Coal Combustion Waste Impoundment

Round 5 - Dam Assessment Report

Lansing Smith Plant (Site #07)

Ash Pond Embankments

Gulf Power Company

Southport, Florida

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

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INTRODUCTION, SUMMARY, CONCLUSION AND RECOMMENDATIONS

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

This assessment of the stability and functionality of the Lansing Smith fly ash management unit is based on a review of available documents and on the site assessment conducted by Dewberry personnel on July 6, 2010. We found the supporting technical information adequate (Section 1.1.3). As detailed in Section 1.2.6 there are a few recommendations that may help to maintain a safe and trouble-free operation,

In summary, the Lansing Smith Plant ash ponds are FAIR for continued safe and reliable operation, with a few minor existing or potential management unit safety deficiencies.

PURPOSE AND SCOPE

The U. S. Environmental Protection Agency (EPA) is embarking on an initiative to investigate 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 impoundment 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 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 December 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 if coal combustion waste. 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 asked utility companies to identify all management units: surface impoundments or similar diked or bermed structures; and; landfills receiving liquid-borne materials that store or dispose of coal-combustion residuals or by-products, including, but not limited to, fly ash, bottom ash, boiler slag, and flue gas emission control residuals. Utility companies responded with information on the size, design, age, and the amount of material placed in the units so that EPA could gauge which management units had or potential could rank as having High Hazard Potential. The USEPA and its contractors used the following definitions for this study:

> "Surface Impoundment or impoundment means a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), which is designed to hold an accumulation of liquid wastes or wastes containing free liquids, and which is not an injection well. Examples of surface impoundments are holding, storage, settling and aeration pits, ponds, and lagoons."
>
> For this study, the earthen materials could include coal combustion residuals. EPA did not provide an exclusion for small units based on whether the placement was temporary or permanent. Furthermore, the study covers not only waste units designated as surface impoundments, but also other units designated as landfills which receive free liquids.
>
> EPA is addressing any land-based units that receive fly ash, bottom ash, boiler slag, or flue gas emission control waster along with free liquids. If the landfill is receiving coal combustion wastes with liquids limited to that for proper compaction, then there should not be free liquids present and the EPA did not seek information on such units which are appropriately designated a landfill.
>
> In some cases coal combustion wastes are separated from the water, and the water containing de minimum levels of fly ash, bottom ash, boiler slag, or flue gas emission control wastes are sent to an impoundment. EPA is including such impoundments in this study, because chemicals of concern may have leached from the solid coal combustion wastes into the waster waters, and the suspended solids from the coal combustion wastes remain.

The purpose of this report is to evaluate the condition and potential of waste release from **management units that have not been rated for hazard potential classification**. A two-person team reviewed the information submitted to EPA, reviewed any relevant publicly available information from state or federal agencies regarding the unit potential hazard classification (if any) and accepted information provided via telephone communication with a management unit representative.

This evaluation included a site visit. EPA sent two engineers, one licensed in the State of Florida, for a one-day visit. The two-person team met with the owner of the management unit as well as technical and several technical representative and management unit supervisors to discuss the engineering characteristics of the unit as part of the site visit. During the site visit the team collected additional information about the management unit to be used in determining the hazard potential classifications of the management unit(s). Subsequent to the site visit the management unit owner provided additional engineering data pertaining to the management unit(s).

Factors considered in determining the hazard potential classification of the management unit(s) included the age and size of the impoundment, that quantity of coal combustion residuals or by-products that were stored or disposed in the these impoundments, its past operating history, and its geographic location relative to down gradient population centers and/or sensitive environmental systems.

This report presents the opinion of the assessment team as to the potential of catastrophic failure and reports on the condition of the management units(s). The team considered criteria in evaluating the dams under the National Inventory of Dams in making these determinations.

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 waste 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

Conclusions are based on visual observations from the one-day site visit, review of technical documentation provided by Gulf Power Company (GPC), and review of state inspection reports.

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

The structural stability of the ash pond embankments are limited based on the following parameters:

- Surface sloughing has occurred in four areas along the northeast downstream slope of the embankment. One of those areas has been repaired with slush grouted rip-rap;
- There is evidence of some small animal burrows along the downstream embankment;
- Widespread rill erosion, surface sloughing and sediment deposition has occurred along downstream slope; and
- Irregular road along west dike downstream buttress with rutting and small surface depressions holding water.

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

According to information provided by GPC, adequate capacity and freeboard exist to safely pass the design storm. The crest elevation of 20’ and the pond elevation at 17.5’ were provided leaving 2.5’ of freeboard. These elevations need to be verified. It was noted in the Hydrologic and Hydraulic Analysis Report dated June 29, 2010 (See Appendix A, Doc 1.)

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

Supporting technical documentation is adequate.

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

Descriptions provided are appropriate.

1.1.5 Conclusions Regarding the Field Observations

Evidence of surficial sloughing was observed along the northeastern downstream dike. Widespread rill erosion, surface sloughing and sediment deposition were apparent on downstream slopes. Crest elevations appear irregular and have minor depressions. Recently cut woody-stem vegetation along embankment and evidence of small animal burrows along the downstream dike were apparent.

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

The current maintenance procedures set in place need to be reviewed. There were widespread observations of maintenance issues that needed to be addressed.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

Existing surveillance and monitoring programs are adequate.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

Facility is FAIR for continued safe and reliable operation. A classification of "fair" is appropriate when acceptable performance is expected under all required loading conditions (static, hydrologic, seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

An action plan needs to be developed to address surficial sloughing, rill erosion and sediment deposition along downstream slopes.

1.2.2 Recommendations Regarding the Hydrologic/Hydraulic Safety

The amount of freeboard needs to be verified. Per information provided by GPC, the freeboard is currently 2.5'.

1.2.3 Recommendations Regarding the Supporting Technical Documentation

None appear warranted at this time.

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

None appear warranted at this time.

1.2.5 Recommendations Regarding the Field Observations

The following issues need to be addressed with routine maintenance:

- Surface sloughing has occurred in four areas along the northeast downstream slope of the embankment. One of those areas has been repaired with slush grouted rip-rap;
- There is evidence of some small animal burrows along the downstream embankment;
- Widespread rill erosion, surface sloughing and sediment deposition has occurred along downstream slope; and
- Irregular road along west dike downstream buttress with rutting and small surface depressions holding water.

1.2.6 Recommendations Regarding the Maintenance and Methods of Operation

Vegetation shall be cut or mowed on as needed basis to prevent large woody-stemmed vegetation from establishing. A plan of action needs to be established to handle the maintenance of surficial sloughing, crest depression and rill erosion when observed.

1.2.7 Recommendations Regarding the Surveillance and Monitoring Program

The weekly inspections performed need to documented and if items of concern appear they need to be addressed in a timely manner.

1.2.8 Recommendations Regarding Continued Safe and Reliable Operation

- Develop an action plan to address surficial sloughing along the downstream slopes.
- Perform remediation along downstream slopes to address surficial sloughing.
- Perform remediation along the slopes where erosion is occurring.
- Perform remediation along crest where depressions are present.

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

James O. Vick – Gulf Power Company (GPC)
Brian Heinfeld – Gulf Power Company (GPC)
James C. Pegues, P.E. – Southern Company Generation (SCG)
Ben Gallagher – Southern Company Generation (SCG)
Michael P. Petrovich – Hopping Green & Sams (HGS)
Russell A. Badders – Beggs & Lane (BL)
Mark King – American Electric Power (AEP)
Michael Hanson – Dewberry & Davis, Inc.
Frederic Shmurak – Dewberry & Davis, Inc

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein has been assessed on July 6, 2009.

____
Michael Hanson, PE, LEED AP
Civil Engineer

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Frederic M. Shmurak, PE, Civil Engineer

1.0 DESCRIPTION OF THE COAL COMBUSTION WASTE MANAGEMENT UNIT(S)

2.1 LOCATION

The Lansing Smith Electric Generating Plant and ash pond are located approximately 4 miles south of Chattahoochee, Florida along the western bank of the Apalachicola River. The Town of New Haven is approximately 1 ½ mile downstream of the ash pond dams. Figure 2.1 depicts a vicinity map around the Lansing Smith Facility, while Figure 2.1 b depicts an aerial view of the Lansing Smith Facility.

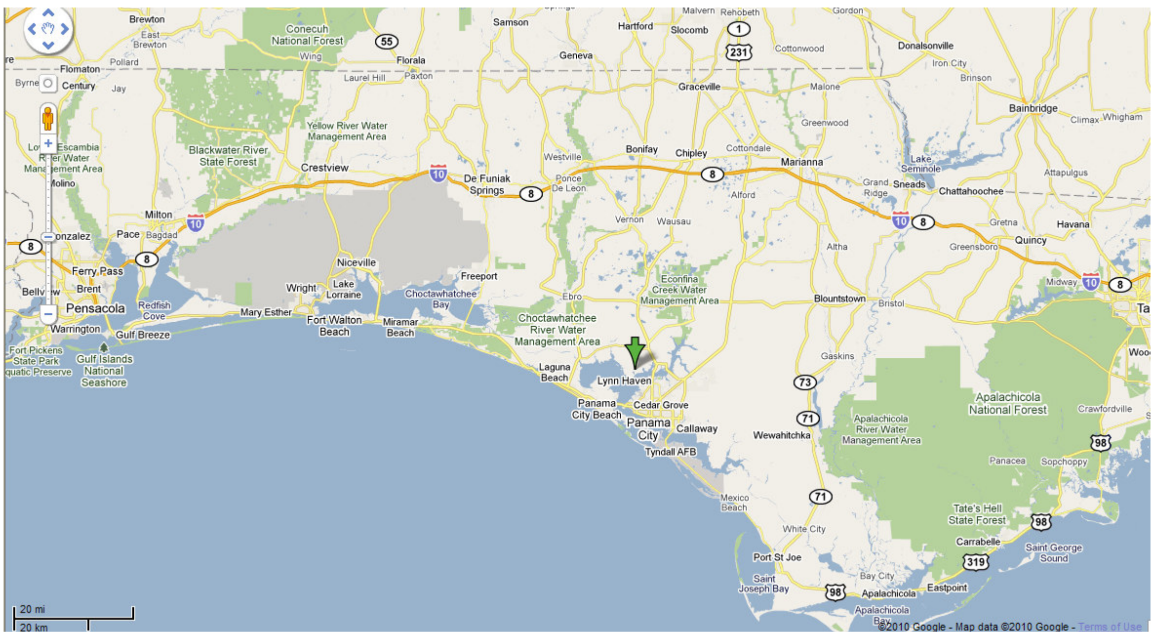


Figure 2.1 a: Lansing Smith Facility Vicinity Map

Figure 2.1 b: Lansing Smith Facility Aerial View

2.2 SIZE AND HAZARD CLASSIFICATION

The ash pond is impounded by an earthen embankment system consisting of a combination of an incised and diked configuration. There are also two internal dikes creating a three cell complex. Based on data provided by Gulf Power Company (GPC), the ash pond embankment system was originally constructed to a maximum height of 15 feet, side slopes of 1.5(H):1(V) to 1 (H):1(V) and the crest widths range from 20 to 30 feet. In 1980 some remedial work was recommended, resulting in steeper slopes and a wider crest. No documentation on the follow up of the remedial work recommendation was provided. The maximum remaining storage volume corresponding to the top of the embankment is 818,081 cubic yards according to plans provide by Gulf Power dated March 11, 2010 (see Appendix A Doc: 02 Ash Pond Topo and Volume.pdf). The classification for size, based on the height of the dam and storage capacity, is Intermediate in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria (see Table 2.2a for size classification criteria).

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

Table 2.2b: Summary of Dam Dimensions and Size	
	Bottom Ash Pond
Dam Height (ft)	15
Crest Width (ft)	20 (Min) – 30’
Length (ft)	Perimeter of ash pond approximately 10,800’
Side Slopes (upstream) H:V	Not Listed
Side Slopes (downstream) H:V	1.5 to 1:1 – Modified to 2.5:1
Hazard Classification	Significant

*length of perimeter dike

No information on the Hazard Classification was provided, but based on observations a classification of Significant may be appropriate. Per the Federal Guidelines for Dam Safety dated April 2004, a significant hazard potential classification applies to 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. Considering the low probability of loss of life should the fly ash dam system fail, a Federal Hazard Classification of **Significant** appears to be appropriate for this facility (see Table 2.2c for Hazard classification criteria).

Table 2.2c FEMA Federal Guidelines for Dam Safety Hazard Classification		
Hazard Potential Classification	**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 this classification)

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

Per State of Florida Wastewater Facility Permit dated December 2, 2009, the Fly Ash Pond contains boiler blowdown, water treatment filter backwash, air preheater wash, ash and pyrite sluice, coal pile runoff, yard runoff, treated metal cleaning waste, treated demineralizer regeneration waste, treated domestic wastewater, and other minor process and non-process waste streams. Documentation was provided stating the ash pond occupies 165 acres. The drainage area is assumed to be the surface area of the pond. The maximum design storage capacity is approximately 307,384 cubic yards.

Table 2.3: Amount of Residuals and Maximum Capacity of Unit*	
	Ash Pond
Surface Area (acre)	Approximately 165
Current Storage Volume (acre-feet)	495,912,853
Max. Design Storage Capacity (acre-feet)	495,912,853

2.4 PRINCIPAL PROJECT STRUCTURES

2.4.1 Earth Embankment Dam

The original material of the dam embankment was not provided. Test results were provided for a modification and a recommendation was made. We do not have any test results, reports or construction drawings of the modification verifying the materials and their properties.

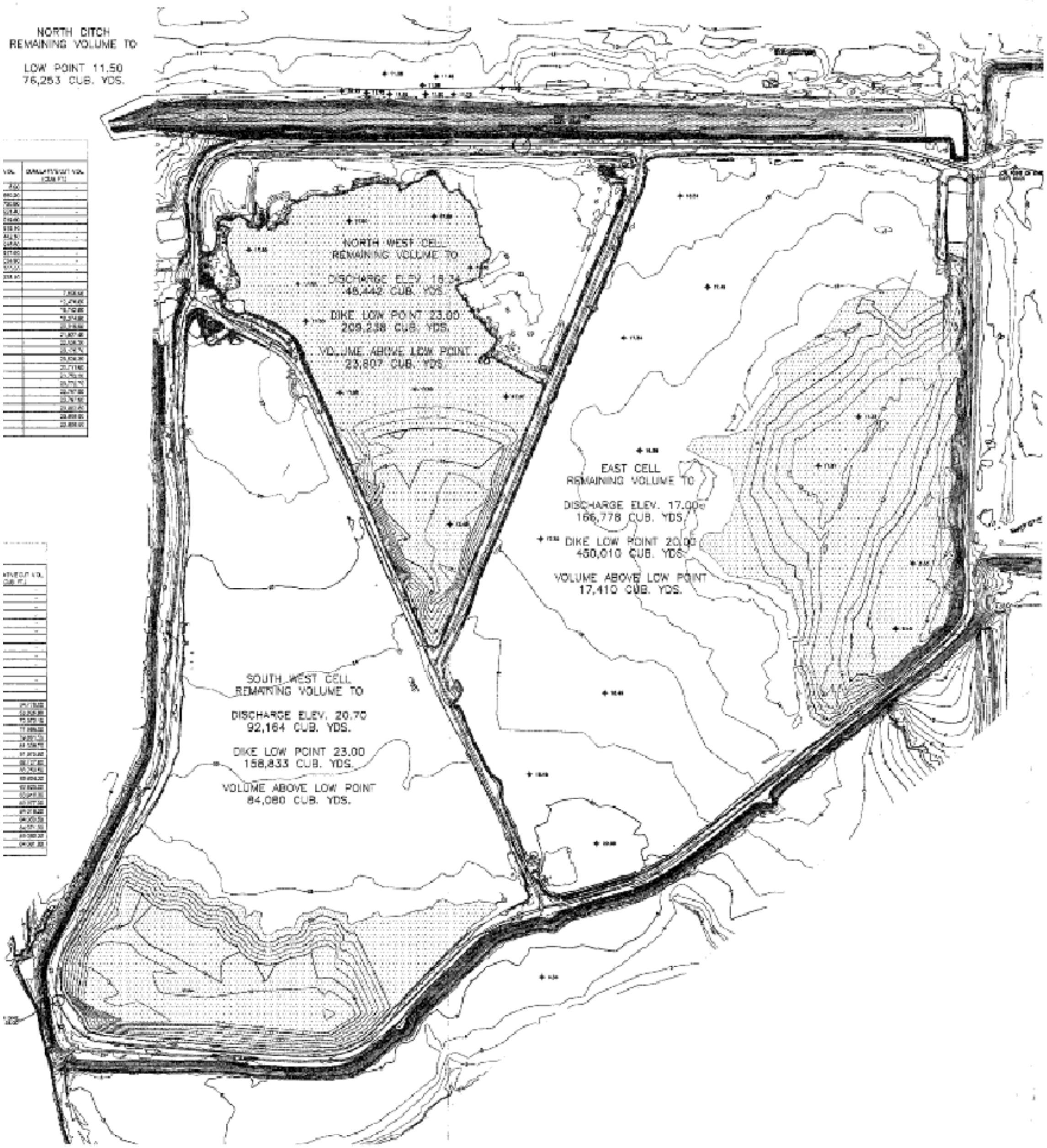


Figure 2.4.1 a: Fly Ash Pond Plan View

2.4.2 Outlet Structures

The weir outlet structure of the East Pond contains three sections of stoplogs and two 14 inch diameter pipes. The top of the stoplogs are assumed to be, as existing now, at approximately Elevation 17'. The outlet pipe through the East Dike is a free outlet with no tailwater condition. The water flows over a weir before entering the recycle canal.

2.5 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

All Critical infrastructures were located using aerial photography and might not accurately represent what currently exists down-gradient of the site. Not all critical infrastructures are labeled for clarity purposes. Figure 2.5 shows the Lansing Smith Plant and associated critical infrastructure, listed in Table 2.5.

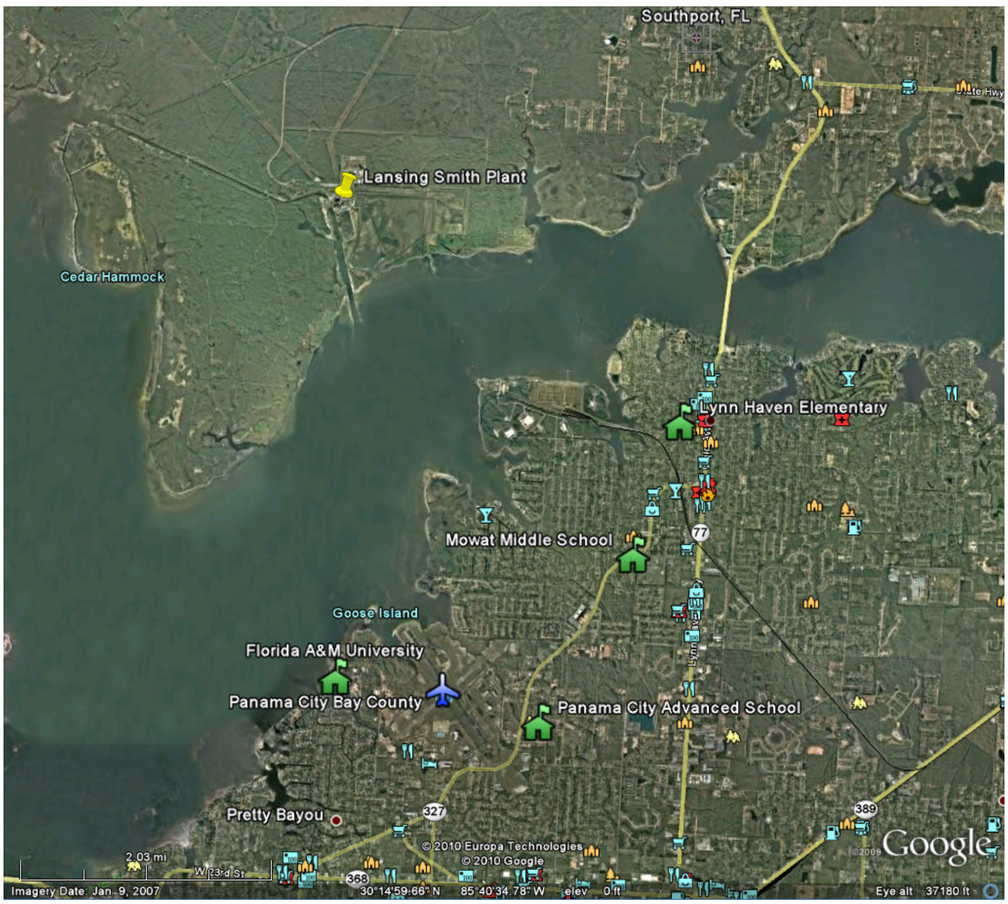


Figure 2.5: Lansing Smith Plant Critical Infrastructure Map

Table 2.5: Lansing Smith Plant Critical Infrastructure

Schools	Schools (Cont)	Nursing Homes
Florida A&M University	Hunter Academy	None Identified
4000 Frankford Ave.	1101 Ohio Avenue	
Panama City, FL 32405	Lynn Haven, FL 32444	
		Transportation
Panama City Advanced School		Lynn Haven Parkway (Hwy 77)
3332 Token Road		
Panama City, FL 32405	**Miscellaneous**	St. Andrews Blvd (Hwy 390)
	Restaurants	
Mowat Middle School	Places of Worship	Panama City Bay County Airport
1903 W. Hwy 390	Businesses	**Fire Stations**
Lynn Haven, FL 32444	Residences	Lynn Haven Fire Department
		1412 Pennsylvania Ave
Lynn Haven Elementary		Lynn Haven, FL 32444
301 West 9th Street		
Lynn Haven, FL 32444		

2.0 SUMMARY OF RELEVANT REPORTS, PERMITS AND INCIDENTS

3.1 SUMMARY OF REPORTS ON THE SAFETY OF THE MANAGEMENT UNIT(S)

Southern Company Generation, Hydro Services 2010 Inspection Report for GPC, Ash Pond Dike Report, March 22, 2010 (Appendix A, Doc 3: 2010 Inspection Report):

- "The inspection team did not see any conditions that posed an imminent threat to the safety of permanence of the ash pond dike or associated structures. The appearance of the dikes is much improved from the previous inspection. It is apparent that much work has gone into the clearing and repair of the dikes."
- Additional grass should be planted on all dike slopes (hydro seeded) for summer growth;
- Seepage found on the slope, near the toe, should be monitored along the area of the West Dike as part of weekly inspections;
- Progress reports from the 2009 inspection were included on this document.

Southern Company Generation, Hydro Services 209 Inspection Report for GPC, Ash Pond Dike Report, March 10, 2009 (Appendix A, Doc 4: 2009 Inspection Report):

- At the time of inspection the water level was the crest. By the end of the day the level had been lowered, but concern about potential damage to the dike when the pond level is at the crest was noted;
- Other than the pond level, no other conditions that posed imminent threat to the safety of the dike were noted;
- The existence of large trees near the crest of the south and west dikes were noted as potential hazards should they be uprooted;
- The inspection team was not able to complete a thorough inspection due to heavy wooded vegetation along the downstream slopes. It was recommended to have all woody vegetation removed from embankment;
- The ash pond dike slopes appear steeper than what is typically recommended. It was also unclear of the material used for the embankments and it was recommended that these be inspected. It was recommended a storm routing analysis be completed;
- The crest of the dike requires some repair and grading to prevent ponding water and to direct stormwater runoff into the pond.

3.2 SUMMARY OF LOCAL, STATE AND FEDERAL ENVIRONMENTAL PERMITS

The Ash Pond facility is under regulation by the Florida Department of Environmental Protection. The discharges of the Ash Pond are permitted under the Federal National Pollutant Discharge Elimination Program.

3.3 SUMMARY OF SPILL/RELEASE INCIDENTS (IF ANY)

No spills or releases from the Ash Pond facilities have been noted by GPC for this site.

3.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

Original construction information was not provided for this facility.

4.1.2 Significant Changes/Modifications in Design since Original Construction

There are multiple references describing some remedial work that needed to be done to the Ash Pond Dike. The figure below shows a cross section of the plans to remediate the dike (see Appendix A: Doc 05 – Remedial Work Dike Section). No documentation was provided on the construction or tests results of this work.

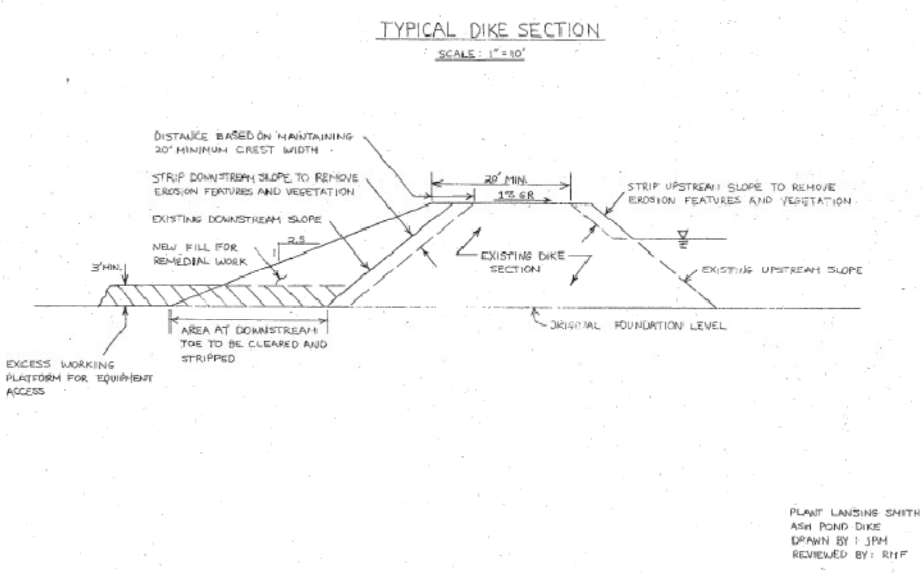


Figure 4.1.2 a: Ash Pond Impoundment Remedial Work Cross-section

4.1.3 Significant Repairs/Rehabilitation since Original Construction

No significant repairs/rehabilitation information was provided.

4.2 SUMMARY OF OPERATIONAL HISTORY

4.2.1 Original Operational Procedures

The ash pond was designed and operated for reservoir sedimentation and sediment storage of fly ash. Plant process waste water, coal combustion waste, coal pile stormwater runoff, and minimal stormwater runoff around the Ash Pond facility are discharged into the reservoir. Inflow water is treated through gravity settling and deposition, and the treated process water and stormwater runoff is discharged through an unregulated type overflow outlet structure to the recycle canal.

4.2.2 Significant Changes in Operational Procedures since Original Startup

No documentation was provided describing any significant changes in Operation Procedures.

4.2.3 Current Operational Procedures

To the best of our knowledge, original operational procedures are in effect. In 1985 a dry ash disposal area was proposed because expansions of the ash pond had been denied multiple times by Florida's Department of Environmental Regulation.

4.2.4 Other Notable Events since Original Startup

No additional information was provided.

4.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND ASSESSMENT

Dewberry personnel Michael Hanson, PE and Frederic Shmurak, PE performed a site visit on Tuesday, July 6, 2010. The site visit began at 9:00 AM. Weather was a cloudy, hot day. The overall visual assessment of the ash pond embankments were that they are in fair condition, but some maintenance items need to be addressed. Coal Combustion Dam Inspection Checklists created on July 6, 2010, by the two engineers for the Lansing Smith Plant ash pond are provided in Appendix B, Documents 1 and 2. Photographs from the site visit are provided in Appendix B, Document 3.

5.2 EARTH EMBANKMENT DAM

5.2.1 Crest

The crest showed elevation irregularities and minor depressions. The crests were covered by graded aggregate base material, but need maintenance.

5.2.2 Upstream Slope

The upstream slopes are mostly vegetated with tall grasses and other wetland vegetation. Scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were not observed.

5.2.3 Downstream Slope and Toe

There were signs of surficial sloughing particularly along the northeastern embankment downstream slope. Widespread rill erosion, surface sloughing, and downstream sediment deposition was found along downstream slopes. Wetlands and the recycle water channel are located along the downstream toe of the embankments.

Rill erosion along downstream slope of west embankment.

Water ponding on west embankment buttress.

Rip rap repair on downstream slope of north embankment

Recently fixed sloughing on west embankment.

5.2.4 Abutments and Groin Areas

The ash pond embankment consists of a combination of a dike and incised system; therefore the earthen embankment does not abut existing hillsides, rock outcrops or other raised topographic features.

5.3 OUTLET STRUCTURES

5.3.1 Overflow Structure

The outlet structure was properly discharging flow from the pond and visually appeared to be in good condition.

5.3.2 Outlet Conduit

The visual portion of the outlet conduit was functioning properly with no apparent deterioration.

5.3.3 Emergency Spillway (If Present)

No emergency spillway is present.

5.3.4 Low Level Outlet

No low level outlet is present.

5.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Floods of Record

No information was provided. The Fly Ash Pond is a diked embankment facility having a contributing drainage area equal to the surface area of the impoundment; therefore the impounded pool would not be anticipated to experience significant flood stages. It was recorded that the storm surge from the adjacent bay overtopped the dike crest and entered the pond sometime during the 1970's. No significant damage was reported.

