ENGINEERS & CONSULTANTS

FINAL REPORT

CCW IMPOUNDMENTS INSPECTION REPORT

ROXBORO STEAM ELECTRIC PLANT
PERSON COUNTY,
NORTH CAROLINA

PREPARED FOR:

U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC

UNDER SUBCONTRACT TO:

LOCKHEED MARTIN
EDISON, NJ

Engineering & Construction Management
Hydro-Nuclear-Fossil
Geotechnical Engineering
Seismic and Structural Engineering
Hydrological & Hydraulic Engineering
Tunnel Engineering
Environmental Engineering & Permitting

PAUL C. RIZZO ASSOCIATES, INC.
101 WESTPARK BOULEVARD, SUITE B
COLUMBIA, SOUTH CAROLINA USA 29210

PROJECT NO. 09-4157
DECEMBER, 2009

ENGINEERS & CONSULTANTS

Paul C. Rizzo Associates, Inc.

SOUTHEAST REGION
101 Westpark Boulevard • Suite B • Columbia, SC 29210
Phone (803) 750-9773 • Fax (803) 750-9116
www.rizzoassoc.com

December 9, 2009
Project No. 09-4157

Mr. Dennis Miller
Lockheed Martin
2890 Woodbridge Ave #209
Edison, NJ 08837

TRANSMITTAL
ASSESSMENT OF DAM SAFETY OF
COAL COMBUSTION SURFACE IMPOUNDMENTS
FINAL INSPECTION REPORT
SITE 29 (ROXBORO)

Dear Mr. Miller:

Transmitted herewith is a CD containing electronic files (PDF and Word) of the referenced Final Inspection Report for management units located at Site 29.

If you have any questions or require any additional information, please contact me at (803)750-9773, ext. 12, or grady.adkins@rizzoassoc.com.

Respectfully submitted,
Paul C. Rizzo Associates, Inc.

For H. Grady Adkins, Jr., P.E.
Chief Engineering Manager

HGA/mlm

cc: Stephen Hoffman – USEPA (CD and hard copy)

U.S. OFFICE LOCATIONS
• Monroeville PA (Corp.HQ) • Oakland CA • St. Louis MO • Tarrytown NY • Columbia SC •
INTERNATIONAL OFFICE LOCATIONS
• Buenos Aires Argentina • Mendoza Argentina • Santiago Chile • Lima Peru •
• Plzen Czech Republic • St. Petersburg Russia • Abu Dhabi UAE •

TABLE OF CONTENTS

PAGE

LIST OF TABLES iii

LIST OF FIGURES iii

LIST OF APPENDICES iv

1.0 EXECUTIVE SUMMARY 1

1.1 GENERAL 1

1.2 SUMMARY OF FIELD INSPECTION FINDINGS 2

1.3 SUMMARY OF O&M STATUS 3

1.4 CONCLUSIONS 3

1.4.1 Project Description 3

1.4.2 Field Inspection 4

1.5 SUMMARY OF RECOMMENDATIONS 4

1.6 CERTIFICATION 5

1.6.1 List of All Field Inspection Participants 5

1.6.2 Signature of Independent Engineer 6

1.6.3 PE Stamp 6

2.0 PROJECT DESCRIPTION 7

2.1 EXISTING PROJECT FEATURES AND HAZARD POTENTIAL CLASSIFICATION 7

2.1.1 West Ash Pond Dam and Dikes 1, 2, and 4 7

2.1.2 FGD Settling and Flush Ponds 9

2.1.2.a FGD Settling Pond 10

2.1.2.b FGD Flush Pond 10

2.2 SUMMARY OF STANDARD OPERATING PROCEDURES 12

2.2.1 Purpose of the Project 12

2.2.2 Current Inspection Schedule 12

2.3 MODIFICATIONS CONDUCTED FOR PROJECT SAFETY 13

2.4 Engineering Information 13

2.4.1 Geologic Conditions 14

2.4.2 Seismicity 15
2.4.3 Slope Stability Analyses 15
2.4.3.1 West Ash Pond Dam and Dikes 1,2, and 4 15
2.4.3.2 New FGD Settling Pond and New FGD Flush Pond 18
2.4.4 Hydrologic Studies 22
2.4.4.1 West Ash Pond 22
2.4.4.2 FGD Settling Pond and FGD Flush Pond 22

3.0 FIELD INSPECTION 24
3.1 FIELD INSPECTION OBSERVATIONS 24
3.1.1 West Ash Pond Dam 24
3.1.2 Dike 1 (Filter Dam) 25
3.1.3 Dikes 2 and 4 26
3.1.4 FGD Settling Pond 26
3.1.5 FGD Flush Pond 27
3.1.6 West Ash Pond Dam Discharge Structure 27
3.2 STATUS OF RESPONSES TO RECOMMENDATIONS IN LAST ANNUAL INSPECTION 27
3.2.1 West Ash Pond Dam 28
3.2.2 Dike No. 1 (Filter Dam) 29
3.2.3 Dikes No. 2 and 4 29

4.0 RECOMMENDATIONS 30
4.1 RECOMMENDATION NO. 1 30
4.2 RECOMMENDATION NO. 2 30
4.3 RECOMMENDATION NO. 3 30
4.4 RECOMMENDATION NO. 4 30
4.5 RECOMMENDATION NO. 5 31
4.6 RECOMMENDATION NO. 6 31

5.0 CONCLUSIONS 32

LIST OF TABLES

TABLE NO.	TITLE	PAGE
TABLE 1 -1	SUMMARY OF RECOMMENDATIONS	5
TABLE 2 -1	WEST ASH POND DAM AND DIKES 1, 2, & 4 LOCATION DATA	9
TABLE 2-2	FGD SETTLING AND FLUSH PONDS LOCATION DATA	11
TABLE 2-3	EMBANKMENT MATERIAL PROPERTIES WEST ASH POND DAM	16
TABLE 2-4	EMBANKMENT MATERIAL PROPERTIES DIKES 1, 2, & 4	17
TABLE 2-5	RESULTS OF STABILITY ANALYSES DIKES 1, 2, & 4	18
TABLE 2-6	SOIL PROPERTIES USED IN STABILITY ANALYSES OF NEW SETTLING AND FLUSH PONDS	20
TABLE 2-7	FACTORS OF SAFETY FOR SLOPE STABILITY OF NEW SETTLING AND FLUSH PONDS	21
TABLE 2 -8	CONTROLLING ELEVATIONS OF ASH AND FLUSH PONDS	23

LIST OF FIGURES

FIGURE NO.	TITLE
FIGURE 1	USGS VICINITY MAP
FIGURE 2	SITE MAP
FIGURE 3	PLAN OF FGD SETTLING POND & FGD FLUSH POND
FIGURE 4	PIEZOMETER LOCATIONS

LIST OF APPENDICES

APPENDIX	TITLE
APPENDIX A	PHOTO LOG
APPENDIX B	FIGURES
APPENDIX C	INSPECTION CHECKLISTS

DAM SAFETY INSPECTION REPORT
ROXBORO STEAM ELECTRIC PLANT
PERSON COUNTY, NORTH CAROLINA
PROJECT N0. 09-4157

1.0 EXECUTIVE SUMMARY

1.1 GENERAL

This Section is a summary of the Independent Engineer's Review of Management Units for the Roxboro Steam Electric Plant (Roxboro). The Report was prepared by Paul C. Rizzo Associates, Inc. (RIZZO) for the United States Environmental Protection Agency (USEPA) under subcontract to Lockheed Martin. This Section summarizes the finding, assessments, conclusions, and recommendations of the Independent Engineer.

The Roxboro Plant is a coal fired power plant located on the South side of Hyco Lake, an impoundment of the Hyco River, near Semora, Person County, North Carolina. The facility is located approximately 9 miles northwest of Roxboro, North Carolina, approximately 6.5 miles downstream of the Town of Roxboro's surface water supply intake, and is owned and operated by Progress Energy Carolinas, Inc. (PGN). Under normal operating conditions, byproducts of coal combustion including fly ash, bottom ash, boiler slag, flue gas emission control residuals, and other general wastewater products are sluiced into either the West Ash Pond storage basin south of the plant or into a wastewater treatment system. The waste water treatment system consists of a FGD Settling Pond and FGD Flush Pond constructed within the West Ash Pond for the treatment of the blow down steam from the FGD absorber units at the power plant. The three impoundments assessed in this Report are the West Ash Pond, the FGD Settling Pond, and the FGD Flush Pond.

The ash pond dam, called the West Ash Pond Dam, was originally constructed as an earth fill embankment with a central earth core and chimney drain in 1973 - 1974. The original structure was raised 13 feet in 1986 to provide additional storage capacity. Along with raising the West Ash Pond Dam in 1986, a system of dikes, Dikes 1, 2, 3, and 4, were constructed to help increase the capacity and modify the circulation pattern of the ash

pond. Dike 3 does not normally impound water; therefore it is not included in this Dam Safety Inspection Report. In 2007, two ponds were constructed inside of the West Ash Pond Dam, the Flue Gas Desulfurization (FGD) Settling Pond and the FGD Flush Pond. For the purpose of this assessment, the West Ash Pond Dam, FGD Settling Pond, and FGD Flush Pond have been classified as significant hazard potential structures by the USEPA. Significant hazard potential structures are classified as structures where failure is not likely to result in loss of life, but may cause significant economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. The predominant risks of failure for the West Ash Pond Dam, FGD Settling Pond, and FGD Flush Pond are disruption of power generation and environmental damage.

1.2 SUMMARY OF FIELD INSPECTION FINDINGS

The site inspection was conducted on September 1, 2009. The Inspection Team consisted of representatives from PGN, North Carolina Department of Environment and Natural Resources – Division of Land Resources (NCDENR-DLR), North Carolina Department of Environment and Natural Resources – Department of Waste Management (NCDENR-DWM), North Carolina Department of Environment and Natural Resources – Department of Water Quality (NCDENR-DWQ), and RIZZO. The Team stopped at each of the Project features to inspect the structures and the surrounding area. Particular attention was paid to site features that may contribute to typical failure modes of embankment structures such as settlement, seepage, and slope stability. A copy of the USEPA Inspection Checklists for each impoundment is included in ***Appendix C***.

The earthfill embankment on the North end of the Ash Pond (West Ash Pond Dam), the rockfill embankment (Filter Dam or Dike No. 1) on the South end of the Ash Pond, and Dikes 2 and 4 were found to be in good condition and well maintained at the time of inspection. The West Ash Pond Dam had tall, thick vegetative cover that prevented full observation of all slopes. Minor seepage was observed only at the designed discharge points from the internal drain. The Filter Dam slopes were clear of vegetation and are designed to filter seepage through the slopes. Decant pipes were clear of obstructions and free flowing. Dikes 2 and 4 had tall thick vegetation on the slopes below the road and above the riprap. Damp spots were noted in isolated areas along the toe of dike slopes. Flowing water was not noted in these areas.

The Settling Pond was constructed in 2007 as part of a wastewater treatment system that also includes the Flush Pond and a Bioreactor. The Settling Pond experienced variable amounts of seepage at spots along the northern and western sides of the pond that resulted in localized shallow slope failures not long after it was put into service. The Settling Pond is currently operating at a reduced water level. A repair plan has been approved by the Owner. The sloughed areas on the outer slopes have been repaired and vegetated. Seepage was noted in the ditch along the toe of the embankment. This seepage is collected in sumps and pumped back into the Settling Pond. Repairs to this structure will be initiated following completion of repairs to the Flush Pond. A second settling pond will be constructed as part of the work.

The Flush Pond is currently under construction. It was taken out of service in February 2008 when a piping failure occurred that resulted in the development of a slough in both the inside and outside slopes.

1.3 SUMMARY OF O&M STATUS

The Project is attended full time by plant operators and dedicated safety personnel. The current inspection schedule for the structures consists of daily observations summarized weekly and a monthly inspection and monitoring of piezometers by trained PGN personnel; and an annual, and a 5-year inspection by a third party Consultant.

At the time of inspection, the structures and the Plant appeared to be generally well maintained and in good working order. The only exception to the well maintained condition is the presence of heavy vegetation on some slopes. This work is scheduled for the near future according to plant personnel.

1.4 CONCLUSIONS

1.4.1 Project Description

The Roxboro Steam Electric Plant is a four unit coal fired power plant that began operations in 1966 with additions in 1973 and 1980. Coal Combustion Waste (CCW)

byproducts are sluiced to on site storage or treatment ponds which appear to be well maintained and operated.

The last major revisions to the CCW storage structures include a raise of the West Ash Pond Dam and construction of the Filter Dam (Dike 1) and Dikes 2,3, and 4 in 1986 to provide more storage and the construction of the gypsum Settling Pond, a bioreactor, and the Flush Pond in 2007 for wastewater treatment. Construction is currently underway to remediate the Flush Pond with repairs to the Settling Pond to follow. The structures are currently regulated by the North Carolina Utilities Commission. On January 1, 2010, dam safety regulation of the impoundments will pass to the North Carolina Department of Environment and Natural Resources, Division of Land Resources, Dam Safety Program. The North Carolina Department of Environment and Natural Resources, Division of Water Quality regulates the NPDES wastewater treatment units and the respective discharges associated with the wet ash.

