Closure Plan

CLOSURE PLAN

Clover Power Station Stage 3 Ash Landfill

Permit #556

Dominion

Submitted To: Dominion – Clover Power Station
S.R. 92
Clover, Virginia 24534

Submitted By: Golder Associates Inc.
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Table of Contents

Tables

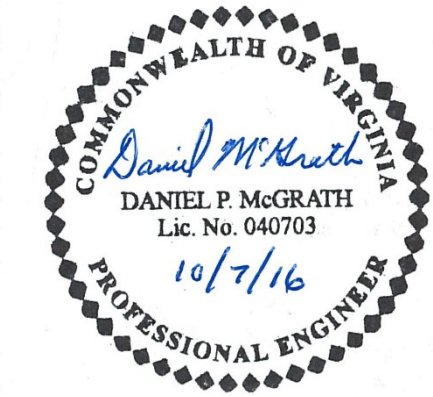
Attachments

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 Clover Power Station Coal Combustion Residuals (CCRs) Stage 3 Landfill (landfill) at Dominion's[1] Clover Power Station (Station) in Halifax County, Virginia. The location of the site is shown on Figure 1. Dominion plans to continue filling the Stage 3 landfill until it reaches its final design grades. This landfill is a captive industrial landfill and at final capacity will contain approximately 8,000,000 cubic yards of CCR material. The landfill is operated under the Virginia Department of Environmental Quality (DEQ) Solid Waste Permit No. 556. The Stage 1 and 2 landfill was closed in 2003 and is not the subject of this plan.

2.1 General Landfill Information

Dominion has operated the Stage 3 landfill for disposal of CCRs produced at the Station since June 2002. The CCRs include fly ash, bottom ash, coal mill rejects and gypsum. The landfill is approximately one-half mile west of the Station on Black Walnut Road. The permitted area of the landfill comprises approximately 78.5 acres designated for CCR disposal. The area was subdivided into phases, all of which have now been constructed. Approximately 24 acres of final cover was constructed on the southern section of the landfill in 2008, leaving approximately 54.5 acres left to close.

Non-contact storm water runoff from the perimeter and areas under intermediate and final cover discharge to six stormwater ponds around the border of the landfill. Discharges from these ponds are regulated under a Virginia Pollutant Discharge Elimination System (VPDES) permit (Permit No. VA0083097) issued by DEQ.

Leachate and contact stormwater is collected in two pairs of lined basins (1A / 1B and 2A / 2B) that are located immediately within the landfill footprint. Water from the lined basins is pumped from the landfill through a dedicated force main to the station's waste water treatment plant for treatment and discharge. Discharge from this treatment system is regulated under VPDES Permit No. VA0083097 issued by the DEQ.

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 serves as the infiltration barrier to prevent water percolation into the CCR. 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 post-

[1] The Clover Power Station and associated landfills are jointly and equally owned by Dominion Virginia Power and Old Dominion Electric Cooperative (ODEC).

closure concern. Leachate will continue to be collected and transported by the existing leachate collection and conveyance system for treatment and disposal.

3.0 CLOSURE TIMEFRAMES

The estimated remaining life of the landfill is approximately 6 to 8 years, depending on the volume of CCR received. It is anticipated the landfill will cease accepting CCR in approximately 2022 to 2024. Progressive closure construction is anticipated to be in accordance with the table below, with the final closure date varying depending on the ash generation rate. Construction of the final closure cap of the facility will take place in three interim stages:

Closure Stage	Approximate Area, Ac.	Approximate Closure Year
1	24	2008 (completed)
2	27	2018
3	27	2024
Final		2024

Selection of the interim closure stage is based on the landfill fill sequence and when an area of approximately 25 acres is at final grades and can be closed. The timeframes for closure presented in this plan are subject to variability due to Station operations and material generation rates.

4.0 CLOSURE OF SUPPORT PONDS AND BASINS

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

The leachate basins will remain in service post-closure to receive leachate from the landfill. The pump station and waste water treatment plant will remain in operation.

