ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS – DRAFT REPORT

Gulf Power
Plant Crist
Pensacola, Florida

Prepared for
U.S. Environmental Protection Agency
Washington, D.C.

October, 2012
Revision 1, November 2013

CDM Smith Project No.:93083.1801.044.SIT.CRIST

CDM Smith

cdmsmith.com

Table of Contents

Tables

Figures

Appendices

Section 1

Introduction, Summary Conclusions and Recommendations

1.1 Introduction

On December 22, 2008 the dike of a coal combustion waste (CCW) ash pond dredging cell failed at a facility owned by the Tennessee Valley Authority in Kingston, Tennessee. The failure resulted in a spill of over one billion gallons of coal ash slurry, which covered more than 300 acres, damaging infrastructure and homes. In light of the dike failure, the United States Environmental Protection Agency (USEPA) is assessing the stability and functionality of existing CCW impoundments at coal-fired electric utilities to ensure that lives and property are protected from the consequences of a failure.

This assessment of the stability and functionality of Gulf Power Company – Plant Crist's CCW impoundments is based on a review of available documents, site assessments conducted by CDM Smith on August 20 and 21, 2012, and technical information provided subsequent to the site visit. In summary, the Gulf Power Company – Plant Crist CCW impoundments embankments are rated POOR for continued safe and reliable operation; unit safety deficiency is recognized for at least one required loading condition, further critical studies or investigations are needed to identify any potential dam safety deficiencies, and liquefaction potential studies were not provided.

1.2 Purpose and Scope

CDM Smith was contracted by the USEPA to perform site assessments of selected surface impoundments. As part of this contract, CDM Smith conducted site assessments of the Ash Pond, Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond at the Plant Crist site owned by Gulf Power Company, a division of Southern Company (Gulf Power). The Ash Pond includes five (5) Ash Decant/Settling Ponds that have been formed within the northwest portion of the Ash Pond through construction of divider embankments. The divider embankments appear to be constructed of a mixture of soil and ash. The purposes of this report are to provide the results of the assessments and evaluations of the conditions and potential for waste release from the CCW impoundments.

Site visits were conducted by CDM Smith representatives on August 20 and 21, 2012, to collect relevant information, inventory the impoundments, and perform visual assessments of the impoundments.

1.3 Conclusions and Recommendations

1.3.1 Conclusions

Conclusions are based on visual observations during site assessment on August 20 and 21, 2012 and review of technical documentation provided by Gulf Power (**Appendix A**).

Plant Crist's CCW impoundments appear to be structurally sound based on the visual observations of the structural elements components (i.e. inlet structures, earth embankments and outlet structures).

- Slope stability calculations determined inadequate factors of safety for Steady-State Condition at Normal Pool and Rapid Drawdown Condition from Normal Pool loading conditions for the Ash Pond.

- Stability analyses for the Gypsum Storage Pond were also provided to CDM Smith. The analyses are dated August 17, 2012.

- Liquefaction potential analyses for the Ash Pond and Gypsum Storage Pond evaluated the liquefaction potential of the two ponds when subjected to loading associated with a seismic event having a 2-percent exceedance over a 50-year period, considering seismic hazards derived from both the Central and Eastern U.S. random faulting source (CEUS) and the New Madrid Source Zone (NMSZ).

  - ✓ At the Ash Pond, the analysis indicates liquefaction of the foundation soils does not appear to be a threat during the CEUS scenario earthquake. During the NMSZ scenario earthquake, soft natural soils encountered immediately below the embankment fill exhibited factors of safety of 1.1 and 1.2. For the purpose of the liquefaction potential analyses, water was assumed to be 10 feet below the top of crest for the Ash Pond. CDM Smith notes there was approximately 3 feet of freeboard in the Ash Pond during our August 20, 2012 condition assessment.

  - ✓ At the Gypsum Storage Area, the analysis indicated liquefaction of the foundation soils is not a threat during either of the scenario earthquakes.

- Documentation of slope stability analyses for the Process Sedimentation Pond and the Process Return Water Pond was not provided.

- Based on the USEPA classification system as presented on Page 2 of the USEPA checklist and our review of the site and downstream areas, a recommended hazard rating of **SIGNIFICANT** has been assigned to the Crist CCW impoundments as summarized in Table 3, Section 2.3. Significant hazard structures are required to store precipitation associated with the 50% Probable Maximum Precipitation (PMP) storm event. Hydrologic/hydraulic analyses for the 50% PMP were not provided for the Plant Crist CCW impoundments. Hydrologic and hydraulic (H&H) data provided by Gulf Power and reviewed by CDM Smith indicate the CCW impoundments have adequate capacity to withstand the 100-year, 24-hour storm event without overtopping.

- There appears to be some potential impact to the CCW impoundments, particularly the Ash Pond, under the 50% PMP flood condition on the Escambia River. No documentation or H&H analyses to determine Escambia River flood levels and flows was provided for the 50% PMP event.

- Some supporting technical documentation was provided and appears to be adequate. Documentation of certain issues was not provided however.

  - ✓ PMP analysis under the Federal Emergency Management Agency (FEMA) standards have not provided for Plant Crist's CCW impoundments for the 50% PMP event.

- ✓ Analyses have not been provided regarding potential impact to the CCW impoundments, particularly the Ash Pond, under the 50 % PMP flood condition on the Escambia River.
- ✓ Liquefaction potential analyses for embankment foundations have not been performed for the Process Sedimentation Pond and Process Return Water Pond.
- ✓ Static/seismic stability analyses have not been provided or the Process Sedimentation Pond and Process Return Water Pond.

- CDM Smith observed the following during our site assessment of the Ash Pond:
  - ✓ Minor areas of erosion, erosion rills, and scarps were observed on the interior slopes of the southwest and southeast embankments.
  - ✓ Animal burrows were observed on the exterior slopes of the northeast and southeast embankments.
  - ✓ Dense vegetation and trees up to 4 inches in diameter were observed along the exterior (northwest) slope of the divider embankment between the Ash Pond and the Ash Decant/Settling Ponds.
  - ✓ Two tree stumps approximately 6 and 18 inches in diameter were observed on the exterior slope of the northeast embankment.
  - ✓ Significant erosion and scarps were observed on the southeast embankment's interior slope, near the south corner of the pond.
  - ✓ Areas of erosion and shallow scarps were observed along the toe of the northeast embankment's exterior slope, where riprap armoring had not been placed.
- CDM Smith observed the following during our site assessment of the Process Sedimentation Pond:
  - ✓ Areas of surface erosion and erosion rills were observed on the exterior slope of the northeast embankment.
- CDM Smith observed the following during our site assessment of the Gypsum Storage Pond:
  - ✓ Animal burrows were observed on the exterior slopes of the northwest and east embankments.
  - ✓ Areas of possible seepage were observed near the toe of the southwest embankment and at the toe of the east embankment.

No apparent unsafe conditions or conditions in need of immediate remedial action were observed at the Plant Crist CCW impoundments.

- Current operation and maintenance procedures appear to be adequate, and there was no existing evidence of previous spills, significant repairs or release of impounded coal ash slurry.

- Based on the information reviewed by CDM Smith, it appears that Gulf Power has adequate inspection practices. Currently weekly, monthly, and yearly inspections are performed.
- Groundwater monitoring, surveillance program, recording, and report preparation for Florida Department of Environmental Protection (FDEP) under the National Pollutant Discharge Elimination System (NPDES) Permit appear to be adequate and complying with FDEP requirements.

1.3.2 Recommendations

Based on CDM Smith's visual assessment of CCW impoundments and review of documentation provided by Gulf Power, CDM Smith provides the following recommendations for consideration.

- Currently the State of Florida does not require Emergency Action Plans (EAPs) for CCW impoundments. Gulf Power does not have an EAP for the CCW impoundments, judged by CDM Smith to be Significant Hazard structures. CDM Smith recommends that Gulf Power develop an EAP for these impoundments.
- Inspections should be made following periods of heavy and/or prolonged rainfall and/or high water events on the Escambia River, and the occurrence of these events should be documented. Inspection records should be retained at the facility for a minimum of three years.
- Regular monitoring is essential to detect and monitor seepage and to reduce the potential for failure. If seepage areas are observed, services of a qualified engineer should be retained by Gulf Power to assess the area of seepage and recommend remedial actions.
- Erosion rills – Erosion rills were observed on the northwest, southwest, and southeast interior slopes of the Ash Pond and on the north exterior slope of the Process Sedimentation Pond. Structural fill should be placed and compacted in the rills and graded to adjacent existing contours. These areas should be covered with sod or hydro seed to establish vegetative cover.
- Voids and missing riprap – Locations of voids within riprap armor and missing riprap were observed at the exterior slopes of the CCW impoundments. In these areas, the existing riprap should be remove and the embankment slope restored to no steeper than 2.5H:1V or the original contour (whichever is flatter) with compacted structural fill. Riprap (similar size to existing), consisting of a heterogeneous mixture of irregular shaped rocks should be placed over the compacted fill and a geotextile fabric. The armoring should extend at least 3 feet vertically below lowest anticipated pool elevation and at least 2 feet above normal pool elevation.
- Scarps - Scarps were observed on the northwest, southwest and southeast interior slopes of the Ash Pond. The embankment slopes should be restored to the original contours by placing select structural fill in 12-inch lifts and compacting to recommended density. The exposed surface of the embankment should be stabilized with sod, hydro-seeding, or riprap consisting of a heterogeneous mixture of irregular-shaped rocks placed over the compacted fill and a geotextile fabric.
- Animal burrows – Animal burrows were observed on the northeast and southeast exterior slopes of the Ash Pond and northwest and east exterior slopes of the Gypsum Storage Pond. Although not seen on other areas, vegetation cover may have hidden additional animal burrows. CDM Smith recommends documenting areas disturbed by animal activity, removing the

animals, and backfilling the burrows with compacted structural fill to protect the integrity of the embankments.

- CDM Smith recommends a qualified professional engineer performs H&H analyses for the Ash Pond, Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond.
- CDM Smith recommends a qualified professional engineer performs liquefaction potential analyses for the Ash Pond with 3 feet of freeboard to determine if strength loss would result in unacceptable seismic deformations.
- CDM Smith recommends a qualified professional engineer performs an H&H analyses to determine Escambia River flood levels and flows for the 50 % PMP event and evaluate potential impacts to the CCW impoundments, particularly the Ash Pond, under the 50 % PMP flood condition.
- CDM Smith recommends remedial actions, designed by a registered professional engineer experienced with earthen dam design, to meet required factors of safety for the Ash Pond.
- CDM Smith recommends remedial repairs for slope restoration, designed by a registered professional engineer experienced with earthen dam design.
- CDM Smith recommends a qualified professional engineer performs embankment stability analyses and liquefaction potential analyses for the Process Sedimentation Pond and the Process Return Water Pond.

1.4 Participants and Acknowledgment

1.4.1 List of Participants

CDM Smith representatives William Fox, P.E. and Eduardo Gutiérrez-Pacheco, P.E. were accompanied during the visual assessment of the impoundments by representatives from Gulf Power, USEPA, and FDEP which included the following individuals:

Company	Name and Title
Gulf Power	James O. Vick, Environmental Affairs Director
Gulf Power	Michael Markey, Land and Water Programs Manager
Southern Company	James C. Pegues, P.E., Geotechnical Engineer, Principal
Hopping Green & Sims	Mike Petrovich, Legal Consultant
Beggs & Lane	Russell A. Badders, Legal Consultant
USEPA	Craig Dufficy, Environmental Engineer
FDEP	Dan Stripling, Wastewater Compliance Representative
FDEP	Kim Allen, Wastewater Compliance Representative
FDEP	Tracy Freiwald, P.G., Bureau of Mining and Minerals Regulation.
FDEP	Owete S. Owete, PhD, P.E., Program Administrator, Bureau of Mining and Minerals Regulation

Representatives from USEPA and FDEP were only present during the impoundments assessment on August 20, 2012.

1.4.2 Acknowledgement and Signature

CDM Smith acknowledges that the Ash Pond, Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond referenced herein were assessed by William L. Fox, P.E. and Eduardo Gutiérrez-Pacheco, P.E.

The Ash Pond is rated **POOR** based on the fact inadequate factors of safety have been determined for liquefaction of the foundation soils under the NMSZ scenario earthquake and because safety factors for embankment static stability under the Steady-State Condition at Normal Pool and the Rapid Drawdown Condition from Normal Pool loading do not meet applicable safety regulatory criteria. No documentation or analyses of impoundment storage capacities for the required 50 % PMP was provided. There also appears to be some potential impact to the CCW impoundments, particularly the Ash Pond, under the 50 % PMP flood condition on the Escambia River. No documentation or H&H analyses to determine Escambia River flood levels and flows were provided for the 50 % PMP event.

The Process Sedimentation Pond and Process Return Water Pond are rated **POOR** based on the fact embankment stability analyses and liquefaction potential analyses following best professional engineering practice to support safety factors in accordance with the applicable safety regulatory criteria were not provided. Hydrologic and hydraulic documentation has been provided for the Process Sedimentation Pond and Process Return Water Pond for the storm events including the 100-year event. However, no documentation or analyses of impoundment storage capacities for the required 50 % PMP was provided.

The Gypsum Storage Pond is rated **POOR** based on the fact that no documentation or analyses of impoundment storage capacities for the required 50 % PMP was provided. EPA requirements state that "if a facility has not conducted hydrologic, static and seismic engineering studies following best professional engineering practice to support factors of safety, the facility must be rated POOR".

We certify that the CCW impoundments referenced herein have been assessed on August 20 and 21, 2012.

____

Michael W. Montgomery, P.E.
Principal Civil Engineer
Florida Registration No. 67279

Section 2

Description of the Coal Combustion Waste Impoundments

2.1 Location and General Description

Plant Crist is located in Escambia County, at 11999 Pate Street, Pensacola, FL 32514 (Latitude: 30° 33' 54.76" N, Longitude: 87° 13' 37.33"W). The plant is located along the west bank of the Escambia River as shown on **Figure 1.** Critical infrastructure within approximately five miles down gradient of Plant Crist is shown on **Figure 2.** An aerial view of Plant Crist including the CCW impoundments is shown on **Figure 3.**

Table 1 shows a summary of the approximate size and dimensions of the CCW impoundments.

Table 1 – Summary of CCW Impoundments Approximate Dimensions and Size

	CCW Impoundments			
	Ash Pond	Gypsum Storage Pond	Process Sedimentation Pond	Process Return Water Pond
Dam Height (ft)	20	32	34	23
Average Crest Width (ft)	20	20	20	20
Length (ft)*	3,600	3,000	1,300	1,500
Interior Slopes H:V	4:1	2:1	3:1	3:1
Exterior Slopes H:V	2:1	3:1	3:1	3:1

*Length was measured along the perimeter embankment crest of each impoundment/unit.

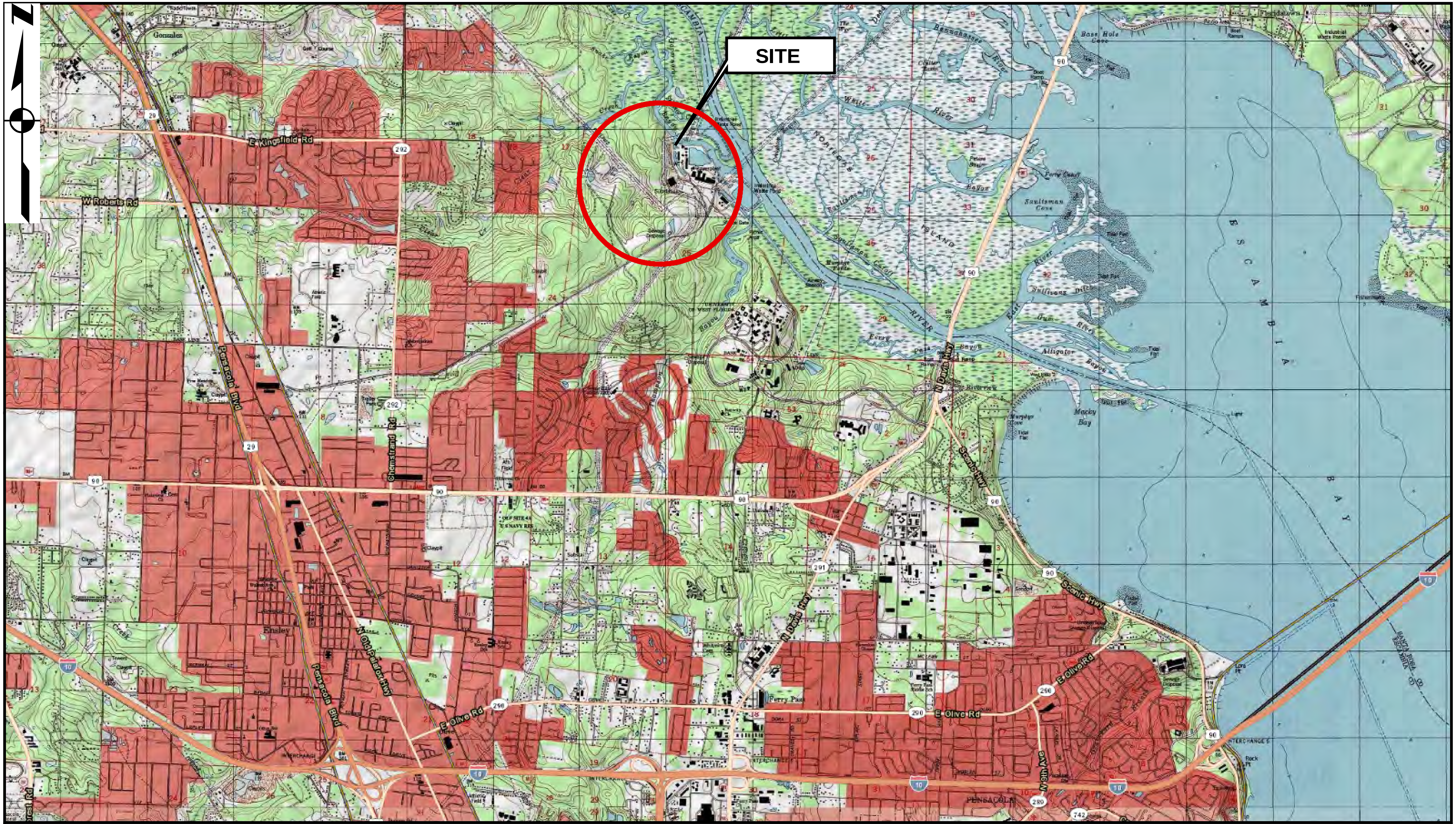
The divider embankment between the Gypsum Storage Pond and the Process Sedimentation Pond is about 600 feet long.

2.1.1 Horizontal and Vertical Datum

Site surveys provided by Gulf Power to CDM Smith used the horizontal and vertical control network established by the National Geodetic Survey (NGS) District. Horizontal survey data in this study reference the North Zone of the Florida State Plane Coordinate System based on North American Datum (NAD) of 1983, 2007 adjustment. Elevations noted herein are in feet and are referenced to 1988 North American Vertical Datum (NAVD 88), unless otherwise noted.

2.1.2 Site Geology

Plant Crist is located along the western bank of the Escambia River. Based on review of the USGS Topographic Map, natural ground surface elevations in the area of the CCW impoundments range from approximately El. 0 to 60. According to the Geologic Map of Florida, Plant Crist is located in the Citronelle Formation that consists of soils deposited in an ancient marine environment. Plant Crist is located in an area of recent alluvial, coastal, and low terrace deposits, water-deposited during the meandering and flooding of the Escambia River. These deposits consist of unconsolidated to poorly consolidated clean to clayey sands and areas containing significant amounts of clay, silt and gravel.



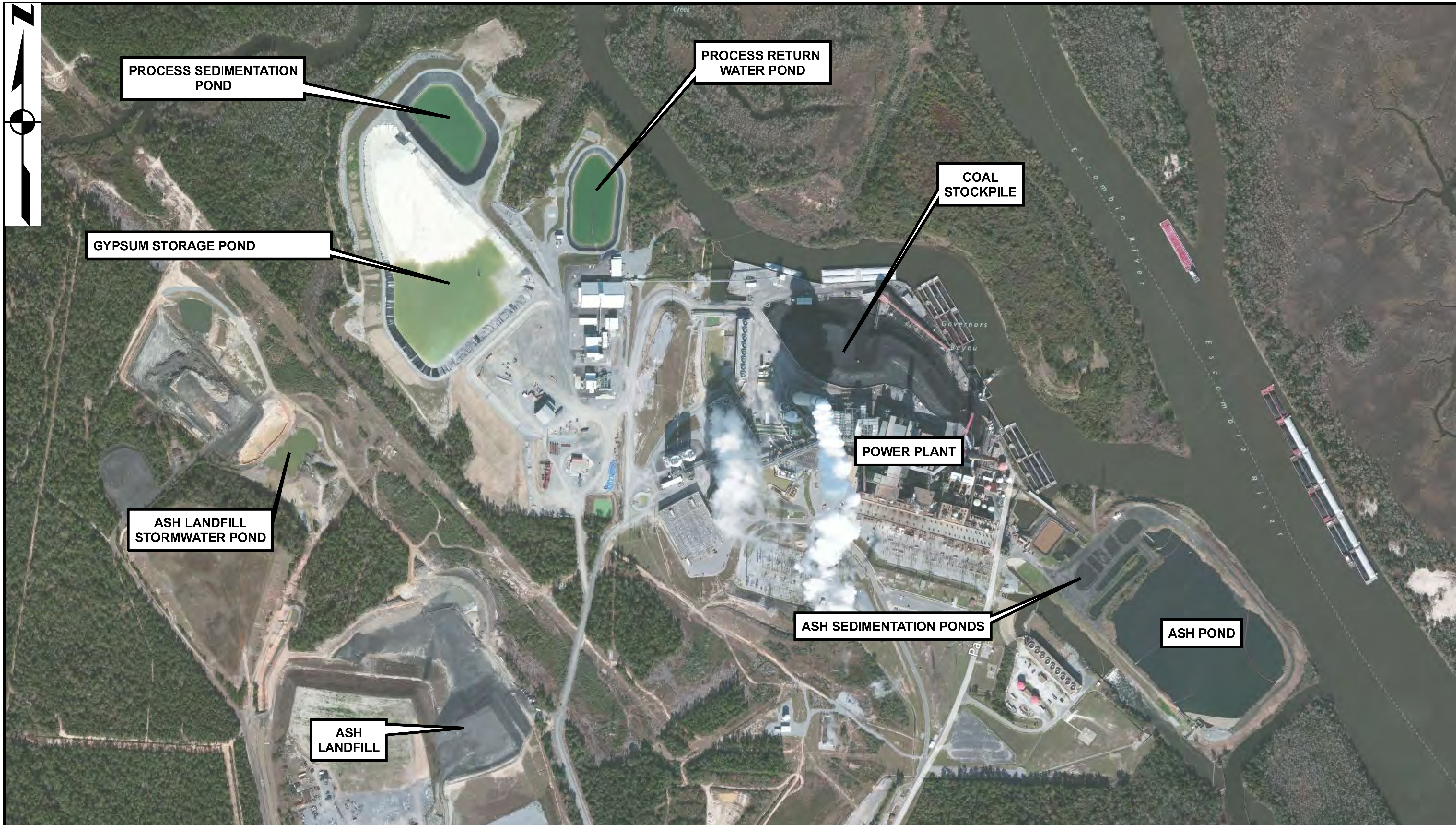
CDM Smith

0 2,000 4,000 8,000 12,000 16,000 Feet

FIGURE-1
LOCUS PLAN
GULF POWER - PLANT CRIST
PENSACOLA, FLORIDA

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

FIGURE-2
CRITICAL INFRASTRUCTURE PLAN
GULF POWER - PLANT CRIST
PENSACOLA, FLORIDA



CDM Smith

0 250 500 1,000 1,500 2,000 Feet

FIGURE-3
AERIAL PLAN
GULF POWER - PLANT CRIST
PENSACOLA, FLORIDA

Boring logs and the subsurface soil profile for the Ash Pond, included in **Appendix A,** indicate that existing soils present within and below the embankments consist of loose to medium dense clayey sand and silty sand, with varying amounts of organic clays and fine sand, underlain by very soft to soft clay and silt layers over a medium dense silty sand stratum.

2.2 Coal Combustion Residue Handling

Bottom ash and fly ash from Plant Crist are hauled by trucks to an on-site landfill located about one-half mile west of the power station. Gypsum is sluiced to the Gypsum Storage Pond where it is dried and stacked. Decant water from the Gypsum Storage Pond overflows to the adjacent Process Sedimentation Pond and Process Return Water Pond. Gulf Power's Plant Crist is not a slag-production type furnace, however a small amount of Boiler Slag is typically found in the bottom ash.

The Ash Pond is currently used as a waste water pond. The Ash Pond receives waste water streams that include ash sluice water, containing amounts of fly ash, bottom ash and boiler slag, and overflow from bottom ash dewatering bins. Coal combustion waste (CCW) was dredged from the Ash Pond approximately 20 years ago however the Ash Pond reportedly still contains residual flyash. Because of the reported presence of residual fly ash, bottom ash and boiler slag, and because it has not been formally closed in compliance with applicable federal or state closure/reclamation regulations, CDM Smith performed a condition assessment of the Ash Pond as per USEPA requirements.

2.3 Size and Hazard Classification

According to the United States Army Corps of Engineers (USACE) Guidelines for Safety Inspection of Dams (1979), the impoundments may be placed in the size classification per **Table 2.**

Table 2 – USACE ER 1110-2-106 Size Classification

Category	Impoundment	
	Storage (Ac-ft)	Height (Ft)
Small	50 to < 1000	25 to < 40
Intermediate	1000 to < 50,000	40 to < 100
Large	> 50,000	> 100

Based on storage capacity and embankments height, Plant Crist impoundments are considered SMALL impoundments.

It is not known if Plant Crist impoundments currently have a Hazard Potential Classification. Based on the USEPA classification system as presented on Page 2 of the USEPA checklist (**Appendix B**) and our review of the site and downstream areas, recommended hazard ratings have been assigned to the impoundments as summarized in **Table 3.**

Table 3 – Recommended Impoundment Hazard Classification Ratings

Impoundment	Recommended Hazard Rating	Basis
Ash Pond	Significant Hazard	▪ Failure or misoperation could result in economic loss and environmental damage to adjacent waterways and downstream estuaries. ▪ Loss of human life is not anticipated. ▪ A breach could result in damage to rural and developed areas located south of the pond, and downstream on the Escambia River.
Gypsum Storage Pond	Significant Hazard	▪ Failure or misoperation could result in environmental damage and economic loss and damage to plant infrastructure, operations and utilities. ▪ Loss of human life as a result of failure or misoperation is not anticipated. ▪ A breach could release waste into the Process Sedimentation Pond which may result in a breach of the Process Sedimentation Pond and cause environmental impacts to the Escambia River and adjacent lands.
Process Sedimentation Pond	Significant Hazard	▪ Failure or misoperation could result in environmental damage and economic loss and damage to plant infrastructure, operations and utilities. ▪ Loss of human life as a result of failure or misoperation is not anticipated. ▪ A breach could release waste into the Gypsum Storage Pond that may result in a breach of the Gypsum Storage Pond embankment(s) and cause environmental impacts to the Escambia River and adjacent lands
Process Return Water Pond	Significant Hazard	▪ Failure or misoperation could result in environmental damage and economic loss and damage to plant infrastructure, operations and utilities. ▪ Loss of human life as a result of failure or misoperation is not anticipated. ▪ A breach could have an environmental impact of the Escambia River, approximately 800 feet north of the pond.

2.4 Amount and Type of Residuals Currently Contained in the Unit(s) and Maximum Capacity

At the time of the assessments, CDM Smith did not have information on the amounts of residuals currently stored in the units. The pool area of the Ash Pond, including five (5) Ash Decant/Settling Ponds is approximately 13 acres. The pool areas of the Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond are approximately 14, 3, and 2½ acres, respectively. Fly ash and bottom ash were historically stored in the Ash Pond. Currently, the Ash Pond receives runoff from stormwater, plant operations, and the coal stockpile. Decant from plant operations contain bottom ash, fly ash and boiler slag. Gypsum, a by-product from the plant's flue gas desulfurization system

(FGD scrubber) is sluiced to the Gypsum Storage Pond for dewatering and storage. Decant water from the Gypsum Storage Pond overflows to the adjacent Process Sedimentation Pond and Process Return Water Pond.

2.5 Principal Project Structures

Principal structures of the Ash Pond include the following:

- A set of two, 30-inch-diameter steel inlet pipes located at the north corner of the pond.
- A series of five settling ponds incised in the northwest embankment connected with 36-inch-diameter HDPE corrugated plastic pipes.
- Earthen perimeter embankments composed of compacted soil.
- A concrete spillway outlet structure located near the south corner of the pond.

Principal structures of the Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond system include the following:

- Inlet pipes located at the east corner of the Gypsum Storage Pond.
- A riser structure located near the east-central portion of the Gypsum Storage Pond.
- A concrete box culvert between the Gypsum Storage Pond and the Process Sedimentation Pond.
- Earthen perimeter embankments composed of compacted soil.
- Composite liner systems and full underdrain systems.
- Concrete pipes and manhole structures between the Gypsum Storage Pond and Process Sedimentation Pond, and between the Process Sedimentation Pond and Process Return Water Pond.

2.6 Critical Infrastructure within Five Miles Downgradient

Based on available topographic maps, surface drainage in the vicinity of Plant Crist appears to be to the southeast toward Escambia Bay. Critical infrastructure, including schools, hospitals, waterways, roadways and bridges, and other major facilities, identified within five miles downgradient of Plant Crist includes the following:

- University of West Florida campus.
- Nativity of Our Lord Catholic Church.
- East Hill Church of Crist.
- St. Luke United Methodist Church.
- Northridge Church.
- Grace Baptist Church.
- Baptist Health Care Walk-in Center.

- Escambia River Barge Canal,
- Thompson Bayou.
- U.S. Highway 90.
- U.S. Highway 90 Bridge over Escambia River.
- Interstate 10 Bridge over Escambia Bay.

Discharge from the Ash Pond will flow either into the Escambia River Barge Canal and/or Thompson Bayou. Discharge from the Gypsum Storage Pond, Process Sedimentation Pond and Process Return Water Pond will flow into Governors Bayou and eventually into the Escambia River. There is no critical infrastructure between the impoundments and these waterways.

A breach of the impoundment embankments would most likely impact low-lying lands surrounding the plant and is not expected to result in loss of human life.

Section 3

Summary of Relevant Reports, Permits and Incidents

3.1 Summary of Reports on the Safety of the CCW Impoundments

At the time of CDM Smith's onsite assessment, no safety reports on the CCW impoundments were available. However, according to plant representatives, there have been no known structural or operational problems associated with the impoundments. No documentation was available to confirm or disprove this claim.

3.2 Summary of Local, State, and Federal Environmental Permits

Currently, the coal combustion waste (CCW) impoundments are regulated by Florida Department of Environmental Protection (FDEP).

Plant Crist was issued a permit under the National Pollutant Discharge Elimination System (NPDES) authorizing discharge to the Escambia River in accordance with effluent limitations, monitoring requirements, and other conditions set forth in the permit. The Plant's permit was issued on January 28, 2011. The permit number is FL0002275.

3.3 Summary of Spill/Release Incidents

According to plant representatives, there have been no known spills or releases related to the impoundment. No documentation was available to confirm or disprove this claim.

Section 4

Summary of History of Construction and Operation

4.1 Summary of Construction History

4.1.1 Impoundment Construction and Historical Information

The Plant began operation in the 1960's. The coal combustion waste (CCW) is currently generated by Unit 4 (on line since the 1960's), Unit 5 (on line since the 1970's), and Unit 6 and Unit 7 (on line since the 1980's). Units 1 through 3 are currently off line. These units were retired by 2006.

There are currently four CCW impoundments at Plant Crist, as shown on Figure 3, designated as Ash Pond, Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond. The Ash Pond, the original CCW impoundment, was constructed in about 1960 (actual year was not readily available within the information provided by Gulf Power). The Ash Pond was reportedly constructed by excavating soil within the pond area to approximately EL. 0 and constructing embankments with a 15- to 25-foot-wide crest at elevations between about El. 17 and 20. Interior slopes were originally constructed at 4H:1V below the existing ground surface, and at 2H:1V above existing ground surface. Exterior slopes were constructed at 2H:1V. Original design drawings for the Ash Pond were not provided. Based on information provided by Gulf Power, the Ash Pond north embankment crest was re-graded to about El. 20 in 2011 when riprap slope treatment was installed along the toe of the exterior slope of the embankment.

Based on soil boring information available in the Ash Pond area, the embankment soils are mostly comprised of loose to medium dense clayey and silty sands. The foundation soils consist of soft clayey silts and silty clays underlain by very soft to soft clayey soils to a depth of about 20 feet below the original ground surface.

The Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond were constructed between 2008 and 2010. Based on design drawings by Southern Company Generation Engineering and Construction Services, dated September, 2008 (revised July, 2010) provided by Gulf Power, the Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond were constructed with "Compacted Type A Embankment Material". No details or specifications were found regarding the "Compacted Type A Embankment Material". The Gypsum Storage Pond was constructed by excavating to about El. 25 within the pond area and placing "Compacted Type A Embankment Material" up to about El. 57, with a 20-foot-wide embankment crest. Interior slopes were constructed at 2H:1V and exterior embankment slopes were constructed at 3H:1V. The Process Sedimentation Pond and the Process Return Water Pond bottoms were excavated to about El. 16 and El. 12, and embankment material placed up to El. 50 and El. 35 respectively. Interior and exterior slopes for the Process Sedimentation Pond and the Process Return Water Pond were constructed at 3H:1V. An engineered composite liner system covers the bottom and entire interior slopes of the ponds.

As shown on Figure 3, the Gypsum Storage Pond and Process Sedimentation Pond share a common divider embankment.

4.2 Summary of Operational Procedures

4.2.1 Current CCW Impoundment Configuration

The Ash Pond impoundment at Plant Crist had historically been used as a settling pond for CCW and reportedly other plant wastes. Wastewater streams that currently discharge into the Ash Pond include:

- Ash sluice water that contains amounts of fly ash, bottom ash and boiler slag.
- Overflow from bottom ash dewatering bins.
- Neutralized demineralizer regeneration wastewater.
- Cooling tower blowdown.
- Boiler blowdown.
- Floor drainage.
- Auxiliary equipment cooling water and seal water.
- Coal pile runoff.
- Yard sump discharge, and treated metal cleaning wastewater.

The Ash Pond was used to store CCW until about 1993. CCW was reportedly dredged from the Ash Pond so it currently contains only residual ash. Ash produced at Plant Crist is now stored in a dry stack landfill. The Ash Pond is currently used as a wastewater pond, receiving wastewater streams that include ash sluice water and overflow from bottom ash dewatering bins. The ash sluice water contains fly ash, bottom ash and boiler slag. Prior to entering the Ash Pond, discharge water from the plant operations flows through a series of five (5) Ash Decant/Settling Ponds that have been formed within the northwest portion of the Ash Pond (water is pumped from plant operations into the southernmost and middle ponds). The Ash Decant/Settling Ponds are hydraulically connected by a series of 36-inch-diameter High Density Polyethylene (HDPE) corrugated plastic equalizer pipes. Water from the northernmost pond flows by gravity to the Ash Pond through two 30-inch-diameter steel pipes that discharge below an existing walkway/catwalk located at the north corner of the Ash Pond. An aerator/oxygenator device is located near the north corner of the Ash Pond. In addition, a series of turbidity barriers is present on the surface of the Ash Pond to create a baffle-type system and increase residence time. Water flows out of the Ash Pond by gravity through a concrete spillway structure located near the south corner of the pond. According to representatives of Gulf Power, the Ash Pond is dredged periodically to maintain permanent pool volume.

The Gypsum Storage Pond is used for storage and primary settling and sedimentation of gypsum while the Process Sedimentation Pond and Process Return Water Pond are used for secondary and tertiary settling and sedimentation, respectively. Gypsum product is sluiced into the Gypsum Storage Pond through a 24-inch diameter HDPE plastic pipe located at the southeast corner pond. Decant water from the Gypsum Storage Pond flows to the Process Sedimentation Pond through either a Decant Riser Structure (located near the southeast corner of the pond) and a series of manhole structures and 30-inch-diameter reinforced concrete pipes (RCPs) or through a 7-foot-wide by 5-foot-high double-barrel concrete box culvert (located at the north corner of the Gypsum Storage Pond). Decant water from the Process Sedimentation Pond flows through a series of a series of manhole structures and 30-inch- RCPs into the Process Return Water Pond.

There is no offsite discharge of water from the Gypsum Storage Pond/Process Sedimentation Pond/Process Return Water Pond system. Water is stored in the Process Return Water Pond and eventually pumped back to the plant for reuse as plant make-up water.

The approximate embankment crest elevations and pond areas are shown in **Table 4.**

Table 4 – Approximate Elevations and Areas

Pond	Approximate Highest Crest Elevation (Feet)	Approximate Lowest Crest Elevation (Feet)	Approximate Pond Area[1] (Acres)
Ash Pond	20	17	13
Gypsum Storage Pond	57	50	14
Process Sedimentation Pond [2]	50	44	3
Process Return Water Pond [2]	35	33	2.5

Notes: [1]Pond areas measured at approximate lowest crest elevation. [2] Lowest elevation located at emergency spillway.

Section 5

Field Observations

5.1 Project Overview and Significant Findings (Visual Observations)

CDM Smith performed visual assessments of the CCW impoundments at the Gulf Power Company Plant Crist site. The impoundments assessed include the Ash Pond, Gypsum Storage Pond, Process Sedimentation Pond and Process Return Water Pond. The perimeter and divider embankments of the Ash Pond, including the Ash Decant/Settling Ponds divider embankments, are approximately 5,100 feet in length and are up to approximately 20 feet high. The perimeter and divider embankments of the Gypsum Storage Pond, Process Sedimentation Pond and Process Return Water Pond are approximately 6,500 feet in length with maximum heights of approximately 32, 34, and 23 feet, respectively.

