracked. The Seepage Action Plan previously mentioned is used to track seeps and determine the level of repair necessary. Signs are in-place at pipe penetrations and known seeps to aid during inspections. In summary:

- Daily inspections are conducted by the on-site Contractor and by or under the supervision of the Field Supervisor and documented in a Daily Field Report and Ash Haul Operations Checklist.

- The weekly inspections are carried out by the Field Supervisor and documented on a Weekly Facility Observation Form.

- The monthly inspections are conducted by the Construction Manager and documented on a Monthly/Quarterly/Special Facility Inspection Form.

- The quarterly inspections are performed by the Routine Handling Operations and Maintenance (RHOM) team led by the RHOM Manager and documented on the Monthly/Quarterly/Special Facility Inspection Form. Conditions requiring engineering recommendations are reported to Coal Combustion Products (CCP) Engineering or to a geotechnical engineer to provide recommendations for the repair.

- Unscheduled inspections are also performed after special events such as heavy rainfall and earthquake and documented on the Monthly/Quarterly/Special Facility Inspection Form.

- The annual inspections focus on structural integrity and are performed by a qualified geotechnical engineer (e.g., Stantec) under the responsibility of CCP Engineering. The inspection includes both active ash ponds (e.g., East Ash Pond) and inactive ash ponds (e.g., West Ash Pond). The annual inspection is documented in a written report. Recommendations for any needed repairs or maintenance or needed studies are included in the annual report.

TVA's inspection and reporting program are included in Appendix A, Doc 15.

9.2 INSTRUMENTATION MONITORING

Dam performance monitoring instrumentation includes 18 piezometers in place along the perimeter dike on most of the north side, east side (next to stilling pond), and south side of the stilling pond. The piezometers had been installed in many of the test borings made by Stantec, which were located primarily on the crest, although two were located on the upper part of the inside slope of the north side dike, two were located at the outside toe of the north side dike, and five were located at the outside toe of the east side dike. The locations of the piezometers are shown on the instrumentation plan included in Appendix A, Doc 06. The piezometer water levels are typically measured monthly, although more frequent readings appear to have been taken in the first month or so after installation, during flooding events, and when the normal water level was lowered in the stilling pond. The piezometer water-level readings and elevations for the 2-year period of record from July 20, 2009 to July 25, 2011 are tabulated in Appendix A, Doc 17. The piezometer water levels appear to have fluctuated up and down, depending on seasonal variations in rainfall and water levels in Lake McKellar, particularly in the piezometers in the outside toe areas. The two piezometers in the outside toe area of the north side dike were actually covered with water in May 2011 due to Mississippi River flooding and extremely elevated water level in Lake McKellar. Since lowering of the normal water level in the stilling pond there appears to have been a gradual trend of lowering water levels in the east side perimeter dike piezometers.

Visual monitoring of seep areas is performed and documented in a Seepage Log. Any needed actions are taken according to the Seepage Action Plan.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

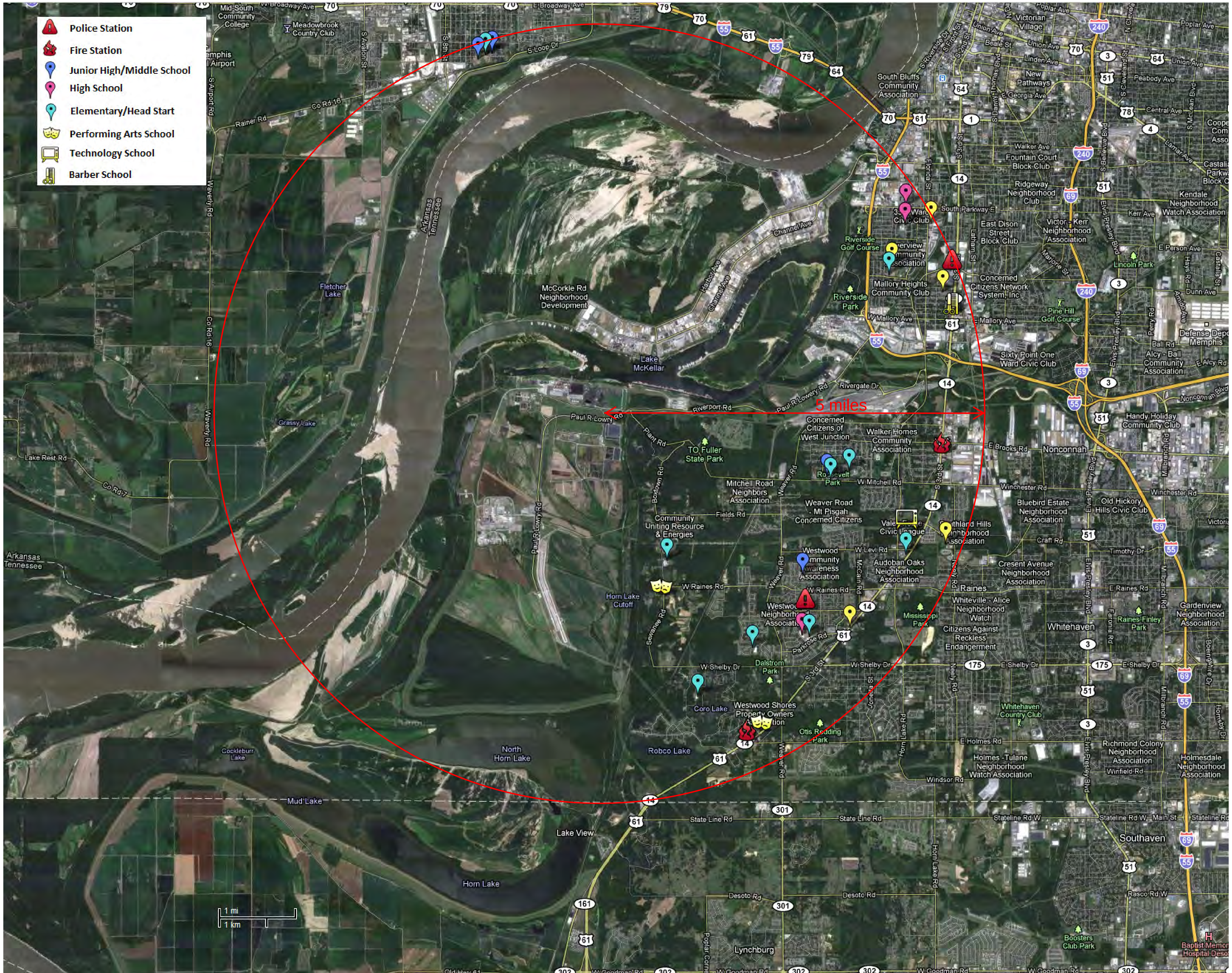
TVA’s inspection program for the ash pond dikes is appropriate and adequate. No major safety issues were noted in any of the inspection reports or check forms reviewed (see discussion in Section 3.1).

9.3.2 Adequacy of Instrumentation Monitoring Program

The instrumentation monitoring program is adequate. No problem or suspect condition, such as excessive settlement, major seepage, shear failure, or displacement was observed in the field that might be reason for installation of additional or different instrumentation. In the absence of stability problems or major seepage issues, there is no need for additional performance monitoring instrumentation at this time.

APPENDIX A

Doc 01: Allen Fossil Plant Aerial Vicinity Map and 5-Mile Radius


Police Station
Fire Station
Junior High/Middle School
High School
Elementary/Head Start
Performing Arts School
Technology School
Barber School
5 miles
1 mi
1 km

- Whites Chapel Elementary School
- Christopher D. Wison
- Coro Lake Elementary School
- Memphis Performing Arts Ministry
- Double Tree Elementary School: City Schools
- Chickasaw Junior High School
- Ford Road Elementary School
- Mitchell Middle/High School
- Headstart
- Southwest Career and Technology Center
- Levi Elementary School
- Westwood High School
- Westwood Elementary School
- Senior Clara Muhammad School
- St Joseph Catholic School
- Last Minute Cuts Sch-Brbrng
- Mallory Heights School
- Riverview Elementary School
- Memphis City Sch Board of Edu
- Carver High School
- Florida Street School
- Carver High School
- Wonder Elementary School
- Wonder Junior High
- Wonder Junior High School
- Memphis Police Westwood
- Memphis Police Department
- Firehouse 45
- Firehouse 36

Doc 02: East Ash Pond Aerial View – Santec Map

STANTEC CONSULTING SERVICES INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Plan View 1 - ALF

Tennessee Valley Authority
Allen Fossil Plant
Memphis, Shelby County, Tennessee

PROJECT NO.	174668118
DATE	MARCH 2009
DRAWN BY	AMG
CHECKED BY	HJK
CHECKED BY	DAG
SCALE	AS SHOWN
REVISED	
1	
2	
3	
4	
5	
6	
7	
8	

SHEET

1 OF 2

Doc 03: West Ash Pond Aerial View – Santec Map

STANTEC
CONSULTING
SERVICES INC.

1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Plan View 2 - ALF

Tennessee Valley Authority
Allen Fossil Plant
Memphis, Shelby County, Tennessee

PROJECT NO.	171468118
DATE	MARCH 2009
DRAWN BY	AMG
CHECKED BY	RJK
CHECKED BY	DAG
SCALE	AS SHOWN
REVISED	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

SHEET

2 OF 2

Doc 04: Allen Fossil Plant – Long Term Disposal Plan

ALLEN FOSSIL PLANT - LONG TERM DISPOSAL PLAN
April 15, 2011

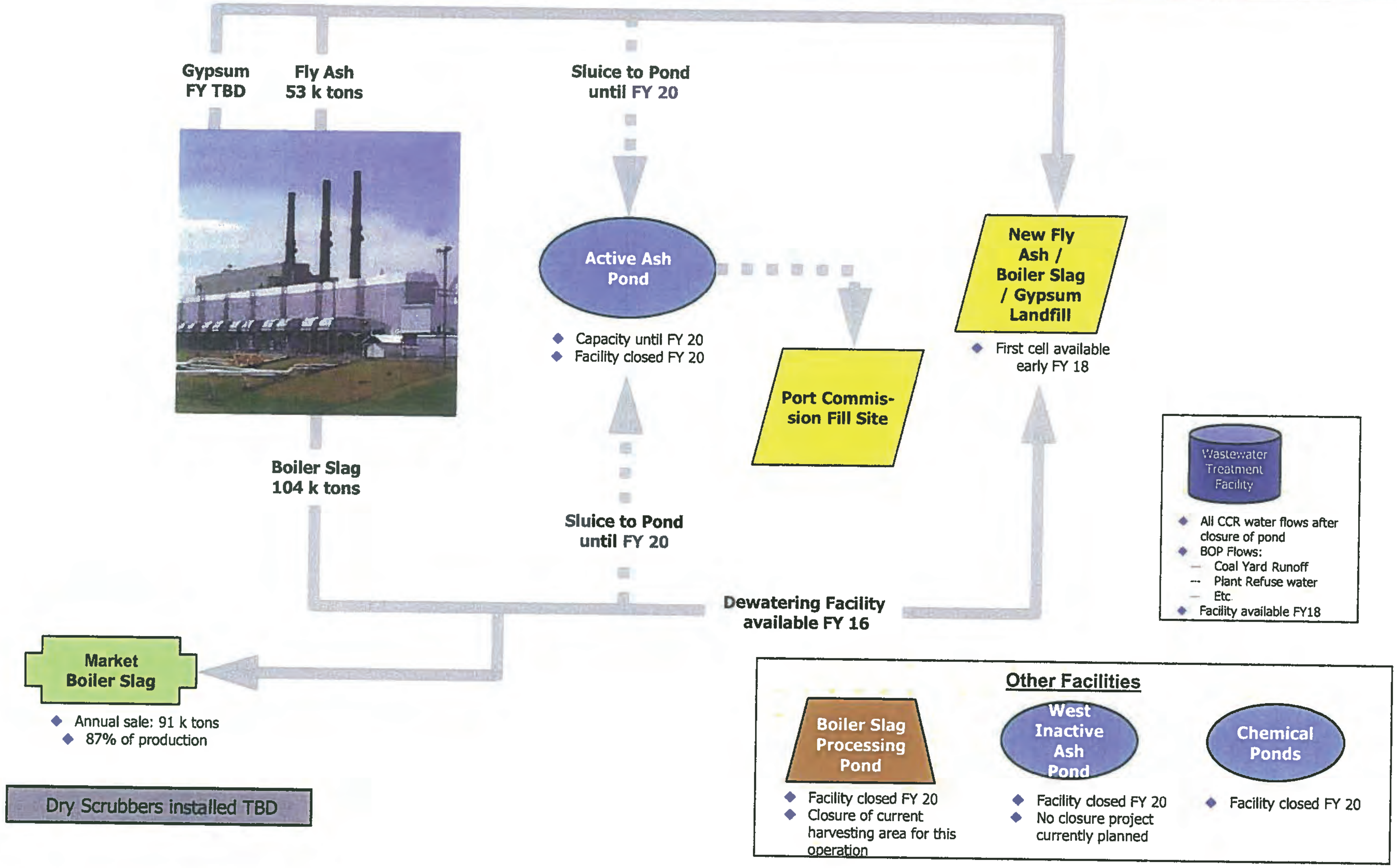
FISCAL YEAR ENDING	PROJECTED COAL BURN (TONS)	FLY ASH PRODUCTION (TONS)	BOILER SLAG PRODUCTION (TONS)	BOILER SLAG RECOVERED (TONS)	TOTAL ASH TO POND (CY)	CUMULATIVE STOCKPILED (CY)	DREDGED VOLUME (CY)	ASH POND CAPACITY (CY)	CAPITAL COSTS ($)	O & M COSTS ($)	TOTAL COSTS ($)
2011	2,855,136	53,941	109,923	70,000	144,851	0	0	162,890	2,553,000	1,458,034	4,011,034
2012	2,914,157	55,056	112,195	70,000	150,078	0	0	12,812	851,000	1,494,485	2,345,485
2013	2,813,405	53,152	108,316	70,000	141,155	0	0	(128,343)	3,015,000	1,531,847	4,546,847
2014	2,696,320	50,940	103,808	70,000	130,785	0	0	(259,128)	2,852,000	1,570,143	4,422,143
2015	1,683,897	31,813	64,830	70,000	41,116	0	0	(300,244)	40,279,752	1,609,397	41,889,149
2016	0	0	0	0	0	0	0	0	21,899,752		21,899,752
2017	0	0	0	0	0	0	0	0	4,000,000		4,000,000
2018	0	0	0	0	0	0	0	0	0		0
2019	0	0	0	0	0	0	0	0	0		0
2020	0	0	0	0	0	0	0	0	0		0
2021	0	0	0	0	0	0	0	0	0		0
2022	0	0	0	0	0	0	0	0	0		0
2023	0	0	0	0	0	0	0	0	0		0
2024	0	0	0	0	0	0	0	0	0		0
2025	0	0	0	0	0	0	0	0	0		0
2026	0	0	0	0	0	0	0	0	0		0
								TOTAL =	**75,450,504**	**7,663,905**	**83,114,409**

Assumptions:
1) Ash production is based on the January 2011, Budget Case Coal Burn Forecast
2) Ash content is 5.50% plus 14.5% unburned carbon, based upon past 3 year average
3) 30% of the total ash is fly ash, the remaining 70% is boiler slag
4) 100% of the boiler slag and fly ash are sluiced to the East Ash Pond, approximately 70,000 tons of boiler slag is marketed (per Mike Sutton
5) Approximately 30% of the fly ash and boiler slag fines are dipped from the channel prior to reaching the ash ponc
6) Ponded ash density = 60 lb/c.f.; Stacked ash density = 75 lb/c.f.
7) The remaining capacity in the ash pond allows for the free water volume requirement of 162,408 c.y
8) Inflation rate = 2.5%.
9) Capital Cost are based on the FGD&C FY11 Budget 3/23/11

Doc 05: Allen Fossil Plant – Master Strategy

Coal Combustion Products – Projects and Engineering

Allen Fossil Plant – Master Strategy



04/04/2011

Doc 06: Boring Plan and Instrumentation Plan East Ash Pond

LEGEND

- SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TESTS
- EXISTING SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TESTS
- EXISTING SOIL BORING (HAND AUGER)

BORING LOCATION TABLE

BORING	NORTHING	EASTING	ELEVATION (FEET)
STN-1	274,580.31	762,195.58	215.5
STN-2	274,441.99	762,201.92	238.8
STN-3	274,411.16	762,192.94	234.5
STN-4	274,367.46	762,679.46	237.5
STN-5	274,364.82	763,202.51	218.0
STN-6	274,263.61	763,180.87	236.5
STN-7	274,235.39	763,163.82	235.5
STN-8	274,166.09	763,641.32	237.8
STN-9	274,009.16	763,820.47	221.2
STN-9R	274,031.78	763,804.13	223.8
STN-10	274,009.41	763,758.03	237.4
STN-11	273,517.12	763,687.47	237.9
STN-11R	273,523.33	763,667.20	236.0
STN-11S	273,500.68	763,688.37	237.5
STN-12	273,018.83	763,676.83	217.2
STN-12R	272,998.01	763,677.51	216.0
STN-13	273,020.94	763,619.04	237.2
STN-14	272,761.04	763,351.79	236.6
STN-15	273,523.32	763,754.75	216.8
STN-16	274,129.01	763,457.76	235.9
STN-16A	273,851.95	763,434.09	236.0
STN-17	273,591.08	763,387.10	236.2
STN-18	273,016.94	763,307.74	235.7
STN-18A	273,170.63	763,328.95	235.5
HA-1	274,226.34	763,209.32	235.7
HA-2	274,202.98	763,201.48	230.5
HA-3	274,265.91	762,999.17	234.2
HA-4	274,333.93	762,669.73	233.6
HA-5	274,409.74	762,201.44	233.7
HA-6	274,395.67	762,191.04	232.5
HA-7	274,398.58	762,201.29	232.4
HA-8	274,392.70	762,251.17	232.1
HA-9	273,021.67	763,612.37	237.0
HA-10	274,010.59	763,748.55	237.2

LOCATIONS FOR STN 1-14 AND HA 1-10 WERE TAKEN FROM DRAWING NO. 10W504-01 R0.

RECORD DRAWING

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

NOTES:

1. THE TOPOGRAPHIC MAPPING PRESENTED ON THIS DRAWING WAS PROVIDED TO STANTEC BY TVA SURVEYING AND PROJECT SERVICES. THIS PLAN VIEW WAS PREPARED TO SUPPORT DEVELOPMENT OF THE GEOTECHNICAL EXPLORATION PROGRAM AND SHOULD NOT BE USED FOR CONSTRUCTION.
2. THE GEOTECHNICAL INFORMATION AND DATA FURNISHED HEREIN ARE NOT INTENDED AS REPRESENTATION OR WARRANTIES BUT ARE FURNISHED FOR INFORMATION ONLY. IT SHALL BE DISTINCTLY UNDERSTOOD THAT THE OWNER OR ENGINEER WILL NOT BE RESPONSIBLE FOR ANY DEDUCTION, INTERPRETATION OR CONCLUSION DRAWN THEREFROM. THE INFORMATION IS MADE AVAILABLE IN ORDER THAT THE CONTRACTOR MAY HAVE READY ACCESS TO THE SAME INFORMATION AVAILABLE TO THE OWNER AND THE ENGINEER AND IS NOT PART OF THIS CONTRACT.

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

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110004

R0 05/08/11 RECORD DRAWING

SHAIKH Z. RAHMAN — STATE OF TENNESSEE — 05/06/2011

SCALE: 1"=100' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
BORING PLAN

Stantec Consulting Services Inc.

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 38 | C | 10W506-01 | R 0

PLOT FACTOR:100
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC | 0
TASK COMPLETED BY: | REV NO.

LEGEND

- PIEZOMETER
- EXISTING PIEZOMETER

NOTES:

1. THE TOPOGRAPHIC MAPPING PRESENTED ON THIS DRAWING WAS PROVIDED TO STANTEC BY TVA SURVEYING AND PROJECT SERVICES. THIS PLAN VIEW WAS PREPARED TO SUPPORT DEVELOPMENT OF THE GEOTECHNICAL EXPLORATION PROGRAM AND SHOULD NOT BE USED FOR CONSTRUCTION.
2. THE GEOTECHNICAL INFORMATION AND DATA FURNISHED HEREIN ARE NOT INTENDED AS REPRESENTATION OR WARRANTIES BUT ARE FURNISHED FOR INFORMATION ONLY. IT SHALL BE DISTINCTLY UNDERSTOOD THAT THE OWNER OR ENGINEER WILL NOT BE RESPONSIBLE FOR ANY DEDUCTION, INTERPRETATION OR CONCLUSION DRAWN THEREFROM. THE INFORMATION IS MADE AVAILABLE IN ORDER THAT THE CONTRACTOR MAY HAVE READY ACCESS TO THE SAME INFORMATION AVAILABLE TO THE OWNER AND THE ENGINEER AND IS NOT PART OF THIS CONTRACT.

INSTRUMENTATION LOCATION TABLE

INSTRUMENT	NORTHING	EASTING	TOP OF CASING ELEVATION (FEET)	GROUND SURFACE ELEVATION (FEET)
PZ-1	274,580.31	762,195.58	218.2	215.5
PZ-2	274,441.99	762,201.92	238.7	238.8
PZ-3	274,411.16	762,192.94	237.4	234.5
PZ-4	274,367.46	762,679.46	237.3	237.5
PZ-5	274,364.82	763,202.51	220.7	218.0
PZ-6	274,263.61	763,180.87	238.4	238.5
PZ-7	274,235.39	763,163.82	235.4	235.5
PZ-8	274,166.09	763,641.32	237.7	237.8
PZ-9	274,009.16	763,820.47	224.2	221.2
PZ-9R	274,031.78	763,804.13	227.0	223.8
PZ-10	274,009.41	763,758.03	237.1	237.4
PZ-11	273,517.12	763,687.47	237.8	237.9
PZ-11S	273,500.68	763,688.37	237.5	237.5
PZ-12	273,018.83	763,676.83	220.1	217.2
PZ-12R	272,998.01	763,677.51	219.8	216.0
PZ-13	273,020.94	763,619.04	237.0	237.2
PZ-14	272,761.04	763,351.79	236.4	236.6
PZ-15	273,523.32	763,754.75	219.8	216.8

LOCATIONS FOR PZ 1-14 WERE TAKEN FROM DRAWING NO. 10W504-10 R0.

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

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

RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110004

R0 | 05/06/11 | PHW | PE | SZR | HRA | SEB | WST | JCK
RECORD DRAWING

SCALE: 1"=100' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
INSTRUMENTATION PLAN

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

Stantec Consulting Services Inc.

Stantec

AUTOCAD R 2000 | 38 | C | 10W506-14 | R0

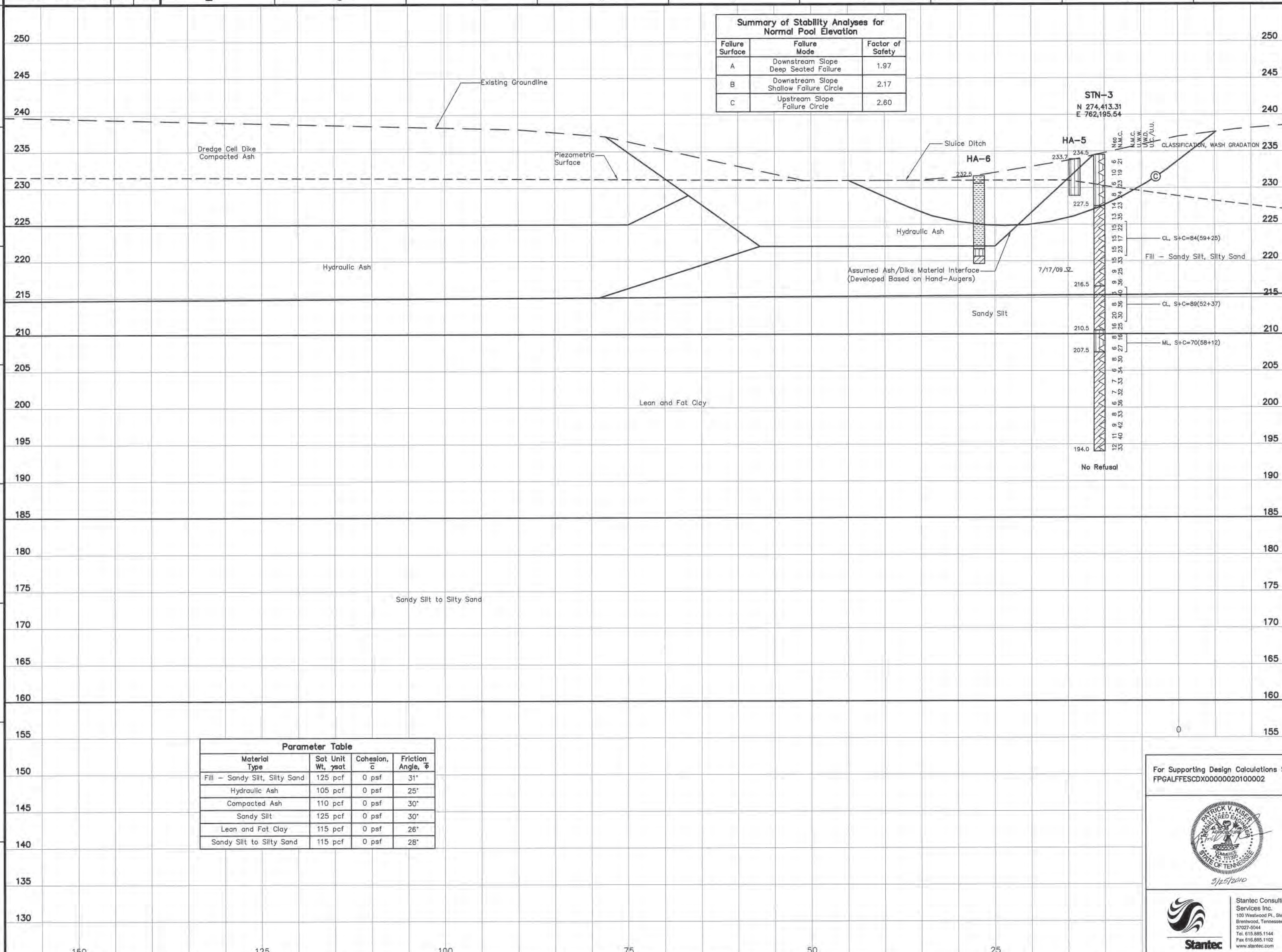
PLOT FACTOR:100
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC | 0
TASK COMPLETED BY: | REV NO

38 | C | 10W506-14

Doc 07: Analysis Sections – North Perimeter Dike East Ash Pond



Summary of Stability Analyses for Normal Pool Elevation

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

Parameter Table

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

LEGEND

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

WH – Weight of Hammer
WR – Weight of Rods
◁ – Standard Penetration Test Interval
■ – Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} – Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} – Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. – Natural Moisture Content (%)
U.W.W. – Unit Weight Wet (lbs./cu.ft.)
U.W.D. – Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. – Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
03/31/09 – Water Level and Date Recorded
T.O.R.– Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.– Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal – Auger Refusal using a carbide-tipped tooth auger bit
No Refusal – No Refusal Encountered
* – Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

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

SCALE: 1"=5' EXCEPT AS NOTED

YARD

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

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

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

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

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

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

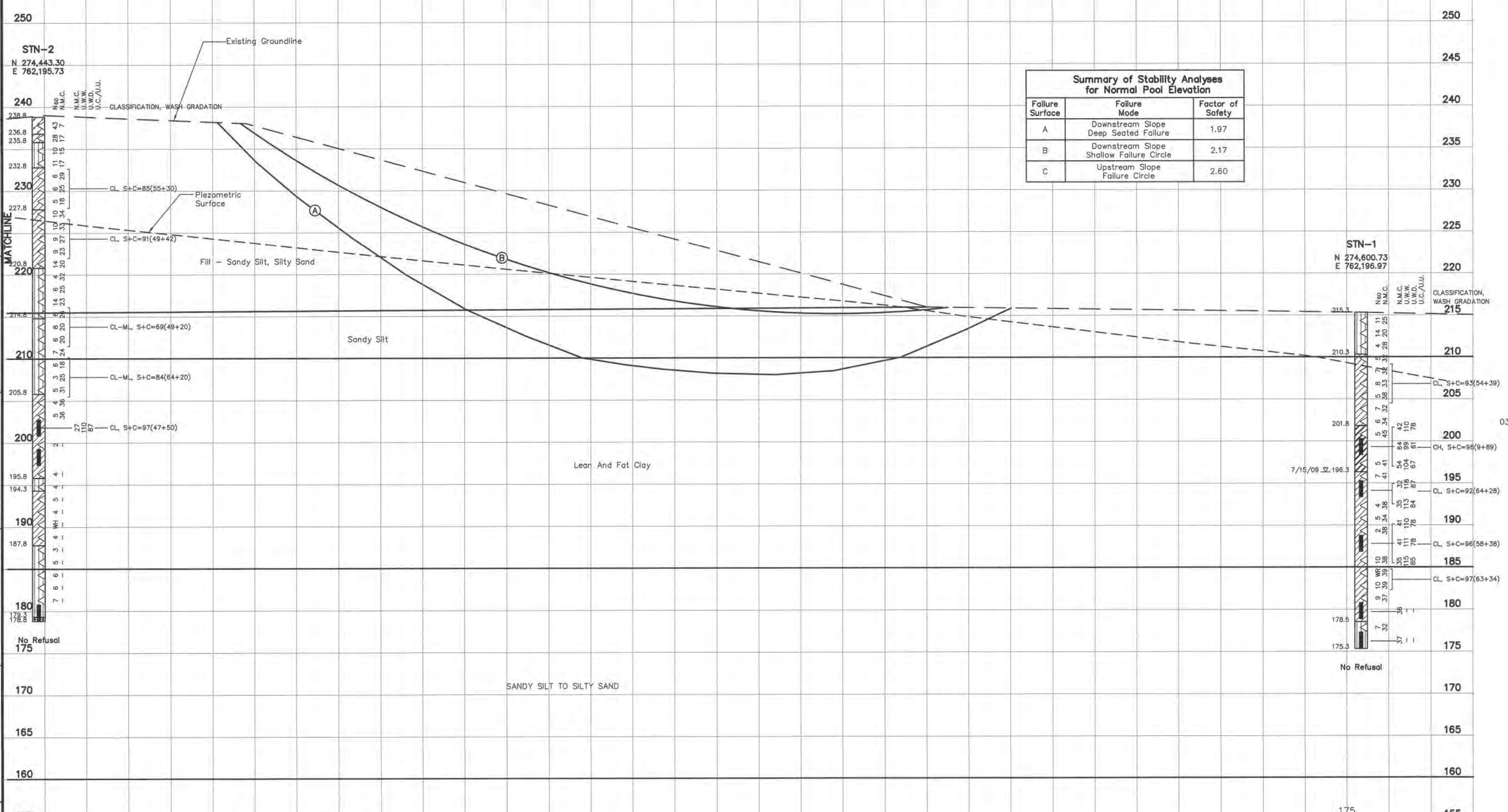
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC | 0
TASK COMPLETED BY: | REV NO.

38 C 10W504-04

10W504-05 | C | 38



Summary of Stability Analyses for Normal Pool Elevation		
Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	1.97
B	Downstream Slope Shallow Failure Circle	2.17
C	Upstream Slope Failure Circle	2.60

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

LEGEND

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

WH Weight of Hammer
WR Weight of Rods
Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
U.W.W. Unit Weight Wet (lbs./cu.ft.)
U.W.D. Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
03/31/09 Water Level and Date Recorded
T.O.R.– Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.– Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal Auger Refusal using a carbide-tipped tooth auger bit
No Refusal No Refusal Encountered
* Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

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

SCALE: 1"=5' EXCEPT AS NOTED

YARD

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

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

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

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

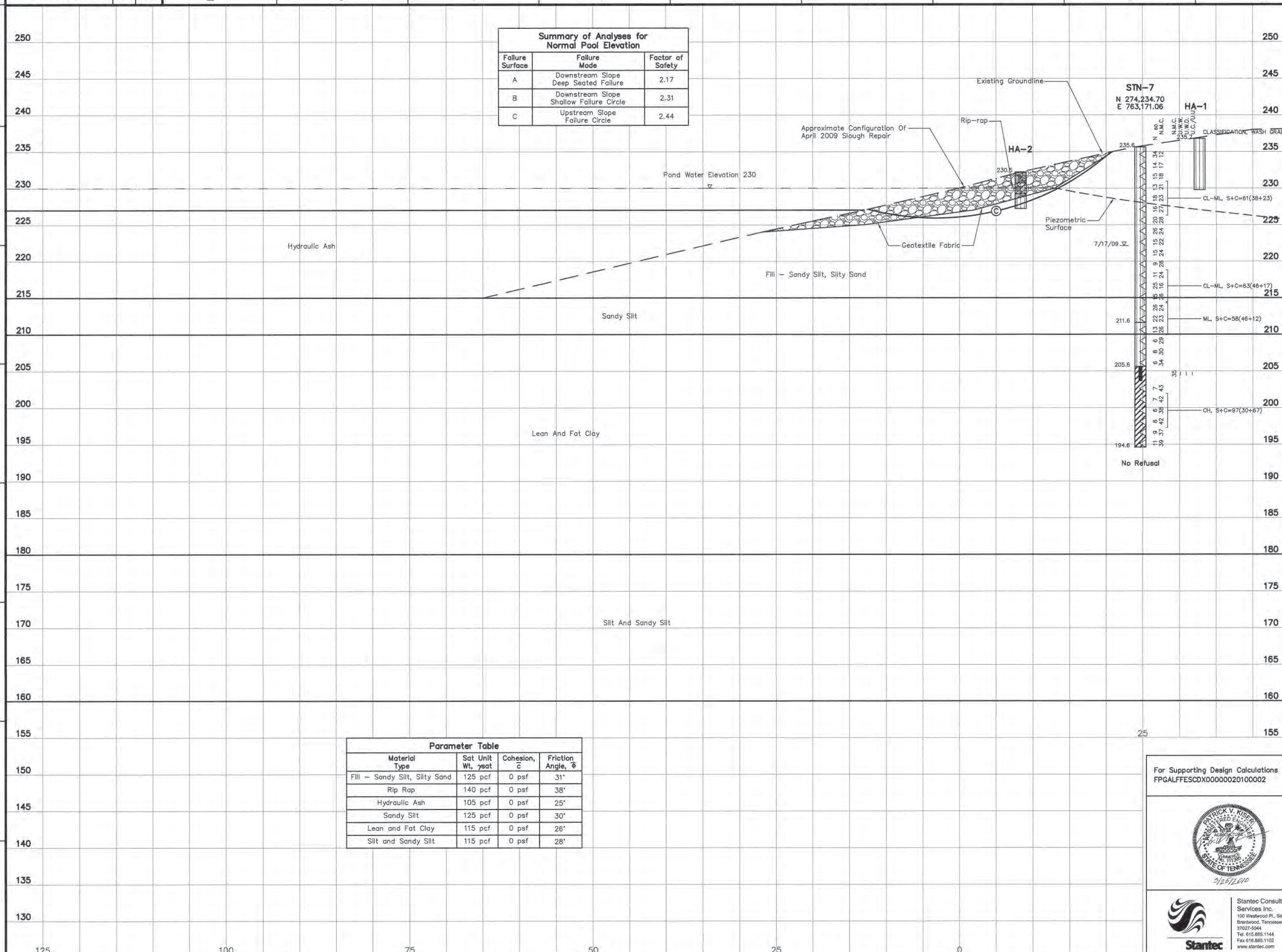
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

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

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



Summary of Analyses for Normal Pool Elevation

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

Parameter Table

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

LEGEND

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

WH Weight of Hammer
WR Weight of Rods
Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
U.W.W. Unit Weight Wet (lbs./cu.ft.)
U.W.D. Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
03/31/09 Water Level and Date Recorded
T.O.R.– Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.– Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal Auger Refusal using a carbide-tipped tooth auger bit
No Refusal No Refusal Encountered
* Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

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

SCALE: 1"=5' EXCEPT AS NOTED

YARD

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

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

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
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AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-06 | R 0

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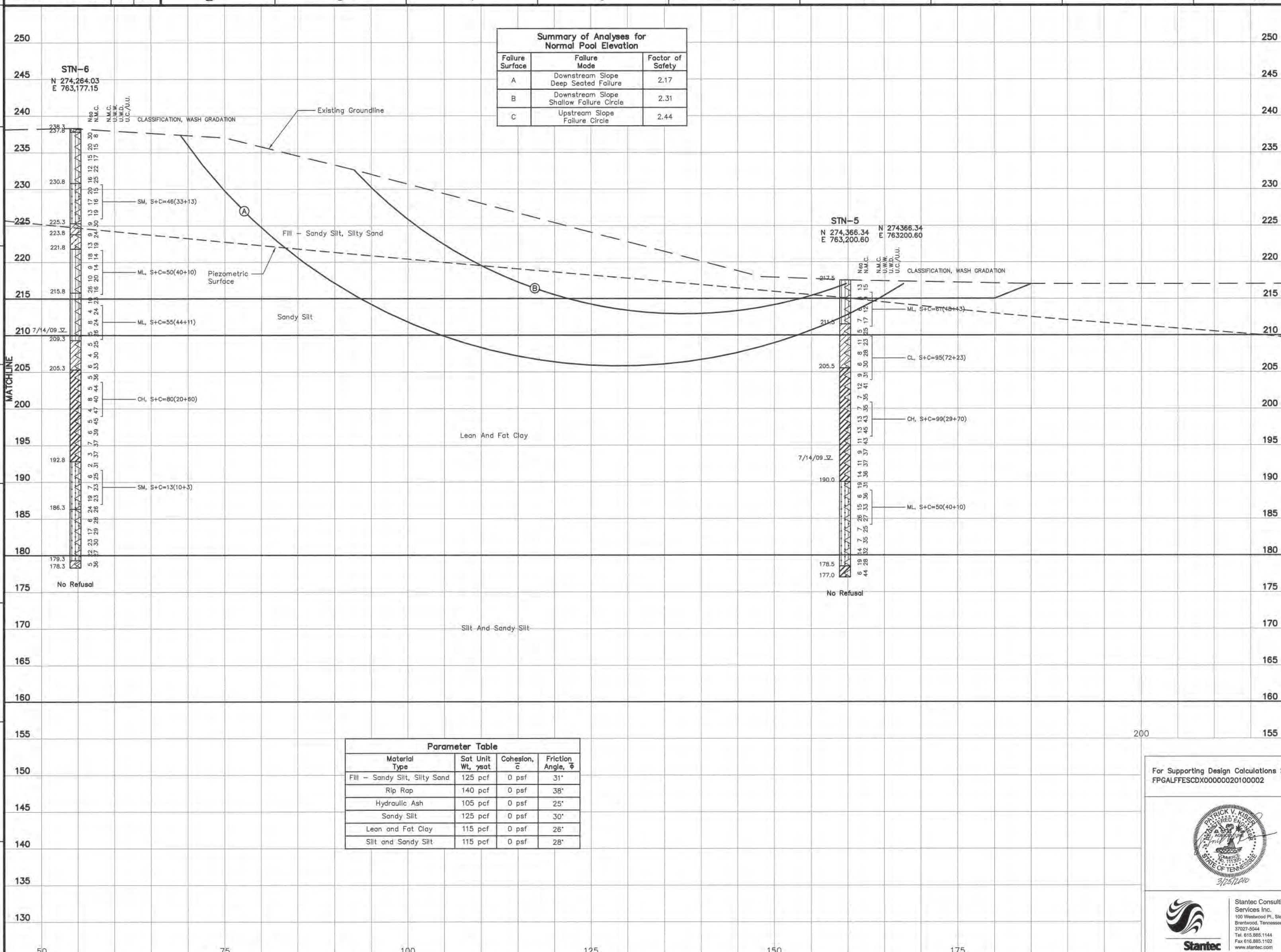
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

38 C 10W504-06



Summary of Analyses for Normal Pool Elevation		
Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	2.17
B	Downstream Slope Shallow Failure Circle	2.31
C	Upstream Slope Failure Circle	2.44

Parameter Table

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

LEGEND

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

WH — Weight of Hammer
WR — Weight of Rods
◁ — Standard Penetration Test Interval
■ — Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu.ft.)
U.W.D. — Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. — Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
03/31/09 ▽ — Water Level and Date Recorded
T.O.R.– — Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.– — Begin Rock Core
R.Q.D. — Rock Quality Designation (%)
REC. — Recovery (%)
Refusal — Auger Refusal using a carbide-tipped tooth auger bit
No Refusal — No Refusal Encountered
* — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

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

SCALE: 1"=5' EXCEPT AS NOTED

YARD

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

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

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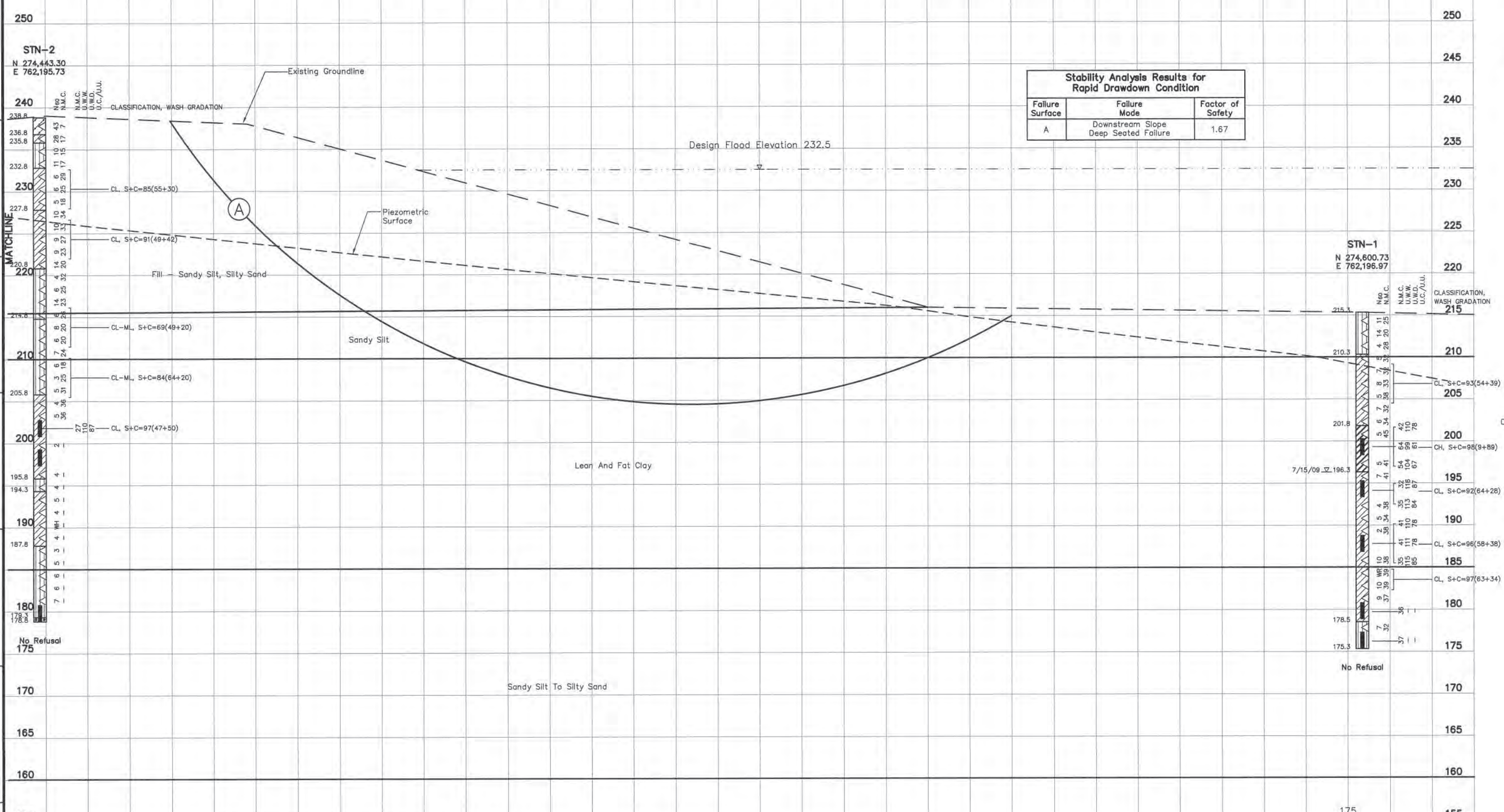
AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-07 | R 0

STANTEC 0
TASK COMPLETED BY: REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



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

LEGEND

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

WH – Weight of Hammer
WR – Weight of Rods
Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} – Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} – Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. – Natural Moisture Content (%)
U.W.W. – Unit Weight Wet (lbs./cu.ft.)
U.W.D. – Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. – Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
03/31/09 – Water Level and Date Recorded
T.O.R.– Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.– Begin Rock Core
R.Q.D. – Rock Quality Designation (%)
REC. – Recovery (%)
Refusal – Auger Refusal using a carbide-tipped tooth auger bit
No Refusal – No Refusal Encountered
* – Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

