Coal Combustion Residuals (CCR) Landfill

CLOSURE AND POST-CLOSURE PLAN

SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION
R.D. Morrow, Sr. Generating Station
Purvis, Lamar County, Mississippi
(601) 235-2700

Prepared by:

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

104 Avalon Court, F
Brandon, MS 39047
(601) 992-8233

7350 Highway 98
Hattiesburg, Mississippi
(601) 992-8233

Revision Record
Original Plan: May 2003
Revised: November 15, 2013
Revised: October 7, 2016

Certification

This CCR Closure Plan for the CCR Landfill at the South Mississippi Electric Power Association, R.D. Morrow, Sr. Generating Station located in Purvis, Mississippi, was prepared by Environmental Management Services, Inc. (EMS) pursuant to the Scope of Services dated March 17, 2016, agreed to and authorized by SMEPA. This Statement of Professional Opinion is based on information available to EMS at the time the CCR Closure Plan was prepared and EMS's technical understanding of the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015 (CCR Rule) and associated public guidance and/or interpretation provided by the U.S. EPA and obtained by EMS as of the date of the CCR Closure Plan.

On the basis of and subject to the foregoing it is my professional opinion as a Professional Engineer licensed in the State of Mississippi that the CCR Closure Plan has been prepared in accordance with good and accepted engineering practices exercised by other engineers practicing in the same discipline(s) under similar circumstances and at the time and place the CCR Closure Plan was prepared, and with the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments", published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015. It is my professional opinion based on my understanding of the technical requirements of the CCR Rule and good and accepted engineering practices that the design of the final cover system as set forth in the CCR Closure Plan meets the technical requirements and/or intent of the CCR Rule (40 CFR 257, Section 257.102(d)(3)(iii)). This Statement of Professional Opinion is not and shall not be interpreted or construed as a guarantee, warranty or legal opinion.

Environmental Management Services, Inc.

Christopher T. Johnson, P.E., P.S.
Engineering Manager/Vice President

Date: 10/7/2016

Seal

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

This Closure and Post-Closure Plan has been developed for the South Mississippi Electric Power Association (SMEPA) R.D. Morrow, Sr. Generating Station located near Purvis, Lamar County, Mississippi. This plan addresses the requirements of the Mississippi Nonhazardous Solid Waste Management Regulations (NSWMR) 11 Miss. Admin. Code Pt. 4, Rule. 1.4. E., and federal CCR regulations (40 CFR 257) for closure and post-closure care of an industrial waste landfill containing Coal Combustion Residuals (CCR) and regulated under both the state and the federal regulations.

1.1 Regulatory Overview

In 1977, South Mississippi Electric Power Association (SMEPA) received Permit No. SW0370020308 from the State of Mississippi; Department of Environmental Quality (MDEQ) to operate its onsite industrial waste landfill. The onsite facility is currently owned and operated by SMEPA. The landfill receives only non-hazardous industrial solid waste from the on-site generating plant as specified in the facility MDEQ nonhazardous solid waste landfill permit. The landfill is also an "existing unit" subject to federal CCR regulations as of the effective date of October 19, 2015. However, the federal regulations have no permitting requirements or EPA oversight. This CCR Closure Plan replaces the 2003 Closure Plan, as modified in 2013 and conforms to the requirements of Section 257.102(b) of the CCR Rule [written closure plan] and applicable sections of the Mississippi NSWMR.

1.2 Site Location and Description

The landfill site is located in the N1/2of the NE1/4 of Sec.21, T3N, R14W, in Lamar County, Mississippi, as shown on the Site Location Map presented as **Figure 1**. The site is located at latitude 31˚ 12' 40" and longitude -89˚ 23' 53". The approximately 72 acre permitted landfill site is located within the 1,200 acre R.D. Morrow, Sr. property. The permitted landfill area is shown on the Existing Site Plan presented as Figure 2. The 72 acre permitted landfill area includes approximately 46 acres of existing landfill permit and a proposed 26 acre expansion area located to the west of the existing landfill.

Under the federal CCR regulations the existing footprint is classified as an existing CCR landfill, and the proposed expansion is classified as a new or lateral expansion of the CCR landfill.

1.3 Closure Description

This plan includes a description of the steps that will be undertaken to close each filled landfill cell, a general schedule for closure, a description of the final cover system and the methods used to install the cover. The general approach for closure is to close the CCR unit in place by grading of waste to meet minimum and maximum grade requirements, then applying final cover materials. A description of post-closure care and monitoring activities is also included.

2 CLOSURE REQUIREMENTS

2.1 Notification Requirements

2.1.1 MDEQ Closure Notifications and Recordkeeping

The MDEQ will be notified in writing at least 90 days before closure or intent to close, seal, or abandon any individual units within the landfill. The notification will include the date of planned closure, changes requested in the approved closure plan (if any), and the closure schedule.

A copy of the approved closure plan will be kept on file at the plant site until the owner is released from the requirements for closure and post-closure care.

2.1.2 Federal Closure Notifications

Federal CCR Regulations require various recordkeeping (Section 257.105), notifications (Section 257.106) and posting of information on a publicly accessible internet site (Section 257.107). The requirements include such items as:

- Notification of intent to initiate closure of a CCR unit.
- Annual progress reports of closure implementation.
- Notification of closure completion.
- Written closure plan, and any amendment of the plan.
- Demonstration(s) for a time extension for initiating closure.
- Demonstration(s) for a time extension for completing closure.
- Notification of completion of closure of a CCR unit.
- Notification recording a notation on the deed
- Notification of intent to comply with the alternative closure requirements.
- Annual progress reports under the alternative closure requirements.
- Written post-closure plan, and any amendment of the plan
- Notification of completion of post-closure care.

This is not an exhaustive list. The reader is directed to the federal CCR Regulations for more complete closure and post-closure requirements and associated timelines in 257.100 through 257.104.

2.2 CCR Volumes and Airspace

2.2.1 State Permitted CCR Volume

The estimated maximum waste disposal capacity for the permitted and developed landfill area is approximately 3.2 million cubic yards (excluding the permitted expansion area). Another approximately 2.1 million cubic yards of free air space is available in a permitted, but not yet

developed, twenty-six acre landfill site west of the current landfill resulting in a total design capacity (including the permitted expansion area) of 5.3 million cubic yards.

As of October 2015, approximately 2.04 million cubic yards of coal combustion residuals and interim cover have been placed in the permitted and developed landfill, leaving an estimated remaining capacity of 1.16 million cubic yards of free air space in the existing permitted and developed area without the permitted expansion area. With the addition of 2.1 million cubic yards of airspace, if and when the western expansion area is developed, a total of 3.26 million cubic yards of remaining air space is available for the R.D. Morrow ash landfill in its currently permitted condition. The estimated capacity is based on the volume calculated by comparing the existing waste surface (or design grade at the base liner system) to the design grade of the waste at the bottom of the final cover system.

2.2.2 Federal CCR Volume

The Federal CCR Regulations do not place specific restrictions on CCR landfill volumes.

3 CLOSURE COVER DESIGN AND INSTALLATION

The final closure cover is designed to ensure that the landfill cells are closed in a manner that minimizes the need for further maintenance and controls, including the minimization of infiltration and erosion. Closure of filled cells will include grading of the waste and installation of a closure cover, which meets the requirements of the Mississippi NSWMR, 11 Miss. Admin. Code Pt. 4, Rule 1.4. E., and 40 CFR 257.

2.3 Closure Schedules and Requirements

2.3.1 MDEQ Requirements

Closure of a landfill cell generally begins within 30 days following the final receipt of waste in the cell. Therefore, the largest area of the landfill unit requiring a final cover at any time during the active life is generally one or two cells. The largest cell area scheduled for closure of the SMEPA permitted landfill footprint is approximately ten acres. A schedule, based on closure of a ten-acre area, for completing all activities necessary for closure is presented on **Table 1**.