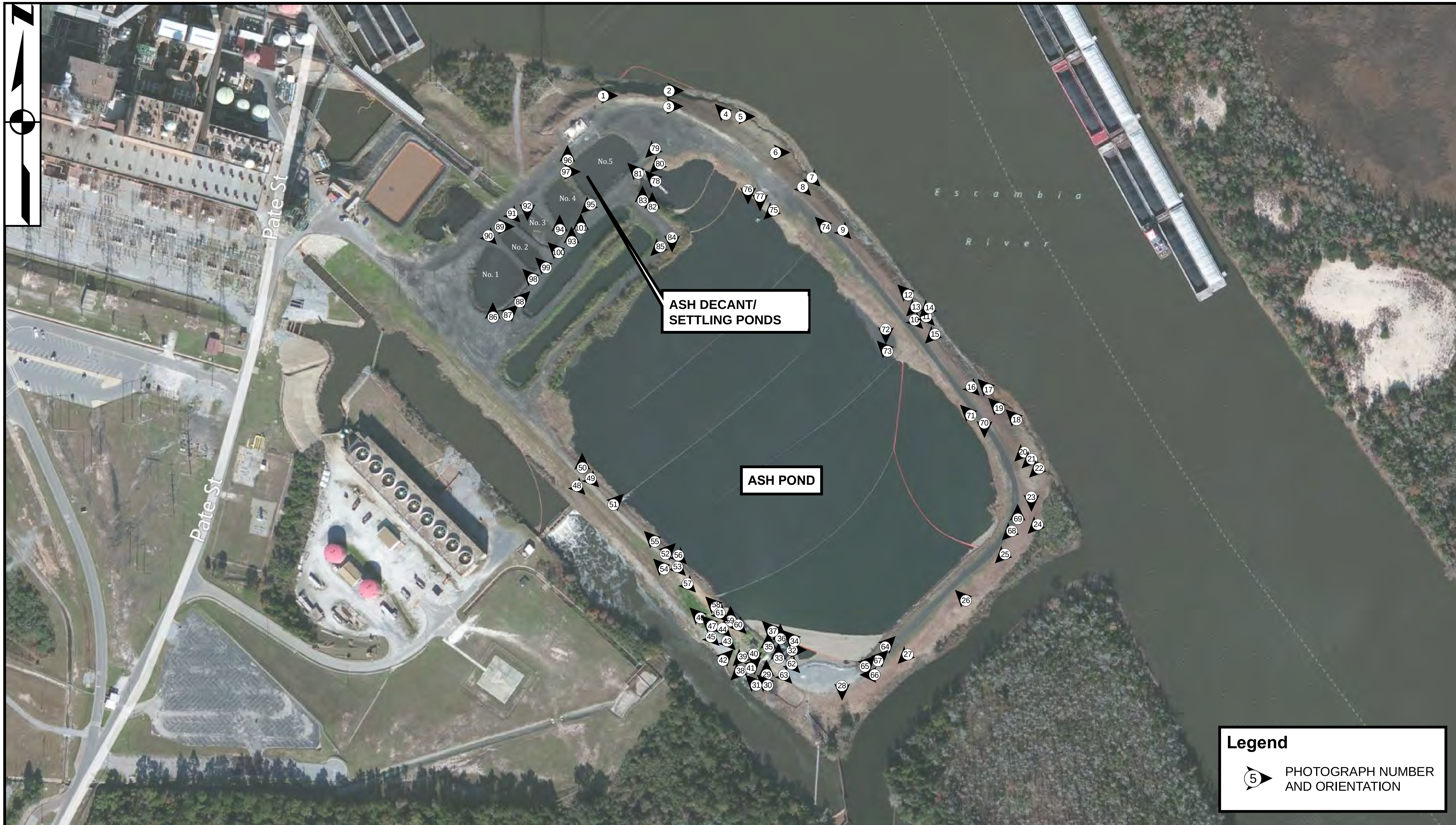
The assessments were completed following the general procedures and considerations contained in Federal Emergency Management Agency's (FEMA's) Federal Guidelines for Dam Safety (April 2004) to make observations concerning settlement, movement, erosion, seepage, leakage, cracking, and deterioration. A Coal Combustion Dam Inspection Checklist Form and a Coal Combustion Waste (CCW) Impoundment Inspection Form, developed by USEPA, were completed for each of the aforementioned impoundments. Copies of these forms are included in Appendix B. Photograph locations are shown on **Figures 4A** and **4B**, and photographs are included in **Appendix C**. Photograph locations were logged using a handheld GPS device. The photograph coordinates are listed in Appendix C**.**

CDM Smith visited the plant on August 20 and 21, 2012, to conduct visual assessments of the impoundments. The weather was generally cloudy with daytime high temperatures up to 80 degrees Fahrenheit. The daily total precipitation prior to the site visit is shown in **Table 5**. The data were recorded at Pensacola Regional Airport Station (13899), approximately 6½ miles south of the Plant.

Table 5 – Approximate Precipitation Prior to Site Visit

Dates of Site Visits – August 20, 2012 & August 21, 2012		
Day	**Date**	**Precipitation (inches)**
Sunday	August 19	0.25
Saturday	August 18	0.05
Friday	August 17	0.54
Thursday	August 16	0.55
Wednesday	August 15	1.51
Tuesday	August 14	0.30
Monday	August 13	0.33
Sunday	August 12	0.00
Total	**(August 1 - 19, 2012)**	**8.61**
Total	**Month Prior to Site Visit (July 2012)**	**8.99**

Note: Precipitation data from www.fsu.edu, Station Location: Pensacola Regional Airport (13899), Pensacola, FL Lat. 30.478; Lon. -87.186; EL. 112 ft above sea level.



CDM Smith

0 100 200 400 600 800 Feet

FIGURE-4A
PHOTOGRAPH LOCATION PLAN
GULF POWER - PLANT CRIST
PENSACOLA, FLORIDA

CDM Smith

FIGURE-4B
PHOTOGRAPH LOCATION PLAN
GULF POWER - PLANT CRIST
PENSACOLA, FLORIDA

5.2 Ash Pond and Ash Decant/Settling Ponds

An overview of the Ash Pond photograph locations is shown on Figure 4A. The condition assessment of the Ash Pond includes five (5) Ash Decant/Settling Ponds that have been formed within the northwest portion of the Ash Pond through construction of divider embankments. The divider embankments appear to be constructed of a mixture of soil and ash. It was indicated by Plant personnel that the Ash Decant/Settling Ponds are dredged as necessary during normal operations to remove accumulated sediments. The Ash Decant/Settling Ponds are inter-connected by 36-inch-diameter HDPE equalizer pipes. The divider embankments that form the two rectangular-shaped ponds, immediately adjacent to the main Ash Pond were inaccessible due to dense vegetation and, therefore, could not be readily observed. At the time of the assessment, the Ash Pond reportedly contained residual ash, sediment and water with approximately 3 feet of freeboard. The Ash Decant/Settling Ponds contained standing water and waste/sediments with approximately 4 feet of freeboard.

For convenience, observations made regarding Ash Pond embankments are presented separately from observations made regarding the divider embankments that form the Ash Decant/Settling Ponds.

5.2.1 Ash Pond Crest

The crest of the Ash Pond appeared to be in **SATISFACTORY** condition (Photographs 55, 56 and 66-69). The crest width ranged from 15 to 25 feet. The crest surface consists of compacted granular soils and gravel and is exposed to vehicle traffic. Puddles and shallow ruts (Photograph 57) were observed on the southwest portion of the crest. The crest along the northwest divider embankment between the Ash Pond and the settling ponds is grass covered, with the grass approximately up to 24 inches high (Photographs 84 and 85). A shallow depression caused by erosion on the crest was observed near the south corner of the pond in the vicinity of the of the former outfall structure (Photographs 59 to 61). The area is located behind the existing sheet pile wall along the interior slope. No other depressions or evidence of settlement were observed on the crest. An animal burrow was also observed in the southwest crest (Photograph 52).

5.2.2 Ash Pond Interior Slope

The interior slopes appear to be in **FAIR** condition. The exposed portions of the interior slopes on the southwest embankment are steeper than 2H:1V at approximately 1H:1V. Short grass up to 6 inches tall covers the interior slopes. Significant erosion of the embankment starting at the waterline was observed near the south corner of the pond in the southeast embankment (Photograph 64). Scarps and eroded areas were observed along the interior slopes of the southwest embankment (Photographs 49, 53 and 58). A delta is located along the interior slope of the northeast embankment (Photographs 72 and 73).

Inlet pipes are located at the north corner of the Ash Pond and consist of two 30-inch-diameter steel pipes (Photographs 78 and 81 to 83).

5.2.3 Ash Pond Exterior Slope

The exterior slopes appear to be in **SATISFACTORY** condition. The exterior slopes of the embankments are approximately 2H:1V. The exterior slopes of the embankments are covered with short grass, approximately 4 to 6 inches tall. The Escambia River (River) flows along the northeast embankment. Riprap armoring has been placed on the northeast corner and the lower portion of the northeast embankment adjacent to the River (Photographs 1 and 7-11). Areas of erosion and shallow scarps were observed along the toe of the northeast embankment's exterior slope, where riprap armoring had not been placed (Photographs 15 to19). Animal burrows (Photographs 13, 14 and 23) were observed on the northeast slope as well as near the southeast corner of the pond. Tree stumps between 6 and 18 inches in diameter from previous vegetation clearing were also observed (Photographs 20 and 21).

Wet soils were observed at the toe of slope, near the southeast corner of the pond (Photographs 22), but no seepage or flowing water appeared to be associated with this wet area. Due to recent rainfall the observed standing water could not be clearly identified as seepage. Shallow depressions and scarps (Photographs 27 and 29) were observed on the slope and at the toe of slope, respectively, on the southwest corner.

5.2.4 Ash Pond Outlet Structure

The outlet structure consists of a concrete spillway (Photographs 31 to 34) located near the south corner of the pond. The spillway has reportedly been in operation for about 2 years. The structure appears to be in **SATISFACTORY** condition. There are no signs of settlement or compromised structural integrity.

5.2.5 Ash Decant/Settling Ponds Crest

The crests of the Ash Decant/Settling Pond embankments appear to be in **POOR** condition. The average crest width is approximately15 feet. The crests of the divider embankments between ponds show signs of significant erosion due to concentrated rainfall runoff (Photographs 79, 88 and 98). No depressions, ruts, or evidence of settlement were observed on the crests. Dense vegetation and trees up to 4 inches in diameter were observed on the southeast divider embankment between Ash Decant/Settling pond 7 and the Ash Pond (Photograph 85).

5.2.6 Ash Decant/Settling Ponds Interior Slope

The interior slopes appear to be in **POOR** condition. The exposed slopes vary from approximately 1H:1V to 1.5H:1V. Vegetative cover on the interior slopes is sparse. Erosion rills were observed on the interior slopes of all the Decant/Settling Ponds. Interior slopes show signs of deterioration, erosion and scarped areas. The embankments' interior toe is generally buried (Photographs 98, 99 and 100). At the time of assessment, Pond #3 was receiving discharge water from plant operations (Photograph 92).

5.2.7 Ash Decant/Settling Ponds Exterior Slope

The Ash Decant/Settling Ponds are inside the northwest portion of the embankment for the Ash Pond. Therefore, no exterior slopes are present.

5.2.8 Ash Decant/Settling Ponds Outlet Structures

The outlets appear to be in **SATISFACTORY** condition. The outlets from the Ash Decant/Settling Ponds consist of two 30-inch-diameter steel pipes located near the east corner of Pond #5. The pipe inverts were submerged at the time of inspection. Water appeared to be flowing freely through the outlet pipes to the Ash Pond (Photograph 78).

5.3 Gypsum Storage Pond

An overview of the Gypsum Storage Pond photograph locations is shown on Figure 4B**.** The pond had areas of standing water and stacked gypsum, with approximately 9 feet of freeboard (Photographs

102 and 103). A portion of the pond's northeast embankment serves as a divider between the Gypsum Storage Pond and the Process Sedimentation Pond. The ponds are hydraulically connected by a 5-foot-high by 7-foot-wide double-barrel concrete box culvert (Photographs 167 to 171).

5.3.1 Crest

The crest of the Gypsum Storage Pond embankments appears to be in **SATISFACTORY** condition (Photographs 104, 172 and 173). The average crest width is approximately 20 feet. The crest surface is gravel-covered without vegetation. No depressions, misalignments, cracks, ruts, or evidence of settlement were observed along the crests of the Gypsum Storage Pond.

5.3.2 Interior Slope

The textured composite HDPE liner (Photographs 174 and 175) is exposed on the interior slopes of the embankments. No signs of tears, leaks, or excessive wear were observed. The interior slopes generally appear be approximately 2H:1V. The embankment interior slopes appear to be in **SATISFACTORY** condition. Slopes appear to be straight and uniform and no signs of bulging were observed.

5.3.3 Exterior Slope

In general, the exterior slopes of the Gypsum Storage Pond appear to be in **SATISFACTORY** condition. Slopes are approximately 3H:1V with the exception of the west embankment slope which appears to be approximately 2.5H: 1V. Embankment vegetation consisted mainly of well-maintained grass approximately 4 to 6 inches tall, with the exception of the west and northwest embankments (Photographs 117, 119 and 120). The exterior slopes of the west and northwest embankments are armored with a layer of riprap from the toe of the slope, extending approximately 30 feet up the slope. The balance of the west and northwest embankments consisted of well-maintained grass approximately 4 to 6 inches tall (Photographs 121 to 125).

The alignment of the slopes appears to be relatively uniform and consistent. Animal burrows (Photographs 129, 130 and 154) were observed on the northwest and east embankments. Discontinuities and collapsed areas of the riprap-covered slope (Photographs 122 and 123) and areas where the underlying filter fabric was exposed (Photographs 124 and 125) were also observed on the west embankment.

Two areas of possible seepage were observed. The first is located near the toe of slope of the southwest embankment, adjacent to the south corner (Photographs 109 to 112). The second is located at the toe of slope of the east embankment (Photographs 155 to 158). The first area consisted of saturated soils and standing water on the perimeter road/maintenance bench, and the second area consisted of saturated soils and ponded water observed within the voids of the riprap. No underlying filter fabric was observed in this area.

Monitoring wells were observed beyond the toe of slope of the west and north embankments (Photographs 118 and 139).

5.3.4 Outlet Structure

The Gypsum Storage Pond outlet structure consists of a decant riser (Photographs 105 and 106) located approximately 220 feet from the crest of the northeast embankment. From the limited view due to the distance, the riser appeared to be free of debris and in good operating condition.

5.4 Process Sedimentation Pond

An overview of the Process Sedimentation Pond photograph locations is shown on Figure 4B**.** The Process Sedimentation Pond contained standing water during the assessment, with approximately 4½ feet of freeboard. The southwest embankment of the pond serves as a divider embankment with the Gypsum Storage Pond. Water levels within this pond are hydraulically connected with the Gypsum Storage Pond by the aforementioned box culvert (Photograph 151).

5.4.1 Crest

The crest of the Process Sedimentation Pond appeared to be in **SATISFACTORY** condition (Photograph 164). The average crest width is approximately 20 feet. The crest surface is gravel-covered without vegetation. No depressions, ruts, or evidence of settlement were observed on the crest. An emergency spillway, approximately 56 feet wide, is located near the northeast corner of the pond. The spillway crest is depressed approximately 3 feet (Photograph 150).

5.4.2 Interior Slope

The interior slopes of the pond appear to be in **SATISFACTORY** condition. The textured HDPE liner (Photograph 164) is exposed on the interior slopes of the pond, and no signs of tear and wear were observed. The interior slopes are approximately 2H:1V. Slopes appear to be straight and uniform, and no signs of bulging were observed.

5.4.3 Exterior Slope

Exterior slopes of the Process Sedimentation Pond appear to be in **SATISFACTORY** condition. Slopes are approximately 2H:1V. With the exception of the northwest embankment, exterior slopes are covered with well-maintained grass about 4 to 6 inches tall (Photograph 146). The exterior slopes of the northwest embankment are covered with riprap from the toe of slope to approximately 30 feet up the slope and then well-maintained grass up to the crest (Photographs 140 and 145). A maintenance road to access the crest is located near the northeast corner of the pond.

The alignment of the slopes appears to be uniform and consistent. No signs of bulging, sloughing or slope failure were observed. Shallow to intermediate surface erosion and erosion rills were observed on the northeast slope (Photographs 132 to138). No animal burrows were observed. Filter fabric beneath the riprap slope treatment was exposed at several locations (Photograph 141) on the northwest embankment.

The downstream side of the emergency overflow spillway is armored with interlocked articulated concrete block mattresses (Photographs 147 to 150). The mattresses appeared to be in good condition with grass and vegetation growing in the open spaces in and between the blocks.

Areas of possible seepage were observed on the northeast corner on both sides of the access road to the crest. These areas were saturated and standing water was observed at the toe of slope (Photographs 142 to 144).

Monitoring wells were observed beyond the toe of slope, in a wooded area south of the Process Sedimentation Pond (Photograph 152).

5.4.4 Outlet Structures

The outlet pipes from the Process Sedimentation Pond to the Process Return Water Pond were submerged at the time of the assessment. Based on information provided by Gulf Power, the pipes are 24- and 30-inch-diameter RCPs.

5.5 Process Return Water Pond

An overview of the Process Return Water Pond photograph locations is shown on Figure 4B**.** The Process Return Water Pond contained standing water during the assessment, with approximately 8 feet of freeboard and an embankment height of about 23 feet at the west embankment. The pond is incised along the northeast, east, south sides and has earthen embankments along on the northwest and west sides. The pond receives water from the Process Sedimentation Pond.

5.5.1 Crest

The crest appeared to be in **SATISFACTORY** condition (Photographs 184, 186 and 188). The average crest width is approximately 20 feet. The crest surface is gravel-covered without vegetation. No depressions, ruts, or evidence of settlement were observed on the crests. An emergency spillway, approximately 55 feet wide, is located approximately midway along the west embankment of the pond. The spillway crest is depressed approximately 2 feet (Photographs 187 and 188).

5.5.2 Interior Slope

The interior slopes appear to be in **SATISFACTORY** condition. The textured HDPE liner (Photographs 178 and 181) is exposed on the interior slopes of the pond. No signs of tears, leaks, or excessive wear were observed. The interior slopes are approximately 2.5H:1V. Slopes appear to be straight and uniform and no signs of bulging were observed.

5.5.3 Exterior Slope

Exterior slopes of the west and northwest embankments appear to be in **SATISFACTORY** condition. Slopes are approximately 2H:1V. The exterior slopes of the northwest embankment are armored with a layer of riprap (Photographs 191 and 192) from the toe of slope extending approximately 20 feet up the slope. The balance of the northwest embankment consists of well-maintained grass approximately 4 to 6 inches tall (Photograph 185). The west embankment exterior slope is covered with well-maintained grass approximately 4 to 6 inches tall.

The alignment of the slopes appears to be uniform and consistent. No signs of erosion or animal burrows were observed in this area. Filter fabric beneath the riprap slope treatment was exposed at several locations (Photograph 192) on the northwest embankment.

The downstream side of the emergency spillway is armored with interlocked articulated concrete block mattresses (Photographs 189 to 190). The mattresses appeared to be in good condition with grass and vegetation growing in the open spaces in and between the blocks.

Monitoring wells were observed beyond the toe of slope on the north embankment (Photograph 183).

5.5.4 Outlet Structures

The Process Return Water Pond does not have an outlet structure or gravity outfall pipes. Water from the Process Return Water Pond is pumped to the plant on an as-needed basis. Pump intake pipe(s) were submerged at the time of the assessment. Based on information provided by Gulf Power, the pipes are 24- to 30-inch-diameter RCPs located near the southwest corner of the pond.

Section 6
Hydrologic/Hydraulic Safety

6.1 Impoundment Hydraulic Analysis

The State of Florida does not currently have requirements related to the hydrologic or hydraulic design of CCW impoundments. FEMA standards require impoundments to have the capacity to store some percentage of the Probable Maximum Precipitation (PMP) for a 6-hour storm event over a 10 square-mile area in the vicinity of the site. Significant and high hazard structures are required to store 50% PMP and 100% PMP, respectively. Based on information provided by Gulf Power, hydrologic and hydraulic analyses have been conducted for the Ash Pond at 25- and 100-year, 24-hour storm events. In addition, analyses have been performed for the 1-, 2-, 5-, 10-, 25-, 50-, and 100-year return periods for the 24-hour storm event for the Gypsum Storage Pond, Process Sedimentation Pond and Process Return Water Pond.

Based on the USEPA classification system as presented on Page 2 of the USEPA checklist and our review of the site and downstream areas, a recommended hazard rating of SIGNIFICANT has been assigned to the Crist CCW impoundments as summarized in Table 3, Section 2.3. Significant hazard structures are required to store precipitation associated with the 50% PMP storm event.

The Escambia River runs along the Ash Pond's northeast embankment. CDM Smith is not aware of hydrologic and hydraulic (H&H) analyses performed to determine the peak river elevation at Plant Crist under flood conditions associated with the 50% PMP event. CDM Smith reviewed historic flow data (period of record: October 1, 1934 to September 30, 2012) for the Escambia River compiled by the United States Geological Survey, Water Resources from USGS Streamgage 02375500 located on the Escambia River near Century, FL. The peak recorded river flow of 118,000 cubic feet per second (cfs) occurred on September 30, 1998 during heavy rainfall associated with Hurricane Georges. The estimated historic peak flow of 215,000 cfs occurred prior to the construction of Plant Crist, in March 1929.

6.2 Adequacy of Supporting Technical Documentation

H&H documentation has been provided for the Ash Pond, the Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond for the storm events analyzed, including the 100-year event. However, no documentation or analyses of impoundment storage capacities for the 50% PMP was provided. There appears to be some potential for erosion of the CCW impoundment embankments, particularly the Ash Pond, under the 50% PMP flood condition on the Escambia River. No documentation or H&H analyses to determine Escambia River flood levels and flows was provided for the 50% PMP event.

6.3 Assessment of Hydrologic/Hydraulic Safety

Hydrologic/hydraulic safety of the CCW impoundments appears to be satisfactory under normal operating conditions based on the following:

- Recent H&H analyses of the Ash Pond and the Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond system are well documented and, in general, determined that adequate freeboard and capacity are provided for the 100-year storm event.
- During visual observations and site assessments, no signs of plugged, collapsed or blocked pipes, or other detrimental conditions were observed.
- Adequate freeboard was observed at the time of the assessments.

H&H analyses and documentation for the 50% PMP were not provided, therefore the CCW impoundments are rated as POOR. EPA requirements state that "if a facility has not conducted hydrologic, static and seismic engineering studies following best professional engineering practice to support factors of safety, the facility must be rated "POOR".

Section 7

Structural Stability

7.1 CCW Impoundments' Structural Stability

Gulf Power provided CDM Smith with the most-recent slope stability analyses performed for the Ash Pond embankments dated August 17, 2012. The slope stability analyses are based on geotechnical information obtained along the Ash Pond embankments by Gulf Power in 1992 and 2010. The soil properties used for the analyses were obtained from blow counts from borings drilled on the embankments, dilatometer data, and triaxial shear testing performed in 1992, and additional cone penetration test (CPT) soundings performed in 2010.

Stability analyses for the Gypsum Storage Pond were also provided to CDM Smith. The analyses are dated August 17, 2012.

7.1.1 Stability Analyses and Load Cases

Currently the State of Florida does not have regulations regarding CCW impoundments. Procedures established by the United States Army Corps of Engineers (USACE), the United States Bureau of Reclamation, the Federal Energy Regulatory Commission, and the Natural Resources Conservation Service are generally accepted engineering practice. Minimum required factors of safety outlined by the USACE in EM 1110-2-1902, Table 3-1 and seismic factors of safety by FEMA Federal Guidelines for Dam Safety, Earthquake Analyses and Design of Dams (pgs. 31, 32 and 38, May 2005) are provided in **Table 6.**

Table 6 - Minimum Safety Factors

Load Case	Minimum Required Factor of Safety
Steady-State Condition at Normal Pool or Maximum Storage Pool Elevation	1.5
Rapid Drawdown Condition from Normal Pool Elevation	1.3
Maximum Surcharge Pool (Flood) Condition	1.4
Seismic Condition from at Normal Pool Elevation	1.1
Liquefaction	1.3

Notes: Above safety factors are based on requirements established by the USACE. Required safety factors have not been established by the State of Florida for CCW impoundments.

7.1.2 Design Parameters and Dam Materials

Gulf Power representatives provided some construction drawings related to the original construction of the Ash Pond, Gypsum Storage Pond, Process Sedimentation Pond, and Process Return Water Pond impoundments. Stability analyses were provided for the Ash Pond and the Gypsum Storage Pond. Stability analyses were not provided for the Process Sedimentation Pond or the Process Return Water Pond.

7.1.2.1 Ash Pond

General soil properties and soil parameters used for the slope stability analyses performed on 6 different cross sections for the Ash Pond are presented in **Table 7.**

Table 7 – Soil Parameters for the Ash Pond Subsurface Soil Profile

Stratum	Unit Weight (psf)	Effective Stress Parameters	
		Φ (degrees)	C (psf)
Clayey Sand 1	120	33	100
Clayey Sand 2	120	28	100
Clayey Silt	115	10	625
Silty Sand	120	30	100
Silty Clay	115	10	385
Silt and Clay	115	10	115
Sand	120	27 to 36	0 to 100
Rip Rap	140	40	0
Fly Ash	80	18	0

Summary of safety factors computed for the different cases and cross sections are included in **Table 8.**

Table 8 – Safety Factors Computed for Various Stability Conditions on the Ash Pond

Failure Condition (Load Case)	Computed Factor of Safety	Recommended Minimum Factor of Safety[1]
Section 1 – Barge Canal/River		
Downstream Steady State	1.4	1.5
Downstream Seismic	1.2	1.1
Upstream Steady State	2.4	1.5
Upstream Seismic	2.1	1.1
Downstream – 100 Year Storm	1.7	1.4
Upstream – 100 Year Storm	2.5	1.4
Upstream Rapid Drawdown	1.2	1.3
Section 2 – River Side		
Downstream Steady State	1.2	1.5
Downstream Seismic	1.1	1.1
Upstream Steady State	2.5	1.5
Upstream Seismic	2.2	1.1
Downstream – 100 Year Storm	1.4	1.4
Upstream – 100 Year Storm	2.5	1.4
Upstream Rapid Drawdown	1.3	1.3
Section 3 – Discharge Canal Weir		
Downstream Steady State	2.2	1.5
Downstream Seismic	1.9	1.1
Upstream Steady State	2.4	1.5
Upstream Seismic	2.1	1.1
Downstream – 100 Year Storm	2.6	1.4
Upstream – 100 Year Storm	2.5	1.4
Upstream Rapid Drawdown	1.3	1.3
Section 4 – Discharge Canal South		
Downstream Steady State – In Bolster	1.4	1.5
Downstream Steady State – In Dike	1.4	1.5

Downstream Seismic	1.2	1.1
Upstream Steady State	2.4	1.5
Upstream Seismic	2.1	1.1
Downstream – 100 Year Storm	1.8	1.4
Upstream – 100 Year Storm	2.5	1.4
Upstream Rapid Drawdown	1.3	1.3
Section 5 – Discharge Canal North		
Downstream Steady State	1.4	1.5
Downstream Seismic	1.3	1.1
Upstream Steady State	1.9	1.5
Upstream Seismic	1.7	1.1
Downstream – 100 Year Storm	1.7	1.4
Upstream – 100 Year Storm	1.9	1.4
Upstream Rapid Drawdown	1.0	1.3
Section 6 – Thompson Bayou		
Downstream Steady State	2.0	1.5
Downstream Seismic	1.7	1.1
Upstream Steady State	2.5	1.5
Upstream Seismic	2.2	1.1
Downstream – 100 Year Storm	2.3	1.4
Upstream – 100 Year Storm	2.5	1.4
Upstream Rapid Drawdown	1.4	1.3

Source: Engineering and Construction Services Calculation – Slope Stability Analyses of Ash Pond Dike, prepared by Southern Company, August 17, 2012.

The seismic analyses were performed based on Gulf Power's review of the USGS "Map for Peak Acceleration with 2% Probability of Exceedance in 50 Years"; the maximum horizontal acceleration is approximately 0.03g in the vicinity of Plant Crist.

7.1.2.2 Gypsum Storage Pond

General soil properties and soil parameters used for the slope stability analyses performed on the Gypsum Storage Pond are presented in **Table 9.**

Table 9 – Soil Parameters for the Gypsum Storage Pond Subsurface Profile

Stratum	Unit Weight (psf)	Effective Stress Parameters	
		Φ (degrees)	C (psf)
In Place Sand (base of disposal area)	110	30	100
Sand Berm	110	32	100
Compacted Gypsum Berm	85	40	0
Sluiced Gypsum prior to Consolidation	70	23	0
Sluiced Gypsum after Consolidation	80	25	0

Summary of safety factors computed for the different cases and cross sections of the Gypsum Storage Pond are included in **Table 10.**

Table 10 – Summary of Computed Safety Factors for the Gypsum Storage Pond

Condition	Factor of Safety Against Sliding
Single Level Stack –Steady State	2.4
Single Level Stack –Seismic Loading	2.2
Full Stack –Steady State	2.4
Full Stack –Seismic Loading	2.2

Source: Engineering and Construction Services Calculation – Slope Stability Analyses of Ash Pond Dike, prepared by Southern Company, August 17, 2012.

The seismic analyses were performed based on Gulf Power's review of the USGS "Map for Peak Acceleration with 2% Probability of Exceedance in 50 Years"; the maximum horizontal acceleration is approximately 0.03g in the vicinity of Plant Crist.

7.1.3 Liquefaction Potential

CDM Smith's review of the available limited subsurface information indicates that soils below the Ash Pond embankments consist of fill underlain by a layer of wet, loose, fine to medium sand, approximately 5 feet thick. The liquefaction susceptibility of loose sandy soils is generally considered to be potentially high. Soil liquefaction occurs in loose, saturated cohesionless soil (sands and silts) when a sudden loss of strength and loss of stiffness is experienced, sometimes resulting in large, permanent displacements of the ground. Even thin lenses of loose saturated silts and sands may cause an overlying sloping soil mass to slide laterally along the liquefied layer during earthquakes.

Gulf Power provided CDM Smith with liquefaction potential analyses for the Ash Pond and Gypsum Storage Pond, dated September 6, 2012. The soil properties used for the analyses were obtained from blow counts resulting from Standard Penetration Tests performed in 1971 and 1992. The analyses evaluated the liquefaction potential of the two ponds when subjected to loading associated with a seismic event having a 2-percent exceedance over a 50-year period, considering seismic hazards derived from both the Central and Eastern U.S. random faulting source (CEUS) and the New Madrid Source Zone (NMSZ). According to the report submitted, nearly 90 percent of the seismic hazard for Plant Crist is derived from the CEUS and about 11 percent of the hazard is attributed to the NMSZ. The analyses evaluated embankment liquefaction potential for an average earthquake of magnitude 5.8 at 100km (CUES source) and an average earthquake of magnitude7.8 at 630km (NMSZ source). The site modified zero-period accelerations (PGA) for the Ash Pond were .066g (CEUS) and 0.039g (NMSZ) and 0.042g (CEUS) and 0.025g (NMSZ) for the Gypsum Storage Pond. For the purpose of the liquefaction potential analyses, water was assumed to be 10 feet below the top of crest for the Ash Pond. CDM Smith notes there was approximately 3 feet of freeboard in the Ash Pond during our August 20, 2012 condition assessment. Water was assumed to be at El. 15 for the Gypsum Storage Pond, however no datum was referenced.

A summary of safety factors computed for the different Ash Pond cross sections is included in **Table 11.**

Table 11 – Summary of Computed Safety Factors for Liquefaction Potential; Ash Pond

Ash Pond Dike Centerline									
	APD-6			B-110			APD-7		
Depth	SPT N- value	Factor of Safety, CEUS	Factor of Safety, NMSZ	SPT N- value	Factor of Safety, CEUS	Factor of Safety, NMSZ	SPT N- value	Factor of Safety, CEUS	Factor of Safety, NMSZ
5	13	>5	>5	5	2.8	2.8	20	>5	>5
10	43	>5	>5	5	2.6	2.5	33	>5	>5
15	32	>5	>5	5	2.4	2.2	17	>5	>5
20	26	>5	>5	5	2.1	1.9	4	2.0	1.8
25	6	2.2	1.8	5	2.0	1.7	8	2.5	2.1
30	5	clay	Clay	4	1.8	1.5	5	Clay	Clay
35	3	2.2	1.7	0	1.4	1.1	1	1.5	1.1
40	3	1.6	1.2	4	1.8	1.4	5	2.0	1.4
45	6	2.0	1.4	4	1.9	1.3	9	2.5	1.8
50				51	>5	>5			

The Ash Pond analysis indicates liquefaction of the foundation soils does not appear to be a threat during the CEUS scenario earthquake. During the NMSZ scenario earthquake, soft natural soils encountered immediately below the embankment fill exhibited factors of safety of 1.1 and 1.2. This suggests some strength loss may occur in this stratum due to earthquake-induced pore pressure build-up. Gulf Power states in the September 6, 2012 report, they believe there is a very low likelihood of an NMSZ scenario earthquake occurring over the life of Plant Crist. CDM Smith recommends that an evaluation be performed to determine if the strength loss would result in unacceptable seismic deformations.

A summary of safety factors computed for the different Gypsum Storage Pond cross sections is included in **Table 12.**

Table 12 – Summary of Computed Safety Factors for Liquefaction Potential; Gypsum Storage Pond

Gypsum Storage Pond									
	GYP-1S			GYP-16			GYP-36		
Depth	SPT N- value	Factor of Safety, CEUS	Factor of Safety, NMSZ	SPT N- value	Factor of Safety, CEUS	Factor of Safety, NMSZ	SPT N- value	Factor of Safety, CEUS	Factor of Safety, NMSZ
5	11	>5	>5	17	Excavated		6	Excavated	
10	8	>5	>5	3			9		
15	10	>5	>5	5			2		
20	15	>5	>5	7			9		
25	21	>5	>5	33			13	>5	>5
30	19	>5	>5	17			20	>5	>5
35	13	>5	>5	24			25	>5	>5
40	21	>5	>5	16			2	4.6	4.1
45	31	>5	>5	27			5	>5	>5
50	40	>5	>5	23	>5	>5	>5	>5	>5
55	47	>5	>5	45	>5	>5	23	>5	>5
60	15	>5	>5	27	>5	>5	28	>5	>5
65	5	>5	3.7				62	>5	>5
70							40	>5	>5
75							25	>5	>5
80							52	>5	>5
85							64	>5	>5

At the Gypsum Storage Pond, the analysis indicates liquefaction of the foundation soils is not a threat during either of the scenario earthquakes, for the conditions evaluated.

Documentation provided by Gulf Power did not include evaluation of liquefaction potential for the Process Sedimentation Pond and Process Return Water Pond.

7.2 Adequacy of Supporting Technical Documentation

Structural stability documentation to support the safety assessment for the embankments at Plant Crist is considered incomplete. Required additional documentation includes:

- Liquefaction analyses –Process Sedimentation Pond and Process Return Water Pond.
- Stability analyses - Process Sedimentation Pond and the Process Return Water Pond.

7.3 Assessment of Structural Stability

Structural Stability of the Process Sedimentation Pond and Process Return Water Pond is rated **POOR** based on the following:

- Liquefaction analyses have not been provided for Process Sedimentation Pond and Process Return Water Pond.
- Stability analyses have not been provided for the Process Sedimentation Pond and the Process Return Water Pond.

Structural Stability of the Ash Pond is rated **POOR** based on the following:

- Inadequate factors of safety have been determined at four of the six cross sections reviewed for Steady-State Condition at Normal Pool, and inadequate factors of safety have been determined at two of the six cross sections reviewed for Rapid Drawdown Condition from Normal Pool.
- Inadequate factors of safety have been determined for liquefaction of the foundation soils under the NMSZ scenario earthquake. The analyses indicate potential strength loss in the soils at two locations. CDM Smith recommends that an evaluation be performed to determine if the potential strength loss would result in unacceptable seismic deformations.

Structural Stability of the Gypsum Storage Pond is rated **SATISFACTORY** based on the following:

- Recent slope stability analyses of the Gypsum Storage Pond embankments are well documented and in general, satisfactory safety factors are reported for the different loading conditions analyzed.
- Recent liquefaction analysis indicates liquefaction of the foundation soils is not a threat for the conditions evaluated.

Section 8

Adequacy of Maintenance and Methods of Operation

8.1 Operating Procedures

The Ash Pond includes five (5) Ash Decant/Settling Ponds that have been formed within the northwest portion of the Ash Pond through construction of divider embankments. The Ash Pond is currently used as a waste water pond, receiving runoff from stormwater, plant operations, and the coal stockpile. Discharge water from plant operations contains bottom ash, fly ash and boiler slag. The Ash Pond also receives overflow from the bottom ash dewatering bins. Prior to entering the Ash Pond, discharge water from the plant operations flows through the five (5) Ash Decant/Settling Ponds (water is pumped from plant operations into the southernmost and middle ponds). Water from the northernmost pond flows by gravity to the Ash Pond through two 30-inch-diameter steel pipes that discharge below an existing walkway/catwalk located at the north corner of the Ash Pond. In addition, a series of turbidity barriers is present on the surface of the Ash Pond to create a baffle-type system and increase residence time. Water flows out of the Ash Pond by gravity through a concrete spillway structure located near the south corner of the pond. Before water is discharged into the Escambia River, water goes through the settling ponds into the main pond and then is discharged into Thompson's Bayou by a concrete spillway outlet structure.

The Gypsum Storage Pond receives sluiced gypsum, a by-product from the plant's flue gas desulfurization system (FGD Scrubber). Decant water from the Gypsum Storage Pond overflows through a riser structure to the adjacent Process Sedimentation Pond and Process Return Water Pond.

8.2 Maintenance of the Dam and Project Facilities

Gulf Power provided CDM Smith with copy of their guidelines and procedures for routine maintenance and inspection of the CCW impoundments described in this report. Also, they provided a copy of "Safety Procedures for Dams and Dikes" by Southern Company, which was reviewed and approved by Southern Company's Executive Vice President on April 30, 2012.

It was indicated by Plant Crist personnel during the site visual assessment by CDM Smith that visual dam inspections are performed at all CCW impoundments every week, and Southern Company performs a general detailed inspection once every year. Copies of the annual inspection reports for the 4 years previous to this assessment were provided to CDM Smith for information.

8.3 Assessment of Maintenance and Methods of Operations

Based on CDM Smith's visual observations and review of documents provided by Gulf Power and Southern Company, maintenance and operations procedures appear to be adequate for Plant Crist. However, several relatively minor deficiencies (i.e. long-established animal burrows, erosion rills, and dense vegetation on the northwest embankment of the Ash Pond) were observed. No major maintenance issues were identified.

