

**Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant**

Documents submitted:

RDP- 0114-C Lateral Expansion Closure (90% submittal)

Date Submitted:

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Stantec



DRAFT

Quality Control Plan

Lateral Expansion (Cell 4)
Closure
Kingston Fossil Plant
Harriman, Roane County,
Tennessee

Document Control Number
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ISSUED FOR REVIEW 90%

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Prepared for:
Tennessee Valley Authority
Kingston, Tennessee

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Quality Control Plan
90% Lateral Expansion (Cell 4) Closure
Kingston Fossil Plant
Harriman, Roane County, Tennessee

1. Purpose and Scope

This document is a site specific Quality Control (QC) Plan that addresses construction and monitoring in association with the Lateral Expansion (Cell 4) Closure. 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.

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.

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 the Tennessee Valley Authority (TVA). TVA 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.

TVA 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. TVA 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 TVA has entered into an agreement to construct the Lateral Expansion (Cell 4) Closure 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 Installer

The INSTALLER will be the entity with which TVA has contracted to furnish and install Flexible Membrane Liner (FML), geocomposite drainage media and geotextile. The INSTALLER is responsible for field testing of liner seams, supplying liner layout diagrams, geocomposite submittals and other activities described in Sections 02373, 02621 and 02700 of the Technical Specifications and as noted in this QC Plan.

3. Quality Control Activities

3.1. Meetings

Meetings shall be coordinated and conducted 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 TVA 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 and INSTALLER Submittals

CONTRACTOR and INSTALLER submittals shall be submitted to TVA procurement and distributed to the QC Manager and Construction Manager unless otherwise directed by TVA. 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. The exceptions to this are activities performed by the INSTALLER. 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 TVA copied) on a daily basis.

4. Embankment

4.1. General

Lifts shall be placed to the maximum horizontal extent practicable to allow pore water dissipation. The daily rate of placement within discrete (or localized) areas shall not exceed two feet per day in areas of ash subgrade or foundation unless otherwise approved by the QC Manager based on response of the material and monitoring of geotechnical instrumentation. Grading shall conform to the lines and grades shown in the accompanying Drawings.

Embankment materials include ash, soils, coarse aggregates, No. 10 Product and riprap. Embankment items include the Cap, ash infill, and the Inner Berm.

4.2. Placement

The sequence of filling shall commence at the lowest section (in elevation) of the subject footprint and proceed upward in specified lifts in a manner to maintain positive drainage at all times. Lift thicknesses for the various materials by application are stated in Section 02300 of the Technical Specifications. Positive drainage shall be maintained on all fill surfaces. The fill sequence shall also be performed in a manner that reduces the potential for uncontrolled sediment runoff and adequately controls runoff from the embankment area. Fill placement shall be performed uniformly and result in slopes no steeper than the design grades.

4.3. Compaction

Each embankment lift shall be compacted with an appropriate roller or rubber tired equipment or tracked in place as approved by the QC Manager for the subject material. Ash 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 constructability issues, field observations and testing.

Soils used for Inner Berm construction shall be compacted to a minimum of 95 percent of standard Proctor maximum dry density at a moisture content within minus two percent and plus two percent of optimum.

The final cap layer shall be compacted by thorough tracking of the entire surface with low ground pressure (6 psi or less) dozers. Under no conditions shall dozers (other than low ground pressure dozers) or other equipment traverse areas of liner and geocomposite placement without the 20-inch layer and topsoil cover in place. The 20-inch layer may be placed in two lifts; however the initial lift shall be a minimum of 12-inches. The final thickness of soil materials shall be no less than 24-inches.

Following initial compaction, the surface of embankment other than cap materials may be sealed with a smooth drum roller to reduce the potential for surface water infiltration. Prior to placement of subsequent lifts the sealed surface shall be lightly scarified to promote lift bonding.

Although material compaction will be confirmed visually by the QC Team based on the response of materials to loaded equipment, field conformance testing shall also be performed and include periodic in-place density and device calibration testing to provide documentation of the compaction operations at the prescribed intervals indicated in the attached testing schedule or as established by the QC Manager. Device calibration/confirmation testing shall consist of in-situ density tests performed at intervals as established by the QC Manager.

4.4. QC Requirements

Embankment placement and compaction methods shall be monitored by the QC Team to assess conformance with program requirements.

Evaluation criteria shall include overall compaction results. Appropriate modifications to embankment placement and compaction methodology shall be developed by the QC Manager if compacted materials do not meet program requirements.

The rate of embankment construction shall be measured by the QC Team every 24-hour period in which work has been performed as well as for a weekly total. Measurement methods shall be as approved by the QC Manager.

Field conformance testing shall include periodic in-place density and device calibration testing to provide documentation of the compaction operations at prescribed intervals as directed by the QC Manager. Moisture testing will include both nuclear density readings and laboratory moistures. Samples may be taken at depth if the QC Manager suspects saturation of the subgrade.

Embankment platform QC requirements shall conform to Section 4.3 of the “Quality Control Plan for Earthwork Construction for Perimeter Containment – North Wall Segment 8 – Sta. C401+30 to Sta. 408+42.30”.

Samples of the FML, Ash, Geocomposite, and Cap soil shall be provided by the CONTACTOR/INSTALLER and sent by the QC Manager to a certified laboratory for large scale direct shear testing to determine the composite strength envelope (combination of internal friction angle and cohesion/adhesion) for the respective components. The QC Manager will compare the results of large-scale direct shear testing of all critical interfaces to the minimum strength requirements established in the engineering calculations. If insufficient resistance to sliding occurs due to low interface angles then changes to the Cap materials shall be required until an adequate Factor of Safety is achieved.

5. Non-Woven Geotextile Filter Fabric

5.1. General

Geotextile materials shall be unloaded and stored by the INSTALLER in accordance with manufacturer recommendations. The INSTALLER shall provide to the QC Manager a copy of receipts from incoming delivery of geotextile. This can be performed by forwarding receipts from TVA procurement or during unloading of material shipments. Geotextile shall conform to the requirements in Section 02373 of the Technical Specifications and as outlined below.

The following items shall be documented by the QC Team to verify compliance with the Technical Specifications and manufacturer recommendations:

- a. Geotextile shall be a 16-ounce weight, non-woven, polyester or polypropylene fabric.
- b. Geotextile shall be protected from direct sunlight, ultraviolet rays, temperature greater than 140 degrees Fahrenheit, mud, dirt, dust and debris. During storage, geotextile filter fabric shall be wrapped in a heavy duty protective covering.
- c. Installation shall be in accordance with manufacturer recommendations.
- d. Surfaces to receive geotextile shall be prepared to a relatively smooth condition, free of obstructions, depressions and debris.
- e. Geotextile shall be placed with the long dimension parallel with the centerline of ditches and roads, and/or parallel to embankment slopes, as applicable. Geotextile shall be laid smooth, and free of tension, stress, folds, wrinkles or creases. Perpendicular seams shall be avoided.
- f. Geotextile shall be covered with designated materials within 15 days of deployment to protect the geotextile from ultraviolet degradation.
- g. Geotextile that is welded or sewn shall be overlapped one foot. Otherwise, geotextile shall be overlapped a minimum of two feet. Care shall be taken during riprap placement to avoid displacement/damage of geotextile.

5.2. QC Requirements

QC requirements are as follows:

- a. Prior to delivery, manufacturer and supplier certifications shall be submitted by the INSTALLER 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 and procedures shall be performed as shown in the testing schedule.
- c. Construction monitoring and field acceptance of geotextile installation shall be documented by the QC Team. Laps and seams shall be visually inspected for conformance.

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. Record 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 infill;
- As-needed to provide support to QC activities;
- Inner Berm and stake-out data;
- Top of Ash Stacking or Infill;
- FML panel locations, and extents;
- Location of cap drain pipes and geocomposite;
- Location and inverts of ditches and drainage structures; and

- Cross sections on 100 foot centers on the project baseline of each work item noted above with maximum survey point incremental distance of 50 feet or any break in grade.

7.2. Quality Control Requirements

- a. All survey activities shall be performed under the direction of a Tennessee licensed Land Surveyor or Professional Engineer.
- b. 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.
- c. The QC Manager will develop as-built Drawings from the provided data.

8. TDOT Machined Riprap

Riprap materials utilized for construction shall conform to the requirements in Section 709.03 of the TDOT "Standard Specifications for Road and Bridge Construction." Riprap sizes specified for construction include TDOT Class A-1 and A-3 Machined Riprap. Prior to delivery, supplier certification shall be submitted to the QC Manager that all materials meet or exceed the minimum established properties.

9. TDOT No. 10 Screening Product

TDOT No. 10 screening product used for construction shall conform to the gradation noted in Section 02300 of the Technical Specifications except that 12 percent or less shall pass the number 200 sieve and shall meet the physical and chemical requirements of Section 709 of the Tennessee Department of Transportation "Standard Specifications for Road and Bridge Construction" latest edition. Prior to delivery, the gradation of the No. 10 screening product and supplier certification shall be submitted to the TVA that all materials meet or exceed the minimum established properties.

10. TDOT Aggregate

Aggregate for use in construction shall consist of quarry stone meeting the requirements of Section 903 of the Tennessee Department of Transportation "Standard Specifications for Road and Bridge Construction" latest edition. Prior to delivery, the gradation of the aggregate and supplier certification shall be submitted to the TVA that all materials meet or exceed the minimum established properties.

11. Flexible Membrane Liner

11.1. General

The FML system consists of a 40 mil thickness, textured, linear low density polyethylene geomembrane conforming to the current requirements of the Geosynthetic Research Institute GM17 specification. A minimum of four weeks prior to the anticipated placement of FML material, the INSTALLER shall submit samples of the FML for large scale direct shear

testing. The QC Manager shall be responsible for arranging the large scale direct shear testing of supplied manufactured products.

11.2. Placement

A signed approval in writing by the FML installation foreman (INSTALLER) is required prior to any installation of FML. The signed approval by the FML installation foreman shall be included in the project documentation. Prior to the placement of FML, the finished surface of the subgrade shall be rolled with a smooth drum roller and the surface approved by the QC Manager. Installation and placement of FML panels shall be in accordance with Manufacturer recommendations and the Technical Specifications.

11.3. QC Requirements

The QC Manager shall record daily observations relative to the condition of FML rolls delivered to the site, FML panel sampling locations, FML seam and repair operations, and general FML placement operations. Observations also include attachments to pipe penetrations and instruments. These observations shall be compiled with the project records.

Laboratory quality control testing of the FML will include destructive and non-destructive tests of samples in accordance with the bottom liner specifications and manufacturer recommendations. The frequency of FML sampling/testing shall be as shown in the testing schedule or stated in Section 02700 of the Technical Specifications.

11.4. Protection

The installed FML shall be protected from damage during construction and general operations. Under no condition shall vehicles or heavy equipment traverse lined areas without the geocomposite media and two feet of cap material in place. It shall be the CONTACTOR's responsibility to place sufficient materials along equipment traverse points or haul routes over the cap to prevent rutting (greater than 3-inches) or pumping of the cap. If rutting or pumping is noted, then the CONTRACTOR shall place additional cover material until the rutting and pumping is eliminated.

The QC Manager can require removal of cover by the CONTRACTOR in order to review the condition of the FML if rutting exceeds three inches.

12. Geocomposite Drainage Media

12.1. Pre-Construction

A minimum of four weeks prior to the anticipated placement of geocomposite drainage material, the INSTALLER shall submit the following information to the QC Manager:

- Copy of the manufacturer quality control program and initial reports of tests conducted by the manufacturer on project designated production runs to verify the quality of the geocomposite is in conformance with all requirements of the Contract Documents.
- Geosynthetic Laboratory qualifications as determined by TVA and the QC Manager.

- Geocomposite samples provided for use in large scale direct shear testing as described in Section 4.4 of the QC Plan.

A minimum of one week prior to the anticipated shipment of materials, the INSTALLER must submit the following information to the QC Manager:

- Origin and production date of the resin and geotextile.
- Roll numbers and identification numbers.
- Quality control certificates that provide reference to the roll numbers, identification numbers, sampling procedures, test methods and conformance test results, which must include those tests listed in Section 02621 of the Technical Specifications unless modifications are approved in writing by the QC Manager.
- Unless otherwise specified, the quality control tests must be conducted at the frequency of one per lot or a minimum of one per 200,000 square feet of delivered material, whichever is more frequent. One lot is defined as a group of consecutively numbered rolls or panels from the same manufacturing lines. The frequency of testing and test methods shall be evaluated at the time of construction. A change in test method or frequency shall be in accordance with Industry Standards and as approved by the QC Manager.

The INSTALLER shall be responsible for loading, unloading, storing and furnishing the geocomposite material. Upon delivery to the site, and daily during installation, the QC Manager shall inspect the physical condition of each roll of material. If the protective wrapping is damaged, or if damage to the roll is suspected by the QC Manager, then the roll shall be separated from the lot for more detailed inspection.

12.2. Construction

The INSTALLER shall inspect and certify in writing that the surface upon which the geocomposite is to be installed is acceptable. The statement shall be submitted to the QC Manager prior to initiating the placement of any geocomposite drainage materials.

The QC MANAGER shall be provided representative conformance samples for testing if deemed necessary.

The INSTALLER and the QC MANAGER, or their representative, shall visually observe all panels after they have been deployed in final position. Observations also include attachments to pipe penetrations and instruments. The INSTALLER and the QC Manager, or their representative, shall verify that proper seaming protocols are followed.

12.3. Post-Construction

The INSTALLER shall submit complete records on all repairs, overlap locations, and panel placement.

The INSTALLER shall prepare record drawings indicating the location of all field panels, sample locations, penetrations patches and repairs. The QC Manager and INSTALLER shall certify the record drawings.

13. Piping

13.1. Pipe

Applications on the project include the following materials:

- Pipe used for cap drainage shall be manufactured from smooth interior high density polyethylene.
- Flowable fill shall conform to the requirements of Sections 02365 and 03100 of the Specifications.
- Pipe for Stormwater application (30" and 42" dia.) includes smooth interior corrugated pipe as described in Section 02365 of the Technical Specifications and the SDR pressure pipe (at road crossings) as described in Section 02600 of the Technical Specifications.

Pipes include both perforated and non-perforated pipes with soil tight couplings, water tight pipes for the storm water system, and fusion pipe at road crossings.

13.2. QC Requirements

Contractor submittals shall include shop drawings and material samples provided to the QC Manager. Pipe suppliers shall submit certified material specifications, delivery tickets and all other available documentation to show that the supplied material meets the project specifications.

QC Manager/QC Team shall document pipe installation including pipe joints, flowable fill backfill, lines and grades and visual observation of placement in accordance with the specifications and drawings. The Contractor shall obtain samples of the flowable fill concrete for QC testing at the rate of one sample per day, or one sample per 50 cubic yards placed, whichever is more frequent. The QC Manager, or their representative, shall be provided conformance sample(s) for testing if deemed necessary. The Contractor shall provide copies of the results of the QC testing performed. Sampling and testing of cast in place concrete shall be in accordance with ASTM C39 and C150.

14. Precast Concrete Structures

14.1. General

Precast concrete structures and related components shall meet all requirements of applicable TDOT and ASTM specifications. Modifications to these standards as required on the project shall be included within shop drawings submitted to the QC Manager for review and approval.

Articulated Block Mats shall meet the requirements of Section 02410 of the Specifications.

14.2. QC Requirements

Submittals shall be reviewed and approved by the QC Manager. The QC Team shall observe all precast structures and Articulated Block Mats upon delivery. Any structures showing signs of shipment damage or non-conformance to design or project specifications shall be replaced by the Contractor. The QC Team shall observe the subgrade and backfill methods for all critical drainage structures and installation of Articulated Block mats.

15. Cast in place Concrete Structures

15.1. Pre-Construction

The Contractor shall submit written reports of the proposed design mix for cast in place concrete to the QC Manager at least four weeks prior to the delivery of any materials.

15.2. Construction

The Contractor shall obtain samples of the cast in place concrete for QC testing at the rate of one sample per day, or one sample per 50 cubic yards placed, whichever is more frequent. The QC Manager, or their representative, shall be provided conformance sample(s) for testing if deemed necessary. The Contractor shall provide copies of the results of the QC testing performed. Sampling and testing of cast in place concrete shall be in accordance with ASTM C39 and C150.

The QC Manager shall visually observe all cast in place concrete placement operations to verify compliance with requirements of the Contract Documents. This includes re-bar placement, embedments and use of sealants.

15.3. Post-Construction

No testing required.

16. Cap Soil

16.1. General

The 20-inch layer of the cap soil component for the facility shall classify as CL, CH, ML-CL, or MH or SM according to the Unified Soil Classification System. The soil shall have a maximum rock size of three -inches. The top four inches of the cap shall consist of topsoil or topsoil like material with a maximum rock size of three-inches.

16.2. QC Requirements

Samples of this material shall be submitted for engineering properties and fertilizer/lime application rates. Conformance testing requirements are outlined in the Testing Schedule. Materials placement shall be observed by the QC Manager or representative for lift thickness, maximum particle size and linear passes of equipment.

17. Instrumentation

17.1. General

Instrumentation monitoring has been established for the Lateral Expansion (Cell 4) Closure project embankment area to monitor the embankment slopes and the underlying foundation materials. Instrumentation for geotechnical monitoring shall be installed, extended or abandoned according to the attached Plan and Detail Sheets. Abandonment shall occur prior to FML installation. The instrumentation program includes the prescribed use of the instrumentation and the specific monitoring of these devices as further detailed below. T-posts and orange safety fence or other protective barriers or high visibility measures approved by the QC Manager shall be installed by the CONTRACTOR around instrumentation.

17.2. Types

- a. Piezometers shall be installed or extended and monitored to characterize the increase and dissipation of pore pressures within the existing ash and native foundation soils-layers due to embankment loading.
- b. Slope inclinometers shall be installed or extended and used to measure lateral displacements within the embankment and foundation materials due to loading. The inclinometers shall be anchored a minimum of 10 feet into bedrock.
- c. Settlement plates shall be utilized to measure the vertical deformation of the foundation soils due to embankment loading.

If any instruments are damaged during construction, they shall be repaired/replaced as directed by the QC Manager.

17.3. Measurements

Baseline data shall be confirmed prior to embankment loading. Piezometers, inclinometers and settlement plates shall be measured once a day in active areas and weekly elsewhere, unless directed otherwise by the QC Manager. The rate of embankment construction shall be monitored by the QC Manager as part of the overall program objectives. Measured instrumentation responses shall be reviewed and evaluated by the QC Manager.

17.4. Thresholds

Embankment loading models have been analyzed which take into account the existing subsurface conditions and the proposed embankment heights. The following threshold limits shall be used for the stacking embankment.

- a. Piezometers – Embankment filling may continue, with regular monitoring frequency, as long as the ratio of excess pore pressure to the applied embankment load is 10 percent or below. When the excess pore pressure ratio within **native foundation soil layers** ranges from 10 to 15 percent, embankment filling may continue, but with an increase in instrumentation monitoring specified by the QC Manager. All fill placements shall stop immediately when the excess pore pressure ratio is above the 15 percent level

within **native foundation soil layers**. Embankment filling shall stop immediately when the excess pore pressure ratio is above the 10 percent level within **wet (foundation) ash layers**. All excess pore pressure measurements shall be evaluated from baseline data values.

- b. Slope Inclinometers and Settlement Plates – Embankment filling may continue with regular monitoring frequency, as long as the displacement ratio of lateral inclinometer movement to vertical settlement plate movement is 20 percent or below. When the displacement ratio ranges from 20 to 30 percent, embankment filling may continue, but with an increase in instrumentation monitoring specified by the QC Manager. All fill placements shall stop immediately when the displacement ratio is above the 30 percent level.

Following a stoppage, embankment filling in affected areas may resume based on the discretion of the QC Manager and engineering considerations on embankment stability. It should be noted that embankment loading may be restricted and/or modified at the discretion of the QC Manager based on other potentially unstable conditions not outlined herein.

18. Project Documentation

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

- Daily construction field reports;
- Observation reports (including instrumentation measurements);
- CONTRACTOR submittals and INSTALLER submittals;
- Material conformance data;
- Photographic documentation in accordance with site SOP;
- Survey data;
- Record Drawings;
- FML and Geocomposite Panel Layouts;
- Field Test results from FML installation;
- Concrete test reports;
- Weekly summary reports for regulatory submittal; including construction issues and their resolution;
- Plan modifications; and
- Meeting minutes.

Lateral Expansion (Cell 4) Closure
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
Ash Fill Stacking Operations				
Ash Fill	Nuclear Density and Moisture	ASTM	Minimum 90% standard Proctor and -4% to +6% optimum moisture	5 tests / acre / lift
	Calibration	ASTM	Drive Tube / Shelby Tube	Random
	Classification and Proctor	ASTM	Varies to be approved by QC Manager	1 / 50,000 CY loose volume
Rate of Embankment Construction	Height in Feet		Measured	Daily/Weekly/Monthly
Non-Woven Geotextile Filter Fabric	Project Requirements	ASTM	Table 1 Section 02373 Technical Specifications (TS)	1/ manufacturer / year visual
Instrumentation				
Readings	Measurements		Observations	Daily in active areas/Weekly elsewhere
Abandonment	TVA Protocols		Manufacturer's Recommendations	Prior to liner installation
Extensions	TVA Protocols		Manufacturer's Recommendations	
Installations	TVA Protocols		Manufacturer's Recommendations	
Flexible Membrane Liner	Project Requirements	per GRI 17	Table 2 TS Section 02700	Section 02700
	Shear Interface	ASTM D5321	Project Requirements	1 / manufacturer / year
Destructive Testing	Project Requirements	ASTM D5641 ASTM D5820	pass	1 / 500 lineal feet of seam length
Non-Destructive Testing	Project Requirements	ASTM D5641 ASTM D5820	pass	Each seam

Geocomposite Drainage Media	Project Requirements Shear Interface	ASTM ASTM D5321	Table1 TS Section 02621 Project Requirements	Varies per test 1 / manufacturer / year
Embankment				
Ash Fill	Nuclear Density and Moisture	ASTM	Minimum 90% standard Proctor and -4% to +6% optimum moisture (subject to constructability)	5 tests / acre / lift
	Classification and Proctor	ASTM	Varies to be approved by QC Manager	1 / 50,000 CY
Soil Embankment	Nuclear Density and Moisture	ASTM	Minimum 95% standard Proctor and -2% to +2% optimum moisture	5 tests / acre / lift
	Classification and Proctor	ASTM	Project Requirements	1 / 10,000 CY
Cap Soils	Classification	ASTM	Project Requirements	1 / 25,000 CY
No. 10 Screening Product	Gradation	ASTM	Project Requirements	1/5,000 tons delivered
Coarse Aggregate	Gradation	ASTM	Project Requirements	1 / 30,000 tons delivered
Erosion Control and Stabilization				
Site Inspections and Evaluations	Project Requirements		Site Wide SWMP	Bi-Weekly inspections
Erosion Control Mats	Shear	ASTM	2 lbs/square foot	1/manufacturer/year
HDPE Pipe	Project Requirements	Varies	Certification	1/ manufacturer / year
Concrete/Flowable Fill	Project Requirements	ASTM	Project Requirements	1/50CY
Articulated Block Mats	Project Requirements	ASTM	TS Section 02410	1/manufacturer/year
Synthetic Turf Reinforcement Mat	Shear Velocity	ASTM	7 lbs/square foot 14 feet per second	1/manufacturer/year

Vegetation	Project Requirements	Visual	80% coverage	end of 2nd season
Thresholds	Pore Pressure Ratios Displacement Ratio	Measurement Measurement	Project Requirements Project Requirements	Daily in active areas/Weekly elsewhere Daily in active areas/Weekly elsewhere
QA/QC Documentation	Project Requirements		Project Requirements	Daily

Lateral Expansion (Cell 4) Closure Quality Control Task Summary⁽¹⁾		
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 -Calibration of nuclear density gauges -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 slope failure and/or instability
Surveying	Construction Manager	-Schedule surveying
B. Embankment		
Task	Responsible Personnel	Task Description/Itemization
Fill Placement and Compaction	QC Manager	-Verify and document embankment 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
C. Non-Woven Geotextile Filter Fabric		
Task	Responsible Personnel	Task Description/Itemization
Submittals	QC Manager	-Approval of material samples and certified material specifications a minimum of 10 days prior to product arrival on site
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation that supplied materials meet or exceed project requirements -Verification of minimum conformance tests
Installation	QC Team	-Monitor geotextile deployment and covering operations -Documentation that operations performed per project requirements, manufacturer recommendations, and industry practice

D. TDOT Machined Riprap		
Task	Responsible Personnel	Task Description/Itemization
Submittals	QC Manager	-Approval of documentation regarding conformance and TDOT ⁽³⁾ acceptance of proposed riprap supplier and riprap materials for TDOT projects a minimum of 10 days prior to material arrival on site
Conformance Testing	QC Manager	-Verify minimum conformance testing per current QC Plan
E. Flexible Membrane Liner		
Task	Responsible Personnel	Task Description/Itemization
Submittals	QC Manager	-Verification of material acceptability based on manufacturer certification of GRI-GM 17 for FML -Approval of installation layout proposed by Contractor per current QC Plan -Approval of qualified field installation supervisor and/or master seamer per current QC Plan
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation that each roll delivered to the site meet or exceed project specifications -Verification of conformance testing/results per current QC Plan.
Installation	QC Team	-Verify storage of geomembranes prior to deployment performed per project specifications and manufacturer/industry standards -Observation and documentation of subgrade preparation performed per project specifications and manufacturer/industry standards prior to geomembrane layout -Monitor and document all geomembrane deployment, field seaming and repair operations performed per project requirements, manufacturer recommendations and industry standard practice -Observation and documentation of anchor trench earthwork performed per project specifications. Observe field testing by INSTALLER
Protection	CONTRACTOR	Observe equipment and hauling equipment for rutting/pumping of cap.
Subgrade	INSTALLER	-A signed approval in writing is required prior to any installation of FML and shall be included in project documentation
Samples	INSTALLER	-Submit samples of FML to QC Manager for large scale direct shear testing
Field Testing	INSTALLER	-Samples shall be submitted to QC Manager for destructive laboratory testing per project specifications
F. Geocomposite Drainage Media		
Task	Responsible Personnel	Task Description/Itemization
Submittals	QC Manager	-Approval of material samples and certified material specifications a minimum of 10 days prior to product arrival on site
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation that supplied materials meet or exceed project requirements -Verification of minimum conformance tests
Installation	QC Team	-Monitor geotextile deployment and covering operations -Documentation that operations performed per project requirements, manufacturer recommendations, and industry practice
Samples	INSTALLER	-Submit samples of Geocomposite to QC Manager for large scale direct shear testing

G. HDPE Pipe		
Task	Responsible Personnel	Task Description/Itemization
Submittals	QC Manager	-Approval of shop drawings, material samples, and certified material specifications a minimum of 10 days prior to product arrival on site
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation confirming that supplied materials meet or exceed project specifications
Installation	QC Team	-Verification of minimum conformance testing/results per current QC Plan -Inspection, acceptance, and documentation of pipe trench/backfill and pipe to structure penetration seals, pipe joints and lines/grades of pipe network
H. Pre-cast Structures and Articulated Block Mat		
Task	Responsible Personnel	Task Description/Itemization
Submittals	QC Manager	-Approval of material samples and certified material specifications a minimum of 15 days prior to product arrival on site
Conformance Testing	QC Manager	-Observe product on arrival and examine for cracks, miscastings and verify that performance standards are met
Installation	QC Team	-Monitor deployment of imported materials -Document materials conform to submittals
I. Instrumentation		
Task	Responsible Personnel	Task Description/Itemization
Abandonment	QC Manager	-Not needed after FML installed
Extensions	QC Manager	-Extend existing instrumentation
New Installations	QC Manager	-Install new geotechnical instrumentation
Readings	QC Manager	-QC Team takes readings for threshold analyses
Protection	Construction Manager	-Arrange and coordinate installation of protective barriers around instrumentation
J. 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
K. 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

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 TVA 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 TVA 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.



**KINGSTON ASH RECOVERY PROJECT
DOCUMENT REVIEW**

Document Title:	90% Removal Design Package for Lateral Expansion (Cell 4) Closure			
Document/RDP No.:	RDP-0114-C	Project No.:	WBS Code:	011403
Reviewed by:	Multiple	Organization:	TDEC	Date: 28 June 2012
Response by:	Multiple	Organization:	Stantec	Date: 03 July 2012
			Rev:	16 July 2012

No.	Section / Para / Page	Reviewer Comment	Response to Comment
1.	General	As with the previous set of documents, I have concerns with the relatively flat crown slopes (less than 3%), and the difficulties associated with building out the herringbone contour pattern on the crown. My concern with loose the initial lift thickness on the crown and the potential for soft spots, etc. also remain. However, these are not concerns based on specific regulatory language, but rather based on experience. As noted before, if ponding, etc. on the crown becomes an issue, TVA can always truck in more soil and recontour/recompact the surface.	Noted.
2.	Technical Specifications Section 02100	On the third page of Section 02100 of the "Technical Specifications" document, under "Inspections", in first paragraph, the second sentence states: "Areas that have been temporarily stabilized shall be inspected at least once per month." TDEC would like to see that sentence amended to include the phrase ", and after every rainfall event exceeding 1 inch within a 24 hour period."	The site is operating under a regulatory approved Storm Water Management Plan (SWMP). We suggest changing the wording in the referenced specification to: "be inspected in accordance with the approved SWMP which will be modified as the work site changes."
3.	Technical Specifications Section 02300	On the sixth page of Section 02300 of the "Technical Specifications" document, under "Cap Material", Section 6.5.2., there are no permeability specifications.	An alternative detail is planned for the project, wherein the FML is the primary component to control infiltration through the cap. The design function of the soil layer is to protect the liner and provide a medium for vegetative growth.
4.	Technical Specifications Section 02700	On the second page of Section 02700 of the "Technical Specifications" document, Division 2 – Site Work, under "Definitions", Section 1.4.2, the requirement for Quality Control Manager is defined as "[a] Party, independent from Manufacturer and Installer that is responsible for observing and documenting activities related to quality assurance during the construction of the project." That Party should also be independent from TVA. On Drawing 10W432-02, Note 1 (Definitions), the definition for Quality Control (QC) Manager includes a statement that "Stantec Consulting Services, Inc is the QC Manager for this project." It would make sense for both definitions to be the same.	TVA has designated Stantec to perform QC duties as part of cap and cover construction. The referenced note is intended to establish this commitment.



KINGSTON ASH RECOVERY PROJECT
DOCUMENT REVIEW

No.	Section / Para / Page	Reviewer Comment	Response to Comment
5.	General	Some of the inground piping is going to be set on a very shallow slope. TDEC has concerns about the potential for addressing any sedimentation/fouling that may occur.	The pipes are set on a minimum 1% slope and are steeper over the outslopes. The referenced concerns are generally anticipated to occur during installation. These will be mitigated as necessary through routine cleaning as outlined in Section 02365, Paragraph 3.5 of the Specifications. It is noted that following installation, piping is effectively surrounded by geotextile and stone, which will serve as a filter.
6.	General	The geonet/filter fabric geocomposite element of drainage system has some substantial fairly flat runs as well, and although it ties in to 4 or 6 inch perforated piping at some points, it only truly "daylights" or discharges at the toe of the slope. Have some concerns about development of potential for veneer failure along drainage layer/soil interface portion of cap caused by excess pore water pressure from backup of water related to changes in grade from relatively steep to relatively flat, as well as at other areas where drainage layer flow may be impeded.	<p>Cross-slopes for the geocomposite are set at 2% along a maximum run of slightly over 300 feet. The conveyance of the geocomposite was analyzed at those slopes. Where the geocomposite ties into the pipe system it is noted that in addition to the pipe capacity there is additional conveyance through the stone layer as well, which was not accounted for in our calculations. (See Details 6 and 10 on Sheet 10W432-28).</p> <p>The majority of outslopes in the Lateral Expansion are 5% so the maximum transition in these areas is 5% to 1%. There is also a short transition from 25% to 5% outslopes in the northwestern portion of the site. The conveyance of pipes in these lateral drains (without consideration of additional conveyance in the stone) exceeds the carrying capacity of the geocomposite.</p> <p>The outslopes were analyzed under saturated conditions as part of an infinite slope analysis. Results show that the final, constructed condition meets established stability criteria.</p>

GENERAL NOTES

1. DEFINITIONS: WHENEVER THE FOLLOWING TERMS ARE USED IN THESE DRAWINGS, IT IS UNDERSTOOD THAT THEY REPRESENT THE FOLLOWING:

CONTRACTOR: THE ENTITY WITH WHICH THE TENNESSEE VALLEY AUTHORITY (TVA) HAS ENTERED INTO AN AGREEMENT TO CONSTRUCT THIS PROJECT (OR THEIR DESIGNEE).

EPA: THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY WHICH IS THE REGULATORY AUTHORITY FOR THE SITE.

DEQ: THE TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION.

ENGINEER: STANTEC CONSULTING SERVICES INC.

OWNER: TENNESSEE VALLEY AUTHORITY - KINGSTON FOSSIL PLANT.

TDOT: THIS MEANS THE TENNESSEE DEPARTMENT OF TRANSPORTATION AND SPECIFICALLY REFERENCES THE "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", CURRENT EDITION. ANY MATERIAL DESIGNATED AS "TDOT" IS TO CONFORM TO THE MATERIAL STANDARDS NOTED AND PLACEMENT/INSTALLATION METHODOLOGY SPECIFIED IN THE CURRENT EDITION OF THE "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION".

QUALITY CONTROL (QC) PLAN: REFERS TO A DOCUMENT THAT ESTABLISHES MINIMUM QUALITY CONTROL REQUIREMENTS, TESTING FREQUENCY AND QUALITY OVERSIGHT RESPONSIBILITY.

QUALITY CONTROL (QC) MANAGER: A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF TENNESSEE THAT IS RESPONSIBLE FOR THE QUALITY OF THE CONSTRUCTED PROJECT AS DEFINED IN THE QC PLAN. THIS INDIVIDUAL IS THE ENGINEER OF RECORD FOR CONSTRUCTION. STANTEC CONSULTING SERVICES, INC. IS THE QC MANAGER FOR THIS PROJECT. THE QC TEAM CONSISTS OF QUALIFIED PERSONNEL THAT WORK UNDER THE DIRECT SUPERVISION OF THE QC MANAGER. THE QC TEAM PERSONNEL ARE INDIVIDUALS THAT ARE FAMILIAR WITH THE MATERIALS UTILIZED.

RETRIEVED ASH: MATERIAL PLACED ON SITE TO INCLUDE ASH AND INCIDENTAL EARTHEN MATERIALS RECOVERED DURING EXCAVATION ACTIVITIES WITHIN THE EMBAYMENT AREAS.

CONSTRUCTION MANAGER: RESPONSIBLE FOR CONSTRUCTION ACTIVITY TO INCLUDE BUT NOT BE LIMITED TO THE CHARACTER AND SEQUENCE OF WORK, COORDINATION AND SCHEDULING. JACOBS IS THE CONSTRUCTION MANAGER FOR THIS PROJECT.

SWMP: STORM WATER MANAGEMENT PLAN.

2. THESE DRAWINGS ARE THE CONSTRUCTION DRAWINGS THAT ARE TO BE REFERENCED ALONG WITH THE TECHNICAL SPECIFICATIONS, THE QC PLAN, THE SITE WIDE SWMP AND APPLICABLE ENVIRONMENTAL AND SAFETY REGULATIONS.

3. TOPOGRAPHIC INFORMATION SHOWN IN THE DRAWINGS IS DATED AND DOES NOT REFLECT CHANGES SINCE THE TIME OF THE LIDAR SURVEY. TEMPORARY STOCKPILING OF MATERIALS AND FILLING HAS OCCURRED SINCE THE DATE OF THE LIDAR SURVEY.

4. JACOBS HAS PERFORMED REQUIRED UTILITY LOCATION SERVICES AND OBTAINED THE PLANT ISSUED EXCAVATION PERMIT FOR THIS PROJECT.

5. JACOBS HAS VERIFIED THAT THERE ARE NO CONFLICTING UTILITY SERVICES WITHIN WORK AREAS.

6. SECURITY ON SITE IS PROVIDED BY TVA.

7. THE CONTRACTOR SHALL PROTECT INSTRUMENTATION FROM DAMAGE. THE CONTRACTOR SHALL INSTALL PROTECTIVE T-POSTS IN ACCORDANCE WITH TVA STANDARDS AROUND SAID INSTRUMENTATION. ORANGE SAFETY FENCE SHALL BE WRAPPED AROUND THE TOP POSTS TO DENOTE LIMITED ACCESS. COMPACTION OF MATERIALS AROUND GEOTECHNICAL INSTRUMENTATION SHALL BE PERFORMED BY MANUALLY OPERATED TAMPING DEVICES. EXISTING INSTRUMENTATION WILL BE EXTENDED UPWARD BY THE QC TEAM DURING THE COURSE OF THE WORK AS DESCRIBED IN THESE CONSTRUCTION DOCUMENTS AND IN ACCORDANCE WITH ESTABLISHED TVA PROCEDURES. PROPOSED GEOTECHNICAL INSTRUMENTATION WILL BE INSTALLED BY THE QC MANAGER.

8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR HEALTH AND SAFETY OF ITS PERSONNEL. THE CONTRACTOR SHALL ADHERE TO TVA REQUIREMENTS FOR SAFETY AND CONSTRUCTION UNLESS OSHA OR OTHER REGULATORY REQUIREMENTS SUPERCEDE THEM.

9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF ALL ACCESS ROADS, STAGING AREAS AND STORAGE AREAS USED DURING CONSTRUCTION, AND SHALL RESTORE SAID AREAS TO THEIR ORIGINAL CONDITION, OR BETTER ONCE CONSTRUCTION IS COMPLETE UNLESS THE TVA GIVES WRITTEN PERMISSION TO THE CONTRACTOR TO RETAIN THE AREA "AS IS".

10. THE CONTRACTOR SHALL CONDUCT ALL OPERATIONS IN ACCORDANCE WITH APPLICABLE ENVIRONMENTAL PERMITS, RULES, LAWS AND REGULATIONS.

11. THE CONTRACTOR IS RESPONSIBLE FOR SITE DRAINAGE THROUGHOUT CONSTRUCTION AND SHALL INSTALL TEMPORARY DRAINAGE STRUCTURES OR PUMP WATER AS NECESSARY TO PREVENT INTERFERENCE WITH THE WORK. SUCH TEMPORARY DRAINAGE FEATURES SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF ENVIRONMENTAL PERMITS AND THE SITE WIDE SWMP.

12. VEGETATIVE AND ORGANIC MATERIALS SHALL BE REMOVED AS DESCRIBED IN THE TECHNICAL SPECIFICATIONS.

13. DRAINAGE CONDITIONS SURROUNDING EXISTING FACILITIES OUTSIDE THE GRADING LIMITS ARE NOT ADDRESSED BY THE DRAWINGS. GRADING, SHAPING AND INSTALLATION OF DRAINAGE STRUCTURES MAY BE REQUIRED TO PROMOTE POSITIVE DRAINAGE.

14. MATERIALS DELIVERED FOR INCORPORATION INTO THE WORK SHALL BE TEMPORARILY STORED IN AREAS SELECTED BY THE CONTRACTOR AND APPROVED BY TVA. IF SAID MATERIALS ARE STORED WITHIN THE DREDGE CELL OR LATERAL EXPANSION, THEN QC MANAGER APPROVAL IS REQUIRED. MATERIALS SHALL BE STORED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. MATERIALS THAT CAN BE DIRECTLY INCORPORATED INTO THE WORK DO NOT NEED TO BE STOCKPILED.

15. THE EROSION AND SEDIMENT CONTROL PLAN MEASURES SHOWN SHALL BE CONSIDERED THE MINIMUM; SUPPLEMENTAL MEASURES SHALL BE PROVIDED BY THE CONTRACTOR AS FIELD CONDITIONS DICTATE OR AS DIRECTED BY THE CONSTRUCTION MANAGER OR THE REGULATORY AUTHORITY.

16. DURING CONSTRUCTION, THE CONTRACTOR SHALL CLEAN AND MAINTAIN ALL SEDIMENT CONTROL DEVICES AS SHOWN ON THE DRAWINGS. THE CONSTRUCTION MANAGER SHALL PROVIDE REPORTING AS REQUIRED BY THE SWMP, TECHNICAL SPECIFICATIONS AND REGULATIONS ON SAID ITEMS.

17. THE CONTRACTOR SHALL CONTROL FUGITIVE DUST EMISSIONS DURING CONSTRUCTION IN SUCH A MANNER AS TO COMPLY WITH APPLICABLE REGULATIONS. DUST CONTROL MEASURES SHALL BE SUBJECT TO APPROVAL OF THE CONSTRUCTION MANAGER AND THE OWNER.

18. TEMPORARY STOCKPILES WITHIN THE LATERAL EXPANSION SHALL BE PLACED IN UNIFORM 24" LIFTS OVER THE EXTENT OF THE QC MANAGER APPROVED STOCKPILE LIMITS. LOCATIONS AND SIZE OF TEMPORARY STOCKPILES SHALL BE APPROVED BY THE QC MANAGER AND TVA PRIOR TO MATERIAL PLACEMENTS. STOCKPILES SHALL BE GRADED TO MAINTAIN POSITIVE DRAINAGE AT ALL TIMES. THE SIDE SLOPES SHALL HAVE MAXIMUM 6H:1V SLOPE. THE TOP OF THE STOCKPILE SHALL HAVE A MINIMUM TWO PERCENT SLOPE. MATERIALS SHALL BE SEGREGATED AS DIRECTED BY THE QC MANAGER.

19. CERTIFICATIONS OF MATERIAL QUALITY AND CONFORMANCE TO PROJECT REQUIREMENTS SHALL BE SUBMITTED TO THE TVA FOR FORWARDING TO THE QC MANAGER.

20. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTION SURVEYOR SELECTION AND COORDINATION OF ALL CONSTRUCTION RELATED SURVEYING. ALL ESTABLISHED TVA BENCH MARKS OR OTHER MONUMENTS SHALL BE PRESERVED AND PROTECTED. ANY ESTABLISHED MARKER OR BENCHMARK THAT IS DAMAGED BY CONSTRUCTION ACTIVITIES SHALL BE REPLACED BY THE CONTRACTOR AT HIS/HER OWN COST.

21. THE CONSTRUCTION MANAGER SHALL COMMUNICATE CONSTRUCTION ISSUES, PROBLEMS OR DISCREPANCIES IN THE DRAWINGS TO THE QC MANAGER AND TVA IMMEDIATELY UPON BECOMING AWARE OF SUCH PROBLEMS.

22. THE CONTRACTOR SHALL NOTE THAT THIS WORK MAY BE PERFORMED CONCURRENT WITH ASH STACKING IN THE DREDGE CELL AND LATERAL EXPANSION. THIS WORK SHALL BE COORDINATED WITH WORK ELEMENTS IN PERIMETER SEGMENTS 1, 2 AND 3.

23. WHERE EXCAVATION OF THE PERIMETER WALL IS REQUIRED FOR PLACEMENT OF PIPES, THE DIFFERENCE IN THE SURFACE ELEVATION OF THE EXCAVATED SURFACE AND/OR THE STONE FILL TO EITHER SIDE OF ANY PERIMETER WALL SHALL NOT EXCEED FOUR FEET AT ANY TIME DURING CONSTRUCTION.

24. ANY PROPOSED MODIFICATION TO DESIGN FEATURES AS SHOWN (OR DESCRIBED) IN THE APPROVED ISSUED FOR CONSTRUCTION DESIGN DOCUMENTS SHALL BE CONTINGENT UPON ENGINEER OF RECORD APPROVAL. TEMPORARY FEATURES TO FACILITATE CONSTRUCTION TO ACHIEVE THE APPROVED DESIGN FEATURES SHALL BE ADDRESSED BY METHODS DESCRIBED IN APPROVED PROJECT DOCUMENTS AND PRACTICES (E.G. STORM WATER MANAGEMENT PLAN, BEST MANAGEMENT PRACTICES, ETC.).