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

For Supporting Design Calculations See FPGALFFESCDX00000020100002

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

SCALE: 1"=5' EXCEPT AS NOTED

YARD

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

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

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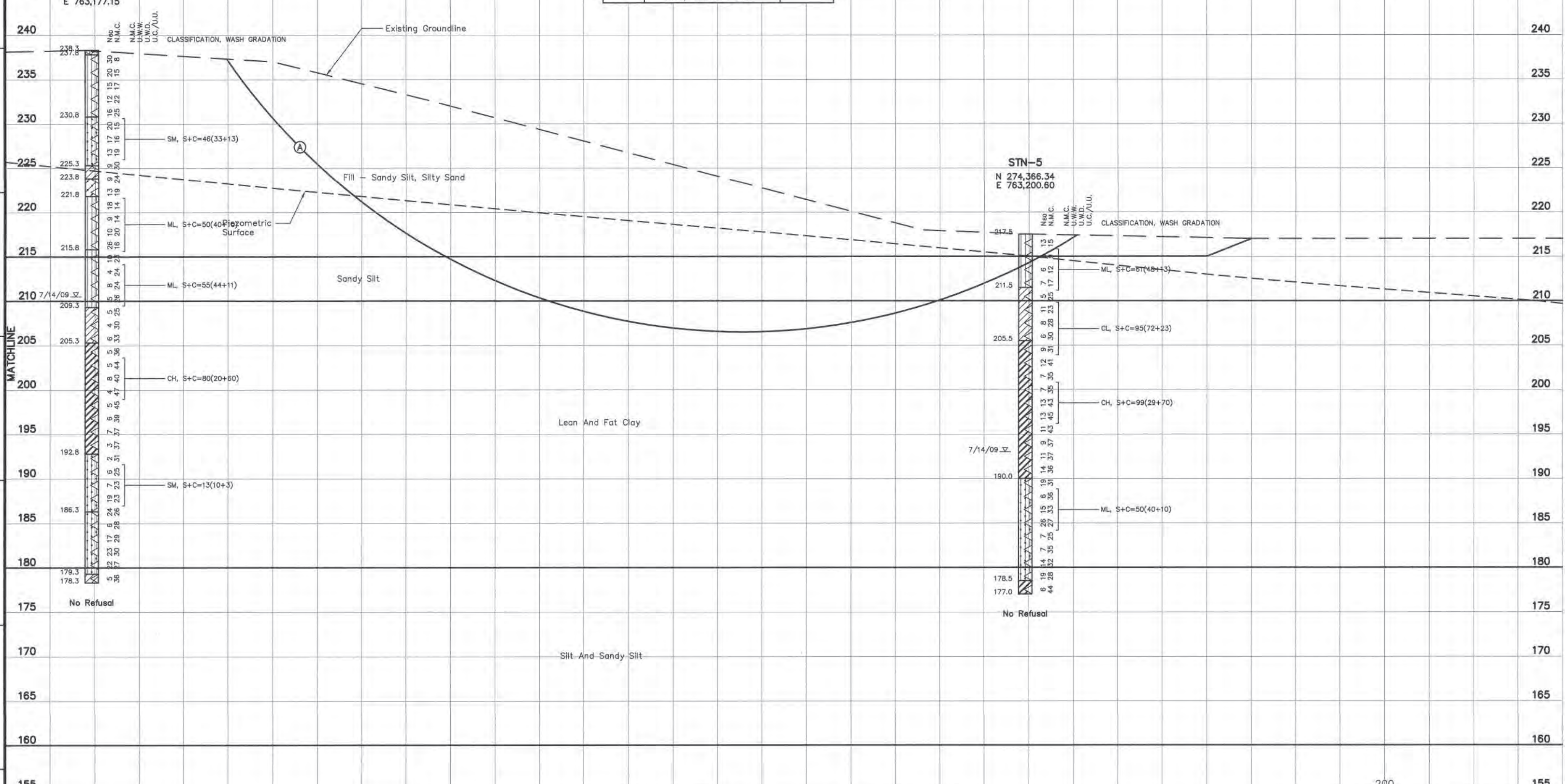
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

Stability Analysis Results for Rapid Drawdown Condition		
Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	1.74



Parameter Table							
Material Type	Sat Unit Wt, γsat	Cohesion, c	Friction Angle, Φ	Total Stress Parameters σKc=Kf	Total Stress Parameters ΨKc=Kf	Undrained Strength Parameters σKc=1	Undrained Strength Parameters ΨKc=1
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Rip Rap	140 pcf	0 psf	38°	0 psf	38°	0 psf	38°
Hydraulic Ash	105 pcf	0 psf	25°	0 psf	10°	0 psf	10.78°
Sandy Silt	125 pcf	0 psf	30°	200 psf	22°	256.79 psf	27.41°
Lean and Fat Clay	115 pcf	0 psf	26°	400 psf	12°	443.97 psf	13.27°
Sandy Silt to Silty Sand	115 pcf	0 psf	28°	200 psf	12°	218.07 psf	13.05°

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
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- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH	Weight of Hammer
WR	Weight of Rods
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{60}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
U.C./U.U.	Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
03/31/09	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

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

SCALE: 1"=5' EXCEPT AS NOTED

YARD

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

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

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

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

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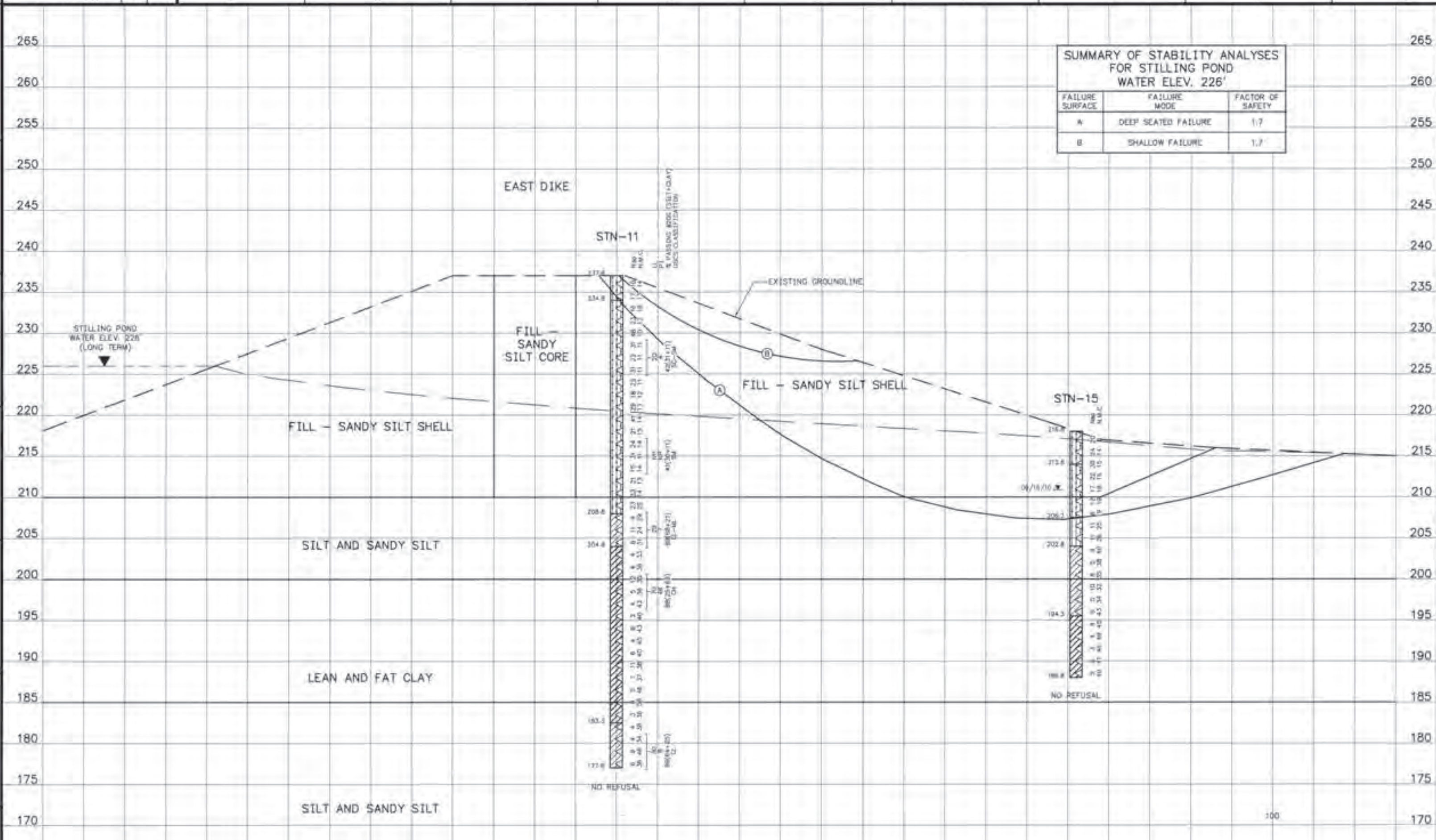
Doc 08: Analysis Sections – East Perimeter Dike East Ash Pond



SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.7
B	SHALLOW FAILURE	1.7

PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt, γsat	COHESION, $\bar{c}$	FRICTION Angle, $\bar{\phi}$
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
DIVIDER DIKE FILL – SAND	120 PCF	0 PSF	34°
RIP-RAP	120 PCF	0 PSF	38°
LEAN AND FAT CLAY	115 PCF	0 PSF	26°
SILT AND SANDY SILT	115 PCF	0 PSF	28°

CROSS-SECTION D-D'
SCALE: 1"=5'

LEGEND

- FLY ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, VERY LOOSE TO HARD
- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
- LEAN CLAY, BROWN TO GRAY, MOIST, STIFF
- FAT CLAY, GRAY, SLIGHTLY MOIST TO SATURATED, SOFT TO VERY STIFF
- SILTY CLAY, GRAY TO GRAY BROWN, MOIST TO VERY MOIST, SOFT TO VERY STIFF
- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
- SANDY CLAY, GRAY, MOIST, STIFF

WH — WEIGHT OF HAMMER
WR — WEIGHT OF RODS
◁ — STANDARD PENETRATION TEST INTERVAL
■ — UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N(60) — STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB AUTOMATIC HAMMER (BLOWS/FT.)
N.M.C. — NATURAL MOISTURE CONTENT (%)
U.W.W. — UNIT WEIGHT WET (LBS./CU.FT.)
U.W.D. — UNIT WEIGHT DRY (LBS./CU.FT.)
04/21/10 ▼ — 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.)
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.

NOTES:

1. THE BORING LOGS AND RELATED INFORMATION SHOWN ON THIS DRAWING DEPICT APPROXIMATE SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC BORING LOCATIONS NOTED AND AT THE TIME OF DRILLING. CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM THOSE OCCURRING AT THE BORING LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE SUBSURFACE CONDITIONS AT THE BORING LOCATIONS. ANY CORRELATIONS SHOWN BETWEEN BORINGS ARE GENERALLY BASED ON STRAIGHT LINE INTERPOLATION. ACTUAL CONDITIONS BETWEEN BORINGS ARE UNKNOWN AND MAY DIFFER FROM THOSE SHOWN.
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESC0X00030020110004

R.0 05/08/11 RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION D-D'

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 38 | C | 10W506-06 | R 0

PLOT FACTOR:5

C.A.D. DRAWING DO NOT ALTER MANUALLY

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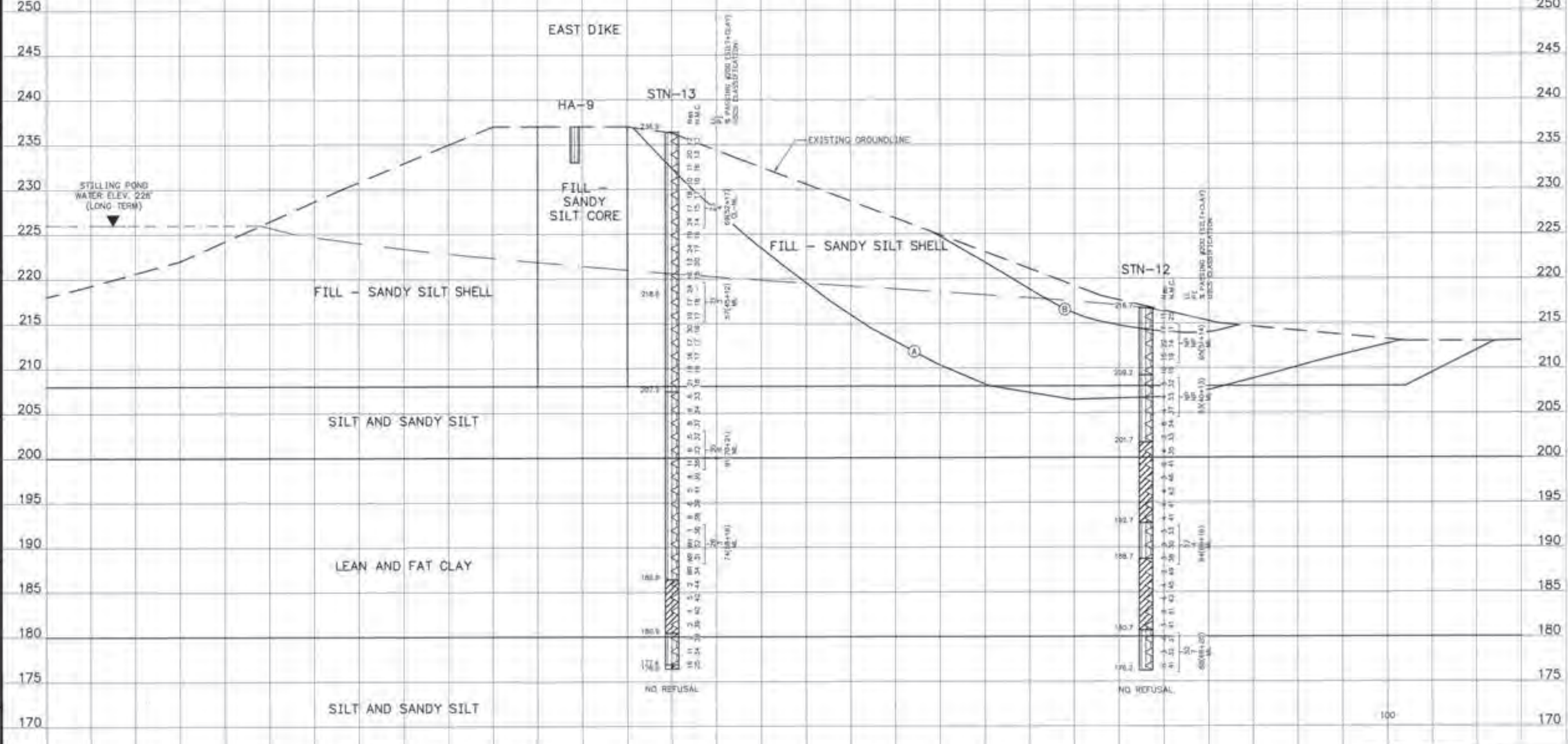
TASK COMPLETED BY | REV NO

38 | C | 10W506-06

38 C 10W506-07

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'		
FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.5
B	SHALLOW FAILURE	1.5



PARAMETER TABLE			
MATERIAL TYPE	SAT UNIT Wt, γsat	COHESION, c	FRICTION Angle, φ
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
DIVIDER DIKE FILL – SAND	120 PCF	0 PSF	34°
RIP-RAP	120 PCF	0 PSF	38°
LEAN AND FAT CLAY	115 PCF	0 PSF	26°
SILT AND SANDY SILT	115 PCF	0 PSF	28°

CROSS-SECTION E-E'
SCALE: 1"=5'

LEGEND

- FLY ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, VERY LOOSE TO HARD
- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
- LEAN CLAY, BROWN TO GRAY, MOIST, STIFF
- FAT CLAY, GRAY, SLIGHTLY MOIST TO SATURATED, SOFT TO VERY STIFF
- SILTY CLAY, GRAY TO GRAY BROWN, MOIST TO VERY MOIST, SOFT TO VERY STIFF
- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
- SANDY CLAY, GRAY, MOIST, STIFF

WH WEIGHT OF HAMMER
WR WEIGHT OF ROCK
◁ STANDARD PENETRATION TEST INTERVAL
■ UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N60 STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB AUTOMATIC HAMMER (BLOWS/FT.)
N.M.C. NATURAL MOISTURE CONTENT (%)
U.W.W. UNIT WEIGHT WET (LBS./CU.FT.)
U.W.D. UNIT WEIGHT DRY (LBS./CU.FT.)
04/23/10 ▼ 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.)
REFUSAL AUGER REFUSAL USING A CARBIDE-TIPPED 100# AUGER BIT
NO REFUSAL NO REFUSAL ENCOUNTERED
\+ STANDARD PENETRATION TEST (SPT) TERMINATED PER ASTM D 1586-99. REFER TO TYPED BORING LOG.

NOTES:

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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110004

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION E-E'

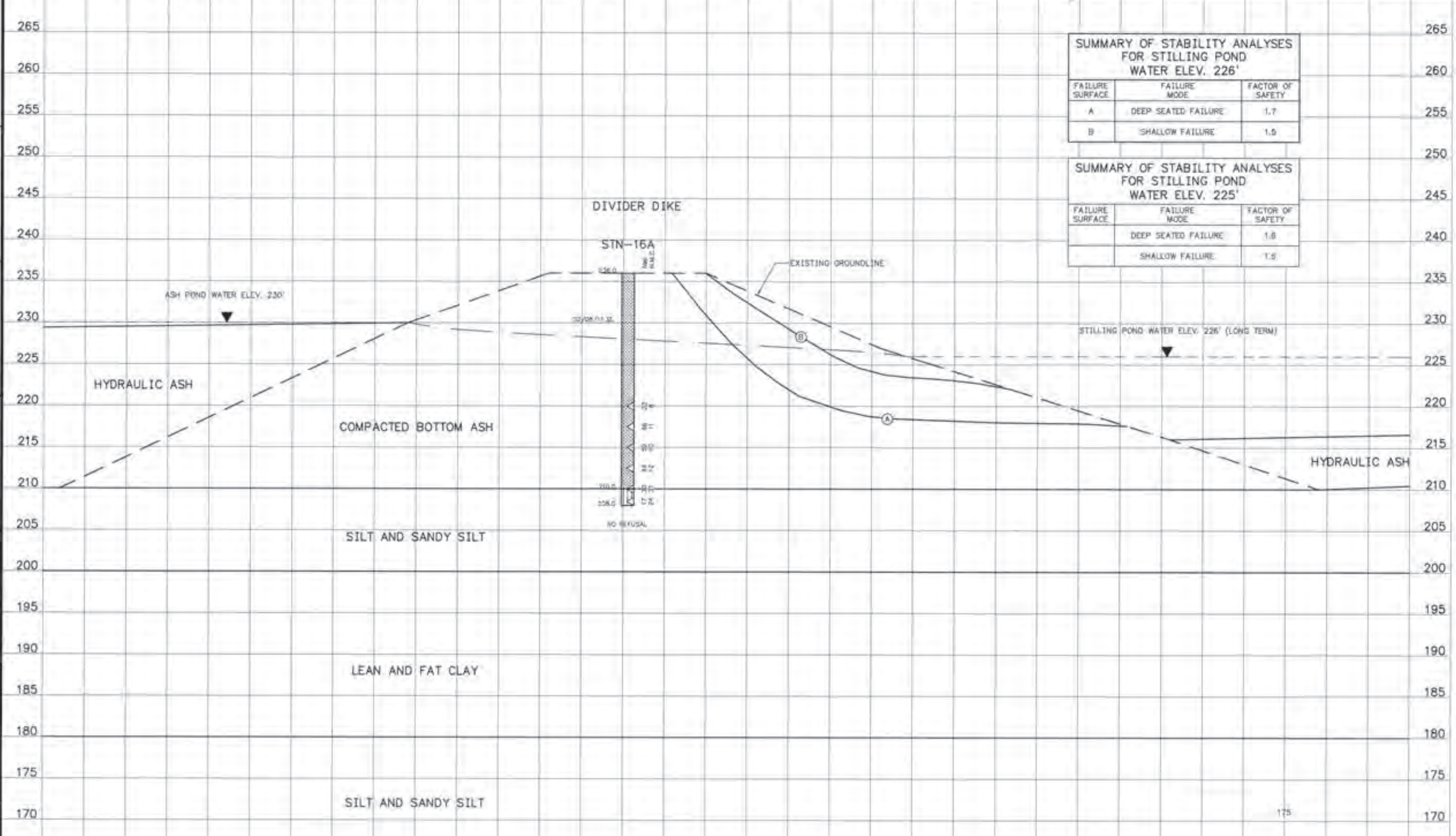
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

Stantec Consulting Services Inc.

AUTOCAD R 2000 | 38 | C | 10W506-07 | R 0

PLOT FACTOR:5

C.A.D. DRAWING DO NOT ALTER MANUALLY



SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.7
B	SHALLOW FAILURE	1.5

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	1.8
	SHALLOW FAILURE	1.5

PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt, γsat	COHESION, c	FRICTION Angle, φ
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
DIVIDER DIKE FILL – SAND	120 PCF	0 PSF	34°
RIP-RAP	120 PCF	0 PSF	38°
LEAN AND FAT CLAY	115 PCF	0 PSF	28°
SILT AND SANDY SILT	115 PCF	0 PSF	28°

CROSS-SECTION C–C'
SCALE: 1"=5'

LEGEND

- FLY ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, VERY LOOSE TO HARD
- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
- LEAN CLAY, BROWN TO GRAY, MOIST, STIFF
- FAT CLAY, GRAY, SLIGHTLY MOIST TO SATURATED, SOFT TO VERY STIFF
- SILTY CLAY, GRAY TO GRAY BROWN, MOIST TO VERY MOIST, SOFT TO VERY STIFF
- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
- SANDY CLAY, GRAY, MOIST, STIFF

WH — WEIGHT OF HAMMER
WR — WEIGHT OF RODS
◁ — STANDARD PENETRATION TEST INTERVAL
■ — UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N60 — STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB. AUTOMATIC HAMMER (BLOWS/FT.)
N.M.C. — NATURAL MOISTURE CONTENT (%)
U.W.W. — UNIT WEIGHT WET (LBS./CU.FT.)
U.W.D. — UNIT WEIGHT DRY (LBS./CU.FT.)
04/23/10 — 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.)
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.

NOTES:

1. THE BORING LOGS AND RELATED INFORMATION SHOWN ON THIS DRAWING DEPICT APPROXIMATE SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC BORING LOCATIONS NOTED AND AT THE TIME OF DRILLING. CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM THOSE OCCURRING AT THE BORING LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE SUBSURFACE CONDITIONS AT THE BORING LOCATIONS. ANY CORRELATIONS SHOWN BETWEEN BORINGS ARE GENERALLY BASED ON STRAIGHT LINE INTERPOLATION. ACTUAL CONDITIONS BETWEEN BORINGS ARE UNKNOWN AND MAY DIFFER FROM THOSE SHOWN.
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110004

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION C–C'

Stantec Consulting Services Inc.

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

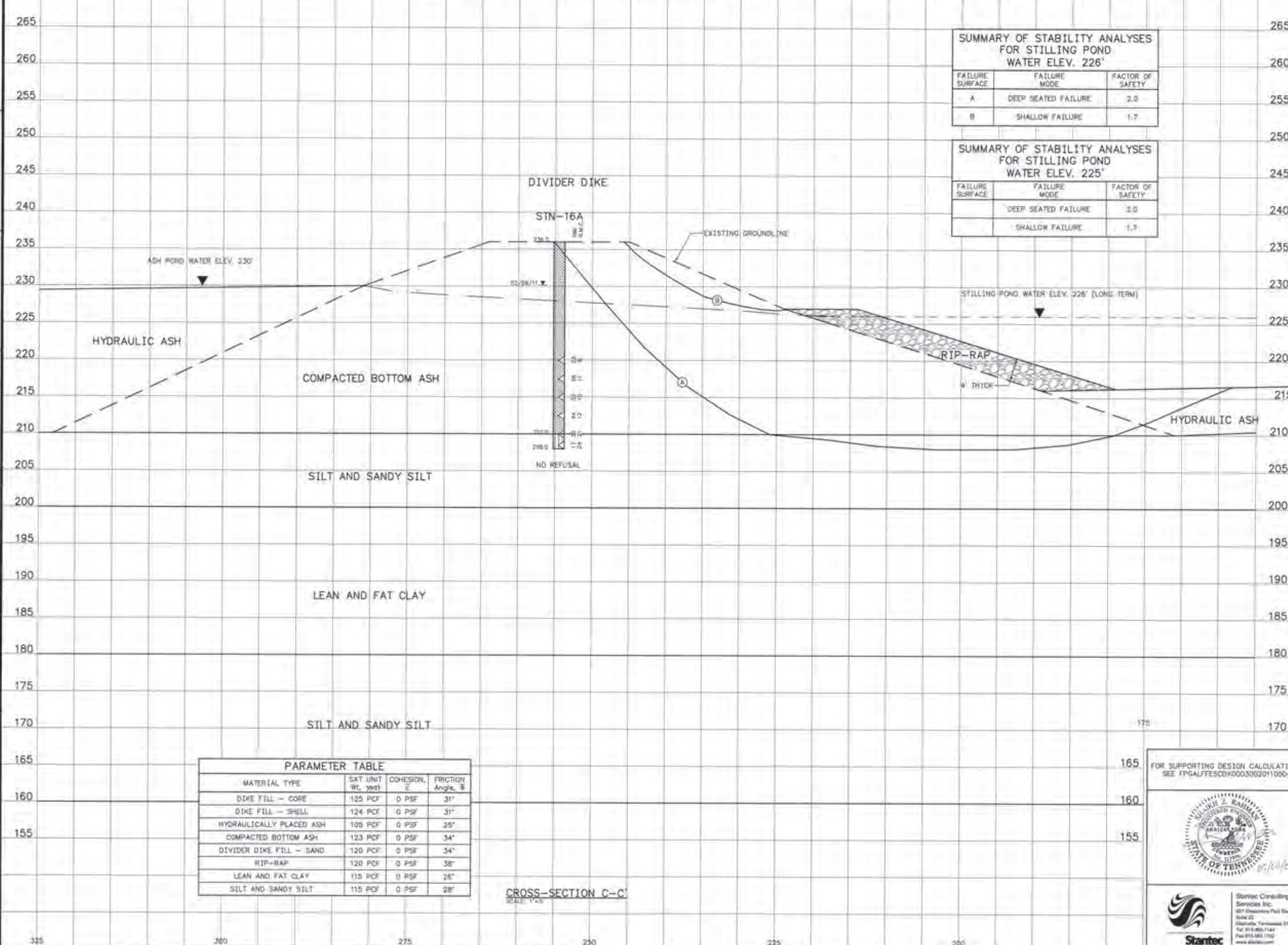
AUTOCAD R 2000 | 38 | C | 10W506-08 | R 0

PLOT FACTOR:5

C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC | 0
TASK COMPLETED BY: | REV NO.

38 | C | 10W506-08



SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	2.0
B	SHALLOW FAILURE	1.7

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	2.0
	SHALLOW FAILURE	1.7

PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt. γsat	COHESION, c	FRICTION Angle, φ
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
DIVIDER DIKE FILL – SAND	120 PCF	0 PSF	34°
RIP-RAP	120 PCF	0 PSF	38°
LEAN AND FAT CLAY	115 PCF	0 PSF	26°
SILT AND SANDY SILT	115 PCF	0 PSF	28°

CROSS-SECTION C-C'
SCALE: 1"=5'

LEGEND

- FLY ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, VERY LOOSE TO HARD
- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110004

R.0 05/06/11 RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION C-C' WITH RIP-RAP

Stantec Consulting Services Inc.

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

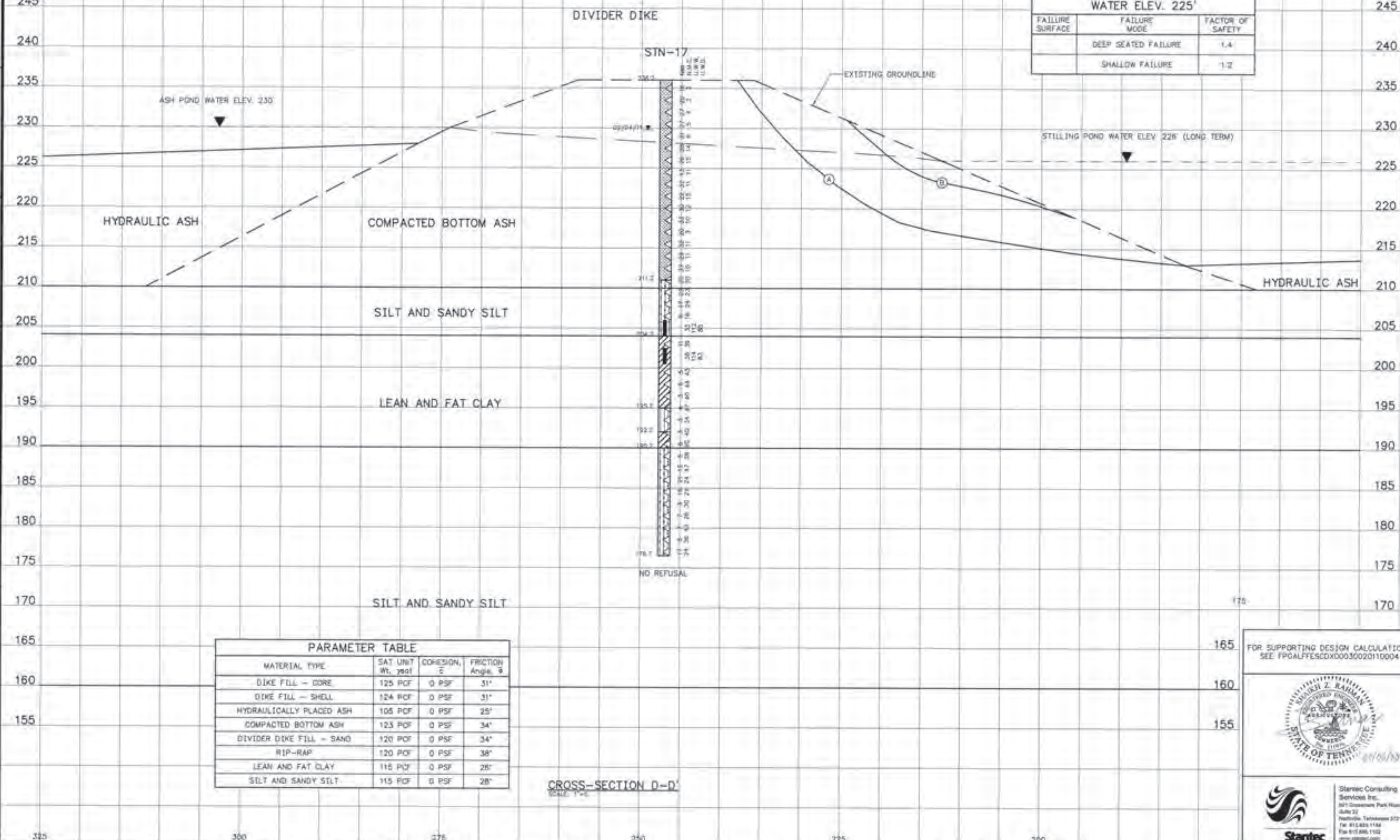
AUTOCAD R 2000 | 38 | C | 10W506-09 | R 0

STANTEC | 0
TASK COMPLETED BY | REV NO.

PLOT FACTOR:5

C.A.D. DRAWING DO NOT ALTER MANUALLY

38 C 10W506-10



CROSS-SECTION D-D'

SCALE: 1"=5'

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'		
FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.5
B	SHALLOW FAILURE	1.4

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'		
FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	1.4
	SHALLOW FAILURE	1.2

PARAMETER TABLE			
MATERIAL TYPE	SAT UNIT Wt, γsat	COHESION, c	FRICTION Angle, φ
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
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LEGEND

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- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
- SANDY CLAY, GRAY, MOIST, STIFF

WH WEIGHT OF HAMMER
WR WEIGHT OF RODS
◁ STANDARD PENETRATION TEST INTERVAL
■ UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N60 STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB AUTOMATIC HAMMER (BLOWS/FT)
N.M.C. NATURAL MOISTURE CONTENT (%)
U.W.W. UNIT WEIGHT WET (LBS./CU.FT.)
U.W.D. UNIT WEIGHT DRY (LBS./CU.FT.)
04/23/10 ▼ WATER LEVEL AND DATE RECORDED
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPOALFFESCDX00030020110004

RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION D-D'

Stantec Consulting Services Inc.

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 38 | C | 10W506-10 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:5

C.A.D. DRAWING DO NOT ALTER MANUALLY

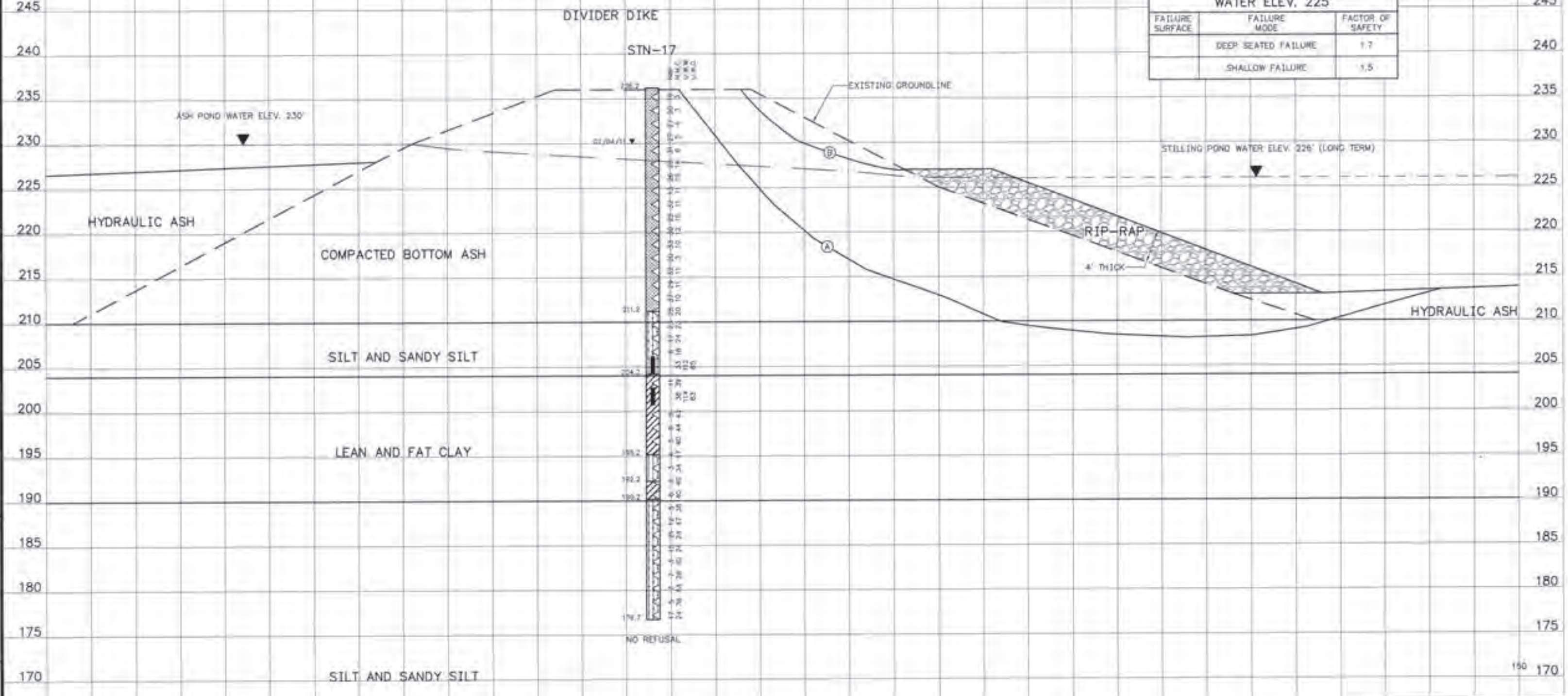
38 C 10W506-11

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.7
B	SHALLOW FAILURE	1.5

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	1.7
	SHALLOW FAILURE	1.5



PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt, γsat	COHESION, c	FRICTION Angle, Φ
DIKE FILL – CORE	125 PCF	0 PSF	31°
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SILT AND SANDY SILT	115 PCF	0 PSF	28°

CROSS-SECTION D-D'
SCALE: 1"=5'

LEGEND

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■ — UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N(60) — STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB AUTOMATIC HAMMER (BLOWS/FT.)
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPOALFFESCDX00030020110004

RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION D-D' WITH RIP-RAP

Stantec Consulting Services Inc.

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R. 2000 | 38 | C | 10W506-11 | R 0

PLOT FACTOR:5
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

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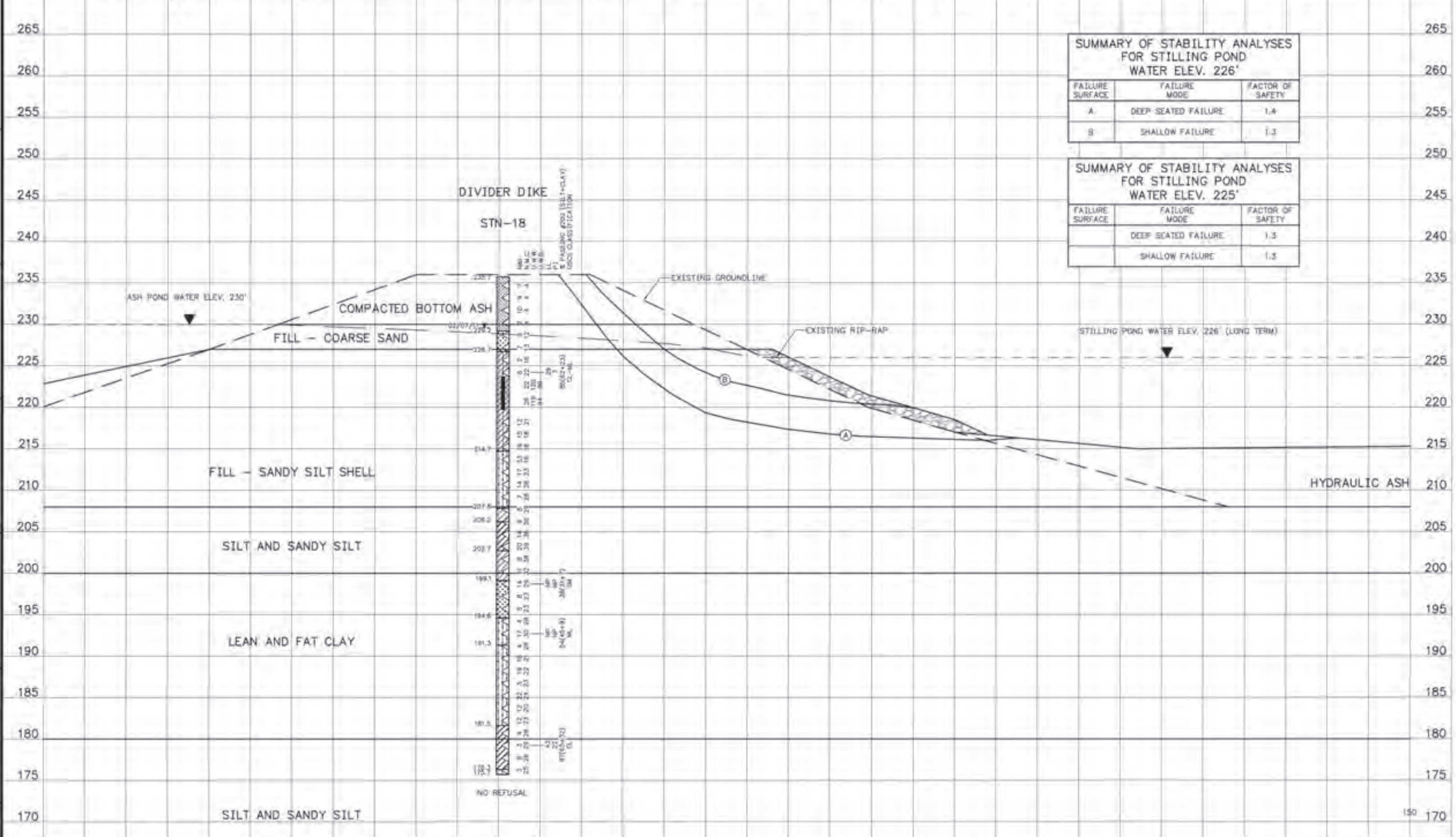

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.4
B	SHALLOW FAILURE	1.3

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	1.3
	SHALLOW FAILURE	1.3

LEGEND

- FLY ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, VERY LOOSE TO HARD
- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
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RECORD DRAWING

PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt, γsat	COHESION, C	FRICTION Angle, Φ
DIKE FILL - CORE	125 PCF	0 PSF	31°
DIKE FILL - SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
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CROSS-SECTION E-E'
SCALE: 1"=5'

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110004

R 0 05/06/11 RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
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REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION E-E'

Stantec Consulting Services Inc.

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 38 | E | 10W506-12 | R 0

PLOT FACTOR:5

C.A.D. DRAWING DO NOT ALTER MANUALLY

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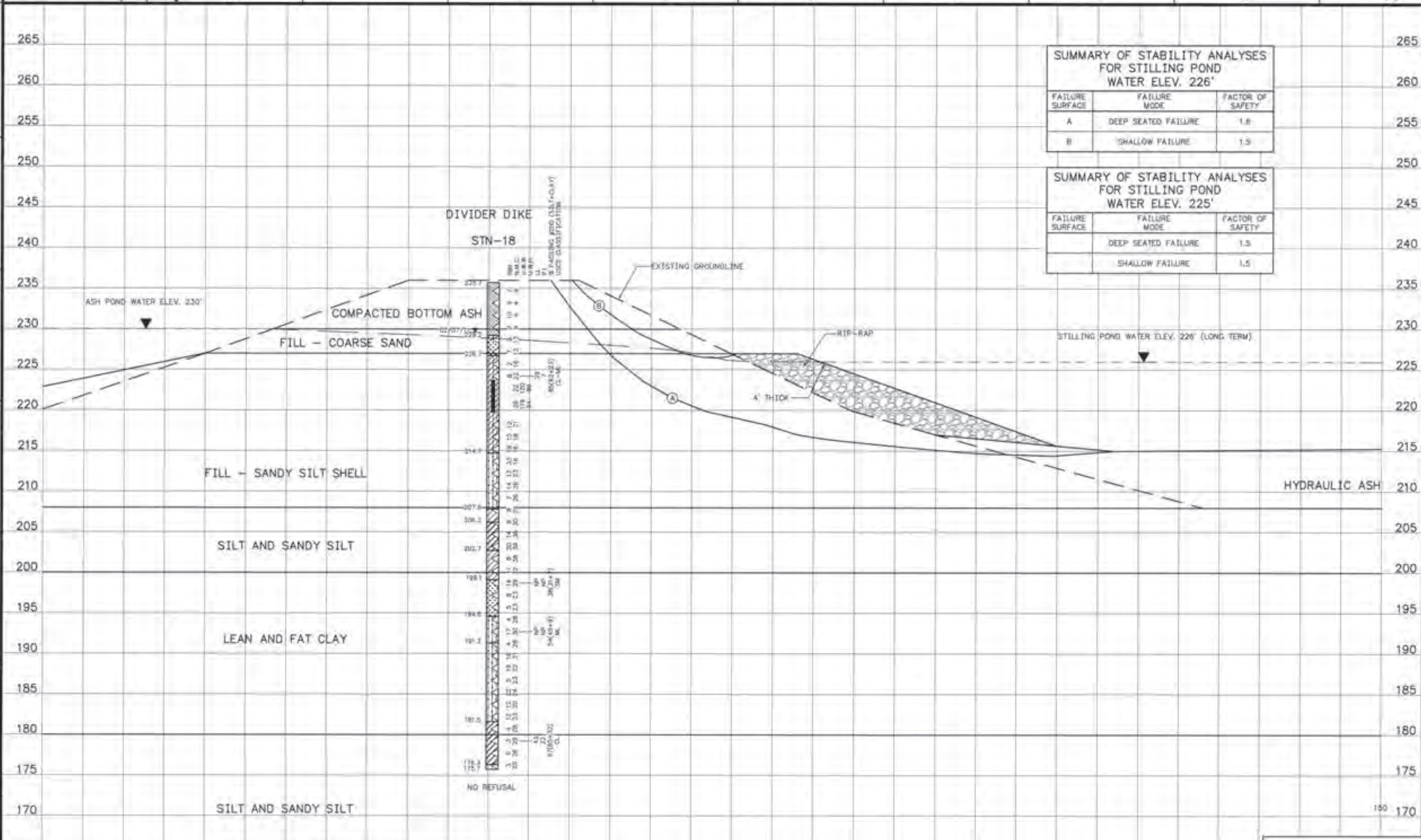
TASK COMPLETED BY: | REV NO.



SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.8
B	SHALLOW FAILURE	1.5

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	1.5
	SHALLOW FAILURE	1.5

PARAMETER TABLE

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◁ STANDARD PENETRATION TEST INTERVAL
■ UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N60 STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB AUTOMATIC HAMMER (BLOWS/FT.)
N.M.C. NATURAL MOISTURE CONTENT (%)
U.W.W. UNIT WEIGHT WET (LBS./CU.FT.)
U.W.D. UNIT WEIGHT DRY (LBS./CU.FT.)
04/23/10 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.)
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.

