santee cooper

CROSS GENERATING STATION

Bottom Ash Pond History of Construction Update

Update to Document: Cross-0-LI-004-0007

Revision: 1

Date: 13 April 2021

Prepared by:

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CONTENTS

1 INTRODUCTION

The EPA published new regulations (40 CFR Part 257) regarding Coal Combustion Residuals (CCRs) on April 17, 2015. One of the new requirements (§257.73(c)) was for the owner of a CCR unit to compile a history of construction by October 17, 2016 and to update significant changes to the history of construction thereafter. An engineering and consulting firm (WorleyParsons) compiled a history of construction report for the Bottom Ash Pond at Cross Generating Station on October 14, 2016. Significant Changes to the Bottom Ash Pond History of construction post October 14, 2016 are presented in this report.

2 UPDATES TO REQUIRED DATA

2.1 Owner's Information

There were no changes to the Owner's information. Please reference section 2.1 of the Bottom Ash Pond History of Construction compiled by WorleyParsons in Appendix C of this document for the Owner's Information.

2.2 CCR Unit Location

There were no changes to the CCR unit location. Please reference section 2.2 of the Bottom Ash Pond History of Construction compiled by WorleyParsons in Appendix C of this document for the Unit locations.

2.3 CCR Unit Purpose

The Bottom Ash Pond no longer accepts coal combustion residuals or wastewater inflows. The bottom ash pond inflows were officially terminated on August 31, 2020.

2.4 Watershed Information

There were no changes to the Watershed Information. Please reference section 2.4 of the Bottom Ash Pond History of Construction compiled by WorleyParsons in Appendix C of this document for watershed information.

2.5 Foundation Properties

There were no changes to the foundation properties. Please reference section 2.5 of the Bottom Ash Pond History of Construction compiled by WorleyParsons in Appendix C of this document for Foundation Properties.

2.6 CCR Unit Stages

In August of 2020, all inflows to the Bottom Ash Pond were permanently terminated. The trapezoidal spillway connecting the Bottom Ash Pond to the Wastewater Decant Pond was filled in to match the top of the adjacent dike. This modification was done to provide more operational capacity to the Wastewater Decant pond and to prevent the Wastewater Decant Pond from overflowing into the Bottom Ash Pond once pond closure activities commence.

2.6.1 Site Preparation and Construction

The spillway modification in 2020 was done by Southard Brothers Construction. The existing 3" concrete revetment, protective soils and bentonite liner was removed within the limits of the spillway. The subgrade was prepared, and the spillway opening was filled with structural fill. New Geosynthetic Clay Liner was installed on the side slope of the dike on the Wastewater Decant pond side. The new GCL overlapped the existing soil/bentonite liner of the Decant Pond at a minimum of 3 feet. The new GCL liner was extended up the side slope and was anchored at elevation 94 feet. Protective soil and new 3" concrete revetment was installed on the side slope over new GCL liner. The side slope on the Bottom Ash Pond was stabilized with 3 inches of topsoil and grass. The top of the dike was surfaced with 6 inches of aggregate base. The finished elevation of the dike after the spillway modification matched the existing top of dike elevation of 95 feet.

Plan and detail drawings for the spillway modification can be found in Appendix A of this document. The specifications can be found in Appendix B.

2.7 CCR Unit Drawings

Drawings for construction activities performed post October of 2016 are included in Appendix A of this report. Please refer to the Bottom Ash Pond History of Construction compiled by WorleyParsons in Appendix C of this document for all other historical construction drawings.

- CROSS-0-DW-112-717-020 R1; Decant Pond Modifications Sitework Plan
- CROSS-0-DW-112-720-017 R2; Decant Pond Modifications Sections and Details

2.8 Instrumentation

There were no changes to the instrumentation related to the Bottom Ash Pond. Please reference section 2.8 of the Bottom Ash Pond History of Construction compiled by WorleyParsons in Appendix C of this document for instrumentation information.

2.9 Area-Capacity Curves

Please reference the Bottom Ash Pond Area-Capacity Curve in section 2.9 of the Bottom Ash Pond History of Construction compiled by WorleyParsons in Appendix C of this document. The present volume of CCR in the Bottom Ash Pond is estimated to be 750 acre-feet. The capacity has not changed since the 2016 inspection because of ongoing beneficial reuse of CCR products in this impoundment.

2.10 Spillway Data

In august of 2020, all inflows to the Bottom Ash Pond were terminated and the trapezoidal spillway that connected the Bottom Ash Pond to the Wastewater Decant Pond was filled in. This modification was done to prevent the operational Wastewater Decant Pond from backing up into the Bottom Ash Pond when closure activities commence. This modification also allowed the emergency spillway elevation of the Decant Pond to be raised.

In august of 2020, The Decant Pond emergency spillway weir height was raised from elevation 89.5 feet to 92.53 feet. This modification provided more operational capacity for the Station.

General dewatering and storm water runoff from the Bottom Ash Pond are now managed with temporary dewatering pumps in lieu of the trapezoidal spillway. These pumps transfer water from the bottom ash pond directly into the wastewater decant pond.

2.11 Construction Specifications, Provisions for Surveillance, Maintenance, and Repair

Construction specifications for the spillway modifications post 2016 are provided in Appendix B of this document. These specifications include:

- CROSS-0-TS-02200: Earthwork Technical Specification
- CROSS-0-TS-02274: Geosynthetic Clay Liner Technical Specification
- CROSS-0-TS-02778; Concrete Erosion Control Revetment Liner
- CROSS-0-TS-02984: Seeding Technical Specification
- SANTEE-0-TS-03300: Concrete Technical Specification

2.12 Structural Instability Records

There is no record of structural instability of the Bottom Ash Impoundment.

3 SUMMARY

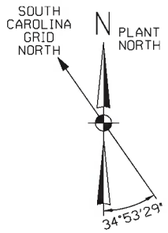
Construction updates to The Bottom Ash Pond at Cross Generation Station since October of 2016 include:

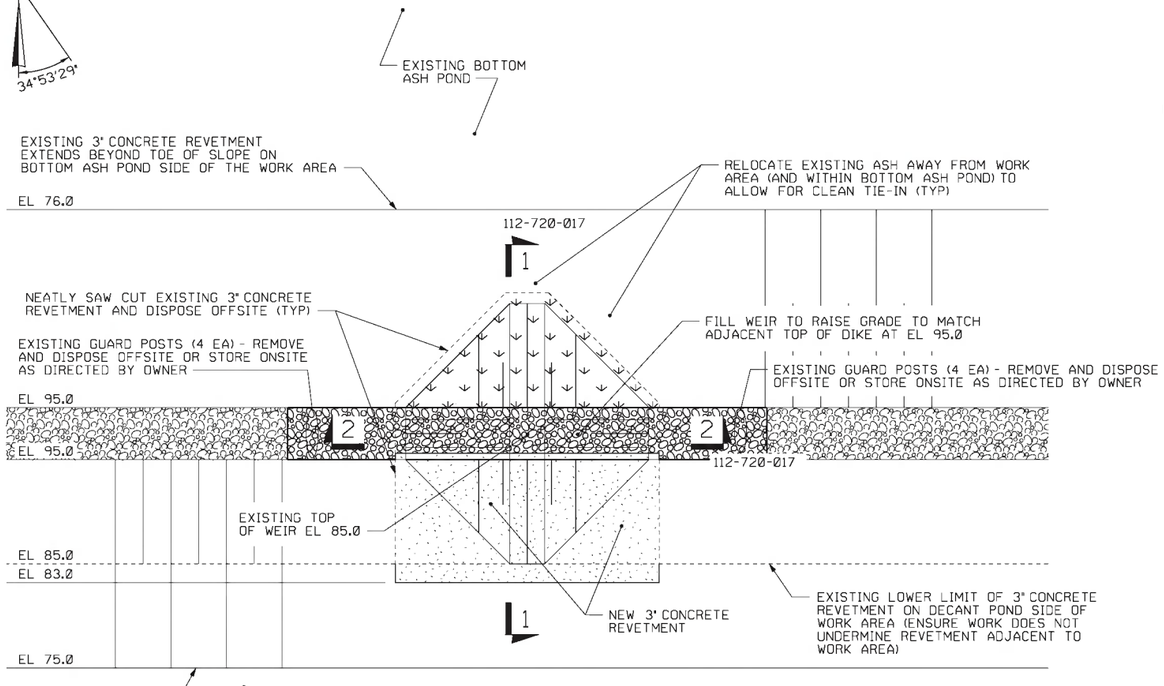
Inflows to the pond were officially terminated on August 31, 2020.

In August of 2020, the spillway connecting the Bottom Ash Pond to the Decant Pond was filled in.

General dewatering and stormwater runoff from the Bottom Ash Pond are now managed with temporary dewatering pumps in lieu of the trapezoidal spillway.

APPENDIX A – New Construction Drawings

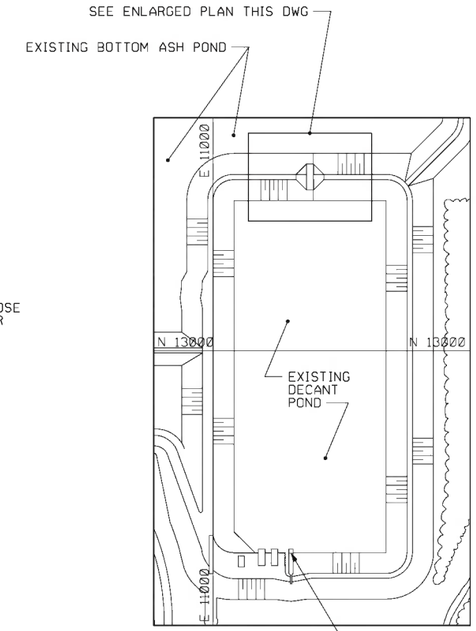




NOTE:

START OF THIS WORK TO BE COORDINATED CLOSELY WITH OWNER TO ENSURE CONSISTENCY WITH BOTTOM ASH POND CLOSURE PLAN SCHEDULE, TERMINATION OF BOTTOM ASH POND INFLOWS, AND LOWERING OF WATER LEVELS WITHIN BOTTOM ASH AND DECANT PONDS.

PLAN
SCALE: 1"=20'



LOCATION PLAN
NOT TO SCALE

LEGEND:

- EXISTING AGGREGATE BASE COURSE
- NEW AGGREGATE BASE COURSE SURFACING
- NEW 3" CONCRETE EROSION CONTROL REVETMENT
- NEW PERMANENT SEEDING WITH ECC-2 EROSION CONTROL BLANKET

REFERENCES:

112-720-017	SECTIONS AND DETAILS

20 0 20 40 60
SCALE: 1" = 20'

REV	DATE	DESCRIPTION	DRAWN	CHECKED	REVIEWED	LDE DESIGNER	DEPUTY/ TECHNICAL	LEAD DISC. SPECIALIST	PROJECT MANAGER
1	07 OCT 19	ISSUED FOR CONSTRUCTION	KPF	FMW	FMW	KPF	FMW	FMW	SK
0	05 FEB 19	ISSUED FOR CONSTRUCTION	KPF	RES	FMW	KPF	FMW	FMW	FPD

DRAWN BY: KPF	ENGINEER/TECH SPECIALIST: FM WOOD
CHECKED BY: RE STOUDT	PROJECT ENGINEERING MANAGER: FP DRZAL
LEAD DESIGNER: KP FEEG	PROJECT MANAGER: JT HICKSON
PRELIMINARY STATUS — LDE — DATE: / /	INFORMATION ONLY - NOT TO BE USED FOR CONSTRUCTION.
APPROVED STATUS — LDE FM WOOD — DATE: 05/FEB/19	REPRESENTS REVIEWED AND APPROVED DESIGN, ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL

SOUTH CAROLINA — WORLEY PARSONS GROUP INC. No. 1505 — CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — REGISTERED PROFESSIONAL ENGINEER — No. 24767 — FLETCHER M. WOOD

Digitally signed by: Fletcher Wood
Date: 2019.10.07 07:49:13 -06'00'

OneWay to zero harm

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF: PE: FLETCHER M. WOOD, STATE: SOUTH CAROLINA — LIC. NO.: 24767 — DATE: 05/FEB/19

CROSS GENERATING STATION

Santee Cooper — SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons
resources & energy

FINAL SITE IMPROVEMENTS
DECANT POND MODIFICATIONS
SITEWORK PLAN

SCALE	DRAWING SIZE	JOB NO.
1"=20'	ARCH D (36" x 24")	

WORLEYPARSONS DWG. NO.	REV
CROSS-0-DW-112-717-020	1

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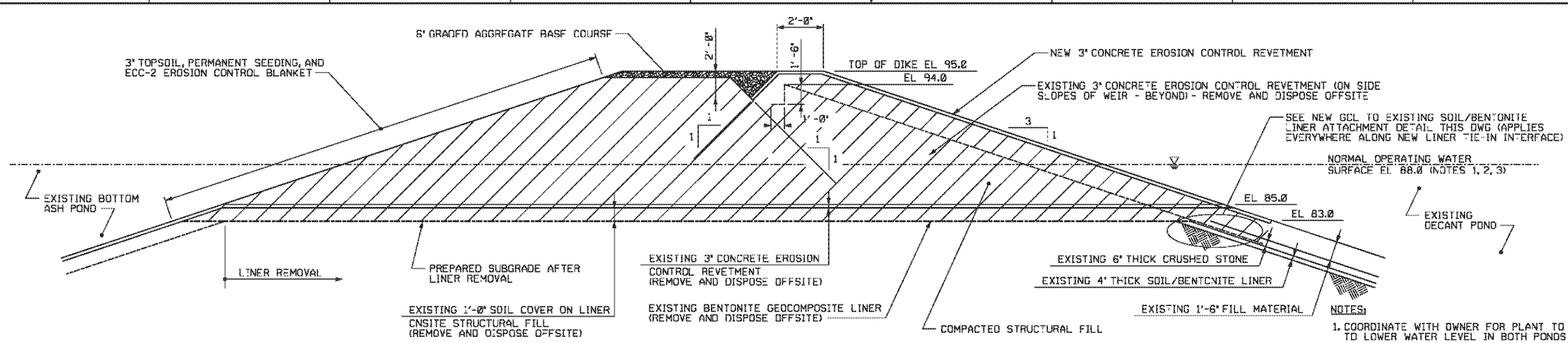
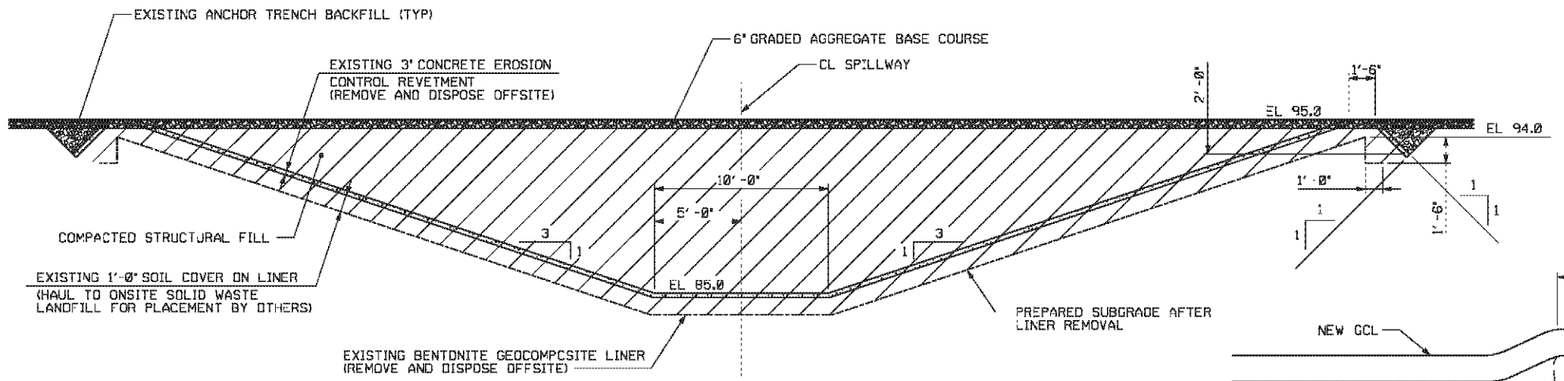


SECTION 1-1
NOT TO SCALE
(112-717-020)

NOTES:

1. COORDINATE WITH OWNER FOR PLANT TO OPERATE DECANT POND PUMPS TO LOWER WATER LEVEL IN BOTH PONDS TO EL 85.0 PRIOR TO WORK.
2. AFTER ALL BOTTOM ASH POND INFLOWS CEASE, CONTRACTOR SHALL CONSTRUCT SMALL DIKE ON BOTTOM ASH POND SIDE OF WORK AREA AND FURNISH AND OPERATE PUMPS AS REQUIRED TO MAINTAIN WATER LEVEL WITHIN WORK AREA SUFFICIENTLY LOW ENOUGH TO PERFORM THE WORK WHILE THE BOTTOM ASH POND WATER LEVEL IS AT MAXIMUM EL 85.0.
3. CONTRACTOR SHALL CONSTRUCT DIKE ON DECANT POND SIDE OF WORK AREA AND FURNISH AND OPERATE PUMPS AS REQUIRED TO MAINTAIN WATER LEVEL WITHIN WORK AREA SUFFICIENTLY LOW ENOUGH TO PERFORM THE WORK WHILE THE DECANT POND WATER LEVEL FLUCTUATES UP TO EL 88.0. ALL DIKE MATERIAL TO BE REMOVED UPON COMPLETION OF WORK. DIKE MAY NOT BE COMPOSED OF COAL COMBUSTION RESIDUAL MATERIALS.



SECTION 2-2
SPILLWAY SECTION ALONG CL OF DIKE
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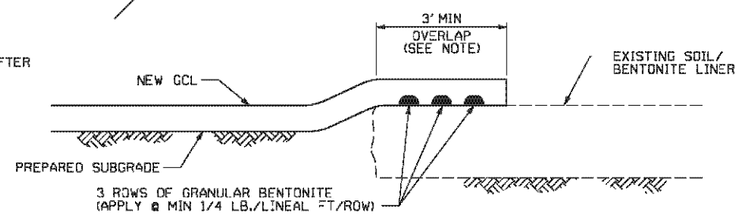
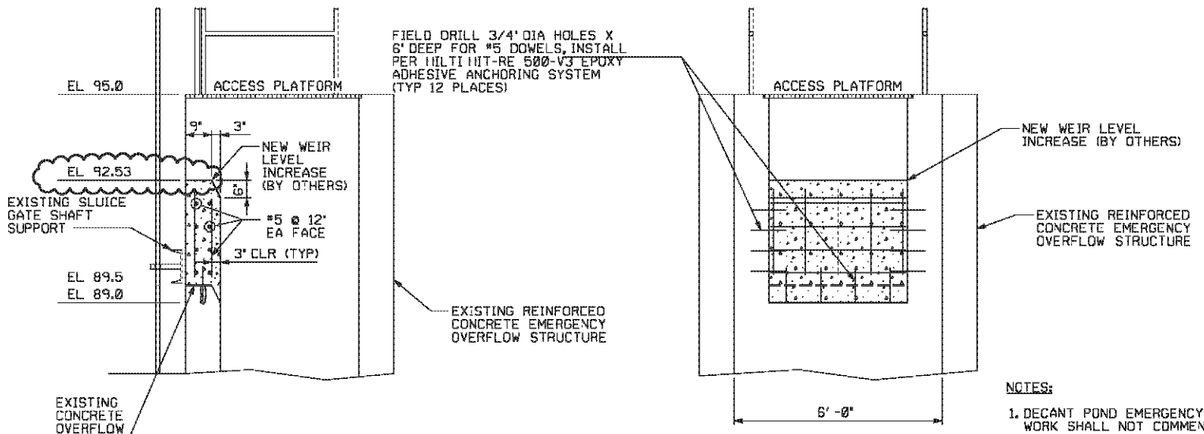
(112-717-020)



NEW GCL TO EXISTING SOIL/BENTONITE LINER ATTACHMENT
NOT TO SCALE

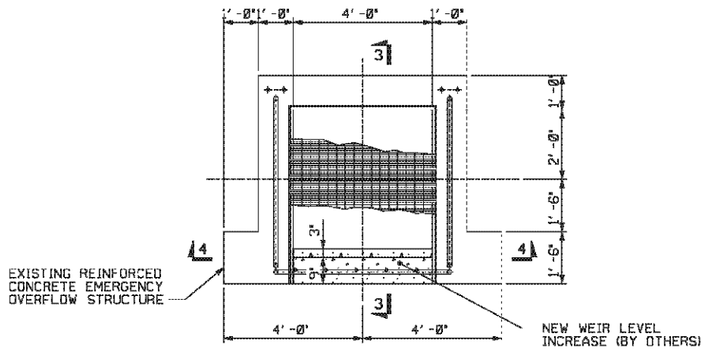


SECTION 3-3
NOT TO SCALE

SECTION 4-4
NOT TO SCALE

NOTES:

1. DECANT POND EMERGENCY OVERFLOW STRUCTURE WORK SHALL NOT COMMENCE UNTIL AFTER WORK TO REMOVE WEIR AND RECONSTRUCT DIKE BETWEEN BOTTOM ASH AND DECANT PONDS IS COMPLETE.
2. EMERGENCY OVERFLOW STRUCTURE MODIFICATIONS TO BE COMPLETED BY OTHERS.



EXISTING EMERGENCY OVERFLOW STRUCTURE
NOT TO SCALE
(112-717-020)

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1	10 OCT 18	ISSUED FOR CONSTRUCTION	KPF	FM	FM	FM	KPF	FM	FM	FM	SK
0	05 FEB 18	ISSUED FOR CONSTRUCTION	KPF	RES	FM	FM	KPF	FM	FM	FM	PD

DRAWN BY: KPF	ENGINEER/TECH SPECIALIST: FM WOOD
CHECKED BY: RE STOUDT	PROJECT ENGINEERING MANAGER: FP DRZAL
LEAD DESIGNER: KP FEEG	PROJECT MANAGER: JT HICKSON
PRELIMINARY STATUS / LDE	DATE: - - — INFORMATION ONLY - NOT TO BE USED FOR CONSTRUCTION.
APPROVED STATUS / LDE: FM WOOD	DATE: 05-FEB-19 — REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL

THIS DOCUMENT ORIGINALLY ISSUED AND SEALED BY WORLEYPARSONS RESOURCES & ENERGY NO. C01505

THIS DOCUMENT ORIGINALLY ISSUED AND SEALED BY FLETCHER M. WOOD P.E. NO. 24767 ON 05/FEB/19

REV. 2 MEETS RECORD CONDITIONS

OneWay

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF FLETCHER M. WOOD, STATE/SOUTH CAROLINA LIC. NO. 24767 DATED 05/FEB/19

CROSS GENERATING STATION

Santee Cooper — SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons resources & energy

FINAL SITE IMPROVEMENTS
DECANT POND MODIFICATIONS
SECTIONS AND DETAILS

SCALE	DRAWING SIZE	JOB NO.
NONE	ARCH D (36" x 24")	

WORLEYPARSONS DWG. NO.: CROSS-0-DW-112-720-017 — REV: 2

APPENDIX B – New Construction Specifications

WorleyParsons
resources & energy

EcoNomics

SANTEE COOPER CROSS GENERATING STATION

Earthwork

Technical Specification

Document: CROSS-0-TS-02200

Revision: 0

Date: Aug 31, 2016

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Facsimile: +1 610 855 2001
www.worleyparsons.com

EARTHWORK
TECHNICAL SPECIFICATION

Disclaimer

REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
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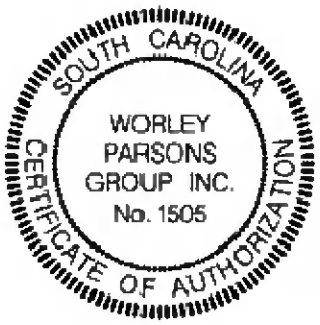

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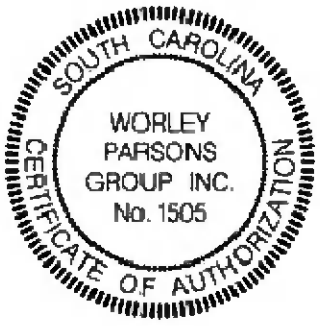

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EARTHWORK
TECHNICAL SPECIFICATION

PART 1 GENERAL

1.1 Section Includes

A. This Section includes the technical requirements for performing excavation and fill operations.

B. This Section covers:

1. Clearing, grubbing, and topsoil stripping.

2. Excavating to the required lines and grades.

3. Segregation of excavated suitable material and unsuitable material.

4. Use, stockpiling, or disposal of materials.

5. Dewatering of excavations and diversion of all surface water away from earthwork operations.

6. Subgrade preparation.

7. Furnishing, placing, and compacting of fill materials.

8. Excavating and filling trenches.

1.2 Related Sections

A. CR34-0-TS-02050, Demolition

B. CR34-0-TS-02101, Sitework

C. CR34-0-TS-02924, Seeding

1.3 References

A. The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Section and, where referred to by title or by

basic designation only, are applicable to the extent indicated by the specific reference unless otherwise required herein.

1. ASTM International (ASTM):

   a. D698, "Standard Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))"

   b. D1557, "Standard Test Methods for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))"

2. South Carolina Department of Health and Environmental Control (DHEC):

   Regulation 61-62.2, "Prohibition of Open Burning"

3. South Carolina Department of Transportation (SCDOT):

   "Standard Specifications for Highway Construction" (Standard Specifications)

4. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA):

   2207, Construction Industry, 29 CFR 1926, Subpart P, "Excavations, Trenching, and Shoring" (OSHA Subpart-P).

B. Where the above referenced codes and standards contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed unless stated otherwise by this Section.

C. In the event of any conflict between codes, or between specifications and codes, the more stringent requirement shall apply.

1.4 Submittals

A. With Bid:

1. Work plan for excavation and fill activities, including source of each type of fill material.

B. After Award:

1. The Contractor shall provide submittals in accordance with the supplier data requirements listed in the scope of work document.

2. The Contractor shall provide material certifications for all materials to be furnished, including, but not limited to, the following:

   a. Graded aggregate base course.

   b. Coarse aggregate.

   c. Sand fill.

   d. Rip rap.

   e. Flowable fill.

1.5 Design Requirements

Not Used

1.6 Performance Requirements

The Contractor shall cease operations immediately if adjacent facilities appear to be in danger and immediately notify the Project Manager. Work shall not be resumed until directed by the Engineer.

1.7 Marking and Identification

Not Used

1.8 Packaging and Delivery

Not Used

1.9 Handling, Storage, and Protection

Not Used

PART 2 PRODUCTS

2.1 Acceptable Manufacturers

Not Used

2.2 Materials

A. Random fill shall consist of Engineer-approved onsite or offsite excavated or stockpiled soil, with the maximum particle size not exceeding one-half the specified lift thickness and with more than 30 percent (by weight) passing the number 200 sieve. It shall not contain ash, organic matter, rubbish, ice, or frozen materials. Material having a moisture content exceeding the limits specified herein shall not be accepted unless brought to within the specified limits.

B. Structural fill shall consist of Engineer-approved onsite or offsite excavated or stockpiled soil, with not more than 30 percent (by weight) passing the number 200 sieve and a plasticity index of 15 or less. It shall not contain ash, organic matter, rubbish, ice, frozen materials, debris, or other deleterious materials. Material having a moisture content exceeding the limits specified herein shall not be accepted unless brought to within the specified limits.

C. Graded Aggregate Base Course material shall be in general accordance with Section 305 of the Standard Specifications for marine limestone.

D. Sand Fill shall be obtained from offsite and shall be No. FA-12 in accordance with Section 801.2.2 of the Standard Specifications. The sand shall consist of hard, tough, durable, uncoated particles, free from clay, vegetation, or friable particles.

E. Coarse Aggregate

1. Coarse Aggregate shall be from offsite, uniformly graded, and of the size indicated on the Drawings in accordance with Appendix A-4 of the Standard Specifications. Limestone is acceptable unless the Drawings require granite.

2. It shall consist of hard, tough, durable, uncoated particles, free of organic matter, clay, or weak, flat, elongated, argillaceous, micaceous, or decomposed material. It shall not be made of acid-forming or toxic-forming rock or slag.

F. Rip Rap shall be obtained from offsite and shall be granite class A or B as indicated on the Drawings in accordance with Section 804 of the Standard Specifications. Rip rap shall be granite.

G. Flowable fill shall be composed of cement, fly ash, sand, and water. Strength at 28 days shall be 100 psi unconfined compressive strength.

H. Topsoil shall be re-used topsoil stripped in the Work, or obtained from the onsite stockpile west of the Class 2 landfill. Topsoil obtained from the onsite stockpile shall not contain ash and shall have large roots removed.

2.3 Mixes and Processes

Not Used

2.4 Fabrication and Assembly Requirements

Not Used

2.5 Personnel Requirements

Not Used

2.6 Inspection and Test Requirements

Not Used

2.7 Cleaning

Not Used

2.8 Corrosion Protection/Coatings

Not Used

PART 3 EXECUTION

3.1 Inspection and Preparation

Not Used

3.2 Installation Requirements

A. Control of Water:

1. Ditches, berms, site grading, sumps, and pumping facilities shall be constructed or provided to direct, collect, and remove water from the Work areas. Water shall be conducted to areas away from the Work to prevent erosion, damage to adjacent structures or utilities, and in accordance with other Engineer requirements.

2. Water shall not be allowed to accumulate in excavations or low areas within the Work area.

3. Groundwater and surface runoff shall be controlled to prevent disturbance of the foundation bearing materials, subgrades, and adjacent structures or utilities.

4. Non-contact construction stormwater pumped from excavations (if applicable) or flowing from the Work areas shall be directed into the site ditch system draining to the sediment control pond, directed to the site catch basins or ditches draining into the Unit 1/2 or Unit 3/4 stormwater ponds, or as otherwise required by the OS-SWPPP. When drainage through the sediment control pond is not possible, dewatering of Work areas shall utilize sediment filter bags or other measures approved by the Engineer to prevent sediment-laden water from discharging offsite. All contact water (i.e. water that has been in contact with coal combustion residuals) shall be directed to the site catch basins or ditches draining into the Unit 1/2 or Unit 3/4 stormwater ponds, or shall be pumped to the Wastewater Decant Pond, as applicable.

B. Clearing and Grubbing:

1. Areas designated for excavation or fill shall be cleared and grubbed of objectionable material, rubbish, trees, stumps, brush, roots, down timber, and other vegetation or organic matter, when present.

2. Materials removed in the clearing and grubbing operations shall be either mulched and disposed of offsite, or burned onsite.

3. Burning shall be in accordance with Federal, State, and local laws and regulations, including SC DHEC Regulation 61-62.2. Burning shall be performed in a manner and in locations so as not to cause a fire hazard. Firefighting equipment shall be available during burning operations. Materials burned shall be reduced to ashes.

4. Topsoil shall be stripped from cleared and grubbed areas and stockpiled where shown on the Drawings or otherwise where directed by the Engineer, or re-applied in the Work prior to seeding.

C. Excavation:

1. Excavation shall conform to the lines, grades, and outlines as shown on the Drawings. Excavation side slopes, bottoms of excavations, and ditches shall be shaped to a smooth and uniform surface, free from bumps and hollows. A neat saw cut shall be used when the excavation extends into existing paving or a concrete slab.

2. The final excavation lines shall be within 0.1 foot of grades as indicated on the Drawings, unless overexcavation is required.

3. Excavation operations shall be conducted so material outside the excavation limits is not disturbed or loosened. Material disturbed or loosened shall be restored to at least its original condition. All excavation operations shall be conducted in accordance with OSHA Subpart-P.

4. Blasting for excavation shall not be permitted.

5. Excavation bottoms shall be accepted by the Engineer before placement of backfill, structures, pipe, or utilities.

6. Suitable material shall be stockpiled at on-Site locations as directed by the Engineer. The material shall be segregated into piles for topsoil, random fill, and structural fill.

7. Excavated materials not meeting the requirements of random fill, structural fill, or topsoil are defined as unsuitable. Unsuitable material shall be disposed of on-Site as directed by the Engineer.

8. Stockpiles and unsuitable material disposal areas shall be shaped and sloped to provide a stable stockpile and to facilitate drainage and prevent erosion. Side slopes shall be sloped at 2:1 maximum, or flatter as required to maintain a stable slope. Pile tops shall be graded to drain at a minimum 1 percent slope to prevent standing water. Erosion and sedimentation shall be controlled in accordance with the OS-SWPPP. Grass and vegetation shall be stripped from existing stockpiles prior to placing additional material on them. Material stripped from the stockpiles shall be disposed of in the unsuitable material stockpile area.

D. Subgrade Preparation:

1. Excavation bottoms for soil supported footings, concrete slabs or paving, and areas to receive fill shall be proof-rolled in the Engineer's presence with a fully loaded pneumatic-tired tandem axle dump truck or other Engineer-approved heavy equipment. Unless otherwise required on the Drawings, confined areas inaccessible to heavy compaction equipment shall be compacted with three to four passes of a largest practicable plate compactor or roller. Unless otherwise required on the Drawings, soft or organic areas detected during subgrade preparation shall be overexcavated as required by the Engineer and backfilled with compacted fill. The fill shall be the same material that is to be subsequently placed on the prepared subgrade. If a structure is to be placed directly on the subgrade, then the removed material shall be replaced with compacted Graded Aggregate Base Course material.

2. The subgrade shall be compacted to a minimum density equal to 95 percent of the maximum dry density, as determined by the Modified Proctor Test (ASTM D1557), for all areas to receive fill (except pond and yard areas), areas to receive Graded Aggregate Base Course surfacing, areas on which a structure is to be placed, and areas below roadways. Pond and yard area subgrade shall be compacted to 90 percent of the maximum dry density, as determined by the Modified Proctor Test (ASTM D1557).The moisture content at the time of compaction shall not vary from the optimum moisture content by more than three percentage points, unless otherwise approved by the Engineer. ASTM D698 may be used in lieu of ASTM D1557 provided that the minimum densities are increased by five percent.

3. At Engineer's prior approval, Contractor may substitute 12 inches (compacted) of Graded Aggregate Base Course material for subgrade which fails to meet the above requirements provided that the new subgrade is compacted to 90 percent of the maximum dry density, as determined by the Modified Proctor Test (ASTM D1557), or as otherwise approved by the Engineer. In this case, Graded Aggregate Base Course material shall be compacted to a minimum density equal to 95 percent of maximum dry density, as determined by the Modified Proctor Test (ASTM D1557).

4. When geosynthetic liner installation is included in the scope of work, surfaces to be lined shall be smooth and free of debris, roots, and angular or sharp rocks. All subgrade fill shall consist of well-graded material, free of organics, trash, clay balls, or other deleterious material that may cause damage to the liner system. The upper 6 inches of the finished subgrade shall not contain stones or debris larger than ½ inch in any direction. The subgrade shall be compacted in accordance with the specifications, but in no event less than what is required to provide a firm, unyielding foundation sufficient to permit the movement of vehicles and welding equipment over the subgrade without causing rutting or other deleterious effects. The subgrade shall have no sudden or abrupt changes in grade. The subgrade shall be protected from desiccation, flooding, freezing, and erosion. Subgrade found to have desiccation cracks greater than ½ inch in width or depth, or which exhibits swelling, heaving, or other similar conditions, shall be replaced or reworked.

5. At least 48 hours notice shall be given to the Engineer prior to performing subgrade preparation.

E. Fill Placement:

1. The surface of the fill shall be kept approximately horizontal during construction, but shall be provided with sufficient longitudinal and transverse slope to allow for runoff of surface water.

2. Hauling equipment shall not be permitted to follow a single track on the same layer, but shall be spread out to provide uniform compaction and prevent rutting.

3. Fill materials shall not be placed against or upon an unstable grade. At junctions between fill and existing grade, the existing grade shall be cut back, if necessary, to expose compact, stable material. Rolling shall extend over this junction to

provide a compact, stable mass. Similar care shall be taken at junctions between adjacent fills.

4. Fill shall not be placed while rain is falling. Before resuming fill operations after rain, all muddy material shall be bladed off the surface to a depth necessary to expose firm compacted material.

5. Fill shall not be placed on frozen ground and frozen material shall not be used for fill.

6. At the end of each day's Work and when rain is threatening, the fill shall be sloped to provide drainage and shall be compacted over the entire cross section and length with a smooth-wheeled roller to seal it against the entry of water.

7. When the top of the fill or subgrade has dried out, or become excessively wet, or been damaged by construction equipment, the surface on which additional fill or a structure is to be placed shall be scarified to a minimum depth of 6 inches, brought to the specified moisture content, and re-compacted to the specified density before the placement of additional fill or a structure.

8. Fill which does not meet the requirements for moisture content at the time of compaction, shall be dried or wetted to meet the specified requirements. If the fill material requires drying, this shall be accomplished by reworking. Water, if required, shall be added carefully by sprinkling and care shall be taken that no more than the amount needed is applied. Ponding or flooding will not be permitted.

9. Only compaction equipment weighing 200 pounds or less shall be allowed within three feet of structures or retaining walls (excluding foundation mats). For backfilling retaining walls, the same height of fill shall be maintained on both sides of the wall until the front of the wall is at final grade. Fill shall not be placed against concrete walls until the concrete reaches at least two-thirds of its design strength.

10. The final fill layer shall be placed within 0.1 foot of the grades as indicated on the Drawings.

11. The placing of fill shall cease in the areas being tested or sampled.

F. Compaction:

1. Random fill, structural fill, and fill within 3 feet horizontally or vertically of a road subgrade, parking area, concrete surfacing, structure, or foundation shall be compacted in maximum 10 inch lifts (loose) to a minimum density of 95 percent of the maximum dry density, as determined by the Modified Proctor Test (ASTM D1557). Fill in pond or yard areas shall be compacted in maximum 10 inch lifts (loose) to a minimum density of 90 percent of the maximum dry density, as determined by the Modified Proctor Test (ASTM D1557). The moisture content at the time of compaction shall not vary from the optimum moisture content by more than three percentage points, unless otherwise approved by the Engineer. ASTM D698 may be used instead of ASTM D1557 provided the minimum densities are increased by 5 percent.

2. Graded Aggregate Base Course material shall be compacted in maximum 10-inch lifts (loose) to a minimum density of 98 percent of the maximum dry density, as determined by the Modified Proctor Test (ASTM D1557). The moisture content at the time of compaction shall not vary from the optimum moisture content by more than three percentage points, unless otherwise approved by the Engineer.

3. Sand bedding and backfill shall be compacted in maximum 6-inch lifts with a minimum of four passes with the largest practicable plate compactor or roller.

4. Coarse Aggregate shall be compacted in maximum 6-inch lifts (loose) for at least 3 passes with Engineer-approved compaction equipment. Granular bedding under the haunches of pipes that is inaccessible to conventional compaction equipment shall be compacted by an Engineer-approved method to the degree required to prevent penetration of a ½" x 3 ft soil probe rod under hand pressure.

5. In confined areas requiring hand-held compaction equipment weighing 200 pounds or less, all fills shall be placed in maximum 6-inch lifts (loose).

G. Flowable Fill:

Flowable fill shall be placed in accordance with the provisions of Section 210 of the Standard Specifications.

H. Compaction Equipment:

1. Compaction equipment shall be of the type and size required to produce the specified compaction as specified herein or on the Drawings. Compaction equipment shall be compatible with the types of materials being placed.

2. Sheepsfoot or rubber-tired rollers and tampers shall be used to compact cohesive soils. Smooth-wheel rollers and vibrating plate compactors shall be used to compact granular materials, unless approved otherwise by the Engineer.

I. Trench Excavation and Backfill:

1. Structures, pipes, and utilities shall be protected from damage during the Work.

2. Trench excavations for buried pipes and utilities shall be performed to the lines and grades shown on the Drawings.

3. Sheeting, bracing, and shoring shall be installed as required to safely maintain excavations and protect existing structures, utilities, and personnel as required by Federal, State, and local laws and ordinances, including OSHA Subpart-P.

4. Trenches for pipes or utilities shall be excavated through natural ground or as required within fills. For pipes or utilities to be installed within fills, the fill shall first be constructed to a minimum height of 4 feet above the required elevation of the top of the pipe or utility. The trench shall then be excavated into the fill, and the pipe or utility installed as required.

5. The minimum width of the trench shall be as shown on the Drawings and shall not be greater than necessary to permit the Work to proceed.

6. Soft or organic material encountered at the bottom of the trench shall be removed for the full width of the trench to the depths required by the Engineer and replaced with compacted Engineer-approved fill.

7. Trench bottoms shall be accurately shaped so the pipe or utilities will be in continuous and uniform contact with undisturbed soil, Engineer-approved fill material, or bedding material as shown on the Drawings.

8. If stones larger than 3 inch diameter are encountered in the bottom of the trench, they shall be removed and the void shall be backfilled with compacted Engineer-approved fill.

9. Trenches shall not be backfilled until all joints are made, required tests performed, pipe encased as necessary, and Project Manager approval is granted to proceed.

10. Bedding and backfill around the pipe shall be of the type and thickness indicated on the Drawings and compacted to the minimum density as specified herein.

11. When the Drawings indicate that compacted random or structural fill shall be placed around the pipe or utilities, the fill shall have a maximum particle size of three inches.

12. Backfill around pipes and utilities shall be placed so the elevation of the fill is the same on both sides. Rammer-type compactors shall be used with caution adjacent to pipes or utilities to avoid damage or movement.

13. After backfilling, the disturbed areas shall be fine-graded to blend in with existing grades, left with puddle-free drainage, and seeded or otherwise protected as shown on the Drawings or approved by the Engineer.

3.3 Personnel Requirements

Not Used

3.4 Inspection and Test Requirements

Not Used.

3.5 Adjustment and Cleaning

Not Used

3.6 Corrosion Protection/Coatings

Not Used

3.7 Protection

Not Used

3.8 Extra Stock/Spare Parts

Not Used

3.9 Schedules and Attachments

Not Used

WorleyParsons
resources & energy

EcoNomics

SANTEE COOPER CROSS GENETATING STATION

Geosynthetic Clay Liner

Technical Specification

Document: CROSS-0-TS-02274

Revision: 0

Date: 14-Nov-2018

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SANTEE COOPER CROSS GENETATING STATION
GEOSYNTHETIC CLAY LINER
TECHNICAL SPECIFICATION

Disclaimer

REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
0	Issued for Construction	Yingwu Xu Y. Xu	Fletcher Wood 2018.11.14 08:57:21 -06'00' F. Wood	Fletcher Wood 2018.11.14 08:57:47 -06'00' F. Wood	14-Nov-2018

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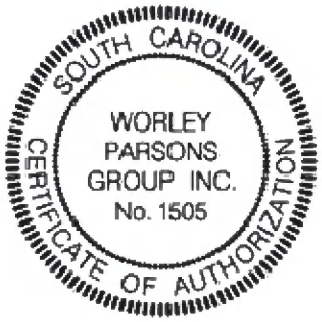

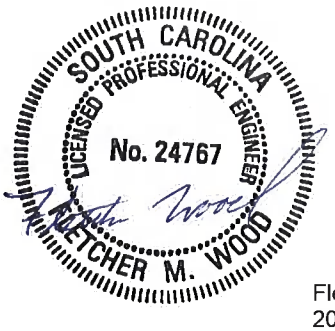

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PART 1 GENERAL

1.1 Section Includes

A. This Section includes technical requirements for furnishing and installing the Geosynthetic Clay Liner (GCL).

B. This Section covers:

1. GCL panel layout.

2. GCL materials.

3. Furnishing and installing GCL.

4. Supervision of GCL installation.

5. Construction of subgrade and GCL cover requirements.

6. Submittal of data per table in Section 3.9.

1.2 Related Sections

Not Used

1.3 References

A. The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference:

ASTM International (ASTM):

1. D 4643, "Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating"

2. D 5261, "Standard Test Method for Measuring Mass per Unit Area of Geotextiles"

3. D 5887, "Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter"

4. D 5890, "Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners"

5. D 5891, "Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners"

6. D 5993, "Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners"

7. D 6141, "Standard Guide for Screening the Clay Portion of a Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids"

8. D 6243, "Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method"

9. D 6496, "Standard Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners"

10. D 6768, "Standard Test Method for Tensile Strength of Geosynthetic Clay Liners"

B. Where the above referenced codes and standards contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed unless stated otherwise by this Section.

C. In the event of any conflict between codes, or Specifications and codes, the more stringent regulation shall apply.

1.4 Submittals

Submittals shall be as required in Section 3.9.

1.5 Design Requirements

Not used.

1.6 Performance Requirements

Not used.

1.7 Marking and Identification

Each roll of GCL delivered to the site shall be labeled by the Manufacturer and include the following information: manufacturer's name and address, trademark, product identification, roll number, lot number, serial number, roll weight, roll dimensions, date of manufacture, geotextile types, and geotextile bonding. Prior to shipment, the GCL Manufacturer shall provide the Project Manager and the CQA Consultant with a quality control certificate for each roll of GCL. For each roll to be delivered, the quality control certificate shall include, at minimum, roll numbers, identification, a statement of verification that all GCL components meet their specified values and were manufactured in accordance with the specifications, and sampling procedures and results of all quality control tests. The quality control certificate shall be signed by a responsible party employed by the GCL Manufacturer, such as the Production Manager.

1.8 Packaging and Delivery

Rolls of GCL shall be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading. At a minimum, all GCL shall be covered during shipment.

1.9 Handling, Storage and Protection

A. The GCL panels shall be stored in a secured area above the ground surface that is level and smooth (i.e. not on wooden pallets), away from dirt, dust, water, and extreme heat. The storage space shall be protected from theft, vandalism, animals, passage of vehicles, and be adjacent to the area to be lined. The Contractor shall be responsible for unloading and storing the GCL in accordance with the manufacturer's recommendations.

B. Handling & Inspections: Materials are to be handled so as to prevent damage. Upon arrival at the jobsite, the Installer shall conduct a surface inspection of all rolls for defects and damage. This inspection shall be conducted without unrolling or unpacking unless defects or damages are found or suspected. This inspection shall occur only in the presence of the Geosynthetics CQA Personnel. The Installer shall notify the Geosynthetics CQA Personnel of any defects or damages observed, which will be documented on the material receiving log form completed by the Geosynthetics CQA Personnel for each truck delivered to the project site. The Installer shall sign off on all material receiving log forms.

PART 2 PRODUCTS

2.1 Acceptable Manufacturers

GCL shall be manufactured by Cetco, GSE Lining Technologies, Inc., Agru America, Inc., or an Engineer-approved equal.

2.2 Materials

A. General Requirements:

1. Each GCL shall be formulated and manufactured by placing bentonite between a non-woven cap geotextile and a woven carrier geotextile, which are needle punched together to provide internal shear reinforcement upon hydration. High swelling sodium bentonite shall be used for the GCL. Refer to 2.2.B.10 for specific GCL requirements based on intended use.

2. Bidders shall submit with their proposal the name of the GCL manufacturer and specification sheets from the manufacturer showing each GCL meets the physical properties as specified herein.

3. Prior to GCL fabrication, the Contractor shall provide material certification from the GCL manufacturer that its GCL meets the physical, chemical, and performance-related requirements specified herein. Bidders may obtain samples of CCR waste as required for performance-related testing.

4. GCL material is to be supplied in roll form. Each roll is to be identified with labels as specified in Section 1.7.

B. Geosynthetic Clay Liner (GCL):

1. The outer layers of each GCL shall consist of a nonwoven cap geotextile and either a woven or a nonwoven scrim-reinforced carrier geotextile.

2. The core of the GCL shall be sodium bentonite, placed on the carrier layer geotextile at a rate of 0.75 lb/sf minimum (at 0% moisture content).

3. The carrier geotextile shall be needle punched through the bentonite into the cap nonwoven geotextile.

4. No glues, adhesives, or other non-mechanical bonding processes shall be used in lieu of the needle punch process or to otherwise enhance the physical properties of the GCL.

5. The minimum acceptable dimensions for the GCL panels shall be 14.5 feet in width and 125 feet in length. Short rolls (rolls less than 125 feet in length) may be supplied at a rate not to exceed 5% of the total square footage produced for the project, unless otherwise approved by the Project Manager.

6. The roll shall be marked with a continuous match line for ease of installation overlap.

7. Bright lighting shall be placed behind the GCL prior to roll up (or other Engineer-accepted method) to ensure consistency of the bentonite layer within the GCL. Fabric encapsulation shall not contain broken needles or needle fragments. Continuous needle detection and removal devices shall be used during GCL product manufacturing prior to roll up. Broken needles shall be cause for rejection. The needle detection and removal equipment shall be capable of removing all needle fragments with no exceptions.

8. The GCL shall be wrapped in plastic to ensure the product stays dry during shipment and prior to use.

9. GCL material not in conformance with these specifications shall be subject to rejection.

10. The GCL shall meet the following requirements and certified values:

Material Property	Test Method	Test Frequency	Certified Values	
			Pond Bottom	Pond Slopes
Bentonite Swell Index	ASTM D 5890	1 per 50 tons	24 mL per 2 g min.	
Bentonite Fluid Loss	ASTM D 5891	1 per 50 tons	18 mL max.	
Bentonite Mass/Area	ASTM D 5993	40,000 ft^2	0.75 lb/ft^2 min.	
Nonwoven Cap Geotextile Mass/Unit Area	ASTM D 5261	40,000 ft2	3.0 oz/yd2 MARV	6.0 oz/yd2 MARV

Material Property	Test Method	Test Frequency	Certified Values	
			Pond Bottom	Pond Slopes
Woven Carrier Geotextile Mass/Unit Area	ASTM D 5261	40,000 ft2	3.0 oz/yd2 MARV	
GCL Tensile Strength	ASTM D 6768	200,000 ft^2	30 lb/in MARV	
GCL Peel Strength	ASTM D 6496	40,000 ft^2	1.0 lbs/in min.	3.5 lbs/in min.
GCL Index Flux	ASTM D 5887	Weekly	1 x 10^{-8} m^3/m^2/sec max.	
GCL Permeability	ASTM D 5887	Weekly	5 x 10^{-9} cm/sec max.	
GCL Hydrated Internal Shear Strength (typical at 200 psf normal stress when hydrated for 48 hours)	ASTM D 6243 (Procedure A)	Periodic	150 psf	500 psf

C. Not Used.

2.3 Mixes and Processes

Not used.