1.4.2 Field Inspection

The field inspection was performed in accordance with EPA guidelines considering typical embankment failure modes. The embankments for the Ash Pond dam and dikes are in good condition but have vegetative maintenance issues to be addressed. The Settling Pond is currently operating at a reduced level awaiting repairs due to a seepage problem. With the exception of the seepage area, the embankments for this structure are in good condition. Reconstruction of the Flush Pond was underway at the time of the field inspection. Recommendations were developed based on field observations and technical review of Project documentation provided by PGN.

1.5 SUMMARY OF RECOMMENDATIONS

There were a total of six recommendations resulting from the document review and field inspection. The recommendations are summarized below in ***Table 1-1*** and discussed in detail in ***Section 4.0.***

TABLE 1-1: SUMMARY OF RECOMMENDATIONS

NO.	RECOMMENDATION	TIMEFRAME
1	Inspect the Slopes of the West Ash Pond Dam at the Interface of the Earth Slope and Top of Riprap for Surface Erosions and Scarps.	Following Maintenance Mowing of Vegetation
2	Check Drain Outlets of the West Ash Storage Pond During Monthly Inspections to Determine if Soil Material is Being Transported	During Monthly Inspections
3	Develop Method to Quantify Amount of Seepage from West Ash Pond Drains	Prior to Next Annual Inspection
4	Continue to Monitor Seepage at Toe of Settling Pond	According to Existing Plan.
5	Follow-Up on Developing and Implementing Repair Plan for Seepage at Discharge Weir	Prior to Next Inspection
6	Review the 1987 Ash Pond Hydrology Study to Determine if Results are Still Valid	Prior to Next 5-year Inspection

1.6 CERTIFICATION

1.6.1 List of All Field Inspection Participants

The field inspection was conducted on September 1, 2009. The individuals participating in the inspection were:

H. Grady Adkins, PE	RIZZO – Independent Engineer
David W. Ray, EIT	RIZZO
Harry Sideris	PGN
Robert Howard	PGN
Billy Milam	PGN
Jodirah Green	PGN
Tom Copolo	PGN
Bill Forester	PGN

John Edelen	PGN
E. Shannon Langley	PGN
John Holley	NCDENR-DLR
Gabi Jones	NCDENR-DLR
Elizabeth Werner	NCDENR-DWM
Geof Little	NCDENR-DWM
Autumn Hoban Romanski	NCDENR-DMQ

1.6.2 Signature of Independent Engineer

I acknowledge that the management units referenced herein were personally inspected by me on September 1, 2009, and were found to be in the following condition:

West Ash Pond: **SATISFACTORY**
No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

FGD Settling Pond and FGD Flush Pond: **FAIR**
Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Deficiencies may exist that require remedial action and/or secondary studies or investigations.

When the remedial work currently underway on these two units is completed as planned, the condition rating should be **SATISFACTORY**.

Signature: H. Grady Adkins, Jr.

H. Grady Adkins, Jr. PE,
NC Registration No. 035584
Independent Engineer
Paul C. Rizzo Associates, Inc.

1.6.3 PE Stamp

NORTH CAROLINA PROFESSIONAL SEAL 035564 ENGINEER H. GRADY ADKINS, JR.

12/08/09

2.0 PROJECT DESCRIPTION

2.1 EXISTING PROJECT FEATURES AND HAZARD POTENTIAL CLASSIFICATION

2.1.1 West Ash Pond Dam and Dikes 1, 2, and 4

The West Ash Pond Dam and Dikes 1, 2, and 4 are identified as Significant Hazard Structures with the ID "NC 0003425" in the National Inventory of Dams.

The West Ash Pond Dam was constructed in 1973 across the mouth of Sargents Creek, a tributary of the Hyco River, which was then a part of the Hyco Lake Reservoir. Hyco Lake is operated by PGN to provide water to the Roxboro Plant. The Dam is an earth fill embankment with a central earth core. The Dam was constructed between two cofferdams over a prepared foundation stripped to sound rock with a central core keyway excavated 10 feet into rock. The original structural height of the dam was 70 feet with a crest elevation of 457 feet (MSL). The original pool elevation was 445 feet (MSL). In 1986, the Dam was raised 13 feet to elevation 470 feet (MSL) to provide greater storage capacity. The normal water level was raised to elevation 463 feet (MSL) and the maximum water level to elevation 465 feet (MSL).

The present West Ash Pond Dam has a random earth fill shell with an impervious core and a vertical chimney drain with a horizontal filter blanket connected to the original drain system. The upstream slope is 2.5(H) to 1(V) and is blanketed with riprap. The downstream slope is 2(H) to 1(V) and is blanketed with riprap on the lower portion of the slope. The circulation pattern of the ash pond was modified in 1986 by constructing a rock filter dike (Dike No. 1) at the southern end of the existing pond to create a secondary settling basin and also to isolate the major portion of the ash pond from the remaining watershed. A channel/dike system, which runs along the west side of the existing pond, ultimately connects with the original spillway constructed in 1973 and discharges into Hyco Lake.

Dike No. 1 is constructed of rock excavated from channel No. 2 ***Figure 4***. The crest elevation is 473 feet (MSL). The design slopes are 1.3(H) to 1(V) on both upstream and downstream slopes. The dam has a 20- foot wide berm on the downstream slope below

elevation 448 feet (MSL). The normal design for the ash pond water elevation is 463 feet (MSL) and maximum design water elevation is 465 feet (MSL) providing 8 feet of freeboard. A sand blanket is located on the northern side of the dike to prevent pond ash from discharging to the south side of the pond and into the channel/dike system.

Dike Nos. 2, 3, and 4 are random earth dikes constructed by end-dumping fill material excavated from channel Nos. 1 and 2. Both upstream and downstream slopes are 2(H) to 1(V) and are protected by riprap underlain by filter fabric. A 20-foot wide berm was added on the downstream side of Dike No. 4 during construction. The crest elevation of the dikes is 470 feet (MSL) and normal design for the water elevation is 463 feet (MSL). The normal design for maximum water level is 465 feet (MSL) providing 5 feet of freeboard. Dike No. 3 is low height dike across a topographic saddle that is mainly above the normal pond level. As it does not normally impound water, it is not included in the dam inspection.

According to information provided by PGN, the West Ash Pond Dam and Dikes 1, 2, and 4 enclose an approximate area of 240 acres.

Based on height and storage capacity, the West Ash Pond Dam and Dikes 1, 2, and 4 are classified as “intermediate” in size under the Corps of Engineers Guidelines. Under North Carolina Regulations, the West Ash Pond and Dike 1 (Filter Dam) are classified as “large” and the remaining dikes are classified as “medium”.

Based on field reconnaissance and a review of USGS maps and aerial photographs, West Ash Pond Dam and Dikes 1, 2, and 4 have been classified by the Independent Engineer as a significant hazard potential structure due to the possibility of disruption of power generation or environmental damage that would be caused by misoperation or failure of the structure.

Table 2-1 below summarizes the location information for the West Ash Pond Dam and Dikes 1, 2, and 4.

TABLE 2-1: WEST ASH POND DAM & DIKES 1, 2, & 4 LOCATION DATA

	DEGREES	MINUTES	SECONDS
Longitude	36	31	16
Latitude	78	59	55
State:	North Carolina	**County:**	Person

2.1.2 FGD Settling Pond and FGD Flush Pond

The Settling and Flush Ponds were constructed in 2007 as part of a wastewater treatment plant. Both ponds are diked on all sides. The wastewater treatment plant consists of a gypsum settling pond, a bioreactor, and a bioreactor flush pond constructed for the treatment of the blowdown steam from the FGD absorber units at the power plant. In February 2008, variable size seeps were observed along the outer northern and western embankments of the Settling Pond. PGN notified the state regulatory agency of the situation and lowered the water level within the pond by controlled discharge into the Ash Pond. Also in February 2008, a sinkhole developed in the embankment of the adjacent Flush Pond resulting in an uncontrolled discharge of water into the Ash Pond. PGN notified the state regulatory agency of the incident and took the Flush Pond out of service.

PGN retained the firm of Worley Parsons to design the repairs to the wastewater ponds. The repair scheme includes:

- Construction of a permanent east settling pond to hold water removed from the West Settling Pond and from plant discharge while the west pond is being repaired;

- Reconstruction of the embankment of the Flush Pond to include both a clay and synthetic liner; and

- Reconstruction of the embankment of the Settling Pond to include both a clay and synthetic liner.

The Flush Pond is currently under construction and the Settling Pond is scheduled for construction following completion of the Flush Pond. The Settling and Flush Ponds were constructed within the perimeter of the ash pond. The embankment subgrades of both ponds consist of variable bottom ash, fly ash, and rock fill materials.

2.1.2.a FGD Settling Pond

The Settling Pond is a diked structure that is located within the West Ash Pond and constructed of variable bottom ash, fly ash, and rock fill materials with an earth fill cap. The embankment is 38 feet high with a crest elevation 506 feet (MSL). The inside slope of the pond is constructed at 3H:1V and the outside slope is constructed at 2.75H:1V. The maximum operating level for the pond is elevation 497.7 feet (MSL). At the time of the inspection, the pond has been operating at a lower level awaiting repairs. Once the repairs are complete the new maximum operating level of the pond will be at elevation 498.2 feet (MSL). The decant structure for the pond is a floating skimmer that operates at the pool elevation. The spillway for the pond is located at elevation 502.5 feet. The spillway is a trapezoidal channel spillway that has a top width of 186 feet, a bottom width of 16.5 feet, and has a depth of 3.5 feet. Once the repairs on the pond are completed the spillway will be raised to a new elevation of 503 feet. The Settling Pond has an approximate area of 16.6 acres. The repairs for the Settling Pond are scheduled to begin as soon as the construction on the Flush Pond is completed.

The Settling Pond is to be relined with a 12-inch to 18-inch thick layer of riprap choked with bottom ash. The choked bottom ash will then be covered with a 12-inch layer of compacted clay on the bottom and an 18-inch layer up the interior slopes of the pond. Then an additional 60-mil, conductive, white LLDPE liner will be placed over the compacted clay and anchored to the top of the embankments.

2.1.2.b FGD Flush Pond

The Flush Pond was under construction at the time the inspection was conducted. All of the information presented and discussed herein is for the new Flush Pond. The Flush Pond is a diked structure that is located within the West Ash Pond and constructed of variable bottom ash, fly ash, and rock fill materials with an earth fill cap. The embankment will be

38 feet high with a crest elevation of 506 feet. The inside slope of the pond is constructed at 3H:1V and the outside slope is constructed at 2.75H:1V. The maximum operating level for the pond is elevation 502.4 feet. The spillway for the new pond will be located at elevation 503.5 feet. The spillway will be a trapezoidal channel spillway that has a top width of 83 feet, a bottom width of 35 feet, and a depth of 3 feet. The Flush Pond has an approximate area of 3.1 acres.

Based on height and storage capacity, the FGD Settling Pond Dam and the FGD Flush Pond Dam are classified as "small", in size under the Corps of Engineers Guidelines. Under North Carolina Regulations, they are classified as "medium" in size.

Based on field reconnaissance and a review of USGS maps and aerial photographs, the FGD Settling and Flush Ponds have been classified by the Independent Engineer as significant hazard potential structures due to the fact that the bottom of the two ponds are at approximately the same elevation as the top of dam and dikes for the West Ash Pond within which they are located. Failure of the two structures could release directly into the channels to the Cooling Reservoir. A release could disrupt power generation and cause environmental damage. ***Table 2-2*** below summarizes the location information for the FGD Settling and Flush Ponds.

TABLE 2-2: FGD SETTLING AND FLUSH PONDS LOCATION DATA

	DEGREES	MINUTES	SECONDS
Longitude	36	31	16
Latitude	33	59	55
State:	North Carolina	**County:**	Person

2.2 SUMMARY OF STANDARD OPERATING PROCEDURES

2.2.1 Purpose of the Project

The Roxboro Plant is a coal fired power plant. The West Ash Pond Dam and Dikes 1, 2, and 4 were constructed to provide storage for waste coal combustion products and to provide necessary decantation capacity for the discharge water from the plant to comply with NPDES permit requirements. The FGD Settling Pond was constructed to store and thicken the FGD gypsum sludge. The FGD Flush Pond was constructed as part of the bioreactor system to remove and store metals from the settling pond discharge.

To date there has been only one failure recorded at the Roxboro Plant. In February 2008, a failure occurred at the Flush Pond in the form of a limited slope failure on both the inner and outer slopes. The Flush Pond was dewatered and the operating level of the Settling Pond was lowered after variable size seeps were observed on the northern and western outer slopes. Repairs to both ponds have been designed and approved. Construction is currently underway at the Flush Pond with repairs to the Settling Pond scheduled to begin after the completion of the work on the Flush Pond.

2.2.2 Current Inspection Schedule

The current inspection schedule for the structures at Roxboro is as follows:

- **Visual Inspection by Site Staff**: Daily observations are made by trained PGN personnel following an inspection checklist. The checklist contains the daily observations for a one week period;

- **Monthly Monitoring and Inspection by Site Staff**: An inspection checklist is used by trained PGN personnel to record the West Ash Pond piezometer readings and assessments of conditions of the main dam and each dike;

- **Annual Limited Field Inspection by Independent Consultant**; and

- **<u>Five-Year Independent Consultant Inspection:</u>** This is a more in-depth inspection required by the North Carolina Utilities Commission.

