June 13, 2013

Christine Bergren
Municipal Solid Waste Permits Section
Waste Permits Division
Texas Commission on Environmental Quality
12100 Park 35 Circle
Austin, Texas 78523

RE: Request for Permit Modification
Municipal Solid Waste - Angelina County
Angelina County Waste Management Center- MSW Permit No. 2105A
CN600833511; RN101947323

Dear Ms. Bergren:

In accordance with §305.70(l) and on behalf of Angelina County Waste Management Center, we hereby request a permit modification to the above referenced permit. The purpose of this permit modification is to revise the Site Development Plan (SDP), Attachment 12, Final Closure Plan to allow for an alternative final cover design over the Pre-Subtitle D areas to accommodate landfill gas header lines installed on top of intermediate cover.

In March 2011, the TCEQ approved a modification to Permit No. 2105A to allow an alternative final cover system over Subtitle D Areas and to lower the final contour elevations (Exhibit 4.5 - Final Contour Map) over the Subtitle D Areas to accommodate the alternative final cover. The modification was completed because of a significant soil deficit at the site. Since the time of the that modification, the County has acquired additional property near the site for use as a borrow source and now has sufficient soil for construction of either traditional final cover systems with 18" clay infiltration layers or the alternative cover systems with thicker erosions layer to achieve originally permitted contours.

Therefore, this permit modification also requests to change the final contour elevations back to the originally permitted elevations. Final top of waste elevations will not change. Final contour elevations will be as shown on the Final Contour Map regardless of which final cover system is installed. Where the alternative final cover system with the geosynthetic liner (GLC) is installed, additional erosion layer soil will be added to meet final contour grades.

The following pages of Part III – Site Development Plan, Attachment 12 - Final Closure Plan have been revised and/or added:

1. Cover Page
2. Table of Contents
3. Pages 1 through 5
4. Exhibits 4.2.1 and 4.3.1 (Typical Alternative Final Cover Details)
5. Exhibit 4.5 (Final Contour Map)
6. Appendix 5.3 – Alternative Final Cover Demonstration
7. Appendix 5.4 – Final Cover System Quality Control Plan; Cover Page, Table of Contents, and Pages 1 and 29.

An original plus three (3) copies of this modification request with revised permit application pages and redline/strikeout copy of revised pages. If you have any questions regarding this permit modification or require any additional information, please feel free to contact me at (361) 883-1984.

Sincerely,

Amy R. Hesseltine, P.E.
Project Manager

Enclosures

cc: TCEQ Region 10 Office, Beaumont, Texas
Rick Freeman, Everett Griffith Jr. & Associates, Inc.
Chuck Brooks, Manager, Angelina County Waste Management Center

Texas Commission on Environmental Quality

Permit or Registration Application for Municipal Solid Waste Facility

Part I

A. General Information

Facility Name:	Angelina County Waste Management Center			
Physical or Street Address (if available):	7521 FM 58			
(City) (County)(State)(Zip Code):	Lufkin	Angelina	TX	75901
(Area Code) Telephone Number:	936-632-7168			
Charter Number:	N/A			

If the application is submitted on behalf of a corporation, provide the Charter Number as recorded with the Office of the Secretary of State for Texas.

Operator Name[1]:	Angelina County			
Mailing Address:	P.O. Box 908			
(City) (County)(State)(Zip Code):	Lufkin	Angelina	TX	75901
(Area Code) Telephone Number:	936-634-5413			
(Area Code) FAX Number:				
Charter Number:	N/A			

If the permittee is the same as the operator, type "Same as Operator".

Permittee Name:	Same as Operator			
Physical or Street Address (if available):				
(City) (County)(State)(Zip Code):				
(Area Code) Telephone Number:				
Charter Number:				

If the application is submitted by a corporation or by a person residing out of state, the applicant must register an Agent in Service or Agent of Service with the Texas Secretary of State's office and provide a complete mailing address for the agent. The agent must be a Texas resident.

Agent Name:	N/A			
Mailing Address:				
(City) (County)(State)(Zip Code):				
(Area Code) Telephone Number:				
(Area Code) FAX Number:				

Application Type:

☒	Permit	☐	Major Amendment	☐	Minor Amendment
☐	Registration	☒	Modification	☐	Temporary Authorization
		☐	w/Public Notice		
		☐	w/out Public Notice	☐	Notice of Deficiency Response

[1] The operator has the duty to submit an application if the facility is owned by one person and operated by another [30 TAC 305.43(b)]. The permit will specify the operator and the owner who is listed on this application [Section 361.087 Texas Health and Safety Code].

Facility Classification:

☒	Type I	☐	Type IV	☐	Type V	☐	Type IX
☐	Type I AE	☐	Type IV AE	☐	Type VI		

Activities covered by this application (check all that apply):

☐	Storage	☐	Processing	☒	Disposal

Waste management units covered by this application (check all that apply):

☐	Containers	☐	Tanks	☐	Surface Impoundments	☒	Landfills
☐	Incinerators	☐	Composting	☐	Type IV Demonstration Unit	☐	Type IX Energy/Material Recovery
☐	Other (Specify)			☐	Other (Specify)		
☐	Other (Specify)			☐	Other (Specify)		

Is this submittal part of a Consolidated Permit Processing request, in accordance with 30 TAC Chapter 33?

☐ Yes ☒ No

If yes, state the other TCEQ program authorizations requested.

Provide a brief description of the portion of the facility covered by this application. For amendments, modifications, and temporary authorizations, provide a brief description of the exact changes to the permit or registration conditions and supporting documents referenced by the permit or registration. Also, provide an explanation of why the amendment, modification, or temporary authorization is requested.

Modification to the Site Development Plan (SDP), Attachment 12, Final Closure Plan to allow for an alternate final cover design over Pre-Subtitle D Area.

Does the application contain confidential Material? ☐ Yes ☒ No

If yes, cross-reference the confidential material *throughout the application* and submit as a separate document or binder conspicuously marked "CONFIDENTIAL."

Alternative Language Notice Instructions

For certain permit applications, public notice in an alternate language is required. If an elementary school or middle school nearest to the facility offers a bilingual program, notice may be required to be published in an alternative language. The Texas Education Code, upon which the TCEQ alternative language notice requirements are based, trigger a bilingual education program to apply to an entire school district should the requisite alternative language speaking student population exist. However, there may not exist any bilingual students at a particular school within a district which is required to offer the bilingual education program. For this reason, the requirement to publish notice in an alternative language is triggered if the nearest elementary or middle school, as a part of a larger school district, is required to make a bilingual education program available to qualifying students and either the school has students enrolled at such a program on-site, or has students who attend such a program at another location in satisfaction of the school's obligation to provide such a program as a member of a triggered district.

If it is determined that an alternative language notice is required, the applicant is responsible for ensuring that the publication in the alternate language is complete and accurate in that language. Electronic

versions of the Spanish template examples are available from the TCEQ to help the applicant complete the publication in the alternative language.

Alternative Language Notice Application Form:

Alternative language notice confirmation for this application:

1. Is a bilingual program required by the Texas Education Code in the school district where the facility is located? ☒ YES ☐ NO

   (If NO, alternative language notice publication not required)

2. If YES to question 1, are students enrolled in a bilingual education program at either the elementary school or the middle school nearest to the facility? ☒ YES ☐ NO

(IF YES to questions 1 and 2, alternative language publication is required; If NO to question 2, then consider the next question)

3. If YES to question 1, are there students enrolled at either the elementary school or the middle school nearest to the facility who attend a bilingual education program at another location? ☐ YES ☐ NO

(If Yes to questions 1 and 3, alternative language publication is required; If NO to question 3, then consider the next question)

4. If YES to question 1, would either the elementary school or the middle school nearest to the facility be required to provide a bilingual education program but for the fact that it secured a waiver from this requirement, as available under 19 TAC §89.1205(g)? ☐ YES ☐ NO

(If Yes to questions 1 and 4, alternative language publication is required; If NO to question 4, alternative language notice publication not required)

If a bilingual education program(s) is provided by either the elementary school or the middle school nearest to the facility, which language(s) is required by the bilingual program? Spanish

Note: Applicants for new permits and major amendments must make a copy of the administratively complete application available at a public place in the county where the facility is, or will be, located for review and copying by the public.

Public place where administratively complete permit application will be located.				
Public Place (e.g., public library, county court house, city hall, etc.):	N/A			
Mailing Address:				
(City) (County)(State)(Zip Code):				
(Area Code) Telephone Number:				

B. Facility Location

Except for Type I AE and Type IV AE landfill facilities, for permits, registrations, amendments, and modifications requiring public notice, provide the URL address of a publicly accessible internet web site where the application and all revisions to that application will be posted.
http://www.angelinacounty.net/waste/lpnotices.html

Local Government Jurisdiction:	Angelina County
Within City Limits of:	N/A
Within Extraterritorial Jurisdiction of City of:	Lufkin

Is the proposed municipal or industrial solid waste disposal or processing facility located in an area in which the governing body of the municipality or county has prohibited the disposal or processing of municipal or industrial solid waste? (If YES, provide a copy of the ordinance or order):

☐ YES ☒ NO

Provide a description of the location of the facility with respect to known or easily identifiable landmarks.
Approximately 1 mile south of the intersection of FM 58 and FM 2108 at 7521 FM 58.

Detail the access routes from the nearest United States or state highway to the facility.
From US- 59 N turn right onto FM 2108, head southeast on FM 2108 for 3.7 miles, then turn right on FM 58 S and continue for 1.3 miles

Provide the latitudinal and longitudinal geographic coordinates of the facility.

Latitude	**N 31°15' 00"**
Longitude	**W 94°42' 20"**
Elevation (above msl)	270 feet

Is the facility within the Coastal Management Program boundary?	☐ Yes	☒ No

Texas Department of Transportation District Location:

TXDOT District Name & Number:	Lufkin District 11			
District Engineer's Name:	Dennis Cooley, P.E.			
Street or P. O. Box:	1805 North Timberland Drive			
(City) (County)(State)(Zip Code):	Lufkin	County	Texas	75901
(Area Code) Telephone Number:	936-633-4321			
(Area Code) FAX Number:	936-633-4378			

The local governmental authority or agency responsible for road maintenance:

Agency Name	Angelina County			
Contact Person's Name:	Scott Cooper			
Street or P. O. Box:	606 E. Lufkin Ave., 2nd floor, Rm 203			
(City) (County)(State)(Zip Code):	Lufkin	Angelina	TX	75902
(Area Code) Telephone Number:	936-632-5531			
(Area Code) FAX Number:				

State Representative:

District Number:	57			
State Representative's Name:	Trent Ashby			
District Office Address:	2915 Atkinson Dr.			
(City) (County)(State)(Zip Code):	Lufkin	Angelina	Texas	75901
(Area Code) Telephone Number:	936-634-2762			
(Area Code) FAX Number:	N/A			

State Senator:

District Number:	3			
State Senator's Name:	Robert Nichols			
District Office Address:	2915 Atkinson Drive			
(City) (County)(State)(Zip Code):	Lufkin	Angelina	Texas	75901
(Area Code) Telephone Number:	936-699-4988			
(Area Code) FAX Number:	936-699-4991			

Council of Government (COG) Information:

COG Name:	Deep East Texas			
COG Representative's Name:	Walter Diggles			
COG Representative's Title:	Executive Director			
Street or P. O. Box:	210 Premier Drive			
(City) (County)(State)(Zip Code):	Jasper	Jasper	Texas	75951
(Area Code) Telephone Number:	409-384-5704			
(Area Code) FAX Number:	409-384-5390			

River Basin Information:

River Authority:	Angelina & Neches River Authority			
Contact Person's Name:	Kelley Holcomb			
Watershed Sub-Basin Name:	Upper Neches River			
Street or P. O. Box:	210 East Lufkin Avenue			
(City) (County)(State)(Zip Code):	Lufkin	Angelina	Texas	75902
(Area Code) Telephone Number:	936-632-7795			
(Area Code) FAX Number:	936-632-2564			

This site is located in the following District of the U.S. Army Corps of Engineers:			
☐ Albuquerque, NM	☒ Ft. Worth, TX	☐ Galveston, TX	☐ Tulsa, OK

C. Maps

General

For permits, registrations, and amendments only, submit a topographic map, ownership map, county highway map, or a map prepared by a registered professional engineer or a registered surveyor which shows the facility and each of its intake and discharge structures and any other structure or location regarding the regulated facility and associated activities. Maps must be of material suitable for a permanent record, and shall be on sheets 8-1/2 inches by 14 inches or folded to that size, and shall be on a scale of not less than one inch equals one mile. The map shall depict the approximate boundaries of the tract of land owned or to be used by the applicant and shall extend at least one mile beyond the tract boundaries sufficient to show the following:

each well, spring, and surface water body or other water in the state within the map area;

the general character of the areas adjacent to the facility, including public roads, towns and the nature of development of adjacent lands such as residential, commercial, agricultural, recreational, undeveloped, etc;

the location of any waste disposal activities conducted on the tract not included in the application; and

the ownership of tracts of land adjacent to the facility and within a reasonable distance from the proposed point or points of discharge, deposit, injection, or other place of disposal or activity.

General location maps

For permits, registrations, and amendments only, submit at least one general location map at a scale of one-half inch equals one mile. This map shall be all or a portion of a county map prepared by Texas Department of Transportation (TxDOT). If TxDOT publishes more detailed maps of the proposed facility area, the more detailed maps shall also be included in Part I. Use the latest revision of all maps.

Land ownership map

Provide a map that locates the property owned by adjacent and potentially affected landowners. The maps should show all property ownership within 1/4 mile of the facility, on-site facility easement holders, and all mineral interest ownership under the facility.