Section 9

Adequacy of Surveillance and Monitoring Program

9.1 Surveillance Procedures

Gulf Power is required by Florida Department of Environmental Protection (FDEP) under National Pollutant Discharge Elimination System (NPDES) Permit No. FL0002275 to monitor discharge of wastewater into Thompson's Bayou, and groundwater in the vicinity of the CCW impoundments described in previous sections of this report. Surveillance procedures should be in accordance with the FDEP – NPDES Permit. Based on the information provided to CDM Smith by Gulf Power, it appears that discharge water into Thompson's Bayou is being monitored accordingly.

Gulf Power is also required to maintain records and make them available for FDEP inspection for at least three years after report preparation.

9.2 Instrumentation Monitoring

Based on the documents reviewed by CDM Smith, thirty four (34) piezometers/ monitoring wells are installed in the vicinity of the CCW impoundments. Gulf Power submits to FDEP groundwater readings, daily rainfall data, and analytical data for groundwater sampling in a semiannual Groundwater Report. CDM Smith was provided with the last 9 Groundwater Reports submitted to FDEP from 2008 to 2012.

9.3 Assessment of Surveillance and Monitoring Program

Based on the documents reviewed by CDM Smith, a series of monitoring wells have been installed for compliance with FDEP in the vicinity of the CCW impoundments. A summary of the water level readings and potentiometric maps were included in the Groundwater Report by Gulf Power to FDEP dated August 9, 2011. A reproduction of the potentiometric maps and summary table of groundwater levels as presented by Gulf Power to FDEP is presented in **Figure 5A** to **Figure 5C**. Based on information provided by Gulf Power, Groundwater Reports are delivered semiannually to FDEP.

A summary of groundwater levels collected on March 23, 2012 by Gulf Power as presented in the Groundwater Report to FDEP, dated August 13, 2012 is presented in **Table 13.**

Table 13: Monitoring Wells Water Levels.

Crist March 2012 Water Levels					
WELL ID.	TOC Elevation	WATER LEVEL	Unit	Area	GW Elevation
MWB-1	89.47	80.7	5	Ash Landfill	8.77
MWC-3	33.45	28.06	5	Ash Landfill	5.39
MWC-4	22.29	14.72	5	Ash Landfill	7.57
GE-5D	32.23	24.61	5	Ash Landfill	7.62
MWC-8	109.71	102.86	5	Ash Landfill	6.85
MWP-9	53.73	46.29	5	Ash Landfill	7.44
MWP-11	69.90	59.53	5	Ash Landfill	10.37

Crist March 2012 Water (Continued)					
WELL ID.	TOC Elevation	WATER LEVEL	Unit	Area	GW Elevation
MWP-13	103.83	92.65	5	Ash Landfill	11.18
GE-1D	20.78	17.41	5	Ash Landfill	3.37
GE-2D	37.79	35.05	5	Ash Landfill	2.73
GE-3D	64.04	57.82	5	Ash Landfill	6.22
GE-4D	18.61	12.49	5	Ash Landfill	6.12
GE-6D	21.25	16.95	5	Ash Landfill	4.30
MWB-2	89.59	78.01	2	Ash Landfill	11.58
GW-1S	65.53	53.87	2	Ash Landfill	11.66
MWI-1	33.35	28.08	2	Ash Landfill	5.27
MWI-2	22.36	14.29	2	Ash Landfill	8.07
GE-5S	32.22	24.94	2	Ash Landfill	7.28
MWC-10	109.71	102.80	2	Ash Landfill	6.91
MWC-12	70.74	57.95	2	Ash Landfill	12.52
MWP-8	53.71	45.65	2	Ash Landfill	8.06
MWP-10	69.75	59.67	2	Ash Landfill	10.08
MWP-12	103.68	42.44	2	Ash Landfill	61.24
GE-1S	20.97	16.81	2	Gypsum Area 1	4.16
GE-2S	38.56	37.17	2	Gypsum Area 1	1.39
GE-3S	63.65	59.39	2	Gypsum Area 1	4.26
GE-4S	18.62	13.19	2	Gypsum Area 1	5.43
GE-6S	21.13	16.02	2	Gypsum Area 1	5.11
MWP-11	115.55	25.23	1	Ash Landfill	90.32
MWP-1	63.37	DRY	1	Ash Landfill	DRY
MWP-2	95.18	11.46	1	Ash Landfill	83.72
MWP-3	81.78	14.44	1	Ash Landfill	67.34
MWP-4	100.99	11.25	1	Ash Landfill	89.74
MWP-7	110.50	16.52	1	Ash Landfill	93.98
All water levels were collected on 3/23/2012					

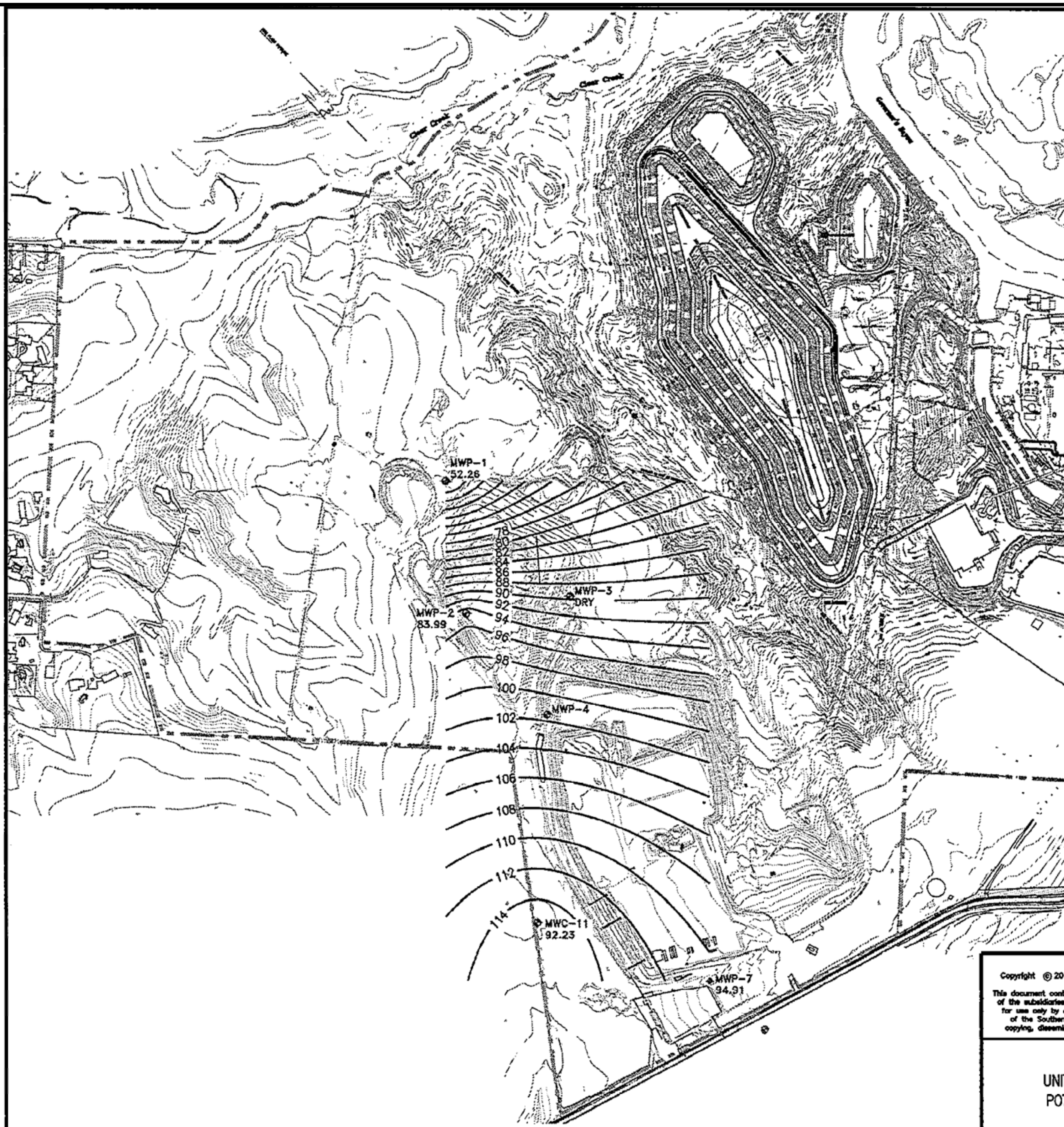
9.3.1 Adequacy of Surveillance Program

Based on the documentation provided by Gulf Power to CDM Smith, the groundwater surveillance program appears to be adequate and follows FDEP- NPDES Permit requirements.

9.3.2 Adequacy of Instrumentation Monitoring Program

Based on the documentation provided by Gulf Power to CDM Smith, the instrumentation monitoring program appears to be adequate for each CCW impoundment. Quantity and locations of piezometers/monitoring wells appear to comply with requirements from FDEP. However, piezometers/monitoring well construction data/logs were not provided to CDM Smith for review.

It should be noted that an earth embankment that is safe under current conditions may not be safe in the future if conditions change. Conditions that may change include changes in the phreatic surface, embankment deformation, or changes in seepage patterns. CDM Smith recommends to routinely monitor for the occurrence of any of these conditions so that preventive measures can be taken in response to any of these observations.



Plant Crist Unit 1 Groundwater Elevation Data Summary:

Unit 1	Northing	Easting	GW ELEV.
MWC-11	577223.10	1107440.55	92.23
MWP-1	579678.30	1106935.18	52.26
MWP-2	578946.50	1107048.31	83.99
MWP-3	579043.70	1107622.00	DRY
MWP-4	578385.00	1107496.00	NA
MWP-7	576900.90	1108396.69	94.91

LEGEND:

- GYPSUM STORAGE AREA MONITORING WELLS
- PLANT CRIST PROPERTY BOUNDARY
- EXISTING GROUND CONTOURS
- FENCE
- GROUNDWATER CONTOURS
- GROUNDWATER FLOW DIRECTION

Southern Company Generation
Engineering and Construction Services
FOR
Gulf Power Company

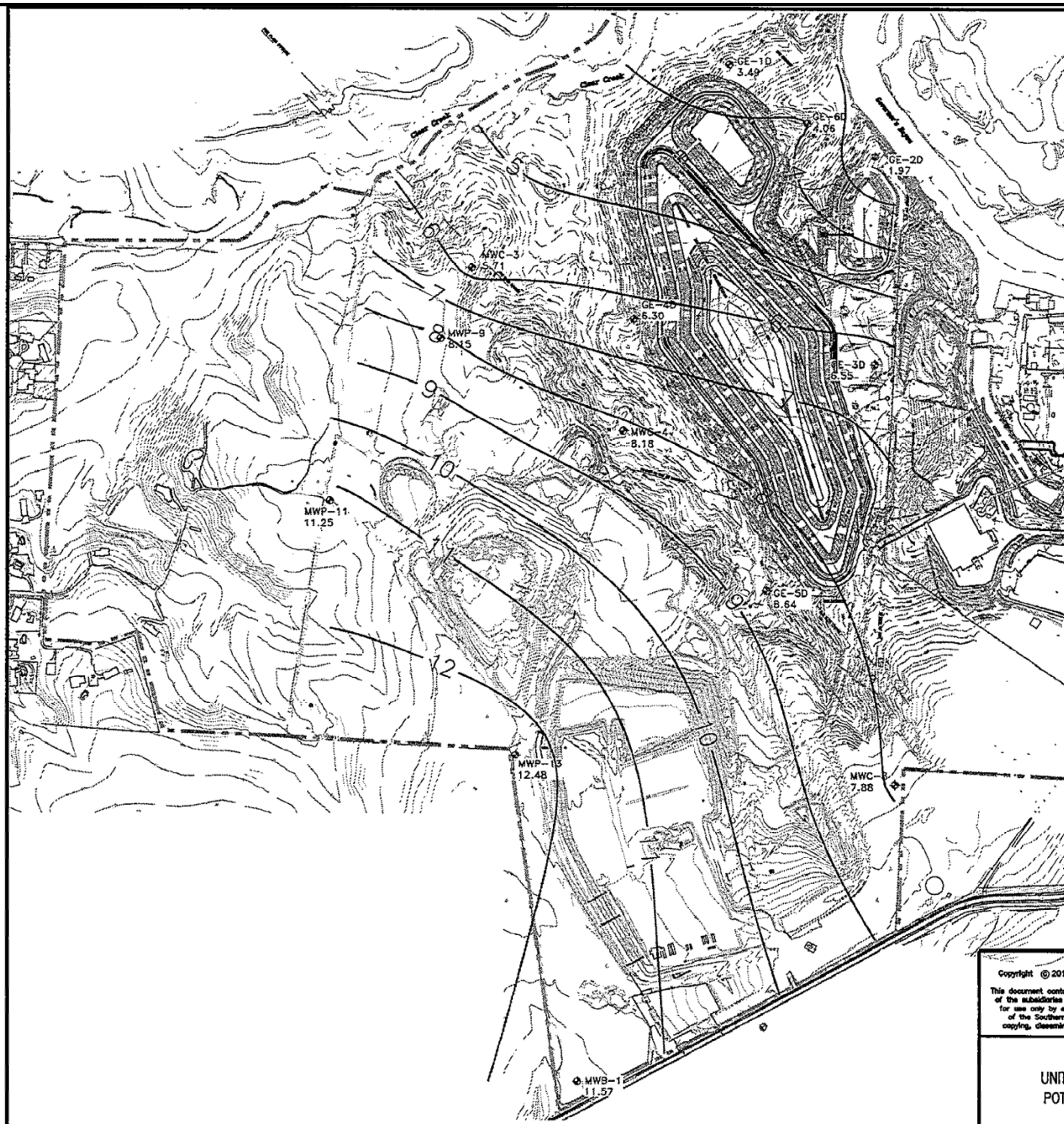
PLANT CRIST
UNIT 1 GYPSUM STORAGE AREA
POTENTIOMETRIC SURFACE MAP
APRIL 14, 2011

SCALE	PROJ I.D.	DRAWING NUMBER	SHEET	CONT'D	REV
1" = 600'		ES2015S1	1	FINAL	0

CDM Smith

NOT TO SCALE

FIGURE-5A
UNIT 1 - POTENTIOMETRIC SURFACE MAP
GULF POWER - PLANT CRIST
PENSACOLA, FLORIDA



Plant Crist Unit 5 Groundwater Elevation Data Summary:

Unit 5	Northing	Easting	GW ELEV.
MWB–1	576316.33	1107666.84	11.57
MWC–3	580867.2	1107075.8	5.71
MWC–4	579957.03	1107920.6	8.18
MWC–8	577981.55	1109436.25	7.88
MWP–9	580469.48	1106903.63	8.15
MWP–11	579563.75	1106289.79	11.25
MPW–13	578144.59	1107323.19	12.48
GE–1D	582000.42	1108507.74	3.49
GE–2D	581490.11	1109320.21	1.97
GE–3D	580329.88	1109320.79	6.55
GE–4D	580579.82	1107978.14	6.3
GE–5D	579065.76	1108720.19	8.64
GE–6D	581673.14	1108943.44	4.06

LEGEND:

- GYPSUM STORAGE AREA MONITORING WELLS
- PLANT CRIST PROPERTY BOUNDARY
- EXISTING GROUND CONTOURS
- FENCE
- GROUNDWATER CONTOURS
- GROUNDWATER FLOW DIRECTION

Southern Company Generation Engineering and Construction Services

FOR

Gulf Power Company

PLANT CRIST
UNIT 5 GYPSUM STORAGE AREA
POTENTIOMETRIC SURFACE MAP
APRIL 14, 2011

SCALE	PROJ I.D.	DRAWING NUMBER	SHEET	CONT'D	REV
1" = 600'		ES2015S3	1	FINAL	0

CDM Smith

NOT TO SCALE

FIGURE-5B
UNIT 5 - POTENTIOMETRIC SURFACE MAP
GULF POWER - PLANT CRIST
PENSACOLA, FLORIDA

Plant Crist Unit 2 Groundwater Elevation Data Summary:

Unit 2	Northing	Easting	GW ELEV.
MWB-2	576320.37	1107675.65	13.46
MWI-1	580866.5	1107082.4	5.8
MWI-2	579957.03	1107905.88	9.05
MWP-8	580426.93	1106880.64	8.67
MWP-10	579577.08	1106284.66	11
MWP-12	578152.04	1107322.62	12.53
GE-1S	582003.37	1108516.39	3.48
GE-2S	581483.15	1109326.43	1.11
GE-3S	580376.89	1109321.13	3.2
GE-4S	580572.7	1107976.09	5.7
GE-5S	579068.53	1108711.13	7.86
GE-6S	581674.53	1108934.89	4.58
GW-1S	578484.47	1106097.19	12.84
MWC-10	577968.69	1109451.94	7.71
MWC-12	578418.02	1106183.31	13.69

LEGEND:

- GYPSUM STORAGE AREA MONITORING WELLS
- PLANT CRIST PROPERTY BOUNDARY
- EXISTING GROUND CONTOURS
- FENCE
- GROUNDWATER CONTOURS
- GROUNDWATER FLOW DIRECTION

Southern Company Generation Engineering and Construction Services

FOR

Gulf Power Company

PLANT CRIST
UNIT 2 GYPSUM STORAGE AREA
POTENTIOMETRIC SURFACE MAP
APRIL 14, 2011

SCALE	PROJ I.D.	DRAWING NUMBER	SHEET	CONT'D	REV
1" = 600'		ES2015S2	1	FINAL	0

CDM Smith

NOT TO SCALE

FIGURE-5C
UNIT 2 - POTENTIOMETRIC SURFACE MAP
GULF POWER - PLANT CRIST
PENSACOLA, FLORIDA

Section 10

Reports and References

The following is a list of reports and drawings that were provided by Gulf Power and Southern Company and were used during the preparation of this report and the development of the conclusions and recommendations presented herein. Gulf Power and Southern Company requested these documents be considered as Confidential Business information (CBI).

1. Notice of Permit FL0002275, prepared by Florida Department of Environmental Protection to Gulf Power Company, January 26, 2011

2. Environmental Resource Permit and State-owned Submerged Lands Authorization Permit No. 17-724498-002-EI, prepared by Florida Department of Environmental Protection Northwest District, September 1, 2011

3. Groundwater Monitoring Reports and Daily Rainfall Logs and Sampling Logs for Plant Crist - Permit FL 000 2275, prepared by Gulf Power to Florida Department of Environmental Protection Northwest District, July 25, 2008

4. Groundwater Monitoring Reports and Daily Rainfall Logs and Sampling Logs for Plant Crist - Permit FL 000 2275, prepared by Gulf Power to Florida Department of Environmental Protection Northwest District, January 26, 2009

5. Groundwater Monitoring Reports and Daily Rainfall Logs and Sampling Logs for Plant Crist - Permit FL 000 2275, prepared by Gulf Power to Florida Department of Environmental Protection Northwest District, July 27, 2009

6. Groundwater Monitoring Reports and Daily Rainfall Logs and Sampling Logs for Plant Crist - Permit FL 000 2275, prepared by Gulf Power to Florida Department of Environmental Protection Northwest District, February 11, 2010

7. Groundwater Monitoring Reports and Daily Rainfall Logs and Sampling Logs for Plant Crist - Permit FL 000 2275, prepared by Gulf Power to Florida Department of Environmental Protection Northwest District, August 12, 2010

8. Safety Procedure for Dams and Dikes, prepared by Southern Company Generation, April 30, 2012

9. Groundwater Monitoring Reports, Daily Rainfall Log, Potentiometric Maps and Sampling Logs for Plant Crist - Permit FL 000 2275, prepared by Gulf Power to Florida Department of Environmental Protection Northwest District, August 9, 2011

10. Application for Department of the Army permit assigned number SAJ-2005-02502, prepared by the Department of the Army Jacksonville District Corp of Engineers to Gulf Power, July 27, 2011

11. Inspection Checklist, prepared by Florida Department of Environmental Protection to Gulf Power Plant Crist Facility, July 26, 2012

12. Inspection Checklist, prepared by Florida Department of Environmental Protection to Gulf Power Plant Crist Facility, Jun 28, 2011

13. Groundwater Monitoring Reports and Daily Rainfall Logs and Sampling Logs for Plant Crist - Permit FL 000 2275, prepared by Gulf Power to Florida Department of Environmental Protection Northwest District, February 15, 2011

14. Groundwater Monitoring Submittal for Sampling conducted at the Plant Crist, prepared by Gulf Power to Florida Department of Environmental Protection, Northwest District, August 13, 2012

15. Safety Procedure for Dams and Dikes, prepared by Southern Company Generation, April 30, 2012

16. Specific Purpose Survey: Pond Spot Elevations Gulf Power Company Crist Plant, prepared by Pittman, Glaze and Associates, Inc., March 14, 2009

17. Crist Completion of Construction – NPDES Permit #FL0002275, prepared by Gulf Power to Florida Department of Environmental Protection, June 25, 2010

18. Ash Pond Certification Letter for Plant Crist, prepared by Gulf Power to Florida Department of Environmental Protection, December 17, 2008

19. Drawing, Escambia River Condition Survey, prepared by U.S. Army Corps of Engineers, Mobile District, Sheet 10 of 13, March 2012

20. Ash Pond Dike Study, along with drawings, logs, and test data, prepared by Southern Company Services to Gulf Power Company, June 1, 1992

21. Plant Crist Proposed Ash Pond Dike Modifications, Phase 2 Report, prepared by Southern Company Services to Gulf Power Company, November 2, 1992

22. Plant Crist Ash Pond Dike Study, Phase 3 Report, prepared by Southern Company Services to Gulf Power Company, February 23, 1993

23. Test Boring Records – Boring Number: B-109A, obtained from Gulf Power Company, August 29, 1971

24. Soil Boring Log, Ash Pond Dike Stability Analysis, prepared by Southern Company Services, Inc., February 4, 1992

25. Drawing Survey, prepared by Southern Company Services, Inc, for Gulf Power Company, February 9, 1993

26. Drawing D-34344 – Detail – Ash Pond Dike Modifications, Cross Sections

27. Hydrographic Survey of a Portion of Crist Plant – Ash Pond, prepared by Pittman, Glaze and Associates for Gulf Power Company, August 25, 2010

28. Ash Pond Dike Inspection Report, Crist Steam Plant, prepared by Southern Company Services for Gulf Power Company, October 31, 1996

29. Plant Crist Ash Pond Dike Modifications Draft – Inquiry Package including Scope Document, Technical Specification, Proposal Form, Soil Boring Logs, Dilatometer Data Sheets, and Laboratory Test Results, and three Design Drawings, prepared by Southern Company Services, April 22, 1994

30. Design Calculations – Slope Stability Analysis of Gypsum Facility, prepared by Southern Company Services, Inc., August 17, 2012

31. Engineering and Construction Services Calculation – Slope Stability Analyses of Ash Pond Dike, prepared by Southern Company, August 17, 2012

32. Ash Pond Certification Letter for Plant Crist, prepared by Gulf Power to Florida Department of Environmental Protection, December 23, 2009

33. Ash Pond Certification Letter for Plant Crist, prepared by Gulf Power to Florida Department of Environmental Protection, December 20, 2010

34. Drawings – Ash Pond Dike Modifications, Plan by Southern Company Services, April 1994

35. Safety Procedure for Dams and Dikes, prepared by Southern Company Generation, June 29, 2009

36. Plant Crist Hydrologic and Hydraulic Study of the Ash Pond and Skimmer Ponds, August 2011

37. Groundwater Monitoring Reports, Daily Rainfall Log, Field Edd, Lab Edd, Potentiometric Maps, Laboratory Analytical Reports and Sampling Logs for Plant Crist - Permit FL 000 2275, prepared by Gulf Power to Florida Department of Environmental Protection Northwest District, February 14, 2012

38. Dam Safety Inspection Report, prepared by Southern Company, to Gulf Power Company, March 10, 2009

39. Annual 2011 Dam Safety Inspection Report of Plant Crist, prepared by Southern Company to Gulf Power Company, April 14, 2011

40. Annual 2010 Dam Safety Inspection Report and Photograph of Plant Crist, prepared by Southern Company to Gulf Power Company, January 24, 2011

41. Annual 2012 Dam Safety Inspection Report and Photographs of Plant Crist, prepared by Southern Company to Gulf Power Company, May 10, 2012

42. Dam Safety Inspection Weekly Report – Blank Form

43. A Specific Purpose Survey, Pond Cross Section, Gulf Power Company Crist Plant, by Pitman Glaze and Associates, Inc, March 14, 2009

44. CD – Plant Crist Gypsum Storage Area – Specifications – Geo/Hydrogeo - Volume 1 – Volume 4

45. CD – Drawings – Plant Crist Gypsum Storage Area

46. CD – Drawings – Plant Crist Weir Replacement

47. CD – Plant Crist Gypsum Storage Area - Stormwater Calculations

Appendix A

Documentation from Gulf Power Company, Plant Crist

Appendix A

Doc 01: Soil Borings

Southern Company Services, Inc.
Soil Boring Log

CONFIDENTIAL

HOLE No. APD-4

SHEET 1 OF 1

Project: PLANT CRIST
Location: ASH POND DIKE
Purpose: STABILITY ANALYSIS
Position: E 1,112,743.6 N 578,242.1 Surface Elevation: 90.50
Rig Type: MOBILE Contractor: PENSACOLA TESTING Driller: MATT AND ROBERT
Drilling Method: WASH BORING Boring Depth: 46.0 No. SPT: 8 No. UD Samples: 0
Date Started: 2/4/92 Date Completed: 2/4/92 Logged By: JOEL MILLER Date Logged: 2/4/92
Hole Closure: GROUT

Depth (ft)	Elevation	Soil Description	SPT Values Blows/6" (N)	Comments
0	90.50			
5		Red-brown slightly clayey fine SAND.	6/13/21 (34)	
	84.50			
10		Red-brown clayey fine SAND.	4/4/6/8 (14)	
	79.50			DIKE FILL
15		Red-tan-gray clayey fine SAND.	10/13/17/17 (34)	
	74.50			
20		Tan-brown slightly clayey fine to medium SAND	4/3/4/5 (9)	
	67.50			
25		Brown-gray slightly silty fine to medium SAND (5" wood fragments at top of spoon).	2/8/11/12 (23)	
30		Brown-gray slightly silty fine to medium SAND with no wood fragments	4/6/7/7 (14)	
	58.50	Bottom of Dike Fill At 32'		
35		Soft Organic CLAY and SILT.		UD ATTEMPT @ 34-36'.NO SAMPLE.
	53.50			
40		Medium gray clayey fine SAND	1/1/1/1 (2)	
45	46.50	12" medium gray fine sandy CLAY.	WH/1/1/10 (11)	
	45.50	12" light gray silty CLAY.		
	44.90	3" orange-tan slightly clayey fine SAND.		
		Bottom of Hole @ 46'		

SS = Split Spoon; ST = Shelby Tube; D = Dennison; P = Pitcher; O = Other

while drilling / after drilling / after 24 hours

Hole No. APD-4

EXHIBIT GP-CR # 24

Southern Company Services, Inc.
Soil Boring Log

CONFIDENTIAL

HOLE No. APD-6

SHEET 1 OF 1

Project:	PLANT CRIST						
Location:	ASH POND DIKE						
Purpose:	STABILITY ANALYSIS						
Position:	E 1,112,893.9 N 578,922.7	Surface Elevation:	91.00				
Rig Type:	MOBLIE	Contractor:	PENSACOLA TESTING	Driller:	MATT & ROBERT		
Drilling Method:	WASH BORING	Boring Depth:	46.0	No. SPT:	8	No. UD Samples:	0
Date Started:	2/4/92	Date Completed:	2/4/92	Logged By:	JOEL MILLER	Date Logged:	2/4/92
Hole Closure:	GROUT						

Depth (ft)	Elevation	Soil Description	SPT Values Blows/6" (N)	Comments
0	91.00	Red-brown clayey fine SAND with occasional clay lense		
5			4/7/6/7 (13)	
	85.00	Brown-gray slightly clayey fine to medium SAND with occasional clay lense.		DIKE FILL
10			3/6/17/26 (43)	OCCASIONAL CLAY LENSES
15			10/13/14/18 (32)	
20			8/9/11/15 (26)	
	69.00	Tan-Medium gray clayey fine to medium SAND (may be very slightly organic).		
25			3/6/3/3 (6)	CLAY LENSE @ 25'
	64.00	Bottom of Dike Fill At 27'		BOTTOM OF DIKE @ 27'
30		Soft Organic CLAY and SILT		UD ATTEMPT @ 29-31'. NO SAMPLE.
	59.00	Medium gray clayey fine SAND to sandy CLAY with few wood fragments.		
35			WH/1/1/2 (3)	UD ATTEMPT @ 36-38'. NO SAMPLE.
40	52.00	Medium gray slightly clayey to slightly silty fine to medium SAND with very few wood fragments	2/1/2 (3)	
45			11/4/2/4 (6)	BOTTOM 8" OF HOLE SHOWED ORGANICS AND WOOD FRAGMENTS.
		Bottom of Hole @ 46'		

Column headings: WATER TABLE; DEPTH AND ELEVN. (FT); SYMBOLIC LOG; SOIL DESCRIPTION; SAMPLE: NUMBER, LEGEND, RECOVERY (%), SPT VALUES BLOWS/6" (N); COMMENTS; TEST RESULTS: MOISTURE CONTENT (%), LIQUID LIMIT (%), PLASTIC LIMIT (%), K (cm/s)

SS = Split Spoon; ST = Shelby Tube; D = Dennison; P = Pitcher; O = Other

while drilling / after drilling / after 24 hours

Hole No. **APD-6**

Southern Company Services, Inc.
Soil Boring Log

CONFIDENTIAL

Project: PLANT CRIST				HOLE No. APD-7	
Location: ASH POND DIKE					
Purpose: STABILITY ANALYSIS				SHEET 1 OF 1	
Position: E 1,112,664.4 N 579,207.2	Surface Elevation: 91.00				
Rig Type: MOBILE	Contractor: PENSACOLA TESTING		Driller: MATT & ROBERT		
Drilling Method: WASH BORING	Boring Depth: 46.0		No. SPT: 8	No. UD Samples: 1	
Date Started: 2/3/92	Date Completed: 2/3/92		Logged By: JOEL MILLER	Date Logged: 2/3/92	
Hole Closure: GROUT					

Water Table	Depth (ft)	Elevn. (ft)	Soil Description	Sample Number	Legend	Recovery (%)	SPT Values Blows/6" (N)	Comments	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	K (cm/s)
	0	91.00	Red-brown slightly clayey Fine to medium grained SAND.									
	5						4/7/10/10 (20)	DIKE FILL				
▼		85.00	Red-brown clayey SAND to sandy CLAY with some plastic clay lenses									
	10						7/8/14/19 (33)					
		80.00	Red-brown slightly clayey fine to medium grained SAND to tan clean SAND					UD ATTEMPT @ 11'. MATERIAL TOO HARD. NO SAMPLE				
	15	76.00					8/9/9/8 (17)	UD ATTEMPT @ 16'. OBTAINED 14-16" OF SAMPLE	14	NP	NP	SM
	20		Red-tan-gray slightly silty medium grained SAND with few small shells.				2/1/2/2 (4)					
		70.00										
	25		Medium gray slightly silty fine to medium grained SAND with lense of wood fragments				3/4/3/5 (8)	UD ATTEMPT @27.5'. TOO HARD (WOOD?). NO SAMPLE				
		64.00	^Bottom of Dike Fill at 27'									
	30		Soft Organic CLAY and SILT					UD ATTEMPT @29-31'.TOO SOFT. NO SAMPLE REDRILL HOLE TO 32'				
	35	57.00						UD ATTEMPT 32-34'. TOO SOFT. NO SAMPLE				
			Medium gray silty clayey fine SAND				1/2/1/0 (1)					
	40						0/1/2/3 (5)					
		50.00										
	45		Medium gray clayey fine to medium SAND				2/2/4/5 (9)					
			Bottom of Hole @ 46'									

SS = Split Spoon; ST = Shelby Tube; D = Dennison; P = Pitcher; O = Other

▽ while drilling ☑ after 24 hours

▼ 8.0 after drilling

Hole No. APD-7

GULF POWER COMPANY
FILE NAME: PLANT CRIST ASH POND DAM
FILE NUMBER: CRIST1D.DAT

CONFIDENTIAL

TEST NO. 1D-1

RECORD OF DILATOMETER TEST NO. 1D-1
USING DATA REDUCTION PROCEDURES IN MARCHETTI (ASCE,J-GED,MARCH 80)
KO IN SANDS DETERMINED USING SCHMERTMANN METHOD (1983)
PHI ANGLE CALCULATION BASED ON DURGUNOGLU AND MITCHELL (ASCE,RALEIGH CONF,JUNE 75)
PHI ANGLE NORMALIZED TO 2.72 BARS USING BALIGH'S EXPRESSION (ASCE,J-GED,NOV 76)
MODIFIED MAYNE AND KULHAWY FORMULA USED FOR OCR IN SANDS (ASCE,J-GED,JUNE 82)

LOCATION: ASH POND DAM
PERFORMED - DATE: 18 MARCH 1992
BY: GILLIAM

CALIBRATION INFORMATION:
DELTA A = .01 BARS DELTA B = .45 BARS GAGE 0 = .15 BARS GWT DEPTH= 1.85 M
ROD DIA.= 3.70 CM FR.RED.DIA.= 5.40 CM ROD WT.= 6.50 KG/M DELTA/PHI= .50 BLADE T=15.00 MM

1 BAR = 1.019 KG/CM2 = 1.044 TSF = 14.51 PSI ANALYSIS USES H2O UNIT WEIGHT = 1.000 T/M3

DEPTH (ft)	Z (M) *****	THRUST (KG) ******	A (BAR) *****	B (BAR) *****	ED (BAR) *****	ID *****	KD *****	UO (BAR) ******	GAMMA (T/M3) ******	SV (BAR) ******	PC (BAR) *****	OCR *****	KO *****	CU (BAR) *****	PHI (DEG) *****	M (BAR) ******	SOIL TYPE ***********	
20.5'	6.30	125.	.60	1.80	26.	31.76	.39	.437	1.700	.060	.00	.08	.11		36.6	21.8	SAND	
									P01 =	.42	PO =	.46	P1 =	1.20				
	6.60	110.	.90	3.00	60.	8.13	2.63	.466	1.700	.081	.13	1.64	.53		31.4	20.0	SAND	φ=31°
	6.90	225.	1.15	4.50	105.	8.20	3.65	.496	1.700	.101	.24	2.33	.61		33.9	171.2	SAND	C=0 psi
	7.20	300.	1.85	4.05	63.	1.66	9.12	.525	1.600	.120	1.45	12.05	1.34		30.9	152.9	SANDY SILT	
	7.50	750.	2.20	6.80	151.	3.35	9.21	.554	1.800	.141	1.41	10.02	1.20		37.2	366.3	SAND	
27.3'	8.40	300.	1.00	1.75	11.	1.50	1.02	.643	1.500	.198	.11	.57	.32		33.9	9.0	MUD	
	8.70	200.	1.30	2.10	12.	.76	2.19	.672	1.600	.215	.25	1.16	.60	.053		11.9	CLAYEY SILT	
	9.00	220.	1.80	2.70	16.	.49	4.03	.702	1.600	.232	.39	2.99	.99	.123		25.2	SILTY CLAY	
	9.30	220.	1.80	2.80	20.	.63	3.61	.731	1.600	.250	.63	2.51	.91	.115		28.7	CLAYEY SILT	
	9.60	250.	2.30	3.20	16.	.34	5.15	.761	1.600	.268	1.17	4.37	1.19	.192		29.2	CLAY	C=135psi
31.2'																		
	10.20	2000.	2.80	14.20	399.	8.88	4.19	.819	1.800	.309	.42	1.37	.41		42.6	695.3	SAND	
	10.50	220.	1.40	2.20	12.	.91	1.20	.849	1.600	.329	.15	.45	.30			10.5	SILT	
	10.80	140.	1.10	2.35	29.	19.66	.12	.878	1.700	.349	.20	.56	.40		26.5	24.5	SAND	φ=27°
	11.10	150.	1.10	2.10	20.	22.46	.07	.908	1.700	.369	.20	.54	.39		26.6	16.7	SAND	C=0
	11.40	200.	1.10	2.75	41.	52.18	.06	.937	1.700	.390	.19	.48	.35		28.1	35.1	SAND	
									P01 =	.90	P0 =	.96	P1 =	2.15				
38.0'	11.70	500.	3.75	11.40	262.	3.31	5.53	.967	1.900	.413	2.48	6.00	1.01		28.2	520.0	SAND	
	12.00	1650.	4.20	11.00	231.	2.42	6.25	.996	1.900	.440	2.32	5.27	.88		37.6	479.0	SILTY SAND	
	12.30	1600.	4.70	12.55	269.	2.45	6.79	1.026	1.900	.466	2.98	6.39	.98		36.7	578.8	SILTY SAND	
41.9'	12.60	1200.	3.75	9.00	175.	2.17	4.70	1.055	1.900	.493	1.81	3.67	.76		35.4	314.7	SILTY SAND	φ=36°
	12.90	2600.	4.50	17.50	457.	4.97	5.10	1.084	1.900	.519	1.57	3.02	.65		40.7	375.1	SAND	C=0 ps

END OF SOUNDING

FILE NAME: PLANT CRIST ASH POND DAM
FILE NUMBER: CRIST2D.DAT

RECORD OF DILATOMETER TEST NO. 2D-1
USING DATA REDUCTION PROCEDURES IN MARCHETTI (ASCE,J-GED,MARCH 80)
KO IN SANDS DETERMINED USING SCHMERTMANN METHOD (1983)
PHI ANGLE CALCULATION BASED ON DURGUNOGLU AND MITCHELL (ASCE,RALEIGH CONF,JUNE 75)
PHI ANGLE NORMALIZED TO 2.72 BARS USING BALIGH'S EXPRESSION (ASCE,J-GED,NOV 76)
MODIFIED MAYNE AND KULHAWY FORMULA USED FOR OCR IN SANDS (ASCE,J-GED,JUNE 82)

LOCATION: ASH POND DAM
PERFORMED - DATE: 18 MARCH 1992
BY: GILLIAM

CONFIDENTIAL

CALIBRATION INFORMATION:
DELTA A = .01 BARS DELTA B = .45 BARS GAGE 0 = .15 BARS GWT DEPTH= 1.85 M
ROD DIA.= 3.70 CM FR.RED.DIA.= 5.40 CM ROD WT.= 6.50 KG/M DELTA/PHI= .50 BLADE T=15.00 MM