2.3 Modifications Conducted for Project Safety

To date construction is currently being conducted due to a limited slope failure of the inner and outer slopes of the FGD Flush Pond. The FGD Settling Pond experienced sizeable seeps on the northern and western outer slopes and is scheduled to start construction immediately following the completion of the new FGD Flush Pond.

2.4 ENGINEERING INFORMATION

The following documents provided by PGN were reviewed in the preparation of this Report:

- Independent Consultant Inspection Report – Main Cooling Lake Dam, West Ash Pond Dam, and Afterbay Dam, Roxboro Steam Electric Plant, Person County, North Carolina -Historical Volume by Law Engineering and Environmental Services, Inc., December 18, 1998;

- Five Year Independent Consultant Inspection Report Volume I by Law Engineering, Raleigh, NC, September 1998;

- Report of Limited Field Inspection, Main Dam, West Ash Pond Dam and Dikes, and Afterbay Dam, Roxboro Plant, Person County, North Carolina, by MACTEC Engineering and Construction May 2007;

- Independent Consultant Inspection Report, Main Cooling Lake Dam, West Ash Pond and Afterbay Dam, Roxboro Electric Plant, Person County, North Carolina by MACTEC Engineering and Construction, December 29, 2008;

- Calculations for Design of Repairs to the Existing Flush and West Settling Ponds and Construction of a New East Settling Pond by Worley Parsons;

- Progress Energy Weekly Waste Water Settling Pond Inspection Forms covering period 22 June 2009 through 16 August 2009; and

- Progress Energy Monthly Piezometer Monitoring Forms for West Ash Pond and Hyco Lake Main Dam and Monthly West Ash Pond Monitoring Inspection Worksheet. Completed forms cover the period January through August 2009.

2.4.1 Geologic Conditions (Source: "*Historical Volume 1998*")

The Roxboro Plant is within the Piedmont Physiographic Province, a northeast trending maturely dissected plateau between the Blue Ridge and Coastal Plain Provinces. The region is underlain primarily by metamorphic, most of which have been complexly folded and faulted in Paleozoic tectonic sequences (Butler and Secor, 1991) and variably deformed igneous rocks. The Piedmont in the southeastern United States has been divided into several northeast trending lithographic structural belts. The site is near the eastern edge of the Milton Belt, near the boundary with the Carolina Slate Belt. The Milton Belt is characterized by metamorphic rocks including strongly foliated gneiss and schist of primarily felsic composition (Butler and Secor, 1987), mafic and felsic metavolcanics, and non-deformed to slightly deformed intrusive granite, gabbro, and diorite.
The bedrock at the site was grouped into three main classes in the "Historic Volume 1998" Report:

(a) Hornblende Gneiss – A metamorphic rock consisting of quartz, orthoclase feldspar, mica, and hornblende;

(b) Chlorite Schist – A crystalline rock having foliated structure in which chlorite is a predominant mineral. Other minerals are mainly silicate with little or no feldspar;

(c) Diabase – An ancient basalt which has undergone metamorphic alteration. The rock is composed mainly of minute crystals of plagioclase and pyroxene with some other ferrous minerals.

The overburden in the area generally consists of a layer of loose silty fine sand resulting from the weathering of the parent gneiss and chlorite schist formations. In some cases, a thin cap of reddish brown sandy clay overlies the silty fine sand. Thickness of overburden varies from one to as much as 15 feet.

2.4.2 Seismicity

The site is located in a relatively inactive seismic area of the Southeastern United States that has experienced only occasional earthquakes of moderate intensities in historic times. Notable exceptions are the earthquakes near Charleston, South Carolina, New Madrid, Missouri, and Giles County, Virginia. Under the Guidelines of the U.S. Army Corps of Engineers *Recommended Guidelines for Safety Inspection of Dams* (ER 1110-2-106, 26 Sep 1979), the site is located in Seismic Zone 2. A seismic coefficient of 0.05g is recommended for pseudo static seismic analyses. The U.S. Geological Survey Open File Report 2008-1128 "*Update of the U.S.National Seismic Hazard Maps*" ***Figure 30*** shows a Peak Ground Acceleration of 0.07g for 2 per cent probability of exceedance in 50 years. This equates to a return period of about 2500 years. The USACE guidelines do not require seismic stability assessment of dams in Seismic Zones 0, 1, and 2 provided static stability analyses are satisfactory and conventional safety margins exist.

2.4.3 Slope Stability Analyses

2.4.3.1 West Ash Pond Dam and Dikes 1, 2, and 4

Summaries of the results of slope stability analyses for the West Ash Pond and Dikes 1, 2, and 4 are summarized in the reference material. Copies of the actual calculations and laboratory tests were not provided at the time of inspection. Since Dike 3 does not impound water, no stability analyses have been performed. The strength properties used in the analyses are reported to be based on laboratory tests on remolded, saturated samples or on reasonable assumed values.

The soil properties used in the analysis of the West Ash Pond Dam are shown in ***Table 2-3***.

TABLE 2-3
EMBANKMENT MATERIAL PROPERTIES WEST ASH POND DAM

MATERIAL	C, ksf	ϕ DEGREES	UNIT WEIGHT	
			MOIST, pcf	SATURATED, pcf
ORIGINAL MAIN DAM				
Soil "A"	0	35	125	135
Soil "B"	0	32	120	130
NEW PORTIONS OF MAIN DAM				
Random Fill	0.120	28	125	135
Core	0.050	25	120	130
Sand Drains, Shot Rock Fill	0	35	125	135

The analysis of the downstream slope used the following conditions:

- Crest Elevation 470 feet (MSL);
- Pool Elevation 463 feet (MSL);
- Tailwater Elevation 410 feet (MSL); and
- Phreatic Surface Elevation 414 feet (MSL) to 410 feet (MSL)

The calculated factors of safety were 1.58 for a deep circular failure that did not intercept the core and 1.46 for a shallow circular failure.

The soil properties used in the analysis of Dikes 1, 2, and 4 are shown in ***Table 2-4***.

TABLE 2-4
EMBANKMENT MATERIAL PROPERTIES DIKES 1, 2, & 4

LOCATION	DIKE NO. 1				DIKE NO. 2				DIKE NO. 4			
	UNIT WT, (pcf)		STRENGTH		Unit Wt, (pcf)		STRENGTH PARAMETERS		UNIT WT, (pcf)		STRENGTH	
Soil Type	**Moist**	**Sat.**	**C, ksf**	**ϕ, Deg**	**Moist**	**Sat.**	**C, ksf**	**ϕ, Deg**	**Moist**	**Sat.**	**C, ksf**	**ϕ, Deg**
1	125	130	0.150	28	125	130	0.150	28	125	130	0.150	28
2	110	115	0.050	20	110	115	0.050	20	110	115	0.050	20
3	105	110	0.025	15	105	110	0.025	15	--	--	--	--
4	125	130	0.500	20	125	130	0.500	20	125	130	0.500	20
5	130	140	0	45	--	--	--	--	130	140	0	45
6	*	*	0	37	--	--	--	--	--	--	--	--

SOIL TYPE	DESCRIPTION
1	Random fill above water
2	Random fill below water
3	Uncompacted end-dumped material
4	Ash
5	Rockfill berm
6	End-dumped random fill mixture of soil and ripped rock
*	Unit weight used in analysis not available from reference

The reported factors of safety for stability of the exterior slopes of Dikes 1, 2, and 4 are shown in ***Table 2-5***. Dike 2 was analyzed for two different pool elevations.

TABLE 2-5
RESULTS OF STABILITY ANALYSES DIKES 1, 2, & 4

Dike	1	2	2	4
Crest Elev (Ft MSL)	473	470	470	470
Pool Elev (Ft MSL)	463	463	457	463
Tailwater Elev (Ft MSL)	445	445	445	445
Phreatic Surface (Ft MSL)	453 to 445	449 to 445	449 to 445	455 to 450
Slope Analyzed	Downstream w/ 20 Ft Berm	Downstream	Downstream	Downstream w/ 20 Ft Berm
Factor of Safety	1.45	1.38	1.48	1.46

2.4.3.2 New FGD Settling Pond and New FGD Flush Pond

The Design Report prepared by Worley Parsons contained the results of stability analyses made for the construction of the new East Settling Pond and the reconstruction of the West Settling Pond and the Flush Pond. Laboratory tests were run on samples taken from the new borrow area for the random fill. Properties for the existing ash and soil materials were the same as used for the stability analyses of the existing embankments and are summarized in ***Table 2-6***.

The following Sections were considered the critical sections for slope stability evaluation:

- Section 1-1: Full West Settling Pond seeping to the existing ash pond canal (in area of largest observed seepage);
- Section 2-2: Full West Settling Pond seeping into the lower existing dam;
- Section 3-3: Full West Settling Pond seeping into the empty East Settling Pond;

- Section 4-4: Full East Settling Pond seeping into adjacent ash pond;
- Section 5-5: Full Flush Pond seeping into adjacent ash pond;
- Section 6-6: Full East Pond seeping into empty Flush Pond; and
- Section 7-7: Full Flush Pond seeping into empty East Settling Pond

Sections 1-1 and 1-2 were analyzed in the initial design and were not reevaluated during the design of the repairs. Section 1-1 was reported to exhibit a safety factor of 1.70 in its existing condition and Section 2-2 was reported to have a safety factor of 1.63. Both factors of safety are expected to increase when the new clay liner is installed.

TABLE 2-6
SOIL PROPERTIES USED IN STABILITY ANALYSES OF NEW SETTLING AND FLUSH PONDS

STRATUM	TOTAL UNIT WEIGHT (PCF)	SATURATED UNIT WEIGHT (PCF)	STRENGTH PARAMETERS	
			COHESION (PSF)	FRICTION ANGLE (DEG)
Random Fill (New Embankment)	115	120	500	28
Soil Cover (Exterior Slopes)	110	115	100	28
ABC Stone Cover	130	130	0	32
Clay Liner	115	122.4	3000	0
Choked Riprap	130	130	0	32
Consolidated Pond Ash (Top 5 ft.)	95	100	220	25
Ash Pond	92.4	92.4	220	23
Partially Weathered Rock	130.4	130.4	18,000	0
Existing Embankment	85	97	0	30
Lower Embankment (Lower 3 – 4 ft)	85	96	0	28
Compact Bottom of Pond	90	92.4	0	30
Existing Gypsum Sludge	65	65	0	0
Concrete Revetment	150	150	0	36

Table 2-7 summarizes the results of the stability analyses performed for Sections 3-3 through 7-7.

TABLE 2-7
FACTORS OF SAFETY FOR SLOPE STABILITY OF NEW SETTLING AND FLUSH PONDS

	WATER @ OPERATING LEVELS		WATER @ SPILLWAY ELEVATION	
SECTION & CONDITION	LONG-TERM STATIC CONDITION	TRANSIENT CONDITION (EQ) (1)	TEMPORARY CONDITION	TRANSIENT CONDITION (EQ) (1) (2)
Section 3-3	1.75	1.44	1.42	1.15
Section 4-4	2.11	1.79	1.57	1.23
Section 5-5	1.49	1.18	1.48	1.17
Section 6-6	2.13	1.83	1.43	1.18
Section 7-7	1.43	1.17	1.38	1.13

NOTES:

(1) Earthquake (EQ) condition assumes a maximum horizontal ground acceleration of 0.1 g.

(2) The earthquake loading combined with the maximum water elevation and a surcharge load of 500 psf for truck traffic include extreme events that likely will not occur at the same time.

Safety factors were computed by the Modified Bishop Method using the computer program STABL6 by Purdue University. The recommended minimum factors of safety contained in the USACE ER 1110-2-106 *Recommended Guidelines for Safety Inspection of Dams* are:

- Steady Seepage: FS = 1.5; and
- Steady Seepage with Earthquake: FS = 1.0

The computed safety factors for several loading conditions are less than 1.5. The conditions analyzed assume a breach in the LLDPE liner overlaying the clay liner from either the operating level or the spillway level. The target safety factors selected by the designers for the temporary condition were 1.25 and 1.5 for the long term condition. We concur that with the conservative selection of parameters used; the computed safety factors are adequate.

2.4.4 Hydrologic Studies

2.4.4.1 West Ash Pond

When the West Ash Pond Dam was constructed, the drainage area was 3.67 square miles. Construction of the dike and channel system in 1986 redirects the runoff from 3.49 square miles of watershed around the main body of the ash pond. The drainage area for the ash pond as presently configured is reported as 1.4 square miles, including 0.5 square miles within the pond and 0.9 square miles of drainage from the East Ash Pond Landfill.

A design flood study for the modified dam and dike system was performed in 1987 by Carolina Power and Light. The design rainfall event was the 0.5 PMP 6-hour duration storm. Rainfall data was taken from Hydrometerological Report No. 51, "*Probable Maximum Precipitation Estimates, United States East of the 105th Meridian*" by the U.S. National Oceanic and Atmospheric Administration. Reports reviewed state that the study showed that the design rainfall event would result in 5 feet of freeboard. The calculations were not available for review for this Report.

We recommend that PGN review this Study in light of the changes that have occurred within the ash pond since 1987 to confirm that the West Ash Pond remains capable of safely passing the design storm.