CURVE	BASELINE	P.I. STA.	NORTHING	EASTING	DELTA	DEGREE OF CURVE	TANGENT	ARC LENGTH	RADIUS	EXTERNAL	P.C. STA.	P.T. STA.
C1	ACCESS ROAD 2	309+26.72	556788.78	2442284.34	32' 28' 34"	11' 27' 33"	145.62'	283.41'	500.00'	20.77'	307+81.09	310+64.50
C2	ACCESS ROAD 2	322+71.54	555511.34	2442729.15	57' 38' 55"	11' 27' 33"	275.15'	503.08'	500.00'	70.71'	319+96.39	324+99.47
C3	ACCESS ROAD 2	332+95.36	554672.55	2442063.13	90' 49' 03"	57' 17' 45"	101.44'	158.51'	100.00'	42.44'	331+93.92	333+52.43
C4	DITCH 5	109+17.20	556772.35	2442255.53	27' 29' 36"	8' 11' 06"	171.25'	335.90'	700.00'	20.64'	107+45.95	110+81.85
C5	DITCH 5	122+60.46	555499.33	2442700.82	57' 38' 58"	10' 54' 49"	288.92'	528.24'	525.00'	74.25'	119+71.54	124+99.78
C6	DITCH 6	150+69.27	556606.89	2442028.72	74' 28' 12"	19' 05' 55"	228.00'	389.92'	300.00'	76.81'	148+41.27	152+31.19
C7	DITCH 6	162+37.31	555520.98	2442452.39	96' 13' 43"	22' 55' 06"	278.77'	419.88'	250.00'	124.45'	159+58.54	163+78.41
C8	DITCH 7	170+61.26	555921.36	2440857.76	62' 58' 50"	57' 17' 45"	61.26'	109.92'	100.00'	17.27'	170+00.00	171+09.92
C9	DITCH 7	173+92.79	555633.91	2441046.96	19' 42' 54"	28' 38' 52"	34.75'	68.82'	200.00'	3.00'	173+58.04	174+26.86

BASELINE	STATION	NORTHING	EASTING	STATION	NORTHING	EASTING
ACCESS ROAD 2	300+00.00	557367.95	2441561.33	300+25.80	557351.95	2441581.57
ACCESS ROAD 2	300+25.80	557351.95	2441581.57	300+76.16	557316.24	2441617.07
ACCESS ROAD 2	300+76.16	557316.24	2441617.07	307+81.09	556879.08	2442170.10
ACCESS ROAD 2	310+64.50	556651.25	2442332.23	319+96.39	555771.19	2442638.67
ACCESS ROAD 2	324+99.47	555295.85	2442558.05	331+93.92	554751.93	2442126.21
ACCESS ROAD 2	333+52.43	554736.76	2441984.60	335+79.67	554880.59	2441808.67
DITCH 5	100+00.00	557349.84	2441544.13	100+28.09	557331.55	2441565.45
DITCH 5	100+28.09	557331.55	2441565.45	101+73.09	557233.63	2441672.39
DITCH 5	101+73.09	557233.63	2441672.39	104+95.75	557045.11	2441934.25
DITCH 5	104+95.75	557045.11	2441934.25	107+45.95	556883.18	2442124.98
DITCH 5	110+81.85	556613.77	2442320.16	112+30.26	556476.34	2442376.18
DITCH 5	112+30.26	556476.34	2442376.18	115+55.80	556164.98	2442471.24
DITCH 5	115+55.80	556164.98	2442471.24	118+81.34	555861.92	2442590.12
DITCH 5	118+81.34	555861.92	2442590.12	119+71.54	555775.66	2442616.46
DITCH 5	124+99.78	555280.20	2442512.52	125+59.79	555234.69	2442473.41
DITCH 5	125+59.79	555234.69	2442473.41	128+75.54	554979.98	2442286.80
DITCH 5	128+75.54	554979.98	2442286.80	131+22.14	554792.95	2442126.08
DITCH 6	140+00.00	557349.43	2441446.42	141+04.72	557278.91	2441523.84
DITCH 6	141+04.72	557278.91	2441523.84	143+65.46	557020.91	2441561.54
DITCH 6	143+65.46	557020.91	2441561.54	146+98.22	556706.80	2441671.39
DITCH 6	146+98.22	556706.80	2441671.39	148+41.27	556668.28	2441809.14
DITCH 6	152+31.19	556378.88	2442028.36	153+20.75	556289.32	2442028.21

BASELINE	STATION	NORTHING	EASTING	STATION	NORTHING	EASTING
DITCH 6	153+20.75	556289.32	2442028.21	155+99.51	556071.13	2442201.70
DITCH 6	155+99.51	556071.13	2442201.70	158+33.90	555836.74	2442201.33
DITCH 6	158+33.90	555836.74	2442201.33	159+58.54	555739.18	2442278.89
DITCH 6	163+78.41	555372.19	2442216.65	164+03.63	555358.73	2442195.33
DITCH 6	164+03.63	555358.73	2442195.33	166+57.61	555118.81	2442111.96
DITCH 6	166+57.61	555118.81	2442111.96	168+78.69	555000.81	2441925.02
DITCH 7	171+09.92	555870.19	2440891.44	173+58.04	555662.94	2441027.85
DITCH 7	174+26.86	555600.13	2441055.16	177+11.27	555323.75	2441122.22
FLUME 7	200+00.00	556467.77	2441201.32	203+40.59	556734.96	2441412.53
FLUME 7	203+40.59	556734.96	2441412.53	209+00.88	557231.84	2441671.45
FLUME 8	210+00.00	555879.26	2441006.27	225+12.96	556756.50	2442338.96
FLUME 9	230+00.00	555759.09	2441305.58	242+32.30	556164.32	2442469.35
FLUME 10	250+00.00	555759.09	2441305.58	263+43.03	555528.34	2442628.65
FLUME 11	270+00.00	555759.09	2441305.58	282+82.62	554961.51	2442310.07
PIPE 1	0+00.00	556188.86	2442539.82	1+00.00	556155.98	2442445.38
PIPE 2	0+00.00	556809.84	2442313.92	1+00.00	556751.85	2442232.45
PIPE 3	0+00.00	556188.86	2442539.82	6+60.79	556809.84	2442313.92
PIPE 3	6+60.79	556809.84	2442313.92	13+00.00	557224.88	2441827.79
PIPE 3	13+00.00	557224.88	2441827.79	13+50.00	557274.10	2441836.61
PIPE 4	0+00.00	555510.38	2442727.02	1+00.00	555528.41	2442628.66

STRUCTURE	NORTHING*	EASTING*
DROP BOX INLET	557,233.65	2,441,672.40
MANHOLE NO. 1	556,164.98	2,442,471.24
MANHOLE NO. 2	556,188.86	2,442,539.82
MANHOLE NO. 3	556,757.65	2,442,240.60
MANHOLE NO. 4	556,809.84	2,442,313.92
MANHOLE NO. 5	557,224.95	2,441,827.84
HEADWALL (INLET)	555,525.41	2,442,644.95
HEADWALL (OUTLET)	555,520.38	2,442,672.27

* LOCATION BASED ON THE CENTER OF THE STRUCTURE.

**ISSUED FOR REVIEW
NOT FOR CONSTRUCTION**

FOR SUPPORTING DESIGN CALCULATIONS
SEE FFGKIFFFSCDX00030020110033

REV. NO.	DATE	ISSN	DRN	CHG	SRVY	RVD	APPD	ISSD	PROJECT	AS CONST	REV
	02/17/12										

SCALE: -- EXCEPT AS NOTED

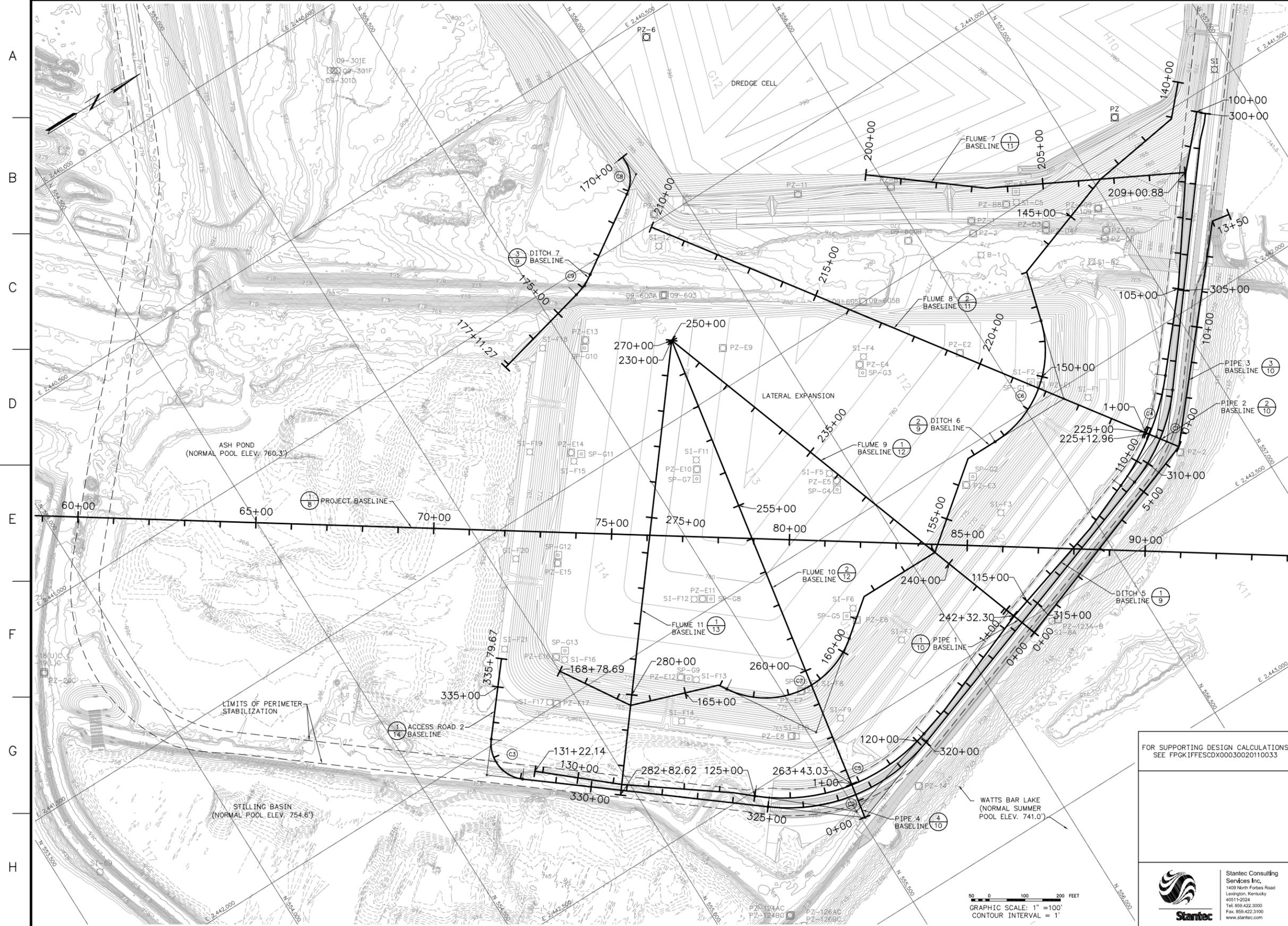
YARD LATERAL EXPANSION (CELL 4) CLOSURE - RDP-0114-C

**CELL 4 CLOSURE
GENERAL NOTES**

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
K.D. LINDQUIST	D.M. GRAHAM	D.E. HERRON	M.J. STEELE	V.J. DOTSON	M.S. TURNBOW	J.C. KAMMEYER

**KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING**

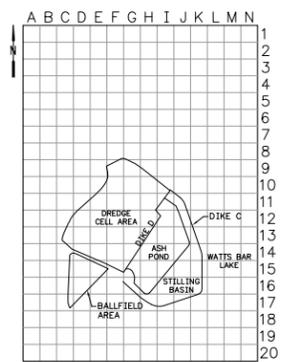
AUTOCAD R 2000 DATE 02/17/12 36 C 10W432-02 R 0



NOTE:
 1. TOPOGRAPHIC MAPPING WAS GENERATED FROM A LIDAR SURVEY PERFORMED ON AUGUST 31, 2011 BY TUCK MAPPING SOLUTIONS, INC. SUPPLEMENTED WITH HYDROGRAPHIC SURVEYS PERFORMED ON FEBRUARY 7, 2011 AND SEPTEMBER 6, 2011, PROPOSED GRADING FROM THE INTERIM DREDGE CELL ASH STACKING PLAN PROVIDED BY JACOBS ON APRIL 14, 2011. DESIGN PACKAGES RDP-0113D-R0, RDP-0114-A, RDP-0113-E, RDP-0113-F, RDP-0113-G, RDP-0114-B AND RDP-0114-G.

SURVEY CONTROL NOTE:
 A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

- LEGEND**
- EXISTING SLOPE INCLINOMETER
 - EXISTING PIEZOMETER
 - ⊠ EXISTING SETTLEMENT PLATFORM



- SECTION OR DETAIL NO. (Symbol: circle with number)
 SHEET WHERE SHOWN (Symbol: circle with number)
 REFERENCE KEY (Symbol: circle with number)

**ISSUED FOR REVIEW
 NOT FOR CONSTRUCTION**

FOR SUPPORTING DESIGN CALCULATIONS
 SEE FPGKIFFSCDX00030020110033

REV. NO.	DATE	ISSN	DRN	CHG	SLVP	RWV	APPD	ISSD	PROJECT	AS CONST	REV. BY
02/17/12	02/17/12	KDL	DMG	DEH	MJS	VJD	MST	JCK			
SCALE: 1"=100' EXCEPT AS NOTED											

YARD
 LATERAL EXPANSION (CELL 4) CLOSURE - RDP-0114-C
 CELL 4 CLOSURE
 EXISTING CONDITIONS AND
 BASELINE LAYOUT



Stantec Consulting
 Services Inc.
 1409 North Forbes Road
 Lexington, Kentucky
 40511-2024
 Tel. 859.422.3000
 Fax. 859.422.3100
 www.stantec.com

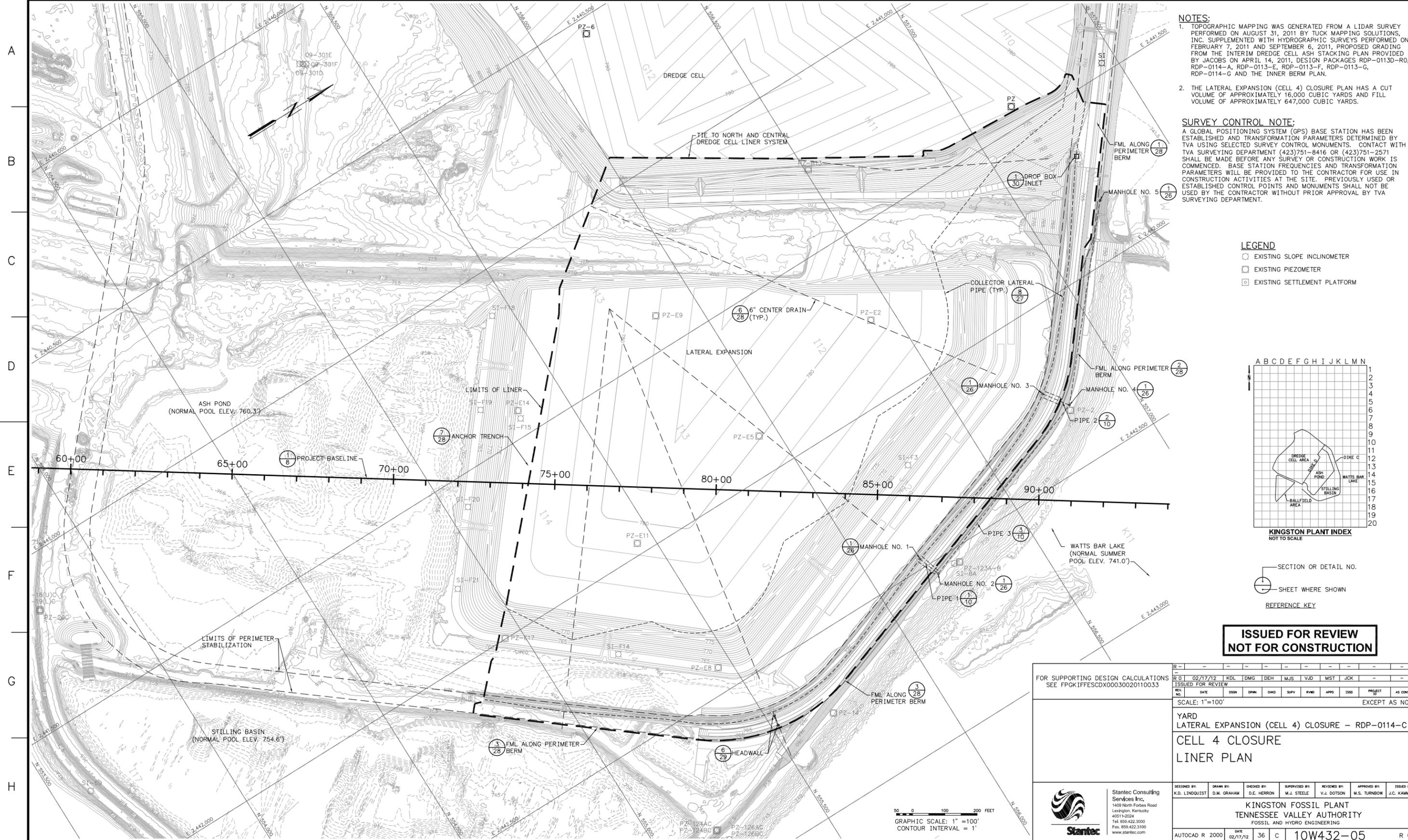
DESIGNED BY:	D.M. GRAHAM	CHECKED BY:	D.E. HERRON	SUPERVISED BY:	M.J. STEELE	REVIEWED BY:	V.J. DOTSON	APPROVED BY:	M.S. TURNBOW	ISSUED BY:	J.C. KAMMEYER
KINGSTON FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING											

AUTOCAD R 2000	DATE	36	C	10W432-03	R 0
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GRAPHIC SCALE: 1" = 100'
 CONTOUR INTERVAL = 1'

STANTEC	0
TASK COMPLETED BY:	REV. NO.

PLOT FACTOR: 100
 W_TVA
 C.A.D. DRAWING
 DO NOT ALTER MANUALLY



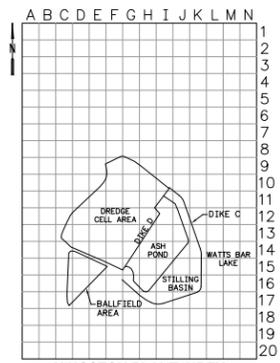
NOTES:

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- THE LATERAL EXPANSION (CELL 4) CLOSURE PLAN HAS A CUT VOLUME OF APPROXIMATELY 16,000 CUBIC YARDS AND FILL VOLUME OF APPROXIMATELY 647,000 CUBIC YARDS.

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- LEGEND**
- EXISTING SLOPE INCLINOMETER
 - EXISTING PIEZOMETER
 - ◻ EXISTING SETTLEMENT PLATFORM



- SECTION OR DETAIL NO. (1/28)
- SHEET WHERE SHOWN (1/26)
- REFERENCE KEY

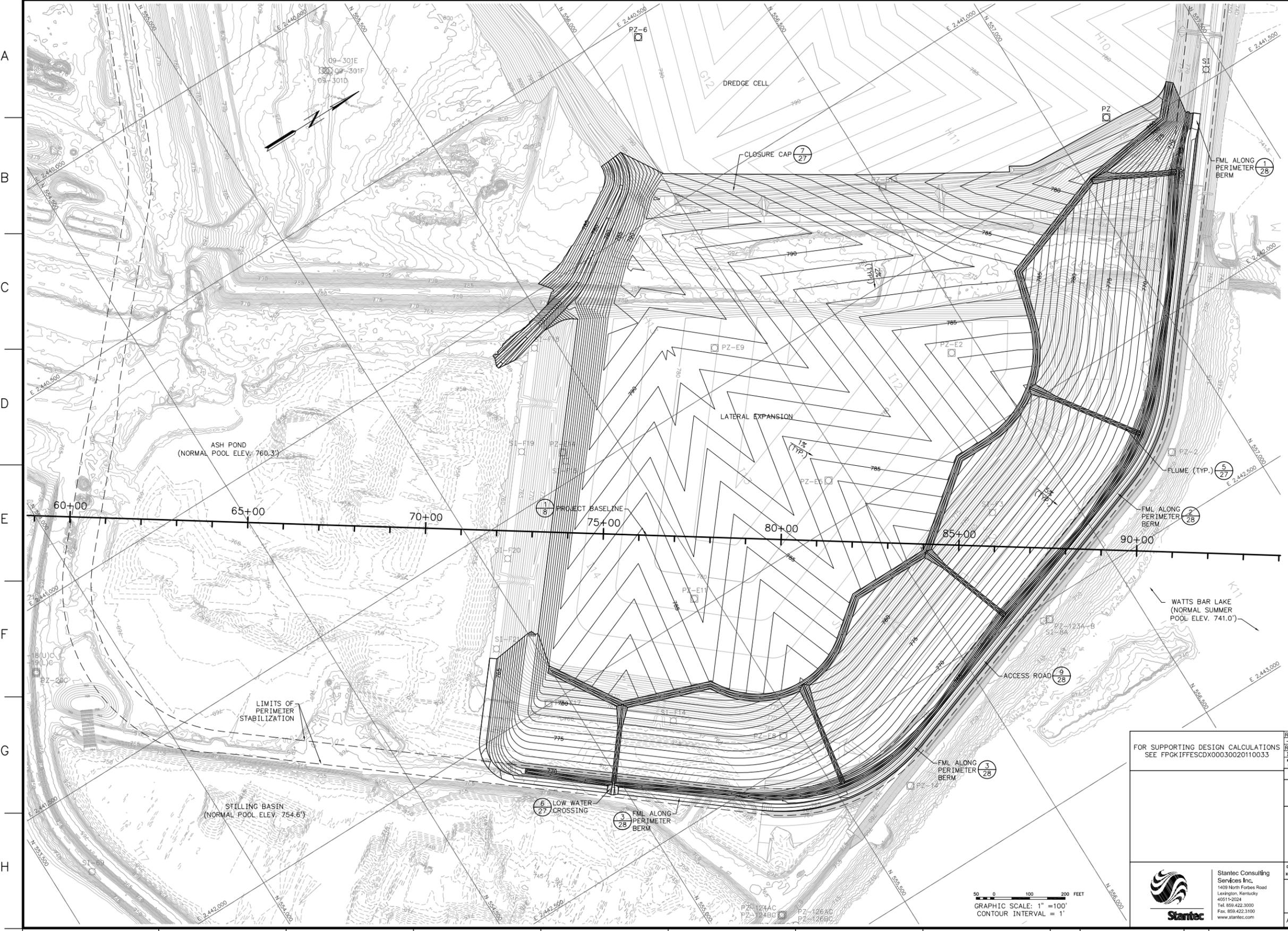
ISSUED FOR REVIEW
NOT FOR CONSTRUCTION

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGKIFFSCDX00030020110033		<table border="1"> <tr> <th>REV. NO.</th> <th>DATE</th> <th>ISSN</th> <th>DRN</th> <th>CHG</th> <th>SLVP</th> <th>RVDG</th> <th>APPD</th> <th>ISSD</th> <th>PROJECT</th> <th>AS CONST</th> <th>REV. NO.</th> </tr> <tr> <td>0</td> <td>02/17/12</td> <td>KDL</td> <td>DMG</td> <td>DEH</td> <td>MJS</td> <td>VJD</td> <td>MST</td> <td>JCK</td> <td></td> <td></td> <td></td> </tr> </table>										REV. NO.	DATE	ISSN	DRN	CHG	SLVP	RVDG	APPD	ISSD	PROJECT	AS CONST	REV. NO.	0	02/17/12	KDL	DMG	DEH	MJS	VJD	MST	JCK			
REV. NO.	DATE	ISSN	DRN	CHG	SLVP	RVDG	APPD	ISSD	PROJECT	AS CONST	REV. NO.																								
0	02/17/12	KDL	DMG	DEH	MJS	VJD	MST	JCK																											
SCALE: 1"=100'		EXCEPT AS NOTED																																	
YARD LATERAL EXPANSION (CELL 4) CLOSURE - RDP-0114-C																																			
CELL 4 CLOSURE LINER PLAN																																			
Stantec Consulting Services Inc. 1409 North Forbes Road Lexington, Kentucky 40511-2024 Tel. 859.422.3000 Fax. 859.422.3100 www.stantec.com		<table border="1"> <tr> <th>DESIGNED BY:</th> <th>DRAWN BY:</th> <th>CHECKED BY:</th> <th>SUPERVISED BY:</th> <th>REVIEWED BY:</th> <th>APPROVED BY:</th> <th>ISSUED BY:</th> </tr> <tr> <td>K.D. LINDQUIST</td> <td>D.M. GRAHAM</td> <td>D.E. HERRON</td> <td>M.J. STEELE</td> <td>V.J. DOTSON</td> <td>M.S. TURNBOW</td> <td>J.C. KAMMEYER</td> </tr> </table>										DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:	K.D. LINDQUIST	D.M. GRAHAM	D.E. HERRON	M.J. STEELE	V.J. DOTSON	M.S. TURNBOW	J.C. KAMMEYER										
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KINGSTON FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING																																			
AUTOCAD R 2000		DATE: 02/17/12		36 C		10W432-05		R 0		PLOT FACTOR: 100 W_TVA																									

GRAPHIC SCALE: 1" = 100'
CONTOUR INTERVAL = 1'

STANTEC 0
TASK COMPLETED BY: REV. NO.

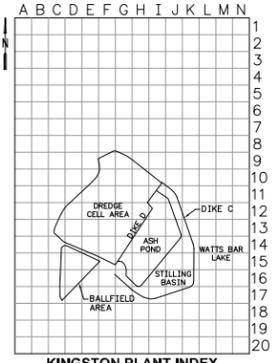
C.A.D. DRAWING DO NOT ALTER MANUALLY



- NOTES:**
1. TOPOGRAPHIC MAPPING WAS GENERATED FROM A LIDAR SURVEY PERFORMED ON AUGUST 31, 2011 BY TUCK MAPPING SOLUTIONS, INC. SUPPLEMENTED WITH HYDROGRAPHIC SURVEYS PERFORMED ON FEBRUARY 7, 2011 AND SEPTEMBER 6, 2011, PROPOSED GRADING FROM THE INTERIM DREDGE CELL ASH STACKING PLAN PROVIDED BY JACOBS ON APRIL 14, 2011. DESIGN PACKAGES RDP-0113D-R0, RDP-0114-A, RDP-0113-E, RDP-0113-F, RDP-0113-G, RDP-0114-G AND THE INNER BERM PLAN.
 2. PROPOSED CONTOURS REPRESENT THE FINAL GRADE CONFIGURATION.
 3. THE LATERAL EXPANSION (CELL 4) CLOSURE PLAN HAS A CUT VOLUME OF APPROXIMATELY 16,000 CUBIC YARDS AND FILL VOLUME OF APPROXIMATELY 647,000 CUBIC YARDS.

SURVEY CONTROL NOTE:
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- LEGEND**
- EXISTING SLOPE INCLINOMETER
 - EXISTING PIEZOMETER
 - ⊠ EXISTING SETTLEMENT PLATFORM



- SECTION OR DETAIL NO. (circle with number)
 SHEET WHERE SHOWN (circle with number)
 REFERENCE KEY (circle with number)

**ISSUED FOR REVIEW
 NOT FOR CONSTRUCTION**

FOR SUPPORTING DESIGN CALCULATIONS
 SEE FPGKIFFSCDX00030020110033

REV. NO.	DATE	ISSN	DRN	CHG	SLVP	RWMD	APPD	ISSD	PROJECT	AS CONST	REV. BY

SCALE: 1"=100' EXCEPT AS NOTED

YARD
 LATERAL EXPANSION (CELL 4) CLOSURE - RDP-0114-C
**CELL 4 CLOSURE
 FINAL GRADING PLAN**



DESIGNED BY: K.D. LINDQUIST
 DRAWN BY: D.M. GRAHAM
 CHECKED BY: D.E. HERRON
 SUPERVISED BY: M.J. STEELE
 REVIEWED BY: V.J. DOTSON
 APPROVED BY: M.S. TURNBOW
 ISSUED BY: J.C. KAMMEYER

**KINGSTON FOSSIL PLANT
 TENNESSEE VALLEY AUTHORITY
 FOSSIL AND HYDRO ENGINEERING**

AUTOCAD R 2000 DATE 02/17/12 36 C 10W432-06 R 0

GRAPHIC SCALE: 1" = 100'
 CONTOUR INTERVAL = 1'

INSTRUMENTS TO BE ABANDONED			INSTRUMENTS TO BE ABANDONED		
INSTRUMENT	NORTHING	EASTING	INSTRUMENT	NORTHING	EASTING
09-6008	556470.71	2441421.34	SI-603	555801.30	2441182.73
09-603	555809.89	2441187.46	SI-605	556277.76	2441498.14
09-603A	555805.42	2441185.06	SI-B2	556877.44	2441744.70
09-605	556273.05	2441498.96	SI-C2	557273.45	2441512.84
09-605B	556277.45	2441498.35	SI-C5	556785.83	2441490.67
B-1	556623.08	2441563.81	SI-F1	556665.74	2442062.60
PZ-1	556650.76	2441468.15	SI-F2	556584.28	2441939.59
PZ-10	556650.77	2441468.10	SI-F4	556192.00	2441629.98
PZ-2	556637.33	2441500.30	SI-F5	555937.38	2441857.00
PZ-20	556636.44	2441500.11	SI-F6	555791.83	2442212.49
PZ-4C	556765.13	2442256.37	SI-F7	555862.18	2442360.59
PZ-11	556277.32	2441146.29	SI-F8	555990.98	2442333.42
PZ-12	555904.47	2440978.82	SI-F9	555599.33	2442454.86
PZ-109	556965.50	2441623.30	SI-F10	555469.02	2442431.95
PZ-600	556470.15	2441420.80	SI-F11	555640.17	2441626.29
PZ-B8	556758.47	2441480.92	SI-F12	555428.08	2441954.67
PZ-B18	556195.41	2441003.47	SI-F13	555312.70	2442146.08
PZ-D3	556822.89	2441588.49	SI-F16	555029.84	2441905.04
PZ-D4	556814.11	2441602.33	SI-F17	554930.79	2441984.17
PZ-D5	556958.41	2441690.90	SP-A3	556800.06	2441465.26
PZ-D6	556944.60	2441707.83	SP-G1	556552.41	2441940.36
PZ-E1	556570.03	2441961.79	SP-G2	556273.97	2442078.10
PZ-E3	556246.58	2442089.92	SP-G3	556165.51	2441667.21
PZ-E4	556171.27	2441643.38	SP-G4	555931.67	2441906.58
PZ-E6	555791.17	2442239.40	SP-G5	555766.53	2442221.74
PZ-E7	555545.30	2442331.11	SP-G6	555567.26	2442338.97
PZ-E10	555627.63	2441649.68	SP-G7	555613.27	2441671.81
PZ-E12	555280.68	2442118.83	SP-G8	555468.34	2441978.42
PZ-E13	555553.50	2441176.18	SP-G9	555296.64	2442134.42
PZ-E15	555156.18	2441665.12	SP-G10	555540.20	2441194.02
PZ-E16	555013.22	2441885.94	SP-G11	555375.04	2441440.88
SI-12	555868.69	2441062.49	SP-G12	555169.56	2441646.99
SI-109	556971.68	2441627.38	SP-G13	555043.51	2441884.24

NOTES:

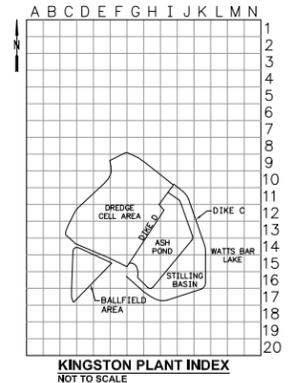
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- INSTALL/EXTEND INSTRUMENTATION AS DIRECTED BY THE QC MANAGER AND REFERENCED IN THE QC PLAN.

SURVEY CONTROL NOTE:

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LEGEND

- EXISTING SLOPE INCLINOMETER
- EXISTING PIEZOMETER
- ⊠ EXISTING SETTLEMENT PLATFORM



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FOR SUPPORTING DESIGN CALCULATIONS
SEE FFGKIFFSCDX00030020110033

REV. NO.	DATE	ISSN	DRN	CHG	SLVP	RVD	APPD	ISSD	PROJECT	AS CONST	REV. BY
0	02/17/12										

SCALE: 1"=100' EXCEPT AS NOTED

YARD
LATERAL EXPANSION (CELL 4) CLOSURE - RDP-0114-C
CELL 4 CLOSURE
INSTRUMENTATION PLAN

DESIGNED BY: K.D. LINDQUIST
DRAWN BY: D.M. GRAHAM
CHECKED BY: D.E. HERRON
SUPERVISED BY: M.J. STEELE
REVIEWED BY: V.J. DOTSON
APPROVED BY: M.S. TURNBOW
ISSUED BY: J.C. KAMMEYER

**KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING**

AUTOCAD R 2000 DATE 02/17/12 36 C 10W432-07 R 0

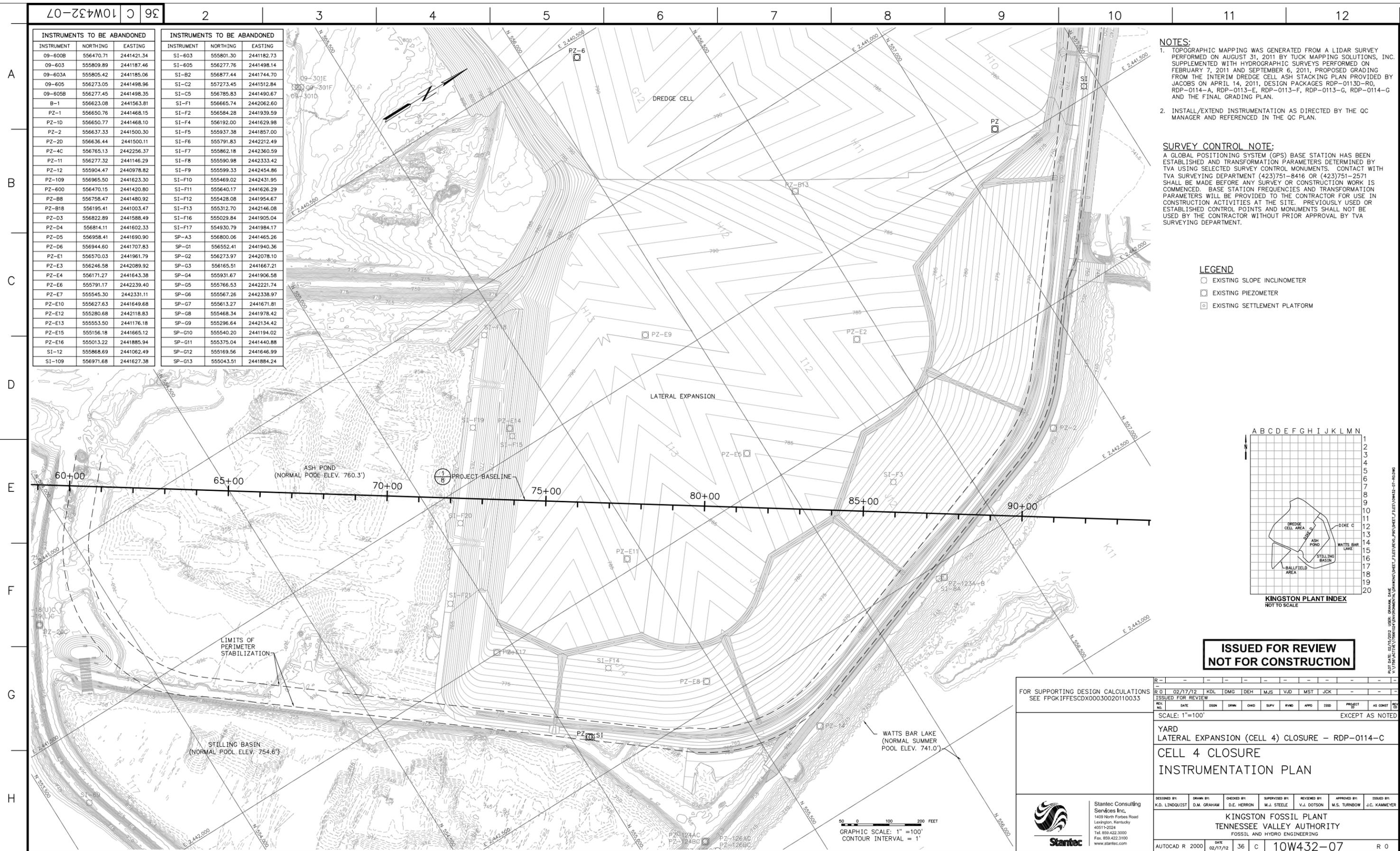


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Tel. 859.422.3000
Fax. 859.422.3100
www.stantec.com

GRAPHIC SCALE: 1" = 100'
CONTOUR INTERVAL = 1'

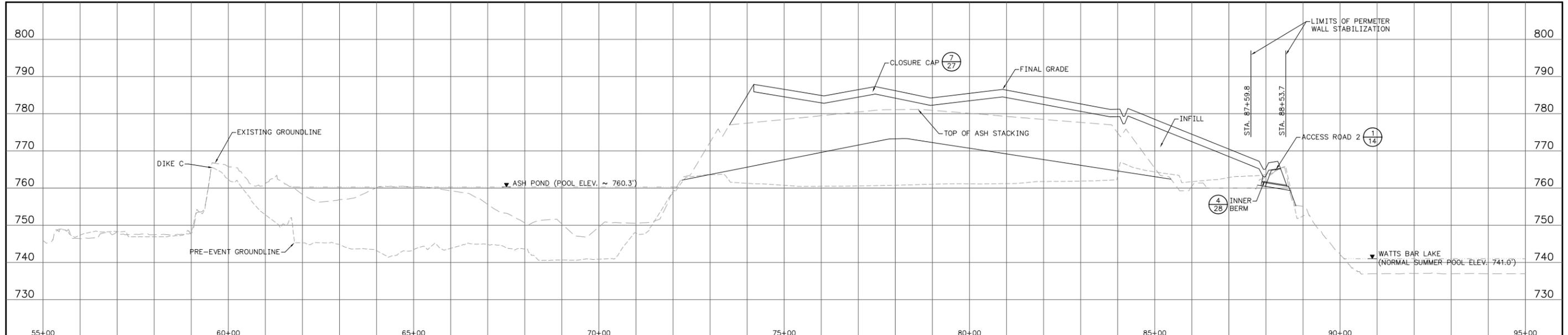
STANTEC 0
TASK COMPLETED BY: REV. NO.

PLOT FACTOR: 100
W_TVA
C.A.D. DRAWING
DO NOT ALTER MANUALLY



A
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1
8 PROFILE - PROJECT BASELINE
SCALE: 1"=100' (HORIZONTAL)
1"=10' (VERTICAL)

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**ISSUED FOR REVIEW
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FOR SUPPORTING DESIGN CALCULATIONS SEE FFGKIFFESCDX00030020110033		<table border="1"> <tr> <td>R</td><td>0</td><td>02/17/12</td><td>KDL</td><td>PJB</td><td>DEH</td><td>MJS</td><td>VJD</td><td>MST</td><td>JCK</td><td></td><td></td> </tr> <tr> <td>ISSUED FOR REVIEW</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>REV. NO.</td><td>DATE</td><td>ISSN</td><td>DRN</td><td>CHG</td><td>SUPV</td><td>RVND</td><td>APPD</td><td>ISSD</td><td>PROJECT</td><td>AS CONST</td><td>REV</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>										R	0	02/17/12	KDL	PJB	DEH	MJS	VJD	MST	JCK			ISSUED FOR REVIEW												REV. NO.	DATE	ISSN	DRN	CHG	SUPV	RVND	APPD	ISSD	PROJECT	AS CONST	REV												
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DESIGNED BY: K.D. LINDQUIST	DRAWN BY: P.J. BOND	CHECKED BY: D.E. HERRON	SUPERVISED BY: M.J. STEELE	REVIEWED BY: V.J. DOTSON	APPROVED BY: M.S. TURNBOW	ISSUED BY: J.C. KAMMEYER																																																					
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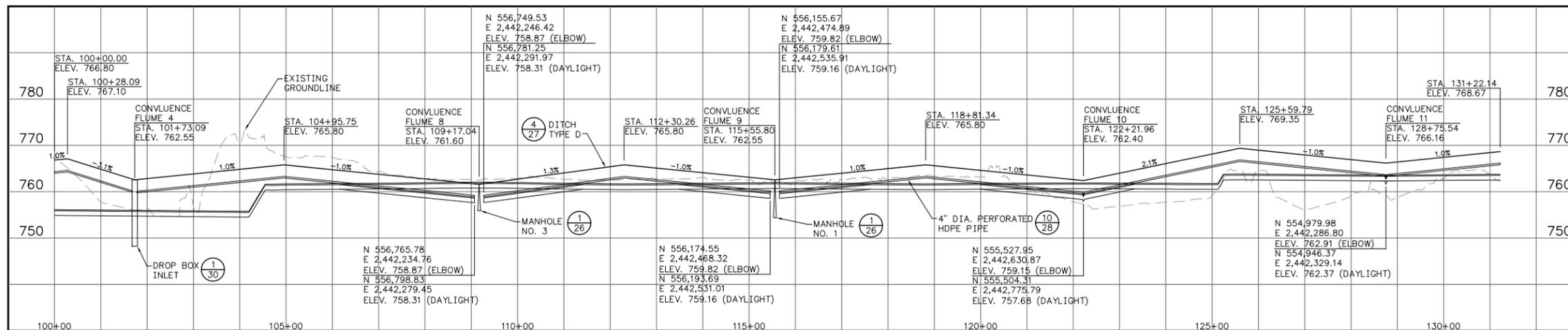
SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY



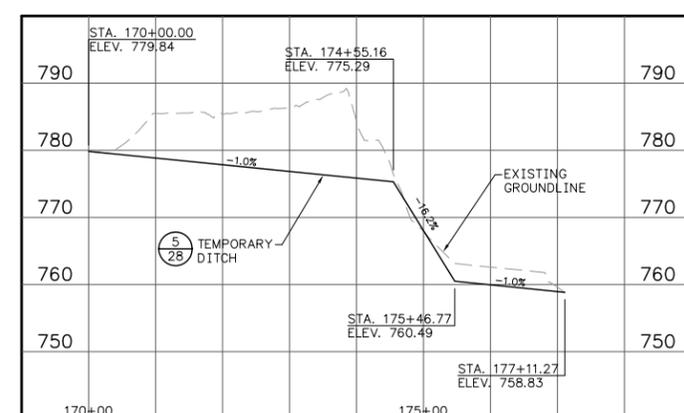
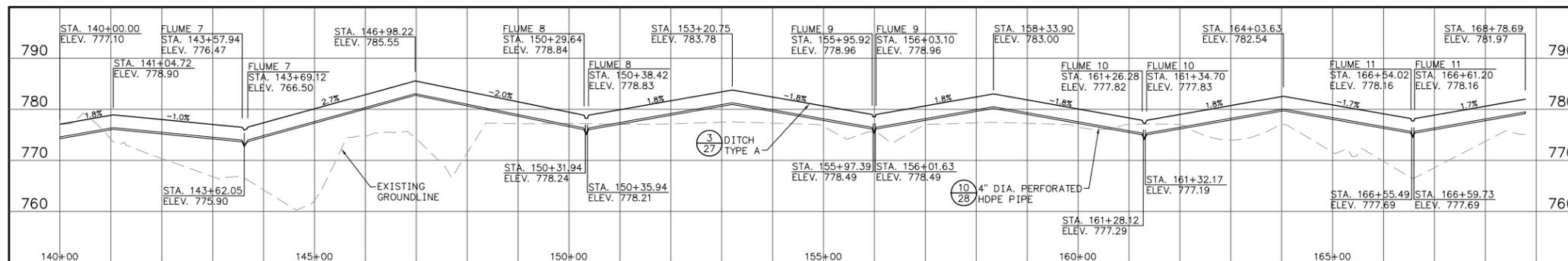
Stantec Consulting Services Inc.
1409 North Forbes Road
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Tel. 859.422.3000
Fax. 859.422.3100
www.stantec.com

STANTEC 0
TASK COMPLETED BY: REV. NO.

