Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant

Documents submitted:
North Wall (Segment 8) Perimeter Containment Design (90% Submittal)

Date Submitted:
October 25, 2011

Submitted to whom
Craig Zeller, EPA

Concurrence

Received	Not Applicable	TVA
☐	☒	Steve McCracken
☒	☐	Kathryn Nash
☒	☐	Ben Obrien
☒	☐	Michelle Cagley

Received	Not Applicable	Jacobs
☒	☐	Jack Howard
☒	☐	Bruce Haas
☐	☐	

Approvals

TVA Kathryn Nash Date 10/25/11

EPA Date 1/13/12

cc:

- ☒ Anda Ray, TVA
- ☒ Barbara Scott, TDEC
- ☒ Brenda Brickhouse, TVA
- ☒ John Dizer, TVA
- ☒ Craig Zeller, EPA
- ☒ Dennis Yankee, TVA
- ☒ Kathryn Nash, TVA
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- ☒ Jack Howard, Jacobs
- ☒ Michelle Cagley, TVA
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- ☒ KIF Incident Document Control
- ☒ Katie Kline, TVA
- ☒ Amanda Miolen, EPA
- ☒ Robert Pullen, Jacobs
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January 31, 2012 let_001_175661022

Ms. Kathryn Nash
General Manager
TVA Kingston Fossil Ash Recovery Operations
1134 Swan Pond Road
Harriman, Tennessee 37748

Re: Design Status Update - Segment 8 (RDP-0113-J)
Kingston Perimeter Containment
Harriman, Roane County, Tennessee

Dear Ms. Nash:

GEI Consultants Inc. (GEI), the peer reviewer designated by Tennessee Valley Authority (TVA) for the above referenced project, concurs with the Segment 8 design prepared by Stantec Consulting Services Inc. (Stantec). GEI's letter expressing agreement on all documented issues is dated January 30, 2012.

As you are aware, the peer review process resulted in a number of questions related to the numerical predictions (in FLAC) of seismic performance. Most of these issues focused on the initiation of liquefaction in the dynamic computer simulations, and the calculated loads that are later applied to the 3D model of the stabilized perimeter. The changes to the design analysis involve parametric variations of a key FLAC parameter to capture worst-case behavior related to liquefaction, plus a more detailed (and less conservative) characterization of the resulting loads on the walls. After working through multiple rounds of review and discussion over the last three months, we (Stantec and GEI) are now in agreement that the design calculations are appropriate. The changes implemented in the design models for Segment 8 are the same as those made in the final Segment 7 analyses, which were submitted earlier this month.

After implementing these changes, we have demonstrated that the previously submitted 90% design for Segment 8 will meet the design criteria without modification. Hence, our final design for this segment will consist of the soil-cement wall layout shown in the 90% submittal drawings. The stabilized footprint will be 50 feet wide with an area replacement ratio of 0.33. Assuming 4-foot thick walls are built, the shear walls will be spaced at 19.7 feet on center.

Changes to the design drawings include minor edits and clarifications to the notes and labels. We have changed one detail on the cross sections, so that Segment 8 construction will be consistent with Segment 1 Field Change Notice (FCN) No. 046. Namely, where ash remains between the buttress walls and beneath the outer rock berm, the ash must be covered with 6 inches of sand and 6 inches of No. 57 aggregate (see Note 13 on Sheet 10W222-07, attached). This change was implemented to reduce the potential for ash to migrate through the No. 2 stone fill in the rock berm. We note that the US Bureau of Reclamation has previously (January 18, 2012) reviewed FCN 046 for Segment 1, and concurred with this detail.

The Quality Control Plan and Specifications for Segment 8 have been revised to be consistent with the recently issued documents for Segment 7. Compared to the 90% design submittal (October 21, 2011) for Segment 8, the following changes have been implemented for the 100% IFC package:

Quality Control Plan, page 1, third bullet changed to:

> Attachment 3 provides the quality control procedures for the QC Representative for Perimeter Wall Stabilization activities. This document was prepared by the Perimeter Wall Stabilization Contractor (Geo-Con), at the start of Segment 1 construction. Details within this part of the QCP are subject to change, with review and approval, prior to execution of subsequent phases of the work.

Quality Control Plan, Attachment 2, Section 8.3, first paragraph changed to:

> Core samples may be tested for strength in accordance with the Specifications (Section 02650). If this option is exercised, this section establishes criteria for the Testing Laboratory to select test specimens for unconfined compressive strength (UCS) testing, from the testing intervals defined by the QC Manager.

Quality Control Plan, Attachment 2, Section 9.1, added paragraph:

> Photographic surveys of cored holes can be obtained with a submersible borehole camera; if such surveys are completed, the QC Manager may use the results to assess the uniformity of or defects within the completed soil-cement walls.

Quality Control Plan, Attachment 2, Section 9.2, item 8 in the example procedure, revised to:

> Two unmixed or unfixated soil inclusions, each one being wider than half the diameter of the core and longer than 6 inches (in the direction of the core length), were discovered in the recovered core. The total length of these two inclusions was 1.9 ft.

Specifications, Special Conditions, Paragraph 1.5, first sentence changed to:

> The Quality Control Manager for construction will review and evaluate test data and other as-built information to check for compliance and consistency with the design.

Specifications, Section 02150, Paragraph 1.3.3, added sentence:

The Relic Area includes Cell 1 or the South Dredge Cell.

Specifications, Section 02150, Paragraph 1.3.5, changed to:

A local north-south oriented, public roadway that roughly forms the western boundary of Kingston site activities.

Specifications, Section 02350, added Paragraph 2.4:

TDOT No. 10 Screening Product shall conform to the requirements of Tennessee Department of Transportation (TDOT) No. 10 Screening Product or equivalent, except that this material shall have 12 percent or less by weight passing the number 200 sieve. Otherwise this product shall meet the material and durability requirements of Section 903 of the latest edition of the TDOT "Standard Specifications for Road and Bridge Construction".

Specifications, Section 02350, added under Paragraph 3.1:

Ash that remains in place beneath the rock berm, outside of the outboard perimeter wall, shall be covered with TDOT No. 10 Screening Product and No. 57 Coarse Aggregate. These layers may be placed without compaction.

TDOT No. 10 Screening Product, No. 57 Coarse Aggregate, No. 2 Coarse Aggregate, and TDOT Class B Machined Riprap shall be placed to the depths, extents and template shown in the Drawings. Note that some areas may require underwater placement.

Specifications, Section 02650, Paragraph 1.4.17, changed to:

A Soil-Cement Panel is a linear portion or segment of a Soil-Cement Wall that is constructed continuously to full depth during one set-up of the excavation equipment.

Specifications, Section 02650, Paragraph 2.2.1, added paragraph:

Mitigation of a defect in a panel may be accomplished by constructing an adjacent panel. For each defect, the mitigation method and the required dimensions will be defined in a work plan reviewed by the Perimeter Wall Stabilization QC Manager and approved by the TCM.

Specifications, Section 02650, Paragraph 4.3.8, second paragraph changed to:

Where formed, a Cold Joint shall be reinforced by doubling the thickness of the soil-cement wall, to full depth of the joint to the top of rock. At a Butt Joint in a Shear Wall or a Perimeter Wall, the double wall thickness shall extend past the Cold Joint in both directions along the wall for a distance not less than twice the effective wall thickness.

At a Tee Joint, the double wall thickness shall bear against the Perimeter Wall and extend from the Cold Joint along the Shear Wall or the Buttress Wall for a distance not less than twice the effective wall thickness. At Tee Joints where both a Buttress Wall and a Shear Wall are present, both the Cold Joint on the Buttress Wall and the Cold Joint on the Shear Wall shall be mitigated.

Specifications, Section 02650, Paragraph 4.3.12, changed to:

If installation observations indicate a lack of mix homogeneity, poor quality, or the existence of a discontinuity due to a collapse of the surrounding soil, improper installation procedures, equipment problems, interruption of mixing, or any other malfunction, then the Perimeter Wall Stabilization QC Manager may order additional testing and/or additional excavation and remixing of any soil-cement panel within the area of the observed problems. Additional wet-grab testing at the time of construction may be used to evaluate the soil-cement panel separately from the remainder of the test parcel and corresponding soil-cement wall panels.

Specifications, Section 02650, Paragraph 4.3.14, changed to:

While Earthwork Contractor is responsible for erosion control on the site, PERIMETER WALL STABILIZATION CONTRACTOR shall be responsible for erosion control associated with its own operations, shall meet the requirements of SECTION 02100 EROSION CONTROL AND STABILIZATION, and shall coordinate with the Construction Manager regarding erosion control issues.

Specifications, Section 02650, Paragraph 4.3.15, changed to:

PERIMETER WALL STABILIZATION CONTRACTOR shall provide dust control for all PERIMETER WALL STABILIZATION CONTRACTOR operations. The PERIMETER STABILIZATION CONTRACTOR shall make every effort to control dust emissions and shall adhere to all applicable rules and regulations of pertinent governmental agencies concerning fugitive dust emissions.

Specifications, Section 02650, Paragraph 4.8, second paragraph changed to:

The number and frequency of unconfined compressive strength specimens, wet-grab or core, and core holes will meet the requirements in Paragraph 2.2.4 for determining the strength of the soil-cement panels. Test Parcel locations, wet-grab sample locations, coring locations, and test specimens will be selected by the Perimeter Wall Stabilization QC Manager. At the discretion of the Perimeter Wall Stabilization QC Manager, the selection of the Test Parcel locations, wet-grab sample locations, coring locations, and test specimens may be random or may be focused in areas of construction joints, low cement ratios, or apparent construction problems. If observations during construction or the test results indicate deficiencies or marginal quality, the TCM or Perimeter Wall Stabilization QC Manager may require additional coring and/or testing.

Specifications, Section 02650, Paragraph 4.8.1(8), changed to:

> For each designated sampling location, molded specimens will be selected by Perimeter Wall Stabilization QC Manager and tested for Unconfined Compressive Strength. The Perimeter Wall Stabilization QC Manager may require such tests on samples that have cured for 14 days, 28 days, 56 days, or some other time period.

Specifications, Section 02650, Paragraph 4.8.2(10), changed to:

> The Perimeter Wall Stabilization QC Manager may select cores for testing for Unconfined Compressive Strength. Such tests shall be conducted in accordance with ASTM D2166, at an axial strain rate of 0.5% per minute, and the axial strain at peak load shall be recorded.

We are now proceeding with the preparation of the 100% IFC package documents, including the calculation package with the revised analyses. If you have any questions or need additional information, please call.

Sincerely,

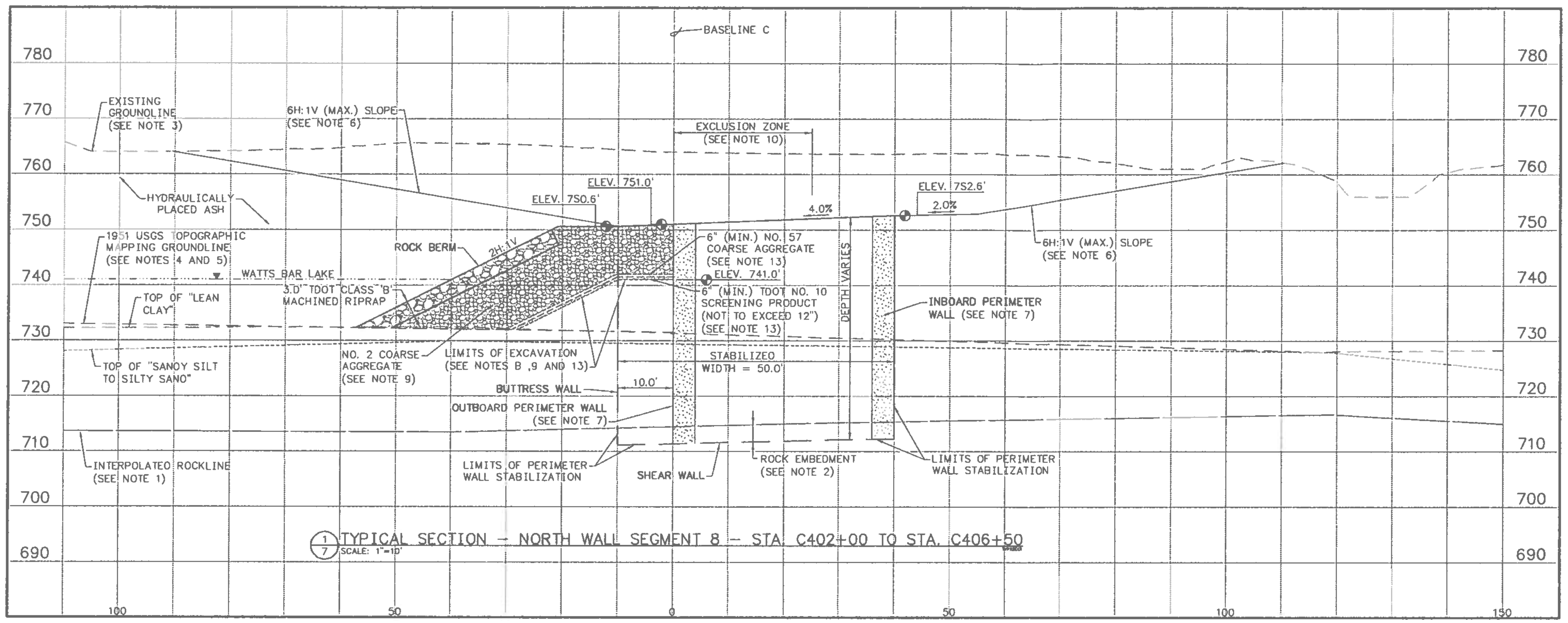
STANTEC CONSULTING SERVICES INC.

Michael J. Steele, PE
Senior Associate

Alan F. Rauch, PhD, PE
Senior Associate

/afr/cmw

Attachment



1/7 TYPICAL SECTION - NORTH WALL SEGMENT 8 - STA. C402+00 TO STA. C406+50
SCALE: 1"=10'

NOTES:

1. THE ELEVATIONS OF THE TOP OF THE SUBSURFACE STRATA AND THE TOP OF ROCK SHOWN ON THIS DRAWING DEPICT APPROXIMATE SUBSURFACE CONDITIONS ONLY AT SPECIFIC BORING LOCATIONS AT THE TIME OF DRILLING. CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM THOSE OCCURRING AT THE BORING LOCATIONS. ANY CORRELATIONS SHOWN BETWEEN BORINGS ARE BASED ON INTERPOLATION. ACTUAL CONDITIONS BETWEEN BORINGS ARE UNKNOWN AND MAY DIFFER FROM THOSE SHOWN.

2. SOIL-CEMENT WALLS SHALL BE CONSTRUCTED TO THE MINIMUM DEPTH OF ROCK EMBEDMENT DEFINED ON THE PROFILE SHEET FOR BASELINE C. THE EMBEDMENT SHOWN HERE IS FOR ILLUSTRATION ONLY.

3. EXISTING GROUNDLINE BASED ON TOPOGRAPHIC MAPPING GENERATED FROM A LIDAR SURVEY ON FEBRUARY 16, 2011, BY TUCK MAPPING SOLUTIONS, INC. AND PROPOSED GRADING FROM DESIGN PACKAGE RDP-0113-E.

4. 1951 USGS GROUNDLINE IS BASED ON INTERPOLATION BETWEEN CONTOURS SHOWN ON 1951 U.S. GEOLOGICAL SURVEY TOPOGRAPHIC MAPPING AND IS INCLUDED TO REPRESENT ORIGINAL TOPOGRAPHY.

5. ASH WITHIN THE EMBAYMENT AREA OUTSIDE THE PERIMETER CONTAINMENT WILL BE EXCAVATED AND REMOVED BY TVA IN ACCORDANCE WITH DESIGN PACKAGE RDP-0112-A AND SUBSEQUENT APPROVED DESIGN PACKAGES. FOR THE PURPOSES OF THESE DRAWINGS ONLY, THE MAXIMUM DEPTH OF EXCAVATION IN THE EMBAYMENT IS ASSUMED TO APPROXIMATELY COINCIDE WITH THE NATURAL GROUND SURFACE PRIOR TO CONSTRUCTION OF THE ASH POND. CONTOUR LINES DIGITIZED FROM A U.S. GEOLOGICAL SURVEY TOPOGRAPHIC MAP (DATED 1951) ARE ASSUMED TO REPRESENT THE FORMER GROUND SURFACE IN THE AREA SHOWN.

6. THE 6H:1V SLOPES IN THE ASH SURFACE DURING PERIMETER WALL STABILIZATION MAY BE SHIFTED TO ACCOMMODATE A WIDER CONSTRUCTION PLATFORM AS MAY BE NEEDED FOR PERIMETER WALL STABILIZATION CONSTRUCTION.

7. SEE SPECIFICATIONS FOR THE THICKNESS OF THE INBOARD PERIMETER WALL AND OUTBOARD PERIMETER WALL. THE WALL THICKNESSES SHOWN HERE ARE FOR ILLUSTRATION ONLY.

8. ASH BETWEEN THE BUTTRESS WALLS SHALL BE EXCAVATED TO FULL DEPTH (AS DEFINED IN DESIGN PACKAGE RDP-0112-A AND SUBSEQUENT APPROVED DESIGN PACKAGES) OR TO ELEVATION 741.0 FEET, WHICHEVER IS HIGHER. OUTSIDE THE BUTTRESS WALLS, THE ASH SHALL BE EXCAVATED ON A SLOPE DOWN TO THE UNDERLYING SOIL, AND THE BASE OF THE ROCK BERM SHALL BE PLACED UPON NATIVE SOIL AND NOT UPON SLUICED OR FAILED ASH.

9. DURING EXCAVATION OF ASH BETWEEN THE BUTTRESS WALLS AND PLACEMENT OF NO. 2 COARSE AGGREGATE, THE DIFFERENCE IN SURFACE ELEVATION ON EITHER SIDE OF ANY BUTTRESS WALL SHALL NOT EXCEED FOUR FEET AT ANY TIME.

10. SURFACE LOADS ON THE TOP OF THE SOIL-CEMENT WALLS SHALL BE RESTRICTED DURING CONSTRUCTION OF THE ROCK BERM. FROM THE START OF MATERIAL EXCAVATION BETWEEN THE BUTTRESS WALLS, UNTIL THE STONE FILL REACHES THE TOP OF THE BUTTRESS WALLS, ALL MATERIALS AND EQUIPMENT THAT WOULD EXERT A SURFACE PRESSURE OF GREATER THAN 50 POUNDS PER SQUARE FOOT SHALL NOT BE PLACED OR OPERATED WITHIN THE AREA MEASURING 25 FEET INSIDE OF THE OUTER FACE OF THE PERIMETER WALL.

11. IF THE SOIL-CEMENT WALLS ARE INITIALLY CONSTRUCTED TO A TOP ELEVATION ABOVE THAT SHOWN, THEN THE WALLS SHALL BE EXCAVATED TO THE FINAL GRADES SHOWN.

12. IF THE ENDS OF THE BUTTRESS WALLS ARE INITIALLY CONSTRUCTED TO A HORIZONTAL OFFSET BEYOND THE OUTBOARD EXTENTS SHOWN, THEN THE WALLS SHALL BE CUT BACK TO AT LEAST 3 FEET BELOW THE FINAL GRADE OF THE ROCK BERM, AND THEN COVERED WITH NO. 2 COARSE AGGREGATE AND TDOT CLASS 'B' MACHINED RIPRAP TO THE LIMITS SHOWN HERE.

13. ASH THAT REMAINS BENEATH THE ROCK BERM, OUTSIDE OF THE OUTBOARD PERIMETER WALL, SHALL BE COVERED WITH TDOT NO. 10 SCREENING PRODUCT HAVING A THICKNESS NOT LESS THAN 6 INCHES AND NOT EXCEEDING 12 INCHES, AND NO. 57 COARSE AGGREGATE HAVING A THICKNESS NOT LESS THAN 6 INCHES.

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION

SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGKIFFESCDX00030020110023

R 0 | 02/03/12 | TGC | DMG | AFR | MJS | VJD | MST | JCK
ISSUED FOR CONSTRUCTION

SCALE: 1"=10' EXCEPT AS NOTED

YARD
NORTH WALL - RDP-0113-J

PERIMETER CONTAINMENT
TYPICAL CROSS SECTION

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KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 02/03/12 | 36 | C | 10W222-07 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:10
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

Technical Specifications

Perimeter Containment
North Wall - Segment 8
Sta. C401+30 to
Sta. C408+42.30
Kingston Fossil Plant
Harriman, Roane County,
Tennessee

Document Control Number
RDP-0113-J

ISSUED FOR REVIEW 90%

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Prepared for

Tennessee Valley Authority
Kingston, Tennessee

October 21, 2011

TECHNICAL SPECIFICATIONS
TABLE OF CONTENTS

SPECIAL CONDITIONS

PART 1 GENERAL

1.1. TECHNICAL CONTRACT MANAGER

The work governed by this contract and performed by the PERIMETER WALL STABILIZATION CONTRACTOR will be administered by the Technical Contract Manager (TCM), who is responsible for the acceptance of completed work by the PERIMETER WALL STABILIZATION CONTRACTOR.

1.2. CONTRACTORS ON SITE

Two prime contractors will be present on site during the perimeter stabilization operations. These two prime contractors are referred to within these specifications as EARTHWORK CONTRACTOR and PERIMETER WALL STABILIZATION CONTRACTOR. A CORING CONTRACTOR, and possibly other contractors and subcontractors, will be engaged for specific portions of the work. All contractors on the site will be coordinated by the Construction Manager.

1.3. CONTRACTOR SCOPES OF WORK

PERIMETER WALL STABILIZATION CONTRACTOR is responsible for the work defined in Section 02650, exclusive of coring and testing of core specimens. PERIMETER WALL STABILIZATION CONTRACTOR is also responsible for erosion control, as defined in Section 02100, within the perimeter wall stabilization work area during the perimeter wall stabilization operations.

EARTHWORK CONTRACTOR is responsible for the work defined in Sections 02100, 02150, 02200, 02300, 02310, 02350, and 02936.

CORING CONTRACTOR is responsible for coring of the Soil-Cement Walls, in accordance with Paragraph 4.8.2 in Section 02650.

The general sequence of activities shall be as follows: In advance of Perimeter Wall Stabilization operations, EARTHWORK CONTRACTOR shall establish a subgrade surface that corresponds to the "Top of Perimeter Wall Stabilization" shown on the Drawings. PERIMETER WALL STABILIZATION CONTRACTOR shall then perform the Perimeter Wall Stabilization construction and shall be responsible for construction and removal of the Construction Platform needed for such operations. PERIMETER WALL STABILIZATION CONTRACTOR shall place excess spoils from its operations on the inboard side of the Perimeter Wall Stabilization zone, after which EARTHWORK CONTRACTOR shall be responsible for the final disposal of the spoils. Test cores shall be acquired from the completed Soil-Cement Walls by the CORING CONTRACTOR. After completion and acceptance of the Perimeter Wall Stabilization work, EARTHWORK CONTRACTOR shall construct the drainage features, the rock berm, and the earthen berm as shown on the Drawings.

1.4. QUALITY ASSURANCE

Quality Assurance of the work done by all contractors is the responsibility of the Quality Assurance Manager. The QA Manager will be responsible for the overall Quality Assurance for the Kingston Recovery Project, with a primary focus on ensuring compliance and documentation consistent with the TVA quality procedures. Quality Assurance for Earthwork activities is the responsibility of the Earthwork QA Manager. Quality Assurance for Perimeter Wall Stabilization activities is the responsibility of the Perimeter Wall Stabilization QA Manager.

1.5. QUALITY CONTROL

The Quality Control Manager for construction will be focused on reviewing and evaluating test data and other as-built information to check for compliance and consistency with the design. The QC Manager will represent the design Engineer of Record and will be a Professional Engineer licensed in the State of Tennessee.

The Quality Control Representative will be responsible for reporting Quality Control data collected by the Quality Control Team during construction.

Quality Control of Earthwork operations is the responsibility of the Earthwork QC Manager. Quality Control testing for the Earthwork Construction shall be performed by the QC Team, with data reported by the Earthwork QC Representative, who may (or may not) be the same individual as the QC Manager.

Quality Control of the Perimeter Wall Stabilization activities is the responsibility of the PERIMETER WALL STABILIZATION CONTRACTOR. The PERIMETER WALL STABILIZATION CONTRACTOR shall provide all sampling and testing associated with the Laboratory Mix Design and Quality Control during construction. PERIMETER WALL STABILIZATION CONTRACTOR shall submit a Quality Control Plan meeting the requirements of Section 02650 for approval prior to commencing work. PERIMETER WALL STABILIZATION CONTRACTOR shall designate a Quality Control Representative responsible for providing all Quality Control data to the Perimeter Wall Stabilization QC Manager.

Quality Control of the Coring activities is the responsibility of the CORING CONTRACTOR. The CORING CONTRACTOR shall log, photograph, preserve, pack, and label all cores obtained from the Soil-Cement Walls and underlying rock, in accordance with the requirements in Section 02650. The

Perimeter Wall Stabilization QC Manager will be responsible for selecting the coring locations, inspecting the core with respect to the acceptability requirements for the Soil-Cement Walls, and selecting specimens for subsequent testing.

The following matrix illustrates the roles related to QA/QC for Earthwork Construction, Perimeter Wall Stabilization, and Coring.

ROLE	EARTHWORK	PERIMETER WALL STABILIZATION	CORING
Project Owner	TVA		
Quality Assurance Manager	Jacobs		
Quality Control Manager	Stantec (Engineer of Record)		
Quality Control Representative	Stantec	Perimeter Wall Stabilization Contractor	Coring Contractor
Quality Control Team	Stantec	Perimeter Wall Stabilization Contractor	Coring Contractor

PART 2 MATERIALS

(Not Applicable)

PART 3 EXECUTION

(Not Applicable)

END OF SPECIAL CONDITIONS

TECHNICAL SPECIFICATIONS

DIVISION 2 – SITE WORK

SECTION 02100 – EROSION CONTROL AND STABILIZATION

PART 1 - GENERAL

1.1. DESCRIPTIONS

1.1.1. This Section includes provisions for erosion control and stabilization. All construction activities shall be conducted in accordance with applicable environmental requirements. Install sediment and erosion control measures prior to disturbance where applicable.

1.1.2. The EARTHWORK CONTRACTOR shall become familiar with the other construction activities ongoing as well as instrumentation plans and the proposed construction under this contract in terms of integration into the Best Management Practices (BMP) Plan.

1.1.3. This Work may be proceeding concurrently with other construction activities, such as Perimeter Wall Stabilization and "North and Central Dredge Cell (Cells 2 & 3) Ash Stacking", as detailed in construction documents. The EARTHWORK CONTRACTOR shall also be familiar with the Site Wide Storm Water Management Plan (SWMP), as well as the Erosion and Sediment Control Details, and the BMP Plan for this Work and shall anticipate, and therefore plan in advance for each construction activity.

1.2. RELATED DOCUMENTS

1.2.1. The Quality Control Plan, Technical Specifications, Engineering Drawings, and the SWMP apply to the work of this section.

1.2.2. Related Sections include the following:

- Section 02150 – Site Preparation
- Section 02200 – Excavation
- Section 02300 – Backfill and Embankment
- Section 02350 – Rock Berm
- Section 02650 – Perimeter Wall Stabilization
- Section 02936 – Revegetation

1.3. DEFINITIONS

1.3.1. TVA

TVA is the Tennessee Valley Authority, which is the project owner.

1.3.2. Technical Contract Manager (TCM)

The Technical Contract Manager (TCM) is the designated TVA representative responsible for the administration and oversight of the Work, including but not limited to the duties outlined in this Specification.

1.3.3. Quality Control (QC) Manager

The Quality Control Manager (QC Manager) is a professional engineer licensed in the State of Tennessee that is responsible for the Quality of the constructed project as defined in the Quality Control Plan. This individual will be designated by TVA and will be the Engineer of Record for Construction.

1.3.4. Contractor

The Contractor is the entity with which TVA has entered into an agreement to construct this project. Section 02100 of the Specifications pertains to work to be accomplished by the EARTHWORK CONTRACTOR.

1.3.5. Drawing

Drawings are the Issued for Construction engineering design.

1.3.6 Construction Manager

The Construction Manager is responsible for construction activity to include but not be limited to the character and sequence of work, coordination and scheduling.

PART 2 - MATERIALS

2.1. Refer to the SWMP, the BMP Plan at the end of this Specification, the Sediment and Erosion Control Details, and Sediment and Erosion Control features noted on the various Plans for products and materials to be employed in erosion control and stabilization efforts.

2.2. This section provides material requirements for silt fence, rock check dams, fiber rolls, and references temporary seeding.

PART 3 - EXECUTION

3.1. CONSTRUCTION PHASE OPERATIONS

3.1.1. The EARTHWORK CONTRACTOR shall evaluate the progress of work on the project and determine phasing of work. Sediment and Erosion Control Measures shall be in place to the extent practicable prior to commencement of excavation, perimeter wall stabilization or embankment construction activities in the vicinity.

3.1.1.1. Perform excavation or grading, in such a manner as to route sediment laden runoff through installed sediment control measures. Excavate and place earth, rock and ash fill materials during dry weather, when possible.

3.1.1.2. Establish final grade in a given area as quickly as practical in order to allow application of protective measures while still maintaining construction rate protocols established under Technical Specifications Section 02300, and the QC Plan.

3.1.2. The EARTHWORK CONTRACTOR shall control fugitive dust emissions.

3.1.2.1. Control dust generation on roads by wetting haul roads or by applying approved (by TVA Environmental) chemical soil binders, as needed.

3.1.2.2. Control dust generation by spraying graded areas with water. If a graded area will not be disturbed again within the next 14 days, spray with Flexterra or equivalent hydromulch, at a rate of 2,000 pounds per acre, to control dusting.

3.1.3. The EARTHWORK CONTRACTOR shall not discharge raw silt and sediment laden water from the site without providing for removal of soil particles. Flow is designed to be routed to the sediment ponds downstream of the project area.

3.1.3.1. Use rock check dams, fiber rolls and/or silt fencing as pretreatment areas to avoid siltation of the ditches.

3.1.3.2. Rock check dams shall be constructed of the materials noted on the Drawings and installed at locations deemed necessary by the Construction Manager. Rock check dams may be placed by mechanical means using an excavator or loader. Larger rocks shall be uniformly distributed with the small rocks and spalls filling the voids between the larger rock.

3.1.3.3. The Construction Manager will provide inspection and maintenance of Best Management Practices in accordance with the SWMP.

3.1.3.4. Maintain all best management devices by removing accumulated silt, repairing or replacing damaged devices and by cleaning up any excess discharges, or mud on gravel roads.

3.2. SEDIMENT BARRIERS

3.2.1. The EARTHWORK CONTRACTOR shall install silt fences, and/or fiber rolls or other suitable measures as practicable along the contour above work areas, at the toe of the slopes and along ditches. Silt fence may also be required at other locations based upon field conditions.

3.2.2. Silt Fences

Silt fences shall conform to the material requirements shown on the Drawings. Install silt fence below proposed disturbed areas in accordance with the plans and details and as needed in other areas to reduce sediment washing into or from work areas. Embed silt fence as shown on the Drawings. Turn ends of silt fence slightly toward the uphill side to help reduce bypassing by runoff around the fence ends. Silt fences shall also be utilized to protect installed areas of the working platform.

3.2.3. Fiber Rolls

Fiber rolls and other commercial products made from coconut fiber, rice straw, plastic, wood shavings, or other material can also be used as sediment barriers along streams. Follow manufacturers' installation instructions and ensure that sediment filter spacing on slopes is correct. Make sure runoff does not bypass barriers, coconut rolls, or other barriers underneath or around the ends.

3.2.4. Maintenance

Inspect silt fences, rock check dams and other installed manmade barriers in accordance with the site wide SWMP. Remove sediment before it reaches ⅓ the height of the silt fence. Reinstall sections of fence which have washed out underneath the fence. Replace broken, torn or worn fences. Rebuild or replace damaged rock check dams. Make repairs within three days of discovery.

3.3. SLOPE PROTECTION

3.3.1. The EARTHWORK CONTRACTOR shall take measures as necessary to minimize sheet, rill and gully erosion prior to constructing the working platform and in areas outside the grading limits affected by this work. Slopes shall be stabilized against erosion and sloughing immediately after grading with measures as described below.

A. Divert Upland Runoff – Use diversion berms as practicable to control flow and route around work areas.

B. Tracking– Track a dozer up and down the slopes to create horizontal breaks which will slow the overland flow of water.

C. Sediment Barriers – See paragraph 3.2.

3.3.2. The ash is a highly erosive material that does not sustain relatively steep slopes without headcuts and piping issues developing. Even relatively gentle slopes have exhibited erosion features. Follow short to medium term slope protection as stipulated in Section 02936 of these specifications. It is imperative that once an area achieves final grade, the area shall be revegetated using long-term measures in accordance with Section 02936 of the Specifications. Coordinate vegetation efforts with other site construction activities. Avoid creating large areas with moderate to relatively steep slopes that have not been protected against erosion related instabilities.

3.3.3 Inspect slopes for erosion in accordance with the site wide SWMP. Repair gullied areas and any upslope areas contributing large volumes of sediment. Install berms, fiber coils or other measures as needed. Remove sediment from sediment control devices as discussed in paragraph 3.2.

3.3.3.1 Daily inspect equipment and hydraulic oil systems at the beginning of the day. Repair or replace frayed or damaged lines or hoses before use in or near water and provide containment measures if required.

3.3.3.2 Keep erosion and sediment controls in good working order until the project is completed. Brush and other debris should be removed from work areas. Sediment accumulating behind silt fences or other sediment filters should be removed regularly. All structures that have become dislodged or damaged (such as silt fences, etc.) should be repaired within three days of discovery.

3.3.3.3 Make sure that waste materials, building materials, and supplies are properly tied down or contained so that wind and storm water runoff cannot carry the materials away. Fuel, lubricants, and hazardous waste products should be stored in an approved tank or other structure to avoid spills and runoff. Provide spill kits and containment material on-site, especially near fueling or equipment service areas. Maintain vehicles and equipment away from the site if possible. If maintenance must occur on-site, ensure that spills are cleaned up quickly.

Best Management Practices Plan
DREDGE CELL CLOSURE, PERIMETER STABILIZATION, NORTH WALL
SEGMENT 8 STA. C401+30 TO STA.C408+42.30

Purpose of the Best Management Practices Plan

The BMP was originally developed to provide a guideline for the Perimeter Stabilization work activities, and shall also apply to all other construction related activities in the project area.

The purpose of the Best Management Practices (BMP) Plan is to evaluate potential sources of sediment and other pollutants at the project site and put controls in place that will effectively prevent pollutant discharges to surface and ground waters. Construction activities shall be performed in accordance with the Kingston site wide SWMP. The following general pollution control requirements have been addressed in the BMP Plan, as applicable:

1. Control limited threat discharges to minimize impacts to water quality;

2. Prevent the discharge of pollutants associated with construction activities to surface waters;

3. Retain soil and sediment on site; and

4. Permanently stabilize disturbed soils.

This plan has been developed based on an understanding of the current conditions of the watershed, a general knowledge of the previous activities at the site, and an anticipation of the proposed remediation activities scheduled for the site. This plan is intended to be a "living" document, in that as the Work at the site progresses, this plan must be periodically reviewed and adjusted to suit the actual conditions and situations as they develop. EARTHWORK CONTRACTOR and all SUBCONTRACTORS shall become familiar with this plan, and shall constantly monitor the site conditions, making appropriate modifications as needed.

