Closure Plan

CLOSURE PLAN

Yorktown Power Station Ash Landfill

Permit #457

Dominion

Submitted To: Dominion – Yorktown Power Station
1600 Waterview Road
Yorktown, Virginia 23692

Submitted By: Golder Associates Inc.
2108 W. Laburnum Avenue
Suite 200
Richmond, VA 23227

October 2016 **1239-6405**

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Attachments

1.0 PLAN CERTIFICATION

I certify that the information contained within this Closure Plan was prepared by me or under my direct supervision, and meets the requirements of Section §257.102 of the Federal Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals (CCR) from Electric Utilities; Final Rule (40 CFR 257; the CCR rule) and the Virginia Solid Waste Management Regulations.

I also certify that the design of the final cover system described in this plan meets the requirements of Section §257.102(d)(3).

Daniel McGrath	Senior Consultant
Print Name	Title
Daniel McGrath	10/7/16
Signature	Date

2.0 CLOSURE PURPOSE

This Closure Plan is written for the Yorktown Power Station Coal Combustion Residuals (CCRs) Landfill (landfill) at Dominion's Yorktown Power Station (Station) in York County, Virginia. The location of the site is shown on Figure 1. Dominion plans to cease coal fired electric power generation at the Yorktown Power Station no sooner than second quarter of 2017. Consequently, after the last ash is placed in the landfill, the solid waste landfill will be subject to closure under the Virginia Solid Waste Management Regulations at 9 VAC 20-81-160 and the Federal Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule (the CCR Final Rule), 40 CFR 257.

At the time of its closure, the landfill will not be at its design capacity grades and will contain approximately 1,740,000 cubic yards of CCR material. Dominion has prepared this revised Closure Plan to amend the final grading plan and closure schedule accordingly. The landfill is operated under the Virginia Department of Environmental Quality (DEQ) Solid Waste Permit No. 457 and the York County Conditional Use Permit [Resolution No. R82-221 (R2)].

2.1 General Landfill Information

Dominion has operated the landfill for disposal of CCRs produced at the Station since the early 1980's. The CCRs include fly ash, bottom ash, pyrites, and limestone injection multi-stage burner (LIMB) ash. The landfill is approximately two miles south of the Station on Wolftrap Road. The permitted area of the landfill comprises approximately 48 acres designated for placement of CCRs. The area is divided into 12 cells of the lower landfill and includes 4 phases in the vertical expansion. Cells 1 through 11 have received CCRs and are covered with intermediate cover soil. Cell 12 is currently open and active, and Phase 1 of the vertical expansion has been constructed for future expansion, but CCRs have not been placed in this area. Phases 2 – 4 of the vertical expansion have not been constructed. The final cover system is designed to cover both the vertical expansion and lower landfill portions, and will be approximately 49 acres in total size.

Storm water runoff from the disposal units is conveyed to sedimentation ponds located along the eastern border of the landfill. Discharges from these ponds are regulated under a Virginia Pollutant Discharge Elimination System (VPDES) permit (Permit No. VA0004103) issued by DEQ.

Leachate is collected in perforated pipe and conveys leachate to a collection sump that is pumped directly to the Hampton Roads Sanitation District (HRSD) system.

2.2 Closure Plan Implementation

The goals of the closure plan design at the landfill are to provide a low maintenance cover system with appropriate stormwater runoff controls to prevent erosion and exposure of the CCRs. The maximum

permitted side slope is 3H:1V, and storm water benches are located to intercept sheet flow before it can concentrate into an erosive flow. The final cover soil will have a vigorous stand of vegetation established to minimize soil erosion. A Linear Low Density Polyethylene (LLDPE) geomembrane liner will serve as the infiltration barrier to prevent water percolation into the CCR.

The closure construction will take place in two phases. The first phase of closure (Phase A) will include approximately 29.6 acres and will consist of closing cells 1-3 and 7-11. The final phase (Phase B) will include the remaining active cells, cells 12 and the vertical expansion. Closure of Phase B will close the remaining 19.2 acres. Construction for Phase A is anticipated to begin during the 4th quarter of 2016, and Phase B closure will begin shortly after the facility ceases coal use for production of electricity and the last placement of ash has occurred. The existing storm water ponds will remain active following completion of the Phase B closure to receive and attenuate storm water flows from the landfill. Discharges for these ponds will continue to be permitted under the Station's VPDES Permit.

CCRs by their nature are non-putrescible, and do not decompose or produce landfill gas. Gas migration and odor is not anticipated to be a concern post-closure. The landfill's leachate system will continue to collect leachate and discharge it directly to the HRSD sanitary system via a leachate pump station. The leachate system that was constructed with Phase 1 of the vertical expansion will be disconnected and removed.

3.0 CLOSURE TIMEFRAMES

Phase A closure, as described above, is anticipated to commence by November 2016 and conclude by May 2017. The active area of the landfill [Cell 12] will continue to receive CCRs until the Station ceases coal fired power generation. The landfill will receive its last waste in conjunction with the shutdown and decommissioning of the Station's coal fired generating units. After the station's coal units are shutdown, the remaining CCR material will be removed from the Station and placed in the landfill.

Based upon historical CCR generation at the Station, the landfill has an estimated remaining disposal life of 23 years. It is anticipated that when the final CCR is placed in the landfill, Cell 12 will not be at its design capacity, nor will CCRs be placed in the vertical expansion.

4.0 CLOSURE OF SUPPORT PONDS AND BASINS

The storm water ponds at the landfill will remain in place to continue providing storm water attenuation for the site post-closure. Discharges for these ponds will continue to be permitted under the Station's VPDES Permit.

5.0 CLOSURE OF LANDFILL UNITS

5.1 Final Cover Design

The Final Cover system to be installed is as described in the landfill's solid waste permit #457. This cover system, in accordance with 9VAC20-81-160-D.2.e, consists of, from the bottom to the top:

- 40 mil LLDPE geomembrane;
- 250 mil Double-sided geocomposite drainage layer;
- A minimum 18-inch protective cover layer of compacted soil; and,
- A minimum 6-inch layer of vegetative support soil that is subsequently seeded.

The final cover system will be placed directly on the prepared subgrade after the intermediate cover soil vegetative cover is stripped and shaped as needed to achieve design grades and minimize the need for future maintenance. The Design Plans included in Attachment 2 show the final cover system. Technical Specifications and the Construction Quality Assurance (CQA) plan for the closure system components are in the landfill permit.

The final cover system design as proposed will also conform with requirements in the CCR rule at 40 CFR 257.102(d)(1) and (3).

5.1.1 Barrier Layer

The barrier layer is a 40-mil, Linear Low Density textured polyethylene geomembrane (LLDPE). Section 02597 of the Technical Specifications describes the material requirements, installation and seaming procedures, and CQA documentation to be recorded during construction of the barrier layer.

5.1.2 Geocomposite Drainage Layer

To provide drainage for the cover soils, a 250-mil geocomposite drainage layer will be placed on top of the geomembrane. The geonet core will be faced on both sides with a nonwoven geotextile to provide filtration and prevent the intrusion of soil into the core. At the toe of slope, the geocomposite will discharge directly into the perimeter drainage channel. Intermediate drains for the geocomposite are proposed to limit the drainage length to 350 feet to prevent saturation of the cover soils. Calculations for the adequacy of the geocomposite for the reduced slope are presented in Attachment 6.

5.1.3 Protective Cover Layer and Vegetative Support Layer

Immediately above the geocomposite drainage layer, a 24-inch thick layer of soil will be placed to serve as the Protective Cover and Vegetative Support layer (18-inches of protective cover and 6-inches of vegetative support soil). The soil will be imported into the site from an offsite borrow source. Acceptable soil types for this layer are: GM, GC, SM, SC, ML, or MH (ASTM D2487) as per the Technical Specifications Sections 02200 and 02235.

5.1.4 Performance of the Final Cover System

The final cover system design as proposed conforms to the requirements in the CCR rule at 40 CFR 257.102(d)(3)(i) as follows:

(A) The permeability of the final cover system is less than or equal to the permeability of the bottom liner system due to the combination of an LLDPE geomembrane, geocomposite drainage layer, 24-inch soil layer, and slopes ranging from 2% minimum to 33% maximum.

(B) The 18-inch protective cover layer soil meets the requirements for the 18-inch layer of earthen material noted as the *infiltration layer*.

(C) The 6-inch vegetative support soil layer meets the requirements for the 6-inch layer of earthen material capable of sustaining native plant growth noted as the *erosion layer*.

The integrity of the final cover system is minimized through the use of flexible design components that are well suited to accommodate small changes over time due to settlement and subsidence.

The 24-inch thickness of the final cover system soils is sufficiently thick to protect the underlying geosynthetics from freezing. The maximum expected frost depth for the York County, Virginia area is 18 inches; therefore, the thickness of the soil layer is adequate to protect against freeze/thaw effects.

The Revised Universal Soil Loss Equation (RUSLE) calculations performed for the revised grading demonstrate that the anticipated soil loss is less than 0.2 tons/acre/year, which is less than the standard of 2.0 tons/acre/year. This calculation is presented in Attachment 4.

The final seeding mixture will be applied in accordance with Section 02936 of the Technical Specifications immediately following the placement of the vegetative support layer soil to the design grades. The soil will be seeded with the mix as presented in the Technical Specifications, or with a site-specific mix based on soil testing. While vegetation is being established, soil stabilization matting or other approved erosion control materials will be used to protect the bare soil surface and foster vegetative growth.

5.2 Final Slopes

The maximum final slope for the landfill is 3H:1V (18.4%). The minimum final slope per the landfill's permit is 2% to prevent ponding of water. Storm water diversion berms are located at approximately the midpoint of the crown and at the grade break above the steeper side slopes to intercept and collect sheet flow runoff before it concentrates into erosive concentrated flow.

Calculations from the permit design (Golder, 2008) show that the 3:1 final slope is stable under static conditions. A seismic analysis was not performed as the landfill is not located in a seismic impact zone.

5.3 Run-Off Controls

Sheet flow from the final cover surface will be collected in a perimeter berm and diverted into downchutes that lead into the perimeter channels. These channels are formed of soil and are sized to convey the runoff from at least the 25-year, 24-hour storm event. The storm water channels are lined with a non-biodegradable erosion control matting to resist erosion and enhance vegetative growth. The average longitudinal slope of the storm water diversion channels is 1.0%.

The perimeter channels drain to the existing stormwater ponds for attenuation and eventual discharge through the VPDES-permitted outfalls 003 and 004. Due to the revised grading plan, a new set of calculations for the stormwater control system and the stormwater ponds are included as Attachment 6 to this Plan. The net effect of the revised landfill grading an overall reduction in the rate of peak discharge resulting from the flatter top slopes having lower surface water flow velocities and a longer time of concentration.

5.4 Settlement, Subsidence and Displacement

It is anticipated that the great majority of foundation settlement to be experienced by the landfill has already occurred, as the landfill has been in operation for approximately 30 years. When CCRs are placed and compacted in a bulk fill, such as a landfill, the material consolidates very rapidly and does not experience further secondary consolidation. Once CCRs are placed, secondary consolidation is negligible. In addition, the landfill is being closed at less than the original design height, resulting in lower than anticipated foundation loading.

Calculations from the permit design (Golder, 2008) show the post-closure settlement of the landfill is anticipated to have a minimal impact on the ability of the cover to prevent infiltration. Localized settlement of the final cover is not anticipated to occur as the CCRs do not decompose and leave voids. Global settlement of the landfill, however small, will cause the liner material to shorten, rather than stretch. Small compressive forces would not affect the integrity or performance of the liner.

6.0 CLOSURE OF STORAGE AND/OR TREATMENT UNITS

The Yorktown Power Station does not operate a waste treatment unit at the landfill.

7.0 SCHEDULE FOR CLOSURE

The landfill will receive its last waste immediately following the shutdown of the Station's coal fired generating units. After shutdown, remaining CCRs will be removed from the Station and placed in the landfill. Table 1 outlines the anticipated sequence of closure schedule activities.

TABLE 1
CLOSURE SCHEDULE

Activity	Tentative Date
Submittal of revised closure plan to DEQ	November 2015
Commence Phase A closure construction	By November 2016
Phase A closure construction complete	By May 2017
Yorktown Station cease coal operations	April 2017
Final CCR placed in landfill	By July 2017
Commence Phase B closure construction	July 2017
Phase B closure construction complete	February 2018
Certification of closure	March 2018

8.0 CLOSURE IMPLEMENTATION

8.1 Closure Posting

One sign will be posted at the site entrance to the landfill notifying all persons of the final closure of the landfill and prohibition against further receipt of CCRs. Unauthorized access to the site will be controlled by fencing (as needed) and lockable gates across the access roads.

8.2 Notification

York County, Virginia will be notified upon the completion of closure of the landfill. The closure notification will also be sent to the DEQ, posted on a publicly accessible internet site, and placed in the facility's operating record as outlined in the Final CCR Rule.

The survey plat will be prepared showing the final closure grades and the locations of the groundwater monitoring wells. The survey plat and deed will have the following notification language:

> **This property has been used for the management and disposal of CCRs. Any future use of the site shall not disturb the integrity of the final cover, liners, or any other components of the containment systems, or the function of the monitoring system unless necessary to comply with the Virginia Solid Waste Management**

Regulations and the Final CCR Rule or approved by the Department of Environmental Quality.

Within 30 days of recording a notation on the deed to the property, a notification indicating the notation has been recorded will sent to DEQ, posted on a publicly accessible internet site, and placed in the facility's operating record.

8.3 Certification

Upon completion of closure construction, a certification statement, signed by a licensed professional engineer, will be submitted to the DEQ along with the results of the CQA plan. The certification statement shall read as follows:

I certify that closure has been completed in accordance with the Closure Plan dated [DATE] for solid waste permit number 457 issued to Dominion, with the exception of the following discrepancies: [To Be Determined]

In addition, a sign(s) was (were) posted on [DATE] at the landfill entrance notifying all persons of the closing [and state other notification procedures if applicable] and barriers [indicate type] were installed at [location] to prevent new waste from being deposited.

A survey plat prepared by [NAME] was submitted to York County, Virginia on [DATE]. A copy of the survey plat is included with this certification.

A notation was recorded on the deed to the landfill property on [DATE]. A copy of the revised deed is attached to this certification.

[Signature, date and stamp of Professional Engineer]

9.0 CLOSURE COST ESTIMATE

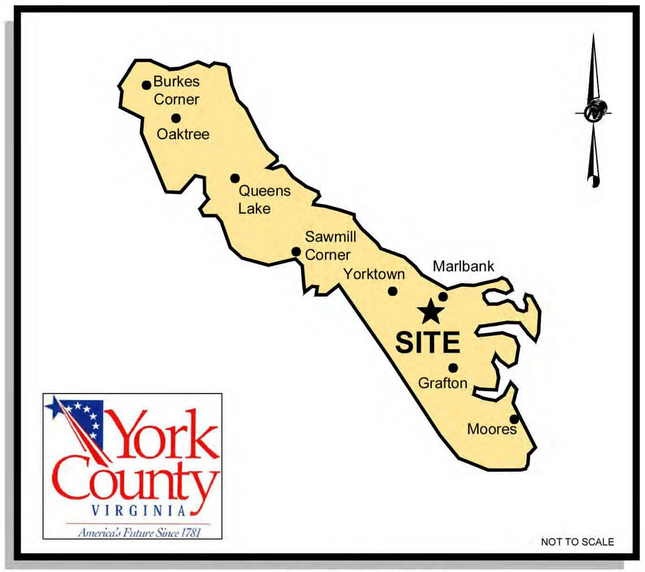
The estimated cost for closure of the 48-acre landfill is $8,600,000. Dominion will hire a construction contractor to provide closure construction services. Calculations for the closure cost estimate are included in Attachment 8.

Attachment 2

Closure Design Plans and Specifications

DOMINION
YORKTOWN POWER STATION
LANDFILL CLOSURE PLAN AMENDMENT
SOLID WASTE PERMIT #457

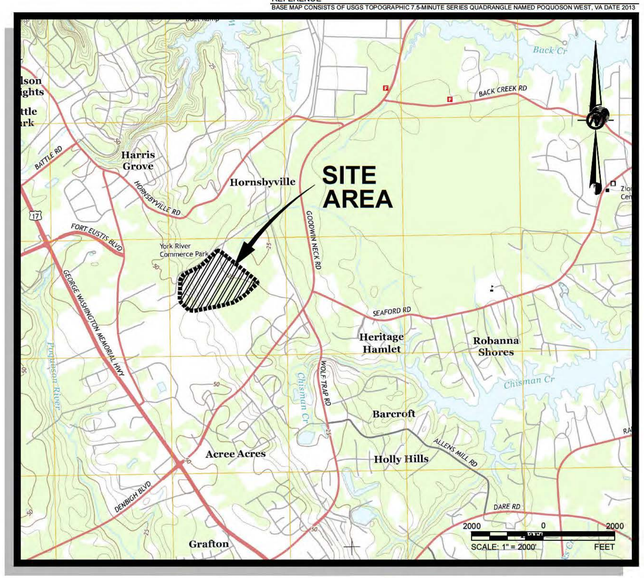
YORK COUNTY, VIRGINIA
NOVEMBER, 2015



VICINITY MAP

SHEET LIST TABLE	
Sheet Number	Sheet Title
1	COVER SHEET
2	EXISTING CONDITIONS
3	PHASE A LINER GRADES
4	PHASE A FINISH GRADES
5	PHASE A CROSS SECTIONS
6	PHASE A STORMWATER MANAGEMENT PLAN
7	PHASE B LINER GRADES
8	PHASE B FINISH GRADES
9	PHASE B CROSS SECTIONS
10	PHASE B FINAL STORMWATER MANAGEMENT PLAN
11	STORMWATER DETAILS
12	LINER DETAILS
13	EROSION AND SEDIMENT CONTROL NOTES AND DETAILS

REFERENCE
BASE MAP CONSISTS OF USGS TOPOGRAPHIC 7.5-MINUTE SERIES QUADRANGLE NAMED POQUOSON WEST, VA DATE 2013



SITE LOCATION MAP

CONTACT INFORMATION

ENGINEER:
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2108 W. LABURNUM AVE., SUITE 200
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PHONE: (804) 358-7900
FAX: (804) 358-2900
EMAIL: DANIEL_McGRATH@GOLDER.COM

OWNER / DEVELOPER:
DOMINION - YORKTOWN POWER STATION
MAIN CONTACT: WARREN DEAL
1600 WATERVIEW ROAD
YORKTOWN, VA 23960
PHONE: (757) 898-2771

PREPARED BY:

Golder Associates

PREPARED FOR:

Dominion

Golder Associates

REV | DATE | DES | REVISION DESCRIPTION | CADD | CHK | RVW

COMMONWEALTH OF VIRGINIA
DANIEL P. McGRATH
Lic. No. 040703
11/17/15
PROFESSIONAL ENGINEER

PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
COVER SHEET

PROJECT No.		123-96405
FILE No.		12396405E01
REV. 0	SCALE	AS SHOWN
DESIGN	KLL	07-15-2015
CADD	ABM	07-22-2015
CHECK		
REVIEW		

DRAWING 1

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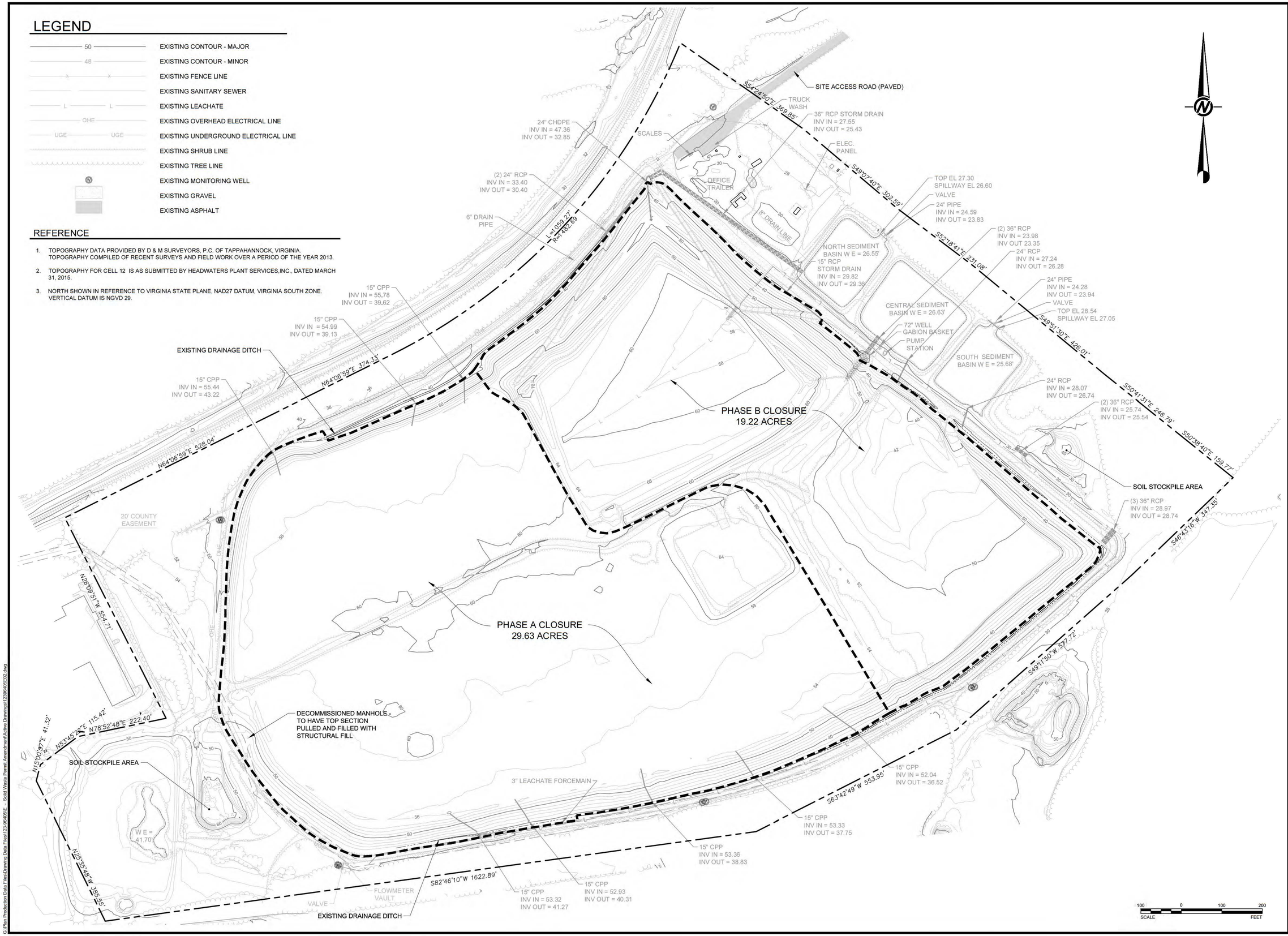
LEGEND

- 50 — EXISTING CONTOUR - MAJOR
- 48 — EXISTING CONTOUR - MINOR
- x — x — EXISTING FENCE LINE
- EXISTING SANITARY SEWER
- L — L — EXISTING LEACHATE
- OHE — EXISTING OVERHEAD ELECTRICAL LINE
- UGE — UGE — EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING SHRUB LINE
- EXISTING TREE LINE
- EXISTING MONITORING WELL
- EXISTING GRAVEL
- EXISTING ASPHALT

REFERENCE

1. TOPOGRAPHY DATA PROVIDED BY D & M SURVEYORS, P.C. OF TAPPAHANNOCK, VIRGINIA. TOPOGRAPHY COMPILED OF RECENT SURVEYS AND FIELD WORK OVER A PERIOD OF THE YEAR 2013.
2. TOPOGRAPHY FOR CELL 12 IS AS SUBMITTED BY HEADWATERS PLANT SERVICES,INC., DATED MARCH 31, 2015.
3. NORTH SHOWN IN REFERENCE TO VIRGINIA STATE PLANE, NAD27 DATUM, VIRGINIA SOUTH ZONE. VERTICAL DATUM IS NGVD 29.



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REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

COMMONWEALTH OF VIRGINIA
DANIEL P. McGRATH
Lic. No. 040703
11/17/15
PROFESSIONAL ENGINEER

PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
EXISTING CONDITIONS

PROJECT No.		123-96405
FILE No.		12396405E02
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- 48 — EXISTING CONTOUR - MINOR
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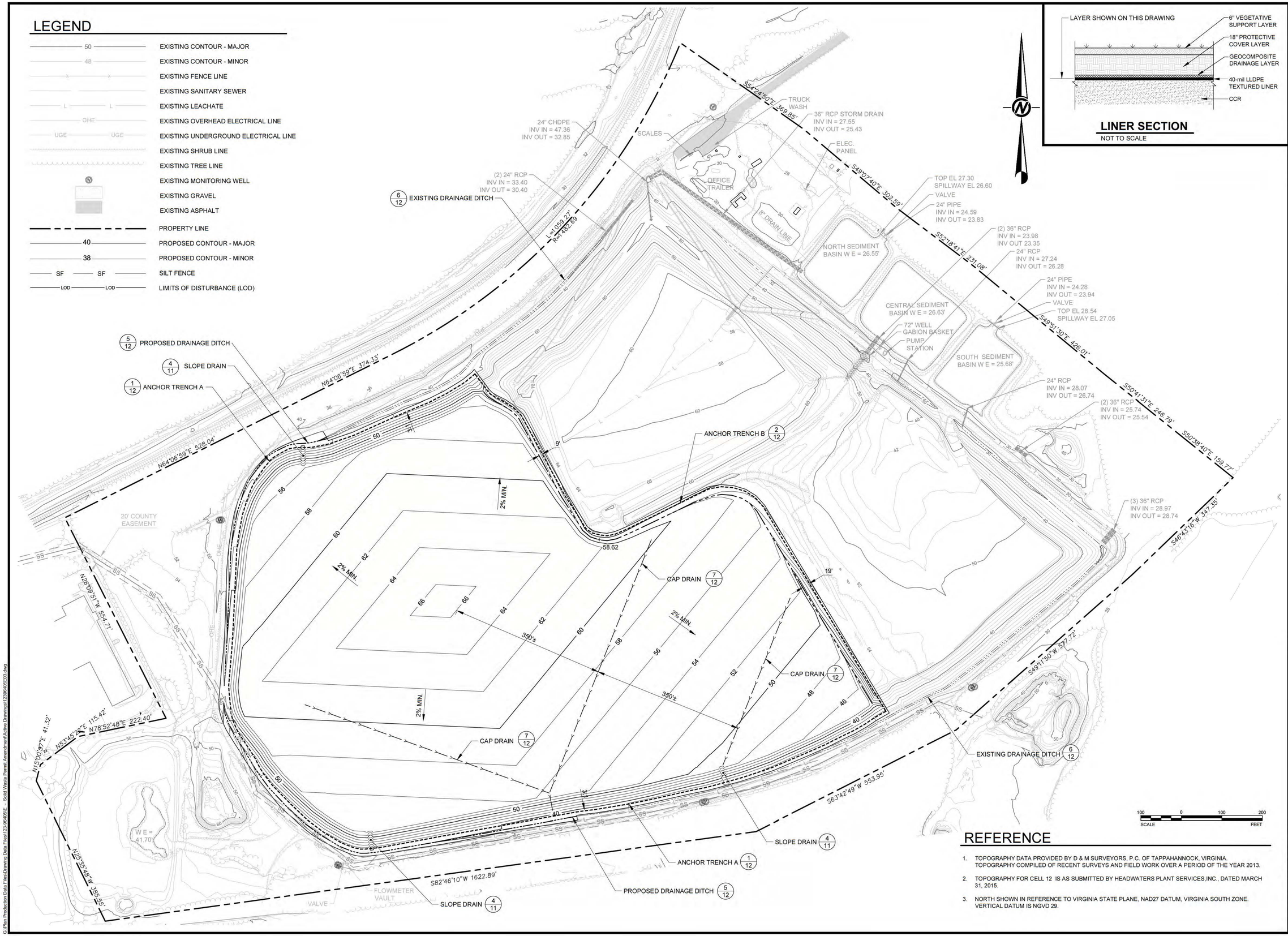
- SS — SS — EXISTING SANITARY SEWER
- L — L — EXISTING LEACHATE
- OHE — EXISTING OVERHEAD ELECTRICAL LINE
- UGE — UGE — EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING SHRUB LINE
- EXISTING TREE LINE
- (W) — EXISTING MONITORING WELL
- EXISTING GRAVEL
- EXISTING ASPHALT
- PROPERTY LINE
- 40 — PROPOSED CONTOUR - MAJOR
- 38 — PROPOSED CONTOUR - MINOR
- SF — SF — SILT FENCE
- LOD — LOD — LIMITS OF DISTURBANCE (LOD)



LINER SECTION
NOT TO SCALE

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1. TOPOGRAPHY DATA PROVIDED BY D & M SURVEYORS, P.C. OF TAPPAHANNOCK, VIRGINIA. TOPOGRAPHY COMPILED OF RECENT SURVEYS AND FIELD WORK OVER A PERIOD OF THE YEAR 2013.
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REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

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11/17/15
PROFESSIONAL ENGINEER

PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
PHASE A
LINER GRADES

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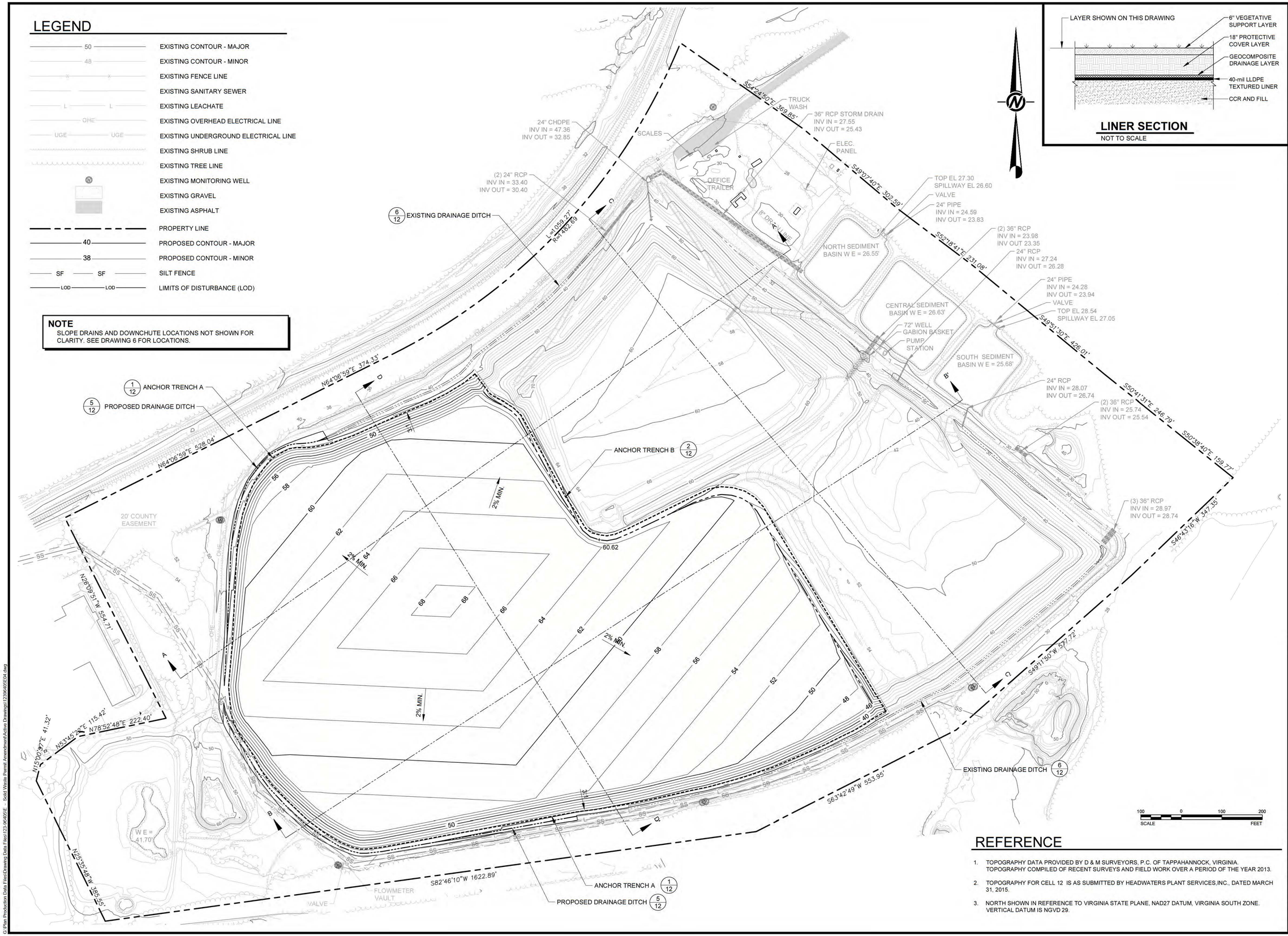
- OHE — EXISTING OVERHEAD ELECTRICAL LINE
- UGE — UGE — EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING SHRUB LINE
- EXISTING TREE LINE
- EXISTING MONITORING WELL
- EXISTING GRAVEL
- EXISTING ASPHALT
- PROPERTY LINE
- 40 — PROPOSED CONTOUR - MAJOR
- 38 — PROPOSED CONTOUR - MINOR
- SF — SF — SILT FENCE
- LOD — LOD — LIMITS OF DISTURBANCE (LOD)

NOTE
SLOPE DRAINS AND DOWNCHUTE LOCATIONS NOT SHOWN FOR CLARITY. SEE DRAWING 6 FOR LOCATIONS.