1 BAR = 1.019 KG/CM2 = 1.044 TSF = 14.51 PSI ANALYSIS USES H2O UNIT WEIGHT = 1.000 T/M3

DEPTH (ft)	Z (M) *****	THRUST (KG) ******	A (BAR) *****	B (BAR) *****	ED (BAR) *****	ID . *****	KD *****	UO (BAR) ******	GAMMA (T/M3) ******	SV (BAR) ******	PC (BAR) *****	OCR *****	KO *****	CU (BAR) *****	PHI (DEG) *****	M (BAR) ******	SOIL TYPE ***********	
20.5'	6.30	190.	1.00	2.95	54.	4.49	5.81	.437	1.700	.060	.27	4.55	.82		34.7	110.1	SAND	
	6.60	360.	1.65	5.50	124.	4.07	10.85	.466	1.700	.081	1.17	14.54	1.44		34.5	318.3	SAND	ϕ=34°
	6.90	525.	1.75	5.30	113.	3.38	9.35	.496	1.800	.103	1.07	10.38	1.22		36.5	274.9	SAND	C=0psf
23.4'	7.20	375.	1.55	4.60	94.	3.60	6.05	.525	1.700	.125	.65	5.22	.89		34.5	194.8	SAND	
	7.50	200.	1.35	3.10	47.	2.29	4.07	.554	1.700	.145	.48	3.32	.76		30.0	78.8	SILTY SAND	ϕ=25°
	7.80	135.	1.55	2.20	7.	.24	5.01	.584	1.500	.163	.68	4.19	1.16	.113		12.4	MUD	
	8.10	125.	1.45	2.95	38.	1.69	3.60	.613	1.600	.179	.60	3.38	.81		25.1	57.8	SANDY SILT	C=0psf
27.3'	8.40	305.	1.80	4.20	71.	2.21	4.64	.643	1.700	.198	.80	4.05	.83		30.5	126.8	SILTY SAND	
	8.70	660.	2.15	5.45	103.	2.49	5.42	.672	1.800	.220	.96	4.33	.81		35.5	201.6	SILTY SAND	
	9.00	725.	2.00	5.00	93.	2.59	4.25	.702	1.700	.243	.67	2.78	.65		36.4	160.5	SILTY SAND	
	9.30	825.	2.80	8.50	191.	3.30	6.30	.731	1.800	.265	1.50	5.68	.93		35.4	400.7	SAND	ϕ=35°
31.2'	9.60	900.	4.40	11.05	226.	2.04	11.01	.761	1.900	.290	4.91	16.95	1.56		32.7	584.4	SILTY SAND	C=0psf
	9.90	1200.	6.25	10.00	120.	.67	16.38	.790	1.800	.315	8.37	26.60	2.48	.959		355.7	CLAYEY SILT	
	10.20	520.	3.75	9.35	187.	2.13	7.46	.819	1.900	.340	3.27	9.62	1.23		28.4	417.4	SILTY SAND	
	10.50	745.	3.90	11.60	264.	2.98	6.96	.849	1.900	.366	2.85	7.79	1.11		31.7	576.4	SILTY SAND	ϕ=29°
	10.80	950.	2.80	7.65	160.	2.95	3.99	.878	1.800	.391	1.08	2.77	.66		35.6	271.9	SILTY SAND	C=0psf
1'	11.10	500.	2.35	4.70	69.	1.64	2.93	.908	1.600	.412	.92	2.22	.64		30.9	91.3	SANDY SILT	
	11.40	350.	3.15	4.75	42.	.59	4.68	.937	1.700	.431	1.62	3.76	1.11	.274		71.5	SILTY CLAY	
	11.70	240.	2.70	4.60	52.	.99	3.38	.967	1.600	.450	1.02	2.27	.86			74.3	SILT	
	12.00	230.	2.65	4.10	36.	.71	3.13	.996	1.600	.468	.94	2.01	.81	.180		47.5	CLAYEY SILT	
	12.30	275.	3.20	5.05	51.	.74	4.04	1.026	1.700	.487	1.46	2.99	.99	.258		79.9	CLAYEY SILT	
	12.60	210.	3.25	4.80	40.	.57	3.94	1.055	1.700	.507	1.46	2.88	.97	.261		61.4	SILTY CLAY	
	12.90	190.	3.50	4.55	21.	.28	4.27	1.084	1.600	.527	1.72	3.26	1.03	.299		35.0	CLAY	C=275ps
	13.20	195.	3.85	5.20	32.	.37	4.68	1.114	1.700	.546	2.05	3.76	1.11	.347		55.8	SILTY CLAY	
	13.50	200.	3.95	5.25	31.	.34	4.63	1.143	1.700	.566	2.10	3.71	1.10	.356		52.4	CLAY	
	13.80	400.	3.35	5.15	49.	.71	3.36	1.173	1.700	.587	1.32	2.24	.86	.247		67.8	CLAYEY SILT	
45.8'	14.10	2100.	2.00	11.50	329.	46.11	.34	1.202	1.700	.608						280.0	SAND	

END OF SOUNDING

[illegible] TEST NO. 3D-1

FILE NAME: PLANT CRIST ASH POND DAM
FILE NUMBER: CRIST3D.DAT

CONFIDENTIAL

RECORD OF DILATOMETER TEST NO. 3D-1
USING DATA REDUCTION PROCEDURES IN MARCHETTI (ASCE,J-GED,MARCH 80)
KO IN SANDS DETERMINED USING SCHMERTMANN METHOD (1983)
PHI ANGLE CALCULATION BASED ON DURGUNOGLU AND MITCHELL (ASCE,RALEIGH CONF,JUNE 75)
PHI ANGLE NORMALIZED TO 2.72 BARS USING BALIGH'S EXPRESSION (ASCE,J-GED,NOV 76)
MODIFIED MAYNE AND KULHAWY FORMULA USED FOR OCR IN SANDS (ASCE,J-GED,JUNE 82)

CONFIDENTIAL

LOCATION: ASH POND DAM
PERFORMED - DATE: 17 MARCH 1992
BY: GILLIAM

CALIBRATION INFORMATION:
DELTA A = .02 BARS DELTA B = .35 BARS GAGE 0 = .15 BARS GWT DEPTH= 2.00 M
ROD DIA.= 3.70 CM FR.RED.DIA.= 5.40 CM ROD WT.= 6.50 KG/M DELTA/PHI= .50 BLADE T=15.00 MM

1 BAR = 1.019 KG/CM2 = 1.044 TSF = 14.51 PSI ANALYSIS USES H2O UNIT WEIGHT = 1.000 T/M3

DEPTH (ft)	Z (M) *****	THRUST (KG) ******	A (BAR) *****	B (BAR) *****	ED (BAR) *****	ID *****	KD *****	UO (BAR) ******	GAMMA (T/M3) ******	SV (BAR) ******	PC (BAR) *****	OCR *****	KO *****	CU (BAR) *****	PHI (DEG) *****	M (BAR) ******	SOIL TYPE ***********	
19.5'	6.00	75.	.60	1.70	27.	18.71	.68	.393	1.700	.060	.02	.34	.24		33.1	22.6	SAND	
	6.30	400.	1.25	4.65	110.	5.82	6.78	.422	1.700	.081	.43	5.32	.86		37.4	238.7	SAND	ϕ=33°
	6.60	380.	1.60	5.15	116.	3.88	8.49	.451	1.700	.101	.95	9.36	1.17		34.5	273.2	SAND	C=0 psf
	6.90	710.	1.45	4.65	103.	4.26	5.73	.481	1.700	.122	.60	4.96	.88		33.4	207.8	SAND	
	7.20	305.	1.30	4.25	94.	5.10	3.73	.510	1.700	.142	.36	2.50	.64		33.7	154.4	SAND	
	7.50	195.	1.20	3.62	75.	5.03	2.62	.540	1.700	.163	.30	1.84	.58		30.3	99.9	SAND	
23.4'	7.80	450.	1.65	4.75	99.	3.52	4.43	.569	1.700	.184	.59	3.23	.71		34.4	178.4	SAND	
	8.10	600.	6.15	9.90	123.	.68	25.53	.599	1.800	.206	10.93	53.14	3.19	1.092		417.2	CLAYEY SILT	
	8.40	300.	4.25	5.70	39.	.33	15.09	.628	1.700	.228	5.33	23.40	2.36	.627		113.7	CLAY	C=625ps
28.3'	8.70	230.	4.10	5.95	54.	.48	13.04	.658	1.700	.248	4.63	18.62	2.16	.569		148.3	SILTY CLAY	
	9.00	720.	1.80	8.20	220.	9.29	2.52	.687	1.800	.271	.32	1.20	.43		37.0	286.2	SAND	
	9.30	1100.	2.90	10.00	245.	4.12	5.84	.716	1.800	.294	1.35	4.60	.83		37.3	498.4	SAND	
	9.60	1060.	2.70	9.55	236.	4.54	4.72	.746	1.800	.318	1.03	3.23	.70		37.2	436.4	SAND	ϕ=37°
	9.90	975.	2.45	8.58	210.	4.81	3.68	.775	1.800	.341	.76	2.22	.59		36.9	342.6	SAND	C=0 psf
33.2'	10.20	700.	2.05	5.95	129.	3.95	2.57	.805	1.800	.365	.56	1.54	.51		34.8	169.9	SAND	
	10.50	575.	2.35	7.05	158.	3.89	3.01	.834	1.800	.388	.84	2.16	.62		32.3	230.0	SAND	
	10.80	560.	2.20	5.95	123.	3.42	2.52	.864	1.800	.412	.72	1.74	.57		32.2	160.4	SAND	ϕ=30°
	11.10	450.	2.05	5.25	103.	3.36	2.04	.893	1.700	.434	.65	1.49	.54		30.6	115.4	SAND	C=0 ps
	11.40	435.	2.15	5.35	103.	3.11	2.10	.922	1.700	.455	.72	1.58	.57		29.9	118.2	SILTY SAND	
38.0'	11.70	400.	2.15	4.10	58.	1.68	2.09	.952	1.600	.474	.78	1.65	.59		29.0	57.8	SANDY SILT	
	12.00	320.	2.40	3.55	28.	.66	2.54	.981	1.600	.491	.71	1.46	.68	.146		31.3	CLAYEY SILT	
	12.30	255.	3.15	4.55	38.	.55	3.85	1.011	1.600	.509	1.41	2.77	.96	.254		57.1	SILTY CLAY	C=340ps
	12.60	255.	3.45	4.45	23.	.29	4.27	1.040	1.600	.527	1.72	3.26	1.03	.299		37.4	CLAY	
	12.90	215.	4.00	5.60	45.	.47	5.02	1.070	1.700	.546	2.29	4.20	1.16	.379		80.4	SILTY CLAY	
	13.20	245.	4.15	6.00	54.	.55	5.03	1.099	1.700	.566	2.38	4.21	1.17	.394		96.8	SILTY CLAY	
43.9'	13.50	275.	3.95	5.60	47.	.51	4.48	1.129	1.700	.587	2.06	3.51	1.07	.354		78.2	SILTY CLAY	
	13.80	390.	3.20	6.40	103.	1.68	2.91	1.158	1.700	.608	1.70	2.79	.78		25.7	136.4	SANDY SILT	
	14.10	2100.	3.50	10.60	245.	3.83	2.92	1.187	1.900	.631	.84	1.34	.44		39.5	351.2	SAND	

END OF SOUNDING

FILE NAME: PLANT CRIST ASH POND DAM
FILE NUMBER: CRIST5D.DAT

RECORD OF DILATOMETER TEST NO. 5D-1
USING DATA REDUCTION PROCEDURES IN MARCHETTI (ASCE,J-GED,MARCH 80)
KO IN SANDS DETERMINED USING SCHMERTMANN METHOD (1983)
PHI ANGLE CALCULATION BASED ON DURGUNOGLU AND MITCHELL (ASCE,RALEIGH CONF,JUNE 75)
PHI ANGLE NORMALIZED TO 2.72 BARS USING BALIGH'S EXPRESSION (ASCE,J-GED,NOV 76)
MODIFIED MAYNE AND KULHAWY FORMULA USED FOR OCR IN SANDS (ASCE,J-GED,JUNE 82)

CONFIDENTIAL

LOCATION: ASH POND DAM
PERFORMED - DATE: 17 MARCH 1992
BY: GILLIAM

CALIBRATION INFORMATION:
DELTA A = .02 BARS   DELTA B = .35 BARS   GAGE 0 = .15 BARS   GWT DEPTH= 2.00 M
ROD DIA.= 3.70 CM   FR.RED.DIA.= 5.40 CM   ROD WT.= 6.50 KG/M   DELTA/PHI= .50   BLADE T=15.00 MM

1 BAR = 1.019 KG/CM2 = 1.044 TSF = 14.51 PSI   ANALYSIS USES H2O UNIT WEIGHT = 1.000 T/M3

DEPTH (ft)	Z (M)	THRUST (KG)	A (BAR)	B (BAR)	ED (BAR)	ID	KD	UO (BAR)	GAMMA (T/M3)	SV (BAR)	PC (BAR)	OCR	KO	CU (BAR)	PHI (DEG)	M (BAR)	SOIL TYPE	
	*****	******	*****	*****	*****	*****	*****	******	******	******	*****	*****	*****	*****	*****	******	***********	
19.5'	6.00	1350.	6.80	12.80	205.	.99	99.93	.393	1.950	.060	26.80	*****	6.60			959.9	SILT	
	6.30	1700.	5.85	17.50	411.	2.50	53.37	.422	2.000	.089	28.24	*****	6.52		35.9	1679.1	SILTY SAND	
	6.60	950.	4.35	10.30	203.	1.68	30.29	.451	1.800	.115	13.20	*****	3.83		33.3	721.6	SANDY SILT	ϕ=34°
	6.90	1500.	1.60	4.60	96.	3.22	6.25	.481	1.700	.137	.25	1.85	.46		44.3	200.4	SILTY SAND	
	7.20	325.	2.80	5.05	68.	.96	13.08	.510	1.700	.158	2.96	18.73	2.17			188.7	SILT	C=0 psf
24.4'	7.50	550.	2.50	4.95	76.	1.27	9.67	.540	1.700	.178	2.32	12.97	1.38		32.8	187.0	SANDY SILT	
	7.80	700.	3.31	5.10	52.	.59	12.76	.569	1.700	.199	3.58	18.00	2.13	.444		141.3	SILTY CLAY	C=390 p
26.3'	8.10	375.	2.85	4.40	43.	.60	9.39	.599	1.700	.220	2.45	11.16	1.77	.334		104.7	CLAYEY SILT	
	8.40	1070.	4.05	13.10	316.	3.19	11.75	.628	1.900	.243	4.28	17.59	1.59		35.2	838.9	SILTY SAND	
	8.70	1075.	3.35	10.00	229.	2.93	8.34	.658	1.900	.270	2.44	9.05	1.15		36.2	535.7	SILTY SAND	
	9.00	1000.	4.25	11.00	232.	2.15	10.51	.687	1.900	.296	4.47	15.09	1.48		33.7	592.1	SILTY SAND	ϕ=34°
	9.30	935.	3.10	8.60	187.	2.70	6.22	.716	1.800	.321	1.83	5.69	.93		35.1	388.3	SILTY SAND	
31.2'	9.60	805.	2.80	8.30	187.	3.23	4.84	.746	1.800	.345	1.34	3.89	.79		34.4	349.3	SILTY SAND	C=0 psf
	9.90	740.	3.75	9.20	185.	2.06	7.00	.775	1.900	.370	2.93	7.92	1.12		31.5	401.4	SILTY SAND	ϕ=31°
33.2'	10.20	465.	2.20	4.75	79.	1.98	2.94	.805	1.700	.393	.88	2.25	.65		30.5	107.6	SILTY SAND	C=0 psf
	10.50	310.	2.50	3.95	39.	.77	3.59	.834	1.600	.413	1.03	2.49	.91	.189		57.5	CLAYEY SILT	
1'	10.80	250.	2.40	3.60	30.	.64	3.17	.864	1.600	.430	.88	2.05	.82	.168		40.1	CLAYEY SILT	C=200 ps
	11.10	285.	1.55	2.85	34.	2.03	1.07	.893	1.700	.449	.45	1.00	.49		28.0	28.8	SILTY SAND	
	11.40	380.	1.50	3.30	52.	3.99	.80	.922	1.700	.470	.34	.73	.40		30.3	44.3	SAND	
	11.70	700.	1.70	6.00	143.	9.79	.86	.952	1.700	.491	.27	.55	.32		34.5	121.7	SAND	
	12.00	1050.	4.25	10.60	218.	2.21	5.52	.981	1.900	.514	2.65	5.15	.91		33.3	425.7	SILTY SAND	ϕ=31°
	12.30	960.	3.90	9.90	205.	2.39	4.58	1.011	1.900	.541	2.11	3.91	.81		32.9	367.4	SILTY SAND	
	12.60	920.	3.45	9.23	197.	2.83	3.54	1.040	1.900	.567	1.52	2.68	.68		33.1	312.8	SILTY SAND	C=0 psf
	12.90	760.	3.05	7.95	165.	2.93	2.74	1.070	1.800	.592	1.19	2.01	.61		32.0	226.2	SILTY SAND	
	13.20	650.	3.05	7.70	156.	2.80	2.61	1.099	1.800	.616	1.24	2.01	.63		30.5	205.1	SILTY SAND	
43.9'	13.50	400.	2.20	4.85	83.	2.89	1.30	1.129	1.700	.638	.76	1.19	.54		27.9	70.6	SILTY SAND	
	13.80	500.	2.35	3.60	32.	.91	1.55	1.158	1.600	.657	.44	.67	.42			27.3	SILT	
	14.10	530.	3.40	5.00	45.	.64	2.99	1.187	1.700	.676	1.27	1.87	.78	.246		56.7	CLAYEY SILT	
	14.40	310.	3.40	4.50	27.	.38	2.90	1.217	1.600	.695	1.24	1.79	.76	.243		32.8	SILTY CLAY	C=275 p
	14.70	255.	3.65	4.85	30.	.39	3.13	1.246	1.600	.713	1.43	2.01	.81	.275		39.6	SILTY CLAY	
	15.00	350.	3.70	5.20	41.	.53	3.06	1.276	1.700	.732	1.42	1.94	.80	.274		52.9	SILTY CLAY	
49.7'	15.30	375.	3.80	5.20	38.	.47	3.07	1.305	1.700	.753	1.47	1.96	.80	.283		48.4	SILTY CLAY	
	15.60	1030.	4.45	13.00	298.	3.33	3.32	1.335	1.900	.776	2.02	2.61	.69		32.1	459.6	SAND	ϕ=32°
	15.90	1025.	4.30	13.00	304.	3.66	2.98	1.364	1.900	.803	1.82	2.26	.65		32.1	439.3	SAND	C=0 psf
52.7'	16.20	750.	2.80	5.80	96.	2.41	1.38	1.394	1.800	.828	.89	1.07	.48		31.1	81.5	SILTY SAND	

END OF SOUNDING

GULF POWER COMPANY

FILE NAME: PLANT CRIST ASH POND DAM

FILE NUMBER: CRIST7D.DAT

CONFIDENTIAL

TEST NO. 7D-1

RECORD OF DILATOMETER TEST NO. 7D-1
USING DATA REDUCTION PROCEDURES IN MARCHETTI (ASCE,J-GED,MARCH 80)
KO IN SANDS DETERMINED USING SCHMERTMANN METHOD (1983)
PHI ANGLE CALCULATION BASED ON DURGUNOGLU AND MITCHELL (ASCE,RALEIGH CONF.JUNE 75)
PHI ANGLE NORMALIZED TO 2.72 BARS USING BALIGH'S EXPRESSION (ASCE,J-GED,NOV 76)
MODIFIED MAYNE AND KULHAWY FORMULA USED FOR OCR IN SANDS (ASCE,J-GED,JUNE 82)

LOCATION: ASH POND DAM
PERFORMED - DATE: 16 MARCH 1992
BY: GILLIAM

CALIBRATION INFORMATION:
DELTA A = .02 BARS   DELTA B = .35 BARS   GAGE 0 = .15 BARS   GWT DEPTH= 2.00 M
ROD DIA.= 3.70 CM   FR.RED.DIA.= 5.40 CM   ROD WT.= 6.50 KG/M   DELTA/PHI= .50   BLADE T=15.00 MM

1 BAR = 1.019 KG/CM2 = 1.044 TSF = 14.51 PSI   ANALYSIS USES H2O UNIT WEIGHT = 1.000 T/M3

DEPTH (ft)	Z (M) *****	THRUST (KG) ******	A (BAR) *****	B (BAR) *****	ED (BAR) *****	ID *****	KD *****	UO (BAR) ******	GAMMA (T/M3) ******	SV (BAR) ******	PC (BAR) *****	OCR *****	KO *****	CU (BAR) *****	PHI (DEG) *****	M (BAR) ******	SOIL TYPE ***********	
13.0'	4.00	130.	.70	3.45	87.	9.81	4.25	.196	1.700	.060	.18	2.98	.67		32.6	152.3	SAND	
	4.30	145.	.60	2.15	43.	6.69	2.30	.226	1.700	.081	.10	1.25	.46		33.0	52.6	SAND	ϕ=33°
	4.60	1000.	3.81	11.20	256.	2.40	29.51	.255	1.900	.104	10.71	*****	3.70		34.7	901.5	SILTY SAND	C=0 psf
	4.90	1925.	12.00	40.05	1009.	2.85	75.94	.285	2.150	.134	*****	*****	9.38		30.6	4457.1	SILTY SAND	
	5.20	1100.	3.95	10.70	232.	2.10	19.37	.314	1.900	.165	7.44	45.19	2.49		35.1	726.7	SILTY SAND	
17.9'	5.50	650.	2.25	7.75	187.	3.54	8.02	.343	1.800	.190	1.66	8.76	1.14		34.6	431.4	SAND	
	5.80	200.	1.05	2.20	28.	1.61	2.42	.373	1.600	.210	.39	1.84	.60		28.4	72.4	SANDY SILT	
	6.10	300.	1.05	4.30	105.	8.09	1.63	.402	1.700	.229	.24	1.04	.44		31.9	97.0	SAND	ϕ=31°
	6.40	285.	.70	4.12	106.	22.07	.55	.432	1.700	.250	.12	.48	.31		32.2	90.0	SAND	
									POI =	.42	PO =	.57	P1 =	3.62				C=0 psf
21.8'	6.70	250.	.87	4.14	106.	22.76	.49	.461	1.700	.271	.14	.52	.34		30.8	89.8	SAND	
	7.00	650.	1.05	8.45	256.	94.85	.27	.491	1.700	.291	.04	.12	.14		37.8	217.7	SAND	
	7.30	900.	1.05	4.05	96.	10.29	.86	.520	1.700	.312	.06	.19	.17		39.2	81.5	SAND	
	7.60	1200.	3.70	13.00	325.	3.64	7.68	.550	1.900	.335	2.68	8.00	1.09		35.9	738.7	SAND	ϕ=36°
25.7'	7.90	650.	2.10	8.55	222.	5.87	3.02	.579	1.800	.360	.73	2.02	.59		33.7	323.2	SAND	C=0 psf
	8.20	450.	2.90	4.65	50.	.69	5.47	.608	1.700	.382	1.84	4.81	1.24	.296		94.8	CLAYEY SILT	
	8.50	350.	3.40	5.09	48.	.54	6.37	.638	1.700	.403	2.45	6.09	1.37	.377		98.0	SILTY CLAY	
	8.80	325.	4.00	5.85	54.	.50	7.39	.667	1.700	.424	3.25	7.68	1.52	.477		118.1	SILTY CLAY	C=385
	9.10	335.	3.45	4.85	38.	.42	5.79	.697	1.700	.444	2.33	5.25	1.29	.369		72.8	SILTY CLAY	
30.6'	9.40	340.	3.45	4.50	25.	.28	5.52	.726	1.600	.463	2.26	4.88	1.25	.363		46.9	CLAY	
	9.70	320.	2.40	3.25	17.	.34	3.10	.756	1.600	.481	.95	1.98	.81	.183		22.7	CLAY	
	10.00	335.	1.90	2.65	14.	.41	1.94	.785	1.600	.499	.47	.95	.53	.105		11.8	SILTY CLAY	
	10.30	370.	2.05	2.70	10.	.27	2.12	.815	1.500	.515	.56	1.10	.58	.122		9.3	MUD	C=115 psf
24.5'	10.60	360.	1.80	2.41	9.	.31	1.54	.844	1.500	.530	.35	.66	.41	.084		7.4	MUD	
	10.90	465.	1.25	2.15	19.	2.53	.40	.873	1.700	.547	.29	.52	.34		31.2	16.4	SILTY SAND	
	11.20	500.	1.20	2.35	28.	6.39	.23	.903	1.700	.568	.25	.43	.31		31.8	24.2	SAND	
	11.50	575.	1.24	1.95	12.	2.22	.27	.932	1.700	.588	.25	.42	.30		32.5	10.5	SILTY SAND	
	11.80	650.	1.30	3.80	78.	21.98	.17	.962	1.700	.609	.22	.35	.28		33.4	66.0	SAND	
	12.10	1030.	3.75	10.40	229.	2.85	3.66	.991	1.900	.633	1.78	2.82	.70		33.1	370.0	SILTY SAND	
	12.40	1130.	3.50	9.80	216.	3.03	3.11	1.021	1.900	.659	1.43	2.17	.62		34.1	321.2	SILTY SAND	
	12.70	1170.	3.65	10.10	222.	2.95	3.16	1.050	1.900	.686	1.53	2.23	.62		34.1	331.2	SILTY SAND	ϕ=33°
	13.00	1240.	3.60	9.90	216.	2.97	2.94	1.079	1.900	.712	1.42	1.99	.59		34.5	310.0	SILTY SAND	C=0 psf
	13.30	1210.	3.45	9.72	215.	3.23	2.59	1.109	1.900	.739	1.26	1.71	.55		34.4	285.5	SILTY SAND	
	13.60	1185.	3.60	10.10	223.	3.18	2.65	1.138	1.900	.765	1.38	1.80	.57		33.9	300.5	SILTY SAND	
	13.90	1120.	3.50	9.65	211.	3.17	2.42	1.168	1.800	.790	1.31	1.66	.55		33.5	267.1	SILTY SAND	
46.2'	14.20	1070.	3.50	9.65	211.	3.22	2.32	1.197	1.800	.814	1.31	1.62	.55		33.0	258.8	SILTY SAND	

END OF SOUNDING

CONFIDENTIAL

Southern Company Services
Soil Testing for Plant Crist
Fill Material

April 20, 1992

Mr. Joel Miller

Mr. Ray Halbert
Alabama Power Company
PGTS - Civil

Enclosed are the test results for the soil sample delivered to the Central Laboratory on March 30, 1992. Performed test included gradation, hydrometer, specific gravity, Atterberg Limits, soil classification and Consolidated-Undrained (R) triaxial test.

Laboratory soil sample #1, represents fill material from location APD-7 from a depth of 16.0' to 18.0' This sample was classified as a light brown well graded sand with silt or SW-SM by the Unified Soil Classification System. Specific gravity was 2.62. Atterberg Limits were non-applicable. Consolidated-Undrained (R) triaxial test were performed on UD sample with 1 and 2.5 ksf load. The total stress angle of internal friction was 24.5 degrees with a cohesion factor of .3 ksf and the effective stress angle of internal friction was 35.5 degrees with a cohesion of 0.0 ksf. Gradation for the sample was as follows:

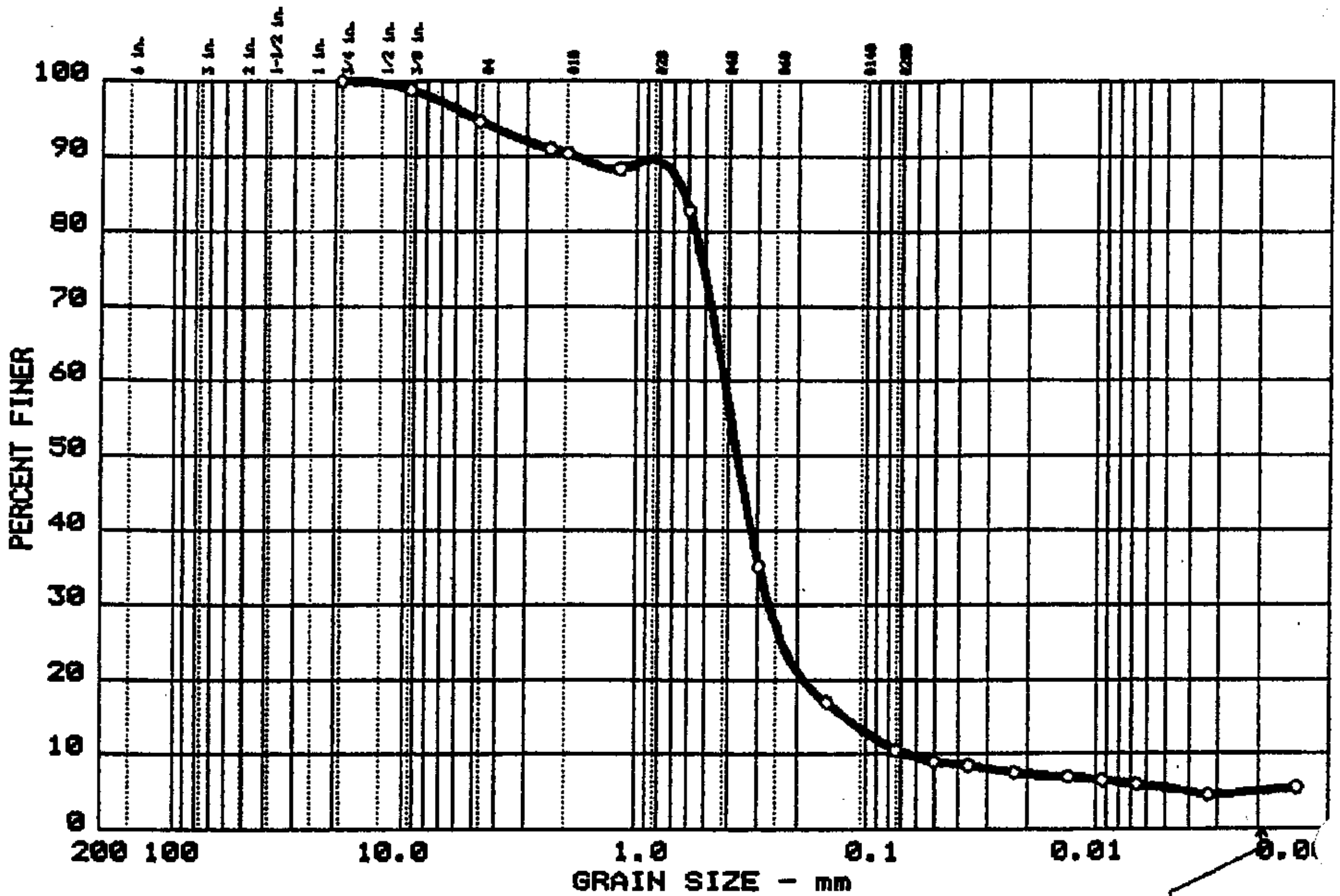
Sieve Size:	% Passing:
3/4 in.	100.0
3/8 in.	98.9
#4	94.6
#8	91.0
#10	90.0
#16	88.3
#30	82.8
#50	35.1
#100	16.9
#200	10.5

If you have any questions about the test performed or if we can be of any further assistance to you please contact me at extension 8-255-6266.

Ray Halbert
Alabama Power Company
Supervisor/Concrete and Soils

CONFIDENTIAL

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	1	0.0	5.4	84.1	10.5	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	0.62	0.42	0.37	0.269	0.1229	0.0652	2.65	6.4

MATERIAL DESCRIPTION	USCS	AASHTO
○ LIGHT BROWN WELL GRADED SAND W/SILT	SW-SM	A-2-4(0.4)

Project No.: 1
Project: PLANT CRIST
○ Location: APD-7

Date: 04-16-92

Remarks:
BORNING-FILL MILT.
DEPTH(ft)-16.0-18.0
TEST BY-SDM LSJ

ALABAMA POWER COMPANY

Figure No.1

DATE: 04/16/92

CONFIDENTIAL

ALABAMA POWER COMPANY
TRIAXIAL SHEAR TEST DATA
CONSOLIDATED-UNDRAINED (R) TEST

Project PLANT CRIST — Lab No. 1

Job FILL MATERIAL — Job Date 03/30/92

Sample Location APD-7 — Depth

SOIL DESCRIPTION: LIGHT BROWN WELL GRADED SAND W/SILT

SOIL CLASSIFICATION: SW-SM LL = NP PI = NP SPECIFIC GRAVITY = 2.62

RECEIVED ON 03/30/92

REPORTED ON 04/16/92

REMARKS:

MINOR PRINCIPAL STRESS	(KSF)	0.99	2.51	0.00
INITIAL CONDITIONS				
WATER CONTENT	(%)	14.0	14.6	0.0
DRY DENSITY	(PCF)	104.1	109.7	0.0
SATURATION	(%)	64.2	78.0	0.0
VOID RATIO	-	0.571	0.491	0.000
DIAMETER	(IN.)	1.400	1.400	0.000
HEIGHT	(IN.)	3.000	3.000	0.000
BEFORE SHEAR				
WATER CONTENT	(%)	21.8	18.7	0.0
DRY DENSITY	(PCF)	104.8	115.3	0.0
SATURATION	(%)	100.0	100.0	0.0
VOID RATIO	-	0.561	0.418	0.000
BACK PRESSURE	(KSF)	12.96	12.96	0.00
RATE OF STRAIN	(%/MIN)	0.130	0.130	0.000

	TOTAL STRESS	EFFECTIVE STRESS (MOHR)	EFFECTIVE STRESS (P-Q)
COHESION C (KSF) =	.3	0.0	
ANGLE OF INTERNAL FRICTION (DEGREES)	24.5	35.5	

ALABAMA POWER COMPANY — CONSOLIDATED-UNDRAINED (R) TRIAXIAL TEST DATA

CONFIDENTIAL

MINOR PRINCIPAL STRESS, KSF: 0.99

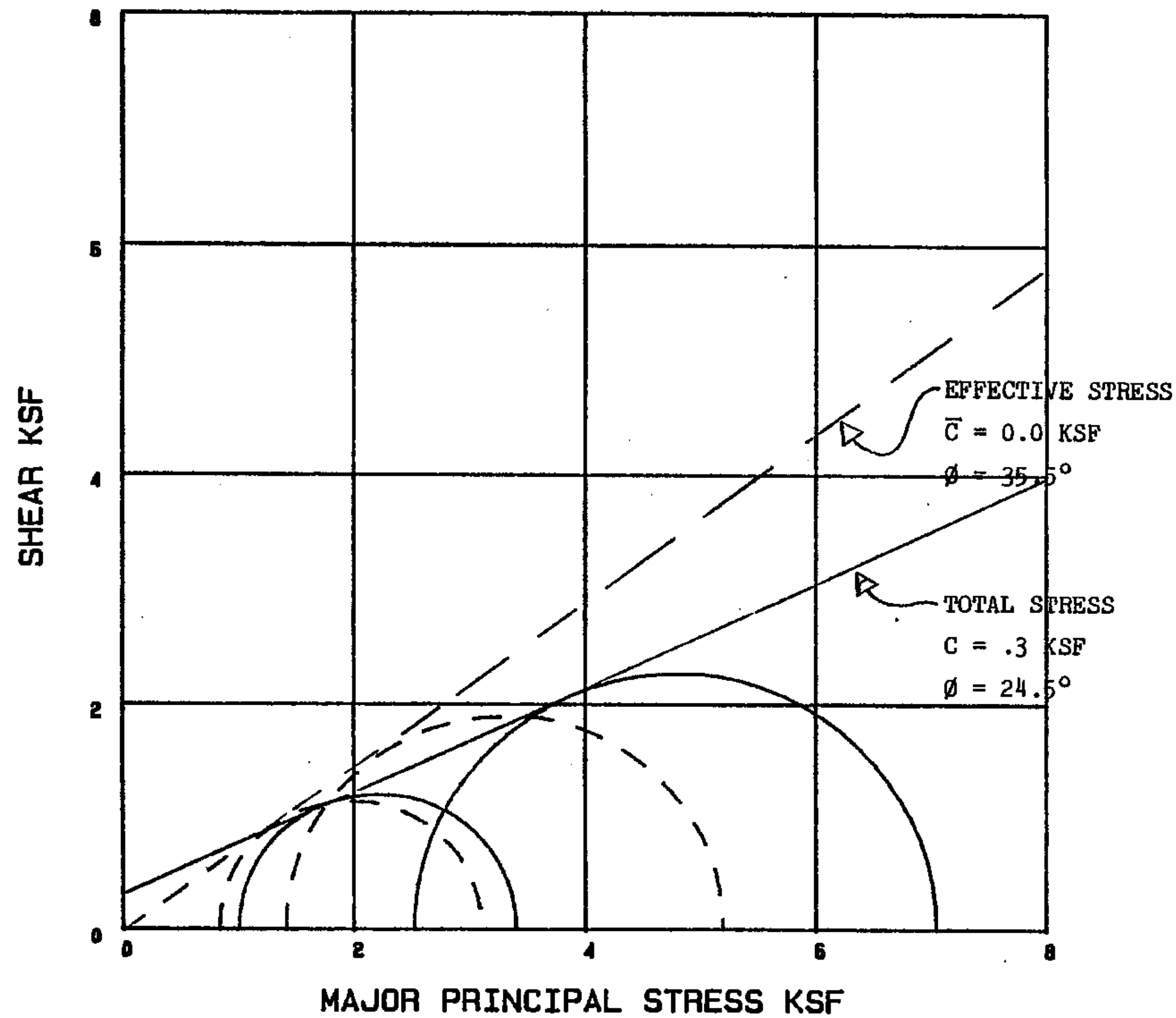
STRAIN %	DEVIATOR STRESS KSF	INDUCED PORE PRESSURE KSF	MAJOR PRINCIPAL STRESS KSF	EFFECTIVE PRINCIPAL STRESS major KSF	EFFECTIVE PRINCIPAL STRESS minor KSF	EFFECTIVE PRINCIPAL STRESS RATIO	P KSF	Q KSF
0.0	0.00	0.00	0.99	0.99	0.99	1.00	0.99	0.00
0.2	0.80	0.14	1.80	1.65	0.84	1.95	1.25	0.40
0.3	1.05	0.20	2.04	1.84	0.79	2.33	1.32	0.53
0.7	1.30	0.26	2.29	2.03	0.73	2.76	1.38	0.65
1.7	1.58	0.33	2.58	2.24	0.66	3.39	1.45	0.79
2.7	1.73	0.24	2.72	2.47	0.74	3.31	1.61	0.86
3.7	1.85	0.27	2.84	2.56	0.72	3.56	1.64	0.92
5.0	1.98	0.23	2.97	2.74	0.76	3.59	1.75	0.99
6.7	2.10	0.19	3.09	2.90	0.80	3.60	1.86	1.05
8.3	2.19	0.13	3.18	3.05	0.86	3.53	1.96	1.09
10.0	2.27	0.17	3.27	3.09	0.82	3.77	1.96	1.14
11.7	2.33	0.12	3.32	3.20	0.87	3.65	2.04	1.16
13.4	2.36	0.12	3.35	3.23	0.87	3.68	2.06	1.18
15.0	2.41	0.10	3.40	3.29	0.89	3.70	2.10	1.20