NOTES:

1. THE BORING LOGS AND RELATED INFORMATION SHOWN ON THIS DRAWING DEPICT APPROXIMATE SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC BORING LOCATIONS NOTED AND AT THE TIME OF DRILLING. CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM THOSE OCCURRING AT THE BORING LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE SUBSURFACE CONDITIONS AT THE BORING LOCATIONS. ANY CORRELATIONS SHOWN BETWEEN BORINGS ARE GENERALLY BASED ON STRAIGHT LINE INTERPOLATION. ACTUAL CONDITIONS BETWEEN BORINGS ARE UNKNOWN AND MAY DIFFER FROM THOSE SHOWN.
2. THE SUBSURFACE INFORMATION AND DATA FURNISHED HEREIN ARE NOT INTENDED AS REPRESENTATION OR WARRANTIES BUT ARE FURNISHED FOR INFORMATION ONLY. IT SHALL BE DISTINCTLY UNDERSTOOD THAT THE OWNER, ENGINEER OR GEOTECHNICAL ENGINEER WILL NOT BE RESPONSIBLE FOR ANY DEDUCTION, INTERPRETATION OR CONCLUSION DRAWN THEREFROM BY THE CONTRACTOR. THE INFORMATION IS MADE AVAILABLE IN ORDER THAT THE CONTRACTOR MAY HAVE READY ACCESS TO THE SAME INFORMATION AVAILABLE TO THE OWNER, ENGINEER AND GEOTECHNICAL ENGINEER AND IS NOT PART OF THIS CONTRACT.

RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPOALFFESCDX00030020110004

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE
REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION E-E' WITH RIP-RAP

Stantec

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

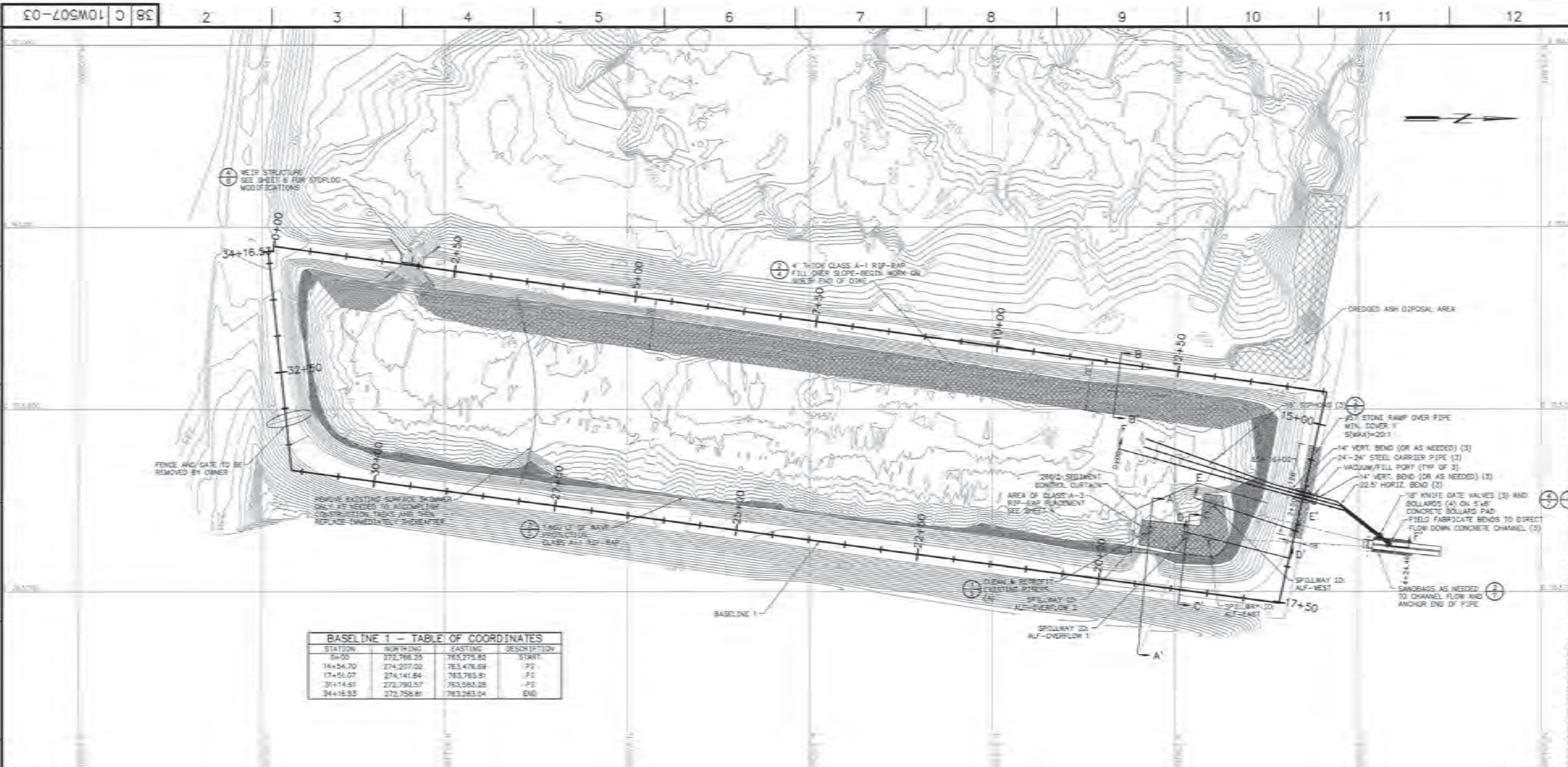
AUTOCAD R 2000 | 38 | C | 10W506-13 | R 0

PLOT FACTOR:5

C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC | 0

Doc 09: Remedial Improvement Plans East Stilling Pond – Selected Dwgs



BASELINE 1 - TABLE OF COORDINATES			
STATION	NORTHING	EASTING	DESCRIPTION
0+00	272,766.25	763,275.82	START
14+54.70	274,207.02	763,476.69	PI
17+51.07	274,141.84	763,765.91	PI
31+14.61	272,790.57	763,583.28	PI
34+16.53	272,758.81	763,263.04	END

PLAN VIEW
SCALE: 1"=50'

GRAPHIC SCALE: 1"=50'
CONTOUR INTERVAL = 1'

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8476 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

NOTES:

1. THE TOPOGRAPHIC MAPPING PRESENTED ON THIS DRAWING WAS PROVIDED TO STANTEC BY TVA SURVEYING AND PROJECT SERVICES INCLUDING A HYDROGRAPHIC SURVEY DRAWING FILE (ALD009T – APRIL 2011). HORIZONTAL COORDINATES ARE REFERENCED TO TENNESSEE STATE PLANE COORDINATE SYSTEM, NAD 27. ELEVATIONS ARE BASED ON NGVD 29.

SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

ISSUED FOR CONSTRUCTION

FOR SUPPORTING DESIGN CALCULATIONS SEE FPCALFFESCDX00030020110005

SCALE: 1"=50' EXCEPT AS NOTED

YARD
EAST STILLING POND - EASTERN PERIMETER DIKE
REMEDIAL IMPROVEMENTS
PLAN
WORK PLAN 6 (ALF-110510-WP-06)

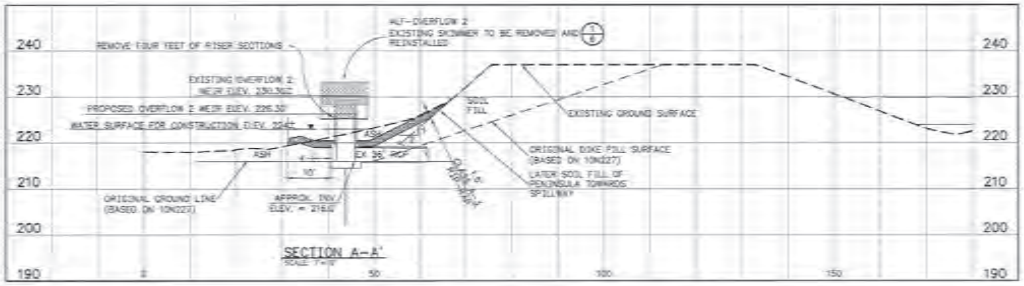
Stantec Consulting Services Inc.

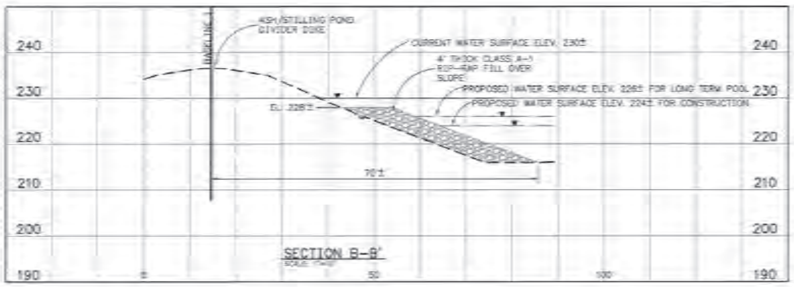
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

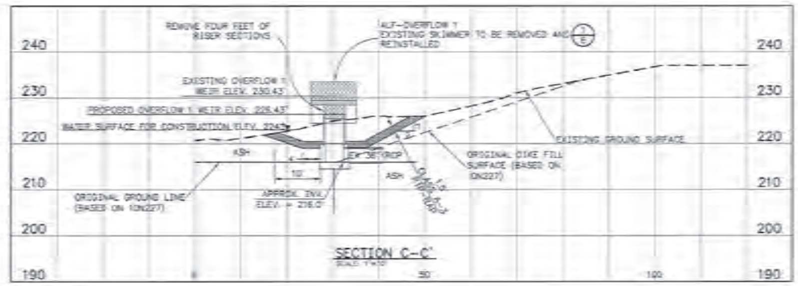
38 C 10W507-03

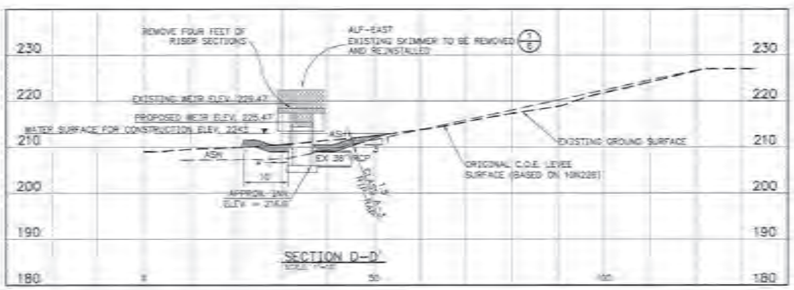
PLOT FACTOR:50

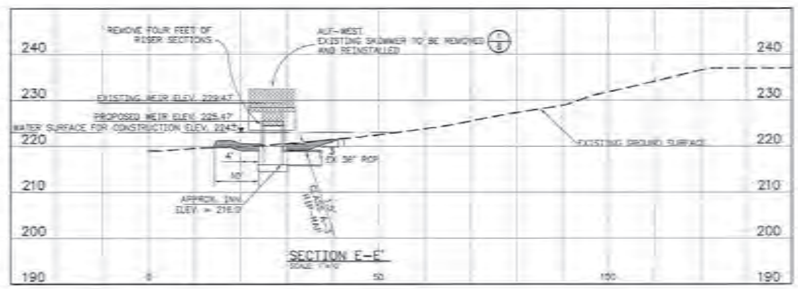
C.A.D. DRAWING DO NOT ALTER MANUALLY











DREDGING AND STONE PLACEMENT (TYP OF 4):

1. DREDGE ASH TO AN ELEVATION OF 219.0 FEET (1' BELOW TOP OF LOWER SQUARE RISER SECTION) EXTENDING LATERALLY 4' OUT FROM RISER. DREDGING SHALL BE CONDUCTED WITH EXTREME CAUTION WITH USE OF DIVER CONTROLLED SUCTION EQUIPMENT.
2. SLOPE DREDGED ASH SURFACE AT 3:1 OR 2:1 TO DAYLIGHT AS INDICATED IN DRAWING.
3. PLACE 18" OF TDOT CLASS A-3 RIP-RAP OVER CUT ASH SURFACE FROM RISER TO AT LEAST 10' FROM RISER.
4. CONTRACTOR SHALL NOTE THE PRESENCE OF 36" OUTLET PIPE AT BASE OF THE RISER AND SHALL TAKE CARE NOT TO DAMAGE SAME WHEN DREDGING OR PLACING RIP-RAP.

DIVIDER DIKE RIP-RAP PLACEMENT

1. CONTRACTOR SHALL PLACE RIP-RAP ON THE DIVIDER DIKE SLOPE FROM NORTH TO SOUTH AND FROM THE BOTTOM OF THE SLOPE UPWARDS.
2. CONTRACTOR SHALL VERIFY THE THICKNESS AND WIDTH OF THE RIP-RAP PLACEMENT BY A PREFILL SURVEY AND DAILY SURVEY OF PLACED MATERIAL AS WORK PROCEEDS.
3. RIP-RAP SHALL NOT BE STOCKPILED ON THE DIVIDER DIKE EXCEPT IN AREAS ABOVE WHICH THE RIP-RAP FILL HAS BEEN COMPLETED.

SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

ISSUED FOR CONSTRUCTION

FOR SUPPORTING DESIGN CALCULATIONS SEE FPSALFFESCDX0003020110005

SCALE: 1"=10' EXCEPT AS NOTED

YARD
EAST STILLING POND - EASTERN PERIMETER DIKE
REMEDIAL IMPROVEMENTS
SECTIONS
WORK PLAN 6 (ALF-110510-WP-06)

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

Stantec

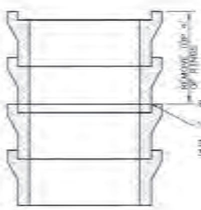
38 | C | 10W507-04

PLOT FACTOR 10

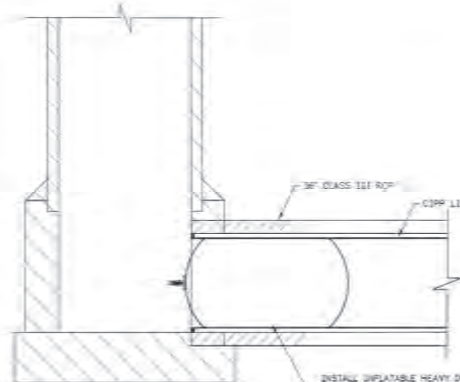
38 | C | 10W507-05

WEIR ELEVATIONS:

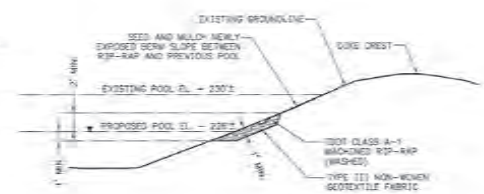
SPILLWAY ID	EXISTING ELEV. (FT)	PROPOSED ELEV. (FT)
ALF-EAST	229.47	225.47
ALF-WEST	229.47	225.47
ALF-OVERFLOW 1	230.45	225.45
ALF-OVERFLOW 2	230.30	226.30



1/5 DETAIL – EXISTING RISER RETROFITS
NOT TO SCALE



2/5 DETAIL – PIPE PLUG
NOT TO SCALE



3/5 DETAIL–WAVE WASH RIP-RAP PROTECTION
NOT TO SCALE

SPILLWAY RETROFIT SEQUENCING:

1. TO BEGIN AFTER STILLING POND WATER SURFACE HAS BEEN LOWERED TO EL. 224±.
2. REMOVE EXISTING SKIMMER, INSPECT CONDITION, COMPLETE RECOMMENDED REPAIRS, AND PRESERVE FOR REINSTALLATION.
3. CONFORM STRUCTURAL ADEQUACY OF RISERS WITH THE ENGINEER.
4. CLEAN EACH SPILLWAY OUTLET PIPE AND RISER.
5. CCTV OUTLET PIPES. INSTALL CIPP LINER IN PRIMARY SPILLWAY OUTLET PIPES PER RECOMMENDATIONS BY ENGINEER.
6. INSTALL PIPE PLUG.
7. LINE RISER SEGMENTS TO REMAIN WITH SPECTRASHIELD IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
8. REMOVE EXISTING SPILLWAY WEIR, INSPECT CONDITION, COMPLETE RECOMMENDED REPAIRS, AND PRESERVE FOR REINSTALLATION.
9. SAWCUT THE EXISTING RISERS TO ALLOW FOR REMOVAL OF RISER SECTIONS.
10. REMOVE FOUR FEET OF RISER FROM EACH SPILLWAY.
11. DREDGE ASH NEAR RISERS.
12. PLACE RIP-RAP AROUND SPILLWAYS.
13. REINSTALL SPILLWAY WEIR.
14. REMOVE PIPE PLUG.
15. REINSTALL SKIMMER STRUCTURE.

INFLATABLE PLUG NOTES:

1. CONTRACTOR SHALL PROVIDE PRESSURE GUAGES AND PRESSURE RELIEF VALVES TO PREVENT INTERIOR PLUG PRESSURES FROM EXCEEDING THE MAXIMUM ALLOWABLE INFLATION PRESSURE.

RIP-RAP WAVE PROTECTION NOTES:

1. REMOVE VEGETATION AND LOOSE SOIL FROM SLOPE AREAS TO BE PROTECTED.
2. UNDERCUT TO MINIMUM OF 1.0' BELOW EXISTING GROUND SURFACE. DISPOSE AT ON SITE LOCATION AS APPROVED BY OWNER.
3. PLACE NONWOVEN GEOTEXTILE OVER AREA TO BE PROTECTED.
4. RIP-RAP TO EXTEND FROM MINIMUM OF 2.0' ABOVE NORMAL POOL ELEVATION TO 1.0' BELOW NORMAL POOL ELEVATION.
5. PLACE RIP-RAP OVER GEOTEXTILE WITH EXCAVATOR IN LAYERS STARTING FROM BOTTOM.
6. PLACE RIP-RAP THICKNESS TO CONFORM TO ORIGINAL GROUND LINE.

SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

ISSUED FOR CONSTRUCTION

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDW00030000110005

ISSUED FOR CONSTRUCTION

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD
EAST STILLING POND – EASTERN DIVIDER DIKE

REMEDIAL IMPROVEMENTS
DETAILS
WORK PLAN 5 (ALF-110510-WP-06)

Stantec Consulting Services Inc.

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

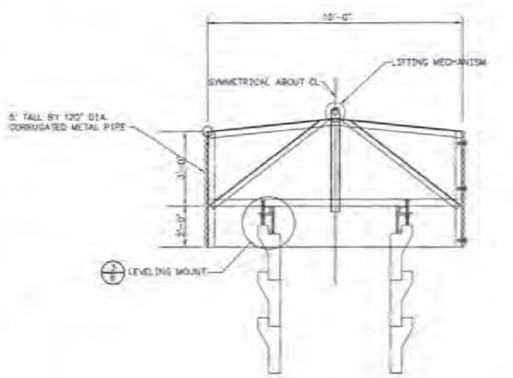
AUTOCAD R. 2000 | 38 | C | 10W507-05 | R 0

STANTEC | 0
TASK COMPLETED BY | REV NO.

PLOT FACTOR:1

C.A.D. DRAWING
DO NOT ALTER MANUALLY

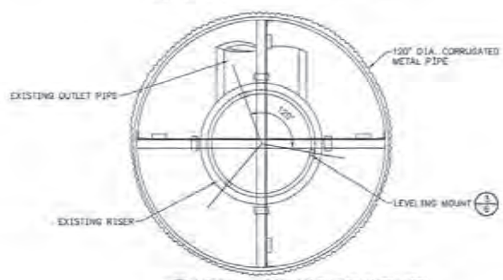
38 C 10W507-06



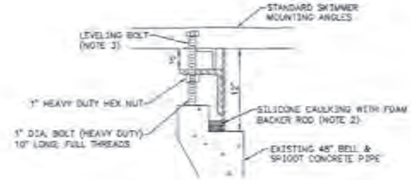
DETAIL – EXISTING SKIMMER
NOT TO SCALE

NOTES:

1. SKIMMER SHALL BE CAREFULLY REMOVED BY CONTRACTOR, PRESSURE WASHED AND STORED FOR REINSTALLATION UPON COMPLETION OF RISER MODIFICATIONS.
2. CONTRACTOR SHALL USE CLEAN WATER ONLY FOR SKIMMER WASHING AND DISCHARGE WATER TO STILLING POND.
3. DETAILS SHOWN ON THESE PLANS ARE FOR CONTRACTOR GENERAL REFERENCE ONLY AND WERE OBTAINED FROM TVA STANDARD DRAWINGS 10N214, 10N229-1, AND 10N229-2.
4. SKIMMERS SHALL BE INSPECTED BY ENGINEER. RECOMMENDED REPAIRS WILL BE COMPLETED PRIOR TO REINSTALLATION.



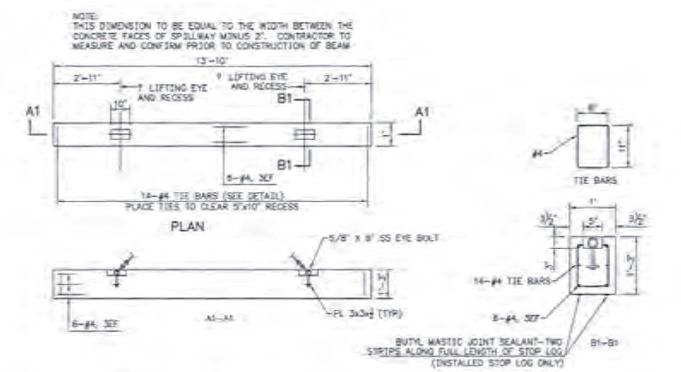
DETAIL – TOP VIEW OF SKIMMER
NOT TO SCALE



DETAIL – LEVELING MOUNT
NOT TO SCALE

NOTES:

1. FOR SKIMMER AND SPILLWAY DETAILS, REFER TO TVA DRAWING 10N229-2.
2. CAULKING SHALL EXTEND COMPLETELY AROUND THE WEIR AND FORM A WATER TIGHT SEAL.
3. WHEN THE WEIR IS REINSTALLED, THE TOP SHALL BE LEVELED WITH THE USE OF LEVELING BOLTS.



DETAIL – PRE-CAST STOP LOG
SCALE: 1"=1' – 2 REQUIRED

NOTES:

1. CONTRACTOR TO FABRICATE PRE-CAST CONCRETE STOP LOGS AS DETAILED.
2. ONE NEW STOP LOG TO BE INSTALLED IN SOUTH SPILLWAY CHANNEL. SECOND STOP LOG TO BE STORED ON SITE AS PER OWNER DIRECTION.
3. TOP OF EXISTING STOP LOG IN SOUTH CHANNEL – 228.05' (PER SURVEY DATA PROVIDED BY TRANSASH 5-6-11)
4. HEIGHT OF NEW STOP LOG – 1.25'
5. TOP OF NEW STOP LOG ELEVATION – 229.30'

ISSUED FOR CONSTRUCTION

SECTION OR DETAIL NO.
SHEET WHERE SHOWN

FOR SUPPORTING DESIGN CALCULATIONS SEE FPOALFFESCDX00030020110005

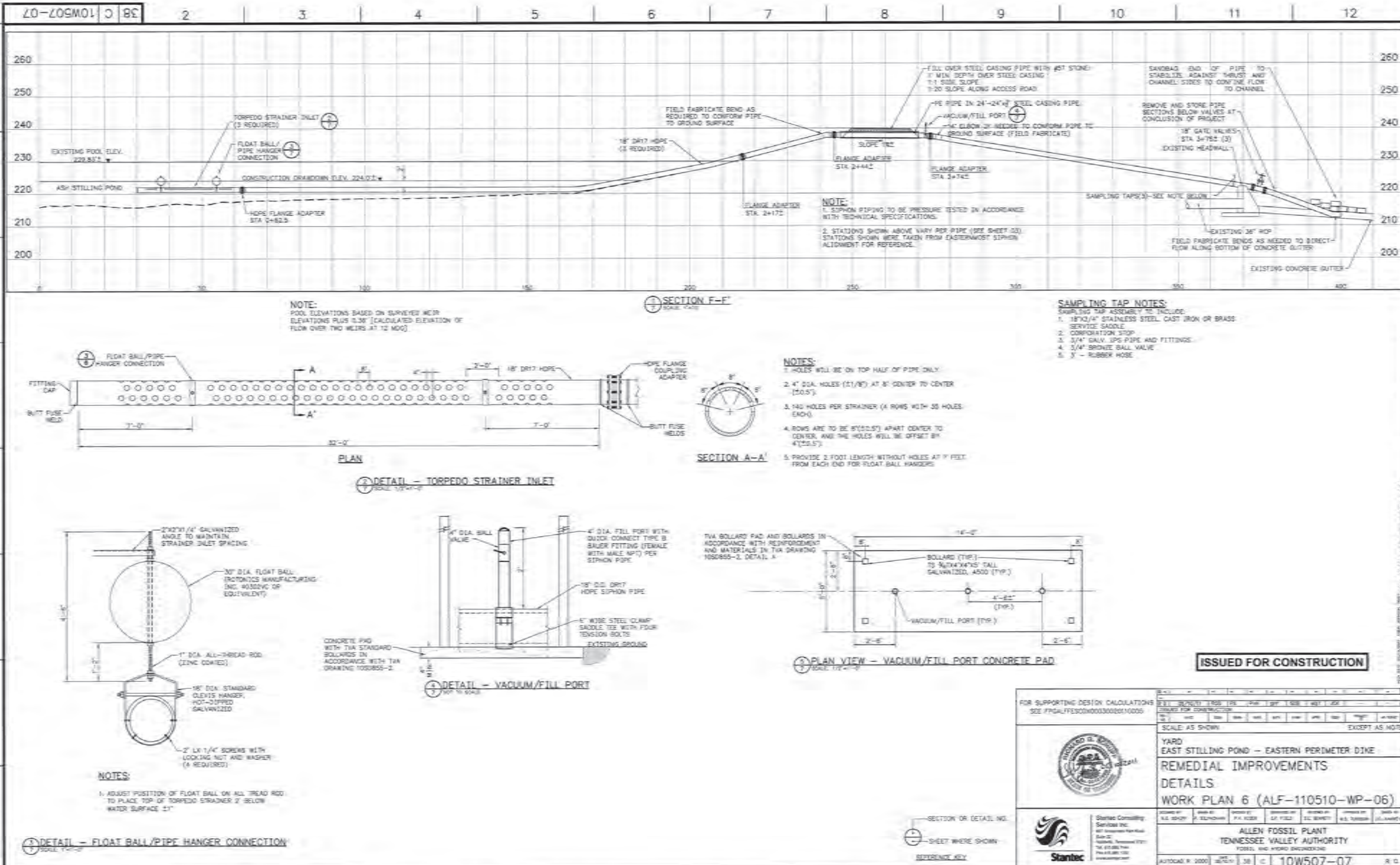
ISSUED FOR CONSTRUCTION

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD
EAST STILLING POND – EASTERN PERIMETER DIKE
REMEDIAL IMPROVEMENTS
DETAILS
WORK PLAN 6 (ALF-110510-WP-06)

Barge Consulting Services Inc.

ALLEN FOSSIL PLANT



NOTE:
1. SIPHON PIPING TO BE PRESSURE TESTED IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
2. STATIONS SHOWN ABOVE VARY PER PIPE (SEE SHEET 03). STATIONS SHOWN WERE TAKEN FROM EASTERNMOST SIPHON ALIGNMENT FOR REFERENCE.

NOTE:
POOL ELEVATIONS BASED ON SURVEYED WEIR ELEVATIONS PLUS 0.38' (CALCULATED ELEVATION OF FLOW OVER TWO WEIRS AT 12 MDG)

SAMPLING TAP NOTES:
SAMPLING TAP ASSEMBLY TO INCLUDE:
1. 18"X3/4" STAINLESS STEEL, CAST IRON OR BRASS SERVICE SADDLE
2. CORPORATION STOP
3. 3/4" GALV. IPS PIPE AND FITTINGS
4. 3/4" BRONZE BALL VALVE
5. 3' - RUBBER HOSE

NOTES:
1. HOLES WILL BE ON TOP HALF OF PIPE ONLY.
2. 4" DIA. HOLES (±1/8") AT 8" CENTER TO CENTER (±0.5").
3. 140 HOLES PER STRAINER (4 ROWS WITH 35 HOLES EACH).
4. ROWS ARE TO BE 8"(±0.5") APART CENTER TO CENTER, AND THE HOLES WILL BE OFFSET BY 4"(±0.5").
5. PROVIDE 2 FOOT LENGTH WITHOUT HOLES AT 1' FEET FROM EACH END FOR FLOAT BALL HANGERS.

NOTES:
1. ADJUST POSITION OF FLOAT BALL ON ALL THREAD ROD TO PLACE TOP OF TORPEDO STRAINER 2' BELOW WATER SURFACE ±1"

ISSUED FOR CONSTRUCTION

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCD0003002010005

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
EAST STILLING POND - EASTERN PERIMETER DIKE
REMEDIAL IMPROVEMENTS
DETAILS
WORK PLAN 6 (ALF-110510-WP-06)

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

Stantec

AUTOCAD R 2000 | 38 | C | 10W507-07 | R0

38 C 10W507-07

PLOT FACTOR:10

C.A.D. DRAWING DO NOT ALTER MANUALLY

Doc 10: Stantec Phase 1 Report

Stantec

TVA Disposal Facility Assessment
Phase 1 Plant Summary
Allen Fossil Plant (ALF)

Location:	Allen Fossil Plant (ALF) 2574 Plant Road Memphis, Shelby County, TN 38109 **Latitude:** 35.074 N **Longitude:** 90.149 W
Plant Contact:	Frank Dominioni System Engineer – Fossil Power Group **Phone:** (901) 789-8400 **Email:** FEDominioni@TVA.gov
Facts and Figures:	The Allen Fossil Plant has three coal-fired generating units and 20 combustion turbines. The plant construction began in 1956 and was completed in 1959. The plant consumes approximately 7,200 tons of coal per day and generates approximately 4.9-billion kilowatt-hours of electricity annually. The winter net dependable generating capacity is about 753 megawatts. It is located about 10 miles southwest of downtown Memphis, Tennessee just south of Lake McKellar which is directly connected to the Mississippi River.
Coal Combustion Byproduct Disposal:	Approximately 85,000 dry tons of fly ash is wet-sluiced to the East Ash Pond every year. The fly ash is then dredged, dewatered and transported to an off-site structural fill project. Approximately 110,000 dry tons of boiler slag is wet-sluiced to the East Ash Pond every year. Approximately 90% of the boiler slag is reclaimed and marketed to outside companies.

Geology and Seismicity:

The Allen Fossil Plant is located in the extreme southwestern corner of Tennessee just west of the city of Memphis. The plant is situated on the south shore of Lake McKellar and the eastern bank of the Mississippi River. Geologic mapping shows the site to be underlain by artificial fills and Quaternary age alluvial deposits. The fill is noted to generally consist of alluvium dredged from the flood plain (or loess in select locations) and range in thickness from a few feet beneath residential areas to tens of feet beneath industrial areas in the floodplain of the river. The alluvial materials are described as consisting of irregular lenses of fine sand, silt, and clay in the upper part, and of coarse sands, gravelly sands, and sandy gravels in the lower part. The alluvium varies from about 45 to 90 feet in thickness adjacent to the loess bluffs along the eastern edge of the quadrangle to as much as 175 feet well out in the flood plain. The mapping indicates the alluvium is underlain by the series of highly consolidated clays and dense sands comprising the Claiborne Group.

Evaluations of seismic hazards affecting western Tennessee, and thus the plant site, are dominated by events emanating from the New Madrid Seismic Zone (NMSZ) of the central Mississippi Valley. The NMSZ is the most active seismic zone east of the Rocky Mountains and the continuing seismicity of the zone is thought to be associated with the reactivation of faults within the Reelfoot Rift System. Although the majority of the events emanating from this zone are too small to be felt at the surface, this zone produced a series of four earthquakes between December 1811 and early February 1812 each exhibiting estimated magnitudes on the order of 7.0 to 8.0. The “Geologic Hazards Map of Tennessee – Environmental Geology Series No. 5” developed and published by the Tennessee Department of Environment and Conservation (TDEC), Division of Geology and compiled by Robert Miller (1978) shows the plant to be located in Seismic Risk Zone 3.

Facilities Reviewed:

East Ash Pond and Dredge Cell
East Ash Stilling Pond
West Ash Pond

1. General Facility Information

Facility Status:	Active	**NID Identification:**	TN15801
Surface Area (inside dikes)	70 Acres	**Maximum Height (toe to top of dike):**	20 feet
Free Water Volume:	Unknown	**Maximum Water Storage:**	140 Acre-feet
Estimated CCB Storage:	Varies	**Dike Length:**	1000 feet
Plant Discharge to Facility:	9.8 MGD	**Current Pool Elevation:**	231 feet

2. Site Visit Information

Stantec Assessment Team:	Rob Kirkbride, PE
TVA Staff Present:	Frank Dominioni
Field Assessment Dates:	February 17, 2009
Weather/Site Conditions:	40 degrees F, cloudy, drizzle, moist ground

3. History/Description of Usage

History and Operation: This facility was originally commissioned in 1967 and expanded in 1978. Approximately 85,000 dry tons of fly ash is wet sluiced to the East Ash Pond annually. The fly ash is dredged, dewatered and transported to an off-site structural fill project. Approximately 110,000 dry tons of boiler slag is wet sluiced to the pond annually. Approximately 90% of the boiler slag is reclaimed and marketed to outside companies. Decant water is transferred into the Ash Stilling Pond through the concrete spillway structure in the southeast corner of the pond.

Past Failures/Releases: No failures or releases reported.

4. Owner's Operations, Maintenance and Inspection Information

Emergency Action Plan:	No EAP has been prepared for this facility.
Operations Manual:	TVA maintains a By Products Operation Manual for the Allen Fossil Plant.
TVA Maintenance:	Exterior slopes are mowed as necessary to keep vegetation minimized.
TVA Inspections:	TVA Engineering performs dike inspections and prepares reports annually. Plant personnel make observations throughout the year on a random basis.
Problems Previously Identified During Past TVA Inspections:	Some erosion problems at the discharge end of the primary spillway structures that discharge into McKellar Lake.

5. Documents Reviewed

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

TVA Design Drawings:	10N226 R2, 10W208-1 R0,10W208-2 R0, 10W208-3 R0, 10W214-3 R0, 10W225 R6, 10W234-1 R0,10W234-2 R0.
TVA As-Built Drawings:	No drawings identified as As-Built.
TVA Construction Testing Records:	None available.
TVA Annual Inspection Reports:	TVA annual inspection reports from 1967 to 2008.
Geotechnical Data:	Limited data includes lab results, but difficult to tell specific locations of soil boring. (File: ALF MEMO TO GLBUCHANAN FROM GENE FARMER ON ALF ASH DISPOSAL AREA DIKES - SOIL INVESTIGATION.pdf)

6. Stantec Field Observations

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

6.1. Interior Slopes

Vegetation: North - Dense phragmites.
East - Dense phragmites.
West - Dense phragmites.
South - Dense phragmites; Portion where dredging operations have removed all vegetation.

Trees: None observed.

Wave Wash Protection: None observed.

Erosion: Difficult to observe. Numerous minor erosion channels.

Instabilities: Difficult to observe.

Animal Burrows: Difficult to observe.

Freeboard: **Measured:** 6 feet
Design: Unknown

Encroachments: East dredge cell in west portion.

Slope: **Measured:** 2H:1V to 3H:1V
Design: 2H:1V to 3H:1V

6.2. Crest

Crest Cover and Slope: North - Gravel. Relatively level.
South - Paved road and grass covered. Relatively level.
East (divider dike) - Boiler slag with some vegetation. Relatively level.
West - Boiler slag with some vegetation. Relatively level.

Erosion: Minor erosion observed.

Alignment: Appears uniform.

Settlement/Cracking: Very little. Some minor (less than 2 inch) low spots.

Bare Spots/Rutting: North - Some minor rutting in gravel.
South - Paved road and grass covered with some rutting.
East (divider dike) - Mostly bare with rutting.
West - Mostly bare.

Width:

Measured:
North - 30 to 40 feet
South - 100 feet +
East (divider dike) - 22 to 25 feet
West - 50 feet +

Design:
North - Unknown (USCOE Levee)
South - Unknown (USCOE Levee)
East (divider dike) - 16 feet
West - Unknown

6.3. Exterior Slopes

Vegetation: North - Good grass cover
South - Good grass cover
East (divider dike) - Mostly phragmites
West - Mostly phragmites

Trees: North - Trees at the toe
South - None
East (divider dike) - None
West - None

Erosion: No significant erosion observed.

Instabilities: None observed.

Uniform Appearance: Yes.

Seepage: None observed.

Benches: None.

Foundations, Drains, Relief Wells, Instrumentation: None observed

Animal Burrows: None observed.

Slope:	**Measured:**	North - 4H:1V South - 4H:1V East (divider dike) - 2H:1V West - varies due to dredge cell
	Design:	North - Unknown (USACE Levee) South - Unknown (USACE Levee) East (divider dike) - 2H:1V West - Unknown
Height:	**Measured:**	North - 20 feet South - 20 feet East (divider dike) - Could not be observed. West - varies due to dredge cell
	Design:	North - Unknown (USACE Levee) South - Unknown (USACE Levee) East (divider dike) - Unknown West - Unknown

6.4. Spillway Weirs/Riser Inlets

Number:	1
Size, Type and Material:	Concrete outlet structure that transfers flow from the ash pond to the stilling pond. Flow is controlled using stop logs. The pool level was approximately 2 to 3 feet below the top of the stop logs.
Height of Riser Inlets:	Unknown.
Access:	Accessible from divider berm.
Joints:	Concrete joints have some deterioration. Could not evaluate stop logs because pool levels on both sides were equal.
Mis-Alignment:	None observed
Closed/Abandoned Conduits:	None known.

6.5. Outlet Pipes

Number: N/A - Concrete spillway structure, see info above.

Size, Type and Material: N/A

Headwall: N/A

Joint Separations: N/A

Mis-Alignment: N/A

Closed/Abandoned Conduits: N/A

7. Notable Observations and Concerns

- There is an active 30-inch public ductile iron sanitary sewer force main pipeline that connects into a 42-inch RCP sanitary sewer that runs north and south across the Ash Pond and Dredge Cell. The approximate top of the 30-inch pipe is at elevation 217.5 and the high point of the 42-inch pipe is at elevation 218.5. TVA drawing 10W208-1 R0 is a plan view showing the pipe locations. Drawing 10W208-3 R0 shows details of the manhole at the connection of the 30-inch pipe to the 42-inch pipe. TVA has an agreement with the City of Memphis to restrict the maximum elevation height of the East Dredge Cell southern dike to 239 feet. Drawing 10W208-3 R0 shows a low dredging elevation of 226 in the area of the pipes, which is approximately 7.5 to 8.5 feet from the top of the pipes.
- There is an inactive 60-inch public sanitary sewer pipeline that runs east and west across the Ash Pond and Dredge Cell. Two of the manholes are located within the Ash Pond. The approximate top of the pipe is at elevation 221 based on drawing 10W208-1 R0. Top elevation of the fly ash is highly variable so the actual depth of material over the pipe is unknown. Notes on the drawings require no dredging be performed within a 50 foot radius of the manholes.
- There are two 161KV electric transmission towers within the Ash Pond and one adjacent to the Ash Pond. Drawing 10W208-1 R0 shows the locations. Notes on the drawings require no dredging be performed within 100 feet of the tower base.
- Erosion is occurring on the interior slope along the south dike. This is considered a secondary issue since the crest width at this location is greater than 100 feet.
- The east slope (divider berm) has steep (approximately 2H:1V) slopes with some erosion.

- There is a seep near the fuel unloader on the bank of McKellar Lake below the USACE Mississippi River Levee and approximately 300 feet from the NW corner of the East Ash Pond. The source of the seep is unknown but suspected to be process water.

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- Evaluate the active and inactive sanitary sewer force mains and determine if rerouting or other measures are feasible or warranted.
- Evaluate current operating procedures for working around the existing electric transmission lines including factor of safety for stability.
- Based on the limited as-built drawings available, it is recommended that a program be established to develop current conditions / as-built drawings to record future modifications to this facility. Construction records should also be included as part of this program to record and quantify construction means, methods and results.
- Due to the limited construction monuments at this facility, it is recommended that additional surveyed construction monuments be established at selected locations. These monuments should be surveyed annually as a minimum.
- Based on the findings of Phase 2 and designs from Phase 3, if performed, Stantec recommends that the existing O & M Manual be reviewed and updated. These updates may include sections on routine monitoring and facility maintenance.

8.2. Maintenance Recommendations

- Cut and maintain heavy/tall vegetation on interior slopes.
- Repair erosion areas where noted and provide rip-rap as necessary.
- Repair / regrade animal paths and burrows and provide seeding and mulching to establish a vegetative cover. Continue to monitor on a regular basis.

TVA Disposal Facility Assessment
Phase 1 Coal Combustion Product Disposal Facility Summary
Allen Fossil Plant (ALF)
East Ash Stilling Pond (EASP)

1. General Facility Information

Facility Status:	Active	**NID Identification:**	TN15801
Surface Area (inside dikes)	10 Acres	**Maximum Height (toe to top of dike):**	20 feet
Free Water Volume:	150 Acre-feet	**Maximum Water Storage:**	200 Acre-feet
Estimated CCB Storage:	Unknown	**Dike Length:**	200 feet
Plant Discharge to Facility:	9.8 MGD	**Current Pool Elevation:**	231 feet

2. Site Visit Information

Stantec Assessment Team:	Rob Kirkbride, PE
TVA Staff Present:	Frank Dominioni
Field Assessment Dates:	February 17, 2009
Weather/Site Conditions:	40 degrees F, cloudy, drizzle, moist ground

3. History/Description of Usage

History and Operation: This facility was part of the Ash Pond expansion in 1978. Decant water is transferred from the Ash Pond into the Stilling Pond through the concrete spillway structure in the southwest corner of the pond. There are two primary outlet spillways presumably made of RCP risers and outlet pipes discharge flow into McKellar Lake. Two emergency outlet spillways also presumably consisting of RCP risers and outlet pipes discharge flow through the east dike and eventually into Horn Lake. The emergency spillways are only used when the pool level in McKellar Lake is too high to discharge.

Past Failures/Releases: No failures or releases reported.

4. Owner's Operations, Maintenance and Inspection Information

Emergency Action Plan:	No EAP has been prepared for this facility.
Operations Manual:	TVA maintains a By Products Operation Manual for the Allen Fossil Plant.
TVA Maintenance:	Exterior slopes are mowed as necessary to keep vegetation minimized.
TVA Inspections:	TVA Engineering performs dike inspections and prepares reports annually. Plant personnel make observations throughout the year on a random basis.
Problems Previously Identified During Past TVA Inspections:	Concerns of damaging the existing sanitary sewer line (abandoned) that is below the pond, erosion, rutting and debris blocking the emergency spillway outlets.

5. Documents Reviewed

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

TVA Design Drawings:	10N226 R2, 10N227 R1, 10N228 R1, 10N229-1 R0, 10N229-2 R0, 10W208-1 R0, 10W208-7 R0, 10W211 R0, 10W225 R6, 10W234-1 R0, 10W234-2 R0.
TVA As-Built Drawings:	No drawings identified as As-Built.
TVA Construction Testing Records:	None available.
TVA Annual Inspection Reports:	TVA annual inspection reports from 1967 to 2008.
Geotechnical Data:	Limited data includes lab results, but difficult to tell specific locations of soil borings. (File: ALF MEMO TO GLBUCHANAN FROM GENE FARMER ON ALF ASH DISPOSAL AREA DIKES - SOIL INVESTIGATION.pdf)

6. Stantec Field Observations

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

6.1. Interior Slopes

Vegetation: All slopes have dense phragmites at lower portion of slope. North, south and east slopes have adequate grass ground cover that has been mowed. The west slope (divider berm) is primarily bare boiler slag.

Trees: None.

Wave Wash Protection: None.

Erosion: Some wave erosion occurring on all slopes. Most is minor, but east slope is more significant with scarp heights of 1 to 2 feet.

Instabilities: Only wave erosion observed.

Animal Burrows: No burrows, but did observe animal path from the crest to the water surface (15 feet long and 1 foot wide). This path matches the path along crest and down the exterior slope.

Freeboard:
Measured: 6 feet
Design: Unknown

Encroachments: None

Slope:
Measured: North - 4H:1V
East - 3H:1V
West (divider berm) - 2H:1V to 3H:1V
South - 3H:1V
Design: 3H:1V

6.2. Crest

Crest Cover and Slope: North, South and East - Grass covered with no slope.
West - Mostly bare boiler slag with no slope.

Erosion:	Primary erosion is on the access ramp located in the southeast corner of the pond. The erosion is 12 to 16 inches wide and approximately 30 feet long. The water drains down the ramp and into an adjacent swale which has also eroded.
Alignment:	Appears uniform.
Settlement/Cracking:	No significant settlement/cracking observed.
Bare Spots/Rutting:	The majority of the west (divider dike) and the access ramp is bare. Minor rutting on all dikes.
Width:	**Measured:** North - 30 to 35 feet East - 12 to 15 feet West (divider berm) - 22 to 25 feet South - 20 feet + **Design:** North - Unknown (USCOE Levee) South - Unknown (USCOE Levee) East - 16 feet West (divider dike) - Unknown

6.3. Exterior Slopes

Vegetation:	North - Good grass cover South - Good grass cover East - Good grass cover. Some phragmites at the toe and 5 to 10 feet up the slope. West (divider dike) - Mostly phragmites
Trees:	None.
Erosion:	No significant erosion observed.
Instabilities:	None observed.
Uniform Appearance:	Yes.
Seepage:	None observed. The toe of the east dike was not observable due to ponding water.
Benches:	None.
Foundations, Drains, Relief Wells, Instrumentation:	None.