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2. TOPOGRAPHY FOR CELL 12 IS AS SUBMITTED BY HEADWATERS PLANT SERVICES,INC., DATED MARCH 31, 2015.
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REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

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11/17/15
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PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
PHASE A
FINISH GRADES

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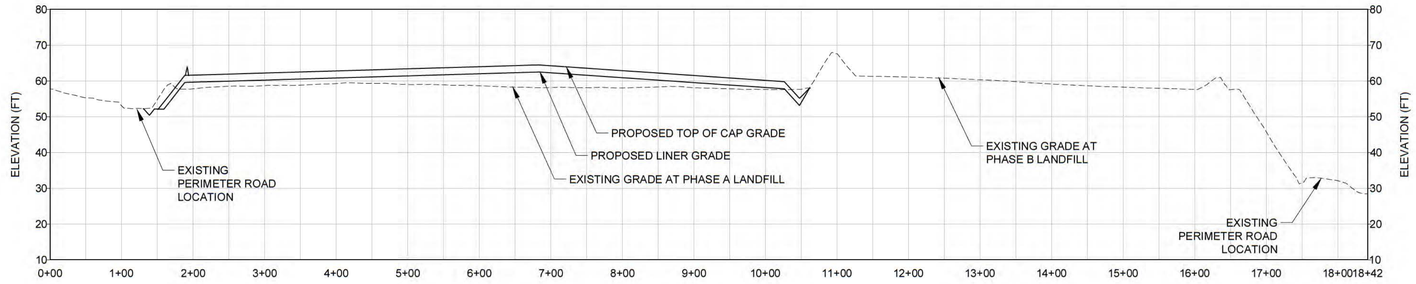

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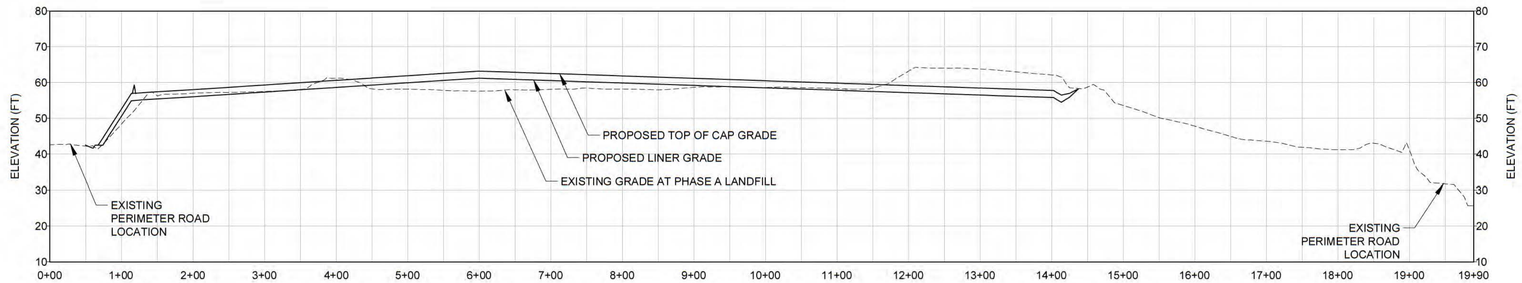

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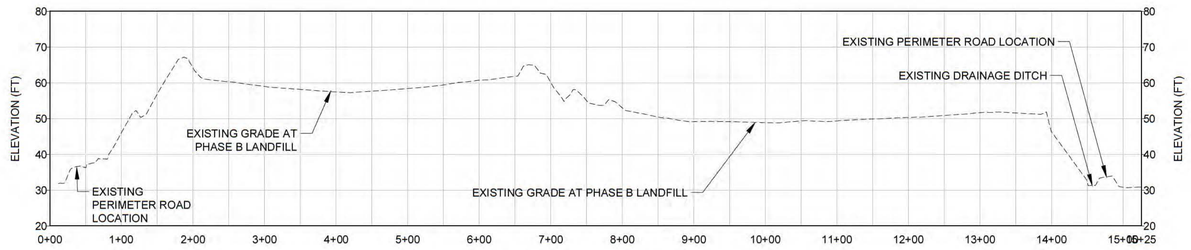

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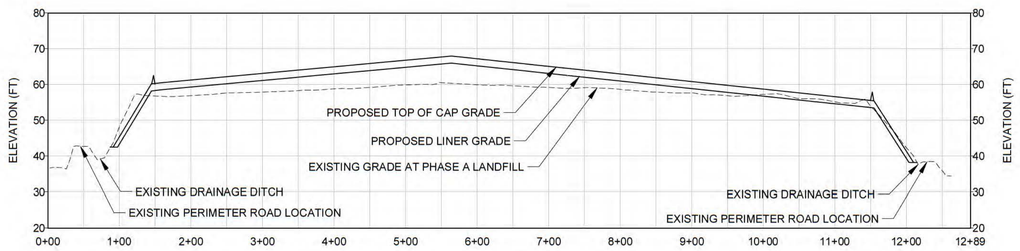

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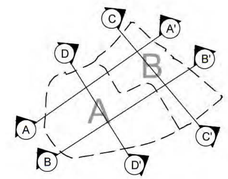

CROSS SECTION KEY

PHASE A ESTIMATE OF REQUIRED EARTHWORK

FROM EXISTING GRADE TO LINER GRADE:
63,231 CY OF FILL
63,214 CY OF CUT

FROM LINER GRADE TO CAP GRADE:
90,072 CY FILL
(25% OF WHICH IS TOPSOIL)

SCALE 20 0 20 FEET

SCALE 100 0 100 200 FEET

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REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

COMMONWEALTH OF VIRGINIA
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PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
PHASE A
CROSS SECTIONS

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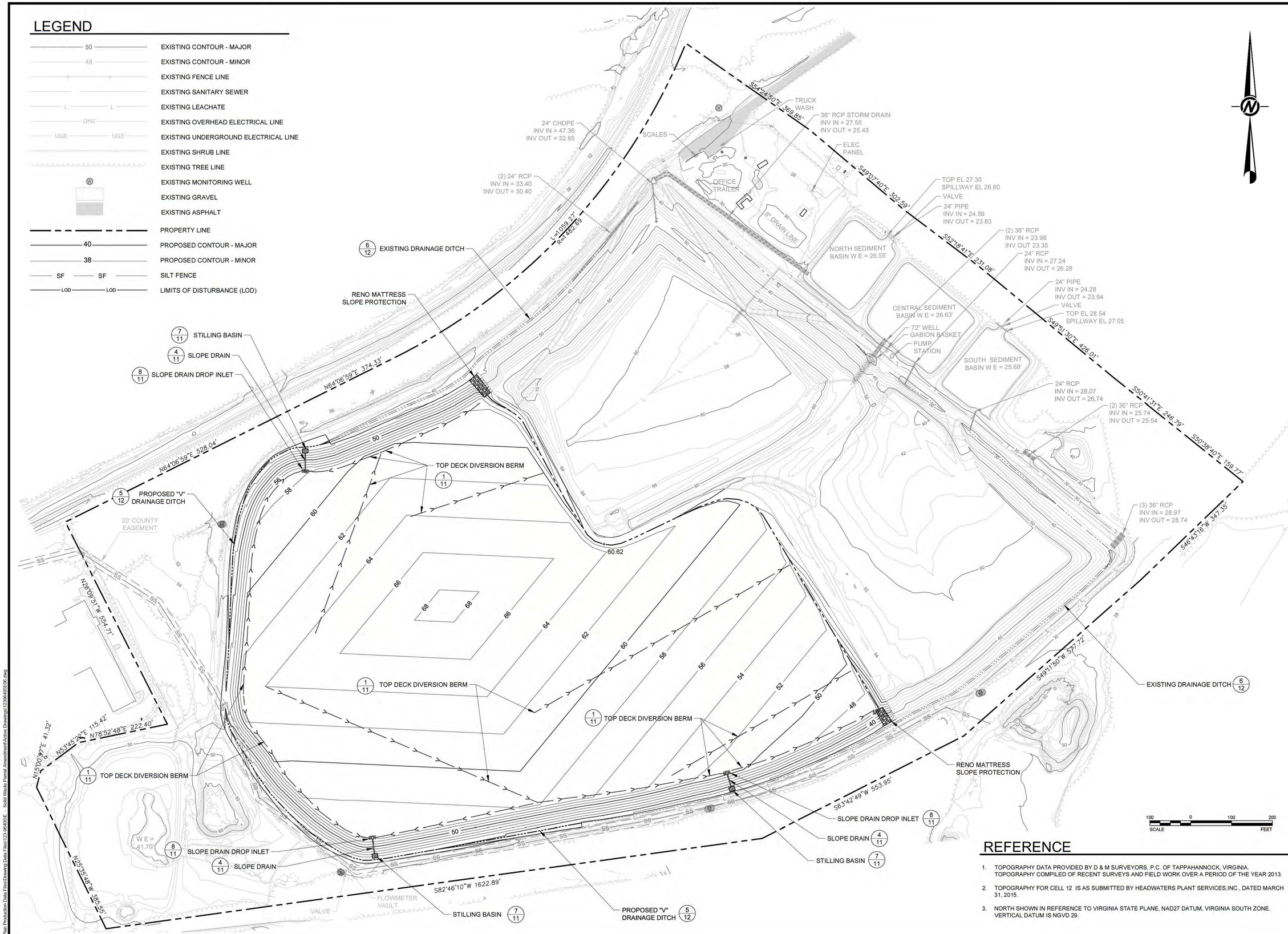
REVIEW		

DRAWING 5

G:\Plan Production Data Files\Drawing Data Files\123-96405E - Solid Waste Permit Amendment\Active Drawings\12396405E05.dwg

LEGEND

- 50 — EXISTING CONTOUR - MAJOR
- 48 — EXISTING CONTOUR - MINOR
- EXISTING FENCE LINE
- EXISTING SANITARY SEWER
- L — L — EXISTING LEACHATE
- OHE — EXISTING OVERHEAD ELECTRICAL LINE
- UGE — UGE — EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING SHRUB LINE
- EXISTING TREE LINE
- EXISTING MONITORING WELL
- EXISTING GRAVEL
- EXISTING ASPHALT
- PROPERTY LINE
- 40 — PROPOSED CONTOUR - MAJOR
- 38 — PROPOSED CONTOUR - MINOR
- SF — SF — SILT FENCE
- LOD — LOD — LIMITS OF DISTURBANCE (LOD)



REFERENCE

1. TOPOGRAPHY DATA PROVIDED BY D & M SURVEYORS, P.C. OF TAPPAHANNOCK, VIRGINIA. TOPOGRAPHY COMPILED OF RECENT SURVEYS AND FIELD WORK OVER A PERIOD OF THE YEAR 2013.
2. TOPOGRAPHY FOR CELL 12 IS AS SUBMITTED BY HEADWATERS PLANT SERVICES,INC., DATED MARCH 31, 2015.
3. NORTH SHOWN IN REFERENCE TO VIRGINIA STATE PLANE, NAD27 DATUM, VIRGINIA SOUTH ZONE. VERTICAL DATUM IS NGVD 29.

Golder Associates

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

COMMONWEALTH OF VIRGINIA
DANIEL P. McGRATH
Lic. No. 040703
11/17/15
PROFESSIONAL ENGINEER

PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
PHASE A
STORMWATER MANAGEMENT PLAN

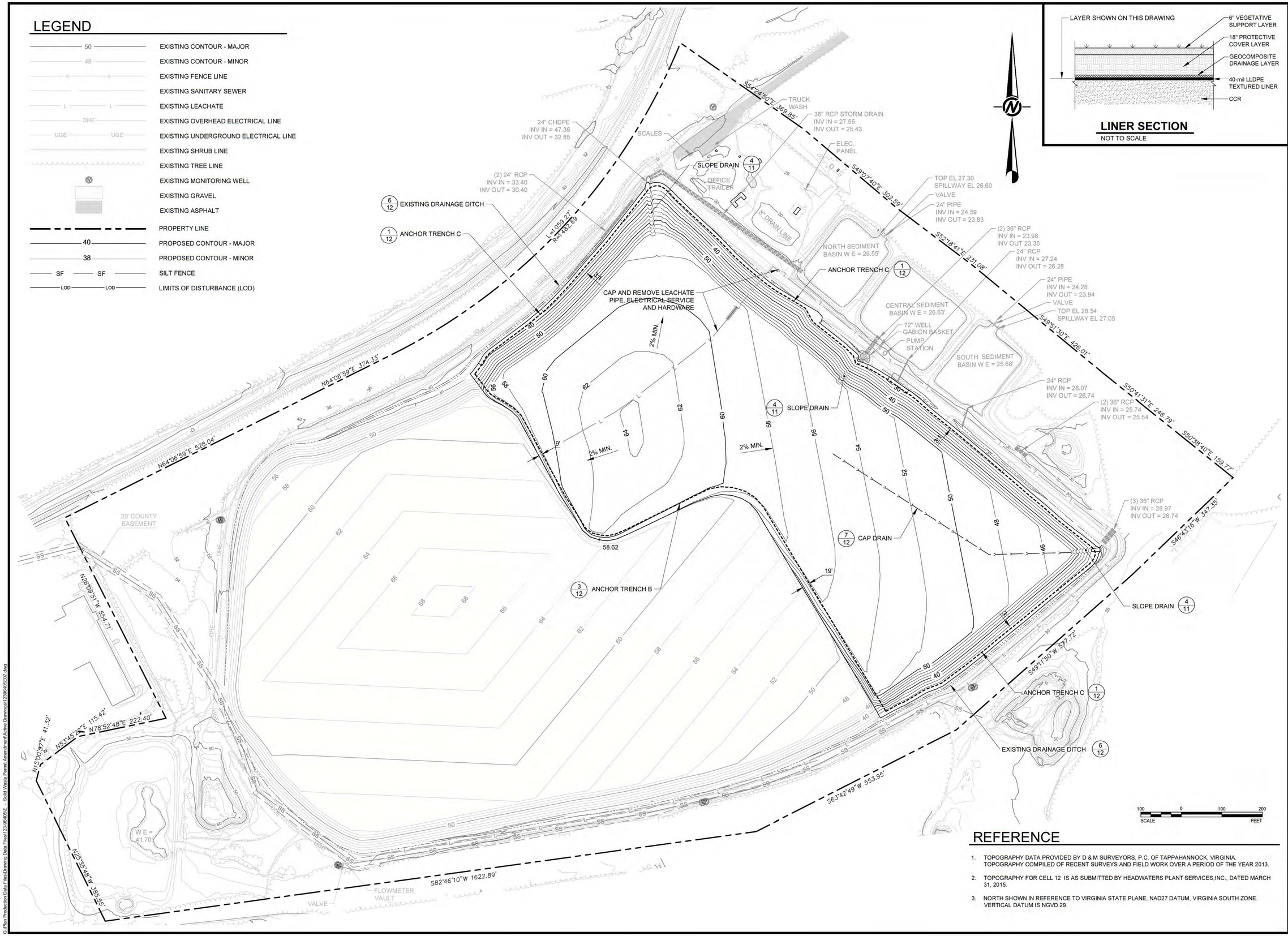
PROJECT No.		123-96405
FILE No.		12396405E06
REV. 0	SCALE	AS SHOWN
DESIGN	KLL	07-15-2015
CADD	ABM	07-22-2015
CHECK		
REVIEW		

DRAWING 6

G:\Plan Production Data Files\Drawing Data Files\123-96405\E - Solid Waste Permit Amendment\Active Drawings\12396405E06.dwg

LEGEND

- 50 — EXISTING CONTOUR - MAJOR
- 48 — EXISTING CONTOUR - MINOR
- EXISTING FENCE LINE
- EXISTING SANITARY SEWER
- L — L — EXISTING LEACHATE
- OHE — EXISTING OVERHEAD ELECTRICAL LINE
- UGE — UGE — EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING SHRUB LINE
- EXISTING TREE LINE
- EXISTING MONITORING WELL
- EXISTING GRAVEL
- EXISTING ASPHALT
- PROPERTY LINE
- 40 — PROPOSED CONTOUR - MAJOR
- 38 — PROPOSED CONTOUR - MINOR
- SF — SF — SILT FENCE
- LOD — LOD — LIMITS OF DISTURBANCE (LOD)



LINER SECTION
NOT TO SCALE

100 0 100 200
SCALE FEET

REFERENCE

1. TOPOGRAPHY DATA PROVIDED BY D & M SURVEYORS, P.C. OF TAPPAHANNOCK, VIRGINIA. TOPOGRAPHY COMPILED OF RECENT SURVEYS AND FIELD WORK OVER A PERIOD OF THE YEAR 2013.
2. TOPOGRAPHY FOR CELL 12 IS AS SUBMITTED BY HEADWATERS PLANT SERVICES,INC., DATED MARCH 31, 2015.
3. NORTH SHOWN IN REFERENCE TO VIRGINIA STATE PLANE, NAD27 DATUM, VIRGINIA SOUTH ZONE. VERTICAL DATUM IS NGVD 29.

Golder Associates

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

COMMONWEALTH OF VIRGINIA
DANIEL P. McGRATH
Lic. No. 040703
11/17/15
PROFESSIONAL ENGINEER

PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
PHASE B
LINER GRADES

PROJECT No.		123-96405
FILE No.		12396405E07
REV. 0	SCALE	AS SHOWN
DESIGN	KLL	07-15-2015
CADD	ABM	07-22-2015
CHECK		
REVIEW		

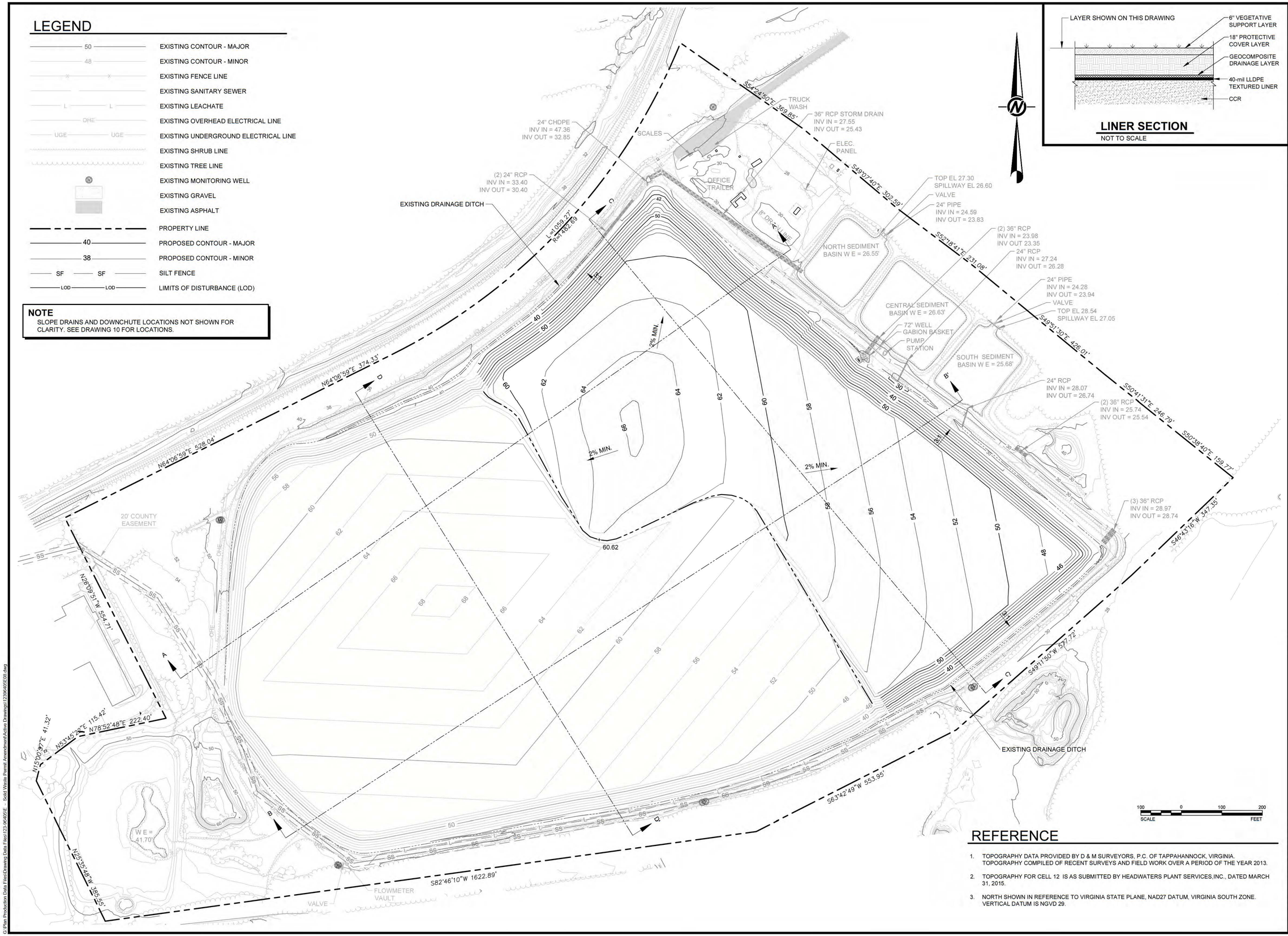
DRAWING 7

G:\Plan Production Data Files\Drawing Data Files\123-96405\E - Solid Waste Permit Amendment\Active Drawings\12396405E07.dwg

LEGEND

- 50 — EXISTING CONTOUR - MAJOR
- 48 — EXISTING CONTOUR - MINOR
- EXISTING FENCE LINE
- EXISTING SANITARY SEWER
- L — L — EXISTING LEACHATE
- OHE — EXISTING OVERHEAD ELECTRICAL LINE
- UGE — UGE — EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING SHRUB LINE
- EXISTING TREE LINE
- EXISTING MONITORING WELL
- EXISTING GRAVEL
- EXISTING ASPHALT
- PROPERTY LINE
- 40 — PROPOSED CONTOUR - MAJOR
- 38 — PROPOSED CONTOUR - MINOR
- SF — SF — SILT FENCE
- LOD — LOD — LIMITS OF DISTURBANCE (LOD)

NOTE
SLOPE DRAINS AND DOWNCHUTE LOCATIONS NOT SHOWN FOR CLARITY. SEE DRAWING 10 FOR LOCATIONS.



LINER SECTION
NOT TO SCALE

100 0 100 200
SCALE FEET

REFERENCE

1. TOPOGRAPHY DATA PROVIDED BY D & M SURVEYORS, P.C. OF TAPPAHANNOCK, VIRGINIA. TOPOGRAPHY COMPILED OF RECENT SURVEYS AND FIELD WORK OVER A PERIOD OF THE YEAR 2013.
2. TOPOGRAPHY FOR CELL 12 IS AS SUBMITTED BY HEADWATERS PLANT SERVICES,INC., DATED MARCH 31, 2015.
3. NORTH SHOWN IN REFERENCE TO VIRGINIA STATE PLANE, NAD27 DATUM, VIRGINIA SOUTH ZONE. VERTICAL DATUM IS NGVD 29.

Golder Associates

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

COMMONWEALTH OF VIRGINIA
DANIEL P. McGRATH
Lic. No. 040703
11/17/15
PROFESSIONAL ENGINEER

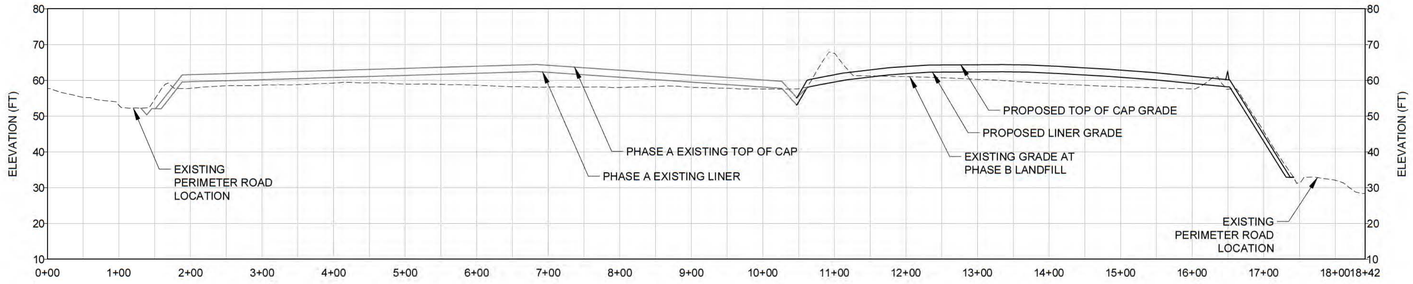
PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
PHASE B
FINISH GRADES

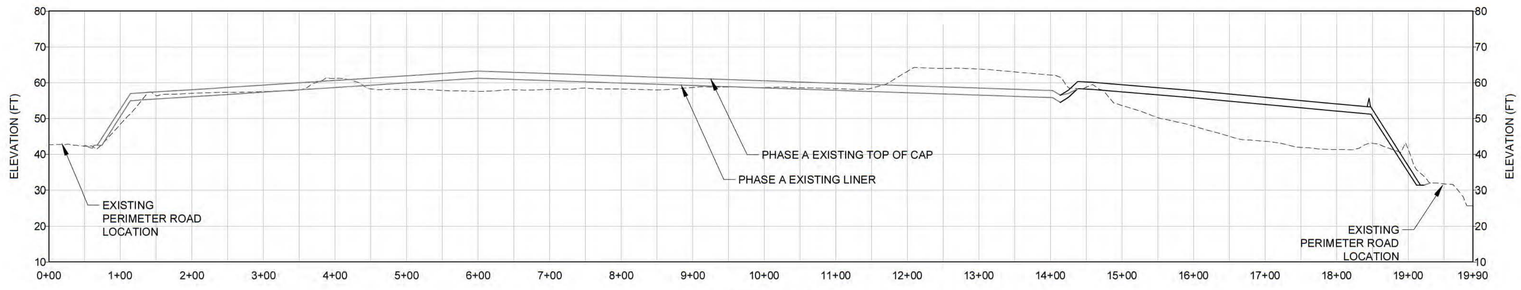
PROJECT No.		123-96405
FILE No.		12396405E08
REV. 0	SCALE	AS SHOWN
DESIGN	KLL	07-15-2015
CADD	ABM	07-22-2015
CHECK		
REVIEW		

DRAWING 8

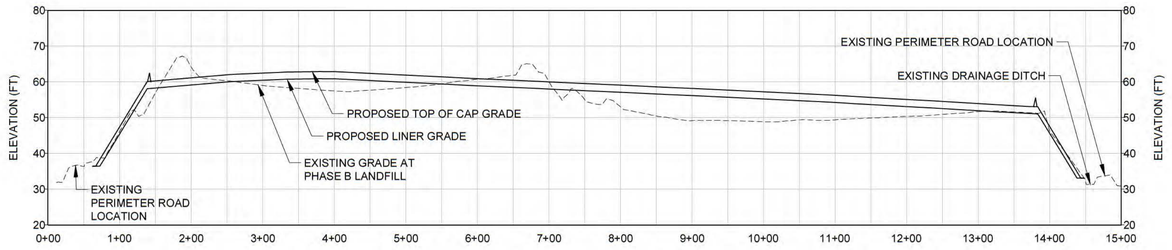
G:\Plan Production Data Files\Drawing Data Files\123-96405\E - Solid Waste Permit Amendment\Active Drawings\12396405E08.dwg



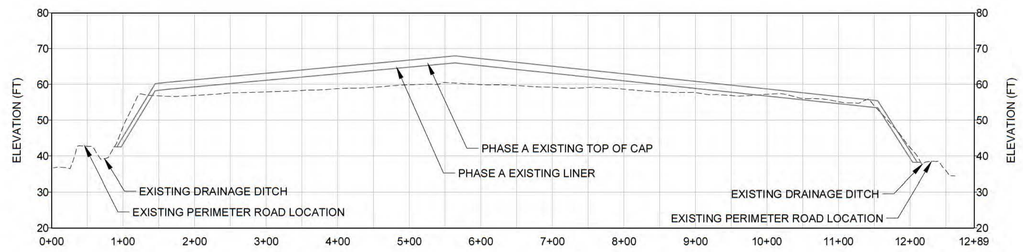
CROSS SECTION A - A'



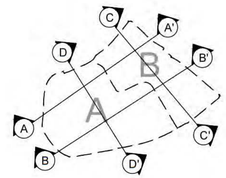
CROSS SECTION B - B'



CROSS SECTION C - C'



CROSS SECTION D - D'



CROSS SECTION KEY

PHASE B ESTIMATE OF REQUIRED EARTHWORK

FROM EXISTING GRADE TO LINER GRADE:
55,279 CY OF FILL
42,856 CY OF CUT
(ACCOUNTS FOR 12,423 CY OF STORAGE OVER CELL 12)
FROM LINER GRADE TO CAP GRADE:
62,253 CY FILL
(25% OF WHICH IS TOPSOIL)

100 0 100 200
SCALE FEET

20 0 20
FEET SCALE

Golder Associates

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

COMMONWEALTH OF VIRGINIA
DANIEL P. McGRATH
Lic. No. 040703
11/17/15
PROFESSIONAL ENGINEER

PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
PHASE B
CROSS SECTIONS

PROJECT No.		123-96405
FILE No.		12396405E09
REV. 0	SCALE	AS SHOWN
DESIGN	KLL	07-15-2015
CADD	ABM	07-22-2015
CHECK		
REVIEW		

DRAWING 9

G:\Plan Production Data Files\Drawing Data Files\123-96405E - Solid Waste Permit Amendment\Active Drawings\12396405E09.dwg

LEGEND

- 50 — EXISTING CONTOUR - MAJOR
- 48 — EXISTING CONTOUR - MINOR
- X — X — EXISTING FENCE LINE
- EXISTING SANITARY SEWER
- L — L — EXISTING LEACHATE
- OHE — EXISTING OVERHEAD ELECTRICAL LINE
- UGE — UGE — EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING SHRUB LINE
- EXISTING TREE LINE
- EXISTING MONITORING WELL
- EXISTING GRAVEL
- EXISTING ASPHALT
- PROPERTY LINE
- 40 — PROPOSED CONTOUR - MAJOR
- 38 — PROPOSED CONTOUR - MINOR
- SF — SF — SILT FENCE
- LOD — LOD — LIMITS OF DISTURBANCE (LOD)

7/11 STILLING BASIN
24" CHDPE
INV IN = 47.36
INV OUT = 32.85
4/11 SLOPE DRAIN
8/11 SLOPE DRAIN DROP INLET
(2) 24" RCP
INV IN = 33.40
INV OUT = 30.40
6/12 EXISTING DRAINAGE DITCH
RENO MATTRESS SLOPE PROTECTION
L=1059.27'
R=482.69'
S54°24'50"E 369.85'
TRUCK WASH
36" RCP STORM DRAIN
INV IN = 27.55
INV OUT = 25.43
ELEC. PANEL
SCALES
OFFICE TRAILER
S49°07'40"E 302.59'
TOP EL 27.30
SPILLWAY EL 26.60
VALVE
24" PIPE
INV IN = 24.59
INV OUT = 23.83
1/11 TOP DECK DIVERSION BERM
NORTH SEDIMENT BASIN W E = 26.55'
S52°18'41"E 231.08'
(2) 36" RCP
INV IN = 23.98
INV OUT 23.35
24" RCP
INV IN = 27.24
INV OUT = 26.28
SLOPE DRAIN DROP INLET 8/11
SLOPE DRAIN 4/11
STILLING BASIN 7/11
72" WELL
GABION BASKET
PUMP STATION
24" PIPE
INV IN = 24.28
INV OUT = 23.94
VALVE
TOP EL 28.54
SPILLWAY EL 27.05
S49°51'30"E 426.01'
SOUTH SEDIMENT BASIN W E = 25.68'
24" RCP
INV IN = 28.07
INV OUT = 26.74
(2) 36" RCP
INV IN = 25.74
INV OUT = 25.54
S50°41'31"E 246.79'
S50°38'40"E 159.77'
TOP DECK DIVERSION BERM 1/11
(3) 36" RCP
INV IN = 28.97
INV OUT = 28.74
S46°43'16"W 347.35'
STILLING BASIN 7/11
SLOPE DRAIN 4/11
SLOPE DRAIN DROP INLET 8/11
EXISTING DRAINAGE DITCH 6/12
S49°11'50"W 577.72'
RENO MATTRESS SLOPE PROTECTION
S63°42'49"W 553.95'
SLOPE DRAIN DROP INLET 8/11
SLOPE DRAIN 4/11
STILLING BASIN 7/11
S82°46'10"W 1622.89'
STILLING BASIN 7/11
1/11 TOP DECK DIVERSION BERM
60.62
1/11 TOP DECK DIVERSION BERM
1/11 TOP DECK DIVERSION BERM
7/11 STILLING BASIN
4/11 SLOPE DRAIN
8/11 SLOPE DRAIN DROP INLET
N64°06'59"E 374.33'
N64°06'59"E 528.04'
20' COUNTY EASEMENT
N26°09'51"W 554.71'
N15°00'34"E 41.32'
N53°45'28"E 115.42'
N78°52'48"E 222.40'
W E = 41.70'
8/11 SLOPE DRAIN DROP INLET
4/11 SLOPE DRAIN
N25°35'48"W 395.55'
FLOWMETER VAULT
VALVE
100 0 100 200
SCALE FEET

REFERENCE

1. TOPOGRAPHY DATA PROVIDED BY D & M SURVEYORS, P.C. OF TAPPAHANNOCK, VIRGINIA. TOPOGRAPHY COMPILED OF RECENT SURVEYS AND FIELD WORK OVER A PERIOD OF THE YEAR 2013.
2. TOPOGRAPHY FOR CELL 12 IS AS SUBMITTED BY HEADWATERS PLANT SERVICES,INC., DATED MARCH 31, 2015.
3. NORTH SHOWN IN REFERENCE TO VIRGINIA STATE PLANE, NAD27 DATUM, VIRGINIA SOUTH ZONE. VERTICAL DATUM IS NGVD 29.

Golder Associates

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

COMMONWEALTH OF VIRGINIA
DANIEL P. McGRATH
Lic. No. 040703
11/17/15
PROFESSIONAL ENGINEER

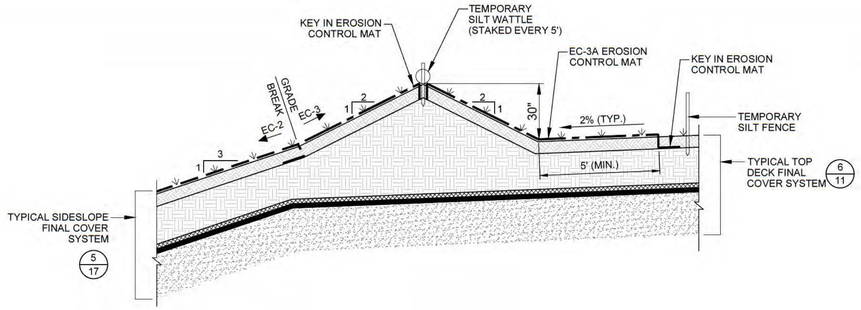
PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
PHASE B
FINAL STORMWATER MANAGEMENT PLAN

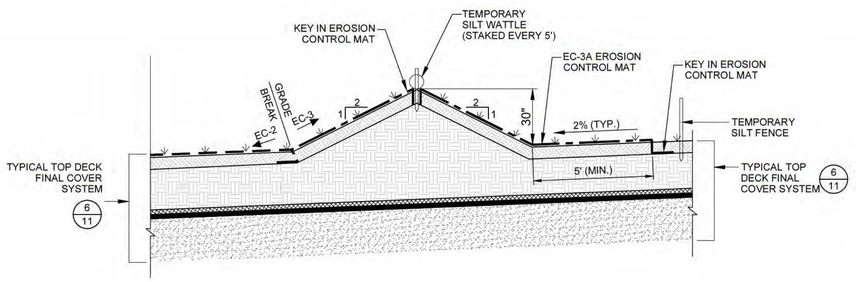
PROJECT No.		123-96405
FILE No.		12396405E10
REV. 0	SCALE	AS SHOWN
DESIGN	KLL	07-15-2015
CADD	ABM	07-22-2015
CHECK		
REVIEW		

DRAWING 10

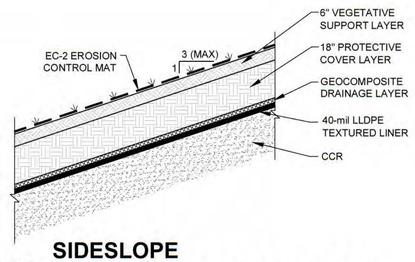
G:\Plan Production Data Files\Drawing Data Files\123-96405E - Solid Waste Permit Amendment\Active Drawings\12396405E10.dwg



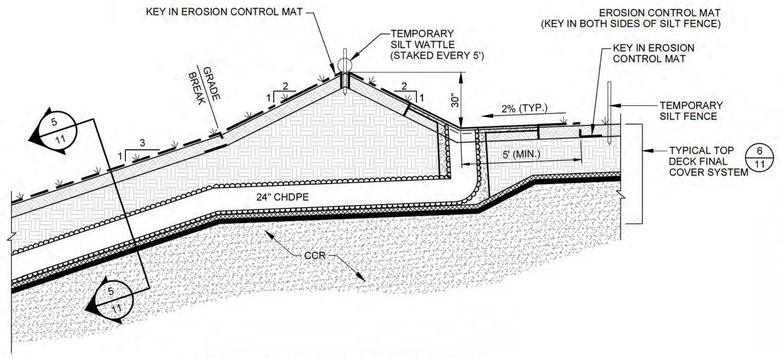
1/11 TOP DECK DIVERSION BERM DETAIL
N.T.S.



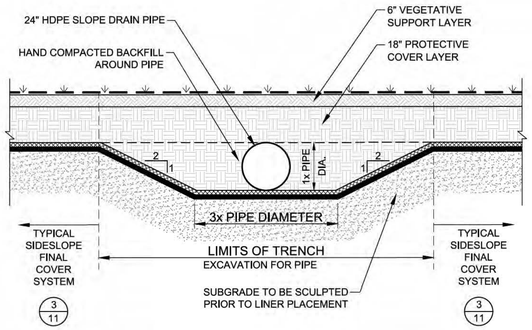
2/11 TOP DECK DIVERSION BERM DETAIL
N.T.S.



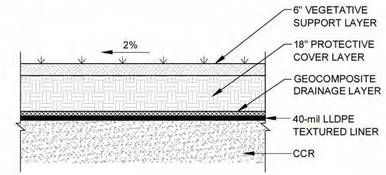
3/11 SIDESLOPE FINAL COVER SYSTEM DETAIL
N.T.S.



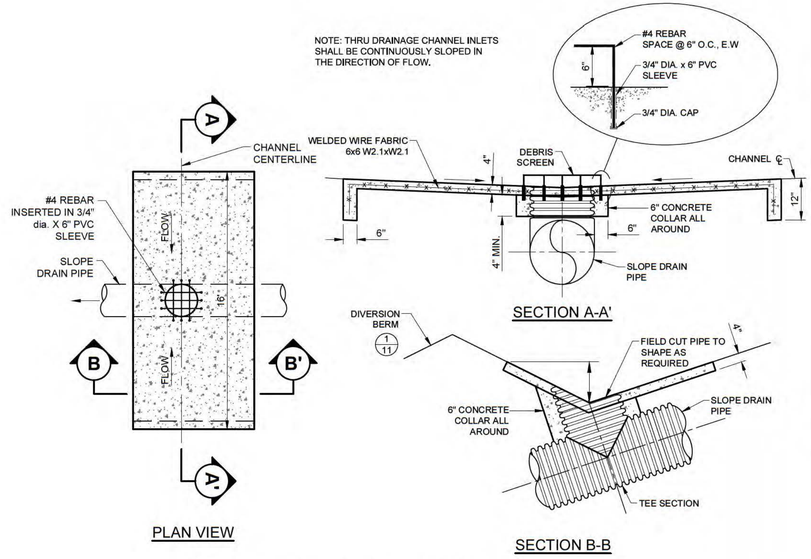
4/11 SLOPE DRAIN DETAIL
N.T.S.



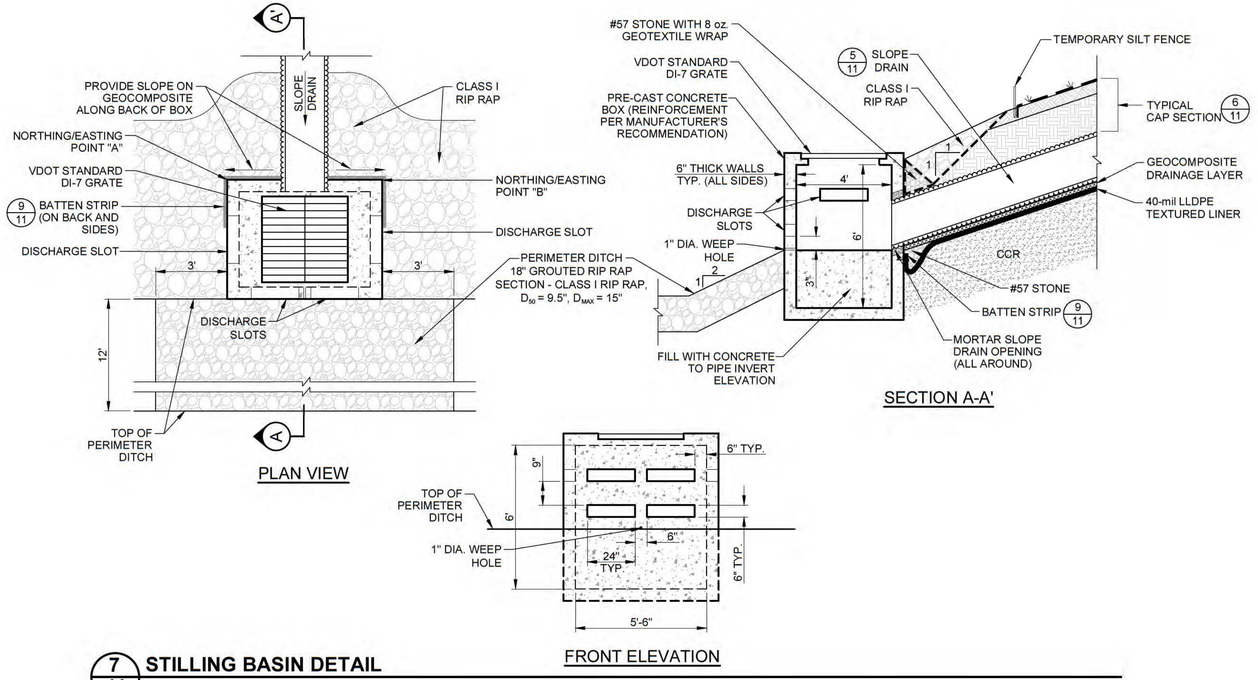
5/11 SLOPE DRAIN CROSS SECTION
N.T.S.