2.4 Fabrication and Assembly Requirements

Not Used.

2.5 Personnel Requirements

A. Manufacturer shall have manufactured a minimum of 2,000,000 square feet of its material installed for linings and shall be approved by the Engineer and Project Manager. A demonstration of this experience shall be included with the proposal.

B. The GCL installation shall be performed under the continuous supervision of the Geosynthetics CQA Personnel.

2.6 Inspection and Test Requirements

Not used.

2.7 Cleaning

Not used.

2.8 Corrosion Protection/Coatings

Not used.

PART 3 EXECUTION

3.1 Inspection and Preparation

The Owner will engage and pay for the services of the Geosynthetic Construction Quality Assurance (CQA) Personnel and Geosynthetics Laboratory to monitor GCL installation and testing.

Upon delivery of the rolls of GCL, the Geosynthetics CQA Personnel will ensure that samples are removed at the specified frequency and forwarded to the Testing Laboratory for testing to ensure conformance to both the design specifications and the list of guaranteed properties. As a minimum, the Testing Laboratory will perform tests for moisture content, mass per unit area (bentonite), free swell of clay component, peel testing, and permeability or fluid loss per 100,000 square feet. Refer to the Supplemental Quality Manual to Technical Specifications.

3.2 Installation Requirements

A. General:

1. The Contractor shall be responsible for the design of the GCL panel layout. Panels shall be placed with seams running up and down slopes, not horizontally. Horizontal seams shall not be located on slopes or within 5 feet of the toe of slope or in areas of potential stress concentrations unless otherwise approved by the CQA Consultant.

2. The Installer shall prepare shop drawings with a proposed panel layout to cover the area shown on the drawings and shop details of any concrete connections around penetrations (if applicable). These drawings shall be submitted for approval by the Engineer and the CQA Consultant prior to fabrication of the GCL. The drawings shall be provided in a reproducible hard copy and electronic format (provided in pdf and AutoCAD formats). Scale shall be a maximum of 1"=50'.

3. Approved drawings will be for concept only and actual panel placement may be adjusted by the Installer as dictated by site conditions and approved by the CQA Consultant.

4. The Manufacturer shall submit a written MQC Plan for the manufacture, fabrication, installation, and quality assurance/quality control for the GCL for review and approval by the CQA Consultant, prior to start of liner fabrication.

5. The General Contractor and the Installer shall inspect the complete subgrade prior to installation of the GCL and submit to the Geosynthetics CQA Supervisor in writing, prior to commencement of the GCL installation, acceptance of the subgrade preparation as outlined in the Supplemental Quality Manual to Technical Specifications.

B. Subgrade Preparation:

1. The subgrade soil shall be as shown on the Drawings. Within the ponds, the GCL will be installed as part of a composite liner system and will be overlain by either a textured geomembrane (pond slopes) or a smooth geomembrane (pond bottoms only).

2. Subgrade surfaces consisting of coarse granular soils or gravel may not be acceptable in ditches (where GCL comprises the only barrier component of the liner system) due to their large void fraction and puncture potential. Subgrade soils in ditches shall possess a particle size distribution such that at least 80 percent of the soil is finer than a #60 sieve (0.250 mm). Subgrade soils in ponds (where the GCL is part of a composite liner system) shall be in accordance with manufacturer requirements.

3. The subgrade surface shall be free of vegetation, sharp-edged rocks, stones, sticks, construction debris, void spaces and other foreign matter that could contact the GCL. The subgrade shall be rolled with a smooth-drum compactor to remove any wheel ruts, footprints, or other abrupt grade changes. Furthermore all protrusions extending more than 0.25 inch (6 mm) from the subgrade surface shall be removed, crushed, or pushed into the surface with a smooth-drum compactor. Where rock is encountered at the finished grade, it may be necessary to over-excavate a minimum of six inches and replace with soils meeting the requirements of 3.2.B.2, as deemed necessary by the Geosynthetics CQA Personnel.

4. On a continuing basis, the Contractor and the Installer shall certify acceptance of the subgrade in the presence of Geosynthetics CQA Personnel before GCL placement.

5. It shall be the Installer's responsibility thereafter to indicate to the Project Manager any change in the condition of the subgrade that could cause the subgrade to be out of compliance with any of the requirements listed in this Section.

6. Site specific compaction requirements shall be followed in accordance with the Drawings and Technical Specifications.

C. Deployment:

1. The Installer shall assign each panel a simple and logical identifying code. The coding system shall be subject to approval by the CQA Consultant and shall be determined at the job site.

2. The Installer shall visually inspect the GCL during deployment for imperfections and mark faulty or suspect areas.

3. The GCL shall be placed over the prepared surface to be lined in such a manner as to ensure minimum handling and shall be installed in accordance with the Manufacturer's recommendations and as required herein. The prepared subgrade shall be maintained in a smooth, uniform, and compacted condition during installation.

4. Materials, equipment, or other items shall not be dragged across the surface of the liner or be allowed to slide down slopes on the lining.

5. The Contractor shall use construction equipment that does not damage or severely stress the liner. It is the option of the Project Manager, CQA Consultant, or Geosynthetics CQA Supervisor to have areas suspected of having undergone liner damage or distress exposed for visual inspection and testing. Any necessary repair work and cost of exposing the liner for inspection will be performed at the Contractor's expense. The Project Manager or CQA Consultant also have the option to reject any equipment that creates damage or distress to the liner by its normal operation and have it removed from the work area.

6. The GCL shall be installed in a relaxed condition and shall be free of tension and stress upon completion of the installation to allow for thermal expansion and contraction of the material. The GCL shall not be stretched to fit. The GCL shall be spread out so there are no folds or bends.

7. Only as much GCL shall be deployed in a given day as can be covered with geomembrane (seamed) during that day.

8. Adequate temporary sandbags shall be provided to prevent GCL uplift due to strong winds.

9. Material shall be deployed from the highest point to the lowest point down the slope, not across the slope.

10. The GCL shall not be placed during any form of precipitation, in the presence of excessive moisture, or in areas of ponded water. Stormwater shall be controlled so that it cannot damage the GCL. Any GCL that becomes wet shall be removed and replaced.

11. The GCL shall have a minimum 6 inch seam overlap. End of panel or butt end seams shall have a minimum 12 inch overlap.

12. Seams at the end of panels shall be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone.

13. Bentonite–enhanced seams shall be constructed between the overlapping, adjacent panels described above. The underlying edge of the longitudinal overlap is exposed and then a continuous bead of granular sodium bentonite shall be applied along a zone defined by the edge of the underlying panel and the 6-inch line. A similar bead of granular bentonite shall be applied at the end-of-roll overlap. The bentonite shall be applied at a minimum rate of one-quarter pound per lineal foot.

14. There shall be no factory seaming.

D. Detail Work:

1. The GCL shall be sealed around penetrations and embedded structures in accordance with the drawings and the GCL Manufacturer.

2. Cutting of the GCL shall be performed with a sharp utility knife or other Engineer-accepted method. Frequent blade changes are required to avoid damage to the geotextile components of the GCL during the cutting process.

E. Liner Covering Requirements:

1. All GCL installed in a given day shall be covered with geomembrane (seamed) during that same day.

2. The method and equipment used to place the geomembrane covering the GCL shall not cause damage to the GCL.

3. Although direct vehicular contact with the GCL is to be avoided, lightweight, low ground pressure vehicles (such as 4-wheel, all-terrain vehicles) may be used to facilitate the initial placement of the geomembrane cover. The GCL Manufacturer shall be contacted with specific recommendations on the appropriate procedures in this situation.

3.3 Personnel Requirements

A. Installer shall have installed a minimum of 2,000,000 square feet of GCL. A demonstration of this experience shall be included with the proposal.

B. Not used.

C. Prior to the installation, the GCL Installer shall certify in writing that all materials and shop drawings regarding panel placement, seaming locations, and construction techniques are in compliance with the Manufacturer's recommendations and other accepted QA/QC procedures. Upon completion of the installation (or each portion of the installation, as required by the Project Manager), the GCL Installer shall certify in writing that the GCL was installed in accordance with the Manufacturer's recommendations as well as the Drawings and Technical Specifications.

3.4 Inspection and Test Requirements

A. Repair Procedures

1. If the GCL is damaged (torn, punctured, perforated, etc.) during installation, it may be possible to repair it by cutting a patch to fit over the damaged area. The patch shall be obtained from a new GCL roll and shall be cut to size that a minimum overlap of 12 inches is achieved around the damaged area. Dry bentonite or bentonite mastic shall be applied around the damaged area prior to placement of the patch. Adhesive or heat bonding shall be used to affix the patch in place so that it is not displaced during cover placement.

2. Installer shall be responsible for repair of defective areas.

3. Repair Verification

Verify, number, and log each patch repair (performed by Geosynthetics CQA Personnel).

B. Quality assurance testing (conformance testing) will be completed by the Owner's CQA representative.

1. At minimum, the following tests will be completed and shall meet the following requirements:

PROPERTY	TEST METHOD	ACCEPTANCE CRITERIA (MINIMUM)	FREQUENCY
Mass per Unit Area, lb/ft^2	ASTM D 5993	Refer to Property Tables in Section 2.2.B	Every 40,000 ft^2
Free Swell of Clay Component, ml/2g	ASTM D 5890		Every 40,000 ft^2
Peel Testing, lbs	ASTM D 6496		Every 40,000 ft^2
Index Flux, m^3/m^2/sec	ASTM D 5887		Every 200,000 ft^2

2. The following procedure will apply whenever a sample fails a conformance test that is conducted by the Owner's CQA representative:

a. The Installer shall replace the roll of GCL that is in non-conformance with the specifications with a roll that meets specifications.

b. The Installer shall remove conformance samples (for testing by the Owner's representative's Geosynthetics CQA Laboratory) from the closest numerical roll on both sides of the failed roll. These two samples must both conform to the Specifications. If either one of these samples fail, every roll of GCL on site and every roll delivered subsequently from the same lot must be tested by the Geosynthetics CQA Laboratory for conformance to the Specifications. This additional conformance testing shall be at the expense of the Installer.

3.5 Adjustment and Cleaning

Not used.

3.6 Corrosion Protection/Coatings

Not used.

3.7 Protection

Not used.

3.8 Extra Stock/Spare Parts

Not used.

3.9 Schedules and Attachments

Paragraph - Submittal Requirements		With Proposal	For Approval		For Record	
			Date	Copies	Date	Copies
All	Alternative Materials or Procedures	Yes	-	-	-	-
1.9.B	Signed Material Receiving Logs	No	-	-	Upon Receipt of Material	1
2.2.A.2	Manufacturer & Specification Sheet	Yes	-	-	-	-
2.2.A.3	Material Certification	No	2 Weeks prior to delivery	3	-	-
1.7, 2.2	QC Test Results and Certifications	No	Prior to Shipment of Rolls	1 + PDF Electronic Format	-	-
2.2	Certificate of Analysis for Each Lot of Clay	No	Prior to Installation	1 + PDF Electronic Format		
2.5.A	Demonstration of Liner Manufacturer's Experience	Yes	-	-	-	-

Paragraph - Submittal Requirements		With Proposal	For Approval		For Record	
			Date	Copies	Date	Copies
3.2.A.2	Shop Drawings for Liner Installation	No	2 Weeks Prior to Fabrication	1 + PDF and AutoCAD Electronic Formats	-	-
3.2.A.4	GCL MQC Plan	No	2 Weeks Prior to Fabrication	1 + PDF Electronic Format	-	-
3.2.A.5	Written Acceptance of Subgrade	No	-	-	Same day / upon completion, and prior to GCL placement	1
3.3.A	Demonstration of Installer's Experience	Yes	-	-	-	-
3.3.C	Written Certifications of Compliance for Work Plan, by Installer	No	-	-	Prior to Installation	1 + PDF Electronic Format
3.3.C	Written Certification of Compliance for Installation, by Installer	No	-	-	Within 2 Weeks after Work	1 + PDF Electronic Format
	As-Built Drawings for GCL Installation, Including GCL Seam and Anchor Trench Locations and Limits	No	Within 2 Weeks after Work	1 + PDF and AutoCAD Electronic Formats		

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EcoNomics

SANTEE COOPER CROSS GENERATING STATION

Concrete Erosion Control Revetment Liner

Technical Specification

Document: CROSS-0-TS-02778

Revision: 0

Date: 17-Mar-2017

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CONCRETE EROSION CONTROL REVETMENT LINER
TECHNICAL SPECIFICATION

Disclaimer

REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
0	Issued for Construction	Ben Gordon B. Gordon	Digitally signed by: Fletcher Wood Date: 2017.03.16 14:52:39 -06'00' F. Wood	Digitally signed by: Fletcher Wood Date: 2017.03.16 14:53:13 -06'00' F. Wood	17-Mar-2017

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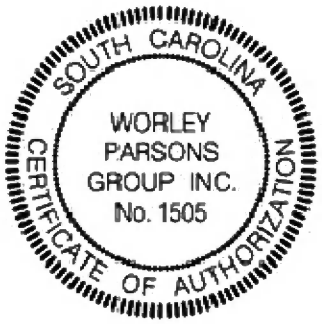

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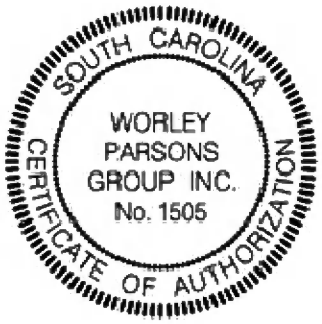

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CONCRETE EROSION CONTROL REVETMENT LINER
TECHNICAL SPECIFICATION

PART 1 GENERAL

1.1 Section Includes

A. This Section includes technical requirements for furnishing and installing concrete revetment liner. The concrete liner shall be Uniform Section Mat (USM) as indicated on the Drawings.

B. This Section covers:

1. Furnishing and installing USM revetment

1.2 Related Sections

Not Used

1.3 References

A. The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference:

1. ASTM International (ASTM):

a. C31, "Standard Practice for Making and Curing Concrete Test Specimens in the Field"

b. C33, "Standard Specification for Concrete Aggregates"

c. C39, "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens"

d. C150, "Standard Specification for Portland Cement"

e. C260, "Standard Specification for Air-Entraining Admixtures for Concrete"

f. C494, "Standard Specification for Chemical Admixtures for Concrete"

g. C618, "Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete"

h. D2256, "Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method"

i. D4491, "Standard Test Methods for Water Permeability of Geotextiles by Permittivity"

j. D4533, "Standard Test Method for Trapezoid Tearing Strength of Geotextiles"

k. D4595, "Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method"

l. D4751, "Standard Test Method for Determining Apparent Opening Size of a Geotextile"

m. D4884, "Standard Test Method for Strength of Sewn or Bonded Seams of Geotextiles"

n. D5199, "Standard Test Method for Measuring the Nominal Thickness of Geosynthetics"

o. D5261, "Standard Test Method for Measuring Mass per Unit Area of Geotextiles"

B. Where the above referenced codes and standards contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed unless stated otherwise by this Section.

C. In the event of any conflict between codes, or Specifications and codes, the more stringent regulation shall apply.

1.4 Submittals

A. With Bid:

1. Any proposed alternative materials or procedures.

B. After Award:

1. The Contractor shall provide submittals in accordance with the supplier data requirements listed in the scope of work document.

2. Concrete mix design and compressive strength test results.

3. Manufacturer's certified test results for fabric forms.

4. Shop drawings for concrete revetment liner.

1.5 Design Requirements

Not Used

1.6 Performance Requirements

Not Used

1.7 Marking and Identification

Not Used

1.8 Packaging and Delivery

Not Used

1.9 Handling, Storage and Protection

Immediately following receipt of fabric forms at the job site, forms shall be inspected and stored in a clean dry area where they shall not be subject to mechanical damage, exposure to moisture, or direct sunlight.

PART 2 PRODUCTS

2.1 Acceptable Manufacturers

Fabric forms shall be manufactured by Construction Techniques, Inc.; Synthetex, LLC; or Engineer-approved equal.

2.2 Materials

A. Fine Aggregate Concrete:

Fine aggregate concrete shall consist of a mixture of Portland cement, fly ash, fine aggregate (sand), and water so proportioned and mixed as to provide a pumpable product. Fluidifier conforming to these Specifications may be used at the option of the Contractor. The mix shall exhibit a minimum compressive strength of 2500 psi at 28 days when made and tested in accordance with ASTM C31 and ASTM C39. The mix shall be an Engineer-approved mixture of cement, fly ash, sand, water, and air.

1. Portland cement shall conform to ASTM C150, Type II.

2. Fine aggregate shall conform to ASTM C33, except in grading. Aggregate shall be of reasonably consistent grading and well graded from the maximum size that can be conveniently handled with available pumping equipment.

3. Water for mixing shall be clean and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.

4. Fly ash shall conform to ASTM C618 and be Class C or F fly ash.

5. Fluidifier, if used, shall be a super-plasticizer agent conforming to ASTM C494. The fluidifier shall serve the purpose of causing more efficient hydration of cement with resulting higher strength.

6. Air-entraining admixtures shall conform to the requirements of ASTM C260.

7. Concrete shall have "Fibermesh 300" micro-reinforcement system, as manufactured by Propex Operating Company, LLC, Chattanooga, TN, or Engineer-approved equal, added to the mix in the minimum amount of 0.1% by volume (1.5 pounds per cubic yard).

8. Calcium chloride or admixtures (except fly ash) containing more than trace amounts of calcium chloride, chlorides, sulfides, or nitrates shall not be used.

B. Fabric Forms

1. The fabric forms shall be Fabriform Unimat Revetment as manufactured by Construction Techniques, Inc.; Hydrotex Uniform Section Lining as manufactured by Synthetex, LLC; or Engineer-approved equal. Fabric form thickness shall be a nominal 3 inches. Each layer of fabric shall meet or exceed the statistical mean (average) roll value (MARV) results as shown below:

Property	Test Method	Unit	MARV
Composition	-	-	Nylon or Polyester
Weight (double layer)	ASTM D5261	oz/yd^2	13
Thickness (double layer)	ASTM D5199	mils	30
Wide Width Strip Tensile Strength MD/XD	ASTM D4595	lbf/in	300/200
Elongation at Break MD/XD	ASTM D4595	%	15/15
Trapezoidal Tear Strength MD/XD	ASTM D4533	lbf	175/150
Water Flow Rate	ASTM D4491	gal/min/sf	35
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve	40
Spacer Cord Break Strength	ASTM D2256	lbf/cord	135

2. The Contractor shall furnish to the Engineer the manufacturer's certified test results showing actual test values obtained when the above physical properties were tested for compliance with the Specifications.

3. Revetment form material shall consist of double-layer woven fabric joined together by spaced, interwoven cords of uniform length to produce a mat with a finished nominal thickness of 3 inches. Points of connection shall be staggered to provide a bonded cobbled surface appearance.

4. Where groundwater conditions require relief of hydrostatic uplift, weep tubes shall be inserted through the fabric per manufacturer's recommendations.

5. The minimum width of individual mill rolls of fabric form shall be 76 inches. Mill width rolls shall be cut to the length required, and the two layers of fabric separately joined, bottom edge to bottom edge and top edge to top edge by

means of sewing thread, to form multiple mill width panels. All factory-sewn seams shall be downward facing. All sewn seams and zipper attachments shall be made using a double line of U.S. Federal Standard Type 401 stitch. All sewn seams shall not be less than 100 lbf/in when tested in accordance with ASTM D4884. Both lines of stitches shall be sewn simultaneously and be parallel to each other, spaced between 0.25 inches and 0.75 inches apart.

6. Grout stops shall be installed at predetermined mill width intervals in order to regulate the flow of fine aggregate concrete.

C. Shop Drawings

Shop drawings of the materials, equipment, method of installation, installation details for the complete system, and manufacturer's product literature and specifications for this installation shall be submitted to the Engineer prior to start of the concrete revetment liner installation for review and acceptance.

2.3 Mixes and Processes

Not Used

2.4 Fabrication and Assembly Requirements

Not Used

2.5 Personnel Requirements

Not Used

2.6 Inspection and Test Requirements

Not Used

2.7 Cleaning

Not Used

2.8 Corrosion Protection/Coatings

Not Used

PART 3 EXECUTION

3.1 Inspection and Preparation

A. Areas on which fabric forms are to be placed shall be constructed to the lines and grades shown on the Drawings. The areas shall be free of organic material and obstructions, such as roots and projecting stones.

B. Excavation and preparation of anchor trenches shall be done in accordance with the lines, grades, and dimensions shown on the Drawings.

C. Immediately prior to placing the fabric forms, the prepared area shall be inspected by the Engineer, and no forms shall be placed thereon until the area has been approved.

3.2 Installation Requirements

A. Fabric Form Placement:

1. Fabric form panels shall be placed within the limits shown on the Drawings.

2. The forms shall be placed over the prepared surface and installed in accordance with the manufacturer's recommendations.

3. Adjacent fabric form panels shall be joined before fine aggregate concrete injection by field sewing or zippering the two bottom layers of fabric together and the two top layers of fabric together. All sewn seams shall be downward facing, unless the Engineer approves otherwise.

4. When conventional joining of panels is impractical, or where called for on the Drawings, adjacent panels may be overlapped a minimum of three feet pending approval by the Engineer. In no case shall simple butt joints between panels be permitted.

5. Lap joints and expansion joints shall be provided as required.

6. Immediately prior to injection of fine aggregate concrete, the assembled fabric form panels shall be inspected, and no fine aggregate concrete shall be pumped therein until the fabric seams, panel connections, and anchor system have been approved.

B. Fine Aggregate Concrete Placement:

1. Following panel placement, small slits shall be cut in the top layer of the fabric form to allow for the insertion of the injection pipe. Fine aggregate concrete shall be injected between the top and bottom layers of fabric, filling the panel to the recommended thickness and configuration.

2. Fine aggregate concrete shall be injected in such a way that excessive pressure on the fabric form and cold joints are avoided.

3. Cold joints shall be avoided. A cold joint is defined as one in which the pumping of fine aggregate concrete into a given section of form is discontinued or interrupted for an interval of more than 45 minutes.

4. The sequence of concrete placement shall be such as to ensure complete filling of the fabric form panel to the required thickness. Prior to removing the injection pipe from the fabric form panel and moving to the next panel, the thickness of the current panel shall be measured by inserting a piece of stiff wire through the fabric form panel at several locations. The average of all thickness measurements shall not be less than the specified thickness.

5. Holes in the fabric left by the removal of the injection pipe shall be temporarily closed by inserting a piece of burlap or similar material. The burlap shall be removed when the concrete is no longer fluid and the concrete surface at the hole smoothed by hand.

6. Foot traffic will not be permitted on the freshly pumped fabric form panel when such traffic will cause permanent indentations in the lining surface. Walk boards shall be used where necessary.

7. Upon completion of the fine aggregate concrete placement, all the anchor trenches shall be backfilled as shown on the Drawings.

8. Excess concrete that was inadvertently spilled on the fabric form panel surface shall be removed with a broom and shovel. The use of a high-pressure water hose to remove spilled concrete from the surface of the freshly pumped fabric form panel is not permitted.

3.3 Personnel Requirements

Not Used

3.4 Inspection and Test Requirements

Not Used

3.5 Adjustment and Cleaning

Not Used

3.6 Corrosion Protection/Coatings

Not Used

3.7 Protection

Not Used

3.8 Extra Stock/Spare Parts

Not Used

3.9 Schedules and Attachments

Not Used

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SANTEE COOPER CROSS GENERATING STATION

Seeding

Technical Specification

Document: CROSS-0-TS-02924

Revision: 1

Date: 17-Mar-2017

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SEEDING
TECHNICAL SPECIFICATION

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REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
0	Issued for Use	L. Lavoie	F. Wood	F. Wood	31-Aug-2016
1	Issued for Construction	Ben Gordon B. Gordon	Digitally signed by: Fletcher Wood Date: 2017.03.16 13:26:35 -06'00' F. Wood	Digitally signed by: Fletcher Wood Date: 2017.03.16 13:29:29 -06'00' F. Wood	17-Mar-2017

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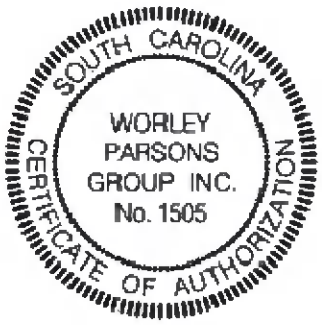

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SEEDING
TECHNICAL SPECIFICATION

PART 1 GENERAL

1.1 Section Includes

A. This Section includes the technical requirements for seeding, fertilizing, liming, and mulching where shown on the Drawings or where otherwise required by the Construction General Permit and OS-SWPPP.

B. This Section covers:

1. Furnishing and applying lime and fertilizer, including conducting of required soil tests.

2. Furnishing and applying seed and mulch.

3. Furnishing and applying Flexible Growth Medium (FGM).

4. Watering seeded areas prior to acceptance.

1.2 Related Sections

A. CROSS-0-TS-02200, Earthwork

1.3 References

A. The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference unless otherwise required herein.

1. ASTM International (ASTM):

a. D 5338, "Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions, Incorporating Thermophilic Temperatures"

b. D 6525, "Standard Test Method for Measuring Nominal Thickness of Rolled Erosion Control Products"

c. D 6566, "Standard Test Method for Measuring Mass per Unit Area of Turf Reinforcement Mats"

d. D 6567, "Standard Test Method for Measuring the Light Penetration of a Turf Reinforcement Mat (TRM)"

e. D 7322, "Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Ability to Encourage Seed Germination and Plant Growth Under Bench-Scale Conditions"

f. D 7367, "Standard Test Method for Determining Water Holding Capacity of Fiber Mulches for Hydraulic Planting"

2. South Carolina Department of Transportation (SCDOT):

a. "Standard Specifications for Highway Construction" (Standard Specifications)

b. "Supplemental Technical Specification for SEEDING: SC-M-810-3 (07/15)"

B. Where the above referenced codes and standards contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed unless stated otherwise by this Section.

C. In the event of any conflict between codes, or between specifications and codes, the more stringent requirement shall apply.

1.4 Submittals

Per Table in Section 3.9 and as listed below:

A. With Bid:

None

B. After Award:

1. The Contractor shall provide submittals in accordance with the supplier data requirements listed in the scope of work document.

2. The Contractor shall submit the following:

   a. Soil test results for lime and fertilizer application rates.

   b. Seed certifications.

   c. FGM Certification, when in Scope of Work: Manufacturer shall submit a letter of certification that the products meets or exceeds all physical property, endurance, performance, and packaging requirements.

   d. FGM Produot Data, when in Scope of Work: Submit manufacturer's product data and installation instructions. Include required substrate preparation, list of materials, and application rate for the FGM.

1.5 Design Requirements

Not Used

1.6 Performance Requirements

Not Used

1.7 Marking and Identification

Not Used

1.8 Packaging and Delivery

Not Used

1.9 Handling, Storage, and Protection

Fertilizer: Store fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

FGM: Deliver materials and products in UV and weather resistant factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures, and construction operations.

Seed: Protect seed from damage by heat, moisture, rodents, or other causes.

Store bagged material in a dry weathertight ventilated structure. Stack bags close together to reduce circulation of air but do not stack against exterior walls.

PART 2 PRODUCTS

2.1 Acceptable Manufacturers

FGM: Profile Products LLC.

2.2 Materials

A. Lime shall be solid agricultural granular and/or fast acting meeting the requirements of Section 1.5.3 of the Standard Specifications: SC-M-810-3.

B. Fertilizer shall be a mixed, commercial, non-acid forming fertilizer. Fertilizer shall be in dry granular or liquid form, delivered to the Site in the manufacturer's original bag or container which shall be plainly marked as to formula and non-acid reaction. Use fertilizer that has a package slip clearly stating the percentage of nitrogen, percentage of slow release nitrogen, percentage of phosphoric acid, and percentage of potash along with the weight (in pounds) of nitrogen, phosphoric acid, and potash. Animal by-product or municipal waste fertilizers are not acceptable.

C. Seed shall conform to Section 1.5.2 of the Standard Specifications: SC-M-810-3. Varieties of seed shall be individually packaged or bagged, and tagged to show name of seed, net weight, origin, percentage of germination and purity, lot number, and date of packaging or testing. Seed that has a test date older than 8 months will not be accepted. Seed that has become wet, moldy, or damaged in transit will not be accepted. Mixtures of different types of seed called for in the seeding schedule shall be weighed and mixed in the proper proportions at the Site in the presence of the Project Manager or the Project Manager's designated representative.

D. Water shall be free from oil, acid, alkali, salt, and other substances harmful to the growth of grass.

E. Mulch shall conform to Section 1.5.5 of the Standard Specifications: SC-M-810-3. All such material shall be free of noxious weeds, and thoroughly "cured" and dried before spreading. Wood chip mulch is not acceptable.

F. Flexible Growth Medium shall conform to Section 1.5.4.2 of the Standard Specifications: SC-M-810-3. FGM shall be Flexterra HP-FGM as manufactured by Profile Products LLC and conform to the following typical property values in Table 1 when uniformly applied at a rate of 3,500 pounds per acre.

TABLE 1		
Property	**Test Method**	**Rate**
PHYSICAL		
Mass Per Unit Area	ASTM D 6566[1]	12 oz/yd^2
Thickness	ASTM D 6525[1]	0.22 in
Ground Cover	ASTM D 6567[1]	99%
Water Holding Capacity	ASTM D 7367	1700%
Cure Time	Observed	< 2 hr
Color (fugitive dye)	Observed	Green
ENDURANCE		
Functional Longevity[2]	ASTM D 5338	≤ 18 months
PERFORMANCE		
Cover Factor[3]	Large Scale[5]	≤ 0.01
% Effectiveness[4]	Large Scale[5]	≥ 99.0%
Vegetation Establishment	ASTM D 7322[1]	800%

Footnotes:

[1] ASTM test methods developed for Rolled Erosion Control Products and have been modified to accommodate hydraulically applied erosion control products.

[2] Functional longevity is an estimate time period, based upon ASTM D 5338 testing and field observations, that a material can be anticipated to provide erosion control and agronomic benefits as influenced by composition, as well as site-specific conditions, including; but not limited to – temperature, moisture, light conditions, soils, biological activity, vegetative establishment and other environmental factors.

[3] Cover Factor is calculated as soil loss ratio of treated surface versus an untreated control surface.

[4] % Effectiveness = One minus Cover Factor multiplied by 100%.

[5] Large scale testing conducted at Utah Water Research Laboratory. For specific testing information, please contact a Profile technical service representative at 866-325-6262.

2.3 Mixes and Processes

Seed mixes shall meet the requirements given in Table 2, Table 3, and Table 4. The total seed rate in pounds per acre shall be the sum total for all varieties of seed opposite the dates of application listed.

TABLE 2: PERMANENT COVER (PERENNIALS)				
COMMON NAME[5]	**BOTANICAL NAME**	**APPROVED SITE(S)**	**PLANTING RATE (lbs/acre)**	**DATES**
		TURF-TYPE GRASSES		
Bahiagrass[1]	Paspalum notatum	Shoulders, Slopes, or Medians	30	March 1st – August 31st
Common Bermudagrass[2] (hulled = hull absent)	Cynodon dactylon	Shoulders, Slopes, or Medians	50	March 1st – August 31st
Common Bermudagrass[2] (unhulled = hull present)	Cynodon dactylon	Shoulders, Slopes, or Medians	60	September 1st – March 31st
Carpet Grass / Centipedegrass Combo	Axonopus affinis Eremochloa ophiuroides	Shoulders, Slopes or Medians	15 10	March 1st – August 31st
		GRASSES		
Weeping Lovegrass	Erograstis curvula	Slopes	10	January 1st – December 31st
Indiangrass	Sorghastrum nutans	Slopes	10	October 1st – June 30th
Little Bluestem	Andropogon scoparius	Slopes	10	October 1st – May 31st
Coastal Panicgrass	Panicum amarum	Slopes	20	February 1st – June 30th
Switchgrass	Panicum virgatum	Slopes	10	October 1st – May 31st
Perennial Rye Grass[3]	Lolium perrene	Shoulders, Slopes, or Medians	15	August 1st – April 30th
Virginia Wild Rye	Elymus virginicus	Shoulders, Slopes, or Medians	6	September 1st – November 30th February 1st – March 31st

SEEDING
TECHNICAL SPECIFICATION

TABLE 2: PERMANENT COVER (PERENNIALS)				
COMMON NAME[5]	**BOTANICAL NAME**	**APPROVED SITE(S)**	**PLANTING RATE (lbs/acre)**	**DATES**
LEGUMES[4]				
White Clover	Trifolium repens	Shoulders, Slopes, or Medians	5	August 1st – November 30th February 1st – April 30th
Sericea Lespedeza (Scarified seed)	Lespedeza cuneta	Slopes	50	March 1st – July 31st
Sericea Lespedeza (Unscarified seed)	Lespedeza cuneta	Slopes	80	January 1st – December 31st

Footnotes:

[1]**Bahiagrass**: Bahiagrass may be used as an optional turf-type permanent cover at the discretion of the RCE.

[2]**Common Bermudagrass**: Do not use Giant Bermudagrass (NK-37).

[3]**Perennial Rye Grass**: Do not use Annual Italian Rye grass (Lolium multiforum).

[4]Only use pre-inoculated legumes or an appropriate inoculant with the seed at planting.

[5]If the Common Name of the seed listed is not available, use seed with the listed Botanical Name.

TABLE 3: PERMANENT COVER NURSE CROPS (ANNUALS)				
COMMON NAME[3]	**BOTANICAL NAME**	**APPROVED SITE(S)**	**PLANTING RATE (lbs/acre)**	**DATES**
Crimson Clover[1]	Trifolium incarnatum	Shoulder, Slopes, or Medians	20	September 1st – March 31st
Lespedeza[1] Kobe / Korean	Lespedeza striata / stipulacea	Shoulders, Slopes	15	March 1st – July 31st
Browntop Millet	Panicum ramosum	Shoulders, Slopes, or Medians	10	March 1st – August 31st
German Millet (Foxtail Millet)	Setaria italioa	Shoulders, Slopes, or Medians	10	April 1st – August 31st
Japanese Millet	Echinoohloa crusgalli	Slopes	10	March 1st – August 31st
Oats	Avena sativa	Slopes	40	September 1st – November 30th
Hairy Vetch[1]	Vicia villosa	Slopes	15	September 1st – April 30th
Pearl Millet	Pennisetum glaucum	Slopes	15	March 1st – August 31st
Sudangrass	Sorghum bicolor	Slopes, Buffers	20	March 1st – August 31st
Barley	Hordeum vulgare	Slopes	55	September 1st – November 30th
Wheat	Triticum spp.	Slopes, Buffers	35	August 1st – December 31st
Rye Grain[2]	Secale cereale	Shoulders, Slopes, or Medians	40	August 1st – March 31st

Footnotes:

[1]Only use pre-inoculated legumes or an appropriate inoculant with the seed at planting.

[2]**Rye Grain**: Do not use Annual Italian Rye Grass (Lolium multiforum).

[3]If the Common Name of the seed listed is not available, use seed with the listed Botanical Name.

TABLE 4: TEMPORARY COVER (ANNUALS)				
COMMON NAME[3]	**BOTANICAL NAME**	**APPROVED SITE(S)**	**PLANTING RATE (lbs/acre)**	**DATES**
Crimson Clover[1]	Trifolium incarnatum	Shoulder, Slopes, or Medians	20	September 1st – March 31st
Lespedeza[1] Kobe / Korean	Lespedeza striata / stipulacea	Shoulders, Slopes	60	March 1st – July 31st
Browntop Millet	Panicum ramosum	Shoulders, Slopes, or Medians	40	March 1st – August 31st
German Millet (Foxtail Millet)	Setaria italioa	Shoulders, Slopes, or Medians	40	April 1st – August 31st
Japanese Millet	Echinoohloa crusgalli	Slopes	50	March 1st – August 31st
Oats	Avena sativa	Slopes	110	September 1st – November 30th
Hairy Vetch[1]	Vicia villosa	Slopes	50	September 1st – April 31st
Pearl Millet	Pennisetum glaucum	Slopes	50	March 1st – August 31st
Sudangrass	Sorghum bicolor	Slopes, Buffers	60	March 1st – August 31st
Barley	Hordeum vulgare	Slopes	110	September 1st – November 30th
Wheat	Triticum spp.	Slopes, Buffers	110	August 1st – December 31st
Rye Grain[2]	Secale cereale	Shoulders, Slopes, or Medians	110	August 1st – March 31st

Footnotes:

[1]Only use pre-inoculated legumes or an appropriate inoculant with the seed at planting.

[2]**Rye Grain:** Do not use Annual Italian Rye Grass (Lolium multiforum).

[3]If the Common Name of the seed listed is not available, use seed with the listed Botanical Name.

2.4 Fabrication and Assembly Requirements

Not Used

2.5 Personnel Requirements

Not Used

2.6 Inspection and Test Requirements

Not Used

2.7 Cleaning

Not Used

2.8 Corrosion Protection/Coatings

Not Used

PART 3 EXECUTION

3.1 Inspection and Preparation

FGM Substrate and Seedbed Preparation:

A. Examine substrates and ccnditions where materials will be applied. Apply product to geotechnically stable slopes that have been designed and constructed to divert runoff away from the face of the slope. Do not proceed with installation until satisfactory conditions are established.

B. Depending upon project sequencing and intended application, prepare seedbed in compliance with Technical Specification CROSS-0-TS-02200.

3.2 Installation Requirements

A. General:

All Wcrk shall be in accordance with Section 810 of the Standard Specifications and as specified herein.

B. Soil Analysis:

Soil analysis shall conform to Section 1.6.2 of the Standard Specifications: SC-M-810-3. The actual quantities of lime and fertilizer and the chemical analysis of fertilizer shall be determined by soil tests made by the Contractor. Test results shall be furnished to the Engineer prior to beginning any seeding wcrk. Final application rates of lime and fertilizer shall be approved by the Engineer.

C. Lime:

Lime applications shall conform to Section 1.6.3 of the Standard Specifications: SC-M-810-3. Liming shall be done immediately after grading has reached the final "smoothing" stage, even though actual seeding may not be done until several months later. Agricultural granular lime shall be used at a rate determined by soil tests, and shall be spread evenly by means of approved mechanical spreaders cr distributors. In the absence of soil test data, and with the approval of the Engineer, lime may be applied at 2,000 pounds per acre. Lime shall be incorporated in the top 2 to 3 inches of soil by harrowing, disking, or cther approved means. Unless required by the Engineer, lime

shall not be applied for temporary seeding. Fast acting liquid lime shall be applied at the rate of 5 gallons per acre or per the manufacturer's recommendations. Fast acting dry lime shall be applied at a rate of 100 pounds per acre or per the manufacturer's recommendations.

D. Fertilizer:

Fertilizer applications shall conform to Section 1.6.4.1 of the Standard Specifioations: SC-M-810-3. Fertilizer shall be spread not more than two weeks in advance of seeding, and ideally within 24 hours of predicted precipitation. Fertilizer shall be spread at a rate as determined by soil tests. In the absence of soil test data, and with the approval of the Engineer, 10-10-10 fertilizer may be applied at the rate of 200 pounds per aore. Fertilizer shall be protected from damage by weather or otherwise until used. Lumpy fertilizer shall be thoroughly pulverized before placing in the distributor. Even distribution shall be accomplished with mechanical spreaders, by spreading half of the rate in one general direction, and the other half at right angles to the first. Within 24 hours after spreading, the fertilizer shall be incorporated into the top 2 to 3 inches of soil by disking, harrowing, or other approved methods.

E. Surface Preparation:

Equipment necessary for the proper preparation of the ground surface and for handling and placing all required materials shall be on hand, in good condition, and accepted before the Work is started. The ground surface shall be cleared of all vegetation, debris, stones, roots, grade stakes, and any other materials that might hinder proper grading, tillage, or subsequent maintenance operations. The areas to be planted shall be thoroughly tilled to a depth of at least 3 inches by plowing, disking, harrowing, or other approved operations. The Work shall be performed only during periods when beneficial results are likely to be obtained. No Work shall be done during periods of drought, excessive moisture, or at other times during which satisfactory results are not likely to be obtained. Grades on the areas to be seeded shall be maintained in a true and even condition and all surfaces shall be left at the prescribed grades in an even and properly compacted oondition so as to prevent the formation of depressions where water will stand.

F. Seeding:

1. Seeding shall meet the requirements of Section 1.2.1 of the Standard Specifications: SC-M-810-3. Seeding work shall not be conducted when the ground is frozen or excessively wet. Seed shall be sown within 24 hours

following preparation of the seedbed. Seed shall be uniformly sown at the rate specified above by the use of mechanical seed drills, rotary based seeders, hydraulic equipment, or any other type of equipment that will produce a uniform application of the seed.

2. All seeded areas shall be lightly compacted by means of a cultipacker or light roller. Compaction shall not be necessary if seeds are planted by mechanical seed drills that perform the compaction procedure.

G. Mulching:

Mulching shall meet the requirements of Section 1.6.5 of the Standard Specifications: SC-M-810-3.

H. Watering:

Immediately following seeding, or when necessary to maintain growth of grass, and in any case when planting is permitted in dry weather, planted areas shall be watered. Each watering shall be in sufficient quantities to obviate rapid drying out, and at a rate that will not cause erosion. The watering equipment shall be of a type that will not damage finished surfaces.

I. Mowing:

As required until permanent grass is established (e.g. to prevent winter grass from killing or otherwise preventing permanent seed from growing).

J. FGM, when in Scope of Work:

1. Strictly comply with the manufacturer's mixing recommendations and installation instructions. Use approved hydraulic seeding/mulching machines with a fan-type nozzle (50-degree tip) whenever possible to achieve the best soil coverage. Apply FGM from opposing directions to the soil surface in successive layers to assure 100% soil surface coverage. Slope interruption devices or water diversion techniques are recommended when slope lengths exceed 100 feet.

2. Erosion Control and Revegetation: For maximum performance, apply FGM in a two-step process:

Step One: Apply fertilizer, other soil amendments, and 50% of seed with a small amount of FGM for visual metering.

Step Two: Mix balance of seed and apply FGM at a rate of 50 pounds per 125 gallons of water over freshly seeded surfaces. Confirm loading rates with equipment manufacturer. Do not leave seeded surfaces unprotected, especially if precipitation is imminent.

Depending upon site conditions, FGM may be applied in a one-step process where all components may be mixed together in single tank loads. Consult with manufacturer for further details.

3. Mixing: A mechanically agitated hydraulic-application machine is recommended. Strictly comply with manufacturer's installation instructions and recommendations for mixing.

3.3 Personnel Requirements

Not Used

3.4 Inspection and Test Requirements

Not Used.

3.5 Adjustment and Cleaning

Not Used

3.6 Corrosion Protection/Coatings

Not Used

3.7 Protection

Not Used

3.8 Extra Stock/Spare Parts

Not Used

3.9 Schedules and Attachments

Not Used

WorleyParsons
resources & energy

EcoNomics

SANTEE COOPER

Concrete

Technical Specification

Document: SANTEE-0-TS-03300

Revision: 3

Date: July 2017

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SANTEE COOPER
CONCRETE
TECHNICAL SPECIFICATION

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REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
0	Issue for Use	E. Kroener	D. Keiser	D. Keiser	11-Aug-2016
1	Re-Issued for Use	E. Kroener	D. Keiser	D. Keiser	06-Sept-2016
2	Re-Isssued for Use	E.Kroener	D. Keiser	D. Keiser	01-Mar-2017
3	Updated Concrete Delivery Temperature	Edward Kroener Digitally signed by Edward Kroener DN: CN = Edward Kroener C = US OU = WorleyParsons Date: 2017.07.03 13:41:57 -05'00'	Derek Keiser 2017.07.03 13:42:30 -05'00' I have reviewed this document	Derek Keiser 2017.07.03 13:42:41 -05'00' I am approving this document	03-Jul-2017
		E. Kroener	D. Keiser	D. Keiser	

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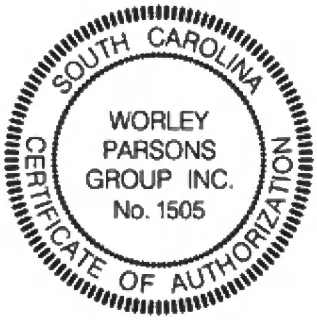

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SOUTH CAROLINA
WORLEY PARSONS GROUP INC.
No. 1505
CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA
LICENSED PROFESSIONAL ENGINEER
No. 30976
DEREK ALLAN KEISER

Derek Keiser
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PART 1 GENERAL

1.1 Section Includes

A. Furnishing and placing concrete.

B. Detailing, furnishing, and placing reinforcing steel.

C. Detailing, furnishing, and placing anchor rods and embedded items

1.2 Related Sections

Not Used

1.3 References

A. The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference:

1. American Concrete Institute (ACI):

a. 117 – Specification for Tolerances for Concrete Construction and Materials

b. 301 - Specifications for Structural Concrete

c. 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete

d. 305R - Hot Weather Concreting

e. 306R - Cold Weather Concreting

f. 309R - Guide for Consolidation of Concrete

g. 318 - Building Code Requirements for Structural Concrete

h. 347 - Guide to Formwork for Concrete

2. American Institute of Steel Construction (AISC), 303 - Code of Standard Practice for Steel Buildings and Bridges

3. American Society of Civil Engineers (ASCE), 7-10 - Minimum Design Loads for Buildings and Other Structures

4. ASTM International (ASTM):

   a. A 36 - Standard Specification for Carbon Structural Steel

   b. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

   c. A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

   d. A 153 - Specification for Zinc Coating (Hot-Dip) on iron and Steel Hardware

   e. A 370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products

   f. A 563 - Standard Specification for Carbons and Alloy Steel Nuts

   g. A 615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

   h. A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

   i. A 992 - Standard Specification for Structural Steel Shapes

   j. B 695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

   k. C 29 - Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate

   l. C 33 - Standard Specification for Concrete Aggregates

m. C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete

n. C 88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

o. C 94 - Standard Specification for Ready-Mixed Concrete

p. C 117 - Standard Test Method for Materials Finer Than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

q. C 123 - Standard Test Method for Lightweight Particles in Aggregate

r. C 127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate

s. C 128 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate

t. C 131 - Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

u. C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

v. C 138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

w. C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates

x. C 150 - Standard Specification for Portland Cement

y. C 172 - Standard Practice for Sampling Freshly Mixed Concrete

z. C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

aa. C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

bb. C 260 - Standard Specification for Air-Entraining Admixtures for Concrete

cc. C 289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)

dd. C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

ee. C 403 – Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

ff. C 451 - Standard Test Method for Early Stiffening of Hydraulic Cement (Paste Method)

gg. C 470 - Standard Specification for Molds for Forming Concrete Test Cylinders Vertically

hh. C 494 - Standard Specification for Chemical Admixtures for Concrete

ii. C 535 - Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

jj. C 566 - Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying

kk. C 617 - Standard Practice for Capping Cylindrical Concrete Specimens

ll. C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

mm. C 881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

nn. C 920 - Standard Specification for Elastomeric Joint Sealants

oo. C 1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

pp. C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete

qq. C 1077 - Standard Practice for Laboratories Testing Concrete, and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

rr. C 1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete

ss. C 1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

tt. D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

uu. D 1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

vv. E 4 - Standard Practices for Force Verification of Testing Machines

ww. F 436 - Standard Specification for Hardened Steel Washers

xx. F 1554 - Standard Specification for Anchor Rods, Steel, 36, 55, and 105-ksi Yield Strength

5. American Welding Society (AWS), D1.1 - Structural Welding Code - Steel

6. Concrete Reinforcing Steel Institute (CRSI), MSP-2-01 - Manual of Standard Practice

7. National Ready Mixed Concrete Association, Certification of Ready-Mixed Concrete Production Facilities

8. The Society for Protective Coatings (SSPC):

   a. PA-1 - Shop, Field, and Maintenance Painting of Steel

   b. SP-6 - Commercial Blast Cleaning

9. U.S. Army Corps of Engineers CRD-C572 - Specifications for Polyvinyl Chloride Waterstops

10. International Code Council, Inc. (ICC)

    a. International Building Code 2012

B. Where the above referenced codes and standards contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed unless stated otherwise by this Section.

C. In the event of any conflict between codes, or specifications and codes, the more stringent regulation applies.

1.4 Submittal

A. With Bid:

None.

B. After Award:

1. Drawings and Calculations:

   a. Detailed drawings showing location and method of forming construction joints,

   b. Shop detail drawings for fabrication and placement of reinforcing steel.

   c. Additional shop fabrication drawings as required to support design drawings.