PLOT FACTOR: 10
W_TVA C.A.D. DRAWING
DO NOT ALTER MANUALLY



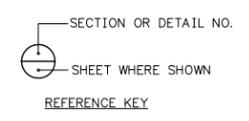
NOTES:
 1. DITCH 5 STATION 122+21.96 AND PIPE 4 INTERSECTS AT A POINT 2 FEET EAST (RIGHT FACING UP STATION) OF THE CENTERLINE.
 2. DITCH 5 AND 6 COLLECTOR LATERAL PIPE INVERT ELEVATION IS 2.83 FEET BELOW DITCH INVERT ELEVATION.



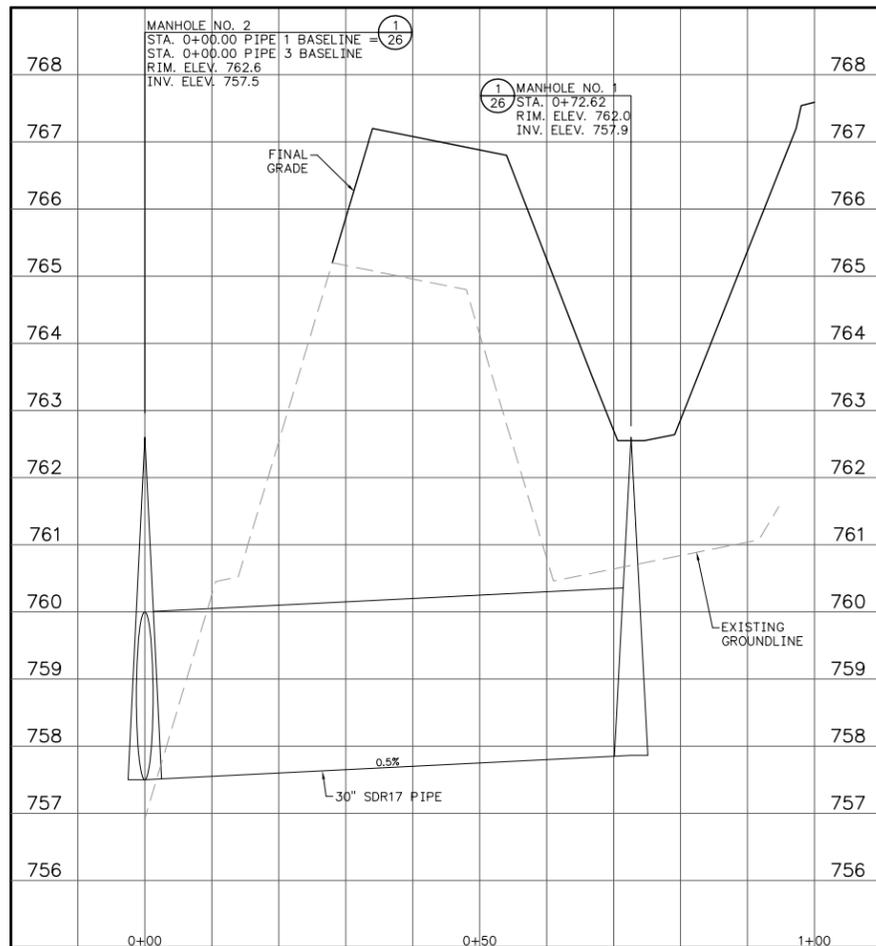
NOTE:
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**ISSUED FOR REVIEW
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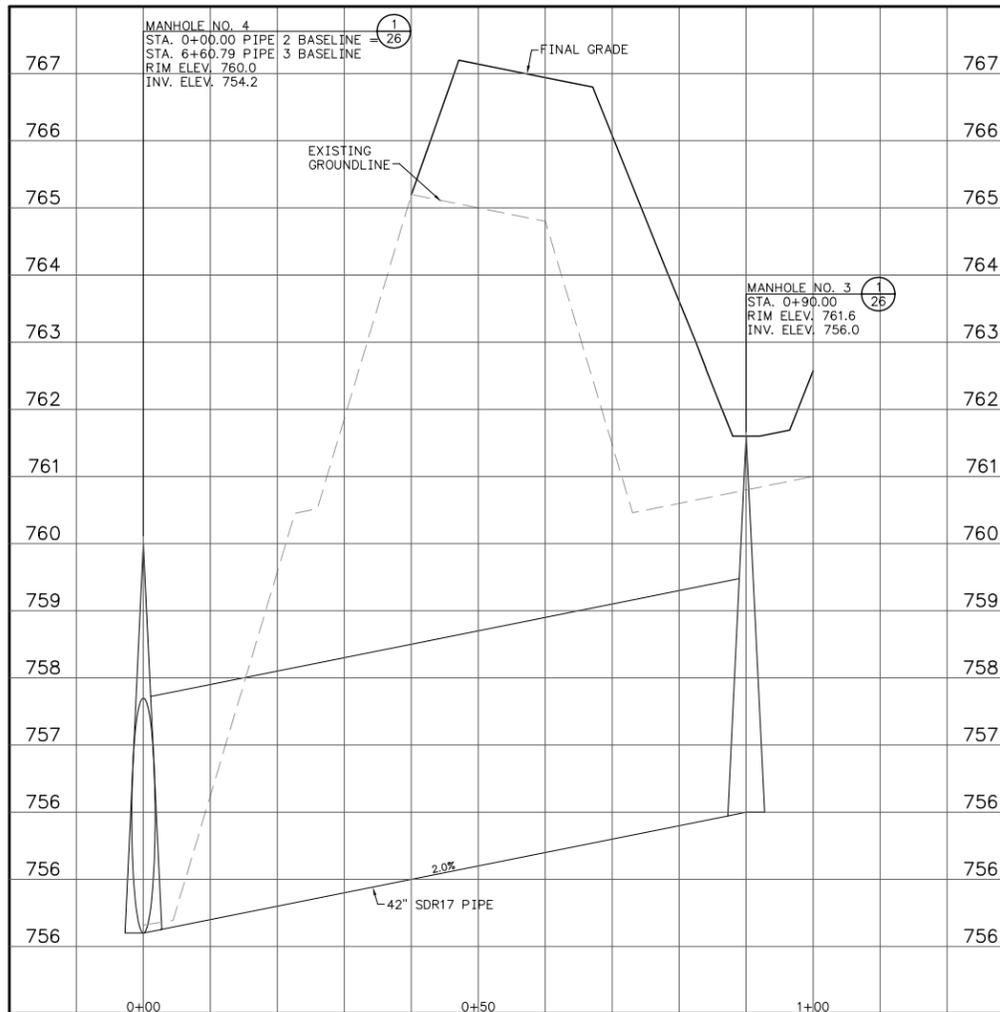
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CELL 4 CLOSURE																																			
PROFILES - DITCHES																																			
DESIGNED BY: K.D. LINDQUIST	DRAWN BY: P.J. BOND	CHECKED BY: D.E. HERRON	SUPERVISED BY: M.J. STEELE	REVIEWED BY: V.J. DOTSON	APPROVED BY: M.S. TURNBOW	ISSUED BY: J.C. KAMMEYER	KINGSTON FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING					AUTOCAD R 2000 DATE: 02/17/12 SHEET: 36 OF: C PROJECT: 10W432-09 R 0																							



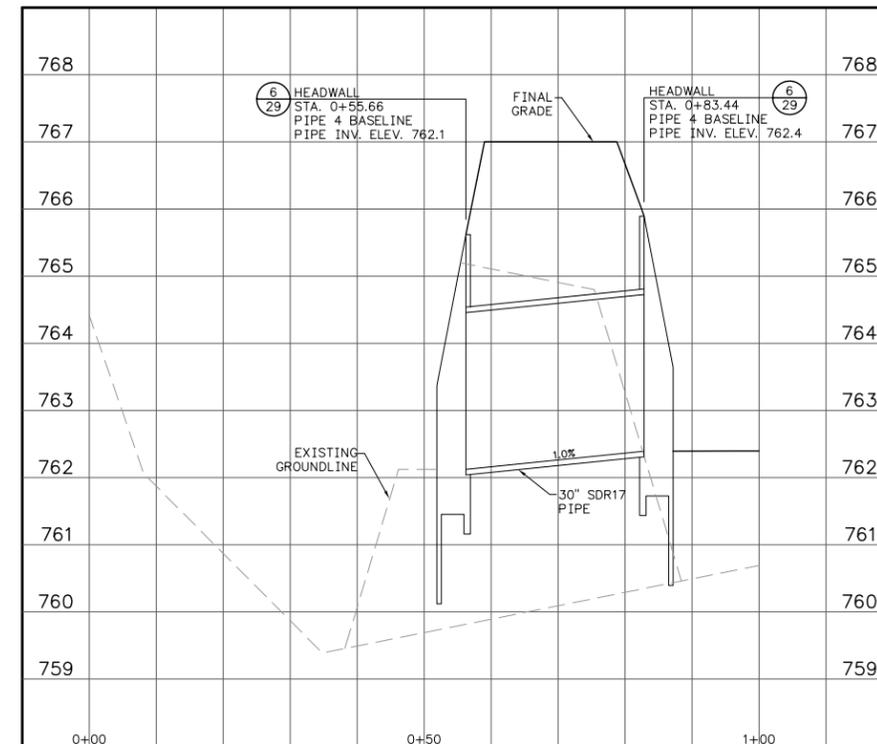
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1 PROFILE - PIPE 1
SCALE: 1"=10' (HORIZONTAL) 1"=1' (VERTICAL)



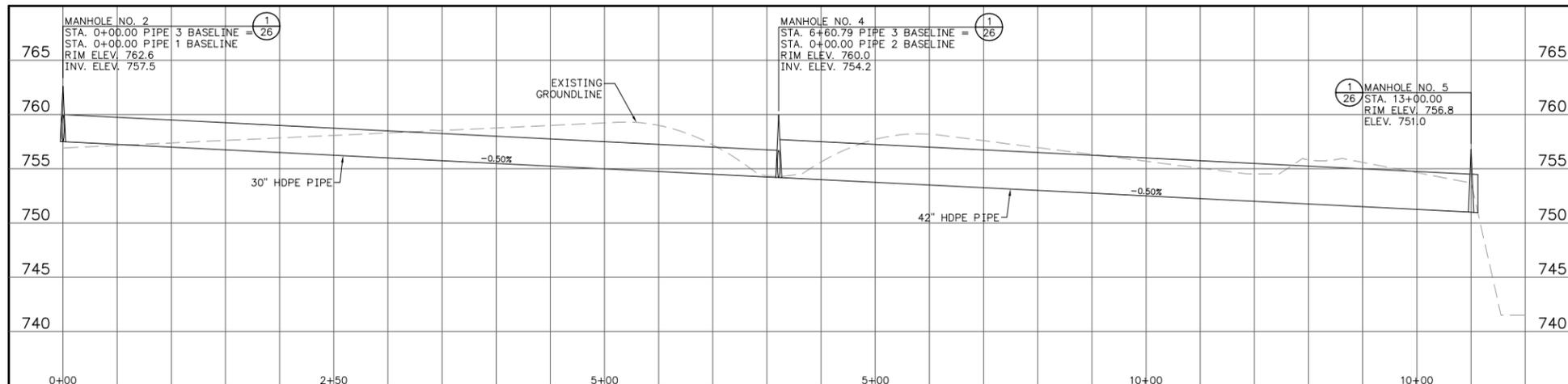
2 PROFILE - PIPE 2
SCALE: 1"=10' (HORIZONTAL) 1"=1' (VERTICAL)



4 PROFILE - PIPE 4
SCALE: 1"=10' (HORIZONTAL) 1"=1' (VERTICAL)

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3 PROFILE - PIPE 3
SCALE: 1"=50' (HORIZONTAL) 1"=5' (VERTICAL)

SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

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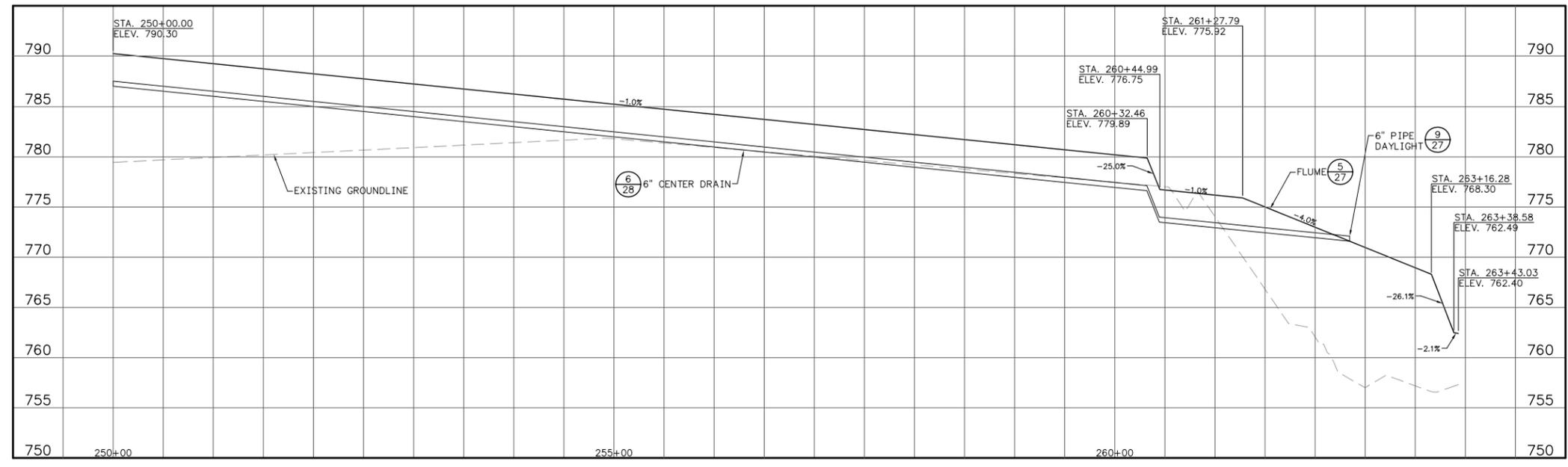
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CELL 4 CLOSURE PROFILES - PIPES																																																							
DESIGNED BY: K.D. LINDQUIST		DRAWN BY: P.J. BOND		CHECKED BY: D.E. HERRON		SUPERVISED BY: M.J. STEELE		REVIEWED BY: V.J. DOTSON		APPROVED BY: M.S. TURNBOW		ISSUED BY: J.C. KAMMEYER																																											
<p>Stantec Consulting Services Inc. 1409 North Forbes Road Louisville, Kentucky 40511-2904 Tel. 859.422.3000 Fax. 859.422.3100 www.stantec.com</p>																																																							
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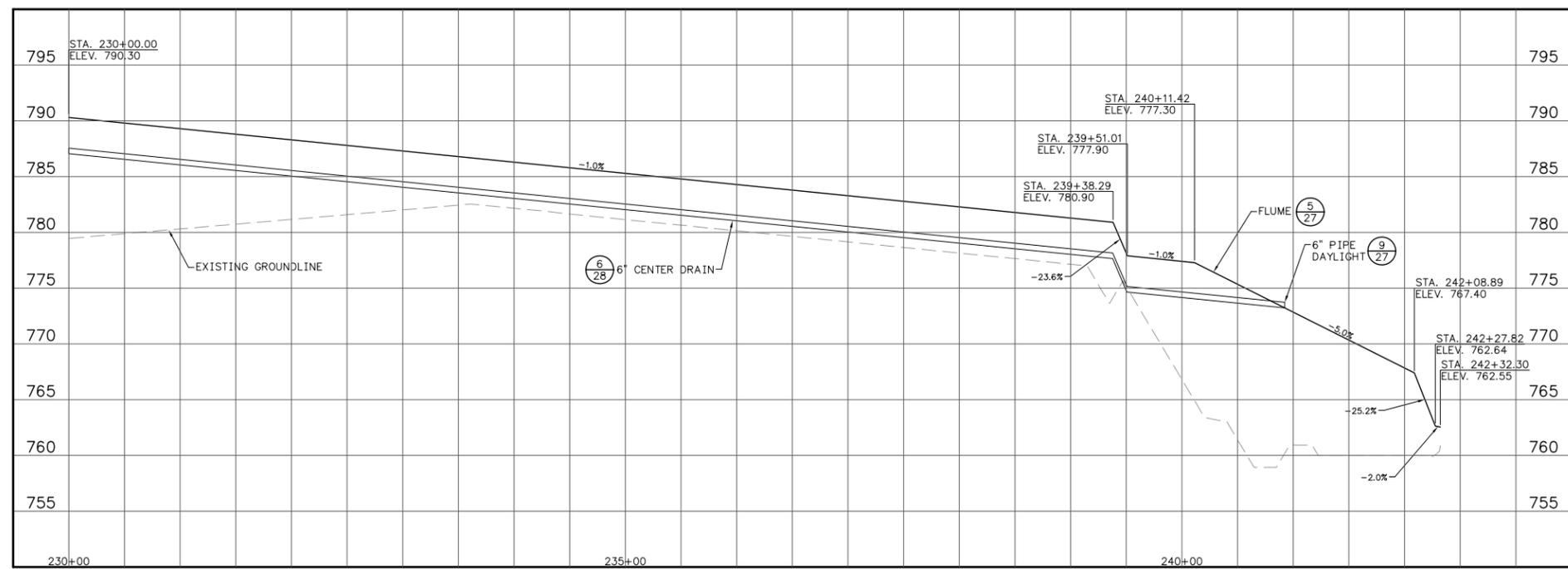
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W_TVA
C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 04/20/2012 USER: BOND, PJ V:\2012\ACTIVITY\06106102\10W432\10W432-10.dwg



2 PROFILE - FLUME 10
SCALE: 1"=50' (HORIZONTAL)
1"=5' (VERTICAL)

NOTES:
1. 6-INCH DIAMETER CENTERDRAIN INVERT ELEVATION IS 3.25 FEET BELOW THE DITCH/FLUME INVERT ELEVATION.
2. USE EROSION CONTROL BLANKET AS NEEDED IN THE CREST VALLEYS.



1 PROFILE - FLUME 9
SCALE: 1"=50' (HORIZONTAL)
1"=5' (VERTICAL)

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DESIGNED BY: K.D. LINDQUIST	DRAWN BY: P.J. BOND	CHECKED BY: D.E. HERRON	SUPERVISED BY: M.J. STEELE	REVIEWED BY: V.J. DOTSON	APPROVED BY: M.S. TURNBOW	ISSUED BY: J.C. KAMMEYER																													
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1409 North Forbes Road
Louisville, Kentucky 40511-2904
Tel. 859.422.3000
Fax. 859.422.3100
www.stantec.com

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TASK COMPLETED BY: REV. NO.

PLOT FACTOR: 1
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C.A.D. DRAWING
DO NOT ALTER MANUALLY

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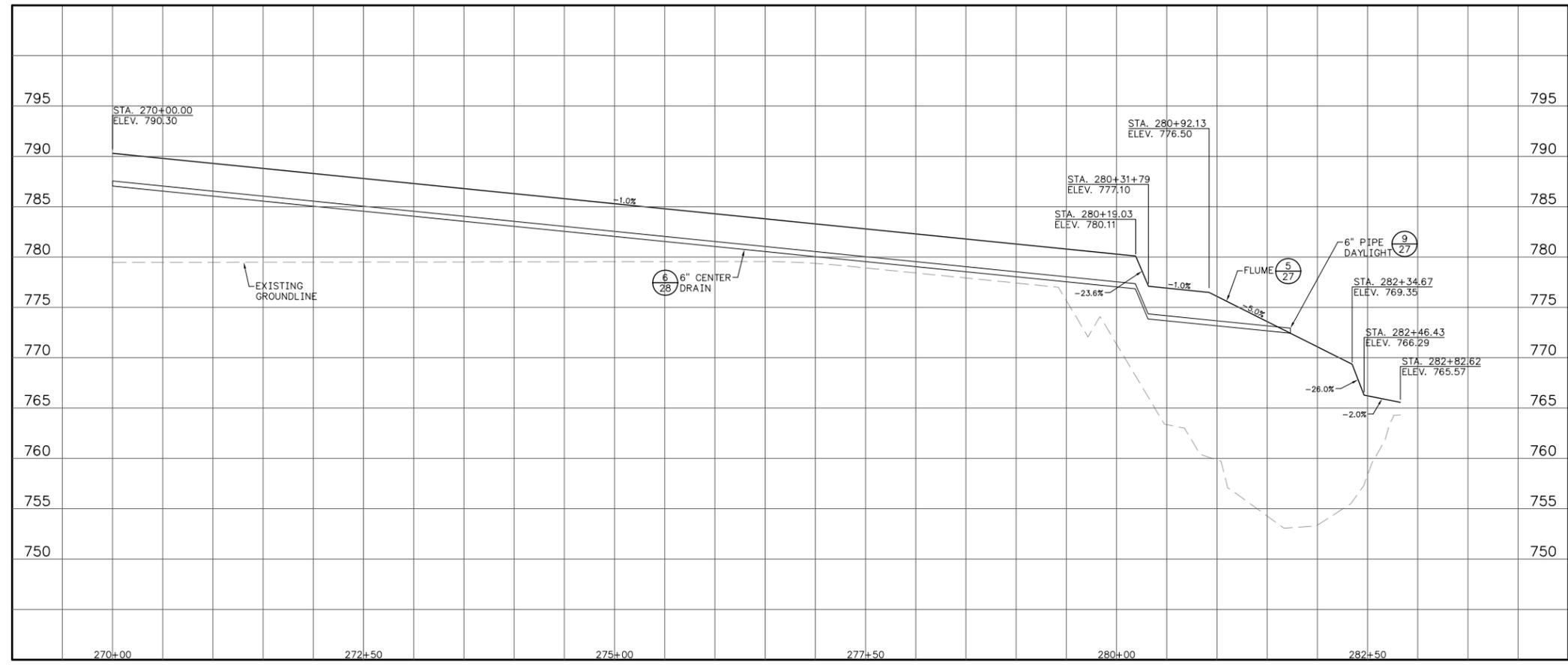
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1 PROFILE - FLUME 11
1.3 SCALE: 1"=50' (HORIZONTAL)
1"=5' (VERTICAL)

NOTES:
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DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:				
K.D. LINDQUIST	P.J. BOND	D.E. HERRON	M.J. STEELE	V.J. DOTSON	M.S. TURNBOW	J.C. KAMMEYER				
KINGSTON FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING										
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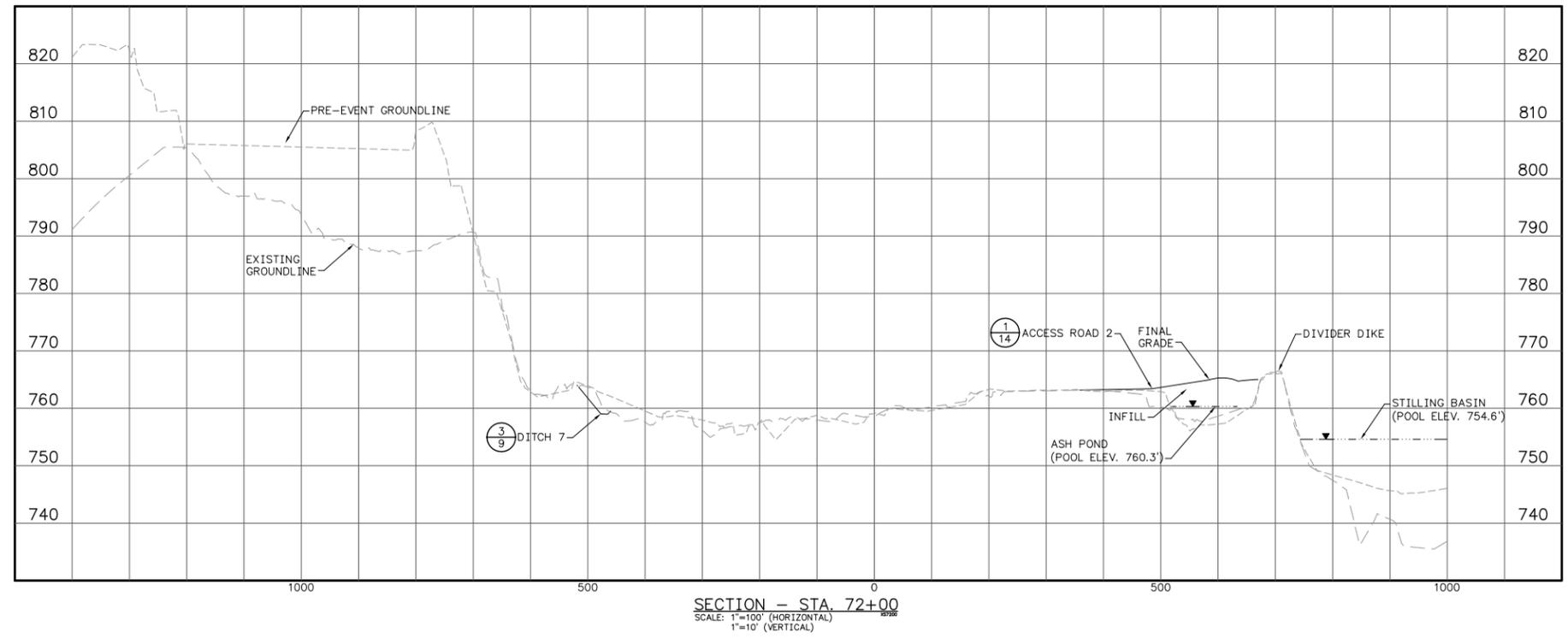
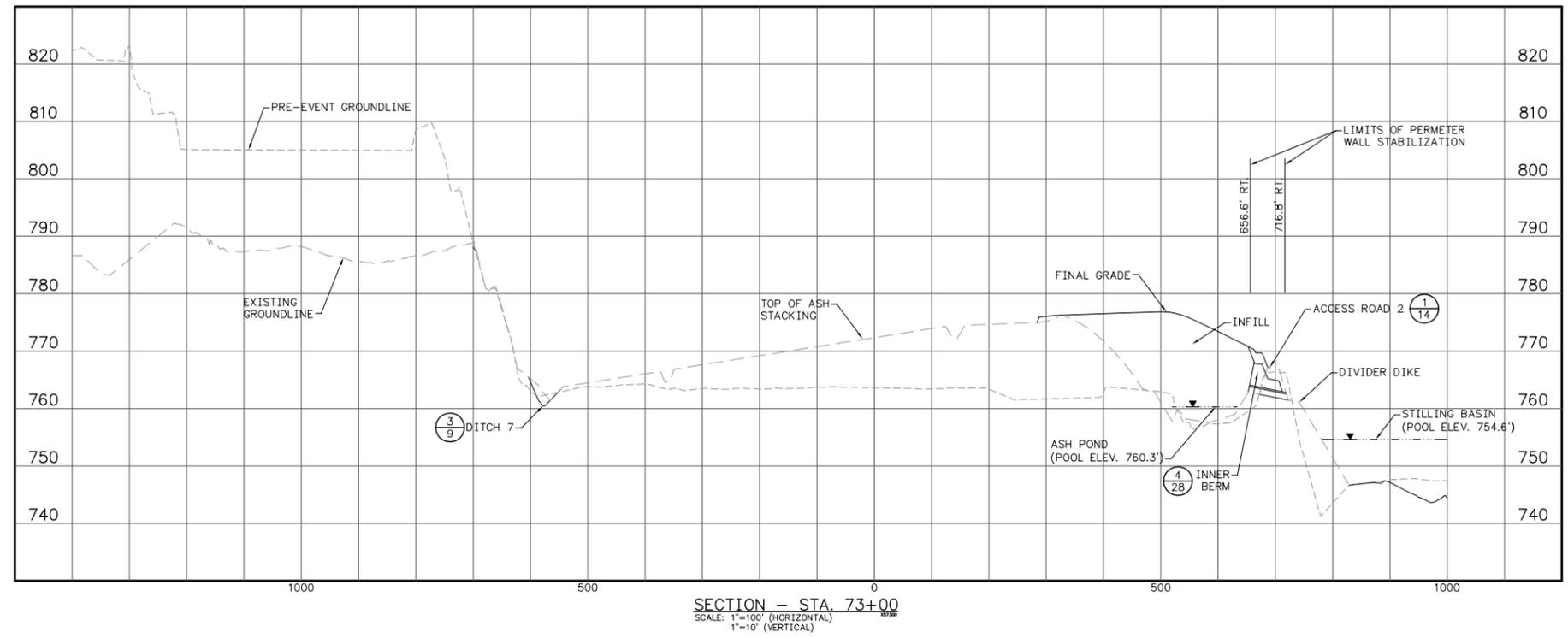


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TASK COMPLETED BY: REV. NO.

PLOT FACTOR: 1
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DO NOT ALTER MANUALLY

PLOT DATE: 04/17/2012 USER: GRAHAM_DAVE V:\1256\ACTIV\1256102\ENVIRONMENTAL\WORKING\SHETS\FILES\REV\PROJ\SHETS\FILES\10W432-13-HEADING

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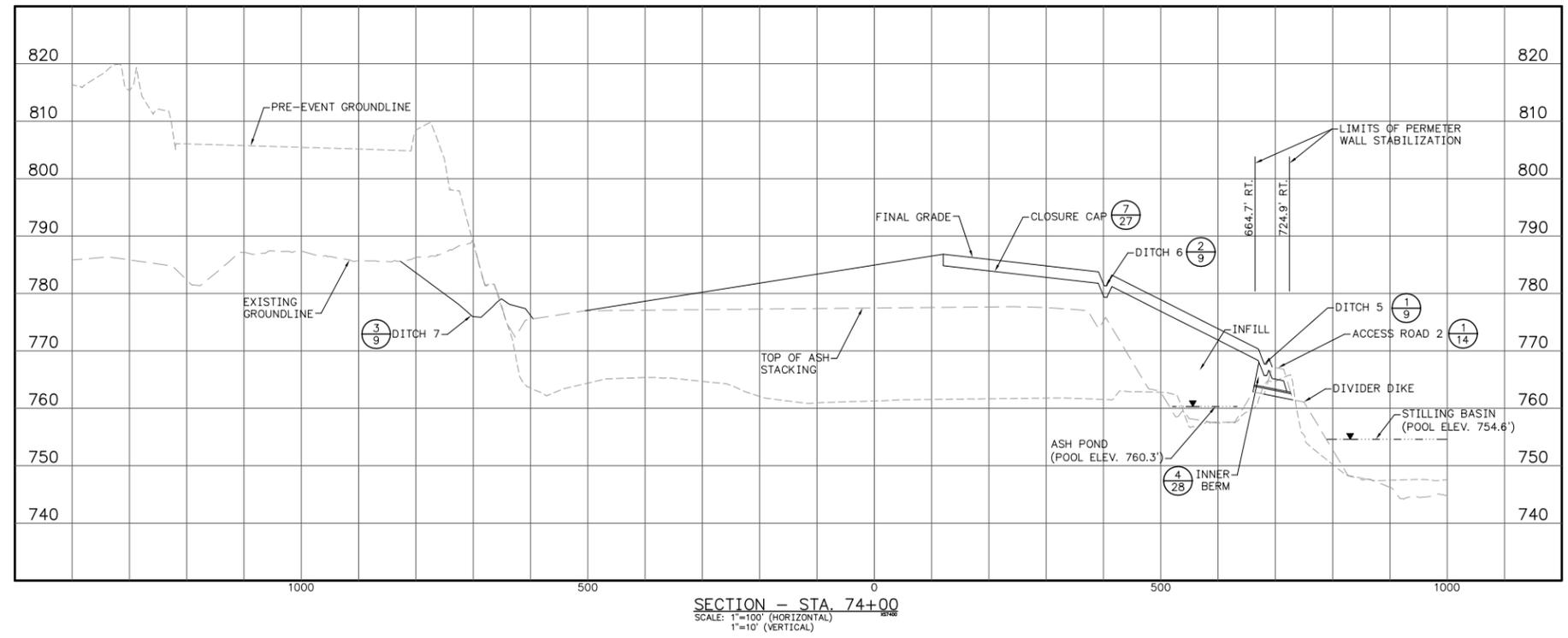
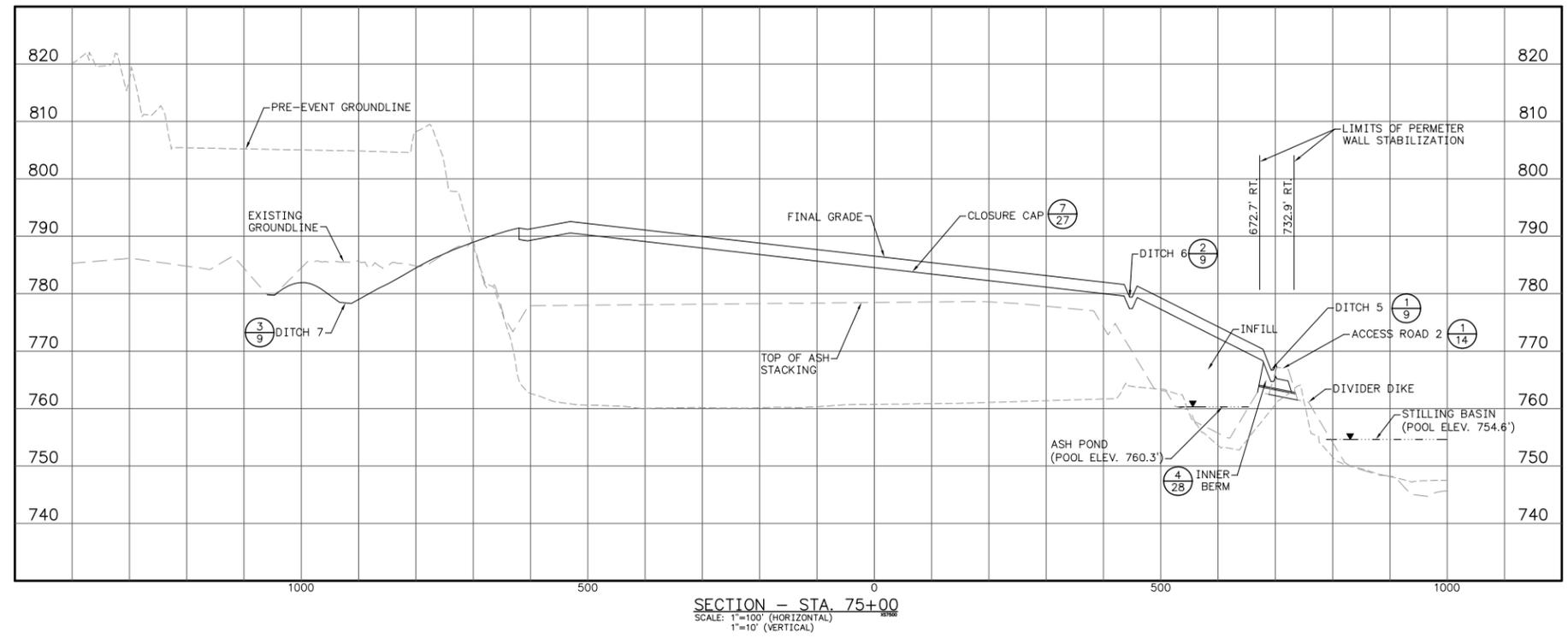


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Stantec Consulting Services Inc. 1409 North Forbes Road Lexington, Kentucky 40511-2204 Tel: 859.422.3000 Fax: 859.422.3100 www.stantec.com		DESIGNED BY: K.D. LINDQUIST DRAWN BY: D.M. GRAHAM CHECKED BY: D.E. HERRON SUPERVISED BY: M.J. STEELE REVIEWED BY: V.J. DOTSON APPROVED BY: M.S. TURNBOW ISSUED BY: J.C. KAMMEYER KINGSTON FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING																																	
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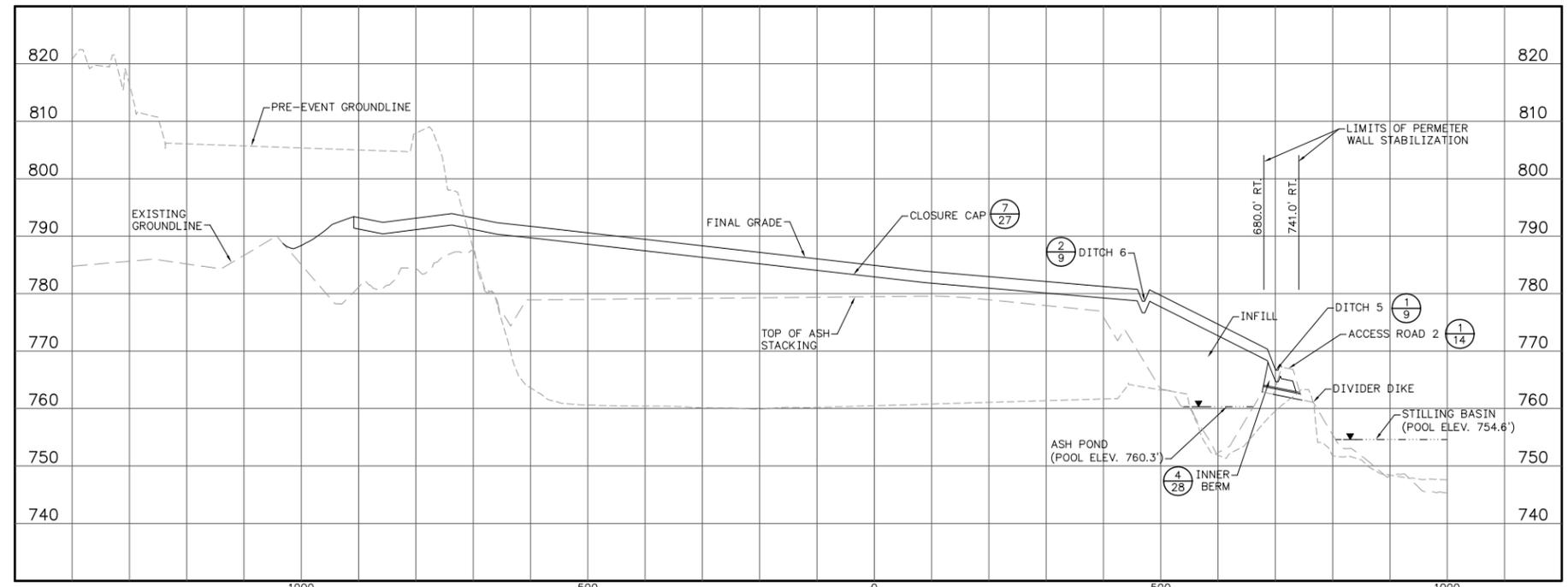
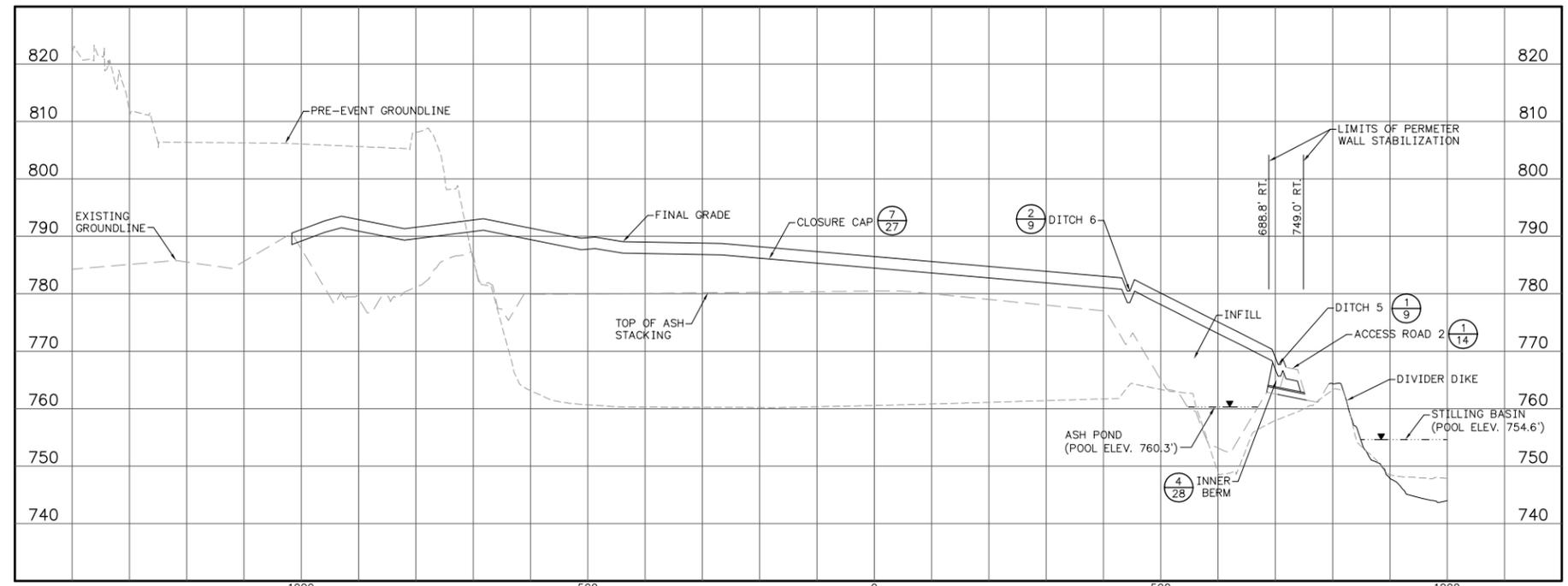


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TASK COMPLETED BY: REV. NO.