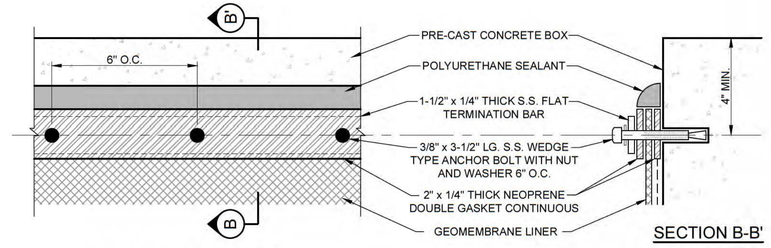
6/11 TOP DECK FINAL COVER SYSTEM DETAIL
N.T.S.



8/11 SLOPE DRAIN DROP INLET DETAIL
N.T.S.



7/11 STILLING BASIN DETAIL
NOT TO SCALE



9/11 BATTEN STRIP
NOT TO SCALE

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

COMMONWEALTH OF VIRGINIA
DANIEL P. McGRATH
Lic. No. 040703
11/17/15
PROFESSIONAL ENGINEER

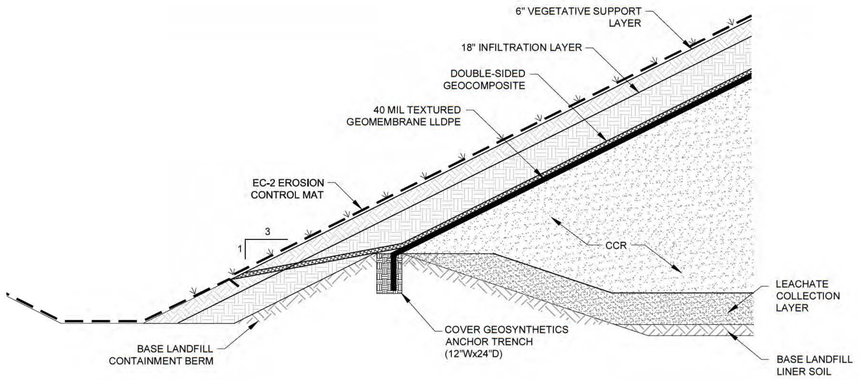
PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
STORMWATER DETAILS

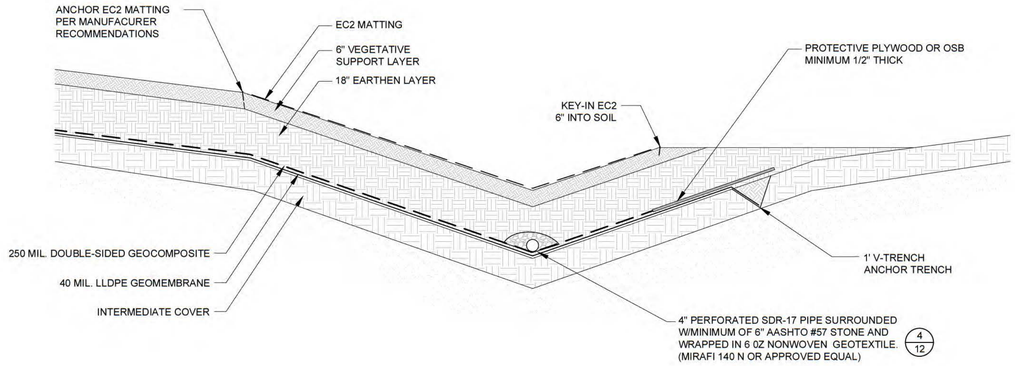
PROJECT No.		123-96405
FILE No.		12396405E11-13
REV. 0	SCALE	AS SHOWN
DESIGN	KLL	07-15-2015
CADD	ABM	07-22-2015
CHECK		
REVIEW		

DRAWING 11

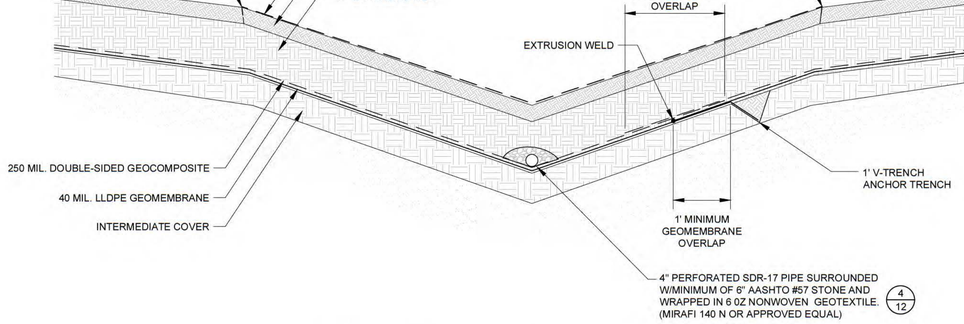
G:\Plan Production Data Files\Drawing Data Files\123-96405E - Solid Waste Permit Amendment\Active Drawings\12396405E11-13.dwg



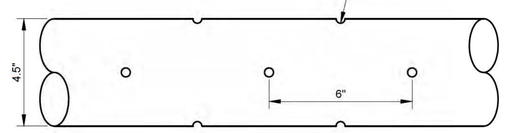
1/12 ANCHOR TRENCH A & C
N.T.S.



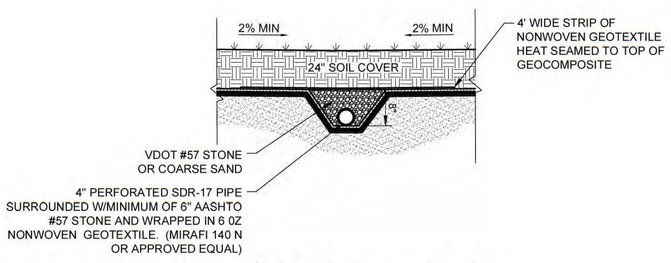
2/12 ANCHOR TRENCH B - PHASE A
NOT TO SCALE



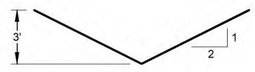
3/12 ANCHOR TRENCH B - PHASE B
NOT TO SCALE



4/12 4" HDPE SDR-17 PIPE
N.T.S.



7/12 CAP DRAIN TRENCH
NOT TO SCALE



5/12 TYPICAL DITCH SECTION
N.T.S.

6/12 EXISTING TRAPEZOIDAL DITCH SECTION
N.T.S.

Golder Associates

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

COMMONWEALTH OF VIRGINIA
DANIEL P. McGRATH
Lic. No. 040703
11/17/15
PROFESSIONAL ENGINEER

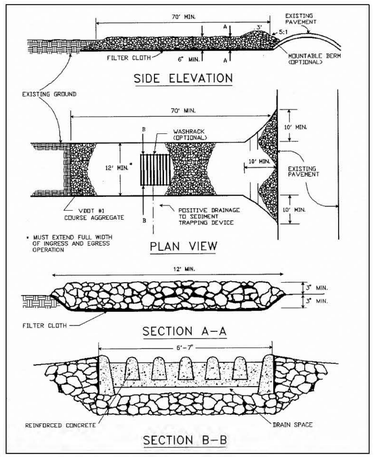
PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
LINER DETAILS

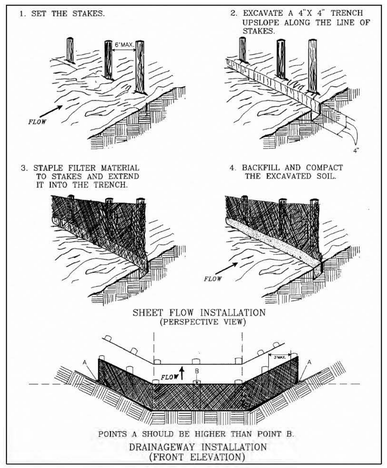
PROJECT No.		123-96405
FILE No.		12396405E11-13
REV. 0	SCALE	AS SHOWN
DESIGN	KLL	07-15-2015
CADD	ABM	07-22-2015
CHECK		
REVIEW		

DRAWING 12

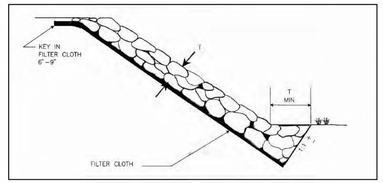
G:\Plan Production Data Files\Drawing Data Files\123-96405E - Solid Waste Permit Amendment\Active Drawings\12396405E11-13.dwg



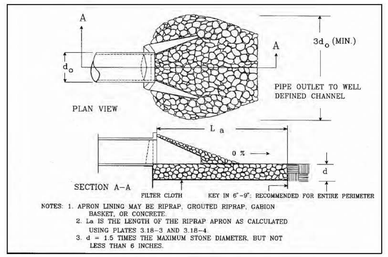
1/13 CONSTRUCTION ENTRANCE DETAIL
NOT TO SCALE



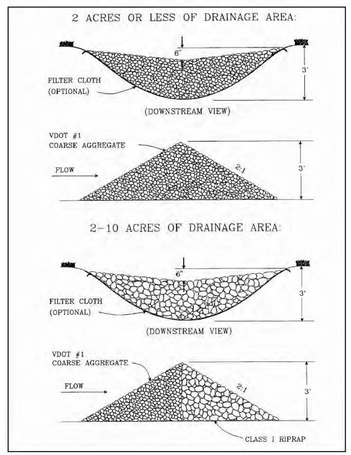
2/13 SILT FENCE DETAIL
NOT TO SCALE



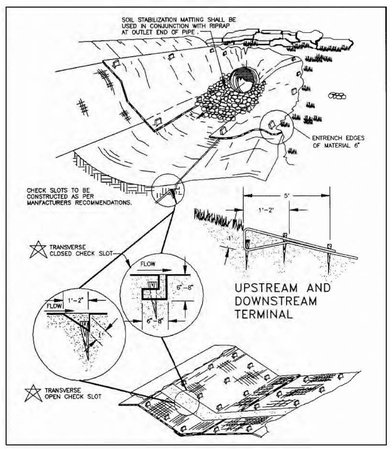
3/13 RIPRAP DETAIL
NOT TO SCALE



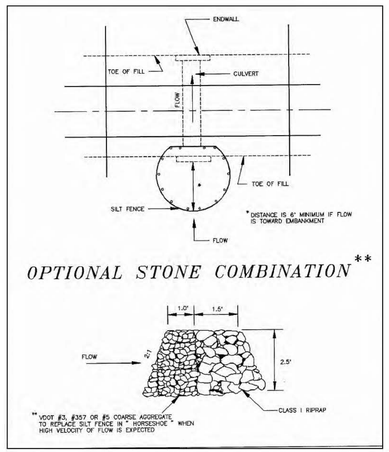
4/13 OUTLET PROTECTION DETAIL
NOT TO SCALE



5/13 CHECK DAM DETAIL
NOT TO SCALE



6/13 SOIL STABILIZATION DETAIL
NOT TO SCALE



7/13 CULVERT INLET PROTECTION DETAIL
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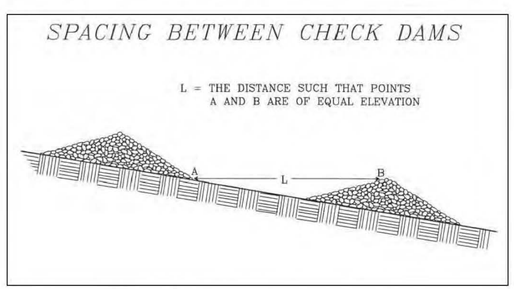

8/13 CHECK DAM SPACING DETAIL
NOT TO SCALE

TEMPORARY SEEDING NOTES

1. ALL TEMPORARY SEEDING, FERTILIZING AND LIMING SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION 3.31 OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH), THIRD EDITION, 1992. MULCHING SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION 3.35 OF THE VESCH.
2. TEMPORARY SEEDING WILL BE APPLIED WITHIN 7 DAYS TO DENUDED AREAS WHICH MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT (UNDISTURBED) FOR LONGER THAN 30 DAYS. FOR TEMPORARY SEEDING USE 50% OF THE RECOMMENDED RATES OF FERTILIZER AND LIME, AND FULL RATES OF SEED AND MULCH, AS SPECIFIED IN THE VESCH STANDARD FOR PERMANENT SEEDING.
3. ALL SOIL STOCKPILES ARE TO BE MULCHED AND SEEDED FOR VEGETATIVE COVER IMMEDIATELY AFTER GRADING. STRAW OR HAY MULCH IS REQUIRED.

TEMPORARY SEEDING MIXTURES FOR ALL AREAS:

PLANTING DATES	SPECIES	RATE (LBS/AC.)
SEPT 1 - FEB 15	50/50 MIX OF ANNUAL RYE & CEREAL WINTER RYE	50-100
FEB 16 - APR 30	ANNUAL RYE	60-100
MAY 1 - AUG 31	GERMAN MILLET	50-100

PERMANENT SEEDING NOTES

1. ALL SEEDING, FERTILIZING AND LIMING SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION 3.32 OF THE VESCH. MULCHING SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION 3.35 OF THE VESCH.
2. CONDUCT SOIL TESTING PRIOR TO SEEDING. THE AREA TO BE SEEDED SHALL FIRST BE FERTILIZED AND TREATED WITH AGRICULTURAL LIME IN ACCORDANCE WITH THE SOIL TESTING RESULTS. SOIL ADDITIVES SHALL BE WORKED INTO THE SURFACE A MINIMUM DEPTH OF ONE INCH.
3. PERMANENT SEEDING SHALL BE DONE ONLY BETWEEN THE DATES OF FEBRUARY 15 AND JUNE 15 OR BETWEEN SEPTEMBER 15 AND DECEMBER 15, EXCEPT AS OTHERWISE DIRECTED BY THE ENGINEER. ABSENT OF SITE-SPECIFIC SOIL TESTING AND SEED MIXTURE RECOMMENDATIONS, FOLLOW THE SEEDING SCHEDULE BELOW:

SEEDING MIXTURES FOR THE COASTAL PLAIN REGION:

SPECIES	RATE (LBS/AC.)
KENTUCKY 31 FESCUE	128
RED TOP GRASS	2
SEASONAL NURSE CROP*	20
	TOTAL: 150 LBS./AC.

*USE SEASONAL NURSE CROP IN ACCORDANCE WITH SEEDING DATES AS STATED BELOW:

PLANTING DATES	SPECIES
FEBRUARY - APRIL	ANNUAL RYE
MAY - AUGUST	FOXTAIL MILLET
SEPTEMBER - NOVEMBER 15	ANNUAL RYE
NOVEMBER 15 - JANUARY	WINTER RYE

4. AFTER SEEDING, THE SURFACE SHALL BE COVERED WITH STRAW OR HAY AT THE RATE OF 70-90 LBS PER 1,000 SQ. FT.
5. LIME AND FERTILIZER SCHEDULE:
   LIME
   2 TON/ACRE PULVERIZED AGRICULTURAL GRADE LIMESTONE (MAXIMUM 100 LBS/1,000 SQ. FT.)
   FERTILIZER
   1000 LBS/ACRE 12-12-12 OR EQUIVALENT NUTRIENTS, (23 LBS/1,000 SQ. FT.)

PHASE 1 EROSION AND SEDIMENT CONTROL SEQUENCE

1. ALL PHASE 1 EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED AT THE LOCATIONS SHOWN ON THE DRAWINGS. CONTROLS SHALL MEET MINIMUM STANDARDS AND SPECIFICATIONS FROM THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH).
2. PHASE 1 EROSION AND SEDIMENT CONTROLS ARE TO BE INSTALLED AS THE FIRST STEP IN CONSTRUCTION. NO LAND DISTURBING ACTIVITIES ARE TO TAKE PLACE PRIOR TO INSTALLATION OF ALL CONTROLS SHOWN ON THE DRAWINGS.
3. CONTACT YORK COUNTY NO LATER THAN FORTY-EIGHT (48) HOURS PRIOR TO LAND DISTURBING ACTIVITIES SO A PRE- CONSTRUCTION MEETING AND INSPECTION CAN BE SCHEDULED.
4. INSTALL CONSTRUCTION ENTRANCE.
5. INSTALL CULVERT INLET PROTECTION ON EXISTING CULVERTS.
6. INSTALL SILT FENCE.
7. ONCE ALL CONTROLS LISTED ABOVE HAVE BEEN INSTALLED, COMMENCE WITH RESHAPING AND GRADING OF LANDFILL.
8. TEMPORARY SEEDING SHALL BE APPLIED WITHIN 7 DAYS TO DENUDED AREAS WHICH MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT (UNDISTURBED) FOR LONGER THAN 30 DAYS. SEE TEMPORARY SEEDING NOTES ABOVE FOR SPECIFICATIONS.
9. WHENEVER SEDIMENT-LADEN WATER IS REMOVED FROM A CONSTRUCTION SITE BY MEANS OF PUMPING, A TEMPORARY SETTLING & FILTERING DEVICE SHALL BE USED TO FILTER THE SEDIMENT-LADEN WATER PRIOR OT THE WATER BEING DISCHARGED FROM THE SITE.

PHASE 2 EROSION AND SEDIMENT CONTROL SEQUENCE

1. ALL PHASE 2 EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED AT THE LOCATIONS SHOWN ON DRAWINGS. CONTROLS SHALL MEET MINIMUM STANDARDS AND SPECIFICATIONS FROM THE VESCH.
2. GRADE LANDFILL TO LINER GRADES.
3. INSTALL LINER.
4. GRADE LANDFILL TO FINISH CAP GRADES. TOPSOIL SEED AND MULCH..
5. INSTALL PERMANENT SEEDING AS AREAS ARE BROUGHT TO FINAL GRADE.
6. THE CONSTRUCTION ENTRANCE MAY BE REMOVED ONCE CONSTRUCTION ACTIVITIES ARE COMPLETE.
7. EROSION AND SEDIMENT CONTROL MEASURES MAY ONLY BE REMOVED ONCE ADEQUATE VEGETATION IS ESTABLISHED AND APPROVAL FOR REMOVAL IS GRANTED BY THE EROSION AND SEDIMENT CONTROL INSPECTOR.
8. RIP RAP OUTLET PROTECTION IS TO REMAIN.

Golder Associates

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

COMMONWEALTH OF VIRGINIA
DANIEL P. McGRATH
Lic. No. 040703
11/17/15
PROFESSIONAL ENGINEER

PROJECT
DOMINION
YORKTOWN POWER STATION
CLOSURE PLAN - SWP #457
YORK COUNTY, VIRGINIA

TITLE
EROSION AND SEDIMENT CONTROL NOTES AND DETAILS

PROJECT No.		123-96405
FILE No.		12396405E11-13
REV. 0	SCALE	AS SHOWN
DESIGN	KLL	07-15-2015
CADD	ABM	07-22-2015
CHECK		
REVIEW		

DRAWING 13

TABLE OF CONTENTS

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 Description of Work

This contract includes all personnel, supervision, services, field labor, materials, tools, equipment and supplies for the following:

(a) Mobilization and demobilization;

(b) Post Erosion and Sediment control bond with York County for the duration of the project and coordinate with County inspector to receive required Land Disturbance Permit;

(c) All field engineering and temporary facilities, including design thereof, required to perform the work, including preparation of a Spill Prevention Control and Countermeasure (SPCC) plan if so required, as well as inspection, compliance and reporting requirements included in the site-specific Storm Water Pollution Prevention Plan (SWPPP);

(d) All temporary and permanent sedimentation and erosion control devices and stormwater channels (both temporary and permanent), as described in the Contract Documents and as needed throughout the duration of construction to control sediment. The E&S controls shown on the plans are the minimum requirement – the CONTRACTOR is responsible to prevent sediment and dust from leaving the construction area. Additional controls as required to prevent sediment and/or dust from leaving the site shall be the CONTRACTOR's sole responsibility, including cost;

(e) Surveying services as necessary to determine proper grades and elevations to meet the design subgrade and finish grade surfaces. Prepare record drawings as listed in Section 01564;

(f) Clear, grub, and strip topsoil within limits of work and excavate unsuitable materials and replace with select fill material. Stage and place stockpiled topsoil material at the location provided by the OWNER for later use as vegetative support soil. Stage or place unsuitable excavated material acceptable for use on-site at the location provided by OWNER, and dispose unsuitable materials at approved off-site disposal facility;

(g) Construction and maintenance of temporary and permanent access roads as required;

(h) Excavate, move, place and compact the existing CCR / soil to shape the subgrade as shown on the base grading plan in the Contract Drawings. Shape grades to the minimum grades shown; however, excess subgrade fill material may be used if needed, forming slightly steeper grades on top;

(i) Supply, unload, store, and install all geosynthetic materials at the site, to include LLDPE geomembrane, geocomposite, and geotextile. The OWNER will arrange for geosynthetic conformance testing by an independent laboratory. The CONTRACTOR shall supply and install all other required geosynthetics associated with erosion and sediment control, roads, etc. The OWNER retains the right to ownership of unused, uninstalled materials purchased for this work;

(j) Supply and install 24" diameter drainage pipe with water-tight joints, concrete apron drop inlets, and concrete stilling basins. Where stilling basins discharge to a perimeter channel, a 13-foot section of grouted riprap channel shall be constructed to prevent scouring;

(k) Following placement and approval of geosynthetic materials, the CONTRACTOR shall supply and install the final cover soil to the lines and grades shown on the Contract Drawings, in compliance with the Technical Specifications;

(l) Dismantle the leachate headworks, forcemain, cleanouts and air release valve(s), as well as the leachate collection manhole and monitoring manhole as specified in the contract drawings;

(m) Dewater north and south sediment basins through a sediment filtration device into a stormwater outfall as directed by the OWNER. Remove accumulated sediment from construction activities to restore required basin volumes;

(n) Supply and install soil stabilization matting, seeding, fertilizer, lime and mulch on the final cover soil in areas designated on the Contract Drawings. Supply and install seeding on remaining soil stockpile or disturbed areas once stockpile activities are complete as well as any other areas disturbed during construction;

(o) Remove for off-site disposal materials generated during the course of the work, such as vegetative wastes, pipe, scrap geosynthetics materials, roll cores, etc. Disposal shall be in a landfill facility permitted to receive such wastes and approved by the OWNER; and,

(p) Removal of temporary sediment control devices once site is stable and they are no longer needed.

1.02 Related Sections

(a) Section 01564 - Project Record Documents

1.03 Quantities

The OWNER reserves the right to alter the quantities of Work to be performed at any time when and as found necessary, and the CONTRACTOR shall perform the Work as altered, increased or decreased. Payment for such increased or decreased quantity will be made in accordance with the Contract Documents. No allowance will be made for any change in anticipated profits nor shall such changes be considered as waiving or invalidating any conditions or provisions of the Contract.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 Section Includes

Procedures for measurement and payment for the Work to be done under the respective items listed in the itemized quantity listing for this project.

1.02 Related Sections

(a) Section 01050 - Field Engineering/Surveying

(b) Section 01300 - Submittals

1.03 General

(a) The following paragraphs describe measurement of and payment for the work to be done under the respective items listed in the itemized bid for this contract.

(b) Each lump sum and unit price stated in the itemized bid shall constitute full compensation for not only all labor, equipment and materials necessary and required to complete all work specified under that particular item including clean up, but also all costs for doing related work as set forth in these Specifications and/or on the Contract Drawings or implied in carrying out their intent.

1.04 Computation Of Quantities

(a) Computation of quantities expressed, as area shall represent the actual surface area conditions as closely as possible. Measurement of items expressed in units of area shall be based upon horizontal and vertical projections determined by survey record drawings for each item with allowances for sloped distances. Measurement of material related to anchor trenches shall be made at the top inside corner of the anchor trench as measured in plan view.

(b) Measurement of quantities expressed as volume shall be based upon comparison of survey record drawings performed both prior to and upon completion of each item.

(c) Computation of the volume shall be by the method of average end areas of surveyed cross sections recorded at 50-foot stations at the same locations both prior to construction and upon completion of construction of these items. Measurement of length for these items shall be recorded along the top centerline for purposes of volume computations.

(d) Measurement of linear items such as piping, channel and access roads will be for quantities actually field installed to the specified work limits, based upon surveyed stations recorded along the straight or curved centerline of each respective item.

(e) Payment for items which have been tested and approved by the OWNER shall be based upon actual in-place quantities as determined by record drawings. No payment shall be made for items which have not been tested and approved.

(f) Progress payments for items by weight (ton) shall be as weighed at the Yorktown Power Station Ash Landfill weigh scale, or other equally certified weigh facility as may be approved by OWNER minus the tare weight of the vehicle.

PART 2 - PROCEDURE

The following items will be awarded as the project progresses. These items outline the major components of the work but are not exclusive of other items as may be required to be performed by the CONTRACTOR in completing the Work as required under the Contract Documents. The CONTRACTOR is responsible for providing a detailed schedule of values for the work, inclusive of all required work under the Contract Documents, based on those general bid and payment items as itemized below.

2.01 Item No. 1 - Mobilization and General Conditions

The Lump Sum price for this item shall be payment in full for mobilization and demobilization of all parts, labor, material and equipment to the Site and post-construction review, as well as CONTRACTOR-provided facilities and utilities and ongoing related expenses considered normal for administration (project coordination, meetings, submittals, etc.) of the work.

2.02 Item No. 2 - Survey

(a) The Lump Sum price for this item shall be payment in full for the services of a licensed Commonwealth of Virginia surveyor to establish all lines, elevations, reference marks, etc., needed by the CONTRACTOR during the progress of the work, and from time to time to verify such marks to allow for the accurate and satisfactory construction and completion of the entire work.

(b) The Lump Sum price shall include the following work activities.

1. Verification of original horizontal and vertical control construction stakeout survey and resetting grade marks and control points as needed to establish baseline and control datum for CONTRACTOR's performance of the work hereunder.

2. Survey as necessary to support Payment Requests for partial completion of lump sum pay items.

3. Completion of the Contract Record Drawings as listed in Section 01564.

2.03 Item No. 3 – Spill Prevention, Control and Countermeasure (SPCC) Plan

(a) The lump sum price for this item shall be payment in full for preparation of an SPCC plan for the projected construction activities under the CONTRACTOR'S control. If the CONTRACTOR'S work plan will result in an "exempt" status from the SPCC rules, the OWNER shall be so notified. Regardless of the legal requirement, the OWNER reserves the right to require preparation of an SPCC plan. If required, the SPCC plan must be prepared and certified in accordance with guidance prepared by the United States Environmental Protection Agency and Title 40, Part 112 of the Code of Federal Regulations (40 CFR 112).

2.04 Item No. 4 - Site Clearing and Grubbing

(a) The lump sum price for this item shall be payment in full for clearing and grubbing the area to be disturbed by the construction activities, mulching, and disposal of material at an approved off-site facility unless otherwise approved by OWNER, in accordance with the Drawings and Specifications.

(b) Payment for installation of this item at the Lump Sum price will be made upon completion accepted by OWNER and ENGINEER.

2.05 Item No. 5 - Erosion and Sediment Control

(a) The lump sum price for this item shall be payment in full for preparation of CONTRACTOR's Erosion and Sedimentation Control Plan, as approved by OWNER, and for furnishing, placing, and maintaining over the life of the contract all silt fence, hay bales, diversion swales, diversion berms, construction entrances, and other items necessary to maintain compliance with the CONTRACTOR's Erosion and Sediment Control Plan.

(b) This lump sum price includes the compliance, inspection and reporting requirements included in the site-specific Storm Water Pollution Prevention Plan (SWPPP).

(c) This lump sum price shall include temporary erosion control mat in grass lined drainage channels during the establishment of vegetation or as otherwise shown on the Contract Drawings.

(d) This lump sum shall include labor, equipment, and materials to maintain the construction access road, as well as restoration to the design as shown on the Contract Drawings on completion of construction.

(e) This lump sum shall include removal and disposal of silt accumulated in any permanent drainage structures and features caused by CONTRACTOR's activities prior to demobilization from the Site.

2.06 Item No. 6 – Liner Subgrade Preparation

(a) The lump sum price shall be payment in full for stripping topsoil, excavation of areas found to be overfilled with ash waste, and filling of areas found to be low of ash waste. The subgrade shall be prepared to the extent designated on the

Contract Drawings. Excess soil material will be stockpiled on-site in a location designated by OWNER, in accordance with the Contract Drawings and Specifications. Excess ash waste material shall be used as fill for low areas or transported to the working face of the active landfill.

(b) Areas found to be overfilled with ash shall be excavated to a minimum six-inches below the required base grade elevation and backfilled with clean soil material to establish the specified base grade for the geomembrane liner.

(c) The lump sum price shall include construction dewatering and liquids handling and disposal in accordance with the Contract Drawings and Specifications.

(d) Payment for subgrade cut will be made upon completion of this item as accepted by OWNER and ENGINEER or with Pay Requests as determined by measurement of the area completed and approved.

2.07 Item No. 7 - Earthwork

(a) The lump sum price for this item shall be payment in full for materials, hauling, placing, grading, compacting, and testing fill material to the bottom elevation of the subgrade; exterior berms, and perimeter berms, in accordance with the Contract Drawings and Specifications and in conformance with the lines and grades shown on the Contract Drawings.

(b) Payment for fill material will be made monthly, based upon percent complete as mutually agreed upon by CONTRACTOR and OWNER.

2.08 Item No. 8 - Temporary Access Road Construction and Maintenance

(a) The lump sum price for this item shall be payment in full for providing materials, hauling, placing, and compacting temporary access road fill, geotextile, and coarse aggregate or equivalent surface, and maintaining the temporary access road during construction, in accordance with the Contract Drawings and Specifications, as required, to complete the Work and restoration of the temporary access road to the specifications and per the Contract Drawings for OWNER's use as a permanent maintenance access road upon completion of CONTRACTOR's work.

2.09 Item No. 9 – Polyethylene Geomembrane

(a) The lump sum price for this item shall be payment in full for providing material and installation of the 40-mil LLDPE or 60-mil HDPE geomembrane in accordance with the Specifications and in conformance with the lines, grades and cross-sections in the Contract Drawings. The lump sum price shall include the installation of pipe boots, anchor trenches, trench backfill and compaction, rubsheets, and appurtenances as presented in the Contract Drawings and Specifications.

(b) Payment for geomembrane delivered to the Site, stored and adequately protected will be paid for at direct cost plus shipping charges upon presentation of a valid receipt or bill with the Payment Request. Measurement of installed quantity will be based on actual surface area installed, measured at the inward top of the anchor trench as measured in plan view. Payment for installation of this item at the lump

sum price will be made monthly, until completion of the item, based on an estimated percentage completion and tested and accepted by the OWNER and ENGINEER, with deductions made for the amount(s) previously paid by OWNER for the cost of material and shipping.

2.10 Item No. 10 – Geocomposite

(a) The lump sum price for this item shall be payment in full for providing material and installation of the double-sided geocomposite in accordance with the Specifications and in conformance with the lines, grades and cross-sections in the Contract Drawings. The lump sum price shall include the installation as presented in the Contract Drawings and Specifications.

(b) Payment for double-sided geocomposite delivered to the Site, stored and adequately protected will be paid for at direct cost plus shipping charges upon presentation of a valid receipt or bill with the Payment Request. Measurement of installed quantity will be based on actual surface area installed, measured at the inward top of the anchor trench as measured in plan view. Payment for installation of this item at the lump sum price will be made monthly, until completion of the item, based on an estimated percentage completion and tested and accepted by the OWNER and ENGINEER, with deductions made for the amount(s) previously paid by OWNER for the cost of material and shipping.

2.11 Item No. 11 – Earthen Material Layer

(a) The lump sum price for this item shall be payment in full for providing materials, hauling, grading, and compacting of the Earthen Material layer in accordance with the Contract Drawings and Specifications and in conformance with the lines, grades and cross-sections shown on the Contract Drawings.

(b) Payment for the subgrade layer at the lump sum price will be made monthly, until completion of this item, based on percentage completion and accepted by OWNER and ENGINEER as shown on progress record drawings.

2.12 Item No. 12 – Downchute Channels

(a) The lump sum price for this item shall be payment in full for providing materials, hauling, grading, and construction of the Downchute Channels in accordance with the Contract Drawings and Specifications and in conformance with the lines, grades and cross-sections shown on the Contract Drawings.

(b) Payment for the Downchute Channels at the lump sum price will be made monthly, until completion of this item, based on Square Yardage completed and accepted by OWNER and ENGINEER as shown on progress record drawings.

2.13 Item No. 13 – Vegetative Soil Layer

(a) The lump sum price for this item shall be payment in full for providing materials and installation of the 6-inch vegetative soil layer in accordance with the Specifications and in conformance with the lines and grades shown on the Contract Drawings.

(b) Payment for installation of this item at the lump sum price will be made monthly, until completion of the item, based on an estimated percentage completion and accepted by the OWNER and ENGINEER.

2.14 Item No. 14 – Final Cover Access Road

(a) The lump sum price for this item shall be payment in full for providing materials and installation of the final cover access road, aggregate surface of the road, drainage culverts and headwalls in accordance with the Specifications and Contract Drawings.

(b) Payment for installation of this item at the lump sum price will be made monthly, until completion of the item, based on an estimated percentage completion and accepted by the OWNER and ENGINEER.

2.15 Item No. 15 – Permanent Seeding

(a) The lump sum price for this item shall be payment in full for providing materials and installation of lime, fertilizer, seed, mulch, tack, scarification, spreading, rolling, watering, and re-seeding as needed to the vegetative support layer in accordance with the Specifications and Contract Drawings.

(b) Payment for installation of this item at the lump sum price will be made monthly, until completion of the item, based on an estimated percentage completion and accepted by the OWNER and ENGINEER. The CONTRACTOR shall re-seed at no cost to OWNER, as needed, to achieve minimum 95% coverage within 1 year of initial seeding.

2.16 Item No. 16 – Downchute Scourholes

(a) The lump sum price for this item shall include payment in full for excavation as needed, and construction of scourholes at the base of each constructed downchute channel in accordance with the Specifications and Contract Drawings.

(b) Payment for installation of this item at the lump sum price will be made monthly based upon percent complete as mutually agreed upon by CONTRACTOR and OWNER.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01050

FIELD ENGINEERING/SURVEYING

PART 1 - GENERAL

1.01 Description of Work

Work under this Section includes all surveying services for accurate location of all features of construction and establishing proposed grades.

1.02 Related Sections

a. Section 01010 - Summary of Work

b. Section 01025 - Measurement and Payment

c. Section 01564 - Project Record Documents

1.03 Quality Control

CONTRACTOR is responsible for all surveying necessary for control of its work at the site. The Surveyor shall be a qualified and Registered Land Surveyor in the Commonwealth of Virginia. This Surveyor shall also have a minimum of two years experience in Construction Surveying layout and maintenance of as-built construction drawings with a record of performing horizontal and vertical control requirements as stated in the contract.

1.04 Submittals

a. Name, address, and telephone number of Surveyor shall be submitted to OWNER before starting survey work by CONTRACTOR.

b. On request, documentation verifying accuracy of survey work shall be submitted to OWNER by CONTRACTOR.

1.05 Survey Requirements

a. CONTRACTOR shall utilize existing control points and establish new control points as needed to complete work under this section.

b. CONTRACTOR shall provide field engineering services and use recognized engineering survey practices.

c. Establish elevations, lines and levels. Locate and layout by instrumentation and similar appropriate means site improvements including roadways, stakes for grading and fill placement, utility locations, slopes, and invert elevations.

d. Periodically verify layouts by same means.

1.06 Survey Tolerances

Grading Tolerances shall be as defined in Section 3.02 of this specification.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 Inspection

CONTRACTOR shall verify locations of site reference and survey control points prior to starting work. OWNER must be promptly notified of any discrepancies discovered.

3.02 Survey Reference Points

a. CONTRACTOR shall take measures to protect site reference and survey control points prior to starting site work, and must preserve permanent reference points during construction. Site reference points may not be relocated without prior written notice to OWNER.

b. The OWNER shall be immediately notified of loss, damage or destruction of any reference point, or relocation required because of changes in grades or other reasons. CONTRACTOR shall replace disturbed survey control points based on original survey control at no extra cost.

c. X, Y and Z coordinates of benchmarks and survey control points shall be determined (and recorded) with a maximum permissible error of 0.10 feet (±) in any coordinate direction.

d. All X and Y coordinates are to be referred to the Plant Grid and Plant Datum coordinate system with an accuracy of 0.10 feet (±).

e. All Z coordinates are to be referred to nearest NGVD benchmark with an accuracy of 0.10 feet (±).