5.0 CLOSURE OF LANDFILL UNITS

5.1 Final Cover Design and Performance

The Final Cover System to be installed is as described in the landfill's solid waste permit #556. 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 it is shaped as needed to achieve design grades. The Design Plans in the solid waste permit (February 7, 2004) show the final cover system (Drawings 18 & 19). Technical

Specifications and the Construction Quality Assurance (CQA) plan for the closure system components are also in the landfill permit. A detailed description of each component of the final cover system is presented in the following paragraphs.

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. The CQA Plan stipulates that prior to geosynthetic panel deployment, the installer and CQA consultant will inspect the subgrade and provide a written subgrade acceptance indicating that the subgrade is acceptable.

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 be tied into a dedicated perimeter drainage system, which will then discharge into the perimeter stormwater channel at regular intervals. This collected water will not have come in contact with the CCR and will be treated as ordinary stormwater.

5.1.3 Erosion Control / Protective Cover Layer

The 18-inch protective cover layer will be constructed of soil. The protective cover layer will be placed and compacted to at least 90% of its Standard Proctor Density, in accordance with Section 02200 (Earthworks) of the Technical Specifications.

5.1.4 Vegetative Support Layer

The top six inches of the Final Cover System will be the vegetative support layer soil. This soil will be placed, but not compacted, and then seeded with the either the seed mix specified in Section 02936 (Seeding) or a site-specific mixture based on recommendations from a soils report. In either case, the seed mixture will consist mainly of turf-type grasses and nurse crops that will lend themselves to quickly establishing a healthy stand of grass. Woody vegetation is not allowed on the Final Cover System.

5.1.5 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*.

(D) 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 anticipated depth of frost penetration for south-central Virginia is approximately 18 inches.

The cover system soils will consist of on-site soils that are fine-grained loamy soils that generally exhibit some degree of plasticity and are classified as low to moderately erodible by wind and water. The calculated soil loss by the Revised Universal Soil Loss Equation (RUSLE) is 1.36 tons per acre per year. Calculations for the RUSLE are included 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 (33%). The minimum final slope per the landfill's permit is 2%. Approximately every 25 to 30 vertical feet, a stormwater diversion bench is graded into the slope to intercept and collect sheet flow runoff before it concentrates into erosive concentrated flow. The graded in benches provide additional slope stability by limiting the uninterrupted slope length to approximately 90 feet. Calculations from the permit design (Golder, 2004) show that the 3:1 final slope is stable under static conditions and seismic conditions.

5.3 Run-Off Controls

Sheet flow from the final cover surface will be collected into stormwater diversion benches and diverted into armored downchutes that lead into the perimeter channels. These benches are formed of soil with grass lining and are sized to convey the runoff from at least the 25-year, 24-hour storm event. The benches 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%.

Stormwater benches discharge into downchute channels which convey the flow to the perimeter channels surrounding the landfill. The downchute channels are trapezoidal-shaped and are armored with rip rap stone, Articulating Concrete Blocks (ACB), gabions, or fabric-formed concrete. Drainage from underneath the stormwater benches is also discharged into the downchutes. At the end of the downchute, a plunge pool or other energy dissipating device will be installed to mitigate erosive forces.

The perimeter channels flow to the existing stormwater basins for attenuation and eventual discharge through the VPDES-permitted outfalls. The perimeter channels are sized to convey the runoff from at least the 25-year, 24-hour storm event. The stormwater basins are sized to meet the Virginia Erosion and Sediment Control Handbook (VESCH) Standard and Specification 3.14, as well as being designed as permanent structures capable of safely passing at least the 25-year, 24-hour storm event.

Calculations for the design of the stormwater control system were prepared during the solid waste permitting process for the Stage 3 landfill (Golder, March 2000). Details for the components of the conveyance system and ponds are in the Design Plans (February 7, 2004), Drawings 8 and 18 – 21A.

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 16 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, 2004) show the post-closure settlement of the landfill is minimal and is anticipated to have negligible effects on the ability of the cover to shed excess stormwater and 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, would 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 Clover Power Station operates a waste water treatment plant that services specific waste water streams from the landfill (leachate commingled with contact stormwater) and from other station operations. As this treatment plant is integral to the station and landfill operations, it will remain active following closure of the Stage 3 landfill.