2.4.4.2 FGD Settling Ponds and FGD Flush Pond

These ponds have no external drainage area; therefore the only uncontrolled liquid into the pond is direct rainfall. Worley Parsons, the pond designers has taken a very conservative approach to sizing the spillway systems for these embankments. Between the maximum

operating level and the crest of the spillway, the ponds are sized to contain a surge flow in the Settling Ponds and a "live storage" in the Flush Pond plus the 100-year rainfall. The spillways are sized to pass the peak discharge, computed using the Rational Formula, from the 100-year storm with 0.5 feet maximum depth of flow over the spillway crest. The spillways have 2 to 3 feet of freeboard from the design depth of flow to the top of dam. The design elevations for the new or reconstructed ponds are shown in ***Table 2-8***.

TABLE 2-8.
CONTROLLING ELEVATIONS OF ASH AND FLUSH PONDS

	WEST ASH POND	**FLUSH POND**	**NEW EAST ASH POND**
Maximum Operating Level (Ft, MSL)	498.4	502.4	489.5
100 Year + Storage (Ft, MSL)	502.4	502.9	501.9
Spillway Crest (Ft, MSL)	503.0	503.5	502.5
Top of Dam (Ft, MSL)	506.0	506.0	506.0

3.0 FIELD INSPECTION

3.1 FIELD INSPECTION OBSERVATIONS

The site inspection was conducted on September 1, 2009. The Inspection Team consisted of representatives from (PGN), North Carolina Department of Environment and Natural Resources – Division of Land Resources (NCDENR-DLR), North Carolina Department of Environment and Natural Resources – Department of Waste Management (NCDENR-DWM), North Carolina Department of Environment and Natural Resources – Department of Water Quality (NCDENR-DWQ), and RIZZO. The Team stopped at each of the Project features to inspect the structures and the surrounding area. Particular attention was paid to site features that may contribute to typical failure modes of embankment structures such as settlement, seepage, and slope stability. Photographs taken during the site inspection can be reviewed in ***Appendix A***.

The individuals participating in the inspection were:

H. Grady Adkins, PE	RIZZO – Independent Engineer
David W. Ray, EIT	RIZZO
Harry Sideris	PGN
Robert Howard	PGN
Billy Milam	PGN
Jodirah Green	PGN
Tom Copolo	PGN
Bill Forester	PGN
John Edelen	PGN
E. Shannon Langley	PGN
John Holley	NCDENR-DLR
Gabi Jones	NCDENR-DLR
Elizabeth Werner	NCDENR-DWM
Geof Little	NCDENR-DWM
Autumn Hoban Romanski	NCDENR-DWQ

3.1.1 West Ash Pond Dam

At the time of inspection, the West Ash Pond Dam appeared to be well maintained and in good condition. The crest of the structure has a hard surface that was well maintained and

showed no signs of settlement or rutting. The upstream slope is covered by the embankment of the FGD Settling Pond. Where observed, the downstream slope appeared to be uniformly graded, without signs of significant sloughing or sliding. The downstream slope is covered with brushy vegetation making a close inspection of the slope difficult. According to PGN personnel the dam is scheduled for mowing in the near future. The slope should be inspected following mowing for surface erosion at the top of the riprap blanket. One small scarp ***Photo 5, Appendix A*** was observed about three feet above the top of the riprap between the second and third drain outlets from the right (East) end of the dam. This could be either the top of a shallow slide or a tractor rut. The abutment contacts appeared to be in good condition both downstream and upstream.

The area between the toe of the dam and the cooling pond had been mowed prior to the inspection. There are seven concrete lined swales that convey seepage from the internal drainage system of the dam to a mixing zone at the confluence of outfall 002 and the heated water discharge canal to the final outfall at 003 to Hyco Lake. These swales had been recently cleaned and all were capable of safely conveying the seepage water from the toe of the dam to the lake.

Seepage water was clear with orange stain typical of flow from dam drainage systems in the Piedmont region. Two drains that were seeping had developed deltas of sand size materials possibly indicative of transport of fine filter material. The deltas could also be from local erosion due to the clean-out operation. The drains should be observed during the weekly inspections to determine if material is being transported from within the dam. A method to quantify the amount of seepage from each outlet is recommended.

The discharge ends of the concrete swales are undermined. This is not considered a dam safety concern due to the distance from the toe of the dam.

3.1.2 Dike 1 (Filter Dam)

Dike 1 is a rockfill structure designed to allow flow through the dam. In addition two discharge structures consisting of vertical risers connected to horizontal conduits through the dam are located in Dike 1. The intake risers have metal trash racks and the conduits outlet through flap gates which appear to be in good condition and functioning normally.

The crest of the dike has a hard surface that is relatively flat with no visible signs of rutting, cracking or settlement. Both interior and exterior slopes are uniform and appear to be in good condition. The berm at the toe of the exterior slope is covered with vegetation except at the outlet channels for the conduits. The outlet channels are free flowing and the seepage through the rockfill appears to be uniform along the toe. Neither cloudy water nor any other indicator of soil transport through the dike was observed.

3.1.3 Dikes 2 and 4

The crest of both dikes has a hard surface that is relatively flat with no visible signs of rutting, cracking or settlement. Both dikes have riprap over filter fabric on both the interior and exterior slopes; however the interior slope of Dike 2 is covered by the exterior slope of the Settling Pond and no longer impounds water.

The exterior slopes terminate at a berm of varying width along the discharge channel. No indications of instability were observed at the time of inspection. No seepage was observed. The downstream slopes and the riprap have small trees, briars, and bushes growing along with the grasses on the earth slopes. Maintenance of the area is needed to control the vegetative growth.

3.1.4 FGD Settling Pond

At the time of inspection, the Settling Pond was operating at a significantly reduced water level due to seepage problems that occurred in February, 2008. The Settling Pond is a completely diked configuration approximately two years old that is scheduled for remedial construction once the new East Settling Pond and repairs to the Flush Pond are completed.

The crest of the structure has a hard surface that is relatively new and showed no signs of cracking, settlement or rutting. The interior slope is covered by riprap and appeared to be uniform with no sloughing, bulging, or scarps. The exterior slope is generally uniform and well grassed with the exception of isolated sloughs that had been patched following the seepage event. See ***Photo 13, Appendix A***.

Seepage is present along the toe of the exterior slope. See ***Photo 12, Appendix A***. This seepage is carried in a toe ditch to a sump where it is pumped back into the pond. Seepage is generally clear; however small boils and deposits of fines indicate that piping of materials is occurring. ***Photo 14, Appendix A***. Monitoring of the seepage should be continued until the repairs are initiated.

3.1.5 FGD Flush Pond

The Flush Pond is currently under reconstruction and was not inspected.

3.1.6 West Ash Pond Discharge Structure

The discharge weir structure is the NPDES Permit NC-0003425 discharge point. See ***Photo 27, Appendix A***. At the time of inspection clear water was freely flowing from the canal to Hyco Lake. Significant seepage was noted flowing from beneath the concrete abutment on the right (East) side of the structure. The flow appears to be coming through the rock foundation. The *2007 Report of Limited Field Inspection* by MACTEC noted this concern and offered assistance in developing and implementing a repair plan for the condition. RIZZO recommends that this action be taken along with monitoring the flow on a monthly basis concurrent with existing scheduled inspections.

3.2 STATUS OF RESPONSES TO RECOMMENDATIONS IN LAST ANNUAL INSPECTION

The following Recommendations were made in the 2008 Independent Consultant Inspection Report prepared for PGN by MACTEC Engineering and Consulting, Inc. In general, the inspection found no indications of concern for dam safety and as such the recommendations are minor in nature.

3.2.1 West Ash Pond Dam

***Recommendation 1*:**

Drain outlet channels at the toe of the dam will require regular maintenance to clear vegetation and sediment. The cleaning should be done at least every two years.

***Status*:**

At the time of inspection, outlet channels had been recently cleaned.

***Recommendation 2*:**

Continue maintenance work (cutting and spraying) to control vegetation growth on the downstream slope with particular attention to the lower third of the downstream slope.

***Status*:**

At the time of the inspection, the area between the toe and Lake Hyco had been mowed, the downstream slope had not.

***Recommendation 3*:**

The wet area at the east end of the dam where seepage has occasionally been seen should be observed during each regular inspection for signs of flow or movement of soil in the flow.

***Status*:**

Seepage was not observed at this location at the time of inspection.

***Recommendation 4*:**

Increase frequency of reading West Ash Pond Dam piezometers to monthly until the planned revisions to the 2006 wastewater treatment pond dike within the ash pond area have been completed.

***Status*:**

Underway - Piezometers are being read and recorded on a monthly basis.

3.2.2 Dike No. 1 (Filter Dam)

***Recommendation 1*:**

Complete placement of additional riprap in small slide areas on the interior slope within the next year.

***Status*:**

Complete

***Recommendation 2*:**

Continue to observe the erosion ditch on the east end of the dike to check that the riprap placed is retarding erosion.

***Status*:**

No erosion problem was noted.

***Recommendation 3*:**

Vegetation and silt accumulations at the flap gates and in the outlet channels leading from them to the channels should continue to be removed during normal maintenance.

***Status*:**

Outlet channels appeared to be free flowing at the time of the inspection.

3.2.3 Dikes No. 2 and 4

***Recommendation 1*:**

Continue maintenance of trees and vegetation on the interior and exterior slopes of Dike No. 4 and on the exterior slope of Dike No. 2 (the interior slope is now covered by the new wastewater treatment and flush pond dikes).

***Status*:**

Maintenance cutting is still needed.

4.0 RECOMMENDATIONS

A total of six recommendations were generated during the preparation of this Inspection Report. All of the Recommendations are considered items that will enhance the existing dam safety program. Each recommendation is presented below along with a proposed schedule to address the recommendation.

4.1 RECOMMENDATION NO. 1

Inspect the slopes of the West Ash Pond Dam at the interface of the earth slope and the top of the riprap blanket for surface erosion or scarps.
Schedule: Following vegetative maintenance mowing.

4.2 RECOMMENDATION NO. 2

Check the drain outlets of the West Ash Storage Dam during monthly inspections to determine if soil material is being transported.
Schedule: During Monthly Inspections.

4.3 RECOMMENDATION NO. 3

A method to quantify the amount of seepage from the West Ash Pond Dam internal drain outlets is recommended
Schedule: Prior to Next Inspection.

4.4 RECOMMENDATION NO. 4

Continue to monitor the seepage at the toe of the Settling Pond Dike until the pond is taken out of service for repairs.
Schedule: According to existing plans.

4.5 RECOMMENDATION NO. 5

Follow-up to developing and implementing a repair plan for the seepage at the NPDES Discharge Point.
Schedule: Prior to Next Inspection.

4.6 RECOMMENDATION NO. 6

Since the 1987 Ash Pond Hydrology Study was completed, portions of the pond have filled with ash and three diked structures have been or will be constructed within the ash pond. The details of the Study were not available to determine if these changes were predicted in the 1987 Study. We recommend that PGN review this Study to determine if the results are still valid.
Schedule: Prior to Next 5-year Inspection.

5.0 CONCLUSIONS

Based on our review of the engineering documentation, inspection forms, and the results of our field inspection, we conclude that the West Ash Pond Complex impoundment is structurally sound and all components are in Satisfactory condition as defined by the USEPA, i.e.,"*No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required."*

We have concluded that the FGD Settling Pond and the FGD Flush Pond are in Fair condition as defined by the USEPA, i.e., "*Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Deficiencies may exist that require remedial action and/or secondary studies or investigations."*

When the remedial work currently underway on these two units is completed as planned, the condition rating should be SATISFACTORY.