Closure of a cell will be completed no later than 90 days after final grades are achieved in the cell, or after the date of known final receipt of industrial waste in the cell, whichever comes first. This schedule may be extended by the MDEQ, if necessary, due to inclement weather or other circumstances, up to a maximum of 60 days for initiation and 180 days for completion of closure.

Prior to closure, standing water will be solidified or removed. Final machine compacting and grading will be completed prior to initiating final cover placement. The runoff diversion system will be maintained until the final cover system is installed, and will be modified, if necessary, to prevent uncontrolled overflow of surface water run-off from the landfill.

2.3.2 Federal CCR Requirements

Prior to final closure of any active CCR landfill must have completed a closure plan and filed it in the operating record. This plan complies with that requirement. 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. The notification must include the certification by a qualified professional engineer for the design of the final cover system as required by § 257.102(d)(3)(iii).

2.4 Cover System Design and Installation

2.4.1 MDEQ Requirements

The Mississippi NSWMR requires that landfill covers contain:

- A vegetated erosion layer consisting of a minimum of 6 inches of earthen material,

- A minimum 18-inch infiltration layer with a permeability ≤ the permeability of any bottom liner or natural subsoils, with a permeability no greater than $1x10^{-5}$ cm/sec, whichever is less, or

- An alternative final cover design which achieves an equivalent protection.

Mississippi NSWMR also requires that maximum slopes not exceed 25% and minimum slopes not be less than 4% unless otherwise approved by MDEQ.

2.4.2 Federal CCR Requirements

Federal CCR Regulations require that a CCR landfill cover system meet the closure performance standard in the federal CCR Regulations Section 257.102(d). The cover will minimize, to the maximum extent feasible, post-closure infiltration of liquids into the waste or releases from the landfill. The design will preclude the probability of impoundment of liquids, provide for slope stability, minimize the need for future maintenance, and be completed in shortest amount of time consistent with generally accepted good engineering practices.

In addition to the performance standards, the cover system will meet the following specific requirements in 257.102(d)(3)(i)(A) through (D) unless an alternative final cover system is used:

(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.

(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.

(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.

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

Under 257.102, an alternative final cover system may be provided if it is certified by an engineer to achieve an equivalent performance to the requirements (A) – (D) above.

2.4.3 Cover Design Overview

The final cover will include one of two different designs based on the slope of the finished area. Areas of relatively flat slopes (minimum 4%) will include a synthetic liner in the cover system, and will include 18 inches of cohesive soil under the synthetic liner. Areas with steep slopes (side slopes) of approximately 25% will not include a synthetic liner in the cover system, but will contain 24 inches of re-compacted clay. The final cover system will be installed directly over the compacted

waste to provide a stable base for subsequent layers.

2.4.4 Steep Slope Cover Design

On nominal slopes of 25 percent (4H:1V), the cover system to be installed is described as follows (from top to bottom):

- a twelve (12) inch layer of vegetative soil cover;
- a minimum 24-inch cohesive soil cover with a permeability of 1 x 10^{-5} cm/sec or less;

Because the steep slopes provide enhanced runoff versus infiltration, no other components (e.g. synthetic liner) are required for the steep slope cover system.

2.4.5 Flat Slope Cover Design

For the areas that nominally slope at ten (10) percent (10H:1V) or less, the cover system to be installed is described as follows (from top to bottom):

- a twelve (12) inch layer of vegetative soil cover;
- a minimum bi-planar geocomposite drainage layer;
- a 40-mil HDPE geomembrane; and
- a minimum 18-inch cohesive soil cover with a permeability of 1 x 10^{-5} cm/sec or less;

2.4.6 Cover System Components Installation Methods

The general installation methods for various cover system components are described in the paragraphs below. More details are provided in the Soil Cover Installation and Testing Plan (**Appendix A**), and the Summary of Quality Control and Quality Assurance Procedures for the Installation of Geosynthetic Lining Systems (**Appendix B**).

Clay Cover: Material used for clay cover will be tested prior to construction in accordance with the preconstruction testing program described in the Soil Cover Installation and Testing Plan presented in Appendix A. Installation of the clay cover will be performed by placing nominal twelve-inch thick loose lifts of clay fill that are free of foreign material in the areas that require a permeability less than or equal to 1 x 10^{-5} cm/sec. In the areas where the clay cover is required to be 1 x 10^{-7} cm/sec, nominal eight-inch thick loose lifts will be placed. The lift thickness will be adjusted, if necessary, to achieve the desired permeability. The moisture content of the clay shall generally be from optimum moisture content to several percent above the optimum moisture content for the material, as determined by the Standard Proctor Test Method (ASTM D-698). The lifts of clay fill will be evenly spread and uniformly compacted to a minimum 92 percent of the maximum Standard Proctor value or to a density that will meet the permeability requirements. Density testing of the in-

place compacted lifts and permeability testing of undisturbed samples of the clay cover will be performed by the construction quality assurance (CQA) monitor, and will be in accordance with the testing frequencies specified in the Soil Cover Installation and Testing Plan. Portions of the clay cover that do not exhibit the required permeability will be reworked and retested in accordance with the Plan.

HDPE (40-mil) Geomembrane Liner: A 40-mil HDPE geomembrane liner will be placed directly over the compacted clay on the nominal 10 percent slopes. Verification of the liner properties, documentation of the installation, and testing of the liner material and seams are further described in the Summary of Quality Control and Quality Assurance Procedures for the Installation of Geosynthetic Lining Systems (Appendix B).

Geocomposite Drainage Layer: A geocomposite consisting of a geonet grid sandwiched between two geotextiles will be placed directly on top of the 40-mil HDPE geomembrane liner. This geocomposite will allow any water that infiltrates into the topsoil to drain laterally from on top of the geomembrane liner. Verification of the geocomposite properties and documentation of the installation are further described in the Summary of Quality Control and Quality Assurance Procedures for the Installation of Geosynthetic Lining Systems (Appendix B).

Vegetative Soil Cover: A twelve (12) inch vegetative soil cover installed over the compacted clay on the nominal 25 percent slopes and over the geocomposite on the nominal 10 percent slopes will be capable of supporting native grass cover. The topsoil will be installed using a wide-track (low ground pressure) dozer operating over a minimum one-foot thick base. The final grade on this soil layer will be a minimum of four (4) percent and a maximum of twenty-five (25) percent.

Partial Sealing: Each year as the fill level rises in the cells, the exposed slopes of the landfill are usually sealed in the summer in accordance with the "Soil Cover Design and Installation" requirements. SMEPA does this to minimize washing of the slopes and minimize wind-blown particles. Partial sealing documentation is performed in accordance with the closure certification requirements.

The cover system installation will be performed with verification by a trained CQA monitor supervised by a registered Mississippi professional engineer.

The final cover of each closed landfill area will be fertilized and planted with native grass seed or other shallow-rooted vegetation to promote good growth and easy care, and to minimize soil erosion. Closure will be considered complete after the final cover has been inspected and approved, and the vegetative cover has been placed. Final closure of the site will be achieved when all cells (currently permitted and future expansions) have been filled and closed.

2.5 Estimated Closure Costs

Since closure and certification of portions of the landfill side slopes is performed on a progressive

basis as perimeter areas achieve their final grades, the maximum area to be closed as part of a final closure is not expected to exceed approximately 10 acres. The estimated cost of closure of the CCR Landfill, based on the cost of hiring a third party to close the facility at the point in the facility's operating life when the extent and manner of its operation would make closure the most expensive, is presented in **Table 2**. These costs are based on closure of a ten-acre area, which is the largest area projected to require closure at one time.

3 CLOSURE DOCUMENTATION

3.1 Closure Notification

SMEPA will provide a notice of intent to close a CCR unit at within 30 days of receipt of final waste into the CCR unit. The notice will be sent to MDEQ and placed in the facility operating record.