Landowners list

Provide the adjacent and potentially affected landowners' list, keyed to the land ownership map with each property owner's name and mailing address. The list shall include all property owners within 1/4 mile of the facility, easement holders, and all mineral interest ownership under the facility. Provide the property, easement holders', and mineral interest owners' names and mailing addresses derived from the real property appraisal records as listed on the date that the application is filed. Provide the list in electronic form, as well.

D. Property owner information

For permits, registrations, amendments, and modifications that change the legal description, a change in owner, or a change in operator only, provide the following:

(1) the legal description of the facility;

(A) the abstract number as maintained by the Texas General Land Office for the surveyed tract of land;

(B) the legal description of the property and the county, book, and page number or other generally accepted identifying reference of the current ownership record;

(C) for property that is platted, the county, book, and page number or other generally accepted identifying reference of the final plat record that includes the acreage encompassed in the application and a copy of the final plat, in addition to a written legal description;

(D) a boundary metes and bounds description of the facility signed and sealed by a registered professional land surveyor;

(E) on-site easements at the facility, and

(F) drawings of the boundary metes and bounds description; and

(2) a property owner affidavit signed by the owner.

E. Legal authority

Provide verification of the legal status of the owner and operator, such as a one-page certificate of incorporation issued by the secretary of state. List all persons having over a 20% ownership in the proposed facility.

Indicate Ownership status of the facility:									
☐	Private	☐	Corporation	☐	Partnership	☐	Proprietorship	☐	Non-Profit Organization
☐	Public	☐	Federal	☐	Military	☐	State	☐	Regional
☒	County	☐	Municipal	☐	Other (Specify)				

Does the operator own the facility units and the facility property?	☒ Yes	☐ No

If "No," for permits, registrations, amendments, and modifications that changes the legal description, a change in owner, or a change in operators submit a copy of the lease for the use of or the option to buy the facility units or facility property, as appropriate, and identify:	
Owner Name:	
Street or P. O. Box:	
(City) (County)(State)(Zip Code):	
(Area Code) Telephone Number:	
(Area Code) FAX Number:	
Charter Number:	

F. Evidence of competency

For permits, registrations, amendments, and modifications that change the legal description, a change in owner, or a change in operators submit a list of all Texas solid waste sites that the owner and operator have owned or operated within the last ten years.

Site Name	Site Type	Permit/Reg. No.	County	Dates of Operation
N/A				

Submit a list of all solid waste sites in all states, territories, or countries in which the owner and operator have a direct financial interest.

Site Name	Location	Dates of Operation	Regulatory Agency (Name & Address)
N/A			

A licensed solid waste facility supervisor, as defined in 30 TAC Chapter 30, Occupational Licenses and Registrations will be employed before commencing facility operation.

Provide the names of the principals and supervisors of the owner's and operator's organization, together with previous affiliations with other organizations engaged in solid waste activities.

Name	Previous Affiliation	Other Organization
N/A		

For landfill permit applications only, evidence of competency to operate the facility shall also include landfilling and earthmoving experience if applicable, and other pertinent experience, or licenses as described in 30 TAC Chapter 30 possessed by key personnel. The number and size of each type of equipment to be dedicated to facility operation will be specified in greater detail on Part IV of the application within the site operating plan.

Landfilling/Earthmoving Equipment Types	Personnel Experience or Licenses

For mobile liquid waste processing units, submit a list of all solid waste, liquid waste, or mobile waste units that the owner and operator have owned or operated within the past five years. Submit a list of any final enforcement orders, court judgments, consent decrees, and criminal convictions of this state and the federal government within the last five years relating to compliance with applicable legal requirements relating to the handling of solid or liquid waste under the jurisdiction of the commission or the United States Environmental Protection Agency. Applicable legal requirement means an environmental law, regulation, permit, order, consent decree, or other requirement.

Solid waste, liquid waste, or mobile waste units owned or operated within past 5 years	Texas and federal final enforcement orders, court judgments, consent decrees, and criminal convictions

G. Appointments

Provide documentation that the person signing the application meets the requirements of 30 TAC §305.44, Signatories to Applications. If the authority has been delegated, provide a copy of the document issued by the governing body of the owner or operator authorizing the person that signed the application to act as agent for the owner or operator.

H. Application Fees

For a new permit, registration, amendment, modification, or temporary authorization, submit a $150 application fee.

For authorization to construct an enclosed structure over an old, closed municipal solid waste landfill in accordance with 30 TAC 330 Subchapter T, submit a $2,500 application fee.

If paying by check, send payment to:

Texas Commission on Environmental Quality
Financial Administration Division, MC 214
P. O. Box 13087
Austin, Texas 78711-3087

Payment maybe made online using TCEQ e-pay at www.tceq.state.tx.us/e-services/	
E-pay confirmation number	582EA000143946

PROPERTY OWNER AFFIDAVIT

"I, _____
(property owner)
,

acknowledge that the State of Texas may hold me either jointly or severally responsible for the operation, maintenance, and closure and post-closure care of the facility. For a facility where waste will remain after closure, I acknowledge that I have a responsibility to file with the county deed records an affidavit to the public advising that the land will be used for a solid waste facility prior to the time that the facility actually begins operating as a municipal solid waste landfill facility, and to file a final recording upon completion of disposal operations and closure of the landfill units in accordance with Title 30 Texas Administrative Code §330.19, Deed Recordation. I further acknowledge that I or the operator and the State of Texas shall have access to the property during the active life and post-closure care period, if required, after closure for the purpose of inspection and maintenance."

_____ _____
(Owner signature) (Date)

Signature Page

I, Wes Suiter (Operator), County Judge (Title),

certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: _____ Date: 5/8/13

TO BE COMPLETED BY THE OPERATOR IF THE APPLICATION IS SIGNED BY AN AUTHORIZED REPRESENTATIVE FOR THE OPERATOR

I, _____ (Print or Type Operator Name), hereby designate _____ (Print or Type Representative Name)

as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a Texas Water Code or Texas Solid Waste Disposal Act permit. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any permit which might be issued based upon this application.

_____
Printed or Typed Name of Operator or Principal Executive Officer

_____
Signature

SUBSCRIBED AND SWORN to before me by the said Wes Suiter

On this 8 day of May, 2013

My commission expires on the 20th day of February, 2014

NOTARY PUBLIC STATE OF TEXAS
SALLIE ALEXANDER
Notary Public
State of Texas
My Comm. Expires 02-20-2014

Sallie Alexander
Notary Public in and for

Angelina County, Texas

(Note: Application Must Bear Signature & Seal of Notary Public)

ANGELINA COUNTY
WASTE MANAGEMENT CENTER
TCEQ Permit No. MSW-2105A

Part III - Site Development Plan
Attachment 12 - Final Closure Plan

prepared by:

LNV Solutions Today with a Vision for Tomorrow
engineers | architects | contractors
TBPE FIRM NO. F-366

November 20, 2007
Revised April 11, 2008
Revised September 25, 2009
Revised October 18, 2010
Revised December 17, 2010
Revised May 7, 2013

5/7/13

Amy R Hesseltine

FOR PERMITTING PURPOSES ONLY

SDP ATTACHMENT 12

Final Closure Plan
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

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EXHIBITS

APPENDICES

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Amy R Hesseltine

FOR PERMITTING PURPOSES ONLY

SDP ATTACHMENT 12

Final Closure Plan
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

1 INTRODUCTION

This plan has been prepared to fulfill the requirements of 30 TAC Subchapter J, §§330.457, 330.459, and 330.461 regarding closure requirements for all Municipal Solid Waste (MSW) landfill units. As stated in the regulations, the required final closure system for each MSW landfill unit is determined by the date which the MSW landfill unit stops receiving waste and by the underlying bottom liner system for the unit. All MSW landfill units at the Angelina County Waste Management Center (ACWMC) received waste after October 9, 1993. This document details the requirement for final closure of all MSW landfill units at the Angelina County Waste Management Center.

2 FINAL COVER SYSTEM REQUIREMENTS

2.1 MSW Landfill Units with Synthetic Bottom Liners

2.1.1 Subtitle D Final Cover System

30 TAC §330.457(a)(1) states that the final cover system for a MSW landfill unit with a synthetic bottom liner must have a synthetic membrane that has permeability less than or equal to the permeability of any bottom liner system overlain by a clay rich cover layer consisting of a minimum of 18 inches of earthen material with a coefficient of permeability no greater than $1x10^{-5}$ cm/sec.

The synthetic membrane currently permitted for the Angelina County Waste Management Center consists of 40 mil linear low density polyethylene. The synthetic membrane will be smooth on the gently sloping top sections of the cap and textured on the 4-horizontal:1-vertical side slopes.

2.1.2 Alternative Final Cover System

In accordance with 30 TAC §330.457(d), the executive director may approve an alternative final cover design that achieves an equivalent reduction in infiltration as the clay-rich soil layer detailed in 30 TAC §330.457(a)(1) and provides equivalent protection from wind and water erosion as detailed in 30 TAC §330.457(a)(3).

As detailed in the Alternative Final Cover Demonstration (Appendix 5.3 of this plan), the currently permitted final cover system is more stringent than the requirements of §330.457(a)(1) and (3), therefore an alternative final cover has been designed that achieves an equivalent or greater reduction in infiltration and provides equivalent protection from wind and water erosion as the currently permitted design.

An alternative final cover system (AFCS) has been designed for the MSW landfill units with synthetic bottom liners and consists of replacing the clay-rich soil layer component in the site's currently permitted final cover system with a geosynthetic clay liner (GCL). The GCL will be overlain with a 40 mil LLDPE geomembrane. The synthetic membrane will be textured on the 4-horizontal:1-vertical side slopes and smooth on lesser top slopes. The alternative final cover system may be used on any areas with a synthetic bottom liner.

2.1.3 Drainage Layer

A geocomposite drainage layer will be placed over the synthetic membrane. The geocomposite drainage layer will consist of a 200 mil geonet heat-fused to 10 oz geotextile filter fabric (single-sided for top slopes, double-sided for the 4-horizontal:1-vertical side slopes).

2.2 MSW Landfill Units With No Synthetic Liner

2.2.1 Pre-Subtitle D Final Cover System

30 TAC §330.457(a)(2) states that the final cover system for a MSW landfill unit with no synthetic bottom liner must have a clay-rich cover soil layer consisting of a minimum of 18 inches of earthen material with a coefficient of permeability less than or equal to the permeability of any constructed bottom liner or natural subsoil present. The coefficient of permeability of the infiltration layer shall in no case exceed $1x10^{-5}$ cm/sec, even though the coefficient of permeability of the constructed bottom liner or natural subsoil is greater than $1x10^{-5}$ cm/sec or no data exist for the value(s) of the coefficient of permeability of the constructed bottom liner or natural subsoil.

Approximately 6.9 acres are underlain with pre-Subtitle D compacted clay liners with no synthetic bottom liners. The final cover for the MSW landfill units with no synthetic bottom liner will be constructed with an infiltration layer consisting of a minimum of 18 inches of compacted clay with a coefficient of permeability less than or equal to the permeability of the constructed bottom liner(s) or $1x10^{-5}$ cm/sec, whichever is less.

2.2.2 Alternative Final Cover System

In accordance with 30 TAC §330.457(d), the executive director may approve an alternative final cover design that achieves an equivalent reduction in infiltration as the clay-rich soil layer detailed in 30 TAC §330.457(a)(2) and provides equivalent protection from wind and water erosion as detailed in 30 TAC §330.457(a)(3).

As detailed in the Alternative Final Cover Demonstration (Appendix 5.3 of this plan), an alternative final cover has been designed that achieves an equivalent or greater reduction in infiltration and provides equivalent protection from wind and water erosion as clay-rich soil cover layer specified in §330.457(a)(2) and (3).

An alternative final cover system (AFCS) has been designed for the MSW landfill units with no synthetic bottom liners and consists of replacing the clay-rich soil layer component in the site's currently permitted final cover system with a geosynthetic clay liner (GCL). The GCL will be overlain with a 40 mil LLDPE geomembrane. The synthetic membrane will be textured on the 4-horizontal:1-vertical side slopes and smooth on lesser top slopes. The alternative final cover system may be used on any areas with no synthetic bottom liner.

2.3 Erosion Layer

In accordance 30 TAC §330.457(a)(3), all final cover systems must include an erosion layer consisting of a minimum of six inches (6") of earthen material that is capable of sustaining native plant and must be seeded or sodded immediately following the application of final cover in order to minimize erosion.

The erosion layer for the Angelina County Waste Management Center will consist of 24 inches of earthen material with the top six inches (6") being capable sustaining native plant growth and will be seeded or sodded immediately following the application of final cover in order to minimize erosion.

3 QUALITY CONTROL TESTING

In accordance with 30 TAC §330.457(c), quality control testing shall be performed and documented on the 18 inches of compacted clay-rich soil cover for its coefficient of permeability at a frequency of no less than one test per surface acre of final cover. Permeability data shall be submitted to the executive director.

Quality control/quality assurance testing and documentation procedures for each final cover system installed will be in accordance with the site's Final Cover Quality Control Plan (FCQCP). A copy of the FCQCP can be found in Appendix 5.4 of this document.

4 LARGEST AREA REQUIRING FINAL COVER

The largest area requiring final cover is based upon the largest active area at any given time during the active life of the landfill. At the present time, approximately 36 acres have been developed. Of the 36 acres, one (1) acre was closed in 1995 and 35 acres are active. Therefore, 35 acres represent the largest area of the landfill requiring final cover.

5 MAXIMUM INVENTORY OF WASTES

The maximum inventory of waste that will ever be on-site during the active life of the landfill is estimated to be approximately 8,000,000 cubic yards. This estimate is based upon the permitted design capacity of the landfill less daily cover and final cover.

As detailed in §II.E (Facilities and Operations Authorized/Waste Volume Available for Disposal) in the Permit, 9,291,965 cubic yards is the total permitted capacity of landfill including daily and final cover. 8,000,000 cubic yards is the estimated total waste capacity of the facility excluding final cover. Therefore 8,000,000 cubic yards represents the "maximum inventory of waste" that will ever be on-site during the active life of the landfill.