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DO NOT ALTER MANUALLY

PLOT DATE: 02/15/2012 USER: GRAHAM, DAVE V. 10756 (ACTIVITY) 066102 FOR ENVIRONMENTAL/CONSTRUCTION/UTILITY/ENGINEERING/PLANNING/DESIGN/CONSTRUCTION

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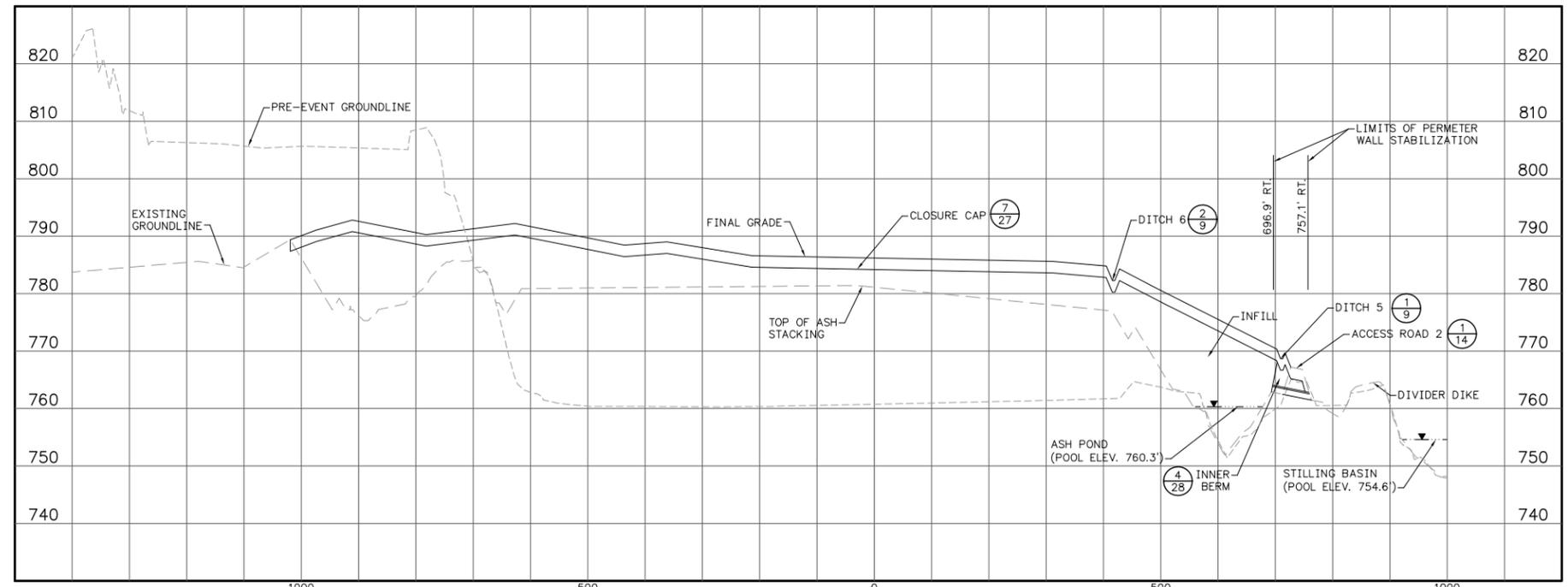
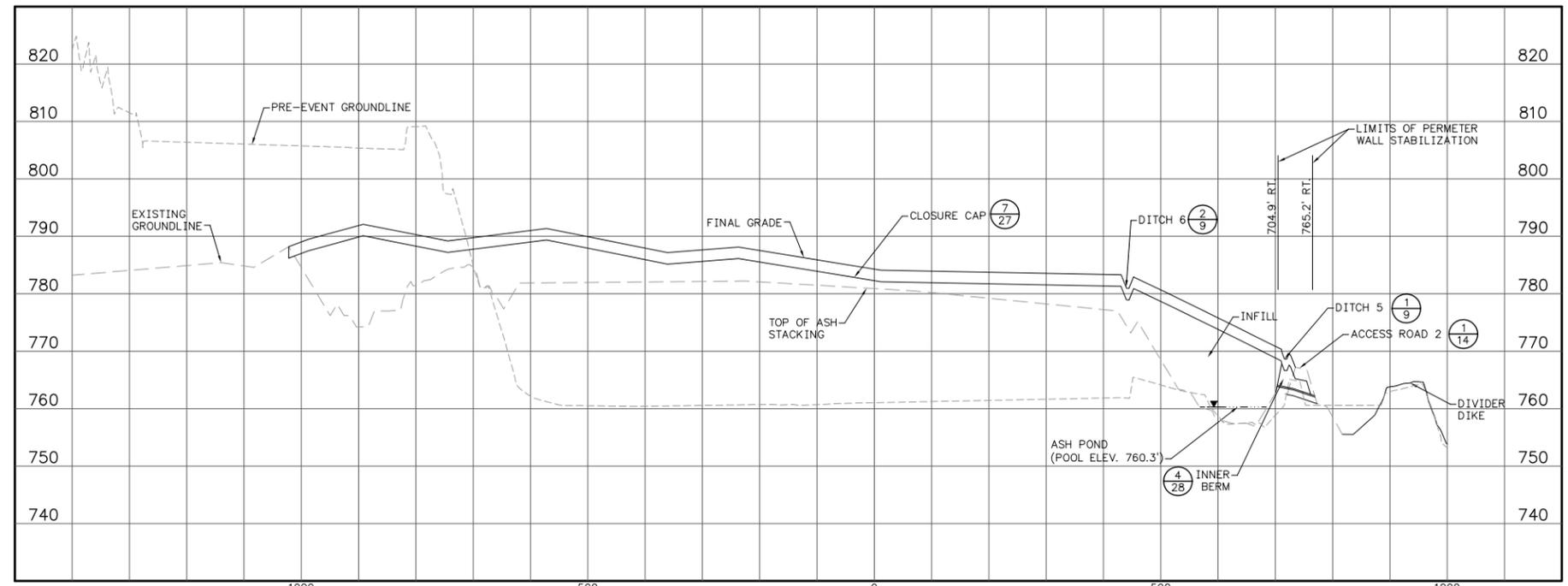
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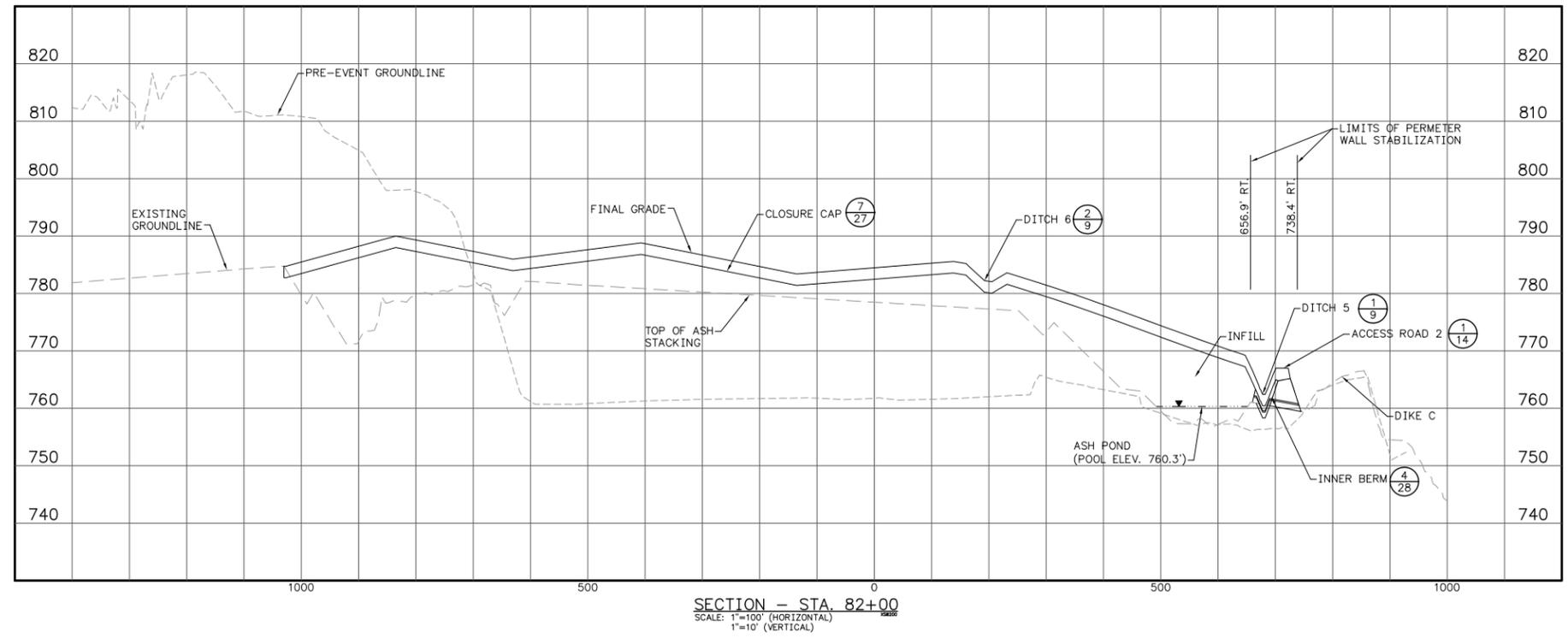
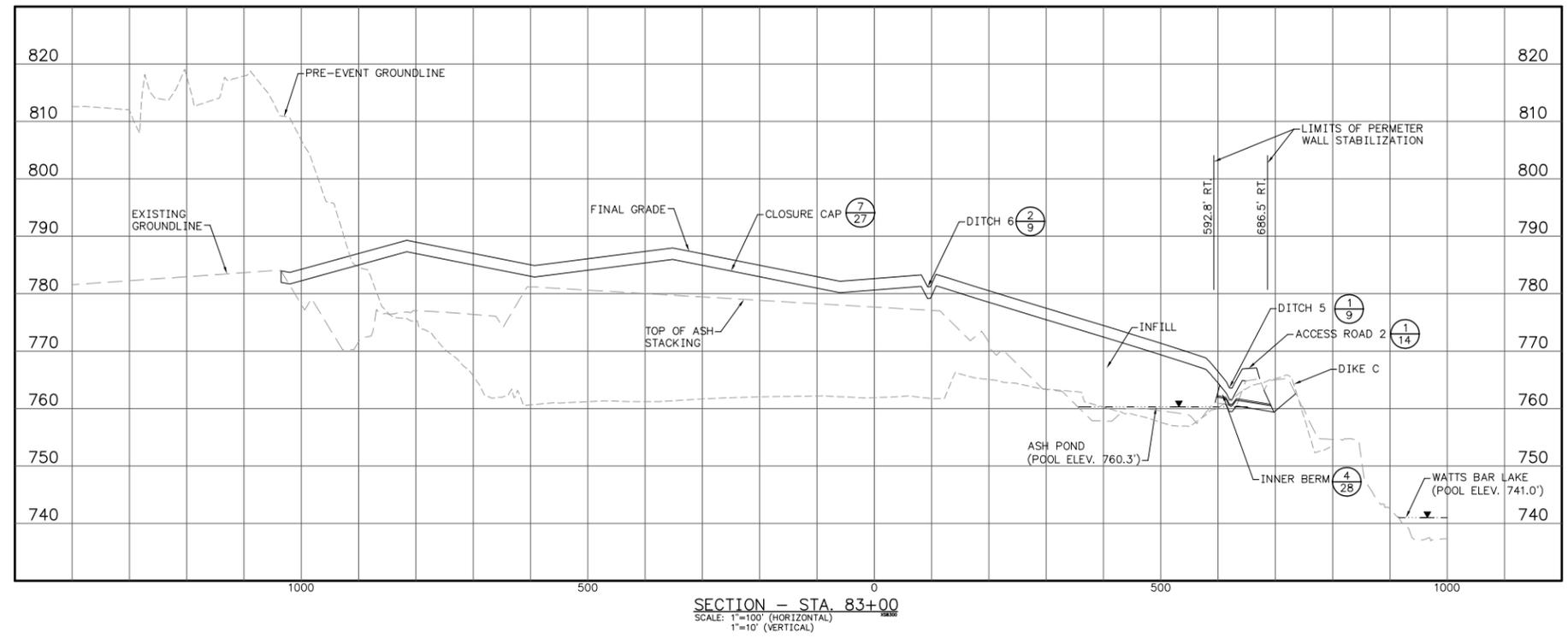
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PLOT FACTOR: 10
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DO NOT ALTER MANUALLY

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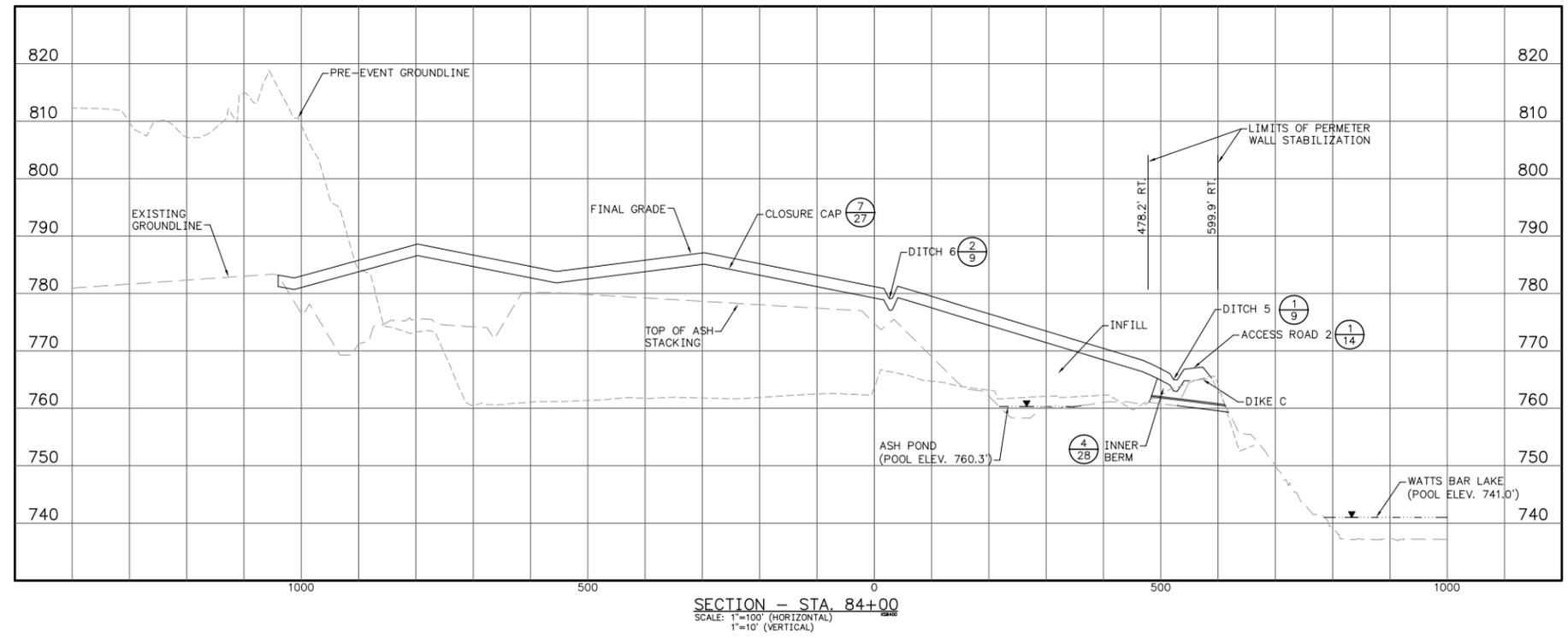
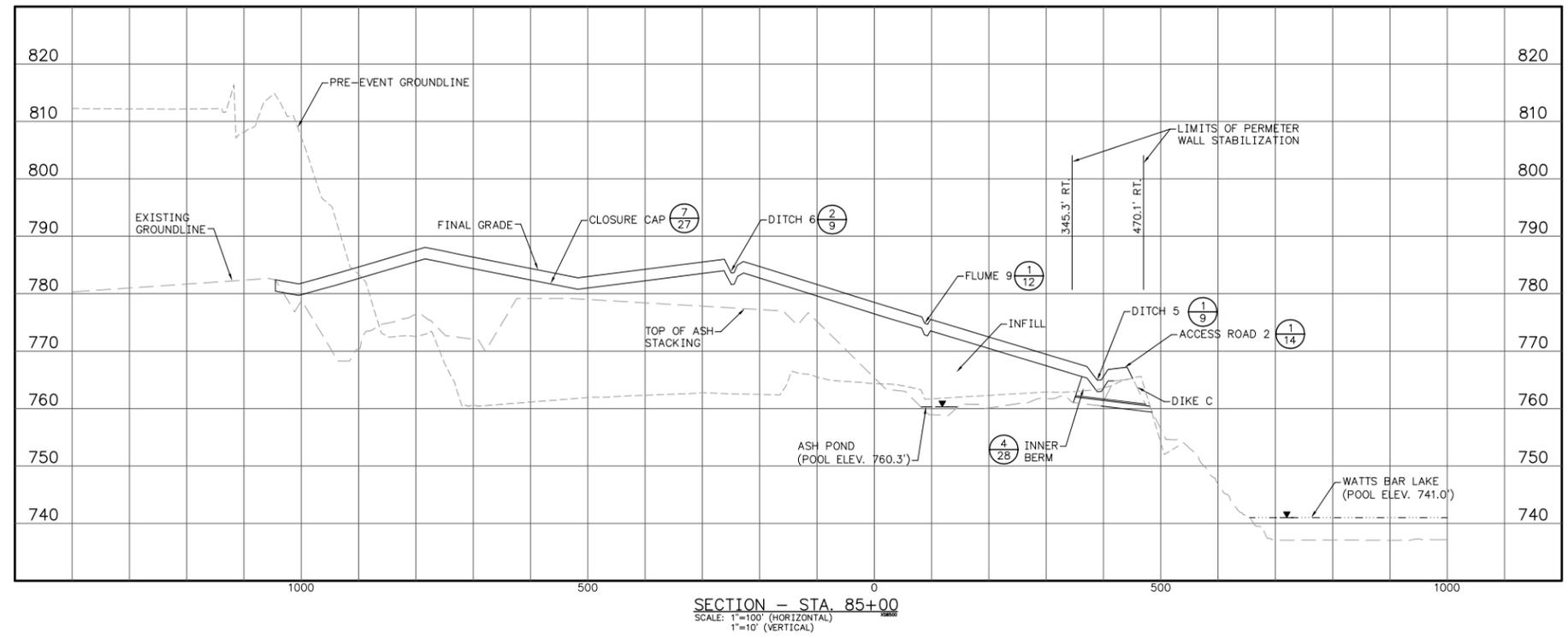
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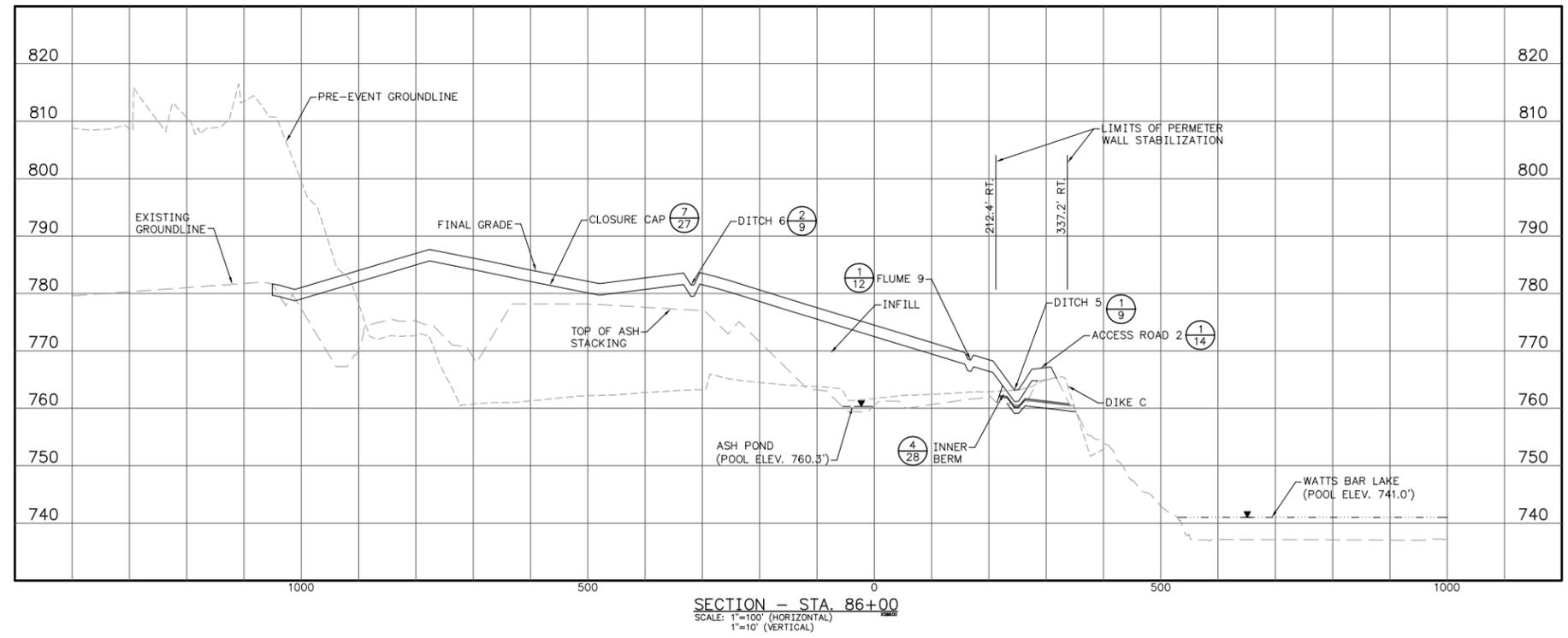
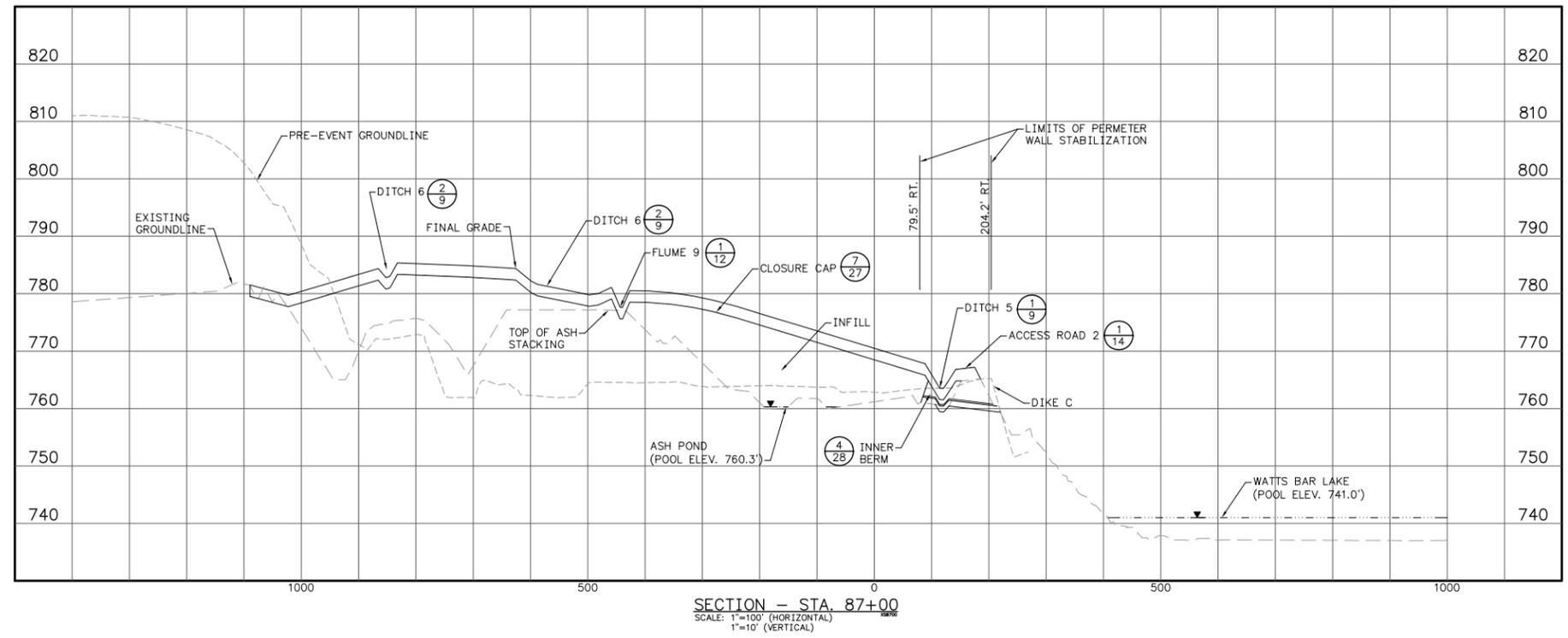
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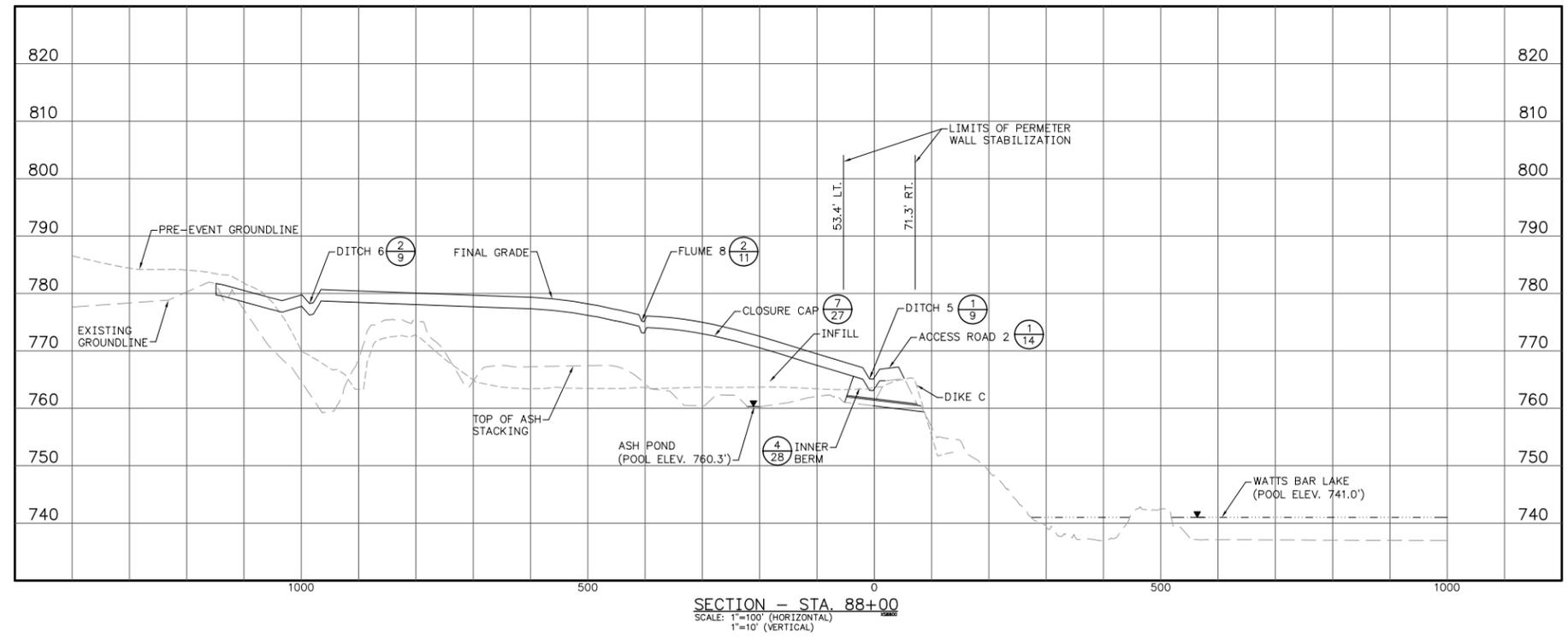
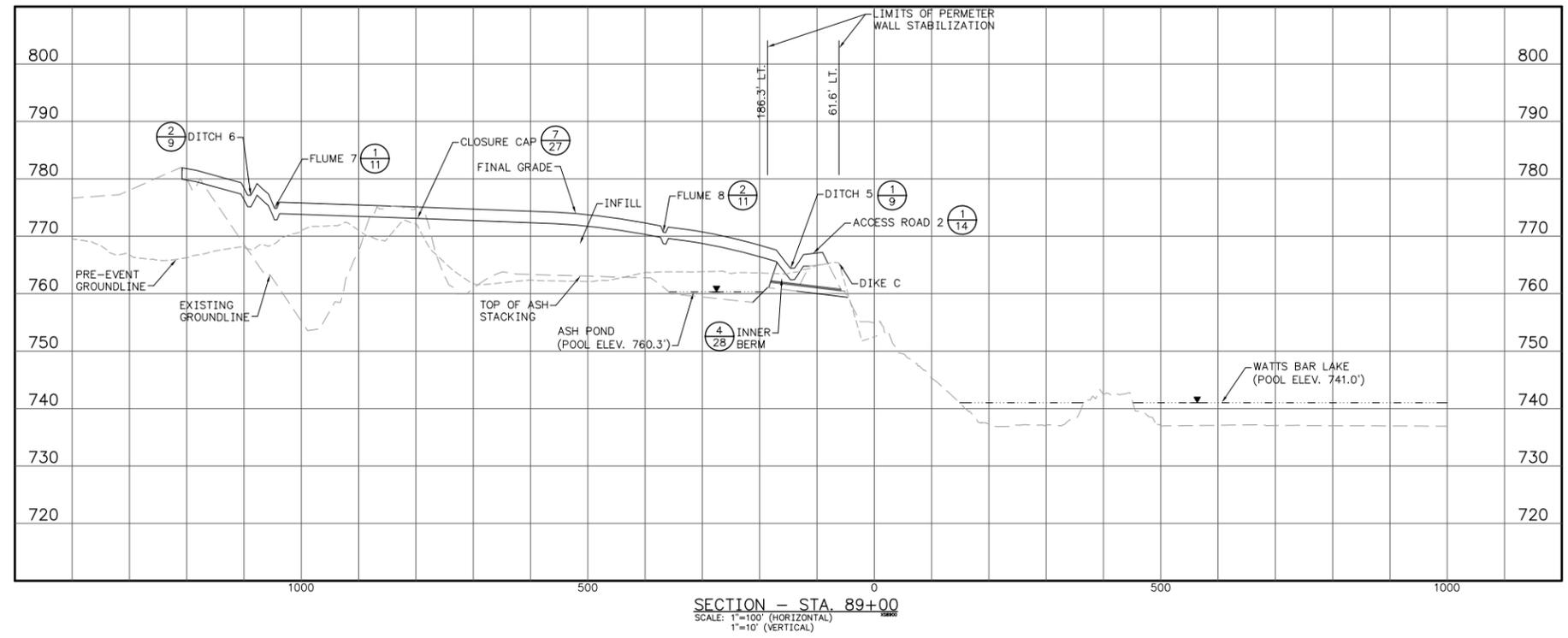
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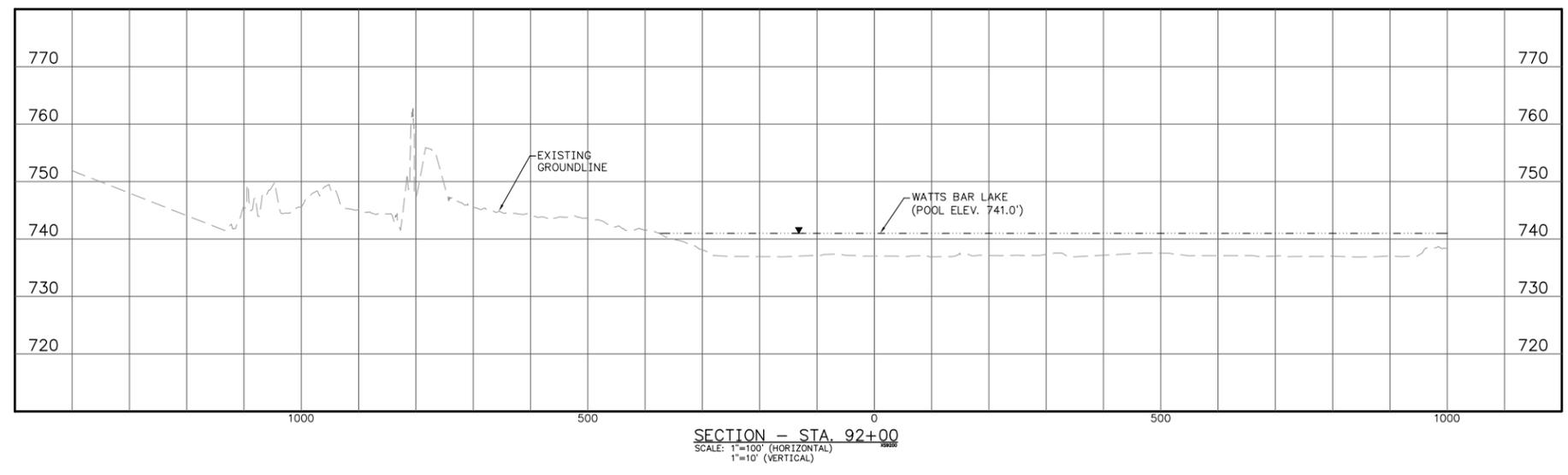
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SECTION - STA. 92+00
SCALE: 1"=100' (HORIZONTAL)
1"=10' (VERTICAL)

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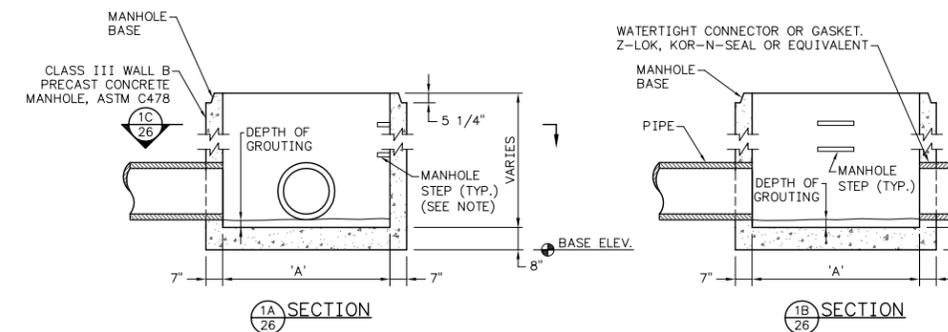
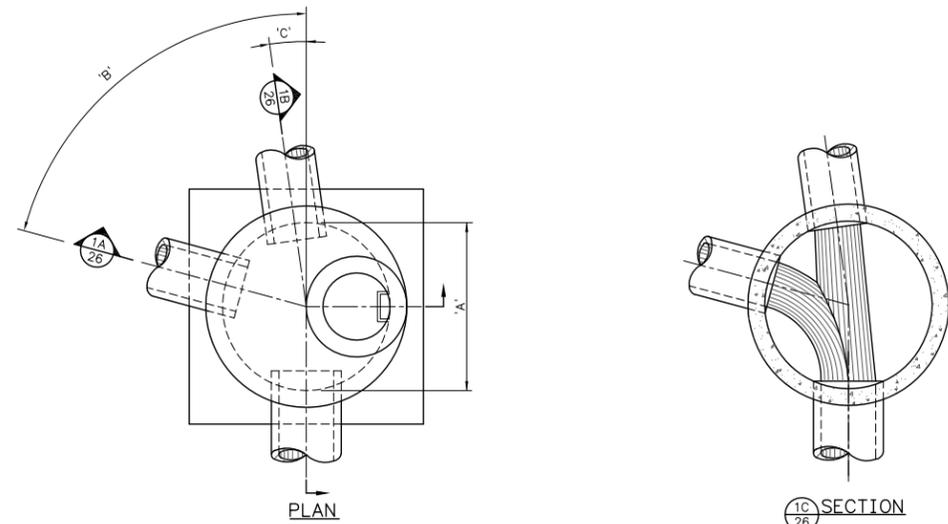
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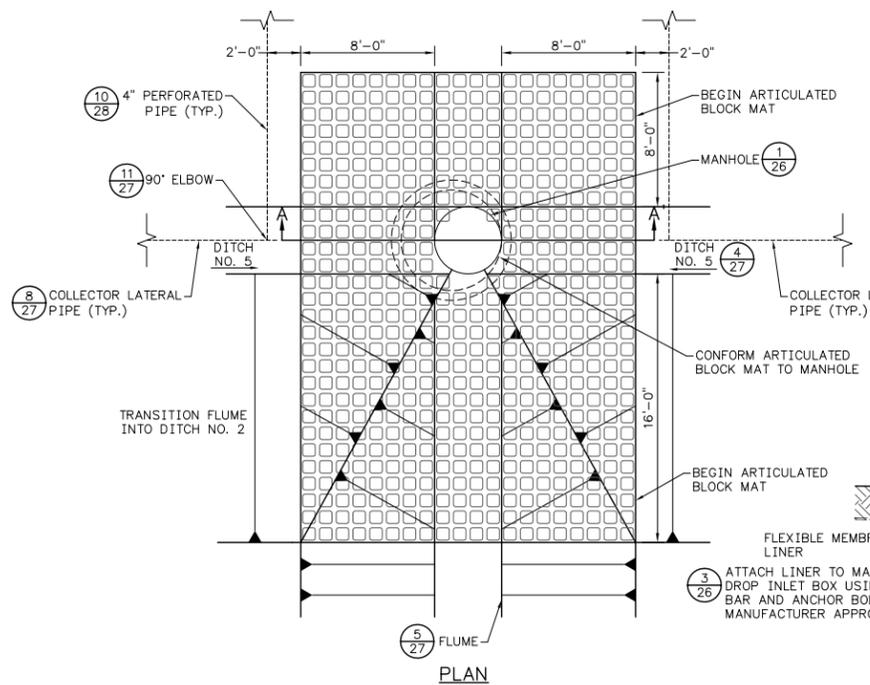
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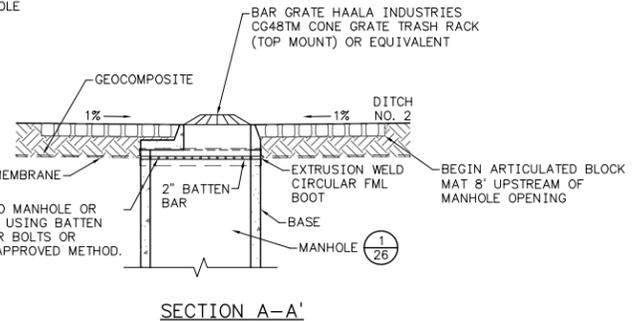
MANHOLE SUMMARY									
MANHOLE NO.	MANHOLE DIA. 'A' (FEET)	OUTLET INVERT ELEVATION (FEET)	ANGLE OF DEFLECTION 'B' AND 'C'	MAXIMUM ANGLE OF DEFLECTION	INLET PIPE DIA. (INCHES)	OUTLET PIPE DIA. (INCHES)	MANHOLE BASE ELEV. (FEET)	MANHOLE BASE HEIGHT (INCHES)	DEPTH OF GROUTING (INCHES)
1	6.0	757.9	N/A	-	N/A	30	755.9	60	13
2	6.0	757.5	91°	102°	30	30	756.0	60	8
3	6.0	756.0	N/A	-	N/A	42	754.4	66	9
4	8.0	754.2	105° AND 30°	107°	42	42	753.3	60	0
5	6.0	751.0	60°	79°	42	42	750.1	60	0

- NOTES:**
- MANHOLE STEPS SHALL BE REQUIRED IN MANHOLES WHEN THE STRUCTURE IS FOUR-FOOT AND GREATER IN DEPTH. STEPS SHALL BE SPACED APPROXIMATELY 12" TO 16" O.C. VERTICALLY TO FORM A CONTINUOUS LADDER.
 - MANHOLE STEPS SHALL BE NEENAH NO. R-1980-M OR ENGINEER APPROVED EQUAL.
 - REINFORCEMENT STEEL NOT SHOWN. USE ASTM C478 REINFORCEMENT.
 - BED AND BACKFILL WITH NO. 57 AGGREGATE OUTSIDE OF PERIMETER STABILIZATION ZONE AND WITH FLOWABLE FILL WITHIN PERIMETER STABILIZATION ZONE.
 - SOFT FOUNDATION CONDITIONS SHALL BE IMPROVED AS APPROVED BY THE QC MANAGER.
 - CONNECTION OF HDPE PIPE TO MANHOLE SHALL BE PERFORMED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. SUCH CONNECTION SHALL FORM A WATERTIGHT SEAL.
 - ANY JOINTS SHALL BE TONGUE AND GROOVE JOINTS WITH EITHER ASTM C442 RUBBER GASKET OR PREFORMED FLEXIBLE JOINT SEALANT.
 - NOTE THAT PIPE FROM MH-1 TO MH-2 AND MH-3 TO MH-4 CONFORMS TO SECTION 02600 OF THE SPECIFICATIONS. OTHER PIPES BETWEEN MANHOLES CONFORM TO SECTION 02365 OF THE SPECIFICATIONS.

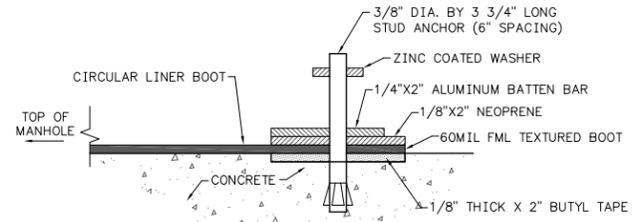
1 DETAIL - MANHOLE SCALE: 1/2"=1'-0"



2 DETAIL - CONFLUENCE FLUME/MANHOLES 1 AND 3 SCALE: 1/4"=1'-0"

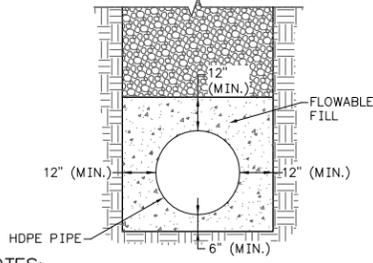


- NOTES:**
- THE WALL THICKNESS OF THE MANHOLES IS 7" AND THE BASE IS 72" OR 96" DIA.
 - ATTACH FML LINER TO BASE SECTION USING CURVILINEAR BATTEN BARS AND ANCHORS. BUTT GEOCOMPOSITE TO MANHOLE SIDES.
 - ARTICULATED BLOCK MAT OR EQUIVALENT SHALL BE INSTALLED TO CONFORM TO MANHOLE OPENING.
 - UPSTREAM AND DOWNSTREAM END OF MAT WILL BE TURNED DOWN ONE-FOOT.
 - 4" PIPES FROM COLLECTOR TURN-90° AT 10 FEET FROM OUTSIDE EDGE OF MANHOLE. (NOT SHOWN FOR CLARITY OF DETAIL)



- NOTES:**
- ANCHORS SHALL BE INSTALLED ON SIX INCH CENTERS AROUND THE MANHOLE.
 - ANCHORS SHALL FEATURE A BOLT BODY AND EXPANDER PLUG.

3 DETAIL - BATTEN BAR ATTACHMENT NOT TO SCALE



- NOTES:**
- IN AREAS OF PERIMETER STABILIZATION, BACKFILL WITH FLOWABLE FILL SHALL BE PERFORMED AT A MINIMUM TO FULL DEPTH OF THE STABILIZATION.
 - OUTSIDE AREAS OF PERIMETER STABILIZATION AND MORE THAN 5 FEET FROM STRUCTURES, BACKFILL WITH NO. 57 STONE.