Site Description:

The Kingston Fossil Plant is located adjacent to the Emory River / Watts Bar Lake in Roane County, Tennessee. The work as described in these documents is a portion of the former ash disposal area located along the Northern Dredge Cell.

Construction Activities and Work Sequence:

This project entails Perimeter Wall Stabilization and associated construction of Earthen and Rock Berms to the lines and grades shown in the Drawings. Drainage improvements within the Dredge Cell under previous design packages promote storm water control. Work measures required to stabilize the site include:

A. Installation of sediment and erosion control measures for the site in accordance with the SWMP, the Drawings and this section of the Technical Specifications.

B. Protection of existing instrumentation in accordance with the Drawings and Section 02150 of these Technical Specifications.

C. Placement of earth and quarry material in an engineered embankment to meet the design template shown in the Drawings. This work shall also be performed in accordance with Sections 02200 and 02300 of these Technical Specifications.

D. Grading of work areas to promote runoff to the previously constructed perimeter ditches.

E. Removal of temporary sediment control measures in a time and manner as deemed appropriate by the Construction Manager.

Sediment and Erosion Control Measures:

Runoff from the work area is conveyed to an outlet that discharges to the Dirty Water Ditch and then to a Sediment Pond that exists downstream of the work area. Pre-treatment will be employed to decrease Total Suspended Solids (TSS) in the runoff to help reduce sediment deposition in the storm water facilities. Measures to reduce TSS for the remainder of the site are described below:

1. Tracking slopes with cleat marks parallel to the contour of slopes to reduce runoff velocity and decrease erosion.

2. Placement of silt fence and fiber coils at toe of slopes, and above ditches and benches and other areas as needed.

3. Installation of rock check dams in drainways.

4. The construction of berms and installation of temporary pipe drains as needed to shorten slope lengths and convey flow around active work areas.

5. Re-vegetate areas as they achieve final grade. To control erosion, re-vegetate all areas where no additional disturbance is planned within the next 21 days.

Other Control Measures:

Dust generation shall be minimized by spraying with water, hydromulch or other TVA, SWMP Manager or Construction Manager approved liquid.

Other Federal, State or Local Laws:

Work on-site shall adhere to all applicable federal, state and local laws.

Maintenance:

All silt fences, fiber coils, berms, pipe drains and other sediment control devices shall be inspected as described below. Tears in the fence shall be repaired or portions of the fence replaced within three days of discovery. Rock check dams shall be cleaned of accumulated sediment when sediment depths exceed one-half the height. The EARTHWORK CONTRACTOR shall likewise ensure that all roads maintain adequate gravel cover and replace same.

Inspections:

Qualified personnel shall inspect storm water control measures, discharge locations, vehicle exits, disturbed areas of the site and material storage areas as noted in the SWMP. Areas that have been temporarily stabilized shall be inspected at least once per month. Revisions to the BMP Plan based on the results of these inspections shall be implemented within seven days.

A report summarizing the scope of the inspection, names and qualifications of the inspecting personnel, the date of the inspection, observations as they relate to the BMP Plan and corrective actions shall be noted in the report. All reports shall be kept for at least three years after the date of the inspection or for one year after coverage under the site specific SWMP. Each report shall be signed, and shall be available at the site for review.

Non-Storm Water Discharges:

All on-site vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Preventive maintenance such as changing oil shall be performed off-site. Spill kits will be required on-site at all times. EARTHWORK CONTRACTOR shall submit a Disposal Plan to TVA for approval. Any spills of hydraulic fluid or oil from machinery shall be immediately cleaned up using rags, mops, kitty litter, sand or sawdust and placed in plastic cans before being disposed of in a legal manner. Containment of any spill using dikes, plastic liners or other methods will be used as necessary. Manufacturer's methods for spill cleanup will be posted on-site and site personnel will be made aware of the location of the procedural information and cleanup supplies. Any spill of toxic or hazardous substances will be immediately reported to the TVA Environmental Compliance Officer who will determine notification procedures. The Construction Manager will be the spill prevention and cleanup coordinator.

Materials expected to be on-site include: petroleum based products, fertilizer, grass seed, mulch, geotextiles, stone, coal combustion products and agricultural lime.

EARTHWORK CONTRACTOR, Subcontractors and Owner:

The EARTHWORK CONTRACTOR and each subcontractor shall implement the appropriate control measures outlined in this BMP plan and the SWMP. The project Owner for the purpose of this work is the Tennessee Valley Authority.

END OF SECTION 02100

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02150 – SITE PREPARATION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

The conditions and description of work shown in other sections of these Technical Specifications as well as the Engineering Drawings and Quality Control Plan apply to this Section.

1.2. SUMMARY

1.2.1. This Section includes the following:

- Stockpiling and protection of materials to be incorporated in the work.
- Protection of geotechnical instrumentation Temporary ditching, access roads or other items needed to facilitate the work.
- Construction stakeout.
- Placement of road gravel as needed to facilitate the work.
- Site Safety Plan.
- Removal of Existing 48-inch Pipe and other obstructions.

1.2.2. Related Sections include the following:

- Section 02100 – Erosion Control and Stabilization
- Section 02200 – Excavation
- Section 02300 – Backfill and Embankment
- Section 02350 – Rock Berm
- Section 02936 – Revegetation

1.3. DEFINITIONS

1.3.1. Dredge Cell

The Dredge Cell is the portion of the former ash storage area that is located between Dike D and Swan Pond Road. It includes Cells 2 and 3 or the North and Central Dredge Cells. It is generally north of the Test Embankment and south of the Dirty Water Ditch with smaller portions of the work lying west of the relic area.

1.3.2. Test Embankment

An area of engineered dry ash fill constructed in a controlled manner upon a granular working platform. The Test Embankment was constructed using prescribed compactive effort, monitored by instruments, and subject to regulatory oversite.

1.3.3. Relic Area

This is an area of the ash storage facility south of the Test Embankment that remained at or near pre-existing grade immediately after the December 2008 incident. Since that time it has been reduced in elevation by grading and has been instrumented.

1.3.4. Dike D

An existing dike constructed of ash and earth materials located between the Dredge Cell and the Ash Pond.

1.3.5. Swan Pond Road

A local north-south oriented road that roughly forms the west boundary of Kingston site activities.

1.3.6. Dirty Water Ditch

A constructed ditch in the embayment that conveys contact water from the site to the Settling Basins.

1.3.7. Ash

Ash is a mixture of fly ash, bottom ash, sand, silt and incidental earthen materials recovered during excavation activities within the embayment area.

1.3.8. Perimeter Wall Stabilization

Perimeter Wall Stabilization is a term for ground improvement accomplished by mixing grout with in-place soils, or replacing excavated soils with grout. The perimeter wall stabilization zone extends from bedrock embedment to the grades shown on the Perimeter Wall Stabilization Grading Plan.

1.3.9. Earthen Berm

The earthen berm is a zoned structure constructed of compacted earth materials built on top of the perimeter wall stabilization zone or in association with the Rock Berm. The earthern berm shall be constructed to the lines and grades shown in the Drawings.

1.3.10. Rock Berm

The rock berm is a structure constructed to provide support for the outer soil-cement wall of the stabilized perimeter.

1.3.11. Technical Contract Manager (TCM)

The Technical Contract Manager (TCM) is the designated TVA representative responsible for the administration and oversight of the Work, including but not limited to the duties outlined in this Specification.

1.3.12. Quality Control (QC) Manager

The Quality Control Manager (QC Manager) is a professional engineer licensed in the State of Tennessee that is responsible for the Quality of the constructed project as defined in the Quality Control Plan. This individual will be designated by TVA and will be the Engineer of Record for Construction.

1.3.13. Contractor

The Contractor is the entity with which TVA has entered into an agreement to construct this project. Section 02150 of the Specifications pertains to work to be accomplished by EARTHWORK CONTRACTOR.

1.3.14. Drawing

Drawings are the Issued for Construction engineering design drawings.

1.3.15. Construction Manager

The Construction Manager is responsible for construction activity to include but not be limited to the character and sequence of work, coordination and scheduling.

1.3.16. Quality Control (QC) Team

The Quality Control (QC) Team is comprised of the individuals responsible for collecting the Quality Control data, and reporting to the QC Manager.

PART 2 - EXECUTION

2.1. PRELIMINARY SUBMITTALS

2.1.1. The EARTHWORK CONTRACTOR shall prepare and present a Safety Plan that has been approved by a TVA Safety Professional. No excavation or embankment work is allowed prior to submittal of the plan and the approval document.

2.1.2. The EARTHWORK CONTRACTOR and Construction Manager shall propose laydown and stockpile areas for discussion with TVA and other entities. The areas and extents of stockpiles are subject to approval by the Earthwork QC Manager and the TCM. The location of the laydown area is subject to approval by TVA.

2.1.3 The Construction Manager shall provide a work schedule showing anticipated milestones for completion of the depicted phases.

2.2. SITE PREPARATION

2.2.1. Protect and maintain geotechnical instrumentation outside the Perimeter Wall Stabilization footprint from disturbance during construction. This shall be accomplished using protective T-posts installed in a closed pattern around the instrument. Orange safety fence shall be installed around the perimeter defined by the T-posts. Alternate means of protecting the geotechnical instrumentation may be approved by the QC Manager. Stockpiled stone shall be located in an area away from concentrated flows and establish run-off diversion ditches away from stockpiles. Concrete pipe shall be stored in accordance with the manufacturer's recommendations. Stockpile locations shall be approved by the Earthwork QC Manager and the TCM prior to any material placement.

2.2.2. Construction stakeouts and as-built surveys shall be performed by the EARTHWORK CONTRACTOR. As a minimum, construction staking shall identify locations of drainage facilities, cut/fill, check profiles of installed items and confirm lines and grades. As-built surveys shall be performed of rock and earthen berm construction, drainage features, top of Perimeter Wall Stabilization subgrade, top of Embankment Platform, and at completion of other items as may be deemed necessary. The as-built survey data shall be provided to the Earthwork QC Manager for review. Survey shots are anticipated at maximum 50 foot horizontal increments and at slope breaks along cross sections taken at the 100 foot stations and provided to the Earthwork QC Manager for approval and final formatting.

2.2.3. The EARTHWORK CONTRACTOR shall construct temporary roads as needed to accomplish the work.

2.2.4. The EARTHWORK CONTRACTOR shall construct temporary diversions or install berms/pipes as needed to divert runoff away from active work areas, stockpiles or temporary roads.

2.2.5. Instrumentation for the site has been installed by multiple entities at different times. Extensions or maintenance may be performed by the Earthwork QC Team in accordance with TVA protocols and manufacturer's recommendations. Drawings of instrumentation shown are for information purposes. Maintenance of existing instrumentation is an Earthwork QC Team function; however, the EARTHWORK CONTRACTOR shall coordinate activities with the Earthwork QC Team to avoid interference with the work and also to protect designated instrumentation outside the Perimeter Wall Stabilization footprint. Instrumentation within the Perimeter Wall Stabilization footprint is not required to be protected as TVA will arrange for removal. The cost of repairs or replacement for instrumentation designated for protection that is damaged by the EARTHWORK CONTRACTOR's activities shall be borne by the EARTHWORK CONTRACTOR. The EARTHWORK CONTRACTOR shall install t-posts and safety fence or remove and re-use t-posts and safety fence to protect instrumentation.

2.2.6. The existing 48-inch diameter, HDPE drainage pipe in the North Dredge Cell shall be removed by the EARTHWORK CONTRACTOR. Other buried pipes, stone fill, and other known obstructions that would interfere with the construction of the soil-cement walls by the PERIMETER WALL STABILIZATION CONTRACTOR shall be excavated and removed, as needed, by the EARTHWORK CONTRACTOR. See Section 02310 for Sheeting and Bracing considerations. Pipe and stone shall be disposed of per TVA requirements. The resulting excavations shall be backfilled with ash and compacted in accordance with the requirements in SECTION 02300 BACKFILL AND EMBANKMENT.

PART 3 - EXECUTION

3.1. CLEARING AND DISPOSAL

The EARTHWORK CONTRACTOR shall remove vegetation to permit installation of new construction. Removal of grassed areas shall be performed by initial mowing followed by scraping of the surface to a minimum depth of one-inch. The organic materials shall be temporarily stockpiled in discrete areas following the same procedures as noted for waste materials in Section 02300, Part 2. Organic materials shall be disposed of within the dredge cell in areas approved by the Earthwork QC Manager. The removal of root hairs and fine grass roots is not required.

3.1.1. Use of lay down area is for the staging and storing of construction related equipment or material for TVA construction activities only.

3.1.2. EARTHWORK CONTRACTOR is responsible for making sure that the lay down areas comply with all local building and fire codes and regulations, as well as, all TVA codes and requirements.

3.1.3. EARTHWORK CONTRACTOR is responsible for keeping the grounds surrounding the lay down area clean of construction materials, litter, trash, and scrap materials. Continuous housekeeping is required including daily removal of combustible waste and storage of combustible waste in approved metal containers and trash bins with metal lids.

3.1.4. EARTHWORK CONTRACTOR is responsible for his own trash management. EARTHWORK CONTRACTOR shall comply with all TVA recycling / removal guidelines.

3.2. SURFACE PREPARATION

Areas to receive embankment shall be prepared with harrow, scarifier or other suitable equipment as noted in Section 02300 of the Specifications.

END OF SECTION 02150

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02200 – EXCAVATION

PART 1 - GENERAL

1.1. DESCRIPTION OF WORK

This Section covers the required excavation, the removal of all excavated materials, and the shaping and finishing of all excavation Work to the required lines, grades and cross-sections.

1.2. RELATED DOCUMENTS

The provisions of the Drawings and Quality Control (QC) Plan Contract apply to the Work specified in this Section. Related Sections of the Technical Specifications include:

- Section 02100 – Erosion Control and Stabilization
- Section 02150 – Site Preparation
- Section 02300 – Backfill and Embankment
- Section 02350 – Rock Berm
- Section 02936 – Revegetation

1.3. DEFINITIONS

1.3.1. TVA

TVA is the Tennessee Valley Authority, which is the project owner.

1.3.2. Technical Contract Manager (TCM)

The Technical Contract Manager (TCM) is the designated TVA representative responsible for the administration and oversight of the Work, including but not limited to the duties outlined in this Specification.

1.3.3. Quality Control (QC) Manager

The Quality Control Manager (QC Manager) is a professional engineer licensed in the State of Tennessee that is responsible for the Quality of the constructed project as defined in the Quality Control Plan. This individual will be designated by TVA and will be the Engineer of Record for Construction.

1.3.4. Contractor

The Contractor is the entity with which TVA has entered into an agreement to construct this project. Section 02200 of the Specifications pertains to work to be accomplished by EARTHWORK CONTRACTOR.

1.3.5. Drawing

Drawings are the Issued for Construction engineering design drawings.

1.3.6. Construction Manager

The Construction Manager is responsible for construction activity to include but not be limited to the character and sequence of work, coordination and scheduling.

1.4. LINES AND GRADES

The Earthwork QC Manager as Engineer of Record reserves the right to increase or decrease the excavation widths and depths or make such other changes in sections as may be deemed necessary based on site conditions encountered. Such changes will be formally documented by the Earthwork QC Manager and routed through appropriate TVA and regulatory agencies.

1.5. DUST CONTROL

The EARTHWORK CONTRACTOR shall provide dust control using water for these operations. The EARTHWORK CONTRACTOR shall provide a water truck and operator and have them continuously available throughout the course of the Work. The EARTHWORK CONTRACTOR shall make every effort to control dust emissions and shall adhere to all applicable rules and regulations of pertinent governmental agencies concerning fugitive dust emissions. The EARTHWORK CONTRACTOR shall be able to readily supply water to the water truck and shall perform additional watering for dust control during transportation and placement of by-product onto the active area of the work or as directed by the Construction Manager. Water shall be obtained from a source approved by TVA.

PART 2 - CLASSIFICATION

2.1. Without regard to the materials encountered, all excavation shall be unclassified, unless noted otherwise.

2.2 Materials expected to be encountered are grouted earth materials as well as bottom ash, fly ash, silts and sands. No rock excavation is envisioned.

PART 3 - TYPES OF EXCAVATION

3.1. GENERAL

3.1.1. Excavation shall include grading work necessary to bring areas of Perimeter Wall Stabilization to the design grades shown in the Drawings and promote positive drainage. Excavation also includes ash removed to prepare for Rock Berm Construction. The EARTHWORK CONTRACTOR shall utilize excavated material to achieve lines and grades or remove excess material and dispose of the same, in accordance with Section 02300 – Backfill and Embankment.

3.1.2. Excavations carried below the indicated depths, except when otherwise directed by the Earthwork QC Manager, shall be replaced with material satisfactory to the Earthwork QC Manager.

3.2. COMMON EXCAVATION

Common excavation shall consist of and include the removal of all materials encountered or involved in the preparation of the subgrade for Perimeter Wall Stabilization, preparation of subgrade after Perimeter Wall Stabilization, excavation for Rock Berm installation and the shaping of areas to promote positive drainage at the locations shown on the Drawings or as directed by the Earthwork QC Manager.

3.3. PIPE AND STRUCTURE EXCAVATION

Pipe excavation includes excavation for the culvert and headwalls as shown in the Drawings or as directed by the Earthwork QC Manager.

PART 4 - CONSTRUCTION METHODS

4.1. UTILIZATION OF EXCAVATED MATERIALS

4.2. Excavation shall include excavation to the designated depths, and the shaping and finishing of all excavation to the required lines and grades as shown on the Drawings or as directed by the Earthwork QC Manager. Classification and utilization of respective materials or disposal of same is defined in Section 02300.

Sheeting and bracing or use of trench box as needed to safely support the sides of excavations shall comply with current OSHA and TVA site requirements and the safety precautions as outlined in current and accepted safety manuals, such as "Associated General Contractors Manual of Accident Prevention in Construction." Where sheeting and bracing are necessary to prevent caving of the walls of excavation and to safeguard the workmen, the excavations shall be dug to such widths that proper allowance is made for the space occupied by the sheeting and bracing.

The EARTHWORK CONTRACTOR shall perform the additional excavation required, furnish and install the necessary sheeting and bracing and trench box and shall remove the same as the excavation is filled.

4.2. REMOVAL OF WATER

The EARTHWORK CONTRACTOR shall construct and maintain all necessary channels, flumes and/or other temporary diversion and protective works; shall furnish all materials required therefore; and shall furnish, install, maintain, and operate all pumping and other equipment for dewatering and maintaining the Work free from water as required. After having served their purpose, temporary protective works shall be removed, or leveled, to give a sightly appearance and so as not to interfere in any way with the operation, usefulness or stability of the permanent structures.

END OF SECTION 2200

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02300 – BACKFILL AND EMBANKMENT

PART 1 - GENERAL

1.1. DESCRIPTION OF WORK

The Work shall consist of performing all operations in connection with construction of earthen berms and backfilling of structures, pipes and excavations. The Work also includes the transportation and placement of all materials in embankment areas to include spreading, moisture control, compaction and preparation of bonding surfaces, to the lines and grades shown on the Drawings. Subgrade preparation prior to Perimeter Wall Stabilization work shall be performed in accordance with Section 02650 of the Specifications.

1.2. RELATED DOCUMENTS

The provisions of the Drawings and Quality Control (QC) Plan apply to the Work specified in this Section. Related Sections of the Technical Specifications include:

- Section 02100 – Erosion Control and Stabilization
- Section 02150 – Site Preparation
- Section 02200 – Excavation
- Section 02350 – Rock Berm
- Section 02936 – Revegetation

1.3. DEFINITIONS

1.3.1. TVA

TVA is the Tennessee Valley Authority, which is the project owner.

1.3.2. Technical Contract Manager (TCM)

The Technical Contract Manager (TCM) is the designated TVA representative responsible for the administration and oversight of the Work, including but not limited to the duties outlined in this Specification.

1.3.3. Quality Control (QC) Manager

The Quality Control Manager (QC Manager) is a professional engineer licensed in the State of Tennessee that is responsible for the Quality of the constructed project as defined in the Quality Control Plan. This individual will be designated by TVA and will be the Engineer of Record for Construction.

1.3.4. Contractor

The Contractor is the entity with which TVA has entered into an agreement to construct this project. Section 02300 of the Specifications pertains to work to be accomplished by EARTHWORK CONTRACTOR.

1.3.5. Drawing

Drawings are the Issued for Construction engineering design drawings.

1.3.6 Construction Manager

The Construction Manager is responsible for construction activity to include but not be limited to the character and sequence of work, coordination and scheduling.

1.4. LINES AND GRADES

Embankments and subgrade shall be constructed to the lines, grades and cross sections indicated on the Drawings, unless otherwise directed by the Earthwork QC Manager. The Earthwork QC Manager reserves the right to increase or decrease embankment slopes or make such other changes in embankment sections as may be deemed necessary based on site conditions encountered.

1.5. BORROW MATERIAL

Borrow material shall be obtained from a location designated by the TVA. Select borrow material shall be hauled to the site for use in embankment construction. Excavation of borrow material shall be performed in such a manner as to promote positive drainage and stable interim slope conditions. Borrow areas shall be regraded to slopes no steeper than 3H:1V upon completion and revegetated in accordance with Section 02936 of these Specifications.

1.6. CONDUCT OF THE WORK

EARTHWORK CONTRACTOR shall maintain and protect embankment in a satisfactory condition at all times until final acceptance of the Work. If, in the opinion of the Earthwork QC Manager, equipment causes horizontal shears or slickensides, rutting, quaking, heaving, cracking or excessive deformation of the embankment, EARTHWORK CONTRACTOR shall limit the type, load or travel speed of the equipment on the subgrade or embankment. Any approved embankment material which is lost in transit or rendered unsuitable after being placed in the embankment and before final acceptance of the Work, shall be replaced by EARTHWORK CONTRACTOR in a satisfactory manner.

EARTHWORK CONTRACTOR shall excavate and remove from the embankment any material with particle size greater than 4 inches (100 mm) or other objectionable material, and shall dispose of such material in accordance with these Technical Specifications and refill the excavated areas as directed. Objectionable materials are defined as hard clay, gravel or rock fragments in the earthfill that are larger than four inches in its greatest dimension, tree limbs or branches greater than one inch in diameter, frozen materials, and man-made or manufactured materials that are not designed specifically for incorporation into the work.

All such work shall be performed in accordance with the approved safety plan.

PART 2 - STOCKPILING

2.1. EARTHEN BERM MATERIALS FROM BORROW SOURCES

Earthen berm materials from the borrow area are anticipated to be incorporated into the work directly. In the event, a temporary stockpile is needed it shall be placed in a location proposed by EARTHWORK CONTRACTOR and approved by the Earthwork QC Manager and Construction Manager. EARTHWORK CONTRACTOR shall plan placement operations to minimize the need for stockpiling. Dress and maintain temporary stockpiles so that the surfaces will be free draining. Suitable erosion control measures are to be incorporated adjacent to stockpile areas in accordance with Section 02100 – Erosion Control and Stabilization and the site wide SWMP.

2.2. EMBANKMENT PLATFORM MATERIALS

Such material shall be delivered to the site and directly incorporated into the work or stockpiled at approved locations adjacent to the Work. Such stockpiles shall be placed in a location proposed by EARTHWORK CONTRACTOR and approved by the Earthwork QC Manager and Construction Manager.

PART 3 - MATERIAL CLASSIFICATION AND DESCRIPTION

3.1. EARTHEN BERM MATERIALS

Soils for the Earthen Berm shall be secured from the excavation of borrow materials from the TVA designated site. Materials containing excessive amounts of brush, roots, sod, or other objectionable materials as described in Paragraph 1.6 will not be considered suitable. The suitability of the materials shall be subject to approval by the Earthwork QC Manager. Earthen berm materials shall consist of soils excavated from the designated borrow area which classify as CH, CL, CL-ML, SC, or GC according to the Unified Soil Classification System.

3.2. EMBANKMENT PLATFORM

The embankment platform shall be constructed of Tennessee Department of Transportation (TDOT) No. 10 Screening Product or equivalent, except that this material shall have 12 percent or less by

weight passing the number 200 sieve. Otherwise this product shall meet the material and durability requirements of Section 903 of the latest edition of the TDOT "Standard Specifications for Road and Bridge Construction".

On top of the No. 10 Screening Product, No. 57 Coarse Aggregate shall be placed to the minimum thickness noted on the Drawings. The No. 57 Coarse Aggregate shall conform to the requirements of Section 903 of the Tennessee Department of Transportation "Standard Specifications for Road and Bridge Construction" latest edition and to the gradation requirements set forth therein. Alternate gradations of durable stone aggregate, which otherwise meet the requirements for this material, may be used only with the written approval of the QC Manager.

3.3. WATER

Water used in controlling moisture shall consist of water obtained from the ash pond, sediment basin or other sources approved by the TVA.

PART 4 - EXECUTION

4.1. SUBGRADE PREPARATION FOR EARTHEN BERM

4.1.1. Following completion of the Perimeter Wall Stabilization, the subgrade shall be proof rolled a minimum of two passes tire to tire by loaded articulated hauling equipment with a maximum gross weight of 100,000 pounds and minimum ground content pressure of 35 psi. If adequate response of the subgrade can be achieved with one pass, then this requirement may be modified by the Earthwork QC Manager. Rutting in excess of three inches shall be repaired and re-rolled. The subgrade shall be uniform and meet the lines and grades of the Drawings prior to the placement of the Embankment Platform. Soft materials shall be stabilized to achieve a surface that will accommodate construction equipment and meet the specified compaction requirements.

4.1.2. No embankment shall be placed until the foundation for that section has been approved by the Earthwork QC Manager. The surface shall be firm and meet the design lines and grades.

Embankment platform material shall be placed on the approved, proof-rolled subgrade to the lines and grades shown in the Drawings. This material overlies the top of the Perimeter Wall Stabilization and underlies the soil berm. Rock Berm construction is described in Section 02350 of the Specifications.

PART 5 - SPREADING

5.1. GENERAL

No fill shall be placed upon a frozen surface, nor shall snow, ice or frozen materials be incorporated in the fill. No material placed by dumping in piles or windrows shall be incorporated in a layer in that position, but shall be moved and spread by blading or similar approved methods.

5.2. EARTHEN BERM

5.2.1 Earthen material for Earthen Berm shall be placed in relatively horizontal lifts with approximate 8-inch maximum (loose) thickness graded to a 1% minimum cross slope for drainage. EARTHWORK CONTRACTOR shall obtain the required borrow material in a sequence which will provide the proper material being available at the time required for proper utilization in the embankment.

5.2.2. Material in the form of large lumps or masses shall be pulverized by disking, harrowing or by the use of mechanical pulverizers prior to compacting. All lumps or masses, whose largest dimension exceeds four (4) inches, shall be broken down prior to compacting.

5.3. EMBANKMENT PLATFORM

5.3.1 Within the Embankment Platform, the No. 10 Screening Product shall be placed in relatively horizontal lifts with approximate 6-inch maximum (loose) thickness and graded to drain. EARTHWORK CONTRACTOR shall obtain the No. 10 Screening Product material soon enough to allow QC testing as to ensure that acceptable material is available at the time required for proper utilization in the embankment. No. 57 Coarse Aggregate shall be spread on top and following compaction of the No. 10 Screening Product.

PART 6 - MOISTURE CONTROL

6.1. MOISTURE ADJUSTMENT

Moisture content shall be adjusted as necessary to facilitate compaction and minimize dusting. Moisture control shall be achieved by either windrowing or adding water to meet project requirements for moisture content and dust control

6.2. FILL PLACEMENT

During the compaction operations the soil materials being placed shall be maintained at a moisture content no drier than optimum minus 2% water content, and no wetter than optimum plus 2% water content, where optimum moisture content is determined by ASTM D-698. No. 10 Screening Product material shall be compacted with sufficient moisture to promote placement and bonding. The moisture content shall be controlled in the following manner:

1. Water may be added to the fill materials at the source or after the material has been brought onto the embankment, whichever is most practical. When material deposited on the embankment is too dry, EARTHWORK CONTRACTOR shall be required to water each layer and obtain uniform moisture distribution in the layer by disking, blading or other approved methods. The amount of water applied shall be accurately controlled so that free water will not appear on the surface during or subsequent to compaction operations.

2. Material deposited on the fill that is too wet shall be removed or spread and permitted to dry, assisted by disking or blading, if necessary, until the moisture content is reduced to the specified limits.

3. When the top surface of a layer becomes too dry or too smooth to permit suitable bonding with the subsequent layer, EARTHWORK CONTRACTOR shall loosen the material by scarifying or disking. Traversing the fill surface with tamping foot compactor or track equipment may not achieve adequate scarification. EARTHWORK CONTRACTOR shall then moisten the loosened material to an acceptable moisture content and re-compact the material to the specified density.

PART 7 - PREPARATION OF SURFACES

7.1. GENERAL

7.1.1. If, in the opinion of the Earthwork QC Manager, the surface of a completed layer is too dry or smooth to bond properly with the layer of material to be placed thereon, it shall be moistened and/or worked with harrow, scarifier, or other suitable equipment, in an approved (by the Earthwork QC Manager) manner to a sufficient depth to provide a satisfactory bonding surface before the next succeeding layer of material is placed. If, in the opinion of the Earthwork QC Manager, the surface of the fill in place is too wet for proper compaction of the layer of material to be placed thereon, it shall be allowed to dry; or be worked with a harrow, scarifier or other suitable equipment to reduce the water content to an acceptable amount; and then it shall be recompacted before the next succeeding layer of material is placed.

7.1.2. During placement operations, the top surface of the fill layer shall be sloped with grades of not less than one percent to maintain positive drainage. At the end of each day's activities, the surface shall be sealed as practicable with a smooth drum roller. Prior to placement of subsequent lifts the existing product surface shall be lightly scarified to promote lift bonding.

PART 8 - COMPACTION

8.1. COMPACTION REQUIREMENTS

8.1.1. Materials shall be placed and spread in accordance with Paragraph 6.2. After each layer has been placed, spread, and contains the required moisture, it shall be compacted by passing an appropriate tamping foot compaction roller for soils, or smooth drum roller or rubber tired equipment for No.10 Screening Product and No. 57 Coarse Aggregate, over the entire surface of the layer. A sufficient number of passes shall be performed for soils to obtain the specified density to full depth of the lift. Adjustments in the compactive effort shall be made on the basis of field density determinations made as the construction progresses.

8.1.2. Earth fill material shall be compacted to 95 percent of its maximum dry density as determined by ASTM D-698. In-place moisture shall be no drier than optimum minus 2% water content, and no wetter than optimum plus 2% water content, where optimum moisture content is determined by ASTM D-698.

8.1.3. No. 10 Screening Product shall be compacted by a minimum of two passes per six inch lift. No. 57 Coarse Aggregate, where placed on top of the Embankment Platform, shall be compacted with a minimum of two passes. Additional or less compactive effort may be required or approved by the QC Manager based on the response of the material to passes of heavy equipment.

8.1.4. Ash placed as fill where the existing ground surface is below the stabilization surface, and where pipe or other buried obstructions are removed to facilitate soil-cement wall construction, shall be placed in accordance with the following standards. On the interior side of the inboard perimeter wall, all ash placement shall be considered part of the ash stacking activities and subject to compaction requirements consistent with the ash stacking design packages. Within the footprint of the Perimeter Wall Stabilization, or any area outside of the inboard perimeter wall, ash shall be compacted by means of no less than three passes of a D-6 (or equivalent) dozer or larger, on lifts that do not exceed twelve inches of compacted thickness.

8.2. COMPACTION AROUND STRUCTURES, TRENCHES AND PIPING.

8.2.1. To the extent practical considering size of equipment and loads, compaction around structures and piping shall be accomplished within two feet horizontally or vertically using the requirements of the appropriate sections of this specification. Compaction around piping or headwalls within two feet horizontally or vertically shall be performed in 6-inch lifts to 95% of the maximum dry density as determined by ASTM D-698.

END OF SECTION 2300

TECHNICAL SPECIFICATIONS
SECTION 02350 – ROCK BERM

PART 1 - GENERAL

1.1. DESCRIPTION OF WORK

This Specification covers placement of shot rock to construct the Rock Berm. Erosion and sediment control measures shall conform to Section 02100– Erosion Control and Stabilization of these Specifications.

1.2. RELATED DOCUMENTS

The provisions of the Drawings and Quality Control (QC) Plan Contract apply to the Work specified in this Section. Related Sections of the Technical Specifications include:

- Section 02100 – Erosion Control and Stabilization
- Section 02150 – Site Preparation
- Section 02200 – Excavation
- Section 02300 – Backfill and Embankment
- Section 02936 – Revegetation

1.3. REFERENCE STANDARDS

Following is a list of standards, which will be referred to in the text. Such referenced standards shall be considered part of these Specifications as if fully repeated herein.

- "Standard Specifications for Road and Bridge Construction: Section 709-Riprap and Slope Pavement," Tennessee Department of Transportation, latest edition.

1.4. DEFINITIONS

1.4.1. TVA

TVA is the Tennessee Valley Authority, which is the project owner.

1.4.2. Technical Contract Manager (TCM)

The Technical Contract Manager (TCM) is the designated TVA representative responsible for the administration and oversight of the Work, including but not limited to the duties outlined in this Specification.

1.4.3. Quality Control (QC) Manager

The Quality Control Manager (QC Manager) is a professional engineer licensed in the State of Tennessee that is responsible for the Quality of the constructed project as defined in the Quality Control Plan. This individual will be designated by TVA and will be the Engineer of Record for Construction.

1.4.4. Contractor

The Contractor is the entity with which TVA has entered into an agreement to construct this project. Section 02350 of the Specifications pertains to work to be accomplished by EARTHWORK CONTRACTOR.

1.4.5. Drawing

Drawings are Issued for Construction engineering design drawings.

1.4.6. Construction Manager

The Construction Manager is responsible for construction activity to include but not be limited to the character and sequence of work, coordination and scheduling.

1.5. SUBMITTALS

Certification statements shall be provided by each supplier that the product conforms to these specifications. The quarry shall also provide a gradation of the supplied shot rock material. In addition, all materials shall meet the testing schedules noted in the QC Plan.

PART 2 - MATERIALS

2.1. TDOT CLASS B MACHINED RIPRAP

Riprap buttress stone shall consist of quarry stone meeting the requirements of Section 709 of the Tennessee Department of Transportation “Standard Specifications for Road and Bridge Construction” latest edition. Machined Riprap (Class B) shall vary in size from 3 inches to 2.25 feet (from 75 to 675 mm) with no more than 20% by weight being less than 6 inches in size (150 mm).

2.2. NO. 2 COARSE AGGREGATE

No. 2 Coarse Aggregate shall conform to the requirements of Section 903 of the Tennessee Department of Transportation “Standard Specifications for Road and Bridge Construction” latest edition and to the gradation requirements set forth therein. Alternate gradations of durable stone aggregate, which otherwise meet the requirements for this material, may be used with the written approval of the QC Manager.

2.3. NO. 57 COARSE AGGREGATE

No. 57 Coarse Aggregate shall conform to the requirements of Section 903 of the Tennessee Department of Transportation "Standard Specifications for Road and Bridge Construction" latest edition and to the gradation requirements set forth therein. Alternate gradations of durable stone aggregate, which otherwise meet the requirements for this material, may be used with the written approval of the QC Manager.

