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Coal Combustion Waste Impoundment
Round 5 - Dam Assessment Report

Winyah Generating Station (Site #004)

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Georgetown, South Carolina

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

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INTRODUCTION, SUMMARY, CONCLUSION AND RECOMMENDATIONS

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

This assessment of the stability and functionality of the Winyah Generating Station coal combustion waste (CCW) management units is based on a review of available documents and on the site assessment conducted by Dewberry personnel on June 29 and 30, 2010. We found the supporting technical information to be limited (Section 1.1.3). As detailed in Section 1.2 there are several recommendations that may help to maintain a safe and trouble-free operation.

In summary, all Winyah Generating Station Ash Ponds and Slurry Ponds are FAIR for continued safe and reliable operation. These ratings are strongly influenced by the lack of some rudimentary engineering data for the dams that impound these CCW ponds.

PURPOSE AND SCOPE

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

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

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

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

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

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

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

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

LIMITATIONS

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

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1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a two-day site visit and review of technical and historical documentation provided by Santee Cooper.

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

No stability analyses of the embankment dams impounding Ash Pond A, Ash Pond B, and Unit 2 Slurry Pond were provided for review, though requested by EPA; presumably such analyses were not available in Santee Cooper’s files. Documented analyses of static stability of the embankment dams impounding the Unit 3 & 4 Slurry Pond, West Ash Pond, and the South Ash Pond were reviewed. The results demonstrate adequate static stability with respect to the reduced safety criterion adopted by the designers. Note the reduced criterion does not appear to have detrimentally affected the static stability performance of these impounding embankments.

On the basis of Dewberry engineers’ visual observations and review of limited available information, all the embankment dams probably have adequate stability under static loading conditions (see assessment in Section 7.3). Although not critical, it would be advisable for Santee Cooper to verify static stability of the perimeter dikes impounding Ash Pond A/ Ash Pond B and the Unit 2 Slurry Pond with documented analyses.

A strong earthquake is possible in the area. The stability of the Winyah GS CCW pond dams during strong earthquake is unknown and cannot be assessed from visual observation. Subsurface information indicates the presence of loose fine sands and very loose silty fine sands in foundation soils under the Ash Pond B perimeter dike and loose silty fine sands under perimeter dikes impounding the Unit 3 & 4 Slurry Pond/ West Ash Pond perimeter dike and the South Ash Pond perimeter dike... In addition, thick deposits of very soft silty clay exist under the South Ash Pond perimeter dike. The apparent presence of loose and very loose sandy soils in the foundation suggests that liquefaction could potentially occur during strong earthquake shaking, but the actual liquefaction potential and its effect on the dikes at the Winyah GS cannot be known without performing a liquefaction study. For the more critical West Ash Pond/Unit 3 & 4 Slurry Pond perimeter dike and South Ash Pond perimeter dike it would be advisable for Santee Cooper to perform a documented engineering review of foundation soil conditions at those locations to determine what, if any, limited or detailed analyses of seismic stability and liquefaction potential should be performed. Although not as critical, due to reduced impact, it would be advisable for Santee Cooper to also perform a similar engineering review for the perimeter dikes impounding Ash Pond A/ Ash Pond B and the Unit 2 Slurry Pond.

With exception of the RCP discharge conduit at Ash Pond B, the principal outlet structures, located at Ash Pond B (riser intake only) and the South Ash Pond, appear to be in sound and stable condition. The Ash Pond B RCP, which has separated joints and soil loss over the pipe, poses a potential threat to the stability of the perimeter dike. The abandoned outlet pipe through the Ash Pond A perimeter dike may also pose a threat to the stability of the perimeter dike, if the severely corroded CMP section observed at the outfall continues all the way back through the dike to the riser structure. Santee Cooper should investigate both of these penetrations and implement appropriate remedial actions, as needed.

There is no indication that the dikes consist of, or are modified with, wet fly ash, slag, or other unsuitable materials.

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

No hydrologic/hydraulic analyses of the Winyah GS CCW ponds were provided for review, though requested by the EPA; presumably such analyses were considered unnecessary for these small impounding structures. . Thus, the ability of the ash ponds and slurry ponds to safely store and pass the appropriate design flood has not been demonstrated through documented analysis. However, on the basis of a rudimentary review of flood storage capacity (see Section 6.2), the ponds are believed to have the capability to store 100 percent of precipitation from a design storm over their areas without overtopping, except possibly at the ring-dike system containing the Unit 3 & 4 Slurry Pond and the West Ash Pond. The hydrologic/hydraulic safety of the Unit 3 & 4 Slurry Pond and the West Ash Pond should be verified in the near future by documented analysis.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

Supporting technical documents are somewhat limited. The original design documentation is limited to design drawings, some of which are not very legible (original drawings for Ash Pond A and Ash Pond B), a design report for a dike raise at Ash Pond B in 1997, and a Subsurface Investigation report prepared by Soil & Material Engineers Inc (S&ME) in 1978 for ash pond construction in areas that include the Unit 3 & 4 Slurry Pond, the West Ash Pond, and the South Ash Pond. No other technical documentation about the design of the existing facilities is available.

Technical documents to verify the hydrologic/hydraulic adequacy of all the ash ponds and structural stability of Ash Pond A, Ash Pond B, and Unit 2 Slurry Pond embankments are not available. However, the hydrologic/hydraulic documentation is considered non-critical for the ring-dike systems containing Ash Pond A and Ash Pond B, the South Ash Pond, and the Unit 2 Slurry Pond because these basins appear to have sufficient flood storage capacity. Therefore, the lack of supporting hydrologic/hydraulic documentation for these ponds is a minor concern until studies can be performed or formal documentation prepared that demonstrates that these ponds have suitable safety against overtopping. However, hydrologic/hydraulic capacity of the ring-dike system containing the Unit 3 & 4 Slurry Pond and the West Ash Pond is not obvious, due to the relatively low available freeboard above normal operating level, the internal drainage from the high filled-in areas of the basins to the low areas, and the fact that pumping is relied upon to remove water from the basins. Therefore, supporting hydrologic/hydraulic documentation for the Unit 3 & 4 Slurry Pond and the West Ash Pond is considered to be inadequate at this time. Santee Cooper should review and document hydrologic safety of the Unit 3 & 4 Slurry Pond and the West Ash Pond.

The lack of supporting structural stability documentation for the Ash Pond A/Ash Pond B perimeter dike and the Unit 2 Slurry Pond perimeter dike is a minor concern for reasons discussed in Section 7.2 until studies can be performed. Documentation of static stability of the West Ash Pond/Unit 3 & 4 Slurry Pond perimeter dike and the South Ash Pond perimeter dike is generally adequate. However, it would be advisable for Santee Cooper to perform a documented review of seismic stability and liquefaction potential of the West Ash Pond/Unit 3 & 4 Slurry Pond perimeter dike and the South Ash Pond perimeter dike.

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

Descriptions provided for the CCW pond dams and basins are appropriate and sufficient. Descriptions provided on initial and supplemental drawings for the outlet works are appropriate and sufficient.

1.1.5 Conclusions Regarding the Field Observations

Ash Pond A and Ash Pond B Dams – A perimeter dam embankment encloses Ash Pond A and Ash Pond B. A cross dike embankment separates Ash Pond A from Ash Pond B. The embankments appeared to be structurally sound. The visible parts of the perimeter dam and cross dike were observed to have no signs of overstress, significant settlement, shear failure, or other signs of instability.

Minor wet areas with some ponding water were observed along the toe of the perimeter dam. These conditions do not threaten the stability of the perimeter dam at this time but should be visually monitored during routine inspections for any change in condition.

Depressions (“dropouts”) along the abandoned discharge pipe of Ash Pond A through the perimeter dam were observed. The depressions are possibly associated with structural failure of the pipe due to corrosion of a CMP section of the abandoned discharge pipe between the toe of the dam and the Discharge Canal and/or due to joint separations. (It is not known if the CMP section continues through the perimeter dike to the intake riser.) Depressions with some exposed gravel along the Ash Pond B discharge pipe (RCP) through the perimeter dam were observed in the section between the toe of the dam and the Discharge Canal. The depressions were observed to be due to loss of overburden soil into separations at joints in the discharge pipe. As previously noted in Subsection 1.1.1, Santee Cooper should investigate both of these penetrations and implement appropriate remedial actions, as needed.

With exception of the conditions noted along the pipe penetrations, the dam embankments appeared to be adequately maintained. There were no other apparent indications of potential unsafe conditions.

South Ash Pond Dam – The perimeter dam embankment appeared to be structurally sound. Visible parts of the embankment dam and outlet structure were observed to have no signs of overstress, significant settlement, significant shear failure, or other signs of instability.

Wet soils and small seeps were observed along the outside toe of the embankment and at the toe drains; the wetness and small seeps appear to be associated with drainage of water collected in the toe drain and gradual seepage through the generally sandy foundation soils. These conditions do not threaten the stability of the perimeter dam at this time but should be visually monitored during routine inspections for any change in condition.

Some areas of poor grass cover were noted, particularly in toe areas where recent work on the toe drain outlets had been conducted. These areas should be reseeded as part of routine maintenance or otherwise protected with an inverted filter in the wet toe areas if grass cannot be established and maintained.

The dam embankment appeared to be adequately maintained. There were no apparent indications of potential unsafe conditions.

West Ash Pond and Unit 3 & 4 Slurry Pond Dams – The perimeter dam embankment encloses the West Ash Pond and the Unit 3 & 4 Ash Slurry Pond. A cross dike embankment separates the West Ash Pond from the Unit 3 & 4 Slurry Pond. The embankments appeared to be structurally sound. The visible parts of the embankment dam and cross dike were observed to have no signs of overstress, significant settlement, shear failure, or other signs of instability. The area of the perimeter dam on the northwest side of the Unit 3 & 4 Ash Slurry Pond where previous repairs were done to stop leakage through an abandoned construction drain through the dam appeared to be in sound condition; the section of the perimeter dam at the southwest corner of the West Ash Pond where another abandoned construction drain had been filled with concrete also appeared to be in sound condition.

Minor wet areas with little ponding water were observed along the toe of the perimeter dam on the west side of the West Ash Pond. These conditions do not threaten the stability of the perimeter dam at this time but should be visually monitored during routine inspections for any change in condition.

The dam embankments appeared to be adequately maintained. There were no apparent indications of potential unsafe conditions.

Unit 2 Slurry Pond Dam – A perimeter dam embankment encloses the Unit 2 Slurry Pond and a cross dike embankment divides the basin. The embankments appeared to be sound. The visible parts of the embankment dams and pump structure were observed to have no signs of overstress, significant settlement, significant shear failure, or other signs of instability. No seepage was observed; the basin had little water in it at the time of the site visit.

The dam embankments appeared to be adequately maintained. There were no apparent indications of potential unsafe conditions.

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

Maintenance of the impounding embankments of the ash ponds and the slurry ponds appears to be generally adequate; reseeding of some bare soil areas, particularly at the South Ash Pond perimeter dike, should be done as part of routine maintenance. Consideration should be given to using an inverted filter in bare soil areas along the wet toe of the dike, if it is not possible to establish and maintain a good grass cover in the wet areas.

Maintenance or repair is needed at the active outlet pipe penetration through the perimeter dike at Ash Pond B and possibly at the abandoned outlet pipe penetration through the perimeter dike at Ash Pond A (see Subsection 1.1.1).

Operational procedures appear to be appropriate and adequate, as long as pumping operations at the West Ash Basin, Unit 3 & 4 Slurry Pond, and Unit 2 Slurry Pond are closely monitored and back-up pumps are available and can be quickly pulled into service, if needed.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The surveillance program is generally adequate. The informal daily observations by plant personnel and formal quarterly inspections by operating personnel with assistance of experienced dam safety engineers when requested are of sufficient frequency and should continue. Santee Cooper's written inspection procedures are generally adequate but could be improved in execution. The daily and quarterly inspections apparently did not note or pick-up on the potentially significant issues at the abandoned outlet pipe at Ash Pond A and the active outlet pipe at Ash Pond B.

Internal inspection of the main outlet structures (Ash Pond B outlet and South Ash Pond outlet) should be performed at a frequency of at least once every 5 years and documented. Although the outlet structures may have been well constructed of durable materials, no structure has an indefinite lifespan. Penetrations through dams always should receive an extra level of scrutiny. Waiting to perform internal inspections only when there is some exterior evidence of a problem may be too late. Even when evidence of a problem condition can be seen by external visual inspection, such as the problem condition observed at the Ash Pond B active outlet, the full extent of the problem condition may not be ascertained by external visual inspection alone.

There are no dam performance monitoring instruments such as observation wells/piezometers, settlement monitoring points, inclinometers, seepage monitoring points, etc. at the CCW pond dams, and none appear to be warranted at this time. A program of groundwater quality monitoring and pond discharge monitoring is in place and will continue in accordance with SCDHEC Bureau of Water/Compliance Assurance Division permit requirements.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

In accordance with EPA criteria, outlined below, all the CCW ponds at the Winyah GS are rated FAIR for continued safe and reliable operation. These ratings are strongly influenced by the lack of some rudimentary engineering data for the dams that impound these CCW ponds. Implementation of recommendations as presented below would help improve the rating.

EPA Classification Criteria:

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.

FAIR
Acceptable performance is expected under all required loading conditions (static, hydrologic, seismic) in accordance with safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations.

POOR

A management unit safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with safety regulatory criteria. Remedial action is necessary. POOR also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.

UNSATISFACTORY

Considered unsafe. A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Reservoir restrictions may be necessary.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

It is recommended that Santee Cooper perform a documented engineering review of foundation soil conditions at the West Ash Pond/Unit 3 & 4 Slurry Pond perimeter dike and the South Ash Pond perimeter dike and determine what, if any, limited or detailed analyses of seismic stability and liquefaction potential should be performed. After reviewing the draft report, Santee Cooper indicated that analyzing seismic stability and liquefaction potential has never been required as part of the original permit to construct ash ponds at the Winyah GS and believes that such analyses of the impounding structures at Ash Pond A, Ash Pond B, Unit 2 Slurry Pond, South Ash Pond, and the West Ash Pond are not critical needs at this time. However, Santee Cooper has indicated that they will evaluate the need to assess the seismic stability and liquefaction potential at the Unit 3 & 4 Slurry Pond.

It is recommended that Santee Cooper investigate the apparent problem conditions along the active (RCP) outlet penetration through the Ash Pond B perimeter dike and along the abandoned (apparent CMP) outlet penetration through Ash Pond A perimeter dike and implement appropriate remedial actions, as needed. After reviewing the draft report, Santee Cooper indicated they are evaluating remedial options for addressing the active RCP outlet penetration through the Ash Pond perimeter dike and along the abandoned (apparent CMP) outlet penetration through Ash Pond A perimeter dike, and will take appropriate action based on the results of the evaluation, ranging from repair to full replacement for the Ash Pond B outlet and appropriate sealing of the abandoned Ash Pond A outlet.

1.2.2 Recommendations Regarding the Hydrologic/Hydraulic Safety

It is recommended that Santee Cooper verify the hydrologic/hydraulic safety of the Unit 3 & 4 Slurry Pond and the West Ash Pond with documented analyses.

After reviewing the draft report Santee Cooper has indicated that they will analyze and verify the hydrologic/hydraulic safety of these ash ponds relative to the available freeboard.

1.2.3 Recommendations Regarding the Supporting Technical Documentation

As recommended above in Subsection 1.2.1, a documented engineering review of seismic stability and liquefaction potential of the South Ash Pond perimeter dike and the West Ash Pond/Unit 3 & 4 Slurry Pond perimeter dike should be performed.

As recommended above in Subsection 1.2.2, the hydrologic/hydraulic safety of the Unit 3 & 4 Slurry Pond and the West Ash Pond should be verified by documented analysis.

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

It is recommended that Santee Cooper continue to maintain project records that contain accurate, legible records of the as-built features of all CCW pond outlet works, as well as information on abandoned works and how they were abandoned. Note that Santee Cooper has indicated that they will continue to document and maintain records of all modifications to any of the ash pond outlet works or dikes for future reference. Furthermore Santee Cooper has indicated that they will review their records pertaining to abandoned outlet works and how they were abandoned and, based on the findings, determine what, if any, additional information is warranted.

1.2.5 Recommendations Regarding the Field Observations

Ash Pond A and Ash Pond B Dams – The draft report recommended that Santee Cooper perform investigations and any needed repairs with respect to problem conditions noted along the two pipe penetrations. In response to the draft report, Santee Cooper has indicated such investigations are already in progress. No other recommendations appear warranted at this time. Santee Cooper should continue to maintain vegetation on the crest and outside slopes and perform visual monitoring of wet soil areas along the toe of the perimeter dam as recommended in Subsections 1.2.6 and 1.2.7, below.

South Ash Pond Dam – None appear warranted at this time, other than to continue maintaining vegetation on the crest and outside slopes, and particularly along the toe, and perform visual monitoring of the areas of wet soil and seepage along the toe of the dam as recommended in Subsections 1.2.6 and 1.2.7, below.

Unit 3 & 4 Slurry Pond and West Ash Pond Dams – None appear to be warranted at this time, other than to continue maintaining vegetation on the crest and outside slopes and perform visual monitoring of the wet soil areas along the toe of the perimeter dam as recommended in Subsections 1.2.6 and 1.2.7, below.

Unit 2 Slurry Pond Dam – None appear to be warranted at this time, other than to continue maintaining vegetation on the crest and outside slopes as a part of routine maintenance as recommended in Subsection 1.2.6, below.

1.2.6 Recommendations Regarding the Maintenance and Methods of Operation

Maintain or repair active and abandoned pipe penetrations through the Ash Pond A/Ash Pond B perimeter dike as recommended above in Subsection 1.2.1. As noted above, Santee Cooper has indicated that evaluation of these penetrations is already in progress.

The draft report recommended that bare soil areas on the dikes, particularly the South Ash Pond perimeter dike be reseeded or otherwise protected against erosion as part of routine maintenance. Santee Cooper has indicated that reseeding of the bare soil areas on the South Ash Pond perimeter dike was completed on August 24, 2010 and a protective grass cover has been established.

No recommendations regarding operational procedures appear to be warranted at this time, but ensure that pumping operations at the West Ash Basin, Unit 3 & 4 Slurry Pond, and Unit 2 Slurry Pond are closely monitored and have back-up pumps in reserve that can be quickly placed into service, if needed. (Santee Cooper has indicated that routine inspections of the pumping operations are performed at least once per shift and that spare pumps are available in the fleet used to perform inspections; furthermore, a contract is in place with a qualified vendor to provide additional pumps and technical support on a 24-hour basis in the event they are needed,)

1.2.7 Recommendations Regarding the Surveillance and Monitoring Program

The draft report recommended that all the CCW pond dikes be walked at least once per year, with close scrutiny in critical outside toe areas, such as at penetrations (conduits, including abandoned ones) or areas of known seepage or wet areas to check for changed conditions. These conditions cannot be viewed properly from the crest. . Santee Cooper has indicated that their quarterly inspections include proper inspection of the upstream and downstream slopes and all structures, including penetrations and that standard inspection procedures outlined in the National Dam Safety Program, Training Aids for Dam Safety are utilized.

It is recommended that the principal outlet structures, which are those located at Ash Pond B and the South Ash Pond, be inspected internally with a remote camera on a frequency of at least once every 5 years and be documented with a written report.

1.2.8 Recommendations Regarding Continued Safe and Reliable Operation

No additional recommendations for continued safe and reliable operation appear warranted at this time, other than to periodically review downstream changes that may alter the hazard potential classification or assessment of the consequences of failure of the dams.

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

*Fred Tucker, Dewberry
*Anne Lee, Dewberry
  Mitch Mitchum, Santee Cooper
*Denise Bunte-Bisnett, Santee Cooper
*Jane Hood, Santee Cooper
*Arthur Ford, Santee Cooper
*Aundry Evans, Santee Cooper

*Participated in field dam inspections.

1.3.2 Acknowledgement and Signature

We acknowledge that the management units referenced herein have been assessed on June 29 and June 30, 2010.

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SEAL
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2.0 DESCRIPTION OF THE COAL COMBUSTION WASTE MANAGEMENT UNIT(S)

2.1 LOCATION AND GENERAL DESCRIPTION

The Winyah Generation Station (Winyah GS) is physically located between Pennyroyal Creek and Turkey Creek, south of the Sampit River in Georgetown County, South Carolina, approximately 1.4 miles southwest of Georgetown, South Carolina. The Winyah GS is located on Steamplant Drive, Georgetown, South Carolina 29440-5035. Winyah Bay is East of Winyah Generating Station. See Appendix A – Doc 1.1 for location of the Winyah GS on an aerial map.

The Winyah GS has six ponds or basins designated for disposal of coal combustion waste (CCW), including:

- Ash Pond A
- Ash Pond B
- South Ash Pond
- West Ash Pond
- Unit 3 & 4 Slurry Pond
- Unit 2 Slurry Pond

See Appendix A – Doc 1.2 for relative locations of the basins on an aerial view map of the Winyah GS. (Note: The terms “dike” and “dam” are used interchangeably in this report, as are the terms “pond” and “basin.”)

All of the basins were manmade primarily by excavating the interior areas of the basins and building a perimeter dike (dam) around the excavated areas. The principal impounding structures are the perimeter dike that encompasses Ash Pond A and Ash Pond B, the perimeter dike that surrounds the South Ash Pond, the perimeter dike that encompasses the West Ash Pond and Unit 3 & 4 Slurry Pond, and the perimeter dike that surrounds the Unit 2 Slurry Pond. A diagonal cross dike separates the northern Ash Pond A from the southern Ash Pond B within the perimeter dike system. Likewise, a cross dike separates the southern West Ash Pond from the northern Unit 3 & 4 Slurry Pond within the perimeter dike system. Similarly, the Unit 2 Slurry Pond was recently separated into two (east and west) cells by extending the original “finger” dike in the middle of the basin to the perimeter dike on the north side of the basin. There is no indication that any of the dikes consist of, or are modified with, wet fly ash, slag, or other unsuitable materials.

Ash Pond A has a surface area of approximately 88 acres. According to a furnished drawing (Appendix A – Doc 1.3), the design top elevation of the perimeter dike is 41.5 feet. The maximum height of the perimeter dike is 24.5 feet above the outside toe. It is an unlined basin that is designated to receive fly ash, bottom ash and boiler slag. The basin is currently active but nearly filled to capacity; remaining storage volume varies due to the excavation of ash for retail. There is practically no free-standing water in this basin. Drainage trenches are excavated in the ash surface to direct sluice water and storm water to the southeast side of the basin, where an outlet conduit through the cross dike discharges into Ash Pond B. (Data on conduit type and size not provided; conduit not seen in the field.) Formerly, drainage from Ash Pond A to Ash Pond B was through a decant tower with bottom discharge conduit ("18" conc. O-ring pipe" according to furnished drawing) through the cross dike near its southwest end; that drainage structure has been abandoned in-place. The original outlet structure (decant tower) on the southwest side of the basin with bottom discharge into a conduit through the perimeter dike is bladder plugged and abandoned. A furnished drawing indicates the conduit was to be 24-inch diameter "conc. o-ring pipe," but badly corroded corrugated metal pipe (CMP) was observed in the field at the outlet end. Ash Pond A wastewater discharge is regulated by SCDHEC Bureau of Water/Compliance Assurance Division, but the dam structure is not regulated by state or federal agencies.

Ash Pond B has a surface area of approximately 63 acres. It is an unlined basin that receives CCW water from Ash Pond A. The maximum height of the perimeter dam is 31 feet above the outside toe. It is an unlined basin that is designated to contain fly ash, bottom ash, and boiler slag. The basin is filled to approximately 60 percent capacity, but is currently active as a clarifying cell with a relatively small pool of free-standing water in the southern one-third of the basin. The outlet structure (decant tower) near the south end on the west side discharges into a conduit through the perimeter dike to the Discharge Canal. Type and size of the conduit are not readable on the furnished drawing, but in the field the shallow-submerged outlet end of the conduit appeared to be reinforced concrete pipe (RCP) on the order of 24 inches in diameter.

The capacity of Ash Pond B was expanded in 1997. The height of the perimeter dike embankment along Ash Pond B was raised approximately 7.0 feet to match the elevation of the Ash Pond A dike embankment crest. Appendix A – Doc 1.4 is a report of the raised dike design prepared by Paul C. Rizzo Associates, Inc. (Rizzo). The decant tower structure was raised 7 feet. Ash Pond B wastewater discharge is regulated by the SCDHEC Bureau of Water/Compliance Assurance Division, but the dam structure is not regulated by state or federal agencies.

The South Ash Pond has a surface area of approximately 61 acres. According to representative sections (Exhibit 1), the design top elevation of the perimeter dike is 37 feet (37.31 feet at centerline). The design of the perimeter dike included a toe drain for seepage control (see Exhibit 2 for details); locations of PVC pipe drain outlets for the toe drain are shown in Appendix A – Doc 1.5, along with the design layout and features of the South Ash Pond perimeter dike. The maximum height of the perimeter dike is 22 feet above the outside toe. The South Ash Pond is an unlined basin designated to receive fly ash, bottom ash and boiler slag; it is currently active and filled to approximately 50 percent of capacity. The South Ash Pond receives water pumped from the West Ash Pond; it also receives water pumped from an outside toe ditch on the perimeter of the basin. Drainage trenches are excavated in the ash surface to direct sluice water, pass-through water, and storm water to the east end of the basin, where there is a relatively small pool of free-standing water. The outlet structure (decant tower) at the east end discharges into a conduit through the perimeter dike and ultimately to the Discharge Canal. (See Section 1 on furnished drawing no. 3-CV-555 in Appendix D – Doc D.1. Also see Appendix D – Doc D.2 for details of the outlet structure.) The South Ash Pond wastewater discharge is regulated by the SCDHEC Bureau of Water/Compliance Assurance Division, but the dam is not regulated by state or federal agencies.

The West Ash Pond (also known as Ash Pond 3 & 4) has a surface area of approximately 62 acres. Design layout and features of the West Ash Pond dikes are shown in Appendix A – Doc 1.6. According to representative sections (Exhibit 3), the design top elevation of the perimeter dike is 37 feet (37.31 feet at centerline). The maximum height of the perimeter dam is 32 feet above the outside toe. It is an unlined basin designated to contain fly ash, bottom ash, and boiler slag; it is filled to approximately 90 percent of capacity, and it currently does not receive ash, and the in-place ash is not mined. The West Ash Basin contains very little free-standing water. Water is pumped into the West Ash Pond from the Unit 3 & 4 Slurry Pond and channeled along the west and southwest sides to the southeast corner, where it is pumped from the former decant tower to the South Ash Pond. The former outlet conduit through the perimeter dike (see Section 2 on furnished drawing no. 3-CV-555 in Appendix D – Doc D.1) at the southeast corner of the basin apparently has been sealed; therefore, there is no gravity flow outlet from the West Ash Pond. The West Ash Pond wastewater discharge is regulated by the SCDHEC Bureau of Water/Compliance Assurance Division, but the dam is not regulated by state or federal agencies.

The Unit 3 & 4 Slurry Pond has a surface area of approximately 100 acres. Design layout and features of the Unit 3 & 4 Slurry Pond dikes are shown in Appendix A – Doc 1.6. According to representative sections (Exhibit 3), the design top elevation of the perimeter dike is 37 feet (37.31 feet at centerline). The maximum height of the perimeter dike is 30 feet above the outside toe. It is an unlined basin designated to receive flue gas emission control residuals (calcium sulfate) from the scrubbers; it is filled to approximately 70 percent of capacity. Although the basin is active, it receives sluiced material only during startup of a unit, until the calcium sulfate meets specifications for use at an adjacent gypsum wallboard plant. Once the material meets specifications, it is dried and sent by conveyor to the wallboard plant. The Unit 3 & 4 Slurry Pond has the largest pool of free-standing water of the six basins at the Winyah GS; it occupies approximately one-half of the basin surface area. The Unit 3 & 4 Slurry Pond receives water pumped from an outside toe ditch on the perimeter of the basin. There is no gravity outflow structure at the basin. Water is pumped from the Unit 3 & 4 Slurry Pond over the northwest end of the cross dike into the West Ash Pond. The Unit 3 & 4 Slurry Pond wastewater discharge is regulated by the SCDHEC Bureau of Water/Compliance Assurance Division, but the dam is not regulated by state or federal agencies.

The Unit 2 Slurry Pond has a surface area of approximately 32 acres. Design layout and features of the Unit 2 Slurry Pond dikes are shown in Appendix A – Doc 1.7. According to the representative sections (Exhibit 4), the design top elevation of the perimeter dike is 37.0 feet. The maximum height of the perimeter dam is 12 feet above the outside toe. It is an unlined basin designated to receive flue gas emission control residuals (scrubber waste); at the time of the assessment it was filled to approximately 65 percent of capacity. However, it no longer receives scrubber waste but is not closed. A finger dike was extended to complete a north-south cross dike across the middle of the basin (see Appendix A – Doc 1.7); a HDPE pipe was installed for pass-through flow of storm water run-off. The concrete pump (sump) structure has an open side that formerly was fitted with wooden slide-gate sections to impound water and form a sump or well from which water was pumped. Currently, all the bottom gates have been removed and the bottom gate is raised to allow water to flow under it. A pump placed inside the structure discharges storm water through a drainage pipe to the Intake Canal and maintains the basin generally free of a pool of water, except for temporary pools during significant rainfalls. The Unit 2 Slurry Pond wastewater is regulated by the SCDHEC Bureau of Water/Compliance Assurance Division, but the dam is not regulated by state or federal agencies.

2.2 SIZE AND HAZARD CLASSIFICATION

The Winyah GS impoundment dams are not regulated by a federal or state agency and currently do not have federal or state hazard classifications. Dams owned by the South Carolina Public Service Authority (Santee Cooper) are specifically exempted from state regulation in Section 72-2 Dam Classifications and Exemptions of the South Carolina Dams and Reservoirs Safety Act Regulations. Santee Cooper created an internal multi-disciplined team composed of professional engineers with backgrounds specializing in dam safety, environmental services, plan operations, and facility maintenance to evaluate the structural integrity and safety of the impoundments. This task force will also establish hazard ratings for each impoundment using nationally recognized criteria.

In the following paragraphs a preliminary hazard potential determination is made on the basis of the hazard potential classification system adopted by USEPA; this classification system and the hazard potential determination and basis are presented on the field observation checklists for the Winyah GS CCW ponds included in Appendix B (also see Table 2.4 below).

Ash Pond A Dam - Maximum dam height is 24.5 feet, according to furnished information. The total storage capacity is 807 acre-feet. Other physical data are summarized in Table 2.1. The dam currently has an undetermined hazard potential rating. For reference the SCDHEC criteria for Size Classification and Hazard Potential Classification are presented in Table 2.2 and Table 2.3, respectively. Based on storage capacity, the Ash Pond A Dam has a Small Size Classification. Failure of the dam would discharge CCW into the Cooling Pond. The failure would not likely cause loss of life but would cause some onsite environmental damage and potential disruption of generation station operations. Therefore, per the USEPA classification (see Table 2.4) the Ash Pond A Dam should be given a Low Hazard Potential Classification.

Ash Pond B Dam - Maximum dam height is 31 feet, according to furnished information. The total storage capacity is 537 acre-feet. Other physical data are summarized in Table 2.1. The dam currently has an undetermined hazard potential rating. Based on storage capacity and SCDHEC criteria (Table 2.2), the Ash Pond B Dam has a Small Size Classification. Failure of the dam would discharge CCW into the Cooling Pond. The failure would not likely cause loss of life but would cause some onsite environmental damage and potential disruption of generation station operations. Therefore, per the USEPA classification the Ash Pond B Dam should be given a Low Hazard Potential Classification.

South Ash Pond Dam - Maximum dam height is 22 feet, according to furnished information. The total storage capacity is 1,129 acre-feet. Other physical data are summarized in Table 2.1.

The dam currently has an undetermined hazard potential rating. Based on storage capacity and SCDHEC criteria (Table 2.2), the South Ash Pond Dam has an Intermediate Size Classification. Failure of the dam would discharge CCW into a perimeter ditch bounded by existing railroad tracks. If the tracks were to be overtopped, CCW could potentially damage the tracks and adjacent private property and/or enter Pennyroyal Creek. The failure would not likely cause loss of life but would cause environmental damage, potential private property damage, and potential disruption of railroad operations and generation station operations. Therefore, per the USEPA classification the South Ash Pond Dam should be given a Significant Hazard Potential Classification.

West Ash Pond Dam - Maximum dam height is 32 feet, according to furnished information. The total storage capacity is 1,178 acre-feet. Other physical data are summarized in Table 2.1. The dam currently has an undetermined hazard potential rating. Based on storage capacity and SCDHEC criteria (Table 2.2), the West Ash Pond Dam has an Intermediate Size Classification. Failure of the dam could potentially damage adjacent private property and/or enter Pennyroyal Creek; if failure occurs on the southwest side, the adjacent railroad tracks could potentially be overtopped with CCW. The failure would not likely cause loss of life but would cause environmental damage, potential private property damage, and potential disruption of railroad operations and generation station operations. Therefore, per the USEPA classification the West Ash Pond Dam should be given a Significant Hazard Potential Classification.

Unit 3 & 4 Slurry Pond Dam - Maximum dam height is 30 feet, according to furnished information. The total storage capacity is 1,700 acre-feet. Other physical data are summarized in Table 2.1. The dam currently has an undetermined hazard potential rating. Based on storage capacity and SCDHEC criteria (Table 2.2), the Unit 3 & 4 Slurry Pond Dam has an Intermediate Size Classification. Failure of the dam could potentially damage adjacent private property and/or release CCW into Pennyroyal Creek with potential impact on the nearby Pennyroyal Road. The failure would not likely cause loss of life, but would cause environmental damage and potential private and public property damage. Therefore, per the USEPA classification the Unit 3 & 4 Slurry Pond Dam should be given a Significant Hazard Potential Classification.

Unit 2 Slurry Pond Dam - Maximum dam height is 12 feet, according to furnished information. The total storage capacity is 416 acre-feet. Other physical data are summarized in Table 2.1. The dam currently has an undetermined hazard potential rating. Based on storage capacity and SCDHEC criteria (Table 2.2), the Unit 2 Slurry Pond Dam has a Small Size Classification. Failure of the dam would discharge CCW into a perimeter ditch. If the perimeter ditch were to be overtopped, CCW could potentially damage adjacent property (gypsum wallboard plant) and/or enter the Intake Canal. The failure would not likely cause loss of life but would cause on-site environmental damage, potential property damage, and potential disruption of generation station operations. Therefore, per the USEPA classification the Unit 2 Slurry Pond Dam should be given a Significant Hazard Potential Classification.

Pertinent physical data are presented in the following Table 2.1.

Table 2.1: Summary of Dam Dimensions and Size*

	Ash Pond A Dam	Ash Pond B Dam	South Ash Pond Dam	West Ash Pond Dam	Unit 3 & 4 Slurry Pond Dam	Unit 2 Slurry Pond Dam
Dam Height	24.5’	31.0’	22.0’	32.0’	30.0’	12.0’
Crest Width	12’	12’	15’	15’	15’	10’
Length	~8,854’ **	~6,243’	~8,663’	~6,950’**	~5,937’	~6,491’ **
Side Slopes (inside)	2:1	2:1	3:1 & 4:1	2:1 & 3:1	2:1 & 3:1	2:1
Side Slopes (outside)	3:1	2:1	3:1 & 4:1	2:1 & 3:1	2:1 & 3:1	2:1
Hazard Potential Classification* **	Low	Low	Significant	Significant	Significant	Significant

**Based on data in Santee Cooper’s response to EPA’s RFI dated March 9, 2009 and furnished information.*
***Includes cross dike.*
****Preliminary Hazard Potential Classification based on available information and hazard potential classification adopted by USPA.*

The SCDHEC Size Classification System is presented in the following Table 2.2. (Based on USACE ER 1110-2-106 dated September 26, 1979, except “Very Small” category was added by SCDHEC.)

Table 2.2: Size Classification*

Category	**Impoundment Storage (Acre-Feet)**	**Dam Height (Feet)**
Very Small	Less than 50	Less than 25
Small	Less than 1,000 but equal to or greater than 50	Less than 40 but equal to or greater than 25
Intermediate	Less than 50,000 but equal to or greater than 1,000	Less than 100 but equal to or greater than 40
Large	Equal to or less than 50,000	Equal to or less than 100

**Note: Size classification may be determined by either storage or height of structure, whichever gives the higher category.*

The SCDHEC Hazard Potential Classification System is presented in the following Table 2.3.

Table 2.3: SC Hazard Potential Classification	
Category	**Hazard Potential**
High Hazard (Class I)	Dams located where failure will likely cause loss of life or serious damage to home(s), industrial and commercial facilities, important public utilities, main highway(s) or railroad(s).
Significant Hazard (Class II)	Dams located where failure will not likely cause loss of life but may damage home(s), industrial and commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important public utilities.
Low Hazard (Class III)	Dams located where failure may cause minimal property damage to others. Loss of life is not expected.

The Hazard Potential Classification System adopted by the USEPA is presented in the following Table 2.4.

Table 2.4: Dam Hazard Potential Classification Used by EPA	
Category	Hazard Potential Description
High Hazard Potential	Dams where failure or misoperation will probably cause loss of human life.
Significant Hazard Potential	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.
Low Hazard Potential	Dams 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.
Less Than Low Hazard Potential	Dams where failure or misoperation results in no probable loss of human life or economic or environmental losses.

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

The amount of CCW residuals currently stored in the units and maximum capacities are summarized in Table 2.5.

Ash Pond A - Based on information from Santee Cooper, this basin contains fly ash, bottom ash and boiler slag deposited over 35 years. As previously mentioned, this basin is currently active and remaining storage volume varies due to the excavation of fly ash for retail. A total of 726 acre-feet of CCW material is contained within Ash Pond A, recorded 2009. The amount of ash produced and removed from 2005 to 2009 is provided, see Appendix A – Doc 1.8. As of 2009, Ash Pond A had an estimated 10 percent remaining in total storage capacity. A normal pool of water is not maintained in this basin other than locally along drainage ditches excavated in the ash surface.

Ash Pond B - Based on information from Santee Cooper, this basin is currently active as a clarifying cell and contains fly ash and bottom ash deposited over 35 years. The storage capacity of Ash Pond B was increased in 1997 with the expansion of the embankment. The height of the dam was raised to approximately meet the existing top of dam elevation of Ash Pond A. A normal pool of water is maintained at approximately 35.0 feet or 6.0 feet below the design top elevation of 41.0 feet indicated in Rizzo's design report (Appendix A – Doc 1.4); the pool level at the time of the site visit was at elevation 34.8 feet. A total of 322 acre-feet of CCW material is contained within Ash Pond A, recorded 2009. Ash Pond B has an estimated 40 percent remaining in total storage capacity. The pool of free-standing water covers approximately one-third of the surface area in the lower (southern) part of the basin.

South Ash Pond - Based on information from Santee Cooper, this basin contains fly ash, bottom ash and boiler slag deposited over 30 years. As previously mentioned, this basin is currently active. A total of 565 acre-feet of CCW material is contained within the South Ash Pond, recorded 2009. The South Ash Pond has an estimated 50 percent remaining in total storage capacity. The design maximum water level is at elevation 34.0 feet, which would leave at least 3.3 feet of freeboard below the design crest centerline elevation of 37.31 feet. The staff gage reading at the time of the site visit was 17.1 feet, but no reference elevation was given to relate this reading to an elevation that can be compared to the dam crest elevation. Visually the pool level appeared to be at least 6.0 feet below the crest at the time of the site visit.

West Ash Pond - Based on information from Santee Cooper, this basin contains fly ash, bottom ash and boiler slag deposited over 30 years. As previously mentioned, this basin no longer receives CCW. A total of 1060 acre-feet of CCW material is contained within the West Ash Pond, recorded 2009. The West Ash Pond has an estimated 10 percent remaining in total storage capacity, but currently the basin is used only for pass-through of water pumped into it from the Unit 3 & 4 Slurry Pond. A normal pool of water is not maintained in this basin other than locally along drainage ditches excavated in the ash surface. The original design maximum pool elevation was 34.0 feet, which was about 3.3 feet below the design crest centerline elevation.

Unit 3 & 4 Slurry Pond - Based on information from Santee Cooper, this basin contains flue gas emission control residuals deposited over 30 years. As previously mentioned, this basin is currently active but receives calcium sulfate slurry only during unit start-up operations, until the material meets specifications for use at the gypsum board manufacturing plant located adjacent to the generating station. A total of 1190 acre-feet of CCW material is contained within Unit 3 & 4 Slurry Pond, recorded 2009. Unit 3 & 4 Slurry Pond has an estimated 30 percent remaining in total storage capacity. The design maximum pool elevation is 34.0 feet, which is about 3.3 feet below the design crest centerline elevation. A staff gage reading at the time of the site visit indicated that the pool level was at elevation 34.9 feet, which was above the design maximum pool elevation. The pool of free-standing water covers approximately one-half of the surface area in the northern part of the basin.

Unit 2 Slurry Pond - Based on information from Santee Cooper, this basin contains flue gas emission control residuals deposited over 33 years. The basin is currently not active but not closed. A total of 270 acre-feet of CCW material is contained within Unit 2 Slurry Pond, recorded 2009. The Unit 2 Slurry Pond has an estimated 35 percent remaining in total storage capacity. A normal pool of water is not maintained in this basin; storm water runoff within the basin is pumped out (to Intake Canal) as it accumulates. The amount of water in the basin at the time of the site visit was minimal.

Table 2.5: Amount of Residuals and Maximum Capacity of Unit*

	Ash Pond A	Ash Pond B	South Ash Pond	West Ash Pond	Unit 3 & 4 Slurry Pond	Unit 2 Slurry Pond
Surface Area (acre)	88	63	61	62	100	34
Current Storage Volume (acre-feet)	726	322	565	1060	1190	270
Total Storage Capacity (acre-feet)	807	537	1129	1178	1700	416

**Based on data in Santee Cooper's response to EPA's RFI dated March 9, 2009.*

2.4 PRINCIPAL PROJECT STRUCTURES

2.4.1 Earth Embankment Dams

Ash Pond A and Ash Pond B Dams - The material used in the construction of the perimeter dam along Ash Pond A and the cross dike embankment is unknown but presumed to be similar to that described below for the original perimeter dam along Ash Pond B. The basins are not lined. The top of Ash Pond A dam elevation from original design plans is 41.5 feet; the original design top of dam elevation for Ash Pond B was 34.5 feet. The original design geometry of the perimeter dam consists of 2 horizontal (H) to 1 vertical (V) inside slopes (upstream slope of cross dike) 3 H to 1 V outside slopes (downstream slope of cross dike), and 12-foot crest width (minimum). From test borings made by Rizzo as part of design studies to raise the Ash Pond B dam, the materials used in the construction of the original perimeter dam embankment along Ash Pond B were revealed to consist of predominantly clayey-silty fine sand and silty fine sand. The perimeter embankment along Ash Pond B was expanded in 1997. The top of dam was raised approximately 6.8 feet to match the top of dam elevation of Ash Pond A (see Appendix A – Doc 1.4). The design geometry of the dam raise consisted of 2 H to 1 V side slopes both inside and outside and crest width of 12 feet. Borrow soil composed of clayey sands was obtained from a property near Winyah GS for use in construction of the embankment raise. No internal drainage blankets or toe drains for seepage control were included in the original design of the perimeter dams or in the design of the dam raise for Ash Pond B. The length of the embankment raised was 5,200 feet. The raised embankment outside toe encroached slightly into the adjacent Cooling Pond. In these areas the design called for the foundation of the embankment toe to be constructed of riprap to above the water level and placement of a filter on top of the riprap before constructing the soil embankment on top of it. The total length of the perimeter dam is approximately 12,875 feet. The total length of the cross dike is approximately 2,222 feet.

South Ash Pond Dam - The soil used in the construction of the dam embankment is unknown but probably locally obtained. The basin is not lined. Original design called for gravel surfacing on part of the crest, from the access road on the north side around to a turn-around located just past the location of decant tower at the east end. The total length of the dam is approximately 8,663 feet. The design geometry of the dam consists of 3 H to 1 V inside and outside slopes for approximately 6,600 feet, 4 H to 1 V inside and outside slopes for approximately 1,750 feet along the west and southwest portions of the embankment, and crest width of 15 feet. A toe drain is used for seepage control. Seepage water collected in the drain discharges through 4-inch diameter solid-wall PVC pipes extending from the internal drain to daylight at the toe; the design spacing of these seepage drainage pipes is 200 feet. A representative section of the embankment dam is shown in Exhibit 1. The toe drain details are shown in Exhibit 2. The design drawings (Appendix A – Doc 1.5) show that a 30-inch diameter CMP through a southwest section of the perimeter dike was used for drainage from the basin area during construction. This CMP was plugged with concrete at the upstream (inside) and downstream (outside) toes of the dam and left in-place at completion of construction in 1980. (A detail of the plugging system is shown on a furnished drawing no. 3-CV-555, dated 5-1-79. See Appendix D – Doc D.1) As subsequently discussed, emergency repairs had to be made at the Unit 3 & 4 Slurry Pond dam when a leak through the dam developed at a similarly plugged CMP. Preventative repairs were made at the plugged CMP through the South Ash Pond dam to preclude a similar leak from developing through this dam. This remedial work was done in 2008 at the same time as the work to secure the leaking construction drain at the Unit 3 & 4 Slurry Pond dam was completed.

Unit 3 & 4 Slurry Pond and West Ash Pond Dams - The material used in the construction of the dam embankments is unknown but probably locally obtained. The basins are not lined. The total length of the perimeter dam is approximately 11,357 feet. The total length of the cross dike is approximately 1,530 feet. The design geometry of the cross dike consists of 3 H to 1 V side slopes and 15-foot crest width. A finger dike that partially divides the Unit 3 & 4 Slurry Pond has like design geometry. The perimeter dam consists of 2 H to 1 V inside and outside slopes along 3 sides, and 3 H to 1 V inside and outside slopes along the west sides of the basins, and crest width of 15 feet. No internal drainage blankets or formal toe drains for seepage control were used. A representative section of the embankment dam is shown in Exhibit 3. The embankment dam on the northwest side of the Unit 3 & 4 Slurry Pond required emergency repair when leakage developed at an abandoned CMP construction drain through the perimeter dam; apparently the pipe plugging system had failed, allowing leakage from the basin. The remedial work is described in Subsection 4.1.3. The area enclosed by a cofferdam during repairs was backfilled and the outside slope restored to original design. At the time remedial work at the abandoned CMP through the Unit 3 & 4 Slurry Pond was completed in 2008, preventative repairs were made at an abandoned CMP construction drain pipe through the perimeter dam at the southwest corner of the West Ash Pond. The repairs were made to preclude a similar leak from developing through this dam.

Unit 2 Slurry Pond Dam - The material used in the construction of the dam embankment is unknown but probably locally obtained. The basin is not lined. Total length of the perimeter dam is approximately 4,867 feet. The original finger dike was extended to complete a cross dike within the basin, dividing the basin into east and west cells, although gravity drainage of storm water runoff from the east cell to the west cell is provided with a corrugated HDPE pipe under the closure section of the cross dike. Total length of the cross dike is approximately 1,624 feet. The design geometry of the dam embankments consists of 2 H to 1 V side slopes and typical 10-foot crest width, except along the south side, which is 25.33 feet. No internal drainage blankets or formal toe drains for seepage control were used. A representative section of the embankment dam is shown in Exhibit 4.

2.4.2 Outlet Structures

Ash Pond A – Two abandoned outlet structures are located near the southwest corner of the basin. One of these outlet structures discharged in a westerly direction through the perimeter dike to outfall into the Discharge Canal; it has been bladder plugged. The other outlet structure discharged in a southerly direction through the cross dike and into Ash Pond B; this outlet structure was not plugged but abandoned in-place. Both of the abandoned outlet works consisted of intake risers with bottom discharge through conduits that passed through the dikes. The furnished design drawings indicate that the discharge conduits were to be concrete o-ring pipes with 24-inch diameter through the perimeter dike and 18-inch diameter through the cross dike. However, a badly corroded 24-inch diameter CMP was observed at the outfall of the conduit through the perimeter dike. The outfall for the abandoned conduit through the cross dike is buried in ash and could not be observed. Both risers are accessed with a steel catwalk but are currently buried in ash.

The current outlet structure discharges into Ash Pond B through the cross dike near the northeast end of the cross dike. Furnished design drawings do not show information on this outlet structure; the structure was not seen in the field. There is no other outlet from Ash Pond A. The original design drawings show that an emergency overflow was to be constructed on the crest of the perimeter dike on the west side of the basin; the overflow section was to have 10-foot bottom width at elevation 39.25 feet (2.25 feet lower than dike crest elevation) with gradual side slopes of 10 H to 1 V. However, this overflow section (low spot) in the crest was not apparent during the site visit.

Ash Pond B - The outlet works consist of a rectangular reinforced concrete decant tower (intake structure) with bottom discharge into a RCP that extends through the bottom of the perimeter dike to the Discharge Canal. The decant tower is located near the south end on the west side of the basin, and the outlet pipe extends through the embankment dam in a westerly direction. As previously noted, the type and size of the conduit are not readable on the furnished drawing, but in the field the shallow-submerged outlet end of the conduit appeared to be reinforced concrete pipe (RCP) on the order of 24 inches in diameter. The top of the decant tower is accessed from the top of the dam with a steel catwalk (footbridge).

South Ash Pond - The outlet works are located at the east end of the basin and consist of a rectangular reinforced concrete decant tower with bottom discharge into a 36-inch diameter RCP conduit that extends easterly through the bottom of the perimeter dike; the discharge ultimately outfalls into the Discharge Canal, as shown in Section 1 on furnished drawing no. 3-CV-555 in Appendix D – Doc D.1. The outfall could not be seen from site visit vantage points in the field. The top of the decant tower is accessed from the top of the dam with a steel catwalk (footbridge).

West Ash Pond – The outlet works are located at the southeast corner of the basin. The original outlet structure at this location is shown in Section 2 on furnished drawing no. 3-CV-555 in Appendix D – Doc D.1. From this section and furnished plans it appears that originally there was gravity flow from the West Ash Pond to the South Ash Pond through an intake tower with bottom discharge into a 36-inch diameter RCP conduit that extended through the West Ash Pond perimeter dike, through the intervening space between the West Ash Pond and the South Ash Pond, and through the South Ash Pond perimeter dike to the interior of South Ash Pond. However, it appears that gravity flow was no longer possible when ash buildup in the South Ash Pond covered the outfall from the West Ash Pond.

Currently, water is pumped from the West Ash Pond to the South Ash Pond through a flexible conduit that is supported on a bridge over a drainage ditch to the South Ash Pond. The old drainage tower is used as a pump structure or well from which to pump the water. The bottom discharge conduit apparently was sealed. The top of the drainage tower is accessed from the top of the dam with a steel catwalk (footbridge).

Unit 3 & 4 Slurry Pond – There is no gravity flow outlet structure at the Unit 3 & 4 Slurry Pond and apparently never has been, other than the temporary drainage pipe (30-inch CMP) that was used for drainage during construction. Water is pumped from the Unit 3 & 4 Slurry Pond to the West Ash Pond over the cross dike at the southwest corner of the basin (northwest end of cross dike). Two pumps were being used at the time of the site visit.

Unit 2 Slurry Pond - The outlet works consist of a pump structure made of a rectangular reinforced concrete box with an open side that can be fitted with sectional wooden slide gates for maintaining a pool in the basin. Currently, only one gate section is in place, but it is lifted to allow water to flow under it into the pump (sump) structure, where a pump is in place to remove storm water runoff as it drains into the structure. The storm water is discharged through a flexible HDPE line to the Intake Canal, and the basin currently is maintained free of a pool of water.

2.5 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

A regional map showing Winyah GS and the ash ponds and slurry ponds in relationship to “critical” infrastructure within a 5-mile radius was provided by Santee Cooper and included in Appendix A – Doc 1.9 in of this report. “Critical” infrastructure includes facilities such as schools and hospitals. There are 7 schools and 1 hospital located within the 5-mile radius, as shown on the map. Three of the schools are located to the east and east northeast on topography that is higher than the ponds. The remaining critical infrastructure (4 schools and 1 hospital) are all located in Georgetown near the 5-mile limit to the northeast and across the Sampit River from the generating station and thus do not lie directly down gradient from Winyah GS. In general, land use downstream from the ponds is conservation/preservation area, forested/agricultural, planned development, and some residential.

Based on USGS quadrangles, flood impacts from postulated failure of the ash pond and slurry pond dams at the Winyah GS would primarily impact the areas along the Pennyroyal Creek and possibly Turkey Creek and/or potentially areas along the Sampit River.

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS AND INCIDENTS

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

Furnished reports of quarterly inspections, conducted by Santee Cooper, for the period July 2009 through June 2010 indicated no major structural or operational problems. No significant deterioration was indicated in the documentation reviewed. No other reports on the safety of the management units were provided. The furnished design report prepared by Rizzo for the Ash Pond B dike raising does not include stability analysis of the raised embankment.

3.2 SUMMARY OF LOCAL, STATE AND FEDERAL ENVIRONMENTAL PERMITS

The Winyah GS is currently regulated under NPDES Permit No. SC-0022471 (see Appendix A – Doc 1.10). This permit became effective March 2008 and will expire on July 2011, according to the furnished documentation.

The ash ponds and slurry ponds at the Winyah GS are regulated for water quality by the South Carolina Department of Health and Environmental Control (SCDHEC) Bureau of Water/Compliance Assurance Division. Groundwater monitoring/sampling is conducted at a number of points (water-quality wells) around the ash and slurry ponds. Surface water sampling is conducted to monitor the quality of discharge.

3.3 SUMMARY OF SPILL/RELEASE INCIDENTS (IF ANY)

Ash Pond A - There have been no reported spill/release incidents at this basin.

Ash Pond B - There have been no reported spill/release incidents at this basin.

South Ash Pond - There have been no reported spill/release incidents at this basin. As stated above, an abandoned CMP construction drain pipe through the perimeter dike along the southwest side of the South Ash Pond was located and sealed along with the surrounding soil using a cement-bentonite slurry wall. This action was taken to preclude a leakage problem, as happened at a similar abandoned construction drain through the Unit 3 & 4 Slurry Pond perimeter dike.

West Ash Pond - There have been no reported spill/release incidents at this basin. As stated above, an abandoned CMP construction drain pipe through the perimeter dam at the southwest corner of the West Ash Pond was located and sealed along with the surrounding soil using a cement-bentonite slurry wall. This action was taken to preclude a leakage problem, as happened at a similar abandoned construction drain through the Unit 3 & 4 Slurry Pond perimeter dike.

Unit 3 & 4 Slurry Pond – On February 14, 2008, the Unit 3 & 4 Slurry Pond had a release of CCW water into plant property. The cause of this release was determined to be a failure of the plugging system in an abandoned 30-inch diameter CMP through the dike embankment on the northwest side of the basin; the CMP had been used for drainage from the basin during original construction, dating back to 1980 (see Appendix A – Doc 1.6 for location of the old construction drain). Remedial work was done to correct the leakage problem (see Subsection 4.1.3 for description). The embankment was restored to original design geometry at the repair location.

Unit 2 Slurry Pond - There have been no reported spill/release incidents at this basin.

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

No construction records are available. Therefore, little is known of original construction other than the year the ponds were completed.

Ash Pond A and Ash Pond B – Ash Pond A and Ash Pond B were built within a perimeter dike system and separated by a diagonal cross dike with Ash Pond A situated on the north side of the cross dike and Ash Pond B on the south side. It appears that the dikes were somewhat field-fitted using minimal design information. The ponds were completed and commissioned in 1975.

Ash Pond A is bounded on the north side by the perimeter dike adjacent to the Intake Canal, on the west side by the perimeter dike adjacent to the Discharge Canal, on the east side by the perimeter dike adjacent to the Cooling Pond, and on the south side by the cross dike. The lowest elevation on the basin’s floor is unknown. The basin was not lined. The original outlet structures, now abandoned, were as described in Subsection 2.4.2.

Ash Pond B is bounded on the north side by the cross dike, on the west side by the perimeter dike adjacent to the Discharge Canal, and on the east side by the perimeter dike adjacent to the Cooling Pond. The crest of the of the original section of perimeter dike around Ash Pond B was approximately 7.0 feet lower than the section around Ash Pond A. The lowest elevation on the basin’s floor is unknown. The basin was not lined. The original outlet structure was as described in Subsection 2.4.2 but the intake riser was approximately 7.0 feet lower.

South Ash Pond – The perimeter dike was constructed in an east-west elongated loop to form the basin. It is the only dike at the station that includes a toe drain for seepage control. It also has some of the flattest slopes (as flat as 4 H to 1 V around the west and southwest sides, suggesting that weaker foundation soils and/or lower ground may exist in that area. The basin is bounded along its perimeter by railroad spurs that supply coal to the station. The lowest elevation on the basin’s floor is unknown. The basin was not lined. The original outlet structure is the same as the current outlet structure as described in Subsection 2.4.2. The South Ash Pond was completed and commissioned in 1980.

West Ash Pond and Unit 3 & 4 Slurry Pond – The West Ash Pond and Unit 3 & 4 Slurry Pond were built within a perimeter dike system and separated by a cross dike with the West Ash Pond situated on the south side of the cross dike and the

Unit 3 & 4 Slurry Pond on the north side. The ponds were completed and commissioned in 1980.

The West Ash Pond is bounded on the northeast side by the cross dike, and on the west, southwest, and east sides by the perimeter dike; a railroad spur borders the southwest side. The lowest elevation on the basin's floor is unknown. The basin was not lined. The original outlet structure appears to have included an intake riser at the southeast corner with bottom discharge into a conduit extending to the South Ash Pond, as described in Subsection 2.4.2.

The Unit 3 & 4 Slurry Pond is bounded along the east, southeast, northeast, northwest, and west sides by the perimeter dike, and on the southwest side by the cross dike. A finger dike was constructed north of and generally parallel to the cross dike (northwesterly) from the east side, partially dividing the basin. The lowest elevation on the basin's floor is unknown. The basin was not lined. There appears to have never been a gravity flow outlet from the operational basin; water has always been pumped from the Unit 3 & 4 Slurry Pond to the West Ash Pond, as described in Subsection 2.4.2.

Unit 2 Slurry Pond – The perimeter dike was constructed in a rectangular loop, longer in the north-south direction, to form the basin. The basin is bounded on the south side by the Intake Canal. A finger dike, from the original design, begins at the midpoint of the south side perimeter dike and extends to the north. The lowest elevation on the basin's floor is unknown. The basin was not lined. There appears to have never been gravity flow of water from this basin; water has always been pumped to the Intake Canal from the gated pump structure described in Subsection 2.4.2. The Unit 2 Slurry Pond was completed and commissioned in 1977.

4.1.2 Significant Changes/Modifications in Design since Original Construction

Ash Pond A – There have been no significant changes/modifications in design since the original construction of the basin, other than that the original discharge structures have been abandoned and a single outlet structure was installed through the cross dike near the northeast end of the cross dike (near southeast corner of the basin. The emergency overflow described on original design drawings was not observed in the field.

Ash Pond B – The perimeter embankment along Ash Pond B was raised approximately 7.0 feet to meet top of dam elevation of Ash Pond A in 1997. The expansion increased the storage capacity of Ash Pond B. The top of the discharge structure (intake riser) was also raised approximately 7.0 feet (see Appendix A – Doc. 1.4). The expansion was designed by Paul C. Rizzo Associates, Inc. (PCRA), a FERC-approved Independent Consultant for dam safety assessments.

The geotechnical investigation performed in conjunction with PCRA's design indicated the embankments were well constructed.

South Ash Pond – There have been no significant changes/modifications in design since the original construction of the basin.

West Ash Pond – There have been no significant changes/modifications in design since the original construction of the basin, other than abandonment of the apparent original gravity-flow discharge structure, so that water is now pumped from the West Ash Pond to the South Ash Pond, rather than flowing by gravity.

Unit 3 & 4 Slurry Pond – There have been no significant changes/modifications in design since the original construction of the basin. During the site visit there appeared to be gypsum-encrusted riprap along the waterline on the inside slope of the perimeter dike on the northeast side of the basin. Riprap is not indicated as a design feature in the original design plans.

Unit 2 Slurry Pond – The finger dike from the original design has been extended to create a cross dike.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

Ash Pond A – There have been no significant repairs/rehabilitation made to this basin since the original construction.

Ash Pond B – There have been no significant repairs/rehabilitation made to this basin since the original construction.

South Ash Pond – The abandoned CMP construction drain pipe through the perimeter dike along the southwest side of the South Ash Pond was located and sealed along with the surrounding soil using a cement-bentonite slurry wall, to preclude a leakage problem occurring there, as happened at a similar abandoned construction drain through the Unit 3 & 4 Slurry Pond perimeter dike.

West Ash Pond – The abandoned CMP construction drain pipe through the perimeter dam at the southwest corner of the West Ash Pond was located and sealed along with the surrounding soil using a cement-bentonite slurry wall, to preclude a leakage problem occurring there, as happened at a similar abandoned construction drain through the Unit 3 & 4 Slurry Pond perimeter dike.

Unit 3 & 4 Slurry Pond – The abandoned 30-inch CMP construction drain through the northwest side of the Unit 3 & 4 perimeter dike required repair in March 2008 when leakage developed at the pipe outlet. A detail on a furnished drawing no. 3-CV-555 (dated 5-1-78) shows that concrete plugs of limited extent were to be placed at both the inlet and outlet ends of the pipe after completion of construction. The detail shows the plug at the inlet end as a block of concrete extending 2 feet above the top of the pipe, 2 feet beyond the sides of the pipe, and 1 foot below the bottom of the pipe. The concrete apparently fills the interior of the pipe a minimum of 3 feet into the pipe from the inlet end. The plug at the outlet end is shown as concrete on the interior of the pipe extending 1 foot back from outlet end. This plugging system (and possibly the CMP itself) apparently failed, allowing leakage from the basin. A cofferdam was constructed around the leak to equalize the head and reduce the flow through the pipe. A 60-foot long by 45-foot deep cement-bentonite slurry wall was constructed along the centerline of the dike to create an impermeable barrier. In addition, the downstream portion of the CMP as well as any voids in the surrounding soils was sealed using cement-bentonite fill.

Unit 2 Slurry Pond – There have been no significant repairs/rehabilitation made to this basin since original construction.

4.2 SUMMARY OF OPERATIONAL HISTORY

4.2.1 Original Operational Procedures

The furnished documents do not include the original operational procedures. The ponds are man-made basins that were designed and operated primarily for the disposal of fly ash, bottom ash, and boiler slag, or for the disposal of flue gas emission control residuals (scrubber wastes). It is presumed that all of the basins were originally operated as wet basins wherein ash and scrubber wastes were transported and disposed by sluicing with water into the basins, where the suspended particles were allowed to settle out and the water detained temporarily in the basins for neutralization and equalization prior to discharge through the gravity-flow outlet structures or, in the case of the slurry ponds, removal by pumping. Through most of the operational history, there has been beneficial reuse of the fly ash, bottom ash, and gypsum from the scrubbers whenever a market was available.

4.2.2 Significant Changes in Operational Procedures since Original Startup

No documents were provided to indicate that basic operational procedures have significantly changed since original startup, except that sluicing of CCW into the West Ash Pond and the Unit 2 Slurry Pond has essentially ceased. Also, the removal of water from the West Ash Pond is now by pumping rather than by gravity flow through an outlet structure to the South Ash Pond.

4.2.3 Current Operational Procedures

The basins are operated and monitored for water quality under a SCDHEC approved NPDES permit. Fly ash is generally dry handled and conveyed to

Southeastern Fly Ash on-site, where the excess carbon is removed for energy recovery and the remaining ash is processed for use in cement; only when the Southeastern plant is down is fly ash sluiced to Ash Pond A or the South Ash Pond, depending on the unit source of the fly ash. Bottom ash is sluiced to Ash Pond A. Flue gas emission control residuals are occasionally sluiced into the Unit 3 & 4 Slurry Pond.

Ash Pond A currently receives primarily bottom ash. The CCW slurry is pumped into excavated channels within the basin and gravity settling separates the fine from the coarser materials. Once the channels become full, the ash is excavated to dry it out for beneficial reuse; some of the bottom ash is used in the manufacture of concrete blocks. The sluice water and storm runoff flow through channels excavated in the ash to a pond area at the south end of the basin. The water flows to Ash Pond B through an outlet structure located near the northeast end of the cross dike.

Ash Pond B currently is mainly used as a clearing basin for water that drains into it from Ash Pond A. Ash waste material from production operations is not currently placed in the basin, although it was directly sluiced into this basin in the past. Water flows into the decant tower near the southwest corner of the basin. Outflow from this pond discharges into the Discharge Canal, which leads to the Cooling Pond.

The South Ash Pond is currently used mainly for pass-through flow of water that is pumped into it from the West Ash Pond and water from yard drains at the station, as well as water pumped into it from the perimeter ditch. Ash waste material from production operations is typically not placed in the basin; however, fly ash is sluiced into the basin whenever the Southeastern Fly Ash plant has an outage. Water flows into the decant tower at the east end of the basin, and the outflow ultimately discharges into the Discharge Canal, which leads to the Cooling Pond.

The West Ash Pond is currently used for pass-through flow of water pumped into it from the Unit 3 & 4 Slurry Pond. Ash waste material from production operations is no longer placed in this basin. Water flows to the southeast corner of the basin, where it is pumped to the South Ash Pond.

The Unit 3 & 4 Slurry Pond receives sluiced flue gas emission control waste only during start-up of one of the units after an outage and only until the gypsum in the waste stream meets specifications for use at the adjacent American Gypsum wallboard manufacturing plant. Ordinarily, when the gypsum meets specifications, it is dried and sent by conveyor to the gypsum wallboard plant. Sluice water, storm water, and water pumped into the basin from the perimeter ditch drains to the southwest corner of the basin, where it is pumped over the cross dike to the West Ash Pond.

The Unit 2 Slurry Pond no longer receives sluiced flue gas emission control waste. The basin will receive scrubber waste in the future only when necessary. The Unit 2 Slurry Pond is currently maintained dry. Storm water collected in the basin is pumped into the Intake Canal.

4.2.4 Other Notable Events since Original Startup

Based on furnished information and discussions with Santee Cooper personnel, there are no other notable events since original startup of the ash and slurry ponds to report at this time.

5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Frederic C. Tucker, PE and Anne Lee collected available data and documents and made field observations during a site visit on June 29-30, 2010, in company with the participants listed in Section 1.3. The design engineer of record for Ash Pond A, Ash Pond B, South Ash Pond, West Ash Pond, Unit 3 & 4 Slurry Pond, and Unit 2 Slurry Pond was not present or available to assist with answering questions about these basins.

The site visit began in the early afternoon of June 29th and continued the following day till noon on June 30th, 2010. Weather conditions during the visit were partly sunny, humid, and generally hot with temperatures around 100 ºF at their peak. Photographs were taken of conditions observed. Photographs referenced below are contained at the end of this chapter.

The overall visual assessment is that the earthen embankments that impound Ash Pond A, Ash Pond B, South Ash Pond, West Ash Pond, Unit 3 & 4 Slurry Pond, and Unit 2 Slurry Pond are in good condition. No visual signs of imminent instability or serious inadequacy of the principal structures at these basins that would require emergency remedial action were observed.

5.2 ASH POND A

5.2.1 Embankment Dam and Basin Area

Crest

Typical views of the crest around the perimeter dam embankment are shown in Photos BA-1, BA-2, BA-3 and BA-4. The crest was observed to have coarse ash surfacing in fair condition. A moist area with some ruts was observed on the crest of the perimeter embankment where vehicles turn to access the ash basin for beneficial reuse operations. Typical views of the coarse ash-surfaced crest of the cross dike is shown in Photos BA-5 and BA-6. No major depressions, sags, tension cracks or other signs of significant settlement were observed in the crest. No tension cracks which might suggest soil shear failure were observed in the crest or along the edge of the crest.

Outside Slope and Toe

The typical outside slope of the perimeter dam embankment of Ash Pond A is visible in Photos BA-7, BA-8 and BA-9. As shown, the grass on the outside slope was typically observed to be maintained in relatively good condition. There are some minor areas with sparse grass cover or bare soil (Photo BA-9). No areas of significant erosion were observed. No obvious signs of slumps, slides, bulges, tension cracks, seepage, or animal holes were observed.

Some areas along the downstream toe were observed to have wet soils with some ponding water and other toe areas were observed to be in need of vegetation maintenance, as shown in Photos BA-10, BA-11, BA-12, and BA-13.

Inside Slope and Basin Area

The inside slope of the Ash Pond A embankment dam was observed to be generally buried with ash. A typical view of the inside slope of the perimeter embankment of the basin is shown in Photo BA-14. The slopes of the cross dike were observed to be buried with ash (see Photos BA-5 and BA-6). No slumps, slides, or other signs of shear failure were observed in the visible parts of the slopes above the ash. The surface of the exposed ash fill is generally covered with tall weeds (reeds) and low-growing bushes, except for the surface of the central area where ash is actively mined for beneficial reuse; sparse vegetation to no vegetation was observed in areas trafficked with construction equipment and other vehicles. The tall reeds are an invasive wetland species called Phragmites. No significant erosion was noted.

Ash sluice lines discharge CCW into the basin at the northwest corner. A view of the sluice lines located at the northwest corner outside of Ash Pond A is shown in Photo BA-15.

Abutments and Groin Areas

Not applicable; there are no abutments or groins in the perimeter ring-dam. However, no erosion or displacements were observed where the cross dike ties in to the perimeter dam.

5.2.2 Outlet Structures

Abandoned Outlet Structures

Two abandoned intake (decant) towers were observed near the southwest corner of the basin. One decant tower has a bottom discharge outlet pipe that extends through the cross dike into Ash Pond B. The tower and outlet pipe are buried in ash and abandoned; the former access footbridge to the tower is shown in Photo BA-5.

The other decant tower has a sealed bottom discharge outlet pipe that extends through the perimeter dam to the Discharge Canal. The pipe has been bladder plugged and abandoned. The decant tower is buried in ash, as shown in Photo BA-16, which also shows the former access footbridge to the tower. The outlet pipe that extends through the cross dike is completely buried and was not observed, except at the outfall. The outfall end of the pipe was observed to be a severely corroded CMP, as shown in Photo BA-17. Depressions or “drop-outs” were observed along the alignment of the buried pipe between the toe of the dam and the Discharge Canal, as shown in Photo BA-18, suggesting that the pipe has failed. It is not known if the CMP actually extends through the dam, since design drawings indicate that the outlet pipe was to be 24-inch concrete o-ring pipe. As previously mentioned, the CMP may only be an extension between the dam toe and the Discharge Canal.

Current Outlet Structure

The current method of conveyance of water from Ash Pond A to Ash Pond B is through a drainage structure through the cross dike near the northeast end of the cross dike; this structure was not observed.

Emergency Spillway (If Present)

No emergency spillway was observed, although the design plans indicate that there was to be an emergency overflow on the perimeter dam on the west side of the basin. Note that an emergency spillway is not ordinarily provided for an ash basin that does not receive off-site drainage, such as Ash Pond A. Santee Cooper has indicated that no evidence could be found that the emergency spillway was constructed as part of original construction.

Low Level Outlet

There is no low level outlet.

5.3 ASH POND B

5.3.1 Embankment Dam and Basin Area

Crest

Typical views of the crest around the perimeter dam embankment are shown in Photos BB-1 and BB-2. As at Ash Pond A the crest was observed to have coarse ash surfacing in fair condition. No major depressions, sags, tension cracks or other signs of significant settlement were observed in the crest. No tension cracks which might suggest soil shear failure were observed in the crest or along the edge of the crest.

Outside Slope and Toe

Typical views of the outside slope of the perimeter dam embankment of Ash Pond B are shown in Photos BB-3 through BB-6. As shown, the grass on the outside slope was typically observed to be maintained in relatively good condition along the majority of the outside slope. Some areas of bare soil and sparse grass cover

were observed as shown in Photo BB-7 and BB-8. No areas of significant erosion were observed. No obvious signs of slumps, slides, bulges, tension cracks, seepage, or animal holes were observed.
Some areas along the downstream toe were observed to have wet soils with some ponding water as shown in Photos BB-6 through BB-8.

Areas along the downstream toe were observed to have ponding water and lack of vegetation maintenance, see Photo. Depressions or drop-outs were observed along the buried discharge pipe extending from the decant tower; one is shown in Photo BB-9. Much of outside toe along the Cooling was submerged Pond (see Photos BB- 4 and BB-5).

Inside Slope and Basin Area

The inside slope of the Ash Pond B embankment dam was observed to be generally buried with ash or submerged in water. Typical views of the inside slope of the perimeter dam embankment of the basin are shown in Photos BB-10 through BB-13. No slumps, slides, or other signs of shear failure were observed in the visible parts of the slopes above the ash and water levels. The surfaces of the inside slope and ash fill buildup in the northern part of the basin are generally covered with a tall growth of reeds (Phragmites). A pool of free-standing water was observed in the southern part of the basin. The water surface elevation at the time of the site visit was 34.8 feet (6.7 feet below design crest elevation). No significant erosion was noted.

Abutments and Groin Areas

Not applicable; there are no abutments or groins in the perimeter ring-dam. However, no erosion or displacements were observed where the cross dike ties in to the perimeter dam.

5.3.2 Outlet Structures

Overflow Structure

The overflow structure is a concrete drop-inlet box with an open side fitted with metal slide gate sections (panels); the top section serves as the overflow weir. The metal gate sections slide in angle-iron gate tracks and control the pond level. The original structure was raised 7 feet in 1997 when the dam was raised. Photo BB-14 provides an outside view of the overflow structure (decant tower), which is located at the southwest corner of Ash Pond B. A view of the inner chamber through the top walkway grate is shown in Photo BA-15. The structure was observed to be in overall good visual condition. At the bottom of the overflow structure water discharges through a RCP outlet to the Discharge Canal.

Outlet Conduit

As noted above, the decant tower has bottom discharge through a circular RCP that extends through the perimeter dam to the Discharge Canal. The outlet pipe is buried all along the majority of its length to its outfall end. Depressions or drop-outs were observed in the section of buried pipe between the dam toe and the Discharge Canal. A gravel layer above the RCP is exposed in a depression at the downstream toe of the embankment. A small amount of water was observed to project out from the gravel under the thatch in the depression shown in Photo BB-9, indicating a separation at a joint. As shown in Photo BB-16, the discharge from the submerged outlet end of the RCP creates a “blowing” or “boiling” effect. This may indicate air intake at separated joints along the pipe downstream of the dam toe. The outlet appeared to be flowing clear.

Emergency Spillway (If Present)

No emergency spillway was observed, although the design plans indicate that there was to be an emergency overflow on the original perimeter dam on the west side of the basin. The raising of the dike by approximately 7 feet in 1997 may have eliminated the low spot that was originally to serve as the emergency overflow; however, as previously mentioned no emergency overflow was observed on the Ash Pond A perimeter dike west side, even though original plans called for it and that dike has not been raised. An emergency spillway is not ordinarily provided for an ash basin that does not receive off-site drainage, such as Ash Pond B. Santee Cooper has indicated that no evidence could be found that the emergency spillway was constructed as part of original construction.

Low Level Outlet

There is no low level outlet.

5.4 SOUTH ASH POND

5.4.1 Embankment Dam and Basin Area

Crest

The surface of the crest was observed to be bare earth and grass, although gravel surfacing was observed along some segments. It was observed that potholes and shallow depressions in the crest of the embankment have been filled with coarse ash as shown in Photo BS-1. A minor ash wash out on the inside of the basin next to the crest of the embankment was observed where water from the toe ditch is pumped into the basin from a new pump structure located outside the west end of the basin; the washout is shown in Photo BS-2. The crest was observed to be in overall good condition. The embankment is enclosed by a perimeter ditch along the outside toe of the embankment. A railroad loop spur line encircles the basin on the outboard side of the perimeter toe ditch. Typical views of the dam crest are shown in Photos BS-3 through BS-5. No major depressions, sags, tension cracks or other signs of significant settlement were observed. No tension cracks which might suggest soil shear failure were observed in the crest or along the edge of the crest.

Outside Slope and Toe

The outside slope and toe of the South Ash Pond perimeter dam are shown in Photos BS-6 to BS-12. Areas of minor erosion, bare earth, and sparse vegetation were observed, particularly along the toe. Some areas with bare earth were caused by maintenance equipment used for toe drain outlet pipe maintenance and construction of a new pump station. A view of the newly constructed pump station located at the west end outside toe of the embankment is shown in Photo BS-13. The grass on the outside slope was observed to be maintained in generally fair condition. No areas of significant erosion were observed on the slope. No obvious signs of slumps, slides, bulges, tension cracks, seepage, or animal holes were observed on the slope.

Bare earth was observed at the location of the new pump construction. Views of the perimeter ditch along the outside toe of the embankment are shown in Photos BS-6, BS-13, BS-14, and BS-15. Tall vegetation (Phragmites) was observed along the perimeter ditch. Erosion was observed along the toe and perimeter ditch at the locations of toe drain maintenance, as shown in Photos BS-16, BS-17 and BS-18. Photo BS-17 shows the damaged end of one of the toe-drain outlet pipes, which design drawings indicate were to be on 200-foot spacing. Wet ground and minor seepage was observed at the toe drains and along the downstream toe as shown in Photo BS-15, BS-18, and BS-19.

Inside Slope and Basin Area

The inside slope of the South Ash Pond embankment dam was observed to be buried with ash in most of the basin and submerged in water where there is a pool of free-standing water at the east end. The water surface elevation at the time of the inspection was 17.1 feet (relative), which appeared to be on the order of 6.0 feet below the dam crest. A view of the inside of South Ash Pond where water is discharged into the basin from the West Ash Pond and from plant drains is shown in Photo BS-20 (near northwest corner) and where water discharges from the basin at the overflow tower is shown in Photo BS-21 (at east end). Views of the inside slope of the embankment dam or inside of the basin are shown in BS-22 through BS-26. No slumps, slides, or other signs of shear failure were observed in the visible parts of the slopes above the ash and water levels. No significant erosion was noted.

Abutments and Groin Areas

Not applicable; there are no abutments or groins in the perimeter ring-dam.

5.4.2 Outlet Structures

Overflow Structure

The overflow structure is a concrete drop-inlet box with an open side fitted with metal slide gate sections (panels); the top section serves as the overflow weir. The metal gate sections slide in angle-iron gate tracks and control the pond level. Photo BS-21 provides an outside view of the overflow structure (decant tower), which is located at the east end of the South Ash Pond. A view of the inner chamber through the top walkway grate is shown in Photo BS-27. The structure was observed to be in overall good visual condition.

Outlet Conduit

The decant tower has a bottom discharge pipe that extends through the embankment dam; the water ultimately discharges into the Discharge Canal to the east. The outside slope and intervening area to the Discharge Canal along the outlet pipe alignment is shown in Photo BS-28. The outlet conduit was not seen. However, no obvious problems, such as seepage or drop-outs, were observed along the apparent alignment of the buried pipe through the embankment dam.

Emergency Spillway (If Present)

There is no emergency spillway.

Low Level Outlet

There is no low level outlet.

5.5 WEST ASH POND

5.5.1 Embankment Dam and Basin Area

Crest

The surface of the crest is a combination of gravel, coarse ash, and bare ground. The surface of the crest was observed to be in good condition. Typical views of the embankment crest around the west, east and north sides are shown in Photos BW-1 to BW-5. Typical views of the crest of the cross dike are shown in Photos BW-6 and BW-7. No major depressions, sags, tension cracks or other signs of

settlement were observed. No tension cracks which might suggest soil shear failure were observed in the crest or along the edge of the crest.
As a precaution after failure of the seal in the abandoned CMP construction drain through the Unit 3 & 4 Slurry Pond perimeter dam, the existing CMP construction drain through the West Ash Pond perimeter dike was filled with concrete.