4 DETAIL - PIPE BACKFILL (WITHIN 5 FEET OF STRUCTURE) SCALE: 1/2"=1'-0"

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REV. NO.	DATE	ISSN	DRN	CHG	SLPY	RWID	APPO	ISSD	PROJECT	AS CONST	REV. DES
0	02/17/12	KDL	ACC	DEH	MJS	VJD	MST	JCK			

SCALE: AS SHOWN EXCEPT AS NOTED

YARD LATERAL EXPANSION (CELL 4) CLOSURE - RDP-0114-C

CELL 4 CLOSURE DETAILS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
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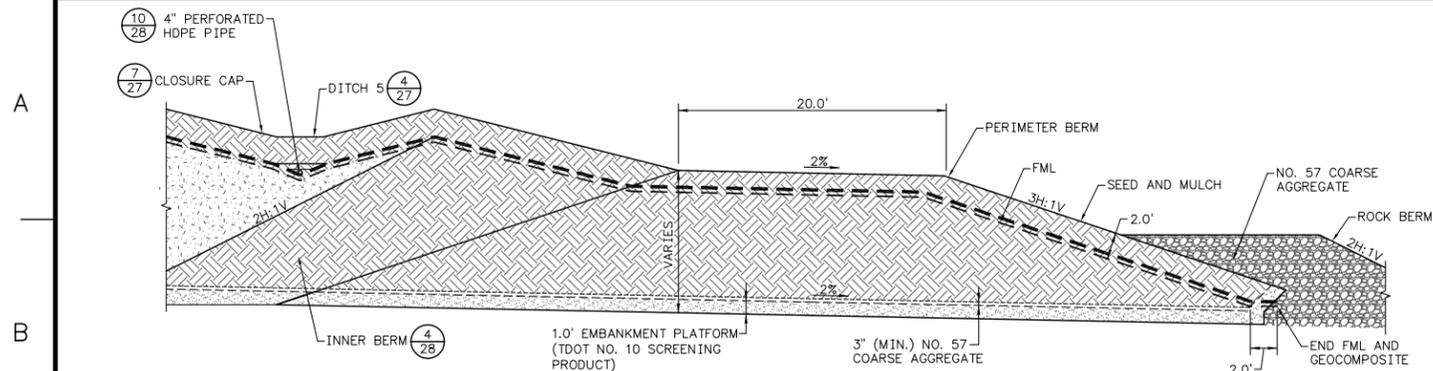
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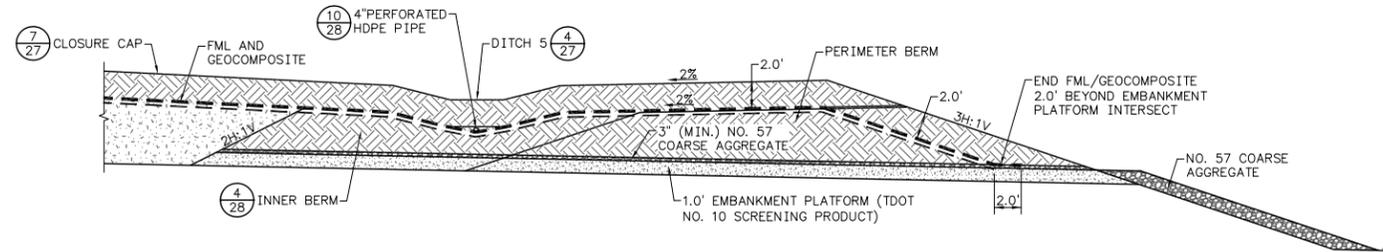


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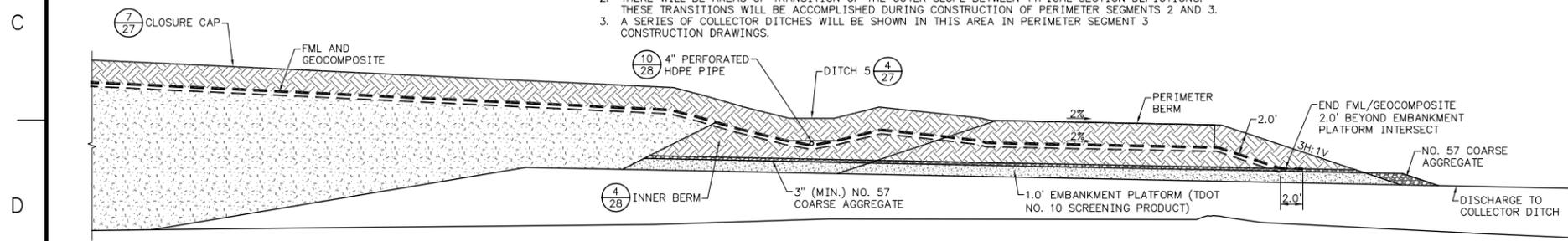


1 TYPICAL SECTION - FML ALONG PERIMETER BERM, PERIMETER SEGMENT STA. A164+17 TO STA. A163+91
SCALE: 1"=5'

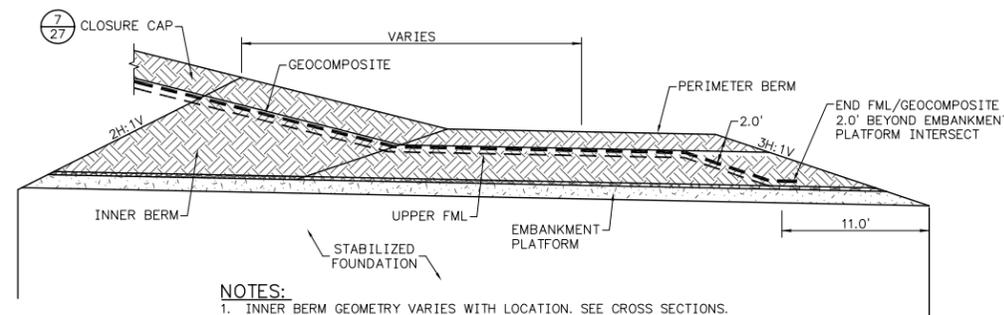


2 TYPICAL SECTION - FML ALONG PERIMETER BERM, PERIMETER SEGMENT STA. A163+91 TO STA. A144+20.84 (B328+75.66)
SCALE: 1"=5'

- NOTES:**
1. THE BERM AND INNER BERM ARE ANTICIPATED TO BE CONSTRUCTED TO THE ELEVATION OF THE UPPER FML LINER SUBGRADE UNTIL TIME FOR LINER INSTALLATION. THE TOP TWO FEET WILL BE ADDED AFTER THE LINER AND GEOCOMPOSITE INSTALLATION.
 2. THERE WILL BE AREAS OF TRANSITION OF THE OUTER SLOPE BETWEEN TYPICAL SECTION DEPICTIONS. THESE TRANSITIONS WILL BE ACCOMPLISHED DURING CONSTRUCTION OF PERIMETER SEGMENTS 2 AND 3.
 3. A SERIES OF COLLECTOR DITCHES WILL BE SHOWN IN THIS AREA IN PERIMETER SEGMENT 3 CONSTRUCTION DRAWINGS.

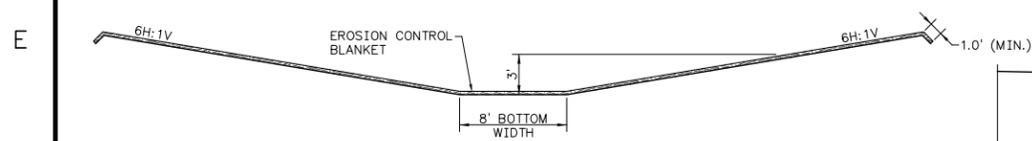


3 TYPICAL SECTION - FML ALONG PERIMETER BERM, PERIMETER SEGMENT STA. B328+75.66 (A144+20.84) TO STA. B317+00
SCALE: 1"=5'



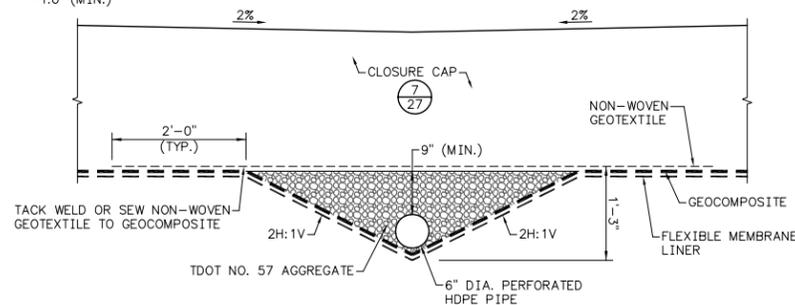
- NOTES:**
1. INNER BERM GEOMETRY VARIES WITH LOCATION. SEE CROSS SECTIONS.
 2. EMBANKMENT PLATFORM AND EARTH BERM ARE CONSTRUCTED PER DETAILS IN THE PERIMETER STABILIZATION PACKAGES.
 3. INNER BERM SHALL BE COMPACTED AS EARTHEN BERM AS DESIGNATED IN THE SPECIFICATIONS.
 4. THE SURFACE OF THE EARTHEN BERM SHALL BE SCARIFIED FILL TO PROMOTE BONDING WITH THE INNER BERM.
 5. FOR LINER LAYOUT SEE SHEET 5 AND 10.

4 DETAIL - TYPICAL INNER BERM
SCALE: 1"=5'

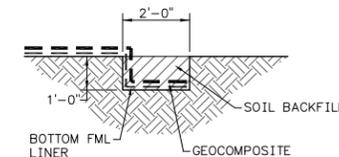


- NOTES:**
1. TEMPORARY DITCH IS INSTALLED ALONG THE SOUTHERN LIMITS AND ALONG THE NORTH EAST LIMITS OF THE WORK AREA.
 2. TEMPORARY DITCH SHALL BE VEGETATED IN ACCORDANCE WITH ASH STACKING PROTOCOLS.

5 DETAIL - TEMPORARY DITCH
SCALE: 1"=5'

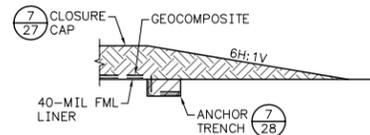


6 TYPICAL SECTION - 6" CENTER DRAIN
SCALE: 1"=1'-0"



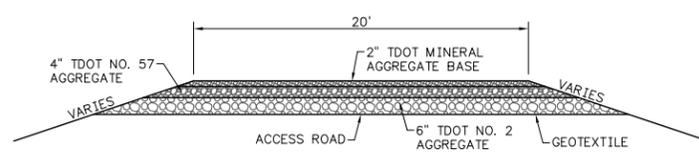
- NOTES:**
1. SOIL BACKFILL SHALL HAVE NO ROCK EXCEEDING 3 INCH MAXIMUM DIMENSION.
 2. SOIL BACKFILL SHALL BE COMPACTED USING MANUALLY OPERATED TAMPERS.
 3. SOIL BACKFILL SHALL BE COMPACTED TO A MINIMUM OF 95% OF STANDARD PROCTOR MAXIMUM DRY DENSITY.
 4. NO. 10 PRODUCT BACKFILL MAY BE UTILIZED WHERE GEOTEXTILE CUSHION IS SHOWN.

7 DETAIL - ANCHOR TRENCH
SCALE: 1/2"=1'-0"

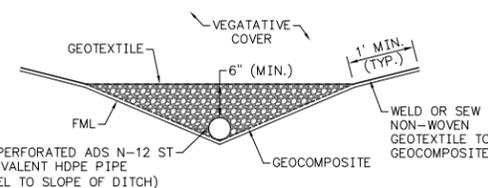


- NOTES:**
1. FML LINER AND GEOCOMPOSITE ALONG THE PROJECT BOUNDARY SHALL BE PLACED IN A TEMPORARY ANCHOR TRENCH FOR LATER EXPOSURE AND SPLICING TO NEW AREAS OF FINAL COVER.
 2. THE CONTRACTOR SHALL MAKE EVERY EFFORT TO MAINTAIN LINER AND GEOCOMPOSITE INTEGRITY IN EXPOSED AREAS. THIS INCLUDES PROTECTION FROM EQUIPMENT, FOOT TRAFFIC AND ULTRAVIOLET DEGRADATION.
 3. THE LINER AND GEOCOMPOSITE SHALL BE MAINTAINED FOR USE IN SPLICING NEW SEGMENTS TO FUTURE WORK EFFORTS.

8 DETAIL - LINER TERMINATION AT PROJECT BOUNDARY
SCALE: 1/4"=1'-0"



9 DETAIL - ACCESS ROAD
SCALE: 1/2"=1'-0"



10 DETAIL - 4" PERFORATED HDPE PIPE
SCALE: 1"=1'-0"

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FOR SUPPORTING DESIGN CALCULATIONS SEE FPGKIFFSCDX00030020110033		R - - - - -	
ISSUED FOR REVIEW		R 0 04/20/12 KDL ACC DEH MJS VJD MST JCK	
REV. NO.	DATE	ISSN	DRWN
1	04/20/12	36	C
SCALE: AS SHOWN		EXCEPT AS NOTED	
YARD LATERAL EXPANSION (CELL 4) CLOSURE - RDP-0114-C			
CELL 4 CLOSURE DETAILS			
DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:
K.D. LINDQUIST	A.C. CLINK	D.E. HERRON	M.J. STEELE
REVIEWED BY:	APPROVED BY:	ISSUED BY:	
V.J. DOTSON	M.S. TURNBOW	J.C. KAMMEYER	
KINGSTON FOSSIL PLANT TENNESSEE VALLEY AUTHORITY FOSSIL AND HYDRO ENGINEERING			
AUTOCAD R 2000	DATE	36	C
04/20/12			
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PLOT FACTOR: 1
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C.A.D. DRAWING
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A

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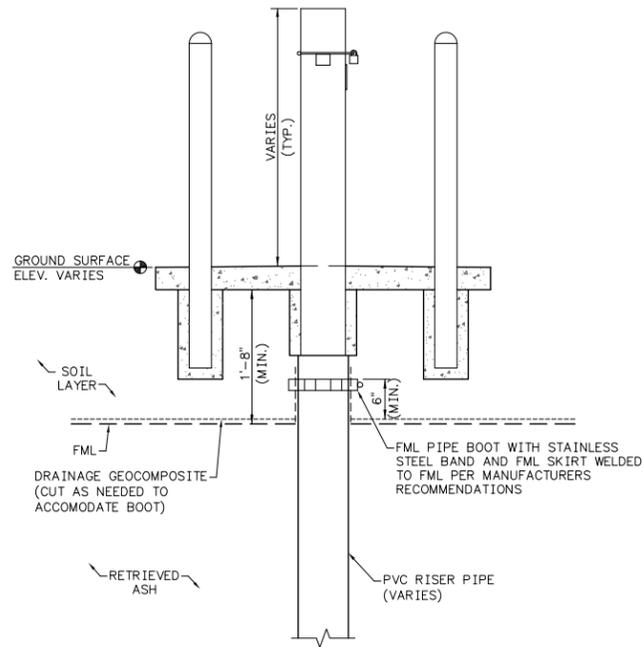
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E

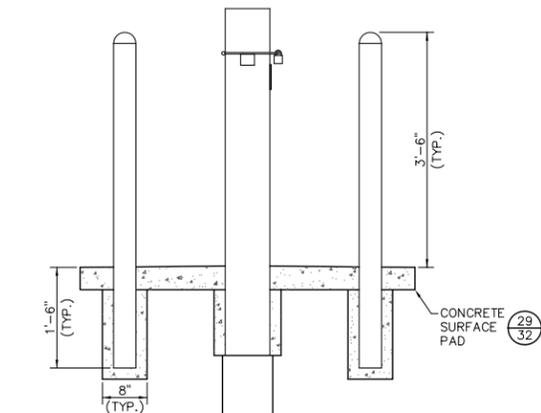
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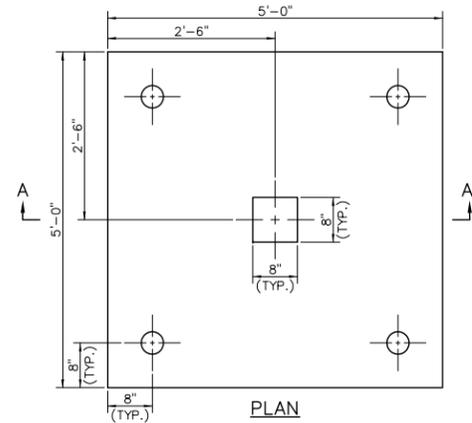


1 DETAIL - LINER PENETRATION BY INSTRUMENTATION
SCALE: 1"=1'-0"



2 DETAIL - CONCRETE PAD
SCALE: 1"=1'-0"

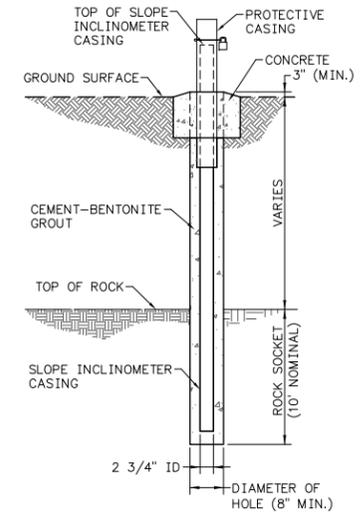
- NOTES:
- PROTECTIVE BOLLARDS TO BE FILLED WITH 3000 PSI CONCRETE AND CONE-TAPER THE TOP.
 - DRILL 3/16" DIAMETER VENT HOLE FOR PIEZOMETERS ONLY, 2 INCHES BELOW TOP OF PVC RISER.
 - NEW PROTECTIVE COVERS DO NOT REQUIRE PAINTING.
 - POSITION PROTECTIVE COVER WITH HINGE AT SAME ELEVATION AS TOP OF PVC RISER. FILL INSIDE OF PROTECTIVE COVER WITH CEMENT GROUT TO SAME LEVEL AS CONCRETE PAD.
 - DRILL 3/16" DIAMETER WEEP HOLE AT TOP OF GROUT INSIDE PROTECTIVE COVER.



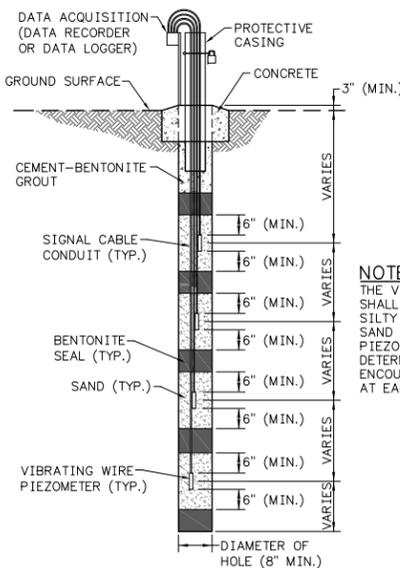
3 DETAIL - CONCRETE SURFACE PAD
SCALE: 1"=1'-0"

- NOTES:
- SLOPE CONCRETE PAD SURFACE TO PREVENT PONDING WATER.
 - PLACE WIRE MESH 2 INCHES MINIMUM FROM ALL CONCRETE EDGES.

SECTION A-A'

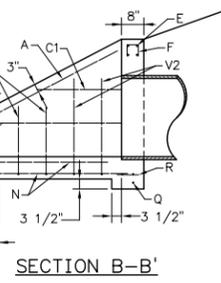
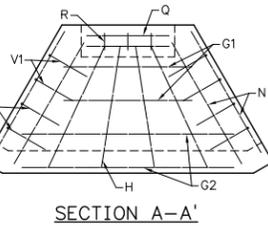
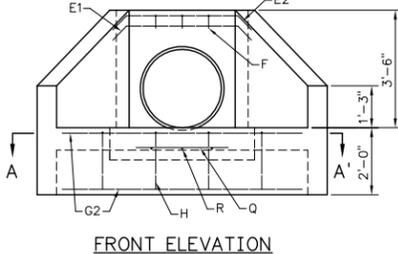
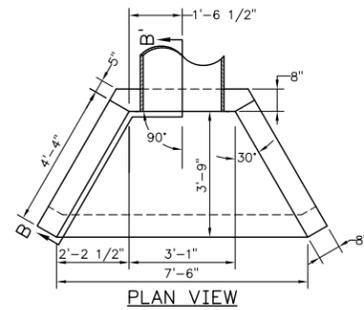


4 DETAIL - SLOPE INCLINOMETER INSTALLATION
SCALE: NOT TO SCALE



5 DETAIL - VIBRATING WIRE PIEZOMETER INSTALLATION
SCALE: NOT TO SCALE

NOTE:
THE VIBRATING WIRE PIEZOMETERS SHALL BE SET IN THE ASH MATERIALS, SILTY CLAY AND CLAYEY TO SILTY SAND WITH GRAVEL LAYERS. PIEZOMETER TIP ELEVATIONS SHALL BE DETERMINED IN THE FIELD BASED ON ENCOUNTERED SUBSURFACE CONDITIONS AT EACH INSTRUMENT LOCATION.



6 DETAIL - 30" HEADWALL
SCALE: 1/2"=1'-0"

- NOTES:
- MAINTAIN A 2" CLEAR DISTANCE BETWEEN THE FACE OF CONCRETE AND ALL STEEL BARS.
 - BARS DESIGNATED WITH THE LETTERS C, G, AND V ARE SPACED AT 1'-0" O.C. ALL OTHER BARS SHALL BE EVENLY SPACED.

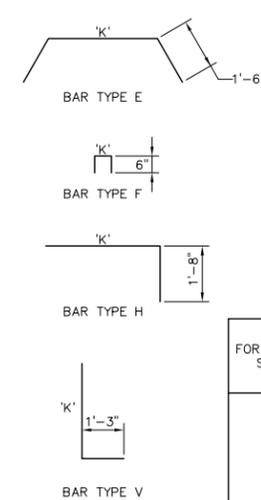
SECTION - WING

ROUGHENED CONSTRUCTION JOINT

BAR SCHEDULE

MARK	SIZE	QTY.	LENGTH	'K' LENGTH
A	5	4	4'-8"	
C1	4	2	2'-4"	
C2	4	2	4'-2"	
E1	5	2	6'-4"	3'-4"
E2	5	2	6'-8"	3'-8"
F	4	3	1'-3"	0'-4"
G1	4	2	3'-10"	
G2	4	3	6'-2"	
H	4	4	5'-1"	3'-5"
N	4	6	4'-2"	
Q	4	2	2'-9"	
R	4	3	0'-8"	
V1	5	4	3'-1"	1'-10"
V2	5	4	4'-1"	2'-10"

BENT BAR SHAPES



- NOTES:
- ABANDONMENT OF INSTRUMENTATION OCCURS IMMEDIATELY PRIOR TO LINER INSTALLATION. SUCH INSTRUMENTATION WILL BE MONITORED BY THE QC TEAM AS LONG AS PRACTICABLE.
 - LINER PENETRATION FOR EXTENDED AND NEW INSTRUMENTATION SHALL BE SECURED AS SHOWN.
 - FOR A LISTING OF INSTRUMENTS TO BE ABANDONED SEE SHEET 10W500-8.

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SEE FPGKIFFSCDX00030020110033

REV. NO.	DATE	ISSN	DRN	CHG	SLPY	R/VD	APPD	ISSD	PROJECT	AS CONST	REV. BY
R-0	02/17/12	KDL	DMG	DEH	MJS	VJD	MST	JCK			

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
LATERAL EXPANSION (CELL 4) CLOSURE - RDP-0114-C
CELL 4 CLOSURE
DETAILS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
K.D. LINDQUIST	D.M. GRAHAM	D.E. HERRON	M.J. STEELE	V.J. DOTSON	M.S. TURNBOW	J.C. KAMMEYER

KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD	R	DATE	SCALE	PROJECT	REV. NO.
R 2000		02/17/12	36	C 10W432-29	R 0

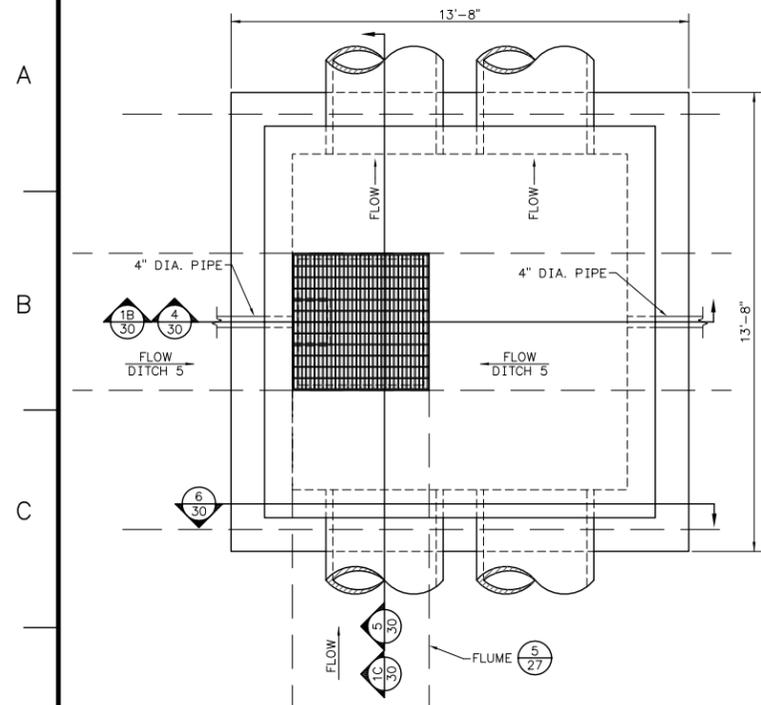
SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY



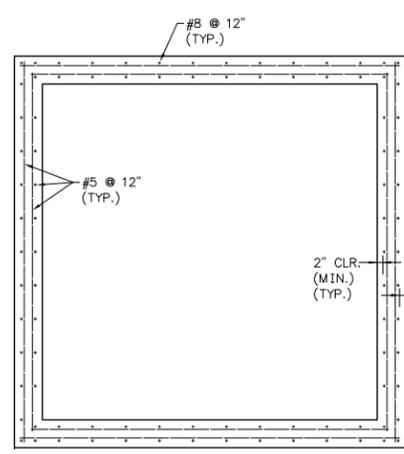
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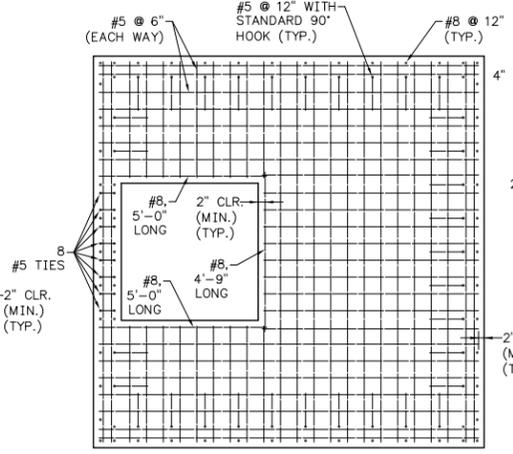
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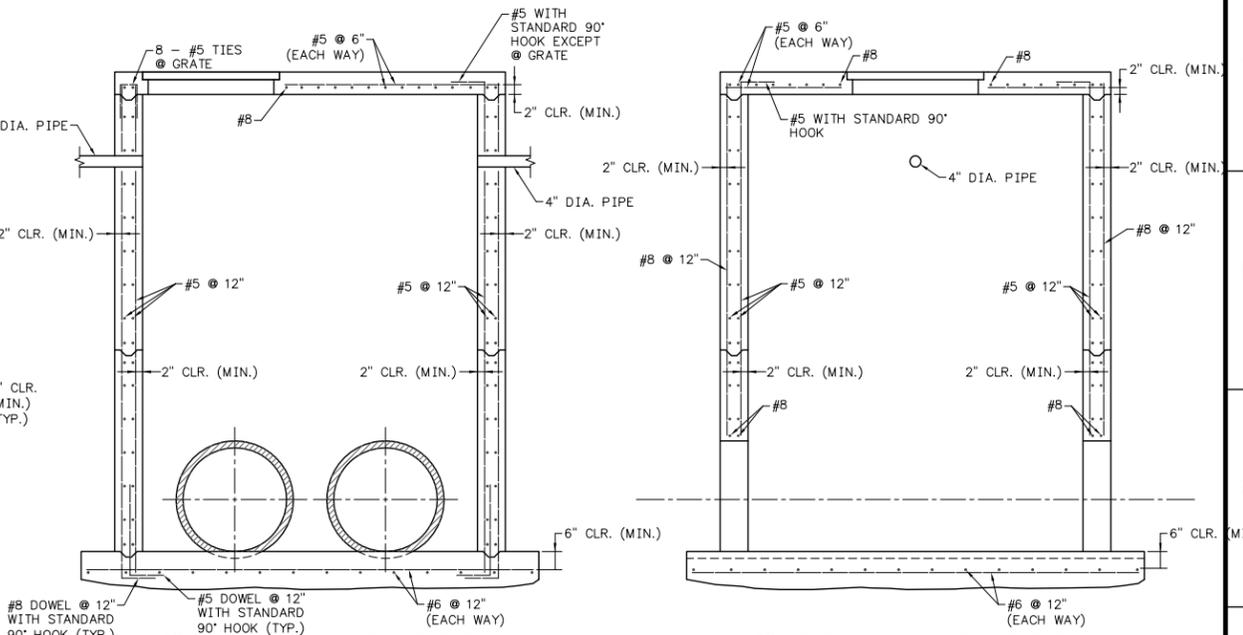
1A SECTION - DROP BOX INLET
SCALE: 1/2"=1'-0"



2 SECTION - REINFORCEMENT
SCALE: 1/2"=1'-0"

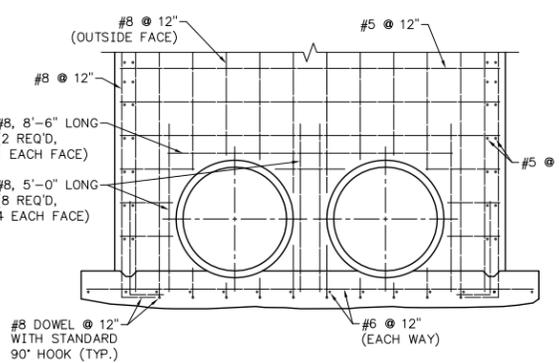


3 SECTION - REINFORCEMENT TOP SLAB
SCALE: 1/2"=1'-0"

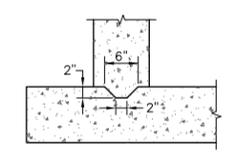


4 SECTION - REINFORCEMENT
SCALE: 1/2"=1'-0"

5 SECTION - REINFORCEMENT
SCALE: 1/2"=1'-0"



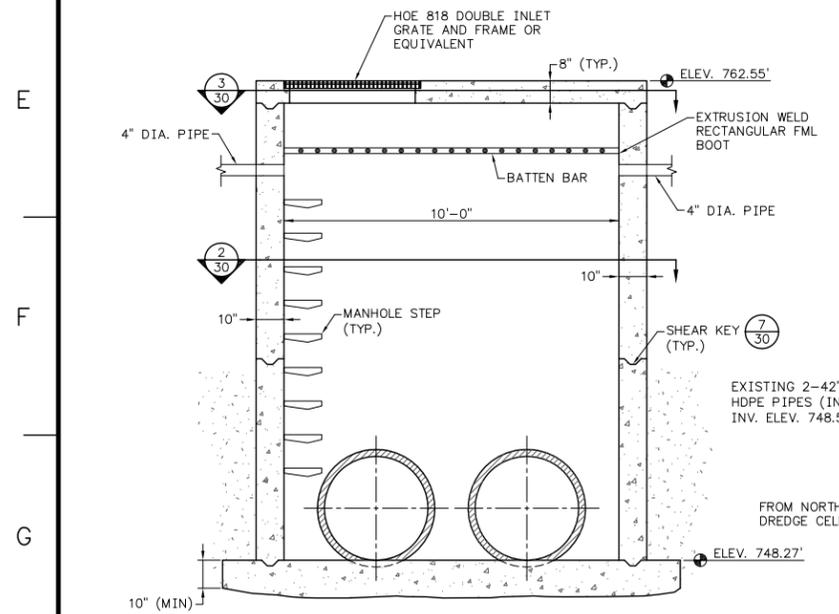
6 SECTION - REINFORCEMENT PIPE PENETRATION (INLET AND OUTLET ENDS)
SCALE: 1/2"=1'-0"



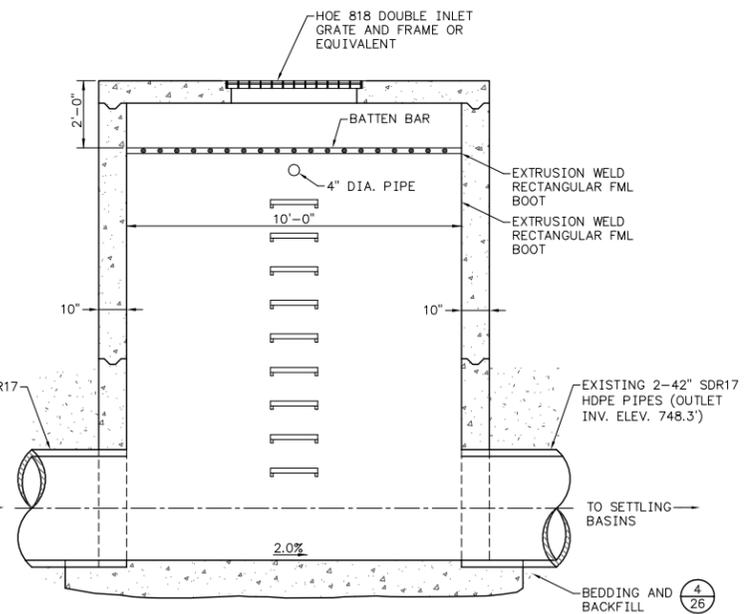
7 DETAIL - SHEAR KEY
SCALE: 1"=1'-0"

- NOTES:**
1. EXPOSE EXISTING PIPES AND FORM DROP BOX. CUT PIPES AND REMOVE SECTIONS OF PIPES AND FLOWABLE FILL FROM WITHIN AREA TO BE FORMED UP.
 2. DROP INLET BOX BEDDING AND BACKFILL SHALL CONFORM TO FLOWABLE FILL.
 3. FORM BOX AROUND EXISTING PIPES AND CAST BOTTOM SLAB AGAINST GROUND AS PRACTICABLE. EXCAVATE BENEATH PIPES AS PRACTICABLE TO ALLOW CONCRETE PLACEMENT.
 4. ALL STRUCTURAL STEEL SHALL BE GALVANIZED AND CONFORM TO GRADE 60 REBAR. USE 2 INCH MINIMUM CLEARANCE AROUND PIPES..
 5. MANHOLE STEPS SHOWN ON OPPOSITE WALL SHALL BE REQUIRED IN DROP INLETS WHEN THE STRUCTURE IS FOUR FEET AND GREATER IN DEPTH. STEPS SHALL BE SPACED APPROXIMATELY 12" TO 16" ON CENTER VERTICALLY TO FORM A CONTINUOUS LADDER.
 6. CONCRETE USED TO CONSTRUCT SECTIONS SHALL EXHIBIT A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS.
 7. MANHOLE STEPS SHALL BE NEENAH R-1980-M OR QC MANAGER APPROVED EQUAL.
 8. SEAL ALL JOINTS WITH APPROVED MATERIALS AS PER SECTION 02350, PARAGRAPH 2.3 OF THE TECHNICAL SPECIFICATIONS.
 9. ATTACH FML LINER TO DROP BOX INLET USING BATTEN BARS AND ANCHOR BOLTS. BUTT GEOCOMPOSITE TO DROP BOX INLET SIDES.
 10. ARTICULATED BLOCKMAT OR EQUIVALENT SHALL BE INSTALLED TO CONFORM TO GRATED OPENING. ARMOR 8" UPSTREAM EACH SIDE OF DROPBOX AND TO FULL HEIGHT OF DITCHES PER 26.

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18 SECTION - DROP BOX INLET
SCALE: 1/2"=1'-0"



19 SECTION - DROP BOX INLET
SCALE: 1/2"=1'-0"



1 DETAIL - DROP BOX INLET
SCALE: 1/2"=1'-0"

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGKIFFCSDX00030020110033		<table border="1"> <tr> <th>REV.</th> <th>NO.</th> <th>DATE</th> <th>ISSN</th> <th>DRWN</th> <th>CHKD</th> <th>SLVP</th> <th>RVWD</th> <th>APPD</th> <th>ISSD</th> <th>PROJECT</th> <th>AS CONST</th> <th>REV</th> </tr> <tr> <td></td> </tr> </table>										REV.	NO.	DATE	ISSN	DRWN	CHKD	SLVP	RVWD	APPD	ISSD	PROJECT	AS CONST	REV													
REV.	NO.	DATE	ISSN	DRWN	CHKD	SLVP	RVWD	APPD	ISSD	PROJECT	AS CONST	REV																									
SCALE: AS SHOWN		EXCEPT AS NOTED																																			
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Technical Specifications

Lateral Expansion (Cell 4)
Closure
Kingston Fossil Plant
Harriman, Roane County,
Tennessee

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Prepared for

Tennessee Valley Authority
Kingston, Tennessee

February 17, 2012

**TECHNICAL SPECIFICATIONS
TABLE OF CONTENTS**

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Section 02305	Borrow
Section 02350	Pre-Cast Structures
Section 02365	HDPE Pipe - REVISED
Section 02373	Geotextile - REVISED
Section 02410	Surface Drainage Ditches
Section 02507	Access Road
Section 02600	HDPE Fusion Pipe
Section 02621	Gecomposite Drainage Media - REVISED
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Section 03100	Concrete Formwork
Section 03200	Concrete Reinforcement
Section 03300	Concrete
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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 CONTRACTOR shall become familiar with the stacking and closure work occurring in the North and Central Dredge Cell (Cells 2 and 3) and the stacking construction in the Lateral Expansion (Cell 4) as well as Perimeter Containment construction in Segments 1, 2, 3, 7, and 8. These projects and the Lateral Expansion (Cell 4) Closure shall be integrated into the Best Management Practices Plan. Work performed on one project may impact another.

1.1.3. This Work may be proceeding concurrent with or shortly following the work detailed in the construction packages noted in Paragraph 1.1.2. The CONTRACTOR shall also be familiar with the Site Wide Storm Water Management Plan (SWMP), as well as the Erosion and Sediment Control Details, and Best Management Practices (BMP) 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 (QC) 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 02305 – Borrow
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 02936 – Revegetation

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 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 or embankment activities in a discrete area.

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 ash fill material 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, Paragraph 5.2 and the QC Plan.

3.1.2. The 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 on graded areas that won't be disturbed again for 14 days or more by spraying with Flexterra or equivalent hydromulch at a rate of 2000 pounds per acre. For lesser periods of time, spray with water.

3.1.3. The 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 from this area and into 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 shall 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 CONTRACTOR shall install silt fences, and/or fiber rolls or other suitable measures as practicable along the contour above benches, 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 below proposed disturbed areas in accordance with the plans and details and as needed in other 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 may also be utilized to protect prepared areas for liner placement and embankment.

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 ditches. 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 ½ 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 CONTRACTOR shall take measures as necessary to minimize sheet, rill and gully erosion prior to stacking and in areas outside the grading limits affected by this work. Slopes shall be stabilized 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 tolerate long slopes without headcuts and piping issues developing. Even relatively gentle slopes have exhibited erosion features. Ash areas that have reached final grade should be prepared for liner placement as quickly as practicable. Once the liner and geocomposite have been placed it is critical that final cover be placed. 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. Avoid creating large areas with long slopes that have not been subject to revegetation efforts.

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 LATERAL EXPANSION (CELL 4) CLOSURE

Purpose of the Best Management Practices Plan

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. This BMP is a guideline for the Lateral Expansion (Cell 4) Closure Plan work activities. 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. The 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 Lateral Expansion as described in these documents is the northern portion of the former ash pond area located between Dike D and the Stilling Pond. It is generally north of the current ash pond and south of Dike C

Construction Activities and Work Sequence:

This project entails stacking ash and dredged materials to the lines and grades shown in the Drawings. The Work also includes drainage improvements within the Lateral Expansion to 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 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 flyash, bottom ash, and river sand in an engineered fill 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. Preparation of the ash surface for liner placement; placement of FML, geocomposite and final cover.
- E. Construction of new drainage paths including ditches, flumes and (storm water) systems to collect surface runoff and route it to (storm water) facilities outside the Lateral Expansion in accordance with the Drawings and Sections 2365 and 02410 of these Technical Specifications.
- F. Construction of Permanent Access Roads and the facility perimeter.
- G. Revegetation of disturbed areas and;
- H. 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 Lateral Expansion are conveyed via a series of ditches, flumes in the southern portion of the site to the Ash Pond. On the northwest portion of the site the runoff is conveyed via ditches, flumes and pipes to the settling basin in the middle embayment. The Northeastern and Eastern portion of the site drains to the Settling Pond. Pre-treatment will be employed to decrease Total Suspended Solids (TSS) in the runoff to help reduce sediment deposition in the (stormwater) system. 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 drop inlets 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. Revegetation of areas as they achieve final grade or if no disturbance is planned for 21 days or more.

Other Control Measures:

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

Other State or Local Plans:

Work on-site shall adhere to all applicable 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 ½ the height. The 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. 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.

CONTRACTOR, Subcontractors and Owner:

The 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

DRAFT

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 and extension 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.

1.2.2. Related Sections include the following:

- Section 02100 – Erosion Control and Stabilization
- Section 02200 – Excavation
- Section 02300 – Backfill and Embankment
- Section 02305 – Borrow
- Section 02350 – Pre-Cast Structures
- Section 02365 – HDPE Pipe
- Section 02373 – Geotextile
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 02621 – Geocomposite Drainage Media
- Section 02700 – Polyethylene Geomembrane Liner (FML)

- Section 02936 – Revegetation

1.3. DEFINITIONS

1.3.1. Lateral Expansion

The Lateral Expansion project area as described in these documents was once the northern portion of the ash pond and is now designated as Cell 4. This project area is south of Dike C, west of the Divider Dike and east of Dike D. The active ash pond is located south of the Lateral Expansion. It is generally east of the Dredge Cells 2 and 3 and west of the Stilling Pond.

1.3.2. 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.

1.3.3. Dike C

Dike C is the existing embankment constructed of earth and ash materials along Swan Pond Embayment extending to the east and south around the Stilling Pond and Ash Pond before tying into Dike D. Portions of Dike C from Dike 2 to the south have been armored with rock buttress.

1.3.4. Divider Dike

This is an existing dike constructed of ash materials that separate the Lateral Expansion/Ash Pond area from the Stilling Pond.

1.3.5. Dike D

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

1.3.6. Ash Pond

The Ash Pond is the active area of sluicing for fly ash and bottom ash disposal for the power plant.

1.3.7. Filter

A layer of geotextile fabric or sand/rock materials used to reduce infiltration of fines and provide stability for drainage features.

1.3.8. Ash

Ash is a mixture of fly ash, bottom ash, sand, silt and incidental earthen materials recovered during excavation activities within the embayment area that have been used in stack construction and for infill for this project.

1.3.9. Perimeter Containment

Perimeter containment is the stabilized wall of cement bentonite slurry and the berm constructed on top of it.

PART 2 - EXECUTION

2.1. PRELIMINARY SUBMITTALS

2.1.1. The 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 QC Manager and the TVA. The location of the laydown area is subject to approval by TVA.

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

2.2. SITE PREPARATION

2.2.1. The CONTRACTOR shall protect and maintain geotechnical instrumentation from disturbance during construction. This shall be accomplished using protective barriers in a closed pattern around the instrument. One such method is the use of T-posts and orange safety fence installed around the instrumentation to form a defined perimeter. Other QC Manager approved means and methods for protecting instrumentation may be used. These methods shall define a visible or hard barrier. The CONTRACTOR shall cooperate with abandonment of designated instrumentation. Such abandonment shall occur prior to liner installation and will be performed by the QC Manager. The installation of new or extension of existing instrumentation will be performed by the QC Manager in accordance with established TVA protocols and the Drawings.

2.2.2. Geotextile fabric, Geocomposite, Flexible Membrane Liner (FML), pipes, pre-cast structures and other manufactured materials shall be protected in accordance with the manufacturer's recommendations. The CONTRACTOR shall stockpile aggregates and in an area away from concentrated flows and establish diversion of run-on away from stockpiles. Stockpile locations shall be proposed by the CONTRACTOR and approved by the QC Manager and the Construction Manager as a concurrence measure prior to any material placement.

2.2.3. Construction stakeout and record surveys shall be performed by the CONTRACTOR. As a minimum construction staking shall identify locations of drainage facilities, (inner berm), FML, geocomposite, cut/fill, check profiles of installed items and confirm lines and grades. Record surveys shall be performed of ditch and flume layout and profiles, inner berm, pipe installation, top of ash stacking, liner and geocomposite installation limits, pre-cast structure locations, final grade and at

completion of other items as may be deemed necessary. The record survey data shall be provided to the QC Manager for review. Staking/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 QC Manager for approval and final formatting.

2.2.4. CONTRACTOR shall construct temporary roads as needed to accomplish the work.

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

2.2.6. Instrumentation for the site has been installed by multiple entities at different times. Extensions, new installation and/or abandonment shall be performed by the QC Team in accordance with TVA protocols and manufacturer's recommendations. Drawings of instrumentation installation and extensions shown are for information purposes. Proposed instrumentation is a QC Team function; however the CONTRACTOR shall coordinate work activities with the QC Team to allow abandonment, extension or installation to occur at the right stage of work to avoid interference with the work and also to protect instrumentation. One such example is coordination of abandonment of instruments prior to FML installation. The CONTRACTOR shall be responsible for the installation of appropriate instrument protection.