PART 3 - EXECUTION

3.1. ROCK BERM CONSTRUCTION

The base of the Rock Berm shall be placed upon native soil, and not on top of sluiced or failed ash, as indicated on the Drawings. Ash may remain under the rock berm only in areas between the buttress walls, and where the excavated ash slopes down to the underlying soils, as shown on the Drawings.

No. 57 Coarse Aggregate, No. 2 Coarse Aggregate, and TDOT Class B Machined Riprap shall be placed to the depths, extents and template shown in the Drawings. Note that some areas may require underwater placement. The surface of the Rock Berm, upon completion, shall be graded as practicable into final position to ensure proper thickness and a uniform surface.

TDOT Class B Machined Riprap may be placed by mechanical means using an excavator or loader. The maximum allowable drop height for placement is two feet. Larger rocks shall be uniformly distributed with the small rocks and spalls filling the voids between the larger rocks.

3.2. PROTECTION OF EXPOSED SOIL-CEMENT WALLS

Construction of the Rock Berm between the Buttress Walls, including excavation of the existing material and placement of No. 2 Coarse Aggregate, shall be executed in a manner that protects the exposed soil-cement walls from damage.

The difference in the surface elevation of the excavated surface and / or the stone fill to either side of any buttress wall shall not exceed 4 feet at any time during construction.

After starting the excavation of material between the Buttress Walls, and before completion of the Rock Berm to the top of the Buttress Walls, surface loads due to construction equipment and material are restricted in the area inside of the perimeter wall. The width of the restricted zone and the limitation on surface pressures are noted on the Drawings.

3.3. ACCESS TO CONSTRUCTION

Placement of the Rock Berm shall not commence before the subgrade has been approved by the Earthwork QC Manager or the designated representative on the QC Team. In order to access locations of placement, temporary access ramps or roads may be needed. These ramps or roads may require choking with aggregate to provide a smooth surface for hauling. This aggregate may remain in place unless contaminated with ash. Ash contaminated stone shall be removed and disposed of as directed by the Earthwork QC Manager.

END OF SECTION 02350

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02650 – PERIMETER WALL STABILIZATION

PART 1 – GENERAL

1.1 PROJECT DESCRIPTION

This Section includes requirements for constructing continuous, subsurface walls of soil-cement around the perimeter of the former Dredge Cell and Ash Pond at the Tennessee Valley Authority (TVA) Kingston Fossil Plant (KIF). The walls shall be built by placing a self-hardening, soil-cement slurry in excavated trenches. Soil and rock berms, ash stacking and miscellaneous other earthwork associated with the perimeter containment system will be built by the Earthwork Contractor after completion of the stabilized foundation. The purpose of the perimeter stabilization is to prevent offsite release of ash as a result of earthquake-induced liquefaction of the loose and saturated subsurface materials, and to mitigate the factors that contributed to failure of the former Dredge Cell.

1.1.1 Scope of Work

The Perimeter Wall Stabilization Work consists of furnishing all plant, labor, equipment, and materials, and of performing all operations as required to construct a stabilized foundation for the perimeter berm, plus testing, monitoring, sampling, and recording as required for Quality Control of the Work.

The perimeter foundation shall be stabilized using a grid of soil-cement walls, laid out in a pattern of intersecting Perimeter Walls and Shear Walls as shown on the Drawings. The stabilized footprint will vary in width, up to a maximum width of 100 feet, and extend approximately 11,500 feet in circumference around the site perimeter.

The walls shall be constructed by placing pre-mixed soil-cement slurry in an excavated trench. The Work shall produce a homogeneous wall to full depth through coal ash and the underlying alluvium (clays, silts, and sands). The soil-cement walls shall be embedded into the underlying shale bedrock to the specified, minimum depth.

1.1.2 Method of Construction

The soil-cement walls shall be built with excavation machines that cut continuous panels of uniform thickness. The trench shall be filled with slurry to provide support and prevent collapse of the trench during excavation. The slurry shall self-harden in the trench to form the completed walls.

1.1.3 Soil Profile

The depth of the soil-cement walls is expected to range between about 30 and 80 feet around the site, with an average depth of about 45 feet. Generalized subsurface conditions at the site consist of approximately 15 to 30 feet of saturated ash, underlain by 2 to 20 feet of lean clay over 2 to 25 feet of alluvial silts and sands. In some segments of the perimeter, stabilization efforts will be advanced through existing embankment materials. Coarser material, possibly including cobble-size particles, may be encountered at depth. The site is underlain by shale bedrock with bedding planes that dip 15 to 20 degrees from horizontal. The upper portion of the shale is highly weathered; the weathered zone varies in thickness from about 0 to 10 feet, with a median thickness of about 2 feet.

The actual conditions encountered during construction and the required depth of treatment may differ from the generalized description given here. PERIMETER WALL STABILIZATION CONTRACTOR shall achieve the specified soil-cement mixture through each encountered soil horizon, and shall complete construction to the depth required to meet the specifications for rock embedment of each soil-cement panel.

1.1.4 Construction Platform

In many areas to be stabilized, weak saturated materials are found at shallow depths below the ground surface. Along significant reaches, the near-surface subgrade at the time of construction will consist of wet and loose ash deposits. The Earthwork Contractor will construct a level subgrade surface across the stabilized footprint, at the design top elevation of the walls, prior to Perimeter Wall Stabilization construction.

Construction of the stabilized foundation will require building a stable Construction Platform (possibly involving stone fill, geosynthetics, timber mats, or other materials) for the construction equipment to be employed. The function of the Construction Platform is to provide a stable base to support necessary equipment for Perimeter Wall Stabilization operations. PERIMETER WALL STABILIZATION CONTRACTOR shall be solely responsible for the evaluation, selection, placement, maintenance, and removal of the Construction Platform.

Around approximately one half of the site perimeter, the stabilization efforts will be advanced through earthen dikes that retain water in the Ash Pond. The crest of the dikes will be widened by Earthwork Contractor to establish the required subgrade width for treatment, but all construction shall be carefully executed to avoid jeopardizing the retention of a pool within the active Ash Pond.

The surface plane of the stabilized footprint, defined by the top of the completed soil-cement walls, will have a 2% cross slope as shown on the Drawings. Along the baseline alignment, the stabilized footprint surface profile will be as steep as 6:1 (horizontal:vertical) in transition areas.

1.1.5 Division of Work

PERIMETER WALL STABILIZATION CONTRACTOR shall construct the Construction Platform as needed and perform the Perimeter Wall Stabilization construction in accordance with the Specifications. After completion of Perimeter Wall Stabilization operations, PERIMETER WALL STABILIZATION CONTRACTOR shall remove the Construction Platform.

In advance of Perimeter Wall Stabilization operations, the Earthwork Contractor will establish a level subgrade surface at the top elevation of Perimeter Wall Stabilization shown on the Drawings. No assurances are given or implied regarding the moisture content, stiffness, strength, stability, and/or trafficability of this subgrade surface. After completion and acceptance of the Perimeter Wall Stabilization work, the Earthwork Contractor will grade the top of the soil-cement walls to the lines and grades shown on the Drawings. The Earthwork Contractor will also construct the earthen berm and the final drainage features shown on the Drawings. The earthwork construction for subgrade, final grading, embankment, and final drainage are not included in the Scope of Work for PERIMETER WALL STABILIZATION CONTRACTOR.

PERIMETER WALL STABILIZATION CONTRACTOR shall provide all testing associated with the Laboratory Mix Design and Quality Control during construction, including acquisition of wet-grab samples. Coring of the completed soil-cement walls will be accomplished by the Coring Contractor, and testing of the core and molded specimens will be completed by a laboratory selected by TVA; acquisition and testing of core samples, and testing of molded wet grab samples, is not included in the Scope of Work for PERIMETER WALL STABILIZATION CONTRACTOR.

1.2 RELATED DOCUMENTS

The provisions of the Drawings apply to the Work Specified in this Section. Related Sections of the Technical Specifications include:

- Section 02100 – Erosion Control and Stabilization

1.3 REFERENCE STANDARDS

Following is a list of standards, which will be referred to in the text by basic designation only. Such referenced standards shall be considered part of these Specifications as if fully repeated herein.

REFERENCE	TITLE OR DESCRIPTION
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C150	Standard Specification for Portland Cement

ASTM C192	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C939	Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM D1632	Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory
ASTM D2113	Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation
ASTM D2166	Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
ASTM D2216	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D3967	Standard Test Method for Splitting Tensile Strength of Intact Rock Core Specimens
ASTM D4380	Standard Test Method for Density of Bentonitic Slurries
ASTM D4767	Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils
ASTM D4832	Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders
ASTM D5079	Standard Practices for Preserving and Transporting Rock Core Samples
ASTM D5084	Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D6910	Standard Test Method for Marsh Funnel Viscosity of Clay Construction Slurries

1.4 DEFINITIONS

1.4.1 TVA

TVA is the Tennessee Valley Authority, which is the project owner.

1.4.2 Technical Contract Manager (TCM)

The Technical Contract Manager (TCM) is defined in the Commercial section of the contract for Perimeter Wall Stabilization.

1.4.3 Quality Control (QC) Manager

The Quality Control Manager (QC Manager) for Perimeter Wall Stabilization is responsible for verifying that the work is performed in accordance with the specifications and approved Quality Control Plan. The QC Manager will be focused on reviewing and evaluating test data and other as-built information to check for compliance and consistency with the design. The QC Manager will represent the design Engineer of Record, and will be a Professional Engineer licensed in the State of Tennessee.

1.4.4 Quality Control (QC) Representative

The Quality Control Representative will be responsible for reporting Quality Control data collected during construction, as required by the Specifications and approved Quality Control Plan. For all work covered by Section 02650, this individual shall be designated by the PERIMETER WALL STABILIZATION CONTRACTOR.

1.4.5 Construction Manager

The Construction Manager is the designated entity responsible for general oversight of construction site activities to include, but not limited to, the character and sequence of work, coordination, and scheduling.

1.4.6 Contractor

The Contractor is the entity with which TVA has entered into an agreement to construct this project. TVA plans to retain multiple contractors to complete the overall project. Section 02650 of the Specifications pertains to the work to be accomplished by PERIMETER WALL STABILIZATION CONTRACTOR.

1.4.7 Drawings

Drawings are engineering design drawings approved by TVA and issued to PERIMETER WALL STABILIZATION CONTRACTOR for construction.

1.4.8 Earthwork Contractor

The Earthwork Contractor is the entity with which TVA has entered into an agreement to construct portions of this project, exclusive of Perimeter Wall Stabilization.

1.4.9 Coring Contractor

The Coring Contractor is the entity with which TVA has entered into an agreement to core the samples from Test Parcels or other Soil-Cement Walls in accordance with the requirements of Paragraph 4.8.2.

1.4.10 Perimeter Wall Stabilization

Perimeter Wall Stabilization is a general term for improvement of the foundation for a new perimeter berm around the project site. The foundation will be stabilized by excavation and replacement in slurry-filled trenches, without dewatering, to form a grid of cemented, subsurface walls. The slurry trench methods may utilize polymers, bentonite, and/or cement slurry mixes.

1.4.11 Construction Platform

The Construction Platform is the surface of stable material, which may or may not include layers of coarse aggregate, geosynthetics, timber mats, and/or other materials on which the Perimeter Wall Stabilization Equipment operates.

1.4.12 Spoils

Spoils are all materials including liquids, slurry, semi-solids, and solids that are discharged on the ground surface during or as a result of Soil-Cement mixing and excavation operations. Subsurface material excavated from the trenches shall be considered Spoils.

1.4.13 Soil-Cement

Soil-Cement is a uniformly blended mixture of self-hardening slurry that replaces excavated soils. The term Soil-Cement shall be considered synonymous with “cement-bentonite” or any other self-hardening slurry mixture that is approved for use in constructing the Perimeter Wall Stabilization.

1.4.14 Grout

Grout is a stable colloidal suspension of Portland Cement and/or Slag Cement, additives and/or other similar materials in water. The terms "grout" and "slurry" are used interchangeably in these Specifications.

1.4.15 Cement Factor

The Cement Factor is the dry weight of cement in pounds remaining in the ground after mixing, divided by the volume measured in cubic yards of a mixed Soil-Cement Panel.

1.4.16 Soil-Cement Wall

A Soil-Cement Wall is a continuous, homogeneous region of Soil-Cement extending from the design top elevation down to the specified embedment into bedrock. Soil-Cement Walls shall be constructed by excavation of a trench and replacement with self-hardening Soil-Cement slurry. The length of the wall is the span of the wall in the longer plan dimension, and is perpendicular to the thickness. Individual Soil-Cement Walls may consist of connecting Soil-Cement Panels.

1.4.17 Soil-Cement Panel

A Soil-Cement Panel is a linear portion or segment of a Soil-Cement Wall that is constructed continuously to full depth during one construction shift.

1.4.18 Construction Joint

A Construction Joint is any connection, including Butt Joints and Tee Joints, between two or more Soil-Cement Panels that are constructed on different days.

1.4.19 Butt Joint

A Butt Joint occurs where the end of one Soil-Cement Panel is connected to the end of a previously constructed Soil-Cement Panel, forming a longer wall segment along the same general alignment.

1.4.20 Tee Joint

A Tee Joint occurs where one Soil-Cement Panel intersects another Soil-Cement Panel, where the intersecting panels are generally perpendicular to one another. The joint itself occurs where the newer and older soil-cement materials meet.

1.4.21 Cold Joint

A Cold Joint is a construction joint that requires reinforcement, strengthening, or other mitigation. The criteria for classifying a Cold Joint are provided in Paragraph 4.3.8.

1.4.22 Perimeter Wall

A Perimeter Wall is a Soil-Cement Wall designated as a Perimeter Wall on the Drawings. Perimeter Walls extend around the perimeter of the contained area, generally following the project baseline. As designated on the Drawings, Inboard Perimeter Walls are located on the interior side of the stabilized footprint, while Outboard Perimeter Walls are located on the exterior side of the footprint.

1.4.23 Shear Wall

A Shear Wall is a Soil-Cement Wall designated as a Shear Wall on the Drawings. Shear Walls are oriented perpendicular to the project baseline as indicated on the Drawings.

1.4.24 Buttress Wall

A Buttress Wall is a Soil-Cement Wall designated as a Buttress Wall on the Drawings. Buttress Walls are oriented perpendicular to the project baseline as indicated on the Drawings.

1.4.25 Stabilized Width

The Stabilized Width is the horizontal distance, measured perpendicular to the project baseline, between the innermost edge of the Effective Thickness of the Inboard Perimeter Wall and ends of the Buttress/Shear Walls. Mathematically, the Stabilized Width is equal to the horizontal distance between the perimeter wall centerlines, plus half the Effective Thickness of the Inboard Perimeter Wall, plus half the Effective Thickness of the Outboard Perimeter Wall, plus the length of the Buttress Walls. In perimeter segments that do not include an Outboard Perimeter Wall and Buttress Walls, the Stabilized Width is equal to the horizontal distance between the centerline of the Inboard Perimeter Wall and the outer end of the Shear Walls, plus half the Effective Thickness of the Inboard Perimeter Wall. The Stabilized Width may vary in different segments of the stabilized perimeter, as shown on the Drawings.

1.4.26 Area Replacement Ratio

The Area Replacement Ratio is the numerical percentage of the total plan area within the treatment footprint that receives treatment. The numerator of this ratio is the total of the plan area of all Soil-Cement Walls, with intersection areas counted only once. The denominator of this ratio is the total footprint area extending from the outer limits of the treated footprint on all sides.

For the layout pattern of Perimeter and Shear Walls shown on the Drawings, the Area Replacement Ratio (ARR) shall be computed as:

$$ARR = \frac{t_s(W - t_{po} - t_{pi}) + S(t_{po} + t_{pi})}{W \cdot S}$$

where t_s is the Effective Thickness of the Shear Walls, t_{po} is the Effective Thickness of the Outboard Perimeter Wall, t_{pi} is the Effective Thickness of the Inboard Perimeter Wall, W is the Stabilized Width, and S is the Shear Wall Spacing. This equation assumes the Effective Thickness of the Buttress Walls equals the Effective Thickness of the Shear Walls. The Area Replacement Ratio may vary in different segments of the stabilized perimeter, and shall be computed based on the value of W tabulated for each segment on the Drawings. In perimeter segments that do not include an Outboard Perimeter Wall, the value of t_{po} is zero in the above equation.

In segments where the stabilized footprint is curved and/or the Shear Walls are not parallel, the Area Replacement Ratio is computed assuming the layout is straight with the Shear Walls evenly spaced. In segments where the Inboard and Outboard Perimeter Walls are not parallel, the Area Replacement Ratio is computed using the Stabilized Width tabulated on the Drawings for that segment.

1.4.27 Effective Thickness

The Effective Thickness of a Soil-Cement Wall is measured in the horizontal plane perpendicular to the alignment of the wall. The Effective Thickness shall correspond to the narrowest point in the wall.

1.4.28 Shear Wall Spacing

The Shear Wall Spacing is measured in the horizontal plane between the centerlines of adjacent Shear Walls. Where adjacent Shear Walls are not parallel in the layout, the Shear Wall Spacing shall be measured as a straight line between the points on the Shear Wall centerlines at the intersection with the Outboard Perimeter Wall. In perimeter segments that do not include an Outboard Perimeter Wall, the Shear Wall Spacing shall be measured as a straight line between the centerlines of the Shear Walls at their outboard ends.

1.4.29 Rock Embedment

The Rock Embedment is the vertical distance between the Top of Rock elevation and the bottom of the Soil-Cement, as determined during construction of each Soil-Cement Panel. The bottom elevation of Soil-Cement shall be defined as the deepest point where the full plan dimensions of the panel are formed (excavated, grouted, and mixed), which may be shallower than the deepest point of penetration of the excavator.

1.4.30 Top of Rock

For each Soil-Cement Panel, the Top of Rock is a single elevation from which the depth of the Rock Embedment is measured for the entire length of that Soil-Cement Panel. The Top of Rock shall be defined to the nearest 0.1 foot, and measured during excavation of each Soil-Cement Panel as described in Paragraph 4.3.10.

1.4.31 Demonstration Section

The Demonstration Section is a segment of Soil-Cement Wall to be constructed upon the initiation of the Work, in accordance with the requirements of Paragraph 4.6. The Demonstration Section shall be constructed using the same equipment, personnel, means, and methods proposed for the remainder of the Project. If multiple methods are proposed, a Demonstration Section shall be constructed for each method.

TVA may accept the Demonstration Section as part of the completed Work, but only if the requirements of these Specifications are met. Testing frequency within the Demonstration Section shall be higher than within the remainder of the Work, as defined in Paragraph 2.2.4.

1.4.32 Test Parcel

A Test Parcel is a length of completed Soil-Cement Wall or Walls from which specimens of Soil-Cement are obtained for testing for compliance with the requirements for strength. The length of a Test Parcel and the sampling, testing, and strength requirements are defined in Paragraphs 2.2.3 and 2.2.4.

1.4.33 Unconfined Compressive Strength

The Unconfined Compressive Strength is defined as the strength of cured Soil-Cement, using molded cylinders or cores as test specimens, as measured by ASTM D2166.

1.4.34 Triaxial Compression Strength

The Triaxial Compression Strength is defined as the strength of cured Soil-Cement molded cylinders or cores, isotropically consolidated and sheared in compression without drainage (consolidated-undrained test), as measured by ASTM D4767.

1.4.35 Splitting Tensile Strength

The Splitting Tensile Strength is the tensile strength obtained indirectly by diametrical line compression of a Soil-Cement cylindrical mold or core specimen, as measured by ASTM D3967.

1.4.36 Hydraulic Conductivity

The Hydraulic Conductivity is the coefficient of permeability for the flow of water through cured Soil-Cement, as measured by ASTM D5084.

1.4.37 Marsh Funnel Viscosity

The Marsh Funnel Viscosity is the viscosity as measured by a funnel test in accordance with ASTM D6910.

1.4.38 Mud Balance Density

The Mud Balance Density is the density as measured by a mud balance test in accordance with ASTM D4380.

1.4.39 Total Inclusion Length

Core samples from completed soil-cement panels will be used to assess the uniformity of the constructed product. The Total Inclusion Length for a Test Parcel shall be defined as the sum of the lengths of all unmixed or unfixated soil inclusions, which are greater than 6 inches in their largest dimension, observed in all core holes in the Test Parcel. The summation shall include all unmixed or unfixated soil that exceeds one half the diameter of the recovered core and exceed 6 inches in the length of the core run. The summation shall also include the lengths of unrecovered core runs longer than 6 inches (for example, a 90% recovery in a core run of 5 feet will be interpreted as 6 inches of unrecovered core). Inclusions or unrecovered core in the top 5 feet of the hole and any bedrock core from below the base of the soil-cement panel shall not be included in the Total Inclusion Length. For each Test Parcel, the Total Inclusion Length shall be calculated using the lengths of all cores in the test parcel without regard to the core diameter.

1.4.40 Inclusion Adjustment Fraction

For each Test Parcel, the Inclusion Adjustment Fraction shall be defined as the ratio of the Total Inclusion Length to the total length of cored holes, exclusive of the top 5 feet of each core hole and any coring into bedrock, in the Test Parcel.

1.4.41 Presumed Inclusion Strength

For the purpose of comparing compressive strength test results to the requirements of this Specification, the Presumed Inclusion Strength is defined as the unconfined compressive strength assigned to unmixed or unfixated soil inclusions, and shall be taken as 10 pounds per square inch.

1.4.42 Adjusted Mean Strength

For each Test Parcel, the Adjusted Mean Strength shall be defined as the sum of two terms. The first term is the product of the Presumed Inclusion Strength and the Inclusion Adjustment Fraction. The second term is the product of the mean (average) of the unconfined compression strength test results for the soil-cement samples, and the value of one minus the Inclusion Adjustment Fraction.

1.4.43 Adjusted Exceedance Fraction

For each Test Parcel, the Adjusted Exceedance Fraction for a given threshold strength specified in Paragraph 2.2.3 shall be defined as the fraction of the unconfined compression strength test results for the soil-cement samples that exceed the given threshold strength, multiplied by the value of one minus the Inclusion Adjustment Fraction.

1.5 SUBMITTALS

1.5.1 Approvals

All submittals required by this Subsection shall be submitted within the time limits indicated in this Subsection. Pending Work described in a submittal shall not commence prior to receiving TCM and Perimeter Wall Stabilization QC Manager approval for that submittal.

1.5.2 Work Plan

At least 30 days prior to the proposed start of Work, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for approval a detailed operating plan describing the proposed construction equipment, procedures, and schedules. The Work Plan shall include, but not be limited to:

(1) Listing of supervisory personnel, including name and experience of the various persons, their role and primary responsibilities. At a minimum, the Work Plan shall designate the Project Manager, Safety Manager, Quality Control Representative, Technical Manager, Field Superintendent, Machine Operators, and Batch Plant/Grout Plant Operators.

(2) Equipment set-up and site use layout, including storage areas, staging areas, grout mixing plant location, access roads, road crossings, haul roads, stream crossings, and construction platform.

(3) Construction means and methods, with description of equipment, construction steps, handling of excess grout and spoil, layout, overlap control at joints, control of drainage, spills, wastes, etc.

(4) Plans and shut-down procedures to be followed in the event of severe weather.

(5) Proposed wall geometry, including effective thicknesses for the Inboard and Outboard Perimeter Walls, Shear Walls, and Buttress Walls, Shear Wall Spacing, and Area Replacement Ratio.

(6) Means of establishing the interconnection between new and cured Soil-Cement ("soft-into-hard" construction) such that the connection does not form a zone of weakness.

(7) Means and methods, and control points used for surveying and stakeout to establish field locations of all Soil-Cement Panels.

(8) A bar chart schedule showing all major activities, durations, and milestones.

1.5.3 Description of Equipment

At least 30 days prior to the proposed start of Work, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for approval a list and description of all equipment and components to be used for the soil-cement wall installations and quality control.

This information shall describe the Perimeter Wall Stabilization Equipment, including specifications, dimensions, and capacities. Provide data on the maximum depth capacity of the equipment, capability for cutting through resistant subsurface layers, and achieving required embedment into bedrock. Include details on the mixing equipment that demonstrate the capability to achieve the required, homogeneous mixture of Soil-Cement. Include descriptions, catalog sheets, dimensions, and capacities for the excavation equipment; cement grout mixing equipment; control equipment; and pumps, pipelines, and hoses.

Information shall also be provided on the instruments, equipment, and procedures to be used for quality control of the Work. Include details on the instrumentation and procedures to determine the horizontal and vertical alignment of the Soil-Cement Panels, and equipment to be used to obtain wet grab samples. Include a calibration plan for the instruments to be used and any applicable calibration data.

1.5.4 Spoils Management Plan

At least 30 days prior to the proposed start of Work, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for approval plans, sketches, and a narrative that describes the procedures to be used to collect, contain and dispose of Spoils. The plans and sketches shall show the proposed locations of holding tanks, holding basins, berms, silt fences, or other temporary facilities required to manage the Spoils in accordance with the requirements of Subsection 4.5.

1.5.5 Water Use Plan

At least 30 days prior to the proposed start of Work, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for approval information regarding the anticipated quantity of water needed, the sources from which it will be obtained, and the rate of use from each source. For each identified source, PERIMETER WALL STABILIZATION CONTRACTOR shall submit water quality tests in accordance with the requirements of Paragraph 2.1.5. If PERIMETER WALL STABILIZATION CONTRACTOR intends to use hydrants, the locations of hydrants shall be noted in the submittal.

1.5.6 Mix Design

At least 15 days prior to the proposed start of Work, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for approval a soil-cement mix design. The proposed mix design shall provide detailed information on the cement type, cement source, source of water for mixing grout, cement chemical composition, water-cement ratio of the grout (by weight), any additives or pertinent details, acceptable limits for Marsh Funnel Viscosity and Mud Balance Density tests on grout, the estimated in-situ cement factor, and laboratory test results for the 28-day and 56-day unconfined compressive strength of the soil-cement. The mix design documentation shall include data from the laboratory mix design tests, performed in accordance with Paragraph 2.2.2.

1.5.7 Quality Control Plan

At least 30 days prior to the proposed start of Work, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for approval a Quality Control Plan describing all testing, sampling, reporting forms, methods, surveying and staking, responsible persons, non-conformance procedures, and all other means to ensure the quality of the Work. Documentation on the calibration of the equipment in the grout batch plant and the frequency of the required calibration of the equipment in the grout plant shall be identified in the Quality Control Plan. The laboratory proposed for quality control testing shall be identified, together with information on the experience, capabilities, capacities, and certifications of the proposed laboratory, in the Quality Control Plan.

1.5.8 Remediation Plan for Defective Soil-Cement Walls

At least 30 days prior to the proposed start of Work, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for approval a Remediation Plan for Defective Soil-Cement Walls. This plan shall address the

potential remediation, repair, reconstruction, or reinforcement procedures for defective Soil-Cement Walls that do not meet the requirements of these Technical Specifications.

1.5.9 Revisions to Work Plan

If the results of the Demonstration Section do not meet the Specification requirements, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for approval revised equipment, procedures, mix design, wall layout, or other plan as needed to satisfy the requirements of the Technical Specifications. Revisions shall be submitted within 30 working days following completion of the Demonstration Section.

1.5.10 Shop Drawings

At least 30 days prior to the proposed start of Work, PERIMETER WALL STABILIZATION CONTRACTOR shall submit shop drawings for approval indicating the sequence and time schedule of all operations. The layout plans shall be of suitable scale to clearly show the details of the layout. The Shop Drawings shall show baselines to be used for field layout, and provide an identification number for each Soil-Cement Panel for use in field records and quality control.

The Shop Drawings shall show the proposed Soil-Cement Panel layout that will achieve the required configuration shown on the Drawings, including the dimensions, spacing, overlaps at joints, and effective thickness of each wall in the soil-cement structure.

1.5.11 Daily Production Reports

Within one working day after the end of each work shift, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for inclusion in the project records a Daily Production Report for the work shift to the Perimeter Wall Stabilization QC Manager. The Daily Production Report shall be filled out in its entirety, checked for correctness, and signed by the field superintendent(s) of PERIMETER WALL STABILIZATION CONTRACTOR and relevant SUBCONTRACTORS at the end of each work shift. The reports shall contain, but not be limited to, the following information:

(1) Time and date (day, month, year) of beginning and end of work shift; name of each superintendent in charge of the work for both PERIMETER WALL STABILIZATION CONTRACTOR and all SUBCONTRACTORS; a list of all workers' names associated with each construction rig; and a summary of equipment used during the shift.

(2) The locations, installation sequence, verticality data, and as-installed top and bottom elevations of the Soil-Cement Panels installed during the work shift, and any deviations from the planned locations and vertical alignment.

(3) Time of start and completion of each Soil-Cement Panel installed during the work shift and a summary of any downtime during the shift including time of work stoppage, duration, reason, and if work stoppage occurred while excavating a Soil-Cement Panel.

(4) Water-cement ratios of the cement grout, grout temperatures, quantities of cement, cement additives, water used, and estimated Cement Factors. Include printouts of all automatic data recorded from the batch plant and other equipment used for Soil-Cement Panel installation.

(5) Results of field tests on grout including, but not limited to, Mud Balance Density, Marsh Funnel Viscosity, and Time of Efflux.

(6) Other pertinent observations including, but not limited to, description of spoil returns, cement grout escapes, ground settlement and/or heave, collapse of the excavated trench, remixing of panels, obstructions, loss of slurry, and any unusual behavior of the equipment during the construction process.

(7) Records of Soil-Cement samples taken during the work shift including sample designation, date, time, plan location, elevation, and the name of the firm and person(s) obtaining the samples.

1.5.12 Health and Safety Plan

At least 30 days prior to the proposed start of Work, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for approval a project specific Health and Safety Plan addressing site specific Work. The safety plan shall address general work safety throughout the project duration. Work specific safety plans shall be developed for each major construction task.

1.5.13 Mobilization Plan

At least 30 days prior to the proposed start of Work, PERIMETER WALL STABILIZATION CONTRACTOR shall submit for approval a Mobilization Plan addressing the requirements of Paragraph 4.2.

PART 2 – PRODUCTS

2.1 CEMENT GROUT

Grout shall consist of a stable colloidal suspension of cement and other additives in water. The grout shall be premixed in batch plants that automatically combine materials in predetermined proportions.

2.1.1 Portland Cement

Cement shall be Type I or II Portland cement conforming to ASTM C150. PERIMETER WALL STABILIZATION CONTRACTOR shall measure, handle, transport and store bulk cement in accordance with the manufacturer's recommendations. PERIMETER WALL STABILIZATION CONTRACTOR shall transport and store cement to prevent damage to or degradation of the cement by moisture. Cement material that has been exposed to moisture or has become caked or lumped shall not be used for Perimeter Wall Stabilization. Cement containing lumps or foreign matter of a nature and in amounts that

might be deleterious to the grouting operations shall not be used. All cement shall be homogeneous in composition and properties and shall be manufactured by the same method.

2.1.2 Grout Admixtures

Grout admixtures, if used, shall be addressed in the approved Mix Design (Paragraph 1.5.6) and included in testing for the Laboratory Mix Design (Paragraph 2.2.2). If proposed, PERIMETER WALL STABILIZATION CONTRACTOR shall provide evidence in support of the benefits accrued, a written statement from the manufacturer as to the appropriate application, the effects on the soil-cement material, the long-term performance and stability, and potential effects on the environment of each proposed admixture.

2.1.3 Temperature of Grout

PERIMETER WALL STABILIZATION CONTRACTOR shall adopt all necessary and appropriate means to assure that the temperature of the grout remains between 35 and 90 degrees Fahrenheit.

2.1.4 Initial Set

The grout shall not have begun its initial set before its injection into the ground. Grout that begins its initial set prior to injection shall be discarded and disposed of in accordance with the requirements for disposal of Spoils.

2.1.5 Water

PERIMETER WALL STABILIZATION CONTRACTOR shall only use water that meets the requirements of ASTM C94 for mixing grout. The water shall be free from oil, acid, alkali, salts, organic materials, and/or other contamination that would reduce the strength of the hardened Soil-Cement. The water temperature shall be maintained above 40 degrees Fahrenheit, and within a range that is not detrimental to the properties of the mix. TVA will designate locations on the site where water may be withdrawn from the Emory River. It is the responsibility of PERIMETER WALL STABILIZATION CONTRACTOR that the grout resulting from the use of this or any water source shall always meet the standards of this Specification. All costs related to obtaining water from an alternate source, as required to meet these Specifications, shall be included in the contract price for Perimeter Wall Stabilization.

2.2 SOIL-CEMENT

2.2.1 Uniformity and Unmixed Soil Inclusions

The in-situ ash, soil, and rock shall be excavated and removed from the trench to full depth. After the Soil-Cement is placed in the trench, mixing shall continue as needed to maintain a uniform and homogenous slurry to the full depth and length of the Panel.

The uniformity of a Soil-Cement Wall will be assessed on the basis of unmixed or unfixated soil inclusions discovered by coring the completed wall. In addition to the recovery of unmixed or unfixated soil inclusions in the core barrel, any length of a core run that is not recovered shall be interpreted as indicating unmixed or unfixated inclusions of soil in the wall.

Completed Soil-Cement Walls shall have no continuous, unmixed or unfixated ash or soil fragments, or other discontinuity or deformity with any dimension exceeding half the effective thickness of the wall. Additionally, in any length of core equal to the thickness of the wall (whether from the same coring run or adjacent runs), the total length of unmixed ash or soil fragments (counting only those that exceed half the diameter of the core sample) and unrecovered core shall not exceed half the effective thickness of the wall.

Within any Soil-Cement Panel, any location below a depth of 5 feet that is found to exhibit unmixed soil inclusions that are greater than half the effective thickness of the wall, as defined in this Paragraph, shall be considered a defect. Such defects shall be mitigated, regardless of the strength or other properties measured in other locations of the same panel. If multiple defects or clusters of inclusions are identified within any Soil-Cement Panel, the entire Panel may be rejected and require mitigation.

2.2.2 Laboratory Mix Design

PERIMETER WALL STABILIZATION CONTRACTOR shall conduct a pre-construction laboratory mix design program to determine appropriate materials and material proportions for achieving the strengths required by this Technical Specification.

The laboratory mix design program shall utilize materials that will be used or encountered during construction. This shall specifically include representative coal ash samples acquired from the TVA Kingston Fossil Plant site. TVA will provide these site materials to PERIMETER WALL STABILIZATION CONTRACTOR for use in the Laboratory Mix Design program. PERIMETER WALL STABILIZATION CONTRACTOR shall be responsible for transportation of these samples from the project site to the laboratory and for return of all sample material to the site at the completion of the test program. Samples from the site shall be transported and handled with appropriate precautions, in accordance with established TVA protocols, resulting from the site being under CERCLA regulatory mandates.

The Laboratory Mix Design program shall obtain test data for molded soil-cement specimens that are mixed in compliance with the materials and proportions proposed in the approved Mix Design (Paragraph 1.5.6) and formed in accordance with ASTM D1632.

The Laboratory Mix Design program shall obtain data on the Marsh Funnel Viscosity (ASTM D6910) and Mud Balance Density (ASTM D4380) of the freshly mixed grout, and on the unconfined compressive strength (ASTM D2166), strength in triaxial compression and stress-strain plots from triaxial testing (ASTM D4767), moisture content (ASTM D2216), tensile strength (ASTM D3967), and hydraulic conductivity (ASTM D5084) of mixed, molded, and cured soil-cement test specimens. The test conditions, including test pressures, shall be selected to represent the range of expected conditions in the completed Work. A

sufficient number of tests shall be conducted to demonstrate that the proposed Mix Design will meet the requirements of the Technical Specifications, and to establish baseline parameters for later comparison to data from samples collected from the Work.