Animal Burrows:	Numerous small (less than 2 inches) animal burrows throughout the east dike.	
Slope:	**Measured:**	North - 4H:1V South - 4H:1V East - 3H:1V West (divider dike) - 2H:1V
	Design:	North - Unknown (USACE Levee) South - Unknown (USACE Levee) East - 3H:1V West (divider dike) - 2H:1V
Height:	**Measured:**	North - 20 feet South - 20 feet East - 20 to 25 feet West (divider dike) - Unknown
	Design:	North - Unknown (USACE Levee) South - Unknown (USACE Levee) East - 20 to 25 feet West (divider dike) - Unknown

6.4. Spillway Weirs/Riser Inlets

Number: 4

Size, Type and Material: The four decant structures are constructed using stacked 48 inch diameter RCP risers. The two primary structures outlet into McKellar Lake via a 36 inch diameter RCP pipe and the secondary (emergency) structures have the same design and outlet downstream of the east dike and flow to the south in a stream channel which outlets into Horn Lake. The base/foundation is designed to be concrete.

Height of Riser Inlets: Approximately 20 feet.

Access: There is no direct access to the spillways, but there is an adjacent catwalk that provides a partial view.

Joints: Could not be observed.

Mis-Alignment: None observed.

Closed/Abandoned Conduits: None.

6.5. Outlet Pipes

Number:	4
Size, Type and Material:	The four outlet pipes are 36 inch diameter RCP.
Headwall:	The two primary outlets have a headwall with sluice gate controlled openings to prevent backflow of water during flood events. The two emergency outlets discharge into a drainage channel and do not have headwalls.
Joint Separations:	Could not be observed.
Mis-Alignment:	None observed.
Closed/Abandoned Conduits:	None.

7. Notable Observations and Concerns

- The Outlet Structure that transfers flow from the Ash Pond into the Stilling Pond includes stop logs to control pool level. The top of the stop logs are approximately 2 to 3 feet below the crest of the divider berm. The pool levels at the time of the site visit were at nearly the same elevation even though the stop logs were well above the pool level. It is likely that flow is seeping through the divider berm keeping the pool levels at a similar elevation. This structure should be evaluated to determine if there are potential overtopping concerns. See Photo EASP-2.
- The four decant structures are possibly constructed using stacked RCP risers. The two primary structures outlet into McKellar Lake and the secondary (emergency) structures outlet downstream of the east dike and flow to the south in a stream channel which outlets into Horn Lake. The two secondary outlets at the toe of the east dike are partially submerged (see Photo EASP-6). Erosion has occurred at the primary decant structure outlet where the concrete channel flows into McKellar Lake (see Photos EASP-7 and EASP-8).
- There is an inactive 60-inch public sanitary sewer pipeline that runs east and west across the Ash Pond and Dredge Cell. Two of the manholes are located within the Ash Pond. The approximate top of the pipe is at elevation 221 based on drawing 10W208-1 R0. Top elevation of the fly ash is highly variable so the actual depth of material over the pipe is unknown. Notes on the drawings require no dredging be performed within a 50 foot radius of the manholes.
- Water is ponding at the toe of the exterior slope of the east dike making it difficult to evaluate if there is any seepage occurring (see Photo EASP-5).

- Tall vegetation has grown up along the lower portion of the exterior slope of the east dike (see Photo EASP-5).
- Animal paths and small (12 inch) animal burrows were present on the exterior slope of the east dike (see Photo EASP-4).
- The west slope (divider berm) has steep slopes (approximately 2H:1V) with some erosion.
- Wave erosion has occurred along the internal slope of the east dike. The height of the erosion varies from 6 inches up to 2 feet.
- Erosion has occurred on the crest ramp in the southeast corner of the pond (see Photo EASP-3).

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- Evaluate existing topography and drainage conditions at the toe of the east dike at the East Ash Stilling Pond. A hydraulic and hydrologic analysis should be performed to determine if positive drainage is being provided away from the east dike.
- Evaluate the active and inactive sanitary sewer force mains and determine if rerouting and/or abandonment is necessary.
- Evaluate the Inlet / Outlet Structure (within the divider berm) that transfers flow from the East Ash Pond to the East Ash Stilling Pond. A hydraulic and hydrologic analysis should be performed to determine suitability and operation procedures.
- Evaluate the decant structures at the East Ash Stilling Pond for suitability and condition.
- Evaluate current operating procedures for working around the existing electric transmission lines including factor of safety for stability.
- Based on the limited as-built drawings available, it is recommended that a program be established to develop current conditions / as-built drawings to record future modifications to this facility. Construction records should also be included as part of this program to record and quantify construction means, methods and results.
- Due to the limited construction monuments at this facility, it is recommended that additional surveyed construction monuments be established at selected locations. These monuments should be surveyed annually as a minimum.

- Based on observations made during the site visits and review of the documents provided, it is recommended that a hydraulic and hydrologic analysis be performed for this facility. This facility has significant flow concentrations and is critical to operation of the plant.
- Based on the findings of Phase 2 and designs from Phase 3, if performed, Stantec recommends that the existing O&M Manual be reviewed and updated. These updates may include sections on routine monitoring and facility maintenance.

8.2. Maintenance Recommendations

- Cut and maintain heavy/tall vegetation on interior slopes.
- Remove trees and brush from the exterior slope of the east dike.
- Repair erosion areas where noted and provide rip-rap as necessary.
- Repair / regrade animal paths and burrows and provide seeding and mulching to establish a vegetative cover. Continue to monitor on a regular basis.

1. General Facility Information

Facility Status:	Inactive	**NID Identification:**	Not Available
Surface Area (inside dikes)	23 Acres	**Maximum Height (toe to top of dike):**	28 feet
Free Water Volume:	0	**Maximum Water Storage:**	600 Acre-feet
Estimated CCB Storage:	0	**Dike Length:**	1200 feet
Plant Discharge to Facility:	0	**Current Pool Elevation:**	n/a - Empty

2. Site Visit Information

Stantec Assessment Team:	Rob Kirkbride, PE
TVA Staff Present:	Frank Dominioni
Field Assessment Dates:	February 17, 2009
Weather/Site Conditions:	40 degrees F, cloudy, drizzle, moist ground

3. History/Description of Usage

History and Operation: This area was the original location of the fly ash pond. Sluiced fly ash was discontinued in 1978 until May 1991 when it was reactivated. Prior to resuming sluicing to this area, approximately 173,000 cubic yards of ash was hauled from it and used for fill material in the Corp of Engineers levee. Sluicing was again discontinued in October 1992 and the pond water was pumped out. The area has been inactive since.

Past Failures/Releases: No failures or releases reported.

4. Owner's Operations, Maintenance and Inspection Information

Emergency Action Plan:	No EAP has been prepared for this facility.
Operations Manual:	No Operations Manual has been prepared for this facility.
TVA Maintenance:	Exterior slopes are mowed as necessary to keep vegetation minimized.
TVA Inspections:	TVA Engineering performs dike inspections and prepares reports annually. Plant personnel make observations throughout the year on a random basis.
Problems Previously Identified During Past TVA Inspections:	Prior to inactivating this area in 1992, seepage problems with the spillway structure were noted. Additional concerns included trees and dense brush cover on most of the exterior slopes.

5. Documents Reviewed

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

TVA Design Drawings:	10N223 R2, 10N224 R1
TVA As-Built Drawings:	No drawings identified as As-Built.
TVA Construction Testing Records:	None available.
TVA Annual Inspection Reports:	TVA annual inspection reports from 1967 to 2008.
Geotechnical Data:	Limited data includes lab results, but difficult to tell specific locations of soil borings. (File: ALF MEMO TO GLBUCHANAN FROM GENE FARMER ON ALF ASH DISPOSAL AREA DIKES - SOIL INVESTIGATION.pdf)

6. Stantec Field Observations

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

6.1. Interior Slopes

Vegetation:	Dense vegetation at the toe of all slopes.	
Trees:	Dense trees at the toe of all slopes.	
Wave Wash Protection:	None.	
Erosion:	No significant erosion observed.	
Instabilities:	None observed.	
Animal Burrows:	None observed.	
Freeboard:	**Measured:**	N/A - pond is empty
	Design:	Unknown
Encroachments:	The Chemical Pond was constructed inside the northeast corner of the pond. Approximately 25% of the pond was filled in to create a staging area for Reed Minerals.	
Slope:	**Measured:**	North, East and West - 3H:1V South - 4H:1V (USACE Levee)
	Design:	North, East and West - 3H:1V South - Unknown (USACE Levee)

6.2. Crest

Crest Cover and Slope:	North - Grass cover with no slope. South - Gravel road with no slope. East - Gravel with no slope. West - Grass cover with no slope.
Erosion:	Minor erosion on all crests.
Alignment:	North and East are somewhat irregular. South and West appear uniform.
Settlement/Cracking:	No significant settlement or cracking observed.
Bare Spots/Rutting:	Several minor bare spots on all dikes. Consistent rutting along the crest (up to 6 inches deep).

Width:	**Measured:**	North - 18 to 20 feet South - 50 feet + (USACE Levee) East - 30 feet + West - 18 to 20 feet
	Design:	North - 16 feet South - Unknown (USACE Levee) East - Unknown West - 16 feet

6.3. Exterior Slopes

Vegetation:	North - Dense brush and vegetation. South - N/A East - N/A West - Dense brush and vegetation.
Trees:	North - Very dense trees covering entire slope. South - N/A East - N/A West - Some trees near the toe and sporadically on slope.
Erosion:	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. None noted.
Instabilities:	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. None noted.
Uniform Appearance:	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. None noted.
Seepage:	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. None noted.

Benches:	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. None noted.	
Foundations, Drains, Relief Wells, Instrumentation:	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. None noted.	
Animal Burrows:	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. None noted.	
Slope:	**Measured:**	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. Estimate 3H:1V.
	Design:	North - Unknown South - N/A East - N/A West - 3H:1V
Height:	**Measured:**	North - Not visible to observe. South - N/A East - N/A West - 10 to 15 feet
	Design:	North - Unknown South - N/A East - N/A West - 10 to 15 feet

6.4. Spillway Weirs/Riser Inlets

Number: 1 (abandoned)

Size, Type and Material: The decant structure is constructed using stacked 48 inch diameter RCP risers that outlet through the west dike into McKellar Lake via a 36 inch diameter RCP pipe and channel. The base/foundation is designed to be concrete.

Height of Riser Inlets: Approximately 15 feet.

Access:	The pond is empty so access to the spillway is difficult due to the dense vegetation.
Joints:	Could not be observed.
Mis-Alignment:	No significant mis-alignment was observed on the exposed portion of the spillway.
Closed/Abandoned Conduits:	Unknown, however design drawing 10N223 R2 shows two pipes that were to be removed prior to construction of the west dike. Their status is unknown.

6.5. Outlet Pipes

Number:	1
Size, Type and Material:	Unable to access outlet.
Headwall:	Unknown.
Joint Separations:	Unknown.
Mis-Alignment:	Unknown.
Closed/Abandoned Conduits:	Unknown.

7. Notable Observations and Concerns

- This structure is inactive and appears to be empty. See Photo WAP-1.
- Original Decant Structure should be evaluated to determine if operation of the pond relies on this structure for storm water hydraulic and hydrologic capacity. No ponding water was observed within the pond during the site visit so the drainage may be adequate. See Photo WAP-1.
- Trees and dense vegetation are growing on the pond interior which is approximately 10 feet below the crest of the dikes (See Photo WAP-2).
- Trees and dense vegetation are growing on the exterior slope of the north dike (See Photo WAP-3).

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- Based on the limited as-built drawings available, it is recommended that a program be established to develop current conditions / as-built drawings to record future modifications to this facility. Construction records should also be included as part of this program to record and quantify construction means, methods and results.
- Although this facility is inactive, based on observations made during the site visits and review of the documents provided, it is recommended that a hydraulic and hydrologic analysis be performed for this facility to evaluate the storm water inflow and determine the suitability of the outlet structure to pass the design storm.
- It is recommended that a facility specific Operations & Maintenance Plan be developed to provide means and methods of operating this facility efficiently and identifying the maintenance necessary to allow for proper evaluations.

8.2. Maintenance Recommendations

- Cut and maintain heavy/tall vegetation on interior and exterior slopes to allow better observation.
- Remove trees and brush from the interior and exterior slopes.

Drawing Mark EAP-1 Erosion is occurring on the interior slope along the south dike looking west.

Drawing Mark EAP-2 Outlet Structure operated using stop logs.

Drawing Mark EAP-3 Fly Ash influent pipes at northwest corner.

Drawing Mark EAP-4 Dredge Cell interior drainage looking south.

Concerns/Photo Log

Drawing Mark	Comments	Photo/GPS ID
EAP-1	Erosion is occurring on the interior slope along the south dike looking west.	IMG_1373
EAP-2	Outlet structure operated using stop logs.	IMG_1327
EAP-3	Fly ash influent pipes at northwest corner.	IMG_1383
EAP-4	Dredge Cell interior drainage looking south.	IMG_1391

Drawing Mark EASP-1 Overview of pond showing railroad to the south.

Drawing Mark EASP-2 Concrete inlet structure with stop logs.

Drawing Mark EASP-3 — Access ramp to crest on southeast corner of pond. Note the erosion on the ramp.

Drawing Mark EASP-4 — Eastern embankment has animal paths extending from toe of exterior slope to water surface of interior slope.

Drawing Mark EASP-5

Eastern embankment showing ponding water and thick vegetation at the toe. Portions of the slope had small (1 to 2 inch diameter) animal burrow holes.

Drawing Mark EASP-6

Decant structure outlets to Horn Lake. Note partially submerged outlet pipes.

Drawing Mark EASP-7 Decant structure outlet into McKellar Lake has erosion occurring.

Drawing Mark EASP-8 Decant structure outlets to McKellar Lake.

Drawing Mark EASP-9 Decant structure inlets with skimmers.

Drawing Mark EASP-10 Interior slope wave erosion.

Concerns/Photo Log		
Drawing Mark	**Comments**	**Photo/GPS ID**
EASP-1	Overview of pond showing railroad to the south.	IMG_1321
EASP-2	Concrete inlet structure with stop logs.	IMG_1327
EASP-3	Access ramp to crest on southeast corner of pond. Note the erosion on the ramp.	IMG_1329
EASP-4	Eastern embankment has animal paths extending from toe of exterior slope to water surface of interior slope.	IMG_1334
EASP-5	Eastern embankment showing ponding water and thick vegetation at the toe. Portions of the slope had small (1 to 2 inch diameter) animal burrow	IMG_1335
EASP-6	Decant structure outlets to Horn Lake. Note partially submerged outlet pipes.	IMG_1338
EASP-7	Decant structure outlet into McKellar Lake has erosion occurring.	IMG_1346
EASP-8	Decant structure outlets to McKellar Lake	IMG_1347
EASP-9	Decant structure inlets with skimmers.	IMG_1348
EASP-10	Interior slope wave erosion.	IMG_1358

Drawing Mark WAP-1 Interior of Ash Pond mainly empty and covered with trees and dense vegetation.

Drawing Mark WAP-2 Dense trees and vegetation are growing on the interior of the pond.

Drawing Mark WAP-3 Dense trees and vegetation are growing on the exterior slope of the north dike.

Drawing Mark WAP-4 Abandoned decant structure on west end of pond. Deteriorated and surrounded by heavy vegetation.

Concerns/Photo Log

Drawing Mark	Comments	Photo/GPS ID
WAP-1	Interior of Ash Pond mainly empty and covered with trees and dense vegetation.	IMG_1401
WAP-2	Dense trees and vegetation are growing on the interior of the pond.	IMG_1399
WAP-3	Dense trees and vegetation are growing on the exterior slope of the north dike.	IMG_1408
WAP-4	Abandoned decant structure on west end of pond. Deteriorated and surrounded by heavy vegetation.	IMG_1404

Stantec

Coal Combustion Product Disposal Facility Assessment
Phase 1 Document Review Form
Allen Fossil Plant (ALF)

Date Reviewed	Reviewed by	File Name	File Type
3/10/2009	RJK	Aerial View From Book ALF East Ash Pond Temorary Dredge Cell.pdf	PDF
3/10/2009	RJK	ALF - Aerial Photo Of East Portion Of Facility.pdf	PDF
3/10/2009	RJK	ALF - Ash Pond Drawings (From Cal).pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2000.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2001.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2002.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2003.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2004.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2005.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2006.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2007.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy67.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy68.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy69.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy70.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy71.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy72.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy73.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy74.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy75.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy76.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy77.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy78.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy79.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy80.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy81.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy82.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy83.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy84.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy85.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy86.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy87.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy88.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy89.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy93.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy94.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy95.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy96.pdf	PDF

Date Reviewed	Reviewed by	File Name	File Type
3/10/2009	RJK	ALF Ash Pond Insp Fy97.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy98.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy99.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Red Water Seep Inspections 2006 - 2008.pdf	PDF
3/10/2009	RJK	ALF Civil Design Gbuide Dg C5.2 Earth Design Slope Stability Analysis.pdf	PDF
3/10/2009	RJK	ALF Memo Ash Disposal Areas Dikes - Soil Investigation Dated May 2 1973 (Duplicate With Notes).pdf	PDF
3/10/2009	RJK	ALF Memo O Fplacy From Jcmccraw On ALF Ash Disposl Area Dike Borrow Source.pdf	PDF
3/10/2009	RJK	ALF Memo To Fplacy From Jcmcgraw ALF Ash Disposal Area Dike - Borrow Exploration.pdf	PDF
3/10/2009	RJK	ALF Memo To Gene Farmer From Glbuchanan On ALF Ash Disposal Areas Kikes Raising - Construction Information.pdf	PDF
3/10/2009	RJK	ALF Memo To Glbuchanan From Gene Farmer On ALF Ash Disposal Areas Kikes - Soil Investigation.pdf	PDF
3/10/2009	RJK	ALF Proposed West Ash Pond Extension Figure 4.pdf	PDF
3/10/2009	RJK	ALF Report Of Additional Geotechnical Exploration Potential Ash Disposal Area Belz Property July 1 2005.pdf	PDF
3/10/2009	RJK	ALF Report Of Geotechnical Exploration East And West Ash Disposal Areas Aug 18 2004 Mactec Project.pdf	PDF
3/10/2009	RJK	ALF Report Of Geotechnical Exploration Potential Ash Disposal Area Belz Property Oct 19 2004.pdf	PDF
3/10/2009	RJK	ALF Table 1 ALF Ccw Drawing List.pdf	PDF
3/24/2009	RJK	ALF.pdf	PDF
3/10/2009	RJK	ALF_Ashpondinsp_Fy09_Draft.pdf	PDF
3/10/2009	RJK	ALF-10N223-Sht -Rev 2 Main Plant - Ash Disposal Areas Ash Disposal Area (cal).pdf	PDF
3/10/2009	RJK	ALF-10N223-Sht -Rev 2 Main Plant - Ash Disposal Areas Ash Disposal Area West Of Powerhouse Sheet 1.cal	CAL
3/10/2009	RJK	ALF-10N224-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area (cal).pdf	PDF
3/10/2009	RJK	ALF-10N224-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area West Of Powerhouse Sheet 2.cal	CAL
3/10/2009	RJK	ALF-10N226-Sht -Rev 2 Main Plant - Ash Disposal Areas Ash Disposal Area (cal).pdf	PDF
3/10/2009	RJK	ALF-10N226-Sht -Rev 2 Main Plant - Ash Disposal Areas Ash Disposal Area East Of Powerhouse Sheet 2.cal	CAL
3/10/2009	RJK	ALF-10N226-Sht -Rev 2.cal	CAL
3/10/2009	RJK	ALF-10N227-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area (cal).pdf	PDF
3/10/2009	RJK	ALF-10N227-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area East Of Powerhouse Sheet 3.cal	CAL
3/10/2009	RJK	ALF-10N227-Sht -Rev 1.cal	CAL
3/10/2009	RJK	ALF-10N228-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area (cal).pdf	PDF
3/10/2009	RJK	ALF-10N228-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area East Of Powerhouse Sheet 4.cal	CAL
3/10/2009	RJK	ALF-10N228-Sht -Rev 1.cal	CAL
3/10/2009	RJK	ALF-10N229-1-Sht -Rev 0 Standard Drawing Weir For Ash Disposal Spillway (cal).pdf	PDF
3/10/2009	RJK	ALF-10N229-1-Sht -Rev 0 Standard Drawing Weir For Ash Disposal Spillway.cal	CAL
3/10/2009	RJK	ALF-10N229-1-Sht -Rev 0.cal	CAL
3/10/2009	RJK	ALF-10N229-2-Sht -Rev 0 Standard Drawing Ash Disposal Spillway (cal).pdf	PDF
3/10/2009	RJK	ALF-10N229-2-Sht -Rev 0 Standard Drawing Ash Disposal Spillway.B00	B00
3/10/2009	RJK	ALF-10N229-2-Sht -Rev 0 Standard Drawing Ash Disposal Spillway.cal	CAL
3/10/2009	RJK	ALF-10N229-2-Sht -Rev 0.cal	CAL
3/10/2009	RJK	ALF-10W200-1-Sht -Rev 4.cal	CAL

Stantec

Date Reviewed	Reviewed by	File Name	File Type
3/10/2009	RJK	ALF-10W201-1-Sht -Rev 7.cal	CAL
3/10/2009	RJK	ALF-10W202-2-Sht -Rev 1.cal	CAL
3/10/2009	RJK	ALF-10W208-1-Sht -Rev 0 Yard East Ash Pond Dredge Cell Plan (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-1-Sht -Rev 0 Yard East Ash Pond Dredge Cell Plan.cal	CAL
3/10/2009	RJK	ALF-10W208-2-Sht -Rev 0 Yard East Ash Pond Dredge Cell Sections & Detai (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-2-Sht -Rev 0 Yard East Ash Pond Dredge Cell Sections & Details.B00	B00
3/10/2009	RJK	ALF-10W208-2-Sht -Rev 0 Yard East Ash Pond Dredge Cell Sections & Details.cal	CAL
3/10/2009	RJK	ALF-10W208-3-Sht -Rev 0 Yard East Ash Pond Dredge Cell - Manhole Detail (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-3-Sht -Rev 0 Yard East Ash Pond Dredge Cell - Manhole Details & Sections.cal	CAL
3/10/2009	RJK	ALF-10W208-4-Sht -Rev 0 Tva Ash Pond Crossing Plan Intersection Of Plt (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-4-Sht -Rev 0 Tva Ash Pond Crossing Plan Intersection Of Plt & Riverport Road Sheet 1.cal	CAL
3/10/2009	RJK	ALF-10W208-5-Sht -Rev 0 Tva Ash Pond Crossing Intersection Of Plt & Riv (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-5-Sht -Rev 0 Tva Ash Pond Crossing Intersection Of Plt & Riverport Road Sheet 2.cal	CAL
3/10/2009	RJK	ALF-10W208-6-Sht -Rev 0 Tva Ash Pond Crossing Intersection Plt & Riverp (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-6-Sht -Rev 0 Tva Ash Pond Crossing Intersection Plt & Riverport Road Sheet 3.cal	CAL
3/10/2009	RJK	ALF-10W208-7-Sht -Rev 0 Yard East Ash Pond Dredge Cell Spillway Structu (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-7-Sht -Rev 0 Yard East Ash Pond Dredge Cell Spillway Structure.cal	CAL
3/10/2009	RJK	ALF-10W208-8-Sht -Rev 0 Tva Ash Pond Crossing Intersection Plt & Riverp (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-8-Sht -Rev 0 Tva Ash Pond Crossing Intersection Plt & Riverport Road Sheet 4.cal	CAL
3/10/2009	RJK	ALF-10W210-1-Sht -Rev 0 Crushing Facility Plan & Sections Crusher Build (cal).pdf	PDF
3/10/2009	RJK	ALF-10W210-1-Sht -Rev 0 Crushing Facility Plan & Sections Crusher Building Wash Down Sump.cal	CAL
3/10/2009	RJK	ALF-10W210-3-Sht -Rev 0 Crushing Facility Washdown Sump Concrete And Re (cal).pdf	PDF
3/10/2009	RJK	ALF-10W210-3-Sht -Rev 0 Crushing Facility Washdown Sump Concrete And Reinforcing Plan, Sections, And Details.cal	CAL
3/10/2009	RJK	ALF-10W211-Sht -Rev 0 Main Plant - East Ash Disposal Area Catwalk To Wa (cal).pdf	PDF
3/10/2009	RJK	ALF-10W211-Sht -Rev 0 Main Plant - East Ash Disposal Area Catwalk To Water Level Monitoring Station.cal	CAL
3/10/2009	RJK	ALF-10W214-3-Sht -Rev 0 Civil Coal Yard Runoff And Drainage Ditch Improv (cal).pdf	PDF
3/10/2009	RJK	ALF-10W214-3-Sht -Rev 0 Civil Coal Yard Runoff And Drainage Ditch Improvements 2006 Retention Pond Plan View.cal	CAL
3/10/2009	RJK	ALF-10W215-Sht -Rev 0 Yard Concrete Retaining Wall At Ash Sluice Pipe T (cal).pdf	PDF
3/10/2009	RJK	ALF-10W215-Sht -Rev 0 Yard Concrete Retaining Wall At Ash Sluice Pipe Trench Near Bc 3A & 3B.cal	CAL
3/10/2009	RJK	ALF-10W225-Sht -Rev 5 Main Plant Ash Disposal Areas Ash Disposal Area E (cal).pdf	PDF
3/10/2009	RJK	ALF-10W225-Sht -Rev 5 Main Plant Ash Disposal Areas Ash Disposal Area East Of Powerhouse Sheet 1.cal	CAL
3/10/2009	RJK	ALF-10W225-Sht -Rev 6 Main Plant Ash Disposal Areas Ash Disposal Area Ea (cal).pdf	PDF
3/10/2009	RJK	ALF-10W225-Sht -Rev 6 Main Plant Ash Disposal Areas Ash Disposal Area East Of Powerhouse Sheet 1.cal	CAL
3/10/2009	RJK	ALF-10W234-1-Sht -Rev 0 Yard Ash Pond Discharge Discharge Flume Repairs (cal).pdf	PDF
3/10/2009	RJK	ALF-10W234-1-Sht -Rev 0 Yard Ash Pond Discharge Discharge Flume Repairs.cal	CAL
3/10/2009	RJK	ALF-10W234-2-Sht -Rev 0 Yard Ash Pond Discharge Partial Plan Sections & (cal).pdf	PDF
3/10/2009	RJK	ALF-10W234-2-Sht -Rev 0 Yard Ash Pond Discharge Partial Plan Sections & Details.cal	CAL
3/10/2009	RJK	ALF-10W235-Sht -Rev 18.cal	CAL

Date Reviewed	Reviewed by	File Name	File Type
3/10/2009	RJK	ALF-10W260-Sht -Rev 0 Yard Units 1-3 Concrete & Misc Steel Ash Disposal (cal).pdf	PDF
3/10/2009	RJK	ALF-10W260-Sht -Rev 0 Yard Units 1-3 Concrete & Misc Steel Ash Disposal Pipe Trench Outline & Reinf (Nldf).cal	CAL
3/10/2009	RJK	ALF-10W402-1-Sht -Rev 1 Yard Units 1 - 3 Concrete And Misc Steel Ash Tre (cal).pdf	PDF
3/10/2009	RJK	ALF-10W402-1-Sht -Rev 1 Yard Units 1 - 3 Concrete And Misc Steel Ash Trench Modifications Outline And Reinforcement.cal	CAL
3/10/2009	RJK	ALF-10W402-2-Sht -Rev 1 Yard Units 1 - 3 Concrete And Misc Steel Ash Tre (cal).pdf	PDF
3/10/2009	RJK	ALF-10W402-2-Sht -Rev 1 Yard Units 1 - 3 Concrete And Misc Steel Ash Trench Modifications Outline And Reinforcement.cal	CAL
3/10/2009	RJK	ALF-10W402-3-Sht -Rev 0 Yard Units 1 - 3 Concrete And Misc Steel Ash Tre (cal).pdf	PDF
3/10/2009	RJK	ALF-10W402-3-Sht -Rev 0 Yard Units 1 - 3 Concrete And Misc Steel Ash Trench Modifications Outline And Reinforcement.cal	CAL
3/10/2009	RJK	ALF-10W402-4-Sht -Rev 0 Yard Units 1 - 3 Concrete And Misc Steel Ash Tre (cal).pdf	PDF
3/10/2009	RJK	ALF-10W402-4-Sht -Rev 0 Yard Units 1 - 3 Concrete And Misc Steel Ash Trench Modifications Outline And Reinforcement.cal	CAL
3/10/2009	RJK	ALF-17W500-4-Sht -Rev 3.cal	CAL
3/10/2009	RJK	ALF-Facility-Wide Drawings (From cal).pdf	PDF
3/10/2009	RJK	Allen Fossil Plant - Aerial Photo Scan With Structure Labels.pdf	PDF
3/10/2009	RJK	Allen Fossil Plant - Aerial Photo.pdf	PDF
3/10/2009	RJK	FY2008_ALF_Summary.pdf	PDF

Doc 11: Typical Quarterly, Monthly, Daily Inspection and Field Reports

TVA Monthly /Quarterly/Special Facility Inspection Form   Form Date 6-01-10

1. Site Name: ALF   2. Facility Name: Ash Complex   3. Date and Start Time of Inspection: 6/22/11 8 am CST

4. Operator Name: Trans Ash   5. Inspection Method: X Walk Ride Both

6. Inspector's Name(s): Griffin R. Lifsey, Jacob Horton, Jake Booth, Bronson Reed, Gary Melton, and Brian Gerbus   (KNOWN KEY DEFICIENCIES MUST BE INSPECTED)

7. Hazard Classification: High Significant Low

8. Inspection Frequency: MONTHLY X QUARTERLY (MUST BE WALKED) SPECIAL (after significant rain or earthquake event)

9. Current weather conditions Cloudy 80°F   Prior Conditions, if notable

Check the appropriate box below. If not applicable, record "N/A". Provide comments when appropriate. Any other areas that should be brought to the attention of the Program Manager should also be noted in the "Comments" section. Indicate the locations of any areas identified, and photograph and attach to the form. Previous observation forms should be reviewed and any NEW observations or degradation of pervious conditions should be reported on this inspection form. (NOTE - ONE FORM PER FACILITY)

	Yes	No
10. Pre-Job Safety Briefing Performed	✓	
11. Activity / Construction on/ at facility	✓	
12. DIKE CREST		
A. Settlement / Cracking		✓
B. Rutting		✓
C. Lateral Displacement		✓
D. Erosion		✓
13. INTERIOR / EXTERIOR DIKE SLOPES		
A. Minimum Freeboard	ft.	
B. Current Freeboard	>4' ft.	
C. Instabilities (Sloughs or Slides)		✓
D. Erosion	✓	
E. Sinkholes/Depressions ○ New ○ Existing		✓
F. Vegetation / Brush / Trees	✓	
○ Heavy/Adequate/Sparse/Bare		
G. Animal Burrows ○ New ○ Existing		✓
H. Seepage ○ New ○ Existing		✓
Clear/Cloudy/Red/Muddy		
○ Flow Increased/Decreased/Same	gpm	
○ Ash or Clay Deposits Below Seep Outlet		
I. Seep around Drain Pipe(s)		✓
○ Clear/Cloudy/Red/Muddy		
14. DEFICIENCIES		
A. Prior Key Deficiencies Checked	✓	
B. New Deficiencies Identified / Flagged	✓	
C. Immediate Actions Taken (Note Below)		✓
D. Photos of deficiencies attached	✓	

	Yes	No
15. DIKE TOE AREAS		
A. Seepage ○ New X Existing	✓	
○ Clear/Cloudy/Red/Muddy — Marked & Logged		
○ Flow Increased / Decreased/Same		gpm
○ Aquatic Vegetation Growing		
○ Ash or Clay Deposits Below Seep Outlet		
B. Boils ○ New ○ Existing		✓
○ Clear/Cloudy/Red/Muddy		
○ Flow Increased / Decreased/Same		gpm
○ Growing in Size		
C. Sinkholes/Depressions ○ New ○ Existing		✓
16. SEEPAGE COLLECTION SYSTEM		
A. Estimated Flow Measurement	N/A	gpm
B. Increased Flow		
C. Emitting Clear or Dirty Water		
17. SPILLWAY WEIRS & OUTLETS		
A. Decant Riser Misaligned		✓
B. Decant Pipe Joints		✓
○ Leaking		
○ Separated		
C. Headwall In Good Condition		
18. OPERATIONS & MAINTENANCE		
A. Routine O&M Performed	✓	
B. Weekly Observations Performed	✓	
C. Any Changes in Operations		✓

19. Major adverse changes in these items could cause instability and should be reported to the Program Manager as soon as possible for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, etc.) in the space below and on the backside of this sheet if needed.

NOTE: Quarterly Inspection Deficiencies to be documented on spreadsheet with applicable latitude and longitude coordinates referenced. SHOW ALL QUARTERLY INSPECTION DEFICIENCIES ON AERIAL PHOTOS

Item #	Comments/New Observations/Action Taken:
	Debris present on corps levee from flooding at the end of April. Once conditions become drier, Facilities will remove & clean up for RHO&M.

20. PA(E) was Notified of New Key Deficiency: (Date / Time)

21. Who else Notified of New Key Deficiency: (Date / Time)

22. I hereby attest the above is original information (not reproduced) based on actual field observations made during the period indicated, by either myself or an appointed representative and are accurate, complete, and correct to the best of my knowledge.

Period Covered:
From: Apr 2011 To: Jun 2011   Signature: Griffin R. Lifsey   Date: 6/27/11

LOCATION: Allen Fossil Plant - 3rd Quarter FY2011 Dike Inspection
WEATHER: 80 degrees F, Cloudy
INSPECTION BY: Griffin Lifsey, Jacob Horton, Jake Booth, Bronson Reed, Brian Gerbus, and Gary Melton
DATE: 06/22/2011

ITEM NO.	DESCRIPTION	PICTURE NO.	POINT NO.	NORTHING	EASTING	COMMENTS
1	Erosion at CYROP	-	1000	273398.14	760763.98	Previously repaired, reoccuring issue. To be repaired with rip-rap already on-site.
2	Erosion/rill near light pole	-	1001	273581.09	760484.28	To be repaired with rip-rap alread on-site.
3	Flood debris all along corps levee	-	-	-	-	Facilities will remove debris at RHO&M's request once conditions become drier to allow the work in the area.


1001
1000

TVA Monthly /Quarterly/Special Facility Inspection Form   Form Date 6-01-10

1. Site Name: ALF 2. Facility Name: East Flyash Pond/ CYROP p 3. Date and Start Time of Inspection: 08/10/2011

4. Operator Name: Trans Ash   5. Inspection Method: ☐ Walk ☐ Ride X Both (KNOWN KEY DEFICIENCIES MUST BE INSPECTED)

6. Inspector's Name(s): Gary Wilford   7. Hazard Classification: ☐ High X Significant ☐ Low

8. Inspection Frequency: X MONTHLY ☐ QUARTERLY (MUST BE WALKED) ☐ SPECIAL (after significant rain or earthquake event)

9. Current weather conditions Partly Cloudy   Prior Conditions, if notable

Check the appropriate box below. If not applicable, record "N/A". Provide comments when appropriate. Any other areas that should be brought to the attention of the Program Manager should also be noted in the "Comments" section. Indicate the locations of any areas identified, and photograph and attach to the form. Previous observation forms should be reviewed and any NEW observations or degradation of pervious conditions should be reported on this inspection form. (NOTE - ONE FORM PER FACILITY)

	Yes	No		Yes	No
10. Pre-Job Safety Briefing Performed	X		**15. DIKE TOE AREAS**		
11. Activity / Construction on/ at facility	X		A. Seepage ○ New x Existing		X
12. DIKE CREST			○ Clear/Cloudy/Red/Muddy		
A. Settlement / Cracking		X	○ Flow Increased / Decreased/Same		gpm
B. Rutting		X	○ Aquatic Vegetation Growing		X
C. Lateral Displacement		X	○ Ash or Clay Deposits Below Seep Outlet		X
D. Erosion		X	B. Boils ○ New ○ Existing		X
			○ Clear/Cloudy/Red/Muddy		
A. Minimum Freeboard		4 ft.	○ Flow Increased / Decreased/Same		gpm
B. Current Freeboard		>4ft.	○ Growing in Size		X
C. Instabilities (Sloughs or Slides)		X	C. Sinkholes/Depressions ○ New ○ Existing		X
D. Erosion		X	**16. SEEPAGE COLLECTION SYSTEM**		
E. Sinkholes/Depressions ○ New ○ Existing		X	A. Estimated Flow Measurement		gpm
F. Vegetation / Brush / Trees	X		B. Increased Flow		n/A
○ Heavy/Adequate/Sparse/Bare	ADEQUATE		C. Emitting Clear or Dirty Water		
G. Animal Burrows ○ New x Existing		X	**17. SPILLWAY WEIRS & OUTLETS**		
H. Seepage ○ New x Existing	X		A. Decant Riser Misaligned		n/a
○ Clear/Cloudy/Red/Muddy			B. Decant Pipe Joints		n/a
○ Flow Increased/Decreased/Same		No change	○ Leaking		
○ Ash or Clay Deposits Below Seep Outlet		X	○ Separated		
I. Seep around Drain Pipe(s)		X	C. Headwall In Good Condition		N/a
○ Clear/Cloudy/Red/Muddy			**18. OPERATIONS & MAINTENANCE**		
14. DEFICIENCIES			A. Major Changes in Operations	X	
A. Prior Key Deficiencies Checked	X		Sewer Repair across ash pond has changed operations		
B. New Deficiencies Identified / Flagged	X		Siphon project started by E&T group; stilling pond draw down started.		
C. Immediate Actions Taken (Note Below)		X			
D. Photos of deficiencies attached	X				

19. Major adverse changes in these items could cause instability and should be reported to the Program Manager as soon as possible for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, etc.) in the space below and on the backside of this sheet if needed.

NOTE: Quarterly Inspection Deficiencies to be documented on spreadsheet with applicable latitude and longitude coordinates referenced.
SHOW ALL QUARTERLY INSPECTION DEFICIENCIES ON AERIAL PHOTOS

20. Item #	Comments/New Observations/Action Taken:

21. PA(E) was Notified of New Key Deficiency: (Date / Time)

22. Who else Notified of New Key Deficiency: (Date / Time)

23. I hereby attest the above is original information (not reproduced) based on actual field observations made during the period indicated, by either myself or an appointed representative and are accurate, complete, and correct to the best of my knowledge.

Period Covered:
From: 7/11   To: 8/11   Signature: Gary U. Wilford   Date: 08/12/2011

TVA **Weekly Facility Observation Form** **Form Date 7-20-10**

1. Site Name: ALF **2. Date & Start Time of Observation** 8-4-11 12:00pm

3. Operator Name: Trans-Ash **4. Observation Method:** □ Walk □ Ride X□ Both

(KNOWN KEY DEFICIENCIES MUST BE INSPECTED)

5. Observer's Name(s): RODOCKER

6. Current Weather Conditions 91' sunny

7. Prior Weather Conditions, if notable

CHECK ALL BOXES WHERE DEFICIENCIES ARE KNOWN AND MAKE APPROPRIATE COMMENTS, OBSERVATIONS, AND/OR ACTIONS TAKEN. NOTE LOCATIONS OF DEFICIENCIES ON AERIAL PHOTO

8. Type(s) of Facilities Observed	Name of Facility	Minimum Freeboard	Current Freeboard
X □ Wet Fly Ash Pond	Active ash pond A-B-C	3' FT	5' FT
□ Wet Gypsum Pond		FT	FT
X □ Wet Bottom Ash Pond	Pond 1 & 2	FT	FT
□ Dry Ash Stack			
□ Dry Gypsum Stack			
□ Other			

	YES	NO	COMMENTS
9 .Pre-Job Safety Briefing Performed	X		
10. Activity / Construction on/ at facility	X		sewer pipe installation.
11. DIKE CREST (Good)	□ Transverse or Longitudinal Cracks or bulges □ Settlement □ Displacement □ Rutting		
12. DIKE SLOPES (Good)	□ Erosion, □ Cracks or Bulges □ Slides/Sloughs □ Subsidence □ Seepage (clear/muddy water, new or flow increasing over time) □ Wet or soft spot □ Changes in geometry, depth and elevation □ Changes in freeboard □ Vegetation (excessive/ sparse) □ Animal Burrows □ Sinkholes □ Rutting X □ Trees		
13. DIKE TOE AREAS (Good)	□ Seepage Areas □ Boils □ Equipment Rutting □ Perimeter Ditches Properly Draining □ Sinkholes		
14. SPILLWAY WEIR SYSTEM (Only visibly accessible features checked)	□ Discharge Channel Erosion □ Riser Vertical Alignment □ Riser/Outlet Pipe Joint Leakage/Separation □ Headwall Condition □ Box Weir/Skimmers Operating Properly □ Vegetation blocking overflow		
15. SEEPAGE COLLECTION SYSTEM	□ Check Flow and Water Clarity □ Check For Blockages		

16. DEFICIENCIES	YES	NO	COMMENTS
A. Prior Key Deficiencies Checked		X	
B. New Deficiencies Identified / Flagged		X	
C. Immediate Actions Taken (Note Below)		X	
D. Photographs Taken / Attached		X	

17. DESCRIPTIONS OF NEWLY IDENTIFIED AND DEGRADING EXISTING KEY DEFICIENCIES/ACTIONS TAKEN/COMMENTS

18. **Who was Notified of New Key Deficiency:** (Date & Time) William Davis/ Dave Boley (Trans Ash)

19. **PA(E) Notified of New Key Deficiency:** (Date & Time) N/A

Period Covered:

8-1-11 8-7-11 **Signature** RJ Rodocker **Date** 8-4-11

RHO&M Daily Field Report

Date	08/08/11	Plant	ALF		Partner	TRANS ASH
oject No.	357	Weather Conditions :	CLEAR	High: 95	Low: 77	Rain Gauge Reading:

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

O DEFICIENCY FOUND AT THIS TIME

ho Was Notified of Deficiency: | Date & Time of Notification:

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ear Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation:

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
/ Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	12	0	0	8
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

Plant / Visitor Interface: | Completed By: WILLIAM DAVIS

Routine Handling Activities

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	8				357905
Mosley					
Vhite	8	TRAC HOE	C-63	8	357600
Smalley	8	DOZER	B-83	8	357601
Boswell	8	GREASE TRUCK	GT-52	8	357704
Plez		SPOTTER			357601
Walker		SPOTTER			357601
Turner		SPOTTER			357601
'.Partee	8	WATER TRUCK	WT-44	8	357704

PPED RIM DITCH, ROLLED ASH, PADDED MINI DREDGE CELL,

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	2				356023
					356023
Plez	4	water pumps	P-92	8	356023
			P-93	8	356023
			P-35	8	356023

:WATERED MANHOLE, DEWATERED DREDGE CELL.

RHO&M Daily Field Report

Date 08/09/11	Plant ALF		Partner TRANS ASH
oject No. 357	Weather Conditions : CLEAR	High 92 / Low 75	Rain Gauge Reading: .30

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing], Sloughs Spillways)

O DEFICIENCY FOUND

ho Was Notified of Deficiency: | **Date & Time of Notification:**

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ar Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation:

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	0	0	0	0
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

Plant / Visitor Interface:

Completed By: WILLIAM DAVIS

Routine Handling Activiti

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
. Davis	3				357905
Mosley		Trac Hoe	C-68		
Vhite	8	Trac Hoe	C-63	8	357600
Smalley	8	Dozer	B-83	8	357601
Boswell	8	Bobcat	Rental	8	356030
Plez		SPOTTER			357601
Walker	4	SPOTTER		4	356030
Turner	4	SPOTTER		4	356030
.Partee		WATER TRUCK	WT-44		357704

PPED RIM DITCH, ROLLED ASH, PADDED MINI DREDGE CELL, BACK FILL AROUND ASPHALT PAVING.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
. Davis	6.5	Trac-hoe	c-95	6.5	356023
Plez	4	water pumps	P-92	8	356023
			P-93	8	356023
			P-35	8	356023
					356023
Turner	6.5	Labor		6.5	356023
Walker	6.5	Labor		6.5	356023
Plez	6.5	Labor		6.5	356023

EWATERED MANHOLE, DEWATERED DREDGE CELL. EXCAVATED IN COE. LEVEE FOR SEWER LINE. REMOVED MANHOLE ON NORTH SIDE OF LEVEE.

RHO&M Daily Field Report

Date	08/10/11	Plant	ALF	Partner	TRANS ASH
oject No.	357	Weather Conditions : CLEAR	High 92	Low 70	Rain Gauge Reading:

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

O DEFICIENCY FOUND

ho Was Notified of Deficiency:		Date & Time of Notification:	

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ear Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation:

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	14	0	0	8
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

ant / Visitor Interface:		Completed By:	WILLIAM DAVIS

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	8				357905
Mosley	8	DOZER	B-83	8	357600
Vhite	8	TRAC HOE	C-63	8	357600
Smalley	8	TRAC HOE	C-68	8	357601
Boswell		BOBCAT	RENTAL	8	356030
Plez		SPOTTER			357601
Walker	8	SPOTTER		8	356030
Turner	8	SPOTTER		8	356030
'.Partee	8	WATER TRUCK	WT-44	8	357704

P RIM DITCH,ROLLED ASH, PADDED POND. DUST CONTROL.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	2				356023
Plez	8	water pumps	P-92	8	356023
			P-93	8	356023
			P-35	8	356023

:WATERED MANHOLE, DEWATERED DREDGE CELL.