PART 3 - EXECUTION

3.1. CLEARING AND DISPOSAL

The CONTRACTOR shall remove vegetation to permit installation of new construction. Removal of grassed areas shall be performed by initial mowing for organic materials six inches or greater in height 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 wet ash in Section 02300, Part 2. Organic materials shall be disposed of within the Lateral Expansion in areas approved by the QC Manager. The removal of root hairs and fine grass roots is not required.

3.2. SURFACE PREPARATION

Areas to receive embankment shall be prepared with harrow, scarifier or other suitable equipment as noted in Section 02300, Paragraph 7.1.1 of these Specifications.

END OF SECTION 02150

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02200 – EXCAVATION

PART 1 - GENERAL

1.1. 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 02305 – Borrow
- Section 02365 – HDPE Pipe
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 02936 – Revegetation

1.2. 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.

1.3. LINES AND GRADES

The 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 QC Manager and routed through appropriate TVA and regulatory agencies.

1.4. DUST CONTROL

The CONTRACTOR shall provide dust control using water for these operations. The CONTRACTOR shall provide a water truck and operator and have them continuously available throughout the course of the Work. The 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 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 bottom ash, fly ash, silt, sand, cement bentonite and previously placed channel lining/shot rock. No bedrock excavation is envisioned.

PART 3 - TYPES OF EXCAVATION

3.1. GENERAL

3.1.1. Excavation shall include grading work necessary to promote positive drainage between sections of the site previously brought to grade. The CONTRACTOR shall utilize excavated material and stockpile the same until ready to use within the appropriate zone of embankment.

3.1.2. Excavation shall include removal of materials in the Lateral Expansion as needed to accommodate the inner berm, serrated cap and pipe drainage systems. Excavation work includes removal of portions of the Divider Dike.

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

3.2. COMMON EXCAVATION

Common excavation shall consist of and include the removal of all materials encountered or involved in the construction of ditches or shaping of areas to promote positive drainage at the locations shown on the Drawings or as directed by the QC Manager.

3.3. DRAINAGE STRUCTURE EXCAVATION

Drainage Structure Excavation includes excavation needed for pipe installation, manhole installation, drop inlet construction, stormwater structures, cap drainage features as well as for the flumes, and ditches, as shown in the Drawings or as directed by the QC Manager. This Work may also be accomplished by embankment to the extent practicable where it meets design lines and grades.

PART 4 - CONSTRUCTION METHODS

4.1. UTILIZATION OF EXCAVATED MATERIALS

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 QC

Manager. Classification and utilization of respective materials is defined in Section 02300. Upon excavation, satisfactory materials shall be stockpiled at a location approved by the QC Manager until such time that embankment construction commences. Ash materials excavated from the work area which contain excessive moisture shall be stockpiled, bladed and disked as necessary to permit adequate drying. No temporary wet ash stockpile shall exceed five feet in height without approval of the QC Manager. See Section 02300, Part 3 for stockpiling limitations.

4.2. SHEETING AND BRACING

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 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.

4.3. REMOVAL OF WATER

The 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 02200

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

1.1. 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 02305 – Borrow
- Section 02365 – HDPE Pipe
- Section 02373 – Geotextile
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 02621 – Geocomposite Drainage Media
- Section 02700 – Polyethylene Geomembrane Liner (FML)
- Section 02936 – Revegetation

PART 2 - GENERAL

2.1. DESCRIPTION OF WORK

The Work shall consist of performing all operations in connection with construction of ash stacking, installation of the inner berm and cap construction. 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.

2.2. 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 QC Manager. The QC Manager reserves the right to increase or decrease embankment slopes or makes such other changes in embankment sections as may be deemed necessary based on site conditions encountered.

2.3. CONDUCT OF THE WORK

The 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 QC Manager, equipment causes horizontal shears or slickensides, rutting, quaking, heaving, cracking or excessive deformation of the embankment, the 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 the CONTRACTOR in a satisfactory manner. The CONTRACTOR shall excavate and remove from the embankment any material which the QC Manager considers objectionable and shall dispose of such material in accordance with these Technical Specifications and refill the excavated areas as directed. Objectionable materials for the ash infill are defined as rock larger than 3-inches in its greatest dimension, tree limbs or branches greater than 1inch in diameter, frozen materials, and man-made or manufactured materials that are not designed specifically for incorporation into the work. Objectionable materials for the cap are defined as any material with particle size greater than 3-inches (75 mm) in its greatest dimension directly above the geocomposite including but not limited to hard clay, gravel or rock fragments, tree limbs or branches, frozen materials, and man-made or manufactured materials that are not designed specifically for incorporation into the work. Established protocols in designated zones established by the QC Manager.

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

2.4. 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 4H: 1V upon completion and revegetated in accordance with Section 02936 of these Specifications. See Section 02305 for more information on Borrow Material.

PART 3 - STOCKPILING

Earthen 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 the CONTRACTOR and approved as noted below. The CONTRACTOR shall plan cap construction operations to minimize the need for stockpiling.

If wet ash is excavated within the work limits, it shall be dried prior to incorporation into the Work. Such material shall be dewatered and stockpiled at approved locations adjacent to the Work until its use is authorized by the QC Manager. Stockpiled ash and borrow soil materials shall be placed in maximum 24-inch lifts with slopes not exceeding 6 horizontal to 1 vertical for ash; 4 horizontal to 1 vertical for soils and 2 horizontal to 1 vertical for sand and coarse aggregates/riprap. The minimum slope for stockpile shall not be less than two percent. Such stockpiles if placed inside the Lateral Expansion shall be in proximity to installed instrumentation in order to monitor pore pressures and monitor movement. The stockpile limits shall be approved by the QC Manager and rate of placement for stockpiled materials where constructed in the Lateral Expansion on ash foundation shall not

exceed one foot in elevation per day. This rate in instrumented areas is subject to threshold limits noted in the QC Plan and may be revised based on the response of the instrumentation to loading. The CONTRACTOR shall make every effort to construct stockpiles over the maximum stockpile footprints before the next lift is placed. Stockpiles shall not exceed five feet in height without approval by the QC Manager.

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.

PART 4 - MATERIAL CLASSIFICATION AND DESCRIPTION

4.1. ASH MATERIAL

Ash material shall consist of bottom ash, fly ash as well as earthen materials recovered from embayment ash removal operations. These materials shall be free of objectionable materials as defined in Paragraph 2.3 above. Ash materials will be commingled during construction operations and placed in accordance with these specifications.

4.2. WATER

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

4.3. CAP MATERIALS AND INNER BERM

4.3.1. Soils for the bottom 20 inches of the Cap and the Inner 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 2.3 will not be considered suitable. The suitability of the materials shall be subject to approval by the Earthwork QC Manager. Cap materials shall consist of soils excavated from the designated borrow area which classify as CH, CL, MH, ML or SM, according to the Unified Soil Classification System and have a Plasticity Index of 13 or greater. Suitable soils include Soils 1 through 5 identified in the "Report of Geotechnical Exploration, Local Borrow Soil Characterization, Tract 1, Dredge Cell Closure Kingston Fossil Plant, Harriman, Tennessee" prepared by Stantec, dated May 5, 2011. Inner berm materials shall consist of CH, CL or other non-liquefiable materials.

4.3.2. Topsoil for use on site shall be natural topsoil or soil treated to contain sufficient organics to have topsoil qualities.

4.4. EMBANKMENT PLATFORM

The embankment platform where shown in the Drawings shall consist of TDOT No. 10 screening product and where noted, TDOT No.57 Aggregate. The sand shall conform to Tennessee Department of Transportation (TDOT) Manufactured Sand 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.

The No. 57 Coarse Aggregate and No.10 screening product shall be placed to the minimum thickness noted on the Drawings.

PART 5 - EXECUTION

5.1. GENERAL

5.1.1. No fill work shall be performed or near bodies of standing water until working conditions have been approved as safe by the TVA Safety Professional.

5.1.2. No embankment shall be placed until the foundation for that section has been approved by the QC Manager. The surface shall be firm and suitable for transit by heavy equipment. Soft areas shall be bridged with dry ash or by use of geogrid and stone or other materials.

5.1.3. Extreme caution shall be exercised by the CONTRACTOR during heavy equipment operations performed over the cap geosynthetic components to control the potential for associated damage to the system. All equipment and methodology shall comply with geosynthetic manufacturer recommendations. Proposed placement and compaction protocols for areas overlying cap geosynthetic components shall be presented in the CONTRACTOR'S work plan, accompanied with geosynthetic manufacturer's site specific written recommendations for review and approval by the QC Manager.

5.2. ASH MATERIAL

All ash embankment material shall be placed within the designated limits as shown on the Drawings. Ash material shall not be placed or used outside of the designated work area without TVA approval.

5.3. CAP MATERIAL

5.3.1 Cap material shall be placed to the lines and grades shown in the Drawings. Cap material shall be spread over geosynthetic materials by low ground pressure equipment.

5.3.2. No cap material shall be placed until the geocomposite has been approved by the QC Manager.

5.4. INNER BERM

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 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.

Inner berm construction shall tie-in to the Perimeter Berm as shown on the Drawings. This material shall be constructed to the lines and grades shown in the Drawings. Embankment platform material shall be placed on the approved, proof-rolled subgrade to the lines and grades shown in the Drawings.

PART 6 - SPREADING

6.1. 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.

6.2. ASH MATERIAL

6.2.1 Ash material for stack construction shall be placed in relatively horizontal lifts with approximate 12-inch maximum (loose) thickness and graded to a 1% minimum slope. Ash placement shall not exceed two feet per day in a discrete area unless authorized by the QC Manager based on the response of instrumentation. Final slopes for ash shall conform to the lines and grades shown in the Drawings and result in the serrated surface shown.

6.2.2. 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.

6.2.3. 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 three (3) inches, shall be broken down prior to compacting.

6.3. EMBANKMENT PLATFORM

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. 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.

6.4. INNER BERM

6.4.1 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. The 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.

6.4.2. 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 three (3) inches, shall be broken down prior to compacting.

6.5. CAP MATERIAL

6.5.1. The distribution and gradation of material throughout the cap layer shall be such that this layer will be free from lenses, pockets, streaks or layers of soft material differing substantially in texture or gradation from the surrounding material. The combined excavation and placing operations shall be such that the material being compacted in the fill will be blended sufficiently to secure the best practicable degree of compaction and stability. Successive loads of material shall be dumped on the fill so as to produce the best practicable distribution of the materials.

6.5.2. The initial lift thickness shall be a minimum of 12-inches. In order to protect the FML system, vegetative cover shall be placed with low ground pressure dozers (ground pressure of 6 psi or less). The initial lift of material shall be pushed from low lying areas up grade while maintaining the minimum 12-inch soil pad beneath the dozers. Pushed materials should be performed in smooth linear passes without sharp changes in direction. Minimum cover thickness requirements for heavy equipment traffic over geosynthetic materials apply to areas where liner is placed. Proposed placement and compaction protocols for areas outside liner areas should be presented within the CONTRACTOR'S work plan, accompanied with geosynthetic manufacturer's site specific written recommendations for review and approval by the Engineer.

6.5.3. Material coming from the borrow area 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 three (3) inches in the top 20-inches of cover and 3-inches in the 4-inch topsoil lift, shall be broken down prior to final placement. Conditioning of this material to meet specifications shall occur prior to placement and spreading over geosynthetics.

6.5.4. Extreme caution shall be exercised by the CONTRACTOR during subsequent heavy equipment operations performed over the geosynthetic components to control the potential for associated damage to the system. All equipment and methodology shall comply with geomembrane manufacturer recommendations. Under no condition shall heavy equipment traverse areas of liner placement without adequate cover to reduce effective ground pressure. Proposed placement and compaction protocols for other areas with FML placement should be presented within the CONTRACTOR'S work plan, accompanied with geosynthetic manufacturer's site specific written recommendations for review and approval by the QC Manager.

6.5.5 The CONTACTOR shall coordinate cap material placement with the installation of drainage pipes.

6.5.6. Once the initial 20-inch layer has been approved, a minimum four inch thick lift of topsoil shall be spread across the cap. This material shall be spread by low ground pressure equipment and tracked in place. Track cleat marks shall be made by equipment travelling perpendicular to the contour and result in cleat marks parallel to the contour.

PART 7 - MOISTURE CONTROL

7.1. 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 achieve workable moisture content. Sprayers located at the working face shall be used as necessary to control dusting depending primarily on local weather conditions.

7.2. ASH STACKING

During the compaction operations the materials being placed shall be maintained within four percent below optimum and six percent above optimum moisture content as determined by ASTM D-698. Testing responsibility is as defined in the QC Plan. The upper limit is subject to constructability and that the moisture content of the respective embankment material is below saturation. The moisture content shall be controlled in the following manner:

Water may be added to the fill materials at the source or after the material has been brought onto the embankment, whichever is the most practical. When material deposited on the embankment is too dry, the 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.

1. 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.
2. When the top surface of a layer becomes too dry or too smooth to permit suitable bonding with the subsequent layer, the 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. The CONTRACTOR shall then moisten the loosened material to acceptable moisture content and re-compact the material to the specified density.
3. Adjustments of moisture content shall be made on the basis of determination of moisture by field tests as construction progresses.

7.3. EMBANKMENT PLATFORM

There are no moisture requirements the Embankment Platform material.

7.4. CAP MATERIALS

During the compaction operations the soil materials being placed shall be maintained at moisture content that allows spreading of the materials without creating constructability issues. The moisture content shall be controlled in the following manner:

1. Water may be added to the cap materials at the source or after the material has been brought onto the embankment, whichever is the most practical. When material deposited on the embankment is too dry, the CONTRACTOR shall be required to water the cap layer and incorporate moisture in the top six inches of the layer by careful blading or other approved methods. The amount of water applied shall be carefully controlled so that free water will not appear on the surface during or subsequent to compaction operations.
2. Material deposited on the cap that is too wet shall be spread and permitted to dry, assisted by light blading, or by mixing with drier materials if necessary, until the moisture content is reduced to a workable limit. Disking or deep blading shall not be performed over in-place geosynthetics due to potential for damage.
3. When the top surface of a layer becomes too dry or too smooth to permit suitable bonding with the subsequent layer, the CONTRACTOR shall carefully provide bonding by tracking the surface with low ground pressure equipment. The CONTRACTOR shall then moisten the surface of the tracked material to promote bonding.
4. Adjustments of moisture content shall be made on the basis of visual behavior of the material as construction progresses.

7.5. INNER BERM

During the compaction operations the soil materials being placed shall be maintained at 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. The moisture content shall be controlled in the following manner:

1. Water may be added to the inner berm materials at the source or after the material has been brought onto the embankment, whichever is the most practical. When material deposited on the embankment is too dry, the CONTRACTOR shall be required to water each layer and obtain uniform moisture distribution in the layer by diskings, 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 diskings 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, the CONTRACTOR shall loosen the material by scarifying or

disking. The CONTRACTOR shall then moisten the loosened material to acceptable moisture content and re-compact the material to the specified density.

4. Adjustments of moisture content shall be made on the basis of determination of moisture by field tests as construction progresses.

PART 8 - PREPARATION OF SURFACES

8.1. GENERAL

8.1.1. If, in the opinion of the QC Manager, the surface of the prepared foundation 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 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 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 recompact before the next succeeding layer of material is placed.

8.1.2. During placement operations, the top surface of the fill layer will be crowned with grades of not less than one percent to maintain positive drainage. Final grades shall conform to the lines and grades shown on the Drawings.

8.2. ASH MATERIAL

At the CONTRACTOR's discretion, the surface may be sealed. Prior to placement of subsequent lifts the sealed surface shall be lightly scarified to promote lift bonding.

8.3. EMBANKMENT PLATFORM

Placed No. 10 screening product shall be covered with No. 57 stone under the inner berm or by soil outside of the perimeter berm as quickly as practicable by the CONTRACTOR in order to help reduce erosion or the contamination of the No. 10 screening product with ash or soil. In no event shall No. 10 screening product remain exposed for more than 24 hours. Any contamination of No. 10 screening product from soil or ash shall be cause to remove and replace the No. 10 screening product.

8.4. CAP MATERIAL

No surface preparation of in-place cap materials is needed other than described above or as needed for revegetation efforts due to potential adverse effects on the liner and pipe system.

8.5. INNER BERM

At the CONTRACTOR's discretion, the surface may be sealed. Prior to placement of subsequent lifts the sealed surface shall be lightly scarified to promote lift bonding.

PART 9 - COMPACTION

9.1. COMPACTION REQUIREMENTS

9.1.1. Ash Material. Ash material shall be placed and spread in accordance with Paragraph 6.2. After each layer of the ash stack has been placed, spread, and contains the required moisture, it shall be compacted by passing an appropriate compaction roller or rubber tired construction equipment over the entire surface of the layer a sufficient number of times 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.

Ash fill shall be compacted to 90 percent of its maximum dry density as determined by ASTM D-698. In-place moisture shall be -4% to +6% of optimum moisture as determined by ASTM D-698 or as established by the QC Manager based on field observations and testing.

9.2. EMBANKMENT PLATFORM

9.2.1 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.

9.3. CAP MATERIAL

The final cap layer shall be compacted by thorough tracking of the entire surface with low ground pressure (6 psi or less) dozers. Under no condition shall dozers or other low ground pressure equipment traverse areas of geocomposite placement without the minimum 12-inch initial lift in place. The 20-inch layer may be placed in two lifts, however, the initial lift shall be a minimum of 12-inches. The final thickness of soil materials shall be no less than 24 inches.

9.4. INNER BERM

9.4.1. Materials shall be placed and spread in accordance with Paragraph 6.4. After each layer has been placed, spread, and contains the required moisture, it shall be compacted by passing an appropriate tamping foot compaction roller 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.

9.4.2. 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.

END OF SECTION 02300

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02305 – BORROW

PART 1 - GENERAL

1.1. 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 02300 – Backfill and Embankment
- Section 02365 – HDPE Pipe
- Section 02373 – Geotextile
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 02936 – Revegetation

1.2. DESCRIPTIONS

This specification covers the borrow material to be obtained from borrow areas to be designated by TVA. This specification also covers the management and reclamation of this area.

1.3. SILT CONTROL

The CONTRACTOR shall provide silt control along the limits of the borrow area. The CONTRACTOR shall install and maintain silt control devices in accordance with Section 02100 of this Division and as directed by the SWMP Manager.

1.4. DUST CONTROL

The CONTRACTOR shall be responsible for providing dust control within the Work area, including the borrow area and borrow area haul roads.

PART 2 - BORROW EXCAVATION

2.1. Borrow Excavation shall consist of and include the required excavation, from the designated borrow areas.

2.2. The control of excavation in the borrow areas, and the selection of materials from there shall at all times be subject to approval by the QC Manager. The borrow area shall be graded and dressed to maintain positive drainage. The maximum permissible final slope within the borrow areas shall be 4:1 (H: V) and the minimum permissible final slope shall be two (2) percent.

2.3. The CONTRACTOR shall sequence borrow operations in such a manner as to minimize erosion. The CONTRACTOR shall only open sufficient borrow area as needed to allow having the required quantities available when needed.

PART 3 - DESIGNATED BORROW AREAS

The CONTRACTOR shall read the "Report of Geotechnical Exploration, Local Borrow Soil Characterization, Tract 1, Dredge Cell Closure Kingston Fossil Plant, Harriman, Tennessee" prepared by Stantec, dated May 5, 2011 to determine the location of useable soils. Cap materials shall consist of soils excavated from the designated borrow area which classify as CH, CL, MH, ML or SM, according to the Unified Soil Classification System and have a Plasticity Index of 13 or greater. Suitable soils include Soils 1 through 5 identified in previously referenced report.

END OF SECTION 02305

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02350 – PRECAST STRUCTURES

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

The provisions of the Contract apply to the work specified in this section. Related sections of the Technical Specifications include:

- Section 02200 – Excavation
- Section 02300 – Backfill and Embankment
- Section 02365 – HDPE Pipe
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 05512 – Miscellaneous Metals

1.2. DESCRIPTION OF WORK

This section covers the Work necessary to install pre-cast reinforced concrete headwalls, as well as manholes, and risers including all materials, labor and incidentals.

1.3. SUBMITTALS

1.3.1. Shop Drawings

The CONTRACTOR shall submit shop drawings showing the proposed pre-cast structures.

1.3.2. Certification

Prior to installing an individual pre-cast drainage structure, or group of structures, the CONTRACTOR shall submit to the QC Manager a certification and all supporting data from the pre-cast subcontractor that the pre-cast concrete elements conform to the standards and specifications outlined herein.

PART 2 - EXECUTION

2.1. INSTALLATION

Construction of precast concrete headwalls, precast concrete sections of manholes, or a pre-cast transition section shall conform to Section 918.07 of the "Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction", (TDOT Specifications) current edition. Pre-cast concrete shall have a minimum 28-day compressive strength of 4,500 psi.

2.2. BACKFILL

Excavation and backfilling around drainage structures shall conform to Sections 02200 and 02300 of these Technical Specifications. Compaction of backfill within two feet of the structure shall be performed using hand operated tampers.

2.3. PIPES AND TREATMENTS

Inlet and Outlet pipes shall be grouted in place using non-shrink grout conforming to TDOT Specifications Section 918.21 "Type I". The inlet and outlets grouted seal for all pipes shall be coated with a QC Manager approved watertight sealant. The waterproof sealant shall be a two component, non-toxic polyamine epoxy product that bonds to concrete. Acceptable products include Enviroline 230, Parsonpoxy FP or QC Manager approved equivalent product.

END OF SECTION 02350

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02365 – HDPE PIPE

PART 1 - GENERAL

1.1. 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 02200 – Excavation
- Section 02300 – Borrow
- Section 02373 – Geotextile
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 02621 – Geocomposite Drainage Media
- Section 02700 – Polyethylene Geomembrane Liner (FML)

1.2 DESCRIPTION OF WORK

This Work shall consist of furnishing, bedding, laying, jointing, and testing of all water tight storm sewer pipe shown on the Construction Plans or otherwise required by the Contract Documents.

1.3. SUBMITTALS

1.3.1. Proof of Compliance

The CONTRACTOR shall furnish three copies of the supplier's certification for each pipe type to the TVA stating that pipe materials were manufactured, sampled, tested and inspected in accordance with the standards listed in this Section and have been found to meet those requirements. The proof of compliance shall be provided to the TVA five working days prior to delivery of any HDPE Pipe to the project site. A design mix for the flowable fill shall be prepared by the supplier and submitted to TVA. The design mix shall be certified by the supplier as conforming to Section 204.06 (b) of the Tennessee Department of Transportation "Standard Specifications for Road and Bridge Construction", consistent with Paragraph 2.5.

PART 2 - MATERIALS

2.1. HIGH-DENSITY POLYETHYLENE PERFORATED AND NON-PERFORATED PIPE

All caps, bands, and other fittings shall be made of the same materials used in the manufacture of the pipe. The manufacturer shall certify that the polyethylene materials used in manufacture of the pipe meet the requirements of these referenced sections. Lengths shall be ordered to minimize the number of joints in a run or line, meet required deflections for curves and to facilitate shipment, handling and installation. All pipe-to-pipe connections shall be in-line bell and spigots, snap-in-place bands, or a split band taped in place with polyethylene tape to the satisfaction of the QC Manager. All joints shall be soil tight for landfill cap applications or water tight for storm water drainage as noted on the Drawings.

The pipe manufacturer's resin certification indicating the cell classification of the PE used to manufacture the pipe shall be submitted prior to installation of the pipe. The minimum cell classification for polyethylene plastic shall apply to each of the seven primary properties of the cell classification limits in accordance with ASTM D 3350.

Cap pipe shall conform to ADS N-12 or equivalent and be capable of being installed in a 250 foot radius yet be rated soil tight. Storm water pipe shall be a watertight pipe conforming to ADS N-12 HP or equivalent and be capable of being installed in a 500 foot radius. Pipe shall be double walled, smooth interior HDPE pipe except where HDPE fusion pipe corresponding to Section 02600 of the Specifications is noted on the Drawings.

2.2. JOINTS

Soil Tight joints shall conform to ASTM F-477.

Watertight joints shall be made using a PVC or E coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM D 3212 and ASTM F 477.

Joints shall be capable of achieving specified bend radii per application as noted in Paragraph 2.1 above.

2.3. AGGREGATES

In areas where the pipe serves as cap drainage, Stone shall conform to TDOT No. 57 aggregate as referenced in Section 02300 of these Specifications.

2.4. Geotextile

Geotextile shall conform to Section 02373 of the Technical Specifications.

2.5 Flowable Fill

Flowable fill backfill and bedding shall conform to Section 204.06 (b) of the Tennessee Department of Transportation "Standard Specifications for Road and Bridge Construction" for Excavatable Flowable

Fill with the exception that the flowable fill achieves a minimum compressive strength of 200 psi in 28 days. Flowable fill backfill shall be utilized in areas where trench excavation has cut through the perimeter wall. For areas outside the perimeter wall backfill shall conform to the Drawings. Soil backfill shall conform to the requirements of Section 02300 of the Specifications.

PART 3 - INSTALLATION

3.1. DELIVERY AND STORAGE

All pipes shall be inspected on delivery and such pipe sections that do not conform to these Specifications and which are not suitable for use shall be rejected and immediately removed from the work site. Materials shall not be stored directly on the ground. The inside of the pipes and fittings shall be kept free of dirt and debris. Before, during and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the materials. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life.

3.2. HANDLING

Equipment used to handle, lay, and joint pipe shall be so used to prevent damage to the pipe and its jointing materials. All pipe and fittings shall be carefully handled and lowered into the trench. The pipe shall not be rolled, dropped, or thrown into the trench. Damaged pipe or jointing material shall not be installed.

3.3. PIPE LAYING AND JOINTING

The laying of pipe shall begin at the lowest point and proceed upstream with the bell or groove ends pointing up-stream. Prior to making pipe joints, all joint surfaces shall be clean and dry and free from gravel or other extraneous materials. All necessary lubricants or adhesives shall be used as recommended by the pipe manufacturer. Suitable means shall be used to force the spigot or tongue end of the pipe the proper distance into the bell or groove end without damage to the pipe and its jointing materials and without disturbing previously laid pipe sections. Special care shall be taken to ensure that the pipe is solidly and uniformly cradled or encased in accordance with these Specifications. No section of pipe shall be brought into position for jointing until the preceding section has been bedded and secured in place.

3.4. LINE AND GRADE

Each section of pipe shall be checked for vertical and horizontal alignment immediately after being laid. All adjustments to line and grade must be made by scraping away or filling in under the barrel of the pipe and not by wedging or blocking up any portion of the pipe or striking the pipe in an effort to drive it down.

3.5. PROTECTION OF INSTALLED PIPE

As the work progresses, the interior of the pipe shall be protected from and cleaned of all dirt, cement, extruded joint materials, debris, and other extraneous material. Wherever pipe laying is stopped for any significant length of time, such as at the end of a workday, the unfinished end shall be protected from displacement, floatation, cave-in, and in-wash of soil or debris. A suitable temporary tight-fitting plug, stopper or bulkhead shall be placed in the exposed bell or groove end of the pipe.

Water shall not be allowed to rise in the excavation until the joint material and/or flowable fill or encasement has hardened and cannot be damaged by the water. Particular care shall be used to prevent disturbance or damage to the pipe and the joints during backfilling or at any other time.

Pipe shall be anchored where flowable fill backfill is used to prevent floatation. Flowable fill shall be placed as bedding to a minimum depth of 6 inches below the pipe and shaped to accommodate the pipe. The pipe shall not be placed until the flowable fill has hardened to the point it can support a 200 pound person. Once the pipe has been placed, the remaining portion shall be backfilled with flowable fill to above the crown of the pipe as shown on the Drawings. Flowable fill shall be placed continuously along the pipe trench until it reaches elevation 12-inches above the top of the pipe. Flowable fill may be placed in lifts to lessen hydrostatic pressure and floatation on the pipe provided that each lift is bonded. The CONTRACTOR shall not backfill the flowable fill with soil for a minimum period of 24 hours. Traffic shall not be routed across the installation for 7 days. Soil backfill shall be placed in four (4) inch maximum loose lifts and compacted using a hand operated tamper or remote operated roller compactor to at least 95 percent of standard Proctor density. A depression in the backfill material shall be placed at the pipe bell location so that after pipe placement, only the barrel of the pipe receives bearing pressure from the supporting material.

END OF SECTION 02365

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02373 – GEOTEXTILE

PART 1 - GENERAL

1.1. 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 02300 – Backfill and Embankment
- Section 02365 – HDPE Pipe
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 02621 – Geocomposite Drainage Media
- Section 02700 – Polyethylene Geomembrane Liner (FML)

1.2. DESCRIPTION OF WORK

This work shall consist of furnishing and splicing a minimum 16 ounce per square yard weight non-woven filter geotextile around the pipes on the cap or as cushion geotextile for the FML or as underlayment for drainage structures at the locations designated on the Drawings. The role of the filter geotextile is as a filter layer to reduce infiltration of fines into the drainage facility or conveying stone and to provide a separator layer under structures.

1.3. SUBMITTALS

Certification statements shall be provided by each supplier that the product conforms to these specifications. Prior to installation, the INSTALLER shall provide TVA and the QC Manager with certification signed by an authorized employee of the geotextile manufacturer. The certification shall indicate that the geotextile material meets or exceeds the specified minimum average roll values provided in Table 1. The manufacturer shall also provide certified laboratory test data for unit weight, tensile strength, puncture strength, mullen burst strength, permittivity, apparent opening size and trapezoidal tear strength measured in accordance with the procedures listed in Table 1 at a minimum frequency of 1 test per 100,000 ft² of geotextile produced, with exception to U.V. resistance, which shall be provided a minimum frequency of twice per year.

In addition all materials shall meet the testing schedules noted in the QC Plan.

PART 2 - MATERIAL

2.1. GENERAL

The geotextile materials supplied under these specifications shall be first quality products specifically manufactured for cushion applications and shall have demonstrated by prior use their suitability for such applications. The geotextile manufacturer shall provide at least three references encompassing at least 1,000,000 ft² of geotextile used in similar projects. The INSTALLER is the party responsible for procurement of geotextile, field handling, transporting, storing, deploying, seaming and forming of the geotextile seams.

2.2. GEOTEXTILE FABRIC

The geotextile shall meet the physical requirements of Table 1. Acceptable geotextile fabrics based on similar properties include the following:

- Skaps Industries GE-1116,
- Propex Geosynthetics Geotex 1701,
- Dalco Non wovens, DalTex 1161,
- Tencate Geosynthetics, Mirafi S1600,
- US Fabrics, Inc, US380 NW,
- Or Equivalent products.

The geotextile shall be free of holes, tears, defects, and patch-repairs of defects. The geotextile shall be composed of nonwoven needle-punched, discontinuous (staple) fibers. Fibers used in manufacture of the geotextile shall consist of a material composed of at least 85 percent by weight polyolefins, polyesters, or polyamides.

Table 1. Geotextile Filter Properties

Property	Test Method	English	Metric
Unit Weight	ASTM D 3776	16 oz/yd ²	542 g/m ²
Tensile Strength	ASTM D 4632	380 lbs	1.69 kN
Puncture Strength	ASTM D 4833	235 lbs	1.04 kN
Trapezoidal Tear Strength	ASTM D 4533	140 lbs	0.623 kN
Grab Tensile Elongation	ASTM D 4632	50%	50%
AOS	ASTM D 4751	100 sieve	0.15 mm
Permittivity	ASTM D 4491	0.5 sec ⁻¹	-
U.V. Resistance	ASTM D 4355	70%	70%

Note: All numerical values represent minimum average roll values (i.e., average of test results from any sampled roll in a lot shall meet or exceed the minimum average roll values in the table) in weaker principle direction. Lot sampled according to ASTM D 4354, "Practice for Sampling Geosynthetics for Testing."

PART 3 - EXECUTION

3.1. SHIPMENT AND STORAGE

The geotextile shall be labeled, stored, and handled in accordance with ASTM D-4873, "Guide for Identification, Storage, and Handling of Geosynthetics." The geotextile shall be kept dry and wrapped in a waterproof wrapping such that it is protected from UV light and the elements during shipping and storage. Geotextile rolls shall be stored in a manner which protects them from the elements. If stored outdoors, they shall be elevated and protected with a waterproof, opaque cover.

3.2. INSTALLATION

3.2.1. General

The geotextile shall not be installed until conformance test results are reviewed and the geotextile is accepted by the QC Manager. The CONTRACTOR and INSTALLER shall handle all geotextiles in such a manner as to ensure the geotextile is not damaged. The surface on which the geotextile is to be placed shall be prepared to a smooth condition free of debris or obstructions which may damage the geotextile. The working platform shall be approved by the QC Manager prior to geotextile placement. Care shall be taken not to entrap stone, excessive dust, or moisture in the geotextile. The CONTRACTOR and INSTALLER shall not operate equipment over the geotextile without meeting minimum cover requirements of capping operations.

3.2.2. Deployment

- Geotextiles shall be deployed free of wrinkles and folds. On slopes, the geotextiles shall be anchored at the top and unrolled down the slope. In the presence of wind, all geotextiles shall be weighted with sandbags or other material which will not damage the geotextile. Geotextile uplifted by wind may be reused upon approval by the QC Manager.
- The INSTALLER shall develop a plan for geotextile deployment for review and approval by the QC Manager. Geotextile shall not be deployed until the deployment plan is approved

3.2.3. Geotextile Placement

Adjacent geotextile panels or bonding of geotextile to geocomposite shall be heat bonded or sewn. Minimum one foot overlaps are required. As an alternative to sewing or heat bonding; two foot overlaps can be employed. All seams shall be oriented parallel to (in the direction of) the slope. Seams constructed perpendicular or transverse to the direction of the slope will not be accepted. The geotextile shall be examined over the entire surface after installation to ensure that no potentially harmful objects are present.

3.3. HEAT-BONDED SEAMS

Seams may be heat bonded using hot plate, hot knife, or ultrasonic devices. Manual or automatic machine driven seaming devices may be used; however, machine driven seaming equipment is preferred. Continuous or spot seams may be used as required by the contract documents. For spot seams, a minimum 6-inch long heat-bonded seam shall be manufactured for each 3-feet of geotextile length. All locations where heat bonding has melted through either geotextile panel shall be repaired. Adjacent geotextile panels shall be overlapped 24-inches prior to seaming. The geotextile panels shall be completely clean dry prior to seaming. The geotextile panel edges shall lay flat against each other prior to seaming such that no gaps are formed in the seam. Heat seaming shall not be performed during rain or snow. Ambient temperatures for seaming should be above freezing, i.e. 32°F, unless test strips indicate satisfactory seams can be fabricated at lower temperatures. The use of a seaming board or slip sheet is recommended for some seaming operations. A seaming board or slip sheet may be a wood board or piece of geomembrane which is placed below the geotextile panels at the location of seaming. The board or sheet may be pulled with a rope or strap as seaming progresses. The purpose of the seaming board or slip sheet are to provide a firm, clean surface for seaming and to reduce condensation onto the geotextile from an underlying soil layer as a result of seaming.

3.4. REPAIRS

Damaged geotextiles and geotextiles contaminated with dirt shall be repaired immediately. Repairs shall be made with the same geotextile product style as the original material. All repairs shall meet the approval of the QC Manager, prior to cover placement.

Geotextile panels which require repair shall be removed and replaced with new material. Replacement material shall be sewn or heat bonded as previously described in this specification. All seams shall be oriented parallel to (in the direction of) the slope. Seams constructed perpendicular or transverse to the slope will not be accepted.

3.5. COVER PLACEMENT

3.5.1. General

Placement of cover on the geotextile shall be accomplished in a manner as to ensure that the geotextile is not damaged. Cover material shall be placed within 15 days of deployment. Geotextile exposure periods may exceed 15 days when approved by the QC Manager based on evaluation of geotextile resistance to UV degradation and on local environmental conditions.

3.5.2. Placement

The cover shall meet the material requirements of the engineering documents and shall be approved by the QC Manager prior to placement. Cover material shall be placed such that excess tensile stress is not mobilized in the geotextile. Cover placement operations shall comply with the requirements and limitations of the contract documents and project design documents.

END OF SECTION 02373

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02410 – SURFACE DRAINAGE DITCHES

PART 1 - GENERAL

1.1. 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 02305 – Borrow
- Section 02350 – Pre-Cast Structures
- Section 02365 – HDPE Pipe
- Section 02373 – Geotextile
- Section 02507 – Access Roads
- Section 02621 – Geocomposite Drainage Media
- Section 02700 – Polyethylene Geomembrane Liner (FML)
- Section 02936 – Revegetation

1.2. DESCRIPTION OF WORK

This Specification covers constructing surface drainage ditches and flumes as well as placing articulated block mat or riprap armor where shown on the Drawings. Ditches may be formed by excavation or by embankment placement. All ditches shall conform to the lines and grades shown on the Drawings.

1.3. SUBMITTALS

Certification statements shall be provided by each supplier that the product conforms to these Specifications. Prior to installation, the articulated block mat manufacturer shall provide TVA and the QC Manager with certification signed by an authorized employee of the manufacturer. The certification shall indicate that the geotextile material meets or exceeds the specified minimum average roll values provided in Section 02373 of the Specifications. A sample of the erosion control blanket shall also be provided to the QC Manager.

In addition all materials shall meet the testing schedules noted in the QC Plan.

PART 2 - MATERIALS

2.1. TDOT CLASS A-1 AND CLASS A-3 MACHINED RIPRAP

Riprap 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. Riprap used in flumes shall conform to TDOT Class A-1 riprap and shall vary in size from 2 in. to 1.25 ft. (50 to 375 mm) with no more than 20% by weight being less than 4 in. (100 mm).

Riprap used in rock check dams or in areas designated as designated as TDOT Class A-3 riprap shall vary in size from 2 inches to 6 inches (from 50 to 150 mm) with no more than 20% by weight being less than 4 inches in size (150 mm).

2.2. SYNTHETIC TURF REINFORCEMENT MAT AND EROSION CONTROL BLANKET

Synthetic Turf Reinforcement Mat (TRM) shall consist of a permanent, high-strength three-dimensional matting structure incorporated with a straw/coconut fiber matrix. TRM shall have a minimum limiting shear stress of 7 lbs. per square foot and a minimum permissible velocity of 14 feet per second.

Erosion control blanket shall be a manufactured product consisting of plastic netting on both sides with excelsior or coconut fiber in between. The blanket shall withstand shear stress in excess of 2 pounds per square foot. Erosion control blanket shall conform to North American Green SC150 or American Excelsior Curlex II products or QC Manager approved equal.

2.3. GEOTEXTILE

The geotextile used in ditches shall conform to Section 02373 of the Technical Specifications. Other equivalent products are noted in the QC Plan.

2.4 Articulated Block Mat

Articulated Block Mat shall be a flexible armor revetment system consisting of interlocking articulated block mats bound with cable. The materials shall conform to ASTM D-6684-04 (2010). The blocks shall be uniformly sized, closed blocks with dimensions of 6 inches or 9 inches tall plus or minus ½ inch tall, depending on location of use as shown on the Drawings. These blocks shall be manufactured of concrete with an average compressive strength of 4,000 psi with no one individual unit below 3500 psi. The system shall be capable of being pre-assembled or connected in place. Cable shall be constructed of galvanized aircraft cable with a minimum cable diameter of 5/16" or larger if needed to provide for safe lifting. The revetment cable shall exhibit resistance to mild concentrations of acids, alkalis, and solvents. Fittings such as sleeves and stops shall be aluminum, and the washers shall be galvanized steel. Acceptable products include Armorflex or Ultraflex articulated block mat systems. All units shall be sound and free of defects that would interfere with

either the proper placement of the unit or impair the performance of the system. Surface cracks incidental to the usual methods of manufacture, or surface chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection.

Cracks exceeding 0.25 inches (.635 cm) in width and/or 1.0 inch (2.54 cm) in depth shall be deemed grounds for rejection. Chipping resulting in a weight loss exceeding 10% of the average weight of a concrete unit shall be deemed grounds for rejection.

PART 3 - EXECUTION

3.1. SHIPMENT AND STORAGE

The geotextile shall be labeled, stored, and handled in accordance Section 02373 of the Technical Specifications. Articulated Block Mat shall be shipped, stored and handled in accordance with the manufacturer's recommendations.

3.2. GEOTEXTILE INSTALLATION

The geotextile shall be installed as described in Section 02373 of the Technical Specifications.

3.3. RIPRAP

3.3.1. Installation

Riprap may be placed by mechanical means using a backhoe or loader. The rock shall be placed to the depths and template shown in the drawings. The surface of the riprap, upon completion, shall be graded into final position to ensure proper thickness and a uniform surface. Larger rocks shall be uniformly distributed with the small rocks and spalls filling the voids between the larger rocks.

3.3.2. Application

Riprap lining shall be used in the Flume and for armoring areas subject to scour and as indicated on the Drawings and Details.

3.4. SYNTHETIC TURF REINFORCEMENT MAT AND EROSION CONTROL BLANKET

3.4.1. Installation

Before placing synthetic turf reinforcement mat or erosion control blanket, the subgrade or subsequent lift of fill shall be uniformly graded and prepared for revegetation. Both materials shall be placed and installed in accordance with the Drawings and Details and the Manufacturer's recommendations.

3.4.2. Application

Synthetic Turf Reinforcement Mat shall be used on Ditch Numbers 5 and 6 as indicated on the Drawings and in other locations as determined by the Construction Manager. Erosion Control Blanket shall be used where concentrated flow paths develop in the serrations or swales formed on the cap and in Ditch No. 7.

3.5. ARTICULATED BLOCK MATS

The slope shall be graded to a smooth plane surface to ensure that intimate contact is achieved between the slope face and the geotextile (filter fabric), and between the geotextile and the entire bottom surface of the articulated block mats. All slope deformities, roots, grade stakes, and stones which project normal to the local slope face must be re-graded or removed. No holes, "pockmarks", slope board teeth marks, footprints, or other voids greater than 1.0 inch in depth normal to the local slope face shall be permitted. No grooves or depressions greater than 0.5 inches in depth normal to the local slope face with a dimension exceeding 1.0 foot in any direction shall be permitted. Where such areas are evident, they shall be brought to grade by placing compacted homogeneous material. Immediately prior to placing the filter fabric and articulated block mats, the prepared subgrade shall be reviewed by the QC Manager and no fabric or mat shall be placed thereon until that area has been approved.

The articulated block mats shall be placed on prepared subgrade in such a manner as to produce a smooth plane surface in intimate contact. No individual block within the plane of placed articulated block mats shall protrude more than one-half inch or as otherwise specified by the Engineer. Articulated block mats should be flush and develop intimate contact with the subgrade section, as approved by the QC Manager.

If assembled and placed as large mattresses, the articulated block mats shall be attached to a spreader bar or other approved device to aid in the lifting and placing of the mats in their proper position by the use of a crane or other approved equipment. The equipment used should have adequate capacity to place the mats without bumping, dragging, tearing or otherwise damaging the underlying fabric. The mats shall be placed side-by-side and/or end-to-end, so that the mats abut each other. Mat seams or openings between mats greater than two (2) inches shall be backfilled with 4000 p.s.i. non-shrink grout, concrete. Whether placed by hand or in large mattresses, distinct changes in grade that results in a discontinuous revetment surface in the direction of flow shall require backfill at the grade change location so as to produce a continuous surface.

END OF SECTION 02410

**TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02507 – ACCESS ROAD**

PART 1 - GENERAL

1.1. 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 02305 – Borrow
- Section 02373 – Geotextile
- Section 02410 – Surface Drainage Ditches
- Section 02621 – Geocomposite Drainage Media
- Section 02700 – Polyethylene Geomembrane Liner (FML)

1.2. DESCRIPTION OF WORK

This specification covers the shaping and surfacing of the Access Road on top of the Perimeter Berm.