MINOR PRINCIPAL STRESS, KSF: 2.51

STRAIN %	DEVIATOR STRESS KSF	INDUCED PORE PRESSURE KSF	MAJOR PRINCIPAL STRESS KSF	EFFECTIVE PRINCIPAL STRESS major KSF	EFFECTIVE PRINCIPAL STRESS minor KSF	EFFECTIVE PRINCIPAL STRESS RATIO	P KSF	Q KSF
0.0	0.00	0.00	2.51	2.50	2.50	1.00	2.51	0.00
0.2	0.50	0.09	3.01	2.92	2.41	1.21	2.67	0.25
0.3	0.95	0.23	3.45	3.22	2.27	1.42	2.75	0.47
0.7	1.36	0.58	3.86	3.28	1.92	1.70	2.61	0.68
1.7	2.19	0.62	4.69	4.07	1.88	2.16	2.98	1.09
2.7	2.40	0.94	4.90	3.96	1.56	2.53	2.77	1.20
3.7	2.34	1.12	4.85	3.72	1.38	2.70	2.55	1.17
5.0	2.34	1.24	4.85	3.60	1.26	2.85	2.44	1.17
6.7	2.91	1.35	5.41	4.06	1.15	3.52	2.61	1.45
8.4	3.21	1.28	5.72	4.43	1.22	3.62	2.83	1.61
10.0	3.77	1.09	6.27	5.17	1.41	3.67	3.29	1.88
11.7	3.80	1.11	6.31	5.19	1.39	3.72	3.30	1.90
13.4	4.24	0.89	6.75	5.85	1.61	3.63	3.73	2.12
15.0	4.54	0.81	7.05	6.23	1.69	3.67	3.97	2.27

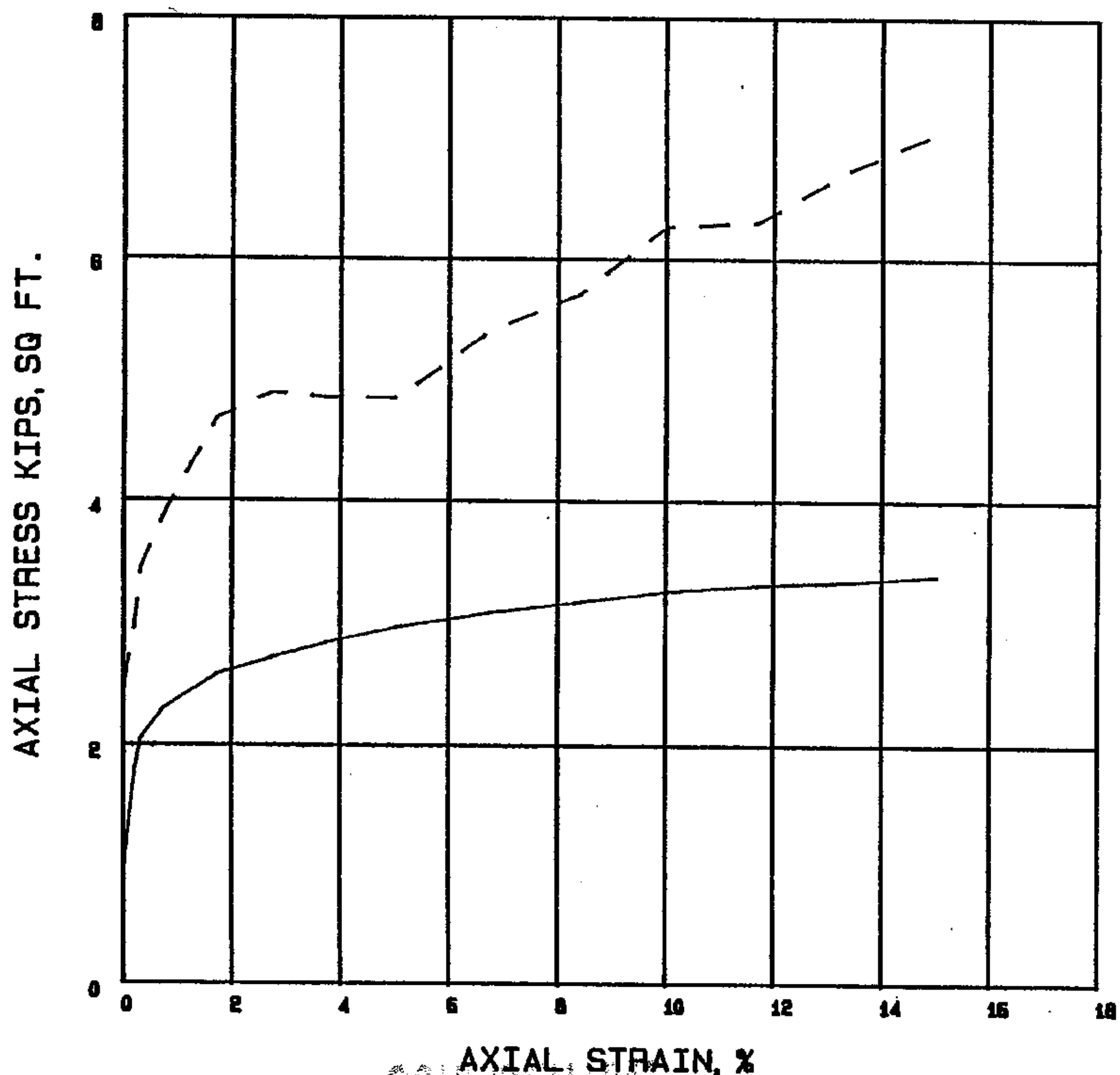
CONFIDENTIAL

ALABAMA POWER COMPANY
TRIAXIAL SHEAR TEST DATA
CONSOLIDATED-UNDRAINED (R) TEST



SAMPLE NUMBER 1

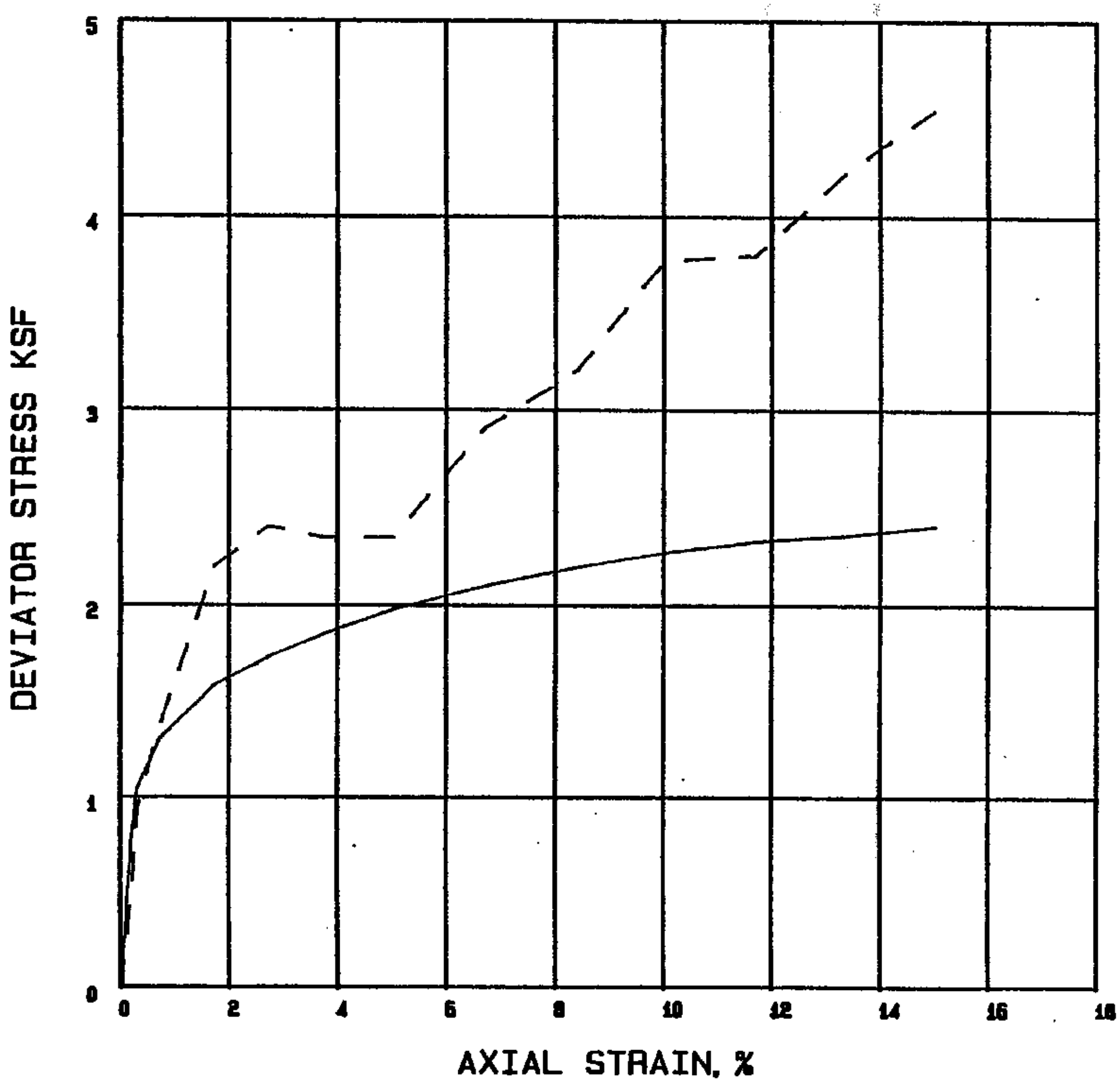
ALABAMA POWER COMPANY
TRIAXIAL SHEAR TEST DATA
CONSOLIDATED-UNDRAINED (R) TEST



SAMPLE NUMBER 1

CONFIDENTIAL

ALABAMA POWER COMPANY
TRIAXIAL SHEAR TEST DATA
CONSOLIDATED-UNDRAINED (R) TEST

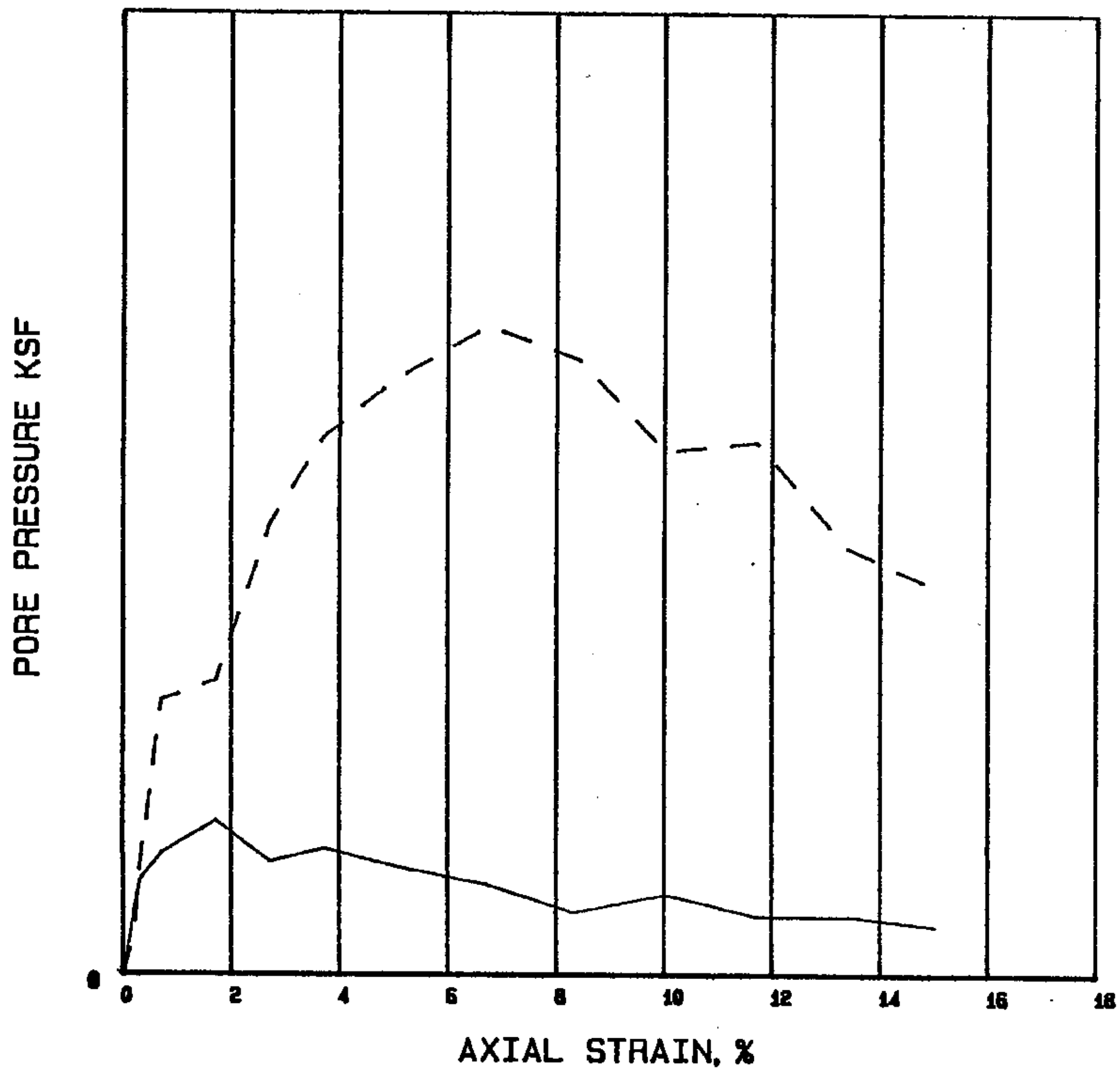


SAMPLE NUMBER 1

CONFIDENTIAL

CONFIDENTIAL

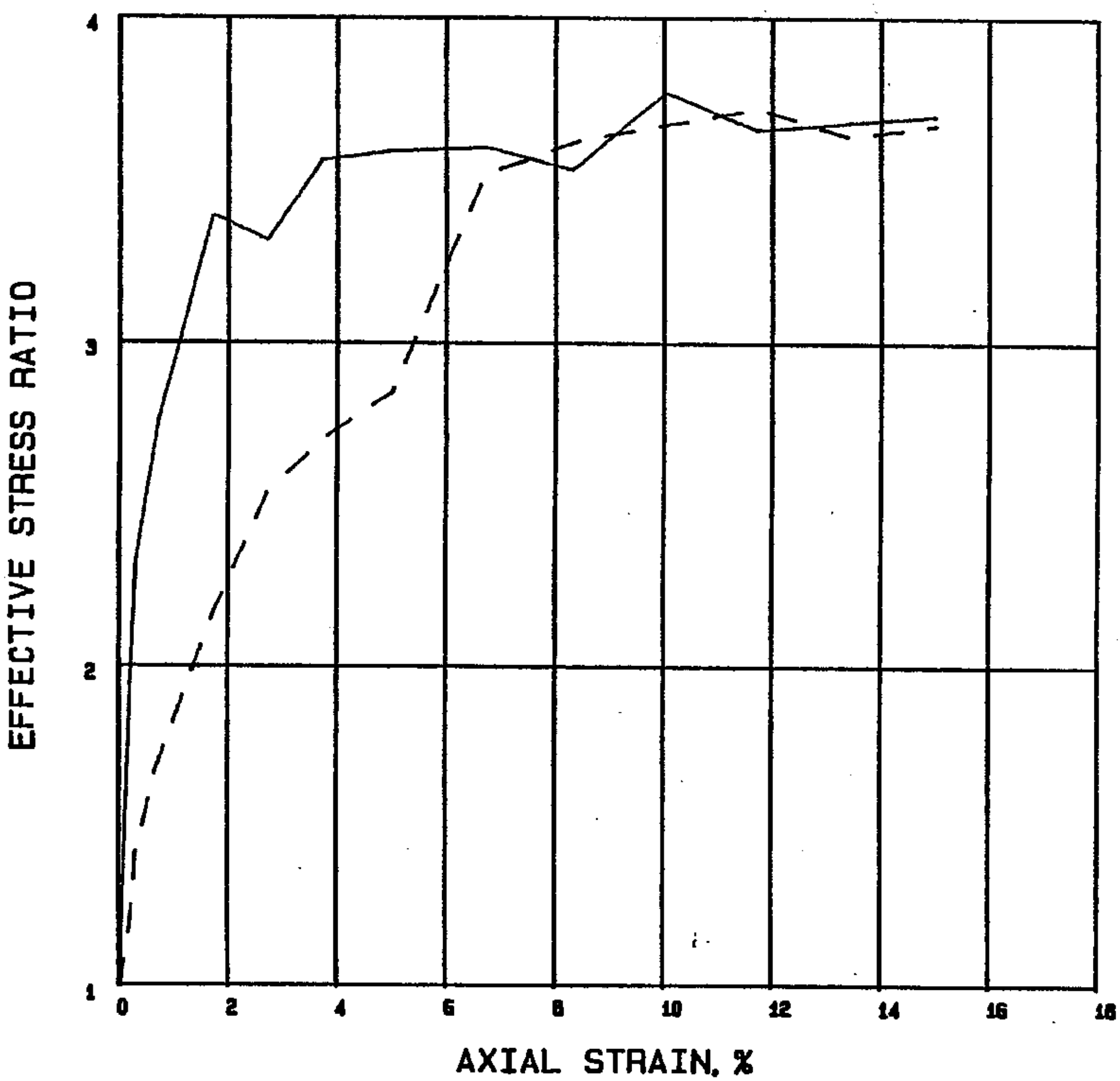
ALABAMA POWER COMPANY
TRIAXIAL SHEAR TEST DATA
CONSOLIDATED-UNDRAINED (R) TEST



SAMPLE NUMBER 1

CONFIDENTIAL

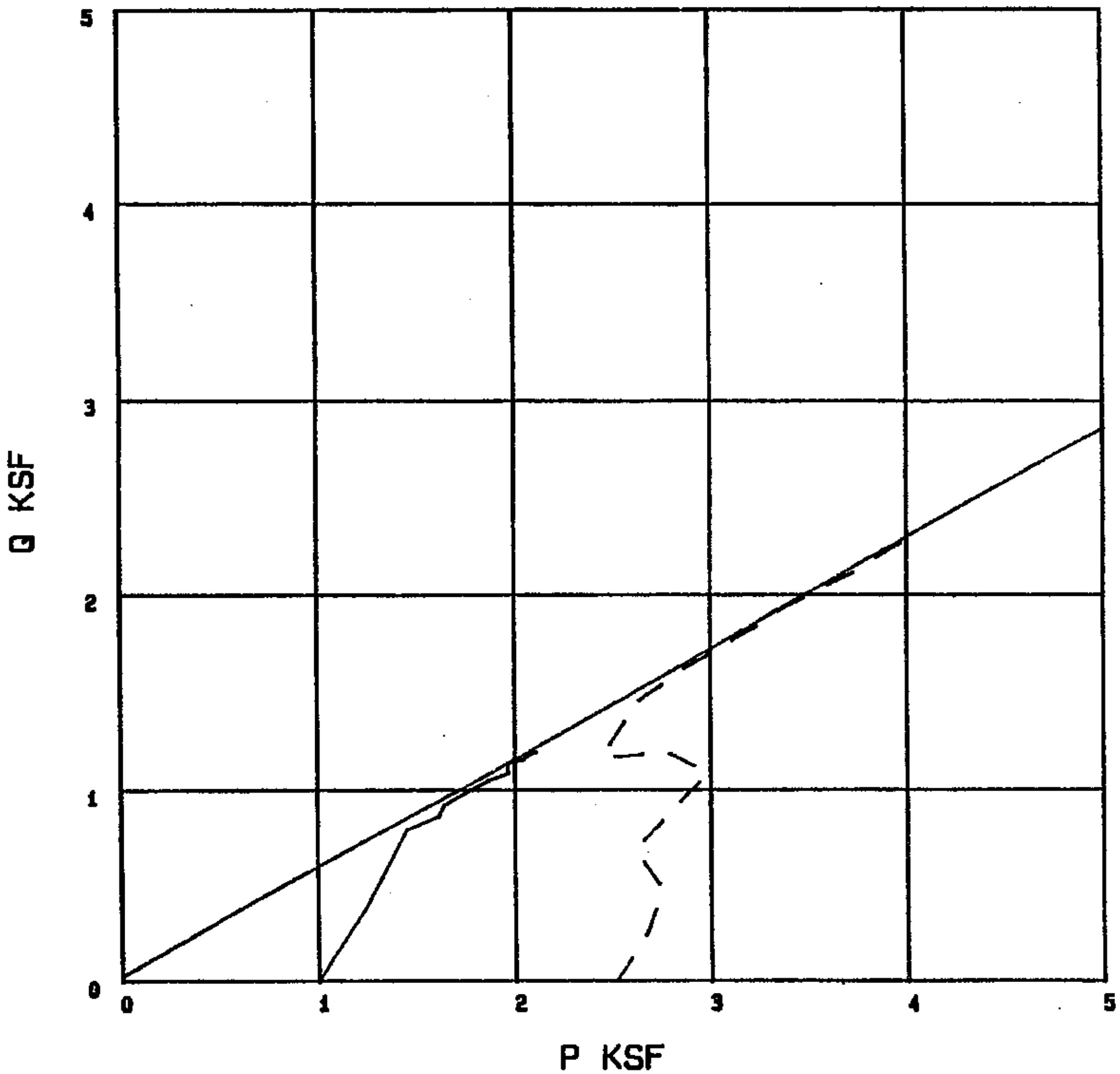
ALABAMA POWER COMPANY
TRIAXIAL SHEAR TEST DATA
CONSOLIDATED-UNDRAINED (R) TEST



SAMPLE NUMBER 1

CONFIDENTIAL

ALABAMA POWER COMPANY
TRIAXIAL SHEAR TEST DATA
CONSOLIDATED-UNDRAINED (R) TEST



SAMPLE NUMBER 1
ALPHA: 29.6 THETA: 34.6
A: 0.03 C: 0.03

CONFIDENTIAL TEST BORING RECORD

ELEV.	DEPTH		DESCRIPTION	N		CR	S	REMARKS
88.7	0.0		EXISTING DIKE					ELEVATIONS OBTAINED FROM GULF POWER COMPANY ELEVATIONS REFERENCED TO PLANT DATUM, 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
61.7	27.0		FIRM MEDIUM GRAINED WHITE SAND	27.0	17			
59.7	29.0		SOFT ORGANIC MUCK, DECAYED WOOD AND BLACK CLAY	30.0	4			
55.7	33.0		LOOSE TO FIRM WHITE MEDIUM GRAINED SAND WITH BLACK SILTY CLAY	35.0	4			
				40.0	2			
				45.0	2			
37.7	51.0			50.0	9			

DRILLING TERMINATED

BORING NUMBER: B-109 A

DATE DRILLED: 8/29/71

JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR— IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

5		5 —	SYMBOLS DESCRIBED BELOW:
18	70 NX	☒	UNDISTURBED SAMPLE, (ASTM D-1587)
	100	-=-	WATER TABLE, TIME OF BORING
23	BX	=	WATER TABLE, 24 HOUR READING
		◄	LOSS OF DRILLING FLUID

EXHIBIT GP-CR # 23

* There are two B-109 so the one in the old ash pond will be

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
89.7	0.0	EXISTING DIKE	2.5	20			ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM. 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
			5.0	52			
			7.5	35			
			10.0	31		(water table, time of boring)	
			15.0	36			
			20.0	8			
64.7	25.0	SOFT ORGANIC MUCK, DECAYED WOOD AND BLACK CLAY	25.0	5			← VANE SHEAR
67.7	32.0	FIRM WHITE MEDIUM GRAINED SAND WITH BLACK SILTY CLAY	35.0	11			
63.7	36.0	DRILLING TERMINATED					

BORING NUMBER: B-110

DATE DRILLED: 8/26-27/71

JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR — IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

5			
18	70 NX	☒	UNDISTURBED SAMPLE, (ASTM D-1587)
	100	(symbol)	WATER TABLE, TIME OF BORING
23	BX	(symbol)	WATER TABLE, 24 HOUR READING
		◄	LOSS OF DRILLING FLUID

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
90.3	0.0	EXISTING DIKE					ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM, 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
61.3	29.0	SOFT ORGANIC MUCK, DECAYED WOOD & BLACK CLAY	30.0	4			
56.8	33.5	VERY LOOSE TO LOOSE WHITE MEDIUM GRAINED SAND WITH BLACK SILTY CLAY	35.0	*			*HAMMERWEIGHT PUSHED SPOON 12 INCHES
			40.0	4			
			45.0	4			
43.3	47.0	DENSE YELLOWISH TAN MEDIUM GRAINED SAND					
			50.0	51			
39.3	51.0	DRILLING TERMINATED					

BORING NUMBER: B-111

DATE DRILLED: 8/29/71

JOB NO: B-1464

N — 15 PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR — 15 % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

5			
18	70 NX	☒	UNDISTURBED SAMPLE, (ASTM D-1587)
	100		WATER TABLE, TIME OF BORING
23	BX		WATER TABLE, 24 HOUR READING
		◀	LOSS OF DRILLING FLUID

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION	SAMPLE DEPTH	N	CR	S
90.7	0.0	EXISTING DIKE	2.5	23		
			5.0	28		
			7.5	34		water table, time of boring
			10.0	21		
			15.0	28		
			20.0	25		
66.2	24.5	SOFT ORGANIC MUCK, DECAYED WOOD AND BLACK CLAY	25.0	4		
62.2	28.5	LOOSE WHITE MEDIUM GRAINED SAND WITH BLACK SILTY CLAY	35.0	4		
			40.0	2		
			45.0	3		
40.7	50.0	STIFF GRAY CLAY	50.0	11		
39.7	51.0	DRILLING TERMINATED				

REMARKS: ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM. 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL

BORING NUMBER: B-112
DATE DRILLED: 8/26/71
JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

N	CR	S
5		
18	70 NX	undisturbed sample
	100	water table, time of boring
23	BX	water table, 24 hour reading
		loss of drilling fluid

CR — IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

- UNDISTURBED SAMPLE, (ASTM D-1587)
- WATER TABLE, TIME OF BORING
- WATER TABLE, 24 HOUR READING
- LOSS OF DRILLING FLUID

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH		DESCRIPTION	N	CR	S	REMARKS
91.0	0.0		EXISTING DIKE				ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM, 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
65.5	25.5		SOFT ORGANIC MUCK, DECAYED WOOD AND BLACK CLAY	26.0	6		
61.5	29.5		FIRM WHITE MEDIUM GRAINED SAND WITH BLACK SILTY CLAY	30.0	20		
59.5	31.5		DRILLING TERMINATED				

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR— IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

UNDISTURBED SAMPLE, (ASTM D-1587)

WATER TABLE, TIME OF BORING

WATER TABLE, 24 HOUR READING

LOSS OF DRILLING FLUID

5		
18	70 NX	☒
	100	
23	BX	

BORING NUMBER: B-113

DATE DRILLED: 8/29/71

JOB NO: B-1464

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
92.6	0.0	EXISTING DIKE					ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM. 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
			2.5	37			
			5.0	34			
			7.5	58			
			10.0	25			
			15.0	31			
			20.0	28			
			25.0	6			
			30.0	2			
62.1	30.5	SOFT BLACK ORGANIC SILTY CLAY WITH DECAYED WOOD					← BORE HOLE SHEAR
			35.0	8			
54.6	38.0	FIRM WHITE MEDIUM GRAINED SAND WITH BLACK SILTY CLAY					
			40.0	15			
51.1	41.5	DRILLING TERMINATED					

BORING NUMBER: B-114

DATE DRILLED: 8/27/71

JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR — IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

UNDISTURBED SAMPLE. (ASTM D-1587)

WATER TABLE, TIME OF BORING

WATER TABLE, 24 HOUR READING

LOSS OF DRILLING FLUID

(Legend example column: 5; 18 | 70 NX; 100; 23 | BX)

TEST BORING RECORD CONFIDENTIAL

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
83.3	0.0	EXISTING DIKE					ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM. 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
			2.0	40			
			5.0	37			
			7.5	100+			
			10.0	16			
69.3	14.0	VERY SOFT BLACK ORGANIC SILTY CLAY AND DECAYED WOOD				WATER TABLE, TIME OF BORING	LOSS OF DRILLING FLUID
			15.0	1		UNDISTURBED SAMPLE	NO RECOVERY
			20.0	2			LOSS OF DRILLING FLUID
			25.0	2			
57.8	25.5	VERY LOOSE GRAY MEDIUM GRAINED SAND WITH BLACK SILTY CLAY LAYERS AND DECAYED PLANT PARTS					
			30.0	3			
			35.0	4			
			41.0	3			
38.8	44.5	FIRM GRAY MEDIUM GRAINED SAND WITH TRACES OF ORGANIC MATTER	44.5	25			
37.3	46.0	DRILLING TERMINATED					

BORING NUMBER: B-115

DATE DRILLED: 8/16/71

JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR — IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

UNDISTURBED SAMPLE, (ASTM D-1587)

WATER TABLE, TIME OF BORING

WATER TABLE, 24 HOUR READING

LOSS OF DRILLING FLUID

(Example column: 5, 18, 70 NX, 100 BX, 23)

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
87.4	0.0	EXISTING DIKE					ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM. 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
			20.0	8			
63.4	24.0	SOFT BLACK SILTY ORGANIC CLAY	25.0	5		⊠	
58.4	29.0	DRILLING TERMINATED					

BORING NUMBER: B-116

DATE DRILLED: 8/20/71

JOB NO: B-1484

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR — IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

5			
18	70 NX	⊠	UNDISTURBED SAMPLE, (ASTM D-1587)
	100		WATER TABLE, TIME OF BORING
23	BX		WATER TABLE, 24 HOUR READING
		◀	LOSS OF DRILLING FLUID

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
84.2	0.0	EXISTING DIKE					ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM. 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
69.2	15.0	-10 VERY SOFT BLACK SILTY ORGANIC CLAY	15.0	1			
						⊠	← BORE HOLE SHEAR ← VANE SHEAR
			25.0	2			
57.2	27.0	VERY LOOSE WHITE MEDIUM GRAINED SAND WITH BLACK SILTY CLAY					
			30.0	1			
			35.0	1			
45.7	38.5	FIRM WHITE TO TAN COARSE GRAINED SAND WITH QUARTZ PEA GRAVELS					
			40.0	6			
			45.0	7			
			50.0	17			
53.2	51.0	DRILLING TERMINATED					

BORING NUMBER: B-117

DATE DRILLED: 8/19/71

JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR — IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

N	CR	S	
5			
18	70 NX	⊠	UNDISTURBED SAMPLE, (ASTM D-1587)
	100		WATER TABLE, TIME OF BORING
23	BX		WATER TABLE, 24 HOUR READING
		◄	LOSS OF DRILLING FLUID

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION	N	CR	S	REMARKS
85.2	0.0	EXISTING DIKE				ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM, 72.3 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
68.2	17.0	SOFT BLACK SILTY ORGANIC CLAY AND DECAYED WOOD	17.0 4		☒	← BORE HOLE SHEAR ← VANE SHEAR
55.7	29.5	FIRM GRAY MEDIUM GRAINED SAND WITH QUARTZ PEA GRAVELS AND BLACK SILTY CLAYEY ZONES	30.0 3 35.0 16			
49.2	36.0	DRILLING TERMINATED				

N — 15 PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR — 15 % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

UNDISTURBED SAMPLE. (ASTM D-1587)

WATER TABLE, TIME OF BORING

WATER TABLE, 24 HOUR READING

LOSS OF DRILLING FLUID

BORING NUMBER: B-118

DATE DRILLED: 8/19/71

JOB NO: B-1464

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
86.3	0.0	EXISTING DIKE					ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM. 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
			2.5	68			
			5.0	45			
			10.0	11			
			15.0	6			
69.3	17.0	SOFT BLACK SILTY ORGANIC CLAY AND DECAYED WOOD				Water table, time of boring	← VANE SHEAR
						Undisturbed sample	← BORE HOLE SHEAR
							← VANE SHEAR
59.3	27.0	LOOSE TO FIRM WHITE MEDIUM GRAINED SAND WITH BLACK SILTY CLAY					
			30.0	8			
			35.0	4			
			40.0	10			
			45.0	17			
40.3	46.0	DRILLING TERMINATED					

BORING NUMBER: B-119

DATE DRILLED: 8/17/71

JOB NO: B-1464

N — 15 PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR— 15 % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

5			
18	70 NX	☒	UNDISTURBED SAMPLE, (ASTM D-1587)
	100	Water table symbol	WATER TABLE, TIME OF BORING
23	BX	Water table symbol	WATER TABLE, 24 HOUR READING
		◀	LOSS OF DRILLING FLUID

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
86.0	0.0	EXISTING DIKE	2.5	100+			ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM, 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
			5.0	38			
			7.5	66			
			10.0	16			
			15.0	3			
67.0	19.0	SOFT BLACK SILTY ORGANIC CLAY WITH DECAYED WOOD	20.0	5			←VANE SHEAR
61.5	24.5	VERY LOOSE BLACK SILTY MEDIUM GRAINED SAND	25.0	2		⊠	NO RECOVERY
58.0	28.0	VERY SOFT BLACK SILTY SANDY ORGANIC CLAY	30.0	*			*HAMMER WEIGHT PUSHED SPOON 12 INCHES
53.0	33.0	DENSE GRAY MEDIUM GRAINED SAND	35.0	36			
50.0	36.0	DRILLING TERMINATED					

BORING NUMBER: B-120

DATE DRILLED: 8/17/71

JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR— IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

Depth	CR	S	Description
5			
18	70 NX	⊠	UNDISTURBED SAMPLE, (ASTM D-1587)
	100		WATER TABLE, TIME OF BORING
23	BX		WATER TABLE, 24 HOUR READING
		◄	LOSS OF DRILLING FLUID

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
84.5	0.0	EXISTING DIKE					ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM, 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
						(water table symbol)	
64.5	20.0	SOFT BLACK SILTY ORGANIC CLAY	20.0	2			← BORE HOLE SHEAR ← VANE SHEAR
						(undisturbed sample symbol)	
57.0	27.5	DENSE GRAY MEDIUM GRAINED SAND	28.0	30			
55.0	29.0	DRILLING TERMINATED					

BORING NUMBER: B-121

DATE DRILLED: 8/24/71

JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR — IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

UNDISTURBED SAMPLE, (ASTM D-1587)

WATER TABLE, TIME OF BORING

WATER TABLE, 24 HOUR READING

LOSS OF DRILLING FLUID

5

18 70 NX

100

23 BX

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
84.5	0.0	EXISTING DIKE					ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM, 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
66.0	18.5	SOFT BLACK SILTY ORGANIC CLAY WITH DECAYED WOOD	18.5	12			
62.5	22.0	DENSE GRAY MEDIUM GRAINED SAND	25.0	29			
58.5	26.0	DRILLING TERMINATED					

BORING NUMBER: B-122

DATE DRILLED: 8/24/71

JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR — IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

UNDISTURBED SAMPLE. (ASTM D-1587)

WATER TABLE, TIME OF BORING

WATER TABLE, 24 HOUR READING

LOSS OF DRILLING FLUID

5		
18	70 NX	
	100	
23	BX	

TEST BORING RECORD

CONFIDENTIAL

ELEV.	DEPTH	DESCRIPTION		N	CR	S	REMARKS
85.9	0.0	EXISTING DIKE				(water table, time of boring)	ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM. 72.5 FT DATUM = 0.0 FT. MEAN SEA LEVEL
61.9	24.0	LOOSE GRAY FINE GRAINED SAND					
60.9	25.0	SOFT BLACK SILTY ORGANIC CLAY	27.0	6			
56.9	29.0	FIRM GRAY FINE GRAINED SAND WITH THIN BLACK SILTY CLAY LENSES	32.0	17			
52.4	33.5	DRILLING TERMINATED					

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR — IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

N	CR	S	
5			
8	70 NX	⊠	UNDISTURBED SAMPLE. (ASTM D-1587)
	100		WATER TABLE, TIME OF BORING
3	BX		WATER TABLE, 24 HOUR READING
		◀	LOSS OF DRILLING FLUID

BORING NUMBER: B-124

DATE DRILLED: 8/25/71

JOB NO: B-1464

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH		DESCRIPTION		N	CR	S	REMARKS
84.4	0.0		EXISTING DIKE				-=-	ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT OATUM. 72.5 FT. OATUM = 0.0 FT. MEAN SEA LEVEL
61.4	23.0		FIRM GRAY MEDIUM GRAINED SAND WITH TRACE OF ORGANIC MATERIAL	25.0	15			
58.4	26.0		DRILLING TERMINATED					

BORING NUMBER: B-125

DATE DRILLED: 8/20/71

JOB NO: 8-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR— IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS OESCRIBED BELOW:

5			
18	70 NX	☒	UNDISTURBED SAMPLE. (ASTM D-1587)
	100	-=-	WATER TABLE, TIME OF BORING
23	BX	═	WATER TABLE, 24 HOUR READING
		◄	LOSS OF DRILLING FLUID

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH		DESCRIPTION		N	CR	S	REMARKS
87.1	0.0		EXISTING DIKE				(water table, time of boring)	ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM, 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
				24.0	4			
59.1	28.0		DRILLING TERMINATED	28.0	6			

BORING NUMBER: B-126

DATE DRILLED: 8/20/71

JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR— IS % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

S — SYMBOLS DESCRIBED BELOW:

5			
18	70 NX	☒	UNDISTURBED SAMPLE. (ASTM D-1587)
	100	(symbol)	WATER TABLE, TIME OF BORING
23	BX	(symbol)	WATER TABLE, 24 HOUR READING
		◀	LOSS OF DRILLING FLUID