APPENDIX A

ROXBORO STEAM PLANT PHOTO LOG

PHOTO 1: TOP OF WEST ASH POND DAM (LOOKING W)

PHOTO 2: TOE OF WEST ASH POND DAM (LOOKING S)

PHOTO 3: CHIMNEY DRAIN AT TOE OF WEST ASH POND DAM

PHOTO 4: END OF CHIMNEY DRAIN AT WEST ASH POND DAM

PHOTO 5: SMALL SCARP LOCATED BETWEEN SECOND AND THIRD DRAIN OUTLETS OF WEST ASH POND DAM

PHOTO 6: ON TOP OF WEST ASH POND DAM LOOKING AT FGD SETTLING AND FLUSH PONDS (LOOKING S)

PHOTO 7: TOP OF FGD SETTLING POND (LOOKING S)

PHOTO 8: TOP OF FGD SETTLING POND (LOOKING N)

PHOTO 9: TOP OF FGD SETTLING POND (LOOKING N)

PHOTO 10: FLOATING SKIMMER OF FGD SETTLING POND (LOOKING N)

PHOTO 11: FGD SETTLING POND SPILLWAY (LOOKING NE)

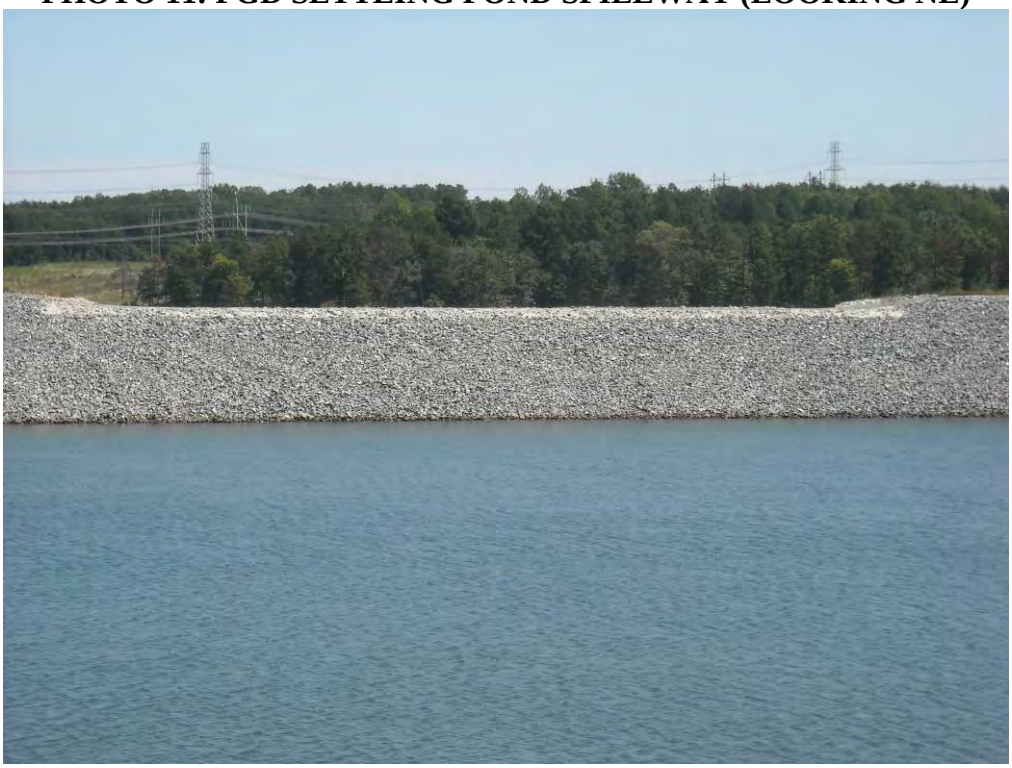


PHOTO 12: TOE OF FGD SETTLING POND (LOOKING S)

PHOTO 13: DOWNSTREAM EMBANKMENT OF FGD SETTLING POND

PHOTO 14: TOE OF FGD SETTLING POND

PHOTO 15: AT BIOREACTOR LOOKING AT FGD FLUSH POND (LOOKING NE)

PHOTO 16: DOWNSTREAM TOE OF FGD FLUSH POND (LOOKING NE)

PHOTO 17: DOWNSTREAM EMBANKMENT OF DIKE 1 (FILTER DIKE, LOOKING SW)

PHOTO 18: DISCHARGE RISER PIPES AT DIKE 1 (FILTER DIKE, LOOKING NE)

PHOTO 19: UPSTREAM EMBANKMENT OF DIKE 1 (FILTER DIKE, LOOKING NE)

PHOTO 20: UPSTREAM EMBANKMENT OF DIKE 1 (FILTER DIKE, LOOKING W)

PHOTO 21: DIKE 1 DOWNSTREAM EMBANKMENT AND DISCHARGE (FILTER DIKE)

PHOTO 22: WEST ASH POND DAM DISCHARGE CHANNEL (LOOKING NW)

PHOTO 23: WEST ASH POND DAM DOWNSTREAM ALONG DISCHARGE CHANNEL (LOOKING SE)

PHOTO 24: WEST ASH POND DAM DOWNSTREAM SLOPE

PHOTO 25: DOWNSTREAM TOE OF WEST ASH POND DAM (LOOKING SE)

PHOTO 26: WEST ASH POND DAM DISHARGE WEIR STRUCTURE (LOOKING SW)

PHOTO 27: CLOSE UP OF WEST ASH POND DAM DISHARGE WEIR STRUCTURE

APPENDIX B

FIGURES

CAD FILE NUMBER	?
CHECKED BY	
APPROVED BY	
DRAWN BY	G.M.J
	10/16/09
PLOT 1:1	

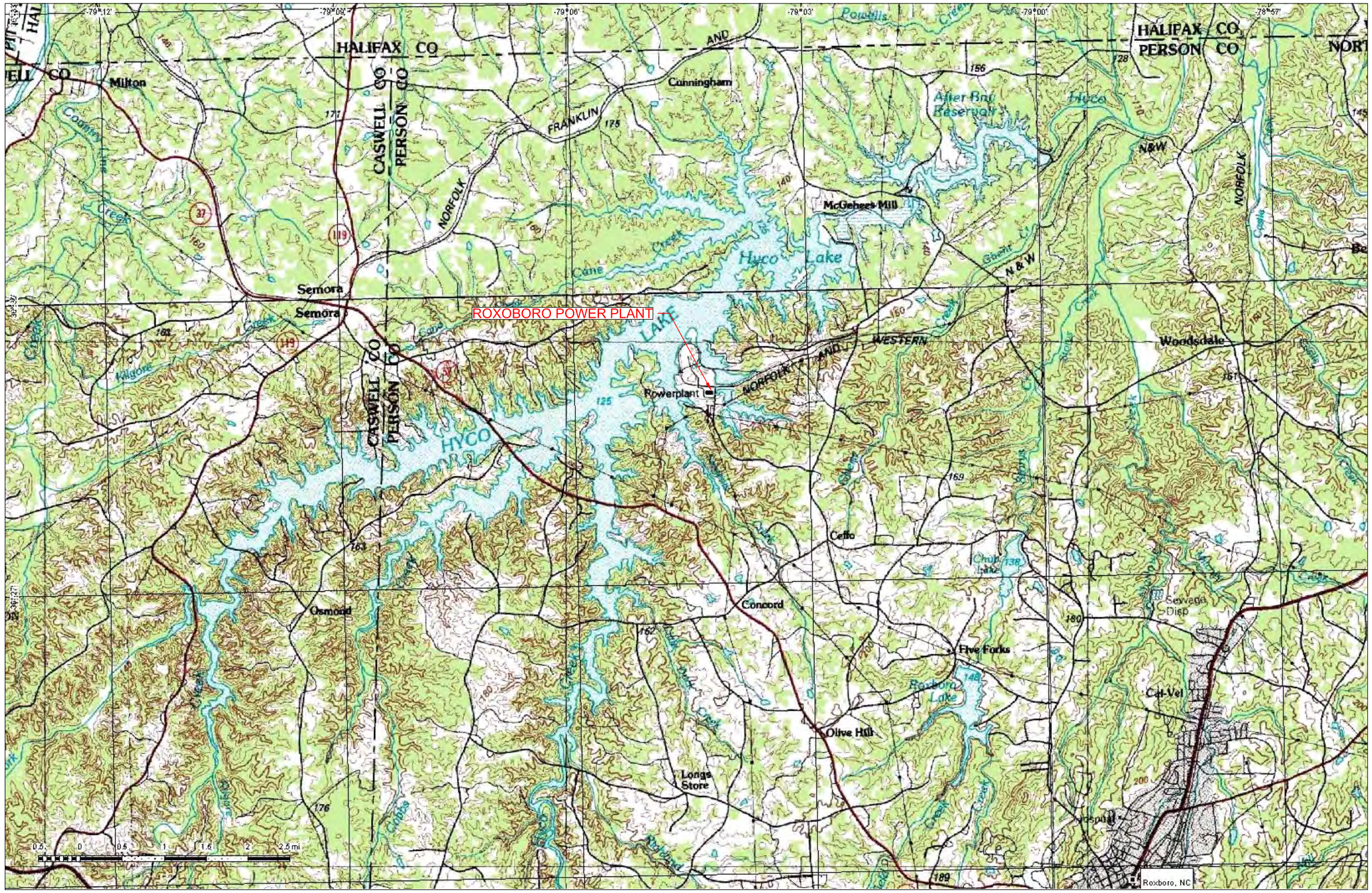


FIGURE I

VICINITY MAP
ROXBORO STEAM ELECTRIC PLANT
DAM SAFETY INSPECTION

PREPARED FOR

USEPA
WASHINGTON, DC

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

PLOT 1=1		DRAWN BY	G.M.J 10/16/09	CHECKED BY APPROVED BY			CAD FILE NUMBER ?

FIGURE 2

SITE FEATURES

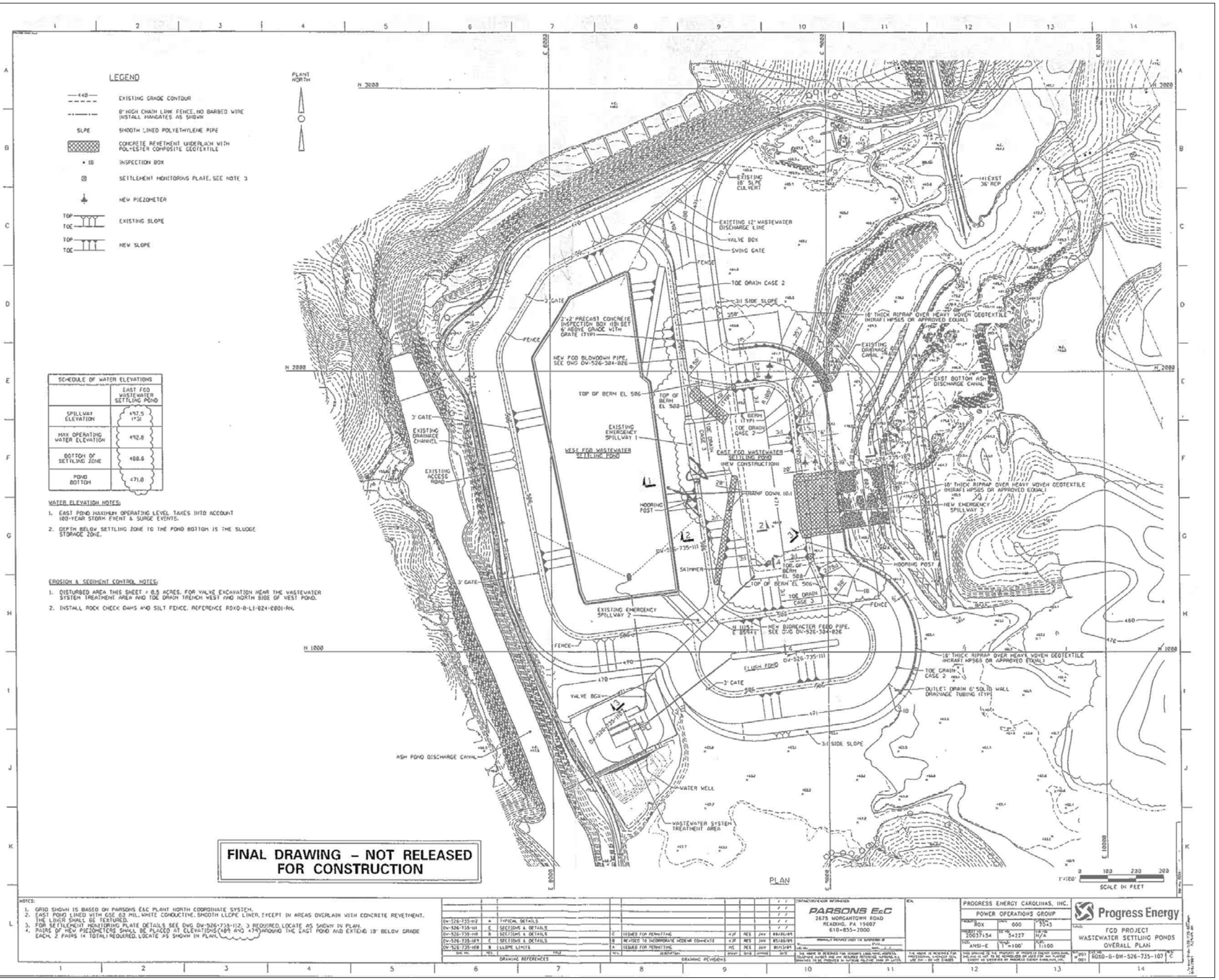
ROXBORO STEAM ELECTRIC PLANT
DAM SAFETY INSPECTION

PREPARED FOR

USEPA
WASHINGTON, DC

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

CAD FILE NUMBER	CHECKED BY	DRAWN BY	PLOT 1=1
?	G.M.J 10/16/09	APPROVED BY	



SCHEDULE OF WATER ELEVATIONS	EAST FGD WASTEWATER SETTLING POND
SPILLWAY ELEVATION	492.5 1:51
MAX OPERATING WATER ELEVATION	492.0
BOTTOM OF SETTLING ZONE	488.8
POND BOTTOM	471.0

WATER ELEVATION NOTES:

1. EAST POND MAXIMUM OPERATING LEVEL TAKES INTO ACCOUNT 100-YEAR STORM EVENT & SURGE EVENTS.
2. DEPTH BELOW SETTLING ZONE TO THE POND BOTTOM IS THE SLUDGE STORAGE ZONE.

EROSION & SEDIMENT CONTROL NOTES:

1. DISTURBED AREA THIS SHEET = 0.5 ACRES. FOR VALVE EXCAVATION NEAR THE WASTEWATER SYSTEM TREATMENT AREA AND TOE DRAIN TRENCH WEST AND NORTH SIDE OF WEST POND.
2. INSTALL ROCK CHECK DAMS AND SILT FENCE. REFERENCE ROXO-0-LI-024-0001-A4.