1.3. SUBMITTALS

The CONTRACTOR shall provide certification submittals for aggregates and geotextile used for access road construction. The certification shall be supplied prior to any stone surfacing arriving at the job site.

1.4. ACCESS ROAD MAINTENANCE

The access road needs to be maintained for construction traffic and access by TVA through the post-closure period until such time that the facility is deemed in compliance with approved closure plans. Maintenance of the road during construction and operation shall be the responsibility of the CONTRACTOR who shall maintain the road in a safe, clean and workmanlike manner throughout landfill construction and operation and the post-closure period.

PART 2 - MATERIALS

2.1. SUBGRADE

Subgrade materials for the perimeter road shall be as shown on the drawings and in accordance with Section 02220 – Embankment, of these Specifications.

2.2. GEOTEXTILE

The geotextile shall conform to the requirements of Section 02373 of the Technical Specifications.

2.3. STONE PAVING

Mineral Aggregate Base Type A or B, Grading D TDOT No. 57 stone and TDOT No. 2 stone for access roads 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.

PART 3 - EXECUTION

3.1. GENERAL

All roads shall be constructed to the lines and grades shown on the drawings. Site preparation shall be conducted in accordance with Section 02150 – Site Preparation and all required excavation shall be conducted in accordance with Section 02200 – Excavation of the Technical Specifications.

3.2. SUBGRADE PREPARATION

Prior to placing stone surfacing, the subgrade shall be shaped to conform to the lines, grades and cross-sections indicated on the drawings. All high areas shall be removed and all low areas filled and compacted. Access road subgrade shall conform to requirements in Section 02300 – Embankment of these specifications. Prior to placing stone surfacing, the compaction of the subgrade shall be finished to smooth out and compact backfilled rutting or indentations. The subgrade shall be inspected for suitability. Soft spots shall be fortified with No. 2 stone to the depths and lengths necessary to provide a stable subgrade surface.

3.3. BASE AND TOP COURSES

After approval of the subgrade by the QC Manager, geotextile material shall be placed on the subgrade. A sufficient amount of No. 2 stone in addition to any No. 2 stone used to fortify the subgrade shall be placed and compacted such that six inches are in place prior to placing No. 57 stone. A sufficient amount of No. 57 stone shall be placed and compacted such that four inches are in place prior to placing Mineral Aggregate Base. Mineral Aggregate Base shall be placed and compacted to a finished thickness of two inches. Mineral Aggregate Base shall not be placed until construction use of the access road has ceased.

END OF SECTION 02507

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TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02600 – HDPE FUSION PIPE

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

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

- Section 02200 – Excavation
- Section 02300 – Backfill and Embankment
- Section 02350 – Pre-Cast Structures
- Section 02373 – Geotextile
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 02621 – Geocomposite Drainage Media Section
- Section 02700 – Polyethylene Geomembrane Liner (FML)

1.2. DESCRIPTION OF WORK

This section covers installing High Density Polyethylene (HDPE) pipe at the locations shown in the Drawings.

1.3. SUBMITTALS

Proof of Compliance

The CONTRACTOR shall submit to the QC Manager an affidavit from the pipe Manufacturer certifying that the pipes and each fitting complies with this Technical Specification. The proof of compliance shall be provided to the QC Manager prior to delivery of any HDPE fitting to the project site. Flowable fill submittals shall conform to Paragraph 1.3.1 of Section 02365 of the Technical Specifications.

PART 2 - MATERIALS

2.1. HDPE PIPE FITTINGS

2.1.1. HDPE Physical Properties

HDPE pipe and fittings shall be manufactured from very high molecular weight high density polyethylene resin recommended by the Plastic Pipe Institute for an 800 pounds per square inch (psi) hydrostatic design stress rating at 140 degrees Fahrenheit, and shall have a Plastic Pipe Institute Material Designation of PE 3408 and a cell classification of PE 34543C as determined by ASTM D-3350. Pressure Class rating shall be 160 psi for water. An approved pipe material is Discoplex 4100 pipe as manufactured by Chevron-Phillips Chemical Company LP. Equivalent pipe shall be subject to approval by the QC Manager.

2.1.2 SDR Rating

The Standard Dimension Ratio (SDR) rating of individual HDPE pipe and fittings shall conform to SDR 17.

2.1.3 Fittings

All fittings, flanges and other materials necessary to install the Work shall be provided in accordance with the Drawings. This includes watertight connection to the manhole. Heat fusing shall be performed in accordance with the Manufacturer's recommendations. Fittings shall conform to the physical properties in Section 2.1.

2.2 Flowable Fill

Flowable fill backfill and bedding shall conform to Section 204.06 (b) of the Tennessee Department of Transportation "Standard Specifications for Road and Bridge Construction" for Excavatable Flowable Fill with the exception that the flowable fill achieves a minimum compressive strength of 200 psi in 28 days. Soil backfill shall conform to the requirements of Section 02300 of the Specifications.

PART 3 - EXECUTION

3.1. GENERAL

Care should be exercised by the CONTRACTOR in all operations such as placing of pipe, jointing, bedding, and backfilling. It shall be the CONTRACTOR's responsibility to see that pipes are not damaged during transportation, unloading, placement, compaction of backfill, or by any other forces including pipe bursting that may cause damage. All installations shall be in accordance with Manufacturer's recommendations.

3.2. EXCAVATION

Excavation required for installation of HDPE pipe shall conform to all requirements of Section 02200 of these Technical Specifications. This excavation includes cut through areas of perimeter stabilization. Such cut shall not be performed until perimeter stabilization in that area is approved.

3.3. JOINING

Successive pipe lengths shall be joined together using the heat fusion method in accordance with the Manufacturer's recommendations and procedures.

3.4. PLACEMENT

Proper facilities and equipment shall be provided by the CONTRACTOR for lowering the pipe into trenches. The pipe shall not be rolled, dropped or thrown into the trench. The pipe shall be laid carefully and true to the given lines and grades. Pipe that is not installed in true alignment or which shows abnormal settlement after placement, shall be removed and replaced.

3.5. BEDDING AND BACKFILL

HDPE pipe excavations shall be bedded as shown in the Drawings. No heavy equipment shall operate directly over the pipe until the working platform/drain has been placed. Pipe shall be anchored where flowable fill backfill is used to prevent floatation. Flowable fill shall be placed as bedding to a minimum depth of 6 inches below the pipe and shaped to accommodate the pipe. The pipe shall not be placed until the flowable fill has hardened to the point it can support a 200 pound person. Once the pipe has been placed, the remaining portion shall be backfilled with flowable fill to above the crown of the pipe as shown on the Drawings. Flowable fill shall be placed continuously along the pipe trench until it reaches elevation 12-inches above the top of the pipe. Flowable fill may be placed in lifts to lessen hydrostatic pressure and floatation on the pipe provided that each lift is bonded. The CONTRACTOR shall not backfill the flowable fill with soil for a minimum period of 24 hours. Traffic shall not be routed across the installation for 7 days. Soil backfill shall be placed in four (4) inch maximum loose lifts and compacted using a hand operated tamper or remote operated roller compactor to at least 95 percent of standard Proctor density.

3.6. CLEANING

Prior to installation of the pipe and at the conclusion of pipe installation, the CONTRACTOR shall visually inspect and clean mud, debris and/or sediment from the pipe. The manholes are access points that facilitate cleaning of installed pipes or future inspection performed by others. The means and method of cleaning shall be determined by the CONTRACTOR subject to Construction Manager Approval.

END OF SECTION 02600

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02621 – GEOCOMPOSITE DRAINAGE MEDIA

PART 1 - GENERAL

1.1. 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 02300 – Backfill and Embankment
- Section 02305 – Borrow
- Section 02365 – HDPE Pipe
- Section 02373 – Geotextile
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 02700 – Polyethylene Geomembrane Liner (FML)

1.2. DESCRIPTION OF WORK

This specification covers the geocomposite drainage media. The INSTALLER is the party responsible for procuring the geocomposite, field handling, transporting, storing, deploying, and seaming of the geocomposite. Geocomposite drainage media has two components, a geonet and geotextile. The geotextile is on either side of the geonet. The work for this section includes furnishing all labor, material, and equipment to complete installation of the geocomposite, including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

1.3. REFERENCE STANDARDS

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

GRI-GC8, Standard Guide for Determination of the Allowable Flow Rate of a Drainage Geocomposite
ASTM D 792, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

ASTM D 4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

ASTM D 4716, Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using Constant Head.

ASTM D 1238, Standard Test Method for Flow Rates of Thermoplastics by Extrusion Process Plastometer.

ASTM D 4218, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique

ASTM D 4491, Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method.

ASTM D 4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

ASTM D 4632, Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).

ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

ASTM D 6241, Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile- Related Products Using a 50-mm Probe.

ASTM D 5199, Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.

ASTM D 7005, Standard Test Methods for Determining the Bond Strength (Ply Adhesion) of Geocomposites

PART 2 - MATERIALS

The polymer used to manufacture the geonet component of the geocomposite shall be high density polyethylene which is clean and free of any foreign contaminants. Regrind material, which consists of edge trimmings and other scraps, may be used to manufacture the geonet, however, post-consumer recycled material shall not be used. An acceptable product includes Syntec Tenflow 770-2.

The geonet shall contain UV inhibitors to prevent ultraviolet light degradation. The geonet shall be manufactured by extruding three sets of polyethylene strands to form a tri-planar drainage net structure consisting of a thick vertical rib with diagonally placed top and bottom ribs. Labels on each roll of geocomposite shall identify the length, width, lot and roll numbers, and name of Manufacturer. Physical properties of the geocomposite shall meet the requirements outlined in this specification.

The geotextile component shall be heat bonded to both sides of the geonet. Heat bonding shall be performed by the Manufacturer prior to shipping to the site. The geotextile shall be a nonwoven needle punched synthetic fabric meeting the property requirements outlined in this specification.

Table 1
Required Geosynthetic Properties

PROPERTY	TEST METHODS	UNITS	VALUE	QUALIFIER	FREQUENCY
TRI-PLANAR GEONET¹					
Thickness	ASTM D 5199	mil (mm)	350 (8.9)	MAV ¹	100,000 sf
Density	ASTM D 792	g/cm ³	0.94–0.96	Range	100,000 sf
Melt Flow Index	ASTM D 1238	g/10 min	1.0	MAX ²	100,000 sf
Carbon Black	ASTM D 4218	%	2-3	Range	100,000 sf
Thickness Retained From 10,000 hour creep test under 2,000 psf, and 20°C temperature	GRI-GC8	%	92	-	-
Creep Reduction Factor From 10,000 hour creep test under 2,000 psf, and 20°C temperature	GRI-GC8	-	1.05	-	-
GEOTEXTILE					
U.V. Resistance (500 hrs)	ASTM D 4355	%	70	MARV ³	Per formula
Grab Tensile	ASTM D 4632	lbs (N)	160 (710)	MARV	100,000 sf
Grab Elongation	ASTM D 4632	%	50	MARV	100,000 sf
Tear Strength	ASTM D 4533	lbs (N)	60 (289)	MARV	100,000 sf
CBR Puncture	ASTM D 6241	lbs (N)	400 (1,776)	MARV	100,000 sf
AOS	ASTM D 4751	US Std Sieve(mm)	70 (0.212)	MaxARV	500,000 sf
Permittivity	ASTM D 4491	sec ⁻¹	1.4	MARV	500,000 sf
Water Flow Rate	ASTM D 4491	gpm/ft ² (l/min/m ²)	110 (4481)	MARV	500,000 sf
GEOCOMPOSITE					
Roll Sizes	12.5 ft x 200 ft (3.81 m x 61 m)				
Peel Adhesion – MD	ASTM D7005	lbs/in	1.0	MAV	100,000 sf
Transmissivity⁴– MD					
Gradient = 0.1	ASTM D 4716	m ² /sec	7.5*10 ⁻³	MAV	200,000 sf
Gradient = 0.33			4.5*10 ⁻³		

¹Minimum Average Value

²Maximum Value

³Minimum Average Roll Value

⁴Gradient at 0.1 is based on Plate/Ottawa Sand/Geocomposite/Geomembrane Interface using ASTM D4716 at, 1000 psf pressure with a 100 hour seating period. Gradient at 0.33 is based on the same interface, pressure and seating period as 0.1 Gradient.

PART 3 - SUBMITTALS

The INSTALLER shall submit the following to the TVA:

3.1. MILL CERTIFICATE AND SAMPLE

Prior to shipping to the site, the INSTALLER shall submit one copy of a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for the geocomposite attesting that the geocomposite meets the physical and manufacturing requirements stated in these Specifications. The INSTALLER shall also submit a sample (12' x 12') of the geocomposite to be used. The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.

3.2. SHIPPING, HANDLING, AND STORAGE INSTRUCTIONS

The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.

3.3. QUALITY CONTROL CERTIFICATES

For geocomposite delivered to the site, quality control certificates, signed by the Manufacturer's quality assurance manager shall be provided for every roll of geocomposite. Each certification shall have the roll identification number(s), test methods, frequency, and test results. At a minimum, the test results and frequency of testing shall be as shown in Table 1.

Furnish copies of delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

PART 4 - EXECUTION

4.1. HANDLING AND PLACEMENT

After the geomembrane (FML) has been constructed, tested and approved by the QC Manager, the surface shall be cleaned and free of excess dirt and debris.

The INSTALLER shall handle all geocomposite in such a manner as to ensure it is not damaged in any way. Precautions shall be taken to prevent damage to the FML during geocomposite installation.

The geocomposite roll should be installed with the machine direction perpendicular to the slope following the labeled instructions as provided by the Manufacturer.

All geocomposite shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.

Each continuous panel of geocomposite shall be extended through the bottom of the pipe drain collection trench prior to collection pipe or gravel placement. There are to be no end panel seams, only side to side panel (seams oriented perpendicular to pipe trench) seams.

If necessary, the geocomposite shall be positioned by hand after being unrolled to minimize wrinkles.

The geocomposite may be temporarily anchored with sand bags within the anchor trench. Anchor trench compacting equipment shall not come into direct contact with the geocomposite. See backfill requirements in Section 02300 of the Technical Specifications.

While deploying the geocomposite, the geocomposite shall be cut to fit around pipe outlets and instrumentation. Care shall be taken as to make sure there is no gap between the obstruction and the geocomposite. The geocomposite shall be cut in a way that the lower geotextile and geonet core is in contact with the obstruction and the upper geotextile has an excess overhang. There must be enough of the upper geotextile to be able to tuck the upper geotextile back under the geocomposite to protect the exposed geonet core, and prevent soil particles from migrating into the geonet core flow channels.

4.2. SEAMS AND OVERLAPS

Each component of the geocomposite (geotextile(s) and geonet) will be secured or seamed to the like component at overlaps.

4.3. GEONET COMPONENT

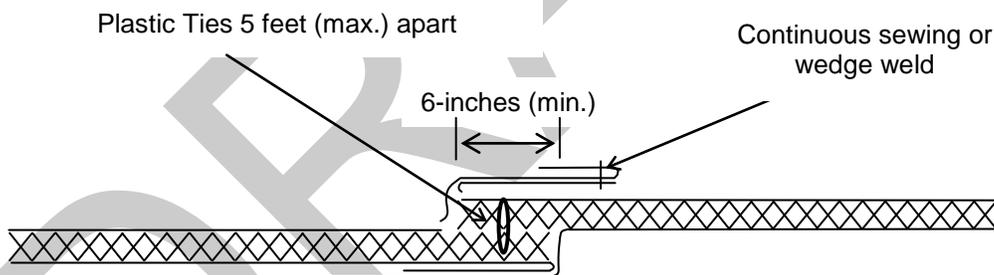


Figure 1. Overlap Along Roll Length (Machine Direction)

Adjacent edges of geonet along the side length (parallel to machine direction) of the geocomposite panels should be overlapped a minimum of 6-inches, see Figure 1. These overlaps shall be joined by tying the geonet cores together with white or yellow plastic fasteners or polymeric braid. These ties shall be spaced at a maximum of every 5 feet along the roll length. The ties should be fixed along the cross machine direction, i.e., tying the two layers across the longitudinal ribs. It should be noted that due to the structure of the geonet, a complete interlocking of the two overlapped layers can occur.

Adjoining geocomposite rolls (end to end) along the roll width shall be shingled down in the direction of the slope, with the geonet portion of the top geocomposite overlapping the geonet portion of the

bottom geocomposite a minimum of 12 inches across the roll width, see Figure 3. Geonet shall be tied every 12 inches across the roll width and every 6 inches in the anchor trench or as specified by the Engineer.

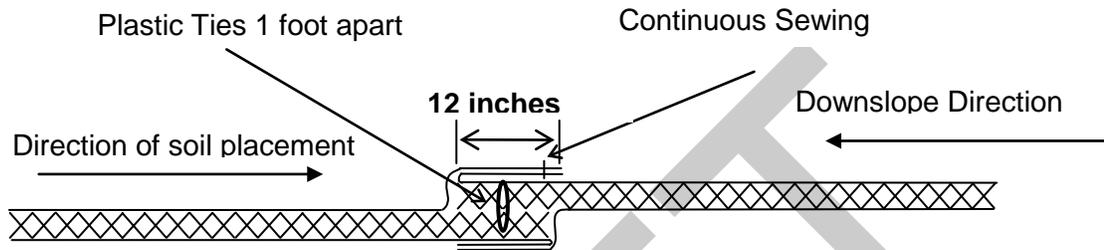


Figure 2: Overlap along Roll Width

4.4. GEOTEXTILE COMPONENT

The bottom layer of geotextile shall be overlapped. The top layers of geotextiles shall be sewn together, or may be heat bonded or wedge weld. Geotextiles shall be overlapped a minimum of 4 inches prior to seaming or heat bonding, geotextile sewing seams to be used are Prayer, "J", or Butterfly, see details in Figure 3. The seam shall be a two-thread, double-lock stitch, or a double row of single-thread, chain stitch. If heat bonding is to be used, care must be taken to avoid burn through of the geotextile. It is important that the geotextiles be joined continuously along to the roll as to prevent any fugitive particle migration into the geonet core flow channels.

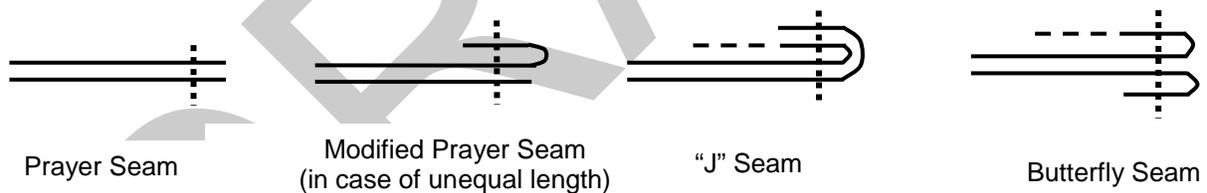


Figure 3. Geotextile Sewing Seams Details

4.5. REPAIRS

Prior to covering the deployed geocomposite, each roll shall be inspected for damage resulting from construction.

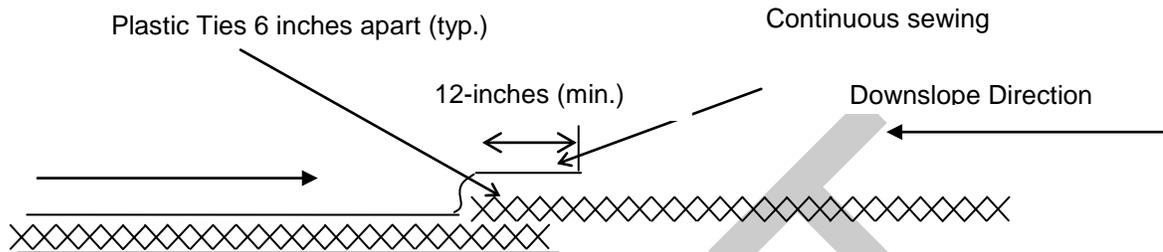


Figure 4. Overlap Along Roll Width

Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched by placing a patch extending 12 inches beyond the edges of the damaged area. The patch shall be secured to the original geonet by tying every 6 inches with approved tying devices. If the hole or tear width across the roll is less than 50 percent of the width of the roll, the damaged area shall be cut out and the two portions of the geonet shall be joined as shown in Figure 3. Any deployed geocomposite which has more than 50 percent of the width damaged shall be replaced by a continuous strip of geocomposite that is end joined as per Figure 2.

4.6. COVER PLACEMENT

In applying fill material, no equipment can drive directly across geocomposite. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure (LGP). The LGP equipment shall have a ground pressure of 6 psi or less. The cover soil shall be placed on the geocomposite from the bottom of the slope proceeding upwards and in a manner which prevents instability of the cover soil or damage to the geocomposite. Placement of the cover soil shall precede immediately following placement and inspection of the geocomposite.

Compaction of the initial lift placed over the geocomposite shall be performed in a manner that does not damage the geocomposite. This is accomplished by spreading a minimum 12-inch thick loose initial lift that is tracked over the entire surface using a LGP dozer.

The installed FML and geocomposite shall be protected from damage during construction and general operations. Under no condition shall vehicles or heavy equipment traverse lined areas without the geocomposite and the 20-inch layer in place. It shall be the CONTRACTOR's responsibility to place sufficient materials along equipment traverse points or haul routes over the cap to prevent rutting (greater than 3-inches) or pumping of the cap. If rutting or pumping is noted, then the CONTRACTOR shall place additional cover material until rutting and pumping is eliminated.

END OF SECTION 02621

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02700 – POLYETHYLENE GEOMEMBRANE LINER (FML)

PART 1 - GENERAL

1.1. 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 02300 – Backfill and Embankment
- Section 02305 – Borrow
- Section 02365 – HDPE Pipe
- Section 02373 – Geotextile
- Section 02410 – Surface Drainage Ditches
- Section 02507 – Access Roads
- Section 02621 – Geocomposite Drainage Media
- Section 02936 – Revegetation

1.2. DESCRIPTION

Specifications and guidelines for manufacturing and installing 40 mil Linear Low Density Polyethylene (LLDPE) also referred to as Flexible Membrane Liner (FML) with textured surfaces conforming to the current requirements of the Geosynthetic Research Institute Specification GM17.

1.3. REFERENCES

ASTM D 792 Specific Gravity (Relative Density) and Density of Plastics by Displacement

ASTM D 1004 Test Method for Initial Tear Resistance of Plastics Film and Sheeting

ASTM D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer

ASTM D 1505 Test Method for Density of Plastics by the Density-Gradient Technique

ASTM D 1603 Test Method for Carbon Black in Olefin Plastics

ASTM D 3895 Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis

ASTM D 4218 Test Method for Determination of Carbon Black Content in ASTM Polyethylene Compounds by the Muffle-Furnace Technique

ASTM D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products

ASTM D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

ASTM D 5323 Practice for Determination of 2% Secant Modulus for Polyethylene Geomembranes

ASTM D 5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics

ASTM D 5617 Test Method for Multi-Axial Tension Test for Geosynthetics

ASTM D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes

ASTM D 5885 Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry

ASTM D 5994 Test Method for Measuring the Core Thickness of Textured Geomembranes

ASTM D 6370 Standard Test Method for Rubber-Compositional Analysis by Thermogravimetry (TGA)

ASTM D 6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

ASTM D 7466 Test Method for Measuring the Asperity Height of Textured Geomembranes

1.4. DEFINITIONS

1.4.1. Lot

A quantity of resin (usually the capacity of one rail car) is used in the manufacture of polyethylene geomembrane rolls. The finished roll shall be identified by a roll number traceable to the resin lot used.

1.4.2. Quality Control Manager (QC Manager)

A Party, independent from Manufacturer and Installer that is responsible for observing and documenting activities related to quality assurance during the construction of the project.

1.4.3. Engineer

The individual or firm retained by the TVA that is responsible for the design and preparation of the project's Contract Drawings and Specifications

1.4.4. Geomembrane Manufacturer (MANUFACTURER)

The party responsible for manufacturing the geomembrane rolls.

1.4.5. Geosynthetic Quality Control Laboratory (TESTING LABORATORY)

A Party, independent from the TVA, MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, under the direction of the QC Manager.

1.4.6. Installer

A Party responsible for FML procurement, field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.

1.4.7. Panel

Unit area of a geomembrane that will be seamed in the field that is larger than 100 square feet.

1.4.8. Owner

Tennessee Valley Authority (TVA).

1.4.9. Subgrade Surface

The subgrade surface is the ash surface or prepared surface layer which immediately underlies the geosynthetic material.

1.5. SUBMITTALS

The INSTALLER shall furnish the following product data, in writing, to the TVA, QC Manager and Construction Manager ten (10) days prior to installation of the geomembrane material:

1.5.1. Resin Data

Include a certification stating that the resin meets the Specification requirements of Table 1 in Paragraph 2.1.1.

1.5.2. Geomembrane Roll

Include a statement certifying conformance with specified properties.

1.5.3. Proposed Layout and INSTALLERS Plan

The INSTALLER shall furnish the following information prior to installation:

1.5.3.1. Installation layout drawings:

- Shall show proposed panel layout including field seams and details.
- Shall be approved prior to installing the geomembrane.
- Approved drawings will be conceptual only and actual panel placement will be determined by site conditions.

1.5.3.2 Installer's Geosynthetic Field Installation Quality Assurance Plan.

1.5.4. As-Builts and Certifications

1.5.4.1. The INSTALLER will submit the following upon completion of installation:

- Certificate stating the geomembrane has been installed in accordance with the Contract Documents.
- Material and installation warranties.
- As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail.

1.6. QUALITY ASSURANCE/CONTROL

The TVA will engage and pay for the services of a Laboratory to perform testing services during geomembrane installation. The Installer will be responsible for field testing. Construction Quality Control will be provided by the QC Manager.

1.7. MATERIAL, LABELING, DELIVERY, STORAGE AND HANDLING

1.7.1. Labeling

Each roll of geomembrane delivered to the site shall be labeled by the Manufacturer. The label shall identify:

- Manufacturer's Name
- Product Identification
- Thickness
- Length

- Width
- Roll Number

1.7.2. Delivery

Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

1.7.3. Storage

The on-site storage location for geomembrane material will be provided by TVA. The INSTALLER shall be responsible for preparing the storage area in such a manner as to protect the geomembrane from punctures, abrasions and excessive dirt and moisture and the storage area shall have the following characteristics:

- Level (No wooden pallets)
- Smooth
- Dry
- Protected from theft and vandalism

1.7.4. Handling

Materials are to be handled so as to prevent damage.

1.8. WARRANTY

Material shall be warranted, on a pro-rated basis against Manufacturer's defects for a period of five (5) years from the date of geomembrane installation.

Installation shall be warranted against defects in workmanship for a period of one (1) year from the date of geomembrane completion.

PART 2 - PRODUCTS

2.1. GEOMEMBRANE

Material shall be 40 mil textured LLDPE as shown on the Drawings.

2.1.1. Resin

Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane. Natural resin (without carbon black) shall meet the following minimum requirements:

Table 1. Resin Requirements

Property	Test Method	FML
Density [g/cm ³]	ASTM D 1505	0.926
Melt Flow Index [g/10 min.]	ASTM D 1238 (190/2.16)	≤1.0
OIT [minutes]	ASTM D 3895 (1 atm/200°C)	100

2.2. MANUFACTURING QUALITY CONTROL

2.2.1. Geomembrane Rolls

Geomembrane shall not exceed a combined maximum total of one (1) percent by weight of additives other than carbon black.

Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating number, thickness, length, width and MANUFACTURER.

All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Paragraph 2.1.1. and be tested by an acceptable method of inspecting for pinholes. Inspection of pinholes shall be performed using standard industry practice. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

Textured surfaced geomembrane shall meet the requirements shown in Table 2.

Table 2. Textured LLDPE Geomembrane Physical Properties

Property	Minimum Average Values		Testing Frequency
	Test Method	MAV	
Thickness, mils	ASTM D 5994	40	Per roll
minimum average		38	
lowest individual of 8 of 10 readings		36	
lowest individual of 10 readings		34	
Asperity Height, mils	ASTM D 7466	10	Every 2 nd roll
Sheet Density, g/cc (max.)	ASTM D 1505/D 792	0.939	200,000 lb.
Tensile Properties ¹	ASTM D 6693		20,000 lb.
1. Break Strength, lb/ in		60	
2. Break Elongation, %		250	
2% Modulus, lb/ in ² (max.)	ASTM D 5323	60,000	Per formulation
Tear Resistance, lb	ASTM D 1004	22	45,000 lb.
Puncture Resistance, lb	ASTM D 4833	44	45,000 lb.
Axi-Symmetric Break Strain %	ASTM D 5617	30	Per formulation
Carbon Black Content ² , %	ASTM D 1603	2.0 - 3.0	45,000 lb.
Carbon Black Dispersion ³	ASTM D 5596	-Note 4-	45,000 lb.
Oxidative Induction Time (OIT)			
Standard OIT, minutes	ASTM D 3895	100	200,000 lb.
Oven Aging at 85°C	ASTM D 5721		
High Pressure OIT	ASTM D 5885	60	Per formulation
(% retained after 90 days)			
UV Resistance ⁴	GRI GM11		
High Pressure OIT ⁵	ASTM D 5885	35	Per formulation
(% retained after 1600 hrs)			

1. Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 inches.
2. Other methods such as ASTM D 4218 or microwave methods are acceptable if an appropriate correlation can be established.
3. Carbon black dispersion for 10 different views: All 9 in Categories 1 and 2 with one allowed in category 3.
4. The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation 60°C.
5. UV resistance is based on percent retained value regardless of the original HP-OIT value.

2.2.2. Extrudate Rod or Bead

Extrudate material shall be made from same type resin as the geomembrane. Additives shall be thoroughly dispersed. Materials shall be free of contamination by moisture or foreign matter.

2.3. PIPE BOOT

Pipe boots shall be fabricated from the FML parent material. A water tight seal shall be formed with a stainless steel clamp at the pipe and extrudate weld along the apron.

PART 3 - EXECUTION

3.1. EQUIPMENT

Welding equipment and accessories shall meet the following requirements:

- 3.1.1. Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.
- 3.1.2. An adequate number of welding apparatus shall be available to avoid delaying work.
- 3.1.3. Power source capable of providing constant voltage under combined line load shall be used.

3.2. DEPLOYMENT

Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site. Visually inspect the subgrade surface for smoothness and the presence of rock fragments. Rock fragments shall be removed from the surface prior to deployment in accordance with manufacturer recommendations. Visually inspect the geomembrane during deployment for imperfections and mark the faulty or suspect areas. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:

- 3.2.1. Unroll geomembrane panels using methods that will not damage geomembrane and will protect underlying surface from damage (i.e., spreader bar, protected equipment bucket).
- 3.2.2. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.
- 3.2.3. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage the geomembrane.
- 3.2.4. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and vehicles are acceptable if ground contact pressure is six psi or less, the tire treads are clean and free of embedded objects, and they are operated in a manner that does not distress the constructed geomembrane product.

3.2.5. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.

3.2.6. Geomembrane deployment shall proceed between ambient temperatures of 32° F and 104° F. Placement can proceed below 32° F only after it has been verified by the inspector that the material can be seamed according to the specification. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, rain, dew) or in the presence of excessive winds, as determined by the installation supervisor.

3.2.7. Sufficient slack in the material shall be provided to allow for thermal expansion and contraction.

3.3. FIELD SEAMING

3.3.1. Seams

Seams shall meet the following requirements:

- To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.
- Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
- Slope seams (panels) shall extend a minimum of ten-feet beyond grade breaks (i.e. changes in slope 10% or greater) into the adjacent flat area.
- Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the QC Manager and INSTALLER.
- Align seam overlaps consistent with the requirements of the welding equipment being used. A six-inch overlap is commonly suggested.
- Cap all "T-joints" at panel intersections. A T-joint is where more than two panels adjoin and are welded one on top of the other. Capping is welding over the top of this junction.

3.3.2. Welding Operations

Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

3.3.3. Extrusion Welding

Extrusion welding shall meet the following conditions:

- Hot-air tack adjacent pieces together using procedures that do not damage geomembrane.
- Clean geomembrane surfaces and remove texturing by disc grinder or equivalent.
- Purge welding apparatus of heat-degraded extrudate before welding.

3.3.4. Hot Wedge Welding

Hot wedge welding shall meet the following conditions:

- Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
- Clean seam area of dust, mud, moisture and debris immediately ahead of the hot wedge welder.
- Protect against moisture build-up between sheets.

3.3.5. Trial Welds

Trial welds shall meet the following conditions:

- Prior to production seaming by any operator and each welding device, perform trial welds on geomembrane samples to verify welding equipment is operating properly.
- Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
- Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
- Cut four, one-inch wide by six-inch long test strips from the trial weld.
- Quantitatively test specimens for peel adhesion, and then for bonded seam strength (shear) in accordance with project requirements.
- Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test.
 - The break, when peel testing, occurs in the liner material itself, not through peel separation (film tear bond).
 - The break is ductile.

Table 3. Minimum Weld Values for

Property	Test Method	Value
Peel Strength (fusion & extrusion.), ppi	ASTM D 6392	50
Shear Strength (fusion & extrusion.), ppi	ASTM D 6392	60

- Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
- No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

3.3.6. Defects and Repairs

3.3.6.1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

3.3.6.2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

3.4. FIELD QUALITY CONTROL

MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the quality control program. CONTRACTOR shall be responsible for assuring this participation. Quality control requirements are as specified in this Section and in the QC Plan.

3.4.1. Field Testing

3.4.1.1. Non-destructive testing may be carried out as the seaming progresses, or after completion of all field seaming.

- Vacuum Testing shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
- Air Pressure Testing shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
- Other approved methods.

3.4.1.2. Destructive Testing shall be performed at the direction of the QC Manager or as directed by the INSTALLER.

The location and frequency of testing shall be as follows:

- Collect destructive test samples at a frequency of one per every 500 lineal feet of seam length.
- Test locations will be determined by the QC Manager.
- Exercise Method of Attributes as described by GRI GM-14 (Geosynthetics Institute, <http://www.geosynthetic-institute.org>) to minimize test samples taken.

Sampling Procedures shall be performed as follows:

- INSTALLER shall cut samples 12 inches wide by 36 inches long with the seam centered lengthwise. These samples shall be taken at locations designated by the QC Manager as the seaming progresses in order to obtain field and laboratory test results before the geomembrane is covered.
- QC Manager will number each sample, and the location will be noted on the adjacent liner as well as the installation as-built.
- The INSTALLER shall cut a 2-inch wide strip from each end of the sample for field-testing.
- The INSTALLER shall cut the remaining sample into two parts for distribution as follows:
 - One portion for INSTALLER, 12-inches by 12 inches
 - One portion for the Third Party laboratory, 12-inches by 18-inches
 - Additional samples may be archived if required.

Testing methods and repair procedures shall be as follows:

- Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
- INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.
- Repair and test the continuity of the repair in accordance with these Specifications.

3.4.2. Failed Seam Procedures

3.4.2.1. If the seam fails by either destructive or non-destructive testing, the INSTALLER shall follow one of two options:

- Reconstruct the seam between any two passed test locations.
- Trace the weld to an intermediate location at least 10 feet minimum, or to where the seam ends in both directions, from the location of the failed test.

3.4.2.2. The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10 feet long.

3.4.2.3. If sample passes, then the seam shall be reconstructed or capped between the test sample locations. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

3.5. REPAIR PROCEDURES

Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test. INSTALLER shall be responsible for repair of defective areas. Agreement upon the appropriate repair method shall be decided between QC Manager and INSTALLER by using one of the following repair methods:

- Patching- Used to repair large holes, tears, undispersed raw materials and seams contaminated by foreign matter.
- Abrading and Re-welding- Used to repair short section of a seam.
- Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
- Capping- Used to repair long lengths of failed seams.
- Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
- Replace the unacceptable seam with new material.

The following procedures shall be observed when a repair method is used:

- All geomembrane surfaces shall be clean and dry at the time of repair.
- Surfaces of the FML which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness and grinding to remove texturing.
- Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

Repair Verification

- Number and log each patch repair (performed by QC Manager).
- Non-destructively test each repair using methods specified in this Specification.

END OF SECTION 02700

TECHNICAL SPECIFICATIONS
DIVISION 2 – SITE WORK
SECTION 02936 – REVEGETATION

PART 1 - GENERAL

1.1. 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 02300 – Backfill and Embankment
- Section 02410 – Surface Drainage Ditches

1.2. DESCRIPTION

This Work consists of furnishing all labor, equipment and materials for long term, stabilization of the Lateral Expansion (Cell 4) Closure 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. Short to medium term erosion control is governed by the sitewide Storm Water Management Plan (SWMP) and the interim Stacking Specifications previously issued.

1.3. SUBMITTALS

- 1.3.1. Agronomic soil test results shall be submitted to the TVA and Construction Manager.
- 1.3.2. Seed tickets, fertilizer certification, and CaCO₃ equivalency certification shall be submitted to the TVA and Construction Manager.
- 1.3.3. A specification sheet on the proposed hydromulch shall be submitted to the Construction Manager.
- 1.3.4. The proposed compost shall be submitted to the TVA for approval by the QC Manager.
- 1.3.5. A sample of the Erosion Control Blanket shall be submitted to the TVA and the Construction Manager.

1.4. QUALITY CONTROL

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

1.4.2. 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.

1.4.3. 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. LIME

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 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 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. 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 3.1.

2.5. COMPOST

Compost 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 soil or mixed with hydraulic mulch. Alternate composts that introduce organic matter will be considered.

2.6. 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.

2.7. 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

3.1.1. The areas to be seeded shall be dressed to a reasonably smooth, firm surface, as determined by the Construction Manager. Compost, where needed to add organic content as determined by the Construction Manager, shall be incorporated into the top four 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 four (4) inches with either a tandem or offset disk meeting the following specifications:

- Disk Size: 22 inches minimum
- Disk Spacing: 13 inches maximum
- Weight: 400 pounds per foot of cut minimum
- 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 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 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 CONTRACTOR shall provide an accurate pH meter to monitor the slurry at all times.

3.1.6. The hydromulch 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 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. Use of alternative techniques or other deviations from the standards and instructions provided herein must be approved by the QC Manager prior to implementation. The 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

TECHNICAL SPECIFICATIONS
DIVISION 3 – CONCRETE
SECTION 03100 – CONCRETE FORMWORK

PART 1 - GENERAL

1.1. DESCRIPTION OF WORK

This section covers furnishing, design, construction, erection, use and subsequent removal of forms for cast-in-place concrete structures.

1.2. CODES AND STANDARDS

In addition to complying with all pertinent codes and regulations, the CONTRACTOR shall comply with all pertinent recommendations of the following standards:

1. American Concrete Institute, ACI 347, "Recommended Practice for Concrete Formwork".
2. American Concrete Institute, ACI SP-4, "Formwork for Concrete".
3. US Department of Commerce, National Bureau of Standards (NBS) Product Standard, PS1-74, "Construction and Industrial Plywood".

1.3. SUBMITTALS

Manufacturer's literature shall be submitted for plywood, form sealers and accessories, prefabricated forms and form coating. The type, shape, size, quality and strength of all materials of which forms are made shall be submitted for review.

All required submittals shall take place within fifteen (15) working days of beginning work.

PART 2 - FORM MATERIALS

2.1. FACING MATERIALS

2.1.1. Forms shall be fabricated with facing materials that produce the specified finish within the surface requirements of this section.

2.1.2. Class A Finish

This class of finish shall apply to all exposed exterior surfaces. The form facing material shall produce a smooth, hard, uniform surface equivalent to new well-matched tongue-and-groove lumber or new plywood panels conforming to NBS Product Standard PS-1, exterior type grade B-B, high density overlaid, or structural plywood.

2.1.3. Class B Finish

This class of finish shall apply to all surfaces not exposed to public view. The sheathing shall be composed of tongue-and-groove or shiplap lumber, plywood conforming to NBS Product Standard PS-1 exterior type grade B-B plyform, concrete form hardboard or steel.

2.1.4. Class C Finish

This class of finish shall apply to all concrete surfaces which backfill will be placed. The sheathing may be of wood or steel.

2.2. FORM SEALERS

Form sealers shall be products specifically designated for use by the manufacturer for the form material for which they are being used. Form sealers used are subject to the approval of the QC Manager.

2.3. TIES AND SPREADERS

2.3.1. Type

All form ties shall be a "water-seal" type with plastic or wooden cones which do not leave an open hole through the concrete and which permits neat and solid patching at every hole.

2.3.2. Design

Form ties shall be designed so that ends or end fasteners can be removed without causing appreciable spalling at the faces of the concrete. When forms are removed, all metal shall be not less than one inch from the surface.

2.3.3. Wire Ties and Wood Spreaders

Do not use non-fabricated wire ties and wood spreaders.

2.4. CHAMFER STRIPS

Chamfer strips shall have a 3/4-inch leg and be made of wood, plastic or other approved material. Chamfer strips shall be provided for all exterior corners or as directed by the QC Manager.

2.5. FORM RELEASE AGENTS

Release agents shall be a commercial formulation of satisfactory and proven performance that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

2.6. ALTERNATE FORMING SYSTEMS

Alternate forming systems may be used subject to the approval of the QC Manager.

2.7. OTHER MATERIALS

All other materials, not specifically described but required for completion of concrete formwork, shall be as selected by the CONTRACTOR subject to the approval of the QC Manager.

PART 3 - EXECUTION

3.1. DESIGN

The design and engineering of the formwork, as well as its construction shall be the responsibility of the CONTRACTOR. It shall be designed by a licensed Professional Engineer in the State of Tennessee and bear the certification of said Engineer. The formwork shall be designed for loads, lateral pressure and allowable stresses in accordance with Chapter 1 of ACI Standard 347. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete and shall have sufficient rigidity to maintain specified tolerances.

3.2. CONSTRUCTION

3.2.1. General

Forms shall be true to line and grade and mortar-tight. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit forms over the complete surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall be constructed such that appurtenances can be placed as shown in the Drawings.

3.2.2. Temporary Openings

Temporary openings shall be provided in the bottom of the inside form of all wall forms to facilitate cleaning and inspection immediately before depositing concrete.

3.2.3. Assembly

Forms shall be so assembled that their removal will not damage the concrete.

3.2.4. Embedded Items

The CONTRACTOR shall set all embedded items such as castings, anchor bolts, steps, safety climb systems and other such items required to be anchored in the concrete before the concrete is placed.

3.2.5. Bracing

The CONTRACTOR shall brace forms in the following manner:

- (1) Properly brace and tie the forms together so as to maintain position and shape and to ensure safety to personnel.
- (2) Construct all bracing, supporting members, and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.
- (3) Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.

3.2.6. Construction Tolerance

The forms shall be constructed and rigidly braced in-place within the following tolerances:

- (1) Variation from true alignment as shown on the Drawings in the lines and surfaces of walls:

In 10 feet	1/4 inch
In 20 feet maximum	3/8 inch
In 40 feet or more	3/4 inch
- (2) Variation from the level or from the grades indicated on the Drawings in floors or slabs:

In 10 feet	1/4 inch
In 20 feet maximum	3/8 inch
In 40 feet or more	3/4 inch
- (3) Variation in sizes and/or locations of floor and/or wall openings:

1/4 inch
- (4) Variation in thickness of slabs and walls:

Minus	1/4 inch
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- Plus 1/2 inch
- (5) Variation in dimension of footings as shown on the Drawings:
- Minus 1/2 inch
- Plus 2 inches
- (6) Variation in location of embedments other than anchor bolts:
- 1/2 inch
- (7) Variation in location of anchor bolts:
- Individual Groups 1/8 inch
- Bolt Groups 1/4 inch

3.2.7. Release Agent

After assembly and immediately prior to erection, coat all formwork with release agent as approved by the QC Manager.