2.2.3 Strength Criteria for Soil-Cement

PERIMETER WALL STABILIZATION CONTRACTOR shall implement a Soil-Cement mix design and mixing procedure that will result in a Soil-Cement strength that meets the requirements of this Paragraph. All sampling and testing of Soil-Cement samples shall be conducted in accordance with Paragraph 4.8.

Soil-Cement strength shall be characterized using the Unconfined Compressive Strength of cored or molded specimens following 56 days of curing, measured in accordance with ASTM D2166 and expressed in units of pounds force per square inch (psi). If approved by the TCM, the strength results for specimens tested after curing more than 56 days may be used as the basis of acceptance.

Specimens from each Test Parcel, to be designated in accordance with Paragraph 2.2.4, of completed Soil-Cement Wall shall meet at least one of the following requirements for strength:

- For acceptance based on testing of wet grab specimens, either:

  the Adjusted Mean Strength shall be at least 280 psi, and the Adjusted Exceedance Fraction of tests above 185 psi shall be at least 90%,

  OR

  the Adjusted Mean Strength shall be at least 340 psi, and the Adjusted Exceedance Fraction of tests above 165 psi shall be at least 90%.

- For acceptance based on testing of cored specimens, either:

  the Adjusted Mean Strength shall be at least 200 psi, and the Adjusted Exceedance Fraction of tests above 135 psi shall be at least 90%,

  OR

  the Adjusted Mean Strength shall be at least 240 psi, and the Adjusted Exceedance Fraction of tests above 120 psi shall be at least 90%.

2.2.4 Test Parcels and Sampling Frequency

For the sole purposes of judging compliance with the requirements in Paragraph 2.2.3 for Soil-Cement strength, a Test Parcel shall be defined as any continuous, 100-foot length of Soil-Cement Wall, except

that within the Demonstration Section each Test Parcel shall be defined as 50 feet in length. Test Parcels will be as selected and designated by Perimeter Wall Stabilization QC Manager. The total summation of the Test Parcels within a segment of the perimeter shall correspond to no less than 20% of the total length of Soil-Cement Walls constructed within that perimeter segment, except for the Demonstration Section. For the Demonstration Section, the total summation of the Test Parcels shall correspond to 100% of the Demonstration Section.

The PERIMETER WALL STABILIZATION CONTRACTOR shall acquire no less than 25 wet grab samples of Soil-Cement from each Test Parcel, and shall form molded specimens from each sample in accordance with Paragraph 4.8.1. The wet grab samples shall be acquired from a minimum of 5 different plan locations in each Test Parcel, and shall be no closer than 5 feet apart vertically at each plan location. Additionally, the CORING CONTRACTOR shall retrieve full-depth cores from no less than three holes in each Test Parcel. If core samples are used to assess the soil-cement strength, then no less than 25 core specimens shall be selected for testing. Sampling locations and Test Specimens shall be as selected by Perimeter Wall Stabilization QC Manager. The visual observations of cores and the measured strengths of cored or molded specimens acquired from all sampling locations within a Test Parcel will be used to verify compliance with the requirements for Soil-Cement strength in Paragraph 2.2.3.

2.3 WALL LAYOUT

The design layout and spacing of the soil-cement walls within the Stabilized Width are shown on the Drawings. The specific layout of the Soil-Cement Walls proposed by PERIMETER WALL STABILIZATION CONTRACTOR shall be submitted for approval in the Shop Drawings (Paragraph 1.5.10), and constructed work shall not differ from the geometry presented in the approved Shop Drawings.

The alignment and position of the inboard and outboard stabilized limits, corresponding to the inner face of the Inboard Perimeter Wall and the outer ends of the Shear/Buttress Walls, are shown on the Drawings. In accordance with the approved Shop Drawings, curved sections of the Perimeter Walls may be built in straight, chord segments that are equal in length to Soil-Cement Panels. The Effective Thickness of the Perimeter Walls shall meet the requirements of Paragraph 2.3.1.

Each Shear Wall shall be constructed on an alignment that is perpendicular to the project baseline, as determined at the point of intersection. The location of Shear Walls within the Stabilized Width may vary, subject to the restrictions on Effective Thickness and the Shear Wall Spacing specified in Paragraphs 2.3.1, 2.3.2, and 2.3.3.

2.3.1 Minimum Effective Thickness of Walls

Shear Walls are permitted to be of different thicknesses than Perimeter Walls, and each Perimeter Wall may have a different thickness, subject to the following restrictions:

- The Inboard Perimeter Wall shall have an Effective Thickness (t_{pi}) not less than 3.0 feet.

- The Outboard Perimeter Wall shall have an Effective Thickness (t_{po}) not less than 3.0 feet.
- The Shear Walls and Buttress Walls shall have an Effective Thickness (t_s) not less than 3.0 feet.
- At each Shear Wall, the difference between the Effective Thickness of the Shear Wall (t_s) and the Effective Thickness of the Perimeter Wall shall not exceed 25% of the lesser Effective Thickness. This requirement shall be met for both the Inboard and Outboard Perimeter Walls (t_{pi} and t_{po}).

2.3.2 Minimum Area Replacement Ratio

Within all areas enclosed by the inboard and outboard limits of Perimeter Wall Stabilization shown on the Drawings, the Area Replacement Ratio shall not be less than the minimum value tabulated on the Drawings for each segment of the perimeter. Reduction of the Area Replacement Ratio below this minimum value shall not be permitted even if the soil-cement compressive strength is higher than the specified minimums, nor for any other reason.

2.3.3 Maximum Shear Wall Spacing

In all areas of the stabilized perimeter, the Shear Wall Spacing (S), as defined in Paragraph 1.4.28, shall not exceed the lesser value of $S_{max\text{-}A}$ or $S_{max\text{-}B}$ as defined here.

(1) The value of $S_{max\text{-}A}$ is based on the requirement for minimum Area Replacement Ratio and is computed, without rounding, as:

$$S_{max-A} = \frac{t_s(W - t_{po} - t_{pi})}{(ARR \cdot W - t_{po} - t_{pi})}$$

where t_s is the Effective Thickness of the Shear Walls, t_{po} is the Effective Thickness of the Outboard Perimeter Wall, t_{pi} is the Effective Thickness of the Inboard Perimeter Wall, W is the Stabilized Width indicated on the Drawings for each segment of the perimeter, and ARR is the minimum Area Replacement Ratio specified in Paragraph 2.3.2. This equation assumes the Effective Thickness of the Buttress Walls equals the Effective Thickness of the Shear Walls. In perimeter segments that do not include an Outboard Perimeter Wall, the value of t_{po} is zero in the above equation.

(2) The value of $S_{max\text{-}B}$ is based on considerations for bearing capacity beneath the perimeter berm. Values of $S_{max\text{-}B}$ for specific segments of the perimeter are tabulated on the Drawings.

2.3.4 Minimum Rock Embedment

Along the full length of each Soil-Cement Panel, the Rock Embedment shall not be less than the minimum required depth of rock embedment ($d_{r\text{-}min}$). The value of $d_{r\text{-}min}$ is defined for each segment of the perimeter on the profile Drawing for Perimeter Wall Stabilization. The Top of Rock is defined in Paragraph 1.4.30 and shall be determined during construction in accordance with Paragraph 4.3.10.

PART 3 – EQUIPMENT

3.1 GROUT MIXING PLANT

Grout shall be pre-mixed in a mixing plant, which combines dry materials and water in predetermined proportions. The mixing plant shall consist of a high shear grout mixer, grout agitator, grout pumps, storage tanks, metering, proportioning (or weighing) equipment, and a computer control unit to display and record grout mixing parameters.

3.1.1 Material Proportioning

The mixing plant shall be equipped to accept dry or liquid additives in measured amounts. Grout mixing shall be monitored and controlled to ensure proper proportioning. The proportioning equipment may use meters, weights, or weight-volumes to ensure proper proportions. Water shall be controlled by flow meter and/or by volume level indicators in the colloidal mixer. The mix materials and proportions shall comply with the approved Mix Design (Paragraph 1.5.6) at all times. Material proportions shall be recorded for purposes of reporting in accordance with Paragraph 1.5.11.

3.1.2 Storage of Mixed Grout

Storage tanks shall be provided to allow for an adequate supply of batches or continuously mixed grout. Grout shall be agitated until fully mixed and re-circulated in the storage tanks to maintain a homogeneous mix and prevent flash set.

3.1.3 Pumping of Grout

The grout shall be delivered to the trench by an individual positive displacement pump having an inline flow meter and pressure gauge. Grout meters or calibrated tanks shall be provided to measure injection volumes. The grout pumps shall be capable of pumping the required distance and elevations to provide and maintain an adequate supply of grout to the trench.

3.2 PERIMETER WALL STABILIZATION EQUIPMENT

The Perimeter Wall Stabilization Equipment shall meet the requirements of this Section. The principal criteria for acceptance are shape, depth and dimensions, rock embedment, strength, and homogeneity of the completed Soil-Cement Panels.

3.2.1 Equipment Capacity

The excavation equipment shall be of sufficient size, capacity, torque, and capability to construct Soil-Cement Walls to the specified thickness, length, and depth.

3.2.2 Overlapping Capability

The Perimeter Wall Stabilization Equipment shall be capable of advancing through previously installed and hardened Soil-Cement Panels ("soft-into-hard") as required to create joint overlaps indicated on the approved Shop Drawings (Paragraph 1.5.10).

3.2.3 Rock Embedment Capability

The Perimeter Wall Stabilization Equipment shall be capable of achieving the specified embedment into rock at the project site, in accordance with the requirements in Paragraph 2.3.4.

3.3 INSTRUMENTATION AND MEASUREMENT

3.3.1 Grout Mix Parameters

Grout mix parameters, including but not limited to the water-cement ratio, admixture proportions, and grout flow rates, shall be recorded and reported for each Soil-Cement Panel.

3.3.2 Depth Measurement

Equipment shall be provided by the PERIMETER WALL STABILIZATION CONTRACTOR for measuring excavated depths at any location during construction of a Soil-Cement Panel. The required accuracy of these measurements shall be consistent with the requirements in Paragraphs 4.4.4 and 4.4.5.

3.3.3 Verticality Measurement

Instrumentation with a digital readout shall be installed for measuring the verticality of the excavation equipment, as specified in Paragraph 4.3.9. The instrument used to measure verticality shall have a resolution and accuracy of +/- 0.1 degree.

The output from all sensors shall be visible to the operator and the supervisor directing the Perimeter Wall Stabilization operations.

3.3.4 Calibration

The instrumentation, operational control indicators, and any display consoles on the Perimeter Wall Stabilization Equipment shall all be calibrated as per manufacturer's instruction manual prior to initiation of construction.

Calibration of grout mixing components shall be performed at the beginning of the project and biweekly thereafter.

3.4 SOIL-CEMENT SAMPLING TOOLS

3.4.1 Wet Grab Sampler

PERIMETER WALL STABILIZATION CONTRACTOR shall retrieve samples of the wet mixed Soil-Cement (wet grab samples) in accordance with Paragraph 4.8.1.

PERIMETER WALL STABILIZATION CONTRACTOR shall provide a device or other means of obtaining samples of mixed material from depth within any Soil-Cement Panel. This sampling device shall be capable of accepting lumps of soil not thoroughly mixed that are up to 6 inches in width. Each retrieved Soil-Cement wet grab sample shall be of sufficient volume to form the size and number of test molds specified in Paragraph 4.8.1.

Wet grab samplers shall meet the following requirements, or approved alternate requirements. The sampler shall consist of a chamber that can be opened and closed from the surface to obtain Soil-Cement from the desired location and depth. Once filled with the Soil-Cement, the sampler shall be closed to exclude entry or loss of the sample while it is pulled to the ground surface.

The sampler may be attached to the Perimeter Wall Stabilization Equipment or supported by a second machine, and shall have the capability to retrieve samples to the maximum depth of any Soil-Cement Panel.

3.4.2 Coring Device

The CORING CONTRACTOR shall retrieve full-depth samples of cured Soil-Cement (core samples) in accordance with Paragraph 4.8.2 for meeting the requirements of Paragraph 4.9.1.

Samples of the cured Soil-Cement Walls shall be retrieved by coring in boreholes, in accordance with ASTM D2113. CORING CONTRACTOR shall provide an appropriate core sampler, drilling equipment, and all associated equipment and personnel needed to obtain the core samples.

The core samples shall be obtained using a triple core (side discharge WM design) barrel, swivel type with a split inner tube, or an equivalent system that has a demonstrated capability for retrieving undisturbed core samples of weak soil-cement or rock formations. The core barrel shall be sized to provide a core having a diameter not less than 3.25 inches when strength testing is to be conducted on the cored specimens, and not less than 2 inches otherwise.

PART 4 – EXECUTION

4.1 GENERAL

The Soil-Cement Walls shall be constructed using the approved method to the lines, grades, and cross sections indicated on the Drawings. All Soil-Cement Panels shall be vertical, extend through the overburden, and be embedded into rock in accordance with the Drawings and Paragraph 2.3.4. A generalized description of the soil profile through which the Soil-Cement Panels are to be constructed is provided in Paragraph 1.1.3.

4.2 MOBILIZATION

PERIMETER WALL STABILIZATION CONTRACTOR shall not mobilize to the site until the Health and Safety Plan, Work Plan, Mobilization Plan, and Description of Equipment submittals have been approved by TCM, and PERIMETER WALL STABILIZATION CONTRACTOR has received written confirmation of the same.

The PERIMETER WALL STABILIZATION CONTRACTOR's mobilization plan shall include, but not be limited to, all activities and costs for preparation, arrangements, and transportation of personnel, equipment, materials, and all necessary facilities and ancillary/supporting supplies required for the performance of the Work.

Equipment that is rented and/or previously used at other sites shall be cleaned and, if previously used on contaminated sites, decontaminated and tested for the contaminants of concern, before being brought to the site.

The PERIMETER WALL STABILIZATION CONTRACTOR's failure to meet regulatory requirements shall result in no additional cost to TVA.

4.3 CONSTRUCTION

4.3.1 General

(1) The Soil-Cement Walls shall be constructed to the lines, grades, and cross sections indicated on the Drawings. All Soil-Cement Panels shall be embedded into rock in accordance with the requirements of Paragraph 2.3.4.

(2) The Soil-Cement Walls shall be constructed to the required layout pattern as shown on the Drawings. The spacing between Shear Walls may be varied within the limits specified in Paragraph 2.3.3, to accommodate the dimensions and capabilities of different construction machinery. The location and layout of all Soil-Cement Panels shall conform to the approved Shop Drawings (Paragraph 1.5.10).

(3) PERIMETER WALL STABILIZATION CONTRACTOR shall mobilize and maintain a sufficient number of perimeter wall stabilization rigs, materials, cement grout mixing plants, and crews to complete the specified work in accordance with the project schedule.

(4) Once Perimeter Wall Stabilization is initiated, the mix design, mixing equipment and procedures, and wall dimensions/spacing shall be kept uniform unless results from the Quality Control (QC) program indicate that modifications are necessary to meet the Specification requirements.

(5) All work shall be executed in compliance with the approved submittals listed in Subsection 1.5 of this Specification.

(6) PERIMETER WALL STABILIZATION CONTRACTOR shall notify TVA at least 48 hours in advance of the start of construction on any Soil-Cement Panel.

4.3.2 Existing Instrumentation

PERIMETER WALL STABILIZATION CONTRACTOR shall maintain existing geotechnical instrumentation and protect from disturbance during construction. This shall be accomplished by installing protective T-posts in a closed pattern around each instrument. Orange safety fence shall be installed around the perimeter defined by the T-posts. Damage to existing instrumentation shall be repaired or the instrumentation replaced at no additional cost to TVA.

4.3.3 Construction Platform

PERIMETER WALL STABILIZATION CONTRACTOR shall be solely responsible for the stability of all construction equipment used to complete the Work.

A temporary Construction Platform, as described in Paragraph 1.1.4, will be needed across most of the construction alignment. The function of the Construction Platform is to provide a stable base to support necessary equipment for Perimeter Wall Stabilization operations. Prior to Perimeter Wall Stabilization, the Earthwork Contractor will establish a level subgrade surface at the Top of Perimeter Wall Stabilization elevation shown on the Drawings. No assurances are given or implied regarding the moisture content, stiffness, strength, stability, and/or trafficability of this subgrade surface. The Construction Platform may be constructed at or above the subgrade elevation.

PERIMETER WALL STABILIZATION CONTRACTOR shall be solely responsible for the evaluation, selection, and placement of the Construction Platform. PERIMETER WALL STABILIZATION CONTRACTOR shall be responsible for maintenance of the platform during Perimeter Wall Stabilization operations. Upon completion of the Perimeter Wall Stabilization, PERIMETER WALL STABILIZATION CONTRACTOR shall remove the Construction Platform. No materials deleterious to subsequent construction efforts may remain on the site. All work required for the Construction Platform shall be considered incidental to Perimeter Wall Stabilization.

4.3.4 Surveying and Stakeout

TVA will provide survey control for the area to be stabilized. Based on the approved Shop Drawings, TVA surveyors will stake out every other Shear Wall at three points on the Shear/Buttress Wall centerline, at (1) end of the Buttress Wall, (2) centerline of the Outboard Perimeter Wall, and (3) centerline of the Inboard Perimeter Wall. In segments where the layout does not include an Outboard Perimeter Wall, stakes will be placed at (1) the outer end of the Shear Wall and (2) centerline of the Inboard Perimeter Wall.

PERIMETER WALL STABILIZATION CONTRACTOR shall perform all other survey and layout required for completing the Perimeter Wall Stabilization work in accordance with the approved Work Plan (Paragraph 1.5.2), Shop Drawings (Paragraph 1.5.10), the tolerances specified by Paragraph 4.4, and all other requirements of the Technical Specifications. This shall include the layout of each Shear Wall and the location of individual Soil-Cement Panels.

4.3.5 Horizontal Location and Alignment

The Soil-Cement Walls shall be accurately surveyed, staked, and constructed to ensure that the completed walls conform to the approved Shop Drawings, and the Stabilized Width and Shear Wall Spacing meet the requirements of the Specifications and Drawings. The location control shall be referenced to surveyed control points.

4.3.6 Sequencing of Soil-Cement Panels

Construction of the walls may be carried out in an alternating sequence of overlapping panels. Mixing of Soil-Cement Panels shall be time sequenced such that the previously completed panels are sufficiently soft to allow the overlapping as needed to achieve continuity of the Soil-Cement Walls across construction joints.

If Soil-Cement Wall overlaps or intersections are formed by cutting through or across a previously completed wall, then joints will occur in the first wall along both faces of the newer wall. At the outer intersections in the design layout, the Shear/Buttress wall shall be built first, and the Outboard Perimeter Wall shall be built last and cut through the Shear Walls. The Inboard Perimeter Wall may be built first, but only if the Shear Walls are not cut through the Inboard Perimeter Wall.

4.3.7 Wall Intersections

The pattern of Soil-Cement Walls will require the construction of walls that intersect and connect to previously completed and cured walls. PERIMETER WALL STABILIZATION CONTRACTOR's means and methods must allow for the construction of these joints ("soft-into-hard") without the loss of structural integrity at the joints.

All intersections or joints between two walls shall result in a contact surface, measured along the intersection between the new and existing Soil Cement, that is not less than two-thirds the thickness of the thinner wall to the full vertical depth of the intersection or joint.

4.3.8 Cold Joints

Construction Joints, including Butt Joints and Tee Joints, that are formed with an existing wall that is more than 14 days old shall be considered a Cold Joint. This definition of a Cold Joint may be altered in writing by the Perimeter Wall Stabilization QC Manager, on the basis of laboratory testing and/or observed field results that show other criteria will result in joint strengths consistent with the overall design.

Where formed, a Cold Joint shall be reinforced by doubling the thickness of the soil-cement wall, to full depth of the joint including rock embedment. The double wall thickness shall extend past the Cold Joint in both directions for a distance not less than twice the effective wall thickness.

4.3.9 Vertical Alignment Monitoring

Verticality of each Soil-Cement Panel may be measured on the basis of a horizontal or level setup of the excavation machinery during operations.

The means, methods, and frequency of verticality measurements shall conform to the approved Quality Control Plan. Changes or alternate methods of measurement, including the frequency of such measurements, shall be approved by the Perimeter Wall Stabilization QC Manager.

4.3.10 Top of Rock from Excavation Observations

Based on observations during excavation, the Top of Rock for each Soil-Cement Panel will be determined by the Perimeter Wall Stabilization QC Manager as follows:

(1) The rockline interpolated from the site borings, as shown on the Drawings, may be used as guidance for the expected elevation of rock at various locations on the site.

(2) During excavation of each Soil-Cement Panel, the PERIMETER WALL STABILIZATION CONTRACTOR shall notify the Perimeter Wall Stabilization QC Manager when bedrock has been encountered.

(3) The QC Manager will physically examine the excavated material to confirm that pieces of intact bedrock have been excavated; material that appears to represent loose rock or boulders above the top of bedrock will be ignored.

(4) After excavated bedrock has been confirmed, the PERIMETER WALL STABILIZATION CONTRACTOR shall take no less than three depth measurements, in the area designated by the Perimeter Wall Stabilization QC Manager, to determine the apparent location of the deepest excavation.

(5) The elevation of the deepest point where rock was retrieved in the excavation shall be designated as the Top of Rock for that Soil-Cement Panel.

The determination of excavated rock and the Top of Rock elevation, based on observations and measurements during construction, shall be made by the Perimeter Wall Stabilization QC Manager.

4.3.11 Interruption of Mixing

Once perimeter wall stabilization is initiated within any Soil-Cement Panel, the operation shall be continued until that Panel is completed. If the mixing process is interrupted for more than 2 hours for any reason, the Panel shall be remixed to full depth and length of the Panel. PERIMETER WALL STABILIZATION CONTRACTOR may submit alternate means of establishing acceptance criteria to the Perimeter Wall Stabilization QC Manager for approval.

4.3.12 Suspect Soil-Cement Panel

If installation observations indicate a lack of mix homogeneity or the existence of a discontinuity due to collapse of the surrounding soil, improper installation procedures, equipment problems, or any other malfunction, then the Perimeter Wall Stabilization QC Manager may order additional excavation and re-mixing of any Soil-Cement Panel within the limits of the observed problems.

4.3.13 Weather Impacts

Construction shall not be permitted when severe weather conditions may compromise the quality of work or worker safety as defined by TVA.

4.3.14 Erosion Control

While Earthwork Contractor is responsible for erosion control on the site, PERIMETER WALL STABILIZATION CONTRACTOR shall be responsible for erosion control within the perimeter wall stabilization work area during those operations, shall meet the requirements of SECTION 02100 EROSION CONTROL AND STABILIZATION, and shall coordinate with the Construction Manager regarding erosion control issues.

4.3.15 Dust Control

PERIMETER WALL STABILIZATION CONTRACTOR shall provide dust control for Perimeter Wall Stabilization operations. The PERIMETER STABILIZATION CONTRACTOR shall make every effort to control dust emissions and shall adhere to all applicable rules and regulations of pertinent governmental agencies concerning fugitive dust emissions.

4.3.16 Lay Down Areas

PERIMETER WALL STABILIZATION CONTRACTOR is responsible for making sure the lay down areas for the Perimeter Wall Stabilization operations comply with all local building and fire codes and regulations, as well as all TVA codes and requirements. Use of lay down area is for the staging and storing of construction related equipment or material for TVA construction activities only.

4.3.17 Site Maintenance and Trash

PERIMETER WALL STABILIZATION CONTRACTOR is responsible for keeping the grounds surrounding the lay down area and perimeter wall stabilization work area clean of construction materials, litter, trash, and scrap materials. Continuous housekeeping is required including daily removal of combustible waste and storage of combustible waste in approved metal containers and trash bins with metal lids. PERIMETER WALL STABILIZATION CONTRACTOR is responsible for his own trash management and shall comply with all TVA recycling/removal guidelines.

4.4 TOLERANCES

4.4.1 Wall Dimensions

The Soil-Cement Walls shall be installed to lengths, locations, and tolerances shown on the Drawings and approved Shop Drawings. Required minimums for the thickness and spacing of the Soil-Cement Walls are specified in Subsection 2.3.

4.4.2 Horizontal Alignment

The maximum horizontal deviation of any Soil-Cement Panel, measured at the center of the panel top, shall not exceed 6 inches from the center location shown on the approved Shop Drawings. The Soil-Cement Panel may vary from the design alignment, to accommodate equipment limitations or unexpected site obstructions, only with approval of Perimeter Wall Stabilization QC Manager.

4.4.3 Vertical Alignment

All Soil-Cement Panels shall be constructed to within +/- 1% of vertical (plumb). Panel verticality may be measured on the basis of a horizontal or level setup of the excavation machinery, in accordance with the approved Quality Control Plan.

For overlapping Soil-Cement Panels, the continuity of the overlap shall be maintained full depth. The Construction Platform and perimeter wall stabilization rig shall be leveled prior to the start of perimeter wall stabilization, and verticality of the excavation rig shall be monitored and adjusted during construction of each Soil-Cement Panel.

4.4.4 Depth to Top of Rock

The constructed depth to Top of Rock shall be measured to within a tolerance of +/- 6 inches.

4.4.5 Depth of Rock Embedment

The depth of the Rock Embedment, as defined by Paragraph 1.4.29, shall be measured with respect to the Top of Rock and to within a tolerance of +/- 2 inches.

4.4.6 Frequency of Depth Measurements

The Top of Rock and Depth of Rock Embedment shall be measured during the construction of all Soil-Cement Panels. The Top of Rock elevation for each Soil-Cement Panel shall be determined in accordance with Paragraph 4.3.10.

At a minimum, the bottom of each excavated Soil-Cement Panel shall be measured:

- at both ends of the excavated Panel, and
- at points along the length of the trench that are no farther apart than 15 feet horizontally.

To meet these minimum requirements, a 30-ft long Panel would require at least three measurements, a 35-foot long Panel would require at least four measurements, a 40-foot long Panel would require at least four measurements, etc.

During construction, the Perimeter Wall Stabilization QC Manager may require additional depth measurements at any location or any spacing in any Soil-Cement Panel.

4.5 SPOILS MANAGEMENT

4.5.1 Containment

Spoils from the construction process shall be managed within the Contractor's Work Limits as designated on the Drawings and in accordance with the approved Spoils Management Plan (Paragraph 1.5.4). PERIMETER WALL STABILIZATION CONTRACTOR shall prevent runoff or uncontrolled release of Spoils from the work site.

Positive means shall be provided for containing all Spoils, flush water, other waste materials, and runoff within the active work area. Spoil materials that are in a fluid state shall be piped, channeled through temporary ditches, or mechanically transported into holding ponds, tanks, or other retaining structures or facilities.

Sedimentation and turbidity control measures, as required by federal, state and local regulations, and the site-wide Stormwater Management Plan (SWMP) shall be deployed and maintained to prevent the spoil materials from contaminating adjacent water courses and groundwater. PERIMETER WALL STABILIZATION CONTRACTOR shall take necessary precautions and implement measures to prevent any Spoils, other waste materials, or stockpiled materials from entering storm drain structures, drainage courses, or otherwise leaving the site via surface runoff.

4.5.2 Clean-up and Removal

In the event that Spoils, ash, waste materials, or stockpiled materials enter an area or facility outside those designated in the approved Spoils Management Plan (Paragraph 1.5.4), then PERIMETER WALL STABILIZATION CONTRACTOR shall be responsible for immediately and completely cleaning and removing these materials to the approval of TCM at no additional cost to TVA.

4.5.3 Blending of Spoils

Spoils may be blended with excavated or stockpiled material within the Contractor's Work Limits. After allowing sufficient time to set or solidify, the blended material shall be excavated for disposal in accordance with Paragraph 4.5.4.

4.5.4 Disposal of Spoils

Blended Spoils may be incorporated into the Construction Platform or placed as fill within the Contractor's Work Limits, but only if the material is first allowed sufficient time to set or solidify, then mechanically excavated and broken into pieces no larger than 4 inches in the greatest dimension. Blended Spoils to be placed as fill in designated areas shall meet the project requirements for fill and compaction.

All Spoils, blended or unblended, that are unsuitable for use as fill within the Contractor's Work Limits shall be placed by PERIMETER WALL STABILIZATION CONTRACTOR at locations on the inboard side of the Perimeter Wall Stabilization zone designated by TVA for disposal by others.

4.6 DEMONSTRATION SECTION

PERIMETER WALL STABILIZATION CONTRACTOR shall construct a Demonstration Section using the equipment, personnel, and procedures proposed for the full-scale production work. The primary objective of the Demonstration Section is to verify capabilities and establish greater confidence in the selected equipment, personnel, and procedures for meeting the requirements of the Specifications, consistent with the design assumptions. Compared to the Work to follow, more frequent testing will be accomplished in the Demonstration Section; this includes additional depth measurements (Paragraph 4.4.6), more coring in smaller test parcels (Paragraph 2.2.4), and other additional measurements or observations as requested by the Perimeter Wall Stabilization QC Manager.

The Demonstration Section shall result in a total constructed wall length that is not less than 400 ft, with no less than three 100-foot long Shear/Buttress Walls, a 50-ft Inboard Perimeter Wall, a 50-ft long Outboard Perimeter Wall, and six connections between these walls. Full rock embedment is required.

If the Demonstration Section is found to meet all Specification requirements, it may be incorporated into the completed Work. If the Demonstration Section fails to meet any Specification requirement, PERIMETER WALL STABILIZATION CONTRACTOR shall propose measures to address the deficiencies. Perimeter Wall Stabilization operations on other portions of the work shall not proceed until the Demonstration Section has been completed by PERIMETER WALL STABILIZATION CONTRACTOR and approved by TCM and Perimeter Wall Stabilization QC Manager.

4.7 QUALITY CONTROL (QC) PROGRAM

4.7.1 General

PERIMETER WALL STABILIZATION CONTRACTOR shall establish and maintain a quality control program for the operations covered under this Section of the Specifications, to assure complete and strict compliance with contract requirements and to maintain and provide quality control records for all operations required under this Work.

Data from pre-construction bench testing of proposed mixes, wet grab sampling of mixed material, and full-depth coring of cured walls will be used to evaluate uniformity of mixing, achievement of required material strengths, and penetration into rock.

Completed walls or sections that do not meet the Specifications will be reconstructed or repaired at no cost to TVA, in accordance with the approved Remediation Plan for Defective Soil-Cement Walls (Paragraph 1.5.8).

PERIMETER WALL STABILIZATION CONTRACTOR shall maintain detailed as-built data as soon as the various portions of the required work are completed. As-built dimensional data and all test data shall be submitted to the Perimeter Wall Stabilization QC Manager.

All photographs taken on the project site shall comply with the Standard Operating Procedure for the Kingston photo data base.

4.7.2 Monitoring and Control

PERIMETER WALL STABILIZATION CONTRACTOR shall implement procedures to monitor, control, and document locations, alignments, depths, verticality, water-cement ratios, cement factors, grout quantities, and all other relevant aspects of the soil-cement mixing process, from the installation of all Soil-Cement Panels.

4.7.3 Documentation

All quality control and measurement for payment data shall be recorded on specially prepared Quality Control Forms. The forms will contain, but not be limited to, the following information:

- Summary of daily activities.
- Quality control test results.
- Locations and dates of test samples.
- Measurement of pay quantity.
- Pay quantity.
- Other comments as necessary.
- Signatures.

All quality control records, tests, and inspections shall be documented by the Perimeter Wall Stabilization QC Representative and made available for review by TCM and Perimeter Wall Stabilization QC Manager. The QC Representative shall record all measurements and test results for submittal to Perimeter Wall Stabilization QC Manager each day.

The Quality Control Forms shall be submitted by the QC Representative as part of the Daily Production Report, as described in Paragraph 1.5.11.

4.7.4 Grout Tests

PERIMETER WALL STABILIZATION CONTRACTOR shall implement procedures to ensure that the grout is prepared, mixed, and injected in a manner that will achieve the requirements of the Specifications. At the beginning of each grout batch, PERIMETER WALL STABILIZATION CONTRACTOR shall test the grout unit weight in accordance with ASTM D4380, the Marsh Funnel viscosity in accordance with ASTM D6910, and the grout time of efflux in accordance with ASTM C939. Grout Test results shall be reported daily to Perimeter Wall Stabilization QC Manager.

4.8 SOIL-CEMENT SAMPLING AND TESTING

Wet grab sampling and molding of test specimens to provide for quality control of the mixed Soil-Cement shall be the responsibility of PERIMETER WALL STABILIZATION CONTRACTOR and shall be considered incidental to placement. Coring of the completed Soil-Cement Walls and/or Test Parcels will be accomplished by the CORING CONTRACTOR selected by TVA. Testing of wet grab or core samples will be performed by a Quality Control Testing Laboratory selected by TVA.

The number and frequency of core holes and core sampling will meet the requirements in Paragraph 2.2.4 for determining the strength of the Soil-Cement in Test Parcels. Test Parcel locations, coring locations, and test specimens will be selected by Perimeter Wall Stabilization QC Manager. At the discretion of Perimeter Wall Stabilization QC Manager, the selection of Test Parcels, coring locations, and test specimens may be random or may be focused in areas of construction joints, low cement ratios, or apparent construction problems. If the test results or observations during installation indicate deficiencies or marginal quality, the TCM or Perimeter Wall Stabilization QC Manager may require additional coring and testing.

4.8.1 Wet Grab Samples

Wet grab samples shall be obtained in accordance with the approved Quality Control Plan. PERIMETER WALL STABILIZATION CONTRACTOR shall also obtain wet grab samples of the mixed Soil-Cement from the locations and depths as directed by the Perimeter Wall Stabilization QC Manager.

(1) The device used to retrieve the wet grab Soil-Cement samples shall conform to the requirements in Paragraph 3.4.1.

(2) For each designated sampling location, the retrieved Soil-Cement wet grab sample shall be of sufficient volume to produce at least four full cylindrical molds. Each molded specimen shall be no less than 2.8 inches in diameter with a height that is no less than two times the diameter.

(3) The entire sample shall be passed through a 0.5 inch sieve size prior to molding. Any soil particles or lumps retained on the sieve shall be cut or reduced to a size that will just pass the 0.5-inch sieve, rock fragments retained on the 0.5-inch sieve may be discarded. All the material shall then be returned to the sample and the molded cylinders shall be formed immediately, in accordance with ASTM D4832.

(4) Both the collection of wet grab samples and preparation of the test cylinders in molds shall be carried out within 60 minutes of completing the Soil-Cement Panel.

(5) The panel identification number, depth, date, and time of the wet grab samples shall be recorded and legibly marked in permanent ink on each cylindrical mold.

(6) Wet grab samples shall be stored and protected on the project site for no less than 4 days (and no longer than a duration to be defined by TVA) following retrieval and molding.

(7) All wet grab samples of Soil-Cement shall be formed, preserved, and cured in accordance with ASTM D4832. The samples shall be cured at 95% to 100% relative humidity, except (a) samples held at the project site before transportation to the testing laboratory shall be maintained in a relative humidity of no less than 80%, and (b) all samples retained for testing beyond 56 days in age shall be kept submerged. The temperature of the environment immediately adjacent to the curing specimens shall be maintained between 60 and 80 degrees Fahrenheit. The samples shall be protected from freezing and extreme weather conditions at all times.