3.2 Documentation on Property Deed

Following placement of final cover over the entire landfill, SMEPA will record a notation and survey plat, prepared by a registered land surveyor, indicating the location and dimensions of the actual filled area with respect to permanently surveyed benchmarks or section corners, and notify MDEQ that the notation and plat have been recorded and a copy of each has been placed in the operating record. This will be done in accordance with the Mississippi NSWMR, 11 Miss. Admin. Code Pt. 4, R. 1.4, E2(g)(2).

3.3 Closure Certification and Report

The closure activities will be monitored by a professional engineer registered in the State of Mississippi to ensure that closure has proceeded according to the approved closure plan. The professional engineer will supervise the CQA monitor(s) and will submit final written certification to the MDEQ that the final cover was completed in accordance with the approved closure plan. The certification will be submitted within 60 days after completion of the final seeding of the landfill.

4 POST CLOSURE CARE REQUIREMENTS

The post-closure period will be 30 years following written confirmation by the MDEQ that the site has been closed in accordance with the approved closure plan, unless the period is decreased or increased by the MDEQ in accordance with 11 Miss. Admin. Code Pt. 4, R 1.4, E3, or unless federal CCR regulations trigger longer post-closure care (such as in the case of assessment groundwater monitoring ongoing under Federal CCR Regulations 257.95, instead of detection monitoring (257.94)).

During this period, the closure cover will be maintained and monitoring activities will be performed as described below.

4.1 Site Maintenance Activities and Access Control

The integrity of the final cover will be maintained, including making repairs as necessary to correct the effects of settlement, subsidence, and erosion. Additionally, storm water run-off and run-on will be prevented from damaging the cover.

During the post-closure period, leachate collection systems will be maintained and the leachate collected will be properly managed and disposed until leachate is no longer generated or until ceasing this activity is approved by the MDEQ.

Access to the site after closure will be controlled through maintenance of existing fencing and signs, and all access gates will be locked to discourage unauthorized entry.

4.2 Post-Closure Cost Estimate

An estimate of the cost of performing post-closure activities, based on the estimated cost of hiring a third party to conduct these activities in accordance with this closure plan, is presented in **Table 3**. The estimated cost may be revised at a later date due to new information on which to base an estimate.

4.3 Site Management and Future Use

The name, address, and telephone number of the person or office to contact about the facility during the post-closure period will be provided at the time of the Final Closure Certification Report. At this time, there are no plans for post-closure use of the landfill facility. Aside from normal maintenance activities, the final landfill cover will not be disturbed without prior approval from the MDEQ.

TABLE 1
Closure Schedule for a Ten-Acre Landfill Disposal Area
R.D. Morrow, Sr. Generating Plant CCR Landfill

Closure Activity	Day
Notify Adminstrative Authority of Intent to Perform Closure	0
Within 30 Days After Final Receipt of Waste, Start Mobilizing Equipment and Materials	30
Grading of Waste	30-32
Install Clay Cover (Both 1.5' thick and 2' thick caps)	33-62
Install 40-mil HDPE Geomembrane Liner on 10% grades	63-69
Install Geocomposite Drainage Layer	70-71
Install Diversion Berms	72-76
Install and Grade Final Topsoil Cover	77-86
Install Runoff Chutes and Enkamat	87-89
Seed Final Cover Area to Prevent Erosion	90
Prepare Survey Plat and Record in Property Deed Records	90-100
Prepare Certification Report	90-120
Submit Certfication Report to MDEQ	120

Notes: (1) The above schedule may be extended due to inclement weather with approval from the administrative authority, but it will not exceed 180 days, without specific approval from the MDEQ, and allowable extensions in accordance with 40 CFR Part 257.102.

TABLE 2

Estimated Closure Cost for 2015 Closure (in 2015 Dollars)[1]

SMEPA Ash Landfill, R.D. Morrow, Sr. Plant

Closure Activity	Quantity	Unit Cost	Cost
Revise Closure Plan, Redesign Closure Configuration, Construction Engineering, Regulatory Support, and Bid Administration	1	$ 60,000 Est	$60,000
Contractor Mobilization/Demobilization (Lump Sum)	1	$ 100,000 LS	$100,000
Rough Grading/Re-grading (D7 or larger Dozers with Operator) and move ash from North part of Area F.	200 hr	$ 150.00 /hr	$30,000
Cleanout Perimeter and Serpentine Ditches	6,800 lf	$ 7.00 /lf	$47,600
Onsite General Fill (to make grades and slopes)	40,491 yd^3	$ 6.80 /yd^3	$275,339
Imported Clay Cover (25% slopes - 2' thick)(1)	5,000 yd^3	$9.60 /$yd^3$	$48,000
Imported Clay Cover (10% slopes - 1.5' thick)	45,425 yd^3	$9.60 /$yd^3$	$436,080
Soil Base Under Geomembrane (included in Gen Fill)	0 yd^3	$6.80 yd^3	$0
40-mil HDPE Geomembrane(1)	775,098 ft^2	$0.50 /$ft^2$	$387,549
Geocomposite Drainage Mat	775,098 ft^2	$0.70 /$ft^2$	$542,569
Imported Vegetative Cover Layer (12" thick)	28,707 yd^3	$19.75 /$yd^3$	$566,963
Construct Diversion Berms	1,450 yd^3	$2.75 /$yd^3$	$3,988
Install Runoff Chutes and Enkamat	20,000 ft^2	$1.00 /$ft^2$	$20,000
Seeding	775,098 ft^2	$0.10 /$ft^2$	$77,510
Surveying		Est	$20,000
Base Contracting Subtotal			**$2,615,597**
Engineering - Testing and Certification (% of Base Amount)		15%	$392,340
Contingency (% of Base Contracting Subtotal)		15%	$392,340
Closure Total			***$3,400,276***

Notes:

(1) This closure estimate is for the landfill conditions as of May 2015. Closure costs an applicable requirements may vary at the time a decision is made to permanently close the landfill.

TABLE 3

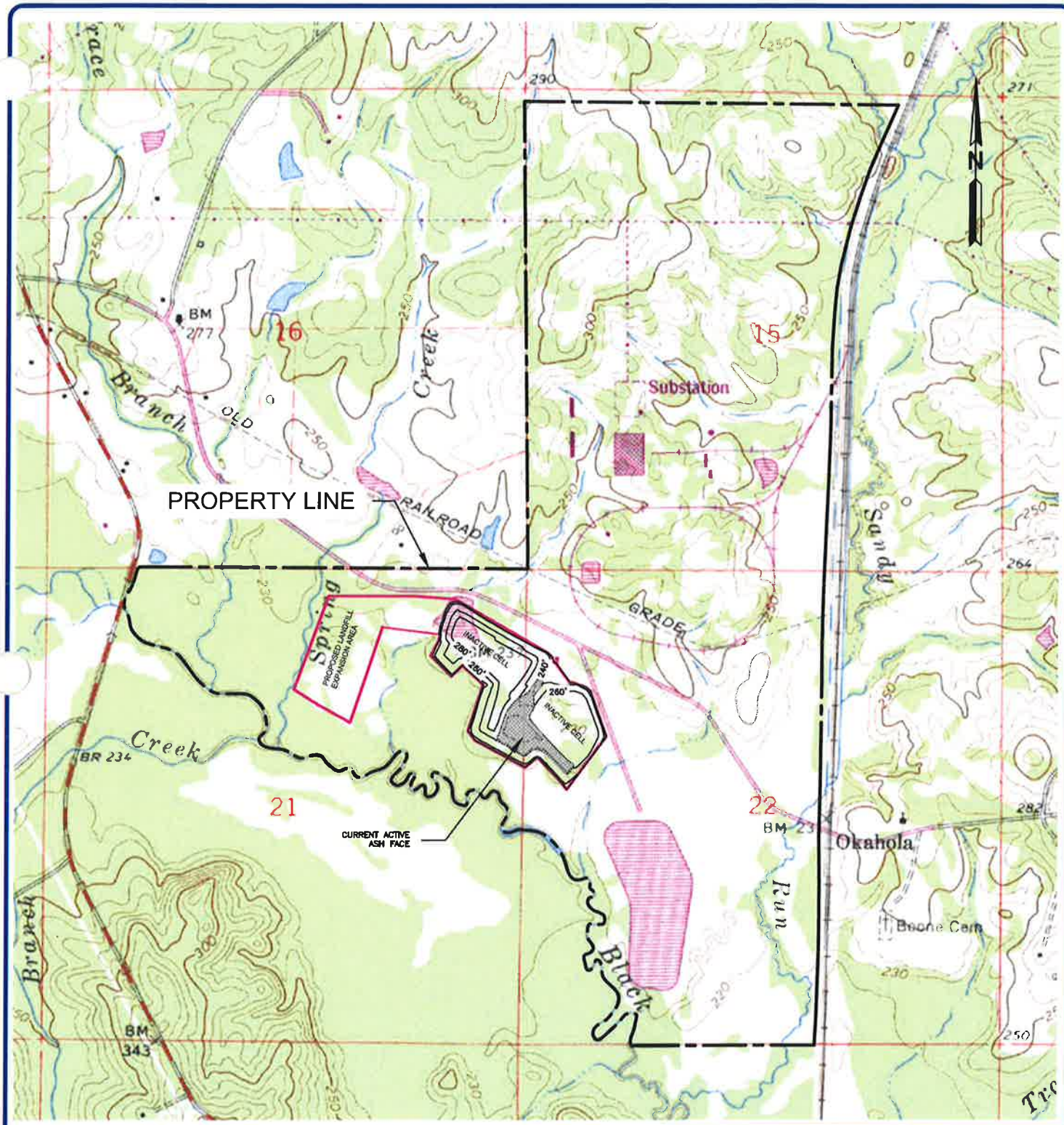
Estimated Post-Closure Costs - for 2015 Closure (in 2015 Dollars)[1]