2. Data and Reports:

   a. Curing Compound Certification - Manufacturer's certification.

   b. Waterstops - Manufacturer's certification.

   c. Premolded Expansion Joints - Manufacturer's literature.

   d. Reinforcing Materials - Qualification Tests or Certifications.

   e. Repair procedure for anchor rods with thread damage

   f. Patching - Proposed areas to be patched, patching materials, and patching procedures.

   g. Cement Certification or mill test results.

   h. Fine Aggregate Certification or test results.

   i. Coarse Aggregate Certification or test results.

   j. Admixture Certification - Manufacturer's certification.

   k. Water Certification or test results.

   l. Fly Ash Certification or test results.

   m. Concrete Mix Design - Proportions of concrete ingredients.

3. Batch Tickets - Ticket for each ready-mix truck.

1.5 Design Requirements

A. Formwork Design:

1. Forms for Cast-in-place Concrete: ACI 301, Section 2 and ACI 347.

2. Loads:

   a. Vertical loads:

i. Weight of reinforcing steel, wet concrete, and formwork as dead loads.

ii. Weight of construction personnel and equipment as live loads.

iii. Wind loads on formwork: ASCE 7.

b. Lateral loads:

i. Lateral pressure from liquid head of wet concrete calculated in accordance with Chapter 2 of ACI 347. Calculate lateral fluid pressure using a chemistry coefficient of 1.2 if Type A or E admixtures are used in the mix design. Use chemistry coefficient of 1.4 if type D or F admixtures are used in the mix design.

ii. Movement of construction equipment.

iii. Effects from wind loads.

3. Develop design calculations and detail drawings of formwork for placements requiring massive concrete under supervision of and sealed by Professional Engineer who is registered in the state where the project is located, and is a qualified structural engineer.

B. Detailing Reinforcing Steel: MSP-2-01, Chapter 6.

1. Develop design calculations and detail drawings of bar supports for slabs in excess of 4'-0" under supervision of and sealed by Professional Engineer who is registered in the state where the project is located, and is a qualified structural engineer.

C. Concrete Mix Proportioning:

1. Prepare concrete mixes for each concrete class required for Work as specified herein and on Drawings, including each variation in cement, aggregate size, fly ash, and admixtures. Utilize actual materials intended for site concrete.

2. Selecting Proportions for Each Design Mix: ACI 301, Section 4.

3. Special Placement Techniques (e.g., pumping, tremie,): Prepare separate design mix.

4. Cementitious Content (cement plus fly ash) of Concrete: ACI 301, Section 4.2.2.1.

5. Water-reducing Admixture: Use in production concrete; comply with manufacturer's recommendations for quantity to be added, controlling temperatures, and method of mixing.

6. Air-entrainment: Provide for all structural concrete; ACI 301, Section 4.2.2.4, except as noted herein.

7. Slump: Measure at point of placement; ACI 117 and ACI 301, Section 4.2.2.2. Slump for tremie placement of concrete for caissons to be between 7 and 9 inches.

8. Maximum Water/Cement Ratio: 0.50, unless noted otherwise.

9. Maximum Soluble Chloride Ion Concentration in Hardened Concrete: At age 28 days not to exceed 0.30, in percent by weight of cement, as determined by ASTM C 1218.

10. Proportion concrete mixes to provide an average compressive strength as prescribed in ACI 318, Chapter 5.

11. Concrete Classes:

Concrete Class *[ACI 318-Exposure Category and Class]*	Design Strength (psi)	Cement Type	Total Air (1) (Percent)	Age at Design Strength (Days)	ASTM C33 Aggregate Gradation	Max. W/C Ratio
A Concrete (non-massive) (foundation mats, footings, piers, columns, slabs, pads, walls)	4500	I/II	3.5 – 7.0	28	57	0.45
B Massive Concrete (Least dimension greater than 48 inches)	4500	I/II	3.0 – 7.0	28	57 467 (optional)	0.45
B1 Caissons (tremie mix)	4500	I/II	None	28	67	0.5
C Pump Priming Grout	3000	I/II	None	28	Sand	0.8
D Lean Fill	2000	I/II	None	28	57	0.8
E Pre-Cast Manholes & Trenches	4500	I/II	5.0-7.0	28	67	0.45

Concrete Class *[ACI 318-Exposure Category and Class]*	Design Strength (psi)	Cement Type	Total Air (1) (Percent)	Age at Design Strength (Days)	ASTM C33 Aggregate Gradation	Max. W/C Ratio
F Electrical Underground Ductbanks	3000	I/II	4.0-8.0	28	67	0.50
G Mud Mats	1500	I/II	3.0 – 6.0	28	467	0.8
H Flowable Fill	100	I/II	None	28	Sand	0.9

(1) Lower percent of total air is permitted if approved by Engineer.

1.6 Performance Requirements

Not Used

1.7 Marking and Identification

A. Tag reinforcing steel with fabricator's identification as shown on detail drawings.

1.8 Packaging and Delivery

Not Used

1.9 Handling, Storage and Protection

A. Reinforcing Steel:

1. Finish and Surface Conditions of Reinforcing Steel: Applicable ASTM reinforcing specifications.

2. Bundle and tag reinforcing steel, Section 3, Chapter 7, (CRSI) MSP-2-01.

3. Inspect at time of delivery and verify shipments as follows:

   a. Separated by size.

   b. Tagged with fabricator's number corresponding to indications on detail drawings.

   c. Suitable condition for placement.

   d. Certification documents received and filed.

4. Store reinforcing steel as groups of bars or shipments in orderly fashion compatible with placement sequence.

B. Anchor Rods and Embedded Items:

1. Deliver with temporary braces, as required, to maintain shape during transportation, storage, and handling.

C. Concrete:

1. Handle and store materials as recommended in ACI 301, Section 5.

PART 2 PRODUCTS

2.1 Acceptable Manufacturers

Not Used

2.2 Materials

A. Liquid Membrane-forming Curing Compounds: ASTM C 309R, Type 1, except achieve retention rate at application rate used in field.

B. Waterstops: Unless otherwise shown on Drawings, use PVC (Polyvinyl chloride) dumbbell or serrated with center bulb waterstop per CRD C572 of size and location indicated on the Drawings.

1. Factory premolded fittings are to be used at directional changes and intersections.

C. Expansion Joints:

1. Filler: ASTM D 1751 or ASTM D 1752 Type II as indicated on Drawings.

2. Sealer: ASTM C 920, compatible with filler.

D. Control Joints: Sealers, ASTM C 920.

E. Reinforcing Steel:

1. Use only deformed bars, ASTM A 615, Grade 60.

2. Bar Supports: Class 3, (CRSI) MSP-2-01, Chapter 3.

3. Tie Wire: Minimum #16 gage black, soft-annealed wire.

F. Anchor Rods and Embedded Items:

1. Rolled Sections, Plates, and Sub-assemblies: ASTM A 36 or A 992 unless noted otherwise on Drawings.

2. Anchor Rods: ASTM F 1554, Grade 36 or 55, as indicated on Drawings

3. Nuts for ASTM F 1554, Grade 36 and 55, Anchor Rods: ASTM A 563, Heavy Hex Grade DH.

4. Washers: Hardened steel ASTM F 436, or A 36 plate washer as indicated on drawings.

5. Pipe Sleeves: ASTM A 53, Schedule 40, plain ends, unless otherwise shown on Drawings.

6. Field drilled adhesive anchors: Hilti HIT-RE-500 SD epoxy adhesive anchor system with type 316 stainless steel or galvanized threaded rod with matching nut and washer, as indicated on the Drawings. Follow manufacturer's installation instructions.

7. Field installed expansion anchors: Hilti Kwik Bolt TZ mechanical type, stainless steel (316) or galvanized with matching nut and washer, as indicated on the Drawings. Follow manufacturer's installation instructions.

8. Steel Studs: Section 7, AWS D1.1.

9. Welding Electrodes and Filler Metal:

   a. Produce low hydrogen deposit of 70,000 pounds per square inch minimum tensile strength.

   b. AWS D1.1, Table 3.1, for type of steel.

G. Concrete:

1. Materials for Concrete: Comply with ACI 301 Section 4 except as noted herein.

2. Cement:

   a. Comply with ASTM C 150, Type I/II

   b. Maximum alkali content of 0.6% of (Na_20 + 0.658 K_2O), unless aggregates shown nonreactive, ASTM C 33, Appendix X1.

c. Test samples of new cement shipments to meet cube strengths determined by ASTM C 109.

d. Minimum 50% final penetration for false set, ASTM C 451.

e. Submit seven day mill test strength results prior to use in concrete.

3. Fine Aggregates:

a. Conform to requirements of Innocuous Aggregates per ASTM C 289.

b. Comply with ASTM C 33, except as noted herein.

c. Minimum specific gravity of 2.55 (saturated surface dry basis), ASTM C 128.

d. Paragraph 7.2 of ASTM C 33 not applicable without written approval of Engineer.

4. Coarse Aggregates:

a. Conform to requirements of Innocuous Aggregates per ASTM C289.

b. ASTM C 33 for Class Designation 4S, except as modified herein.

c. Paragraph 11.3 of ASTM C 33 not applicable without written approval of Engineer.

d. Specific gravity of 2.60 (saturated surface dry basis) and maximum absorption of 1.5%, ASTM C 127.

e. Abrasion Loss: Appropriate ASTM Specification (ASTM C 131 or C 535),

		Revolutions		Maximum Loss %	
		Initial	Final	Initial	Final
1)	ASTM C 131	100	500	10	40
2)	ASTM C 535	200	1000	10	40

5. Admixtures:

   a. Air Entraining: ASTM C 260.

   b. Water-reducing Admixtures: ASTM C 494, Type A. Substitute Type D, E or F with Engineer approval.

   c. Do not use calcium chloride or admixtures containing more than trace amounts of calcium.

6. Water and Ice:

   a. Clear and clean or meet requirements of ASTM C 94 and C 1602.

7. Fly Ash:

   a. Conform to ASTM C 618 for Class C or F fly ash.

   b. Obtain from single plant with established reputation for producing uniform, high quality fly ash.

   c. Store to preclude confusion with cement and to allow representative sampling for testing.

   d. Percentage of fly ash in mix design not to exceed 20% of total cementitious content unless noted otherwise.

   e. Percentage of fly ash in mix design not to exceed 25% of total cementitious content for mass concrete placements.

   f. For massive concrete use Class F fly ash only.

8. Bonding Agents for bonding fresh to hardened concrete:

   a. Latex agents conform to ASTM C 1059 Type II.

   b. Epoxy resins conform to ASTM C 881, Type V.

2.3 Mixes and Processes

Not Used

2.4 Fabrication and Assembly Requirements

A. Reinforcing Steel:

1. Obtain material test results or certifications before fabrication.

2. Keep reinforcing separated by size.

3. Bend reinforcing steel to shapes shown on fabricating details.

B. Anchor Rods and Embedded Items:

1. Conform to AISC Code of Standard Practice (AISC 303), Section 6, unless otherwise noted herein.

2. Welding: AWS D1.1.

3. Gr 55 anchor rods may be welded if the anchor rod is fabricated in accordance with the Supplemental Requirements of ASTM F 1554.

C. Mixing and Production of Concrete:

1. Comply with ACI 301, Section 4, ACI 304R, and ASTM C 94 except as noted herein.

2. Adjust proportion of water in each batch to compensate for moisture content of aggregates and liquid admixtures and thereby maintain water quantities within limits of design mix. Base adjustment on tests of material contained in batch hoppers.

3. Produce concrete to maintain delivery temperatures as follows:

a. Massive Concrete (less than 8 feet but more than 4 feet thick): Maximum 85°F and minimum 50°F.

b. Sections Equal to or Greater than 12 inches and up to 48 inches in Thickness: Maximum 95°F and minimum 50°F.

c. Sections Less than 12 inches in Thickness: Maximum 95° and minimum 55°F.

4. Deliver concrete in agitating equipment.

5. One addition of water at delivery point permitted if neither maximum permissible water-cement ratio and water content of that design mix nor maximum slump exceeded. Incorporate additional water mixing with at least 30 additional revolutions at mixing speed.

6. Batch Tickets:

a. Accompany each truckload of concrete.

2.5 Personnel Requirements

A. Welders: AWS D1.1, Section 4, Parts A and C.

2.6 Inspection and Testing

A. Reinforcing Steel:

1. Provide qualification tests, ASTM A 370, of representative reinforcing materials using full specimen test sections or provide certification documents that state conformance to applicable ASTM specification.

2. Visually inspect all reinforcing steel as follows:

a. Grade and correct size.

b. Tolerances for bending, hooks, and bar details as defined in Figures 3 and 4 of Chapter 7 of (CRSI) MSP-2-01.

c. Cleanliness before shipment.

B. Anchor Rods and Embedded Items:

1. Provide certification of material to applicable ASTM and/or AWS specification.

2. Welder qualification records on file before performance of work.

3. Welding Inspections:

a. AWS D1.1, Section 6 to quality acceptance levels defined in AWS D1.1.

b. Visually inspect 100% all welds.

c. Repair unacceptable welds using same procedure for original weld or with qualified repair procedure.

C. Concrete:

1. Provide either qualification test results of representative samples of materials to be used in project or certification documents which state conformance to requirements of this Section.

2. Qualification Concrete Testing Requirements:

a. For each class of concrete for construction, Contractor shall submit concrete mix designs from a certified batch plant that comply with the material and strength requirements specified herein.

2.7 Cleaning

Not Used

2.8 Corrosion Protection/Coatings

A. Galvanizing unless indicated otherwise on Drawings:

1. Shapes, Plates: ASTM A 123.

2. Anchor Rods, Nuts, Washers: ASTM A 153 or B 695.

a. Purchase galvanized rods and nuts together from a single supplier to assure a proper match and ship together in plastic bags or steel containers. Matched rods and nuts shall not be mixed with other supplier's materials. Supply nuts that have been lubricated.

b. Do not intermix mechanically galvanized rods and nuts with hot-dip galvanized nuts and rods.

PART 3 EXECUTION

3.1 Inspection and Preparation

A. Check "as-built" condition of existing construction to verify that Work can be installed within tolerances specified herein.

B. Construct formwork to ensure that finished concrete surfaces conform to tolerances specified in ACI 117, except as noted herein or as shown on Drawings.

1. Top of equipment foundations: ±½"

2. Concrete supporting column base plates: ±½"

C. Subgrade Preparation:

1. Requirements of ACI 301 Section 5.3 apply.

2. Level and trim subgrade for concrete to finish lines and dimensions shown on Drawings. Remove debris and organic material.

3. Immediately before concrete placed on or against rock or mud slabs, clean surface of all dirt, gravel, boulders, scale, loose fragments, and other deleterious substances by air and/or water jet brooming.

3.2 Installation Requirements

A. Formwork:

1. Formwork: ACI 301, Section 2, except as revised herein.

2. Form all cast-in-place concrete including sides of footings, foundation mats, and other portions of structures below grade unless shown otherwise on the Drawings or approved by the Engineer.

3. Provide 3/4-inch chamfer for all exposed to view corners unless otherwise specified on Drawings.

4. Use form materials to provide required concrete surface finish defined in Article 3.2.G.

5. Formwork for Concrete:

   a. Not Exposed to View: Rough form finish ACI 301, Section 2.2.1.1.

   b. Exposed to View: Smooth form finish ACI 301, Section 2.2.1.1.

6. Form tie assemblies for below water table structures to leave no material other than concrete within 1-1/2 inches of the formed surface.

   a. When portions of single-rod ties are to remain in a below water table structure, provide integral waterstop at midpoint. Assembly to provide cone shaped depression, in the forms at the surface, at least 1 inch in diameter and 1-1/2 inch deep, to allow filling and patching.

   b. Through ties that are to be entirely removed from the structure to be tapered over the portion that passes through the concrete with the large end of tapered ties on liquid side of wall. Submit method and materials to be used to fill the void thus formed for approval.

7. Thoroughly clean forms after each use. Use an approved form release agent at surfaces in contact with concrete which receive finish coating. As alternate to using form release agent, use approved form material that facilitates form removal.

B. Reinforcing Steel:

1. Comply with Chapter 8, (CRSI) MSP-2-01 and ACI 301, Section 3.

2. Support of reinforcement for slabs on grade with precast concrete brick and/or standard reinforcing chair type supports in accordance with (CRSI) MSP-2-01 are acceptable.

3. Provide lap splice lengths as shown on Drawings. Where locations of lap splices not indicated provide staggered splices.

4. Welding of reinforcing bars not permitted.

5. Obtain Engineer approval for following requests:

   a. Field cutting of reinforcing steel to permit positioning of embedded items.

   b. Field bending reinforcing steel.

   c. Relocation of reinforcing steel beyond normal tolerances to position embedded items.

   d. Adjustment of lap splice lengths and locations.

C. Embedded Items:

1. Embed in concrete only items shown and located on Drawings except as noted herein or approved by Engineer.

2. Keep exposed surface of all embedded items clean, uncontaminated, and protected from damage resulting from construction activity. Specific requirements for embedded plates and anchor rods follow:

   a. Clean exposed surfaces of embedded plates of all concrete after stripping of forms.

   b. Protect threads of all anchor rods from rusting and damage.

   c. Notify the Engineer of anchor rods with thread damage. Submit for Engineer approval, repair procedures for anchor rods that cannot be returned to original undamaged condition by using thread die of same diameter as rod or by filing.

3. Set anchor rods in position as shown on Drawings prior to concrete placement.

4. Repair damaged embedded items after approval by Engineer.

5. Seal anchor rod sleeves to protect from water penetration and possible freezing.

D. Joints:

1. Locate and install joints and embedded items in accordance with ACI 301 Section 2, except as noted herein.

2. Prepare construction joint surfaces before concrete placement as follows:

   a. Thoroughly clean, remove all laitance, and maintain wet with water for minimum of 4 hours immediately before concrete placement.

   b. Remove standing water immediately prior to placement of concrete thereon.

3. Joints requiring bonding (Indicated on Drawings):

   a. Achieve bonding by any of methods specified in Section 5.3.2.6 of ACI 301. Where a bonding agent is used, conform to Article 2.2-G.8.

4. Provide construction joints with keys in accordance as follows:

   a. Minimum depth of 1 1/2 inches with width and spacing as shown on Drawings.

   b. Tolerance of +1 inch on required width and location of key.

   c. Provide sides of key with side slope not exceeding 1 in 6.

5. Provide construction joints for large concrete placements where located on Drawings. Acceptable forms include cast-in-place expanded metal bulkheads as follows:

   a. Provide forming intention and include technical information on materials.

   b. Prior to start of construction, submit work procedure and detailed drawings.

6. Locate additional construction joints not indicated on Drawings with least impairment to strength of structure, and do not affect continuity of reinforcing steel. Submit location of joints for approval.

7. Avoid cold joints defined as discontinuities in concrete resulting from delay in concrete placement that precludes proper consolidation of two successive lifts. Confirm existence of cold joint and proceed as follows:

a. Check for cold joints by observing if vibrator under own weight will not penetrate previously placed concrete lift.

b. Stop concrete placement operations.

c. Obtain Engineer approval of cold joint.

d. Allow cold joint to harden, and prepare cold joint surface as construction joint as for new concrete placement in accordance with Articles 3.2-D.3 and 3.2-D.4 herein.

8. Provide location, size, and detail of expansion joints as shown on Drawings.

9. Provide clean and continuous waterstops at construction joints and expansion joints as shown on the Drawings. Use factory premolded fittings at directional changes and intersections.

E. Placement of Concrete:

1. Comply with ACI 301, Section 5, except as specified herein.

2. Deposit concrete under water only where such placement specifically indicated on Drawings and only using procedure approved by Engineer.

3. Satisfy recommendations specified in ACI 304R "Guide for Measuring, Mixing, Transporting, and Placing Concrete."

4. Satisfy recommendations specified in ACI 305R "Hot Weather Concreting."

5. Satisfy recommendations specified in ACI 306R "Cold Weather Concreting."

6. For pumped concrete follow ACI 301, Section 5.3.2.3, except may exceed slump loss criteria with proper concrete consolidation.

7. Obtain Engineer approval of pneumatic placing of concrete.

8. Limit gravity free fall of concrete to five feet, where discharge point not embedded in fresh concrete.

9. Deposit concrete in horizontal layers not exceeding 18 inches in loose thickness unless otherwise approved by Engineer.

F. Consolidation:

1. Consolidate concrete during placement per Section 5.3.2.5 of ACI 301, using internal vibrators that conform to ACI 309R, Table 5.1.

2. Penetrate vibrators six inches minimum into previously placed layer.

G. Concrete Finishes:

1. Formed Concrete Surfaces Not Exposed to View: Rough form finish, ACI 301, Section 2.2.1.1.

2. Formed Concrete Surfaces Exposed to View: As-cast smooth form finish, ACI 301, Section 5.3.3.3.b, unless noted otherwise on the drawings. Extend finish twelve inches below final grade.

3. Top Surface of all Foundations (Unless noted otherwise): Floated finish, ACI 301, Section 5.3.4.2.b.

4. Interior Floor Slabs: Trowel finish, ACI 301, Section 5.3.4.2.c.

5. Exterior Grade Slabs: Broom Finish

6. Flatness Tolerance: Flat Per ACI 117, Section 4.5.7 unless noted otherwise.

H. Massive Concrete:

1. Follow ACI 301, Section 8, for massive concrete placements (least dimension exceeding four feet), except as otherwise specified herein.

2. Allow minimum of three days between placing of abutting massive concrete segments, unless otherwise approved by Engineer.

3. Use continuous wet cure period of seven days minimum for all massive concrete.

I. Form Removal:

1. Comply with ACI 301, except as specified herein.

2. Remove side forms, as defined in ACI 301, Section 2.3.2, after curing concrete in accordance with Article 3.2-K of this Section for minimum of either 24 hours or until field-cured cylinders indicate compressive strength of 1,000 pounds per square inch.

3. Remove forms supporting weight of concrete, as defined in ACI 301, Section 2.3.4, as follows, unless otherwise noted on Drawings:

   a. Remove after concrete cured in accordance with ACI 301, Section 5.3.6, for at least 14 days at temperature of at least 50° F or for at least 10 days at temperature of at least 70° F. Time periods reflect cumulative number of days or fractions thereof, not necessarily consecutive, during which temperature of air in contact with concrete above 50° F or 70° F, respectively. Follow recommendations of ACI 306R, Chapters 7 & 8.

   b. Remove forms after standard cylinders or field cured under identical conditions as concrete representing, attain at least 2/3 of f'c. Follow method of ACI 306R, Section 6.2, for field cylinders except ignore in-place and nondestructive testing.

4. Remove forms, form ties, and other materials from spaces between structures or adjacent walls unless otherwise shown on Drawings.

5. Reshoring not permitted without Engineer approval.

6. Repair surface defects following placement of concrete in accordance with Article 3.2-J of this Section.

J. Patching:

1. Patching for Repair of Surface Defects, including Tie Holes: ACI 301, Section 5.3.7.

2. Before patching, trial mix and establish patching procedures. Submit proposed repair methods, materials, and modifications needed to assure that concrete work will meet requirements of the Contract Documents (if required).

K. Curing and Protection:

1. Use wet curing methods only per ACI 301, except when other specific curing procedures are specified on Drawings.

2. Continuously wet all concrete work for a minimum of 7 days.

3. Continuously moisten or "fog" non-massive concrete surfaces until implementation of proper curing provisions.

3.3 Personnel Requirements

Not Used

3.4 Inspection and Test Requirements

A. Reinforcing Steel:

1. Verify correct grade, number, size, and spacing of bars; adequacy of support ties, chairs and splices; specified dimension clearances from formwork, subgrade, and between adjacent bars; and satisfactory conditions and level of cleanliness.

B. Anchor rods and Embedded Items:

1. Tolerances for Anchor Rod Displacement from Theoretical Position:

a. Column anchor rods.

i. AISC Code of Standard Practice (AISC 303), Section 7.5.

ii. ± 1/4-inch from projection or top of rod elevation.

b. Equipment: (Unless noted otherwise on foundation Drawings or more stringent requirements by Equipment Manufacturer).

i. ± 1/8-inch from theoretical position.

ii. ± 1/4-inch from specified projection or top of rod elevation.

c. Any anchor rod bent in excess of five degrees:

i. Submit repair procedures for Engineer review.

ii. Repair or replace as required by Engineer.

2. Embedded items.

a. Check for line and grade before and after concrete placement.

b. ± 1/2-inch from specified location shown on Drawings (Unless noted otherwise on foundation Drawings or more stringent requirements by Equipment Manufacturer).

c. ± 1/8-inch in elevation from theoretical position shown on Drawings (Unless noted otherwise on foundation Drawings or more stringent requirements by Equipment Manufacturer).

d. Embedded plate surface flush with concrete surface unless otherwise shown on Drawings.

C. Concrete:

1. Acceptance: ACI 301, Section 1.7 at age specified in Article 1.4-C.10 except Section 17 of ASTM C 94 not applicable.

2. Finishing: ACI 301, Sections 1.7, 5.3.3, and 5.3.4, unless otherwise indicated on Drawings.

3.5 Adjustment and Cleaning

Not Used

3.6 Corrosion Protection/Coatings

A. Apply protective coating to concrete surfaces where indicated on Drawings per recommendations of manufacturer.

B. Repair damaged galvanized areas: ASTM A 780.

3.7 Protection

Not Used.

3.8 Extra Stock/Spare Parts

Not Used.

3.9 Schedules and Attachments

Not Used

APPENDIX C – Original (2016) Cross Generating Station Bottom Ash Pond History of Construction Report.

WorleyParsons
resources & energy

EcoNomics

SANTEE COOPER
CROSS GENERATING STATION

Bottom Ash Pond History of Construction

Document: CROSS-0-LI-044-0007

Revision: 0

Date: 14 Oct 2016

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CROSS GENERATING STATION
BOTTOM ASH POND HISTORY OF CONSTRUCTION

Disclaimer

REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
0	Issued for Use	B Gordon	Y Xu	Digitally signed by: Fletcher Wood Date: 2016.10.14 10:19:13 -06'00' F Wood	14 Oct 2016

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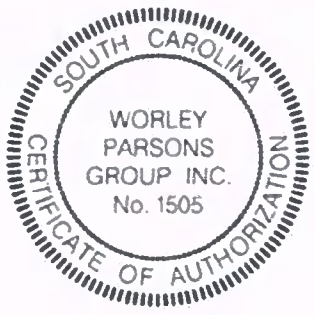

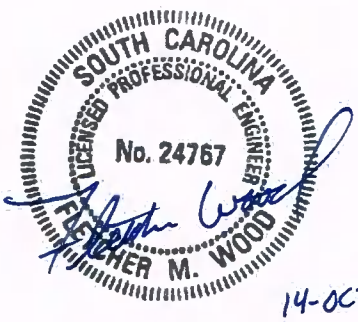

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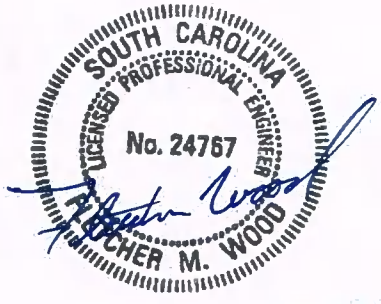

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CROSS GENERATING STATION
BOTTOM ASH POND HISTORY OF CONSTRUCTION

1. INTRODUCTION

The United States Environmental Protection Agency (EPA) promulgated new regulations regarding Coal Combustion Residuals (CCRs). These regulations (40 CFR Part 257) were published in the Federal Register on April 17, 2015. One of the requirements of the new regulations (§257.73(c)(1)) is to compile a history of construction of the CCR unit. As indicated in the Preamble to the Rule, the compilation of this data is "only to the extent available." EPA does not expect owners or operators to generate new information or provide anecdotal or speculative information regarding the CCR surface impoundment's design and construction history. Therefore, the information presented herein is based on readily accessible data. The order of presentation is based on the order of the requirements listed in the regulations.

2. REQUIRED DATA

2.1 Owner's Information

2.1.1 Name and Address

South Carolina Public Service Authority (Santee Cooper)
Cross Generating Station
553 Cross Station Road
Pineville, SC 29468

2.1.2 CCR Unit Name

At the time of Dewberry & Davis' Dam Assessment Report [Ref. 1] in December 2011, there were two designated bottom ash ponds: Bottom Ash Pond 1 and Bottom Ash Pond 2. The ponds are connected via a trapezoidal notch through the northern embankment of Bottom Ash Pond 1. In 2015, all coal combustion residuals were removed from Bottom Ash Pond 1 and the pond was repurposed as a wastewater pond. Since this pond no longer impounds CCR, it is not subject to the requirements in the CCR rule. However, since (former) Bottom Ash Pond 1 functions as the discharge for Bottom Ash Pond 2, information for both ponds will be presented herein as necessary to develop a complete history of the impoundments.

The former Bottom Ash Pond 1 has been renamed the Wastewater Decant Pond. The former Bottom Ash Pond 2 is now referred to as the Bottom Ash Pond. For the purposes of this report, the CCR unit name is the Bottom Ash Pond.

2.1.3 CCR Unit Identification Number

Section 72-2.D of the South Carolina Dams and Reservoirs Safety Act specifically exempts dams owned by the South Carolina Public Service Authority. Therefore, the state has not assigned a unit identification number. However, signage at the pond identifies it as NPDES #SC0037401.

2.2 CCR Unit Location

The location of the Bottom Ash Pond is shown on the USGS Quadrangle Map in Appendix A. The Map is a compilation of the 2014 USGS Chicora, Cross, Eadytown, and Pineville 7.5 minute quadrangles.

2.3 CCR Unit Purpose

As its name implies, the Bottom Ash Pond is primarily used for storage of bottom ash and boiler slag from the four generating units at the station. Units 1 and 2 each have a dedicated pipeline for ash disposal to the pond, while Units 3 and 4 share a pipeline. Another pipeline conveys pyrites and economizer ash into the pond, as well as SCR ash from Units 3 and 4. The Bottom Ash Pond also receives water from the Gypsum Filtrate Pond (currently undergoing closure by removal), the Coal Pile Runoff Pond, the Landfill Leachate Collection Pond, the Unit 1 and 2 Stormwater Pond, the Unit 3 and 4 Stormwater Pond, and numerous station drainage sumps. After flowing from the Bottom Ash Pond to the Wastewater Decant Pond, water is recycled for use in the ash seal and ash sluice systems or undergoes pH treatment prior to discharge into the Diversion Canal.

2.4 Watershed Information

Cross Generating Station is located within the Lake Moultrie watershed (Watershed 03050201-01). This watershed covers approximately 79,000 acres of the Lower Coastal Plain region [Ref. 3]. Approximately 70 percent of the watershed is water, and another 22 percent is forested. A map of the Lake Moultrie Watershed is provided as Appendix B.

2.5 Foundation Properties

Cross Generating Station is situated on Pleistocene sediments overlying Santee Limestone, within the Atlantic Coastal Plain Physiographic Province. As indicated in the Law geotechnical report [Ref. 4], the Pleistocene soil profile generally can be characterized as a relatively "firm" layer overlying more compressible layers. This characterization is consistent with the results of the geotechnical exploration performed by Terracon in 2015 for the Bottom Ash Pond. The results of their exploration are presented in more detail in the safety factor assessment [Ref. 5]. The boring logs and CPT soundings from the Terracon exploration are provided in Appendix C for reference. Generally, soils encountered above an elevation of 80 feet are considered embankment soils.

Subsurface conditions encountered below the natural ground surface (80 feet) during the Terracon exploration are summarized in Table 1. Figure 1 is a plot of SPT N-value as a function of elevation.

Table 1: Summary of Terracon Exploration Data Below Elevation 80 Feet

Boring or CPT	Layer 1			Layer 2			Layer 3			Elev. of Rock (ft)
	Elev. (ft)	Soil Type	N-Value	Elev. (ft)	Soil Type	N-Value	Elev. (ft)	Soil Type	N-Value	
B-734	79 – 70	Clay	9	70 – 59	Clay	5	59 – 47	Clay	1	43.9
B-735	80 – 73	Clay	5	73 – 67	Clay	2	67 – 62	Clay	9	62.2
C-834	80 – 69	Clay	7	69 – 66	Clay	10	66 – 63	Sand	40	62.9
C-835	80 – 74	Clay	5	74 – 55	Clay	3				54.1
C-836	80 – 78	Clay	7	78 – 76	Sand	20	76 – 61	Clay	7	60.4
C-837	80 – 75	Clay	10	75 – 60	Clay	7	60 – 51	Clay	5	51.0

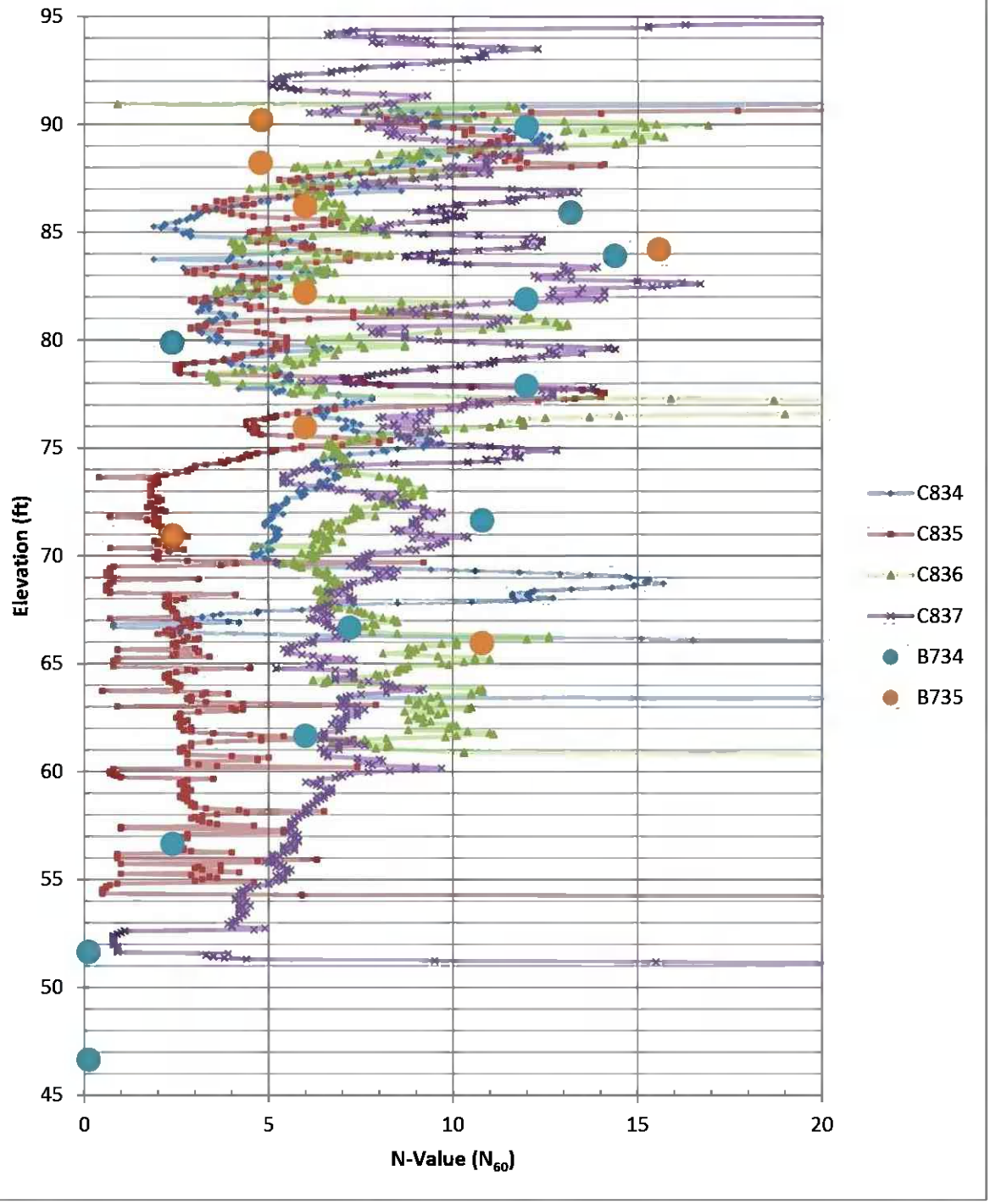
As shown in Figure 1, there is a general decrease in N-value below an elevation of approximately 70 feet in Boring B-734 and Sounding C-837. In Sounding C-835, the decrease occurs at approximately elevation 74 feet. Boring B-735 and Soundings C-834 and C-836 show relatively consistent N-values as a function of elevation. Laboratory test data for soil samples from Borings B-734 and B-735 at depths below the natural ground surface is summarized in Table 2.

Table 2: Summary of Soil Classification Data Below Elevation 80 Feet

Boring	Elevation (ft)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Fines Content (%)	USCS Classification
B-734	78.9 - 76.9	15	36	23	--	CL
	72.4 - 70.9	17	29	15	--	CL
	67.4 - 65.9	31	57	40	--	CH
	62.4 - 60.9	44	74	52	81	CH
	57.4 - 55.9	50	44	26	69	CL
	52.4 - 50.9	64	84	64	67	CH
	47.4 - 45.9	42	43	32	35	SM
B-735	76.7 - 74.7	22	47	16	--	CL
	71.7 - 69.7	37	56	20	91	CH
	66.7 - 65.2	25	39	15	--	CL
	46.7 - 45.2	--	Nonplastic	Nonplastic	--	SM

CROSS GENERATING STATION
BOTTOM ASH POND HISTORY OF CONSTRUCTION

Figure 1



The soil classification results in Table 2 indicate predominately sandy lean clay (CL) and fat clay with sand (CH) to elevations of approximately 47 feet. The fines contents of these soils are typically above 67 percent, and in many samples the moisture contents are closer to the liquid limit than the plastic limit. Laboratory shear strength testing was performed on the Terracon soil samples obtained above an elevation of approximately 80 feet in order to characterize the embankment soils. CPT soundings and laboratory data from the Law geotechnical report [Ref. 4] was used to characterize the subsoils below an elevation of approximately 80 feet. A summary of soil strength data for samples with similar soil classifications is presented in Table 3. For the safety factor assessment, the test results were re-interpreted using the assumption that cohesion is negligible for long-term drained conditions. This re-interpretation is presented in the right-most column of Table 3.

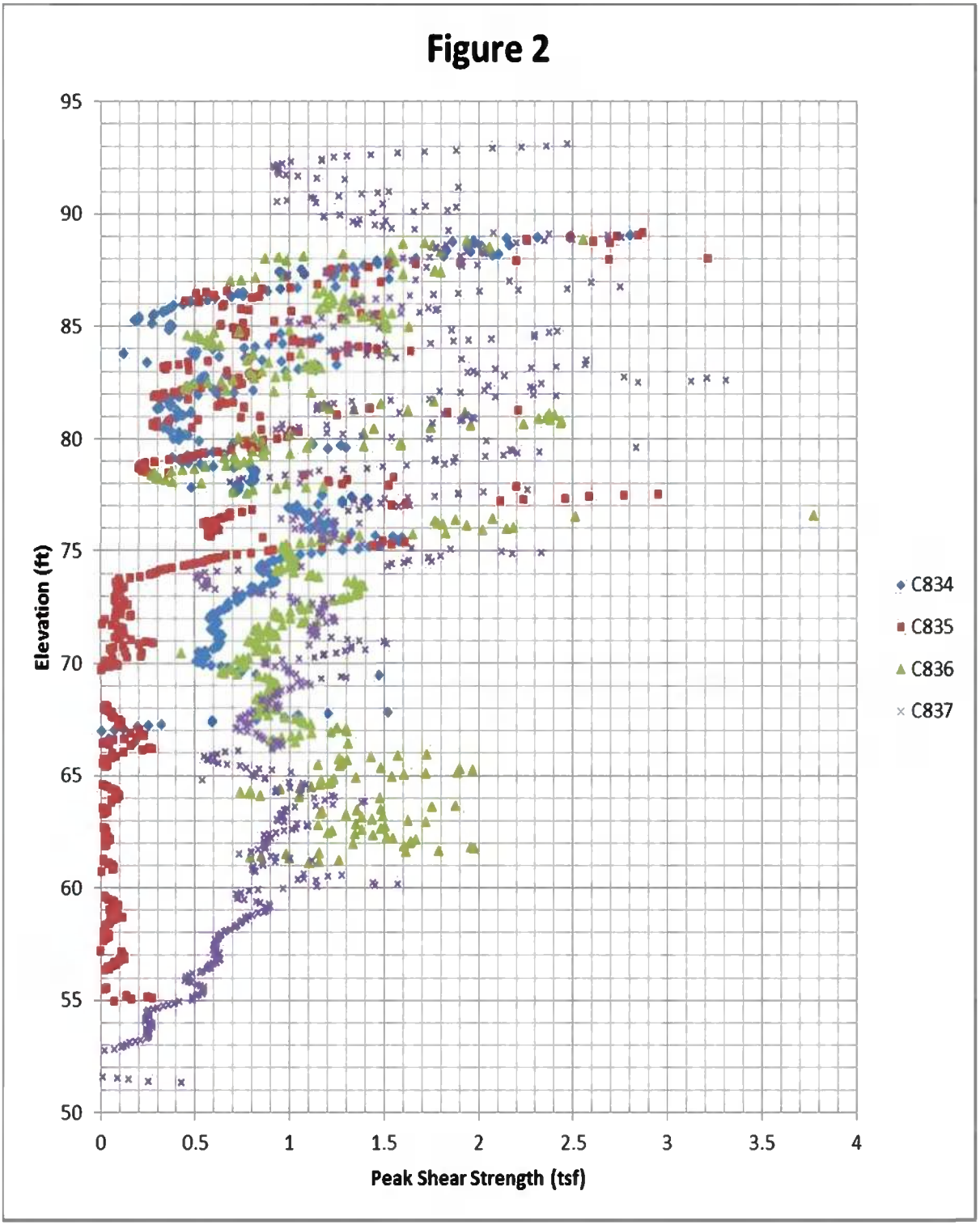
Table 3: Effective Stress Shear Strength

Boring	Elevation (ft)	Effective Cohesion (psf)	Friction Angle (degrees)	Equivalent Friction Angle (degrees)
221A	74.9 - 72.9	190	19.0	22.1
224	74.4 - 72.4	260	16.1	20.5
244	63.8 - 61.8	630	12.0	22.8

A plot of peak undrained shear strength as a function of elevation for the four CPT soundings performed by Terracon in 2015 is presented in Figure 2.

While there is more scatter in the data between the elevations of 80 and 75 feet, peak undrained shear strengths are generally less than 2.0 tsf, and average around 1.0 tsf. At the location of sounding C-835, the soils encountered were particularly soft, with peak shear strengths generally less than 0.1 tsf at depths below elevation 74 feet. Based on the analyses performed for the safety factor assessment [Ref. 5], the foundation soils are not considered liquefiable.

Figure 2


95
90
85
80
75
70
65
60
55
50
Elevation (ft)
0
0.5
1
1.5
2
2.5
3
3.5
4
Peak Shear Strength (tsf)
C834
C835
C836
C837

Beneath the typically clay-like soil deposits lies the Santee Limestone. In many locations the Santee Limestone is highly weathered and was able to be sampled with a spilt-spoon sampler. The recovered highly weathered rock samples typically classified as silty sand (SM). SPT N-values in the weathered limestone were greater than 40. The depths to the weathered limestone layer ranged from approximately 33 feet in Boring B-735 to 47 feet in Boring B-734. The depths to CPT tip refusal ranged from approximately 28 feet at sounding C-834 to 44 feet in sounding C-837. These depths are in general agreement with the boring data presented in Reference 4 and consistent with the understanding that the surface of the limestone bedrock varies due to relic solution weathering.

2.6 CCR Unit Stages

The CCR unit at Cross Generating Station was constructed in two major stages. The original impoundment was designed by Lockwood Greene Architects and Engineers, of Spartanburg, South Carolina. The first basin was constructed in 1982 and was approximately 600 feet wide and 1,200 feet long. The toe of the inside slope was constructed at elevation 75 feet with a flat pond bottom, and the top of the embankment extended up to elevation 95 feet. This basin was referred to as Bottom Ash Pond 1. As indicated previously, all coal combustion residuals were removed from this basin in 2015, and the basin is now referred to as the Wastewater Decant Pond.

In 1993, a much larger basin was constructed to the north and west of the Wastewater Decant Pond. This basin was designed by Gilbert/Commonwealth, Inc., of Reading, Pennsylvania. Construction was performed by Higgerson-Buchanan, Inc., of Chesapeake, Virginia. This basin was approximately 2,700 feet long and almost 2,000 feet wide at its widest point. The basin has a surface area of approximately 84 acres. The toe of the inside slope was constructed at elevation 76 feet, with the pond bottom gradually sloping down to elevation 73 feet near the center of the pond, and the top of the embankment extended up to elevation 91 feet. Originally referred to as Bottom Ash Pond 2, this basin is now known as the Bottom Ash Pond.

The ponds are connected via a trapezoidal spillway through the northern embankment of the Wastewater Decant Pond. The spillway is 10 feet wide with three horizontal to one vertical (3:1) sideslopes, and is covered with concrete revetment.

2.6.1 Embankment Properties

Information on the physical and engineering properties of the Bottom Ash Pond embankments was obtained as part of Terracon's 2015 geotechnical exploration. Two geotechnical borings and four CPT soundings were advanced through the embankments of both the Bottom Ash Pond and the Wastewater Decant Pond. For the purposes of this report, the embankment is considered to extend from the crest of the pond embankment (approximately Elevation 91 feet for the Bottom Ash Pond and Elevation 95 feet for the Wastewater Decant Pond) to the existing ground surface surrounding the ponds (approximate

Elevation 80 feet). Subsurface conditions below Elevation 80 feet were presented in the Foundation Properties section of this report.

Table 4 presents the results of the soil classifications performed by Terracon. Within the embankment, soil moisture contents are generally closer to the plastic limit of the soil than to its liquid limit. The fines percentages vary between approximately 40 and 60, resulting in typical soil classifications of clayey sand (SC) and sandy lean clay (CL).

Table 4: Summary of Soil Classification Data Above Elevation 80 Feet

Boring	Elevation (ft)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Fines Content (%)	USCS Classification
B-734	88.9 - 86.9	17	44	32	62	CL
	84.9 - 82.9	23	42	24	49	SC
	80.9 - 78.9	39	40	26	41	SC
B-735	93.2 - 91.2	17	44	29	--	CL
	91.2 - 89.2	27	50	31	45	SC
	87.2 - 85.2	18	37	22	46	SC
	83.2 - 81.2	22	30	19	55	CL

Soil strength data for the embankment soils is presented in Table 5. The effective friction angle varied from approximately 29 to 33 degrees and the apparent cohesion varied from 2.9 to 4.0 psi. Undrained shear strengths were approximately 9 psi at a consolidation stress of 5.2 psi and 12 psi at a consolidation stress of 10.4 psi. Average moist soil densities ranged from approximately 122 pounds per cubic foot (pcf) to 130 pcf.

Table 5: Embankment Soil Strength Summary

Boring	Elevation (ft)	Average Dry Sample Unit Wt. (pcf @ % moisture)	Test Type	Effective Stress		Undrained Shear Strength (psi)
				Friction Angle	Cohesion (psi)	
B-734	88.9 - 86.9	110.0 @ 16.4	Direct Shear	31.6	2.9	--
	84.9 - 82.9	111.3 @ 15.7	Consolidated Undrained Triaxial	29.9	3.5	8.5, 11.5
B-735	91.2 - 89.2	97.8 @ 25.1	Direct Shear	33.3	3.0	--
	87.2 - 85.2	107.7 @ 20.8	Consolidated Undrained Triaxial	29.2	4.0	9.0, 12.1

The properties of the soils comprising the embankment are generally uniform and similar to the upper portions of the foundation soils. Figures 1 and 2 demonstrate the similarity in SPT N-value and peak shear strength above elevation 74 feet. Laboratory test results show similar moisture contents, Atterberg Limits, and fines contents. These observations are consistent with the understanding that the embankments for the ash basin were constructed of soils obtained from on-site borrow areas. Soils comprising the embankment are not considered liquefiable [Ref 5].

2.6.2 Site Preparation and Construction

There are minimal records documenting the site preparation and construction of the Wastewater Decant Pond. The Law geotechnical report [Ref. 4] states that embankments should be compacted to densities of 95 percent of modified Proctor maximum dry density if sand is used for fill, and 90 percent if on-site clayey sands/silty sands are used. The Woodward-Clyde geotechnical report [Ref. 6] included the following statement, "We understand from Mr. R. Rohr that Lockwood Greene Architects and Engineers is considering excavating the interior of the pond to provide fill material for the construction of the embankment." Based on the construction drawings and similarity of the embankment soils to the top few feet of foundation soils, it seems likely that the materials excavated from the pond interior were used to construct the embankments. The Woodward-Clyde report recommended a compactive effort of 95 percent of Standard Proctor and that the soils have a moisture content at least one percent greater than the optimum moisture content.

In a letter dated January 29, 1993, from Higgerson-Buchanan, Inc., to Gilbert/Commonwealth, Inc., it is stated that "The source of suitable on-site fill material may be the spoil bank along the diversion canal, or any other temporary onsite stockpiles within the Santee Cooper Cross Site as determined by the Engineer." The earthwork specifications (included in Appendix F) for the Bottom Ash Pond confirm that the embankments were constructed of on-site excavated soil with the maximum particle size not exceeding 1/2 of the lift thickness (12 inches). The specifications required the subgrade to be compacted to a minimum density of 90 percent of modified Proctor (or 95 percent of standard Proctor) in areas receiving fill. Fill was to be placed in maximum 12-inch loose lifts and compacted to either 90 percent of modified Proctor or 95 percent of standard Proctor. Since part of the area of the Bottom Ash Pond was previously used as a borrow area, the specifications indicated that submerged portions of the borrow pit be filled by end-dumping sand to displace soft sediments that were subsequently removed. The specificatons also allowed for limestone cores and concrete pile cutoffs to be placed within the interior of the pond (not under embankments). These materials were to be placed so that no voids were created, and they had to be a minimum of one foot below the bottom of the bentonite liner.