FINAL DRAWING – NOT RELEASED FOR CONSTRUCTION

NOTES:

1. GRID SHOWN IS BASED ON PARSONS E&C PLANT NORTH COORDINATE SYSTEM.
2. EAST POND LINED WITH GSE 63 MIL, WHITE CONDUCTIVE, SMOOTH LLDPE LINER, EXCEPT IN AREAS OVERLAIN WITH CONCRETE REVETMENT. THE LINER SHALL BE TEXTURED.
3. FOR SETTLEMENT MONITORING PLATE DETAILS SEE DWG DW-526-738-112. 3 REQUIRED. LOCATE AS SHOWN IN PLAN.
4. PAIRS OF NEW PIEZOMETERS SHALL BE PLACED AT ELEVATIONS (489 AND 479) AROUND THE EAST POND AND EXTEND 18' BELOW GRADE EACH. 2 PAIRS (4 TOTAL) REQUIRED. LOCATE AS SHOWN IN PLAN.

DWG NO.	REV.	TITLE
DW-526-735-102	A	TYPICAL DETAILS
DW-526-735-101	C	SECTIONS & DETAILS
DW-526-735-108	B	SECTIONS & DETAILS
DW-526-735-109	C	SECTIONS & DETAILS
DW-526-735-108	B	SLOPE LIMITS

DRAWING REFERENCES

REV.	DESCRIPTION	DRAWN	CHKD	APPROVED	DATE
B	ISSUED FOR PERMITTING	KJF	RES	JAH	09/30/09
B	REVISED TO INCORPORATE MODIFIED CONCRETE	KJF	RES	JAH	09/30/09
A	ISSUED FOR PERMITTING	MS	RES	JAH	09/23/09

DRAWING REVISIONS

CONTRACTOR/VENDOR INFORMATION
PARSONS E&C
2675 MORGANTOWN ROAD
READING, PA 19607
610-855-7000

PROGRESS ENERGY CAROLINAS, INC.
POWER OPERATIONS GROUP
Progress Energy
FGD PROJECT
WASTEWATER SETTLING PONDS
OVERALL PLAN
ROXO-0-DW-526-735-107

FIGURE 3

PLAN OF FGD
SETTLING PONDS
FLUSH POND

PREPARED FOR

USEPA
WASHINGTON, DC

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

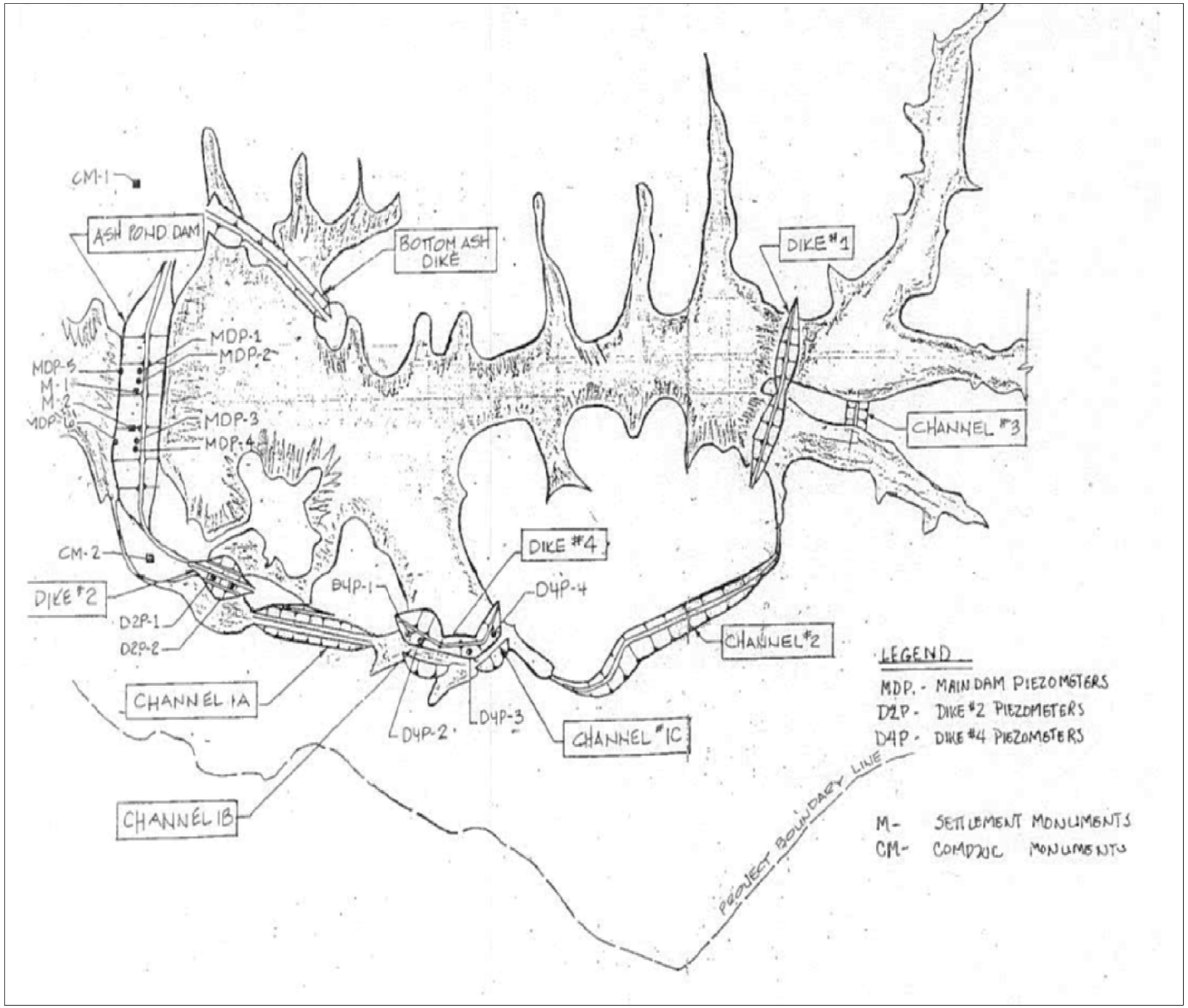


FIGURE 4

PIEZOMETER LOCATIONS
ROXOBORO STEAM ELECTRIC PLANT
DAM SAFETY INSPECTION

PREPARED FOR

USEPA
WASHINGTON, DC

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DRAWN BY	G.M.J	CHECKED BY		CAD FILE NUMBER ?
PLOT 1:1	10/16/09	APPROVED BY		

APPENDIX C

FIELD INSPECTION CHECKLISTS

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Roxboro Power Plant	Date: 09/01/2009
Unit Name: West Ash Pond Dam & Dikes 1, 2,,& 4	Operator's Name: Progress Energy
Unit I.D.:	Hazard Potential Classification: High☐ Significant☒ Low☐
Inspector's Name: Grady Adkins, David Ray	

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?	Regular *		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	463 *		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	463 *		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	470 *		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	X		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)?	X		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?	X		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?		X	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

* See attached Comment Sheet

Coal Combustion Waste Dam Inspection Checklist Form - Continuation
Roxboro Power Plant NC
West Ash Pond and Dikes 1, 2, & 4

Comment Sheet

Inspection Issue No. and Comments

1. Operating Personnel ride the perimeter daily or weekly. Monthly report of piezometer readings and visual assessment. Limited field inspections by Independent Consultant annually since at least 2004. 5-Yr. Independent Consultant Inspection – latest in 2008.

2. Maximum operating level for pool is Elevation 465 to maintain minimum freeboard of 5 feet.

5. Crest of West Ash Pond Dam and Dikes 2 and 4 is Elevation 470. Crest of Filter Dam (Dike 1) is Elevation 473.

8. Record drawings show that West Dam was founded on competent bedrock.

9. Small trees and brush on West Dam are 2 inches or less max diameter.

17. Tall, thick vegetative cover prevents full observation of all slopes. One small scarp approximately 6 inches high was noted and photographed near upper limit of riprap on West Pond Dam – may be indicative of shallow surface slide.

21. Minor seepage at designated discharge points (concrete flumes) at West Ash Pond Dam. Deposit of fines was observed at upstream end of two discharge flumes.
The Filter Dam is designed to filter seepage through it. Seepage water is clear. Seepage outcrops (wet spots rather than running water) were noted at isolated spots along toe of dike slopes.

23. There is a berm between the toe of the West dam and standing water from the cooling pond. The Filter Dam (Dike 1) has water at the toe. These are both design features.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NC-0003425 INSPECTOR Grady Adkins/David Ray

Date 09/01/2009

Impoundment Name West Ash Pond

Impoundment Company Progress Energy

EPA Region 4

State Agency (Field Office) Addresss NC Department of Environment and Natural Resources (NCDENR)
Division of Water Quality, Raleigh, NC

Name of Impoundment West Ash Pond

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

New _____ Update _____

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

IMPOUNDMENT FUNCTION: CCW Impoundment

Nearest Downstream Town : Name Homes on Hyco Lake

Distance from the impoundment Adjacent to Roxboro Power Plant

Impoundment Location:

Longitude 36 Degrees 31 Minutes 16 Seconds

Latitude 78 Degrees 59 Minutes 55 Seconds

State NC County Person County

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

If So Which State Agency? NC Utilities Commission. In Jan 2010,NCDENR Dam Safety will regulate.

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.

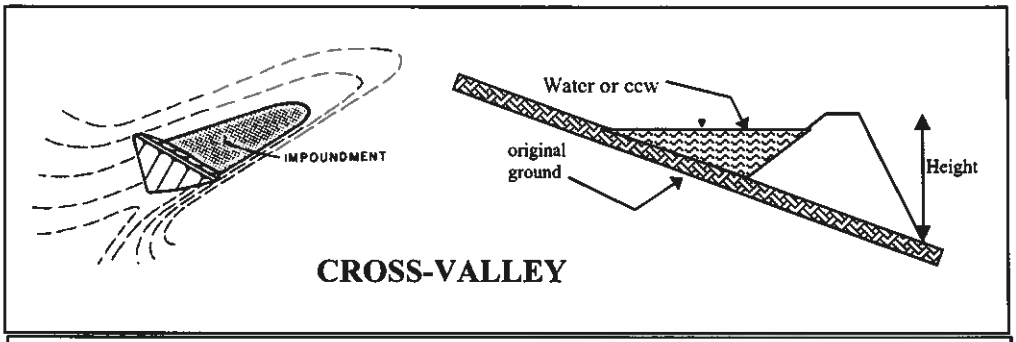
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

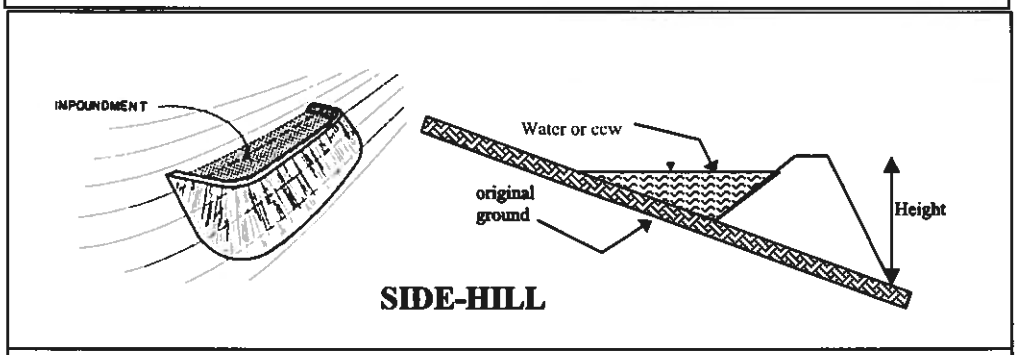
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

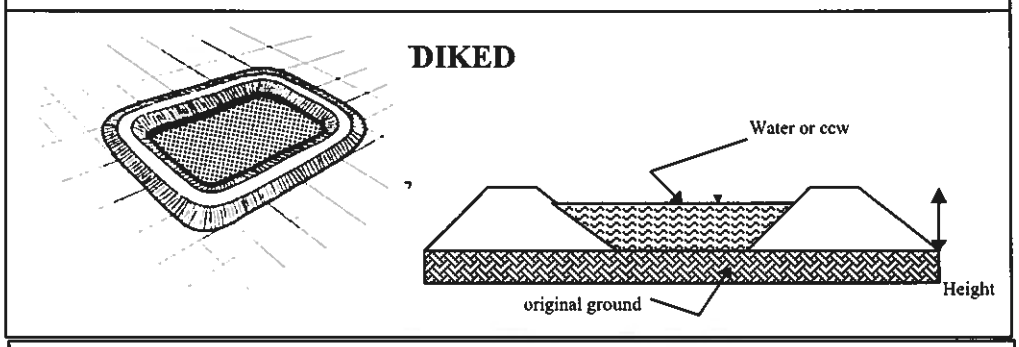
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

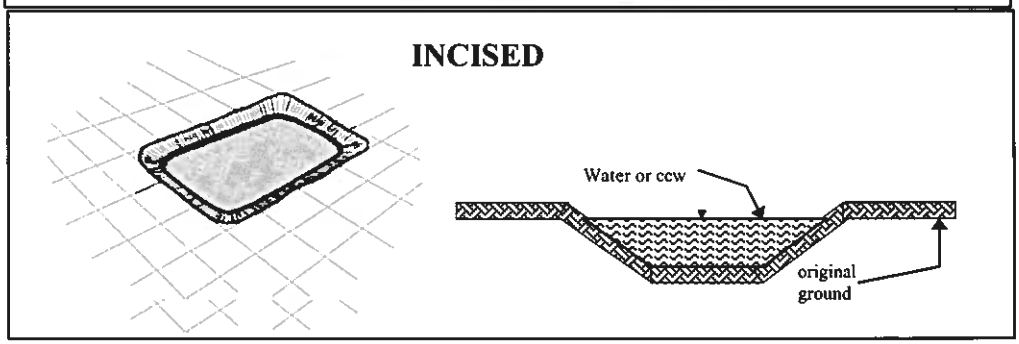
Failure of the West Ash Pond Dam or Dikes would release directly or indirectly into the cooling lake reservoir (Lake Hyco). A release could disrupt power generation and cause environmental damage. A release would be contained in the lake.