CONFIDENTIAL

TEST BORING RECORD

ELEV.	DEPTH	DESCRIPTION	Sample depth	N	CR	S	REMARKS
82.0	0.0	EXISTING DIKE	2.0	36			ELEVATIONS OBTAINED FROM GULF POWER CO. ELEVATIONS REFERENCED TO PLANT DATUM, 72.5 FT. DATUM = 0.0 FT. MEAN SEA LEVEL
			5.0	22			
			7.5	7			
			10.0	5		◄ (loss of drilling fluid)	
			15.0	2			
						☒ (undisturbed sample)	
			20.0	14			
60.0	22.0	SOFT BLACK TO GRAY SILTY CLAYEY FINE GRAINED SAND WITH TRACES OF ORGANIC MATTER	25.0	2			
			30.0	3			
			35.0	3			
			40.0	3			
						☒ (undisturbed sample)	
40.0	42.0	DENSE WHITE MEDIUM GRAINED SAND	43.5	62			
37.0	45.0	DRILLING TERMINATED					

BORING NUMBER: B-127

DATE DRILLED: 8/16/71

JOB NO: B-1464

N — IS PENETRATION IN BLOWS PER FOOT (ASTM D-1586)

CR— 15 % CORE RECOVERY, NX OR BX DESIGNATES BIT SIZE (ASTM D 2113)

(Legend example: 5; 18 — 70 NX; 23 — 100 BX)

S — SYMBOLS DESCRIBED BELOW:

- ☒ UNDISTURBED SAMPLE, (ASTM D-1587)
- WATER TABLE, TIME OF BORING
- WATER TABLE, 24 HOUR READING
- ◄ LOSS OF DRILLING FLUID

CONFIDENTIAL

TABLE I

UNIT WEIGHT AND MOISTURE CONTENT DATA

RING	DEPTH	NATURAL MOISTURE CONTENT, PERCENT	WET UNIT WEIGHT, PCF	MATERIAL TYPE
-110	2.5	15	127	Dike Fill
-112	7.5	16	122	Dike Fill
-115	7.5	11	133	Dike Fill
-119	15.0	13	131	Dike Fill
-120	25.0 Porosity 79%	172	75	Marsh Soil
-117	18.0 Porosity 57%	125*	102	Marsh Soil
-118	23.0 Porosity 57%	95*	99	Marsh Soil
-119	21.0 ~~Porosity 66%~~	207*	**	Marsh Soil
-121	25.0 Porosity 66%	119*	97	Marsh Soil
-122	21.0	108*	**	
-127	19.0	18*	118	Dike Fill
-127	42.0	33*	117	Sand

verage of Moisture Content at Top & Bottom of Tube

Sample Condition Prevented Determination of Unit Weight

CONFIDENTIAL

TABLE II

SUMMARY OF FIELD AND LABORATORY SHEAR STRENGTH DATA

A. FIELD VANE TESTS

ORING UMBER	DEPTH, FEET	UNDRAINED SHEAR STRENGTH, PSF	
		PEAK	REMOLDED
-110	27.5	1360	300
-117	18.5	1140	75
-118	24.0	530	225
-119	18.5	760	30
-119	24.5	610	150
-120	22.0	610	150
-121	25.5	980	---

B. BORE HOLE SHEAR TESTS

ORING UMBER	DEPTH, FEET	FRICTION ANGLE, Ø, DEGREES	COHESION, C, PSF	COMPUTED SHEAR STRENGTH AT TEST DEPTH, PSF
-114	32.0	0	980	980
-117	16.5	14	374	820
-118	22.5	10	403	760
-119	20.5	6	202	400
-121	24.0	20	187	890

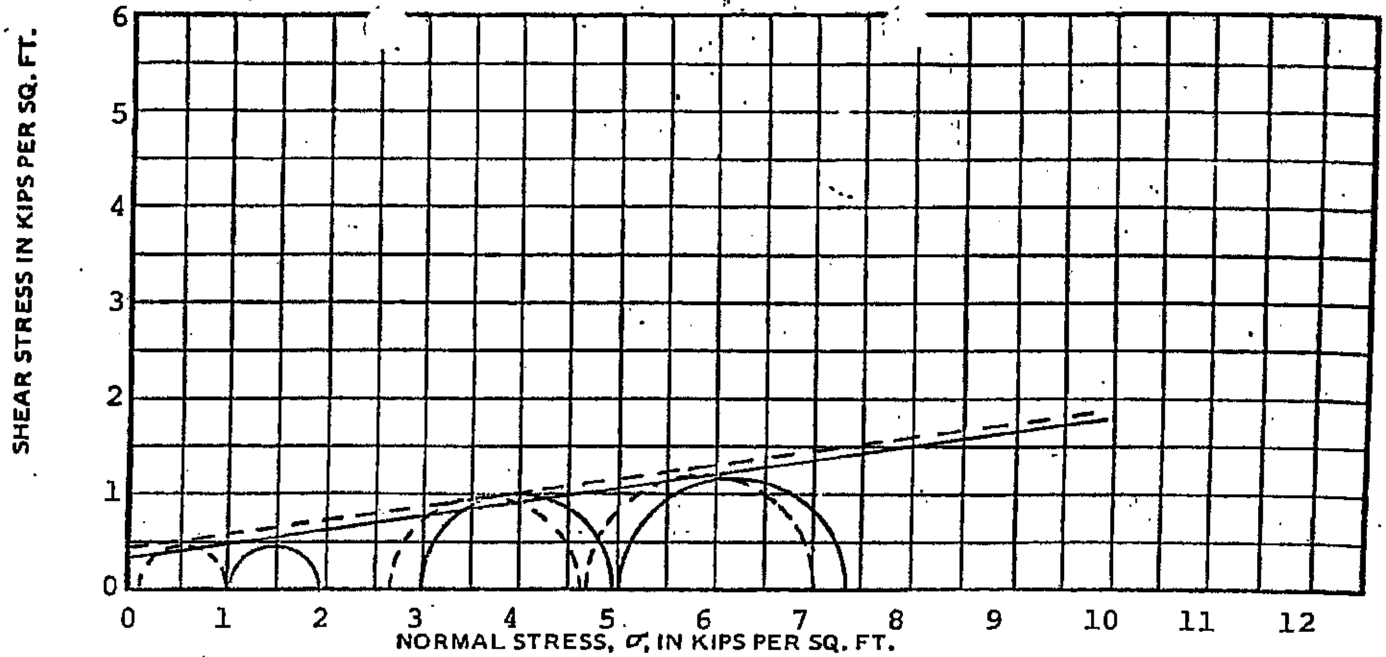
C. PRESSUREMETER TEST

ORING UMBER	DEPTH, FEET	PRESSUREMETER "COHESION",PSF
-116	25.5	1040
-116	27.5	1200

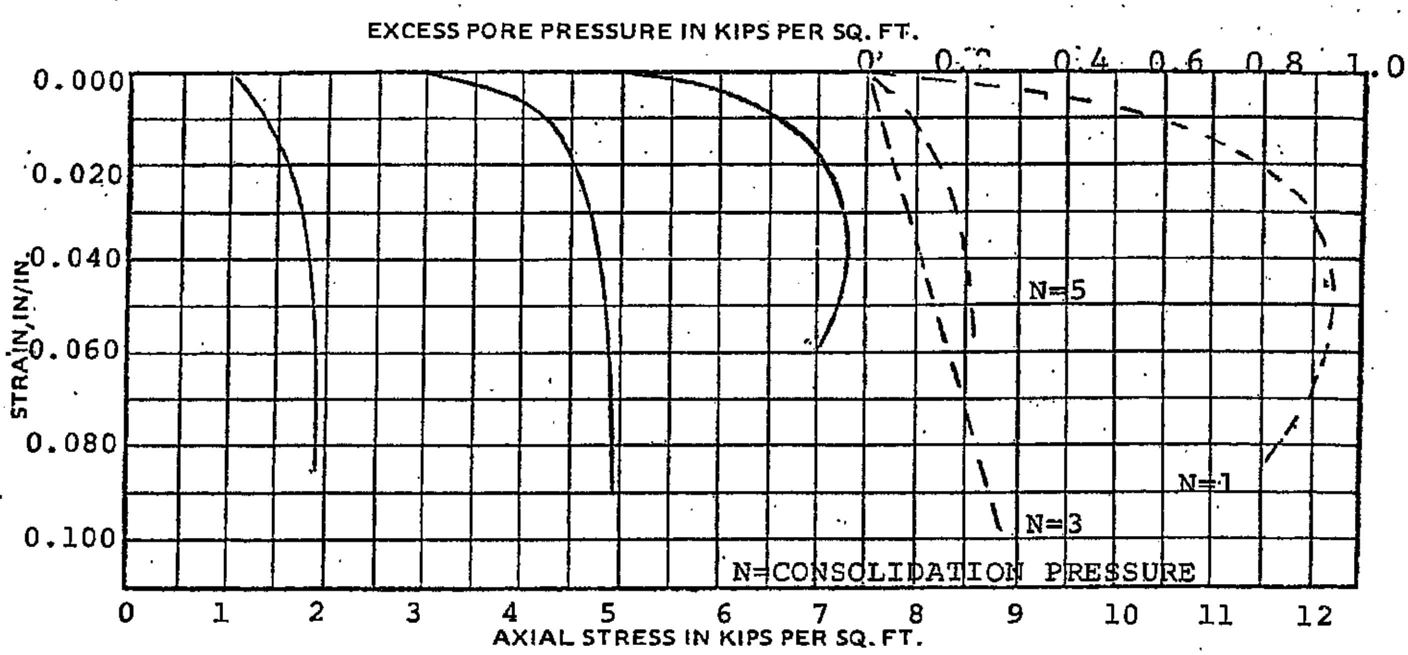
D. LABORATORY TESTS

ORING UMBER	DEPTH, FEET	FRICTION ANGLE, Ø, DEGREES	COHESION, C, PSF	UNDRAINED SHEAR STRENGTH, PSF	TEST TYPE
-110	25.0	---	---	570	Unconfined
-117	18.0	8	410		Consolidated Undrained
-118	23.0	0	300	300	Unconsolidat Undrained

CONFIDENTIAL



MOHR DIAGRAMS



STRESS-STRAIN AND PORE PRESSURE-STRAIN CURVES

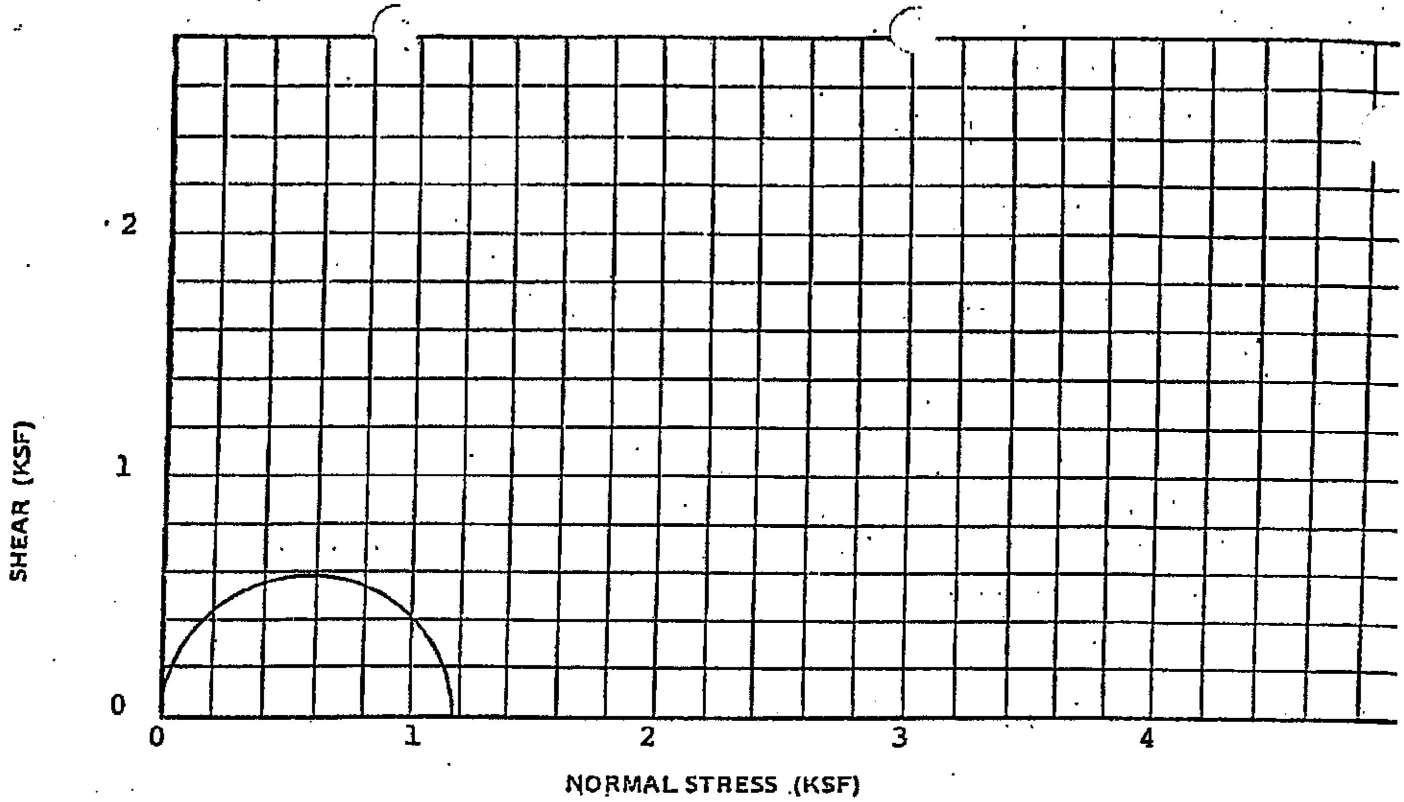
EFFECTIVE COHESION, c̄ 0.48 KSF
EFFECTIVE SHEAR ANGLE, $\bar{\phi}$ 8°
TOTAL COHESION, c 0.41 KSF
TOTAL SHEAR ANGLE, ϕ 8°

SATURATED, CONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST WITH PORE PRESSURE MEASUREMENTS

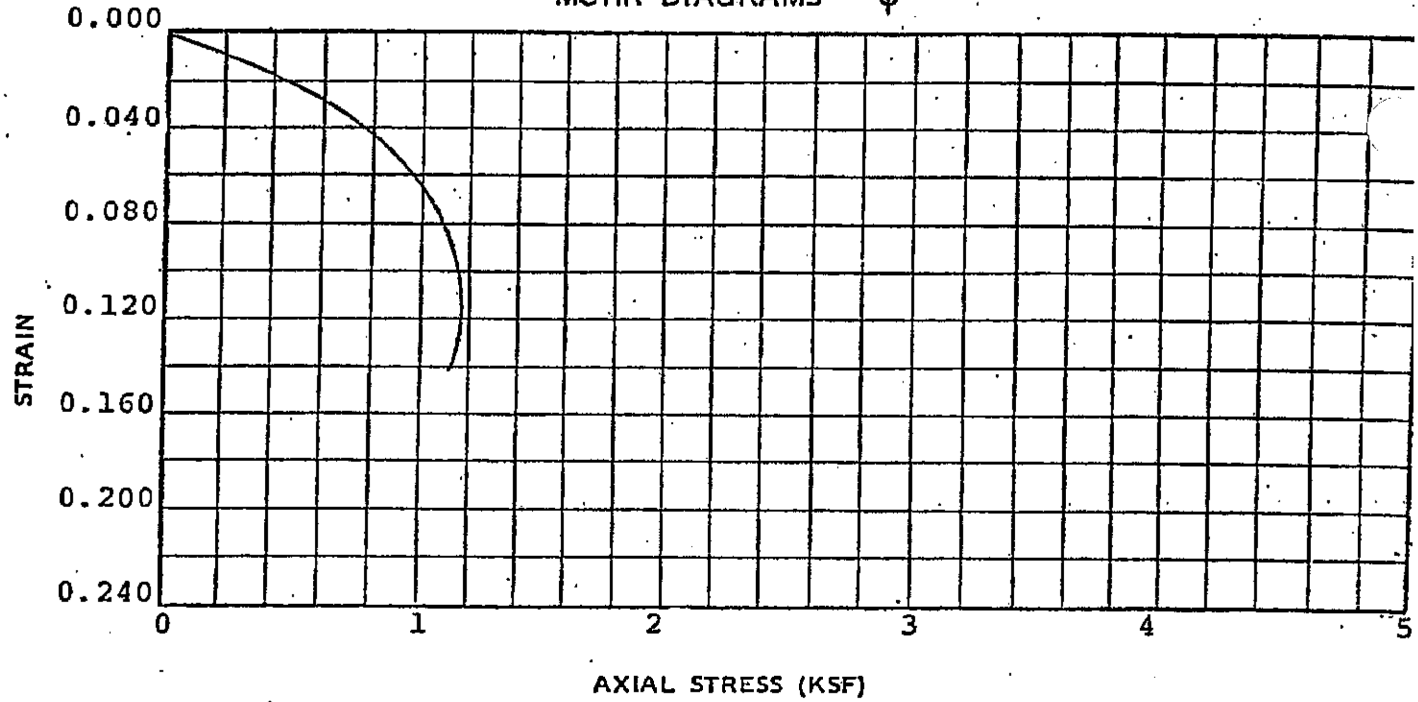
SAMPLE NO. UD BORING NO. B-117
DEPTH 17-19 JOB NO. B-1464

LAW ENGINEERING TESTING COMPANY
BIRMINGHAM, ALABAMA

CONFIDENTIAL



MOHR DIAGRAMS — φ



STRESS — STRAIN CURVES

"COHESION", C 0.57 KSF

WET UNIT WEIGHT, PCF 74.6

WATER CONTENT, % 71.6

SPECIFIC GRAVITY 2.10

VOID RATIO 3.770 SATURATION 95.6

(Porosity 79%)

UNCONFINED COMPRESSION TEST

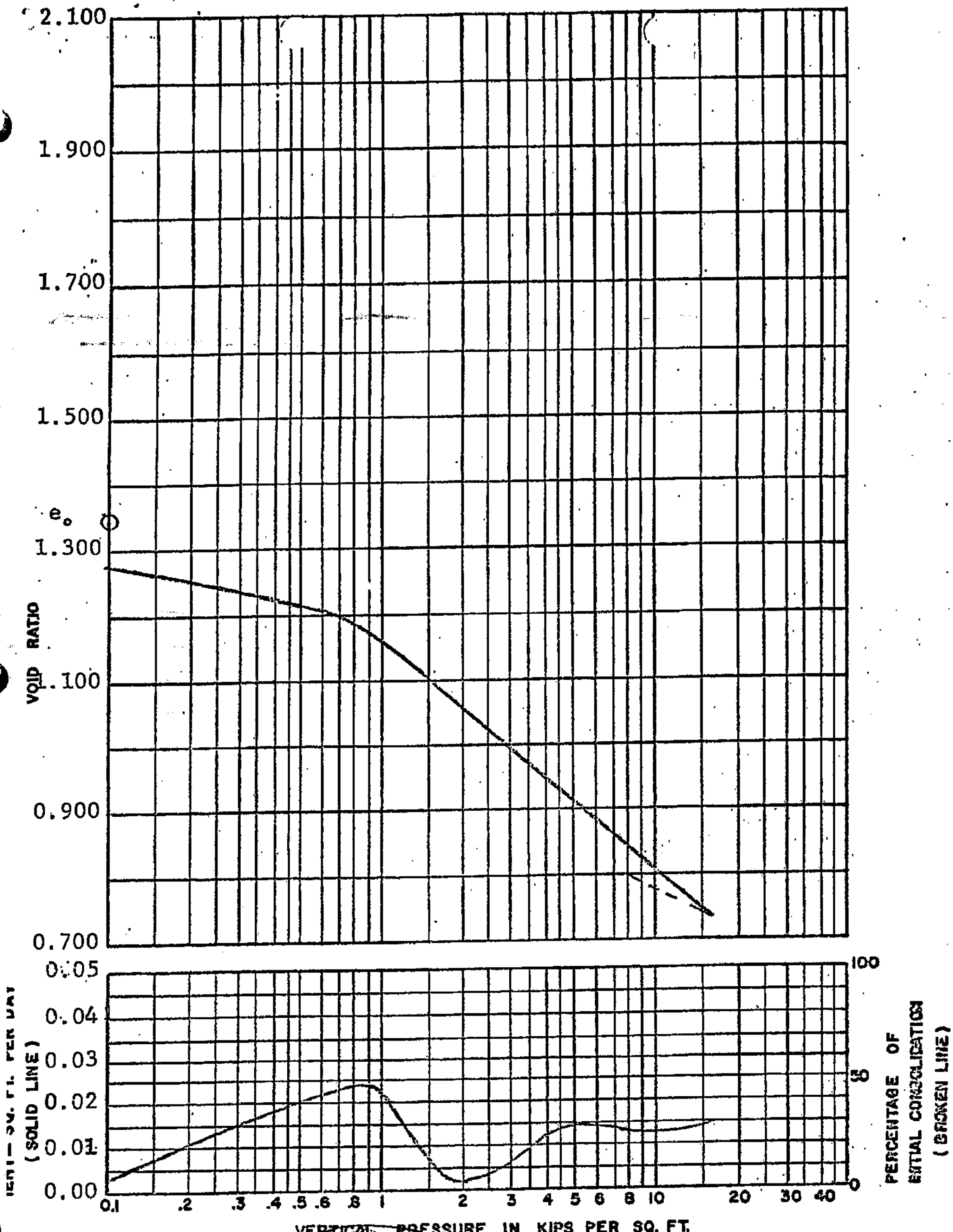
JOB NUMBER: B-1464

SAMPLE NUMBER: S-25

BORING NUMBER: B-110

DEPTH, FT. 25

CONFIDENTIAL



ECIFIC GRAVITY 2.53

IPRESSION INDEX 0.379

T WEIGHT 104.3 PCF (WET)

ER CONTENT 51.2%

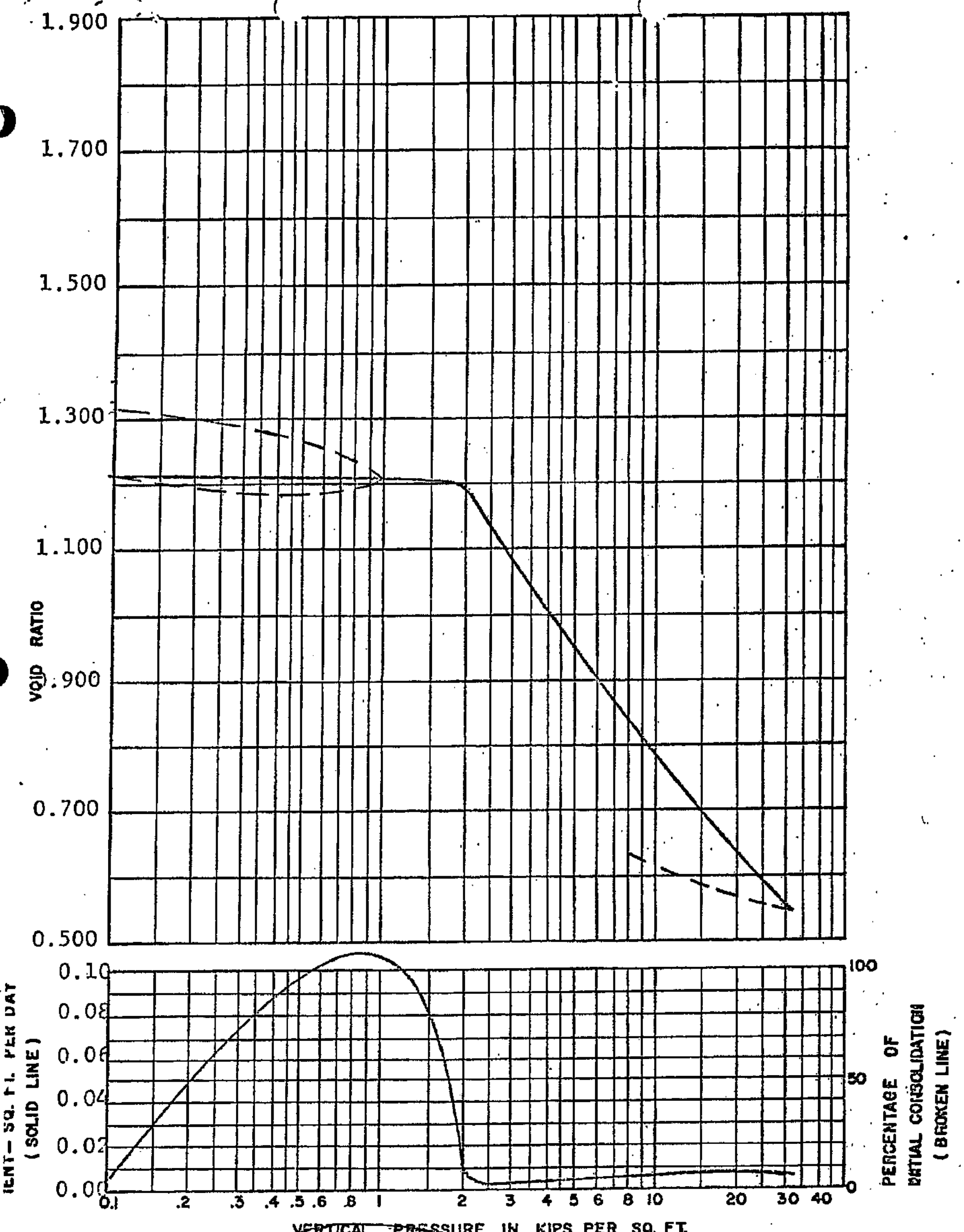
Porosity = 57%

CONSOLIDATION TEST

BORING NO. B-117 SAMPLE NO. 1D

ELEV. OR DEPTH 17-19 JOB NO. B-1464

CONFIDENTIAL



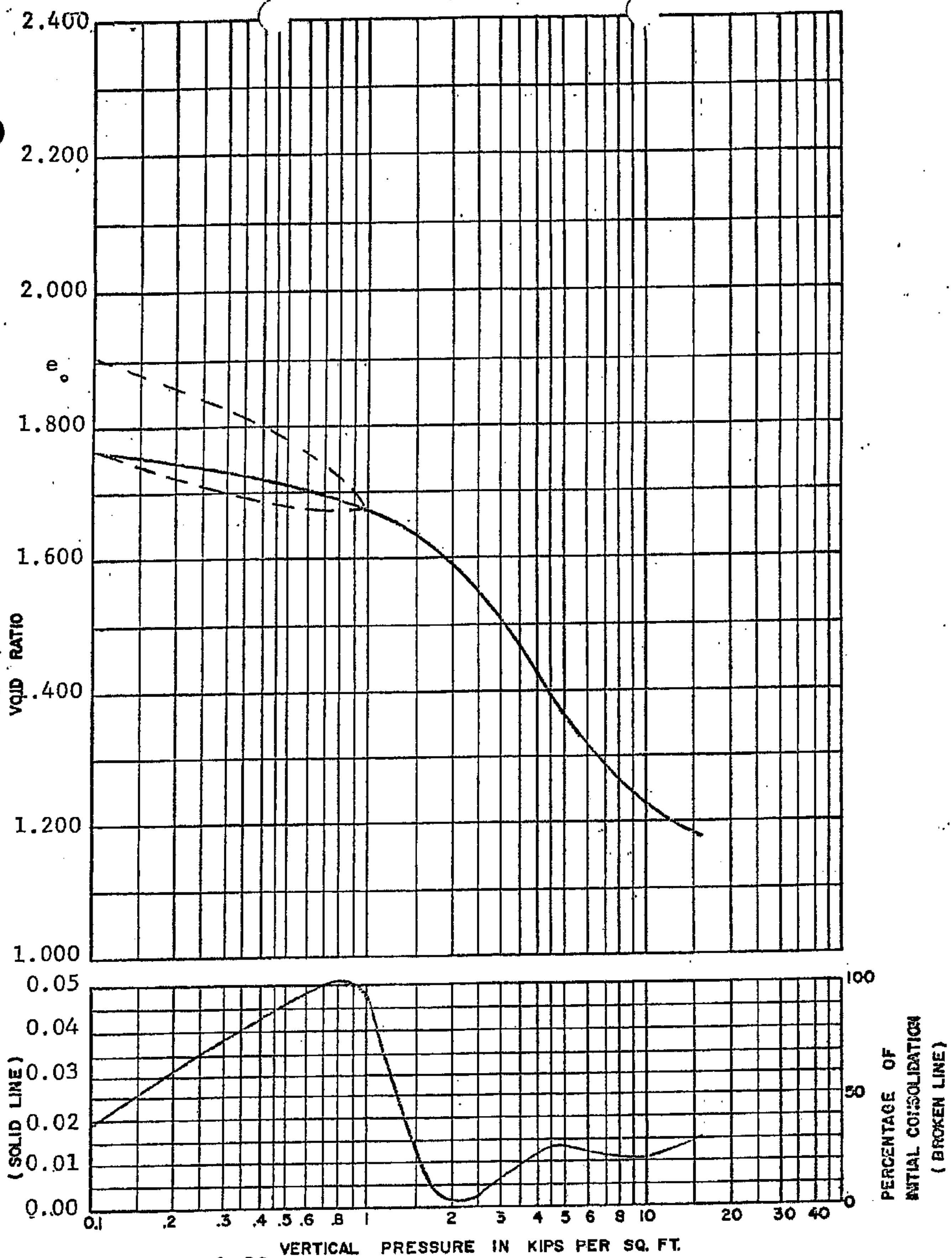
ECIFIC GRAVITY 2.55
MPRESSION INDEX 0.599
T WEIGHT 103.8 PCF (WET)
TER CONTENT 45.0%

Porosity= 56.8%

CONSOLIDATION TEST

BORING NO. B-118 SAMPLE NO. UD
ELEV. OR DEPTH 22-24 JOB NO. B-1464

CONFIDENTIAL



ECIFIC GRAVITY 2.38

PRESSION INDEX 0.570

WEIGHT 101.9 PCF (WET)

ER CONTENT 90.5%

RATION 100.0%

Porosity = 65.5%

CONSOLIDATION TEST

BORING NO. B-121 SAMPLE NO. UD

ELEV. OR DEPTH 24-26' JOB NO. E-1464

Appendix A

Doc 02: Analysis of Liquefaction Potential for Ash Pond

SOUTHERN COMPANY

Engineering and Construction Services Calculation

Calculation Number:
TV-SZ-FPC33667-001

Project/Plant: Plant Crist CCB Facilities	**Unit(s):** Common	**Discipline/Area:** Geotechnical
Title/Subject: Analysis of Liquefaction Potential for Ash Pond		
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/09-07-12	JCP/09-07-12	JCP/09-07-12

Notes:

Purpose of Calculation

Plant Crist is a coal-fired steam plant. Pollution controls installed at the plant produce solid materials including ash and scrubber waste (gypsum). The ash is presently stored in a dry stack landfill, and the gypsum is sluiced to a storage multi-cell storage facility where it is dried and stacked. In past times, ash was sluiced to a pond. This pond has been dredged to remove the majority of the ash. This pond is presently used as part of the wastewater treatment process, and is referred to as the Stormwater Pond.

Both the Stormwater Pond and the Gypsum Storage Area are surrounded by dikes made of compacted earth bearing on native soils. The purpose of this calculation is to evaluate the potential for liquefaction of the dikes and foundation soils to occur during earthquake shaking.

Summary of Conclusions

The USGS online map of Quaternary Fault and Fold Database indicates Plant Crist is located within the area of Gulf-margin normal faults. The USGS report indicates there is little evident of Quaternary slip on these faults, and states that is it not clear that slip on these faults would occur seismically. They have a “strikingly low historical seismicity.”

At the Gypsum Storage Area, the analysis indicates liquefaction of the foundation soils is not a threat during either of the scenario earthquakes.

At the Stormwater Pond, liquefaction does not appear to be threat during the CEUS scenario earthquake, which comprises nearly 90 percent of the hazard.

During the NMSZ scenario earthquake, some of soft naturals soils encountered immediately beneath the dike exhibited factors of safety between 1.1 and 1.4. This suggests some strength loss may occur in this stratum due to earthquake-induced pore pressure buildup. Evidence suggests the major earthquakes at the NMSZ recur on the order of every 500 years, with last major events happening about 200 years ago. A time-dependant model for the NMSZ hazard is not available at present. However, we believe there is very low likelyhood of an NMSZ scenario earthquake occurring over the life of the plant.

To evaluate the impact of earthquake-induced strength loss in the soft stratum, it would be necessary to perform seismic deformation analysis on the dike. This would be an extensive undertaking including significant additional field and laboratory testing and significant engineering analysis. Given this low risk, and the fact that ash is no longer sluiced to this pond. such an extensive study is unwarranted.

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 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).

The deaggregation of the published 2008 PSHA data for the site indicates the nearly 90% of the seismic hazard for Plant Crist is derived from the Central and Eastern US random faulting source (CEUS), and about 11% percent of the hazard is attributed to the distant New Madrid Source Zone. Two scenarios were evaluated for potential liquefaction, the average magnitude and acceleration from the CEUS random source and the distant M7.8 NMSZ event.

Criteria and Assumptions

Based on the historical SPT data (1971 and 1992 borings), the subsurface conditions at the Stormwater Pond are considered consistent with Site Class E, Soft Soils. Based on the SPT data, the subsurface conditions at the Gypsum Storage Area are considered consistent with Site Class D, Stiff Soils.

The deaggregation of the USGS PSHA data (2% chance of exceedance over 50 years) for the Plant Crist indicated an average earthquake of M5.8 at 100km for the CUES source and a M7.8 at 630km for the NMSZ. The corresponding site-modified zero period accelerations (PGA) are 0.066g (CEUS) and 0.039g (NMSZ) for the Stormwater Pond (Site Class E) and 0.042g (CEUS) and 0.025g (NMSZ) for Gypsum Storage Area (Site Class D).

A topographic amplification factor of 1.42 was applied to the site-modified PGA values to determine the acceleration at the crest of the Stormwater Pond Dike.

At the Gypsum Storage Area, the borings predate the construction and the liquefaction analysis considers the foundation soils only. Because the gypsum and dikes are drained, they will not be subject to liquefaction. The overburden pressure of the dikes and gypsum will increase as gypsum is stored, enhancing the liquefaction resistance of the foundation soils.

SPT testing was 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. Liquefaction potential is evaluated as the CRR divided by CSR. Values of less than 1.1 are considered at risk of liquefaction during a design earthquake event, values between 1.1 and 1.4 are considered to have the potential for some pore-pressure induced strength loss, and values greater than 1.4 are considered not likely to liquefy.

Design Inputs/References

1. Southern Company SPT Test Borings APD-6 and APD-7 (1992)
2. Law Engineering SPT Test Boring B-110 (1971)
3. Southern Company SPT Test Borings GYP-1S, GYP-16 and GYP-36
4. USGS Probabilistic Earthquake Hazard Data Interactive Deaggregation (2008 data; 2% exceedance over 50 years)

Body of Calculation

Attached

Plant Crist CCB Facilities

Simplified Evaluation of Liquefaction Potential in SPT Test Borings

prepared by Ben Gallagher, 9/6/2012

Stormwater Pond Dike Centerline									
	APD-6			B-110			APD-7		
Depth	SPT N-value	Factor of Safety, CEUS	Factor of Safety, New Madrid	SPT N-value	Factor of Safety, CEUS	Factor of Safety, New Madrid	SPT N-value	Factor of Safety, CEUS	Factor of Safety, New Madrid
5	13	>5	>5	5	2.8	2.8	20	>5	>5
10	43	>5	>5	5	2.6	2.5	33	>5	>5
15	32	>5	>5	5	2.4	2.2	17	>5	>5
20	26	>5	>5	5	2.1	1.9	4	2.0	1.8
25	6	2.2	1.8	5	2.0	1.7	8	2.5	2.1
30	5	clay	clay	4	1.8	1.5	5	clay	clay
35	3	2.2	1.7	**0**	1.4	**1.1**	**1**	1.5	**1.1**
40	3	1.6	**1.2**	4	1.8	1.4	5	2.0	1.4
45	6	2.0	1.4	4	1.9	**1.3**	9	2.5	1.8
50				51	>5	>5			
55									

Water at 10 feet below top of dike

Gypsum Stroage Area Foundation									
	GYP-1S			GYP-16			GYP-36		
Depth	SPT N-value	Factor of Safety, CEUS	Factor of Safety, New Madrid	SPT N-value	Factor of Safety, CEUS	Factor of Safety, New Madrid	SPT N-value	Factor of Safety, CEUS	Factor of Safety, New Madrid
5	11	Excavated		17	Excavated		6	Excavated	
10	8	>5	>5	3			9		
15	10	>5	>5	5			2		
20	15	>5	>5	7			9		
25	21	>5	>5	33			13	>5	>5
30	19	>5	>5	17			20	>5	>5
35	13	>5	>5	24			25	>5	>5
40	21	>5	>5	16			2	4.6	4.1
45	31	>5	>5	27			5	>5	>5
50	40	>5	>5	23	>5	>5	16	>5	>5
55	47	>5	>5	45	>5	>5	23	>5	>5
60	15	>5	>5	27	>5	>5	28	>5	>5
65	5	>5	3.7				62	>5	>5
70							40	>5	>5
75							25	>5	>5
80							52	>5	>5
85							64	>5	>5

Water at Elev. 15

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 "Simplified" 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.

The ground motions were selected based on sources identified using the interactive deaggregation of the USGS-published 2008 PSHA data. For comparison, two earthquake sources were considered, the CEUS gridded random source (88% the hazard) with a average magnitude of 5.8 and distance of 100.6 km and the New Madrid Source Zone (11% of the Hazard) with a magnitude of 7.78 and distance of 627 km. The site-modified zero period accelerations (PGA) are 0.042g (CESU) and 0.025g (NMSZ) for Gypsum Storage Area (Site Class D) and 0.066g and 0.039g (NMSZ) for the Stormwater Pond dike (Site Class E). A topographic amplification factor of 1.42 was applied to the site-modified PGA values to determine the acceleration at the crest of the ash pond dike.