Drawings for the Wastewater Decant Pond (included in Appendix D) indicate the berms were constructed of suitable compacted fill. Embankment sideslopes were three horizontal to one vertical (3:1) for both interior and exterior slopes. Most of the embankment had a crest width of 15 feet; however, the southwest corner from approximately the intake structure to the timber pipe support trestle had a width of

30 feet. The interior of the pond was lined with a four-inch thick layer of bentonite which was covered with six inches of crushed granite having a South Carolina DOT gradation of No. 4. Above the crushed stone was 18 inches of suitable backfill material compacted to 95 percent of standard Proctor. Within four feet of the normal water surface elevation, a layer of Mirafi 140S filter fabric was placed above the crushed stone, followed by six more inches of crushed stone. Riprap having a South Carolina DOT gradation of 12 inches was then placed on top of the crushed stone.

Drawings for the Bottom Ash Pond (included in Appendix D) indicate similar construction to the Wastewater Decant Pond. Embankments were constructed of compacted random fill to approximate Elevation 91 feet. Interior and exterior slopes were 3:1. The crest width was 15 feet, except for the southern segment of embankment, which was 24 feet wide. The bottom and interior pond slopes were covered with a bentonite geocomposite liner, covered by one foot of protective cover fill. Across the bottom of the pond, the protective cover was bottom ash, while the cover on the slopes was sand or onsite structural fill. A concrete revetment mat, three inches thick, extended from the crest of the embankment to four feet beyond the inside toe of the embankment.

An underdrain system was installed beneath the Bottom Ash Pond at the time of construction to aid with dewatering the subgrade soils in order to facilitate placement of the bentonite liner. Five-inch diameter perforated pipes bedded in sand were connected to 12-inch diameter perforated header pipes. The header pipes flowed into a junction box located in the center of the pond. The junction box was drained by two 12-inch diameter corrugated HDPE pipes that discharged into a 60-inch diameter concrete manhole located beyond the northern toe of the embankment in the vicinity of Monitoring Well CAP-8. A pair of 6-inch diameter pumps then conveyed the water from the manhole to the outfall. The manhole and the 12-inch diameter pipes were reportedly grouted shut once pond construction was completed. In the fall of 2014, the area around the manhole was excavated to confirm the integrity of the piping and evaluate the source of drainage in this area. It was confirmed that at least 10 feet of the outlet piping and the manhole was grouted, and the source of the drainage was water moving through the sand backfill around the outlet pipes. The area was then backfilled with flowable fill and a rock filter was installed to minimize the potential for piping of the sand backfill around the pipes.

When the Bottom Ash Pond was constructed, concrete revetment was added to the Wastewater Decant Pond. The existing riprap was choked with run of crusher (ROC) and revetment placed overtop existing grades. The revetment extended from the crest of the embankment to Elevation 85 feet.

Part of the construction of the Bottom Ash Pond included installation of a trapezoidal spillway connecting the two ponds, and modifications to the discharge structure in the Wastewater Decant Pond. The discharge structure was further modified in 2014. The extent of this work is presented in Section 2.10.

In 2004, additional piping and a pump structure was constructed to support Units 3 and 4. This work primarily affected the Wastewater Decant Pond. The configuration of the ash ponds and the embankment slope designs did not change.

In 2015, a new 16-inch diameter HDPE leachate collection pipe was installed through the southern berm, near the southwest corner of the ash pond. The pipe was installed above the elevation of the bentonite liner.

2.6.3 Dates of Construction

Drawings indicate the initial ash basin (Wastewater Decant Pond) went to construction on March 25, 1982. It appears construction was completed by September 11, 1984. Drawings for the expansion of the bottom ash pond (the creation of what is now known as the Bottom Ash Pond) indicate it went to construction on February 24, 1993. The construction schedule included in the contract indicated pond filling was to be complete by October 31, 1994.

2.7 CCR Unit Drawings

Construction drawings are included in Appendix D. The CV- series drawings pertain to the initial ash basin, which is now known as the Wastewater Decant Pond. The BA- series drawings are for the ash pond expansion, and cover the area now referred to as the Bottom Ash Pond.

- 2-CV-601: Layout, Grading and Drainage Plan (south end)
- 2-CV-602: Layout, Grading and Drainage Plan (north end)
- 2-CV-650: Miscellaneous Details and Sections
- 2-CV-651: Miscellaneous Details and Sections
- 2-C-684: Drawdown Structure Plans, Sections & Details
- BA-117-S0001: Bottom Ash Pond Expansion Plan
- BA-117-S0002: Sections and Details
- BA-117-S0003: Sections and Details
- BA-117-S0004: Monitoring Well Location Plan
- Underdrain Collection Box
- Underdrain System
- CR34-3-DW-SC-716-0503: Pipe Trench Plans and Details
- CR34-3-DW-SC-716-0505: Pipe Trench Plans and Details
- CR34-3-DW-SC-716-0506: Pipeline and Pipe Trench Sections
- CR34-3-DW-SC-716-0507: Ash Pond Piping Area
- Ash Pond Overflow Weir Elevation Modification
- Record Drawing - Bottom Ash Pond Underdrain Exploration and Closure

- CR34-0-DW-LF-719-0331: Leachate Collection Pond 1B/1D Pump Structure Bottom Ash Pond Outfall

2.8 Instrumentation

The only formal instrumentation for the Bottom Ash Pond is a staff gauge, located in the Wastewater Decant Pond. This gauge is used to measure water levels in the pond.

There are several groundwater monitoring wells located around the ponds. These wells are used primarily for water quality sampling, and are not formally considered instrumentation for the impoundments. The Wastewater Decant Pond originally had four piezometers surrounding it, P-1 through P-4. The piezometers were located beyond the toe of the exterior slope, one along each side of the pond. Construction drawings indicate the piezometers were constructed of minimum three-inch diameter PVC pipe with a gravel filter pack. It would appear the screened intervals extended from approximately 2.5 feet below the groundwater level to the top of the Santee Limestone.

When the Bottom Ash Pond was constructed, piezometers P-1 and P-4 were abandoned, as they were within the footprint of the new ash pond. Fourteen new monitoring wells, the CAP- series, were installed, as shown on Drawing BA-117-S0004, included in Appendix D. CAP-2 through CAP-12 were installed along the crest of the embankment in a clockwise direction, starting along the southern embankment of the Bottom Ash Pond. CAP-1 was installed in a groin area near the western embankment of the Wastewater Decant Pond and the southern embankment of the Bottom Ash Pond. Monitoring wells CAP-13 and CAP-14 are located north and west of the Bottom Ash Pond. The monitoring wells were constructed of 2.5-inch diameter PVC casing and a sand filter pack. The screened intervals are provided in Table 6.

Table 6: CAP- Monitoring Well Screen Intervals

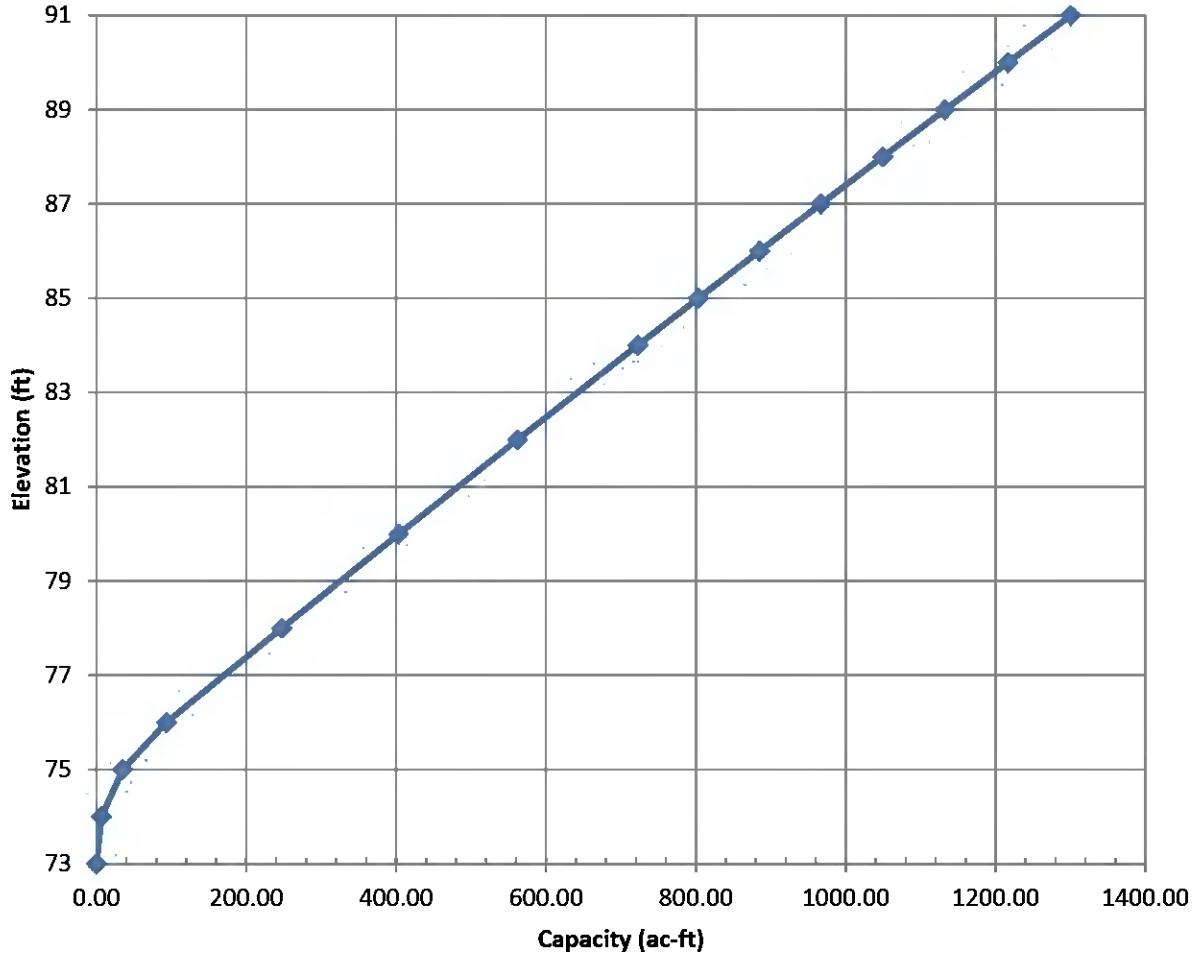
Monitoring Well	Screened Interval Elevation (ft)	Monitoring Well	Screened Interval Elevation (ft)
CAP 1	77.3 - 62.3	CAP 8	50.0 - 30.0
CAP 2	50.0 - 30.0	CAP 9	75.0 - 60.0
CAP 3	75.0 - 60.0	CAP 10	50.0 - 30.0
CAP 4	50.0 - 30.0	CAP 11	75.0 - 60.0
CAP 5	75.0 - 60.0	CAP 12	50.0 - 30.0
CAP 6	50.0 - 30.0	CAP 13	75.0 - 60.0
CAP 7	75.0 - 60.0	CAP 14	50.0 - 30.0

Water level readings are obtained from the CAP- series monitoring wells approximately twice per year. A graph of water level data is provided in Appendix E. The data reflects the expected seasonal variation in water levels. However, there is a general decrease in water levels from approximately 1995 to 2005.

2.9 Area-Capacity Curves

The area-capacity curve for the Bottom Ash Pond is presented in Figure 3. At Elevation 90 feet, the approximate capacity of the impoundment is 1200 acre-feet. At the time of the April 2016 inspection, the approximate volume of CCR in the Bottom Ash Pond was estimated as 750 acre-feet.

Figure 3



2.10 Spillway Data

Water from the Bottom Ash Pond is discharged into the Wastewater Decant Pond via a trapezoidal weir. The weir is 10 feet wide, with 3:1 sideslopes. The weir extends from the top of the Wastewater Decant

Pond embankment (elevation 95 feet) to elevation 85.0 feet. The weir is surfaced with concrete erosion control revetment. Beneath the revetment is a foot of structural fill or sand, followed by a bentonite geocomposite liner.

Water from the Bottom Ash Pond flows over the weir into the Wastewater Decant Pond where it is pumped back to the power block for use as ash sluice and ash seal water. The Wastewater Decant Pond also contains the emergency spillway. This spillway is a reinforced concrete box structure having a 4.25-foot wide overflow section at elevation 89.5 feet. The spillway elevation was originally set at elevation 94.0 feet. When the Bottom Ash Pond was constructed, the spillway elevation was lowered to 89.0 feet. In 2014, the spillway was raised to elevation 89.5 feet to allow for greater operational flexibility of the ponds. The overflow section discharges into an 18-inch diameter concrete pipe that extends through the embankment and outlets into a drainage ditch leading to stormwater outfall SW005, an unnamed tributary connected to Lake Moultrie.

2.11 Construction Specifications, Provisions for Surveillance, Maintenance, and Repair

Available specifications for the Bottom Ash Pond are provided in Appendix F. These specifications include:

- 02220: Excavation and Fill
- 02220-A: Excavation and Fill Attachment A - Modification to Modified Proctor Test
- 02246: Soil Testing
- 02246-A: Soil Testing Attachment A - Required Tests
- 02246-B: Soil Testing Attachment B - Modification to Modified Proctor Test
- 02500: Sitework
- 02644: Bentonite Geocomposite Liner
- 02645: Concrete Erosion Control Revetment

According to personnel involved with the design and construction of the Bottom Ash Pond, all work was verified by third party monitoring, testing, and inspection services.

Santee Cooper conducts periodic surveillance, maintenance, and repair of the Bottom Ash Pond. Santee Cooper engineers inspect the Bottom Ash Pond dikes in accordance with the dike inspection procedures presented in Appendix G. Site personnel conduct weekly and annual inspections of the ash pond embankments. Personnel performing inspections are required to undergo an initial inspector training as well as refresher training every three years. Qualified dam safety engineers accompanied by Site personnel conduct annual inspections. Routine inspections are documented on an Inspection Checklist (included in Appendix G).

2.12 Structural Instability Records

In the thirty plus years since the original basin was constructed, there has been no record of structural instability. Over the years, minor erosional features have formed and were subsequently repaired. Some drainage in the area of the dewatering manhole has been noted. This drainage is attributed to groundwater movement along the sand used to bed the dewatering piping.

3. SUMMARY

This document is intended to present the history of construction of the Bottom Ash Pond at Cross Generating Station. The document was prepared in accordance with 40 CFR §257.73(c)(1). The contents of this report are based on available drawings and reports. If there are any significant changes to the information presented herein, this document will be revised to present the updated information.

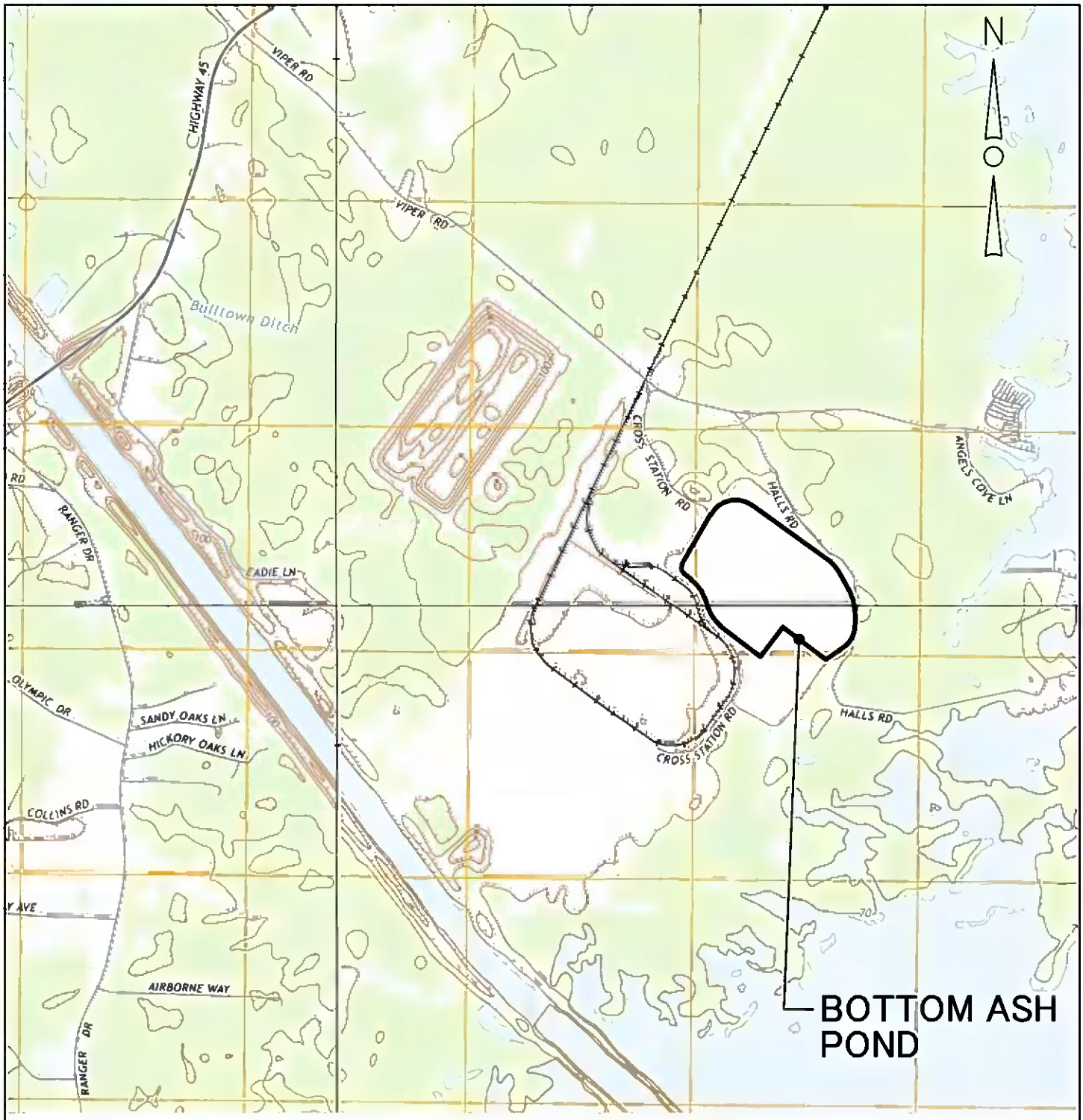
In general, the Bottom Ash Pond is an impoundment containing primarily bottom ash. It was constructed in the mid-1990's. The pond is partially incised, with the bottom of the pond approximately six feet lower than the surrounding ground surface. The embankments, constructed of on-site material, have slopes of three horizontal to one vertical, and extend to Elevation 91 feet. The crest width varies from approximately 15 to 24 feet. The pond is lined with a bentonite composite liner, and protected by concrete revetment. Discharge from the pond is through a trapezoidal weir into the Wastewater Decant Pond.

4. REFERENCES

1. Dewberry & Davis, LLC, Coal Combustion Residue Impoundment Round 9 - Dam Assessment Report Cross Generating Station, December 2011.
2. Santee Cooper, Coal Combustion Residual Impoundment Inspection - Cross Generating Station, January 2016.
3. SC Watershed Atlas, https://gis/dhec.sc.gov/watersheds/
4. Law Engineering Testing Company, Final Report Cross Generating Station, February 9, 1979.
5. WorleyParsons Calculation CROSS-0-LI-044-0010, Bottom Ash Pond Initial Safety Factor Assessment, October, 2016.
6. Woodward-Clyde Consultants, Final Report Unit 1 Generating Station, January 26, 1981.

Appendix A - CCR Unit Location Map

(2 total pages)



SOURCE: EADYTOWN, SC 2014
PINEVILLE, SC 2014
CROSS, SC 2014
CHICORA, SC 2014

VICINITY MAP

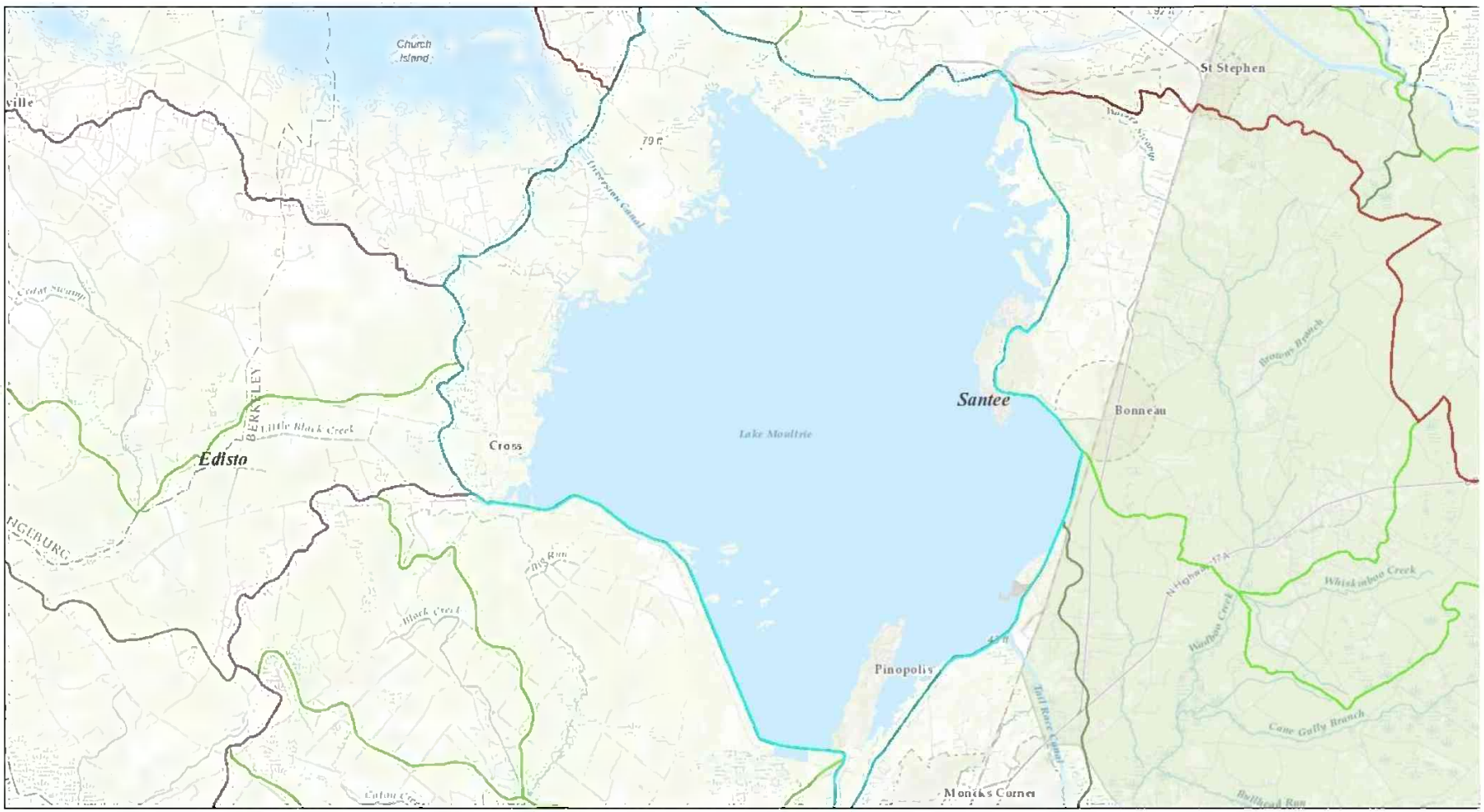
CROSS-0-DW-024-735-001.DWG

APPLICANT: SOUTH CAROLINA PUBLIC SERVICE AUTHORITY (SANTEE COOPER)				P/N:	
PROJECT: CROSS STATION CCR/ELG COMPLIANCE			LOCATION: CROSS, BERKELEY COUNTY, SC		
PURPOSE: BOTTOM ASH POND				LAT: N 33° 22′ 65"	
2	10/13/16	ISSUED FOR INFORMATION	SCALE: 1" = 2000′	LONG: E 80° 06′ 14"	
REV	DATE	DESCRIPTION	DATE: 09/06/16	SHT. 1 OF 1	

Appendix B - Watershed Map

(2 total pages)

Lake Moultrie Watershed



September 6, 2016

- Major River Basin (Outline)
- 8-Digit Watersheds
- 10-Digit Watersheds
- 12-Digit Watersheds

1:144,448

0 1.75 3.5 7

0 2.75 5.5 11 k

Sources: Esri, HERE, DeLorme, Intermap, increment P, GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadast Ordnance Survey, Esri Japan, METI, Esri China (Hong K swisstopo, MapmyIndia, © OpenStreetMap contributors, and th User Community

B. Bureau of Water, SC

Appendix C - Boring Logs and CPT Soundings

(8 total pages)

BORING LOG NO. B-734

PROJECT: Cross Generating Station- Ash Pond Dikes

CLIENT: Santee Cooper
Moncks Corner

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons

LOCATION See Exhibit A-2

Latitude: 33.377012° Longitude: -80.10171°
Northing: 14692 Easting: 10701

Surface Elev.: 90.9 (Ft.)

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
		SANDY LEAN CLAY (CL), tan to brown, stiff to very stiff **-Shelby tube taken in offset boring between 2 to 4 feet**				3-4-6-8 N=10							
6.0	85					8-9-10-10 N=19				17		44-12-32	62
			5			2-2-9-10 N=11				20			
		CLAYEY SAND (SC), tan, soft **-Shelby tube taken in offset boring between 6 to 8 feet**				4-6-6-7 N=12				23		42-18-24	49
12.0	79		10			2-4-6-7 N=10				22			
		SANDY LEAN CLAY (CL), reddish brown to gray, stiff				1-1-1-1 N=2				39		40-14-26	41
			15			3-4-6-8 N=10				15		36-13-23	
21.0	70		20			3-3-6 N=9				17		29-14-15	
		FAT CLAY WITH SAND (CH), gray, medium stiff	25			2-2-4 N=6				31		57-17-40	
32.0	59		30			1-2-3 N=5				44		74-22-52	81
		SANDY LEAN CLAY (CL), gray to tan, soft to medium-stiff	35			1-1-1 N=2				50		44-18-26	69
38.0	53												
		SANDY FAT CLAY (CH), gray, soft	40			WOH-WOH-WOH N=0				64		84-20-64	67
44.0	47												
		SILTY SAND (SM), trace gravel, gray	45			WOH-WOH-WOH N=0				42		43-32-11	35
47.0	44												
		SILTY SAND (SM), gray, dense to very dense, strong cementation, (Weathered Santee Limestone)	50			13-28-15 N=43							
55.0	36		55			26-50/2" N=100							
		Boring Terminated at 55 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic
SPT energy 71.9%

Advancement Method:
mud rottary

Abandonment Method:
Borings backfilled with cement-bentonite grout upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

- *13.4 ft after casing removed*
- *18 ft at end of day*
- *after boring completion*

Terracon
1450 5th Street West
North Charleston, South Carolina

Boring Started: 10/8/2015 | Boring Completed: 10/8/2015
Drill Rig: CME-45 | Driller: J. Pawless
Project No.: EN131025 | Exhibit: A-2

BORING LOG NO. B-735

PROJECT: Cross Generating Station- Ash Pond Dikes

CLIENT: Santee Cooper
Moncks Corner

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons

LOCATION See Exhibit A-2

Latitude: 33.373027° Longitude: -80.101761°
Northing: 13447 Easting: 11565

Surface Elev.: 95.2 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
					9-8-12-9 N=20							
4.0	91				7-9-11-12 N=20				17		44-15-29	
SANDY LEAN CLAY (CL), reddish brown, very stiff		5			3-2-2-2 N=4				27		50-19-31	45
					2-2-2-2 N=4				32			
CLAYEY SAND (SC), with silt, brown, soft to medium-stiff		10			3-3-2-2 N=5				18		37-15-22	46
-Shelby tube taken in offset boring between 4 to 6 feet									12			
-Shelby tube taken in offset boring between 8 to 10 feet			▽		4-4-9-10 N=13				22		30-11-19	55
12.0	83	15	▽		2-2-3-3 N=5							
SANDY LEAN CLAY (CL), gray to brown, medium stiff		20			2-2-3-3 N=5				22		47-16-31	
22.0	73											
FAT CLAY (CH), gray, whith to tan, loose		25			1-1-1-1 N=2				37		56-20-36	91
28.0	67		▨									
SANDY LEAN CLAY (CL), gray, whith to tan		30			3-4-5 N=9				25		39-15-24	
33.0	62											
SILTY SAND (SM), gray, dense to very dense, strong cementation, (Weathered Santee Limestone)		35			5-19-27 N=46							
		40			16-20-26 N=46							
		45			8-15-26 N=41							
50.0	45	50			28-32-50/2" N=100						NP	
Boring Terminated at 50 Feet												

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic
SPT energy 71.9%

Advancement Method:
mud rottary

Abandonment Method:
Borings backfilled with cement-bentonite grout upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13 ft after casing removed*

▽ *17.6 ft at end of day*

▨ *after boring completion*

Terracon
1450 5th Street West
North Charleston, South Carolina

Boring Started: 10/8/2015 | Boring Completed: 10/8/2015

Drill Rig: CME-45 | Driller: J. Pawless

Project No.: EN131025 | Exhibit: A-2

CPT LOG NO. C-834

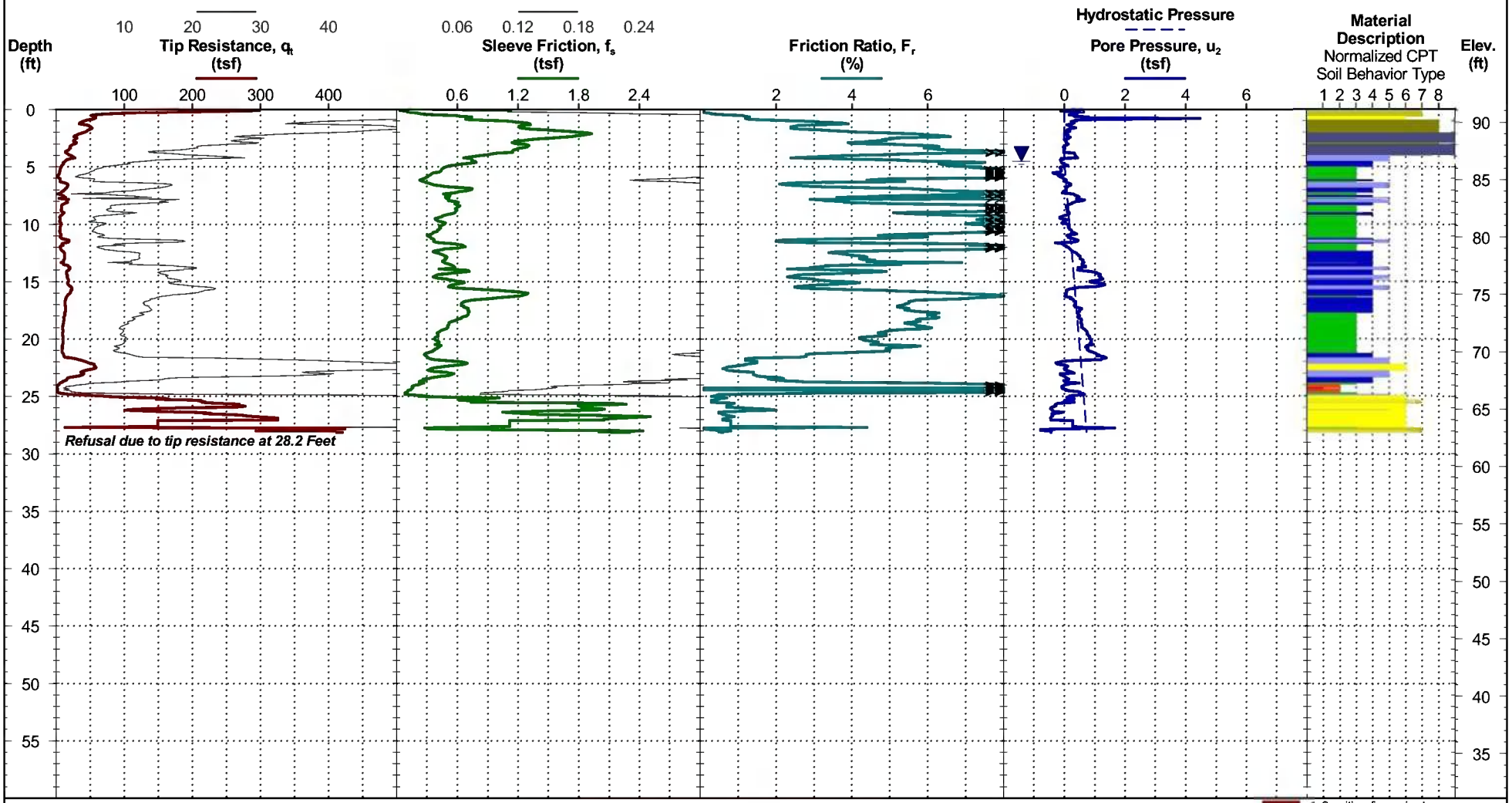
PROJECT: Cross Generating Station- Ash Pond Dikes

CLIENT: Santee Cooper
Moncks Corner

TEST LOCATION: See Exhibit A-2
Surface Elev.: 91.1 ft
LL: 33.3796°,-80.10488°
NE: 14899,9355

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons



See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION
▼ 4.5 ft estimated water depth
(used in normalizations and correlations; see Appendix C)

Probe no. 4675 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 10/22/2015
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 10/9/2015	CPT Completed: 10/9/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN131025	Exhibit: A-1

CPT LOG NO. C-835

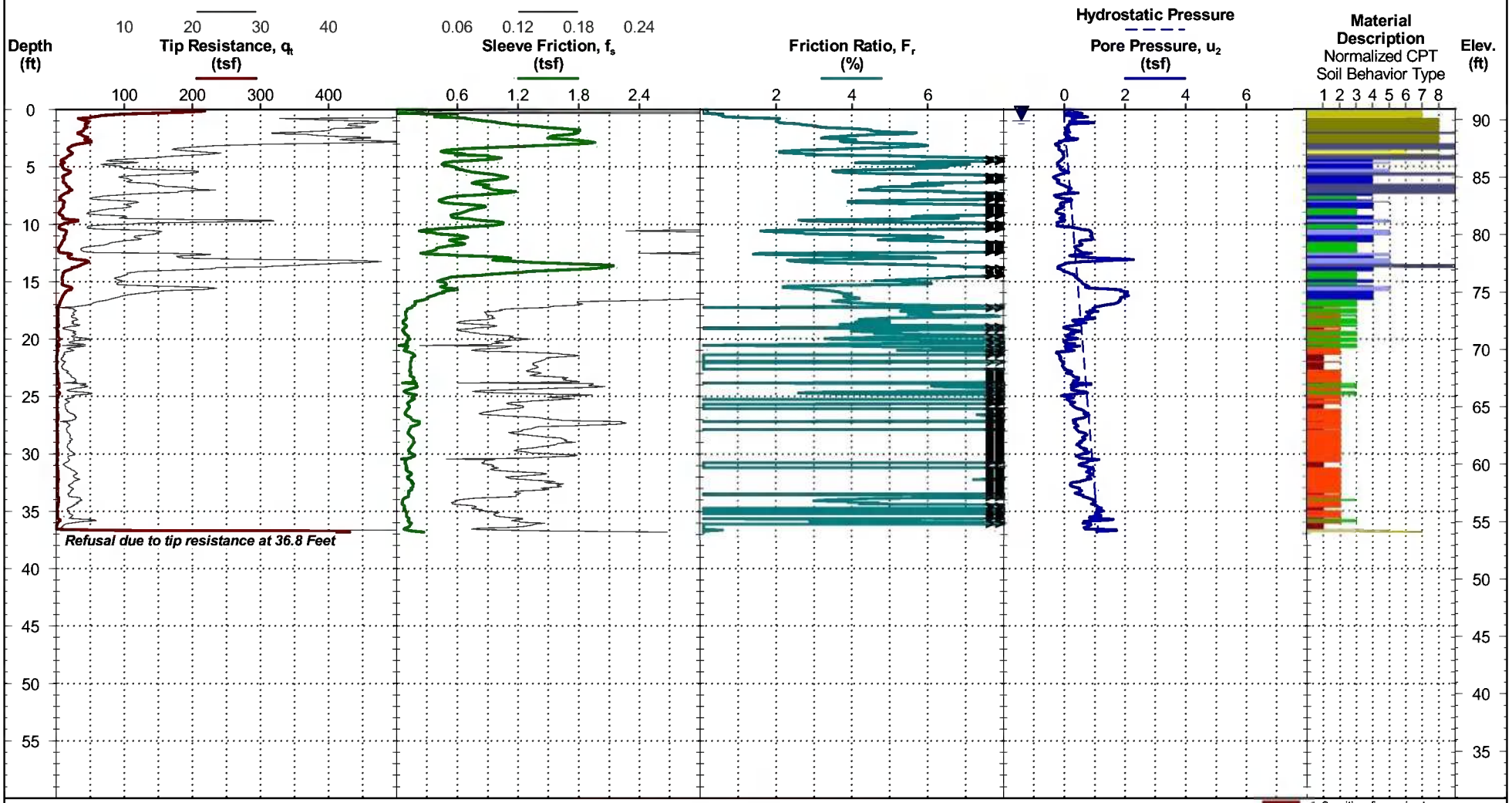
PROJECT: Cross Generating Station- Ash Pond Dikes

CLIENT: Santee Cooper
Moncks Corner

TEST LOCATION: See Exhibit A-2
Surface Elev.: 90.9 ft
LL: 33.37689°,-80.10157°
NE: 14692,10701

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons



See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION
▼ 1 ft estimated water depth
(used in normalizations and correlations; see Appendix C)

Probe no. 4675 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 10/22/2015
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 10/9/2015	CPT Completed: 10/9/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN131025	Exhibit: A-2

CPT LOG NO. C-836

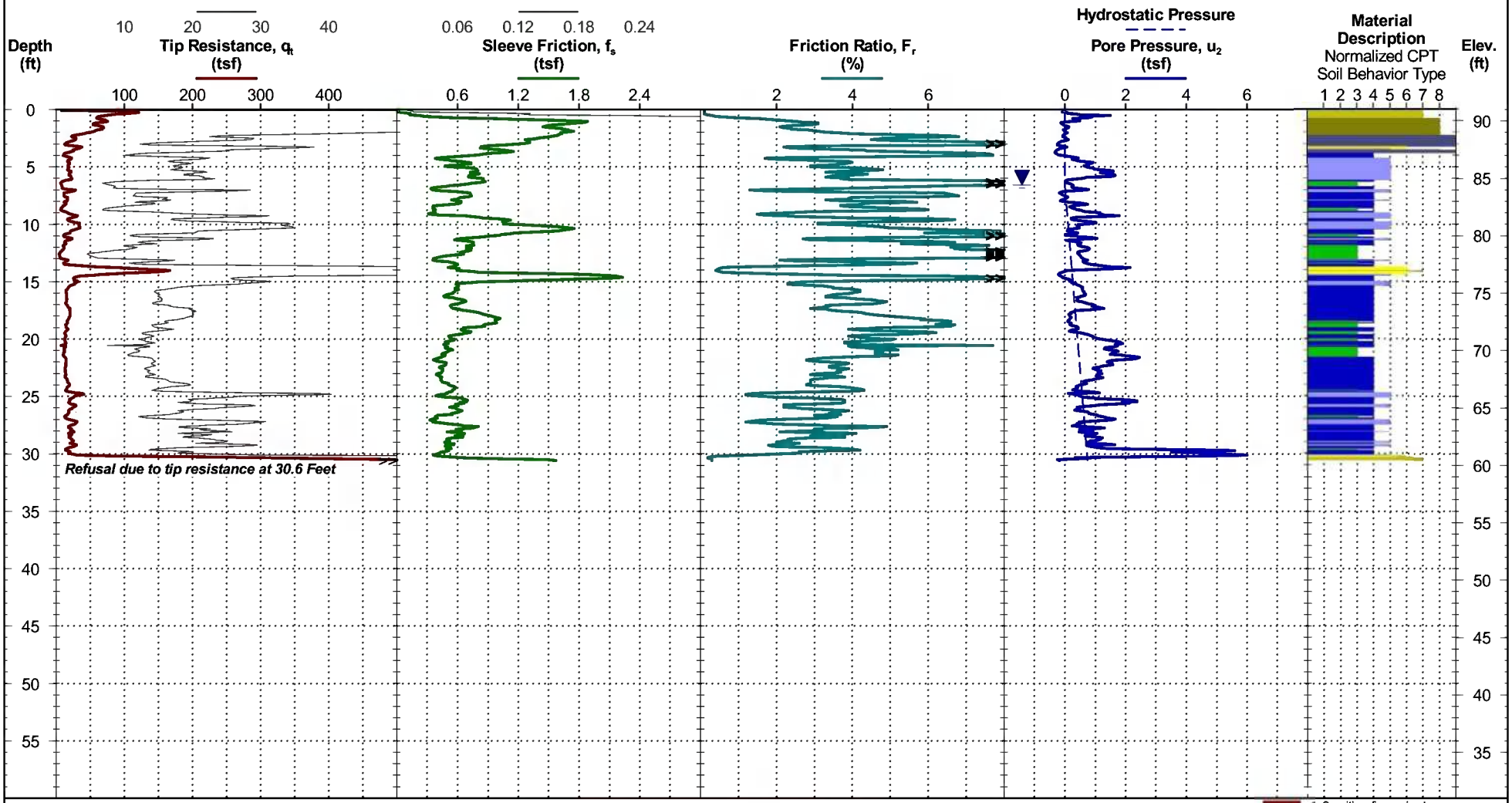
PROJECT: Cross Generating Station- Ash Pond Dikes

CLIENT: Santee Cooper
Moncks Corner

TEST LOCATION: See Exhibit A-2
Surface Elev.: 91.0 ft
LL: 33.374°,-80.10619°
NE: 12993,10212

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons



See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION
▼ 6.6 ft estimated water depth
(used in normalizations and correlations; see Appendix C)

Probe no. 4675 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 10/22/2015
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 10/9/2015	CPT Completed: 10/9/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN131025	Exhibit: A-3

CPT LOG NO. C-837

PROJECT: Cross Generating Station- Ash Pond Dikes

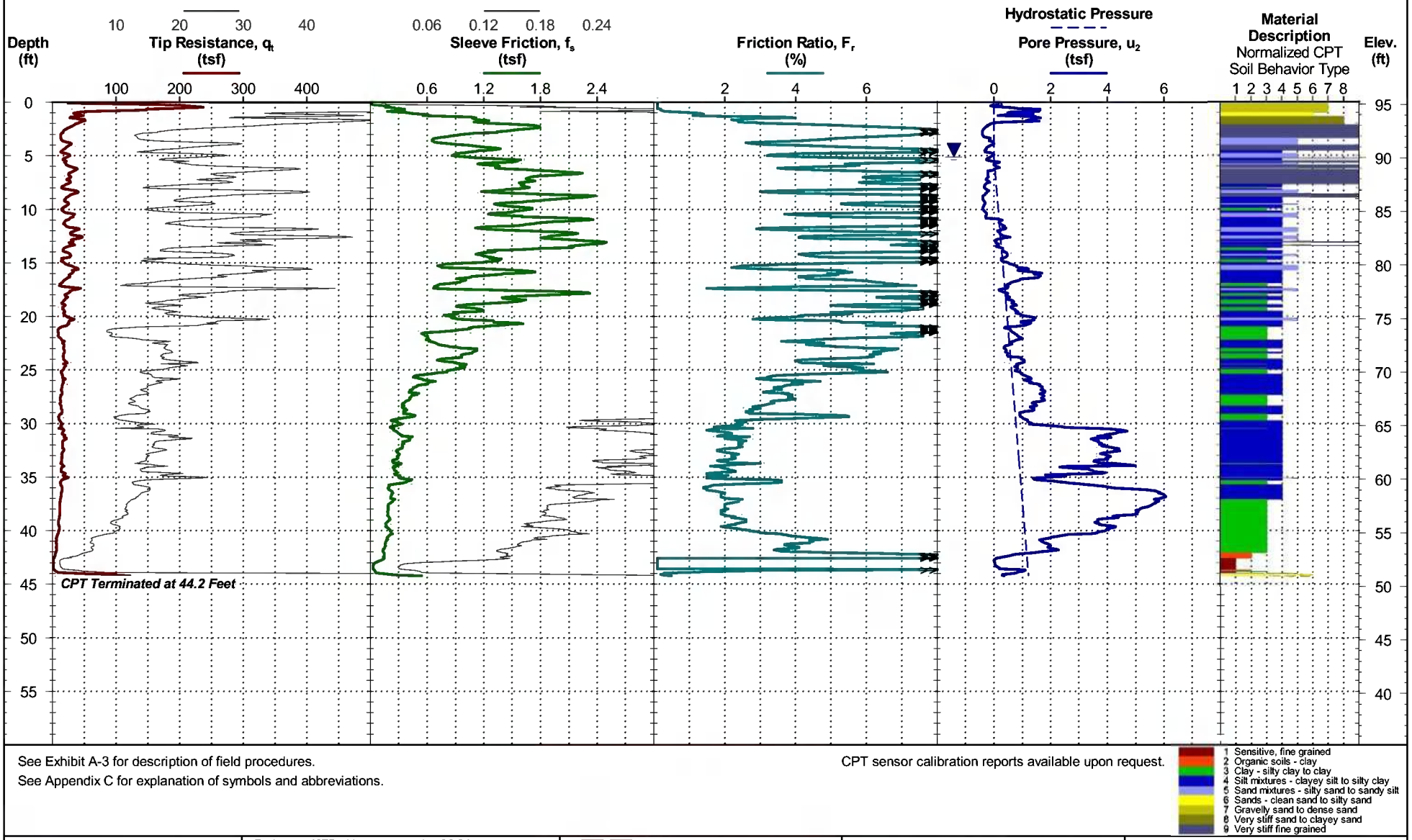
CLIENT: Santee Cooper
Moncks Corner

TEST LOCATION: See Exhibit A-2

Surface Elev.: 95.2 ft
LL: 33.37303°,-80.10186°
NE: 13447,11565

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons



See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

WATER LEVEL OBSERVATION

▼ 5.1 ft estimated water depth
(used in normalizations and correlations; see Appendix C)

Probe no. 4675 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 10/22/2015
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 10/9/2015	CPT Completed: 10/9/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN131025	Exhibit: A-4

Appendix D - Construction Drawings

(19 total pages)

AP 7485

MATCH LINE, SEE DWG. NO. 2-CV-602

BOTTOM ASH POND
WATER SURFACE ELEV. 93.00

SEE DWG. 2-CV-519 FOR CONTINUATION OF ROAD

℄ DITCH-GRADE TO DRAIN & GRASS — 7 / 2-CV-650

℄ 24'-0" WIDE GRAVEL ROAD @ E 109+35.0

P.I.@ N127+56.89 E108+65.29

H.P.

GUARD RAIL SEE DET. "20" DWG. 2-CV-562 EXD. GUARD RAILS @ CURVE TANGENTS (TYP.)

ROADWAY SLOPES TO BE GRASSED (TYP. BOTH SIDES) — 9 / 2-CV-650

3.5% GR. TO EL. (88.5)

EXISTING TREE LINE

℄ 30'-0" WIDE DIKE @ E 109+35.0 TOP EL. (96.63)

TOE OF SLOPE @ EL. (75.0)

EL. (94.6)

PROPOSED CONC. TRENCH (SEE DWG. 2-C-682) — 3

PROPOSED INTAKE STRUCTURE SEE DWG. 2-C-650. DIKE AT STRUCTURE SHALL BE CONSTRUCTED FIRST & LEFT IN PLACE AS A SURCHARGE UNTIL ENTIRE DIKE IS COMPLETE, THEN STRUCTURE SHALL BE BUILT.

OIL SKIMMER BOOM (TYP.) — 4

END OF SHEET PILE BULKHEAD @ E 110+60.0

END PIPE TRENCH @ N 124+67.50

TRENCH @ EL. (98.25)

P.I. @ N 124+28.0

DETAIL 14 / 2-CV-652

DETAIL 5 / 2-CV-652

℄ DRAWDOWN & OVERFLOW STRUCT. @ E 112+75.0 = ℄ WALKWAY

DRAWDOWN STRUCTURE (NO. 1 SEE DWG. 2-C-684

TOE OF SLOPE @ EL. (75.0)

N 124+17.50

℄ 15'-0" WIDE DIKE @ E 115+67.0 TOP EL. (95.31)

PROPOSED TREE LINE

3 / 2-CV-650

℄ DITCH-GRADE TO DRAIN & GRASS

EXISTING TREE LINE

EXISTING ROAD

P.I. @ N 123+50.0 E 115+67.0

END PIPE TRENCH @ N 123+57.50

P.I. @ N 123+52.0 E 104+17.5

℄ @ E 109+98 ±

EL. (82.16)

6" THK. CRUSHED LIMESTONE

GRASS SIDE SLOPES (TYP.)

℄ BERM FOR PIPE SUPPORT SEE DWG. 2M0149

℄ TRENCH @ N 123+40.25

CONC. TRENCH FOR DETAIL SEE DWG. 2-C-682

℄ TRENCH @ E 112+25.0

6" THK. CRUSHED STONE (TYP.)

