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**SANTEE COOPER
CROSS GENERATING STATION**

Existing Class Three CCR Landfill Area 1B Closure Plan Narrative

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**CROSS GENERATING STATION
EXISTING CLASS THREE CCR LANDFILL AREA 1B CLOSURE PLAN NARRATIVE**

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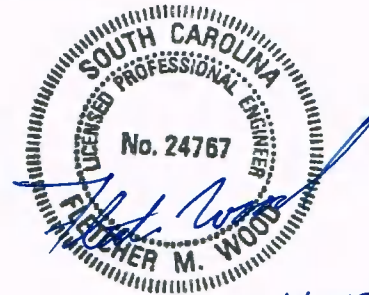


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14-OCT-2016



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1. INTRODUCTION

The United States Environmental Protection Agency (EPA) promulgated new regulations regarding Coal Combustion Residuals (CCRs). These regulations (40 CFR Part 257) were published in the Federal Register on April 17, 2015. One of the requirements (§257.102(b)(1)) of the new regulations is to prepare a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices. This written closure plan must be placed in the facility's operating record no later than October 17, 2016, as required by §257.102(b)(2).

This report presents the written closure plan for the existing Class Three CCR Landfill Area 1B at Cross Generating Station in Pineville, South Carolina.



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2. DISCUSSION

The previously-permitted written closure plan for the existing Class Three Landfill Area 1B is included in Appendix A. Title 40 CFR §257.102(b)(1)(i) through (vi) specify the minimum required information that must be included in the written closure plan. Each requirement is stated below, along with a reference to the appropriate section in the permitted written closure plan where the information can be found, in addition to any supplemental information that may be required. The written closure plan must include, at minimum, the following:

(§257.102(b)(1)(i)) *A narrative description of how the CCR unit will be closed in accordance with this section.*

Refer to Section 8 of Appendix A for a narrative description of how the existing Class Three Landfill Area 1B will be closed. In general, the final cover system will be installed in phases as CCR waste placement reaches threshold elevations that generally correspond to each bench elevation. Over time, this phased approach will reduce the exposed surface of the waste, reduce leachate generation, and minimize the remaining area to be closed upon final receipt of waste.

(§257.102(b)(1)(ii)) *If closure of the CCR unit will be accomplished through removal of CCR from the CCR unit, a description of the procedures to remove the CCR and decontaminate the CCR unit in accordance with paragraph (c) of this section.*

The above requirement is not applicable, as the closure will not be accomplished through removal of CCR.

(§257.102(b)(1)(iii)) *If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.*

Paragraph (d) of this section (§257.102(d)(1) through (3)) specifies the minimum performance standards for closure when leaving CCR in place, including:

(1) ensuring that the CCR unit is closed in a manner that will:

(1)(i) *Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;*



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Per Section 8.2 of Appendix A, the final cover system is designed to provide a maximum permeability less than or equal to the bottom liner system of the landfill, to minimize stormwater infiltration through the closed landfill, and to resist erosive forces. This will minimize post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.

(1)(ii) *Preclude the probability of future impoundment of water, sediment, or slurry;*

Per Section 8.2 of Appendix A, the final cover system shall promote positive drainage with final design grades of the top surface not less than 3 percent. This will prevent the impoundment of water, sediment, or slurry.

(1)(iii) *Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;*

Per Section 8.2 of Appendix A, the side slopes will not exceed three horizontal feet to one vertical foot (3:1). Furthermore, slope stability analyses have been performed on the permitted final cover system described in this closure plan (including all system components and the maximum side slopes) to ensure that sloughing or movement of the final cover system will not occur during the closure and post-closure care periods.

(1)(iv) *Minimize the need for further maintenance of the CCR unit; and*

Per Section 8.2 of Appendix A, the upper-most component of the final cover system includes a soil layer capable of supporting native vegetation. The native vegetation will minimize erosion and therefor minimize the amount of further maintenance required.

(1)(v) *Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.*

Per Section 8.4 of Appendix A, and as mentioned previously, the final cover system will be installed in phases to minimize the time required to complete closure upon final receipt of waste. Per Section 8.9 of Appendix A, closure must be completed within 180 days.

(2) Drainage and stabilization of CCR surface impoundments. The owner or operator of a CCR surface impoundment or any lateral expansion of a CCR surface impoundment must meet the requirements of paragraphs (d)(2)(i) and (ii) of this section prior to installing the final cover system required under paragraph (d)(3) of this section.