*** Deaggregation of Seismic Hazard at One Period of Spectral Accel. ***
*** Data from U.S.G.S. National Seismic Hazards Mapping Project, 2008 version ***
PSHA Deaggregation. %contributions. site: Crist_CCB_Facil long: 87.233 W., lat: 30.568 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.04419 g. Weight * Computed_Rate_Ex 0.404E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.00952
#This deaggregation corresponds to Mean Hazard w/all GMPEs

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
13.5	4.60	1.510	0.042	0.250	0.628	0.517	0.071	0.002
34.4	4.60	2.564	0.199	1.165	1.148	0.052	0.000	0.000
61.3	4.61	0.861	0.336	0.525	0.000	0.000	0.000	0.000
88.4	4.61	0.175	0.172	0.004	0.000	0.000	0.000	0.000
116.6	4.61	0.112	0.112	0.000	0.000	0.000	0.000	0.000
13.6	4.79	2.627	0.069	0.412	1.034	0.947	0.160	0.004
34.8	4.80	5.239	0.327	1.956	2.695	0.260	0.000	0.000
61.7	4.80	2.100	0.554	1.514	0.032	0.000	0.000	0.000
88.6	4.81	0.500	0.387	0.112	0.000	0.000	0.000	0.000
118.2	4.81	0.393	0.392	0.001	0.000	0.000	0.000	0.000
13.8	5.03	1.792	0.045	0.266	0.668	0.666	0.141	0.007
35.5	5.03	4.375	0.211	1.263	2.450	0.451	0.000	0.000
62.2	5.03	2.265	0.357	1.608	0.299	0.000	0.000	0.000
88.8	5.04	0.651	0.269	0.382	0.000	0.000	0.000	0.000
119.5	5.04	0.622	0.529	0.094	0.000	0.000	0.000	0.000
166.5	5.05	0.123	0.123	0.000	0.000	0.000	0.000	0.000
13.9	5.21	0.662	0.016	0.095	0.239	0.239	0.069	0.004
35.9	5.21	1.852	0.076	0.452	1.035	0.289	0.000	0.000
62.6	5.21	1.148	0.128	0.720	0.300	0.000	0.000	0.000
88.9	5.21	0.376	0.096	0.280	0.000	0.000	0.000	0.000
120.3	5.21	0.407	0.249	0.158	0.000	0.000	0.000	0.000
168.4	5.21	0.110	0.110	0.000	0.000	0.000	0.000	0.000
13.9	5.39	0.978	0.023	0.138	0.346	0.346	0.117	0.007
36.3	5.39	3.059	0.110	0.655	1.619	0.666	0.009	0.000
63.0	5.40	2.233	0.185	1.106	0.942	0.000	0.000	0.000
89.0	5.40	0.834	0.140	0.672	0.022	0.000	0.000	0.000
121.1	5.40	1.025	0.382	0.642	0.000	0.000	0.000	0.000
169.7	5.41	0.352	0.335	0.017	0.000	0.000	0.000	0.000
217.3	5.41	0.070	0.070	0.000	0.000	0.000	0.000	0.000
14.0	5.61	0.468	0.011	0.065	0.163	0.163	0.062	0.004
36.7	5.61	1.643	0.052	0.309	0.775	0.490	0.018	0.000
63.4	5.62	1.444	0.087	0.522	0.822	0.014	0.000	0.000
89.2	5.62	0.625	0.066	0.393	0.167	0.000	0.000	0.000
121.9	5.62	0.878	0.180	0.678	0.020	0.000	0.000	0.000
170.7	5.62	0.379	0.262	0.116	0.000	0.000	0.000	0.000
219.7	5.62	0.112	0.112	0.000	0.000	0.000	0.000	0.000
14.0	5.80	0.407	0.009	0.056	0.141	0.141	0.056	0.005
36.9	5.80	1.526	0.045	0.266	0.668	0.514	0.033	0.000
63.7	5.80	1.502	0.075	0.450	0.906	0.071	0.000	0.000
89.3	5.81	0.714	0.057	0.338	0.319	0.000	0.000	0.000
122.6	5.81	1.108	0.155	0.802	0.150	0.000	0.000	0.000
171.4	5.81	0.561	0.255	0.306	0.000	0.000	0.000	0.000
220.6	5.82	0.198	0.194	0.004	0.000	0.000	0.000	0.000
269.4	5.82	0.058	0.058	0.000	0.000	0.000	0.000	0.000
13.7	6.01	0.286	0.007	0.039	0.098	0.098	0.039	0.005
36.4	6.01	1.103	0.030	0.177	0.445	0.406	0.045	0.000
61.6	6.00	0.927	0.036	0.215	0.534	0.142	0.000	0.000
85.7	6.01	0.813	0.045	0.267	0.498	0.004	0.000	0.000
123.7	6.01	1.055	0.096	0.576	0.383	0.000	0.000	0.000
172.6	6.01	0.629	0.157	0.468	0.005	0.000	0.000	0.000
221.4	6.01	0.280	0.206	0.074	0.000	0.000	0.000	0.000
271.1	6.02	0.107	0.107	0.000	0.000	0.000	0.000	0.000
13.3	6.21	0.275	0.006	0.038	0.094	0.094	0.037	0.005
36.5	6.21	1.070	0.027	0.164	0.412	0.400	0.066	0.000
60.6	6.21	0.817	0.028	0.165	0.415	0.209	0.000	0.000

379.7	7.39	0.693	0.175	0.454	0.065	0.000	0.000	0.000
624.2	7.45	0.826	0.457	0.369	0.000	0.000	0.000	0.000
628.2	7.42	1.042	0.829	0.213	0.000	0.000	0.000	0.000
721.4	7.39	0.822	0.822	0.000	0.000	0.000	0.000	0.000
126.1	7.59	0.050	0.001	0.008	0.020	0.020	0.001	0.000
176.2	7.59	0.068	0.002	0.012	0.031	0.022	0.000	0.000
224.4	7.59	0.077	0.003	0.018	0.044	0.012	0.000	0.000
274.0	7.59	0.061	0.003	0.019	0.039	0.000	0.000	0.000
380.5	7.59	0.125	0.019	0.077	0.029	0.000	0.000	0.000
627.4	7.70	5.490	2.354	3.135	0.000	0.000	0.000	0.000
627.0	8.00	4.181	1.331	2.230	0.619	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 100.0
Mean src-site R= 164.0 km; M= 6.03; eps0= -0.01. Mean calculated for all sources.
Modal src-site R= 627.4 km; M= 7.70; eps0= 1.51 from peak (R,M) bin
MODE R*= 626.9km; M*= 7.70; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 3.135

Principal sources (faults, subduction, random seismicity having > 3% contribution)

Source Category:	% contr.	R(km)	M	epsilon0 (mean values).
New Madrid SZ no clustering	10.99	627.0	7.78	1.42
CEUS gridded	88.12	100.6	5.80	-0.21

Individual fault hazard details if its contribution to mean hazard > 2%:

Fault ID	% contr.	Rcd(km)	M	epsilon0	Site-to-src azimuth(d)
New Madrid FZ, central	7.61	628.6	7.78	1.43	-30.6

#*********End of deaggregation corresponding to Mean Hazard w/all GMPEs *********#

PSHA Deaggregation. %contributions. site: Crist_CCB_Facil long: 87.233 W., lat: 30.568 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.04419 g. Weight * Computed_Rate_Ex 0.938E-04
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.01155
#This deaggregation corresponds to Toro et al. 1997

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
13.7	4.60	0.412	0.042	0.250	0.120	0.000	0.000	0.000
35.0	4.60	0.891	0.199	0.679	0.013	0.000	0.000	0.000
61.9	4.61	0.411	0.298	0.112	0.000	0.000	0.000	0.000
88.2	4.61	0.087	0.087	0.000	0.000	0.000	0.000	0.000
115.6	4.61	0.046	0.046	0.000	0.000	0.000	0.000	0.000
13.8	4.79	0.690	0.069	0.412	0.209	0.000	0.000	0.000
35.3	4.80	1.630	0.328	1.256	0.047	0.000	0.000	0.000
62.2	4.80	0.843	0.515	0.328	0.000	0.000	0.000	0.000
88.3	4.81	0.199	0.198	0.001	0.000	0.000	0.000	0.000
116.9	4.81	0.122	0.122	0.000	0.000	0.000	0.000	0.000
13.9	5.03	0.463	0.045	0.266	0.153	0.000	0.000	0.000
35.9	5.03	1.321	0.211	1.022	0.087	0.000	0.000	0.000
62.7	5.03	0.855	0.357	0.498	0.000	0.000	0.000	0.000
88.5	5.04	0.241	0.212	0.029	0.000	0.000	0.000	0.000
118.4	5.04	0.182	0.182	0.000	0.000	0.000	0.000	0.000
166.7	5.05	0.035	0.035	0.000	0.000	0.000	0.000	0.000
13.9	5.21	0.169	0.016	0.095	0.058	0.000	0.000	0.000
36.3	5.21	0.545	0.076	0.413	0.057	0.000	0.000	0.000
63.0	5.21	0.412	0.128	0.284	0.000	0.000	0.000	0.000
88.7	5.21	0.132	0.093	0.039	0.000	0.000	0.000	0.000
119.2	5.21	0.113	0.111	0.002	0.000	0.000	0.000	0.000
168.9	5.21	0.030	0.030	0.000	0.000	0.000	0.000	0.000
14.0	5.39	0.248	0.023	0.138	0.087	0.000	0.000	0.000
36.6	5.39	0.879	0.110	0.636	0.133	0.000	0.000	0.000
63.4	5.39	0.761	0.185	0.576	0.000	0.000	0.000	0.000
88.8	5.40	0.273	0.140	0.134	0.000	0.000	0.000	0.000
119.9	5.40	0.264	0.238	0.026	0.000	0.000	0.000	0.000
170.2	5.40	0.089	0.089	0.000	0.000	0.000	0.000	0.000
217.5	5.40	0.020	0.020	0.000	0.000	0.000	0.000	0.000
14.0	5.61	0.118	0.011	0.065	0.042	0.000	0.000	0.000

Appendix B

USEPA Checklists

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Gulf Power- Plant Crist	Date:	August 20, 2012
Unit Name:	Ash Pond	Operator's Name:	Gulf Power
Unit I.D.:		Hazard Potential Classification:	High **Significant** (circled) Low
Inspector's Name:	William Fox/ Eduardo Gutierrez		

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		18. Sloughing or bulging on slopes?	X	
2. Pool elevation (operator records)?	87.0		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	87.5		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	87.0		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	90.0		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	DNA		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	DNA		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	DNA		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?	DNA		23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?	X		24. Were Photos taken during the dam inspection?	X	

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

Inspection Issue # — Comments

1. Weekly by plant personnel, annually by Southern Company Services.

2,3,4,5. Referenced to plant datum.

6. Instrumentation is not present.

12. Trashracks are not present.

17,18. Minor erosion scarps and minor bulging at the Rip-Rap area on the northeast outboard toe of slope.

21. Wet areas were observed along the toe of slope on the southeast adjacent to Thompson Bayou (Outflow Canal).

NA = Not Available
DNA = Does Not Apply

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW) Impoundment Inspection

Impoundment NPDES Permit # 0002275 INSPECTOR William Fox and Eduardo Gutierrez

Date August 20, 2012

Impoundment Name Ash Pond
Impoundment Company Gulf Power Company
EPA Region 4
State Agency (Field Office) Addresss 61 Forsyth Street, SW
Atlanta, Ga 30303-8960
Name of Impoundment Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ____

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

IMPOUNDMENT FUNCTION: Settling of ash and coal combustion waste

Nearest Downstream Town : Name Pensacola, Florida
Distance from the impoundment 0.5 miles
Impoundment
Location: Longitude 87 Degrees 13 Minutes 11.70W Seconds
Latitude 30 Degrees 33 Minutes 47.95N Seconds
State Florida County Escambia County

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

If So Which State Agency? Florida Department of Environmental Protection

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.

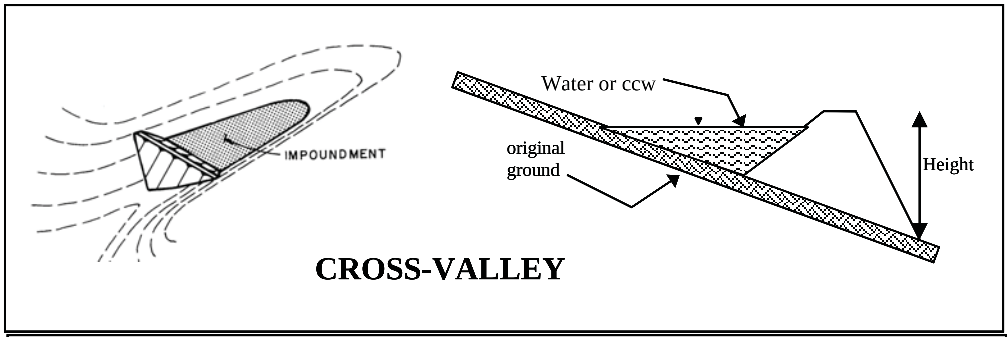
__X____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

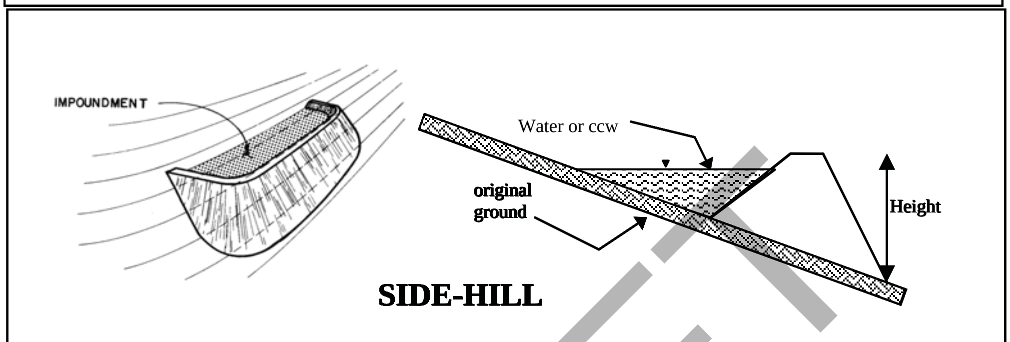
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

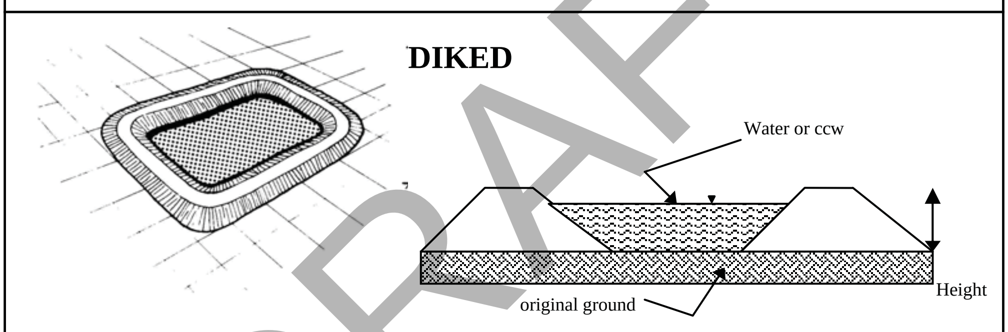
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

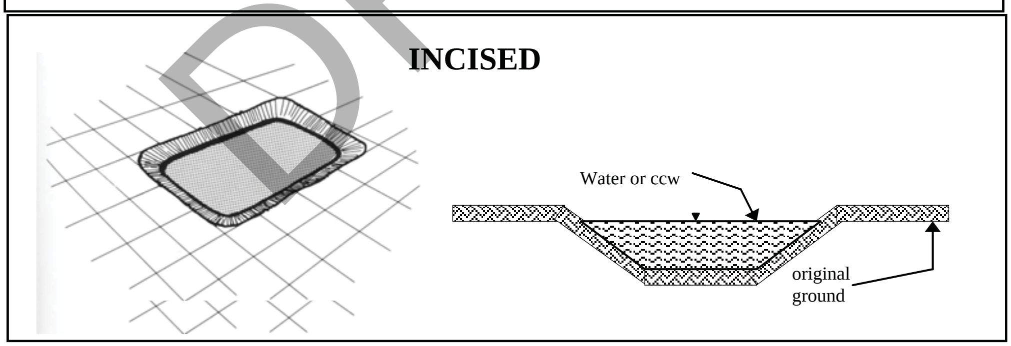
Failure or misoperation could result in economic loss and environmental damage to adjacent waterways and downstream estuaries. No probable loss of human life is anticpated.

CONFIGURATION:









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

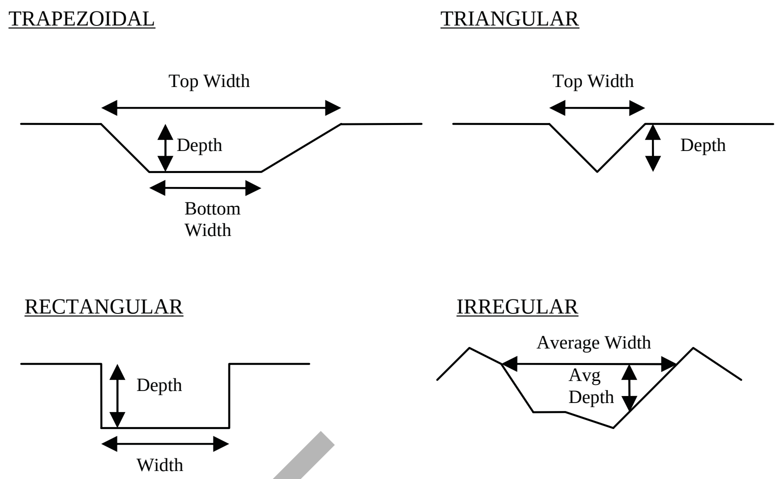
Embankment Height 24 feet   Embankment Material Earthen
Pool Area 13 acres   Liner DNA
Current Freeboard 3 feet   Liner Permeability DNA

NA = Not Available
DNA = Does Not Apply

TYPE OF OUTLET (Mark all that apply)

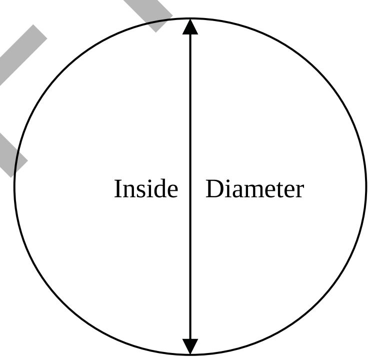
__X__ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
__X__ Rectangular (concrete)
_____ Irregular

__2'__ depth
__20'__ bottom (or average) width
__20'__ top width



__DNA__ **Outlet**

_____ inside diameter



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

Is water flowing through the outlet? YES __X__ NO _______

_____ **No Outlet**

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

The Impoundment was Designed By __Southern Company Services__

NA = Not Available
DNA = Does Not Apply

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

If So When? ___________________________

If So Please Describe : ____

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

If So When? ___________________________

IF So Please Describe: ____

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

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

If so Please Describe : ____

ADDITIONAL INSPECTION QUESTIONS

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

CDM Smith's review of the available limited subsurface information indicates the embankment construction was not over wet ash or slag, however there is a layer of wet, loose, fine to medium sand immediately below the embankment fill.

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

The assessor did not meet with, or have documentation from, the design Engineer of Record concerning foundation preparation.

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

There was no indication of prior releases, failures or patchwork on the embankments.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Gulf Power - Plant Crist	Date:	August 21, 2012
Unit Name:	Gypsum Stacking/Storage Pond	Operator's Name:	Gulf Power
Unit I.D.:		Hazard Potential Classification:	High **(Significant)** Low
Inspector's Name:	William Fox/ Eduardo Gutierrez		

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		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	113.0		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	DNA		20. Decant Pipes: DNA		
4. Open channel spillway elevation (operator records)?	DNA		Is water entering inlet, but not exiting outlet?		
5. Lowest dam crest elevation (operator records)?	122.0		Is water exiting outlet, but not entering inlet?		
6. If instrumentation is present, are readings recorded (operator records)?	DNA		Is water exiting outlet flowing clear?		
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	DNA		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?	X	
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?	X	
12. Are decant trashracks clear and in place?	DNA		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?	DNA		23. Water against downstream toe?		X
17. Cracks or scarps on slopes?	X		24. Were Photos taken during the dam inspection?	X	

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

Inspection Issue # Comments

1. Weekly by plant personnel, annually by Southern Company Services.

2,5. Referenced to plant datum.

6. Instrumentation is not present.

12. Trashracks are not present.

17. Minor erosion scarps and small erosion gullies observed at isolated locations on the west outboard slope.

21. Wet areas were observed at and near the toe of slope along southwest and west outboard slopes.

NA = Not Available
DNA = Does Not Apply

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW) Impoundment Inspection

Impoundment NPDES Permit # 0002275 INSPECTOR William Fox and Eduardo Gutierrez

Date August 21, 2012

Impoundment Name Gypsum Stacking/Storage Pond

Impoundment Company Gulf Power Company

EPA Region 4

State Agency (Field Office) Addresss 61 Forsyth Street, SW
Atlanta, Ga 30303-8960

Name of Impoundment Gypsum Stacking/Storage Pond

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

New X Update ____

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

IMPOUNDMENT FUNCTION: Disposal and primary settling of gypsum

Nearest Downstream Town : Name Pensacola, Florida

Distance from the impoundment 0.5 miles

Impoundment Location:

Longitude 87 Degrees 13 Minutes 58.72W Seconds

Latitude 30 Degrees 34 Minutes 6.54N Seconds

State Florida County Escambia County

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

If So Which State Agency? Florida Department of Environmental Protection

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.

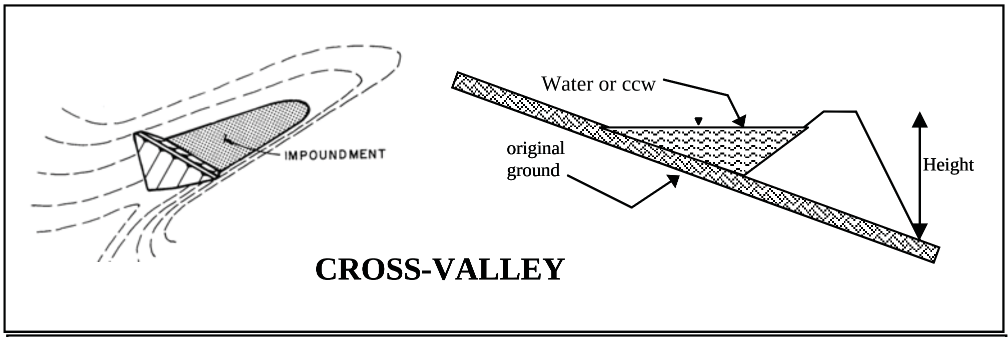
__X___ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

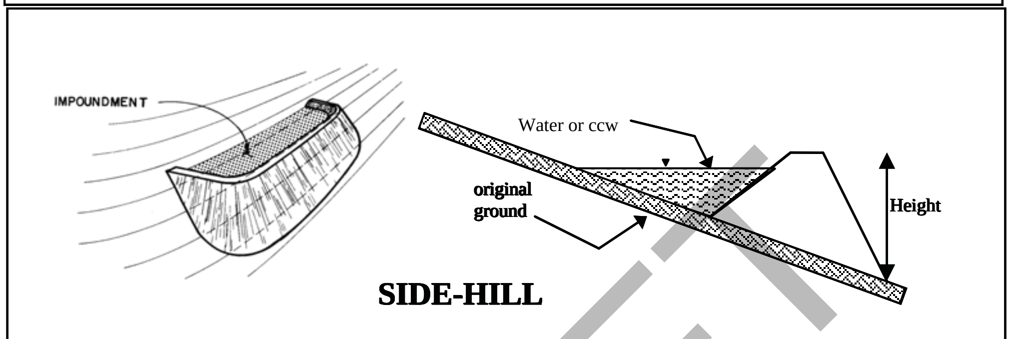
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

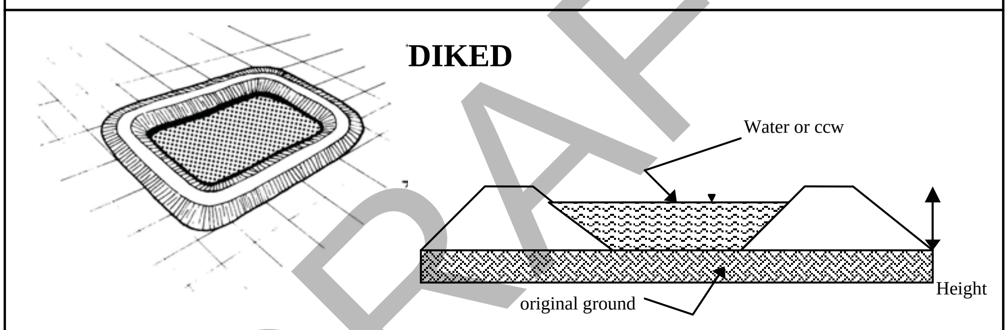
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

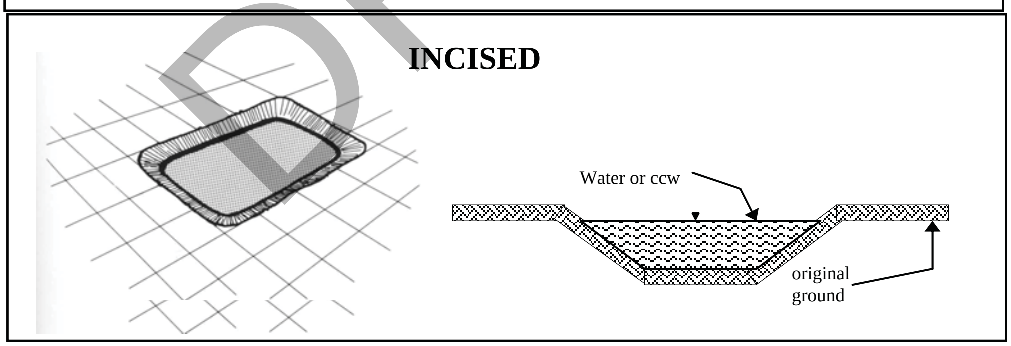
Failure or misoperation could result in environmental damage and economic loss and damage to plant infrastructure, operations and utilities. Loss of human life as a result of failure or misoperation is not anticipated.

<u>CONFIGURATION</u>:









______ Cross-Valley
______ Side-Hill
__X__ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

Embankment Height ___32___ feet

Pool Area ___14___ acres

Current Freeboard ___9___ feet

Embankment Material ___Earthen___

Liner ___Composite (bottom and inboard slopes)___

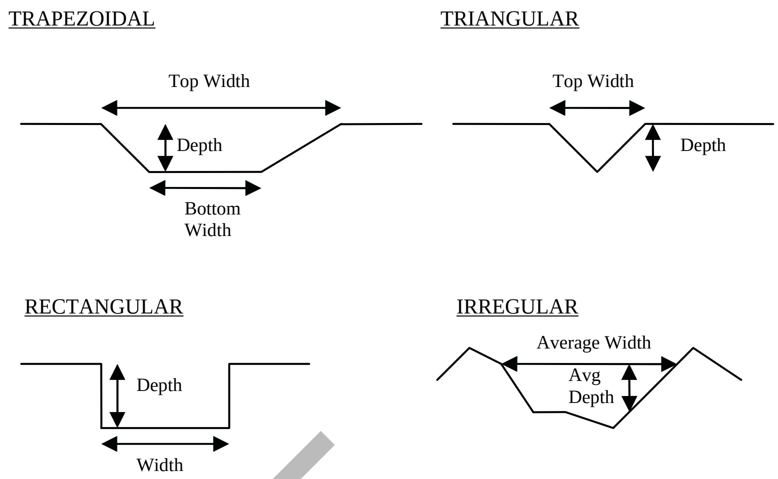
Liner Permeability ___1.0 E-7 cm/sec for clay___
1.0 E-9 cm/sec for GCL
1.0 E-12 cm/sec for liner

NA = Not Available
DNA = Does Not Apply

TYPE OF OUTLET (Mark all that apply)

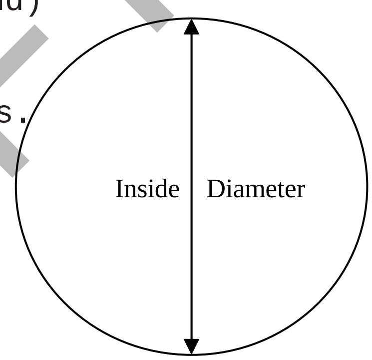
DNA **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



X **Outlet** (to Process Sedimentation Pond)

36" inside diameter
(Decant Riser Pipe/Structure with stop logs. Pipe size reduces to 30" inside diameter.)



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

Is water flowing through the outlet? YES X NO _______

_____ **No Outlet**

X **Other Type of Outlet** (specify) 36-foot long, twin 7'W x 5'H concrete box culvert at NE corner of pond connecting to Process Sedimentation Pond

The Impoundment was Designed By Southern Company Services

NA = Not Available
DNA = Does Not Apply

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

If So When? ___________________________

If So Please Describe : ____

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

If So When? ___________________________

IF So Please Describe: ____

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

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

If so Please Describe : ____

ADDITIONAL INSPECTION QUESTIONS

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

It is unknown if the embankment construction was over wet ash, slag or other unsuitable material.

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

The assessor did not meet with, or have documentation from, the design Engineer of Record concerning foundation preparation.

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

There was no indication of prior releases, failures or patchwork on the embankments.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Gulf Power - Plant Crist	Date: August 21, 2012
Unit Name: Process Return Water Pond	Operator's Name: Gulf Power
Unit I.D.:	Hazard Potential Classification: High **Significant** (circled) Low
Inspector's Name: William Fox/ Eduardo Gutierrez	

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

	Yes	No
1. Frequency of Company's Dam Inspections?	Weekly	
2. Pool elevation (operator records)?	98.0	
3. Decant inlet elevation (operator records)?	85.3	
4. Open channel spillway elevation (operator records)?	DNA	
5. Lowest dam crest elevation (operator records)?	106.0	
6. If instrumentation is present, are readings recorded (operator records)?	DNA	
7. Is the embankment currently under construction?		X
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	DNA	
9. Trees growing on embankment? (If so, indicate largest diameter below)		X
10. Cracks or scarps on crest?		X
11. Is there significant settlement along the crest?		X
12. Are decant trashracks clear and in place?	DNA	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X
14. Clogged spillways, groin or diversion ditches?		X
15. Are spillway or ditch linings deteriorated?		X
16. Are outlets of decant or underdrains blocked?	DNA	
17. Cracks or scarps on slopes?		X

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

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

Inspection Issue #	Comments

1. Weekly by plant personnel, annually by Southern Company Services.

2,3,5. Referenced to plant datum.

6. Instrumentation is not present.

12. Trashracks are not present.

20. Water is pumped from pond to plant for reuse.

EPA FORM -XXXX

NA = Not Available
DNA = Does Not Apply

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # 0002275 INSPECTOR William Fox and Eduardo Gutierrez

Date August 21, 2012

Impoundment Name Process Return Water Pond

Impoundment Company Gulf Power Company

EPA Region 4

State Agency (Field Office) Addresss 61 Forsyth Street, SW
Atlanta, Ga 30303-8960

Name of Impoundment Process Return Water Pond

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

New X Update ____

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

IMPOUNDMENT FUNCTION: Tertiary sedimentation and settling of gypsum

Nearest Downstream Town : Name Pensacola, Florida

Distance from the impoundment 0.5 miles

Impoundment Location:
Longitude 87 Degrees 13 Minutes 49.27W Seconds
Latitude 30 Degrees 34 Minutes 10.90N Seconds
State Florida County Escambia County

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

If So Which State Agency? Florida Department of Environmental Protection

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.

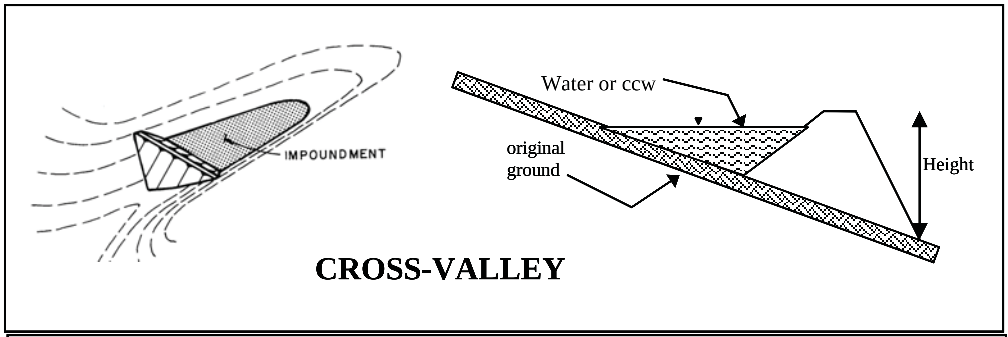
__X___ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

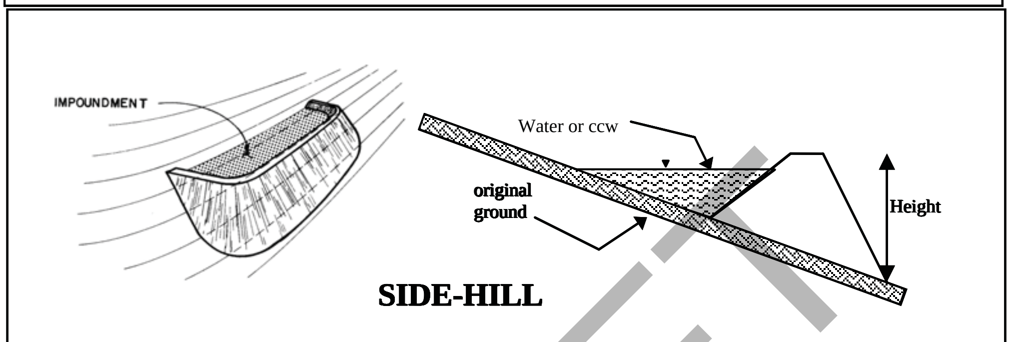
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

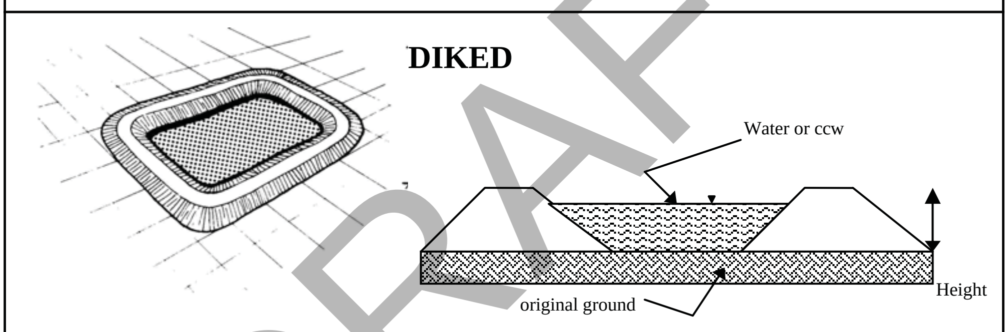
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

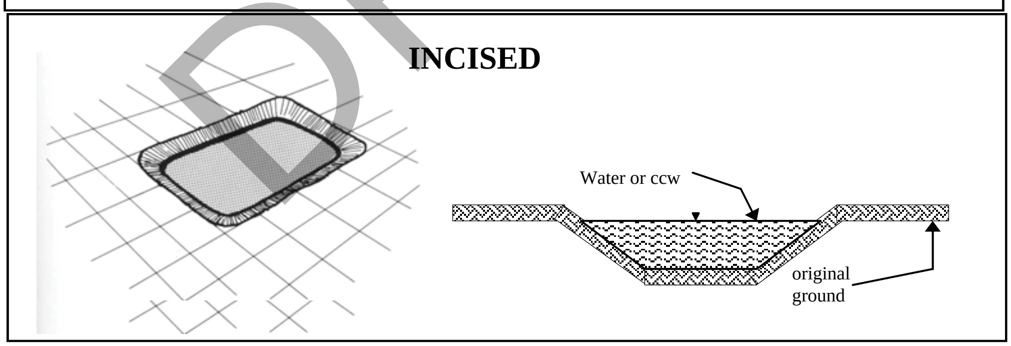
Failure or misoperation could result in environmental damage and economic loss and damage to plant infrastructure, operations and utilities. Loss of human life as a result of failure or misoperation is not anticipated.

CONFIGURATION:









______ Cross-Valley
______ Side-Hill
______ Diked
______ Incised (form completion optional)
__X__ Combination Incised/Diked

Embankment Height ___23___ feet
Pool Area ___2.5___ acres
Current Freeboard ___8___ feet

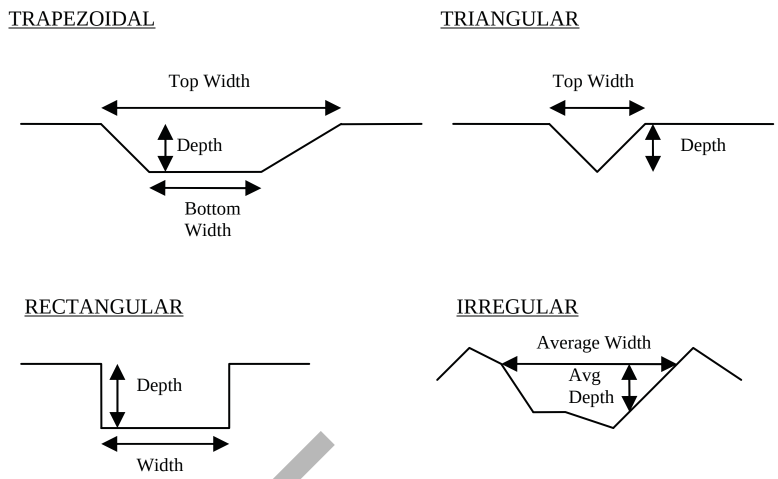
Embankment Material ___Earthen___
Liner Composite (bottom and inboard slopes)
Liner Permeability 1.0 E-7 cm/sec for clay
1.0 E-9 cm/sec for GCL
1.0 E-12 cm/sec for liner

NA = Not Available
DNA = Does Not Apply

TYPE OF OUTLET (Mark all that apply)

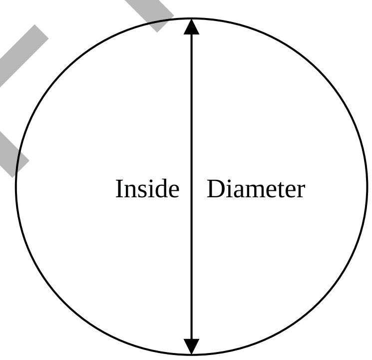
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ 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 __X__ NO ______

__X__ **No Outlet** (Water is pumped from pond to plant for reuse)

_____ **Other Type of Outlet** (specify) Emergency spillway approximately 20 feet wide on West Side of Pond. Downstream slope is articulated concrete block armoring.