℄ E 111+78

18"ϕ A.W.W.A. C-301 PRESTRESSED CONC. CYLINDER PIPE. — 2

℄ E 15'-0" WIDE DIKE @ N 123+50.0 TOP EL. (95.31)

10'-0" WIDE FLAT BOTTOM DITCH W/3:1 SIDE SLOPES ROUTE TO EXIST. DITCH GRADE TO DRAIN & GRASS

24"ϕ R.C.P. CLASS III (40'Lg)

SANDBAG RIP RAP SEE DETAIL "4" DWG. 2-CV-650

P.I. @ N 122+50 E 112+75

P.I. @ N 122+20 E 109+65

MATCH EXIST. DITCH ELEV.

DETAIL 4 / 2-CV-650

EXISTING ROAD

N 129+00 · N 128+00 · N 126+00 · N 124+00 · N 122+00

E 108+00 · E 110+00 · E 112+00 · E 114+00 · E 116+00 · E 118+00 · E 119+00

PLANT NORTH

1" = 30' (0 10' 20' 40' 60' 80' 100')

B & R #200-00-0424

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
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ATLANTA DALLAS NEW YORK
LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

no	date	REVISION	by	ck.	appr.
2	5/21/82	REV. PIPE SIZE @ DRAWDOWN STRUCTURE	CWL	Tomb	
1	3-25-82	REVISED LOCATION OF POND DIKE, REV. TRANSFORMER PAD LAYOUT @ INTAKE STR. & ISSUED FOR CONSTRUCTION (CONTRACT 284)	CWL	Tomb	
0	1-4-82	ISSUED FOR BIDS (CONT. 284)	SDO	Tomb	
4	9/9/82	ADDED OIL SKIMMER BOOM & POLES	CWL	Tomb	
3	6/28/82	REV. EFFLUENT PIPE DIA. & REF. DWG. NO.	CWL	Tomb	

drawn by G.A. · dept. ck. · dept. appr. · coord. ck. · p.m. appr. · B&R appr. 9/11/84

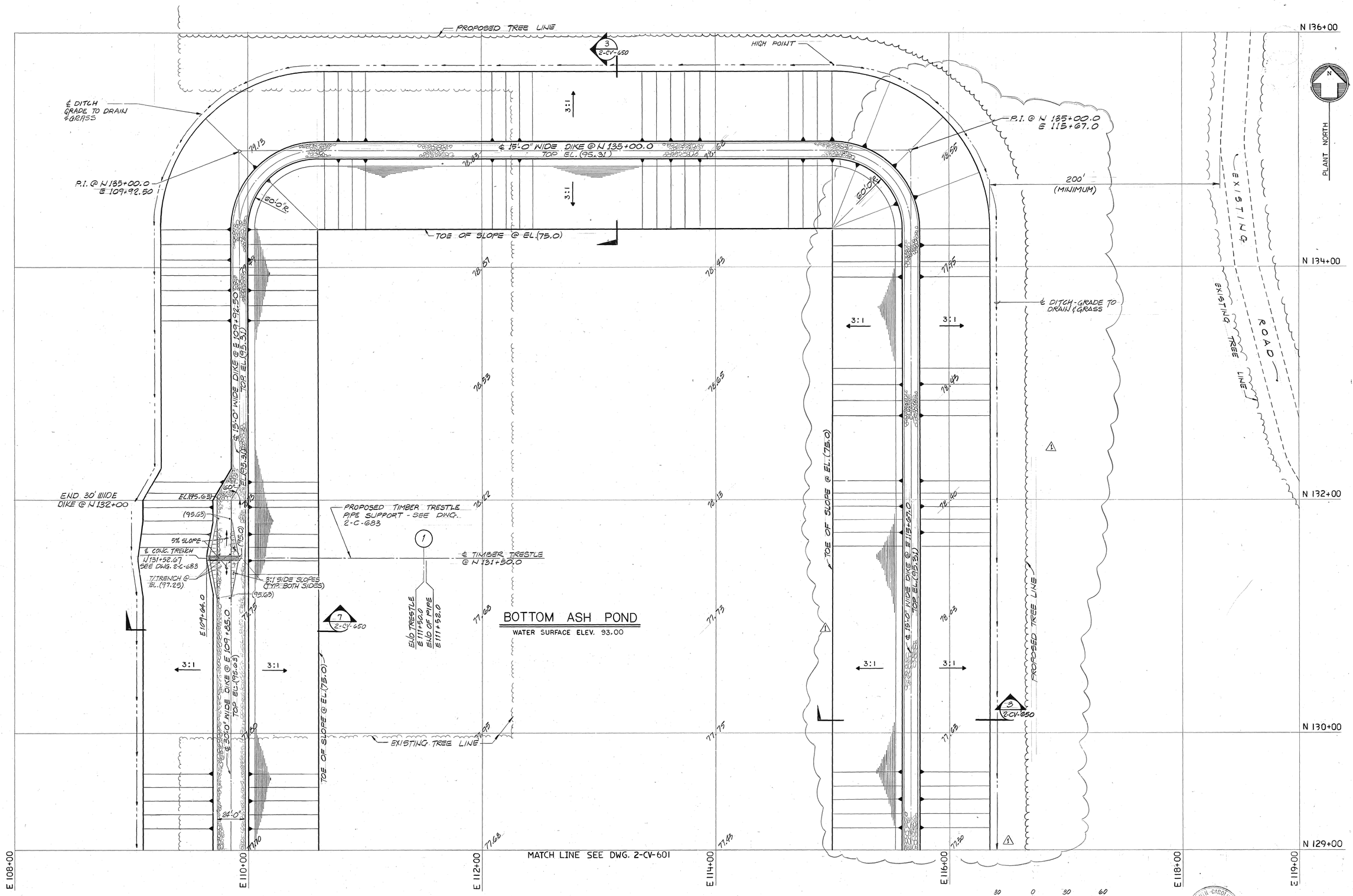
job name: SANTEE COOPER
CROSS GENERATING STATION UNIT 2
CROSS, SOUTH CAROLINA

sheet title: LAYOUT, GRADING AND DRAINAGE PLAN

284	CONSTR.	3-25-82	1
284	BID	1-4-82	0
PKG.	ISSUE	DATE	REV.

scale: 1" = 30'
B&R W.O. NO. 3446.02
date: 8-3-81
dwg. no.: 2-CV-601
rev. no.: 4

AF 7495



1 3258 VISE LOCATION O BOND D E
ISSUED FOR CONSTRUCTION CONTRACT C
0 1-9 ISSUED FOR BIDS (CONT. 284) DR.
no date REVISION by ck. appr. no date REVISION by ck. appr.

drawn by G.A.
dept. ck.
dept. appr.
coord. ck.
p.m. appr.
B&R appr.

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

job name
SANTEE COOPER
CROSS GENERATING STATION UNIT 2
CROSS, SOUTH CAROLINA

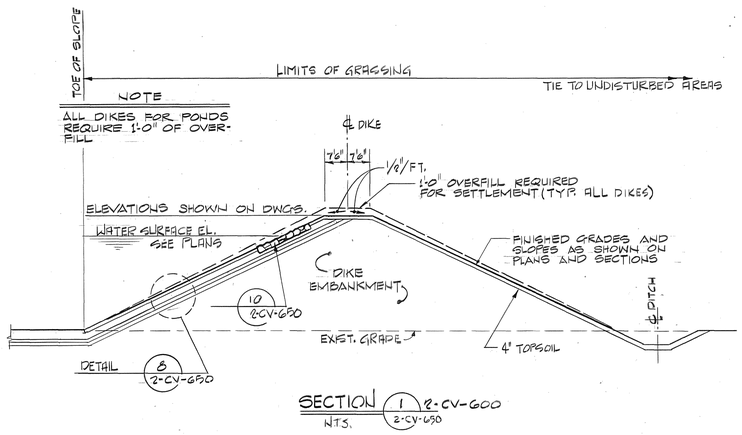
B & R #200-00-0425

sheet title
LAYOUT, GRADING AND DRAINAGE PLAN

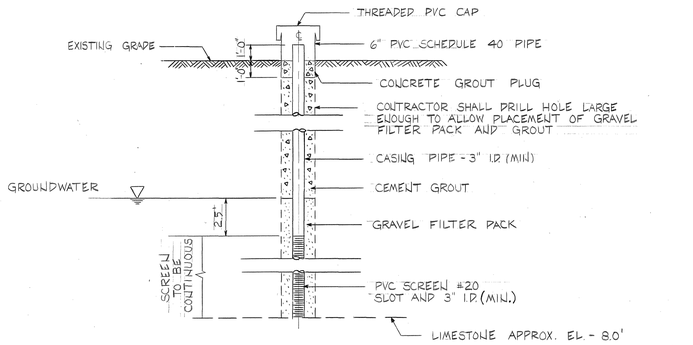
scale 1" = 30'
date 8-3-81
dwg. no 2-CV-602
rev. no. 1

284 CONSTR. 3-2582 1
284 BID 1-982 0
PKG. ISSUE DATE REV.
L-G JOB NO. 78271.01
B&R W.O. NO. 3446.02

AF 16184

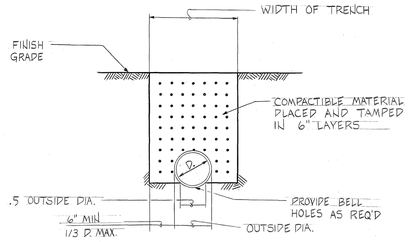


SECTION 1 2-CV-600
N.T.S. 2-CV-650



DETAIL 2 2-CV-650
N.T.S. 2-CV-650

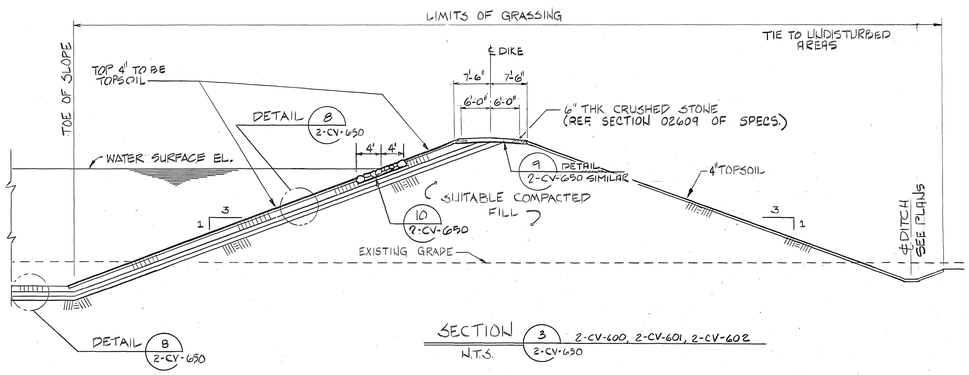
MONITORING WELL



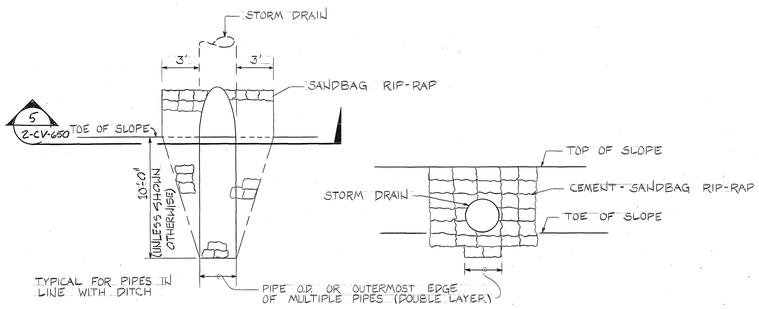
NOTE

ABOVE DETAIL TO BE USED FOR ALL PIPING INSTALLATIONS EXCEPT DRAWDOWN PIPES, REFER TO DETAIL ON 2-C-684 FOR DRAWDOWN PIPE BEDDING.

TYPICAL PIPE BEDDING DETAIL
N.T.S

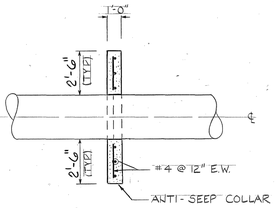


SECTION 3 2-CV-600, 2-CV-601, 2-CV-602
N.T.S. 2-CV-650

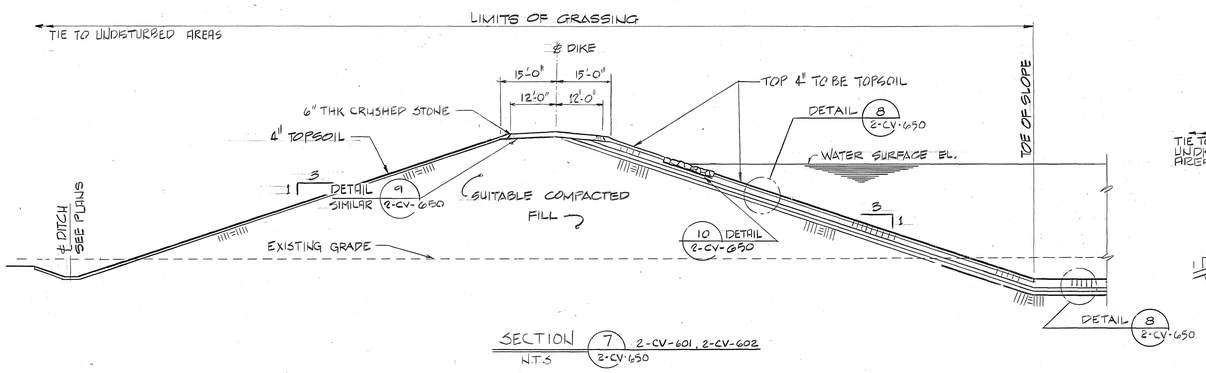


DETAIL 4 2-CV-600, 2-CV-601
N.T.S. 2-CV-650 2-CV-519

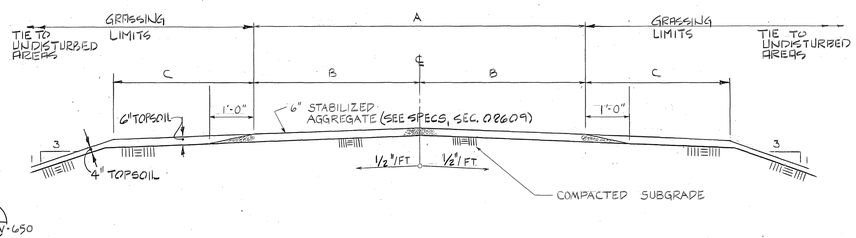
SECTION 5 2-CV-650
N.T.S. 2-CV-650



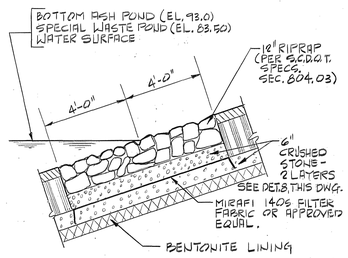
DETAIL 6 2-CV-651
N.T.S. 2-CV-650



SECTION 7 2-CV-601, 2-CV-602
N.T.S 2-CV-650



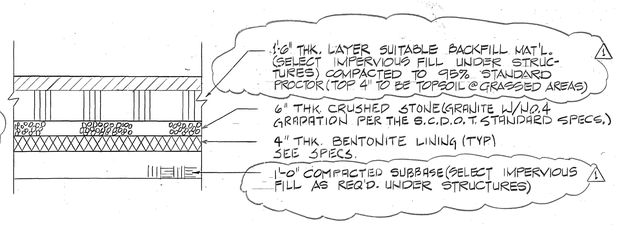
DIMENSIONS		
A	B	C
12'-0"	6'-0"	4'-0"
24'-0"	12'-0"	8'-0"



DETAIL 10 2-CV-650
N.T.S. 2-CV-650

NOTE

1 CONTRACTOR SHALL ENSURE THAT BENTONITE LINING IS PROPERLY PLACED IN AREA ADJACENT TO CONCRETE STRUCTURES, SHEET PILING, AND TIMBER PILING. BENTONITE LINING MUST EXTEND IN AN UNINTERRUPTED LAYER TO CONTACT SURFACES OF STRUCTURES AND PILING.



DETAIL 8 2-CV-650, 2-CV-651
N.T.S. 2-CV-650

UNPAVED ROADWAY DETAIL 9 2-CV-650, 2-CV-651
N.T.S 2-CV-560

no	date	REVISION	by	ck.	appr.
1	8-3-81	D NOTES TO DETAIL 8 ISSUED ISSUED FOR CONSTRUCTION (CONTRAC 284 CONT.)	CBK	DDO	
0	1 82	ISSUED FOR BIDS (CONT. 284			

drawn by D OLSON
dept. ck. C
dept. appr.
coord. ck.
p.m. appr.
B&R appr. Verne 9/11/81

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LOCKWOOD GREENE
ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

B & R #200-00-0427

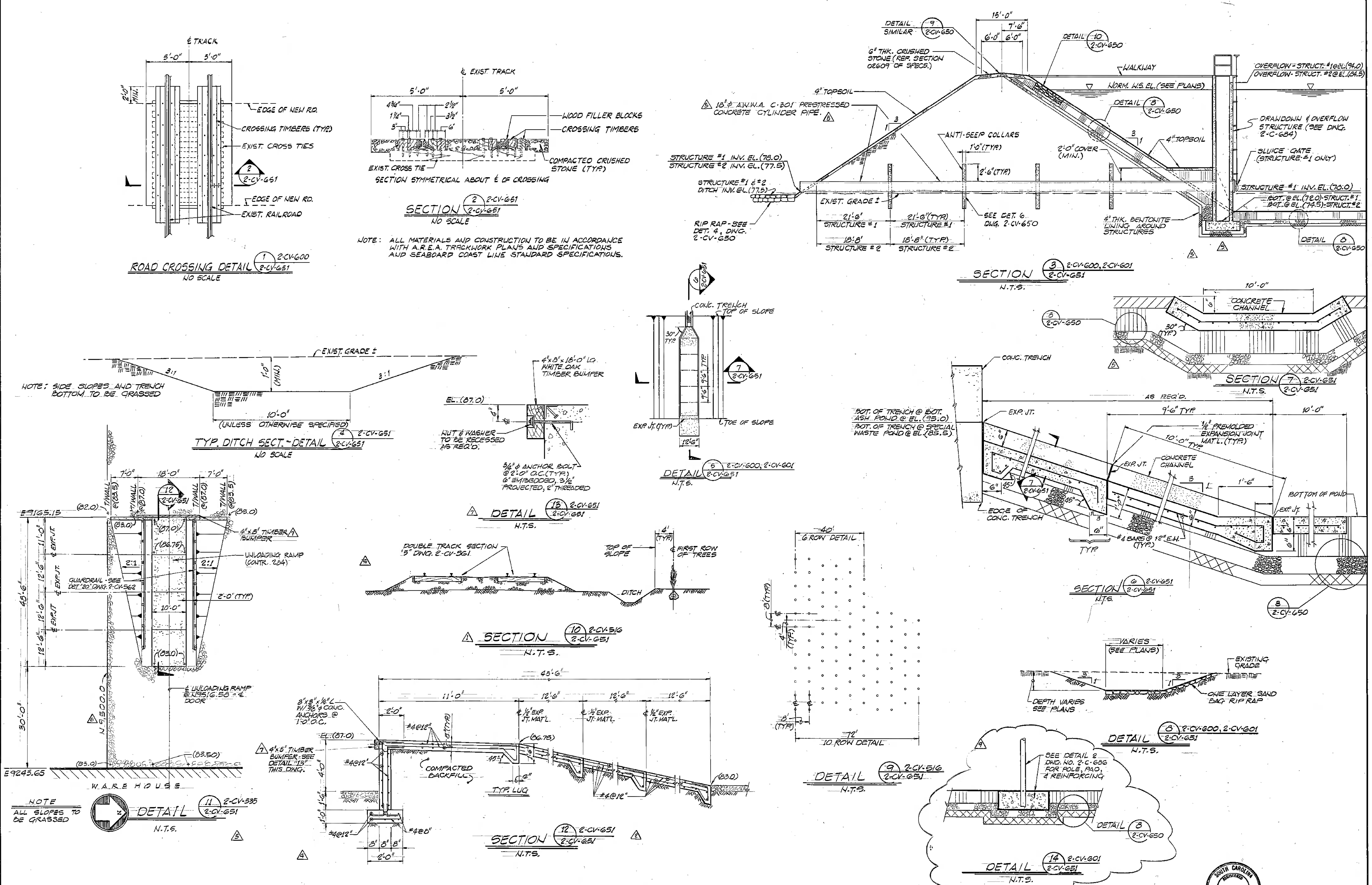
job name
SANTEE COOPER
CROSS GENERATING STATION UNIT 2
CROSS, SOUTH CAROLINA

sheet title
MISCELLANEOUS DETAILS AND SECTIONS

SOUTH CAROLINA REGISTERED 5444 ENGINEER P. E. DUGGINS

284 CONSTR. 72582 1
284 BID 1482 0
PKG. ISSUE DATE REV

scale AS NOTED
date 8-3-81
L-G JOB NO. 78271.01
B&R W.O. NO. 3446.02
dwg. no. 2-CV-650
rev. no. 1



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ARCHITECTS · ENGINEERS
SPARTANBURG, S.C.

B&R #200-00-0428

no	date	REVISION	by	ck.	appr.
4	4-16-82	REVISED DETAIL "9" & SECTION "10"	SDO		
3	3-25-82	REVISED SECT. 3 "HOLD" DET. 11 & ISSUED FOR CONSTRUCTION (CONTRACT 284)	CGA		
2	1-18-82	ADDED DETAIL "11" & SECTION "12"	CGA		
1	1-8-82	ADDED DETAIL "9" & SECTION "10"	CGA		
0	1-4-82	ISSUED FOR BIDS (CO 284)	SDO		

no	date	REVISION	by	ck.	appr.
9	9/9/82	ADDED DETAIL 14	CGA		
8	6/23/82	REVISED EFFLUENT PIPE DIAMETER	CGA		
7	5/26/82	ADDED DETAIL 13	CGA		
6	5/19/82	REV. LIMITS OF GRAVEL SURFACING	CGA		
5	5/12/82	REV. DET. "11", SECT. "7" & REV. PIPE SIZE	CGA		

drawn by CALAIS
dept. ck. McEntyre
dept. appr. D.R. Durilia
coord. ck.
p.m. appr.
B&R appr. 9/11/84

PKG	ISSUE	DATE	REV
284	CONSTR.	3-25-82	3
284	BID	1-4-82	0

job name: SANTEE COOPER
CROSS GENERATING STATION UNIT 2
CROSS, SOUTH CAROLINA

sheet title: MISCELLANEOUS DETAILS AND SECTIONS

scale: AS NOTED
date: 8-3-81
L-G JOB NO. 78271.01
B&R W.O. NO. 3446.02
dwg. no. 2-CV-651
rev. no. 9

AF 0248

4

BACKFILL WITH SANDY CLAY MATERIAL COMPACTED TO 95% STD. PROCTOR.

6" CLUMP CONCRETE BEDDING TO SPRING LINE.

STOP CONCRETE BEDDING CRADLE OUTSIDE OF DRAWDOWN STRUCTURE WALL.

CONCRETE PIPE SEE SPEC'S.

INV. ELEV.

6'-0" MINIM M

EXCAVATED SLOPES AS REQUIRED FOR CONSTRUCTION

DRAWDOWN PIPE BEDDING DETAIL THROUGH DIKES

NO SCALE

4

WALL PIPING (PLACE INTEGRALLY DURING THE POURING OF CONCRETE.)

LOOK JOINT PIPE Nº E-2-1994 TYPE I OR EQUAL

FLOW

DRAWDOWN STRUCTURE WALL

SPIGOT WALL FITTING DETAIL

NOTE: CONTRACT 284

1. COAT ALL CONCRETE & STEEL BELOW EL. 93'-0" (NO 1) OR EL. 83'-6" (Nº 2) W/BITUMASTIC COATING (SEE SPEC'S) ~ FOR FOOT BRIDGE COAT PORTION OF PIER CONCRETE BELOW EL. 93'-0" (NO. 1) OR EL. 82'-0" (Nº 2) WITH BITUMASTIC COATING.
2. ALL SUBMERGED STEEL TO BE STAINLESS STEEL. ALL STEEL ON TOP OF STRUCTURE TO BE GALVANIZED.

EXCAVATE TO GOOD BEARING MAT'L. ~ SEE NOTE AT SECT. 1/C-684

STRUCTURE

1'-0" 2'-0" 2'-0" 1'-0"

2'-0" 2'-0" 3'-0" 2'-0" 1'-0"

C-684

OPNG. FOR SLUICE GATE

#4 TIES @ 9"

4~#9 VERT (TYP.)

7'-0" 8'-0" 2'-0" 8'-0"

4'-0" 4'-0"

BOTT. PLAN ~ DRAWDOWN STA. NO. 1 & NO. 2

SCALE: 3/4" = 1'-0"

NOTE: OPENING FOR SLUICE GATE FOR DRAWDOWN STRUCTURE Nº 1 ONLY

STRUCTURE FOOT BRIDGE

FOOT BRIDGE ~ SEE PLAN THIS DWG

2-AB-1

BOLTS PUR. FOOT BRIDGE

EPOXY COATING

REMOVABLE HANDRAIL

4'-0" 4'-0"

TOP PLAN ~ DRAWDOWN STA. Nº 1 & Nº 2

SCALE: 3/4" = 1'-0"

NOTE: FOR LOCATION OF STRUCTURES SEE CIVIL DRAWINGS 2-CV-600 & CV-601

WATER SURFACE EL. 93'-0" Nº 1 WATER SURFACE EL. 83'-6" Nº 2

INV. EL. 78'-0" STR. Nº 1 INV. EL. 78'-6" STR. Nº 2

SLUICE GATE NOTE 8

SLUICE GATE REQ'D FOR STR. Nº 1 ONLY ~ USE ROONEY-HUNT INTEGRAL FRAME SLUICE GATE WITH BRONZE MOUNTED CAST IRON BODY, STAINLESS STEEL STEM, STAINLESS STEEL NUTS AND BOLTS, BRONZE WEDGES AND BRONZE BUSHED CAST IRON STEM GUIDES. ROONEY-HUNT TYPE F CAST IRON WALL THIMBLE WITH STAINLESS STEEL NUTS AND BOLTS FOR USE IN MOUNTING GATE TO STRUCTURE.
ROONEY-HUNT S-2000 HANDWHEEL & FLOOR STAND

STRUCTURE

T/STR EL. 95'-0"

T/WEIR EL. 94'-0"

PROJ. 2" 10" THD

6'-0" 3'-3" 6'-0" 6'-0"

4½" 4½"

3" 3"

FACE OF WALL

MAGNETIC (STAINLESS STL.)

EL. 78'-9"

18"ϕ OPNG FOR SLUICE GATE

ANCHOR BOLT AB-2

(8 REQ'D TOTAL)

ELEV. ANCHOR BOLT SETTING FOR SLUICE GATE ~ STR. Nº 1 ONLY

NTS

STRUCTURE

2'-6" 2'-0"

REMOVABLE HANDRAIL ~ SEE DET. 10/C-507

3 C-507 DETAIL

EL. 95'-0" STR. Nº 1 EL. 83'-6" STR. Nº 2

1½ GRTG

DETAIL 4 C-507

SEE ELEV. THIS DWG FOR SLUICE GATE ANCHOR BOLT SETTING (STR. 1 ONLY)

SLUICE GATE REQ'D FOR STR. Nº 1 ONLY ~ SEE SLUICE GATE NOTE THIS DWG

2'-0" 2'-0"

#6@12" E.W. U/ FACE

4-#5x5'-0" E.A. FACE

INV. EL. 72'-0" STR. Nº 1 ~ INV. EL. 74'-6" STR. Nº 2

INV. EL. 73'-0" STR. Nº 1 ONLY

2'-2"

P.V.C. WATERSTOP (TYP.)

CONC. FILL TO INV. OF PIPE

#5@12"

#5 BARS @ 12

3'-0"

3'-6" CL

BACKFILL W/ SELECT IMPERVIOUS FILL ~ COMPACTED TO 95% STD PROCTOR

EXCAVATED SLOPES AS REQUIRED FOR CONSTRUCTION

15'-0" (MIN.)

SECTION

1 C-684

SCALE: 3/16" = 1'-0"

FOR BENTONITE LINING, CRUSHED STONE LAYER, SUB-BASE, ETC. ~ SEE CIVIL DWGS 2-CV-650 & 651

HANDWHEEL

STRUCTURE

3 C-507 DETAIL

ACCESS BRIDGE

OVERFLOW WEIR EL. OF: STRUCTURE 1 ~ 94'-0" STRUCTURE 2 ~ 84'-6"

2'-0" 2'-0"

NEW CONC.

EXISTING CONC.

18"ϕ

18"ϕ

4

SLUICE GATE FLG GROUT IN PLACE

CONC. FILL TO INV. OF PIPE

15'-0" (MIN.)

SECTION

8 C-684

SCALE: 3/16" = 1'-0"

64'-6" Nº 1
28'-6" Nº 2

℄ DRAWDOWN STR. #I & II

2'-6"

6" 6"

T/DRAWDOWN STR. EL. SEE SECT.

DIAG BRACING L 3x3x¼ (GALV.) MAX. SPA. @ 10'-0" BTWN SUPP.

2-AB-1 (TYP.) SEE 2-C-684

T/PIER EL. SEE SECT.

44LH09 (GALV.)

44LH09 (GALV.)

1'-0" 2'-0" 2'-0" 1'-0"

2'-6" 3'-0" 3'-4" 3'-0" 3'-4"

2¾" 2¾"

1'-6" 2'-6"

2¾" PVC (TYP.) 4-THD

7'-6" 7'-6"

¼ GALV.

4"

FRAMING PLAN ~ FOOT BRIDGE TO DRAWDOWN STRUCTURE 1 & 2

(2 REQD) SCALE: 1/4" = 1'-0"

NOTE: FOR LOCATION SEE CIVIL DRAWING 2-CV-600 & 601
FOOT BRIDGE DESIGN L.L. ~ 100 PSF

ANCHOR BOLT AB-1

℄ DIKE

10'-0"

℄ FOOT BRIDGE

2'-6" 2'-6"

L 3x3x¼ BRACE @ 10'-0" ℄ MAX.

44LH (TYP.)

2"WD FL. SALT TREATED

5'-0" (TYP.)

¼" ℄ CONT

L 4x4x⅜ (GALV.) @ 10'-0" ℄ MAX. FROM END SUPPORTS

℄ BOLT

3/16 V 2-9

SECTION

5 C-684

EXCAVATE TO GOOD BEARING MATERIAL ~ SHOULD SOFT SILT OR CLAY SOILS BE ENCOUNTERED IN THE BOTT. OF THE EXCAVATION, SUCH MAT'L SHALL BE REMOVED & BACKFILLED W/ SELECT IMPERVIOUS FILL. ANY OVER EXCAVATION & BACKFILLING SHALL BE DONE AS DIRECTED BY THE ENGINEER

EL. 95'-0" Nº 1 EL. 83'-6" Nº 2

PROVIDE 2" SLOTTED CONN. THIS END ONLY

44LH

1" GROUT

2"WOOD FLOORING SALT TREATED (TYP.)

WATER SURFACE

SECTION

3 C-684

SCALE: 3/8" = 1'-0"

44LH

T/PIER EL. 95'-6" Nº 1
T/PIER EL. 86'-0" Nº 2

℄ DIKE

EL. 92'-0" Nº 1 EL. 82'-6" Nº 2

ALL REINF. #4@12"

1'-0" 1'-0" 2'-0"

SECTION

4 C-684

SCALE: 3/8" = 1'-0"

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 6883 EDWARD B. BLACKWELL

NOTES:

1. FOR GENERAL CONC. NOTES & STD DETAILS SEE DWG C-507

284 CONSTR.	3-25-82	2
284 ADDEM.	1-15-82	1
284 BIDS	1-15-82	0
284 REVIEW	11-24-81	B
284 FOR REVIEW	8-14-81	A
PRG ISSUE	DATE	REV.

B & #200-00-0433

-2- E. PIPE TO 1'
-21 REV. PIPE & T. 30" ~ DD SLUICE GATE AB'S — JF
-15-8 EV. 80 E. ~ ADD OTE ~ ADD OLD — F
11-5-82 R. OTE 0 GON, 284 — JF

drawn by J. ORD
dept. c
dept. appr
coord. ck.
p.m. appr.
B&R appr.

BURNS AND ROE, INC.
ENGINEERS AND CONSTRUCTORS
ORADELL, N. J. WOODBURY, N. Y. LOS ANGELES, CALIF. JACKSONVILLE, FLA.

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

job name
SANTEE COOPER
CROSS GENERATING STATION UNIT 2
CROSS, SOUTH CAROLINA

sheet title
DRAWDOWN STRUCTURE PLANS, SECTIONS, & DETAILS

scale
L-G JOB NO. 78271.01
B&R W.O. NO. 3446.02

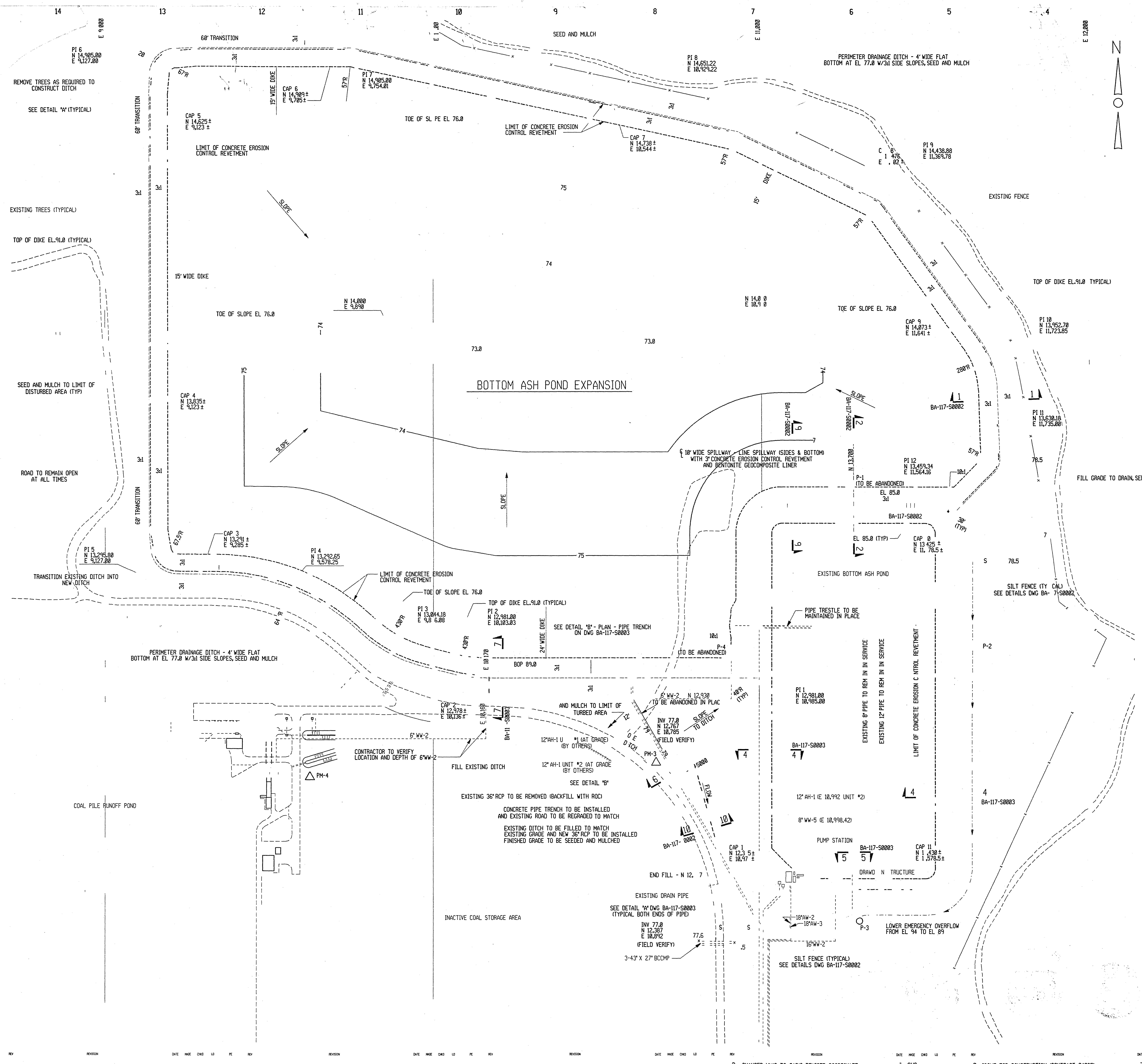
date

dwg. no. 2-C-684

rev. no. 4

BF POLYTRACE® 033

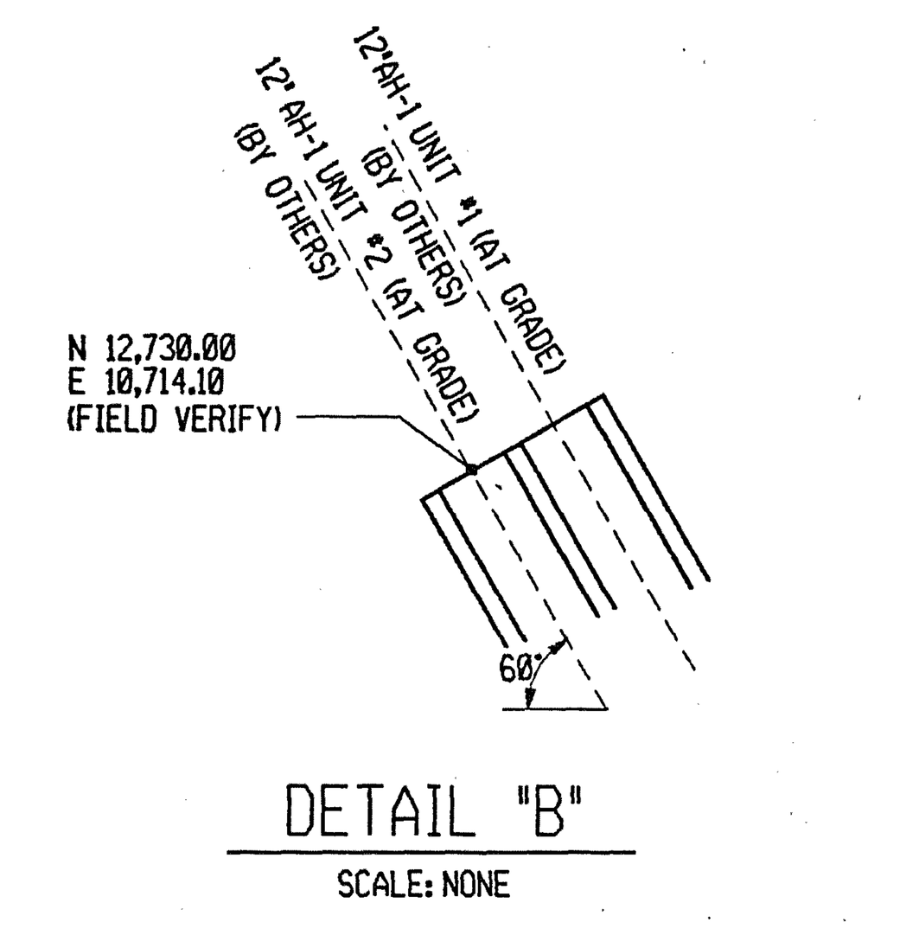
no date REVISION by ck. appr. no date REVISION by ck. app.



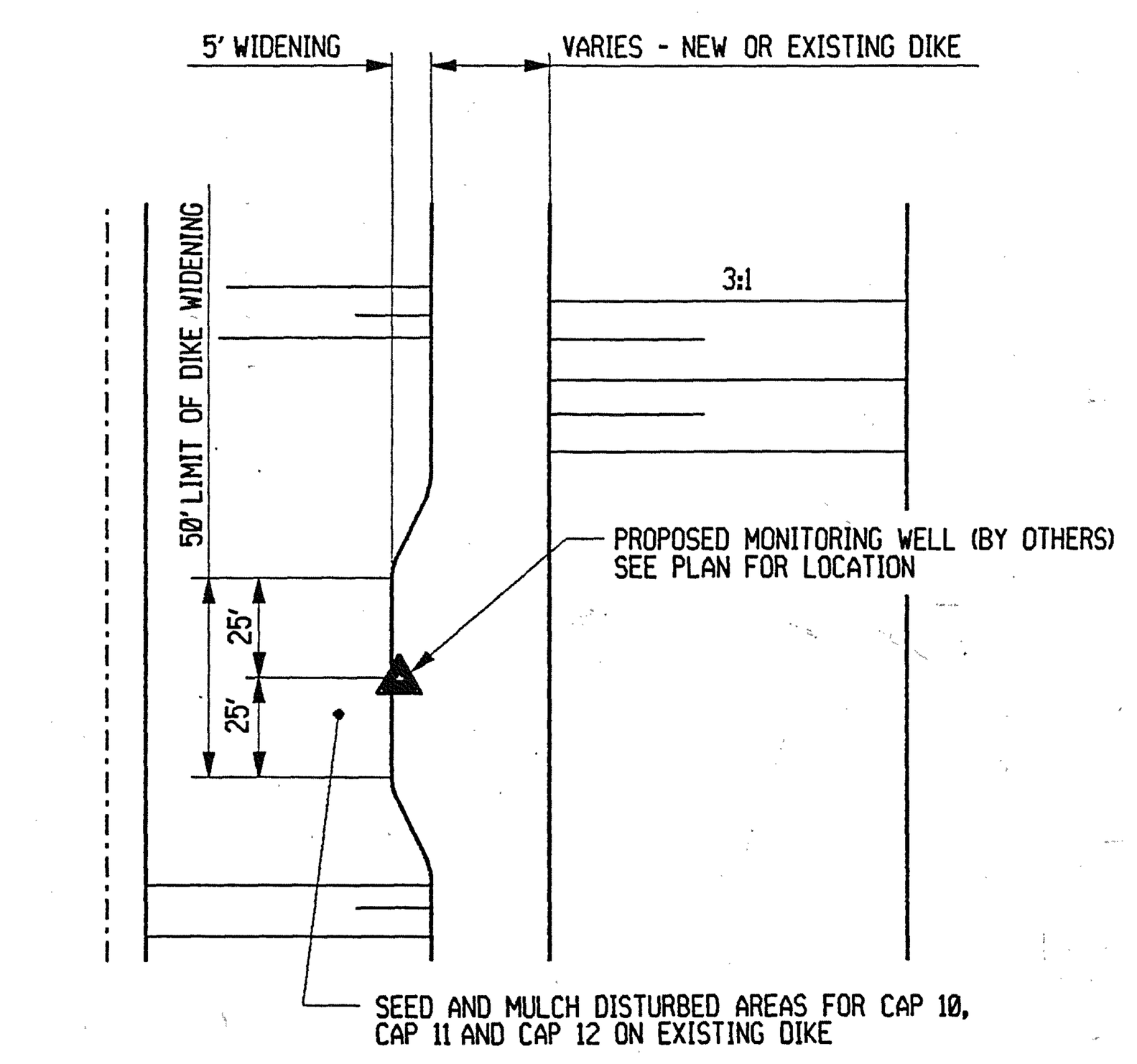
60' TRANSITION
SEED AND MULCH
PI 6
N 14,905.00
E 9,127.00
REMOVE TREES AS REQUIRED TO CONSTRUCT DITCH
SEE DETAIL 'A' (TYPICAL)
PI 8
N 14,651.22
E 10,929.22
PERIMETER DRAINAGE DITCH - 4' WIDE FLAT BOTTOM AT EL 77.0 W/3:1 SIDE SLOPES, SEED AND MULCH
PI 7
N 14,905.00
E 9,754.01
CAP 6
N 14,909 ±
E 9,705 ±
15' WIDE DIKE
CAP 5
N 14,625 ±
E 9,123 ±
TOE OF SL PE EL 76.0
LIMIT OF CONCRETE EROSION CONTROL REVETMENT
CAP 7
N 14,738 ±
E 10,544 ±
PI 9
N 14,438.88
E 11,369.78
EXISTING TREES (TYPICAL)
TOP OF DIKE EL.91.0 (TYPICAL)
EXISTING FENCE
15' WIDE DIKE
TOE OF SLOPE EL 76.0
N 14,000
E 9,890
N 14,0 0
E 10,9 0
TOE OF SLOPE EL 76.0
CAP 9
N 14,073 ±
E 11,641 ±
TOP OF DIKE EL.91.0 TYPICAL)
PI 10
N 13,952.70
E 11,723.85
SEED AND MULCH TO LIMIT OF DISTURBED AREA (TYP)
BOTTOM ASH POND EXPANSION
CAP 4
N 13,835 ±
E 9,123 ±
BA-117-S0002
PI 11
N 13,630.10
E 11,735.00
10' WIDE SPILLWAY - LINE SPILLWAY (SIDES & BOTTOM) WITH 3" CONCRETE EROSION CONTROL REVETMENT AND BENTONITE GEOCOMPOSITE LINER
ROAD TO REMAIN OPEN AT ALL TIMES
PI 12
N 13,459.34
E 11,564.16
P-1 (TO BE ABANDONED)
EL 85.0
FILL GRADE TO DRAIN, SEED AND MULCH
CAP 3
N 13,291 ±
E 9,285 ±
PI 5
N 13,295.80
E 9,127.00
PI 4
N 13,292.65
E 9,578.25
EL 85.0 (TYP)
CAP 8
N 13,425 ±
E 11,785 ±
TRANSITION EXISTING DITCH INTO NEW DITCH
LIMIT OF CONCRETE EROSION CONTROL REVETMENT
TOE OF SLOPE EL 76.0
EXISTING BOTTOM ASH POND
SILT FENCE (TYPICAL) SEE DETAILS DWG BA-117-S0002
PI 3
N 13,044.18
E 9,886.08
PI 2
N 12,981.00
E 10,103.03
TOP OF DIKE EL.91.0 (TYPICAL)
SEE DETAIL 'B' - PLAN - PIPE TRENCH ON DWG BA-117-S0003
PIPE TRESTLE TO BE MAINTAINED IN PLACE
PERIMETER DRAINAGE DITCH - 4' WIDE FLAT BOTTOM AT EL 77.0 W/3:1 SIDE SLOPES, SEED AND MULCH
24' WIDE DIKE
BOP 89.0
P-4 (TO BE ABANDONED)
EXISTING 8" PIPE TO REM IN IN SERVICE
EXISTING 12" PIPE TO REM IN IN SERVICE
LIMIT OF CONCRETE EROSION CONTROL REVETMENT
CAP 2
N 12,978 ±
E 10,136 ±
AND MULCH TO LIMIT OF TURBED AREA
6" WW-2 N 12,930 TO BE ABANDONED IN PLAC
PI 1
N 12,981.00
E 10,985.00
6" WW-2
INV 77.0
N 12,767
E 10,785
(FIELD VERIFY)
CONTRACTOR TO VERIFY LOCATION AND DEPTH OF 6" WW-2
FILL EXISTING DITCH
12" AH-1 UNIT #1 (AT GRADE) (BY OTHERS)
12" AH-1 UNIT #2 (AT GRADE (BY OTHERS)
SEE DETAIL 'B'
PM-3
PM-4
BA-117-S0003
EXISTING 36" RCP TO BE REMOVED (BACKFILL WITH ROC)
CONCRETE PIPE TRENCH TO BE INSTALLED AND EXISTING ROAD TO BE REGRADED TO MATCH
EXISTING DITCH TO BE FILLED TO MATCH EXISTING GRADE AND NEW 36" RCP TO BE INSTALLED FINISHED GRADE TO BE SEEDED AND MULCHED
COAL PILE RUNOFF POND
12" AH-1 (E 10,992 UNIT #2)
8" WW-5 (E 10,998.42)
PUMP STATION
CAP 1
N 12,3 5 ±
E 10,97 ±
CAP 11
N 1 ,430 ±
E 1 ,578.5 ±
DRAWD N TRUCTURE
END FILL - N 12, 7
EXISTING DRAIN PIPE
SEE DETAIL 'A' DWG BA-117-S0003 (TYPICAL BOTH ENDS OF PIPE)
INV 77.0
N 12,387
E 10,892
(FIELD VERIFY)
INACTIVE COAL STORAGE AREA
18" AW-2
18" AW-3
P-3
LOWER EMERGENCY OVERFLOW FROM EL 94 TO EL 89
3-43' X 27" BCCMP
16" WW-2
SILT FENCE (TYPICAL) SEE DETAILS DWG BA-117-S0002

LEGEND

- ○ EXISTING PIEZOMETER LOCATION (APPROX)
- △ EXISTING MONITORING WELL LOCATION (APPROX)
- —74— FINAL TOP OF LINER CONTOUR
- • 72.0 FINAL GRADE ELEVATION
- CAP 11 ▲ PROPOSED MONITORING WELL (BY OTHERS)



DETAIL "B"
SCALE: NONE



DETAIL "A"
WIDENING OF DIKE FOR MONITORING WELL INSTALLATION
SCALE : NONE

NOTES :
1. PI COORDINATES FOR THE BOTTOM ASH POND EXPANSION DIKE LOCATION WERE OBTAINED FROM TRICO ENGINEERING AND SURVEYING, INC DRAWING SL 091-009.