SMEPA Ash Landfill, R.D. Morrow, Sr. Plant

Post-Closure Activity	Quantity	Unit Cost	Cost
Regulatory/Compliance Support	30 yrs	$4,000 /yr	$120,000
Site Management, Security	30 yrs	$5,000 /yr	$150,000
Mowing (3 times per year)	90 events	$2,500 /event	$225,000
Road Maintenance (once per 7.5 years)	4 events	$10,000 /event	$40,000
Erosion Maintenance (2.5 yd^3/acre/yr x 45 Ac x $12/$yd^3$)	30 yrs	$1,350 /yr	$40,500
Leachate Pumping, Inspections, Effluent Sampling	30 yrs	$20,000 /yr	$600,000
Groundwater Monitoring and Reporting	30 yrs	$12,000 /yr	$360,000
Monitor Well Maintenance, New Wells, etc	3 Wells	$4,000 /well	$12,000
Groundwater Remediation	Not known at this time.		$0
Miscellaneous Maintenance & Repairs	30 yrs	$5,000 /yr	$150,000
Engineering Certification of Post-Closure			$15,000
Post-Closure Total - 30 Years in 2015 Dollars			***$1,712,500***

Notes:

(1) This estimate was prepared in 2015 before the CCR rule effective date and has not been adjusted in 2016. Actual post-closure costs will vary depending on various factors which cannot be known at this time (September 2016), including primarily items relating to groundwater monitoring and groundwater remediation, if applicable.



SCALE 1 INCH = 1500 FEET

375 750 1500

0 375 750 1500 3000

REFERENCE: 7.5 MIN. SERIES TOPOGRAPHIC MAP
PURVIS, MISSISSIPPI 1982

SITE LOCATION

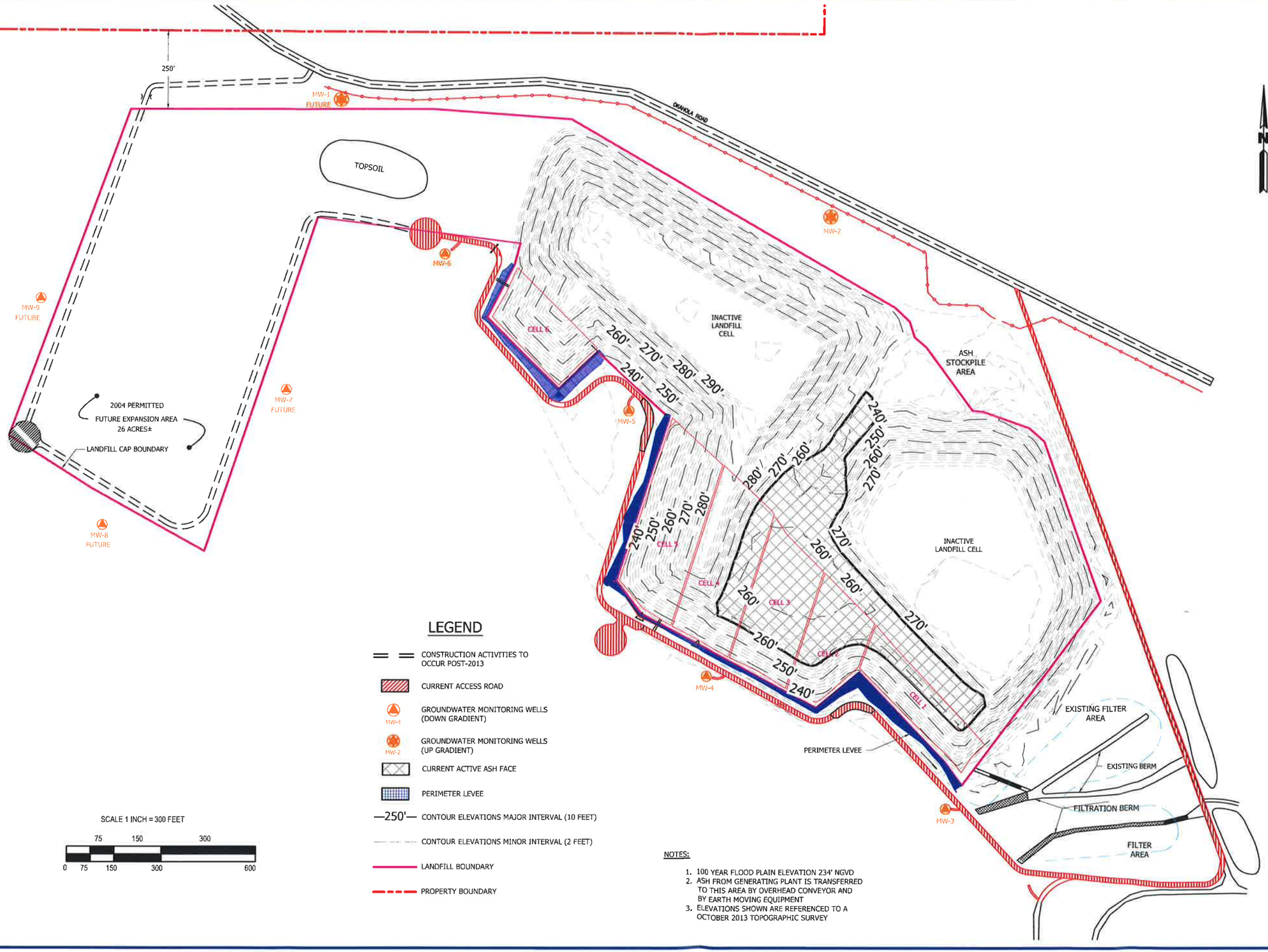
SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION

R.D. MORROW SR. GENERATING PLANT
PURVIS, MISSISSIPPI

DATE: 11/15/2013	APPROVED: BY: DATE:	DRAWN BY: T.R.B.
SCALE: 1" = 1500'		CAD NO. 01 SITE LOCATION

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

FIGURE 1



LEGEND

- CONSTRUCTION ACTIVITIES TO OCCUR POST-2013
- CURRENT ACCESS ROAD
- MW-1 — GROUNDWATER MONITORING WELLS (DOWN GRADIENT)
- MW-2 — GROUNDWATER MONITORING WELLS (UP GRADIENT)
- CURRENT ACTIVE ASH FACE
- PERIMETER LEVEE
- —250'— CONTOUR ELEVATIONS MAJOR INTERVAL (10 FEET)
- CONTOUR ELEVATIONS MINOR INTERVAL (2 FEET)
- LANDFILL BOUNDARY
- PROPERTY BOUNDARY

SCALE 1 INCH = 300 FEET

0 75 150 300 600

NOTES:

1. 100 YEAR FLOOD PLAIN ELEVATION 234' NGVD
2. ASH FROM GENERATING PLANT IS TRANSFERRED TO THIS AREA BY OVERHEAD CONVEYOR AND BY EARTH MOVING EQUIPMENT
3. ELEVATIONS SHOWN ARE REFERENCED TO A OCTOBER 2013 TOPOGRAPHIC SURVEY

CAD FILE:	02 SITE LAYOUT
PROJECT:	SOU2-13-003
SCALE:	1" = 300'
DATE:	11/15/2013
CHECKED:	C.T.J.
DRAWN BY:	T.R.B.