6 IMPLEMENTATION OF FINAL CLOSURE PLAN

Implementation of the final closure plan for the Angelina County Waste Management Center will be as follows:

- No later than 45 days prior to the initiation of closure activities for an MSW landfill unit, ACWMC shall provide written notification to the executive director of the intent to close the unit and place this notice of intent in the operating record.

- Upon notification to the executive of its intent to close, ACWMC shall post a minimum of one sign at the main entrance and all other frequently used points of access for the facility notifying all persons who may utilize the facility of the date of closing for the entire facility and the prohibition against further receipt of waste materials after the stated date. Further, suitable barriers shall be installed at all gates or access points to adequately prevent the unauthorized dumping of solid waste at the closed facility.

- ACWMC shall begin closure activities for each unit no later than 30 days after the date on which the unit receives the known final receipt of wastes or, if the unit has remaining capacity and there is a reasonable likelihood that the unit will receive additional wastes, no later than one year after the most recent receipt of wastes. A request for an extension beyond the one-year deadline for the initiation of closure may be submitted to the executive director for review and approval and shall include all applicable documentation necessary to demonstrate that the unit has the capacity to receive additional waste and that the owner or operator has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the MSW landfill unit.

- ACWMC shall complete closure activities for the unit in accordance with the approved closure plan within 180 days following the initiation of closure activities. A request for an extension for the completion of closure activities may be submitted to the executive director for review and approval and shall include all applicable documentation necessary to demonstrate that closure will, of necessity, take longer than 180 days and all steps have been taken and will continue to be taken to prevent threats to human health and the environment from the unclosed MSW landfill unit.

- Following completion of all closure activities for the MSW landfill unit, ACWMC shall comply with the post-closure care requirements. ACWMC shall submit to the executive director by registered mail for review and approval a certification, signed by an independent licensed professional engineer, verifying that closure has been completed in accordance with the approved closure plan. The submittal to the executive director shall include all applicable documentation necessary for certification of closure. Once approved, this certification shall be placed in the operating record.

- Following receipt of the required closure documents, as applicable, and an inspection report from the agency's regional office verifying proper closure of the MSW landfill unit according to the approved closure plan, the executive director may acknowledge the termination of operation and closure of the unit and deem it properly closed.

- Within ten days after closure of all MSW landfill units, ACWMC shall submit to the executive director by registered mail a certified copy of an affidavit to the public in accordance with the requirements of 330.19 (relating to Deed Recordation) and place a copy of the affidavit in the operating record. In addition, the owner or operator shall record a certified notation of the deed to the facility property, or on some other instrument that is normally examined during title search, that will in perpetuity notify any potential purchaser of the property that the land has been used as a landfill facility and use of the land is restricted according to the provisions specified in 330.465 (relating to Certification of Completion of Post-Closure Care). ACWMC shall submit a certified copy of the modified deed to the executive director and place a copy of the modified deed in the operating record within the time frame specified in this subsection.

- No later than 90 days prior to the initiation of a final facility closure, ACWMC, through a public notice in the newspaper(s) of largest circulation in the vicinity of the facility, provide public notice for final facility closure. This notice shall provide the name, address, and physical location of the facility; the permit number; and the last date of intended receipt of waste. ACWMC shall also make available an adequate number of copies of the approved final closure and post-closure plans for public access and review. ACWMC shall also provide written notification to the executive director of the intent to close the facility and place this notice of intent in the operating record.

7 FINAL CONTOUR MAP

The Angelina County Waste Management Center consists of two fill sectors, Tract 1 and Tract 2. Final contours for each tract consist of 4-horizontal:1-vertical side slopes with top slopes ranging from 2 percent to 6 percent. Intermediate plateaus will be built along portions of the side slopes as shown in Exhibit 4.5, Sheets 1 and 2 of 2.

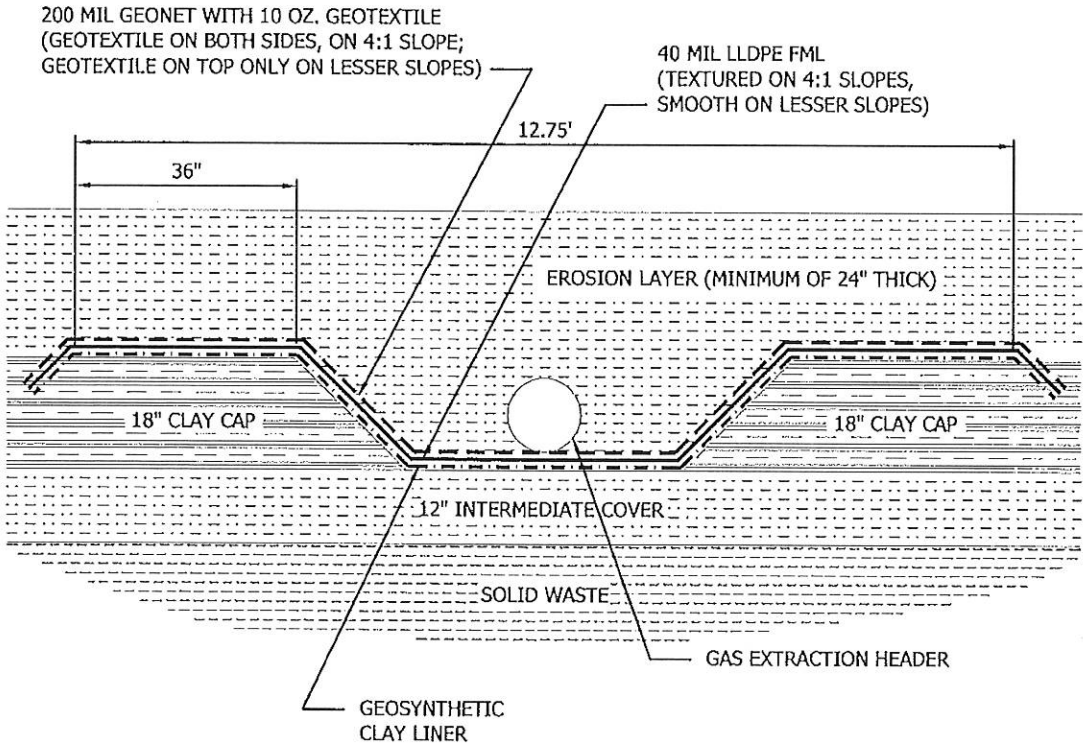
8 SOIL EROSION LOSSES COMPUTATIONS

Soil erosion losses computations can be found in Appendix 5.1.

9 SLOPE STABILITY ANALYSIS

Slope stability analysis for the final cover can be found in Appendix 5.2.

Exhibits



NOTES:

1. THIS DETAIL IS TO BE USED IN THE PRE-SUBTITLE D AREA WHERE GAS EXTRACTION HEADERS ARE ALREADY CONSTRUCTED AND LIE DIRECTLY ON INTERMEDIATE COVER.

STATE OF TEXAS
AMY REIN HESSELTINE
93578
LICENSED PROFESSIONAL ENGINEER

5/7/13

Amy R Hesseltine

FOR PERMITTING PURPOSES ONLY

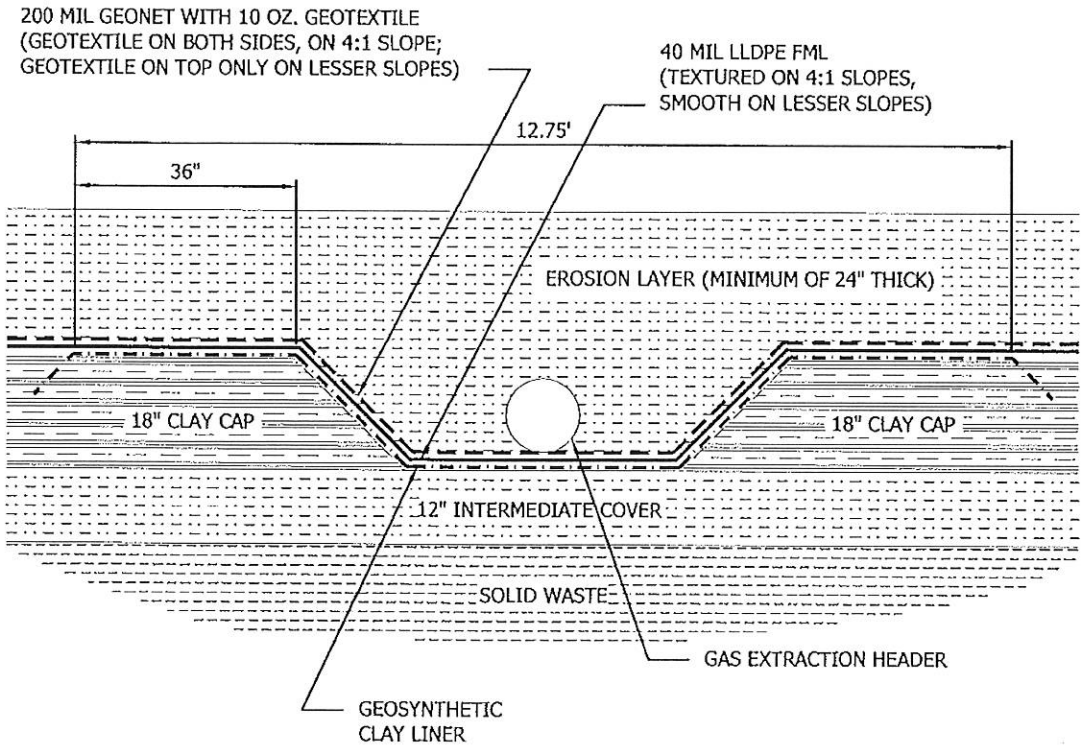
BASE DRAWING PROVIDED BY:
EVERETT GRIFFITH, JR & ASSOCIATES, INC.

NO.	DATE	DESCRIPTION	BY

EXHIBIT 4.2.1
TYPICAL ALTERNATIVE FINAL COVER
PRE-SUBTITLE D AREAS
ANGELINA COUNTY
WASTE MANAGEMENT CENTER

LNV
engineers | architects | contractors
TBPE FIRM NO. F-315 WWW.LNVINC.COM

DRAWN BY: CMP
APPROVED BY: ARH
DATE: 05-06-13
SCALE: NTS
130080\P001\dwgs\figs\Typ Alt Pre-D.dwg
SHEET 1 of 1



NOTES:

1. THIS DETAIL IS TO BE USED IN THE SUBTITLE D AREAS WHERE GAS EXTRACTION HEADERS ARE ALREADY CONSTRUCTED AND LIE DIRECTLY ON INTERMEDIATE COVER, AND WHERE THE ORIGINAL APPROVED SUBTITLE D FINAL COVER SYSTEM IS USED IN LIEU OF THE GCL.
2. THE ALTERNATIVE FINAL COVER SYSTEM (GCL, LLDPE AND GEONET) BEING UTILIZED WAS APPROVED FOR USE ON MARCH 18, 2011.

STATE OF TEXAS
AMY REIN HESSELTINE
93578
LICENSED PROFESSIONAL ENGINEER

5/7/13

Amy R Hesseltine

FOR PERMITTING PURPOSES ONLY

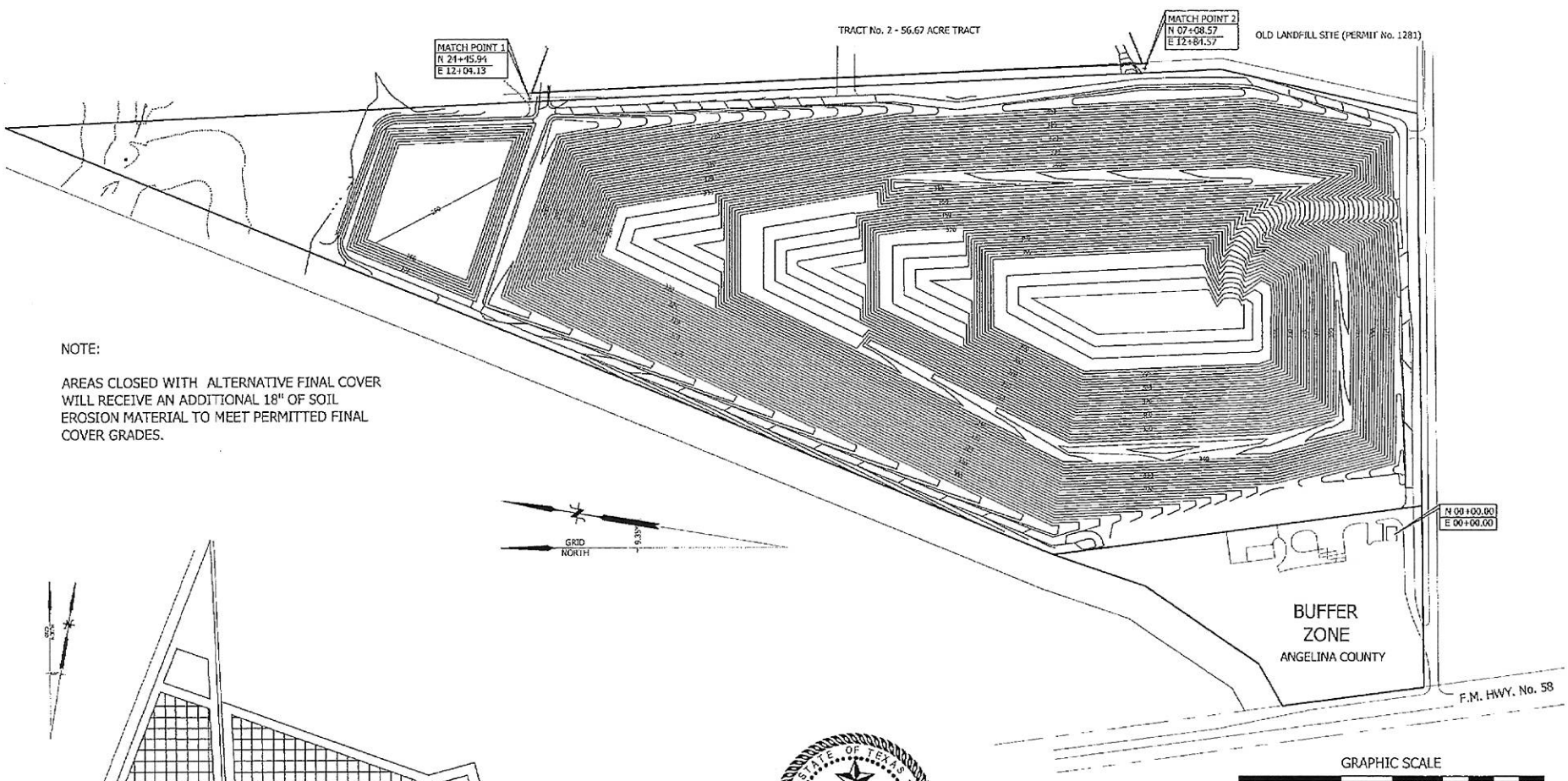
BASE DRAWING PROVIDED BY:
EVERETT GRIFFITH, JR & ASSOCIATES, INC.