REFERENCES :

BA-117-S0002	BOTTOM ASH POND EXPANSION - SECTIONS AND DETAILS
BA-117-S0003	BOTTOM ASH POND EXPANSION - SECTIONS AND DETAILS

REV	REVISION	DATE	MADE	CHKD	LD	PE
3	CHANGED MW'S TO CAP'S. REVISED COORDINATE LOCATIONS OF CAPS. ADDED CAPS 2, 3, 4 AND 12. (CONTRACT 04085)		GHC			EFK
	ISSUE FOR INFORMATION ONLY (CONTRACT 04032)	2-4-94				EFK
0	ISSUE FOR CONSTRUCTION (CONTRACT 04085)		GHC	DRE	VND	EFK
1	REMOVED IRRELEVANT ELEVATION NUMBERS (CONTRACT 04085)		VND	DRE	VND	EFK
2	CHANGED BOTTOM ASH POND DIKE ALIGNMENT PER TRICO ENGINEERING & SURVEYING, INC MODIFICATIONS. INCREASED TOP OF SOUTH DIKE TO 24' WIDE FROM 15' WIDE AND RELOCATED PIPE TRENCH (CONTRACT 04085)		GHC	DRE	VND	EFK

100 0 50 100 200
SCALE IN FEET

DRAWN BY GHC

Santee Cooper
CROSS GENERATING STATION
UNIT 1
BOTTOM ASH POND EXPANSION
PLAN

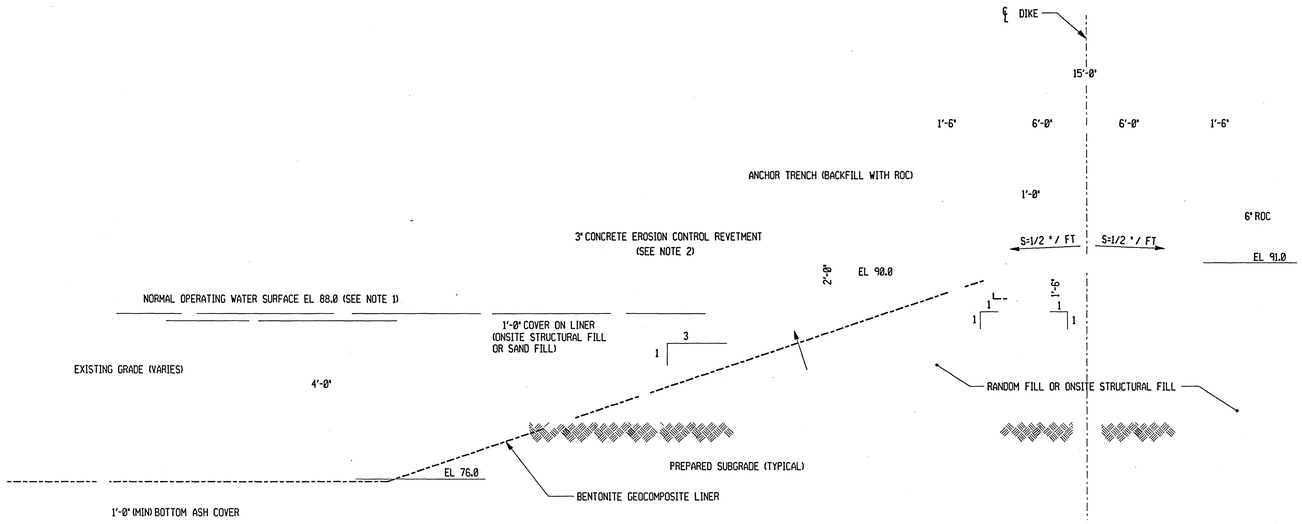
GILBERT/COMMONWEALTH, INC.
ENGINEERS AND CONSULTANTS READING, PA

Scale: 1"=100'
W.O. 046151

BA-117-S0001 3
DRAWING NUMBER REV

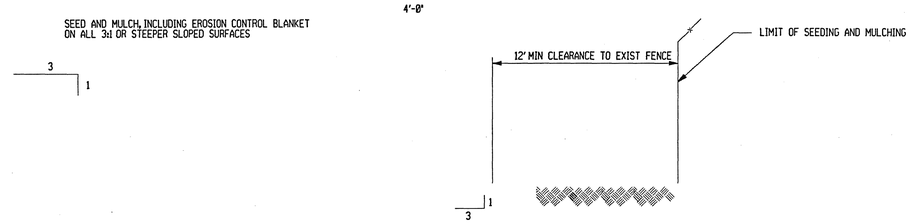
PROPOSED BOTTOM ASH POND EXPANSION

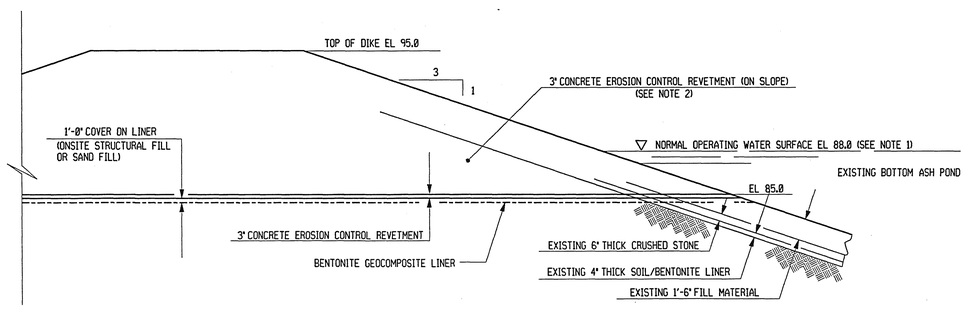
Wed Feb 24 10:51:17 1993
33100\117S0002.DGN



SECTION 1 - 1

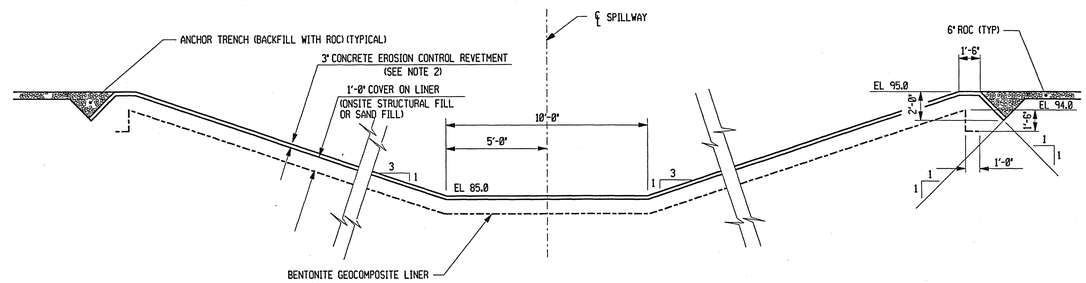
SCALE : 1"=4'
(BA-117-S0001)





SECTION 2 - 2

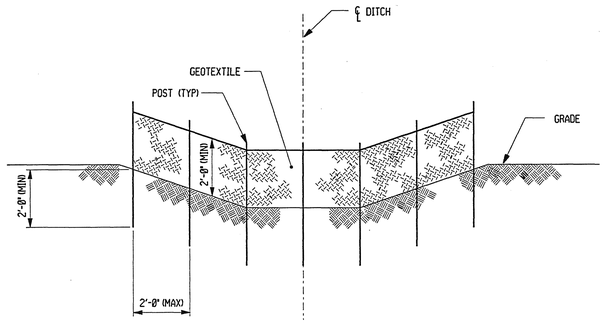
SCALE : 1"=4'
(BA-117-S0001)



SECTION 3 - 3

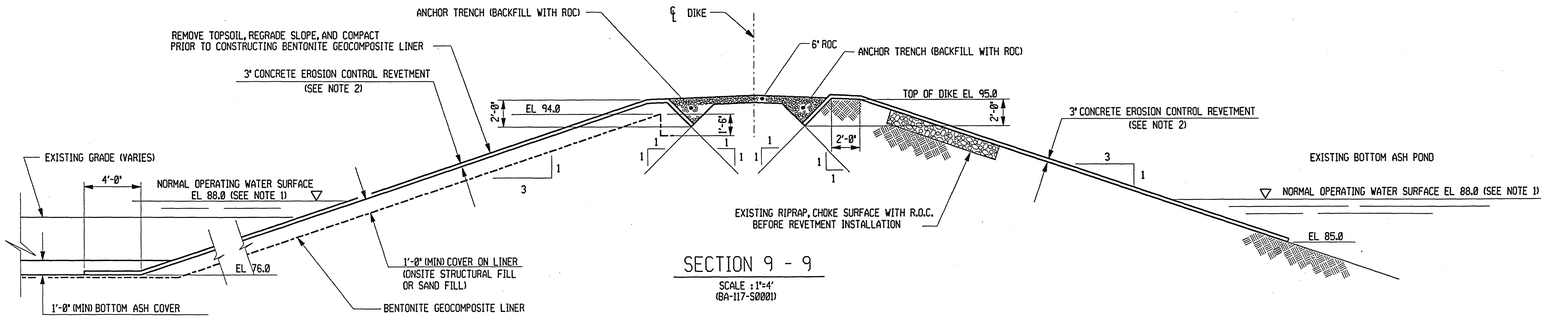
SPILLWAY SECTION ALONG ℄ OF DIKE

NO SCALE
(BA-117-S0001)



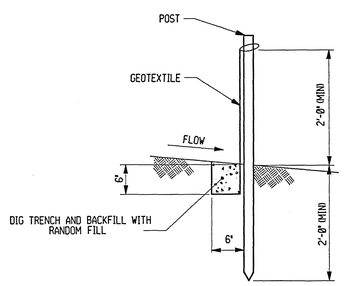
SILT FENCE SEDIMENT BARRIER
PLACEMENT IN DRAINAGE WAY

SCALE : ½" = 1'-0"



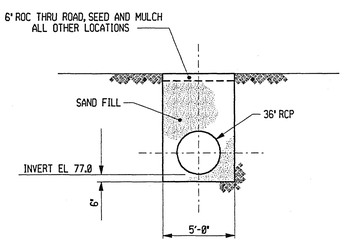
SECTION 9 - 9

SCALE : 1"=4'
(BA-117-S0001)



SILT FENCE SEDIMENT
BARRIER INSTALLATION

NO SCALE



SECTION 10 - 10

NO SCALE
(BA-117-S0001)

NOTES :

1. WATER SURFACE IN THE EXISTING BOTTOM ASH POND WILL BE UP TO ELEVATION 93.0 UNTIL THE ASH IS DREDGED FROM THE POND.
2. CONCRETE EROSION CONTROL REVETMENT SHALL BE ARMORFORM OR FABRIFORM AS SPECIFIED IN SECTION 02645 OF THE TECHNICAL SPECIFICATIONS.

BA-117-S0001	BOTTOM ASH POND EXPANSION - PLAN
BA-117-S0003	BOTTOM ASH POND EXPANSION - SECTIONS AND DETAILS

REGISTERED PROFESSIONAL ENGINEER — SOUTH CAROLINA — No. 14328 — DAVID R. ERAL
David R. Eral

REV	REVISION	DATE	MADE	CHKD	LD	PE
0	ISSUE FOR CONSTRUCTION (CONTRACT 04085)	3/4	GNC	DRE	3/10	EFK
	ISSUE FOR INFORMATION ONLY (CONTRACT: 04032)	2-4	W	M	H	EFK

DRAWN BY GNC. CHECKED BY DRE 3/10/93 DATE 3/4/93
Discipline Review
MECH
ELECT
CONTROLS
STRUCT D.R.Eral 3/10/93
PE E.F.Knox 4/4/93
Approved For Use T. J. - 5/26/93
Scale: AS NOTED E
W.O. 046151

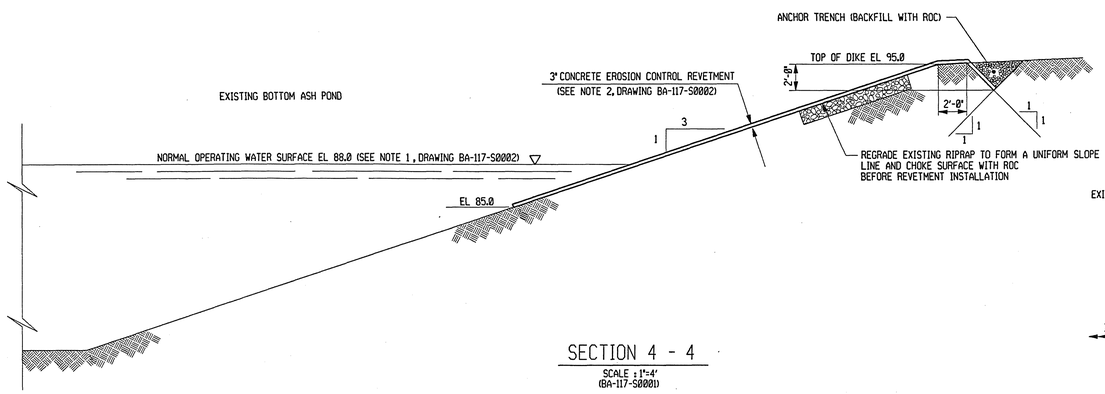
Santee Cooper CROSS GENERATING STATION
UNIT 1

BOTTOM ASH POND EXPANSION
SECTIONS AND DETAILS

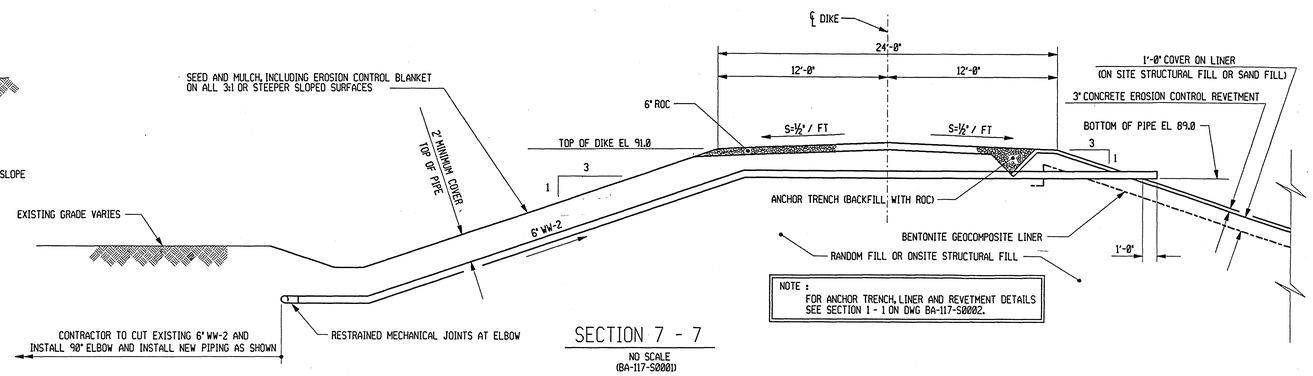
GILBERT/COMMONWEALTH, INC.
ENGINEERS AND CONSULTANTS READING, PA

UNIT 2 DWG. NO. BA-117-S0002 0
DRAWING NUMBER REV

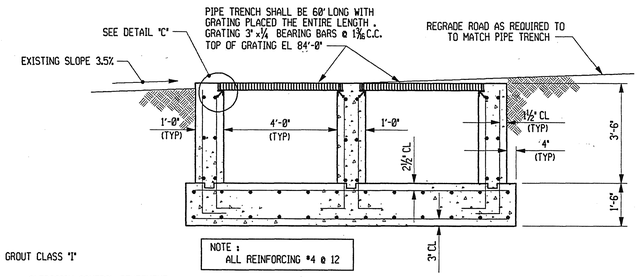
SECTIONS AND DETAILS



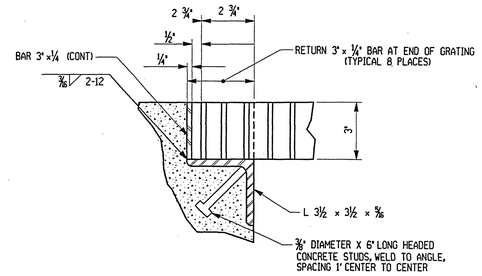
SECTION 4 - 4
SCALE : 1"=4'
(BA-117-S0001)



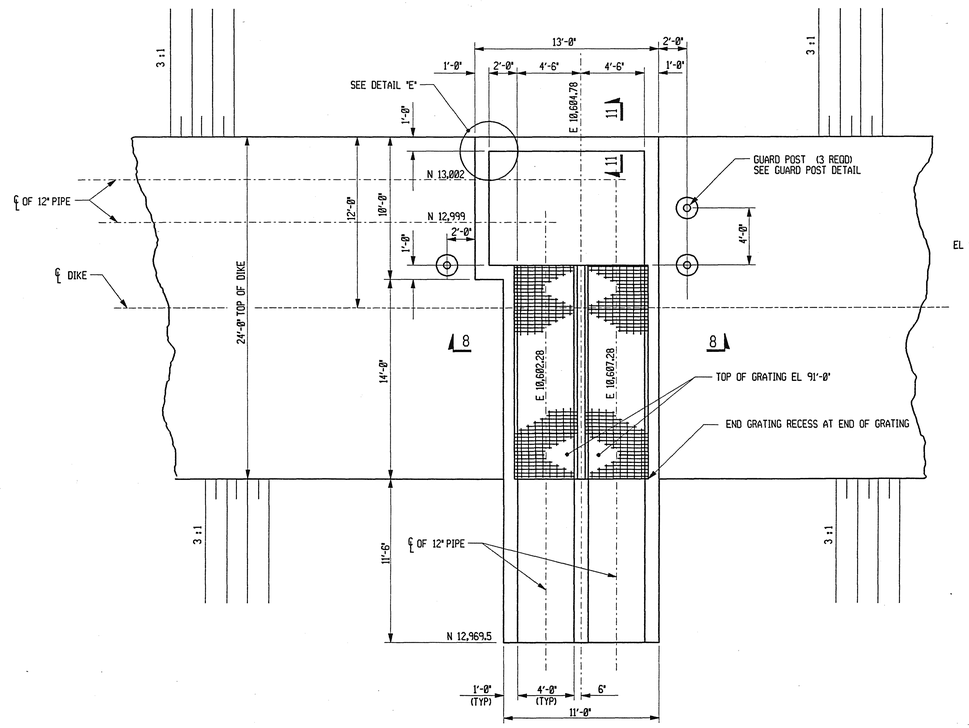
SECTION 7 - 7
NO SCALE
(BA-117-S0001)



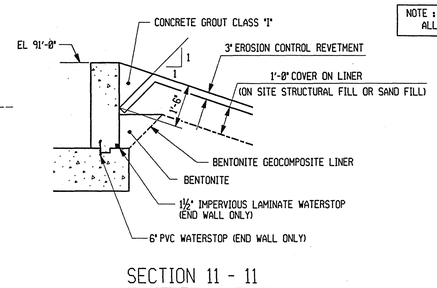
SECTION 6 - 6
NO SCALE
(BA-117-S0001)



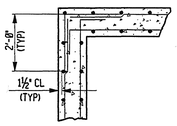
DETAIL "C"
NO SCALE



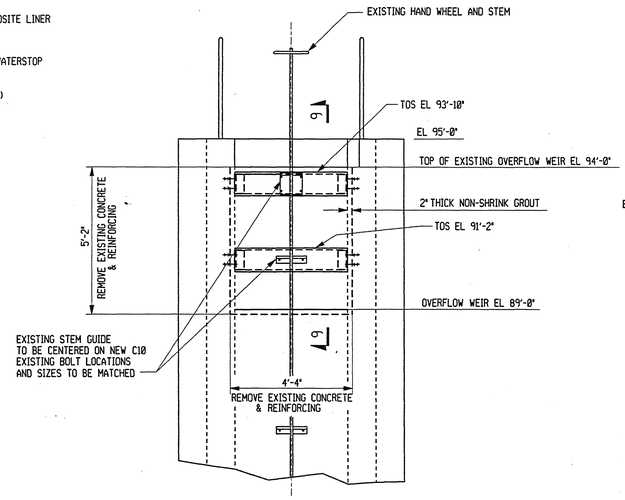
DETAIL "B " - PLAN - PIPE TRENCH
NO SCALE



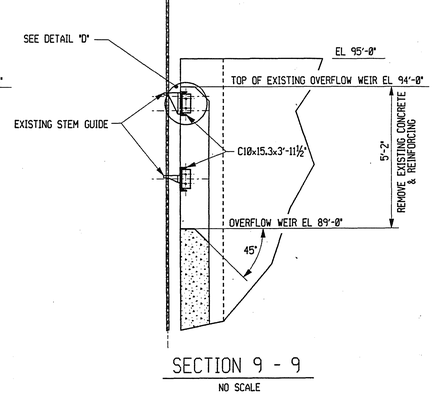
SECTION 11 - 11
NO SCALE



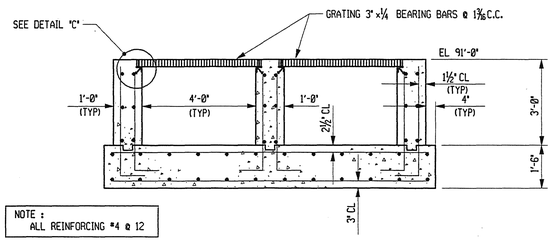
DETAIL "E"
TYPICAL CORNER REINFORCEMENT
NO SCALE



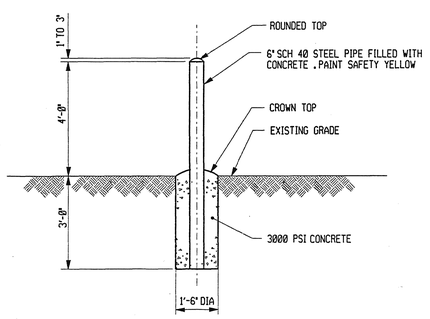
SECTION 5 - 5
NO SCALE
(BA-117-S0001)



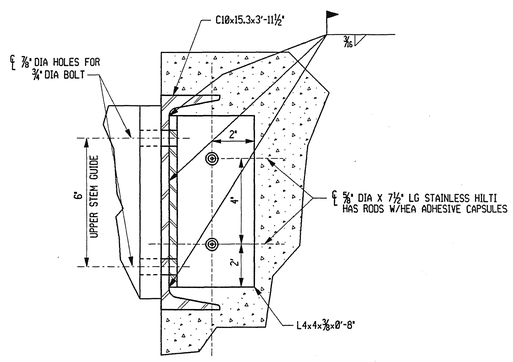
SECTION 9 - 9
NO SCALE



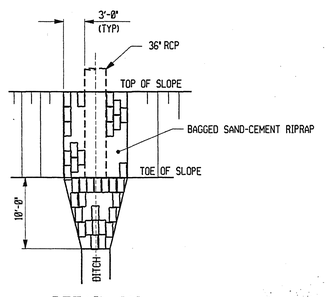
SECTION 8 - 8
NO SCALE



GUARD POST DETAIL
NO SCALE



DETAIL "D "
NO SCALE



DETAIL "A"
NO SCALE
(BA-117-S0001)

REFERENCES :

BA-117-S0001	BOTTOM ASH POND EXPANSION - PLAN
BA-117-S0002	BOTTOM ASH POND EXPANSION - SECTIONS AND DETAILS

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 14328 DAVID R. ERAL

REV	REVISION	DATE	MADE	CHKD	LD	PE
0	ISSUE FOR CONSTRUCTION (CONTRACT 04085)	2-24-93	G.H.C.	DRE	WHD	EFK
1	CHANGED SECTION 7 - 7, INCREASED TOP OF DIKE TO 24' FROM 15', CHANGED DETAIL "B", ALTERED SIZE AND SHAPE OF PIPE TRENCH ADDED GUARD POSTS AND GUARD POST DETAIL. (CONTRACT 04085) ISSUE FOR INFORMATION ONLY (CONTRACT 04032)	2-9-94	G.H.C.	WH		EFK

DRAWN BY G.H.C. · CHECKED BY D.R.E. · DATE 1-4-93 Discipline Review

MECH
ELECT
CONTROLS
STRUCT D.R. Eral Jr. Inter
PE D.R. Eral Approved For Use

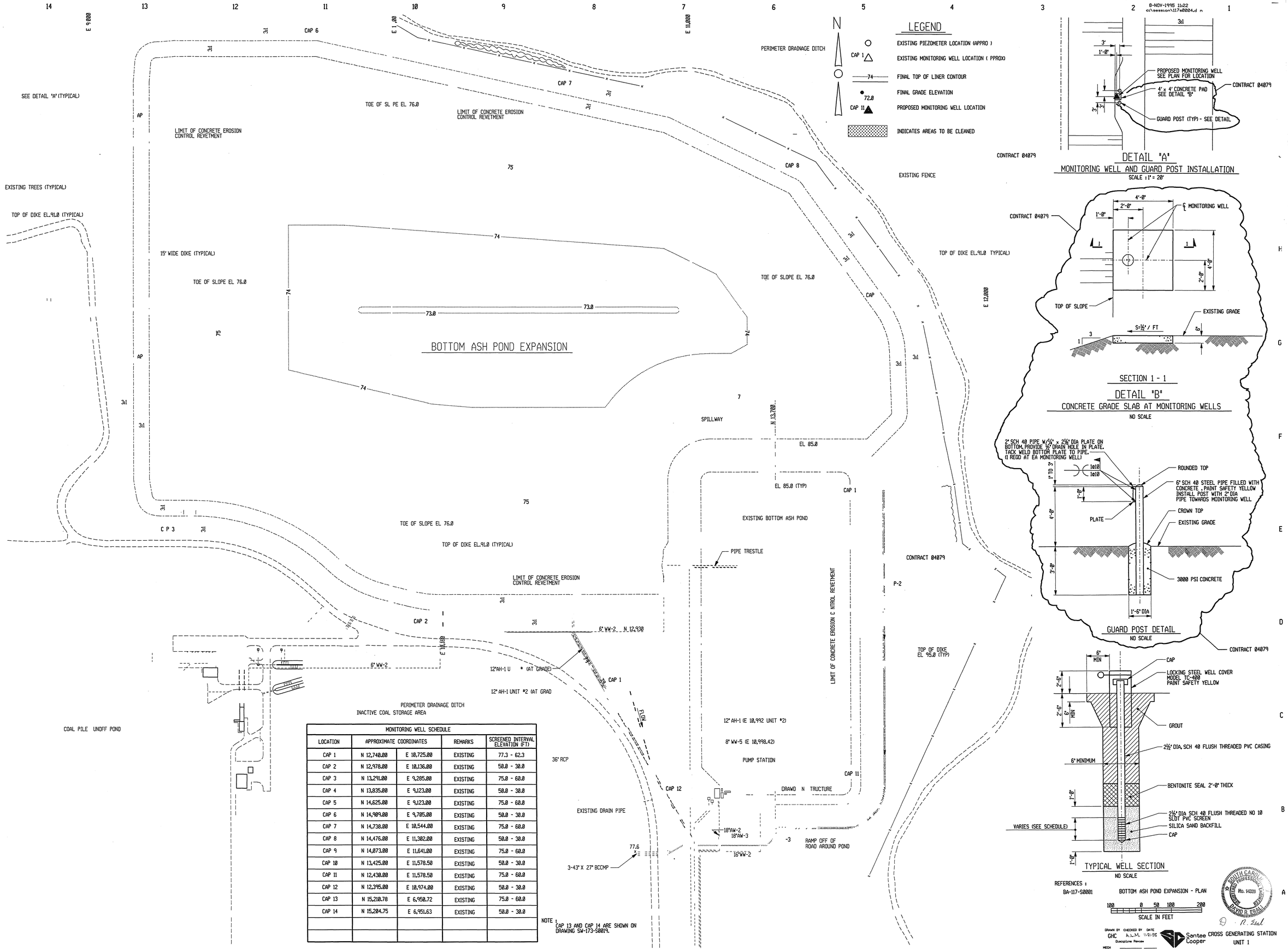
Santee Cooper CROSS GENERATING STATION
UNIT 1

BOTTOM ASH POND EXPANSION
SECTIONS AND DETAILS

GILBERT/COMMONWEALTH, INC.
ENGINEERS AND CONSULTANTS READING, PA

Scale: AS NOTED E
W.O. 046151
UNIT 2 DWG. NO.
BA-117-S0003 1
DRAWING NUMBER REV

8-NOV-1995 11:22
c:\session\117s0004.dgn



MONITORING WELL SCHEDULE				
LOCATION	APPROXIMATE COORDINATES		REMARKS	SCREENED INTERVAL ELEVATION (FT)
CAP 1	N 12,740.00	E 10,725.00	EXISTING	77.3 - 62.3
CAP 2	N 12,978.00	E 10,136.00	EXISTING	50.0 - 30.0
CAP 3	N 13,291.00	E 9,285.00	EXISTING	75.0 - 60.0
CAP 4	N 13,835.00	E 9,123.00	EXISTING	50.0 - 30.0
CAP 5	N 14,625.00	E 9,123.00	EXISTING	75.0 - 60.0
CAP 6	N 14,909.00	E 9,705.00	EXISTING	50.0 - 30.0
CAP 7	N 14,738.00	E 10,544.00	EXISTING	75.0 - 60.0
CAP 8	N 14,476.00	E 11,302.00	EXISTING	50.0 - 30.0
CAP 9	N 14,073.00	E 11,641.00	EXISTING	75.0 - 60.0
CAP 10	N 13,425.00	E 11,578.50	EXISTING	50.0 - 30.0
CAP 11	N 12,438.00	E 11,578.50	EXISTING	75.0 - 60.0
CAP 12	N 12,395.00	E 10,974.00	EXISTING	50.0 - 30.0
CAP 13	N 15,210.78	E 6,950.72	EXISTING	75.0 - 60.0
CAP 14	N 15,204.75	E 6,951.63	EXISTING	50.0 - 30.0

NOTE : CAP 13 AND CAP 14 ARE SHOWN ON DRAWING SW-173-S0019.

DETAIL "A"
MONITORING WELL AND GUARD POST INSTALLATION
SCALE : 1" = 20'

TYPICAL WELL SECTION
NO SCALE

REFERENCES :
BA-117-S0021

BOTTOM ASH POND EXPANSION - PLAN
100 0 50 100 200
SCALE IN FEET

SOUTH CAROLINA PROFESSIONAL ENGINEER DAVID R. ERAL No. 14328

D. R. Eral

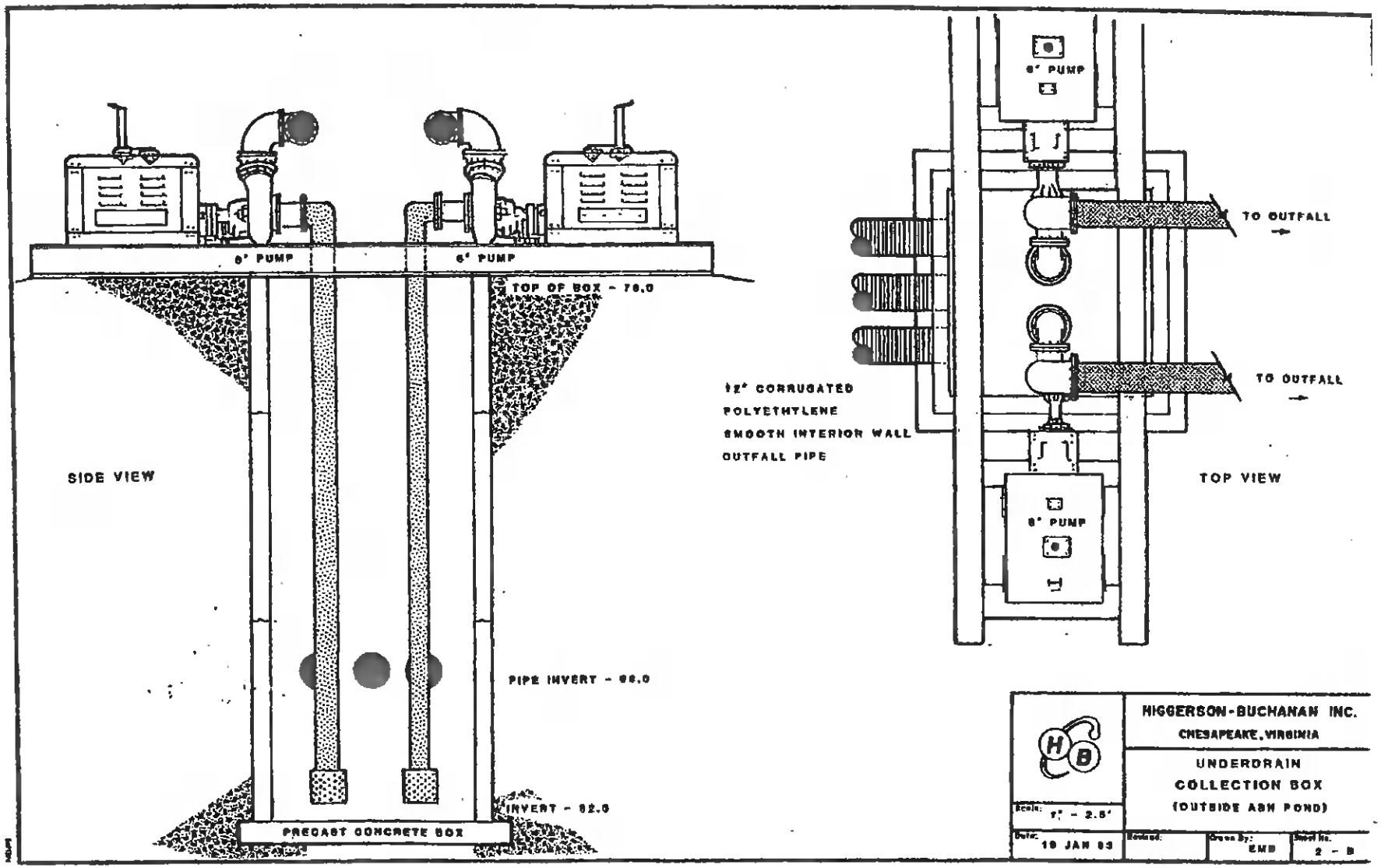
REV	REVISION	DATE	MADE	CHKD	LD	PE
0	ISSUE FOR CONSTRUCTION (CONTRACT 04079)	-	KPF	ALM	ALM	EFK
1	ISSUED FOR RECORD - INCORPORATED AS-BUILT MARK-UPS SUBMITTED BY CONTRACTOR	11/21/95	KPF	ALM	ALM	EFK

DRAWN BY GHC CHECKED BY A.L.M. DATE 11-21-95
Discipline Review
MECH
ELECT
CONTROLS
STRUCT
PE
Approved For Use 11-21-95
Scale: 1"=100'
W.O. 046151

Santee Cooper CROSS GENERATING STATION UNIT 1
BOTTOM ASH POND EXPANSION
MONITORING WELL LOCATION PLAN

GILBERT/COMMONWEALTH, INC.
ENGINEERS AND CONSULTANTS READING, PA
UNIT 2 DWG. NO.
BA-117-S0004 1
DRAWING NUMBER REV

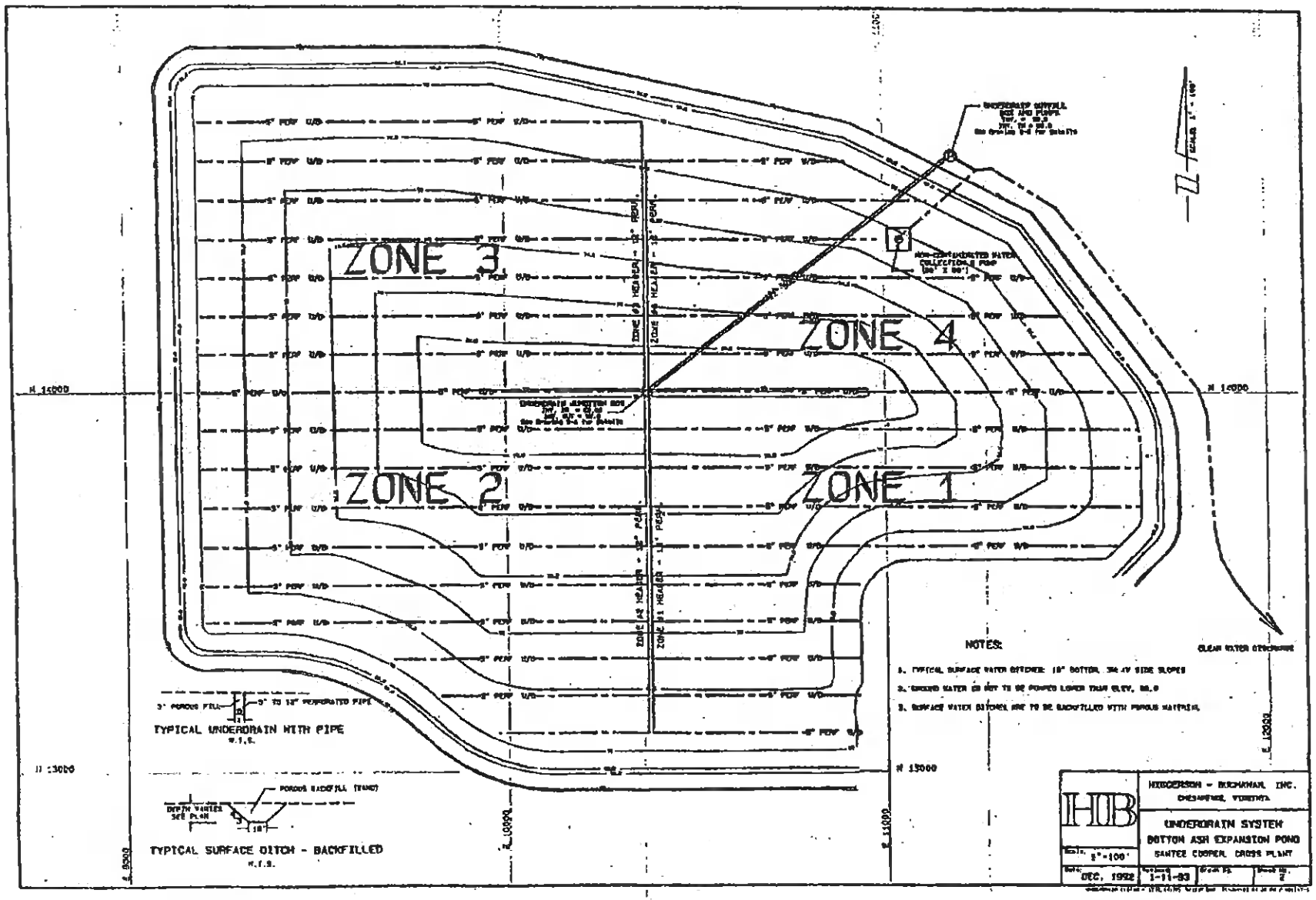
MONITORING WELL LOCATION PLAN

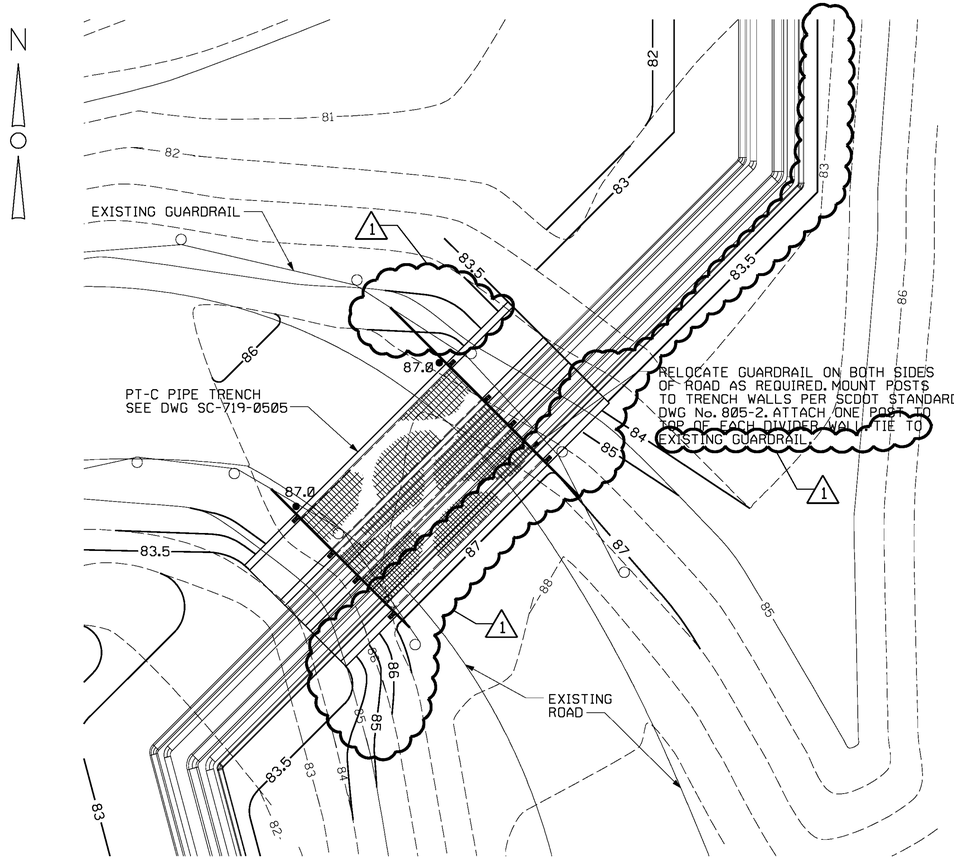


HIGGERSON-BUCHANAN INC.
CHESAPEAKE, VIRGINIA

UNDERDRAIN
COLLECTION BOX
(OUTSIDE ASH POND)

Scale: 1" = 2.5'	Date: 19 JAN 83	Revised:	Drawn By: EMB	Sheet No. 2 - B

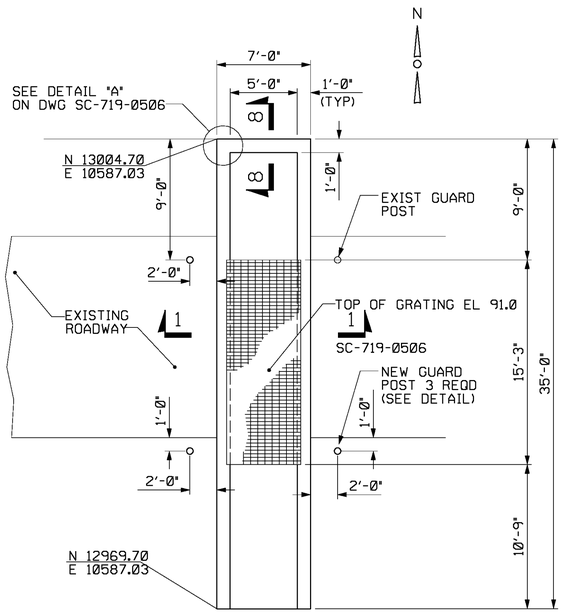

ZONE 3
ZONE 4
ZONE 2
ZONE 1
NOTES:
TYPICAL UNDERDRAIN WITH PIPE
TYPICAL SURFACE DITCH - BACKFILLED
HIB
HENDERSON - BUCHANAN, INC.
CHESAPEAKE, VIRGINIA
UNDERDRAIN SYSTEM
BOTTOM ASH EXPANSION POND
SANTEE COOPER, CROSS PLANT
DEC. 1992
1-11-83



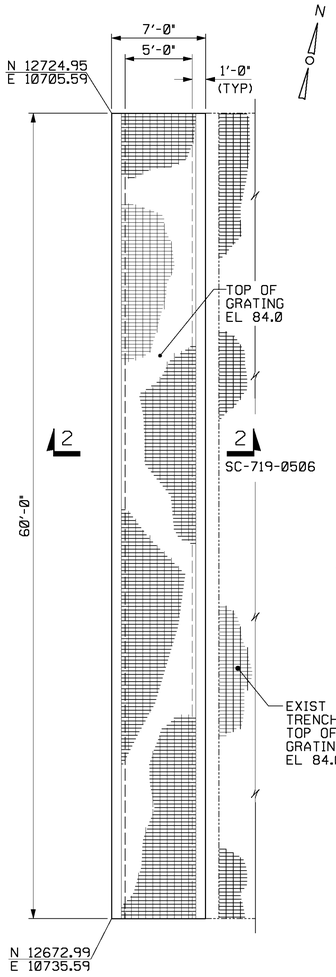
0 10 20 30

SCALE IN FEET

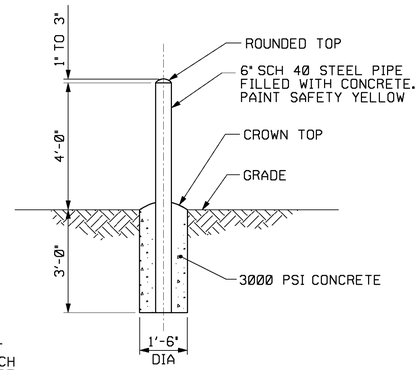
ENLARGED PLAN "A"
SCALE: 1"=10'
(SC-716-0507)



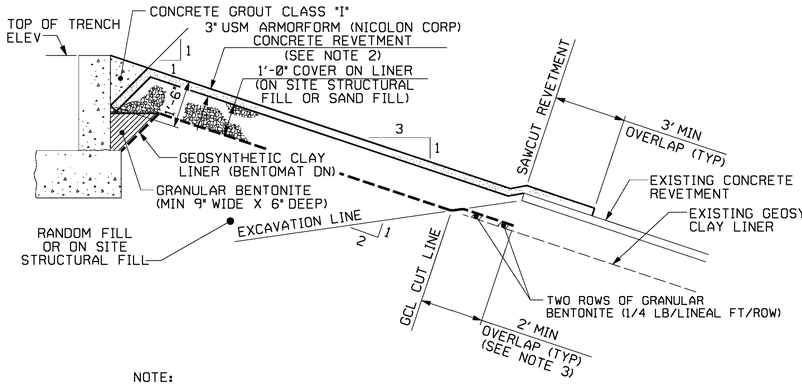
PLAN
PT-A PIPE TRENCH
SCALE: 3/16"=1'-0"
(SC-716-0507)



PLAN
PT-B PIPE TRENCH
SCALE: 3/16"=1'-0"
(SC-716-0507)



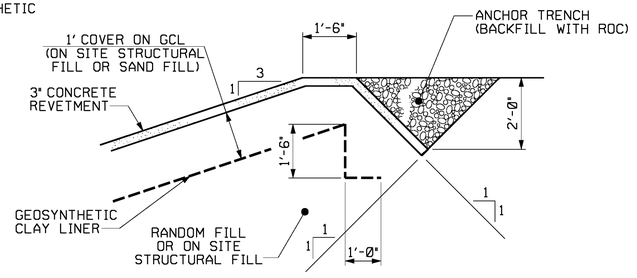
GUARD POST DETAIL
NO SCALE
(SC-716-0507)



NOTE:

1. CONCRETE REVETMENT AND GEOSYNTHETIC CLAY LINER SHALL BE INSTALLED PER MANUFACTURER'S REQUIREMENTS.
2. EQUIVALENT FABRIFORM CONCRETE REVETMENT MANUFACTURED BY CONSTRUCTION TECHNIQUES, INC. MAY BE USED AS ALTERNATE.
3. GCL OVERLAP SEAMS PARALLEL TO THE POND SLOPE SHALL BE MINIMUM 6" WITH ONE ROW OF GRANULAR BENTONITE APPLIED AT ¼ LB/LINEAR FT

SECTION 8-8
TYPICAL LINER ATTACHMENT DETAIL
NO SCALE
(SC-719-0503, SC-719-0505)



TYPICAL LINER ANCHOR TRENCH DETAIL
NO SCALE

REV	DATE	DESCRIPTION	DR CHK	LD ENGR	LDE
1	02/07/05	REV ENL PLAN "A" RELEASED HOLD	JKF ALM	KPF DRE	DRE
0	09/20/04	ISSUED FOR CONSTR	KPF ALM	KPF DRE	DRE

DRAWN BY: KPF	ENGINEER: D.R. ERALI
CHECKED BY: A.L. MERKEL	PROJECT ENGINEERING MANAGER: P.K. SHEWCHUK
LEAD DESIGNER: K.P. FEEG	PROJECT MANAGER: J.T. HICKSON
PRELIMINARY STATUS — DATE — LDE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS — DATE — LDE D.R. ERALI 02/07/05	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — PARSONS ENERGY & CHEMICALS GROUP INC. No. C01505 — CERTIFICATE OF AUTHORIZATION

PROFESSIONAL ENGINEER'S SEAL

THIS DOCUMENT ORIGINALLY ISSUED AND SEALED BY DAVID R. ERALI P.E. NO. 14328 ON 02/07/05 THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT.

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: DAVID R. ERALI STATE: SOUTH CAROLINA LIC. NO.: 14328 DATE: 02/07/05

CROSS GENERATING STATION / UNIT 3

Santee Cooper — PE&C Parsons Energy & Chemicals Group Inc.