ENVIRONMENTAL MANAGEMENT SERVICES, INC.
P.O. BOX 15369
HATTIESBURG, MS 39404

PREPARED FOR SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION
P.O. BOX 15849
HATTIESBURG, MS 39404-5849

SITE LAYOUT

SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION
R.D. MORROW SR. GENERATING PLANT
LAMAR COUNTY, MISSISSIPPI

FIGURE
2

LEGEND

LANDFILL BOUNDARY

CHAIN LINK FENCE

SCALE 1 INCH = 400 FEET

100 200 400

0 100 200 400 800

REFERENCE: AERIAL IMAGE
2012 GOOGLE EARTH
PURVIS, MISSISSIPPI

CAD FILE: AERIAL.DWG
PROJECT: SOU2-13-003
SCALE: 1" = 400'
DATE: 09/16/2016
CHECKED: C.T.J.
DRAWN BY: T.R.B.

ENVIRONMENTAL MANAGEMENT SERVICES, INC.
P.O. BOX 15369
HATTIESBURG, MS 39404

PREPARED FOR
SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION
P.O. BOX 15849
HATTIESBURG, MS 39404-5849

AERIAL PHOTOGRAPH

SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION
R.D. MORROW, SR. GENERATING PLANT
LAMAR COUNTY, MISSISSIPPI

FIGURE
3

APPENDICES

APPENDIX A

Soil Cover Installation and Testing Plan

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this Soil Cover Installation and Testing Plan is to define the scope of work for the design, construction and quality assurance testing of the compacted soil layers installed for closure cover construction at the SMEPA Industrial Waste Landfill in Purvis, Mississippi. It details the necessary information and guidance to verify soil cover construction and assure compliance with the permeability requirements for two types of soil covers. Cover to be applied over areas of the landfill having a nominal 25 percent (4H:1V) final cover slope will consist of two (2) feet of recompacted clay with a permeability of 1 x 10^{-7} cm/sec or less, overlain by a minimum 12 inches of soil capable of sustaining vegetation. Cover to be applied over areas of the landfill with a nominal ten (10) percent (10H:1V) slope will consist of a 1.5 -foot thick cohesive soil cover with a permeability of 1 x 10^{-5} cm/sec or less and will be overlain by a 40-mil HDPE geomembrane liner, geocomposite, and 12 inches of vegetative soil cover. The specified quality assurance tests and measures for each soil cover, along with the required frequency of testing, are provided below.

2.0 RESPONSIBILITY AND AUTHORITY

The responsibility and authority of the individuals and organizations involved in the design, permitting, construction and inspection of a closed landfill are discussed below. These responsibilities and authorities are in accordance with the EPA Technical Guidance Document Quality Assurance and Quality Control for Waste Containment Facilities. The individuals, their affiliation, responsibilities and authorities are described as follows:

2.1 Permitting Agency

The Mississippi Department of Environmental Quality (MDEQ) is the agency responsible for permitting the landfill. MDEQ maintains the responsibility to review the construction specifications and this plan for compliance with the agency's regulations. MDEQ also has the responsibility to review all Construction Quality Assurance/Construction Quality Control (CQA/CQC) documentation during or after construction of the final cover, possibly including visits to the construction site to observe the CQC and CQA practices, to confirm that this plan was followed and that the final cover was constructed as specified in the design.

2.2 Owner/Operator

South Mississippi Electrical Power Authority (SMEPA) is the

owner/operator. SMEPA is responsible for the design, construction, and operation of the facility. This responsibility includes complying with the requirements of the MDEQ, the submission of CQA/CQC documentation, and assuring the MDEQ that the facility was constructed as specified in the construction plans and specifications and as approved by the permitting agency. SMEPA has the authority to select and dismiss organizations charged with design, construction, and CQA/CQC.

2.3 Owner's Representative

SMEPA will designate an official representative who is responsible for coordinating schedules, meetings, and field activities. This responsibility includes communications to other members in the owner/operator's organization, owner's representative, permitting agency, material suppliers, general contractor, specialty subcontractors or installers, and CQA engineer.

2.4 Design Engineer

The design engineer is selected by the Owner/Operator. He is responsible for developing a landfill that fulfills the operational requirements of the owner/operator, complies with accepted design practices for landfills, and meets or exceeds the minimum requirements of the permitting agency. The Design Engineer for the SMEPA Industrial Waste Landfill is Environmental Management Services (EMS). The design engineer may be requested to change some aspects of the design if unexpected conditions are encountered during construction (e.g., a change in site conditions, unanticipated logistical problems during construction, or lack of availability of certain materials). Such modifications may be in writing or verbally. In either case, details of the changes must be received by the CQA Engineer and CQA/CQC Personnel. The plans and specifications referred to in this plan are the product of the Design Engineer. They are a major and essential part of the permit application process and the subsequently constructed final cover.

2.5 General Contractor

The general contractor has overall responsibility for construction of the final cover. SMEPA will select a general contractor for various phases of construction, typically for each area to be covered. The general contractor arranges for purchase of materials that meet specifications, contracts with subcontractors for specialized needs, and has overall control over the construction operations, including scheduling. The general contractor has the primary responsibility for ensuring that the final cover is constructed in accordance with the plans and specifications that have been developed

by the design engineer and approved by MDEQ. The general contractor is also responsible for informing SMEPA and the CQA engineer of the scheduling and occurrence of all construction activities. SMEPA may serve in the capacity of general contractor and arrange for all the necessary material, fabrication, and installation contracts. In such cases, SMEPA's representative will serve the same function as the general contractor.

2.6 Subcontractor

Specialized portions of the construction may be performed by a subcontractor to the general contractor, or by a specialty contractor hired directly by the manufacturer, or fabricator or by SMEPA directly. The duties of the subcontractor will be established by the general contractor or SMEPA. The subcontractor is responsible for informing the contractor, SMEPA and the CQA engineer of the scheduling and occurrence of all construction activities to be performed by them.

2.7 CQC Personnel

Construction quality control personnel are individuals who work for the general contractor, installation contractor, subcontractor or CQA engineer and whose job it is to collect the data necessary to document that construction is in accord with the plans and specifications. The CQC Personnel should be individuals who are experienced in those aspects of landfill construction including clay and geosynthetic liner construction. The CQC Personnel should maintain overall responsibility for the collection and assimilation of CQC data, and the transfer of these data to the CQA Engineer. Prior to commencement of the project, the CQC Personnel shall obtain from the design engineer a full set of the plans and specifications for the project. The CQC Personnel will check the plans and specifications, including revisions, against the CQC plans and specifications. Any discrepancies will be brought to the attention of the CQA Engineer for resolution. The CQC Personnel will ensure that an up-to-date set of the plans and specifications is maintained at the site.