RHO&M Daily Field Report

Date	08/11/11	Plant	ALF		Partner	TRANS ASH
oject No.	357	Weather Conditions :	CLEAR	High: 93	Low 78	Rain Gauge Reading:

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

O DEFICIENCY FOUND

ho Was Notified of Deficiency:		Date & Time of Notification:	

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ear Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
terventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation:

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation	
o "A"	0	0	0	0	0
o "B"	0	0	0	0	0
o "C"	n/a	n/a	n/a	n/a	n/a
o "D"	n/a	n/a	n/a	n/a	n/a

Constraints / Expectation

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	13	0	0	8
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

ant / Visitor Interface:		Completed By:	WILLIAM DAVIS

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	8				357905
Mosley	8	DOZER	B-83	8	357600
Nhite	8	TRAC-HOE	C-63	8	357600
Smalley	8	TRAC-HOE	C-68	8	357601
Boswell	7	GREASE TRUCK	GT-52	7	357704
Plez	3	SPOTTER		3	357601
Walker	8	SPOTTER		8	356030
Turner	8	SPOTTER		8	356030
'.Partee	4	WATER TRUCK	WT-44	4	357704
Boswell	2	BOBCAT	RENTAL	2	356030

P RIM DITCH,ROLLED ASH, PADDED POND. DUST CONTROL.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	2				356023
Plez	4	water pumps	P-92	8	356023
			P-93	8	356023
			P-35	8	356023

:WATERED MANHOLE, DEWATERED DREDGE CELL.

RHO&M Daily Field Report

Date	08/12/11	Plant	ALF			Partner	TRANS ASH
oject No.	357	Weather Conditions :	CLEAR	High 90	Low 72	Rain Gauge Reading:	

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

O DEFICIENCY FOUND

ho Was Notified of Deficiency: | **Date & Time of Notification:**

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ear Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations	0	0
fety Coaching		0	Safety Coaching		0

fety / Environmental:

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	14	0	0	8
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

ant / Visitor Interface:

Completed By: Michael Gerbus

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	8				357905
Mosley	8	DOZER	B-83	8	357600
Vhite	8	TRAC-HOE	C-63	8	357600
Smalley	8	TRAC-HOE	C-68	8	357601
Boswell	8	GREASE TRUCK	GT-52	8	357704
Plez	3	SPOTTER		3	357601
Walker	8	SPOTTER		8	356030
Turner	8	SPOTTER		8	356030
'.Partee	4	WATER TRUCK	WT-44	4	357704

P RIM DITCH,ROLLED ASH, PADDED POND. DUST CONTROL.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	2				356023
Plez	4	water pumps	P-92	8	356023
			P-93	8	356023
			P-35	8	356023

:WATERED MANHOLE, DEWATERED DREDGE CELL.

RHO&M Daily Field Report

Date	08/13/11	Plant	ALF	Partner	TRANS ASH
oject No.	357	Weather Conditions :	High	Low	Rain Gauge Reading:

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

ho Was Notified of Deficiency: | Date & Time of Notification:

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ar Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	0	0	0	0
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

ant / Visitor Interface:

Completed By: Michael Gerbus

Routine Handling Activiti

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

O TRANS ASH EMPLOYEES ON SITE

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

RHO&M Daily Field Report

Date	08/14/11	Plant	ALF	Partner	TRANS ASH
oject No.	357	Weather Conditions :	High	Low	Rain Gauge Reading:

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

ho Was Notified of Deficiency: | Date & Time of Notification:

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ear Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	0	0	0	0
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

escription:

ant / Visitor Interface:

Completed By: William Davis

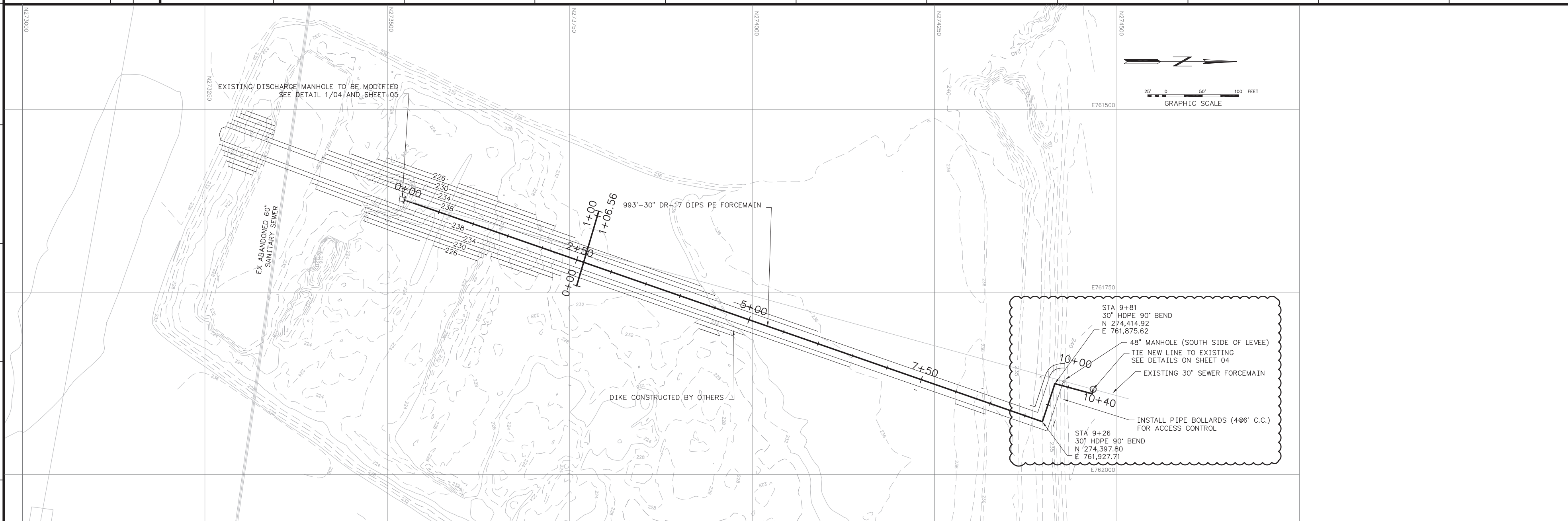
Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

Ɔ TRANS ASH EMPLOYEES ON SITE

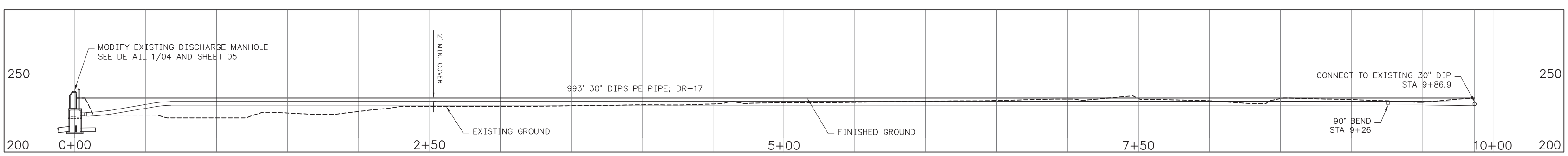
Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

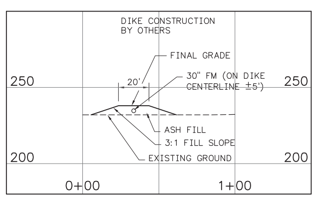
Doc 12: Sewer Force Main Temporary Bypass Plan - Selected Dwgs



GRADING AND PIPE ALIGNMENT PLAN
SCALE: 1"=50'



PROFILE-FORCEMAIN
SCALE: 1"=30'



CROSS SECTION-DIKE
SCALE: 1"=30'

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

ISSUED FOR CONSTRUCTION

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV ID
R 1	07/10/11	RGS	RGS	PVK	SFF	SEB	MST	JCK	-	-	-
REVISION 1											
R 0	02/16/11	RGS	PS	PVK	SFF	SEB	MST	JCK	-	-	-
ISSUED FOR CONSTRUCTION											

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD
EAST DREDGE CELL

FORCEMAIN TEMPORARY BYPASS
PLAN AND PROFILE
WORK PLAN 5 (ALF-110216-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
R.G. SCHUFF	P. SILPACHARN	R.G. SCHUFF	S.F. FIELD	S.E. BENNETT	M.S TURNBOW	J.C. KAMMEYER

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

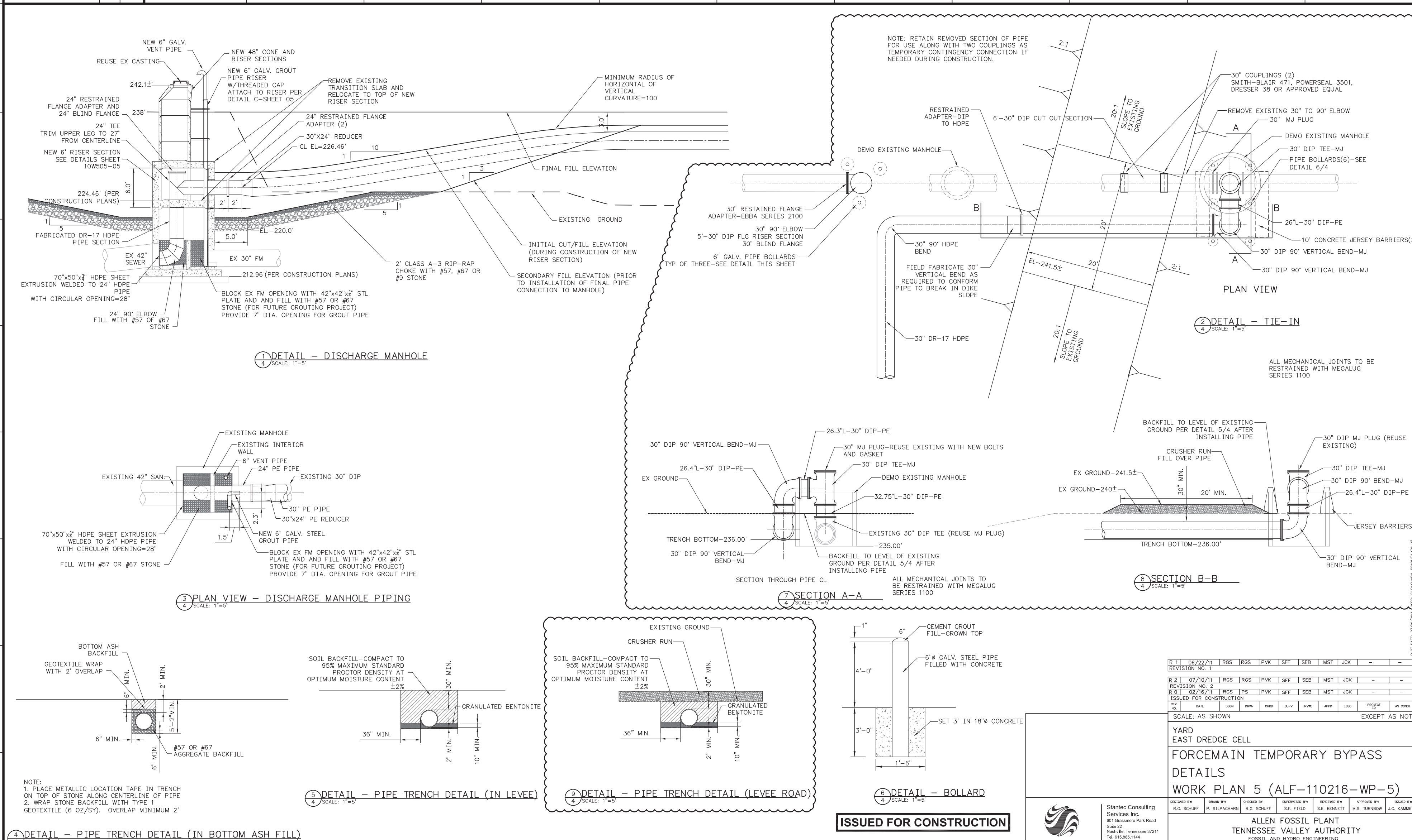
Stantec Consulting Services Inc.
601 Grassmere Park Road
Suite 22
Nashville, Tennessee 37211
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

AUTOCAD R 2000 | DATE 02/16/11 | 38 | C | 10W505-03 | R 1

STANTEC	1
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:50
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



ISSUED FOR CONSTRUCTION

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV ID
R 1 (REVISION NO. 1)	06/22/11	RGS	RGS	PVK	SFF	SEB	MST	JCK	-	-	-
R 2 (REVISION NO. 2)	07/10/11	RGS	RGS	PVK	SFF	SEB	MST	JCK	-	-	-
R 0 (ISSUED FOR CONSTRUCTION)	02/16/11	RGS	PS	PVK	SFF	SEB	MST	JCK	-	-	-

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD
EAST DREDGE CELL

FORCEMAIN TEMPORARY BYPASS DETAILS
WORK PLAN 5 (ALF-110216-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
R.G. SCHUFF	P. SILPACHARN	R.G. SCHUFF	S.F. FIELD	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER

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Fax 615.885.1102
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ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 02/16/11 | 38 | C | 10W505-04 | R 2

PLOT FACTOR:5
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC | 2
TASK COMPLETED BY: | REV NO.

Doc 13: Stantec Hydrologic and Hydraulic Analysis Report - East Ash Pond

Stantec

Report of Hydrologic and Hydraulic Analysis

Ash Pond and Stilling Pond
TVA Allen Fossil Plant
Shelby County, Tennessee

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

September 30, 2010

Stantec

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

September 30, 2010 rpt_001_175660008

Ms. Shannon Bennett
Tennessee Valley Authority
1101 Market Street, LP 5E-C
Chattanooga, Tennessee 37402

Re: Report of Hydrologic and Hydraulic Analysis
Ash Pond and Stilling Pond
TVA Allen Fossil Plant
Shelby County, Tennessee

Dear Ms. Bennett:

Stantec Consulting Services Inc. (Stantec) has been assisting TVA with risk assessment and mitigation for a number of facilities associated with its coal combustion processes at various fossil plants. The Ash Pond and Stilling Pond at the Allen Power Plant were identified for Hydrologic and Hydraulic Freeboard Analysis (H&H) as a part of our Phase 1 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 Ash Pond and Stilling Pond during various hydrologic events. Results of this modeling effort and recommendations are included in the attached report.

The normal freeboard conditions were assessed and found to be adequate (>5 feet) according to TVA guidelines. Storm surge conditions were also assessed. In general, the capacity of the Ash Pond and Stilling Pond along with their spillways was found to be adequate for the assessed storm events up to and including the Probable Maximum Precipitation (PMP) storm event. However, if during the course of operations TVA were to alter the current weir configuration between the Ash Pond and the Stilling Pond it is possible for the Ash Pond to overtop its embankment. A closure scenario for the Ash Pond was also modeled and it was found that there is a chance the Stilling Pond could overtop during the PMP event under that scenario. Stantec recommends that TVA assess the risk associated with a PMP event in comparison with the amount of time this pond system will remain in operation, and then consider options to reduce the flooding potential for this pond system if performance during the PMP event is required. Additional information from the modeling efforts and an explanation of the modeling results is included herein.

We appreciate the opportunity to assist TVA with these assessment efforts and look forward to continuing work on other TVA facilities. Please do not hesitate to contact Stantec with any questions, concerns, or clarifications.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Nathan Jean

Nathan Jean, PE
Water Resource Engineer

Erman Caudill

Erman Caudill, PE, CFM
Project Manager

/cmw

Report of Hydrologic and Hydraulic Analysis

Ash Pond and Stilling Pond
TVA Allen Fossil Plant
Shelby County, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

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Executive Summary

A hydrologic and hydraulic study was conducted for the Ash Pond and Stilling Pond at the Allen Fossil Plant in Shelby County, Tennessee. 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 Tennessee 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 and hydraulic (H&H) modeling was performed.

The current conditions at the plant consist of two ponds, an Ash Pond and a Stilling Pond. The Ash Pond captures process water and storm water runoff from a 128 acre drainage area consisting of the pond itself, the coal stockpile, the dredge cell area and part of the power plant. The Stilling Pond captures storm water runoff from a 9.9 acre drainage area consisting of the pond itself. The Ash Pond is hydraulically connected to the downstream Stilling Pond by an adjustable weir. The Stilling Pond spillway system consists of 4 concrete risers 4-feet in diameter with 3-foot diameter outlet pipes. Storm water runoff must enter the Ash Pond then flow into the Stilling Pond before it can enter the adjacent McKellar Lake.

An H&H model was developed to simulate storm water drainage and runoff from overland areas, process discharges, and pond interconnectivity by spillways based on our understanding of the geometry and design of the drainage and conveyance network. A map showing the hydraulic connectivity is attached as Appendix A. 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 the 6-hour PMP.

Based on the data gathering efforts, collective review of the data available, and the modeling efforts, Stantec noted the following observations:

- Aside from the principal spillway systems, there are no defined emergency spillways or overflow paths. Ponds similar in size and capacity to these typically have emergency spillway systems to prevent overflows.
    - If the principal spillways were to become clogged, or if a heavy rainfall event were to cause any of the ponds to overtop, there are no defined and protected overflow paths to help prevent erosion of the dikes.
- Based on modeling the current conditions, the Ash Pond and Stilling Pond appear able to pass the 6-hr PMP event through the existing principle spillway system without overtopping the embankment.
- It is possible for the Ash Pond to overtop by altering the weir structure that separates the Ash Pond and Stilling Pond. If the weir were to extend from the pond floor to an elevation of approximately 231 feet, the Ash Pond could overtop during the 6-hr PMP event. The key to preventing this overtopping appears to be maintaining a minimum of 6 feet of freeboard for normal operations.

- A potential closure scenario was modeled assuming the Ash Pond would be closed and the Stilling Pond would act as a settling basin prior to discharge. As presently configured and under this operational scenario, the Stilling Pond appears unable to pass the 6-hr PMP event through the spillway system without overtopping the embankment. It does appear to be able to pass the 100-year storm event.
  - In the event of a PMP storm during close-out conditions, the Stilling Pond would overtop the dike between the Stilling Pond and the McKellar Lake.

Based on the results of the analysis, Stantec recommends TVA consider the following:

- Assess the risk of a PMP event occurring during the remaining life of the pond system.
- The current pond and riser configuration can convey each of the modeled storm events, so Stantec recommends operating the weir structure as presently configured and maintaining at least 6 feet of freeboard in the Ash Pond and Stilling Pond.
- Consider installing an emergency spillway between the Stilling Pond and McKellar Lake for the closeout condition or closeout the Stilling Pond and the Ash Pond at the same time.

Stantec recommends that these potential improvements be further evaluated by TVA to determine if they are warranted and can be incorporated into future construction projects at the plant

Report of Hydrologic and Hydraulic Analysis

Ash Pond and Stilling Pond
TVA Allen Fossil Plant
Shelby County, Tennessee

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 at the Allen Fossil Plant in Shelby County, Tennessee. The ponds evaluated include the Ash Pond and Stilling Pond.

The current conditions at the plant consist of two ponds, an Ash Pond and a Stilling Pond. The Ash Pond captures process water and storm water runoff from a 128 acre drainage area consisting of the pond itself, the coal stockpile, the dredge cell area and part of the power plant. The Stilling Pond captures storm water runoff from a 9.9 acre drainage area consisting of the pond itself. The Ash Pond is hydraulically connected to the downstream Stilling Pond by an adjustable weir. The Stilling Pond spillway system consists of 4 concrete risers 4-feet in diameter with 3-foot diameter outlet pipes. Storm water runoff must enter the Ash Pond then flow into the Stilling Pond before it can enter the adjacent McKellar Lake.

This analysis included field visits, review of historical TVA drawings and discussions with TVA personnel. This report details the assumptions, methodology, and results of the H&H analyses for the ponds analyzed.

2. Modeling Assumptions

a. Pipes are assumed to be flowing freely and are not clogged or leaking. Some of the pipes may, in actuality, be clogged 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. This assumption is inherent in this type of analysis and is acceptable.

b. 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. In actuality, wave action would likely play a role in the overtopping of the ponds. The modeling performed for this work is conceptual in nature. Compensating for wave action is beyond this scope of work and would not change the outcome of the study.

c. The model takes into account the tailwater effect from downstream water surface elevation (WSEL) of the Stilling Pond on the upstream outfall structures in the Ash Pond. A rating curve was developed for each storm event for the Ash Pond utilizing an expected downstream WSEL for the Stilling Pond. The expected WSEL of the Stilling Pond was generated using the HEC-HMS model as if the outfall structures of the Ash Pond were free flowing. This generated a maximum WSEL for the Stilling Pond. This WSEL was then used to generate a new rating curve for the Ash Pond. This gives a conservative value for the Ash Pond rating curves because only the maximum WSEL of the downstream Stilling Pond was used. All rating curves can be reviewed in Appendix C

d. NRCS TR-55 methodology was used for runoff calculations. Wherever ash existed in the drainage area, it was treated as a Hydrologic Group C soil. The water surfaces of the ponds are considered to be impervious, in order to model 100% of the rainfall being captured in the pond.

e. Contours were not available in the coal stack area and the buildings and operational facilities surrounding the coal stack. Field observations and aerial photography were used to estimate the area draining to the Ash Pond.

f. Detailed survey information was not available for the minimum weir elevation for structure that separates the Ash Pond from the Stilling Pond. Maximum possible weir height was noted in the TVA survey. It is known that there is an opening below the weir because the water surface elevations are noted as being the same for the Ash Pond and the Stilling Pond in the TVA provided survey and were observed as such during the site visit. It was assumed for this model that the weir is at a maximum elevation and that the opening from the pond floor to the bottom of the weir is 2 feet.

g. As a boundary condition, calculations were made to determine what the maximum height of the weir could be raised to and still have enough volume in the pond to store runoff from the 6-hr probable maximum precipitation (PMP) event. This calculation assumes that the weir touches the pond floor. The 6-hr PMP event Ash Pond elevation was used to determine what amount of storage the pond could be reduced by and still contain the runoff from the 6-hr PMP event. Iterations were made to determine to what elevation the weir could be raised before the volume reduction was greater than the remaining volume in the Ash Pond after the 6-hr PMP event.

h. The Stilling Pond overflow structures 1 and 2 are assumed to have no tailwater effects.

i. It should be noted, that this was an uncalibrated model and sufficient data from actual storms was not available to calibrate it. Stantec tested the sensitivity of the model to input parameters and found the overall general results of the model consistent throughout. This model is suitable for planning purposes, but it should not be used for simulation of actual storm events without further calibration efforts involving actual storm discharge and stage measurements. This model is suitable as a screening and planning tool, however Stantec would discourage its use beyond the current scope of work and the context described in this report.

3. Methodology

Rainfall-runoff relationships were determined using methods described by the NRCS in "Part 630-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.

A HEC-HMS model was developed and used to simulate runoff from the probable maximum precipitation (PMP) event in accordance with TVA design guidance. SCS Type II rainfall depth for the 1, 10, 15, 50, and 100-year storm events were taken from NOAA Atlas 14 for Memphis, TN. Rainfall depth for the 6-HR PMP event was taken from NOAA HMR-56. From Figure 23 *"6 hr 1-mi^2 PMP (in.) – eastern half of Tennessee River Watershed"* of HMR-56, the 6-HR PMP rainfall depth for the Allen site was estimated to be 29.8 in.

The PMP event was formatted using the distribution chart included in NRCS TR-60, Figure 2-4 "*Dimensionless design storm distribution, auxiliary spillway and freeboard.*" A formatted 6-HR PMP chart was developed using Excel and can be found in Appendix C. This allows the PMP event to be formatted in a distribution matching TR-60 Figure 2-4 and also calculates a dataset that can be entered into HEC-HMS.

A flow schematic, dated January 2010, shows the various flows into the Ash Pond. The combination of all plant process flows into the Ash pond generates a flow of 9.05 MGD (14 cfs). This value is used as a constant flow source in the model (Appendix E).

4. Input Data

4.1. Watershed Parameters

It is our understanding that process water enters the Ash Pond. The Ash Pond discharges to the Stilling Pond through an adjustable weir structure. Drawings utilized to develop the connectivity which was used in the creation of the hydrologic model are included in Appendix A. The following table lists the main hydrologic parameters of the watersheds draining to the ponds. The impervious area is a separate entry into the model and the curve numbers listed below are for the pervious sections of the drainage areas only.

Table 1. Watershed Parameters

Name	Drainage Area (acres)	Receiving Pond	Curve Number	*Percent Impervious	Estimated Lag Time (min)
Ash Pond Area	128	Ash Pond	84	43	3
Stilling Pond Area	10	Stilling Pond	82	76	3

*The amount of impervious area is not reflected in the Curve Number.

A potential closure scenario for the Ash Pond was also modeled assuming the Stilling Pond would act as a settling basin prior to discharge. The Ash Pond Area was assumed to be filled and regraded to drain positively to the stilling pond and all the process water was routed through the Stilling Pond. Although the exact configuration may change during design, this assumption appears to be sufficient for this concept level model.

4.2. Rainfall Data

SCS Type II rainfall depth for the 1, 10, 15, 50, and 100-year storm events were taken from NOAA Atlas 14 for Memphis, TN.

Rainfall depth for the 6-Hr PMP event was taken from NOAA HMR-56. From Figure 23 *"6 hr 1-mi^2 PMP (in.) – eastern half of Tennessee River Watershed"* of HMR-56, the 6-hr PMP rainfall depth for the Allen Fossil Plant site was estimated at 29.8 in.

From NRCS TR-60, Figure 2-4 "*Dimensionless design storm distribution, auxiliary spillway and freeboard*", the PMP event was formatted using this distribution chart. A formatted 6-hr PMP chart was developed using Excel and can be found in Appendix C. This allows the PMP event to be formatted in a distribution matching TR-60 Figure 2-4 and also calculates a data table that can be entered into HEC-HMS.

Rainfall depths were taken from NOAA Atlas 14 for the storm events evaluated. The PMP event was formatted using the distribution chart included in NRCS TR-60, Figure 2-4 "*Dimensionless design storm distribution, auxiliary spillway and freeboard.*" Rainfall depths used in the HMS model are summarized below in Table 2.

Table 2. Rainfall Depths

Storm Event	Rainfall Depth (inches)
1-year 24-hour	3.35
10-year 24-hour	5.58
25-year 24-hour	6.51
50-year 24-hour	7.25
100-year 24-hour	8.02
6-hour PMP	29.8

4.3. Spillway Data

TVA drawings 10N226, 10N227, 10N229-1, 10N229-2 depict the 4 risers in the Stilling Pond. The 4 riser structures as shown in these drawings were consistent with conditions observed during the field visit. Data was used from these drawings in the H&H analysis.

An Excel file provided by TVA titled "TVA Spillway Concrete Top Survey", dated 1-23-09, lists multiple plants with surveyed riser elevations and approximate riser invert elevations. Data was used from these files in the H&H analysis. See Appendix C.

Table 3. Existing Principal Spillway Data – Ash Pond

Pond	Weir/Orifice Structure	Weir Length (ft)	Weir Elevation (ft)	Orifice Opening (ft^2)	Orifice Invert (ft)	Data Source
Ash Pond	1	28.5	234.9	57	222.00	TVA Survey 08/02/2010 & Stantec Assumptions

Table 4. Existing Principal and Overflow Spillway Data – Spilling Pond

Pond	Riser Structure	Riser Diameter (inches)	Rim Elevation (ft)	Pipe Diameter (inches)	Pipe Invert (ft)	Data Source
Stilling Pond	East	48	229.47	36	216.00	**TVA drawings 10N226, 10N227, 10N229-1, 10N229-2**
Stilling Pond	West	48	229.47	36	216.00	**TVA drawings 10N226, 10N227, 10N229-1, 10N229-2**
Stilling Pond	Overflow 1	48	230.43	36	216.00	**TVA drawings 10N226, 10N227, 10N229-1, 10N229-2**
Stilling Pond	Overflow 2	48	230.30	36	216.00	**TVA drawings 10N226, 10N227, 10N229-1, 10N229-2**

Table 5. Pond Tailwater Elevations

Pond	Weir/Riser Structure	Storm Event	Tailwater Elevation (ft)
Ash Pond	1	1-YR	230.3
Ash Pond	1	10-YR	230.6
Ash Pond	1	25-YR	230.7
Ash Pond	1	50-YR	230.8
Ash Pond	1	100-YR	230.8
Ash Pond	1	6-hr PMP	232.7
Stilling Pond	East and West	1, 10-YR	217.0
Stilling Pond	East and West	25,50,100-YR,6-hr PMP	225.0

4.4. Pond Overflow and Normal Pool

Table 6 shows the embankment elevation and the assumed normal pool elevations at each pond. The normal pool elevations were assumed to be equal to the principal riser elevation in the pond.

Table 6. Pond Overflow Elevation

Pond Name	Embankment Elevation (feet)	Normal Pool Elevation (feet)
Ash Pond	236	229.5
Stilling Pond	236	229.5

4.5. Stage Storage Data

Stage storage curves were developed for each pond based on data provided by TVA. For the Ash Pond and Stilling Pond, the stage-storage data came from AutoCAD files *79016c-cb05-06-09.dwg*. Stage-storage curves are included in Appendix C for each pond. Survey data utilized can be found in Appendix D.

4.6. 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 were 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.

The model takes into account a tailwater effect of the downstream WSEL of the Stilling Pond on the upstream outfall structures in the Ash Pond. A rating curve was developed for each storm event for the Ash Pond utilizing an expected downstream WSEL for the Stilling Pond. Tailwater elevation for the Stilling Pond was assumed to be the 100-YR WSEL of the receiving waterway (McKellar Lake), for the 25, 50, 100-yr and 6 hr PMP events. Tailwater elevation for the Stilling Pond was assumed to be the 10-yr WSEL of the receiving waterway (McKellar Lake), for the 1 and 10-yr events. Rating curves for each pond are attached in Appendix C.

4.7. Plant Process Flow

A flow schematic, dated January 2010, shows the various flows into the Ash Pond. The combination of all plant process flows into the Ash Pond generates a flow of 9.05 MGD (14 cfs). This value is used as a constant flow source in the model.

5. Results

Results are summarized in the following sections for the capacity/freeboard analysis. The results shown are based on the assumptions described herein and should be considered approximate.

5.1. Capacity and Freeboard Results

Estimated peak pool elevations for the storms analyzed are shown in Table 7. Table 8 shows the estimated peak pond inflows associated with each event and Table 9 shows estimated peak pond outflows associated with each event.

Table 7. Estimated Peak Pool Elevations – Existing Conditions

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-hr PMP storm (ft)
Ash Pond	230.4	230.8	231.0	231.1	231.3	234.8
Stilling Pond	230.3	230.6	230.7	230.7	230.8	232.7

Table 8. Estimated Peak Pond Inflows – Existing Conditions

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-hr PMP storm (cfs)
Ash Pond	483	879	1046	1178	1316	2807
Stilling Pond	119	162	192	207	232	450

Table 9. Estimated Peak Pond Outflows – Existing Conditions

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-hr PMP storm (cfs)
Ash Pond	100	129	149	158	174	384
Stilling Pond	62	100	123	134	152	393

6. Conclusions and Recommendations

Based on the data gathering efforts, collective review of the data available, and the modeling efforts, Stantec noted the following observations:

- Aside from the principal spillway systems, there are no defined emergency spillways or overflow paths. Ponds similar in size and capacity to these typically have emergency spillway systems to prevent overflows.
    - If the principal spillways were to become clogged, or if a heavy rainfall event were to cause any of the ponds to overtop, there are no defined and protected overflow paths to help prevent erosion of the dikes.
- Based on modeling the current conditions, the Ash Pond and Stilling Pond appear able to pass the 6-hr PMP event through the existing principle spillway system without overtopping the embankment.
- It is possible for the Ash Pond to overtop by altering the weir structure that separates the Ash Pond and Stilling Pond. If the weir were to extend from the pond floor to an elevation of approximately 231 feet, the Ash Pond could overtop during the 6-hr PMP event. The key to preventing this overtopping appears to be maintaining a minimum of 6 feet of freeboard for normal operations.

- A potential closure scenario was modeled assuming the Ash Pond would be closed and the Stilling Pond would act as a settling basin prior to discharge. As presently configured and under this operational scenario, the Stilling Pond appears unable to pass the 6-hr PMP event through the spillway system without overtopping the embankment. It does appear to be able to pass the 100-year storm event.
    - In the event of a PMP storm during close-out conditions, the Stilling Pond would overtop the dike between the Stilling Pond and the McKellar Lake.

Based on the results of the analysis, Stantec recommends TVA consider the following:

- Assess the risk of a PMP event occurring during the remaining life of the pond system.
- The current pond and riser configuration can convey each of the modeled storm events, so Stantec recommends operating the weir structure as presently configured and maintaining at least 6 feet of freeboard in the Ash Pond and Stilling Pond.
- Consider installing an emergency spillway between the Stilling Pond and McKellar Lake for the closeout condition or closeout the Stilling Pond and the Ash Pond at the same time.

Stantec recommends that these potential improvements be further evaluated by TVA to determine if they are warranted and can be incorporated into future construction projects at the plant.

7. References

"Allen Fossil Plant Flow Schematic Diagram." NPDES Permit No. TN0005452FP August, 2003.

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Brater, E.F. and King, H.W. Handbook of Hydraulics. 1976.

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Schreiner, Louis C. and Riedel, John T. (National Weather Service), "Hydrometeorological Report No. 51, Probable Maximum Precipitation Estimates, United States East of the 105th Meridian."

United States Department of Agriculture, Natural Resources Conservation Service, Urban Hydrology for Small Watersheds TR-55. June 1986.

US Department of Agriculture (USDA) National Engineering Handbook Part 630 – Hydrology. May, 2007.

US Department of Agriculture, Natural Resources Conservation Service, Earth Dams and Reservoirs TR-60. July, 2005.

US Department of Transportation Federal Highway Administration (FHWA) "Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5 (HDS-5)." 1985.

Appendix A

Connectivity Map

SaveDate: 2010/09/01 1:30 PM Login: Gaskill, CW
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Legend

Notes

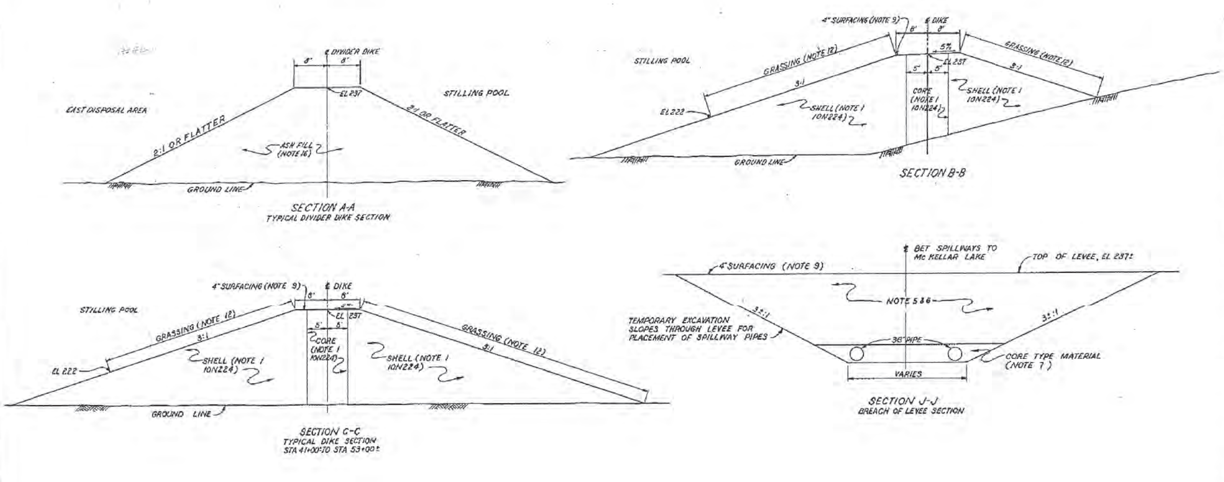
Client/Project
TVA
ALLEN H&H

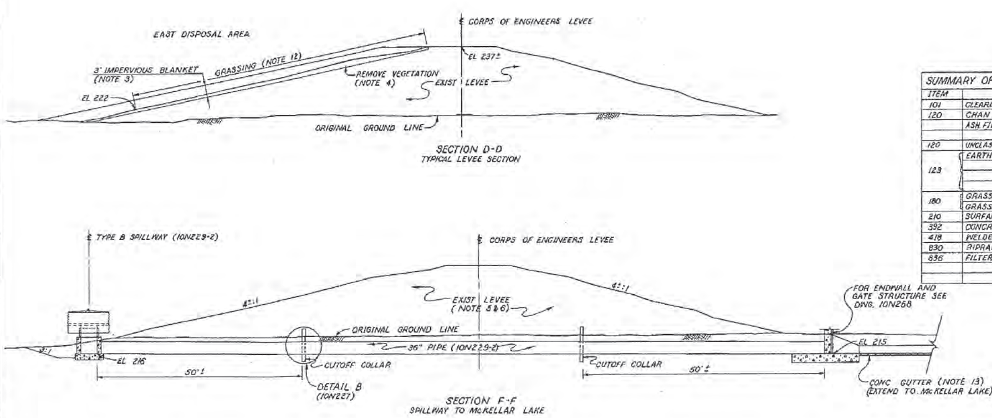
Figure No.

Title

Appendix B

TVA Historical Drawings





SUMMARY OF QUANTITIES EAST DISPOSAL AREA

ITEM	DESCRIPTION	QUANTITY	UNIT
101	CLEARING AND GRUBBING (DIKE)	3.4	AC.
120	CHAN EXCAV (TO HORN LAKE CUTOFF)	290	C.Y.
	ASH FILL (DIVIDER DIKE)	74,000	C.Y.
120	UNCLASSIFIED EXCAVATION (BREACH LEVEE)	4,745	C.Y.
123	EARTH BORROW - SHELL MATERIAL (DIKE)	102,000	C.Y.
	- CORE MATERIAL (DIKE)	13,500	C.Y.
	- SHELL MATERIAL (LEVEE)	5,945	C.Y.
	- CORE MATERIAL (LEVEE)	26,000	C.Y.
180	GRASSING (DIKE)	21,000	S.Y.
	GRASSING (LEVEE)	26,000	S.Y.
210	SURFACING (DIKE)	610	TONS
392	CONCRETE GUTTER (LEVEE)	300	L.F.
418	WELDED WIRE FABRIC	810	S.Y.
830	RIPRAP (DIKE)	390	C.Y.
836	FILTER (DIKE)	460	TONS

NOTES:

1. FOR GENERAL NOTES SEE DRAWING 10N224.
2. FIELD SHALL USE EXTREME CAUTION TO AVOID DAMAGE TO THE 60" RAW SEWER LINE LYING OUTSIDE AND SOUTH OF THE DISPOSAL AREA.
3. THE IMPERVIOUS BLANKET PLACED ON THE LANDSIDE SLOPE OF THE CORPS OF ENGINEERS' LEVEE SHALL BE OF CORE TYPE MATERIAL (MINIMUM 3 FEET THICK). PLACEMENT AND COMPACTION SHALL BE AS SPECIFIED FOR THE CORE MATERIAL (NOTE 1, 10N224). AT THE INTERSECTION OF THE LEVEE AND THE DIKE, THE IMPERVIOUS BLANKET ON THE SLOPE OF THE LEVEE SHALL EXTEND TO INTERSECT WITH THE CORE OF THE DIKE.
4. EXISTING VEGETATION SHALL BE STRIPPED FROM THE LANDSIDE SLOPE OF THE LEVEE BEFORE PLACEMENT OF THE IMPERVIOUS BLANKET AND STOCKPILED. AFTER PLACEMENT OF THE IMPERVIOUS BLANKET, THE STOCKPILED MATERIAL SHALL BE UNIFORMLY SPREAD OVER THE IMPERVIOUS BLANKET. THIS SLOPE SHALL THEN BE SEEDED PER NOTE 7, DRAWING 10N224.
5. THE BREACH IN THE LEVEE FOR CONSTRUCTION OF THE DISCHARGE SPILLWAYS TO McKELLAR LAKE SHALL NOT BE MADE UNTIL THE DIKES FOR THE EAST DISPOSAL AREA ARE CONSTRUCTED.
6. MATERIALS EXCAVATED FROM THE BREACH IN THE LEVEE SHALL BE STOCKPILED AND USED IN REFILLING THE BREACH AFTER INSTALLATION OF THE SPILLWAY PIPES. COMPACTION SHALL BE AS SPECIFIED FOR OTHER DIKE MATERIALS, (NOTE 1, 10N224), WITH CONTROLS AS ESTABLISHED BY THE CENTRAL SOILS LABORATORY. THE EXISTING LEVEE BREACH WHERE THE ASH SLUICE PIPES ARE LOCATED SHALL BE FILLED WITH SHELL TYPE MATERIAL, (NOTE 1, 10N224). THE LANDSIDE LEVEE SLOPE AT BOTH BREACHES SHALL BE PROVIDED WITH THE IMPERVIOUS BLANKET OF NOTE 3. SEVERAL ROUTINE FILL COMPACTION TESTS SHALL BE MADE ON THE COMPACTED FILL IN EACH BREACH, WELL DISTRIBUTED IN PLAN AND ELEVATION TO OBTAIN GOOD REPRESENTATION THROUGHOUT THE FILLS.
7. PIPE BACKFILL AND BEDDING MATERIAL SHALL CONSIST OF CORE TYPE MATERIAL (NOTE 1 10N224) AND SHALL BE PLACED IN ACCORDANCE WITH SECTION 7.7 OF THE G-9 SPECIFICATIONS.
8. THE ASH, HYDRAULIC FILL, AND FOUNDATION STRIPPING, EXCEPT FOR THAT REMOVED FROM THE CORPS OF ENGINEERS' LEVEE EXCAVATED FOR CONSTRUCTION OF THE EAST DISPOSAL AREA DIKES SHALL BE DISPOSED OF INSIDE THE DISPOSAL AREA.
9. CRUSHED STONE OR GRAVEL SURFACING, 4" THICK, SHALL BE APPLIED FOR THE FULL WIDTH OF THE TOP OF DIKE AND ALL DISTURBED SECTIONS OF THE CORPS OF ENGINEERS' LEVEE IN ACCORDANCE WITH SECTION 210 OF T-1 SPECIFICATIONS.
10. RIPRAP SHALL BE PLACED AT SPILLWAY OUTLETS AS SHOWN. AT LEAST 50%, BY WEIGHT, OF THE RIPRAP SHALL CONSIST OF STONES AT LEAST 200 POUNDS EACH. RIPRAP SHALL CONFORM TO SECTION 830 OF THE T-1 SPECIFICATIONS.
11. FILTER SHALL CONFORM TO SECTION 836.
12. ALL CUT AND FILL SLOPES AND OTHER DISTURBED AREAS SHALL BE SEEDED WITH TYPE 6, MIXTURE B OR TYPE 7, MIXTURE A IN ACCORDANCE WITH SECTION 180 OF T-1 SPECIFICATIONS. DEPENDING ON THE TIME OF CONSTRUCTION, IT MAY BE NECESSARY TO PROVIDE A TEMPORARY COVER (TYPE 9) ON THE DIKE AND LEVEE SLOPES. ALL GRASSED AREAS SHALL BE FERTILIZED AND MULCHED IN ACCORDANCE WITH SECTIONS 180 AND 182 RESPECTIVELY.
13. CONCRETE GUTTER SHALL CONFORM TO SECTION 390. INTERMEDIATE ANCHORS AND 3/4" EXPANSION JOINTS SHALL BE PLACED AT INTERVALS NOT TO EXCEED 50'.
14. WELDED WIRE FABRIC SHALL CONFORM TO ASTM SPECIFICATION A185 PLAIN FINISH, AND SHALL HAVE A MINIMUM LAP DISTANCE OF 6 INCHES.
15. THE MINIMUM FACTOR OF SAFETY FOR ALL LOADING CONDITIONS ON THE EAST DISPOSAL AREA IS 1.42. THIS FACTOR OF SAFETY IS FOR THE END OF CONSTRUCTION CONDITION.
16. THE DIVIDER DIKE SHALL BE CONSTRUCTED OF BOTTOM ASH PLACED IN NOT MORE THAN 9-INCH LAYERS, AND WELL COMPACTED WITH RUBBER-TIRED HAULING EQUIPMENT.