NO.	DATE	DESCRIPTION	BY

EXHIBIT 4.3.1
TYPICAL ALTERNATIVE FINAL COVER
SUBTITLE D AREAS
ANGELINA COUNTY
WASTE MANAGEMENT CENTER

LNV
engineers | architects | contractors
TBPE FIRM NO. F-565 WWW.LNVINC.COM

DRAWN BY: CMP	
APPROVED BY: ARH	
DATE: 05-06-13	
SCALE: NTS	
130080\P001\dwgs\figs\Typ Alt Pre-D.dwg	SHEET 1 of 1



NOTE:

AREAS CLOSED WITH ALTERNATIVE FINAL COVER WILL RECEIVE AN ADDITIONAL 18" OF SOIL EROSION MATERIAL TO MEET PERMITTED FINAL COVER GRADES.

KEY MAP

STATE OF TEXAS
AMY REIN HESSELTINE
93578
LICENSED PROFESSIONAL ENGINEER

5/7/13

Amy R Hesseltine

FOR PERMITTING PURPOSES ONLY

GRAPHIC SCALE
0 300' 600' 900'

NO.	DATE	DESCRIPTION	BY
1	05/06/13	REVISED CONTOURS TO ORIGINAL	CMP

EXHIBIT 4.5
FINAL CONTOUR MAP
ANGELINA COUNTY
WASTE MANAGEMENT CENTER

LNV
engineers | architects | contractors

DRAWN BY: CMP	
APPROVED BY: ARH	
DATE: 11-14-11	
SCALE: NTS	
130080\P001\dwgs\figs\Final Contours 2013	SHEET 1 of 1

Appendix 5.3

Alternative Final Cover Demonstration

ANGELINA COUNTY
WASTE MANAGEMENT CENTER
TCEQ Permit No. MSW-2105A

SDP Attachment 12, Appendix 5.3
Alternative Final Cover Demonstration

prepared by:

LNV Solutions Today with a Vision for Tomorrow

engineers | architects | contractors

TBPE FIRM NO. F-366

November 20, 2007
Revised April 11, 2008
Revised September 25, 2009
Revised May 7, 2013

5/7/13

Amy R Hesseltine

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SDP ATTACHMENT 12, APPENDIX 5.3

Alternative Final Cover Demonstration
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

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ATTACHMENTS

5/7/13

Amy R Hesseltine

FOR PERMITTING PURPOSES ONLY

Alternative Final Cover Demonstration
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

1 INTRODUCTION

In accordance with 30 TAC §330.457(d), the executive director may approve an alternative final cover design that achieves an equivalent or greater reduction in infiltration as the clay-rich soil layer detailed in 30 TAC §330.457(a)(1) and provides equivalent protection from wind and water erosion as detailed in 30 TAC §330.457(a)(3).

One alternative final cover system (AFCS) has been designed for both the MSW landfill units with synthetic bottom liners and MSW landfill units with no synthetic bottom liner. The alternative final cover system consists of replacing the clay-rich soil layer component in the site's currently permitted final cover systems with a geosynthetic clay liner (GCL).

This documentation will show that the alternative final cover system that has been designed for the Angelina County Waste Management Center meets the requirements of 30 TAC §330.457(d).

2 MODELING APPROACH

All modeling for this demonstration was performed utilizing the Hydrologic Evaluation of Landfill Performance (HELP) Model, Version 3.07 (1 November 1997).

The simulations were performed with the HELP model using the program's synthetic weather data generation capabilities for Houston, Texas, with temperature and precipitation data adjusted with monthly normals from 1971-2000, obtained from the National Climactic Data Center (NCDC). The HELP Model is equipped with synthetic weather capabilities for large cities, such as Houston, Dallas, Austin, San Antonio, etc. Houston was chosen due to proximity to the site and the similarity of seasonal weather averages. The synthetic weather capabilities include precipitation, temperature, solar radiation and evapotranspiration. Where local data existed for the City of Lufkin (closest dataset to the facility) the model was adjusted to include this data. LNV Engineering was able to utilize actual temperature and precipitation data obtained for the City of Lufkin. The monthly normal from 1971-2000 was the most readily available historic weather data. The latitude used in the model (31.337°) correlates to the location of the weather station for the City of Lufkin and was obtained from the National Climactic Weather Center. Data was generated for a thirty year period to correspond with the post-closure care period for the facility.

The runoff curve was generated by the model using a slope of 5% and a length of 200 feet. A slope of 5% with a slope length of 200 feet is consider conservative while using the HELP model as steeper slopes and longer slope lengths both generate faster run-off resulting in less infiltration. Therefore, using 5% and 200 feet to generate the run-off curve for modeling purposes is considered a conservative approach because it maximizes the infiltration capabilities of the model. Additionally, the same slope values were used in all modeled simulations. Run-off was allowed from the area modeled.

An evaporative zone depth of 22 inches was assumed. This depth was suggested by the model as a fair value for corresponding to the presence of fair vegetative cover. This should be a fair assumption considering that vegetation will be promoted on the final cover system to limit erosion and the low permeability soils in the final cover will hold water and promote evapotranspiration in addition to reducing infiltration.

For simulation purposes when modeling final cover systems with geosynthetic components, geomembrane manufacturer defects (pinholes) were assumed at one per acre and field installation defects were assumed at two per acre with a placement factor of 3 (good). The HELP Model's User's Guide recommendations were used in deriving the defect values. As stated in the "HELP Model User's Guide for Version 3" by Paul R. Schroeder, Cheryl M. Lloyd, Paul A Zappi, and Nadim M. Aziz, "Typical geomembranes may have 0.5 -1 pinholes per acre (1 to 2 pinholes per hectare) from manufacturing defects....Representative installation defect densities as a function of the quality of installation of installation are given below for landfills being built today with the state of the art-minerals, equipment and QA/QC....

Installation Quality	Defect Density (number per acre)
Good	1 to 4

Good: Assumes good field installation with well-prepared, smooth soil surface and geomembrane wrinkle control to insure good contact between geomembrane and adjacent soil that limits drainage rate."

Additionally, in accordance with Geosynthetic Research Institute (GRI) Standard Specification GRI - GCL3 "Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs)", GCLs (as manufactured) shall have a minimum hydraulic conductivity of 5.0×10^{-9} cm/sec. This value was manually inputted to override the higher default value provided in the HELP Model.

In all models, the area of performance used for Subtitle D final cover systems was calculated as 82.1 acres and the area of performance used for Pre-Subtitle D final cover systems was 6.9 acres.

3 FINAL COVER SYSTEM PERFORMANCE

3.1 MSW Landfill Units with Synthetic Bottom Liners

3.1.1 Subtitle D Final Cover System

In order to determine the most stringent final cover design and to establish performance criteria for an alternative final cover system, the site's permitted Subtitle D final cover design for MSW landfill units with synthetic bottom liners was modeled and compared to the regulatory Subtitle D final cover system design specified in §330.457(a)(1) and §330.457(a)(3).

3.1.1.1 Permitted

The permitted Subtitle D final cover system for was modeled using four layers; a 24-inch erosion layer, a 200 mil geonet drainage layer, a 40 mil linear low density polyethylene, and an 18-inch barrier layer of compacted clay with a hydraulic conductivity not exceeding $1x10^{-5}$ cm/sec.

As calculated by the HELP model using the currently permitted final cover system design parameters, the peak daily percolation/leakage through layer 4 for years 1 to 30 is 3.47290 cubic feet, as shown on page 6 of 6 of the HELP model output for this analysis (Attachment A of this Appendix).

3.1.1.2 Regulatory

The regulatory Subtitle D final cover system was modeled using three layers; a 6-inch erosion layer, an 18-inch barrier layer of compacted clay with a hydraulic conductivity not exceeding $1x\ 10^{-5}$ cm/sec and a geomembrane layer consisting of 40 mil linear low density polyethylene.

As calculated by the HELP model using the Subtitle D final cover system parameters, the peak daily percolation/leakage through layer 3 for years 1 to 30 is 9.20968 cubic feet, as shown on page 5 of 5 of the HELP model output for this analysis (Attachment B of this Appendix).

The HELP model results indicate that the permitted Subtitle D final cover design is more stringent than the regulatory Subtitle D final cover design specified in §330.457(a)(1) and (3). Therefore, the alternative final cover design must achieve an equivalent reduction in infiltration and provide equivalent protection from wind and water as the permitted Subtitle D final cover design for MSW landfill units with synthetic bottom liners.

3.1.2 Alternative Subtitle D Final Cover System

The alternative Subtitle D final cover system was modeled using four layers, a 24-inch erosion layer, a 200 mil geonet, 40 mil linear low density polyethylene and a 0.24-inch bentonite GCL with a hydraulic conductivity of $5.0x10^{-9}$ cm/sec which was modeled as a barrier layer utilizing the same parameters outlined in 3.1.1, above.

As calculated by the HELP model, the peak daily percolation/leakage through layer 4 of the alternative Subtitle D final cover system, for years 1 to 30, is 0.03020 cubic feet, as shown on page 6 of 6 of the HELP model output for this analysis (Attachment C of this Appendix).

3.2 MSW Landfill Units with No Synthetic Bottom Liners

3.2.1 Pre-Subtitle D Final Cover System

30 TAC §330.457(a)(2) states that the final cover system for a MSW landfill unit with no synthetic bottom liner must have a clay-rich cover soil layer consisting of

a minimum of 18 inches of earthen material with a coefficient of permeability less than or equal to the permeability of any constructed bottom liner or natural subsoil present. To accommodate landfill gas header lines installed top of intermediate cover, an alternative final cover system is proposed for select areas of Pre-Subtitle D Areas.

In order to determine the performance criteria for an alternative Pre-Subtitle D final cover system, historic Soil Liner Evaluation Report documents were reviewed to obtain a value for the coefficient of permeability less than or equal to the permeability of any constructed bottom liner. The review indicated that 4.42 x 10^{-9} cm/sec is the lowest permeability result obtained during any construction event of compacted clay liners within the Pre-Subtitle D areas. This value was used for modeling purposes only as it would result in the most conservative value for comparison purposes. It does not constitute the value with which soil only based Pre-Subtitle D final cover systems will be constructed.

Therefore, permitted Pre-Subtitle D final cover system was modeled using two layers; a 6-inch erosion layer and an 18-inch barrier layer of compacted clay with a hydraulic conductivity not exceeding 4.42 x 10^{-9} cm/sec.

As calculated by the HELP model using the permitted Pre-Subtitle D final cover system parameters, the peak daily percolation/leakage through layer 2 for years 1 to 30 is 7.64061 cubic feet, as shown on page 4 of 4 of the HELP model output for this analysis (Attachment D of this Appendix).

3.2.2 Alternative Pre-Subtitle D Final Cover System

The alternative Pre-Subtitle D final cover system was modeled using four layers, a 24-inch erosion layer, a 200 mil geonet, 40 mil linear low density polyethylene and a 0.24-inch bentonite GCL with a hydraulic conductivity of 5.0x10^{-9} cm/sec which was modeled as a barrier layer.

As calculated by the HELP model, the peak daily percolation/leakage through layer 4 of the alternative final cover system, for years 1 to 30, is 0.00312 cubic feet, as shown on page 5 of 5 of the HELP model output for this analysis (Attachment E of this Appendix).

4 CONCLUSION

The HELP model simulations performed for this demonstration show that the alternative final cover designs proposed for both Subtitle D and Pre-Subtitle D areas of the Angelina County Waste Management Center will achieve an equivalent or greater reduction in infiltration and provide equivalent protection from wind and water erosion as the permitted final cover designs as required by 30 TAC §330.457(d).