Outside Slope and Toe
The outside slope of the West Ash Pond perimeter dam is shown in Photos BW-8 and BW-10 through BW-13. As shown, the grass on the outside slope and berm was observed to be maintained in generally good condition. Areas along the southeast side of the embankment were observed to be unmaintained. The outside slope of the cross dike (Unit 3 & 4 Slurry Pond side) is submerged by water and scrubber waste (calcium sulfate). No areas of significant erosion were observed on the outside slopes. No obvious signs of slumps, slides, bulges, tension cracks, seepage, or animal holes were observed.

The toe of the perimeter dam on the west side is shown in Photos BW-9. Areas of wet soil were observed at the toe along the west side of the perimeter dam as shown in Photos BW-9 and BW-14. The vegetation along the downstream toe in some areas was observed to have been avoided by mowers due to wet-soil conditions. No areas of significant erosion were observed. No scarps, sloughs, depressions or other indications of slope instability were observed.

Inside Slope and Basin Area

The inside slope of the West Ash Pond perimeter dam was observed to be submerged with ash and with water in drainage ditches excavated in ash next to the dam. The water surface elevation at the southeast corner (pump intake location) at the time of the site visit was not provided but appeared to be on the order of 2.5 feet below the crest of the perimeter dam. Views of the pond interior and inside slope at the north end, along the southwest side, and along the southeast corner of the basin are shown in Photos BW-15 through BW-16. No slumps, slides, or other signs of shear failure were observed in the visible parts of the slopes above the water level. No significant erosion was noted.

Abutments and Groin Areas

Not applicable; there are no abutments or groins in the perimeter ring-dam. However, no erosion or displacements were observed where the cross dike ties in to the perimeter dam.

5.5.2 Outlet Structures

Overflow Structure
The existing decant structure is submerged in water and ash. The former intake tower (overflow structure) is used as a well or sump for pumping water from the West Ash Pond into the South Ash Pond via discharge lines over a bridge; several views of the pumping equipment and the intake and discharge lines are shown in Photos BW-4, BW-18, and BW-19.

Outlet Conduit

There is no active gravity flow outlet structure; water is pumped from the basin as described above.

Emergency Spillway (If Present)

There is no emergency spillway.

Low Level Outlet

There is no low level outlet.

5.6 UNIT 3 & 4 SLURRY POND

5.6.1 Embankment Dam and Basin Area

Crest

The surface of the crest is a combination of fine gravel/sand, coarse ash, and bare ground. The surface of the crest was observed to be in good condition. Typical views of the perimeter dam crest are shown in Photos B3-1 through B3-3 (also see BW-7). Typical views of the crest of the cross dike are as shown in previously referenced Photos BW-7 and BW-8. No major depressions, sags, tension cracks or other signs of settlement were observed. No tension cracks which might suggest soil shear failure were observed in the crest or along the edge of the crest.

Outside Slope and Toe

During remedial work to stop leakage at an abandoned CMP construction drain in 2008, a cofferdam was constructed and a portion of the dike (outside slope) along the northwest side was excavated. The dike was rebuilt to original design geometry where excavations had been made. Views of the vicinity are shown in Photos B3-4 through B3-7. A pump station in the vicinity is shown in Photo B3-4. The pump station was constructed at the northwest corner of the perimeter dam in 2004 in the vicinity of the original drainage ditch as part of an overall improvement in stormwater management at the generating station. Views of the perimeter dam outside slope and crest along the reconstructed portion of the embankment are shown in Photos B3-5 and B3-7. The repaired area appeared to be in good condition.

Typical views of the outside slope of the perimeter dam of Unit 3 & 4 Slurry Pond are shown in Photos B3-8, B3-9, B3-10, and B3-11. As shown, the grass on the outside slope was observed to be maintained in generally good condition; areas of the slope along the northeast side were observed to be in need of mowing. The outside slope of the cross dike (West Ash Pond side) is generally buried with ash. No areas of significant erosion were observed. No obvious signs of slumps, slides, bulges, tension cracks, seepage, or animal holes were observed.
The toe of the perimeter dam on the southeast side is visible in Photo B3-8 adjacent to a toe ditch, and on the northeast side it is shown in Photos B3-12 and B3-13. The toe ditch on the northeast side was observed to be heavily overgrown with vegetation (Photo B3-13). No areas of significant erosion were observed. No scarps, sloughs, depressions or other indications of slope instability were observed.

Inside Slope and Basin Area

The lower part of the inside slope of the Unit 3 & 4 Slurry Pond embankment dam was observed to be submerged in water. The water surface elevation at the time of the inspection was 34.9 feet (2.4 feet below design centerline crest elevation). Views of the pond interior and inside slope are shown in Photos B3-6 and B3-15 through B3-17. No slumps, slides, or other signs of shear failure were observed in the visible parts of the slopes above the water level. No significant erosion was noted.

Abutments and Groin Areas

Not applicable; there are no abutments or groins in the perimeter ring-dam. However, no erosion or displacements were observed where the cross dike ties in to the perimeter dam.

5.6.2 Outlet Structures

Overflow Structure

There is no gravity overflow structure indicated on design plans and no overflow structure was observed. Water is pumped from the Unit 3 & 4 Slurry Pond to the West Ash Pond as shown in previously referenced see Photos BW-6 and BW-15. Two portable pumps were being used at the time of the site visit.

Outlet Conduit

There is no outlet conduit. As previously mentioned, remedial work to stop leakage at an abandoned CMP construction drain was done in 2008 (see Subsection 4.1.3).

Emergency Spillway (If Present)

There is no emergency spillway.

Low Level Outlet

There is no low level outlet.

5.7 UNIT 2 SLURRY POND

5.7.1 Embankment Dam and Basin Area

Crest

The surface of the crest was observed to be in generally good condition, consisting variously of fine gravel/sand, coarse ash, grass, and bare ground. Views of the perimeter dam crest are shown in Photos B2-1 through B2-6. Sparse grass cover was observed on some areas of the crest of the perimeter dam on the east side (see Photo B2-5). Typical views of the crest of the cross dike are shown in Photos B2-7 and B2-8. The cross dike originally was a finger dike extending from the south side partially across the middle of the basin. It appeared that the finger dike had recently been completed across the basin to the north side. A corrugated HDPE pipe had been installed through this dike extension to allow storm water to drain from the east cell of the basin to the west cell; views of this pipe at the inlet and outlet ends are shown in Photos B2-23 and B2-24. No major depressions, sags, tension cracks or other signs of settlement were observed in the crest. No tension cracks which might suggest soil shear failure were observed in the crest or along the edge of the crest.

Outside Slope and Toe

Views of the outside slope of the perimeter dam of the Unit 2 Slurry Pond are shown in Photos B2-9 through Photo B2-13; the outside toe along embankment dam is also visible. As shown, the grass along the east side of the embankment on the outside slope was observed to be maintained in generally good condition. A minor area of surface disturbance in the turf on the east side is shown in Photo B2-14. No areas of significant erosion were observed. No obvious signs of slumps, slides, bulges, tension cracks, seepage, or animal holes were observed.

Areas along the outside toe appeared to be overdue for cutting of woody vegetation, particularly on the north and south sides. No areas of significant erosion were observed along the outside toe. No scarps, sloughs, depressions or other indications of slope instability were observed.

Inside Slope and Basin Area

Portions of the inside slope and basin area are buried in scrubber waste (calcium sulfate). The basin was essentially pumped dry of water at the time of the site visit and the water surface elevation was minimal. The surface of the waste fill and the inside slope was observed to be generally covered with tall weeds, reeds, and low-growing bushes. Views of the inside slope of the perimeter dam and the interior basin area are shown in Photos B2-15 through B2-20. No slumps, slides, or other signs of shear failure were observed in the visible parts of the slopes above the waste surface. No significant erosion was noted.

Abutments and Groin Areas

Not applicable; there are no abutments or groins in the perimeter ring-dam. However, no erosion or displacements were observed where the cross dike ties in to the perimeter dam.

5.7.2 Outlet Structures

Overflow Structure

The outlet structure is a concrete chamber (pump structure) with an open side that can be fitted with wooden slide gates (panels) for impounding a pool; a view of the structure is shown in Photo B2-21. The wooden panels slide in gate tracks and control the pond level. At the time of the site visit only one gate panel was in place, and it was partially raised to allow water to flow under it into the pump structure. The Unit 2 Slurry Pond is not currently active. A pump has been placed at the bottom of the structure as shown in Photo B2-22; it pumps storm water to the Intake Canal.

Outlet Conduit

There is no outlet conduit. A pump (Photo B2-22) discharges storm water into the Intake Canal via an HDPE pipe through the top of the perimeter dike on the south side is shown in Photo B2-25.

Emergency Spillway (If Present)

There is no emergency spillway.

Low Level Outlet

There is no low level outlet.

FINAL

Photo BA-1: Crest of Perimeter Dike West Side of Pond A near Northwest Corner – Viewed South

Photo BA-2: Crest of Perimeter Dike at Ash Removal Equipment Access on Ash Pond A – Viewed South.

FINAL

Photo BA-3: Crest of Perimeter Dike East Side of Pond A Near Cross Dike Intersection – Viewed North.

Photo BA-4: Crest of Perimeter Dike North Side of Ash Pond A near Northwest Corner – Viewed East.

[redacted]

Photo BA-5: Crest of Cross Dike and Walkway to Abandoned Decant Tower and Drainline from Ash Pond A to Ash Pond B – Viewed Northeast.

Photo BA-6: Crest of Cross Dike Between Ash Pond B and Ash Pond A – Viewed Southwest.

Photo BA-7: Outside Slope of Perimeter Dike at Northwest Corner of Ash Pond A – Viewed South.

Photo BA-8: Outside Slope of Perimeter Dike West Side of Ash Pond A near a Ash Removal Equipment Access on Ash Pond A – Viewed South.


[redacted]
[redacted]

Photo BA-9: Outside Slope of Perimeter Dike at Cross Dike Intersection.

Photo BA-10: Outside Toe of Perimeter Dike at Cross Dike Intersection.

[redacted]

Photo BA-11: Outside Slope of Perimeter Dike North Side of Ash Pond A at Northeast Corner – Viewed West.

Photo BA-12: Toe of Perimeter Dike North Side of Ash Pond A.

Photo BA-13: Outside Slope of Perimeter Dike East Side of Ash Pond A Near Cross Dike Intersection – Viewed North (Cooling Pond to Right).

Photo BA-14: Tall Vegetation on Inside of Perimeter Dike North Side of Ash Pond A – Viewed South (Typical View Where Ash Is Not Being Placed or Mined.

Photo BA-15: Ash Sluice Lines Outside Ash Pond A at Northwest Corner

Photo BA-16: Location of Abandoned Decant Tower and CMP Outfall in Ash Pond A that Extends Through West Dike (See Associated Photos BA-13, - 14, and -15).

Photo BA-17: Failed CMP Outfall of Abandoned Decant Tower Drain Through West Dike of Ash Pond A – Viewed at Discharge Canal.

Photo BA-18: Depression in Ground Along Centerline of Failed CMP Outfall of Abandoned Decant Tower Drain Through West Dike of Ash Pond A.

Photo BB-1: Crest of Perimeter Dike at Cross Dike Intersection – Viewed South.

Photo BB-2: Crest of Perimeter Dike South Side of Pond B near South Corner – Viewed Northeast (Cooling Pond to the Right).

Photo BB-3: Outside Slope of Perimeter Dike West Side of Ash Pond B at Cross Dike Intersection – Viewed South.

FINAL

Photo BB-4: Outside Slope of Perimeter Dike South Side of Ash Pond B near South Corner – View Northeast (Cooling Pond to Right).

Photo BB-5: Outside Slope of Perimeter Dike near Southeast Corner - Viewed Northeast (Cooling Pond to Right).

Photo BB-6: Outside Slope and Toe of Perimeter Dike West Side of Ash Pond B near South Corner –Viewed North (Note Wet Area At Toe).

Photo BB-7: Closer View of North Part of Wet Area Shown in Previous Photo.

Photo BB-8: Outside Toe of Perimeter Dike West Side of Ash Pond B Decant Tower North of Buried Outfall Drain Pipe – View North.

Photo BB-9: Depression and Exposed Gravel (Under Grass) Upstream of Ash Pond B Drain Outfall. (Apparent Separation at Last Joint in RCP).

Photo BB-10: Inside Slope of Perimeter Dike East Side of Ash Pond B Near Southeast Bend – Viewed Northeast. (Cooling Pond to Right)

Photo BB-12: Inside Slope of Perimeter Dike South Side of Ash Pond B at South Corner – Viewed Northeast.

Photo BB-13: Inside Slope of Perimeter Dike West Side of Ash Pond B South of Cross Dike Intersection – Viewed South.

Photo BB-14: View of North and East Side of Ash Pond B Decant Tower.

Photo BB-15: View Through Top Grate of Ash Pond B Decant Tower.

Photo BB-16: View Downstream Along RCP Outfall Pipe of Ash Pond B Decant Tower. (Note “blow” of discharge from partially submerged outlet due to entrapped air.).

Photo BS-1: Crest and Outside Slope of Perimeter Dike at Southwest Bend of South Ash Pond – Viewed West.

Photo BS-2: Ash Washout Adjacent to Crest of Perimeter Dike of South Ash Pond at Western End.

[redacted]

Photo BS-3: Crest of Perimeter Dike North Side of South Ash Pond Perimeter Dike at Access Road – Viewed West.


[redacted]

Photo BS-4: Crest of Perimeter Dike North Side of South Ash Pond – Viewed East.


[redacted]

Photo BS-5: Crest of Perimeter Dike on East Side of South Ash Pond Near Decant Tower – Viewed North.

FINAL

Photo BS-6: Outside Slope and Toe of Perimeter Dike at Southwest Bend of South Ash – Viewed East.

Photo BS-7: Crest and Outside Slope of Perimeter Dike on West Side of South Ash Pond.

Photo BS-8: Area of Sparse Vegetation Outside Toe of Perimeter Dike South Side of Ash Pond Near Southeast Corner.

[redacted] [redacted] [redacted] [redacted] [redacted]

Photo BS-9: Outside Slope of Perimeter Dike East Side of South Ash Pond Near Decant Tower – Viewed North.

[redacted]

Photo BS-10: Outside Slope of Perimeter Dike North Side of South Ash Pond – Viewed East.

Photo BS-11: Outside Slope of Perimeter Dike South Side of South Ash Pond – Viewed East.

Photo BS-12: Outside Slope and Crest of Perimeter Dike on South Side of South Ash Pond – Viewed West from Southeast Corner.

Photo BS-13: New Pump Station at Outside Perimeter Toe Ditch Northeast Side of South Ash Pond (For Pumping \Water from Toe Ditch Through Buried Line Into South Ash Pond).

Photo BS-14: Ditch Along Outside Toe of Perimeter Dike North Side of South Ash Pond – Viewed East.

Photo BS-15: Small Seeps at Outside Toe Ditch North Side of South Ash Pond.

Photo BS-16: Outside Slope of Perimeter Dike and Toe Ditch South Side of South Ash Pond B – Viewed East.

Photo BS-17: Damaged End of Toe Drain PVC Pipe Outlet at Toe Ditch Exposed by Erosion – Viewed East.

Photo BS-18: Wet Ground and Seepage Along Outside Toe Ditch South Side of South Ash Pond.

Photo BS-19: Wet Ground and Seepage from Toe Drain PVC Pipe Outlet at Outside Toe of South Ash Pond Perimeter Dike at Southwest Bend End.

Photo BS-20: Photo BS-16: Inside South Ash Pond Where Water Pumped From West Ash Pond is Discharged Through Flexible Liner Over The North Perimeter Dike Near West End.

Photo BS-21: Decant Tower at East End of South Ash Pond.

Photo BS-22: Inside Slope and Crest Perimeter Dike South Side of South Ash Pond– Viewed East.

Photo BS-23: Inside Slope and Crest of Perimeter Dike of South Ash Pond at Southwest Bend – Viewed East.

[redacted]

Photo BS-24: Inside Slope of Perimeter Dike Southeast Corner of South Ash Pond– Viewed Northeast.

Photo BS-26: Inside Slope of Perimeter Dike East Side of South Ash Pond
Near Decant Tower – Viewed South.

Photo BS-27: View Through Top Grate of South Ash Pond Decant Tower.

Photo BS-28: Outside Toe of Perimeter Dike East Side of South Ash Pond

Photo BW-1: Crest along Southwest Perimeter Dike of West Ash Pond –
Viewed Southeast.

Photo BW-2: Crest of Perimeter Dike Southwest Side of West Ash Pond – Viewed Southeast.

Photo BW-3: Crest of Perimeter Dike Along Southwest Corner of West Ash Pond – Viewed Northwest.

[redacted] [redacted]

Photo BW-4: Intake Line and Discharge Lines for Pumping Water from West Ash Pond to South Ash Pond. View of Pump Located on Crest Along Southeast Corner of West Ash Pond – Viewed East.

Photo BW-5: Crest of Perimeter Dike East Side of West Ash Pond– Viewed South.

[redacted] [redacted] [redacted]

Photo BW-6: Cross Dike between Unit 3 & 4 Slurry Pond and West Ash Pond– Viewed Southeast.

Photo BW-7: Cross Dike between West Ash Pond and Unit 3 & 4 Slurry Pond – Viewed Northwest.

Photo BW-8: Crest and Outside Slope of Perimeter Dike to Along West Side of West Ash Pond– Viewed South.

Photo BW-9: Outside Toe of Perimeter Dike West Side of West Ash Pond – Viewed South (Note Mower Ruts Due to Wet Soil).

Photo BW-10: Outside Slope Perimeter Dike Southwest Side of West Ash Pond – Viewed Southeast.

Photo BW-11: Outside Slope Perimeter Dike West Side of West Ash Pond – Viewed North.

Photo BW-12: Outside Slope of Perimeter Dike along East Side of West Ash Pond– Viewed South.

Photo BW-13: Outside Slope of Perimeter Dike near Southeast Corner – Viewed Southeast.

Photo BW-14: Wet Soil Area Outside Toe of Embankment Perimeter Dike West Side of West Ash Pond.

[redacted]

Photo BW-15: Inside View of West Ash Pond Where Unit 3 & 4 Slurry Pond Discharge into Pond at North End of West Perimeter Dike.

FINAL

Photo BW-16: Inside Slope of Perimeter Dike at Bend to at Southwest Side of West Ash Pond – Viewed Southeast.

Photo BW-18: View of Pump Discharge Lines on Bridge from West Ash Pond Southeast Corner to South Ash Pond – Viewed East.

[redacted] [redacted]

Photo BW-19: Existing Decant Towner in Southeast Corner of West Ash Basin (Note Suction Lines for Pumping Water from Decant Tower to South Ash Basin).

[redacted]

Photo B3-1: Crest of Perimeter Dike Southeast Side of Unit 3 & 4 Slurry Pond
- Viewed North.

Photo B3-2: Crest of Perimeter Dike Northeast Side of Unit 3 & 4 Slurry Pond
- Viewed Northwest.

Photo B3-3: Crest of Perimeter Dike West Side of Unit 3 & 4 Slurry Pond – Viewed South.

Photo B3-4: Pump Station at Outside Toe of Northwest Side of Unit 3 & 4 Slurry Pond (For Pumping Water from Toe Ditch through Buried Line into Unit 3 & 4 Slurry Pond).

Photo B3-5: Outside Slope of Perimeter Dike of Northwest Side of Unit 3 & 4 Slurry Pond at Repaired Location.

Photo B3-6: Inside Slope of Perimeter Dike at Northeast side of Unit 3 & 4 Slurry Pond – Viewed Northwest.

Photo B3-7: Crest of Perimeter Dike at Northwest side of Unit 3 & 4 Slurry Pond at Repaired Location – Viewed East.

[redacted]

Photo B3-8: Outside Slope of Perimeter Dike Southeast Side of Unit 3 & 4 Slurry Pond – Viewed North.

Photo B3-9: Outside Slope of Perimeter dike Northeast Side of Unit 3 & 4 Slurry Pond – Viewed Northwest.

Photo B3-10: Outside Slope of Perimeter Dike Northwest Side of Unit 3 & 4 Slurry Pond – Viewed East.

Photo B3-11: Outside Slope of Perimeter Dike West Side of Unit 3 & 4
Slurry Pond – Viewed North.

[redacted]

Photo B3-12: Outside Toe of Perimeter Dike Northeast Side of Unit 3 & 4
Slurry Pond – Viewed Southeast.

Photo B3-13: Outside Toe of Perimeter Dike Northeast Side of Unit 3 & 4 Slurry Pond (Note Overgrown Toe Ditch).

[redacted]

Photo B3-15: Inside Slope of Perimeter Dike Southeast Side of Unit 3 & 4 Slurry Pond - Viewed South.

Photo B3-16: Inside Slope of Perimeter Dike West Side of Unit 3 & 4 Slurry Pond – Viewed North.

Photo B3-17: Inside Slope of Perimeter Dike at Northwest Side of Unit 3 & 4 Slurry Pond – Viewed West.

[redacted]

Photo B2-1: Crest of Perimeter Dike West Side of Unit 2 Slurry Pond– Viewed North.

Photo B2-2: Crest of Perimeter Dike North Side of Unit 2 Slurry Pond East of Cross Dike– Viewed East.

Photo B2-3: Crest of Perimeter Dike North Side of Unit 2 Slurry Pond East of Cross Dike – Viewed East.

Photo B2-4: Crest of Perimeter Dike South Side of Unit 2 Slurry Pond West of Cross Dike – Viewed East.

Photo B2-5: Crest of Perimeter Dike East Side of Unit 2 Slurry Pond– Viewed South (Note Sparse Grass Cover).

Photo B2-6: Crest of Perimeter Dike North Side of Unit 2 Slurry Pond West of Cross Dike – Viewed East.

Photo B2-7: Crest of Cross Dike in Unit 2 Slurry Pond– Viewed South (Original Middle "Finger Dike" Had Been Recently Extended Northerly To The North Perimeter Dike To Divide The Pond Into Two Cells).

Photo B2-8: Crest of Cross Dike in Unit 2 Slurry Pond– Viewed North.

[redacted]

Photo B2-9: Crest and Outside Slope of Perimeter Dike West Side of Unit 2
Slurry Pond– Viewed North.

Photo B2-10: Outside Slope of Perimeter Dike North Side of Unit 2 Slurry Pond West of Cross Dike – Viewed East.

Photo B2-11: Outside Slope of Perimeter Dike East Side of Unit 2 Slurry Pond– Viewed South.

Photo B2-12: Outside Slope of Perimeter Dike East Side near Southeast Corner of Unit 2 Slurry Pond – Viewed South.

[redacted]

[redacted]

Photo B2-13: Outside Crest and Slope of Perimeter Dike South Side of Unit 2 Slurry Pond West of Cross

Photo B2-14: Outside Slope of Perimeter Dike East Side of Unit 2 Slurry Pond – Viewed South

[redacted]

Photo B2-15: Inside Slope of Perimeter Dike West Side of Unit 2 Slurry Pond– Viewed North.

FINAL

Photo B2-16: Inside Slope of Perimeter Dike North Side of Unit 2 Slurry Pond West of Cross Dike – Viewed East.

Photo B2-17: Inside Slope of Perimeter Dike East Side of Unit 2 Slurry Pond– Viewed South.

FINAL


[redacted]
[redacted]

Photo B2-18: Inside Slope and Crest of Perimeter Dike South Side of Unit 2 Slurry Pond West of Cross Dike – Viewed West.


[redacted]

Photo B2-19: Inside Slope and Crest of Perimeter Dike South Side of Unit 2 Slurry Pond East of Cross Dike– Viewed West.

Photo B2-20: Inside Slope of Perimeter Dike North Side of Unit 2 Slurry Pond East of Cross Dike – Viewed East.

[redacted]

Photo B2-21: View of East Side of Pump Structure of Unit 2 Slurry Pond. (Open Side Formally was Fitted with Wooden Slide Gates to Impound Water in the Pond; Note Normal Water Level Stain on Concrete.)

FINAL

Photo B2-22: View of Pump Placed Inside of Pump Structure of Unit 2 Slurry Pond. (Note Bottom Section of Slide Gate is Raised Slightly.)

Photo B2-23: Inlet of Corrugated HDPE Pipe Under the North (Extended) Portion of the Cross Dike in Unit

Photo B2-24: Outlet of Corrugated HDPE Pipe Under the North (Extended) Portion of the Cross Dike in Unit 2 Slurry Pond.

Photo B2-25: Plastic Pipe Conveying Stormwater Pumped Unit 2 Slurry Pond to Intake Channel Located at Outside Slope of South Perimeter Dike at Southwest Corner. (Note Large Diameter Casing Pipe within which Discharge Line – Smaller Pipe – Passes under Crest of Dike.)

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Floods of Record

Flood record information was not provided for the CCW ponds. Hearsay evidence from Santee Cooper personnel is that a 15-inch (24-hour duration) rainfall occurred in 1988, which caused water to flow through the 25-foot wide emergency spillway at the Cooling Pond (not included in this assessment); it was reported that the emergency spillway was designed to flow beginning at a flood produced by the 25-year frequency, 24-hour duration rainfall event. No issues with the ash pond and slurry ponds were reported as a result of this storm, although no details were given, such as amount of freeboard at the ponds. The ash ponds have been in service for 30 to 35 years and have experienced many severe rainstorms and a number of hurricanes during that time. Santee Cooper indicated no unusual problems at the pond embankments as a result of such storms.

6.1.2 Inflow Design Flood

No hydrologic/hydraulic analyses were provided for the ash and slurry ponds; thus, no inflow design flood was available. Santee Cooper representatives stated that drainage structures at the station are designed for the 25-year frequency, 24-hour duration rainfall event. Presumably, the outlet structures at the ash ponds are designed for at least this event.

The issue of inflow design flood often is not significant for ash and slurry ponds formed with ring (perimeter) dikes. The basins are contained and isolated by the dike embankments, so that they do not receive off-site drainage. Usually during normal operations sufficient freeboard is available to contain 100 percent of rainfall over the basin area from significant storm events, even up to the probable maximum precipitation (PMP), which is a little over 44 inches at this location (based on HMR-51, all season PMP for 24-hour duration, 10 mi^2).

As previously mentioned, the SCDHEC Dams and Reservoirs Safety Act Regulations specifically exclude state regulation of dams owned and operated by the South Carolina Public Service Authority (Santee Cooper). The state recognizes Santee Cooper's jurisdiction over its own dams; therefore safety of those dams comes under Santee Cooper's purview, and Santee Cooper has the authority to set the safety standard. Santee Cooper has set up a task force to evaluate the structural integrity and safety of its impoundments and to establish hazard potential ratings for each impoundment using nationally recognized criteria. This task force is expected to set the safety standard for impounding structures such as those at the Winyah Generating Station. If Santee Cooper's hazard potential ratings and safety standards closely follow those given in the

South Carolina dam safety regulations, the Winyah ash and slurry ponds would have spillway design floods as indicated below:

Ash Pond A – Based on Small Size Classification and Low Hazard Potential Classification, the spillway design flood (SDF) criterion is 50 to 100-year frequency.

Ash Pond B – Based on Small Size Classification and Low Hazard Potential Classification, the spillway design flood (SDF) criterion is 50 to 100-year frequency.

South Ash Pond – Based on Intermediate Size Classification and Significant Hazard Potential Classification, the spillway design flood (SDF) criterion is ½ probable maximum flood (1/2 PMF) to probable maximum flood (PMF).

West Ash Pond – Based on Intermediate Size Classification and Significant Hazard Potential Classification, the spillway design flood (SDF) criterion is ½ probable maximum flood (1/2 PMF) to probable maximum flood (PMF).

Unit 3 & 4 Slurry Pond – Based on Intermediate Size Classification and Significant Hazard Potential Classification, the spillway design flood (SDF) criterion is ½ probable maximum flood (1/2 PMF) to probable maximum flood (PMF).

Unit 2 Slurry Pond – Based on Small Size Classification and Significant Hazard Potential Classification, the spillway design flood (SDF) criterion is 100-year frequency to ½ probable maximum flood (1/2 PMF).

The above spillway design floods are preliminary and used for the purposes of this assessment only. Santee Cooper's task force may find lesser or greater spillway design floods to be more appropriate for these ash basins. This report's assessment of size and hazard potential classifications is discussed in Section 2.2 of this report.

6.1.3 Spillway Rating

No spillway rating computations or information is available for the ash and slurry ponds as they do not have practical use in the ash pond operations. Free water levels in the ponds are typically controlled by pumping and managed below the maximum design water surface elevation. Additional pumps are staged when needed to control free water levels in the ponds.

6.1.4 Downstream Flood Analysis

No downstream flood analysis has been provided for the ash and slurry ponds.

A qualitative analysis based on field observations and review of available data is as follows:

Ash Pond A Dam - Failure of the dam would discharge CCW into the Cooling Pond. The failure would not likely cause loss of life but would cause some onsite environmental damage and potential disruption of generating station operations. The influx of water and ash into the Cooling Pond would likely be relatively gradual. However, a sudden release of a large mass into the Cooling Pond, considered unlikely, could set up a wave that could travel down the Cooling Pond and impact its dam; any overspill through the emergency spillway or over the dam would go into Turkey Creek. Most of the ash (except some of the finest particles in any overspill at the Cooling Pond Dam) would likely remain in the Cooling Pond.

Ash Pond B Dam - Failure of the dam would be as described above for Ash Pond A Dam, except that a larger volume of water would be released, which would potentially activate the emergency spillway or add to the emergency spillway flow, particularly if the release occurred during a major flooding event. The failure would not likely cause loss of life but would cause some onsite environmental damage and potential disruption of generating station operations.

South Ash Pond Dam - Failure of the dam would discharge water and CCW into a perimeter ditch bounded by existing railroad tracks. If the tracks were to be overtopped, considered likely, the release could potentially damage the tracks and adjacent private property and/or enter Pennyroyal Creek. CCW that enters the creek would be carried downstream, with the finest particles likely reaching the Sampit River, which flows into Winyah Bay. The failure would not likely cause loss of life but would cause environmental damage, potential private property damage, and potential disruption of railroad operations and generating station operations.

West Ash Pond Dam - Failure of the dam would be much as described above for the South Ash Pond Dam. The release of water and CCW could potentially damage adjacent private property and/or enter Pennyroyal Creek; if failure occurs on the southwest side, the adjacent railroad tracks could potentially be overtopped with CCW. The failure would not likely cause loss of life but would cause environmental damage, potential private property damage, and potential disruption of railroad operations and generating station operations.

Unit 3 & 4 Slurry Pond Dam - Failure of the dam could potentially damage adjacent private property and/or release CCW and a large volume of water into Pennyroyal Creek with potential impact on the nearby Pennyroyal Road. The finer particles of CCW would likely reach the Sampit River. The failure would not likely cause loss of life, but would cause environmental damage and potential private and public property damage.

Unit 2 Slurry Pond Dam – Because of the generally dewatered and consolidated nature of CCW in the Unit 2 Slurry Pond, failure of the dam would not likely release much CCW outside the impoundment area by flowing of the CCW itself.

However, dam failure due to overtopping during extreme flood could release water and CCW eroded by the water into a perimeter ditch. If the perimeter ditch were to be overtopped, some of the transported CCW could potentially be deposited on adjacent property (gypsum wallboard plant) and/or enter the Intake Canal. No off-site impacts are likely. The failure would not likely cause loss of life but may cause some minor on-site environmental damage and potential minor property damage (wallboard plant).

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

An analysis of the ability of the ash ponds and slurry ponds to safely store and pass the inflow design flood was not provided. Basin elevation-storage curves, spillway rating curves, and dam break analyses are not available for the ponds. However, it does not appear to be critical documentation that is needed at this time, except for the ring-dike system containing the Unit 3 & 4 Slurry Pond and the West Ash Pond. The hydrologic/hydraulic documentation is considered non-critical for the ring-dike system containing Ash Pond A and Ash Pond B, the South Ash Pond, and the Unit 2 Slurry Pond because these basins appear to have sufficient flood storage capacity between normal operating pool levels (or interior surface elevations) and the dike crest elevations to contain at least ½ Probable Maximum Precipitation (1/2 PMP); also, the consequences of failure of the Ash Pond A and Ash Pond B perimeter dike appear to be relatively low. Therefore, the lack of supporting hydrologic/hydraulic documentation for these ponds is a minor concern until studies can be performed or formal documentation prepared that demonstrates that these ponds have suitable safety against overtopping. The ability of the ring-dike system containing the Unit 3 & 4 Slurry Pond and the West Ash Pond to store and pass (through pumping) runoff from a design storm of at least ½ PMP is not obvious, due to the relatively low available freeboard above normal operating level (2.4 feet at time of site visit), the internal drainage from the high filled-in areas of the basins to the low areas, and the fact that pumping is relied upon to remove water from the basins. Therefore, the lack of supporting hydrologic/hydraulic documentation for the Unit 3 & 4 Slurry Pond and the West Ash Pond is considered inadequate at this time. Santee Cooper should review and document hydrologic safety of the Unit 3 & 4 Slurry Pond and the West Ash Pond in the near future and perform analysis for any of the Winyah GS ponds as required by criteria and procedures that may arise from evaluations to be conducted by the internal task force.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

As noted above, the ability of the ash ponds and slurry ponds to safely store and pass the appropriate design flood has not been demonstrated through documented analysis. However, on the basis of a preliminary review of flood storage capacity and the fact that the ponds do not have contributory drainage, the ponds are believed to have the capability to fully contain 100 percent of the precipitation from the design storm over their areas without overtopping, except possibly at the ring-dike system containing the Unit 3 & 4 Slurry Pond and the West Ash Pond. The hydrologic/hydraulic safety of the Unit 3 & 4 Slurry Pond and the West Ash Pond should be verified in the near future by documented analysis. One or more of the other Winyah GS ponds may also require analysis of hydrologic/hydraulic safety, as determined from evaluations to be conducted by Santee Cooper's internal task force.

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

The designer of record for the original dams for all of the CCW ponds was Lockwood Greene (LG), Spartanburg, SC. As previously mentioned, Rizzo designed the Ash Pond B dike raise prior to its construction in 1997. No stability analyses of the embankment dams that impound Ash Pond A, Ash Pond B, and the Unit 2 Slurry Pond were provided for review. Any such analyses that may have been performed by designers prior to construction are not available. The furnished design report prepared by Rizzo does not include a stability analysis of the Ash Pond B dike raise (see Appendix A – Doc 1.4). From visual observations in the field the embankment dams impounding Ash Pond A, Ash Pond B, and the Unit 2 Slurry Pond probably have adequate stability, at least for static loading conditions.

Stability Analyses were performed as part of subsurface investigations performed by Soil & Materials Engineers Inc (S&ME) prior to construction of the Unit 3 & 4 Slurry Pond, West Ash Pond, and South Ash Pond. The stability analyses, as well as findings and recommendations, are presented in a Subsurface Investigation Report by S&ME dated June 21, 1978 (see Appendix D – Doc D.3). The report was provided by Santee Cooper following review of the draft EPA dam assessment report. The subsurface investigation explored three different areas for potential pond construction, including Area A north of the plant island, Area B west of the plant island, and Area C south of the plant island. Area B pertains to the Unit 3 & 4 Slurry Pond and West Ash Pond, and Area C pertains to the South Ash Pond; no pond was constructed in Area C. The load cases analyzed were:

1. End of Construction (basin empty)
2. Long Term Steady Seepage (basin full of liquid)

Rapid drawdown was not analyzed as it was considered not to be a condition that the ash ponds would experience. Seismic loading was also not analyzed since the ash pond dikes were considered to be insignificant structures with low impact in case of failure.

7.1.2 Design Properties and Parameters of Materials

Soil design properties and parameters for the embankment dams that impound Ash Pond A, Ash Pond B, and the Unit 2 Slurry Pond were not provided for review.

The predominant borrow soil available for construction of the embankment dams for the Unit 3 & 4 Slurry Pond and West Ash Pond (Area B) was found by S&ME to consist of clayey sand. Based on laboratory testing, design shear strength parameters for well compacted clayey sand were as follows:

C = 780 psf; Ø = 15° (Total Stress)
C´ = 536 psf; Ø´ = 34° (Effective Stress)

The predominant borrow soil available for construction of the embankment dam for the South Ash Pond (Area C) was found by S&ME to consist of silty sand. Based on laboratory testing, design shear strength parameters for well compacted silty sand were as follows:

C = 0 psf; Ø = 32.5° (Total & Effective Stress)

A variety of embankment dam heights and different foundation soil profiles were analyzed for each area. (See cross sections in the Subsurface Investigation report in Appendix D – Doc D.3 for design strength parameters used for the various foundation soil strata. It is noted that design soil unit weights are not shown in the report.)

7.1.3 Uplift and/or Phreatic Surface Assumptions

Phreatic surface assumptions for the embankment dams impounding Ash Pond A, Ash Pond B, and the Unit 2 Slurry Pond were not provided for review.

No internal drains were found to be necessary by S&ME for the clayey sand embankment dams that would impound the Unit 3 & 4 Slurry Pond and West Ash Pond (Area B). Therefore, a theoretical phreatic line extending through the embankment section and cropping out on the outside slope above the toe was assumed be S&ME in their stability analyses of the Unit 3 & 4 Slurry Pond and West Ash Pond embankment dams. However, an internal drain was found to be necessary for stability of the silty sand embankment dam that would impound the South Ash Pound (see Exhibits 1 and 4 for sections and details of the internal drain). In this embankment the design phreatic line was assumed to be drawn down to the internal drain below the outside slope and be no closer than 5 feet from the outside toe. (See cross sections in the Subsurface Investigation report in Appendix D – Doc D.3 for the design phreatic line.)

From visual observations in the field, the phreatic surface does not crop out on the outside slopes of any of the perimeter dikes, although some wet areas were observed at the toes of the Ash Pond B perimeter dike (west side), West Ash Pond perimeter dike (west side), and South Ash Pond perimeter dike (generally all-around, including small seeps). The wet areas and small seeps appeared to be associated primarily with very gradual underseepage through foundation soils, although some of the wet areas at the Ash Pond B dike toe may possibly be due to poor surface drainage. At the South Ash Pond perimeter Dike the wetness and small seeps may be associated with seepage from the toe drain; it is doubtful that the solid-wall PVC discharge pipes leading from the internal toe drain at 200-foot spacing collects and removes all the seepage intercepted by the toe drain, i.e., much of the water likely seeps directly from the drain toward the embankment toe in between the removal pipes. The wet areas and small seeps are not considered to be serious conditions that threaten the stability of the dikes, although they create some maintenance issues, since mowers cannot traverse the wet areas without creating ruts. Many of the seep areas along the toe of the South Ash Pond perimeter dike need to have a better grass cover established; alternatively, if grass is difficult to establish and maintain in the seep areas, an effective measure would be to install an inverted filter, consisting of a layer of filter fabric placed directly on the seep area overlaid with a layer of coarse gravel or small riprap (surge stone).

7.1.4 Factors of Safety and Base Stresses

No computed factors of safety from slope stability analyses of the embankment dams impounding the Ash Pond A, Ash Pond B, and the Unit 2 Slurry Pond were available for review.

In S&ME’s stability analyses of the Unit 3 & 4 Slurry Pond, West Ash Pond, and South Ash Pond, a reduced safety factor criterion of 1.25 was adopted, versus the usual safety factor of 1.5 for long term static stability. This reduction was agreed to between the designers Burns and Roe and Lockwood Greene Engineers, apparently due to the low, non-critical nature and function of the ash pond dikes.

S&ME’s stability analyses showed that typically 2 H to 1 V side slopes would have acceptable safety factors except in some locations where critical combinations of dike height and poor foundation soil conditions required the design slopes to be 3 H to 1 V or even 4 H to 1 V in one area. For the Unit 3 & 4 Slurry Pond and West Ash Pond (Area B) the most critical section occurs where a 27-foot high clayey sand embankment overlies loose silty sand/clayey sand foundation soils. Side slopes of 2 H to 1 V were found to be unacceptable. For the selected design slopes of 3 H to 1 V the computed minimum factors of safety were as follows:

Unit 3 & 4 Slurry Pond/ West Ash Pond

Pond empty FS = 1.50 (end of construction)
Pond full of liquid FS = 1.35 (steady seepage, 3’ freeboard)

For the South Ash Pond (Area C) the most critical section occurs where a 26-foot high silty sand embankment overlies a foundation soil profile consisting of silty sand on a 21-foot thick stratum of very soft clay. Side slopes of 3 H to 1 V were found to be unacceptable. For the selected design slopes of 4 H to 1 V the computed minimum factors of safety were as follows:

South Ash Pond

Pond empty FS = 1.25 (end of construction)
Pond full of liquid FS = 1.25 (steady seepage, 3' freeboard)

7.1.5 Liquefaction Potential

No liquefaction potential analyses have been performed for the embankment dams that impound the CCW ponds. Available subsurface information, discussed below in Subsection 7.1.6, suggests that the foundation soils typically consist of fine sands and silty fine sands with some clayey sands and a little clay. There also are some thick deposits of soft to very soft silty clay, particularly in the area of the South Ash Pond. Depending on their relative densities, the fine sands and possibly the silty fines sands could be susceptible to liquefaction; very soft clay may also be susceptible to large distortions during strong earthquake shaking.

7.1.6 Critical Geological Conditions and Seismicity

The reviewed documents did not include much information regarding the critical geological conditions and seismicity used in the original design of the embankment dams that impound the Ash Pond A, Ash Pond B, and the Unit 2 Slurry Pond. Minimal subsurface information was provided by six boring logs included in Rizzo's design report for the Ash Pond B dike raise (see Appendix A – Doc 1.4). The borings had been made through the original dike and extended 13 to 22 feet into the foundation soils. The foundation soils revealed by the borings consist predominantly of fine sands, fine to medium sands, and silty fine sands with some clayey sand and a little clay. Soil survey information available from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service's (NRCS) Web Soil Survey indicates similar soils are present in the areas around all the ponds. The Unified Soil Classifications (USCs) are predominantly SP, SP-SM, and SM and secondarily SC and CL. Standard penetration tests performed in the borings indicate typically loose to medium dense relative densities in the foundation soils, although one very loose zone of silty fine sand (SM) with standard penetration resistance (N) of 2 blows/foot (bpf) was encountered immediately beneath the embankment in one boring (B-5). Soils such as this could potentially be susceptible to liquefaction, and any very loose fine sands (SP) that potentially exist in the foundation would be susceptible to liquefaction.

Test borings made for S&ME's 1978 Subsurface Investigation encountered foundation soils similar to those described above but also penetrated some thick deposits of soft to very soft silty clay (N = 1 bpf), which significantly impacted slope design for the South Ash Pond embankment. All of the S&ME borings were extended to a hard stratum of shell limerock, which was encountered at elevations ranging from -8 to -12 feet, msl. Groundwater was encountered at or near the ground surface, which ranged in elevation from 5 to 24 feet, msl. In the area of the Unit 3 & 4 Slurry Pond and West Ash Pond (Area B) the foundation soil profile was found to generally consist of 4 to 6 feet of clayey sand overlying loose and firm silty sand, except in an area near Pennyroyal Creek where the upper layer of clayey sand was missing. In the area of the South Ash Pond (Area C) the foundation soil profile was found to generally consist of silty fine sand overlying soft silty clay and sand-shells.

Seismicity – The site of the CCW basins is in an area of high seismic hazard. Based on USGS Seismic-Hazard Maps for Central and Eastern United States, dated 2008, the Winyah Generating Station, including the CCW basins, is located in an area anticipated to experience 0.50g or higher peak ground acceleration with a 2-percent probability of exceedance in 50-years.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation for the Ash Pond A, Ash Pond B, and the Unit 2 Slurry Pond dams is absent. However, for the Ash Pond A/Ash Pond B perimeter dike and the Unit 2 Slurry Pond perimeter dike, it does not appear to be critical documentation that is needed at this time. Structural stability documentation is considered non-critical for these dikes based on 1) the low height and generally low consequences of failure of the perimeter dikes, and 2) the generally good condition of the basins and embankments based on visual observation. Therefore, the lack of supporting structural stability documentation for the Ash Pond A/Ash Pond B perimeter dike and the Unit 2 Slurry Pond perimeter dike is a minor concern until studies can be done.

Supporting documentation of static stability of the West Ash Pond/Unit 3 & 4 Slurry Pond perimeter dike and the South Ash Pond perimeter dike is adequate with respect to the reduced safety criterion adopted by the designers. The reduced criterion does not appear to have detrimentally affected the static stability performance of the impounding embankments. Seismic stability and liquefaction potential of these dikes are unknown. Since the consequences of failure of these dikes could be significant with respect to property damage and environmental damage, it would be advisable for Santee Cooper to perform a documented review of seismic stability and liquefaction potential of the West Ash Pond/Unit 3 & 4 Slurry Pond perimeter dike and the South Ash Pond perimeter dike.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Overall, the structural stability under static loading conditions of the embankment dams impounding the Winyah CCW ponds appears to be satisfactory based on the following observations during the June 29-30, 2010 field visit by Dewberry, available recent dam inspection reports, and the July 2009 to April 2010 dike quarterly inspection reports.

- There were no indications of scarps, sloughs, major depressions or bulging anywhere along the slopes of the dams;
- Boils, sinks or uncontrolled seepage was not observed along the slopes or toes; and
- The crest appeared free of major depressions and no significant vertical or horizontal alignment variations were observed.
- Documented static stability analyses for the Unit 3 & 4 Slurry Pond, West Ash Pond, and South ash Pond.

Seismic stability and liquefaction potential of the embankment dams are unknown.
The apparent presence of loose and very loose sandy soils in the foundation (based on available subsurface information) suggests that liquefaction could potentially occur during strong earthquake shaking, but the actual liquefaction potential and its effect on the dikes at the Winyah GS cannot be known without performing a study of liquefaction potential and analysis of displacements that could occur as a result of liquefaction of the susceptible soils. For the more critical West Ash Pond/Unit 3 & 4 Slurry Pond perimeter dike and the South Ash Pond perimeter dike it would be advisable for Santee Cooper to perform a documented engineering review of foundation soil conditions at those locations in some greater detail. If this detailed review indicates a preponderance of data showing very loose sands (or very soft clay) in or near the dike foundations, seismic stability and liquefaction analyses should be performed as part of verification and documentation of structural stability of the West Ash Pond/Unit 3 & 4 Slurry Pond perimeter dike and the South Ash Pond perimeter dike.

The principal outlet structures, which are those at Ash Pond B and the South Ash Pond, appear to be in generally sound and stable condition with no visual evidence of significant deterioration, except along the RCP at Ash Pond B; joint separations occur in the section of pipe between the dike toe and the discharge end at the Discharge Canal. Santee Cooper should review the integrity of the entire length of outlet pipe and perform appropriate remedial measures.

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATIONAL PROCEDURES

Ash Pond A – This basin is currently used for disposal and storage of CCW. Ash waste material (predominantly bottom ash) is sluiced into excavated trenches in the north part of the basin. Fly ash generally is dry-handled and trucked to Southeastern Fly Ash, where it is processed for use in cement. However, fly ash is sluiced into the ash pond whenever there is an outage at the Southeastern Fly Ash plant. Current on-going operations include mining bottom ash on the northwest portion of the basin for beneficial use (manufacture of concrete blocks). The ash is excavated and placed in windrowed stockpiles to allow the material to drain prior to loading and transport offsite. Sluice water and storm water are channeled through trenches excavated in the ash surface to direct flow to the southeast corner of the basin, where the water is discharged through the cross dike into Ash Pond B.

Ash Pond B – This basin is currently used as a clearing basin or “polishing” pond prior to discharge of water that drains into it from Ash Pond A. Ash waste material from production operations is not currently placed in the basin. The water is channeled through trenches excavated in the ash surface to a pond of free-standing water in the south approximately one-third of the basin. Water leaves the basin through the outlet structure located near the south end of the perimeter dike on the west side of the basin; the water discharges into the Discharge Canal from a RCP that penetrates the perimeter dike.

South Ash Pond – This basin is mainly used for disposal of CCW, primarily bottom ash; however, fly ash is sluiced into the South Ash Pond whenever there is an outage at the Southeastern Fly Ash plant. Water from the West Ash Pond is pumped into the South Ash Pond over the perimeter dike on the north side near the west end; water from station drains is discharged into the basin from HDPE lines through the top part of the perimeter dike at the same location, and water from the perimeter toe ditch is discharged into the basin through an HDPE line through the top part of the perimeter dike at the west end. Water sluiced or pumped into the basin and storm water are channeled through trenches excavated in the ash surface to a pond of free-standing water at the east end of the basin. Water leaves the basin through the outlet structure located at the east end of the basin; the water ultimately discharges into the Discharge Canal from a conduit that penetrates the perimeter dike.

West Ash Pond – Ash waste material from production operations is no longer placed in this basin. The basin is mainly used for pass-through of water pumped into it from the Unit 3 & 4 Slurry Pond. The water flows along an interior ditch excavated in ash along the west and southwest sides to the southeast corner of the basin, where the water is pumped from a former intake tower through flexible lines extending over to the South Ash Pond.

Unit 3 & 4 Slurry Pond – This basin receives flue gas emission control waste only when the material does not meet specifications for use in the manufacture of gypsum wallboards at the adjacent American Gypsum plant, which is usually during start-up of a generating unit after an outage. The scrubber waste is currently sluiced in with water from the southeast side of the basin on the northeast side of the finger dike. The water flows to the pond of free-standing water that occupies the north half of the basin and extends around the finger dike to the southwest corner of the basin, where water is pumped over the northeast end of the cross dike to the West Ash Pond. Water from the perimeter toe ditch is discharged into the basin through an HDPE line through the top part of the perimeter dike on the northwest side of the basin.

Unit 2 Slurry Pond – This basin no longer receives sluiced flue gas emission control waste. The basin will return to service only when/if necessary. The Unit 2 Slurry Pond is currently maintained dry. Storm water collected at the pump structure in the southwest corner of the basin is pumped through a flexible line to the Intake Canal.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

Maintenance of the impounding embankments and outlet works of the ash ponds and slurry ponds, and essential operating equipment, such as the pumps at the West Ash Pond, the Unit 3 & 4 Slurry Pond, and the Unit 2 Slurry Pond, are performed as needed, as determined by routine inspections performed by operating personnel. Vegetation on the embankment slopes and crest is generally mowed or cut twice a year or whenever it becomes necessary, when the work can be performed by maintenance personnel at the station. Slopes as steep as 2 H to 1 V are mowed on a rotation basis by an outside service that uses specialized equipment for operation on relatively steep slopes. Because of the workload, the rotation schedule is typically on the order of 18 months for the steeper slopes.

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATION

8.3.1 Adequacy of Operational Procedures

Operational procedures appear to be appropriate and adequate, as long as pumping operations at the West Ash Basin, Unit 3 & 4 Slurry Pond, and Unit 2 Slurry Pond are closely monitored and back-up pumps are available and can be quickly pulled into service, if needed.

8.3.2 Adequacy of Maintenance

No major maintenance issues were noted from review of dam inspection reports and checklists. Based on field observations, some minor maintenance of bare soil areas is needed, primarily on the South Ash Pond perimeter dike. Maintenance of the impounding embankments and outlet works of the ash ponds and the slurry ponds appears to be generally adequate.

One potentially significant maintenance issue observed during the site visit is the condition of the abandoned outlet pipe through the perimeter dike on the west side of Ash Pond A. The outlet end of the pipe at the outfall was observed to be severely corroded CMP in a failed state. Drop outs observed in areas along the CMP alignment between the outside toe of the dike and the outfall at the

Discharge Canal suggest that the pipe has either collapsed or joints have opened (or both) to allow loss of soil through the pipe. The condition should be investigated and repairs made, if needed.

Another potentially significant maintenance issue observed during the site visit is the condition of the outlet works at Ash Pond B. The buried RCP of the outlet structure of Ash Pond B has become separated at one or more joints in the section between the outside toe of the dike and the outfall at the Discharge Canal; the top of the pipe has become exposed or nearly exposed in a couple of areas where there has been soil loss around the pipe, apparently through the joints that have opened up. Air is taken in at the exposed joints and causes the discharge to "boil" or "blow" at the discharge end, which is submerged.

9.0 SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

Santee Cooper personnel inspect the ash pond embankments per dike inspection procedures in Section 4.9 of Santee Cooper's BMP plan (Appendix A – Doc 1.11). Santee Cooper has indicated that the intent of the BMP plan is to train operating personnel to conduct routine, periodic inspections of the impoundment dikes and have qualified dam safety personnel assist operating personnel with the quarterly inspections as requested. The quarterly inspections are documented on Dike Inspection Reports in checklist format. Dike Inspection Reports are included for reference in Appendix A – Doc 1.12.

Miscellaneous Inspections – Santee Cooper operating personnel and security guards are trained in making daily observations of the ash pond embankments. Engineers accompany the operating personnel during the quarterly inspections when requested.

9.2 INSTRUMENTATION MONITORING

9.2.1 Instrumentation Plan

There is no dam performance monitoring instrumentation in place in the CCW impounding embankments. Groundwater monitoring wells are in place at various locations around the basins for compliance monitoring of groundwater quality. Staff gauges are in place at the active discharge structures in Ash Pond B the South Ash Pond (as well as the Cooling Pond) and in the Unit 3 & 4 Slurry Pond to measure the water surface elevations.

9.2.2 Instrumentation Monitoring Results

There are no dam performance monitoring instruments and, thus, no results of dam monitoring. Staff gauge results for the day of the site visit are included in Appendix A – Doc 1.13.

9.2.3 Dam Performance Data Evaluation

Not applicable, since there are no dam performance data to evaluate. In-depth evaluation of groundwater quality monitoring results is beyond the scope of this structural/stability assessment.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

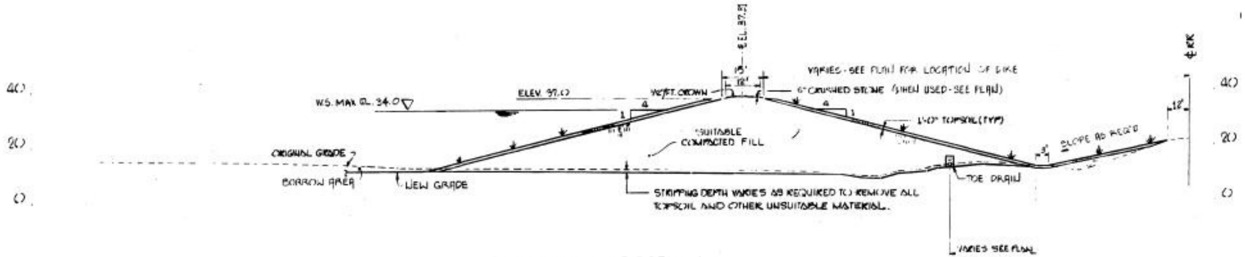
9.3.1 Adequacy of Inspection Program

The inspection program is generally adequate, based on review of Santee Cooper's written inspection procedures, but could be improved in execution. The daily and quarterly inspections apparently did not note or pick-up on the potentially significant issues at the abandoned outlet pipe at Ash Pond A and the active outlet pipe at Ash Pond B. Although the dikes are quite long, they should be walked at least once per year, with close scrutiny in critical outside toe areas, such as at penetrations (conduits) or areas of known seepage or wet areas, to check for changed conditions. These conditions cannot be viewed properly from the crest. In addition, internal inspections of the outlet structures with a remote camera should be conducted on a frequency of at least once every 5 years and be documented.

9.3.2 Adequacy of Instrumentation Monitoring Program

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

EXHIBIT 1: SOUTH ASH POND - REPRESENTATIVE SECTIONS OF EMBANKMENT



3-CV-548
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2
3-CV-551
SECTION
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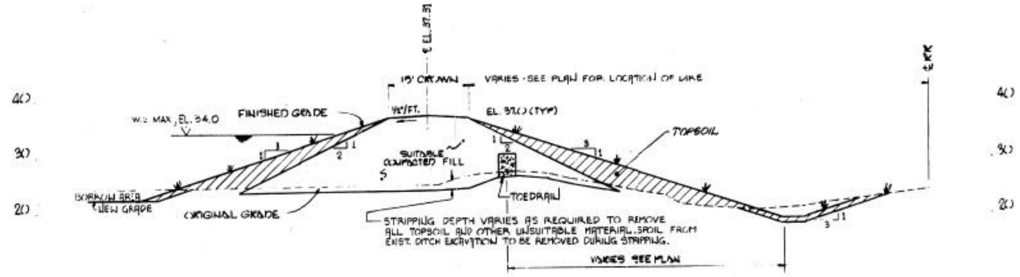

3-CV-549
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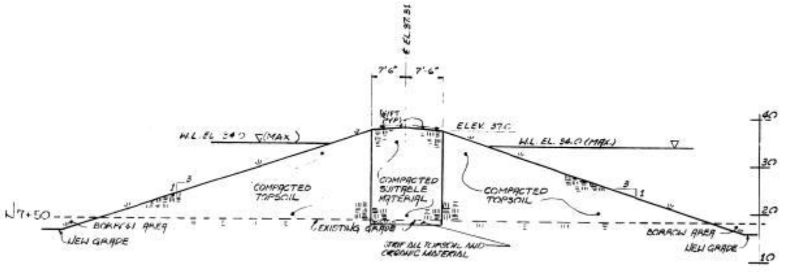
1
3-CV-551
SECTION
SCALE 1" = 10'

FINAL

EXHIBIT 2: UNIT 3 & 4 SLURRY POND AND WEST ASH POND – REPRESENTATIVE SECTIONS OF EMBANKMENT



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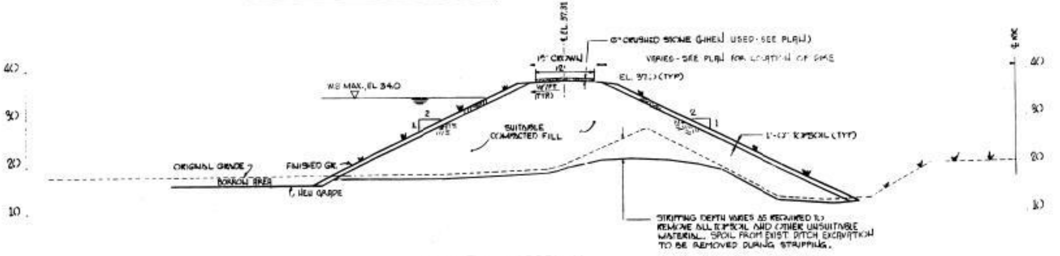
TYPICAL FINGER DIKE SECTION



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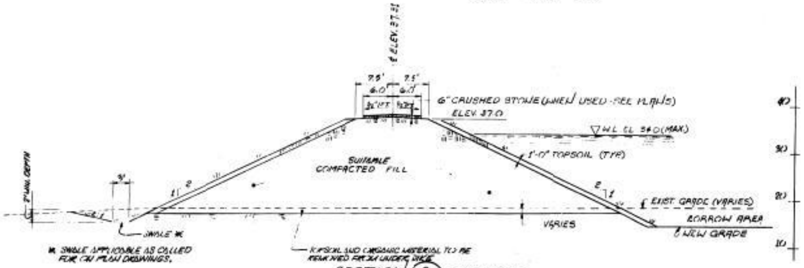

SECTION ② 3-CV-542, 543, 545
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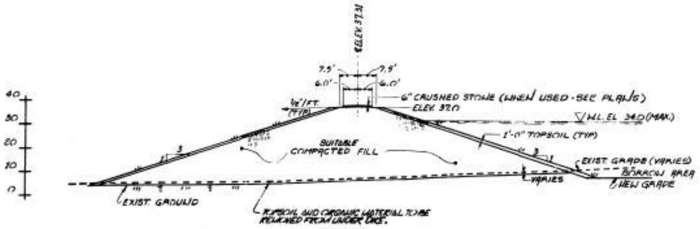
TYPICAL FOR DIKES WITH 2:1 SLOPES



SECTION ① 3-CV-542, 544
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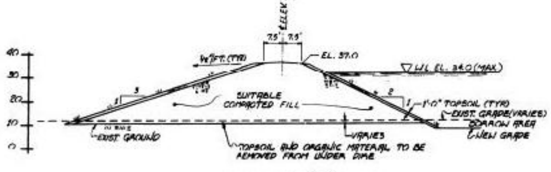
TYPICAL FOR DIKES WITH 3:1 SLOPES



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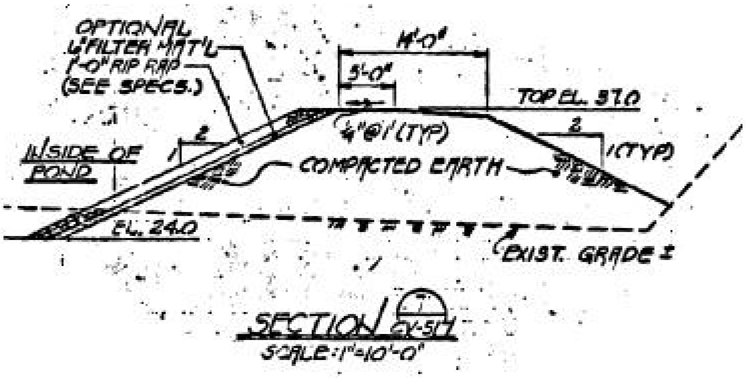
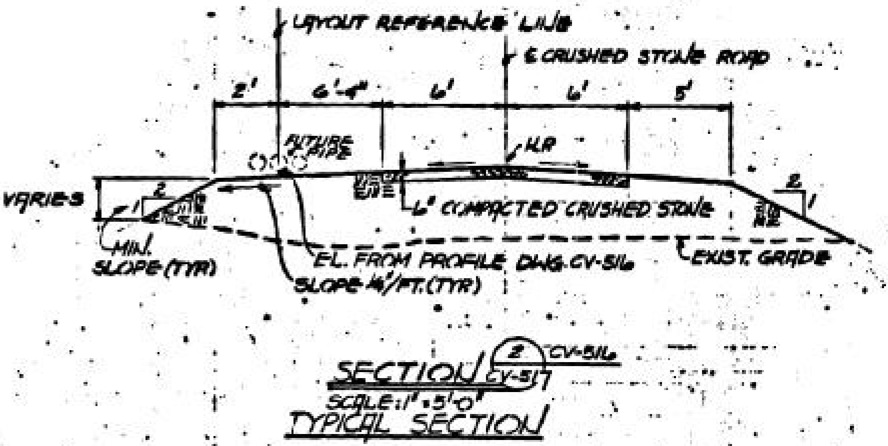
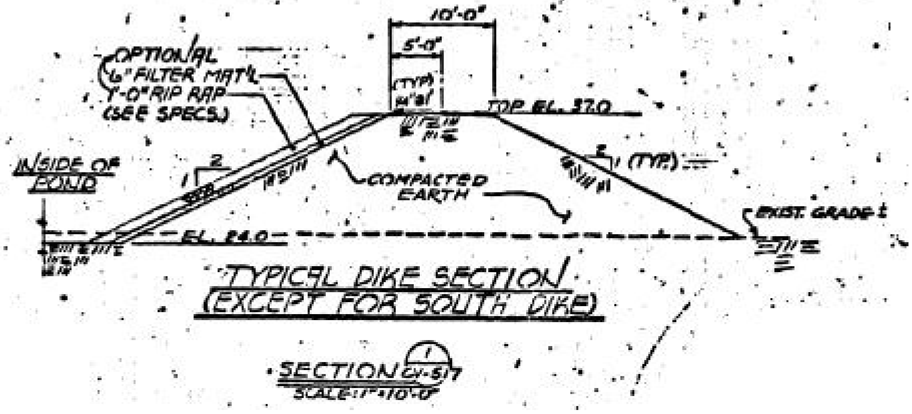
FINAL

EXHIBIT 3: UNIT 2 SLURRY POND – REPRESENTATIVE SECTIONS OF EMBANKMENT

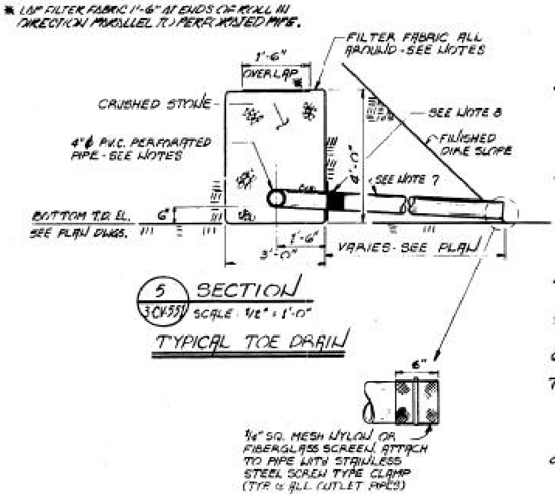






FINAL

EXHIBIT 4: SOUTH ASH POND – TOE DRAIN DETAILS



5 SECTION
3-CV-551 SCALE: 1/2" = 1'-0"

TYPICAL TOE DRAIN

TOE DRAIN NOTES

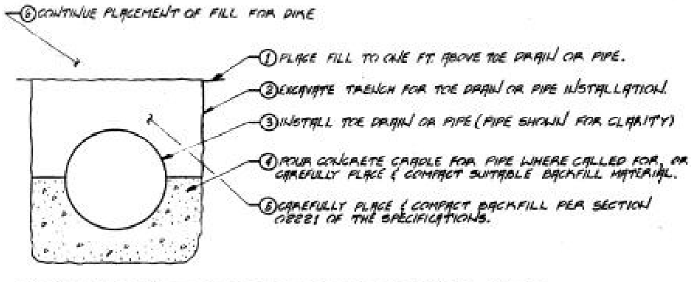
1. THE CRUSHED STONE SHALL BE GRADATION #57 ACCORDING TO SOUTH CAROLINA STATE HIGHWAY DEPT. STD. SPECIFICATIONS. CRUSHED STONE SHALL BE GRANITE.
2. FILTER FABRIC SHALL BE WOVEN OR SPUNBONDED POLYESTER OR POLYPROPYLENE FABRIC. APPROVED MANUFACTURERS:

   DUPONT "TYPAR" STYLE 3401
   ADVANCE CONST. SPECIALTIES "LAUREL EROSION CLOTH, TYPE I."
   CARTHAGE MILLS, INC. "FILTER-X"
   MONSANTO TEXTILES "BIDIM C-38"

3. PERFORATED PIPE SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS:

ASTM	TITLE
D1754	RIGID POLY (VINYL CHLORIDE) COMPOUNDS AND CHLORINATED POLY (VINYL CHLORIDE) COMPOUNDS
D 3034	TYPE PSM POLY (VINYL CHLORIDE)(PVC) SEWER PIPE AND FITTINGS

4. THE PIPE SHALL BE MADE OF PVC PLASTIC HAVING A CELL CLASSIFICATION OF 12454-B AND THE SDR SHALL NOT BE GREATER THAN 35.
5. PERFORATIONS SHALL BE IN ACCORDANCE WITH ASTM C 700 "VITRIFIED CLAY PIPE, EXTRA STRENGTH, STANDARD STRENGTH AND PERFORATED."
6. PERFORATED PIPE SHALL BE LAID WITH PERFORATIONS DOWN.
7. OUTLET PIPE, 4"ϕ NON-PERFORATED P.V.C., SPACED AT 200' ON CENTER MAXIMUM. FIELD ADJUST WHERE NECESSARY SO THAT OUTLET PIPE IS INSTALLED AT ALL LOW POINTS ON TOE DRAIN. SLOPE OUTLET PIPE @ 0.5% MIN.
   GRADE AREA AT TOE OF DIKES SO THAT NO PONDING OF WATER CAN OCCUR AND SO THAT OUTLET PIPES ARE FREE TO DRAIN.
8. CONTRACTOR SHALL WRAP ANY PIPE PENETRATION THRU FILTER FABRIC WITH 12" WIDE BY 4'-0" LONG PIECE OF FILTER FABRIC TO INSURE THAT NO AGGREGATE IS EXPOSED TO EARTH.



⑥ CONTINUE PLACEMENT OF FILL FOR DIKE

① PLACE FILL TO ONE FT. ABOVE TOE DRAIN OR PIPE.

② EXCAVATE TRENCH FOR TOE DRAIN OR PIPE INSTALLATION.

③ INSTALL TOE DRAIN OR PIPE (PIPE SHOWN FOR CLARITY)

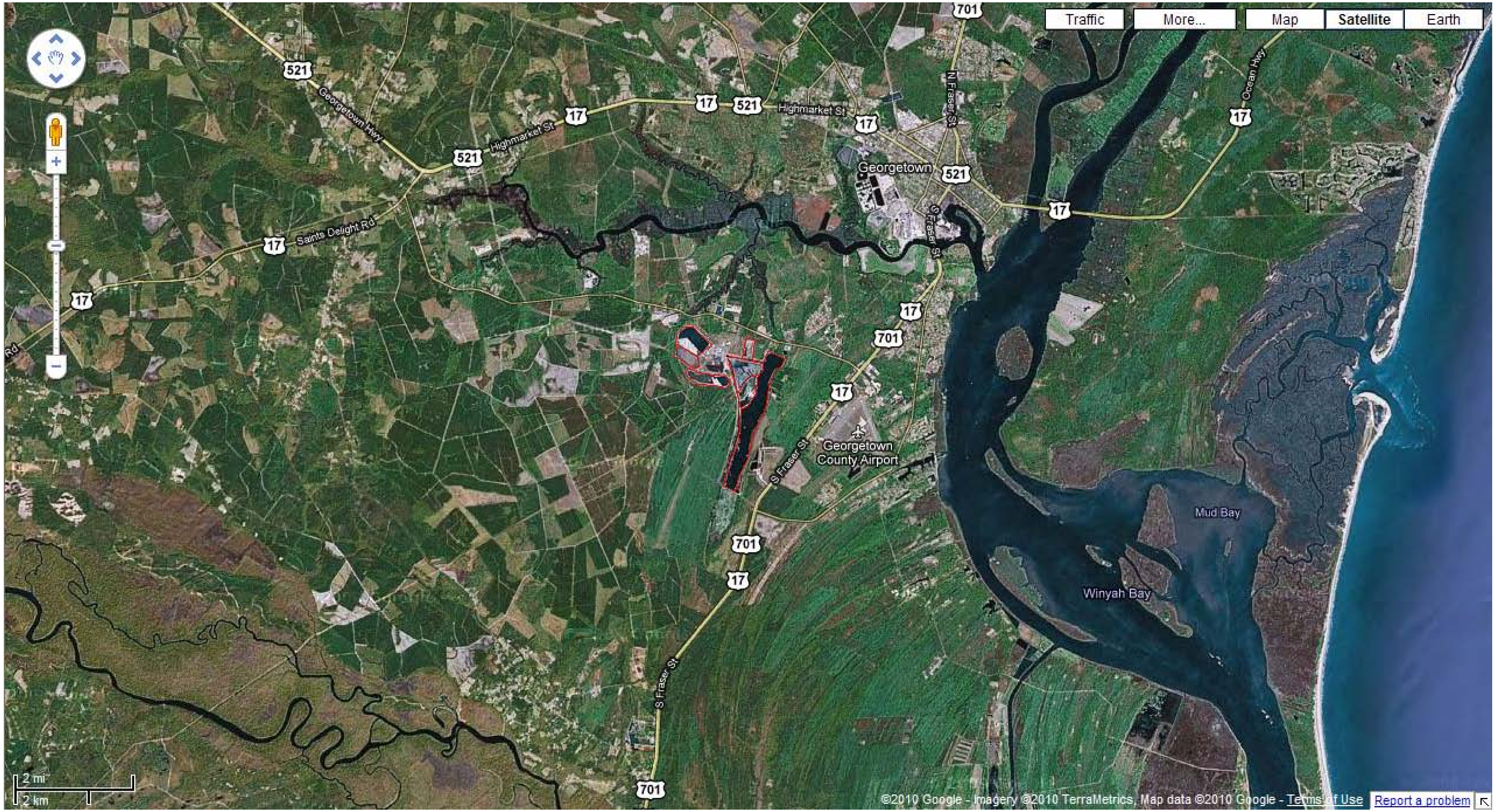
④ POUR CONCRETE CRADLE FOR PIPE WHERE CALLED FOR, OR CAREFULLY PLACE & COMPACT SUITABLE BACKFILL MATERIAL.

⑤ CAREFULLY PLACE & COMPACT BACKFILL PER SECTION 02221 OF THE SPECIFICATIONS.

INSTALLATION OF PIPES OR TOE DRAINS UNDER DIKES

6 DETAIL
3-CV-551 N.T.S.

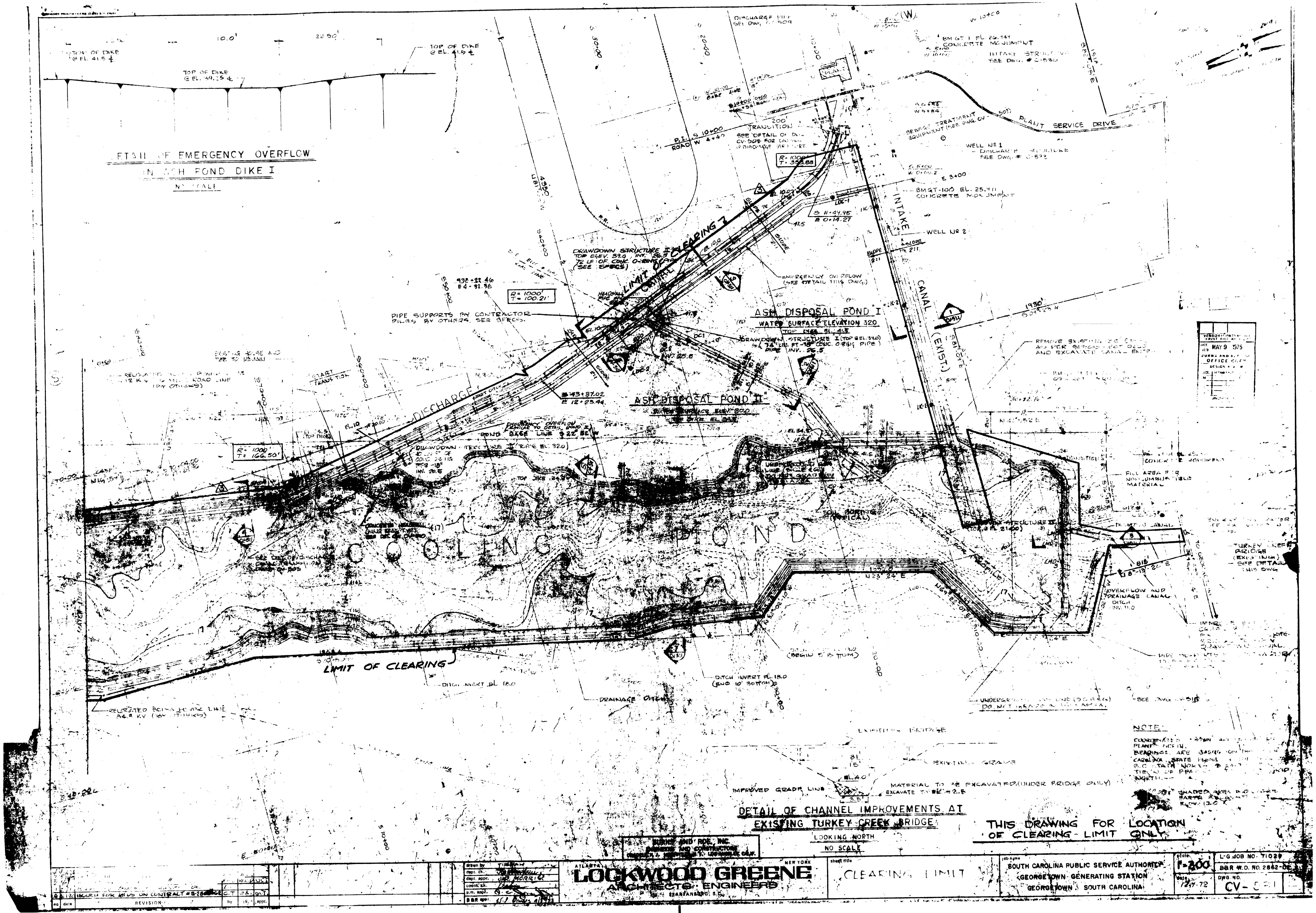
Appendix A - Doc 1.1 Winyah Generating Station Google Maps Vicinity Map


Traffic
More...
Map
Satellite
Earth
701
521
Georgetown Hwy
17
521
Highmarket St
N Fraser St
Ocean Hwy
Georgetown
Saints Delight Rd
S Fraser St
701
Georgetown County Airport
Mud Bay
Winyah Bay
S Fraser St
Rd
2 mi
2 km
©2010 Google - Imagery ©2010 TerraMetrics, Map data ©2010 Google - Terms of Use
Report a problem

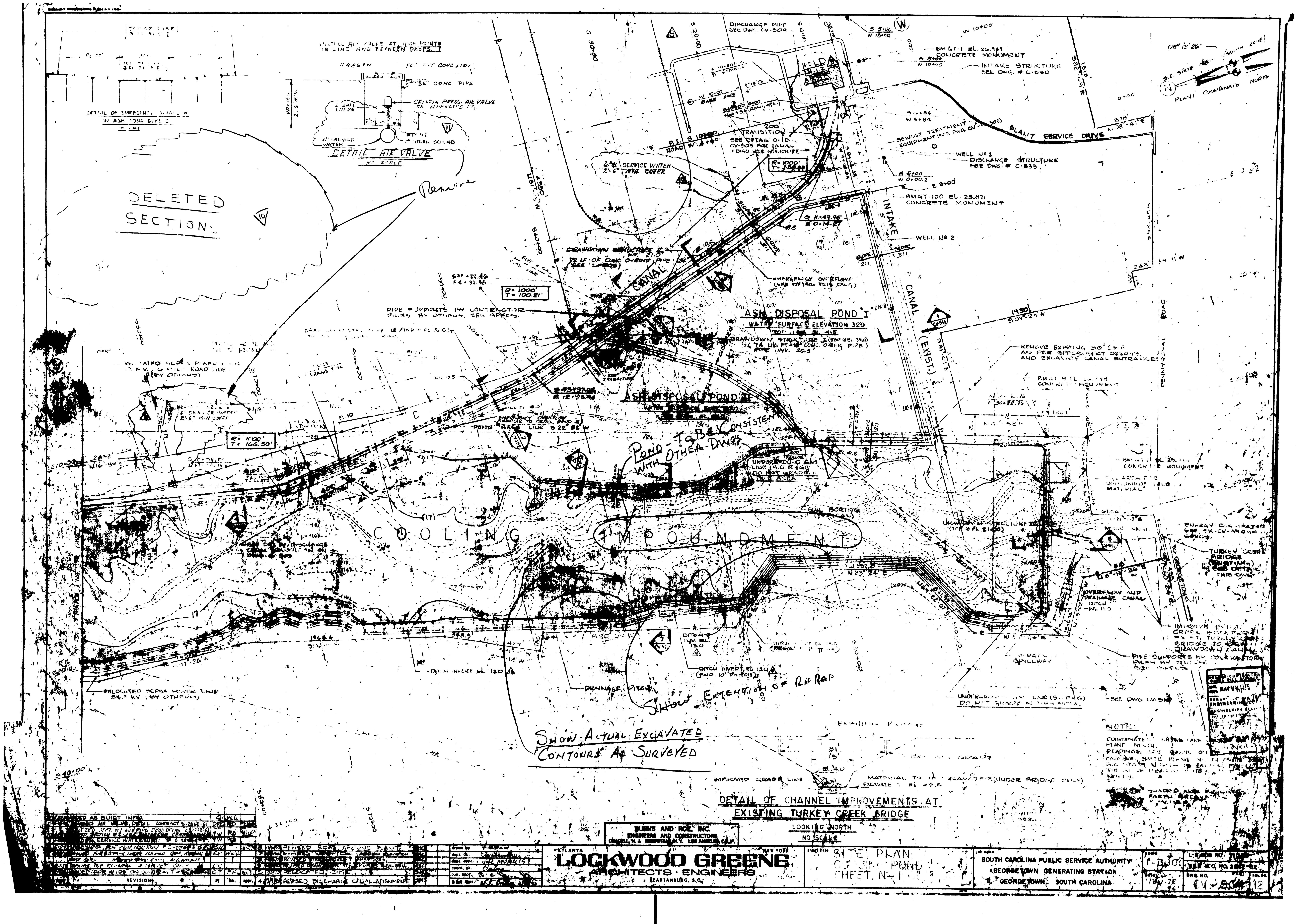
<u>Appendix A - Doc 1.2 Winyah Generating Station Georgetown GIS 2006 Aerial</u>


Unit 3&4
Slurry Pond
Unit 2
Slurry
Pond
West Ash
Pond
Ash Pond A
South Ash Pond
Ash
Pond B

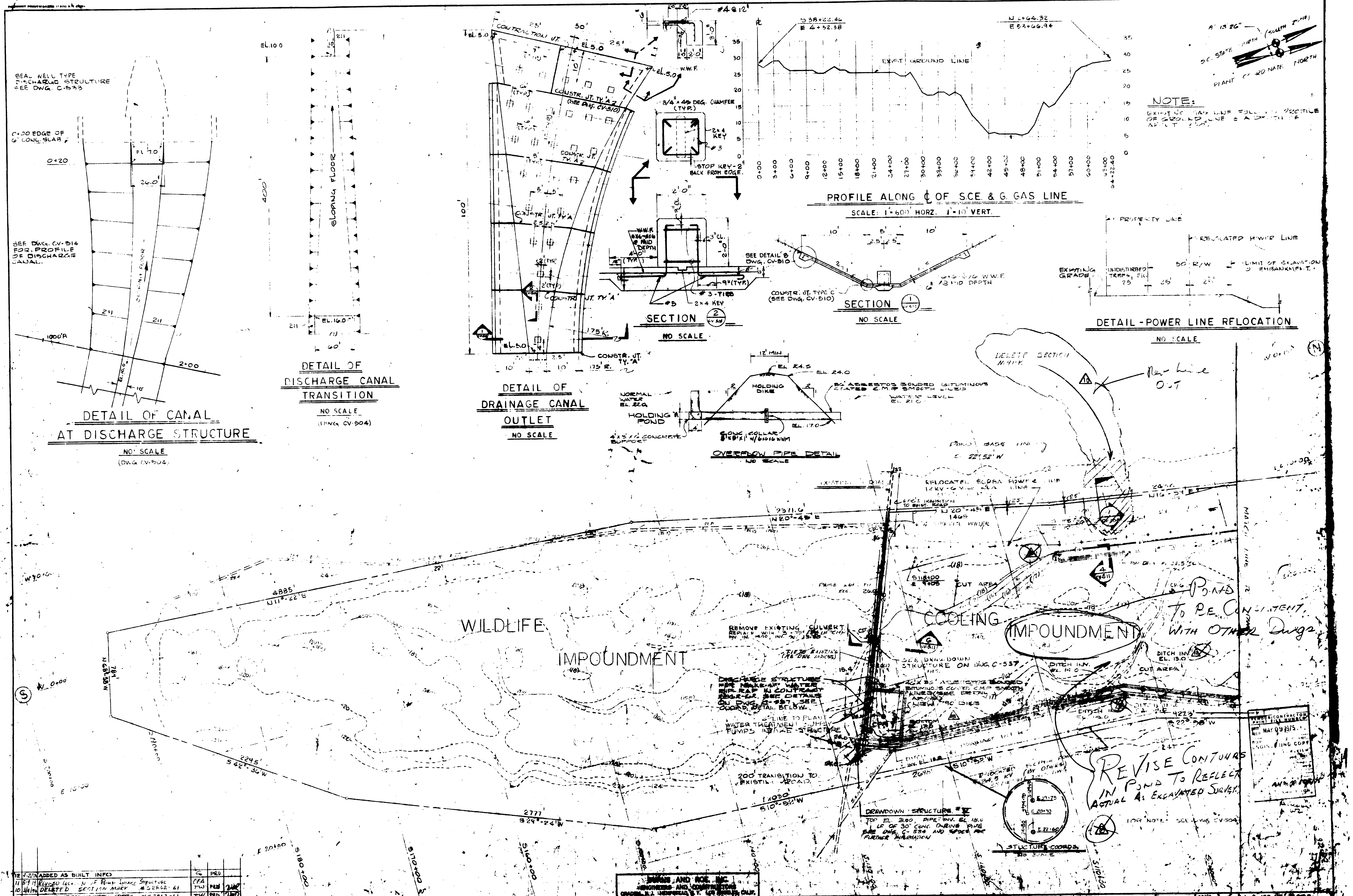
Appendix A - Doc 1.3 Ash Pond A and Ash Pond B Impoundment Drawings



Ash Ponds A & B
+ Cooling Pond
(Similar to previous)



Ponds A & B area
+ Cooling Pond area in part (Site Plan)



12	4-22-7	ADDED AS BUILT INFO	G	PRD	
11	5-9-11	REVISED LOCATION OF PUMP INTAKE STRUCTURE	EFA		
10	3/6/94	DELETED SECTION MARK #S2862-61	TW	PRD	
9	2-22-7	ADDED 6" SERVICE WATER DETAIL #S2862-61	T.W.	PRD	
4		ISSUED FOR CONSTRUCTION #S2862-61			
3		REVISED VELOCITY BREAKER	J.N.		
2		ISSUED FOR GRADING OF [illegible] ONLY	E.K.		
1		ISSUED [illegible] SURVEY ONLY	E.K.		
0		ISSUED FOR BIDS ON CONTRACT #S-2862-61	L.T.	E.K.	
no.	date	REVISION	by	ck.	appr.