6.1.2 Inflow Design Flood

According to FEMA Federal Guidelines for Dam Safety, current practice in the design of dams is to use the Inflow Design Flood (IDF) that is deemed appropriate for the hazard potential of the dam and reservoir, and to design spillways and outlet works that are capable of safely accommodating the floodflow without risking the loss of the dam or endangering areas downstream from the dam to flows greater than the inflow. The recommended IDF or spillway design flood for a significant hazard intermediate sized structure (See section 2.2), in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria is the ½ PMF to PMF (See Table 6.1.2).

Table 6.1.2: USACE Hydrologic Evaluation Guidelines Recommended Spillway Design floods

Hazard	Size	Spillway Design Flood
Low	Small	50 to 100-yr frequency
	Intermediate	100-yr to ½ PMF
	Large	½ PMF to PMF
Significant	Small	100-yr to ½ PMF
	Intermediate	½ PMF to PMF
	Large	PMF
High	Small	½ PMF to PMF
	Intermediate	PMF
	Large	PMF

The Probable Maximum Precipitation (PMP) is defined by American Meteorological Society as the theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage area at a certain time of year. The National Weather Service (NWS) further states that in consideration of our limited knowledge of the complicated processes and interrelationships in storms, PMP values are identified as estimates. The NWS has published application procedures that can be used with PMP estimates to develop spatial and temporal characteristics of a Probable Maximum Storm (PMS). A PMS thus developed can be used with a precipitation-runoff simulation model to calculate a probable maximum flood (PMF) hydrograph.

In a hydrologic and hydraulic analysis report date June 29, 2010 it was stated the existing ash pond will handle both the 10 year and 100 year – 24 hour rainfall events, and that the low point top of dike elevations will not be exceeded, though freeboard particularly for the Northwest Cell is very minimum. (See Appendix A: Doc 1: Hydrologic and Hydraulic Analysis Report.pdf). The 24 hour 10 square mile PMP depth is approximately 47 inches. In order to pass the ½ PMP to PO PMP approximately 2 to 4' of freeboard must be present. It is reported that the low point of the dike crest is at elevation 20' and the normally operating pool is 17.5'; Therefore adequate freeboard may exist the ½ PMP.

6.1.3 Spillway Rating

No spillway rating was provided. The Fly Ash Pond is a diked embankment facility having a contributing drainage area equal to the surface area of the impoundment; therefore the impounded pool would not be anticipated to experience significant changes in elevation. The outlet structure type is unregulated and given little change in the normal pool elevation the resulting discharge rate is expected to be relatively constant.

6.1.4 Downstream Flood Analysis

No downstream flood analysis was provided.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Supporting technical documentation is sufficient.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

Adequate capacity and freeboard exists to safely pass the design storm.

6.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

A stability analysis report for the ash pond dated April 2010, by Southern Company Generation Technical Services Earth Science and Environmental Engineering, provides information on the stability analysis results and is presented in Section 7.1.4 Factors of Safety and Base Stresses. Both steady state (normal) loading and earthquake loading conditions were analyzed. See Appendix A (Doc 6: Ash Pond Evaluation.pdf) for the complete report.

7.1.2 Design Properties and Parameters of Materials

A report for the Lansing Smith Plant ash pond was prepared by Southern Company Generation Technical Services Earth Science and Environmental Engineering in 2010. The 2010 Engineering Report includes documentation of the shear strength design properties for the ash pond embankments, which is included in this report and is presented in the following section; see Appendix A (Doc 6: Ash Pond Evaluation.pdf) for the complete report. An engineering report from MACTEC Engineering and Consulting, Inc. was also provided dated March 23, 2010. This report shows the geotechnical results of soils samples provided by Southern Company.

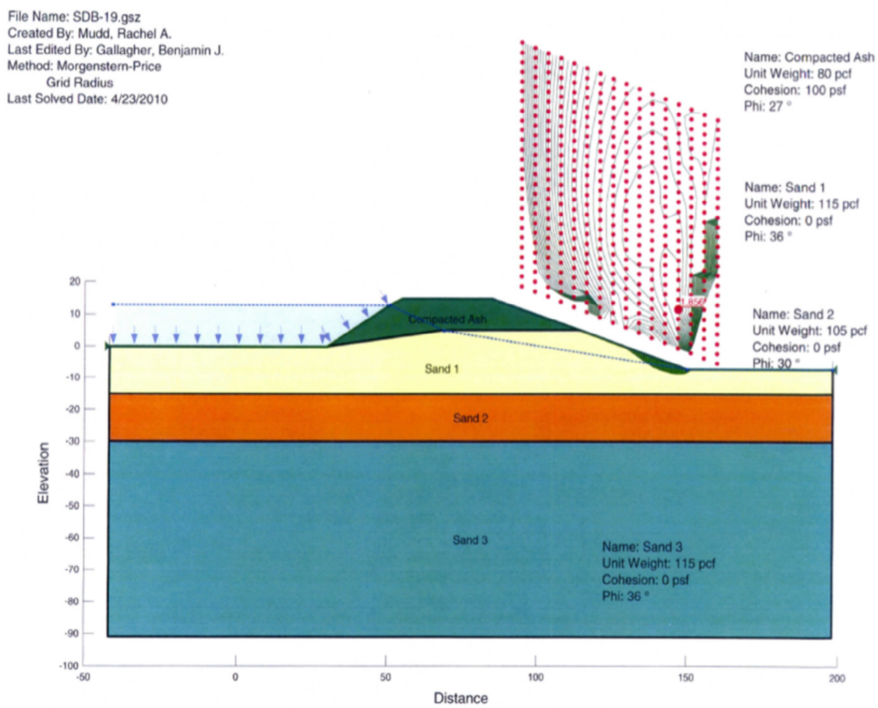
Test results showing the strength parameters of the embankments are presented below.

Table 4a
Soil Properties for Stability Analysis North Embankment

Soil Description	Unit Weight (pcf)	Fiction Angle (degrees)	Cohesion (psf)
Dike Ash	80	27	100
Pond Ash	70	24	50
Embankment and Upper Foundation Sand	105	30	0

Table 4b
Soil Properties for Stability Analysis South Embankment

Soil Description	Unit Weight (pcf)	Fiction Angle (degrees)	Cohesion (psf)
Dike Ash	80	27	100
Pond Ash	70	24	50
Embankment and Upper Foundation Sand	115	36	0
Lower Foundation Sand	105	30	0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Last Edited By: Gallagher, Benjamin J.
Method: Morgenstern-Price
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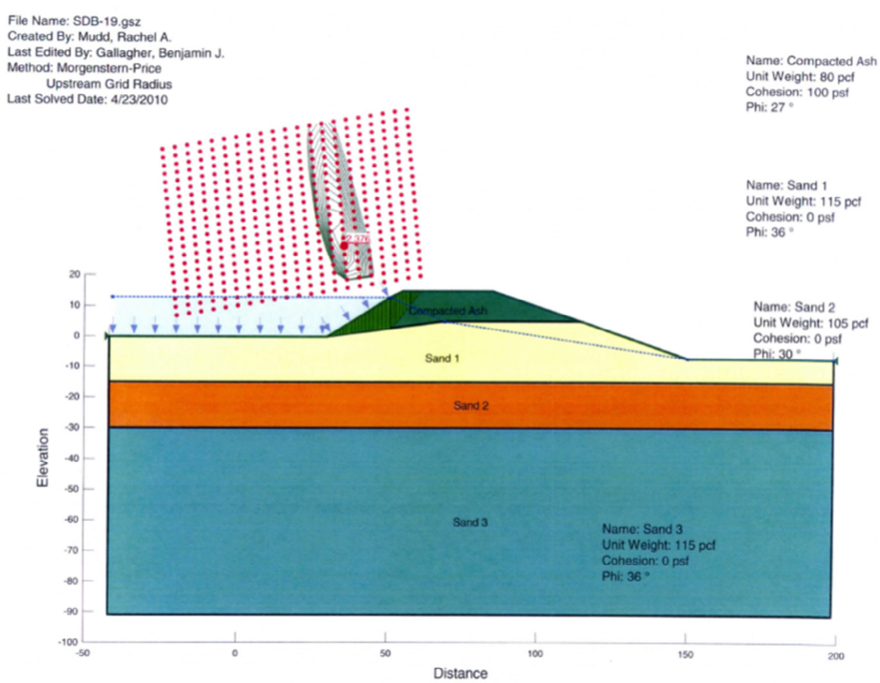
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
Name: Sand 1
Unit Weight: 115 pcf
Cohesion: 0 psf
Phi: 36 °
Name: Sand 2
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
Compacted Ash
Sand 1
Sand 2
Sand 3
Name: Sand 3
Unit Weight: 115 pcf
Cohesion: 0 psf
Phi: 36 °
Elevation
Distance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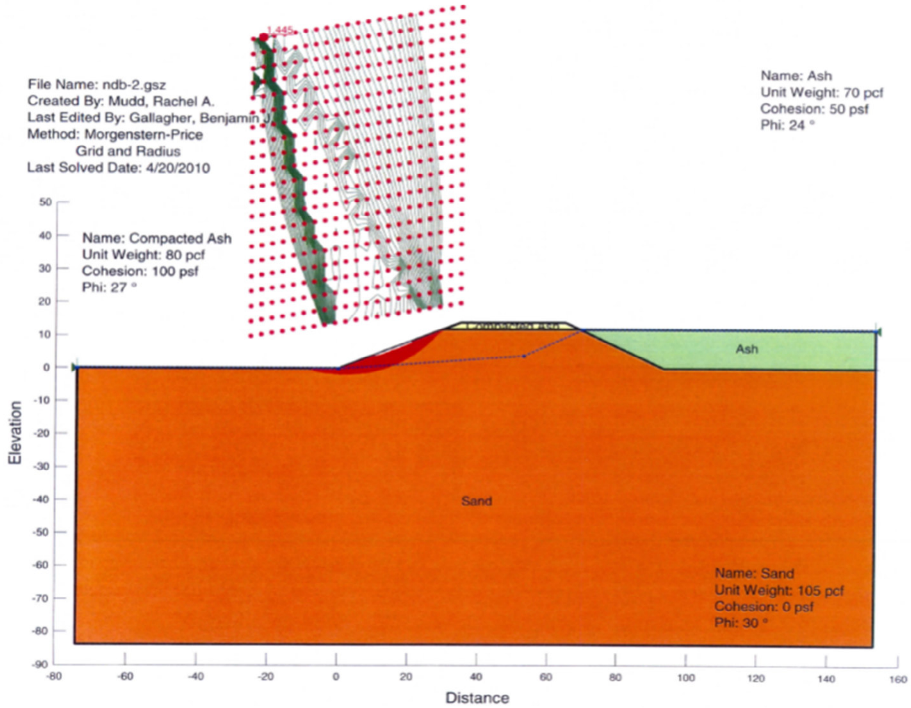
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
Name: Sand 1
Unit Weight: 115 pcf
Cohesion: 0 psf
Phi: 36 °
Name: Sand 2
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
Compacted Ash
Sand 1
Sand 2
Sand 3
Name: Sand 3
Unit Weight: 115 pcf
Cohesion: 0 psf
Phi: 36 °
Elevation
Distance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Last Edited By: Gallagher, Benjamin J.
Method: Morgenstern-Price
Grid and Radius
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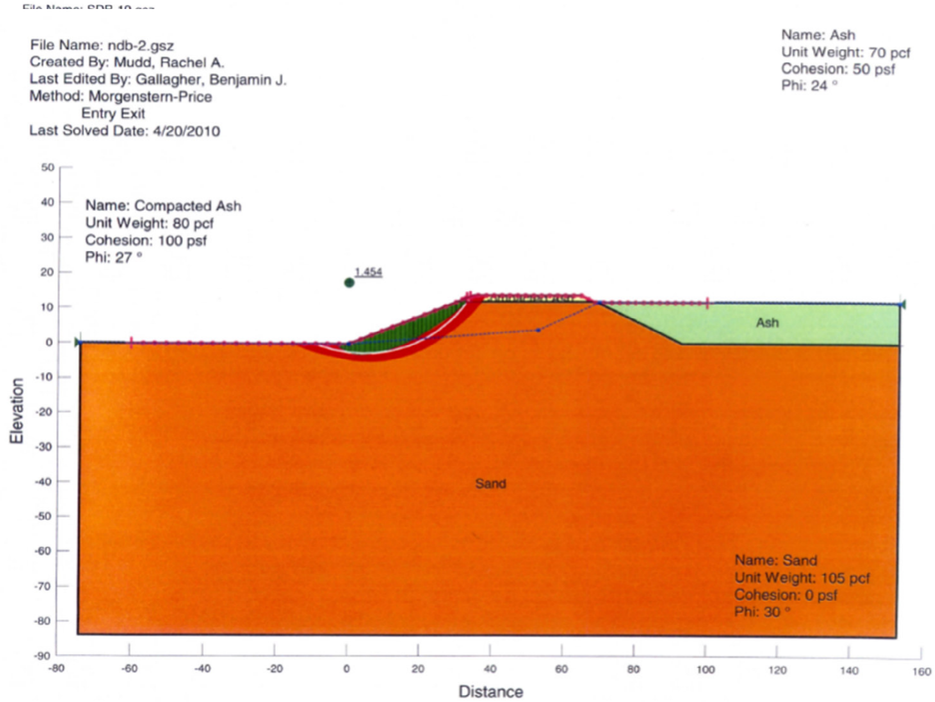
Name: Ash
Unit Weight: 70 pcf
Cohesion: 50 psf
Phi: 24 °
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
Ash
Sand
Name: Sand
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
Elevation
Distance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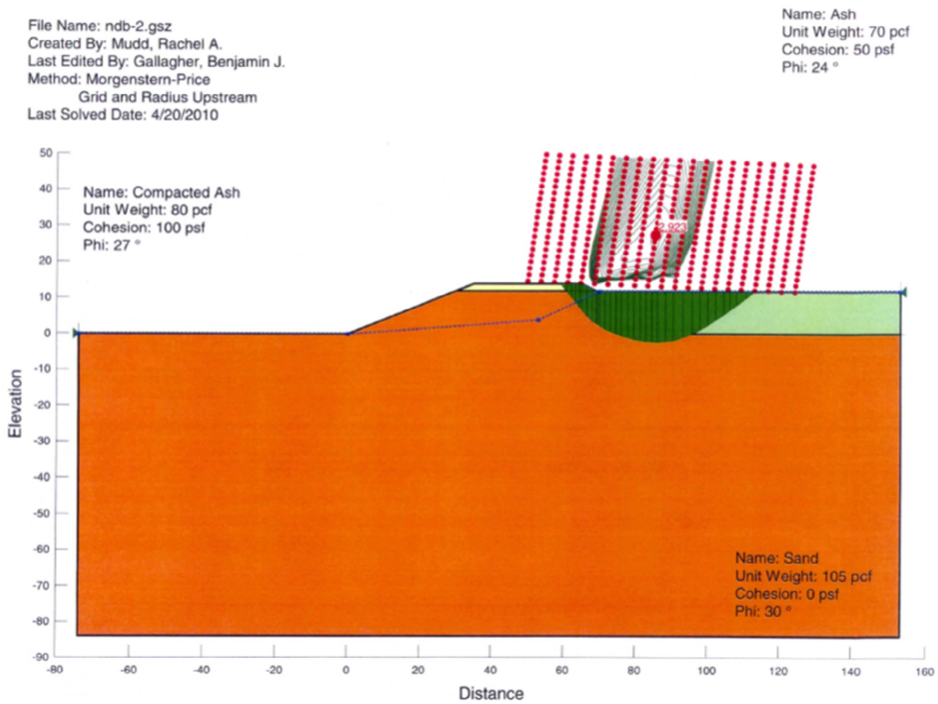
Last Edited By: Gallagher, Benjamin J.
Method: Morgenstern-Price
Entry Exit
Last Solved Date: 4/20/2010
Name: Ash
Unit Weight: 70 pcf
Cohesion: 50 psf
Phi: 24 °
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
1.454
Ash
Sand
Name: Sand
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
Elevation
Distance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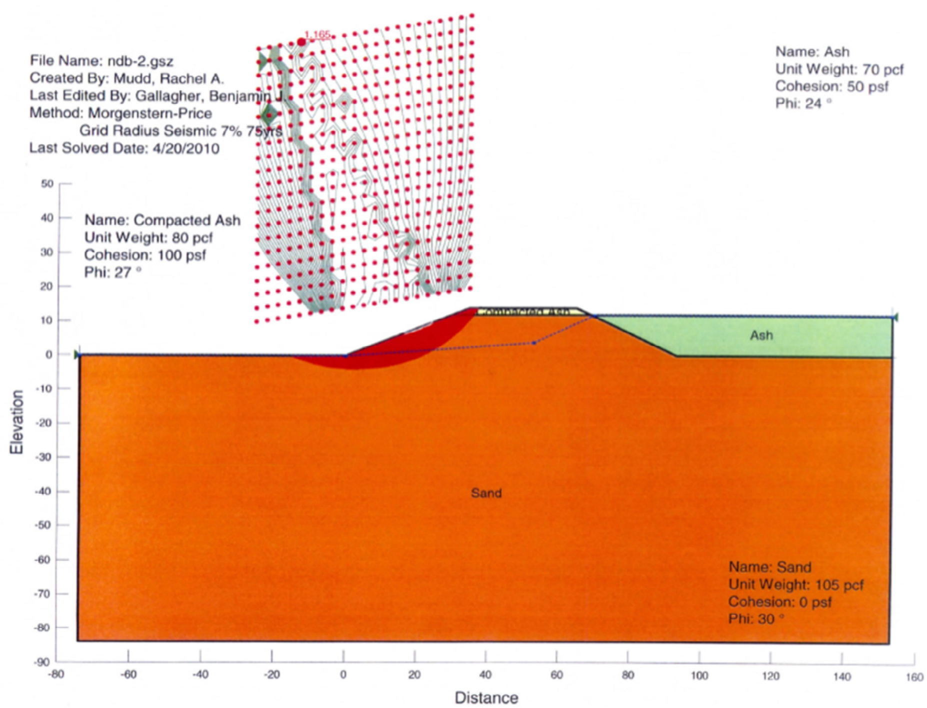
Grid and Radius Upstream
Last Solved Date: 4/20/2010
Name: Ash
Unit Weight: 70 pcf
Cohesion: 50 psf
Phi: 24 °
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
Name: Sand
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
Elevation
Distance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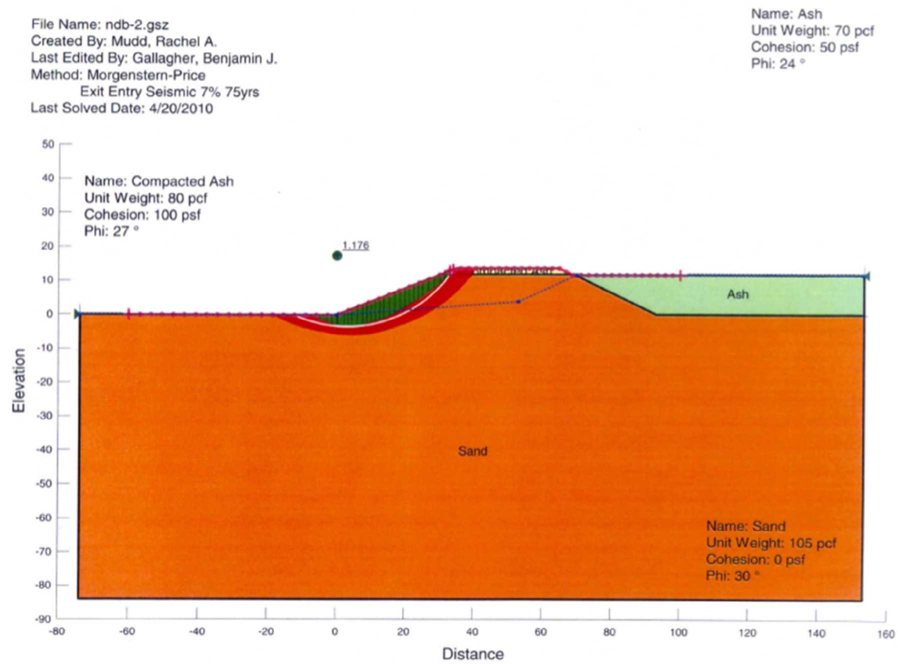
Grid Radius Seismic 7% 75yrs
Last Solved Date: 4/20/2010
Name: Ash
Unit Weight: 70 pcf
Cohesion: 50 psf
Phi: 24 °
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
Ash
Sand
Name: Sand
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
Elevation
Distance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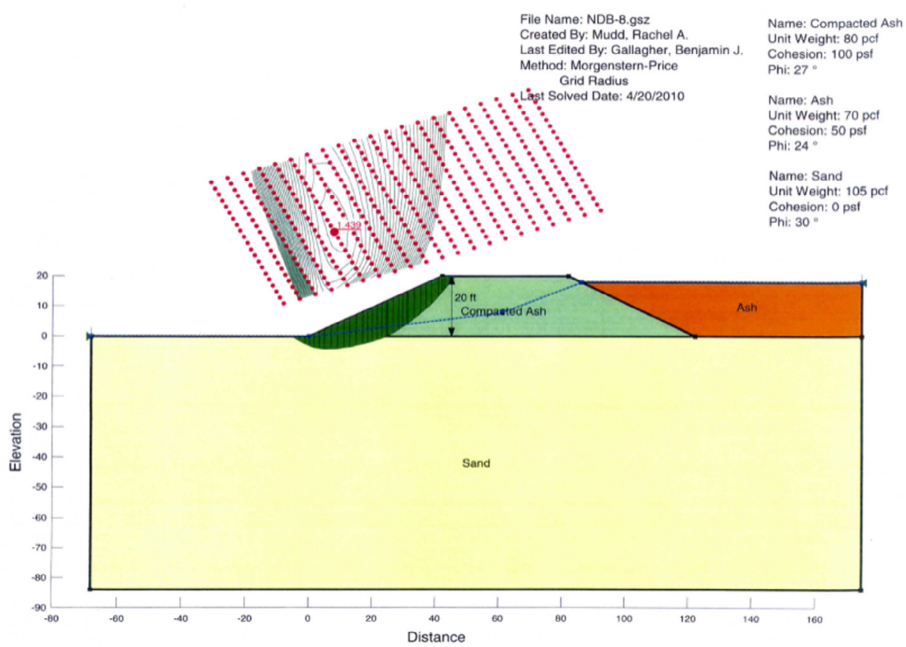
Last Edited By: Gallagher, Benjamin J.
Method: Morgenstern-Price
Exit Entry Seismic 7% 75yrs
Last Solved Date: 4/20/2010
Name: Ash
Unit Weight: 70 pcf
Cohesion: 50 psf
Phi: 24 °
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
1.176
Ash
Sand
Name: Sand
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
Elevation
Distance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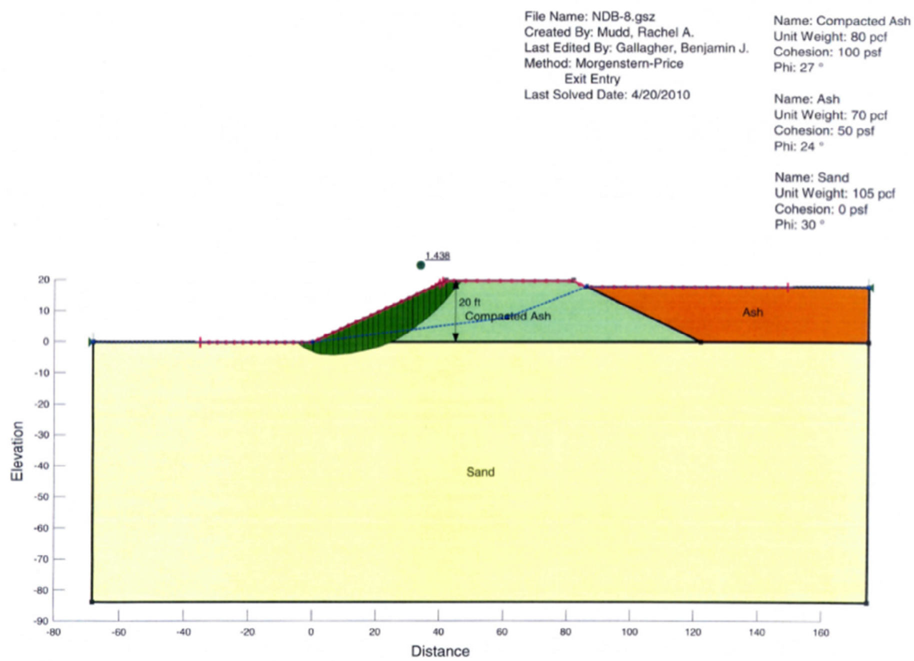
Last Edited By: Gallagher, Benjamin J.
Method: Morgenstern-Price
Grid Radius
Last Solved Date: 4/20/2010
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
Name: Ash
Unit Weight: 70 pcf
Cohesion: 50 psf
Phi: 24 °
Name: Sand
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
20 ft
Compacted Ash
Ash
Sand
Elevation
Distance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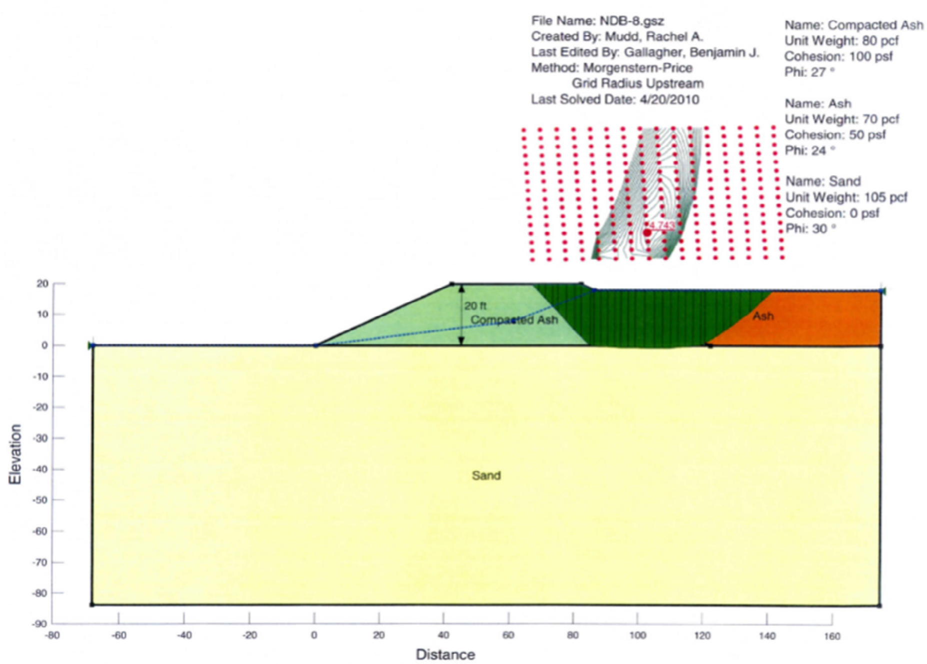
Last Edited By: Gallagher, Benjamin J.
Method: Morgenstern-Price
Exit Entry
Last Solved Date: 4/20/2010
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
Name: Ash
Unit Weight: 70 pcf
Cohesion: 50 psf
Phi: 24 °
Name: Sand
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
1.438
20 ft
Compacted Ash
Ash
Sand
Elevation
Distance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Method: Morgenstern-Price
Grid Radius Upstream
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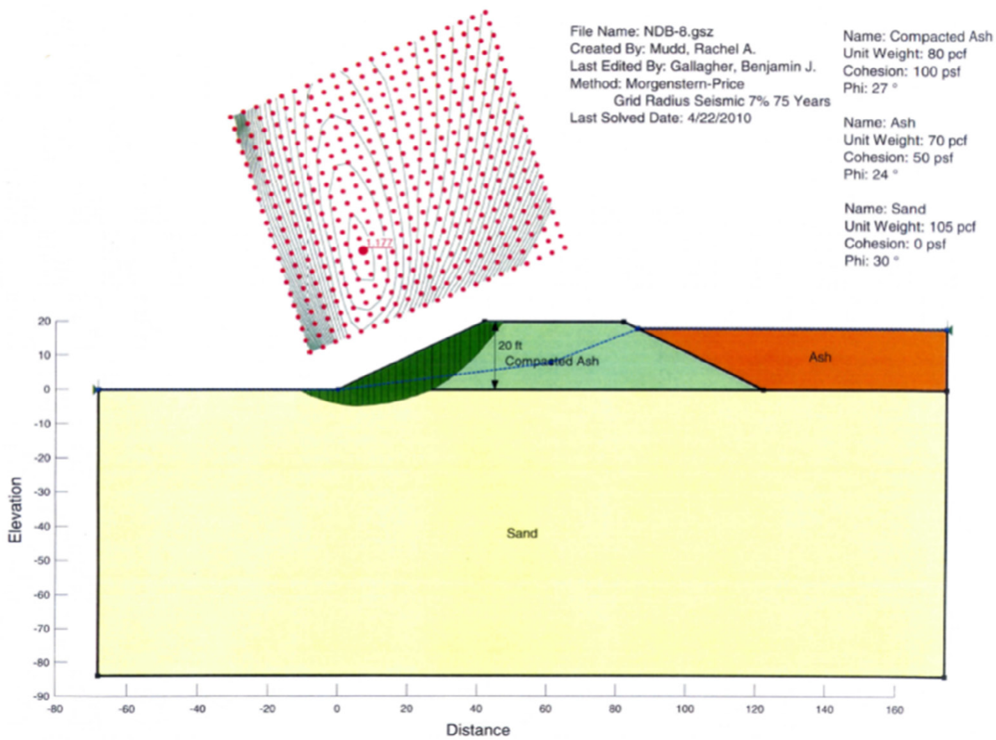
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
Name: Ash
Unit Weight: 70 pcf
Cohesion: 50 psf
Phi: 24 °
Name: Sand
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
20 ft
Compacted Ash
Ash
Sand
Elevation
Distance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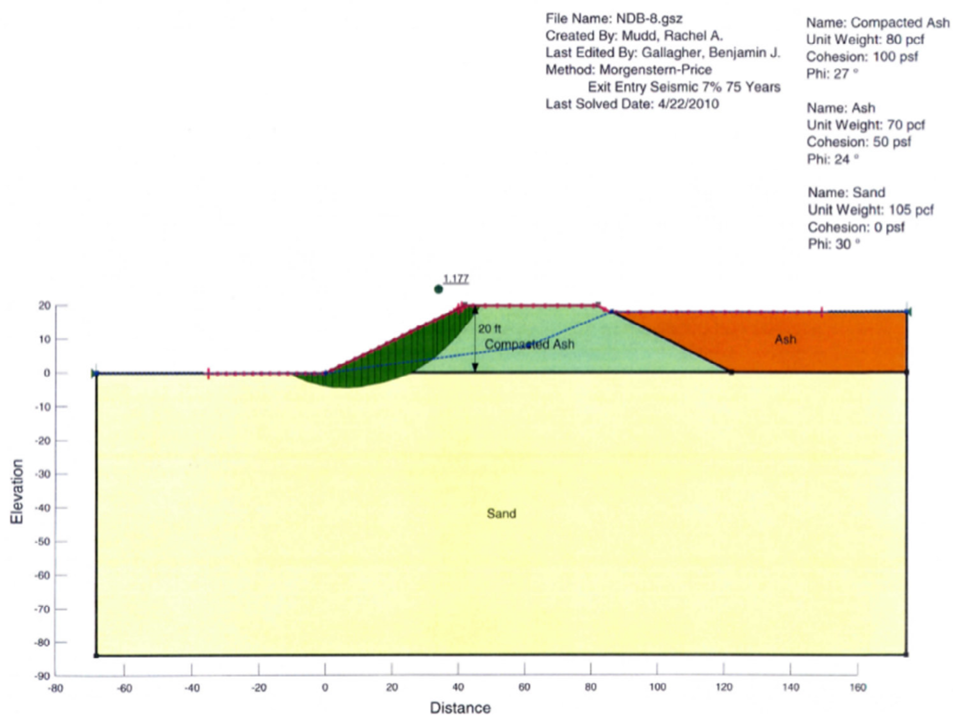
Created By: Mudd, Rachel A.
Last Edited By: Gallagher, Benjamin J.
Method: Morgenstern-Price
Grid Radius Seismic 7% 75 Years
Last Solved Date: 4/22/2010
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
Name: Ash
Unit Weight: 70 pcf
Cohesion: 50 psf
Phi: 24 °
Name: Sand
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
1.177
20 ft
Compacted Ash
Ash
Sand
Elevation
Distance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Created By: Mudd, Rachel A.
Last Edited By: Gallagher, Benjamin J.
Method: Morgenstern-Price
Exit Entry Seismic 7% 75 Years
Last Solved Date: 4/22/2010
Name: Compacted Ash
Unit Weight: 80 pcf
Cohesion: 100 psf
Phi: 27 °
Name: Ash
Unit Weight: 70 pcf
Cohesion: 50 psf
Phi: 24 °
Name: Sand
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 30 °
1.177
20 ft
Compacted Ash
Ash
Sand
Elevation
Distance

7.1.3 Uplift and/or Phreatic Surface Assumptions

Monitoring instrumentation devices have not been installed to verify water levels within the embankment. The assumed phreatic surfaces are shown on the figures in section 7.1.2. No additional information was provided. The water level of the pond was stated to be 17.5'. This elevation was not verified.