Attachment A

Currently Permitted Final Cover System
HELP Model Simulation

```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************

PRECIPITATION DATA FILE:     C:\HELP3\ANGELINA.D4
TEMPERATURE DATA FILE:       C:\HELP3\ANGELINA.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\ANGELINA.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\ANGELINA.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\ANGCLAY.D10
OUTPUT DATA FILE:            C:\HELP3\ANGCLAY.OUT

TIME:  13:26     DATE:   05/06/2013

**********************************************************************
     TITLE:  Angelina County Waste Management Center-Currently Permitted
**********************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
               COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  10
     THICKNESS                     =      24.00   INCHES
     POROSITY                      =       0.3980 VOL/VOL
     FIELD CAPACITY                =       0.2440 VOL/VOL
     WILTING POINT                 =       0.1360 VOL/VOL
     INITIAL SOIL WATER CONTENT    =       0.3135 VOL/VOL
     EFFECTIVE SAT. HYD. COND.     =  0.119999997000E-03 CM/SEC
   NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
            FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                LAYER  2
                                --------

                  TYPE 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER  20
     THICKNESS                     =       0.20   INCHES
     POROSITY                      =       0.8500 VOL/VOL
     FIELD CAPACITY                =       0.0100 VOL/VOL
     WILTING POINT                 =       0.0050 VOL/VOL
     INITIAL SOIL WATER CONTENT    =       0.0117 VOL/VOL
     EFFECTIVE SAT. HYD. COND.     =   10.0000000000     CM/SEC
     SLOPE                         =       5.00   PERCENT
     DRAINAGE LENGTH               =     200.0    FEET
```


5/7/13

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LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4000	VOL/VOL
FIELD CAPACITY	=	0.3660	VOL/VOL
WILTING POINT	=	0.2880	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A

FAIR STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	86.30	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	82.100	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	6.936	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.756	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.992	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	14.726	INCHES
TOTAL INITIAL WATER	=	14.726	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
HOUSTON TEXAS

STATION LATITUDE	= 31.34	DEGREES
MAXIMUM LEAF AREA INDEX	= 2.00	
START OF GROWING SEASON (JULIAN DATE)	= 31	
END OF GROWING SEASON (JULIAN DATE)	= 362	
EVAPORATIVE ZONE DEPTH	= 22.0	INCHES
AVERAGE ANNUAL WIND SPEED	= 7.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	= 74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	= 76.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	= 77.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	= 77.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.45	3.17	3.53	3.13	5.29	4.18
2.60	3.08	4.08	4.13	4.54	4.44

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
48.60	52.90	59.80	66.20	73.70	79.70
82.60	82.20	77.30	67.70	57.70	50.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS
AND STATION LATITUDE = 31.34 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.83	3.29	3.27	2.87	4.23	3.67
	2.91	2.99	4.09	3.65	5.36	3.91
STD. DEVIATIONS	2.78	1.90	2.12	1.75	2.50	3.50
	1.39	1.77	1.70	2.64	2.94	1.93
RUNOFF						
TOTALS	0.714	0.219	0.240	0.218	0.654	0.456
	0.074	0.132	0.210	0.430	0.971	0.415
STD. DEVIATIONS	1.018	0.302	0.497	0.370	0.885	0.923
	0.158	0.274	0.262	0.637	0.903	0.512
EVAPOTRANSPIRATION						
TOTALS	1.555	2.123	2.912	3.432	3.387	3.105
	2.935	2.771	3.253	1.931	1.179	0.860
STD. DEVIATIONS	0.124	0.203	0.676	1.161	1.284	1.903
	1.240	1.242	1.132	0.626	0.162	0.125
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	2.7158	1.6207	0.6930	0.2322	0.2018	0.2927
	0.0457	0.0004	0.0881	0.4815	2.1126	2.4352
STD. DEVIATIONS	1.7906	1.3332	0.9510	0.3943	0.4931	0.8463
	0.1108	0.0009	0.3212	1.0229	1.9471	1.5885
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0065	0.0041	0.0016	0.0005	0.0005	0.0008
	0.0001	0.0000	0.0002	0.0012	0.0059	0.0058
STD. DEVIATIONS	0.0046	0.0034	0.0022	0.0009	0.0011	0.0022
	0.0003	0.0000	0.0008	0.0025	0.0062	0.0041

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	45.09	(6.729)	13436368.00	100.00
RUNOFF	4.732	(1.9622)	1410247.00	10.496
EVAPOTRANSPIRATION	29.442	(2.8668)	8774355.00	65.303
LATERAL DRAINAGE COLLECTED FROM LAYER 2	10.91978	(3.91620)	3254347.000	24.22043
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00006	(0.00002)	17.440	0.00013
AVERAGE HEAD ON TOP OF LAYER 3	0.002	(0.001)		
CHANGE IN WATER STORAGE	-0.009	(0.9239)	-2599.56	-0.019

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	4.62	1376866.000
RUNOFF	2.570	765964.7000
DRAINAGE COLLECTED FROM LAYER 2	1.13242	337486.1000
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000012	3.47290
AVERAGE HEAD ON TOP OF LAYER 3	0.246	
MAXIMUM HEAD ON TOP OF LAYER 3	0.196	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.8 FEET	
SNOW WATER	2.21	658724.700
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3468	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

****

FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	7.2618	0.3026
2	0.0020	0.0100
3	0.0000	0.0000
4	7.2000	0.4000
SNOW WATER	0.000	

****
****

Attachment B

Subtitle D Final Cover System
HELP Model Simulation

```
**********************************************************************************
**********************************************************************************
**                                                                              **
**                                                                              **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                   **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                    **
**                DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                USAE WATERWAYS EXPERIMENT STATION                             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                  **
**                                                                              **
**                                                                              **
**********************************************************************************
**********************************************************************************

PRECIPITATION DATA FILE:     C:\HELP\ANGELINA.D4
TEMPERATURE DATA FILE:       C:\HELP\ANGELINA.D7
SOLAR RADIATION DATA FILE:   C:\HELP\ANGELINA.D13
EVAPOTRANSPIRATION DATA:     C:\HELP\ANGELINA.D11
SOIL AND DESIGN DATA FILE:   C:\HELP\ANG-SUBD.D10
OUTPUT DATA FILE:            C:\HELP\ANG-SUBD.OUT

TIME:  13:38     DATE:   05/06/2013

**********************************************************************************
     TITLE: Angelina County Waste Management Center - Subtitle D
**********************************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                  LAYER  1
                                  --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  10
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.3980 VOL/VOL
          FIELD CAPACITY               =      0.2440 VOL/VOL
          WILTING POINT                =      0.1360 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.3935 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.119999997000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

                                  LAYER  2
                                  --------

                  TYPE 3 - BARRIER SOIL LINER
                      MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =     18.00   INCHES
          POROSITY                     =      0.4000 VOL/VOL
          FIELD CAPACITY               =      0.3660 VOL/VOL
          WILTING POINT                =      0.2880 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.4000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000001000E-06 CM/SEC
```

5/7/13

Amy R Hesseltine

For Permitting Purposes Only

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.300	
FRACTION OF AREA ALLOWING RUNOFF	=	100.000	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	82.100	ACRES
EVAPORATIVE ZONE DEPTH	=	6.000	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.361	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	2.388	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.816	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	9.561	INCHES
TOTAL INITIAL WATER	=	9.561	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
HOUSTON TEXAS

STATION LATITUDE	=	31.34	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	31	
END OF GROWING SEASON (JULIAN DATE)	=	362	
EVAPORATIVE ZONE DEPTH	=	6.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.45	3.17	3.53	3.13	5.29	4.18
2.60	3.08	4.08	4.13	4.54	4.44

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
48.60	52.90	59.80	66.20	73.70	79.70
82.60	82.20	77.30	67.70	57.70	50.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS
AND STATION LATITUDE = 31.34 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.83	3.29	3.27	2.87	4.23	3.67
	2.91	2.99	4.09	3.65	5.36	3.91
STD. DEVIATIONS	2.78	1.90	2.12	1.75	2.50	3.50
	1.39	1.77	1.70	2.64	2.94	1.93
RUNOFF						
TOTALS	3.295	1.544	0.925	0.528	1.384	1.077
	0.221	0.252	0.743	1.444	3.462	2.800
STD. DEVIATIONS	2.727	1.705	1.495	0.893	1.731	2.128
	0.500	0.553	0.971	1.906	2.731	1.886
EVAPOTRANSPIRATION						
TOTALS	1.633	2.106	2.676	2.707	2.801	2.681
	2.669	2.734	3.121	1.914	1.352	1.010
STD. DEVIATIONS	0.135	0.212	0.816	1.237	1.079	1.742
	1.090	1.297	1.035	0.703	0.174	0.136

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.0009	0.0007	0.0005	0.0003	0.0003	0.0002
	0.0001	0.0002	0.0004	0.0005	0.0008	0.0009
STD. DEVIATIONS	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0001	0.0002	0.0002	0.0003	0.0001	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2

AVERAGES	4.8281	3.6270	2.0208	1.0868	0.8999	0.7521
	0.3767	0.4717	1.3458	1.9225	4.0608	5.0734
STD. DEVIATIONS	0.8822	1.2763	1.3105	0.8747	0.6934	0.9074
	0.5173	0.5550	0.8830	1.2998	1.1654	0.6656

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.09 (6.729)	13436368.00	100.00
RUNOFF	17.674 (5.6196)	5267143.00	39.201
EVAPOTRANSPIRATION	27.405 (2.4051)	8167228.00	60.784
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.00579 (0.00052)	1726.316	0.01285
AVERAGE HEAD ON TOP OF LAYER 2	2.205 (0.240)		
CHANGE IN WATER STORAGE	0.001 (0.2595)	269.83	0.002

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	4.62	1376866.000
RUNOFF	4.211	1255047.5000
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.000031	9.20968
AVERAGE HEAD ON TOP OF LAYER 2	6.000	
SNOW WATER	2.21	658724.7200
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3980	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360	

****

****

FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.3880	0.3980
2	7.2000	0.4000
3	0.0000	0.0000
SNOW WATER	0.000	

****
****

Attachment C

Alternative Final Cover System
HELP Model Simulation

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**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY          **
**                     USAE WATERWAYS EXPERIMENT STATION            **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY      **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************

PRECIPITATION DATA FILE:     C:\HELP3\ANGELINA.D4
TEMPERATURE DATA FILE:       C:\HELP3\ANGELINA.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\ANGELINA.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\ANGELINA.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\ANGALT.D10
OUTPUT DATA FILE:            C:\HELP3\ANGALT.OUT

TIME:   16:43     DATE:   05/06/2013

**********************************************************************
     TITLE:  Angelina County Waste Management Center-Alternative Final Cover
**********************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  10
          THICKNESS                     =      24.00   INCHES
          POROSITY                      =       0.3980 VOL/VOL
          FIELD CAPACITY                =       0.2440 VOL/VOL
          WILTING POINT                 =       0.1360 VOL/VOL
          INITIAL SOIL WATER CONTENT    =       0.3135 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.119999997000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

                                LAYER  2
                                --------

                  TYPE 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER  20
          THICKNESS                     =       0.20   INCHES
          POROSITY                      =       0.8500 VOL/VOL
          FIELD CAPACITY                =       0.0100 VOL/VOL
          WILTING POINT                 =       0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT    =       0.0117 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =   10.0000000000      CM/SEC
          SLOPE                         =       5.00   PERCENT
          DRAINAGE LENGTH               =     200.0    FEET


                                Page 1 of 6
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5/7/13

Amy R Hesseltine

For Permitting Purposes Only

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.24	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	86.30	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	82.100	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	6.936	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.756	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.992	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	7.706	INCHES
TOTAL INITIAL WATER	=	7.706	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
HOUSTON TEXAS

STATION LATITUDE	=	31.34 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	31
END OF GROWING SEASON (JULIAN DATE)	=	362
EVAPORATIVE ZONE DEPTH	=	22.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.45	3.17	3.53	3.13	5.29	4.18
2.60	3.08	4.08	4.13	4.54	4.44

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
48.60	52.90	59.80	66.20	73.70	79.70
82.60	82.20	77.30	67.70	57.70	50.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS
AND STATION LATITUDE = 31.34 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.83	3.29	3.27	2.87	4.23	3.67
	2.91	2.99	4.09	3.65	5.36	3.91
STD. DEVIATIONS	2.78	1.90	2.12	1.75	2.50	3.50
	1.39	1.77	1.70	2.64	2.94	1.93
RUNOFF						
TOTALS	0.714	0.219	0.240	0.218	0.654	0.456
	0.074	0.132	0.210	0.430	0.971	0.415
STD. DEVIATIONS	1.018	0.302	0.497	0.370	0.885	0.923
	0.158	0.274	0.262	0.637	0.903	0.512
EVAPOTRANSPIRATION						
TOTALS	1.555	2.123	2.912	3.432	3.387	3.105
	2.935	2.771	3.253	1.931	1.179	0.860
STD. DEVIATIONS	0.124	0.203	0.676	1.161	1.284	1.903
	1.240	1.242	1.132	0.626	0.162	0.125
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	2.7158	1.6207	0.6930	0.2322	0.2018	0.2927
	0.0457	0.0004	0.0881	0.4815	2.1127	2.4352
STD. DEVIATIONS	1.7906	1.3332	0.9510	0.3943	0.4931	0.8463
	0.1108	0.0009	0.3212	1.0229	1.9471	1.5885
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0065	0.0041	0.0016	0.0005	0.0005	0.0008
	0.0001	0.0000	0.0002	0.0012	0.0059	0.0058
STD. DEVIATIONS	0.0046	0.0034	0.0022	0.0009	0.0011	0.0022
	0.0003	0.0000	0.0008	0.0025	0.0062	0.0041

****
****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.09 (6.729)	13436368.000	100.00
RUNOFF	4.732 (1.9622)	1409227.35	10.496
EVAPOTRANSPIRATION	29.442 (2.8668)	8768009.90	65.303
LATERAL DRAINAGE COLLECTED FROM LAYER 2	10.91984 (3.91622)	3252010.39	24.22056
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00000 (0.00000)	0.355	0.00000
AVERAGE HEAD ON TOP OF LAYER 3	0.002 (0.001)		
CHANGE IN WATER STORAGE	-0.009 (0.9239)	-2597.68	-0.019

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	4.62	1376866.000
RUNOFF	2.570	765410.862
DRAINAGE COLLECTED FROM LAYER 2	1.13243	337246.45310
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.0302
AVERAGE HEAD ON TOP OF LAYER 3	0.246	
MAXIMUM HEAD ON TOP OF LAYER 3	0.196	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.8 FEET	
SNOW WATER	2.21	658248.3972
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3468	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

****

FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	7.2618	0.3026
2	0.0020	0.0100
3	0.0000	0.0000
4	0.1800	0.7500
SNOW WATER	0.000	