8		ADDED WATER STRUCTURE, REVISED CONTOURS	
8		ADDED DISCHARGE STRUCTURE DETAIL	
8		REVISED WEST DIKE, ADDED NEW [illegible] DIKE	
7		ADDED DRAWDOWN & DISCHARGE STRUCTURE	
6		ADDED DRAWDOWN STRUCTURE	
5	3/4/73	REVISED DISCHARE CANAL	

drawn by TILPAK
dept. ck.
dept. appr. J. R. MORRIS
coord. ck.
p.m. appr.
B&R appr.

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N.J. HEMPSTEAD, N.Y. LOS ANGELES, CALIF.

LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

sheet title: SITE PLAN COOLING POND SHEET Nº 2

job name: SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
GEORGETOWN GENERATING STATION
GEORGETOWN SOUTH CAROLINA

scale 1"=300'
date 12-7-72
L-G JOB NO. 7108
B&R W.O. NO. 2860-
DWG. NO. CV-505
rev. no. 12

Cooling Pond
Site Plans (In Part)

Appendix A - Doc 1.4 Ash Pond B Dike Elevation Report

Project No. 93-1356
December 1993

Paul C. Rizzo Associates, Inc.
CONSULTANTS

Report

Ash Pond B Dike Elevation

Winyah Generating Station

South Carolina Public Service Authority (Santee Cooper)
Moncks Corner, South Carolina

TABLE OF CONTENTS

LIST OF FIGURES

ASH POND B
DIKE ELEVATION
WINYAH GENERATING STATION

1.0 INTRODUCTION

Paul C. Rizzo Associates was initially retained by South Carolina Public Service Authority (Santee Cooper) to evaluate the feasibility of raising the Ash Pond B earth embankment at the Winyah Generating Station in order to increase storage capacity. Tim Onstott and Jeff Holchin of our firm met Ms. Joan Cahill and Mr. Henry Stevens of Santee Cooper at the site on August 30, 1993. A reconnaissance of the site and a nearby potential soil borrow source was performed. Photographs of the site and associated facilities were taken. A plan drawing of the site and an aerial photograph were obtained from Santee Cooper.

After careful evaluation of the field observations and the requirements of Santee Cooper for storage of fly ash, it was concluded that elevation of the earth embankment at Ash Pond B to increase storage capacity of the pond is feasible.

Subsequently, Paul C. Rizzo Associates was retained by Santee Cooper to perform a geotechnical investigation of the site and to provide plans and specifications for raising the embankment.

This report provides a description of the geotechnical investigation and the results obtained, and it also provides plans and specifications for the raising of the Ash Pond B impounding dike.

2.0 GEOTECHNICAL INVESTIGATION

Six borings were drilled at the site on October 21 and 22, 1993. The borings were drilled from the crest of the Ash Pond B dike (Figure 1) to an approximate depth of 30 feet. The borings were drilled with hollow-stem augers, and Standard Penetration Test (SPT) samples were obtained at five-foot intervals. Logs for each of the borings drilled are provided in Appendix A to this report. A plan view of the boring locations is provided on Figure 1.

Both the embankment and foundation soils were found to be competent. The embankment soils are generally clayey or silty fine sand with SPT blow counts generally exceeding 30 except near the surface. The foundation soil is a silty fine sand with SPT blow counts generally averaging 10 or higher.

No piezometers were installed at the site, but water levels observed in the boreholes during the drilling indicate that the phreatic surface is well below the impoundment water level. Approximate phreatic surfaces based on the field observations are shown on the embankment cross sections presented on Figures 2 through 7. The cross sections also show the stratigraphy, as determined from the borings, the variation of SPT blow count with depth, the geometry of the embankment, and the levels of upstream and downstream water. Note that the water levels shown are those when the cross sections were surveyed and will vary somewhat.

The cross section geometry and top of boring elevation at each boring location was determined from survey data provided by Santee Cooper personnel. Because there was no stationing system for the Ash Pond B embankment, a temporary system was established by Paul C. Rizzo Associates (Figure 1) to aid in locating in the field the cross sections shown on Figures 2 through 7 and to facilitate field construction activities.

As part of the field investigation, samples of potential borrow soil were obtained with a tractor-mounted backhoe from the nearby property of Mr. Orrin Harrelson. Samples for laboratory testing were obtained from two locations.

3.0 LABORATORY TESTING

Two samples of potential borrow soil were obtained from property near the Winyah Generating Station owned by Mr. Orrin Harrelson. The samples were taken to a geotechnical testing laboratory where the following tests were run:

- Grain-size
- Atterberg limits
- Standard Proctor Compaction

The grain-size analyses indicated that the soil samples are very uniform fine sands with fines contents (portion passing the No. 200 sieve) of nearly 20 percent. Based on the Unified Soil Classification System, the soil samples can be classified as clayey sands, which are very suitable for constructing the addition to the embankment.

Standard Proctor Compaction tests were performed in order to establish the compaction characteristics of the two soil samples. The optimum moisture content for compaction averaged 17 percent and the average maximum dry density of the samples was 109 pcf. Results of the laboratory testing are provided in Appendix B.

4.0 DESIGN OF DIKE ELEVATION

The perimeter dike of Ash Pond B will be raised by approximately seven feet to increase the storage capacity. The portion of the dike between Ash Pond A and Ash Pond B is already at an adequate elevation. The existing pond discharge structure for Ash Pond B will also be raised by about seven feet.

The existing dike for Ash Pond B consists of a competent fine sand with silt or clay fines. Grass is the primary vegetation, with some marsh vegetation present at the toe of the upstream slope and small shrubs and on the downstream slope along with marsh vegetation at the toe. The existing crest width ranges from approximately 12 to 17 feet, and side slopes range between approximately 2 horizontal to 1 vertical (2:1) and 4 horizontal to 1 vertical (4:1), as shown on Figures 2 through 7. Some riprap protection is present on the lower portion of the upstream face of the existing dike.

The dike elevation is shown on the cross sections presented on Figures 2 through 7. The top of the existing dike will be raised to Elevation 41.0 feet (NGVD). The embankment slopes for the reconstructed dike will be 2 horizontal to 1 vertical (2:1). The design width of the crest is 12 feet. This is approximately the minimum width of the existing dike, and will not restrict vehicle or equipment travel. Note that the centerline of the reconstructed dike will be shifted outward from that of the existing dike. A longitudinal profile of the dike elevation is presented on Figure 8.

The existing dike surface will be cleared of vegetation, and any top soil will be removed and stored for later use. The existing side slopes will be notched so that the imported backfill can be tied into the existing surface, as shown on the cross sections presented on Figures 2 through 7. In some cases, the toe of the downstream slope of the reconstructed dike will extend into the existing waterway for a short distance. In areas where this occurs, soft soil or muck will be removed and riprap will be placed to provide a dry, solid base upon which to construct the new dike. Geotextile will be placed between the riprap and the embankment soil to minimize movement of embankment soil particles into the riprap. Riprap will also be placed, as needed, on the upstream slope of the reconstructed dike to minimize the potential for erosion. The completed dike will be seeded. Complete specifications for the embankment reconstruction are provided in Appendix D.

The existing pond discharge structure is shown on Figures 9 and 10. This structure is essentially a concrete drop-inlet box in which the water drops down a shaft and out a lateral discharge pipe under the dike and into the discharge canal. The ash pond level is controlled by a metal overflow gate which slides in angle-iron gate tracks. To accommodate the new pond level, the existing structure will simply be raised by approximately seven feet, as shown on Figure 11. Reinforced concrete will be placed as shown, and the overflow gate can be extended to the elevation desired by Santee Cooper. The existing walkway, railing, grating, and gate hoist will be reattached to the rebuilt structure.

A calculation of the estimated volume of borrow soil required for the dike reconstruction is provided in Appendix C. Two calculation methods were employed and survey data provided by Santee Cooper were utilized. The average volume of borrow soil required is approximately 80,000 cubic yards based on this analysis.

Complete construction specifications are provided in Appendix D. The construction specifications are basically those used by Santee Cooper for previous projects with some minor modifications or additions to meet the requirements of this project. The changes to the specifications are provided in an addendum at the beginning of Appendix D.

5.0 SUMMARY

Paul C. Rizzo Associates has been retained by Santee Cooper to investigate the feasibility of raising the elevation of the impounding dike at Ash Pond B at the Winyah Generating Station and to provide plans and specifications for the work.

It has been determined that elevation of the dike is feasible, as indicated to Santee Cooper in our letter report of September 7, 1993

As part of the present investigation, six borings were drilled from the crest of the existing embankment to an approximate depth of 30 feet. The borings indicate that the existing embankment is well compacted. The underlying foundation soils are also in generally good condition.

Cross sections of the reconstructed dike have been provided at each of the six locations where drilling was performed. A longitudinal profile of the reconstruction has also been provided. Design drawings are also provided for modification of the outlet structure. Specifications for the work are presented in Appendix D to this report.

Respectfully submitted,
Paul C. Rizzo Associates

Jeffrey D. Holchin

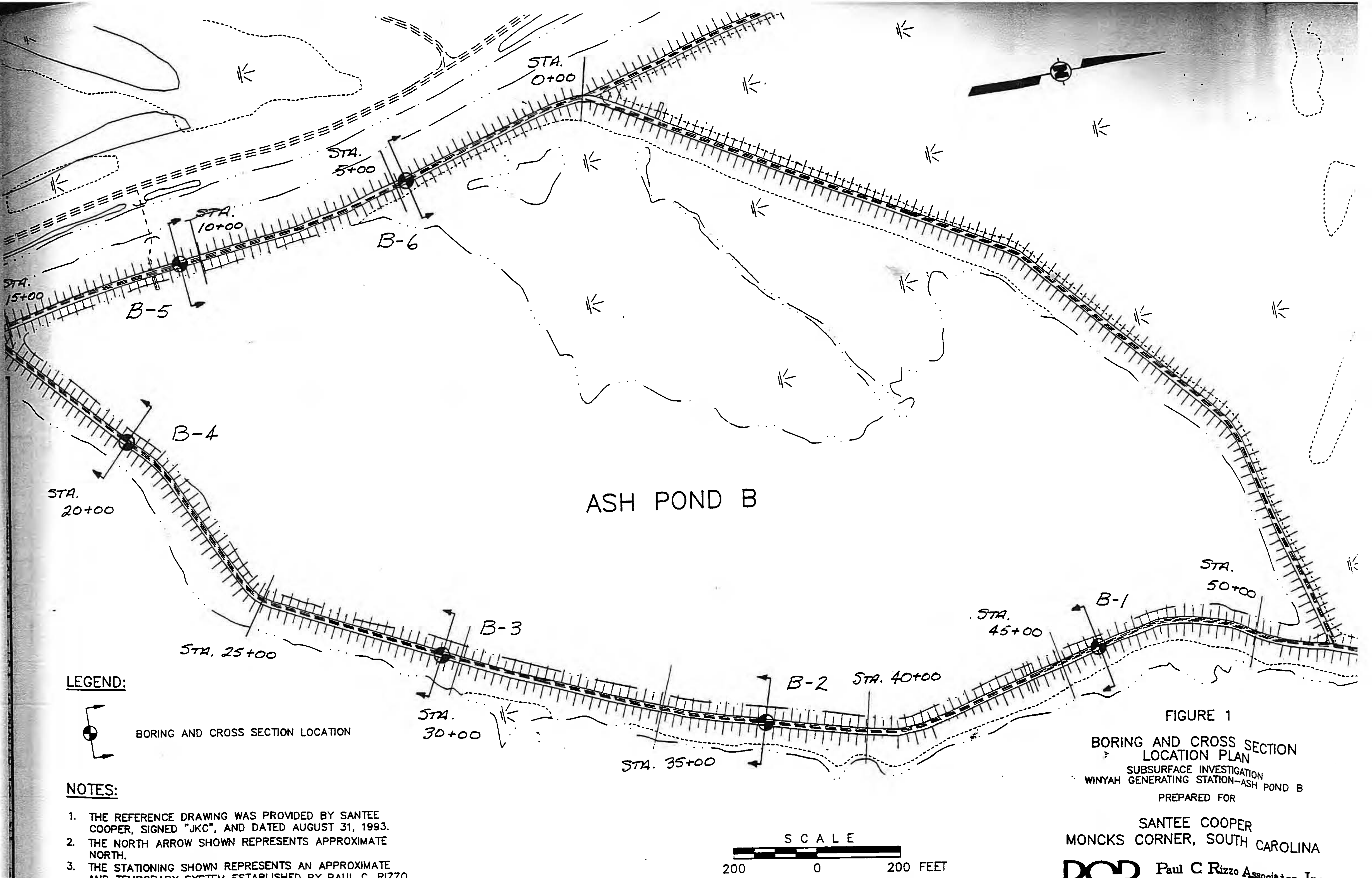
Jeffrey D. Holchin, P.E.
Project Engineer

Tim Onstott

J. Timothy Onstott
Project Manager

JDH/JTO/rcr

FIGURES



LEGEND:

BORING AND CROSS SECTION LOCATION

NOTES:

1. THE REFERENCE DRAWING WAS PROVIDED BY SANTEE COOPER, SIGNED "JKC", AND DATED AUGUST 31, 1993.
2. THE NORTH ARROW SHOWN REPRESENTS APPROXIMATE NORTH.
3. THE STATIONING SHOWN REPRESENTS AN APPROXIMATE AND TEMPORARY SYSTEM ESTABLISHED BY PAUL C. RIZZO ASSOCIATES FOR CONSTRUCTION PURPOSES ONLY.

FIGURE 1

BORING AND CROSS SECTION LOCATION PLAN

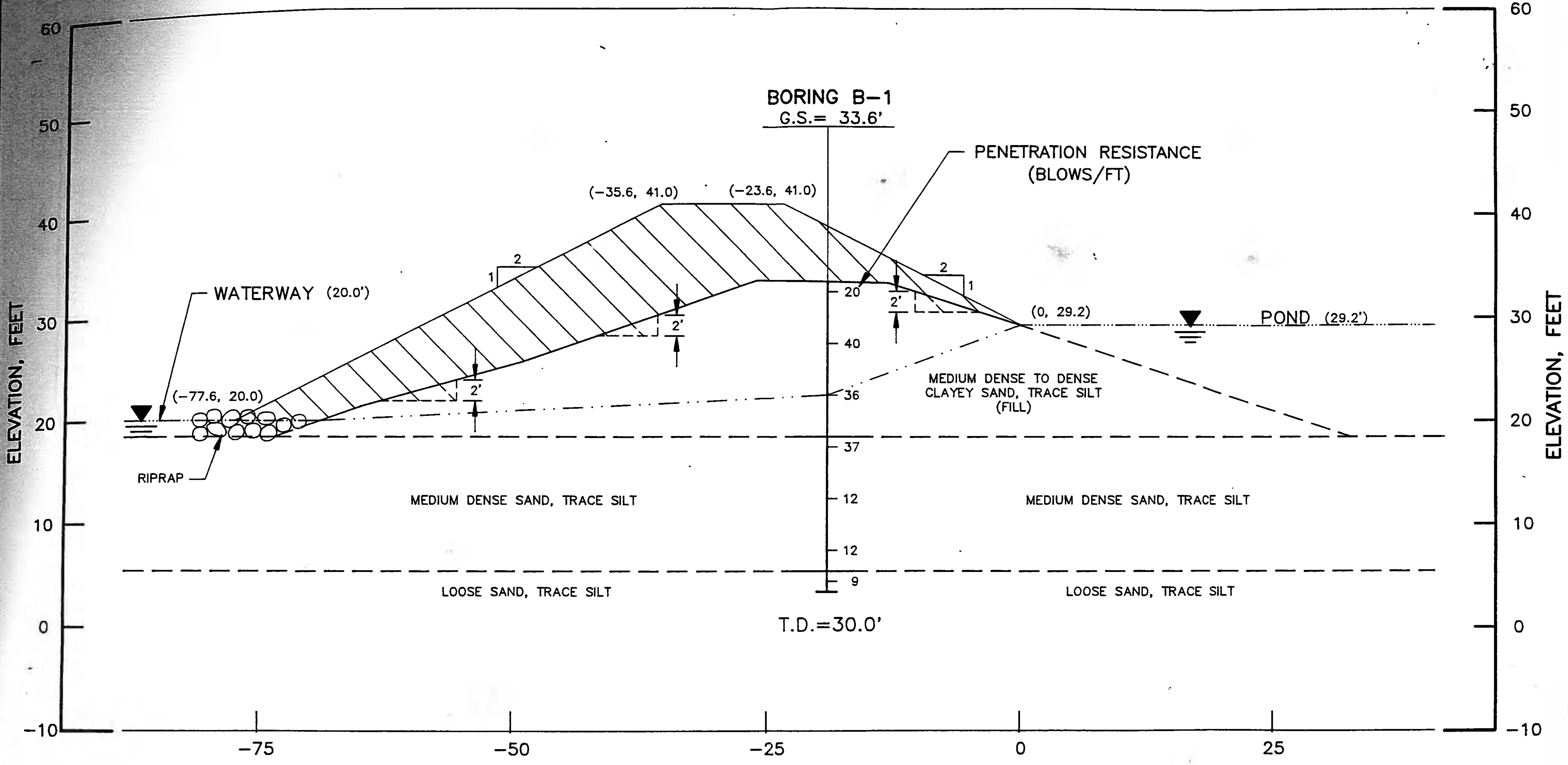
SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION–ASH POND B

PREPARED FOR

SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C. Rizzo Associates, Inc.
CONSULTANTS

PLOT 1:10
DRAWN BY T.Meskel 12-7-93
CHECKED BY T.D.H. 12-7-93
APPROVED BY 770 12-8-93
CAD FILE NUMBER 93-1356-B1



NOTES:

1. ALL ELEVATIONS ARE FROM NGVD.
2. SOME RIPRAP MAY BE REQUIRED TO PROVIDE A SOLID BASE IF THE DOWNSTREAM TOE OF THE DIKE ADDITION EXTENDS INTO THE WATERWAY.
3. NOTCH THE EXISTING DIKE SLOPES AS SHOWN TO TIE IN ADDITIONAL DIKE SOIL.

SCALE
10 0 10 FEET

FIGURE 2

CROSS SECTION B-1
SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION-ASH POND B
PREPARED FOR
SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C. Rizzo Associates, Inc.
CONSULTANTS

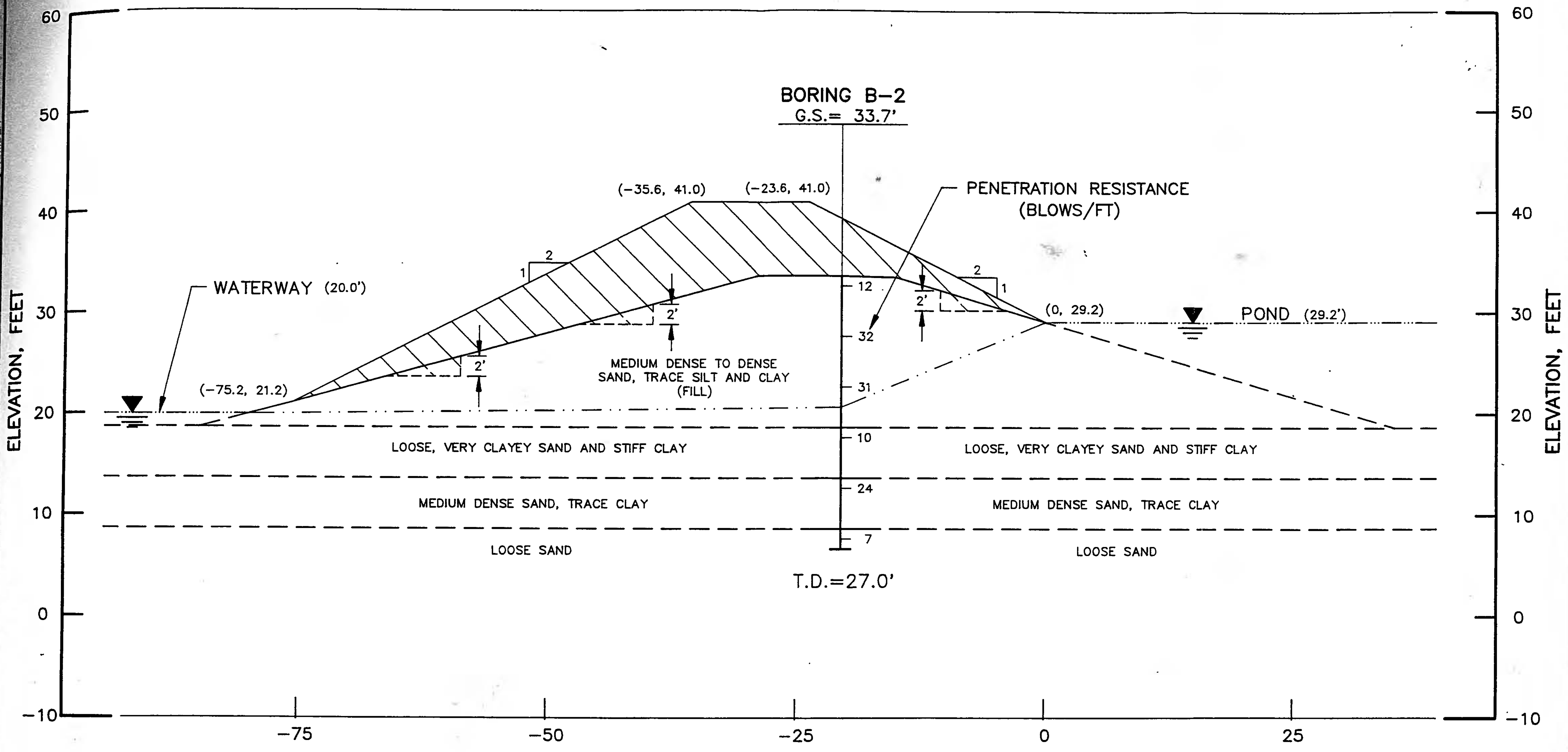
1:10

DRAWN BY T.Moskel 12-7-93

CHECKED BY J.D.H. 12-7-93

APPROVED BY JTO 12-8-93

CAD FILE NUMBER 93-1356-B2



NOTES:

1. ALL ELEVATIONS ARE FROM NGVD.
2. SOME RIPRAP MAY BE REQUIRED TO PROVIDE A SOLID BASE IF THE DOWNSTREAM TOE OF THE DIKE ADDITION EXTENDS INTO THE WATERWAY.
3. NOTCH THE EXISTING DIKE SLOPES AS SHOWN TO TIE IN ADDITIONAL DIKE SOIL.

SCALE

10 0 10 FEET

FIGURE 3

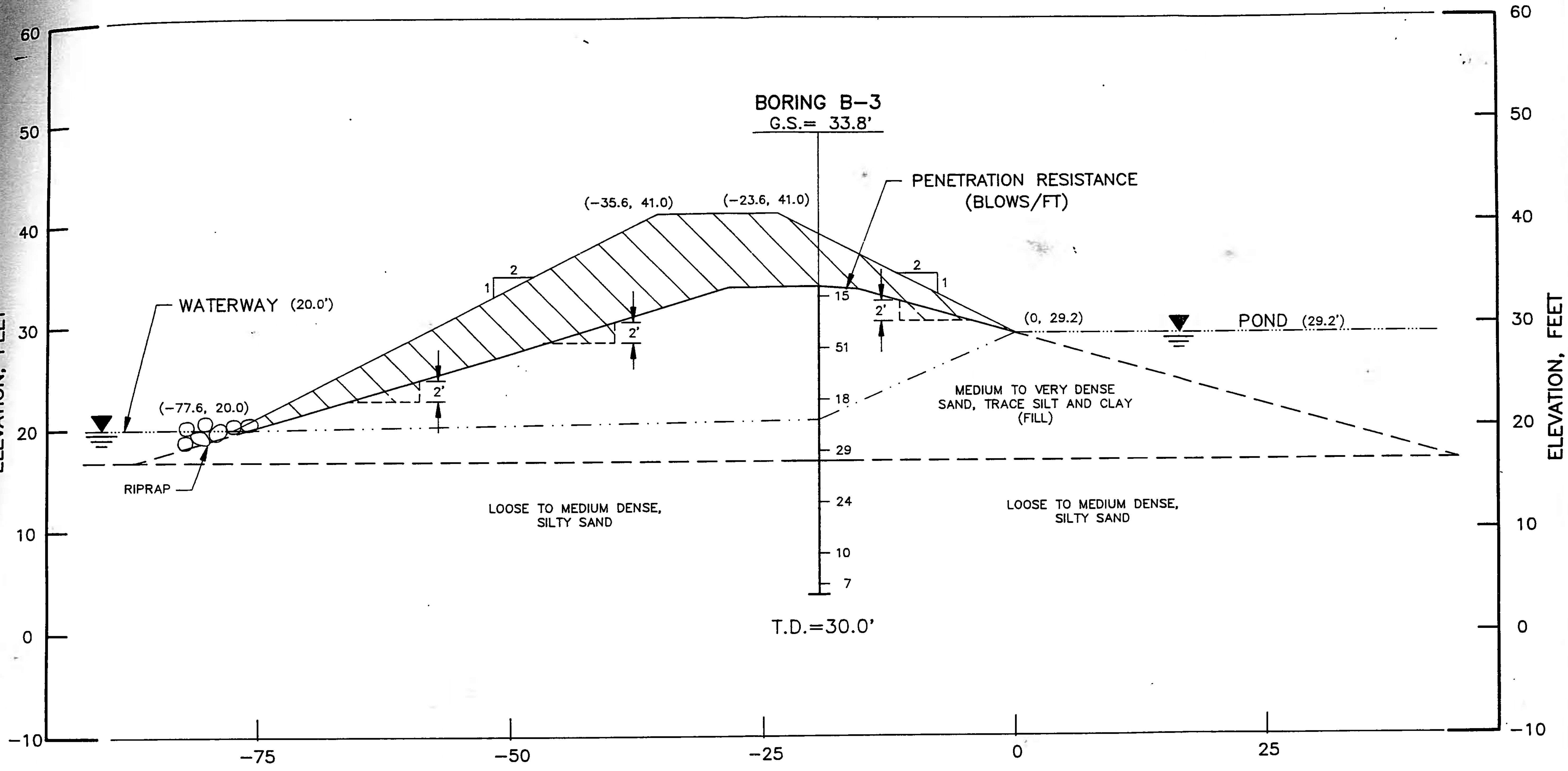
CROSS SECTION B−2
SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION−ASH POND B

PREPARED FOR

SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C. Rizzo Associates, Inc.
CONSULTANTS

PLOT 1:10	DRAWN BY	T.Meskel 12-7-93	CHECKED BY APPROVED BY	J.D.H. 12-7-93 JTC 12-8-93	CAD FILE NUMBER 93-1356-B3



NOTES:

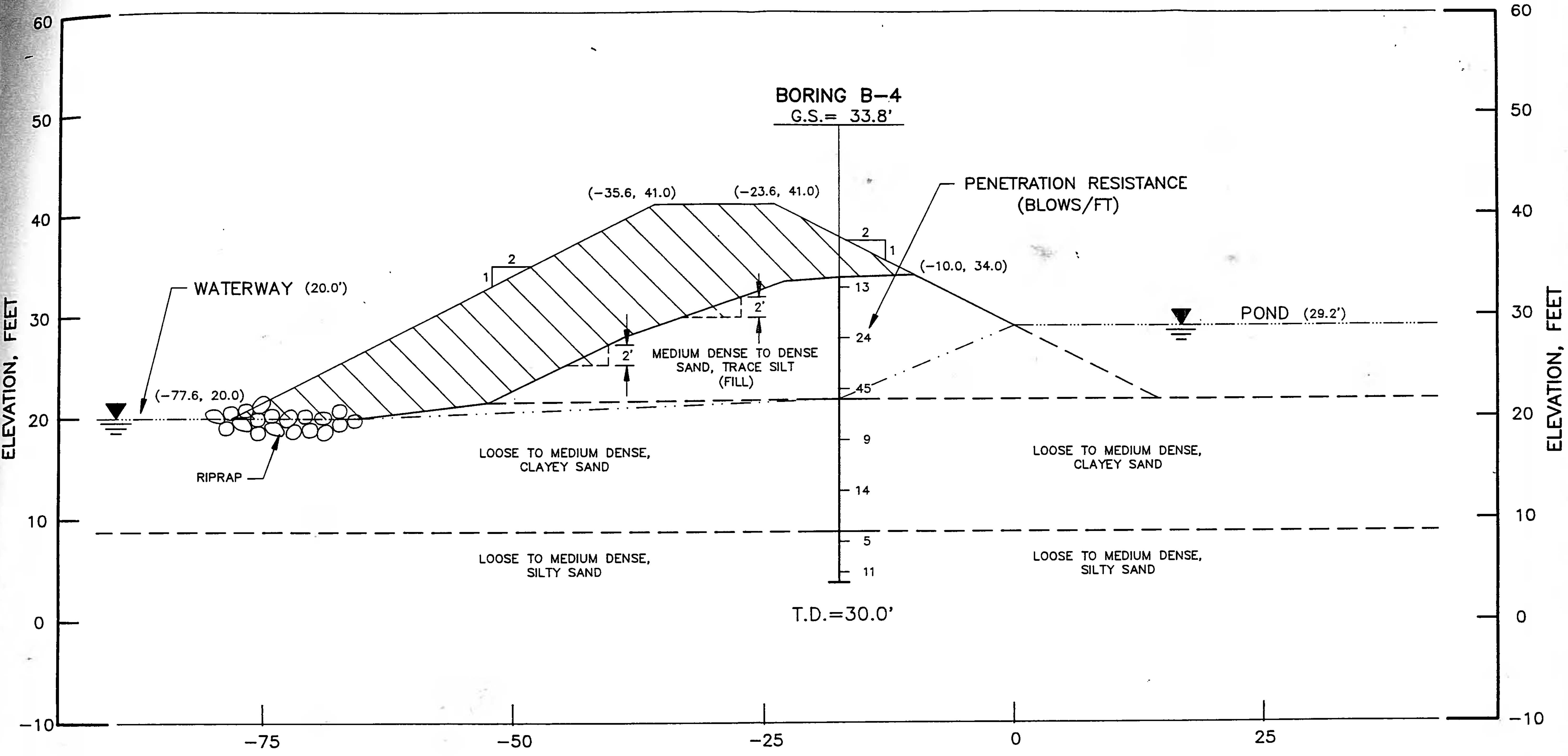
1. ALL ELEVATIONS ARE FROM NGVD.
2. SOME RIPRAP MAY BE REQUIRED TO PROVIDE A SOLID BASE IF THE DOWNSTREAM TOE OF THE DIKE ADDITION EXTENDS INTO THE WATERWAY.
3. NOTCH THE EXISTING DIKE SLOPES AS SHOWN TO TIE IN ADDITIONAL DIKE SOIL.

SCALE
10 0 10 FEET

FIGURE 4

CROSS SECTION B-3
SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION-ASH POND B
PREPARED FOR
SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C. Rizzo Associates, Inc.
CONSULTANTS



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APPROVED BY JTO 12-8-93
CAD FILE NUMBER 93−1356−B4

NOTES:

1. ALL ELEVATIONS ARE FROM NGVD.
2. SOME RIPRAP MAY BE REQUIRED TO PROVIDE A SOLID BASE IF THE DOWNSTREAM TOE OF THE DIKE ADDITION EXTENDS INTO THE WATERWAY.
3. NOTCH THE EXISTING DIKE SLOPES AS SHOWN TO TIE IN ADDITIONAL DIKE SOIL.

FIGURE 5

CROSS SECTION B−4

SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION−ASH POND B

PREPARED FOR

SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C. Rizzo Associates, Inc.
CONSULTANTS

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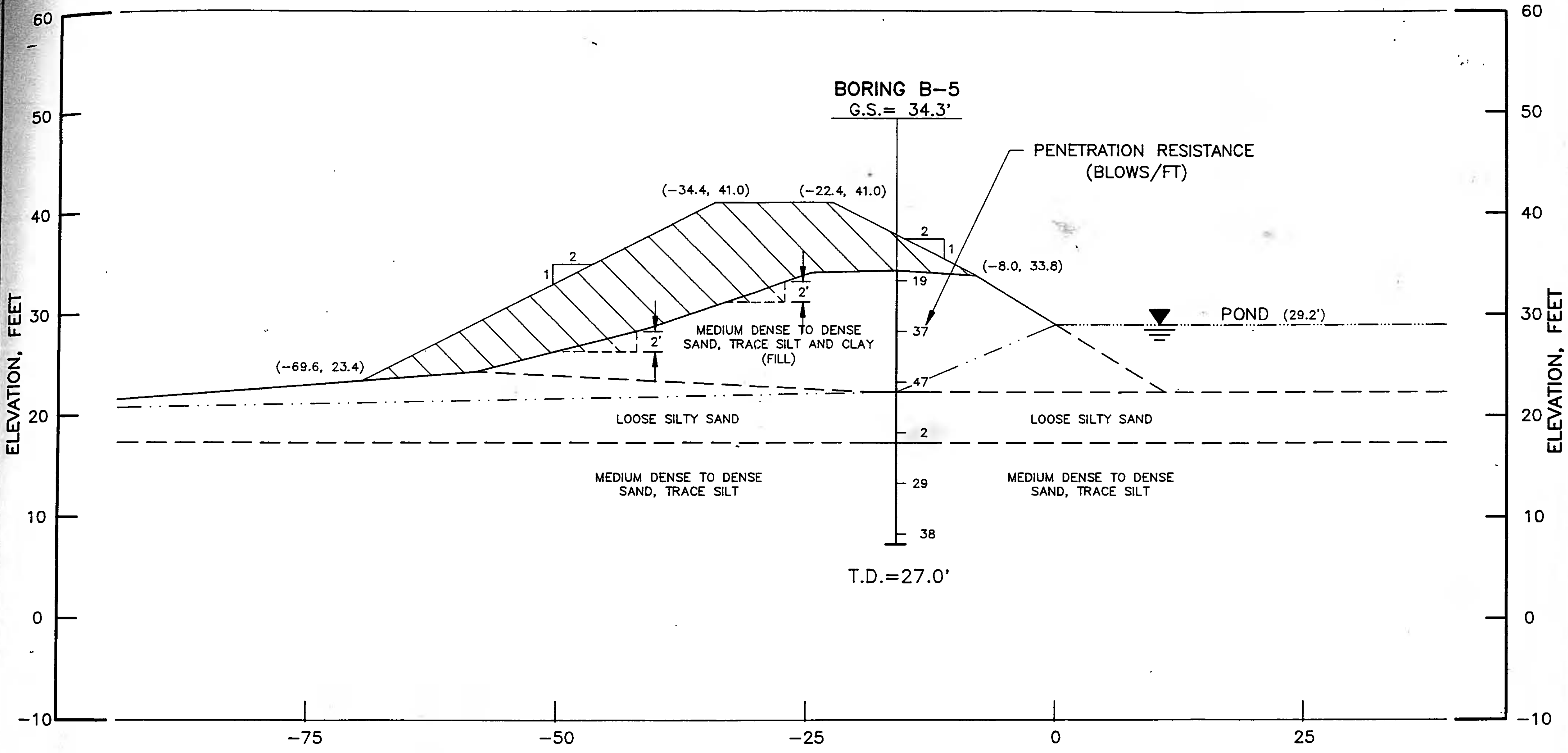
CHECKED BY J.D.H. 12-7-93
APPROVED BY JTO 12-8-93
CAD FILE NUMBER 93-1356-B5



NOTES:

1. ALL ELEVATIONS ARE FROM NGVD.
2. SOME RIPRAP MAY BE REQUIRED TO PROVIDE A SOLID BASE IF THE DOWNSTREAM TOE OF THE DIKE ADDITION EXTENDS INTO THE WATERWAY.
3. NOTCH THE EXISTING DIKE SLOPES AS SHOWN TO TIE IN ADDITIONAL DIKE SOIL.

SCALE
10 0 10 FEET

FIGURE 6

CROSS SECTION B-5
SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION-ASH POND B

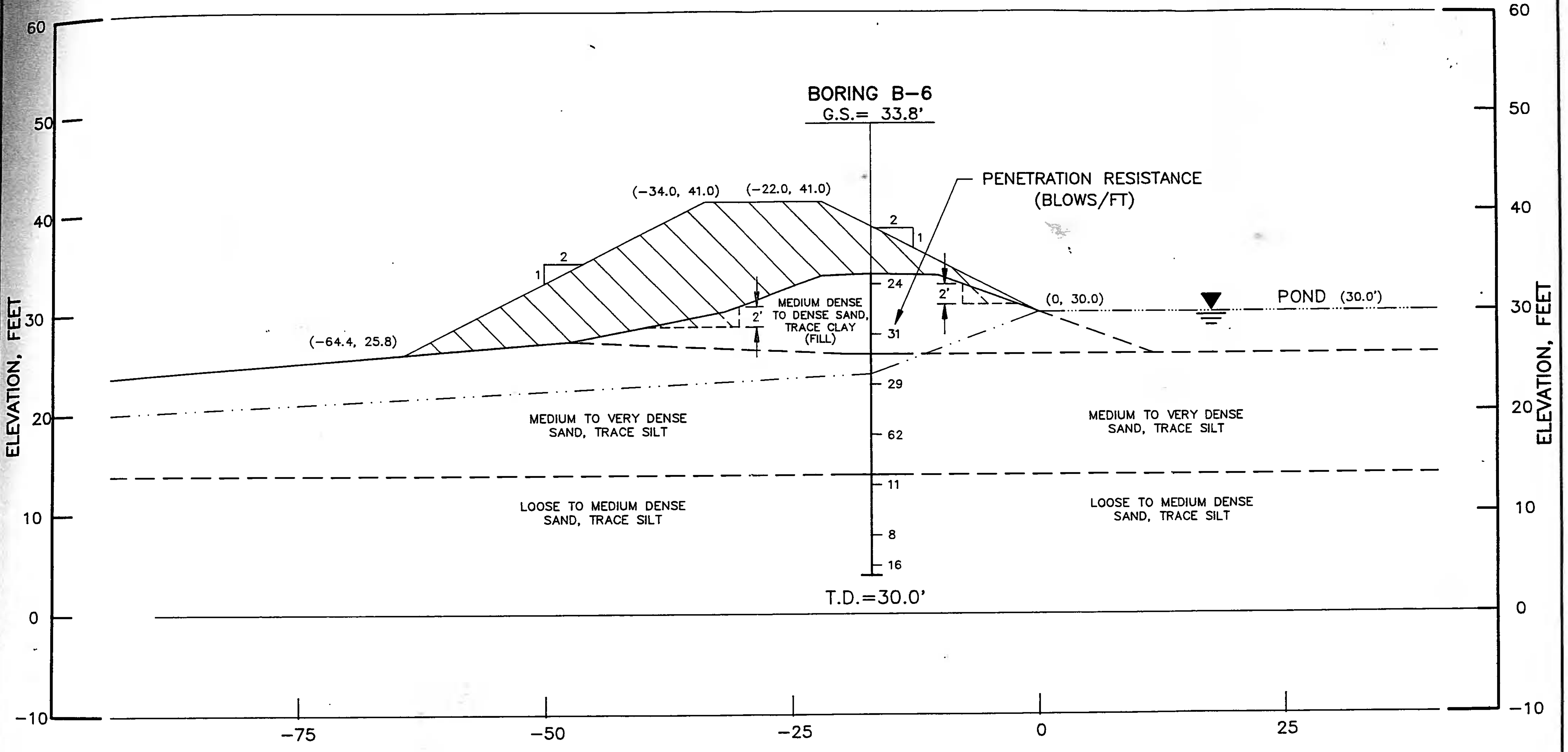
PREPARED FOR

SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C. Rizzo Associates, Inc.
CONSULTANTS

PLOT 1:10	DRAWN BY	T.Meskel 12-7-93	CHECKED BY APPROVED BY	J.D.H. 12-7-93 770 12-8-93

CAD FILE NUMBER 93-1356-B6



NOTES:

1. ALL ELEVATIONS ARE FROM NGVD.
2. SOME RIPRAP MAY BE REQUIRED TO PROVIDE A SOLID BASE IF THE DOWNSTREAM TOE OF THE DIKE ADDITION EXTENDS INTO THE WATERWAY.
3. NOTCH THE EXISTING DIKE SLOPES AS SHOWN TO TIE IN ADDITIONAL DIKE SOIL.

SCALE

10 0 10 FEET

FIGURE 7

CROSS SECTION B-6
SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION-ASH POND B
PREPARED FOR

SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C. Rizzo Associates, Inc.
CONSULTANTS

PLOT 1:10	DRAWN BY T.Meskal 12-6-93	CHECKED BY JJO 12-6-93	CAD FILE NUMBER 93-1558-B10
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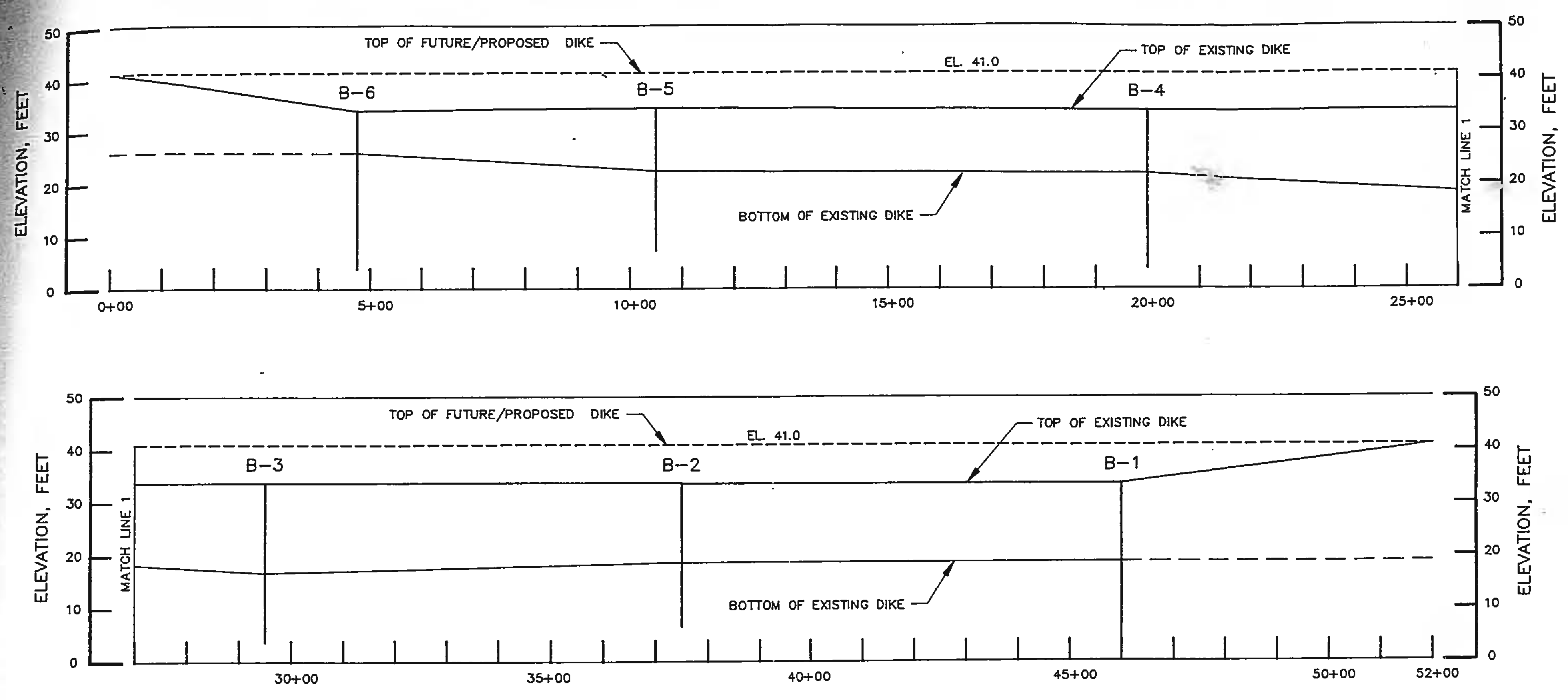

10X VERTICAL EXAGGERATION

HORIZONTAL SCALE
SCALE
200 0 200 FEET

VERTICAL SCALE
SCALE
20 0 20 FEET

NOTES:

1. ALL ELEVATIONS ARE FROM NGVD.
2. TIE TOP OF FUTURE DIKE INTO EXISTING GROUND SURFACE AT ENDS OF DIKE.

FIGURE 8

LONGITUDINAL PROFILE
OF DIKE RECONSTRUCTION
SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION-ASH POND B
PREPARED FOR

SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C. Rizzo Associates, Inc.
CONSULTANTS

PLOT 1:1	DRAWN BY	T.Meskel 12-7-93	CHECKED BY APPROVED BY	T.D.H. 12-7-93 JTC 12-8-93
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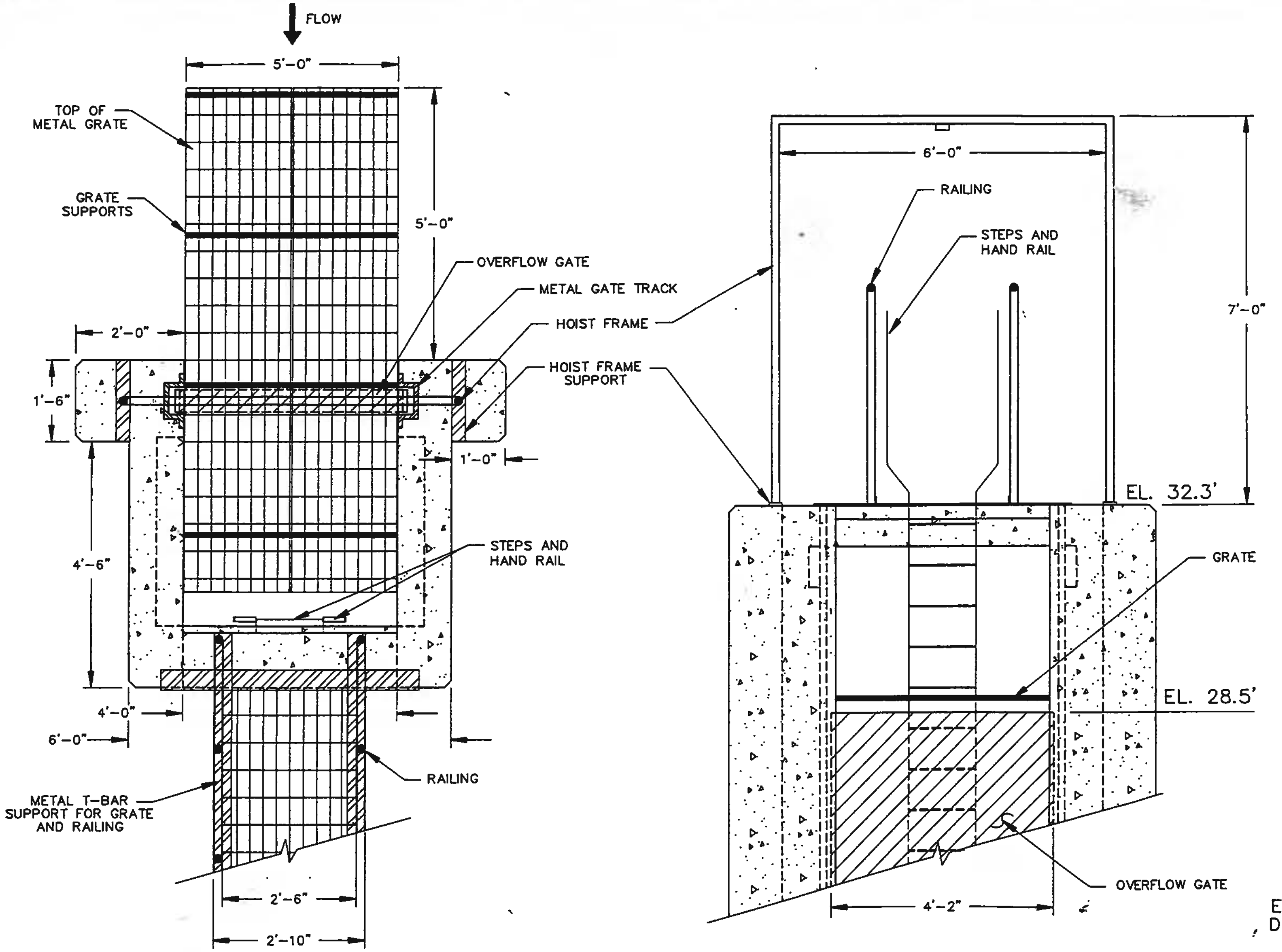


PLAN VIEW

SCALE: 1" = 2'

ELEVATION

SCALE: 1" = 2'

NOTE:

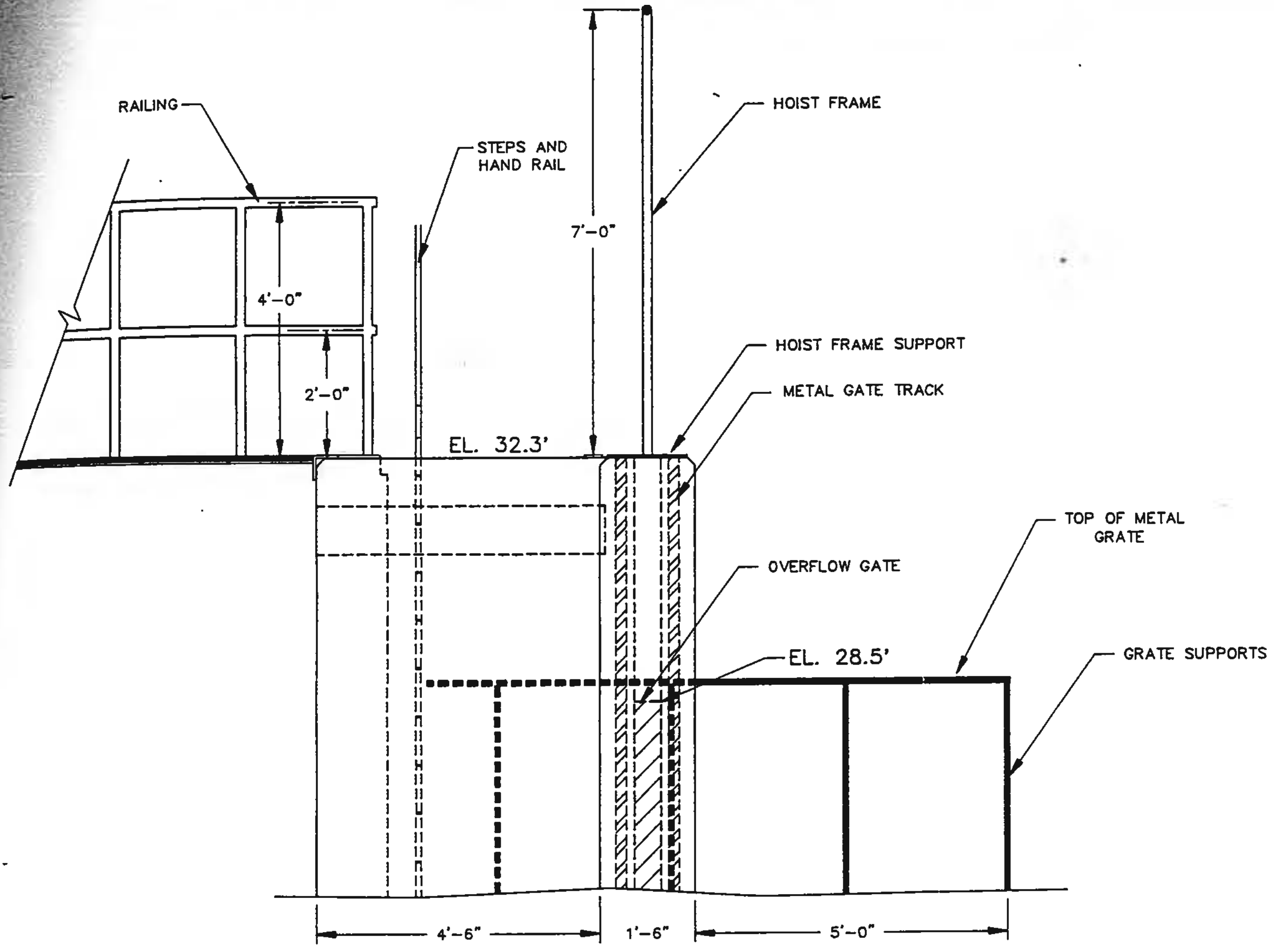
1. ALL ELEVATIONS ARE FROM NGVD.

FIGURE 9

EXISTING ASH POND B
DISCHARGE STRUCTURE
SHEET 1 OF 2
SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION–ASH POND B
PREPARED FOR

SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C. Rizzo Associates, Inc.
CONSULTANTS



SIDE VIEW
1" = 2'

NOTE:

1. ALL ELEVATIONS ARE FROM NGVD.

FIGURE 10

EXISTING ASH POND B
DISCHARGE STRUCTURE
SHEET 2 OF 2
SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION–ASH POND B
PREPARED FOR

SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C. Rizzo Associates, Inc.
CONSULTANTS

PLOT 1:1	DRAWN BY	T.Mdakel 12-6-93	CHECKED BY APPROVED BY	D.DNH JTTP	12-7-93 12-9-93	CAD FILE NUMBER 93-1356-B8

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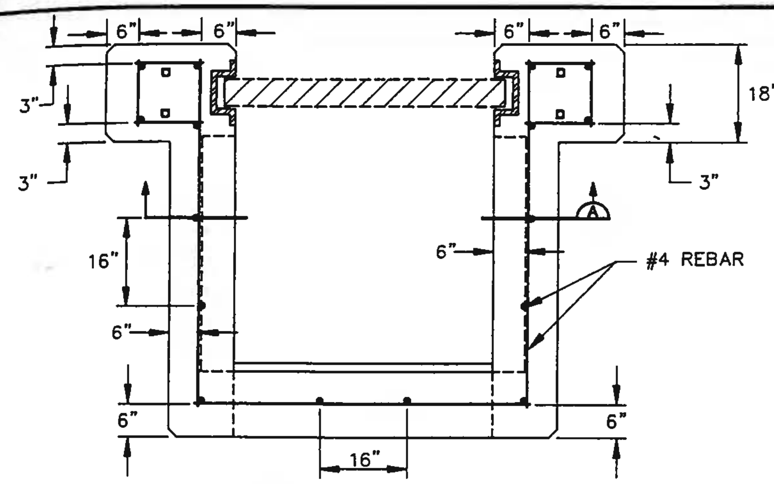
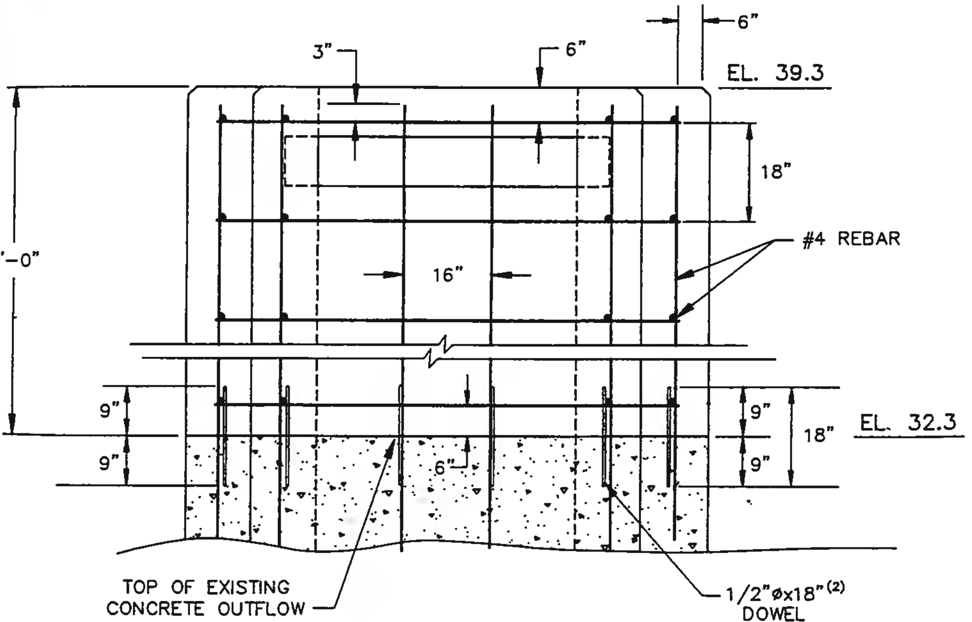


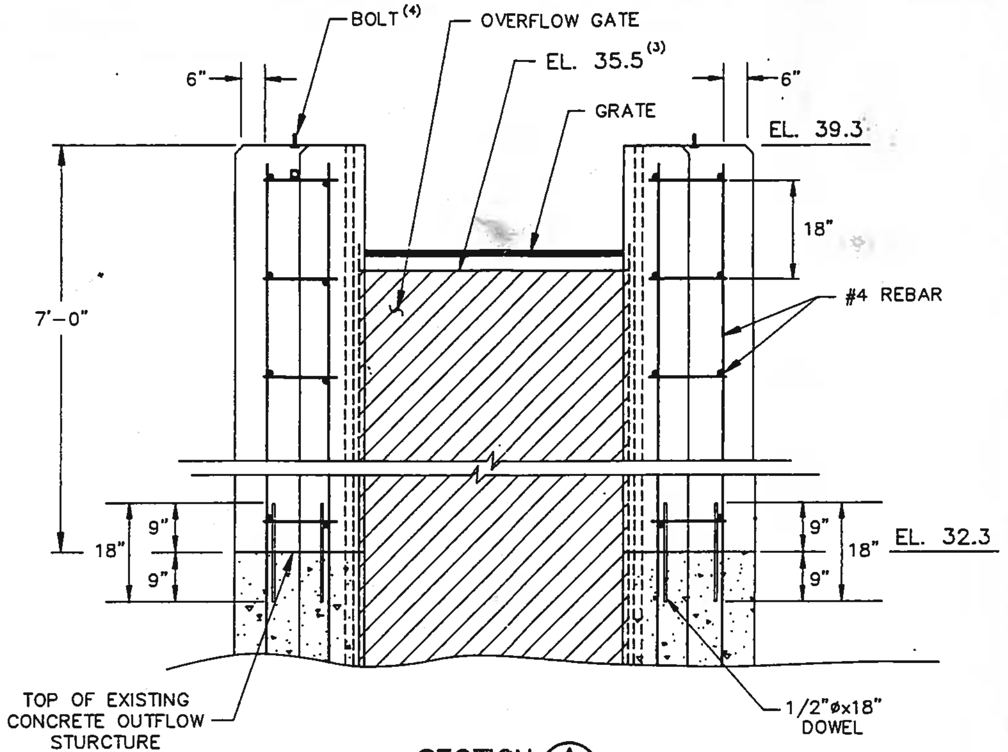
PLAN VIEW

SCALE: 1" = 2'



END VIEW

SCALE: 1" = 2'



SECTION A

SCALE: 1" = 2'

NOTES:

1. ALL ELEVATIONS ARE FROM NGVD.
2. OPENINGS IN THE TOP OF THE EXISTING CONCRETE CAN BE USED FOR PLACING THE DOWEL BARS.
3. THE ELEVATION OF THE OVERFLOW GATE IS TO BE DETERMINED BY SANTEE COOPER.
4. BOLTS ARE FOR ATTACHMENT OF HOIST FRAME.
5. THE MODIFIED ASH POND DISCHARGE STRUCTURE SHOULD BE BUILT TO THE SPECIFIED ELEVATION, AND MATCH THE EXISTING STRUCTURE IN CONFIGURATION, OPENINGS, AND ATTACHMENTS, SUCH AS RAILING, GRATING AND HOIST FRAME.

FIGURE 11

EXTENSION OF EXISTING ASH POND B DISCHARGE STURCTURE
SUBSURFACE INVESTIGATION
WINYAH GENERATING STATION–ASH POND B
PREPARED FOR

SANTEE COOPER
MONCKS CORNER, SOUTH CAROLINA

Paul C Rizzo Associates, Inc.
CONSULTANTS

APPENDIX A

BORING LOGS

GUIDE FOR SOIL DESCRIPTIONS:

1. SOIL DENSITY/CONSISTENCY.
2. COLOR (INCL. DARK, LIGHT, MED.).
3. SECONDARY SOIL TYPE (SILTY, ETC.) 30–40% BY WEIGHT.
4. PRIMARY SOIL TYPE (CLAY, ETC.).
5. DESCRIPTIVE TERMS, SUCH AS:
   - SOME (12–30% BY WEIGHT)
   - TRACE (5–12% BY WEIGHT)
   - LENS (≤ 1" IN THICKNESS)
   - LAYER (> 1" IN THICKNESS)
   - INTERBEDDED
   - SLICKENSIDED
   - POCKETS, ETC.
6. MOISTURE (DRY, MOIST, OR WET COMPARED TO OPTIMUM M/C).

MEASURED CONSISTENCY

MEASURED CONSISTENCY= UNCONFINED COMPRESSIVE STRENGTH FROM POCKET PENETROMETER TEST; RESULTS OF TORVANE TESTS ARE IDENTIFIED AS SUCH ON THE LOGS.

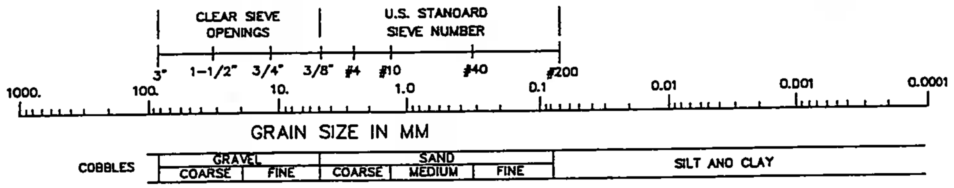
DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0–4
LOOSE	5–10
MEDIUM DENSE	11–30
DENSE	31–50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 OR 24 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE SECOND AND THIRD INTERVALS IS THE STANDARD PENETRATION RESISTANCE.

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)	FIELD IDENTIFICATION
VERY SOFT	LESS THAN 0.25	EASILY PENETRATED SEVERAL INCHES WITH FIST
SOFT	0.25 TO 0.50	EASILY PENETRATED SEVERAL INCHES WITH THUMB
MEDIUM STIFF	0.50 TO 1.0	PENETRATED SEVERAL INCHES WITH THUMB UNDER MODERATE PRESSURE
STIFF	1.0 TO 2.0	READILY IDENTED WITH THUMB, BUT PENETRATED WITH GREAT EFFORT
VERY STIFF	2.0 TO 4.0	READILY IDENTED WITH THUMBNAIL
HARD	MORE THAN 4.0	INDENTED WITH DIFFICULTY WITH THUMBNAIL



COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURE
	GC	CLAYEY GRAVELS
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-CLAY MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

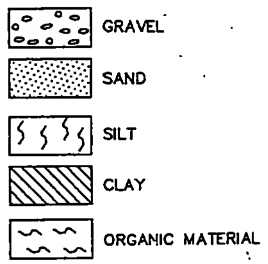
FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASICITY
SILTS AND CLAYS (LIQUID LIMIT GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH ORGANIC CONTENTS

FOR USCS (UNIFIED SOIL CLASSIFICATION SYSTEM) CLASSIFICATIONS ON BORING LOGS, UPPER CASE LETTERS INDICATE LAB TEST CLASSIFICATION, LOWER CASE LETTERS INDICATE VISUAL FIELD CLASSIFICATION.

SYMBOLS TO BE USED FOR DESIGNATION OF SUBSURFACE MATERIALS ON ALL BORING LOGS AND SUBSURFACE SECTIONS

SOILS

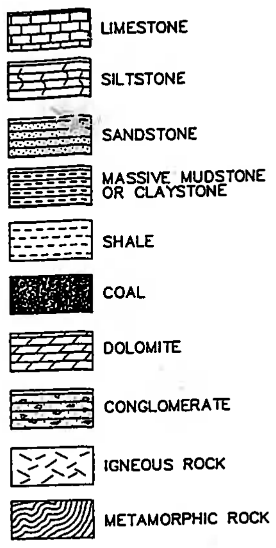


GRAIN SIZE DESIGNATIONS FOR BOTH GRANULAR SOILS AND GRANULAR ROCKS FOLLOW USCS NOMENCLATURE

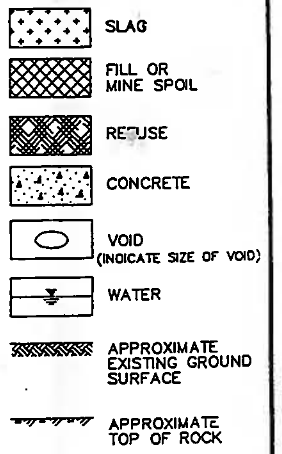
THE SPACING OF THE DISCONTINUITIES IN THE ROCK MAY BE DESCRIBED BY ONE OF THE FOLLOWING TERMS

DESCRIPTIVE TERMS	SPACING
VERY BROKEN	LESS THAN 1 IN.
BROKEN	1 IN. TO 3 IN.
SLIGHTLY BROKEN	3 IN. TO 6 IN.
UNBROKEN	6 IN. AND GREATER

ROCKS

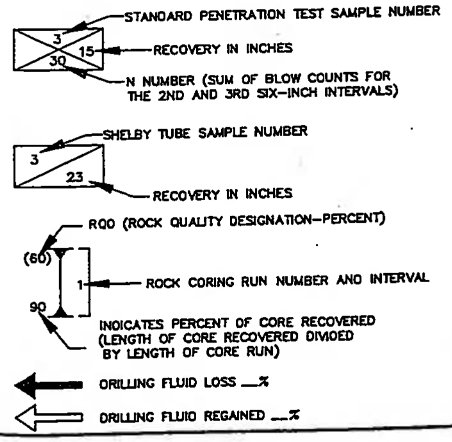


MISCELLANEOUS



TERMS USED TO DESCRIBE THE RELATIVE DEGREES OF ROCK CORE HARDNESS

DESCRIPTIVE TERMS	DEFINING CHARACTERISTICS
VERY SOFT	CRUSHES UNDER PRESSURE OF FINGERS AND/OR THUMB
SOFT	CRUSHES UNDER PRESSURE OF PRESSED HAMMER
MEDIUM HARD	BREAKS EASILY UNDER SINGLE HAMMER BLOW BUT WITH CRUMBLY EDGES
HARD	BREAKS UNDER ONE OR TWO STRONG HAMMER BLOWS BUT WITH RESISTANT SHARP EDGES
VERY HARD	BREAKS UNDER SEVERAL STRONG HAMMER BLOWS BUT WITH VERY RESISTANT SHARP EDGES AND MAY SPALL LEAVING CONCHOIDAL FRACTURES



NOTES

1. THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SOIL AND ROCK CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING LOCATIONS.
2. THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION MAY BE GRADUAL.

GENERAL NOTES AND LEGEND – BORINGS IN SOIL AND ROCK

Paul C. Rizzo Associates, Inc.
CONSULTANTS

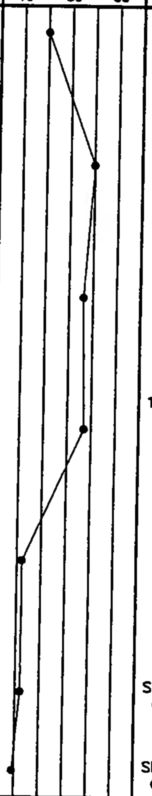
Paul C. Rizzo Associates, Inc.
CONSULTANTS

WINYAH GENERATING STATION–ASH POND B
LOG OF BORING NO. B-1

LOCATION
STATION: ~46+00 DISTANCE: 19'
SURFACE EL: 33.6'

ELEV. (FEET M.S.L.)	DEPTH (FEET)	SAMPLE NO. AND TYPE	DESCRIPTION	USCS SYMBOL	REMARKS
	0	1 16 20	MEDIUM DENSE, REDDISH BROWN TO DARK GRAY, FINE, CLAYEY SAND, MOIST	sc	0'–15' FILL
30					
	5	2 19 40	5.5'	sc sp	
	10	3 20 36	DENSE, LIGHT TO DARK GRAY, FINE SAND, TRACE SILT, WET	sp	
20					
	15	4 18 37	15.0'	sp	15.0'–30.0' FOUNDATION SOILS
	20	5 22 12	MEDIUM DENSE, BROWNISH GRAY TO DARK BLACKISH BROWN, FINE SAND, TRACE TO SOME SILT, WET	sp	
10					
	25	6 20 12		sp	SLIGHT ORGANIC ODOR
		7 24 9	28.0' LOOSE, DARK BROWNISH GRAY, FINE SAND, TRACE SILT, WET 30.0'	sp	SLIGHT ORGANIC ODOR
3.6	30		BOTTOM OF BORING 30.0'		
	35				

PENETRATION RESISTANCE (BLOWS PER FOOT)



PROJECT NO.: 93–1356
DATE STARTED: 10–21–93
DATE COMPLETED: 10–21–93
FIELD GEOLOGIST: JDH
CHECKED BY: JTO

GWL: DEPTH ~11' DATE/TIME 0820 10–21–93
GWL: DEPTH ____ DATE/TIME ____
DRILLING METHOD: 4 1/4" I.D. H.S.A., SPT SAMPLING (140 lb HAMMER, 30" DROP, 2 WRAPS ON CATHEAD)

NOTES:
CONTRACTOR: S&ME
RIG: CME 55
DRILLER: Chris Simril
Distance under location is from ash pond water edge.
All elevations are from NGVD.

F-237
ADM 12/3/93

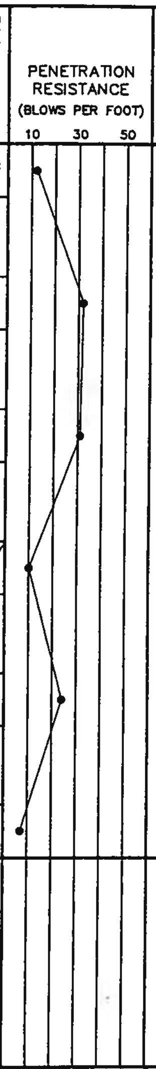
BORING NO. B-1
SHEET 1 OF 1

Paul C. Rizzo Associates, Inc.
CONSULTANTS

WINYAH GENERATING STATION–ASH POND B
LOG OF BORING NO. B-2

LOCATION
STATION: ~37+50 DISTANCE: 20.5'
SURFACE EL: 33.7'

ELEV. (FEET M.S.L.)	DEPTH (FEET)	SAMPLE NO. AND TYPE	DESCRIPTION	USCS SYMBOL	REMARKS
	0	1 18 12	MEDIUM DENSE, REDDISH BROWN AND GRAY, FINE TO MEDIUM CLAYEY SAND, SOME CLAY LENSES, MOIST 2.0'	sc	0'–15' FILL
30	5	2 24 32	DENSE, GRAY, FINE TO MEDIUM SAND, TRACE SILT, MOIST TO WET	sp	
20	10	3 20 31	15.0'	sp	
	15	4 17 10	LOOSE, TANNISH GRAY, FINE TO MEDIUM, CLAYEY TO VERY CLAYEY SAND AND STIFF CLAY, WET 20.0'	sc/cl	15.0'–27.0' FOUNDATION SOILS
10	20	5 24 24	MEDIUM DENSE, TANNISH TO PALE GRAY, FINE TO MEDIUM SAND, TRACE CLAY, WET 25.0'	sp	
6.7	25	6 24 7	LOOSE, GRAY TO DARK GRAY, FINE TO MEDIUM SAND, WET 27.0'	sp	
	30		BOTTOM OF BORING 27.0'		
	35				



PROJECT NO.: 93-1356
DATE STARTED: 10-21-93
DATE COMPLETED: 10-21-93
FIELD GEOLOGIST: JDH
CHECKED BY: JTO

GWL: DEPTH ~13' DATE/TIME 1100 10-21-93
GWL: DEPTH ______ DATE/TIME ______
DRILLING METHOD: 4 1/4" I.D. H.S.A., SPT SAMPLING (140 lb HAMMER, 30" DROP, 2 WRAPS ON CATHEAD)

NOTES:
CONTRACTOR: S&ME
RIG: CME 55
DRILLER: Chris Simril
Distance under location is from ash pond water edge.
All elevations are from NGVD.

F-237
ADM 12/3/93

BORING NO. B-2

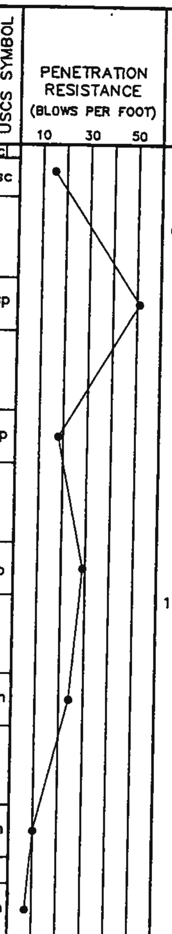
WINYAH GENERATING STATION—ASH POND B
LOG OF BORING NO. B-3

LOCATION

STATION: ~29+50 DISTANCE: 19'

SURFACE EL: 33.8'

ELEV. (FEET M.S.L.)	DEPTH (FEET)	SAMPLE NO. AND TYPE	DESCRIPTION	USCS SYMBOL	REMARKS
	0	1 (16 / 15)	MEDIUM STIFF, REDDISH BROWN, SANDY CLAY, MOIST 0.5'	cl	0'-17' FILL
			MEDIUM DENSE, GRAYISH BROWN, MEDIUM SAND, MOIST 3.0'	sc	
30	5	2 (20 / 51)	VERY DENSE, DARK GRAY TO BLACK, FINE TO MEDIUM SAND, TRACE CLAY LENSES, MOIST 10.0'	sp	CUTTINGS TURNING BLACK
20	10 15	3 (18 / 18) 4 (17 / 29)	MEDIUM DENSE, TAN, LIGHT TO DARK GRAY AND BLACK, FINE SAND, TRACE SILT, MOIST TO WET 17.0'	sp sp	
10 3.8	20 25 30	5 (20 / 24) 6 (24 / 10) 7 (24 / 7)	LOOSE TO MEDIUM DENSE, DARK GRAY TO DARK GRAYISH BROWN AND BLACK, FINE, SILTY SAND, WET 30.0'	sm sm sm	17.0'-30.0' FOUNDATION SOILS
	35		BOTTOM OF BORING 30.0'		



PROJECT NO.: 93-1356
DATE STARTED: 10-21-93
DATE COMPLETED: 10-21-93
FIELD GEOLOGIST: JDH
CHECKED BY: JTO

GWL: DEPTH ~13' DATE/TIME 1300 10-21-93
GWL: DEPTH ______ DATE/TIME ______
DRILLING METHOD: 4 1/4" I.D. H.S.A., SPT SAMPLING (140 lb HAMMER, 30" DROP, 2 WRAPS ON CATHEAD)

NOTES:
CONTRACTOR: S&ME
RIG: CME 55
DRILLER: Chris Simril
Distance under location is from ash pond water edge.
All elevations are from NGVD.