CONFIGURATION:









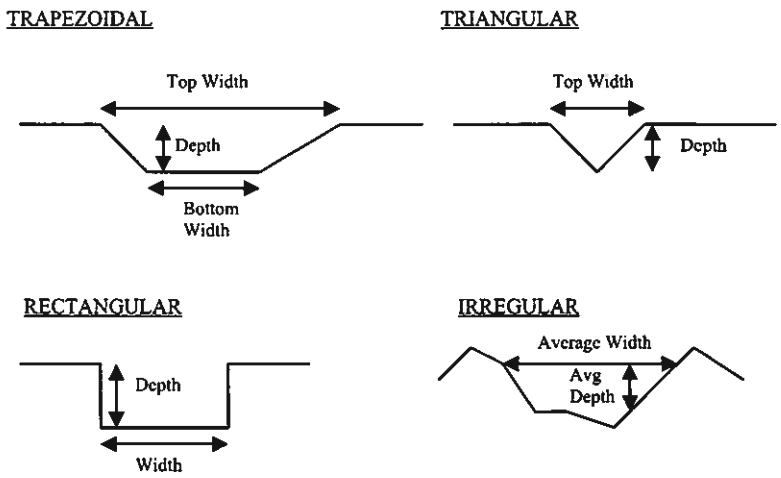
__X__ Cross-Valley (Dam and Dike 1)
_____ Side-Hill
__X__ Diked (on Westside)
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 93 feet Embankment Material earth fill
Pool Area 2400 acres Liner N/A
Current Freeboard 5 feet Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

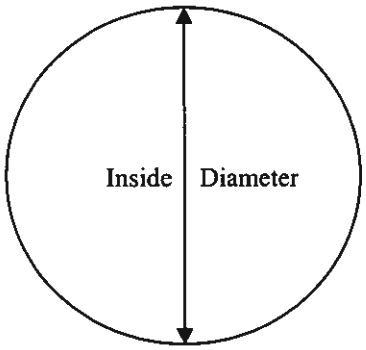
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



2 **Outlet**

48" inside diameter



Material
_____ corrugated metal
X welded steel Riser Pipes
X concrete Conduits through Dam
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) _____

Is water flowing through the outlet? YES X NO _____

_____ **No Outlet**

X **Other Type of Outlet** (specify) Filter Dam (Dike 1)

The Impoundment was Designed By Brown and Root, Inc.

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 ___x___ NO _____

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

If so Please Describe : _____

Piezometers were installed in 1987 and monitored on a regular basis. Monitoring was increased from quarterly to monthly following recommendation in the 2007 Independent Consultant's Limited Field Inspection Report.

ADDITIONAL INSPECTION QUESTIONS

ROXBORO POWER STATION – SEMORA, NC – WEST ASH POND AND DIKES 1, 2, AND 4

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.

The record drawings show that the West Ash Pond Dam and Dikes 1 and 2 were constructed over a prepared foundation stripped to sound rock with a central core keyway excavated 10 feet into rock.

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

Record Drawings were provided by the owner. There was no contact with the design Engineer of Record.

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

None on this structure. Dikes constructed within the Ash Pond have experienced seepage problems in the past and are addressed in a separate report.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Roxboro Power Plant	Date: 09/01/2009
Unit Name: FGD Settling Pond	Operator's Name: Progress Energy
Unit I.D.:	Hazard Potential Classification: High☐ Significant☒ Low☐
Inspector's Name: Grady Adkins, David Ray	

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?	Regular *		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	497 *		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	Pool Level		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	502.5		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	506		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	X		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)?	X		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?	X		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?		X	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

* See attached Comment Sheet

Coal Combustion Waste Dam Inspection Checklist Form - Continuation
Roxboro Power Plant NC
Settling Pond

Comment Sheet

Inspection Issue No. and Comments

1. Operating Personnel ride the perimeter daily or weekly. Monthly report of piezometer readings and visual assessment. Limited field inspections by Independent Consultant annually since at least 2004. 5-Yr. Independent Consultant Inspection – latest in 2008.

2. Maximum operating level for pond is Elevation 497.7. Pond is now operating at a lower level awaiting repairs. Future maximum operating level is planned to be Elevation 498.2

3. Decant is floating skimmer that operates at pool elevation.

7. Embankment is scheduled for repair after construction of repairs to the Flush Pond are completed.

8. The Settling Pond was constructed within the perimeter of the Ash Pond. The embankment subgrade consists of variable bottom ash, fly ash, and rock fill materials.

17 &18. Repaired sloughs and scarps from seepage on outside face of Settling Pond were noted.

21. Seepage is exiting into a toe ditch downstream of Settling Pond and Flush Pond. Seepage is collected in sumps and pumped back into pond. One area with small (1-inch or less diameter) boils was observed in the toe ditch. Seepage outcrops (wet spots rather than running water) at isolated spots along dike slopes were noted.

23. The only water at the toe is in the seepage collection ditch along the base of the embankment.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NC-0003425 INSPECTOR Grady Adkins, David Ray

Date 09/01/2009

Impoundment Name FGD Settling Pond

Impoundment Company Progress Energy

EPA Region 4

State Agency (Field Office) Addresss NC Department of Environment and Natural Resources (NCDENR)
Division of Water Quality, Raleigh, NC

Name of Impoundment FGD Settling Pond

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

New _____ Update _____

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

IMPOUNDMENT FUNCTION: Store and thicken the FGD gypsum sludge

Nearest Downstream Town : Name Homes on Hyco Lake

Distance from the impoundment Adjacent to Roxboro Power Plant

Impoundment Location:

Longitude 36 Degrees 31 Minutes 16 Seconds

Latitude 78 Degrees 59 Minutes 55 Seconds

State NC County Person County

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

If So Which State Agency? NC Utilities Commission. In Jan 2010, NCDENR Dam Safety will regulate.

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.

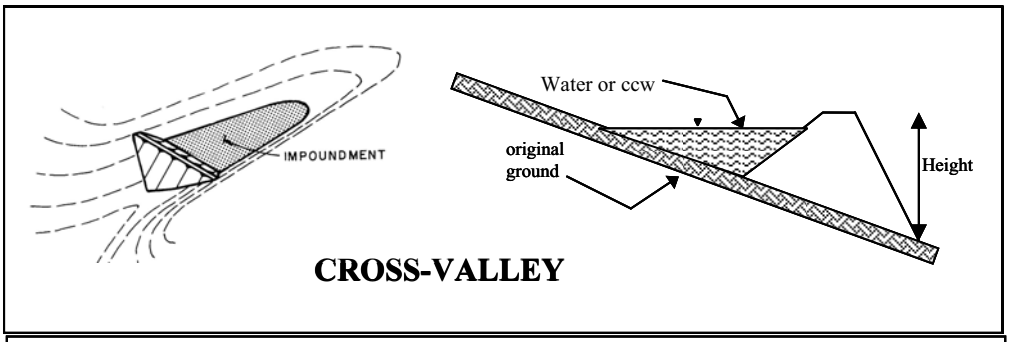
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

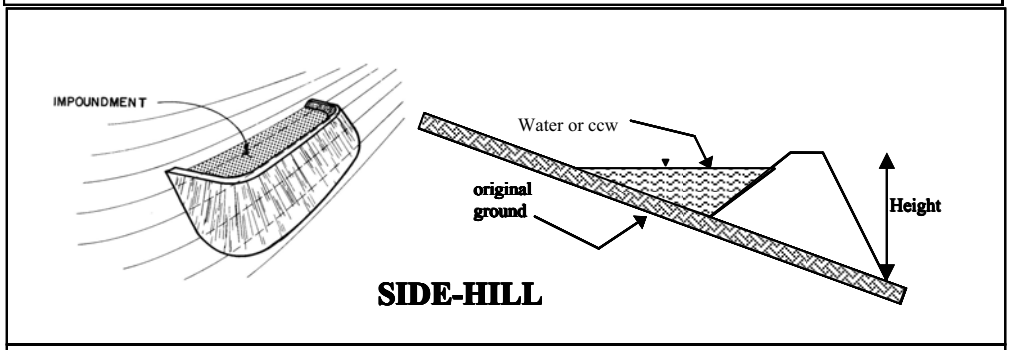
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

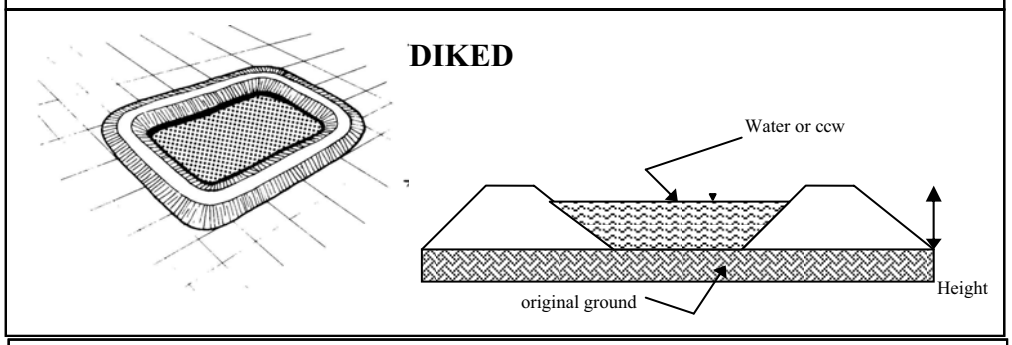
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

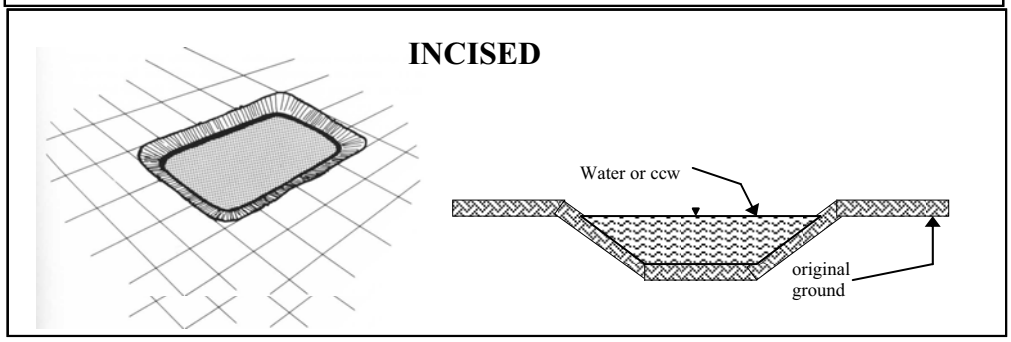
The bottom of this pond is at approximately the same elevation as the top of dam and dikes for the Ash Pond within which it is located. Failure of this structure could release directly into the channels to the Cooling Reservoir. A release could disrupt power generation and cause environmental damage - A release would be contained within Lake Hyco.

CONFIGURATION:









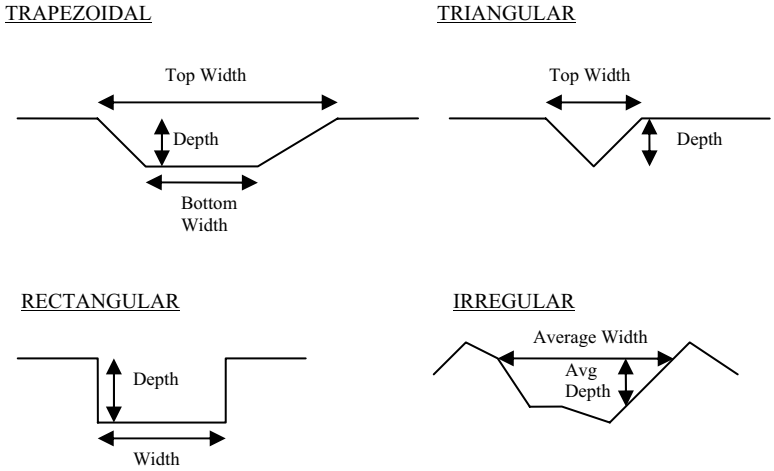
_____ Cross-Valley
_____ Side-Hill
__X__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 38 feet Embankment Material Ash with earth fill cap
Pool Area 16.6 acres Liner GCL
Current Freeboard 8.3 feet Liner Permeability unknown

TYPE OF OUTLET (Mark all that apply)

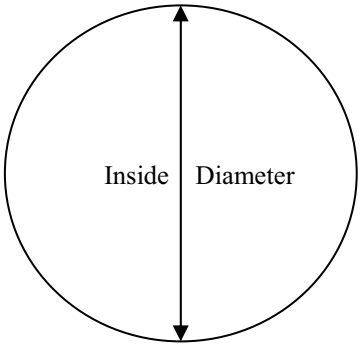
_____ **Open Channel Spillway**
X Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

3.5 depth
16.5 bottom (or average) width
186 top width



_____ **Outlet**

_____ inside diameter



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

Is water flowing through the outlet? YES _____ NO X

_____ **No Outlet**

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

The Impoundment was Designed By Brown and Root, Inc.