3.03 Survey Requirements

a. CONTRACTOR shall reference survey and data reference points to permanent benchmarks and record locations of survey control points, with horizontal and vertical data.

b. CONTRACTOR shall reverify layouts periodically during construction by same means.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Wherever submittals are required in this and other Sections of the Technical Specifications, all such submittals by the CONTRACTOR shall be submitted to the ENGINEER.

B. Prior to mobilization onto the Site and within seven (7) days after date of commencement as stated in the Notice to Proceed:

1. The CONTRACTOR shall submit a Construction Schedule using critical path analysis. This schedule shall indicate man loading and the start and completion dates of the various stages of the Work.
2. The CONTRACTOR shall prepare a preliminary schedule of submittals and submit it to the ENGINEER for review. The schedule should include Shop Drawing, sample, and proposed substitutes or "or equal" submittals. The CONTRACTOR shall thoroughly read each Section of the Technical Specifications and carefully review the Design Drawings and reference the Specification for each submittal. The submittals comprising the schedule shall be numbered in a systematic and logical fashion that allows for future additions or deletions. This schedule shall be a prerequisite to the first partial payment.
3. The CONTRACTOR shall submit a Site-Specific Health and Safety Plan developed in accordance with Section 01550 of the Technical Specifications and OSHA 1910.120 regulations.
4. The CONTRACTOR shall submit its unit rate schedule for manpower and equipment to be used for any time-and-material Work, if required.
5. The CONTRACTOR shall submit a list of potential permits and approvals, which may be required to perform the Work.
6. The CONTRACTOR shall submit an Erosion and Sediment Control Plan in accordance with Section 02125 of the Technical Specifications.

C. Identification and provision of any details deemed by the CONTRACTOR, as required for construction but not indicated on the Design Drawings, are the responsibility of the CONTRACTOR.

1.02 SHOP DRAWING SUBMITTAL

A. Whenever called for in the Contract Documents, or where required by the OWNER, the CONTRACTOR shall furnish to the ENGINEER for review, five (5) copies of each Shop Drawing submittal. The ENGINEER shall submit this information to the OWNER for final review and comment. The term "Shop Drawings," as used herein, shall be understood to include detailed design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, operating instructions, catalog sheets, data sheets, and similar items.

B. All Shop Drawing submittals shall be accompanied by a fully completed OWNER's standard submittal transmittal form. This form may be obtained in quantity from the OWNER or ENGINEER at reproduction cost. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal.

C. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items, using a single transmittal form, will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the ENGINEER and OWNER.

D. All materials of a submittal shall be clearly legible. When only a particular portion of stand-issue material, such as a manufacturer's catalog or data sheet, is relevant to a submittal, the relevant portion(s) shall be clearly indicated on all copies and all non-relevant portion(s) shall be struck through on all copies.

E. Except for submittals which are provided for information purposes, the ENGINEER, upon final review by the OWNER, will return prints of each submittal to the CONTRACTOR with its comments noted thereon, within fifteen (15) calendar days following their receipt by the ENGINEER. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the ENGINEER by either the first or the second submission of a submittal item. The OWNER reserves the right to withhold monies due the CONTRACTOR to cover additional costs of the review beyond the second submittal. Any consequences or delays due to unacceptable submittals will not be cause for extensions in schedule.

F. If the submittal is returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.

G. If the submittal is returned to the CONTRACTOR marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal will not be required. Final Record Drawings must reflect requested changes.

H. If the submittal is returned to the CONTRACTOR marked "AMEND-RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the ENGINEER and OWNER.

I. If the submittal is returned to the CONTRACTOR marked "REJECTED-RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the ENGINEER and OWNER.

J. Fabrication of an item may be commenced only after the ENGINEER and/or OWNER have reviewed the pertinent submittals and copies have been returned by the ENGINEER to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work. Items fabricated without approval will not qualify for payment.

K. The CONTRACTOR's Shop Drawing submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the ENGINEER and OWNER. Each submittal shall be dated, signed, and certified by the CONTRACTOR, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. No consideration for review by the OWNER and/or ENGINEER of any CONTRACTOR submittals will be made for any items that have not been so certified by the CONTRACTOR. All non-certified submittals will be returned to the CONTRACTOR without action taken by the OWNER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

L. The ENGINEER and/or OWNER review of CONTRACTOR Shop Drawing submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in the CONTRACTOR's submittals. The CONTRACTOR shall be responsible for the dimensions and design of adequate connections and details.

M. The CONTRACTOR shall present Shop Drawings at least one month before Work is due to start unless agreed to in writing by the CONTRACTOR and OWNER.

1.03 CONTRACTOR'S PROGRESS SCHEDULE SUBMITTALS

A. The CONTRACTOR's initial Construction Schedule, using critical path analyses, shall be prepared and submitted to the ENGINEER within five (5) days after date of OWNER-CONTRACTOR Agreement. This schedule will show the starting and completion dates of the various stages of the Work.

1.04 PROPOSED SUBSTITUTES OF “OR EQUAL” ITEMS

A. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function, and quality required. If the name is followed by the words “or equal” or “or approved equal” indicating that a substitution is permitted (i.e., if “or equal” is not indicated, substitutes are not allowed), materials or equipment of other suppliers may be accepted by the OWNER and/or ENGINEER and DESIGNER if sufficient information is submitted by the CONTRACTOR and verified by the ENGINEER and DESIGNER to allow the OWNER to determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements:

1. The burden of proof as to the type, function, and quality of any such substitute material or equipment shall be upon the CONTRACTOR.
2. The OWNER and ENGINEER and DESIGNER will determine as to the type, function, and quality of any such substitute material or equipment and the OWNER’S decision shall be final.
3. The OWNER an/or ENGINEER may require the CONTRACTOR to furnish at the CONTRACTOR’s expense additional data about the proposed substitute.
4. The OWNER and/or ENGINEER may require the CONTRACTOR to furnish at the CONTRACTOR’s expense a special performance guarantee or other surety with respect to any substitution.
5. Acceptance by the OWNER of a substitute item proposed by the CONTRACTOR shall not relieve the CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute item.
6. The CONTRACTOR shall be responsible for resultant changes and all additional costs which the accepted substitution requires in the CONTRACTOR’s Work, the Work of its Subcontractors and of others, and shall effect such changes without cost to the OWNER.
7. All proposed substitutions shall be listed at the time of bidding.

B. The procedure for review by the OWNER will include the following:

1. If the CONTRACTOR wishes to furnish or use a substitute item of material or equipment, the CONTRACTOR shall make written application through the ENGINEER to the OWNER.
2. Unless otherwise provided by law or authorized in writing by the OWNER, the substitution request shall be submitted within the ten (10) day period after Notice of Award of the Work.

3. Wherever a proposed substitute material or equipment has not been submitted within said twenty-one (21) day period, or wherever the submission of a proposed substitute material or equipment has been judged to be unacceptable by the OWNER, the CONTRACTOR shall provide the material or equipment named in the Contract Documents. The OWNER, at his sole discretion, may elect to waive or shorten the twenty-one (21) day period.

4. The CONTRACTOR shall certify that the proposed substitute will adequately perform the functions and achieve the results called for by the general design, be similar and of equal substance to that specified, and be suited to the same use as that specified.

5. The OWNER and/or ENGINEER and DESIGNER will be allowed a reasonable time within which to evaluate each proposed substitute with assistance from the CONTRACTOR.

6. As applicable, no Shop Drawing submittals will be made for a substitute item nor will any substitute item be ordered, installed, or utilized without the OWNER's prior written acceptance of the CONTRACTOR's substitution request.

7. The ENGINEER and DESIGNER will record the time, materials, and expenses required by the OWNER and ENGINEER to evaluate substitutions proposed by the CONTRACTOR and to make changes in the Contract Documents occasioned thereby.

C. The CONTRACTOR's substitution application shall contain the following statements and/or information that shall be considered by the OWNER and ENGINEER in evaluating the proposed substitution:

1. The evaluation and acceptance of the proposed substitute will not prejudice the CONTRACTOR's achievement of substantial completion on time.

2. Whether or not acceptance of the substitution for use in the Work will require a change in any of the Contract Documents to adapt the design to the proposed substitute.

3. Whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.

4. All variations of the proposed substitute for that specified shall be identified.

5. Available maintenance, repair, and replacement service shall be indicated.

6. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including cost of redesign and claims of other Contractors affected by the resulting change.

1.05 SAMPLES SUBMITTAL

A. Whenever in the Technical Specifications samples are required, the CONTRACTOR shall submit at his expense, not less than three (3) samples of each such item or material to the ENGINEER for review at no additional cost to the OWNER. The ENGINEER shall submit this information to the OWNER for final review and comment.

B. Samples, as required herein, shall be submitted for acceptance a minimum of twenty-one (21) days prior to ordering such material for delivery to the Site, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the Work.

C. All samples shall be individually, legibly, and indelibly labeled or tagged, indicating thereon all specified physical characteristics and Supplier's names for identification and submittal to the ENGINEER and/or acceptance by the OWNER. Upon receiving acceptance of the OWNER, one set of the samples will be stamped and dated by the ENGINEER and returned to the CONTRACTOR, one set will be retained by the OWNER, and one set of samples shall remain at the Site until completion of the Work.

D. Unless otherwise specified, all colors and textures of specified items will be selected by the OWNER from the manufacturer's standard colors and standard materials, products, or equipment lines.

E. Any tests performed by the ENGINEER to verify acceptability of substitutes shall be at the CONTRACTOR's expense.

1.06 TECHNICAL MANUAL SUBMITTAL

A. The CONTRACTOR shall furnish to the OWNER four (4) identical sets of Technical Manuals, also sometimes referred to as O&M Manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, three-ring, loose leaf, and vinyl plastic hard cover binder suitable for bookshelf storage. A binder's ring size shall not exceed three (3) inches. The contents of the Technical Manual(s) shall be well organized to the OWNER's satisfaction and subsections shall be separated with dividers. A table of contents shall be provided which indicates all equipment and related information bound in the Technical Manuals.

B. The CONTRACTOR shall include in the Technical Manual(s) for each item the following:

1. Complete operating instructions, including location of controls, special tools or other equipment required, related instrumentation, and other equipment needed for operation.

2. Lubrication schedules, including the lubricant SAE grade and type, temperature range of lubricants, and including frequency of required lubrication.

3. Preventative maintenance procedures and schedules.

4. Parts lists, by generic title and identification number, complete, with exploded views of each assembly.

5. Disassembly and reassembly instructions.

6. Name and location of nearest supplier and spare parts warehouse.

7. Recommended troubleshooting procedures.

8. Reproducible prints of the Record Drawings, including diagrams and schematics, as required under the electrical and instrumentation ports of the Technical Specifications.

C. All Technical Manual(s) shall be submitted in final form to the OWNER not later than the seventy-five percent (75%) percent of construction completion date. All discrepancies or deficiencies found by the OWNER and/or ENGINEER in the Technical Manual(s) shall be corrected by the CONTRACTOR within 30 days from the date of written notification by the OWNER and/or ENGINEER.

1.07 RECORD DRAWINGS SUBMITTAL

A. The CONTRACTOR shall keep and maintain at the Site, one set of Record Drawings ("As-Built Drawings"). On these, the CONTRACTOR shall mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Design Drawings, including buried or concealed construction and utility features which were revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Design Drawings. The Record Drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master Record Drawings of the CONTRACTOR's representation of as-built conditions, including all revisions made necessary by addenda, change orders, and the like shall be maintained up-to-date during the progress of the Work. The OWNER and/or ENGINEER shall verify the accuracy of the information.

B. Record Drawings shall be accessible to the OWNER and/or ENGINEER at all times during the construction period and shall be delivered to the OWNER upon completion of the Work. Submit in accordance with Section 1564.

1.08 MANUFACTURER'S INSTRUCTIONS

A. When specified by individual Sections of the Technical Specifications, submit manufacturer's printed warranties, instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data. All warranties shall be in the OWNER's name, where applicable.

B. The CONTRACTOR shall identify conflicts between the manufacturer's instructions and Contract Documents.

1.09 MANUFACTURER'S CERTIFICATES

A. When specified by individual Sections of the Technical Specifications, submit manufacturer's certificate(s) to the OWNER for review, in quantities specified for Product Data.

B. Indicate that the material or product conforms to, or exceeds, specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.

B. Certificates may be recent or previous test results on the material or product, but must be acceptable to the OWNER.

1.10 LIST OF EQUIPMENT AND PERSONNEL

A. The CONTRACTOR shall provide the OWNER and ENGINEER with a listing of all construction equipment and construction personnel tabulated by day. The ENGINEER will verify the information for accuracy and submit to the OWNER.

1. The list of construction equipment shall include the manufacturer, model number, hours used, and component of Work performed for all equipment on-site. The initial submittal shall include hourly and weekly rental rates for each piece of equipment as well as the hourly operating costs thereof.

2. The list of construction personnel shall include employee name, job classification, hours worked, and component of Work performed for all of the CONTRACTOR's employees and Subcontractors not otherwise considered site overhead.

B. The listing of construction equipment and construction personnel shall be submitted with each request for payment. Application for Payment will not be processed unless complete and includes listing of equipment and personnel.

1.11 SHEETING, SHORING, BRACING, OR SLOPING OF TRENCH PLAN SUBMITTAL

A. Prior to commencement of any excavation which has a planned depth greater than the threshold limits of the OSHA regulations, the CONTRACTOR shall submit to the OWNER and ENGINEER a detailed plan showing the design of sheeting, shoring, bracing, sloping, or equivalent method and shall be in receipt of the OWNER acceptance of same. This design shall be sealed by a registered Professional Engineer licensed in the Commonwealth of Virginia.

1.12 SOIL EROSION AND SEDIMENTATION CONTROL PLAN

A. Prior to performing any soil removal or material placement, the CONTRACTOR shall submit a plan for temporary and permanent erosion and sedimentation control in accordance with Section 02125 of the Technical Specifications.

1.13 DAILY, WEEKLY, AND MONTHLY REPORTS

A. The CONTRACTOR shall prepare daily reports summarizing on-site activities. Daily reports shall include as a minimum the following:

1. Weather conditions;
2. Active work area;
3. Crew description;
4. Subcontractor activity;
5. Equipment operating;
6. Hours worked;
7. Work performed;
8. Problems; and,
9. Health and safety issues.

B. The CONTRACTOR shall also submit weekly and monthly reports describing the activities of the period. Daily reports shall be submitted the day following the report day. Weekly reports shall be submitted within three (3) days of the report period. Monthly reports shall be submitted within fourteen (14) days of the report period.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01400

QUALITY ASSURANCE/QUALITY CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Dominion Yorktown Power Station (OWNER) will employ and pay for the services of the Construction Quality Assurance (CQA) Consultant for observing, testing and documenting activities related to the quality assurance at the site, to assure the OWNER that the Work is completed according to the CQA Plan, Specifications, and Drawings. Onsite Quality Control testing is the responsibility of the CONTRACTORs in respect to their Work.

B. CONTRACTOR shall cooperate with the CQA Consultant to facilitate the execution of its required services.

C. Employment of the CQA Consultant shall in no way relieve CONTRACTOR's obligations to perform the Work and supply materials in accordance with the Contract Documents.

D. The CONTRACTOR shall provide any additional testing he requires to control construction quality at no additional cost to the OWNER.

1.02 Related Section

(a) Section 01300 - Submittals

(b) Section 01410 - Testing Laboratory Services

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 CONTRACTOR'S RESPONSIBILITIES

The CONTRACTOR shall:

A. Cooperate with the CQA Consultant and its personnel and provide access to Work and to Supplier's operations.

B. Secure and deliver to the CQA Consultant adequate quantities of representative samples of materials proposed to be used which require testing.

C. Furnish copies of Supplier's test reports as required.

D. Furnish incidental labor and facilities:

1. To provide access to Work to be tested.

2. To obtain and handle samples at the Project site or at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For storage and curing of test samples.

5. To maintain records and documentation for handling and processing samples.

E. Coordinate activities to accommodate services with a minimum delay. Notify CQA Consultant 48 hours in advance of operations to allow for laboratory assignment of personnel and scheduling of tests. When tests or inspections cannot be performed after such notice, reimbursing OWNER for laboratory personnel and travel expenses incurred due to CONTRACTOR's negligence.

F. Employ and pay for the services of a separate, qualified independent testing laboratory to perform additional inspections, sampling and testing required:

1. for the CONTRACTOR's convenience,

2. as required by the Specifications and the CQA Plan, or

3. when initial tests indicate Work does not comply with Contract Documents.

G. Promptly notify the CQA Consultant of observed irregularities or deficiencies of Work or products.

H. Promptly submit five copies of a written report of each test to CQA Consultant. Each report shall include:

1. Date issued.

2. Project title and number.

3. Testing laboratory name, address and telephone number.

4. Name and signature of laboratory inspector.

5. Date and time of sampling or inspection.

6. Record of temperature and weather conditions.

7. Date of test.

8. Identification of product and specification section.

9. Location of sample or test in the Project.

10. Type of inspection or test.

11. Results of tests and compliance with Contract Documents.

12. Interpretation of test results, when requested by CQA Consultant.

I. Be responsible for retesting, at no cost to the OWNER, where results of inspections and tests prove unsatisfactory and indicates noncompliance with requirements.

3.02 REPAIR AND PROTECTION

Unless specified otherwise, the CONTRACTOR shall protect construction exposed for testing and shall repair construction damaged by sampling, testing or inspection.

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 Description of Work

(a) The OWNER will select and employ an Independent Testing Laboratory to perform services as required by the supplementary General Conditions and the Technical Specifications.

(b) The OWNER shall pay all charges of the Testing Laboratory.

1.02 Related Sections

(a) Submittals - Section 01300

(b) Project Record Documents - Section 01564

1.03 Laboratory Duties

(a) Cooperate with OWNER, ENGINEER and QAC, provide qualified personnel promptly on notice. Perform specified inspections, sampling and testing of materials and methods of construction; ascertain compliance with requirements of Contract Documents.

(b) Promptly notify OWNER, ENGINEER and QAC of irregularities or deficiencies of work which are observed during performance of services. Submit two (2) copies of reports of inspections and tests to OWNER, including:

(1) Date issued

(2) Project title and number

(3) Testing Laboratory name and address

(4) Name and signature of Inspector

(5) Date of inspection or sampling

(6) Record of temperature and weather

(7) Date of test

(8) Identification of product and specification section

(9) Location in project

(10) Type of inspection or test

(11) Observations regarding compliance with Contract Documents

(c) Laboratory is not authorized to release, revoke, alter or enlarge on requirements of Contract Documents; to approve or accept any portion of work, or perform any duties of the CONTRACTOR.

1.04 Laboratory Reports

(a) After each inspection and test, WITHIN 72 HOURS, submit two (2) copies of laboratory report to QAC, ENGINEER and to the OWNER.

(b) Include:

(1) Date issued

(2) Project title and number

(3) Name of inspector

(4) Date and time of sampling or inspection

(5) Identification of product and Specifications Section

(6) Location in the Project

(7) Type of inspection or test

(8) Date of test

(9) Results of tests

(10) Conformance with Contract Documents

(c) When requested by OWNER, provide interpretation of test results.

1.05 CONTRACTOR's Responsibility

(a) Cooperate with Laboratory personnel and provide access to work.

(b) Provide to Laboratory, preliminary representative samples of materials to be tested, in required quantities.

(c) Furnish casual labor and facilities to provide access to work to be tested, to obtain and handle samples at the site, and to facilitate inspections and tests.

(d) Notify Laboratory sufficiently in advance of operations to allow for his assignment of personnel and schedule of tests.

(e) Arrange with Laboratory, and pay for, any additional samples and testing required for CONTRACTOR's convenience.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01540

DUST CONTROL

PART 1 - GENERAL

1.01 Description of Work

The CONTRACTOR shall employ construction methods and means that keep airborne particulates to the minimum and shall provide for the application of water or employ other appropriate preventive means or methods to maintain dust control, subject to the approval of the OWNER.

Dust control measures shall be compatible with existing on-site materials and proposed materials.

1.02 Related Sections

(a) Site Preparation - Section 02100

(b) Site Clearing and Grubbing- Section 02110

(c) Earthwork - Section 02220

(d) "Fugitive Dust Control Plan" Yorktown Power Station – Coal Combustion Residual Management

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Watering equipment shall be used to minimize airborne concentrations and shall consist of pipelines, tank trucks, or other devices approved by the OWNER, which are capable of applying a uniform spread of water over the ground surface. A suitable device for a positive shut-off and for regulating the flow rate of water shall be located so as to permit positive operator control. Calcium chloride is not allowed for dust control.

END OF SECTION

SECTION 01550

HEALTH AND SAFETY
SPECIFICATIONS FOR CONSTRUCTION

PART 1 - GENERAL

1.01 Description of Work

(a) The CONTRACTOR is responsible to monitor working conditions at all times during construction and, if it is found to be necessary, to provide appropriate protective clothing, equipment and facilities for his personnel, and/or to establish workplace procedures to ensure their safety, and to enforce the use of these procedures, equipment and/or facilities in accordance with the following guidelines:

1. Safety and Health Regulations Promulgated by the U.S. Department of Labor OSHA, 29 CFR 1910 - Occupational Safety and Health Standards, and 29 CFR 1920 - Safety and Health Regulations for Construction.

2. U.S. Environmental Protection Agency Interim Standard Operating Safety Guides - Office of Emergency and Remedial Response - Hazardous Response Support Division, Rev. September 1982.

3. U.S. Environmental Protection Agency Medical Monitoring Program Guidelines.

4. CONTRACTOR's Health and Safety Plan.

5. Dominion Safety Policies

(b) If, at any time, the OWNER is apprised of a safety hazard which demands immediate attention because of its high potential for harm to public travel, persons on or about the work, or public or private property, the OWNER shall have the right to order such safeguards to be erected and such precautions to be taken as necessary and the CONTRACTOR shall comply with such orders.

If, under such circumstances, the CONTRACTOR does not or cannot immediately put the work into proper and approved condition, or if the CONTRACTOR or his representative is not upon the Site so that he can be notified immediately of the insufficiency of safety precautions, then the OWNER may put the work into such a condition that it shall be, in his opinion, in all respects safe, and the CONTRACTOR shall pay all expenses of such labor and materials as may have been used for this purpose by him or by the OWNER. The fact that the OWNER does not observe a safety hazard or does not order the CONTRACTOR to take remedial measures shall in no way relive the CONTRACTOR of the entire responsibility for any

costs, loss or damage by any party sustained on account of the insufficiency of the safety precautions taken by him or by the OWNER acting under authority of this Section.

(c) It is the responsibility of the CONTRACTOR to take appropriate safety precautions to meet whatever conditions of hazard may be present during the performance of the Work, whether reasonably foreseeable or not. The CONTRACTOR is alerted to the fact that it shall be his responsibility to anticipate and provide such additional safety precautions, facilities, personnel and equipment as shall be necessary to protect life and property from whatsoever conditions of hazard are present or may be present.

1.02 Submittals

The CONTRACTOR shall prepare and submit a Health and Safety Plan to the OWNER at least 7 calendar days prior to mobilization for construction. Submission of the Health and Safety Plan by the CONTRACTOR shall not relieve the CONTRACTOR of the Regulatory Requirements given in Part 1.01 above.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 RECORD KEEPING

All parties engaged in on-site activities must read the CONTRACTOR's Health and Safety Plans for the relevant tasks. Documentation demonstrating compliance with this requirement shall be maintained on-site by the CONTRACTOR.

3.02 ON-SITE CONTROL

CONTRACTOR shall be responsible for the enforcement of all on-site safety rules. The CONTRACTOR's Health and Safety Officer shall periodically evaluate the adequacy of the Work zone protocol. Personnel shall maintain visual/aural contact with at least one other person on-site.

END OF SECTION

SECTION 01564

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 Description of Work

(a) The work under this Section includes, but is not necessarily limited to, the maintenance, recording and submittal of Project Record Documents as herein specified.

(b) The CONTRACTOR shall maintain in designated locations at the Site for the OWNER one record copy of:

(1) Drawings and Addenda.

(2) Specifications and Addenda.

(3) Change orders and other modifications to the Contract

(4) OWNER/CQA consultant field orders or written instructions

(5) Reviewed shop drawings, product data and samples

(6) Field test records

(7) Manufacturer's certificates

(8) Daily work activity reports, including:

a. Field test records
b. Photographs
c. Reports on emergency response actions
d. Records of all site work
e. Chain-of-custody documents
f. Laboratory test records
g. Meteorological records
h. Daily inspection records
i.. Reports on all safety and accident incidents
j. Reports on all spill incidents
k. Air monitoring reports and data
l. Manifest documents, truck-load tickets and shipping papers
m. Security records
n. Other items that may be required by OWNER
o. Log of control and survey work

(c) Other Documents: Manufacture's certifications, inspection certifications, field test records required by individual Specifications Sections.

(d) The CONTRACTOR shall keep and maintain at the Site, one set of progress drawings. On these, it shall mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings. The record drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These progress drawings of the CONTRACTOR's representation of as-built conditions, including all revisions made necessary by addenda, change orders, and the like shall be maintained up-to-date during the progress of the Work.

(e) Progress drawings shall be accessible to the CQA consultant at all times during the construction period and shall be delivered to the CQA consultant upon completion of the Work.

(f) Upon Substantial Completion of the Work and prior to final acceptance, the CONTRACTOR shall complete and deliver 4 complete hard copy sets of record drawings and two compact disks containing Autocad DWG and Land-Surveyor sealed Adobe PDF versions of the complete record drawing set to the CQA consultant, conforming to the construction records of the CONTRACTOR. This set of drawings shall consist of corrected drawings showing the reported location of the Work. The information submitted by the CONTRACTOR and incorporated by the CQA consultant into the Record Drawings will be assumed to be reliable, and the CQA consultant will not be responsible for the accuracy of such information, nor for any errors or omissions which may appear on the Record Drawings as a result.

1.02 Maintenance of Documents and Samples

(a) Storage

(1) Store documents and samples in CONTRACTOR's field office apart from documents used for construction.

(2) Provide files and racks for storage of documents.

(3) Provide locked cabinet or secure storage space for storage of samples.

(b) File documents and samples in accordance with format of these Specifications.

(c) Maintenance

(1) Maintain documents in a clean, dry, legible condition and in good order.

(2) Do not use record documents for construction purposes.

(d) Make documents and samples available at all times for inspection by OWNER.

1.03 Recording

(a) Drawings: Progress drawings shall be reproducible, shall have a title block indicating that the drawings are record drawings, the name of the company preparing the progress drawings and the date the progress drawings were prepared. The CONTRACTOR will be provided paper sepias of the Contract Drawings, at the cost of reproduction, or he may elect to provide reproducible drawings via another method. Legibly mark drawings to record actual construction:

(1) Field changes of dimension and detail.

(2) Changes made by Requests for Information (RFI), field order or by change order.

(3) Details not on original Contract Drawings.

(b) Specifications: Legibly mark each section to record:

(1) Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

(2) Changes made by Requests for Information (RFI), field order or by change order.

1.04 Submittal

(a) At Contract closeout, deliver record documents in the form of a Final Construction Report to the OWNER.

(b) Accompany submittal with transmittal letter, in duplicate, containing:

(1) Date

(2) Project title and number

(3) CONTRACTOR's name, address, and telephone number

(4) Title and number of each record document

(5) Signature of CONTRACTOR's authorized representative.

PART 2 – PRODUCTS

2.01 Record Drawings

The CONTRACTOR shall submit, as described in Section 1.01 (f) of this specification, as-built drawings sealed by a Virginia Licensed Land Surveyor. These drawings must be to scale, have a contour interval of 2 feet or less, and be on a 24”x36” sheet size.

- As a minimum, drawings will include (as appropriate for the project):
- Existing (pre-construction) Conditions;
- Top of Geosynthetic subgrade;
- Geosynthetic panel layout and destructive sample locations;
- Geosynthetic panel layout including panel numbers, roll numbers and repair locations;
- Top of Final Cover Layer, including thickness verification of layer;
- Other project-specific construction items

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 02110

SITE CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 Description of Work

(a) The CONTRACTOR shall furnish all materials, labor, equipment, tools and appurtenances required to complete the work as described below. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

(b) Site clearing includes, but is not limited to, removing from the limits of work and disposing of trees, stumps, roots, brush, structures, abandoned utilities, trash, asphalt, debris and all other materials found on or near the surface of the ground in the construction area. Precautionary measures that prevent damage to existing features to remain are part of the work.

(c) Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.

(d) No clearing and grubbing will be allowed without adequate erosion and sedimentation control measures in place and to the satisfaction of the OWNER or ENGINEER.

1.02 Related Sections

(a) Section 01540 - Dust Control

(b) Section 01550 - Health & Safety Specifications for Construction

(c) Section 02125 - Temporary and Permanent Erosion and Sediment Control

(d) Section 02220 - Earthwork

1.03 Job Conditions

Location of the Work: The area to be cleared and grubbed includes all areas designated for cell construction, access road construction, channel construction, Leachate basin construction, excavation and required construction access areas.

PART 2 - PRODUCTS

The CONTRACTOR shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, dozers, shears, skidders, loaders, root rakes, chipping equipment and stump grinders.

PART 3 - EXECUTION

3.01 Scheduling Of Clearing

(a) CONTRACTOR shall install all temporary Soil Erosion and Sedimentation Control Plan per CONTRACTOR's plan to the acceptance of OWNER and ENGINEER prior to start up of clearing operations. Possession of a valid Land Disturbance Permit from York County is also required prior to commencing clearing activities.

(b) CONTRACTOR shall maintain all survey controls.

3.02 Construction Area Clearing And Grubbing

(a) Materials to be cleared, grubbed and removed from the construction areas include, but are not limited to, the following: all trees, stumps, roots, brush, trash, organic matter, miscellaneous structures, debris and abandoned utilities.

(b) Grubbing shall consist of completely removing roots, stumps, trash and other debris from all graded areas so that surface material is free of roots and debris. Surface material is to be left sufficiently clean so that further picking and raking will not be required.

(c) All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed.

(d) Surface rocks and boulders shall be grubbed from the soil and removed to the area on Site as directed by the OWNER.

(e) All construction areas shall be grubbed by tractors with root rakes.

(f) Where tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility. The CONTRACTOR shall be responsible for damages to utilities and shall replace/repair damaged utilities at no cost to OWNER.

(g) Any work pertaining to utility poles and guy wires shall comply with the requirements of the appropriate utility.

(h) After removing small growth less than 6 inches in diameter in the staging area, the CONTRACTOR shall protect all existing growth larger than 6 inches in diameter. Any potential growth damaged by the CONTRACTOR shall be replaced with vegetation of similar species and size as approved by the OWNER at no cost to the OWNER.

(i) Stumps and roots shall be grubbed and removed to a depth not less than two feet below grade. All holes or cavities which extend below the subgrade elevation of the proposed work shall be filled with crushed rock or other

suitable material, compacted to a similar density as the surrounding material.

(j) The CONTRACTOR shall exercise special precautions for the protection and preservation of trees and shrubs situated adjacent to the limits of the construction area. The CONTRACTOR shall be held liable for any damage the CONTRACTOR's operations have inflicted on such property.

(k) The CONTRACTOR shall be responsible for all damages to existing structures and/or improvements resulting from CONTRACTOR's operations.

3.03 Overhead Utility Line Right of Way Clearing

(a) All tree trimming operations within the right of way of overhead utility lines shall be completed in accordance with Dominion Virginia Power Specifications.

(b) Trees at edge of right of way shall be side-walled ground to sky.

(c) Stumps shall be cut to within 3" of ground level.

(d) Brush shall be chipped and windrowed out of right of way, or ground up with a brush hog in the right of way.

(e) No wood shall be left in right of way (stack it out of right of way).

3.04 Disposal Of Debris

(a) All wood debris (stumps, roots, branches, and leaves) resulting from the clearing and grubbing operation shall be disposed of by burning or by other methods as approved by OWNER, in accordance with the Drawings and Specifications.

(b) All large debris, pipe, large metal objects, and bulky items will be removed and hauled to an off-site approved disposal facility.

END OF SECTION

SECTION 02125

TEMPORARY AND PERMANENT EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 Description of Work

(a) The CONTRACTOR shall provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with all applicable federal, state, and local enforcing agency guidelines and these Specifications. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

(b) The work shown on the Contract Drawings and working drawings shall be considered a minimum requirement. What is shown shall not relieve the CONTRACTOR of the responsibility to actively take all steps necessary to control soil erosion and sedimentation.

(c) Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.

(d) CONTRACTOR shall repair any material or existing surface conditions damaged by erosion or covered with sedimentation at the CONTRACTOR's expense.

(e) Erosion Control Measures shall be provided for all construction activities in the Vertical Expansion area as well as other related work throughout the site. CONTRACTOR shall maintain at least 20% overstock of erosion control items stockpiled on-site or have ready access to needed items via a supplier for ease of use to replace installed items as deemed necessary.

(f) The temporary erosion control features installed by the CONTRACTOR shall be maintained by the CONTRACTOR until no longer needed as determined by the OWNER, or permanent erosion control methods are installed.

(g) It shall be the sole responsibility of the CONTRACTOR to properly schedule and coordinate all necessary labor, equipment and materials such that the specified work is performed in accordance with the project schedule and the Contract requirements. At the discretion of the OWNER, the OWNER may reject or direct the CONTRACTOR to repair (at the CONTRACTOR's sole expense) those items which are detrimental to the project or not in compliance with the Contract Documents. Such direction or rejection by the OWNER shall not relieve the CONTRACTOR of his obligation to properly schedule and perform other specified work items in conformance with the Contract Documents.

1.02 Related Sections

(a) Section 01550 - Health and Safety Specifications for Construction

(b) Section 02110 - Site Clearing and Grubbing

(c) Section 02220 - Earthwork

(d) Section 02233 - Coarse Aggregate

(e) Section 02271 - Stone Riprap

(f) Section 02595 - Geotextile

(g) Section 02936 - Seeding

(h) Virginia Erosion and Sediment Control Handbook, 1992 Edition.

1.03 Submittals

At the preconstruction conference, the CONTRACTOR shall submit for OWNER's approval, a schedule and construction drawing for accomplishment of temporary and permanent erosion control work, as applicable for clearing and grubbing, grading, structures at watercourses, and general construction. No work shall be started until the erosion control schedules and methods of operations for each phase of construction have been accepted by the OWNER. This plan will be referred to as the CONTRACTOR's Soil Erosion and Sediment Control Plan.

PART 2 - PRODUCTS

2.01 Silt Fence

Silt fence shall be Filter X, Mirafi 100X, Stabilinka T140N, or approved equal.

2.02 Seed

Seed type shall meet the requirements of Section 02936 "Seeding".

2.03 Temporary Erosion Control Mat (EC-2)

Temporary Erosion Control Mat shall be a natural fiber or natural fiber with photodegradable netting with a functional longevity of 12 months or more. The material shall be suitable for placement on slopes up to 2:1. Example products include: Western Excelsior Excel SS-2, North American Green EroNet S150, or approved equal.

Spray-applied Bonded-Fiber Matrix products that include biodegradable fiber strands with a bonding agent (plus seed and fertilizer as options) may be applied given a site-specific soil analysis and adequate demonstration as an “or equal” to EC-2 rolled matting.

2.04 Permanent Erosion Control Mat (EC-3 Type A)

Permanent Erosion Control Mat shall be an ultraviolet-stabilized, synthetic fiber matting with a functional longevity of three years or more. The material shall be suitable for placement on slopes up to 1:1 and for channel flow with shear stress up to 2.0 psf (unvegetated). Example products include: Western Excelsior PP5-10, North American Green P300, or approved equal.

PART 3 - EXECUTION

3.01 General

(a) The Project-Specific erosion and sediment construction sequence outlined on the project's construction drawings will contain specific items tailored for that construction activity, including required pre-construction meetings and inspections.

(b) Conduct earthwork and excavation activities in such a manner to fit the topography, soil type and condition.

(c) Minimize the area being disturbed and the duration of exposure to erosion elements.

(d) All E&S measures shall be designed, installed and maintained in accordance with the Virginia Erosion and Sediment Control Handbook.

(e) Retain on-site, sediment that was generated on-site. Place sediments under cover after dewatering, during construction, and dispose of sediments as daily cover at landfill if not laden with seeps or perched groundwater.

(f) Prevent silt and sediment from entering any watercourse if soil erosion cannot be prevented.

(g) Prevent silt and sediment from migrating downstream in the event it cannot be prevented from entering the watercourse.

(h) Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

(i) The OWNER has the authority to limit the surface area of erodible material exposed by clearing and grubbing, and to direct the CONTRACTOR to provide immediate temporary or permanent control measures to prevent sediment impact on adjacent watercourses.

(j) Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the Project conditions permit; otherwise, erosion control measures may be required between successive construction stages.

(k) The OWNER will limit the area of excavation, and embankment operations in progress commensurate with the CONTRACTOR's capability and progress in keeping the finish grading, mulching, seeding and other such permanent control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measure shall be taken immediately to the extent feasible and justified.

(l) In the event that additional temporary erosion and sedimentation control measures are required due to the CONTRACTOR's negligence, carelessness or failure to install permanent controls as a part of the work schedule, and are ordered by the OWNER, such work shall be performed by the CONTRACTOR at the CONTRACTOR's expense, and no time extension shall be given.

3.02 Temporary Erosion and Sedimentation Control

(a) Temporary erosion control measures shall be used to correct conditions that develop during construction that lead to soil erosion or deposition of waterborne sediments; that are needed prior to installation of permanent erosion control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the Project.

(b) Temporary erosion and sedimentation control devices shall be installed and maintained prior to the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

(c) The CONTRACTOR shall coordinate the installation of temporary erosion and sedimentation control provisions contained herein with the permanent erosion control features, to ensure economical, effective and continuous erosion control throughout the construction and post-construction period.