F-237
AOM 12/3/93

Paul C. Rizzo Associates, Inc.
CONSULTANTS

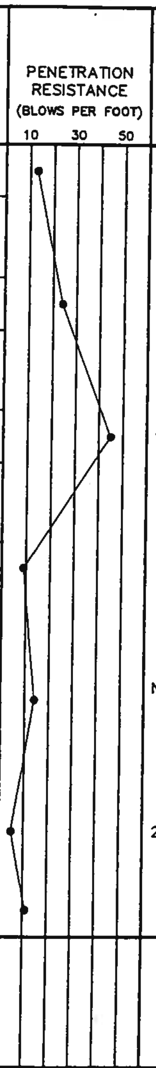
WINYAH GENERATING STATION–ASH POND B
LOG OF BORING NO. B-4

LOCATION

STATION: ~20+00 DISTANCE: 17.5'

SURFACE EL: 33.8'

ELEV. (FEET M.S.L.)	DEPTH (FEET)	SAMPLE NO. AND TYPE	DESCRIPTION	USCS SYMBOL	REMARKS
	0	1 18 13	MEDIUM DENSE TO DENSE, DARK GRAY, TAN, AND BROWNISH GRAY, FINE SAND, TRACE SILT, MOIST	sp	0'–12' FILL
30					
	5	2 18 24		sp	TRACE CLAY LENSES WOOD FRAGMENTS
	10	3 20 45	12.0'	sp	WOOD FRAGMENTS
					12.0'–30.0' FOUNDATION SOILS
20			LOOSE TO MEDIUM DENSE, DARK GRAY TO BLACK, FINE TO MEDIUM, CLAYEY SAND, WET		
	15	4 16 9		sc	
	20	5 0 14		–	NO SAMPLE WOOD FRAGMENT BLOCKING SPOON
10			25.0'		
	25	6 16 5	LOOSE TO MEDIUM DENSE, DARK GRAY TO BLACK, FINE SILTY SAND, WET	sm	2" WOOD FRAGMENTS
		7 16 11		sm	
3.8	30		30.0'		
			BOTTOM OF BORING 30.0'		
	35				



PROJECT NO.: 93-1356
DATE STARTED: 10-21-93
DATE COMPLETED: 10-21-93
FIELD GEOLOGIST: JDH
CHECKED BY: JTO

GWL: DEPTH ~12' DATE/TIME 1410 10-21-93
GWL: DEPTH ____ DATE/TIME ____
DRILLING METHOD: 4 1/4" I.D. H.S.A., SPT SAMPLING (140 lb HAMMER, 30" DROP, 2 WRAPS ON CATHEAD)

NOTES:
CONTRACTOR: S&ME
RIG: CME 55
DRILLER: Chris Simril
Distance under location is from ash pond water edge.
All elevations are from NGVD.

F-237
ADM 12/3/93

BORING NO. B-4
SHEET 1 OF 1

Paul C. Rizzo Associates, Inc.
CONSULTANTS

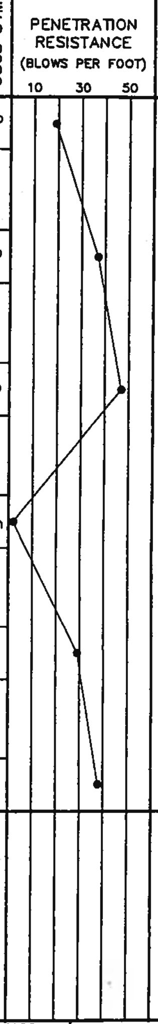
WINYAH GENERATING STATION–ASH POND B
LOG OF BORING NO. B-5

LOCATION

STATION: ~10+50 DISTANCE: 16'

SURFACE EL: 34.3'

ELEV. (FEET M.S.L.)	DEPTH (FEET)	SAMPLE NO. AND TYPE	DESCRIPTION	USCS SYMBOL	REMARKS
30	0 – 5.0'	1 17 19	MEDIUM DENSE, BROWN TO GRAY BROWN, FINE SAND, TRACE CLAY LENSES, MOIST	sp	0'–12' FILL 1/2" CLAY LENS
	5.0' – 12.0'	2 24 37	DENSE, BROWN TO BLACK, FINE SAND, TRACE SILT, MOIST TO WET	sp	WOOD FRAGMENTS
		3 15 47		sp	WOOD FRAGMENTS 12.0'–27.0' FOUNDATION SOILS
20	12.0' – 17.0'	4 24 2	LOOSE, DARK BROWN TO BLACK, SILTY SAND, WET	sm	TRACE ROOTS IRON STAINING
10	17.0' – 27.0'	5 24 29	MEDIUM DENSE TO DENSE, BROWN, GRAYISH BROWN, AND BLACK, FINE SAND, TRACE SILT, WET	sp	WOOD FRAGMENTS SAND HEAVING INTO AUGER
7.3		6 24 38		sp	SAND HEAVING INTO AUGER
	27.0'		BOTTOM OF BORING 27.0'		



PROJECT NO.: 93-1356
DATE STARTED: 10-22-93
DATE COMPLETED: 10-22-93
FIELD GEOLOGIST: JDH/ADM
CHECKED BY: JTO

GWL: DEPTH ~12' DATE/TIME 1100 10-22-93
GWL: DEPTH ______ DATE/TIME ______
DRILLING METHOD: 4 1/4" I.D. H.S.A., SPT SAMPLING (140 lb HAMMER, 30" DROP, 2 WRAPS ON CATHEAD)

NOTES:
CONTRACTOR: S&ME
RIG: CME 55
DRILLER: Chris Simril
Distance under location is from ash pond water edge.
All elevations are from NGVD.

F-237
ADM 12/3/93

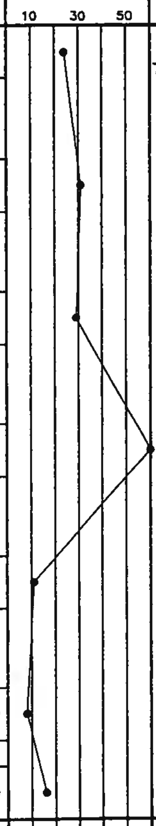
BORING NO. B-5
SHEET 1 OF 1

Paul C. Rizzo Associates, Inc.
CONSULTANTS

WINYAH GENERATING STATION–ASH POND B
LOG OF BORING NO. B–6

LOCATION
STATION: ~4+75 DISTANCE: 17'
SURFACE EL: 33.8'

ELEV. (FEET M.S.L.)	DEPTH (FEET)	SAMPLE NO. AND TYPE	DESCRIPTION	USCS SYMBOL	PENETRATION RESISTANCE (BLOWS PER FOOT)	REMARKS
	0	1 / 20 / 24	MEDIUM DENSE TO DENSE, BROWNISH GRAY, DARK GRAY, AND BLACK, FINE SAND, TRACE CLAY, MOIST TO WET	sp		0'–8' FILL TRACE CLAY LENSES
30						
	5	2 / 19 / 31		sp		
			8.0'			8.0'–30.0' FOUNDATION SOILS
	10	3 / 17 / 29	MEDIUM TO VERY DENSE, DARK GRAY TO BLACK, FINE SAND, TRACE SILT, WET	sp		WOOD FRAGMENTS AND ROOTS
20						
	15	4 / 19 / 62		sp	62	IRON STAINING
			20.0'			
	20	5 / 24 / 11	LOOSE TO MEDIUM DENSE, DARK GRAYISH BLACK, FINE SAND, TRACE SILT, WET	sp		
10						
	25	6 / 24 / 8		sp		SAND HEAVING INTO AUGER
		7 / 24 / 16		sp		
3.8	30		30.0'			
			BOTTOM OF BORING 30.0'			
	35					



PROJECT NO.: 93–1356
DATE STARTED: 10–22–93
DATE COMPLETED: 10–22–93
FIELD GEOLOGIST: JOH/ADM
CHECKED BY: JTO

GWL: DEPTH ~10' DATE/TIME 0950 10–22–93
GWL: DEPTH ____ DATE/TIME ____
DRILLING METHOD: 4 1/4" I.D. H.S.A.,
SPT SAMPLING (140 lb HAMMER, 30"
DROP, 2 WRAPS ON CATHEAD)

NOTES:
CONTRACTOR: S&ME
RIG: CME 55
DRILLER: Chris Simril
Distance under location is from ash pond water edge.
All elevations are from NGVD.

F–237
ADM 12/3/93

BORING NO. B–6
SHEET 1 OF 1

APPENDIX B

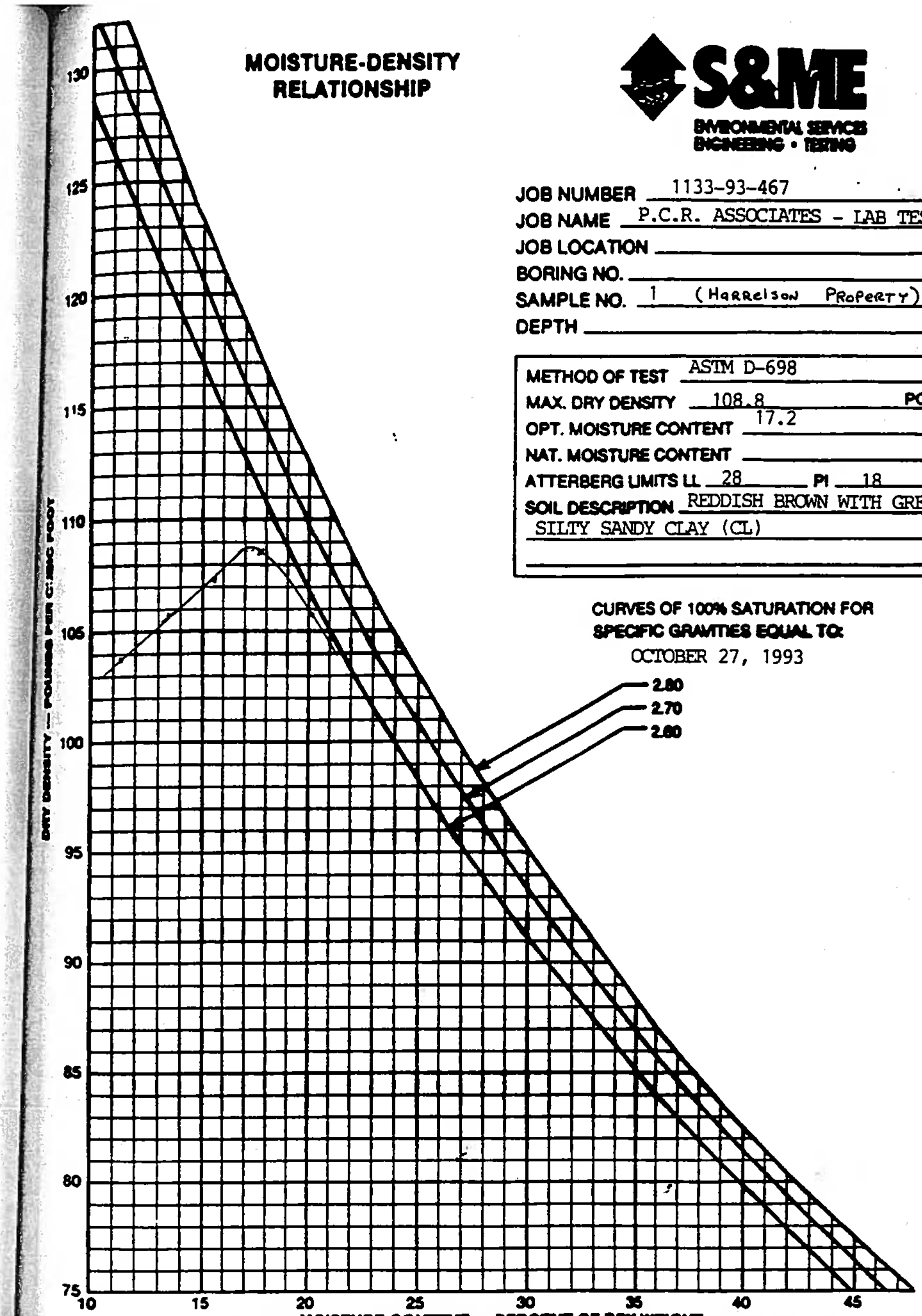
LABORATORY TEST RESULTS

MOISTURE-DENSITY RELATIONSHIP

S&ME
ENVIRONMENTAL SERVICES
ENGINEERING • TESTING

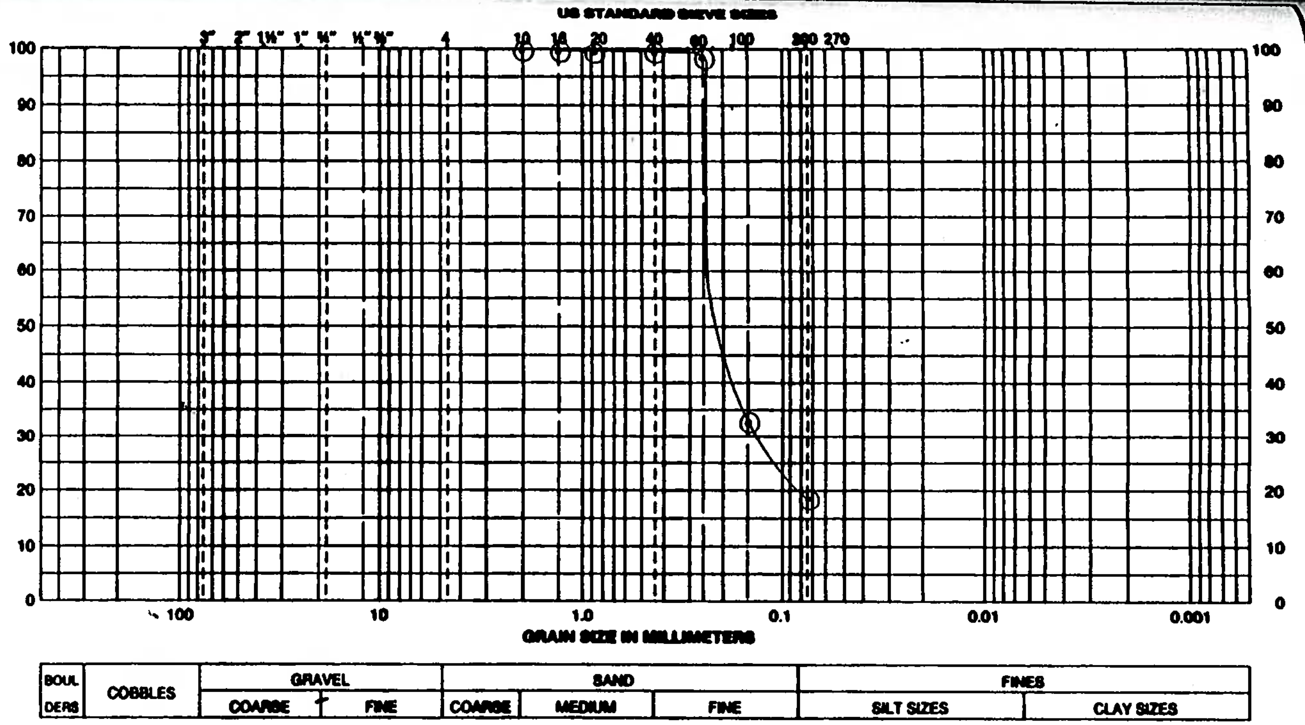
JOB NUMBER 1133-93-467
JOB NAME P.C.R. ASSOCIATES - LAB TESTING
JOB LOCATION
BORING NO.
SAMPLE NO. 1 (Harrelson Property)
DEPTH

METHOD OF TEST ASTM D-698
MAX. DRY DENSITY 108.8 PCF
OPT. MOISTURE CONTENT 17.2 %
NAT. MOISTURE CONTENT %
ATTERBERG LIMITS LL 28 PI 18
SOIL DESCRIPTION REDDISH BROWN WITH GREY SILTY SANDY CLAY (CL)



CURVES OF 100% SATURATION FOR SPECIFIC GRAVITIES EQUAL TO:

OCTOBER 27, 1993



BORING NO.	ELEV./DEPTH	NAT. WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
SAMPLE 1			28	18	10	CL - SANDY LEAN CLAY

JOB NO 1133-93-467

GRAIN SIZE DISTRIBUTION

S&ME
ENVIRONMENTAL SERVICES
ENGINEERING • TESTING

S&ME SFL-006
(REV 6/88)

CLAY??

MOISTURE-DENSITY RELATIONSHIP

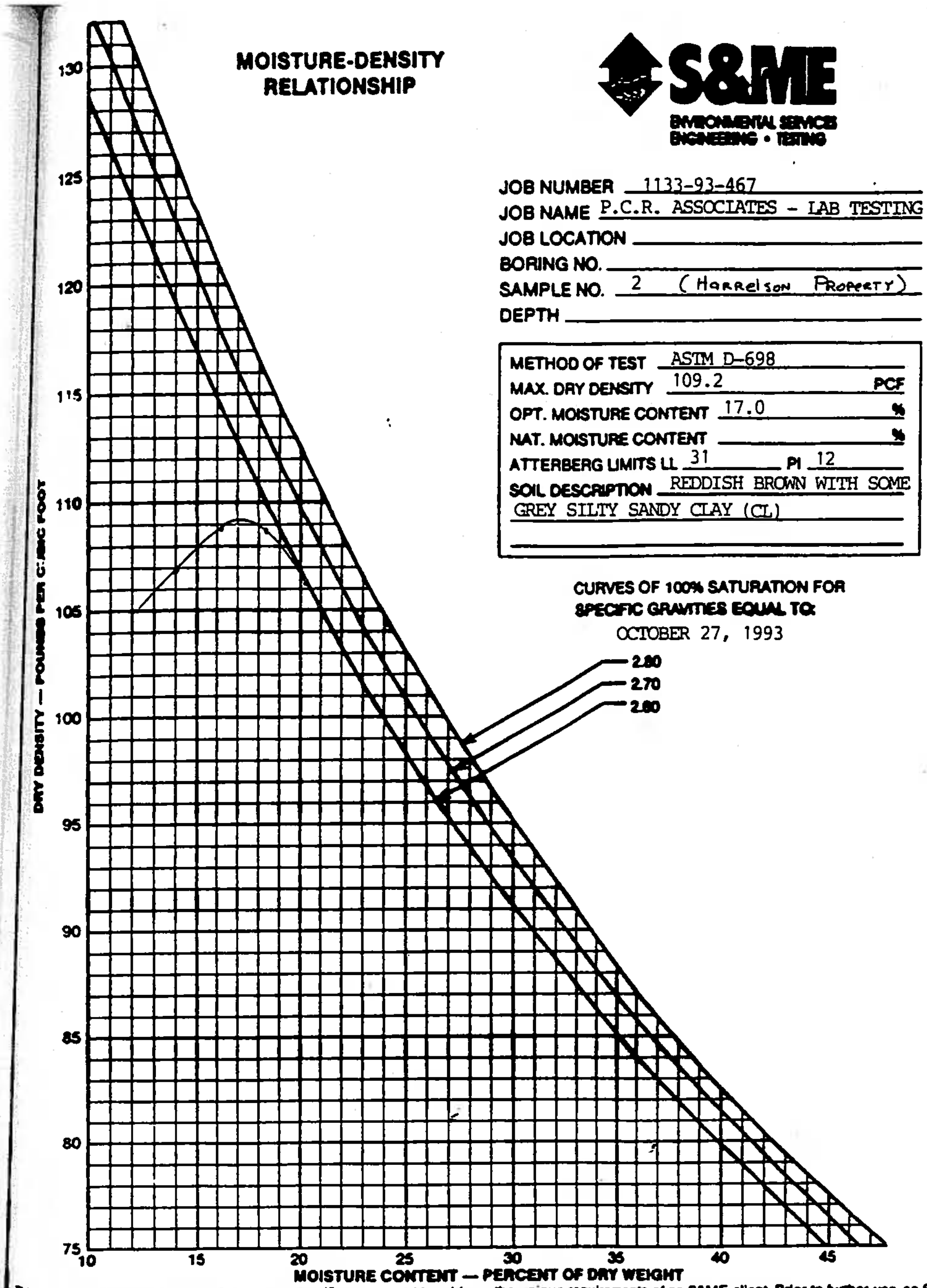
S&ME
ENVIRONMENTAL SERVICES
ENGINEERING • TESTING

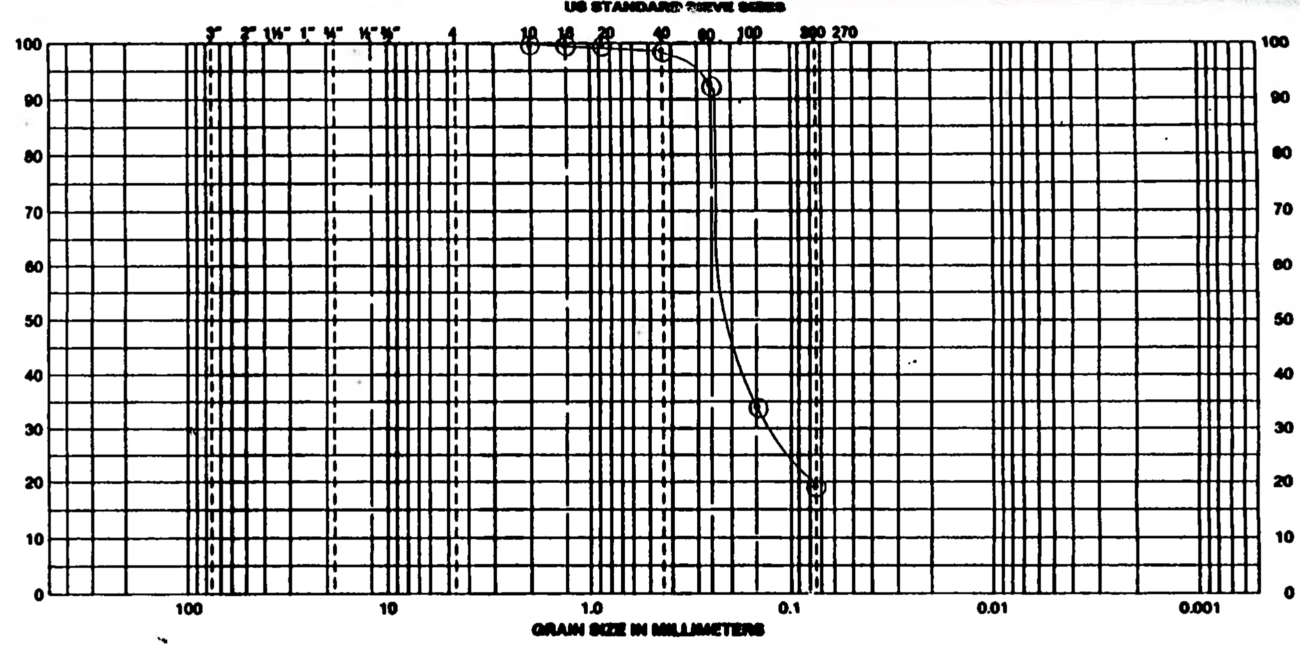
JOB NUMBER 1133-93-467
JOB NAME P.C.R. ASSOCIATES - LAB TESTING
JOB LOCATION
BORING NO.
SAMPLE NO. 2 (Harrelson Property)
DEPTH

METHOD OF TEST ASTM D-698
MAX. DRY DENSITY 109.2 PCF
OPT. MOISTURE CONTENT 17.0 %
NAT. MOISTURE CONTENT %
ATTERBERG LIMITS LL 31 PI 12
SOIL DESCRIPTION REDDISH BROWN WITH SOME GREY SILTY SANDY CLAY (CL)

CURVES OF 100% SATURATION FOR SPECIFIC GRAVITIES EQUAL TO:

OCTOBER 27, 1993





BOUL DERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO.	ELEV./DEPTH	NAT. WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
SAMPLE 2			31	19	12	CL - SANDY LEAN CLAY

JOB NO 1133-93-467

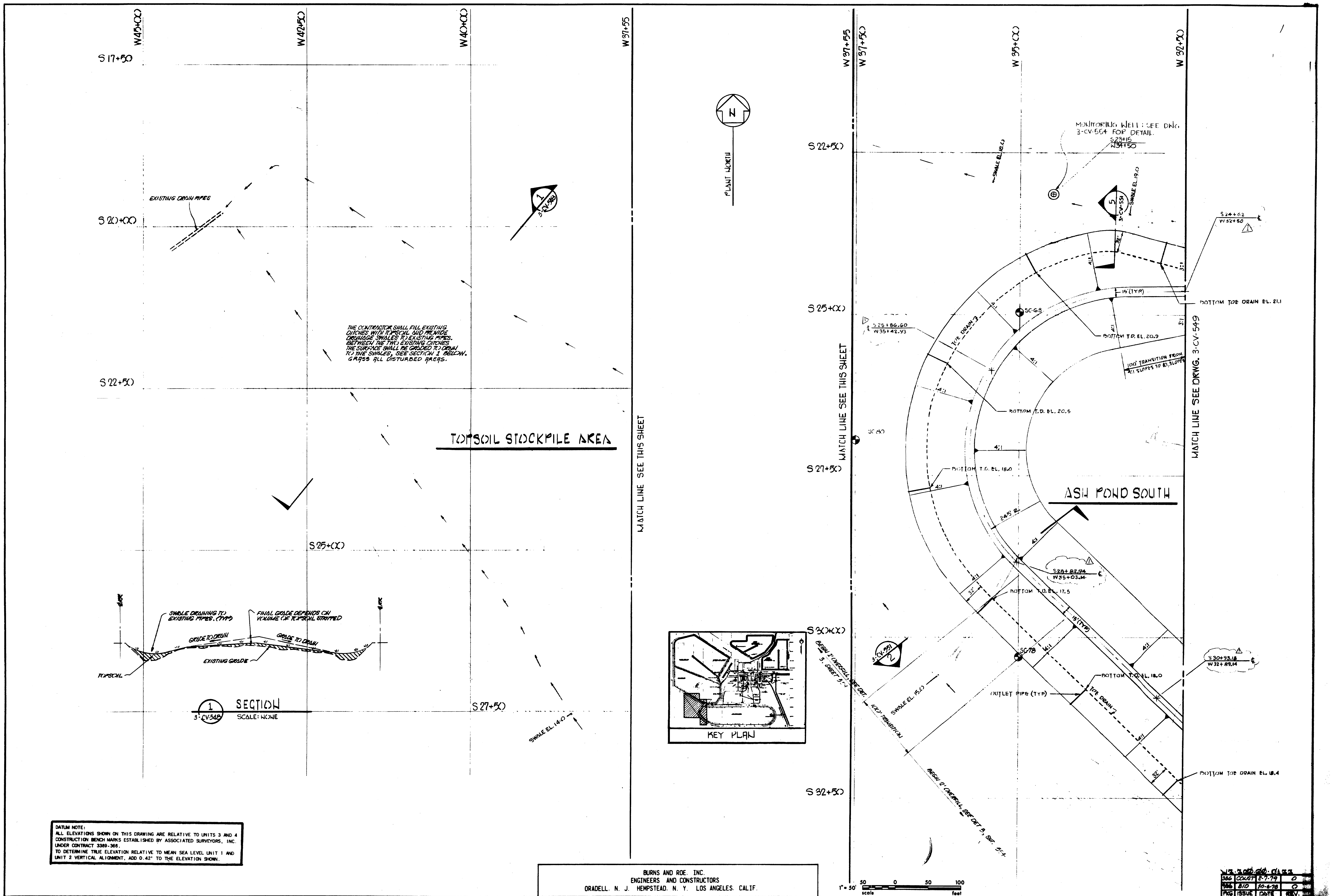
GRAIN SIZE DISTRIBUTION

S&ME
ENVIRONMENTAL SERVICES
ENGINEERING • TESTING

S&ME [illegible]
(REV. [illegible])

clay?
?.

Appendix A - Doc 1.5 South Ash Pond Impoundment Drawings



THE CONTRACTOR SHALL FILL EXISTING DITCHES WITH TOPSOIL AND PROVIDE DRAINAGE SWALES TO EXISTING PIPES. BETWEEN THE TWO EXISTING DITCHES THE SURFACE SHALL BE GRADED TO DRAIN TO THE SWALES, SEE SECTION 1 BELOW. GRASS ALL DISTURBED AREAS.

1 SECTION
3-CV-548
SCALE: NONE

DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-386.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

no	date	REVISION	by	ck.	appr.
1	12-12-79	REVISED AS PER AS BUILT DRAWINGS	BKB		
0	10-[illegible]	ISSUED FOR BIDS-CONTR. 386	G	PRD	
B	[illegible]	ISSUED FOR OWNER'S REVIEW	G		
A	[illegible]	B&R REVIEW			

drawn by B TURNER III
dept. ck. PR Duval A
dept. appr. Fred Glen
coord. ck.
p.m. appr. WX
B&R appr. M. J. Bri 1/29/80

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

sheet title
PLAN - ASH POND SOUTH
SHEET 1

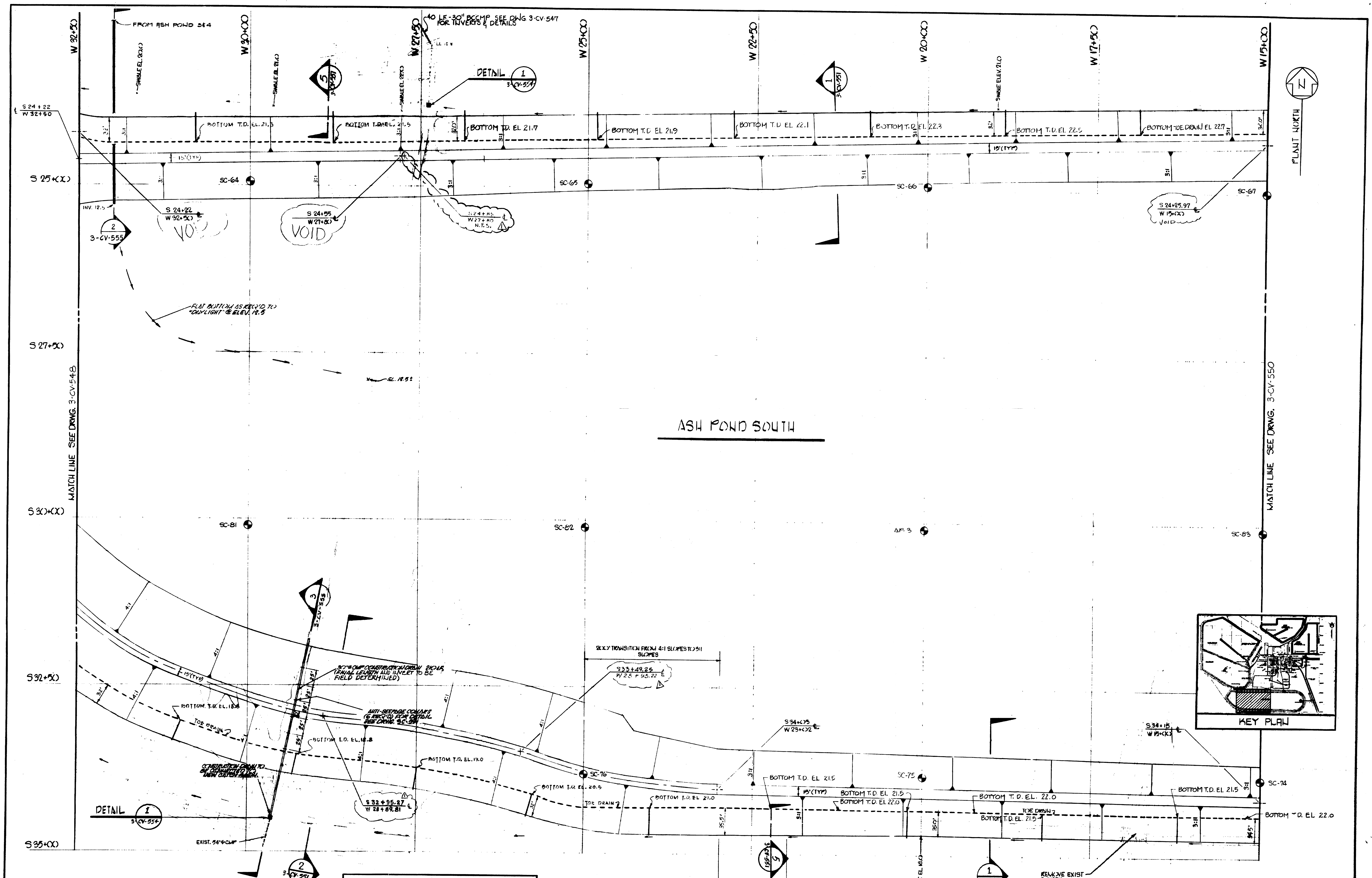
scale 1" = 50'
date 5-1-78

W3.300.00.0433

PKG	ISSUE	DATE	REV.
386	CONST	2-7-79	0
386	BID	10-6-78	0

L-G JOB NO. 77043.01
B&R W.O. NO. 3389
dwg. no. 3-CV-548
rev. 1

South Ash Pond



DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-366.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN

BURNS AND ROE. INC.
ENGINEERS AND CONSTRUCTORS
ORADELL. N. J. HEMPSTEAD. N. Y. LOS ANGELES. CALIF.

no	date	REVISION	by	ck.	appr.
1	[illegible]	REVISED AS PER AS BUILT DRAWINGS	[illegible]		
0	10-6-78	ISSUED FOR BIDS CONTR. 386	CW	PRD	
B	[illegible]	ISSUE FOR OWNER'S REVIEW	[illegible]		
A	[illegible]	B&R REVIEW			

drawn by B TURNER III
dept. ck. [illegible] DURALIA
dept. appr. Fred Glen
coord. ck.
p.m. appr. WS
B&R appr. M. J. Peri 1/29/80

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN. SOUTH CAROLINA

sheet title
PLAN - ASH POND SOUTH
SHEET 2

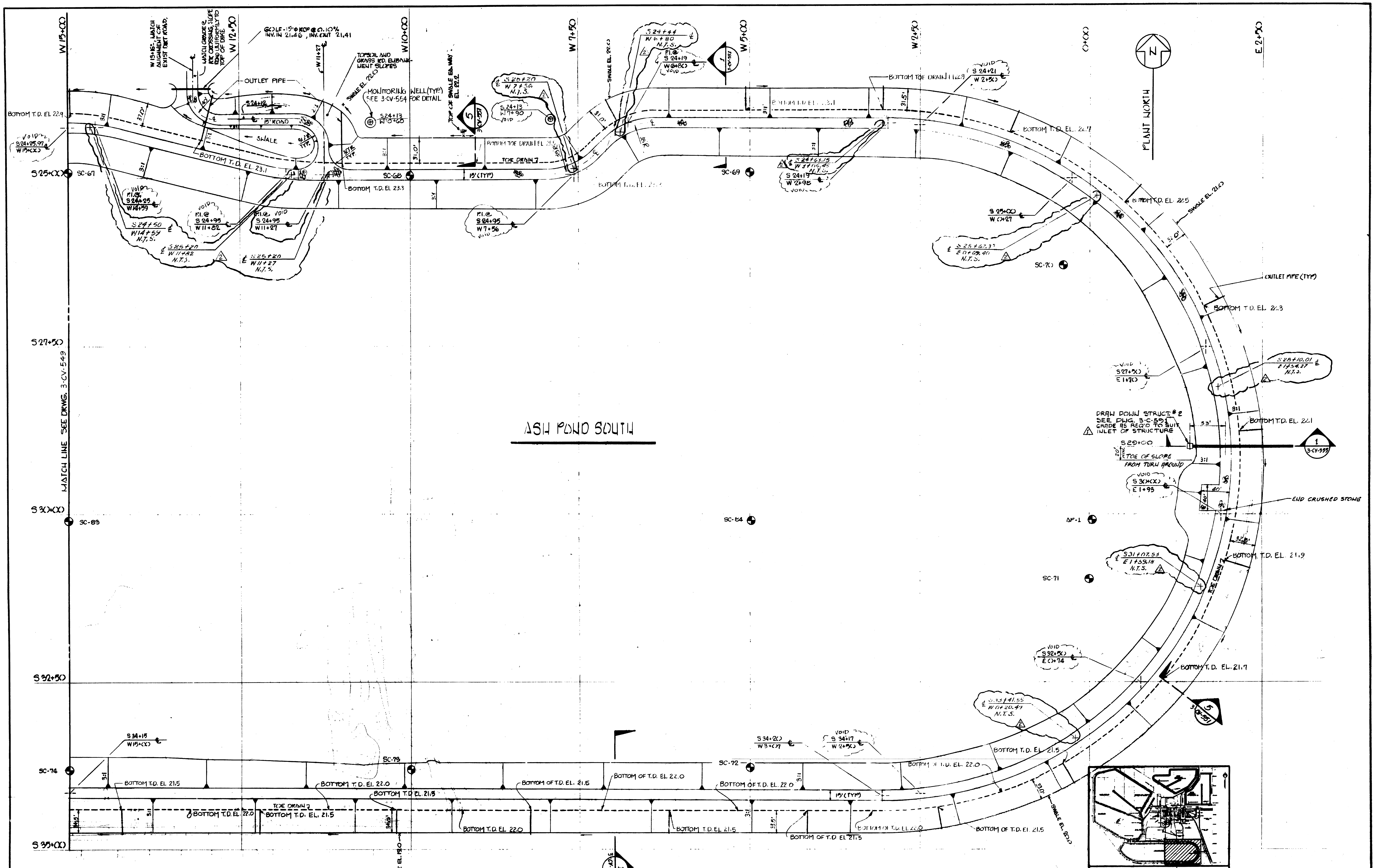
scale 1" = 50'
date 5·1·78

W3-300-60-0134

PKG.	ISSUE	DATE	REV.
386	CONST.	2-7-79	0
386	BID	10-6-78	0

L-G JOB NO. 77043.01
B&R W.O. NO. 3389
dwg. no. 3-CV-549
rev. 1

South Ash Pond



DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3309-386.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

no	date	REVISION	by	ck.	appr.
2	2-4-79	ADDED AS BUILT COORDINATES TO ℄ DIKE	BKB		
1	2-7-79	REVISED NOTE - FOR CONST. CONTR. 386	G	PRD	
0	10-6-78	ISSUED FOR BIDS - CONTR. 386	CW	PRD	
B	[illegible]	ISSUED FOR OWNER'S REVIEW	G		
A	5-5-78	B&R REVIEW			

drawn by B TURNER III
dept. ck. P.R. DUKALIA
dept. appr. Fred M Clun
coord. ck.
p.m. appr. WA
B&R appr. M. J. Peri 1/29/81

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

1" = 50' 50 0 50 100
scale feet

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

sheet title
PLAN - ASH POND SOUTH
SHEET 3

scale 1"=50'
date 5·1·78

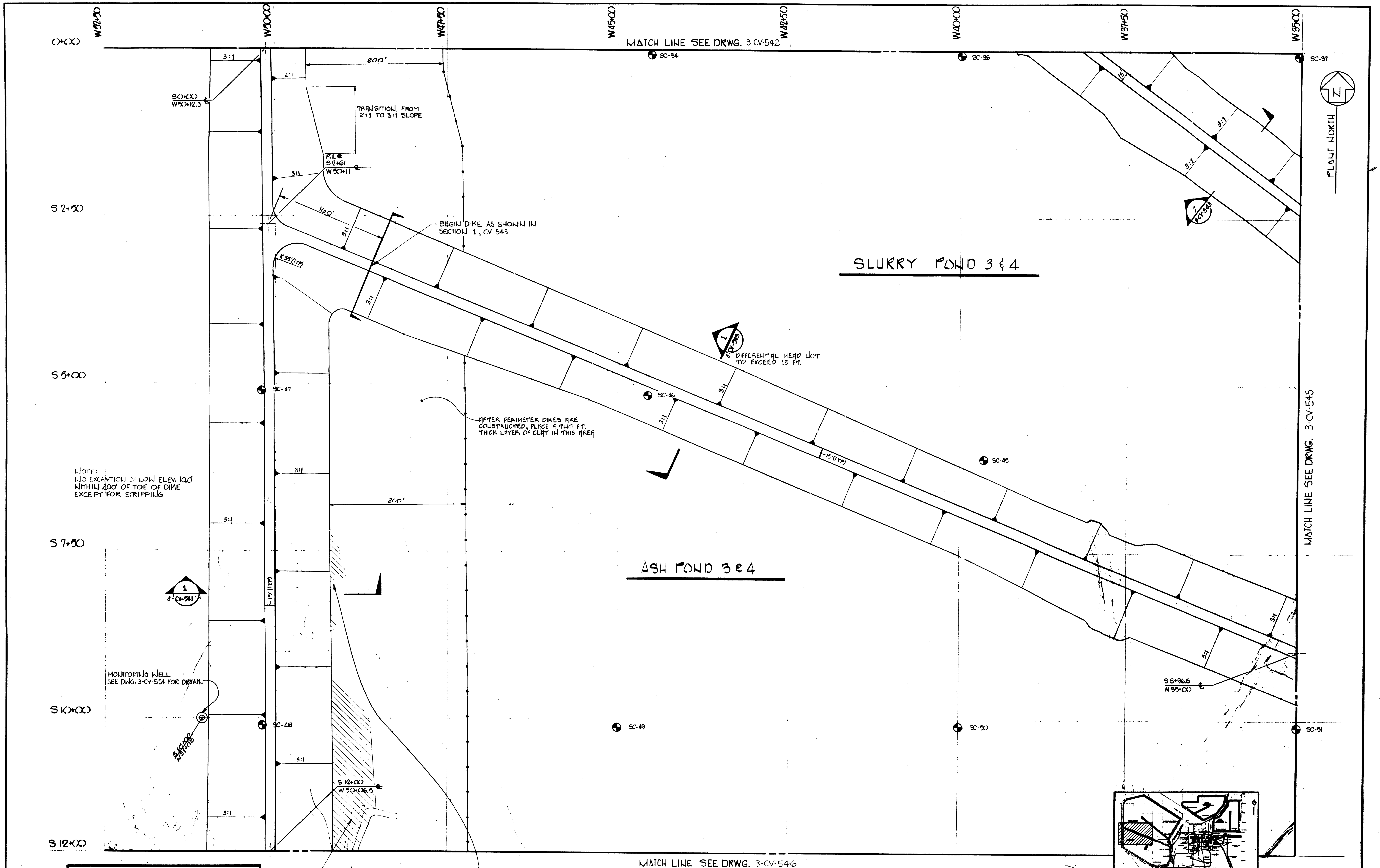
L-G JOB NO. 77043.01
B&R W.O. NO. 3309
dwg. no. 3-CV-550
rev 2

N3-300-00-0135

PKG.	ISSUE	DATE	REV
386	CONST	2-7-79	1
386	BID	10-6-78	0

South Ash Pond

Appendix A - Doc 1.6 Ash Pond 3&4 and Slurry Pond 3&4 Impoundment Drawings



FILL W/CLAY & COMPACT (AVAILABLE ON SITE) TO ELEV. 10.0 AFTER STRIPPING TOPSOIL

DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-366.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

1" = 50'
50 0 50 100
scale feet

W3-700-00-0128

386	Const	2-7-79	0
386	BID	10-6-78	0
PKG	ISSUE	DATE	REV

no	date	REVISION	by	ck.	appr.	no	date	REVISION	by	ck	appr.
0	[illegible]	ISSUED FOR BIDS - CONTR 386	G	PRD							
1	[illegible]	ISSUED FOR OWNER'S REVIEW	CN								
	[illegible]	B&R REVIEW									

drawn by B TURNER III
dept. ck. PR Duncan
dept. appr.
coord. ck.
p.m. appr. WK
B&R appr. 1/29/80

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

sheet title
PLAN - ASH POND 3 & 4
SHEET 1

scale
AS NOTED

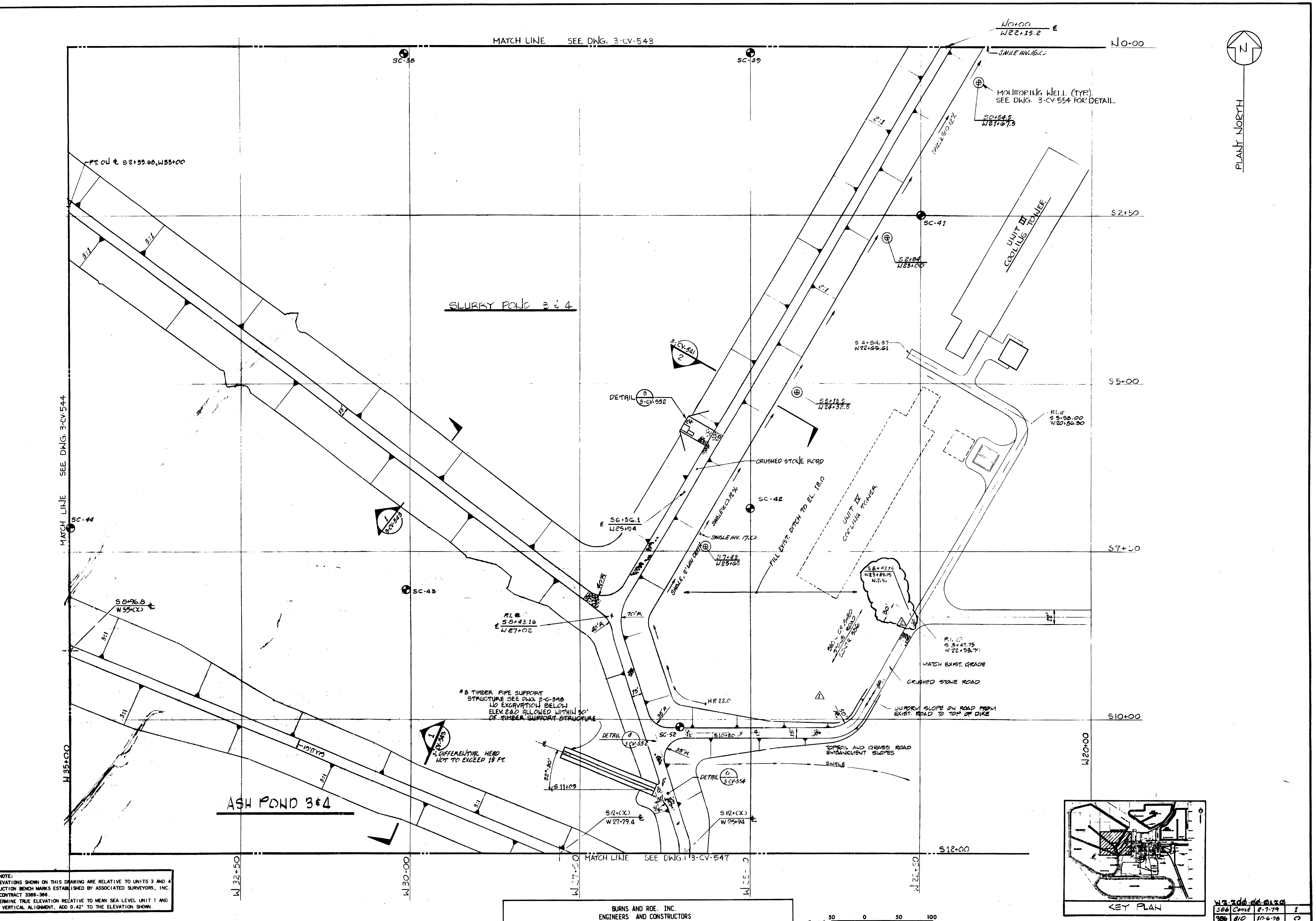
date
5-1-78

L-G JOB NO. 77043.01
B&R W.O. NO. 3389

dwg. no.
3-CV-544

rev.
0

West Ash Pond + 3-4 Slurry Pond



DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-366.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

no	date	REVISION	by	ck.	appr.
2	12-18-79	ADDED AS BUILT COORDINATE	BXB		
1	8-7-79	Revised road - issued for Const. Contr. 386	G	PRD	
0	10-6-78	ISSUED FOR BIDS - CONTR 386	G	PRD	
B	6-23-78	ISSUED FOR OWNER'S REVIEW			
A	5-5-78	B&R REVIEW			

drawn by TURNER, WALKER, CALDIS
dept. ck. PK Duralia
dept. appr.
coord. ck.
p.m. appr.
B&R appr. M.J. Penn 1/24/80

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

1" = 50' 50 0 50 100 scale feet

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

sheet title
PLAN - ASH POND 3 & 4
SHEET 2

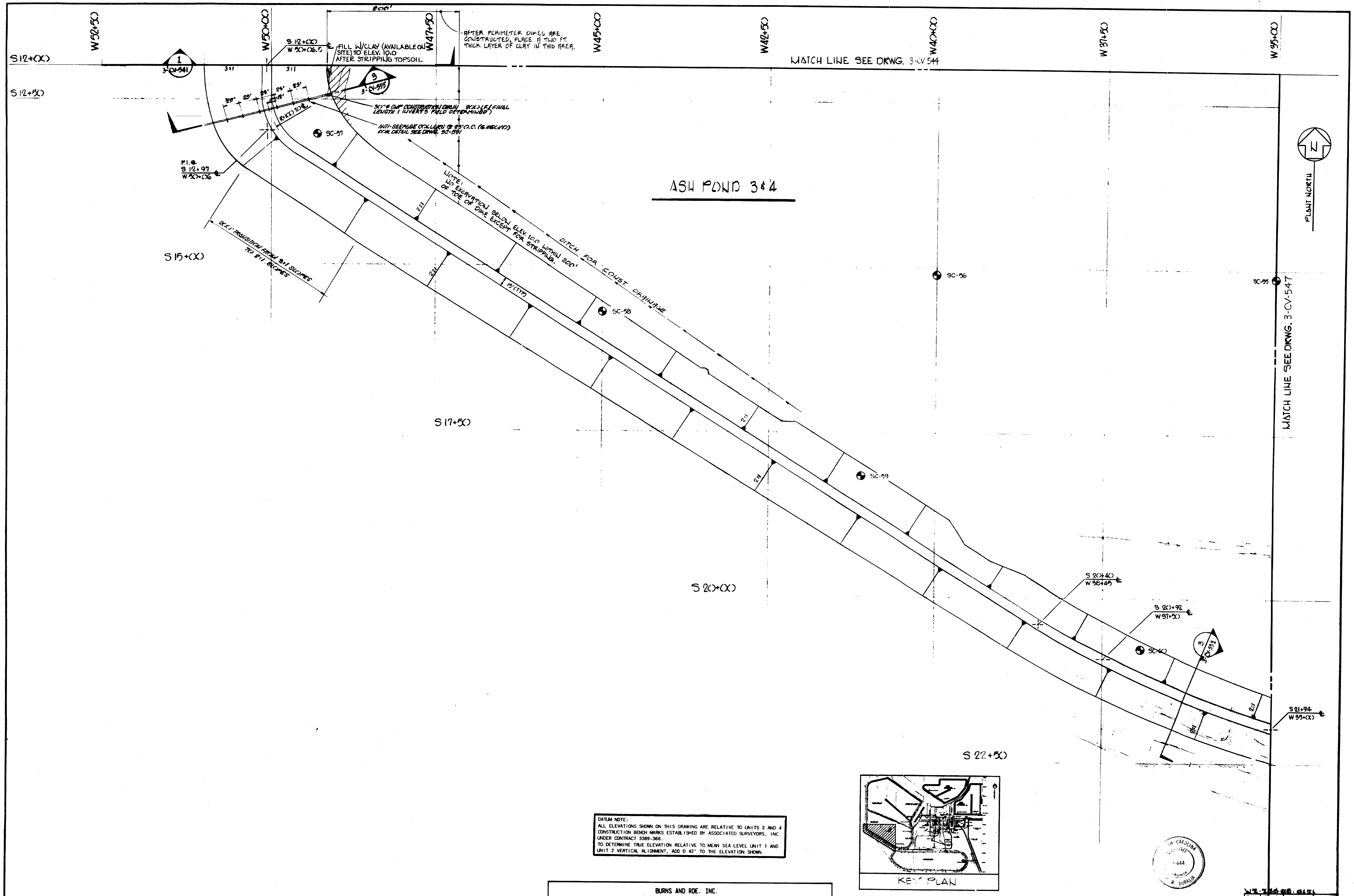
scale AS NOTED
date 5-1-78

W3-300-00-0130

PKG	ISSUE	DATE	REV
386	Const	8-7-79	1
386	BID	10-6-78	0

L-G JOB NO. 77043.01
B&R W.O. NO. 3389
dwg. no. 3-CV-545
rev. 2

3-4 Slurry Pond



DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-366.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

R. DURALIA
444

PKG	ISSUE	DATE	REV
386	Const	2-7-79	0
386	BID	10-6-78	0

no	date	REVISION	by	ck.	appr.
0	10-6-78	ISSUED FOR BIDS - CONTR 386	G	PRD	
B	6-29-78	ISSUED FOR OWNER'S REVIEW			
A	[illegible]	B&R REVIEW			

drawn by B. TURNER III
dept. ck. PR. Duralia
dept. appr. Fred Glenn
coord. ck.
p.m. appr.
B&R appr. M. J. [illegible] 1/29/80

BURNS AND ROE. INC.
ENGINEERS AND CONSTRUCTORS
ORADELL. N. J. HEMPSTEAD. N. Y. LOS ANGELES. CALIF.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN. SOUTH CAROLINA

sheet title
PLAN - ASH POND 3 & 4
SHEET 3

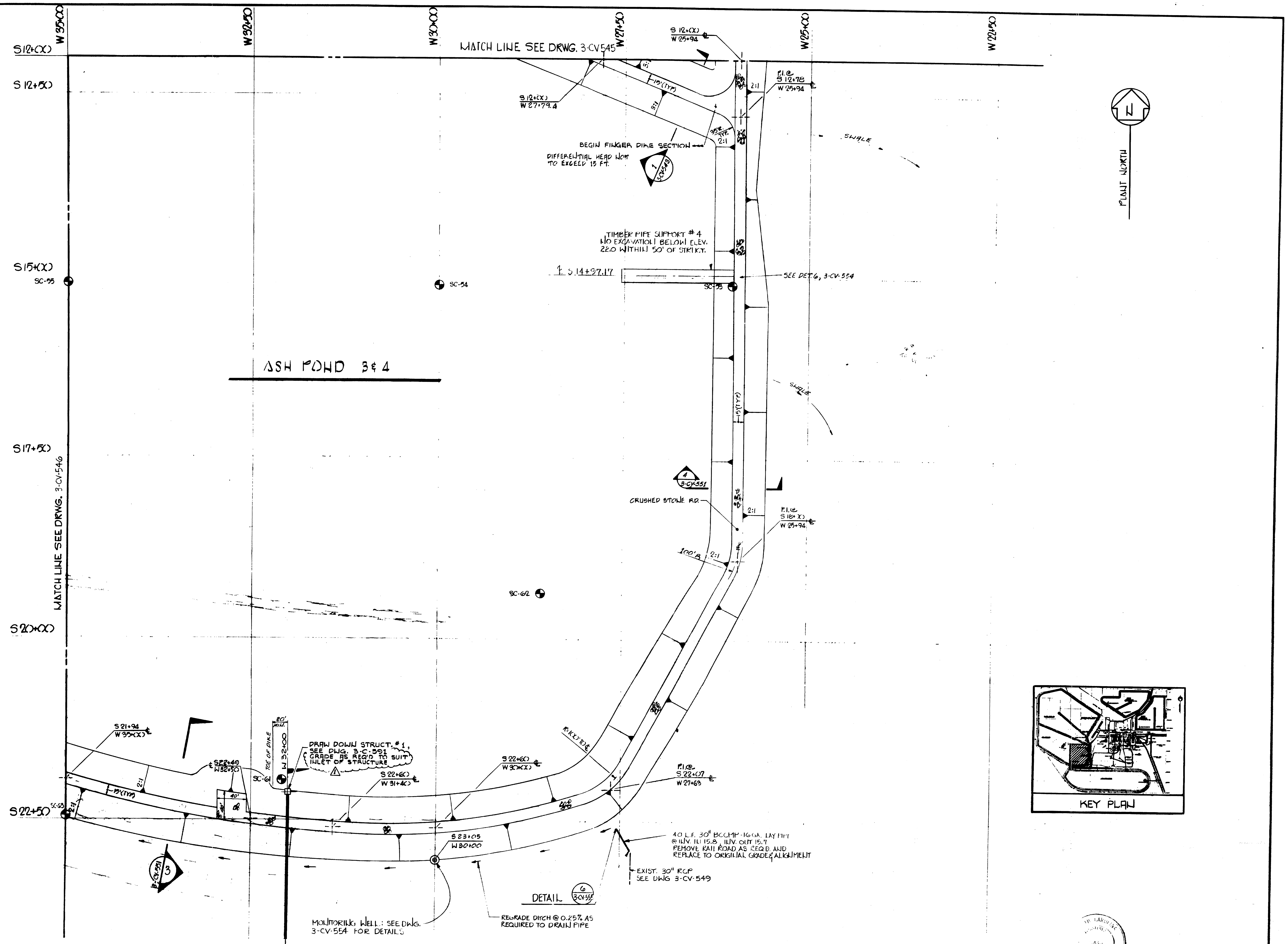
scale
AS NOTED

date
5-1-78

L-G JOB NO. 77043.01
B&R W.O. NO. 3389

dwg. no.
3-CV-546

rev.
0



DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-366.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

no	date	REVISION	by	ck.	appr.	no	date	REVISION	by	ck	appr
1	2-7-79	REVISED NOTE-FOR CONST. CONTR. 386	G	PRD							
0	10-6-78	ISSUED FOR BIDS - CONTR 386	G	PRD							
B	[illegible]	ISSUED FOR OWNER'S REVIEW	G								
A	[illegible]	B&R REVIEW									

drawn by B TUKNEK III
dept. ck. PK DURALIA
dept. appr.
coord. ck.
p.m. appr. WX
B&R appr. M.J. P[illegible] 1/29/80

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

1" = 50' scale 50 0 50 100 feet

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

sheet title
PLAN - ASH POND 3 & 4
SHEET 4

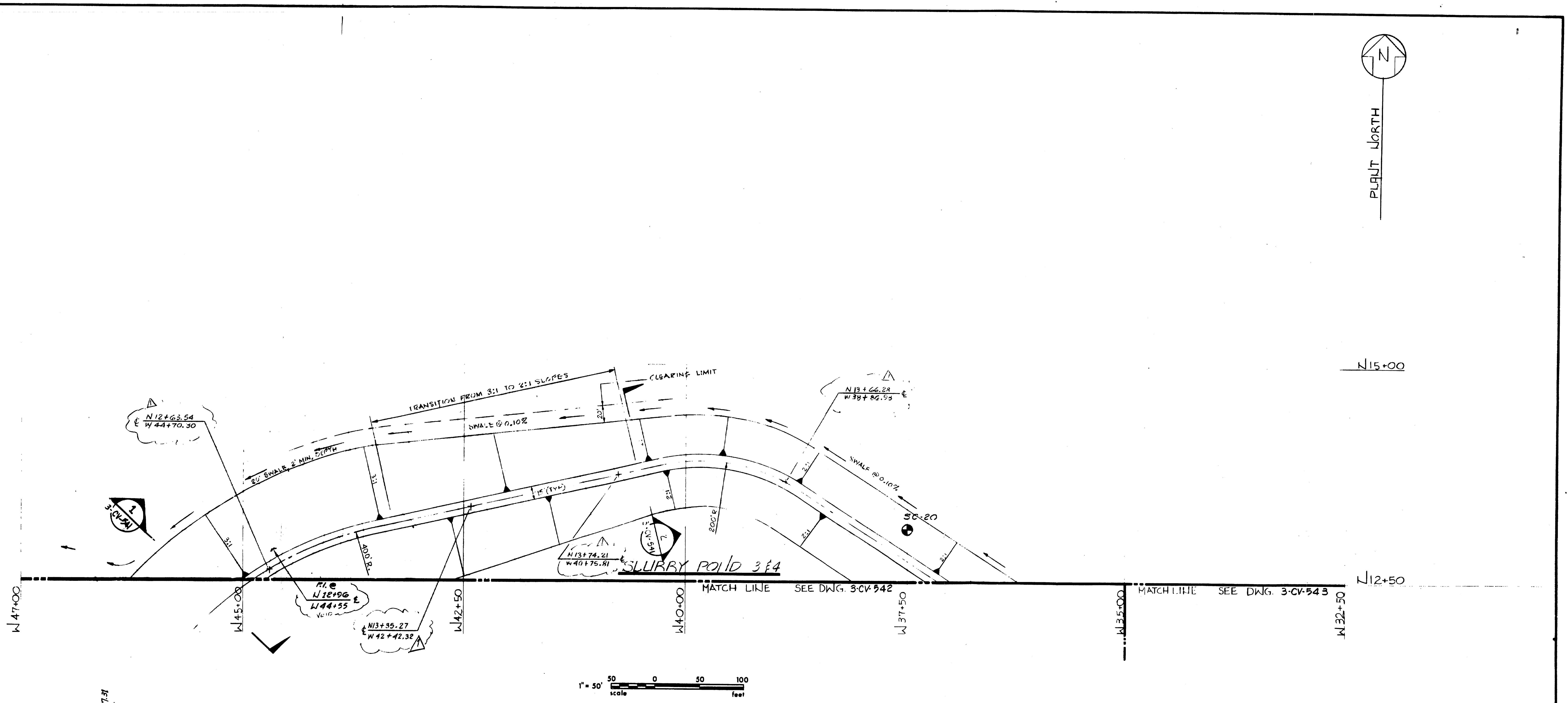
scale 1"=50'
date 5-1-78

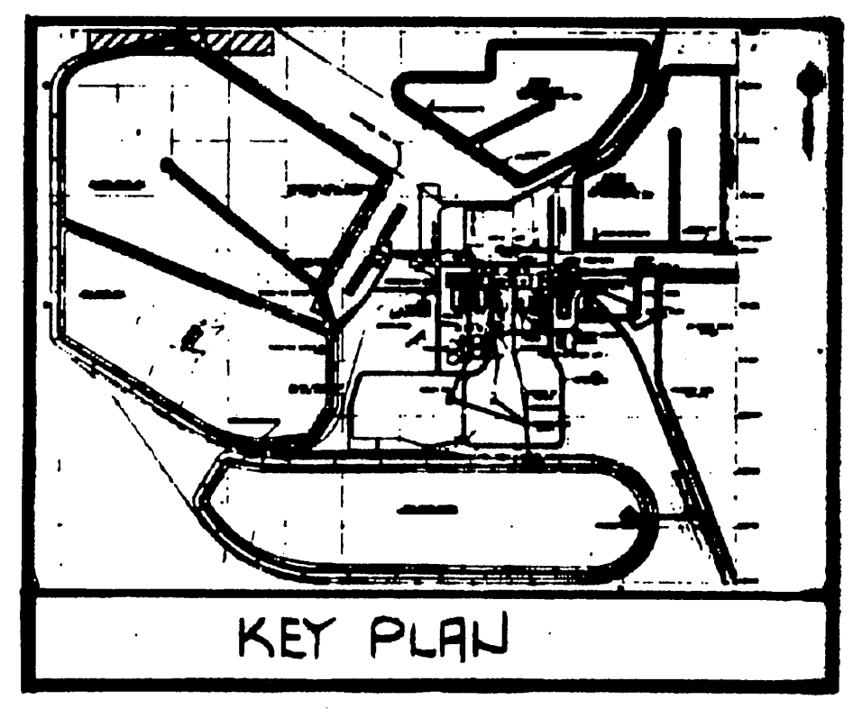
W3.300.00.0432

PKG	ISSUE	DATE	REV
386	Const	2-7-79	1
386	BID	10-6-78	0

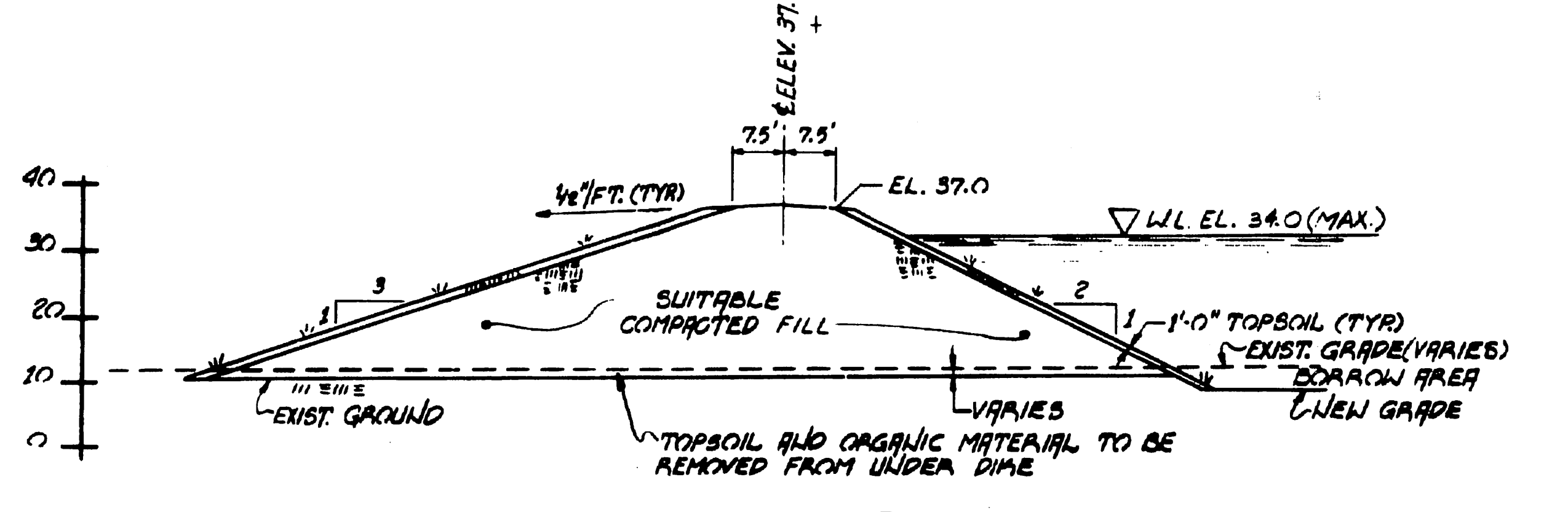
L-G JOB NO. 77043.01
B&R W.O. NO. 3389
dwg. no. 3-CV-547
rev.

West Ash Pond

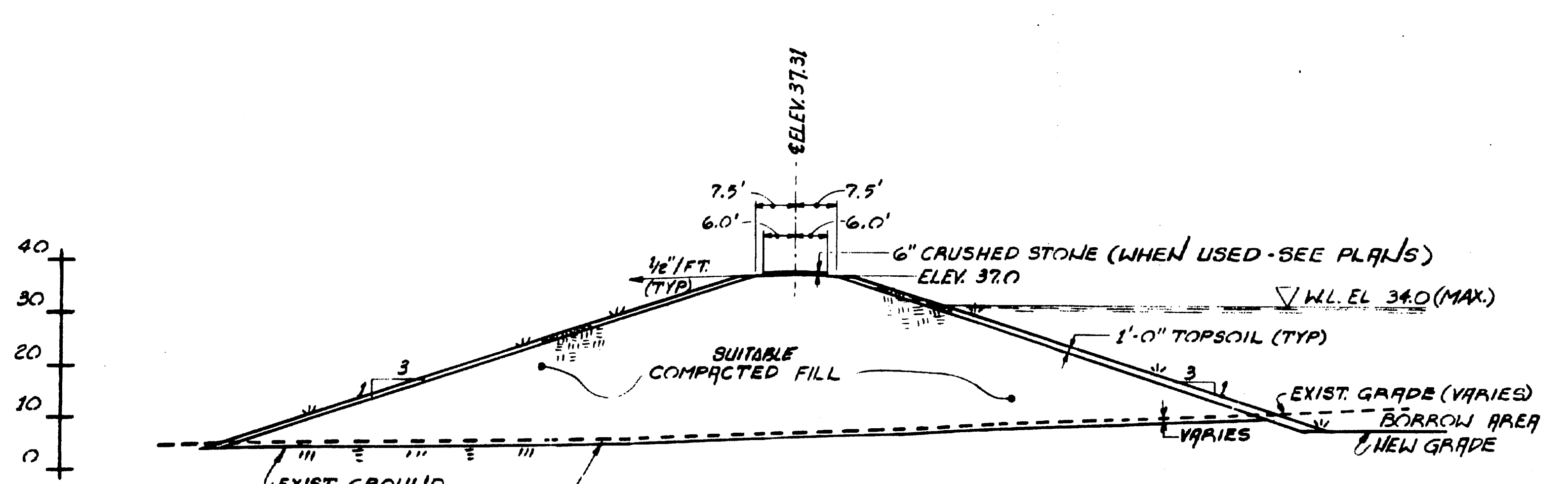




KEY PLAN

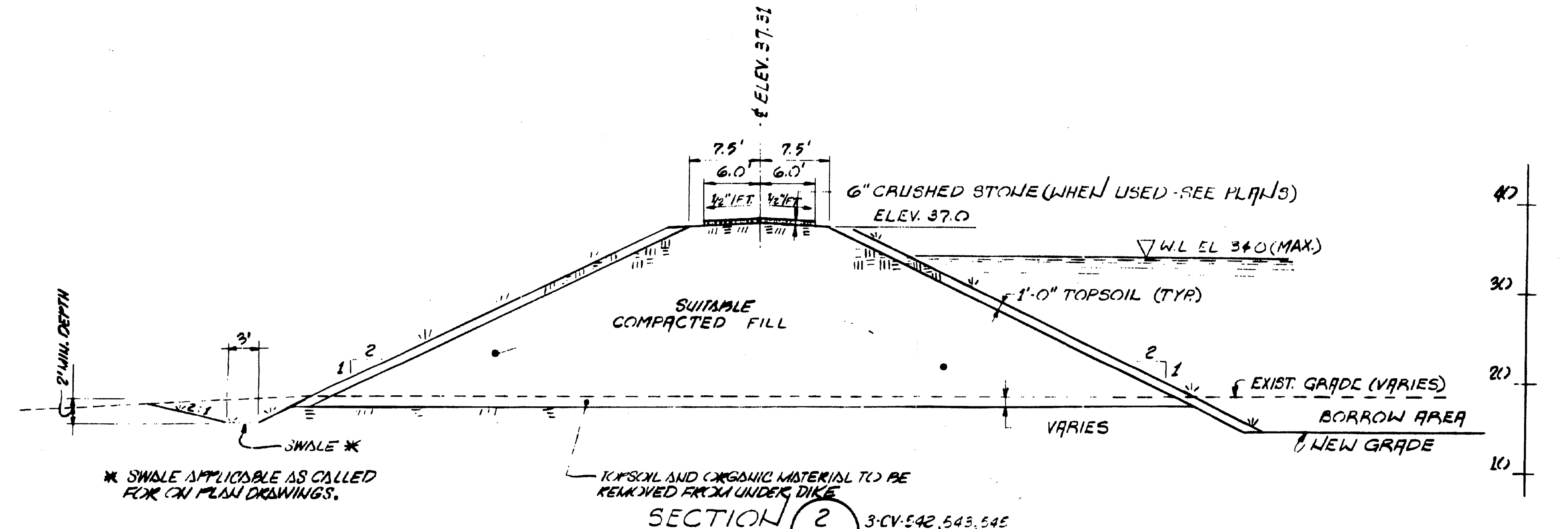


SECTION ③ 3-CV-542
SCALE: 1" = 20'-0" 3-CV-541



SECTION ① 3-CV-542, 544
SCALE: 1" = 20'-0" 3-CV-541

TYPICAL FOR DIKES WITH 3:1 SLOPES



SECTION ② 3-CV-542, 543, 545
SCALE 1" = 10'-0" 3-CV-541

TYPICAL FOR DIKES WITH 2:1 SLOPES

DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-366.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

CAROLINA

N3-300-00-0126

PKG	ISSUE	DATE	REV.
386	Const	2-7-79	0
386	BID	10-6-78	0

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

no	date	REVISION	by	ck.	appr.
1	12-14-79	REVISED AS PER AS BUILT DRAWINGS	BKB		
0	10-6-78	ISSUED FOR BIDS - CONTR. 386	G	PRD	
B	5-23-78	ISSUED FOR OWNER'S REVIEW	G		
A	5-2-78	B&R REVIEW			

drawn by Calaio
dept. ck. PR Dukalia
dept. appr. Nel Glen
coord. ck.
p.m. appr. WG
B&R appr. M. J. Peri 1/29/80

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

sheet title
PLAN - SLURRY POND 3 & 4
SHEET 1

scale
AS NOTED

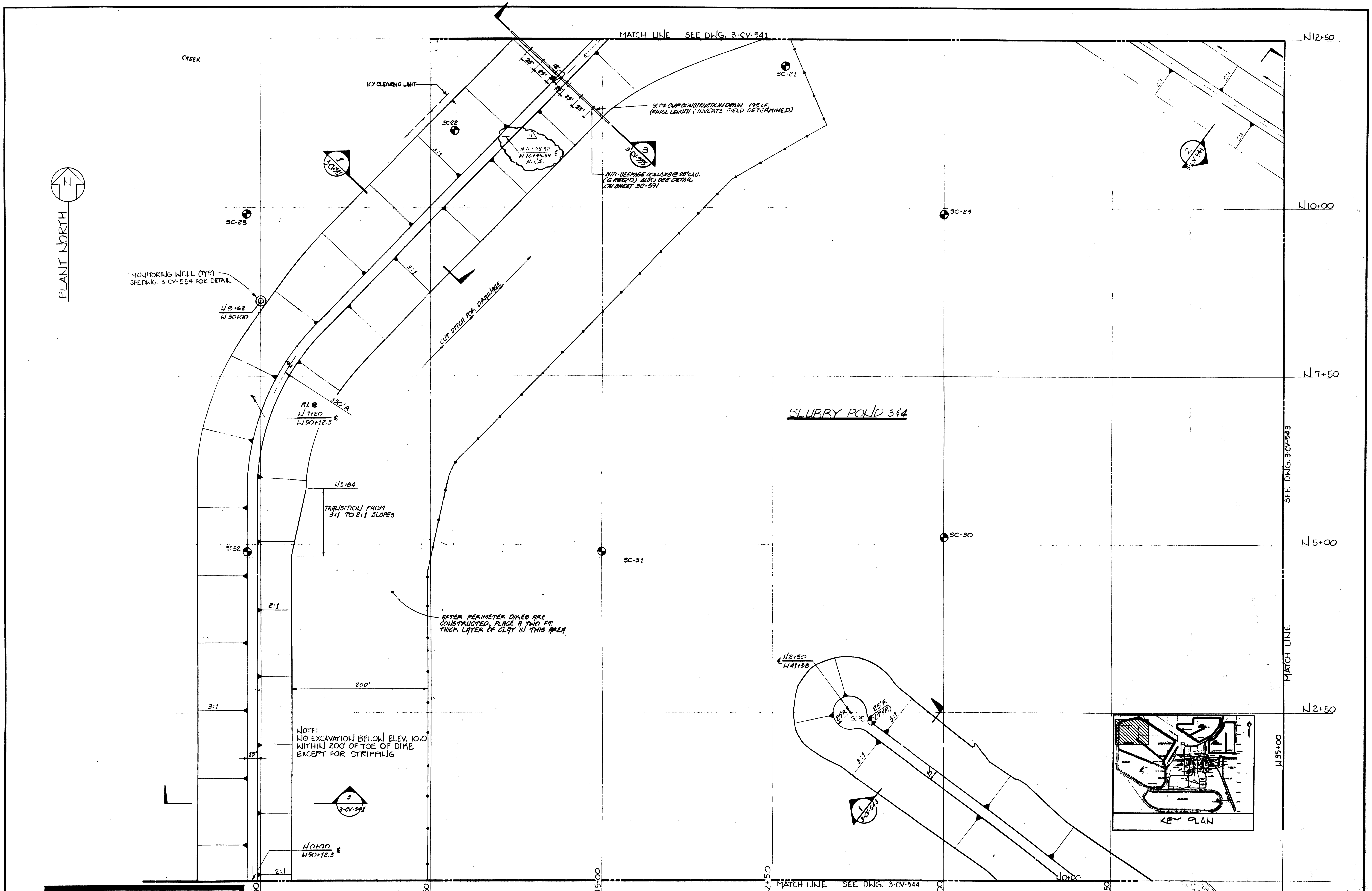
date
5-1-78

L-G JOB NO. 77043.01
B&R W.O. NO. 3389

dwg. no.
3-CV-541

rev.
1

3-4 Slurry Pond 2-3



DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-366.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

1" = 50' 50 0 50 100 scale feet

no	date	REVISION	by	ck.	appr.	no	date	REVISION	by	ck	appr
1	[illegible]	ADDED AS BUILT COORDINATES TO ℄ DIKE	[illegible]								
0	10-6-78	ISSUED FOR BIDS-CONTR. PKG	G	PRD							
B	[illegible]	ISSUED FOR OWNER'S REVIEW	CW/G								
A	[illegible]	B&R REVIEW									

drawn by G
dept. ck. F.R. DURALIA
dept. appr.
coord. ck.
p.m. appr. WS
B&R appr. M.J. Peri 1/29/80