7.1.4 Factors of Safety and Base Stresses

A stability analysis report for the ash pond dated April 2010, by Southern Company Generation Technical Services Earth Science and Environmental Engineering, provides information on the factors of safety and is presented below. See Appendix A (Doc 6: Ash Pond Evaluation.pdf) for the complete report.

Table 5
Summary of Minimum Slope Stability Factors of Safety

Cross Section	Analysis Condition		
	Steady-State [1]		Steady-State with Seismic [2]
	Upstream	Downstream	
SDB-1	3.86	2.41	1.65
SDB-19	2.37	1.86	1.46
NDB-2	2.92	1.45	1.17
NDB-8	4.74	1.44	1.18

[1] Normally accepted industry standard minimum factor of safety = 1.5
[2] Normally accepted industry standard minimum factor of safety = 1.1

"The stability analysis results indicate all calculated minimum factors of safety are above generally accepted minimum factors of safety with the exception of the downstream slopes of the north embankment. Calculated factors of safety were 1.44 and 1.45, whereas the generally accepted minimum is 1.5.

These lower factors of safety do not represent a condition of imminent or likely failure of the slopes."

It is important to note, that a section of the embankment system was not evaluated under earthquake loading conditions.

7.1.5 Liquefaction Potential

Liquefaction studies were submitted by GPC as additional documentation concerning the potential for liquefaction of embankment and foundation soils and are included in Appendix C.

Documentation provided from Southern Company concluded that the foundation soil conditions do not appear susceptible to support liquefaction.

The following are some of the criteria and assumptions made for the liquefaction analysis:

1. "The peak acceleration at the top of the dike is 0.078g as derived from the USGS-mapped, site-modified, short-period spectral acceleration at Plant Smith (7% chance of exceedance over 75 years, 1050-year return period).
2. The design earthquake is a magnitude 5.55, as determined by the USGS mapped earthquake with a 7% probability of exceedance over 75 years and located within 300 kilometers of Plant Smith"

Based on historical information, we understand there is little evidence of liquefaction occurring at distances much greater than 100 kilometers from the earthquake source, with large magnitude earthquakes. The USGS online map of Quaternary Fault and Fold Database indicates the closest faults to Plant Smith are the Gulf-margin normal faults located at least 110 kilometers west of these faults, and that is it not clear that slip on these would occur seismically. They have a 'strikingly low historical seismicity'."

7.1.6 Critical Geological Conditions and Seismicity

No critical geologic conditions or seismic conditions are present at the site.

A Northwest Florida Hurricane Evacuation Study dated July 1999 states the following:

The coastal plain is generally flat and represents ancient sea bottoms and beaches. The underlying rock in the area began as lime accumulations from marine organisms or sedimentary deposits of silt, sand and clay. The lower Tertiary beds of limestone, clay, gravel and sand form thick alters toward the south and taper to the north. The Chipola formation and the Marianna and Ocala limestones have identifiable beds and are important water bearing formations. This complex of Tertiary limestones form the principle artesian aquifer in North west Florida. These sediments rest on a base of crystalline rock, which is from 2,500 to 4,000 feet below the land surface.

Section 7.1.5 also describes some of the seismicity documentation.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation is adequate.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Use section 1.1.1

The structural stability of the ash pond embankments are limited based on the following parameters:

- Surface sloughing has occurred in four areas along the northeast downstream slope of the embankment. One of those areas has been repaired with slush grouted rip-rap;
- There is evidence of some small animal burrows along the downstream embankment;
- Widespread rill erosion, surface sloughing and sediment deposition has occurred along downstream slope; and
- Irregular road along west dike downstream buttress with rutting and small surface depressions holding water.

Based on the previous assessment reports/inspections provided by GPC, our assessment of the ash pond is generally consistent with historical observations.

7.0 MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATIONAL PROCEDURES

Operational procedures are adequate. The facility is operated for reservoir sedimentation and sediment storage; specifically, fly ash and flue emission control residuals. Coal combustion process waste water and stormwater runoff from the facility are discharged into the reservoir, inflow water is treated through gravity settling and deposition, and treated process water and stormwater runoff is discharged through an unregulated overflow outlet structure into a water recycling canal.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

Maintenance procedures need to be improved. Embankments showed signs of recently mowed woody-stem vegetation. There was evidence of small animal burrows along the downstream dike. Not all of the deficiencies as noted in the surveillance & monitoring program were corrected and documented. There were signs of surficial sloughing that had been corrected and rip rap that was placed to prevent erosion.

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATION

8.3.1 Adequacy of Operational Procedures

Operational procedures are adequate.

8.3.2 Adequacy of Maintenance

The current maintenance procedures are inadequate. A better program needs to be set in place.

8.0 SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

Weekly Inspections:
It was stated from the Lansing Smith Plant weekly inspections are performed and a blank copy of the inspection formed included in Appendix A Doc 08: Weekly Inpsection.pdf.

Annual Inspections:
Annual inspection reports have been provided by GPC from 2009 and 2010. The 2010 Inspection Report can be found in Appendix A Doc 03: Smith Report 2010.pdf, while the 2009 Inspection Report can be found at Appendix A Doc 04: Smith Report 2009.pdf.

9.2 INSTRUMENTATION MONITORING

9.2.1 Instrumentation Plan

No monitoring instrumentation devices (piezometers) are at the facility during the time of the inspection. Monitoring wells are on site, but are used for water quality purposes only.

9.2.2Instrumentation Monitoring Results

No instrumentation monitoring data has been provided, as there are no piezometers for this purpose.

9.2.3Evaluation

Evaluation is not possible until monitoring instrumentation is installed on site.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

Inspection program is inadequate. Any inspections need to be documented and all concerns need to be addressed in a timely manner.

9.3.2Adequacy of Instrumentation Monitoring Program

This is not applicable for this site.

Appendix A

Plant Smith
Hydrologic and Hydraulic Analysis Report
of the
Ash Pond and Outlet Structures

June 29, 2010

Objective

The objective of this work was to perform a storm water routing analysis, for both the 10 year and 100 year - 24 hour rainfall events, for all three cells of the ash pond and to evaluate the hydraulic adequacy of all outlet structures, weirs, pipes, and to evaluate the operation of the ash pond. The ash pond is divided into three ponds or cells. These ponds include the Northwest Pond, Southwest Pond, and East Pond. Specifics of this analysis were to evaluate the system of ponds individually as well as to evaluate the total ash ponds as a whole.

Assumptions/Input Data

Process flows and current operation of the ponds were supplied by the plant. Topographic survey and aerial mapping of the pond including under water soundings were performed and supplied by SCS Civil Field Services. All outlet structures, weirs and pipes in each pond were also located and surveyed by SCS Civil Field Services.

The pipes between ponds appear to be flowing well and clear and free of substantial sediments and debris. It was assumed that all pipes will continue to be maintained and functioning in proper order.

It is assumed that the outlet pipe through the East Dike into the recycle canal is a free outlet w/no tailwater condition.

Conditions Analyzed

10 year – 24 hour rainfall event with and without plant process flows.
100 year – 24 hour rainfall event with and without plant process flows.

The weir outlet structure of the East Pond contains three sections of stoplogs and two 14 inch dia. pipes. The top of stoplogs are assumed to be, as existing now, at approximately El 17. As for the two 14 inch pipes, each condition was evaluated with the pipes fully operative (opened), and non-operative (fully closed, or clogged).

Summary and Conclusion

As shown in the summary tables, it was determined that for all conditions analyzed, and for the existing available stormwater storage capacity, that each pond with the current outlet structures and pipes in-place and functioning, will handle both the 10 year and 100 year - 24 hour rainfall events, and that the low point top of dike elevations will not be exceeded, though freeboard particularly for the Northwest Cell is very minimum.

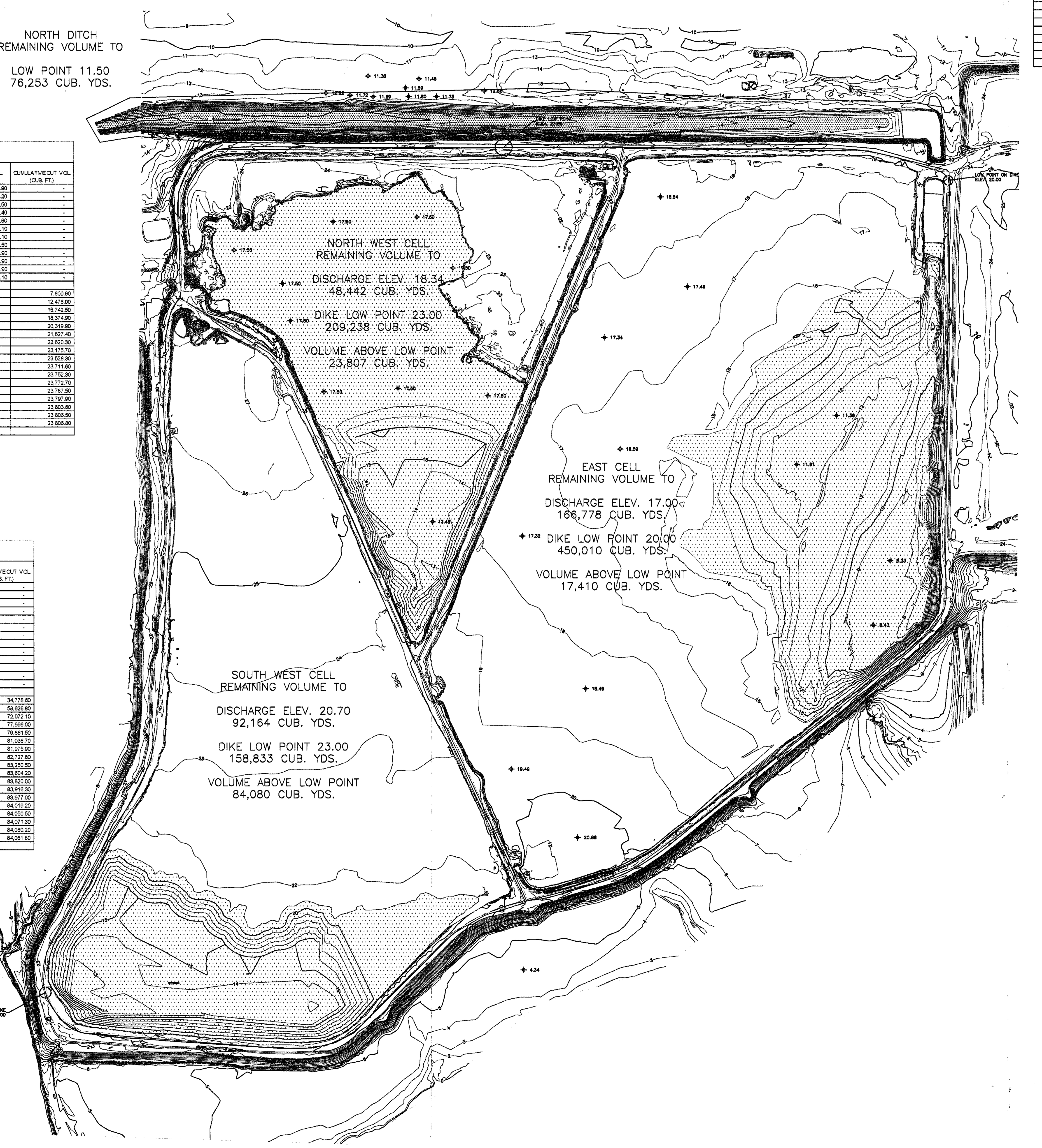
It was also determined that as long as the East Pond discharge weir stays unsubmerged and free flowing, as it does for both storm events and for all conditions analyzed, the pool elevation of the East Cell is controlled by the weir and the two 14 inch pipes within the weir structure, and not the 48 inch dia. pipe below the weir that runs through the dike into the recycle canal.

It should be noted that in the Southwest Pond, the 100 storm event (EL 22.55) exceeds the swale (low point EL 22.28) that was constructed within the dike between the Southwest Cell and the East Cell.

This analysis only evaluates the hydrologic and hydraulic condition of the ash pond and does not contain recommendations for remedial repair or improvements.

NORTH DITCH
REMAINING VOLUME TO

LOW POINT 11.50
76,253 CUB. YDS.



PLANT SMITH ASH POND
NORTH DITCH

ELEV.		ELEV.	FILL BELOW 11.50 (CUB. FT.)	CUT ABOVE 11.50 (CUB. FT.)	CUMULATIVE FILL VOL. (CUB. FT.)
(2.26)	>	(2.00)	0.90	-	0.90
(2.00)	>	(1.00)	50.90	-	51.80
(1.00)	>	0.00	481.30	-	533.10
0.00	>	1.00	1,647.20	-	2,180.30
1.00	>	2.00	2,553.80	-	4,734.10
2.00	>	3.00	3,386.60	-	8,120.70
3.00	>	4.00	4,381.60	-	12,502.30
4.00	>	5.00	5,362.60	-	17,864.90
5.00	>	6.00	6,553.20	-	24,418.10
6.00	>	7.00	7,661.60	-	32,079.70
7.00	>	8.00	8,346.00	-	40,425.70
8.00	>	9.00	9,039.10	-	49,464.80
9.00	>	10.00	9,777.50	-	59,242.30
10.00	>	11.00	11,120.60	-	70,362.90
11.00	>	11.50	5,889.70	-	76,252.60

PLANT SMITH ASH POND
NORTH WEST CELL

ELEV.		ELEV.	FILL BELOW 23.00 (CUB. FT.)	CUT ABOVE 23.00 (CUB. FT.)	CUMULATIVE FILL VOL. (CUB. FT.)	CUMULATIVE CUT VOL. (CUB. FT.)
12.68	>	13.00	6.90	-	6.90	-
13.00	>	14.00	653.30	-	660.20	-
14.00	>	15.00	3,060.30	-	3,720.50	-
15.00	>	16.00	6,200.90	-	9,921.40	-
16.00	>	17.00	8,098.20	-	18,019.60	-
17.00	>	18.00	19,895.50	-	37,915.10	-
18.00	>	18.34	10,527.00	-	48,442.10	-
18.34	>	19.00	21,474.40		69,916.50	
19.00	>	20.00	32,001.40	-	101,917.90	-
20.00	>	21.00	33,117.00	-	135,034.90	-
21.00	>	22.00	34,666.00	-	169,700.90	-
22.00	>	23.00	39,537.20	-	209,238.10	-
23.00	>	24.00	-	7,600.90		7,600.90
24.00	>	25.00	-	4,875.10		12,476.00
25.00	>	26.00	-	3,266.50		15,742.50
26.00	>	27.00	-	2,632.40		18,374.90
27.00	>	28.00	-	1,945.00		20,319.90
28.00	>	29.00	-	1,307.50		21,627.40
29.00	>	30.00	-	992.90		22,620.30
30.00	>	31.00	-	555.40		23,175.70
31.00	>	32.00	-	352.60		23,528.30
32.00	>	33.00	-	183.30		23,711.60
33.00	>	34.00	-	40.70		23,752.30
34.00	>	35.00	-	20.40		23,772.70
35.00	>	36.00	-	14.80		23,787.50
36.00	>	37.00	-	10.40		23,797.90
37.00	>	38.00	-	5.90		23,803.80
38.00	>	39.00	-	2.70		23,806.50
39.00	>	39.93	-	0.30		23,806.80
	>					

PLANT SMITH ASH POND
SOUTH WEST CELL

ELEV.		ELEV.	FILL BELOW 23.00 (CUB. FT.)	CUT ABOVE 23.00 (CUB. FT.)	CUMULATIVE FILL VOL. (CUB. FT.)	CUMULATIVE CUT VOL. (CUB. FT.)
11.91	>	12.00	0.20	-	0.20	-
12.00	>	13.00	295.90	-	296.10	-
13.00	>	14.00	2,816.90	-	3,113.00	-
14.00	>	15.00	6,401.20	-	9,514.20	-
15.00	>	16.00	10,529.60	-	20,043.80	-
16.00	>	17.00	12,419.90	-	32,463.70	-
17.00	>	18.00	13,756.60	-	46,220.30	-
18.00	>	19.00	15,086.50	-	61,306.80	-
19.00	>	20.00	16,466.50	-	77,773.30	-
20.00	>	20.70	14,390.50	-	92,163.80	-
20.70		21.00	6,522.60		98,686.40	
21.00	>	22.00	24,586.60	-	123,273.00	-
22.00	>	23.00	35,560.20	-	158,833.20	-
23.00	>	24.00	-	34,778.60	-	34,778.60
24.00	>	25.00	-	23,848.20	-	58,626.80
25.00	>	26.00	-	13,445.30	-	72,072.10
26.00	>	27.00	-	5,923.90	-	77,996.00
27.00	>	28.00	-	1,865.50	-	79,861.50
28.00	>	29.00	-	1,175.20	-	81,036.70
29.00	>	30.00	-	939.20	-	81,975.90
30.00	>	31.00	-	751.90	-	82,727.80
31.00	>	32.00	-	522.70	-	83,250.50
32.00	>	33.00	-	353.70	-	83,604.20
33.00	>	34.00	-	215.80	-	83,820.00
34.00	>	35.00	-	96.30	-	83,916.30
35.00	>	36.00	-	60.70	-	83,977.00
36.00	>	37.00	-	42.20	-	84,019.20
37.00	>	38.00	-	31.30	-	84,050.50
38.00	>	39.00	-	20.80	-	84,071.30
39.00	>	40.00	-	8.90	-	84,080.20
40.00	>	41.00	-	1.60	-	84,081.80

PLANT SMITH ASH POND
EAST CELL

ELEV.		ELEV.	FILL BELOW 20.00 (CUB. FT.)	CUT ABOVE 20.00 (CUB. FT.)	CUMULATIVE FILL VOL. (CUB. FT.)	CUMULATIVE CUT VOL. (CUB. FT.)
5.57	>	6.00	3.20	-	3.20	-
6.00	>	7.00	189.60	-	192.80	-
7.00	>	8.00	853.80	-	1,046.60	-
8.00	>	9.00	2,821.30	-	3,867.90	-
9.00	>	10.00	5,874.20	-	9,742.10	-
10.00	>	11.00	7,579.70	-	17,321.80	-
11.00	>	12.00	10,648.80	-	27,970.60	-
12.00	>	13.00	17,044.10	-	45,014.70	-
13.00	>	14.00	21,851.50	-	66,866.20	-
14.00	>	15.00	24,694.50	-	91,560.70	-
15.00	>	16.00	29,262.90	-	120,823.60	-
16.00	>	**17.00**	45,953.90	-	**166,777.50**	-
17.00	>	18.00	76,570.20	-	243,347.70	
18.00	>	19.00	95,526.90	-	338,874.60	-
19.00	>	20.00	111,135.10	-	450,009.70	-
			-			
20.00	>	21.00	-	6,197.30		6,197.30
21.00	>	22.00	-	3,523.60		9,720.90
22.00	>	23.00	-	2,757.70		12,478.60
23.00	>	24.00	-	2,224.10		14,702.70
24.00	>	25.00	-	1,612.30		16,315.00
25.00	>	26.00	-	811.20		17,126.20
26.00	>	27.00	-	234.30		17,360.50
27.00	>	28.00	-	49.10		17,409.60
28.00	>	28.12	-	0.10		17,409.70

GRAPHIC SCALE
(IN FEET)
1 inch = 200 ft.

NOTES:

1) SOUNDING, TOPOGRAPHICAL (FIELD AND AERIAL) DATA COLLECTED JANUARY 2010 BY CIVIL FIELD SERVICES SURVEY AND MAPPING GROUP PHONE: (205) 664-6209.

2) CONTOUR INTERVAL 1.0 FEET

3) CONTOURS AND VOLUMES WERE PRODUCED FROM DIGITAL TERRAIN MODEL

4) ELEVATION DATUM FOR VOLUME CALCULATION OF EAST CELL: 17.00 MSL.
ELEVATION USED TO CALCULATE REMAINING VOLUME; FROM DECEMBER 2000 VOLUME REPORT FROM BUCHANAN & HARPER, INC.
735 WEST 11TH STREET PANAMA CITY, FL. 32401 PHONE: (850) 763-7427.

5) ELEVATION DATUM FOR VOLUME CALCULATION OF NORTHWEST CELL: 18.34 MSL.
ELEVATION USED TO CALCULATE REMAINING VOLUME; FROM DECEMBER 2000 VOLUME REPORT FROM BUCHANAN & HARPER, INC.

6) ELEVATION DATUM FOR VOLUME CALCULATION OF SOUTHWEST CELL: 20.70 MSL.
ELEVATION USED TO CALCULATE REMAINING VOLUME; FROM DECEMBER 2000 VOLUME REPORT FROM BUCHANAN & HARPER, INC.

7) DRAWING IS ACCURATE ONLY AT ORIGINAL SCALE.

AREAS OF REMAINING WATER VOLUME

GRID COORDINATES NAD 83
FLORIDA STATE PLANE
NORTH ZONE

HYDROGRAPHIC/TOPOGRAPHIC SURVEY

Southern Company Services, Inc.
for
Gulf Power Company

JOB: PLANT LANSING SMITH
DETAIL: ASH POND
TOPO AND VOLUME

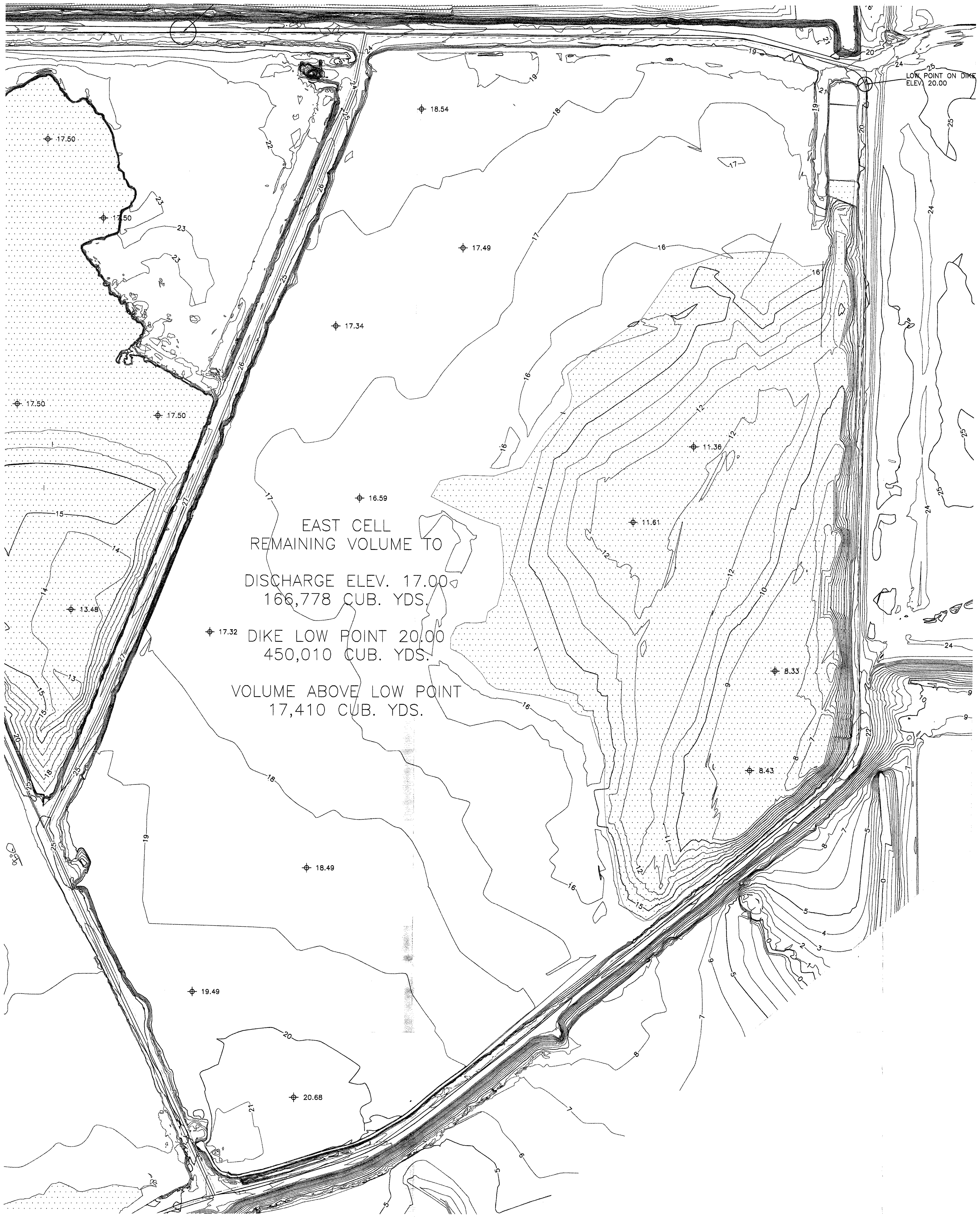
DRAWN: ENP CHECKED: DESIGNED:
APPROVED: DATE: 3/11/2010
APPROVED: DATE:

SCALE: AS NOTED
SHEET 1 OF 1 SHEETS
SUPERSEDES

3727LAN
REV 0

REV | DATE:

GP-SM-#0009



PLANT SMITH ASH POND EAST CELL						
ELEV.		ELEV.	FILL BELOW 20.00 (CUB. FT.)	CUT ABOVE 20.00 (CUB. FT.)	CUMULATIVE FILL VOL. (CUB. FT.)	CUMULATIVE CUT VOL. (CUB. FT.)
5.57	>	6.00	3.20	-	3.20	-
6.00	>	7.00	189.60	-	192.80	-
7.00	>	8.00	853.80	-	1,046.60	-
8.00	>	9.00	2,821.30	-	3,867.90	-
9.00	>	10.00	5,874.20	-	9,742.10	-
10.00	>	11.00	7,579.70	-	17,321.80	-
11.00	>	12.00	10,648.80	-	27,970.60	-
12.00	>	13.00	17,044.10	-	45,014.70	-
13.00	>	14.00	21,851.50	-	66,866.20	-
14.00	>	15.00	24,694.50	-	91,560.70	-
15.00	>	16.00	29,262.90	-	120,823.60	-
16.00	>	**17.00**	45,953.90	-	**166,777.50**	-
17.00	>	18.00	76,570.20	-	243,347.70	
18.00	>	19.00	95,526.90	-	338,874.60	-
19.00	>	20.00	111,135.10	-	450,009.70	-
			-			
20.00	>	21.00	-	6,197.30		6,197.30
21.00	>	22.00	-	3,523.60		9,720.90
22.00	>	23.00	-	2,757.70		12,478.60
23.00	>	24.00	-	2,224.10		14,702.70
24.00	>	25.00	-	1,612.30		16,315.00
25.00	>	26.00	-	811.20		17,126.20
26.00	>	27.00	-	234.30		17,360.50
27.00	>	28.00	-	49.10		17,409.60
28.00	>	28.12	-	0.10		17,409.70

GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.