Has there ever been a failure at this site? YES _____ NO _____x_____

If So When? _____

If So Please Describe : _____

Has there ever been significant seepages at this site? YES ___X___ NO _____

If So When? _____

IF So Please Describe: _____

Pond was constructed in 2007. Variable size seeps were observed along the outer slope of the northern and western embankments. A sinkhole developed in the embankment of the adjacent flush pond that is currently under construction. The settling pond will be modified to place a more impervious liner. Design has been approved - Construction will follow reconstruction of the Flush Pond.

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

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

If so Please Describe : _____

Operating level has been lowered following seepage at this embankment and sinkhole at Flush Pond.

ADDITIONAL INSPECTION QUESTIONS

ROXBORO POWER STATION – SEMORA, NC – FGD SETTLING POND

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.

The embankment was constructed over a subgrade consisting of variable Bottom Ash, Fly Ash, and Rock Fill Materials.

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

Copies of Construction Drawings and calculations for repair were provided by the Owner. There was no contact with the design Engineer of Record.

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

The FGD Settling Pond experienced variable amounts of seepage at spots along the northern and western sides of the ponds not long after it was put in service in 2007. In response to the seepage problems at the Flush Pond, the water level was lowered and a repair plan developed. Spot repairs were made at several locations. Final repair work will follow completion of repairs to the Flush Pond.

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Roxboro Power Plant	Date: 09/01/2009
Unit Name: FGD Flush Pond	Operator's Name: Progress Energy
Unit I.D.:	Hazard Potential Classification: High☐ Significant☒ Low☐
Inspector's Name: Grady Adkins, David Ray	

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?	Regular *		18. Sloughing or bulging on slopes?		
2. Pool elevation (operator records)?	502.4		19. Major erosion or slope deterioration?		
3. Decant inlet elevation (operator records)?	501		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	503.5		Is water entering inlet, but not exiting outlet?		
5. Lowest dam crest elevation (operator records)?	506		Is water exiting outlet, but not entering inlet?		
6. If instrumentation is present, are readings recorded (operator records)?	X		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)?	X		From underdrain?		
9. Trees growing on embankment? (If so, indicate largest diameter below)			At isolated points on embankment slopes?		
10. Cracks or scarps on crest?			At natural hillside in the embankment area?		
11. Is there significant settlement along the crest?			Over widespread areas?		
12. Are decant trashracks clear and in place?			From downstream foundation area?		
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?			"Boils" beneath stream or ponded water?		
14. Clogged spillways, groin or diversion ditches?			Around the outside of the decant pipe?		
15. Are spillway or ditch linings deteriorated?			22. Surface movements in valley bottom or on hillside?		
16. Are outlets of decant or underdrains blocked?			23. Water against downstream toe?		
17. Cracks or scarps on slopes?			24. Were Photos taken during the dam inspection?	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
9-24	Flush pond is under construction - being rebuilt after seepage and piping problems in February 2008. No water is impounded.
2-5	Elevations are new construction elevations.
8 -	Foundation will be existing or reworked fly ash and and rock fill. The Flush Pond is inside the perimeter of the Ash Pond.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NC-0003425 INSPECTOR Grady Adkins, David Ray

Date 09/01/2009

Impoundment Name FGD Flush Pond

Impoundment Company Progress Energy

EPA Region 4

State Agency (Field Office) Addresss NC Department of Environment and Natural Resources
Division of Water Quality, Raleigh, NC

Name of Impoundment FGD Flush 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: Part of the bioreactor system to remove and store the metals from settling pond discharge.

Nearest Downstream Town : Name Homes on Hyco Lake

Distance from the impoundment Adjacent to the Roxboro Power Plant

Impoundment Location:

Longitude 36 Degrees 31 Minutes 16 Seconds

Latitude 78 Degrees 59 Minutes 55 Seconds

State NC County Person County

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

If So Which State Agency? NC Utilities Commission. In Jan 2010, NCDENR Dam Safety will regulate.

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.

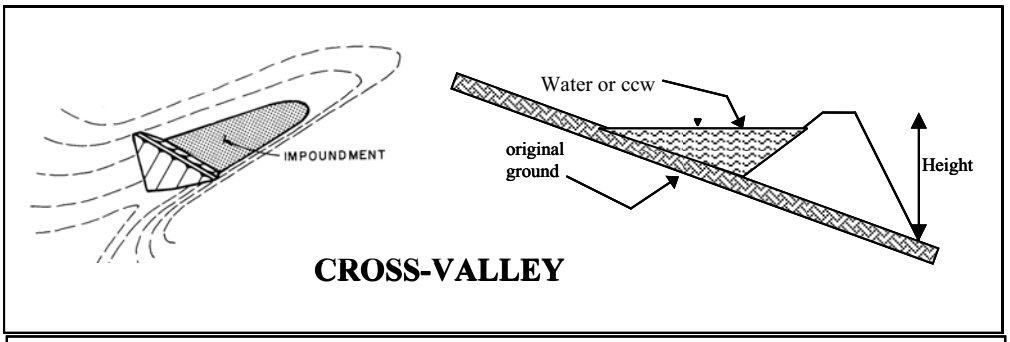
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

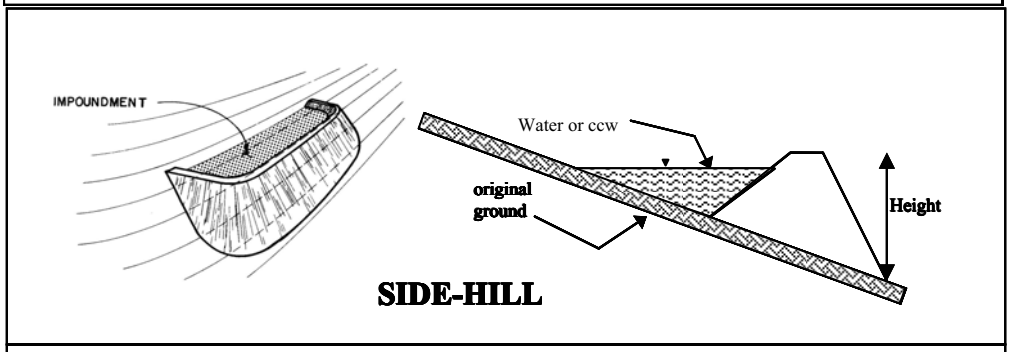
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

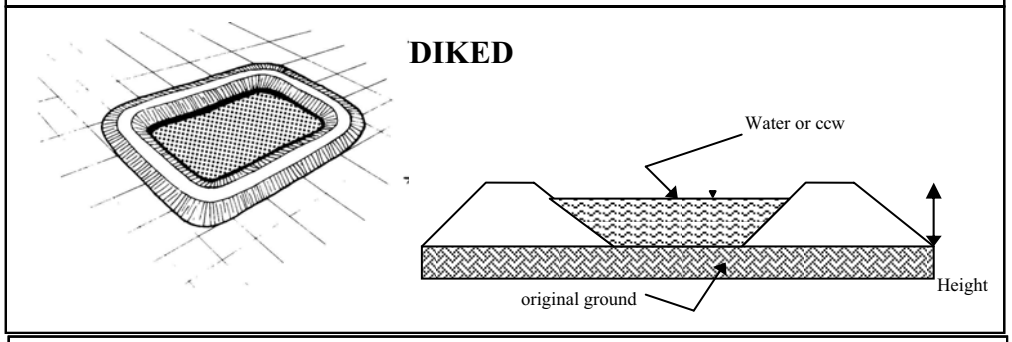
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

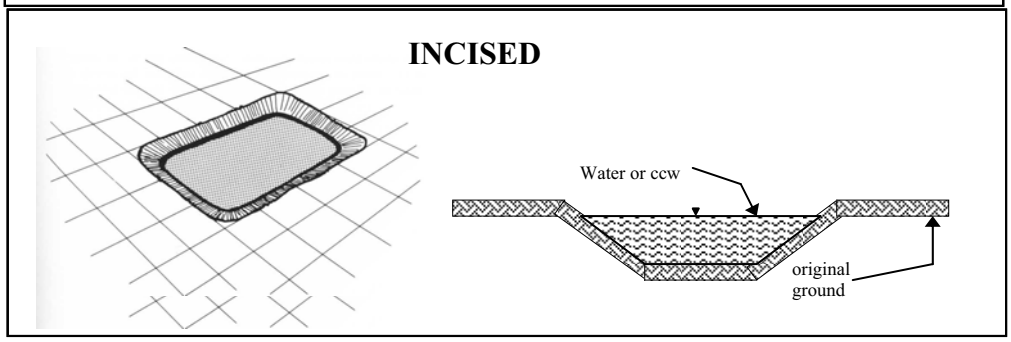
The bottom of this pond is at approximately the same elevation as the top of dam and dikes for the Ash Pond within which it is located. Failure of this structure could release directly or indirectly into the channels to the Cooling Reservoir. A release could disrupt power generation and cause environmental damage - A release would be contained within Lake Hyco.

CONFIGURATION:









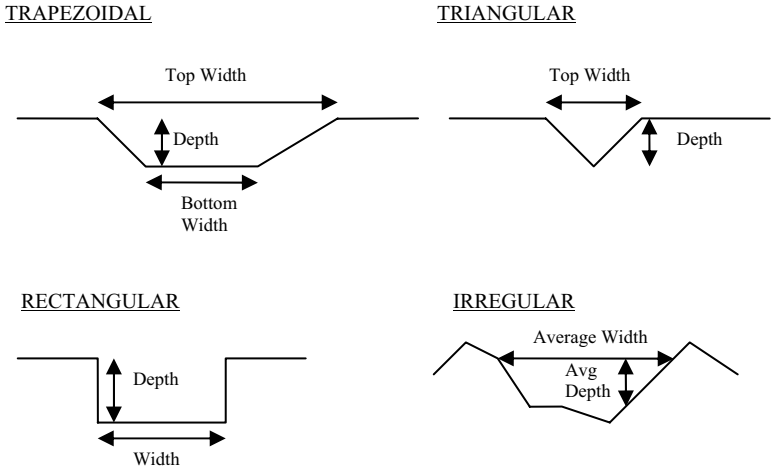
_____ Cross-Valley
_____ Side-Hill
__X__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 37.5 feet Embankment Material Ash with earth fill cap
Pool Area 3.1 acres Liner 60 MIL LLDPE
Current Freeboard 4 feet Liner Permeability very low

TYPE OF OUTLET (Mark all that apply)

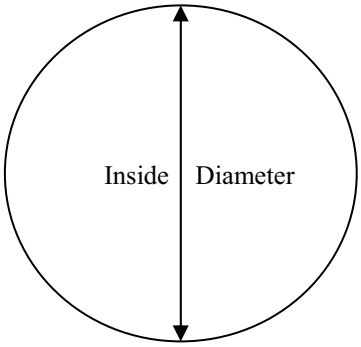
_____ **Open Channel Spillway**
X Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

3' depth
35' bottom (or average) width
83' top width



_____ **Outlet**

_____ inside diameter



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

Is water flowing through the outlet? YES _____ NO X

_____ **No Outlet**

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

The Impoundment was Designed By Worley Parsons

Has there ever been a failure at this site? YES ____X____ NO _____

If So When? February 2008

If So Please Describe :

In 2007, a wastewater treatment system, consisting of a gypsum settling pond, a bioreactor flush pond and a bioreactor was constructed for treatment of the blowdown steam from the FGD absorber units at the power plant. Pond water leakage was observed at various locations along the outer slopes of the settling and flush ponds.

In February 2008, a failure occurred at the Flush Pond in the form of a limited slope failure on both inner and outer slopes. The Flush Pond was dewatered and the operating level of the Settling Pond was lowered. Repairs to both ponds have been designed and approved. Construction is currently underway at the Flush Pond with repairs to the Settling Pond scheduled after completion of the work on the Flush Pond.

Has there ever been significant seepages at this site? YES ___X___ NO _____

If So When? _____

IF So Please Describe: _____

See previous sheet

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 : _____

Repair work underway

ADDITIONAL INSPECTION QUESTIONS

ROXBORO POWER STATION – SEMORA, NC – FGD FLUSH POND

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.

The embankment was constructed over a subgrade consisting of variable Bottom Ash, Fly Ash, and Rock Fill Materials.

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

Copies of Construction Drawings and calculations for repair were provided by the Owner. There was no contact with the design Engineer of Record.

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

The FGD Flush Pond experienced a failure in February 2008 that is described in a previous section. Repair work is under construction at the time of this inspection.