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

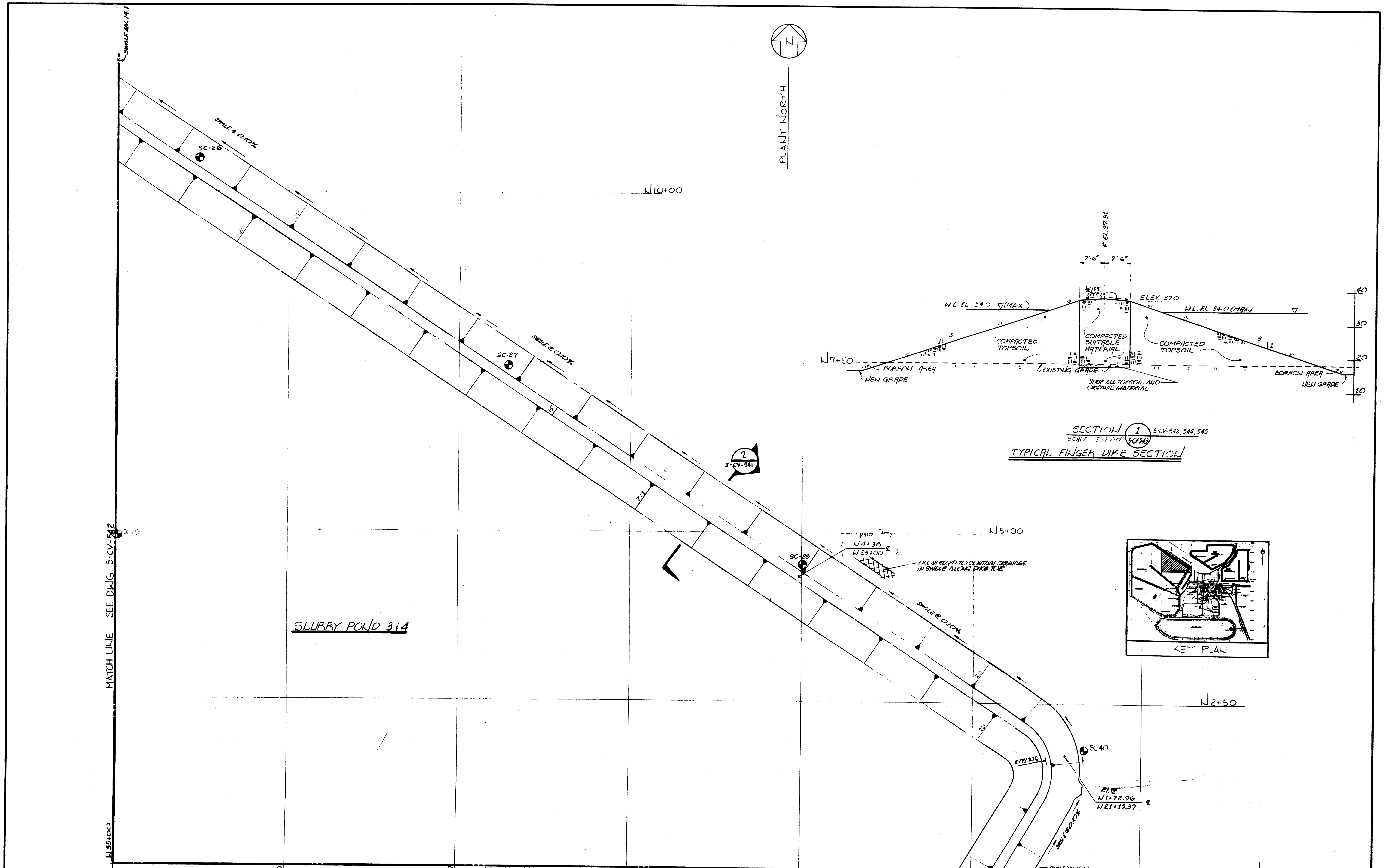
sheet title
PLAN - SLURRY POND 3 & 4
SHEET 2

scale AS NOTED
date 5-1-78
L-G JOB NO. 77043.01
B&R W.O. NO. 3389
dwg. no. 3-CV-542
rev. 1

W3-300-00-0127

386	Const	2-7-79	0
386	BID	10-6-78	0
PKG	ISSUE	DATE	REV

3-4 Slurry Pond



DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-368.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

no	date	REVISION	by	ck.	appr.	no	date	REVISION	by	ck	appr.
1	12-14-79	REVISED AS PER AS BUILT DRAWINGS	BKB								
0	10-6-78	ISSUED FOR BIDS - CONTR. 386	Co	PRD							
B	6-23-78	ISSUED FOR OWNER'S REVIEW	CW/Co								
A	5-2-78	B&R REVIEW									

drawn by Co
dept. ck. P.K. Dubacia
dept. appr. Fred Allen
coord. ck.
p.m. appr. WB
B&R appr. M. J. Barr 1/29/80

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

1" = 50' 50 0 50 100
scale feet

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

sheet title
PLAN - SLURRY POND 3 & 4
SHEET 3

scale
AS NOTED

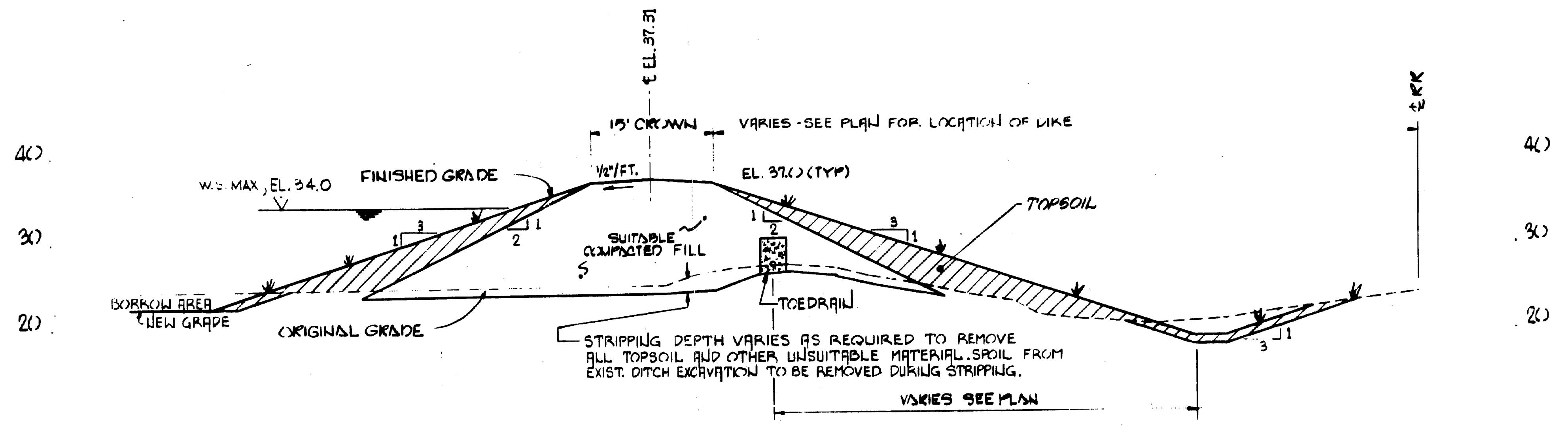
date
5-1-78

W3-300-00-0128

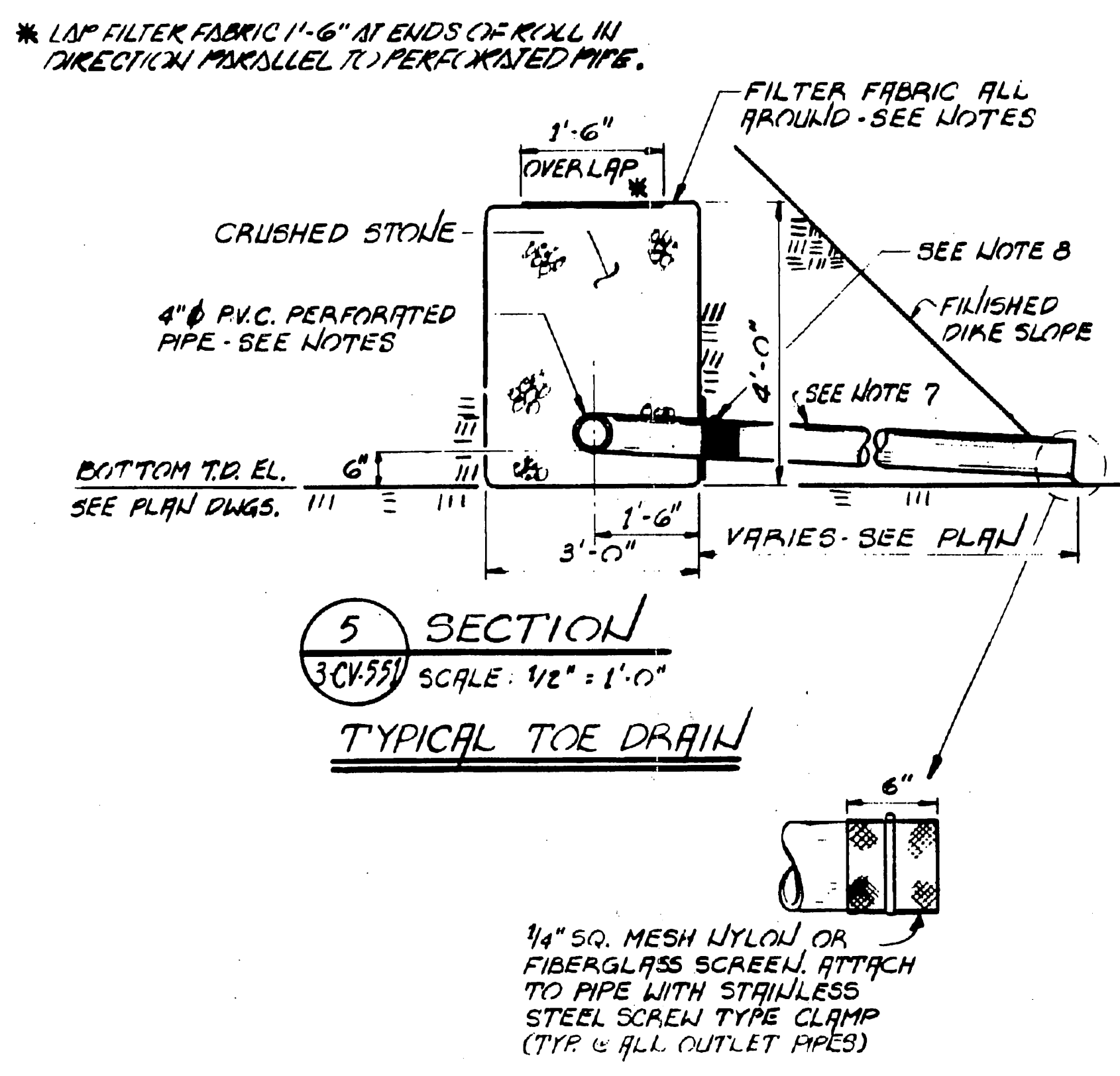
PKG	ISSUE	DATE	REV
386	Const	8-7-79	0
386	BID	10-6-78	0

L-G JOB NO. 77043.01
BSR W.O. NO. 3389
dwg. no. 3-CV-543
rev. 1

3-4 Slurry Pond



3-CV-549
3-CV-550
1
3-CV-551
SECTION
SCALE 1" = 10'



5
3-CV-551
SECTION
SCALE: 1/2" = 1'-0"

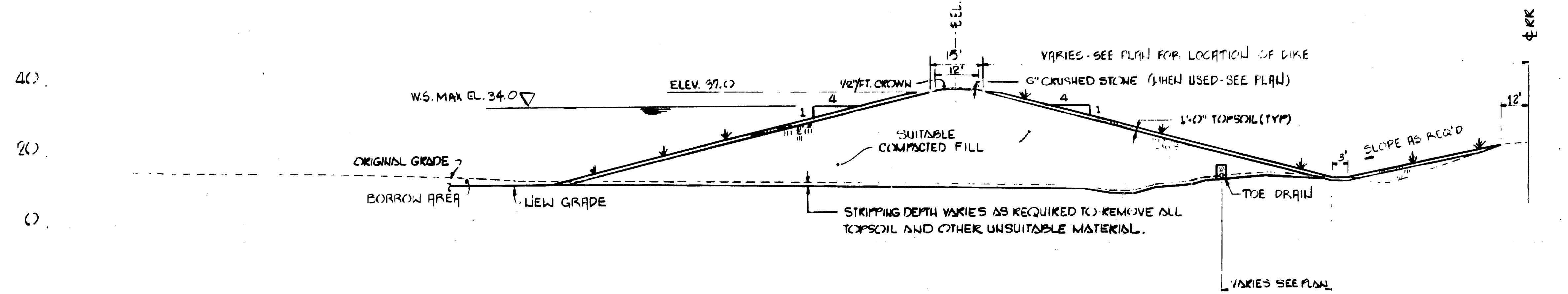
TYPICAL TOE DRAIN

TOE DRAIN NOTES

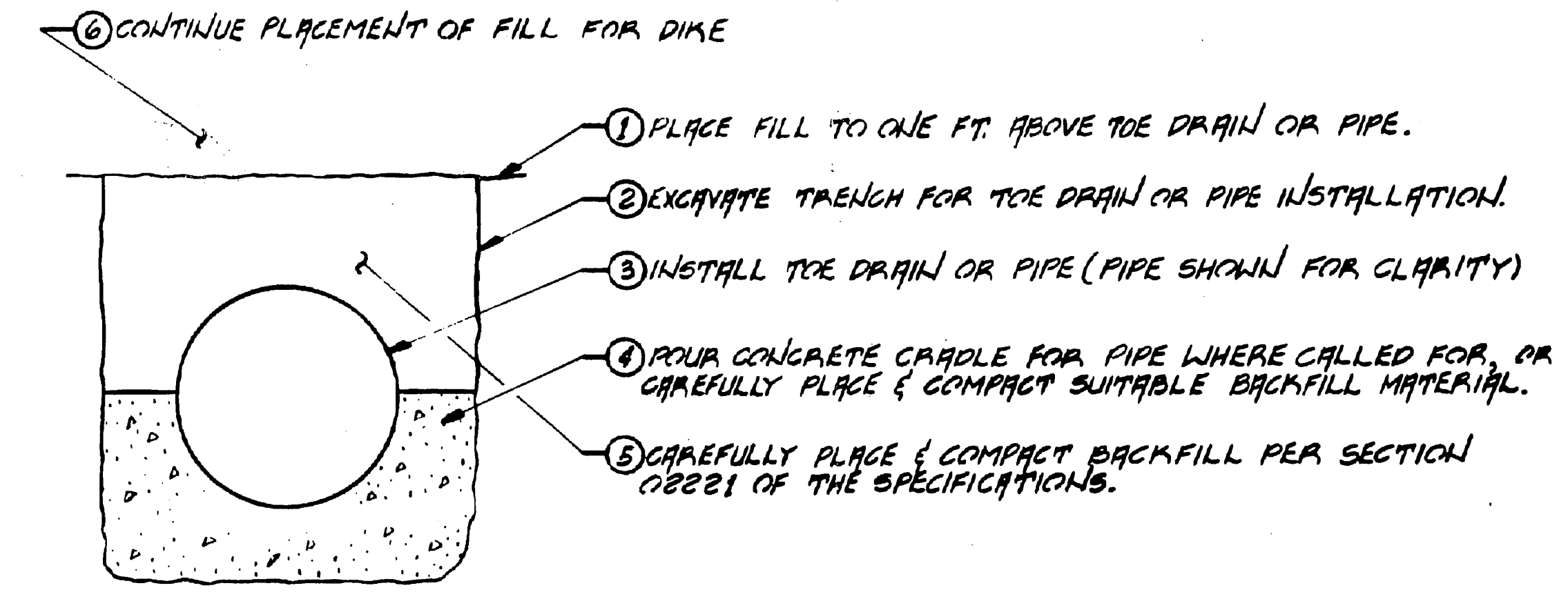
1. THE CRUSHED STONE SHALL BE GRADATION #57 ACCORDING TO SOUTH CAROLINA STATE HIGHWAY DEPT. STD. SPECIFICATIONS. CRUSHED STONE SHALL BE GRANITE.
2. FILTER FABRIC SHALL BE WOVEN OR SPUNBONDED POLYESTER OR POLYPROPYLENE FABRIC. APPROVED MANUFACTURERS:
   - DUPONT "TYPAR" STYLE 3401
   - ADVANCE CONST. SPECIALTIES "LAUREL EROSION CLOTH, TYPE I."
   - CARTHAGE MILLS, INC. "FILTER-X"
   - MONSANTO TEXTILES "BIDIM C-38"
3. PERFORATED PIPE SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS:

ASTM	TITLE
D1754	RIGID POLY (VINYL CHLORIDE) COMPOUNDS AND CHLORINATED POLY (VINYL CHLORIDE) COMPOUNDS
D 3034	TYPE PSM POLY (VINYL CHLORIDE)(PVC) SEWER PIPE AND FITTINGS

4. THE PIPE SHALL BE MADE OF PVC PLASTIC HAVING A CELL CLASSIFICATION OF 12454-B AND THE SDR SHALL NOT BE GREATER THAN 35.
5. PERFORATIONS SHALL BE IN ACCORDANCE WITH ASTM C 700 "VITRIFIED CLAY PIPE, EXTRA STRENGTH, STANDARD STRENGTH AND PERFORATED."
6. PERFORATED PIPE SHALL BE LAID WITH PERFORATIONS DOWN.
7. OUTLET PIPE, 4"φ NON-PERFORATED P.V.C., SPACED AT 200' ON CENTER MAXIMUM. FIELD ADJUST WHERE NECESSARY SO THAT OUTLET PIPE IS INSTALLED AT ALL LOW POINTS ON TOE DRAIN. SLOPE OUTLET PIPE @ 0.5% MIN. GRADE AREA AT TOE OF DIKES SO THAT NO PONDING OF WATER CAN OCCUR AND SO THAT OUTLET PIPES ARE FREE TO DRAIN.
8. CONTRACTOR SHALL WRAP ANY PIPE PENETRATION THRU FILTER FABRIC WITH 12" WIDE BY 4'-0" LONG PIECE OF FILTER FABRIC TO INSURE THAT NO AGGREGATE IS EXPOSED TO EARTH.

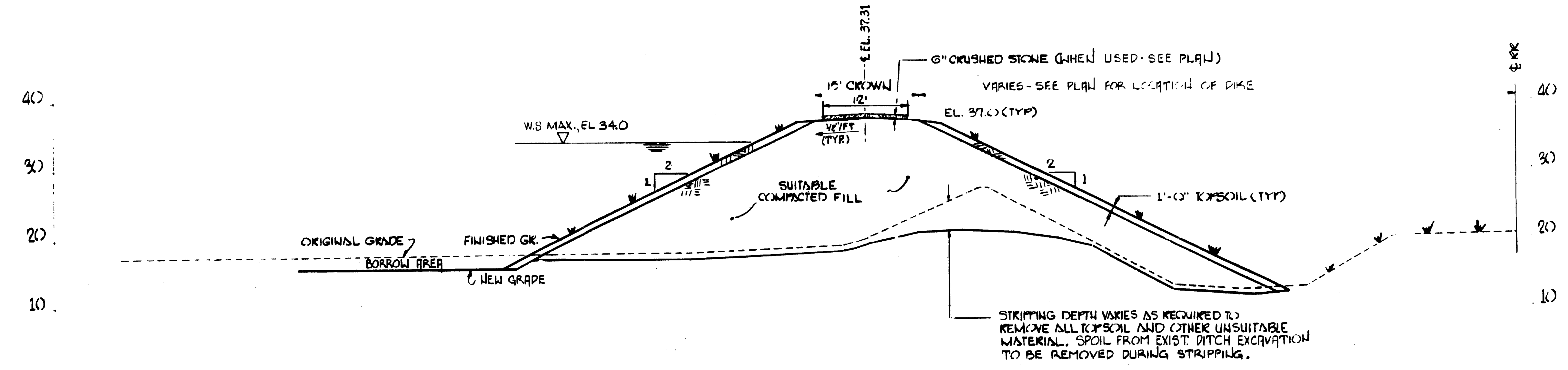


3-CV-548
3-CV-549
2
3-CV-551
SECTION
SCALE 1" = 20'

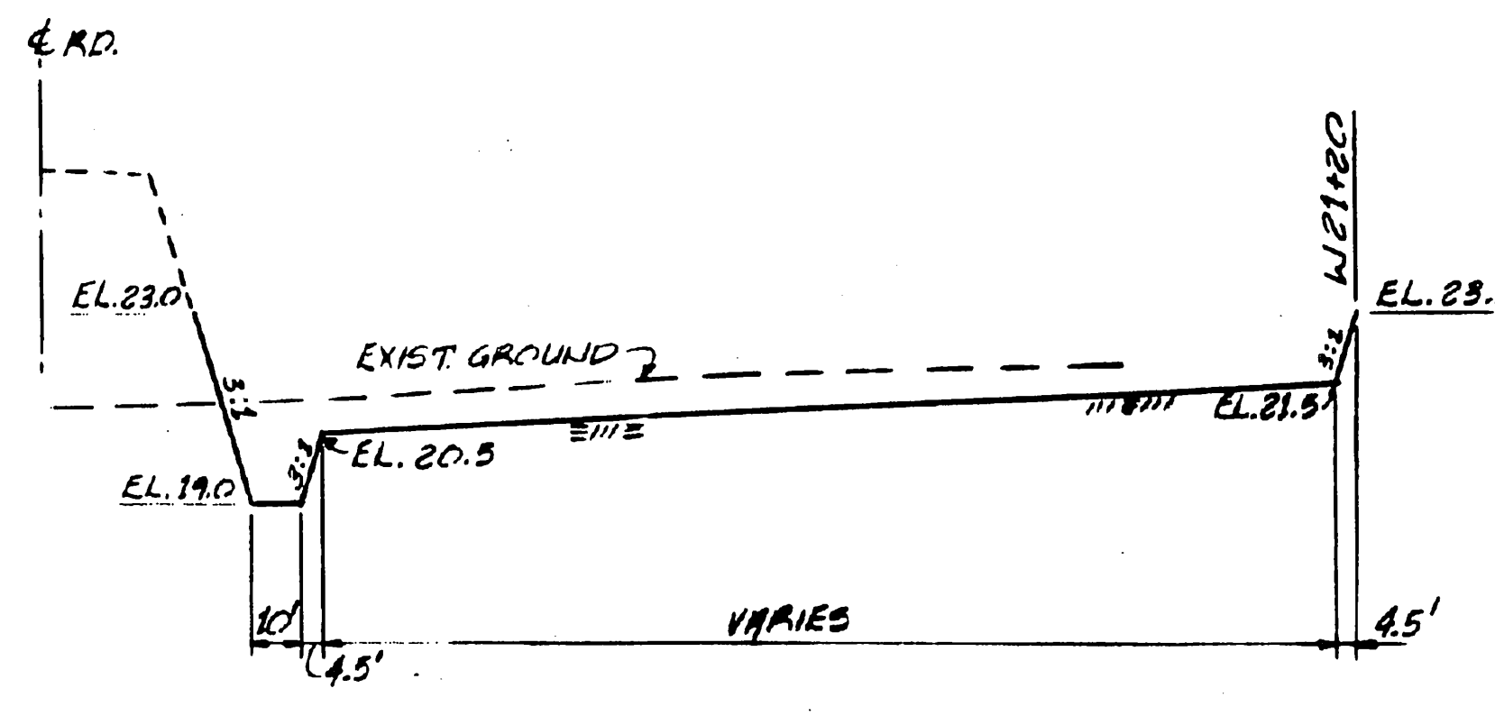


INSTALLATION OF PIPES OR TOE DRAINS UNDER DIKES

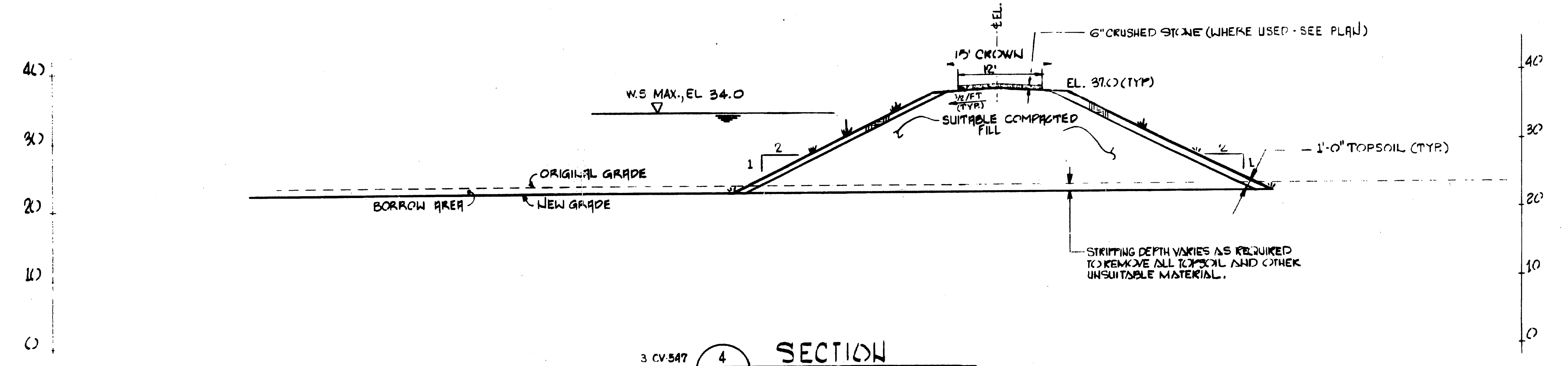
6
3-CV-551
DETAIL
N.T.S.



3-CV-547
3-CV-546
3
3-CV-551
SECTION
SCALE 1" = 10'



7
3-CV-551
3-CV-546, 547
SECTION
SCALE: 1" = 40' HORZ.
1" = 4' VERT.



3 CV-547
4
3-CV-551
SECTION
SCALE 1" = 10'

DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-366.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

sheet title
MISCELLANEOUS SECTIONS
SHEET 1

P. R. DURALIA
ENGINEER
444

386	CONST	2-7-79	0
386	BIC	10-6-78	0
PKG	ISSUE	DATE	REV

scale AS NOTED
L-G JOB NO. 77043.01
B&R W.O. NO. 3389
date 5-1-78
dwg. no. 3-CV-551
rev. 0

no	date	REVISION	by	ck.	appr.	no	date	REVISION	by	ck.	appr.
0	10-6-78	ISSUED FOR BIDS - CONTR. 386	G	PRD							
B	8-?-78	ISSUED FOR OWNER'S REVIEW	G								
A	5-?-78	B&R REVIEW									

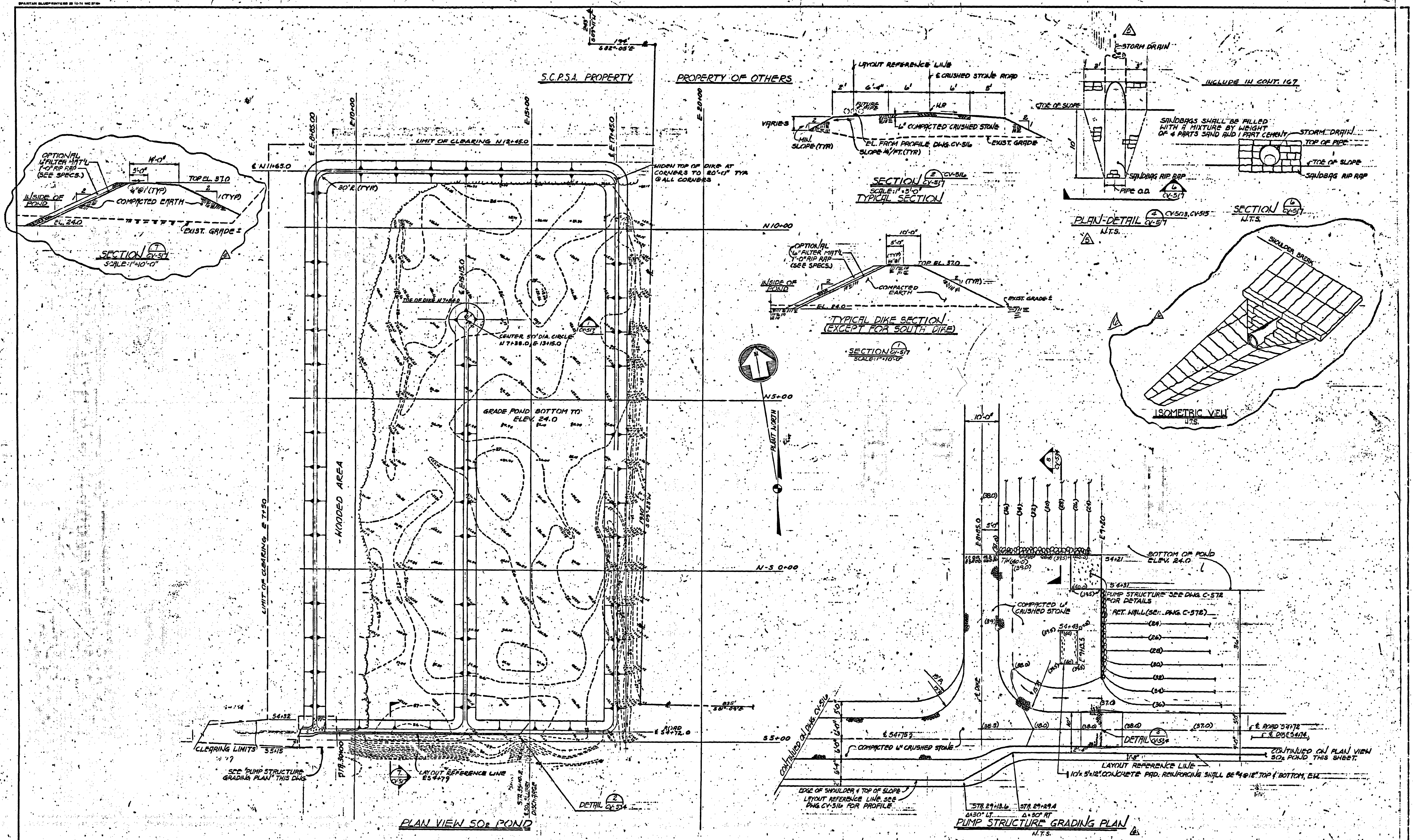
drawn by B. TUCKER III
dept. ck. P.R. DURALIA
dept. appr.
coord. ck.
p.m. appr.
B&R appr. M. J. Peri 1/29/81

South Ind
Section

Appendix A - Doc 1.7 Unit 2 Slurry Pond Impoundment Drawing

W2- CV517

SPARTAN BLUEPRINTERS 20 12-74 MC 5736



GENERAL NOTES

1. CRUSHED STONE SHALL CONFORM TO SIZE SABC AS DEFINED IN THE SOUTH CAROLINA STATE HIGHWAY DEPT. STANDARD SPECIFICATIONS.
2. ALONG SOUTH DIKE OF POND THE CONTRACTOR SHALL SHAPE EXISTING EARTHEN DIKE TO CONFORM TO 2(H):1(V) SLOPE ONLY ON INSIDE OF POND. TOP WIDTH SHALL BE AS SHOWN IN "PUMP STRUCTURE GRADING PLAN." VOID

SOUTH CAROLINA REGISTERED ENGINEER 5444 P. R. DURALIA

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N.J. HEMPSTEAD, N.Y. LOS ANGELES, CALIF.

no	date	REVISION	by	ck.	appr.	no	date	REVISION	by	ck.	appr.
4	11-24-76	ADDED SECTION-REVISE PLAN CONT. 3197-186	Co	RGG	LF						
3	11-5-76	REVISED DIKE COORDS. - CONTRACT 3197-186	Co	PRD	LF						
2	10-7-76	ISSUED FOR CONSTRUCTION - CONTRACT 3197-186	Co	RGG	LF						
1	8-11-76	ISSUED FOR BIDS CONTRACT NO 186	Co	RGG	LF	6	9-28-77	ISSUED FOR CONSTRUCTION · CONTR. 167	G	RAH	LF
0	4-7-76	ISSUED FOR B&R APPROVAL	Co	PRD	LF	5	8-22-77	ISSUED FOR BIDS - CONTRACT 167	RAH	PRD	LF

drawn by Co
dept. ck. P.R. DURALIA
dept. appr.
coord. ck.
p.m. appr. L. Fowler
B&R appr.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

sheet title
SO$_2$ SLURRY POND
PLAN AND SECTIONS

job name
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
GEORGETOWN GENERATING STATION
GEORGETOWN SOUTH CAROLINA

scale AS NOTED
date 4-7-76
L-G JOB NO. 74090.02
B&R W.O. NO. 3197.02
DWG. NO. CV-517
rev. 6

WSP-104

Unit 2 Slurry Pond

Appendix A - Doc 1.8 2005-2009 Ash Management and Sales

Ash Management and Sales

Winyah Generating Station

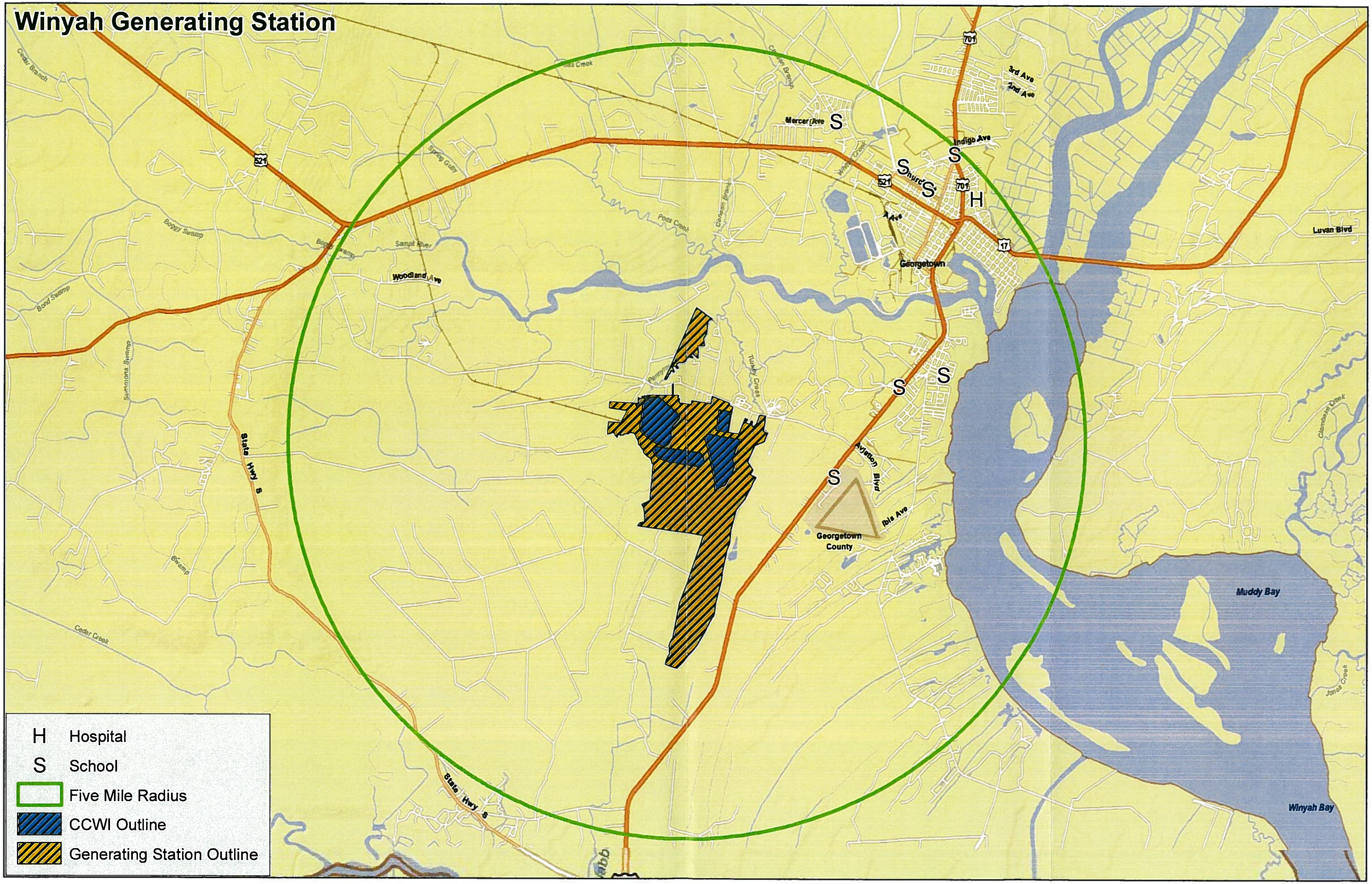
	Ash Produced (T)	Ash Removed (T)	% Sold
2005	338,384	328,560	97%
2006	362,713	328,490	91%
2007	341,900	296,680	87%
2008	326,497	225,190	69%
2009	264,294	144,840	55%
5-yr total	**1,633,787**	**1,323,760**	**81%**

Bottom Ash: Normally wet sluiced to the ash ponds.
Some is sold after dewatering in the pond.

Fly Ash: Normally handled dry to the carbon burn out facility.
Some is sluiced to the ash pond.

Appendix A - Doc 1.9 Winyah Generating Station Regional Map Showing the Management Unit(s) in Relationship to Critical Infrastructure

Winyah Generating Station



Appendix A - Doc 1.10 NPDES Permit

DHEC

PROMOTE PROTECT PROSPER

South Carolina Department of Health
and Environmental Control

National Pollutant Discharge Elimination System Permit

for Discharge to Surface Waters

This Permit Certifies That

South Carolina Public Service Authority
Winyah Generating Station

has been granted permission to discharge from a facility located at

661 Steam Plant Drive
Georgetown, SC
Georgetown County

to receiving waters named

001 - Turkey Creek to Sampit River
002 - North Santee River

in accordance with limitations, monitoring requirements and other conditions set forth herein. This permit is issued in accordance with the provisions of the Pollution Control Act of South Carolina (S.C. Code Sections 48-1-10 *et seq*., 1976), Regulation 61-9 and with the provisions of the Federal Clean Water Act (PL 92-500), as amended, 33 U.S.C. 1251 *et seq*., the "Act."

Jeffrey P. deBessonet, P.E., Director
Water Facilities Permitting Division

Issue Date: **January 7, 2008**

Expiration Date: **July 31, 2011**

Effective Date: **March 1, 2008**

Permit No.: **SC0022471**

Modification Issue Date: **March 4, 2009**

Modification Effective Date: **April 1, 2009**

Appendix A - Doc 1.11 Dike Inspection Procedure

4.9. Dike Inspection Procedure

4.9.1. Inspections are to be performed annually on the cooling ponds, and quarterly on the ash, slurry, and special waste ponds and documented on the Dike Inspection Report, found in Appendix E - FORMS.

4.9.2. The individual inspecting the dike(s) should inspect the crest, the slopes, and the area downstream, and complete the form, noting issues as follows:

Leaks
Any leaks on the dry side of the dike should be described such as the approximate quantity of flow, whether the water is discolored and the exact location of the leak. If a leak is found, Generation Technical Services should be notified immediately so that the appropriate steps to control the situation, and notify agencies if necessary, can be taken.

Seepage
Seepage on the dry side of the dike can be an indication of changes or shifts in the dike structure and possible future leaks. Any seepage should be described in the report.

Wet Spots
The dikes should be inspected when it has been dry for a period of time. Any areas on the dikes where the soil appears damp compared to the surrounding soil should be noted. This could be evidence of seepage.

Aquatic Weed Growth
Any aquatic weeds or wetland weeds, such as cattails, mosses, and algae, seen around the dry side of dikes could signify seepage from the ponds. If wetlands are downstream of the toe on the dry side of the dike, then the aquatic weed growth will not necessarily be a sign of dike seepage and does not need to be included in the report.

Trees and Woody Vegetation
Trees and woody vegetation can obscure problems, provide habitat for burrowing animals, and prevent growth of a protective grass cover. Trees growing along the downstream slope and near the toe of the downstream slope are a special concern and should be noted so maintenance or repair can be made.

Erosion
Any signs of erosion should be included in the report.

Depressions or Ruts
Depressions and ruts can hold water and make maintenance mowing more difficult or can weaken the soil and cause localized sloughing of the

Appendix A - Doc 1.12 Dike Inspection Reports

File: WG 51229

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

SOUTH ASH POND (Unit 3 & 4)

DATE: June 29th and 30th 2010
INSPECTOR: Arthur W. Ford
REVIEWED BY: Mitch Mitchum

SIGNATURE: Arthur Wm. KE
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	Freeboard > 3 feet required.
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Visible surfaces of concrete and metal in good condition.
5. Overall Condition		
Note any other issues	√	Overall good condition.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
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Revised 4/15/2009

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

ASH POND A (Unit 1 & 2)

DATE: June 29th and 30th 2010
INSPECTOR: Arthur W. Ford
REVIEWED BY: Mitch Mitchum

SIGNATURE: Arthur Wm. / AE
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition. Mowing - an ongoing process.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
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FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

ASH POND B (Unit 1 & 2)

DATE: June 29th and 30th 2010
INSPECTOR: Arthur W. Ford
REVIEWED BY: Mitch Mitchum

SIGNATURE: Arthur Wm Ford /AE
SIGNATURE: D. C. Mitchum

FEATURE	OK √	LOCATION & COMMENTS - Quarterly Inspection
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Visible surfaces of concrete and metal in good condition.
5. Overall Condition		
Note any other issues	√	

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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Revised 4/15/2009

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

WEST ASH POND (Unit 3 & 4)

DATE: June 29th and 30th 2010
INSPECTOR: Arthur W. Ford
REVIEWED BY: Mitch Mitchum

SIGNATURE: Arthur Wm. Ford AE
SIGNATURE: D. C. Mitchum

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

SLURRY POND (Unit 3 & 4)

DATE: June 29th and 30th 2010
INSPECTOR: Arthur W. Ford
REVIEWED BY: Mitch Mitchum

SIGNATURE: Arthur Wm. AE
SIGNATURE: D.C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	Freeboard required is 3ft as shown on design drawings
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	Ditches clean and well graded.
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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Revised 4/15/2009

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION
SLURRY POND (Unit 2)

DATE: June 29th and 30th 2010
INSPECTOR: Arthur W. Ford
REVIEWED BY: Mitch Mitchum

SIGNATURE: Arthur Wm. Ford
SIGNATURE: R.C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
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Revised 4/15/2009

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION
SLURRY POND (Unit 2)

DATE: 13-Apr-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Mitch Mitchum
SIGNATURE: Arthur Wm.
SIGNATURE:

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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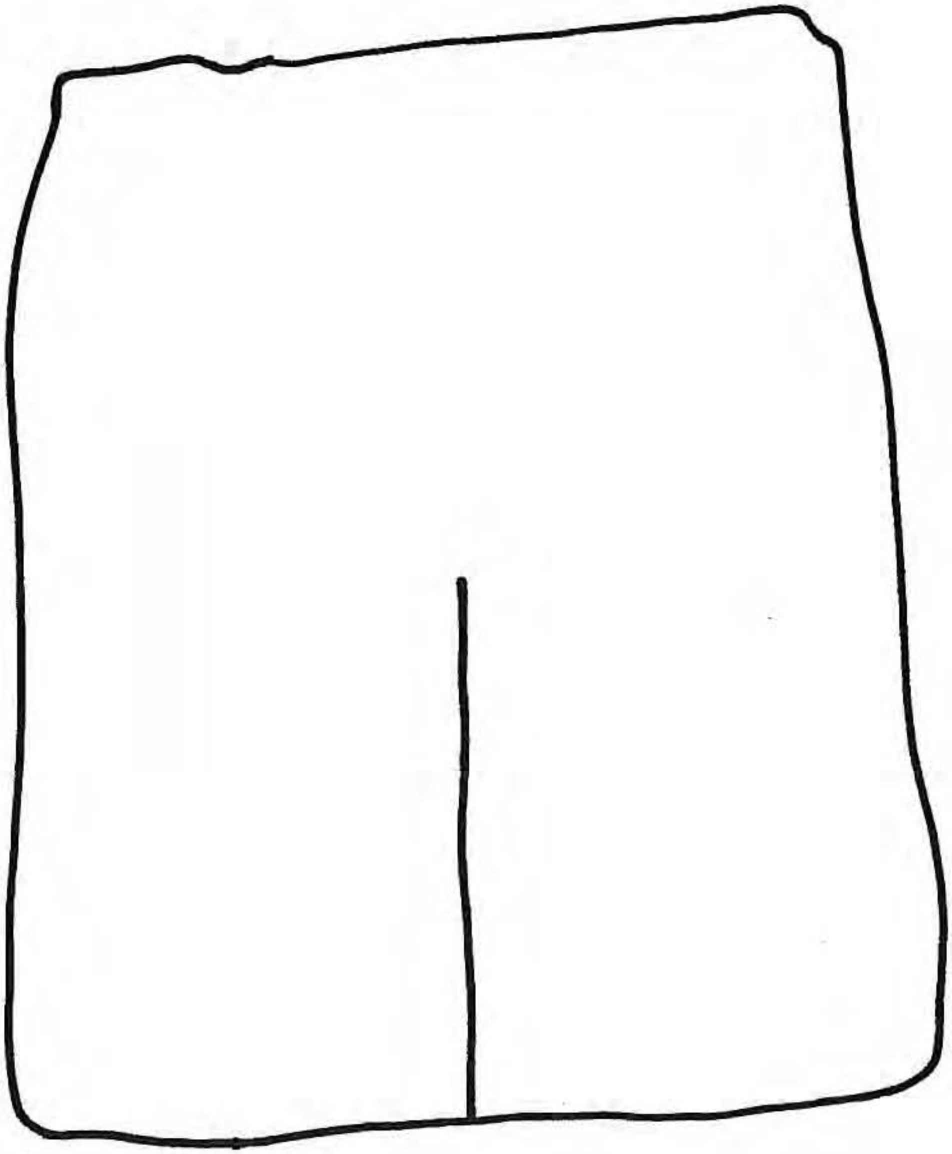
Revised 4/15/2009

#2 Slurry Pond



FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

SLURRY POND (Unit 3 & 4)

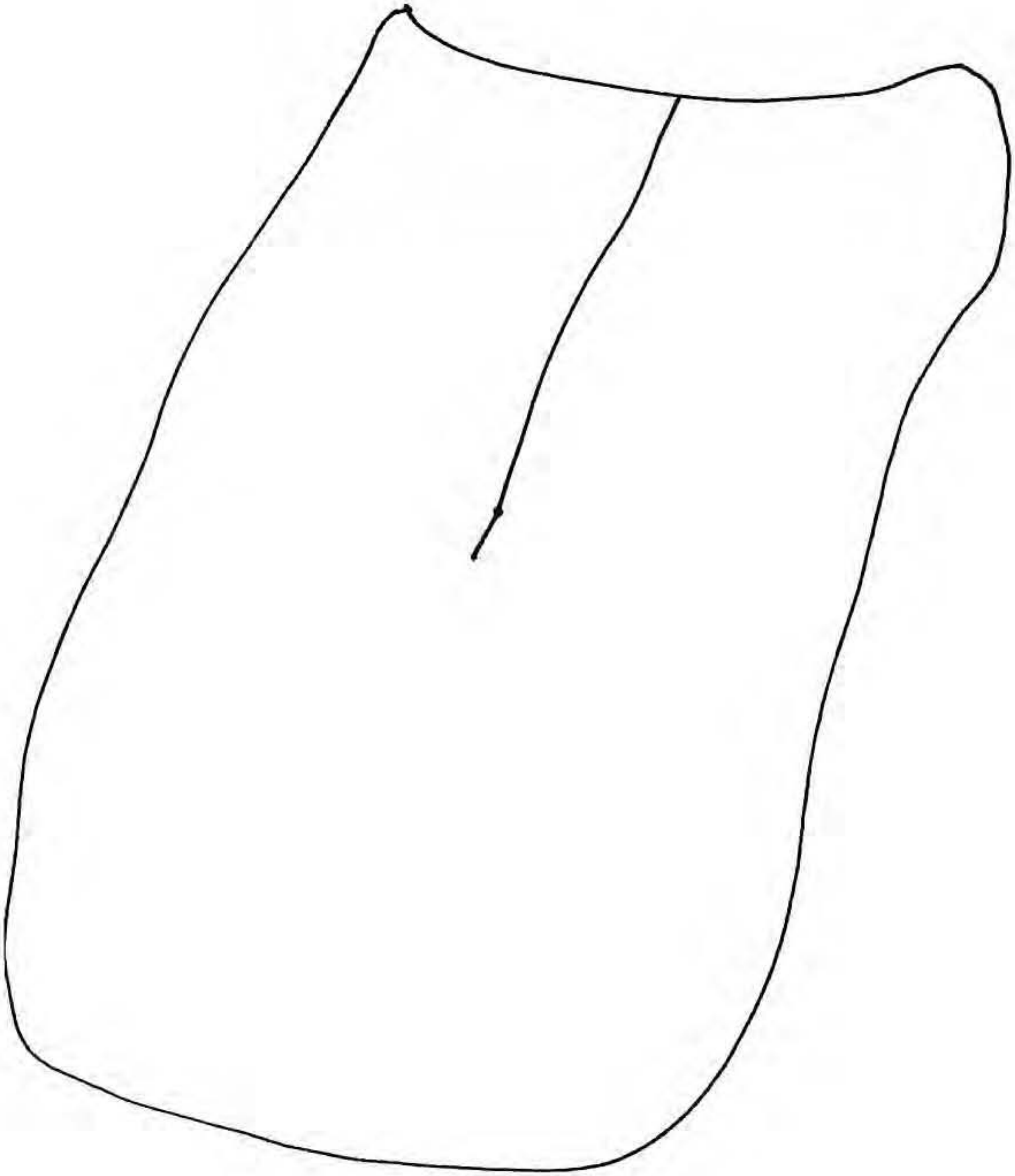
DATE: 13-Apr-10
INSPECTOR: Arthur W. Ford **SIGNATURE:** Arthur Wm.
REVIEWED BY: Mitch Mitchum **SIGNATURE:** D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	Freeboard required is 3ft as shown on design drawings
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	Ditches clean and well graded.
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
Fossil and Hydro Generation Technical Services - Jane Hood

3+4 Slurry Pond



FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

WEST ASH POND (Unit 3 & 4)

DATE: 13-Apr-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Mitch Mitchum

SIGNATURE: Arthur Wm. Ford
SIGNATURE: D.C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good. Mowing completed.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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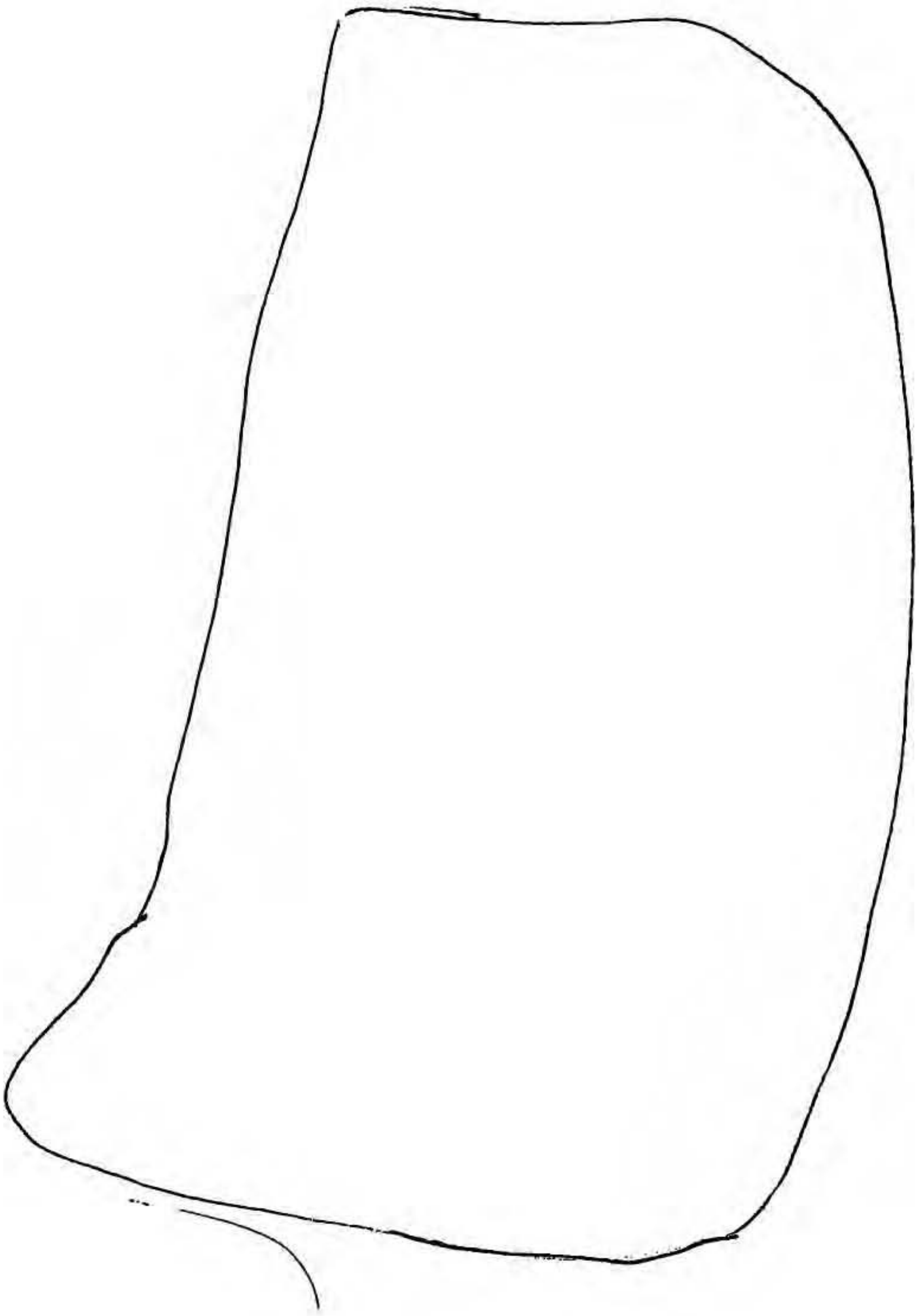
West Fish Pond



FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

SOUTH ASH POND (Unit 3 & 4)

DATE: 13-Apr-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Mitch Mitchum
SIGNATURE: Arthur Wm.
SIGNATURE: P. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	Freeboard > 3 feet required.
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	Maintenance on drainage ditches is completed.
Drainage Pipes	√	Maintenance on outlets to toe drains is completed.
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Visible surfaces of concrete and metal in good condition.
5. Overall Condition		
Note any other issues	√	Overall good condition. Mowing completed.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
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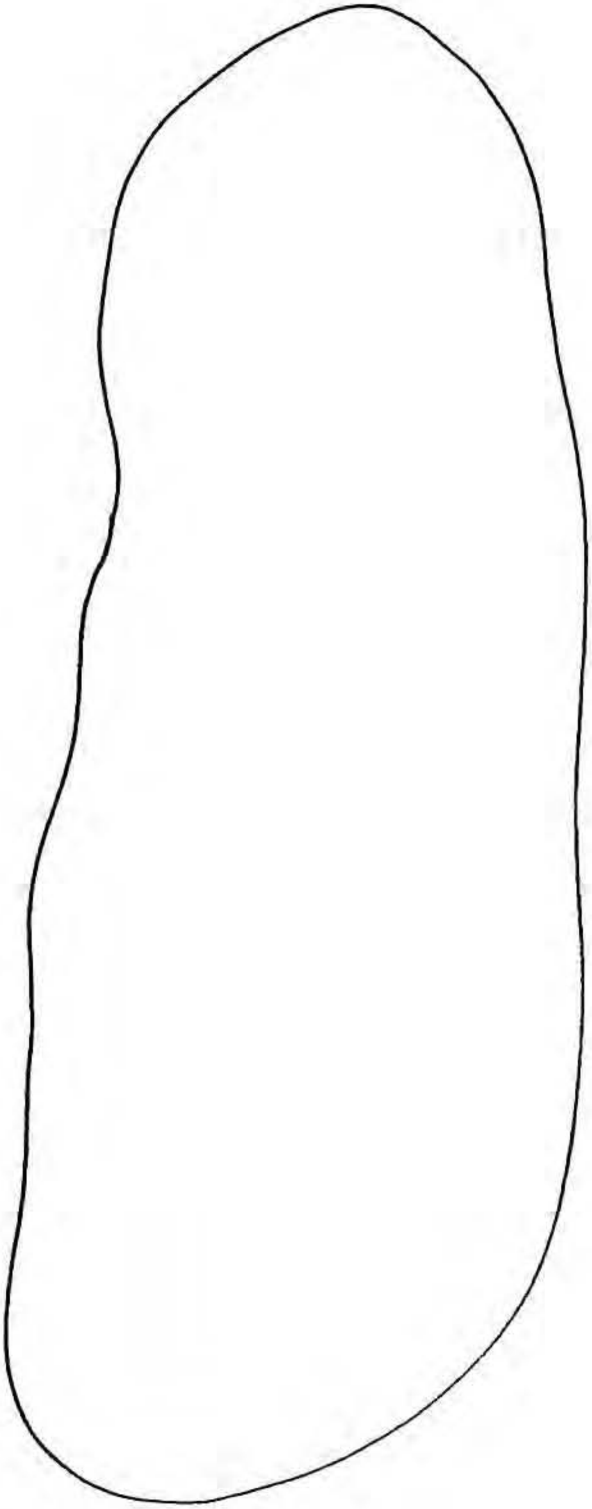
South HSh 1 ond



FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

ASH POND B (Unit 1 & 2)

DATE: 13-Apr-10
INSPECTOR: Arthur W. Ford **SIGNATURE:** Arthur Wm.
REVIEWED BY: Mitch Mitchum **SIGNATURE:** R. C.

FEATURE	OK √	LOCATION & COMMENTS - Quarterly Inspection
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Visible surfaces of concrete and metal in good condition.
5. Overall Condition		
Note any other issues	√	Overall condition adequate and improving due to vegetation management. Mowing completed. There is no evidence of air entrainment occuring within drop inlet structure - this action is interminent

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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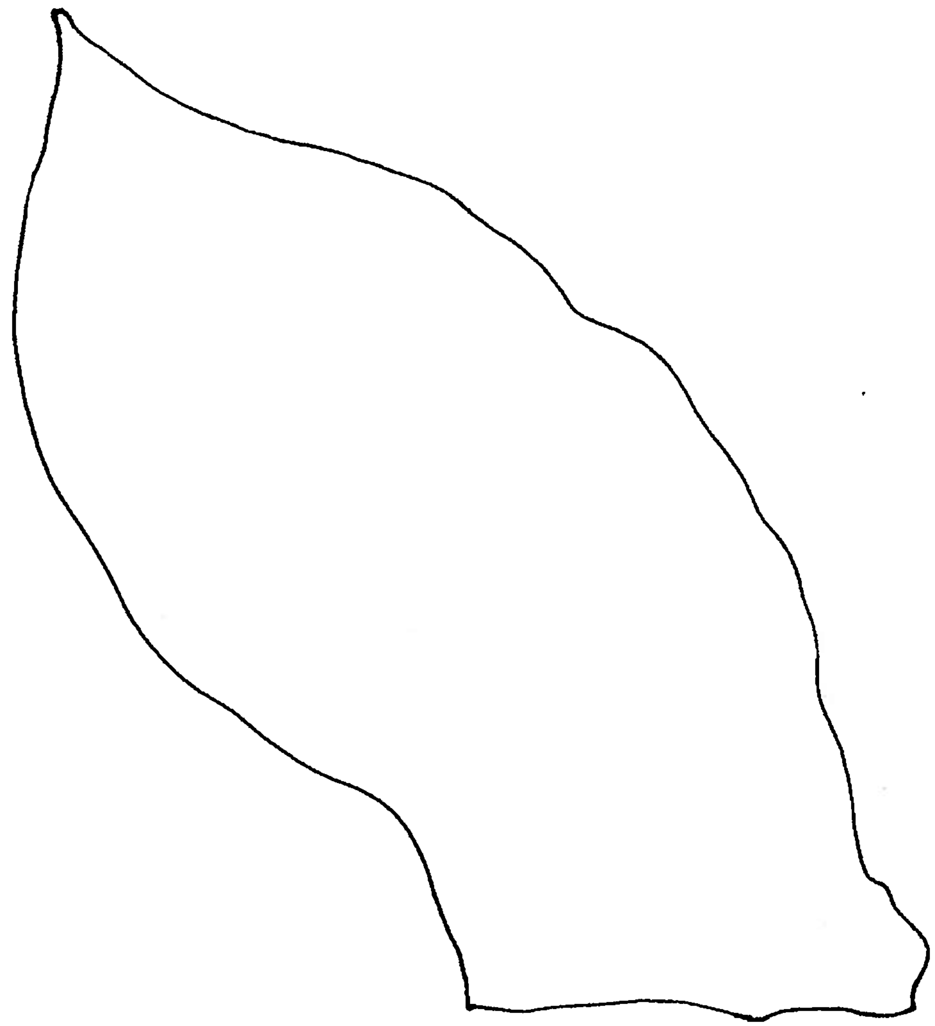


B Ash Pond

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

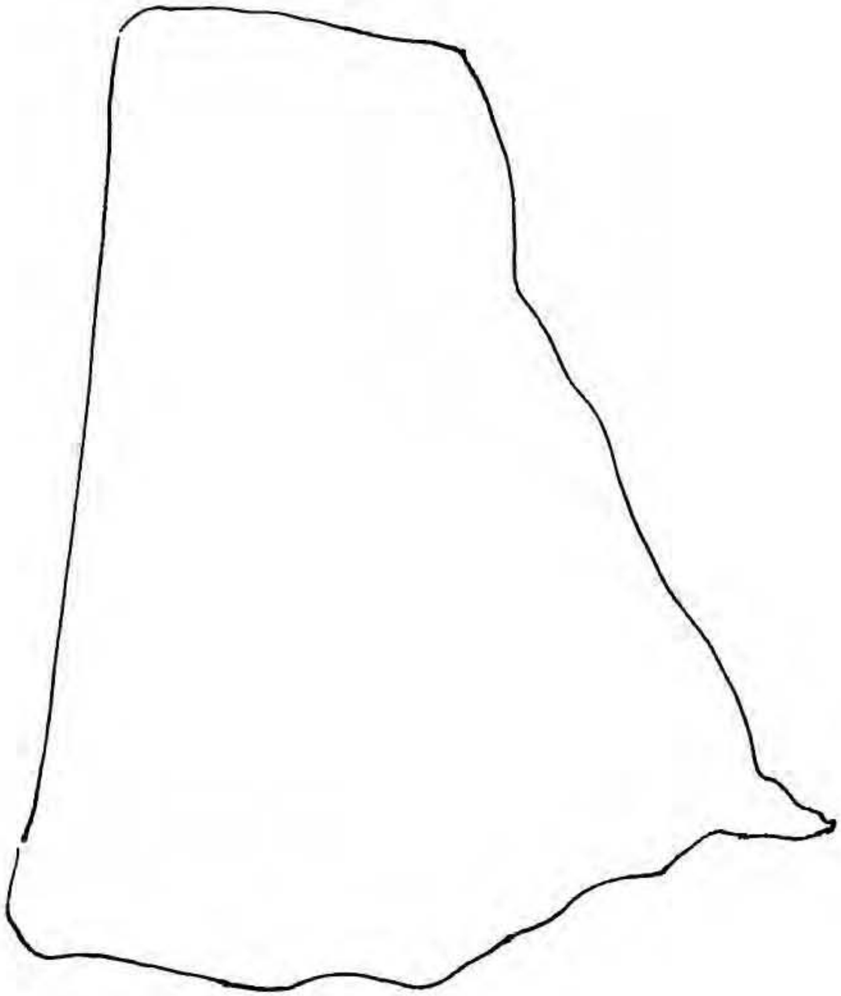
ASH POND A (Unit 1 & 2)

DATE: 13-Apr-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Mitch Mitchum
SIGNATURE:
SIGNATURE:

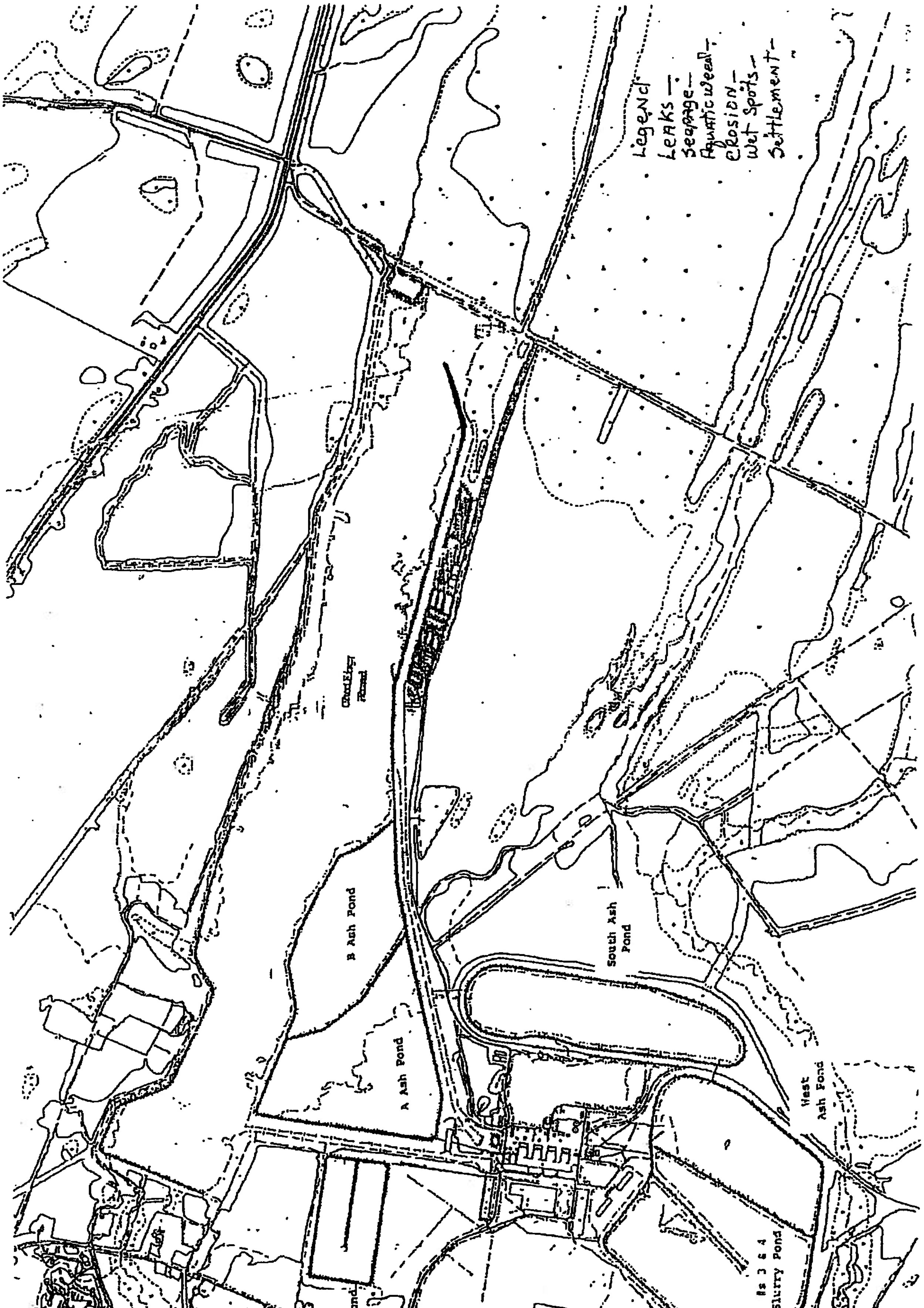
FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition. Mowing - an ongoing process.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
Fossil and Hydro Generation Technical Services - Jane Hood



A Ash Pond


Legend
Leaks —
Seepage —
Aquatic weed —
Erosion —
Wet Spots —
Settlement —
B Ash Pond
A Ash Pond
South Ash Pond
West Ash Pond
#s 3 & 4 Slurry Pond
#2 Slurry Pond

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

COOLING POND

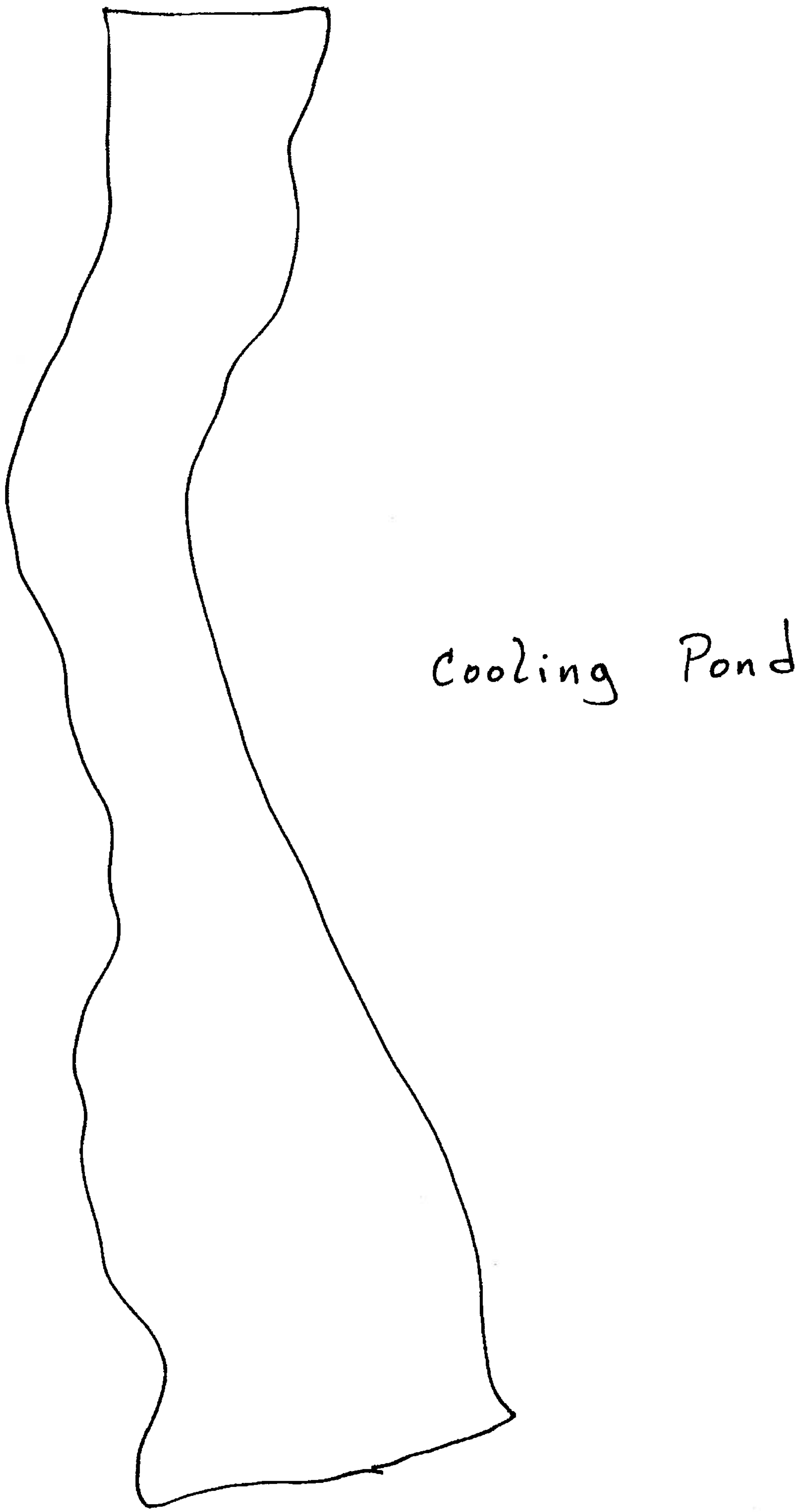
DATE: 19-Jan-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm. KF
SIGNATURE:

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	Rip-rap is scheduled to be upgraded during the first quarter of 2010
Freeboard Adequate	√	Freeboard was >1.8 feet and meets 25 yr-24 hr capacity
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Spillway and outlet discharge structure in good condition.
5. Overall Condition		
Note any other issues	√	Overall good condition

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
Fossil and Hydro Generation Technical Services - Jane Hood


Cooling Pond

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION
ASH POND A (Unit 1 & 2)

DATE: 19-Jan-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm. Ford AF
SIGNATURE: P. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition. Mowing - an ongoing process.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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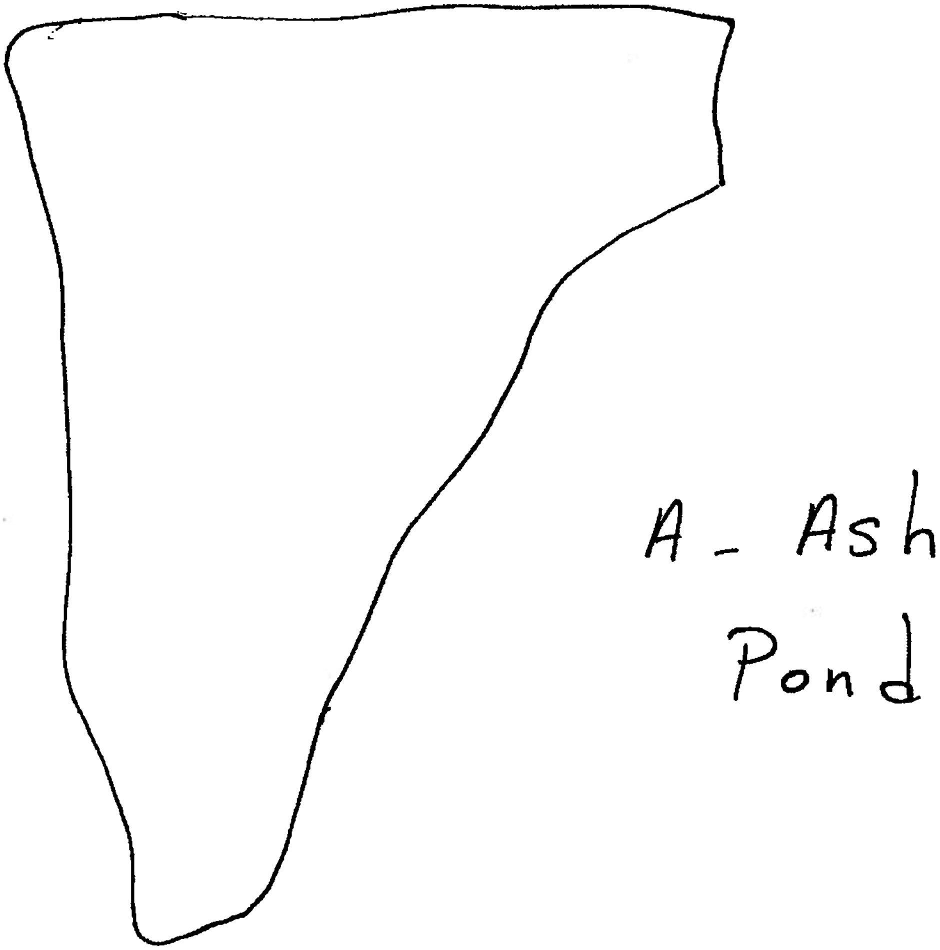

A- Ash
Pond

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

ASH POND B (Unit 1 & 2)

DATE: 19-Jan-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

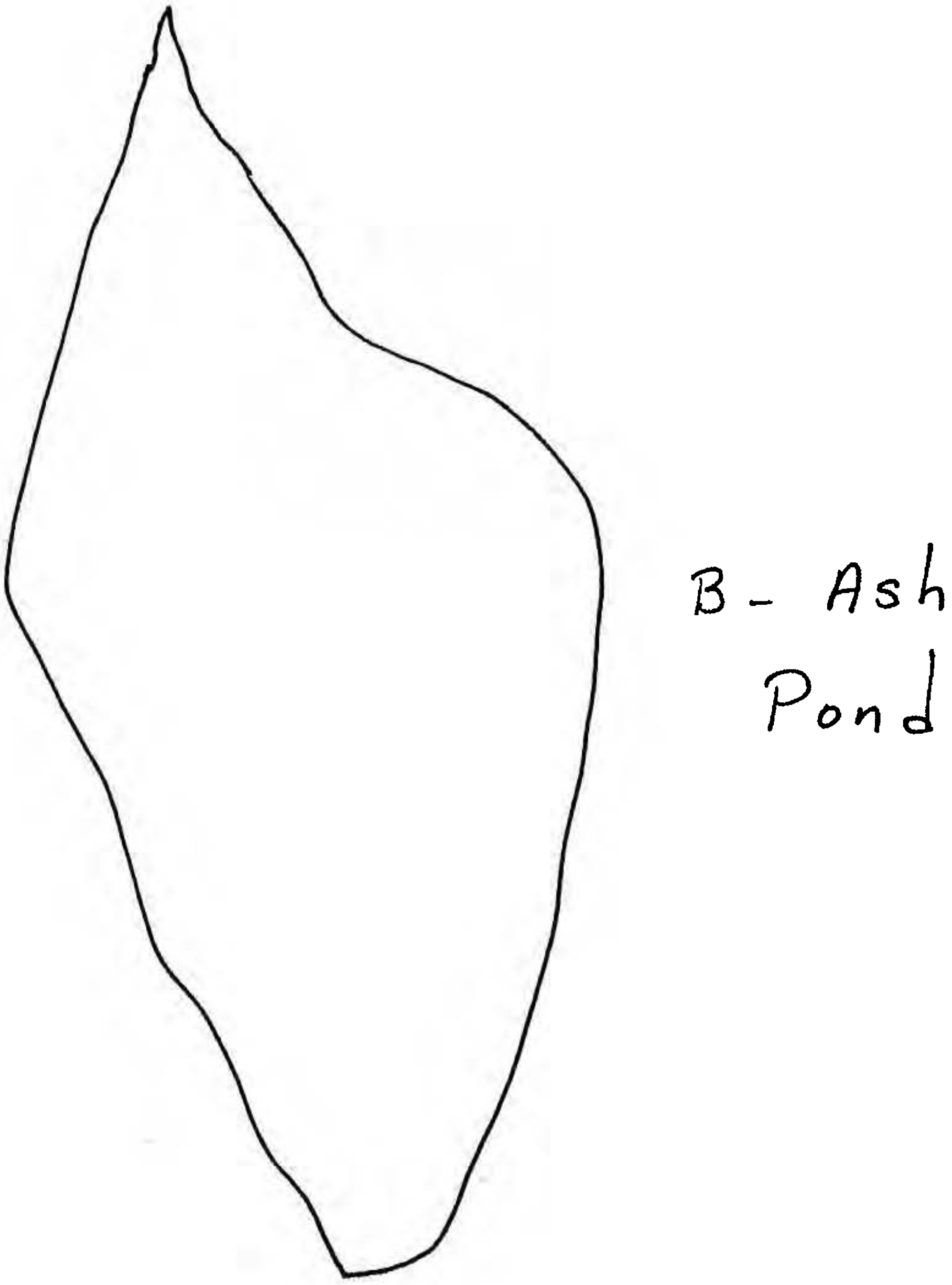
SIGNATURE: AE
SIGNATURE: P. C.