****
****

Attachment D

Permitted Pre-Subtitle D Final Cover System (for MSW Landfill Units with No Synthetic Liner) HELP Model Simulation

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                  **
**                     USAE WATERWAYS EXPERIMENT STATION                    **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:     C:\HELP\ANGELINA.D4
TEMPERATURE DATA FILE:       C:\HELP\ANGELINA.D7
SOLAR RADIATION DATA FILE:   C:\HELP\ANGELINA.D13
EVAPOTRANSPIRATION DATA:     C:\HELP\ANGELINA.D11
SOIL AND DESIGN DATA FILE:   C:\HELP\ANGPRE-D.D10
OUTPUT DATA FILE:            C:\HELP\ANG-PRED.OUT

TIME:  12:16     DATE:   05/06/2013

******************************************************************************

     TITLE:  Angelina County Waste Management Center - Pre-Subtitle D

******************************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
            COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  10
        THICKNESS                     =     24.00   INCHES
        POROSITY                      =      0.3980 VOL/VOL
        FIELD CAPACITY                =      0.2440 VOL/VOL
        WILTING POINT                 =      0.1360 VOL/VOL
        INITIAL SOIL WATER CONTENT    =      0.3971 VOL/VOL
        EFFECTIVE SAT. HYD. COND.     =  0.119999997000E-03 CM/SEC
      NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
             FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

                                LAYER  2
                                --------

                  TYPE 3 - BARRIER SOIL LINER
                  MATERIAL TEXTURE NUMBER   0
        THICKNESS                     =     18.00   INCHES
        POROSITY                      =      0.4270 VOL/VOL
        FIELD CAPACITY                =      0.4180 VOL/VOL
        WILTING POINT                 =      0.3670 VOL/VOL
        INITIAL SOIL WATER CONTENT    =      0.4270 VOL/VOL
        EFFECTIVE SAT. HYD. COND.     =  0.441999992000E-08 CM/SEC
```

5/7/13

Amy R Hesseltine

For Permitting Purposes Only

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	86.30	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	6.900	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	8.734	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.756	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.992	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	16.730	INCHES
TOTAL INITIAL WATER	=	16.730	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM HOUSTON TEXAS

STATION LATITUDE	=	31.34	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	31	
END OF GROWING SEASON (JULIAN DATE)	=	362	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.45	3.17	3.53	3.13	5.29	4.18
2.60	3.08	4.08	4.13	4.54	4.44

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
48.60	52.90	59.80	66.20	73.70	79.70
82.60	82.20	77.30	67.70	57.70	50.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS AND STATION LATITUDE = 31.34 DEGREES

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.83	3.29	3.27	2.87	4.23	3.67
	2.91	2.99	4.09	3.65	5.36	3.91
STD. DEVIATIONS	2.78	1.90	2.12	1.75	2.50	3.50
	1.39	1.77	1.70	2.64	2.94	1.93
RUNOFF						
TOTALS	3.190	1.535	0.896	0.462	0.791	0.501
	0.068	0.127	0.190	0.527	2.036	2.390
STD. DEVIATIONS	2.854	1.671	1.416	0.762	1.167	1.160
	0.147	0.268	0.235	0.924	2.188	2.019
EVAPOTRANSPIRATION						
TOTALS	1.466	2.074	2.870	3.551	5.432	3.796
	3.241	2.786	3.225	1.915	1.125	0.802
STD. DEVIATIONS	0.124	0.193	0.638	0.983	0.590	2.030
	1.565	1.255	1.107	0.600	0.148	0.109
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	0.0101	0.0091	0.0093	0.0084	0.0070	0.0055
	0.0053	0.0052	0.0051	0.0057	0.0074	0.0095
STD. DEVIATIONS	0.0013	0.0009	0.0008	0.0005	0.0009	0.0008
	0.0003	0.0000	0.0003	0.0011	0.0018	0.0018

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2						
AVERAGES	20.9711	20.4789	18.0537	15.4075	9.1842	3.7903
	2.4983	1.9361	2.2013	4.0665	11.3442	18.6530
STD. DEVIATIONS	5.1264	3.8005	3.1596	2.1068	3.5106	3.2186
	1.3050	0.0249	1.0539	4.0791	7.2993	7.0031

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.09 (6.729)	981951.4	100.00
RUNOFF	12.714 (4.9984)	276910.97	28.200
EVAPOTRANSPIRATION	32.283 (3.1193)	703119.62	71.604
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.08746 (0.00552)	1904.783	0.19398
AVERAGE HEAD ON TOP OF LAYER 2	10.715 (1.805)		
CHANGE IN WATER STORAGE	0.001 (1.3594)	15.99	0.002

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	4.62	100623.594
RUNOFF	4.056	88350.0703
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.000351	7.64061
AVERAGE HEAD ON TOP OF LAYER 2	24.000	
SNOW WATER	2.21	48140.6602
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3980	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360	

****

****

FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	9.5519	0.3980
2	7.2000	0.4000
SNOW WATER	0.000	

****
****

Attachment E

Alternative Pre-Subtitle D Final Cover System HELP Model Simulation

```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY          **
**                     USAE WATERWAYS EXPERIMENT STATION            **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************

PRECIPITATION DATA FILE:     C:\HELP\ANGELINA.D4
TEMPERATURE DATA FILE:       C:\HELP\ANGELINA.D7
SOLAR RADIATION DATA FILE:   C:\HELP\ANGELINA.D13
EVAPOTRANSPIRATION DATA:     C:\HELP\ANGELINA.D11
SOIL AND DESIGN DATA FILE:   C:\HELP\PRED-ALT.D10
OUTPUT DATA FILE:            C:\HELP\PRED-ALT.OUT

TIME:  12:25     DATE:   05/06/2013

**********************************************************************

 TITLE:  Angelina County Waste Management Center - Alternative Pre-Subtitle D

**********************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                  LAYER  1
                                  --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  10
        THICKNESS                     =     24.00   INCHES
        POROSITY                      =      0.3980 VOL/VOL
        FIELD CAPACITY                =      0.2440 VOL/VOL
        WILTING POINT                 =      0.1360 VOL/VOL
        INITIAL SOIL WATER CONTENT    =      0.3133 VOL/VOL
        EFFECTIVE SAT. HYD. COND.     =  0.119999997000E-03 CM/SEC
      NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
               FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
                                  --------