(d) Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt, and sediment from entering the watercourses. The preferred method is to provide an undisturbed natural buffer, extending a minimal 5 feet from the top of the bank, to filter the run-off.

(e) Silt fences, barriers, temporary sedimentation basins and other temporary measures and devices shall be installed, and shall be maintained until no longer needed, as determined by the York County E&S Representative and the OWNER. At that time, the items shall be removed by the CONTRACTOR. All temporary items and devices must be removed with the OWNER's approval prior to final demobilization from the Site.

(f) Where permanent vegetation is not appropriate, and where the CONTRACTOR's temporary erosion and sedimentation control practices are inadequate, the CONTRACTOR shall provide temporary vegetative cover. Such temporary vegetative cover shall be provided by the

CONTRACTOR in compliance with Section 02936 "Seeding" of these specifications.

(g) All erosion and sedimentation control devices shall be inspected by the CONTRACTOR at least weekly and after each rainfall occurrence, and cleaned out and repaired by the CONTRACTOR as necessary.

3.03 Temporary Erosion and Sediment Control Techniques

(a) Temporary Diversion Berms

(1) A temporary diversion berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes.

(2) These diversion berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.

(3) A temporary diversion berm shall be constructed of compacted soil, with a minimum width of 24-inches at the top and a minimum height of 12-inches with or without a shallow ditch. Side slopes shall be three horizontal to one vertical (3H:1V) or flatter.

(b) Temporary Slope Drains

(1) A temporary slope drain may consist of stone downchutes, fiber mats, plastic sheets, half-round pipe, metal pipe, plastic pipe, sod or other material acceptable to the OWNER that may be used to carry water down slopes to reduce erosion prior to installation of permanent facilities or growth of adequate ground cover on slopes.

(2) Fiber matting and plastic sheeting shall not be used on slopes steeper than 4H:1V except for short distances of 20 feet or less.

(3) All temporary slope drains shall be adequately anchored to the slope to prevent disruption by the force of the water flowing in the drains. The base of temporary slope drains shall be compacted and concavely formed to channel water or hold the slope drain in place. The inlet end shall be properly constructed to channel water into the temporary slope drain.

(4) Energy dissipators, sediment basins or other approved devices shall be constructed at the outlet end of the slope drains to reduce erosion downstream.

(c) Sediment Control Structures

(1) Sediment basins, ponds and traps, are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect stream channels below the construction areas from excessive siltation.

(2) Sediment structures shall be utilized to control sediment where slope drains outlet. All sediment structures shall be at least twice as long as they are wide.

(3) When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural or intended condition.

(d) Riprap

Unless shown otherwise on the Contract Drawings, riprap shall be placed where ordered by the OWNER and at all points where banks of streams or drainage ditches are disturbed by excavation. Fill or backfill shall be carefully compacted and riprap placed to prevent subsequent settlement and erosion. This requirement applies equally to construction along side a stream or drainage ditch as well as crossing a stream or drainage ditch.

(e) Silt Wattles

(1) Silt Wattles are temporary measures to control erosion and retain the suspended silt particles in the runoff water leaving disturbed areas. Wattles shall be at least 6 inches in diameter.

(2) Silt Wattles shall be embedded in the ground per the manufacturer's recommendations to prevent water flowing under them. The wattles shall also be anchored securely to the ground by wooden stakes driven through the wattle into the ground at a minimum 5 foot spacing. Ends of the wattles shall be overlapped to prevent gaps.

(3) Silt Wattles shall be used at the toe of fill slopes, in ditches, or other areas where siltation, erosion or water run-off is a problem.

(f) Silt Fence

(1) Silt fences are temporary measures utilizing wooden posts with filter cloth attached to the upstream side of the fence to retain the suspended silt particles in the runoff water.

(2) Temporary silt fences shall be placed on the natural ground, at the toe of fill slopes, in ditches or other areas where siltation is a problem. Temporary silt fences shall be anchored as indicated on the Contract Drawings.

(3) The CONTRACTOR shall be required to maintain the silt fence in a satisfactory condition for the duration of the Project or until its removal is requested by the OWNER. The silt accumulation at the fence must be removed and placed on Site as directed by the OWNER.

(g) Temporary Vegetation and Soil Stabilization

(1) Temporary vegetation and soil stabilization are measures consisting of seeding, mulching, fertilizing and/or matting utilized to reduce erosion. All cut and fill slopes shall be stabilized when and where necessary to eliminate erosion. Disturbed or bare soil areas shall be stabilized within 7 days if they are to remain dormant longer than 14 days.

(2) Seeding, mulching and fertilizing shall be performed in accordance with Section 02936 "Seeding" of these Specifications.

(3) If late fall completion prevents germination. Disturbed areas shall be protected by mulching or Bonded Fiber Matrix (BFM) without application of seed as a minimum.

3.04 Permanent Erosion and Sediment Control

(a) The CONTRACTOR shall incorporate all permanent erosion control features into the Project at the earliest practicable time as outlined in the CONTRACTOR's Soil Erosion and Sediment Control Plan accepted schedule or as land disturbance for each segment of the Project has been completed.

(b) Restore the work site to its original contours, unless shown otherwise on the Drawings or directed by the OWNER.

(c) All references to permanent vegetation, unless noted otherwise, shall relate to establishing permanent vegetative cover and be in accordance with Section 02936 "Seeding" of these specifications.

(d) When final grade has been established, all bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched in an effort to restore to a protected condition. Areas that are not stabilized with seed and mulch shall be sodded as approved or directed by the OWNER.

(e) Specified permanent vegetation shall be established at the first appropriate season following establishment of final grading in each section of the Site.

(f) Where sod is removed or damaged, such areas shall be replanted using sod of the same species of grass at the first appropriate season.

(g) Permanent vegetative cover activities shall comply with local soil and water conservation guidelines.

(h) Where permanent vegetative cover cannot be immediately established (due to season or other circumstances) the CONTRACTOR shall provide temporary vegetative cover.

3.05 Permanent Erosion and Sediment Control Techniques

(a) Permanent Vegetation

All references to permanent vegetation, unless noted otherwise, shall relate to establishing permanent vegetative cover and be in accordance with Section 02936 "Seeding" of these specifications.

(b) Riprap

(1) Riprap or Grouted Riprap used for permanent stabilization of channels, slopes and culvert outlets shall be installed in accordance with the Contract Drawings and Section 02271 "Stone Riprap" of these specifications.

(2) Placing of riprap at locations other than those specified on the Contract Drawings shall be done only with approval or by the direction of the OWNER.

(3) The ground surface upon which the riprap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Undercut as necessary such that the final grade after riprap placement matches the design and intent of the Contract Drawings.

(4) Unless otherwise shown or specified, riprap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be two feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the riprap is placed, the toe ditch shall be backfilled and the excess soil spread neatly within the construction area.

(5) Minimum 6-oz / SY nonwoven Geotextile shall be placed in all areas to receive riprap, unless otherwise required by the Contract Documents. The surface to receive geotextile shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The geotextile shall be placed with the machine (long) dimension running up the slope and shall be placed to provide a minimum number of seams. Geotextile shall be overlapped a minimum of 6-inches prior to seaming. All geotextile seams shall be continuously sewn or thermally bonded. The geotextile shall be placed loosely so as to give and, therefore avoid stretching and tearing during placement of riprap. Riprap shall be dropped no more than three feet during construction. The geotextile shall be protected at all times during construction from runon containing clay, silts, chemicals or other substances. Any geotextile damaged during its installation or during placement of riprap shall be removed and replaced with undamaged geotextile at no expense to OWNER.

END OF SECTION

SECTION 02140

CONSTRUCTION DEWATERING

PART 1 - GENERAL

1.01 Description Of Work

(a) This section specifies the requirements for handling and management of dewatering activities.

(b) CONTRACTOR shall design, construct and maintain all dikes, sumps, and diversion and drainage channels as necessary to complete the construction and to protect the areas to be occupied by permanent work from water damage. CONTRACTOR shall remove temporary works after they have served their purpose.

(c) CONTRACTOR shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials and structures damaged by water, both surface and subsurface, to the lines, grades and conditions existing prior to the damage, at no additional cost to OWNER.

(d) CONTRACTOR shall provide a “Competent Person” to implement and supervise all Work.

(e) The CONTRACTOR shall submit a description of its methods for accomplishing construction dewatering to OWNER and ENGINEER for approval.

(f) CONTRACTOR shall provide measures to minimize accumulation of surface water in the work area.

(g) CONTRACTOR will segregate all surface runoff and waters from perched groundwater and seeps encountered by CONTRACTOR during excavation filling operations. Perched groundwater and seeps encountered by CONTRACTOR will be collected, pumped, transferred and hauled to an on-site discharge point as directed by OWNER.

1.02 Related Sections

(a) Section 02125 - Temporary and Permanent Erosion and Sediment Control

(b) Section 02150 - Shoring and Bracing

(c) Section 02220 - Earthwork

PART 2 - PRODUCTS

Piping, pumping equipment, and all other equipment and materials required for dewatering shall be suitable for the intended purpose. Standby pumping units shall be maintained at the Site to be used in case of failure of the normal pumping units.

PART 3 - EXECUTION

3.01 Handling Of Water

(a) Design, furnish, install, maintain, monitor, operate and remove necessary pumping and other equipment for dewatering the various parts of the Work and for maintaining the work areas free from water as required for constructing each part of Work.

(b) Install all drainage ditches, sumps, and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables and to drain impervious surfaces at final excavation elevation.

(c) Water shall be filtered by a dewatering structure to remove sediment prior to discharge by means of a filter box, sediment tank, Dirtbag®, or other means compliant with Std. & Spec 3.26 of the Virginia Erosion and Sediment Control Handbook, Third Edition.

(d) Discharge water only where directed by the OWNER.

(e) All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic or the Work of other contractors, and in accordance with all Federal, State, and local laws, ordinances and regulations.

(f) Do not overload or obstruct existing drainage facilities.

(g) Separate all surface runoff water and segregate and collect all water from perched groundwater and seeps that may be encountered during excavation or site grading. Collect, segregate, hold and dispose of water collected from perched groundwater and seeps separately from surface runoff.

(h) After they have served their purpose, remove all temporary protective work at a time and in a manner approved by the OWNER. All temporary diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled and processed under the same specifications as those governing the compacted fill (Section 02200).

(i) When the temporary works will not adversely affect any item of permanent work on the planned usage of the project, CONTRACTOR may be

permitted to leave such temporary works in place. In such instances, breaching of dikes and other temporary works may be required.

3.02 Dewatering

(a) By the use of pumps, tile drains or other approved methods, CONTRACTOR shall control the flow and accumulation of water in excavated areas to prevent excessive softening and disturbance of exposed soils in excavations as necessary for completion of the Work.

(b) The system used shall not cause settlement damage to adjacent structures. The CONTRACTOR shall carry out the Work by the use of other methods which will not endanger adjacent structures; all such Work shall be done at the CONTRACTOR's expense.

(c) Disposal of all dewatering liquids shall follow the sites VPDES permit and be in accordance with all Federal, State, and local laws, ordinances and regulations.

END OF SECTION

SECTION 02150

SHORING AND BRACING

PART 1 - GENERAL

1.01 Description of Work

(a) The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of shoring, bracing, and sheeting or sheet piling, necessary to complete the construction, protect structures, and prevent the loss of ground or caving of embankments, excavations, or cut slopes, as shown, specified or required, and shall meet all applicable building and safety codes. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all shoring and bracing.

(b) CONTRACTOR shall be solely responsible for proper excavation procedures including, but not limited to, safe slope angles and the design and use of properly designed and installed shoring and bracing systems in accordance with OSHA and other applicable standards and requirements. As required, shoring and bracing shall be designed by the CONTRACTOR's engineer who is a licensed Professional Engineer in the Commonwealth of Virginia. Remove all shoring and bracing without disturbing backfill, bedding, haunching, pipes or structures. The presence of the QAC shall not relieve the CONTRACTOR of his responsibility to properly design, install and maintain shoring and bracing. The OWNER shall not be the "Competent Person" on the Site.

(c) Pressures on sheeting and the stability of the sheeting and bottom of the excavation are dependent not only on soil conditions but upon many procedures and options available to the CONTRACTOR, such as dewatering, staging of excavation and installation of bracing, flexibility of sheeting, construction equipment used, and time of completing the work. All such factors shall be considered and investigated as necessary in the design of the sheeting and bracing.

(d) Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.

1.02 Related References

(a) Recommended Technical Provisions for Shoring and Sloping of Trenches and Excavations, U.S. Department of Commerce.

(b) Construction Safety and Health Regulations, U.S. Department of Labor, Occupational Safety and Health Administration.

(c) Occupational Safety and Health Regulations- Excavations, U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926.

1.03 Related Sections

(a) Section 01550 - Health and Safety Specifications for Construction

(b) Section 02220 - Earthwork

1.04 Submittals

(a) In cases where the excavation cannot be open cut to a safe working angle in accordance with applicable requirements or where excavation may jeopardize adjacent site areas or the stability of nearby structures or facilities, the CONTRACTOR shall submit drawings, computations and substantiating data, prepared, signed, and sealed by a Professional Engineer licensed in the Commonwealth of Virginia, showing his proposed shoring and bracing design and method of construction for the information of the OWNER prior to the start of such construction.

(b) Shoring and bracing systems shall be designed such that removal shall not jeopardize work already performed. Shoring and bracing systems shall not remain permanently in place without the written approval of the OWNER.

(c) Any review or comments by the OWNER shall not relieve the CONTRACTOR of his responsibility for sheeting and bracing.

(d) In trenches, the sheeting shall be designed so that the lowest brace is no closer than 12 inches above the base of the structure to be installed.

1.05 Quality Control

During the installation of the sheeting and bracing and as long as the excavation is open, the CONTRACTOR's "Competent Person" shall monitor the work to ensure that it is carried out in accordance with his design and procedures.

PART 2 - PRODUCTS

All materials shall meet, or exceed, the minimum requirements of the applicable codes and those assumed in the design submitted by the CONTRACTOR.

PART 3 - EXECUTION

3.01 Verifying Existing Conditions

Before commencing work, the CONTRACTOR shall check and verify all governing dimensions and elevations, including field measurements of existing and adjoining work on which his work is dependent, to assure proper fit and clearance of each part of the work to the new and existing structures.

3.02 Coordination With Other Operations

The schedule and progress of the shoring, bracing, and sheeting work shall be coordinated with the excavation and backfilling work. If, during the progress of the excavation, lateral movement of the surrounding soils, or any other evidence of instability is discovered, further excavation or backfilling work in the excavation shall cease and corrective measures shall be taken immediately to prevent further movement.

3.03 Removal of Shoring and Bracing Materials

(a) Where the CONTRACTOR elects and is permitted not to remove shoring and bracing material, all such material shall be removed to the extent that the top of the material shall be a minimum of 5 feet below the proposed finished grade. No shoring or bracing may remain in place within the limits of the proposed geomembrane liner placement.

(b) Removal of shoring and bracing shall be carried out in a manner such that no structure shall be disturbed or damaged during or after removal. Protection of structures during the removal of shoring and bracing shall be the sole responsibility of the CONTRACTOR, and any disturbance or damage shall be rectified at no expense to the OWNER.

3.04 Safety

Installation and removal methods of shoring and bracing shall meet, or exceed, the minimum requirements of the applicable codes and safety precautions as outlined in such codes, and shall be enforced by the CONTRACTOR.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The work under this section includes the furnishing of all labor, equipment and materials, and completing all operations in connection with excavating, backfilling, compacting, grading, and placing soil materials and all other incidental work necessary for construction according to Drawings and Technical Specifications.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

C. The CONTRACTOR shall locate all existing active and abandoned utilities and structures in work areas prior to commencing any excavation activities and shall protect from damage those utilities and structures which are to remain in place

1.02 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements affecting the work of this section.

B. Other specification sections containing requirements relating to this section include, but are not limited to, the following:

1. Section 02110 – Site Clearing and Grubbing

2. Section 02140 – Construction Dewatering

3. Section 02125 – Erosion and Sediment Control

4. Section 02224 – Coal Combustion Residual Fill

5. Section 02233 – Coarse Aggregate

6. Section 02235 – Vegetative Support Layer

1.03 DEFINITIONS

A. Excavation shall mean the removal from place of all materials and shall include soil, facilities, structures above and below ground, rock, pavements, topsoil, boggy waste, rubbish, tree stumps, boulders, logs, ashes, cinders, organic material such as peat, humus or organic silt, softened or disturbed soils or other unsuitable bearing materials determined in the field by the ENGINEER.

B. Mucking or mucking-out shall mean excavation, as defined herein before, without prior dewatering.

1.04 PROTECTION OF PEOPLE AND PROPERTY

A. The CONTRACTOR shall plan and conduct operations in accordance with OSHA and local codes and ordinances so as to prevent damage to existing structures, safeguard people and property, minimize traffic inconvenience, protect the structures to be installed, and provide safe working conditions.

B. The CONTRACTOR shall control stormwater such that run-on and run-off do not affect the quality of receiving wetlands, brooks, streams, or rivers. The CONTRACTOR shall be responsible for cleaning (removal of silt) stormwater structures (swales, culverts, basins) as needed during construction, after stabilization of project areas, and at the conclusion of work prior to demobilization.

C. The CONTRACTOR shall be responsible for protecting existing environmental monitoring devices such as groundwater monitoring wells within the limits of work. Any damage to existing environmental monitoring devices resulting from construction activities shall be the responsibility of the CONTRACTOR to correct at no additional cost to the OWNER.

D. Excavations, except as specified, shall be adequately shored and braced. Where the installation of shoring is impractical or might cause damage, as a result of, but not limited to, vibration, settlement or lateral movement, the CONTRACTOR shall utilize other methods.

E. CONTRACTOR shall be solely responsible for proper excavation procedures including, but not limited to, safe slope angles and the design and use of properly designed and installed shoring and bracing systems in accordance with OSHA and other applicable standards and requirements. As required, shoring and bracing shall be designed by the CONTRACTOR's engineer who is a registered Professional Engineer in the Commonwealth of Virginia. Remove all shoring and bracing without disturbing backfill, bedding, haunching, pipes or structures. The presence of the ENGINEER shall not relieve the CONTRACTOR of his responsibility to properly design, install and maintain shoring and bracing. The OWNER shall not be the competent person on the Site.

F. In cases where excavation without shoring and bracing is not permissible solely because of protection of workers, trench boxes may be used.

G. The CONTRACTOR shall not stockpile any excavated material without OWNER approval. Stockpile location shall be approved by the ENGINEER or OWNER.

1.05 REFERENCES

A.	ASTM D422	Grain Size Analysis of Soils
B.	ASTM D698	Laboratory Compaction Characteristics of Soil Using Standard Compaction Effort

C. ASTM D2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D. ASTM D3080 Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions

E. ASTM D4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

F. ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.06 SUBMITTALS

A. Shoring and Bracing

1. In cases where the excavation cannot be open cut to a safe working angle in accordance with applicable requirements or where excavation may jeopardize adjacent site areas or the stability of nearby structures or facilities, the CONTRACTOR shall submit drawings, computations and substantiating data, prepared, signed, and sealed by a Professional Engineer licensed in the Commonwealth of Virginia, showing his proposed shoring and bracing design and method of construction for the information of the OWNER prior to the start of such construction.

2. Shoring and bracing systems shall be designed such that removal shall not jeopardize work already performed. Shoring and bracing systems shall not remain permanently in place without the written approval of the OWNER.

3. Any review or comments by the OWNER shall not relieve the CONTRACTOR of his responsibility for sheeting and bracing.

4. In trenches, the sheeting shall be designed so that the lowest brace is no closer than 12 inches above the base of the structure to be installed.

B. The CONTRACTOR shall submit the technical data sheet for the proposed compaction equipment to the OWNER or ENGINEER for review and approval.

C. The CONTRACTOR shall provide the OWNER or ENGINEER samples from each borrow source to be used as structural fill. From each borrow source, representative composite sample(s) shall be tested for the following:

1. Soil Classification (ASTM D2487, which includes Grain Size Analysis - ASTM D422 and Atterberg Limits – ASTM D4318); two per source or material type

2. Compaction Testing (Proctor) (ASTM D698); two per source or material type

If the OWNER or ENGINEER determines that the source contains more than one soil type, as determined by the Unified Soil Classification System (USCS), the tests listed shall be completed for each soil type.

1.07 TOLERANCES

Grading tolerance for all fill and backfill shall be ±0.1 feet.

1.08 QUALITY ASSURANCE

A. The CONTRACTOR shall be an experienced earthwork CONTRACTOR who has at least five years experience. The CONTRACTOR shall have completed at least three projects with the same material and of similar scope as that indicated for this project with a successful installation and maintenance record of in-service performance.

B. The CONTRACTOR is required to demonstrate compliance to the above requirements to the satisfaction of the ENGINEER and OWNER.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All backfill and fill materials, unless otherwise specified, shall consist of suitable, selected, and approved (by the OWNER) soil from borrow areas.

B. Maximum particle size, unless otherwise specified or approved by the ENGINEER, shall be as given in Paragraph 2.02.

C. Within the footprint of all structures and for a five-foot surrounding area around such structures, a minimum density of 95 percent of maximum dry density shall be used as determined by standard Proctor test (ASTM D698), unless otherwise specified. For all other areas, a minimum density of 95 percent of maximum dry density shall be used.

D. No frozen earth shall be used for backfill and fill, and no fill or backfill shall be placed over frozen surfaces. All backfill and fill materials shall be free from all perishable and objectionable (as described below) materials. All fill shall be protected from frost if the ENGINEER judges frost will prevent the material from performing as required.

E. All required fill materials shall be free from organic materials, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. It shall not contain rock fragments, broken concrete, masonry rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted to the specified density. Snow, ice, and frozen soil shall be removed from fill material prior to placement.

2.02 STRUCTURAL FILL

A. Structural fill materials shall be used as subgrade to the bottom of the liner grades, clean backfill, pipe bedding and as other material as shown on the Drawings. Structural fill shall be free of rubble, wood, stumps, brush, metal, cinders, trash, demolition debris, garbage, topsoil, organic soil, loam, sludge and other deleterious materials. The maximum stone size shall be two inches in any dimension and shall not comprise more than five percent of the total soil mass. Structural fill materials shall be classified according to the USCS as GM, GC, SC, CL, SM, ML, or MH (ASTM D2487) or Coal Combustion Residuals (CCR). CCR used as structural fill shall meet the requirements of Section 02224 of the Technical Specifications. Structural fill shall be approved by the ENGINEER for each application.

B. The liner subgrade shall consist of the top six inches of Structural fill underlying a geomembrane liner. It shall contain particles no larger than 3/8" in their greatest dimension and be free of organic materials.

C. The interface friction angle between the structural fill and the HDPE geomembrane shall be greater than or equal to 27° as determined by ASTM D5321 or as approved by the ENGINEER. Each test shall determine interface strength at normal stresses of 100 pounds per square foot (psf), 300 psf, and 500 psf. The interface shear test shall be completed using installation procedures used under actual field conditions. Tests shall be completed under fully saturated conditions (saturation time of 15 minutes), have a seat time of 15 minutes, and have a shear rate of 0.04 inches per minute (in/min). Additional samples shall be collected and tested if the material does not meet the minimum requirements of this technical specification.

2.03 SAND AND AGGREGATE

Sand and Aggregate shall conform to the requirements of the Virginia Department of Transportation Road and Bridge Specification, 2002 edition.

2.04 LANDFILL FINAL PROTECTIVE COVER

Fill for the Final Protective Cover layer shall consist of structural fill material that is void of deleterious materials, has no particles over 3/8" in their greatest dimension and meets the requirements of section 2.02 of this specification. Under no circumstances will CCR material be used as Landfill Protective Cover.

2.05 VEGETATIVE SUPPORT LAYER

Fill for the Vegetative Support Layer shall consist of soil material that is void of deleterious materials, has no particles over 3/8" in their greatest dimension and meets the requirements of Section 02235 of the Technical Specifications. Under no circumstances will CCR material be used as Vegetative Support Layer material.

PART 3 – EXECUTION

3.01 PREPARATION

A. The CONTRACTOR shall establish and identify required lines and levels.

B. The CONTRACTOR shall maintain benchmarks, monuments, and other reference points and reestablish them if disturbed or destroyed, at no cost to OWNER.

C. Before start of grading, the CONTRACTOR shall establish the location and extent of utilities in the work areas. The CONTRACTOR shall notify utilities to remove and relocate lines that are in the way of construction and are not to be relocated as a part of the work covered by these specifications.

D. The CONTRACTOR shall maintain, protect, reroute, or extend as required existing utilities to remain in place that pass through the work area.

E. The CONTRACTOR shall develop access to the construction area in accordance with the requirements of the drawings.

F. The CONTRACTOR shall install silt fences as needed to prevent erosion immediately downslope of each area to be disturbed prior to the beginning of work in that area. The CONTRACTOR shall maintain the silt fences for the duration of construction. Accumulated sediment behind the silt fences shall be disposed of on-site by the CONTRACTOR in a manner approved by the OWNER.

G. Diversion ditches, either permanent or temporary, shall be constructed in accordance with the drawings and as necessary to control surface water. The CONTRACTOR shall be responsible for constructing diversion ditches as required to divert run-on around the construction area and maintain the diversions until approved by the OWNER or ENGINEER.

H. The CONTRACTOR shall install barriers and other devices to protect areas adjacent to construction.

3.02 STOCKPILING

A. Excavated materials classified suitable for use as structural fill shall be stockpiled in designated areas free of incompatible soil, clearing debris, or other objectionable materials. Stockpile areas shall be approved by the OWNER.

B. Excavated material classified as topsoil shall be segregated from fill and stockpiled in the manner shown on the Drawings or as specified by the OWNER.

C. Stockpiles of fill or topsoil shall be no steeper than 3:1 (horizontal:vertical), graded to drain, sealed by tracking parallel to the slope with a dozer or other means approved by the ENGINEER, and dressed daily during periods when fill is taken from the stockpile.

3.03 EXCAVATION - GENERAL

A. Excavation shall be performed, at a minimum, to the lines and grades indicated on the Drawings. Additional excavation shall only be performed to achieve a stable working base or to "bridge" over weak subgrade materials if approved by the ENGINEER. The limits of additional excavation shall be determined by the ENGINEER.

B. Excavated materials shall be transported to stockpile or placement locations, as indicated on the Drawings or as directed by the OWNER.

3.04 GRADING - GENERAL

A. Uniformly grade areas to a smooth surface, free of irregular surface changes, to the lines and grades indicated on the Drawings. Provide a smooth transition between existing grades and new grades.

B. Unless otherwise specified, place borrow fill and trench backfill material in lifts of not more than eight inches in loose depth for material compacted by heavy construction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers. Compact borrow fill and trench backfill material to not less than 90% of the maximum dry density as determined by a standard Proctor according to ASTM D698, unless otherwise specified.

3.05 TRENCH EXCAVATION AND BACKFILL

A. Excavation for all drainage, piping, and other structures shall conform to the lines and grades shown on the Construction Drawings. Excess or unsuitable material removed from the excavations shall be replaced with approved material. The CONTRACTOR will be responsible for all shoring, bracing, trench boxes, etc., necessary to complete the excavation and pipe installation in a safe manner.

B. Stability of Excavations: Slope sides of excavations shall comply with OSHA and local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Comply with all OSHA and other applicable safety requirements.

C. Unless directed otherwise by the OWNER or ENGINEER, excavations shall not be backfilled until the work as installed conforms to all requirements specified in these Technical Specifications. Each lift of trench backfill material shall be moistened as necessary and compacted in such a manner as to permit the proper and desired compaction of the filled excavation to provide the necessary support and protection for the pipe.

D. Placement of pipe bedding shall be done in accordance with the following procedures.

1. The bottoms of excavations shall be thoroughly compacted and in an approved condition prior to placing pipe bedding. Pipe bedding shall be placed in layers not exceeding four inches in loose depth. Each layer

shall be compacted by at least two passes of an approved plate-type vibratory compactor.

2. Pipe bedding shall be graded, compacted, and shaped so that the full length of pipe barrel has complete and uniform bearing for the bottom quadrant of each pipe.

3. The CONTRACTOR shall exercise care in all operations to prevent disturbing joints, displacement of or damage to the pipes already installed, and tearing of geotextile. As the work progresses, the pipelines will be checked by the OWNER or ENGINEER to determine whether any disturbance, displacement, or damage has occurred. If inspection shows poor alignment, displaced or damaged pipe, disturbed joints, or any other defects, all defects designated by the OWNER or ENGINEER shall be remedied in a satisfactory manner by the CONTRACTOR, at no additional expense to the OWNER.

E. The balance of backfill, as shown on the Drawings and specified in this section, shall be structural fill or other compactable materials as approved by the OWNER or ENGINEER and as detailed. All trench backfilling shall be carefully placed to avoid disturbance of new work.

F. Backfill trench with clean backfill in accordance with the details shown on the Drawings. Place backfill material by hand, and compact in layers not exceeding six inches compacted thickness. The moisture content of backfill shall be such that proper compaction will be obtained. Backfill shall be compacted to the minimum requirements specified. It is the responsibility of the CONTRACTOR to ensure that the minimum specified densities are obtained. Puddling or jetting of backfill with water will not be permitted.

G. Compact soil materials using equipment suitable for materials to be compacted and work area locations. Hand-operated plate type vibratory or other suitable equipment may be used in areas not accessible to larger rollers or compactors, and to avoid damaging pipes or structures. Any pipe that is damaged shall be replaced at the CONTRACTOR's expense.

H. Backfill material shall be compacted to achieve the compaction specified in Paragraph 2.01.C.

I. During filling and backfilling operations, pipelines will be checked by the OWNER or ENGINEER to determine whether any displacement of the pipe has occurred. If the inspection of the pipelines shows poor alignment, displaced pipe or any other defects, the defects designated by the OWNER or ENGINEER shall be remedied in a satisfactory manner by the CONTRACTOR at no additional expense to the OWNER.

J. Any backfill that fails to comply with the minimum compaction requirements specified shall be recompacted or, if necessary, removed to the limits directed by the OWNER or ENGINEER. The trench shall then be refilled with approved materials and by approved methods. The backfill shall be compacted by

approved methods to the minimum requirements specified. All of this work shall be completed by the CONTRACTOR at no additional expense to the OWNER.

K. After backfilling, the CONTRACTOR shall maintain the filled surfaces in good condition with a smooth surface level with adjacent undisturbed surfaces. Any subsequent settling shall be immediately repaired by the CONTRACTOR in a manner satisfactory to the OWNER or ENGINEER. Such maintenance shall be provided by the CONTRACTOR for the remainder of this contract at no additional expense to the OWNER.

3.06 STRUCTURAL FILL

A. Subgrade Preparation

1. Prepare areas to receive structural fill by:

a. Clearing and grading areas required for access to site and execution of the work. Clearing shall be limited to areas within the limits of construction that need to be cleared in order to execute the work.

b. Grubbing areas within a 10-foot zone bordering all proposed structures and pipelines.

c. In areas to be cleared, removing all stumps, roots ½-inch or larger, organic material, and debris to a depth of approximately one foot below existing grade, or one foot below the proposed subgrade elevation, whichever is lower.

d. Stockpiling topsoil material on site in areas designated by the ENGINEER, OWNER, or facility personnel.

e. Burning will be permitted when allowed by local ordinance. No burning will be allowed within 100 feet of waste disposal areas or site access roads.

f. At the end of the construction period, the CONTRACTOR shall restore to existing grade those areas disturbed by construction activities that lie beyond the limits of construction shown on the drawings and that are outside the borrow area. Areas to be filled shall be nominally compacted as may be achieved with construction equipment, and permanently seeded in accordance with the requirements of Section 02936.

2. Grade areas to receive fill to a uniform surface. Scarify surface if directed by the ENGINEER.

3. Dry or wet subgrade at the direction of the ENGINEER to establish subgrade with acceptable moisture content.

4. Do not construct structural fill layer until the subgrade has been approved by the ENGINEER.

B. Construction

1. Construct project features to the lines and grades shown on the drawings.

2. Place fill material in lifts no greater than eight inches compacted depth.

3. Compact fill material to a minimum percentage of the maximum dry density as determined by a standard Proctor (ASTM D698) as shown in the table below:

Material Type / Use	Compaction Requirement	Moisture Content
Structural Fill / Liner Subgrade	95%	-2% to +4%
Structural Fill / Road Subgrade	98%	-2% to +2%
Structural Fill / Trench Backfill & Stockpile	90%	-2% to +4%
CCR / Liner Subgrade	95%	-2% to +4%
Structural Fill / Final Cover	90%	-2% to +4%
Structural Fill / Embankments	95%	-2% to +4%
Structural Fill / Foundations	95%	-2% to +4%
Structural Fill / All other uses	95%	-2% to +4%
Vegetative Soil / Final Cover	Do not compact	n/a

4. Fill material in place, which does not meet the density requirements, shall be recompacted or removed and reworked to meet density objectives.

5. Do not place or compact fill material during sustained period of temperatures below 32° F.

6. Employ a professional land surveyor licensed in Virginia to conduct a topographic survey of the top of the structural fill layer, and prepare a survey drawing showing contours at maximum two-foot intervals.

7. Furnish the ENGINEER with three copies of the topographic survey drawing. This drawing shall become part of the record drawings required by this contract.

3.07 PROTECTION AND ACCEPTANCE

A. Protect the finished surface from erosion, desiccation, or other damage.

B. Develop a contingency plan for responding to construction deficiencies due to inclement weather, defective materials, and construction inconsistent with the Technical Specifications. The plan shall provide a methodology for selecting and implementing corrective action.

C. Portions of the work damaged due to exposure shall be reworked to meet the Technical Specifications or, at the discretion of the ENGINEER, removed and replaced with conforming material at no additional cost to the OWNER.

3.08 REMOVAL OF SHORING AND BRACING MATERIALS

A. Where the CONTRACTOR elects and is permitted not to remove shoring and bracing material, all such material shall be removed to the extent that the top of the material shall be a minimum of 5 feet below the proposed finished grade. No shoring or bracing may remain in place within the limits of the proposed geomembrane liner placement.

B. Removal of shoring and bracing shall be carried out in a manner such that no structure shall be disturbed or damaged during or after removal. Protection of structures during the removal of shoring and bracing shall be the sole responsibility of the CONTRACTOR, and any disturbance or damage shall be rectified at no expense to the OWNER.

3.09 QUALITY ASSURANCE

A. Under the supervision of the ENGINEER, a soils technician from a commercial geotechnical testing company approved by the ENGINEER shall perform soil tests described herein and in the Construction Quality Assurance (CQA) Plan. Samples shall be collected by field testing personnel at the minimum frequencies presented below.

B. Test schedule for placement of structural fill:

1. At least one grain size analysis shall be performed per 5,000 cubic yards of structural fill placed. The grain size analysis shall conform to ASTM D422.

2. At least one moisture content test shall be performed per 10,000 cubic yards of structural fill placed. The moisture content tests shall conform to ASTM D2216.

3. At least one moisture-density relationship (Proctor) test for 10,000 cubic yards of structural fill. The moisture density curve test shall conform to ASTM D698.

4. Additional tests may be required when soil gradation tests indicate that there has been a change in the material being supplied.

5. Testing of the in-place structural fill will include in-place density and moisture content tests in accordance with ASTM D6938. Frequency: one test per 10,000 square feet per lift.

6. Testing of the in-place structural fill will include in-place density and moisture content tests in accordance with ASTM D2937 (Drive Cylinder). Frequency: 1 test per 20 nuclear density tests.

7. The horizontal and vertical location of all test locations will be recorded by the QAC. A drawing will be prepared showing all test locations.

C. Test schedule for trench backfill:

Testing of the trench backfill will include in-place moisture content and density tests in accordance with ASTM D6938. Frequency: One test per 100 linear feet of trench.

D. The CONTRACTOR shall cooperate with the ENGINEER and his representative in obtaining samples for testing and conducting in-situ tests during the construction period. The CONTRACTOR shall provide all necessary labor, equipment, and material to refill sample locations as directed.

E. If the tests conducted on a particular lift and section of the placed material do not meet required specifications, the CONTRACTOR shall be responsible for any expenses incurred performing additional tests following recompaction of the material until passing test results are achieved.

* * * * * END OF SECTION * * * * *

SECTION 02221

WASTE EXCAVATION AND DISPOSAL

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

(a) The CONTRACTOR shall furnish all materials, labor, equipment, tools and appurtenances required to complete the Work as described below. CONTRACTOR shall provide a "Competent Person" to implement, supervise and inspect all Work.

(b) Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities.

(c) Excavation of existing waste and existing unsuitable materials in the Lined Ash Area which require cut or trenching to obtain suitable grades and bearing soils.

(d) Hauling and stockpiling of waste and soils acceptable for use at the operating landfill by OWNER at an on-site location as designated by OWNER.

(e) Off-site disposal of the unacceptable waste or debris shall be at a permitted waste disposal facility approved by the OWNER.

1.02 RELATED SECTIONS

(a) Section 01550 - Health and Safety Plan

(b) Section 02110 - Site Clearing and Grubbing

(c) Section 02140 - Construction Dewatering

(d) Section 02150 - Shoring and Bracing

(e) Section 02220 - Earthwork

1.03 SUBMITTALS

Submit under provisions of Section 01300.

(a) Waste Excavation Plan: Indicate sequence proposed for excavating waste, proposed equipment, operation procedures, and surface water, contact water and leachate management control procedures.

(b) Location, permits and information relative to off-site disposal facility for approval by OWNER.