2.8 CQA Engineer

The CQA engineer is responsible for confirming that the final cover was constructed in accordance with the plans and specifications as developed by the design engineer and approved by MDEQ. The CQA engineer has overall responsibility for manufacturing quality assurance, construction quality control and construction quality assurance. SMEPA will select a CQA Engineer for various phases of construction, typically for each area to be covered. The CQA engineer should be a registered professional engineer in the State of Mississippi and possess individual experience in

those aspects of landfill construction including clay and geosynthetic liner construction. The CQA engineer is responsible for reviewing this plan as well as general plans and specifications for the project so that this plan can be implemented with minimal contradictions or unresolved discrepancies. Other responsibilities of the CQA engineer include: education of CQA/CQC Personnel on CQA/CQC requirements, scheduling and coordinating of CQA/CQC inspection activities, ensuring that the procedures established by this plan are followed, ensuring that test data are maintained for later reporting, and preparation of periodic reports. In the event of nonconformance with the project specifications or this plan, the CQA engineer should notify SMEPA as to the details and, if appropriate, recommend work stoppage and possibly remedial actions. The CQA engineer is usually required to be at the construction site, or have a representative on-site, during all major construction operations to oversee construction and CQA/CQC personnel.

2.9 Testing Laboratory

Many CQA/CQC tests are performed by commercial laboratories. The testing laboratory should have its own internal QC plan to ensure that laboratory procedures conform to the appropriate American Society for Testing and Materials (ASTM) standards or other applicable testing standards. The testing laboratory is responsible for ensuring that tests are performed in accordance with applicable methods and standards, for following internal QC procedures, for maintaining sample chain-of-custody records, and for reporting data. The testing laboratory must be willing to allow the owner/operator, permitting agency, design engineer, installer, or CQA engineer to observe the sample preparation and testing procedures, or record-keeping procedures, if they so desire.

3.0 PRECONSTRUCTION TESTING PROGRAM

Potential borrow sources for use in the compacted clay cover or cohesive soil cover will be tested and evaluated for suitability prior to construction. The following testing program will be utilized:

TEST	FREQUENCY (CLAY COVER)	FREQUENCY (SOIL COVER)
Moisture content (ASTM D2216)	1 per 10,000 cy*	1 per 25,000 cy**
Particle Size (ASTM D1140)	1 per 10,000 cy*	1 per 25,000 cy**
Atterberg Limits (ASTM D4318)	1 per 10,000 cy*	1 per 25,000 cy**
Moisture-Density (ASTM D698)	1 per 10,000 cy*	1 per 25,000 cy**
Permeability (ASTM D5084)	1 per 10,000 cy*	1 per 25,000 cy**

* per 10,000 cy or minimum one test per source, whichever is greater.

** or one per soil type, whichever is greater.

After identifying potential clay or cohesive soil cover sources, a family of moisture-density curves and permeabilities will be developed for use as a field reference. This data will be compiled from the laboratory test data and will correlate soil densities to permeabilities. By compiling this data, the need for continuous borrow source testing is reduced. The family of curves can be used as a reference to compare the field results to known changes in materials. If borrow materials change relative to the referenced family of curves and lab data, a sample of the new material will be sent to the lab for evaluation. New test results will be added to the family of data, thereby updating the reference.

4.0 PRECONSTRUCTION MEETING

At least one preconstruction meeting is conducted, and always includes a representative of the general contractor, the CQA Engineer, the CQA/CQC Personnel, and SMEPA's representative. At this meeting, all details and design considerations regarding the installation of the clay cover at the site are discussed. The purpose of this meeting is to familiarize all parties involved with site conditions and rules, construction requirements including CQA procedures, time schedules, and general documenting and reporting procedures. It may also be necessary during this meeting to develop a site specific addendum to this plan. Once developed, this site specific addendum is incorporated, along with this plan, as part of the construction quality assurance program for the site.

5.0 CONSTRUCTION

Prior to placement of any cover material, the final grade on the waste will be inspected for compliance with design. Soil cover material may be used to fill in low areas or to provide additional support for the clay cover material, if needed. The cover material (clay or cohesive soil) and the areas with nominal slopes of ten (10) percent will be placed in nominal 12-inch loose lifts and compacted to lifts

approximately nine (9) inches thick. In areas with nominal slopes of 25 percent the clay cover will be placed in nominal 8-inch loose lifts and compacted to lifts approximately six (6) inches thick. The lift thickness will be reduced, if necessary, to achieve the desired permeability. To prevent moisture loss or damage during installation, visual inspections and moisture tests will be periodically performed. A watering program will be implemented, if necessary, to reduce the potential for desiccation of the compacted cover material. Areas which are damaged or have insufficient moisture content shall be repaired by scarifying and recompacting.

Actual testing of the lifts of compacted clay cover shall consist of a combination of laboratory testing, field testing, and visual inspection to assure the consistency and integrity of the cover. The items shall include, but not be limited to the following:

- Testing of the moisture content and other physical properties of the clay soils after compaction. Compacted clay cover material will be placed within a range of zero to ten percent wet of optimum moisture content; the appropriate range of moisture content for the clay cover material will be determined from the Proctor Test curves and permeability data; *(see end of this section)

- Visual inspection and testing of compacted lifts to verify the thickness and that the minimum acceptable dry density was achieved. The minimum acceptable dry density is that referenced density at which the permeability of the clay cover material is less than 1×10^{-7} cm/sec for the nominal 25 percent slopes or 1×10^{-5} cm/sec for the areas to be overlain by a synthetic liner); and

- Visual inspection of the natural or constructed lift surfaces for cracks, flaws, evidence of desiccation, or other defects.

For placement of cover material with a maximum permeability of 1×10^{-5} cm/sec, some of the above precautions may be waived, provided the specified permeability is achieved. Documentation of this waiver must be agreed upon by the Owner, and the Mississippi registered professional engineer certifying closure activities.

6.0 COMPACTED CLAY OR COHESIVE SOIL COVER VERIFICATION

The compacted clay or cohesive soil cover shall be constructed with verification by a trained soils technician supervised by a professional engineer registered in the State of Mississippi. At a minimum the soils technician shall examine each

compacted lift and perform the required field testing. In-place testing, preconstruction lab data and field judgment can all be used by the technician to monitor potential changes in borrow materials and adjust the testing accordingly.

Field testing of in-place compacted clay or cohesive soil cover material shall consist of the following program:

TEST	FREQUENCY (CLAY COVER)	FREQUENCY (COHESIVE SOIL)
In-place Densities, Nuclear Methods (ASTM D2922, D3017) and/or Sand Cone (ASTM D1556)	1 test on a minimum 100-foot centers per horizontal lift	1 test on a minimum 100-foot centers per horizontal lift
Undisturbed Sample Permeability (ASTM D5084)	1 test per 43,560 square feet for each lift in place	1 test per 87,120 square feet for each lift in place

In locations where field testing indicates densities below the specification, the failing area shall be reworked. Alternatively, undisturbed samples of in-place material shall be obtained and permeability tests conducted. The density requirements may be waived in a given area if the permeability tests reveal acceptable results.

7.0 CONSTRUCTION VERIFICATION

In addition to testing the in-place compacted lifts of clay cover or cohesive soil cover during construction, the cover shall be visually inspected at completion to detect any flaws or deficiencies. Due to the unpredictability of waste compaction, the cover thickness cannot be accurately verified by standard surveying techniques. The final cover thickness shall be determined by hand borings, settlement plates or excavations on a grid with a spacing of 200 feet or less. The CQA Engineer may grant variances from the thickness requirements provided that:

- The point is not deficient by more than 0.1 feet, and
- No more than 5% of points are deficient, and
- These points are not concentrated in one area, and
- The average thickness (including the deficient points) meets or exceeds the specified value.

8.0 SOIL COVER PERFORATIONS

Perforations of the clay cover shall be made in accordance with the testing

methods and frequencies specified previously. Permeability samples of constructed clay cover sections shall be normal to the liner surface. All perforations of the cover shall be backfilled in three inch thick layers with a dry clay-bentonite mixture. The mixture will be compacted in place with a tamping rod, Proctor hammer, or hand tamper, depending on the size of the perforation.