7.0 SCHEDULE FOR CLOSURE

Phase 3 of the landfill is anticipated to remain in service until approximately as late as the 4th quarter of 2024. At this point in the operation, it is anticipated there will be approximately 27 acres remaining to be closed. Based on site specific characteristics and previous closure construction experience at Clover, the construction is anticipated to take approximately 8 to 10 months to complete final closure. Table 1 outlines the anticipated sequence of closure schedule activities.

TABLE 1
CLOSURE SCHEDULE

Activity	Tentative Date
Last receipt of CCR	4Q 2024
Initiate closure activities (e.g. engineering & procurement)	4Q 2024
Commence closure construction	1Q 2025
Closure construction complete	By 4Q 2025
Certification of closure	December 2025

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

Halifax 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 be sent to the 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 556 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 Halifax 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 seal of Professional Engineer]

9.0 CLOSURE COST ESTIMATE

The estimated cost for closure of the remaining 54.5-acre± landfill is $6,300,000. Dominion will hire a construction contractor to provide closure construction services. Calculations for the closure cost estimate are included in Attachment 8.

Attachment 4

RUSLE Calculations

Golder Associates Richmond, Virginia	Subject: RUSLE Calculation – Clover Ash Landfill SWP #556		
	Job No. 1139-6277	Made By: DPM	Date: 8/25/16
	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	187 (for Halifax County, VA)
K	Soil Erodibility factor	0.30 (aggregate)
LS	Slope Length/Steepness factor	4.85 (33% slope, 75' 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=187*0.30*4.85*.005*1.0 = 1.36 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	54.5	acres	x 4,840yd2/ac	263,780	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	43,963	yd3
d.	Percentage of soil from off-site	0%				
e.	Purchace unit cost for off-site material	$18.00	/yd3			
f.	Percentage of soil from on-site			(1 - d)	100%	
g.	Excavation unit cost (on-site material)	$3.00	/yd3		0	
h.	Total soil unit cost			(d x e) + (f x g)	$3.00	/yd3
i.	Hauling, Placement and Spreading unit cost	$1.50	/yd3		0	
j.	Compaction unit cost	$0.62	/yd3			
k.	Total soil unit cost			h + i + j	$5.12	/yd3
l.	Soil subtotal			k x b	$225,092	
m.	Percent compaction	10%				
	Total Slope & Fill Cost			l x (1 + m)	***$247,601***	
II.	**Infiltration Layer Soil**					
Infiltration Soil Cost						
a.	Area to be capped	0	acres	x 4,840yd2/ac	0	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 Spredding 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	0	acres			
s.	Testing unit cost	$0.00	/acre			
t.	*Subtotal soil testing cost*			a x b	*$0*	
	Total Infiltration Soil Cost (soil, admixtures, and testing)			n + q + t	***$0***	

III. Erosion Control / Protective Cover Soil

a.	Area to be capped	54.5	acres	x 4,840yd2/ac	263,780	yd2
b.	Depth of soil needed	18	inches	x 1yd/36in	0.50	yd
c.	Quantity of soil needed			a x b	131,890	yd3
d.	Percentage of soil from off-site	0%				
e.	Purchace unit cost for off-site material	$15.00	/yd3			
f.	Percentage of soil from on-site			(1 - d)	100%	
g.	Excavation unit cost (on-site material)	$3.00	/yd3			
h.	Total erosion/protective soil unit cost			(d x e) + (f x g)	$3.00	/yd3
i.	Hauling, Placement and Spredding unit cost	$1.50	/yd3			
j.	Compaction unit cost	$0.62	/yd3			
k.	Total soil unit cost			h + i + j	$5.12	/yd3
l.	Erosion/Protective soil subtotal			k x b	$675,277	
m.	Percent compaction	10%				
	Total Erosion Control/Protective Cover Soil Cost			l x (1 + m)	***$742,804***	

IV. Vegetative support soil (Topsoil)

a.	Area to be capped	54.5	acres	x 4,840yd2/ac	263,780	yd2
b.	Depth of topsoil needed	6	inches	x 1yd/36in	0.17	yd
c.	Quantity of topsoil needed			a x b	43,963	yd3
d.	Percentage of topsoil from off-site	0%				
e.	Purchace unit cost for off-site material	$15.00	/yd3			
f.	Percentage of topsoil from on-site			(1 - d)	100%	
g.	Excavation unit cost (on-site material)	$3.00	/yd3			
h.	Total topsoil unit cost			(d x e) + (f x g)	$3.00	/yd3
i.	Hauling, Placement and Spredding unit cost	$1.50	/yd3			
j.	Total soil unit cost			h + i	$4.50	/yd3
	Total Topsoil Cost			c x j	***$197,835***	