The Impoundment was Designed By Southern Company Services

NA = Not Available
DNA = Does Not Apply

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

If So When? ___________________________

If So Please Describe : ____

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

If So When? ______________________________

IF So Please Describe: ____

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

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

If so Please Describe : ____

ADDITIONAL INSPECTION QUESTIONS

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

It is unknown if the embankment construction was over wet ash, slag or other unsuitable material.

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

The assessor did not meet with, or have documentation from, the design Engineer of Record concerning foundation preparation.

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

There was no indication of prior releases, failures or patchwork on the embankments.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Gulf Power - Plant Crist	Date: August 21, 2012
Unit Name: Process Sedimentation Pond	Operator's Name: Gulf Power
Unit I.D.:	Hazard Potential Classification: High (Significant) Low
Inspector's Name: William Fox/ Eduardo Gutierrez	

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		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	112.5		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	88.0		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	DNA		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	117.0		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	DNA		Is water exiting outlet flowing clear?	NA	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	DNA		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?	X	
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	DNA		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?	DNA		23. Water against downstream toe?		X
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

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

Inspection Issue #	Comments
1.	Weekly by plant personnel, annually by Southern Company Services.
2,3,5.	Referenced to plant datum.
6.	Instrumentation is not present.
12.	Trashracks are not present.
20.	No water flow was observed.
21.	Wet areas were observed at and near the toe of slope along the northeast outboard slopes.

EPA FORM -XXXX

NA = Not Available
DNA = Does Not Apply

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # 0002275 INSPECTOR William Fox and Eduardo Gutierrez

Date August 21, 2012

Impoundment Name Process Sedimentation Pond

Impoundment Company Gulf Power Company

EPA Region 4

State Agency (Field Office) Addresss 61 Forsyth Street, SW
Atlanta, Ga 30303-8960

Name of Impoundment Process Sedimentation Pond

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

New X Update ____

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

IMPOUNDMENT FUNCTION: Sedimentation and secondary settling of gypsum

Nearest Downstream Town : Name Pensacola, Florida

Distance from the impoundment 0.5 miles

Impoundment Location:
Longitude 87 Degrees 13 Minutes 58.55W Seconds
Latitude 30 Degrees 34 Minutes 14.62N Seconds
State Florida County Escambia County

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

If So Which State Agency? Florida Department of Environmental Protection

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.

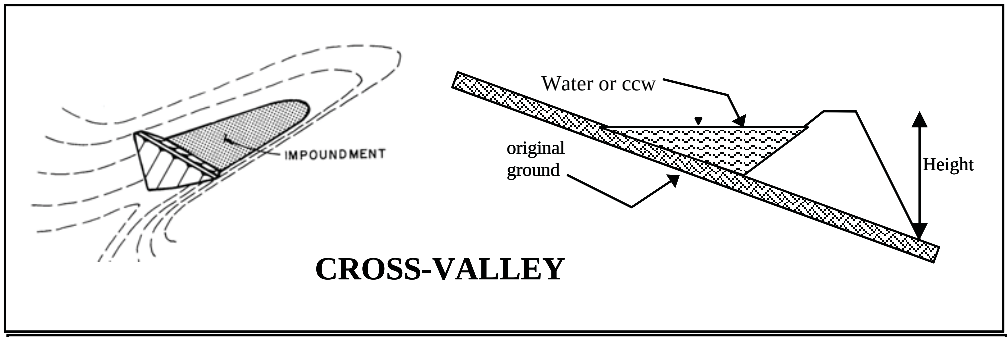
__X___ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

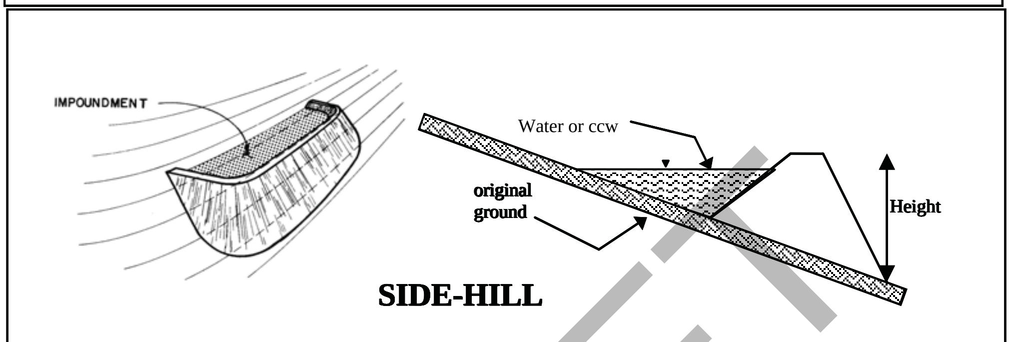
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

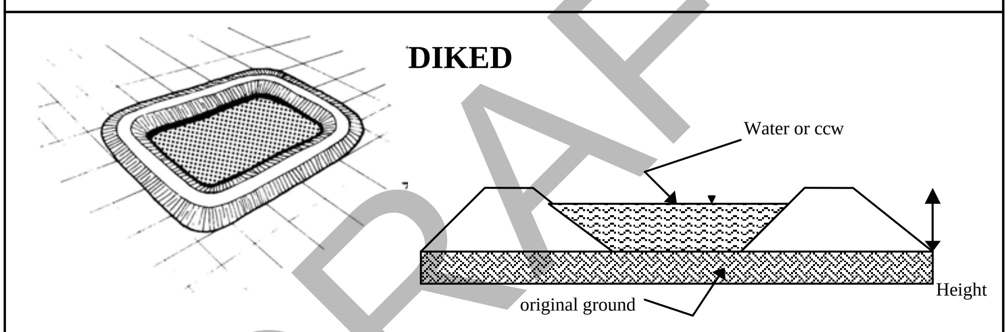
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

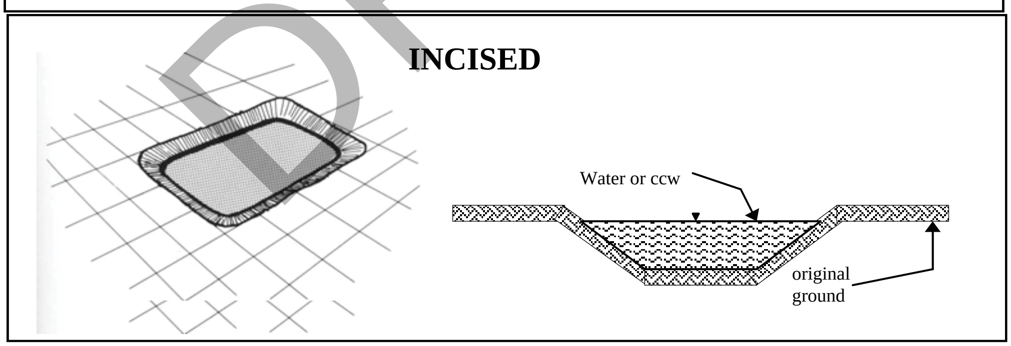
Failure or misoperation could result in environmental damage and economic loss and damage to plant infrastructure, operations and utilities. Loss of human life as a result of failure or misoperation is not anticipated.

CONFIGURATION:









______ Cross-Valley
______ Side-Hill
__X___ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

Embankment Height __34__ feet — Embankment Material __Earthen__
Pool Area __3__ acres — Liner Composite (bottom and inboard slopes)
Current Freeboard __4.5__ feet — Liner Permeability 1.0 E-7 cm/sec for clay
1.0 E-9 cm/sec for GCL
1.0 E-12 cm/sec for liner

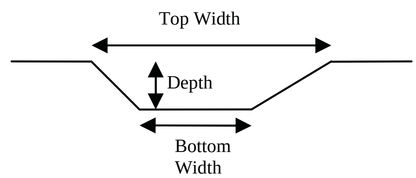
NA = Not Available
DNA = Does Not Apply

TYPE OF OUTLET (Mark all that apply)

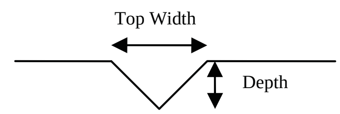
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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

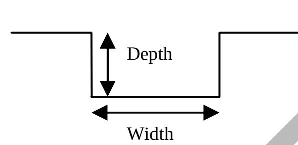
TRAPEZOIDAL



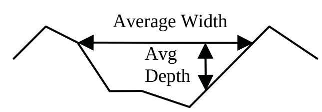
TRIANGULAR



RECTANGULAR

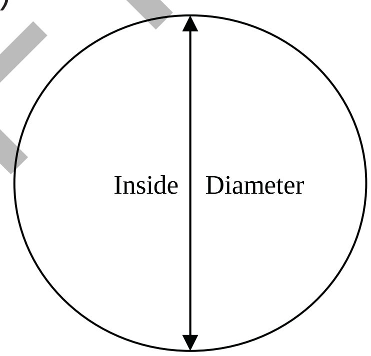


IRREGULAR



__X__ **Outlet** (to Process Return Water Pond)

__30"__ inside diameter



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

Is water flowing through the outlet? YES __X__ NO ______

_____ **No Outlet**

__X__ **Other Type of Outlet** (specify) Emergency spillway approximately 20 feet wide on East Side of Pond. Downstream slope is articulated concrete block armoring.

The Impoundment was Designed By Southern Company Services
____

NA = Not Available
DNA = Does Not Apply

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

If So When? ___________________________

If So Please Describe : ____

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

If So When? ___________________________

IF So Please Describe: ____

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

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

If so Please Describe : ____

ADDITIONAL INSPECTION QUESTIONS

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

It is unknown if the embankment construction was over wet ash, slag or other unsuitable material.

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

The assessor did not meet with, or have documentation from, the design Engineer of Record concerning foundation preparation.

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

There was no indication of prior releases, failures or patchwork on the embankments.

Appendix C

Photographs

Appendix C
Photographs GPS Locations

Site: Gulf Power - Plant Crist
Datum: NAD83
Coordinate Units: Decimal Degrees

Photograph No.	Latitude	Longitude
1	30.565318	-87.221083
2	30.565293	-87.220632
3	30.565293	-87.220632
4	30.565213	-87.220134
5	30.565213	-87.220134
6	30.565005	-87.219888
7	30.564816	-87.219679
8	30.564816	-87.219679
9	30.564551	-87.219411
10	30.564026	-87.218901
11	30.564046	-87.218822
12	30.564174	-87.218947
13	30.564103	-87.218892
14	30.564101	-87.218799
15	30.563944	-87.218759
16	30.563634	-87.218498
17	30.563621	-87.218381
18	30.563444	-87.218181
19	30.563510	-87.218305
20	30.563253	-87.218122
21	30.563213	-87.218070
22	30.563159	-87.218018
23	30.562986	-87.218068
24	30.562824	-87.218019
25	30.562642	-87.218239
26	30.562360	-87.218502
27	30.562030	-87.218894
28	30.561834	-87.219340
29	30.561888	-87.219861
30	30.561825	-87.219853
31	30.561824	-87.219932
32	30.562037	-87.219692
33	30.561989	-87.219782
34	30.562092	-87.219677
35	30.562054	-87.219855
36	30.562105	-87.219771
37	30.562148	-87.219826
38	30.561908	-87.220044
39	30.561992	-87.220030
40	30.562010	-87.219953
41	30.561925	-87.219974
42	30.561969	-87.220166
43	30.562083	-87.220138
44	30.562159	-87.220175
45	30.562107	-87.220251
46	30.562217	-87.220329
47	30.562171	-87.220248
48	30.562990	-87.221200
49	30.563035	-87.221107

Appendix C
Photographs GPS Locations

Site: Gulf Power - Plant Crist
Datum: NAD83
Coordinate Units: Decimal Degrees

Photograph No.	Latitude	Longitude
50	30.563096	-87.221164
51	30.562881	-87.220946
52	30.562594	-87.220579
53	30.562520	-87.220496
54	30.562505	-87.220586
55	30.562668	-87.220656
56	30.562588	-87.220490
57	30.562422	-87.220421
58	30.562285	-87.220221
59	30.562205	-87.220119
60	30.562181	-87.220065
61	30.562251	-87.220196
62	30.561946	-87.219699
63	30.561890	-87.219745
64	30.562070	-87.219049
65	30.561996	-87.219162
66	30.561903	-87.219118
67	30.561987	-87.219098
70	30.563421	-87.218402
71	30.563464	-87.218496
68	30.562782	-87.218194
69	30.562854	-87.218156
73	30.563836	-87.219082
72	30.563966	-87.219098
74	30.564567	-87.219529
75	30.564661	-87.219891
76	30.564781	-87.220071
77	30.564741	-87.219988
78	30.564817	-87.220709
79	30.565012	-87.220717
80	30.564922	-87.220683
81	30.564859	-87.220829
82	30.564662	-87.220726
83	30.564699	-87.220793
84	30.564483	-87.220588
85	30.564427	-87.220665
86	30.563983	-87.221806
87	30.563996	-87.221706
88	30.564077	-87.221626
89	30.564523	-87.221775
90	30.564467	-87.221852
91	30.564604	-87.221694
92	30.564650	-87.221591
93	30.564445	-87.221277
94	30.564515	-87.221362
95	30.564669	-87.221151
96	30.564929	-87.221318
97	30.564858	-87.221329
98	30.564214	-87.221535

Appendix C
Photographs GPS Locations

Site: Gulf Power - Plant Crist
Datum: NAD83
Coordinate Units: Decimal Degrees

Photograph No.	Latitude	Longitude
99	30.564284	-87.221449
100	30.564377	-87.221365
101	30.564525	-87.221214
102	30.568349	-87.231398
103	30.568234	-87.231295
104	30.568151	-87.231393
105	30.567546	-87.232198
106	30.567546	-87.232198
107	30.566900	-87.233081
108	30.566883	-87.233501
109	30.566839	-87.233345
110	30.566754	-87.233518
111	30.566587	-87.233366
112	30.566669	-87.233539
113	30.567360	-87.233976
114	30.567550	-87.234153
115	30.567584	-87.234378
116	30.567499	-87.234314
117	30.567806	-87.234177
118	30.568022	-87.234353
119	30.568598	-87.234294
120	30.568689	-87.234297
121	30.568789	-87.234423
122	30.569115	-87.234588
123	30.569115	-87.234588
124	30.569241	-87.234538
125	30.569286	-87.234609
126	30.569539	-87.234577
127	30.569639	-87.234584
128-130	30.570349	-87.234691
131	30.571015	-87.234279
132	30.571075	-87.234193
133	30.571143	-87.234128
134	30.571477	-87.233760
135	30.571543	-87.233678
136	30.571664	-87.233417
137	30.571740	-87.233114
138	30.571741	-87.233218
139	30.571976	-87.232849
140	30.571845	-87.232853
141	30.571712	-87.233701
142	30.571710	-87.232739
143	30.571680	-87.232846
144	30.571436	-87.232524
145	30.571491	-87.232437
146	30.571325	-87.232450
147	30.571199	-87.232297
148	30.571307	-87.232261
149	30.571107	-87.232452

CDM Smith

Appendix C
Photographs GPS Locations

Site: Gulf Power - Plant Crist
Datum: NAD83
Coordinate Units: Decimal Degrees

Photograph No.	Latitude	Longitude
150	30.571019	-87.232368
151	30.571222	-87.232540
152	30.571074	-87.231494
153	30.568386	-87.231037
154	30.569099	-87.231730
155	30.568932	-87.231716
156	30.569033	-87.231654
157	30.569059	-87.231544
158	30.568962	-87.231580
159	30.569500	-87.232165
160	30.569603	-87.232195
161	30.570487	-87.231814
162	30.570352	-87.231804
163	30.570324	-87.231940
164	30.569760	-87.232725
165	30.569779	-87.232594
166	30.570285	-87.233380
167-171	30.570561	-87.233651
172	30.569467	-87.234351
173	30.569574	-87.234358
174	30.567644	-87.233871
175	30.567760	-87.233943
176	30.568453	-87.231340
177	30.568332	-87.231198
178	30.568871	-87.230638
179	30.568872	-87.230909
180	30.568881	-87.230793
181	30.568899	-87.230055
182	30.569238	-87.229918
183	30.570563	-87.230215
184	30.570465	-87.230212
185	30.570444	-87.230595
186	30.569995	-87.230903
187	30.569829	-87.230872
188	30.569664	-87.230903
189	30.569763	-87.231019
190	30.569973	-87.231052
191	30.570109	-87.231038
192	30.570448	-87.230780
193	30.569071	-87.230866
194	30.569017	-87.230762
195	30.565560	-87.235081
196	30.565456	-87.235136

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 1: Ash Pond – (typical) riprap along exterior slope of north embankment adjacent to Escambia River looking east.

Photo 2: Ash Pond - Minor scour/erosion along toe of exterior slope of northeast embankment looking east.

Photo 3: Exterior slope and crest of north embankment of Ash Pond showing minor scarp at toe of slope looking east.

Photo 4: Close up of eroded area at exterior toe of slope adjacent to Escambia River looking northwest.

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 5: Scarps and erosion along the exterior slope of Ash Pond north embankment looking east.

Photo 6: View of exterior slope of Ash Pond north embankment looking east.

Photo 7: Ash Pond north embankment looking southeast. Note steep slope and apparent remedial works (riprap) where previous sloughing occurred.

Photo 8: Ash Pond north embankment looking southeast. Note steep slope and apparent remedial works (riprap) where previous sloughing occurred.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 9: View of exterior slope of Ash Pond north embankment looking east.

Photo 10: Erosion at toe of northeast embankment exterior slope looking southeast.

Photo 11: General view of exterior slope of Ash Pond northeast embankment looking southeast.

Photo 12: General view of exterior slope of Ash Pond northeast embankment looking northwest.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 13: Animal burrow on exterior slope of Ash pond northeast embankment.

Photo 14: Animal burrow on exterior slope of Ash pond northeast embankment.

Photo 15: View of rill at exterior toe of slope of Ash Pond along Northeast embankment looking east.

Photo 16: Erosion along toe of slope Ash Pond northeast embankment looking southeast.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 17: Scarp with sand fan at toe of slope of Ash Pond along northeast embankment.

Photo 18: Scarp with sand fan at toe of slope of Ash Pond along northeast embankment.

Photo 19: Exterior slope of Ash Pond along northeast embankment showing scarp with sand fan at toe of slope looking northwest.

Photo 20: Tree stump found on exterior slope of Ash Pond.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 21: Tree stump found on exterior slope of Ash Pond.

Photo 22: Area of saturation along exterior toe of slope of Ash Pond near southeast corner.

Photo 23: Animal Burrow at southeast corner of Ash Pond.

Photo 24: Exterior slope of Ash Pond along southeast embankment looking southwest.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 25: Southeast embankment exterior slope looking southwest.

Photo 26: Southeast embankment exterior slope, tree stump and abandoned silt fence.

Photo 27: Exterior slope of Ash Pond along southeast embankment looking southwest. Note depression due to erosion.

Photo 28: View of sheet pile discharge weir looking south.

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 29: Scarp at toe of slope of Ash Pond along southwest corner.

Photo 30: Downstream view of discharge weir for outfall looking southeast.

Photo 31: Spillway and discharge channel of outfall structure.

Photo 32: Spillway and discharge channel of outfall structure.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 33: Downstream side and west wall of Ash Pond looking north.

Photo 34: Ash Pond spillway looking north.

Photo 35: View of Ash Pond from spillway structure looking north.

Photo 36: View of Ash Pond spillway structure looking northwest.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 37: Walkway on upstream side of spillway structure looking northwest.

Photo 38: Spillway structure looking downstream.

Photo 39: Spillway structure looking downstream.

Photo 40: Spillway structure looking downstream.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 41: Downstream side of Ash Pond spillway.

Photo 42: Downstream side of Ash Pond spillway.

Photo 43: East wall of Ash Pond spillway channel.

Photo 44: East wall of Ash Pond spillway channel.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 45: Exterior slope of Ash Pond along southwest embankment.

Photo 46: Exterior toe of slope of Ash Pond along southwest embankment looking northwest.

Photo 47: Exterior embankment slope of Ash Pond along southwest embankment.

Photo 48: Exterior slope of Ash Pond along southwest embankment looking southeast.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 49: Interior slope and crest of Ash Pond along southwest embankment looking southeast.

Photo 50: Interior slope of Ash Pond looking north.

Photo 51: Electrical pull box located along Ash Pond crest of southeast embankment.

Photo 52: Animal ōurrow located on crest of Ash Pond.

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 53: Interior slope scarps along Ash Pond southwest embankment looking southeast.

Photo 54: Interior slope scarps along Ash Pond southwest embankment looking northwest. Note steepness and discontinuity of eroded slope.

Photo 55: Crest of Ash Pond along southwest embankment looking northwest.

Photo 56: Crest of Ash Pond along southwest embankment looking southeast.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 57: Ruts and ponding of water on crest southwest embankment of Ash Pond.

Photo 58: Southwest embankment interior slope looking northwest. Note scarp and erosion at waterline.

Photo 59: Settlement erosion behind sheet pile wall and riprap on crest of Ash Pond southwest embankment. Note isolated area of loss of soil support.

Photo 60: Settlement erosion area behind sheet pile wall and riprap on crest of Ash Pond southwest embankment. Note isolated area of loss of soil support.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 61: Erosion area behind sheet pile wall and riprap on crest of Ash Pond southwest embankment. Note isolated area of loss of soil support.

Photo 62: Portion of abandoned sheet pile cofferdam left in place on south side of spillway used to construct spillway.

Photo 63: Portion of abandoned sheet pile cofferdam left in place on south side of spillway used to construct spillway.

Photo 64: Interior slope and crest of Ash Pond along southeast embankment looking northeast.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 65: Erosion at interior slope and crest of Ash Pond along southeast embankment looking northeast.

Photo 66: Crest of Ash Pond near south corner of pond looking west.

Photo 67: Crest of Ash Pond near south corner of pond looking northeast.

Photo 68: Crest of Ash Pond near east corner of pond looking southwest.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 69: Crest of Ash Pond near east corner of pond looking north.

Photo 70: Interior slope and crest of Ash Pond along northeast embankment looking south.

Photo 71: Interior slope and crest of Ash Pond along northeast embankment looking northwest.

Photo 72: Ash delta located along interior slope of northeast embankment of Ash Pond looking south.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 73: Ash delta located along interior slope of northeast embankment of Ash Pond looking northwest.

Photo 74: Emergency response materials (gravel, sand, riprap) located near north corner of Ash Pond.

Photo 75: Aerator/oxygenator located near north corner of Ash Pond.

Photo 76: General view of Ash Pond surface from north corner of pond looking south. Note presence of turbidity barriers.

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 77: General view of Ash Pond surface from north corner of pond looking west.

Photo 78: 30-inch diameter inlet pipes at north corner of Ash pond looking northwest.

Photo 79: Crest and southeast interior slope of Decant/Settling Pond #5.

Photo 80: Surface and southeast interior slope of Decant/Settling Pond #5.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 81: 30-inch diameter inlet pipes located below walkway/catwalk at north corner of Ash pond looking northwest.

Photo 82: 30-inch diameter inlet pipes located below walkway/catwalk at north corner of Ash pond looking northwest.

Photo 83: 30-inch diameter inlet pipes located below walkway/catwalk at north corner of Ash pond looking northwest.

Photo 84: Crest of Ash Pond along northwest side. Note dense vegetation.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 85: Crest of Ash Pond along northwest side. Note dense vegetation.

Photo 86: Interior slopes and surface of Decant/Settling Pond #1 looking north.

Photo 87: Interior slopes and surface of Decant/Settling Pond #1 looking northeast. Note equalizer pipe between ponds.

Photo 88: Interior slopes and surface of Decant/Settling Pond #1 looking northeast.

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 89: Interior slopes, divider Ŝϒōl·ƴʅϒŜƴ̈ and surface of Decant/Settling Pond #3 looking east.

Photo 90: Interior slopes, divider Ŝϒōl·ƴʅϒŜƴ̈ and surface of Decant/Settling Pond #2 looking southeast. Note presence of ash/CCW.

Photo 91: Interior slopes and surface of Decant/Settling Pond #3 looking southeast.

Photo 92: Discharge water from plant operations into Decant/Settling Pond #3.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 93: Interior slope, divider ŜƳōl·ƴʅƳŜƴ̋ and equalizer pipe between Decant/ Settling Ponds #3 and 4 looking northwest.

Photo 94: Surface of Settling Pond #4 and divider ŜƳōl·ƴʅƳŜƴ̋ between Decant/ Settling Ponds #4 and #5 looking north.

Photo 95: Interior slope and surface of Decant/Settling Pond #4 looking southwest.

Photo 96: Chemical storage area located near north corner of Ash Pond.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012


Photo 97: Surface of Decant/Settling Pond #5 looking east.


Photo 98: Divider dike between Decant/Settling Ponds #1 and #2 looking northwest.


Photo 99: Surface of Decant/Settling Pond #2 looking northwest.


Photo 100: Surface of Decant/Settling Pond #3 looking northwest.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 101: Surface of Decant/Settling Pond #4 looking north.

Photo 102: View of surface and south interior slope of Gypsum Pond looking northwest. Note discharge pipe and deposition of gypsum in foreground.

Photo 103: View of surface of Gypsum {ű2ǋl·ƎŜ Pond looking west. Note discharge pipe & deposition of gypsum in foreground and Decant Riser in center of photo.

Photo 104: Crest and interior slope of south embankment of Gypsum {ű2ǋl·ƎŜ Pond looking southwest.

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 105: Surface of Gypsum {ű2ⅢI·ƎŜ Pond and Decant Riser looking north.

Photo 106: Surface of Gypsum {ű2ⅢI·ƎŜ Pond and Decant Riser looking north.

Photo 107: Piezometers on south exterior slope of Gypsum {ű2ⅢI·ƎŜ Pond looking south.

Photo 108: Exterior slope and perimeter road/maintenance bench along southwest side of Gypsum {ű2ⅢI·ƎŜ Pond looking northwest.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 109: Perimeter road/maintenance bench at toe of southwest slope of Gypsum {ǘ2ǁl·ƎŜ Pond looking southwest. Note standing water at toe.

Photo 110: Perimeter road/maintenance bench at toe of SW slope of Gypsum {ǘ2ǁl·ƎŜ Pond looking northwest. Note standing water at toe.

Photo 111: Perimeter road/maintenance bench at toe of southwest slope of Gypsum {ǘ2ǁl·ƎŜ Pond looking southwest. Note standing water at toe.

Photo 112: Close-up of wet area/possible seepage at toe of southwest Slope of Gypsum {ǘ2ǁl·ƎŜ Pond.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 113: Exterior slope along southwest side of Gypsum {ű2ǁl·ƎŜ Pond looking southwest.

Photo 114: Trash and grass cuttings on southwest exterior slope of Gypsum {ű2ǁl·ƎŜ Pond.

Photo 115: General view from toe of exterior slope on southwest side of Gypsum {ű2ǁl·ƎŜ Pond looking east. Note area of wet area at toe of slope.

Photo 116: General view from toe of exterior slope on southwest side of Gypsum {ű2ǁl·ƎŜ Pond looking east.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 117: Exterior slope along west side of Gypsum {ű2ǁ·ƎŜ Pond looking north.

Photo 118: Monitoring Wells located beyond exterior toe of slope on west Side of Gypsum {ű2ǁ·ƎŜ Pond.

Photo 119: Exterior slope along west side of Gypsum {ű2ǁ·ƎŜ Pond looking south.

Photo 120: Exterior slope along west side of Gypsum {ű2ǁ·ƎŜ Pond looking north.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 121: Start of riprap slope protection along toe of west exterior Slope of Gypsum {ǘ2ǊI·ƎŜ Pond looking north. Slope in this area is about 2.5H:1V.

Photo 122: Riprap slope protection along toe of west exterior slope of Gypsum {ǘ2ǊI·ƎŜ Pond looking east. Note depressed area at center.

Photo 123: Riprap slope protection along toe of west exterior slope of Gypsum {ǘ2ǊI·ƎŜ Pond looking east. Note depressed area at center.

Photo 124: Riprap slope protection along toe of west exterior slope of Gypsum {ǘ2ǊI·ƎŜ Pond looking east. Note exposed filter fabric.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 125: Riprap slope protection along toe of west exterior slope of Gypsum {ů2ŀl·ƎŜ Pond looking east. Note exposed filter fabric.

Photo 126: Exterior slope along west side of Gypsum {ů2ŀl·ƎŜ Pond looking south.

Photo 127: Exterior slope along west side of Gypsum {ů2ŀl·ƎŜ Pond looking north.

Photo 128: Rill located at approximate mid-face of west exterior slope of Gypsum {ů2ŀl·ƎŜ Pond. Depth is about 4 to 6 inches.

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 129: Animal ōurrow located at approximate mid-face of west exterior slope of Gypsum {ů2ℿl·ƎŜ Pond.

Photo 130: Animal ōurrow on west exterior slope of Gypsum {ů2ℿl·ƎŜ Pond.

Photo 131: 16-foot long rill on north exterior slope of Gypsum {ů2ℿl·ƎŜ Pond (Depth x Width ~ 1 foot, respectively). Note adjacent, parallel 5-foot long rill.

Photo 132: Approximate 16-foot long rill erosion on north exterior slope of Process Sedimentation Pond (Depth x Width ~1 foot, respectively).

CDM Smith

Photo 133: Approximate 16-foot long rill erosion on north exterior Slope of Process Sedimentation Pond (width is about 1 foot).

Photo 134: Rill located on north exterior slope of Process Sedimentation Pond (typical of six).

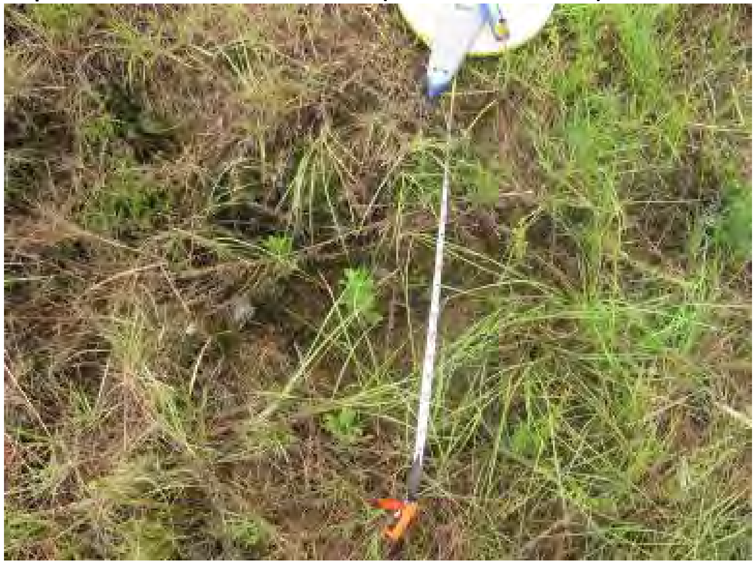


Photo 135: Rill located on north exterior slope of Process Sedimentation Pond (typical of six).

Photo 136: Rill located near toe of north exterior slope of Process Sedimentation Pond looking southeast (up slope).

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 137: Three rills located along toe of north exterior slope of Process Sedimentation Pond looking east.

Photo 138: Three rills located along toe of north exterior slope of Process Sedimentation Pond looking north (down slope).

Photo 139: Groundwater monitoring wells located beyond toe of slope of north embankment of Process Sedimentation Pond looking north.

Photo 140: Northeast exterior slope of Process Sedimentation Pond looking south.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 141: Exposed filter fabric beneath riprap where a depression is located.

Photo 142: Wet area/saturation located at toe of slope adjacent to access road on northeast exterior slope of Process Sedimentation Pond looking north.

Photo 143: Wet area/saturation located at toe of slope adjacent to access road on northeast exterior slope of Process Sedimentation Pond looking east.

Photo 144: Wet area/possible seepage located approximately mid-slope along east exterior slope of Process Sedimentation Pond looking west.

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 145: Area of wet area/possible seepage located approximately mid-slope along east exterior slope of Process Sedimentation Pond looking east.

Photo 146: East exterior slope of Process Sedimentation Pond looking northwest.

Photo 147: Emergency spillway/articulated concrete block mattress located on east ext.slope of Process Sed. Pond looking west (up slope).

Photo 148: Emergency spillway/articulated concrete block mattress located on east ext. slope of Process Sed. Pond looking south.

CDM Smith

Photo 149: Emergency spillway/ articulated concrete block mattress located on east exterior slope of Process Sedimentation Pond looking east (down slope).

Photo 150: Top of emergency spillway along crest of east embankment of Process Sedimentation Pond.

Photo 151: Concrete box culvert discharge between Gypsum Storage Pond and Process Sedimentation Pond.

Photo 152: Monitoring well pairs located near wooded area east of Process Sedimentation Pond.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 153: East exterior slope of Gypsum Storage Pond looking northwest.

Photo 154: Animal burrow located at toe of slope east exterior slope of Gypsum Storage Pond.

Photo 155: Wet area at toe of slope along east exterior slope of Gypsum Storage Pond looking northwest.

Photo 156: Wet area at toe of slope along east exterior slope of Gypsum Storage Pond.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 157: Wet area at toe of slope along east exterior slope of Gypsum Storage Pond.

Photo 158: Wet area at toe of slope along east exterior slope of Gypsum Storage Pond.

Photo 159: Exterior slope of east embankment of Gypsum Storage Pond looking southeast.

Photo 160: Exterior slope of south embankment of Process Sedimentation Pond looking east.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 161: Scarp located on exterior slope of southeast embankment of Process Sedimentation Pond looking northwest.

Photo 162: Wet area/potential seepage located on exterior slope near southeast corner Process Sedimentation Pond.

Photo 163: East exterior slope of Process Sedimentation Pond showing sloughed area looking north.

Photo 164: Intermediate embankment between Gypsum Pond and Process Sedimentation Pond looking northwest.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 165: Surface of Process Sedimentation Pond looking north.

Photo 166: Discharge pipe into Gypsum Storage Pond. Gypsum and water currently at approximate Elevation 113 feet.

Photo 167: Concrete box culvert outlet between Gypsum Storage Pond and Process Sedimentation Pond.

Photo 168: South wingwall of concrete box culvert outlet between Gypsum Storage Pond and Process Sedimentation Pond.

CDM Smith

Photo 169: North wingwall concrete box culvert outlet between Gypsum Storage Pond and Process Sedimentation Pond.

Photo 170: Concrete box culvert outlet between Gypsum Storage Pond and Process Sedimentation Pond.

Photo 171: Concrete apron on top of concrete box culvert between Gypsum Storage Pond and Process Sedimentation Pond.

Photo 172: Crest of west embankment of Gypsum Storage Pond looking south.

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 173: Crest of west embankment of Gypsum Storage Pond looking north.

Photo 174: Textured HDPE liner on interior slope of Gypsum Storage Pond looking southeast (typical of entire pond).

Photo 175: Textured HDPE liner on interior slope of Gypsum Storage Pond looking northwest (typical of entire pond).

Photo 176: Inflow of water into Gypsum Storage Pond looking northwest. Note presence of textured HDPE liner on interior slope of (typical of entire pond).

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 177: Surface of Gypsum Storage Pond looking west.

Photo 178: South crest and interior slope of Process Return Water Pond looking east. Note presence of textured HDPE liner on interior slope (typical).

Photo 179: Surface of Process Return Water Pond looking northeast.

Photo 180: West crest and interior slope of Process Return Water Pond looking north.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 181: South crest and interior slope of Process Return Water Pond looking west.

Photo 182: East crest and interior slope of Process Return Water Pond looking north.

Photo 183: Monitoring well pairs located beyond exterior toe of slope of Process Return Water Pond looking north.

Photo 184: General view of Process Return Water Pond looking south.

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 185: Northwest exterior slope of Process Return Water Pond looking southwest.

Photo 186: West exterior slope of Process Return Water Pond looking south.

Photo 187: Crest and emergency spillway along west embankment of Process Return Water Pond looking south.

Photo 188: Emergency spillway/ACBM located on west exterior Slope of Process Return Water Pond looking west (down slope).

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

Photo 189: Emergency spillway/ACBM located on west exterior slope of Process Return Water Pond looking west (down slope).

Photo 190: Emergency spillway/ACBM located on west exterior slope of Process Return Water Pond looking east (up slope).

Photo 191: Riprap slope treatment along toe of slope of northwest, exterior of Process Return Water Pond looking north.

Photo 192: Riprap slope on toe of slope of northwest, exterior of Process Return Water Pond looking north. Note exposed filter fabric.

CDM Smith

EPA Assessment Gulf Power - Crist Plant Photos August 20 and 21, 2012

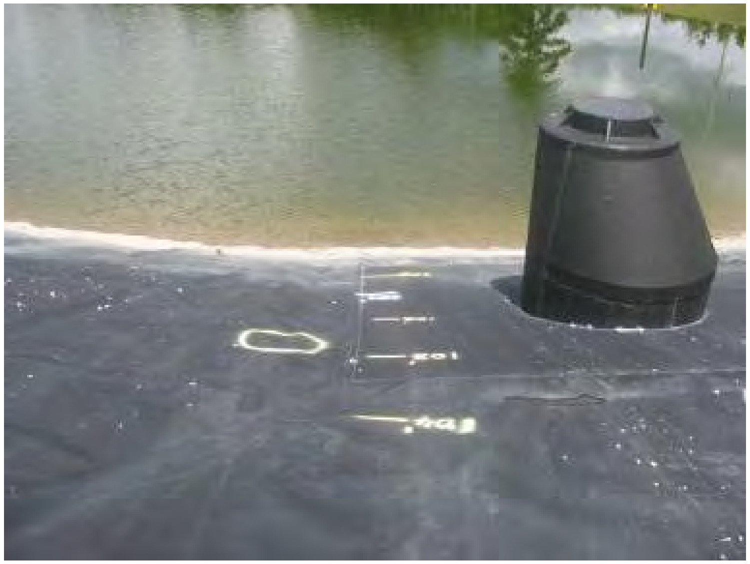


Photo 193: Manhole structure located at southwest corner of Process Return Water Pond looking east.

Photo 194: Textured HDPE liner on interior slope of Process Return Water Pond looking north. Note elevation data on slope.

Photo 195: General view of fly Ash Landfill stormwater pond area looking northwest.

Photo 196: General view of fly Ash Landfill stormwater pond area looking west.