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The above requirement is not applicable, as the existing Class Three CCR Landfill Area 1B is not a surface impoundment.

(3) Final cover system. If a CCR unit is closed by leaving CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (d)(3)(i) of this section, or the requirements of the alternative final cover system specified in paragraph (d)(3)(ii) of this section.

(3)(i) The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.

(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less.

Per Section 8.2 of Appendix A, final cover system Option 1 (Standard Final Cover System) will provide a maximum permeability less than or equal to the bottom liner system. The Standard Final Cover System will have a permeability less than 1×10^{-5} cm/sec.

(B) The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.

Per Section 8.2 of Appendix A, the Standard Final Cover System satisfies this requirement.

(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.

Per Section 8.2 of Appendix A, the upper-most component of the Standard Final Cover System includes a 24-inch thick soil layer capable of supporting native vegetation.

(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

Per Section 8.2 of Appendix A, post-closure differential settlement is not anticipated with this waste mass because it consists of compacted CCR. The



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integrity of the Standard Final Cover System will not be disrupted due to settling or subsidence.

(3)(ii) The owner or operator may select an alternative final cover system design, provided the alternative final cover system is designed and constructed to meet the criteria in paragraphs (f)(3)(ii)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.

(A) The design of the final cover system must include an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (d)(3)(i)(A) and (B) of this section.

Per Section 8.2 of Appendix A, final cover system Option 2 (Alternate Final Cover System) will provide a maximum permeability less than or equal to the bottom liner system. The Alternate Final Cover System will have a permeability less than 1×10^{-5} cm/sec, and meet or exceed the performance of the Standard Final Cover System.

(B) The design of the final cover system must include an erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in paragraph (d)(3)(i)(C) of this section.

Per Section 8.2 of Appendix A, the upper-most component of the Alternate Final Cover System includes a 24-inch thick soil layer capable of supporting native vegetation.

(C) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

Per Section 8.2 of Appendix A, post-closure differential settlement is not anticipated with this waste mass because it consists of compacted CCR. The integrity of the Standard Final Cover System will not be disrupted due to settling or subsidence.

(3)(iii) The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the design of the final cover system meets the requirements of this section.

Refer to Section 4 of this document.



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(§257.102(b)(1)(iv)) *An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit.*

Per Section 8.5 of Appendix A, an estimate of the maximum inventory of CCR ever on-site in Landfill Area 1B is 6,050,000 cubic yards.

(§257.102(b)(1)(v)) *An estimate of the largest area of the CCR unit ever requiring a final cover as required by paragraph (d) of this section at any time during the CCR unit's active life.*

Per Section 8.4 of Appendix A, an estimate of the largest area of Landfill Area 1B ever requiring a final cover is 64.6 acres. Because the landfill will be closed in phases, this is likely a conservative estimate of the maximum area.

(§257.102(b)(1)(vi)) *A schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phases of CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR unit closure. When preparing the written closure plan, if the owner or operator of a CCR unit estimates that the time required to complete closure will exceed the timeframes specified in paragraph (f)(1) of this section, the written closure plan must include the site-specific information, factors, and considerations that would support any time extension sought under paragraph (f)(2) of this section.*

For the purpose of this section, the schedule for completing closure is based on the permitted maximum annual CCR waste placement rate, which is 1,360,000 cubic yards. It also is based on the total volume (6,050,000 cubic yards) and area (64.6 Acres) of Landfill Area 1B, although only Cell 1 (one of two total) is operational at this time. The actual annual waste placement rate may be less, which will result in a later closure date.

Landfill Area 1B began receiving waste in December 2015. The earliest possible date for final receipt of waste is May of 2020. On this basis, the schedule for completing all activities necessary to satisfy the closure criteria in this section is as follows:



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Final Closure Schedule for Existing Class Three CCR Landfill Area 1B

<u>Activity</u>	<u>Completion Date</u>
Obtaining closure permits / approvals from SCDHEC	March 2013 (Permit # LF3-00007)
Borrow source investigation	June 2019 - August 2019
Obtain borrow source permits	September 2019 - December 2019
Procure final closure contractor	December 2019 - February 2020
Borrow source site development	February 2020 - April 2020
Final receipt of waste	May 2020
¹ Notification of intent to initiate closure	May 2020
² Begin installation of final cover system	May 2020
³ Install final cover system	May 2020 - October 2020
⁴ Notification of closure completion	November 2020
⁵ Record deed notation	November 2020
⁶ Place notification of deed notation in operating record	December 2020

The duration of installation of the final cover system will be less than six months, and as such satisfies the requirements of §257.102(f)(1)(i).