V. Vegetative Cover

a.	Area to be vegetated	54.5	acres			
b.	Vegetative cover (seeding) unit cost	$2,100	/acre			
c.	Erosion control matting unit cost	$9,600	/acre			
	Total Vegetative Cover Cost			a x (b + c)	***$637,650.00***	

Soil Cap Component Subtotal (I + II + III + IV + V): $1,825,891

Geosynthetic Barrier & Infiltration Layers

VI. Flexible Membrane Liner

				Calculation or Conversion		
a.	Quantity of FML needed	54.5	acres	x 43,560ft2/ac	2,374,020	ft2
b.	Purchase unit cost	$0.30	/ft2			
c.	Installation unit cost	$0.18	/ft2			
d.	Total FML unit cost			b + c	$0.48	
	Total FML cost			a x d	***$1,139,530***	

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): $1,139,530

Drainage Components

VIII. Sand or Gravel Drainage

				Calculation or Conversion	
a.	Area to be capped	0	acres	x 4,840yd2/ac	0 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	5	acres	x 43,560ft2/ac	217,800 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	***$35,406***

X. Geonet Composite

a.	Quantity of geonet composite needed	54.5	acres	x 43,560ft2/ac	2,374,020 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	***$1,353,191***

XI. Drainage Tile (Toe Drain)

a.	Length of drainage tile needed	5,700	LF		
b.	Purchase unit cost	$13.50	/LF		
c.	Trenching and backfilling cost	$5.00	/LF		
d.	Total drainage tile unit cost			b + c	$18.50 /ft2
	Total Drainage Tile Cost			a x d	***$105,450***

XII. Drainage Channels (Stormwater Control)

Drainage benches and berms

a.	Length of drainage bench needed	25,207	LF		
b.	Drainage bench unit cost	$5	/LF	**4" pipes installed for drainage, remainder in earthworks**	
c.	*Subtotal drainage bench cost*			a x b	*$126,035*
d.	Length of ACB Downchute needed	2,700	LF		
e.	Downchute unit cost	$125	/LF		
f.	*Subtotal drainage swale/berm cost*			d x e	*$337,500*

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	0	yd3		
k.	Gabian basket unit cost	$25.00	/yd3		
l.	Subtotal gabian basket cost			j x k	*$0*
	Total Stormwater Control			c + f + i + l	***$470,535***

Drainage Component Subtotal (VIII + IX + X + XI+ XII): $1,964,582

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	0	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	7,500	LF		
b.	Silt Fence unit cost	$3.56	/LF		
	Total Silt Fence Cost			a x b	***$26,670***
XVII.	**Landfill Access Road**				
a.	Size of LF access road	-	yd2	**Installed during Phase 1 Closure in 2008**	
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)	0 yd3
e.	Road material unit cost	$28.96	/yd3		
f.	Placement/Spreading unit cost	$3.56	/yd3		
	Total access road cost			c x (d + e)	***$0***
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	$75,000			
	Total mobilization/demobilization cost				***$75,000***

Miscellaneous Subtotal (XV + … + XIX): $103,039

Closure Cost Subtotal (CCS):		(I + … + XIX)	$5,033,042
City Cost Index (Small City)	100%=1		***1***
Adjusted Closure Cost (ACC)			$5,033,042
Contingency (10%):		CCS x 0.10	$503,304
Adjusted Closure Cost + Contingency (ACC+C)			$5,536,346
Engineering & Documentation:			
Construction QA/QC		$12,500 / Acre	$688,750
Closure Certification and CQA Report (1%)		ACC x 0.01	$50,330
Survey and as-builts (2%)		ACC x 0.01	$50,330
Cost for survey and deed notation			$9,000
Total Engineering & Documentation Costs			***$798,411***
Total Closure Cost:	ACC + Contingency + Engineering		**$6,334,757**

$116,234.07 Per Acre Cost