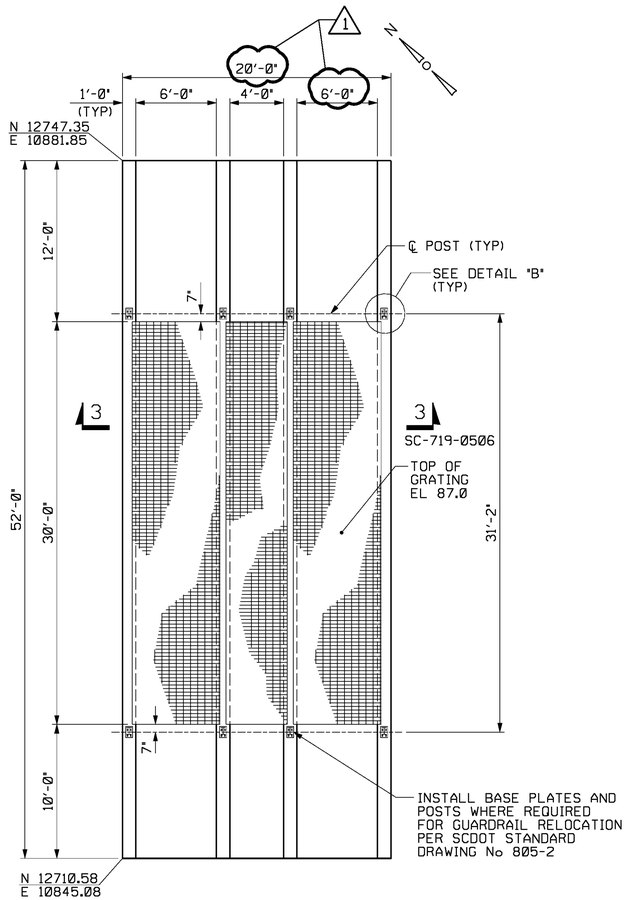
YARD AREA FOUNDATIONS
ASH POND SITE WORK
PIPE TRENCH PLANS AND DETAILS

SCALE: AS NOTED — JOB NO.: 537365

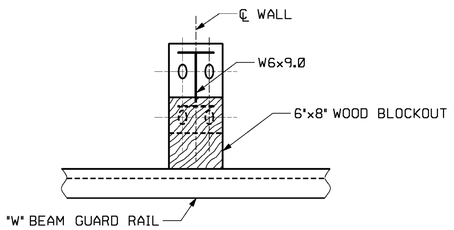
PE&C DWG. NO.: CR34-3-DW-SC-719-0503 — REV: 1

FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

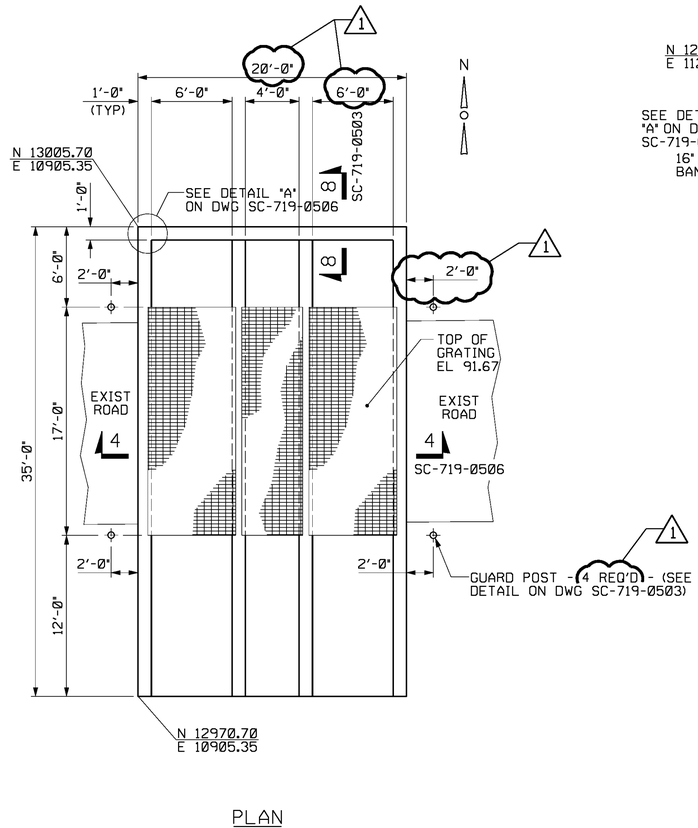
PE&C-FILE: cr-34-3-dw-sc-719-0503.dgn
PE&C-DATE: 06-Jan-05 10:31



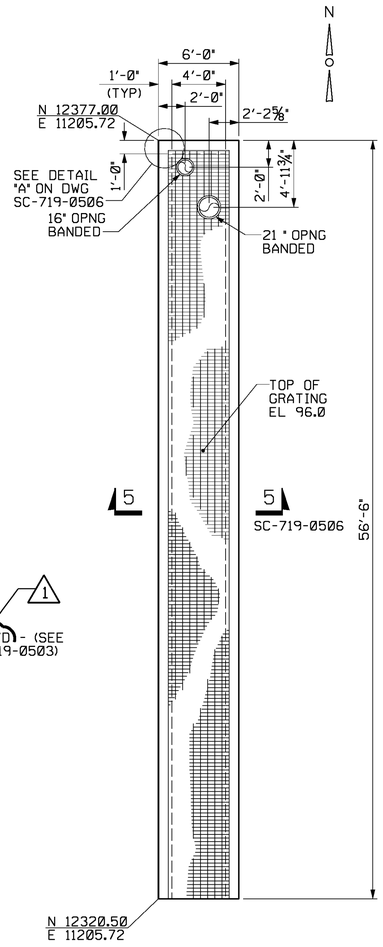
PLAN
PT-C PIPE TRENCH
SCALE: 3/16"=1'-0"
(SC-716-0507)



DETAIL "B"
SCALE: 1½"=1'-0"



PLAN
PT-D PIPE TRENCH
SCALE: 3/16"=1'-0"
(SC-716-0507)



PLAN
PT-E PIPE TRENCH
SCALE: 3/16"=1'-0"
(SC-716-0507)

DRAWN BY: GJU	ENGINEER: D.R. ERALI
CHECKED BY: A.L. MERKEL	PROJECT ENGINEERING MANAGER: P.K. SHEWCHUK
LEAD DESIGNER: K.P.FEEG	PROJECT MANAGER: J.T. HICKSON
PRELIMINARY STATUS LDE DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS LDE D.R. ERALI 02/07/05	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL

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CROSS GENERATING STATION / UNIT 3

Santee Cooper

PE&C Parsons Energy & Chemicals Group Inc.

REV	DATE	DESCRIPTION	DR CHK	LD ENGR	LDE
1	02/07/05	REV PT-C & PT-D RELEASED HOLD	JKF ALM	KPF DRE	DRE
0	09/20/04	ISSUED FOR CONSTR	GJU ALM	KPF DRE	DRE

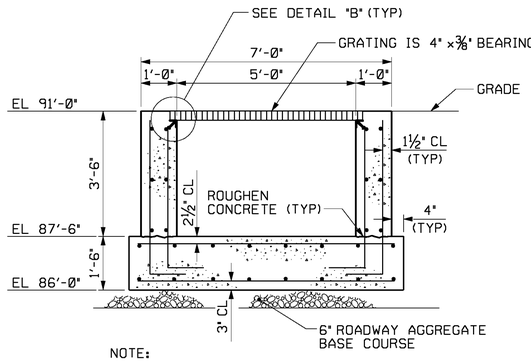
YARD AREA FOUNDATIONS
ASH POND SITE WORK
PIPE TRENCH PLANS AND DETAILS

SCALE: AS NOTED — JOB NO.: 537365

PE&C DWG. NO.: CR34-3-DW-SC-719-0505 — REV: 1

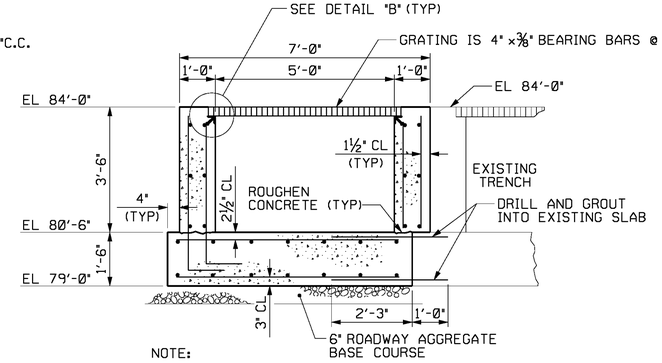
FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

PE&C-FILE: cr34-3-dw-sc-719-0505.dgn
PE&C-DATE: 06-Jan-05 08:28



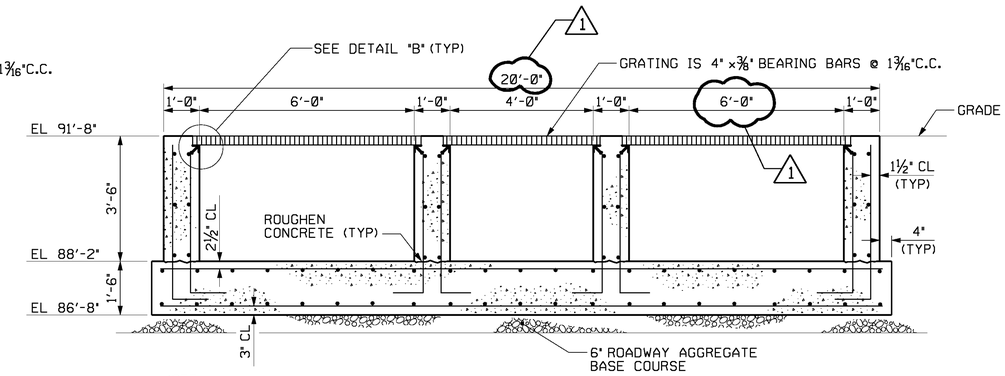
NOTE:
ALL REINFORCING #4 @ 12

SECTION 1-1
PT-A
(SC-719-0503)



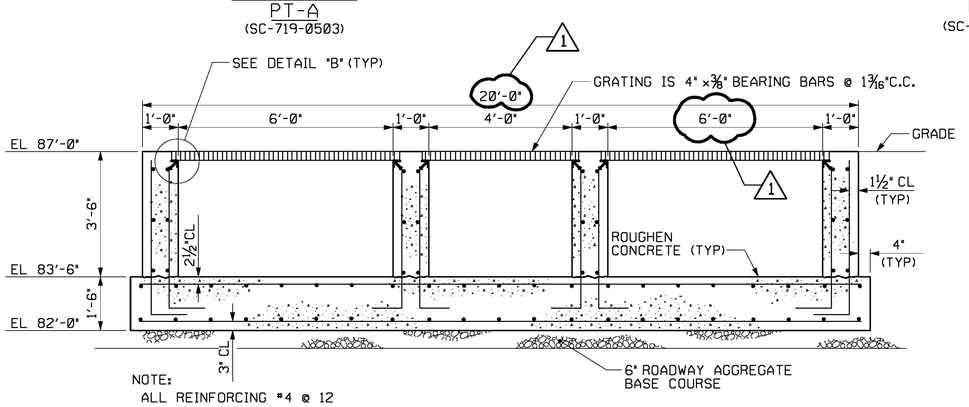
NOTE:
ALL REINFORCING #4 @ 12

SECTION 2-2
PT-B
(SC-719-0503)



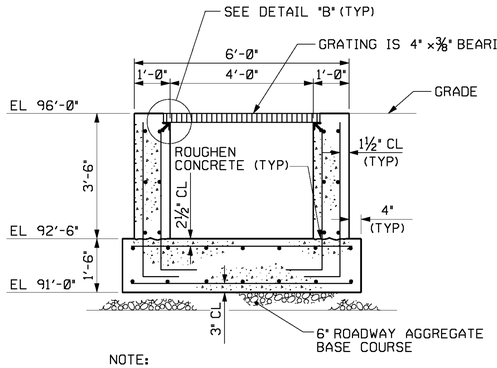
NOTE:
ALL REINFORCING #4 @ 12

SECTION 4-4
PT-D
(SC-719-0504)



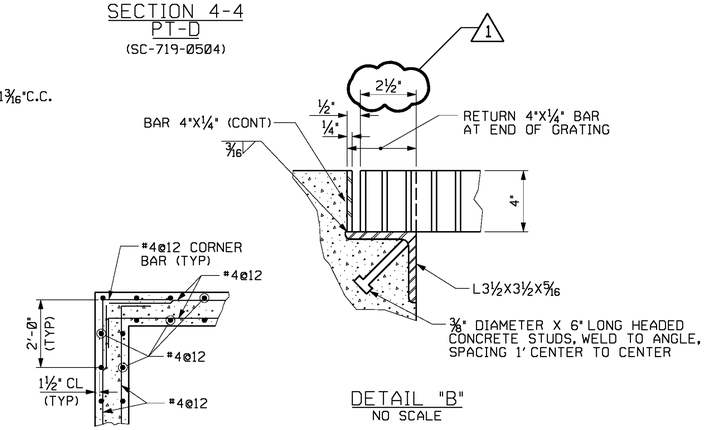
NOTE:
ALL REINFORCING #4 @ 12

SECTION 3-3
PT-C
(SC-719-0504)



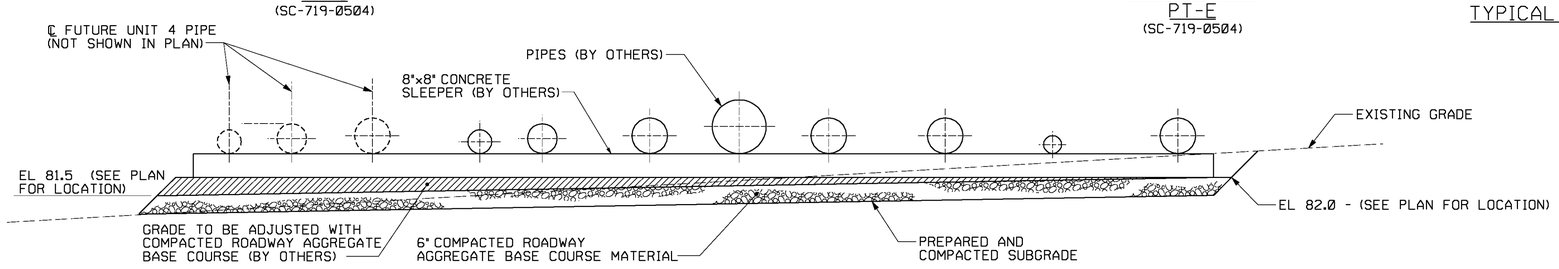
NOTE:
ALL REINFORCING #4 @ 12

SECTION 5-5
PT-E
(SC-719-0504)

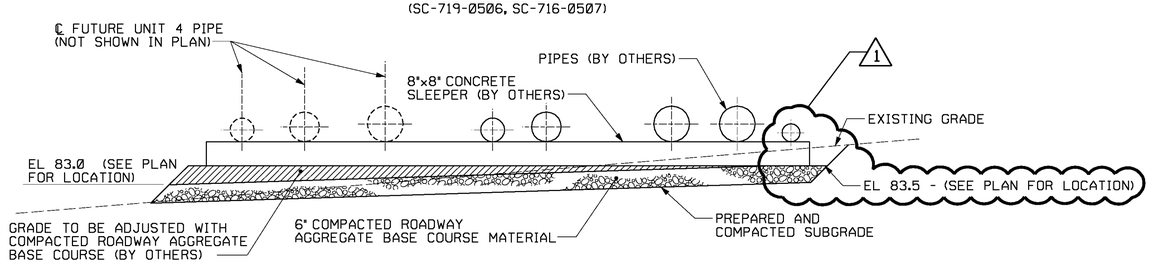


DETAIL "B"
NO SCALE

DETAIL "A"
TYPICAL CORNER REINFORCEMENT
NO SCALE



SECTION 6-6
(SC-719-0506, SC-716-0507)



SECTION 7-7
(SC-716-0507)

DRAWN BY: GJU	ENGINEER: D.R. ERALI
CHECKED BY: A.L. MERKEL	PROJECT ENGINEERING MANAGER: P.K. SHEWCHUK
LEAD DESIGNER: K.P.FEEG	PROJECT MANAGER: J.T. HICKSON
PRELIMINARY STATUS — DATE: LDE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS — DATE: LDE D.R. ERALI 02/07/05	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA — PARSONS ENERGY & CHEMICALS GROUP INC. No. C01505 — CERTIFICATE OF AUTHORIZATION

PROFESSIONAL ENGINEER'S SEAL

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ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF: PE: DAVID R. ERALI — STATE: SOUTH CAROLINA — LIC. NO.: 14328 — DATE: 02/28/04

CROSS GENERATING STATION / UNIT 3

Santee Cooper — PE&C Parsons Energy & Chemicals Group Inc.

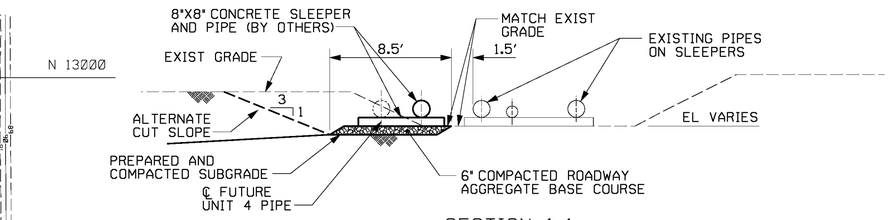
REV	DATE	DESCRIPTION	DR CHK	LD ENGR	LDE
1	02/07/05	REV AS INDICATED RELEASED HOLD	JKF ALM	KPF DRE	DRE
0	09/20/04	ISSUED FOR CONSTR	GJU ALM	KPF DRE	DRE

YARD AREA FOUNDATIONS
ASH POND SITE WORK
PIPELINE AND PIPE TRENCH SECTIONS

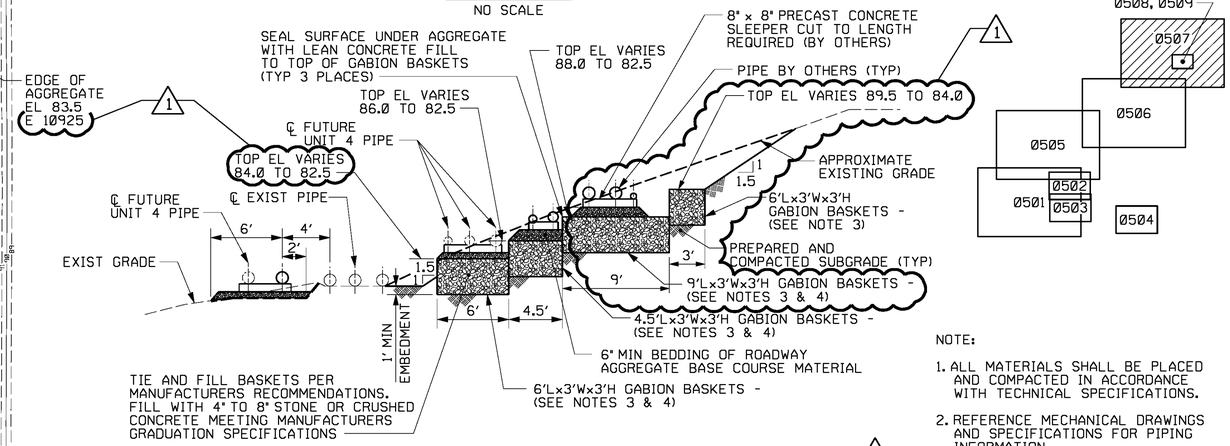
SCALE: NONE
JOB NO.: 537365
PE&C DWG. NO.: CR34-3-DW-SC-719-0506
REV: 1

FAC	PIPING	I & C	ELECT	MECH	CIVIL	STRUC

PE&C-FILE: cr34-3-dw-sc-719-0506.dgn
PE&C-DATE: 06-Jan-05 08:28



SECTION 1-1
NO SCALE



SECTION 2-2
NO SCALE

NOTE:

1. ALL MATERIALS SHALL BE PLACED AND COMPACTED IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
2. REFERENCE MECHANICAL DRAWINGS AND SPECIFICATIONS FOR PIPING INFORMATION.
3. USE 1.5' HIGH GABIONS OVER DUCT BANKS.
4. GALMAC COATED GABION BASKETS SHALL BE BY MACCAFERRI OR ENGINEER APPROVED EQUAL.

50 0 50 100 150
SCALE IN FEET

MATCH LINE SC-716-0506
PLAN

DRAWN BY	ENGINEER
KPF	D.R. ERALI
CHECKED BY	PROJECT ENGINEERING MANAGER
A.L. MERKEL	P.K. SHEWCHUK
LEAD DESIGNER	PROJECT MANAGER
K.P.FEEG	J.T. HICKSON
PRELIMINARY STATUS LDE — DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS LDE D.R. ERALI — DATE 02/07/05	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

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ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: DAVID R. ERALI — STATE: SOUTH CAROLINA LIC. NO.: L 14328 — DATE: 02/28/05

CROSS GENERATING STATION / UNIT 3

Santee Cooper

PE&C Persons Energy & Chemicals Group Inc.

REV	DATE	DESCRIPTION	DR CHK	LD ENGR	LDE
1	02/07/05	REV GRD & SECT 2-2 RELEASED HOLD	JKF ALM	KPF DRE	DRE
0	09/20/04	ISSUED FOR CONSTR	KPF ALM	KPF DRE	DRE

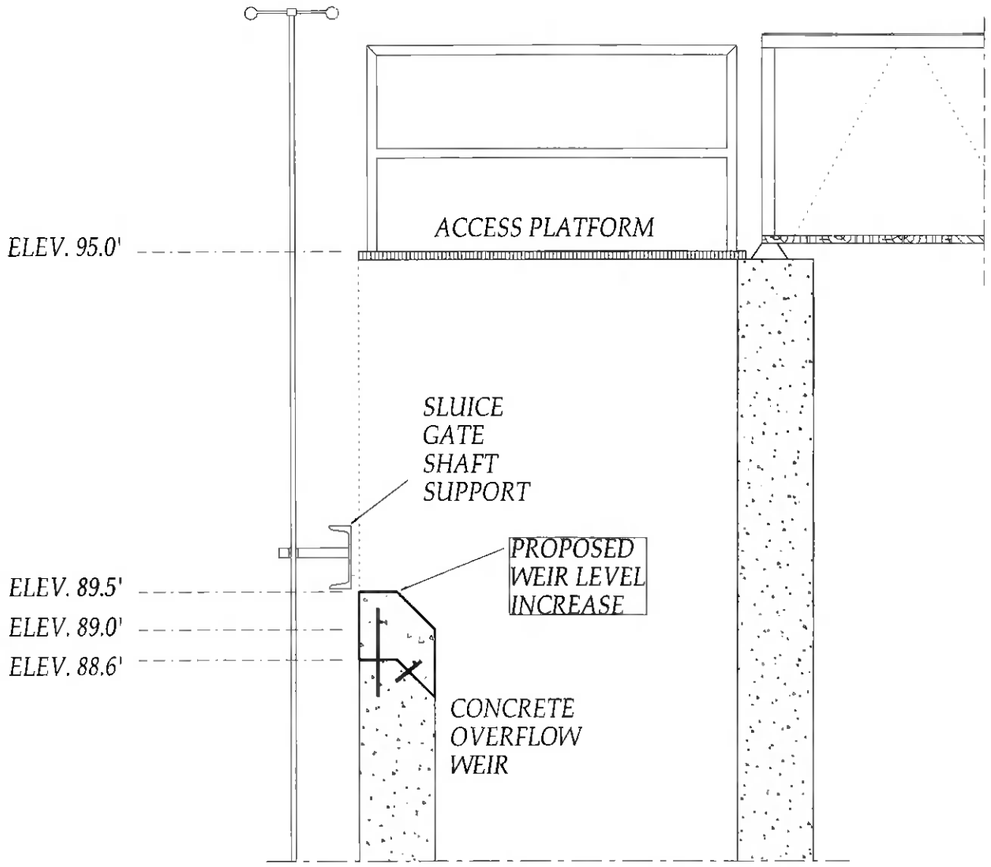
YARD AREA FOUNDATIONS
SITE WORK PLAN
ASH POND PIPING AREA

SCALE 1"=50' — JOB NO. 537365

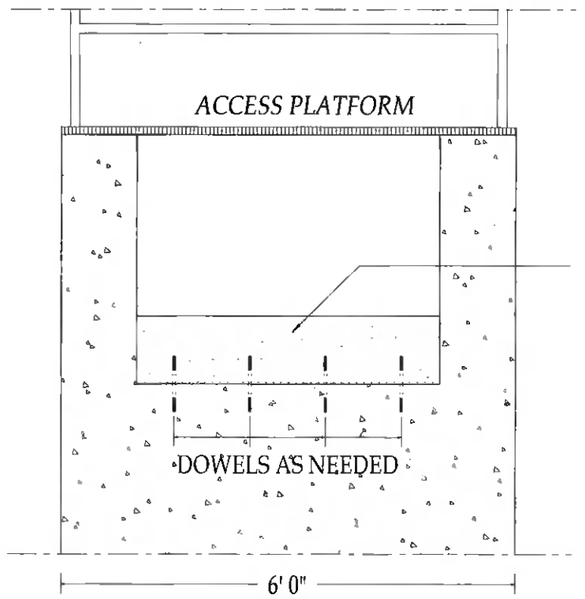
PE&C DWG. NO. CR34-3-DW-SC-716-0507 — REV 1

FAC	PIPING	I & C	ELECT	MECH	CIVIL	STRUC

PE&C-FILE: cr34-3-dw-sc-716-0507.dgn
PE&C-DATE: 06-Jan-05 10:02



SIDE ELEVATION (SECTION)



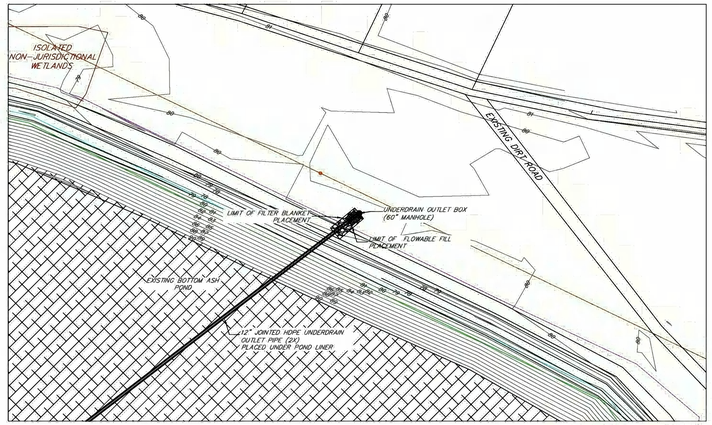
FRONT ELEVATION

DRAWN BY	ENGINEER: Darby Gallagher, P.E., SCLLR 20925
CHECKED BY	PROJECT ENGINEER:
APPROVED	PROJECT MANAGER:
AS-BUILT STATUS	
11/7/13	
CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER SEAL
NOT REQUIRED	11/7/13

CROSS GENERATING STATION

ASH POND OVERFLOW WEIR ELEVATION MODIFICATION

SCALE: NONE	PROJECT NO: 115889
DRAWING NUMBER: NONE	REV: B

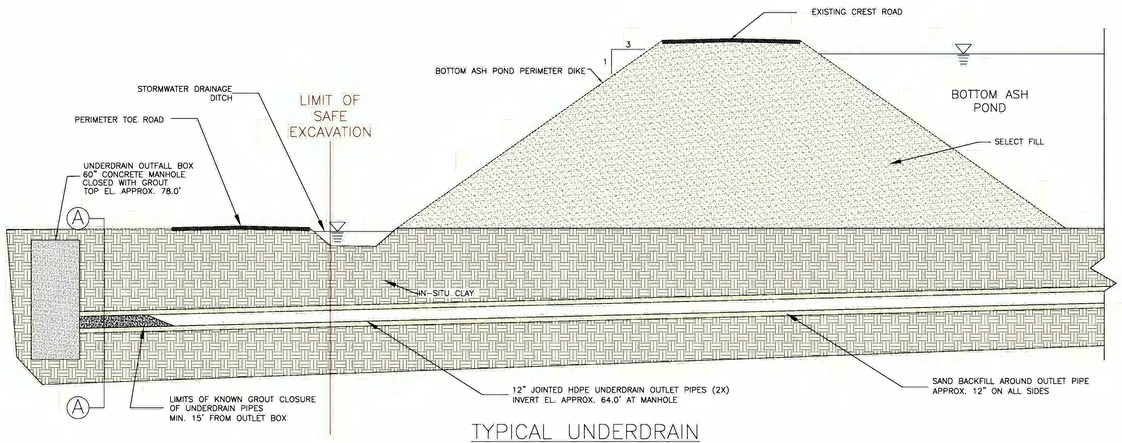


CROSS GENERATING STATION BOTTOM ASH POND – UNDERDRAIN CLOSURE
(PLAN VIEW)

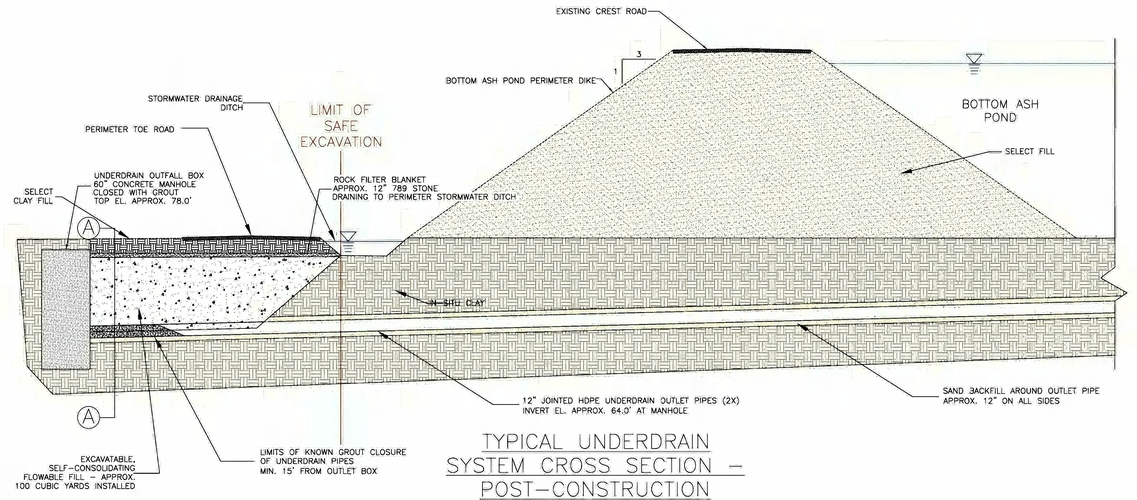
GENERAL NOTES:

1. Dike cross-section based on information obtained from Gilbert Commonwealth Inc. Drawing No. BA-117-50002.
2. Underdrain system layout taken from Higgerson Buchanan Inc. schematic dated Jan. 1993.
3. Elevation datum is NGVD 1929.
4. 12" jointed HDPE underdrain outlet pipe is approximately 13.0' below existing grade.
5. Approximately 100 cubic yards of excavatable flowable fill placed over existing underdrain outlet pipes to filter seepage from sand backfill layer around pipes.
6. Approximately 15 tons #789 granite stone placed as filter blanket above flowable fill to mitigate further soil particle transport by seepage.
7. Clay from West Dike Borrow Pit used to isolate filter blanket and ensure that seepage flowpath is filtered before discharging into perimeter stormwater ditch.

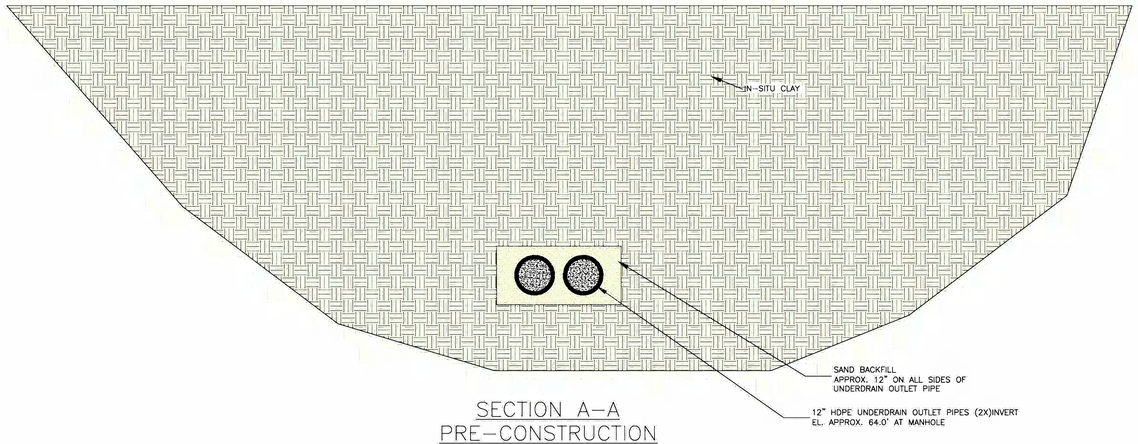
VICINITY MAP – CROSS GENERATING STATION
(NTS)



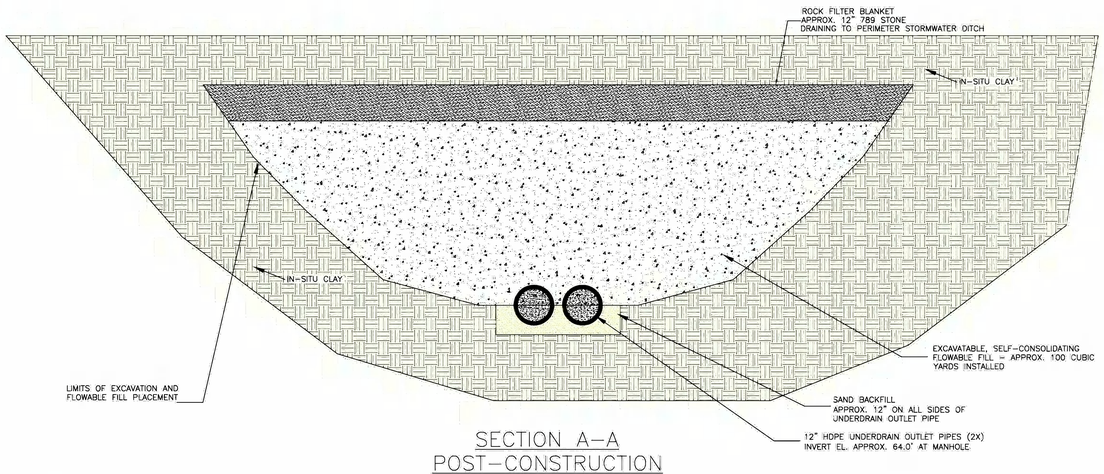
TYPICAL UNDERDRAIN
SYSTEM CROSS SECTION –
PRE-CONSTRUCTION



TYPICAL UNDERDRAIN
SYSTEM CROSS SECTION –
POST-CONSTRUCTION



SECTION A–A
PRE-CONSTRUCTION



SECTION A–A
POST-CONSTRUCTION

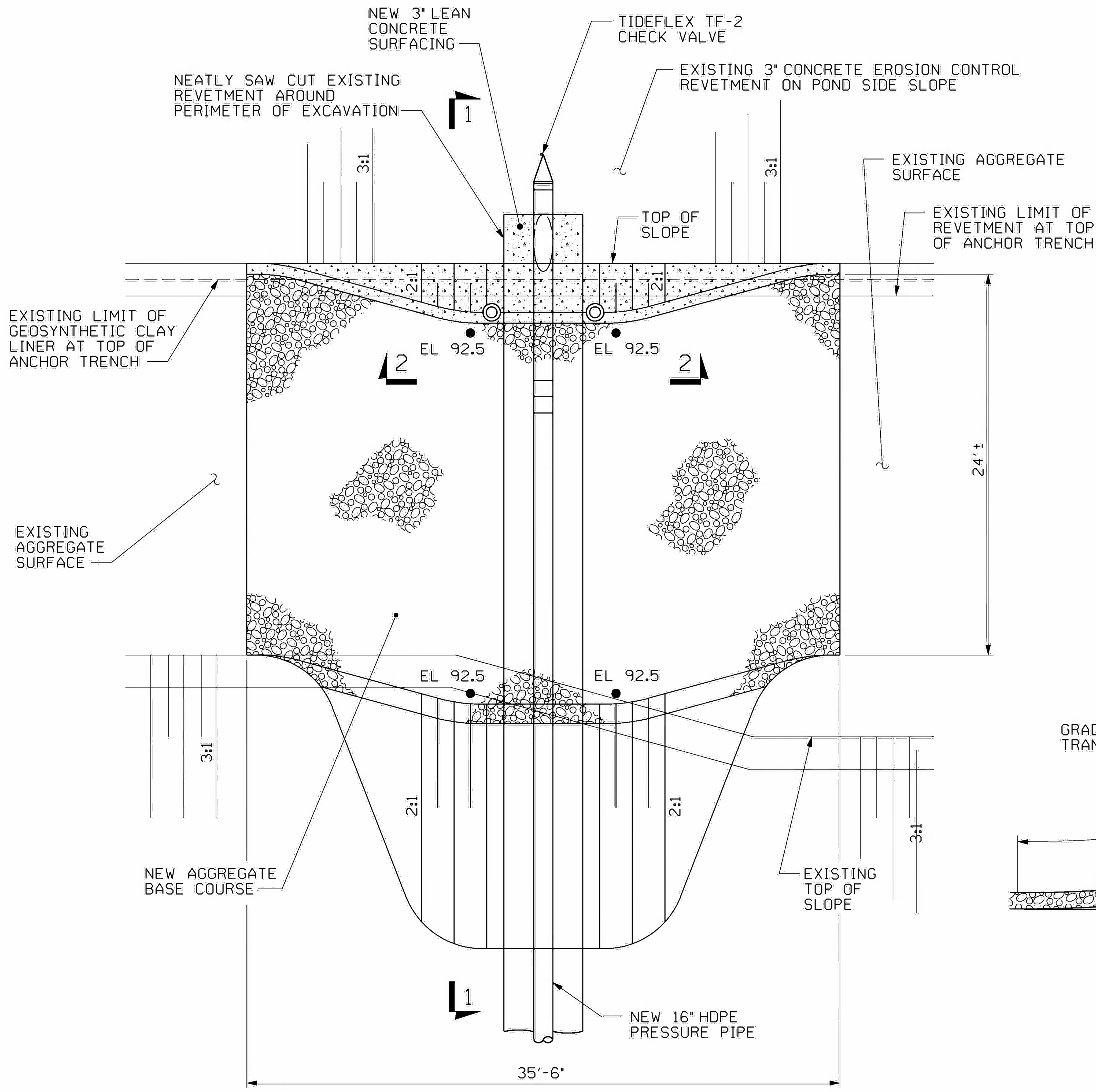
REVISIONS

Santee Cooper
One Riverwood Drive
P.O. Box 2946101
Moncks Corner, South Carolina 29461-2901
(843)761-8000

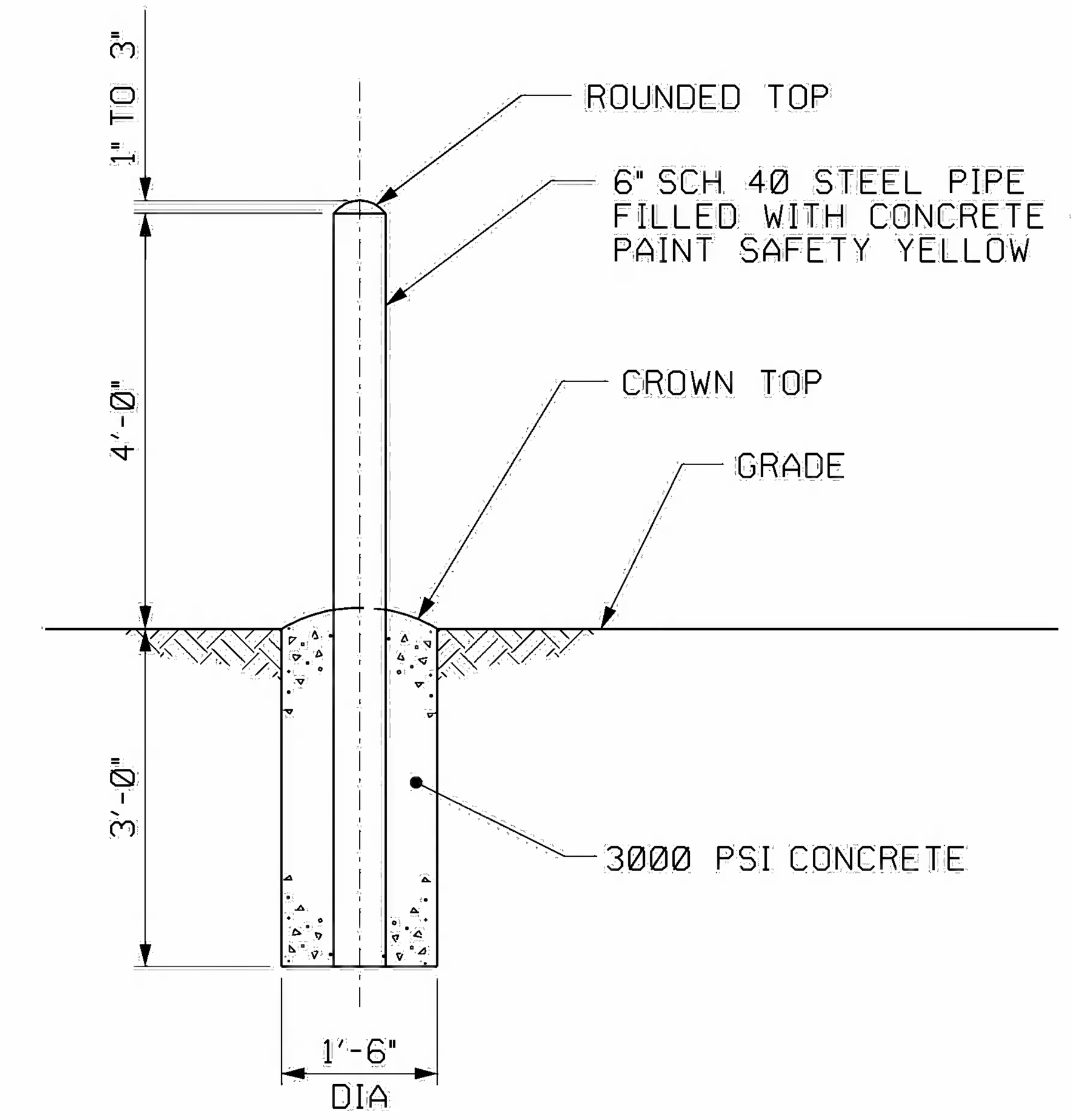
santee cooper®

CONSTRUCTION SERVICES
CIVIL PROJECTS
ENGINEER M. MELCHERS CHECKED S. MONAHIN
DATE 01/28/2015 PROJ. NO. 116827 SCALE: AS NOTED
SHEET 1 OF 1 DWG NO.

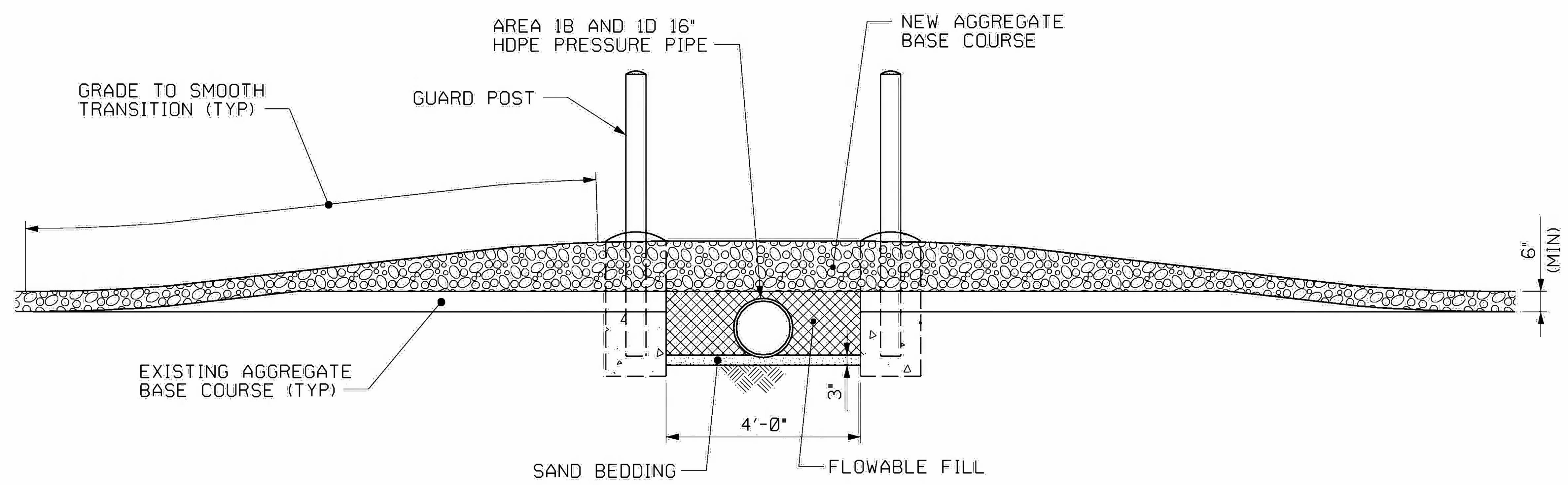
CROSS GENERATING STATION
RECORD DRAWING -
BOTTOM ASH POND UNDERDRAIN EXPLORATION
AND CLOSURE



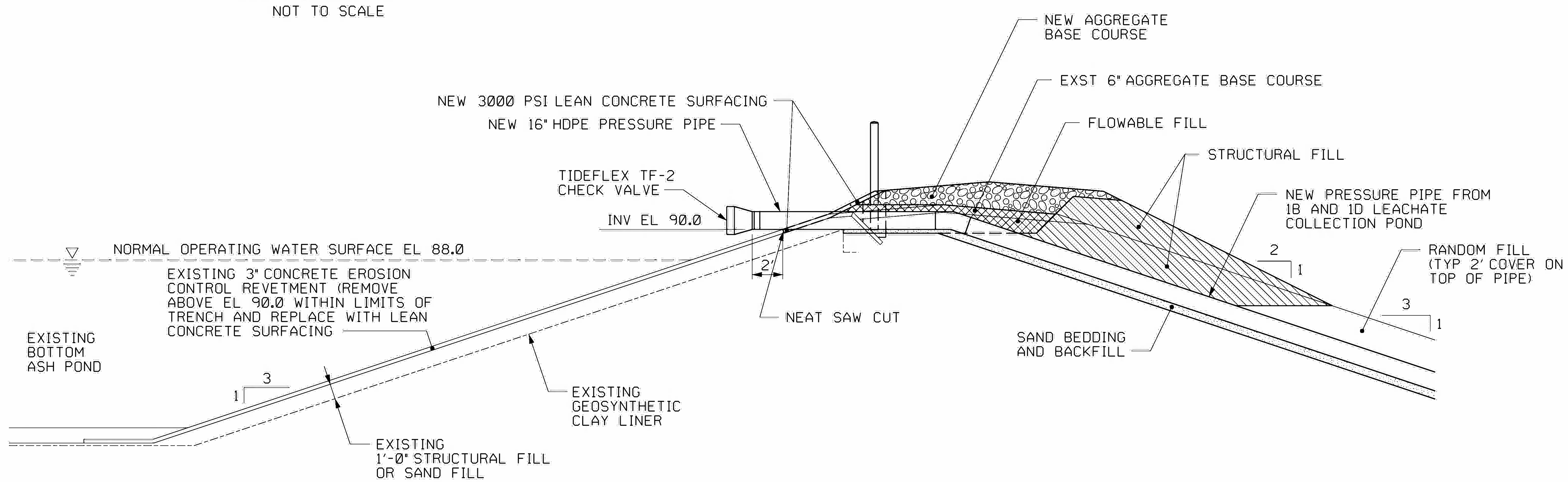
ENLARGED PLAN
NOT TO SCALE



GUARD POST DETAIL
NOT TO SCALE
(LF-719-0334)



SECTION 2-2
NOT TO SCALE



SECTION 1-1
NOT TO SCALE

NOTES:

1. ELEVATIONS BASED ON NGVD 29 DATUM UNLESS OTHERWISE STATED.

LEGEND:

● EL 92.5	NEW FINAL GRADE SPOT ELEVATION

REFERENCES:

LF-716-0332	SITEWORK PLAN
LF-719-0330	DISCHARGE PIPE PROFILE
LF-719-0334	SITEWORK SECTION AND DETAILS

DRAWN BY: KPF
ENGINEER: F.M. WOOD
CHECKED BY: R.E. STOUDT
PROJECT ENGINEERING MANAGER: R.E. SKIPTUNAS
LEAD DESIGNER: K.P. FEEG
PROJECT MANAGER: S.J. KRUMSKY
PRELIMINARY STATUS — DATE — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE
APPROVED STATUS — DATE — REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE F.M. WOOD 07/02/15
CERTIFICATE OF AUTHORIZATION — PROFESSIONAL ENGINEER'S SEAL

WORLEY PARSONS GROUP INC. No. 1505 — SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 24767 FLETCHER M. WOOD

OneWay to zero harm

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: FLETCHER M. WOOD STATE: SOUTH CAROLINA LIC. NO.: 24767 DATE: 07/02/15

CROSS GENERATING STATION

Santee Cooper — SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons resources & energy

LEACHATE COLLECTION POND 1B/1D
PUMP STRUCTURE
BOTTOM ASH POND OUTFALL

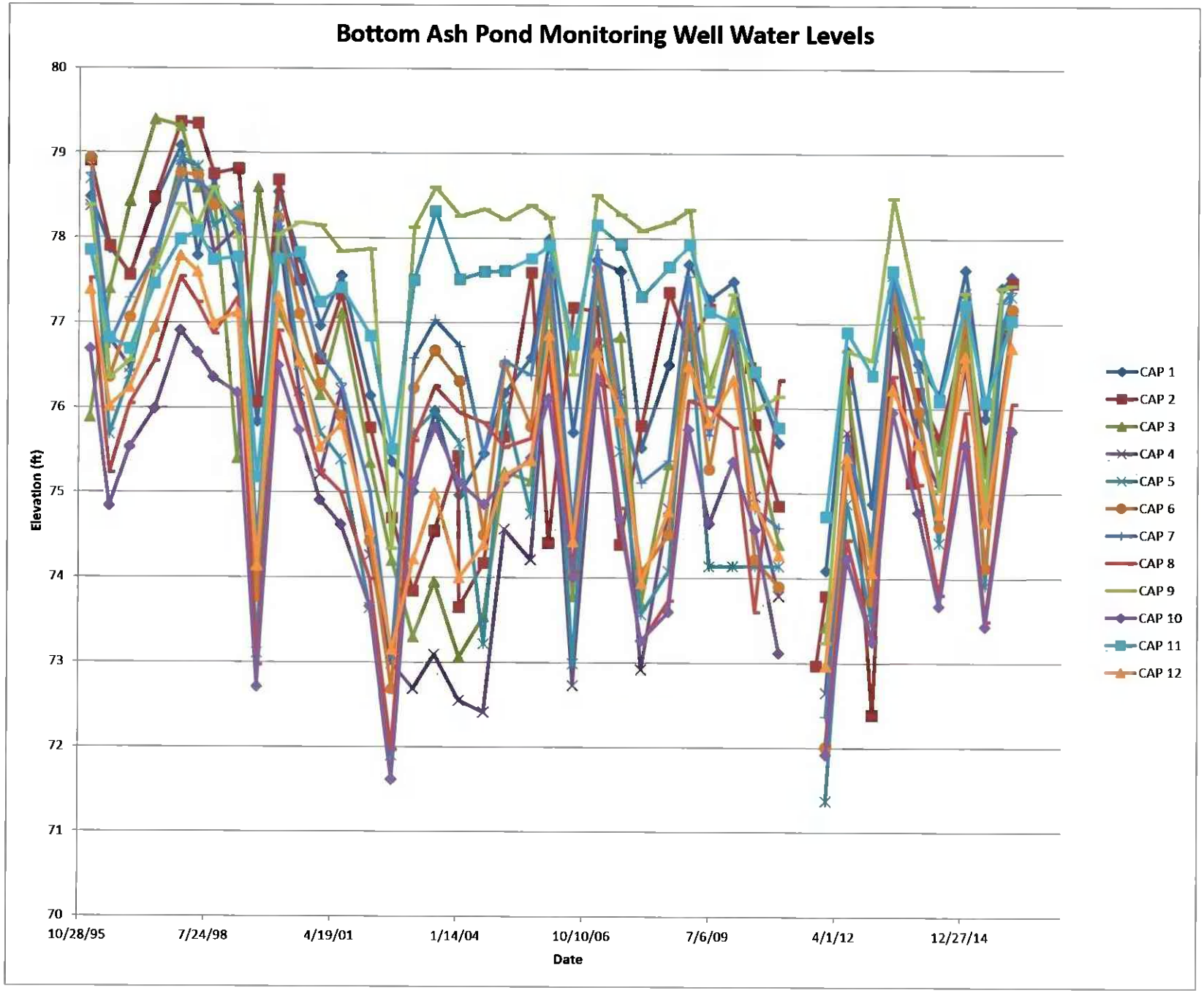
SCALE: 1"=40'
DRAWING SIZE: ARCH D (36" x 24")
JOB NO. 108008-01330
WORLEYPARSONS DWG. NO.: CR34-0-DW-LF-719-0331
REV: 0

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH. SPEC.	LEAD DISC ENGINEER	
0	07/02/15	KPF	RES	KPF	FMW	FMW	ISSUED FOR CONSTRUCTION

...\cr34-0-dw-lf-719-0331.dgn 7/2/2015 1:36:38 PM

Appendix E - Water Level Data

(2 total pages)


Bottom Ash Pond Monitoring Well Water Levels
80
79
78
77
76
75
74
73
72
71
70
Elevation (ft)
10/28/95
7/24/98
4/19/01
1/14/04
10/10/06
7/6/09
4/1/12
12/27/14
Date
CAP 1
CAP 2
CAP 3
CAP 4
CAP 5
CAP 6
CAP 7
CAP 8
CAP 9
CAP 10
CAP 11
CAP 12

Appendix F - Construction Specifications

(29 total pages)

SECTION 02220
EXCAVATION AND FILL
TABLE OF CONTENTS

EXCAVATION
AND FILL
CROSS-04085
02220-

1.0 SCOPE

1.1 This Section covers the technical requirements for performing excavation and fill operations.

1.2 This Section includes the requirements for the following:

1. Establishing lines and grades.
2. Performing soil erosion and sedimentation control.
3. Disposition of materials.
4. Excavating to the required lines and grades, including segregation of excavated materials and removal of unsuitable materials.
5. Dewatering of excavations and diversion of all surface water away from earthwork operations.
6. Subgrade preparation.
7. Furnishing, placing, and compacting of fill materials.
8. Excavating and filling of trenches.
9. Cleaning, repair, and maintenance of drainage ditches and culverts adjacent to the work area.