(8) For each designated sampling location, molded specimens will be selected by Perimeter Wall Stabilization QC Manager and tested at 14, 28, and 56 days for Unconfined Compressive Strength. After preparation for testing, all molded specimens shall have a height not less than 1.75 times the diameter. Test in accordance with ASTM D2166 at an axial strain rate of 0.5% per minute. The axial strain at peak load shall also be recorded. Any remaining molded specimens will be retained and designated as spares. This test schedule may be modified by Perimeter Wall Stabilization QC Manager.

4.8.2 Core Samples

The CORING CONTRACTOR selected by TVA shall obtain core samples from Test Parcels or Soil-Cement Walls at the locations selected by the Perimeter Wall Stabilization QC Manager. CORING CONTRACTOR shall submit a sampling and testing plan and receive approval in writing from Perimeter Wall Stabilization QC Manager prior to initiating any coring work. Core samples shall be used for purposes of Quality Control, shall be provided to the Perimeter Wall Stabilization QC Manager, and shall remain the property of TVA.

All coring of the cured Soil-Cement Walls shall meet the following minimum requirements.

(1) Coring of a Soil-Cement Panel shall be completed no sooner than 14 days after the completion of the Panel.

(2) Coring shall be accomplished in accordance with ASTM D2113, using a coring device that meets the requirements of Paragraph 3.4.2.

(3) The equipment and method of coring shall ensure that the core samples retrieved are undisturbed and unbroken. The core samples shall otherwise meet the requirements of ASTM D2166.

(4) The coring shall be performed by experienced drillers using appropriate drilling fluids with monitoring/logging by experienced drilling inspectors. The inner surface of the sampling tube shall be appropriately lubricated. Delay coring to allow for curing to a higher strength, reduce the rate of core barrel penetration, or otherwise adjust sampling methods to minimize disturbance and breakage of the core samples.

(5) Coring for the core samples shall be continuous through the full depth of the Soil-Cement Wall, and continue into rock at least 2 feet beyond the termination depth.

(6) Following completion of core drilling, the borehole shall be grouted uniformly throughout the depth of coring with a non-expansive, Portland cement grout having the same or higher cement ratio as the original panel. The borehole shall be grouted from the bottom up using the tremie pipe method.

(7) Immediately after retrieving the Soil-Cement core samples from a boring, the core samples shall be photographed, then wrapped and sealed to prevent moisture loss. All cores shall be placed in appropriately sized wooden storage boxes with appropriate cushioning materials (for

example, sawdust) and labeled with the panel identification number, depth, date, and time of the core in accordance with ASTM D5079. Core photographs shall be provided to Perimeter Wall Stabilization QC Manager at regular intervals.

(8) The core samples shall be protected from extreme weather conditions during all periods of storage, handling, and transportation. Samples shall be transported and handled with appropriate precautions, in accordance with established TVA protocols, resulting from the site being under CERCLA regulatory mandates.

(9) Core samples selected for testing shall be immediately transported to the Quality Control Testing Laboratory selected by TVA. The core samples shall be stored in a curing environment that meets the requirements of ASTM C192. Core samples selected for testing shall be stored at 95% to 100% relative humidity, except that samples beyond 56 days in age shall be kept submerged. The temperature immediately adjacent to the cores shall be maintained in the range of 60 to 80 degrees Fahrenheit.

(10) Selected cores shall be tested for Unconfined Compressive Strength in accordance with ASTM D2166 at an axial strain rate of 0.5% per minute. The axial strain at peak load shall also be recorded.

(11) Left-over core samples shall be preserved and stored onsite for additional testing if required and as directed by Perimeter Wall Stabilization QC Manager. At reasonable intervals during the work, the core samples shall be delivered to TVA.

4.9 ACCEPTANCE OF COMPLETED WORK

4.9.1 Acceptance of Soil-Cement Walls

Perimeter Wall Stabilization QC Manager will review and evaluate each Soil-Cement Panel based on the conformance of Quality Control data and installation procedures to the requirements of the Specifications. Interpretation and evaluation of the Quality Control data and other data for acceptance or rejection of a Soil-
Cement Panel, Soil-Cement Wall, Test Parcel, or other defined area will be at the discretion of TCM. The TCM may also perform additional testing of the work and incorporate the results of such tests into the decision for or against acceptance of the work.

The strength of the Soil-Cement shall be evaluated on the basis of tests on wet grab or core samples and compared to the strength requirements in Paragraph 2.2.3. The uniformity of the Soil-Cement shall be evaluated on the basis of the core samples as compared to the requirements in Paragraph 2.2.1.

In the event tests indicate that a Test Parcel does not meet any requirement of this Specification, PERIMETER WALL STABILIZATION CONTRACTOR may elect to obtain additional core samples from the areas in question. Additional cores obtained under this provision shall be acquired at no cost to TVA, and shall meet the requirements in Paragraph 4.8.2. Results from testing of additional core samples may form the basis for TCM acceptance of the designated Test Parcel or Soil-Cement Wall.

4.9.2 Remedial Actions

If a Soil-Cement Wall, or a portion thereof, is rejected, PERIMETER WALL STABILIZATION CONTRACTOR shall implement remedial measures in accordance with the approved Remediation Plan for Defective Soil-Cement Walls (Paragraph 1.5.8) at no additional cost to TVA.

Pending approval by TCM and Perimeter Wall Stabilization QC Manager, acceptable remedial actions may include, but are not limited to the following.

(1) Remove, remix, or otherwise reconstruct the defective section.

(2) Install additional Shear Walls and/or reduce the spacing between the Shear Walls.

(3) Increase Effective Thickness of defective sections, by constructing overlapping panels to either or both sides of the defective section.

(4) Reinforce defective Soil-Cement Walls.

Cold Joints created as part of a remedial effort shall conform to the requirements of Paragraph 4.3.8. Remedial actions shall not involve the construction of Soil-Cement Panels outside the outboard limits of Perimeter Wall Stabilization as indicated on the Drawings.

4.10 AS-BUILT PLANS

As-built plans will be prepared by the Engineer of Record, using as-built and test data provided by the PERIMETER WALL STABILIZATION CONTRACTOR, survey data collected by TVA, and other relevant data.

4.11 DEMOBILIZATION

Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies/materials not used in the Work, including the disassembly, removal, and site cleanup of any offices or other facilities assembled at the site by PERIMETER WALL STABILIZATION CONTRACTOR.

Demobilization shall begin only after PERIMETER WALL STABILIZATION CONTRACTOR has restored all access areas to the same condition as prior to the start of the work, or as shown in the Contract Documents.

Prior to removal from the project site, all equipment shall be cleaned and decontaminated in accordance with the current site requirements, relating to the site being under CERCLA regulatory mandates.

4.12 CLEANUP

PERIMETER WALL STABILIZATION CONTRACTOR shall remove all equipment, excess materials, temporary structures, stockpiles, etc., following completion of the Work. PERIMETER WALL STABILIZATION CONTRACTOR shall remove all excess soil, grout, soil-cement, and other spoil waste and dispose of same in areas at the site designated by TVA.

The Construction Platform shall be removed from all areas within the Contractor's Work Limits, in accordance with Paragraph 4.3.3.

END OF SECTION 02650

TECHNICAL SPECIFICATIONS
SECTION 02936 – REVEGETATION

PART 1 - GENERAL

1.1. DESCRIPTION

This Work consists of furnishing all labor, equipment and materials for long term, medium term and short term stabilization of the Earthen Embankment and staging or work areas within the Dredge Cell limits during construction. The work includes methods for preparing the seedbed, adding soil amendments, and seeding disturbed areas until final cover is applied in a later project.

1.2. RELATED DOCUMENTS

The provisions of the Drawings and Quality Control (QC) Plan Contract apply to the Work specified in this Section. Related Sections of the Technical Specifications include:

- Section 02100 – Erosion Control and Stabilization
- Section 02150 – Site Preparation
- Section 02200 – Excavation
- Section 02300 – Backfill and Embankment
- Section 02350 – Rock Berm

1.3. DEFINITIONS

1.3.1. TVA

TVA is the Tennessee Valley Authority, which is the project owner.

1.3.2. Technical Contract Manager (TCM)

The Technical Contract Manager (TCM) is the designated TVA representative responsible for the administration and oversight of the Work, including but not limited to the duties outlined in this Specification.

1.3.3. Quality Control (QC) Manager

The Quality Control Manager (QC Manager) is a professional engineer licensed in the State of Tennessee that is responsible for the Quality of the constructed project as defined in the Quality Control Plan. This individual will be designated by TVA and will be the Engineer of Record for Construction.

1.3.4. Contractor

The Contractor is the entity with which TVA has entered into an agreement to construct this project. Section 02936 of the Specifications pertains to work to be accomplished by EARTHWORK CONTRACTOR.

1.3.5. Drawing

Drawings are Issued for Construction engineering design drawings.

1.3.6 Construction Manager

The Construction Manager is responsible for construction activity to include but not be limited to the character and sequence of work, coordination and scheduling.

1.4. SUBMITTALS

A. Agronomic soil test results shall be submitted to the TVA and Earthwork QC Manager.

B. Seed tickets, fertilizer certification, and $CaCO_3$ equivalency certification shall be submitted to the TVA and Earthwork QC Manager.

C. A specification sheet on the proposed hydromulch shall be submitted to the TVA and Earthwork QC Manager.

D. The proposed compost shall be submitted to the TVA and Earthwork QC Manager

E. A sample of the Erosion Control Blanket shall be submitted to the TVA and the Earthwork QC Manager.

1.5. QUALITY CONTROL

1.5.1. Agricultural limestone shall be purchased from quarries approved by the Tennessee Department of Agriculture.

1.5.2. Fertilizer (bagged or bulk) either dry or liquid, must be manufactured and sold under the jurisdiction of the Tennessee Department of Agriculture, Ag Inputs Section.

1.5.3. All seed shall be certified by an Official Seed Certifying Agency. Seeds shall have been tested within nine months prior to use. Each kind of seed shall be separately packed and delivered to the project in a seed-tight bag. Each bag shall bear a tag or label bearing the seal of the Official Seed Certifying Agency. The analysis of the seed (% pure seed, % germination, date tested, etc.) shall be attached to the bag.

PART 2 - PRODUCTS

2.1. AGRICULTURAL LIMESTONE

Agricultural ground limestone or its equivalent shall be used. The ground limestone must meet the following requirements: contain sufficient calcium and magnesium carbonate and be equivalent to not less than 80 percent calcium carbonate and must be fine enough so that not less than 90 percent shall pass through a US Standard No. 10 sieve and not less than 35 percent shall pass through a US Standard No. 50 sieve. Lime shall be applied at the rate specified in Paragraph 3.1. Agricultural ground limestone shall be purchased from quarries approved by the Tennessee Department of Agriculture.

2.2. FERTILIZER

The fertilizer shall be a commercial fertilizer containing the plant nutrients of nitrogen (N), available phosphoric acid (P_2O_5) and soluble potash (K_2O) and shall be applied at the rate specified in Section 3.1. The fertilizer utilized shall be 19-19-19 or equivalent. Bagged fertilizer shall display the following information on the bag or on a sticker or tag attached to the bag: net weight, brand and grade, guaranteed analysis, and name and address of manufacturer. Bulk fertilizer (dry or liquid) shall be accompanied by a statement from the manufacturer which contains the same information required for the bagged fertilizer.

2.3. SEED

2.3.1. Seed shall be applied to all disturbed areas, in accordance with Table 1 with no alterations except with the written consent of the Earthwork QC Manager. The seed mixture shall be totally free of any wild onion, giant foxtail, nodding thistle, Johnsongrass, and Canada thistle seed and contain less than two percent other crop seed. The seed shall also comply with all Tennessee seed laws and regulations.

2.3.2. Seed shall be furnished fully tagged and labeled in accordance with the state laws and the US Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of invitations for bid. All seed must be from the latest crop available. No seed will be accepted with a date of test of more than nine (9) months prior to the date of delivery to the site. Any seed which has become wet, moldy or otherwise damaged in transit or storage will not be accepted.

2.3.3. All seed shall be delivered in separate bags or packages according to species or be a certified seed mixture. The tags from each seed bag shall be given to the Earthwork QC Manager at the site. These tags will be required for final payment.

2.3.4. All legume seed shall be treated with inoculant prior to seeding in accordance with Paragraph 2.7 (Inoculants).

Table 1

Seed Mixtures	Hydroseed Rate (pounds/acre PLS*)
Application Period: February 1 to November 15)	
German Millet (Annual)	15
Bermuda Grass	15
Alfalfa	20
White Sweet Clover	5
Red Clover	5
Perennial Rye	30
Fescue (Endophyte free)	25
Weeping Lovegrass	3
Seed Mixes: November 15 to February 1	
Winter Wheat	60
Temporary Seed Mix:	
Annual Rye	60

*PLS Pure Live Seed is determined by multiplying the percent germination of the seed times the percent purity

2.4. SHORT TO MID-TERM DURATION HYDROMULCH

The hydromulch utilized for short to medium term applications (less than two months) shall consist of a matrix of wood fibers, and crimped man-made fibers and performance-enhancing additives. Hydromulch shall conform to Flexterra FGM or equivalent for short to moderate term applications. Mulch shall be applied at the rate specified in Paragraph 3.3.

2.5. LONG-TERM DURATION HYDROMULCH

The hydromulch utilized for long term applications (greater than two months) shall consist of a matrix of blended coconut and wood fibers, with crimped interlocking man-made fibers and additives. Hydromulch shall conform to Cocoflex ET-FGM or equivalent for long term applications. Mulch shall be applied at the rate specified in Paragraph 3.3.

2.6. COMPOST

Compost placed in areas of ash shall consist of organic matter such as Buffalo Compost or equivalent. The compost shall be free of deleterious amounts of metals, pesticides, or other environmental hazards. The compost shall be capable of being spread and incorporated into the ash or mixed with hydraulic mulch. Alternate composts that introduce organic matter will be considered. Compost is not required for Earthen Berm.

2.7. INOCULANTS

The inoculant for treating legume seeds shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container or otherwise specified. A mixing medium, as recommended by the manufacturer, shall be used to bond the inoculant to the seed. Four times the amount of the inoculant recommended by the manufacturer shall be used. Seed shall be sown within 24 hours of treatment and shall not remain in a hydroseeder longer than four (4) hours.

2.8. EROSION CONTROL BLANKET

Erosion control blanket shall be a manufactured product consisting of plastic netting on both sides with excelsior or coconut in between. Erosion Control Blanket shall be utilized in areas where hydromulch is not providing acceptable erosion protection.

PART 3 - EXECUTION

3.1. LONG TERM COVER (GREATER THAN 60 DAYS)

3.1.1. For areas that have been disturbed by grading activities but will lay idle for more than 60 days the following work shall be performed. The areas to be seeded shall be dressed to a reasonably smooth, firm surface, as determined by the Earthwork QC Manager. Compost shall be placed in areas of ash to a depth of two inches and incorporated into the top six inches of soil by disking or tilling or shall be incorporated with the hydromulch. Lime (if needed) shall be applied at the rate determined by testing. Fertilizer shall be applied at a rate sufficient to meet the requirements of nitrogen (N), phosphorus (P_2O_5) and potash (K_2O) indicated by soil testing performed immediately prior to seeding. These soil tests shall be the responsibility of the Construction Manager.

3.1.2. The surface shall be tilled to a minimum depth of six (6) inches with either a tandem or offset disk meeting the following specifications:

F. Disk Size: 22 inches minimum

G. Disk Spacing: 13 inches maximum

H. Weight: 400 pounds per foot of cut minimum

I. Equipped with a drag of sufficient weight to remove any furrows left by the disk.

3.1.2.1. Preparation shall be suspended when soil conditions are not suitable for the preparation of a satisfactory seedbed. The Earthwork QC Manager shall make this determination.

3.1.3. The specified mixtures of pure live seed (PLS) will be used on all disturbed areas using the seasonal variations shown.

3.1.4. All areas shall be seeded immediately following seedbed preparation. In the event the date does not concur with the seeding schedules specified, seeding shall be accomplished using any one of the specified rates or an equivalent rate designed to fit the site and weather conditions, as directed by the Earthwork QC Manager.

3.1.5. All seed shall be broadcast evenly over the area immediately following tilling using a hydroseeder. The slurry PH shall not be allowed to drop below a pH of 5.0. In addition, the Earthwork QC Manager shall provide an accurate pH meter to monitor the slurry at all times.

3.1.6. Hydromulch materials shall be spread uniformly over all seeded areas. The mulch shall be applied uniformly over all seeded areas at the rate of one and a half (1.5) tons per acre immediately following seeding. Hydromulch may be mixed with seed and fertilizer for application.

3.1.7. Erosion control blankets shall be employed to repair areas where erosion features have formed in previously hydromulched areas. Install up and down the hill (vertical) for long slopes. Walk blankets down to ensure good contact with the soil. Use plenty of staples to keep blankets flat. Overlap blankets at 6 to 8 inches on sides, tops and bottoms. Do not stretch blankets, and do not exceed manufacturer's directions on maximum slope angle for the product. Refer to the Manufacturer's recommendations for installation patterns and stapling.

3.1.8. The EARTHWORK CONTRACTOR shall achieve 80 percent vegetative cover at the end of the second growing season. Such vegetative cover shall be measured using a transect method along the project baseline or other convenient baseline. This method shall involve taping along chosen transects and observing vegetation at each one-foot interval. At each observation point it will be noted whether vegetation is in contact with the transect. The sum of positive observations divided by total observations will determine compliance. Noticeably bare or eroded areas along or between transects shall be repaired even if the overall vegetative cover exceeds 80 percent.

3.1.9. These seeding specifications are intended to stabilize the project area through establishment of an adequate vegetative cover to provide protection until the Dredge Cell is capped. The EARTHWORK CONTRACTOR may be permitted to incorporate alternate seeding, fertilization and/or protection techniques which produce the intended results. The EARTHWORK CONTRACTOR is encouraged to consider such applications. However, the EARTHWORK CONTRACTOR is cautioned that if an alternate technique is utilized, the EARTHWORK CONTRACTOR shall still meet the requirements of Paragraph 3.1.8.

3.1.10. Use of alternative techniques or other deviations from the standards and instructions provided herein must be approved by the Earthwork QC Manager prior to implementation. The Earthwork QC Manager will partially base his assessment on the purity of the constituents proposed, as well as the potential for interference of the proposed alternate techniques with other elements of the project and the overall design intent.

3.2. MID TERM COVER (GREATER THAN 21 DAYS, LESS THAN 60 DAYS)

3.2.1. For areas that have been disturbed by grading activities but will lay idle for more than 21 days but less than 60 days, the following work shall be performed. The areas to be seeded shall be dressed to a reasonably smooth, firm surface, as determined by the Earthwork QC Manager. Hydromulch shall be placed as discussed below. Fertilizer shall be applied at a rate sufficient to meet the requirements of nitrogen (N), phosphorus (P_2O_5) and potash (K_2O) indicated by soil testing performed immediately prior to seeding. These soil tests shall be the responsibility of the Construction Manager.

3.2.2. The surface shall be tilled to a minimum depth of six (6) inches with either a tandem or offset disk meeting the following specifications:

A. Disk Size: 22 inches minimum

B. Disk Spacing: 13 inches maximum

C. Weight: 400 pounds per foot of cut minimum

D. Equipped with a drag of sufficient weight to remove any furrows left by the disk.

3.2.2.1. Seedbed preparation shall be suspended when soil conditions are not suitable for the preparation of a satisfactory seedbed. The Earthwork QC Manager shall make this determination.

3.2.3. The specified mixtures of pure live seed (PLS) will be used on all disturbed areas using the temporary seed mixture shown.

3.2.4. All areas shall be seeded immediately following seedbed preparation. In the event the date does not concur with the seeding schedules specified, seeding shall be accomplished using any one of the specified rates or an equivalent rate designed to fit the site and weather conditions, as directed by the Earthwork QC Manager.

3.2.5. All seed shall be broadcast evenly over the area immediately following tilling using a hydroseeder. The slurry PH shall not be allowed to drop below a pH of 5.0. In addition, the Earthwork QC Manager shall provide an accurate pH meter to monitor the slurry at all times.

3.2.6. Hydromulch materials shall be spread uniformly over all seeded areas. The mulch shall be applied uniformly over all seeded areas at the rate of one (1.0) tons per acre immediately following seeding. Hydromulch may be mixed with seed and fertilizer for application

3.2.7. Erosion control blankets shall be employed to repair areas where erosion features have formed in previously hydromulched areas. Install up and down the hill (vertical) for long slopes. Walk blankets down to ensure good contact with the soil. Use plenty of staples to keep blankets flat. Overlap blankets at 6 to 8 inches on sides, tops and bottoms. Do not stretch blankets, and do not exceed manufacturer's directions on maximum slope angle for the product. Refer to the Manufacturer's recommendations for installation patterns and stapling.

3.2.8. These seeding specifications are intended to stabilize the project area through establishment of an adequate vegetative cover to provide protection until additional grading work is performed. The EARTHWORK CONTRACTOR may be permitted to incorporate alternate seeding, fertilization and/or protection techniques which produce the intended results. The EARTHWORK CONTRACTOR is encouraged to consider such applications.

3.2.9. Use of alternative techniques or other deviations from the standards and instructions provided herein must be approved by the Earthwork QC Manager prior to implementation. The Earthwork QC Manager will partially base his assessment on the purity of the constituents proposed, as well as the potential for interference of the proposed alternate techniques with other elements of the project and the overall design intent.

3.3. SHORT TERM COVER (LESS THAN 21 DAYS)

3.3.1.1. Areas that have been disturbed by grading activities but will lay idle for more than 14 days and less than 21 days or are generating dust or pose an erosion hazard as determined by the Construction Manager or Earthwork QC Manager, shall have the following work performed.

I. The surface shall be tracked using a dozer with cleat marks parallel to the contour.

II. Temporary surface water diversions as needed in place prior to mulching.

3.3.2. Hydromulch materials shall be spread uniformly over all areas. The mulch shall be applied uniformly over all seeded areas at the rate of 2000 pounds tons per acre.

3.3.3. Use of alternative techniques or other deviations from the standards and instructions provided herein must be approved by the Earthwork QC Manager prior to implementation. The Earthwork QC Manager will partially base his assessment on the purity of the constituents proposed, as well as the potential for interference of the proposed alternate techniques with other elements of the project and the overall design intent.

END OF SECTION 02936

Quality Control Plan

Perimeter Containment
North Wall – Segment 8
Sta. C401+30 to Sta. C408+42.30
Kingston Fossil Plant
Harriman, Roane County,
Tennessee

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Quality Control Plan

Perimeter Containment
North Wall – Segment 8
Sta. C401+30 to Sta. C408+42.30
Kingston Fossil Plant
Harriman, Roane County, Tennessee

Stantec Consulting Services, Inc.
October 21, 2011

This document is the Quality Control Plan (QCP) for construction operations on the Perimeter Containment for Segment 8, which is defined as the perimeter segment from Station C401+30 to C408+42.30. The Quality Control Plan is divided into three parts, included as attachments to this cover page. Each attachment covers the Quality Control (QC) procedures to be followed by the entity responsible for a different portion of the overall quality control program. Definitions of these entities can be found in the project Special Conditions within the Technical Specifications.

- Attachment 1 provides the quality control procedures for the QC Manager for Earthwork activities. This document was prepared by the Engineer of Record (Stantec).

- Attachment 2 provides the quality control procedures for the QC Manager for Perimeter Wall Stabilization activities. This document was prepared by the Engineer of Record (Stantec).

- Attachment 3 provides the quality control procedures for the QC Representative for Perimeter Wall Stabilization activities. This document was prepared by the Perimeter Wall Stabilization Contractor (Geo-Con) and reviewed by the Engineer of Record (Stantec).

Attachment 1

Quality Control Plan for Earthwork Construction

Quality Control Plan for
Earthwork Construction

Perimeter Containment – North Wall
Segment 8 - Sta. C401+30 to Sta. C408+42.30
Kingston Fossil Plant
Harriman, Roane County, Tennessee

1. Purpose and Scope

This document is a site specific Quality Control (QC) Plan for the earthwork components for this project. This plan addresses construction and monitoring in association with the Perimeter Stabilization of the North Wall, Segment 8 C401+00 to Sta. C408+50. The QC Plan is intended to present minimum project requirements and shall serve as an outline for use in developing site specific protocols based on conditions encountered during the work.

2. Responsibility and Authority

A summary of QC personnel and associated responsibilities is presented below and on the attached Organization Chart for Quality Management.

2.1. Regulatory Agency

Work conducted under this project shall be coordinated with the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC). Designated EPA and TDEC personnel shall serve as the regulatory contact. TVA will provide direct interface with EPA and TDEC personnel.

2.2. Quality Control Manager and Team

A professional engineer licensed in the state of Tennessee shall be designated as the QC Manager and shall be responsible for overall management of construction monitoring, testing and related documentation as outlined herein. The QC Manager shall be the Engineer of Record for project construction. The QC Manager shall determine appropriate test standards and methods for designated field observations and/or laboratory testing and shall be responsible for review of QC data to assess conformance with project requirements.

The QC Team shall consist of qualified personnel working under the direct supervision of the QC Manager. The QC Team shall be familiar with the materials used and the functional intent of the respective QC Plan components.

2.3. Owner

The plant and its ancillary functions are owned by TVA (Owner). The Owner shall be responsible for overall management of construction activities to include, but not be limited to, contracting, administration and retaining the services of qualified consultants as required during the project. The Technical Contract Manager (see Section 2.5) is the Owner's representative.

The Owner and/or their Designee shall appoint one representative to serve as the Construction Manager. The Construction Manager shall be responsible for the overall planning, coordination, and control of project construction. This includes, but is not limited to, the character and sequence of work, coordination, scheduling, and management of cost, time and contract administration as related to the execution of the project. The Owner shall be responsible for providing qualified professionals to establish and enforce safety protocols related to the project.

2.4. Contractor

The CONTRACTOR will be the entity with which the Owner has entered into an agreement to construct earthwork aspects of this project. The CONTRACTOR shall designate a Site Superintendent responsible for construction activity and communication with the QC Manager and Construction Manager. Any portion(s) of the work designated to others shall be conducted under the direct supervision of the CONTRACTOR.

2.5. Technical Contract Manager

The Technical Contract Manager (TCM) is the designated TVA representative responsible for the administration and oversight of the work, including but not limited to the duties outlined herein.

3. Quality Control Activities

3.1. Meetings

Meetings shall be coordinated and conducted by the Technical Contract Manager and attended by the QC Manager and/or the Construction Manager on a weekly basis. The primary purpose of these meetings shall be to confirm that all parties involved are familiar with the project, required procedures and associated QC objectives along with any safety issues related to construction. Specific safety issues shall be the responsibility of designated safety professionals. Minutes of each meeting shall be documented for inclusion with the project records.

Pre-construction meetings shall be held prior to initiating individual phases of construction. The QC Manager, Construction Manager, Site Superintendent, and other parties that will actively participate in the construction activities shall attend these meetings.

3.2. Alternative Methods

Consistent with the overall objectives of the project, alternative construction and QC methods may be used during the course of the work. Proposed modifications shall be developed by the QC Manager and submitted to the Owner for review prior to incorporation into the project. Documentation of these alternative methods shall be prepared with copies retained for inclusion with the project records.

3.3. Contractor Submittals

CONTRACTOR submittals shall be submitted to TVA procurement and distributed to the TCM, QC Manager and Construction Manager. These submittals shall be reviewed and approved by the QC Manager prior to delivery and/or use of the respective construction materials. Copies of all submittals shall be included with the project records.

3.4. Conformance Testing

Conformance testing consists of periodic testing of materials and/or constructed products. Conformance testing shall be conducted by the QC Team as required by this plan and additional testing may be added at the discretion of the QC Manager. Results of conformance testing shall be reviewed by the QC Manager to assess conformance with project requirements. Copies of all conformance testing results shall be included with the project records.

3.5. Field Observations

The QC Team shall observe and document (as outlined herein) all construction activities associated with the project. Results shall be reported to the QC Manager and Construction Manager (with the Owner copied) on a daily basis.

4. Embankment Construction

4.1. General

The term subgrade references the ground surface after PWS activities have occurred and immediately prior to Earthen Berm Construction.

Earthen Berm is the perimeter containment dike constructed of compacted soils.

Embankment Platform is a layer of Tennessee Department of Transportation (TDOT) No. 10 screening product material and TDOT No. 57 aggregate placed to provide structural support for Earthen Berm construction.

4.2. Subgrade QC Requirements

Prior to placement of any embankment the QC Manager or qualified representative shall verify the following:

The exposed surface was inspected to:

a. Evaluate the suitability of the subgrade;

b. Confirm that the subgrade surface is properly compacted, smooth, and uniform;

c. Observe proof roll of subgrade using heavy equipment with a minimum gross weight of 100,000 pounds and providing a minimum ground contact pressure of 35 pounds per square inch prior to placement of overlying materials. This proofroll shall not be performed within perimeter stabilization areas until design strength has been met. QC personnel shall provide written approval of proof roll operations. Significant pumping or rutting observed during proof rolls shall be corrected as directed by the QC Manager until satisfactory proof roll results are attained.

d. Confirm that elevations are consistent with the approved construction plan.

4.3. Embankment Platform QC Requirements

1. Material Requirements:

a. Prior to delivery, supplier certifications shall be submitted to the QC Manager indicating that all materials meet, or exceed, the minimum established properties. Certifications shall be accompanied by supporting QC testing.

b. Conformance testing shall consist of one gradation at every 5,000 tons of each material at the final stockpile location prior to incorporation into the work or as directed by the QC Manager.

c. Construction monitoring and field acceptance of No. 10 screening product and TDOT No. 57 coarse aggregate placement shall be documented by the QC Team.

d. The following protocols will be adhered to regarding conformance testing:

i. A running average of the last 10 conformance tests must have a result of 12.0% or less on average passing the No. 200 sieve for the No. 10 screening product.

ii. In the event that conformance testing for the No. 10 screening product does not meet the criteria designated above, subject in-place material shall be removed as practicable and replaced with a minimum of 6 inches of No. 10 screening product. Required removal of the rejected material shall not result in disturbance of the underlying subgrade.

iii. If the average of the last 10 conformance tests for the No. 10 screening product is not in compliance with (ii) above, the working panel(s) that contains the conformance test that has exceeded 12.0% passing the No. 200 sieve by the greatest margins shall be removed

and replaced until the revised running average is in compliance with (i) above. This may result in more than one panel requiring removal and replacement.

iv. TDOT No. 57 coarse aggregate shall meet the gradations specified and fall within the ranges noted in Table 1 of Section 903.22 of the TDOT Standard Specifications for Road and Bridge Construction. This material shall be tested at the last stockpile prior to incorporation.

2. Inspect fill placement and compaction operations to:

   a. Evaluate the suitability of the compacted material,
   b. Document that No. 10 screening product fill is placed in uniform 6-inch lifts,
   c. Document that No. 57 aggregate is placed to a minimum thickness of 3-inches, not exceeding 6-inches.
   d. Verify that fill is compacted by 3 passes of a smooth drum roller,
   e. Confirm that each lift is properly bonded to the adjacent lift by blading and scarification techniques, and
   f. Verify that elevations and grades are consistent with the approved construction plan.

3. Confirm that conformance testing of the Embankment Platform material is performed in accordance with the Testing Schedule.

4.4. Earthen Berm QC Requirements

Earthen Berm QC requirements include construction monitoring by the QC Team, laboratory conformance testing as well as review, approval and generation of appropriate QC documentation by the QC Manager.

Embankment specifications are provided in Section 02300 of the Technical Specifications. Prior to and during placement of any Earthen Berm material the QC Manager or a qualified QC Team representative shall:

1. Coordinate sampling of borrow soils proposed for use as Earthen Berm with the CONTRACTOR and TVA and related conformance documentation.
2. Inspect fill placement and compaction operations to:
   a. Evaluate the suitability of the Earthen Berm material,
   b. Document that fill is placed in uniform 8-inch lifts,
   c. Verify that fill is compacted to a minimum 95% of the standard Proctor density at a moisture content ±2% of optimum,
   d. Verify that compaction around pipes and structures is performed in 4-inch lifts using hand operated tamping devices when within 2 feet horizontally or vertically of the pipe or structure,

e. Confirm that each lift is properly bonded to the adjacent lift by blading and scarification techniques,

f. Verify that elevations are consistent with the approved construction plan, and

g. Confirm that the finished surface of the Earthen Berm has been prepared for revegetation efforts.

3. Confirm that conformance testing of the Earthen Berm material is performed in accordance with the Testing Schedule.

4.5. Ash Backfill QC Requirement

4.5.1. Inside the Inboard Perimeter Wall

The sequence of backfilling shall commence at the lowest section (in elevation) of the subject footprint and proceed upward in maximum 12-inch loose lifts in a manner to maintain positive drainage as practicable. Each embankment lift shall be compacted with a appropriate tamper or rubber tired equipment as approved by the QC Manager for the subject material. Materials shall be compacted to a minimum of 90 percent of standard Proctor maximum dry density at a moisture content within minus four percent and plus six percent of optimum. The QC Manager may make adjustments to this moisture range based on field observations, constructability issues and testing.

Ash Backfill specifications are provided in Section 02150 of the Technical Specifications. Prior to and during placement of Ash Backfill material, the QC Manager or a qualified QC Team Representative shall:

1. Inspect fill placement and compaction operations to:

   a. Document that fill is placed in 12-inch maximum lifts.

   b. Verify that fill is compacted in accordance with ash stacking.

2. Confirm that conformance test of the Ash Backfill material is performed in accordance with the testing schedule.

4.5.2. Outside of Inboard Perimeter Wall

Maximum 12-inch compacted lifts shall be compacted by a minimum of three passes of heavy equipment of sufficient weight to create a bearing surface for subsequent construction.

Ash Backfill Specifications are provided in Section 02300 of the Technical Specifications. During placement of Ash Backfill material, the QC Manager or a qualified QC Team Representative shall:

1. Inspect fill placement and compaction operations to:

   a. Document compacted lift thickness does not exceed 12-inches.

   b. Verify that a minimum of three passes with heavy equipment has been performed or the embankment has passed a proof-roll.

4.6. Embankment QC Requirements

Submittal and conformance testing frequencies for the respective materials are presented on the attached Material Testing and Product Certification Schedule. Representative sampling and testing shall be performed sufficiently ahead of the borrow operations to identify any significant change in material prior to placement and compaction. Conformance density testing of all embankment, including Embankment Platform materials and Ash Backfill, shall consist of either standard Proctor testing or the determination of minimum/maximum densities depending on the nature of the material.

5. Rock Berm Construction

5.1. General

The term Rock Berm references the armored surface between the Earthen Berm and Watts Bar Lake. The Rock Berm construction extends below normal pool of the lake and is accomplished by excavation and embankment. Embankment consists of Class B Machined Riprap and TDOT No. 2 aggregate placed on the shaped surface. The Rock Berm construction shall meet the lines and grades shown in the Drawings.

5.2. Excavation

Existing surfaces shall be excavated to the lines and grades shown in the Drawings. The CONTRACTOR shall establish grade stakes for use in excavation and embankment activities.