¹Per §257.102(g), no later than the date the owner or operator initiates closure of a CCR unit, the owner or operator must prepare a notification of intent to close a CCR unit

²Per §257.102(e)(1)(i), the owner or operator must commence closure of the CCR unit no later than 30 days after the date of which the CCR unit receives the known final receipt of waste

³Per §257.102(f)(1)(i), the owner or operator must complete closure of the CCR unit, for existing and new CCR landfills and any lateral expansion of a CCR landfill, within six months of commencing closure activities

⁴Per §257.102(h), within 30 days of completion of closure of the CCR unit, the owner or operator must prepare a notification of closure of a CCR unit

⁵Per §257.102(i)(1), following closure of a CCR unit, the owner or operator must record a notation on the deed to the property, or some other instrument that is normally examined during title search

⁶Per §257.102(i)(3), within 30 days of recording a notation on the deed to the property, the owner or operator must prepare a notification stating that the notation has been recorded



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3. CONCLUSIONS

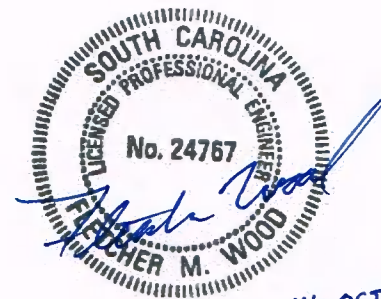
The existing permitted closure plan for the existing Class Three CCR Landfill Area 1B at Cross Generating Station in Pineville, South Carolina, and supplemental information included in this report, satisfy the written closure plan requirements outlined in Title 40 CFR §257.102.



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4. CERTIFICATION

I, the undersigned Professional Engineer registered in good standing in the State of South Carolina, do hereby certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. I certify, for the above-referenced CCR Unit, that the written closure plan contained herein is in accordance with the requirements of Title 40 CFR §257.102, and that the proposed design of the final cover system meets the requirements of Title 40 CFR §257.102(d)(3).



14-OCT-2016

Fletcher Wood
Printed Name of Professional Engineer


Signature of Professional Engineer

24767
South Carolina License #



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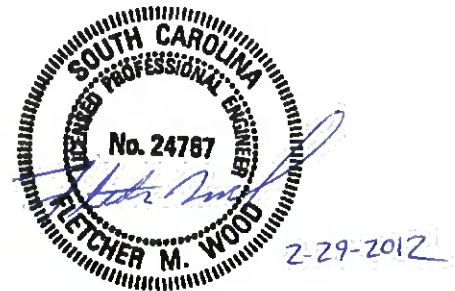
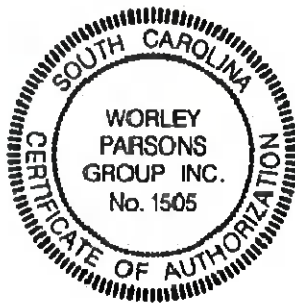
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Appendix A - Permitted Closure Plan

CLOSURE PLAN

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8.1 Closure Plan

Regulation 61-107.19 of the Solid Waste Management Regulations requires a permittee of a Class Three Landfill to prepare a closure plan that addresses the criteria for closure defined in Section 258.60. This closure plan describes the steps necessary to close the Cross Station Class Three Landfill at any point during the active life in accordance with the requirements of that Section, as applicable. Partial closure refers to the closure of a portion of, or phase of the landfill; final closure is achieved upon closure of the entire landfill.

This plan addresses the objectives and implementation of closure, including minimizing the exposure of the waste fill and generation of leachate. Specifically, this closure plan provides a description of the final cover (cap) design, establishes a preliminary plan for closure and cost estimate to construct the final closure cap.

8.2 Final Cover System

The final cover (cap) design includes two options. The cap is designed to minimize stormwater infiltration through the closed landfill and to resist erosive forces. The multi-layered cap system provides a maximum permeability less than or equal to the bottom liner system of the landfill, a soil layer atop to minimize erosion and support vegetation and stormwater management features to convey stormwater.