1.04 HEALTH AND SAFETY REQUIREMENTS

Work shall be performed in compliance with all applicable health and safety and OSHA regulations and in accordance with the CONTRACTOR's Health and Safety Plan. The CONTRACTOR's Health and Safety Plan shall include, at a minimum, air monitoring for volatile organic compounds and explosive gases (methane). When continuous air monitoring results exceed one part per million total volatile organic compounds, personnel shall either upgrade to Level B (supplied air) respiratory protection, or expand the air monitoring program to include compound-specific analyses for vinyl chloride, benzene, and chloroform.

1.05 HAZARDOUS MATERIALS

If, during the CONTRACTOR's execution of the Work, potentially hazardous materials are encountered, the CONTRACTOR shall cease and desist all work in the affected work area and relocate all construction activities to another part of the site until otherwise directed by the OWNER. No increase in contract time or price will be allowed for encountering hazardous materials.

PART 2 - PRODUCTS

2.01 Temporary Cover: Material used for covering of any exposed waste at the end of the working day if waste excavation is to continue at a later date or the next day.

2.02 Waste: Waste, refuse, debris, impacted soils, etc., are the end product of past landfilling operations that took place within and adjacent to the limits of work. It is imperative that all personnel associated with this activity be thus trained and familiar with the Health and Safety Plan developed for this project, as per Section 01550.

2.03 "Clean" Soils: Underlying material deemed to be visibly free of waste materials and to be segregated from the waste materials whenever possible or practicable.

2.04 Waste Disposal Areas: Locations on the existing Yorktown Landfill for final disposal of acceptable wastes excavated from areas of cut or trenching as directed by OWNER.

2.05 Off-Site Disposal Area: OWNER approved off-site, permitted waste disposal facility for disposal of unacceptable wastes.

PART 3 - EXECUTION

3.01 PREPARATION OF WASTE EXCAVATION AREAS

(a) Perform test pits, excavation and other work as required by the OWNER to identify required lines, levels, contours, datum, and limits of waste excavation

(b) Protect bench marks, and existing structures from excavation equipment and vehicular traffic and from collapse of excavation. Provide shoring and bracing, when required.

3.02 EXCAVATION

(a) Grade top perimeter of excavation to prevent surface water from draining into excavation.

(b) Excavate to required grades or as directed by ENGINEER, whichever is lower.

(c) Notify so that the QAC can closely observe the excavated area.

(d) Do not perform excavations outside of the limits of excavation or below the proposed subgrade without approval of the OWNER and QAC.

(e) Notify QAC of unexpected subsurface conditions and discontinue affected Work in area until notified by OWNER to resume Work.

(f) Maintain excavation area dry. All water pumped from excavation in contact with waste shall be handled as potentially contaminated water to be handled and disposed per Section 02140 (Construction Dewatering).

(g) Transport excavated waste material acceptable for use at the operating landfill to the area designated on Site by OWNER.

(h) Transport all unacceptable waste off-site to an approved disposal area as directed by OWNER

(i) Keep all transportation equipment, roads and traffic areas free of debris and or waste.

3.03 WASTE DISPOSAL

(a) CONTRACTOR shall dispose of all waste unacceptable for use at the Yorktown Landfill and encountered during site preparation, clearing and grubbing, subgrade preparation, and excavation within the limits of the excavation at an approved off-site disposal facility. Payment shall be included in the base bid, with no additional cost to the OWNER.

(b) CONTRACTOR shall dispose of acceptable or unacceptable waste, removed from outside the original grades and limits of excavation as directed by the QAC or OWNER, to an approved off-site disposal facility at the unit cost per ton included in the base bid.

(c) Wood waste (e.g. trees, brush, stumps) from clearing and grubbing operations shall be chipped or burned. Chippped wood waste shall be disposed off-site at an approved disposal facility or stockpiled on-site if directed by OWNER.

(d) Topsoil shall be segregated from waste materials whenever practicable and reused in construction where approved by the QAC or stockpiled on-site as directed by OWNER.

(e) "Clean" soils should be segregated from waste materials whenever practicable. Clean soils approved for use as select backfill material by the QAC will be reused in the construction. Other clean soils, not suitable as topsoil or select backfill material, shall be stockpiled on-site as directed by OWNER.

3.04 PROTECTION OF EXCAVATION

Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

3.05 FIELD QUALITY CONTROL

Provide for visual inspection of excavated surfaces and waste.

3.06 WASTE EXCAVATION SURVEY CONTROL

(a) The CONTRACTOR will certify that the excavation meets the requirements in the Contract Drawings and submit documentation of such to the QAC.

(b) CONTRACTOR will survey and/or measure areas of waste excavation beyond the limits of excavation as provided for in the CONTRACTOR's base bid for purposes of determining estimates of quantities required for backfill of the excavation for determining the cost of backfill.

END OF SECTION

SECTION 02224

COAL COMBUSTION RESIDUAL FILL AND BACKFILL

PART 1 - GENERAL

1.01 Description of Work

a) The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of the geomembrane liner subgrade, embankments, anchor trenches, access road subgrade, overexcavated subgrade areas and other related and incidental work within the designated area and as required for the construction of other work, as shown specified or required. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

b) Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.

1.02 Related Sections

a) Section 01050 - Field Engineering/Surveying

b) Section 01550 - Health and Safety Specifications for Construction

c) Section 02150 - Shoring and Bracing

d) Section 02220 - Earthwork

e) Section 02221 - Waste Excavation and Disposal

f) Section 02233 - Coarse Aggregate

g) Section 02597 - Polyethylene Geomembrane

h) “Fugitive Dust Control Plan” Yorktown Power Station – Coal Combustion Residual Management

1.03 Definitions

a) CCR means coal combustion residuals.

b) Coal combustion residuals includes fly ash, bottom ash, boiler slag, and flue gas emission control waste produced by coal-fired electrical or steam generating units.

1.04 Protection of People and Property

Protection of people and property shall conform to the requirements of Section 02220 - Earthwork, of the specifications.

Control of dust from CCR construction practices shall be held to a minimum, and control measures outlined in the 'Fugitive Dust Control Plan - Yorktown Power Station – Coal Combustion Residual Management' shall be adhered to.

1.05 Tolerances

Grading tolerance for all fill shall be - 0 to + 0.1 feet.

PART 2 - PRODUCTS

2.01 Materials

a) All CCR fill materials, unless otherwise specified, shall consist of suitable selected CCR from borrow areas designated by the OWNER.

b) Where density requirements are not specified, a minimum density of 95 percent of maximum dry density shall be used as determined by standard Proctor test (ASTM D698), unless otherwise specified.

c) No frozen CCR shall be used for backfill and fill, and no fill or backfill shall be placed over frozen surfaces. All backfill and fill materials shall be free from all perishable and objectionable (as described below) materials. All fill shall be protected from frost if the QAC judges frost will prevent the material from performing as required.

d) All required fill materials shall be free from organic materials, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. It shall not contain rock fragments, broken concrete, masonry rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted to the specified density. Snow, ice, and frozen soil shall be removed from fill material prior to placement.

e) CCR Fill Material shall be tested according to Subsection 2.03.

2.02 Select CCR Fill and Backfill Material

a) CCR Fill Material shall consist of on-site CCR materials, and that which may come from power generation operations at the Yorktown Power Station. Import of CCR from other sources is not allowed.

b) The liner subgrade shall consist of the top 6 inches of structural fill underlining the geosynthetic liner. The liner subgrade shall contain no particles larger than 3/8 of and inch in their greatest dimension, and be free of organic materials.

c) CCR Fill Material shall meet the testing parameters specified in Subsection 2.03

2.03 Testing

a) 10 days prior to use of proposed materials, the QAC shall submit to the ENGINEER certification that the CCR proposed for fill comply with the Toxicity Characteristic Leachate Procedure (TCLP) Analysis specifications for various constituents as specified in Table 1 (below) of 9VAC20-85-150 (dated April 2, 2007). CCR Fill Material with constituent concentrations exceeding the specified values in Table 1 shall NOT be placed.

Table 1

Constituent	Level, mg/L
Arsenic	5.0
Barium	100
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
Silver	5.0

b) There shall be at least one sampling/testing event for every CCR source, or when there is a noticeable change in a previously sampled/tested source material.

c) The OWNER shall be responsible for testing.

d) Additional confirmation testing may be required by the OWNER to confirm compliance with the specifications as follows:

TEST	METHOD	FREQUENCY
Particle-Size Analysis	ASTM D422	2 per source/type
Standard Proctor Compaction	ASTM D698	2 per source/type

e) The CONTRACTOR shall not proceed with fill operations until the QAC has approved the proposed materials.

f) If in the opinion of the QAC or OWNER, the CONTRACTOR's proposed soil is unsuitable for the proposed application, the CONTRACTOR shall submit the above certification for material of another type or from another source for consideration by the QAC.

2.04 Surveying

All work shall be surveyed as specified in Section 01050 – Field Engineering/Surveying.

PART 3 - EXECUTION

3.01 Precautions

Filling shall not be performed with frozen materials, over frozen materials, snow or ice, or over ponded water, mud or uncompacted subgrades.

3.02 Location Restrictions

Placement of CCR shall be restricted based on 9VAC20-85-70 of the Virginia Administrative Code. CCR shall be placed as fill material only in areas specifically designated on the construction drawings to receive CCR fill.

3.02 CCR Placement and Compaction

(a) Unless otherwise directed, excavations shall be backfilled as soon as possible after subgrades are compacted, structures are constructed, pipes are laid and the work is inspected, tested as required and accepted, and permission to backfill has been given by the QAC. Immediately prior to backfilling, all rubbish, debris, forms, loose or disturbed soils and similar materials shall be removed from the excavations.

(b) Subgrade shall be proofrolled under the observation of the QAC prior to placement of fill. Proofrolling shall be performed with a minimum of the complete coverages with a roller weighing at least 10 tons. Soft or unstable areas identified by QAC during proofrolling shall be overexcavated as directed by QAC to remove unsuitable materials. Excavated unsuitable materials shall be backfilled and compacted with materials satisfying the specification for fill over the subgrade.

(c) The thickness of each compacted layer shall not exceed that specified herein unless otherwise directed by the ENGINEER. Care shall be taken to ensure that no damage is done to structures, geotextiles, or protective coatings thereon.

(d) Unless otherwise stated herein, compaction shall be to 95 percent of maximum dry density determined by ASTM D698 (standard Proctor).

(e) Fill shall be brought up in essentially horizontal uniform lifts throughout the area. The loose lifts shall not exceed 12 inches of thickness and shall be compacted immediately after placement to 95 percent of the standard proctor maximum density.

3.03 Erosion and Sediment Control

Uncovered active fossil fuel combustion products fill areas shall be graded to a maximum slope of 5.0% and a smooth surface maintained to provide for sheet flow runoff and to prevent dusting. Runoff from the use, reuse, or reclamation area shall be controlled and contained by use of diversion ditches, sediment traps, berms, or collection ponds in accordance with the project specification Section 02125 and in accordance with the Virginia Soil and Erosion Control Handbook. Controls shall be designed to divert surface water run on from a 25-year, 24 hour storm event.

3.04 Field Quality Assurance

(a) Testing of fill shall be performed for each lift by the QAC and the results, locations, and lift levels of the field quality assurance tests shall be provided to the OWNER and ENGINEER within 72 hours of review. Any areas that do not meet the above requirements shall be reworked by providing additional compaction effort and adjusting moisture content until acceptable test results are obtained. The CONTRACTOR shall not proceed with a new lift of material until the QAC has confirmed that the previous lift has attained the required density. The CONTRACTOR shall rework by wetting, drying or recompacting noncompliant fill. At his sole convenience and expense, the CONTRACTOR may remove and replace fill materials with prior approval from the QAC.

(b) During construction, tests for the CCR Fill and Backfill Material will be made by a testing laboratory employed by the OWNER as follows:

TEST	METHOD	FREQUENCY
Mechanical Analysis	ASTM D422	One test per 10,000 cubic yards in place (minimum)
Standard Proctor	ASTM D698	A minimum of one test per 10,000 cubic yards of material in place (minimum)
Field Density and Moisture	ASTM D6938	A minimum of one test per 10,000 square foot per lift and one per lift per 100 L.F. of pipe trench

(c) A minimum one test per source shall be performed for all properties in above table.

(d) In areas where the degree of compaction is doubtful, or the uniformity of materials is not maintained based on visual observation, additional tests will be made as directed by the QAC.

(e) The CONTRACTOR shall be responsible for conducting any and all quality control testing necessary for CONTRACTOR's purposes.

END OF SECTION

SECTION 02233

COARSE AGGREGATE

PART 1 - GENERAL

1.01 Description of Work

(a) The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing, placing and compacting the stone as shown, specified or required. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

(b) Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.

1.02 Related Sections

(a) Section 01550 - Health and Safety Specifications for Construction

(b) Section 02150 - Shoring and Bracing

(c) Section 02200 - Earthwork

(d) Section 02595 - Geotextile

PART 2 - PRODUCTS

2.01 Material

(a) The material shall be clean, sound, tough, durable, angular, subangular, subrounded or round stone, not lumpy, and free from slag, cinders, ashes, rubbish, or other deleterious material. Subangular, angular, subrounded, and round shall be as defined in ASTM D2488 entitled "Standard Practice for Description and Identification of Soils [Visual-Manual Procedure].

(b) The CONTRACTOR shall maintain a uniform gradation of coarse aggregate.

(c) Aggregate shall be stored in designated areas approved by the OWNER. The CONTRACTOR is responsible for maintaining the stone free of contamination, and any stone determined by the OWNER to be contaminated shall not be incorporated into the work.

(d) Coarse Aggregate shall meet the following grading requirements.

VDOT No. 57:

Opening of Sieve Size	Percent Passing by Weight
1-1/2 inch	100
1 inch	95-100
1/2 inch	25-50
No. 4	0-10
No. 8	0-5

VDOT No. 21A:

Opening of Sieve Size	Percent Passing by Weight
1/2 inch	100
3/8 inch	85-100
No. 8	10-30
No. 4	0-10
No. 16	0-5

2.02 Testing

(a) The CONTRACTOR shall submit to the ENGINEER and OWNER for approval, certification that the materials proposed for use as coarse aggregate comply with specification for the proposed application. The certification shall include, but not necessarily be limited to testing provided by the material supplier including one or more of the following tests:

(1) Grain Size ASTM D422

(b) Additional confirmatory testing may be required by the QAC to confirm compliance with the specifications.

(c) No material shall be placed unless approved by the QAC.

(d) If, in the opinion of the QAC, the material is unsuitable for the proposed application, then the CONTRACTOR shall submit to the QAC the required certification as specified in (a) above for material from a different source.

PART 3 - EXECUTION

3.01 Placement

(a) A uniform layer of coarse aggregate shall be placed to the lines, depths and grades as shown on the Drawings.

(b) Backfilling of coarse aggregate shall be performed by the CONTRACTOR in a manner such that the material is kept clean and free of foreign materials.

(c) For pipe bedding, the bedding and backfill shall be compacted with the compaction effort acceptable to the QAC. The compaction effort shall be applied to both the bedding and the backfill around the pipes. The method of compaction shall not damage the pipe, geotextile or the flexible membrane liner.

(d) The QAC will at any time inspect the stone in the trenches or in stockpile on-Site for contamination and, if necessary, reject all or portions of the stone.

(e) The CONTRACTOR shall use extreme care in the placing of the material over geosynthetics. The material shall be placed in a manner to maintain a minimum thickness of eighteen inches between the geosynthetics and the spreading equipment. All coarse aggregate placed within the limits of the geosynthetics shall be placed by low pressure equipment. Equipment with ground pressure less than 5 psi may travel on a minimum 18-inch thick coarse aggregate layer. Equipment with a ground pressure equal to or greater than 5 psi must travel on a minimum 36-inch thick coarse aggregate layer.

END OF SECTION

SECTION 02235

VEGETATIVE SUPPORT LAYER

PART 1 - GENERAL

1.01 WORK INCLUDED

This work shall consist of applying topsoil in accordance with these Specifications in all disturbed areas that were originally vegetated.

1.02 RELATED SECTIONS

A. Section 02125 – Erosion and Sediment Control

B. Section 02200 – Earthwork

C. Section 02936 – Seeding

1.03 QUALITY CONTROL

The CONTRACTOR shall provide vegetative support soil samples to the local agricultural agent, in size and quantity necessary, for testing and evaluation. The CONTRACTOR shall furnish and apply the types and quantities of soil conditioner, fertilizer, and seed as recommended by the local agricultural agent.

1.04 SUBMITTALS

At least 14 days prior to the proposed placement of vegetative support soil, the CONTRACTOR shall submit the test results and recommendation of the local agricultural agent to the CQA Consultant for review. Information on soil conditioner and/or fertilizer shall also be submitted, if they are recommended.

PART 2 - PRODUCTS

2.01 MATERIALS

Vegetative support soil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, clay loam). It shall be free of debris, trash, stumps, rocks, roots and noxious weeds, and shall give evidence of being able to support plant growth. Topsoil shall have:

a. Organic matter content not less than 1.5 percent by weight.

b. pH range of 6.0 to 7.5.

c. Soluble salts less than 500 ppm.

d. No substance that is toxic to plant growth

PART 3 - EXECUTION

3.01 PREPARING AREAS TO RECEIVE VEGETATIVE SUPPORT SOIL

Unless otherwise directed by the OWNER, areas designated to receive vegetative support soil shall be graded, shaped, and then scarified or tilled by disking, harrowing, or other approved methods to a depth of approximately 2 inches. Soil shall be applied only when the subsoil is in a loose, friable condition.

Subsoil on slopes that have been horizontally grooved in accordance with the Contract Drawings shall not be loosened.

3.02 APPLYING VEGETATIVE SUPPORT SOIL

The loose depth of topsoil shall be sufficient to restore the disturbed areas to their original condition.

Topsoil shall not be used in muddy or frozen conditions. After topsoil has been applied, large clods, hard lumps, and unacceptably large stones; brush; roots; stumps; litter, and foreign material shall be removed from the area. When the operation is complete, the area shall be in a condition to receive seed, sod, or plants without further soil preparation. Areas shall be seeded within 15 days after topsoil is applied.

* * * * * END OF SECTION * * * * *

SECTION 02271

STONE RIPRAP AND GROUTED RIPRAP

PART 1 - GENERAL

1.01 Description of Work

(a) The CONTRACTOR shall provide all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing and placing stone riprap, as shown, specified or required. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

(b) Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.

1.02 Related Sections

(a) Section 02125 - Temporary and Permanent Erosion and Sediment Control

(b) Section 02595 – Geotextile

(c) Virginia Erosion and Sediment Control Handbook, Section 3.19 – Riprap

(d) U.S. Army Corps of Engineers, Engineering Technical Letter ETL 1110-2-334 “Design and Construction of Grouted Riprap” August 1992

PART 2 - PRODUCTS

2.01 Material

(a) Stone riprap shall consist of hard, durable, subangular material. It shall be free from any considerable amount of flat, laminated or elongated particles; and shall be free from cracks, overburden shells, clay, organic matter, or other deleterious matter.

(b) The riprap shall be composed of an evenly distributed mixture such that 50 percent of the mixture by weight shall be larger than the d_{50} size as indicated on the Contract Drawings. The diameter of the largest stone size in such a mixture shall be at least 2.0 times the d_{50} size. The diameter of the smallest stone size in such a mixture shall be greater than 0.5 times the d_{50} size.

(c) Nonwoven geotextile shall be a nonwoven geotextile of at least 6 oz / sy and be placed in order to minimize seams and be securely anchored at the edges. The geotextile shall be overlapped a minimum of 6-inches prior to seaming. All geotextile seams shall be continuously sewn or thermally bonded. The geotextile shall be placed loosely so as to ‘give’ and, therefore avoid stretching and tearing during placement of riprap.

2.02 Submittals

Submit manufacturer's certification of material properties as outlined in Part 2 to the ENGINEER.

PART 3 - EXECUTION

3.01 Installation – Loose Riprap

(a) All stone riprap shall be placed either on a nonwoven geotextile or aggregate stone base per Standard & Specification 3.19 of the Virginia Erosion and Sediment Control Manual. The edges of the geotextile shall be sufficiently anchored to prevent movement during rock placement.

(b) Stone riprap shall be placed to thicknesses as indicated on Contract Drawings.

(c) Stone riprap shall be placed in a manner that will not damage geotextile, synthetics, utilities or other facilities. Riprap shall not be dropped from a height exceeding three feet.

(d) The tolerance in riprap thickness in place shall be -0 to +0.3 feet.

(e) No material shall be placed unless approved by the OWNER.

3.02 Installation – Grouted Riprap

(a) Grout shall consist of 1 part hydraulic cement and 3 parts sand, thoroughly mixed with water to produce grout having a thick, creamy consistency.

(b) Stones shall be of the same sizes and placed in the same manner as specified for dry riprap, Class I. Care shall be taken during placing to keep earth or sand from filling spaces between stones. After stones are in place, spaces between them shall be filled with grout from bottom to top and the surface swept with a stiff broom.

(c) Riprap shall not be grouted in freezing weather. In hot, dry weather, the work shall be protected from sunlight and kept moist for at least 3 days after grouting by the use of saturated burlap or other suitable method.

END OF SECTION

SECTION 02286

GEOMEMBRANE PIPE BOOTS AND SLEEVES

PART 1 GENERAL

1.01 Description

Furnish and install HDPE or LLDPE pipe boot or pipe sleeve for use in areas where the geomembrane liner must be penetrated by drainage conveyance system as shown on plans and in accordance with these specifications.

1.02 Quality Assurance

The CONTRACTOR shall assist the QAC in all testing required; the CONTRACTOR will supply any laborers and equipment necessary for assistance in the testing at no additional cost. This work may include, but is not limited to providing material, samples and revising work to meet the intent of the plans and specifications.

1.03 Submittals

(a) The CONTRACTOR shall supply material certificates for the boots, sleeves and stainless steel straps.

(b) If the boot or sleeve is fabricated by the manufacturer, shop drawings must be submitted for approval by the ENGINEER. The boot or sleeve shall not be shipped until the shop drawings are approved.

1.04 Related Work

(a) Geomembrane - Section 02597

(b) Leachate Collection and Conveyance Pipe - Section 02650

PART 2 - PRODUCTS

2.01 Pipe Boots And Pipe Sleeves

The pipe boot or sleeve shall be constructed or manufactured with 60 mil (nominal) smooth sheet high density polyethylene (HDPE), or 40 mil Linear Low Density Polyethylene (LLDPE).

PART 3 - EXECUTION

3.01 Construction Methods

(a) The pipe boot or sleeve shall be installed in areas where the geomembrane liner must be penetrated as shown on the Contract Drawings.

(b) Prior to constructing the boot or sleeve, the CONTRACTOR shall assure that the material in the area of the penetration is properly compacted and that the area is clean. The CONTRACTOR shall take extreme care in work to assure the geomembrane liner is not damaged.

(c) The size of the boot or sleeve shall be adequate to provide 6" overlap of the geomembrane liner.

(d) Extrusion welding shall be as shown on the Contract Drawings.

(e) When tightening the stainless steel adjustment bands, the CONTRACTOR shall be careful not to over tighten the bands, thereby causing damage to the boot or sleeve.

3.02 Inspection and Testing

(a) The CONTRACTOR shall employ non-destructive testing of all welds to the geomembrane liner. A vacuum box test or spark test would provide adequate testing.

(b) The CONTRACTOR is responsible for providing all necessary test equipment and shall conduct the test. The testing of welds shall be observed by the QAC.

END OF SECTION

SECTION 02418

GEOCOMPOSITE DRAINAGE LAYER

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, and equipment necessary for the installation of a geocomposite drainage layer as specified herein, as shown on the Drawings, and in accordance with the Quality Assurance/Quality Control (QA/QC) Program.

B. The Contractor shall be prepared to install the geocomposite drainage layer in conjunction with earthworks and other components of the liner system.

1.02 REFERENCES

A. Quality Assurance/Quality Control (QA/QC) Program.

B. Latest version of American Society for Testing and Materials (ASTM) standards:

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

2. ASTM D 1505, Standard Test Method for Density of Plastics by the Density-Gradient Technique.

3. ASTM D 4716, Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.

4. ASTM D 1603, Standard Test Method for Carbon Black in Olefin Plastics.

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

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

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

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

9. ASTM F 904, Standard Test Method for Comparison of Bond Strength or Ply Adhesion of Similar Laminates Made from Flexible Materials.

10. ASTM D 1777, Standard Method for Measuring Thickness of Textile Materials.

11. ASTM D 5261-92(2003) Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

1.03 QUALIFICATIONS

A. The Contractor shall provide the services of a Geocomposite Manufacturer and Installer, who shall meet the following qualifications. The Contractor shall, however, accept and retain full responsibility for all materials and installation and shall be held responsible for any defects in the completed system.

1. Manufacturer

a. The Geocomposite Manufacturer shall be responsible for the production and delivery of geocomposite rolls and shall be a well-established firm with more than one year of experience in the manufacture of geocomposite. The Manufacturer shall submit a statement to the QAC listing:

1) Certified minimum property values of the proposed geocomposite and the tests used to determine those properties.

2) Production capacity available and projected delivery dates for this project.

2. Installer

a. The Installer shall be responsible for field handling, storing, deploying, seaming or joining, temporary restraining (against wind), anchoring systems, and other site aspects of the geocomposite drainage layers.

b. The Installer shall be trained and qualified to install geocomposite. The installer's qualifications will require the QAC's approval.

B. Prior to confirmation of any contractual agreements, the potential installer shall provide the QAC with the written information that corresponds to the information required in this Part.

1.04 SUBMITTALS

A. The Contractor shall submit to the QAC in writing the following documentation on the raw materials used to manufacture the geocomposite prior to transporting any geocomposite to the site:

1. Copies of quality control certificates issued by the resin supplier including production dates of the resin.

2. Results of tests conducted to verify the quality of the resin used to manufacture the geonet and geotextile material assigned to the project.

3. Certification that no reclaimed polymer is added to the resin during the manufacture of the geonet and geotextile material to be used in this project.

B. The Contractor shall submit to the QAC the following information on the geotextile:

1. Copies of quality control certificates issued by the geotextile manufacturer. The certificate should include roll number and identification.

2. The quality control certificate shall include:

a. roll numbers lot or batch numbers and identification;

b. sampling procedures; and

c. results of quality control tests, including descriptions of test methods used.

3. The geotextile shall meet the requirements of Table 02418-1. Quality Control Testing of the geotextile shall be in conformance with the frequencies specified in Table 02418-2.

C. The Contractor shall submit to the QAC the following information on geocomposite production:

1. Manufacturing quality control certificates for each shift's production, signed by responsible parties employed by the Manufacturer (such as the production manager), and notarized.

2. The quality control certificate shall include:

a. roll numbers and identification;

b. sampling procedures; and

c. results of quality control tests, including descriptions of test methods used.

3. The quality control testing to be performed by the manufacturer is presented in Part 2.02 of this Section.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The installation of the geocomposite shall be monitored as outlined in the Quality Assurance/Quality Control (QA/QC) Program.

B. The Contractor shall be aware of the activities outlined in the QA/QC Program and shall account for these CQA activities in the installation schedule.

PART 2 - PRODUCTS

2.01 GEOCOMPOSITE DRAINAGE LAYER PROPERTIES

A. The Manufacturer shall furnish geocomposite having properties that comply with the required property values shown in Table 02418-1. The Manufacturer shall provide test results for these procedures, as well as certification that the materials meet or exceed the specified values.

B. In addition to the property values listed in Table 02418-1, the geocomposite shall:

1. Retain their structure during handling, placement, and long-term service.

2. Be capable of withstanding outdoor exposure for a minimum of 30 days with no measurable deterioration.

3. Be chemically inert when immersed in the leachate from a typical landfill.

2.02 MANUFACTURING QUALITY CONTROL

A. The geocomposite shall be manufactured with quality control procedures that meet generally accepted industry standards.

B. The Contractor shall require that the Geocomposite Manufacturer sample and test the geocomposite to demonstrate that the material conforms to the requirements of this Section.

C. Any geocomposite sample that does not comply with this Section shall result in rejection of the roll from which the sample was obtained. The Contractor shall replace any rejected rolls at no additional cost to The Owner.

D. Additional sample testing may be performed, at the Geocomposite Manufacturer's discretion and expense, to more closely identify any non-complying rolls and/or to qualify individual rolls.

E. Sampling shall, in general, be performed on sacrificial portions of the geocomposite material such that repair is not required. The Contractor shall require that the Geocomposite Manufacturer sample and test the geocomposite at the frequencies presented in the Geocomposite Manufacturer's Quality Control Plan.

F. The manufacturer shall test the materials at the frequencies shown in Table 02418-2 to demonstrate that its properties conform to the values specified in Table 02418-1.

G. The Contractor shall require that the Geocomposite Manufacturer comply with the certification and submittal requirements of the QA/QC Program.

2.03 LABELING

A. Geocomposite shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.

B. Geocomposite rolls shall be labeled with the following information.

1. manufacturer's name;

2. product identification;

3. lot or batch number;

4. roll number; and

5. roll dimensions.

C. If any special installation is required, it shall be so marked on the geotextile component e.g., "This Side Up" or "This Side Against Soil".

2.4 HANDLING AND STORAGE

A. Handling, storage, and care of the geocomposite prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by the Owner.

B. The Contractor shall be responsible for storage of the geocomposite at the site. The geocomposite shall be stored off the ground and out of direct sunlight, and shall be protected from excessive heat or cold, mud, dirt, and dust. Any additional storage procedures required by the manufacturer shall be the Contractor's responsibility.

PART 3 - EXECUTION

3.01 FAMILIARIZATION

A. Prior to implementing any of the work described in this Section, the Contractor shall become thoroughly familiar with all portions of the work falling within this Section and the QA/QC Program.

B. Inspection

1. Prior to implementing any of the work in this Section, the Contractor shall carefully inspect the installed earthwork, liner and other related Sections and verify that all work is complete to the point where the installation of this Section may properly commence without adverse impact.

2. If the Contractor has any concerns regarding the installed work of other Sections, he/she shall notify the QAC in writing within 48 hours of his site inspection. Failure to inform the QAC in writing or installation of the geocomposite will be construed as Contractor's acceptance of the related work of all other Sections.

3.02 CQA CONFORMANCE TESTING

A. Upon delivery to the site or at the location of the manufacturer, samples of the geocomposite shall be removed by the QAC and sent to the laboratory selected by the QAC for testing to ensure conformance to this Section.

B. Samples and tests shall be selected by the QAC in accordance with this Section and the procedures outlined in the QA/QC Program.

C. Samples shall be taken at the rate of one sample per 200,000 square feet with a minimum of one sample per lot. Samples shall be tested for the properties presented in Table 02418-3.

D. The QAC may increase the frequency of sampling as outlined in the QA/QC Program in the event that test results do not comply with Part 2.01 of this Section. This additional testing shall be performed at the expense of the Contractor.

E. Any geocomposites that are not certified in accordance with Part 1.03 and 1.04 of this Section, or that conformance testing indicates do not comply with Part 2.01 of this Section shall be rejected and replaced with new material by the Contractor at no additional cost to the Owner.

3.03 HANDLING AND PLACEMENT

A. The Contractor shall handle the geocomposite in such a manner as to ensure the geocomposite drainage layers are not damaged in any way.

B. The Contractor shall take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite.

C. In the presence of wind, the geocomposite shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.

D. On side slopes, the geocomposite shall be secured in the anchor trench and then rolled down the slope in such a manner as to continually keep the geocomposite in tension.

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

F. Care shall be taken during placement of geocomposite not to entrap dirt or excessive dust in the geonet core that could cause clogging of the drainage system, and/or stones that could damage the adjacent liner. If dirt or excessive dust is trapped in the geocomposite, it should be cleaned prior to placement of the next material on top of it.

G. Geocomposite shall only be cut using Manufacturer's recommended procedures.

H. Unless otherwise specified, geocomposite shall not be welded to liners.

I. Tools shall not be left on, in, or under the geocomposite.

J. After unwrapping the geocomposite from its opaque cover, the geocomposite shall not be left exposed for a period in excess of 30 days unless a longer exposure period is approved by the QAC, based on a formal demonstration from the Contractor that the geotextile component of the geocomposite is stabilized against U.V. degradation for a period in excess of 30 days.

K. If white colored geotextile is used in the geocomposite, precautions shall be taken against "snowblindness" of personnel.

3.04 INSTALLATION

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

B. Geonet Components

1. Adjacent edges of geonet shall be overlapped at least 4 inches. These overlaps shall be secured by tying with white nylon ties at 5 foot intervals in the direction of the roll length.

2. Geonet roll ends (butt seams) shall be shingled down in the direction of the slope, with the geonet portion of the top overlapping the geonet portion of the bottom geocomposite a minimum of 12 inches across the roll width. White nylon ties shall be applied at 6 inch intervals.

3. Geonet shall be tied at 6 inch intervals with white nylon ties in the anchor trench.

C. Geotextile Components

1. The bottom layer of geotextile shall be overlapped. The top layer of geotextile shall be continuously sewn with contrasting color thread in the direction of the roll length or heat bonded using methods demonstrated to the satisfaction of the ENGINEER. Geotextiles shall be overlapped a minimum of 4 inches prior to seaming.

2. Polymeric thread, with chemical resistance properties equal to or exceeding those of the geotextile component, shall be used for all sewing. The thread shall be a contrasting color (white or other light color) to facilitate seam inspection. The seams shall be sewn to provide a flat (prayer) seam, "J" seam, or "butterfly-folded" seam and shall be a two-thread, double-lock stitch or a double row of single-thread, chain stitch.

3.05 REPAIR

A. Any holes or tears in the geocomposite shall be repaired by placing a patch extending 2 feet beyond the edges of the hole or tear. The patch shall be secured by tying fasteners through the bottom geotextile and the geonet of the patch, and through the top geotextile and geonet on the slope. The patch shall secure every 6 inches with approved tying devices. The top geotextile component of the patch shall be heat sealed to the top geotextile of the geocomposite needing repair. If the hole or tear width across the roll is more 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 in accordance with Subsection 3.04 above.

3.06 PLACEMENT OF SOIL MATERIALS

A. The Contractor shall place the soil materials in such a manner as to ensure that:

1. no construction equipment operates directly on the geocomposite;

2. the geocomposite and underlying lining materials are not damaged;

3. minimal slippage occurs between the geocomposite and underlying layers; and

4. excess tensile stresses are not produced in the geocomposite.

B. Unless otherwise specified by the QAC, all equipment operating on soil material overlying the geonet shall comply with the following:

Equipment Ground Pressure (psi)	Thickness of Overlying Material (in.)
<5	18
>5	36

3.07 PRODUCT PROTECTION

A. The Contractor shall use all means necessary to protect all prior work, and the materials and completed work of other Sections.

B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary, to the approval of the QAC and at no additional cost to the Owner.

TABLE 02418-1 GEOCOMPOSITE PROPERTY VALUES (MARV)				
PROPERTIES AND REQUIREMENTS	**QUALIFIER**	**UNITS**	**SPECIFIED VALUES**	**TEST METHOD**
HDPE GEONET CORE				
Thickness	Minimum	mil	250	ASTM D 5199
Geonet Density	Minimum	g/cm^3	0.94	ASTM D 1505
Carbon Black Content	Range	%	2 - 3.5	ASTM D 1603
GEOTEXTILE COMPONENT				
Mass Per Unit Area	Minimum	oz/yd^2	8.0	ASTM D 5261
Apparent Opening Size	Maximum	US sieve	80	ASTM D 4751
Permittivity	Minimum	Sec^{-1}	1.5	ASTM D 4491
Grab Strength	Minimum	lb	200	ASTM D 4632
Puncture Strength	Minimum	lb	100	ASTM D 4833
UV Resistance	Minimum	%@hr	70@500	ASTM D 4355
GEOCOMPOSITE				
Transmissivity	Minimum	m^2/s	$3x10^{-4}$	ASTM D 4716
Ply Adhesion	Minimum	g/cm	178	ASTM F 904 or ASTM D 7005

NOTES:
The design transmissivity is the transmissivity of the geocomposite drainage layer measured using water at 70°F with a gradient of not less than 0.1, under a compressive stress of not less than 10,000 psf. For the test, the geocomposite shall be sandwiched between stainless steel plates for 100 hours.

TABLE 02418-2 REQUIRED MANUFACTURER QUALITY CONTROL TEST FREQUENCIES		
PROPERTY	TEST METHOD	FREQUENCY
GEONET CORE		
Geonet Density	ASTM D 1505	Every 100,000 ft^2
Geonet Carbon Black Content	ASTM D 1603	Every 100,000 ft^2
Geonet Thickness	ASTM D 5199	Every 100,000 ft^2
GEOTEXTILE COMPONENT		
Mass Per Unit Area	ASTM D 5261	Every 100,000 ft^2
Grab Tensile	ASTM D 4632	Every 100,000 ft^2
Apparent Opening Size	ASTM D 4571	Every 200,000 ft^2
Permittivity	ASTM D 4491	Every 200,000 ft^2
Puncture Strength	ASTM D 4833	Every 100,000 ft^2
GEOCOMPOSITE		
Transmissivity	ASTM D 4716	One per production lot
Ply Adhesion	ASTM F 904	Every 200,000 ft^2

TABLE 02418-3 REQUIRED CQA QUALITY CONTROL TEST FREQUENCIES		
PROPERTY	TEST METHOD	FREQUENCY
GEOCOMPOSITE		
Transmissivity	ASTM D 4716	One per production lot
Ply Adhesion	ASTM F 904	Every 200,000 ft^2

END OF SECTION

SECTION 02419

DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to perform all demolition activities.

B. Coordination:

1. Review demolition procedures with the ENGINEER.

1.02 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Department ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.03 SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for dust and noise control.

B. Indicate proposed locations and construction of barriers.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with local and State regulations before beginning demolition.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

3.1 UTILITY SERVICES /ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

C. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of demolition and that maintain continuity of services/systems.