FEATURE	OK √	LOCATION & COMMENTS - Quarterly Inspection
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Visible surfaces of concrete and metal in good condition.
5. Overall Condition		
Note any other issues	√	Overall condition is good.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
Fossil and Hydro Generation Technical Services - Jane Hood

Revised 4/15/2009


B - Ash
Pond

AF

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

SOUTH ASH POND (Unit 3 & 4)

DATE: 19-Jan-10
INSPECTOR: Arthur W. Ford SIGNATURE: Arthur Wm. Ford
REVIEWED BY: Station Manager SIGNATURE: D.C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	Freeboard > 3 feet required.
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	Maintenance on drainage ditches is completed.
Drainage Pipes	√	Maintenance on outlets to toe drains is completed.
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Visible surfaces of concrete and metal in good condition.
5. Overall Condition		
Note any other issues	√	Overall good condition. Mowing completed.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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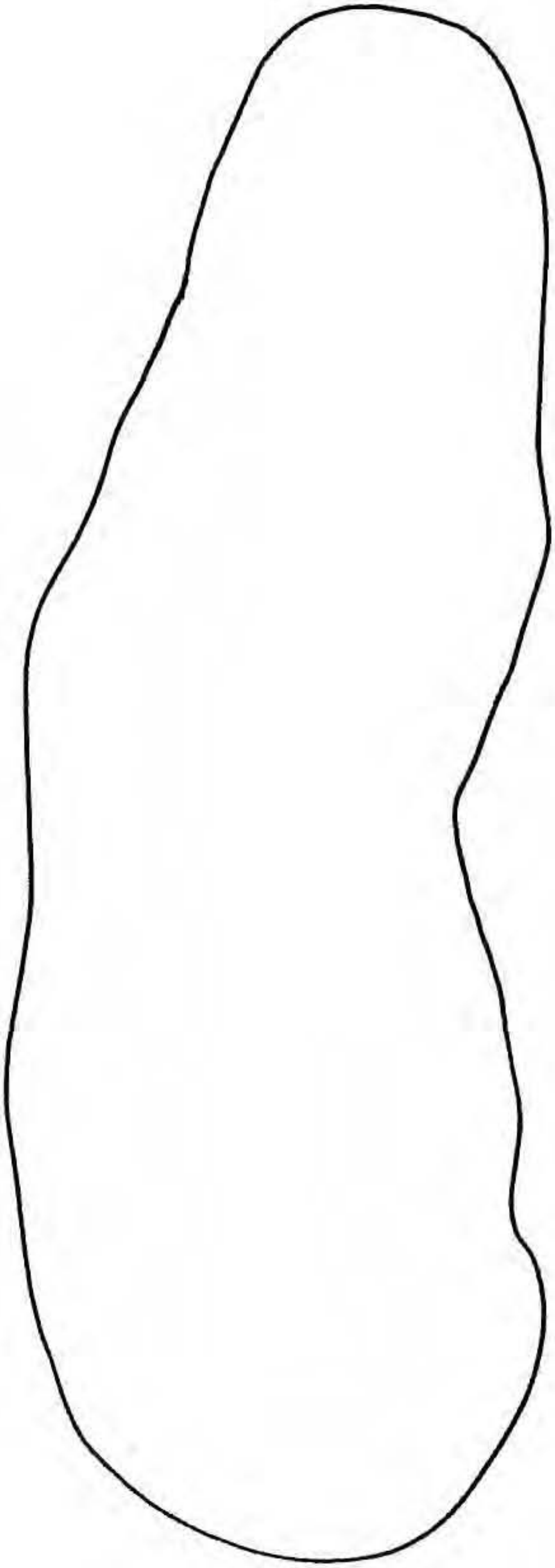
Fossil and Hydro Generation Technical Services - Jane Hood



South
Ash
Pond

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

WEST ASH POND (Unit 3 & 4)

DATE: 19-Jan-10
INSPECTOR: Arthur W. Ford **SIGNATURE:** Arthur Wm. / AE
REVIEWED BY: Station Manager **SIGNATURE:** D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good. Mowing completed. Continue with program to remove woody growth.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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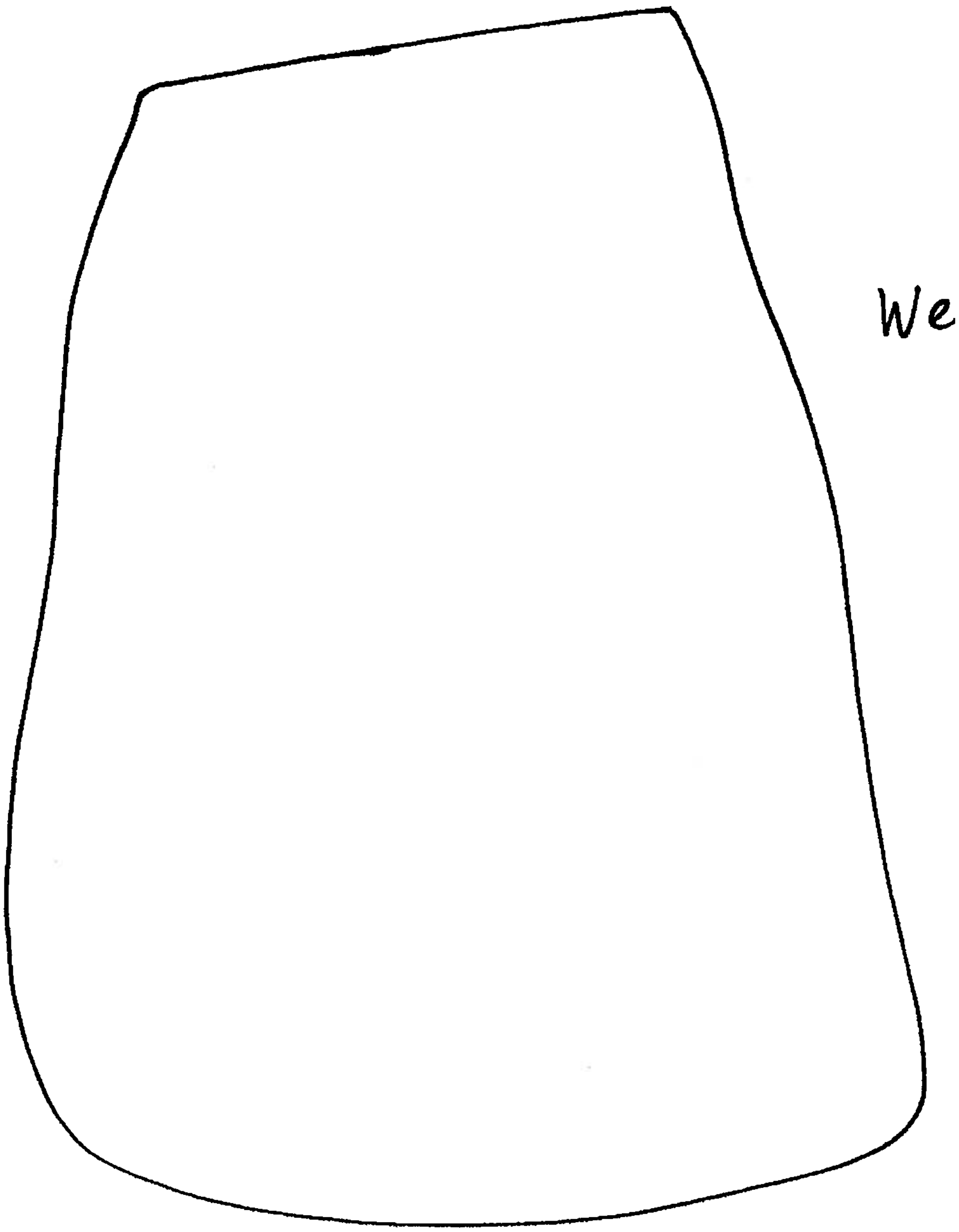

West
Ash
Pond

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

SLURRY POND (Unit 2)

DATE: 19-Jan-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm. AF
SIGNATURE: P. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
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Revised 4/15/2009


#2
Slurry
Pond

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

SLURRY POND (Unit 3 & 4)

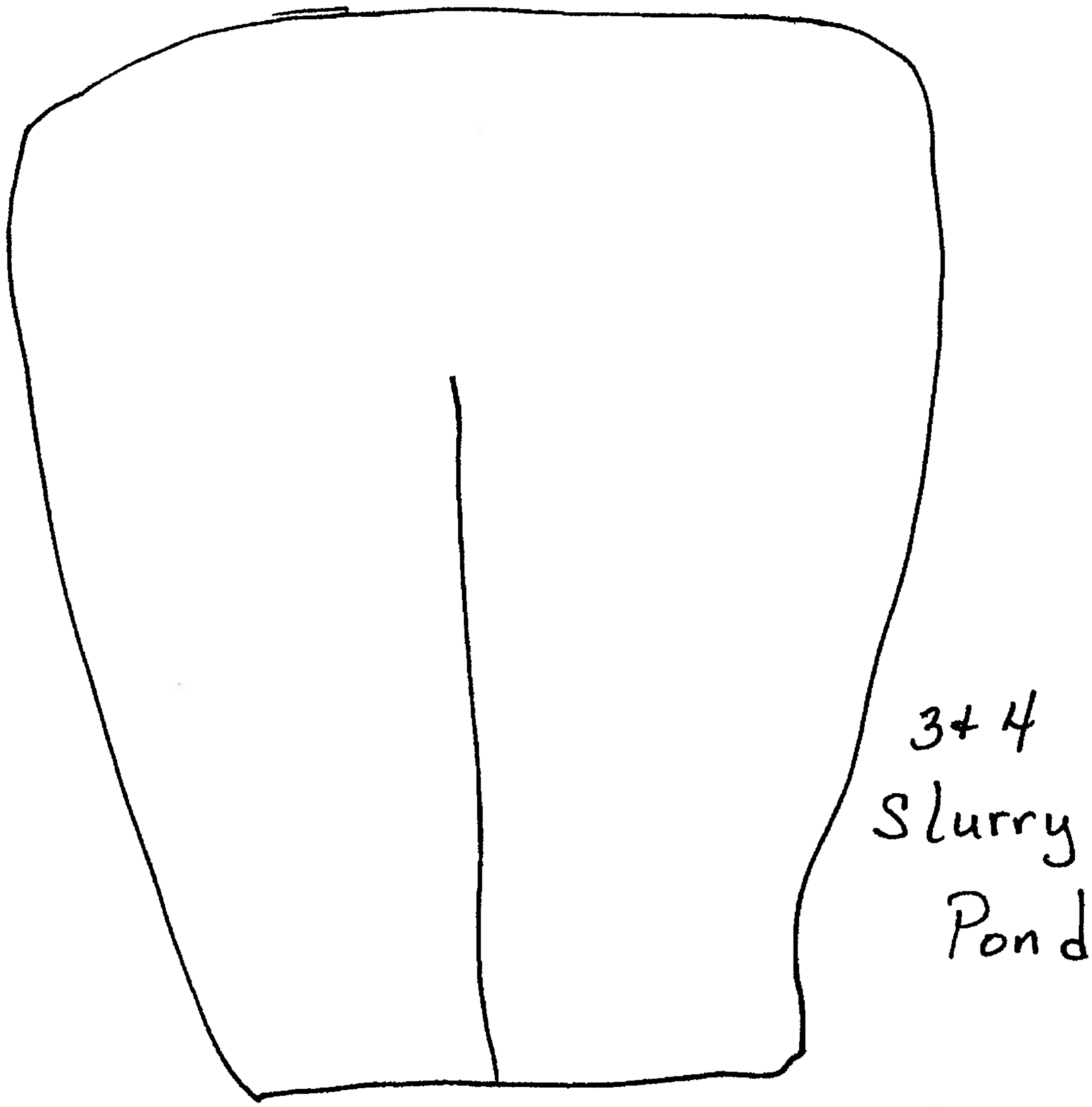
DATE: 19-Jan-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm. AE
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	Freeboard required is 3ft as shown on design drawings --
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	Ditches clean and well graded.
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
Fossil and Hydro Generation Technical Services - Jane Hood


3+4
Slurry
Pond

AE

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

INTAKE CANAL

DATE: 19-Jan-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm.
SIGNATURE: D. a.

FEATURE	OK √	LOCATION & COMMENTS
1. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
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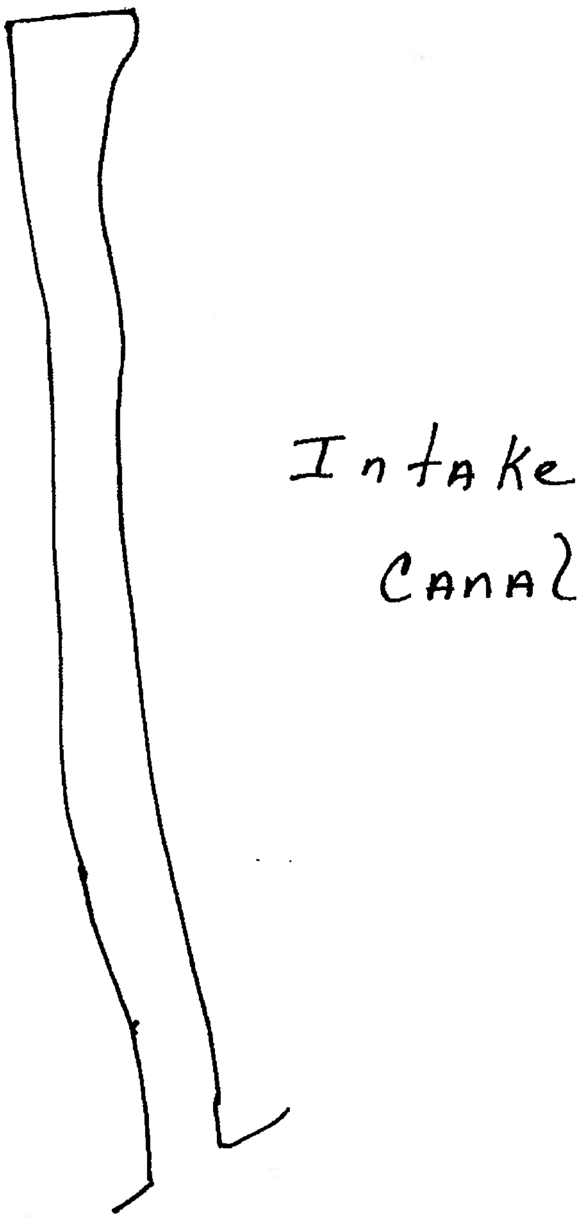

Intake
Canal

AF

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

DISCHARGE CANAL

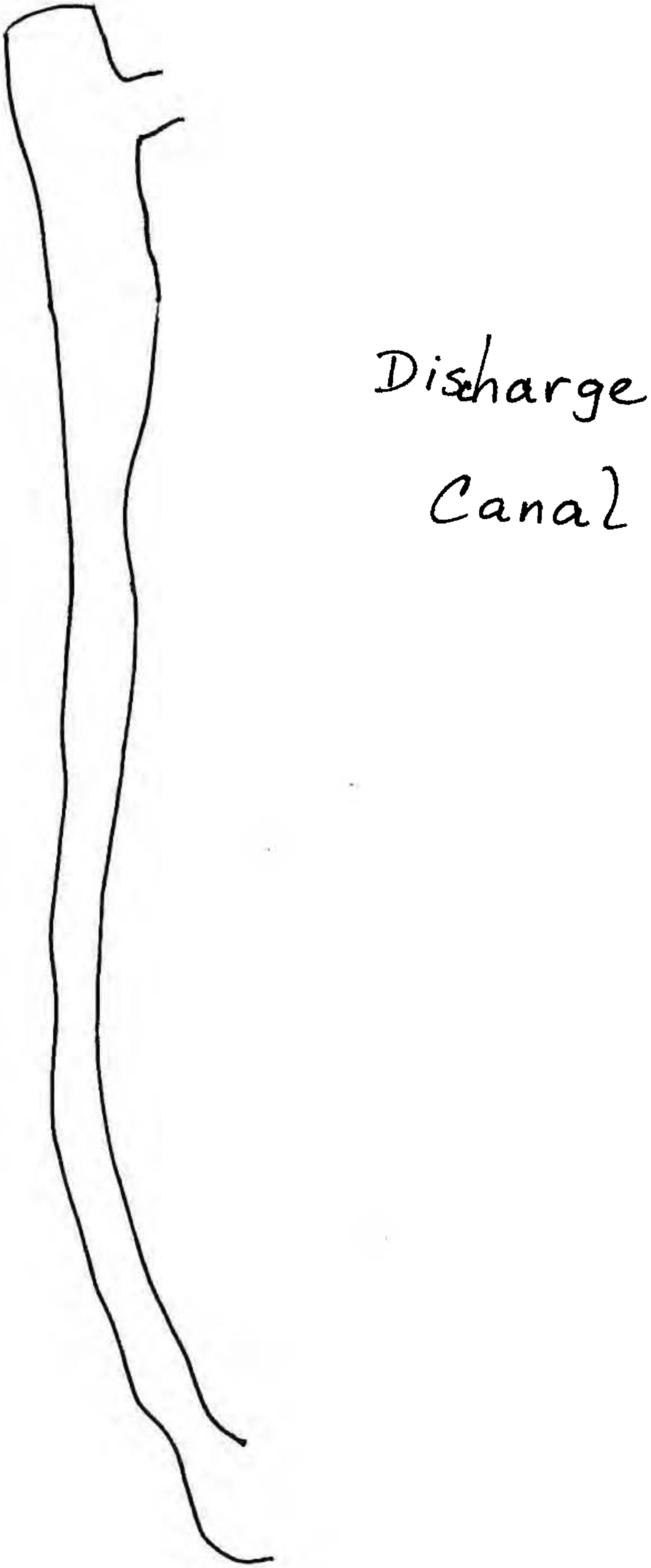
DATE: 19-Jan-10
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm.
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

Copies: Station Files (original)
Fossil and Hydro Generation Technical Services - Jane Hood


Discharge
Canal

FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

SLURRY POND (Unit 2)

DATE: 15-Oct-09
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm. Ford
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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DIKE INSPECTION REPORT
WINYAH STATION

SLURRY POND (Unit 3 & 4)

DATE: 15-Oct-09
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm.
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	Freeboard required is 3ft as shown on design drawings
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	Ditches clean and well graded.
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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DIKE INSPECTION REPORT
WINYAH STATION

DATE: 15-Oct-09
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm.
SIGNATURE: D. C.

ASH POND A (Unit 1 & 2)

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition. Mowing - an ongoing process.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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DIKE INSPECTION REPORT
WINYAH STATION

ASH POND B (Unit 1 & 2)

DATE: 15-Oct-09
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm.
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS - Quarterly Inspection
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Visible surfaces of concrete and metal in good condition.
5. Overall Condition		
Note any other issues	√	Overall condition adequate and improving due to vegetation management. Mowing completed. There is no evidence of air entrainment occuring within drop inlet structure - this action is interminent

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

SOUTH ASH POND (Unit 3 & 4)

DATE: 15-Oct-09
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm.
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	Freeboard > 3 feet required.
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	Maintenance on drainage ditches is completed.
Drainage Pipes	√	Maintenance on outlets to toe drains is completed.
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Visible surfaces of concrete and metal in good condition.
5. Overall Condition		
Note any other issues	√	Overall good condition. Mowing completed.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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DIKE INSPECTION REPORT
WINYAH STATION

WEST ASH POND (Unit 3 & 4)

DATE: 15-Oct-09
INSPECTOR: Arthur W. Ford
REVIEWED BY: Station Manager

SIGNATURE: Arthur Wm. Ford
SIGNATURE: P. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good. Mowing completed. Continue with program to remove woody growth.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

COOLING POND

DATE: 22-Jul-09
INSPECTOR: Bisnett, Ford
REVIEWED BY: Station Manager

SIGNATURE: Bisnett
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)		Did not inspect this quarter
Settlement (V)		
Cracks (Measure Dimensions)		
Excessive Vegetation		
Burrows or Ruts		
2. Slopes		
Seepage (Flow, lush grass, clarity)		Did not inspect this quarter
Erosion gullies		
Slides (cracks, bulges, scarps)		
Vegetation (trees present, no grass)		
Animal burrows		
Rip-rap displacement	√	Evidence of rip-rap displacement is being assessed.
Freeboard Adequate	√	Freeboard was >1.8 feet and meets 25 yr-24 hr capacity
Settlement/Depression		
3. Area Downstream		
Seepage (Flow, lush grass, clarity)		Did not inspect this quarter
Boils		
Drainage Ditches		
Drainage Pipes		
Vegetation (trees present, no grass)		
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Spillway and outlet discharge structure in good condition.
5. Overall Condition		
Note any other issues		

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

DATE: 22-Jul-09
INSPECTOR: Bisnett, Ford
REVIEWED BY: Station Manager

SIGNATURE: D Bisnett
SIGNATURE: P. C.

ANE

SLURRY POND (Unit 2)

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	No evidence of dead grass during growing season.
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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DIKE INSPECTION REPORT
WINYAH STATION

SLURRY POND (Unit 3 & 4)

DATE: 22-Jul-09
INSPECTOR: Bisnett, Ford
REVIEWED BY: Station Manager

SIGNATURE: Bisnett JANE
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	Freeboard required is 3ft as shown on design drawings
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	Ditches clean and well graded.
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
S I M P L E - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

WEST ASH POND (Unit 3 & 4)

DATE: 22-Jul-09
INSPECTOR: Bisnett, Ford
REVIEWED BY: Station Manager

SIGNATURE: Bisnett
SIGNATURE: D. C.

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	X	Regrade and establish grass. Redirect surface runoff from crest road until grass is well established
Slides (cracks, bulges, scarps)	√	Small scarp at depression was repaired.
Vegetation (trees present, no grass)	X	Small woody vegetation along S and E slopes
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	Depression was inspected and regraded.
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good. Mowing completed. Continue with program to remove woody growth.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION
SOUTH ASH POND (Unit 3 & 4)

DATE: 22-Jul-09
INSPECTOR: Bisnett, Ford
REVIEWED BY: Station Manager

SIGNATURE: Bisnett
SIGNATURE: D. C.

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FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	Grading completed and crest road in good condition.
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	Drain maintenance completed.
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	X	Vegetation management and removal of woody growth completed except for NW section.
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	Freeboard > 3 feet required.
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	Maintenance on outlet drains is completed and ground cover is being established.
Boils	√	
Drainage Ditches	√	Maintenance on drainage ditches is completed.
Drainage Pipes	√	Maintenance on outlets to toe drains is completed.
Vegetation (trees present, no grass)	X	Vegetation management and removal of woody growth completed except for NW section.
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Visible surfaces of concrete and metal in good condition.
5. Overall Condition		
Note any other issues	√	Overall good condition. Mowing completed. Continue with removal of woody vegetation.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION
ASH POND B (Unit 1 & 2)

DATE: 22-Jul-09
INSPECTOR: Bisnett, Ford
REVIEWED BY: Station Manager

SIGNATURE: D Bisnett
SIGNATURE: D.C.

FEATURE	OK √	LOCATION & COMMENTS - Quarterly Inspection
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	X	Monitor lush vegetation and possible seepage in vicinity of discharge structure
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	Vegetation Control underway, woody growth removal complete adjacent to discharge canal
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	X	Monitor lush vegetation and possible seepage in vicinity of discharge structure
Boils	√	
Drainage Ditches	√	
Drainage Pipes	X	Follow-up on sinkhole over discharge pipe at a possible pipe joint adjacent to discharge canal
Vegetation (trees present, no grass)	√	Vegetation Control underway, woody growth removal complete adjacent to discharge canal.
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	Visible surfaces of concrete and metal in good condition. Note comment on discharge pipe in section 3 above.
5. Overall Condition		
Note any other issues	√	Overall condition adequate and improving due to vegetation management. Mowing completed. Evidence of air entrainment occuring within drop inlet structure

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
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FOSSIL & HYDRO GENERATION - TECHNICAL SERVICES
DIKE INSPECTION REPORT
WINYAH STATION

DATE: 22-Jul-09
INSPECTOR: Bisnett, Ford
REVIEWED BY: Station Manager

SIGNATURE: DBisnett
SIGNATURE: D. C.

ASH POND A (Unit 1 & 2)

FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	Control of woody vegetation growth underway
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush grass, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	Control of woody vegetation growth underway
4. Outlet Works		
Inspect Concrete, Metal, and Wood	√	
5. Overall Condition		
Note any other issues	√	Overall good condition. Mowing completed. Continue with removal of woody vegetation.

NOTE: SHOW LOCATION OF PROBLEM AREAS ON AN ATTACHED DRAWING and DESCRIBE DEFICIENCY
SIMPLE - Sketch, Inspect, Measure, Photograph, Locate, Engage a Qualified Engineer if necessary

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Daily Dike Inspection
Bulk Material Handling - WGS
Date6/28/2010
Inspector J.J. EADDY

	ASH POND A (U1 & U2)	
FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	

Daily Dike Inspection
Bulk Material Handling - WGS
Date 6/28/2010
Inspector J.J. EADDY

	ASH POND B (U1 & U2)	
FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	
		Discharge area has wet spots and caves ir

Daily Dike Inspection
Bulk Material Handling - WGS
Date 6/28/2010
Inspector J.J. EADDY

	INTAKE CANAL	
FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	

Daily Dike Inspection
Bulk Material Handling - WGS
Date6/28/2010
InspectorJ.J. EADDY

	DISCHARGE CANAL	
FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	

Daily Dike Inspection
Bulk Material Handling - WGS
Date 6/28/2010
Inspector J.J. EADDY

	COOLING POND	
FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	

Daily Dike Inspection
Bulk Material Handling - WGS
Date6/28/2010
Inspector J.J. EADDY

	WEST ASH POND (U3 & U4)	
FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	√	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush, clarity)	√	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	

Daily Dike Inspection
Bulk Material Handling - WGS
Date6/28/2010
Inspector J.J. EADDY

	SLURRY POND (U3 & U4)	
FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	v	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush, clarity)	v	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	

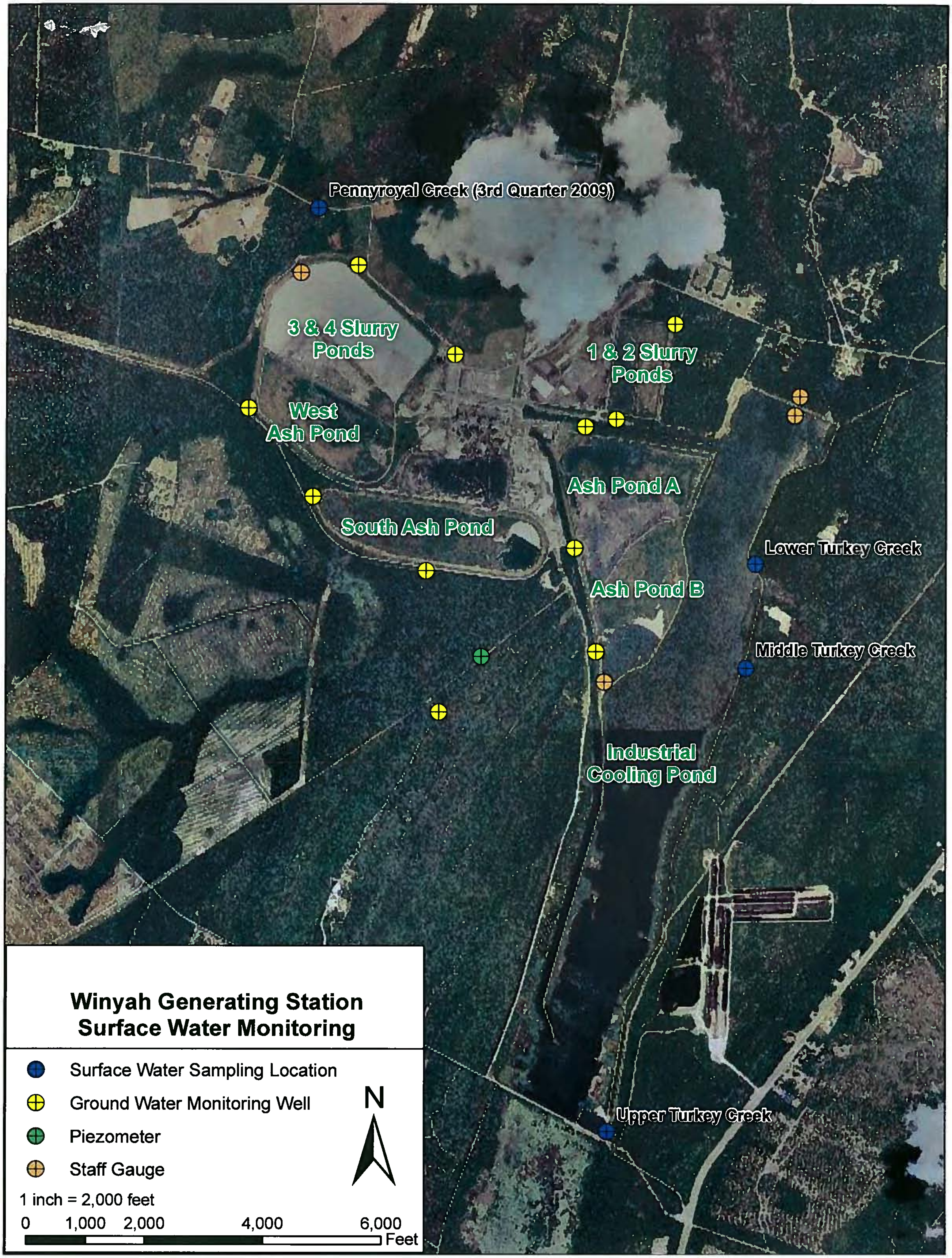
Daily Dike Inspection
Bulk Material Handling - WGS
Date 6/28/2010
Inspector J.J. EADDY

	SLURRY POND (U2)	
FEATURE	OK √	LOCATION & COMMENTS
1. Crest		
Alignment (H)	√	
Settlement (V)	√	
Cracks (Measure Dimensions)	√	
Excessive Vegetation	√	
Burrows or Ruts	√	
2. Slopes		
Seepage (Flow, lush grass, clarity)	√	
Erosion gullies	√	
Slides (cracks, bulges, scarps)	v	
Vegetation (trees present, no grass)	√	
Animal burrows	√	
Rip-rap displacement	√	
Freeboard Adequate	√	
Settlement/Depression	√	
3. Area Downstream		
Seepage (Flow, lush, clarity)	v	
Boils	√	
Drainage Ditches	√	
Drainage Pipes	√	
Vegetation (trees present, no grass)	√	

Appendix A - Doc 1.13 Staff Gauge and Rain Gauge Readings

Winyah Generating Station (W)
Surface Water Staff Gauges (SW)

Date	Label	Enter Staff Gauge Reading (nearest 0.1')	+	Ref Elev. (ft.)[1]	=	Water Surface Elev (ft)	Location
Dec-09							
16-Dec	W-SW-WSP	2.1	+	33	=	35.1	West Slurry Pond near Pennyroyal Creek Stormwater pump station
16-Dec	W-SW-APB	2.86	+	32	=	34.86	Ash Pond B - Concrete outlet structure
16-Dec	W-SW-ICP	2.96	+	17.73	=	20.69	Industrial Cooling Pond - Outlet Structure (Flume)
16-Dec	W-SW-TC	4.02	+	0	=	4.02	Turkey Creek - Downstream of Flume
Jan-10							
13-Jan	W-SW-WSP	1.8	+	33	=	34.8	West Slurry Pond near Pennyroyal Creek Stormwater pump station
13-Jan	W-SW-APB	2.8	+	32	=	34.8	Ash Pond B - Concrete outlet structure
13-Jan	W-SW-IOP	3	+	17.73	=	20.73	Industrial Cooling Pond - Outlet Structure (Flume)
13-Jan	W-SW-TC	3.7	+	0	=	3.7	Turkey Creek - Downstream of Flume
Feb-10							
23-Feb	W-SW-WSP	1.56	+	33	=	34.56	West Slurry Pond near Pennyroyal Creek Stormwater pump station
23-Feb	W-SW-APB	2.88	+	32	=	34.88	Ash Pond B - Concrete outlet structure
23-Feb	W-SW-ICP	3.4	+	17.73	=	21.13	Industrial Cooling Pond - Outlet Structure (Flume)
23-Feb	W-SW-TC	4	+	0	=	4	Turkey Creek - Downstream of Flume
Mar-10							
16-Mar	W-SW-WSP	2.45	+	33	=	35.45	West Slurry Pond near Pennyroyal Creek Stormwater pump station
16-Mar	W-SW-APB	2.51	+	32	=	34.51	Ash Pond B - Concrete outlet structure
16-Mar	W-SW-ICP	3.22	+	17.73	=	20.95	Industrial Cooling Pond - Outlet Structure (Flume)
16-Mar	W-SW-TC	4.07	+	0	=	4.07	Turkey Creek - Downstream of Flume
Apr-10							
15-Apr	W-SW-WSP	1.83	+	33	=	34.83	West Slurry Pond near Pennyroyal Creek Stormwater pump station
15-Apr	W-SW-APB	2.58	+	32	=	34.58	Ash Pond B - Concrete outlet structure
15-Apr	W-SW-ICP	3	+	17.73	=	20.73	Industrial Cooling Pond - Outlet Structure (Flume)
15-Apr	W-SW-TC	3.55	+	0	=	3.55	Turkey Creek - Downstream of Flume
May-10							
17-May	W-SW-WSP	1.73	+	33	=	34.73	West Slurry Pond near Pennyroyal Creek Stormwater pump station
17-May	W-SW-APB	2.52	+	32	=	34.52	Ash Pond B - Concrete outlet structure
17-May	W-SW-ICP	2	+	17.73	=	19.73	Industrial Cooling Pond - Outlet Structure (Flume)
17-May	W-SW-TC	3	+	0	=	3	Turkey Creek - Downstream of Flume
Jun-10							
17-Jun	W-SW-WSP	2.13	+	33	=	35.13	West Slurry Pond near Pennyroyal Creek Stormwater pump station
17-Jun	W-SW-APB	2.77	+	32	=	34.77	Ash Pond B - Concrete outlet structure
17-Jun	W-SW-ICP	1.53	+	17.73	=	19.26	Industrial Cooling Pond - Outlet Structure (Flume)
17-Jun	W-SW-TC	3.45	+	0	=	3.45	Turkey Creek - Downstream of Flume



Winyah Generating Station
Surface Water Monitoring

WGS POND LEVEL READINGS
6/30/2010

LOCATION	STAFF GAUGE READING (FT)	REFERENCE ELEVATION (FT).	WATER SURFACE ELEVATIONS (FT)
B ASH POND	2.82	32	34.82
SOUTH ASH POND	17.08	N/A	17.08
WEST FGD POND (3&4)	1.88	33	34.88
COOLING POND	1.9	17.73	19.63

Winyah Generating Station

Rainfall Gauge Readings

Date	Inches
6/24/2010	0
6/25/2010	0.4
6/26/2010	0
6/27/2010	2.4
6/28/2010	0
6/29/2010	1.625
Total	**4.425**

Appendix B - Winyah GS Ash Pond A Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name:	**Winyah Generating Station**	**Date:**	**30 June 2010**
Unit Name:	**Ash Pond A**	**Operator's Name:**	**Santee Cooper**
Unit I.D.:		**Hazard Potential Classification:**	**High** ☐ **Significant** ☐ **Low** ☒
	Inspector's Name:	**Frederic C. Tucker, PE; Anne Lee**	

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?	Quarterly[1]		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?		n/a[2]	19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	TBP[3]		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		n/a	Is water entering inlet, but not exiting outlet?		n/a[6]
5. Lowest dam crest elevation (operator records)?		n/a[4]	Is water exiting outlet, but not entering inlet?		n/a[6]
6. If instrumentation is present, are readings recorded (operator records)?	n/a[5]		Is water exiting outlet flowing clear?		n/a[6]
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)?		n/a	From underdrain?		n/a
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		n/a	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?		n/a	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		n/a	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		n/a[6]	23. Water against downstream toe?	X[7]	
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.

Issue #	Comments
	TBP – to be provided n/a – not applicable or not a feature
1	Santee Cooper conducts quarterly internal inspections by a registered engineer; also informal daily inspections take place over the course of the year by plant operating personnel and security personnel.
2	No actual pool. Pond filled with CCW. Water drains along ditches cut in ash surface. Water flows through discharge structure to Ash Pond B.
3	Discharge structure, from Ash Pond A into Ash Pond B, are to be provided by Santee Cooper personnel. An existing decant structure has been plugged and abandoned. Existing CMP condition is poor. Settlement of ground surface along the alignment of pipe may indicate CMP failure.

4	No formal survey or records of dam elevations. Design top of dam elevations to be provided by Santee Cooper personnel.
5	There is no geotechnical instrumentation. Staff gage monitored at Pond B outlet. Water quality wells monitored for groundwater contamination.
6	Discharge from Ash Pond A flows through a structure into Ash Pond B. Practically no water in Ash Pond A at time of visit.
7	A dividing dike separates Ash Pond A from Ash Pond B. The discharge channel to the Cooling Pond flows along the toe of the south western portion of Ash Pond A embankment. The intake channels from the Cooling Pond flows along the toe of the northern portion of Ash Pond A embankment.

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit # SC 0022471 **INSPECTOR** Frederic C. Tucker, PE; Anne Lee

Date

Impoundment Name Ash Pond A Winyah Generating Station

Impoundment Company Santee Cooper

EPA Region 4

State Agency South Carolina Department of Health and Environmental Control (DHEC)

(Field Office) Address 2600 Bull Street
Columbia, SC 29201

Name of Impoundment Ash Pond A

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

New ☐ **Update** ☒

	Yes	**No**
Is impoundment currently under construction?	☐	☒
Is water or ccw currently being pumped into the impoundment? As needed but minor water on date of visit.	☒	☐

IMPOUNDMENT FUNCTION: The Ash Pond A functions as a settling basin for wastewater containing fly and bottom ash, and boiler slag. The wastewater flows to Ash Pond B in series prior to discharging into the Cooling Pond discharge channel.

Nearest Downstream Town Name: Georgetown, SC

Distance from the impoundment: 6.2 miles (along flow path to nearest town limit)

Location:

Latitude	33	Degrees	19	Minutes	31.89	Seconds	**N**
Longitude	-79	Degrees	20	Minutes	50.50	Seconds	**E**

State SC **County** Georgetown

	Yes	No
Does a state agency regulate this impoundment?	☒	☐

If So Which State Agency?	DHEC, Bureau of Water/Compliance Assurance Division. For water quality only.

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

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

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

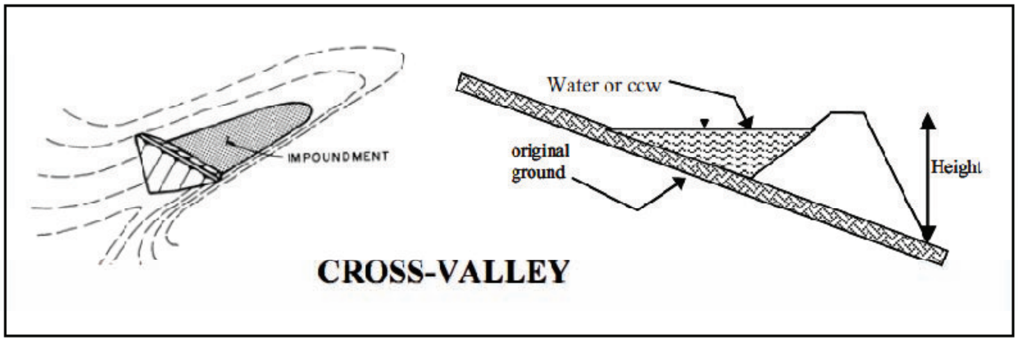
☐ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

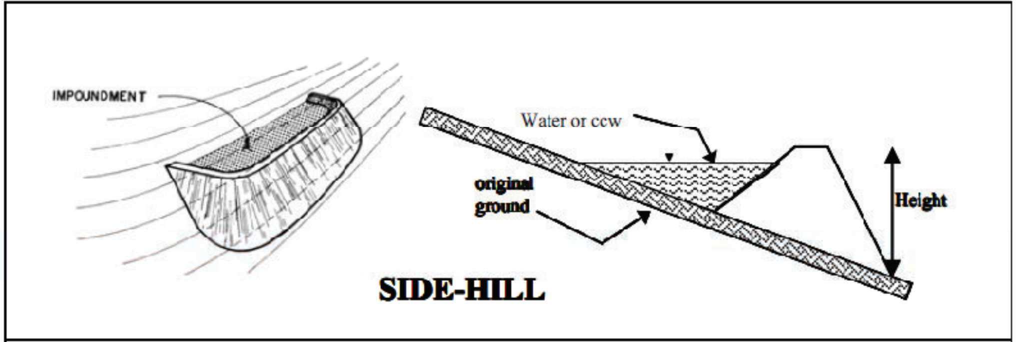
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

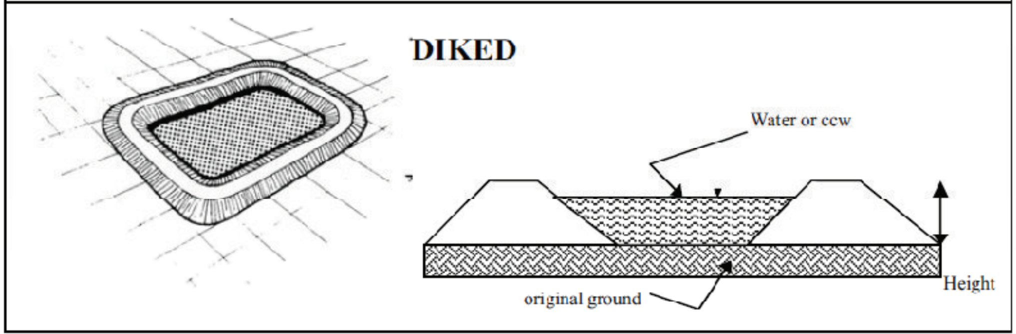
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

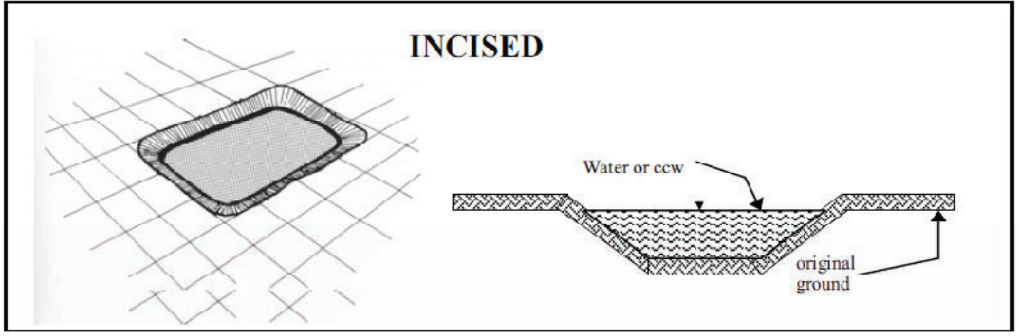
Failure of this structure would release directly into the Cooling Pond. A release would be contained within the Cooling Pond due to the extensive storage capacity in comparison to the capacity of the ponds. A release may disrupt power generation and cause minor environmental damage.

CONFIGURATION:









☐ Cross-Valley ☐ Side-Hill ☒ Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft) 24.5

Embankment Material Earth

Pool Area (ac) 88

Liner None

Current Freeboard (ft) TBP* **Liner Permeability** ---

*To be provided by plant personnel. Ash surface level varies across the pond area from above the perimeter dike on the upper end to approximately 5'-6' below crest of cross dike at the lower end. Practically no water was in the pond at the time of the site visit.

TYPE OF OUTLET (Mark all that apply)

☐ **Open Channel Spillway**

☐ Trapezoidal

☐ Triangular

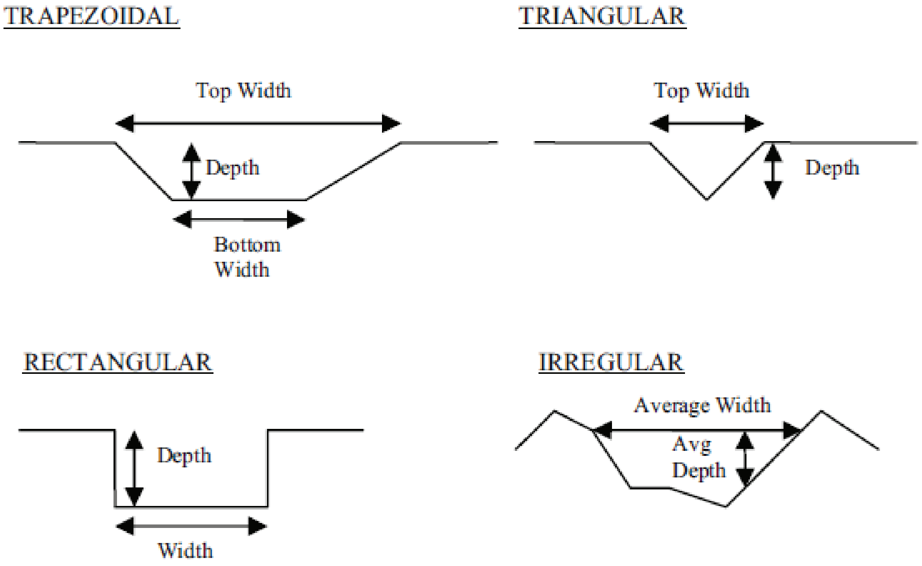
☐ Rectangular

☐ Irregular

depth (ft)

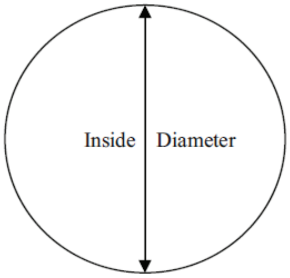
average bottom width (ft)

top width (ft)



☒ **Outlet** (structure not seen)

TBP inside diameter



Material (TBP)

☐ corrugated metal

☐ welded steel

☐ concrete

☐ plastic (hdpe, pvc, etc.)

☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☒ (Minor amount)	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By **Burns & Roe**

	Yes	No
Has there ever been a failure at this site?	☐	☒
If So When?		

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	☐	☒
If So When?		

If So Please Describe :

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	☒
If so, which method (e.g., piezometers, gw pumping,...)?		

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.

Santee Cooper personnel report that the embankment was not constructed on wet ash, slag, or other unsuitable material. Design drawings are to be furnished.

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

The design Engineer of Record was not present during the site visit.

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

The embankments seemed to be intact and undisturbed. It was reported by plant personnel that the embankment was in its original condition and has been undisturbed since its construction in 1975. Unit has never had a failure since its original construction.

Appendix B - Winyah GS Ash Pond B Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name:	**Winyah Generating Station**	**Date:**	**30 June 2010**
Unit Name:	**Ash Pond B**	**Operator's Name:**	**Santee Cooper**
Unit I.D.:		**Hazard Potential Classification:**	**High** ☐ **Significant** ☐ **Low** ☒
	Inspector's Name:	**Frederic C. Tucker, PE; Anne Lee**	

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?	Quarterly[1]		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	34.82 ft		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	TBP[2]		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)?		n/a[3]	Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	n/a[4]		Is water exiting outlet flowing clear?	X[6]	
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)?		n/a	From underdrain?		n/a
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		n/a	From downstream foundation area?	X[7]	
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[5]	22. Surface movements in valley bottom or on hillside?		n/a
16. Are outlets of decant or ~~underdrains~~ blocked?		X	23. Water against downstream toe?	X[8]	
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.

Issue #	Comments
	TBP – to be provided n/a – not applicable or not a feature
1	Santee Cooper conducts quarterly internal inspections by a registered engineer; also informal daily inspections take place over the course of the year by plant operating personnel and security personnel.
2	Decant structure, from Ash Pond B, is to be provided by Santee Cooper personnel.
3	No formal survey or records of dam elevations. Design top of dam elevations to be provided by plant personnel.
4	There is no geotechnical instrumentation. Staff gage monitored at Pond B outlet structure. Water quality wells monitored for groundwater contamination.

5	Sunken ground and dropouts beyond the downstream toe of the embankment along the length of the principal spillway may indicate separation of the joints of the RCP principal spillway. Separation of the last joint of the RCP principal spillway was observed. Water discharging from submerged end of outlet "boils" upward due to entrapped air in the spillway system.
6	Discharge from Ash Pond B flows directly into discharge channel of the Cooling Pond.
7	Areas observed to have moist soil conditions and water puddles at downstream toe of dam. Conditions may indicate minor seepage through embankment. It is noted that it rained two days prior to inspection.
8	A dividing dike separates Ash Pond A from Ash Pond B to the north. To the east of Ash Pond B, an embankment separates Ash Pond B from the Cooling Pond. The discharge channel to the Cooling Pond flows along the toe of the south western portion of Ash Pond B embankment.

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit # SC 0022471 **INSPECTOR** Frederic C. Tucker, PE; Anne Lee

Date
Impoundment Name Ash Pond B Winyah Generating Station

Impoundment Company Santee Cooper
EPA Region 4

State Agency South Carolina Department of Health and Environmental Control (DHEC)
(Field Office) Address 2600 Bull Street
Columbia, SC 29201
Name of Impoundment Ash Pond B

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

New ☐ **Update** ☒

	Yes	No
Is impoundment currently under construction?	☐	☒
Is water or ccw currently being pumped into the impoundment? Minor amount of water draining by gravity into Ash Pond B from Ash Pond A.	☒	☐

IMPOUNDMENT FUNCTION: The Ash Pond B functions as a settling basin for wastewater containing fly and bottom ash, and boiler slag. The wastewater discharges into the Cooling Pond discharge channel.

Nearest Downstream Town Name: Georgetown, SC

Distance from the impoundment: 5.6 miles (along flow path to nearest town limit)

Location:

Latitude	33	Degrees	19	Minutes	07.40	Seconds	**N**
Longitude	-79	Degrees	21	Minutes	04.90	Seconds	**E**

State SC **County** Georgetown

	Yes	No
Does a state agency regulate this impoundment?	☒	☐

If So Which State Agency?	DHEC, Bureau of Water/Compliance Assurance Division. For water quality only.

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

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

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

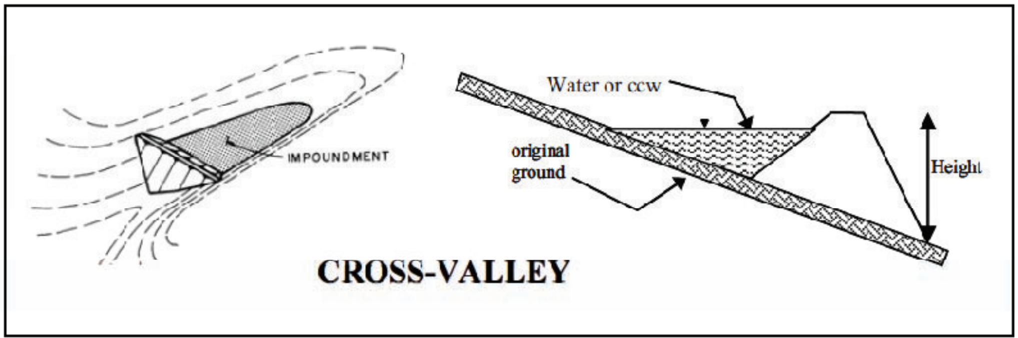
☐ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

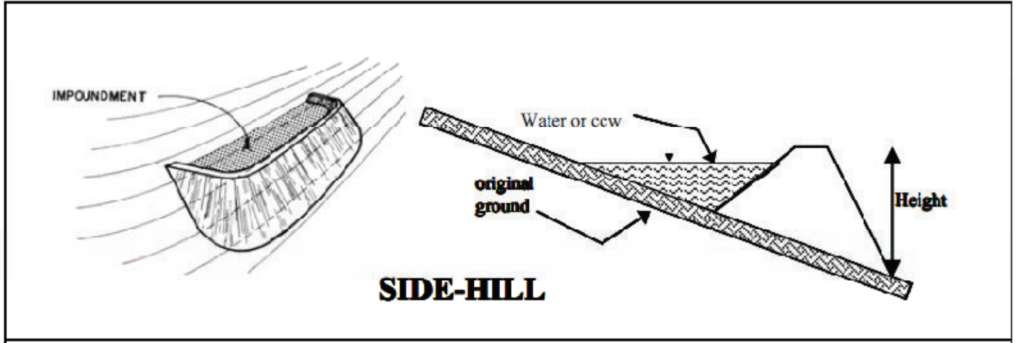
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

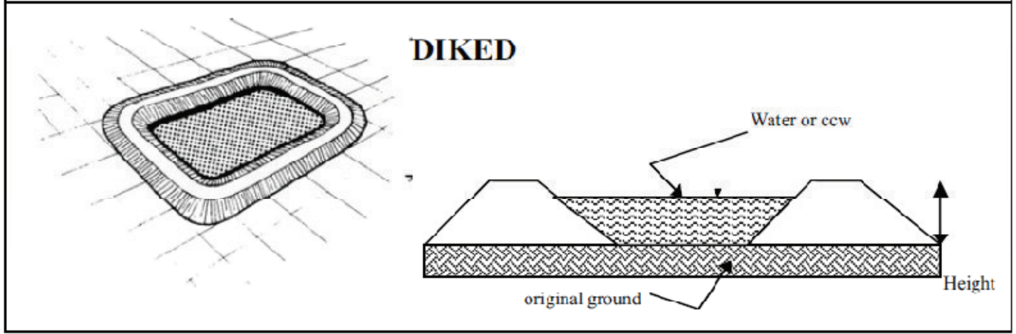
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

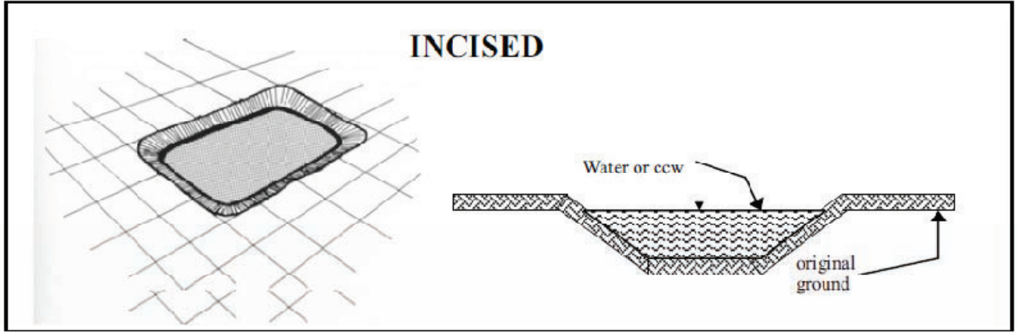
Failure of this structure would release directly into the Cooling Pond. A release would be contained within the Cooling Pond due to the extensive storage capacity in comparison to the capacity of the ponds. A release may disrupt power generation and cause minor environmental damage.

CONFIGURATION:









☐ Cross-Valley ☐ Side-Hill ☒ Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft) 31 **Embankment Material** Earth

Pool Area (ac) 63 **Liner** None

Current Freeboard (ft) TBP* **Liner Permeability** ---

*To be provided by Santee Cooper personnel. Water level in lower part of pond at discharge structure appeared to be approximately 5’-6’ below crest of west perimeter dike.

TYPE OF OUTLET (Mark all that apply)

☐ **Open Channel Spillway**

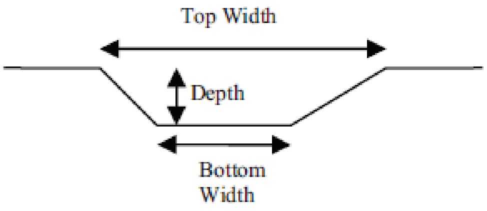
- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
- ☐ Irregular

depth (ft)

average bottom width (ft)

top width (ft)

TRAPEZOIDAL



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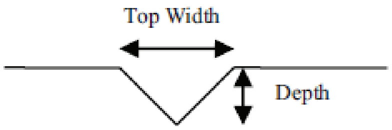

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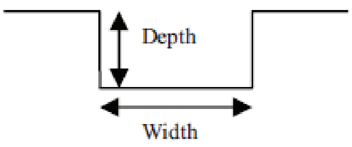
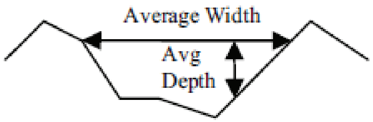
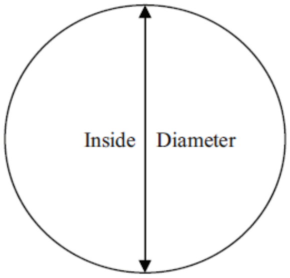


IRREGULAR



☒ **Outlet**

TBP inside diameter



Material

- ☐ corrugated metal
- ☐ welded steel
- ☒ concrete
- ☐ plastic (hdpe, pvc, etc.)
- ☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☒	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By **Burns & Roe/Paul C. Rizzo Associates, Inc. (PCRA)**

	Yes	No
Has there ever been a failure at this site?	☐	☒

If So When?

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	☐	☒
If So When?		

If So Please Describe :

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	☒
If so, which method (e.g., piezometers, gw pumping,...)?		

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.

Santee Cooper personnel report that the embankment was not constructed on wet ash, slag, or other unsuitable material. Design drawings are to be furnished. A stability evaluation was conducted for Ash Pond B in 1993.

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

The design Engineer of Record was not present during the site visit.

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

The embankment seemed to be intact and undisturbed. It was reported by plant personnel that the embankment was evaluated for stability in 1993 and raised in 1997 as an expansion of the pond. Unit has never had a failure since its original construction.

Appendix B - Winyah GS South Ash Pond Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name:	**Winyah Generating Station**	**Date:**	**29 June 2010**
Unit Name:	**South Ash Pond**	**Operator's Name:**	**Santee Cooper**
Unit I.D.:		**Hazard Potential Classification:**	**High** ☐ **Significant** ☒ **Low** ☐
		Inspector's Name:	**Frederic C. Tucker, PE; Anne Lee**

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?	Quarterly[1]		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	17.08 ft [2]		19. Major erosion or slope deterioration?		X[6]
3. Decant inlet elevation (operator records)?	TBP[3]		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		n/a	Is water entering inlet, but not exiting outlet?		n/a[7]
5. Lowest dam crest elevation (operator records)?		n/a[4]	Is water exiting outlet, but not entering inlet?		n/a[7]
6. If instrumentation is present, are readings recorded (operator records)?	n/a[5]		Is water exiting outlet flowing clear?		n/a[7]
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)?		n/a	From underdrain?	X[8]	
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?		n/a	From downstream foundation area?	X[8]	
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?		n/a
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	X[9]	
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.

Issue #	Comments
	TBP – to be provided n/a – not applicable or not a feature
1	Santee Cooper conducts quarterly internal inspections by a registered engineer; also informal daily inspections take place over the course of the year by plant operating personnel and security personnel.
2	Relative elevation. Water flows through discharge structure to a channel that leads to the discharge channel to the Cooling Pond.
3	Decant structure, from South Ash Pond, is to be provided by Santee Cooper personnel.
4	No formal survey or records of dam elevations. Design top of dam elevation to be provided by plant personnel.

5	There is no geotechnical instrumentation. Staff gage monitored at South Ash Pond outlet structure. Water quality wells monitored for groundwater contamination.
6	Some areas with little grass cover observed with minor erosion along the downstream side of the embankment.
7	Discharge from South Ash Pond flows into a channel to the discharge channel into the Cooling Pond. Flow at the outlet end could not be observed due to submergence.
8	Recent maintenance of underdrains conducted. Minor erosion observed along the downstream toe of dam. Rust colored residual trailing from toe drain pipes and minor foundation soil seeps at various points along the downstream toe of embankment may indicate seepage with iron bacteria in seepage water.
9	A drainage channel runs along the toe of the South Ash pond and collects stormwater draining from the slopes of the South Ash Pond and the train tracks, as well as seepage from toe drain pipes and minor seepage from foundation soil.

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit # SC 0022471 **INSPECTOR** Frederic C. Tucker, PE; Anne Lee

Date

Impoundment Name South Ash Pond Winyah Generating Station

Impoundment Company Santee Cooper

EPA Region 4

State Agency South Carolina Department of Health and Environmental Control (DHEC)

(Field Office) Address 2600 Bull Street
Columbia, SC 29201

Name of Impoundment South 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?	☐	☒
Is water or ccw currently being pumped into the impoundment?	☒	☐

IMPOUNDMENT FUNCTION: The South Ash Pond functions as a settling basin for wastewater containing fly and bottom ash, and boiler slag. Wastewater in the Unit 3&4 Slurry Pond, is pumped into the West Ash Pond and ultimately pumped into the South Ash Pond from the West Ash Pond. The water discharges from the South Ash Pond into the Cooling Pond discharge channel.

Nearest Downstream Town Name: Georgetown, SC

Distance from the impoundment: 6.4 miles (along flow path to nearest town limit)

Location:

Latitude	33	Degrees	19	Minutes	27.67	Seconds	**N**
Longitude	-79	Degrees	21	Minutes	16.28	Seconds	**E**

State SC **County** Georgetown

	Yes	No
Does a state agency regulate this impoundment?	☒	☐

If So Which State Agency?	DHEC, Bureau of Water/Compliance Assurance Division. For water quality only.

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

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

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

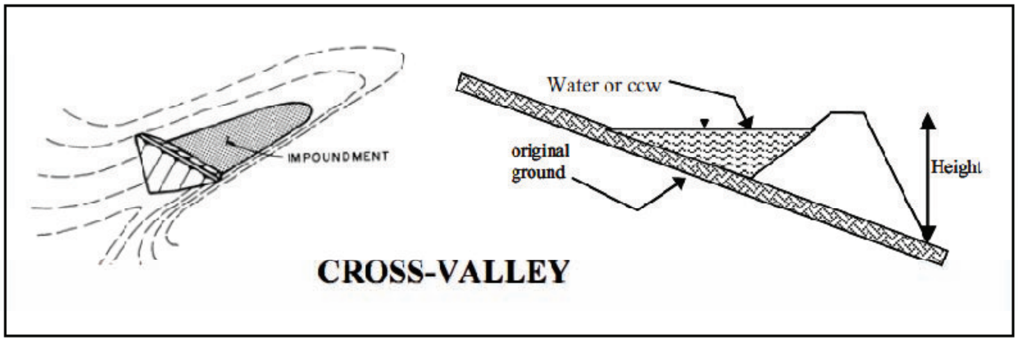
☒ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

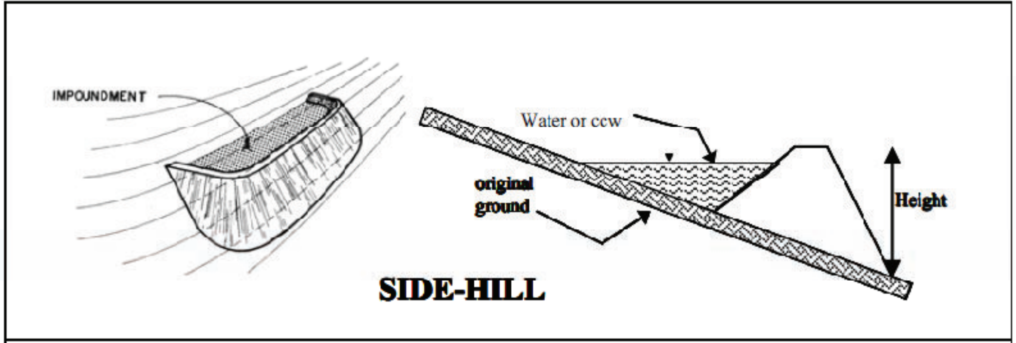
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

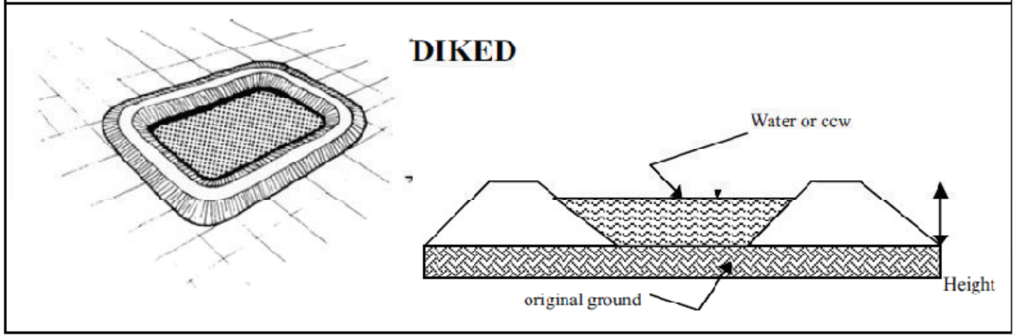
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

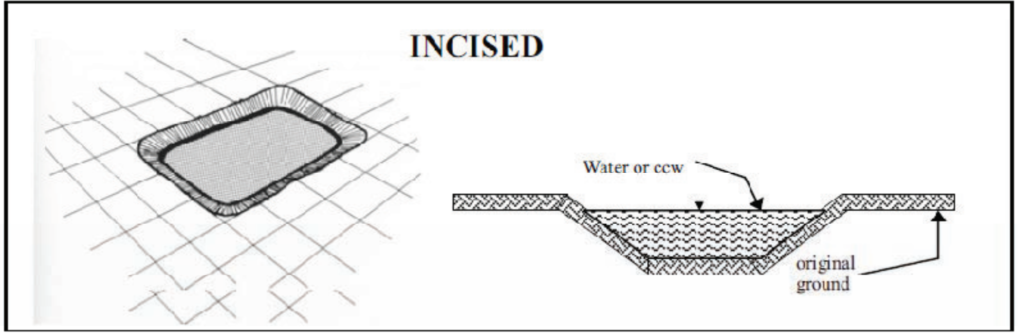
Failure of this structure would release directly into a perimeter ditch bounded by existing railroad tracks. If the tracks were to be overtopped, ccw could potentially damage adjacent private property and/or enter Pennyroyal Creek.

CONFIGURATION:









☐ Cross-Valley ☐ Side-Hill ☒ Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft) 22 **Embankment Material** Earth

Pool Area (ac) 61 **Liner** None

Current Freeboard (ft) TBP* **Liner Permeability** ---

*To be provided by Santee Cooper personnel. Water level in lower part of pond at discharge structure appeared to be approximately 5’-6’ below crest of east perimeter dike.

TYPE OF OUTLET (Mark all that apply)

☐ **Open Channel Spillway**

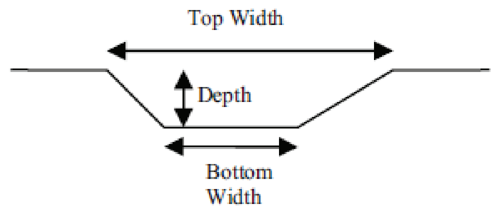
- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
- ☐ Irregular

depth (ft)

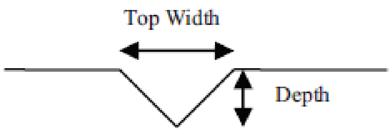
average bottom width (ft)

top width (ft)

TRAPEZOIDAL



TRIANGULAR



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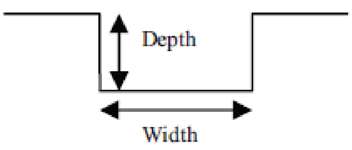
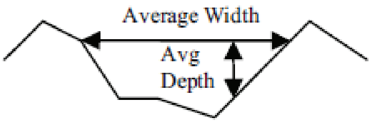
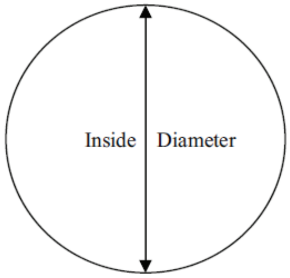


IRREGULAR



☒ **Outlet** (pipe not visible)

TBP inside diameter



Material (TBP)

- ☐ corrugated metal
- ☐ welded steel
- ☐ concrete
- ☐ plastic (hdpe, pvc, etc.)
- ☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☒	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By **Burns & Roe/Lockwood Greene**

	Yes	No
Has there ever been a failure at this site?	☐	☒

If So When?

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	☐	☒

If So When?

If So Please Describe :

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	☒

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

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.

Santee Cooper personnel report that the embankment was not constructed on wet ash, slag, or other unsuitable material. Design drawings are to be furnished.

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

The design Engineer of Record was not present during the site visit.

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

The embankments seemed to be in tack and undisturbed. It was reported by plant personnel that the embankment was in its original condition and has been undisturbed since its construction in 1980. Unit has never had a failure since its original construction.

Appendix B - Winyah GS West Ash Pond Checklist

Site Name:	**Winyah Generating Station**	**Date:**	**30 June 2010**
Unit Name:	**West Ash Pond**	**Operator's Name:**	**Santee Cooper**
Unit I.D.:		**Hazard Potential Classification:**	**High** ☐ **Significant** ☒ **Low** ☐
	Inspector's Name:	**Frederic C. Tucker, PE; Anne Lee**	

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?	Quarterly[1]		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	34.88 ft [2]		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?		n/a[3]	20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		n/a	Is water entering inlet, but not exiting outlet?		n/a[3]
5. Lowest dam crest elevation (operator records)?		n/a[4]	Is water exiting outlet, but not entering inlet?		n/a[3]
6. If instrumentation is present, are readings recorded (operator records)?		n/a[5]	Is water exiting outlet flowing clear?		n/a[3]
7. Is the embankment currently under construction?		X[6]	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		n/a	From underdrain?		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?		n/a	From downstream foundation area?	X[7]	
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?		n/a	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		n/a	23. Water against downstream toe?	X[8]	
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.

Issue #	Comments
	TBP – to be provided n/a – not applicable or not a feature
1	Santee Cooper conducts quarterly internal inspections by a registered engineer; also informal daily inspections take place over the course of the year by plant operating personnel and security personnel.
2	Pool elevation in internal drainage ditch recorded by plant personnel for West Ash Pond. No actual pool. Pond filled with CCW. Water from the Unit 3&4 Slurry Pond is pumped into the West Ash Pond. Water drains along ditches cut in ash surface and is pumped into the South Ash Pond.
3	Water from the West Ash Pond is pumped into the South Ash Pond.

4	No formal survey or records of dam elevations. Design top of dam elevations to be provided by Santee Cooper personnel.
5	There is no geotechnical instrumentation. Water quality wells monitored for groundwater contamination.
6	Due to the failure of a seal of an existing drain pipe on Feb. 14, 2008, on the Unit 3&4 Slurry Pond, an existing CMP drain pipe was located and filled within the West Ash Pond embankment to preclude a similar failure in the West Pond embankment.
7	Areas observed to have moist soil conditions, minor erosion, and water puddles at downstream toe of dam. Conditions may indicate minor seepage through or under embankment. It is noted that it rained two days prior to inspection.
8	A dividing dike separates Unit 3&4 Slurry Pond from the West Ash Pond. A drainage channel runs along the toe of the Slurry and Ash ponds and collects stormwater draining from the slopes and the train tracks.

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit # SC 0022471 **INSPECTOR** Frederic C. Tucker, PE; Anne Lee

Date

Impoundment Name West Ash Pond Winyah Generating Station

Impoundment Company Santee Cooper

EPA Region 4

State Agency South Carolina Department of Health and Environmental Control (DHEC)

(Field Office) Address 2600 Bull Street
Columbia, SC 29201

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?	☐	☒
Is water or ccw currently being pumped into the impoundment?	☒	☐

IMPOUNDMENT FUNCTION: The West Ash Pond functions as a settling basin for wastewater containing fly ash, bottom ash, and boiler slag. It also collects wastewater from the Unit 3&4 Slurry Pond in series prior to being pumped into the South Ash Pond and ultimately into the discharge channel to the Cooling Pond.

Nearest Downstream Town Name: Georgetown, SC

Distance from the impoundment: 5.9 miles (along flow path to nearest town limit)

Location:

Latitude	33	Degrees	19	Minutes	54.81	Seconds	**N**
Longitude	-79	Degrees	22	Minutes	13.54	Seconds	**E**

State SC **County** Georgetown

	Yes	No
Does a state agency regulate this impoundment?	☒	☐

If So Which State Agency?	DHEC, Bureau of Water/Compliance Assurance Division. For water quality only.

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

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

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

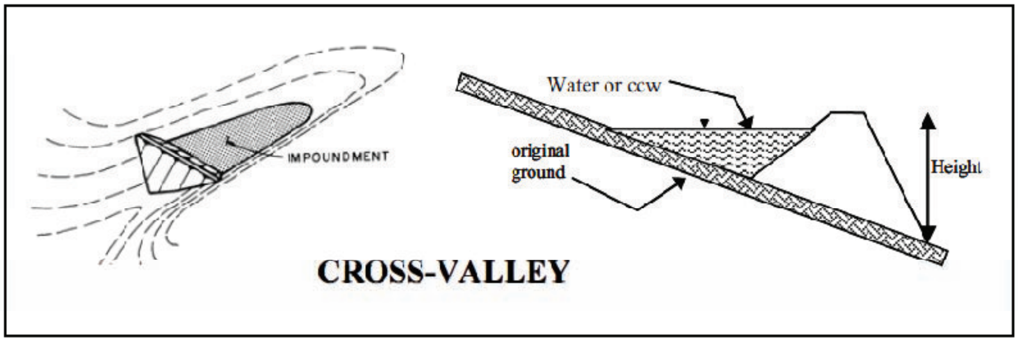
☒ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

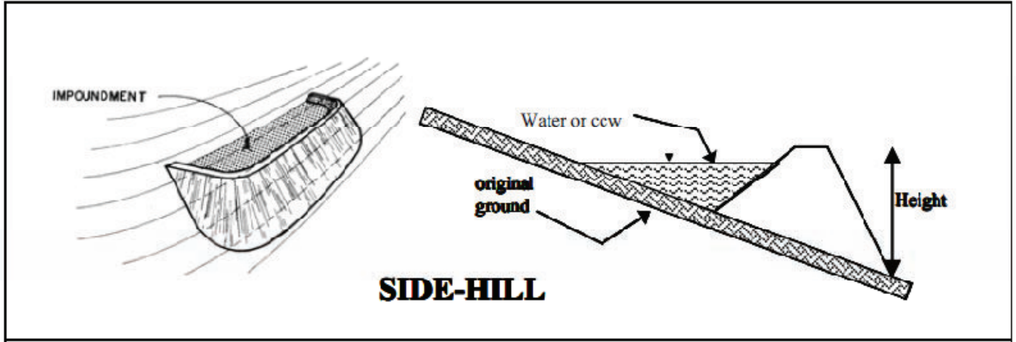
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

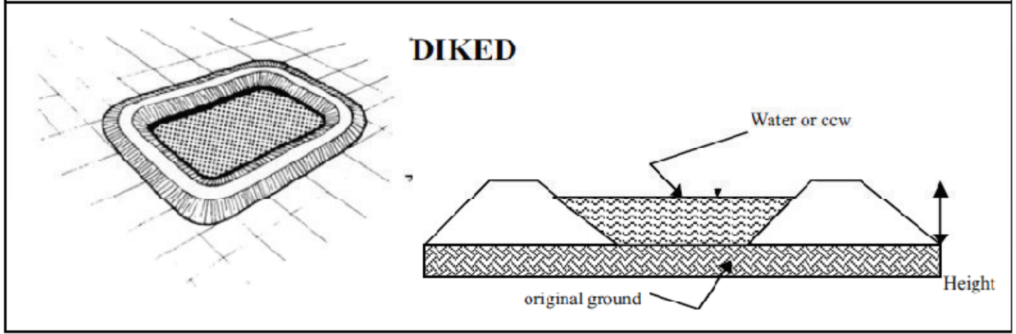
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

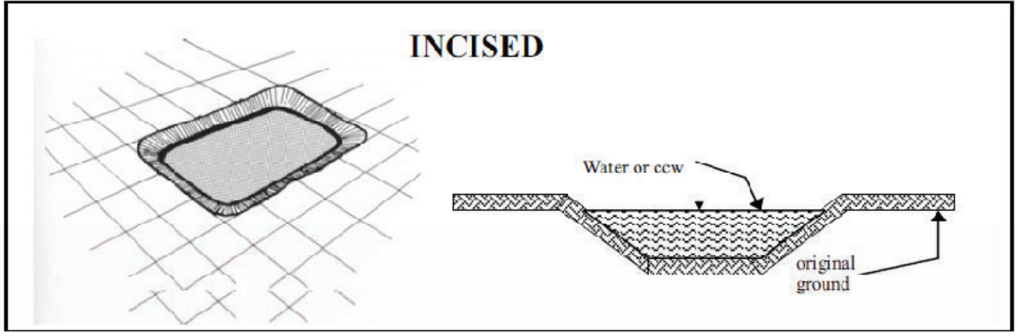
Failure of this structure would release directly into the Pennyroyal Creek and/or could potentially damage adjacent private property.

CONFIGURATION:









☐ Cross-Valley ☐ Side-Hill ☒ Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft) 32

Embankment Material Earth

Pool Area (ac) 62

Liner None

Current Freeboard (ft) TBP* **Liner Permeability** ---

*To be provided by Santee Cooper personnel. Water level in internal drainage ditch in lower part of pond at pump appeared to be approximately 3’-5’ below crest of south perimeter dike.

TYPE OF OUTLET (Mark all that apply)

☐ **Open Channel Spillway**

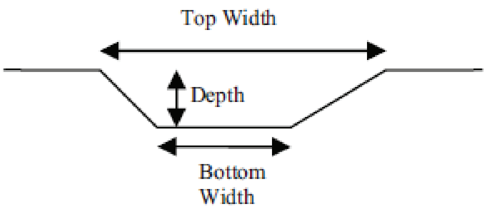
- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
- ☐ Irregular

depth (ft)

average bottom width (ft)

top width (ft)

TRAPEZOIDAL



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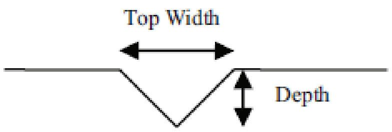

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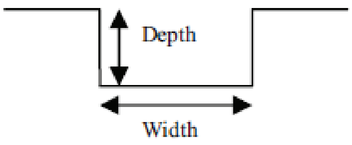

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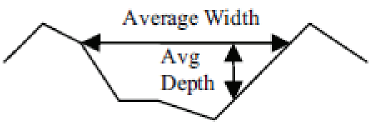
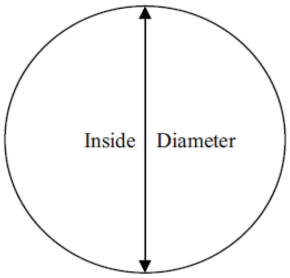


☐ **Outlet**

inside diameter



Material

- ☐ corrugated metal
- ☐ welded steel
- ☐ concrete
- ☐ plastic (hdpe, pvc, etc.)
- ☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☒	☐

☐ **No Outlet**

☒ **Other Type of Outlet** (specify): Water is pumped through HDPE piping to the South Ash Pond

The Impoundment was Designed By Burns & Roe/Lockwood Greene

	Yes	No
Has there ever been a failure at this site?	☐	☒

If So When?

If So Please Describe :

	Yes	**No**
Has there ever been significant seepages at this site?	☐	☒

If So When?

If So Please Describe :

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	☒

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

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.

Santee Cooper personnel report that the embankment was not constructed on wet ash, slag, or other unsuitable material. Design drawings are to be furnished. A 1999 geotechnical investigation by Paul C. Rizzo Associates, Inc (PCRA) indicated the embankment was well constructed.

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

The design Engineer of Record was not present during the site visit.

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

The embankments seemed to be intact. The embankment was constructed in 1980. An existing CMP drain pipe within the embankment was filled in 2008 as a precautionary measure due to the failure of a similar CMP drain pipe within the Unit 3&4 Slurry Pond.

Appendix B - Winyah GS Unit 3 & 4 Slurry Pond Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name:	**Winyah Generating Station**	**Date:**	**30 June 2010**
Unit Name:	**Unit 3&4 Slurry Pond**	**Operator's Name:**	**Santee Cooper**
Unit I.D.:		**Hazard Potential Classification:**	**High** ☐ **Significant** ☒ **Low** ☐
	Inspector's Name:	**Frederic C. Tucker, PE; Anne Lee**	

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?	Quarterly [1]		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	34.88 ft [2]		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?		n/a[3]	20. Decant Pipes:	■	■
4. Open channel spillway elevation (operator records)?		n/a	Is water entering inlet, but not exiting outlet?		n/a[3]
5. Lowest dam crest elevation (operator records)?		n/a[4]	Is water exiting outlet, but not entering inlet?		n/a[3]
6. If instrumentation is present, are readings recorded (operator records)?	n/a[5]		Is water exiting outlet flowing clear?		n/a[3]
7. Is the embankment currently under construction?		X[6]	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):	■	■
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		n/a	From underdrain?		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?		n/a	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?		n/a	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		n/a	23. Water against downstream toe?	X[7]	
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.

Issue #	Comments
	TBP – to be provided n/a – not applicable or not a feature
1	Santee Cooper conducts quarterly internal inspections by a registered engineer; also informal daily inspections take place over the course of the year by plant operating personnel and security personnel.
2	Pool elevation recorded by plant personnel for West Ash Pond.
3	Water is pumped from the Unit 3&4 Slurry Pond into the West Pond.

4	No formal survey or records of dam elevations. Design top of dam elevations to be provided by Santee Cooper personnel.
5	There is no geotechnical instrumentation. Staff gage monitored at Unit 3&4 Slurry Pond. Water quality wells monitored for groundwater contamination.
6	Due to the failure of a seal of an existing drain pipe on Feb. 14, 2008, a portion of the embankment was excavated and repaired after a portion of the existing pipe was removed and filled.
7	A dividing dike separates Unit 3&4 Slurry Pond from the West Ash Pond. A drainage channel runs along the toe of the Slurry and Ash ponds and collects stormwater draining from the slopes and the train tracks.