Perforations that must be filled include, but are not limited to the following:

- Nuclear density test probe locations;
- Permeability sampling locations; and
- Final Cover thickness verification locations.

9.0 DOCUMENTATION

Documentation of the Soil Cover Installation and Testing Plan will be in the form of a certification report prepared upon completion of the construction of each sector of the compacted soil cover.

* Note: An actual acceptable moisture range must be determined during the pre-construction testing period, and updated as more data becomes available.

APPENDIX B

Summary of Quality Control and Quality Assurance Procedures for the Installation of Geosynthetic Lining Systems

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this document is to summarize the quality control (QC) and quality assurance (QA) procedures for the installation of geosynthetic lining systems. A geosynthetic lining system will be placed over the SMEPA Industrial Waste Landfill in Purvis, Mississippi on top of the clay cover where the slopes are nominally ten (10) percent. First a 40-mil HDPE liner will be placed over the 18 inches of compacted clay that exhibits a permeability of 1×10^{-5} cm/sec or less. On top of the HDPE liner, a geocomposite will be placed to allow drainage of infiltrated rain water. This geocomposite as well as the surface water will drain water toward chutes that run down the side of the landfill.

2.0 RESPONSIBILITY AND AUTHORITY

The responsibility and authority of the individuals and organizations involved in the design, permitting, construction and inspection of a closed landfill are discussed below. These responsibilities and authorities are in accordance with the EPA Technical Guidance Document Quality Assurance and Quality Control for Waste Containment Facilities. The individuals, their affiliation, responsibilities and authorities are described as follows:

2.1 Permitting Agency

The Mississippi Department of Environmental Quality (MDEQ) is the agency responsible for permitting the landfill. MDEQ maintains the responsibility to review the construction specifications and this plan for compliance with the agency's regulations. MDEQ also has the responsibility to review all Construction Quality Assurance/Construction Quality Control (CQA/CQC) documentation during or after construction of the final cover, possibly including visits to the construction site to observe the CQC and CQA practices, to confirm that this plan was followed and that the final cover was constructed as specified in the design.

2.2 Owner/Operator

South Mississippi Electrical Power Authority (SMEPA) is the owner/operator. SMEPA is responsible for the design, construction, and operation of the facility. This responsibility includes complying with the requirements of the MDEQ, the submission of CQA/CQC documentation, and assuring the MDEQ that the facility was constructed as specified in the construction plans and specifications and as approved by the permitting agency. SMEPA has the authority to select and dismiss organizations charged with design, construction, and CQA/CQC.

2.3 Owner's Representative

SMEPA will designate an official representative who is responsible for coordinating schedules, meetings, and field activities. This responsibility includes communications to other members in the owner/operator's organization, owner's representative, permitting agency, material suppliers, general contractor, specialty subcontractors or installers, and CQA engineer.

2.4 Design Engineer

The design engineer is selected by the Owner/Operator. He is responsible for developing a landfill that fulfills the operational requirements of the owner/operator, complies with accepted design practices for landfills, and meets or exceeds the minimum requirements of the permitting agency. The Design Engineer for the SMEPA Industrial Waste Landfill is Environmental Management Services (EMS). The design engineer may be requested to change some aspects of the design if unexpected conditions are encountered during construction (e.g., a change in site conditions, unanticipated logistical problems during construction, or lack of availability of certain materials). Such modifications may be in writing or verbally. In either case, details of the changes must be received by the CQA Engineer and CQA/CQC Personnel. The plans and specifications referred to in this plan are the product of the Design Engineer. They are a major and essential part of the permit application process and the subsequently constructed final cover.

2.5 General Contractor

The general contractor has overall responsibility for construction of the final cover. SMEPA will select a general contractor for various phases of construction, typically for each area to be covered. The general contractor arranges for purchase of materials that meet specifications, contracts with subcontractors for specialized needs, and has overall control over the construction operations, including scheduling. The general contractor has the primary responsibility for ensuring that the final cover is constructed in accord with the plans and specifications that have been developed by the design engineer and approved by MDEQ. The general contractor is also responsible for informing SMEPA and the CQA engineer of the scheduling and occurrence of all construction activities. SMEPA may serve in the capacity of general contractor and arrange for all the necessary material, fabrication, and installation contracts. In such cases, SMEPA's representative will serve the same function as the general contractor.

2.6 Subcontractor

Specialized portions of the construction may be performed by a subcontractor to the general contractor, or by a specialty contractor hired directly by the manufacturer, or fabricator or by SMEPA directly. The duties of the subcontractor will be established by the general contractor or SMEPA. The subcontractor is responsible for informing the contractor, SMEPA and the CQA engineer of the scheduling and occurrence of all construction activities to be performed by them.

2.7 CQC Personnel

Construction quality control personnel are individuals who work for the general contractor, installation contractor, subcontractor or CQA engineer and whose job it is to collect the data necessary to document that construction is in accord with the plans and specifications. The CQC Personnel should be individuals who are experienced in those aspects of landfill construction including clay and geosynthetic liner construction. The CQC Personnel should maintain overall responsibility for the collection and assimilation of CQC data, and the transfer of these data to the CQA Engineer. Prior to commencement of the project, the CQC Personnel shall obtain from the design engineer a full set of the plans and specifications for the project. The CQC Personnel will check the plans and specifications, including revisions, against the CQC plans and specifications. Any discrepancies will be brought to the attention of the CQA Engineer for resolution. The CQC Personnel will ensure that an up-to-date set of the plans and specifications is maintained at the site.

2.8 CQA Engineer

The CQA engineer is responsible for confirming that the final cover was constructed in accordance with the plans and specifications as developed by the design engineer and approved by MDEQ. The CQA engineer has overall responsibility for manufacturing quality assurance, construction quality control and construction quality assurance. SMEPA will select a CQA Engineer for various phases of construction, typically for each area to be covered. The CQA engineer should be a registered professional engineer in the State of Mississippi and should possess individual experience in those aspects of landfill construction including clay and geosynthetic liner construction. The CQA engineer is responsible for reviewing this plan as well as general plans and specifications for the project so that this plan can be implemented with minimal contradictions or unresolved discrepancies. Other responsibilities of the CQA engineer include: education of CQA/CQC Personnel on CQA/CQC requirements, scheduling and coordinating of CQA/CQC inspection activities, ensuring that the procedures established by this plan are followed, ensuring that test data are maintained for later reporting, and preparation of periodic reports.

In the event of nonconformance with the project specifications or this plan, the CQA engineer should notify SMEPA as to the details and, if appropriate, recommend work stoppage and possibly remedial actions. The CQA engineer is usually required to be at the construction site, or have a representative on-site, during all major construction operations to oversee construction and CQA/CQC personnel.

2.9 Testing Laboratory

Many CQA/CQC tests are performed by commercial laboratories. The testing laboratory should have its own internal QC plan to ensure that laboratory procedures conform to the appropriate American Society for Testing and Materials (ASTM) standards or other applicable testing standards. The testing laboratory is responsible for ensuring that tests are performed in accordance with applicable methods and standards, for following internal QC procedures, for maintaining sample chain-of-custody records, and for reporting data. The testing laboratory must be willing to allow the owner/operator, permitting agency, design engineer, installer, or CQA engineer to observe the sample preparation and testing procedures, or record-keeping procedures, if they so desire.

3.0 MATERIAL SPECIFICATIONS

The geomembrane supplier shall provide the CQA Engineer with manufacturer quality control (MQC) information and warranty data for the materials to be delivered on site at least one week prior to delivery. Based upon the information provided, the Construction Quality Control Personnel or CQA Engineer will accept the materials for shipment if the requirements of the specifications are met.