P.A. 3092
AND W.O. P33-544-82-31401-J6

COMPANION DWGS., 10N223, 224, 225, 227, 228, 229-1, 229-2
SCALE 1" = 10'

INSPECTED AND APPROVED FOR ISSUE
B.H. Montgomery

REV NO.		DATE									
2	REVISED RIPRAP & FILTER QUANTITIES P.A. 3076	3-16-77									
1	ADD DIVIDER DIKE - P.A. 3076; EXTEND ASH AREA DIKE TO RR FILL - P.A. 3092	10-19-76									

DSGN J.L. GLOVER
DRWN J.S. BERRY
CHKD R.W. SCHENK
SUPV J.L. GLOVER
ENGINEER H.W. Burnett

MAIN PLANT - ASH DISPOSAL AREAS

ASH DISPOSAL AREA
EAST OF POWERHOUSE
SHEET 2

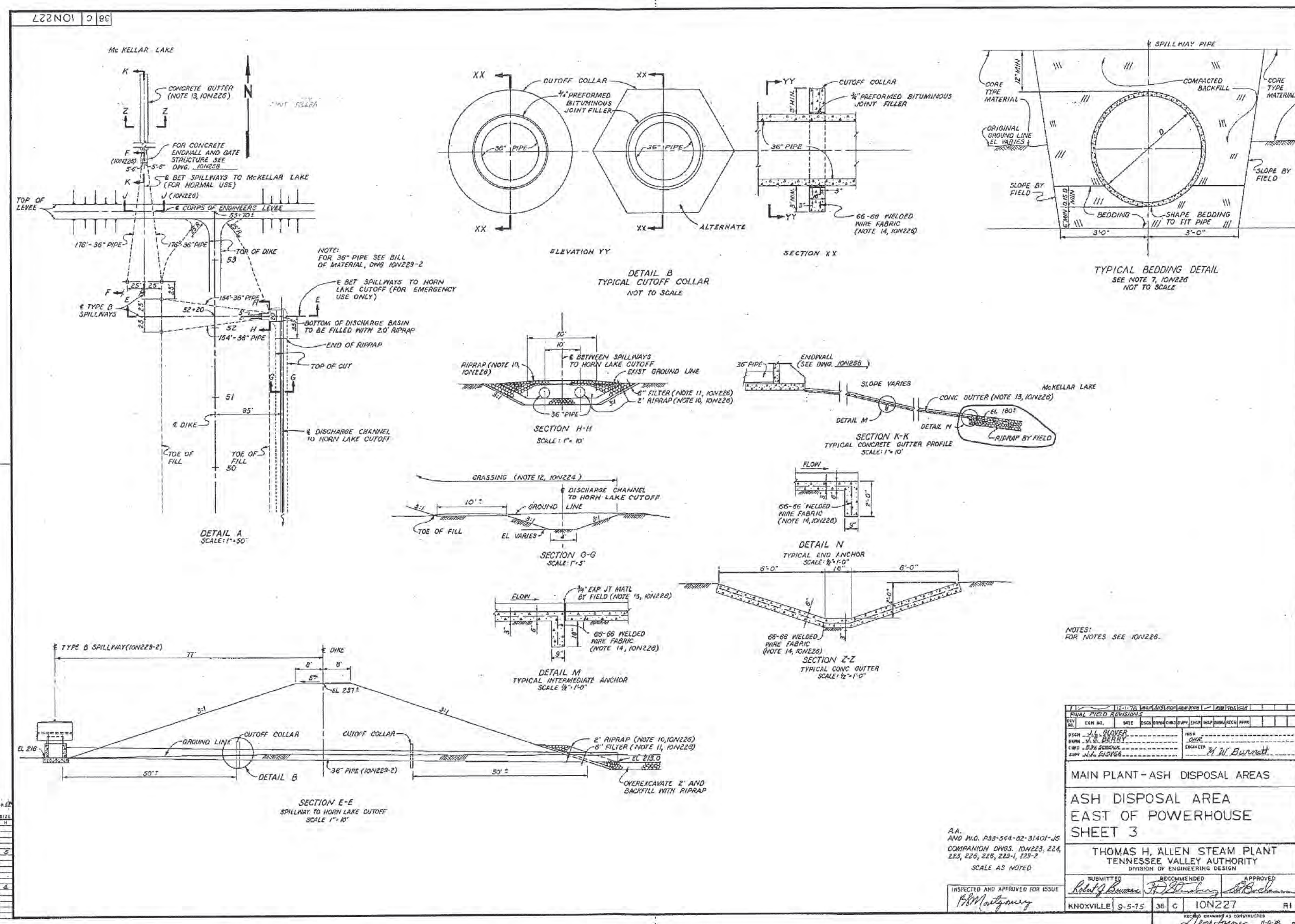
THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED Robert J. Bowman | RECOMMENDED F.D. Stoneburg | APPROVED

KNOXVILLE 9-5-75 38 C 10N226 R2

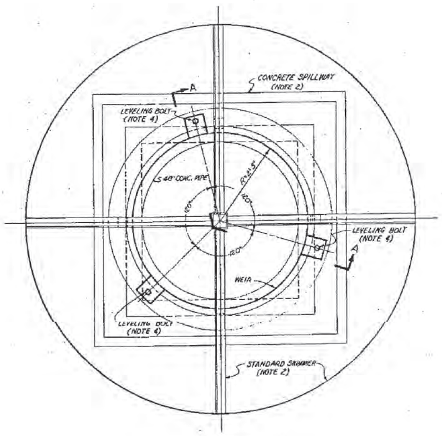
RECORD DRAWING AS CONSTRUCTED 11-6-78 R2

38 C 10N226

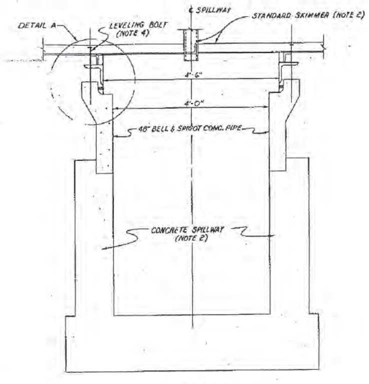


38 C 10N227
DETAIL A
SCALE: 1"=50'
DETAIL B
TYPICAL CUTOFF COLLAR
NOT TO SCALE
ELEVATION YY
SECTION XX
TYPICAL BEDDING DETAIL
SEE NOTE 7, 10N226
NOT TO SCALE
SECTION H-H
SCALE: 1"= 10'
SECTION K-K
TYPICAL CONCRETE GUTTER PROFILE
SCALE: 1"= 10'
SECTION G-G
SCALE: 1"=5'
DETAIL N
TYPICAL END ANCHOR
DETAIL M
TYPICAL INTERMEDIATE ANCHOR
SECTION Z-Z
TYPICAL CONC GUTTER
SECTION E-E
SPILLWAY TO HORN LAKE CUTOFF
SCALE 1"= 10'
NOTE:
FOR 36" PIPE SEE BILL OF MATERIAL, DWG 10N229-2
NOTES:
FOR NOTES SEE 10N226.
A.A.
COMPANION DWGS. 10N223, 224, 225, 226, 228, 223-1, 229-2
SCALE AS NOTED
MAIN PLANT - ASH DISPOSAL AREAS
ASH DISPOSAL AREA
EAST OF POWERHOUSE
SHEET 3
THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN
SUBMITTED
RECOMMENDED
APPROVED
INSPECTED AND APPROVED FOR ISSUE
KNOXVILLE 9-5-75 36 C 10N227 R1

10N229-1 | C | 38



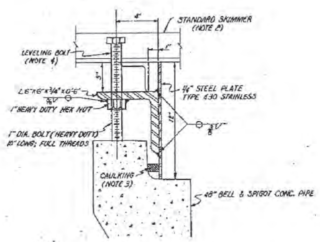
PLAN
SCALE: 1"=1'-0"



SECTION A-A
SCALE: 1"=1'-0"

WEIR DISCHARGE IN CUBIC FEET PER SECOND										
HEAD IN FEET	0.0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0	.04	.11	.21	.35	.52	.72	.95	1.20	1.34
0.1	1.54	1.75	1.97	2.20	2.44	2.70	2.96	3.24	3.52	3.81
0.2	4.11	4.41	4.72	5.04	5.36	5.69	6.04	6.38	6.73	7.10
0.3	7.47	7.85	7.23	8.62	9.00	9.41	9.82	10.2	10.6	11.1
0.4	11.5	11.9	12.4	12.8	13.3	13.7	14.2	14.7	15.1	15.6
0.5	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.6	20.1	20.7
0.6	21.2	21.7	22.3	22.8	23.4	23.9	24.5	25.0	25.6	26.2
0.7	26.7	27.3	27.9	28.5	29.1	29.7	30.3	30.9	31.5	32.1
0.8	32.7	33.4	34.0	34.6	35.2	35.9	36.5	37.2	37.8	38.5
0.9	39.1	39.8	40.4	41.1	41.8	42.5	43.1	43.8	44.5	45.2
1.0	45.9									

NOTES:
1. ALL CONNECTIONS TO BE WELDED.
2. FOR SKIMMER AND SPILLWAY DETAILS SEE DWG. 10N229-2
3. CAULKING SHALL EXTEND COMPLETELY AROUND THE WEIR AND FORM A WATER TIGHT SEAL.
4. WHEN THE WEIR IS INSTALLED THE TOP SHALL BE LEVELED WITH THE USE OF LEVELING BOLTS.



DETAIL A
3 REQUIRED
SCALE: 3"=1'-0"

BILL OF MATERIAL				
ITEM	DESCRIPTION	NO. SPWYS.*	PER SPWY.	TOTAL REQD.
ANGLES	6"×6"×3/4"×0'-6"	5	3	15
BOLTS	1"×10" HEAVY DUTY (FULL THREADS) W/NUT	5	3	15
STEEL PLATE	12"×14"-2"; TYPE 430 STAINLESS	5	1	5
CAULKING	BY FIELD			

* INCLUDES 4 SPILLWAYS FOR DISPOSAL AREA EAST OF POWERHOUSE AND 1 SPILLWAY FOR DISPOSAL WEST OF POWERHOUSE.

SCALE AS NOTED

P.A.
AND W.O. P33-544-82-31401-J8

COMPANION DWGS., 10N223, 224, 225, 226, 227, 229-2

INSPECTED AND APPROVED FOR ISSUE
B.M. Montgomery

STANDARD DRAWING

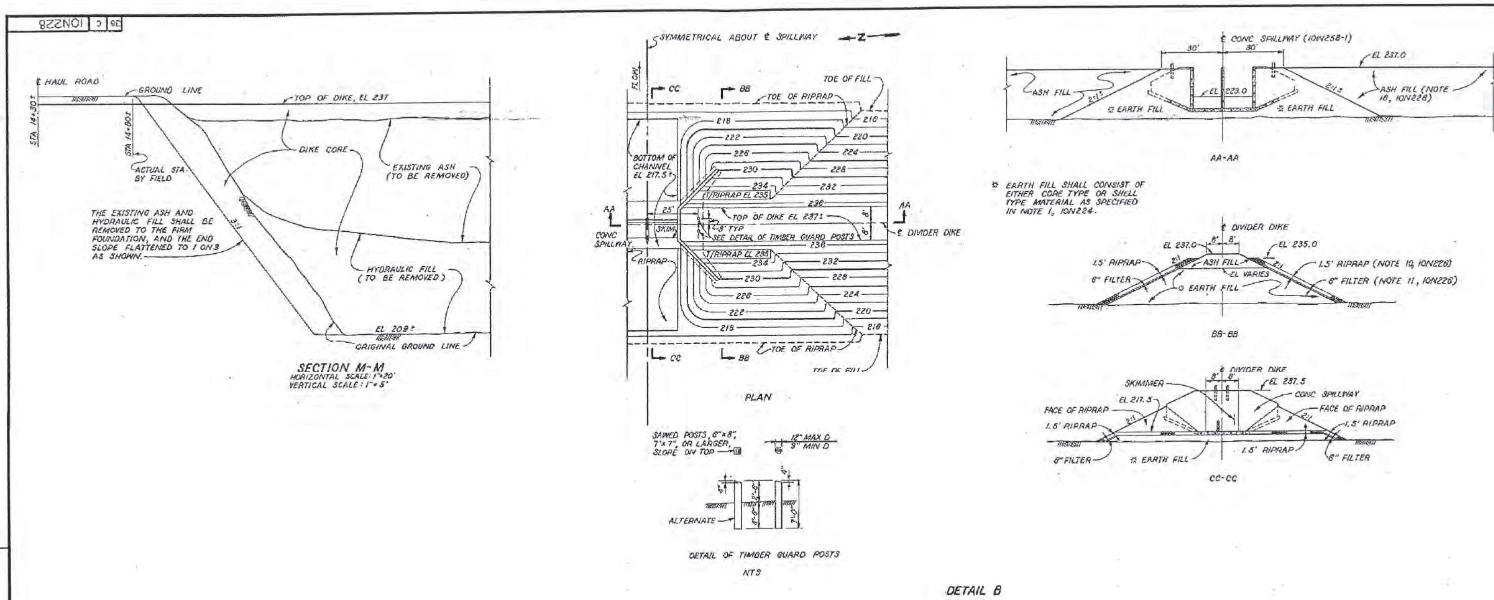
WEIR FOR ASH DISPOSAL
SPILLWAY

THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED
Robert J. Bowman	[illegible]	[illegible]

KNOXVILLE | 9-5-75 | 38 | C | 10N229-1 | R0

RECORD DRAWING AS CONSTRUCTED



P.A. 8092
AND NO. P33-544-82-31401-J8

COMPANION DWGS., 10N223, 224, 225, 226, 227, 228-1, 228-2
SCALE 1"=20' EXCEPT AS NOTED

INSPECTED AND APPROVED FOR ISSUE

1 ADDED DETAIL B P.A. 8092

DSGN J.L. GLOVER
DRWN J.S. BERRY
CHKD R.W. SCHENK
SUPV J.L. GLOVER
ENGINEER R.W. Burnett

MAIN PLANT - ASH DISPOSAL AREAS

ASH DISPOSAL AREA
EAST OF POWERHOUSE
SHEET 4

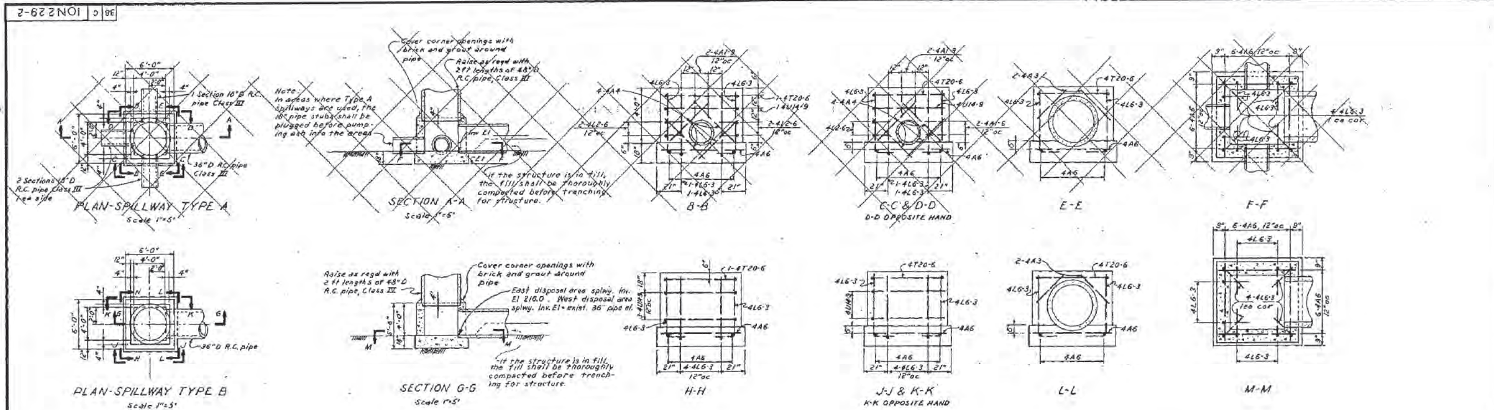
THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

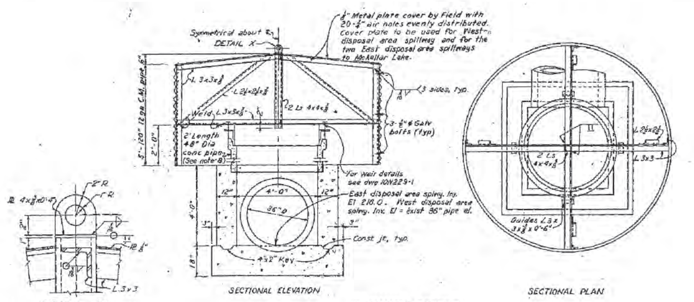
SUBMITTED | RECOMMENDED | APPROVED

KNOXVILLE | 9-6-78 | 38 | C | 10N228 | R1

RECORD DRAWING AS CONSTRUCTED

38 C 10N228





SKIMMER DETAILS
SCALE: 1/2" = 1'-0"

REINFORCEMENT SCHEDULE

Location	Mark	No. of Units	Per Unit	Total Reqd	Bend Dim. a	b	c
Sect B-B	4T20-6	1		1	5-0	5-0	
	4U14-9	1		1	5-0	5-0	Ex
	4L6-3	1		2	2-0	Ex	
	4L2-6	4		4	1-3	Ex	
	4A4	1		4			
	4A1-9	1		2			
Sect C-C & D-D	4L6-3	2	2	4	2-0	Ex	
	4A4	2	4	8			
	4A1-9	2	2	4			
	4A1-6	2	2	4			
Sect E-E	4A3	1		2			
Sect F-F	4L6-3	1		4	2-0	Ex	
	4A6	1		12			

~~TYPE A SPILLWAY~~

Location	Mark	No. of Units	Per Unit	Total Reqd	Bend Dim. a	b	c
Sect H-H	4T20-6	1		1	5-0	5-0	
	4U14-9	1		3	5-0	5-0	Ex
	4L6-3	1		4	2-0	Ex	
Sect J-J & K-K	4L6-3	2	4	8	2-0	Ex	
Sect L-L	4A3	1		2			
Sect M-M	4L6-3	1		4	2-0	Ex	
	4A6	1		12			

TYPE B SPILLWAY

BILL OF MATERIAL

	ITEM	DESCRIPTION	NO. OF SPLWYS	PER SPLWY	TOTAL REQD
ASH DISPOSAL AREA EAST OF POWERHOUSE	401	CLASS A CONCRETE	4	5 CY	20 CY
	418	REINFORCING STEEL	4	170 LB	680 LB
	603	36" D "O" RING RUBBER GASKET REINFORCED CONCRETE PIPE - CLASS IV	4	[illegible]	660 FT
		48" D REINF CONC PIPE - CLASS IV (BELL & SPIGOT) (2' LENGTHS)	4	12 FT	48 FT
	660	120" - 12 GAGE CORRUGATED METAL PIPE	4	5 FT	20 FT
		1/2" ϕ GALVANIZED BOLT	4	12	48
		2 1/2 x 2 1/2 x 3/8 ANGLE	4	23 FT	92 FT
		3 x 3 x 3/8 ANGLE	4	67 FT	268 FT
		4 x 4 x 3/8 ANGLE	4	8 FT	32 FT
ASH DISPOSAL AREA WEST OF POWERHOUSE	401	CLASS A CONCRETE	1	5 CY	5 CY
	418	REINFORCING STEEL	1	170 LB	170 LB
	603	48" D REINF CONC PIPE - CLASS IV (BELL & SPIGOT) (2' LENGTHS)	1	12 FT	12 FT
	660	120" - 12 GAGE CORRUGATED METAL PIPE	1	5 FT	5 FT
		1/2" ϕ GALVANIZED BOLT	1	12	12
		2 1/2 x 2 1/2 x 3/8 ANGLE	1	23 FT	23 FT
		3 x 3 x 3/8 ANGLE	1	67 FT	67 FT
		4 x 4 x 3/8 ANGLE	1	8 FT	8 FT

P.A.
AND W.O. P33-544-82-31401-J6

COMPANION DRAWING: 10N223, 224, 225, 226, 227, 229-1

INSPECTED AND APPROVED FOR ISSUE

NOTES:

① SPECIFICATIONS: All work shall be done in accordance with the T-1 Specifications.

② All concrete shall be Class A in accordance with Section 400.

~~③ Where earth borrow can be obtained economically, for example, from disposal area, it may be used to raise dikes.~~

~~④ Vegetation shall be established on all earth slopes. Initial and future construction. Seeding specifications to be furnished with drawings for each project. In general, Type 7 Section 180 of T-1 Specifications is recommended.~~

~~⑤ Location and elevation of the spillways shall be selected so as to maintain the depth of water in the ash pond at an absolute minimum.~~

~~⑥ Use Type A spillways for ash areas not scheduled for immediate use.~~

⑦ A section of 120" corrugated metal pipe, fully coated, shall be used for the skimmer device. All seams and joints shall be riveted. Fabrication of the pipe shall be complete prior to coating.

⑧ During initial construction, two 2' sections of 48" dia pipe shall be installed at the east disposal area spillways to Horn Lake cutoff. One 2' section of 48" dia pipe shall be installed at all other spillways.

⑨ As additional sections of 48" pipe are added, grout the joint to form a stable and water-tight connection.

⑩ Top of dike must be maintained a minimum of 4' above the elevation of water in the Ash Disposal Area.

~~⑪ As dikes are raised the Field shall provide drainage from the top and outside slopes of the dikes that will control erosion of dikes.~~

REFERENCE DRAWINGS:
30B519 REINFORCEMENT BENDING DIAGRAMS

Scale 1/8" = 1'-0"
Except as noted

STANDARD DRAWING

ASH DISPOSAL SPILLWAY

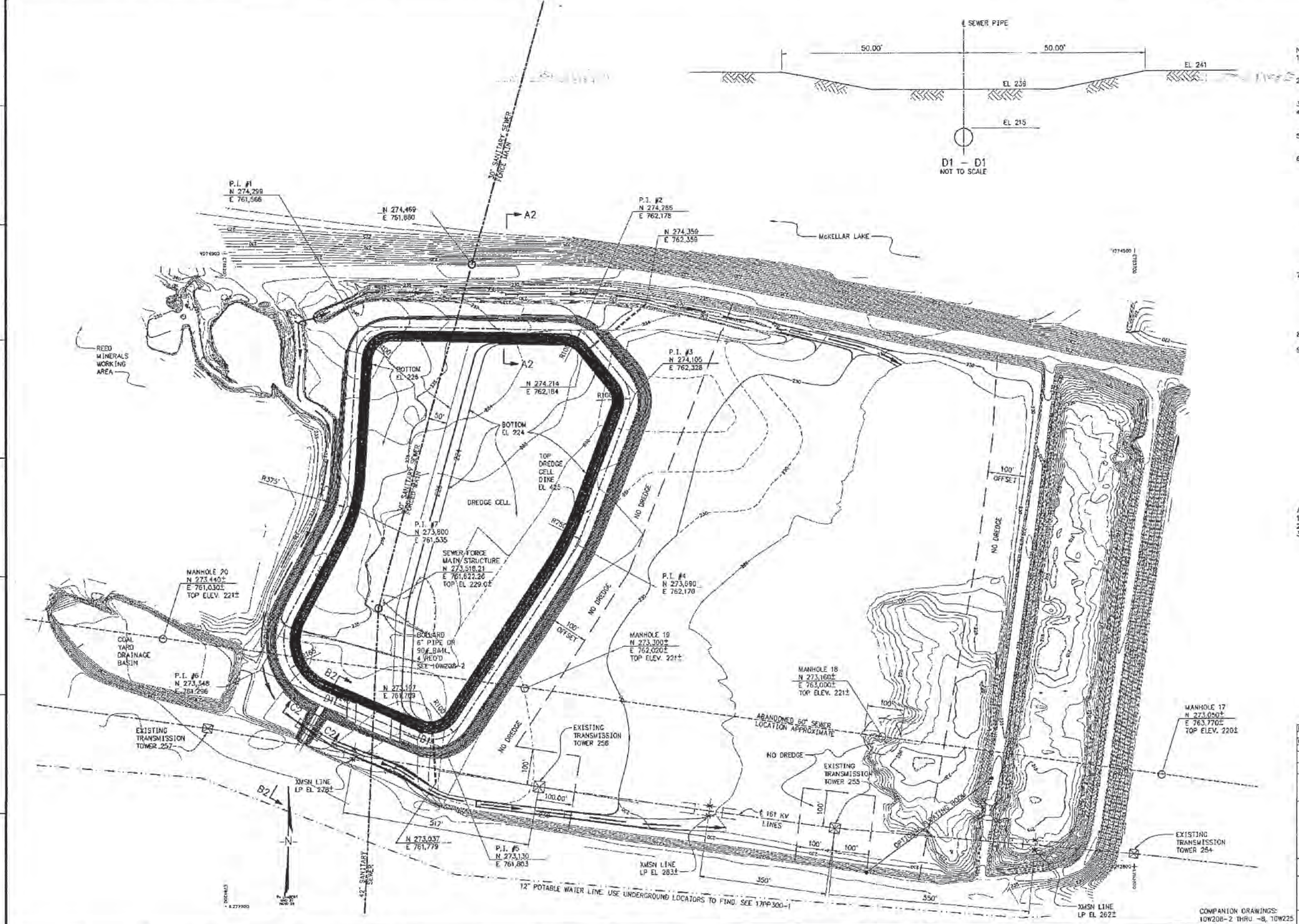
THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED | RECOMMENDED | APPROVED

KNOXVILLE 9-5-75 38 C 10N229-2 R0

RECORD DRAWING AS CONSTRUCTED

38 C 10N229-2



NOTES:
1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE T-1 GENERAL CONSTRUCTION SPECIFICATIONS, UNLESS OTHERWISE NOTED. SECTION NUMBERS REFER DIRECTLY TO THE T-1 SPECIFICATION.
2. THE AREA FOR THE BASE OF THE DIKE IS TO BE CLEARED OF VEGETATION BY SCRAPING THE SURFACE ACCORDING TO SECTION 101.
3. BASE REINFORCEMENT SHALL CONSIST OF 18" TO 24" OF BOTTOM ASH.
4. TYPE A RIPRAP SHALL BE 9" THICK. A MINIMUM OF 50%, BY WEIGHT, OF THE STONES SHALL BE 25 LB. EACH AND IN ACCORDANCE WITH SECTION 575.
5. TYPE B RIPRAP SHALL BE 18" THICK. A MINIMUM OF 50%, BY WEIGHT, OF THE STONES SHALL BE 100 LB. EACH AND IN ACCORDANCE WITH SECTION 575.
6. FACTORS OF SAFETY FOR THE 3.5:1 OUTSIDE SLOPE OF DREDGE CELL USING PCSTABLE 5M
   FOR Q VALUES F.S. = 2.00
   FOR RBAR VALUES F.S. = 1.51

SOIL	UNIT WEIGHT (pcf)		Q		RBAR	
	MOIST	SATURATED	c (psf)	ϕ (deg.)	c (psf)	ϕ (deg.)
EXIST. DIKE & INSITU	125	125	1000	35	1000	35
EXIST. ASH	100	100	150	25	150	25
DREDGED ASH	100	100	150	25	150	25
ASH DIKE FILL	102.8	102.8	250	28	0	30
EXIST. ASH UNDER DIKE	101	101	165	27	165	27

7. COMPACTED ASH IN DREDGE CELL DIKE TO 95% OF STANDARD PROCTOR USING COMPACTION EQUIPMENT. SPREAD ASH IN 6" TO 9" LAYERS BEFORE COMPACTION. TEST FOR COMPACTION AT LEAST ONCE PER WEEK OR EVERY 5000 CUBIC YARDS OF ASH PLACED, WHICHEVER IS MORE FREQUENT, USING NUCLEAR DENSIMETER OR EQUAL TECHNOLOGY. COMPACTION TESTING OF THE FIRST 3 FEET OF THE BASE OF THE DIKE IS OPTIONAL. RECORDS OF COMPACTION TESTING MUST BE KEPT OF THE JOB UNTIL COMPLETION AND THEN FORWARDED TO JOHN ALBRIGHT, LP 2P-C.
8. LOCATION OF DREDGE POND SPILLWAYS SUGGESTED. ANY OTHER LOCATION IN THE DREDGE POND IS ACCEPTABLE.
9. FLOATING BOOM OPTIONAL FOR CONTROL OF CENOSPHERES.

ADDITIONAL NOTES
1. FOR ADDITIONAL NOTES SEE SHEET 2
2. EXISTING CONTOURS FROM MAY 20, 2004 POND SURVEY.
3. MINIMUM CLEARANCE FROM EQUIPMENT TO 161KV TRANSMISSION LINE CONDUCTORS IS 14 FEET. MINIMUM CLEARANCE FROM 161KV CONDUCTORS TO GROUND IS 26 FEET.

R0 | OCT 07 | JGA | DRD | HLP | SRC | LJP | DLL | ALFSHORF
INITIAL ISSUE PER DCA ALF-04-1001-001-R0

SCALE: 1" = 100' EXCEPT AS NOTED

YARD

EAST ASH POND
DREDGE CELL
PLAN

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.G. ALBRIGHT	D.R. DODSON	H.L. PETTY	S.R. CATHEY	L.J. PETERSON	D.L. LUNDY	

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14 | 38 | C | 10W208-1 | R 0

PLOT FACTOR:100
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.

Appendix C

Rating Curves

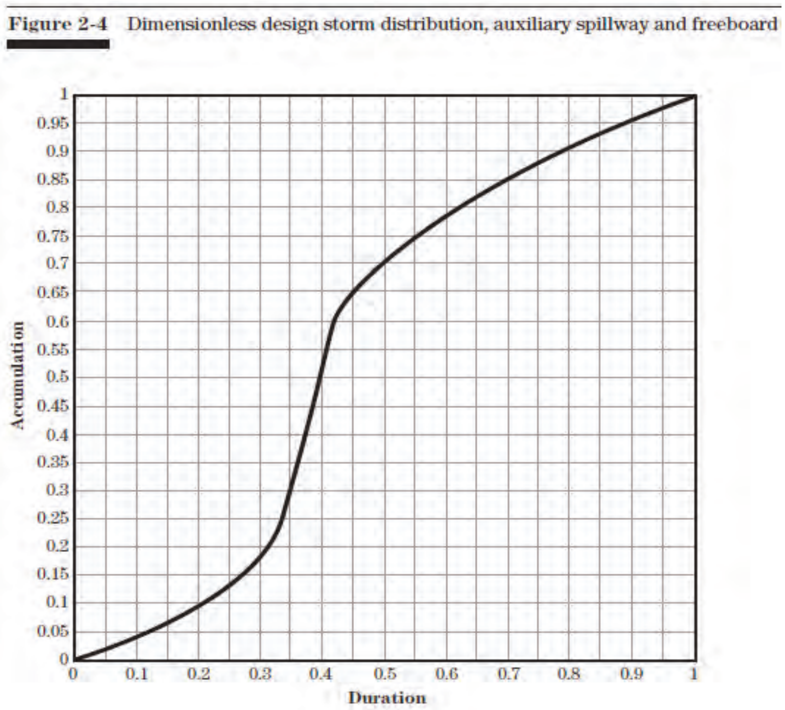
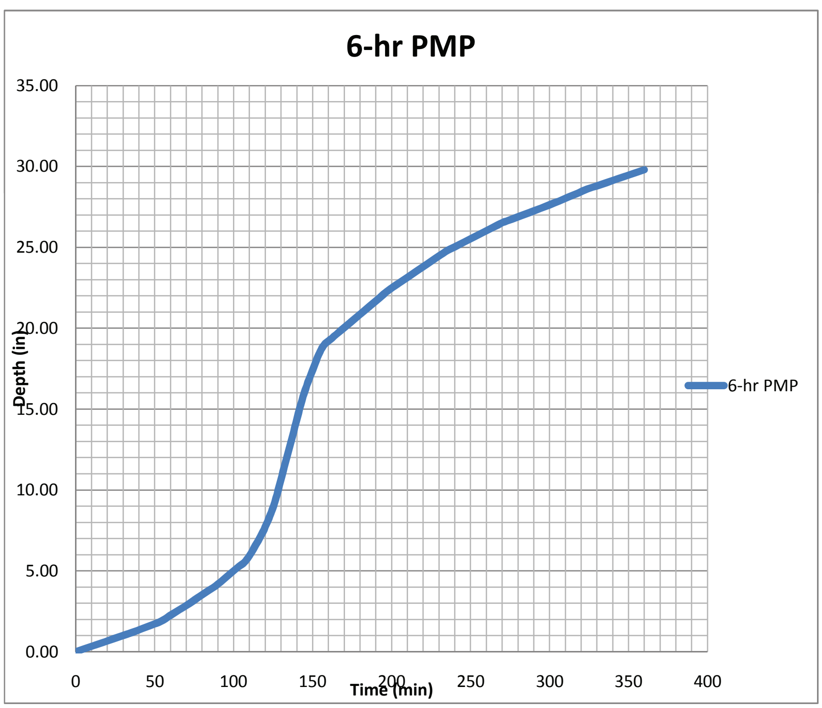


Fig 2-4 NRCS TR-60 - Eath Dams and Reseviors, July 2005



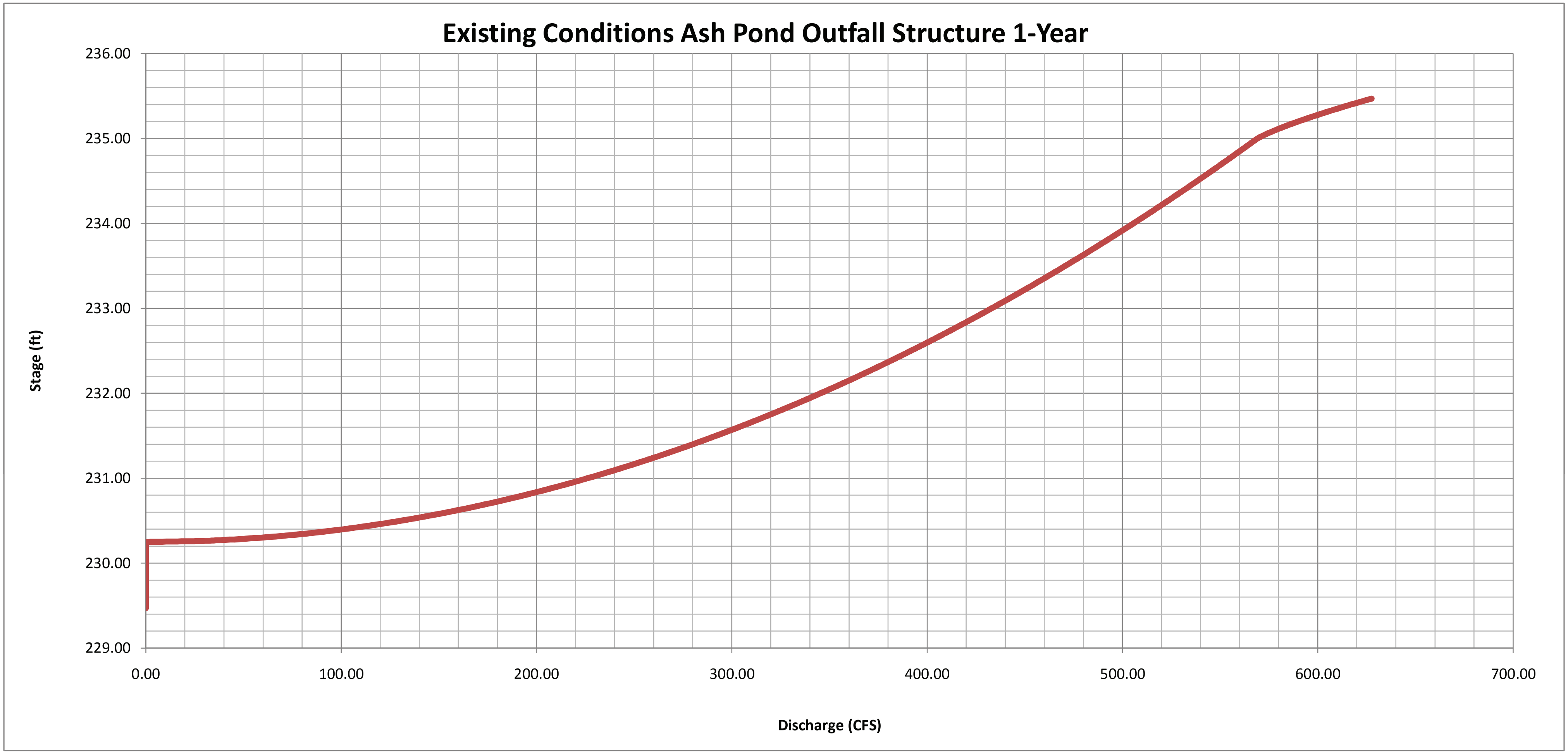
ASH POND

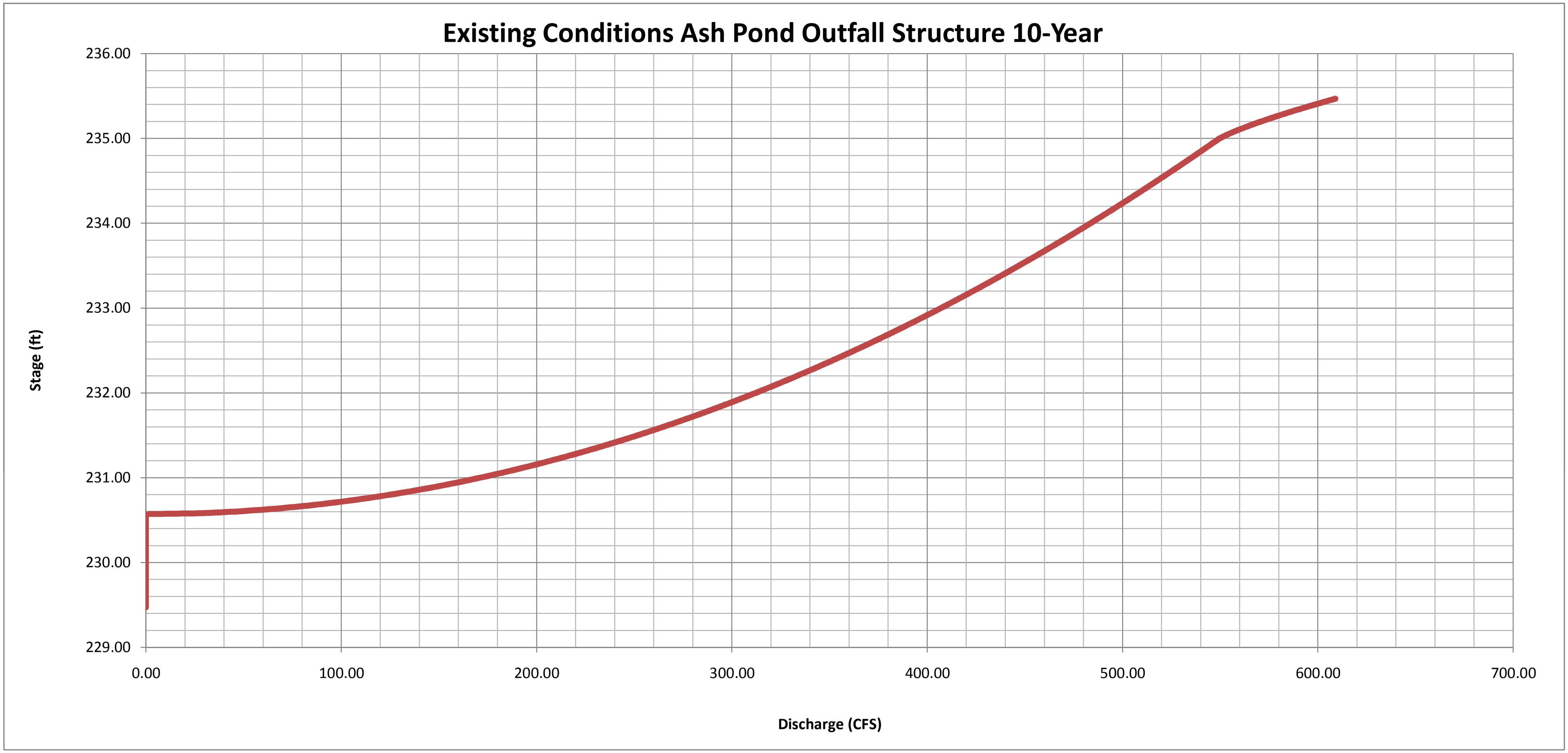
Pond Elev. (ft)	Pond Area (SF)	Pond Area (ac)	Incremental Volume (ft^3)	Cumulative Volume (ft^3)	Cumulative Volume (gal)	
211	17295	0.397036974	0	0	0	
212	44630	1.024559708	29,873	29,873	223,462	
213	66932	1.536541124	55,350	85,223	637,509	
214	90643	2.0808686	78,410	163,632	1,224,054	
215	120296	2.761605078	105,015	268,647	2,009,620	
216	164669	3.780264901	141,761	410,408	3,070,064	
217	197433	4.532419825	180,622	591,030	4,421,210	
218	276364	6.344418981	235,558	826,588	6,183,308	
219	443797	10.18813634	356,433	1,183,021	8,849,614	
220	594774	13.65407743	516,927	1,699,949	12,716,499	
221	641636	14.7298766	617,436	2,317,385	17,335,244	
222	685198	15.7299185	662,632	2,980,017	22,292,075	
223	733981	16.84981759	708,737	3,688,754	27,593,799	
224	767285	17.61436916	749,818	4,438,572	33,202,827	
225	799991	18.36519259	782,794	5,221,366	39,058,536	
226	844088	19.37751635	821,116	6,042,482	45,200,908	
227	910475	20.90154605	876,192	6,918,674	51,755,276	
228	1033310	23.72143831	970,270	7,888,943	59,013,399	
229	1226599	28.15872537	1,127,441	9,016,385	67,447,246	
230	1344424	30.86360432	1,283,771	10,300,156	77,050,521	Water Surface Elev. 229.47
231	1560480	35.82354768	1,449,654	11,749,810	87,894,688	
232	1801315	41.35233632	1,677,772	13,427,582	100,445,292	
233	1861604	42.73637577	1,829,538	15,257,120	114,131,189	
234	1910560	43.86024637	1,884,135	17,141,255	128,225,502	
235	1967353	45.16402902	1,936,941	19,078,196	142,714,824	
236	1997950	45.86643666	1,980,641	21,058,837	157,531,050	Lowest Elevation at Top of Dike

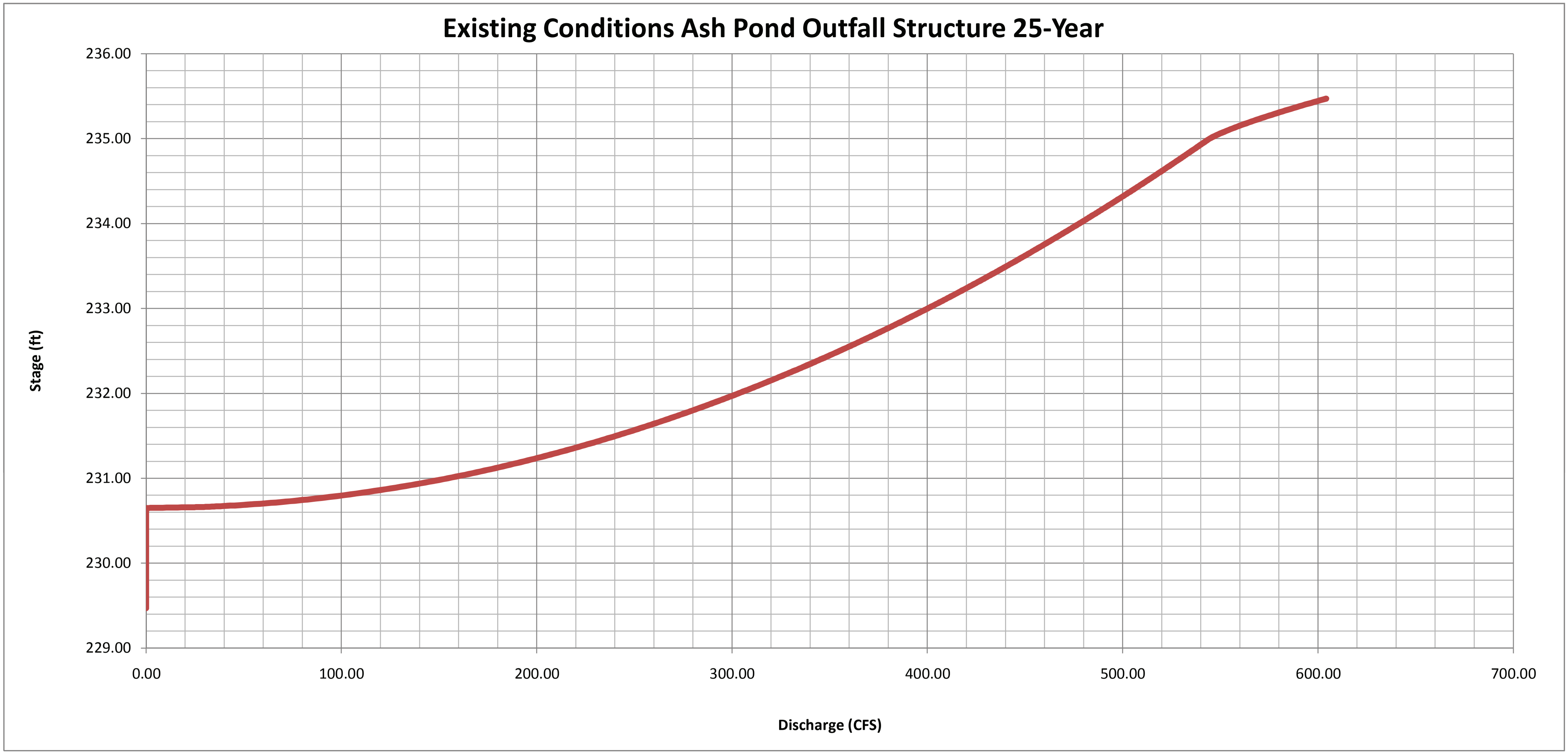
STILLING POND

Pond Elev(ft)	Pond Area (SF)	Pond Area(ac)	Incremental Volume (ft^3)	Cumulative Volume (ft^3)	Cumulative Volume (gal)	
215	67532	1.550315173	0	0	0	
216	133053	3.054464325	98,360	98,360	735,783	
217	179384	4.118073463	155,487	253,846	1,898,903	
218	201521	4.626267015	190,154	444,000	3,321,354	
219	217734	4.998464787	209,365	653,365	4,887,512	
220	230387	5.288936532	223,806	877,171	6,561,695	
221	241557	5.545363418	235,713	1,112,884	8,324,952	
222	251060	5.763521404	246,046	1,358,930	10,165,503	
223	260148	5.972152339	255,334	1,614,264	12,075,534	
224	269519	6.187280034	264,554	1,878,818	14,054,534	
225	277909	6.379887158	273,428	2,152,246	16,099,921	
226	287725	6.605230606	282,519	2,434,765	18,213,309	
227	297136	6.821276571	292,124	2,726,889	20,398,551	
228	307003	7.047790813	301,753	3,028,642	22,655,819	
229	317167	7.28112321	311,758	3,340,400	24,987,930	
230	325001	7.460966382	320,754	3,661,154	27,387,334	Water Surface Elev. 229.47
231	331738	7.615626	648,199	4,309,353	32,236,200	
232	339008	7.782521565	335,030	4,644,382	34,742,396	
233	346770	7.960711851	342,537	4,986,920	37,304,754	
234	355138	8.152813926	350,593	5,337,513	39,927,375	
235	365097	8.38144019	359,744	5,697,258	42,618,450	
236	377459	8.665231521	370,888	6,068,146	45,392,886	Lowest Elevation at Top of Dike