GRID COORDINATES NAD 83
FLORIDA STATE PLANE
NORTH ZONE

AREAS OF REMAINING WATER VOLUME

NOTES:

1) SOUNDING, TOPOGRAPHICAL (FIELD AND AERIAL) DATA COLLECTED JANUARY 2010 BY CIVIL FIELD SERVICES SURVEY AND MAPPING GROUP PHONE: (205) 664-6209.

2) CONTOUR INTERVAL 1.0 FEET

3) CONTOURS AND VOLUMES WERE PRODUCED FROM DIGITAL TERRAIN MODEL

4) ELEVATION DATUM FOR VOLUME CALCULATION OF EAST CELL: 17.00 MSL.
ELEVATION USED TO CALCULATE REMAINING VOLUME; FROM DECEMBER 2000 VOLUME REPORT FROM BUCHANAN & HARPER, INC.

4) DRAWING IS ACCURATE ONLY AT ORIGINAL SCALE.

HYDROGRAPHIC/TOPOGRAPHIC SURVEY

Southern Company Services, Inc.
for
Gulf Power Company

REV	DATE:

JOB PLANT LANSING SMITH
DETAIL ASH POND EAST CELL
TOPO AND VOLUME

DRAWN ENP CHECKED DESIGNED
APPROVED DATE 3/11/2010
APPROVED DATE

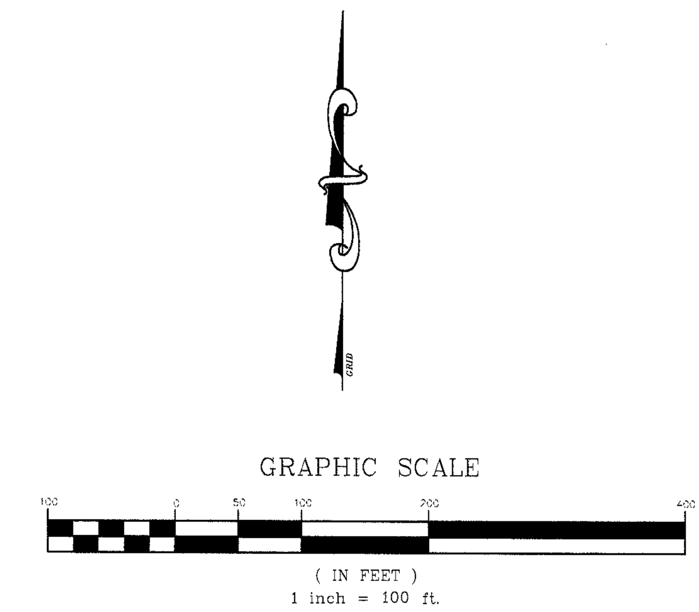
SCALE AS NOTED B/M
SHEET 1 OF 1 SHEETS
SUPERSEDES

3727LAN REV 0

GP-SM-#0010

PLANT SMITH ASH POND
SOUTH WEST CELL

ELEV.		ELEV.	FILL BELOW 23.00 (CUB. FT.)	CUT ABOVE 23.00 (CUB. FT.)	CUMULATIVE FILL VOL. (CUB. FT.)	CUMULATIVE CUT VOL. (CUB. FT.)
11.91	>	12.00	0.20	-	0.20	-
12.00	>	13.00	295.90	-	296.10	-
13.00	>	14.00	2,816.90	-	3,113.00	-
14.00	>	15.00	6,401.20	-	9,514.20	-
15.00	>	16.00	10,529.60	-	20,043.80	-
16.00	>	17.00	12,419.90	-	32,463.70	-
17.00	>	18.00	13,756.60	-	46,220.30	-
18.00	>	19.00	15,086.50	-	61,306.80	-
19.00	>	20.00	16,466.50	-	77,773.30	-
20.00	>	20.70	14,390.50	-	92,163.80	-
20.70		21.00	6,522.60		98,686.40	
21.00	>	22.00	24,586.60	-	123,273.00	-
22.00	>	23.00	35,560.20	-	158,833.20	-
23.00	>	24.00	-	34,778.60	-	34,778.60
24.00	>	25.00	-	23,848.20	-	58,626.80
25.00	>	26.00	-	13,445.30	-	72,072.10
26.00	>	27.00	-	5,923.90	-	77,996.00
27.00	>	28.00	-	1,865.50	-	79,861.50
28.00	>	29.00	-	1,175.20	-	81,036.70
29.00	>	30.00	-	939.20	-	81,975.90
30.00	>	31.00	-	751.90	-	82,727.80
31.00	>	32.00	-	522.70	-	83,250.50
32.00	>	33.00	-	353.70	-	83,604.20
33.00	>	34.00	-	215.80	-	83,820.00
34.00	>	35.00	-	96.30	-	83,916.30
35.00	>	36.00	-	60.70	-	83,977.00
36.00	>	37.00	-	42.20	-	84,019.20
37.00	>	38.00	-	31.30	-	84,050.50
38.00	>	39.00	-	20.80	-	84,071.30
39.00	>	40.00	-	8.90	-	84,080.20
40.00	>	41.00	-	1.60	-	84,081.80



GRID COORDINATES NAD 83
FLORIDA STATE PLANE
NORTH ZONE

AREAS OF REMAINING WATER VOLUME

NOTES:

1) SOUNDING, TOPOGRAPHICAL (FIELD AND AERIAL) DATA COLLECTED JANUARY 2010 BY CIVIL FIELD SERVICES SURVEY AND MAPPING GROUP PHONE: (205) 664-6209.

2) CONTOUR INTERVAL 1.0 FEET

3) CONTOURS AND VOLUMES WERE PRODUCED FROM DIGITAL TERRAIN MODEL

4) ELEVATION DATUM FOR VOLUME CALCULATION OF SOUTHWEST CELL: 20.70 MSL. ELEVATION USED TO CALCULATE REMAINING VOLUME; FROM DECEMBER 2000 VOLUME REPORT FROM BUCHANAN & HARPER, INC.

4) DRAWING IS ACCURATE ONLY AT ORIGINAL SCALE.

HYDROGRAPHIC/TOPOGRAPHIC SURVEY

Southern Company Services, Inc.
for
Gulf Power Company

JOB PLANT LANSING SMITH
DETAIL ASH POND SOUTH WEST CELL
TOPO AND VOLUME

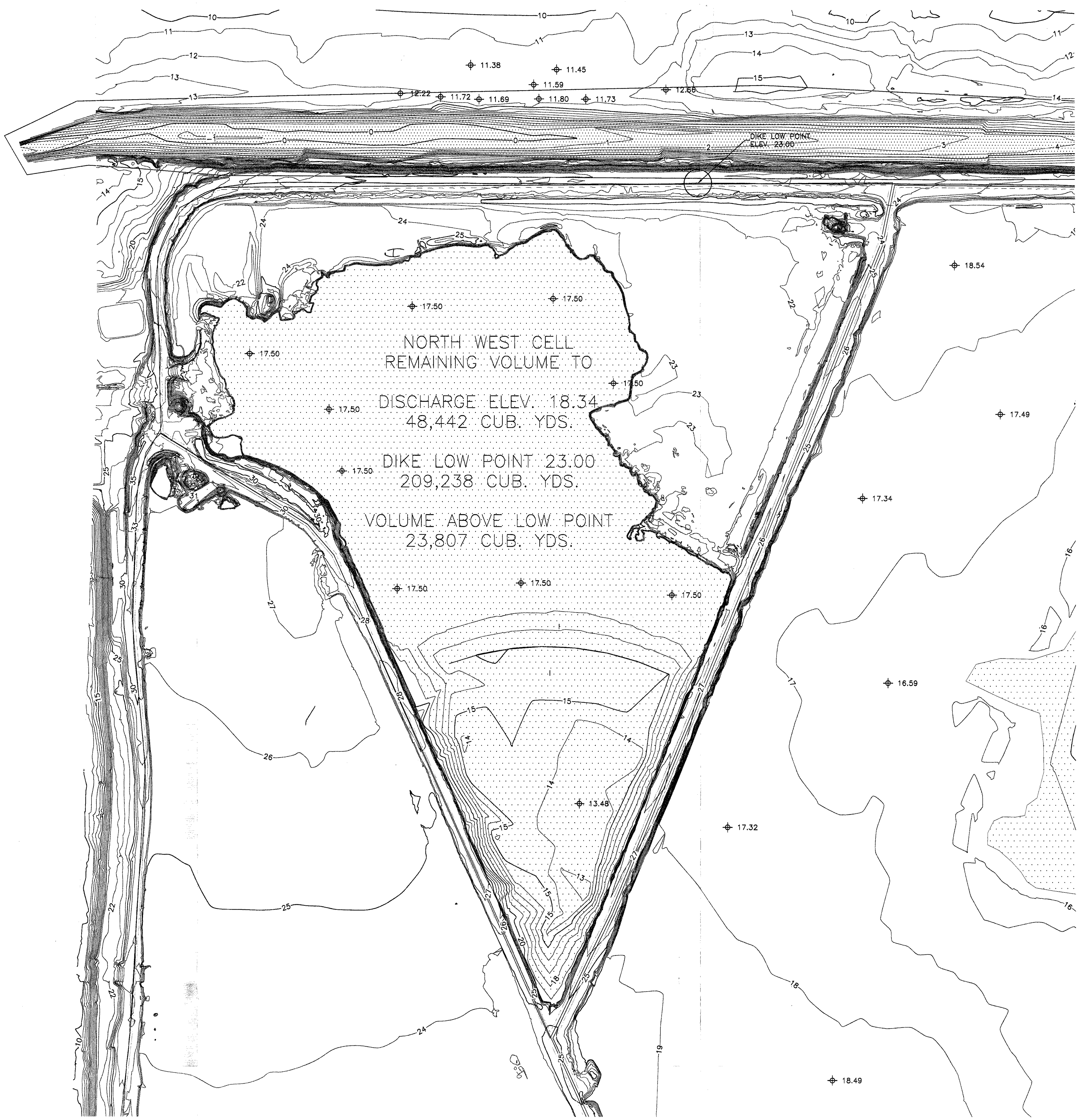
REV	DATE:

DRAWN ENP CHECKED DESIGNED
APPROVED DATE 3/11/2010
APPROVED DATE

SCALE AS NOTED B/M
SHEET 1 OF 1 SHEETS
SUPERSEDES

3727LAN REV 0

GP-SM-#0011



PLANT SMITH ASH POND NORTH WEST CELL						
ELEV.		ELEV.	FILL BELOW 23.00 (CUB. FT.)	CUT ABOVE 23.00 (CUB. FT.)	CUMULATIVE FILL VOL. (CUB. FT.)	CUMULATIVE CUT VOL. (CUB. FT.)
12.68	>	13.00	6.90	-	6.90	-
13.00	>	14.00	653.30	-	660.20	-
14.00	>	15.00	3,060.30	-	3,720.50	-
15.00	>	16.00	6,200.90	-	9,921.40	-
16.00	>	17.00	8,098.20	-	18,019.60	-
17.00	>	18.00	19,895.50	-	37,915.10	-
18.00	>	18.34	10,527.00	-	48,442.10	-
18.34	>	19.00	21,474.40		69,916.50	
19.00	>	20.00	32,001.40	-	101,917.90	-
20.00	>	21.00	33,117.00	-	135,034.90	-
21.00	>	22.00	34,666.00	-	169,700.90	-
22.00	>	23.00	39,537.20	-	209,238.10	-
23.00	>	24.00	-	7,600.90		7,600.90
24.00	>	25.00	-	4,875.10		12,476.00
25.00	>	26.00	-	3,266.50		15,742.50
26.00	>	27.00	-	2,632.40		18,374.90
27.00	>	28.00	-	1,945.00		20,319.90
28.00	>	29.00	-	1,307.50		21,627.40
29.00	>	30.00	-	992.90		22,620.30
30.00	>	31.00	-	555.40		23,175.70
31.00	>	32.00	-	352.60		23,528.30
32.00	>	33.00	-	183.30		23,711.60
33.00	>	34.00	-	40.70		23,752.30
34.00	>	35.00	-	20.40		23,772.70
35.00	>	36.00	-	14.80		23,787.50
36.00	>	37.00	-	10.40		23,797.90
37.00	>	38.00	-	5.90		23,803.80
38.00	>	39.00	-	2.70		23,806.50
39.00	>	39.93	-	0.30		23,806.80
	>					

GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.

GRID COORDINATES NAD 83

FLORIDA STATE PLANE
NORTH ZONE

AREAS OF REMAINING WATER VOLUME

NOTES:

1) SOUNDING, TOPOGRAPHICAL (FIELD AND AERIAL) DATA COLLECTED JANUARY 2010 BY CIVIL FIELD SERVICES SURVEY AND MAPPING GROUP PHONE: (205) 664-6209.

2) CONTOUR INTERVAL 1.0 FEET

3) CONTOURS AND VOLUMES WERE PRODUCED FROM DIGITAL TERRAIN MODEL

4) ELEVATION DATUM FOR VOLUME CALCULATION OF NORTHWEST CELL: 18.34 MSL. ELEVATION USED TO CALCULATE REMAINING VOLUME; FROM DECEMBER 2000 VOLUME REPORT FROM BUCHANAN & HARPER, INC.

5) DRAWING IS ACCURATE ONLY AT ORIGINAL SCALE.

HYDROGRAPHIC/TOPOGRAPHIC SURVEY

Southern Company Services, Inc.
for
Gulf Power Company

REV	DATE:

DRAWN ENP CHECKED DESIGNED
APPROVED DATE 3/11/2010
APPROVED DATE

JOB PLANT LANSING SMITH
DETAIL ASH POND NORTH WEST CELL
TOPO AND VOLUME
SCALE AS NOTED B/M
SHEET 1 OF 1 SHEETS
SUPERSEDES
3727LAN REV 0

GP-SM-#0012

Southern Company Generation
Hydro Services
Bin 10193
241 Ralph McGill Boulevard NE
Atlanta, Georgia 30308-3374
Tel 404.506.7033

SOUTHERN COMPANY
Energy to Serve Your World™

CONFIDENTIAL

March 22, 2010

Plant Smith
Dam Safety Inspection
Ash Pond Dike Report

Mr. Brian E. Heinfeld
Plant Manager
Gulf Power Co.
Plant Smith

Dear Mr. Heinfeld:

Attached is the 2010 Dam Safety Inspection Report for Plant Smith. This inspection was performed by R. D. Wood and H. H. Armitage of the SCG Hydro Services Group on February 10, 2010. The report includes a checklist and photographs of observations of site conditions made during the dam and dike inspections. We would like to thank Mr. Eddie Jackson for his hospitality and assistance during the inspection.

The inspection team did not see any conditions that posed an imminent threat to the safety or permanence of the ash pond dike or associated structures. The appearance of the dikes is much improved from the previous inspection. It is apparent that much work has gone into the clearing and repair of the dikes.

Three recommendations have come from this inspection:

#1 - Additional grass should be planted (hydro-seeded) on all dike slopes for summer growth. (This action will complete Previous Recommendation #1, see below)

#2 - Seepage found on the slope, near the toe, should be monitored along the area of the West Dike as part of weekly plant inspections. Any sloughing or loss of material observed during the weekly inspection should be reported to SCG Hydro Services immediately.

#3 - A sign should be placed at the granular stockpiles to mark them for "Emergency Dike Repair Use Only".

Following is a listing of Previous Recommendations from the 2009 inspection and their dispositions:

1. Trees and brush on the upstream and downstream of all dike slopes should be removed and slopes grassed and maintained. The process of tree removal and root ball repair should be done in accordance with the guidelines and procedures set forth in FEMA Publication #534, "Impacts of Plants on Earthen Dams", pages 6-1 through 6-12.

Disposition – Continues - Trees and brush on all slopes have been removed and soil repairs made. Establishment of grass cover (hydro-seeding) is to be done at the appropriate time.

2. A survey of the crest elevation on a 10-foot spacing should be performed to confirm the elevation and to aid in repair efforts.

   Disposition - Completed

3. Using the survey information the crest should be graded to direct drainage into the pond. Traffic ruts and potholes on the dike crest should be filled with soil and then graveled to prevent water from standing/ponding on the crest. Downstream slope erosion should also be repaired.

   Disposition - Continues – Repairs of the crest and slope erosion are in progress.

4. Construction techniques and materials used for original construction of the dike and for any subsequent repair should be evaluated for suitability and stability. This will require some drilling and sampling of the dike material plus surveying to determine the dike geometry.

   Disposition - Continues – Drilling has been completed. Evaluation of the dike construction and material used and the dike stability, is in progress.

5. Sufficient stockpiles of sand, gravel, and riprap should be maintained near the toe for emergency dike repairs. At a minimum, this should consist of two truckloads each of filter sand (902 – 4 – Fl. DOT Spec), #89 stone, #57 stone, and surge stone.

   Disposition – Completed, except for Recommendation #3 above.

6. After clearing of the dike slopes has been completed, another safety inspection should be performed to assess the areas which could not be properly observed during this visit.

   Disposition – Completed by this inspection.

7. A storm routing analysis of the pond should be done to determine the hydraulic adequacy of the outlet and the safe operating level.

   Disposition - Continues

Details of this inspection were discussed with Mr. Eddie Jackson at the conclusion of the inspection.

Should you have any questions, please contact me at 404-506-7273.

Sincerely,

Larry B. Wills
Principal Engineer - SCG Hydro Services

/rdw
Attachments

XC: **Gulf Power Company**
T. J. McCullough (w/ attachment)
E. W. Jackson (w/ attachment)
C. M. Largilliere (w/ attachment)

Southern Company Services
E. B. Allison (w/ attachment)
J. F. Crew (w/ attachment)
J. C. Pegues (w/ attachment)
H. H. Armitage (w/ attachment)
R. D. Wood (w/ attachment)
T. Sadler (w/ attachment)

EWO: 4133 OM

T:\Core Projects\HYDRO\Quarterly Reports\Fossil Plants\2010\Smith\2010 SMITH Ash Dike Inspection Transmit.DOC

Plant Smith
2010 - Ash Dike Inspection
Dam Safety and Surveillance

Date of Inspection:	February 10, 2010	**Inspection by:**	H. H. Armitage - SCG R. D. Wood- SCG Eddie Jackson - Gulf Power
Weather:	Clear and Cold		
Temperature:	30's to 40's		
Rainfall (past 24 hrs):	< 0.5" on 2/9; > 2.0" on 2/8		

SUMMARY

Slopes and crest of the ash pond dikes looked good. *There were no conditions identified during this inspection that represented a threat to the safety or permanence of the various structures.* Tree stumps have been removed and disturbed areas repaired; brush has been removed down to toe at the wetlands, on all downstream slopes. Any erosion on dike slopes should be repaired and all slopes should be hydroseeded at the appropriate time. No animal burrows were noted. Drillers had just completed soil borings along the dike crest. At and beyond the toe of the dike slope can not be cleared due to presence of wetlands. Some trees at the toe will need to be left due to wetlands. The area of seepage found along the West Dike by this inspection, could not be seen during the 2009 inspection, due to the brush/undergrowth on the slope.

ADDITIONAL COMMENTS

Results of this inspection were discussed with Mr. Jackson at the conclusion of the inspection.

CURRENT RECOMMENDATIONS

No.	Description	Location	Photo No.
1	Plant (hydroseed) additional grass on all dike slopes for summer growth. (This will complete previous recommendation #1, see below)	All dikes.	**3, 5, 8 and 10**
2	Monitor seepage in this area of the West Dike as part of weekly plant inspection. Any sloughing or loss of material observed during the weekly inspection (or at anytime) should be reported to SCG Hydro Services immediately.	West Dike	**3 and 4**
3	Sign to be placed at granular stockpiles to mark them for "Emergency Dike Repair Use Only".	South end of the West Dike	**6**

PREVIOUS RECOMMENDATIONS

No.	Description	Location	Status Open/Closed
1	Trees and brush on the upstream and downstream of all dike slopes should be removed and slopes grassed and maintained. The process of tree removal and root ball repair should be done in accordance with the guidelines and procedures set forth in FEMA Publication #534, "Impacts of Plants on Earthen Dams", pages 6-1 through 6-12.	Most of the dike as typified in photos.	**Continues**
2	A survey of the crest elevation on a 10 foot spacing should be performed to confirm the elevation and to aid in repair efforts.	All of the perimeter dike.	**Completed**
3	Using the survey information the crest should be graded to direct drainage into the pond. Traffic ruts and potholes on the dike crest should be filled with soil and then gravelled to prevent water from standing/ponding on the crest. Downstream slope erosion should also be repaired.	All of the perimeter dike.	**Continues**
4	Construction techniques and materials used for original construction of the dike and for any subsequent repairs, should be evaluated for suitability and stability. This will require some drilling and sampling of the dike material plus surveying to determine the dike geometry.	All of the perimeter dike.	**Continues**
5	Sufficient stockpiles of sand, gravel and riprap should be maintained near the toe for emergency dike repairs. At a minimum, this should consist of two truckloads each of filter sand (902-4 FL. DOT Spec.), #89 stone, #57 stone and surge stone.		**Completed**
6	After clearing of the dike slopes has been completed, another safety inspection should be performed to assess the areas which could not be properly observed during this visit.		**Completed by this inspection.**
7	A storm routing analysis of the pond should be done to determine the hydraulic adequacy of the outlet and the safe operating level.		**Continues**

Plant Smith

2010 - Ash Dike Inspection

OBSERVATIONS FROM THIS INSPECTION -

I - Ash Pond - 'West' Section Embankment		**Ash Pond Elev. ? '**
	Observations - Comments	**Photograph No.**
1. Upstream Slope		
a. Condition	Good; Brush has been removed; 'berm' of ash has also been removed.	2
b. Erosion/Sloughing	*Yes (X) No ( )* Erosion due to steepness, ditch has been excavated in ash.	
2. Crest		
a. Condition	Generally good; still some variation in crest elevation; crest has been surveyed and soil borings made; there is none to minimal rutting from traffic.	1
3. Downstream Slope		
a. Condition	Generally good; brush and trees have been removed and root ball areas repaired; some rye grass beginning to grow; **Recommendation #1** - Plant (hydroseed) additional grass for summer growth. Some trees and brush at toe of slope must be left to avoid encroaching on wetlands.	3
b. Seepage/Wet Spots	*Yes (X) No ( )* Several areas of seepage up from toe about 2' to 3', very small flow along ~50' length of dike; **Recommendation #2** - Monitor this area as part of weekly plant inspection. Any sloughing or loss of material observed during the weekly inspection (or at anytime) should be reported to SCG Hydro Services immediately. See the attached aerial photo for location.	3 and 4
c. Erosion/Sloughing	*Yes (X) No ( )* Some erosion; mostly small rills. No sloughing.	3 and 4
4. Emergency Aggregate Stockpiles		
a. Available	*Yes (X) No ( )* **Recommendation #3** - Signs to be placed at granular stockpiles to mark them for "Emergency Dike Repair Use Only".	6

II - Ash Pond - Discharge Structure to Perimeter Ditch		
	Observations - Comments	**Photograph No.**
1. Structure		
a. Condition	Good; brush has been cleared.	12
b. Seepage/Wet Spots	*Yes ( ) No (X)*	
2. Downstream of Structure (Channel)		
a. Condition	Good; brush has been cleared.	12

III - Groundwater Monitoring Wells		
	Observations - Comments	**Photograph No.**
1. Outlet Channel		
a. Condition of Wells	Not inspected.	
b. Water Level Readings		
c. Other Comments	Samples taken by others annually.	

IV - Ash Pond - 'South' Section Embankment		
	Observations - Comments	**Photograph No.**
1. Upstream Slope		
a. Condition	Brush and trees have been removed; 'berm' of ash has also been removed.	9
b. Erosion/Sloughing	*Yes (X) No ( )* Erosion due to steepness in ash. Slope to be graded and grassed.	9
2. Crest		
a. Condition	Generally good; still some variation in crest elevation; crest has been surveyed and soil borings made; there is none to minimal rutting from traffic.	9
3. Downstream Slope		
a. Condition	Generally good; brush and trees have been removed and root ball areas repaired; some rye grass beginning to grow; **Recommendation #1** - Should plant (hydroseed) additional grass for summer growth. Some trees and brush at toe of slope must be left to avoid encroaching on wetlands.	5, 7, 8, 10 and 11
b. Seepage/Wet Spots	*Yes ( ) No (X)*	7
c. Erosion/Sloughing	*Yes ( ) No (X)* None noted.	
4. Emergency Aggregate Stockpiles		
a. Available	*Yes (X) No ( )* See Recommendation #3.	6

Plant Smith
2010 - Ash Dike Inspection

V - Ash Pond - 'East' Section Embankment

	Observations - Comments	Photograph No.
1. Upstream Slope		
a. Condition	Generally good	12
b. Erosion/Sloughing	*Yes (X) No ( )* Due to steepness of ash.	
2. Crest		
a. Condition	Generally good; no rutting. (See I.2.a. above)	12
3. Downstream Slope		
a. Condition	No downstream slope due to higher natural ground.	

VI - Ash Pond - 'North' Section Embankment

	Observations - Comments	Photograph No.
1. Upstream Slope		
a. Condition	Brush and trees have been removed; small 'berm' of ash has also been removed.	
b. Erosion/Sloughing	*Yes ( ) No (X)*	
2. Crest		
a. Condition	Good; road (crest) in good condition; well maintained due to ash hauling traffic.	13
3. Downstream Slope		
a. Condition	Good; slope is ~2:1 or 1.5:1down to perimeter ditch.	13
b. Seepage/Wet Spots	*Yes ( ) No (X)* None noted.	
c. Erosion/Sloughing	*Yes (X) No ( )* Some erosion due to clearing; no sloughing.	
4. Emergency Aggregate Stockpiles		
a. Available	*Yes ( ) No (X)*	

VII - Retention Pond

	Observations - Comments	Photograph No.
1. Condition	Good; much vegetation growing in the pond. Height of the dike appears to be approximately 3 ft.	

VIII - DRY STACK

	Observations - Comments	Photograph No.
1. Condition	*Good; only a cursory look was made.*	
2. Erosion/Sloughing	*Yes ( ) No ( )* Not observed.	

XIV - Additional Observation/Comments - General

Observations - Comments	Photograph No.

Randall O. Wood

R. D. Wood - Sr. Eng. Geologist

SCG - Hydro Services

Plant Smith

2010 - Inspection Photographs - Feb. 10, 2010

(See the accompanying report attached)

Photo No.	Description	
1	West Ash Pond Dike - Showing cleared Crest and slopes, facing south. Grass beginning to grow.	
2	West Ash Pond Dike - Showing inside slope and ditch excavated in ash to aid drainage, facing south. Excavated ash to be cleared.	
3	West Ash Pond Dike - Showing downstream berm after clearing, facing south. Marshy area to the right and area of seepage circled.	
4	West Ash Pond Dike - Close-up of area of seepage circled in Photo 3 above.	

Plant Smith

2010 - Inspection Photographs - Feb. 10, 2010

(See the accompanying report attached)

Photo No.	Description	
5	South Ash Pond Dike - Showing cleared downstream slope, facing east. Some grass beginning to grow.	
6	South Ash Pond Dike - Emergency granular stockpiles. Additional stockpiles are located near the west side of the plant.	
7	South Ash Pond Dike - Toe of slope showing ~ 2' to 3' drop-off to wetlands/marsh, facing east.	
8	South Ash Pond Dike - Downstream slope showing ~2' to 3' drop-off to wetlands/marsh at toe, facing west.	

Plant Smith

2010 - Inspection Photographs - Feb. 10, 2010

(See the accompanying report attached)

Photo No.	Description	
9	South Ash Pond Dike - Showing Crest and erosion of upstream 'slope', facing east.	
10	South Ash Pond Dike - Downstream slope showing grass beginning to grow after clearing , facing west.	
11	South Ash Pond Dike - Downstream slope showing ~2' to 3' drop-off to wetlands/marsh at toe, facing southwest.	
12	Discharge Structure - Showing cleared area around structure, facing south. Area of the East Dike in the background (circled).	