The cap system will be constructed on the prepared CCR waste subgrade and consists of the following layers (listed from top to bottom):

OPTION 1 – Standard Final Cover System

- 24-inch soil layer capable of supporting native vegetation;
- 200-mil Geonet
- 20-mil Linear Low Density Polyethylene (LLDPE) geomembrane
- 18-inch thick (minimum) low permeable soil layer ($K_{\max} = 1 \times 10^{-5}$ cm/sec)

OPTION 2 – Alternate Final Cover System

- 24-inch soil layer capable of supporting native vegetation;
- 200-mil Geonet
- 20-mil Linear Low Density Polyethylene (LLDPE) geomembrane
- Reinforced Geosynthetic Clay Layer (GCL)

The final cover system shall promote positive drainage with final design grades of the top surface not less than 3-percent. The side slopes without turf reinforcement matting will not exceed three horizontal feet to one vertical foot (3:1). *Refer to the Permit Drawings for details of the proposed final cover (cap) system and final grading plan.*

Differential settlement is not anticipated to occur with this waste mass.

A description of the materials to be used in the final cover system and the methods and procedures required to install the final cover system can be found in *Section 6 – Construction Quality Assurance (CQA) Report*, of the permit application.

8.3 Landfill Gas Management System

The waste materials disposed in the facility have little or no organic element and is not anticipated to produce gas resulting from decomposition. The closure plan does not include a gas management system.

8.4 Estimate of Largest Area Requiring Final Cover

The Cross Station Class Three Landfill is designed as four distinct areas. The largest area requiring final cover is summarized in Table 8-1 below.

Table 8-1
Final Cover Areas

Class Three Landfill Area	Final Cover Area (acres)
Area 1B	64.6
Area 1D	76.4
Area 2	43.5
Area 5	70.3
Total	254.8

As illustrated on the Engineering Drawings, the final cover system will be installed incrementally, as the filling operations progress in height.

8.5 Estimate of Maximum Inventory of Waste

The proposed Class Three Landfill is estimated to provide about 24.6 million cubic yards of capacity. The volume for each Class Three Landfill area is summarized in Table 8-2 below.

Table 8-2
Maximum Waste Inventory

Class Three Landfill Area	Waste Volume (cubic yards)
Area 1B	6,050,000
Area 1D	7,620,000
Area 2	3,880,000
Area 5	7,080,000
Total	24,630,000

8.6 Landfill Closure Sequence

Closure activities may be initiated in phases according to the sequence of filling. Partial closure events will occur after a phase or significant portion of the landfill has reached the final grades (waste) indicated on the Drawings. At capacity or once the last remaining active area achieves final grades (waste), closure activities for final closure of the facility will begin. The steps for implementing the closure process are described in the following subsections. The steps are the same for partial closure and final closure.

8.7 Determination of Closure Area

Santee Cooper will determine the location and acreage of areas to be closed. Closure construction will not be initiated until final grades (waste) of an adequate sized area are achieved. The facility will be surveyed periodically to determine the status and estimate the landfill area that has reached final grades. Santee Cooper will determine the number of closure events and size of each closure event for the facility.

For final closure, closure activities shall begin no later than 30 days after the date on which the Class Three Landfill receives the known final receipt of wastes; or if capacity is remaining and there is a reasonable likelihood that the landfill will receive additional wastes, no later than one year after the most recent receipt of wastes. Extensions beyond the one-year deadline for beginning closure may be granted by the Department if the permittee, Santee Cooper demonstrates that the landfill has capacity to receive additional wastes and the permittee has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the unclosed landfill.

8.8 Notification of Intent to Initiate Closure

Once Santee Cooper has determined that an area will be closed, a Notice of Intent shall be submitted to the Department to include a schedule outlining the planned closure activities. A description of the area to be closed, acreage, and schedule of the closure activities will be provided.

8.9 Closure Schedule

Santee Cooper will prepare a schedule for closure activities once an area is determined to be closed. Closure of the subject area must be completed within 180 days following of beginning closure activities. Extensions of the closure event period may be granted by the Department if the permittee, Santee Cooper demonstrates that closure will take longer than 180 days and they have taken and will continue to take all steps to prevent threats to human health and the environment from the unclosed landfill

8.10 Construction Contract Documents

Construction plans and documents will be prepared for each respective closure event. Construction plans and specifications will be used for bidding and construction of the project. Only pre-qualified contractors will be selected to bid on the closure project(s). Quantity estimates of soils and materials required for the project will be prepared and a cost estimate will be generated for the closure event and for each successive closure event, respectively.

8.11 Final Cover Soil

The material to be used for construction of the closure cap system will be obtained from either on-site and/or off-site borrow areas. The source or sources will be selected based on ability to provide material conforming to project specifications, availability of the required volumes and

proximity to the site. This may be determined prior to a closure event or during bidding of the project. Soil stockpile locations are indicated on the Permit Drawings.