5.3. Rock

1. Material requirements for TDOT Class B Machined Riprap are outlined in Section 8 of the QC Plan.

   TDOT No. 57 and No. 2 coarse aggregate shall meet the gradations specified and fall within the ranges noted in Table 1 of Section 903.22 of the TDOT Standard Specifications for Road and Bridge Construction. This material shall be tested at the last stockpile prior to incorporation.

2. Inspect fill placement and compaction operations to:

   a. Evaluate the suitability of the compacted material,

   b. Document that rock fill of riprap and aggregate is carefully placed to not disturb underlying material,

   c. Verify that rock placement results in uniform fill with large spaces filled with smaller rock as described in Section 02350 of the Specifications,

   d. Verify that elevations and grades are consistent with the approved construction plan.

3. Confirm that conformance testing of the Rock Berm material is performed in accordance with the Testing Schedule.

6. Erosion Control

Erosion Control shall conform to the site wide Storm Water Management Plan (SWMP). Erosion and sediment control measures shall be provided as field conditions dictate and approved by the Construction Manager, or as directed by the appropriate Regulatory Agency.

The Construction Manager shall periodically monitor these structures as well as overall site drainage conditions. Appropriate adjustments to site drainage and related sediment control structures shall be made as necessary based on current site conditions during the project.

7. As-built Documentation

7.1. General

The CONTRACTOR will grade stake the existing configuration and provide cut/fill stakes on an appropriate interval as needed for construction. The location (northing and easting) and elevation of the existing surface shall be recorded and provided to the QC Manager. Other surveys shall include:

- Monthly progress survey of embankment;
- As-needed to provide support to QC activities;
- Top of Perimeter Wall Stabilization, subgrade, top of Embankment Platform and Earthen Berm final grade;
- Location of ditches, limits of flowable fill and drainage structures; and
- Cross sections on 100-foot centers along project baseline of each work item noted above with maximum survey point incremental distance of 50 feet.

7.2. Quality Control Requirements

1. All survey activities shall be performed under the direction of a Tennessee licensed Land Surveyor or Professional Engineer.
2. Survey data shall be provided to the QC Manager within 10 days of survey completion in survey point files with a description for each of the points. Survey shots shall be performed along cross sections and along breaks in slopes.
3. The QC Manager will develop as-built Drawings from the provided data.

8. TDOT Class A-3 and Class B Machined Riprap

Riprap utilized for rock check dams (Class A-3) as needed, shall conform to the requirements in Section 709.03 of the TDOT “Standard Specifications for Road and Bridge Construction.” Riprap used as buttress stone shall consist of quarry stone meeting the requirements for TDOT Class B Machined Riprap as stated in Section 709 of the Tennessee Department of Transportation “Standard Specifications for Road and Bridge Construction” latest edition.

9. Instrumentation

9.1. General

Instrumentation has been installed in the North Dredge Cell to monitor the embankment slopes and the underlying foundation materials. This instrumentation shall be removed by the CONTRACTOR within the footprint for the perimeter wall stabilization and shall be protected elsewhere. Instrumentation for geotechnical monitoring shall be removed, protected, or extended according to the attached Plan and Detail Sheets. The instrumentation program for the "North and Central Dredge Cells (Cells 2 and 3) Ash Stacking" prescribed the use of the instrumentation and the specific monitoring of these devices. Protective barriers shall be installed by the CONTRACTOR around the instrumentation outside of the perimeter wall stabilization footprint. Instrumentation designated for protection that is damaged or destroyed by the CONTRACTOR shall be replaced by the CONTRACTOR as noted in Section 02150 of the Specifications. Extensions and maintenance of instrumentation are the responsibility of the QC Team.

9.2. Types

1. Piezometers have been installed and are monitored to characterize the increase and dissipation of pore pressures within the existing ash and native foundation soils-layers due to embankment loading.
2. Slope inclinometers are used to measure lateral displacements within the embankment and foundation materials due to loading. The inclinometers are anchored a minimum of 10 feet into bedrock.
3. Settlement plates are utilized to measure the vertical deformation of the foundation soils due to embankment loading.

If any instruments designated for protection are damaged during construction by the CONTRACTOR's activities, they shall be repaired/replaced as directed by the QC Manager at no additional cost to the Owner.

10. Project Documentation

Documentation shall be collected and maintained by the QC Manager (copied to the Owner) during the project. This documentation shall include but not be limited to the following:

- Daily construction field reports;
- Observation reports;
- CONTRACTOR submittals;
- Material conformance data;
- Photographic documentation (per Kingston photo data base Standard Operating Procedure);
- Survey data;
- As-Built Drawings;

- Construction issue and solution reports;
- Weekly summary reports (for regulatory submittal);
- Plan modifications; and
- Meeting minutes.

Perimeter Containment - North Wall
Segment 8 - Sta. C401+30 to Sta C408+42.30
Kingston Fossil Plant
Harriman, Roane County, Tennessee

Quality Control Plan - Material Testing and Product Certification Schedule

Material	Property	Test Method	Value	Minimum Conformance Test Frequency
Earth Berm				
Earth Berm	Nuclear Density and Moisture	ASTM	Minimum 95% standard Proctor and -2% to +2% optimum moisture	5 tests / acre / lift
	Classification and Proctor	ASTM	Varies to be approved by QC Manager	1 / 10,000 CY
Embankment Platform				
No. 10 Screenings Product	3 Passes by Roller	Visual	Visually Firm	Daily
	Gradation	ASTM	Less than 12% passing No. 200 sieve	1 / 5,000 tons stockpiled
No. 57 Coarse Aggregate	3 Passes by Roller	Visual	Visually Firm	Daily
	Gradation	ASTM	TDOT Ranges	1 / 30,000 tons stockpiled

Material	Property	Test Method	Value	Minimum Conformance Test Frequency
Ash Backfill	Nuclear Density	ASTM	Minimum 90% Compaction -4% to +6% Optimum Moisture Content	5 tests / acre / lift 1 / 50,000 CY
	Class and Proctor	ASTM	Varies, to be approved by QC Manager	1 / 50,000 CY
Class A-3 & B Machined Riprap	QC Manager Certification Statement		Project Requirements	1 / manufacturer / year
Instrumentation **Extensions**	TVA Protocols		Manufacturer's Recommendations	
QA/QC Documentation	Project Requirements		Project Requirements	On-going
TDOT No. 57 and No. 2 Coarse Aggregate	Gradation	ASTM	Project Requirements	1/30,000 tons

Perimeter Containment - North Wall
Segment 8 - Sta. C401+30 to Sta. C408+42.30
Kingston Fossil Plant
Harriman, Roane County, Tennessee

Quality Control Task Summary[(1)] - Earthwork

A. General Site and Construction Tasks

Task	Responsible Personnel[(4)]	Task Description/Itemization
QC Testing	QC Manager	-Designate appropriate test standards and methods to maintain quality standards outlined in the project requirements -Review all QC data for conformance with project standards and requirements -Collection and maintenance of all QC documentation -Generation of all QC related reports
Project Meetings	QC Manager / Construction Manager	-Organize meetings as necessary to ensure construction related personnel are familiar with design, construction procedures, and QA/QC requirements.
Contractor Submittals	QC Manager (QC Team)	-Approval of contractor submittals a minimum of 10 days before materials arrive on site -Verify materials utilized in site construction meet or exceed project requirements
Scheduling	Construction Manager	-Develop and maintain construction schedule and verify construction progress
Site Inspections	Construction Manager	-Site observations for indications of trench or slope failure and/or instability
Surveying	Construction Manager	-Schedule surveying
As-built	QC Manager	-As-built Drawings
Site Construction Issues	TCM	-Approval of Contractor requests for access locations and stockpiles

B. Embankment

Task	Responsible Personnel	Task Description/Itemization
Earthen Berm, Embankment Platform, and Ash Backfill Placement and Compaction	QC Manager	-Verify and document fill placement and compaction per project requirements -Verify fill meets or exceeds project requirements -Confirm proper lift thickness -Verify proper lift surface preparation and scarification techniques -Establish and record elevations
Submittals		-Certification Statement -Collection, organization and maintenance of delivery tickets and all available documentation that supplied materials meet or exceed project requirements -Verification of minimum conformance tests
Density Meter Calibration	QC Manager	-Random Drive Tube Sampling, Density and Moisture Testing

C. TDOT Class A-3 and B Machined Riprap and Coarse Aggregates

Task	Responsible Personnel	Task Description/Itemization
Submittals	QC Manager	-Approval of documentation regarding conformance to Technical Specifications of proposed riprap and coarse aggregate supplier a minimum of 10 days prior to material arrival on site
Conformance Testing	QC Manager	-Verify minimum conformance testing per current QC Plan

D. Instrumentation

Task	Responsible Personnel	Task Description/Itemization
Extensions	QC Manager	-Extend existing instrumentation and arrange for any new instrumentation.
Protection	Construction Manager/ Contractor	-Arrange and coordinate installation of t-posts and safety fence around instrumentation. Protect existing instrumentation.
Removal	TVA	-Arrange removal of Instrumentation within Deep Mixing Footprint

E. Erosion and Sediment Control

Task	Responsible Personnel	Task Description/Itemization
Site Inspections and Evaluations	Construction Manager	-Periodic erosion and sediment control structure inspections and overall site drainage evaluations -Adjustments to site drainage and structures as necessary, based upon prevalent site conditions -Documentation of sediment control observations and modifications

F. QA/QC Documentation

Task	Responsible Personnel	Task Description/Itemization
Documentation	QC Manager AND Construction Manager	-Overall organization and maintenance of QA/QC documentation of items outlined above as well as those designated in the QA/QC Plan
Protection	Contractor	-Document any damage and concur with QC Manager.

Notes:

[1)] The task summary is an itemized list of the general responsibilities to be administrated by the Construction Manger and the QC Manger/QC Team per the current Quality Control Plan and the associated testing schedule.

[2)] All materials testing and site observations are to be conducted in accordance with the current Quality Control Plan and the associated testing schedule to assure that minimum project requirements are maintained on the site during the construction of the special waste disposal facility. Frequency stated when applicable. Many manager or team tasks, such as subgrade inspection, have no quantifiable testing frequency but are required during work progress.

[3)] TDOT- "Tennessee Department of Transportation"

[4)] Responsible Personnel Definitions:

Construction Manager - A TVA employee or consultant designated to be the Owner representative on the construction site. Responsibilities involve overall management of site operations including construction administration tasks, waste disposal, contracting and retaining the services of all necessary personnel (including a qualified engineer) for the life of the facility. The Construction Manager is also a liaison for the Owner to the QC Manager and Contractors.

QC Manager - Registered Professional Engineer in the State of Tennessee that becomes the Engineer of Record for construction. Responsibilities generally include the management of the QC Team as well as determining conformance of submittals and test results with project requirements, review of data, construction monitoring and/or testing, and construction document preparation.

QC Team - Personnel qualified in construction quality assurance/quality control (QA/QC) testing procedures pertinent to the Kingston Fossil Plant facility working under the direct supervision of the QC Manager.

TCM - Designated TVA representative responsible for the administration and oversight of the Work, including but not limited to the duties outlined in the QC Plan and other project documents.

Attachment 2

Quality Control Plan for Perimeter Wall Stabilization QC Manager

Quality Control Plan for
Perimeter Wall Stabilization QC Manager

Perimeter Containment – North Wall
Segment 8 Sta. C401+30 to Sta. C408+42.30
Kingston Fossil Plant
Harriman, Roane County, Tennessee

1. Purpose and Scope

This document is a site specific Quality Control (QC) Plan for Perimeter Wall Stabilization (PWS), which will involve the construction of a grid of soil-cement (cement-bentonite) walls. This QC Plan addresses activities and procedures to be followed by the QC Manager for Perimeter Wall Stabilization for the North Wall, Segment 8, Sta. C401+30 to C408+42.30. The QC Plan is intended to present minimum project requirements and shall serve as an outline for use in developing site specific protocols based on conditions encountered during the work. Project requirements are addressed in Section 02650 of the Technical Specifications and in the Drawings.

2. Responsibility and Authority

A summary of QC personnel and associated responsibilities is presented below.

2.1. Regulatory Agency

Work conducted under this project shall be coordinated with the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC). Designated EPA and TDEC personnel shall serve as the regulatory contact. TVA will provide direct interface with EPA and TDEC personnel.

2.2. Owner

The plant and its ancillary functions are owned by TVA (Owner). The Owner shall be responsible for overall management of construction activities to include, but not be limited to, contracting, administration and retaining the services of qualified consultants as required during the project. The Technical Contract Manager (see Section 2.3) is the Owner's representative.

The Owner and/or their Designee shall appoint one representative to serve as the Construction Manager. The Construction Manager shall be responsible for the overall planning, coordination, and control of project construction. This includes, but is not limited to, the character and sequence of work, coordination, scheduling, and management of cost, time and contract administration as related to the execution of the project.

The Owner shall be responsible for providing qualified professionals to establish and enforce safety protocols related to the project.

2.3. Technical Contract Manager

The Technical Contract Manager (TCM) is the designated TVA representative responsible for the administration and oversight of the work, including but not limited to the duties outlined herein.

2.4. Perimeter Wall Stabilization Contractor

The Perimeter Wall Stabilization Contractor will be the entity with which the Owner has entered into an agreement to construct subsurface soil-cement walls. The Perimeter Wall Stabilization Contractor shall designate a Site Superintendent responsible for construction activity and communication with the QC Manager and Construction Manager. Any portion(s) of the work designated to others shall be conducted under the direct supervision of the Perimeter Wall Stabilization Contractor.

2.5. Quality Control Manager

A professional engineer licensed in the state of Tennessee shall be designated as the QC Manager for Perimeter Wall Stabilization and shall be responsible for overall management of construction monitoring and related documentation as outlined herein. The QC Manager shall be the Engineer of Record for project construction. The QC Manager shall determine appropriate test standards and methods for designated field observations and/or laboratory testing and shall be responsible for review of QC data to assess conformance with project requirements.

The QC Manager may be assisted at times by qualified personnel working under the direct supervision of the QC Manager. These personnel shall be familiar with the materials used and the functional intent of the respective QC Plan components.

2.6. Quality Control Representative and Team

The PWS Contractor shall develop and implement a Quality Control Plan for defined testing and reporting activities (see Attachment 3). That plan addresses activities and procedures to be followed by the QC Representative and Team for PWS Construction.

The PWS Contractor shall designate a Quality Control Representative, who will be responsible for collecting and reporting QC data to the QC Manager. The Contractor's QC Team shall consist of qualified personnel working under the direct supervision of the QC Representative. The QC Representative and Team shall be familiar with the materials used and the functional intent of the respective QC Plan components.

2.7. Coring Contractor

An independent contractor shall be selected by the Owner to obtain core samples from the completed soil-cement walls. All coring work shall comply with the requirements of the Technical Specifications (Section 02650, Paragraphs 3.4.2 and 4.8.2) and related ASTM standards.

Coring operations and recovered core shall be observed by the QC Manager, or qualified personnel working under the direct supervision of the QC Manager. Recovered core shall be logged, photographed, preserved, transported, and otherwise handled by the Coring Contractor.

2.8. Testing Laboratories

An independent, qualified testing laboratory shall be selected by the Owner for curing and testing soil-cement samples (wet grab or core) for strength. Testing requirements are defined in the Technical Specifications (Section 02650, Paragraph 4.8). The PWS Contractor may designate a different laboratory to conduct other testing required by the Contractor's QC Program.

All testing shall conform to applicable ASTM or other standardized testing procedures, except where superseded by the requirements of the Technical Specifications. All laboratory test results shall be reported to the QC Manager for evaluation.

3. Quality Control Activities

3.1. Meetings

Meetings shall be coordinated and conducted by the Technical Contract Manager and attended by the QC Manager, QC Representative, Site Superintendent, and/or the Construction Manager on a weekly basis. The primary purpose of these meetings shall be to confirm that all parties involved are familiar with the project, required procedures, associated QC objectives, and any safety issues related to construction. Specific safety issues shall be the responsibility of designated safety professionals. Minutes of each meeting shall be documented for inclusion with the project records.

Pre-construction meetings shall be held prior to initiating individual phases of construction. The QC Manager, Construction Manager, Site Superintendent, and other parties that will actively participate in the construction activities shall attend these meetings.

3.2. Alternative Methods

Consistent with the overall objectives of the project, alternative construction and QC methods may be used during the course of the work. Proposed modifications shall be developed by the QC Manager and submitted to the Owner for review prior to incorporation into the project. Documentation of these alternative methods shall be prepared with copies retained for inclusion with the project records.

3.3. Contractor Submittals

Perimeter Wall Stabilization Contractor submittals (per Section 02650, Paragraph 1.5, of the Specifications) shall be submitted to the TCM and distributed to the QC Manager and Construction Manager. These submittals shall be reviewed and approved by the QC Manager prior to delivery and/or use of the respective construction materials. Copies of all submittals shall be included with the project records.

3.4. Conformance Testing

Conformance testing consists of periodic testing of materials and/or constructed products. Conformance testing shall be conducted by the QC Team and an independent testing laboratory (to be selected by TVA) as required by this plan. Additional testing may be added at the discretion of the QC Manager. Results of conformance testing shall be reviewed by the QC Manager to assess conformance with project requirements. Copies of all conformance testing results shall be included with the project records.

4. Confirmation of Panel Alignment

4.1. Horizontal Alignment

The plan location of each constructed soil-cement panel shall be in accordance with the approved Shop Drawings (see Section 02650, Paragraph 1.5.10, of the Specifications). Locations in the field shall be marked or staked by TVA Surveyors, in accordance with the Specifications. Prior to excavation, the Perimeter Wall Stabilization Contractor shall measure offsets and set temporary pins or markers as needed to establish the horizontal locations and extents of individual panels.

At the start of excavation for each panel, the QC Manager shall visually observe the initial, surficial excavation to confirm the following:

1. The excavation follows the alignment between the field stakes or pins.

2. The centerline of the excavation does not deviate from the marked alignment by more than the allowable horizontal tolerance established in the Specifications (Section 02650, Paragraph 4.4.2).

4.2. Vertical Alignment

The Perimeter Wall Stabilization Contractor shall measure the verticality of the excavation machinery, to demonstrate compliance with the allowable tolerances for deviation from plumb per Section 02650, Paragraph 4.4.3, of the Specifications. Measurements shall be recorded during construction of each panel and reported daily to the QC Manager.

5. Depth Soundings

During construction of each soil-cement panel, the Perimeter Wall Stabilization Contractor shall take soundings to confirm the required embedment within rock, per the requirements in the Specifications (Section 02650, Paragraph 2.3.4) and the Drawings.

The QC Manager shall directly observe these measurements and approve the final excavated depth, specifically including conformance with the requirements for rock embedment, prior to the Contractor departing from the location of the excavated panel.

5.1. Top of Rock

The top of rock for each soil-cement panel shall be determined by the QC Manager per Section 02650, Paragraph 4.3.10, of the Specifications.

1. The rockline interpolated from the site borings, as shown on the Drawings, may be used as guidance for the expected elevation of rock at various locations on the site.

2. During excavation of each Soil-Cement Panel, the Perimeter Wall Stabilization Contractor shall notify the QC Manager when bedrock has been encountered.

3. The QC Manager will physically examine the excavated material to confirm that pieces of intact bedrock have been excavated; material that appears to represent loose rock or boulders above the top of bedrock will be ignored.

4. After excavated bedrock has been confirmed, the Perimeter Wall Stabilization Contractor shall take no less than three depth measurements, in the area designated by the QC Manager, to determine the apparent location of the deepest excavation.

5. The depth to the top of rock shall be measured to within the tolerance established in Specifications (Section 02650, Paragraph 4.4.4).

6. The elevation of the deepest point where rock was retrieved in the excavation shall be designated as the top of rock for that soil-cement panel.

The determination of excavated rock and the top of rock elevation, based on observations and measurements during construction, shall be made by the Perimeter Wall Stabilization QC Manager.

5.2. Rock Embedment

The required depth of rock embedment shall be confirmed by the QC Manager during the construction of each soil-cement panel, in accordance with the Specifications (Section 02650). The depth of rock embedment shall be measured with respect to the top of rock for each soil-cement panel, to within the tolerance established in the Specifications (Section 02650, Paragraph 4.4.5).

Soundings of the excavated trench shall be made by the Perimeter Wall Stabilization Contractor. The required frequency of the soundings, including the maximum allowable horizontal spacing, is defined in the Specifications (Section 02650, Paragraph 4.4.6). The QC Manager may require additional depth measurements at any location or any spacing in any soil-cement panel.

6. Designation of Test Parcels

The Perimeter Wall Stabilization QC Manager shall select and designate Test Parcels for the purposes of evaluating the uniformity and strength requirements of the completed walls. The size and frequency of the test parcels shall be as required in Section 02650 Paragraph 2.2.4 of the Specifications.

Test Parcels are continuous sections of soil-cement wall, which may include portions of shear and perimeter walls. A Test Parcel may be located wholly within one perimeter wall or shear wall, or portions of either. For example, a designated Test Parcel may include contiguous portions of a shear wall, inboard perimeter wall, and the adjacent shear wall. Test Parcels represent a fraction of the completed soil-cement walls in a specific area of the perimeter.

Test Parcels shall be selected and defined by the QC Manager prior to construction of the walls in the Test Parcel. This is required to facilitate the collection of wet grab samples from the slurry-filled trenches within the Test Parcel. At the discretion of the QC Manager, the selection of Test Parcels may be random or may be focused in areas of apparent construction problems.

Where defective sections of wall are identified, additional Test Parcels may be defined in the adjacent areas by the QC Manager. Supplemental coring may be undertaken in these Test Parcels to further define the limits of acceptable or unacceptable product.

7. Selection of Sampling Locations

7.1. General

Samples of the soil-cement walls (wet grab samples and/or core samples) and core holes shall be obtained to assess conformance to the Specification requirements for strength and uniformity.

The locations of all sampling and core holes shall be selected by the Perimeter Wall Stabilization QC Manager, with the goal of obtaining an unbiased, representative indication of the constructed wall quality. To the extent practical, sampling locations and core holes should be randomly and evenly distributed within the length and full depth of each designated Test Parcel.

7.2. Location of Wet Grab Samples

The minimum number of molded wet grab samples required for strength testing is defined in Section 02650, Paragraphs 2.2.4 and 4.8.1, of the Specifications.

The QC Manager shall select the locations within the trench for acquiring wet grab samples. The minimum number of horizontal locations and the minimum vertical spacing between sample depths are defined in the Specifications (Section 02650, Paragraph 2.2.4). Wet grab samples will not be collected from the top 5 feet of any wall.

7.3. Location of Core Holes

The minimum number of core holes required for evaluating uniformity is defined in Section 02650, Paragraph 2.2.4, of the Specifications.

The Quality Control (QC) Manager shall select the locations of core holes to be advanced into the completed soil-cement walls. In each Test Parcel, at least one coring location shall target a joint between adjacent soil-cement panels. Core holes may be targeted in areas of

uncertain quality, where defects are suspected (Specification Section 02650, Paragraph 2.2.1).

7.4. Selection of Core Samples for Testing

The minimum number of core samples required for strength testing is defined in Section 02650, Paragraphs 2.2.4 and 4.8.2, of the Specifications. Core samples shall be selected for testing by the QC Manager per the following procedures:

1. The QC Manager shall examine the core sample (from each defined core run) extracted from the inner tube of the core barrel prior to the sample being wrapped in plastic to retain moisture.
2. Compressive strength specimens will not be selected from the top 5 feet of any core hole (i.e., core recovered from 0 to 5 feet).
3. The QC Manager shall examine each end of the individual core runs where the core is mechanically broken between runs for additional fracturing. Specimens shall not be selected within 4 inches of any breaks or fractures observed at the end of the core runs.
4. Specimens shall not be selected from areas including or immediately adjacent to locations where debris has been caught in the core lifters and created grooves around the circumference or other deformations in the exterior of the core sample.
5. Selected specimens shall be void of visible particles of unmixed soil, unmixed ash, or rock fragments having any dimension greater than 1/6 of the core diameter (particles larger than 0.5 inch in a 3-inch core, or larger than 0.67 inch in a 4-inch core), or any wood or other debris.
6. Selected specimens shall be void of visible fractures.
7. To the extent possible, selected specimens should be distributed evenly among the different cored holes and over the full depth of the Test Parcel.
8. All specimens are to be a minimum of 7 inches in length prior to trimming at the testing laboratory. To the extent possible, the QC Manager will select specimens that are at least 12 inches in length in order to provide flexibility to laboratory personnel during the trimming process.

8. Testing Soil-Cement Samples for Strength

8.1. Testing Wet Grab Samples

The preparation, curing, and handling of molded wet grab samples for unconfined compressive strength testing shall conform to the requirements of Section 02650, Paragraph 4.8.1, of the Specifications.

Wet grab samples collected from the slurry trench shall be molded into test specimens by the Perimeter Wall Stabilization QC Representative or QC Team. The wet grab samples shall be screened to remove unmixed particles, fragments, or debris larger than the specified size, and then molded into test specimens. Prior to transportation to the testing laboratory, the

molded specimens shall be stored on site and maintained under the specified curing conditions.

Molded specimens shall be tested for unconfined compressive strength (UCS) by the Testing Laboratory. Following testing, each failed specimen shall be sketched on the testing data sheet, to provide a record of the developed failure surfaces. Except for samples tested before 28 days of curing, all specimens with a UCS result less than 140 psi shall be documented by photograph and detailed description. All data collected by the Testing Laboratory shall be forwarded to the TCM and QC Manager for evaluation.

8.2. Taking Core Samples

This section establishes recommended field practices to be followed by the Coring Contractor when obtaining and handling core samples from cured soil-cement walls.

1. If core samples will be tested for strength, special care is required to minimize the potential for damage to the core samples. This may necessitate a slower rate of core barrel penetration, or other adjustments to the drilling tools or methods
2. When removed from the core barrel or core boxes, special care is required to avoid inducing flexural stresses in the core samples. The core shall be supported at all times along its entire length to prevent bending while being handled. For longer sections of intact core, a rigid, split tube may be used to support the core.
3. Core samples shall be placed in core boxes and protected in accordance with the Specifications (Section 02650, Paragraph 4.8.2). All core sample boxes shall be handled by two individuals when lifting or carrying.

8.3. Testing Core Samples

This section establishes criteria for the Testing Laboratory to select test specimens for unconfined compressive strength (UCS) testing, from the testing intervals defined by the QC Manager.

1. All core sample boxes shall be handled by two individuals when lifting or carrying. One end of each core box shall be removed in order to remove the core samples horizontally from the box without lifting the samples.
2. Laboratory personnel shall visually examine the exterior of the core samples prior to trimming. Areas containing unmixed soil particles or fragments larger than 0.5 inch, or visible fractures or breaks, shall not be selected for testing.
3. The laboratory personnel may select alternate specimen locations within any core run, in the event an inclusion, fracture, or mechanical break is observed in an area previously designated for testing by the QC Manager.
4. Test specimens shall be trimmed to length using a high-speed diamond rock saw, and then capped so that the ends are true and straight. Specimens shall be trimmed to a length consistent with the applicable ASTM Standards.

5. Following testing for unconfined compressive strength, each failed specimen shall be sketched on the testing data sheet, to provide a record of the developed failure surfaces.
6. Following testing for unconfined compressive strength, the failure surface shall be visually inspected and any inclusions (unmixed soil, unmixed ash, rock fragments, or other debris) shall be documented on the testing data sheet, noting the number of inclusions in the size ranges of 0.25 to 0.50 inch, 0.50 to 0.75 inch, 0.75 to 1.0 inch, and greater than 1.0 inch.
7. Specimens with a UCS result less than 100 psi shall be documented by photograph and detailed description.

All data collected by the Testing Laboratory shall be forwarded to the TCM and QC Manager for evaluation.

9. Evaluation of Strength Test Results

The QC Manager shall evaluate the results from the unconfined compressive strength tests on the core or wet grab specimens and determine if the strength of individual test parcels is consistent with the Specifications. The QC Manager will provide a recommendation to the TCM regarding the acceptability of each test parcel.

9.1. Data to be Considered

All available strength data, corresponding to a consistent curing period since construction, will be used in this evaluation, except that strengths measured on molded wet grab and core samples shall be kept separate. Available test results may be removed from the assessment only if there are specific, documented indications that the results are nonrepresentative. Criteria that may be used to exclude test data include, but are not limited to:

- outliers from the body of data for adjacent areas,
- heterogeneities not seen in borehole images,
- unusually low axial strains at failure,
- visual evidence of damage during handling and prior to testing,
- anomalous curing conditions prior to testing, or
- other evidence that suggests disturbance due to coring or handling.

Data from individual, unconfined compressive strength tests on core samples may be rejected if inclusions of unmixed soil larger than 0.5 inches in their greatest dimension (one-sixth of the specimen diameter) are observed on the principal failure surface of the failed test specimen.

The evaluation of measured versus specified unconfined compressive strengths shall be made using the results from no less than the minimum number of test specimens specified in Section 02650, Paragraph 2.2.4, of the Specifications. If fewer than the minimum number of specimens is available, alternate specimens shall be selected and tested.

9.2. Adjusted Strength Calculations

The unconfined compressive strength data shall be evaluated by the QC Manager, for each test parcel, relative to the specification criteria for distribution of strengths as a percentage of the sample population, adjusted for the presence of unmixed or unfixated soil inclusions. The criteria are provided in Section 02650 of the Specifications (Paragraph 2.2.3, and the definitions in Paragraphs 1.4.39 through 1.4.43).

The following example (based on hypothetical data) is provided to clarify how these calculations will be made by the QC Manager:

1. Unconfined compression tests were run on 27 molded wet grab samples, cured between 50 and 56 days, from a particular Test Parcel.

2. The mean UCS of this data set was determined to be **293 psi**.

3. The mean strength of the wet grabs was greater than 280 psi, but less than 340 psi. Hence, the Test Parcel can meet only the first criteria listed in the Specifications under Section 02650, Paragraph 2.2.3. Accordingly, the threshold strength of 185 psi should be considered.

4. Of the 27 tests, one was below the threshold strength of 185 psi. Thus, the fraction exceeding 185 psi was 26 / 27 = **96.3%**.

5. Three core holes were advanced in the Test Parcel to total depths of 53 ft, 48 ft, and 54 ft. Each one was advanced 2 feet into bedrock.

6. For the purposes of computing the Inclusion Adjustment Fraction, the first 5 ft of the core hole and the penetration into rock are ignored (Specifications Section 02650, Paragraph 1.4.39). Then:

   Total length of coring = (53 - 5 - 2) + (48 - 5 - 2) + (54 - 5 - 2) = 134 ft

7. In four 5-ft core runs in the soil cement (each below a depth of 5 ft), the core recovery was less than 90% (core loss greater than 6 inches in each case). The total length of unrecovered core in these four runs was 2.8 ft.

8. Two unmixed or unfixated soil inclusions, each one being more than half the diameter of the core and longer than 6 inches, were discovered in the recovered core. The total length of these two inclusions was 1.9 ft.

9. The Inclusion Adjustment Fraction, as defined in the Specifications (Section 02650, Paragraph 1.4.40), is computed as follows:

   Inclusion Adjustment Fraction = (2.8 ft + 1.9 ft) / 134 ft = **0.035**

10. The Presumed Inclusion Strength is 10 psi, per the Specifications (Section 02650, Paragraph 1.4.41).

11. The Adjusted Mean Strength, as defined in the Specifications (Section 02650, Paragraph 1.4.42), is computed as follows:

    Adjusted Mean Strength = 10 psi (0.035) + 293 psi (1.0 - 0.035) = **283 psi**

12. The Adjusted Exceedance Fraction for UCS greater than 185 psi, as defined in the Specifications (Section 02650, Paragraph 1.4.43), is computed as follows:

    Adjusted Exceedance Fraction = 96.3% * (1.0 - 0.035) = **92.9%**

The Adjusted Mean Strength and Adjusted Exceedance Fraction of the wet grab samples exceeds the limits provided in Section 02650, Paragraph 2.2.3, of the Specifications. Hence, the strength of this particular Test Parcel would be found to meet the specification requirements.

10. Test Parcel Failure

The QC Manager will not recommend acceptance of a test parcel where:

- the distribution of unconfined compressive strength, adjusted for the presence of unmixed or unfixated inclusions, is below the ranges specified in Section 02650, Paragraph 2.2.3, of the Specifications, or
- the uniformity and unmixed soil inclusions requirements of Section 02650, Paragraph 2.2.1, have not been met.

In the event that a Test Parcel fails to meet the specification requirements, the QC Manager shall promptly notify the TCM, Engineer of Record, and Perimeter Wall Stabilization Contractor. Potential options for proceeding include, but are not limited to:

- Testing spare wet grab or core samples to obtain supplemental data. If additional testing is conducted, the new test data shall be added to the previous data set for the same test parcel, except that wet grab test results and core test results shall be kept separate.

- Conducting additional coring to obtain supplemental core samples for strength testing, or to further assess the impacts or extents of unmixed or unfixated soil inclusions.

- Waiting some period of time to allow for additional curing prior to testing spare wet grab or core samples. The specifications require that the soil cement reach the specified compressive strength within 56 days. With the approval of the TCM and the Engineer of Record, the wall may be accepted on the basis of strengths measured after more than 56 days of curing.

- Further engineering analyses of the area in question to see if the constructed walls achieve the required performance, based on the measured strength data. For example, completed walls that exhibit excessive variability but with a higher average strength may achieve adequate reliability with respect to stability. Acceptance in all such cases shall be based on additional stability analyses, consistent with the

documented design calculations, that are completed under the direction of the Engineer of Record.

- Mitigation of the constructed wall in accordance with a specific remediation plan prepared by the Perimeter Wall Stabilization Contractor, reviewed by the Engineer of Record, and approved by the TCM.

11. Project Documentation

Documentation shall be collected and maintained by the QC Manager (copied to the TCM) during the project. This documentation shall include but not be limited to the following:

- Daily construction field reports;
- Observation reports;
- Perimeter Wall Stabilization Contractor submittals;
- Material conformance data;
- Photographic documentation (per Kingston photo data base Standard Operating Procedure);
- Survey data;
- As-Built Drawings;
- Construction issue and solution reports;
- Weekly summary reports (for regulatory submittal);
- Plan modifications; and
- Meeting minutes.

Attachment 3

Quality Control Plan for Perimeter Wall Stabilization QC Representative

KINGSTON ASH RECOVERY PROJECT
PERIMETER STABILIZATION

PERIMETER WALL STABILIZATION
QUALITY CONTROL PLAN

Revision 0

Specification 02650
Sections:
1.5.8

Geo-Con
A Trade Name of Environmental Barrier Co., LLC
400 Penn Center Blvd Suite 503
Pittsburgh, PA 15235

July 11, 2011

TABLE OF CONTENTS

1. OVERVIEW

This Quality Control Plan (QC Plan) has been developed as a guide to ensure the quality of Geo-Con's scope of work as performed for the installation of the Cement-Bentonite Slurry Wall (CB Wall) for perimeter Stabilization of the Kingston Ash Recovery site. Additional details on the construction means and methods and layout drawings are provided in other submittals.