Plant Smith

2010 - Inspection Photographs - Feb. 10, 2010

(See the accompanying report attached)

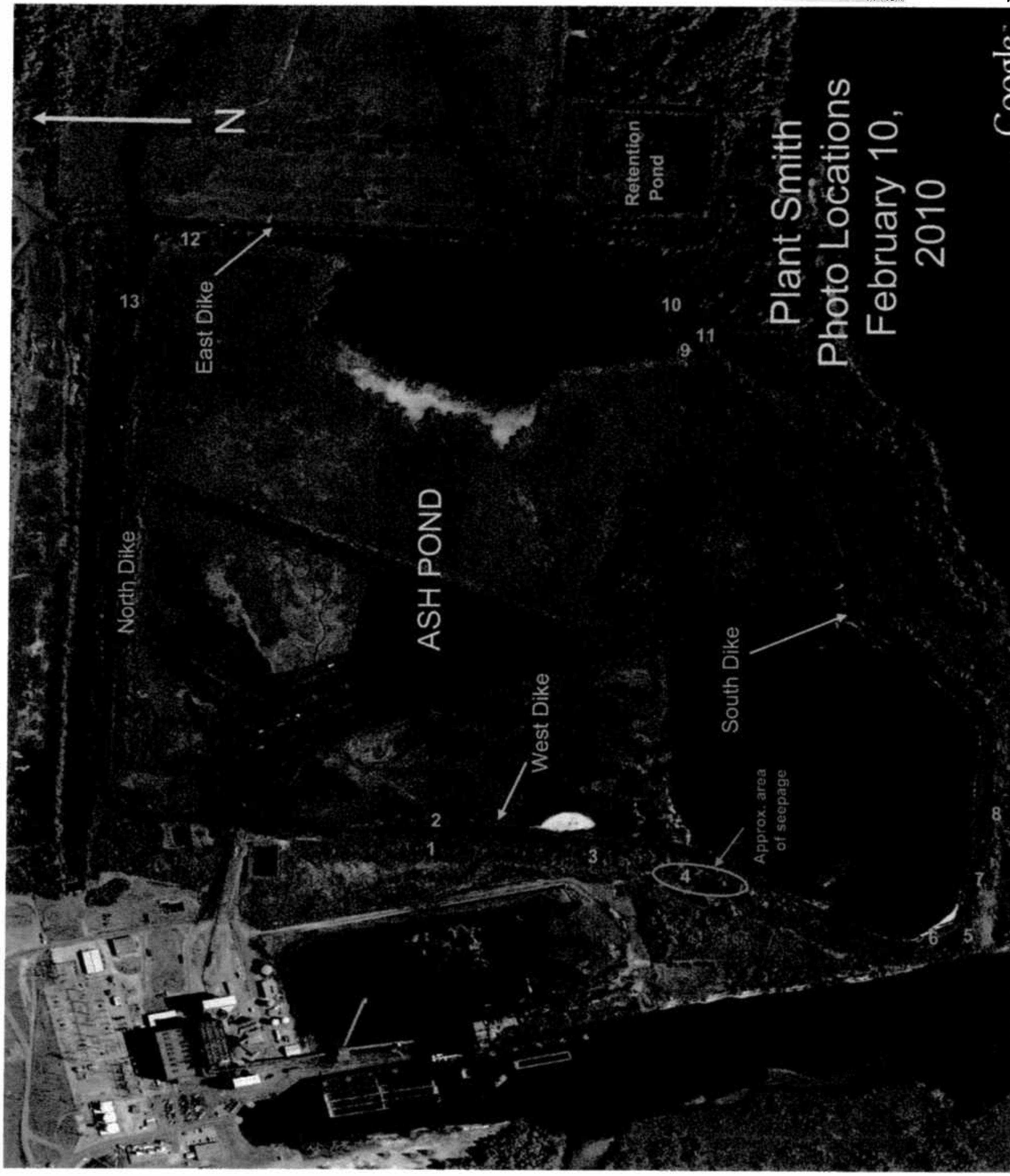
Photo No.	Description	
13	North Ash Pond Dike and Perimeter Ditch - Showing cleared dike and ditch, facing west, plant in the background.	

Plant Smith

2010 - Inspection Photographs - Feb. 10, 2010

(See the accompanying report attached)

Photo No.	Description	



Southern Company Generation
Hydro Services
Bin 10193
241 Ralph McGill Boulevard NE
Atlanta, Georgia 30308-3374
Tel 404.506.7033

SOUTHERN COMPANY
Energy to Serve Your World™

March 10, 2009

Plant Smith
Dam Safety Inspection
Ash Pond Dike Report

Mr. Brian E. Heinfeld
Plant Manager
Gulf Power Co.
Plant Smith

CONFIDENTIAL

Dear Mr. Heinfeld:

Attached is the 2009 Dam Safety Inspection Report for Plant Smith. This inspection was performed by R. D. Wood and G. J. Bruce of the SCG Hydro Services Group and J. A. Lippert of SCS ESEE, on January 14, 2009. The report includes a checklist and photographs of observations of site conditions made during the dam and dike inspections. We would like to thank Ms. Marie Largilliere, Mr. Tim Batyski, Mr. Jason Best, and Mr. Clayton Crum for their hospitality and assistance during the inspection.

On the day of this inspection the level of the water in the southwest area of the ash pond was at the crest of the dike, though by later in the day the water level had been lowered somewhat. This condition could have posed a danger to the ash pond dike. Other than this, the inspection team did not see any conditions that posed an imminent threat to the safety of the ash pond dike.

The existence of large trees near the crest of the West and South sections of the Dike could pose a serious risk should strong winds blow the trees over. The uprooting of the root ball could create a condition where the dike could be compromised by being partially or totally breached, thereby allowing the release of water and ash. Any release along this portion of the dike could flow to the canal and/or bay, which are at least 100 to 200 feet away at several locations.

The inspection team was not able to do as thorough an inspection as they would have liked due to the heavy vegetation on the dike slopes. In addition to preventing inspection of the dikes, woody brush and trees degrade the earth structure. For this reason it is standard industry practice to keep all woody vegetation off of earth dikes. Therefore, we recommend that trees and brush be removed from the dikes.

There are some questions that need to be answered before the safety of the ash pond can be determined. From a visual observation, the ash pond dike slopes appear somewhat steeper than what is generally accepted and it is not clear of what materials the dike is constructed. These issues should be investigated. It would also be prudent to perform a storm routing analysis on the pond to determine the hydraulic adequacy of the outlet and to determine the safe operating level.

There are some maintenance issues that need to be addressed. In addition to the removal of the trees and brush from the dike slopes, the crest of the dike requires some repair and grading to prevent ponding of water and to direct runoff into the pond. It would also be prudent to provide access around the toe of the dike for equipment and to stockpile granular filter materials at the toe for use in emergency repairs. It is our understanding that the implementation of these recommendations could depend on wetland permitting.

A detailed listing of these recommendations is included in the attached report. Tree removal, surveying, dike repair, storm routing and stability analysis should be planned and directed by a qualified engineer. SCG Hydro Services is available to talk over how to carry out the recommendations and will provide assistance in obtaining the engineering resources necessary to carry out the work and studies recommended.

Details of this inspection were discussed with Mr. Steven Ford at the conclusion of the inspection. We recommend that after clearing of the dike is complete, another safety inspection be performed to assess the areas which could not be properly observed during this visit.

Should you have any questions, please contact me at 404-506-7033.

Sincerely,

Joel Galt

Joel Galt
Hydro Services Supervisor

/rdw
Attachments
XC: **Gulf Power Company**
T. J. McCullough (w/ attachment)
S. L. Ford (w/ attachment)
C. M. Largilliere (w/ attachment)

Southern Company Services
E. B. Allison (w/ attachment)
J. A. Lippert (w/ attachment)
G. J. Bruce (w/ attachment)
R. D. Wood (w/ attachment)

Plant Smith
2009 - Ash Dike Inspection
Dam Safety and Surveillance

Date of Inspection:	January 14, 2009	**Inspection by:** G. J. Bruce - SCG
Weather:	Clear and Cold	R. D. Wood- SCG
Temperature:	30's to 50's	J. A. Lippert-ESEE
Rainfall (past 24 hrs):	0.0"	

SUMMARY

The existence of large trees near the crest of the West and South sections of the Dike could pose a serious problem should strong winds blow the trees over. The uprooting of the root ball could create a condition where the dike could be compromised by being partially or totally breached thereby allowing the release of water and ash. Any release along this portion of the dike could flow to the canal and/or bay, which is approximately 100 to 200 feet away at several locations. A survey of the crest elevation, followed by grading and maintenance of the dike crest to prevent ponding of water and to direct surface drainage into the ash pond, should be done. The stability of the North and South Dikes should be evaluated. This will require some drilling and sampling of the dike material. It was difficult to see if there were any animal burrows or other damage, due to high and dense vegetation on the dike slopes. There were no stockpiles of sand, gravel and riprap available on site for emergency dike repairs. See the CURRENT RECOMMENDATIONS section below for additional details and references.

ADDITIONAL COMMENTS

Mr. Bruce, Mr. Lippert and Mr. Wood were escorted around the site by Ms. Marie Largilliere, Mr. Tim Batyski, Mr. Jason Best, and Mr. Clayton Crum. Their hospitality and assistance during the inspection were greatly appreciated.

The results of the inspection were discussed with Mr. Steven Ford at the conclusion of the inspection.

CURRENT RECOMMENDATIONS

No.	Description	Location	Photo No.
1	Trees and brush on the upstream and downstream of all dike slopes should be removed and slopes grassed and maintained. The process of tree removal and root ball repair should be done in accordance with the guidelines and procedures set forth in FEMA Publication #534, "Impacts of Plants on Earthen Dams", pages 6-1 through 6-12.	Most of the dike as typified in photos.	**1,2,3 and 5**
2	A survey of the crest elevation on a 10 foot spacing should be performed to confirm the elevation and to aid in repair efforts.	All of the perimeter dike.	
3	Using the survey information the crest should be graded to direct drainage into the pond. Traffic ruts and potholes on the dike crest should be filled with soil and then gravelled to prevent water from standing/ponding on the crest. Downstream slope erosion should also be repaired.	All of the perimeter dike.	**3,4 and 5**
4	Construction techniques and materials used for original construction of the dike and for any subsequent repairs, should be evaluated for suitability and stability. This will require some drilling and sampling of the dike material plus surveying to determine the dike geometry.	All of the perimeter dike.	
5	Sufficient stockpiles of sand, gravel and riprap should be maintained near the toe for emergency dike repairs. At a minimum, this should consist of two truckloads each of sand, #89 stone, #57 stone and surge stone.		
6	After clearing of the dike slopes has been completed, another safety inspection should be performed to assess the areas which could not be properly observed during this visit.		**2**
7	A storm routing analysis of the pond should be done to determine the hydraulic adequacy of the outlet and the safe operating level.		

PREVIOUS RECOMMENDATIONS

No.	Description	Location	Status Open/Closed
1	NONE		

Plant Smith

2009 - Ash Dike Inspection

OBSERVATIONS FROM THIS INSPECTION - 01/14/2009

I - Ash Pond - 'West' Section Embankment		Ash Pond Elev. XXX '
	Observations - Comments	Photograph No.
1. Upstream Slope		
a. Condition	*Trees and brush growing on 'slope'; slightly steepened from lack of maintenance.*	1
b. Erosion/Sloughing	*Yes ( ) No (X)*	n/a
2. Crest		
a. Condition	*An ash berm has been created on the upstream edge of the crest by excavation of a ditch in the ash pond along the pond side of the dike. At several low points in the dike, this 'berm' may have been the only thing retaining water in the pond. The water level of the pond was high (i.e. very little freeboard) at the time of this inspection. An ash berm has also been created on the downstream edge of the crest, creating a 'U' shape to the crest. Erosion was noted at low points on the crest where rainfall is 'directed' to and has washed out the ash berm, causing the erosion of the crest and downstream slope.*	3
3. Downstream Slope		
a. Condition	*Hard to determine due to the high and dense vegetation.*	2
b. Seepage/Wet Spots	*Yes ( ) No ( ) Undetermined*	n/a
c. Erosion/Sloughing	*Yes (X) No ( ) Some erosion noted where runoff from crest is directed to low points, as described above in I.2.a.*	4
4. Emergency Aggregate Stockpiles		
a. Available	*Yes ( ) No (X)*	n/a

II - Ash Pond - Discharge Structure to Perimeter Ditch		
	Observations - Comments	Photograph No.
1. Structure		
a. Condition	*Good*	n/a
b. Seepage/Wet Spots	*Yes ( ) No (X)*	n/a
2. Downstream of Structure (Channel)		
a. Condition	*Channel appeared open; some vegetation.*	n/a

III - Groundwater Monitoring Wells		
	Observations - Comments	Photograph No.
1. Outlet Channel		
a. Condition of Wells	*Not observed.*	7
b. Water Level Readings	*Not available.*	n/a
c. Other Comments	*Samples are collected by an outside company.*	n/a

IV - Ash Pond - 'South' Section Embankment		
	Observations - Comments	Photograph No.
1. Upstream Slope		
a. Condition	*Trees and brush growing on 'slope'; slightly steepened from lack of maintenance.*	5
b. Erosion/Sloughing	*Yes ( ) No (X)*	n/a
2. Crest		
a. Condition	*Same conditions as described in Section I.2.a. above.*	5
3. Downstream Slope		
a. Condition	*Hard to determine due to high and dense vegetation.*	7
b. Seepage/Wet Spots	*Yes ( ) No ( ) Undetermined.*	n/a
c. Erosion/Sloughing	*Yes (X) No ( ) Some erosion noted where runoff from crest is directed to low points, as described above in I.2.a.*	4
4. Emergency Aggregate Stockpiles		
a. Available	*Yes ( ) No (X)*	n/a

Plant Smith
2009 - Ash Dike Inspection

V - Ash Pond - 'East' Section Embankment		
	Observations - Comments	**Photograph No.**
1. Upstream Slope		
a. Condition	*Generally good; ash berm along crest and slope with much high growth.*	6
b. Erosion/Sloughing	*Yes (X) No ( ) Some slight erosion.*	*n/a*
2. Crest		
a. Condition	*Generally good; mostly on natural ground. Needs to be graded to drain into the pond.*	*n/a*
3. Downstream Slope		
a. Condition	*No downstream slope due to higher natural ground.*	*n/a*
b. Seepage/Wet Spots	*Yes ( ) No ( ) n/a*	*n/a*
c. Erosion/Sloughing	*Yes ( ) No ( ) n/a*	*n/a*

VI - Ash Pond - 'North' Section Embankment		
	Observations - Comments	**Photograph No.**
1. Upstream Slope		
a. Condition	*Generally good; ash berm along crest and slope with much high growth.*	*n/a*
b. Erosion/Sloughing	*Yes ( ) No ( )*	*n/a*
2. Crest		
a. Condition	*An ash berm has been created on the upstream edge of the crest. The water level of the pond was high at the time of this inspection. An ash berm has also been created on the downstream edge of the crest, creating a 'U' shape to the crest. Erosion was noted at low points in the upstream and downstream crest where rainfall is 'directed' to run and wash out the ash berm, causing erosion of the crest and downstream slope.*	*n/a*
3. Downstream Slope		
a. Condition	*Generally good; runoff runs into the adjoining drainage ditch. Generally low vegetation.*	*n/a*
b. Seepage/Wet Spots	*Yes ( ) No (X)*	*n/a*
c. Erosion/Sloughing	*Yes (X) No ( ) Slight to moderate erosion due to concentrated runoff from the crest.*	*n/a*
4. Emergency Aggregate Stockpiles		
a. Available	*Yes ( ) No (X)*	*n/a*

VII - Retention Pond		
	Observations - Comments	**Photograph No.**
1. Condition	*Good; much vegetation growing in the pond. Height of the dike appears to be approximately 3 ft.*	9

VIII - DRY STACK		
	Observations - Comments	**Photograph No.**
1. Condition	*Did not inspect.*	*n/a*
2. Erosion/Sloughing	*Yes ( ) No ( ) n/a*	*n/a*

XIV - Additional Observation/Comments - General	
Observations - Comments	**Photograph No.**
1. The outfall from the swampy area along the toe of the South Dike was inspected at low tide. No problems were noted.	8

Randall O. Wood

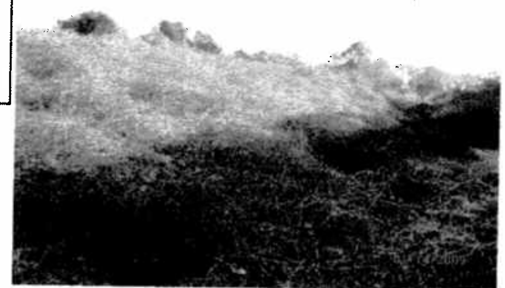
R. D. Wood - Sr. Eng. Geologist
SCG - Hydro Services

Plant Smith

2009 - Inspection Photographs - January 14, 2009

(See the accompanying report attached)

Photo locations and direction of view are shown on the attached aerial photo.

Photo No.	Description	
1	Section of the West Dike showing vegetation, berms and difference in elevation (from low point), facing north. Ash Pond is to the right.	
2	Vegetation on the downstream slope of the South Dike. This condition made inspection of the downstream slopes extremely difficult and unsafe for inspection. Ash Pond is to the left.	
3	Crest of the South Dike showing vegetation on the upstream and downstream slopes, and the ash berms along both sides of the crest. Ash Pond is to the left.	
4	Erosion on the downstream slope from runoff at a low point in the South Dike. Crest should be graded to drain into the pond to prevent this.	

Plant Smith

2009 - Inspection Photographs - January 14, 2009

(See the accompanying report attached)

Photo locations and direction of view are shown on the attached aerial photo.

Photo No.	Description	
5	Trees and other vegetation along both sides of the crest of the South Dike. Ash Pond is to the left.	
6	East portion of dike on natural ground with the ash stack to the right, pond to the left.	
7	View from the South Dike looking out toward the bay, facing generally southeast. A monitoring well location is shown by the oval.	
8	Outfall from the swampy area along the toe of the South Dike into the bay, at low tide.	

Plant Smith

2009 - Inspection Photographs - January 14, 2009

(See the accompanying report attached)

Photo locations and direction of view are shown on the attached aerial photo.

Photo No.	Description	
9	View across the retention pond, facing southeast.	
10	View across the ash pond, with the plant in the background. Facing northwest.	

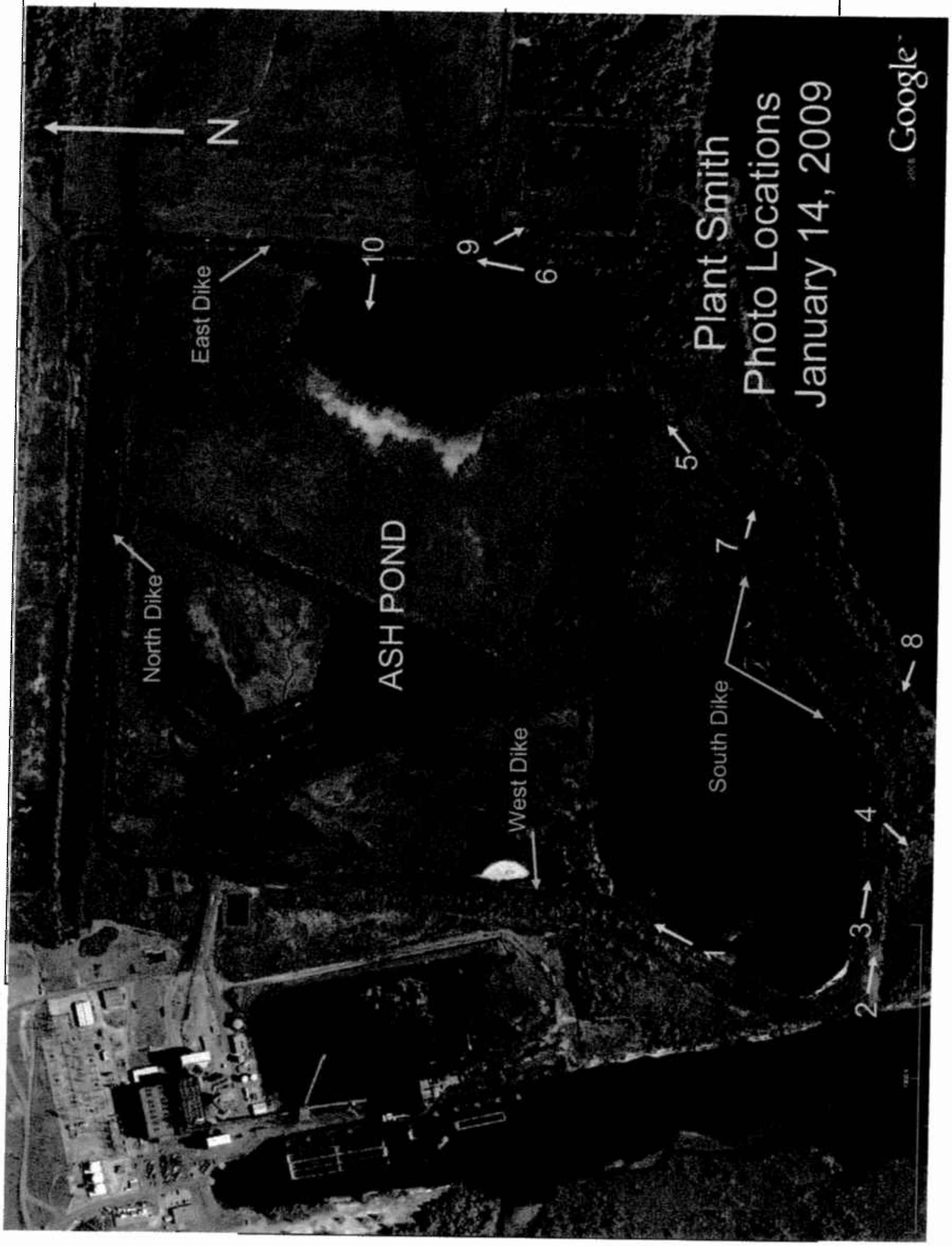
Plant Smith

2009 - Inspection Photographs - January 14, 2009

(See the accompanying report attached)

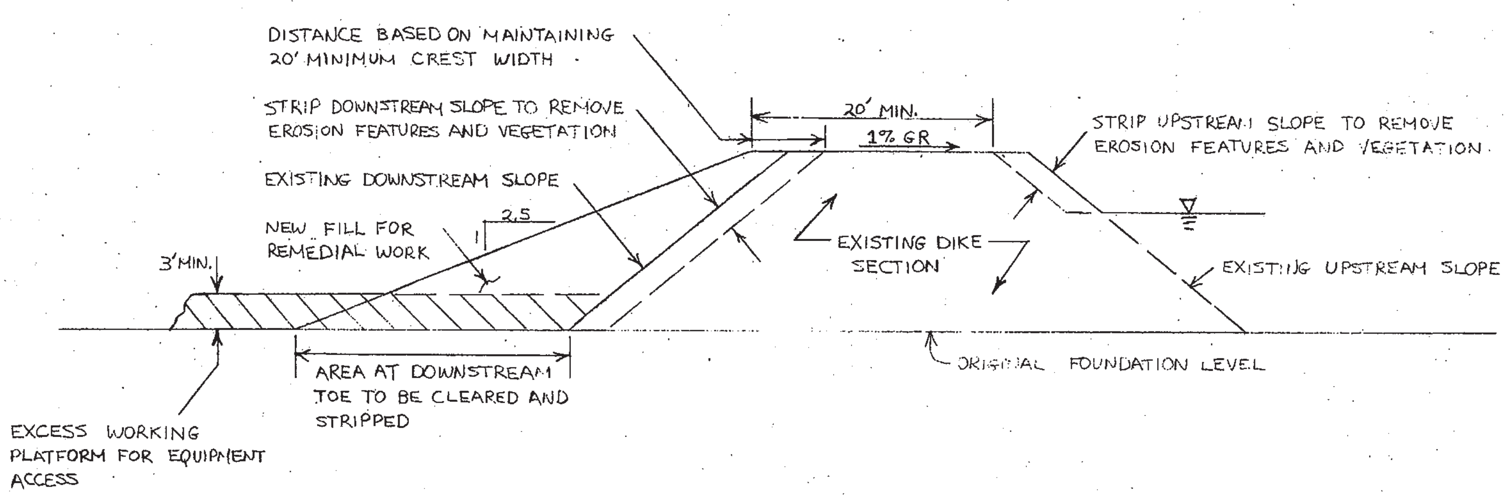
Photo locations and direction of view are shown on the attached aerial photo.

Photo No.	Description	



TYPICAL DIKE SECTION

SCALE : 1" = 10'



PLANT LANSING SMITH
ASH POND DIKE
DRAWN BY : JPM
REVIEWED BY : RMF

CONFIDENTIAL ATTORNEY-CLIENT PRIVILEGE

ASH POND EVALUATION

PLANT LANSING SMITH

PANAMA CITY, FLORIDA

ES 1840

Prepared By

Southern Company Generation
Technical Services
Earth Science and Environmental Engineering

April 2010

Originator: James C. Pegues — Date 4/23/10

Reviewer: Rachel A. Mudd — Date 4/23/10

Approval: ~~David~~ W. Morris — Date 4-23-10

Revision No.	Date
0 – Report Issued for Use	04/23/2010

CONFIDENTIAL ATTORNEY-CLIENT PRIVILEGE

ASH POND EVALUATION

PLANT LANSING SMITH

PANAMA CITY, FLORIDA

ES 1840

Prepared By

Southern Company Generation
Technical Services
Earth Science and Environmental Engineering

April 2010

EXECUTIVE SUMMARY

The Earth Science & Environmental Engineering Department (ES&EE) of Southern Company Generation Technical Services has prepared this report to present geotechnical findings and analyses related to the assessment of the existing north and south ash pond dikes at Plant Lansing Smith north of Panama City, Florida. Included in this report is a discussion of the geotechnical exploration and findings, laboratory test results and stability analysis results.

In response to the recommendations presented in the 2009 annual inspection of the ash pond by Southern Company Hydro Services, this study focused on the north and south dikes of the ash pond. A total of ten borings were drilled along the north dike (noted as borings NDB-*), and nineteen were drilled along the south dike (SDB-*), including a portion of the southern end of what would be considered the west dike.

The borings found that much of the upper dike structure consists of ash, with ash depths as shallow as 2 feet and as deep as 25 feet. The deeper ash was generally encountered more often within the south dike borings, but ash was found to depths of about 20 feet along the north embankment as well. The borings encountered sands and silty sands immediately below the ash. It is difficult to distinguish between sands placed as fill or naturally placed sands, as the material is the same. In addition, some fat clays (i.e. highly plastic clays) were encountered at depth.

Standard penetration testing and split-spoon sampling were performed in each boring at regular depth intervals. In some borings, relatively intact Shelby tube samples were collected of the ash materials for the laboratory testing portion of this assessment. Due to the physical characteristics of the lower sands and silty sands, we were not able to obtain relatively intact Shelby tube samples of these materials.

Topographic survey information obtained by Southern Company Generation Civil Field Services (CFS) was used to develop representative cross-sections to assist in stability analyses. Stability analyses were evaluated for static, steady-state conditions and seismic loading. The stability analyses indicate all calculated minimum factors of safety are above generally accepted minimum factors of safety with the exception of the downstream slopes of the north embankment. Calculated factors of safety were 1.44 and 1.45, whereas the generally accepted minimum is 1.5.

These lower factors of safety do not represent a condition of imminent or likely failure of the slopes. Given the adjustment (downward) of shear strength parameters for the ash and the somewhat conservative assumptions for shear strength parameters for the sand (it was not possible to obtain intact samples of the sand for laboratory testing), one could reasonably argue that the calculated factors of safety are acceptable.

Additional discussion of our conclusions and recommendations can be found in the text of this report.

DOCUMENT REVIEW

A series of historic and recent documents were reviewed as a part of our evaluation of the ash pond. The reviewed documents included the 2009 and 2010 dam safety inspections performed by Hydro Services, and historic drawings retrieved from Documentum.

The 2009 Dam Safety Inspection report served as the guideline for this assessment. In addition to maintenance related items, one of the recommendations included in the 2009 report was for stability analyses to be performed on the North and South dikes of the facility. This report addresses and satisfies this recommendation.

A second recommendation was for a storm routing analysis to be performed to determine the hydraulic adequacy of the pond outlet(s) and the safe operating level of the pond. Storm routing is not addressed in this report, and is a function typically performed by Generation Civil Design. It is our understanding the storm routing evaluation will be reported later under separate cover by Civil Design.

ES&EE performed a search of applicable historic drawings in Documentum in an attempt to create a history of design and construction activities related to the ash pond. Little detailed information was found in the drawing database. However, Mr. Eddie Jackson (Plant Smith) directed us to Drawing No. Y-120 (Lansing Smith Steam Plant Unit 1, General Arrangement, Plant Site, dated February 16, 1965) which shows the ash pond in a similar configuration to the current layout. The ash pond layout shows a perimeter dike around the south, east and north sides of the ash pond. Notes and details on this drawing indicate an initial dike crest elevation at about EL 7 ft. As much of the surrounding topography was at about EL 4 ft to EL 5 feet, it is apparent initial dike heights were on the order of only a few feet. Details indicate initial dike crest widths varying from about 20 ft to 30 ft.