                  TYPE 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER  20
        THICKNESS                     =      0.20   INCHES
        POROSITY                      =      0.8500 VOL/VOL
        FIELD CAPACITY                =      0.0100 VOL/VOL
        WILTING POINT                 =      0.0050 VOL/VOL
        INITIAL SOIL WATER CONTENT    =      0.0352 VOL/VOL
        EFFECTIVE SAT. HYD. COND.     =   10.0000000000     CM/SEC
        SLOPE                         =      5.00   PERCENT
        DRAINAGE LENGTH               =    200.0    FEET
```


5/7/13

Amy R. Hesseltine

For Permitting Purposes Only

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.24	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	86.30	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	6.900	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	6.939	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.756	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.992	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	7.629	INCHES
TOTAL INITIAL WATER	=	7.629	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
HOUSTON TEXAS

STATION LATITUDE	=	31.34	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	31	
END OF GROWING SEASON (JULIAN DATE)	=	362	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00	%

AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.45	3.17	3.53	3.13	5.29	4.18
2.60	3.08	4.08	4.13	4.54	4.44

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
48.60	52.90	59.80	66.20	73.70	79.70
82.60	82.20	77.30	67.70	57.70	50.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS
AND STATION LATITUDE = 31.34 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.83	3.29	3.27	2.87	4.23	3.67
	2.91	2.99	4.09	3.65	5.36	3.91
STD. DEVIATIONS	2.78	1.90	2.12	1.75	2.50	3.50
	1.39	1.77	1.70	2.64	2.94	1.93
RUNOFF						
TOTALS	0.714	0.219	0.240	0.218	0.654	0.456
	0.074	0.132	0.210	0.431	0.968	0.415
STD. DEVIATIONS	1.018	0.302	0.497	0.370	0.885	0.923
	0.158	0.274	0.262	0.637	0.901	0.512
EVAPOTRANSPIRATION						
TOTALS	1.556	2.122	2.911	3.431	3.392	3.105
	2.935	2.770	3.252	1.937	1.182	0.860
STD. DEVIATIONS	0.126	0.203	0.679	1.153	1.285	1.903
	1.241	1.242	1.133	0.615	0.159	0.125
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	2.7159	1.6204	0.6917	0.2339	0.1999	0.2924
	0.0460	0.0004	0.0882	0.4791	2.1114	2.4330

STD. DEVIATIONS	1.7914	1.3321	0.9482	0.3941	0.4946	0.8461
	0.1108	0.0008	0.3212	1.0224	1.9576	1.5879
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3						
AVERAGES	0.0064	0.0041	0.0016	0.0006	0.0006	0.0008
	0.0001	0.0000	0.0002	0.0011	0.0058	0.0057
STD. DEVIATIONS	0.0044	0.0034	0.0022	0.0009	0.0016	0.0022
	0.0003	0.0000	0.0008	0.0025	0.0061	0.0039

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.09 (6.729)	981951.4	100.00
RUNOFF	4.729 (1.9649)	102988.26	10.488
EVAPOTRANSPIRATION	29.453 (2.8630)	641484.12	65.327
LATERAL DRAINAGE COLLECTED FROM LAYER 2	10.91223 (3.92589)	237668.281	24.20367
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00000 (0.00000)	0.047	0.00000
AVERAGE HEAD ON TOP OF LAYER 3	0.002 (0.001)		
CHANGE IN WATER STORAGE	-0.009 (0.9224)	-189.45	-0.019

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	4.62	100623.594
RUNOFF	2.570	55978.1367
DRAINAGE COLLECTED FROM LAYER 2	1.13151	24644.36910
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00312
AVERAGE HEAD ON TOP OF LAYER 3	0.246	
MAXIMUM HEAD ON TOP OF LAYER 3	0.195	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	1.7 FEET	
SNOW WATER	2.21	48140.6602

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3466

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	7.2638	0.3027
2	0.0020	0.0100
3	0.0000	0.0000
4	0.1025	0.4270
SNOW WATER	0.000	

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Appendix 5.4

Final Cover System Quality Control Plan

ANGELINA COUNTY
WASTE MANAGEMENT CENTER
TCEQ Permit No. MSW-2105A

SDP Attachment 12, Appendix 5.4
Final Cover Quality Control Plan

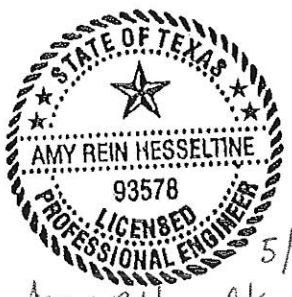
prepared by:

LNV Solutions Today with a Vision for Tomorrow

engineers | architects | contractors

TBPE FIRM NO. F-366

November 20, 2007
Revised April 11, 2008
Revised September 25, 2009
Revised October 18, 2010
Revised December 17, 2010
Revised May 7, 2013



5/7/13

Amy R Hesseltine

FOR PERMITTING PURPOSES ONLY

Final Cover Quality Control Plan
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

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LIST OF ATTACHMENTS

5/7/13 Amy R Hesseltine

FOR PERMITTING PURPOSES ONLY

Final Cover Quality Control Plan
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

1 INTRODUCTION

As per 30 TAC §330.457(e)(1), this Final Cover Quality Control Plan (FCQCP) was prepared to detail methods and procedures for the installation of final cover at the Angelina County Waste Management Center.

2 SCOPE

This Final Cover Quality Control Plan (FCQCP) has been prepared to provide materials, construction, and QA/QC (Quality Assurance/Quality Control) criteria for the various elements of the final cover system/alternative final cover system which includes (as required):

- Soil infiltration layer
- Geosynthetic clay liner
- Infiltration layer geomembrane
- Drainage layer, and
- Erosion layer

Typical final cover sections are provided in the Final Closure Plan.

This plan also provides guidance necessary for testing and reporting evaluation procedures to the professional preparing the Final Cover System Evaluation Report (FCSER) describing the necessary procedures for implementation.

3 DEFINITIONS

The following list of definitions pertinent to the FCQCP is provided for reference:

ASTM: American Society for Testing and Materials - One of the largest, professionally recognized voluntary standards development systems in the world.

Atterberg Limits: (ASTM D4318) A series of six "limits of consistency" of fine-graded soils defined by Swedish soil scientist Albert Atterberg, two of which are frequently used today to establish a soil's physical boundaries dealing with its plasticity characteristics. These soil boundaries or limits used most frequently are based upon the numerical difference of the Liquid Limit and the Plastic Limit as defined below:

the erosion layer. The geocomposite will consist of 200-mil HDPE drainage netting heat bonded to 10 oz geotextile filter fabric. Double-sided geocomposite will be placed on side slopes and single-sided geocomposite on top slopes.

All materials placed over the geomembrane should be placed during the coolest part of the day and deployed in "fingers" along the surface to control the amount of slack and minimize wrinkles and folds in the geocomposite. These materials must be deployed only up-slope on the side slopes so that stress imparted to the geomembrane is minimized. Full-time observation by the POR or his/her Qualified Engineering Technician is required during deployment of the geocomposite drainage material.

Materials, placement procedures, and construction quality assurance for geocomposite will be in accordance manufacturer's recommendations.

8 EROSION LAYER REQUIREMENTS (ALL AREAS)

The erosion layer shall consists of a minimum of 24 inches of earthen material which is capable of sustaining native plant growth. For landfill units with no synthetic bottom liner, an erosion layer will be placed over the soil infiltration layer. For landfill units with a synthetic bottom liner and areas closed using the alternative final cover system, the erosion layer will be placed over the geonet with 10 oz geotextile. Refer to the Final Closure Plan for typical final cover sections.

The erosion layer will be seeded or sodded immediately after completion of the final cover. Temporary or permanent erosion control measures may be used to minimize erosion and aid establishment of vegetation.

The erosion layer will be placed using any appropriate equipment capable of accomplishing the work and should receive only the minimal compaction required for stability. The thickness of the erosion layer will be verified by survey methods at a frequency of one (1) verification point every 10,000 ft^2. Other quality assurance for the erosion layer should consist of continuous observation by the POR or his/her Qualified Engineering Technician during construction, and performing additional tests felt necessary by the POR to verify that the erosion layer has been constructed in accordance with the Final Closure Plan.

9 DOCUMENTATION

Following completion of final cover activities for a MSWLF unit, certification verifying that construction of the final cover system was performed in compliance with the approved Final Closure Plan will be signed by the POR and will include a Final Cover System Evaluation Report. The FCSER provides documentation and certification of final cover system for a MSWLF unit or MSW site.

Refer to Section 6 of the Final Closure Plan for certification requirements following completion of all closure activities for a MSW landfill unit or final facility closure.

All final cover quality assurance/quality control testing must be performed in conformance with this plan. Data from all testing will be submitted in the FCSER.

REDLINE/STRIKEOUT

SDP ATTACHMENT 12

Final Closure Plan
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

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Rev 4, Oct. 18, 2010, Rev 5, Dec 17, 2010 .

FOR PERMITTING PURPOSES ONLY

TABLE OF CONTENTS (cont.)

EXHIBITS

APPENDICES

FOR PERMITTING PURPOSES ONLY

SDP ATTACHMENT 12

Final Closure Plan
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

1 INTRODUCTION

This plan has been prepared to fulfill the requirements of 30 TAC Subchapter J, §§330.457, 330.459, and 330.461 regarding closure requirements for all Municipal Solid Waste (MSW) landfill units. As stated in the regulations, the required final closure system for each MSW landfill unit is determined by the date which the MSW landfill unit stops receiving waste and by the underlying bottom liner system for the unit. All MSW landfill units at the Angelina County Waste Management Center (ACWMC) received waste after October 9, 1993. This document details the requirement for final closure of all MSW landfill units at the Angelina County Waste Management Center.

2 FINAL COVER SYSTEM REQUIREMENTS

2.1 MSW Landfill Units with Synthetic Bottom Liners

2.1.1 Subtitle D Final Cover System

30 TAC §330.457(a)(1) states that the final cover system for a MSW landfill unit with a synthetic bottom liner must have a synthetic membrane that has permeability less than or equal to the permeability of any bottom liner system overlain by a clay rich cover layer consisting of a minimum of 18 inches of earthen material with a coefficient of permeability no greater than $1x10^{-5}$ cm/sec.

The synthetic membrane currently permitted for the Angelina County Waste Management Center consists of 40 mil linear low density polyethylene. The synthetic membrane will be smooth on the gently sloping top sections of the cap and textured on the 4-horizontal:1-vertical side slopes.

2.1.2 Alternative Final Cover System

In accordance with 30 TAC §330.457(d), the executive director may approve an alternative final cover design that achieves an equivalent reduction in infiltration as the clay-rich soil layer detailed in 30 TAC §330.457(a)(1) and provides equivalent protection from wind and water erosion as detailed in 30 TAC §330.457(a)(3).

As detailed in the Alternative Final Cover Demonstration (Appendix 5.3 of this plan), the currently permitted final cover system is more stringent than the requirements of §330.457(a)(1) and (3), therefore an alternative final cover has been designed that achieves an equivalent or greater reduction in infiltration and provides equivalent protection from wind and water erosion as the currently permitted design.

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An alternative final cover system (AFCS) has been designed for the MSW landfill units with synthetic bottom liners and consists of replacing the clay-rich soil layer component in the site's currently permitted final cover system with a geosynthetic clay liner (GCL). The GCL will be overlain with a 40 mil LLDPE geomembrane. The synthetic membrane will be textured on the 4-horizontal:1-vertical side slopes and smooth on lesser top slopes. The alternative final cover system may be used on any areas with a synthetic bottom liner.

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2.1.3 Drainage Layer

A geocomposite drainage layer will be placed over the synthetic membrane. The geocomposite drainage layer will consist of a 200 mil geonet heat-fused to 10 oz geotextile filter fabric (single-sided for top slopes, double-sided for the 4-horizontal:1-vertical side slopes).

2.2 MSW Landfill Units With No Synthetic Liner

2.2.1 Pre-Subtitle D Final Cover System

30 TAC §330.457(a)(2) states that the final cover system for a MSW landfill unit with no synthetic bottom liner must have a clay-rich cover soil layer consisting of a minimum of 18 inches of earthen material with a coefficient of permeability less than or equal to the permeability of any constructed bottom liner or natural subsoil present. The coefficient of permeability of the infiltration layer shall in no case exceed $1x10^{-5}$ cm/sec, even though the coefficient of permeability of the constructed bottom liner or natural subsoil is greater than $1x10^{-5}$ cm/sec or no data exist for the value(s) of the coefficient of permeability of the constructed bottom liner or natural subsoil.

Approximately 6.9 acres are underlain with pre-Subtitle D compacted clay liners with no synthetic bottom liners. The final cover for the MSW landfill units with no synthetic bottom liner will be constructed with an infiltration layer consisting of a minimum of 18 inches of compacted clay with a coefficient of permeability less than or equal to the permeability of the constructed bottom liner(s) or $1x10^{-5}$ cm/sec, whichever is less.

2.2.2 Alternative Final Cover System

In accordance with 30 TAC §330.457(d), the executive director may approve an alternative final cover design that achieves an equivalent reduction in infiltration as the clay-rich soil layer detailed in 30 TAC §330.457(a)(2) and provides equivalent protection from wind and water erosion as detailed in 30 TAC §330.457(a)(3).

As detailed in the Alternative Final Cover Demonstration (Appendix 5.3 of this plan), an alternative final cover has been designed that achieves an equivalent or greater reduction in infiltration and provides equivalent protection from wind and water erosion as clay-rich soil cover layer specified in §330.457(a)(2) and (3).

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<sp><sp>Final Closure Plan . Page 2
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An alternative final cover system (AFCS) has been designed for the MSW landfill units with no synthetic bottom liners and consists of replacing the clay-rich soil layer component in the site's currently permitted final cover system with a geosynthetic clay liner (GCL). The GCL will be overlain with a 40 mil LLDPE geomembrane. The synthetic membrane will be textured on the 4-horizontal:1-vertical side slopes and smooth on lesser top slopes. The alternative final cover system may be used on any areas with no synthetic bottom liner.

2.3 Erosion Layer

In accordance 30 TAC §330.457(a)(3), all final cover systems must include an erosion layer consisting of a minimum of six inches (6") of earthen material that is capable of sustaining native plant and must be seeded or sodded immediately following the application of final cover in order to minimize erosion.

The erosion layer for the Angelina County Waste Management Center will consist of 24 inches of earthen material with the top six inches (6") being capable sustaining native plant growth and will be seeded or sodded immediately following the application of final cover in order to minimize erosion.

3 QUALITY CONTROL TESTING

In accordance with 30 TAC §330.457(c), quality control testing shall be performed and documented on the 18 inches of compacted clay-rich soil cover for its coefficient of permeability at a frequency of no less than one test per surface acre of final cover. Permeability data shall be submitted to the executive director.

Quality control/quality assurance testing and documentation procedures for each final cover system installed will be in accordance with the site's Final Cover Quality Control Plan (FCQCP). A copy of the FCQCP can be found in Appendix 5.4 of this document.

4 LARGEST AREA REQUIRING FINAL COVER

The largest area requiring final cover is based upon the largest active area at any given time during the active life of the landfill. At the present time, approximately 36 acres have been developed. Of the 36 acres, one (1) acre was closed in 1995 and 35 acres are active. Therefore, 35 acres represent the largest area of the landfill requiring final cover.

5 MAXIMUM INVENTORY OF WASTES

The maximum inventory of waste that will ever be on-site during the active life of the landfill is estimated to be approximately 8,000,000 cubic yards. This estimate is based upon the permitted design capacity of the landfill less daily cover and final cover.

As detailed in §II.E (Facilities and Operations Authorized/Waste Volume Available for Disposal) in the Permit, 9,291,965 cubic yards is the total permitted capacity of landfill including daily and final cover. 8,000,000 cubic yards is the estimated total waste capacity of the facility excluding final cover. Therefore 8,000,000 cubic yards represents the "maximum inventory of waste" that will ever be on-site during the active life of the landfill.

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6 IMPLEMENTATION OF FINAL CLOSURE PLAN

Implementation of the final closure plan for the Angelina County Waste Management Center will be as follows:

- No later than 45 days prior to the initiation of closure activities for an MSW landfill unit, ACWMC shall provide written notification to the executive director of the intent to close the unit and place this notice of intent in the operating record.

- Upon notification to the executive of its intent to close, ACWMC shall post a minimum of one sign at the main entrance and all other frequently used points of access for the facility notifying all persons who may utilize the facility of the date of closing for the entire facility and the prohibition against further receipt of waste materials after the stated date. Further, suitable barriers shall be installed at all gates or access points to adequately prevent the unauthorized dumping of solid waste at the closed facility.

- ACWMC shall begin closure activities for each unit no later than 30 days after the date on which the unit receives the known final receipt of wastes or, if the unit has remaining capacity and there is a reasonable likelihood that the unit will receive additional wastes, no later than one year after the most recent receipt of wastes. A request for an extension beyond the one-year deadline for the initiation of closure may be submitted to the executive director for review and approval and shall include all applicable documentation necessary to demonstrate that the unit has the capacity to receive additional waste and that the owner or operator has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the MSW landfill unit.

- ACWMC shall complete closure activities for the unit in accordance with the approved closure plan within 180 days following the initiation of closure activities. A request for an extension for the completion of closure activities may be submitted to the executive director for review and approval and shall include all applicable documentation necessary to demonstrate that closure will, of necessity, take longer than 180 days and all steps have been taken and will continue to be taken to prevent threats to human health and the environment from the unclosed MSW landfill unit.

- Following completion of all closure activities for the MSW landfill unit, ACWMC shall comply with the post-closure care requirements. ACWMC shall submit to the executive director by registered mail for review and approval a certification, signed by an independent licensed professional engineer, verifying that closure has been completed in accordance with the approved closure plan. The submittal to the executive director shall include all applicable documentation necessary for certification of closure. Once approved, this certification shall be placed in the operating record.