2. PERSONNEL

- Project Manager – Steven Artman
  12 Years Geotechnical Construction Experience
  - Managing day-to-day operation of the project
  - Coordinating technical submittals
  - Responsibility for the implementation of the Quality Control and Safety programs
  - Interface with TVA management personnel
- Quality Control Representative – Amy Robinson Grass, PE
  5 Years Geotechnical Construction Experience
  - Administration of the Quality Control Program
  - Coordination of Laboratory Testing
  - Reporting quality control data
- QC Technicians
  - Additional qualified technicians will be employed as needed to assist the QC Representative in collection of samples and other QC testing

3. MATERIALS

Geo-Con will be responsible to ensure that all work is performed to the standards established herein, subject to review and inspection by TVA. All quality control records, routine tests, observations, and measurements will be available for inspection. Certificates of compliance for materials will be generated by the manufacturers as truckloads are created, and will be submitted throughout the duration of the project. Example certificates of compliance are attached. The MSDS for each of the materials have been submitted separately and will be available in the Geo-Con office trailer.

4. FIELD QUALITY CONTROL TESTING

Samples of the slurry will be obtained from both the trench and mixing plant for testing. Equipment and personnel for performing these tests will be supplied by Geo-Con. This testing is performed to serve as a method of controlling the stability of the trench during installation and ensure that the CB wall will ultimately meet the acceptance criteria. These frequencies are minimums and additional testing may be performed during installation. The TVA[1] will be notified, to the extent practical, when testing is being conducted. Details on testing are presented below.

5. ON-SITE QC EQUIPMENT

The following equipment will be utilized for on-site quality control testing:

- 2 Mud balances for density testing.
- 2 Marsh funnels for slurry viscosity measurement.

[1] TVA in this instance refers to QC Manager or his/her designated representative

- 2 Flow Cones
- Sounding tape or cable for trench depth measurement.
- 3" by 6" cylinder molds
- Pocket Penetrometer
- Survey Grade Rod and Level

The instrumentation, indicators, and display controls for testing and monitoring shall be calibrated as per the manufacturer's specifications prior to being brought on site. Certificates of calibration for scales and flow meters are provided separately to the QC Manager. Calibration of mud balances and marsh funnels shall be performed at the beginning of the project and checked bi-weekly thereafter, in accordance with the specifications.

6. BATCHING CONTROL

The components of the Cement-Bentonite (CB) slurry will be controlled by measuring the quantities of each component as it is introduced. The CB slurry will be mixed in stages, by first mixing the bentonite and water, and then adding the Slag and Portland cement once the bentonite slurry is fully hydrated.

The bentonite water slurry will be mixed in both a high-shear tank mixer, and a Venturi-type jet-shear mixer by adding water to the bentonite powder. The bentonite in the high-shear tank mixers will be measured using a scale under the mixing tank after the appropriate amount water is delivered to the tank and measured using a flow meter. The quantity of bentonite used with the jet-shear mixer will controlled by the quantity of material in each jumbo bag, generally 3000 pounds. The water pumped through the jet-shear mixer will also be measured using a flow meter. A table will be developed as a guide for the operator of the jet shear mixer. This table will establish the correct gallons of water that are appropriate for a given size bag of bentonite. The table will be developed based on the on the final selected mix design.

The pre-mixed bentonite slurry will be pumped into the tank mixers and measured using a flow meter. The appropriate quantity of slag cement will be delivered from the silo via screw-auger directly into the mixing chamber. The CB slurry may be mixed in batches or in a continuous manner. Load cells mounted under the legs of the silo will record the amount of slag delivered to the mixer. A control unit with digital readout will be mounted on the batch plant to allow the operator to record the quantities of slag cement and bentonite slurry used. Portland cement will be added to the mixer from 47-pound bags and controlled by recording the number of bags used. Cement bags that are compromised due to moisture or damage will be discarded.

Proportions of the CB mix will be determined prior to construction based on the results of the Laboratory Mix Design.

The daily quantities of materials used will be recorded by the operators and incorporated into the daily QC report by the QC Representative. Each plant will generally pump exclusively to one excavator. All batches from a given shift will generally be blended together in a panel during the course of excavation. The batches made during a given shift will correlate to the panel installed by the rig to which those batches were pumped. This information will be noted on the daily QC report and will provide correlation between batching operations and the panel (i.e. range of stations completed during the shift) into which those batches were placed in the trench.

With the proposed batch plant set-up, a newly mixed batch of grout is transferred to a holding tank until it is sent to the trench. If a discrepancy in the mix is noted, the batch can be recirculated back to the mixing tank and corrected. If the discrepancy is noted after the batch has been sent to the trench, the next batch can be made with additional materials to compensate for the deficient batch. The motion of the excavator passing through the grout in the trench will ensure that the batches are thoroughly combined and the deficient batch will not adversely affect the finished wall.

In the unlikely event that a significant number of batches are deficient, the panel where they were placed will be allowed to gel, and the solidified slurry therein will then be excavated and replaced with the correct mix.

7. SLURRY PROPERITES

Properties of the cement-bentonite (CB) slurry, including Marsh Funnel viscosity, mud balance density , and grout efflux will be tested at the beginning of each shift and at a minimum every fifty batches thereafter for each batch plant that is in operation. Fresh cement-bentonite slurry will be sampled from the holding tank immediately prior to pumping or at the end of the fill line into the trench.

SUBJECT	STANDARD	TYPE OF TEST	MINIMUM FREQUENCY	SPECIFIED VALUE
Water	ASTM C94	pH	1 per source	5.0-8.0
		hardness	1 per source	<250 mg/L
		TDS	1 per source	<1000 mg/L
		Clarity	1 per source	apparently clear
Bentonite	API Specification 13A	Certificate of compliance	1 per truck load	Premium grade sodium cation montmorillonite
CB Slurry at the each mixer	API Specification 13B-1	Viscosity	1 per 50 batches	Info Only
		Grout Efflux	1 per 50 batches	Info Only
		Density	1 per 50 batches	Info Only
		Temperature	1 per 50 batches	35-90 F

The mud balance density of the CB slurry is used as quality control check to compare the actual density of the mixture as compared to the theoretical density of the mixture.

The effects of hot and cold ambient temperatures have a minimal effect on the construction of a CB slurry wall. The curing of the CB wall occurs underground which stabilizes the curing environment. The bentonite in the grout prevents flash set in hot weather. If the ambient temperature is below 32° F, the CB slurry will be monitored for freezing. If freezing of the slurry starts to occur in the HDPE pipe, operations will be ceased until the slurry can be pumped without freezing.

8. WET-GRAB SAMPLING AND TESTING

Wet-grab sampling of the CB slurry will be done by Geo-Con for Quality Control purposes. Samples will be collected at the discretion of TVA in accordance with the specifications (Section 02650, Paragraph 2.2.4). These samples will be obtained by use of a sampler that is capable of retrieving a discreet sample at the specified depth. From each sample, at least six 3 inch by 6 inch specimen cylinders will be molded in accordance with ASTM D4832.

ASTM D4832 is the Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders. Typically this standard is applied to specimens with a compressive strength from 100-300psi, thus making it appropriate for this application.

Immediately after samples are collected from the trench, the material will be passed through a 0.5-inch screen to remove any debris or unmixed material from the specimen. The specimen will then be transported to the QC trailer where the cylinders will be molded. The storage facility will be kept between 68°F and 80°F. The humidity on the trailer will be maintained between 85% and 95% as per ASTM D4832. The temperature and humidity will be maintained with space heaters, humidifiers, and fans. The temperature and humidity within the trailer will be recorded at the beginning of each shift and every four hours throughout the shift. Samples will remain in the controlled environment until they are transported to the lab.

Laboratory Unconfined Compressive Strength (UCS) testing of the samples will be conducted at 28 and 56 days and at additional ages as necessary. The samples will be cured on-site for a minimum of 4 days prior to transport, as per ASTM D4832. Samples will then be transported to S&ME of Knoxville, TN for UCS testing. Samples will be transported using a dedicated courier that is an employee of the testing lab using specialty containers designed to protect low-strength samples from vibration and will maintain a controlled temperature. Containers will be coolers or other sturdy containers with custom formed internal foam or other vibration absorbing material.

Upon reaching the lab, the samples will be placed in a curing room meeting the temperature and humidity requirements of ASTM D4832 until broken. Samples to be held longer than 56 days will be submerged as opposed to being held in the moist curing facility.

Testing will be conducted in accordance with ASTM D2166. Samples may be tested on-site for UCS at 7 days with a pocket penetrometer for additional information and to monitor initial set and early strength gain.

The UCS tests on the wet-grab samples will be used as the basis for acceptance of the completed work, in accordance with the Specifications (Section 02650, Paragraph 2.2.3).

9. BATCH PLANT SAMPLES

Geo-Con may collect and mold samples of the CB slurry from the batch plant during production. These samples will be cured and tested at the laboratory. These samples will be used to evaluate the consistency of batches and to compare UCS of fresh CB to CB after introduction to the trench.

10. CORE DRILL SAMPLING

Core drilling of the perimeter wall will be conducted under separate contract by TVA and will be used to verify uniformity of the Cement Bentonite Wall. UCS tests on the cored samples may be used to supplement the wet-grab data for acceptance of the completed work.

11. DEPTH AND TRENCH ALIGNMENT

Geo-Con will make measurements of the trench depth where designated by the QC Manager in accordance with the Specifications (Section 02650, Paragraph 4.3.10 and 4.4.6). All depth measurements will be made from a platform spanning the trench to the bottom of the trench with a weighted steel cable or cloth tape. The weight will consist of a flat-bottom anchor or other steel weight heavy enough to sink through the slurry. The geometry of the weight will be such that it will rest on top of any material in the bottom of the trench. This will indicate to the operator that additional passes will be required to fully remove the material from the trench. A typical weight will be a 3" diameter by 12" long solid steel cylinder. The work platform elevation will be surveyed when the centerline is laid out, and a benchmark set out by TVA surveyors will be used as the basis for depth measurement. A rod and level will be used to provide the elevation of a reference point the sounding platform and this measurement with the sounding cable measurement will be used to obtain elevations of the bottom of the trench The platform will include necessary safety measures including handrails and toe-boards to ensure safety compliance.

The depth of the slurry wall trench will be determined by identifying key material in the field. The depth to the top of bedrock will be determined in accordance with the Specifications (Section 02650, Paragraph 4.3.10). Prior to the start of construction, a table will be developed with the anticipated depth to the top of bedrock for each station of the inboard or outboard wall, and for each shear wall. When the depth of the trench excavation is within 5 feet of the anticipated top of rock, the QC Manager's representative will be alerted so that the evaluation process to identify the rock can begin. When a change in material is recognized by the equipment operator, a sample of the material will be presented from the bucket cuttings for inspection. The operator will detect this change in material by the sound and feel of the excavator resistance, as well as the change in hydraulic pressures required for excavation. If the samples of the material from the bucket cuttings indicate the presence of bedrock, the depth of the cut will be measured. These measurements along with the sample evaluation and other factors will be used by the QC Manager to determine if bedrock has been reached. The depth measurements will be recorded before continuing to penetrate into the bedrock. The excavation will then continue until the trench is embedded 2.7 feet (for a 3-foot wide wall) or 3.1 feet (for a 4-foot wide wall) into the bedrock. This will be verified by additional trench depth measurements in accordance with the Specifications (Section 02650, Paragraph 4.4.6).

The work platform and/or excavating equipment will be leveled to plumb within 1 % of vertical. Verticality of the excavating equipment will be checked with a 2-foot level mounted on the frame of the excavator within sight of the operator. The level will be equipped with a digital readout. The machine operator will document that the machine is level at the beginning and completion of each cut of the slurry trench.

The layout of the inboard, outboard, shear, and buttress walls is defined in the Shop Drawing submittal. The survey layout of the walls and intersections will be completed by TVA. The survey will consist of stakes placed at the intersection of every or every other shear wall and perimeter wall. Offset stakes will also be placed by the surveyor. Geo-Con will place temporary pin-flags at 10-foot intervals along trench alignment to mark stations. Additional offset stakes or flags will also be placed by Geo-Con so that the shear wall/longitudinal intersection can be re-established after the inboard wall has been installed. A similar process will be used for the outboard wall. The intersection of shear/longitudinal walls can also be re-established by Geo-Con by pulling a tape measure between two other existing survey stakes.

In areas where there is a curve in the alignment of the inboard or outboard walls, the trench will be excavated in a series of 30-foot minimum length chords. In all locations, the trench will be excavated within 6-inches of the Shop Drawing layout. The alignment and horizontal location of each panel excavation will be visually confirmed during the initial excavation of the dry cut.

Wall joints will be defined as the intersection of two panels of CB slurry trench. A panel is the segment of wall installed by a rig in a given shift. The connection of 2 panels will be verified visually in the field by ensuring no significant additional native soil is present in the excavation spoils at the completion of the cut of trench. When tying into a panel that has achieved a set weaker than the adjacent soil, the tie-in will be further verified by the operator feeling little resistance to the excavator when bucket passes into the previous shift's panel. When making tie-ins to cured CB walls, the following procedure will be used. The excavator bucket will scrape the vertical face of the cured CB at the front or back of the trench using the bucket teeth. When the full depth of the cut is reached, an additional vertical pass of the excavator bucket will be made along the cured face of the CB wall. The bucket cuttings will be examined to verify no significant native material is present. Additional verification of contact with the CB wall will be made by observing the sounds and action of the excavator arm. During tie-in, a small amount of native soil may be present in the cuttings from the side of the excavator bucket or arm scraping the sides of the slurry trench.

12. AS-BUILT DRAWINGS

Geo-Con will maintain red-lined drawings depicting the depth and embedment of the CB wall into the bedrock. The progress of wall installation on plan view drawings will be notated as well. Red-line drawings will be updated daily and be available for viewing in Geo-Con's office trailer and will be submitted to the QC Manager on a weekly basis.

13. QC REPORTING

Records will be maintained by Geo-Con for all testing, measurements, observations, and inspections. Quality Control Reports will be submitted by noon of the following day. These reports will list all test results, measurements, and observations made of the work for that day. The content of the report will include the elements required by the specification. A sample daily report is included as an attachment to this plan.

14. NON-CONFORMANCE AND REPAIR

In the event of a non-conformance, Geo-Con will initiate a Non-Conformance Report (NCR). This report will detail the type of non-conformance, the proposed corrective action, results of corrective action and methodology to prevent reoccurrence.

In the event that a section of stabilization wall fails to meet the required minimum strength, or if a section contains sufficient unacceptable inclusions as defined in Section 02650 of the Specifications, the affected sections will be supplemented by construction of additional CB stabilized wall. The limits of a failed section of wall will first be defined. If the samples collected from a given Test Parcel do not meet the requirements as specified in paragraph 2.2.3 of Section 02650 of the Specification, the segment of wall installed by the same excavation rig and on the same date as the test parcel will require remediation. If the segment of wall requiring remediation is a shear wall, a parallel shear wall will be installed alongside the originally placed wall. The new shear wall will be tied into both the inboard and outboard wall. A buttress wall section that requires remediation will be similarly reinforced with a parallel wall. The parallel

buttress wall will be approximately 30 feet in length at the surface (to accommodate the long reach boom) and 10 feet in length for the wall imbedded into rock. The portion of the trench at the surface will extend beyond the limit of the outboard work platform and will not extend across the previously installed outboard wall. Where the additional buttress wall extends above the final grade, the wall may be cut or demolished during construction of the rock buttress. Inboard walls will be remediated with a parallel wall in the inboard side of the inboard perimeter wall. Outboard walls will be remediated with a parallel wall on either the inboard or outboard side of the outboard perimeter wall depending on the position of the shear and buttress walls in relation to the remediation section.

If a section of wall requires remediation, a detailed geometric plan will be submitted prior to the installation of remediation sections. This will include plan, profile and typical details of the deficient wall sections, tie-ins and cold joints. If a wall contains unacceptable inclusions, as defined in Section 02650 of the Specifications, then that wall shall be remediated as outlined above.

LAFARGE NORTH AMERICA

NewCem MILL TEST REPORT

CONSIGNEE:

SHIPPED:	**May-08**
PRODUCED:	**May-08**
PLANT:	**South Chicago**
TYPE:	**GGBFS**

Reference Cement Results

Fineness by Air Permeability *(m2/kg; ASTM C204-05)*	368		
Fineness by 45 um (No. 325) Sieve			
(% passing; ASTM C430-96)	91.4		
(% retained; ASTM C430-96)	8.6		
Total Alkali as Sodium Oxide		**Min**	**Max**
(NaEq; ASTM C150-05)	0.90	0.60	0.90

Compressive Strength *(ASTM C109 / C109M - 05)*	**MPa**	**psi**	**Min**
7-day	33.2	4810	na
28-day	38.7	5610	35 MPa

Slag Results

Fineness by Air Permeability *(m2/kg; ASTM C204-05)*	510	
Fineness by 45 um (No. 325) Sieve		
(% passing; ASTM C430-96)	98.9	
(% retained; ASTM C430-96)	1.1	
Specific Gravity *(g/cm^3; ASTM C188-95)*	2.90	
Air Content of Mortar *(%; ASTM C185-02)*	6	*Max 12%*
Sulfate *($\%SO_3$; ASTM C114-05)*	0.00	*Max 4.0%*
Sulfide Sulfur *(%S; ASTM C114-05)*	1.17	*Max 2.5%*
Chloride *(%Cl; ASTM C114-05)*	0.065	

Compressive Strength *(ASTM C109 / C109M - 05)*	**MPa**	**psi**
7-day	33.2	4820
28-day	49.1	7120

Slag Activity Index *(ASTM C989-05)*	**%**	**Min**
7-day	100%	95%
28-day	127%	115%

Certified by:

Scott Podhaisky, Quality Manager
June 5, 2008

The slag represented by the above chemical and physical analysis is certified to meet the requirements of ASTM C989, and AASHTO M302 for Grade 120 Ground Granulated Blast-Furnace Slag (GGBFS).

Holcim Material Certification Report

Brand: Envirocore™ Family of Products
Material: GranCem®
Type: 100 (ASTM C 989)
Date Range: February 1-28, 2010
Lot Number: Multiple Lots

Certification

This slag cement meets the requirements of ASTM specification C 989 for Grade 100.

General Information

Supplier:	Holcim (US) Inc.	Source Location:	Chicago Skyway Plant
Address:	3020 East 103rd Street		3020 East 103rd Street
	Chicago, IL 60617		Chicago, IL 60617
Telephone:	Roberto Carrillo/773-768-1717 x 254	Contact:	Roberto Carrillo/773-768-1717 x 254
Date Issued:	17-Mar-2010		

The following information is based on average test data during the test period. The data is typical of cement shipped by Holcim; individual shipments may vary.

Test Data on ASTM Standard Requirements

Chemical			Physical		
Item	**Limit[A]**	**Result**	**Item**	**Limit[A]**	**Result**
			+45 µm (No. 325) Sieve (%)	20 max	0.514
			Blaine Fineness (m2/kg)	-	622
Sulfide S (%)	2.5 max	0.92	Air Content (%)	12 max	3.77
Sulfate Ion - SO_3 (%)	-	0.07	Slag Activity Index (%)		
			Avg 7 Day Index	75 min	82
			Avg 28 Day Index	95 min	122
			Compressive Strength Slag-Ref (psi):		
			7 Day	-	27 (3900)
			28 Day	-	47 (6850)

Test Data on Reference Cement

Chemical			Physical		
Item	**Limit[A]**	**Result**	**Item**	**Limit[A]**	**Result**
Total Alkalies as Na_2O (%)	0.60 - 0.90	0.76	Blaine Fineness (m2/kg)	-	417
C_3S	-	66.11	Compressive Strength MPa (psi):		
C_2S	-	6.32	7 Day	-	33 (4730)
C_3A	-	8.15	28 Day	35 (5000) min	39 (5640)
C_4AF	-	8.22			

Notes

[A]Dashes in the limits columns means Not Applicable
Specific Gravity: 2.87
This data may have been reported on previous mill certificates. It is typical of the cement being currently shipped which was produced in February of 2010

BLACK HILLS BENTONITE LLC

A Limited Liability Company

Certificate Of Analysis / API Grade 13A (sec. 9)

For: H&H Environmental / Geo Con

Attn: Don Kendall / Fax No: (970) 243-0098

Attn: Steve Artman (GeoCon) / sartman@geocon.net / Fax: 303-845-6997

Caton Lake Slurry Wall
Canton, OK

API 13A, Section 9, License No. 13A-0008.2
Processing Plant: Mills, WY

Date Shipped	Bag Code Number	Destination	Delivery Ticket	Customer P.O. #	Car or Truck Number	Vis.Dial 600/300 rpm	YP/PV Ratio	Filtrate Volume,ml	Wet Sieve %
						Specification 30 min./ 600 rpm	Specification 3 max.	Specification 15 max.	Specification 4 max.
						(Test results based on "Daily Composite")			
	BHM722JD	Canton, OK	182025	7402-2	truck	42-31	1.8	13.8	2.3
	BHM722JD	Canton, OK	182024	7402-1	Lonestar 900218	42-31	1.8	13.8	2.3
	BHM722JD	Canton, OK	182026	7402-3	lonestar 900034	42-31	1.8	13.8	2.3

American Colloid Company
664 US Highway 212 Belle Fourche, SD 57717
Phone (605) 892-7652 Fax (307) 896-2168

Geo-Con

Certificate of Analysis

250th St at 230th Ave

Eldridge, IA

Attention: Steve Artman

A Shipment of Premium Gel was produced on 07/17/2010 and left our Colony East Plant on 07/17/2010 as requested on your Purchase Order # 89301. The shipment was from our lot number 19810.

A sample from this lot was tested and gave the following results:

	Required Min	Max	Result
Moisture		**10**	**9.1**
Visc600	**30**		**33**
Grit		**4**	**1.7**
YP/PV		**3**	**1.3**
Fluid Loss		**15**	**14.2**

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and / or customer approved laboratory procedures.

Tests were conducted by: Allen Rhoads

Approved by: Richard Wheaton

Any Correspondence regarding this shipment, please refer to our Order # 267618

WYO-BEN, INC.

CERTIFICATE OF ANALYSIS

DATE: 11/05/10

TO: H & H ENVIROMENTAL INC.

SHIP DATE: 11/03/10

PRODUCT: HYDROGEL

LOT NO.: 10251032 10281032 11011032

ORDER NO.: 51060

P.O NO.: 8299-3

TRUCK NO.: PRIME TRANS.-700004

EMAIL: sartman@geocon.com

THE FOLLOWING RESULTS WERE OBTAINED FROM TESTS RUN ON A COMPOSITE SAMPLE TAKEN FROM THE ABOVE LOT.

LOT NUMBER:	10251032	10281032	11011032
600/300 RPM READING	39/29	36/27	38/29
PV/YP	10/19	9/18	9/20
YP/PV RATIO	1.90	2.00	2.22
YIELD	98.0	96.0	97.0
MOISTURE %	7.3	5.9	5.3
MESH % THRU 200 SCREEN	79.2	83.6	73.6
GEL STRENGHTS 10SEC/10MIN	28/44	15/39	19/35
WATER LOSS	12.0	11.4	11.4
pH	9.6	9.2	9.3
WET SCREEN %-200	3.6	2.5	3.6

WE CERTIFY THAT THE TEST RESULTS CONTAINED HEREIN ARE ACCURATE AS REPORTED. THE RESULTS SHOULD BE REPLICATIVE ALLOWING FOR A MARGIN OF TEST PROCEDURE AND OPERATOR ERROR. WE ALSO CERTIFY THAT THE ABOVE PRODUCT DOES MEET OR EXCEED ALL SPECIFICATIONS SET FORTH IN API 13A SECTION 9, SEVENTEENTH EDITION FOR BENTONITE.

WYO-BEN, INC.

Sue Anderson

Sue Anderson
Quality Assurance

STUCCO PLANT
WYOMING OPERATIONS OFFICE
P.O. BOX 1072
GREYBULL, WYOMING 82426 USA

SAGE CREEK PLANT LUCERNE PLANT CORPORATE HEADQUARTERS

Holcim (US) Inc.
300 Prairie Center Drive
Suite 110
Eden Prairie, MN 55344

Phone 952-890-2732
800-562-3989
Fax 952-890-2109
www.holcim.com/us

October 15, 2009

TO: Whom It May Concern

FROM: Joe Clendenen, Technical Service Engineer
Northern Sales Group
Holcim (US) Inc.

RE: CERTIFICATION STATEMENT FOR ST. GENEVIEVE TYPE I/II LA CEMENT

To Whom It May Concern:

This letter is to certify that the Type I/II LA produced by Holcim (US) Inc at the St. Genevieve plant in Bloomsdale, MO meets ASTM C150, AASHTO M 85, IaDOT (PC3202), MnDOT, WisDOT, NDDOT, SDDOT, and NDOR requirements for Type I/II LA portland cement.

Should you have any further questions, please contact your local Holcim (US) Inc. representative.

Sincerely,

Joseph W. Clendenen, EIT
Technical Service Engineer
Holcim (US) Inc.
Joe.clendenen@holcim.com
Cell: 952-334-7887

Version 6.20

Holcim

Material Certification Report

Material: Portland Cement
Type: I, II (C 150)

Test Period: 01-Sep-2009
To: 21-Sep-2009

Certification

This cement meets specifications ASTM C 150 and AASHTO M 85 specifications for Type I and II cement.

General Information

Supplier: Holcim (US) Inc.
Address: 2942 US Highway 61
Bloomsdale, MO 63627
Telephone: 636 524 8155
Date Issued: **21-Sep-2009**

Source Location: Ste. Genevieve Plant
2942 US Highway 61
Bloomsdale, MO 63627
Contact: Erin Watson

The following information is based on average test data during the test period. The data is typical of cement shipped by Holcim; individual shipments may vary.

Tests Data on ASTM Standard Requirements

Chemical			Physical		
Item	Limit[A]	Result	Item	Limit[A]	Result
SiO_2 (%)	-	20.3	Air Content (%)	12 max	6
Al_2O_3 (%)	6.0 max	4.6	Blaine Fineness (m^2/kg)	260 min 430 max	380
Fe_2O_3 (%)	6.0 max	3.2	Average[B] Blaine Fineness (m2/kg)	280 min 420 max	389.40
CaO (%)	-	64.7			
MgO (%)	6.0 max	2.4	Autoclave Expansion (%) (C 151)	0.80 max	0.04
SO_3 (%)	3.0 max	2.9	Compressive Strength MPa (psi):		
Loss on Ignition (%)	3.0 max	2.2			
Insoluble Residue (%)	0.75 max	0.26	3 Day	12.0 (1740) min	31.3 (4515)
CO_2 (%)	-	0.8	7 Day	19.0 (2760) min	37.3 (5410)
Limestone (%)	-	1.9			
$CaCO_3$ In Limestone (%)	-	95	Initial Vicat (minutes)	45-375	78
Potential Compounds:					
C_3S (%)	-	61	Mortar Bar Expansion (%) (C 1038)	-	-
C_2S (%)	-	12			
C_3A (%)	8 max	7	Heat of Hydration: 7 days, kJ/kg (cal/g)[C]	-	356 (85)
C_4AF (%)	-	10			
$C_3S + 4.75C_3A$ (%)	100 max	93.8			

Tests Data on ASTM Optional Requirements

Chemical			Physical		
Item	Limit[A]	Result	Item	Limit[A]	Result
Equavalent Alkalies (%)	0.6	0.45			

Notes

[A] Dashes in the limits columns means Not Applicable

[C] Test results represent most recent value and is provided for information only.
This data may have been reported on previous mill certificates. It is typical of the cement being currently shipped.

Geo-Con

Cement-Bentonite Slurry Wall
Personnel and Equipment Summary
Kingston Ash Recovery Project
Harriman, Roane County, Tennessee

DATE	SUPT.	PROJ. MGR.	QC REP	SSO
	G Warrington	Steve Artman	Amy Robinson Grass	Aaron Handel

GEO-CON PROJECT NUMBER	SHIFT START	SHIFT END
P10-063		

TRADE	NAME	HRS ST	HRS OT	EQUIPMENT	TASK	EQUIPMENT (Cont)	TASK
	Total Hours Today:						
	Total Hours To Date:						

MATERIALS RECEIVED	UNIT	AMT
Bentonite	Ton	
Portland	LBS	
Slag	Ton	

Activity Summary:

Comments

QUALITY CONTROL REPRESENTATIVE	
Amy Robinson Grass- Geo-con/EBC	

Geo-Con

Cement-Bentonite Slurry Wall

Kingston Ash Recovery Project
Harriman, Roane County, Tennessee

Date: _____ **Project Number:** P10-063

Trench Excavation

Wall Type (Inboard, Outboard, Buttress-Shear)	Station	Offset-Wall Centerline to Baseline	Length of Cut	Start Time	Stop Time	Max. Verticality Deviation (Degrees)	Workpad Elevation	Depth (From workpad in Ft)		Slurry Level				
								Top of Key	Bottom of Trench	Average Cubic Yardage Soil	Average Cubic Yardage Rock	Station	Slurry Level Elevation PM Prev. Day (Ft)	Slurry Level Elevation AM Today (Ft)

Bucket Width(ft): _____ GroundwaterElevation: _____

Linear Feet Today: _____ Cubic Yardage Soil Today: _____ Cubic Yardage Rock Today: _____

Linear Feet To Date: _____ Cubic Yardage Soil To Date: _____ Cubic Yardage Rock To Date: _____

CB Samples

Sample ID	Station	Date Taken	Time Taken	Number of Cylinders Taken	Depth	28 Day Date	56 Day Date	Temperature in Cure Room	% Humidity in Cure Room	Comments
					FBGS			°F	%	

Comments: _____

Geo-Con

Cement-Bentonite Slurry Wall

Kingston Ash Recovery Project
Harriman, Roane County, Tennessee

Date: **Project Number:** P10-063

Cement-Bentonite Slurry Quality Control

Batch Plant 1

Time	VISC (MFV)	Density	Temperature	Grout Efflux	pH
	Seconds	PCF	°F	Seconds	

Batch Plant 2

Time	VISC (MFV)	Density	Temperature	Grout Efflux	pH
	Seconds	PCF	°F	S	
N/A					

Batch Plant 1

Pumping to Rig	Number Batches	Bentonite Slurry	Slag	Portland
		GAL	TONS	LBS

Batch Plant 2

Pumping to Rig	Number Batches	Bentonite Slurry	Slag	Portland
		GAL	TONS	LBS
N/A				

Slag Today (TONS): _____
Slag to Date (TONS): _____

Water Today (GAL): _____
Water To Date (GAL): _____

Portland Today (LBS): _____
Portland to Date (LBS): _____

Bentonite Today (TONS): _____
Bentonite To Date (TONS): _____

Mix Proportions	
Slag:	20.0%
Portland:	0.5%
Bentonite:	3.0%

Comments:

Amy Robinson Grass-Geo-Con/EBC

George Warrington Geo-Con/EBC

LAFARGE NORTH AMERICA

NewCem MILL TEST REPORT

CONSIGNEE:

SHIPPED:	**May-08**
PRODUCED:	**May-08**
PLANT:	**South Chicago**
TYPE:	**GGBFS**

Reference Cement Results

Fineness by Air Permeability *(m2/kg; ASTM C204-05)*	368		
Fineness by 45 um (No. 325) Sieve			
(% passing; ASTM C430-96)	91.4		
(% retained; ASTM C430-96)	8.6		
Total Alkali as Sodium Oxide		**Min**	**Max**
(NaEq; ASTM C150-05)	0.90	0.60	0.90

Compressive Strength *(ASTM C109 / C109M - 05)*	**MPa**	**psi**	**Min**
7-day	33.2	4810	na
28-day	38.7	5610	35 MPa

Slag Results

Fineness by Air Permeability *(m2/kg; ASTM C204-05)*	510	
Fineness by 45 um (No. 325) Sieve		
(% passing; ASTM C430-96)	98.9	
(% retained; ASTM C430-96)	1.1	
Specific Gravity *(g/cm^3; ASTM C188-95)*	2.90	
Air Content of Mortar *(%; ASTM C185-02)*	6	*Max 12%*
Sulfate *($\%SO_3$; ASTM C114-05)*	0.00	*Max 4.0%*
Sulfide Sulfur *(%S; ASTM C114-05)*	1.17	*Max 2.5%*
Chloride *(%Cl; ASTM C114-05)*	0.065	

Compressive Strength *(ASTM C109 / C109M - 05)*	**MPa**	**psi**
7-day	33.2	4820
28-day	49.1	7120

Slag Activity Index *(ASTM C989-05)*	**%**	**Min**
7-day	100%	95%
28-day	127%	115%

Certified by:

Scott Podhaisky, Quality Manager
June 5, 2008

The slag represented by the above chemical and physical analysis is certified to meet the requirements of ASTM C989, and AASHTO M302 for Grade 120 Ground Granulated Blast-Furnace Slag (GGBFS).

Holcim Material Certification Report

Brand: Envirocore™ Family of Products
Material: GranCem®
Type: 100 (ASTM C 989)
Date Range: February 1-28, 2010
Lot Number: Multiple Lots

Certification

This slag cement meets the requirements of ASTM specification C 989 for Grade 100.

General Information

Supplier:	Holcim (US) Inc.	Source Location:	Chicago Skyway Plant
Address:	3020 East 103rd Street		3020 East 103rd Street
	Chicago, IL 60617		Chicago, IL 60617
Telephone:	Roberto Carrillo/773-768-1717 x 254	Contact:	Roberto Carrillo/773-768-1717 x 254
Date Issued:	17-Mar-2010		

The following information is based on average test data during the test period. The data is typical of cement shipped by Holcim; individual shipments may vary.

Test Data on ASTM Standard Requirements

Chemical			Physical		
Item	**Limit[A]**	**Result**	**Item**	**Limit[A]**	**Result**
			+45 µm (No. 325) Sieve (%)	20 max	0.514
			Blaine Fineness (m2/kg)	-	622
Sulfide S (%)	2.5 max	0.92	Air Content (%)	12 max	3.77
Sulfate Ion - SO_3 (%)	-	0.07	Slag Activity Index (%)		
			Avg 7 Day Index	75 min	82
			Avg 28 Day Index	95 min	122
			Compressive Strength Slag-Ref (psi):		
			7 Day	-	27 (3900)
			28 Day	-	47 (6850)

Test Data on Reference Cement

Chemical			Physical		
Item	**Limit[A]**	**Result**	**Item**	**Limit[A]**	**Result**
Total Alkalies as Na_2O (%)	0.60 - 0.90	0.76	Blaine Fineness (m2/kg)	-	417
C_3S	-	66.11	Compressive Strength MPa (psi):		
C_2S	-	6.32	7 Day	-	33 (4730)
C_3A	-	8.15	28 Day	35 (5000) min	39 (5640)
C_4AF	-	8.22			

Notes

[A]Dashes in the limits columns means Not Applicable
Specific Gravity: 2.87
This data may have been reported on previous mill certificates. It is typical of the cement being currently shipped which was produced in February of 2010

BLACK HILLS BENTONITE LLC

A Limited Liability Company

Certificate Of Analysis / API Grade 13A (sec. 9)

For: H&H Environmental / Geo Con

Attn: Don Kendall / Fax No: (970) 243-0098

Attn: Steve Artman (GeoCon) / sartman@geocon.net / Fax: 303-845-6997

Caton Lake Slurry Wall
Canton, OK

API 13A, Section 9, License No. 13A-0008.2
Processing Plant: Mills, WY

Date Shipped	Bag Code Number	Destination	Delivery Ticket	Customer P.O. #	Car or Truck Number	Vis.Dial 600/300 rpm	YP/PV Ratio	Filtrate Volume,ml	Wet Sieve %
						Specification 30 min./ 600 rpm	Specification 3 max.	Specification 15 max.	Specification 4 max.
						(Test results based on "Daily Composite")			
	BHM722JD	Canton, OK	182025	7402-2	truck	42-31	1.8	13.8	2.3
	BHM722JD	Canton, OK	182024	7402-1	Lonestar 900218	42-31	1.8	13.8	2.3
	BHM722JD	Canton, OK	182026	7402-3	lonestar 900034	42-31	1.8	13.8	2.3

American Colloid Company
664 US Highway 212 Belle Fourche, SD 57717
Phone (605) 892-7652 Fax (307) 896-2168

Geo-Con

Certificate of Analysis

250th St at 230th Ave

Eldridge, IA

Attention: Steve Artman

A Shipment of Premium Gel was produced on 07/17/2010 and left our Colony East Plant on 07/17/2010 as requested on your Purchase Order # 89301. The shipment was from our lot number 19810.