An earlier plant General Arrangement (Drawing No. D-13511, Lansing Smith Steam Plant – Unit #1, General Arrangement, Plant Site, dated October 1, 1963) shows a different ash pond layout, being somewhat circular in shape. Notes on this drawing reference dike crest elevations as follows: "Roadway on top of dike EL 9.0' North End, EL 4.5' South End, Ultimate Top of Dike EL 23.5'." This "ultimate" top of dike elevation generally reflects current top of dike elevation, with some slight variation.

FIELD EXPLORATION

General

Borings were completed in late-January and early-February, 2010. Boring locations were established in the field by an engineer from ES&EE. Actual boring coordinates were determined after drilling by the CFS Surveying Department.

Since underground utilities were not a concern along the ash pond dikes, hydroexcavation was not required (as is standard practice for utility clearance). Split-spoon sampling and standard penetration testing began in each boring at a depth of about 2.5 feet below the ground surface, and was performed at about 2.5-ft depth intervals in the upper 10 feet, and at 5-ft intervals below a depth of 10 feet. Also, Shelby tube samples were taken at select locations to obtain relatively intact samples for laboratory triaxial shear strength testing.

Original boring depths were planned to be on the order of 35 feet. However, due to the presence of lower SPT N-values at or near the planned termination depths, some borings were extended to depths of as much as about 65 feet to all an assessment of the deeper embankment foundation materials.

The soils obtained during split-spoon sampling were visually classified by a geotechnical engineer. It should be noted that since native soils were used to construct the lower reaches of the embankments, it is sometimes difficult to distinguish between fill materials and residual soils; therefore, the approximate interface of fill and native soil is not reflected on the boring records. Five borings were converted to temporary piezometers to allow for more accurate 24-hr (or later) water level readings. Upon the completion of the borings and water level measurements, the piezometer casings were removed and each borehole was filled with grout.

Discussion of the findings of the borings is presented in the following paragraphs for the north and south embankment sections.

North Embankment

Borings NDB-1 through NDB-10 were drilled along the north embankment to depths of about 36 feet to 56 feet. Boring NBD-1 was located on the east end of the north embankment, and subsequent boring numbers increase from east to west.

Ash was encountered at the ground surface in all borings, and the depth of ash varied, as shown in Table 1. In some instances, upper ash layers were separated by materials identified as brown sand.

Table 1
Ash Depths, North Embankment

Boring No.	Depth of Ash Below Ground Surface (ft)
NDB-1	14.5
NDB-2	2
NDB-3	4
NDB-4	9.5
NDB-5	7.5 (with sand from 2 to 4.5 ft)
NDB-6	4.5
NDB-7	19.5 (with sand from 4.5 to 7.5 ft)
NDB-8	19.5
NDB-9	7.5
NDB-10	19.5 (with sand from 2.5 to 4.5 ft, and from 7.5 to 14.5 ft)

The borings encountered very loose to medium dense sands below the ash. As some of these sands were encountered above the elevations indicated as natural grade on the historic drawings, it is apparent that some of the sand represents fill. Generally, any sands present above a depth of 10 feet (east end) to 15 feet (west end) likely represent fill materials placed during the initial ash pond development.

Borings NDB-3 and NDB-8 were converted to temporary piezometers to allow for measurement of groundwater levels after the completion of drilling. Water level measurements indicate a stabilized water level at the time of our exploration at about EL 11.5 to EL 12, or about 11 to 12 feet below the top of the embankment.

South Embankment

Borings SDB-1 through SDB-19 were drilled along the south and southwest embankment sections to depths of about 36 feet to 66 feet. Boring SBD-1 was located approximately 1000 feet north of the SW corner of the ash pond. Boring numbers in this area increased to the south (along the west embankment) and then to the east (along the south embankment), with boring SDB-19 located near what would be referenced as the south end of the east embankment.

As with the north embankment borings, ash was encountered at the ground surface in all borings, and the depth varied. Ash depths encountered in the south embankment borings are summarized in Table 2. In some instances, upper ash layers were separated by materials identified as brown sand.

Table 2
Ash Depths, South Embankment

Boring No.	Depth of Ash Below Ground Surface (ft)
SDB-1	24.5
SDB-2	19.5
SDB-3	4.5
SDB-4	7.5
SDB-5	4.5
SDB-6	19.5
SDB-7	24.5
SDB-8	19.5
SDB-9	9.5
SDB-10	19.5
SDB-11	19.5
SDB-12	16
SDB-13	7.5
SDB-14	4.5
SDB-15	9.5 (with sand from 4.5 to 7.5 ft)
SDB-16	4.5
SDB-17	4.5
SDB-18	2
SDB-19	9.5 (with sand from 4.5 to 7.5 ft)

Similar to the north embankment borings, very loose to medium dense sands were encountered below the ash. As some of these sands were encountered above the elevations indicated as natural grade on the historic drawings, it is apparent that some of the sand represents fill. Generally, any sands present above a depth of about 20 feet likely represent fill materials placed during the initial ash pond development. It should also be noted that boring SDB-2 encountered a layer of very soft fat clay from a depth of about 50 to 55 feet.

Relatively intact Shelby tube samples were collected from the ash in borings SDB-1, SDB-6, SDB-8 and SDB-11. All intact samples were taken from a depth of about 6 to 8 feet. The tubes were waxed sealed on both ends and securely stored until they were extruded and evaluated for possible strength testing. Strength testing, as discussed in the section that follows, was performed on the SDB-1 samples, and combined samples from SDB-6 and SDB-8.

Borings SDB-4, SDB-14 and SDB-19 were converted to temporary piezometers to allow for measurement of groundwater levels after the completion of drilling. Water level measurements indicate a stabilized water level at the time of our exploration at about EL 8 ft near the SW corner to EL 10 ft along the south and EL 12.5 ft at the easternmost end of the south embankment.

Laboratory Testing Results

Laboratory testing was performed on representative split-spoon samples and three of the Shelby tube samples. Due to a lack of sufficient sample in the tube from SDB-8, a combined sample was utilized from this boring (two test specimens) and SDB-6 (one test specimen) for consolidated-undrained triaxial shear testing.

Most of the selected samples were tested for basic index properties to characterize the soils and to confirm visual classifications. Tests include grain size analyses, Atterberg limits, natural moisture content and specific gravity. Due to organic smells in some of the deeper samples, organic content (measured as loss on ignition) were performed on some deeper samples. (Note: organic contents were low, and do not present a concern.) As stated above, triaxial shear strength testing was performed on Shelby tube samples collected in the ash.

Table 3 summarizes the laboratory test results from all selected samples.

Triaxial shear strength testing was performed using consolidated-undrained testing procedures with pore pressure measurements. This test methodology provides friction angles and cohesion values for undrained conditions (known as *total* values), as well as for drained conditions (known as *effective* strength values). Typically, the effective friction angle is higher than the total friction angle, while the reverse is true for cohesion.

The samples tested for this study revealed characteristics of sample dilatancy and negative pore pressure, resulting in lower effective friction angles. Dilatancy, normally a characteristic noted during triaxial testing of dense sands or overly consolidated clays (as well as some silts), occurs when the individual soil particles move up and over each other, resulting in a sample volume increase (generally, the sample volume decreases with compression during testing). This effect can also result in negative pore pressures. In addition, silts (the ash has the physical properties of silt) can be extremely difficult to sample and test without some sample disturbance, even under ideal laboratory preparation conditions. Such sample disturbance is well documented in published materials, and may account for erratic test results.

The test results obtained reflected higher total friction angles than effective, and much higher cohesion values than one would normally expect for a material of this type. Based on prior experience with ash materials and published literature, the decision was made to adjust the measured shear strength properties downward in the stability analysis models, as discussed in more detail in the section that follows.

Table 3
Laboratory Test Results

Boring	Depth (ft)	Percent Passing No. 200 Sieve	Atterberg Limits		Natural Moisture Content	Specific Gravity	Organic Content (loss on ignition, %)
			LL	PI			
SDB-1	6-8	92.6	NP	NP	97.6		
SDB-1	6-8	91.7	NP	NP	90.7		
SDB-2	5.5	79.2	NP	NP	78.2	2.17	
	10.5	91.2	NP	NP	76.4	2.22	
	20.5	13.6			27.5		
	30.5	4.9			18.8		
	40.5	17.1			23.4	2.64	
	50.5	60.0	55	29	34.1	2.68	
	60.5	29.3	25	1	26.8		
	65.5	30.0	NP	NP	24.2		
SDB-3	8.5	7.4			9.2		
	15.5	3.3	NP	NP	13.9		
	30.5	7.9	NP	NP	15.7		
	50.5	19.0	39	21	20.5	2.61	
	60.5	37.5			29.4		
SDB-5	35.5	16.1			23.0		1.5
	45.5	14.2			21.3		1.6
	55.5	10.5			19.5		0.8
SDB-8	6-8	92.6			97.6		
SDB-14	15.5	8.0	NP	NP	21.4	2.64	
	20.5	8.4	NP	NP	16.4		
NDB-1	5.5	50.5			59.9	2.26	
	20.5	5.4	NP	NP	17.5		
	35.5	11.5	33	11	28.4		
	45.5	18.7	NP	NP	25.0		
NDB-10	15.5	95.7			49.9	2.41	
	30.5	8.2	NP	NP	23.5		
	35.5	11.9	NP	NP	20.6		
	40.5	16.6	36	12	35.1		

ANALYSIS AND FINDINGS

As stated earlier, borings were drilled on both the north and south embankments of the ash pond, as recommended in the 2009 Dam Safety Inspection Report. Using the topographic survey performed by Civil Field Services in February 2010, representative cross-sections, two for the south embankment and two for the north, were developed for use in the stability analyses. Similarly, a representative stratigraphy was developed using our boring information. Cross-section reference is to the nearest boring. While all triaxial shear strength testing was performed on samples obtained from the south embankment, the same adjusted shear strength parameters for ash were used in the north embankment stability analyses.

Tables 4a and 4b summarize the strength values utilized in the stability analyses.

Table 4a
Soil Properties for Stability Analyses
North Embankment

Soil Description	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)
Dike Ash	80	27	100
Pond Ash	70	24	50
Embankment and Upper Foundation Sand	105	30	0

Table 4b
Soil Properties for Stability Analyses
South Embankment

Soil Description	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)
Dike Ash	80	27	100
Pond Ash	70	24	50
Embankment and Upper Foundation Sand	115	36	0
Lower Foundation Sand	105	30	0

Stability analyses were performed for current, steady-state conditions (upstream and downstream slopes) and pseudostatic seismic (downstream only). The water level as modeled is near the crest of the embankments (2-ft of freeboard), so a separate "high water" or "flood pool" condition was not modeled as an individual case. For the seismic analysis, the earthquake load was applied as a pseudstatic coefficient (K_h) of 0.08. This value is equal to the USGS-mapped, site-modified, short-period spectral acceleration for a 7 percent probability of exceedance over 75 years. Also, while rapid drawdown is a typical condition evaluated for impoundment structures, the method of operation for the Smith ash ponds suggests it may not be applicable at this site, and therefore is not reported.

Table 5 summarizes the minimum factors of safety obtained for each model at each cross-section.

Table 5
Summary of Minimum Slope Stability Factors of Safety

Cross-Section	Analysis Condition		
	Steady-State[1]		Steady-State with Seismic[2]
	Upstream	Downstream	
SDB-1	3.86	2.41	1.65
SDB-19	2.37	1.86	1.46
NDB-2	2.92	1.45	1.17
NDB-8	4.74	1.44	1.18

[1]Normally accepted industry standard minimum factor of safety = 1.5
[2]Normally accepted industry standard minimum factor of safety = 1.1

As can be seen in Table 5, the steady-state factors of safety for the downstream sections along the north embankment are slightly less than the recommended minimum factor of safety of 1.5. Additional discussion of these factors of safety is provided in the Conclusions and Recommendations section of this report.

CONCLUSIONS AND RECOMMENDATIONS

As recommended in the 2009 Dam Safety Inspection Report issued by Hydro Services, the Earth Science & Environmental Engineering Department of Southern Company Technical Services has performed a geotechnical exploration of the north and south embankments at the Plant Lansing Smith ash pond. The exploration was accomplished with standard penetration test borings in which both disturbed split-spoon samples and relatively intact Shelby tube samples were obtained for visual classification and/or laboratory testing. Index property tests were performed, as were triaxial shear strength tests. The laboratory data obtained was used in slope stability models to evaluate the minimum factors of safety of both embankments.

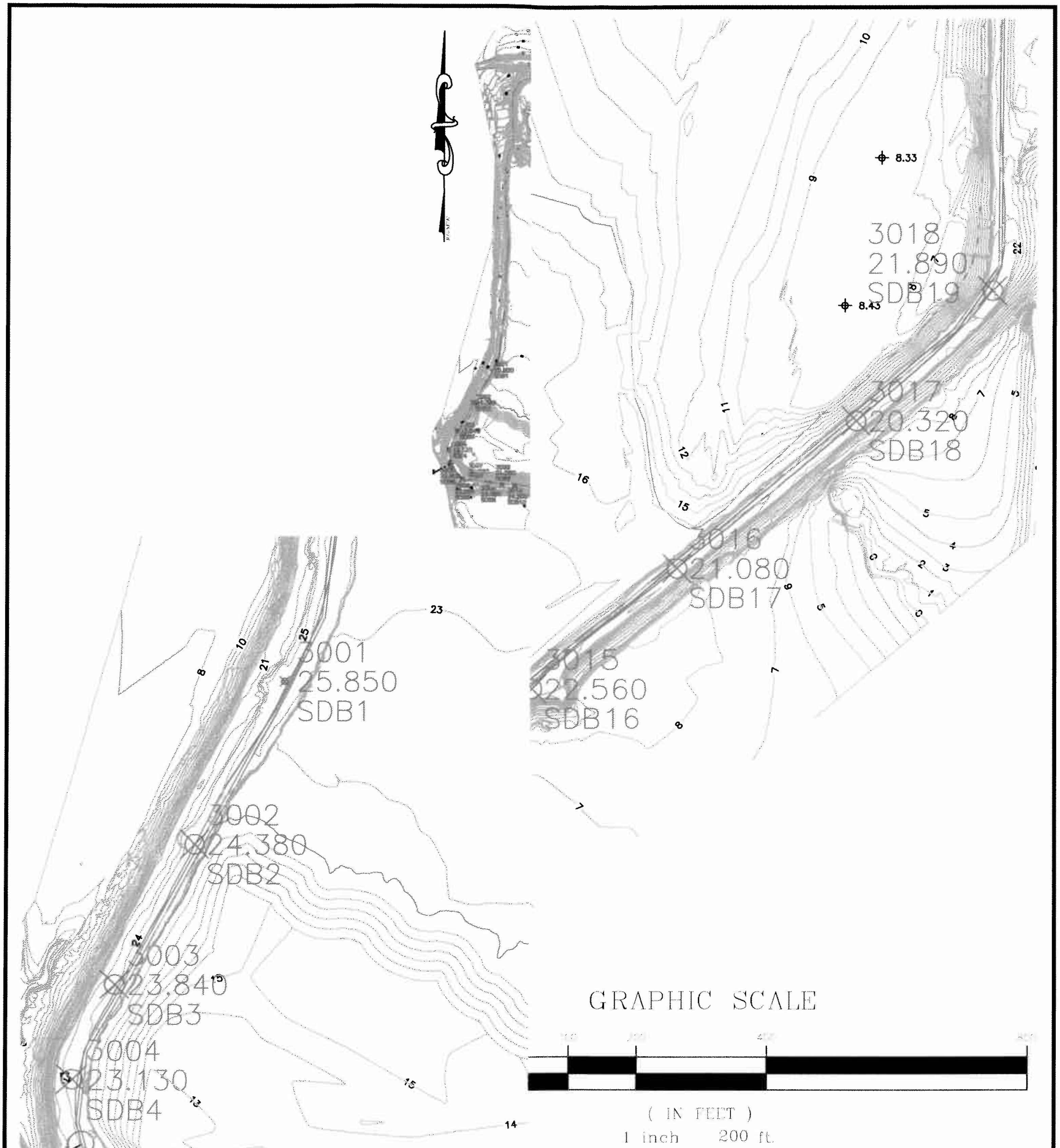
The stability analysis results indicate all calculated minimum factors of safety are above generally accepted minimum factors of safety with the exception of the downstream slopes of the north embankment. Calculated factors of safety were 1.44 and 1.45, whereas the generally accepted minimum is 1.5.

These lower factors of safety do not represent a condition of imminent or likely failure of the slopes. Given the adjustment (downward) of shear strength parameters for the ash and the somewhat conservative assumptions for shear strength parameters for the sand (it was not possible to obtain intact samples of the sand for laboratory testing), one could reasonably argue that the calculated factors of safety are acceptable. If one wished to increase these factors of safety through modification to the slopes, then the downstream slopes would need to be flattened by adding resisting weight at the toe and maintaining the general geometry of the top of the slopes. This could be problematic given the presence of the canal at the toe in this area. We would recommend delay of any consideration of slope modifications until after the proposed draft (and probably final) rules for CCB disposal facilities have been issued by EPA in the event other or further modifications to the current facility may be mandated. It would also be prudent to perform in-situ testing along the existing embankments using cone penetration test soundings to obtain what could result in more representative soil strength parameters if the decision is made to consider modifications or improvements.

An additional recommendation of the 2009 Dam Safety Inspection Report was storm routing analysis of the pond to determine the hydraulic capacity of the pond and its outlet structures, and to determine the safe operating level of the pond. As stated previously in this document, storm routing is not addressed in this report, and is a function typically performed by Generation Civil Design. It is our understanding the storm routing evaluation will be reported later under separate cover. We will review the findings of that study to see if it impacts any of our analyses, conclusions and recommendations. If necessary, modification will be made to our analyses and an amended report issued at that time.

Plant personnel have asked for a maintenance summary and/or checklist to use as a part of the operations and maintenance program for the ash pond. A formal stand-alone document will be prepared and issued once the storm routing study is complete. However, among the recommendations that will be included will be the maintenance related items addressed in the Hydro Services inspection reports of 2009 and 2010, including, but not limited to, the following:

- Vegetation on the embankment slopes should be regularly maintained. Trees and large brush should not be allowed to become established on the embankment slopes.
- Well established grass cover and/or other appropriate erosion control measures should be maintained on the embankment slopes to reduce the potential for surface erosion.
- Any erosion features that develop should be addressed in a timely manner to prevent their worsening.
- Any traffic-related ruts and/or potholes that develop on the embankment crests should be backfilled with soil and then surfaced with gravel to prevent standing/ponding water on the embankment crests.
- The surface of the roadway and embankment crest should be maintained so as to divert surface water runoff into the pond.



Southern Company Generation
ngineering and Construction Services

FOR

Gulf Power Company

E	PROJ I.D.	DRAWING NUMBER	SHEET	CONT'D	REV
200'		**ES1840S1**	1	FINAL	0

Plant Smith Weekly Dike Inspection Log

Weather:	Date of Inspection:
Temperature:	Inspection by:
Rainfall (past 24 hrs):	
Rainfall (past week):	Pond Elev.:

General Comments

I - Ash Pond - 'West' Section Dike

	Observations - Comments
1. Upstream Slope	
a. Condition	
b. Erosion/Sloughing Yes / No	
c. Woody brush Yes / No	
d. Burrows Yes / No	
2. Crest	
a. Condition	
b. Bare Areas Yes / No	
c. Rutting Yes / No	
3. Downstream Slope	
a. Condition	
b. Seepage/Wet Spots Yes / No	
c. Erosion/Sloughing Yes / No	
d. Burrows Yes / No	
4. Emergency Aggregate Stockpiles	
a. Available/Condition Yes / No	Good / Not Good

II - Ash Pond - Discharge Structure to Perimeter Ditch

	Observations - Comments
1. Structure	
a. Condition	
b. Seepage/Wet Spots Yes / No	
2. Downstream of Structure (Channel)	
a. Condition	

III - Ash Pond - 'South' Section Dike

	Observations - Comments
1. Upstream Slope	
a. Condition	
b. Erosion/Sloughing Yes / No	
c. Woody brush Yes / No	
d. Burrows Yes / No	
2. Crest	
a. Condition	
b. Bare Areas Yes / No	
c. Rutting Yes / No	
3. Downstream Slope	
a. Condition	
b. Seepage/Wet Spots Yes / No	
c. Erosion/Sloughing Yes / No	
d. Burrows Yes / No	
4. Emergency Aggregate Stockpiles	
a. Available/Condition Yes / No	*Good / Not Good*

GP-SM-#0015

IV - Ash Pond - 'East' Section Dike	
	Observations - Comments
1. Upstream Slope	
a. Condition	
b. Erosion/Sloughing Yes / No	
c. Woody brush Yes / No	
d. Burrows Yes / No	
2. Crest	
a. Condition	
b. Bare Areas Yes / No	
c. Rutting Yes / No	
3. Downstream 'Slope' (**Note**: No 'downstream slope' due to higher natural ground.)	
a. Condition	
b. Erosion Yes / No	

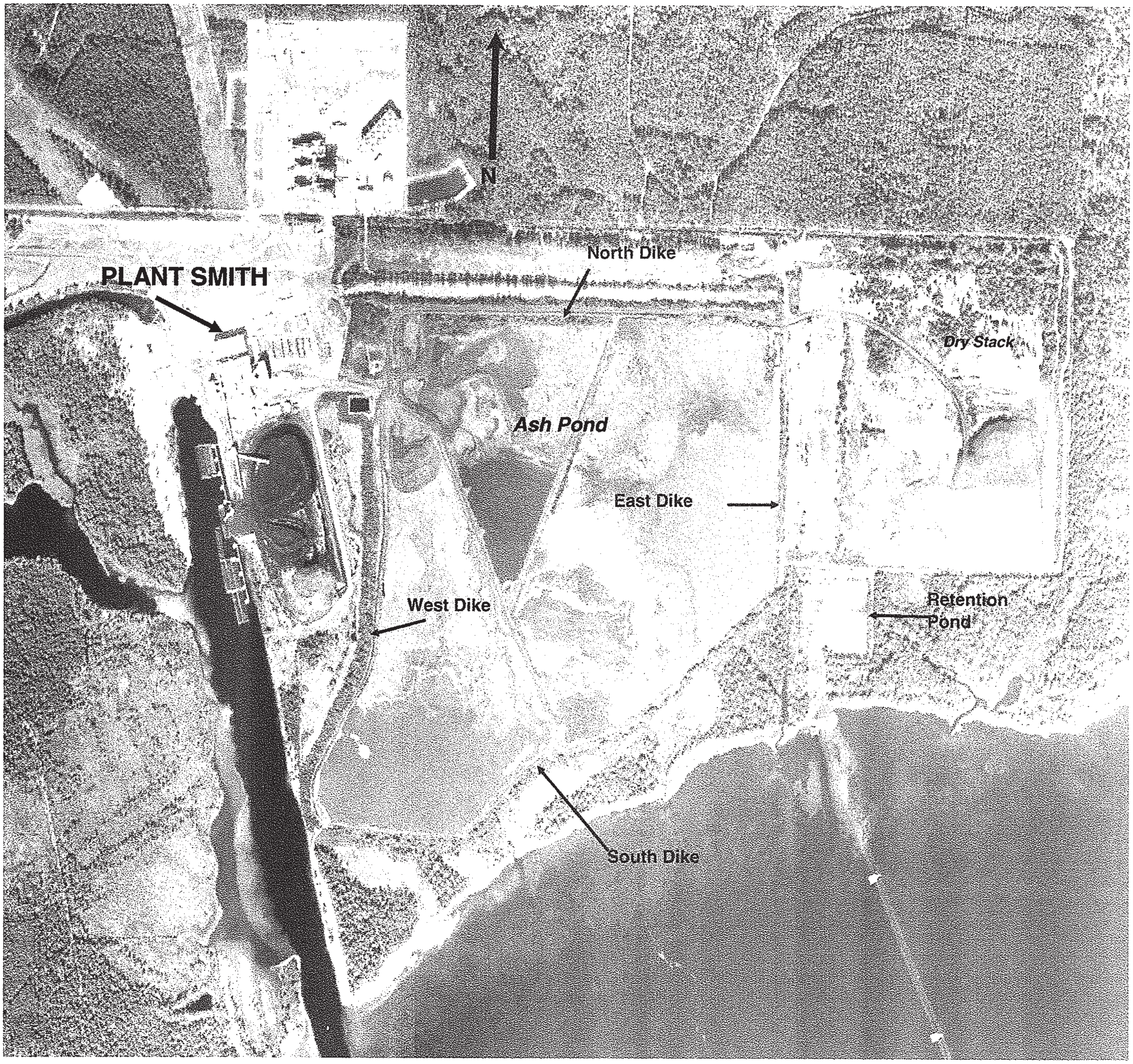
V - Ash Pond - 'North' Section Dike	
	Observations - Comments
1. Upstream Slope	
a. Condition	
b. Erosion/Sloughing Yes / No	
c. Woody brush Yes / No	
d. Burrows Yes / No	
2. Crest	
a. Condition	
b. Bare Areas Yes / No	
c. Rutting Yes / No	
3. Downstream Slope	
a. Condition	
b. Seepage/Wet Spots Yes / No	
c. Erosion/Sloughing Yes / No	
d. Burrows Yes / No	
4. Emergency Aggregate Stockpiles	
a. Available/Condition Yes / No	*Good / Not Good*

VI - Retention Pond	
	Observations - Comments
1. Condition	

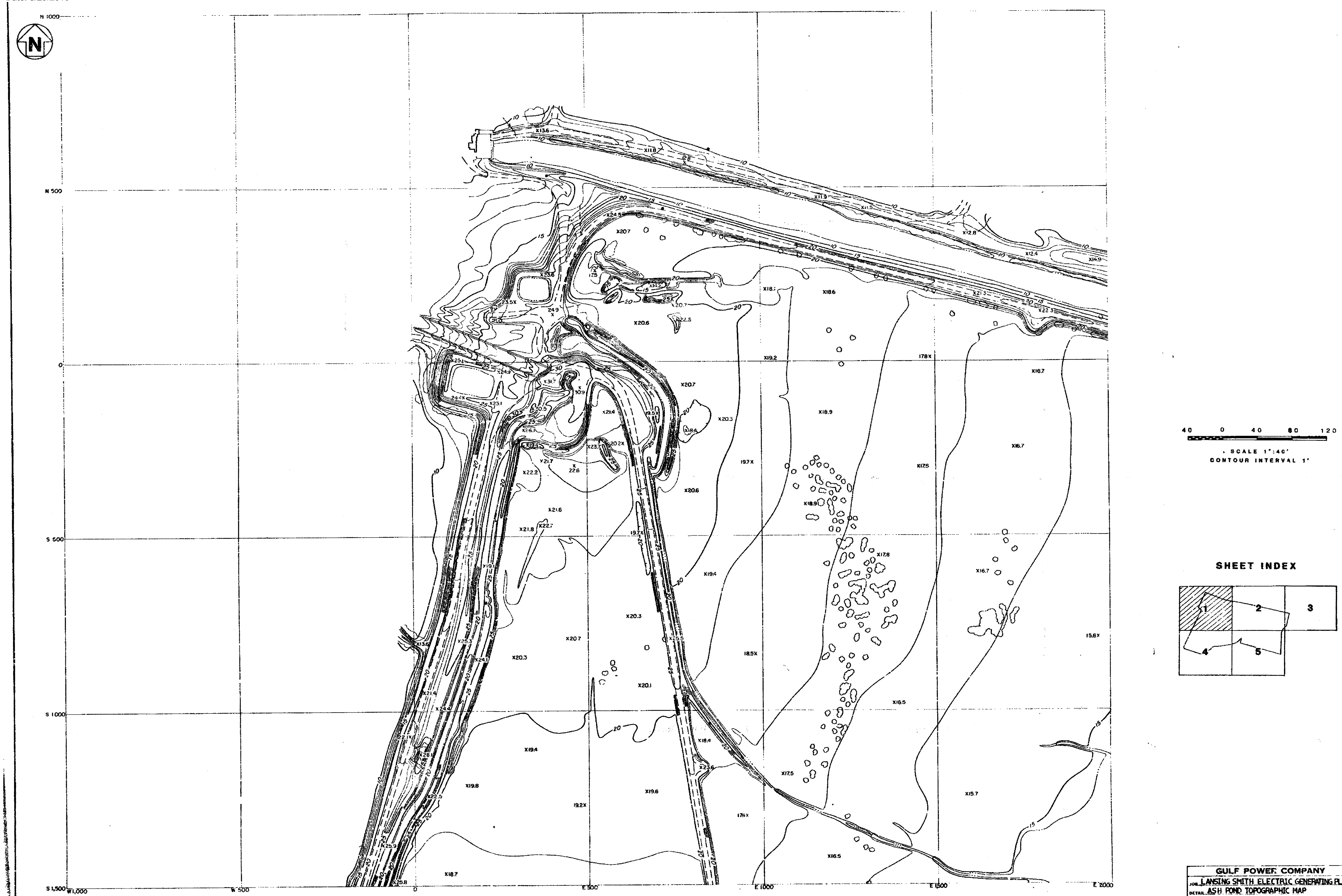
VII - DRY STACK	
	Observations - Comments
1. Condition	
c. Erosion/Sloughing Yes / No	