3.2 PREPARATION

A. Site Access and Temporary Controls: Conduct demolition and debris-removal operations to ensure minimum interference with roads and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to facilities to remain.

3.4 DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required and as indicated. Use methods required to complete the Work within limitations of governing regulations. Dispose of demolished items and materials promptly.

3.5 DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Asphalt: Demolish in sections. Cut asphalt full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove asphalt between saw cuts.

B. Piping: Saw cut pipe at limit of removal, then cut pipe into manageable/transportable sections and remove from site. Cap end sections of pipe to remain. Pipe indicated to be abandoned in-place shall be capped at termination point or at ground surface as directed by the ENGINEER.

C. Electrical: Electrical demolition shall comply with OWNER requirements as directed by the OWNER.

1. Utility Poles and Appurtenances: utility poles shall be cut at ground surface and disposed at the direction of the OWNER. Cross ties, and appurtenances shall be removed from utility poles prior to utility pole demolition. Cross ties and appurtenances shall be disposed at the direction of the OWNER.

2. Fencing: Fence fabric and wire shall be removed, rolled and disposed on-site at the direction of the OWNER. Fencing hardware, i.e. latches, hinges shall be disposed off site or as directed by the OWNER.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove demolished materials from Project site and dispose of them as directed by the OWNER.

END OF SECTION

SECTION 02595

GEOTEXTILE AND GEOGRID

PART 1 - GENERAL

1.01 Description of Work

(a) The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing, and placing geotextile, complete with appurtenances, as shown, specified or required. CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all work.

(b) Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

1.02 Related Sections

(a) Section 01300 – Submittals

(b) Section 02223 – Earthwork

(c) Section 02233 – Coarse Aggregate

(d) Section 02597 – Polyethylene Geomembrane

1.03 Submittals

(a) The CONTRACTOR shall furnish a mill certificate from the company manufacturing the woven and non-woven geotextile attesting that the geotextile meets the chemical, physical, and manufacturing requirements specified. Geotextiles shall be rejected by the ENGINEER and replaced by the CONTRACTOR if they are found to have defects, rips, holes, flaws, deterioration or other damage.

(b) The contractor shall submit shop drawings to the QAC showing proposed construction methods: geosynthetics panel arrangements; and tie-in details between geosynthetics, drainage structures, fill materials, and the like.

1.04 Product Handling

(a) The CONTRACTOR shall protect the work described in this Section before, during, and after installation, and shall protect the installed work covered by other Sections.

(b) The CONTRACTOR shall, during all periods of shipment and storage, protect the geotextile from direct sunlight, ultraviolet light, temperatures greater than 120 degrees F, mud, dirt, dust, debris and other deleterious sources. Geotextiles shall be maintained, wrapped in a heavy-duty protective covering until it is installed.

(c) If the QAC determines material is damaged or has excessive sunlight exposure, the CONTRACTOR shall immediately make all repairs and replacements, at no additional cost to the OWNER.

1.05 Definitions

On the Drawings and in the Specifications, the word geotextile is used and refers to either a woven or non-woven geotextile as described in Section 2.01.

1.06 Conformance Testing of Geotextile

(a) Filter geotextiles will be tested prior to shipment to ensure that the properties of the finished product are in accordance with the construction specifications. The required material properties, test methods, values, and units are presented in Section 2.01. Samples of geotextiles will be tested by the manufacturer at a frequency of one sample for every 50,000-ft² of material produced. Geotextile samples will have test results for the properties and to the requirements given in Section 2.01 or Section 2.02. Each roll of geotextile will have the product identification, roll number, lot number, date of manufacturer, and manufacturer name clearly marked.

(b) Prior to or upon delivery of the geotextile to the Site, the ENGINEER shall obtain certifications for the materials.

(c) Upon delivery of the geotextile to the Site, the QAC shall obtain representative samples of the furnished product for conformance testing, the required material properties, test methods, values, and units are presented in Section 2.01. Samples of the geotextile will be tested by an independent testing laboratory at a frequency of one sample per lot, but a minimum of one sample per 100,000 square feet of material delivered.

PART 2 - MATERIALS

2.01 Woven Geotextile

(a) Woven geotextiles used in the perimeter roadways shall be manufactured by Mirafi, Amoco, Exxon, Nicolon, Hoechst or other approved manufacturers. Woven geotextiles shall meet the requirements of AASHTO M288 Survivability Class 2 or better.

(b) Woven geotextiles shall be placed at the roadway subgrade elevations as indicated on the Contract Drawings. Woven geotextile shall meet the following MARV minimum properties:

Property	Test Method	Value
Polymer Composition	-	95% polypropylene or polyester by weight
Grab Tensile Strength	ASTM D4632	250 lbs
Grab Tensile Elongation	ASTM D4632	10 %
Trapezoidal Tear Strength	ASTM D4533	90 lb
CBR Puncture Strength	ASTM D6241	500 lbs
Apparent Opening Size	ASTM D4751	40 sieve (0.425 mm)

(c) To keep the number of seams to a minimum, the geotextile shall be provided in sections not less than 12 feet wide.

2.02 Filter Geotextile

(a) The filter geotextile used for wrapping the leachate collection stone shall be a nonwoven geotextile conforming to AASHTO M288 Survivability Class 2 and be suitable for fines in excess of 50% in the surrounding material.

Property	Test Method	Value	Manufacturer's QC Testing Frequency	QA Testing Frequency
Polymer Composition	-	95% polypropylene or polyester by weight	Certified by Manufacturer	N/A
Grab Tensile Strength	ASTM D4632	158 lbs (MD)[1]	1 test per 50,000 sf	1 test per 100,000 sf
Grab Tensile Elongation	ASTM D4632	>50 % (MD)[1]	1 test per 50,000 sf	1 test per 100,000 sf
Trapezoidal Tear Strength	ASTM D4533	56 lb	1 test per 50,000 sf	1 test per 100,000 sf
CBR Puncture Strength	ASTM D6241	320 lbs	1 test per 50,000 sf	1 test per 100,000 sf
Apparent Opening Size	ASTM D4751	70 sieve	1 per production lot	1 test per 200,000 sf
Permitivity	ASTM D4491	0.28 sec^{-1}	1 per production lot	1 test per 200,000 sf
UV Resistance	ASTM D4355	70 %	Certified by Manufacturer	N/A

1. Machine Direction

2.03 Geogrid

(a) The geogrid used for the containment of the stone underdrain of the Articulated Concrete Block (ACB) channel shall be a biaxial geogrid with apertures sizes less than one inch (1”), but greater than 1/8”. Geogrid shall be manufactured from polyester (PET) or polypropylene (PP) and have an inert outer coating.

PART 3 - EXECUTION

3.01 Site Preparation

(a) Site subgrade preparation shall conform to the requirements of this Section, and Section 02200 - Earthwork.

(b) The surface to receive geotextile shall be cleared of sharp objects, boulders, stumps, or any materials that may contribute to fabric punctures, shearing, rupturing or tearing to the satisfaction of the QAC.

(c) The base surface or surface of embankments shall be graded as smooth as possible and compacted with a smooth - drummed roller having a minimum operating weight of 10 tons capable of vibratory and static compaction mode. The subgrade shall be inspected for unstable areas or soft spots, before the geotextile is placed and additional fill shall be placed and compacted to eliminate those unstable areas.

3.02 Installation

(a) The geotextile shall be placed in the manner and at the locations shown. Geotextile shall be laid smooth and free of tension, stress, folds, wrinkles, or creases.

(b) Woven geotextiles and geogrids will be overlapped a minimum of 2 feet, with the upgradient rolled lapped over the downgradient roll, prior to placing stone.

(c) All filter geotextile seams shall be continuously sewn or heat bonded by means approved by the ENGINEER. Spot sewing is not allowed. Filter geotextiles will be overlapped a minimum of 6 inches prior to seaming.

(d) No vehicles shall be permitted on the geomembrane, non-woven geotextile, or geotextile prior to placement of the 18-inch thick drainage layer. Equipment with ground pressure less than 5 psi may travel on a minimum 18-inch layer. Equipment with ground pressure equal to or greater than 5 psi must travel on a minimum 36-inch thick layer.

(e) Stone or drainage collection material shall be spread in the direction of the geotextile overlap (i.e., upgradient to downgradient).

(f) If geotextile is damaged during any step of installation, a piece of geotextile material shall be cut and placed over the damaged area and overlap the undamaged material a minimum of 3 feet in each direction.

(g) The geotextile shall be placed on side slopes as shown on the contract drawings. If necessary, the geotextile shall be positioned by hand after being unrolled to minimize wrinkles. The geotextile shall not be placed in the horizontal direction (i.e. across the slope) on slopes steeper than 10 (horizontal): 1 (vertical), except as part of a patch.

3.03 Protection

(a) After installation, the geotextile should be visually inspected to assure that no objects are present that could potentially harm the geotextile.

(b) Any geotextile damaged during its installation or during placement of cover material, as deemed by the QAC, shall be replaced by the CONTRACTOR at no additional cost to the OWNER.

(c) The work shall be scheduled so that the covering of the geotextile with the material to be placed over it is accomplished within 30 days after placement of the geotextile. Failure to comply with this requirement shall require replacement of an additional geotextile at no additional cost to the owner.

(d) When spot-repairing geotextile with patches, a 3-foot lystered overlap will be used or by a means approved by the ENGINEER.

END OF SECTION

SECTION 02597

POLYETHYLENE GEOMEMBRANE (HDPE AND LLDPE)

PART 1 GENERAL

1.01 SUMMARY

(A) Section Includes:

1. Textured polyethylene (HDPE) geomembrane shall be used for base liner construction.
2. Textured polyethylene (LLDPE) geomembrane shall be used for final cover systems.

1.02 References

(A) Quality Assurance/Quality Control Plan

(B) Latest Version of American Society for Testing and Materials (ASTM) standards:

1. D 792 Specific Gravity (Relative Density) and Density of Plastics by Displacement
2. D 1004 Test Method for Initial Tear Resistance of Plastics Film and Sheeting
3. D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
4. D 1505 Test Method for Density of Plastics by Density-Gradient Technique
5. D 3895 Test Method for Oxidative Inductive Time of Polyolefins by Thermal Analysis
6. D 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
7. D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
8. D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
9. D 5397 Procedure to Perform a Single Point Notched Constant Tensile Load –(SP-NCTL) Test: Appendix
10. D 5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
11. D 5617 Test Method for Multi-Axial Tension Test for Geosynthetics
12. D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes
13. D 5885 Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
14. D 5994 Test Method for Measuring the Core Thickness of Textured Geomembranes
15. D 6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

(C) Geosynthetic Research Institute (GRI) Standard Specifications and Test Methods:

1. GM 12: Measurement of the Asperity Height of Textured Geomembranes Using a Depth Gage

2. GM 13: Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
3. GM 17: Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes
4. GM 19: Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

1.03 SUBMITTALS

(A) Pre-installation: Submit prior to geomembrane deployment:

1. Origin (supplier's name and production plant) and identification (brand name and number) of resin used to manufacture geomembrane.
2. Copies of dated quality control certificates issued by resin supplier.
3. Results of tests conducted by geomembrane manufacturer to verify that resin used to manufacture geomembrane meets Specifications.
4. Manufacturer’s certification concerning no more than 10% rework and no post-consumer resins used in the formulation as listed in Section 2.01.A of this Specification.
5. List of materials that comprise geomembrane, expressed in following categories as percent by weight: polyethylene, carbon black, and other additives.
6. Manufacturer's specification for geomembrane that includes properties listed and measured using appropriate test methods.
7. Written certification that minimum values given in manufacturer's specification are guaranteed by geomembrane manufacturer.
8. Quality control certificates, signed by geomembrane manufacturer. Each quality control certificate shall include applicable roll identification numbers, testing procedures, and results of quality control tests.
9. Field panel layout and identification code including dimensions and details.
10. Resumes of Geomembrane superintendent and master seamer including dates and duration of employment.
11. Installation schedule.
12. List of personnel performing seaming operations including experience information.
13. Certificate that extrudate to be used is comprised of same resin as geomembrane to be used.
14. List of seaming devices with identification numbers.

(B) Installation: Submit as installation proceeds.

1. Quality control documentation recorded during installation.
2. Subgrade surface acceptance certificates signed by LINER INSTALLER for each area that will be covered directly by geomembrane. Submit prior to geomembrane deployment.
3. Deployment of geomembrane will be considered acceptance of subgrade if certificate is not submitted.
4. Material and Installation Warranty from manufacturer.

(C) Submit in accordance with Section 01300.

1.04 PREQUALIFICATIONS:

(A) Manufacturer:

1. Manufacturer shall have minimum 5 yrs continuous experience in manufacture of HDPE or LLDPE geomembrane or experience totaling 10,000,000 sq ft of manufactured HDPE or LLDPE geomembrane for minimum of 10 completed facilities.

(B) Fabricator (if applicable):

1. Fabricator shall have minimum 5 yrs continuous experience in fabrication of HDPE or LLDPE geomembrane or experience totaling 2,000,000 sq ft of fabricated HDPE or LLDPE geomembrane for minimum of 10 completed facilities.

(C) Installer:

1. Installer shall have a minimum of 5 yrs continuous experience in installation of HDPE or LLDPE geomembrane or experience totaling 2,000,000 sq ft of installed HDPE or LLDPE geomembrane for minimum of 10 completed facilities.
2. Personnel performing seaming operations shall be qualified by experience or successfully passing seaming tests. Minimum of one seamer shall have experience seaming minimum 2,000,000 sq ft of HDPE or LLDPE geomembrane using the same type of seaming apparatus in use at site. Most experienced seamer, "master seamer," shall provide direct supervision, as required, over less experienced seamers.

1.05 QUALITY ASSURANCE PROGRAM

(A) Manufacturer, fabricator, and installer shall participate in and conform to the items and requirements of quality assurance program as outlined in this section and in the document entitled: Construction Quality Assurance Plan for the Yorktown Power Station Ash Structural Fill Facility Vertical Expansion Construction, dated August 2008.

1.06 DELIVERY, STORAGE, AND HANDLING

(A) Packing and Shipping:

1. Manufacturer shall identify each roll delivered to site with the following:

a. Manufacturer's name.
b. Product Identification.
c. Thickness.
d. Roll number.
e. Roll dimensions.

2. Protect geomembrane from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions during loading, transport, and unloading at site.

(B) Acceptance at Site:

1. Conduct surface observations of each roll for defects and damage. This examination shall be conducted without unrolling rolls unless defects or damages are found or suspected.
2. Defected or damaged rolls or portions of rolls will be rejected and shall be removed from site and replaced with new rolls.
3. Rolls or portions of rolls without proper identification or labeling will be rejected and shall be removed from site.

(C) Storage and Protection:

1. OWNER will provide on-site storage area for geomembrane rolls from time of delivery until deployment.
2. INSTALLER shall, protect geomembrane from dirt, water, and other sources of damage.
3. Preserve integrity and readability of geomembrane roll labels.
4. Rolls, which do not have proper identification at delivery, will not be accepted.

PART 2 PRODUCTS

2.01 MATERIALS

(A) Polyethylene Resin

1. The resin shall be virgin material with no more than 10% rework. If rework is used, it must be a similar formulation (HDPE or LLDPE) of the parent material.
2. No post-consumer resin of any type shall be added to the formulation.

(B) Textured Polyethylene Geomembrane Properties:

Testing Properties	**Testing Method**	**40 mil LLDPE Value**	**60 mil HDPE Value**
Thickness mils (min ave.) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	ASTM D 5994	38 mils 36 mils 34 mils	57 mils 54 mils 51 mils
Density g/cc	ASTM D1505 or ASTM D792	0.939 (max)	0.940 (min ave.)
Asperity Height (min ave.) (1) (2)	GM-12	10 mils	10 mils

Testing Properties	Testing Method	40 mil LLDPE Value	60 mil HDPE Value
Tensile Properties (min. ave.) (3) • Yield strength – lb/in • Break strength – lb/in • Yield elongation - % • Break elongation - %	ASTM D6693 Type IV	 N/A 60 N/A 250	 126 90 12 100
Tear Resistance – lb (min. ave.)	ASTM D1004	22	42
Puncture Resistance – lb (min. ave.)	ASTM D4833	44	90
Stress Crack Resistance (11)	ASTM D5397	NA	300 hr
Carbon Black Content - %	ASTM D1603 (4)	2.0 to 3.0	2.0 to 3.0
Carbon Black Dispersion	ASTM D 5596	Note (5)	Note (5)
Oxidative Induction Time (OIT) (min ave.) (6) • Standard OIT, or • High Pressure OIT	 ASTM D3895 ASTM D5885	 100 400	 100 400
Oven Aging at 85°C (7) • Std. OIT (min. ave.), % retained after 90 days or • High Pressure OIT (min. ave.), % retained after 90 days	 ASTM D5721 ASTM D3895 ASTM D5885	 35 60	 55 80
UV Resistance (8) • Std. OIT (min. ave.), or • High Pressure OIT (min ave.) % retained after 1600 hrs	 ASTM D3895 ASTM D5885	 N.R. (9) 35	 N.R. (9) 50

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils

(2) Alternate the measurement side for double sided textured sheet.

(3) 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 in. at 2.0 in./min.

(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.

(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
- 9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.
(11) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheet made from the same formulation as being used for the textured sheet materials.

(C) Geomembrane shall be manufactured from new polyethylene resin, except as noted below:

1. Use of geomembrane recycled during manufacturing process shall be permitted with written approval from OWNER and if recycled geomembrane does not exceed 2% by weight.
2. Geomembrane manufactured from non-complying resin shall be rejected.

(D) Geomembrane Characteristics:

1. Contain maximum of 1% by weight of additives, fillers or extenders (not including carbon black).
2. Contain between 2% and 3% by weight of carbon black for ultraviolet light resistance.
3. No pinholes, bubbles or other surface features that compromise geomembrane integrity are allowed. Geomembrane shall be free of blisters, nondispersed raw materials, or other signs of contamination resulting from the manufacturing process. Geomembrane rolls or portions of rolls with these defects shall be rejected.

2.02 SEAMING AND TESTING EQUIPMENT

(A) Welding:

1. Maintain on-site a minimum of 2 spare operable seaming apparatus, unless otherwise agreed upon at the pre-construction meeting.
2. Seaming equipment shall not damage geomembrane.
3. Use extrusion welding apparatus equipped with gauges giving temperature of extrudate at nozzle of apparatus, or utilize hand-held gauges to measure extrudate temperatures.
4. Use fusion-welding apparatus that are self-propelled devices equipped with following:
   a. Gauge indicating temperature of heating element.
   b. Gauge indicating the speed of travel
5. Place electric generator on smooth base such that no damage occurs to geomembrane.

(B) Vacuum Testing Equipment:

1. Vacuum box assembly consisting of: rigid housing, transparent viewing window, soft neoprene gasket attached to bottom of housing, porthole or valve assembly, and vacuum gauge.
2. Pump assembly equipped with pressure controller and pipe connections.
3. Pressure/vacuum rubber hose with fittings and connections.
4. Soapy solution to wet test area.
5. Means of applying soapy solution.

(C) Air Pressure Testing Equipment:

1. Air pump (manual or motor driven), equipped with a pressure gauge, capable of generating, sustaining, and measuring pressure between 20 and 35 psi (160 and 240 kPa), and mounted on cushion to protect geomembrane.
2. Rubber hose with fittings and connections.
3. Sharp hollow needle, or other approved pressure feed device.
4. Air pressure monitoring device.

(D) Tensiometer Testing Equipment:

1. Tensiometer shall be capable of maintaining constant jaw separation rate of 2 in. per minute, and shall be calibrated, with certificate of calibration less than 1 yr old kept with tensiometer.

2.03 SOURCE QUALITY CONTROL

(A) Tests, Inspections shall be performed by geomembrane manufacturer as follows:

1. Test geomembranes to demonstrate that resin meets this Specification.
2. Continuously monitor geomembrane during manufacturing process for inclusions, bubbles, or other defects. Geomembranes, which exhibit defects, shall not be acceptable for installation.
3. Monitor thickness continuously during manufacturing process.
4. Tests shall be conducted for following properties in accordance with the test methods specified in the following table. Samples not complying with Specifications shall result in rejection of rolls. At the geomembrane manufacturer's discretion and expense, additional testing of individual rolls may be performed to identify and reject non-complying rolls and to approve individual rolls.

Testing Properties	**Testing Method**	**Manufacturer QC Testing Frequency**
Thickness mils (min ave.)	ASTM D 5994	1 per Roll
Density g/cc	ASTM D1505 or ASTM D792	1 per 200,000 lb
Asperity Height (min ave.) (1) (2)	GM-12	Every 2nd roll

Testing Properties	Testing Method	Manufacturer QC Testing Frequency
Tensile Properties (min. ave.) (3)	ASTM D6693 Type IV	1 per 20,000 lb
Tear Resistance – lb (min. ave.)	ASTM D1004	1 per 45,000 lb
Puncture Resistance – lb (min. ave.)	ASTM D4833	1 per 45,000 lb
Stress Crack Resistance (11)	ASTM D5397	per GRI GM10
Carbon Black Content - %	ASTM D1603 (4)	1 per 20,000 lb
Carbon Black Dispersion	ASTM D 5596	1 per 45,000 lb
Oxidative Induction Time (OIT) (min ave.) (6) • Standard OIT, or • High Pressure OIT	ASTM D3895 ASTM D5885	(11)
Oven Aging at 85°C (7) • Std. OIT (min. ave.), % retained after 90 days or • High Pressure OIT (min. ave.), % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	(11)
UV Resistance (8) • Std. OIT (min. ave.), or • High Pressure OIT (min ave.) % retained after 1600 hrs	ASTM D3895 ASTM D5885	(11)

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils

(2) Alternate the measurement side for double sided textured sheet.

(3) 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 in. at 2.0 in./min.

(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.

(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
- 9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(9) Not recommended since high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.
(11) Manufacturer may provide a certification letter

PART 3 EXECUTION

3.01 QUALITY ASSURANCE SAMPLING

(A) CONTRACTOR or INSTALLER shall make rolls available and assist GEOSYNTHETIC CONSTRUCTION QUALITY ASSURANCE CONSULTANT (CQAC) in obtaining material inventory and material samples. Samples shall be tested in accordance with the test methods specified in the following table:

Testing Properties	Testing Method	Conformance QA Testing Frequency
Thickness mils (min ave.)	ASTM D 5994	1 per 200,000 sf
Density g/cc	ASTM D1505 or ASTM D792	1 per 200,000 sf
Asperity Height (min ave.) (1) (2)	GM-12	1 per 200,000 sf
Tensile Properties (min. ave.) (3)	ASTM D6693 Type IV	1 per 200,000 sf
Tear Resistance – lb (min. ave.)	ASTM D1004	1 per 200,000 sf
Puncture Resistance – lb (min. ave.)	ASTM D4833	1 per 200,000 sf
Carbon Black Content - %	ASTM D1603 (4)	1 per 200,000 sf
Carbon Black Dispersion (5)	ASTM D 5596	1 per 200,000 sf

(1) Of 10 readings, 8 out of 10 must be $\geq$7 mils, and lowest individual reading must be $\geq$ 5 mils
(2) Alternate the measurement side for double sided textured sheet.
(3) 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 in. at 2.0 in./min.

(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
- 9 in Categories 1 or 2 and 1 in Category 3

(B) Rolls represented by quality assurance testing shall be rejected if test failure occurs. INSTALLER may at their expense request additional testing to validate individual rolls. Rolls bracketed by passing tests will be allowed to be deployed and seamed.

3.02 PREPARATION

(A) Surface Preparation:

1. EARTHWORK CONTRACTOR is responsible for preparing supporting surface for geomembrane placement.
2. After prepared surface has been accepted in accordance with Quality Assurance Plan, report to OWNER any change in supporting surface condition that may require repair work. Maintain prepared surface.
3. Do not place geomembrane onto an area that has become softened by precipitation or cracked due to desiccation. Observe and report surface condition daily to evaluate degree of softening and desiccation cracking.
4. Repair damage to prepared surface caused by installation activities at INSTALLER'S expense.

3.03 INSTALLATION

(A) Panel Nomenclature:

1. Field panel is defined as a roll or portion of roll cut and seamed in field, excluding patches and cap strips.
2. Identify each field panel with identification code (number or letter-number) consistent with INSTALLER'S layout plan. This identification code shall be agreed upon by OWNER, INSTALLER, and GEOSYNTHETIC CQAC.
3. Writing on liner with colored markers shall be as agreed upon in the Pre-Construction Meeting. Only authorized personnel shall be permitted to write on liner.

(B) Protection:

1. Do not use equipment that damages geomembrane.
2. Ensure prepared surface underlying geomembrane has not deteriorated since previous acceptance, and remains acceptable immediately prior to geomembrane deployment.
3. Keep geosynthetic elements immediately underlying geomembrane clean and free of debris.
4. Do not permit personnel to smoke or wear shoes that can damage geomembrane while working on geomembrane. Personnel shall not bring glass bottles on geomembrane.
5. Unroll panels in manner that does not cause excessive scratches or crimps in geomembrane and does not damage supporting soil.
6. Place panels in manner that minimizes wrinkles (especially differential wrinkles between adjacent panels).

7. Prevent wind uplift by providing adequate temporary loading and/or anchoring (e.g., sandbags) that shall not damage geomembrane. In case of high winds, continuous loading is recommended along panel edges.
8. Protect geomembrane in areas where excessive traffic is expected with geotextiles, extra geomembrane, or other suitable materials.

(C) Field Panel Deployment:

1. Install field panels at locations indicated on INSTALLER'S layout plan.
2. Replace seriously damaged (torn, twisted or crimped) field panels, or portions thereof, at no cost to OWNER. Repair less serious damage as specified herein. GEOSYNTHETIC CQAC shall determine if material shall be repaired or replaced.
3. Remove damaged panels or portions of damaged panels that have been rejected from work area.
4. Do not proceed with deployment at ambient temperature below 32 F (0 C) or above 104 F (40 C) unless otherwise authorized, in writing, by OWNER.
5. Do not deploy during precipitation, in presence of excessive moisture, (fog, dew), in areas of ponded water or in presence of excessive winds.
6. Do not undertake deployment in weather conditions that will preclude material seaming on same day as deployment.
7. Do not deploy more geomembrane field panels in one day than can be seamed during that day.

(D). Seam Layout:

1. When possible, orient seams parallel to line of maximum slope, i.e., oriented along, not across, slope.
2. No horizontal seam shall be less than 5 ft (1.5 m) from the top of or toe of slope.
3. In general, maximize lengths of field panels and minimize number of field seams.
4. Align geomembrane panels to have nominal overlap of 3 in. (75 mm) for extrusion welding and 4 to 6 in. (100 mm to 150 mm) for fusion welding. Final overlap shall be sufficient to allow peel tests to be performed on the seam.

(E) Temporary Bonding:

1. Hot air device (Liester) may be used to temporarily bond geomembrane panels to be extrusion welded.
2. Do not damage geomembrane when temporarily bonding adjacent panels. Apply minimal amount of heat to lightly tack geomembrane panels together. Control temperature of hot air at nozzle of any temporary welding apparatus to prevent damage to geomembrane.
3. Do not use solvent or adhesive.

(F) Seaming Methods:

1. Approved processes for field seaming are extrusion fillet welding and fusion welding. Proposed alternate processes shall be documented and submitted to OWNER for approval. Alternate procedures shall be used only after being approved in writing by OWNER.
2. Seams shall meet following requirements:

Material	Test	Seam Type	Minimum Value lb/in
HDPE 60 mil	Shear	Hot Wedge (Fusion)	120
HDPE 60 mil	Shear	Extrusion	120
HDPE 60 mil	Peel	Hot Wedge (Fusion)	91
HDPE 60 mil	Peel	Extrusion	78
LLDPE 40 mil	Shear	Hot Wedge (Fusion)	60
LLDPE 40 mil	Shear	Extrusion	60
LLDPE 40 mil	Peel	Hot Wedge (Fusion)	50
LLDPE 40 mil	Peel	Extrusion	44

Note: Values listed for shear and peel strengths are for 4 out of 5 test specimens; the 5^{th} specimen can be as low as 80% of the listed values

3. Use fusion welding as primary method of seaming adjacent field panels.

   a. Cross seam tees, associated with fusion welding or extrusion welding, shall be patched to a minimum distance of 6-in. (150-mm) on each side of tee.
   b. Place welder on protective pad to prevent geomembrane damage between seaming.
   c. When subgrade conditions dictate, use movable protective layer (e.g. extra piece of geomembrane) directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between sheets and prevent debris from collecting around pressure rollers.

4. Use extrusion fillet welding as secondary method for seaming between adjacent panels and as primary method of welding for detail and repair work.

   a. Purge heat-degraded extrudate from barrel of extruder under following conditions:

      1) Prior to beginning seam.
      2) Whenever extruder has been inactive.

   b. Place a smooth insulating plate or fabric beneath the hot welding apparatus after usage.
   c. Use clean and dry welding rod or extrudate pellets.
   d. Complete grinding process without damaging geomembrane within 1 hr of seaming operation.

e. Minimize exposed grinding marks adjacent to extrusion weld. Do not allow exposed grinding marks to extend more than 1/4 in. outside finished seam area and grind perpendicular to seam.

(G) Seaming Procedures:

1. General Seaming Procedures: (Ambient temperature between 32°F (0°C) and 104°F (40°C)).
   a. Do not field seam without master seamer being present.
   b. Dry conditions, i.e., no precipitation or other excessive moisture, such as fog or dew.
   c. No excessive winds.
   d. If required, provide firm substrate by using extra piece of geomembrane, or similar hard surface directly under seam overlap to achieve proper support for seaming apparatus.
   e. Align seams with fewest possible number of wrinkles and fishmouths.
   f. Extend seams to outside edge of panels placed in anchor trench.
   g. Prior to seaming, ensure that seam area is clean and free of moisture, dust, dirt, debris or foreign material.
   h. Fishmouths or wrinkles at seam overlaps shall be cut along ridge of wrinkle in order to achieve flat overlap. Cut fishmouths or wrinkles shall be seamed and any portion where overlap is inadequate shall be patched with an oval or round patch of same geomembrane extending minimum of 6-in. beyond cut in each direction.

2. Cold Weather Seaming Procedures (ambient temperature is below 32° F (0° C)).

   a. GEOSYNTHETIC CQAC shall determine geomembrane surface temperatures at intervals of at least once per 100 ft of seam length to determine if preheating is required. For extrusion welding, preheating shall be required if the surface temperature of the geomembrane is below 32° F.
   b. Preheating may be waived by OWNER based on recommendation from GEOSYNTHETIC CQAC, if demonstrated to GEOSYNTHETIC CQAC'S satisfaction that welds of equivalent quality may be obtained without preheating.
   c. If preheating is required, GEOSYNTHETIC CQAC shall observe areas of geomembrane that have been preheated by hot air device prior to seaming, to ensure they have not been subjected to excessive melting.
   d. GEOSYNTHETIC CQAC shall confirm that surface temperatures are not below the minimum surface temperatures specified for welding due to winds or other adverse conditions. It may be necessary to provide wind protection for the seam area.
   e. Preheating devices used shall be pre-approved by OWNER prior to use.
   f. Additional destructive seam tests shall be taken at interval between 500 ft and 250 ft of seam length, at GEOSYNTHETIC CQAC'S discretion.
   g. Sheet grinding may be performed before preheating, if applicable.
   h. Trial seaming shall be conducted under same ambient temperature and preheating conditions as actual seams. New trial seams shall be conducted if ambient temperature drops by more than 10° F (3°C) from

initial trial seam test conditions. New trial seams shall be conducted upon completion of seams in progress during temperature drop.

3. Warm Weather Procedures (ambient temperature is above 104° F (40° C)).

   a. No seaming of geomembrane is permitted unless it is demonstrated to GEOSYNTHETIC CQAC that the geomembrane seam quality will not be compromised.
   b. Trial seaming shall be conducted under the same ambient temperature conditions as actual seams. New trial seams shall be conducted if the ambient temperature rises by more than 5° F (3° C) from initial trial seam test conditions. Such new trial seams shall be conducted upon completion of seams in progress during temperature rise.
   c. At the option of the GEOSYNTHETIC CQAC, additional destructive seam tests may be required for any suspect areas.

(H) Repair Procedures:

1. Repair portions of geomembrane exhibiting flaws, or failing destructive or nondestructive tests.
2. The final decision as to repair procedure shall be agreed upon between OWNER, INSTALLER, and GEOSYNTHETIC CQAC.
3. Acceptable repair procedures include the following:

   a. Patching: Piece of same geomembrane material extrusion welded into place. Use to repair large holes, tears, nondispersed raw materials, and contamination by foreign matter. All panel intersections shall be patched.
   b. Spot welding or seaming: Bead of molten extrudate placed on flaw. Use to repair small tears, pinholes, or other minor, localized flaws.
   c. Capping: Strip of same geomembrane material extrusion welded into place over inadequate seam. Use to repair large lengths of failed seams.
   d. Removal and replacement: Remove bad seam and replace with strip of same geomembrane material welded into place. Use to repair large lengths of failed seams.
   e. Extrusion welding flap: Repairs of this type shall not be used unless approved by GEOSYNTHETIC CQAC and shall not exceed 100 ft in length.

4. For each repair method:

   a. Ensure surfaces are clean, dry, and prepared in accordance with specified seaming process.
   b. Ensure seaming equipment used in repairing procedures meet requirements of this Specification.
   c. Extend patches or caps at least 6 in. beyond edge of defect. Round corners of patches with radius of approximately 6 in.

5. Do not place overlying layers over locations which have been repaired until appropriate acceptable nondestructive and destructive (laboratory) test results are obtained.

(J) Anchor Trench:

1. EARTHWORK CONTRACTOR shall excavate anchor trenches, unless otherwise specified, to lines and grades shown on design construction drawings prior to geomembrane placement. Anchor trench shall be drained to prevent ponding or softening of adjacent soils while trench is open.
2. Slightly rounded corners shall be provided in the anchor trench to avoid sharp bends in geomembrane.
3. If the anchor trench is excavated in clay material susceptible to desiccation, the amount of trench open at any time should be minimized.
4. Remove construction-related debris from anchor trench.
5. Earthwork Contractor shall backfill and compact anchor trench as soon as practical after geomembrane installation is completed. Take care when backfilling trenches to prevent damage to geosynthetics.

3.04 FIELD QUALITY CONTROL

(A) Visual Inspection:

1. GEOSYNTHETIC CQAC will examine seam and non-seam areas of geomembrane for identification of defects, holes, blisters, nondispersed raw materials, and any sign of contamination by foreign matter.
2. Clean and wash geomembrane surface if GEOSYNTHETIC CQAC determines that amount of dust or mud inhibits examination.
3. Do not seam any geomembrane panels that have not been examined for flaws by GEOSYNTHETIC CQAC.
4. Nondestructively test seams and any non-seam areas identified by GEOSYNTHETIC CQAC.

(B) Trial Seams:

1. Make trial seams on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming.
2. Make trial seams at beginning of each seaming period, following restart of welding equipment, upon change of seamers, and at least once every 4 to 6 hours, for each production seaming apparatus used that day.
3. Make trial seams under same conditions as actual seams.
4. Make trial seams only under observation of GEOSYNTHETIC CQAC.
5. Seam overlap shall be as indicated for finished seam.
6. Trial seam sample shall be at least 5 ft long by 1 ft wide (after seaming) with seam centered lengthwise.
7. Cut 6 specimens from sample with 1 in. wide die. These specimen locations shall be selected randomly along trial seam sample by GEOSYNTHETIC CQAC. Test 3 specimens in peel and 3 specimens in shear using field tensiometer. Samples shall fail in sheet or exceed the specified peel and shear criteria stated in this Specification.
8. If specimen fails, entire trial seam operation shall be repeated. If additional specimen fails, do not use seaming apparatus and seamer until deficiencies are corrected and two (2) consecutive successful trial welds are achieved.

9. The remainder of the successful trial seam is to be retained by GEOSYNTHETIC CQAC for possible laboratory destructive seam testing until project completion.

(C) Nondestructive Seam Testing:

1. General:

   a. Purpose of nondestructive tests is to check continuity of seams. It will not provide quantitative information on seam strength.
   b. Nondestructively test field seams over their full length using vacuum test for extrusion seams, air pressure for double-fusion seams or other OWNER approved method. Document results.
   c. Perform nondestructive testing as seaming work progresses.

2. Vacuum Testing for extrusion seam:

   a. Energize vacuum pump and reduce tank pressure to approximately 3 psi gauge pressure.
   b. Wet strip of geomembrane approximately 12 in. by 48 in. with soapy solution.
   c. Place box over wetted area.
   d. Close bleed valve and open vacuum valve.
   e. Ensure that leak-tight seal is created.
   f. For minimum of 10 sec, apply vacuum and examine geomembrane through viewing window for presence of soap bubbles.
   g. If no bubbles appear within 10 sec, close vacuum valve and open bleed valve, move box over to next adjoining area with minimum 3 in. overlap and repeat process.
   h. Mark and repair areas where soap bubbles appear.

3. Air Pressure Testing for double-fusion seam:

   a. Seal both ends of seam to be tested.
   b. Insert needle or other approved pressure feed device into air channel created by fusion weld.
   c. Insert protective cushion between air pump and geomembrane.
   d. Pressurize air channel to pressure specified in table below. Close valve and allow pressure to stabilize for approximately 2 minutes.
   e. Observe air pressure 5 min after initial 2-min stabilization period ends. If pressure loss exceeds Maximum Permissible Pressure Differential or pressure does not stabilize, locate faulty area and repair.