- Following receipt of the required closure documents, as applicable, and an inspection report from the agency's regional office verifying proper closure of the MSW landfill unit according to the approved closure plan, the executive director may acknowledge the termination of operation and closure of the unit and deem it properly closed.

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- Within ten days after closure of all MSW landfill units, ACWMC shall submit to the executive director by registered mail a certified copy of an affidavit to the public in accordance with the requirements of 330.19 (relating to Deed Recordation) and place a copy of the affidavit in the operating record. In addition, the owner or operator shall record a certified notation of the deed to the facility property, or on some other instrument that is normally examined during title search, that will in perpetuity notify any potential purchaser of the property that the land has been used as a landfill facility and use of the land is restricted according to the provisions specified in 330.465 (relating to Certification of Completion of Post-Closure Care). ACWMC shall submit a certified copy of the modified deed to the executive director and place a copy of the modified deed in the operating record within the time frame specified in this subsection.

- No later than 90 days prior to the initiation of a final facility closure, ACWMC, through a public notice in the newspaper(s) of largest circulation in the vicinity of the facility, provide public notice for final facility closure. This notice shall provide the name, address, and physical location of the facility; the permit number; and the last date of intended receipt of waste. ACWMC shall also make available an adequate number of copies of the approved final closure and post-closure plans for public access and review. ACWMC shall also provide written notification to the executive director of the intent to close the facility and place this notice of intent in the operating record.

7 FINAL CONTOUR MAP

The Angelina County Waste Management Center consists of two fill sectors, Tract 1 and Tract 2. Final contours for each tract consist of 4-horizontal:1-vertical side slopes with top slopes ranging from 2 percent to 6 percent. Intermediate plateaus will be built along portions of the side slopes as shown in Exhibit 4.5, Sheets 1 and 2 of 2.

8 SOIL EROSION LOSSES COMPUTATIONS

Soil erosion losses computations can be found in Appendix 5.1.

9 SLOPE STABILITY ANALYSIS

Slope stability analysis for the final cover can be found in Appendix 5.2.

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SDP ATTACHMENT 12, APPENDIX 5.3

Alternative Final Cover Demonstration
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

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ATTACHMENTS

Alternative Final Cover Demonstration
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

1 INTRODUCTION

In accordance with 30 TAC §330.457(d), the executive director may approve an alternative final cover design that achieves an equivalent or greater reduction in infiltration as the clay-rich soil layer detailed in 30 TAC §330.457(a)(1) and provides equivalent protection from wind and water erosion as detailed in 30 TAC §330.457(a)(3).

One alternative final cover system (AFCS) has been designed for both the MSW landfill units with synthetic bottom liners and MSW landfill units with no synthetic bottom liner. The alternative final cover system consists of replacing the clay-rich soil layer component in the site's currently permitted final cover systems with a geosynthetic clay liner (GCL).

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This documentation will show that the alternative final cover system that has been designed for the Angelina County Waste Management Center meets the requirements of 30 TAC §330.457(d).

2 MODELING APPROACH

All modeling for this demonstration was performed utilizing the Hydrologic Evaluation of Landfill Performance (HELP) Model, Version 3.07 (1 November 1997).

The simulations were performed with the HELP model using the program's synthetic weather data generation capabilities for Houston, Texas, with temperature and precipitation data adjusted with monthly normals from 1971-2000, obtained from the National Climactic Data Center (NCDC). The HELP Model is equipped with synthetic weather capabilities for large cities, such as Houston, Dallas, Austin, San Antonio, etc. Houston was chosen due to proximity to the site and the similarity of seasonal weather averages. The synthetic weather capabilities include precipitation, temperature, solar radiation and evapotranspiration. Where local data existed for the City of Lufkin (closest dataset to the facility) the model was adjusted to include this data. LNV Engineering was able to utilize actual temperature and precipitation data obtained for the City of Lufkin. The monthly normal from 1971-2000 was the most readily available historic weather data. The latitude used in the model (31.337°) correlates to the location of the weather station for the City of Lufkin and was obtained from the National Climactic Weather Center. Data was generated for a thirty year period to correspond with the post-closure care period for the facility.

The runoff curve was generated by the model using a slope of 5% and a length of 200 feet. A slope of 5% with a slope length of 200 feet is consider conservative while using the HELP model as steeper slopes and longer slope lengths both generate faster run-off resulting in less infiltration. Therefore, using 5% and 200 feet to generate the run-off curve for modeling purposes is considered a conservative approach because it maximizes the infiltration capabilities of the model. Additionally, the same slope values were used in all modeled simulations. Run-off was allowed from the area modeled.

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An evaporative zone depth of 22 inches was assumed. This depth was suggested by the model as a fair value for corresponding to the presence of fair vegetative cover. This should be a fair assumption considering that vegetation will be promoted on the final cover system to limit erosion and the low permeability soils in the final cover will hold water and promote evapotranspiration in addition to reducing infiltration.

For simulation purposes when modeling final cover systems with geosynthetic components, geomembrane manufacturer defects (pinholes) were assumed at one per acre and field installation defects were assumed at two per acre with a placement factor of 3 (good). The HELP Model's User's Guide recommendations were used in deriving the defect values. As stated in the "HELP Model User's Guide for Version 3" by Paul R. Schroeder, Cheryl M. Lloyd, Paul A Zappi, and Nadim M. Aziz, "Typical geomembranes may have 0.5 -1 pinholes per acre (1 to 2 pinholes per hectare) from manufacturing defects....Representative installation defect densities as a function of the quality of installation of installation are given below for landfills being built today with the state of the art-minerals, equipment and QA/QC....

Installation Quality	Defect Density (number per acre)
Good	1 to 4

Good: Assumes good field installation with well-prepared, smooth soil surface and geomembrane wrinkle control to insure good contact between geomembrane and adjacent soil that limits drainage rate."

Additionally, in accordance with Geosynthetic Research Institute (GRI) Standard Specification GRI - GCL3 "Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs)", GCLs (as manufactured) shall have a minimum hydraulic conductivity of 5.0×10^{-9} cm/sec. This value was manually inputted to override the higher default value provided in the HELP Model.

In all models, the area of performance used for Subtitle D final cover systems was calculated as 138.2 acres and the area of performance used for Pre-Subtitle D final cover systems was 6.9 acres.

3 FINAL COVER SYSTEM PERFORMANCE

3.1 MSW Landfill Units with Synthetic Bottom Liners

3.1.1 Subtitle D Final Cover System

In order to determine the most stringent final cover design and to establish performance criteria for an alternative final cover system, the site's permitted Subtitle D final cover design for MSW landfill units with synthetic bottom liners was modeled and compared to the regulatory Subtitle D final cover system design specified in §330.457(a)(1) and §330.457(a)(3).

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In order to determine the most stringent final cover design and to establish performance criteria for an alternative final cover system, the currently permitted design was modeled and compared to the final cover design specified in §330.457(a)(1) (Subtitle D final cover system) and §330.457(a)(3) (Erosion Layer).¶
¶
The currently permitted final cover system was modeled using four layers; a 24-inch erosion layer, a 200 mil geonet drainage layer, a 40 mil linear low density polyethylene, and an 18-inch barrier layer of compacted clay with a hydraulic conductivity not exceeding $1x10^{-5}$ cm/sec.

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3.1.1.1 Permitted

The permitted Subtitle D final cover system for was modeled using four layers; a 24-inch erosion layer, a 200 mil geonet drainage layer, a 40 mil linear low density polyethylene, and an 18-inch barrier layer of compacted clay with a hydraulic conductivity not exceeding $1x10^{-5}$ cm/sec.

As calculated by the HELP model using the currently permitted final cover system design parameters, the peak daily percolation/leakage through layer 4 for years 1 to 30 is 5.85021 cubic feet, as shown on page 6 of 7 of the HELP model output for this analysis (Attachment A of this Appendix).

3.1.1.2 Regulatory

The regulatory Subtitle D final cover system was modeled using three layers; a 6-inch erosion layer, an 18-inch barrier layer of compacted clay with a hydraulic conductivity not exceeding $1x\ 10^{-5}$ cm/sec and a geomembrane layer consisting of 40 mil linear low density polyethylene.

Deleted: For simulation purposes, geomembrane manufacturer defects (pinholes) were assumed at one per acre and field installation defects were assumed at two per acre with a placement factor of 3 (good).

As calculated by the HELP model using the Subtitle D final cover system parameters, the peak daily percolation/leakage through layer 3 for years 1 to 30 is 15.51400 cubic feet, as shown on page 5 of 5 of the HELP model output for this analysis (Attachment B of this Appendix).

The HELP model results indicate that the permitted Subtitle D final cover design is more stringent than the regulatory Subtitle D final cover design specified in §330.457(a)(1) and (3). Therefore, the alternative final cover design must achieve an equivalent reduction in infiltration and provide equivalent protection from wind and water as the permitted Subtitle D final cover design for MSW landfill units with synthetic bottom liners.

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4 . ALTERNATIVE FINAL COVER MODEL ¶
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3.1.2 Alternative Subtitle D Final Cover System

The alternative Subtitle D final cover system was modeled using four layers, a 24-inch erosion layer, a 200 mil geonet, 40 mil linear low density polyethylene and a 0.24-inch bentonite GCL with a hydraulic conductivity of $5.0x10^{-9}$ cm/sec which was modeled as a barrier layer utilizing the same parameters outlined in 3.1.1, above.

As calculated by the HELP model, the peak daily percolation/leakage through layer 4 of the alternative Subtitle D final cover system, for years 1 to 30, is 0.05090 cubic feet, as shown on page 6 of 6 of the HELP model output for this analysis (Attachment C of this Appendix).

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¶

3.2 MSW Landfill Units with No Synthetic Bottom Liners

3.2.1 Pre-Subtitle D Final Cover System

30 TAC §330.457(a)(2) states that the final cover system for a MSW landfill unit with no synthetic bottom liner must have a clay-rich cover soil layer consisting of

a minimum of 18 inches of earthen material with a coefficient of permeability less than or equal to the permeability of any constructed bottom liner or natural subsoil present. To accommodate landfill gas header lines installed top of intermediate cover, an alternative final cover system is proposed for select areas of Pre-Subtitle D Areas.

In order to determine the performance criteria for an alternative Pre-Subtitle D final cover system, historic Soil Liner Evaluation Report documents were reviewed to obtain a value for the coefficient of permeability less than or equal to the permeability of any constructed bottom liner. The review indicated that 4.42×10^{-9} cm/sec is the lowest permeability result obtained during any construction event of compacted clay liners within the Pre-Subtitle D areas. This value was used for modeling purposes only as it would result in the most conservative value for comparison purposes. It does not constitute the value with which soil only based Pre-Subtitle D final cover systems will be constructed.

Therefore, permitted Pre-Subtitle D final cover system was modeled using two layers; a 6-inch erosion layer and an 18-inch barrier layer of compacted clay with a hydraulic conductivity not exceeding 4.42×10^{-9} cm/sec.

As calculated by the HELP model using the permitted Pre-Subtitle D final cover system parameters, the peak daily percolation/leakage through layer 2 for years 1 to 30 is 7.64061 cubic feet, as shown on page 4 of 4 of the HELP model output for this analysis (Attachment D of this Appendix).

3.2.2 Alternative Pre-Subtitle D Final Cover System

The alternative Pre-Subtitle D final cover system was modeled using four layers, a 24-inch erosion layer, a 200 mil geonet, 40 mil linear low density polyethylene and a 0.24-inch bentonite GCL with a hydraulic conductivity of 5.0×10^{-9} cm/sec which was modeled as a barrier layer.

As calculated by the HELP model, the peak daily percolation/leakage through layer 4 of the alternative final cover system, for years 1 to 30, is 0.00312 cubic feet, as shown on page 5 of 5 of the HELP model output for this analysis (Attachment E of this Appendix).

4 CONCLUSION

The HELP model simulations performed for this demonstration show that the alternative final cover designs proposed for both Subtitle D and Pre-Subtitle D areas of the Angelina County Waste Management Center will achieve an equivalent or greater reduction in infiltration and provide equivalent protection from wind and water erosion as the permitted final cover designs as required by 30 TAC §330.457(d).

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Final Cover Quality Control Plan
Angelina County Waste Management Center
Type 1 MSW Landfill
TCEQ Permit No. MSW-2105A

1 INTRODUCTION

As per 30 TAC §330.457(e)(1), this Final Cover Quality Control Plan (FCQCP) was prepared to detail methods and procedures for the installation of final cover at the Angelina County Waste Management Center.

2 SCOPE

This Final Cover Quality Control Plan (FCQCP) has been prepared to provide materials, construction, and QA/QC (Quality Assurance/Quality Control) criteria for the various elements of the final cover ~~system. Materials, construction, and QA/QC criteria for the alternate~~system/alternative final cover system are also included. The final cover system components of landfill units with a synthetic bottom liner (SUBTITLE D AREA) are:which includes (as required):

- Soil infiltration layer
- Geosynthetic clay liner
- Infiltration layer geomembrane
- Drainage layer~~;~~, and
- Erosion layer

~~The final cover system components of landfill units without a synthetic bottom liner (PRE SUBTITLE D AREA) are:~~

- ~~Soil infiltration layer; and~~
- ~~Erosion layer~~

Typical final cover sections are provided in ~~Exhibits 4.2 and 4.3 of~~ the Final Closure Plan.

This plan also provides guidance necessary for testing and reporting evaluation procedures to the professional preparing the Final Cover System Evaluation Report (FCSER) describing the necessary procedures for implementation.

3 DEFINITIONS

The following list of definitions pertinent to the FCQCP is provided for reference:

ASTM: American Society for Testing and Materials - One of the largest, professionally recognized voluntary standards development systems in the world.

Atterberg Limits: (ASTM D4318) A series of six "limits of consistency" of fine-graded soils defined by Swedish soil scientist Albert Atterberg, two of which are frequently used today to establish a soil's physical boundaries dealing with its plasticity characteristics. These soil boundaries or limits used most frequently are based upon the numerical difference of the Liquid Limit and the Plastic Limit as defined below:

A geocomposite drainage layer will placed between the erosion layer and the geomembrane infiltration layer to reduce storm water infiltration into the waste and to enhance the overall stability of the final cover by removing water which percolates through the erosion layer. The geocomposite will consist of 200-mil HDPE drainage netting heat bonded to 10 oz geotextile filter fabric. Double-sided geocomposite will be placed on side slopes and single-sided geocomposite on top slopes.

All materials placed over the geomembrane should be placed during the coolest part of the day and deployed in "fingers" along the surface to control the amount of slack and minimize wrinkles and folds in the geocomposite. These materials must be deployed only up-slope on the side slopes so that stress imparted to the geomembrane is minimized. Full-time observation by the POR or his/her Qualified Engineering Technician is required during deployment of the geocomposite drainage material.

Materials, placement procedures, and construction quality assurance for geocomposite will be in accordance manufacturer's recommendations.

8 EROSION LAYER REQUIREMENTS (ALL AREAS)

The erosion layer shall consists of a minimum of 24 inches of earthen material which is capable of sustaining native plant growth. For landfill units with no synthetic bottom liner, an erosion layer will be placed over the soil infiltration layer. For landfill units with a synthetic bottom liner and areas closed using the alternative final cover system, the erosion layer will be placed over the geonet with 10 oz geotextile. Refer to ~~Exhibits 4.2 and 4.3 of~~ the Final Closure Plan for typical final cover sections.

The erosion layer will be seeded or sodded immediately after completion of the final cover. Temporary or permanent erosion control measures may be used to minimize erosion and aid establishment of vegetation.

The erosion layer will be placed using any appropriate equipment capable of accomplishing the work and should receive only the minimal compaction required for stability. The thickness of the erosion layer will be verified by survey methods at a frequency of one (1) verification point every 10,000 ft^2. Other quality assurance for the erosion layer should consist of continuous observation by the POR or his/her Qualified Engineering Technician during construction, and performing additional tests felt necessary by the POR to verify that the erosion layer has been constructed in accordance with the Final Closure Plan.

9 DOCUMENTATION

Following completion of final cover activities for a MSWLF unit, certification verifying that construction of the final cover system was performed in compliance with the approved Final Closure Plan will be signed by the POR and will include a Final Cover System Evaluation Report. The FCSER provides documentation and certification of final cover system for a MSWLF unit or MSW site.

Refer to Section 6 of the Final Closure Plan for certification requirements following completion of all closure activities for a MSW landfill unit or final facility closure.

All final cover quality assurance/quality control testing must be performed in conformance with this plan. Data from all testing will be submitted in the FCSER.

Michael G. Parker

From: "Jonathan JWP. Pinner" <jpinner@cbtx.com>
To: "Michael Parker" <mgps-ega@consolidated.net>
Cc: "Christine CMG. Gresham" <cgresham@cbtx.com>
Sent: Friday, June 14, 2013 9:56 AM
Attach: Acevedo Survey.pdf
Subject: Ruben Acevedo

Mike,

You did a site survey (attached) for Ruben and Edna Acevedo. The borrower called and said the house is complete. Please go back out to the house and do a new survey with the house and improvements added in. They would like to close by the end of the month if possible.

Jonathon Pinner
Commercial Bank of Texas, N.A.
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