VIII - Additional Observation/Comments - General
Observations - Comments

DATE:


N
PLANT SMITH
North Dike
Dry Stack
Ash Pond
East Dike
West Dike
Retention
Pond
South Dike

Date: 6/29/2010



GULF POWER COMPANY

JOB LANSING SMITH ELECTRIC GENERATING PLANT

DETAIL ASH POND TOPOGRAPHIC MAP

SHEET 1 OF 5

SCALE 1":40' JOB NO. SM85794

SHEET OF SHEETS

SUPERSEDES

D-31123

REV O	11-13-85	DRAWN R.C.B. CHECKED E.E.P. DSGN R.C.B.
APPROVED FOR CONSTRUCTION		APPROVED EEP DATE 11-13-85
		APPROVED JW DATE 11-13-85

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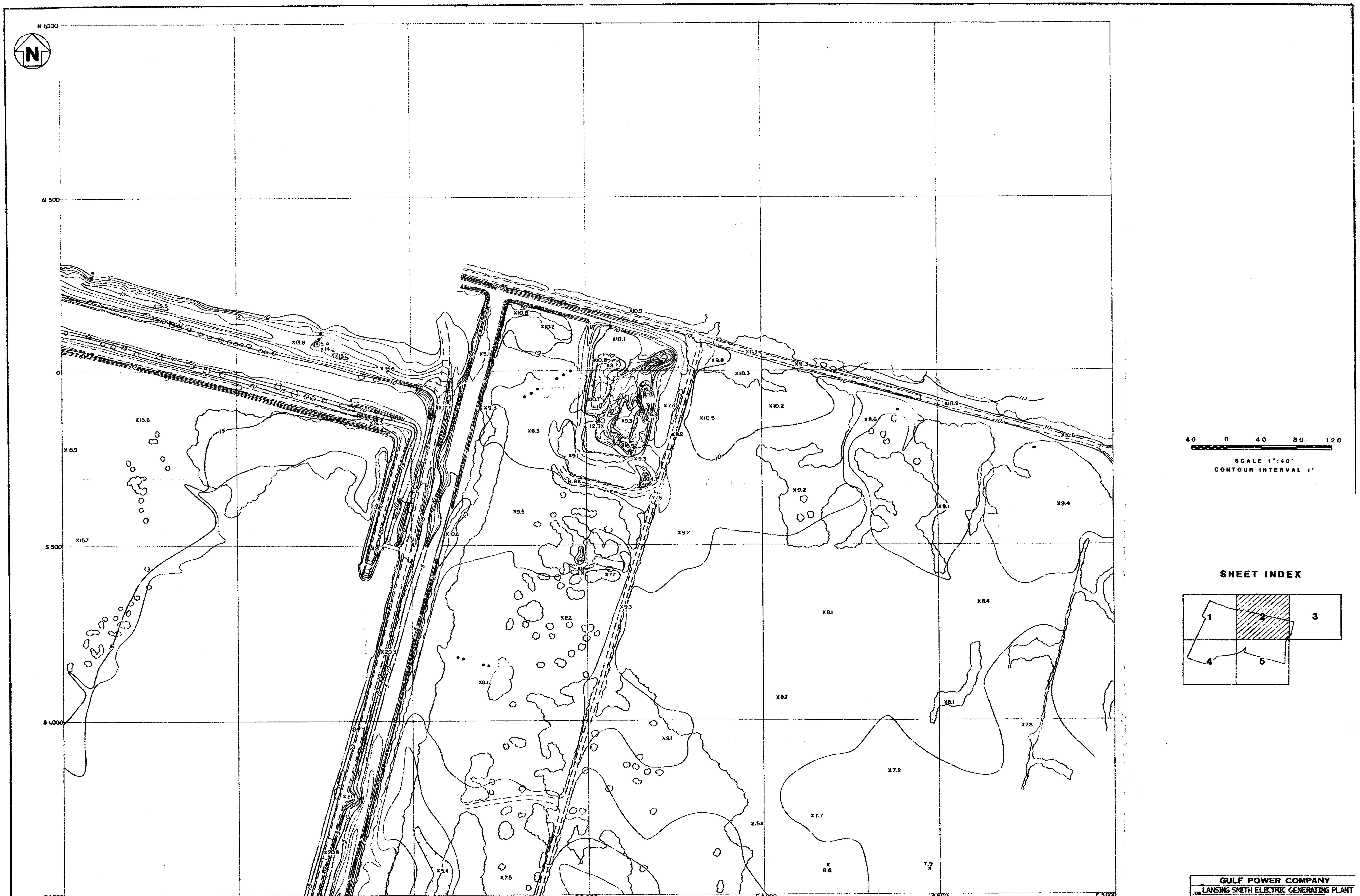


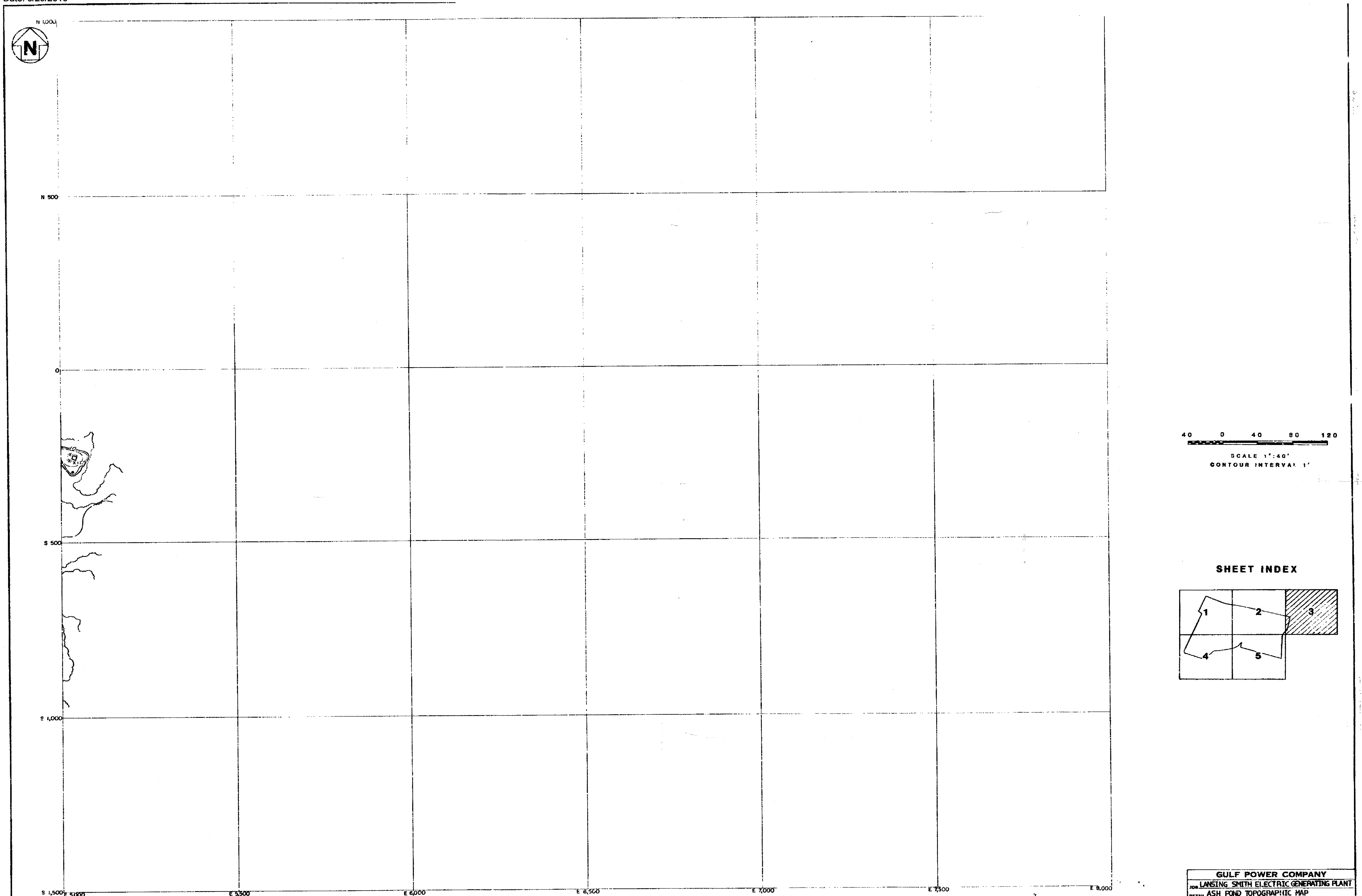
GULF POWER COMPANY

JOB	LANSING SMITH ELECTRIC GENERATING PLANT
DETAIL	ASH POND TOPOGRAPHIC MAP SHEET 2 OF 5
SCALE	1":40'
B/M	JOB NO. SM95794
SHEET OF SHEETS	D-31124
SUPERSEDES	

REV. O	11-13-85
APPROVED FOR CONSTRUCTION	

DRAWN R.C.B. CHECKED E.E.P. DESIGN R.C.B.
APPROVED EEP DATE 11-13-85
APPROVED JW DATE 11-13-85

Date: 6/29/2010



REV. 0	11-13-85	DRAWN R.C.B. CHECKED E.E.P. DSGN R.C.B.
APPROVED FOR CONSTRUCTION		APPROVED EEP DATE 11-13-85
		APPROVED DATE 11-13-85

GULF POWER COMPANY

JOB LANSING SMITH ELECTRIC GENERATING PLANT

DETAIL ASH POND TOPOGRAPHIC MAP SHEET 3 OF 5

SCALE 1":40' JOB NO. SM85794

SHEET OF SHEETS

SUPERSEDES

D-31125

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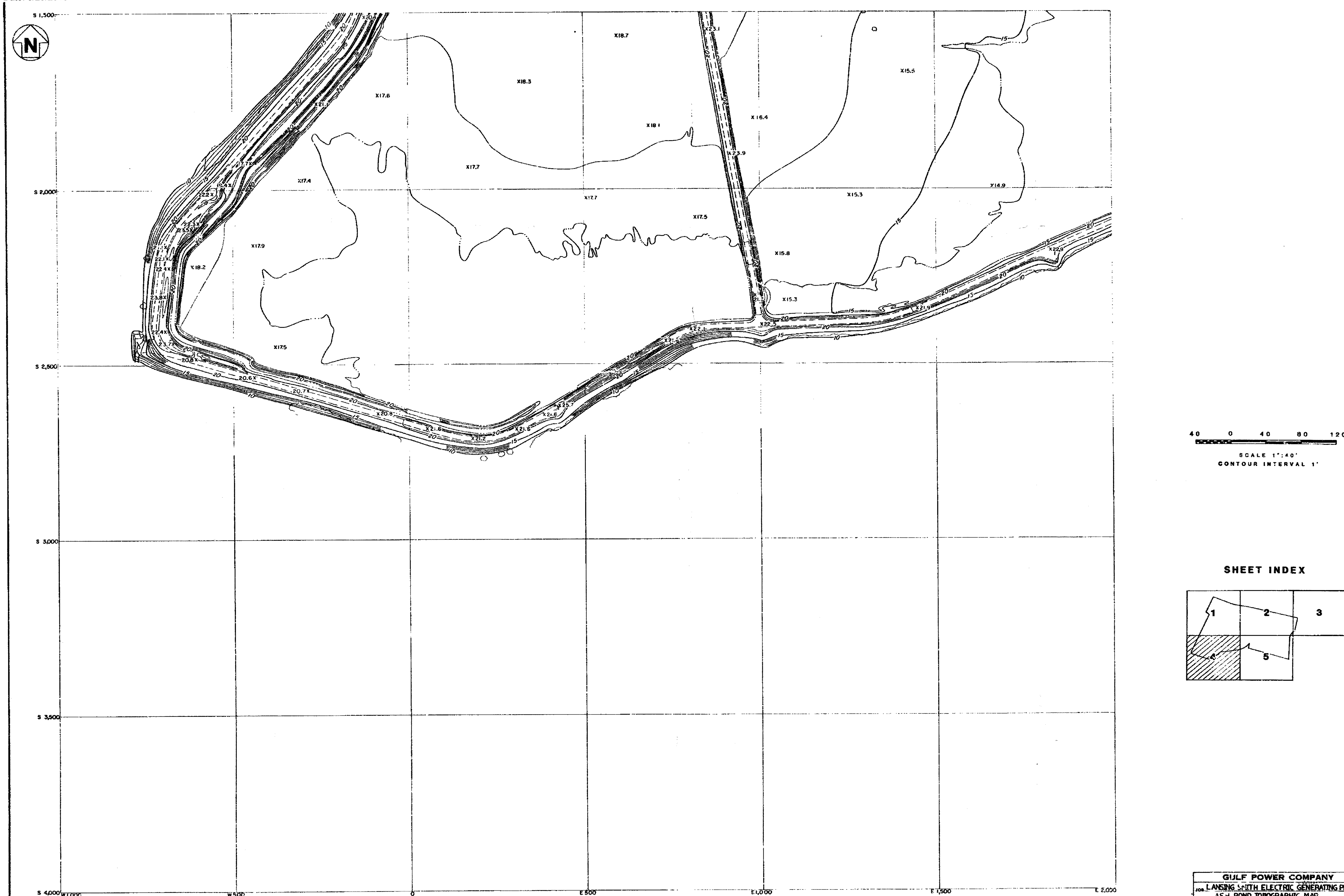
GP-SM-#0005

Date: 6/29/2010



REV. 0	11-13-85
APPROVED FOR CONSTRUCTION	

DRAWN R.C.B. CHECKED E.E.P. DSGN R.C.B.
APPROVED EEP DATE 11-13-85
APPROVED DATE 11-13-85

GULF POWER COMPANY
JOB LANSING SMITH ELECTRIC GENERATING PLANT
DETAIL ASH POND TOPOGRAPHIC MAP
SHEET 4 OF 5
SCALE 1":40' JOB NO. SM857-4
SHEET OF SHEETS
SUPERSEDES
D-31126

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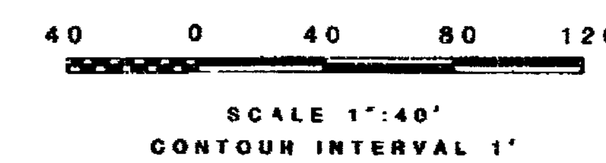
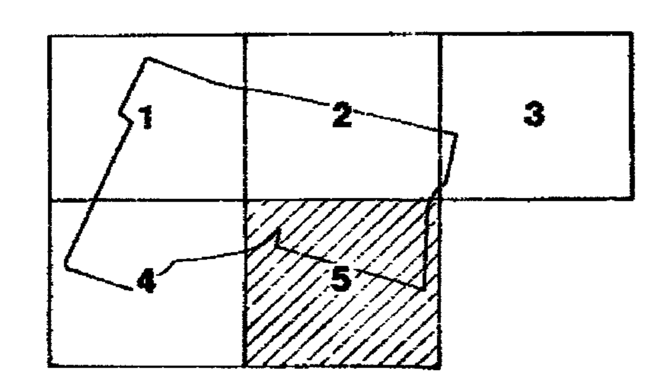
Date: 6/29/2010



SHEET INDEX



REV 0	11-13-85	DRAWN R.C.B. CHECKED E.E.P. DSGN R.C.B.	GULF POWER COMPANY
APPROVED FOR CONSTRUCTION		APPROVED EEP DATE 11-13-85	JOB LANSING SMITH ELECTRIC GENERATING PLANT
		DATE 11-13-85	DETAIL ASH POND TOPOGRAPHIC MAP SHEET 5 OF 5
			SCALE 1":40' DWG JOB NO. SM85794
			SHEET OF SHEETS SUPERSEDES D-31127

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GP-SM-#0007

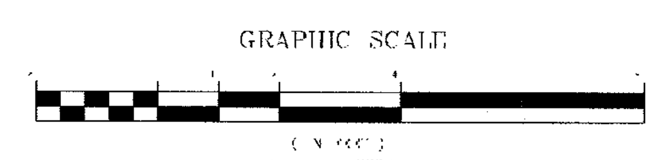
4) ELEVATION DATUM FOR VOLUME CALCULATION OF EAST CELL: 17.00 MSL.
ELEVATION USED TO CALCULATE REMAINING VOLUME; FROM DECEMBER 2000 VOLUME REPORT FROM BUCHANAN & HARPER, INC. 735 WEST 11TH STREET PANAMA CITY, FL. 32401 PHONE: (850) 763-7427.

5) ELEVATION DATUM FOR VOLUME CALCULATION OF NORTHWEST CELL: 18.34 MSL.
ELEVATION USED TO CALCULATE REMAINING VOLUME; FROM DECEMBER 2000 VOLUME REPORT FROM BUCHANAN & HARPER, INC.

6) ELEVATION DATUM FOR VOLUME CALCULATION OF SOUTHWEST CELL: 20.70 MSL.
ELEVATION USED TO CALCULATE REMAINING VOLUME; FROM DECEMBER 2000 VOLUME REPORT FROM BUCHANAN & HARPER, INC.

7) DRAWING IS ACCURATE ONLY AT ORIGINAL SCALE.

AREAS OF REMAINING WATER VOLUME



GRID COORDINATES NAD 83
FLORIDA STATE PLANE
NORTH ZONE

HYDROGRAPHIC/TOPOGRAPHIC SURVEY

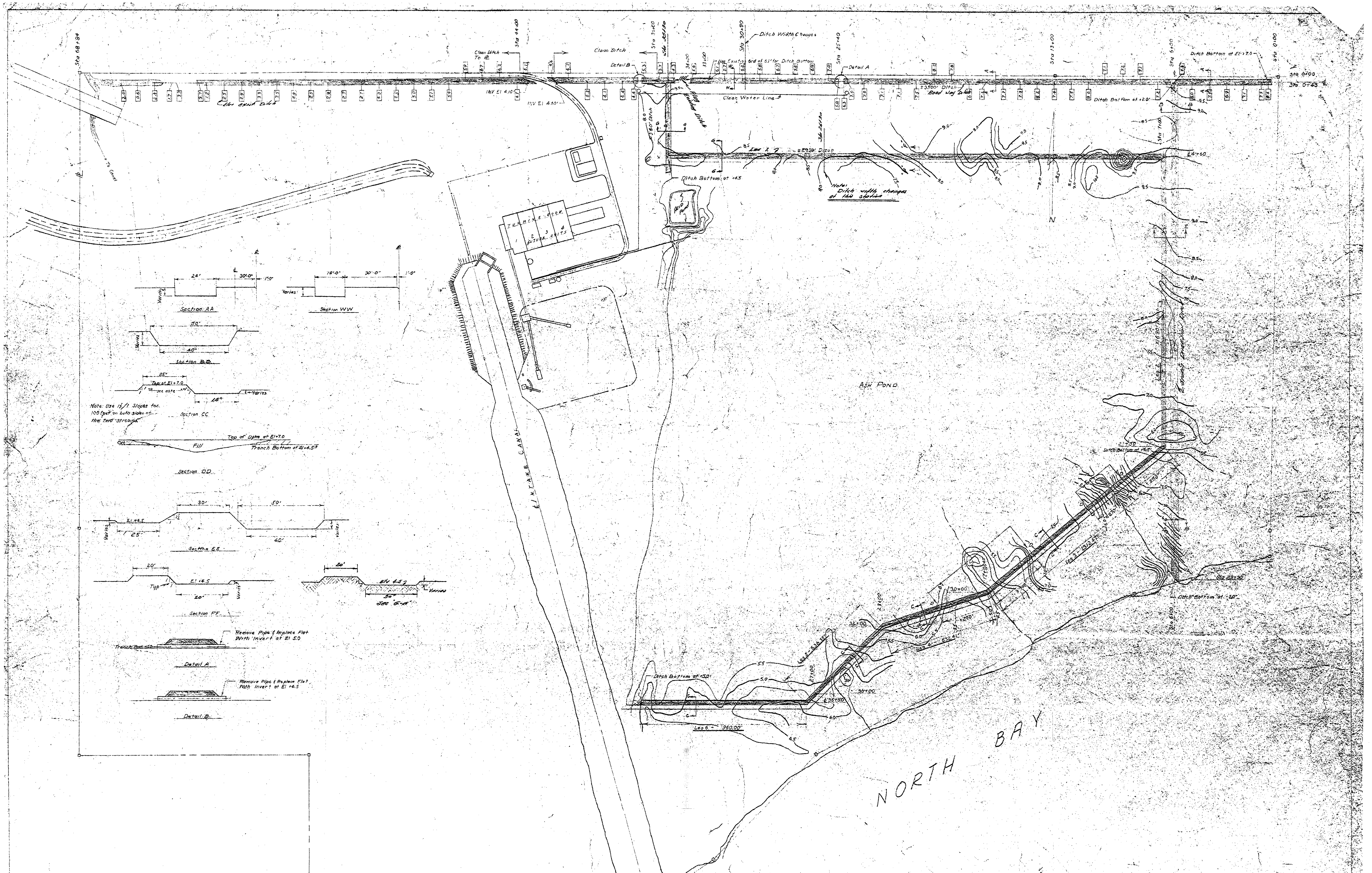
Southern Company Services, Inc.
for
Gulf Power Company

REV	DATE:

DRAWN: ENP CHECKED: DESIGNED:
APPROVED: DATE: 3/11/2010
APPROVED: DATE:

JOB: PLANT LANSING SMITH
DETAIL: ASH POND
TOPO AND VOLUME
SCALE: AS NOTED B/M:
SHEET 1 OF 1 SHEETS
SUPERSEDES:
3727LAN REV 0

GP-SM-#0008



Rev. 4 7-9-65 JM - Added Section WW	Rev 3: 6-30-65 G.O.L. Revised Sec. "C-C", Added Sec. "GG", Relocated "Plug" & Dike, Identified Leg 1. Added Note on ditch	Rev 2 5-26-65 JM - Moved road drainage ditch 8' South	Rev 1 - Changed Leg Lengths Located Leg 2 - jm 3-23-65

DRAWN jm CHECKED GOL TRACED jm
APPROVED GOL DATE 2-16-65
APPROVED ____ DATE ____

GULF POWER COMPANY
JOB: LANSING SMITH STEAM PLANT UNIT No. 1
DETAIL: GENERAL ARRANGEMENT PLANT SITE
SCALE 1" = 200'-0"
SHEET 1 OF 1 SHEETS
SUPERSEDES
Y-120

GP-SM-#0001

Appendix B

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Gulf Power - Lansing Smith Date: 6 July 2010
Unit Name: Ash Pond Operator's Name:
Unit I.D.: Hazard Potential Classification: High Significant (Low)
Inspector's Name: Frederic Shmurak & Michael Hanson - Dewberry

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?	Weekly & Annual		18. Sloughing or bulging on slopes?	✓	
2. Pool elevation (operator records)?	17.5		19. Major erosion or slope deterioration?	✓	
3. Decant inlet elevation (operator records)? (Weir)	17.0		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	20.0		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?		N/A	Is water exiting outlet flowing clear?	✓	
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?		N/A	From underdrain?		N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?		N/A	From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?		N/A	23. Water against downstream toe?	✓	
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

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

Inspection Issue # Comments

5. East cell crest elev 20.0; Remaining cells crest elev. 23.0

9. Recently mowed woody stem vegetation; evidence of small animal burrows along D/S dike

11. crest elev is irregular; minor depressions

18. Three small sloughs (fourth retained w/ slush grouted rip-rap) along N.E D/S dike

19. Widespread rill erosion, surface sloughing and D/S sediment deposition from D/S slopes. Irregular road along west dike D/S buttress w/ small surface depressions holding water.

23. Wetlands & recycle water channel located along D/S toes.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW) Impoundment Inspection

Impoundment NPDES Permit # FL0002267 INSPECTOR Dewberry
Date 6 JULY 2010

Impoundment Name Ash Pond
Impoundment Company GULF POWER
EPA Region IV
State Agency (Field Office) Addresss ______

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

New ______ Update ✓

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

IMPOUNDMENT FUNCTION: CCW SETTLEMENT & STORAGE

Nearest Downstream Town : Name LYNN HAVEN
Distance from the impoundment 1.6 miles SE
Impoundment
Location: Longitude N 85 Degrees 41 Minutes 51 Seconds
Latitude W 30 Degrees 15 Minutes 41 Seconds
State FL County BAY

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

If So Which State Agency? FL DEPT. of ENV. CONTROL for NPDES.

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.

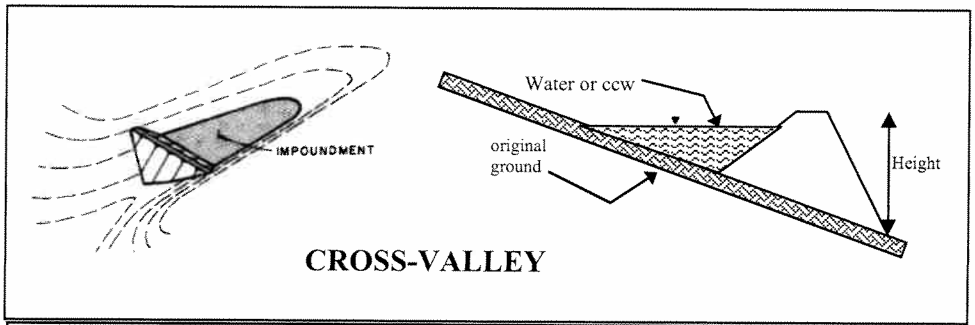
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

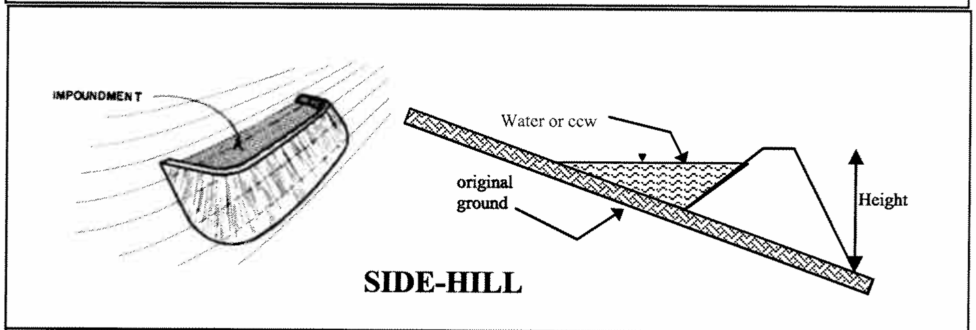
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

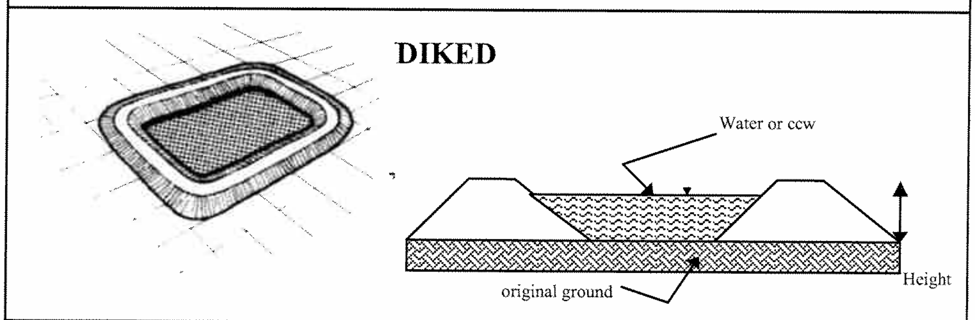
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

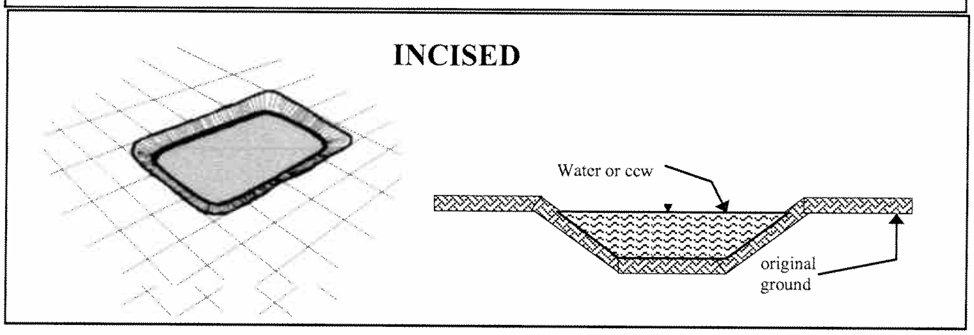
SIZE & LOCATION of EMBANKMENT

CONFIGURATION:









______ Cross-Valley

______ Side-Hill

✓ Diked

✓ Incised (form completion optional)