A sample from this lot was tested and gave the following results:

	Required Min	Max	Result
Moisture		**10**	**9.1**
Visc600	**30**		**33**
Grit		**4**	**1.7**
YP/PV		**3**	**1.3**
Fluid Loss		**15**	**14.2**

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and / or customer approved laboratory procedures.

Tests were conducted by: Allen Rhoads

Approved by: Richard Wheaton

Any Correspondence regarding this shipment, please refer to our Order # 267618

WYO-BEN, INC.

CERTIFICATE OF ANALYSIS

DATE: 11/05/10

TO: H & H ENVIROMENTAL INC.

SHIP DATE: 11/03/10

PRODUCT: HYDROGEL

LOT NO.: 10251032 10281032 11011032

ORDER NO.: 51060

P.O NO.: 8299-3

TRUCK NO.: PRIME TRANS.-700004

EMAIL: sartman@geocon.com

THE FOLLOWING RESULTS WERE OBTAINED FROM TESTS RUN ON A COMPOSITE SAMPLE TAKEN FROM THE ABOVE LOT.

LOT NUMBER:	10251032	10281032	11011032
600/300 RPM READING	39/29	36/27	38/29
PV/YP	10/19	9/18	9/20
YP/PV RATIO	1.90	2.00	2.22
YIELD	98.0	96.0	97.0
MOISTURE %	7.3	5.9	5.3
MESH % THRU 200 SCREEN	79.2	83.6	73.6
GEL STRENGHTS 10SEC/10MIN	28/44	15/39	19/35
WATER LOSS	12.0	11.4	11.4
pH	9.6	9.2	9.3
WET SCREEN %-200	3.6	2.5	3.6

WE CERTIFY THAT THE TEST RESULTS CONTAINED HEREIN ARE ACCURATE AS REPORTED. THE RESULTS SHOULD BE REPLICATIVE ALLOWING FOR A MARGIN OF TEST PROCEDURE AND OPERATOR ERROR. WE ALSO CERTIFY THAT THE ABOVE PRODUCT DOES MEET OR EXCEED ALL SPECIFICATIONS SET FORTH IN API 13A SECTION 9, SEVENTEENTH EDITION FOR BENTONITE.

WYO-BEN, INC.

Sue Anderson

Sue Anderson
Quality Assurance

STUCCO PLANT
WYOMING OPERATIONS OFFICE
P.O. BOX 1072
GREYBULL, WYOMING 82426 USA

SAGE CREEK PLANT LUCERNE PLANT CORPORATE HEADQUARTERS

Holcim (US) Inc.
300 Prairie Center Drive
Suite 110
Eden Prairie, MN 55344

Phone 952-890-2732
800-562-3989
Fax 952-890-2109
www.holcim.com/us

October 15, 2009

TO: Whom It May Concern

FROM: Joe Clendenen, Technical Service Engineer
Northern Sales Group
Holcim (US) Inc.

RE: CERTIFICATION STATEMENT FOR ST. GENEVIEVE TYPE I/II LA CEMENT

To Whom It May Concern:

This letter is to certify that the Type I/II LA produced by Holcim (US) Inc at the St. Genevieve plant in Bloomsdale, MO meets ASTM C150, AASHTO M 85, IaDOT (PC3202), MnDOT, WisDOT, NDDOT, SDDOT, and NDOR requirements for Type I/II LA portland cement.

Should you have any further questions, please contact your local Holcim (US) Inc. representative.

Sincerely,

Joseph W. Clendenen, EIT
Technical Service Engineer
Holcim (US) Inc.
Joe.clendenen@holcim.com
Cell: 952-334-7887

Version 6.20

Holcim

Material Certification Report

Material: Portland Cement
Type: I, II (C 150)

Test Period: 01-Sep-2009
To: 21-Sep-2009

Certification

This cement meets specifications ASTM C 150 and AASHTO M 85 specifications for Type I and II cement.

General Information

Supplier: Holcim (US) Inc.
Address: 2942 US Highway 61
Bloomsdale, MO 63627
Telephone: 636 524 8155
Date Issued: **21-Sep-2009**

Source Location: Ste. Genevieve Plant
2942 US Highway 61
Bloomsdale, MO 63627
Contact: Erin Watson

The following information is based on average test data during the test period. The data is typical of cement shipped by Holcim; individual shipments may vary.

Tests Data on ASTM Standard Requirements

Chemical			Physical		
Item	Limit[A]	Result	Item	Limit[A]	Result
SiO_2 (%)	-	20.3	Air Content (%)	12 max	6
Al_2O_3 (%)	6.0 max	4.6	Blaine Fineness (m^2/kg)	260 min 430 max	380
Fe_2O_3 (%)	6.0 max	3.2	Average[B] Blaine Fineness (m2/kg)	280 min 420 max	389.40
CaO (%)	-	64.7			
MgO (%)	6.0 max	2.4	Autoclave Expansion (%) (C 151)	0.80 max	0.04
SO_3 (%)	3.0 max	2.9	Compressive Strength MPa (psi):		
Loss on Ignition (%)	3.0 max	2.2			
Insoluble Residue (%)	0.75 max	0.26	3 Day	12.0 (1740) min	31.3 (4515)
CO_2 (%)	-	0.8	7 Day	19.0 (2760) min	37.3 (5410)
Limestone (%)	-	1.9			
$CaCO_3$ In Limestone (%)	-	95	Initial Vicat (minutes)	45-375	78
Potential Compounds:					
C_3S (%)	-	61	Mortar Bar Expansion (%) (C 1038)	-	-
C_2S (%)	-	12			
C_3A (%)	8 max	7	Heat of Hydration: 7 days, kJ/kg (cal/g)[C]	-	356 (85)
C_4AF (%)	-	10			
$C_3S + 4.75C_3A$ (%)	100 max	93.8			

Tests Data on ASTM Optional Requirements

Chemical			Physical		
Item	Limit[A]	Result	Item	Limit[A]	Result
Equavalent Alkalies (%)	0.6	0.45			

Notes

[A] Dashes in the limits columns means Not Applicable

[C] Test results represent most recent value and is provided for information only.
This data may have been reported on previous mill certificates. It is typical of the cement being currently shipped.

Geo-Con

Cement-Bentonite Slurry Wall
Personnel and Equipment Summary
Kingston Ash Recovery Project
Harriman, Roane County, Tennessee

DATE	SUPT.	PROJ. MGR.	QC REP	SSO
	G Warrington	Steve Artman	Amy Robinson Grass	Aaron Handel

GEO-CON PROJECT NUMBER	SHIFT START	SHIFT END
P10-063		

TRADE	NAME	HRS ST	HRS OT	EQUIPMENT	TASK	EQUIPMENT (Cont)	TASK
	Total Hours Today:						
	Total Hours To Date:						

MATERIALS RECEIVED	UNIT	AMT
Bentonite	Ton	
Portland	LBS	
Slag	Ton	

Activity Summary:

Comments

QUALITY CONTROL REPRESENTATIVE	
Amy Robinson Grass- Geo-con/EBC	

Geo-Con

Cement-Bentonite Slurry Wall

Kingston Ash Recovery Project
Harriman, Roane County, Tennessee

Date: _____ **Project Number:** P10-063

Trench Excavation

Wall Type (Inboard, Outboard, Buttress-Shear)	Station	Offset-Wall Centerline to Baseline	Length of Cut	Start Time	Stop Time	Max. Verticality Deviation (Degrees)	Workpad Elevation	Depth (From workpad in Ft)		Slurry Level				
								Top of Key	Bottom of Trench	Average Cubic Yardage Soil	Average Cubic Yardage Rock	Station	Slurry Level Elevation PM Prev. Day (Ft)	Slurry Level Elevation AM Today (Ft)

Bucket Width(ft): _____ GroundwaterElevation: _____

Linear Feet Today: _____ Cubic Yardage Soil Today: _____ Cubic Yardage Rock Today: _____

Linear Feet To Date: _____ Cubic Yardage Soil To Date: _____ Cubic Yardage Rock To Date: _____

CB Samples

Sample ID	Station	Date Taken	Time Taken	Number of Cylinders Taken	Depth	28 Day Date	56 Day Date	Temperature in Cure Room	% Humidity in Cure Room	Comments
					FBGS			°F	%	

Comments: _____

Geo-Con

Cement-Bentonite Slurry Wall

Kingston Ash Recovery Project
Harriman, Roane County, Tennessee

Date: **Project Number:** P10-063

Cement-Bentonite Slurry Quality Control

Batch Plant 1

Time	VISC (MFV)	Density	Temperature	Grout Efflux	pH
	Seconds	PCF	°F	Seconds	

Batch Plant 2

Time	VISC (MFV)	Density	Temperature	Grout Efflux	pH
	Seconds	PCF	°F	S	
N/A					

Batch Plant 1

Pumping to Rig	Number Batches	Bentonite Slurry	Slag	Portland
		GAL	TONS	LBS

Batch Plant 2

Pumping to Rig	Number Batches	Bentonite Slurry	Slag	Portland
		GAL	TONS	LBS
N/A				

Slag Today (TONS): _____
Slag to Date (TONS): _____

Water Today (GAL): _____
Water To Date (GAL): _____

Portland Today (LBS): _____
Portland to Date (LBS): _____

Bentonite Today (TONS): _____
Bentonite To Date (TONS): _____

Mix Proportions	
Slag:	20.0%
Portland:	0.5%
Bentonite:	3.0%

Comments:

Amy Robinson Grass-Geo-Con/EBC

George Warrington Geo-Con/EBC

Kingston Ash Recovery Project (KRP)

Design Basis and Criteria Dredge Cell Closure Kingston Fossil Plant Harriman, Roane County, Tennessee

Revision 3

Stantec Consulting Services Inc.
One Team. Infinite Solutions
1409 North Forbes Road
Lexington, KY 40511-2050
Tel: (859) 422-3000 • Fax: (859) 422-3100
www.stantec.com

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

September 12, 2011

Document Revisions

Document Version	Date	Section	Details of Changes
Rev. 0	10/20/2010	All	Initial issue of document
Rev. 1	4/29/2011	All	Numbered all sub-sections
		Figure	Aerial site view, with key site features identified, moved to become an attachment at the end of the document
		1.1	Added, to provide general description of site, location, history, dredge cell failure, and clean-up operations
		2.2 - 2.3	Minor editing to improve narrative
		3	Removed Table 1, specific material parameters to be documented in the calculation package (see also Section 10)
		3.1.4	Added, describes 5% and 25% outslopes surrounding the capped ash stack
		3.2.1	Added, project elevations referenced to NGVD29 datum
		3.2.2	Changed allowable grade on access roads from 5% to 10% maximum
		3.2.3	Added references to Non-Time Critical Removal Action work plans for the embayment excavation
		4.1.4	Moved discussion of the perimeter berm to Section 7
		4.1	Revised pool and flood elevations to match Watts Bar Lake operations
		4.1	Removed comment regarding stilling pond elevation after decommissioning
		4.2	Added, describes lowering of ash pond for construction of certain project elements
		5.1 – 5.5	Minor editing to improve narrative
		6.2	Added separate item describing containment during a seismic event
		6.4	Added, describes the top elevation of the stabilized perimeter walls when using the slurry trench method
		7	Added section describing perimeter berm
		10	Moved, previously was Section 3
		10.1.2	Added, describes soil properties based on lab and field data, engineering interpretation, and documentation
		10.4.1	Added, defines probabilistic design earthquake event
		11.1 - 11.3	Minor editing to improve narrative
		12.1	Added description of anchorage for edges of FML
		13.1 – 13.4	Minor editing to improve narrative
Rev. 2	7/29/2011	9	Removed discussion of “Capillary Break”

Document Version	Date	Section	Details of Changes
Rev. 3	9/12/2011	2.3	Removed “capillary break” from list of proposed improvements
		5.4	Removed “capillary break”, added comment on groundwater elevations above perimeter stabilization
		9.1.3	Added large scale direct shear testing for cap materials
		9.3	For Veneer Sliding, required factor of safety changed from 1.0 to 1.1 (per Peer Review comment on 90% submittal for RDP-0113-G)
		9.4	Added performance requirements for structural integrity of the soil-cement walls (per TVA Memo No. KIF11-0003, August 31, 2011
		9.4.6	Revised to clarify allowable ash displacements on different sides of the project site (per TVA Memo No. KIF11-0003, August 31, 2011)
		10.2.3	Added reference to Section 3.1.4 for maximum slopes
		12.5	Added requirements for short-term drainage controls during construction (per TVA Memo No. KIF11-0002, August 31, 2011)

Kingston Ash Recovery Project (KRP)
Design Basis and Criteria
Dredge Cell Closure
Kingston Fossil Plant
Harriman, Roane County, Tennessee

1. Purpose

1.1. Tennessee Valley Authority (TVA) owns and operates the Kingston Fossil Plant (KIF) in Roane County, near Harriman, Tennessee. Coal ash produced and captured at the plant over the past five decades has been sluiced as wet slurry to the ash pond complex, located adjacent to the power plant. The accumulated ash was stacked upward for storage within the Dredge Cell, a wet stack within the footprint of the ash pond. On December 22, 2008, about 5.4 million cubic yards of coal ash spilled from the Dredge Cell into the Swan Pond Embayment and the Emory River. TVA is conducting a cleanup of the spilled ash, and closing the former Dredge Cell and adjacent Ash Pond under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. The U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC) are providing regulatory oversight of the cleanup. Ash in the river has been retrieved and transported offsite for disposal. Ash in the embayment is being retrieved and placed in a dry stack embankment within the area of the former Dredge Cell and Ash Pond. See the site overview (from EPA) in the Appendix showing key features of the site prior to closure.

1.2. The purpose of this Design Basis and Criteria document is to establish the design goals, criteria, procedures, and references for the Dredge Cell Closure. This document provides guidance for design factors including stability, site geometry, surface water runoff, groundwater seepage, design elements, and site management during construction. This is a living document that may be amended or revised as the project proceeds

2. Scope

The objective of the closure project is to design a stable ash storage facility meeting stakeholder criteria within approved boundaries.

2.1. Design Basis

2.1.1. Construct dry (unsaturated) ash embankment within approved boundaries.

2.1.2. Construct a stable embankment that will contain retrieved ash under static and seismic loading conditions.

2.1.3. Construct a facility that accommodates predicted stormwater flows.

2.1.4. Control infiltration of precipitation through the final cover.

2.1.5. Meet applicable regulatory closure requirements relative to stability and final cover.

2.1.6. Meet requirements of the approved Action Memorandum including ARARs.

2.2. Design Goals

2.2.1. Additional storage areas, including the ash pond and lateral expansion, will be closed and integrated into the Dredge Cell Closure.

2.2.2. Address the documented, contributing factors to the Dredge Cell failure as identified by AECOM. For design, consider:

- Control height of ash and loading on wet ash and in areas with slimes.
- Construct perimeter containment on good foundation conditions, or mitigate the poor foundation conditions.
- Design to mitigate against creep failure.
- Control rate of construction on sluiced ash and analyze undrained conditions.

2.2.3. Constructability: safe use of construction equipment and processes to complete the project in accordance with project goals.

2.2.4. Conduct phased embankment construction concurrent with perimeter improvements.

2.2.5. Use industry best practices for design:

- TVA Coal Combustion Products Management Program - Master Programmatic Document.
- Tennessee Department of Environment and Conservation (TDEC) Regulations.
- U.S. Army Corps of Engineers Manuals.
- Established engineering methods.
- Independent peer review.

2.2.6. Foster stakeholder buy-in.

2.2.7. Monitor construction and post closure conditions.

2.2.8. Consider existing NPDES permit requirements.

2.3. Proposed Improvements

The proposed improvements involve closure of the Dredge Cell in accordance with applicable TDEC regulations. The proposed improvements for this site address slope stability for static and seismic loading conditions, defined geometric considerations, surface water control, and erosion/sediment control. Specific design items include:

- Compacted, dry (unsaturated) ash embankment.
- Stabilized perimeter containment, including foundation improvements and berm.
- Surface water drainage facilities.
- Site revegetation, final cover, and erosion controls.
- Performance monitoring instrumentation to be installed and monitored during and after closure.
- Perimeter riprap and slope protection next to Watts Bar Reservoir to prevent scour and erosion during flooding and reservoir drawdown.

3. Geometry and Elevations

3.1. Plan and Height Limits

3.1.1. On the northern and eastern perimeters of the site, in areas bounded by Watts Bar Lake, the closed facility will not extend beyond the limits of the previous Dredge Cell and ash pond.

3.1.2. The closed facility will not encroach within 100 feet of the edge of the existing pavement along Swan Pond Road, on the western perimeter of the site.

3.1.3. The closed Dredge Cell, including the final cover, will not exceed an elevation of 790 feet (plus or minus five feet).

3.1.4. The outslopes of the capped ash stack will have approximately 25% surface grades (4H:1V) along the western side of the site (North Dredge Cell, Swan Pond Road, and Ball Field corridors) and approximately 5% surface grades along the eastern side of the site (Lateral Expansion and Ash Pond perimeters). Actual slopes in the final cover will vary to accommodate benches, drainage, and other design features.

3.2. Other Design Criteria

3.2.1. Design elevations will be referenced to the National Geodetic Vertical Datum of 1929 (NGVD29).

3.2.2. An access road having a minimum width of 16 feet will be established around the full perimeter of the closed facility. Surface grade on the access road will not exceed ten percent at any location.

3.2.3. Criteria for excavation in the northwest corner of the Dredge Cell will be consistent with approved Non-Time-Critical Removal Action Work Plans.

3.2.4. Maintain and monitor performance monitoring instrumentation to validate design assumptions.

4. Water Surface Elevations

4.1. The design will assume the following water elevations:

- Watts Bar Lake – Summer Pool Elevation: 741.0 feet
  (normal operating range is 740 to 741 feet)
- Watts Bar Lake – Winter Pool Elevation: 737.0 feet
  (normal operating range is 735 to 737 feet)
- Watts Bar Lake – 100 Year Flood Elevation: 747.1 feet
- Watts Bar Lake – 500 Year Flood Elevation: 748.3 feet
- Ash Pond in Operation During Construction – Pool Elevation: 761 feet
- Stilling Basin in Operation During Construction – Pool Elevation: 755 feet

4.2. Water levels in the Ash Pond and Stilling Basin may be lowered prior to construction of certain project elements. If lowered water levels are assumed, the assumed elevation will be clearly documented in the design.

5. Groundwater Seepage

5.1. Predictions of the long-term ground water levels within the closed facility will be included in the design analyses. The predictions will only consider the potential infiltration in the capped condition. The long term phreatic surface outside the Dredge Cell limits should be modeled on the basis of the existing groundline or available hydrogeological data.

5.2. The facility will be an unlined facility. Regulations (TDEC Division of Solid Waste Management Chapter 1200-01-07, Rule 1200-01-07.04) that require less percolation through the cover than through the liner do not apply.

5.3. Groundwater from within the facility will not be collected and/or discharged at specified design points (no point discharges). Design of the top elevation of Perimeter Wall Stabilization (PWS) will be based on the "Best Estimate" of the long term groundwater elevation.

5.4. The impact of elevated groundwater levels within the closed ash facility will be evaluated. Groundwater elevations at or above the perimeter stabilization will be evaluated for compliance with the design criteria.

5.5. Long-term monitoring of groundwater levels will be included with the closure plan, to allow the assessment of water levels in comparison to the maximum acceptable limits.

6. Stabilized Perimeter

6.1. Ash will be placed in a facility that is fully enclosed (in plan) with a stabilized perimeter. The foundation soils will be stabilized, treated, or otherwise improved so the

perimeter will support the lateral pressure of the facility and achieve the required performance for static and dynamic conditions.

6.2. The stabilized perimeter will be designed to contain the stacked material during a seismic event.

6.3. The stabilization process may reduce the hydraulic conductivity of various foundation layers, but the stabilized perimeter will not be designed for groundwater retention.

6.4. To facilitate construction by the slurry trench method, the top elevation of the stabilized perimeter walls will be at least 5 feet above the groundwater elevation expected at the time of construction in that area of the project site.

7. Perimeter Berm

7.1. Ash within the closed Dredge Cell will be contained within a perimeter berm constructed of structural fill materials that meet the stability objectives.

7.2. The perimeter berm will have a crest that is no lower than an elevation of 765 feet around the perimeter.

7.3. The height of the perimeter berm will be 5 feet or greater, to allow for needed tie-in with the final cover system.

7.4. Riprap and slope protection on the perimeter segments that are next to Watts Bar Reservoir will extend to an elevation that is above the 100-year flood elevation.

8. Compaction of Ash Fill

8.1. Recovered ash to be placed inside the Dredge Cell will be compacted in conformance with engineering controls. The material will be placed within specified ranges of water content in an unsaturated condition.

8.2. In some areas of the ash pond, ash may be sluiced to fill submerged areas. After a ground surface above water is established, additional fill in these areas will be compacted.

9. Static and Dynamic Slope Stability

9.1. Slope Stability

9.1.1. Stability analyses of the closure design will be performed using established methods of engineering analysis.

9.1.2. Appropriate soil unit weights and strength parameters will be established on the basis of available laboratory data, field data, and engineering interpretation. The properties selected and used in the slope stability analyses will be documented in the design calculation package.

9.1.3 Large scale direct shear testing shall be performed on cap materials and the results compared to minimum interface friction angle requirements for veneer stability.

9.2. Stability During Construction

The following factors of safety against slope stability will be maintained during construction:

- Drained Stability (FS_d) $FS_d \geq 1.5$
- Undrained Stability (FS_u) $FS_u \geq 1.3$
- Undrained Stability after Next Lift (FS_{ul}) $FS_{ul} \geq 1.5$

The criterion for FS_{ul} applies only to potential failures through saturated fly ash. The stability of the embankment during construction will be verified through monitoring, instrumentation, and engineering evaluation.

9.3. Stability Following Construction

The following factors of safety against static slope stability will be maintained in the long-term, following project completion:

- Drained Stability (FS_d) $FS_d \geq 1.5$
- Veneer Sliding (FS_v) $FS_v \geq 1.1$

9.4. Seismic Stability

9.4.1. The design earthquake event will be defined probabilistically on the basis of a site-specific seismic hazards study.

9.4.2. The design earthquake event will correspond to a 10% probability of exceedance in 250 years (recurrence interval = 2,373 years) per Section 1.4.2.2.1 of the TVA Coal Combustion Products Management Program Master Programmatic Document.

9.4.3. The facility will be designed to meet the criteria for stability after the occurrence of only one design earthquake event.

9.4.4. The post-earthquake factor of safety for slope and foundation stability will be greater than unity (1.0).

9.4.5 Where the perimeter foundation is stabilized with soil-cement walls, the walls will be evaluated for structural integrity with regard to the following:

- For all perimeter segments, 100% of the wall elements will have a factor of safety greater than or equal to 1.0.
- For perimeter segments bordering Swan Pond Road, 90% of the wall elements will also have a factor of safety greater than or equal to 1.2.
- For perimeter segments bordering Watts Bar Lake, 90% of the wall elements will also have a factor of safety greater than or equal to 1.5.

9.4.6 Following the design seismic event, ash from the closed facility will not displace beyond the established boundary with Watts Bar Lake, will not displace onto Swan Pond Road, and will not otherwise displace outside of TVA property. Deformations that do not exceed these limits will be considered acceptable.

9.5. Liquefaction Assessment

9.5.1. For soils susceptible to classical liquefaction:

- $FS_{liq} \leq 1.1$ Assume layer liquefies under design event
- $1.1 < FS_{liq} \leq 1.4$ Assume partial liquefaction and strength loss in layer
- $FS_{liq} > 1.4$ Assume no liquefaction

9.5.2. For soils susceptible to cyclic softening:

- $FS_{cs} \leq 1.4$ Assume cyclic softening occurs as a result of design event
- $FS_{cs} > 1.4$ Assume no cyclic softening occurs

10. Final Cover

10.1. General Performance

Per TDEC Division of Solid Waste Management Chapter 1200-01-07 (Rule 1200-01-07.04), the final cover will be designed to:

- provide long-term control of infiltration for the closed facility,
- function with minimum maintenance,
- promote positive surface drainage, and
- accommodate settling and subsidence so that the cap's integrity is maintained.

10.2. Cap Requirements

10.2.1. A total of 36 inches of soil are required, of which a minimum of 12 inches will be for the support of vegetative cover. This cap will include a compacted soil layer of at least 24 inches which has a permeability no greater than 1×10^{-7} cm/sec.

10.2.2. Per Section 1.3.4.2 of the TVA Coal Combustion Products Management Program Master Programmatic Document, and TDEC regulations, an alternate cap system may be considered, if clay materials are unavailable or difficult to obtain. The alternate system should consist of the following layers: vegetative cover soil of 24 inches, a drainage layer, and a geomembrane liner (flexible membrane liner, or FML).

10.2.3. The slope of all cap system layers should not exceed 3 Horizontal to 1 Vertical (3H:1V) or the maximum slopes noted in Section 3.1.4 of this document, whichever is more conservative.

10.2.4. Final slopes will be based on stability analyses. The cap system and final cover should not be constructed until after perimeter containment for that segment has been constructed.

10.3. Erosion Protection

10.3.1. Run-on from adjacent areas should be controlled and diverted around the subject area.

10.3.2. Run-off from the landfilled area should be collected in a manner that controls erosive forces. This can be accomplished by:

- Controlling erosion of cover material (e.g., no steep slopes).
- Controlling drainage of precipitation falling on the disposal facility or disposal facility parcel (e.g., prevent pooling).
- Providing a surface drainage system which is consistent with the surrounding area and does not adversely affect drainage from these adjacent lands.
- Establish a protective vegetative cover of acceptable grasses over disturbed areas of the site.

10.3.3. In general, requirements of TDEC Division of Solid Waste Rule 1200-01-07.04 will be met or exceeded for design and the site wide Stormwater Management Plan (SWMP) will be followed.

11. FML Anchor Trench (if applicable)

11.1. Per Section 1.4.5 of the TVA Coal Combustion Products Management Program Master Programmatic Document, anchorage will be provided for the edges of a Flexible Membrane Liner (FML) system, if used.

11.2. Anchorage will be designed for a worst-case, temporary scenario occurring during construction.

11.3. Anchor trench design should be in general accordance with the methodology given in Qian, Koerner, and Gray (2002).

11.4. A minimal anchor trench or combination runout section and anchor trench should be specified in the facility design.

12. Stormwater Management

12.1. Requirements

Per TDEC Division of Solid Waste Management Chapter 1200-01-07 (Rule 1200-01-07.04), the following are required:

- A run-on control system for all flow up to and including peak discharge from a 24-hour, 25-year storm.

- A run-off management system to collect and control at least the peak flow volume resulting from a 24-hour, 25-year storm.

- Holding facilities (e.g., sediment basins) designed to detain at least the water volume resulting from a 24 hour, 25 year storm and to divert through emergency spillways at least the peak flow resulting from a 24-hour, 100-year storm.

- Collection and holding facilities must be emptied after storms to maintain design capacity of the system.

- Other erosion control measures (e.g., temporary mulching or seeding, silt barriers) as necessary to control erosion of the site.

12.2. Cap System Erosion Control

Per Section 1.6.1 of the TVA Coal Combustion Products Management Program Master Programmatic Document, the Revised Universal Soil Loss Equation (RUSLE) will be used to predict maximum soil loss from the final cap system.

12.3. Erosion Control During Construction

12.3.1. Per Section 1.6.1 of the TVA Coal Combustion Products Management Program Master Programmatic Document, sediment and erosion control Best Management Practices (BMPs) will be provided during all construction activities, and to manage sediment from the facility area and stockpiles during operations. For the Kingston site, a site specific Stormwater Management Plan (SWMP) has been prepared and will be referenced in the design documents.

12.3.2. Surface water calculations will be prepared using the Soil Conservation Service (SCS) method (previously the USDA Soil Conservation Service, now the Natural Resources Conservation Service (NRCS)).

12.3.3. All surface water drainage structures, including channels, culverts, and benches on the facility cap system will be designed to carry expected flows based on the 24-hour, 25-year storm event for the particular region.

12.3.4. The following additional design elements will be considered during the design of the surface water system:

- Velocity of the surface water flow.

- The dimensions and slope of the surface water drainage structure energy dissipation devices.

- The use of non-mechanical gravity-flow surface water conveyance structures is most desirable and recommended.

12.4. Assumptions

12.4.1. Rainfall data used for design purposes will be obtained from National Oceanic and Atmospheric Administration (NOAA)-14 and Natural Resources Conservation Service (NRCS) publications.

12.4.2. SEDCAD (Sediment, Erosion, Discharge by Computer Aided Design) will be utilized to design and evaluate the surface water, erosion and sediment control systems.

12.4.3. Technical Release 55 (TR-55) methods will be utilized to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for the watershed.

12.4.4. Runoff from the Dredge Cell prior to closure will be routed to permitted NPDES discharge points.

12.4.5. Runoff from the closed cover of the facility may be discharged directly offsite at multiple locations.

12.5 Short Term Drainage Controls During Construction

12.5.1 Short Term Drainage Controls, defined as temporary drainage structures expected to be in place for 6 months or less, may be exempted from the above requirements on a case by case basis if such waiver is approved by TVA CCP Engineering and if performed in accordance with the EPA- and TDEC-approved SWMP.

13. Filter or Separation Criteria (if applicable)

13.1. Granular Filter Criteria

Granular filter design must meet the criteria as established in the USACE Manual EM 1110-2-2300, Appendix B, dated July 30, 2004.

13.2. Geotextile Design by Specification

The Geotextile must satisfy the American Association of State Highway and Transportation Officials (AASHTO) requirements established in the AASHTO M288 specifications.

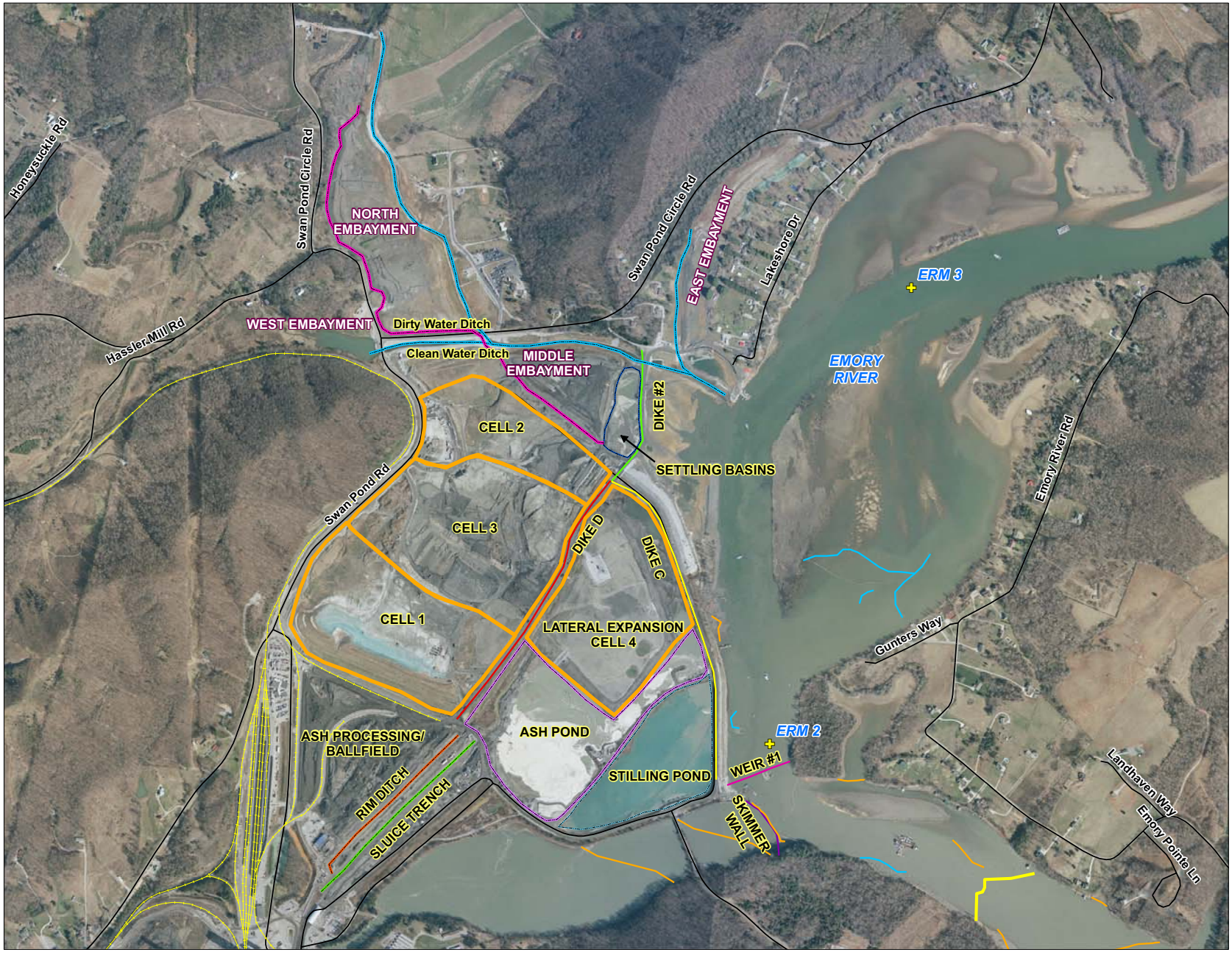
13.3. Filter Cover and Protection

13.3.1. Adequate cover materials will be placed over filter before allowing transit of heavy equipment. Manufacturer's recommendations for geotextile protection will be followed.

13.3.2. Geotextile will be protected from ultraviolet degradation as per the manufacturer's recommendations.

Appendix

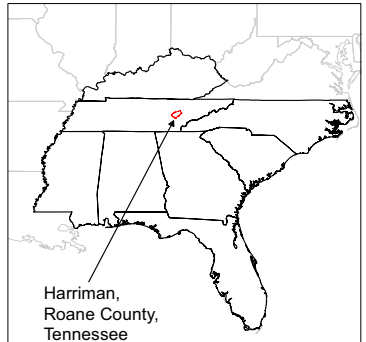
Site Overview with Identification of Key Features



Legend

- RiverMiles
- Dirty Water Ditch
- Railroads
- Sluice Trench
- Rim Ditch
- Clean Water Ditch
- Weir 1
- Skimmer Wall
- Ash Settling Pond
- Cells
- Dike D
- Dike C
- Dike 2
- Settling Basins
- Stilling Ponds
- Roads
- Booms
- Closure Booms
- Turbidity Curtains

0 500 1,000 2,000
Feet



United States Environmental Protection Agency

TVA KINGSTON FOSSIL PLANT
HARRIMAN, ROANE COUNTY, TENNESSEE
TDD No. TNA-05-001-0079

EE/CA OPERATIONS
MARCH 19, 2010

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