Material	Minimum Pressure (psi)	Maximum Pressure (psi)	Maximum Pressure (psi) Differential After 5 Minutes
40 mil LLDPE	20	30	4.0
60 mil HDPE	27	30	3.0

f. Cut opposite end of tested seam area once testing is completed to verify continuity of air channel. If air does not escape, locate blockage and retest unpressurized area. Repair cut end of air channel.
g. Remove needle or other approved pressure feed device and repair hole in geomembrane.

4. Inaccessible Seams:

a. Cap-strip seams that cannot be nondestructively tested.
b. Cap-strip material shall be composed of same type and thickness geomembrane as geomembrane to be capped.
c. Examine cap-stripping operations with GEOSYNTHETIC QAC for uniformity and completeness. Document observations.

(D) Destructive Seam Testing:

1. General:

a. Purpose of destructive seam testing to evaluate seam strength.
b. Perform destructive seam test as seaming progresses.
c. The destructive seam sample shall fail if the grips of testing machine cannot be closed on sample test flap (available flap is 1/2 in. long or less) due to excessive temporary welding.

2. Location and frequency:

a. Test at minimum frequency of one test location per 500 ft of welding length performed by each welding machine.
b. Test locations shall be determined during seaming, at GEOSYNTHETIC QAC'S discretion.
c. INSTALLER will not be informed in advance of locations where seam samples will be taken.
d. OWNER reserves right to increase frequency of testing in accordance with performance results of samples previously tested.

3. Sampling Procedures:

a. Cut samples at locations chosen by GEOSYNTHETIC QAC.
b. GEOSYNTHETIC QAC shall number each sample and record sample number and location in panel layout drawing.
c. Repair holes in geomembrane resulting from destructive seam sampling immediately in accordance with repair procedures described in this Specification.
d. Continuity of repair and seams shall be tested in accordance with vacuum testing requirements.

4. Sample Dimensions: Take two 1-in. wide samples for field testing prior to cutting full laboratory sample.

a. Field Testing: Cut 1 in. wide samples, 6 inches long with seam centered parallel to width. Distance between these 2 samples shall be 42 in. Test both samples on field tensiometer in peel. If both samples pass field test, take sample for laboratory testing.
b. Laboratory Testing: Take laboratory test sample from between samples taken for field testing. Cut sample for laboratory testing 12 in. wide by a minimum 42 in. long with seam centered lengthwise. Cut this sample into three parts. GEOSYNTHETIC QAC shall distribute parts as follows:

    1) One part to INSTALLER for optional laboratory testing, a minimum 12 in. by 12 in.
    2) One part to Geosynthetic Quality Assurance Laboratory for testing, a minimum 12 in. by 18 in.
    3) One part to OWNER for archive storage, a minimum 12 in. by 12 in.

c. Final determination of sample sizes shall be agreed upon at pre-construction meeting.
d. Submit laboratory sample for quantitative testing

5. Destructive Test Failure Procedures:

When a sample fails destructive testing, whether test is conducted by the Geosynthetic QAL or by field tensiometer, CONTRACTOR has following options:

a. Repair seam between any 2 passing destructive test locations.
b. Trace welding path to intermediate point (10 ft minimum from point of failed test in each direction) and take small sample with 1 in. wide die for an additional field test at each location. If these additional samples pass test, then take full laboratory samples. If the laboratory samples pass tests, repair seam between these locations. If either sample fails, repeat process to establish zone in which seam should be repaired.
c. Acceptable repaired seams shall be bound by 2 locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 ft of repaired seam, GEOSYNTHETIC CQAC may have INSTALLER destructively test repair seam.
d. When the sample fails, OWNER may require additional testing of seams that were welded by same welder and/or welding apparatus during same time shift.

(E) Repair Verification:

1. GEOSYNTHETIC QAC shall observe number and log each repair.
2. Nondestructively test each repair.
3. Nondestructive test results that pass shall indicate adequate repair.
4. Repairs more than 150 ft long, require destructive test sampling.
5. Failed destructive or nondestructive tests indicate that repair shall be redone and retested until passing test results.

(F) Large Wrinkles: Wrinkle is considered to be large when geomembrane can be folded over onto itself.

1. When seaming of geomembrane is completed, and prior to placing overlying materials, GEOSYNTHETIC CQAC shall identify all excessive geomembrane wrinkles, which should be cut and reseamed.
2. Cut and reseam all wrinkles identified by GEOSYNTHETIC CQAC. Seams produced while repairing wrinkles shall be nondestructively tested.
3. Repair wrinkles identified by GEOSYNTHETIC CQAC. Repair during coldest part of installation period.

END OF SECTION

SECTION 02650

HDPE PIPE

PART 1 - GENERAL

1.01 Description of Work

(a) The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing, placing and compacting the drainage conveyance pipe as shown, specified or required. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

(b) Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.

1.02 Related Sections

(a) Section 02220 - Earthwork

(b) Section 02286 - HDPE Boots and Sleeves

(c) Section 02651 - HDPE Pipe and Manhole Leak Testing

1.03 Submittals

The CONTRACTOR shall submit manufacturer’s data sheets, certification of compliance with specifications for all pipes, fittings and appurtenances and leak testing requirements per Section 01300 - Submittals of these Specifications.

1.03 Quality Assurance

(a) Pipe installation shall be performed by skilled workers. Each pipe laying crew shall have a pipe laying foreman.

(b) Pipe shall be accurately installed to the lines and grades shown on the Construction Drawings, or as approved by the Quality Assurance Contractor (QAC), so that inverts are smooth.

(c) Deflections in horizontal alignment at joints are not permitted without the written consent of the OWNER. If so approved, the deflections shall not exceed one-half the manufacturer's recommendation.

(d) The OWNER shall be notified in advance whenever an existing pipeline location conflicts with the proposed locations of the Work.

(e) Pipe and fittings of the same type shall be the products of a single manufacturer.

(f) Pipe Adaptors - Join pipes of different materials with adaptors specifically manufactured for that purpose and as approved by the OWNER, or as detailed on the Construction Plans.

(g) All piping shall be of the type and size as shown on the Construction Drawings and described in this Section of the Specifications.

1.04 Delivery, Storage, and Handling

(a) All pipes and fittings shall be carefully handled when loading and unloading. Lift by hoists or lower on skidways in a manner to avoid shock.

(b) Where required, due to weight of material and for the safety and protection of workmen, materials, equipment, property, and the work, use derricks, ropes, or other suitable equipment for lowering pipe into trenches. Take particular care to avoid damaging the pipe.

(c) Pipe and fittings shall be protected against the damaging ultraviolet rays of the sun when stored for any period. Such protection shall consist of canvas covering, or other material as recommended by the manufacturer. Plastic sheets shall not be used which may allow excessive temperatures to develop where pipe is stored. All pipe which has been distorted or otherwise negatively affected by high temperatures shall be rejected, regardless of the pipe's appearance after return to ambient temperatures. Rejected pipe shall be marked by the QAC and removed from the site of the work at the sole expense the CONTRACTOR.

(d) The manufacturer's recommended procedures for pipe stacking shall be followed. When pipe is stacked for storage, the heaviest series of pipe shall be placed at the bottom.

(e) Pipe and fittings shall be protected from damage by sharp objects through all phases of work.

(f) If any defective pipe is discovered after being laid or placed, removal and replacement with a sound pipe will be required without cost to the OWNER.

PART 2 - MATERIALS

2.01 Pipe and Fittings

(a) Piping resins shall be high performance, high molecular weight, high density polyethylene conforming to ASTM D1248 (Type III, Class C, Category 5, Grade P34), and ASTM D3350 (Cell Classification PE345434C). The pipe and fittings shall be manufactured from pre-compounded resin manufactured by the pipe manufacturer, with a minimum of two percent carbon black to withstand outdoor exposure without loss of properties. In-plant blending of non-compounded resins is not acceptable. All polyethylene pipe shall meet the requirements of ASTM F714 for SDR-11, SDR-17, or SDR-21 pipe. Pipe shall be furnished non-perforated or perforated, as required by the application. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code, and standard dimension ratio.

(b) The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes (other than those manufactured), foreign inclusions, or other deleterious defects, and shall be identifiable in color, density, melt index, and other physical properties.

(c) The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific product. This stress regression testing shall have been done in accordance with ASTM D2837, Class PE3408, and the manufacturer shall provide a product supplying a minimum hydrostatic design basis (HDB) of 1,600 psi at 63.4 degrees F, as determined in accordance with ASTM D2837.

PART 3 - EXECUTION

3.01 Inspection - General

(a) Each length of pipe and each fitting shall be carefully inspected prior to placement. All materials not meeting the requirements of these Specifications, or otherwise found defective or unsatisfactory by the QAC, shall be rejected and immediately marked and removed from the job site by the CONTRACTOR.

(b) Bedding, sub-bedding, and other trench conditions shall be carefully inspected prior to laying pipe in each stretch of open trench. All conditions shall be made available to the QAC for inspection purposes, and the QAC shall be further advised where, in the CONTRACTOR's opinion, unstable or otherwise deleterious conditions exist.

(c) Each stretch of completed pipeline shall be inspected prior to backfilling. Backfilling operations shall not be initiated prior to inspection by the QAC.

3.02 Preparation

Pipe and fitting interiors and joint surfaces, shall be thoroughly cleaned prior to installation. Pipe and fittings shall be maintained clean.

3.03 Pipe Installation

(a) Pipes and fittings shall be carefully lowered into place.

(b) Pipe and fittings shall be installed so that there will be no deviation at the joints and so that inverts present a smooth surface. Pipe and fittings which do not fit together to form a tight fitting joint are not permitted.

(c) All HDPE joints shall be butt-fusion welded.

(d) Pipes shall be installed in the locations and to the required lines and grades as shown on the Construction Drawings and provided in these Specifications, using an approved method of control. The OWNER has the authority to order the removal or relaying of all pipe laid contrary to the specifications, his instructions, or during his absence.

(e) Excavations shall be maintained free of water during the progress of the Work. No pipes shall be laid in water nor shall there be any joints made up in water. All slides or cave-ins of the trenches or cuts shall be remedied to the satisfaction of the OWNER.

(f) Cleanliness of installed pipe and fitting interiors shall be maintained throughout the Work.

(g) All adjustments to the line and grade of pipe shall be done by scraping away or compacted filling of the bedding stone under the barrel of the pipe, and not by blocking or wedging.

(h) Fittings shall be installed as required and in accordance with the Construction Drawings and Specifications. The installation of fittings after the pipeline has been laid will not be permitted without the written approval of the OWNER. In such cases, complete details pertaining to the proposed type of fittings and the installation procedure shall be submitted by the CONTRACTOR to the ENGINEER for review and approval before such work can be performed.

(i) Approval by the OWNER is required prior to changing the location of any of the Work due to field conditions. Changes in pipe sizes are prohibited without prior written consent from the OWNER.

(j) All installed piping shall form completely connected systems including connections to and appurtenances specified in other sections to result in a satisfactorily operating installation.

(k) All pipe shall be so laid that after the line is completed, the interior surface thereof shall conform accurately to the established grade and alignment. No deflections shall be allowed at joints.

(l) Pipe lengths of at least 20 feet shall be utilized, except that shorter random lengths may be utilized where wyes and tees, and similar circumstances are present, only inasmuch as is necessary to properly effect the joint(s) in the desired location. In all cases, the number of pipe joints shall be minimized. In the case of random lengths of pipe, the CONTRACTOR shall provide proper smooth and square ends prior to assembling.

(m) All pipe ends not terminated by another specific fitting shall be capped with a slip cap. Caps shall not be bonded to the pipe unless otherwise specifically noted on the Construction Drawings.

3.04 Testing

Testing of the leachate collection and conveyance pipe shall performed as specified in Section 02651 of the Technical Specifications.

END OF SECTION

SECTION 02651

HDPE PIPE & MANHOLE LEAK TESTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. CONTRACTOR shall furnish all labor, material, equipment, tools, and appurtenances required to setup and pressure test non-perforated HDPE pipe and manholes.

B. CONTRACTOR shall conduct all pressure testing using water as the testing method. The piping manufacturer and the ENGINEER shall be consulted before using pressure testing methods other than those presented here. Other pressure testing procedures may or may not be applicable, depending upon piping products and/or piping applications.

C. CONTRACTOR shall comply with all applicable codes, ordinances, rules, regulations and laws of local, municipal, State, or Federal authorities having jurisdiction. CONTRACTOR shall also comply with all applicable health and safety regulations as required by OSHA and in accordance with the CONTRACTOR's Health and Safety Plan.

D. CONTRACTOR shall conduct all tests in a manner to minimize as much as possible any interference with the day-to-day operations of existing facilities or other contractors working on site.

1.02 RELATED SECTIONS

A. Section 01564 - Project Record Documents

B. Section 02650 - HDPE Pipe

1.03 SUBMITTALS

A. General

Provide all submittals, including the following, as specified in Division 1.

B. Testing Report

Prior to placing the leachate conveyance system into service, submit for review and approval a detailed report summarizing the leakage test data, describing the test procedure and showing the calculations on which the leakage test data is based. The report shall include, at a minimum, the following information:

1. The length and diameter of the section of line tested.

2. A complete description of test procedures and methods, including:

   a) Trench backfilling and pipe cleaning status
   b) Types of plugs used and where
   c) Stabilization time period and water pressure
   d) The allowed time by specifications
   e) The actual test time
   f) The water pressure at the beginning and end of the test.

3. The name of the inspector / tester and the date and time of all testing, including any retesting

4. A description of any repairs made.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 LEAKAGE TESTING FOR PIPES

A. General

All new non-perforated leachate conveyance pipe installed shall be tested for leakage. The test used will be hydrostatic testing. Testing to be performed will be indicated by the ENGINEER and witnessed by the ENGINEER and the OWNER's representative.

B. Flushing

All pipe shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall be at least 4 fps. Flushing shall be terminated at the direction of the QAC or ENGINEER. Dispose of the flushing water without causing a nuisance or property damage.

C. Test Preparation and Inspection

1. Perform hydrostatic testing of the system as set forth in the following, and perform such testing in the presence of the QAC and the OWNER's representative. Give 48 hours notice of planned testing.

2. Piping and appurtenances to be tested shall be sections of at least 250 feet in length, unless unavoidable. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from the extremities of the test section, with additional release cocks (provided by the CONTRACTOR) if required. Venting may be provided by loosening flanges. Re-tighten any loosened flanges before applying test pressure.

3. Test equipment and the pipeline should be examined before pressure is applied to ensure that connections are tight, necessary restraints are in place and secure, and components that should be isolated or disconnected are isolated or disconnected. All low pressure filling lines and other items not subject to the test pressure should be disconnected or isolated.

4. If a lower pressure rated component the system cannot be removed or isolated, then the maximum allowable test pressure is the allowable pressure of the component.

D. Monitored Make-Up Water Test

1. The test procedure consists of initial expansion and test phases. During the initial expansion phase, the test section is pressurized to the test pressure, and sufficient make-up water is added each hour for three (3) hours to return to test pressure.

2. After the initial expansion phase, the test phase begins. The test phase may be one (1), two (2), or three (3) hours, after which a measured amount of water is added to return to test pressure. If the amount of water does not exceed the amount shown in Table 1, leakage is not indicated.

3. The testing procedure shall consist of the continued application of the specified pressure to the test system for the duration of the test period, by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume of water taken from said container.

4. Hydrostatic testing shall be performed with a sustained pressure after the expansion phase for a minimum of one (1) hour at 1-1/2 times the working pressure of the pipe, unless otherwise approved by the OWNER. The allowable leakage shall be less than the number of gallons per hour determined from the following table:

Table 1 - Test Phase Make-Up Amount

Nominal Pipe Size, in.	Make-Up Water Allowance (U.S. Gallons per 100 ft of Pipe)		
	1 Hour Test	2 Hour Test	3 Hour Test
2	0.07	0.11	0.19
4	0.13	0.25	0.4
6	0.3	0.6	0.9
8	0.5	1.0	1.5
10	0.8	1.3	2.1
12	1.1	2.3	3.4
14	1.4	2.8	4.2

5. The testing duration, including initial pressurization, initial expansion and time at test pressure must not exceed eight (8) hours. If the pressure test is not completed due to leakage, equipment failure, etc. the test section shall be depressurized and allowed to "relax" for eight (8) hours before bringing the test section up to test pressure again.

3.01 LEAKAGE TESTING FOR HDPE STRUCTURES

A. Perform leakage testing for vaults, wet wells and manholes prior to backfilling by filling the structure with water to the overflow level and observing the water level for the following 24 hours.

B. Make an inspection for leakage of the exterior surface of the structure, especially in areas around construction joints.

C. Leakage will be accepted as within allowable limits for structures from which there are no visible leaks and the leakage rate does not exceed 0.02 gallon per 100 gallons of computed capacity per hour. Method for testing leakage shall be submitted to the ENGINEER prior to testing.

D. If visible leaks appear, repair the structure by removing and replacing the leaking portions of the structure, waterproofing the inside, or by other methods approved.

E. Water for testing will be provided by the OWNER at the CONTRACTOR's expense.

F. Submit a report describing the manhole description, duration of test, results of testing, and any repairs made.

END OF SECTION

SECTION 02936

SEEDING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Furnish all labor, materials, equipment and incidentals required to place seeding. This work shall include maintenance of established vegetation until final acceptance. The CONTRACTOR shall be expected to provide and place all vegetative support soil necessary to complete the work.

B. CONTRACTOR shall revegetate all areas disturbed by his operations. All areas disturbed or not having sufficient vegetation to prevent erosion shall be revegetated.

1.02 RELATED SECTIONS

A. Section 02125 – Temporary and Permanent Erosion and Sediment Control

B. Section 02200 – Earthwork

C. Section 02235 – Vegetative Support Layer

1.03 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.04 MAINTENANCE DATA

A. Submit maintenance data for continuing OWNER maintenance.

B. Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Transport and handle products in accordance with the Manufacturer's instructions.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging will not be acceptable.

C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

D. Store and protect products in accordance with the Manufacturer's instructions with seals and labels intact and legible.

1.06 TEMPORARY VEGETATION

A. Reference Std. & Spec. 3.31, Virginia Erosion and Sediment Control Handbook. When earth moving activities are completed more than 15 days prior to installation of permanent control measures, or final grading is completed during a season not favorable for immediate establishment of permanent vegetation, stabilize with rapid growing annual grasses of a seasonally appropriate species. Provide species that allow quick protective cover and are compatible with future permanent measures.

1.07 PERMANENT SEEDING

A. Reference Std. & Spec 3.32, Virginia Erosion and Sediment Control Handbook.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. Topsoil Material: Excavated from site and free of weeds as specified in Technical Specification Section 02235.

2.02 ACCESSORIES

A. Mulching material: Oat or wheat straw, dry, free from weeds and foreign matter detrimental to plant life.

B. Lime: Lime shall comply with applicable Virginia state laws and shall be delivered in unopened bags or other convenient standard containers, each fully labeled with the Manufacturer's guaranteed analysis. Lime shall be ground limestone containing not less than 85 percent total carbonates and shall be ground to such fineness that 90 percent by weight will pass through a No. 20 mesh sieve and 50 percent by weight will pass through a No. 100 mesh sieve.

C. Fertilizer: Fertilizer shall comply with applicable Virginia state laws and shall be delivered in unopened bags or other convenient standard container, each fully labeled with the manufacturer's guaranteed analysis. Fertilizer shall contain not less than 10 percent nitrogen, 10 percent available phosphoric acid and 10 percent water soluble potash (N-P-K, 10-10-10). Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be acceptable and shall be immediately removed from the job site.

PART 3 – EXECUTION

3.01 GENERAL

A. Areas to be seeded include all areas disturbed during construction that are not to be paved.

B. Verify that prepared soil base is ready to receive the work of this section.

3.02 FERTILIZER AND LIME

A. Apply lime and fertilizer according to soil tests, or apply lime at the rate of 90 lbs./1000 ft^2, and fertilizer at the rate of 23 lbs./1000 ft^2.

B. Mix thoroughly into upper four inches of topsoil.

C. Lightly water to aid the dissipation of fertilizer and lime.

3.03 SEEDBED PREPARATION

A. Prepare seedbed to a depth of four to six inches.

B. Remove loose rocks, roots, and other obstructions so that they will not interfere with the establishment and maintenance of vegetation.

3.04 TEMPORARY SEEDING

A. Provide temporary seeding on any cleared, non-vegetated, or sparsely vegetated soil surface where vegetative cover is needed for less than one year or when seeding dates will prevent the establishment of vegetative cover if permanent seeding is attempted.

Seed in accordance with the following schedule and application rates:

Seeding Dates	Seeding Mixture Species and Application Rate
September 1 – February 15	50% Annual Ryegrass (*Lolium multi-florum*) at 60 lbs/acre and 50% Cereal (Winter) Rye (*Secale cereale*) at 50 lbs/acre
February 16 – April 30	Annual Ryegrass at 100 lbs/arce
May 1 – August 31	German Millet at 50 lbs/acre

B. To amend soil, follow recommendations of soil tests or apply 4000 lbs/acre ground agricultural limestone and 600 lbs./acre 10-20-10 fertilizer.

C. Mulch with three inch straw applied at the rate of 4000 lbs/acre, and anchor by tacking with netting or a mulch anchoring tool.

D. Refertilize if growth is not fully adequate.

E. Reseed, refertilize, and mulch immediately following erosion or other damage.

3.05 PERMANENT SEEDING

A. Seed shall be brought on site unmixed unless the mixture is certified and stated on the package as to the quality and mixture. Mixing shall be done at the project site from the original unopened packages. Unless otherwise indicated from soil-specific analysis, seed mixtures and application rates shall be as follows:

Seeding Dates	Seeding Mixture Species and Rate
April – May 15 or August 16 – October (for slopes 3:1 or flatter)	Kentucky 31 Fescue at 128 lbs/acre Red Top Grass at 2 lbs/acre Annual Rye at 20 lbs/acre
April – May 15 or August 16 – October (for slopes 3:1 or steeper)*	Kentucky 31 Fescue at 108 lbs/acre Red Top Grass at 2 lbs/acre Common Bermudagrass at 20 lbs/acre *Sericea lespedeza* at 20 lbs/acres (hulled)
May 16 – August 15 (for slopes 3:1 or shallower)	Kentucky 31 Fescue at 128 lbs/acre Red Top Grass at 2 lbs/acre Foxtail Millet at 20 lbs/acre
May 16 – August 15 (for slopes 3:1 or steeper)*	Kentucky 31 Fescue at 108 lbs/acre Red Top Grass at 2 lbs/acre Foxtail Millet at 20 lbs/acre *Sericea lespedeza* at 20 lbs/acres (hulled)

* In lieu of adjustments to the seed mixture, VESCH Treatment 2 or VDOT's EC-3 may be used in conjunction with the original seed mixture as mulch.

B. Apply lime and fertilizer according to soil tests, or apply 4,000 lbs/acre ground agricultural limestone and 1,000 lbs/acre 10-20-10 fertilizer.

C. Mulch with three inch straw applied at the rate of 4000 lbs./acre. Anchor straw by tacking with netting, roving, or by crimping with a mulch anchoring tool.

D. Refertilize in the second year unless growth is fully adequate. Reseed, refertilize, and mulch damaged areas immediately.

END OF SECTION

Attachment 4

RUSLE Calculations

Golder Associates Richmond, Virginia	Subject: RUSLE Calculation – Yorktown Ash Landfill SWP #457		
	Job No. 1239-6405	Made By: DPM	Date: 8/3/15
	Ref:	Checked: KAL	
		Reviewed: JRD	Sheet 1 of 1

OBJECTIVE

To compute the expected amount of soil to be lost from the site after closure, by using the Revised Universal Soil Loss Equation (RUSLE).

METHOD

RUSLE is an empirically derived formula based on several decades of field research by the National Resource Conservation Service (NRCS). It is based on several site-specific factors involving precipitation, soil type, slope, and cover/conservation practices employed.

REFERENCES

1. Predicting Soil erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE) USDA Handbook Number 703 (AH-703), July 1996.

CALCULATIONS

The RUSLE equation is as follows:

A=R*K*LS*C*P

Variable	Description	Value Used
A	soil loss in tons/yr/acre	-
R	Rainfall-Runoff erosivity factor	250 (for York County, VA)
K	Soil Erodibility factor	0.30 (aggregate)
LS	Slope Length/Steepness factor	0.37 (2% slope, 400' long, moderate rill to interrill erosion (Table 4-2))
C	Cover management factor	.005 (good stand of dense grass)
P	Support Practice Factor	1.0 (no specific measures)

Values for each of the above variables were chosen based on guidance presented in AH-703. Soil erodibility factor (K) was selected as an aggregate average value of soils in the vicinity of the Facility, based on the NRCS's Web Soil Survey website.

RESULTS

A=250*0.30*0.37*.005*1.0 = 0.14 tons/acre/year

CONCLUSIONS

The landfill final cover as designed meets the criteria of less than two tons of soil loss per acre per year.

Attachment 8

Closure Cost Estimate

Worksheet CEW-01: FORMAT FOR THE ESTIMATION OF CLOSURE COSTS

FILL IN THE BOXES. THE REST WILL BE CALCULATED FOR YOU

Soil Cap Components

				Calculation or Conversion		
I.	**Slope & Fill**					
a.	Area to be capped	48.5	acres	x 4,840yd2/ac	234,740	yd2
b.	Depth of soil needed for slope and fill	6	inches	x 1yd/36in	0.17	yd
c.	Quantity of soil needed			a x b	39,123	yd3
d.	Percentage of soil from off-site	33%				
e.	Purchace unit cost for off-site material	$15.00	/yd3			
f.	Percentage of soil from on-site			(1 - d)	67%	
g.	Excavation unit cost (on-site material)	$5.00	/yd3		0	
h.	Total soil unit cost			(d x e) + (f x g)	$8.30	/yd3
i.	Hauling, Placement and Spreading unit cost	$3.00	/yd3		0	
j.	Compaction unit cost	$0.62	/yd3			
k.	Total soil unit cost			h + i + j	$11.92	/yd3
l.	Soil subtotal			k x b	$466,350	
m.	Percent compaction	10%				
	Total Slope & Fill Cost			l x (1 + m)	***$512,985***	
II.	**Infiltration Layer Soil**					
Infiltration Soil Cost						
a.	Area to be capped	48.5	acres	x 4,840yd2/ac	234,740	yd2
b.	Depth of infiltration soil needed	0	inches	x 1yd/36in	0.00	yd
c.	Quantity of infiltration soil needed			a x b	0	yd3
d.	Percentage of soil from off-site	100%				
e.	Purchace unit cost for off-site material	$18.00	/yd3			
f.	Percentage of soil from on-site			(1 - d)	0%	
g.	Excavation unit cost (on-site material)	$0.00	/yd3			
h.	Total infiltration soil unit cost			(d x e) + (f x g)	$18.00	/yd3
i.	Hauling, Placement and Spreading unit cost	$3.00	/yd3			
j.	Compaction unit cost	$0.62	/yd3			
k.	Total infiltration soil unit cost			h + i + j	$21.62	/yd3
l.	Infiltration soil subtotal			k x b	$0	
m.	Percent compaction	10%				
n.	*Subtotal Infiltration Soil Cost*			l x (1 + m)	*$0*	
Soil Admixture Cost						
o.	Area to be capped	0	acres	x 4,840yd2/ac	0	yd2
p.	Soil admixture unit cost	$2.85	/yd2			
q.	*Subtotal admixture cost*			a x b	*$0*	
Soil Testing						
r.	Area to be capped	48.5	acres			
s.	Testing unit cost	$2,500.00	/acre			
t.	*Subtotal soil testing cost*			a x b	*$121,250*	
	Total Infiltration Soil Cost (soil, admixtures, and testing)			n + q + t	***$121,250***	

III. Erosion Control / Protective Cover Soil

a.	Area to be capped	48.5	acres	x 4,840yd2/ac	234,740	yd2
b.	Depth of soil needed	18	inches	x 1yd/36in	0.50	yd
c.	Quantity of soil needed			a x b	117,370	yd3
d.	Percentage of soil from off-site	100%				
e.	Purchace unit cost for off-site material	$15.00	/yd3			
f.	Percentage of soil from on-site			(1 - d)	0%	
g.	Excavation unit cost (on-site material)	$0.00	/yd3			
h.	Total erosion/protective soil unit cost			(d x e) + (f x g)	$15.00	/yd3
i.	Hauling, Placement and Spreading unit cost	$3.00	/yd3			
j.	Compaction unit cost	$0.62	/yd3			
k.	Total soil unit cost			h + i + j	$18.62	/yd3
l.	Erosion/Protective soil subtotal			k x b	$2,185,429	
m.	Percent compaction	10%				
	Total Erosion Control/Protective Cover Soil Cost			l x (1 + m)	***$2,403,972***	

IV. Vegetative support soil (Topsoil)

a.	Area to be capped	48.5	acres	x 4,840yd2/ac	234,740	yd2
b.	Depth of topsoil needed	6	inches	x 1yd/36in	0.17	yd
c.	Quantity of topsoil needed			a x b	39,123	yd3
d.	Percentage of topsoil from off-site	100%				
e.	Purchace unit cost for off-site material	$15.00	/yd3			
f.	Percentage of topsoil from on-site			(1 - d)	0%	
g.	Excavation unit cost (on-site material)	$0.00	/yd3			
h.	Total topsoil unit cost			(d x e) + (f x g)	$15.00	/yd3
i.	Hauling, Placement and Spreading unit cost	$3.00	/yd3			
j.	Total soil unit cost			h + i	$18.00	/yd3
	Total Topsoil Cost			c x j	***$704,220***	

V. Vegetative Cover

a.	Area to be vegetated	48.5	acres			
b.	Vegetative cover (seeding) unit cost	$3,250	/acre			
c.	Erosion control matting unit cost	$6,000	/acre			
	Total Vegetative Cover Cost			a x (b + c)	***$448,625.00***	

Soil Cap Component Subtotal (I + II + III + IV + V): $4,191,052

Geosynthetic Barrier & Infiltration Layers

VI. Flexible Membrane Liner

				Calculation or Conversion		
a.	Quantity of FML needed	53.35	acres (+10%)	x 43,560ft2/ac	2,323,926	ft2
b.	Purchase unit cost	$0.26	/ft2			
c.	Installation unit cost	$0.18	/ft2			
d.	Total FML unit cost			b + c	$0.44	
	Total FML cost			a x d	***$1,022,527***	

VII. Geosynthetic Clay Liner

a.	Quantity of GCL needed	0	acres	x 43,560ft2/ac	0	ft2
b.	Purchase unit cost	$0.00	/ft2			
c.	Installation unit cost	$0.00	/ft2			
d.	Total GCL unit cost			b + c	$0.00	/ft2
	Total GCL Cost			a x d	***$0***	

Geosynthetic Layers Subtotal (VI + VII): $1,022,527

Drainage Components

				Calculation or Conversion	
VIII.	**Sand or Gravel Drainage**				
a.	Area to be capped	48.5	acres	x 4,840yd2/ac	234,740 yd2
b.	Depth of sand or gravel needed	0	inches	x 1yd/36in	0.00 yd
c.	Quantity of drainage material needed			a x b	0 yd3
d.	Percentage of media from off-site	100%			
e.	Purchace unit cost for off-site material	$16.49	/yd3		
f.	Percentage of material from on-site			(1 - d)	0%
g.	Excavation unit cost (on-site material)	$0.00	/yd3		
h.	Total drainage material unit cost			(d x e) + (f x g)	$16.49 /yd3
i.	Hauling, Placement and Spredding unit cost	$1.65	/yd3		
j.	Compaction unit cost	$0.82	/yd3		
k.	Total drainage material unit cost			h + i + j	$18.96 /yd3
l.	Drainage material subtotal			k x b	$0.00
m.	Percent compaction	10%			
	Total drainage material cost			l x (1 + m)	***$0***
IX.	**Geotextile**				
a.	Quantity of geotextile needed	0	acres	x 43,560ft2/ac	0 ft2
b.	Purchase unit cost	$0.11	/ft2		
c.	Installation unit cost	$0.05	/ft2		
d.	Total geotextile unit cost			b + c	$0.16 /ft2
	Total Geotextile Cost			a x d	***$0***
X.	**Geonet Composite**				
a.	Quantity of geonet composite needed	53.35	acres (+10%)	x 43,560ft2/ac	2,323,926 ft2
b.	Purchase unit cost	$0.45	/ft2		
c.	Installation unit cost	$0.12	/ft2		
d.	Total geonet composite unit cost			b + c	$0.57 /ft2
	Total Geonet Composite Cost			a x d	***$1,324,638***
XI.	**Drainage Tile (cap drains)**				
a.	Length of drainage tile needed	4,500	LF		
b.	Purchase unit cost	$10.00	/LF		
c.	Trenching and backfilling cost	$15.00	/LF		
d.	Total drainage tile unit cost			b + c	$25.00 /ft2
	Total Drainage Tile Cost			a x d	***$112,500***

XII. Drainage Channels (Stormwater Control)

Drainage benches and berms

a.	Length of drainage bench needed	5,500	LF		
b.	Drainage bench unit cost	$25	/LF		
c.	*Subtotal drainage bench cost*			a x b	*$137,500*
d.	Length of 24" drainage pipe needed	300	LF		
e.	Drainage pipe unit cost	$55	/LF		
f.	*Subtotal drainage swale/berm cost*			d x e	*$16,500*

Rip Rap

g.	Quantity of Rip Rap needed	200	yd2		
h.	Rip rap unit cost	$35.00	/yd2		
i.	*Total rip rap cost*			g x h	*$7,000*

Gabian Baskets

j.	Quantity of gabian baskets needed	100	yd3		
k.	Gabian basket unit cost	$55.00	/yd3		
l.	Subtotal gabian basket cost			j x k	*$5,500*
	Total Stormwater Control			c + f + i + l	***$166,500***

Drainage Component Subtotal (VIII + IX + X + XI+ XII): $1,603,638

Landfill Gas and Groundwater Features

XIII. Landfill Gas Monitoring & Control Components

Landfill Perimeter System

				Calculation	
a.	Number of probes to be installed	0	probes		
b.	LFG probe unit cost	$1,099	/probe		
c.	*Subtotal LFG probe cost*			a x b	*$0*

Landfill Control Systems

d.	Area to be closed	28	acres		
e.	Average number of vents per acre	0	vents / acre		
f.	LFG vent unit cost	$3,518	/vent		
g.	*Subtotal LFG vent cost*			d x e x f	*$0*
h.	Length of header pipe needed	-	LF		
i.	Header pipe unit cost	$2.79	/LF		
j.	Header pipe installation cost	$5.59	/LF		
k.	*Subtotal LFG active vent hook-up*			h x (i + j)	*$0*
	Total Landfill Gas Management Cost			c + g + k	***$0***

XIV. Groundwater Monitoring Components

a.	Hydrogeologic study cost	$0			
b.	Number of wells to be installed	0	wells		
c.	GW Monitoring Well unit cost	$1,270	/well		
d.	Number of wells > 50 ft length	0	wells		
e.	Additional well length over 50 ft	0	LF/well		
f.	Unit cost for additional well length	$25	/LF		
	Total Groundwater Monitoring Well Cost			a + (b x c) + (d x e x f)	***$0***

Landfill Gas & Groundwater Features Subtotal (XIII + XIV): $0

Miscellaneous

XV.	**Removal and Disposal of Stockpiled Material**			Calculation	
a.	Quantity of stockpiled materials	-	yd3		
b.	Loading and Hauling unit cost	$1.68	/yd3		
c.	Disposal unit cost	$25.40	/yd3		
d.	***Total Removal/Disposal Cost***			a x (b + c)	***$0***
XVI.	**Erosion/Sediment Control**				
a.	Quantity of silt fence needed	15,000	LF		
b.	Silt Fence unit cost	$2.50	/LF		
	Total Silt Fence Cost			a x b	***$37,500***
XVII.	**Landfill Access Road**				
a.	Size of LF access road	3,500	yd2		
b.	Depth of gravel needed	6	inches	x 1yd/36in	0.2 yd
c.	Depth of asphalt needed	0	inches	x 1yd/36in	0.0 yd
d.	Total material needed			a x (b + c)	583 yd3
e.	Road material unit cost	$35.00	/yd3		
f.	Placement/Spreading unit cost	$3.56	/yd3		
	Total access road cost			c x (d + e)	***$22,491***
XVIII.	**Site Security**				
Fencing					
a.	Length of fencing needed	-	ft		
b.	Fence unit cost	$15.24	/ft		
c.	*Subtotal fencing cost*			a x b	*$0*
Gate or Barrier					
d.	Number of gates required	1			
e.	Gate unit cost	$1,219.20	/gate		
f.	*Subtotal gate cost*			d x e	*$1,219*
Closed Sign					
g.	Number of signs required	2			
h.	Sign unit cost	$75.00	/sign		
i.	*Subtotal sign cost*			g x h	*$150*
	Total site security cost			c + f + i	***$1,369***
XIX.	**Mobilization / Demobilization**				
a.	Cost for mobilization/demobilization	$145,000			
	Total mobilization/demobilization cost				***$145,000***

Miscellaneous Subtotal (XV + … + XIX): $207,579

Closure Cost Subtotal (CCS):		(I + … + XIX)	$7,024,797
City Cost Index (Small City)	100%=1		***1***
Adjusted Closure Cost (ACC)			$7,024,797
Contingency (10%):		CCS x 0.10	$702,480
Adjusted Closure Cost + Contingency (ACC+C)			$7,727,277
Engineering & Documentation:			
Construction QA/QC		$12,500 / Acre	$600,000
Closure Certification and CQA Report (1%)		ACC x 0.01	$70,248
Survey and as-builts (3%)		ACC x 0.03	$210,744
Cost for survey and deed notation			$15,000
Total Engineering & Documentation Costs			***$895,992***
Total Closure Cost:	ACC + Contingency + Engineering		**$8,623,269**