______ Combination Incised/Diked

Embankment Height 18 feet Embankment Material COAL ASH & SOIL

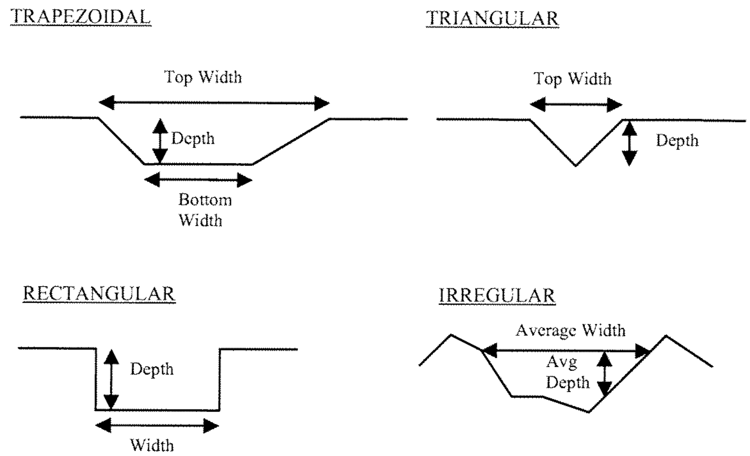
Pool Area 165 acres Liner NONE

Current Freeboard ± 2 feet Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

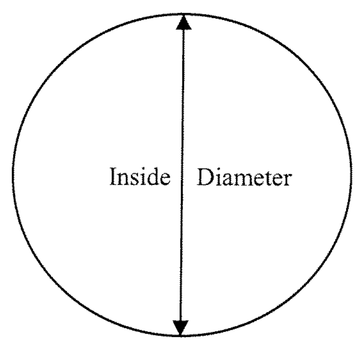
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_✓_ Rectangular WEIR
_____ Irregular

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



_____ **Outlet**

_____ inside diameter



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

Is water flowing through the outlet? YES _✓_ NO _____

_____ **No Outlet**

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

The Impoundment was Designed By Southern Company

Has there ever been a failure at this site? YES ____________ NO ____✓____

If So When? ________________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________ NO ✓

If So When? ______________________________

IF So Please Describe: ______________________________

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

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

If so Please Describe : ____________

Job No. 50040902
Visit Date: 7/6/10

CCWI Safety Assessment
Gulf Power – Lansing Smith

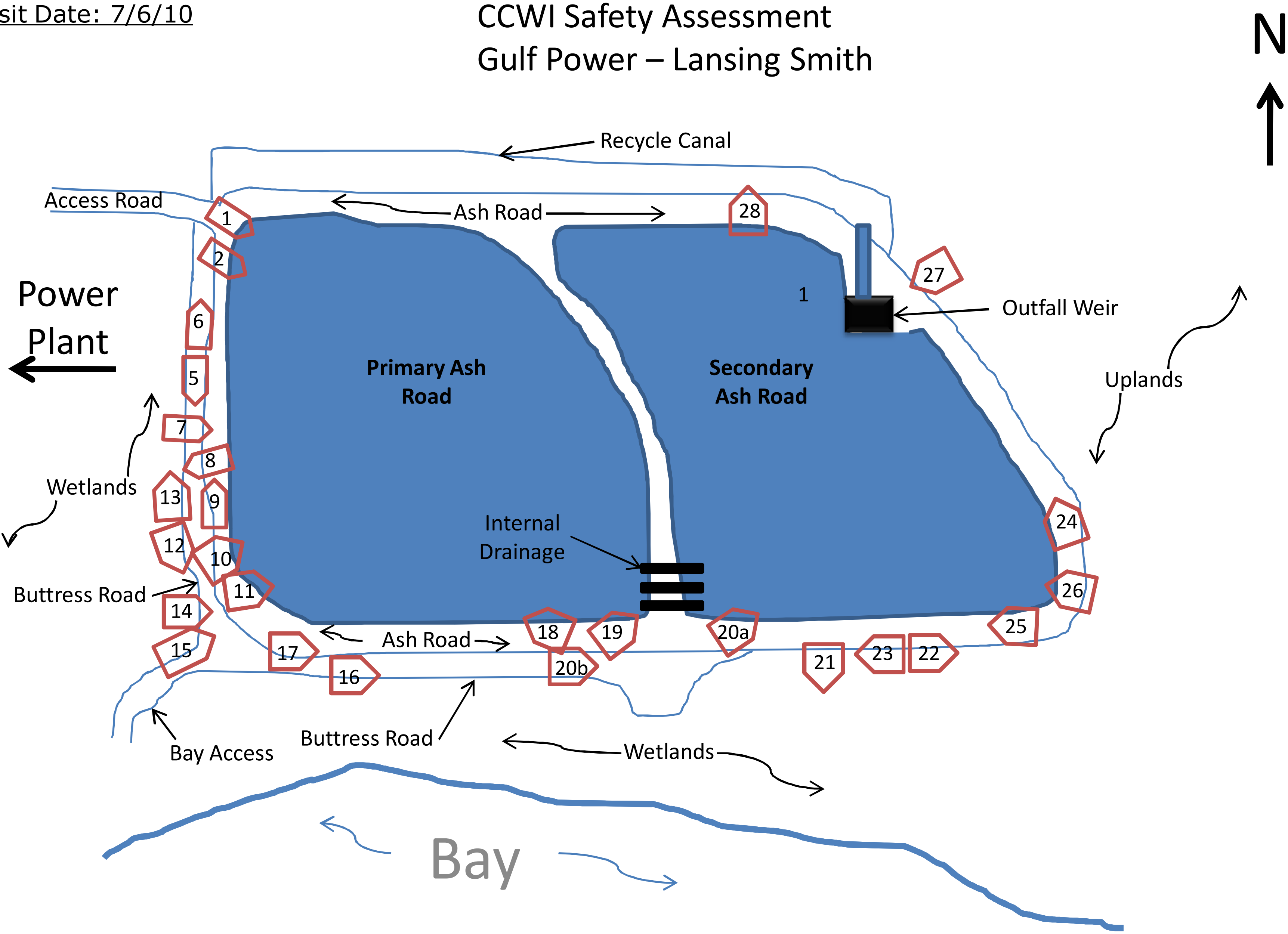


Photo 1
Ash Pond near North West Access Road - looking South East

Photo 2
Ash Pond near North West Access Road – looking South

Photo 5
Slope of West Embankment

Photo 6
West embankment buttress fill (Old road bed) ponding water

Photo 7
Rilling on slope of West embankment

Photo 8
Recently fixed Sloughing on West embankment

Photo 9
West embankment at South West corner of Ash Pond – looking North

Photo 10
Ash Pont at South West Corner – looking North East

Photo 11
Ash Pond at South West corner – looking South East

Photo 12
West embankment looking South

Photo 13
West embankment at South West corner – looking North note slope rilling

Photo 14
Emergency repair stockpile at South West corner of pond

Photo 15
Emergency repair stockpile at South West corner of pond

Photo 16
South embankment – looking East

Photo 17
Abandoned test well at top of banks on South embankment

Photo 18
Ash Pond at internal dike on South embankment - looking North West

Photo 19
Internal drainage near center of South embankment

Photo 20a
Ash Pond near center of South embankment – looking East

Photo 20b
South embankment near center

Photo 21
Wetlands and bay South of Ash Pond

Photo 22
South embankment – looking East

Photo 23
South embankment – looking West

Photo 24
East embankment – looking North - note inflow pipe from stormwater management facility

Photo 25
South embankment – looking West

Photo 26
Cattails recently trimmed on East embankment interior

Photo 27
Ash Pond outfall weir

Photo 28
Rip rap repair of North embankment near North East corner and adjacent to recycle canal

Appendix C

CONFIDENTIAL

SOUTHERN COMPANY

Engineering and Construction Services Calculation

Calculation Number:
TS-SM-ECS3389-100

Project/Plant: Plant Smith Ash Pond	**Unit(s):**	**Discipline/Area:** Geotechnical
Title/Subject: Analysis of Liquefaction Potential for Ash Pond Dike and Foundation		
Purpose/Objective: Evaluate the potential for dike and foundation soils to liquefy under earthquake shaking		
System or Equipment Tag Numbers: NA	**Originator:** Benjamin J. Gallagher, P.E.	

Contents

Revision Record

Rev. No.	Description	Originator Initial / Date	Reviewer Initial / Date	Approver Initial / Date
0	Issued for Information	BJG/07-23-10		JCP/07-23-10

Notes:

Purpose of Calculation

Plant Smith is has two coal-fired units that produce ash as a combustion residual. Presently, the facility sluices ash to an on-site ash pond. The pond is contained by a ring dike made of compacted soil and ash. The purpose of this calculation is to evaluate the potential for liquefaction of the dike or foundation soils to occur during earthquake shaking.

Summary of Conclusions

SPT tests were generally performed at 5-foot increments throughout the borings. The liquefaction potential was analyzed at each SPT test and the results are summarized on the attached table. The analysis indicates all soils have a factor of safety against liquefaction of at least 1.2. The soils represented by four SPT test intervals had factors of safety of 1.2 to 1.3, and the remaining SPT intervals had factors of safety of 1.4 or greater. A factor of safety of greater than 1 indicates that liquefaction should not be triggered by the design earthquake. A variety of sources interpret these data differently. We understand the FERC considers a factor of safety of 1.1 acceptable. However, other sources recommend performing post-earthquake stability analyses with reduced strengths for some materials with factors of safety greater than 1. For example, the current MSHA Engineering And Design Manual: Coal Refuse Disposal Facilities recommends that earthquake-reduced strengths be applied to soil with factors of safety less than 1.4.

Based on the USGS Quaternary fault map, we don't believe there is evidence of significant seismic sources near the Plant. We believe that the probabilistic hazard data are conservative for this site and include contributions from distant seismic sources, such as the New Madrid Seismic Zone, that wouldn't likely trigger liquefaction at Plant Smith. Based on the limited number of samples subject to potential liquefaction (that is, factors of safety less than 1.4) and the conservative earthquake parameters, revisions to the pseudo-static dike stability analyses completed in April 2010 are not warranted at this time. However, we recommend that any future borings for structures at Plant Smith be screened for liquefaction potential due to the potential for variation in subsurface conditions.

Methodology

Liquefaction potential was assessed using procedures outlined in the 2004 paper by Idriss and Boulanger titled, "Semi-Empirical Procedures for Evaluating *Liquefaction Potential During Earthquakes*". The SPT test data collected for the recent slope stability study (ES 1840) was used to evaluate liquefaction potential. Supplemental information regarding SPT correction factors was obtained from the 2001 paper by Youd and Idriss " Liquefaction Resistance of Soils: Summary

Report From The 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils" and ASTM D 6066-04. The reported factor of safety is the ratio of the cyclic resistance ratio (CRR) to the cyclic stress ratio (CSR).

Criteria and Assumptions

The liquefaction analysis criteria:

1. The peak acceleration at the top of the dike is 0.078g as derived from the USGS-mapped, site-modified, short-period spectral acceleration at Plant Smith (7% chance of exceedance over 75 years, 1050-year return period).

2. The design earthquake is magnitude 5.55, as determined by the USGS mapped earthquake with a 7% probability of exceedance over 75 years and located within 300 kilometers of Plant Smith.

Based on historical information, we understand there is little evidence of liquefaction occurring at distances much greater than 100 kilometers from the earthquake source, even with large magnitude earthquakes. The USGS online map of Quaternary Fault and Fold Database indicates the closest faults to Plant Smith are the Gulf-margin normal faults located at least 110 kilometers west of the site. The USGS report indicates there is little evident of Quaternary slip on these faults, and that is it not clear that slip on these would occur seismically. They have a "strikingly low historical seismicity."

Design Inputs/References

1. SPT Test Borings, Ash Pond Evaluation (ES 1840), April 2010
2. USGS Probabilistic Earthquake Hazard Data for Plant Smith (N30.262, W85.696)

Body of Calculation

Attached

Plant Smith Ash Pond

Evaluation of Liquefaction Potential in SPT Test Borings

prepared by Ben Gallagher, 7/23/2010

	NDB-1		NDB-2		NDB-3		NDB-4		NDB-5		NDB-6		NDB-7		NDB-8		NDB-9		NDB-10	
Depth	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety
5	6	>5	7	>5	5	>5	11	>5	13	>5	12	>5	9	>5	11	>5	20	>5	8	>5
10	3	3.5	1	1.9	2	2.2	3	3.5	4	3.9	5	3.2	3	3.5	9	>5	4	2.8	7	4.0
15	9	>5	15	>5	5	3.1	1	1.6	2	2.0	1	1.6	0	2.0	6	4.8	2	2.0	2	>5
20	7	3.4	8	3.8	21	>5	13	>5	28	>5	14	>5	21	>5	21	>5	18	>5	10	>5
25	5	2.5	5	2.5	8	3.5	4	2.2	3	2.0	2	1.7	6	2.8	12	>5	5	2.5	11	>5
30	10	4.0	0	1.3	4	2.2	4	2.2	5	2.4	5	2.4	4	2.2	5	2.4	6	2.7	2	>5
35	0	1.4	11	4.2	2	1.7	6	2.7	4	2.2	3	1.9	3	1.9	5	2.4	1	1.5	7	>5
40	6	3.0					20	>5	1	1.6									0	1.4
45	12	>5							0	1.5									9	3.5
50									12	4.5									11	>5
55									15	>5										
60																				

	SDB-1		SDB-2		SDB-3		SDB-4		SDB-5		SDB-6		SDB-7		SDB-8		SDB-9		SDB-10	
Depth	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety
5	14	>5	10	>5	4	3.6	4	4.9	5	>5	5	>5	10	>5	9	>5	9	>5	20.0	>5
10	9	>5	15	>5	2	2.3	1	2.0	1	2.0	5	4.4	7	>5	8	>5	5	3.2	11.0	>5
15	5	4.1	2	2.6	6	3.5	1	1.8	4	2.7	13	>5	4	3.6	2	2.6	1	1.5	3.0	3.1
20	7	4.6	5	3.6	7	3.5	8	3.8	9	4.2	10	4.8	0	1.8	1	1.5	2	1.8	0.0	1.2
25	35	>5	10	>5	6	2.9	11	4.7	6	2.9	6	2.8	2	1.7	12	>5	5	2.5	4.0	2.2
30	16	>5	18	>5	9	3.7	4	2.2	5	2.5	3	1.9	5	2.4	4	2.2	8	3.3	4.0	2.2
35	2	1.7	2	1.7	2	1.8	0	1.4	0	1.4	1	1.5	5	2.4	4	2.1	5	2.4	6.0	2.6
40			0	1.8	0	1.5			0	1.5										
45			0	1.9	0	1.6			0	1.6										
50			0	2.0	5	3.4			8	3.4										
55			0	2.4	0	2.3			12	4.8										
60			2	2.9	7	4.5														
65			12	>5	11	>5														
70																				

	SDB-11		SDB-12		SDB-13		SDB-14		SDB-15		SDB-16		SDB-17		SDB-18		SDB-19	
Depth	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety	SPT N-value	Factor of Safety
5	6	>5	4	4.9	10	>5	25	>5	11	>5	6	4.6	14	>5	7	>5	15	>5
10	7	>5	4	3.9	18	>5	11	>5	17	>5	12	>5	4	3.0	1	2.0	12	>5
15	2	2.6	12	>5	4	2.7	0	1.5	17	>5	4	2.7	2	2.1	5	3.1	1	1.8
20	8	3.8	5	2.7	0	1.4	13	>5	15	>5	24	>5	17	>5	3	2.2	12	>5
25	17	>5	20	>5	5	2.6	4	2.4	2	1.9	4	2.3	9	3.9	5	2.6	2	1.8
30	0	1.3	0	1.3	1	1.6	11	4.5	4	2.3	5	2.5	0	1.4	0	1.4	0	1.4
35	3	1.9	2	1.7	17	>5	11	4.4	5	2.5	1	1.6	1	1.6	0	1.4	0	1.4
40	3	1.9											0	1.9				
45	22	>5											0	1.6				
50	11	4.2											2	2.0				
55													14	>5				
60																		

Note: Reported N-values are uncorrected field values

Factor of Safety = Cyclic Resistance Ratio (CRR) divided by the Cyclic Shear Stress Ratio (CSR)

This evaluation was performed following the using the procedures described by Idriss and Boulanger in the paper titled "Semi-emprical procedures for evaluating liquefaction potential during earthquakes " dated January 2004 and the journal article titled "Liquefaction Resistance of Soils: Summary report fromthe 1996 NCEER and 1998 NCEER/NSF Workshops on evaluation of liquefaction resistance of soils" by Youd and Idriss dated April 2001. A maximum acceleration value of 0.08 was selected based on the site-modified short-period spectral acceleration from 2002 USGS probabilistic maps for 7% exceedence over 75 years. USGS mapped earthquake probability indicated magnitude 5.55 earthquake for a return period of within 300km of the site (7%

TS-SM-ECS3389-100

Conterminous 48 States
2007 AASHTO Bridge Design Guidelines
AASHTO Spectrum for 7% PE in 75 years
Latitude = 30.262000
Longitude = -085.692000
Site Class B
Data are based on a 0.05 deg grid spacing.

Period (sec)	Sa (g)	
0.0	0.022	PGA - Site Class B
0.2	0.049	Ss - Site Class B
1.0	0.029	S1 - Site Class B

Conterminous 48 States
2007 AASHTO Bridge Design Guidelines
Spectral Response Accelerations SDs and SD1
Latitude = 30.262000
Longitude = -085.692000
As = FpgaPGA, SDs = FaSs, and SD1 = FvS1
Site Class D - Fpga = 1.60, Fa = 1.60, Fv = 2.40
Data are based on a 0.05 deg grid spacing.

Period (sec)	Sa (g)	
0.0	0.035	As - Site Class D
0.2	0.078	SDs - Site Class D
1.0	0.069	SD1 - Site Class D

Plant Smith Ash Pond

Plant Smith Ash Pond

#USGS-NSHMP Earthquake probabilities in vicinity of -85.70_d_E
#Site x,y -85.700 30.260 Rmax= 300.0 km. Report on mean rates and Poisson Pr
#Rates below are annual; probabilities, however, correspond to time T

# M	Int_ARate	Cumul_ARate	Int_Prob	Cumul_Prob for T= 75.0 yrs
7.65	.82528E-06	.82528E-06	.61870E-04	.61870E-04
7.55	.53285E-06	.13581E-05	.39935E-04	.10186E-03
7.45	.43974E-05	.57554E-05	.32973E-03	.43154E-03
7.35	.80098E-05	.13765E-04	.60058E-03	.10319E-02
7.25	.43159E-05	.18081E-04	.32365E-03	.13552E-02
7.15	.80932E-05	.26175E-04	.60683E-03	.19612E-02
7.05	.16649E-04	.42823E-04	.12479E-02	.32066E-02
6.95	.69970E-05	.49820E-04	.52464E-03	.37295E-02
6.85	.13261E-04	.63080E-04	.99403E-03	.47199E-02
6.75	.24824E-04	.87904E-04	.18601E-02	.65712E-02
6.65	.10510E-04	.98424E-04	.78863E-03	.73546E-02
6.55	.19905E-04	.11833E-03	.14918E-02	.88354E-02
6.45	.37232E-04	.15556E-03	.27885E-02	.11599E-01
6.35	.15827E-04	.17139E-03	.11864E-02	.12772E-01
6.25	.49877E-04	.22127E-03	.37338E-02	.16458E-01
6.15	.37362E-04	.25863E-03	.27982E-02	.19210E-01
6.05	.70620E-04	.32925E-03	.52825E-02	.24391E-01
5.95	.2929[illegible]E-04	.35854E-03	.21948E-02	.26532E-01
5.85	.929[illegible]E-04	.45147E-03	.69455E-02	.33294E-01
5.75	.70275E-04	.52175E-03	.52568E-02	.38375E-01
5.65	.13283E-03	.65459E-03	.99131E-02	.47908E-01
5.55	.56470E-04	.71106E-03	.42263E-02	.51932E-01
5.45	.179[illegible]2E-03	.89018E-03	.13344E-01	.64583E-01
5.35	.222[illegible]E-03	.11131E-02	.16580E-01	.80092E-01
5.25	.2774[illegible]E-03	.13905E-02	.20592E-01	.99036E-01
5.15	.000[illegible]E+00	.13905E-02	.00000E+00	.99036E-01
5.05	.345[illegible]E-03	.17358E-02	.25562E-01	.12207E+00

EHP Qua ary fault and fold database IMS 0 16mi 0 2

Earthqua   azards Program

Databas Search

Complete   port for Gulf-margin normal faults, Alabama and Florida (Class B) No. 26

Brief Rep   Partial Report

citation f record: **Wheeler, R.L., compiler, 1998, Fault number 2654, Gulf-margin n   faults, Alabama and Florida, in Quaternary fault and fold database of the Uni States: U.S. Geological Survey website, http://eart akes.usgs.gov/regional/qfaults, accessed 07/22/2010 03:19 PM.**

Syno   elt of mostly seaward-facing normal faults borders the northern Gulf of Mexico in westernmost Florida, uthwestern Alabama, southern Mississippi, all of Louisiana and southernmost Arkansas, and eastern and outhern Texas (Ewing and Lopez, 1991 #2032). For the purposes of his compilation, the Gulf Coast faults are vided in four large groups because they number in the hundreds. To reflect regional differences in the aracteristics of the faults, those in Florida and Alabama (described here) are evaluated together in a single up, as are those in Mississippi, those in Louisiana and Arkansas, and those in Texas. Because numerous ividual faults are combined into a single group for this compilation, it is not possible to provide to provide digital ation about the azimuth, length, and dip of each individual fault. The gulf-margin normal faults in Alabama Florida are assigned as Class B structures because their low seismicity and because they may be decoupled m underlying crust, making it unclear if they can generate significant seismic ruptures that could cause maging ground motion.

Name comme

County(s) a **Stat**

AMS shee   dalusia obile

Physiogra provinc

Reliabili loca   iled at 1:2,500,000 scale.

mments: Most of the area was evaluated with regional maps at scales of 1:2,500,000 because no individual ts have sufficient evidence of seismic slip to justify singling it out for attention here at a larger map scale. Faults i areas having abundant drill-hole data may be better located in the subsurface than at the surface.

Geologic setting A belt of mostly seaward-facing normal faults borders the northern Gulf of Mexico. These gulf-margin faults face thwest in westernmost Florida, southwestern Alabama, and southern Mississippi; south in Louisiana and thernmost Arkansas; and southeast in eastern and southern Texas (Ewing and Lopez, 1991 #2032). In early to te Mesozoic time, the opening of the Gulf of Mexico formed a south-facing, rifted, passive margin at the ern edge of North America (DuBar and others, 1991 #2010; Salvador, 1991 #2019; Salvador, 1991 #2020). sequently, the rifted margin was buried beneath the thick, Middle Jurassic, Louann Salt and an overlying, nate and clastic, marine sequence that continues to accumulate today. This post-rift sequence thickens ard (Salvador, 1991 #2020). It is at least 2 km thick everywhere in the belt of gulf-margin normal faults. At the ne, the sequence is at least 10 km thick west of the Mississippi River and at least 5 km thick farther east. nesses exceed 12 km under coastal Texas and southern Louisiana and perhaps 16 km offshore Louisiana.

id deposition and the resulting enormous thickness of the post-rift sediments caused them to collapse and s ad seaward. Salt flowed southward and pierced upward, and the overlying sediments extended on listric, rmal, growth faults that flatten downward into detachments in the salt and in overpressured shales (Ewing, 1991 #1994; Nelson, 1991 #1995). These listric normal faults, their splays, and their antithetic and transfer faults make the belt of gulf-margin normal faults described here.

R ional fluctuations in the overall deposition rate divide the belt of gulf-margin faults into two parts with different r ages of faulting and different degrees of Quaternary faulting. (1) The interior zone of Ewing (1991 #1994) i es the entire belt except southern Louisiana, coastal Texas, and their offshore extensions. Triassic-Jurassic r and sedimentation, including deposition of the Louann Salt, led to Mesozoic growth faulting and salt t ism. A line of large grabens approximates the landward limit of Jurassic salt, and Cenozoic faulting is sparse i nterior zone (Ewing, 1991 #1994; Salvador, 1991 #2019; Ewing and Lopez, 1991 #2032). (2) The Coastal zo... of Ewing (1991 #1994) covers southern Louisiana, coastal Texas, and their offshore extensions, and is se...rated from the Interior zone by the Early Cretaceous shelf edge (Ewing, 1991 #1994; Ewing and Lopez, 1991 #...2). Late Cretaceous and especially Cenozoic clastic sediments prograded southward led to abundant C...zoic and continuing growth faulting and salt tectonism (for example DuBar and others, 1991 #2010, p. 584-5...; Salvador, 1991 #2019). The post-rift sequence as a whole is at least 9-11 km thick throughout the Coastal z... (Salvador, 1991 #2020). Calculations show that the crustal load from rapid Quaternary sedimentation may aid C...ernary normal faulting and reactivate Tertiary faults of the Coastal zone by imposing extensional bending s...ses on the post-rift sequence; older extensional stresses imposed by the Mesozoic sediment load have had ti... to relax (Nunn, 1985 #2215).

E...center maps show only sparse, low-magnitude seismicity within the fault belt (Engdahl, 1988 #1959; Stover and C...man, 1993 #1986). The only damaging earthquakes reported through 1989 in this huge tract of land are four M...I VI earthquakes in westernmost Florida (1780), southern Louisiana (1930), and eastern Texas (1891, 1932) (S...ver and Coffman, 1993 #1986). This level of seismicity is even less than that of sparsely seismic North and S...h Dakota, which together cover approximately the same area as the belt of gulf-margin faults and which had s...n earthquakes of MMI VI since 1909 (Stover and Coffman, 1993 #1986). Furthermore, some of the sparse s...icity in the normal-fault belt may be artificially induced. Earthquakes of mbLg 3.4 and 3.9 and M of 4.0 and 4... southeastern Texas and M 4.9 in southwestern Alabama may have been induced by extraction of oil and gas o...ection of fluids for secondary recovery (Pennington and others, 1986 #1876; Chang and others, 1998 #1806; G...berg and others, 1998 #1828; Gomberg and Wolf, 1999 #3440). Therefore, the natural seismicity rate in the n...al-fault belt might be even less than the recent historical record would indicate.

T...post-rift sequence and its belt of gulf-margin normal faults may be mechanically decoupled from the underlying c.... The stress field is extensional throughout the post-rift sequence in both the Interior and Coastal zones of the n...al-fault belt, as determined mostly from drill-hole data that demonstrate fault slips and well-bore breakouts (Z...ack and Zoback, 1991 #2006). The orientations of Shmin are radial to the Gulf of Mexico, in contrast to the e...-northeast trends of SHmax that characterize most of North America east of the Rocky Mountains; the stress fi... in the crust beneath the thick post-rift sequence is unknown (Zoback and Zoback, 1991 #2006). Consistent w... the stress field in the post-rift sequence, the normal-faulting focal mechanism of the 1997, M 4.9 earthquake in s...western Alabama indicated south-southwest extension (Chang and others, 1998 #1806). The presence of the n...al faults throughout the post-rift sequence from westernmost Florida to southern Texas (Ewing and Lopez, 1... #2032) demonstrates that the sequence is sliding and extending seaward on detachments in weak salt and o...ressured shales.

In ...mmary, the belt of gulf-margin normal faults in from Florida through Texas has strikingly low historical s...icity; the stress field and seismogenic potential of the underlying crust are unknown; and, therefore, the ability o... fault belt to generate significant seismic ruptures that could cause damaging ground motion is unclear. A...rdingly, the fault belt is assigned to class B.

Length (km) 0

C...ments:

M... faults are mapped, of widely varying lengths.

Average strike

Sense of movement N... al

C...ments: In addition to the normal faults, a few strike-slip faults might form transtensional links between the n...al faults.

Dip 0... 0°, SW, NE

C...ments: Dips vary, but faults are generally steeper in their upper parts and shallow downward. Dips are d...nantly southwestward, with southwesterly and northeasterly dips paired in grabens.

Paleoseismology studies

Geomorphic expression Sc...s and drainage, topographic, and tonal lineaments (DuBar and others, 1991 #2010).

Age of faulted surficial deposits Eo...ne to Holocene (Szabo and Copeland, 1988 #1946; DuBar and others, 1991 #2010).

Historic earthquake

Most recent prehistoric deformation Q...ernary (<1.6 Ma)

C...ments: A belt of mostly seaward-facing normal faults borders the northern Gulf of Mexico (Ewing and Lopez, 1... #2032). Ewing (1991 #1994) and Ewing and Lopez (1991 #2032) divided the faults into an Interior zone and a C...tal zone, which are separated by a boundary that begins in southeastern Louisiana and runs westward across Lo...siana and Texas approximately 100 km inland from the coast. In the Interior zone, which includes so...hwestern Alabama and westernmost Florida, little Quaternary slip is documented (DuBar and others, 1991 #2...0, flure 3). However, probably many or most faults in the Interior zone have the potential for Quaternary to

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p· ·sent-day slip. As explained in "Geologic setting", it is unclear whether such slip was or is likely to occur se·smically. In contrast, the Coastal zone contains more abundant evidence of Quaternary slip, but this slip may be ev·:n less likely to occur seismically than slip in the interior zone.

Recurrence Interval

Co·· ·ments: Estimates of recurrence interval are premature because it is not yet clear whether these faults can ge· ·rate significant tectonic earthquakes, as explained under "Geologic setting".

Slip-rate category Le· s than 0.2 mm/yr

C· ·ments: The slip rate is unknown. However, a slip rate of 0.2 mm/yr would produce 320 m of slip during the 1. ·0,000 years of the Quaternary. It is unlikely that any single fault in the gulf-margin belt of normal faults has s· · a large Quaternary offset. Therefore, probably the long-term rate is less than 0.2 mm/yr.

Date and Compiler(s) 1· ·8
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