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit # SC 0022471 **INSPECTOR** Frederic C. Tucker, PE; Anne Lee

Date
Impoundment Name Unit 3&4 Slurry Pond Winyah Generating Station

Impoundment Company Santee Cooper
EPA Region 4

State Agency South Carolina Department of Health and Environmental Control (DHEC)
(Field Office) Address 2600 Bull Street
Columbia, SC 29201
Name of Impoundment Unit 3&4 Slurry Pond

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

New ☐ **Update** ☒

	Yes	**No**
Is impoundment currently under construction?	☐	☒
Is water or ccw currently being pumped into the impoundment?	☒	☐

IMPOUNDMENT FUNCTION: The Unit 3&4 Slurry Pond functions as a settling basin for wastewater containing fuel gas emission control residuals. The wastewater flows to the West Ash Pond in series prior to being pumped into the South Ash Pond and ultimately into the discharge channel to the Cooling Pond.

Nearest Downstream Town Name: Georgetown, SC

Distance from the impoundment: 5.8 miles (along flow path to nearest town limit)

Location:

Latitude	33	Degrees	20	Minutes	14.81	Seconds	**N**
Longitude	-79	Degrees	22	Minutes	06.28	Seconds	**E**

State SC **County** Georgetown

	Yes	No
Does a state agency regulate this impoundment?	☒	☐

If So Which State Agency? DHEC, Bureau of Water/Compliance Assurance Division. For water quality only.

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

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

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

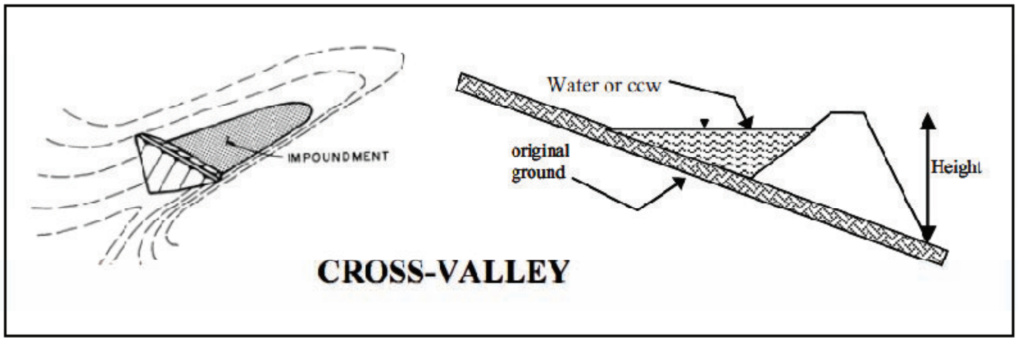
☒ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

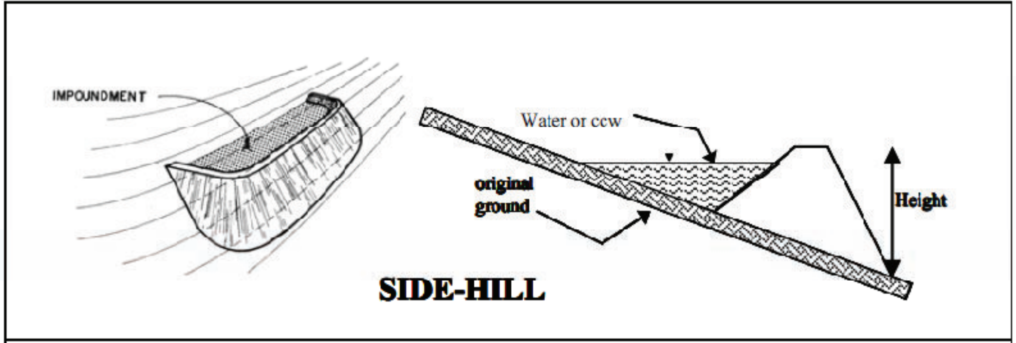
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

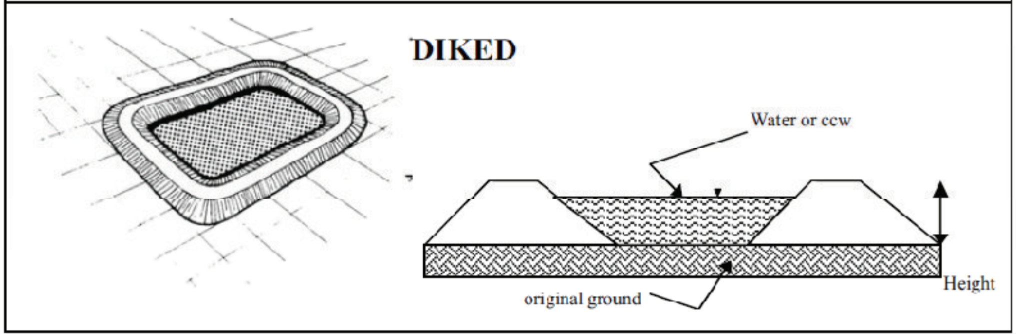
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

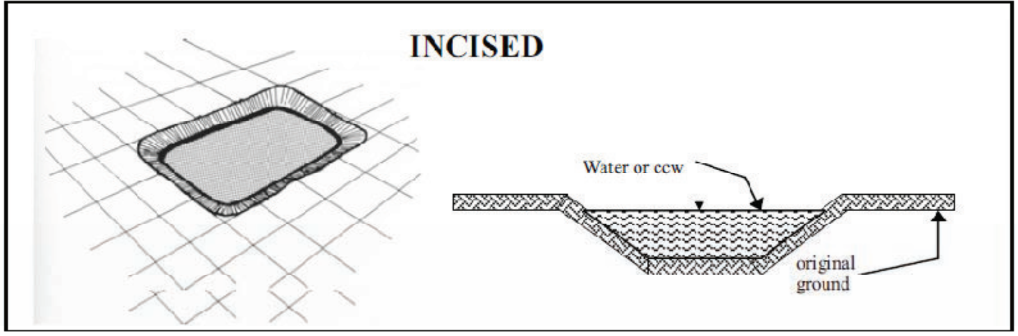
Failure of this structure would release directly into the Pennyroyal Creek and/or could potentially damage adjacent private property.

CONFIGURATION:









☐ Cross-Valley ☐ Side-Hill ☒ Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft) 30 **Embankment Material** Earth

Pool Area (ac) 100 **Liner** None

Current Freeboard (ft) TBP* **Liner Permeability** ---

*To be provided by Santee Cooper personnel. Water level in internal drainage channel near west corner of pond at pump structure appeared to be approximately 5’-6’ below crest of west perimeter dike.

TYPE OF OUTLET (Mark all that apply)

☐ **Open Channel Spillway**

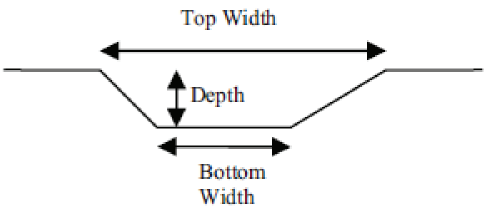
- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
- ☐ Irregular

depth (ft)

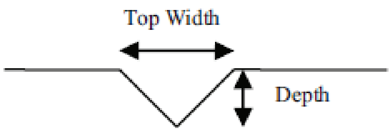
average bottom width (ft)

top width (ft)

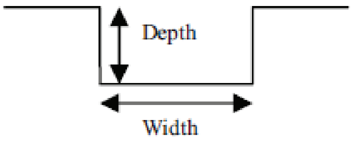
TRAPEZOIDAL



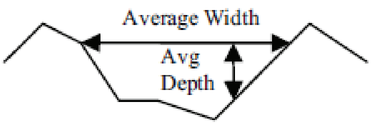
TRIANGULAR



RECTANGULAR

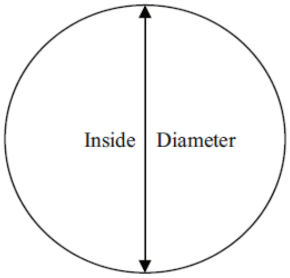


IRREGULAR



☐ **Outlet**

inside diameter



Material

- ☐ corrugated metal
- ☐ welded steel
- ☐ concrete
- ☐ plastic (hdpe, pvc, etc.)
- ☐ other (specify):

Is water flowing through the outlet? **Yes** ☒ **No** ☐

☐ **No Outlet**

☒ **Other Type of Outlet** (specify): Water is pumped through HDPE piping to the West Ash Pond

The Impoundment was Designed By **Burns & Roe/Lockwood Greene**

	Yes	**No**
Has there ever been a failure at this site?	☒	☐

If So When? February 14, 2008

If So Please Describe : Existing seal of a CMP drain pipe failed and released wastewater from Unit 3&4 Slurry Pond. A portion of the embankment was excavated to remove a portion of the pipe. The remaining portion of the pipe within the embankment was filled and the embankment was repaired.

	Yes	No
Has there ever been significant seepages at this site?	☒	☐

If So When? February 14, 2008

If So Please Describe : Existing seal of a CMP drain pipe failed and released wastewater from Unit 3&4 Slurry Pond. A portion of the embankment was excavated to remove a portion of the pipe. The remaining portion of the pipe within the embankment was filled and the embankment was repaired.

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	☒
If so, which method (e.g., piezometers, gw pumping,...)?		

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.

Santee Cooper personnel report that the embankment was not constructed on wet ash, slag, or other unsuitable material. Design drawings are to be furnished. A 1999 geotechnical investigation by Paul C. Rizzo Associates, Inc (PCRA) indicated the embankment was well constructed.

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

The design Engineer of Record was not present during the site visit.

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

The embankments seemed to be intact. The embankment was constructed in 1980 and repaired in 2008 due to a failure of an existing CMP drain pipe seal.

Appendix B - Winyah GS Unit 2 Slurry Pond Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name:	**Winyah Generating Station**	**Date:**	**29 June 2010**
Unit Name:	**Unit 2 Slurry Pond**	**Operator's Name:**	**Santee Cooper**
Unit I.D.:		**Hazard Potential Classification:**	**High** ☐ **Significant** ☒ **Low** ☐
	Inspector's Name:	**Frederic C. Tucker, PE; Anne Lee**	

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?	Quarterly[1]		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?		n/a[2]	19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?		n/a[3]	20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		n/a	Is water entering inlet, but not exiting outlet?		n/a[6]
5. Lowest dam crest elevation (operator records)?		n/a[4]	Is water exiting outlet, but not entering inlet?		n/a[6]
6. If instrumentation is present, are readings recorded (operator records)?		n/a[5]	Is water exiting outlet flowing clear?		n/a[6]
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)?		n/a	From underdrain?		n/a
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		n/a	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?		n/a	Around the outside of the decant pipe?		n/a
15. Are spillway or ditch linings deteriorated?		n/a	22. Surface movements in valley bottom or on hillside?		n/a
16. Are outlets of decant or underdrains blocked?		n/a	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.

Issue #	Comments
	TBP – to be provided n/a – not applicable or not a feature
1	Santee Cooper conducts quarterly internal inspections by a registered engineer; also informal daily inspections take place over the course of the year by plant operating personnel and security personnel.
2	Unit 2 Slurry Pond is not currently in use. Stormwater from the surface of the pond is pumped directly into the intake channel from the Cooling Pond. No pool is currently maintained although some stormwater ponds in low areas. Water level at pump appeared to be 8'-10' below dam crest.
3	Decant structure and pond are not currently in use. Stormwater is pumped from the pond into the intake channel from the Cooling Pond.

4	No formal survey or records of dam elevations. Design top elevation to be provided.
5	There is no geotechnical instrumentation. Water quality wells monitored for groundwater contamination.
6	Stormwater from the surface of the pond is the only source of water. The water is pumped from the pond to the intake channel from the Cooling Pond.

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit # SC 0022471 **INSPECTOR** Frederic C. Tucker, PE; Anne Lee

Date

Impoundment Name Unit 2 Slurry Pond Winyah Generating Station

Impoundment Company Santee Cooper

EPA Region 4

State Agency South Carolina Department of Health and Environmental Control (DHEC)

(Field Office) Address 2600 Bull Street
Columbia, SC 29201

Name of Impoundment Unit 2 Slurry Pond

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

New ☐ **Update** ☒

	Yes	No
Is impoundment currently under construction?	☐	☒
Is water or ccw currently being pumped into the impoundment? Only when needed. None on date of site visit.	☐	☒

IMPOUNDMENT FUNCTION: The Unit 2 Slurry Pond is not currently in use and does not receive any discharge. The only source of water within the pond is stormwater from the surface of the pond. The water is pumped into the intake channel of the Cooling Pond.

Nearest Downstream Town Name: Georgetown, SC

Distance from the impoundment: 4.6 miles (along flow path to nearest town limit)

Location:

Latitude	33	Degrees	19	Minutes	50.34	Seconds	**N**
Longitude	-79	Degrees	21	Minutes	03.12	Seconds	**E**

State SC **County** Georgetown

	Yes	No
Does a state agency regulate this impoundment?	☒	☐

If So Which State Agency?	DHEC, Bureau of Water/Compliance Assurance Division. For water quality only.

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

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

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

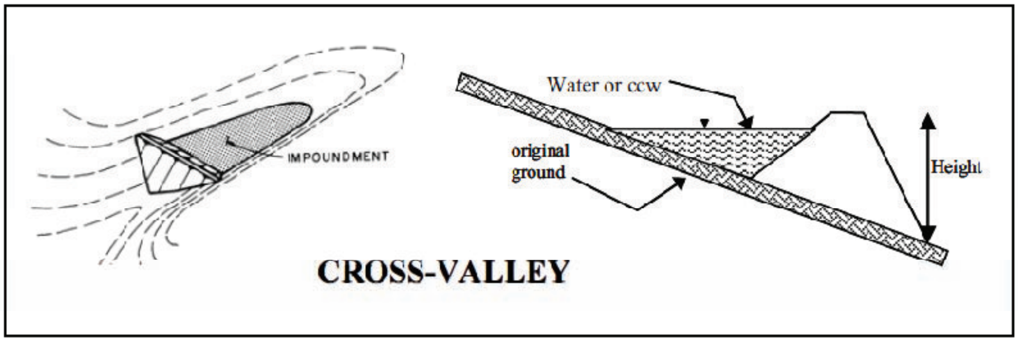
☒ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

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

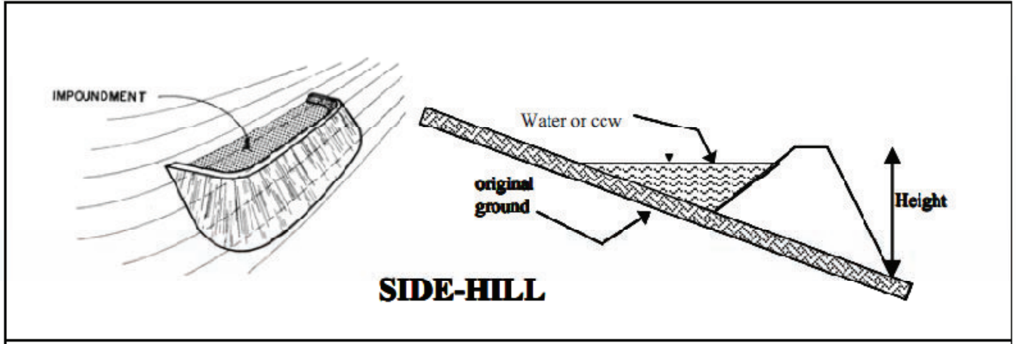
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Failure of this structure would release directly into a perimeter ditch. If the ditch were to be overtopped, ccw could potentially damage adjacent private property.

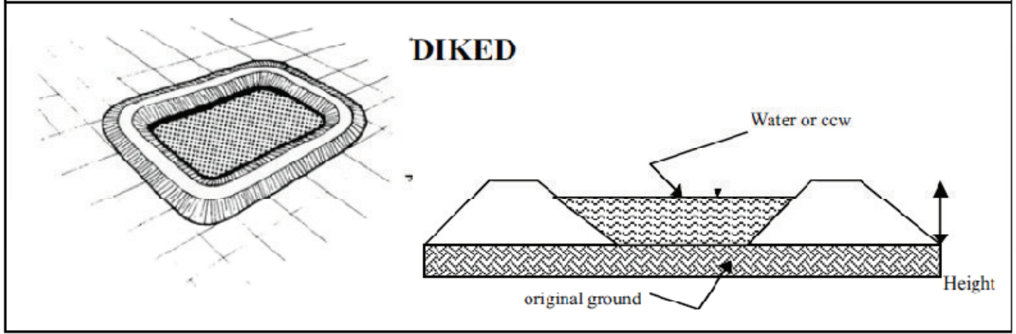
CONFIGURATION:

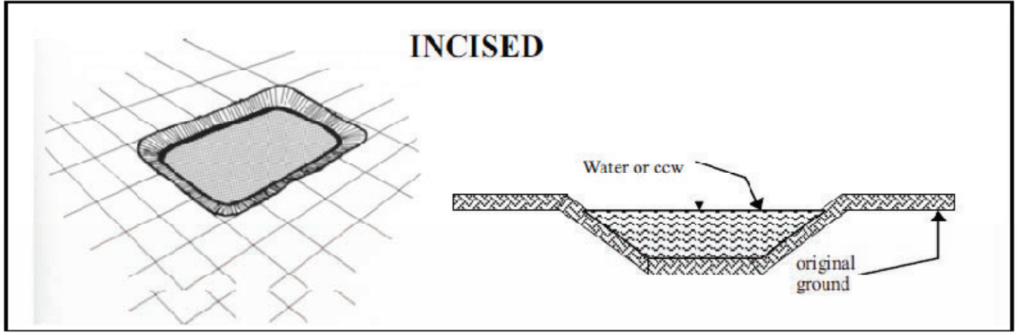


CROSS-VALLEY



SIDE-HILL


DIKED


INCISED

☐ Cross-Valley ☐ Side-Hill ☒ Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft) 12 **Embankment Material** Earth

Pool Area (ac) 34 **Liner** None

Current Freeboard (ft) TBP[*] **Liner Permeability** ---

*To be provided by Santee Cooper personnel. Water level in lower part of pond at discharge structure appeared to be approximately 8’-10’ below crest of perimeter dike.

TYPE OF OUTLET (Mark all that apply)

☐ **Open Channel Spillway**

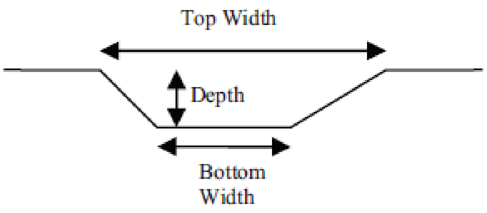
- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
- ☐ Irregular

depth (ft)

average bottom width (ft)

top width (ft)

TRAPEZOIDAL



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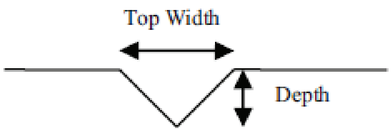

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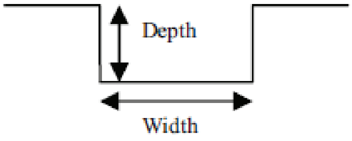
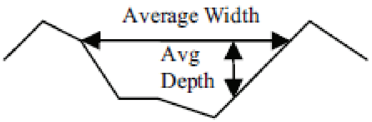
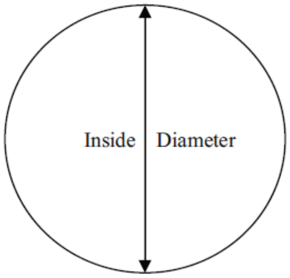


IRREGULAR



☐ **Outlet**

inside diameter



Material

- ☐ corrugated metal
- ☐ welded steel
- ☐ concrete
- ☐ plastic (hdpe, pvc, etc.)
- ☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☐	☐

☐ **No Outlet**

☒ **Other Type of Outlet** (specify): Water is pumped through HDPE piping to the intake channel of the Cooling Pond

The Impoundment was Designed By Burns & Roe/Lockwood Greene

	Yes	No
Has there ever been a failure at this site?	☐	☒

If So When?

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	☐	☒
If So When?		

If So Please Describe :

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	☒
If so, which method (e.g., piezometers, gw pumping,...)?		

If So Please Describe :

Appendix C - Management of Change Procedure

5.6 *Management of Change*

"Describe a process for ensuring consideration of Environmental Requirements and environmental concerns in the planning, design, and operation of ongoing, new and/or changing processes, equipment, and maintenance activities." (CD Appendix ¶ 5.e.vi.)

Santee Cooper ensures consideration of environmental requirements and environmental concerns in the planning, design, and operation of ongoing, new and/or changing process, equipment, and maintenance activities through a combination of the following:

- An environmental review, which is governed by Santee Cooper's Management of Change process; and
- EMS training to educate Santee Cooper employees, contractors, and on-site service providers about environmental issues and requirements.

5.6.1 Triggering a Management of Change (MOC) Environmental Review

A formal environmental review is required for all "significant changes" with potential environmental requirements, impacts, or other concerns. Examples of significant changes or other events that would trigger a formal environmental review include, but are not limited to:

- Any project or activity requiring capital approval;
- Addition of new operations or processes that use equipment or materials whose environmental risks have not previously been assessed and environmental impacts and requirements determined;
- Installation of new equipment, replacement of equipment, or any construction activities that are not "replacement-in-kind" and which has not been assessed previously (e.g., re-routing of piping, emission points, water and wastewater conveyances, and significant earth moving);
- "Non-routine" maintenance activities which have not been assessed previously;
- Any activity that would require a permit modification, new permit, or contradict a condition in an existing permit;
- Any new or changing activity or process (including revising an SOP), where the resulting action will have an impact on the environment or be covered by an environmental requirement (i.e. changes that create a new waste stream, alters a permit condition); and
- Changes in regulatory requirements that will cause a physical modification at the facility, installation of new equipment, or changes in standard operating procedures.

5.6.2 Management of Change Environmental Review Process

Any originator of a potential change ("Originator") consults with the Station or Corporate EMS Coordinator to determine whether they must complete an environmental review, based on examples provided in this manual. Originators may include, but are not limited to, supervision/management in Generation Operations, Maintenance, and Technical Services, the Station Manager, Engineering & Construction Services (E&CS), General Construction Services, or Corporate Environmental Management. This list is not exclusive. Any Santee Cooper employee may originate a change requiring a MOC Environmental Review. Contact the Station or Corporate EMS Coordinator. The originator of the change completes the MOC Environmental Review form, per the instructions in the Appendix to this Manual, and forwards it to his or her supervision.

MOC reviews will require review and approval by the following:

- Originator's Supervision;
- Station EMS Coordinator;
- Generation Technical Services Superintendent; and
- Corporate EMS Coordinator.

After the environmental review is completed and approved, and before the changes are implemented, the Station EMS Coordinator ensures that the changes and any resulting requirements are communicated to appropriate employees, contractors, and on-site service providers. Training occurs for employees as necessary and as identified in the MOC, and all documentation, including SOPs, are updated.

Documentation of all MOC Environmental Reviews will be maintained at the station by the Station EMS Coordinator in the environmental files and by the change Originator with the project files. The Corporate EMS Coordinator will maintain a copy in the Corporate EMS files.

13.13 Policy

ENVIRONMENTAL MANAGEMENT OF CHANGE

MANAGEMENT OF CHANGE PROCESS

Change Identification

A change is identified by an individual. Table 1 Definition of a Change lists various types of changes and whether or not they are covered by the Management of Change (MOC) process.

Any employee can originate a change – although most changes will originate with planners, engineers, supervisors, superintendents, or construction personnel.

Change Initiation

Prior to beginning a project, the originating employee must decide if a project requires an MOC review. If a change requires an MOC, the originator completes the Management of Change Environmental Review Form (SC1039). Capital projects and O&M activities requiring an MOC review should not be approved until the MOC has been authorized.

The Management of Change Environmental Review Form includes:

- Description of the Change – including location, specifics on equipment, and planned implementation dates if known
- Identification of Temporary Changes – Any temporary changes require a removal date
- Potential Effect of the Change – Environmental impacts of the change, when known, should be identified here. Details of the effects and other information known should be provided.

Attach drawings, vendor information, or other instructive information if appropriate.
The MOC originator signs and dates the document.

Environmental Review

The Station EMS Coordinator coordinates a review of the change, and includes the originator and their supervisor, appropriate station personnel, the Generation Technical Services Superintendent, and the Corporate EMS Coordinator. These individuals determine any further actions necessary for the change to proceed.

Actions may include the following:

- Obtain or modify environmental permits
- Notify regulatory agencies
- Train employees, contractors and/or on-site service providers
- Edit Standard Operating Procedures or Operations and Maintenance Manuals
- Modify preventive maintenance (PM) tasks
- Modify Environmental Risk Assessment
- Develop job-specific work instructions
- Edit requirements matrix, training matrix, and other documents

The Station EMS Coordinator notifies the responsible persons of the required actions, and gains agreement on the Target Completion Date.

The originator/Supervisor, the Station EMS Coordinator, the Generation Technical Services Superintendent, and the Corporate EMS Coordinator sign and date the form indicating that the change has been reviewed to determine environmental impacts and all necessary Actions have been listed.

The Station EMS Coordinator or Corporate EMS Coordinator documents all actions in the MOC Tracking Spreadsheet.

Completion of Action List

Individuals who are assigned specific actions communicate with the Station EMS Coordinator indicating the status or completion of their assigned actions. As actions are completed, the Station EMS Coordinator or Corporate EMS Coordinator updates the MOC Tracking Spreadsheet with actual completion dates. The MOC Tracking Spreadsheet is used to track the status of all changes with uncompleted actions.

Authorization for Implementation

Prior to project or activity implementation, the change will be communicated to all affected employees, contractors, and on-site service providers.

The Station EMS Coordinator ensures that this communication has taken place and that all actions required in the Environmental Review are complete. The change is then authorized by the Station EMS Coordinator.

If it becomes necessary to implement a change prior to completion of some actions, the Station EMS Coordinator will determine if this is appropriate, and that this will not cause or have the potential to cause an environmental impact. All changes will be tracked to completion.

Documentation

The completed MOC form for each change, and any associated documentation, is maintained in the station EMS files. A copy of the completed form is sent to the Generation Technical Services Superintendent, the Corporate EMS Coordinator, and to the originator. If the change is associated with a project, a copy will be maintained in the project files. A copy of each completed MOC form will also be posted on the EMS iPort page.

TABLE 1

Definition of a Change

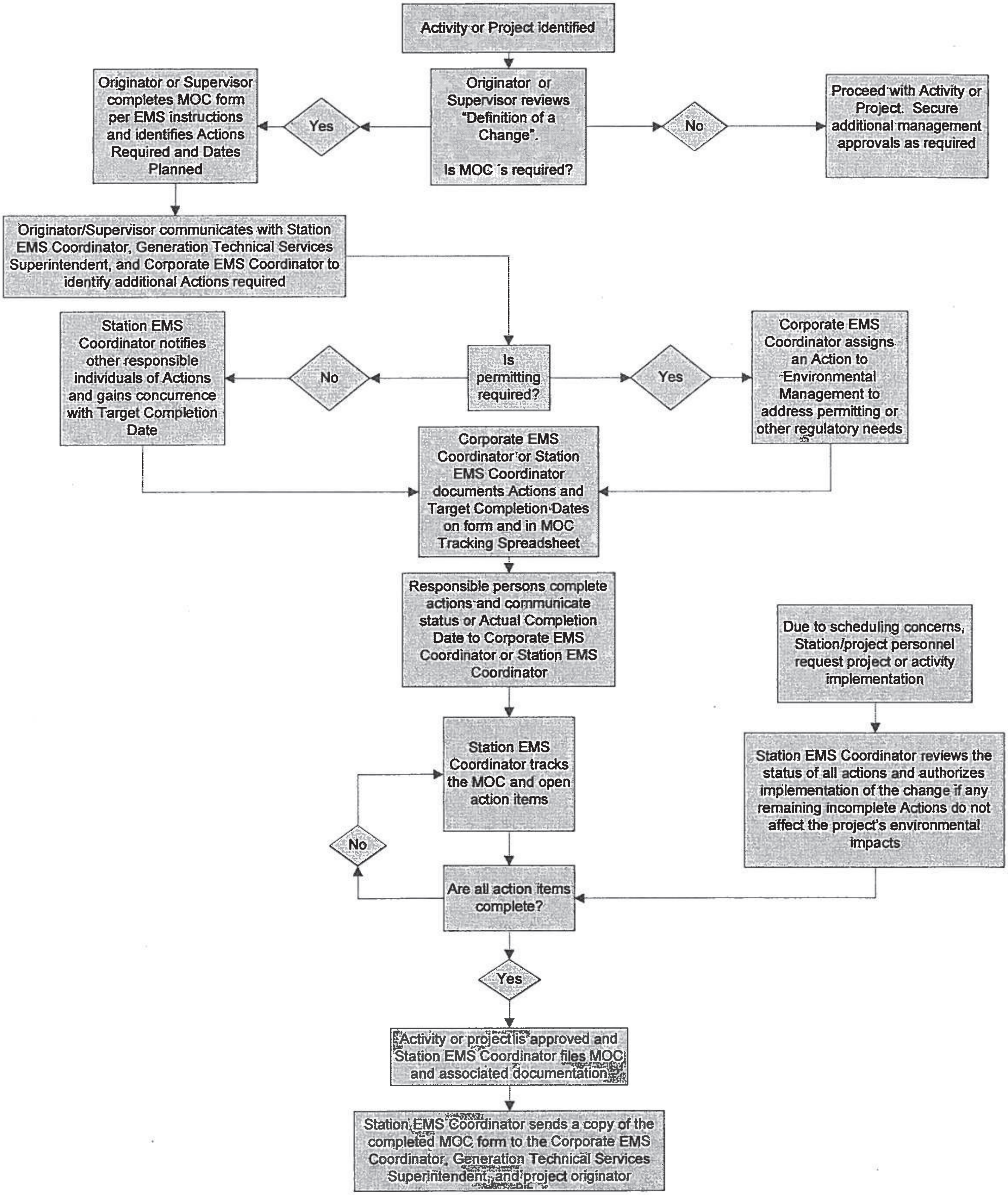
A formal environmental review using the Management of Change process is required for all "significant changes" with potential environmental requirements, impacts, or other concerns.

	Type of Change	MOC Required?
Processes A change to existing processes, work practices, or the use of existing equipment or structures	Activities or projects requiring capital approval	Yes
	Start up or shutdown of existing equipment	No
	Use of existing equipment for a purpose other than that for which it was originally intended	Yes
	Alteration to site, including: - Clearing or grading including road modifications - Modifications to stormwater collection - Change in location of material storage areas for oil, fuel, chemicals, by-products, etc.	Yes
	Activities generating new waste products	Yes
	Pond dredging – routine	No
	Pond dredging – non-routine, changing capacity	Yes
	Change of a pond use or change in inputs to a pond	Yes
	Changes in chemical suppliers	No
	Additions of chemicals not previously used	Yes
	Fuel Change to: – Fuel not currently permitted to burn, or – Fuel currently permitted but outside specifications	Yes
	Changes or additions to Standard Operating Procedures that are intended to improve clarity or format, and do not impact operating practices or have environmental issues	No
	Changes to a Standard Operating Procedure (Operations or Maintenance) that will have an impact on operating practices or has the potential to impact the environment	Yes
	Modifications (permanent or temporary) to controls or alarms in critical processes with impacts to the environment	Yes

	Type of Change	MOC Required?
Equipment Modifications to existing equipment – including rotating equipment, vessels, piping, tanks, containment areas, specialty items, instrumentation, and software – with potential environmental impacts	Identical replacement or replacement-in-kind (such as the same capacity, design conditions, materials of construction, speed, power, grade, internals, service, and operating theory)	No
	Equipment repairs and modifications to equipment that do not deviate from the original design specifications	No
	Equipment modifications not described above	Yes
	Modifications intended to extend the life of the station beyond original life expectancy	Yes
	Modifications that will increase the generating capacity/output of the station	Yes
	Temporary repairs or clamps on process equipment/piping with impacts to the environment	Yes
	Temporary changes to instrumentation or software with impacts to the environment	Yes
	Equipment temporarily out of service, pending return to service, abandonment, or demolition with impacts to the environment	Yes
New additions – including rotating equipment, vessels, piping, tanks, specialty items, instrumentation, software, and chemicals	New chemical being introduced into the process	Yes
	New facility installations (permanent or temporary)	Yes
	New equipment in parallel service	Yes
Maintenance Activities	Activities or projects requiring capital approval	Yes
	Piping or tubing replacement with like materials	No
	Piping changes other than normal repair or replacement-in-kind	Yes
	Repair of existing equipment to return it to its original design specifications	No
	Rerouting of existing piping	Yes
	Alterations or additions to potable water systems or sanitary systems	Yes
	A bypass to an alarm, shutdown, or interlock with impacts to the environment that is not described in existing operating procedures	Yes
	Changes to relief devices (relief valves, rupture disks, etc.) with impacts to the environment	Yes
	Changes to PM intervals on fuel burning or environmental compliance equipment	Yes
	Changes to PM intervals on equipment other than that described above	No
	Changes to or additions of lubricants not previously used	Yes

Santee Cooper Environmental Management System

Management of Change Process Flow



Santee Cooper.

MANAGEMENT OF CHANGE ENVIRONMENTAL REVIEW

Station:

WO#:

Description of Change:
(Include location, specifics on equipment, and planned implementation date if known)

Is this change Temporary? ☐ No

☐ Yes- Date of Removal:

Is a MOC review required? ☐ No - Indicate Reason:

☐ Yes

Select the potential effect(s) of the change on the environment:	Describe effects and any known details:
☐ Creates a new waste or pollutant emission	
☐ Requires Environmental permits or permit modifications	
☐ Involves the use of chemicals	
☐ Results in a change to an SOP	
☐ Extends the life of equipment	
☐ Changes waste stream/air emission/wastewater levels or characteristics	
☐ Has an environmental impact or potential environmental risk	
☐ Requires pollution control equipment, measures, or procedures	
☐ Increases station capacity	
☐ Other environmental impacts	

Originator: *(Print Name)*	Signature:	Date:

Environmental Review

List any further actions necessary before initiating the change:

Action	Responsible Person	Target Completion Date

Signatures below indicate changes have been reviewed to determine environmental impacts, and all actions have been listed:

Supervisor: *(Print Name)*	Signature:	Date:

Station EMS Coordinator: *(Print Name)*	Signature:	Date:

Generation Technical Services Superint.: *(Print Name)*	Signature:	Date:

Corporate EMS Coordinator: *(Print Name)*	Signature:	Date:

Authorization for Implementation

All actions listed above are complete. If not complete prior to Authorization, this will not cause or have the potential to cause environmental impact. All changes will be tracked to completion.

Station EMS Coordinator: *(Print Name)*	Signature:	Date:

Copies to:
- Station EMS Coordinator - Original
- Generation Technical Services Superintendent
- Corporate EMS Coordinator
- Originator
- Project files, if applicable

Appendix C - BMP and EMS Manual Coversheets

santee cooper®

Environmental Management System Manual

April 2010

Pollution Prevention Plan
With Best Management Practices (BMPs)
South Carolina Public Service Authority

2010 Revision

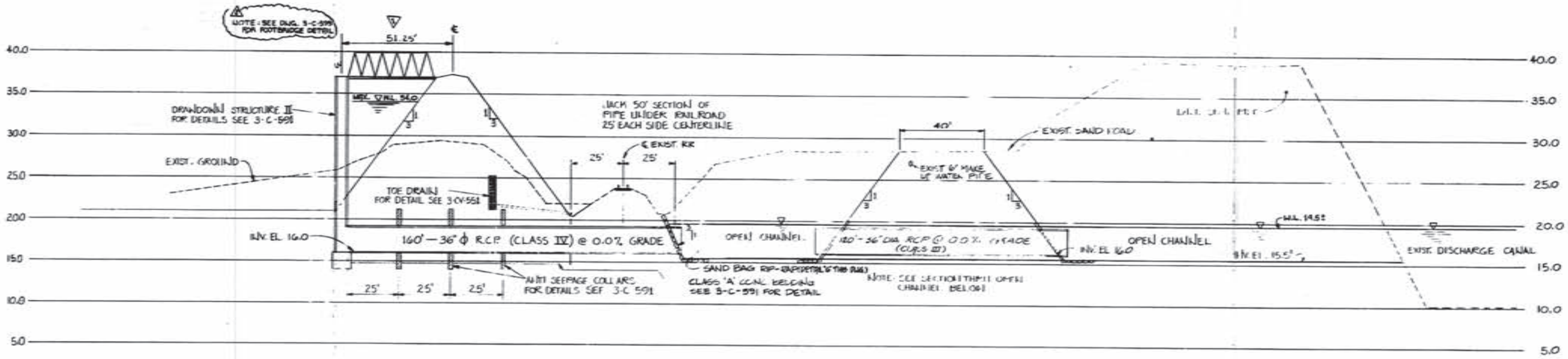
Items Requested

- Descriptive Information
    - Impoundment Capacity (Normal & Max) **(included in Santee Cooper response to EPA's Request for Information)**
    - Impoundment Surface Area (Normal & Max) **(included in Santee Cooper response to EPA's Request for Information)**
    - Hazard Classification **(undetermined)**
    - Freeboard (Normal & Min) **(N/A)**
    - Maximum Dam Height **(included in Santee Cooper response to EPA's Request for Information)**
    - Dam Crest Elevation **(included in original design plans, but not surveyed elevations)**
    - Crest Width **(typical details included in original design plans)**
    - Upstream Slope Inclination **(typical details included in original design plans)**
    - Downstream Slope Inclination **(typical details included in original design plans)**
    - Spillway Type, Size, & Crest Elevation **(N/A)**
    - Outlet Conduit Type, Size, & Max Flow Capacity **(N/A)**
    - Historical Maximum Pond Elevation **(N/A)**
    - Year Built **(included in Santee Cooper response to EPA's Request for Information)**
    - Design Life **(N/A)**
    - Specific Wastes Permitted in Impoundment **(included in Santee Cooper response to EPA's Request for Information)**
    - Other (describe)
- Regional map including schools, hospitals, etc. **(received from Jay Hudson)**
- Management Unit Drawings
    - Plans **(received from Jay Hudson)**
    - Sections **(received from Jay Hudson)**
    - Elevations **(received from Jay Hudson)**
    - Other (describe)
- Design Information
    - Name of Designer of Record **(included in Santee Cooper response to EPA's Request for Information)**
    - Design Assumptions **(N/A)**
    - Design Analysis **(N/A)**
    - Spillway Design Flood or Design Basis **(N/A)**
    - Slope Stability Factor of Safety **(N/A)**
    - Design Soil Properties and Parameters **(N/A)**
    - Other (describe)
- Permits
    - NPDES SC0022471 **(received from Jay Hudson)**
    - Dam Safety – Operating Permit **(N/A)**
    - Other (describe)

- Subsurface Information
    - Geology **(N/A)**
    - Geotechnical Report **(N/A)**
    - Subsurface Profiles **(for Ash Pond B expansion only)**
    - Other (describe)
- Monitoring Information:
    - Observation Wells/Piezometer Readings **(N/A)**
    - Seepage Readings **(N/A)**
    - Settlement Readings **(N/A)**
    - Alignment Readings **(N/A)**
    - Inclinometer Readings **(N/A)**
    - Time vs Reading Graphs **(N/A)**
    - Other (describe)
        - Staff Gauge Readings **(received from Jay Hudson)**
- Instrumentation Drawings
    - Location Plan **(N/A)**
    - Section Views **(N/A)**
    - Other (describe)
- Operation, Maintenance, & Surveillance
    - Operating Procedures **(N/A)**
    - Maintenace Procedures **(N/A)**
    - Inspection Procedures **(received from Jay Hudson)**
    - Third Party Inspection Reports **(received from Jay Hudson)**
    - Other (describe)
        - Ash Management and Sales **(received from Jay Hudson)**
- Emergency Action Plan **(N/A)**
- Inundation Map **(N/A)**

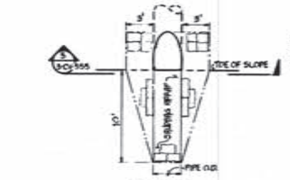
Appendix D – Additional Provided Documents

Appendix D – D.1 Sections of Outlet Structures for South Ash Pond Outlet & Orig West Ash Pond Outlet & Orig Detail for Plugging Temporary Construction Drain Pipes



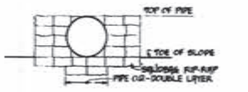
3-CV-550 ① SECTION 3-CV-555
SCALE HORIZ. 1" = 20'
VERT. 1" = 5'

NOTE:
1. "O" RING JOINTS PER SPECIFICATION SECTION 02510 ARE REQUIRED ON CLASS IV CONCRETE PIPE.
2. SEE DETAIL 6, DWG. 3-CV-551 FOR PIPE INSTALLATION UNDER DIKES.

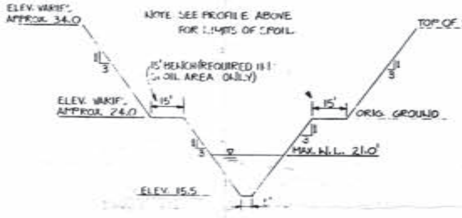


NOTE:
SANDBAGS SHALL BE FILLED WITH A MIXTURE OF 5 PARTS SAND AND 1 PART CEMENT BY WEIGHT.

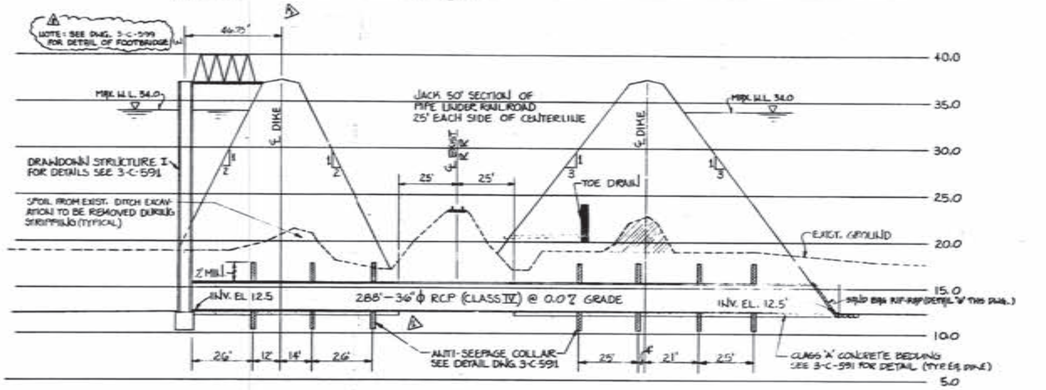
DETAIL ⑥ 3-CV-555
N.T.S.



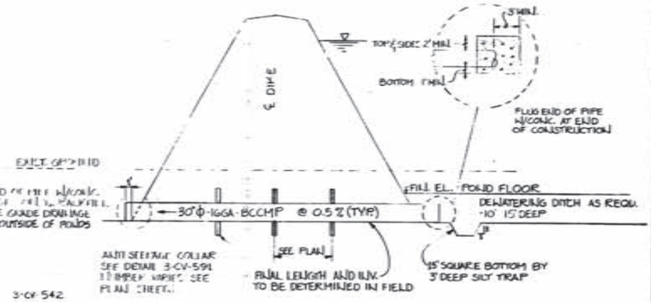
SECTION ⑤ 3-CV-555
N.T.S.



④ TYPICAL SECTION THRU OPEN CHANNEL 3-CV-555
SCALE: HORIZ. 1" = 20', VERT. 1" = 5'



3-CV-547, 3-CV-549 ② SECTION 3-CV-555
SCALE: HORIZ. 1" = 20'
VERT. 1" = 5'



3-CV-542
3-CV-546
3-CV-549
③ TYPICAL CONSTRUCTION DRAINAGE OUTLET PIPE 3-CV-555
NO SCALE

DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3300-300.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.42' TO THE ELEVATION SHOWN.

no	date	REVISION	by	ck.	appr.	no	date	REVISION	by	ck.	appr.
[illegible]	[illegible]	[illegible] DIKE - FOR CONST. CONTR. [illegible]	Gr	RED							
[illegible]	[illegible]	[illegible] DRAWDOWN STRUCT. LOCATION	CN	RED							
C	[illegible]	ISSUED FOR [illegible] - CONTR. [illegible]	dr	RED							
A	[illegible]	ISSUED FOR OWNER'S REVIEW	CN								

drawn by C.N.
dept. ch. PE Dupuis
dept. appr.
coord. ch.
p.e. appr.
B&R appr. [illegible]

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

job name
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

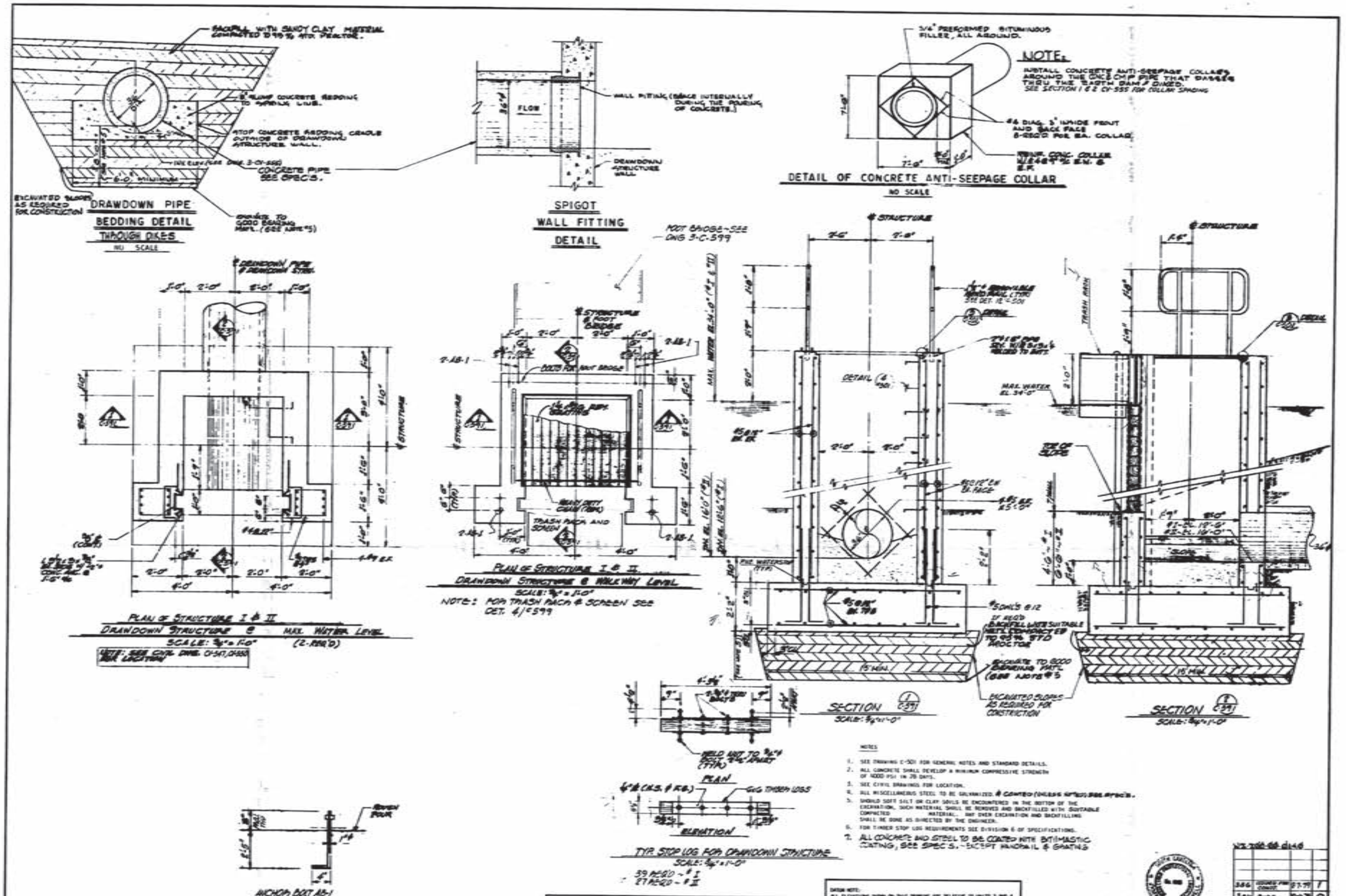
sheet title
MISCELLANEOUS SECTIONS
SHEET 2

W3-2dd-dd-[illegible]

ISS.	CONST	5-7-79	E
ISS.	BID	10-6-78	D
PHA	ISSUE	DATE	REV.

scale AS NOTED
L-G JOB NO. 77043.01
B&R W.O. NO. 3389
date 5-1-78
dwg. no. 3-CV-555
rev. 2

Appendix D – Doc D.2 Details of Outlet Structures for South Ash Pond Outlet & Orig West Ash Pond Outlet



NOTES

1. SEE DRAWING C-501 FOR GENERAL NOTES AND STANDARD DETAILS.
2. ALL CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI IN 28 DAYS.
3. SEE CIVIL DRAWINGS FOR LOCATION.
4. ALL MISCELLANEOUS STEEL TO BE GALVANIZED. & COATED (UNLESS NOTED) SEE SPEC'S.
5. SHOULD SOFT SILT OR CLAY SOILS BE ENCOUNTERED IN THE BOTTOM OF THE EXCAVATION, SUCH MATERIAL SHALL BE REMOVED AND BACKFILLED WITH SUITABLE COMPACTED MATERIAL. ANY OVER EXCAVATION AND BACKFILLING SHALL BE DONE AS DIRECTED BY THE ENGINEER.
6. FOR TIMBER STOP LOG REQUIREMENTS SEE DIVISION 6 OF SPECIFICATIONS.
7. ALL CONCRETE AND STEEL TO BE COATED WITH BITUMASTIC COATING, SEE SPEC'S. - EXCEPT HANDRAIL & GRATING

DATUM NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE RELATIVE TO UNITS 3 AND 4 CONSTRUCTION BENCH MARKS ESTABLISHED BY ASSOCIATED SURVEYORS, INC. UNDER CONTRACT 3389-366.
TO DETERMINE TRUE ELEVATION RELATIVE TO MEAN SEA LEVEL UNIT 1 AND UNIT 2 VERTICAL ALIGNMENT, ADD 0.47' TO THE ELEVATION SHOWN

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. HEMPSTEAD, N. Y. LOS ANGELES, CALIF.

ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

JOB NAME
SANTEE COOPER
WINYAH GENERATING STATION UNIT 3
GEORGETOWN, SOUTH CAROLINA

SHEET TITLE
DRAWDOWN STRUCTURE
PLANS, SECTIONS & DETAILS

SCALE
AS NOTED

DATE

L-G JOB NO. 7710.01
B&R W.O. NO. 3389

DWG. NO.
3-C-591

REV.
1

NS 200-68 d146

386	ISSUED FOR CONST.	8-7-79	1
380	B-O-S	8-0-78	0
386	OWNER'S REVIEW	7-21-78	B
580	OWNER'S REVIEW	6-4-78	A
PHB	15-50-B	3-17-78	

Appendix D – Doc D.3 Soil & Materials Engineers Inc Subsurface Investigation Report dated June 21, 1978 (Test Boring Logs and Lab Test Data excluded)

SOIL & MATERIAL ENGINEERS INC. ENGINEERING-TESTING-INSPECTION

349 E. Blackstock Road, Spartanburg, South Carolina 29301, Phone (803) 574-2360

June 21, 1978

Burns & Roe, Inc.
P. O. Box 663
Paramus, New Jersey 07652

Attention: Mr. Bill Richardot

Subject: Subsurface Investigation
Ash and Slurry Pond Dikes
Winyah Electric Generating Station
Georgetown, South Carolina
SME Job No. SS7735

Gentlemen:

Please find enclosed a report of subsurface conditions and design recommendations for the above referenced project. In the following sections we have presented a discussion of the subsurface conditions existing at the site, together with our analyses and recommendations for design and construction of the impoundment dikes. We have also taken the liberty of including herewith copies of previously submitted geotechnical reports for Units 3 and 4 and the Cooling Tower. This manuscript thus contains all the field and laboratory test data as well as engineering analyses which Soil and Material Engineers has performed at this site.

In summary, all soil test borings, like those drilled for Generator Units 3 and 4, encountered interbedded strata of loose to firm sand, and soft to stiff silt and clay overlying a hard, thin stratum of shell limerock. While the ground surface elevations vary from 5 to 24 msl across the proposed construction area, the surface of the shell limerock strata varies only slightly from -8 to -12 msl. Groundwater level is very near the existing ground surface and will thus have a significant impact on the construction of the dikes. Deep (10 to 15 feet) drainage ditches will be required within the impoundments for dewatering prior to earthmoving. The on-site soils can be used for construction of the impoundment dikes. There are, however, potential long range seepage problems associated with the use of the sandy soils containing only small percentages of silt and clay. Subsurface conditions are suitable for constructing dikes to a height which will result in average impoundment depths of 20 feet. With the exception of a few isolated areas requiring 3:1 and 4:1 slopes, the dikes can be constructed on 2(H):1(V) slopes for both upstream and downstream faces. A toedrain is recommended for those dikes constructed of silty fine sand soils. Contained within the borrow areas are shallow, highly organic "pockets" or "bays" which the earthmoving contractor must avoid to minimize muck excavation. The complete findings of our investigation along with our recommendations are contained within the following report.

We appreciate the opportunity to have provided our geotechnical engineering services on this project. If you have any questions concerning the investigation or report or if we can be of further assistance during the final stages of design or construction, feel free to contact us.

Very truly yours,

SOIL & MATERIAL ENGINEERS, INC.

Jim Willmer/jw
Jim Willmer, P. E.
Soils Engineer

Glenn Futrell, P. E.
President

Bill Wright, E. I. T.
Construction Services Manager

Ron Calsing
Ron Calsing, P. E.
Branch Manager

SOUTH CAROLINA
REGISTERED
5161
PROFESSIONAL ENGINEER
RONALD L. CALSING

jw

PROJECT AND SITE DESCRIPTION

The addition of Electric Generator Units 3 and 4 at the Winyah Generating Station in Georgetown, South Carolina will significantly increase waste generated as sulfur dioxide slurry and coal ash slurry. The existing ash and slurry ponds constructed for Units 1 and 2 do not have the reserve capacity to handle this increased waste. As a result, additional diked impoundments must be constructed over a large portion of the remaining property originally purchased by South Carolina Public Service Authority for the Winyah Electric Generating Station.

General. Basically, there are three impoundment areas to be constructed north, west and south of the existing power plant island. We have referenced these areas as Impoundment Areas A, B, and C counter-clockwise beginning north of the plant island. Within Impoundment Area A are two sulfur dioxide slurry holding ponds, 3E and 3W. To the west of the plant island will be Impoundment Area B. This impoundment will be divided into two cells by a center dike. The north cell will be used as a sulfur dioxide slurry pond whereas the south cell will be used as an ash slurry pond. The remaining Impoundment Area C, located south of the Generator Plant, will be used as an ash slurry pond. Total surface area of the three impoundment areas will be approximately 300 acres. Total length of dikes is estimated at 6.8 miles. Total earthwork is estimated to range from 2 to 2.5 million cubic yards.

As stated, each of the pond areas will be used for the impoundment of slurrys generated from the power plant. The depth of slurry liquid will be regulated by a discharge structure location within each impoundment to allow maximum time for "settling out" of precipitants. The precipitants, however, will not settle uniformly throughout the bottom of the impoundment and, as a result, the depth of precipitants near the intake pipe will be much greater than at the discharge pipe. Consequently, the depth of liquid retained within the impoundments will vary depending on the location. Over a period of several years, the impoundments will become essentially full causing the liquid surface to be near the top of the dikes. The maximum depth of precipitants will thus be near the intake pipe and maximum liquid depth near the discharge pipe.

The proposed crest elevation of the impoundment dikes is 37.0 msl. This will result in an average "storage" depth of 20 feet within the impoundments.

Not constructed

Impoundment Area A. As can be seen on our drawing, SME-1, Impoundment Area A includes two slurry ponds, 3E and 3W, located adjacent to the entrance road leading to the generating plant. Each of these ponds encompass surface areas of 28 to 30 acres. Each pond will have a center "finger" dike for routing effluent discharge in an effort to increase settling time. The 3E pond will require a total dike length of 3600 feet, while the 3W impoundment will require 5800 feet of dike. The quantity of earthwork required to construct the dikes for both ponds is estimated to be 400,000 cubic yards.

The existing ground surface elevation is generally flat but does have a gentle slope west towards Pennyroyal Creek. Slurry Pond 3E ground surface elevation varies only slightly from elevation 24 to elevation 29 msl. The area has been cleared and grubbed of its originally heavy tree growth. The ground surface elevation in Slurry Pond 3W varies from elevation 18 to 26 msl. As in the case of 3E, the area has been cleared and grubbed of original heavy tree growth. Our site inspection and review of area photographs indicate a low area exists near the middle of Impoundment Area 3W which contains a surface deposit of highly organic matter. This type of surface condition is commonly found throughout the project site and will play a significant role in the earthmoving requirements.

U&4 Slurry & W Ash

Impoundment Area B. This impoundment area is located immediately west of the existing generating units and is divided into two cells. The north cell will emcompass a surface area of approximately 95 acres. Including the dike which divides the two compartments, and a "finger"dike, total dike length is approximately 10,000 feet for the north cell. The south cell encompasses approximately 56 acres of surface area. Total dike length excluding the dividing compartment dike is 4500 feet. Earthwork quantities for construction of the total impoundment dikes is estimated at 1.2 million cubic yards.

Site topography over the impoundment area is characterized by a north-south "ridge" which is parallel to plant coordinate W20+00. The surface elevation of the ridge varies from 15 to 19 msl. The ground surface slopes downward, east to west, from the ridge to a low ground surface elevation of 5 msl. An old borrow pit used for construction of the original cooling pond dam and railroad is located within the south cell. Four to eight feet of soil has been removed to form the borrow pit. The entire impoundment area has been cleared and grubbed of all originally existing pine and hardwood trees. Shallow lateral ditches have been excavated within the impoundment area to aid in the surface dewatering during the clearing and grubbing operations. Our review of aerial photographs revealed low areas containing shallow deposits of organic matter within the north cell. The attached drawing, SME-1, indicates the various surface characteristics and topography described above.

As in the case of the other impoundment areas, the desired dike crest elevation is 37 msl. Based on available topography, the dike heights will vary from a low of 10 feet to as high as 30 feet above existing grade. More typically, however, dikes will be 20 feet high.

Impoundment Area C. The third impoundment area is located immeidately south of the power plant within the existing railroad loop. This impoundment area encompasses approximately 78 acres of surface area. Total length of dikes required to construct this impoundment is approximately 10,000 feet. Earthwork is estimated to be 560,000 cubic yards. The impoundment will be used for the retention of ash slurry. Site topography is characterized by an east-west drainage ditch which begins about halfway across the length of the impoundment. This drainage feature begins at a ground elevation of approximately 17 msl and falls to a low elevation of approximately 10 msl. It contains a considerable amount of organic matter and soft wet saturated soils. The eastern half of the impoundment is generally level with an average ground elevation of 24 msl. The height of dikes will range from 13 to 27 feet with an average of 18 feet high. As in all the other cases, the area has been cleared and grubbed of all tree growth.

SITE SUBSURFACE CONDITIONS

To aid interpretation of the existing soil conditions, ten generalized soil profiles depicting subsurface conditions are presented herein with the location of each profile indicated on the soil boring layout drawing SME-1. Each profile is located along the center line of each dike contained within the three impoundment areas. The profiles were developed by plotting the soil conditions at each location and extrapolating between the widely spaced borings. Thus, the actual soil conditions between borings may vary from that shown on the profiles. They do provide, however, the most efficient method of studying existing soil conditions and topography relative to the proposed planned construction.

In addition to a general description of the subsurface conditions encountered at the site, a brief description of the engineering properties of those soils existing at the site is also included. In the appendix of this report, all of the laboratory testing data has been summarized and presented on a sheet entitled "Soil Data Summary". We have also tabulated moisture content and percent passing the #200 sieve data for numerous samples taken throughout the site. The detailed results of all laboratory testing arealso included.

Impoundment Area A. Seventeen (17) soil test borings were drilled to shell limerock within this impoundment area. Additionally, three test pits were excavated to depths of 10 feet. Bag samples were recovered from the test pit excavations for later laboratory testing. A written log of each test pit and boring is included in the appendix of this report. Drawings SP-1, SP-2, and SP-3 graphically show the subsurface soils existing beneath the pond dikes.

Organically stained, silty fine sand containing tree roots, pine needles, limbs, etc. exist within the upper 6 to 12 inches across both slurry ponds of this impoundment area. The depth and organic content of this stratum varies considerably over the impoundment area and has been altered significantly by the recent clearing, grubbing, and stockpiling for burning of organic matter. Tracted equipment used for the clearing operation has caused considerable rutting and mixing of the original surface organics with the lower organic stained sands. Additionally, the ground surface is characterized with "pockets" or "bays" containing primarily peat, root, stumps, limbs, etc. Such conditions can normally be found in isolated low areas throughout the site which have poor drainage. In many cases, the depth of this organic matter ranges from 2 to 6 feet thick.

Immediately underlying this surface layer of organically stained sand and organic matter, the borings encountered loose to firm silty fine sand to a general depth of 15 feet, except in Borings SC-4, 5, 6, 13, and 14 where the sand stratum extends to a depth of 30 feet. Standard penetration resistance varies from 4 to as high as 20 blows per foot. These silty fine sands contain 5 to 17 percent fines (silts and clays) passing the #200 sieve. The moisture content in the upper 6 feet varies from 17 to 30%. Generally, these sandy soils contain smaller percentages of silts and clays with depth. Standard Proctor density tests and several "check plugs" (1 point Proctors) were performed on numerous samples taken throughout the impoundment area. These soil samples had maximum dry densities of approximately 106 pcf and optimum moisture contents of 14 percent. The results of two consolidated drained triaxial shear tests of these silty sand soils indicate total stress friction angles of 30 degrees and 32.5 degrees with corresponding neglible cohesion values. Corresponding effective stress friction angles were 34 and 38.7 degrees with zero cohesion in both cases.

Where the silty fine sand is approximately 15 feet deep, it is underlain by a 6 to 10 foot thick strata of soft silty clay containing thin lenses of fine sand. Standard penetration resistances varied from 2 to 6 blows per foot. Undisturbed samples recovered from this stratum contained high moisture contents ranging from 70 to 135 percent. Dry unit weights varied from 33 to 60 pounds per cubic foot. Void ratios varied from approximately 1.9 to 3.7. Samples of the soft silty clay recovered from Borings B-19 (16 to 18'), B-15 (9.5 to 11.5'), and B-15 (17 to 19') had shear strength values determined by unconsolidated undrained triaxial shear tests (confined at overburden pressure) of 600, 1900, and 2300 pounds per square foot.

Underlying this soft silty clay and areas where 30 feet of silty sand occurs, exists an 8 to 15 foot stratum of loose to dense fine sand containing a very high percent of small shell. This sand-shell stratum continues to the top of the shell limerock which generally exists near elevation -9 msl. It is noted in Boring SC-17 our drill rig did not meet refusal on the shell limerock stratum as in all other borings indicating less cementation of the shell limerock. Instead, little resistance was met at this depth allowing us to drill 15 feet into the underlying gray silty clay known to exist throughout the project site to several hundred feet deep.

Exceptions to the above general stratigraphy existed at Borings SC-15, 16, 17, and 18 which are located along the westside of the 3W Pond. In this area, the surface organic sand is underlain by a 3 to 5 foot stratum of stiff fine sandy silty clay containing small amounts of organic matter. Standard penetration resistances of this soil vary only slightly from 6 to 7 blows per foot. Immediately underlying this stratum a 6 foot layer of fine silty sand exists. This strata has standard penetration resistances and engineering characteristics similar to those described above for the fine silty sand. At generally 10 feet deep, a very soft gray silty clay exists 10 to 15 feet thick which has standard penetration resistances of less than 1 blow per foot. Based on our visual inspection of the clay samples and results of standard penetration resistances, we consider the soil engineering characteristics (strength and compressibility) to be similar to the soft clay stratum discussed later which exists in Impoundment Area C (SC-78, 77, and 76).

Groundwater encountered at the time of our investigation generally ranged from 1 to 3 feet below the ground surface. As previously stated, shallow drainage ditches have been installed throughout the area to drain surface water. During excavation of test pits in this area, groundwater flowed rapidly into excavations causing the slopes to slough. The groundwater levels are indicative of the stabilized groundwater level throughout the impoundment area, and as such, will require extensive deep ditching to remove the water from the saturated subsoils.

<u>Impoundment Area B</u>. Along the dike center line of this very large two cell impoundment, 26 soil test borings were drilled. Thirteen test pits were excavated within the limits of the impoundment to depths of 10 to 15 feet below the existing ground surface. Each of the test pit and boring logs are included in the attached appendix. Drawings SP-4 through SP-7 indicate generalized soil profiles for this impoundment area. In each case, except Boring SC-27, the borings were terminated on the shell limerock layer which generally exists at an elevation of -9 msl.

As stated above, this area is characterized by a north-south "ridge" extending the full width of the impoundment. Below the surface organically stained sand, roots, and limbs, etc. as previously described, exists a stratum 5 to 8 foot thick of clayey sand having intermittent layers of sandy clay. Standard penetration resistances vary from 4 to 12 blows per foot with 6 and 8 blows being more typical. This stratum continues to the west of the ridge towards Pennryroyal Creek but becomes somewhat thinner and in a few cases, nonexistent in the bottom of the eroded ravines (SC-44, 26, 57; and 23). These clayey sand soils contain 10 to 40% fines (silt and clay) passing the #200 sieve. They have plasticity indices ranging from 10 to 12 and natural moisture contents ranging from 20 to 28%.

Maximum standard proctor dry densities range from 111 to 113 pcf with corresponding optimum moisture contents varying from 14 to 15 percent. The natural moisture contents are thus 10% greater than the optimum moisture content. Results of triaxial shear testing of clayey sand samples compacted within 95 to 100 percent of Maximum Standard Proctor Dry Density, indicate a total stress friction angle ranging from 19 to 23.5 degrees and cohesion values of 2000 to 1750 psf. Corresponding effective stress friction angle and cohesion were 26 degrees, 40 degrees, and 1110 psf, and 150 psf respectively.

To the northwest of the ridge, the near surface soils become extremely plastic and very stiff as verified by our test pits SC-37, 38, and 39. The soils in this area contain in excess of 50% silts and clays (passing the #200 sieve) and have plasticity indices ranging from 10 to as high as 40. Natural moisture content is near 30%. It was noted that these very plastic soils were extremely difficult to excavate and to remove from the bucket of the backhoe during excavation of the test pits. Once excavated and placed near the ground surface, they characteristically remained molded similar to "modeling clay".

In the southeast corner of the impoundment, the near surface clayey sand is nonexistent. Instead, the near surface soils are visually similar to those previously described for Impoundment Area A as silty fine sand. Standard penetration resistances and engineering characteristics are also similar.

Underlying the surface layer of clayey sand or where it is nonexistent, loose to dense silty fine to coarse sand exists. Standard penetration resistances vary from a low of 12 to a high of 30 blows per foot. This layer of sand generally exists to elevation zero msl where the sand-shell strata as described for Impoundment Area A is encountered. Standard penetration resistances, although somewhat misleading because of the high shell content, generally range from 7 to as high as 45 blows per foot.

Groundwater levels recorded at the soil boring locations were within 3 feet of the ground surface. However, during excavation of our test pits, groundwater was not initially encountered until the excavation had penetrated the near surface layer of clayey sand. Upon excavating into the sand stratum (6 to 8 feet) water rapidly began to flow into the excavated pit causing all slopes to cave. Days later, once the groundwater had stabilized, it was noted that its surface was within 1 to 3 feet of the ground surface. Such a condition suggests the groundwater may be restrained or "artesian" under the "capping" layer of clayey sandy soils.

Impoundment Area C. A total of 17 soil test borings were drilled along the centerline of the proposed dikes for this impoundment. Auger borings without split spoon sample recovery were drilled to recover bag samples for laboratory testing rather than excavating test pits. Soil profiles SP-8 through SP-10 graphically illustrate the subsurface conditions beneath these impoundment dikes.

Subsurface conditions at this impoundment are very similar to those encountered in Impoundment Area A. That is, the surface one foot contains organically stained silty sand containing high wood debris and is underlain by loose to firm silty fine sand to a depth of 15 to 20 feet. Standard penetration resistances of this silty sandy soil varies from 6 to 30 blows per foot. Laboratory testing, including sieve analysis, moisture content, and standard Proctor compaction tests indicate these soils have generally the same engineering characteristics as those silty fine sands encountered in Impoundment Area A.

In the southwest corner of this impoundment area where the groundsurface elevation varies from 10 to 15 msl, some of the borings encountered clayey sands immediately underlying the surface layer of organically stained sands. This clayey sand generally had standard penetration resistance values varying from 4 to 15 blows per foot. The engineering characteristics of this material is very similar to those we discussed above for the near surface soils in Impoundment Area B. This clayey sand is generally 5 to 10 feet thick and in most cases underlain by the silty fine sands found elsewhere throughout the impoundment area.

With a few exceptions, a 5 to 15 foot thick stratum of very soft to firm gray silty clay exists at a depth of 10 to 20 feet underlying the silty fine sand. Standard penetration resistances of this material, excluding boring locations SC-76 through SC-80, generally range from 2 to 17 blows per foot. Based on our correlation of standard penetration resistances and other test data performed throughout the site, we consider these soils to have unconsolidated undrained triaxial shear cohesion resistances ranging from 500 to 1000 pounds per square foot. In boring locations SC-76 through SC-80 this gray silty clay becomes very soft having penetration resistances ranging from weight of hammer to 3 blows per foot. Maximum thickness was found near Boring SC-78 to be 20 feet thick. Laboratory test results of undisturbed samples taken from this very soft silty clay stratum indicate moisture contents varying from 71 to 97% and corresponding dry unit weights ranging from 58 to 45 pounds per cubic foot. Void ratios varied from approximately 2 to 2.6. Triaxial shear testing of samples recovered from SC-77 and SC-78 of this very soft silty clay indicated total stress friction angles of 9 and 11.5 degrees and corresponding cohesion of 400 and 300 psf. Effective stress friction angles were 20 degrees and 15.5 degrees and with corresponding cohesions of 300 psf and 400 psf. Unconsolidated undrained triaxial testing of samples recovered from SC-76 and SC-78 resulted in shear strength values ranging from 300 to 570 pounds per square foot.

Underlying the soft very silty clay, our borings encountered a strata of sand shell commonly found throughout the total project site. Standard penetration resistances, as reported in other areas, varied from approximately 3 to 40 blows per foot. The surface of this sand-shell strata generally dipped east to west from elevation zero msl to -10 msl.

Immediately underlying the sand-shell strata our borings encountered the shell limerock commonly found throughout the project site. The top of the shell limerock generally varied in elevation from approximately -8 msl to -12 msl.

EMBANKMENT AND FOUNDATION ANALYSES

In the following paragraphs, results of seepage and stability analyses of the impoundment dikes are presented. As discussed above, there are generally two types of borrow soils available at the site for construction of the dikes. These soils consist of the silty fine sands in Impoundment Areas A and C and clayey sands in Impoundment Area B. Within each impoundment, the dikes vary in height and will be constructed over variable subsurface conditions. Obviously, combinations of dike height, foundation conditions and types of borrow soils are numerous. In an effort to logically consider the critical conditions, our analyses were generally divided into two main phases:

1. Determine the stability of embankments constructed with the two available borrow soils and having variable height and water levels but without regards to foundation conditions.
2. Analyze foundation stability for various site subsurface conditions and stable embankment heights. Adjust embankment slopes as required to determine overall embankment and foundation stability.

General. All slope stability analyses were performed with the use of a computer program, written by Mr. Guy Lefebure of the University of California at Berkeley. The program calculates the factor of safety for specified circles or, as in our case, searches for the circular slip surface having the minimum factor of safety, using Bishop's modified method of slices. The factor of safety calculated by the ordinary method of slices is also given for each circle. The program is capable of utilizing both total and effective stress analyses or a combination of both with and without seismic forces. The factors of safety reported herein are those calculated for the Bishop modified method of slices.

Various design conditions were maintained constant throughout our analyses. Seismic forces induced by a potential earthquake were not considered. The minimal acceptable factor of safety against failure was reduced from the normally accepted 1.5 (for large critical water impoundment dams) to 1.25. This reduction was agreed upon with Burns & Roe and Lockwood-Greene Engineers personnel in consideration of the dike functional requirements. Sealing effects of the pond precipitants were neglected. Three feet of freeboard was assumed for each embankment. Stability analyses considered the condition of the ponds when they contain no liquid and several years later when the ponds would be full of liquid. Crest width was assumed 15 feet. "Rapid drawdown" condition was not considered applicable for these impoundments.

Soil engineering characteristics of the various soil strata and borrow soils were based on results of our laboratory, and field testing and experience with similar soils. Where large variations in test results occurred in samples taken from the same stratum, strength values less than the average were used in our analyses.

Based on discussions with Lockwood-Greene personnel, we have assumed borrow for construction of the embankments will be obtained from within the limits of the ponds. Preliminary calculations indicate sufficient borrow will be available providing the soils are selectively obtained and dewatering techniques are implemented.

<u>Embankment Stability of Silty Fine Sand Borrow</u>. As previously discussed, silty fine sand containing 5 to 17 percent passing the #200 sieve exists generally to depths of 3 to 6 feet within Impoundment Areas A and C. Based on our review of available topography, embankments within these two impoundments will have heights varying from 10 to 27 feet. The highest embankments in Impoundment A will be at boring locations SC-15 through 18 and in Impoundment C near boring locations SC-76 through SC-78.

The stability of numerous variations in embankment heights were considered in our analyses of the silty fine sand borrow. Embankments having heights varying from 14 to 25 feet and side slopes of 2(H):1(V) had factors of safety varying from 1.32 to 1.28 immediately following construction. However, several years hence when a full head of liquid is to be retained by the embankments, factors of safety of the downstream slopes of embankment the same height and side slopes range from 0.5 to 0.7, thus indicating failure. Flatter slopes of 3(H):1(V) have slightly greater factors of safety, 0.7 to 0.9; again, however, indicating slope failure. Even on a 4(H):1(V) slope, a 25 foot high embankment, has a factor of safety of 1.1. The mode of failure is generally in the form of "toe sloughing" which is aggrevated by seeping water. However, there are cases where deeper, more critical "failure arcs" have factors of safety between 1.0 and 1.25.

Because these embankment failures are influenced largely by seepage rather than side slopes, we considered the use of a drainage system within the embankment to prevent water from exiting on the downstream slope. For embankments of different heights, we evaluated slope stability for various phreatic surface locations within the embankment. For a 25 foot high embankment constructed with 2(H):1(V) downstream slopes and the phreatic surface drawdown and discharge internally within 10 feet of the downstream toe the factor of safety was calculated to be 1.38. For a 35 foot high embankment, the factor of safety decreased to 1.24. Flattening the downstream slope to 3(H):1(V) and assuming the seeping water was drawn down internally to within 5 feet of the toe, increased the factor of safety to 1.45.

As stated earlier, "finger" dikes will be constructed within Impoundment Area A, ponds 3E and 3W. Because these dikes extend into the ponds, liquid levels on both sides of the dikes will be near the same elevation. Furthermore, failure of these dikes is not critical to the operation of the generating plant. For these reasons, and because the quantity of available suitable borrow is critical, we evaluated the possibility of utilizing the organic contaminated surface soils (which are to be stripped prior to filling) for construction of the finger dikes. Assuming a shear strength friction angle of 25° for the organic soils, the factor of safety for a saturated 25 foot high embankment constructed on 3(H):1(V) slopes is greater than 1.25.

Foundation Stability - Impoundments A & C. As previously discussed, subsurface conditions within these two impoundments are somewhat similar (silty fine sand overlying soft silty clay and sand-shell). Because of the similarity of foundation conditions and because the dikes for these impoundments are to be constructed of similar soils (silty fine sand), we analyzed the impoundment dike stabilities concurrently.

Basically, three different foundation conditions exist within these two impoundment areas. The most typical, are dikes to be constructed less than 20 feet high on 10 to 20 feet of silty fine sand which overlies a 10 to 15 foot stratum of soft silty clay having standard penetration resistances between 2 and 6 blows per foot. The second condition is dikes constructed 20 feet high on silty fine sand which overlies a 14 to 17 foot stratum of softer silty clay (standard penetration resistances less than one blow per foot). This condition exists in pond 3W at Borings SC-15 through SC-18. A third condition occurs in Impoundment Area C near Borings SC-76 through SC-78, where a 26 foot high dike is to be constructed over silty fine sand which overlies a 21 foot thick stratum of very soft clay (standard penetration resistance less than one blow per foot). Our foundation stability analyses included each of the above subsurface conditions with embankments constructed of silty fine sand. An internal drainage system was assumed in each embankment as required by previous analyses. For the typical subsurface condition discussed above, the factor of safety against a foundation failure of dikes less than 20 feet high having 2(H):1(V) side slopes was 1.38 and 2.4, with and without retention of liquid respectively. However, for the second condition of slightly higher embankments and softer silty clay, the same side slopes had factors of safety less than 1.25. By flattening the slopes to 3(H):1(V), the computed factor of safety exceeded 1.25, with and without retention of liquid. For the third condition of even higher embankments and thicker very soft, silty clay stratum (SC-76 through SC-78) 4(H):1(V) side slopes were required to obtain factor of safety values of 1.25.

Foundation Stability - Impoundment Area B. Two subsurface conditions generally exist throughout this impoundment area. The most typical condition is 4 to 6 feet of clayey sand overlying several feet of loose to firm silty sand. The second condition exists in isolated areas next to Pennyroyal Creek (west dike) where the surface layer of clayey sand has been eroded exposing the underlying loose silty fine sand and clayey sand.

Our analyses of foundation stability included the above two subsurface conditions having a clayey sand embankment of varying heights. As was previously determined, an internal drainage system for these embankments was not considered necessary. For the most typical condition the factors of safety for a 2(H):1(V) embankment with and without retention of liquid were greater than 1.5 for varying heights of embankments (less than 20 feet high). However, for the second condition of higher dikes (27 feet) and absences of surface clayey layer the factor of safety of the downstream 2(H):1(V) slope is between 1.0 and 1.25. By flattening the slopes to 3(H):1(V), the factor of safety increases to 1.35 to 1.5. Based on our boring logs and site topography, this second subsurface condition is generally limited to near boring locations SC-47, 48, 57, and 23.

Embankment Stability of Clayey Sand Borrow. As stated, a 4 to 6 foot stratum of clayey sand exists along a "ridge" within the limits of Impoundment Area B. This potential borrow source generally contains a greater percent of silts and clays (10 to 40 percent) and greater shear strength than the silty sand borrow. Available earthwork calculations indicate sufficient clayey sand borrow exists within this impoundment to construct the perimeter dikes. The intermediate dike and finger dike may have to be constructed of silty sand (similar to that existing in Impoundment Areas A & C). Maximum height of dike to be constructed using this clayey sand borrow in Impoundment Area B is approximately 27 feet.

Similar to the analyses of the silty sand borrow, we initially examined embankments constructed of the clayey sand with 2(H):1(V) slopes (both faces) immediately following construction (no liquid retained). The factor of safety against failure for an embankment 27 feet high subject to the above conditions was computed as 2.76. Based on this analysis, embankments constructed of this same soil borrow having shorter heights and/or flatter slopes would have a greater factor of safety and thus additional analyses of shorter heights were not performed. For the case of the impoundment being full of liquid the 2(H):1(V) downstream slopes of a 27 and 30 foot high embankment had factors of safety of 2.5 and 1.6, respectively. A 27 foot high, 3(H):1(V) downstream slope had an increased factor of safety of 3.2. Thus, unlike the silty sand, embankments constructed of clayey sand borrow were determined stable during both conditions of liquid impoundment depth, and are so without the use of internal drainage.