The CQA/CQC Personnel shall inventory all geomembrane materials that are received on site. The inventory will document that the MQC information provided previously to the CQA Engineer is applicable to the inventory shipped. Each roll of geomembrane material will be sampled, and the sample will be archived for the duration of the project. Confirmatory tests will be performed on selected samples of the geomembrane. The types and frequency of the confirmatory tests will be determined by the CQA Engineer after reviewing the MQC data, but confirmatory testing will include, at a minimum, thickness (ASTM D 5199), and tensile strength with elongation (ASTM D 638) on at least one sample as obtained from the delivered materials for every 100,000 square feet of geomembrane to be installed.

The CQA/CQC Personnel shall also observe material handling and storage. Handling of the geomembrane should be with devices that are not capable of cutting, puncturing or otherwise abrading the materials. Any noticeable defects of the delivered material will be documented on the material inventory sheets, and the damaged rolls shall be segregated.

4.0 PRE-CONSTRUCTION MEETING

At least one preconstruction meeting is conducted, and always includes a representative of the geosynthetics installer, the CQA Engineer, the CQA/CQC Personnel, and SMEPA's representative. At this meeting, all details and design considerations regarding the installation of geosynthetics at the site are discussed. The purpose of this meeting is to familiarize all parties involved with site conditions and rules, construction requirements including CQA procedures, time schedules, and general documenting and reporting procedures. It may also be necessary during this meeting to develop a site specific addendum to this plan. Once developed, this site specific addendum is incorporated, along with this plan, as part of the construction quality assurance program for the site.

5.0 GEOMEMBRANE INSTALLATION

Prior to placing the geomembrane, the supporting soil must be properly prepared. The CQA/CQC Personnel must verify that a qualified land surveyor has checked all lines and grades, that the supporting soil meets the required density specification, that the surface to be lined has been rolled and compacted so that it is free of irregularities, loose soil, protrusions, and abrupt changes in grade, that the surface of the soil does not contain stones which may damage the geomembrane, and that no area has been excessively softened by high water content.

During liner deployment, it is the responsibility of the CQA/CQC Personnel to ensure that each field panel is given an identification code consistent with the layout plan. Each field panel identification code shall be related to the factory roll numbers through a table or chart. The CQA/CQC Personnel shall record the identification code, location and date of installation of each field panel.

Deployment of the geomembrane panels is carefully controlled so that it is not adversely affected by excessive moisture or winds. Care is taken during installation to see that the geomembrane is not damaged by equipment or personnel working on the geomembrane, and the geomembrane is placed as much as possible in its final location with minimum wrinkles or other problems.

After deployment, seaming is performed. All seaming is required to be performed under the direct supervision of the most experienced seamer, the "Master Seamer". Approved processes for field seaming are extrusion welding and fusion welding. Adequate amounts of spare parts and equipment must be kept on site or must be available within 24 hours so that seaming operations are not impaired due to lack of equipment.

Prior to seaming the QA Consultant must verify that the seam area is cleaned and free of moisture, dust, dirt, and foreign materials. Seams must be aligned with the fewest possible number of wrinkles and "fish mouths". Other preparations, such

as overlapped grinding if extrusion welding is used, must be performed in a way that does not damage the geomembrane.

Prior to performing any seams, each seamer and piece of equipment must perform a trial seam. Such trial seams must be made at the beginning of each seaming period, and each seamer must make at least one trial seam each day. After performing each trial seam, two adjoining one-inch specimens are cut from the trial seam and tested in shear and peel. The tested seams shall not fail in the seam, and must meet the materials minimum specification (Shear is 120 ppi, and peel is 90/78 ppi for fusion/extrusion welds). The seaming apparatus and seamer will not be used until satisfactory trial seams have been performed.

All geomembrane seaming shall be monitored by the CQA/CQC Personnel. All field seams shall be nondestructively tested using a vacuum test unit for extrusion weld and single fusion seams, and air pressure test apparatus for double fusion seams. This continuity testing is carried out as the seaming work progresses, not at the completion of all field seaming. No air bubbles appearing after 10 seconds under a vacuum box is acceptable for the vacuum box test. During an air pressure test, minimum pressure of 30 psi applied, the loss of pressure equal to or less than 3 psi after five minutes is acceptable.

Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. All destructive testing is done as the seaming work progresses, not at the completion of all field seaming. The CQA/CQC Personnel shall select locations where seam samples will be cut out for laboratory testing. These test samples shall be cut at a minimum frequency of one test location per 500 feet of seam length. More frequent testing shall be performed as necessary if the CQA/CQC Personnel is prompted by suspicion of excessive crystallinity, contamination, off-set welds, or any other potential cause of imperfect welding. The installer is not informed in advance of locations where seam samples will be taken. The sample should be of sufficient size to yield three 1 foot by 1 foot samples with the seam approximately centered in each sample. One sample shall be provided to the Installer for testing, one seam shall be tested by an independent third party laboratory and the remaining sample shall be archived by the CQA/CQC Personnel. All samples should be labeled to identify the sample and seam number and date seamed, the welder and the welding equipment. The label should also identify the technician who tested the seam.

Five subsamples should be tested in shear and five in peel in accordance with ASTM D4437. A passing test is one that achieves the minimum acceptable requirement of the specifications (Shear is 120 ppi, and peel is 90/78 ppi for fusion/extrusion welds), failure mode is by FTB (Film Tearing Bond), and peel incurs no more than 10 percent into the seam.

The results of the testing should be compared to the specifications by the CQA Engineer, and the results should be faxed to the CQA/CQC Personnel who shall notify the Installer of the results.

The procedures to be followed if the sample fails a destructive test are as follows:

- Move over a minimum of 25 feet on either side of the failed test area and take two new samples to be pulled and tested in the same manner as described previously.
- If these two samples pass, then all acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken.
- If they do not pass then repeat steps 1 and 2 until passing results are identified.

It is the responsibility of the CQA/CQC Personnel to document all actions taken in conjunction with destructive tests, repairs and capping of imperfections, destuctive locations, etc. The repair procedures available include patching, grinding, rewelding, spot welding or seaming, capping, topping, or removing the bad seam and replacing it with a strip of new material welded into place.

The geomembrane system shall be accepted by the owner when the installation has been finished and documentation, including "As Built" drawings, has been received.

6.0 GEOCOMPOSITE INSTALLATION

The contractor shall be responsible for storage and protection of the rolls of geocomposite at the site prior to its installation. The CQA/CQC Personnel will be responsible for approving the rolls of geocomposite prior to its use. The geocomposite should be adequately secured in the anchor trench and temporarily anchored during deployment. Care shall be taken to prevent entrapment of excessive dust or dirt during installation. If the geocomposite is not free of soil and debris before installation, it shall be cleaned by the contractor just prior to installation.

The geocomposite shall be placed with the long dimension of the rolls running vertical with the slope, rather than across (horizontal to) the slope. The geocomposite shall be rolled down the slope in a manner that continually keeps the material in tension. If necessary, the geocomposite shall be straightened by hand after being unrolled to minimize wrinkles. Adjacent rolls shall be overlapped approximately 2 to 4 inches and secured by plastic ties approximately every 5 feet along the roll length. End-to-end overlaps shall be tied at least every 2 feet, and the rolls shall be oriented such that these overlaps are staggered. Plastic ties shall be white or brightly-colored for easy inspection. Metallic ties

will not be allowed. The geotextile will then be overlapped and sewn or heat tacked per the manufacturer's recommendation.

7.0 DOCUMENTATION

Careful documentation of the construction procedures is essential to the successful installation of geosynthetic lining systems. Daily reports are prepared by the CQA/CQC Personnel to keep the Project Manager informed of the day-to-day activities in conjunction with construction of the lining system. In addition, periodic progress reports are also prepared and submitted to the owner. The frequency of these reports is usually determined at the preconstruction meeting. These progress reports also must include the results of the destructive test program.

At the completion of geosynthetic installation, the CQA/CQC Personnel must prepare an As Built drawing and a final certification report. This final report will serve as the basis for acceptance of the lining system, and a copy of this report will be kept available at the site at all times during its operation.