The estimated volume of the soil required for final closure of the landfill is about 1.5 million cubic yards.

8.12 Certification of Closure

Upon completion of each closure event, Santee Cooper shall submit to the Department for approval, certification signed by a South Carolina registered professional engineer, verifying that closure has been completed in accordance with the closure plan. A copy of this certification shall be placed in the operating record.

Procedures for certification of closure construction may be found in *Section 6 – Construction Quality Assurance Report* of this Application, and the associated specifications sections therein.

8.13 Record Notation to Deed

Within 30 days of the Department's issuance of final closure approval of the landfill, Santee Cooper shall record with the appropriate Register of Deeds, a notation in the record of ownership of the property - or some other instrument which is normally examined during title search - that will in perpetuity notify any potential purchaser of the property that the land or a portion thereof was used for the disposal of solid waste. This notice shall define the final boundaries of the waste disposal area including the latitude and longitude, identify the type, location, and quantities of solid waste disposed on the property, and advise potential owners of the property that there are land use restrictions.

8.14 Financial Assurance

Santee Cooper is required to provide financial assurance for the costs to close the largest active area ever requiring final cover at any time during the life of the facility. The largest active area requiring final cover is based on the planned first phase of construction, Area 1B, and will be approximately 65 acres. The cost estimate will be annually adjusted to account for inflation and any changes in conditions at the facility or in the design. If conditions call for a reduction in the amount to be financially assured, approval of the Department must be obtained prior to officially reducing the amount.

A cost estimate for closure of the planned first phase of construction, Area 1B, is provided in Table 8-3.

8.15 Revisions to the Plan

If for any reason changes occur, requiring deviations from the approved closure plan or final cover (cap) design, the closure plan will be revised and submitted to the Department for review and approval prior to implementation.

Any updates to the closure plan, and any monitoring, testing, or analytical data as required by Sections 258.60, shall be maintained in the Operating Record.

**TABLE 8-3
CLOSURE COST ESTIMATE
AREA 1B
CROSS STATION
CLASS THREE LANDFILL**

Item Number	Description	Estimated Quantity	Unit	Unit Price	Extended Total
1	Bonds, Insurance, Mobilization and Demobilization	5%	LS	\$ 558,133	\$ 558,133
2	Temporary Stormwater Water Management	64.6	AC	\$ 2,000.00	\$ 129,200
3	Strip and Fine Grade Ex. Waste/Intermediate Cover	312,664	SY	\$ 1.25	\$ 390,830
4	18-inch Low Permeability (1x10 ⁻⁵) Soil	312,664	SY	\$ 9.00	\$ 2,813,976
5	LLDPE Flexible Membrane Liner	312,664	SY	\$ 4.00	\$ 1,250,656
6	Geocomposite Drainage Net	312,664	SY	\$ 4.25	\$ 1,328,822
7	24-Inch Drainage and Erosion Layer	312,664	SY	\$ 8.00	\$ 2,501,312
8	6-inch Perforated PE Pipe and Trench	12,000	LF	\$ 15.00	\$ 180,000
9	3'x5'x5' Concrete Drop Inlet	4	EA	\$ 5,000.00	\$ 20,000
10	24" HDPE Downdrain Pipe	2,000	LF	\$ 50.00	\$ 100,000
11	Waste Excavation and Disposal for Downdrain Pipes	6,000	CY	\$ 8.00	\$ 48,000
12	Structural Fill for Downdrain Pipes	6,000	CY	\$ 8.00	\$ 48,000
13	Downdrain Headwall	4	EA	\$ 5,000.00	\$ 20,000
14	Downdrain Outlet Structure Rip Rap Apron	4	EA	\$ 3,500.00	\$ 14,000
15	Gravel Access Road	4,600	SY	\$ 25.00	\$ 115,000
16	Seeding & Mulching	64.6	AC	\$ 2,000.00	\$ 129,200
17	Erosion Control Matting	312,664	SY	\$ 2.50	\$ 781,660
18	Miscellaneous Work & Cleanup	64.6	AC	\$ 5,000.00	\$ 323,000
19	Engineering and CQA Services	64.6	AC	\$ 15,000.00	\$ 969,000
20	5% Contingency of Above Items	5%	LS	\$ 586,039	\$ 586,039
Total Closure Cost					\$ 12,306,828