2.0 CODES AND STANDARDS

2.1 The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference:

1. American Society for Testing and Materials (ASTM):
   a. C 127, "Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate."
   b. D 422, "Standard Test Method for Particle-Size Analysis of Soils."
   c. D 698, "Standard Test Method for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5 lb. (2.49 kg) Rammer and 12 in. (305 mm) Drop."
   d. D 1557, "Standard Test Method for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18 in. (457 mm) Drop."
2. South Carolina State Highway Department, "Standard Specifications for Highway Construction," (Standard Specifications).
3. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), "Construction Industry Standards and Interpretations," Volume III.
   a. Subpart P - Excavations, Trenching, and Shoring (OSHA Subpart P).

2.2 Where the above referenced codes and standards contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed unless stated otherwise by this technical specification Section.

2.3 In the event of any conflict between codes, or Technical Specifications and codes, the more stringent regulation shall apply.

3.0 SUBMITTALS

3.1 With Bid:

The Contractor shall submit a dewatering plan and pond filling plan as specified in Articles 5.2.2 and 5.3.4.

3.2 After Award:

1. The Contractor shall submit manufacturer's data for each piece of compaction equipment.

2. The Contractor shall lay out the bottom ash pond per the coordinates and determine the actual clearance distances from the existing fence, cleared areas and existing roads. This data shall be submitted to the Engineer for review prior to performing any embankment construction. The Engineer may modify the embankment location based on the new field survey data.

4.0 MATERIAL REQUIREMENTS

4.1 Random Fill:

Random fill shall consist of approved onsite excavated soil and rock, with the maximum particle size not exceeding one half the specified lift thickness and with more than 50 percent (by weight) passing the number 200 sieve. It shall not contain ash, organic matter, rubbish, ice, or frozen materials. Material having moisture content exceeding the limits specified in Article 5.5 of this Section (i.e., optimum moisture content +3%) shall not be approved unless brought to within the limits.

4.2 Onsite Structural Fill:

Onsite structural fill shall consist of approved onsite excavated soil and rock, with not more than 50 percent (by weight) passing the number 200 sieve. It shall not contain ash, organic matter, rubbish, ice, or frozen materials. Material having moisture content exceeding the limits specified in Article 5.5 of this Section (i.e., optimum moisture content +3%) shall not be approved unless brought to within the limits.

4.3 Run of Crusher (ROC):

Run of crusher (ROC) shall be in general accordance with Section 306 (Type 1) of the Standard Specifications.

4.4 Silt Fence:

Silt fence shall be No. 100X as manufactured by Mirafi, Inc. of Charlotte, North Carolina or Engineer-approved equal.

4.5 Drainage Aggregate:

Drainage aggregate shall be No. 789 in accordance with Section 801.02 of the Standard Specifications.

4.6 Sand Fill:

Sand fill shall be obtained from the onsite dredged sand stockpile area. All sand above Elevation 82.7 feet presently existing in the stockpile shall be used in the Work.

4.7 Bottom Ash:

Bottom ash used for covering the geocomposite bentonite liner shall be obtained from the existing onsite bottom ash pond. The existing bottom ash pond will be in use, with water level up to Elevation 93 feet, during dredging of the bottom ash. Turbidity curtains shall be provided, as required, to prevent suspended solids from entering the existing pump station. A two feet minimum buffer zone of bottom ash shall be maintained in the sides and bottom of the pond. In addition, the final dredging profile shall provide a minimum 30 feet wide channel with bottom no higher than Elevation 80 feet from the new spillway to the existing pump.

5.0 INSTALLATION REQUIREMENTS

5.1 Soil Erosion and Sedimentation Control:

1. Soil erosion and sedimentation control shall be implemented prior to the start of any construction activity.

2. Earthmoving operations shall be conducted in such a manner as to minimize accelerated soil erosion in accordance with applicable

Federal, State and local laws and regulations as specified herein, and as shown on the Drawings.

3. Silt barriers shall be installed downstream of construction, borrow, and stockpile areas to confine sediment that may be washed from all disturbed areas, including new cut and fill slopes.

4. Erosion and sediment control practices shall be inspected daily. Damage shall be repaired immediately. Sediment accumulations shall be removed and placed in the topsoil stockpile.

5. All facilities shall be maintained for the duration of the Contract.

5.2 Control of Water:

1. The Contractor shall design, furnish, install, and operate a dewatering system to collect and remove surface water and groundwater from the work areas. The dewatering system shall operate continuously during the performance of the work and shall maintain the groundwater level at least two feet below the bottom of the bentonite geocomposite liner or prepared subgrade, but no lower than Elevation 68 feet. Discharge from the dewatering system shall be routed as required by the Engineer and shall be in accordance with all South Carolina erosion control regulations. Regulations include "Storm Water Management Guidelines (South Carolina Coastal Council), and "Erosion and Sediment Control Practices for Developing Areas" (South Carolina Land Resources Conservation Commission, Erosion and Sediment Control Division). A level spreader having a minimum length of 30 feet shall be provided at the end of the discharge to prevent erosion of existing soils. All disturbed areas shall be regraded and revegetated at the conclusion of Work.

2. The Contractor shall submit a dewatering plan showing all system details including location and number of sumps, trenches, pipes, and road crossings. Pump sizes shall be noted and onsite backup pumps shall be available.

3. Upon completion of the bentonite geocomposite liner, cover material, and concrete erosion control revetment, the dewatering system shall be deactivated and the bottom ash pond expansion area filled with water to Elevation 78 feet. Source of water for filling shall be the discharge (diversion) canal at approximate coordinates N 7200 and E 10,600. The maximum intake velocity for water drawn from the canal shall be 0.5 feet per second. Pipe routing shall be proposed by the Contractor and approved by the Engineer. A supplementary source of water for pond filling may be the discharge from the dewatering system. The dewatering system deactivation and pond filling shall be performed in such a manner to prevent upward hydrostatic force on the bentonite geocomposite liner, and to prevent erosion or damage to completed work. In addition, all temporary sumps and liner penetrations shall be sealed as required by the Engineer.

4. The Contractor shall submit a pond filling plan showing all system details including location and size of pumps and pipelines, road crossings, inlet facilities, and capacity calculations.

5.3 Excavation:

1. Excavation shall conform to the lines, grades, and outlines as shown on the Drawings. Excavation side slopes, bottoms of excavations, and ditches shall be shaped to a smooth and uniform surface, free from bumps and hollows. A neat saw cut shall be used when the excavation extends into existing paving or a concrete slab.

2. The final excavation lines shall be within 0.1 foot of grades, as indicated on the Drawings, unless overexcavation is required.

3. Excavation operations shall be conducted so that material outside the excavation limits is not disturbed or loosened. Material disturbed or loosened shall be restored to at least its original condition. All excavation operations shall be conducted in accordance with OSHA Subpart P.

4. An excavation shall be classified as either earth excavation or rock excavation. Earth excavation shall consist of excavation in soil and other overburden materials not classified as rock.

5. Rock excavation shall consist of removal of material classified as rock. The material must be boulders of two cubic yard or more in volume, solid or ledge rock, or other hard material in place that cannot be excavated by power shovels or bulldozers equipped with ripping points. Material classified as rock shall be removed by drilling and feathering, bull point wedging, or other suitable means.

6. Blasting for excavation will not be permitted.

7. Excavation bottoms shall be approved by the Engineer prior to placement of backfill, structures, pipe, or utilities.

8. Material suitable for fill shall be stockpiled within the limits of the work area. The material shall be segregated into piles for random fill and onsite structural fill.

9. Excavated materials not meeting the requirements of random fill, onsite structural fill, or topsoil are defined as unsuitable. Unsuitable material, including excess suitable material, shall be placed onsite as required by the Engineer.

10. Temporary fill stockpiles, including fills of unsuitable and excess materials, shall be shaped and sloped to provide drainage. Silt barriers shall be installed down gradient of all stockpiles as required by the Engineer.

11. Debris such as wood or rebar that is discovered during excavation shall be disposed of in the onsite construction waste disposal area.

5.4 Subgrade Preparation:

1. Excavation bottoms for soil supported footings, concrete slabs, bentonite geocomposite liner, and embankment fill areas shall be proofrolled in the Engineer's presence with at least four passes of a large (greater than 10 tons) smooth wheeled roller or other approved heavy compaction equipment. Unless otherwise required on the Drawings, confined areas inaccessible to heavy compaction equipment shall be compacted with three to four passes of a largest practicable plate compactor or roller. Unless otherwise required on the Drawings, soft or organic areas detected during subgrade preparation shall be overexcavated as required by the Engineer and backfilled with compacted fill. The fill shall be the same material that is to be subsequently placed on the prepared subgrade. If a structure is to be placed directly on the subgrade, then the removed material shall be replaced with compacted ROC.

2. The subgrade shall be compacted to a minimum density equal to 90 percent of the maximum dry density, as determined by the Modified Proctor Test (ASTM D 1557), for all areas to receive random fill, onsite structural fill, or bentonite geocomposite liner, and to 95 percent of the maximum dry density, as determined by the Modified Proctor Test (ASTM D 1557), for all areas to receive ROC, on which a structure is to be

placed, or below roadways. ASTM D 698 may be used in lieu of ASTM D 1557 provided that the minimum densities are increased by five percent.

3. At least 48 hours notice shall be given to the Engineer prior to performing subgrade preparation.

5.5 Fill Placement:

1. General Requirements:

a. The surface of the fill shall be kept approximately horizontal during construction, but shall be provided with sufficient longitudinal and transverse slope to allow for runoff of surface water.

b. Hauling equipment shall not be permitted to follow a single track on the same layer, but shall be directed to spread out to provide uniform compaction and prevent rutting.

c. Fill materials shall not be placed against or upon an unstable grade. At junctions between fill and existing grade, the existing grade shall be cut back, if necessary, to expose compact, stable material. Rolling shall extend over this junction to provide a compact, stable mass. Similar care shall be taken at junctions between adjacent fills.

d. Fill shall not be placed while rain is falling. Prior to resuming fill operations after rain, all muddy material shall be bladed off the surface to a depth necessary to expose firm compacted material.

e. Fill shall not be placed on frozen ground, and frozen material shall not be used for fill.

f. At the end of the day's operation and when rain is threatening, the fill shall be sloped to provide drainage and shall be compacted over the entire cross section and length with a smooth wheeled roller to seal it against the entry of water.

g. When the top of the fill or subgrade has dried out, or become excessively wet, or been damaged by construction equipment, the surface on which additional fill or a structure is to be placed shall be scarified to a minimum depth of 6 inches, brought to the specified moisture content, and recompacted to the specified density prior to the placement of additional fill or a structure.

h. Fill which does not meet the requirements for moisture content at the time of compaction shall be dried or wetted to meet the specified requirements. If the fill material requires drying, this may be accomplished by reworking it under warm and dry atmospheric conditions. Water, if required, shall be added carefully by sprinkling and care shall be taken that no more than the amount needed is applied. Ponding or flooding will not be permitted.

i. Only compaction equipment weighing 200 pounds or less shall be allowed within three feet (measured horizontally) of structures or retaining walls. For backfilling retaining walls, the same height of fill shall be maintained on both sides of the wall until the front of the wall is at final grade. Fill shall not be placed against concrete walls until the concrete reaches at least two thirds of its design strength.

j. The final fill layer shall be placed within 0.1 foot of the grades as indicated on the Drawings.

k. The placing of fill shall cease in the areas being tested or sampled.

2. Underwater Sand Fill:

a. The existing borrow pit water elevation shall be maintained at Elevation 68 feet ±0.25 feet during placement of underwater sand fill.

b. Submerged areas of the existing borrow pit below Elevation 68 feet shall be filled by end dumping sand fill through water until the fill surface reaches Elevation 71 feet.

c. The below water filling shall proceed uniformly from the edges of the borrow pit towards the center of the bottom ash pond expansion.

d. Soft sediments displaced by the underwater fill shall be removed and placed onsite as required by the Engineer.

3. Limestone Core and Concrete Pile Cutoff Fill:

a. Random limestone cores discovered in the work area, along with up to 2,500 concrete pile cutoffs stockpiled in the work area, shall be incorporated into the fill as specified below.

b. The cores and cutoffs shall be used only within the pond interior (not under embankments). These materials shall be spread and worked into the subgrade in such a manner so that no voids are created. A minimum of one foot shall be maintained between the top of the cores or cutoffs and the bottom of the bentonite geocomposite liner.

4. Compaction Requirements:

a. Random Fill, Sand Fill, and Onsite Structural Fill:

Random fill, sand fill, and onsite structural fill shall be compacted in maximum 12 inch lifts (loose) to a minimum density of 90 percent of the maximum dry density, as determined by the Modified Proctor Test (ASTM D 1557) and Appendix A (if applicable). For fill within 3 feet (measured vertically) of a road subgrade or structure, the minimum density shall be 92 percent. The moisture content at the time of compaction shall not vary from the optimum moisture content by more than three percentage points, unless otherwise approved by the Engineer. ASTM D 698 may be used in lieu of ASTM D 1557 provided that the minimum densities are increased by 5 percent.

b. ROC:

ROC shall be compacted in maximum 10 inch lifts (loose). The fill shall be compacted to a minimum density of 95 percent of the maximum dry density, as determined by the Modified Proctor Test (ASTM D 1557) and Appendix A (if applicable). The moisture content at the time of compaction shall not vary from the optimum moisture by more than three percentage points.

c. Drainage Aggregate:

Drainage aggregate shall be placed in maximum 10 inch lifts (loose) and compacted with a minimum of two passes of a vibratory drum compactor weighing a minimum of one ton.

d. In confined areas requiring hand held compaction equipment weighing 200 pounds or less, all fills shall be placed in maximum 6 inch lifts (loose).

5. Compaction Equipment Requirements:

a. Compaction equipment shall be of the type and size required to produce the specified compaction and as specified herein or on the Drawings. Compaction equipment shall be compatible with the types of materials being placed.

b. Sheepsfoot or rubber tired rollers and tampers shall be used to compact cohesive soils. Smooth wheel vibratory rollers and

vibrating plate compactors shall be used to compact granular materials, unless approved otherwise.

5.6 Trench Excavation and Backfill:

1. Trench excavations for buried pipes and utilities shall be performed to the lines and grades shown on the Drawings.

2. No damage shall occur to any structures, pipes, or utilities.

3. Sheeting, bracing, and shoring shall be installed, as required, to safely maintain excavations and protect existing structures, utilities, and personnel as required by Federal, State, and local laws and ordinances, including OSHA Subpart P.

4. Trenches for pipes or utilities shall be excavated through natural ground or as required within fills. For pipes or utilities to be installed within fills, the fill shall first be constructed to a minimum height of 4 feet above the required elevation of the top of the pipe or utility. The trench shall then be excavated into the fill, and the pipe or utility installed as required.

5. The minimum width of the trench shall be as shown on the Drawings and shall not be greater than that necessary to permit the work to proceed.

6. Soft or organic material encountered at the bottom of the trench shall be removed for the full width of the trench to the depths required by the Owner and replaced with compacted sand fill.

7. Trench bottoms shall be accurately shaped so that the pipe or utilities will be in continuous and uniform contact with either undisturbed soil, sand fill material, or bedding material as shown on the Drawings.

8. If stones larger than 3 inch diameter are encountered in the bottom of the trench, they shall be removed and the void shall be backfilled with compacted sand fill.

9. When rock is encountered, it shall be removed to a minimum depth of six inches below the bottom of the pipe or utilities for the full width of the trench, and replaced with compacted sand fill.

10. Trenches shall not be backfilled until all joints are made, required tests performed, pipe encased as necessary, and Owner approval is granted to proceed.

11. Bedding and backfill around the pipe shall be of the type and thickness indicated on the Drawings and compacted to the minimum density as specified in Article 5.5 of this Section.

12. When the Drawings indicate that compacted random fill or onsite structural fill shall be placed around the pipe or utilities, the fill shall have a maximum particle size of three inches.

13. Backfill around pipes and utilities shall be placed so that the elevation of the fill is the same on both sides. Rammer type compactors shall be used with caution adjacent to pipes or utilities to avoid damage or movement.

14. After backfilling, the disturbed areas shall be fine-graded to blend in with existing contours, left with puddle free drainage, and seeded or otherwise protected as shown on the Drawings.

5.7 Cleaning and Repair of Drainage Ditches and Culverts:

1. Existing drainage ditches and culverts adjacent to the work area shall be cleaned and repaired as required. The ditches shall be restored to their original cross sections, lines, and grades as shown on the Reference Drawings.

2. The ditches and culverts, including new ditches and culverts installed under this Contract, shall be maintained during the Contract. Sediment accumulations shall be removed and placed onsite as required by the Engineer. Fly ash removed from the ditches shall be placed in the special waste pond. Ditch damage or washouts shall be repaired as required.

6.0 TESTING

6.1 The Owner will provide testing and inspection of all items in this Section. Fill or subgrade not meeting the compaction requirements shall be reworked and recompacted as required until the specification requirements are met.

END

ATTACHMENT A

MODIFICATION TO MODIFIED PROCTOR TEST (ASTM D 1557)

For structural or random fills or stabilized aggregate base course having more than 30 but less than 50 percent (by weight) of material greater than ¾ inch, the maximum dry density of the fill shall be determined by the following formula:

$$W = \frac{ww'}{Ow' + Cw}$$

where:

W = maximum dry density (lb/cu ft).

w = density of the material coarser than ¾ inch, given by its bulk specific gravity (determined) by ASTM C 127) multiplied by 62.4 (lb/cu ft).

w' = maximum dry density for the material passing the ¾ inch sieve as determined by the Modified Proctor Test, Method C (ASTM D 1557) (lb/cu ft).

O = fraction by dry weight of the material coarser than the ¾ inch sieve.

C = fraction by dry weight of the material finer than the ¾ inch sieve.

SECTION 02246

SOIL TESTING

TABLE OF CONTENTS

SOIL TESTING
CROSS-SL093
02246-

1.0 SCOPE

1.1 This Section covers the technical requirements for performing soil testing operations.

1.2 This Section includes the requirements for the following:

1. Furnishing a testing laboratory and equipment.
2. Providing qualified personnel in the testing laboratory and at the jobsite.
3. Providing material and field testing.
4. Submitting test reports.

2.0 CODES AND STANDARDS

2.1 The latest edition and published addenda of the followings publications in effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference:

1. American Society for Testing and Materials (ASTM):
   a. C 127, "Test Method for Specific Gravity and Absorption of Coarse Aggregate."
   b. D 422, "Method for Particle-Size Analysis of Soils."
   c. D 698, "Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5 lb. (2.49 kg) Rammer and 12 in. (305 mm) Drop."
   d. D 1140, "Test Method for the Amount of Material in Soils Finer Than the No. 200 (75 mm) Sieve."
   e. D 1556, "Test Method for Density of Soil in Place by the Sand Cone Method."
   f. D 1557, "Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18 in. (457 mm) Drop."
   g. D 2167, "Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method."
   h. D 2488, "Practice for Description and Identification of Soils (Visual-Manual Procedure)."
   i. D 2922, "Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)."
   j. D 3017, "Test Method for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)."
   k. D 4318, "Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils."

2.2 Where the above referenced codes and standards contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed unless stated otherwise by this technical specification Section.

2.3 In the event of any conflict between codes, or Technical Specifications and codes, the more stringent regulation shall apply.

3.0 SUBMITTALS

3.1 With Bid:

1. The information and data below shall be submitted by the Bidder:
   a. Resumes of responsible personnel.
   b. Sample forms and documentation sheets.
   c. Test equipment data.

d. Location and testing certifications for off-site test laboratory.

e. Procedures for required tests.

2. After acceptance by the Owner, this data will become part of the Contract.

3.2 After Award:

The information and data below shall be submitted in accordance with Appendix D of the Special Conditions:

1. Test results.

4.0 FACILITY AND PERSONNEL REQUIREMENTS

4.1 An onsite laboratory shall be provided. This facility shall be equipped with all items required to perform specified tests.

4.2 The test laboratory shall have its procedures approved by the Engineer and its equipment inspected not more than three years prior to beginning the Work by a qualified national authority. A copy of the certification shall be submitted. The Material Reference Laboratories of the National Bureau of Standards are such qualified national authorities. The equipment shall be maintained for achieving the level of accuracy during the work similar to that achieved at the time of the certification.

4.3 The testing services shall be under the direction of a person charged with an engineering-managerial responsibility. The person shall be a registered engineer and a full time employee. He or she shall have at least five years experience in the testing of construction and materials.

4.4 The testing laboratory shall be supervised by a laboratory technician who shall have at least five years experience performing tests on soil and rock and be able to demonstrate the ability to perform the tests required in the manner stipulated by ASTM or other governing procedure.

4.5 Testing personnel shall be qualified to a Level I technician (in accordance with Article 4.6 below), unless performing tests or preparing samples under the direct supervision of a Level II technician (in accordance with Article 4.7 below).

4.6 A Level I technician shall be capable of performing the tests that are required to be performed in accordance with documented procedures and/or industry practices. The individual shall be familiar with the tools and equipment to be employed and shall have demonstrated proficiency in their use. The individual shall also be capable of determining that the calibration status of inspection and measuring equipment is current, that the measuring and test equipment is in proper condition for use, and that the test procedures are approved. The educational and experience requirements shall be as follows:

1. Two years of related experience in equivalent testing activities, or

2. High school graduation and six months of related experience in equivalent testing activities, or

3. Completion of college level work leading to an Associate Degree in a related discipline plus three months of related experience in the equivalent testing activities.

4.7 A Level II technician shall have all of the capabilities of a Level I technician for the test category or class in question. Additionally, a Level II technician shall have demonstrated capabilities in planning tests; in setting up tests including preparation and set up of related

equipment, as appropriate; in supervising or maintaining surveillance over the tests; in supervising and certifying lower level personnel; in reporting testing results; and in evaluating the validity and acceptability of test results. The educational and experience requirements shall be as follows:

1. One year of satisfactory performance as Level I technician in the corresponding test category or class, or
2. High school graduation plus three years of related experience in equivalent testing activities, or
3. Completion of college level work leading to an Associate Degree in a related discipline plus one year related experience in equivalent testing activities, or
4. Four year college graduation plus six months of related experience in equivalent testing activities.

4.8 All necessary sampling, sample making, and testing equipment shall be provided in sufficient quantities to support the work.

5.0 TESTING REQUIREMENTS

5.1 The number of personnel maintained at the site office per working shift shall be sufficient for the construction operation.

5.2 Tests shall be conducted in accordance with the methods indicated in Attachment A, and submitted in accordance with Appendix D of the Special Conditions. The frequency of the testing shall be determined by the Engineer. Tests which do not meet specification requirements shall be reported immediately to the Engineer.

5.3 The test reports shall include the following information, as a minimum:

1. Project description and Job No.
2. Sample or Test No.
3. Description of material.
4. Location of sample or test (horizontal-within 5.0 feet, elevation-within 0.5 feet).
5. Tested by.
6. Date of testing.
7. Temperature and weather conditions.
8. References to any other tests used in the analysis.
9. Results of the test.
10. Any deviations from specified testing procedure.
11. Any difficulties in performing test.
12. Whether material or test passes or fails, if applicable.

5.4 All samples shall be transported to the onsite or offsite laboratory and stored prior to testing in accordance with the applicable codes and standards.

END

SOIL TESTING
AND INSPECTION
CROSS-SL093
Rev. 0
8/23/91 02246-A-
ATTACHMENT A
ATTACHMENT A (Cont'd)
REQUIRED TESTS

Item	Requirement	Test Method
1	Subgrade Testing:	
	Proctor Test	ASTM D 1557 or D 698
	Field Density Test	Sand Cone Method ASTM D 1556, or Nuclear Method ASTM D 2922, D 3017, or Rubber Balloon Method ASTM D 2167
	Soil Description	ASTM D 2488
2	Random Fill:	
	Proctor Test	ASTM D 1557 or D 698 modification to this standard per Attachment B, if required.
	Specific Gravity	ASTM Cÿ127
	Field Density Test	Sand Cone Method ASTM D 1556, or Nuclear Method ASTM D 2922, D 3017, or Rubber Balloon Method ASTM D 2167
	Soil Description	ASTM D 2488
3	Structural Fill and Stabilized Aggregate Base Course:	
	Gradation	ASTM D 422 (w/o Hydrometer) ASTM D 1140 (onsite structural fill)
	Proctor Test	ASTM D 1557 modification to this standard per Attachment B, if required.
	Specific Gravity	ASTM C 127
	Field Density Test	Sand Cone Method ASTM Dÿ1556, or Nuclear Method ASTM D 2922, D 3017, or Rubber Balloon Method ASTM D 2167
4	Sand Fill:	
	Gradation	ASTM D 422 (w/o Hydrometer)
	Proctor Test	ASTM D 1557

	Field Density Test	Sand Cone Method ASTM D 1556, or Nuclear Method ASTM D 2922, D 3017, or Rubber Balloon Method ASTM D 2167
5	Uniformly Graded Coarse Aggregate:	
	Gradation	ASTM D 422 (w/o Hydrometer)

SOIL TESTING
AND INSPECTION
CROSS-SL093
Rev. 0
8/23/91 02246-B-
ATTACHMENT B
MODIFICATION TO MODIFIED PROCTOR TEST (ASTM D 1557)
For structural and random fills and stabilized aggregate base course having more than 30 but less than 50 percent (by weight) of material greater than 3/4-inch, the maximum dry density of the fill shall be determined by the following formula:

$$W = \frac{ww'}{Ow' + Cw}$$

W = maximum dry density (lb/cu ft)
w = density of the material coarser than 3/4-inch, given by its bulk specific gravity (determined by ASTM C 127) multiplied by 62.4 (lb/cu ft)
w' = maximum dry density for the material passing the ¾ inch sieve as determined by the Modified Proctor Test, Method C (ASTM D 1557) (lb/cu ft)
O = fraction by dry weight of the material coarser than the ¾ inch sieve
C = fraction by dry weight of the material finer than the ¾ inch sieve

SECTION 02500
SITEWORK
TABLE OF CONTENTS

SITEWORK
CROSS-04085
02500-

1.0 SCOPE

1.1 This Section covers the technical requirements for the furnishing and installation of civil sitework facilities.

1.2 This Section covers:

1. Soil erosion and sedimentation control practices.
2. Bagged sand-cement riprap.
3. Reinforced concrete pipe culvert.
4. Pipe trench with grating.
5. Perforated corrugated polyethylene underdrain.
6. Drawdown structure modifications.
7. Relocation of 6 inch WW-2 pipe.

2.0 CODES AND STANDARDS

2.1 The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference:

1. American Society for Testing and Materials (ASTM):
   a. A36, "Standard Specification for Structural Steel."
   b. A123, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
   c. A153, "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
   d. A307, "Standard Specification for Carbon Steel Externally Threaded Standard Fasteners."
   e. A563, "Standard Specification for Carbon and Alloy Steel Nuts."
   f. A569, "Standard Specification for Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip, Commercial Quality."
   g. C76, "Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe."
   h. C150, "Specification for Portland Cement."
   i. C443, "Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets."
   j. F436, "Standard Specification for Hardened Steel Washers."
2. American Welding Society (AWS):
   a. D1.1, "Structural Welding Code."
3. "Erosion and Sediment Control Practices for Developing Areas" (E&SC Practices), South Carolina Land Resources, Conservation Commission, Erosion and Sediment Control Division.
4. South Carolina State Highway Department, "Standard Specifications for Highway Construction", (Standard Specifications).

2.2 Where the above referenced codes and standards contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed unless stated otherwise by this technical specification Section.

2.3 In the event of any conflict between codes, or Technical Specifications and codes, the more stringent regulation shall apply.

3.0 SUBMITTALS

3.1 With Bid:

None.

3.2 After Award:

1. The Contractor shall submit material certifications and shop drawings in accordance with Appendix E to the Special Conditions for the following:

   a. Reinforced concrete pipe.

   b. Pipe trench grating.

4.0 DETAILED REQUIREMENTS

4.1 Material Requirements:

1. Reinforced Concrete Pipe (RCP):

   RCP shall be Class IV strength in accordance with Section 714.03 of the Standard Specifications and ASTM C76. Joints shall be in accordance with ASTM C443.

2. Bagged Sand-Cement Riprap:

   The riprap shall be bagged sand-cement in accordance with Section 804.07 of the Standard Specifications. Paper bags constructed of 3-ply heavy-duty kraft paper are acceptable.

3. Grout:

   Grout shall be an approved grout consisting of premixed, prepackaged Portland cement grout which requires only the addition of water. Cement used in the grout shall conform to ASTM C150. Masterflow 928, manufactured by Masterbuilders Co., is an approved grout.

4. Structural and Miscellaneous Steel:

   a. Rolled shapes and plates shall conform to ASTM A36.

   b. Bolts for connecting structural and miscellaneous steel shall conform to ASTM A307.

   c. Nuts for bolts shall conform to ASTM A563, Grade C.

   d. Washers shall conform to ASTM F436.

   e. Steel studs shall conform to Sectionÿ7 of AWS D1.1.

   f. Steel for grating shall conform to ASTM A569.

   g. Grating shall be welded grating of the size shown on the Drawings.

5. Coatings:

   a. All structural steel rolled shapes and plates including steel grating and embedded angles and plates shall be hot-dipped galvanized in accordance with ASTM A123.

   b. All bolts, nuts, and washers shall be hot-dipped galvanized in accordance with ASTM A153.

5.0 INSTALLATION

5.1 Soil Erosion and Sedimentation Control:

Erosion and sediment control practices shall be implemented as required by the E&SC Practices and shall be inspected daily. Damage shall be repaired immediately.

5.2 Riprap:

Bagged sand-cement riprap shall be installed in accordance with Section 804.15 of the Standard Specifications and as shown on the Drawings.

5.3 Reinforced Concrete Pipe (RCP):

RCP shall be installed in accordance with Section 714 of the Standard Specifications. Trenching and fill shall be in accordance with Section 02220 and the Drawings.

5.4 Pipe Trench with Grating:

1. Reinforcing steel placement shall be in accordance with Section 03211 and as shown on the Drawings.

2. Concrete placement shall be in accordance with Section 03311 and as shown on the Drawings.

5.5 Drawdown Structure Modifications:

1. Concrete wall shall be removed in accordance with Section 02210, Article 3.1, and as shown on the Drawings.

2. Existing handwheel stem guides shall be attached to structural steel supports as shown on the Drawings.

5.6 6" WW-2 Pipe:

The 6" WW-2 pipe shall be installed in accordance with Section 15060 and as shown on the Drawings.

END

SECTION 02644

BENTONITE GEOCOMPOSITE LINER

TABLE OF CONTENTS

BENTONITE
GEOCOMPOSITE LINER
CROSS-04085
02644-

1.0 SCOPE

1.1 This Section covers the technical requirements for the furnishing and installation of the bentonite geocomposite liner.

1.2 This Section covers the requirements for the following:

1. Subgrade preparation.
2. Furnishing and installation of bentonite geocomposite liner.
3. Placement of cover material.

2.0 CODES AND STANDARDS

2.1 The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference:

None.

2.2 Where the above referenced codes and standards contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed unless stated otherwise by this technical specification Section.

2.3 In the event of any conflict between codes, or Technical Specifications and codes, the more stringent regulation shall apply.

3.0 SUBMITTALS

3.1 With Bid:

1. The Contractor shall submit the following information:
   a. Conceptual scheme showing a plan of the liner panel arrangement and typical sections and elevations.
2. After acceptance by the Owner, this data will become part of the Contract.

3.2 After Award:

1. The following drawings, information and data shall be submitted in accordance with Appendices B, C, and E to the Special Conditions:
   a. Drawings showing the layout, size, and direction of the liner panels.
   b. Material certification and test results.
   c. A material and workmanship warranty shall be provided by the Contractor for the bentonite geocomposite liner. The warranty shall be a 25 year warranty.

4.0 DETAILED REQUIREMENTS

4.1 The bentonite geocomposite liner shall be BENTOMAT, as manufactured by Colloid Environmental Technologies Company (CETCO), or Engineer-approved equal.

4.2 The bentonite geocomposite liner shall be formulated and manufactured from polypropylene geotextiles and a minimum of one pound per square foot of Volclay PLS-50, medium contaminant resistant sodium bentonite and shall be approximately ¼ inch thick in the unhydrated state.

4.3 The liner shall be manufactured by the mechanical bonding of the needlepunch process. No glues or adhesives shall be used in lieu of this process. The needlepunch process for manufacture shall be:

1. A uniform layer of sodium bentonite shall be spread at a rate of one pound per square foot over the layer of woven geotextile. The

nonwoven geotextile shall then be placed on top of the layer of bentonite. These three components shall be needlepunched together by a board of barbed needles to push fibers from the layer of nonwoven geotextiles through the bentonite into the bottom layer of woven geotextile.

4.4 The encapsulating geotextiles shall be polypropylene. The bottom layer of geotextile shall be a minimum 6 oz. per square yard nonwoven polypropylene needlepunched fabric. The top layer of geotextile shall be a minimum 5 oz. per square yard woven polypropylene fabric.

5.0 INSTALLATION

5.1 All roll materials shall be labeled and bagged in ultraviolet resistant packaging. Stored rolls shall be on a flat dry surface and tarped to avoid any unnecessary stress on the packaging.

5.2 The surface upon which the liner will be installed shall be graded in accordance with the Drawings. Any debris, roots, and angular or sharp rocks larger than one inch in diameter shall be removed as well as any other organic or deleterious materials. The subgrade shall be compacted as specified in Article 5.4 of Section 02220. Prior to the deployment of the liner, the subgrade shall be final graded as required to fill any voids, cracks, or abrupt changes such as windrows and grooves from construction traffic.

5.3 Work on the slopes shall be undertaken before the bottom to prevent erosion in the event of rainfall. Seams shall be perpendicular to the toe of the slope at all times. Seams at the base of the slope shall be a minimum of five feet from the toe of slope.

5.4 Work on the bottom of the pond shall be performed in a sequence and manner so as to prevent erosion or damage to completed work. Dewatering of the bottom of the pond shall be maintained so the projected work area has been free of standing water for a minimum of 24 hours.

5.5 Lap joints shall be formed by lapping the edges of the panels a minimum of 9 inches. All edges shall be pulled tight to maximize contact and to smooth out any wrinkles or creases between adjacent panels. A bead of pure bentonite shall be hand applied at a minimum rate of ¼ pound per lineal foot continuously along all seams, centered in the lap joint, after the panels have been anchored in place.

5.6 For any penetrations or structures the liner will contact, a 4 inch deep by 12 inch wide notch shall be cut along the edge of the area. The liner shall be brought up to the appurtenance and trimmed to fit snugly. A pure bead of bentonite shall be hand applied and compacted into half of the notch. The liner shall then be inserted. The remaining area of the notch shall be filled with pure bentonite and compacted.

5.7 Liner cover material shall be placed on the liner on the same day that the liner is installed. Light ground pressure equipment (less than 6 psi contact pressure) shall be used and shall be operated on a minimum of 12 inches of cover. The liner anchor trenches shall be filled prior to placement of cover. The cover material shall be placed so as not to cause any ripples or folds in the liner.

5.8 When covering the side slopes with onsite structural fill or sand fill, the cover material shall be placed up the slope from the bottom. The material shall be within the moisture content range specified in Article 5.5 of Section 02220; however, there will be no specified minimum density. Instead, compaction shall be by a minimum of four uniform passes of the spreading equipment.

5.9 Bottom ash used for liner cover on the pond bottom shall be dewatered such that no free water is present in the ash at the time of placement. Water that drains from the ash prior to placement as liner cover shall be directed into the existing bottom ash pond. Compaction shall be by a minimum of four uniform passes of the spreading equipment.

5.10 The primary area for temporary storage of dewatered bottom ash shall be within the existing bottom ash pond. If the Contractor desires to temporarily store dewatered bottom ash outside of the existing bottom ash pond, the following procedures shall be implemented.

1. An area shall be prepared that confines the bottom ash and storm water runoff within approximately two feet high berms.

2. The temporary storage area within the berms shall be lined with a minimum 6 mil thick polyethylene liner, or Engineer-approved equal.

3. All water within the berms shall be immediately pumped to the existing bottom ash pond.

5.11 Liner areas that have been completed and covered with bottom ash shall not be used for the temporary storage of bottom ash. Construction traffic also shall not be allowed on the completed and covered lined areas.

END

SECTION 02645
CONCRETE EROSION CONTROL REVETMENT
TABLE OF CONTENTS

CONCRETE EROSION
CONTROL REVETMENT
CROSS-04085
02645-

1.0 SCOPE

1.1 This Section covers the technical requirements for the furnishing and installation of concrete erosion control revetment.

2.0 CODES AND STANDARDS

2.1 The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference:

None.

2.2 Where the above referenced codes and standards contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed unless stated otherwise by this technical specification Section.

2.3 In the event of any conflict between codes, or Technical Specifications and codes, the more stringent regulation shall apply.

3.0 SUBMITTALS

3.1 With Bid:

1. The Contractor shall submit the following information:
   a. Proposed supplier of fabric form material.
   b. Grout mix design.
   c. Conceptual panel layout drawing.

3.2 After Award:

1. The following drawings, information, and data shall be submitted in accordance with Appendices B, C, and E to the Special Conditions:
   a. Material certification for fabric form material.
   b. A drawing showing installation details, panel layout, sizes, and direction of panels.

4.0 DETAILED REQUIREMENTS

4.1 The fabric form shall be ARMORFORM, as manufactured by Nicolon Corporation; FABRIFORM, as manufactured by Construction Techniques, Inc., or Engineer-approved equal.

4.2 Fabric form material shall consist of double-layer woven fabric joined together by spacer cords, of uniform length, to produce a mat with a minimum finished nominal thickness of three inches, and a minimum nominal weight after grout placement of 35 lb/ft2 Points of connection shall be staggered to provide a bonded cobbled surface appearance.

4.3 Mill width rolls shall be cut to the length required, and the two layers of fabric separately joined bottom edge to bottom edge and top edge to top edge by means of sewing thread to form multiple width panels. All factory sewn seams shall be downward facing.

4.4 Grout stops shall be installed at predetermined, mill width, intervals to regulate the flow of grout.

4.5 Immediately following receipt of the fabric forms at the Job Site, forms shall be inspected and stored in a clean dry area where they will not be subject to mechanical damage, exposure to moisture, or direct sunlight.

4.6 Grout shall consist of a mixture of Portland cement, fly ash, fine aggregate (sand), and water so proportioned and mixed as to provide a pumpable grout. Grout fluidizer conforming to these specifications may

be used at the option of the Contractor. The mix shall be Class "I" and shall exhibit a compressive strength of 2500 psi at 28 days when made and tested in accordance with Section 03310.

5.0 INSTALLATION

5.1 The concrete erosion control revetment shall be placed over the bentonite geocomposite liner cover material within five days of cover material placement. Any damage to the cover material shall be repaired prior to placing the fabric forms.

5.2 Site Preparation:

1. Areas on which fabric forms are to be placed shall be constructed to the lines and grades shown on the Drawings.

2. No fabric forms shall be placed over the subgrade material until the subgrade surface has been approved by the Engineer.

5.3 Fabric Form Placement:

1. Fabric form panels shall be placed within the limits shown on the Drawings.

2. Adjacent fabric form shall be joined before grout injection by field sewing or zippering the two bottom layers of fabric together and the two top layers of fabric together. All sewn seams shall be downward facing.

3. When conventional joining of panels is impractical, adjacent panels may be overlapped a minimum of 3 feet. Simple butt joints between panels shall not be permitted.

4. Expansion joints shall be provided at maximum 400 feet intervals. Each expansion joint shall be a minimum 3 feet overlap with six mil polyethylene bond break between panels.

5.4 Grout Placement:

1. Grout shall be injected in such a way that excessive pressure on the fabric and cold joints are avoided.

2. Foot traffic on the filled mat shall be prohibited for one hour after pumping.

3. All anchor trenches shall be backfilled and compacted within three days of completing grout placement.

5.5 The Contractor shall only work on an area that can be completed in one working day. Completion shall be defined as the placement of the liner and placement of the protective layer of 12 inches of cover material. During the cover material placement, a minimum of 12 inches of material shall be kept between the liner and any machinery or equipment at all times.

END

Appendix G - Provisions for Surveillance, Maintenance, and Repair of the CCR Unit

(6 total pages)

4.10. Impoundment and Landfill Inspection Procedure

4.10.1. Inspections are to be performed on the following schedule:

Cross	Inspection by Plant Personnel (Personnel must complete: Initial Inspector Training and 3-yr Refresher Training)	Inspection by a Qualified Dam Safety Engineer (contact Civil Projects Supervisor)
Wastewater Decant Pond	Weekly	Every 5 years
Bottom Ash Pond	Weekly	Annuallyw/ internal inspection of decant structure every 5 years
Gypsum Pond	Weekly	Annually
Stormwater Pond (Units 1&2)	Annually	Not required
Stormwater Pond (Units 3&4)	Annually	Not required
Coal Pile Runoff Pond	Annually	Not required
Leachate Collection Pond	Annually	Not required
Landfill Non-Contact Stormwater Pond	Annually	Not required
Sediment Pond	Annually	Not required
Class 2 Landfill	Weekly	Annually
Class 3 Landfill	Weekly	Annually
Grainger		
Ash Pond 1	Monthly	Annually
Ash Pond 2	Monthly	Annually
Cooling Pond	Annually	Every 5 years
Jefferies		
Ash Pond A	Weekly	Annually
Ash Pond B	Weekly	Annually w/internal inspection of outlet structure every 5 years
Spoil Bank – Exterior Inspection (Boat or Walking)	Weekly	Annually
Winyah		
Ash Pond A	Weekly Annually – walking inspection	Annually
Ash Pond B	Weekly Annually – walking inspection	Annually w/internal inspection of outlet structure every 5 years
South Ash Pond	Weekly Annually – walking inspection	Annually w/internal inspection of outlet structure every 5 years
West Ash Pond	Weekly Annually – walking inspection	Annually
Slurry Pond 2	Weekly Annually – walking inspection	Annually
Slurry Pond 3&4	Weekly Annually – walking inspection	Annually

Cooling Pond	Annually	Every 5 years
Intake Canal	Annually	Every 5 years
Discharge Canal	Annually	Every 5 years

Rainey

Process Water Retention Pond	Quarterly	Every 5 years
Stormwater Pond 01	Annually	Every 5 years
Stormwater Pond 02	Annually	Every 5 years
Stormwater Pond 03	Annually	Every 5 years
Stormwater Pond 04	Annually	Every 5 years

Document inspections on the Impoundment Inspection Reports, in Appendix E - FORMS.

4.10.2. 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 slope. These should be filled and graded to drain. Re-establish vegetation if needed.

Water Level in the Pond
Pond levels should be inspected and recorded to be sure freeboard is adequate and the dikes will not be overtopped.

Overall Condition
The overall condition of the dike should be described. The back of the report form can be used to continue any comments or descriptions.

Excessive Sediment Buildup
Stormwater ponds shall be inspected for excessive sediment buildup. Buildup shall be periodically cleaned out of stormwater ponds and properly disposed of.

Discharges and Pipe Crossings
All outlets of hydraulic structures which pass through a dike or abutment or underneath the base of a surface impoundment should be inspected for abnormal discoloration, flow, or discharge of debris or sediment which could indicate a leak. In addition, all pipe crossings, whether through, under, or over a dike, should be inspected.

4.10.3. Driving Inspections should involve a view of both sides of the dike and around the toe of the dike exterior looking up whenever possible. The inspector should walk to evaluate pipe crossings, the area around discharge structures, wet areas, or areas demonstrating erosion.

4.10.4. Inspections by Qualified Dam Safety Engineer shall include participation by station personnel. Documentation shall be as appropriate and shall be provided for station files. When noted, inspections should include internal inspections of principal outlet structures. Consideration should be given to performing the annual walking inspection coincidentally with the Dam Safety Engineer's inspection when required annually.

4.10.5. If any issues are noted, a map or drawing of the dike/pond(s) inspected should be attached to the report form. Sketches of the ponds at each station are available in Appendix E, FORMS. Significant issues shall be immediately communicated to supervision.

4.10.6. Work orders should be written to address any problems noted on the reports. The person performing the inspections is responsible for the writing and follow-up on the work request.

4.10.7. The completed report forms should be reviewed by management, and reviewed and approved by the Station Manager. Copies should be kept in the station's files and sent to Generation Technical Services.

GENERATION - TECHNICAL SERVICES **DATE:** _____

IMPOUNDMENT INSPECTION REPORT: CCR UNIT **INSPECTOR:** _____ **SIGNATURE:** _____

CROSS STATION **REVIEWED BY:** Station Manager **SIGNATURE:** _____

BOTTOM ASH 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 grass, clarity)		
Boils		
Drainage Ditches		
Drainage Pipes		
Vegetation (trees present, no grass)		
4. Outlet Works		
Inspect Outlet Weir to Decant Pond		
Flowing as expected from outlet?		
No abnormal flow, discoloration, debris, or sediment?		
5. Crossings		
No flow, settlement, erosion, voids, or sediment loss visible at pipe crossings (both sides of dike and crest)		Main pipe entry point: Coal Pile Runoff Pond pipe entry point (current): Coal Pile Runoff Pond pipe entry point (abandoned): Leachate Collection Pond entry point: Abandoned underdrain: Note other:
6. Overall Condition		
Note any other issues		New pipes?
7. Instrumentation		
Staff gauge reading as expected?		Record reading if applicable.

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)
Operating Record - ECM
Generation Technical Services - Tim Swicord