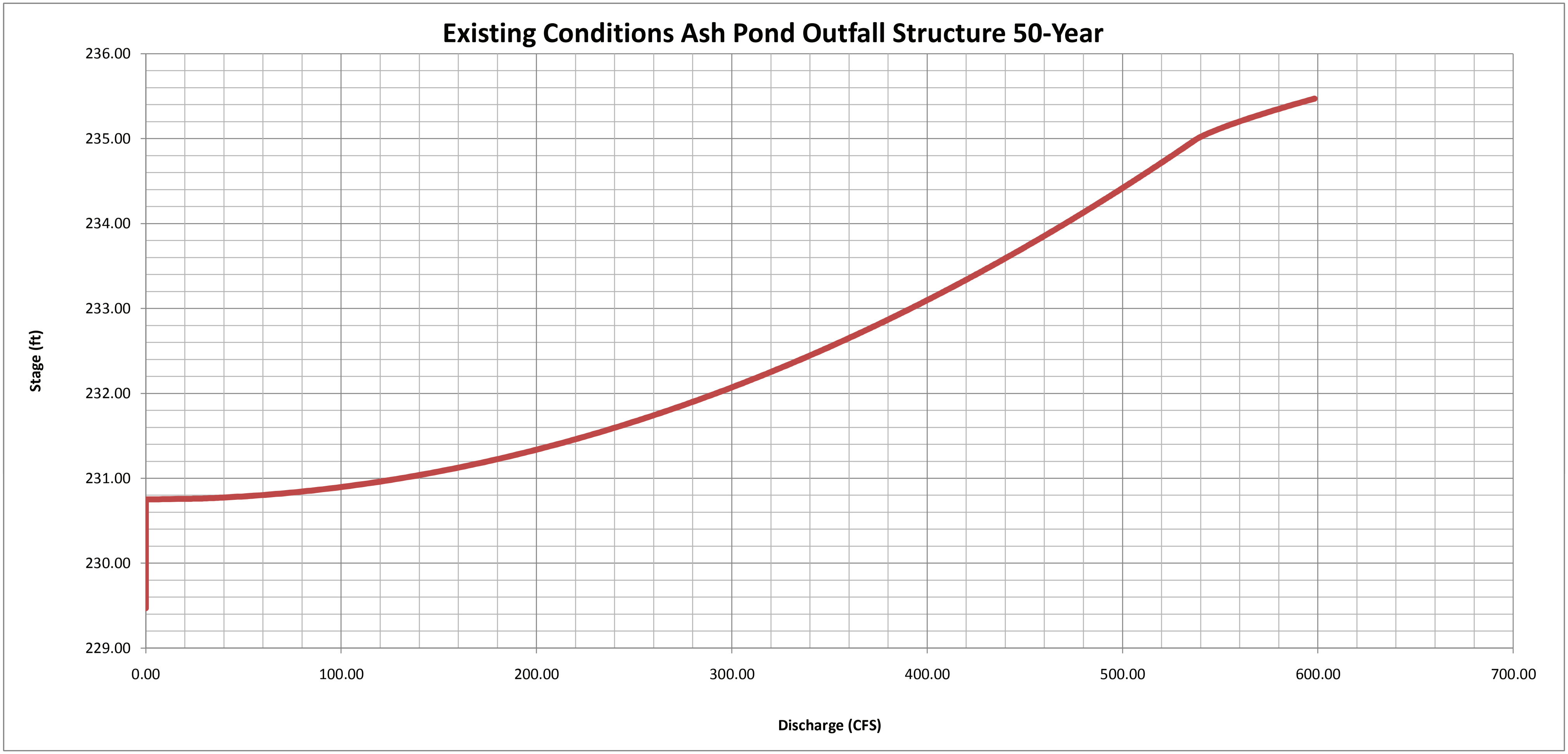
		Total Free Water Volume	Storage Capacity	Total Capacity
Ash Pond (gal)		67,447,246	90,083,804	157,531,050
Stilling Pond (gal)		24,987,930	20,404,957	45,392,886
Total (gal)		92,435,176	110,488,761	202,923,937
Permit Requirement (gal)		32,000,000		


Existing Conditions Ash Pond Outfall Structure 1-Year
Stage (ft)
236.00
235.00
234.00
233.00
232.00
231.00
230.00
229.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)

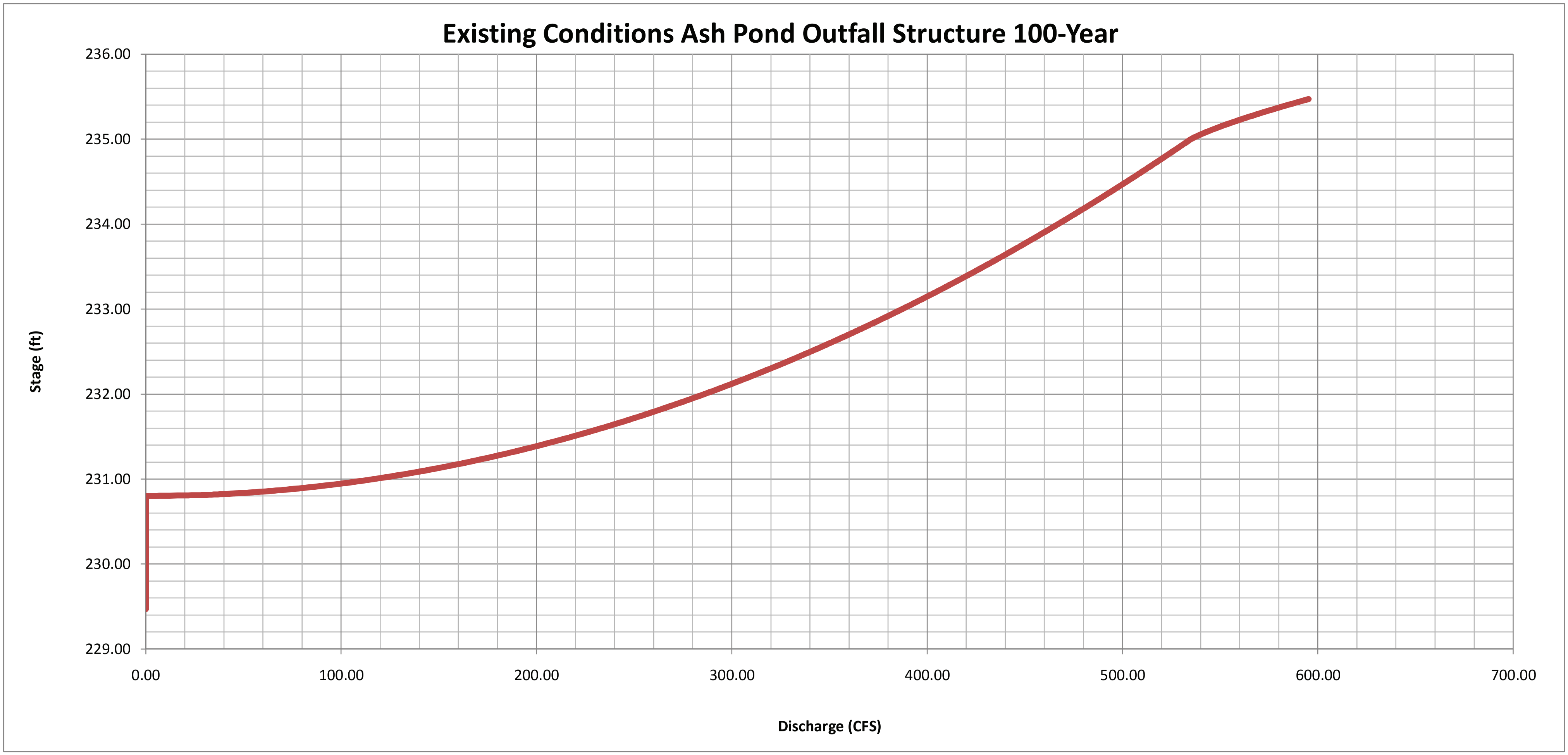

Existing Conditions Ash Pond Outfall Structure 10-Year
Stage (ft)
236.00
235.00
234.00
233.00
232.00
231.00
230.00
229.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)

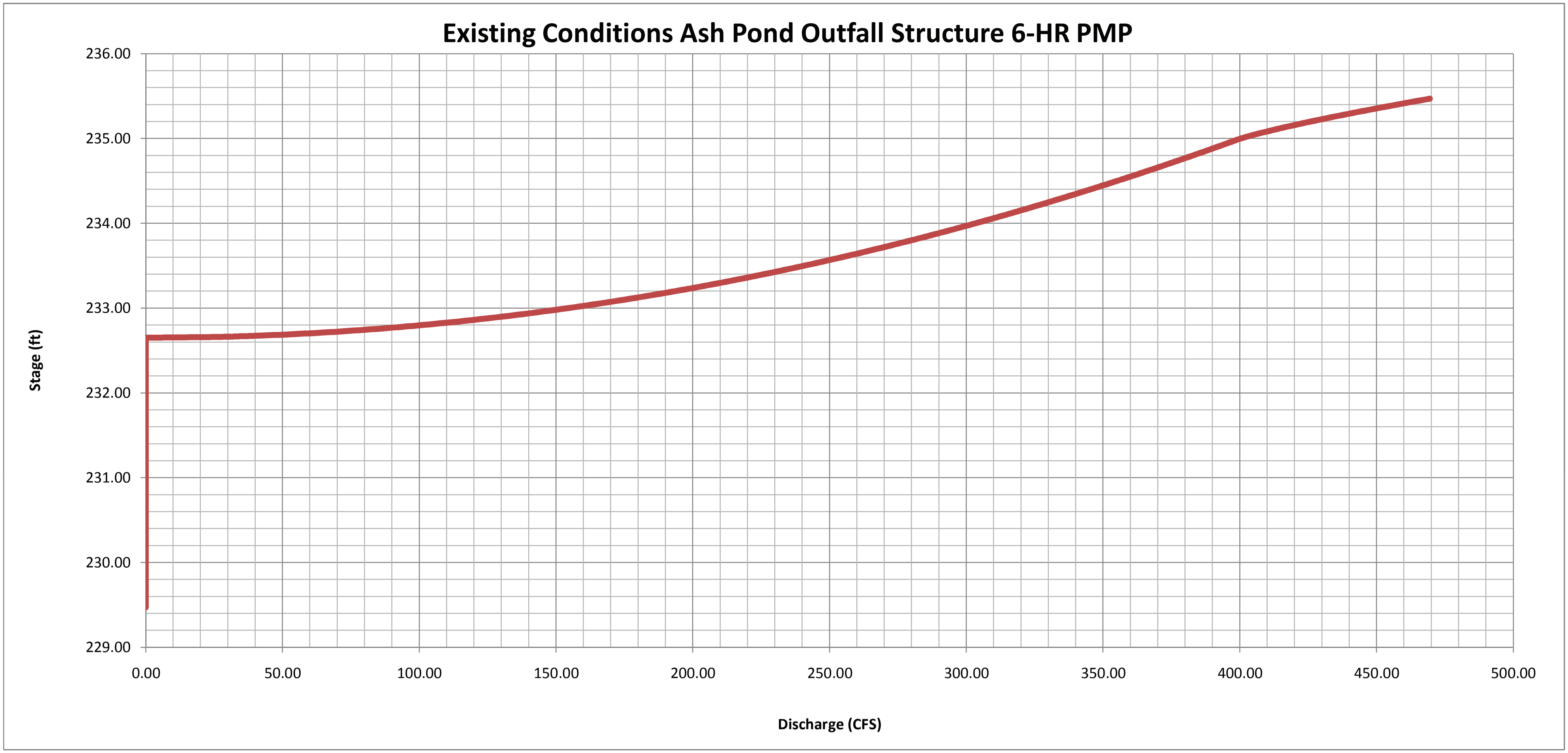


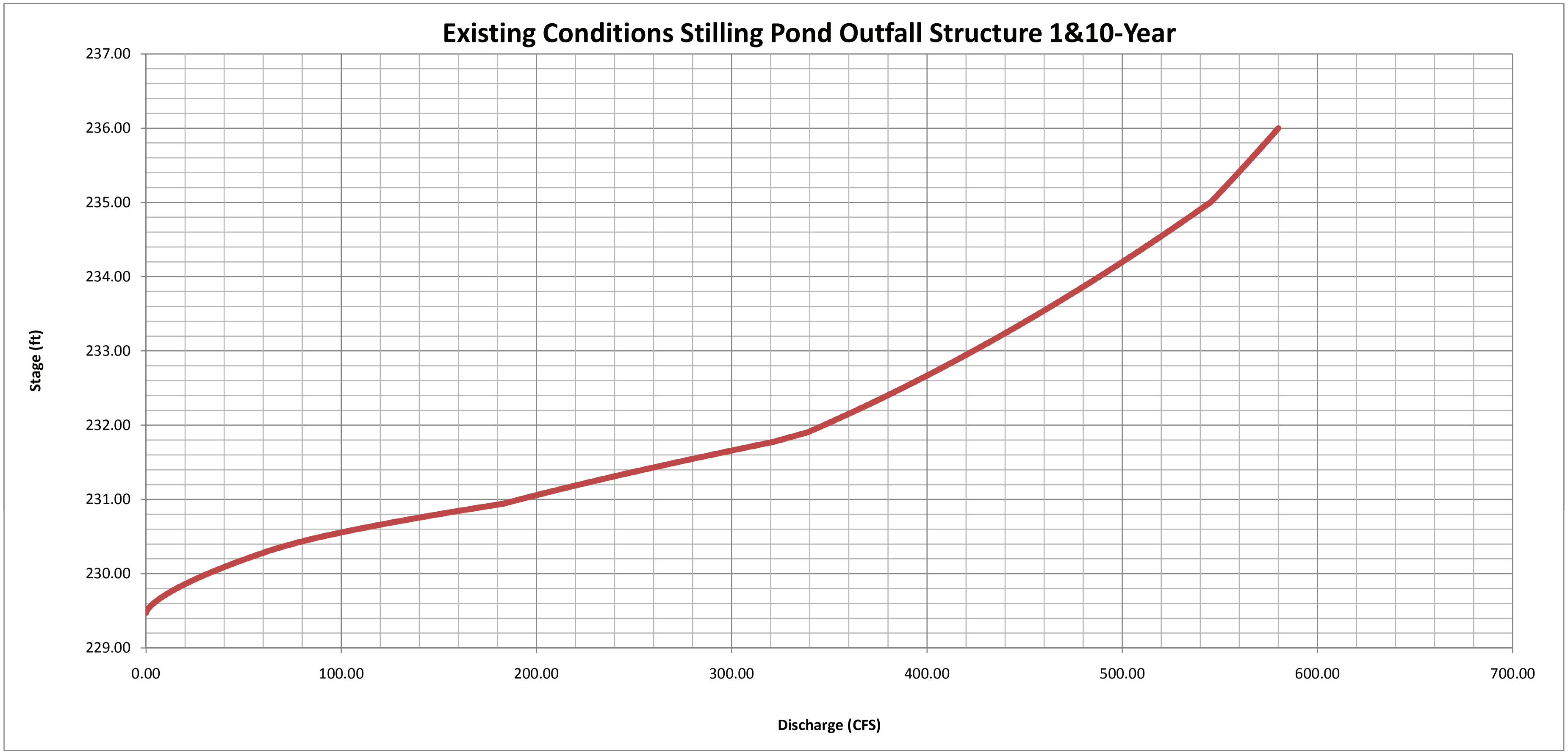
Existing Conditions Ash Pond Outfall Structure 25-Year
Stage (ft)
236.00
235.00
234.00
233.00
232.00
231.00
230.00
229.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)



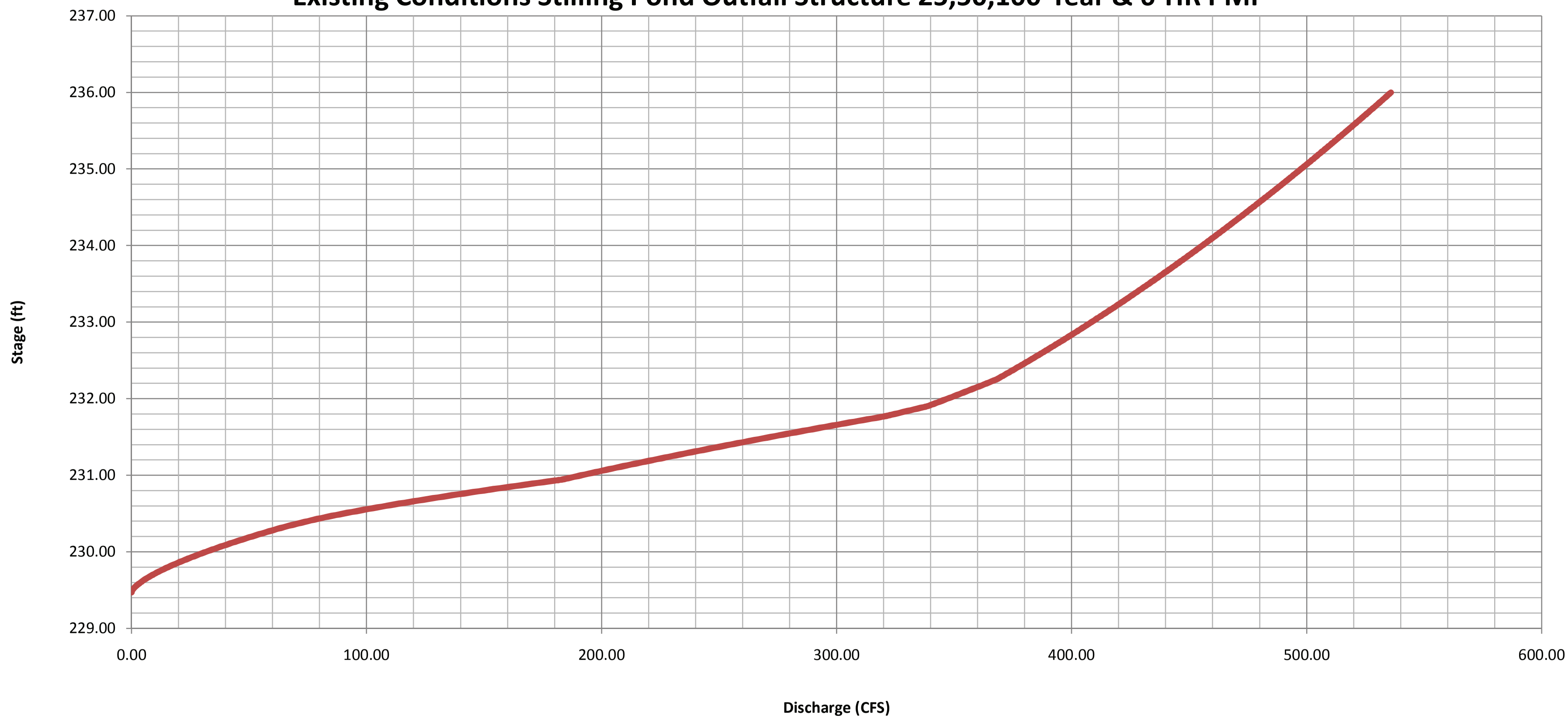
Existing Conditions Ash Pond Outfall Structure 50-Year
Stage (ft)
236.00
235.00
234.00
233.00
232.00
231.00
230.00
229.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)


Existing Conditions Ash Pond Outfall Structure 100-Year
Stage (ft)
236.00
235.00
234.00
233.00
232.00
231.00
230.00
229.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)


Existing Conditions Ash Pond Outfall Structure 6-HR PMP
Stage (ft)
236.00
235.00
234.00
233.00
232.00
231.00
230.00
229.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
Discharge (CFS)


Existing Conditions Stilling Pond Outfall Structure 1&10-Year
237.00
236.00
235.00
234.00
233.00
232.00
231.00
230.00
229.00
Stage (ft)
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)

Existing Conditions Stilling Pond Outfall Structure 25,50,100-Year & 6-HR PMP



Appendix D

TVA Survey Data

Doc 14: Pseudo-Static Slope Stability Analysis Summary - East Ash Pond

Enclosure B

Pseudostatic Analysis Results

Allen Fossil Plant - Pseudostatic Stability Analysis Summary

CCP Disposal Facility		Cross-Section Information		500 yr Return		FS = 1 Data		Mitigation and Improvement Activities Since January 2009 As-Found Conditions
Name	Type	Section Analyzed	Section Location	PGA (g)	Factor of Safety	PGA (g)	Approx. Return Period (yrs)	
East Active Ash Pond	Impoundment	B	North Side	0.127	0.7	0.06	250	No mitigation activities were necessary for the north dike of the stilling pond. As-found static FS was sufficient. Section B represents current and as-found conditions.
East Stilling Pond	Impoundment	D	East Side		0.9	0.09	370	Pool level in stilling pond lowered to El. 226. Section D represents lowered pool.

Notes:

1) Acceleration is from March 28, 2011 TVA region-specific seismic hazard study performed by AMEC Geomatrix, Inc. (total hazard).
2) Refer to layout plan for locations of cross-sections.
3) Stability models reflect current ground lines and recent improvements/mitigations using either construction drawings or as-built information, as appropriate.
4) Liquefaction was not considered in this analysis.

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

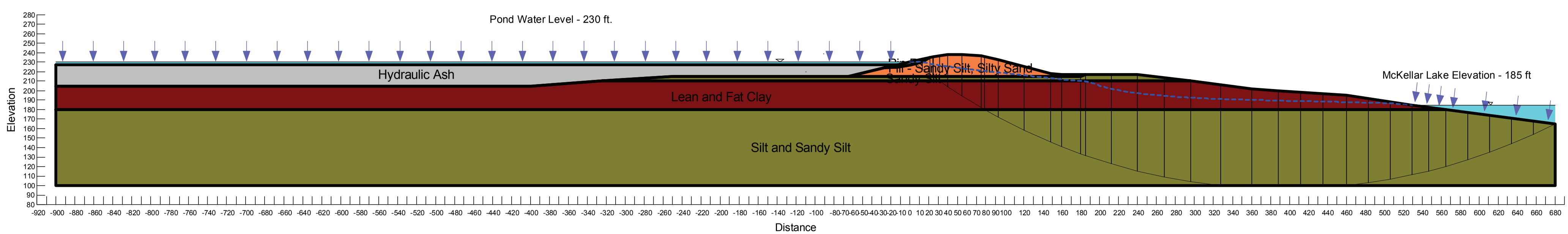
Section BB - East Active Ash Pond
Allen Fossil Plant
Memphis, Tennessee

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	200 psf	22 °
Rip Rap	115 pcf	115 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	200 psf	12 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	10 °
Lean and Fat Clay	115 pcf	110 pcf	400 psf	12 °
Sandy Silt	125 pcf	125 pcf	200 psf	22 °

Factor of Safety: 0.73

Horizontal Seismic Coefficient Kh = 0.127 g
500-year Return Period Event



Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section DD - East Stilling Pond
Allen Fossil Plant
Memphis, Tennessee

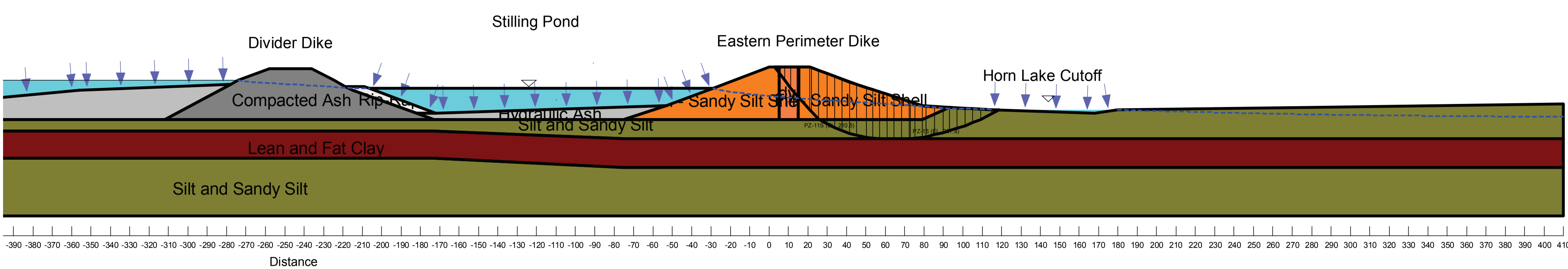
Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt Shell	124 pcf	124 pcf	200 psf	22 °
Fill - Sandy Silt Core	125 pcf	125 pcf	200 psf	22 °
Lean and Fat Clay	115 pcf	110 pcf	400 psf	12 °
Silt and Sandy Silt	115 pcf	110 pcf	200 psf	12 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	10 °
Compacted Ash	123 pcf	110 pcf	0 psf	30 °
Rip-Rap	115 pcf	115 pcf	0 psf	38 °

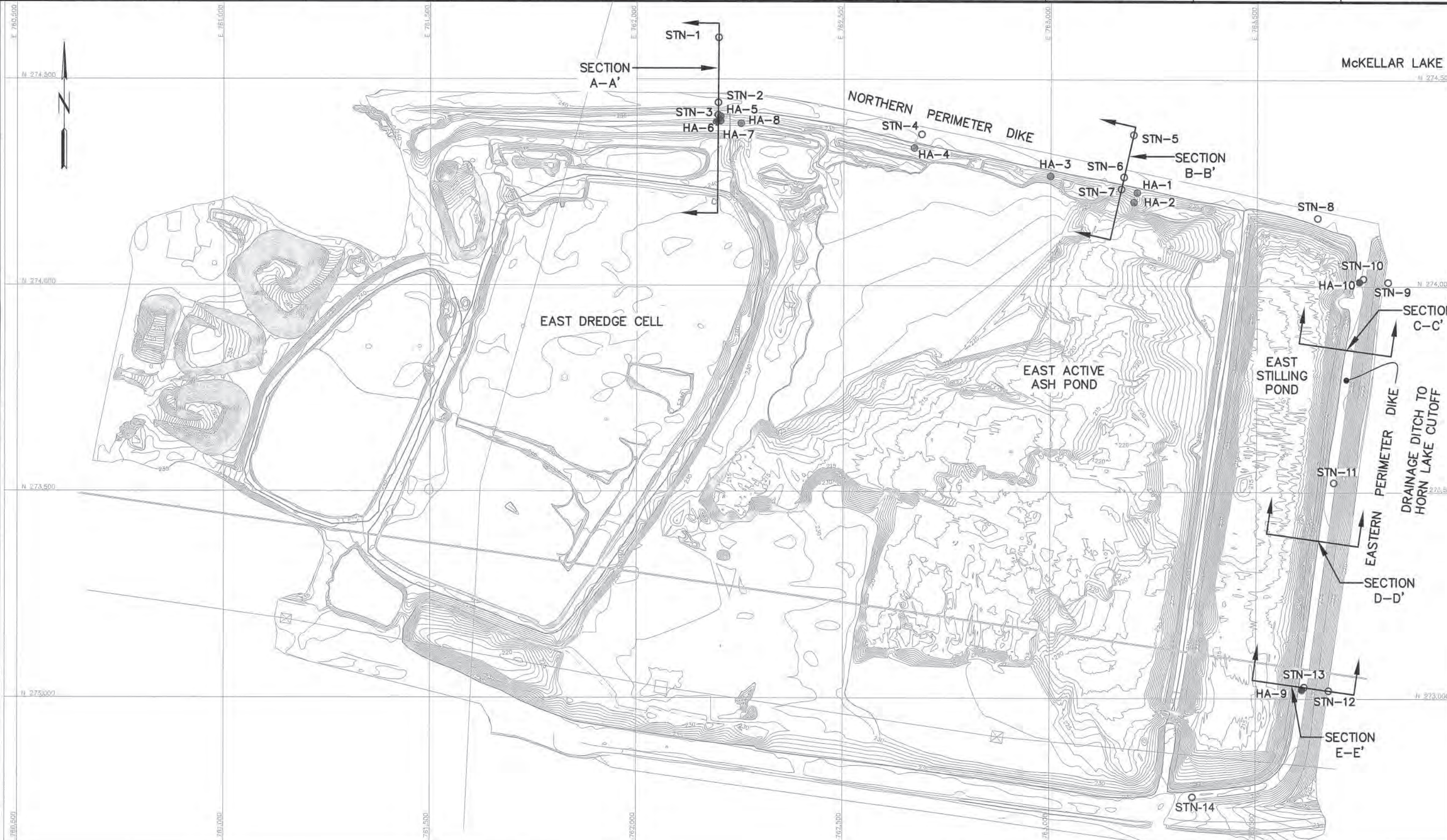
Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Deep Failure Circle

Factor of Safety: 0.90

Horizontal Seismic Coefficient Kh = 0.127 g
500-year Return Period Event





LEGEND

- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests and Location of Piezometers
- Hand Auger Boring

NOTES:

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

BORING LOCATION TABLE

BORING	NORTHING	EASTING	ELEV. (FT.)
STN-1	274600.73	762196.97	215.3
STN-2	274443.30	762195.73	238.8
STN-3	274413.31	762195.54	234.6
STN-4	274366.97	762687.88	237.5
STN-5	274366.34	763200.60	217.5
STN-6	274264.03	763177.15	238.3
STN-7	274234.70	763171.06	235.6
STN-8	274165.16	763646.95	237.5
STN-9	274009.16	763820.47	221.2
STN-10	274018.24	763758.37	236.9
STN-11	273523.29	763688.16	237.8
STN-12	273018.83	763676.83	216.7
STN-13	273020.21	763618.05	236.9
STN-14	272761.34	763347.91	236.5

HAND AUGER BORING LOCATION TABLE

BORING	NORTHING	EASTING	ELEV. (FT.)
HA-1	274226.34	763209.32	235.7
HA-2	274202.98	763201.48	230.5
HA-3	274265.91	762999.17	234.2
HA-4	274333.93	762669.73	233.6
HA-5	274409.74	762201.44	233.7
HA-6	274395.67	762191.04	232.5
HA-7	274398.58	762201.29	232.4
HA-8	274392.70	762251.17	232.1
HA-9	273021.67	763612.37	237.0
HA-10	274010.59	763748.55	237.2

RECORD DRAWING

GRAPHIC SCALE: 1" = 100'
CONTOUR INTERVAL = 1'
50 0 100 200 FEET

For Supporting Design Calculations See FPGALFFESCDX00000020100001

2/4/2010

Stantec

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

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	02/04/10 RECORD DRAWING	PVK	PS	SF	HRA	HRA	PVK	TJ	–	–

SCALE: 1"=100' EXCEPT AS NOTED

YARD
—

GEOTECHNICAL EXPLORATION
EASTERN PERIMETER DIKE
BORING LAYOUT

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

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 02/04/10 | 38 | C | 10W502-01 | R 0

PLOT FACTOR:XX
TJ

C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC | 0
TASK COMPLETED BY: | REV NO.

38 C 10W502-01

Doc 15: Allen Fossil Plant Procedures

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1.0 PURPOSE

The purpose of this document is to define the procedures for handling production ash at Kingston Fossil Plant (KIF). This document defines the roles and responsibilities of all parties, active permits, operational requirements, required documentation, and general procedures for the daily operations of the Ballfield Interim Ash Staging Area and the Peninsula Site at KIF.

2.0 OPERATIONS

Operations at ALF consist of sluicing material the East Ash Pond. Material is excavated and hauled to the Pidgeon Industrial offsite landfill where it is used as structural fill. The operations are described in more detail below.

2.1 Dredge Cell

Fly ash and boiler slag are wet sluiced to a rim ditch in either the East Dredge Cell (EDC) or West "Mini" Dredge Cell (WDC). The CCP material is then excavated from the rim ditch using a long reach excavator where it is stockpiled in rows and allowed to dewater. Once a sufficient amount of material has dewatered, it is loaded into dump trucks and hauled to the offsite landfill. Hauling operations are discontinued during inclement weather when ash is unable to dewater to a suitable moisture content for hauling and placing. Specific operations are determined by the contractor. The current contractor, Trans-Ash, developed an operations plan for the east disposal area which is included under Section 1101 – Operations Plans.

2.2 Offsite Hauling

Material that has been excavated and allowed to dewater is loaded into trucks suitable for on-road travel and transported to the offsite structural fill location. The haul route is shown on the Trans-Ash 2011 operations plan included in Section 1101.

All posted speed limits are to be observed and are strictly enforced. This includes a speed limit of 20 MPH on all roads within the plant, unless otherwise posted. Dust and debris from haul trucks is to be cleaned from plant roads using a sweeper truck. Dust suppression is to be used on all ash/gravel haul roads to reduce fugitive dust.

3.0 GENERAL MAINTENANCE

3.1 Mowing and Vegetation Removal

The slopes shall be mowed to reduce the opportunity for tree growth and allow for visual inspection and observations. The slopes shall be mowed to a height of no less than 3-inches and no more than 12-inches tall with a minimum of three mowings per growing season. If woody growth is detected, it shall be removed.

3.2 Tree Removal

At the location of all trees which are greater than two (2) inches in base diameter, remove the tree and grub to the bottom of the root system at least twelve inches below grade. Backfill the excavations with a similar slope material and compact with a manual tamper. See the *General Guidelines for Tree Removal* in Section 1104.

3.3 Fertilize and Reseed Bare Areas

Prepare all regraded and exposed areas for seeding by disking the surface three (3) inches in depth. Apply fertilizer (600 lbs/acre), seed mixture (as directed by facility engineer), mulch (1.5 tons/acre), and netting (0.75 inch by 1.0 inch mesh openings) with pins to the prepared areas. Other application rates may be requested by the facility engineer. The seed mixture utilized depends on the seeding application period and location.

3.4 Erosion Rill and Gully Repair

The cause of erosion shall be identified before beginning repair. Causes of erosion include poor vegetative cover, breach of a hydraulic structure or ditch, long or steep slopes and concentrated flows. Gullies or rills shall be graded, re-seeded and covered with an erosion control blanket. If the problem is ongoing, then consider shaping the gully and forming a ditch lined with riprap. See the *General Guidelines for Rill and Gully Erosion Repair* in Section 1104.

3.5 Animal Burrow Repair

Animal burrows provide a potential location for seepage and piping to occur. In order to repair animal burrows, locate burrows, trap animals, and relocate or dispose of animals as directed. See the *General Guidelines for Animal Burrow Repair* in Section 1104.

3.6 Wave Wash Riprap Protection

Wave erosion shall be controlled on TVA facilities to maintain the integrity of dams and dikes. When present, wave wash erosion typically occurs along interior slopes of dikes near pool level. If left unrepaired, erosion can expand, deepen, and can eventually lead to interior slope sloughing. General guidelines for repair of wave erosion using riprap are provided below. See the *General Guidelines for Wave Wash Erosion Repair & Rip-rap Protection* in Section 1104.

3.7 Rutting Repair

Rutting due to maintenance vehicle traffic can commonly occur along dike crests, slopes, and other areas at TVA fossil plant facilities. It is typically caused by near-surface dike crest materials which have become weak over time because of moisture infiltration. Repeated passes of maintenance traffic/equipment over weakened materials can lead to rutting. The *General Guidelines for Rutting Repair* is provided in Section 1104. The attached guide is intended to be applicable for minor to moderate cases of rutting, and generally consists of reworking the upper portion of the affected area, followed by re-shaping to provide positive surface drainage. Where widespread or extensively deep rutting has occurred or is recurring, case-specific engineering evaluations may be needed.

4.0 INSPECTIONS AND REPORTING

TVA conducts daily, weekly, quarterly, and annual inspections of the active ash disposal areas at JOF. Following these inspections, reports are completed and filed. Any deficiencies requiring corrective actions/maintenance are reported and tracked using Maximo. A seepage action plan has been developed to track seeps and determine the level of repair necessary. Signs have been placed at all known seeps and pipe penetrations to aid during inspections.

4.1 Daily Field Reports

The daily field reports are used to determine minor deficiencies in operations. These are compiled by the contractor into a weekly report. These two reports are described below.

a. **RHO&M Daily Field Report** - Contractor

The purpose of the **RHO&M Daily Field Report** is to list deficiencies found beyond routine maintenance issues such as seeps or boils, freeboard issues, sloughs, or spillway issues. Also, daily production and activities conducted shall be tracked. The RHO&M Daily Field Repot is included in Section 1105.

b. **Ash Haul Operations Checklist** – Field Supervisor

The **Ash Haul Operations Checklist** is the responsibility of the field supervisor. When not onsite, the field supervisor should delegate a representative of the contractor to complete the form. The form is used to rate the effectiveness of various haul route requirements. The form is included in Section 1105.

c. **RHO&M Weekly Field Report -** Contractor

The **RHO&M Weekly Field Report** summarizes the daily activities for the week based on the daily field report. The Weekly Field Report is included in Section 1106.

4.2 Weekly Inspections

The active ash disposal area shall be inspected weekly by the Field Supervisor. The inspection shall be recorded using the **Weekly Facility Observation Form** included in Section 1107. The dikes shall be inspected for cracks, rutting, settlement, erosion, sloughs, seepage, vegetation, animal burrows, sinkholes, and other deficiencies. Deficiencies noted in previous inspections shall be checked if repairs have not yet been implemented.

4.3 Monthly Inspections

The active ash disposal area shall be inspected monthly by the Construction Manager. The inspection shall be recorded using the **Monthly/Quarterly/Special Facility Inspection Form** included in Section 1108. The dikes shall be inspected for cracks, rutting, settlement, erosion, sloughs, seepage, vegetation, animal burrows, sinkholes, and other deficiencies. Deficiencies noted in previous inspections shall be checked if repairs have not yet been implemented.

4.4 Quarterly Inspections

Quarterly inspections shall be conducted once every three months. The inspection shall be recorded using the **Monthly/Quarterly/Special Facility Inspection Form** included as in Section 1108. The quarterly inspection shall be led by the RHOM Program Manager. The RHOM team including the construction manager and field supervisor shall walk the active ash disposal areas, looking for seeps, sloughs, animal burrows, and any other deficiency which could affect the integrity of the facility. All deficiencies shall be flagged, surveyed, and photographed. A report shall be compiled with all deficiencies, locations, photos, and recommendations for repairs. Areas requiring engineering recommendations shall be sent to CCP Engineering or a geotechnical engineer to provide recommendations for the repair.

4.5 Annual Inspection

Once a year, an annual inspection shall be performed under the ownership of CCP Engineering. This shall be performed by a qualified geotechnical engineer. The purpose of the annual inspection is to inspect both the active and inactive ash disposal areas for structural integrity and make recommendations for any deficiencies noted. Photos shall be taken to describe the existing conditions at the time of the inspection, as well as to show the deficiencies found.

4.6 Inspection Deficiencies

Each potential deficiency encountered as a result of an inspection should be recorded in accordance with the CPP RHO&M Work Control procedure (FGDC-SPP-07.007), Section 3.2 E. Deficiency Monitoring. Recorded deficiencies should be tracked in the Maximo system as “Other” work orders with a work type of “OTH.”

4.7 Seepage Monitoring

The Seepage Action Plan for Allen dated June 25, 2010 shall be followed as planned to observe, document, and remediate potential seepage areas. The seepage action plan shall be routinely implemented and updated at Johnsonville. This requires stockpiles of aggregate, sandbags and culvert pipe and updates to the seepage log when evidence of seepage is observed. Signs shall be installed at any new seepage areas.

5.0 PROJECT MANAGEMENT

The following forms are included to assist in project management requirements.

a. Project Startup Checklist

The purpose of the project startup checklist is to define the roles and responsibilities of the various groups within TVA and to insure that the required tasks are completed during the project planning stage. It also includes the required steps to be completed at project completion. The project startup checklist is included in Section 1109.

b. RHO&M Additional Work/ Change Order Form

The additional work/ change order form shall be used when the scope of work changes for the routine handling contractor. The form addresses the reason for the change, who initiated the change, who needs to be notified, and the financial impacts of the change. The additional work/ change order form is included in Section 1110.

c. Environmental Review (NEPA)

Procedures were developed to provide guidance for compliance with the National Environmental Policy Act (NEPA). These procedures for the environmental review of a project are included in Section 1111.

6.0 Work Control Process

The work control process was developed to provide guidance for implementing a work control process that maximizes safety, facility reliability, work productivity, and risk assessment and management. The procedures describe the process by which maintenance and modification work activities are identified, planned, scheduled, monitored, and completed. It describes the work order process using the Maximo system. The work control process is included in Section 1112.

7.0 Clay Dike Restrictions

The clay dike study report is due September 2, 2011. A summary of the results should be discussed here and included in Section 1113.

8.0 Records

In accordance with the TVA Master Programmatic Documents, the Maximo database shall be used to track all inspection, monitoring, reporting, and maintenance recommendations. Final inspection reports and instrumentation data collection and analysis will be placed in the TVA BSL.

9.0 Subsections

Section 1101 – Operations Plan – Trans-Ash 2011

Section 1104 – General Maintenance Guidelines

Section 1105 – RHO&M Daily Field Report and Haul Road Inspection

Section 1106 – RHO&M Weekly Field Report

Section 1107 – Weekly Facility Observation Form

Section 1108 – Monthly/Quarterly/Special Facility Inspection Form

Section 1109 – Project Startup Checklist

Section 1110 – RHO&M Additional Work/ Change Order Approval Form

Section 1111 – NEPA Process

Section 1112 – CCP RHO&M Work Control Procedures

Section 1113 – Clay Dike Restrictions

Trans-Ash – 2011 Operations Plan for TVA Allen Plant Ash Pond & Structural Fill

Revised – March 10, 2011

Objective:
This plan is intended to provide a clear description of current and planned operations for time period described and as necessary to accommodate the recent changes to operating conditions as a result of the Process Water Repair Project. The purpose is to provide an effective planning tool that ensures a mutually agreed to schedule and methodology while maximizing efficiency and mitigating risks associated with ash excavation, hauling and placement operations.

Description of Activities through Winter 2011:

During this period, Trans-Ash will continue construction of the Levee across Dredge Cell #1 (DC1) for the Emergency Process Water Response. All production ash has temporarily been sluiced into the West "Mini" Dredge Cell (WDC) to allow for construction activities on the levee and manhole connections. Trans Ash will continue the following tasks until production can be turned over into the existing Rim Ditch Operation in (DC1) after the connections have been made to the Manhole:

- Dip production ash up to (7) days per week in efforts to maximize the capture rate.
- Utilizing dewatered production ash to pad across the (WDC) as a contingency to our operating plan described herein.

Description of Activities Spring 2011 through Fall 2011:

Trans Ash has installed a 30" culvert pipe under the proposed temporary sewer line in order to maintain and finish the working pad established in 2010. Trans Ash plans to turn the sluice water back into Dredge Cell 1 in order to operate from our existing working pad and to maximize the capture rate of the ash. In order to accommodate the recent modifications to Dredge Cell 1, Trans Ash plans to install a culvert pipe through the South end of the new levee to ensure equal water pressures from either side.

Production ash will continue to flow into the (DC1) Rim Ditch for dipping and dewatering. When the quantity of dewatered ash is sufficient enough to justify hauling, broker trucks will be brought in to transport the ash to the beneficial use site for placement per the grading plan. Routine Handling operations will continue year round with a hauling period during the months of April through November. When inclement weather has set in, hauling operations will temporarily shut down; however, routine operations will continue at the pond on a daily basis to include using a portion of the production material to continue padding across (DC1). Trans

Ash will monitor weather conditions and haul dewatered material throughout the winter months as permissible.

At the structural fill site, the ash, sand, and soil cover will be placed as indicated on the plans. Also, closure operations will continue to provide finished product wherever possible. This includes silt fence maintenance, completion of slope letdowns, ditch grading, grading of fill area, clearing and grubbing, sand & soil cover, and seeding of all areas at final grade.

Current Plant Production:

- Plant production = **175,000 CY** dewatered ash per year.

Safety Guidelines:

Dike Inspections:
- Trans Ash to perform daily inspections of pond levees and dikes and perform quarterly repairs as needed.

Truck Loading:
- Watch for cracks in the ash surface. If tension cracks appear, move the machine at least 10-feet behind the cracking zone to more stable ground.
- Do not swing the excavator bucket over the truck cab at any time.
- Excavator shall maintain a safe slope in order to avoid undercutting the loading machine and creating an unstable condition.
- Keep trucks on the designated proven haul road at all times. If haul roads start to rut, or pump, move truck traffic to a more stable location or stop hauling until the affected area can be repaired.
- When excavating near water, swing with cab away from the water whenever possible.

Pond Gloving & Dipping:
- Pad lift shall be a minimum of 12-inches.
- Trucks must be kept in stable areas that have been checked by excavator or dozer.
- If the pond surface begins to pump, stop pond prep operations until the pond heals.
- Ensure material used for padding is adequately dewatered before placement across the pond area.