3.2.8. Wetting

The inside surface of wood board forms shall be soaked with clean water and kept continuously wet for 12 hours before any concrete is placed. If forms have been erected for some time and have become dry so that joints have opened, then the forms shall be thoroughly soaked at least twice each day for at least three days prior to placing concrete. If the forms cannot be tightened to the satisfaction of the QC Manager, they shall be torn down and rebuilt.

3.2.9. Removal of Forms

Formwork not supporting weight of concrete, such as walls and similar parts of the Work may be removed 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained. The CONTRACTOR shall assume full responsibility for removal of formwork and forms.

3.2.10. Reused Forms

Reused forms shall be thoroughly cleaned of dirt, debris, concrete, and foreign matter. Forms shall not be reused if they have developed defects which would affect their tightness and strength. Marred surfaces in contact with concrete shall be repaired before reuse.

3.3. INSPECTION AND APPROVAL OF FORMWORK

Forms, form joints, and reinforced steel placement shall be checked by the QC Manager before closing the forms. Concrete shall not be placed in any form until the placing of steel and erection of formwork have been completed and approved in completed state by the QC Manager. Immediately after completion of placement, tops of all forms shall be adjusted to line and approved by the QC Manager as to conformity within the tolerances specified herein.

END OF SECTION 03100

TECHNICAL SPECIFICATIONS
DIVISION 3 – CONCRETE
SECTION 03200 – CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1. DESCRIPTION OF WORK

This Section covers furnishing, cutting, bending, handling, and placing of steel reinforcement for all reinforced cast-in-place concrete and/or grout shown on the Drawings.

1.2. CODES AND STANDARDS

The provisions of the following codes, specifications, and standards latest editions shall apply:

1. American Concrete Institute, ACI-315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures."
2. American Concrete Institute, ACI-318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars" and "Manual of Standard Practice."

1.3. SUBMITTALS

1.3.1. Shop Drawings

The CONTRACTOR shall prepare and submit to the QC Manager for review complete shop drawings in accordance with this Section of these Technical Specifications at least 15 days prior to beginning Work. The CONTRACTOR shall not allow delivery of the reinforcing steel to the job site until a review of the shop drawings has been completed by the QC Manager. Shop drawings shall include the following:

1. Reinforcement bar schedules complete with the quantity, shape and size, dimensions, weight per foot and total weights, and bending details.
2. Details of bar supports including types, sizes, and support spacing and sequence.
3. Drawing and elevation views detailing reinforcement placement.

1.3.2. Mill Tests

Mill tests of reinforcement shall be submitted prior to use for each 15 tons or less shipped to the job site. Tests shall be conducted in conformance with ASTM A 615, and the methods described therein. Cost of the test shall be borne by the TVA. Three (3) copies of each test report shall be submitted to the TVA for distribution to the QC Manager and Construction Manager. The bars shall be properly tagged so as to permit identification of the heat number shown on the mill test report for all steel delivered to the Work.

PART 2 - MATERIALS

2.1. REINFORCING STEEL BARS

All bar reinforcement shall be new billet steel deformed bars of American manufacture conforming to ASTM A615 Grade 60.

2.2. BAR SUPPORTS

Bar supports shall conform to ACI-315. The CONTRACTOR shall provide sufficient bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2.3. WIRE TIES

Ties shall be 16-gage or heavier black annealed wire.

2.4. OTHER MATERIALS

All other materials not specifically described but required for proper completion of concrete reinforcement, shall be as selected by the CONTRACTOR subject to the approval of the QC Manager.

2.5. REJECTION OF MATERIALS

Reinforcement with any of the following defects will not be permitted in the Work:

1. Bar lengths, depth and bends exceeding the specified fabrication tolerances.
2. Bends or kinks not indicated on the Drawings or shop drawings.
3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.1. BENDING

Reinforcing bars may be mill or field bent. No bars partially embedded in the concrete shall be field bent. All bends shall be made in compliance with requirements of the American Concrete Institute Standard 315 and by approved machine methods except as noted otherwise on the Drawings. All bends shall be made without heating.

3.2. HANDLING AND PROTECTION

3.2.1. Protection

The CONTRACTOR shall protect concrete reinforcement from damage by adjacent equipment operations before, during, and after installation.

3.2.2. Storage

Steel reinforcement shall be stored above the surface of the ground upon platforms, skids, or other supports and shall be protected, as far as practicable, from mechanical injury, surface deterioration caused by conditions producing rust, and fouling with dirt, grease and other bond breaking coatings.

3.2.3. Identification

The Contractor shall exercise all necessary precautions to maintain identification of bars after the bundles are broken.

3.3. PLACING

3.3.1. Surface Coatings

All reinforcement shall be free from dirt, oil, grease, paint, mill scale, loose or thick rust, or other coating which might destroy or reduce its bond with the concrete when the surrounding concrete is placed.

3.3.2. Bracing Reinforcement

All reinforcement shall be placed in accordance with the Drawings and shall be held so securely in position by wiring and blocking from the forms and by wiring together at intersections that it will not be displaced during the depositing and compacting of the concrete. Tack welding of bars will not be permitted.

3.3.3. Support of the Work

Piping and conduits shall not be supported or tied directly to the steel. They shall be supported by bar chairs or support bars provided for piping or conduits only.

3.4. SPLICES

3.4.1. General

All splices in reinforcement shall be as shown on the Drawings or as directed by the QC Manager. Unless otherwise specified on the Drawings, by statement or scaled distance, splices listed in Table 1 shall be considered a minimum.

Table 1

<u>Bar Size</u>	<u>Minimum Splice Length Grade 60 Steel</u>
#3	1'-4"
#4	1'-7"
#5	2'-0"
#6	2'-4"
#7	2'-9"
#8	3'-3"
#9	4'-2"
#10	5'-3"
#11	6'-5"

3.4.2. Method of Splicing

Splice by lapping ends, placing bars in contact, and tightly wire tying.

3.4.3. Splices in Adjacent Bars

Alternate sides for splices of horizontal reinforcing bars in all walls.

3.5. TOLERANCES

3.5.1. Minimum Cover

The minimum cover for all main reinforcement shall conform to the dimensions shown on the Drawings.

3.5.2. Allowable Tolerances

The following tolerances will be allowed in the placement of reinforcing bars as shown on the Drawings:

1. Variation in protective cover
1/4 inch for 2-inch cover
3/16 inch for 3-inch cover
2. Variation of spacing
1/12 of indicated spacing

The tolerances indicated above apply to large areas uninterrupted by openings or embedments. Bar spacing may be adjusted locally up to one-third the specified spacing if required to clear openings or embedments.

3.6. INSPECTIONS

3.6.1. Notice

The QC Manager or his representative shall have 24 hours notice and the opportunity to inspect and approve the placement of reinforcing steel before concrete is placed.

3.6.2. Purpose

Such inspections are in the nature of assisting the CONTRACTOR to minimize errors, and in no case will they relieve the CONTRACTOR of the responsibility to provide the materials and workmanship required by the Contract Documents.

END OF SECTION 03200

TECHNICAL SPECIFICATIONS
DIVISION 3 – CONCRETE
SECTION 03300 – CONCRETE

PART 1 - SCOPE

This Section covers the furnishing of all material, equipment, labor and plant, and performing all operations specified herein, including the manufacturing, transporting, placing, finishing, and curing of all cast-in-place concrete, including concrete used in catch basins, manholes, risers, and headwalls.

PART 2 - CODES AND STANDARDS

In addition to complying with all pertinent codes and regulations, the CONTRACTOR shall comply with all pertinent recommendations of the following standards:

- (1) American Concrete Institute, ACI 301, "Specifications for Structural Concrete Buildings".
- (2) American Concrete Institute, ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete".
- (3) American Concrete Institute, ACI 308, "Recommended Practice for Curing Concrete".
- (4) American Concrete Institute, ACI 309, "Recommended Practice for Consolidation of Concrete".
- (5) American Concrete Institute, ACI 311, "Recommended Practice for Concrete Inspection".
- (6) American Concrete Institute, ACI 318, "Building Code Requirements for Reinforced Concrete".

PART 3 - COMPOSITION

Concrete shall be composed of Portland cement, water, fine aggregate, coarse aggregate, and when specified or approved in writing by the Quality Control (QC) Manager, admixtures for entraining air or retarding agents to slow concrete curing. The design of the concrete mixture will be based on the water-cement ratio necessary to secure (1) a plastic workable mixture suitable for the specific conditions of placement and (2) when properly cured, a product having durability, impermeability and strength in accordance with all the requirements set forth by these Technical Specifications. The concrete mixture shall be designed so that the concrete placed according to Drawings shall produce a minimum laboratory cylinder compressive strength equal to the strength designated in Paragraph 4 for the class of concrete specified.

PART 4 - DESIGN REQUIREMENTS

All cast-in place concrete shall meet the following minimum design requirements:

<u>Minimum 28-Day Strength (psi)</u>	<u>Air Entraining (%)</u>	<u>Minimum Cement Content (lbs./cu.yd.)</u>	<u>Maximum Water/Cement Ratio</u>
4,000	4 (min.) – 8 (max.)	564	0.45

Class A concrete shall include all reinforced cast in place structures. Class B concrete shall be unreinforced concrete. Flowable fill shall conform to Section 02365, Paragraph 2.5 of these Specifications.

PART 5 - CONSISTENCY

5.1. GENERAL

The consistency of concrete shall be such that it can be worked readily into corners and angles of forms and around reinforcement without permitting the materials to segregate or excess water to collect on the surface. The extreme limits of allowable slump when tested in accordance with ASTM Designation C-143 shall be 1 to 3 inches. Where vibrators are used, the QC Manager may allow a slightly lower slump than the specified minimum.

5.2. MIXING WATER

Mixing water shall be potable water. The ratio of mixing water to cement shall not be changed without prior approval from the QC Manager.

PART 6 - SUBMITTALS

6.1. MATERIALS LIST

The CONTRACTOR shall, 15 days before any concrete is delivered to the job site, submit to the QC Manager a complete list of all materials to be furnished and installed under this portion of the work, showing manufacturer's name and catalog number of all items such as admixtures, curing compounds, cement and the name and address of the ready-mix concrete supplier (if applicable).

6.2. DESIGN MIX

At least 15 days before any concrete is delivered to the job site, the CONTRACTOR shall submit written reports to the QC Manager of the design mix.

6.3. MATERIALS FOR TESTING

Within seven days after construction activities begin, the CONTRACTOR shall deliver materials for testing in accordance with applicable sections of this section.

6.4. READY-MIX DELIVERY SLIPS

The CONTRACTOR shall:

- (1) Keep a record at the job site showing time and place of each batch of concrete, together with ready-mix delivery slips certifying contents of each batch.
- (2) Make records available to the QC Manager for his inspection upon request.
- (3) Upon completion of this portion of the work, deliver the record and delivery slips to the QC Manager.

PART 7 - DESIGN MIXES

7.1. GENERAL

The CONTRACTOR shall be responsible for the design of the concrete mixtures and the quality of the concrete, including ready-mix batches. The CONTRACTOR shall use an independent testing laboratory, approved by the QC Manager, for preparing and reporting proposed mix designs.

7.2. PROPORTIONING AND REPORTS

Design mixes shall be proportioned by weight for each class of concrete required, complying with ACI-211 "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete." At least fifteen (15) calendar days prior to the start of any concrete work, the CONTRACTOR shall furnish to the QC Manager, written reports of each design mix for each class of concrete. The reports shall contain:

- (1) Project Identification Name and Number.
- (2) Date of Report.
- (3) Name of CONTRACTOR.
- (4) Name of Concrete Supplier.
- (5) Name of Concrete Testing Service.
- (6) Class of Concrete.
- (7) Complete Identification of Aggregate Supply Source.

- (8) Test Results of Aggregates for Compliance with Specified Requirements.
- (9) Scale Weight of Each Aggregate.
- (10) Absorbed Water in Each Aggregate.
- (11) Brand, Type, Composition and Amount of Cement.
- (12) Amounts of Water Used in Trial Mixes.
- (13) Brand, Type and Amount of Air-entraining Agents (If Used) in Trial Mixes.
- (14) Proportions of Each Material (by Weight) per Cubic Yard.
- (15) Gross Weight and Yield per Cubic Yard of Trial Mixes.
- (16) Measured Slump.
- (17) Measured Air Content.
- (18) Compressive Strength Developed at seven Days and 28 Days from Not Less Than Three (3) Test Cylinders Cast for Each seven and 28 Day Test, and for Each Design Mix.

7.3. DESIGN CRITERIA

The concrete mixes shall be designed so that the compressive strength of laboratory-cured cylinders, for each required strength, will be at least 15 percent greater than the minimum specified compressive strength; and such that not more than one test, of any 10 consecutive tests for strength, will have a value of less than 90 percent of the required strength.

7.4. ADJUSTMENTS

The criteria specified herein are maximums or minimums and shall not be construed to predetermine fixed quantities of materials in the mix design, or to preclude change of an accepted mix design at any time. Mix design adjustments may be requested by the CONTRACTOR when characteristics of materials, job conditions, weather, test results or other circumstances warrant; and as accepted by the QC Manager. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the QC Manager before being used in the Work.

7.5. AIR-ENTRAINED CONCRETE

All concrete shall be air-entrained. Air-entrainment shall be accomplished by using an air-entrained Portland cement (Type IIA) or by using an air-entraining admixture with normal Type II Portland cement. If the entrained air content falls below the specified limits when using air-entrained cement, an air-entraining admixture shall be added in sufficient quantity to bring the entrained air content within the specified limits. If the entrained air content is found to be greater than the maximum specified limits when using an air-entraining cement, the use of that cement shall be prohibited and air-entrainment shall be accomplished by using an air-entraining admixture with Type II Portland cement. Air-entraining admixtures shall be added to a portion of the mixing water by means of a mechanical batcher in a manner that will insure uniform distribution of the agent throughout the batch.

PART 8 - FAILURE TO MEET STRENGTH REQUIREMENTS

8.1. REMOVAL AND REPLACEMENT

In the event that the concrete fails to meet the strength requirements of these Technical Specifications, the CONTRACTOR shall be required to remove such concrete from the structure and replace such sections in a manner satisfactory to the QC Manager.

8.2. NOTIFICATION

When it is determined that such concrete shall be removed and replaced, the CONTRACTOR shall be notified in writing, stating the extent of the replacement to be made.

PART 9 - CONCRETE MATERIALS

9.1. GENERAL

The CONTRACTOR shall use ready-mix concrete for this project.

9.2. CEMENT

9.2.1. Portland Cement

Portland cement shall meet the requirements of ASTM Designation C-150 for the type of cement specified. The cement shall be either Type II or Type IIA cement unless otherwise directed by the QC Manager.

9.2.2. Air-Entraining Portland Cement

Air-entraining Portland cement shall meet the requirements of ASTM Designation C-150 for the type of cement specified.

9.3. WATER

Water used in mixing concrete shall be potable water.

9.4. ADMIXTURES

9.4.1. Air-Entrainment

Air-entraining admixtures shall fully meet the requirements of ASTM Designation C-260 and shall be subject to tests in accordance with ASTM Designation C-233. Air-entraining admixtures shall be added to the concrete mixture in the form of solutions rather than solids. The manufacturer's storage recommendations shall be followed.

9.4.2. Retarding Agents

Approved types of retarding agents shall be included in the concrete mix when specified on Drawings or authorized in writing by the QC Manager.

9.4.3. Acceleration Agents

The use of calcium chloride or other accelerating admixtures for anti-freeze compounds will not be allowed. Approved accelerators shall be included in the concrete mix when authorized in writing by the QC Manager.

9.4.4. High-Range Water-Reducing Admixture

The use of high-range water-reducing (H-RW-R) admixtures (super plasticizer) shall only be permitted with the written consent of the QC Manager. Any H-RW-R admixture used shall comply with ASTM C-494 Type F or Type G and contain not more than 0.1 percent chloride ions. An acceptable product is Rheobuild 1000 by Master Builders, or equal.

9.4.5. Water-Reducing Admixture

The use of water-reducing admixture shall require the prior approval of the QC Manager. Any water-reducing admixture used must comply with ASTM C-494, Type A and contain not more than 0.1 percent chloride ions.

9.4.6. Water-Reducing Retarding Admixture

The use of water reducing, retarding admixtures shall require the prior approval of the QC Manager. Any water-reducing, retarding admixture used must comply with ASTM C-494, Type D, and contain not more than 0.1 percent chloride ions.

PART 10 - CONCRETE SAMPLING AND TESTING

10.1. GENERAL

Standard tests of the material and concrete shall be made by the QC Team, as required by these Technical Specifications. Retests required due to non-conformity of the materials shall also be made by QC Team as approved by the QC Team Manager. The following tests will be performed by the methods and minimum frequencies indicated.

10.2. FRESH CONCRETE

ASTM C-172; each sample shall be obtained from a different batch of concrete on a random basis.

10.3. SLUMP

ASTM C-143; one test for each set of compressive strength test specimens, and whenever consistency of concrete appears to vary.

10.4. AIR CONTENT

ASTM C-231, pressure method; one for each set of compressive strength test specimens.

10.5. COMPRESSIVE TEST

ASTM C-31; one set of four (4) standard cylinders for each compressive strength test. One set of specimens shall be cast from a composite sample of concrete placed in one day or each 50 cubic yards placed, whichever is minimum. The QC Manager or his representative will determine and record the batch number for the concrete and the exact location in the work at which each batch represented by test specimens is deposited.

10.6. CONCRETE TEMPERATURE

Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compressive test specimens is made.

10.7. COMPRESSIVE STRENGTH

ASTM C-39; for each set of compressive strength test specimens there shall be one test at seven (7) days after placing for information and two (2) tests at twenty-eight (28) days for acceptance. One specimen shall be held in reserve. The acceptance test results shall be the average of the two strengths of the specimens at 28 days. If one specimen in the test manifests evidence of improper sampling, molding, transportation or testing, it shall be discarded and the reserve specimen shall replace it. If two specimens in a test show any defects, the test result shall be the remaining cylinder strength. If more than two specimens show evidence of damage the test shall be discarded, and the concrete shall be tested as indicated in Section 10.8.

10.8. CORE SAMPLE

The QC Team if directed by the QC Manager, shall take core samples of in-place concrete when test results are such that there is reasonable doubt that the specified concrete strengths and other characteristics have not been attained in the structure. The QC Manager shall conduct tests to determine the strength and other characteristics of the in-place concrete by compression tests on cored cylinders complying with ASTM C-42.

10.9. REPORTS

Test results shall be reported in writing to the QC Manager, TVA and CONTRACTOR on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, designate the CONTRACTOR, name of concrete supplier and truck number (if applicable), name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days and the compressive breaking strength for all tests completed for a particular set of cylinders on the day that the reports are submitted.

10.10. STORAGE FACILITY

The CONTRACTOR shall provide a stable, insulated storage facility equipped with thermostatically controlled heat for the storage of compression test cylinders in the first 24 hours after molding.

PART 11 - PRODUCTION OF CONCRETE

11.1. READY MIX

11.1.1. General

Ready-mixed concrete includes both central-mixed and truck-mixed concrete. When the CONTRACTOR elects to use ready-mixed concrete he shall make adequate arrangements for preventing delays in delivery and placing concrete.

11.1.2. Central Plant Mix

When a central-mixing plant is used, the concrete shall be mixed in an approved drum-type mixer or pan-type mixer. Mixing time for drum-type mixers having a rated capacity of two cubic yards or less shall be a minimum of 60 seconds. For mixers having capacities greater than two cubic yards, the mixing time shall be a minimum of 90 seconds; however, the minimum mixing time for drum-type mixers may be reduced from 90 to 75 seconds when the concrete ingredients are uniformly blended during the charging of the mixer. In order to attain uniform blending, the batch shall be charged so that the flows of water, coarse aggregate, fine aggregate, and cement are started, continued, and ended simultaneously or nearly simultaneously.

The mixing time for pan-type mixers, having a rated capacity of three cubic yards or less, shall be a minimum of 45 seconds. The mixing time for pan-type mixers having rated capacities greater than

three cubic yards shall be increased by 15 seconds for each three cubic yards, or fraction thereof, over that permitted for the three cubic yard mixer.

The QC Manager may increase the minimum mixing time for any type of mixer specified herein, provided the mixer does not produce the desirable quality with respect to uniformity of mixture, slump, and air content, or upon proof by tests that undesirable quality of concrete produced by a given mixer with regard to compressive strength would be prevented by additional mixing. The mixing time shall be measured from the time all cement and aggregates are charged into the mixture until the mixture is ready for discharging.

Concrete for use at points other than the central plant site shall be delivered in approved truck mixers. Each truck mixer shall have attached, in a prominent place, a metal plate on which is stamped its rated capacity in cubic yards of mixed concrete, as certified by the manufacturer for the different uses to which the equipment is adapted and the manufacturer's stated speeds of rotation for both mixing and agitation. Agitating shall start immediately after the batch is introduced and shall continue without interruption until the batch is discharged. Each batch shall be completely discharged before the succeeding batch is introduced. Drums and auxiliary parts for the equipment shall be maintained free from accumulations of hardened materials.

The rates of rotation of the mixer drum for both the mixing and agitation of concrete shall be as designated on the metal plate furnished by the manufacturer of the equipment.

11.1.3. Truck Mix

When concrete is truck-mixed, the truck mixer shall be of an approved revolving drum or revolving blade type, constructed to produce a thoroughly mixed concrete mass with a uniform distribution of materials throughout. The truck mixer shall be equipped with a discharge mechanism which will ensure discharging of the mixed concrete without segregation. Truck mixers that will not discharge concrete within the specified slump and air content ranges will be barred from use unless satisfactory repairs are made. Each truck mixer shall have a metal plate attached on which is stated the manufacturer's capacities in terms of volume of mixed concrete for the various uses to which the equipment is applicable and the manufacturer's stated speeds of rotation for mixing and agitation.

The rates of rotation of the mixer drum used for mixing and agitation shall be as designated on the metal plate by the manufacturer of the equipment. The mixer drum shall not permit loss of water or concrete during charging, mixing, and agitation, or during transportation.

The truck mixer shall be equipped with an automatic revolution counter which will permit reading of the count at the plant and at the destination. Use of trucks on which the revolution counter is defective will not be permitted. The interior of the mixer drums shall be maintained free from hardened concrete. The tanks containing mixing water on truck mixers shall be equipped with a device for accurately determining the quantity of water added at the job site.

The entire quantity of mixing water shall be accurately measured and controlled to within 1.0 percent accuracy. Each batch shall be mixed no less than 70 revolutions at the plant site, at the rate of rotation specified by the manufacturer for mixing speed. Mixing may be reduced to 50 revolutions when the batch is charged so that all ingredients, including water, are uniformly blended during charging, and a satisfactory mixture is produced. The concrete shall then be mixed an additional ten revolutions at the

specified mixing speed at the job site. When the QC Manager permits additional water to be added at the job site, the concrete shall be mixed an additional 30 revolutions at the specified mixing speed after water has been added. Any additional mixing shall be done at a lower speed as specified by the mixer manufacturer. Agitation shall be continuous until the batch is discharged.

When deemed necessary, the CONTRACTOR will be required to provide baffle plates in the chute to avoid segregation in the concrete placed in the Work.

PART 12 - PLACING CONCRETE

12.1. PREPARATION BEFORE PLACING

12.1.1. Clean Equipment

Hardened concrete and foreign materials shall be removed from the inner surfaces of the conveying equipment.

12.1.2. Formwork

Formwork shall conform to Section 03100 of the Specifications.

12.1.3. Embedded Items

Castings, anchor bolts and other embedded items shall be positioned properly and shall be clean and free of oil or loose coatings of paint, rust or scale.

12.1.4. Inspection

Verification that reinforcement is placed properly with the required clearance and that all reinforcing steel is free of oil or other coatings that might impair bond with the concrete shall be completed before placing any concrete.

12.2. NOTIFICATION

No concrete shall be placed until the QC Manager, or his representative, has given his approval of the forms and reinforcing steel in place. If the reinforcing steel is not placed in accordance with the Drawings, the QC Manager will stop the CONTRACTOR from placing any concrete until the error is corrected. Under no circumstances will an attempt be made to correct errors by inserting additional unscheduled bars. No concrete shall be placed except in the presence of the QC Manager or his representative, and the CONTRACTOR shall give the QC Manager at least 24 hours advance notice.

12.3. CONVEYING CONCRETE

12.3.1. General

Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. There shall be no vertical drop greater than five (5) feet, except where suitable equipment is provided to prevent segregation and where specifically authorized by the QC Manager.

12.3.2. Exposed Conveying

Belt conveyers, chutes or other similar equipment in which the concrete is delivered to the structure in a thin, continuously exposed flow, will not be permitted, except for very limited or isolated sections of the Work and only then if approved in writing by the QC Manager. Such equipment shall be arranged to prevent objectionable segregation.

12.3.3. Maximum Concrete Drop

Where wall forms exceed five (5) feet in height, suitable measures, such as the use of elephant trunks or drop chutes, where practicable, or portholes, shall be provided in the forms to limit the vertical drop of the concrete to a maximum of five (5) feet. Openings shall be spaced around the perimeter of the formed area so that lateral flow of fresh concrete will be limited to three (3) feet. Drop chutes which may be provided to convey the concrete through wall ports shall have an outside pocket under each form opening to stop the concrete and allow it to flow easily over into the form without separation.

12.3.4. Pumping

Pumping or pneumatic conveying equipment, if used, shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation does not occur in the discharged concrete. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy.

12.4. PLACING CONCRETE

12.4.1. General

Concrete shall be placed within one and one-half (1) hours after the introduction of the water to the cement and aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or where the temperature of the concrete is 85°F or above, the time shall be reduced to 45 minutes. The QC Manager may allow a longer time, providing the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding mixture. Concrete shall be deposited as closely as possible to its final position in the forms so that flow within the mass and consequent segregation is reduced to a minimum.

12.4.2. Use of Vibrators

Use of vibrators to transport concrete within the forms shall not be allowed. Vibrators may be used to aid in the consolidation of the concrete provided they are used under experienced supervision, and the forms designed to withstand their action. The duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. Vibration shall not be applied directly to the steel reinforcement or the forms or to concrete which has hardened to the degree that it becomes plastic when vibrated.

12.4.3. Spading Concrete

When a vibrator is used, the CONTRACTOR shall also spade the concrete along form surfaces a sufficient amount to prevent excessive size or numbers of air- void pockets in the concrete surface.

12.4.4. Spare Vibrator

The CONTRACTOR shall keep at least one spare vibrator on the job during all concrete placing operations.

12.4.5. Lifts in Concrete

All concrete shall be deposited in horizontal layers not exceeding twenty (20) inches in thickness, unless otherwise authorized by QC Manager. The placement shall be carried on at such a rate that the formation of cold joints will be prevented. If a delay occurs in excess of a forty (40) minute interval between any two (2) consecutive batches or loads, or in case of any delay between placing batches that allow previously placed concrete to take initial set, the CONTRACTOR shall discontinue the placing of concrete and make a construction joint satisfactory to the QC Manager before proceeding with the placing operations. The CONTRACTOR shall remove any portion of the previously placed concrete that is deemed necessary for the proper formation of the construction joint. The forty (40) minute limitation cited above may be extended in those cases where an approved type retarder is added to the concrete mixture to delay the set of the concrete. Use of a retarder in the mix shall be subject to approval by the QC Manager.

12.4.6. Prevention of Splashing

Hoppers, chutes, and pipes shall be used as necessary to prevent splashing of mortar on forms and reinforcing above the layer being placed.

12.4.7. Prevention of Additional Water

Unless adequate protection is provided and approval is obtained, concrete shall not be placed in rain, sleet, or snow. Rainwater will not be allowed to increase the mixing water.

12.4.8. Placing Temperature

Concrete shall be mixed and placed only when the ambient air temperature is at least 40°F and rising, unless permission to place is obtained from the QC Manager, in which event all material shall be heated and otherwise properly prepared so that batching and mixing can proceed in full accord with the provisions of these Technical Specifications. The method proposed for heating the materials and protecting the concrete shall be approved by the QC Manager. Salt, chemicals, or other materials shall not be mixed with the concrete for the purpose of preventing freezing.

12.4.9. Placement Not Permitted

Concrete placement will not be permitted when, in the opinion of the QC Manager, the sun, heat, wind, or humidity prevents proper placement and consolidation. Concrete shall not be placed when the ambient air temperature is 100°F or higher without consent of the QC Manager. For ambient air temperature above 85°F see Section 12.4.11.

12.4.10 Cold Weather

When the atmospheric temperature may be expected to drop below 40°F at the time concrete is delivered to the work site, during placement or any time during the curing period, the following provisions also shall apply:

- (1) The temperature of the concrete at the time of placing shall not be less than 50°F nor more than 90°F. The temperature of neither aggregates nor mixing water shall be more than 100°F just prior to mixing with the cement.
- (2) When the daily minimum temperature is less than 40°F, concrete structures shall be insulated or housed and heated after placement. The temperature of the concrete and air adjacent to the concrete shall be maintained at not less than 50°F nor more than 90°F for the duration of the curing period.
- (3) Methods of insulating, housing and heating the structure shall conform to "Recommended Practice for Cold Weather Concreting," ACI Standard 306.
- (4) When dry heat is used to protect concrete, means of maintaining an ambient humidity of at least 40 percent shall be provided unless the concrete has been coated with curing compound or is covered tightly with an approved impervious material.

12.4.11 Hot Weather

When climatic or other conditions are such that the temperature of the concrete may be expected to exceed 85°F at the time of delivery at the work site, during placement, or during the first 24 hours after placement, the following provisions also shall apply:

- (1) The CONTRACTOR shall maintain the temperature of the concrete below 85°F during mixing, conveying, and placing. Methods used shall conform to "Recommended Practice for Hot Weather Concreting," ACI Standard 305.

- (2) The concrete shall be placed in the Work immediately after mixing. Truck mixing shall be delayed until only time enough remains to accomplish it before the concrete is placed.
- (3) Exposed concrete surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or otherwise protected, as directed by the QC Manager, from drying during the time between placement and finishing, and after finishing.
- (4) Finishing of slabs and other exposed surfaces shall be started as soon as the condition of the concrete allows and shall be completed without delay.
- (5) Concrete surfaces exposed to the air shall be covered as soon as the concrete has hardened sufficiently and shall be kept continuously wet for at least the first 24 hours of the curing period and for the entire curing period unless curing compound is applied.
- (6) Formed surfaces shall be kept completely and continuously wet for the duration of curing period (prior to, during and after form removal) or until curing compound is applied.
- (7) If moist curing is discontinued before the end of the curing period, white pigmented curing compound shall be applied immediately.

12.5. INSTALLING CONSTRUCTION AND EXPANSION JOINTS

12.5.1. General

Construction and expansion joints shall be of the types indicated on the Drawings and shall be constructed wherever and only in such places as are directed by the QC Manager. The CONTRACTOR shall plan the work to minimize the use of joints in addition to those indicated. In no case shall any fixed metal be continuous through an expansion joint. Unless otherwise directed, all joints shall have keyways.

12.5.2. Materials

Bituminous joint compound for joints shall conform to ASTM Standard Specifications for Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Poured Elastic Type, Designation D1854-74.

The compound shall be applied to prepared surfaces in accordance with the printed instructions of the manufacturer, using a suitable primer and sealer.

Premolded-joint filler shall completely fill the expansion joint thickness indicated on the Drawings, be of suitable length and width, and shall be Type I or Type II filler conforming to ASTM Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction, Designation D1752-67. As far as practicable, sheets shall be of correct width

so that no longitudinal cutting will be required in the field. When strips are cut in the field, the cut surface shall be treated as recommended by the manufacturer.

Waterstops shall be installed where shown on the Drawings or discussed in the Technical Specifications and shall be manufactured of PVC plastic or rubber.

12.5.3. Installation

Concrete to be sealed with joint compound shall be clean and dry and the compound shall be carefully placed to prevent spilling the material over the adjoining surfaces. Joints shall not be sealed when the compound, air or concrete temperature is less than 40°F. Bond breaker and back-up material shall be installed where required. Concrete shall be primed, filled flush with joint compound of the proper thickness and sealed if required, all in accordance with the printed instructions of the manufacturer.

Surfaces to which bituminous coating is to be applied shall be prepared and primed and an approved bituminous mastic coating material shall be applied in accordance with the instruction of the manufacturer.

Premolded-joint filler shall be placed against the bulkhead form and fastened to the inside of the form with noncorrodible fasteners to secure mechanical bond with the concrete placed on both sides of the joint filler. Care shall be taken at all times to prevent any disturbance of or damage to premolded-joint filler.

Premolded-joint filler shall have wood strips secured to all surfaces which are to receive joint compound, and shall be accurately positioned and secured against displacement. The wood strips shall be the same width as the expansion joint and be slightly tapered, dressed, and of the depth required to properly install the joint compound and back-up materials.

Material used to secure premolded-joint fillers and wood strips shall not harm the concrete and shall not affect the joint compound bond to the concrete. The wood strips shall not be removed until after the concrete curing period. The groove shall be thoroughly cleaned of all laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

Waterstops in expansion joints shall be carefully and correctly positioned during installation to eliminate faulty installation that may result in joint leakage. All waterstops shall be installed so as to form a continuous watertight diaphragm in each joint. Adequate provision shall be made to support and protect the waterstop during the progress of work. Any waterstop damaged shall be replaced or repaired as directed by the QC Manager. The concrete shall be thoroughly consolidated in the vicinity of the waterstop. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued.

12.6. PATCHING AND REPAIRING CONCRETE

Any concrete which is not formed as shown on the Drawings, or for any reason is out of alignment or level, or shows a defective surface, or shows defects which reduce the structural adequacy, shall be considered as not conforming to the intent of these Technical Specifications; and shall be removed

from the job by the CONTRACTOR unless the QC Manager grants permission to patch the defective area. Permission to patch any such surface shall not be considered a waiver of the QC Manager's right to require complete removal of the defective work if the patching does not, in his opinion, satisfactorily restore the quality and appearance of the surface, or if patching does not restore the structural adequacy of the member or members. Repair work shall be performed only when the QC Manager is present. Repair of formed surfaces shall be started within 24 hours after removal of the forms. All new concrete shall be secured with keys, dovetails, or anchors.

After removing forms, the QC Manager shall inspect all concrete surfaces. The CONTRACTOR shall patch any poor joints, voids, honeycomb, stone pockets, or other defective areas permitted by the QC Manager, and all tie holes (except where noted otherwise). Where necessary, the CONTRACTOR shall chip away defective areas to a depth of not less than one inch, with the edges perpendicular to the surface.

The CONTRACTOR shall apply bonding agent to areas to be patched with care to keep bonding agent off of areas to remain exposed. The CONTRACTOR shall apply bonding agent in accordance with manufacturer's printed instructions.

The patching mortar shall be made of the same material (and of approximately the same proportions) as used for the concrete for the same location except that the coarse aggregate shall be omitted for concealed locations. Patching mortar shall be of same composition as adjacent concrete in exposed-aggregate concrete. The mortar shall not be richer than one part cement to three parts sand. On exposed surfaces, white Portland cement shall be substituted for a part of the gray Portland cement so as to match the color of the surrounding concrete. The proportion of white and gray cements shall be determined by making a trial patch. The amount of mixing water shall be as little as is consistent with the requirements of handling and placing. The mortar shall be retempered without the addition of water by allowing it to stand for a period of one hour, during which time it shall be mixed occasionally with a trowel to prevent setting.

The CONTRACTOR shall compact mortar thoroughly into place, and screed off so as to leave the patch slightly higher than the surrounding surface. The patch shall be left undisturbed for a period of one to two hours to permit initial shrinkage before beginning final finishing. The patch should be finished in such a manner as to match the adjoining surface. All patches shall be finished and cured in accordance with requirements for surface in which the patch occurs. The patch shall be kept moist for not less than three days after installation.

Tie-holes left by withdrawal of rods, or holes left by removal of ends of ties shall be filled solidly with mortar after first being wet thoroughly. For holes passing entirely through a wall, a plunger-type grout-gun shall be used to force the mortar through the wall, starting at the back face. A piece of burlap or canvas shall be held over the hole on the outside; and when the hole is completely filled, the excess mortar shall be struck off flush with the surface. Holes not passing entirely through the walls shall be filled with a small tool that will permit packing of the hole solidly with mortar. Any excess mortar at the surface of the wall shall be struck off flush with a cloth.

12.7. CURING AND PROTECTING CONCRETE

12.7.1. General

All concrete shall be cured for a period of not less than seven (7) consecutive days by an approved method, or combination of methods. The curing process shall be done so as to prevent loss of moisture from the concrete for the duration of the entire curing period. Unhardened concrete shall be protected from heavy rains and flowing water. All concrete shall be adequately protected from damage.

12.7.2. Moist Curing

Concrete shall be moist cured by maintaining all surfaces continuously (not periodically) wet for the duration of the entire curing period. Water for curing shall be clean and free from any elements which will cause staining or discoloration of the concrete. Where forms of wood are used and left in place during curing, the wood shall be kept wet at all times.

12.7.3. Membrane Curing

At the option of the CONTRACTOR and when approved by the QC Manager, the concrete may be cured with an approved curing compound of surface membrane type in lieu of moist curing with water. The curing compound shall be applied to formed surfaces immediately after the forms have been removed and the surfaces cleaned of any loose sand, mortar and debris. The surface to receive the compound shall be moistened thoroughly with water and the compound applied as soon as the moisture film has disappeared but when the surface is still damp. On unformed surfaces, the compound shall be applied immediately after the surface loses its free water and has a dull appearance or immediately following finishing operations.

Membrane curing compound shall be white pigmented and meet the requirements of ASTM Designation C-309, "Liquid Membrane Forming Compounds for Curing Concrete," Type 2. Membrane curing, using spray applied curing compound, will not be allowed on any surface against which concrete will later be placed.

The curing compound shall be applied in a two-coat continuous operation by approved spraying equipment and at coverage of not more than two hundred (200) square feet per gallon for both coats. The second coat shall be applied to overlap the first coat in a direction at approximately right angles to the direction of the first application. Concrete surfaces which are subjected to heavy rainfall within three (3) hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified herein. All concrete surfaces, on which curing compound has been applied, shall be adequately protected for the duration of the entire curing period from any damage that would disrupt the continuity of the curing membrane.

All curing compound shall be delivered to the work site in the original sealed container bearing the name of the manufacturer, the brand name and the manufacturer's batch number. The compound shall be approved by the QC Manager prior to use. The compound shall be stored so as to prevent damage to the containers, and water-emulsion types shall be protected from freezing.

12.8. FINISHING CONCRETE

12.8.1. Formed Surfaces

After removal of forms, all fins shall be completely removed. No later than the day following form removal, surfaces shall be wetted and rubbed with a carborundum brick or other abrasive material approved by the QC Manager, until a uniform color and smooth texture are produced.

12.8.2. Unformed Surfaces

Following placement, consolidation, and screening, the surface should be darbied or bull-floated to eliminate high and low spots and embed large aggregates. After surface water has disappeared and concrete has hardened sufficiently, the surface shall be floated by power driven or hand floats. The CONTRACTOR shall check and level the surface to a tolerance not exceeding one and a half inches in ten feet when tested with a ten-foot straightedge. After leveling, the CONTRACTOR shall refloat surface to a uniform granular texture. Care shall be exercised to prevent migration of excess water and fines to the surface during finishing operations.

END OF SECTION 03300

TECHNICAL SPECIFICATIONS
DIVISION 5 – METALS
SECTION 05512 – MISCELLANEOUS METALS

PART 1 - GENERAL

1.1. 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 02350 – Pre-Cast Structures
- Section 02365 – HDPE Pipe
- Section 02621 – Geocomposite Drainage Media
- Section 02700 – Polyethylene Geomembrane Liner (FML)
- Section 03100– Polyethylene Geomembrane Liner (FML)
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1.2. DESCRIPTION OF WORK

The work shall consist of furnishing all materials, equipment, and labor for the installation of the miscellaneous metal items specified below in accordance with the Drawings and directions of the QC Manager.

1.3. SUBMITTALS

Shop drawings, as called for in the Specifications, giving complete information necessary for fabrication, layout and installation of metal Work, shall be submitted to the QC Manager for approval prior to fabrication. The CONTRACTOR shall make all field measurements necessary to verify all dimensions which may affect installation/fabrication of the metals.

1.4. ANCHORAGE ITEMS

The CONTRACTOR shall furnish all bolts, nuts, shims, pins, screws, straps, nails and other anchors which may be required by the Drawings or job conditions, to secure all items permanently in place, whether or not specifically called for or shown on the Drawings.

1.5. FABRICATION

1.5.1. All metal items shall be accurately fabricated and erected with exposed joints close fitting. All joints shall be of such character and so assembled that they will be as strong and rigid as adjoining

sections. Joints shall be located where least conspicuous. Items shall have smooth finished surfaces except where otherwise shown or specified.

1.5.2. Where welding is required or permitted, it shall conform to the requirements for shielding metal arc welding of the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society. Shop drawings shall show welding and shall indicate the size, length, spacing and type of welds. Joints required to be welded shall be continuously welded or spot welded as specified and face of welds dressed flush and smooth where exposed to view.

PART 2 - MATERIALS

2.1. MANHOLE INLET GRATES

Manhole inlet grates shall conform to Haala Industries, Inc. Item # CG48TM Cone Grate Trash Rack (Top Mount) or equivalent. Minimum inlet area of 9.3 square feet is required with a 48" diameter beehive or conical grate.

2.2. MANHOLE STEPS

The manhole steps shall be Neenah R-1980-M cast iron manhole steps or QC Manager approved equal.

2.3. SAFETY CLIMB

The safety climb shall be a SAF-T-Climb Fall Prevention system manufactured by the Norton Company, Safety Products Division, Cerritos, California, or other similar system approved by the QC Manager. The carrier rail and mounting brackets shall be aluminum. All other connections, parts, etc. shall be galvanized steel. CP shall provide the TVA two sleeves (safety locking mechanism) and belt per safety climb installed.

2.4. BATTEN BAR AND COUPLING BANDS

2.5. DROP INLET GRATES

The drop inlet grates shall conform to a HOE 818 Double Inlet Grate and framer or equivalent. The grate shall consist of 2 – 24-inch by 48 inch grates with a combined drainage inlet area of 6.6 square feet. Castings shall be of uniform quality and free from defects which may impair the service of the casting. Castings shall be finished to a smooth surface and cleaned by the manufacturer by shotblasting. Iron castings shall conform to ASTM A48, Class 35B and be rated for H-20 wheel loads.

PART 3 - EXECUTION

3.1. MANHOLE AND DROP INLET GRATES

Manhole and drop inlet grates shall be installed in compliance with manufacturer's recommendations and the details of the Contract Documents.

3.2. SAFETY CLIMB

Installation of the safety climb system shall be in strict compliance with the manufacturer's recommendations and drawings.

3.3. MANHOLE STEPS

The manhole steps shall be cast-in-place in the walls of the gate box in a vertical row on 12-inch centers as shown on the Drawings.

3.4. EMBEDMENT

Items shall be properly embedded and anchored prior to application of non-shrink grout. These items include the manhole steps, and safety climb brackets, as well as attachment bolts for other items.

3.5. INSTALLATION

All items shall be installed to the lines, grades, elevations and sections as shown in the drawings.

3.6. COMPATIBILITY

All attachments and couplings shall be made as per the manufacturer's recommendations and in accordance with applicable codes or standards. The CONTRACTOR shall ensure that all couplings are compatible and watertight.

3.7. DOCUMENTATION AND MANUALS

The manufacturers shall furnish necessary installation drawings and installation, operation and maintenance manuals for the manhole/safety climb system. It shall be The CONTRACTOR's responsibility to handle, store and install all operating mechanisms in accordance with the manufacturer's drawings and recommendations. The maintenance manual and operation manual shall become the property of the TVA upon acceptance of the Work.

3.8. EQUIVALENCY

Alternate or equivalent products will be considered by the QC Manager. The CONTRACTOR shall ensure that substitute items are compatible with one another and will function properly.

END OF SECTION 05512