<u>Seepage Analysis</u>. Analyses of seepage conditions were limited to the construction of flow nets through critical embankment cross sections and determining the phreatic surface through the embankments with and without toe drains. Our estimate of seepage quantity was limited to that required to design the drainage system within the silty fine sand embankments. No attempt was made to estimate the overall seepage quantity from the impoundments as this was beyond our defined scope of work.

Utilizing the slope configurations analyzed for slope stability, flow nets were drawn to estimate the internal and exit gradients, which are indicative of the potential for "piping". In all cases, the gradients were less than 0.4 with the exception near the internal drainage system. At this location, a filtering system is to be specified to prevent piping and clogging.

In addition to the normal seepage through the embankments, a cursory review of seepage through the deep subsurface stratum of shell limestone was made. Based on a review of boring logs, an impervious stratum of soft silty clay generally exists throughout Impoundment Areas A and C. This stratum will adequately impede any flow into the underlying shell limestone. Additionally, in other areas like Impoundment Area B, a relatively impervious stratum of sand-shell which contains some clay and silty fraction overlies the shell limestone. Furthermore, based on an examination of cores of the shell limestone taken at the power plant location, the surface 6 to 18 inches of the otherwise porous shell limestone is a highly cemented dense rock. These conditions, coupled with some sealing effects from the impoundment precipitants and generally 20 to 25 feet of soil overlying the shell-limestone, minimize the possibility of piping into and through this stratum.

Settlement. As indicated by the above description of subsurface conditions, a soft gray silty clay stratum of varying thickness exists throughout Impoundment Areas A and C. Based on limited consolidation tests of samples recovered from this stratum, we estimate residual settlements after construction of the embankments in Impoundment Areas A & C to be 1.0 to 1.5 feet at the embankment centerline. At two boring locations, SC-15 through SC-18 and SC-76 through SC-78 this layer is generally thicker and more compressible than other areas. For these isolated areas, residual settlement is estimated to range from 1.5 to 2.5 feet. Residual settlement of Impoundment Area B embankments are estimated to be less than 6 inches. The compressible soft silty clay generally does not exist in this impoundment. To maintain a final crest elevation of 37 msl, it will be necessary to initially overbuild the embankments to sufficient heights in these areas to compensate for the settlement of the soft clays.

In conjunction with the general overall settlements of the embankments, settlement of the adjacent railroad in Impoundment C was evaluated. With the exception of an area near our Borings SC-76 through SC-78, settlement along the centerline of the railroad is estimated to be less than 3 inches. In the isolated area of SC-76 through SC-78, we estimate 6 to 8 inches of settlement of the railroad can be expected. This settlement should be expected to occur within one year following construction of the dikes.

RECOMMENDATIONS FOR DESIGN

The following design recommendations are based on information obtained from the borings and test pits, our understanding of the requirements and constraints, accepted engineering practices, rules and procedures for embankment design, and our previous experience monitoring the construction of the existing ash and cooling pond dikes at this site and other sites along the east coast.

Impoundment Areas A and C - Perimeter Dikes. Based on the results of laboratory testing and slope stability analyses, we consider the silty sand soils existing near the surface within this impoundment area to be marginal for the construction of the dikes. Without the incorporation of an internal drainage system, the silty sand downstream slopes will begin to show signs of seepage and sloughing when the impoundments become full. Prevention of downstream slope sloughing or failure (other than using an internal drainage system) would involve continual inspection by an experienced engineer; and a maintenance program incorporating external granular drainage berms at embankment sections where sloughing develops. Controlled placement and/or relocation of pond precipitants may ultimately be required. Because of these limitations and constraints which would have to be placed on the filling of the impoundments, we recommend the embankments be constructed with provisions to internally collect seeping water, thereby preventing both sloughing and seepage at the downstream slopes and minimizing maintenance.

With two exceptions, we recommend both Impoundment Area A and C embankment slopes be constructed utilizing 2(H):1(V) upstream and downstream slopes. The two exceptions include the length of dike from our soil boring locations SC-15 to SC-18 and SC-75 to SC-80. For these areas, we recommend flatter 3(H):1(V) and 4(H):1(V) slopes, respectively. The enclosed drawing SME-1 delineates the location of the slope changes. The flatter slopes are required as stated above due to the underlying very soft gray silty clay.

For each of the embankment slopes recommended, an internal drainage system is required to prevent failure ("sloughing") of the downstream slope. Chimney, toe and blanket drains were all considered and any could be incorporated to provide the necessary drainage. We recommend, however, that a toedrain be utilized largely as a result of availability of materials, economics, and ease of construction. The location of the toe drain was determined during our slope stability analyses to be at a point approximately one-third the dike base width from the toe of downstream slope. For ease of design and construction we recommend the following guidelines be followed:

Dike Height, Ft.	Location of Toedrain (Distance from Downstream Toe), Ft.
Less than 30 Greater than 20	25'
Less than 20 Greater than 10	20'
Less than 10	15'

Two general methods of construction and/or design of the toedrains are applicable for the embankments. In each case, the critical criteria for design is to prevent piping and ultimate clogging of the system.yet maintain adequate flow. Sketches of the two toedrain systems are shown on Drawing SME-2. As noted, a 4"-diameter perforated PVC pipe is utilized to collect and discharge the water. A filter fabric is used in one method to prevent clogging of the large porous stone. The other method utilizes a blended aggregate graded to prevent natural clogging from surrounding silty fine sand while maintaining a permeable drain. The gradation required for both aggregate types is given on SME-2. The choice of the two systems should be based largely on cost and contractor preference as they will both adequately provide the drainage required.

As stated above, significant residual settlements can be expected along the dikes. Generally, one foot of subsidence should be anticipated along most of the impoundment dikes. In the two isolated areas having very soft silty clay (SC-15 through SC-18 and SC-80 through SC-75) an average settlement of two feet should be anticipated. Overfilling or reduction of freeboard can be utilized to counter this settlement. Settlement of the railroad at boring locations SC-80 through SC-75 caused by construction of the dike can be corrected by reballasting the track as needed to maintain traffic.

In conjunction with construction of Impoundment C dikes (along the existing railroad) appreciable erosion and rainfall runoff during and after construction should be anticipated. Currently, there exists a deep drainage ditch along the inside of the railroad loop. We recommend the downstream toe of the embankment slope begin at the top of this ditch rather than next to the railroad ballast. Maintaining positive drainage and minimizing silting along the railroad track will be hampered by filling this ditch. Furthermore, this ditch, if left at its present depth will prevent softening of the railroad subgrade which will be caused by seeping water once Impoundments C and B are put into operation.

Impoundment Area B - Perimeter and Intermediate Dikes.

Unlike the silty sandy soils to be used for the other impoundment dikes, Impoundment Area B dikes will be constructed of competent clayey sand soils. Based on the results of our slope stability analyses, we recommend the clayey sand perimeter dikes be constructed having 2(H):1(V) slopes except for two locations. Because of increased dike height and less favorable foundation conditions, dikes constructed in the area of Borings SC-47, 48 and 57 and SC-22 and 23 should be constructed having both upstream and downstream slopes of 3(H):1(V). Because of the increased shear strength and clay content, interal toe drains are not required for the clayey sand dikes.

Sufficient clayey sand borrow may not be available for construction of the intermediate dike which divides the impoundment into two cells. Based on our stability analysis of other dike configurations this dike can be constructed utilizing the surface layer of organic silty sand which cannot be used to construct the perimeter dikes. We recommend side slopes of 3(H):1(V) for this dike if constructed of the organic silty sand soil. If a differential in water level in the cells is expected to be greater than 10 feet, we recommend a 15 foot wide "core" of clayey sand be incorporated into the embankment to minimize seepage and potential downstream slope sloghing.

As stated in the previous section, a cursory review of seepage beneath the dikes via the shell limerock was made. Unlike all other impoundment dikes, the west dike of Impoundment Area B borders along Pennyroyal Creek. Ground surface elevation decreases to near 0 msl west of the dike. Furthermore, it could be assumed the bottom of the creek is at or near the surface of the shell limerock stratum (-8 msl). These conditions coupled with areas where soil overburden is less than 20 feet immediately upstream from the west dike, increase the potential of seepage beneath the dike via the shell limerock. Although we do not feel the condition is critical enough to warrant installation of a grout cutoff wall, we do recommend excavations within 200 feet of the inside slope be limited to elevation +10 msl. Additionally, areas currently existing below elevation +10 msl within 200 feet of the inside slope should be backfilled to the 10 msl level with clayey sand or sandy clay. These constraints will increase the seepage path thereby decreasing gradients beneath the dikes.

Finger Dikes. Within ponds 3E and 3W and the north cell of Impoundment Area B, finger dikes are to be constructed. Due to the critical availability of suitable borrow, the fact that these dikes are noncritical and that they will not be exposed to a differential in water levels; we recommend they be constructed of the existing surface silty sands which contain organic debris. Side slopes should be designed as 3(H):1(V). Large pockets or heavy concentrations of large stumps, limbs, etc. should not be permitted.

Grassing and Topsoil Disposal. As has been witnessed of the site's existing embankments, slope erosion of the sandy soils develops rapidly in areas of no vegetation. Such erosion is caused by rain, waves, and wind. Aside from expensive alternatives (riprap, synthetic liners, etc.) grassing, coupled with minor site grading, is the most apparent means of control. To aid in promoting growth of vegetation and to also dispose of the organic silty sand overlying the surface of the impoundment area, we recommend wherever practical this soil be wasted on the downstream slopes of the 2(H):1(V) impoundment dike slopes; thus in effect flattening the slopes to more nearly 3(H):1(V).

Influent and Effluent Pipe Structures. We understand an overflow pipe will be required through dikes at various locations within each of the impoundments. We recommend the pipe be embedded on a Class A partial concrete cradle bedding. Special care should be taken to compact all fill on both sides and above the pipe. The pipes should be installed prior to construction of the embankments.

EARTHWORK RECOMMENDATIONS

In the following paragraphs we have presented our recommendations for construction of the impoundment dikes. These recommendations are based on the project requirements, site conditions, and our experience with other similar projects in the Coastal Geological Region.

General. Site grading will begin by stripping the surface stratum of silty sand which contains a high content of organics, the full width of each dike base width. We estimate this layer to be 2 to 6 inches thick. This material along with similar surface soils to be removed from the borrow areas, should be wasted to form "finger" dikes and flatten dike slopes as previously recommended. Wherever feasible, the Contractor should be encouraged to segregate by raking large stumps, limbs, etc. for later burning. In addition to the normal stripping, there will be low ravines or "bays" containing highly organic matter in the surface 2 to 4 feet which must be removed prior to filling. These areas are easily recognized in the field by their black, marshy appearance. Based on our previous experience at this project site, the organic matter normally requires removal by dragline. Because of the wide boring spacing, we were unable to determine specific locations and thicknesses of these bays. In general, however, they should be anticipated in the bottom of shallow ravines, gulleys, or depressed areas as indicated by the site topographic mapping.

After stripping and/or undercutting, but prior to filling, those areas receiving fill should be proofrolled. This operation should be done with pneumatic tired equipment having a weight of 15 to 20 tons, making a minimum of two passes over the fill area. Any areas that deflect appreciably beneath the wheels of the proofroller and do not tighten up after successive passes should be undercut and replaced with soil compacted to a minimum of 95 percent of its standard Proctor maximum dry density. The above proofrolling operation is often accomplished concurrently with the stripping operation. That is, an experienced technician observing the passing of earthpans during stripping can normally detect fill areas which are deflecting or "pumping" excessively and make the approprite corrections.

The stripping and proofrolling operations will be an important aspect of the site grading. If soft, wet pockets of topsoil, organic matter, clays, silts, etc. are not removed or recompacted in fill areas, this could result in complications obtaining the specified density in the fill material.

This could cause the fill material to "pump" under heavy loading and ultimately require complete removal.

It is recommended that compaction of all fill material be a minimum of 95% of its standard Proctor maximum dry density as defined by ASTM D-698. All soils should be placed on the embankment and compacted at a moisture content not exceeding 2% of its optimum moisture content for the silty sandy borrow soils and 4% for the clayey sandy soils. We further recommend each lift thickness be limited to 10 inches (loose measure) for the silty sand borrow if the Contractor uses a vibratory type roller and a maximum lift of 6 inches (loose measure) for the clayey sand borrow when a sheep-foot roller is being utilized. Comments concerning the requirements for obtaining the specified density are presented hereinafter.

Due to the original heavy tree growth in each impoundment area, the Contractor should anticipate excavating numerous "tap roots". These roots should be removed from the fill prior to placement of additonal lifts. During previous dike construction at this site, it was necessary for laborers to follow behind the earthmoving pans to segregate large stumps and roots from the fill material. Some discretion must be made as to amount and size or organic matter which can be left within the embankments. The general intent would be to remove any limbs greater than 2 inches in diameter, 2 to 3 feet long. As importantly, "pockets" or layers of organic matter regardless of size of the individual members, should not be permitted.

Dewatering. The high groundwater level throughout each impoundment area has been referenced several times throughout this report. Adequately lowering this high water table within each borrow area will be the most important aspect of successfully completing the construction of the impoundment dikes. Without it being lowered, sufficient suitable borrow may not be available and considerable time will be lost aerating borrow soils.

Concurrent with the stripping operation, deep open trenches should be excavated within each impoundment, discharging to areas on the site of lowest surface elevation. Wherever site topography will allow, these ditches should be excavated 4 to 6 feet below the proposed excavation level. In most cases, these flat bottom ditches will thus be 8 to 14 feet deep. On the enclosed drawing SME-1, we have indicated a suggested location of major trenches which should be installed. Each trench should be excavated beginning at the lower discharge end of the trench, thus allowing dewatering during excavation. Other "lateral" trenches will be required and should be located during construction following an evaluation of the effectiveness of the initial trench excavations. We strongly recommend these trenches be an intregal part of the Contractor's earthwork requirements. The existing shallow surface trenches are inadequate to lower the groundwater table.

Once the trenches have been excavated, the earth-moving pans should remove borrow outwardly from the trenches. This will allow maximum time for lowering and discharging of the groundwater. Some selection of excavated trench soils will be required. For example, 8 to 12 feet deep trenches excavated in Impoundment Area B, will encounter clean coarse sand which should not be used in perimeter dikes. Dragline operators should be encourage to segregate unsuitable soils wherever practical.

Unsuitable Borrow. Based on results of our test pit excavations and visual inspection of site surface conditions, we have delineated on drawing SME-1 three major areas where unsuitable surface soils exist. These locations are within the proposed limits of the borrow areas of Impoundment Areas B and C and pond 3W. In each case the surface soils are composed of either highly plastic stiff clay or in "low" depressed areas contain several feet of organic "peaty" matter. We recommend these general areas be avoided initially by the Contractor as a borrow source. Once excavation of borrow begins, these areas should be specifically outlined on the site by a knowledgeable soils engineer.

Compaction of Borrow. Generally, the surface 3 to 5 feet of silty sand in Impoundment Areas A and C are suitable for construction of the surrounding dikes. However, at deeper depths and in isolated areas of the impoundments, the sands contain only 1 to 5 percent material passing the number 200 sieve. The borrow soils within these impoundments should be continuously inspected and tested to minimize the use of large quantities of these relatively "clean" sands. Otherwise, greater slope erosion and less growth of vegetation will result. Moreover, layers of these clean sands placed the full width of the embankments could transmit seeping water directly to the downstream slopes.

The silty sandy soils can best be compacted utilizing a vibratory type roller. A systematic sequence involving a number of passes, lift thickness and size of compactor versus soil density should be determined during the initial stages of construction. The near surface silty sands will have moisture contents less than their optimum, whereas those sands excavated near the groundwater level will be wet of optimum. The Contractor should anticipate having to mix these soils to obtain the required moisture content. Where this is not feasible, water will have to be added for dry soils and aerating with discs, soils which are too wet.

The clayey sandy soils found in Impoundment Area B generally had moisture contents 6 to 14 percent greater than their optimum moisture content. Because of their higher clay content, these soils are sensitive to moisture variations and unlike the silty fine sands found elsewhere on the project site, earthmoving operations will be significantly effected by rainfall and cold damp weather. The Contractor should be required to have on site discs, harrows, rippers, etc. for aerating the clayey sandy soils to be borrowed from within Impoundment Area B.

Succeeding lifts of fill should not be placed until preceeding lifts have been properly compacted and the moisture content reduced to within the specified limits. If not followed, the soils will begin to "pump", potentially requiring later removal or stability problems.

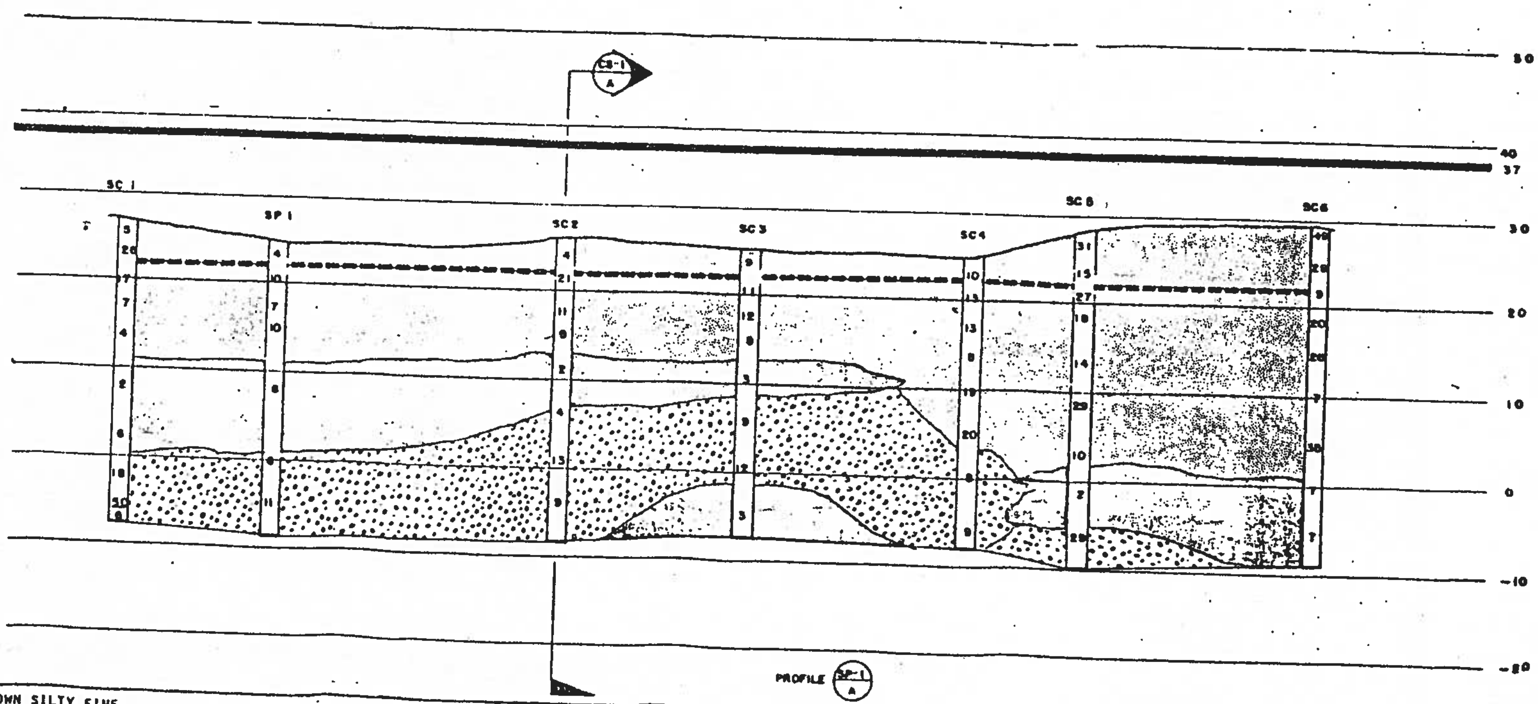
<u>Sequence of Construction</u>. We recommend the design be expedited in an effort to begin construction in the summer or early fall months, if possible. There will be dewatering and wet soil problems associated with this project which can only be aggrevated by delaying construction until the wet cold winter months.

Once construction begins, the first operation, aside from stripping, should be the excavation of the dewatering trenches. Because of the clayey sandy soils being effected most by wet weather, we recommend initial dike construction begin in Impoundment Area B. The perimeter dikes should be the first to be constructed utilizing all available clayey sandy soils. Any excess should then be used for construction of the intermediate divider dike. Stripped material can be placed to form the finger dike during initial stripping operations. This sequence will allow evaluation throughout the dike construction as to availability of suitable borrow soils. Changes in design, if required, can thereby be made with minimal confusion.

Following construction of Impoundment B dikes or when wet cold weather begins making it difficult to compact the clayey sandy soils, dike construction can progress to either of the other two impoundment areas. The silty sand soils will be less sensitive to wet weather and will thus permit maximum construction time through the winter months. Moreover, the drainage trenches will have had maximum time to lower the groundwater levels. The following spring or early summer when warmer, drier weather returns, the unfinished portion of Impoundment B dikes can be completed.

QUALITY CONTROL PROGRAM

As was previously discussed and shown on the drawings, soil test borings and test pits performed for this investigation were spaced on 500 foot centers. We consider this a reasonable boring spacing considering the length of dikes, subsurface conditions, and type of construction proposed. It is, however, almost impossible to determine where all surface and subsurface unsuitable soils exist over an area as large as this site. For these reasons, we feel it is of utmost importance that a detailed quality control program administered by experienced engineering technicians, who are supervised by an experienced soils engineer, be assigned to the project to perform soil density and gradation tests, solve related soil problems, and verify soils used for borrow are similar to those analyzed and used in the design analyses. There will be numerous occasions throughout the construction of the dikes where on site decisions must be made such as depth of undercutting, suitability of borrow soils, compaction problems, dewatering, etc. These decisions cannot be left to chance as they may directly affect the stability of the dikes. These trained technicians should also be able to detect areas of exceptionally high settlement and/or surface tension cracks which are indicative of slope failures or sloughing. Based on our experience of similar type dike construction along the East coast: we strongly feel, as important as the geotechnical investigation, will be a successfully implemented quality control program and that continuity between the two is paramount to the successful construction of the dikes.



☐ GRAY-BROWN SILTY FINE TO MEDIUM SAND
☐ FIRM TO SOFT GRAY SILTY CLAY WITH SAND SEAMS
▨ SHELL AND LIMESTONE
▨ VERY FIRM GRAY SILTY CLAY WITH SAND SEAMS
▨ VERY LOOSE GRAY SILTY FINE TO MEDIUM SAND WITH SHELLS
▨ GRAY BROWN SILTY CLAY
☐ VERY SOFT SILTY CLAY WITH SAND SEAMS
▬ ▬ BOTTOM OF EXCAVATION
▬ TOP OF DIKE
▮ UNDISTURBED SAMPLES

JOB NO.	DRAWING NO.
SS7735	SP-1
SCALE (H) 1"=200' (V) 1"=10'	DATE 3-20-78

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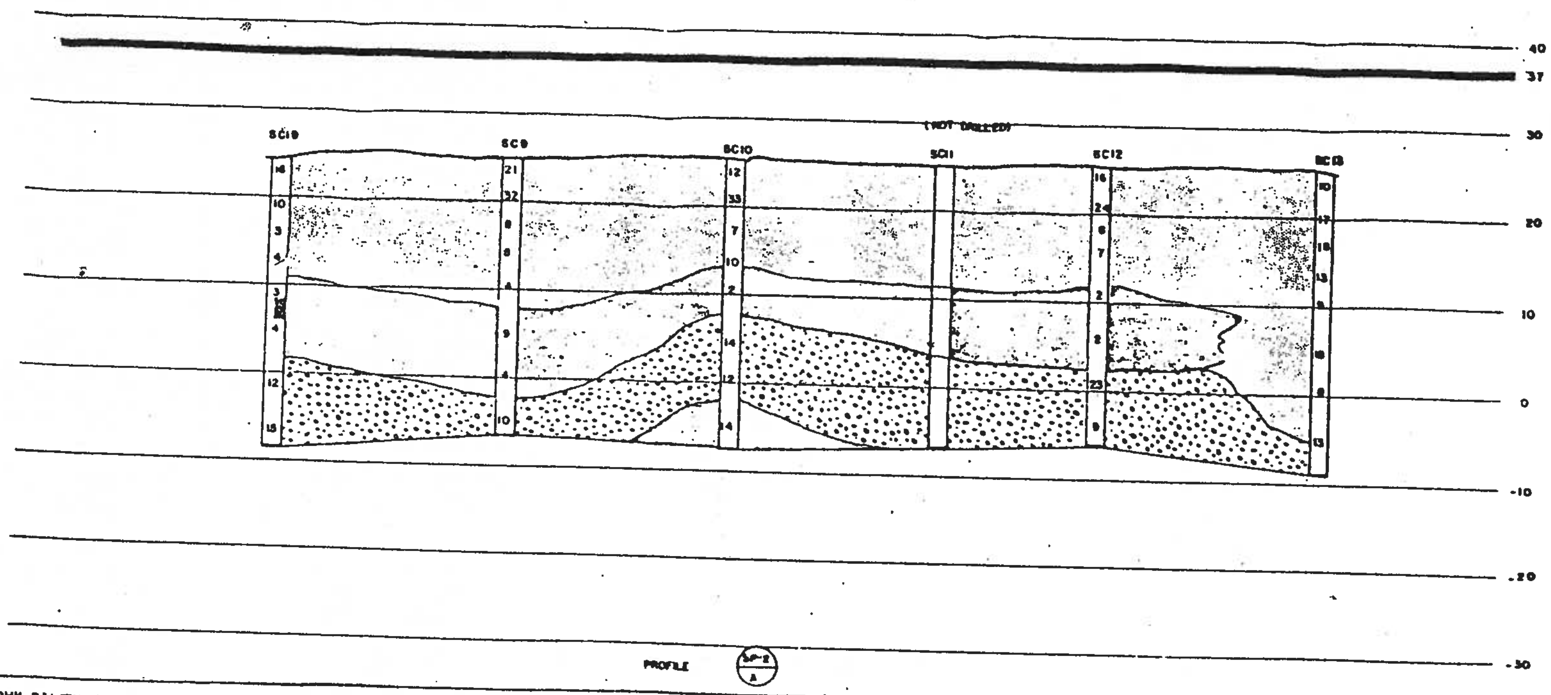

☐ GRAY-BROWN SILTY FINE TO MEDIUM SAND

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▨ SHELL AND LIMESTONE

▨ VERY FIRM GRAY SILTY CLAY WITH SAND SEAMS

▨ VERY LOOSE GRAY SILTY FINE TO MEDIUM SAND WITH SHELLS

▨ GRAY BROWN SILTY CLAY

☐ VERY SOFT SILTY CLAY WITH SAND SEAMS

- - BOTTOM OF EXCAVATION

▬ TOP OF DIKE

▮ UNDISTURBED SAMPLES

JOB NO.	DRAWING NO.
SS7735	SP-2
SCALE 1"(H)=200' 1"(V)=10'	DATE 3-20-78

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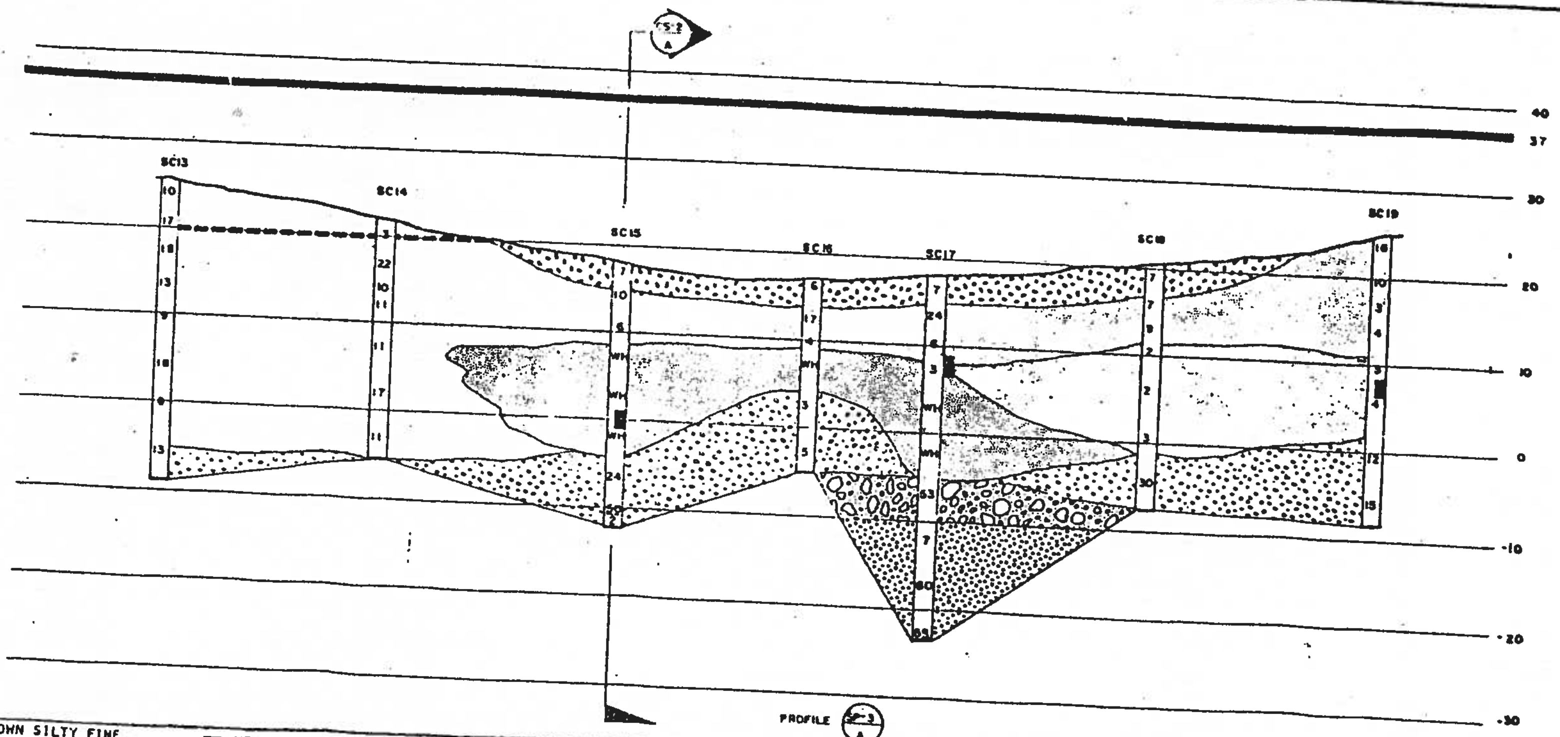

PROFILE SP-3 A

▨ GRAY-BROWN SILTY FINE TO MEDIUM SAND
▨ FIRM TO SOFT GRAY SILTY CLAY WITH SAND SEAMS
▨ SHELL AND LIMESTONE
▨ VERY FIRN GRAY SILTY CLAY WITH SAND SEAMS
▨ VERY LOOSE GRAY SILTY FINE TO MEDIUM SAND WITH SHELLS
▨ GRAY BROWN SILTY CLAY
☐ VERY SOFT SILTY CLAY WITH SAND SEAMS
- - BOTTOM OF EXCAVATION
▬ TOP OF DIKE
▮ UNDISTURBED SAMPLES

JOB NO.	DRAWING NO.
SS7735	SP-3
SCALE 1"(H)=200' 1"(V)=10'	DATE 3-20-78

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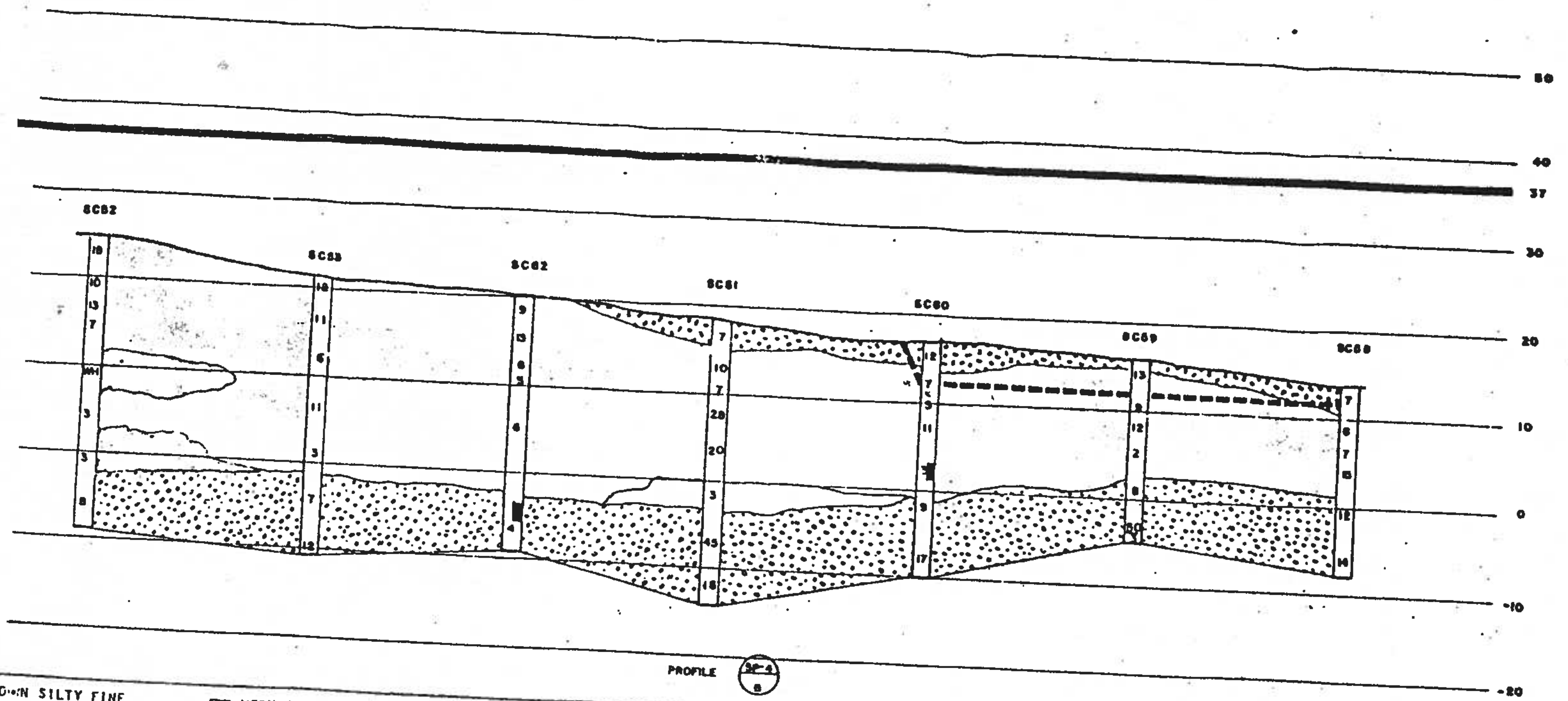

PROFILE (SP-4 / 6)

☐ GRAY-BROWN SILTY FINE TO MEDIUM SAND

☐ FIRM TO SOFT GRAY SILTY CLAY WITH SAND SEAMS

▨ SHELL AND LIMESTONE

▨ VERY FIRM GRAY SILTY CLAY WITH SAND SEAMS

⁘ VERY LOOSE GRAY SILTY FINE TO MEDIUM SAND WITH SHELLS

▨ GRAY BROWN SILTY CLAY

☐ VERY SOFT SILTY CLAY WITH SAND SEAMS

▬ ▬ BOTTOM OF EXCAVATION

▬ TOP OF DIKE

▮ UNDISTURBED SAMPLES

JOB NO. SS7735	DRAWING NO. SP-4
SCALE 1"(H)=200' 1"(V)=10'	DATE 3-20-78

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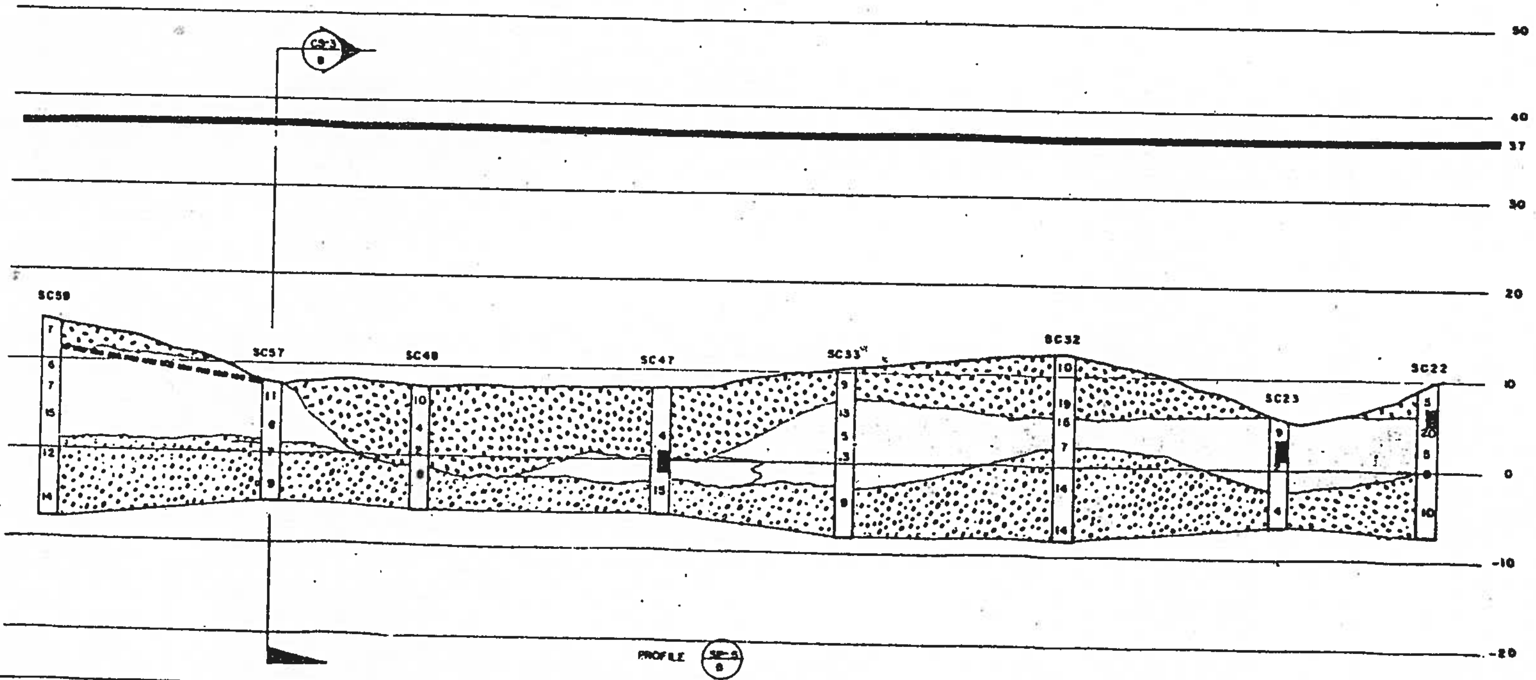

☐ GRAY-BROWN SILTY FINE TO MEDIUM SAND

☐ FIRM TO SOFT GRAY SILTY CLAY WITH SAND SEAMS

▨ SHELL AND LIMESTONE

▨ VERY FIRM GRAY SILTY CLAY WITH SAND SEAMS

▨ VERY LOOSE GRAY SILTY FINE TO MEDIUM SAND WITH SHELLS

▨ GRAY BROWN SILTY CLAY

☐ VERY SOFT SILTY CLAY WITH SAND SEAMS

━ ━ BOTTOM OF EXCAVATION

━━ TOP OF DIKE

▮ UNDISTURBED SAMPLES

JOB NO.
SS7735

DRAWING NO.
SP-5

SCALE
1" (H) = 200'
1" (V) = 10'

DATE
3-20-78

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WINYAH ELECTRIC GENERATING STATION
SOIL PROFILE
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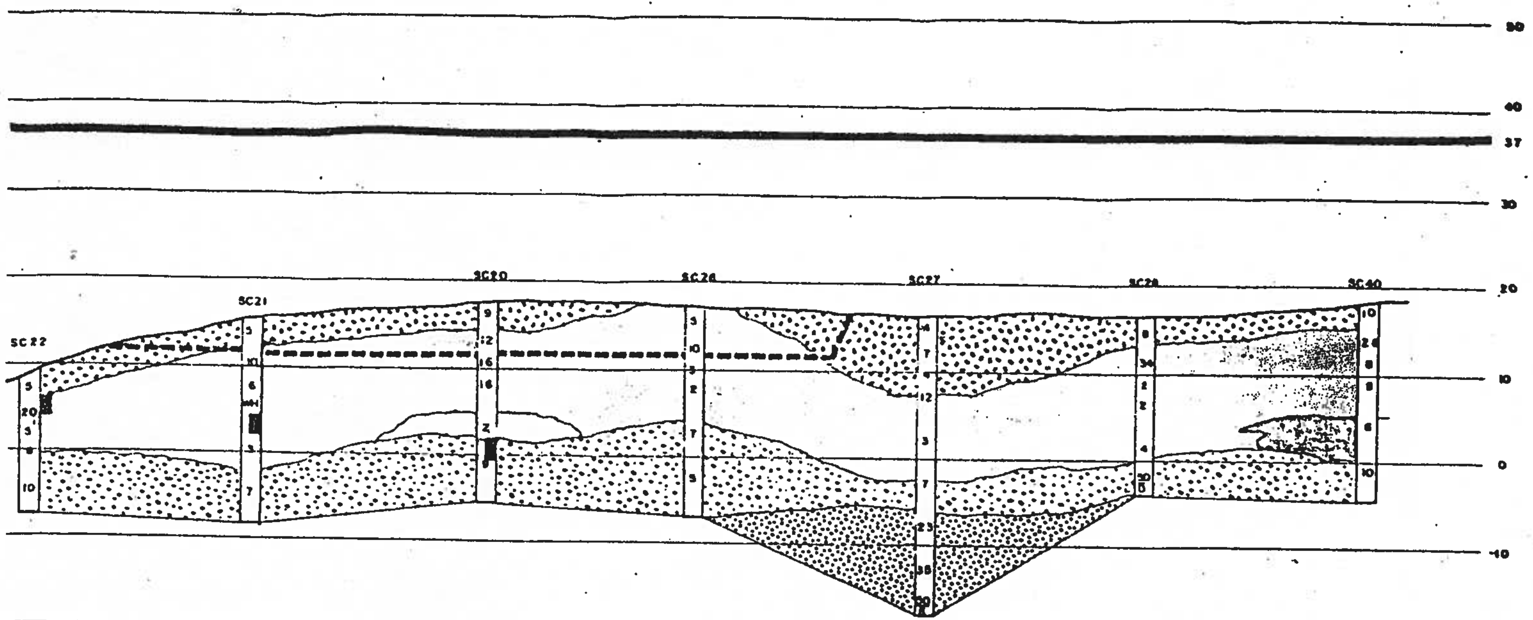

PROFILE SP-6 / 6

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☐ FIRM TO SOFT GRA- SILTY CLAY WITH SAND SEAMS

▨ SHELL AND LIMESTONE

▨ VERY FIRM GRAY SILTY CLAY WITH SAND SEAMS

▨ VERY LOOSE GRAY SILTY FINE TO MEDIUM SAND WITH SHELLS

▨ GRAY BROWN SILTY CLAY

☐ VERY SOFT SILTY CLAY WITH SAND SEAMS

▬ ▬ BOTTOM OF EXCAVATION

▬ TOP OF DIKE

▮ UNDISTURBED SAMPLES

JOB NO. SS7735

DRAWING NO. SP-6

SCALE 1"=(H)=200' 1"=(V)=10'

DATE 3-20-78

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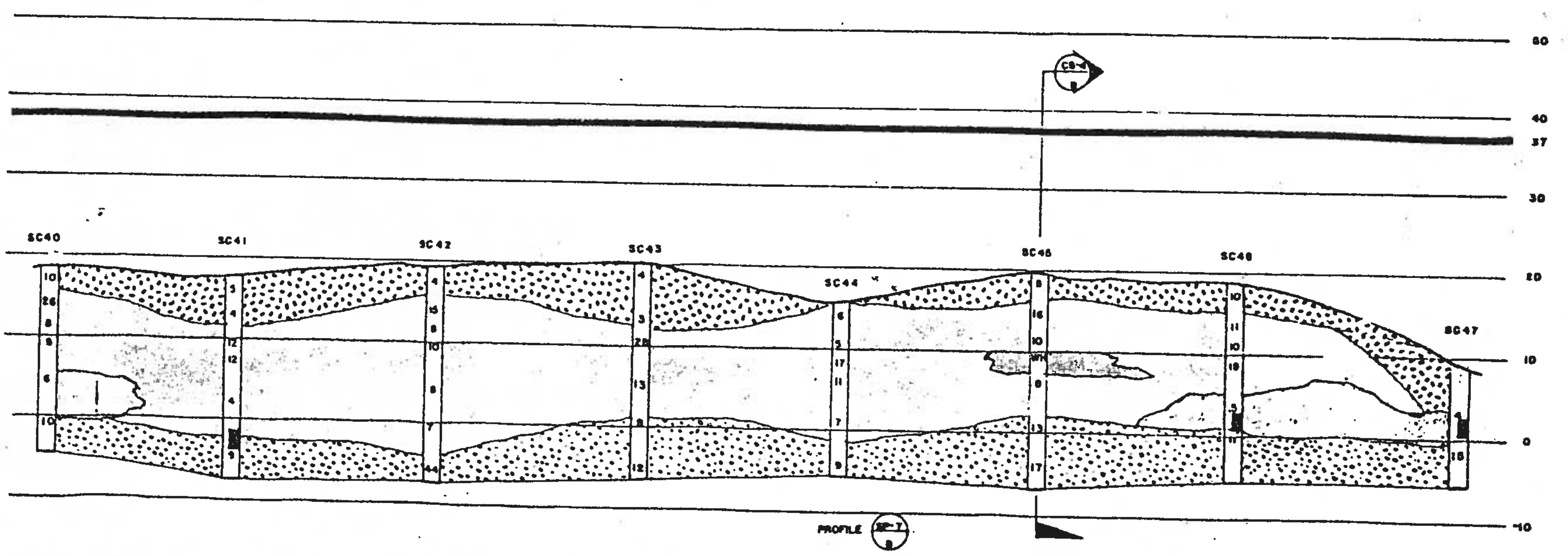

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▨ SHELL AND LIMESTONE
▨ VERY FIRM GRAY SILTY CLAY WITH SAND SEAMS
⁘ VERY LOOSE GRAY SILTY FINE TO MEDIUM SAND WITH SHELLS
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☐ VERY SOFT SILTY CLAY WITH SAND SEAMS
▬ ▬ BOTTOM OF EXCAVATION
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▮ UNDISTURBED SAMPLES

JOB NO. SS7735
DRAWING NO. SP-7
SCALE 1"(H)=200' 1"(V)=10'
DATE 3-20-78

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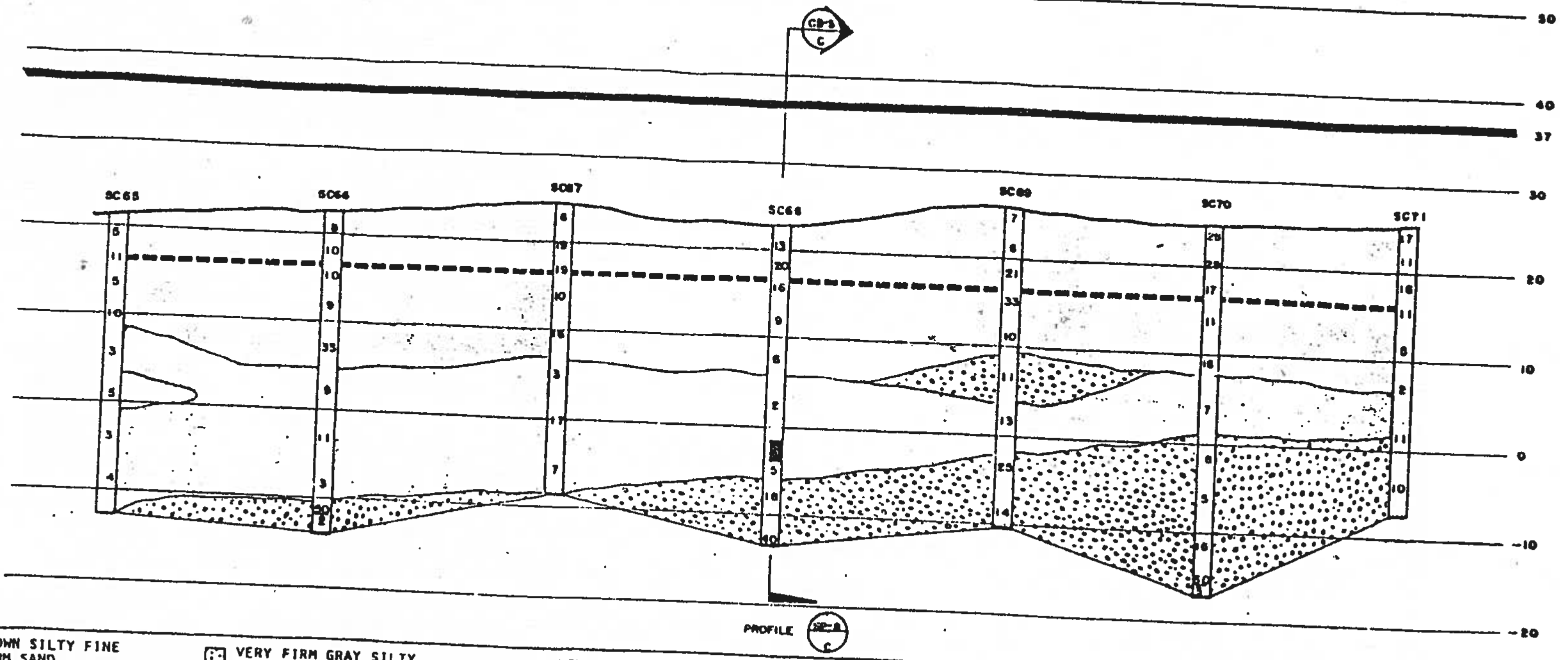

GRAY-BROWN SILTY FINE TO: MEDIUM SAND
FIRM TO SOFT GRAY SILTY CLAY WITH SAND SEAMS
SHELL AND LIMESTONE

▨ VERY FIRM GRAY SILTY CLAY WITH SAND SEAMS
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▮ UNDISTURBED SAMPLES

JOB NO.	DRAWING NO.
SS7735	SP-8
SCALE 1"(H)=200' 1"(V)=10'	DATE 3-20-78

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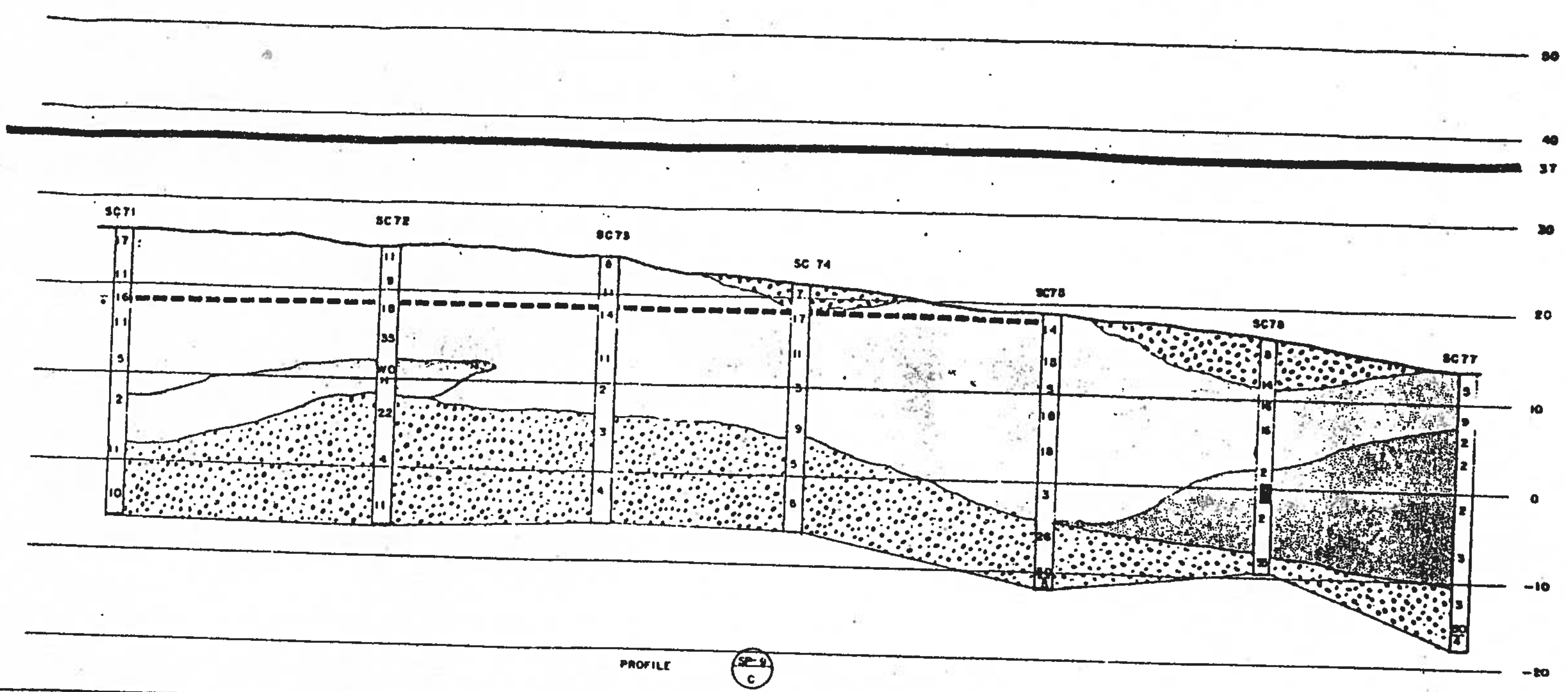

▯ GRAY-BROWN SILTY FINE TO MEDIUM SAND

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▨ SHELL AND LIMESTONE

▨ VERY FIRM GRAY SILTY CLAY WITH SAND SEAMS

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-- BOTTOM OF EXCAVATION

━ TOP OF DIKE

■ UNDISTURBED SAMPLES

JOB NO. SS7735	DRAWING NO. SP-9
SCALE 1"=200' 1"=10'	DATE 3-20-78

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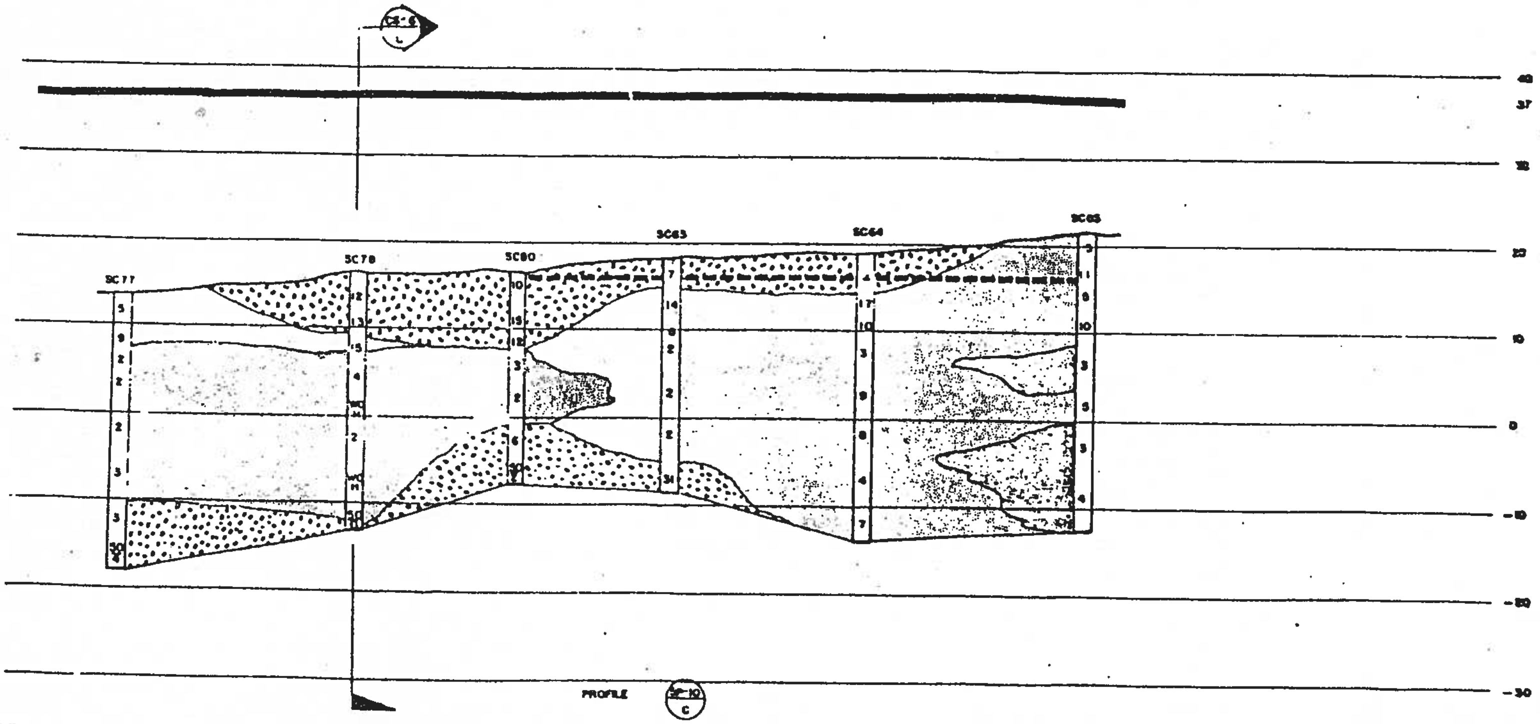

▢ GRAY-BROWN SILTY FINE TO MEDIUM SAND
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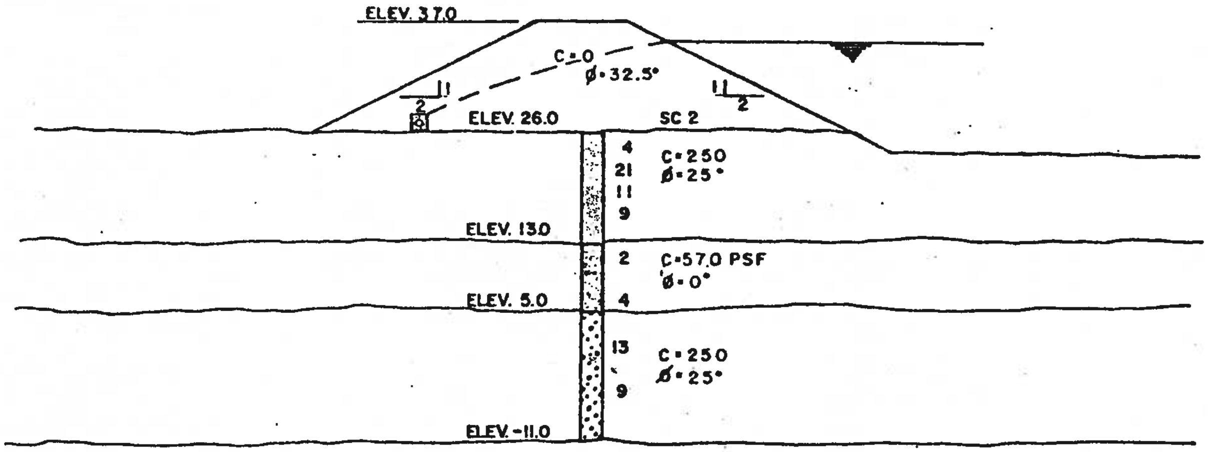
JOB NO. SS7735	DRAWING NO. SP-10	**SOIL & MATERIAL ENGINEERS, INC.** ENGINEERING-TESTING-INSPECTION	WINYAH ELECTRIC GENERATING STATION SOIL PROFILE GEORGETOWN, SOUTH CAROLINA
SCALE 1"(H)=200' 1"(V)=10'	DATE 3-20-78		



SECTION (CS-1 / A)

☐ GRAY-BROWN SILTY FINE TO MEDIUM SAND
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JOB NO.	DRAWING NO.
SS7735	CS-1
SCALE	DATE
NONE	3-20-78

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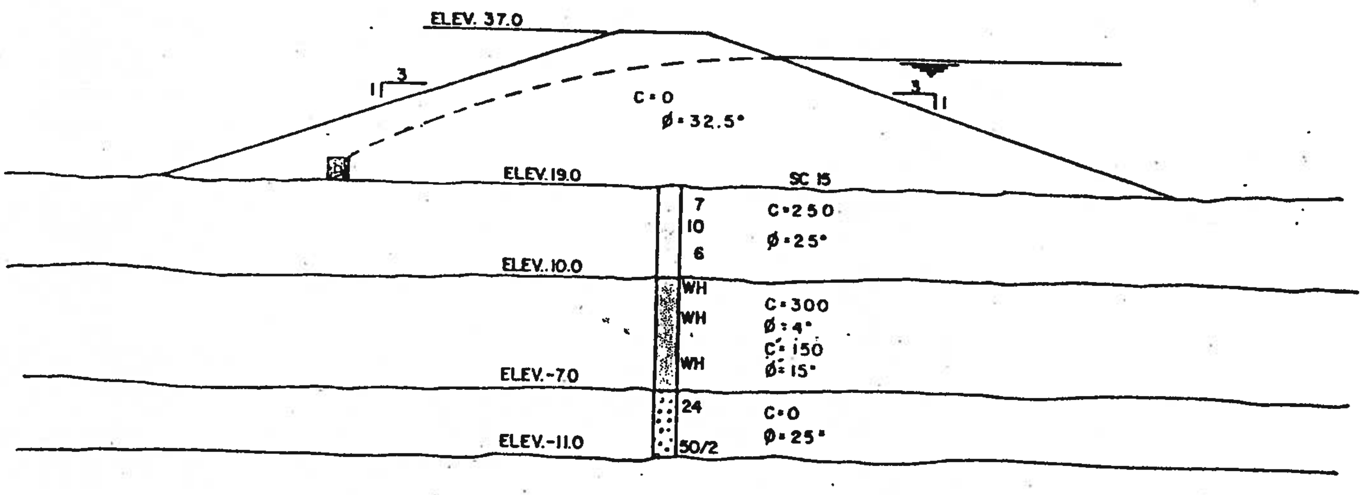
DIKE CROSS SECTION



SECTION $\frac{CS\text{-}2}{A}$

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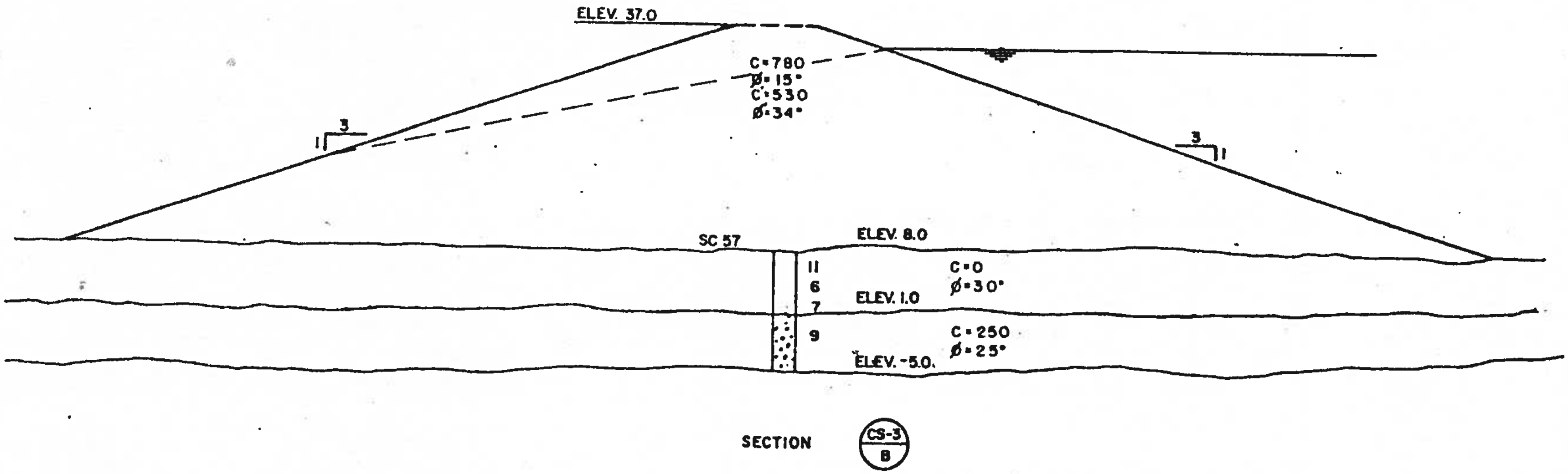
JOB NO.	DRAWING NO.
SS7735	CS-2
SCALE	DATE
NONE	3-20-78

SOIL & MATERIAL ENGINEERS, INC.
ENGINEERING-TESTING-INSPECTION

DIKE CROSS SECTION



SECTION CS-3/B

- ☐ GRAY-BROWN SILTY FINE TO MEDIUM SAND
- ☐ FIRM TO SOFT GRAY SILTY CLAY WITH SAND SEAMS
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- ▮ UNDISTURBED SAMPLES

JOB NO. SS7735	DRAWING NO. CS-3
SCALE NONE	DATE 3-20-78

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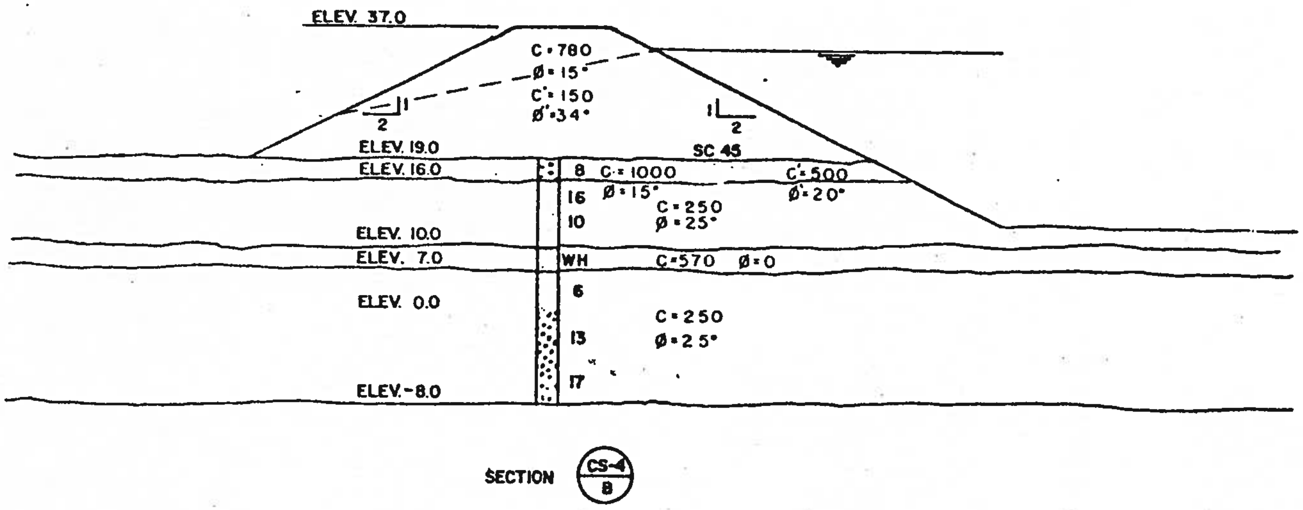
DIKE CROSS SECTION



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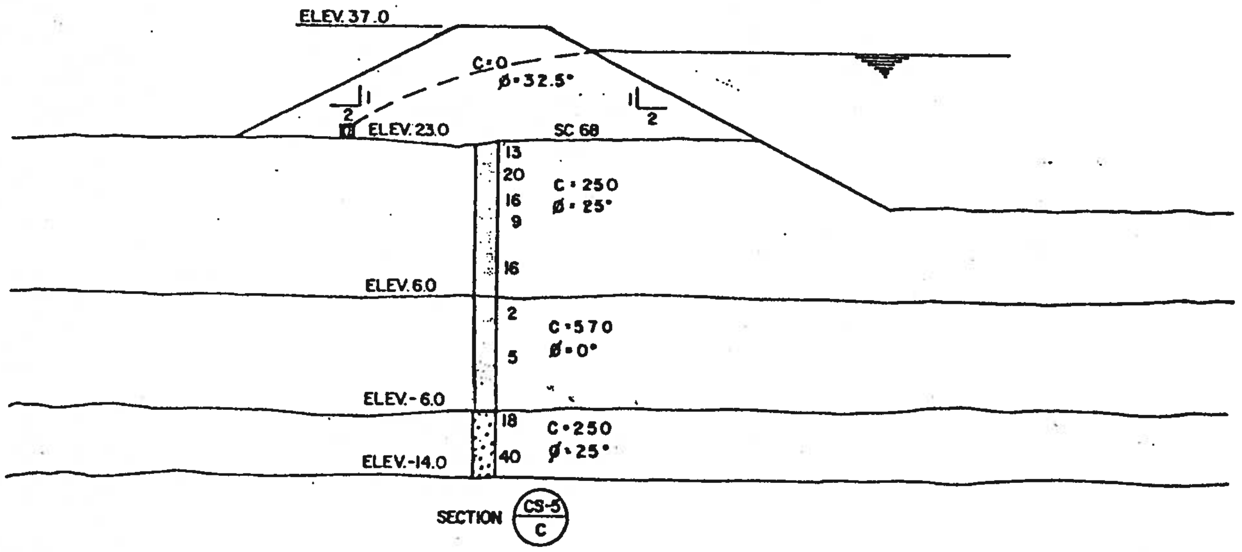
▨ SHELL AND LIMESTONE
▨ VERY FIRM GRAY SILTY CLAY WITH SAND SEAMS
▨ VERY LOOSE GRAY SILTY FINE TO MEDIUM SAND WITH SHELLS
▨ GRAY BROWN SILTY CLAY
☐ VERY SOFT SILTY CLAY WITH SAND SEAMS
— — BOTTOM OF EXCAVATION
▬ TOP OF DIKE
▮ UNDISTURBED SAMPLES

JOB NO. SS7735	DRAWING NO. CS-4
SCALE NONE	DATE 3-20-78

SOIL & MATERIAL ENGINEERS, INC.
ENGINEERING-TESTING-INSPECTION

DIKE CROSS SECTION

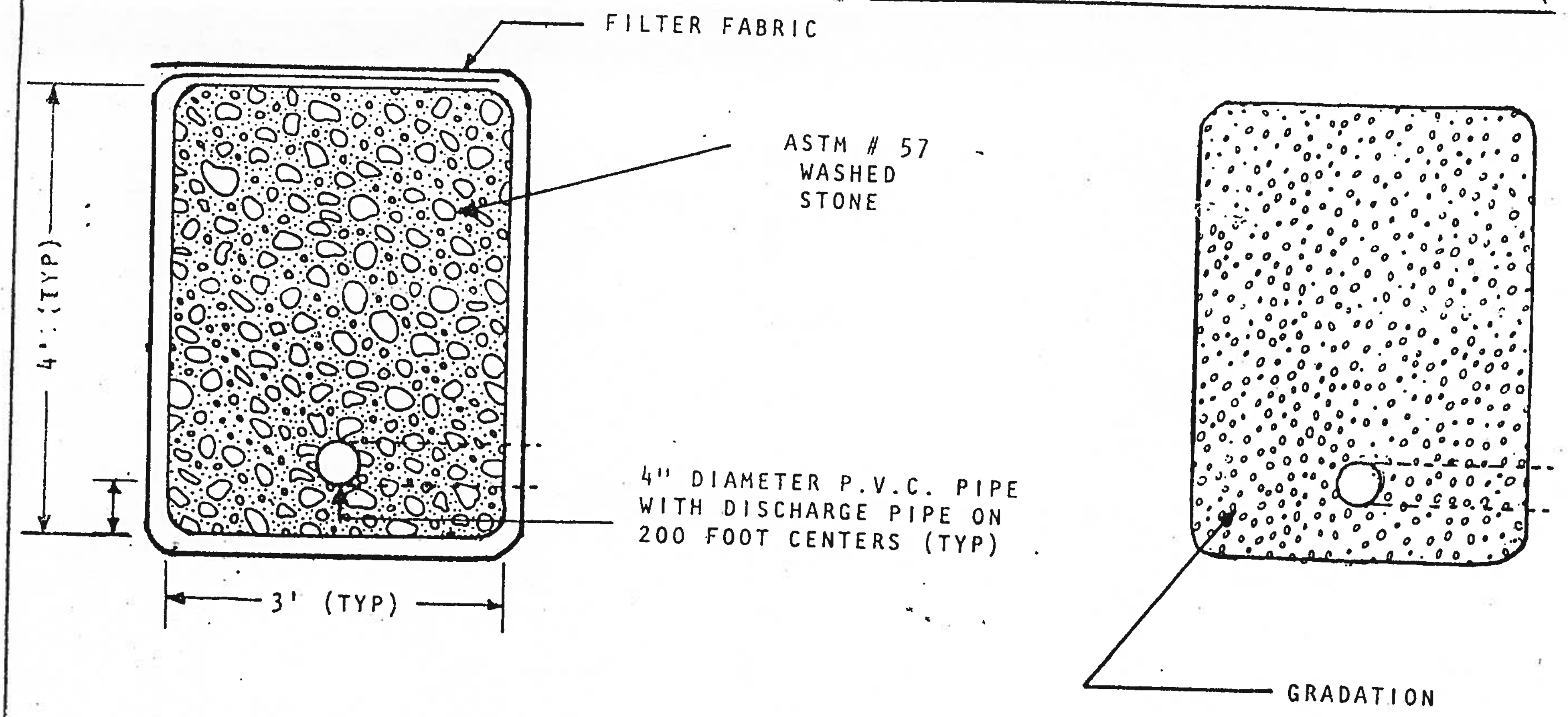


☐ GRAY-BROWN SILTY FINE TO MEDIUM SAND
☐ FIRM TO SOFT GRAY SILTY CLAY WITH SAND SEAMS
▨ SHELL AND LIMESTONE
▨ VERY FIRM GRAY SILTY CLAY WITH SAND SEAMS
▨ VERY LOOSE GRAY SILTY FINE TO MEDIUM SAND WITH SHELLS
▨ GRAY BROWN SILTY CLAY
☐ VERY SOFT SILTY CLAY WITH SAND SEAMS
-- BOTTOM OF EXCAVATION
▬ TOP OF DIKE
■ UNDISTURBED SAMPLES

JOB NO. SS7735
DRAWING NO. CS-5
SCALE NONE
DATE 3-20-78

SOIL & MATERIAL ENGINEERS, INC.
ENGINEERING-TESTING-INSPECTION

DIKE CROSS SECTION



SIEVE SIZE	% PASSING
1/2	100
3/8	90 to 97
4	45 to 75
10	20 to 35
20	10 to 17
40	7 to 12
60	0 to 5

JOB NO. SS7735

DRAWING NO. SME-2

SCALE NONE

DATE June 21-73

SOIL & MATERIAL ENGINEERS, INC.

ENGINEERING-TESTING-INSPECTION

TOE DRAIN DETAIL

SOIL DATA SUMMARY

S&ME JOB NO. SS7735

BORING NUMBER	SAMPLE DEPTH	CLASSIFICATION	STANDARD PENETRATION RESISTANCE	NATURAL MOISTURE (%)	% FINER # 200	UNIT WEIGHT P.C.F.		PROCTOR DATA		SPECIFIC GRAVITY	VOID RATIO E₀	UNCOFINED COMP. MAX.	ATTER-BERG LIMIT		TRIAXIAL SHEAR		CONSOLIDATION C_C	OTHER
						W	D	MAX	OMC				LL	PI	C	ϕ		
SC30	2-3'	Gray Clayey SAND		27.5	40.1								30	13				
SC31	2-4'	Gray Clayey SAND		19.7	25.2								27	9				
SC34	1.5-3'	Tan Clayey SAND		16.7 24	33.6	113.2	97.0	110.5	15.6		.738		31	11	1750 150	21° 36.9°		
SC34	7-9'	Gray Silty SAND			11.1			106.0	15.0					NP				
SC36	2-3'	Gray Sandy CLAY		32.7	62.5								39	17				
SC36	3-4'	Gray Clayey SAND		17.6 22.3	37.9	123.8	105.3	113.1	14.5		.838		30	12	1150 170	23.5° 40°		
SC36	6-7'	Gray SAND			1.2									NP				
SC15	9.5-11.5 17-19														1200	16°	(UU)	
SC38	2-3'	Gray Sandy CLAY		33.8	52.4								43	22				
SC39	1.5-3'	Gray Sandy CLAY		28.8	75.2								60	38				
SC39	6-7'	Gray SILT			57.9								33	10				
SC49	1-2'	Gray Sandy CLAY		28.0	44.7								42	18				
SC50	1-2'	Gray Sandy CLAY		26.9	49.5								36	17				

* A detailed description is presented on attached Test Pit Logs.

SOIL & MATERIAL ENGINEERS, INC

SOIL DATA SUMMARY

SBME JOB NO. SS7735

BORING NUMBER	SAMPLE DEPTH	CLASSIFICATION	STANDARD PENETRATION RESISTANCE	NATURAL MOISTURE (%)	% FINER # 200	UNIT WEIGHT P.C.F.		PROCTOR DATA		SPECIFIC GRAVITY	VOID RATIO Eo	UNCOFINED COMP. MAX.	ATTER-BERG LIMIT		TRIAXIAL SHEAR		CONSOLIDATION C_C	OTHER
						W	D	MAX	OMC				LL	PI	C	ϕ		
SC55	2-4'	Gray Silty SAND		22.6	11.6									NP				
SP4	2-3'	Brown Silty SAND		21.1 14.9	8.6	109.4	95.9	105.8	13.8		.757			NP	0	32.5°		
SC19	6-8'	Black Silty SAND			4.7									NP				
SC41	20.5	Gray Slightly Clayey SAND & SHELLS				123.6	111.9				.507				250	0°	(UU)	
SC7	2-5'	Gray Brown Silty SAND		14.7		109.7	95.6				.762				0	30°		
SC77	10-12'	Gray Silty CLAY		89.2		99.1	52.4				2.2				350 (400°	11.5° 15.5°)		
SC19	16-18'	Gray Silty CLAY		69.1		101.3	59.9				1.89				600	0°		
SC15	17-19'	Gray Silty CLAY		129.2		77.1	33.6				3.64						2.44	
SC78	11-13'	Gray Silty CLAY		71.4		99.9	58.3				1.98				570	0°	(UU)	
SC76	16.5 - 18.5	Gray Silty CLAY		96.7		91.3	46.4				2.66				300	0°	(UU)	
SC68	24.5 - 26.5	Gray Silty CLAY with Sand Seams				102.4	83.5				0.65						.094	
SC17	9.5 - 11.5	Gray Silty CLAY		135.2		84.6	34.0				3.76							
SC78	16-20'	Gray Silty CLAY		87.9		85.3	45.4				2.1				400 (300	9° 20°)	2.48	
MP13	41.5'	Gray Sandy Silty CLAY		45.8		109.1	74.8				1.25				2900	4°		
SC25	3-4'	Gray Clayey SAND		17.6	27.7	124.0	105.4	112.8	16.0		.585		34	17	2000 (1110	19° 25.8°)		
SC25	6-8'	Gray Silty SAND			25.0			108.8	15.8					NP				

SOIL & MATERIAL ENGINEERS, INC