Doc 16: Allen Fossil Plant General Maintenance Guidelines

1.0 GENERAL MAINTENANCE GUIDELINES

1.1 GENERAL GUIDELINES FOR REPAIR OF ANIMAL BURROWS

1.1.1 IDENTIFICATION

Animal burrows are relatively common along slopes of dams and dikes. If left untreated, these burrows can result in the creation of seepage paths through the embankment. Additionally tunnels may eventually collapse resulting in surface irregularities in the embankment. General guidelines for repair of animal burrows are provided below. However, if the burrow extends more than three (3) feet below the embankment surface or extends across a dam, the repair of these features should be evaluated by a geotechnical engineer on a case-by-case basis so that appropriate recommendations can be made.

1.1.2 GUIDELINES FOR BURROW REPAIR

It is recommended that shallow animal burrows (up to 3 feet) shall be repaired with surface treatment methods as follows:

- Animals shall be captured and removed from the area. It is recommended that a local conservation representative be consulted prior to this action.
- The animal burrow shall be excavated and cleaned of excess soil along its pathway up to a depth of 3 feet. With this type of repair, an isolated excavated area of the embankment is exposed.
- The excavated area shall be backfilled with compacted cohesive material.
- If the burrow extends more than three feet into the embankment, a geotechnical engineer shall further evaluate the burrow depth and recommend a deep burrow treatment method or other exploratory methods.
- One possible method which may be recommended to treat a deep burrow can consist of a special grout (flowable fill) pumping system with a hose inserted into the burrow.

Ultimately, these repairs will not prevent rodents from creating new burrows within dam embankments. Accordingly, continual efforts must be made to discourage rodent activity. Mowing of vegetation on the slopes / crest of the embankment and trimming of water-side vegetation at regular intervals will tend to discourage rodents from re-establishing burrows along the dike and will allow timely observation of new activity if it occurs.

1.2 GENERAL GUIDELINES FOR REPAIR OF RILL AND GULLY EROSION

1.2.1 IDENTIFICATION

Erosion features can commonly occur along dike slopes, dry stack slopes, or other sloped surfaces at TVA fossil plant facilities. Erosion normally appears in the form of rills (shallow channels) and gullies (larger and deeper eroded channels) and is formed by concentrated flow of storm water runoff, especially on bare slopes or where vegetation is sparse. If left untreated, the rills and gullies can progress in size and could lead to slope instability or other adverse issues. General guidelines for the repair of rills and gullies are provided below. The following guide is intended to be applicable to minor to moderate cases of rill/gully erosion. Where widespread or extensively deep gullies have formed or are recurring, case-specific engineering evaluations may be needed.

1.2.2 GUIDELINES FOR RILL AND GULLY EROSION REPAIR

Shallow Rills and Gullies:

For cases where shallow rills and gullies are present, repair should consist of the following:

- Dump and spread clay soil to fill, re-grade, and shape affected areas to conform to original ground line. Tracking and blading material with a dozer should be performed until the original ground line is reformed and material is reasonably compacted.

- Repaired areas should be seeded to re-establish vegetative cover. Erosion control blankets should be placed over re-graded areas following seeding. Materials and placement of erosion control blankets should comply with the following specifications, depending on the state in which the work is being performed.

Kentucky Plants –	KYTC Standard Specifications, Sections 212.03.03 E and 827.07
Tennessee Plants –	Vegetation Specifications, Landfill Permit
Alabama Plants –	ALDOT Standard Specifications, Section 659

Deep Rills and Gullies:

For deep gullies that cannot be repaired as described above, the following filling procedures apply:

- Clean loose soil/debris from bottom and sides of gullies.

- Place and compact clay in 6 inch lifts using small compaction equipment or hand-held tampers. Vibratory plate compactors are not applicable for clay. Filling should start at the toe (or lowest elevation) and progress upslope.

- In some cases, over-excavation may be required to create benches to facilitate compaction on level surfaces. Benching, if required, will likely have to be performed by hand methods or using small excavation equipment.

- If several side-by-side deeper gullies are present in an area to be repaired, it may be more practical to rework the entire affected area to facilitate use of larger equipment. In this case, slight over-excavation of the slope face will be needed so that foundation benches can be cut to facilitate compaction on level surfaces. Filling should start at the lowest elevation and progress upslope.

- Final filling/shaping to reform the original ground line can be executed by tracking and blading with a dozer.

- Repaired areas should be seeded to re-establish vegetative cover. Erosion control blankets should be placed over re-graded areas following seeding. Materials and placement of erosion control blankets should comply with the following specifications, depending on the state in which the work is being performed.

Kentucky Plants –	KYTC Standard Specifications, Sections 212.03.03 E and 827.07
Tennessee Plants –	Vegetation Specifications, Landfill Permit
Alabama Plants –	ALDOT Standard Specifications, Section 659

1.3 GENERAL GUIDELINES FOR REPAIR OF RUTTING

1.3.1 IDENTIFICATION

Rutting due to maintenance vehicle traffic can commonly occur along dike crests, slopes, and other areas at TVA fossil plant facilities. It is typically caused by near-surface materials which have become weak over time because of moisture infiltration. Repeated passes of equipment over weakened materials can lead to rutting. Maintenance traffic/equipment should avoid wet/rutted areas until repairs can be made. General guidelines for the repair of rutting are provided below. The following guide is intended to be applicable for minor to moderate cases of rutting, and generally consists of reworking the upper portion of the affected area, followed by re-shaping to provide positive surface drainage. Where widespread or extensively deep rutting has occurred or is recurring, case-specific engineering evaluations may be needed.

Guidelines for Rutting and Repair

- Drain any standing water and undercut affected areas to remove rutted and overly wet/soft materials. The undercut depth will be determined by TVA in the field, depending on the severity of the rutting.
- Fill undercut area with clay or bottom ash material and compact in 6 to 8 inch lifts to restore original ground line. Excavated material can be re-used if it is free of organics and can be dried to facilitate re-compaction. Otherwise, borrow material will be needed. For compaction, use hand held jumping jacks or small power equipment.
- Grade and shape repaired areas to provide positive/improved drainage. For dike crests, grade the area to drain inwardly toward the pond or perimeter ditch, as applicable. Re-grade surrounding areas and/or drainage ditches to improve drainage, if possible.
- Repaired surfaces or dike crests that are to be used as access roads should be topped with crushed stone or bottom ash. The thickness should be equal to that which was originally in place prior to the repair, or as judged by TVA to be sufficient for the expected amount of vehicle/equipment traffic.

- For other repaired areas, place seed and cover with erosion control blanket to re-establish vegetation. Materials and placement of erosion control blankets should comply with the following specifications, depending on the state in which the work is being performed.

Kentucky Plants –	KYTC Standard Specifications, Sections 212.03.03 E and 827.07
Tennessee Plants –	TDOT Standard Specifications, Section 805
Alabama Plants –	ALDOT Standard Specifications, Section 659

1.4 GENERAL GUIDELINES FOR TREE REMOVAL ON SLOPES

1.4.1 IDENTIFICATION

Trees and heavy brush growth should be controlled on TVA dams and dikes. If left in place, trees can result in the creation of seepage paths within the embankment. Allowing vegetation to become overgrown restricts the level of inspection that can be performed on the structure. General guidelines for removal of trees and maintenance of vegetation are provided below. Evaluations other than those outlined below shall be made by a geotechnical engineer in consultation with facility representatives on a case-by-case basis.

1.4.2 GUIDELINES FOR TREE REMOVAL AND MAINTENANCE OF VEGETATION

Tree Removal

At locations where it is not reasonable to remove trees by a mowing them with a bush hog or with similar mowing equipment:

- All trees shall be cut using a handsaw or chainsaw and the cut tree and branches discarded.
- Remove the remaining tree trunk, stump, and rootwad.
- Grub any remaining roots of the tree so that only 2 inches or smaller roots are left in place.
- The resulting cavity from removal of the rootwad shall be cleaned of loose soil and debris.
- The cavity shall then be backfilled with cohesive soil and compacted and the area seeded to re-establish vegetation. If the tree has been removed from along the upstream or downstream face of a slope, benches shall be cut into the slope face where the cavity is to be backfilled. This will allow for a proper bond between the existing dike and the backfill being used to reform the slope. If benches are needed, bench heights shall not exceed 4 to 5 feet in height.

Maintenance of Vegetation

- Mowing is recommended at regular intervals to allow for appropriate inspection of embankment slopes.

- If areas lacking vegetation are observed during mowing and clearing operations or subsequent inspections, the areas should be seeded to re-establish vegetation as soon as practicable.

1.5 GENERAL GUIDELINES FOR REPAIR OF WAVE WASH EROSION REPAIR AND CONSTRUCTION OF RIPRAP PROTECTION

1.5.1 IDENTIFICATION

Wave erosion should be controlled on TVA facilities to maintain the integrity of dams and dikes. When present, wave wash erosion typically occurs along interior slopes of dikes near pool level. If left unrepaired, erosion can expand, deepen, and can eventually lead to interior slope sloughing. General guidelines for repair of wave erosion using riprap are provided below.

<u>Guidelines for Wave Wash Erosion Repair and Riprap Protection</u>

The following describes repair of wave wash erosion using riprap protection:

- Vegetation and loose soil should be removed within the affected slope areas to be repaired. This includes undercutting the slope a minimum of 12 inches to remove vegetation and associated roots. The minimum vertical extent of the vegetation removal should extend from one-foot below the pool level upwardly to two feet above pool level.

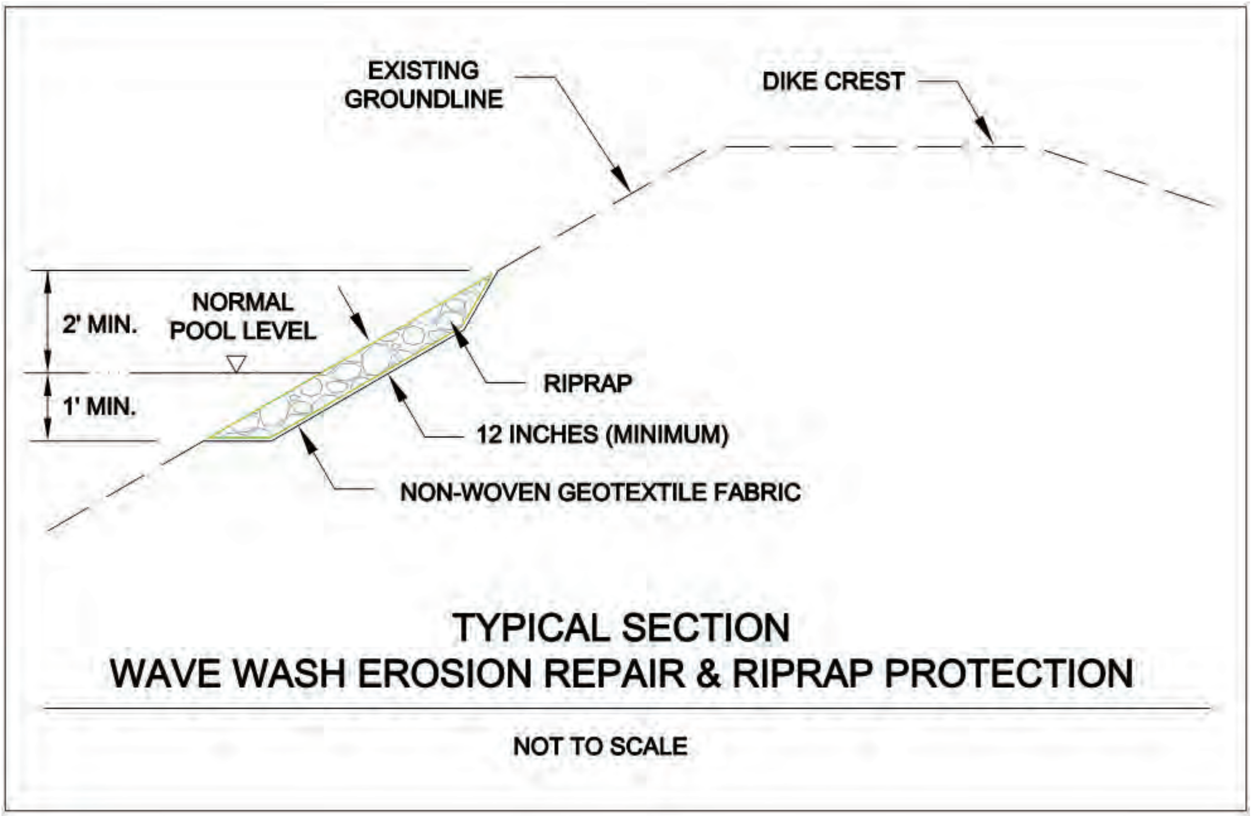
- Place non-woven geotextile fabric along the slope where vegetation and loose soil have been removed. Use fabric meeting or exceeding the following designations, depending on the state in which the work is being performed.

Kentucky Plants -	KYTC Type I Geotextile Fabric
Tennessee Plants -	TDOT Type III Geotextile Fabric
Alabama Plants -	Fabric conforming to Section 608 of ALDOT Standard Specifications

- Place riprap over the geotextile fabric. An excavator should be used to place the riprap in layers (starting from the bottom). Place thickness of riprap to conform to original ground line, or as necessary to create a stable slope face. Use riprap meeting the following designations, depending on the state in which the work is being performed.

Kentucky Plants -	KYTC Class II Channel Lining
Tennessee Plants -	TDOT Class A-1 Machined Riprap
Alabama Plants -	ALDOT Class 2 Riprap

- Field adjustments may be necessary as the work progresses, depending on actual conditions encountered.



1.6 GENERAL GUIDELINES FOR MOWING AND VEGETATION REMOVAL

Slopes shall be mowed to reduce the opportunity for tree growth and allow for visual inspection and observations. The slopes shall be mowed to a height of no less than 3 inches and no more than 12 inches tall with a minimum of three mowings per growing season. If woody growth is detected, it shall be removed.

1.7 GENERAL GUIDELINES FOR BARE AREA FERTILIZING AND RESEEDING

Prepare exposed or bare areas for seeding by discing the surface 3 inches in depth. Apply fertilizer (600 lbs./acre), seed mixture (as directed by facility engineer), mulch (1.5 tons/acre), and netting (0.75" x 1" mesh openings) with pins to the prepared areas. Other application rates may be requested by the facility engineer. The seed mixture utilized depends on the seeding application period and location.

Doc 17: Instrumentation (Piezometer) Readings

Stantec

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

					7/20/2009		8/3/2009		8/13/2009		8/31/2009		9/11/2009	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	25.85	192.39	26.54	191.70	25.90	192.34	28.78	189.46	29.71	188.53
STN-2	19.65	238.78	238.69	219.04	18.03	220.66	17.56	221.13	17.30	221.39	18.07	220.62	17.94	220.75
STN-3	20.07	234.52	237.44	217.37	13.12	224.32	12.46	224.98	13.50	223.94	14.66	222.78	12.78	224.66
STN-4	19.20	237.55	237.32	218.12	17.85	219.47	17.79	219.53	15.50	221.82	19.09	sump	19.12	sump
STN-5	38.18	218.04	220.69	182.51	24.57	196.12	24.64	196.05	23.70	196.99	26.20	194.49	26.58	194.11
STN-6	17.94	238.47	238.41	220.47	17.85	sump	17.84	sump	17.80	sump	17.86	sump	17.85	sump
STN-7	15.56	235.53	235.44	219.88	Dry	dry	Dry	dry	Dry	dry	Dry	dry	Dry	dry
STN-8	19.03	237.75	237.67	218.64	Dry	dry	19.02	sump	19.03	sump	19.04	sump	Dry	dry
STN-9	41.00	221.15	224.19	183.19	8.41	215.78	10.06	214.13	10.40	213.79	10.76	213.43	10.93	213.26
STN-10	13.05	237.39	237.10	224.05	Dry	dry	11.00	226.10	11.70	225.40	12.21	224.89	12.42	224.68
STN-11	14.35	237.93	237.81	223.46	Dry	dry	Dry	dry	Dry	dry	Dry	dry	Dry	dry
STN-12	43.10	217.16	220.08	176.98	27.60	192.48	28.32	191.76	27.60	192.48	30.02	190.06	30.77	189.31
STN-13	17.68	237.24	236.96	219.28	15.19	221.77	12.05	224.91	11.60	225.36	Damaged	NM	11.88	225.08
STN-14	19.50	236.64	236.44	216.94	8.27	228.17	6.71	229.73	6.90	229.54	8.07	228.37	8.79	227.65
Mississippi River Gauge MS126 - Memphis						192.33		192.81		190.58		187.49		185.07
McKellar Lake Pool Elevation						189.55		189.05		187.85		184.05		182.65

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

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					10/12/2009		11/2/2009		11/11/2009		11/17/2009		12/11/2009	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	24.19	194.05	15.58	202.66	13.98	204.26	17.19	201.05	19.23	199.01
STN-2	19.65	238.78	238.69	219.04	16.80	221.89	15.97	222.72	16.26	222.43	16.50	222.19	17.68	221.01
STN-3	20.07	234.52	237.44	217.37	11.97	225.47	10.98	226.46	11.68	225.76	11.99	225.45	12.02	225.42
STN-4	19.20	237.55	237.32	218.12	17.27	220.05	15.57	221.75	16.03	221.29	16.11	221.21	17.48	219.84
STN-5	38.18	218.04	220.69	182.51	25.23	195.46	16.02	204.67	14.38	206.31	17.21	203.48	20.45	200.24
STN-6	17.94	238.47	238.41	220.47	17.86	sump	17.85	sump	17.94	sump	17.93	sump	17.94	sump
STN-7	15.56	235.53	235.44	219.88	Dry	dry	Dry	dry	15.90	sump	15.58	sump	15.90	sump
STN-8	19.03	237.75	237.67	218.64	19.05	sump	Dry	dry	19.14	sump	19.04	sump	19.06	sump
STN-9	41.00	221.15	224.19	183.19	11.40	212.79	11.66	212.53	18.80	205.39	18.31	205.88	19.39	204.80
STN-10	13.05	237.39	237.10	224.05	11.25	225.85	10.14	226.96	11.32	225.78	10.68	226.42	11.89	225.21
STN-11	14.35	237.93	237.81	223.46	14.19	sump	14.22	sump	14.28	sump	14.30	sump	14.20	sump
STN-12	43.10	217.16	220.08	176.98	30.29	189.79	24.41	195.67	21.90	198.18	23.47	196.61	25.44	194.64
STN-13	17.68	237.24	236.96	219.28	11.42	225.54	10.45	226.51	11.01	225.95	11.09	225.87	12.54	224.42
STN-14	19.50	236.64	236.44	216.94	7.98	228.46	7.63	228.81	8.19	228.25	8.42	228.02	8.98	227.46
Mississippi River Gauge MS126 - Memphis						192.45		206.19		207.44		201.13		198.96
McKellar Lake Pool Elevation						189.75		202.05		203.05		198.05		195.55

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

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					1/12/2010		2/2/2010		2/25/2010		4/6/2010		5/5/2010	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	20.98	197.26	10.76	207.48	19.54	198.70	10.14	208.10	12.58	205.66
STN-2	19.65	238.78	238.69	219.04	17.87	220.82	16.79	221.90	14.79	223.90	16.30	222.39	17.50	221.19
STN-3	20.07	234.52	237.44	217.37	12.48	224.96	10.90	226.54	11.41	226.03	11.74	225.70	12.00	225.44
STN-4	19.20	237.55	237.32	218.12	17.61	219.71	16.83	220.49	16.19	221.13	18.01	219.31	18.92	sump
STN-5	38.18	218.04	220.69	182.51	21.57	199.12	12.28	208.41	18.87	201.82	11.37	209.32	13.76	206.93
STN-6	17.94	238.47	238.41	220.47	17.97	sump	17.97	sump	17.94	sump	17.97	sump	17.97	sump
STN-7	15.56	235.53	235.44	219.88	13.52	221.92	11.75	223.69	11.13	224.31	11.47	223.97	11.72	223.72
STN-8	19.03	237.75	237.67	218.64	19.07	sump	19.07	sump	19.05	sump	19.07	sump	19.07	sump
STN-9	41.00	221.15	224.19	183.19	17.81	206.38	18.18	206.01	16.54	207.65	15.34	208.85	17.27	206.92
STN-10	13.05	237.39	237.10	224.05	12.12	224.98	10.13	226.97	10.27	226.83	11.45	225.65	11.07	226.03
STN-11	14.35	237.93	237.81	223.46	14.24	sump	14.32	sump	14.27	sump	14.28	sump	14.28	sump
STN-12	43.10	217.16	220.08	176.98	25.05	195.03	19.86	200.22	23.57	196.51	17.68	202.40	19.80	200.28
STN-13	17.68	237.24	236.96	219.28	12.46	224.50	11.79	225.17	11.45	225.51	12.31	224.65	12.23	224.73
STN-14	19.50	236.64	236.44	216.94	9.28	227.16	8.47	227.97	8.15	228.29	8.18	228.26	7.91	228.53
Mississippi River Gauge MS126 - Memphis						193.53		212.72		196.42				
McKellar Lake Pool Elevation						190.75		208.55						

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

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					6/1/2010		7/7/2010		8/2/2010		9/10/2010		10/22/2010	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	12.11	206.13	15.90	202.34	18.23	200.01	23.85	194.39	25.25	192.99
STN-2	19.65	238.78	238.69	219.04	17.34	221.35	19.60	sump	19.30	sump	19.50	sump	19.62	sump
STN-3	20.07	234.52	237.44	217.37	12.69	224.75	15.40	222.04	14.10	223.34	15.55	221.89	17.74	219.70
STN-4	19.20	237.55	237.32	218.12	17.01	220.31	19.30	sump	18.75	218.57	19.20	sump	19.17	sump
STN-5	38.18	218.04	220.69	182.51	12.17	208.52	17.23	203.46	19.56	201.13	25.70	194.99	26.34	194.35
STN-6	17.94	238.47	238.41	220.47	17.97	sump	17.98	sump	17.90	sump	17.90	sump	17.91	sump
STN-7	15.56	235.53	235.44	219.88	11.95	223.49	12.20	223.24	11.90	223.54	12.28	223.16	12.19	223.25
STN-8	19.03	237.75	237.67	218.64	19.07	sump	19.00	sump	18.70	sump	19.00	sump	19.15	sump
STN-9	41.00	221.15	224.19	183.19	13.79	210.40	16.47	207.72	17.50	206.69	20.42	203.77	22.45	201.74
STN-9R	15.25	223.76	227.01	211.76	NA	NM	NA	NM	NA	NM	NA	NM	11.01	216.00
STN-10	13.05	237.39	237.10	224.05	11.49	225.61	12.10	225.00	12.00	225.10	12.55	224.55	13.32	sump
STN-11	14.35	237.93	237.81	223.46	14.27	sump	14.30	sump	14.30	sump	14.35	sump	14.31	sump
STN-11S	27.00	237.52	237.52	210.52	NA	NM	NA	NM	NA	NM	NA	NM	18.79	218.73
STN-12	43.10	217.16	220.08	176.98	17.75	202.33	21.40	198.68	23.05	197.03	28.23	191.85	30.03	190.05
STN-12R	14.83	215.99	219.82	204.99	NA	NM	NA	NM	NA	NM	NA	NM	13.74	206.08
STN-13	17.68	237.24	236.96	219.28	11.66	225.30	11.95	225.01	11.90	225.06	12.15	224.81	13.22	223.74
STN-14	19.50	236.64	236.44	216.94	8.17	228.27	9.10	227.34	8.34	228.10	9.57	226.87	10.77	225.67
STN-15	15.00	216.77	219.77	204.77	NA	NM	NA	NM	NA	NM	NA	NM	8.15	211.62
Mississippi River Gauge MS126 - Memphis														
McKellar Lake Pool Elevation														

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

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Memphis,TN
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					11/11/2010		12/8/2010		1/18/2011		2/11/2011		3/11/2011	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	28.42	189.82	21.48	196.76	26.70	191.54	24.88	193.36	9.41	208.83
STN-2	19.65	238.78	238.69	219.04	19.53	sump	19.53	sump	17.73	220.96	18.84	219.85	15.89	222.80
STN-3	20.07	234.52	237.44	217.37	15.15	222.29	11.79	225.65	10.75	226.69	11.84	225.60	10.95	226.49
STN-4	19.20	237.55	237.32	218.12	19.15	sump	19.18	sump	18.89	sump	18.75	218.57	17.85	219.47
STN-5	38.18	218.04	220.69	182.51	27.63	193.06	23.51	197.18	26.09	194.60	26.17	194.52	12.28	208.41
STN-6	17.94	238.47	238.41	220.47	dry	dry	17.92	sump	17.92	sump	17.93	sump	dry	dry
STN-7	15.56	235.53	235.44	219.88	12.10	223.34	11.44	224.00	11.90	223.54	12.08	223.36	14.44	221.00
STN-8	19.03	237.75	237.67	218.64	18.60	219.07	18.90	sump	18.90	sump	18.93	sump	dry	dry
STN-9	41.00	221.15	224.19	183.19	23.60	200.59	23.31	200.88	22.55	201.64	23.81	200.38	20.22	203.97
STN-9R	15.25	223.76	227.01	211.76	10.53	216.48	9.19	217.82	8.61	218.40	8.35	218.66	7.85	219.16
STN-10	13.05	237.39	237.10	224.05	13.00	sump	13.08	sump	13.08	sump	13.08	sump	11.33	225.77
STN-11	14.35	237.93	237.81	223.46	14.32	sump	14.32	sump	14.32	sump	14.32	sump	dry	dry
STN-11S	27.00	237.52	237.52	210.52	18.72	218.80	18.08	219.44	17.29	220.23	17.34	220.18	17.35	220.17
STN-12	43.10	217.16	220.08	176.98	32.10	187.98	28.26	191.82	30.02	190.06	30.12	189.96	21.14	198.94
STN-12R	14.83	215.99	219.82	204.99	13.25	206.57	7.79	212.03	7.14	212.68	7.01	212.81	6.78	213.04
STN-13	17.68	237.24	236.96	219.28	13.87	223.09	14.43	222.53	13.85	223.11	13.72	223.24	12.72	224.24
STN-14	19.50	236.64	236.44	216.94	10.93	225.51	10.12	226.32	9.44	227.00	9.25	227.19	8.62	227.82
STN-15	15.00	216.77	219.77	204.77	7.32	212.45	5.80	213.97	5.23	214.54	5.17	214.60	5.03	214.74
Mississippi River Gauge MS126 - Memphis														
McKellar Lake Pool Elevation														

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

Stantec

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

Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	4/7/2011 Depth Measurement (ft)	4/7/2011 Water Elevation (ft)	5/3/2011 Depth Measurement (ft)	5/3/2011 Water Elevation (ft)	6/17/2011 Depth Measurement (ft)	6/17/2011 Water Elevation (ft)	6/25/2011 Depth Measurement (ft)	6/25/2011 Water Elevation (ft)	6/28/2011 Depth Measurement (ft)	6/28/2011 Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	12.08	206.16	**	**	14.62	203.62	NA	NA	NA	NA
STN-2	19.65	238.78	238.69	219.04	15.27	223.42	14.76	223.93	17.42	221.27	NA	NA	NA	NA
STN-3	20.07	234.52	237.44	217.37	11.29	226.15	9.48	227.96	13.30	224.14	NA	NA	NA	NA
STN-4	19.20	237.55	237.32	218.12	16.00	221.32	13.67	223.65	17.04	220.28	NA	NA	NA	NA
STN-5	38.18	218.04	220.69	182.51	10.79	209.90	**	**	14.16	206.53	NA	NA	NA	NA
STN-6	17.94	238.47	238.41	220.47	17.96	sump	15.87	222.54	17.85	sump	NA	NA	NA	NA
STN-7	15.56	235.53	235.44	219.88	11.74	223.70	12.18	223.26	12.37	223.07	NA	NA	NA	NA
STN-8	19.03	237.75	237.67	218.64	18.64	219.03	17.91	219.76	***	***	NA	NA	NA	NA
STN-9	41.00	221.15	224.19	183.19	14.55	209.64	12.74	211.45	11.68	212.51	13.19	211.00	13.56	210.63
STN-9R	15.25	223.76	227.01	211.76	7.73	219.28	6.53	220.48	7.98	219.03	8.58	218.43	8.83	218.18
STN-10	13.05	237.39	237.10	224.05	11.27	225.83	9.40	227.70	11.95	225.15	12.09	225.01	12.17	224.93
STN-11	14.35	237.93	237.81	223.46	14.28	sump	14.24	sump	14.25	sump	14.35	sump	dry	dry
STN-11S	27.00	237.52	237.52	210.52	17.41	220.11	17.29	220.23	17.77	219.75	18.07	219.45	18.33	219.19
STN-12	43.10	217.16	220.08	176.98	19.43	200.65	11.69	208.39	19.13	200.95	19.63	200.45	19.35	200.73
STN-12R	14.83	215.99	219.82	204.99	6.91	212.91	6.45	213.37	7.22	212.60	9.58	210.24	10.16	209.66
STN-13	17.68	237.24	236.96	219.28	12.46	224.50	11.63	225.33	11.74	225.22	11.87	225.09	11.98	224.98
STN-14	19.50	236.64	236.44	216.94	8.24	228.20	7.67	228.77	8.35	228.09	8.51	227.93	8.78	227.66
STN-15R	15.00	216.77	219.77	204.77	5.27	214.50	4.74	215.03	5.78	213.99	dry	dry	6.80	212.97
Mississippi River Gauge MS126 - Memphis														
McKellar Lake Pool Elevation														

sump	Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.
Dry	The PZ was dry at depth so no water level was measured.
** Underwater	The piezometer was underwater due to the recent flooding of the Mississippi River.
*** Buried	

Stantec

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

					6/29/2011		7/6/2011		7/11/2011		7/25/2011		8/26/2011	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	NA	NA	NA	NA	14.71	203.53	NA	NA	22.54	195.70
STN-2	19.65	238.78	238.69	219.04	NA	NA	NA	NA	19.26	219.43	NA	NA	19.62	sump
STN-3	20.07	234.52	237.44	217.37	NA	NA	NA	NA	16.70	220.74	NA	NA	19.21	218.23
STN-4	19.20	237.55	237.32	218.12	NA	NA	NA	NA	dry	dry	NA	NA	19.20	sump
STN-5	38.18	218.04	220.69	182.51	NA	NA	NA	NA	15.78	204.91	NA	NA	24.92	195.77
STN-6	17.94	238.47	238.41	220.47	NA	NA	NA	NA	17.89	sump	NA	NA	17.92	sump
STN-7	15.56	235.53	235.44	219.88	NA	NA	NA	NA	15.20	220.24	NA	NA	14.43	221.01
STN-8	19.03	237.75	237.67	218.64	NA	NA	NA	NA	***	***	***	***	***	***
STN-9	41.00	221.15	224.19	183.19	13.71	210.48	14.04	210.15	14.42	209.77	16.28	207.91	20.13	204.06
STN-9R	15.25	223.76	227.01	211.76	8.86	218.15	9.36	217.65	9.61	217.40	10.61	216.40	11.68	215.33
STN-10	13.05	237.39	237.10	224.05	12.29	224.81	12.35	224.75	12.47	224.63	dry	dry	13.09	sump
STN-11	14.35	237.93	237.81	223.46	14.34	sump	14.34	sump	dry	dry	dry	dry	14.35	sump
STN-11S	27.00	237.52	237.52	210.52	18.46	219.06	19.06	218.46	19.35	218.17	19.80	217.72	20.16	217.36
STN-12	43.10	217.16	220.08	176.98	19.26	200.82	19.28	200.80	20.21	199.87	22.85	197.23	27.21	192.87
STN-12R	14.83	215.99	219.82	204.99	10.28	209.54	11.13	208.69	11.47	208.35	12.67	207.15	14.18	205.64
STN-13	17.68	237.24	236.96	219.28	12.12	224.84	12.39	224.57	12.64	224.32	13.28	223.68	14.12	222.84
STN-14	19.50	236.64	236.44	216.94	8.88	227.56	9.39	227.05	9.78	226.66	10.50	225.94	10.86	225.58
STN-15R	15.00	216.77	219.77	204.77	6.67	213.10	7.00	212.77	7.02	212.75	7.69	212.08	8.30	211.47
Mississippi River Gauge MS126 - Memphis														
McKellar Lake Pool Elevation														

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

*** Buried

APPENDIX B

Doc 18: Dam Inspection Checklist Form

Site Name:	**Allen Fossil Plant**	**Date:**	**19 September 2011**
Unit Name:	**East Ash Pond/Dredge Cell & East Ash Stilling Pond**	**Operator's Name:**	**TVA**
Unit I.D.:	**NID: TN15801**	**Hazard Potential Classification:**	**High ☐ Significant ☒[1] Low ☐**
	Assessor's Name:	**Stanley W. Notestine, PE; Frederic C. Tucker, PE**	

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?	Annually[2]		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	230'/226'[3]		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	225.5'		20. Decant Pipes: (Emergency Outfall Structure)		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	237' TBV		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	X[4]		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	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)?	UKN[5]		From underdrain?	N/A	
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?	N/A	
11. Is there significant settlement along the crest?		X[6]	Over widespread areas?		X[10]
12. Are decant trashracks clear and in place?	X[7]		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X[8]	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?	N/A	
16. Are outlets of decant or underdrains blocked?		X[9]	23. Water against downstream toe?		X[11]
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

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.

N/A = Not Applicable UKN = Unknown TBP = To Be Provided TBV = To Be Verified

Note #	Comments
1	Hazard potential classification was determined by TVA. The indicated "significant" hazard potential classification also is Dewberry's interpretation, based on EPA criteria shown on page 3.
2	TVA engineers conduct annual inspections. The inspections are documented in written reports, which include measures, as needed, for maintenance and repair. Plant personnel make observations throughout the year.

3	These are the normal operating water levels in the East Ash Pond (EAP) & East Ash Stilling Pond (EASP) cells, respectively. The water level in the EASP historically was maintained at about the same elevation as in the EAP but is now maintained 4’ lower than that in the EAP to provide greater stability of the east side perimeter dike.
4	Piezometers are monitored monthly.
5	Construction records are not available. However, test borings made in 2009 did not encounter organic matter, such as stumps, decayed vegetation, and other such deleterious material or evidence that would suggest that the foundation was not prepared.
6	A large puddle of water from recent rainfall was noted on the crest of the south perimeter dike, near the Dredge Cell, where there appeared to be a slight depression, possibly due to heavy equipment traffic, and poor drainage between railroad tracks on the south side of the crest and a windrow along the upstream (inside) edge of the crest.
7	Skimmers are in place at the inlets.
8	TVA reported that an active 30” diameter sanitary sewer line passing north-south under the Dredge Cell part of the East Ash Pond developed a hole that allowed ash material into the pipe; a new plastic pipe was installed at a higher elevation across most of the Dredge Pond to bypass the defective sewer line, which was abandoned in place.
9	Outlets are not blocked, but emergency outlets are partly submerged. There are no underdrains.
10	No areas of seepage were observed during the site visit. However, along a portion of the outside toe of the east perimeter dike seepage has been observed in the past, when the water level in the Stilling Pond was maintained at a 4’ higher elevation. The ends of the seepage area had been marked with signs, but only the north marker was seen. The other one was not observed but may have been obscured by tall weedy vegetation that was present along the dike toe.
11	No water was observed against the downstream (outside) toe at the time of the site visit. However, it is understood that during the wet season (generally winter and early spring) water does rise onto the outside toe along portions of the east perimeter dike.

Coal Combustion Waste (CCW)

Impoundment Assessment

Impoundment NPDES Permit TN0005355 **ASSESSOR** Stanley W. Notestine, PE; Frederic C. Tucker, PE
Effective Date 01/01/2008
Impoundment Name East Ash Pond (EAP)/Dredge Cell & East Ash Stilling Pond (EASP)

Impoundment Company TVA
EPA Region 4

State Agency Tennessee Department of Environment and Conservation
Division of Water Pollution Control.
(Field Office) Address 401 Church street, 6th Floor, L & C Annex
Nashville, TN 37243-1534
Name of Impoundment East Ash Pond/Dredge Cell & East Ash Stilling Pond

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

New ☐ **Update** ☒

	Yes	**No**
Is impoundment currently under construction?	☐	☒
Is water or ccr currently being pumped into the impoundment?	☒	☐

IMPOUNDMENT FUNCTION: The impoundment currently serves as a transfer facility. The impoundment receives both fly ash and boiler slag, which are stored temporarily. The fly ash is dredged, dewatered, loaded onto haul trucks and transported to a structural fill project. Approximately 90 % of the bottom ash/boiler slag is reclaimed and sold for beneficial reuse.

Nearest Downstream Town Name: Memphis, Tennessee

Distance from the impoundment: 0 miles (within city limits)

Location:

Latitude	35	Degrees	04	Minutes	19.1	Seconds	**N**
Longitude	90	Degrees	08	Minutes	11.4	Seconds	**W**

State Tennessee **County** Shelby

	Yes	No
Does a state agency regulate this impoundment?	☒	☐

If So Which State Agency? Tennessee Department of Environment and Conservation. For water quality only.

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.

☐ **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.

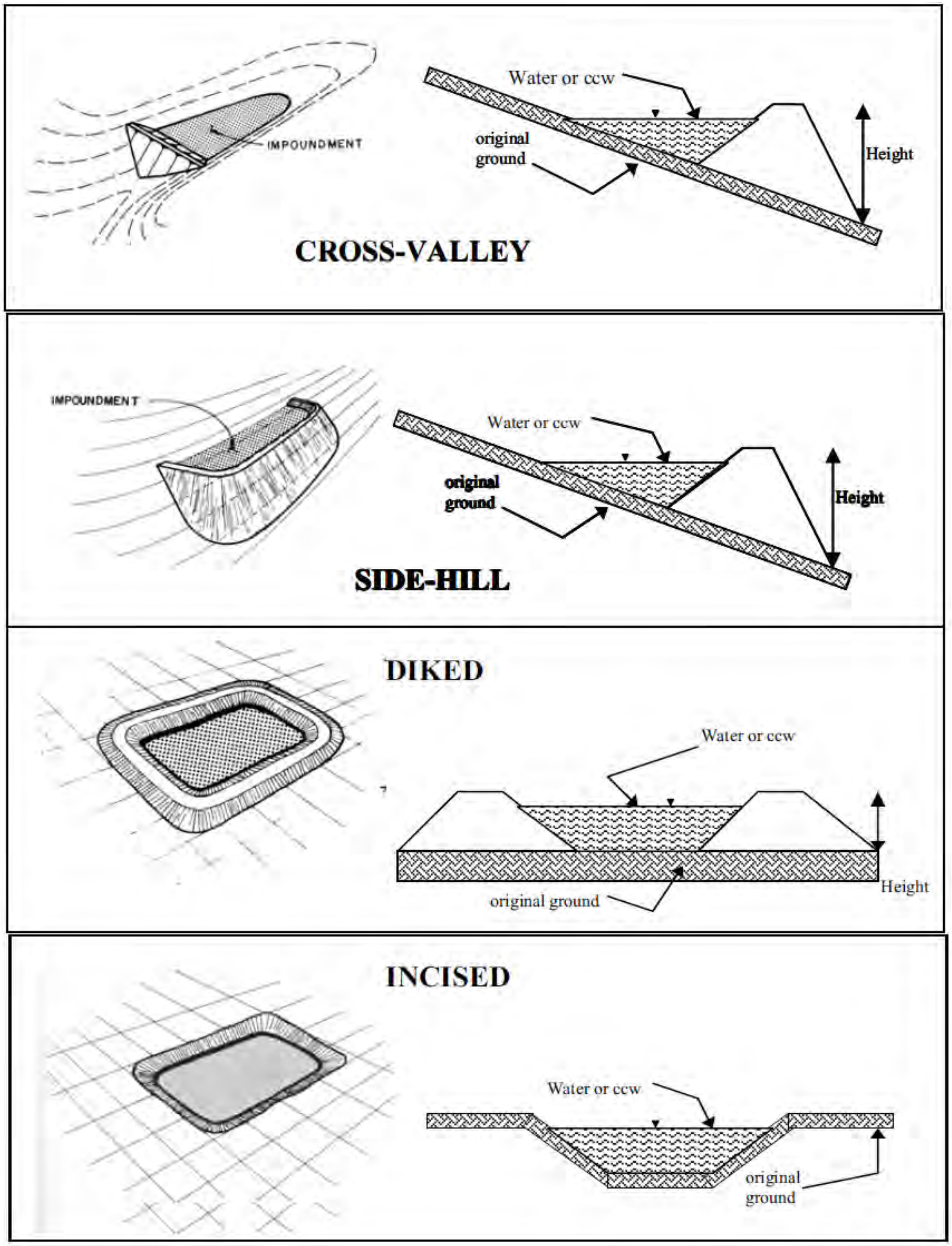
☒ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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 failure would discharge coal combustion residue into Lake McKellar with potentially significant environmental consequences and some potential impact on nearby lower-lying shore areas that are within the Memphis City Limits.

CONFIGURATION:



☐ Cross-Valley ☐ Side-Hill ☐ Diked

☐ Incised (form completion optional) ☒ Combination Incised/Diked

Embankment Height (ft) 20 (max) **Embankment Material** Earth

Pond Area (ac) 70 EAP +10 EASP = 80 **Liner** No

Current Freeboard (ft) 7 EAP / 11 EASP **Liner Permeability** N/A

TYPE OF OUTLET (Mark all that apply)

☐ **Open Channel Spillway**

☐ Trapezoidal

☐ Triangular

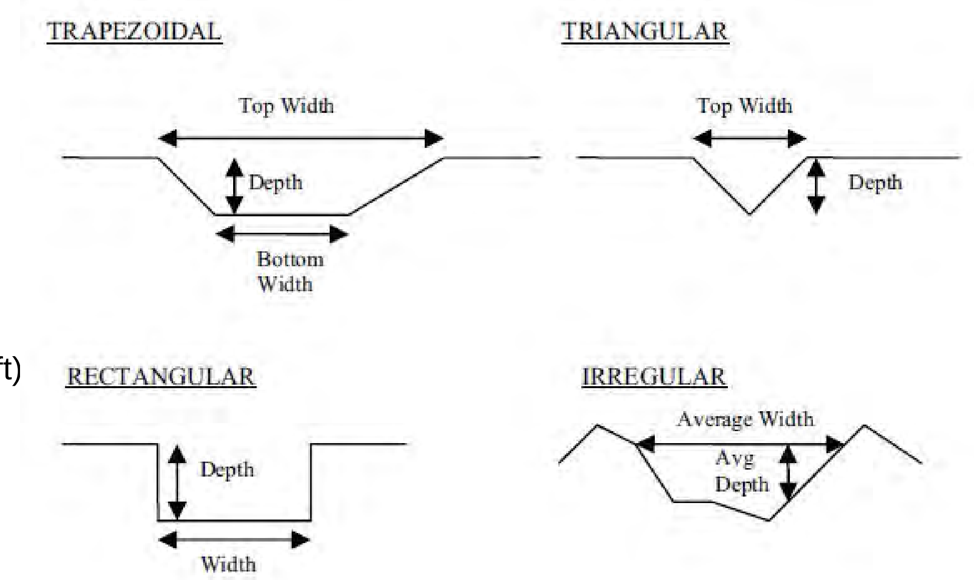
☐ Rectangular

☐ Irregular

depth (ft)

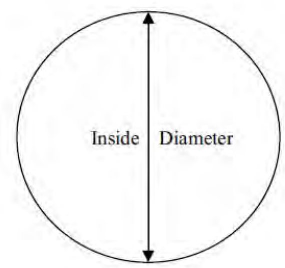
average bottom width (ft)

top width (ft)



☒ **Outlet**

Four decant structures each consisting of 48" RCP risers with bottom discharge through 36" I.D. RCP outlet conduits lined with PVC. Two primary conduits pass through the north dike of the Stilling Pond to discharge into Lake McKellar, which is connected to the Mississippi River; the outlet ends of these conduits are fitted with sluice gates to prevent backflow when the Mississippi River floods into Lake McKellar. Two secondary (emergency) outlet conduits pass through the east dike of the Stilling Pond to discharge into a channel that flows south to Horn Lake and are used when the primary conduits cannot be used when the water level is too high in Lake McKellar. Flow into the Stilling Pond from the East Ash Pond/Dredge Cell is through a rectangular concrete spillway structure with an overall width of approximately 25' and fitted with stop-log gates across two bays. Water is allowed to flow only through the right (south) 12' wide (TBV) bay for purposes of pH adjustment.



Material

☐ corrugated metal

☐ welded steel

☒ Concrete (RCP) lined with PVC

☐ plastic (hdpe, pvc, etc.)

☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☒	☐

Through primary conduits only (and through rectangular concrete spillway in divider dike)

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By UNK (TVA acquired the plant in 1985)

	Yes	No
Has there ever been a failure at this site?	☐	☒

If So When?

If So Please Describe: There has been no failure. There was some damage done to the inside slope of the north perimeter dike from dredging operations, but the damage was reported to be immediately repaired.

	Yes	No
Has there ever been significant seepages at this site?	☐	☒
If So When?		

If So Please Describe: There have been no reported significant seepages. The area of seepage observed in the past along the outside toe of the east perimeter dike was reported to be an area of water saturation of the embankment soil with little or no observable flow.

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☒	☐
If so, which method (e.g., piezometers, gw pumping,...)?	Normal operating pool level was permanently lowered 4' in the Stilling Pond.	

If So Please Describe: The normal operating pool level was permanently lowered to enhance slope stability to acceptable factor of safety.

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, failures, or patchwork on the dikes?

There was no indication of prior releases, failures, or patchwork on the dikes.